



CLOSURE AND POST-CLOSURE PLAN

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**Southeast Section 16 CCR Landfill
Coal Creek Station
Great River Energy**

Submitted To: Great River Energy
Coal Creek Station
2875 Third Street SW
Underwood, North Dakota 58576

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October 13, 2016

1649586





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1.0 INTRODUCTION

Great River Energy (GRE) owns and operates Coal Creek Station (CCS) located near Underwood, North Dakota. GRE disposes of coal combustion residuals (CCRs) in several existing landfills and surface impoundments including the Southeast Section 16 CCR Landfill (Southeast 16). Southeast 16 is located approximately 1.5 miles east of the CCS generating units (see Figure 1).

Golder Associates Inc. (Golder) has prepared this closure plan and post-closure plan for Southeast 16 on behalf of GRE to serve as the written closure plan required under 40 CFR 257.102(b), and the written post-closure plan required under §257.104(d). The facility will be closed with CCRs left in place in accordance with the requirements of §257.102(d) (EPA 2015). At the completion of closure activities in accordance with the closure plan, the post-closure care period will commence.

2.0 CLOSURE PLAN

2.1 Narrative Description of Facility Closure

The lined Southeast 16 footprint comprises approximately 69 acres. The final configuration of Southeast 16 includes the currently lined footprint as well as piggy-backing CCR and final cover placement over the east side of the Upstream Raise CCR Surface Impoundment (adjacent facility to the west) as shown on the final waste grades and final cover grades drawings (Golder 2012, Appendix A). The total area that will receive final cover is approximately 76.5 acres.

Southeast 16 will be closed incrementally as CCR placement progresses, through construction of both temporary and final cover. The incremental closure allows placement of temporary and/or final cover on final outside slopes to aid in dust control, and to allow shedding of non-contact storm water from the facility. Installation of final cover will occur when a substantial portion of side-slope and/or cap area has reached final CCR design grades. Final cover has already been constructed over approximately 8 acres of Southeast 16. Future final cover will be installed in accordance with the Closure Plan in effect at the time of closure.

The primary closure activities include adjusting CCR grades if necessary, installing the final cover system with surface water controls, and establishing vegetation.

2.1.1 Final Cover System Installation

The final cover system will be installed using conventional soil placement techniques and common earthmoving equipment, such as bulldozers, haul trucks, scrapers, motor graders, and/or compactors. Soils that are suitable for use in the final cover system will be obtained from select on-site stockpiles and borrow sources. Disruption of the integrity of the final cover system will be inhibited by compacting the underlying CCRs to establish a firm and unyielding subgrade prior to installation of the final cover system and by



establishing a slope of approximately 3% to 5% across the top surface to provide positive drainage, limit ponding, and mitigate the potential effects of settling and subsidence. Final cover soil placement, moisture conditioning, compaction, and testing will be in accordance with the site construction quality assurance plan (Golder 2013). A North Dakota Registered Professional Engineer or a person working under their direct supervision will observe the placement of the final cover. A report indicating that closure was in compliance with the Closure Plan and signed by a North Dakota-registered Professional Engineer will be prepared after the closure of the facility. The closure report will be placed into the operating record of the facility.

2.1.2 Surface Water Controls

The surface of the final cover will have side slopes of up to 25% and a crown of between 3% and 5% along the top of the facility. The slopes will promote surface water runoff, aid in preventing surface water from ponding on the final cover, and allow for maintenance of the final cover (erosion repairs, mowing, etc.).

Surface water control features will be installed with the final cover and include terrace channels and down-chute channels to direct surface water runoff and minimize cover erosion.

- Terrace channels are grass-lined v-notch channels that direct flow from the side-slopes to down-chute channels. The terrace channels are constructed with the final cover approximately every 25 to 30 vertical feet to minimize erosion and soil loss.
- Down-chute channels are armored trapezoidal channels and convey runoff collected from the terrace channels off the facility to site surface water drainage ditches.

Surface water controls have been designed for the 24-hour, 100-year storm for Southeast 16 and are discussed further in the Run-on and Run-off Control Systems Plan (Golder 2016).

The combination of soil types, grasses, and surface water controls have been selected to control long-term surface soil loss to two tons per acre per year or less.

2.1.3 Vegetation

Vegetation enhances evapotranspiration and reduces erosion, thus playing an important part in surface water control. Vegetation activities will include preparing the soil surface, applying fertilizer if necessary, seeding, and mulching.

The seedbed should be roughened to a depth of 4 to 6 inches by scarifying, disking, harrowing, or equivalent methods. Rows should be spaced a minimum of 12 inches apart. Immediately prior to seeding in areas that have been heavily compacted by trucks or equipment, the topsoil surface should be ripped and scarified. All areas to be seeded should be dozer-tracked prior to seeding. The seedbed should not be prepared prior to completion of earthwork activities and no more than 2 weeks prior to planting.



Seed rates should be applied by broadcast or drilled methods, or by the hydraulic seeding method and are to be applied as directed in the facility's Operations Plan (Golder 2015). If broadcast or drilled, seed should be buried by harrowing, chain dragging, or other scarification measures. Equipment and procedures should be appropriate for the seed as recommended by the seed supplier. A suitable native species seed mix and application rates shall be selected at the time of final cover placement.

Straw mulch should be applied immediately after seeding at a rate of 2 tons per acre. To prevent dispersal or removal of straw by wind, mulch should be anchored using a crimper run perpendicular to the prevailing wind direction. A disc should not be used for crimping. The mulch should be applied over the seed in a separate application. At least 50% of individual straws should be 6 inches or greater in length.

2.2 Final Cover System

The federal CCR rule requires the final cover system to meet the requirements of §257.102(d)(3) with a minimum 18-inch infiltration layer and 6-inch erosion layer. The permeability of the final cover system must be less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than 1×10^{-5} centimeters per second (cm/sec), whichever is less.

The bottom liner system for Southeast 16 consists of 2-feet of compacted clay rich material with a hydraulic conductivity of 1×10^{-7} cm/sec, overlain with a 60-mil high-density polyethylene (HDPE) geomembrane liner.

2.2.1 Alternative Final Cover System

An alternative cover design utilizing an evapotranspiration (ET) cover has been previously permitted by the North Dakota Department of Health (NDDH) for this site based on both modeling and test plot instrumentation. The ET cover design consists of the following layers (from the top down):

- 6 inches of topsoil (erosion layer) that is capable of sustaining native plant growth.
- 30 inches of clay-rich, plant root zone soil (growth medium/infiltration layer), being compacted between 80% and 95% of the maximum dry unit weight as determined by ASTM D698 (standard Proctor).

