MEMORANDUM

SUBJECT: Comments on draft report "Coal Ash Impoundment – Site Assessment Draft Report – Stanton Station – Great River Energy – Coal Creek, North Dakota."

DATE: July 2, 2012

EPA Comments:

1. On page 9, section 3.1, second to last line in the first paragraph, replace "filter" with "filler."
2. On page 10, section 3.1, in the second full paragraph, please correct "110 ac."
3. On page 57, section 5.1, underline the title "Structural Stability."

GREAT RIVER ENERGY

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August 24, 2012

Mr. Stephen Hoffman
U.S. Environmental Protection Agency
Two Potomac Yard
2733 South Crystal Drive
5th Floor, N-5237
Arlington, VA 22202-2733

RE: Comments on EPA Coal Ash Impoundment Site Assessment Draft Report for Great River Energy's Coal Creek Station, Underwood, North Dakota

Dear Mr. Hoffman:

Great River Energy (GRE) received and has reviewed the Coal Ash Impoundment Site Assessment Draft Report for Coal Creek Station dated June 21, 2012 (received July 2, 2012). This draft report resulted from the site assessment of Ash Pond 91 and the Upstream Raise/Ash Pond 92, conducted by the U.S. Environmental Protection Agency's (EPA) contractor, Kleinfelder, on May 17, 2011. GRE appreciates the opportunity to provide comments on the draft report before it is finalized. This letter provides GRE's comments on the draft report, particularly responses to report recommendations.

Management Unit Condition and Potential Hazard Rating

We are pleased that the report concludes that the coal combustion product (CCP) management units at Coal Creek Station are in "Satisfactory" condition. We also agree with the report's recommended potential hazard rating as "Low."

Comments on Draft Report

Factual corrections to the draft report are listed below:

3.1 Site Information and History, 2nd paragraph, last sentence: The majority of fly ash generated at Coal Creek Station is sold and beneficially used with only a small amount being used in the construction of the Upstream Raise. Bottom Ash is also used beneficially on-site in addition to the Upstream Raise construction.

3.6 Structural Considerations, 1st paragraph, last sentence: The pump station can be used to pump water from Ash Pond 91 to the Drains Pond or Plant. It is not used to pump water to the Upstream Raise.

4.1.6 Impoundment Inlet: FGD material is sluiced to the Upstream Raise through 8" HDPE pipes, not 18".

4.2.6 Outlet Works: The cross-over pipes between Ash Pond 91 and the Drains Pond are 18" SDR-19 flanged HDPE pipe (per the construction drawings).

4.2.8 Other, last paragraph, and 5.1 Analysis and Conclusions, last bullet: Operation Plans exist for Ash Pond 91 (1989) and the Upstream Raise (2004).

Report Recommendations

The draft report includes seven recommendations; those recommendations are provided below, followed by GRE's responses.

1. ***Prepare an Emergency Action Plan (EAP) for the facility by October 31, 2012.*** *An EAP should be prepared for both Ash Pond 91 and the Upstream Raise. The EAP could be a very short and straightforward document that basically documents that sufficient volume exists in Samuelson Slough to contain releases, and outlines procedures to undertake in the event of an unplanned release, including gate closure and phone calls to interested and potentially impacted parties.*

   GRE Response – Coal Creek Station has an Emergency Response Safety Procedure (attached) for the entire site that is reviewed annually and updated as needed. This procedure provides for a site-wide uniform procedure for notification, response, and reporting of a chemical spill or release. This procedure will be updated to explicitly include a release of CCP material from the CCP management units, as well as defining the notification procedure for such a release (North Dakota Department of Health, State Engineer). As stated in the draft report, sufficient volume exists on Coal Creek Station property to contain a release from the CCP management units. This information will be added to the Contingency Plans section of the CCP management units' Operation Plan, which will also reference the site Emergency Response Safety Procedure.

2. ***Control vegetation on the downstream slopes. Remove the isolated trees and woody brush, including roots/stumps, at the toe of the embankment by October 31, 2012.*** *Refer to FEMA Manual 534 (Impact of Plants on Earthen Impoundments) for guidance on vegetation removal. This manual is available on the FEMA website.*

   GRE Response – The identification and removal of trees and woody brush on the embankments of the CCP management units is part of GRE's ongoing maintenance practice. GRE is in the process of removing the isolated vegetation identified by Kleinfelder and will continue to evaluate the facility for future vegetation growth during regular inspections. GRE will continue to remove future vegetation growth in a timely manner.

3. ***Repair erosion of Upstream Raise/Ash Pond 92 embankment by October 31, 2012.*** *Minor surface erosion was noted at the Upstream Raise. Areas where erosion has occurred should be filled in and revegetated to prevent erosion from cutting further into the embankments. This action is only necessary on areas that have been topsoiled and vegetated, as it is recognized that parts of the Upstream Raise are under construction and will be dressed and vegetated at the appropriate time.*

   GRE Response – The identification and correction of erosion on the embankments and covered slopes of the CCP management units is part of GRE's ongoing maintenance practice. GRE is in the process of repairing the eroded areas identified by Kleinfelder and will continue to evaluate the facility for erosion damage during regular inspections and correct it in a timely manner.

4. ***Evaluate and repair erosion at the toe on west embankment of Ash Pond 91 by October 31, 2012.*** *Ash Pond 91 west embankment toe appears to have a permanent slough feature adjacent to the downstream toe and was observed to have scarps along the slough water line. Erosion at the toe can shorten seepage paths and decrease stability of the embankment. Since the slough likely keeps the toe in a saturated condition a seepage and stability analysis should be performed on the west embankment and the toe should be repaired and armored based on results of the analysis.*

   GRE Response – The identification and correction of erosion on the embankments of the CCP management units is part of GRE's ongoing maintenance practice. GRE will repair the eroded areas identified by Kleinfelder and will continue to evaluate the facility for erosion damage during regular inspections and correct it in a timely manner. Due to the location of this erosion along the slough, GRE is currently working with its design engineer for an appropriate repair. Once an appropriate repair is identified it will be implemented as soon as weather permits but not later than July of 2013.

5. ***Maintain a log of maintenance and other activities at Ash Pond 91 and the Upstream Raise impoundments and supporting facilities by October 31, 2012.*** *We have seen examples of Work Orders documenting inspection of the facilities by plant staff. Other Work Orders may exist that document routine maintenance and repair activities, and if so, those should be collected and bound in a notebook in a secure location if that practice is not being followed currently. We believe that this log will provide continuity during periods of staff change.*

   GRE Response – GRE currently maintains a record of inspections and maintenance Work Orders for Ash Pond 91 and the Upstream Raise facility on GRE's electronic workspace accessible to GRE employees. This system may not have been sufficiently described to the Kleinfelder engineers. The system automatically initiates work orders for scheduled inspections and maintenance, and is the method by which site personnel record observations and maintenance needs resulting from the site operations and inspections. All future, active and historical records are maintained in this system. GRE's best management practices are to use the electronic document to assure that outdated documents do not exist. Coal Creek

Station employs an Environmental Management System that is ISO 14001 registered and that utilizes this best management practice.

