Comments

EPA:

Need to reconcile name of impoundments with the impoundment names used in the company response to EPA's CERCLA 104e survey response. Specifically, in the survey response, the company considers the "30-year pond" to be Cell 2 that was commissioned in 2005. The response seems to make no mention of Cell 1 that was commissioned in 1997. This should be made clear in the final report.

State: None

Company: See letter dated February 22, 2011

2-2161

COPY

Minnkota Power
MPC COOPERATIVE, INC.

Your Touchstone Energy® Partner

1822 Mill Road • P.O. Box 13200 • Grand Forks, ND 58208-3200 • Phone (701) 795-4000

February 22, 2011

Mr. Stephan Hoffman
US Environmental Protection Agency
Two Potomac Yard
2733 South Crystal Dr
5th Floor N 5237
Arlington, VA 22202-2733

RE: Comments of Minnkota Power Cooperative, Inc. on the Draft Specific Site Assessment for Coal Combustion Waste Impoundments at Minnkota Power Cooperative Milton R. Young Station, Center, North Dakota (GEI Consultants, Inc., December 2010)

Dear Mr. Hoffman,

Enclosed are comments from Minnkota Power Cooperative, Inc. (Minnkota) on the subject Draft Report prepared by GEI Consultants, Inc. This report documents the results of the October 20, 2010 dam safety inspection of coal combustion waste (CCW) impoundments at the Milton R. Young Station near Center, North Dakota.

We appreciate the opportunity to review the content and technical conclusions of the Draft Report. Additional information where applicable, is included to further assist GEI Consultants, Inc. and USEPA in preparing the most accurate report. Minnkota takes our responsibilities to the public, NDDH, USEPA, and our member-owners very seriously. We hope the comments and clarification attached will result in sufficient information to allow GEI Consultants, Inc. to re-evaluate, and consider our facilities to be in "satisfactory" condition rather than "fair" condition.

Minnkota is pleased to continue to cooperate with USEPA's efforts to gather information regarding the management of coal combustion waste impoundments at our facilities.

If you have any additional questions, please contact me at 701-795-4221, or email at jgraves@minnkota.com.

Sincerely

MINNKOTA POWER COOPERATIVE, INC.

John T. Graves
Environmental Manager

C: David Sogard
Craig Bleth
Scott Hopfauf
Steve Tillotson, NDDH
Karen Goff, NDSWC

Comments of Minnkota Power Cooperative, Inc. on the Draft Specific Site Assessment for Coal Combustion Waste Impoundments at Minnkota Power Cooperative Milton R. Young Station, Center, North Dakota (GEI Consultants, Inc., December 2010).

1.0 Introduction

Section 1.1 Purpose (first paragraph)

"The Milton R. Young Station is owned and operated by Minnkota Power Cooperative (Minnkota)."

Minnkota Comment #1: Unit 1 of the Milton R. Young Station is owned by Minnkota. Unit 2 at the Milton R.Young Station is owned by Square Butte Electric Cooperative. Both units are operated by Minnkota. The ownership and operator information is correctly described in Section 2.1 of the report.

Section 1.1 Purpose (first paragraph)

"The impoundments are Cell 1, Cell 2, and the Alternative Bottom Ash Pond."

Minnkota Comment #2: Minnkota's response to the Request for Information Under Section 104(e) of the Comprehensive Environmental Response, Compensation and Liability Act, U.S.C. 9604(e), dated March 17, 2009, described the three current surface impoundment management units at the Milton R. Young Station, which included Cell 2, the Alternate Bottom Ash Pond, and the Horseshoe Pit Evaporation Pond. Cell 1 was not included in Minnkota's response to the ICR because Cell 1 had not received sluiced CCW since 2005. Since that time, Cell 1 has been substantially dewatered, which has allowed the facility to function as a dry waste landfill. Dewatering continues as the waste consolidates and is loaded from above. Dry waste disposal is necessary to reach the permitted final facility closure grades. Because Cell 1 is not a functioning surface impoundment and is substantially dewatered, Minnkota does not believe it should be included in the Draft Report as an impoundment. There are many succeeding sections of the report making reference to Cell 1 as an impoundment, which should be corrected. Similarly, Minnkota believes that the Horseshoe Pit Evaporation pond should be included as a surface impoundment management unit in the GEI report. That topic will be addressed in later comments.

Section 1.7 Prior Inspections (first paragraph)

"Inspection reports were not provided for the Alternative Bottom Ash Pond".

Minnkota Comment #3: The NDDH Division of Water Quality reports from 2007-2010 are attached .

2.0 Description of Project Facilities

Section 2.2 Impoundment Dams and Reservoirs (second paragraph)

"The Alternate Bottom Ash Pond temporarily holds sluiced bottom ash when Units 1 and 2 are in outage."

Minnkota Comment #4: The alternative bottom ash pond is placed in service only during a scheduled major outage for Unit 2 (for approximately 8 weeks every 3 years) or in the event of a disruption in the normal bottom ash dewatering system. Bottom ash from both units is normally mechanically dewatered and handled as a dry product.

Section 2.2 Impoundment Dams and Reservoirs (second paragraph)

"During our site visit on October 20, 2010, the plant was in outage and the Alternate Bottom Ash Pond was being used."

Minnkota Comment #5: On October 20, 2010, only Unit 2 was in a scheduled major outage, which was why the Alternate Bottom Ash Pond was in service.

Section 2.2 Impoundment Dams and Reservoirs (third paragraph)

"Each pond is designed for a 10 year life span at the end of which the pond is full of ash."

Minnkota Comment #6: In addition to fly ash, Cells 1, 2, and future Cell 3 contain primarily flue gas desulfurization sludge.

Section 2.2 Impoundment Dams and Reservoirs (sixth paragraph)

"The interior slopes of Cell 1 and Cell 2 have a 4-foot thick clay liner covered with a 5-foot thick random clay layer, geotextile for erosion control and a layer of bottom ash."

Minnkota Comment #7: The liner design includes a minimum 10-foot thick clay sidewall liner from the base of the facility to an elevation just above the Hagel Bed. It is a 4-foot thick liner thereafter. The 5-thick random clay layer (to protect the clay liner from freezing and erosion) extends from the base of the pond, up the sidewall, and covers the clay liner at the top of the sidewall. The geotextile is placed over the random clay, with a layer of bottom ash over the geotextile.

Section 2.2 Impoundment Dams and Reservoirs (seventh paragraph)

"In approximately 1979 to 1980, the Butterfly Pond was commissioned to hold ash sluiced from the plant."

Minnkota Comment #8: The Butterfly Ponds (a two-pond temporary waste storage facility) was used for temporary storage of FGD sludge. Fly ash is a component of the FGD sludge as it was used as a reagent, so some fly ash was also stored in the facility while it was in operation. Bottom ash was never sluiced to the Butterfly Pond. The facilities have been evacuated and have not been used as a pond since 1997. Therefore, there are no surface water impoundment issues related to this facility, nor is it necessary to include it in this Draft Report. To include it may lead to confusion as to why this facility was not included in Minnkota's March 17, 2009 ICR response. Minnkota did not include it because it is not a functioning impoundment. The current NDDH does not allow use as an impoundment. There are no plans to return this facility into impoundment service.

Section 2.2 Impoundment Dams and Reservoirs (eighth paragraph)

"The Horseshoe Pit Evaporation Pond is not assessed in this report because it does not receive sluiced ash or other CCW."

Minnkota Comment #9: The Horseshoe Pit Evaporation Pond was inspected during the October 20, 2010 site visit by GEI. In the March, 2009 ICR response submitted by Minnkota this pond was reported as a management unit because it is an impoundment that receives liquid-borne materials from the storage or disposal of residuals from the combustion of coal. This evaporation pond is used to store leachate collected from a closed CCW landfill (the Horseshoe Pit landfill). Again to avoid confusion and maintain consistency with our ICR submittal, Minnkota believes this facility should be one of the three facilities assessed in the Draft Report.

Section 2.4 Intakes and Outlet Works (second paragraph)

"Cell 1 leachate is discharged through two 18-inch-diameter PVC pipes at about invert El. 2005' that discharge to Cell 2."

Minnkota Comment #10: Leachate is removed from the bottom of Cell 1 through the leachate collection system (at approximately El. 2005') by means of a pump and discharge pipe, which are installed within one of the two 18-inch-diameter pipes.

Section 2.4 Intakes and Outlet Works (third paragraph)

"The intake invert of the pipes is currently set at about EL. 2071.5."

Minnkota Comment #11: By design the floating intake invert of the siphon pipes is set at five feet below the impoundment's water elevation. At the time of the inspection, the water elevation within Cell 2 was EL. 2071.5', thus the siphon pipe (suction) invert would be El. 2066.5'.

Section 2.4 Intakes and Outlet Works, (third paragraph)

"Currently, the pipes penetrate the dike at about El. 2081, and the water level is maintained by Minnkota below El. 2079."

Minnkota Comment #12: At the time of the inspection the water elevation within Cell 2 was El. 2071.5'. Typical CCW disposal rates cause the impounded water elevation to raise approximately five feet per year. The NDDH Solid Waste Management Permit SP-159 requires a minimum of two feet of available freeboard at all times, below the currently-constructed clay liner elevation of El. 2081'. Minnkota's facility design requires an additional five feet of clay-rich frost protection cover material over the liner. Therefore, while the current maximum allowable fill elevation is El. 2079, the current actual embankment elevation is El. 2086'. By design, this facility would never operate without seven feet of physical freeboard.

Section 2.7 Standard Operational Procedures (first paragraph)

"The burning of coal produces several gases and fly ash which are vented from the boiler, and bottom ash, which is made of coarse fragements, falls to the bottom of the boiler, and is removed along with boiler slag."

Minnkota Comment #13: In Units 1 and 2, flue gases and fly ash are conducted through the boiler, through an electrostatic precipitator where the fly ash is collected. Bottom ash (or more appropriately "boiler slag") is produced as molten slag, then is quenched, crushed, and sluiced from the bottom of the boiler.

Section 2.7 Standard Operational Procedures (first paragraph)

"Coal combustion wastes from Units 1 and 2 are wet sluiced into Cell 2. When Units 1 and 2 are in outage, bottom ash is wet sluiced into the alternative bottom ash pond.

Minnkota Comment #14: Only FGD waste from Unit 2, with some fly ash (used as a reagent) from both units, was sluiced to Cell 2. Only during a Unit 2 major outage, or in the event of a disruption in the normal bottom ash dewatering system, would bottom ash be sluiced into the alternative bottom ash pond.

Section 2.7 Standard Operational Procedures (second paragraph)

"Cells 1 and 2 are used for primarily settling and permanent storage of CCW."

Minnkota Comment #15: Only Cell 2 is currently being used for settling. Cell 1 was formerly used for settling, however is currently employed as a dry CCW landfill.

Section 2.7 Standard Operational Procedures (third paragraph)

"The Alternate Bottom Ash Pond is used only during plant outages for approximately 2 to 3 months every 3 years."

Minnkota Comment #16: Only during a Unit 2 major outage or in an emergency is bottom ash sluiced into the alternative bottom ash pond.

3.0 Summary of Construction History and Operation

Section 3.0 Summary of Construction History and Operation (third paragraph)

"Cells 1 and 2 have a 4-foot thick clay liner covered with 5 feet of random clay fill, a geotextile for erosion control and a layer of bottom ash."

Minnkota Comment #17: See Minnkota Comment #7.

Section 3.0 Summary of Construction History and Operation (fourth paragraph)

"The clay liner was removed from the top of the dike during the dam raise and reconstructed on the upstream slope to provide a continuous 4-foot thick clay liner as the dike was raised."

Minnkota Comment #18: The terms dike and dam seem to be used interchangeably, leading to confusion. Minnkota would like to clarify the construction sequence by replacing the sentence above with the following: *"The random clay fill protective layer was removed to expose the clay liner. They clay liner was extended to the new height. The clay liner was then re-covered with the 5-foot thick layer of random clay fill."*

4.0 Hazard Potential Classification

Section 4.3 Cell 1 and 2 - Table 4.1 Milton R Young Station, Summary of Impoundment Parameters (Table 4.1)

Minnkota Comment #19: Table 4.1 implies both Cell 1 and Cell 2 are in-service as surface impoundments at the same time. This is not correct. Please refer to Minnkota's Comment #2.

Section 4.3 Cell 1 and 2, (third paragraph)

"A hydraulics and hydrology study and dam break analysis has not been performed for Cell 1 or Cell 2.

Minnkota Comment #20: The impoundment design either eliminates run-in completely or controls it to only precipation that falls on the top of the impoundment berms. Therefore no hydraulics and hydrology study is necessary. Dam break analyses for the Cell 1 or Cell 2 impoundments were not required by the regulatory agencies in North Dakota.

5.0 Hydrology and Hydraulics

Section 5.1, Floods of Record

"Floods of record have not been evaluated and documented for the CCW impoundments at the Milton R. Young Station."

Minnkota Comment #21: Minnkota agrees that floods of record have not been documented for the CCW impoundments. However, Minnkota is very aware of floods of record for our region and has applied this information to Nelson Lake Dam and its associated Emergency Action Plan. Minnkota has not applied this information *"for the CCW impoundments"* because of the impoundment design. The impoundment design either eliminates run-in completely or controls it to only precipation that falls on the top of the impoundment berms. As described in **Minnkota Comment # 12**, the minimum freeboard of these facilities is always at least seven feet, more than sufficient to contain any appropriate PMP.

Section 5.2, Inflow Design Floods

Minnkota Comment #22: Previous Minnkota comments address the various observations made by GEI relative to the application of Inflow Design Floods to these facilities, and the fact that no dam break analyses have been performed for the alternate bottom ash pond or Cell 1 or Cell 2. GEI acknowledges that contributing drainage areas are non-existent (in the case of the alternate bottom ash pond), or are limited (in the case of Cell 1 and Cell 2) due to the perimeter dikes and topography. At the time of permitting these solid waste management units were never proposed or permitted as "dams" under North Dakota's existing regulations, therefore dam standards and classifications were not developed.

Section 5.2 Inflow Design Floods (second paragraph)

"Based on observations during the field inspection, we recommend Cells 1 and Cell 2 be rated a "Significant" hazard dam."

Minnkota Comment #23: Minnkota would like GEI to provide more clarification in this section, describing what *"observations during the field inspection"* led to the classification as a

"Significant" rating. It may be appropriate, however it is an important statement, and therefore should be supported. According to the North Dakota Dam Design Handbook, Cell 2 would most likely be rated as a low hazard Class III dam.

Because Cell 1 is in a substantially dewatered condition, and is being used as a dry waste landfill, Minnkota repeats its objection to the classification of Cell 1 as an impoundment for the purpose of applying a dam classification. See **Minnkota Comment #2.**

Subsection 5.2.1 ABP, (second paragraph)

"The maximum operating water level is approximately El. 1957.3' which provides about 2.7 feet of freeboard."

Minnkota Comment #24: The operation of the ABP requires the installation or removal of stop logs which controls the flow exiting the pond. Typical operation requires six stop logs to be installed which limits water elevation to El. 1953' providing seven feet of freeboard. This significantly exceeds the 6-inch impact of a 6-hour 30 percent PMP. While GEI correctly states the maximum operating water level, in practice, the operating level is much lower.

Subsection 5.2.2 Cell 1 and Cell 2

"At the time of the site visit, there was a limited amount of water observed in Cell 1. Any water in Cell 1 was maintained with a minimum of 2 feet of freeboard."

Minnkota Comment #25: Cell 1 is a dry waste landfill. It has not been used as an impoundment since 2005. This statement implies that Cell 1 being used as an impoundment.

Section 5.3 Spillway Rating Curves

"The three CCW impoundments do not have emergency spillways".

Minnkota Comment #26: This statement could be potentially alarming to someone believing these facilities are "dams" in the traditional sense. As concluded by GEI in their evaluation, the impoundments meet and significantly exceed the required storage due to a major precipitation event. Minnkota requests clarification of this statement, to the effect that *"The impoundments do not have emergency spillways because they are always operated with substantial freeboard and are not subject to overtopping as a result of an extreme precipitation event."*

7.0 Instrumentation

Section 7.1 Location and Type (first paragraph)

"There are no instruments installed at the CCW impoundments. According to the project drawings, there are monitoring wells along the Cell 1 east embankment and the divider dike between Cell 1 and Cell 2; however, the monitoring wells are for environmental purposes and readings are not analyzed with respect to dam safety."

Minnkota Comment #27: Both statements are incorrect. The active impoundment (Cell 2) has surveyed markings on the concrete dewatering structure. Minnkota utilizes these markings to measure impoundment water level, relative to this surveyed datum.

There are monitoring wells, referred to as piezometers, surrounding the facility. Although these wells are indeed for environmental purposes (groundwater quality monitoring), another one of their purposes is to act as an "early warning" system to monitor for water in the embankment. To state *"no instruments are installed"* is incorrect.

Subsection 7.2.1 Flow Rates

"Flow rates are not recorded at the CCW impoundments."

Minnkota Comment #28: This is incorrect. All water discharges into Cell 2 are known since all discharges are from pumps at the plant site. The return water from Cell 2 is controlled by the scrubber control room operators, and all return water flow rates are captured real time by flow transmitters. The data from the flow transmitters is logged by the distributed control system, as well as by a separate computerized historian software program.

Flows to the alternate bottom ash pond are also pumped, or known flows. Discharges from the alternate bottom ash pond are monitored daily by operators, who estimate flow by measuring the depth of flow in the discharge pipe. These outflow estimates are used by Minnkota to complete the monthly discharge monitoring reports required by the Station NDPDES permit.

Subsection 7.2.2 Staff gauges

"There are no staff gauges at the CCW impoundments"

Minnkota Comment #29: This statement is incorrect. See **Minnkota Comment #27.**

Section 7.3 Evaluation

Minnkota Comment #30. Minnkota requests this section to be rewritten, in consideration of Minnkota Comments 27, 28, and 29.

8.0 Field Assessment

Subsection 8.4.4 Water Surface Elevations and Reservoir Discharges

"Minnkota personnel indicated that any water in Cell 1 was maintained with a minimum of two feet of freeboard."

Minnkota Comment #31: For clarity, Cell 1 was being utilized as a dry waste landfill at the time of the facility visit. The statement implies the cell was in service as an impoundment. It is true that during the facility's useful life as an impoundment, a minimum of two feet of freeboard was maintained. In fact, a minimum of seven feet of freeboard was maintained (See **Minnkota Comment # 12**).

9.0 Structural Stability

Section 9.6 Summary of Results

"No slope stability analyses have been performed for the Alternate Bottom Ash Pond."

Minnkota Comment #32: These ponds were designed by Ebasco Services Incorporated in approximately 1984. Due diligence by the engineering firm would have been to conduct the appropriate slope stability analyses during their engineering design of the facility. Minnkota has a subsurface investigation, specifications, and design drawing for the facility, therefore it is likely that a slope stability analysis was performed, although Minnkota does not possess a copy of such an analysis.

Section 9.6 Summary of Results

"Based on the Barr Engineering Co. analyses, the stability analyses that have been performed for the embankments at Cells 1 and 2 exceed the minimum required factors of safety; however, consideration should be given to analyzing the divider dike between Cell 2 and Cell 3. It is likely this section would result in a lower factor of safety than the downstream slope analyzed because the slope is steeper, and the factor of safety could be lower than 1.5.

Minnkota Comment #33: Barr Engineering Co. has re-evaluated the divider dike between Cell 2 and Cell 3, and has provided a slope stability analysis, which is attached for your use. Appropriate factors of safety are present.

10.0 Maintenance and Methods of Operation

Section 10.1 Procedures (first paragraph)

"Minnkota does not have a formal operational and maintenance manual in which standard operating procedures exist for the CCW impoundments.

Minnkota Comment #34: Minnkota has a formal Facility Operations Plan for Cell 2. This plan was part of the facility Permit Application. Detailed facility inspections are made monthly. As a practical matter, scrubber operators, BNI Coal, Ltd., personnel, Minnkota ash handling personnel, and the environmental department engineer responsible for the site all visit the site frequently, for varying reasons.

Minnkota also has a basin operating procedure for the Alternate Bottom Ash Pond.

Copies of these plans are attached for your information.

11.0 Conclusion

Subsection 11.1.2 Adequacy of Structural Stability

"No slope stability analysis exists for the Alternative Bottom Ash Pond."

Minnkota Comment #35: See **Minnkota Comment #32**. As stated on Page 25 of the Draft Report "The dikes at the Alternate Bottom Ash Pond are Low Hazard structures…."

Subsection 11.1.2 Adequacy of Structural Stability

"..however, consideration should be given to analyzing the divider dike between Cell 2 and 3."

Minnkota Comment #36: Barr Engineering Co. has re-evaluated the divider dike between Cell 2 and Cell 3, and has provided a slope stability analysis, which is attached for your use. Appropriate factors of safety are present.

Subsection 11.1.3 Adequacy of Hydrologic/Hydraulic Safety

Minnkota Comment #37: The hydrologic capacity of the impoundments is limited to direct precipitation, or only a very limited amount of run-in from the top of the impoundment berm. Therefore, a "site flood study" is not necessary, and would be a costly exercise for already apparent results. These structures do not lie within water courses where traditional flood studies would be merited.

A stage-storage curve for Cell 2 is attached.

Subsection 11.1.4 Adequacy of Instrumentation and Monitoring of Instrumentation

"Instrumentation and monitoring programs are considered inadequate for the current facility operations."

Minnkota Comment #38: Minnkota does not believe our instrumentation and monitoring programs are inadequate for the current facility operations. Please refer to Minnkota Comments 27, 28, 29, and 30. Due to the facility design factors of safety and the quality control exerted during construction, settlement monuments have never been considered.

Subsection 11.1.5 Adequacy of Maintenance and Surveillance

"... however there are currently no staff members trained in dam safety inspections."

Minnkota Comment #39: Minnkota strongly disagrees with this conclusion. At the time of the inspection, the qualifications of Minnkota staff to perform dam inspections were not addressed by GEI.

The following discussion is given to substantiate the qualification of Minnkota personnel as regards their qualifications to conduct dam safety inspections.

Craig Bleth, Plant Environmental Superintendent, is a registered professional civil engineer. Craig Bleth conducted quarterly Nelson Lake Dam inspections from 1990 to 2006. Mr. Bleth also participated in four formal North Dakota State Water Commission Nelson Lake Dam inspections and numerous other Barr Engineering Company Nelson Lake dam inspections.

Scott Hopfauf, a geological engineer in the plant environmental department since 2006, currently has responsibility for the quarterly Nelson Lake Dam inspections, as well as the waste management facility inspections. Mr. Hopfauf has attended the following trainings related to dam safety inspections:

- Safety Evaluation of Existing Dams, May 12-16, 2008 – Golden, CO
  Provider of Training - US Department of the Interior Bureau of Reclamation
- Need-to-Know Basics of Owning a Dam, December 2, 2008 – Bismarck, ND
  Provider of Training - Association of State Dam Safety Officials
- Classroom Dam Operator Training, February 2, 2010 – Bismarck, ND
  Provider of Training - US Department of the Interior Bureau of Reclamation

The conclusion that no current staff members are trained in dam safety inspections is incorrect.

Subsection 11.1.5 Adequacy of Maintenance and Surveillance

There are currently no scheduled inspections by state regulators or third party engineering companies experienced in dam safety inspections."

Minnkota Comment #40: The state regulators (NDDH) visit the site at least annually. Although these inspections are not aimed specifically at performing detailed dam safety inspections, such inspections would result in any obvious dam safety issues being noted.

Site visits by design engineers from Barr Engineering commonly take place several times during construction. Barr also makes visits to the site between construction events. Whether during construction or not, these visits typically involve facility tours and walk-arounds. Typically these visits are not documented as "impoundment safety inspections", however in the future it is Minnkota's intention to have Barr perform such inspections, and document them.

12.0 Recommendations

Section 12.1 Corrective Measures and Analyses for the Structures

Minnkota Comment #41:

1. Minnkota agrees that the erosion observed west of Cell 1 must be repaired. Repair to such areas is on-going, and it is a typical task of Minnkota's to inspect and repair as necessary.

2. Barr has re-checked the factors of safety of the divider dike between Cells 1 and 2. Appropriate factors of safety are present.

3. The hydrologic capacity of the impoundments is limited to direct precipitation. Therefore, there is no design "flood." A "site flood study" is not necessary, and would be a costly exercise for already apparent results. These structures do not lie within water courses where traditional flood studies would be merited.

Section 12.2 Corrective Measures Required for Instrumentation and Monitoring Procedures,

Minnkota Comment #42: As expressed earlier, instrumentation does exist and is used to monitor level and performance of the Cells.

Section 12.3 Corrective Measures Required for Maintenance and Surveillance Procedures.

Minnkota Comment #43: Minnkota's facility design engineer, Barr Engineering Company, is on-site during all impoundment construction activities, often for four to five months at a time. Site visits by design engineers from Barr Engineering commonly take place several times during construction. Barr also makes visits to the site between construction events. Whether during construction or not, these visits typically involve facility tours and walk-arounds. Typically these visits are not documented as "impoundment safety inspections", however in the future it is Minnkota's intention to have Barr perform such inspections, and document them.

Section 12.5 Basis of Assessment

Minnkota Comment #43: Minnkota has responded to each of the "bullets" in this section in previous responses. Please see the appropriate comments above.