GRE intends to update the alternative cover demonstration previously done to show that the cover system described above is in compliance with the requirements of §257.102(d)(3). If this demonstration cannot be made, GRE will adjust the cover design as required. No final cover will be placed until either the demonstration is made or the cover design is adjusted to meet the requirements of §257.102(d)(3).

2.3 Closure Estimates

2.3.1 Maximum Inventory of CCR

The final design contours shown on Drawing 7 (Appendix A), provide for a maximum inventory of CCR of approximately 5,500,000 cubic yards.



2.3.2 Largest Area Requiring Final Cover

The entire footprint of Southeast 16 has been developed (lined) and has received CCR. Including the piggyback of CCR disposal onto the east side of the Upstream Raise, the current maximum area requiring final cover is approximately 68.5 acres. As incremental closure continues at Southeast 16, this maximum area requiring final cover will be reduced.

2.4 Closure Schedule

Within 30 days after the last receipt of waste (either CCR or any non-CCR waste stream) permitted for disposal, the closure plan will be implemented. Notification of intent to close the facility will be placed in the operating record prior to the commencement of closure activities. The NDDH will also be notified in accordance with the engineering design and operations plan for the facility. At this time, closure activities are expected to commence in the year 2022 depending upon plant operation and the use of the other CCR facilities at CCS.

Closure activities will be completed in accordance with the closure plan within 6 months after commencing closure activities, or as allowed through a closure extension demonstration in accordance with §257.102(f)(2)(i). Closure activities to be completed during this time include preparation of bid documents and solicitation of contractor's bids, installation of the final cover system, and preparation and submittal of as-built documents and certifications as required under §257.102(f)(3) and the engineering design and operations plan for the facility. An extension of the closure timeframe may be pursued in accordance with §257.102(f)(2)(i) due to factors such as:

- Site weather conditions do not allow for reliable construction of soil cover components from approximately November through April. If the last receipt of waste occurs in late fall or in this non-construction period, closure activities will not be completed within 6 months.
- The largest area requiring final cover is estimated at approximately 68.5 acres. The quantity of soil materials to be identified and borrowed from on-site resources as well as the magnitude of this much cover placement is also likely to extend the closure period beyond 6 months.

Notification that closure of Southeast 16 has been completed will be placed in the operating record within 30 days of the completion of closure activities. This notification will include certification by a qualified professional engineer that closure has been completed in accordance with the closure plan. Following closure of Southeast 16, GRE will record a notation on the deed to the property (or another instrument that is normally examined during title search) that will notify potential purchasers of the land that the land has been used as a CCR landfill and its use is restricted under post-closure care requirements. Within 30 days of recording the notation, notification will be placed in the operating record.



3.0 POST-CLOSURE PLAN

During the post-closure care period for Southeast 16, GRE will implement inspection, maintenance, and monitoring programs to maintain the integrity of the final cover system, maintain the groundwater monitoring system, and monitor groundwater in accordance with the requirements of §257.90 through §257.98. The post-closure care period will be 30 years in duration. If GRE is operating under assessment monitoring in accordance with §257.95 at the conclusion of the post-closure care period, GRE will continue to conduct post-closure care until it can return to detection monitoring in accordance with §257.95. Within 60 days following the completion of the post-closure care period, GRE will prepare a notification certified by a qualified professional engineer that post-closure care has been completed in accordance with the post-closure plan and will place the notification in the operating record.

3.1 Inspection

Regular inspections will be conducted during the post-closure care period to help ensure that the integrity of Southeast 16 is maintained. The final cover system will be inspected for signs of settlement, subsidence, erosion, and other damage or deficiency. Surface water control features, including terrace channels, down-chute channels, and culverts, will be inspected to verify that the run-on and run-off controls are adequately limiting erosion and other damage to the final cover system. Surface water control features will also be inspected for erosion damage and clogging by sediment, weeds, and other debris. Surface components of groundwater monitoring wells will be inspected for damage.

Inspections will be conducted on an annual basis (typically between late spring and early fall) to facilitate inspection of the final cover vegetation. Inspection forms will be completed to document each inspection. Completed inspection forms will be maintained in the operating record. To maintain consistency in the inspection process, trained GRE employees or contract employees will conduct the inspections. Issues identified during the inspections will be reported to the person responsible for compliance with this post-closure plan as soon as practical.

3.2 Maintenance

GRE will oversee post-closure maintenance of Southeast 16, using appropriate internal resources and/or third-party personnel and equipment. Post-closure maintenance of Southeast 16 will include making necessary repairs to the final cover system to maintain its integrity and effectiveness. Earthen fill will be placed as needed to correct the effects of settlement, subsidence, and erosion and to prevent run-on and run-off from eroding or otherwise damaging the final cover system. Maintenance of surface water control features will include clearing excess sediment and debris and armoring or implementing other appropriate measures in areas of persistent erosion. The final cover system will be reseeded in areas that have been repaired and where additional vegetation is needed to effectively limit erosion and promote transpiration of



soil moisture. GRE will control noxious weeds and unwanted trees and shrubs from becoming established on Southeast 16.

3.3 Monitoring

Groundwater monitoring will be conducted during the post-closure care period in accordance with the requirements of §257.90 through §257.98. Groundwater samples will be collected and analyzed in accordance with the sampling and analysis program for Southeast 16. Results of the analyses will be placed in the operating record.

3.4 Contact Information

The post-closure contact for Southeast 16 will be:

Attention: Manager, Regulatory Services
Great River Energy – Coal Creek Station
2875 Third Street SW
Underwood, North Dakota 58576
Phone: (701) 442- 3211
Email: Environmental@GREnergy.com

3.5 Planned Property Usage

The closed facility will be designated as open space during the post-closure period and will be controlled via fence and/or signage. No agricultural, recreational, public, or otherwise active uses are planned for the Southeast 16 during the post-closure care period. There will be no grazing or feeding of farm or domestic animals at Southeast 16 during the post-closure care period. Activities on GRE property are anticipated to include the continued operation of a power generating station, and will be managed to not disturb the integrity of the final cover or function of the monitoring systems associated with Southeast 16.



4.0 CERTIFICATION

The undersigned attest to the completeness and accuracy of this closure and post-closure plans, and certify that the plans meet the requirements of 40 CFR §257.102(b) and 40 CFR §257.104(d).

GOLDER ASSOCIATES INC.