6. ***Develop an Operation and Maintenance (O&M) manual for the impoundments and the facility by October 31, 2012.*** *The O&M manual should include at least the following three key elements:*

   - *Procedures needed for operation and maintenance of the impoundments during typical operating conditions.*
   - *Procedures for monitoring performance of the impoundments, including visible changes such as surface erosion, settlement and sloughing; internal embankment changes such as erosion due to uncontrolled seepage; interpretation of piezometer readings, and fluctuations in groundwater level.*
   - *The EAP.*

   GRE Response – An Operations Plan already exists for the CCP management facilities. These plans may not have been reviewed by Kleinfelder during their site evaluation. The plans for Ash Pond 91 and for the Upstream Raise are attached. These plans, in concert with the facility inspection reports (attached) and annual operator solid waste facility training, provide the recommended procedures outlined above. As discussed in response to Comment 1, the Emergency Action Plan information will be added to the Contingency Plans section of the Operations Plan, which will also reference the site Emergency Response Safety Procedure.

7. ***Perform video assessments of culvert piping by October 31, 2012.*** *This would include only the permanent culvert piping used for the outlet works of the impoundments, and specifically the cross connection pipes between Ash Pond 91 and the Drains Pond. The video survey should determine the type of pipe material, the condition of the pipes, and the condition of the valves. In addition, the valves should be exercised to assess functionality. Because most of the other piping is moved around or replaced as it loses capacity due to scale deposition, video survey of those pipes in the pond do not appear to be necessary.*

   GRE Response – GRE disagrees with performing this assessment of outlet piping based on operational characteristics of Coal Creek Station. Unlike a dam where indirect and uncontrollable natural influences (i.e., run-on) may cause excess water to build up and overtop a dam, water levels (inflows) in these facilities are directly controlled by plant operations. If a problem with the outlet lines connecting Ash Pond 91 and the Drains Pond were to exist, GRE may utilize backup pumps to remove water from Ash Pond 91 or may reduce or eliminate inflows to Ash Pond 91 until the outlet lines are repaired. Since GRE can control the inflow to Ash Pond 91, the blockage of these lines would not lead to an overtopping condition. This recommendation relates to plant operations and not impoundment stability.

Thank you for this opportunity to comment. If you have any questions concerning our comments or the information we have provided, please contact Jennifer Charles at 701-442-7081.

Sincerely,

Mary Jo Roth
Manager, Environmental Services

c: Jennifer Charles

Attachments: *Great River Energy, Coal Creek Station Safety Procedure SF 10.14 Emergency Response* (Revision 5, 11/28/11)
Operations plan for Ash Pond 91, *Appendix D-1, Application to Renew Permit to Operate a Special Use Disposal Site (Permit No. SU-033) February 3, 1989*
Operations plan for Upstream Raise, *Ash Pond 92 and Section 16 Upstream Raise Operations Plan* (Revision 02, July 8, 2004)
Sample facility inspection reports (Ash Pond 91; Ash Pond 92 & Section 16)

GREAT RIVER ENERGY
COAL CREEK STATION
SAFETY PROCEDURE

SF 10.14 *Emergency Response*

APPROVED BY: REVISION DATE: 11/28/11 REVISION: 5

REVIEW DATE- 11/28/11

I. PURPOSE:

To establish a uniform procedure for notification, response, and reporting of a chemical spill or release in accordance with the Superfund Amendments and Reauthorization Act (SARA), Title III. To ensure that the response to spill of a hazardous material conforms with OSHA 1910.120 (Hazardous Waste Operators and Emergency Response).

II. APPLICABILITY:

All Coal Creek Station employees. Chemical emergencies can occur at any time. Each emergency will vary depending on the cause and severity of the release. Located on the Coal Creek Station plant site are bulk containers and storage tanks for hazardous chemicals. In the event of a spill listed are the responsibilities, emergency guidelines, notifications and reporting procedures to follow.

III. RESPONSIBILITIES:

SARA on-site Emergency Coordinator:	Diane Stockdill Work phone: 442-7012 Home phone: 337-5491
SARA backup Emergency Coordinator:	Jennifer Charles Work phone: 442-7081 Cell phone: 460-7280
Incident Commander:	Leader, Plant Operations Work phone: 442-7017
Public Safety Officer:	Don Charging, McLean County Sheriff Washburn, ND 58577 Phone Contact: 911
DEM Coordinator:	Richard Johnson Washburn, ND 58577 Phone Contact: 911

IV. **EMERGENCY GUIDELINES IN THE EVENT OF A SPILL:**

(Leader, Plant Operations/Incident Commander responsibilities:)

A. Upon notification of a spill, the Leader, Plant Operations will assess the situation and prevent unauthorized entry into the area.

B. The Leader, Plant Operations is responsible to notify all plant employees of any release that is potentially hazardous and initiate an on-site evacuation per SF 10.15 as conditions necessitate.

C. In the event that the release poses a health/safety hazard to the surrounding area, the Leader, Plant Operations will initiate the off-site evacuation procedure per SF 10.15.

D. The Leader, Plant Operations will assign a containment and/or cleanup team from the qualified HAZMAT list. The Leader, Plant Operations will assure that disposal is in accordance with state and federal regulations.

E. When designating the HAZMAT team, the Leader, Plant Operations shall:

1. designate proper PPE
2. limit the number of responders
3. assure there are available backup personnel
4. designate a safety officer
5. assure the area is monitored
6. provide instruction to skilled personnel
7. implement the decontamination procedure.

F. If the release is the result of a fire, the fire response procedure shall also be implemented.

G. The Leader, Plant Operations shall document the HAZMAT incident with the CCS Injury/Accident/Incident Report.

V. **NOTIFICATION:**

Leader, Plant Operations notification:

A. Notify all personnel on-site and initiate an on-site evacuation per SF 10.15 as necessary.

B. If a spill involves a SARA hazardous chemical, the SARA Emergency Coordinator shall be notified. In the event that the SARA Emergency Coordinator cannot be reached, notify the SARA backup Emergency Coordinator. If neither of these can be contacted, the Leader, Plant Operations will assume the SARA Emergency Coordinator responsibility.

C. In the event of an off-site evacuation, the Leader, Plant Operations will contact the McLean County DEM Coordinator and the Public Safety Officer, per SF 10.15.

D. Notify the designated primary and secondary fire departments and ambulances as necessary.

First Responder notification:

When any person finds a chemical spill it is his/her responsibility to notify the Control Room. The Control Room should be informed of:

1. personnel affected
2. spill location
3. the chemical involved, if known
4. nature and cause of the spill, if known
5. plant equipment that is affected
6. spill volume
7. secure the area to prevent entry.