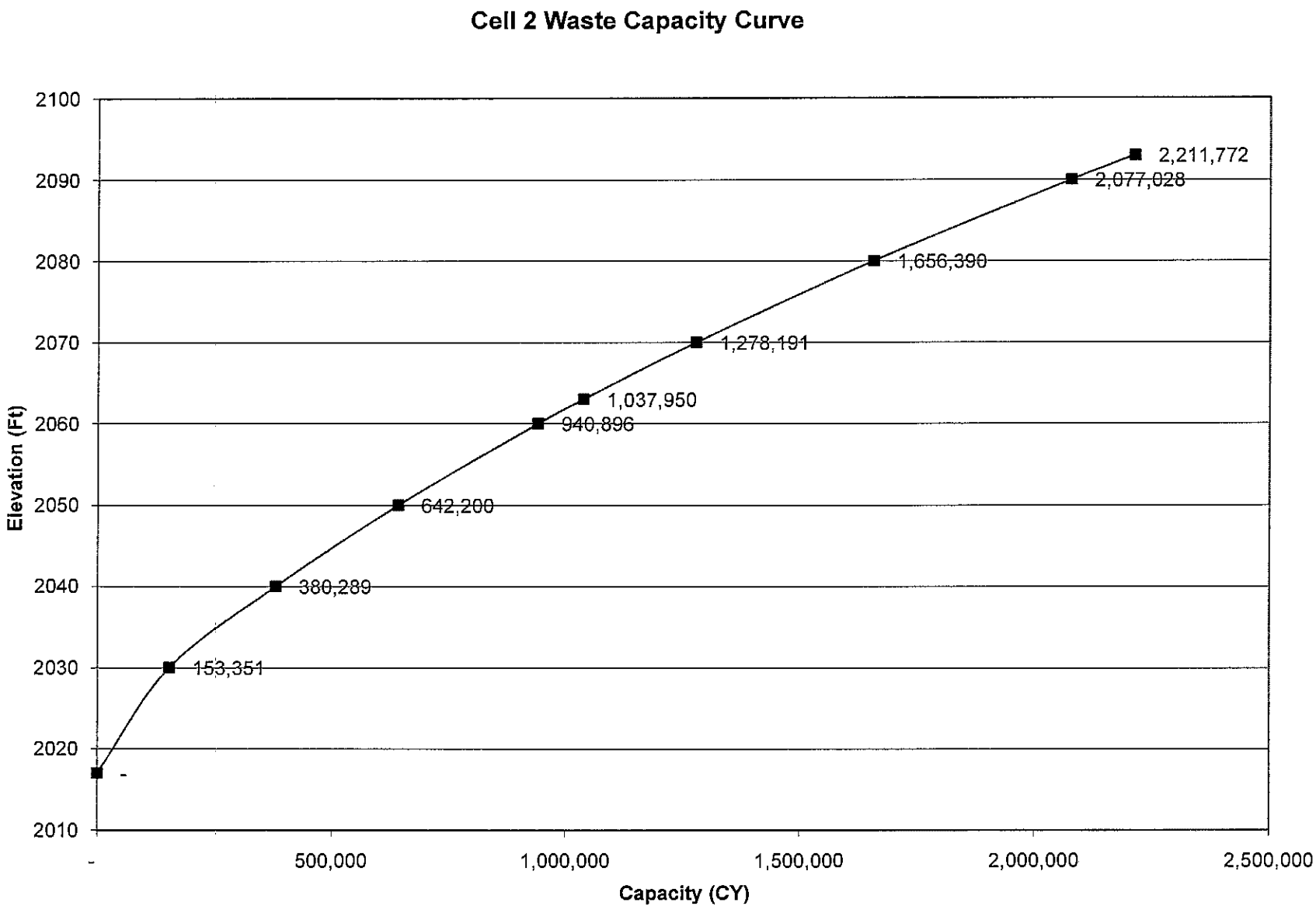

Figure 1
Cell 2 Waste Disposal Capacity

SECTION 4.0

FACILITY OPERATIONS PLAN

4.1 Introduction

This plan describes the operational procedures and administrative controls for efficient, environmentally sound operation of the FGD Sludge Disposal Facility. Copies of this plan will be kept at the plant site at all times for reference by facility personnel and State Agency inspection personnel.

4.2 Facility Description

The FGD Sludge Disposal Facility consists of three primary cells, each having an approximate life of 10 years. Each cell is further subdivided into phases. The initial phase of a cell includes the gradient control system, the dewatering system, the sump, and initial portions of the liner and sidewall riser system. Subsequent phases include additional sections of liner and sidewall riser. The final phase of a cell includes the final sections of liner, sidewall riser, overflow structure, and dewatering system pump and lift station.

The first activity in developing a cell will be stripping suitable plant growth material from the surface and excavation of soil down to the Hagel Bed. Perimeter dikes will be constructed using excavated material and coal will be removed from the basin floor. Excavated clay soil will be stockpiled for future liner construction. After coal removal, a gradient control system may be constructed at the southern side of the cell to collect and drain groundwater to a sedimentation basin. Excavated clay will be used to construct the liner upon all interior surfaces in the cell. A dewatering system will be constructed upon the clay liner, this consisting of perforated piping surrounded by granular bedding and covered with granular drainage material. Slurry discharge and decant return pipelines will then be constructed. Slurry discharge and decant return piping will be mounted on floating barges to enable discharge and decant pipe access to all areas of a cell. Reference may be made to the Facility Designs Plan in Section 3.0 for a detailed description of the facility design.

4.3 Site Development Timetable

The disposal facility will be filled in three cells, beginning in 1997. Each cell should allow sludge disposal for approximately 8 to 10 years, with facility closure expected for 2024. Dewatering of the sludge and subsequent settlement may provide increased disposal capacity and allow filling to occur an additional 1 to 2 years in each cell.

Cell 1, located in the northernmost portion of the disposal site, encloses a surface area of approximately 27 acres and is sized to contain approximately 1,800,000 cubic yards of solids. Based on an approximate filling rate of 225,000 cubic yards per year, it is anticipated that filling in Cell 1 will continue until approximately 2005. At that time, it will be necessary to begin filling in Cell 2, located immediately south of Cell 1, and to begin closure measures for the Cell 1 fill area. To ensure that adequate disposal capacity is available at all times, it is anticipated that construction (including site stripping, coal removal, and liner construction) of Cell 2 will begin in 2002.

Cell 2, located in the central portion of the disposal site, encloses a surface area of approximately 30 acres and is sized to contain approximately 2,000,000 cubic yards of solids. Based on an approximate filling rate of 225,000 cubic yards per year, it is anticipated that filling in Cell 2 will continue until approximately 2014. At that time, it will be necessary to begin filling in Cell 3, located immediately south of Cell 2, and to begin closure measures for the Cell 2 fill area. To ensure that adequate disposal capacity is available at all times, it is anticipated that construction of Cell 3 will begin in 2011.

Cell 3, located in the southernmost portion of the disposal site, encloses a surface area of approximately 32 acres and is sized to contain approximately 2,300,000 cubic yards of solids. Based on an approximate filling rate of 225,000 cubic yards per year, Cell 3 should provide capacity for approximately 10 years of solids disposal, with Cell 3 closure activities expected to begin in 2024. Table 4-1 summarizes the anticipated site development timetable. The timetable will be adjusted as necessary during operation to account for variations that may occur in utilization of cell capacity.

4.4 Site Operating Procedures

4.4.1 General Filling Procedures

The site will be operated by MPC. The Facility will normally operate on a 24-hour work day and a 7-day work week to manage the average solids disposal requirement of 615 cubic yards per day. Facility operation should be sequenced to fit the ultimate development plan. FGD sludge disposal will proceed so to avoid problems with stability, drainage, and dust generation.

The overall development concept of the facility involves a continuous process of the phased deposition of sludge while ponding, solids settlement, and consolidation. The water that is impounded during this process is to be returned to the plant for reuse in the scrubber system. Alternatively, impounded water may be diverted to an operational pond for further clarification.

Facility operations should be adjusted as necessary to account for variable weather conditions anticipated at the site.

Winter operations will require snow removal on access roads and ramps. This will be provided by plant and facility equipment as required.

4.4.2 Nuisance Control

4.4.2.1 Dust Control

Dust generation from operations equipment generally should not be significant with the facility design as proposed. The primary source of dust generation will be from construction vehicles during facility construction. Dust generation during construction will be controlled as required by the Technical Specifications. During facility operation the FGD sludge will be deposited in a slurry form, with the waste surface generally being submerged or in a saturated condition. Therefore, dust emissions from the waste surface are not anticipated.

4.4.2.2 Fire Protection

All operations equipment on-site should be equipped with dry chemical fire extinguishers which can be used on small grass and equipment fires. If a fire becomes uncontrollable, BNI Coal Ltd. or the Center Fire Department should be called for assistance in extinguishing the fire.

4.4.3 Drainage and Erosion Control

Drainage of water from the sludge as well as any stormwater runoff into the cell is collected as decant water for return to the plant. The dewatering system will also transfer water accumulated from downward percolation through the drainage layer. Runon and runoff of precipitation is minimal at the site as all watersheds east and west of the site drain away from the Facility. Runon from the south will be intercepted by a drainage trench and transferred to a suitable location.

Surface erosion can be minimized during active cell operations by maintaining surface and side slopes, and collecting and routing of stormwater into drainage ditches for transport to the sedimentation ponds. Upon closure of solids fill areas, the top and side slopes of the site are to be graded, sloped to drain, covered and vegetated to provide long-term erosion control. Short-term erosion control (i.e., mulch, silt fences, etc.) will be provided to prevent erosion of rooting soil until significant vegetation has been established.

4.4.4 Dewatering System

The facility liner consists of a clay layer on the base and sideslopes, overlain by a granular drainage layer consisting of bottom ash or sand on horizontal portions of the liner. The dewatering system will transfer any water from the base of the cell to the adjacent cell. Free liquid will be returned by the decant barge to the plant for reuse in the scrubber system or will be sent through an overflow structure to the next cell.

4.4.5 Environmental Monitoring

Regular procedures consist of sampling groundwater monitoring systems. This monitoring is described in the Facility Monitoring Plan presented in Section 5.0.

4.5 Personnel Training

Appropriate facility personnel shall be trained to operate the site in accordance with the facility permit and to deal effectively with problems at the site including:

- Using, inspecting, repairing and replacing facility emergency and monitoring equipment.
- Activating communications and alarm systems.
- Responding to fires.
- Responding to facility failures, including erosion and failure of liners or monitoring devices.
- Responding to groundwater or surface water pollution incidents.

The adequacy of personnel training and familiarity with the site Contingency Action Plan should be reviewed by the MPC Environmental Department on an annual basis, with training updated as the facility is modified. Records of training will be included with other operations records and maintained on site.

4.6 Inspection and Reporting Requirements

Records of operation, monitoring, and inspections at the site should be submitted to the North Dakota State Department of Health and Consolidated Laboratories on an annual basis. The reporting will include the items

summarized below. Records will be retained by MPC for a minimum of five years after site closure.

4.6.1 General Inspection Requirements and Records

4.6.1.1 Preliminary Inspection

According to Subsection 33-20-04.1-04(1), a solid waste management facility cannot accept solid waste until the department has approved a report verifying proper construction of the facility. After constructing each cell and prior to discharging waste into the cell, an inspection shall examine critical aspects of the facility design to verify that the cell has been constructed in accordance with both the approved plans and the permit. A report summarizing the inspection will include:

- "as-built" or record drawings
- test results of soil properties and groundwater monitoring wells
- Professional Engineer certification that the impoundment dike and liner have structural integrity

4.6.1.2 Routine Inspections

A site inspection schedule for inspecting monitoring equipment, safety and emergency equipment, security devices, survey monuments, drainage systems and sedimentation basins is contained in Table 4-2. Table 4-3 lists items which will be inspected during monthly and semiannual site inspections.

Results of an inspection will be documented in an inspection log maintained at the facility for the duration of its operation. This and other records of operation will be retained at least five years. Records involving enforcement actions will be retained until the action is resolved. Inspection records will include at least the following information:

- Date and time of the inspection
- Name of inspector
- List of observations made

- Date and nature of any repairs or other actions taken

4.6.2 Monitoring Well Construction and Sampling Records

Monitoring well construction and sampling records will be kept as follows:

- Accurate records of soil and rock types encountered during drilling (i.e., boring log and well installation diagram).

- Record of monitoring well construction including soil and well construction log, Unique Well Number, copy of water well record submitted to the North Dakota State Department of Health, log of geophysical testing (if done), well development data, record of any other measurements or tests done on well, surveyed location and elevation of wells, and revised facility plan sheet showing well locations.

- Well sealing records will include: well name, surveyed location, elevation of top of each casing and the ground surface, casing material type and diameter, Unique Well Number, depth of well (prior to sealing), type and quantity of seal materials, well seal installation method and verification by a water well contractor licensed, or an engineer registered, under rules of North Dakota.

- Record of routine inspection of all monitoring points.

- For groundwater sampling: record of procedures, measurements, the condition of the monitoring point, and documentation as to whether the procedures comply with the requirements of the site Groundwater Monitoring Plan.

4.6.3 Annual Report

An annual report will be prepared and submitted to the North Dakota State Department of Health and Consolidated Laboratories no later than March 1 (unless otherwise required by the permit) for the preceding calendar year. The annual

report will cover all facility activities during the previous calendar year and include the following:

- The permit number, name, and address of the facility.
- The year covered by the report.
- The approximate quantity of waste disposed.
- The remaining capacity for disposal of waste at the facility.
- An assessment of the adequacy of the closure, postclosure care, and contingency action plans.
- A summary and evaluation of the groundwater monitoring program.
- Identification of occurrences and conditions that prevented compliance with the permit or required corrective actions.
- A summary of facility personnel training activities.

4.6.4 Emergency Reporting Requirements

An emergency will be defined as a fire, explosion, or any release to air, land, or water of pollutants that threaten human health and the environment. When an emergency occurs at the site, reference will be made to the Contingency Action Plan for a description of the appropriate response and notifications required.

TABLE 4-1
FGD SLUDGE DISPOSAL FACILITY
SITE DEVELOPMENT TIMETABLE*

Year	Total Capacity Start-of-Year (yd^3)	Construct**		Capacity Constructed (yd^3)	Capacity Used (yd^3)	Capacity Remaining End-of-year (yd^3)
		Cell	Phase			
1996	0	1	1	340,000	0	340,000
1997	340,000			0	225,000	115,000
1998	115,000	1	2	450,000	225,000	340,000
1999	340,000			0	225,000	115,000
2000	115,000	1	3	470,000	225,000	360,000
2001	360,000			0	225,000	135,000
2002	135,000	1	4	520,000	225,000	430,000
2003	430,000			0	225,000	205,000
2004	205,000	2	1	350,000	225,000	330,000
2005	330,000			0	225,000	105,000
2006	105,000	2	2	530,000	225,000	410,000
2007	410,000			0	225,000	185,000
2008	185,000	2	3	540,000	225,000	500,000
2009	500,000			0	225,000	275,000
2010	275,000	2	4	590,000	225,000	640,000
2011	640,000			0	225,000	415,000
2012	415,000			0	225,000	190,000
2013	190,000	3	1	410,000	225,000	375,000
2014	375,000			0	225,000	150,000
2015	150,000	3	2	620,000	225,000	545,000
2016	545,000			0	225,000	320,000
2017	320,000	3	3	620,000	225,000	715,000
2018	715,000			0	225,000	490,000
2019	490,000			0	225,000	265,000
2020	265,000	3	4	660,000	225,000	700,000
2021	700,000			0	225,000	475,000
2022	475,000			0	225,000	250,000
2023	250,000			0	225,000	25,000

* Assumes annual solids disposal rate of 225,000 yd^3. Does not account for possible increase in site life resulting from settlement of waste.

** Represents approximate year of liner construction. Site stripping and coal removed for first phase of each cell to begin two years earlier.

TABLE 4-2

FGD SLUDGE DISPOSAL FACILITY
MONTHLY INSPECTION REQUIREMENTS

ITEM	INSPECT FOR
1	Adequate Slope Maintenance
2	Adequate Liner Protection/Erosion Control
3	Adequate Freeboard
4	Adequate Surface Water Drainage
5	Vector/Rodent Control
6	Dust Control
7	Dike Integrity
8	Adequate Rooting Soil on Cover
9	Adequate Vegetation on Cover
10	Adequate Erosion Control on Cover
11	Signs of Seepage on Perimeter Dikes
12	Adequate Fire Fighting Equipment
13	Proper Equipment Storage
14	Communications Equipment Operable
15	Road Maintenance Adequate
16	Adequate Equipment Available
17	Sudden Drops in Pond Level

TABLE 4-3

FGD SLUDGE DISPOSAL FACILITY
SEMIANNUAL INSPECTION REQUIREMENTS

ITEM	INSPECT FOR	MINIMUM INSPECTION FREQUENCY
Groundwater monitoring points -	Locking cap, damaged casing, protective casing settlement, evidence of tampering, proper I.D. on well cap, soil erosion around well casing	At the same time as routine monitoring is performed
Final cover integrity -	Soil erosion, poor vegetation, rodents and burrowing animals, excessive settlement	Semiannually and after severe rainfall events
Surface Water Drainage System -	Erosion, sediment buildup, clogged pipes, integrity of energy dissipaters, uncontrolled vegetative growth	Semiannually and after severe rainfall events
Dewatering System -	Proper system performance	Semiannually
Survey monuments -	Damaged or missing monuments	Semiannually
Perimeter Dikes and Haul Roads -	Excessive settlement, rough road surface, soil erosion	Semiannually
Sedimentation Basin -	Sediment buildup, berm erosion	Semiannually

Technical Memorandum

To: Craig Bleth, Minnkota Power Cooperative, Inc.

From: Barr Engineering Company

Subject: Review of "DRAFT Specific Site Assessment for Coal Combustion Waste Impoundments at Minnkota Power Cooperative—Milton R. Young Station", GEI Consultants Inc., December 2010

Date: February 15, 2011

Project: 34/33-0014

A site specific assessment of the dam safety of coal combustion waste (CCW) impoundments was performed at Minnkota Power Cooperative, Inc. (Minnkota) FGD Disposal Facility at the Milton R. Young Station on October 20, 2010 by GEI Consultants as authorized by the U.S. Environmental Protection Agency (EPA). Results of the assessment are provided in the "DRAFT Specific Site Assessment for Coal Combustion Waste Impoundments at Minnkota Power Cooperative—Milton R. Young Station" (GEI, 2010). The assessment requested "*consideration should be given to analyzing the divider dike between Cell 2 and Cell 3 for slope stability*".

At the request of Minnkota, Barr Engineering Co. (Barr) has conducted a review and analyzed the slope stability of the divider dike between Cells 2 and 3. The review/analysis included; (1) determining an appropriate factor of safety for the divider dike, (2) a re-calculation of the stability based on final design and the actual conditions and findings since 1994 (when the first analyses were performed), and (3) re-examining the 1994 analysis to verify it meets the appropriate factors of safety for stability as originally designed. The following is a brief summary of the findings. Attachment A provides a more detailed response to the stability issue raised in the "DRAFT Specific Site Assessment for Coal Combustion Waste Impoundments at Minnkota Power Cooperative—Milton R. Young Station".

Factor of Safety Review

Since Cell 3 has not yet been constructed, the 95-foot high divider dike between Cell 2 and Cell 3 is a future condition. When constructed, the dike is a temporary condition and will be essentially "under construction" during the filling of Cell 3. When Cell 3 is filling, Cell 2 will be undergoing dewatering so

that eventually these dikes will no longer function as water retaining structures. Because of the temporary "under construction" phase of the dike, a factor of safety of 1.3 is allowable. The appropriate Factor of Safety for "under construction" phase of work is referenced in the Strength of Materials for Embankment Dams prepared by the United States Society on Dams (USSD), February 2007 (Included in Attachment C). As shown in the referenced USSD document, a Factor of Safety for Construction and End of Construction Conditions of 1.3 is accepted by both the Federal Energy Regulation Committee (FERC) and the U.S. Army Corps of Engineers (USACE).

Re-calculation of Stability with actual conditions and findings since 1994

Barr has updated the slope stability analysis for the planned future interior dike between cells 2 and 3 during the "under construction" phase, when Cell 2 is full and Cell 3 is just being constructed. This condition was analyzed using 2.5H:1V slopes, 95 feet high excavation, with the excavation to below the Hagel Coal Bed. The updated soil strengths used in the updated modeling are based on the current design and the actual conditions encountered in the field over the last 17 years (soil data is provided in Attachment D). Furthermore, the analysis very conservatively assumes that Cell 3 is excavated to its full depth below the hagel bed, but remains unfilled, and that a phreatic surface will have developed. The slope stability under these conditions was modeled and resulted in a factor of safety of 1.82 (Modeling results are provided in Attachment B). Thus, the modeling of actual conditions indicates that the interior dike between Cell 2 and Cell 3 meets all standards and regulations for stability and is acceptable for the planned future design conditions.

Re-examination of the 1994 Analysis

The original design in 1994 contemplated the potential removal of the coal beneath the divider dikes and constructing the divider dike with the excavated sandstone and claystone placed in a semi-compacted condition. The stability analysis (Barr, 1994) for this condition had factors of safety of 1.5 or greater for the interior and exterior dikes—using conservative uncompacted soil strengths (rather than intact sandstone and/or claystone strengths) and a slope of 3H:1V. The re-created slope stability model with a dike slope of 2.5H:1V, 95 feet high and the semi-compacted soil strengths, resulted in a factor of safety of 1.31. This factor of safety is acceptable, but of no consequence, since actual conditions are different from what was assumed in 1994. The actual design condition as it currently exists is to leave the coal in-place beneath the interior dikes and maintain the intact sandstone and claystone as the dike material.

In summary, the stability review of the interim divider dike between Cell 2 and Cell 3 focused on three key items; (1) the appropriate Factor of Safety, (2) the resulting Factor of Safety for the as-designed condition using intact rock strengths, and (3) the resulting Factor of Safety using the "under construction" conditions presented in the 1994 analysis that allowed Minnkota Power the flexibility to recover the coal and construct the divider dikes from fill rather than using the intact rock. The review provided the following conclusions:

1. A Factor of Safety of 1.3 is appropriate for the divider dikes since the cells are considered "under construction" because the fully excavated slope to a depth of 95 feet is only temporary.
2. A detailed analysis depicting actual design and the existing rock strength conditions design with Cell 2 at capacity yields a Factor of Safety of greater than 1.8 and meets all regulatory guidelines
3. A review of the 1994 analysis yields an acceptable Factor of Safety of greater than 1.3 if the intact rock was replaced with semi-compacted fill for the dike material and the dike height is 95 feet high, with a 2.5H:1V back slope, and Cell 2 full of water. This scenario is no longer relevant for Cells 2 and 3 as soil strengths are better than conservatively assumed in 1994.

The review and analysis of slope stability for the interim divider dike between Cell 2 and Cell 3 confirms that the dike meets the Factor of Safety criteria established by FERC and the USACE for stability.

Attachment A

Detailed Review of the Stability Analysis

Technical Memorandum

To: Craig Bleth, Minnkota Power Cooperative, Inc.
From: Barr Engineering Company
Subject: Attachment A – Detailed Documentation of Slope Stability Review
Date: February 7, 2011
Project: 34/33-0014

The original slope stability analysis was completed by Barr Engineering Co. (Barr) in 1994 as part of the Permit Application for Minnkota Power Cooperative, Inc. (Minnkota) Milton R. Young Station Flue Gas Desulfurization (FGD) Sludge Disposal Facility. The original slope stability analysis looked at several scenarios for the interior and exterior slopes and assumed the entire dike sections would be constructed with semi-compacted fill material. In all applicable cases, the modeling showed the resulting Factor of Safety for slope stability would be greater than 1.5 which meets all standards and regulations for stability. This memorandum has been prepared to provide detailed documentation of the updated slope stability review for the divider dike between Cells 2 and 3 as requested by Minnkota.

Provided below, a detailed review re-creates the original slope stability analysis performed in 1994. The review determines the original assumptions are far too conservative and do not replicate actual conditions found in the field. However, the original assumptions are utilized to show the Cell 2-3 divider dike meets the applicable Factor of Safety for stability utilizing the conservative "minimum" conditions. Additionally, the divider dike was modeled using data obtained from field conditions encountered over the last 17 years. The updated model depicting actual conditions shows the resulting Factor of Safety for stability exceeds all standards and regulations. The following paragraphs provide the detailed documentation of the review.

Summary of Barr's 1994 Slope Stability Analysis—Conservative assumptions were used to assess slope stability and factors of safety were found to be acceptable

Preliminary designs were developed for Cells 1, 2, and 3 in 1994 as part of the Minnkota Power Cooperative FGD Permit Application to the North Dakota State Department of Health (Barr, 1994). As

part of the preliminary design, computations were provided for storage volumes, seepage through proposed liner, and slope stability.

The software program Slope/W (stability model developed by GeoStudio) was utilized to model the factor of safety of proposed dikes based on soil strengths from soil laboratory testing. Stability models were performed for both the interior cell and exterior slopes. Interior slopes were assumed to be 2.5H:1V and have a max height of 30 feet due to ash buttress and phased construction. The following interior cases were modeled:

1. Rapid Liner Construction (Case 1)
2. Liner Construction (Case 2)
3. Facility Operations – Early Stages (Case 3a and 3b)
4. Facility Operations – Late Stages (Case 4)
5. Liner Failure-Rapid Drawdown (Case 5)
6. Deep Rotational Failure (Case 6)

In each of these cases total and effective soil strengths for the entire embankment were assumed to be equal to strengths for those of the liner material. As a result the stability models are conservative as subgrade soils are anticipated to have higher strengths than the clay liner. Soils strengths assumed for interior dike stability modeling are presented below in Table 1.

Table 1. Interior Dike Soil Strength Parameters Assume din 1994 Analysis

Soil	Unit Weight (pcf)	Friction Angle (deg)	Cohesion (tsf)
Effective	94	23.9	0.16
Total	115	19.4	0.05

Exterior slopes were modeled at 3H:1V at a height of 95 feet. Models for the exterior dikes assumed an ineffective liner with a phreatic surface developed from a maximum pool on the interior slope to the exterior toe. Average and minimum soil strengths were applied to three soil types for the exterior analyses. Table 2 presents the soil strengths assumed in the 1994 models.

Table 2. Exterior Dike Soil Strength Parameters Assumed in 1994 Analysis

Layer	Unit Weight (pcf)	Minimum Strength Parameters		Average Strength Parameters	
		Friction Angle (deg)	Cohesion (tsf)	Friction Angle (deg)	Cohesion (tsf)
Liner	130	25	0	25	0
Soil 1	127	27	0	31.6	0
Soil 2	127	27	0	31.6	0

Results of the exterior dike modeling show all cases met a factor of safety greater than 1.5 (Barr, 1994). Similar to the interior dike modeling the exterior models are believed to be conservative given that the native subgrade is anticipated to be stronger and the affects of clay liner are not accounted for in the original modeling.

Given the results from the 1994 modeling the dike designs were deemed adequate for both interior and exterior dikes. Consequently, all cells are deemed safe even assuming very conservative conditions.

The actual facility was constructed in a manner that increased overall slope stability

Currently, Cells 1 and 2 are constructed to the full height. Cell 3 has not been constructed, but some excavation (up to 30-feet) has occurred on the downstream side of the Cell 2, Cell 3 dike. No instabilities were observed during the construction of the interior divider dike between Cell 1 and 2.

The exterior slopes were modified to 4.5H:1V due to soil material balance issues.