Todd Stong, PE
Associate and Senior Engineer

TS/CS/rjg

Craig Schuettpelz, PE
Senior Project Engineer

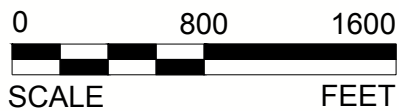




5.0 REFERENCES

- EPA. 2015. Environmental Protection Agency, Code of Federal Regulations Title 40 Part 257: Hazardous and Solid Waste Management System; *Disposal of Coal Combustion Residuals from Electric Utilities*. April.
- Golder. 2012. *Permit Modification Document, Permit No. SP-033*. December.
- Golder. 2013. *Construction Quality Assurance Guidelines for Final Cover Construction, Revision 1*. July.
- Golder. 2015. *Operations Plan for Ash Pond 91, Ash Pond 92, and Section 16 – Permit No. SP-033*. February.
- Golder. 2016. *Run-On and Run-Off Control System Plan, Southeast Section 16 CCR Landfill*. October.

FIGURE

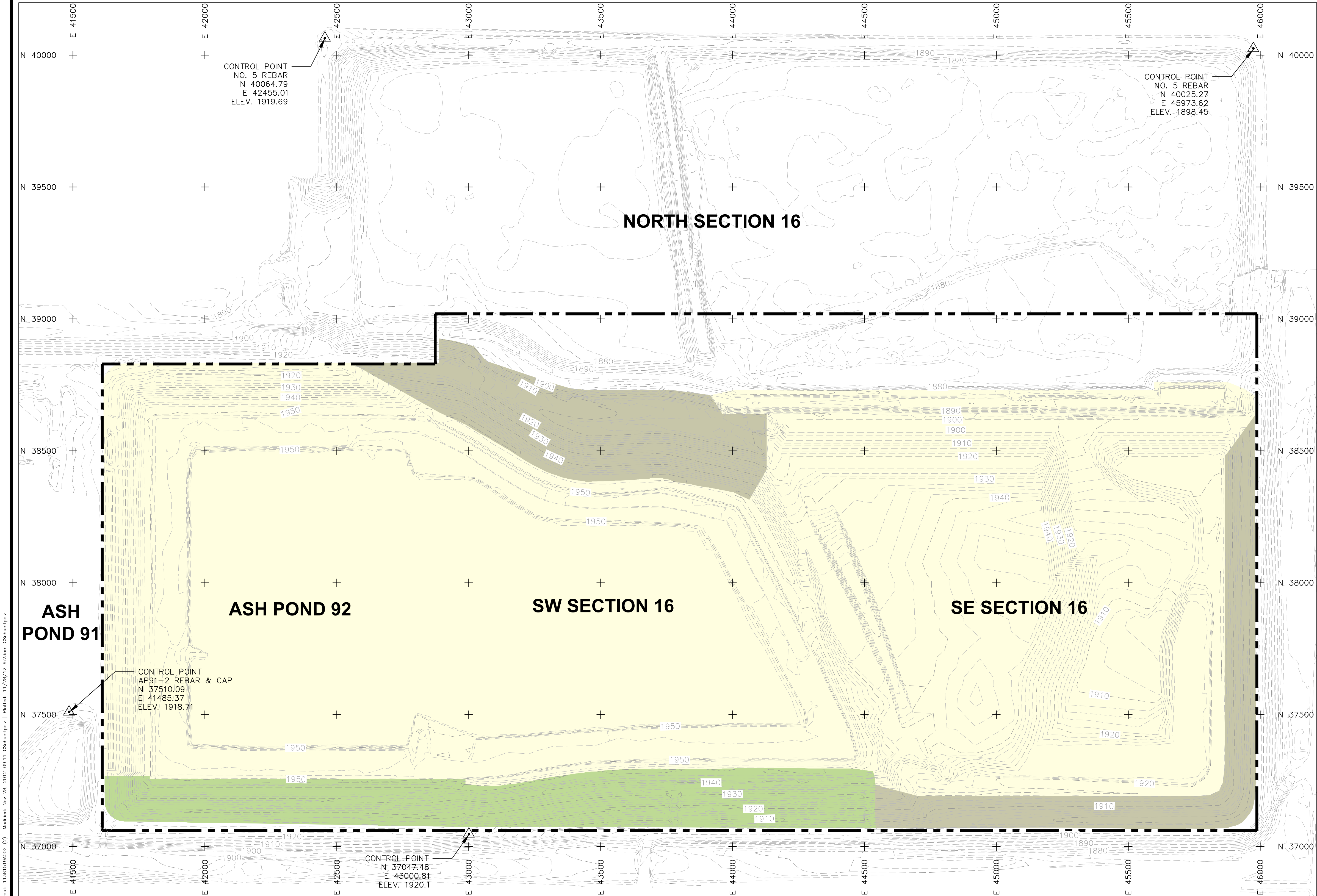


COAL CREEK STATION
CCR FACILITIES

FIGURE 1

APPENDIX A
DRAWINGS FROM NDDH PERMIT MODIFICATION DOCUMENT
(DECEMBER 2012)

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LEGEND

EXISTING GROUND TOPOGRAPHY

AREA OF ACTIVE CCP PLACEMENT

TEMPORARY COVER PLACED

FINAL COVER PLACED

PERMITTED LIMIT OF CCP PLACEMENT

SURVEY CONTROL POINT

- NOTES
1. GRADES SHOWN REPRESENT FINAL AND INTERIM COVER AND CCP GRADES AS OF DECEMBER 2010.

2. PERMITTED LIMIT OF CCP PLACEMENT BOUNDARY IS APPROXIMATE.

- REGULATORY DESIGN BASIS
1. CONTROL OF RUN-ON AND RUN-OFF DURING OPERATIONS, PER SUBDIVISION A OF SUBSECTION 3 OF NDAC SECTION 33-20-04.1-09.

2. OPERATE THE UPSTREAM RAISE (SURFACE IMPOUNDMENT) TO HAVE A FREEBOARD OF AT LEAST TWO FEET, PER SUBDIVISION D OF SUBSECTION 2 OF NDAC SECTION 33-20-08.1-01.

3. MINIMIZE EROSION OF FINAL COVER, PER SUBDIVISION B3 OF SUBSECTION 4 OF NDAC SECTION 33-20-04.1-09.

4. MAXIMUM FINAL SLOPES NOT LESS THAN THREE PERCENT, NOR MORE THAN TWENTY-FIVE PERCENT, PER SUBDIVISION B3 OF SUBSECTION 4 OF NDAC SECTION 33-20-04.1-09.

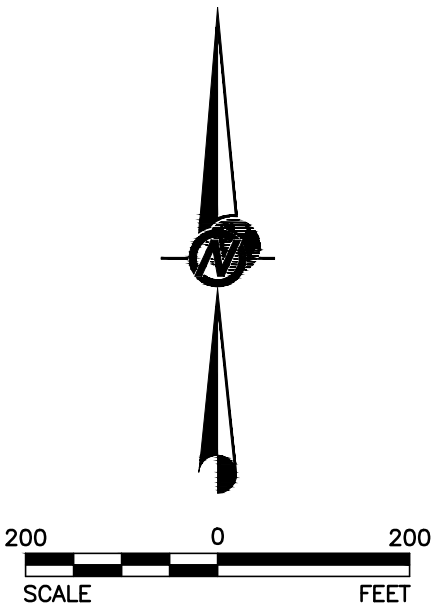
5. EVALUATE SLOPES STEEPER THAN FIFTEEN PERCENT TO ENSURE STABILITY, PER SUBDIVISION B3 OF SUBSECTION 4 OF NDAC SECTION 33-20-04.1-09.