SARA Emergency Coordinator notification:

A. The SARA emergency coordinator or backup coordinator will notify the state and/or the national emergency response center within 24 hours if a fire, explosion, or other release threatens human health outside the facility or if a spill has reached surface water.

State Emergency Number	1-800-472-2121

National Response Center	1-800-424-8802

B. If the spill is a hazardous waste, this notification will include:

Name:	Great River Energy
Address:	7 mi. so. of Underwood, ND 58576
Generator Identification Number:	NDD030019145
Date, time and type of incident:	
Quantity & type of hazardous waste involved:	
Extent of injuries, if any:	
Estimated quantity & disposition of recovered materials, if any:	

VI. REPORTING:

In the event of a chemical emergency, the Leader, Plant Operations will complete and route a CCS Injury/Accident/Incident. The report should include:

A. what happened

B. when it occurred

C. where it happened

D. who was involved (names, employer)

E. who was exposed or injured

F. extent of injury

G. how much damage occurred to plant equipment or property

H. who was notified

I. was medical assistance required

J. critique of response and follow-up

K. Atmosphere testing and cleanup/disposal details

VII. DEFINITIONS:

SARA, Title III - The Superfund Amendment and Reauthorization Act (SARA) was signed into law on October 17, 1986. A provision of SARA Title III is also known as the Emergency Planning and Community Right to Know Act. SARA, Title III requires that facilities notify their local planning committee of:

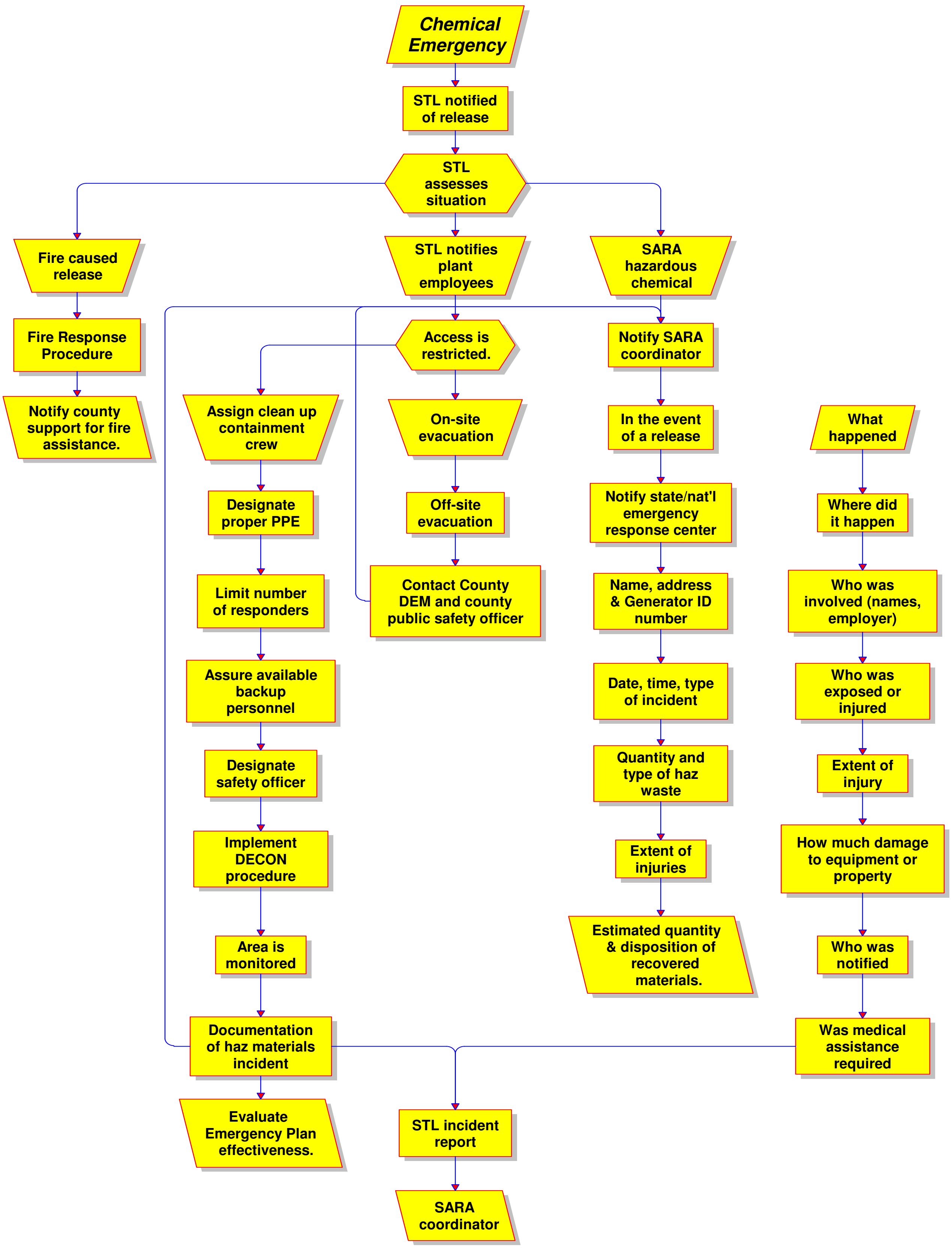
A. Chemicals that exceed the threshold planning quantities and the facilities ability to contain and respond to emergencies.

B. Releases - a release is any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment of any hazardous chemical, extremely hazardous chemical, or CERCLA hazardous substances.

Revision Date	Description of Revision
1/9/06 05/08/09	Added Record of Change Added revised telephone numbers
11/28/2011	Updated SARA back up emergency coordinator information

p:\CCS Procedure Manual\Safety Procedures\SF10.14, Emergency Response.doc

Emergency Guidelines In The Event of a Release



APPENDIX D-1

APPLICATION TO RENEW PERMIT TO OPERATE A SPECIAL USE DISPOSAL SITE (PERMIT NO. SU-033) FEBRUARY 3, 1989

APPLICATION TO RENEW PERMIT TO OPERATE A SPECIAL USE DISPOSAL SITE
NORTH DAKOTA STATE DEPARTMENT OF HEALTH AND CONSOLIDATED LABORATORIES
SFN 8396 (7/87)

DATE OF APPLICATION: 2/3/89

SEE INSTRUCTIONS ON BACK OF APPLICATION

APPLICANT'S NAME: Cooperative Power and United Power Association				PERMIT NUMBER: SU-033
ADDRESS: 14615 Lone Oak Road, Eden Prairie, MN 55344-2287				TELEPHONE NUMBER: 612/937-8599
PROPERTY OWNER: Same as Above	ADDRESS: Same as Above			TELEPHONE NUMBER
PERSON WHO PREPARED APPLICATION: William Kaul	ADDRESS: Same as Above			TELEPHONE NUMBER
LEGAL DESCRIPTION OF SITE	SECTION: 16	TOWNSHIP: 145N	RANGE: 82W	COUNTY: McLean
NUMBER OF ACRES IN DISPOSAL SITE: 220	ACRES NOT DEVELOPED	EXPECTED LIFETIME OF SITE: 20 YR	PROPOSED FUTURE USE OF SITE: None	
AREA TO BE SERVED BY THIS SITE: Coal Creek Station			POPULATION IN THAT AREA	