Passive design elements prevent saturated dike conditions. The facility has also been constructed with drainage features that improve slope stability, and help to ensure that the conservative conditions modeled (saturated dike condition) never occur. The exterior dikes, below the Hagel Bed elevation are designed and constructed with a layer of granular random fill and a graded filter at the toe of the exterior dike, to allow water to drain effectively and safely from the Hagel Bed. Thus, protecting against a saturated dike with a passive system—and thus preventing one of the conservative assumptions used in the stability modeling. In addition, the facility design and the construction of Cell 1 and 2 also include an active,

mechanical system that could be utilized to drain water from the Hagel Bed. A drain system has been placed at the base of the Hagel Bed coal, adjacent to the clay liner—while appreciable amounts of water have never been present in the Hagel Bed, the system is designed as a contingency control measure that could be used to remove water from the Hagel Bed should it accumulate.

Actual soil conditions are better than the "minimum" soil conditions modeled in 1994. It is important to note that the interior divider dikes are constructed in an area of cut, not fill, and the natural soils are competent claystones, sandstones, and siltstones (Carlson, 1973 and Barr, 2010). The natural soils above the Hagel Bed transition from predominantly clay in Cell 1 to predominantly sand in Cell 3. The analysis for the "minimum" soil conditions assumed clay placed 95 feet high. Actual conditions show maximum fill is only about 30 feet and soil conditions have improved in Cell 3. Data documenting the improved soil conditions is provided in Attachment D.

When the 1994 slope stability modeling results are reviewed and evaluated, it is important to consider the following conservative assumptions were used in the analysis.

- The 1994 models assumed a liner system which has essentially failed. With additional effort, the actual hydraulic conductivities (minimum required hydraulic conductivity to liner is 1.0x10-7 cm/sec) could be incorporated, which would be anticipated to drop the modeled phreatic surface, thus creating a more stable model of actual conditions.
- The 1994 models assume a single soil strength applies to the entire embankment. In reality approximately 30 feet of placed fill overlies native ground. The embankment material is documented to have a minimum compaction of 95% proctor and is document to primarily consist of clayey sand (Barr, 2009). Ranges of angle of friction values for dense sand range between 35 and 40 degrees for rounded sand (Das, 1998). The minimum of this range is greater than any angle of friction values used in previous modeling.
- The native material underlying the placed embankment fill is composed of claystone and sandstone. Boring logs [Barr, 2010] describe the native material as hard, well-cemented interbedded layers of clay, silt, and sandstone. These native soils are part of the Tongue River formation. Some sandstone layers within this formation have been described as being very well

cemented and cap high buttes and ridges in the area (Carlson, 1973). Consequently, the strength of these materials most likely includes a tensile strength and higher angle of friction than previously modeled in 1994. Consequently the current modeled conditions are conservative.

The existing divider dike between Cell 2 and Cell 3 are only 30-feet high on the downstream slope and are adequately modeled by the 1994 modeling

The existing dike is currently not constructed to its full height. Side slopes are 2.5H:1V as both are designed to be interior slopes with a compacted clay liner. Currently, the maximum height from native ground is approximately 30 feet near the west edge. Correspondingly, the maximum thickness of placed fill is approximately 30 feet. Below 30 feet the embankment is native ground. Per geotechnical investigations the material consists of claystone and sandstone most likely part of the Tongue River Formation (Carlson, 1973). The dike is constructed primarily of sand and sits on native claystone and sandstone (Barr, 2010). All fill placed is compacted to 95% standard proctor (Barr, 2009), is documented, and was supervised by a field engineer.

The dike in its current state is adequately assessed by the 1994 slope stability modeling. The current dike is in effect acting as an exterior dike, however, the interior dike stability analysis still applies to the current conditions observed at the site given the 2.5H:1V slope and approximate 30 feet high dike. The 1994 interior dike stability assumes weaker strength parameters and meets minimum required factor of safety conditions. Therefore existing modeling applies to the current site condition and indicates slope stability to be adequate for the existing dike.

Using the conservative 1994 assumptions, the future divider dike between Cell 2 and Cell 3 provides a factor of safety of between 1.31 (minimum soil strength) and 1.56 (average soil strengths), which is adequate for construction and at the end of construction (minimum factor of safety recommended is 1.3)

While final design of Cell 3 has not been completed, Barr has performed an updated stability analysis per Minnkota's request to review a dike condition with 2.5H:1V slope on both sides of the interior dike, with a maximum water pool elevation in Cell 2, and with Cell 3 excavated to below the Hagel Bed.

This modeling was done using Slope/W in GeoStudio 2007 (latest version of the software utilized in 1994). First, the original 1994 models were recreated with the current software to verify results. Then a

model was created explicitly for the 2.5H:1V downstream slope. Model results are presented in Attachment B and in Table 3 below.

Factor of safety recommendations summarized in United States Society on Dams, "Strength of Materials for Embankment Dams" (USSD, 2007) indicates that recommended minimum factor of safety for loading conditions at the end of construction are 1.3 per the United States Army Corp of Engineers (USACE), Tennessee Valley Authority (TVA), and FERC. (Selected pages from USSD document are included in Attachment C).

Table 3. Summary of Stability Modeling

Condition Modeled	F of S (Average Strength Values)	F of S (Minimum Strength Values)
3:1 (95 ft) – original 1994 results	1.83 – 1.97	1.54 – 1.63
3:1 (95 ft) - 2011	1.79	1.48
2.5:1 (95 ft) - 2011	1.56	1.31

Note: 1.3 is the acceptable factor of safety for construction and after construction.

These models recreated the 1994 factor of safety results in an acceptable manner—see the first two lines of Table 3.

When the 1994 modeled assumptions were modified only to account for the downstream slope, the results indicate that both the average and minimum soil strength values for the 2.5:1 slope with 95 foot high dike exceed the recommended minimum factor of safety value (1.3). However, conditions encountered in the field over the last 17 years do not match the "minimum" or "average" strength values.

Using assumptions representing actual soil and design conditions (phreatic surface), the future divider dike between Cell 2 and Cell 3 provides a factor of safety of 1.82

Models were also updated applying some estimated strength parameters which represent actual soil conditions and stratigraphy in the field. Table 4 summarizes the soil strength parameters assumed and used in the model update. Additionally, hydraulic conductivity was added to the model to simulate the effect of the clay liner.

Table 4. Summary of Estimated Actual Conditions Strength Properties

Soil	Unit Weight (pcf)	Angle of Friction (deg)	Cohesion (tsf)	Hydraulic Conductivity (ft/s)
Liner[1]	130	25	0	$3.3*10^{-8}$
Embankment Fill[2]	127	35	0	$3.3*10^{-4}$
Claystone[3]	127	27	3.1	$3.3*10^{-8}$
Sandstone[4]	127	38	5[6]	$3.3*10^{-4}$
Hagel Formation[5]	127	29.8	5[6]	$3.3*10^{-8}$

[1] Liner properties are same as previous modeled properties (Barr, 1994).
[2] Embankment fill strength properties are based on published ranges for dense, rounded sand grains (Das, 1998).
[3] Claystone strength properties are taken from published values of siltstone and shales (Goodman, 1989).
[4] Sandstone strength properties are taken from published values of sandstone (Goodman, 1989).
[5] Hagel formation strength properties are taken from published values for coals in Western Canada (Gentzis, 2007).
[6] Cohesion values for sandstone and Hagel formation are assumed. Values selected are significantly less than values published.

The model was also updated to provide results that more closely depict actual conditions. Actual conditions include: an embankment composed of placed fill, claystone, Hagel formation, and sandstone. Layer thicknesses and contact elevations are based on topography and boring logs (Barr, 2010). Additionally, hydraulic conductivity was included in the stability model using Seep/W. The phreatic surface determined from seepage modeling was imported into the stability model (The model conservatively assumes the cells will not be dewatered, thus, a phreatic surface will occur in the embankment). Stability models were performed for a 3:1 slope and a 2.5:1 slope, both with a dike height of 95 feet. Table 5 presents the resulting factor of safety values for the actual conditions.

Table 5. Summary of Assumed Actual Conditions Stability Modeling

Model Condition	Factor of Safety
3:1 Slope (95 ft.)	2.15
2.5:1 Slope (95 ft.)	1.82

Conclusion

The review determines the original 1994 stability analysis provided a basis to allow adjustments to the original design to account for changing field conditions. The review also determined the original stability analysis was very conservative and does not depict actual conditions encountered. The divider dike between Cell 2 and 3 was analyzed using the "minimum" conditions from the original stability analysis as well as utilizing conditions that more closely depicted actual conditions encountered over the past 17 years. In both cases, the Factor of Safety for stability exceeded the required 1.3 which is accepted by the USACE and FERC for construction and post construction conditions (USSD 2007).

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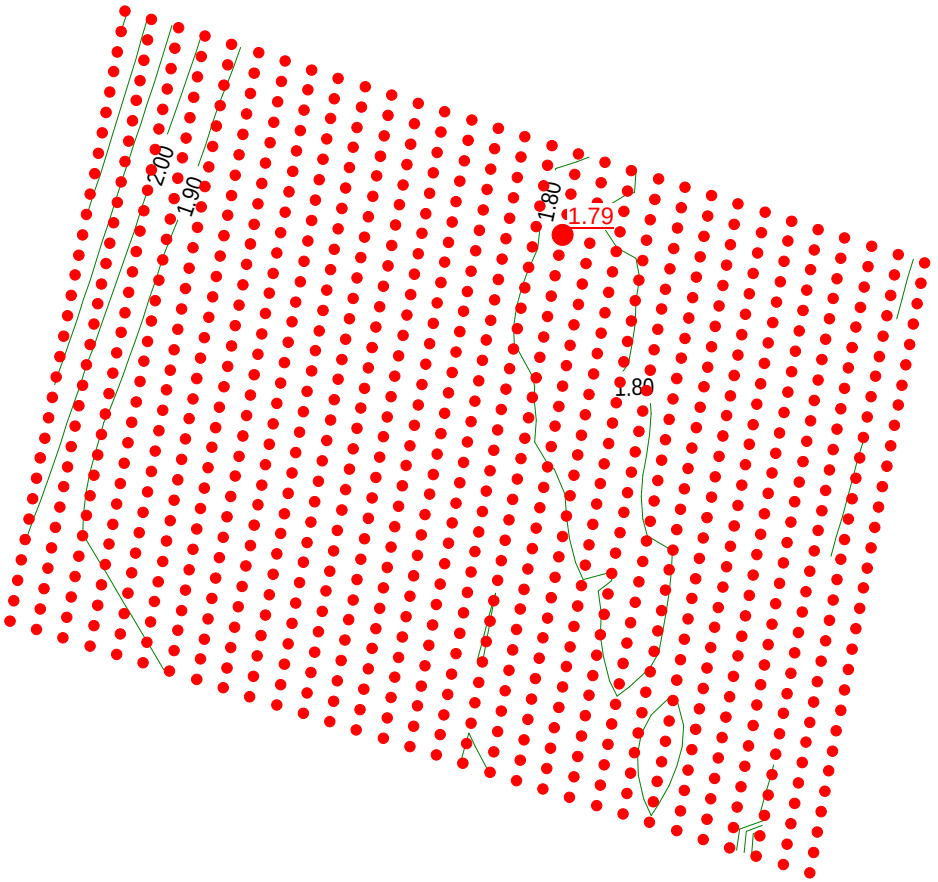
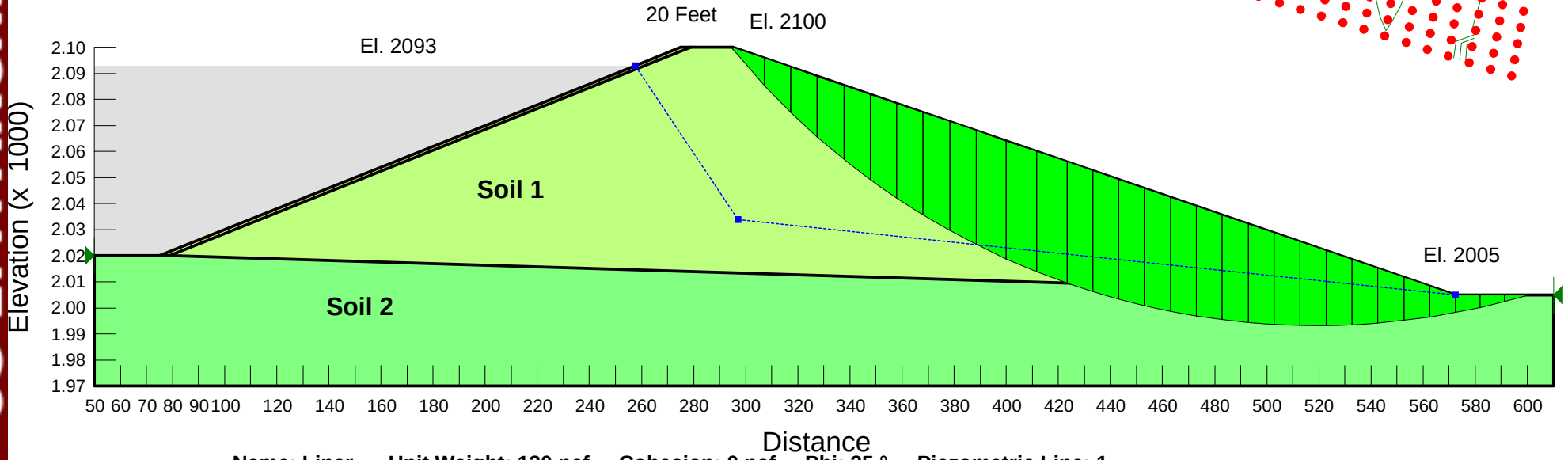
Attachment B

Geo-Studio Stability Model Results

Name: Minnkota
Description: Exterior Slope Analysis - 3:1 Slope
Method: Spencer
File Name: Cell3 - slope_analysis_3-1-95 ft-ave.gsz
Date: 2/2/2011
Slip Surface Option: Grid and Radius
Average Properties

FOS: 1.79





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Name: Soil 1 Unit Weight: 127 pcf Cohesion: 0 psf Phi: 31.6 ° Piezometric Line: 1
Name: Soil 2 Unit Weight: 127 pcf Cohesion: 0 psf Phi: 31.6 ° Piezometric Line: 1
Name: Water Piezometric Line: 1

Name: Minnkota
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Method: Spencer
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Date: 2/2/2011
Slip Surface Option: Grid and Radius
Minimum Properties

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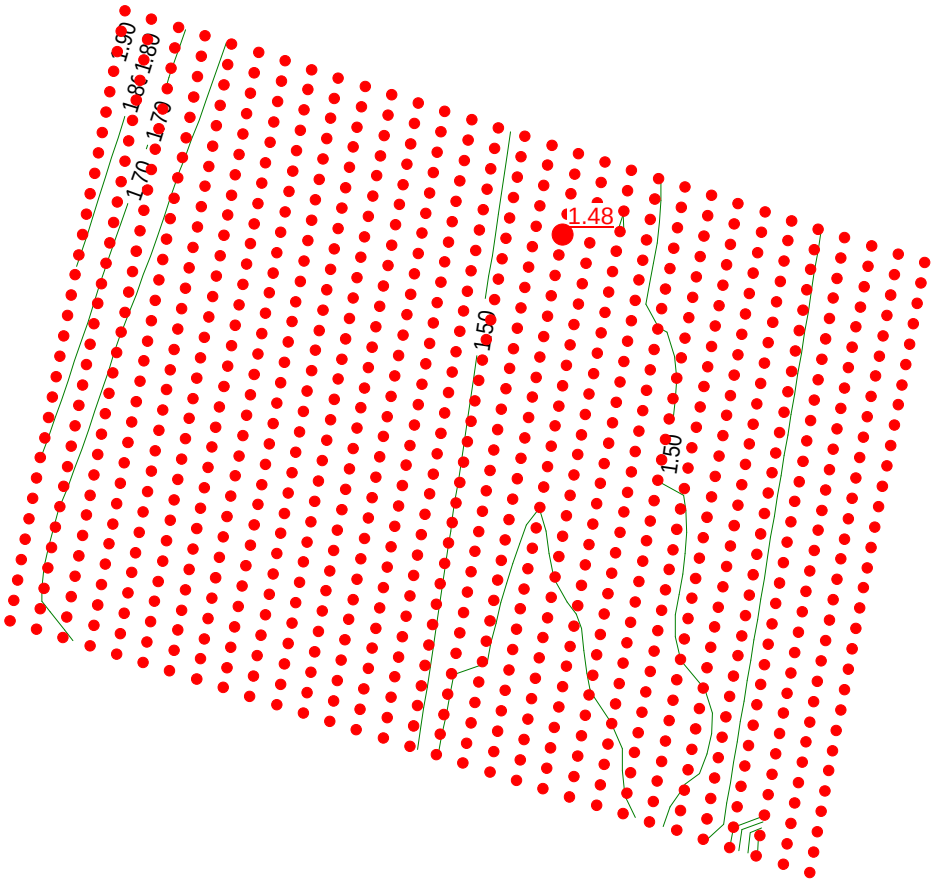

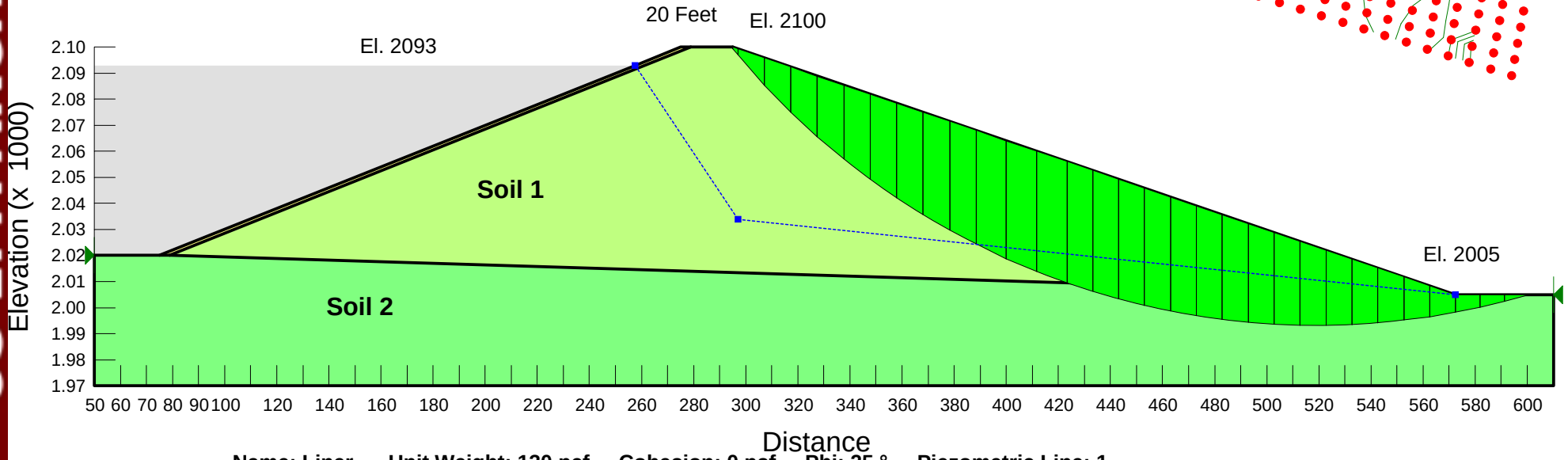

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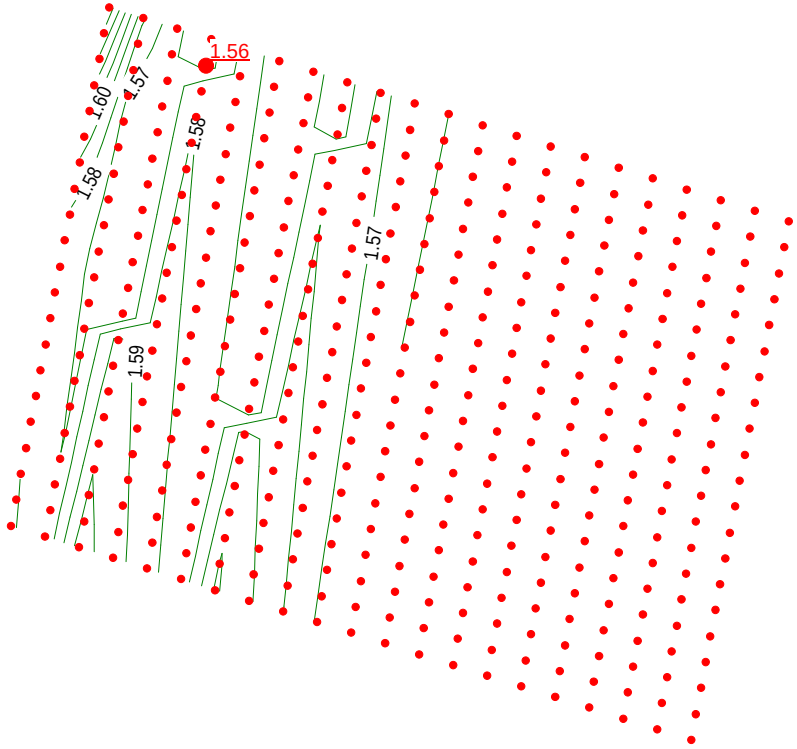

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Date: 2/2/2011
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Average Properties

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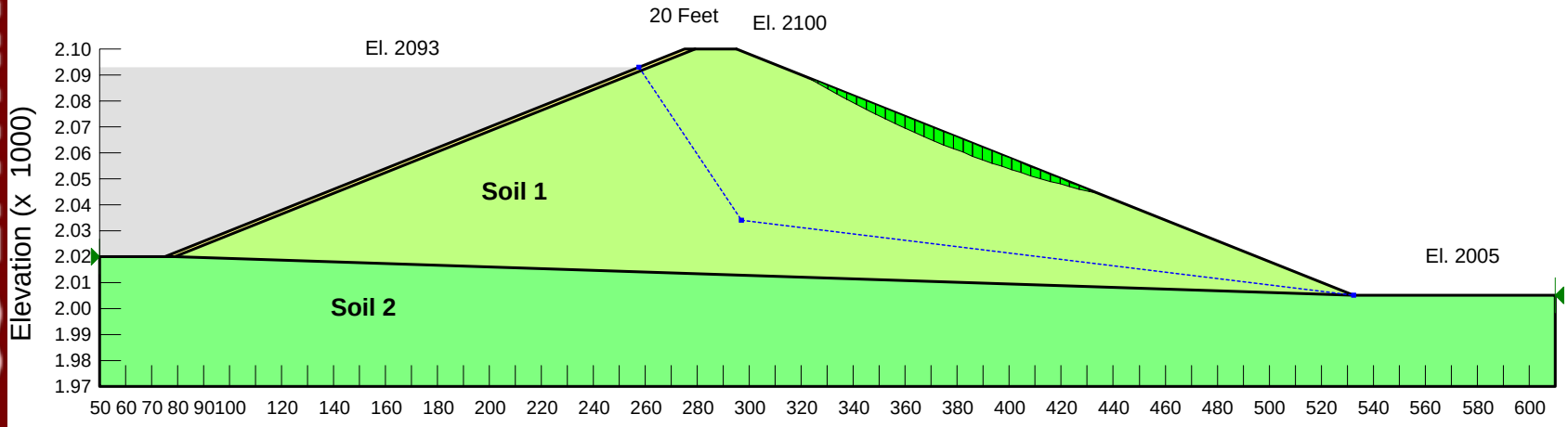

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Name: Water Piezometric Line: 1

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Slip Surface Option: Grid and Radius
Minimum Properties

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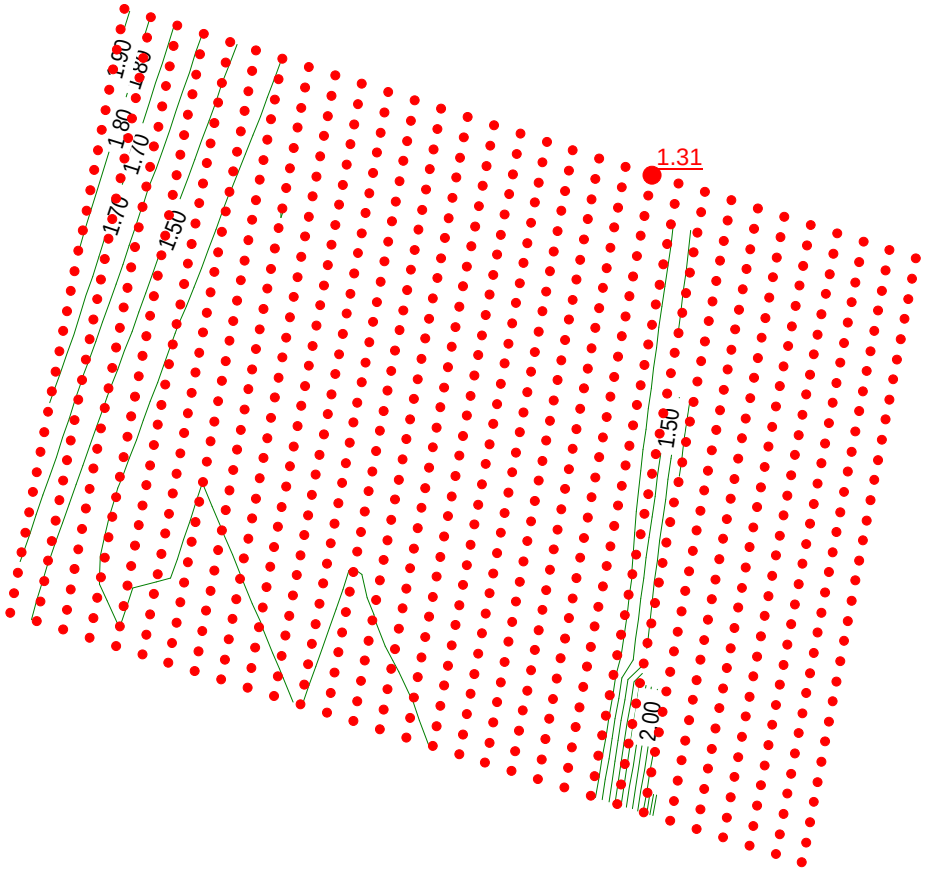