6. CONTROL OF SURFACE WATER DRAINAGE FROM FINAL SLOPES, PER SUBDIVISIONS B2-B4 OF SUBSECTION 4 OF NDAC SECTION 33-20-04.1-09.

7. COMPOSITE LINER, PER SUBDIVISION B OF SUBSECTION 2 OF NDAC SECTION 33-20-08.1-01.

8. APPROPRIATE ENGINEERED FINAL COVER DESIGN, PER NDAC SECTION 33-20-07.1-02.

9. ALL OTHER APPLICABLE RULES FROM NDCC CHAPTER 23-29 AND NDAC ARTICLE 33-20.



- REFERENCES
1. SITE LOCATION: SECTION 16, T145N, R82W, MCLEAN COUNTY, NORTH DAKOTA.

2. EXISTING GROUND TOPOGRAPHY PROVIDED BY GREAT RIVER ENERGY. PERFORMED BETWEEN 1996 AND 2011.

3. COORDINATES BASED ON PLANT GRID SYSTEM.

4. CONTOUR INTERVAL IS TWO FEET.

5. ALL PROPERTY SHOWN ON THIS MAP IS OWNED BY GREAT RIVER ENERGY.

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PROJECT

GREAT RIVER ENERGY
COAL CREEK STATION
PERMIT NO. SP-033 PERMIT MODIFICATION

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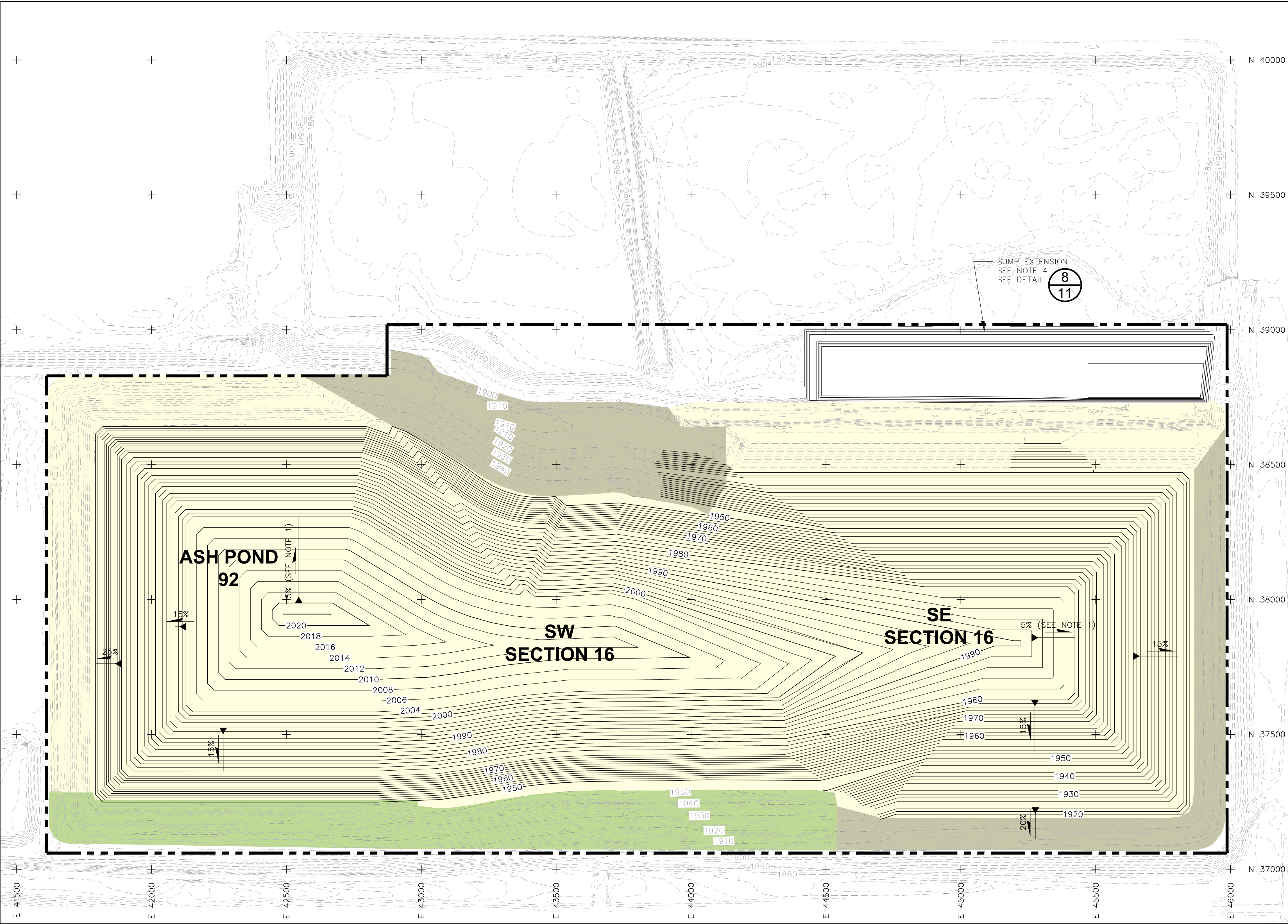
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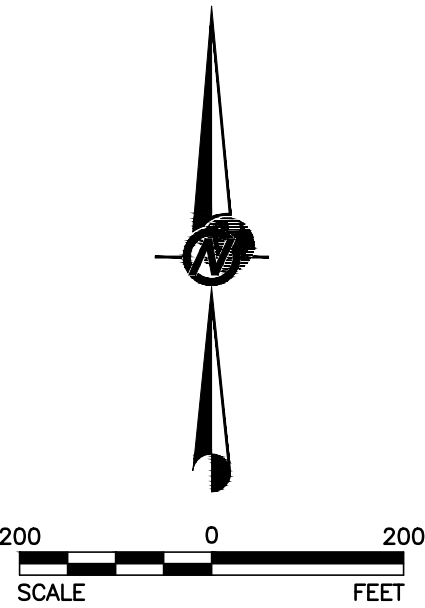
- EXISTING GROUND TOPOGRAPHY
- PROPOSED TOP OF CCP TOPOGRAPHY
- AREA OF ACTIVE CCP PLACEMENT
- TEMPORARY COVER PLACED
- FINAL COVER PLACED
- PERMITTED LIMIT OF CCP PLACEMENT

NOTES

- CCP GRADES OF THE CROWN OF THE FACILITY ARE SHOWN AT 5%, BUT MAY BE CONSTRUCTED BETWEEN 3% AND 5%.
- CONTACT WATER IS COLLECTED IN THE DITCH AROUND ASH POND 92 AND SW SECTION 16. WATER IS DIRECTED THROUGH CULVERTS TO ASH POND 91 OR DOWNWARD INTO THE UPSTREAM RAISE.
- CONTACT WATER WILL BE COLLECTED IN PERIMETER TOE DITCHES AROUND SE SECTION 16 AND DIRECTED TO THE SUMP IN THE NE CORNER OF THE LANDFILL.
- THE SUMP WILL BE ENLARGED AS REQUIRED. SEE CONTACT WATER ENGINEERING WORKSHEET FOR DETAILS.