TYPE OF COVER MATERIALS "X" APPLICABLE ITEMS: X CLAY ___ SANDY ___ LOAM ___ OTHER (SPECIFY)

TYPES OF REFUSE MATERIAL TO BE DEPOSITED AT SITE ("X" APPLICABLE ITEMS)

[ ] PUTRESCIBLE WASTE (GARBAGE)	[X] FGD SLUDGE	[ ] PESTICIDE CANS
[ ] CONSTRUCTION WASTE	[ ] OIL FIELD WASTES	[ ] BRUSH AND TREE TRIMMINGS
[X] FLY ASH	[ ] NONHAZARDOUS INDUSTRIAL WASTES	[ ] TIRES
[X] BOTTOM ASH	[ ] OTHER (SPECIFY)	

TYPES OF EQUIPMENT USED AT SITE

SPECIAL SITE REQUIREMENTS

YES	NO	THE FOLLOWING TO BE ANSWERED FOR ALL SITES
X		DOES YOUR FACILITY HAVE A SYNTHETIC/CLAY LINER
X		IS THE LINER BEING MAINTAINED
X		DO YOU HAVE ADEQUATE MATERIAL FOR FUTURE LINER CONSTRUCTION
X		DO YOU HAVE A GROUNDWATER/SURFACE WATER MONITORING PROGRAM IN PLACE AT THE DISPOSAL SITE

HOW FREQUENTLY ARE SAMPLES COLLECTED FROM MONITORING POINTS? Semiannually

WHAT IS YOUR ANNUAL COLLECTION SCHEDULE?

NAME OF LANDFILL EQUIPMENT OPERATOR: John Weeda, Plant Manager — TELEPHONE NUMBER: 701/442-3211

If not already completed, the permittee shall record, a notarized affidavit with the County Registrar of Deeds to place a notation in the County's tract system specifying that this solid waste management site, as specified in the legal description, is permitted to accept solid wastes for disposal. This affidavit shall specify that another affidavit must be recorded upon the facility's final closure.

Upon closure, a second affidavit shall be recorded specifying any final details regarding the types of wastes disposed of at the site, as well as any final details regarding the site's location, construction, management, etc. The Department must be provided a copy of both affidavits certified by the Registrar of Deeds in the county in which the disposal site is located. These certified copies must be forwarded to the Department within thirty (30) days of their recorded dates or if notification has been formally completed prior to completion of this permit renewal application, a certified copy of said notification shall be forwarded with the completed application.

I certify that the information in this application is true, correct and complete to the best of my knowledge.

William Kaul
SIGNATURE OF PERSON COMPLETING APPLICATION

William Kaul
SIGNATURE OF APPLICANT

(over)

TABLE OF CONTENTS

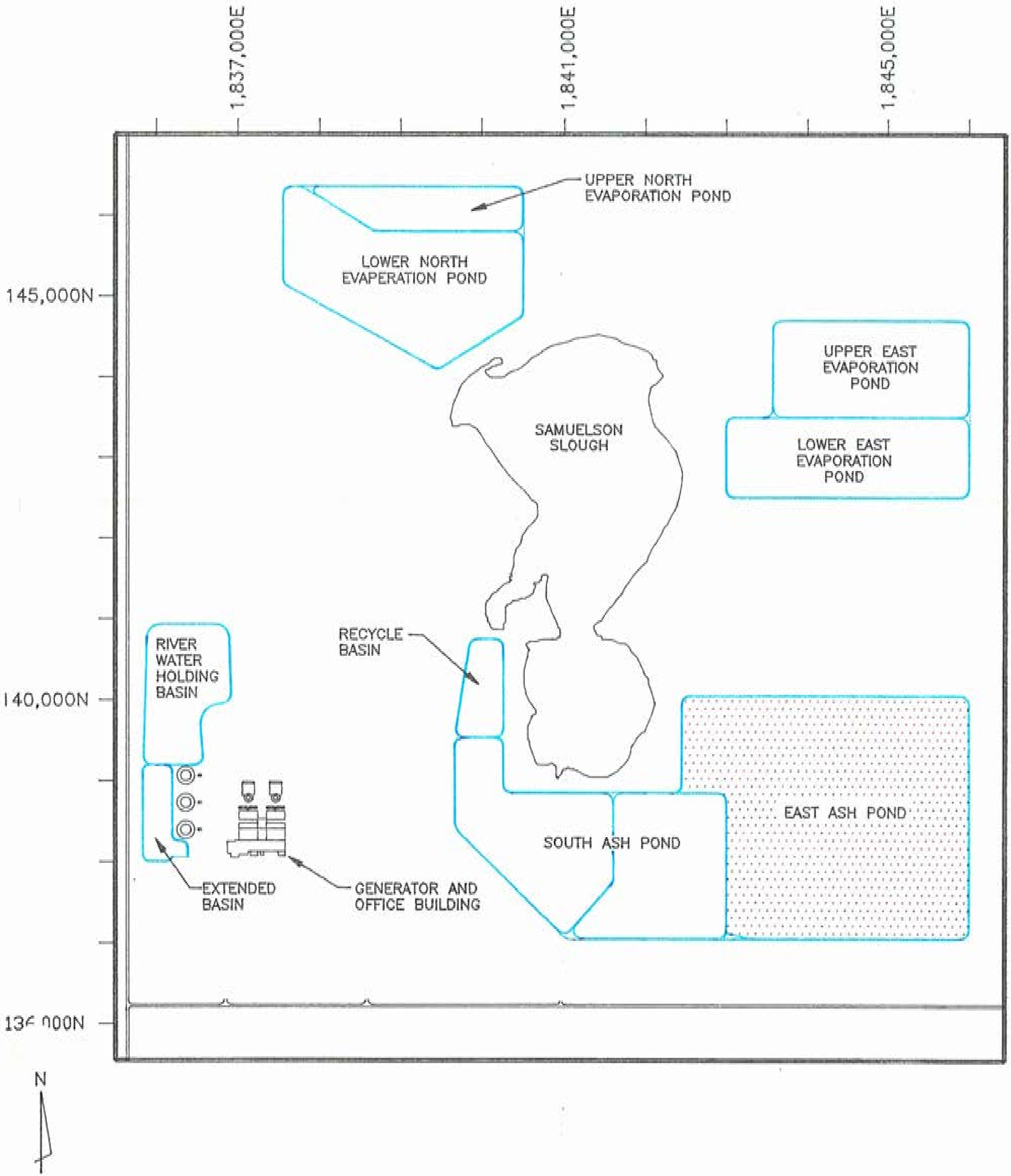
INTRODUCTION

This application is for a special use disposal permit for an already permitted facility (SU-033) at Coal Creek Station (CCS), a 1000 MW electric generating plant located near Underwood, North Dakota. Permit SU-033 expired in July, 1985, but was extended indefinitely by letter from the North Dakota State Department of Health (Department) dated August 20, 1985, pending further review by the Department. The facility in question is called the east ash pond (EAP) and has been used on and off since 1980 as a wet impoundment for the disposal of the by-products of combustion at CCS, namely bottom ash and flue gas desulfurization (FGD) sludge. (See Figure 1.)