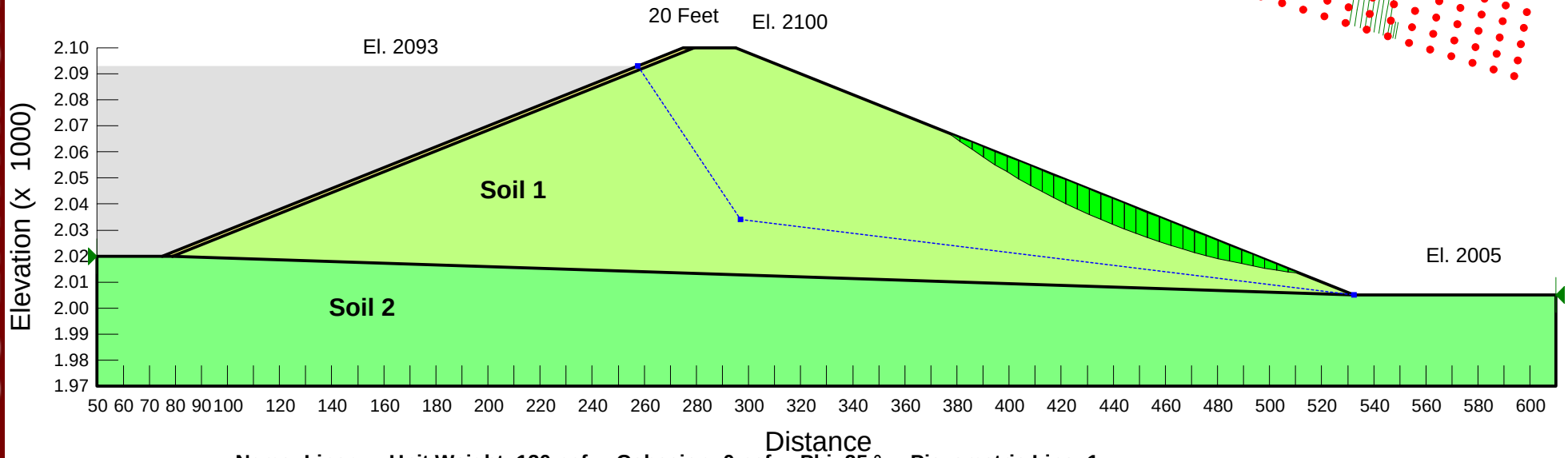

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Name: Soil 2 Unit Weight: 127 pcf Cohesion: 0 psf Phi: 27 ° Piezometric Line: 1
Name: Water Piezometric Line: 1

Name: Minnkota
Description: Exterior Slope Analysis - 2.5:1 Slope - Estimated Actual Conditions
Method: Spencer
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Date: 2/4/2011
Slip Surface Option: Grid and Radius
Minimum Properties

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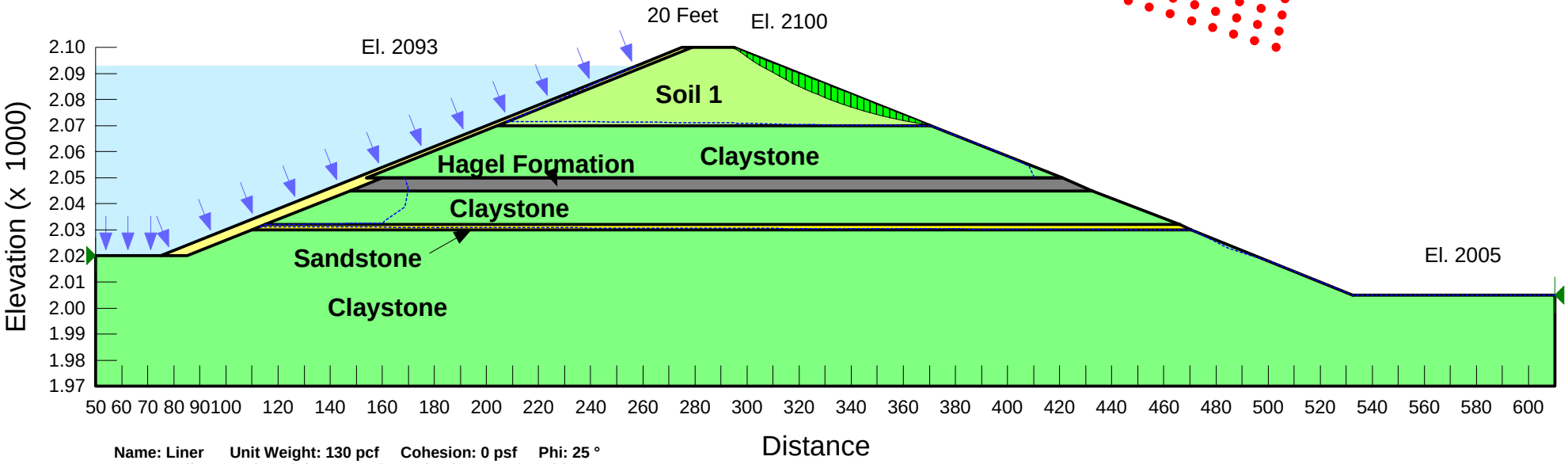

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Name: Water
Name: Hagel Unit Unit Weight: 127 pcf Cohesion: 10000 psf Phi: 29.8 °
Name: Sandstone Unit Weight: 127 pcf Cohesion: 10000 psf Phi: 38 °

Name: Minnkota
Description: Exterior Slope Analysis - 3:1 Slope - Estimated Actual Conditions
Method: Spencer
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Date: 2/4/2011
Slip Surface Option: Grid and Radius
Minimum Properties

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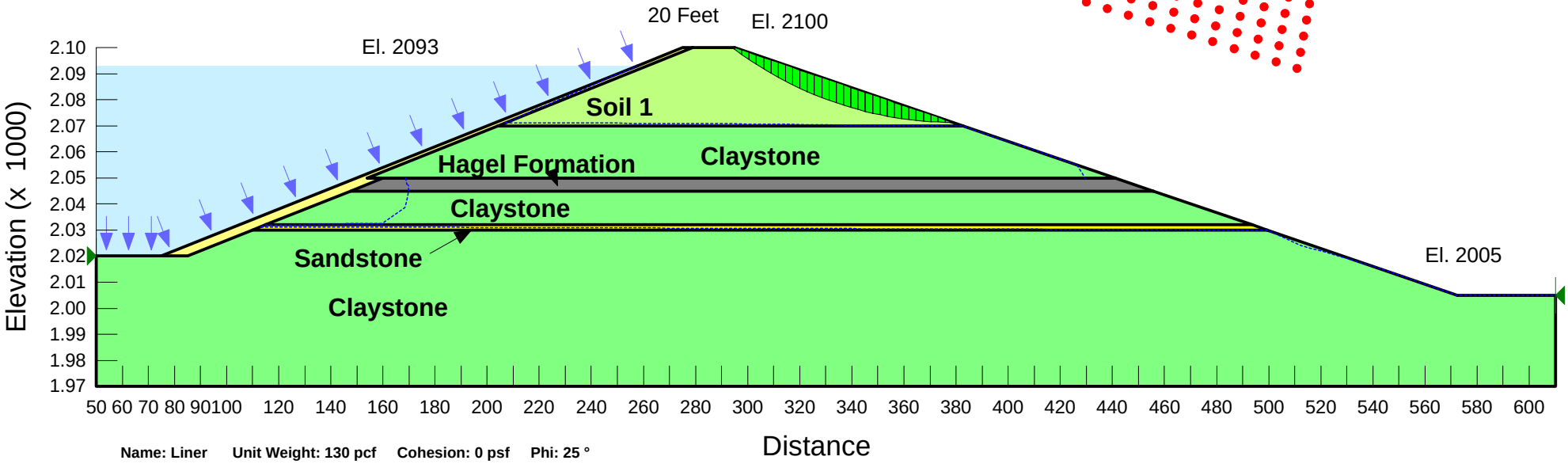

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Name: Soil 1 Unit Weight: 127 pcf Cohesion: 0 psf Phi: 35 °
Name: Claystone Unit Weight: 127 pcf Cohesion: 6200 psf Phi: 27 °
Name: Water
Name: Hagel Unit Unit Weight: 127 pcf Cohesion: 10000 psf Phi: 29.8 °
Name: Sandstone Unit Weight: 127 pcf Cohesion: 10000 psf Phi: 38 °

Attachment C

Selected Pages from USSD 2007 Document

United States Society on Dams

Strength of Materials for Embankment Dams

February 2007

A White Paper prepared by the USSD Committee on Materials for Embankment Dams

Table 9. Factors of Safety for Embankment Dams

Agency	Loading Condition	Stress Parameter	F.S.
USACE	During Construction and End of Construction	Total and Effective	1.3
	Long-term (Steady seepage, max. storage pool, spillway crest or top of gates	Effective	1.5
	Max. Surcharge Pool	Effective	1.4
	Sudden Drawdown from Max. Surcharge Pool	Total and Effective	1.1
	Sudden Drawdown from Max. Storage Pool	Total and Effective	1.3
	Sudden Drawdown when Routine Operating Condition (Pumped storage facility	Total and Effective	1.4-1.5
USBR	End of Construction – Pore pressures in embankment and foundation with laboratory determination of pore pressure and monitoring during construction.	Effective	1.3
	End of Construction – Pore pressures in embankment and foundation with no laboratory determination and no monitoring during construction.	Effective	1.4
	End of Construction – Pore pressures in embankment only with or without field monitoring and no laboratory determination.	Effective	1.3
	End of Construction	Undrained (Total)	1.3
	Steady-State Seepage from Active Pool	Effective	1.5
	Operational – Max. Pool Level	Effective or Undrained	1.5
	Operational – Rapid Drawdown from Normal Pool	Effective or Undrained	1.3
	Operational – Rapid Drawdown from Max. Pool		1.3
	Unusual		1.2

Table 9. Factors of Safety for Embankment Dams (continued)

Agency	Loading Condition	Stress Parameter	F.S.
NRCS	I. End of Construction	Total for impervious; effective for pervious	1.4
	II. Rapid Drawdown	Composite	1.2
	III. Steady Seepage – Normal Pool	Composite	1.5
	IV. Steady Seepage with Earthquake	Total	1.1
FERC	End of Construction	Total	1.3
	Sudden Drawdown from Max. Pool	Effective and Total	1.1
	Sudden Drawdown from Spillway Crest	Effective and Total	1.2
	Steady Seepage – Max. Storage Pool	Effective and Total	1.5
	Steady Seepage – Surcharge Pool	Effective and Total	1.4
	Earthquake – Steady Seepage	Effective and Total	> 1.0
TVA	End of Construction	Total	1.3
	Sudden Drawdown	Total	1.2
	Steady Seepage – Normal Operating Condition	Total	1.5
	Steady Seepage – Flood Surcharge Pool	Total	1.25
California DSOD	Post Construction	Total	1.25
	Steady Seepage (Full Pool)	Effective	1.5
	Steady Seepage (Partial Pool)	Effective	1.5
	Sudden Drawdown	Total	1.25
	Pseudostatic	Total	1.1

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3. USBR (1987). *Design Standards No. 13, Embankment Dams, Chapter 4. Static Stability Analyses;* available from the National Technical Information Service.

4. Duncan, J. M., Horz, R. C. and Yang, T. L. (1989). "Shear Strength Correlations for Geotechnical Engineering," Virginia Tech, Department of Civil Engineering.

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8. USACE (2003). *Slope Stability,* Engineering Manual 1110-2-1902, Department of the Army, Corps of Engineers, Washington, D. C.; available at www.usace.army.mil/inet/usacoe-docs/eng-manuals/em1110-2-1902/entire.pdf

9. NRCS (2005). *Technical Release No. 60, Earth Dams and Reservoirs,"* Natural Resources Conservation Service; available at www.info.usda.gov/CED/ftp/CED/TR_210_60_Second_Edition.pdf

10. FERC (1991). *Chapter IV, Embankment Dams,* Federal Energy Regulatory Commission; available at http://www.ferc.gov/industries/hydropower/safety/guidelines/eng-guide/chap4.PDF

11. Kleiner, D. E. (1997). "Report – Analysis and Static Strength of Embankment Materials," Harza Engineering Company (now part of MWH), correspondence.

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15. USACE (1970, revised 1986). *Laboratory Testing,* Engineering Manual 1110-2-1906, Department of the Army, Corps of Engineers, Washington, D. C.; available at www.usace.army.mil/inet/usacoe-docs/eng-manuals/em1110-2-1906/entire.pdf

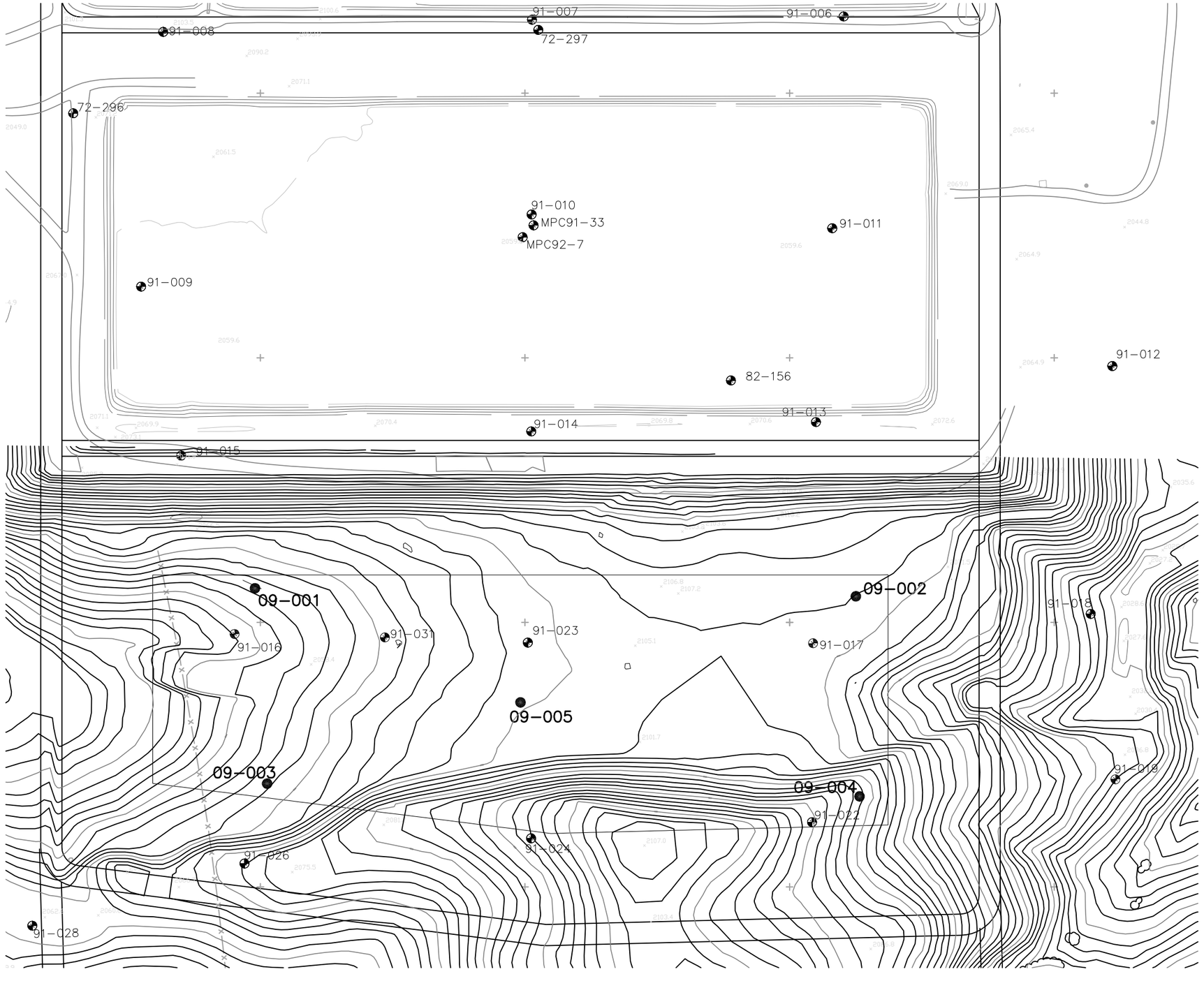
16. USBR (1998). *Earth Manual, Part 1*; available from the National Technical Information Service and at www.usbr.gov/library/BRreclamation.html

17. USBR (1990). *Earth Manual, Part 2*; available from the National Technical Information Service

18. ASTM 04.08 *Soil and Rock (I)* and 04.09 *Soil and Rock (II).*

Attachment D

Existing Soil Conditions near the Cell 2-3 Divider Dike



0 100 200
SCALE IN FEET

LEGEND

- UNPAVED ROAD
- TRAIL (TRAIL)
- LAKE/POND WATERLINE
- BUILDING
- FIELD LINE (FL)
- FENCE LINE
- SINGLE TREES/VEGETATION
- INDEX CONTOUR (100)
- INTERMEDIATE CONTOURS
- UTILITY POLE
- H 10001 / 123.45 — HORIZONTAL CONTROL
- V 20001 / 123.45 — VERTICAL CONTROL
- 123.4 — EXISTING SPOT ELEVATION
- TOE OR TOP OF SLOPE
- **07-012** — 2007 PROPOSED SOIL BORING
- XX-012 — PREVIOUS SOIL BORING LOCATIONS

BORING NUMBER	NORTHING	EASTING
09-001	508064.4	1820489.8
09-002	508049.2	1821625.3
09-003	507695.3	1821625.3
09-004	507660.2	1821627.4
09-005	507848.7	1820991.5

NOTE: COORDINATES ARE REFERENCED TO MINNKOTA PLANT COORDINATE SYSTEM.

NO.	BY	CHK.	APP.	DATE	REVISION DESCRIPTION

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF NORTH DAKOTA.

SIGNATURE

PRINTED NAME

DATE REG. NO.

CLIENT
BID
CONSTRUCTION

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Corporate Headquarters: Minneapolis, Minnesota
Ph: 1-800-632-2277

Project Office:
BARR ENGINEERING CO.
4700 WEST 77TH STREET
MINNEAPOLIS, MN.
55435-4803
Ph: 1-800-632-2277
Fax: (952) 832-2601
www.barr.com

Scale	AS SHOWN
Date	05/19/09
Drawn	JMM2
Checked	
Designed	
Approved	

MILTON R. YOUNG STATION NO. 2
MINNKOTA POWER COOPERATIVE, INC
CENTER, NORTH DAKOTA

MINNKOTA
CENTER, NORTH DAKOTA

PROPOSED SOIL BORING LOCATIONS
2009

BARR PROJECT No. 34/33-014
CLIENT PROJECT No.
DWG. No. 7PER-1
REV. No. A

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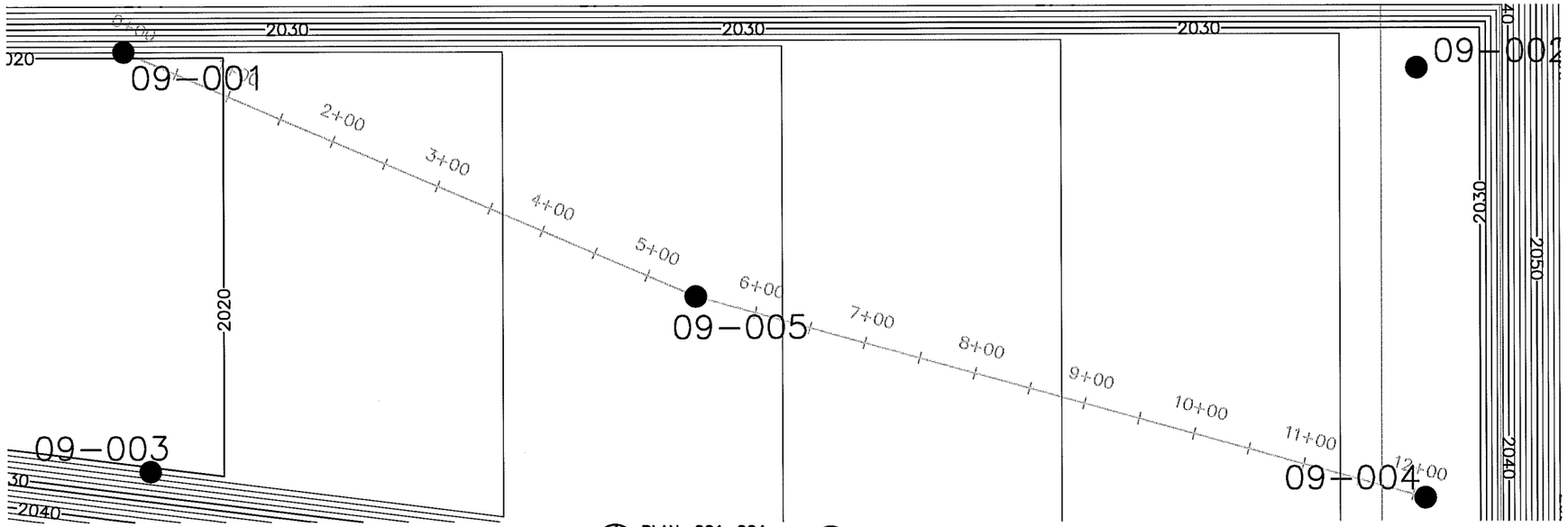
jda M:\cad\3433014\Boring_Locations_2009.DWG Plot at 1 05/26/2009 11:31:22



1 PLAN: 001–004

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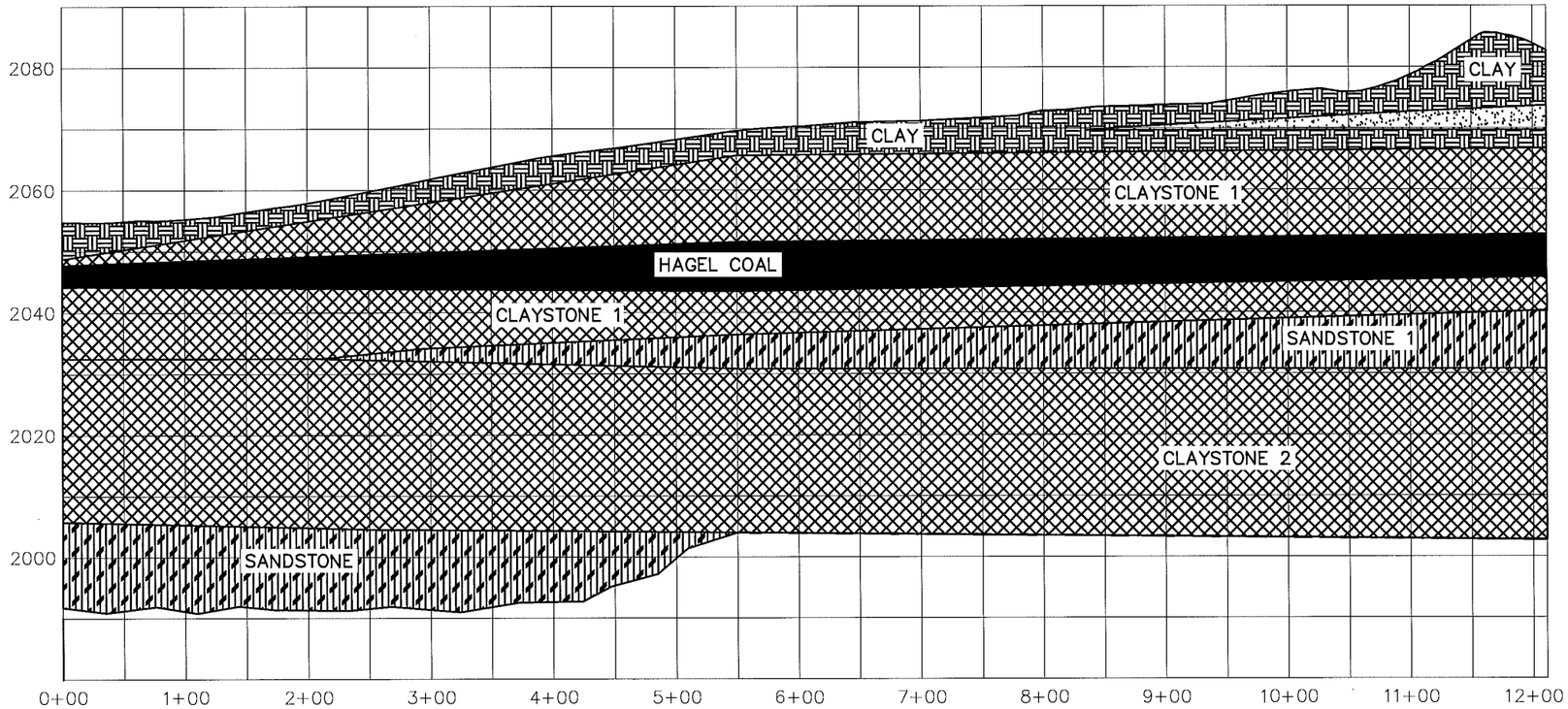

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Scale	1:60
Date	3–8–10
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Checked	JDA
Designed	JDA
Approved	JDA

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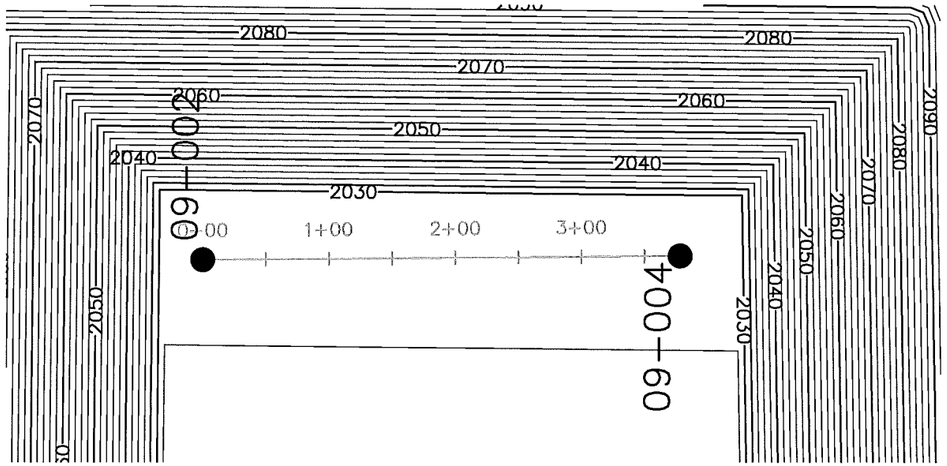
MINNKOTA POWER COOPERATIVE, INC.
CENTER, NORTH DAKOTA