REFERENCES

- SITE LOCATION: SECTION 16, T145N, R82W, MCLEAN COUNTY, NORTH DAKOTA.
- EXISTING GROUND TOPOGRAPHY PROVIDED BY GREAT RIVER ENERGY. PERFORMED BETWEEN 1996 AND 2011.
- COORDINATES BASED ON PLANT GRID SYSTEM.
- CONTOUR INTERVAL IS TWO FEET.
- ALL PROPERTY SHOWN ON THIS MAP IS OWNED BY GREAT RIVER ENERGY.

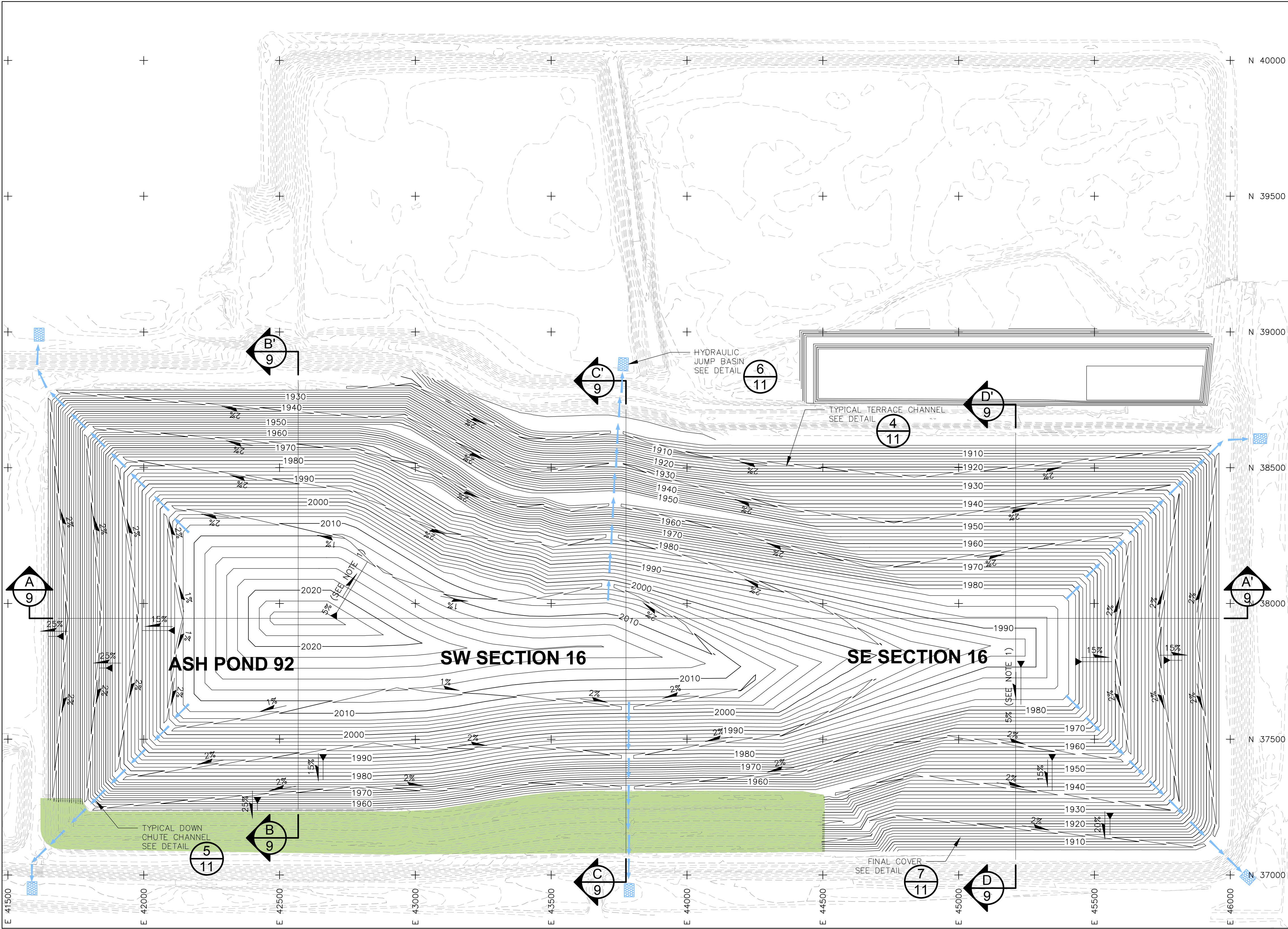


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TITLE FINAL WASTE GRADES	
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	PROJECT No. 113-81519
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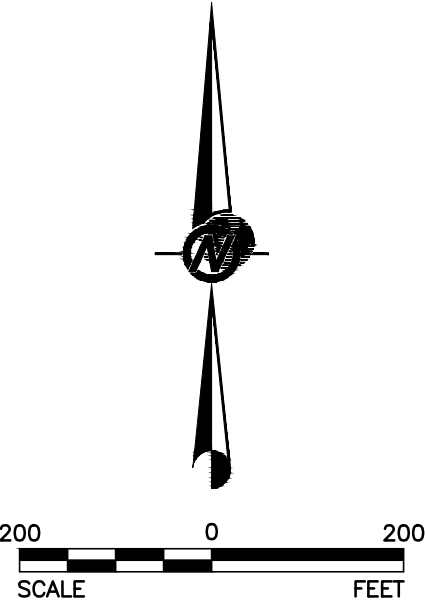
- EXISTING GROUND TOPOGRAPHY
- PROPOSED TOP OF COVER TOPOGRAPHY
- FINAL COVER PLACED
- DOWNCHUTE/OUTLET CHANNEL

NOTES

- TOP OF COVER GRADES OF THE CROWN OF THE FACILITY ARE SHOWN AT 5%, BUT MAY BE CONSTRUCTED BETWEEN 3% AND 5%.
- SEE THE SURFACE WATER ENGINEERING WORKSHEET FOR FURTHER DETAILS CONCERNING THE SURFACE WATER CONTROL PLAN.