Due to a combination of factors, including a high groundwater table, unfavorable geology, and an inadequate clay liner, the EAP has been taken out of service pending significant modifications, both in its construction and operation, which are the subject of this application.

Also subject to permit SU-033 is a separate, but adjacent facility called the south ash pond (SAP). Since these two facilities will no longer be used in the manner for which they were originally permitted (wet impoundments, permanent storage), and since they are each being redesigned and upgraded for different purposes, (EAP — dry, permanent disposal; SAP — wet, temporary disposal) it is proposed herein that separate permits be issued for these facilities. This application, however, will address only the EAP.

FIGURE 1
LOCATION MAP
COAL CREEK STATION



The SAP will be addressed in a subsequent application. However, in order to understand the overall plan for handling wastes in the future at CCS, it should be noted here for the benefit of reviewing agencies that the SAP has been emptied, partitioned and will be used in the future as a temporary storage or holding pond. One side will alternate as an active wet impoundment, receiving sludge and bottom ash from the plant, while the other side is dewatered prior to the wastes being hauled to the EAP or subsequent permanent disposal area. Currently, the western section of the SAP is receiving wastes from the plant.

The proposed modifications in the EAP include a significant addition of clay and spoils materials to most of the bottom which will serve to raise it to a level of at least five feet above the water table and which should also serve to provide a permeability coefficient in the liner of at least 1×10^{-7} cm/sec. The only exception is the southwest corner of the EAP which is partially filled with ash and sludge. This section of the EAP has favorable geology and the cost of removing the waste materials would be excessive. Therefore, it is proposed that it be dewatered and covered to control runoff and infiltration, prior to continued use as a dry landfill.

Based on a thorough study of all aspects of the situation, these physical and operational changes should minimize or eliminate further degradation of the groundwater. In fact, once these modifications are made, there should be a steady improvement in the groundwater quality in the area.

I. WASTE CHARACTERISTICS

A. Quantities (Foth & Van Dyke, 1987; Black & Veatch, 1988)

The solid wastes generated at CCS include fly ash, bottom ash and FGD sludge. Fly ash constitutes about 55 to 65 percent of the total ash produced during combustion. Over 99 percent of the fly ash produced during combustion is captured in the electrostatic precipitators for disposal. Historically, a large portion of the collected fly ash has been used as a reagent in the FGD system. Also, large quantities of fly ash have been sold for use in concrete. Fly ash which is not used as FGD reagent or sold, has been trucked off site and disposed of in specially designed pits located in mined areas north of the plant.

The remaining 35 to 45 percent of the ash forms into bottom ash or boiler slag. This material is sluiced together with the FGD sludge to the wet impoundments.

In 1988, CCS burned 6.8 million tons of lignite and operated at a plant capacity factor of about 85 percent. The following quantities of wastes were produced.

Material	Cubic Yards-1988	Cubic Yards/Day
Fly Ash	222,443	609
Bottom Ash	384,775	1054
FGD Sludge	522,694	1432
Total	1,129,912	3095

It should be noted here that a total volume of fly ash of 522,409 cubic yards was produced at CCS in 1988; however, of that volume 216,752 cubic yards were used as a FGD reagent and are included in the above FGD sludge numbers. Also not included in the fly ash quantities listed in the above table are 83,215 cubic yards that were sold. The volumes of bottom ash and FGD sludge are "wet" volumes assuming 25 percent and 50 percent moisture, respectively.

Since 1988 was a record year in terms of the quantity of lignite burned, and since an 85 percent plant capacity factor is near the maximum practical limit of operation for CCS, the volumes given here can be considered to be near the maximum amount of waste that can be generated at CCS in a year.

B. Physical Characteristics (Foth & Van Dyke, 1987; Black & Veatch, 1989)

Ash is the inorganic residue remaining either as fly ash or bottom ash after the lignite is burned. It originates chiefly from the mineral matter that was present in the unburned coal. Ash composition is a function of the type of coal burned, the combustion method and the emission control devices used. Typically, ash constitutes about 11 percent of the lignite by weight.

Bottom ash consists of angular particles with a porous surface texture that is normally gray to black in color. Boiler slag is composed of black angular particles having a glossy appearance. Table 1 contains an elemental analysis of CCS bottom ash.

TABLE 1

Elemental Analyses of CCS Bottom Ash
(ppm by weight)

Sample I.D.	A	B	C	D	E	F
pH	12.0	12.0	11.9	12.0	12.0	12.1
Organic-N	0.055	0.048	0.038	0.062	0.064	0.043
(NO_3+NO_2)-N	0.5	0.5	0.5	0.5	0.5	0.5
Sulfate	1970	3780	1140	2660	3430	3850
Calcium	17810	19650	11910	20950	20120	15780
Magnesium	407	475	306	432	471	347
Potassium	221	272	255	188	218	169
Sodium	132	141	121	137	134	119
Iron	286	289	157	246	365	239
Copper	0.04	0.05	0.03	0.01	0.01	0.03
Cadmium	0.01	0.01	0.01	0.01	0.01	0.01
Chromium	0.03	0.03	0.05	0.04	0.04	0.02
Nickel	0.12	0.12	0.08	0.03	0.16	0.03
Lead	0.59	0.67	0.39	0.57	0.50	0.35
Zinc	0.02	0.02	0.11	0.02	0.02	0.02

NOTE: These samples were taken from one 55-gallon barrel of bottom ash collected for analysis. Bottom ash is not analyzed on a regular basis.

Fly ash produced at CCS is comprised of very fine particles, the majority of which are glassy spheres, with the remainder being crystalline matter and carbon. A minerological analysis of the fly ash reveals that its principal chemical constituents are silica (SiO_2), lime (CaO), and alumina (Al_2O_3). See Table 2 for the complete analysis. Table 3 contains a trace element analysis of CCS fly ash conducted in 1979 (sample 3) and 1980 (samples 1 and 2).

The FGD system at CCS is a combination lime/fly ash system. This system is capable of using lime only or a combination of lime and fly ash as a reagent. A thorough study of these wastes was conducted in November 1987 by Foth & Van Dyke, a geosciences consulting firm. The materials, located in the SAP and subsequently hauled to a permanent disposal site north of CCS, were visually classified in a laboratory according to the relative proportions of the major components: fly ash, bottom ash and FGD sludge. This was done in order to determine whether a reasonable correlation existed between the physical and chemical properties of the ponded materials. Six types were identified.