CELL 3
SOIL BALANCE

BORING CROSS SECTIONS
BORING 001–004

BARR PROJECT No. 34/33–014
CLIENT PROJECT No.
DWG. No. EXHIBIT 1
REV. No. 0



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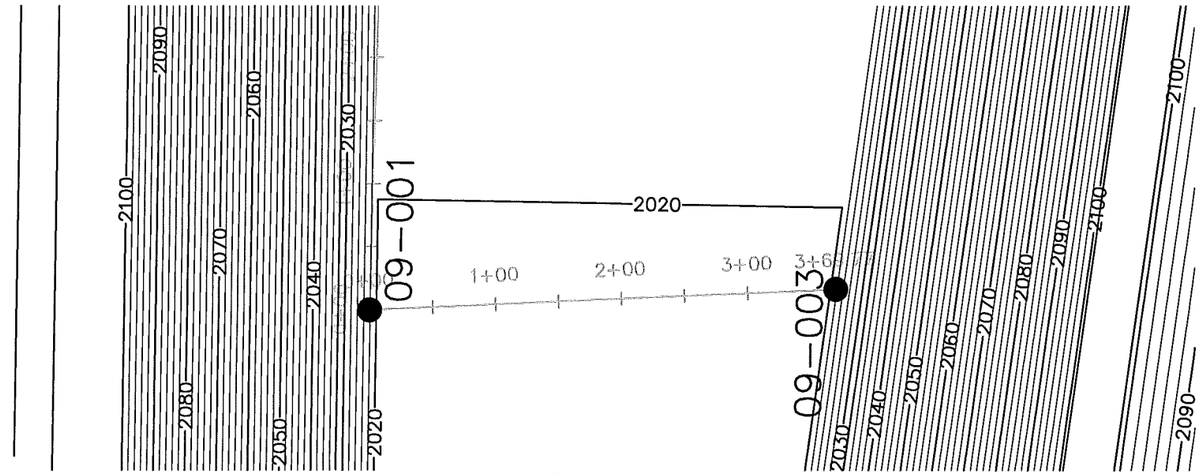

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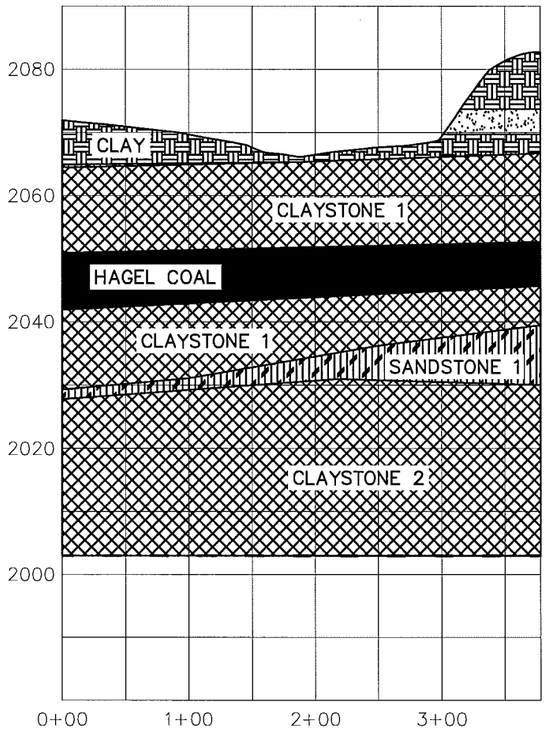

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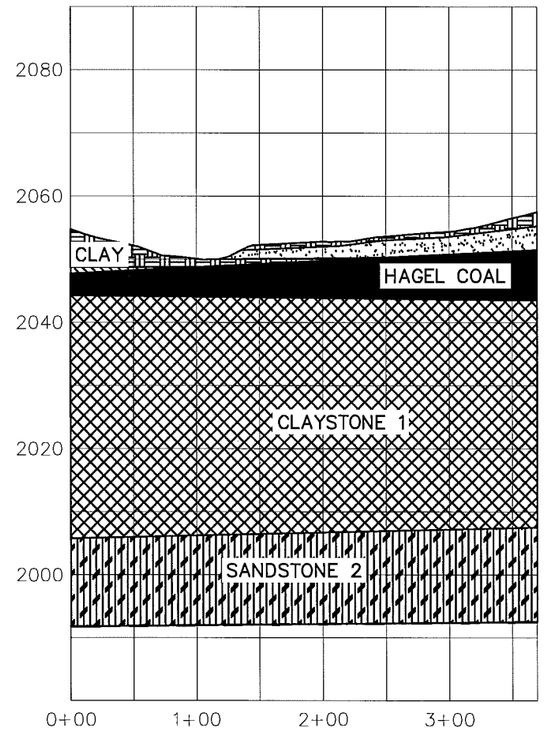

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Drawn	KKB
Checked	JDA
Designed	JDA
Approved	JDA

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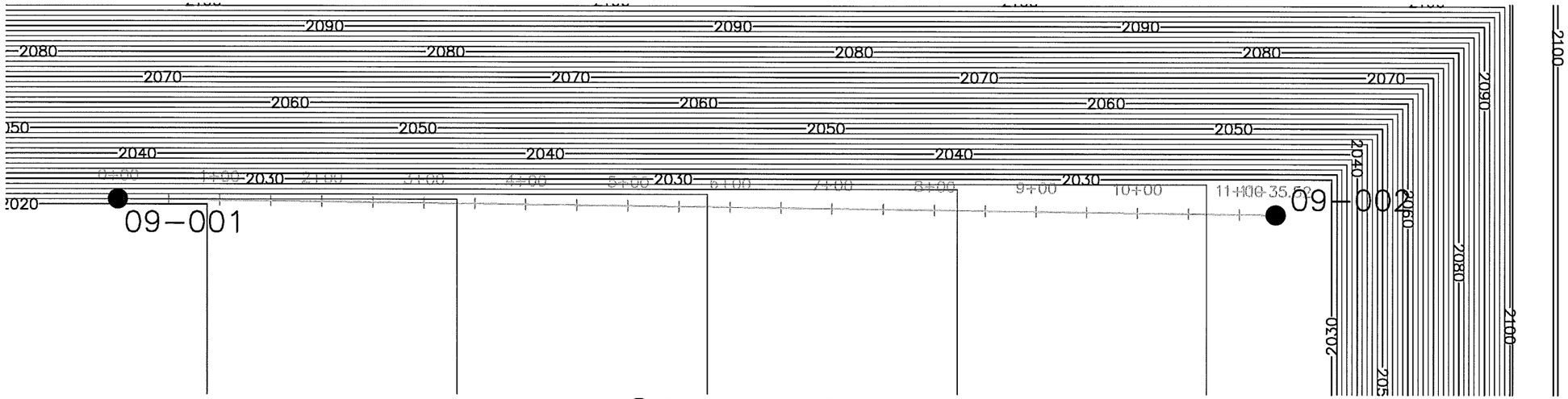
MINNKOTA POWER COOPERATIVE, INC.

CELL 3
SOIL BALANCE

BORING CROSS SECTIONS
BORING 001-003 AND 002-004

BARR PROJECT No. 34/33-014
CLIENT PROJECT No.
DWG. No. EXHIBIT 2
REV. No. 0



7 PLAN: 001–002

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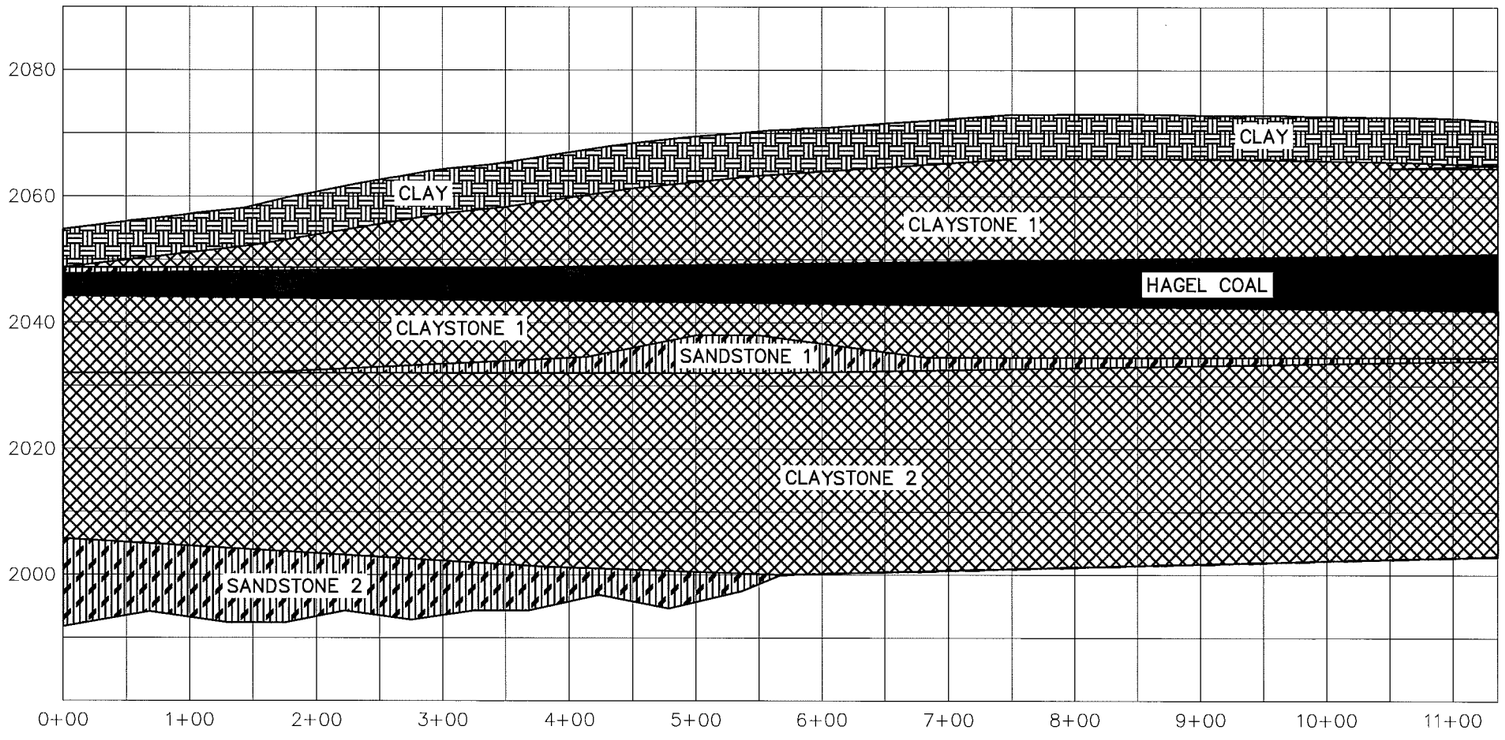
SCALE IN FEET



8 CROSS SECTION: 001–002

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					CONSTRUCTION
					RECORD
					RELEASED TO/FOR

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DATE RELEASED						

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Scale	1:60
Date	3–8–10
Drawn	KKB
Checked	JDA
Designed	JDA
Approved	JDA

MILTON R. YOUNG STATION NO. 2
MINNKOTA POWER COOPERATIVE, INC.

CELL 3
SOIL BALANCE

BORING CROSS SECTIONS
BORING 001–002

BARR PROJECT No.	
34/33–014	
CLIENT PROJECT No.	
DWG. No.	REV. No.
EXHIBIT 3	0

Client Minnkota
Project Name FGD Pond Cell 3 Phase 0
Number 34330014
Location Cell 3

Drill Contractor Braun Intertec
Drill Method HSA
Drilling Started 8/17/09 Ended 8/17/09
Logged By JLS4

LOG OF Boring 09-001

DRAFT

SHEET 1 OF 1

Elevation 2055.0
Total Depth 63.0

DEPTH FEET	SAMP. LENGTH & RECOVERY	SAMP. NUMBER	Blows/6 in.	Moisture	ASTM	LITHOLOGY	DESCRIPTION	ELEV. FEET
		1	3-6-6-5	Damp	CL		0-6': Sandy Lean Clay, plastic, brown (10YR 5/3).	
		2	5-7-8-12	Damp			2-4': Interbedded with several thin (0.01') fine sand layers.	
		3	4-8-7-8				5-7': Iron Staining, strong brown (10YR 5/8).	2050
		4	3-4-3-4	Damp	Rock		6-7': Siltstone, with clay, little to some 5-30% fine sand, lignite coal fragments, friable, hard, poor recovery, gray (10 YR 6/1).	
		5	3-3-2-2	Damp	Coal		7-10.5': Lignite Coal, carbonaceous, poor recovery, black (10YR 2/1).	
10		6		Damp	Rock		10.5-54': Claystone, interbedded with Siltstone and Sandstone, hard, cemented, sand, silt, and clay content varies throughout section, sand content varies from little to some 1 to 30%, sand content appears to increase with silt content, grey (10 YR 5/1).	
				Damp			13-22.5': Siltstone, with clay and little 5-12% fine sand, hard, friable, stratified, brown (10 YR 5/3) with grey (10YR 6/1).	2040
20		7						
				Damp			~22.5' Color change from brown (10YR 5/3) to grey (10YR 6/1).	
		8					22.5-24.5' Stratified	2030
				Damp				
30					Rock		29.2-29.3': Siltstone, with clay and fine sand, light gray (10YR 7/1).	
		9						2020
				Damp				
40							41-42.5': Claystone, carbonaceous, hard, black (10YR 2/1).	
		10					42.4-42.5': Lignite Coal, carbonaceous, black (10YR 2/1).	
							43-49': Siltstone, with clay and little to some 5-30% fine sand, friable, hard, gray (10 YR 6/1).	2010
				Damp				
50					Rock		49-63': Sandstone, fine grained, with fines, stratified, hard, friable, thin lignite stringers, gray (10YR 6/1).	
		11					51-54': Siltstone, with clay and little to some 5-30% fine sand, crumbles, hard, friable, gray (10 YR 6/1).	2000
				Moist				
60		12						
							End of Boring - 63 feet	

Barr Engineering Co.
4700 W 77th St. Suite 200
Edina, MN 55435
Telephone: 952-832-2600
Fax: 952-862-2601

Remarks: Driller, Kyle Haag

Additional data may have been collected in the field which is not included on this log.

Client Minnkota | Drill Contractor Braun Intertec

Project Name FGD Pond Cell 3 Phase 0 | Drill Method HSA

Number 34330014 | Drilling Started 8/18/09 Ended 8/18/09

Location Cell 3 | Logged By JLS4

LOG OF Boring 09-002

DRAFT

SHEET 1 OF 1

Elevation 2072.0

Total Depth 69.0

DEPTH FEET	SAMP. LENGTH & RECOVERY	SAMP. NUMBER	Blows/6 in.	Moisture	ASTM	LITHOLOGY	DESCRIPTION	ELEV. FEET
		1	4-6-9-	Damp			0-7.5': Lean Clay, some silt and trace fine sand, grayish brown (10YR 5/2) with brown mottling (10YR 5/3). Lean Clay transitions to Silty Lean Clay with increasing depth, iron staining, dark yellowish brown (10YR 4/4).	2070
		2	6-11-16-	Damp	CL		6.5': Clayey Sand, thin layer (0.1' thick).	
		3		Damp				
					Rock		7-7.5': Sandstone, not fryable, well cemented, light gray (10YR 6/1).	
10		4		Damp	Rock		7.5-21': Claystone, interbedded with Siltstone, hard, clay and silt content varies throughout section, sand content varies throughout section from little to some 1 to 30 %, sand content appears to increase with silt content, grey (10 YR 5/1). 7.5-10.5': Siltstone, with clay and little to some fine sand, hard, gray (10YR 5/1). 13.5': Thin lignite stringer	2060
20				Damp				
		5			Coal		21-29' Lignite Coal, carbonaceous, very dark brown (10YR 2/2)	2050
30				Damp			29-69': Claystone, interbedded with Siltstone and Sandstone, hard, well cemented, sand, silt, and clay content varies throughout section, sand content varies from 1 to 30%, sand content appears to increase with silt content, color varies, grey (10 YR 5/1, 10 YR 6/1) and greenish grey (Gley 2, 5/1). 30': Thin lignite stringers (0.02' thick). 31.5-34': Siltstone, with clay and trace fine sand, well cemented, friable, stratified, gray (10YR 5/1). 34.5-37.5': Siltstone, with clay, little 5-12% fine sand, friable, hard, gray (10 YR 6/1). 34-34.5': Sandstone, with fines, hard, friable, gray (10YR 6/1). 36.5-37': Mudstone, low plasticity, wet. 42-43.5': Sand Stone, well cemented, not friable, very hard, dry, light gray (10YR 6/1). 44.5-48': Siltstone, with clay and little 5-12% fine sand, hard, friable, gray (10 YR 6/1).	2040
		6						
40				Damp				2030
		7						
50				Damp	Rock		47.5-47.7': Limestone, well cemented, not friable, very pale brown (10YR 8/2). 48-56': Claystone, stratified.	2020
		8					56-57': Siltstone, with trace to little fine sand, friable, gray (10YR 6/1).	
60				Damp				2010
		9						
				Damp	Rock		64-65': Claystone, carbonaceous, hard, black (10YR 2/1).	
		10					65-69': Claystone, with silt and little to some fine sand, hard, greenish gray (Gley 2 10BG 5/1).	
							End of Boring - 69 feet	

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Remarks: Driller, Kyle Haag

Additional data may have been collected in the field which is not included on this log.

Client Minnkota | Drill Contractor Braun Intertec

Project Name FGD Pond Cell 3 Phase 0 | Drill Method HSA

Number 34330014 | Drilling Started 8/18/09 Ended 8/19/09

Location Cell 3 | Logged By JLS4

LOG OF Boring 09-003

DRAFT

SHEET 1 OF 1

Elevation 2057.5

Total Depth 65.0

DEPTH FEET	SAMP. LENGTH & RECOVERY	SAMP. NUMBER	Blows/6 in.	Moisture	ASTM	LITHOLOGY	DESCRIPTION	ELEV. FEET
		1	4-6-9-	Damp				
		2	5-8-14-	Damp Damp	ML		0-6': Silt with Clay, trace fine grained sand, dark yellowish brown (10YR 5/4). 1' Thin layer of Clayey Sand. 3.5-3.8': Sandy Silt. 4 to 6' Carbonaceous fractures. Top (0 to 1') Sandy Lean Clay, brown (10YR 5/3).	
		3		Moist	Coal		6-14: Lignite Coal, carbonaceous, black (10YR 2/1).	2050
10				Damp				
		4			Rock		14-50': Claystone, interbedded with Siltstone and Sandstone, typically fractures, cohesive, cemented, clay and silt content varies throughout section, sand varies from 1 to 40%, sand content appears to increase with silt content, color transitions from brown (10YR 5/3) to gray (10 YR 5/1). 16-23.5': Claystone, with silt and fine sand, weathered transition zone, stratified, hard, brown (10YR 5/3).	2040
20								
				Damp			~23.5' Color change from brown to gray	
				Dry			23.5-25.5': Claystone, with silt, some 12-30% fine sand, hard, stratified, gray (10YR 5/1).	
				Moist			25-27': Sandstone, well cemented, not friable, hard, fine grained, light grey (10YR 7/1).	2030
		5					27-28': Sandstone, fine grained, with silt, friable, hard, gray (10YR 6/1).	
30					Rock			
				Damp			34-42.5': Siltstone, with clay and some 12-30% fine sand, cemented, hard, friable, stratified, gray (10YR 5/1).	
								2020
40		6						
				Damp				
		7					45.5-47': Claystone, silt, carbonaceous, fractures, hard, black (10YR 2/1). 47-50': Siltstone, clay, some >30% fine sand, non-plastic, homogeneous, friable, dark gray (10YR 4/1).	2010
50				Damp				
		8			Rock		50-65' Sandstone, fine grained, with fines, hard, friable, sand content appears to increase with depth, gray (10YR 6/1).	2000
60				Dry			60-62.5': Sandstone, well cemented, not friable, dry, fine grained, light grey (10YR 7/1).	
		9		Moist			63-63.3': Limestone, cobble, very pale brown (10YR 8/3).	
							End of Boring - 65 feet	1990

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Remarks: Driller, Kyle Haag

Additional data may have been collected in the field which is not included on this log.

Client Minnkota | Drill Contractor Braun Intertec

Project Name FGD Pond Cell 3 Phase 0 | Drill Method HSA

Number 34330014 | Drilling Started 8/20/09 Ended 8/20/09

Location Cell 3 | Logged By JLS4

LOG OF Boring 09-004

DRAFT

SHEET 1 OF 1

Elevation 2083.0

Total Depth 80.0

DEPTH FEET	SAMP. LENGTH & RECOVERY	SAMP. NUMBER	Blows/6 in.	Moisture	ASTM	LITHOLOGY	DESCRIPTION	ELEV. FEET
		1	3-3-5-	Damp			0-9': Sandy Lean Clay, fine grained sand, medium plasticity, brown (10YR 5/3). Interlayered with thin layers of Clayey Sand, from 0-2.5', 2.9-3.7', 4-5'), brown (10YR 4/3). Top 0-0.6' includes roots.	2080
		2	5-7-9-	Damp				
		3	5-7-9-	Damp	CL			
		4	4-8-8-7	Damp				
				Damp				
10		5			ML		9-13' Clayey Silt, with trace fine sand, iron staining, strong brown (7.5YR 5/6), from 9 to10', brown (10YR 5/3).	
				Damp	CL		13-16': Lean Clay, medium plasticity, color transitions with depth from grayish brown (10 YR 5/2) with strong brown mottling to gray (10YR 5/1) with dark brown brown mottling.	2070
20		6			Rock		16-30': Claystone, interbedded with Siltstone, hard, clay and silt content varies throughout section, stratified, sand content ranges from 1-30%, sand content appears to increase with silt content, Color transitions in color from dark brown (10YR 3/3) to gray (10 YR 5/1).	2060
				Damp			26.5-26.7': Concretion, well cemented, not friable, white (10 YR 8/1), thin bands of pyrite.	
30		7					29-29.1': Scoria, hard, well cemented, not friable, reddish brown (5YR 4/4).	
					Coal		30-37': Lignite Coal, carbonaceous, black (10 YR 2/1)	2050
				Moist				
				Damp				
40		8			Rock		37-42.5': Claystone, interbedded with Siltstone, hard, clay, silt, and sand content varies throughout section, stratified, sand content ranges from 1-30%, sand content appears to increase with silt content, Color transitions in color from brown (10YR 4/3) to gray (10 YR 5/1).	2040
				Moist			42.5-52': Sandstone, fine grained, with fines, hard, friable, sand and fine content varies throughout section, gray (10YR 6/1).	
					Rock			
50		9						
				Moist				
				Damp			52-80': Claystone, interbedded with Siltstone, hard, clay and silt content varies throughout section, sand content varies throughout section from 10 to 30%, sand content appears to increase with silt content, color varies, grey (10 YR 5/1, 10 YR 6/1) and greenish grey (Gley 2, 5/1).	2030
60		10					52-54': Siltstone with clay and some 12-30% fine sand, hard, friable, stratified, gray (10 YR 6/1).	
							53.8': Claystone, with gravel, thin layer, coarse, angular gravel.	
				Moist			56.2-56.4': Limestone, well cemented, not friable, yellowish brown (10YR 5/8).	2020
					Rock		57.2-57.3': Limestone, well cemented, not friable, yellowish brown (10YR 5/8).	
70		11					63-67': Siltstone, clay, little 5-12% fine sand, friable, stratified, hard, gray (10 YR 6/1).	
				Damp			72-73': Claystone, carbonaceous, hard, fractures, dark brown (10YR 3/3).	2010
					Rock		73-75': Claystone with silt and little fine sand, hard, greenish gray (Gley 2 10BG 5/1).	
				Damp				
		12		Moist			77-79': Siltstone, clay with some 12-30% fine sand, friable, hard, gray (10 YR 6/1).	
80				Moist Damp			79-79.5': Sandstone, fine grained, with fines, hard, gray (10YR 6/1).	
							End of Boring - 80 feet	2000

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Remarks: Driller, Kyle Haag

Additional data may have been collected in the field which is not included on this log.