REFERENCES

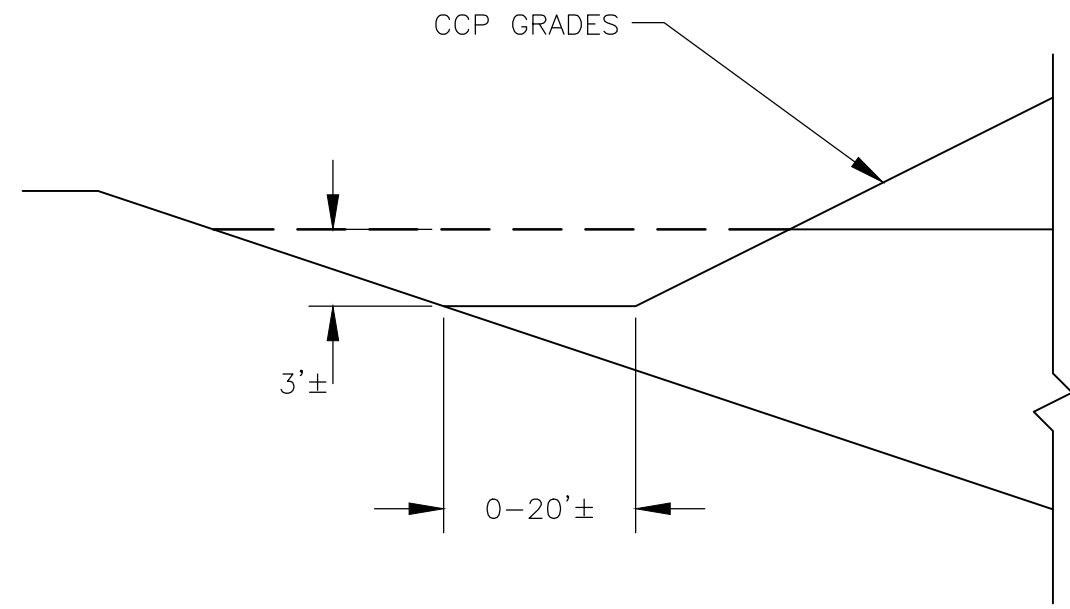
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- ALL PROPERTY SHOWN ON THIS MAP IS OWNED BY GREAT RIVER ENERGY.