Type 1 Bottom ash with less than 20 percent fly ash and/or FGD sludge.

Type 2 Bottom ash with 20-50 percent fly ash and/or FGD sludge.

Type 2T Bottom ash with 20-50 percent fly ash and/or FGD sludge — thixotropic.

TABLE 2

Typical CCS Fly Ash Analysis

Constituent	Average* Percent
SiO_2	46.6
Al_2O_3	16.0
Fe_2O_3	7.8
CaO	19.4
MgO	5.7
SO_3	1.5
P_2O_5	0.33
Na_2O	0.89
K_2O	1.7
TiO_2	0.62
Total	100.54
Acid Insoluable Residue	45.05
Available Alkalinity**	2.94

* Arithmetic average of two analyses from Twin City Testing.

** Arithmetic average of 44 analyses performed by Cooperative Power between 1986 and 1988.

Source: Black & Veatch, 1989

TABLE 3

Trace Element Analyses of CCS Fly Ash
(ppm by weight)

	Sample #1	Sample #2	Sample #3
Uranium	11	11	—
Lead	34	45	100
Thallium	<28	<28	—
Mercury	0.20	0.10	<0.1
Barium	3089	3634	7500
Tellurium	<20	<20	—
Antimony	10.2	8.0	—
Phosphorus (%)	0.12	0.13	—
Cadmium	<8	<8	<2.5
Silver	<6	<6	2.2
Molybdenum	28	26	—
Strontium	4470	5552	4200
Bromine	<5	<5	—
Selenium	7.8	7.4	2.4
Arsenic	106.9	102.5	100
Germanium	<15	<15	—
Zinc	74	70	60
Copper	67	64	65
Nickel	31	31	1000
Manganese	573	530	—
Chromium	53	63	55
Vanadium	159	140	0.40
Fluorine	220	220	—
Boron	1078	1095	210
Beryllium	4.9	4.9	7.5

Type 2S   Bottom ash with 20-50 percent fly ash and/or FGD sludge -- soft.

Type 3   Material with greater than 50 percent fly ash and/or FGD sludge.

Type 3T   Material with greater than 50 percent fly ash and/or FGD sludge -- thixotropic.

Approximately one-third (33 percent) of the material in the SAP was judged to be relatively clean bottom ash or Type 1 material. Another one-fifth (20 percent) of the material was estimated to be Type 2 material. Type 3 material made up the remaining 47 percent of the sediments. Approximately 15 percent of the Type 2 material and approximately 50 percent of the Type 3 material was thixotropic.

C. Chemical Characteristics (Foth & Van Dyke, 1987)

As a part of the above study, 88 samples were analyzed for various chemical parameters. The total included 87 samples from borings and one fresh FGD sludge sample. All of the samples were analyzed for total and leachable arsenic, cadmium and boron. Sulfate, chloride and pH were measured in the leachate solutions of these samples. Eight selected samples were also analyzed for total and leachable magnesium, sodium, calcium, potassium and lead. Fluoride, total dissolved solids and specific conductivity were also measured in the leachate solutions of the select samples. Digestion and analyses for the total constituents were conducted following Standard Methods. Leaching analyses were performed according to ASTM Method D 3987-81 as requested by the Department. All of the analyses were performed in the Foth & Van Dyke Chemistry Laboratory in Green Bay, Wisconsin. A complete report is on file at the Department.

The results of these analyses indicate that the values of total and leachable cadmium and leachable selenium were below the detection limits of the methods employed. All but four of the total selenium values were below the detection limit and the four that were measured were at detection limit values. All but four of the leachable arsenic values were below the detection limit, and the four with measurable values had concentrations that were only slightly above the detection limit. These data indicate that, although metals are present in the samples, the metals do not leach out of the ash material under conditions found in the pond.

The pH of the leachate solutions was remarkably consistent from sample to sample. Fly ash reacts with water, leading to immediate dissolution of the alkalis and the alkaline earths from their oxide forms within the ash grains, subsequently forming hydrated ions. These reactions result in the high pH which is observed in the ash pond. The average pH value is approximately 10.2 units. An elevated pH level in a reaction stable environment, such as the SAP, tends to minimize leachability of the metals that are present.

FGD sludge reacts with the water in the pond releasing considerable quantities of sulfate and calcium. The principal components of FGD sludge are generally calcium sulfate and calcium carbonate. Upon reacting with water in the ash pond, the calcium sulfate becomes hydrated forming the mineral phase gypsum. The presence of the FGD sludge in the basin has a limiting effect on the leaching of materials from the fly and bottom ashes, since the high concentrations of sulfate tend to inhibit the dissolution of the ash. In addition, the high sulfate makes the calcium sulfate minerals less soluble than they would otherwise be due to the common ion effect.

Total boron concentrations varied between samples, and when these values were grouped according to the type of material analyzed, differences in the mean values between the groups were observed. As shown on Table 4 the Type 1 materials have the highest total boron (317 mg/kg) and the Type 3T have the lowest total boron concentrations (220 mg/kg). T-test comparisons between the mean values indicated that the differences between the groups is significant. Probabilities that significant differences exist between Type 1 and Type 2's are 99 percent, between Type 2's and Type 3 are 81 percent, and between Type 3 and Type 3T are 92 percent.

Leachable boron concentrations vary widely between samples. There were no significant differences between the means of the grouped data. However, leachable boron exhibits a distributional pattern for the highest concentrations. Those samples collected near the southern and

TABLE 4

Mean Concentrations

Material	No. Samples	Total Boron (mg/kg)	Total Arsenic (mg/kg)	Leachable Chloride (mg/l)	Leachable Sulfate (mg/l)
Type 1	22	317 ± 62	45.4 ± 18.8	17.4 ± 11.4	1346 ± 547
Type 2, 2S and 2T	22	264 ± 71	57.1 ± 21.6	27.8 ± 16.5	1750 ± 153
Type 3	18	240 ± 42	80.7 ± 21.0	29.1 ± 19.7	1695 ± 433
Type 3T	25	220 ± 31	94.2 ± 19.1	36.5 ± 22.8	1806 ± 259
Comparison of Statistical Probability by Material Type:		1:2 99% 2:3 81% 3:3T 92%	>93% among all types	1:2 98% 2:3 No diff. 3:3T 83%	1:2/3 99% 2:3 No diff. 3:3T No diff.

Source: Foth and Van Dyke, 1987

western borders of the pond and many of those collected at, or near, the base of the accumulated sediments contained relatively high concentrations.

Total arsenic concentrations when grouped by material type showed considerable differences in mean values as shown in Table 4. Type 1 materials have the lowest total arsenic concentrations (45.4 mg/kg) and Type 3T the highest (94.2 mg/kg). T-tests performed on the total arsenic calculations revealed that there is a 93 percent, or greater, probability that the differences between the mean values is significant.