Client Minnkota | Drill Contractor Braun Intertec

Project Name FGD Pond Cell 3 Phase 0 | Drill Method HSA

Number 34330014 | Drilling Started 8/19/09 Ended 8/19/09

Location Cell 3 | Logged By JLS4

LOG OF Boring 09-005

DRAFT

SHEET 1 OF 1

Elevation 2070.0

Total Depth 65.0

DEPTH FEET	SAMP. LENGTH & RECOVERY	SAMP. NUMBER	Blows/6 in.	Moisture	ASTM	LITHOLOGY	DESCRIPTION	ELEV. FEET
		1	4-7-10-	Moist	CL		0-4': Sandy Lean Clay, medium plasticity, dark grayish brown (10YR 4/2). Interlayered with thin layers of fine to medium grained sand, 1.2-1.5' and 3.5-3.6', olive yellow (2.5YR 6/6) and Clayey Silt/ Sand, fined grained sand, 3.8-4.0', yellowish brown (10YR 5/8).	
		2	10-11-18-	Damp				
				Damp				
		3			Rock		4-18': Claystone, fractures, interbedded with Siltstone, cohesive, hard, clay and silt content varies throughout section, stratified, sand content varies from 1 to 20%, sand content appears to increase with silt content, color transitions from brown (10YR 4/3) to gray (10 YR 5/1).	
10				Damp				2060
		4		Damp				
				Moist			~15': Color change from brown to gray 15-18': Claystone, with silt and little 5-12% fine sand, fractures, hard, gray (10YR 5/1).	
20				Moist	Coal		16.1': Claystone, thin layer of Gravel, fine, rounded. 16.3': Claystone, thin layer of Gravel, fine, rounded. 18-26': Lignite Coal, carbonaceous, black (10 YR 2/1).	2050
		5		Moist				
				Damp	Rock		26-33': Claystone, fractures, Interbedded with Siltstone and Sandstone, cohesive, hard, clay and silt content varies throughout section, sand content varies from 1 to 40%, sand content appears to increase with silt content, light gray (10 YR 7/1), and grey (10YR 6/1, 10YR 5/1).	
30				Damp			28-40': Siltstone, with clay and some 12-30% fine sand, friable, hard, gray (10YR 6/1).	2040
		6			Rock		30-31.5': Sandstone, fine grained, with fines, hard, friable, sand and fine content varies, gray (10YR 6/1). 31.5-33': Siltstone, with clay and some 12-30% fine sand, friable, hard, gray (10YR 6/1).	
				Moist				
40				Damp			33-38.5': Sandstone, fine grained, with fines, hard, friable, sand and fine content varies throughout section, gray (10YR 6/1).	2030
		7					38.5-65': Claystone, fractures, interbedded with Siltstone, hard, clay and silt content varies throughout section, sand content varies from 1 to 40%, sand content appears to increase with silt content, color is grey (10YR 6/1, 10YR 5/1). 38.5-41': Siltstone, with clay and some 12-30% fine sand, fryable, hard, gray (10YR 6/1).	
50				Damp	Rock			2020
		8						
				Damp			54-56': Siltstone, with clay and some 12-30% fine sand, friable, hard, gray (10YR 6/1).	
				Damp			58.5-60.5': Claystone, carbonaceous, hard, dark brown (10YR 3/3).	
60		9					60.5': Claystone, color transitions from dark gray (10YR 4/1) to gray (10YR 6/1)	2010
				Damp				
				Moist			63-65': Siltstone, with clay and some 12-30% fine sand, friable, hard, gray (10YR 6/1).	
							End of Boring - 65 feet	

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Remarks: Driller, Kyle Haag

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GEOSERV, INC. *Testing - Exploration - Engineering*

Construction Materials Testing, Geotechnical, Geosynthetics, Geoenvironmental, Drilling

TO:	Mr. Joe Kessel Baranko Bros, Inc. P.O. Box 0820 Dickinson, ND 58602-0820	**DATE:** **PROJECT NO:** **COPIES TO:**	April 23, 2008 GEO-040821 Minnkota Power Coop Barr Engineering Co
PROJECT:	Minnkota FGD Pond - Cell 2 Phase III Center, North Dakota		

DENSITY TESTS OF COMPACTED FILL

TEST NUMBER:	RF-13	RF-14	RF-15
DATE TAKEN	4/23/08	4/23/08	4/23/08
ASTM: D2488-00 DESCRIPTION AND IDENTIFICATION of SOILS (Visual-Manual Procedure):	Clayey Sand, trace of gravel, brown 2008 (SC-1)	Clayey Sand, trace of gravel, brown 2008 (SC-1)	Clayey Sand, trace of gravel, brown 2008 (SC-1)
LOCATION:	Embankment fill, Station 24+95, 35' West of RF-F Line	Embankment fill, Station 23+00, 50' West of RF-F Line	Embankment fill, Station 21+90, 55' West of RF-F Line
ELEVATION OF TEST:	2071'	2072'	2072'
DEPTH BELOW EXISTING GRADE:	1.0'	1.0'	1.0'

FIELD DENSITY DETERMINATION:

ASTM: D2922-01 Density of Soil-Aggregate in Place by Nuclear Density Methods (Shallow Depth), Direct Transmission

Dry Density (pcf)	107.9	106.7	107.1
Moisture Content (%)	17.9	14.6	14.5
Plus #4 Material (%)	1	1	1
Probe Depth (inches)	12	12	12
Operator	M. J. Tschosik	M. J. Tschosik	M. J. Tschosik

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method	ASTM:D698-00a, Method "A"		
Maximum Dry Density (pcf)	110.0	110.0	110.0
Optimum Moisture (%)	17.4	17.4	17.4

COMPACTION TEST RESULTS:

Compaction (%)	98.1	97.0	97.4
Specified Compaction (%)	95	95	95
Specified Moisture (%)	13.3 - Min	13.3 - Min	13.3 - Min

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested. The test locations and number of tests were selected by Baranko Brothers. Compaction and moisture content meet project specifications in the above test areas.

Mark Tschosik

GEOSERV, INC.

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GEOSERV, INC. *Testing - Exploration - Engineering*

Construction Materials Testing, Geotechnical, Geosynthetics, Geoenvironmental, Drilling

TO:	Mr. Joe Kessel Baranko Bros, Inc. P.O. Box 0820 Dickinson, ND 58602-0820	**DATE:** **PROJECT NO:** **COPIES TO:**	April 24, 2008 GEO-040821 Minnkota Power Coop Barr Engineering Co
PROJECT:	Minnkota FGD Pond - Cell 2 Phase III Center, North Dakota		

DENSITY TESTS OF COMPACTED FILL

TEST NUMBER:	RF-16	RF-17	RF-18
DATE TAKEN	4/24/08	4/24/08	4/24/08
ASTM: D2488-00 DESCRIPTION AND IDENTIFICATION of SOILS (Visual-Manual Procedure):	Clayey Sand, trace of gravel, brown 2008 (SC-1)	Clayey Sand, trace of gravel, brown 2008 (SC-1)	Clayey Sand, trace of gravel, brown 2008 (SC-1)
LOCATION:	Embankment fill, Station 24+80, 40' West of RF-F Line	Embankment fill, Station 22+80, 50' West of RF-F Line	Embankment fill, Station 21+43, 60' West of RF-F Line
ELEVATION OF TEST:	2075'	2075'	2075'
DEPTH BELOW EXISTING GRADE:	1.0'	1.0'	1.0'

FIELD DENSITY DETERMINATION:

ASTM: D2922-01 Density of Soil-Aggregate in Place by Nuclear Density Methods (Shallow Depth), Direct Transmission

Dry Density (pcf)	109.3	107.6	110.2
Moisture Content (%)	15.2	14.8	14.2
Plus #4 Material (%)	1	1	1
Probe Depth (inches)	12	12	12
Operator	M. J. Tschosik	M. J. Tschosik	M. J. Tschosik

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method	ASTM:D698-00a, Method "A"		
Maximum Dry Density (pcf)	110.0	110.0	110.0
Optimum Moisture (%)	17.4	17.4	17.4

COMPACTION TEST RESULTS:

Compaction (%)	99.4	97.8	100.2
Specified Compaction (%)	95	95	95
Specified Moisture (%)	13.3 - Min	13.3 - Min	13.3 - Min

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested. The test locations and number of tests were selected by Baranko Brothers. Compaction and moisture content meet project specifications in the above test areas.

Mark C. Tschosik

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GEOSERV, INC. *Testing - Exploration - Engineering*

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TO: Mr. Joe Kessel
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P.O. Box 0820
Dickinson, ND 58602-0820

DATE: May 2, 2008
PROJECT NO: GEO-040821
COPIES TO: Minnkota Power Coop
Barr Engineering Co

PROJECT: Minnkota FGD Pond - Cell 2 Phase III
Center, North Dakota

DENSITY TESTS OF COMPACTED FILL

TEST NUMBER:	RF-41	RF-42	RF-43
DATE TAKEN	5/2/08	5/2/08	5/2/08
ASTM: D2488-00 DESCRIPTION AND IDENTIFICATION of SOILS (Visual-Manual Procedure):	Clayey Sand, trace of gravel, brown 2008 (SC-1)	Clayey Sand, brown 2008 (SC-2)	Clayey Sand, trace of gravel, brown 2008 (SC-1)
LOCATION:	Embankment fill, Station 25+45, 45' South of RF-A Line	Embankment fill, Station 26+24, 62' South of RF-A Line	Embankment fill, Station 24+18, 136' West of RF-F Line
ELEVATION OF TEST:	2087'	2089'	2087'
DEPTH BELOW EXISTING GRADE:	1.0'	1.0'	1.0'

FIELD DENSITY DETERMINATION:

ASTM: D2922-01 Density of Soil-Aggregate in Place by Nuclear Density Methods (Shallow Depth), Direct Transmission

Dry Density (pcf)	110.5	111.4	111.6
Moisture Content (%)	16.5	12.3	16.3
Plus #4 Material (%)	1	None	1
Probe Depth (inches)	12	12	12
Operator	M. J. Tschosik	M. J. Tschosik	M. J. Tschosik

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method	ASTM:D698-00a, Method "A"		
Maximum Dry Density (pcf)	110.0	111.2	110.0
Optimum Moisture (%)	17.4	13.8	17.4

COMPACTION TEST RESULTS:

Compaction (%)	100.5	100.1	100.9
Specified Compaction (%)	95	95	95
Specified Moisture (%)	13.3 - Min	11.8 - Min	13.3 - Min

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested. The test locations and number of tests were selected by Baranko Brothers. Compaction and moisture content meet project specifications in the above test areas.

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GEOSERV, INC. Testing - Exploration - Engineering

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TO: Mr. Joe Kessel
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P.O. Box 0820
Dickinson, ND 58602-0820

DATE: May 6, 2008
PROJECT NO: GEO-040821
COPIES TO: Minnkota Power Coop
Barr Engineering Co

PROJECT: Minnkota FGD Pond - Cell 2 Phase III
Center, North Dakota

DENSITY TESTS OF COMPACTED FILL

TEST NUMBER:	RF-44	RF-45	RF-46	RF-47
DATE TAKEN	5/6/08	5/6/08	5/6/08	5/6/08
ASTM: D2488-00 DESCRIPTION AND IDENTIFICATION of SOILS (Visual-Manual Procedure):	Sandy Lean Clay, trace of gravel, brown 2008 (CL)-3	Sandy Lean Clay, trace of gravel, brown 2008 (CL)-3	Sandy Lean Clay, trace of gravel, brown 2008 (CL)-3	Sandy Lean Clay, trace of gravel, brown 2008 (CL)-3
LOCATION:	Embankment fill, Station 18+10, 140' West of RF-F Line	Embankment fill, Station 23+20, 140' West of RF-F Line	Embankment fill, Station 24+50, 145' West of RF-F Line	Embankment fill, Station 26+40, 55' South of RF-A Line
ELEVATION OF TEST:	2094'	2095'	2091'	2091'
DEPTH BELOW EXISTING GRADE:	1.0'	1.0'	1.0'	1.0'
FIELD DENSITY DETERMINATION:				
ASTM: D2922-01 Density of Soil-Aggregate in Place by Nuclear Density Methods (Shallow Depth), Direct Transmission				
Dry Density (pcf)	108.4	105.9	108.0	109.4
Moisture Content (%)	15.2	15.3	15.1	16.3
Plus #4 Material (%)	2	2	2	2
Probe Depth (inches)	12	12	12	12
Operator	M. J. Tschosik	M. J. Tschosik	M. J. Tschosik	M. J. Tschosik
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:				
Method	ASTM:D698-00a, Method "A"			
Maximum Dry Density (pcf)	109.2	109.2	109.2	109.2
Optimum Moisture (%)	18.1	18.1	18.1	18.1
COMPACTION TEST RESULTS:				
Compaction (%)	99.3	97.0	98.9	100.2
Specified Compaction (%)	95	95	95	95
Specified Moisture (%)	14.9 - Min	14.9 - Min	14.9 - Min	14.9 - Min

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested. The test locations and number of tests were selected by Baranko Brothers. Compaction and moisture content meet project specifications in the above test areas.

Mark Tschosik

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TO: Mr. Joe Kessel
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P.O. Box 0820
Dickinson, ND 58602-0820

DATE: May 7, 2008
PROJECT NO: GEO-040821
COPIES TO: Minnkota Power Coop
Barr Engineering Co

PROJECT: Minnkota FGD Pond - Cell 2 Phase III
Center, North Dakota

DENSITY TESTS OF COMPACTED FILL

TEST NUMBER:	RF-48	RF-49	RF-50
DATE TAKEN	5/7/08	5/7/08	5/7/08
ASTM: D2488-00 DESCRIPTION AND IDENTIFICATION of SOILS (Visual-Manual Procedure):	Clayey Sand, brown 2008 (SC-2)	Clayey Sand, brown 2008 (SC-2)	Clayey Sand, brown 2008 (SC-2)
LOCATION:	Embankment fill, Station 37+60, 65' South of RF-A Line	Embankment fill, Station 40+20, 69' South of RF-A Line	Embankment fill, Station 34+25, 70' South of RF-A Line
ELEVATION OF TEST:	2078'	2073'	2087'
DEPTH BELOW EXISTING GRADE:	1.0'	1.0'	1.0'

FIELD DENSITY DETERMINATION:

ASTM: D2922-01 Density of Soil-Aggregate in Place by Nuclear Density Methods (Shallow Depth), Direct Transmission

Dry Density (pcf)	106.4	107.7	108.7
Moisture Content (%)	12.0	13.9	14.1
Plus #4 Material (%)	None	None	None
Probe Depth (inches)	12	12	12
Operator	M. J. Tschosik	M. J. Tschosik	M. J. Tschosik

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method	ASTM:D698-00a, Method "A"		
Maximum Dry Density (pcf)	111.2	111.2	111.2
Optimum Moisture (%)	13.8	13.8	13.8

COMPACTION TEST RESULTS:

Compaction (%)	95.7	96.9	97.8
Specified Compaction (%)	95	95	95
Specified Moisture (%)	11.8 - Min	11.8 - Min	11.8 - Min

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested. The test locations and number of tests were selected by Baranko Brothers. Compaction and moisture content meet project specifications in the above test areas.

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GEOSERV, INC. *Testing - Exploration - Engineering*

Construction Materials Testing, Geotechnical, Geosynthetics, Geoenvironmental, Drilling

TO: Mr. Joe Kessel
Baranko Bros, Inc.
P.O. Box 0820
Dickinson, ND 58602-0820

DATE: May 8, 2008
PROJECT NO: GEO-040821
COPIES TO: Minnkota Power Coop
Barr Engineering Co

PROJECT: Minnkota FGD Pond - Cell 2 Phase III
Center, North Dakota

DENSITY TESTS OF COMPACTED FILL

TEST NUMBER:	RF-51	RF-52	RF-53	RF-54
DATE TAKEN	5/8/08	5/8/08	5/8/08	5/8/08
ASTM: D2488-00 DESCRIPTION AND IDENTIFICATION of SOILS (Visual-Manual Procedure):	Clayey Sand, brown 2008 (SC-2)	Clayey Sand, brown 2008 (SC-2)	Clayey Sand, brown 2008 (SC-2)	Clayey Sand, brown 2008 (SC-2)
LOCATION:	Embankment fill, Station 41+00, 75' South of RF-A Line	Embankment fill, Station 39+60, 80' South of RF-A Line	Embankment fill, Station 37+20, 70' South of RF-A Line	Embankment fill, Station 35+60, 70' South of RF-A Line
ELEVATION OF TEST:	2075'	2079'	2085'	2089'
DEPTH BELOW EXISTING GRADE:	1.0'	1.0'	1.0'	1.0'
FIELD DENSITY DETERMINATION:				
ASTM: D2922-01 Density of Soil-Aggregate in Place by Nuclear Density Methods (Shallow Depth), Direct Transmission				
Dry Density (pcf)	106.7	107.9	110.6	109.6
Moisture Content (%)	12.6	14.0	12.1	12.7
Plus #4 Material (%)	None	None	None	None
Probe Depth (inches)	12	12	12	12
Operator	M. J. Tschosik	M. J. Tschosik	M. J. Tschosik	M. J. Tschosik
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:				
Method	ASTM:D698-00a, Method "A"			
Maximum Dry Density (pcf)	111.2	111.2	111.2	111.2
Optimum Moisture (%)	13.8	13.8	13.8	13.8
COMPACTION TEST RESULTS:				
Compaction (%)	96.0	97.0	99.5	98.6
Specified Compaction (%)	95	95	95	95
Specified Moisture (%)	11.8 - Min	11.8 - Min	11.8 - Min	11.8 - Min

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Mark Tschosik

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TO: Mr. Joe Kessel
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DATE: May 13, 2008
PROJECT NO: GEO-040821
COPIES TO: Minnkota Power Coop
Barr Engineering Co

PROJECT: Minnkota FGD Pond - Cell 2 Phase III
Center, North Dakota

DENSITY TESTS OF COMPACTED FILL

TEST NUMBER:	RF-55	RF-56	RF-57	RF-58
DATE TAKEN	5/13/08	5/13/08	5/13/08	5/13/08
ASTM: D2488-00 DESCRIPTION AND IDENTIFICATION of SOILS (Visual-Manual Procedure):	Clayey Sand, brown 2008 (SC-2)	Clayey Sand, brown 2008 (SC-2)	Clayey Sand, brown 2008 (SC-2)	Lean Clay, trace of lignite, brown 2004 (CL-11)
LOCATION:	Embankment fill, Station 38+42, 80' South of RF-A Line	Embankment fill, Station 36+80, 85' South of RF-A Line	Embankment fill, Station 34+75, 85' South of RF-A Line	Embankment fill, Station 1+50, 60' North of RF-A Line
ELEVATION OF TEST:	2092'	2093'	2093'	2088'
DEPTH BELOW EXISTING GRADE:	1.0'	1.0'	1.0'	1.0'
FIELD DENSITY DETERMINATION:				
ASTM: D2922-01 Density of Soil-Aggregate in Place by Nuclear Density Methods (Shallow Depth), Direct Transmission				
Dry Density (pcf)	111.5	105.6	106.7	100.6
Moisture Content (%)	12.4	12.6	12.9	20.6
Plus #4 Material (%)	None	None	None	4
Probe Depth (inches)	12	12	12	12
Operator	M. J. Tschosik	M. J. Tschosik	M. J. Tschosik	M. J. Tschosik
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:				
Method ASTM:D698-00a, Method "A"				
Maximum Dry Density (pcf)	111.2	111.2	111.2	100.3
Optimum Moisture (%)	13.8	13.8	13.8	23.0
COMPACTION TEST RESULTS:				
Compaction (%)	100.3	95.0	96.0	100.2
Specified Compaction (%)	95	95	95	95
Specified Moisture (%)	11.8 - Min	11.8 - Min	11.8 - Min	19.8 - Min

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TO: Mr. Joe Kessel
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DATE: June 5, 2008
PROJECT NO: GEO-040821
COPIES TO: Minnkota Power Coop
Barr Engineering Co

PROJECT: Minnkota FGD Pond - Cell 2 Phase III
Center, North Dakota

DENSITY TESTS OF COMPACTED FILL

TEST NUMBER:	RF-59	RF-60	RF-61	RF-62
DATE TAKEN	6/5/08	6/5/08	6/5/08	6/5/08
ASTM: D2488-00 DESCRIPTION AND IDENTIFICATION of SOILS (Visual-Manual Procedure):	Clayey Sand, brown 2008 (SC-2)	Clayey Sand, brown 2008 (SC-2)	Clayey Sand, brown 2008 (SC-2)	Clayey Sand, brown 2008 (SC-2)
LOCATION:	Embankment fill, Station 42+00, 30' South of RF-D Line	Embankment fill, Station 46+20, 150' West of RF-D Line	Embankment fill, Station 47+30, 155' West of RF-D Line	Embankment fill, Station 42+80, 80' South of RF-D Line
ELEVATION OF TEST:	2078'	2055'	2045'	2079'
DEPTH BELOW EXISTING GRADE:	1.0'	1.0'	1.0'	1.0'
FIELD DENSITY DETERMINATION:				
ASTM: D2922-01 Density of Soil-Aggregate in Place by Nuclear Density Methods (Shallow Depth), Direct Transmission				
Dry Density (pcf)	111.9	108.1	107.1	110.8
Moisture Content (%)	13.4	12.7	12.6	13.1
Plus #4 Material (%)	None	None	None	None
Probe Depth (inches)	12	12	12	12
Operator	M. J. Tschosik	M. J. Tschosik	M. J. Tschosik	M. J. Tschosik
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:				
Method	ASTM:D698-00a, Method "A"			
Maximum Dry Density (pcf)	111.2	111.2	111.2	111.2
Optimum Moisture (%)	13.8	13.8	13.8	13.8
COMPACTION TEST RESULTS:				
Compaction (%)	100.6	97.2	96.3	99.6
Specified Compaction (%)	95	95	95	95
Specified Moisture (%)	11.8 - Min	11.8 - Min	11.8 - Min	11.8 - Min

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested. The test locations and number of tests were selected by Baranko Brothers. Compaction and moisture content meet project specifications in the above test areas.

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TO:	Mr. Joe Kessel Baranko Bros, Inc. P.O. Box 0820 Dickinson, ND 58602-0820	**DATE:** **PROJECT NO:** **COPIES TO:**	June 27, 2008 GEO-040821 Minnkota Power Coop Barr Engineering Co
PROJECT:	Minnkota FGD Pond - Cell 2 Phase III Center, North Dakota		

DENSITY TESTS OF COMPACTED FILL

TEST NUMBER:	RF-77	RF-78
DATE TAKEN	6/27/08	6/27/08
ASTM: D2488-00 DESCRIPTION AND IDENTIFICATION of SOILS (Visual-Manual Procedure):	Sandy Lean Clay, trace of gravel, brown 2008 (CL-3)	Sandy Lean Clay, trace of gravel, brown 2008 (CL-3)
LOCATION:	Embankment fill, Station 42+70, 55' West of RF-D Line	Embankment fill, Station 42+25, 35' West of RF-D Line
ELEVATION OF TEST:	2055'	2062'
DEPTH BELOW EXISTING GRADE:	1.0'	1.0'

FIELD DENSITY DETERMINATION:

ASTM: D2922-01 Density of Soil-Aggregate in Place by Nuclear Density Methods (Shallow Depth), Direct Transmission

Dry Density (pcf)	105.7	104.9
Moisture Content (%)	17.2	15.6
Plus #4 Material (%)	2	2
Probe Depth (inches)	12	12
Operator	M. J. Tschosik	M. J. Tschosik

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method	ASTM:D698-00a, Method "A"	
Maximum Dry Density (pcf)	109.2	109.2
Optimum Moisture (%)	18.1	18.1

COMPACTION TEST RESULTS:

Compaction (%)	96.8	96.1
Specified Compaction (%)	95	95
Specified Moisture (%)	14.9 - Min	14.9 - Min

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested. The test locations and number of tests were selected by Baranko Brothers. Compaction and moisture content meet project specifications in the above test areas.

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TO: Mr. Joe Kessel
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DATE: July 7, 2008
PROJECT NO: GEO-040821
COPIES TO: Minnkota Power Coop
Barr Engineering Co

PROJECT: Minnkota FGD Pond - Cell 2 Phase III
Center, North Dakota

DENSITY TESTS OF COMPACTED FILL

TEST NUMBER:	RF-79	RF-80	RF-81	RF-82
DATE TAKEN	7/7/08	7/7/08	7/7/08	7/7/08
ASTM: D2488-00 DESCRIPTION AND IDENTIFICATION of SOILS (Visual-Manual Procedure):	Clayey Sand, trace of gravel, brown 2008 (SC-4)	Clayey Sand, trace of gravel, brown 2008 (SC-4)	Clayey Sand, trace of gravel, brown 2008 (SC-4)	Clayey Sand, trace of gravel, brown 2008 (SC-4)
LOCATION:	Embankment fill, Station 42+00, 30' West of RF-D Line	Embankment fill, Station 43+27, 80' West of RF-D Line	Embankment fill, Station 43+60, 170' West of RF-D Line	Embankment fill, Station 42+35, 163' West of RF-D Line
ELEVATION OF TEST:	2066'	2059'	2059'	2065'
DEPTH BELOW EXISTING GRADE:	1.0'	1.0'	1.0'	1.0'
FIELD DENSITY DETERMINATION:				
ASTM: D2922-01 Density of Soil-Aggregate in Place by Nuclear Density Methods (Shallow Depth), Direct Transmission				
Dry Density (pcf)	111.0	110.6	107.7	110.5
Moisture Content (%)	14.2	14.3	15.1	15.6
Plus #4 Material (%)	1	1	1	1
Probe Depth (inches)	12	12	12	12
Operator	M. J. Tschosik	M. J. Tschosik	M. J. Tschosik	M. J. Tschosik
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:				
Method	ASTM:D698-00a, Method "A"			
Maximum Dry Density (pcf)	111.8	111.8	111.8	111.8
Optimum Moisture (%)	16.4	16.4	16.4	16.4
COMPACTION TEST RESULTS:				
Compaction (%)	99.3	98.9	96.3	98.8
Specified Compaction (%)	95	95	95	95
Specified Moisture (%)	13.8 - Min	13.8 - Min	13.8 - Min	13.8 - Min

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested. The test locations and number of tests were selected by Baranko Brothers. Compaction and moisture content meet project specifications in the above test areas.

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TO:	Mr. Joe Kessel Baranko Bros, Inc. P.O. Box 0820 Dickinson, ND 58602-0820	**DATE:** **PROJECT NO:** **COPIES TO:**	June 5, 2008 GEO-040821 Minnkota Power Coop Barr Engineering Co
PROJECT:	Minnkota FGD Pond - Cell 2 Phase III Center, North Dakota		

DENSITY TESTS OF COMPACTED FILL

TEST NUMBER:	RF-63	RF-64	RF-65
DATE TAKEN	6/5/08	6/5/08	6/5/08
ASTM: D2488-00 DESCRIPTION AND IDENTIFICATION of SOILS (Visual-Manual Procedure):	Clayey Sand, brown 2008 (SC-2)	Clayey Sand, brown 2008 (SC-2)	Clayey Sand, brown 2008 (SC-2)
LOCATION:	Embankment fill, Station 38+00, 33' South of RF-C Line	Embankment fill, Station 34+50, 35' South of RF-C Line	Embankment fill, Station 35+80, 37' South of RF-C Line
ELEVATION OF TEST:	2093'	2093'	2093'
DEPTH BELOW EXISTING GRADE:	1.0'	1.0'	1.0'

FIELD DENSITY DETERMINATION:

ASTM: D2922-01 Density of Soil-Aggregate in Place by Nuclear Density Methods (Shallow Depth), Direct Transmission

Dry Density (pcf)	111.5	109.8	110.4
Moisture Content (%)	14.6	14.2	15.3
Plus #4 Material (%)	None	None	None
Probe Depth (inches)	12	12	12
Operator	M. J. Tschosik	M. J. Tschosik	M. J. Tschosik

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method	ASTM:D698-00a, Method "A"		
Maximum Dry Density (pcf)	111.2	111.2	111.2
Optimum Moisture (%)	13.8	13.8	13.8

COMPACTION TEST RESULTS:

Compaction (%)	100.3	98.7	99.3
Specified Compaction (%)	95	95	95
Specified Moisture (%)	11.8 - Min	11.8 - Min	11.8 - Min

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested. The test locations and number of tests were selected by Baranko Brothers. Compaction and moisture content meet project specifications in the above test areas.