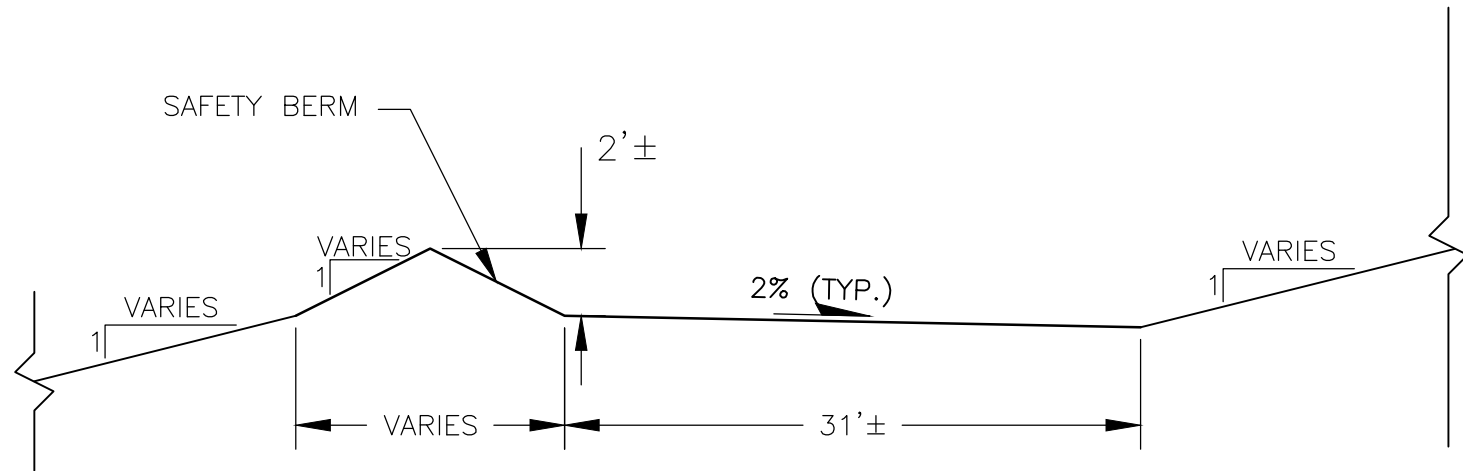
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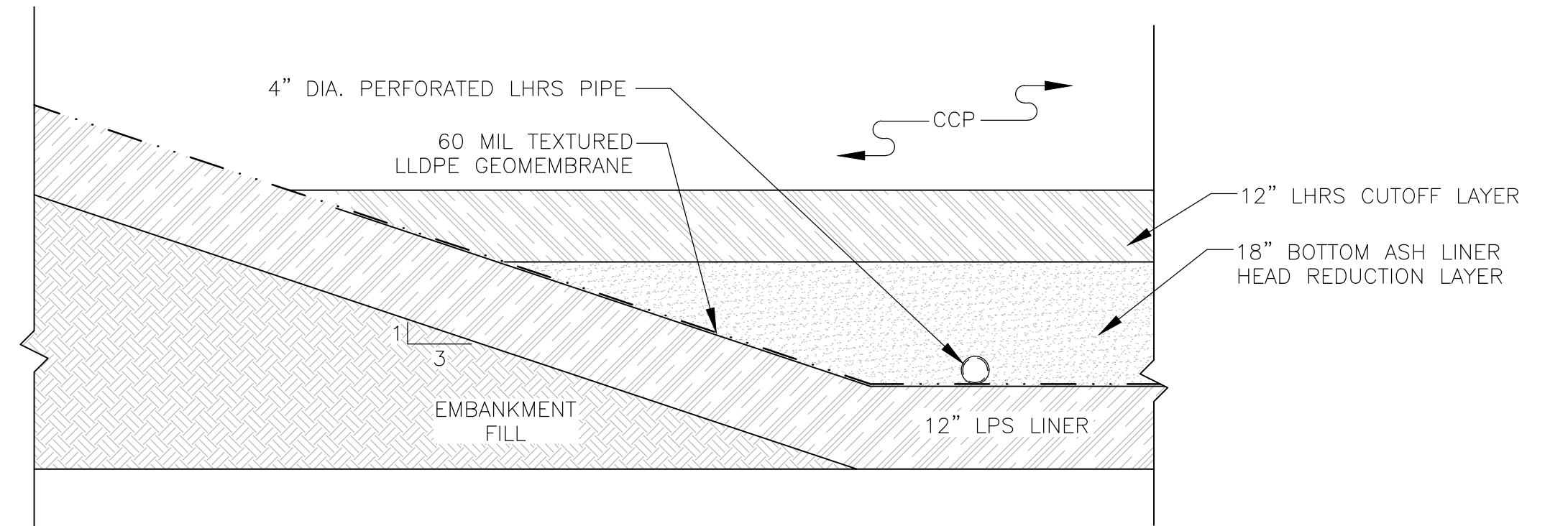
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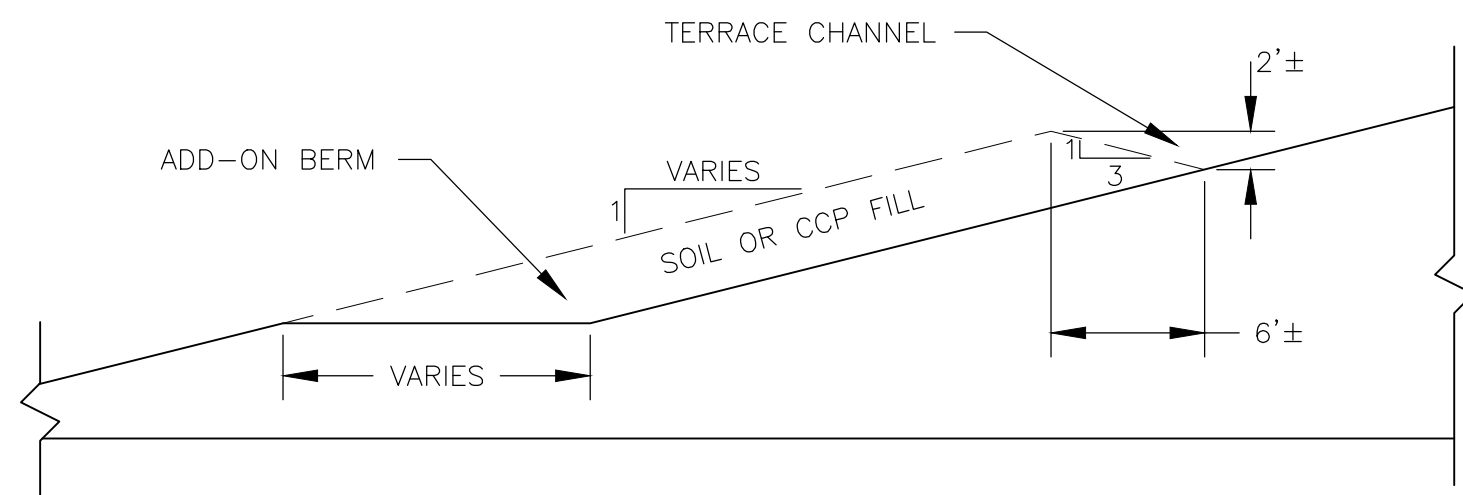
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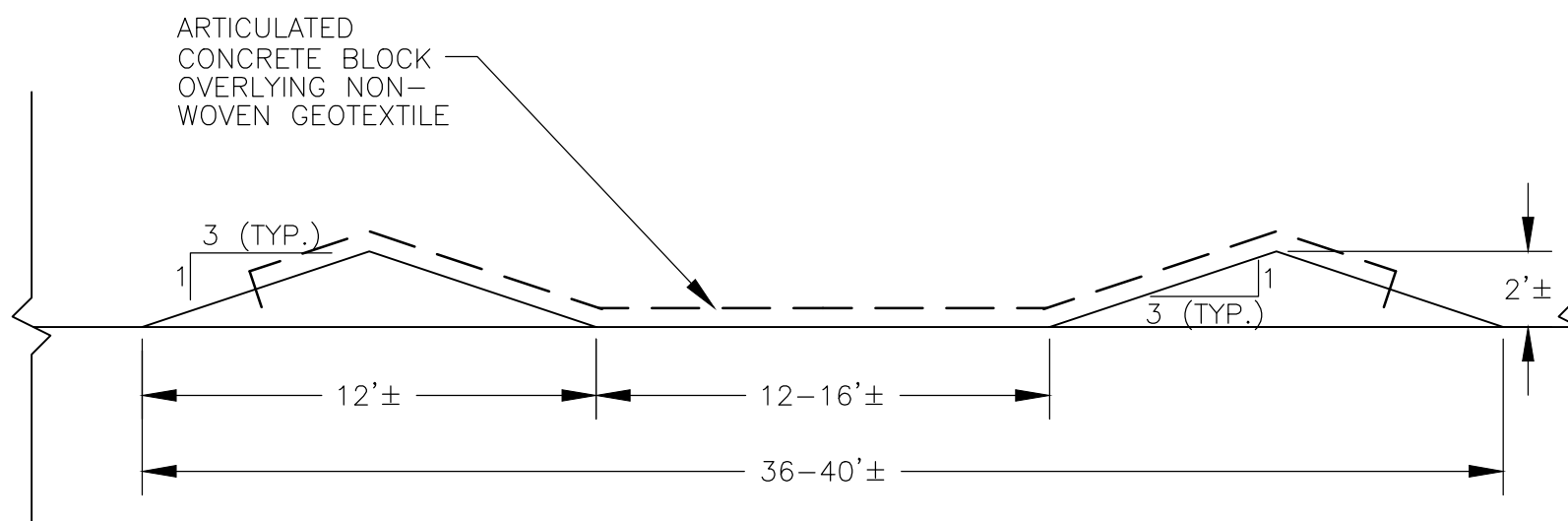
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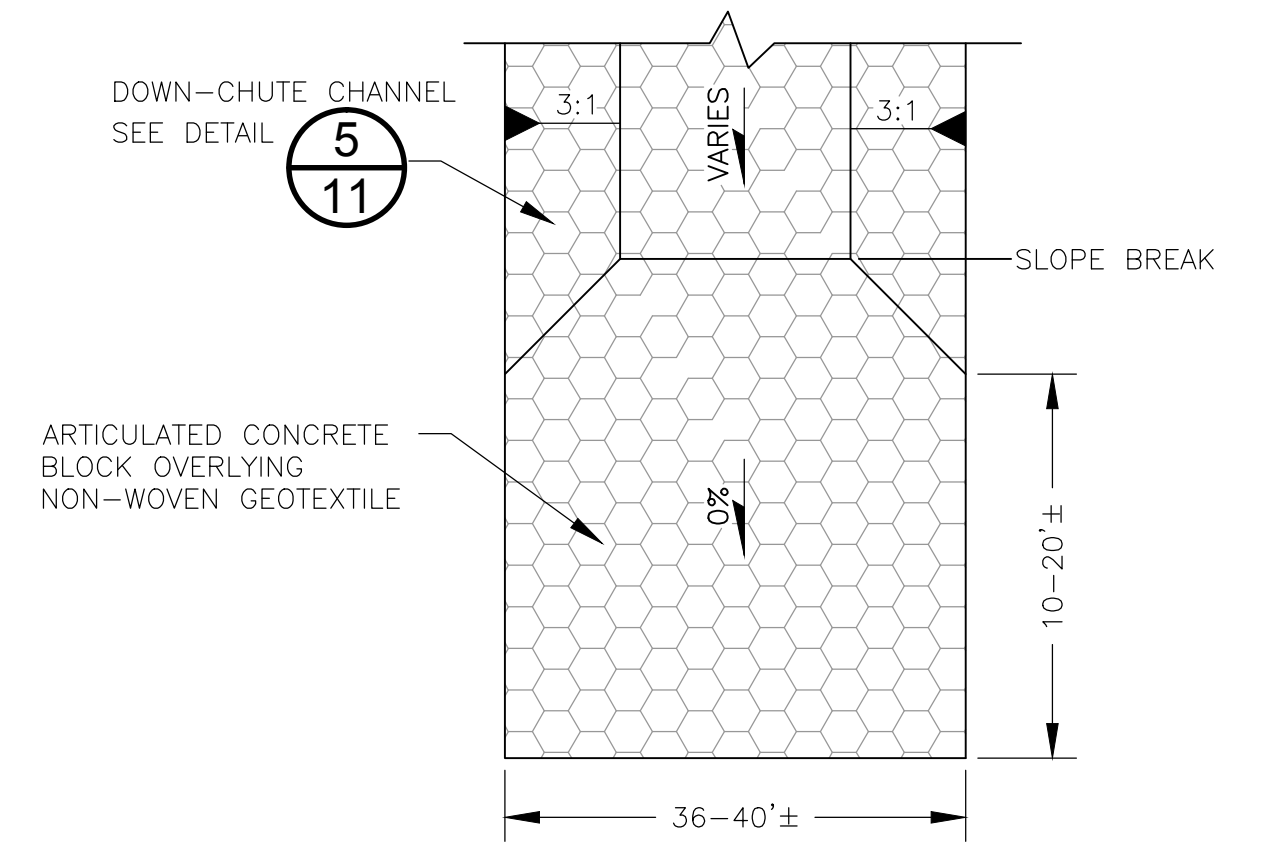