Leachable chloride concentrations differed between samples. Mean values of the concentrations grouped according to type of material leached are shown in Table 4. Type 1 materials have the lowest leachable chloride concentrations (17.4 mg/kg) and the Type 3T have the highest (36.5 mg/kg). T-tests performed on the means indicate that there is no significant difference between the Type 2's and the Type 3 means. There is a 98 percent probability that the difference between the Type 1 and the Type 2's is significant, and a 83 percent probability that the differences between the Type 3 and the Type 3T are significant.

Leachable sulfate concentrations, when grouped according to type of material leached, have somewhat differing mean concentrations as shown in Table 4. There are no significant differences in the mean leachable concentrations among Type 2 (1,750 mg/l), Type 3 (1,695 mg/l) and Type 3T (1,806 mg/l) materials. A significant difference (99 percent probability) does exist between the mean concentrations in Type 1 material (1,346 mg/l), which are the lowest, and the other materials.

Selected ash samples and fresh FGD sludge were analyzed for total and leachable alkalis, alkaline earths and lead. Leachable fluoride, total dissolved solids and specific conductivity were also measured. The results are presented in Tables 5 and 6.

The data show that the pond sample at location 458-1 is physically and chemically similar to the fresh FGD sludge. However, the ash contained lower leachable fluoride, total dissolved solids and had lower leachate conductivities than the fresh FGD sludge. There were no differences in total lead concentrations between the ponded ash materials and the fresh sludge. Leachable lead concentrations were below the detection limit for all samples.

The total and leachable sodium concentrations were lower in the ponded samples than in the fresh sludge. The total magnesium concentrations were approximately the same in all of the materials, but the leachable magnesium concentrations were much lower in the sediments than in the sludge. Total calcium and potassium concentrations in the sediments were lower than the sludge, but leachable calcium was greater and leachable potassium much greater in the sediments than in the sludge. High levels of calcium are typical for wastes derived from the combustion of Western lignite and sub-bituminous coals.

Western ashes commonly develop significant strength after several months of burial, especially if the burial is in an unsaturated site. This is due to the cementitious nature of these high calcium materials. The materials in the cement are likely to include hydrous calcium sulfate,

TABLE 5

Total and Leachable Concentration of Magnesium, Sodium, Calcium and Potassium

Location	Material (Type)	pH (Standard Units)	Total Magnesium (mg/kg)	Leach Magnesium (mg/l)	Total Sodium (mg/kg)	Leach Sodium (mg/l)	Total Calcium (mg/kg)	Leach Calcium (mg/l)	Total Potassium (mg/kg)	Leach Potassi (mg/l)
90-1	1	11.0	17,000	0.96	1,800	93	69,000	630	2,300	26
90-12	2	10.3	16,000	0.69	2,700	150	81,000	600	2,200	120
90-18	3	10.8	15,000	0.46	3,000	150	130,000	580	4,000	90
252-3	2	10.7	20,000	0.76	4,000	170	121,000	700	2,200	120
252-12	2	10.4	14,000	0.70	1,700	150	150,000	580	3,400	75
318-15	3T	10.3	11,000	0.56	2,300	150	160,000	680	2,500	50
458-1	3	8.2	17,000	118	4,000	150	120,000	550	2,700	15
Scrubber Sludge (9/25/87)	3	9.3	16,000	310	7,200	210	150,000	340	3,200	13

Source: Foth and Van Dyke, 1987

TABLE 6

Total and Leachable Lead, Leachable Fluoride and pH Data

Location	Material (Type)	pH (Standard Units)	Leach Fluoride (mg/l)	Total Lead (mg/kg)	Leach Lead (mg/l
90-1	1	11.0	1.9	2.1	<0.50
90-12	2	10.3	1.1	6.3	<0.50
90-18	3	10.8	1.5	7.3	<0.50
252-3	2	10.7	1.7	4.5	<0.50
252-12	2	10.4	2.0	6.1	<0.50
318-15	3T	10.3	1.8	5.2	<0.50
458-1	3	8.2	6.3	8.8	<0.50
Scrubber Sludge (9/25/87)	3	9.3	13	6.1	<0.50

Source: Foth and Van Dyke, 1987

calcium and magnesium carbonates and hydrous iron oxides. Fly ash tends to be pozzolanic, a special type of self-cementation. During this process, hydrous aluminosilicates form, especially the mineral ettringite. The leaching potential of these materials greatly decreases once cementitious reactions have occurred. Some of the sediment samples from the pond were found to be partially cemented.

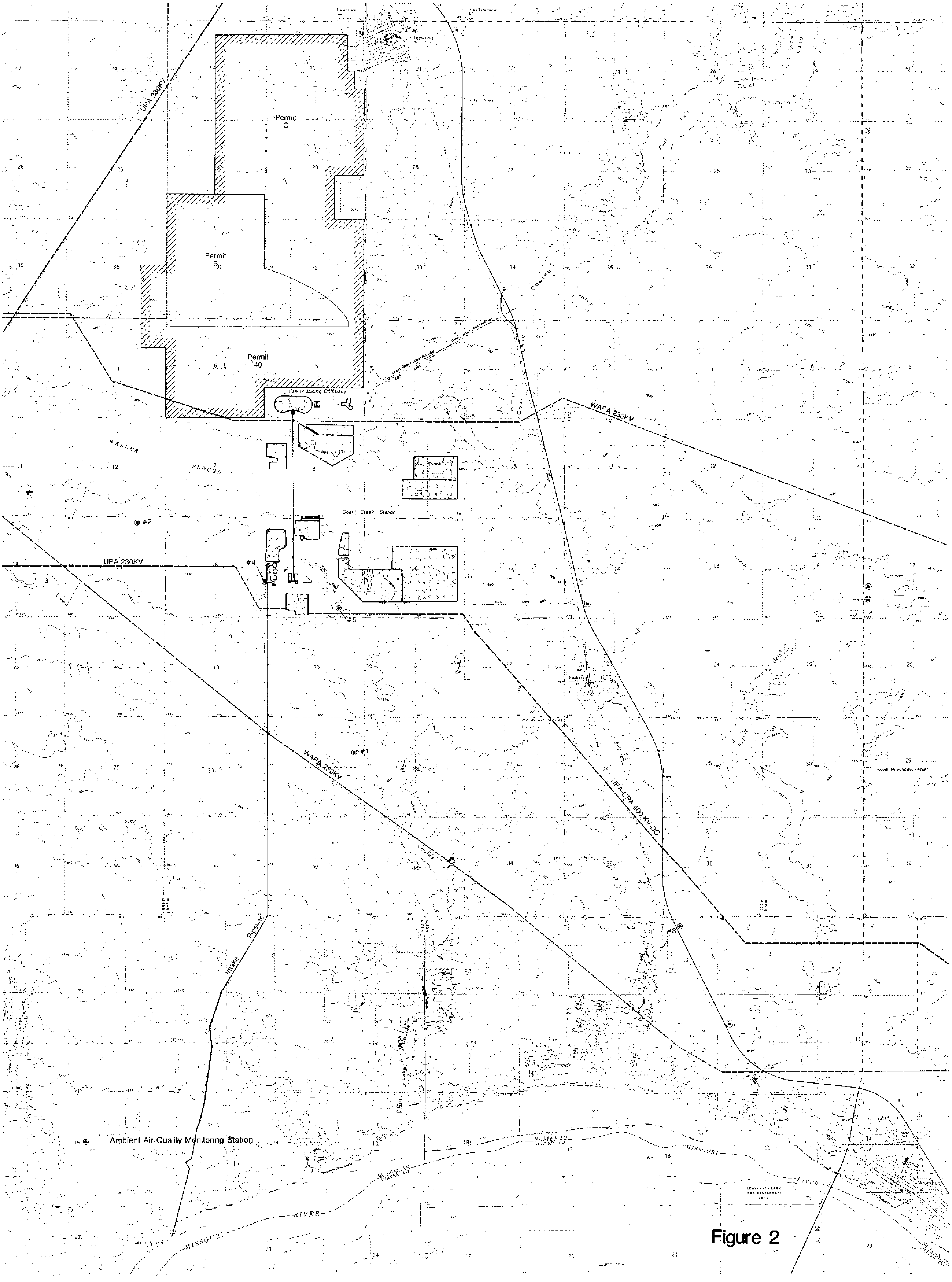
In summary, bottom ash and FGD sludge generally exhibit similar potential for leaching. Boron and sulfates exhibit the greatest leachability potential of the parameters tested. Arsenic, selenium, cadmium and lead are bound up in the ash materials and are immobilized because of the high pH level, which is evenly distributed throughout most of the ash material.