Mark Tschosik

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DATE: June 27, 2008
PROJECT NO: GEO-040821
COPIES TO: Minnkota Power Coop
Barr Engineering Co

PROJECT: Minnkota FGD Pond - Cell 2 Phase III
Center, North Dakota

DENSITY TESTS OF COMPACTED FILL

TEST NUMBER:	RF-73	RF-74	RF-75	RF-76
DATE TAKEN	6/27/08	6/27/08	6/27/08	6/27/08
ASTM: D2488-00 DESCRIPTION AND IDENTIFICATION of SOILS (Visual-Manual Procedure):	Sandy Lean Clay, trace of gravel, brown 2008 (CL-3)	Sandy Lean Clay, trace of gravel, brown 2008 (CL-3)	Sandy Lean Clay, trace of gravel, brown 2008 (CL-3)	Sandy Lean Clay, trace of gravel, brown 2008 (CL-3)
LOCATION:	Embankment fill, Station 43+60, 190' West of RF-D Line	Embankment fill, Station 43+00, 155' West of RF-D Line	Embankment fill, Station 42+30, 100' West of RF-D Line	Embankment fill, Station 42+50, 112' West of RF-D Line
ELEVATION OF TEST:	2051'	2060'	2063'	2058'
DEPTH BELOW EXISTING GRADE:	1.0'	1.0'	1.0'	1.0'
FIELD DENSITY DETERMINATION:				
ASTM: D2922-01 Density of Soil-Aggregate in Place by Nuclear Dehsity Methods (Shallow Depth), Direct Transmission				
Dry Density (pcf)	106.3	109.5	108.6	107.1
Moisture Content (%)	15.7	15.4	17.1	15.8
Plus #4 Material (%)	2	2	2	2
Probe Depth (inches)	12	12	12	12
Operator	M. J. Tschosik	M. J. Tschosik	M. J. Tschosik	M. J. Tschosik
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:				
Method	ASTM:D698-00a, Method "A"			
Maximum Dry Density (pcf)	109.2	109.2	109.2	109.2
Optimum Moisture (%)	18.1	18.1	18.1	18.1
COMPACTION TEST RESULTS:				
Compaction (%)	97.3	100.3	99.5	98.1
Specified Compaction (%)	95	95	95	95
Specified Moisture (%)	14.9 - Min	14.9 - Min	14.9 - Min	14.9 - Min

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested. The test locations and number of tests were selected by Baranko Brothers. Compaction and moisture content meet project specifications in the above test areas.

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TO:	Mr. Joe Kessel Baranko Bros, Inc. P.O. Box 0820 Dickinson, ND 58602-0820	**DATE:** **PROJECT NO:** **COPIES TO:**	July 7, 2008 GEO-040821 Minnkota Power Coop Barr Engineering Co
PROJECT:	Minnkota FGD Pond - Cell 2 Phase III Center, North Dakota		

DENSITY TESTS OF COMPACTED FILL

TEST NUMBER:	RF-83
DATE TAKEN	7/7/08
ASTM: D2488-00 DESCRIPTION AND IDENTIFICATION of SOILS (Visual-Manual Procedure):	Clayey Sand, trace of gravel, brown 2008 (SC-4)
LOCATION:	Embankment fill, Station 42+10, 145' West of RF-D Line
ELEVATION OF TEST:	2068'
DEPTH BELOW EXISTING GRADE:	1.0'

FIELD DENSITY DETERMINATION:

ASTM: D2922-01 Density of Soil-Aggregate in Place by Nuclear Density Methods (Shallow Depth), Direct Transmission

Dry Density (pcf)	108.6
Moisture Content (%)	15.6
Plus #4 Material (%)	1
Probe Depth (inches)	12
Operator	M. J. Tschosik

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method	ASTM:D698-00a, Method "A"
Maximum Dry Density (pcf)	111.8
Optimum Moisture (%)	16.4

COMPACTION TEST RESULTS:

Compaction (%)	97.1
Specified Compaction (%)	95
Specified Moisture (%)	13.8 - Min

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested. The test locations and number of tests were selected by Baranko Brothers. Compaction and moisture content meet project specifications in the above test area.

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TO:	Mr. Joe Kessel Baranko Bros, Inc. P.O. Box 0820 Dickinson, ND 58602-0820	**DATE:** **PROJECT NO:** **COPIES TO:**	July 21, 2008 GEO-040821 Minnkota Power Coop Barr Engineering Co
PROJECT:	Minnkota FGD Pond - Cell 2 Phase III Center, North Dakota		

DENSITY TESTS OF COMPACTED FILL

TEST NUMBER:	RF-107	RF-108	RF-109	RF-110
DATE TAKEN	7/21/08	7/21/08	7/21/08	7/21/08
ASTM: D2488-00 DESCRIPTION AND IDENTIFICATION of SOILS (Visual-Manual Procedure):	Clayey Sand, brown 2008 (SC-6)	Clayey Sand, brown 2008 (SC-6)	Clayey Sand, brown 2008 (SC-6)	Clayey Sand, brown 2008 (SC-6)
LOCATION:	Embankment fill, Station 47+80, 110' West of RF-D Line	Embankment fill, Station 46+30, 115' West of RF-D Line	Embankment fill, Station 44+70, 120' West of RF-D Line	Embankment fill, Station 42+90, 115' West of RF-D Line
ELEVATION OF TEST:	2063'	2065'	2067'	2067'
DEPTH BELOW EXISTING GRADE:	1.0'	1.0'	1.0'	1.0'
FIELD DENSITY DETERMINATION:				
ASTM: D2922-01 Density of Soil-Aggregate in Place by Nuclear Density Methods (Shallow Depth), Direct Transmission				
Dry Density (pcf)	103.9	106.2	105.1	105.2
Moisture Content (%)	18.2	17.8	17.7	13.8
Plus #4 Material (%)	None	None	None	None
Probe Depth (inches)	12	12	12	12
Operator	M. J. Tschosik	M. J. Tschosik	M. J. Tschosik	M. J. Tschosik
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:				
Method	ASTM:D698-00a, Method "A"			
Maximum Dry Density (pcf)	106.6	106.6	106.6	106.6
Optimum Moisture (%)	16.6	16.6	16.6	16.6
COMPACTION TEST RESULTS:				
Compaction (%)	97.5	99.6	98.6	98.7
Specified Compaction (%)	95	95	95	95
Specified Moisture (%)	9.9 - Min	9.9 - Min	9.9 - Min	9.9 - Min

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested. The test locations and number of tests were selected by Baranko Brothers. Compaction and moisture content meet project specifications in the above test areas.

GEOSERV, INC.
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geoservinc@quest.net

GEOSERV, INC. *Testing - Exploration - Engineering*

Construction Materials Testing, Geotechnical, Geosynthetics, Geoenvironmental, Drilling

TO:	Mr. Joe Kessel Baranko Bros, Inc. P.O. Box 0820 Dickinson, ND 58602-0820	**DATE:** **PROJECT NO:** **COPIES TO:**	August 1, 2008 GEO-040821 Minnkota Power Coop Barr Engineering Co
PROJECT:	Minnkota FGD Pond - Cell 2 Phase III Center, North Dakota		

DENSITY TESTS OF COMPACTED FILL

TEST NUMBER:	RF-142	RF-143
DATE TAKEN	8/1/08	8/1/08
ASTM: D2488-00 DESCRIPTION AND IDENTIFICATION of SOILS (Visual-Manual Procedure):	Clayey Sand, brown 2008 (SC-6)	Clayey Sand, brown 2008 (SC-6)
LOCATION:	Embankment fill, Station 43+30, on RF-D Line	Embankment fill, Station 41+80, 30' South of RF-A Line
ELEVATION OF TEST:	2084'	2089'
DEPTH BELOW EXISTING GRADE:	1.0'	1.0'

FIELD DENSITY DETERMINATION:

ASTM: D2922-01 Density of Soil-Aggregate in Place by Nuclear Density Methods (Shallow Depth), Direct Transmission

Dry Density (pcf)	106.3	103.6
Moisture Content (%)	11.9	13.1
Plus #4 Material (%)	None	None
Probe Depth (inches)	12	12
Operator	M. J. Tschosik	M. J. Tschosik

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method	ASTM:D698-00a, Method "A"	
Maximum Dry Density (pcf)	106.6	106.6
Optimum Moisture (%)	16.6	16.6

COMPACTION TEST RESULTS:

Compaction (%)	99.7	97.2
Specified Compaction (%)	95	95
Specified Moisture (%)	9.9 - Min	9.9 - Min

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested. The test locations and number of tests were selected by Baranko Brothers. Compaction and moisture content meet project specifications in the above test areas.

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TO:	Mr. Joe Kessel Baranko Bros, Inc. P.O. Box 0820 Dickinson, ND 58602-0820	**DATE:** **PROJECT NO:** **COPIES TO:**	August 8, 2008 GEO-040821 Minnkota Power Coop Barr Engineering Co
PROJECT:	Minnkota FGD Pond - Cell 2 Phase III Center, North Dakota		

DENSITY TESTS OF COMPACTED FILL

TEST NUMBER:	RF-151	RF-152	RF-153	RF-154
DATE TAKEN	8/8/08	8/8/08	8/8/08	8/8/08
ASTM: D2488-00 DESCRIPTION AND IDENTIFICATION of SOILS (Visual-Manual Procedure):	Sandy Lean Clay, trace of gravel, brown 2008 (CL-3)	Sandy Lean Clay, trace of gravel, brown 2008 (CL-3)	Sandy Lean Clay, trace of gravel, brown 2008 (CL-3)	Sandy Lean Clay, trace of gravel, brown 2008 (CL-3)
LOCATION:	Embankment fill, Station 29+10, 25' North of RF-E Line	Embankment fill, Station 26+30, 30' North of RF-E Line	Embankment fill, Station 2+30, 15' North of T RF-A Line	Embankment fill, Station 6+10, 10' North of T RF-A Line
ELEVATION OF TEST:	2098'	2099'	2100'	2100'
DEPTH BELOW EXISTING GRADE:	1.0'	1.0'	1.0'	1.0'
FIELD DENSITY DETERMINATION:				
ASTM: D2922-01 Density of Soil-Aggregate in Place by Nuclear Density Methods (Shallow Depth), Direct Transmission				
Dry Density (pcf)	107.7	107.9	108.4	108.1
Moisture Content (%)	15.6	15.6	16.5	17.1
Plus #4 Material (%)	2	2	2	2
Probe Depth (inches)	12	12	12	12
Operator	M. J. Tschosik	M. J. Tschosik	M. J. Tschosik	M. J. Tschosik
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:				
Method	ASTM:D698-00a, Method "A"			
Maximum Dry Density (pcf)	109.2	109.2	109.2	109.2
Optimum Moisture (%)	18.1	18.1	18.1	18.1
COMPACTION TEST RESULTS:				
Compaction (%)	98.6	98.8	99.3	99.0
Specified Compaction (%)	95	95	95	95
Specified Moisture (%)	14.9 - Min	14.9 - Min	14.9 - Min	14.9 - Min

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested. The test locations and number of tests were selected by Baranko Brothers. Compaction and moisture content meet project specifications in the above test areas.

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GEOSERV, INC. *Testing - Exploration - Engineering*

Construction Materials Testing, Geotechnical, Geosynthetics, Geoenvironmental, Drilling

TO:	Mr. Joe Kessel Baranko Bros, Inc. P.O. Box 0820 Dickinson, ND 58602-0820	**DATE:** **PROJECT NO:** **COPIES TO:**	August 13, 2008 GEO-040821 Minnkota Power Coop Barr Engineering Co
PROJECT:	Minnkota FGD Pond - Cell 2 Phase III Center, North Dakota		

DENSITY TESTS OF COMPACTED FILL

TEST NUMBER:	RF-162	RF-163	RF-164
DATE TAKEN	8/13/08	8/13/08	8/13/08
ASTM: D2488-00 DESCRIPTION AND IDENTIFICATION of SOILS (Visual-Manual Procedure):	Sandy Lean Clay, trace of gravel, brown 2008 (CL-3)	Clayey Sand, brown 2008 (SC-6)	Clayey Sand, brown 2008 (SC-6)
LOCATION:	Embankment fill, Station 20+10, 35' East of CR-C Line	Embankment fill, Station 26+10, 30' North of RF-F Line	Embankment fill, Station 28+30, 30' North of RF-F Line
ELEVATION OF TEST:	2088'	2100'	2100'
DEPTH BELOW EXISTING GRADE:	1.0'	1.0'	1.0'
FIELD DENSITY DETERMINATION:			
ASTM: D2922-01 Density of Soil-Aggregate in Place by Nuclear Density Methods (Shallow Depth), Direct Transmission			
Dry Density (pcf)	105.4	105.6	104.4
Moisture Content (%)	16.4	11.3	11.1
Plus #4 Material (%)	2	None	None
Probe Depth (inches)	12	12	12
Operator	M. J. Tschosik	M. J. Tschosik	M. J. Tschosik
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:			
Method	ASTM:D698-00a, Method "A"		
Maximum Dry Density (pcf)	109.2	106.6	106.6
Optimum Moisture (%)	18.1	16.6	16.6
COMPACTION TEST RESULTS:			
Compaction (%)	96.5	99.1	97.9
Specified Compaction (%)	95	95	95
Specified Moisture (%)	14.9 - Min	9.9 - Min	9.9 - Min

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested. The test locations and number of tests were selected by Baranko Brothers. Compaction and moisture content meet project specifications in the above test areas.

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TO:	Mr. Joe Kessel Baranko Bros, Inc. P.O. Box 0820 Dickinson, ND 58602-0820	**DATE:** **PROJECT NO:** **COPIES TO:**	August 18, 2008 GEO-040821 Minnkota Power Coop Barr Engineering Co
PROJECT:	Minnkota FGD Pond - Cell 2 Phase III Center, North Dakota		

DENSITY TESTS OF COMPACTED FILL

TEST NUMBER:	RF-165	RF-166	RF-167	RF-168
DATE TAKEN	8/18/08	8/18/08	8/18/08	8/18/08
ASTM: D2488-00 DESCRIPTION AND IDENTIFICATION of SOILS (Visual-Manual Procedure):	Sandy Lean Clay, trace of gravel, brown 2008 (CL-3)	Sandy Lean Clay, trace of gravel, brown 2008 (CL-3)	Sandy Lean Clay, trace of gravel, brown 2008 (CL-3)	Sandy Lean Clay, trace of gravel, brown 2008 (CL-3)
LOCATION:	Embankment fill, Station 39+20, 45' South of CR-C Line	Embankment fill, Station 33+10, 45' South of CR-C Line	Embankment fill, Station 30+50, 45' South of CR-C Line	Embankment fill, Station 23+25, 30' East of CR-C Line
ELEVATION OF TEST:	2097'	2097'	2097'	2100'
DEPTH BELOW EXISTING GRADE:	1.0'	1.0'	1.0'	1.0'
FIELD DENSITY DETERMINATION:				
ASTM: D2922-01 Density of Soil-Aggregate in Place by Nuclear Density Methods (Shallow Depth), Direct Transmission				
Dry Density (pcf)	105.6	106.6	107.3	108.5
Moisture Content (%)	17.6	15.9	17.2	15.6
Plus #4 Material (%)	2	2	2	2
Probe Depth (inches)	12	12	12	12
Operator	M. J. Tschosik	M. J. Tschosik	M. J. Tschosik	M. J. Tschosik
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:				
Method	ASTM:D698-00a, Method "A"			
Maximum Dry Density (pcf)	109.2	109.2	109.2	109.2
Optimum Moisture (%)	18.1	18.1	18.1	18.1
COMPACTION TEST RESULTS:				
Compaction (%)	96.7	97.6	98.3	99.4
Specified Compaction (%)	95	95	95	95
Specified Moisture (%)	14.9 - Min	14.9 - Min	14.9 - Min	14.9 - Min

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested. The test locations and number of tests were selected by Baranko Brothers. Compaction and moisture content meet project specifications in the above test areas.

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3.0 BASIN DESIGN/OPERATING PHILOSOPHY

3.1 Bottom Ash Basin

The bottom ash basin will be utilized whenever the plant bottom ash dewatering system is not operable. Sufficient water depth will be maintained in the basin by insertion of stoplogs at the outlet works, to control total suspended solids. At the completion of a use cycle, the basin will be dewatered and bottom ash excavated, if possible, leaving the basin ready for next use.

The bottom ash basin will also be utilized to receive the dewatering effluent from the north retention basin.

3.2 North and South Retention Basins

During the summer period, the south retention basin has been sized as a once-through system with a retention time of 1 day for the 10 year - 24 hour rainfall to control total suspended solids. If possible, prior to freezing winter weather, the basin will be dewatered and cleaned to provide winter storage capacity for the normal total water equivalent of precipitation occurring during the months of November through April.

4.0 BASIN OPERATING PROCEDURES

4.1 Bottom Ash Basin

4.1.1 Normal Operation

Prior to use, the Basin should be clean down to the design basin floor elevation.

1. Insert six stoplogs prior to beginning sluicing bottom ash to the basin. With six stoplogs in place, water surface elevation will be 1949.0 feet.

2. As ash is collected in the pond, the suspended solids content will increase. At the time, as determined by operating experience, that suspended solids approaches the allowable limit, additional stoplogs (up to twelve total) will be inserted to limit suspended solids. With twelve stoplogs in place the water surface elevation will be at the maximum level of 1957.3 feet.

At the lower pond elevations, some additional control of total suspended solids can be obtained by accelerating the stoplog insertion schedule. If total suspended solids exceed the allowable, immediate insertion of one or more stoplogs will raise the water level thereby increasing retention time and sedimentation efficiency. With additional basin operating experience, the operators should develop a feel for control of total suspended solids.

At the completion of the basin operating cycle, the ash must be dewatered prior to excavation. Initial dewatering will occur through stoplog leakage. If the schedule permits, dewatering in that manner, although slower, should result in lower total suspended solids in the dewatering

effluent. The faster, alternate dewatering procedure would be removal of the stoplogs on a periodic basis, exercising care to prevent bottom ash from enter the outlet works.

4.1.2 Operation During North Runoff Retention Basin Dewatering

The effluent from the north runoff retention basin dewatering pump is routed to the bottom ash basin by way of the ash sluice line. Prior to beginning dewatering of the north runoff retention basin, the following operating procedures should be observed:

1. Insert a sufficient number of stoplogs in the bottom ash basin outlet works to raise the overflow elevation to a minimum of four feet above the level of bottom ash.

Additional control of suspended solids can be achieved with insertion of one or more additional stoplogs.

4.2 North Retention Basin

Operating procedures are described in the following paragraphs.

180.039

NORTH DAKOTA
DEPARTMENT of HEALTH

ENVIRONMENTAL HEALTH SECTION
Gold Seal Center, 918 E. Divide Ave.
Bismarck, ND 58501-1947
701.328.5200 (fax)
www.ndhealth.gov

June 29, 2007

Craig Bleth,
Plant Environmental Superintendent
Minnkota Power Cooperative
PO Box 127
Center ND 58530-0127

RE: NDPDES Permit No. ND0000370

Dear Mr. Bleth:

On June 20, 2007, an inspection of the above-referenced facility's wastewater management system was completed by this Department. Enclosed is a copy of the results of the inspection for your review.

Should you have any questions concerning this inspection, please contact me at 328-5239.

Sincerely,

Randy Kowalski
Environmental Scientist
Division of Water Quality

RK

cc: EPA
Scott Hopfauf, Minnkota
Keith Johnson, CDHU

INDUSTRIAL INSPECTION

FACILITY: Minnkota Power Cooperative

DATE: June 20, 2007

LOCATION: Center, ND

TIME: 9:00 a.m.

PERMIT NO.: ND-0000370, NDR05-0012

CONDITIONS: Calm, clear
Approx. 75^{O}-80^{O}

CONTACT PERSON: Scott Hopfauf

INSPECTOR: Randy Kowalski

SITE REVIEW

At the time of the inspection both units were in operation. Overall the plant appeared orderly and the wastewater treatment structures appeared to be in good condition.

The North Retaining Basin (008) was not discharging and the water level in the basin was about 1 foot below the v-notches on the outlet (~4 feet below the top of the stop logs). While the current water level in the pond was believed to be sufficient to contain the runoff from a 10 yr – 24hr storm, we were not certain on the design runoff volume and the available pond capacity. Mr. Hopfauf indicated that they were able to manage basin without overflowing the spillway stop logs during the rains that occurred in May and early June. He also indicated that the pond is scheduled for clean out to remove accumulated sediment. As part of the cleanout the stage - capacity information for the pond should be updated. We also agreed that the debris and sediment should be removed from the emergency spillway.

The alternate bottom ash pond (009) was not in use and less than 1/4 full of bottom ash.

The butterfly ponds were being used for storing material for disposal or recycle. A significant amount of water had collected in the west cell used for recyclable materials. Mr. Hopfauf indicated that the water would be sent to the FGD/solid waste disposal area. Cell 1 of the solid waste disposal facility used for fly ash and solid waste disposal had collected some water that will be sent to cell 2. Cell 2, the current FGD recycle cell appeared in good condition and maintained to ensure no discharge. Runoff from the inactive areas and future solid waste cells is handled by detention ponds operated by BNI Coal.

The South Retaining Basin (020) was being dewatered to the thickener. The temporary pump had been set to route the SRB water to the thickener since it had received water from the solid waste system which it is not authorized to discharge. The solid waste system water entered the basin when the blowdown line was opened to clear a clog that occurred during the recent boiler cleaning on unit 2. It was estimated that less than a 1000 gallons drained to the SRB. Ultimately the water sent to the thickener will be used for make-up water in the FGD system.

The surface preparation (sand-water blasting) activity for the painting project on the north side of the plant was reviewed. A tarp with curbing was in-place on the northeast corner of the building

to capture fines from the blasting operation. Any water from the blasting and washing on the lower portion of the building was being intercepted in the last sump in the east yard drainage ditch and then pumped to wastewater treatment (DP 025). On the area above the office the fines were being captured on the office roof and the water was draining to the roof drain (DP 010). We reviewed the outfall for roof drain discharge point 010. The drainage from the outlet was clear and was estimated to be flowing at less than 5 gpm. Routing the discharge to wastewater treatment was not a feasible option for this section of the building.

The sewage treatment plant (DP 003) was reviewed and appeared to be operating normally. The discharge from the package unit appeared clear. The instrumentation on the unit indicated a chlorine residual of 0.10 mg/l and flow rates of 1.12 gpm (reading #2 - discharge?) and 2.88 gpm (reading #3 – inflow?).

The wastewater treatment plant outfall (DP 025) was observed and appeared clear. We noticed that the water near the shoreline from the contractor parking area to the intakes looked like slime which appeared to be caused by floating algae that had drifted into the area.

STORMWATER REVIEW (permit NDR05-0012)

A number of storm water discharge points were reviewed at the main plant site and the HVDC terminal area. Areas that were in need of maintenance or improved BMPs were the silt fence controls for the bone yard, the new area being grade for equipment storage and the washouts in the drainage path from the area south east of the lake spillway.

The drainage ditches along the haulroad from coal handling to Hagel creek appeared in good condition. The rock check closest to coal handling on the south side of the road had recently been cleaned. The lower rock checks did not appear to have significant sediment accumulation. We did note an area of scour/headward erosion occurring at a culvert entering the south ditch near the intersection with the access road to the west of the coal stockpile.

The silt fence runoff controls for the storage area (bone yard) were reviewed and were in need of repair. A section of fence in the second row of fence had washed-out. The next row had washed out the berm extending to the north of the silt fence. The gully extended along the north side of the remaining silt fence and berm structures. A significant amount or sediment had collected behind the silt fences indicating the structures had been working to trap sediment transported from the bare soil areas of the storage area prior the washouts occurring. The need to repair the structures was discussed as well as the possibility of replacing the silt fences with a sediment trap or basin type of structure.

A new equipment lay-down and storage area was being graded on the hill north of the current storage area. Aside from the vegetative buffer from the natural vegetation around the site, it did not appear that any erosion and sediment controls were being provided for the area. There are limits to the ability of natural vegetation to capture sediment and the build-up of sediment will eventually cause the vegetation to deteriorate and become overtaken by weeds. It appeared that a v-bottom ditch cut to provide drainage on the east side of the area which would be vulnerable to erosion and promote the transport of sediment from the graded area.

The drainage path for runoff from the area between the plant entrance road and the emergency spillway was reviewed. The drainage from hose leakage / spillage from water truck filling allowed us to follow the flow path from the area to the wooded draw southeast of the emergency spillway. Several gullies were present in the area where the flow breaks over the edge of the draw. A stabile slope drain needs to be provided for surface drainage that outlets to the wooded draw to prevent the headward advance of the gullies and to reduce the resulting sediment contribution to Square Butte creek.

RECORDS

NDPDES permit related correspondence, monitoring reports and supporting records were reviewed. All records were complete and contained the required information. Laboratory records were not reviewed as they are generally required as part of the state's laboratory certification program.

RECOMMENDATIONS / CORRECTIVE ACTIONS

1. Clean and repair the silt fence and berm sediment controls for the storage area (bone yard). Consider replacing the silt fence with a more durable control measure sized for the contributing drainage area such as sediment basins, rock check dams or similar.

2. Implement sediment and erosion controls at the new equipment storage area that was being developed. Drainage on the west side of the area could affect the quality of the discharge from point 019 which is subject to Best Management Practice (BMP) conditions and sampling requirements.

3. Design and implement drainage improvements to correct the gully erosion that is occurring southeast of the emergency spillway.

RECORDS AND REPORTS

Yes No N/A 1. Permit information (including any calibration and maintenance records) is kept for the required 3 year period.

Yes No N/A 2. Sampling and analysis data for all parameters at all discharge points (including visual monitoring, flow measuring, WET samples, and influent monitoring) are adequate and include:

Yes No N/A a. Dates, times, location of sampling

Yes No N/A b. Initials of individual performing sampling

Yes No N/A c. Dates and times of analysis

Yes No N/A d. Initials of individual performing analysis

Yes No N/A e. Analytical methods and techniques reference

Yes No N/A 3. Holding times complied with for all parameters

Yes No N/A 4. Proper sampling frequencies for all parameters

5. List discharge points and parameters reviewed
April 2007; Discharge Points: 001, 002, 003, 008, 025.

Yes No N/A 6. Flow monitoring charts, tables, etc. available

Yes No N/A 7. Flow measuring provides results within required accuracy level
Did not attempt to confirm accuracy, methods indicated appear reasonable for nature of discharge. May be over estimating pump curve flows due to wear.

8. List how flow is determined at each point
001 - Pump rating and hours – plant data system
003 - Recorder on weir
008 - Pump rating and hours
019 - Depth in pipe & chart; estimated on extreme low flows
020 – Pump rating and hours
025 - Totalizer

Comments:

DISCHARGE MONITORING REPORTS

Yes No N/A 1. Analytical results consistent with the data reported on Discharge Monitoring Reports (DMR's).

Yes No N/A 2. All additional data summarized on DMR as required by permit.

Yes No N/A 3. Bacteria data summarized as a geometric mean where required by permit.