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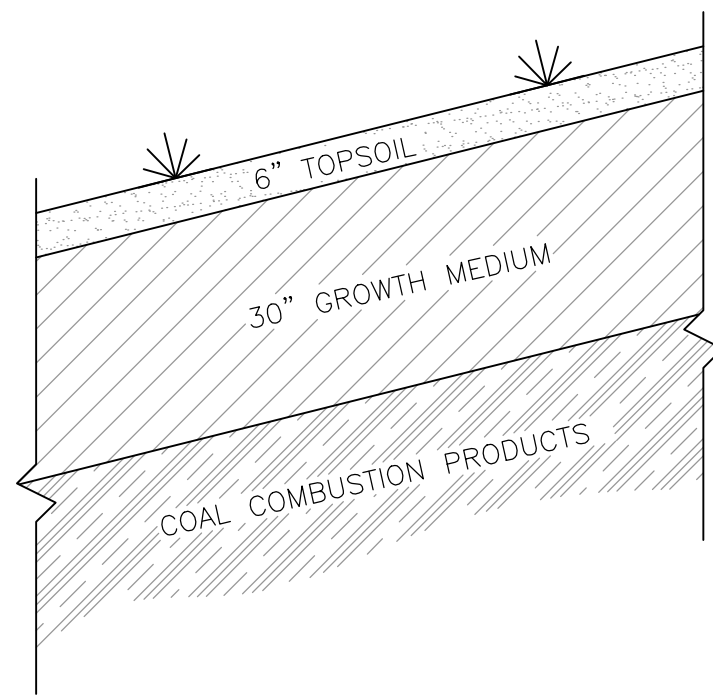
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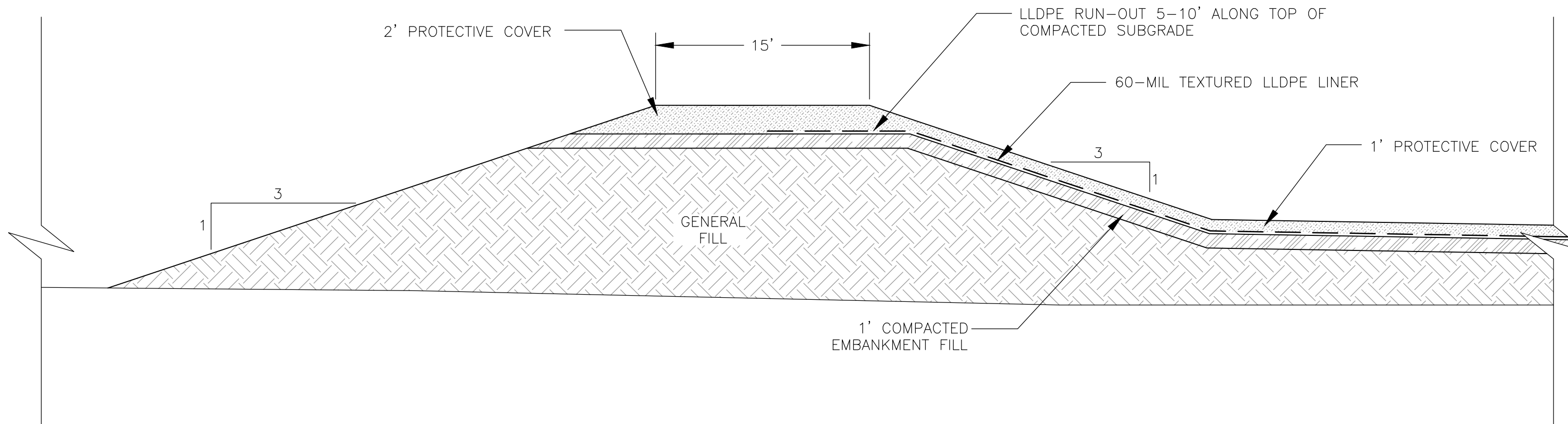
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11 **HYDRAULIC JUMP BASIN**
NOT TO SCALE





7
11 **FINAL COVER DETAIL**
NOT TO SCALE



8
11 **SUMP EXTENSION DETAIL**
NOT TO SCALE

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		PROJECT No.	113-81519
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