Yes No N/A 4. Instantaneous maximum and minimum values calculated and reported properly on DMR where required by permit.

Yes No N/A 5. Daily maximum and minimum values (arithmetic, geometric) calculated and reported properly on DMR where required by permit.

Yes No N/A 6. 7-Day maximum and minimum values (arithmetic, geometric) calculated and reported properly on DMR where required by permit.

Yes No N/A 7. Daily average/monthly average values (arithmetic, geometric) calculated and reported properly on DMR where required by permit.

Yes No N/A 8. All loading values calculated and reported properly on DMR where required by permit.

Yes No N/A 9. Predischarge samples reported properly on DMR.

Yes No N/A 10. State compliance samples reported properly on DMR.

Yes No N/A 11. Split samples reported properly on DMR.

Yes No N/A 12. Multiple daily samples reported properly on DMR.

Yes No N/A 13. Number of exceedances reported properly on DMR.
None on reports reviewed.

Yes No N/A 14. Sampling frequencies reported properly on DMR.

15. List DMR's reviewed
April 2007; Discharge Points: 001, 002, 003, 008, 025.

Comments:

No discrepancies noted

LABORATORIES AND TESTING EQUIPMENT

1. List laboratories utilized for all permit-required parameters.
   Minnkota- TSS, pH, BOD, TFe, TRC
   MVTL- Oil & Grease, Non routine tests
   ASCi Corp, Duluth MN - WET

Yes No N/A 2. All laboratories have up-to-date state certification.

Yes No N/A 3. State certification visibly posted in permittee laboratory.

Yes No N/A 4. Results of last DMR/QA test available. Date **Not Checked**

Yes No N/A 5. Calibration and maintenance records of laboratory equipment available and up-to-date.
Not checked

Yes No N/A 6. Calibration records of flow meter available and up-to-date.
Not checked

Comments:

WHOLE EFFLUENT TOXICITY TESTING AND REPORTING

Yes No N/A 1. WET sampling by permittee is adequate to meet the conditions of the permit.

Yes No N/A a. Chain of custody used.
Yes No N/A b. Method of shipment and preservation adequate.
Yes No N/A c. Holding time met (received within 36 hours).

Yes No N/A 2. Lab reoprts/chain of custody sheets indicate temperature of sample when it is received by the lab.
Indicate temperature: **3.2 C (008); 3.6 C (025); 5.5 C (Nelson Lake)**

Yes No N/A 3. Lab has provided available quality control data, i.e., reference toxicant control charts.

Comments:

Samples from 008, 025.

Collected: March 12, 2007: 0843
Received: March 13 2007: 0700

File: 180.039

NORTH DAKOTA
DEPARTMENT of HEALTH

ENVIRONMENTAL HEALTH SECTION
Gold Seal Center, 918 E. Divide Ave.
Bismarck, ND 58501-1947
701.328.5200 (fax)
www.ndhealth.gov

July 11, 2008

Craig Bleth, CB 7/15/08
Plant Environmental Superintendent
Minnkota Power Cooperative
PO Box 127
Center ND 58530-0127

RE: NDPDES Permit No. ND0000370

Dear Mr. Bleth:

On June 25, 2008, an inspection of the above-referenced facility's wastewater management system was completed by this Department. Enclosed is a copy of the results of the inspection for your review.

Should you have any questions concerning this inspection, please contact me at 328-5239.

Sincerely,

Randy Kowalski
Environmental Scientist
Division of Water Quality

RK

cc: EPA
Scott Hopfauf, Minnkota
Keith Johnson, CDHU

INDUSTRIAL INSPECTION

FACILITY: Minnkota Power Cooperative

DATE: June 25, 2008

LOCATION: Center, ND

TIME: 9:00 a.m.

PERMIT NO.: ND-0000370, NDR05-0012

CONDITIONS: Light NW wind, clear
Approx. 70^{O}-80^{O}

CONTACT PERSON: Scott Hopfauf

INSPECTOR: Randy Kowalski & Cory Lawson

SITE REVIEW

At the time of the inspection both units were in operation. Overall the plant appeared orderly and the wastewater treatment structures appeared to be in good condition. The facility was making preparations for the construction of the new stack for Unit 2 and the scrubber for Unit 1.

The alternate bottom ash pond (009) was not in use. The pond was approximately 1/3 full of bottom ash which was in the process of being hauled out. The North Retaining Basin (008) was not discharging and the water level in the basin was about 3 to 4 feet below the top of the stop logs. The South Retaining Basin (020) was not discharging and had approximately 5 feet of freeboard. Mr. Hopfuaf indicated that he recently calculated the sizing for basins and both have more than adequate storage to contain runoff from a 10yr-24hr storm event.

The butterfly ponds were being used for storing material for disposal or recycle. The solid waste facility was reviewed and the current FGD recycle cell (Cell 2) appeared in good condition and maintained to ensure no discharge. Runoff from the inactive areas and future solid waste cells is handled by detention ponds operated by BNI Coal.

The sewage treatment plant (DP 003) was reviewed and appeared to be operating normally. The discharge from the package unit appeared clear. The flow rate reading was 2.02 gpm and the chlorine level was 0.72 mg/L.

The wastewater treatment plant (DP 025) was reviewed. The plant equipment appeared to be in good condition and operating normally. The final effluent discharge from the plant appeared clear.

STORMWATER REVIEW (permit NDR05-0012)

The drainage ditches along the haulroad from coal handling to Hagel creek were reviewed. The rock check closest to coal handling on the south side of the road had recently been cleaned and had filled again due to recent rains. The lower rock checks did not appear to have significant sediment accumulation. The narrow, un-vegetated ditch upstream of the checks presents an ongoing source for sediment which results in the need for frequent clean-out.

The silt fence runoff controls for the storage area (bone yard) were reviewed. The fences had been cleaned recently and appeared in good condition. Mr. Hopfauf pointed out grading and rock surfacing completed in the storage area to reduce the sediment load to the silt fences. Additional improvements to control sediment and reduce maintenance frequency were also discussed including the possibility of replacing the silt fences with a sediment trap or basin.

The gully repairs made south of the plant entrance road and the emergency spillway were reviewed. The lack of plant growth on the repaired slope is a concern since it had been seeded last fall and this spring (about 4 weeks prior to visit). The topsoil quality and other factors that could affect germination and growth were discussed.

At the DC terminal, rock had been added below the culverts for SW points 010 and 011 to prevent erosion. There appeared to be some distressed vegetation in the drainage leading from the switchyard.

RECORDS

NDPDES permit related correspondence, monitoring reports and supporting records were reviewed. All records were complete and contained the required information. Laboratory records were not reviewed as they are generally required as part of the state's laboratory certification program.

The stormwater permit records were also reviewed. The SWPP plan was up-to-date with the most recent revision occurring on 10/27/2007. There are nine active discharge points, four of which are sampled. The last sample date was 6/5/2008 and the last stormwater inspection was 9/18/2007. The facility also has stormwater permits for an offsite temporary batch plant and for small construction activity which were also reviewed.

RECOMMENDATIONS / CORRECTIVE ACTIONS

1. Monitor the gully erosion repair area near the plan entrance until vegetation is reestablished. Take corrective action as needed to establish vegetation and to repair any damage that may occur due to erosion.

STORMWATER INSPECTION / SITE REVIEW

FACILITY: Minnkota (Small Construction) DATE: June 25, 2008

PERMIT #: ND10-0835 TIME: 9:00

LOCATION: Center ND

FACILITY CONTACT: Scott Hopfauf

INSPECTORS: Randy Kowalski & Cory Lawson

Findings / Observations

No construction activities were taking place at the time of the visit. No activity has taken place under this permit in over two years. The permit would apply to construction outside the main plant site involving less than five acres of disturbance.

An Annual Location Record for 2007 was not found when reviewing records. The company provided an ALR by letter on June 30, 2008 which indicated no activity for 2007.

Requirements / Follow-up

None

ND Department of Health
Division of Water Quality
(701) 328-5210

Mining & Paving Plant Sites
Storm Water Inspection
NDR32-0000

Facility Name **Minnkota Power**		Permit No **ND32-0630**
Location **Center ND**		County **Oliver**
Contact *(if available)* **Scott Hopfauf**	Title **Civil Engineer**	Phone **794-8711**
Inspector **Randy Kowalski & Cory Lawson**	Date **June 25, 2008**	Time **9:00**
Documents: SWPP Plan (Y N) If no, where?	Inspection Record (Y N)	Application date **5/27/08**

Visual Assessment			**Comments**
Evidence of soil erosion on site	Yes	**No**	
Evidence of soil erosion or deposition off site	Yes	**No**	
Observed erosion control measures / Best Management Practices settling pond, **berms, silt fence, bale dikes**, rock check dam, etc.	Yes	**No**	
Observed controls appeared appropriately maintained and effective Should not be washed out, filled with sediment, falling down, etc.	**Yes**	No	
Evidence of bulk storage on site Above ground tanks, Drums, Pressurized cylinders, Underground Storage tanks (USTs) Other: (RR cars, bulk trucks, etc.)	Yes	**No**	
Evidence of leakage at bulk storage areas	Yes	**No**	
Vehicle maintenance or fueling areas	Yes	**No**	
Evidence of substances exposed to storm water Motor/Lubricating Oil, Paints/Solvents, Pesticides/Herbicides, etc:	Yes	**No**	
Observable soil stains	Yes	**No**	
Observable distressed or damaged vegetation Possibly from spills, leaks, herbicides or sediment accumulations	Yes	**No**	
Evidence of current or former landfills or refuse dumps	Yes	**No**	
Observable Trash	Yes	**No**	
Adjacent to surface water body(s) Natural Lake, Reservoir, Stock Pond, ditch, creek/river, wetland	**Yes**	No	Hagel Creek
Observable trenches, ditches, or depressions which could lead to offsite runoff	**Yes**	No	Controlled
Does the facility include a wash plant or process wastewater? *(if Yes complete a-c below)*	Yes	**No**	
a. Wastewater treatment and/or storage provided on site? *(Indicate: Recycled, storage ponds/pit, other _____)*	Yes	No	**NA**
b. Observed discharge structure on system (pipe, channel, pump, etc)	Yes	No	**NA**
c. Evidence of offsite discharge from the wash plant (ie sediment build up, water flow)? *Wash plant discharges require specific NDPDES permit* *Check permit and recent test results; or* *Take photos and/or smple of the discharge if no permit*	Yes	No	**NA**
Evidence of other Non-storm water discharges?	Yes	**No**	

Notes: The permit was recently obtained. Site grading had been graded and being prepared for plant set-up and operation by Knife River. Runoff water collects in a small basin at the NE corner of the site. We discussed the importance of keeping the basin spillway area stabilized and dewatering methods.

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NORTH DAKOTA
DEPARTMENT of HEALTH

ENVIRONMENTAL HEALTH SECTION
Gold Seal Center, 918 E. Divide Ave.
Bismarck, ND 58501-1947
701.328.5200 (fax)
www.ndhealth.gov

July 28, 2009

Craig Bleth,
Plant Environmental Superintendent
Minnkota Power Cooperative
PO Box 127
Center ND 58530-0127

RE: Minnkota Power – Center
NDPDES Permit #s: ND0000370, NDR050012, NDR320630
ND100835, ND102616

Dear Mr. Bleth:

On July 16, 2009, an inspection was completed by this Department at the above-referenced facility to review wastewater and stormwater management practices. We appreciate the time and cooperation provided during the site review and to comply with the permit conditions. Enclosed are copies of the inspection reports for your review.

Should you have any questions concerning this inspection, please contact me at 328-5239.

Sincerely,

Randy Kowalski
Environmental Scientist
Division of Water Quality

RK

cc: EPA
Scott Hopfauf, Minnkota
Keith Johnson, CDHU

INDUSTRIAL INSPECTION

FACILITY: Minnkota Power Cooperative

DATE: July 16, 2009

LOCATION: Center, ND

TIME: 9:00 a.m.

PERMIT NO.: ND-0000370

CONDITIONS: NW wind, clear
Approx. 60^{O}-70^{O}

CONTACT PERSON: Scott Hopfauf

INSPECTOR: Randy Kowalski

SITE REVIEW

At the time of the inspection both units were in operation. Extensive construction work was in progress around the plant site primarily associated with the scrubber addition and electrical upgrades. The wastewater treatment structures appeared to be in good condition.

The alternate bottom ash pond (DP 009) was not in use. The North Retaining Basin (DP 008) was not discharging and the water level in the basin was about 1/2 to 1 foot below the bottom of the v-notch weir. The South Retaining Basin (DP 020) was not discharging and had more than 10 feet of freeboard. Both basins had adequate storage to contain runoff from a 10yr-24hr storm event. The drainage areas for both of the basins are heavily involved in construction work.

The sewage treatment plant (DP 003) was reviewed and appeared to be operating normally. The discharge from the package unit appeared clear. The flow rate reading was 3.0 gpm. Portable lavatories were in-place at several locations onsite for construction crews.

The plant site runoff discharge (DP 019) was reviewed. The discharge from the pipe appeared clear and to be from groundwater drainage and/or flow from upstream of the plant site. There did not appear to be any significant surface drainage to the pipe at the time of the inspection. The construction activity and traffic on the east side of the plant presents a additional sediment source for sediment sumps built into the surface drain leading to the discharge point. We discussed the possible need to increase the inspection and clean-out frequency for the sumps while construction is in progress.

The wastewater treatment plant (DP 025) was in operation but not reviewed.

RECORDS

NDPDES permit related correspondence, monitoring reports and supporting records were reviewed. All records were complete and contained the required information. Laboratory records were not reviewed as they are generally required as part of the state's laboratory certification program.

North Dakota Department of Health
Water Quality Division

STORMWATER INSPECTION / SITE REVIEW

FACILITY:	Minnkota Power Cooperative – M.R. Young Station	DATE:	July 16, 2009
PERMIT #:	NDR050012	TIME:	9:00
LOCATION:	Center ND	Conditions:	NW wind, clear Approx. 60^{o}-70^{o}
CONTACT:	Scott Hopfauf		
INSPECTOR:	Randy Kowalski		
RECORDS:	SWPP: Yes	Inspections / samples:	Yes

Findings / Observations

Stormwater outfall 10 at the DC terminal area was reviewed. The channel leading to the outfall was walked to review erosion in the channel. A channel cut/gully approximately 1½ feet deep by 2 feet wide was noted at the fence crossing upstream of the road along the lake. Closer to the road the drain fans-out into smaller channels. Reshaping the drainage was briefly discussed however there would be a concern that disturbance to the drainage channel would be difficult to stabilize and result in additional erosion. We also discussed the possible addition of rock check dams to the unvegetated ditches at the upper end of the drainage near the DC terminal to provide some erosion and sediment control.

Areas leading to stormwater outfall 8 were reviewed. The gully repairs made south of the plant entrance road and the emergency spillway still lacked plant growth on the repaired repair area. The area had been seeded again this year. A drainage channel had been reshaped east of the equipment laydown area. The drain outlets northeast of the bone yard silt fence area. A new longer row of silt fence was added in the bone yard drainage. The new fence replaced some of the former upstream rows to make room for reshaping and expansion of an equipment laydown area.

The drainage ditches along the haulroad from coal handling to Hagel creek were reviewed. The rock check closest to coal handling was full and scheduled to be cleaned. The lower rock checks did not appear to have significant sediment accumulation.

An access road west of the plant in the drainage area for stormwater points 4 and 5 had been reshaped. The ditches had been seeded and silt fence check dams were in place to provide sediment control in the ditches.

Records

The stormwater permit records were reviewed as part of the inspection. The SWPP plan and inspection records appeared up-to-date. There are nine active discharge points, four of which are sampled. The allowance in the permit to reduce sampling based on sample results was discussed.

North Dakota Department of Health
Water Quality Division

STORMWATER INSPECTION / SITE REVIEW

FACILITY:	Minnkota Power Cooperative – Airstrip	DATE:	July 16, 2009
PERMIT #:	NDR102616	TIME:	9:00
LOCATION:	Center ND	Conditions:	65°, Clear, NW wind
CONTACT:	Scott Hopfauf		
INSPECTOR:	Randy Kowalski		
RECORDS:	SWPP plan: Yes	Inspection records: Yes	

Findings / Observations

The project is for decommissioning an airstrip. At the time of the visit the asphalt surfacing from the airstrip and in front of the hanger had been removed. Silt fence was in place at outlets from the disturbed airstrip area to drainage swales adjacent to the former airstrip. The drainage swales on each side of the airstrip were not disturbed thus minimizing erosion potential. Mr. Hopfauf indicated that the strip is on subsoil material which would be ripped prior to final grading. He also indicated that topsoil is not available for the airstrip area as originally thought. They plan on using any surplus topsoil they can find on the site to spread on the area to improve re-vegetation success.

Records relevant to the stormwater permit were reviewed as part of the inspection. The following documents were onsite at the facility office and available for review: NOI, coverage letter, general permit, SWPP plan, and inspection records. The records appeared complete and maintained in accordance with the general permit

North Dakota Department of Health
Water Quality Division

STORMWATER INSPECTION / SITE REVIEW

FACILITY: Minnkota (Small Construction) DATE: July 16, 2009

PERMIT #: ND10-0835 TIME: 9:00 am

LOCATION: Center ND

FACILITY CONTACT: Scott Hopfauf

INSPECTORS: Randy Kowalski

Findings / Observations

There has been no activity under this permit in at least three years. During the review we discussed the Department's intention to phase-out the current small construction permitting when the construction stormwater general permit is renewed. At such time a separate permit would be required for each construction project involving one or more acres of disturbance. This permit coverage for multiple projects not exceeding five acres in size will be discontinued when the permit is renewed in the fall of 2009.

Records relevant to the stormwater permit were reviewed as part of the inspection. The following documents were onsite at the facility office and available for review: NOI, coverage letter, general permit, and Annual Location Record. Since there has been no activity under this permit recently there were no required inspection or SWPP plan records.

North Dakota Department of Health
Water Quality Division

STORMWATER INSPECTION / SITE REVIEW

FACILITY:	Minnkota Power Cooperative – Batch Plant	DATE:	July 16, 2009
PERMIT #:	NDR320630	TIME:	9:00am – 2:00pm
LOCATION:	Center ND	Conditions:	65°, Clear, NW wind
CONTACT:	Scott Hopfauf		
INSPECTOR:	Randy Kowalski		
RECORDS:	SWPP **Yes**	Inspections **Yes**	

Findings / Observations

The batch plant site appeared clean and orderly. One concrete batch plant was set at the site at the time of the review. Mr. Hopfauf indicated that for a time two plants had been set at the site to supply concrete for the larger pours at the power plant. The runoff from the plant site is contained by the stripping edge that was formed when the site was graded. Topsoil from the site is stockpiled on the west end of the site. Runoff from the site is directed to a small basin at the northeast corner of the site. The discharge from the basin is overland and would pass through vegetation and silt fence before leaving the site. No deficiencies were noted onsite during the site review.

Records relevant to the stormwater permit were reviewed as part of the inspection. The following documents were onsite at the facility office and available for review: NOI, coverage letter, general permit, SWPP plan, and inspection records. The records appeared complete and maintained in accordance with the general permit.

NORTH DAKOTA
DEPARTMENT of HEALTH

ENVIRONMENTAL HEALTH SECTION
Gold Seal Center, 918 E. Divide Ave.
Bismarck, ND 58501-1947
701.328.5200 (fax)
www.ndhealth.gov

May 5, 2010

Craig Bleth,
Plant Environmental Superintendent
Minnkota Power Cooperative
PO Box 127
Center ND 58530-0127

RE: Minnkota Power – Center
NDPDES Permit #s: ND0000370, NDR050012, NDR320630
ND102616

Dear Mr. Bleth:

On April 20, 2010, an inspection was completed by this Department at the above-referenced facility to review wastewater and stormwater management practices. We appreciate the time and cooperation provided during the site review and to comply with the permit conditions. Enclosed are copies of the inspection reports for your review.

Should you have any questions concerning this inspection, please contact me at 328-5239.

Sincerely,

Randy Kowalski
Environmental Scientist
Division of Water Quality

RK

cc: EPA
Scott Hopfauf, Minnkota
Keith Johnson, CDHU

INDUSTRIAL INSPECTION

FACILITY: Minnkota Power Cooperative

DATE: April 20, 2010

LOCATION: Center, ND

TIME: 9:00 a.m.

PERMIT NO.: ND-0000370

CONDITIONS: Calm, clear
Approx. 55^{O}-65^{O}

CONTACT PERSON: Scott Hopfauf

INSPECTOR: Randy Kowalski

SITE REVIEW

At the time of the inspection only unit 2 was in operation. Extensive construction work was in progress around the plant site for the unit 1 outage and pollution control additions. The wastewater treatment structures appeared to be in good condition.

The condenser for unit 1 was open for cleaning and looked at during the inspection. Mr. Hopfauf indicated that when the condenser was first opened the inside was covered with moss-like growth. At the time of the visit the material had dried and appeared as brownish colored crust on the surfaces of the lake water side of the condenser.

The South Retaining Basin (DP 020) was not discharging and the water level was 8 to 10 below the outlet. The North Retaining Basin (DP 008) was not discharging and the water level in the basin was about 3 feet below the top of the stop logs. Mr. Hopfauf indicated the north retaining basin was at the level which they normally initiate discharge to maintain runoff capacity.

The alternate bottom ash pond (DP 009) was not in use. Temporary lines were in-place to convey bottom ash sluice water to the pond during a unit 2 shutdown while work continued on the unit 1 scrubber system. A small amount of bottom ash was being stored in the pond.

The plant site runoff discharge (DP 019) was reviewed. The trickle discharge from the pipe appeared clear and believed to be from groundwater drainage. There did not appear to be any significant surface drainage at the time of the inspection.

The wastewater treatment plant (DP 025) outfall had a trickle (<5gpm) discharge. The treatment plant releases treated wastewater batches and the observed discharge was believed to be drainage following a batch discharge.

The sewage treatment plant (DP 003) was reviewed and appeared to be operating normally. The discharge from the package unit appeared clear. The flow rate reading was 2.85 gpm.

RECORDS

NDPDES permit related correspondence, monitoring reports and supporting records were reviewed. All records were complete and contained the required information. Laboratory records were not reviewed as they are generally required as part of the state's laboratory certification program.

NDPDES PERMIT PROGRAM
RECORD REVIEW

Facility Name: **Minnkota Power Coop**
Permit Number: **ND0000370**
Date: **4/20/2010**

RECORDS AND REPORTS

Yes No N/A 1. Permit information (including any calibration and maintenance records) is kept for the required 3 year period.

Yes No N/A 2. Sampling and analysis data for all parameters at all discharge points (including visual monitoring, flow measuring, WET samples, and influent monitoring) are adequate and include:

Yes No N/A a. Dates, times, location of sampling

Yes No N/A b. Initials of individual performing sampling

Yes No N/A c. Dates and times of analysis

Yes No N/A d. Initials of individual performing analysis

Yes No N/A e. Analytical methods and techniques reference

Yes No N/A 3. Holding times complied with for all parameters

Yes No N/A 4. Proper sampling frequencies for all parameters
One analysis missed for 008 when sample inadvertently tossed out.

5. List discharge points and parameters reviewed
Discharge Points: 003, 008, 025 for December 2009

Yes No N/A 6. Flow monitoring charts, tables, etc. available

Yes No N/A 7. Flow measuring provides results within required accuracy level
Did not attempt to confirm accuracy, methods indicated appear reasonable for nature of discharge.

8. List how flow is determined at each point
003 – Flow meter
008 – Pump rating, 225 gpm
025 – Flow meter

Comments:

DISCHARGE MONITORING REPORTS

Yes No N/A 1. Analytical results consistent with the data reported on Discharge Monitoring Reports (DMR's).

Yes No N/A 2. All additional data summarized on DMR as required by permit.

Yes No N/A 3. Bacteria data summarized as a geometric mean where required by permit.
Fecal testing on 003 conducted and reported even though it was not required.

Yes No N/A 4. Instantaneous maximum and minimum values calculated and reported properly on DMR where required by permit.

Yes No N/A 5. **Daily maximum and minimum values** (arithmetic, geometric) calculated and reported properly on DMR where required by permit.

Yes No **N/A** 6. 7-Day maximum and minimum values (arithmetic, geometric) calculated and reported properly on DMR where required by permit.

Yes No N/A 7. Daily average/monthly average values (arithmetic, geometric) calculated and reported properly on DMR where required by permit.

Yes No N/A 8. All loading values calculated and reported properly on DMR where required by permit.

Yes No **N/A** 9. Predischarge samples reported properly on DMR.

Yes No **N/A** 10. State compliance samples reported properly on DMR.

Yes No **N/A** 11. Split samples reported properly on DMR.

Yes No **N/A** 12. Multiple daily samples reported properly on DMR.

Yes No N/A 13. Number of exceedances reported properly on DMR.

Yes No N/A 14. Sampling frequencies reported properly on DMR.

15. List DMR's reviewed
Discharge Points: 003, 008, 025 for December 2009

Comments:

LABORATORIES AND TESTING EQUIPMENT

1. List laboratories utilized for all permit-required parameters.
   Minnkota- TSS, pH, BOD, TRC
   MVTL- Oil & Grease, Non routine tests
   Environmental Toxicity Control, Woodbury MN

Yes No N/A 2. All laboratories have up-to-date state certification.

Yes No **N/A** 3. State certification visibly posted in permittee laboratory. **Not Checked**

Yes No N/A 4. Results of last DMR/QA test available. Date **Not Checked**

Yes No N/A 5. Calibration and maintenance records of laboratory equipment available and up-to-date.
Not checked

Yes No N/A 6. Calibration records of flow meter available and up-to-date.
Not checked

Comments:

Lab procedures and records checked as part of state lab certification program.

WHOLE EFFLUENT TOXICITY TESTING AND REPORTING

Yes No N/A 1. WET sampling by permittee is adequate to meet the conditions of the permit.

Yes No N/A a. Chain of custody used.
Yes No N/A b. Method of shipment and preservation adequate.
Yes No N/A c. Holding time met (received within 36 hours).

Yes No N/A 2. Lab reports/chain of custody sheets indicate temperature of sample when it is received by the lab.
Indicate temperature: **3.7^0 C**

Yes No N/A 3. Lab has provided available quality control data, i.e., reference toxicant control charts.
Provides control chart description and result of most recent Reference Toxicity Test for the test species.

Comments:

Report reviewed for discharge 025, 12/15/09 sample tested with ceriodaphnia

Collected: 12/15/09 8:15 sample & 9:10 receiving water
Received: 12/16/09 8:15