The analysis of these materials is provided as representative of the physical and chemical characteristics of the materials to be deposited in the EAP in the future. It should be noted, however, that some variations are possible — both in the quantities and the chemical characteristics of the various wastes produced — depending on the amount of fly ash that is used as a reagent in the FGD system. The range of quantities of fly ash used as a reagent can vary from zero to as much as 40 percent of the fly ash produced at CCS. It is further contemplated that dry fly ash may also be deposited in the EAP in the event that it is not used as a reagent, or sold or trucked to the mine pit disposal area. Thus, this application specifically includes fly ash as a waste intended for disposal in the EAP.

II. LOCATION INFORMATION

Coal Creek Station is located in on a 2560 acre site in McLean County, North Dakota. A composite U.S.G.S. Quadrangle map showing its location has been developed and enclosed as Figure 2. The EAP is located in section 16, Township 145N, Range 82W. An aerial photograph showing the EAP and the SAP is included in this application as Figure 3. A detailed site map is included as Figure 4.

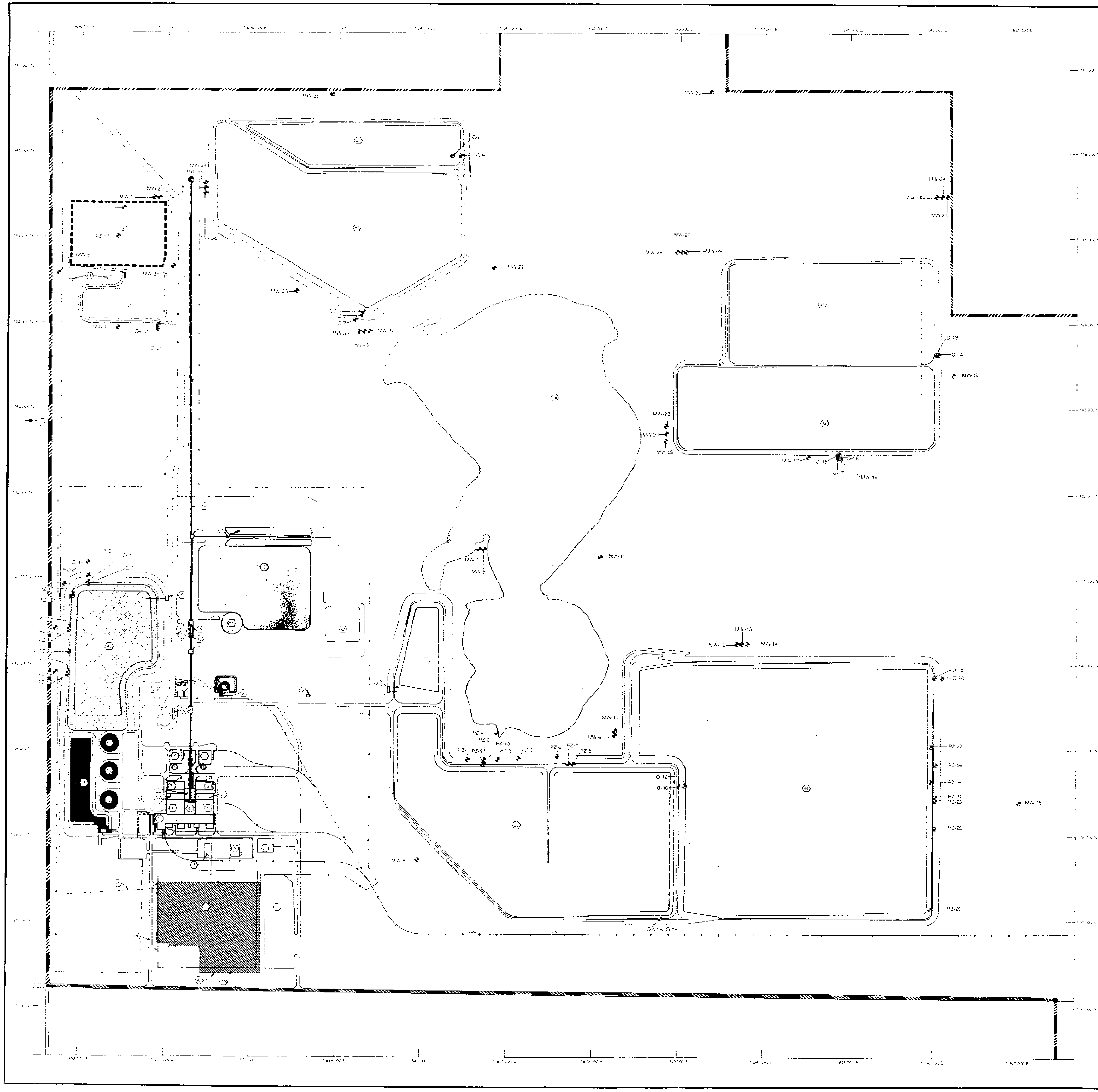
Since the EAP is an already permitted solid waste disposal site, no change in local zoning is anticipated.



UPA 230KV
Permit
C
Permit
B
Permit
40
Falkirk Mining Company
WAPA 230KV
WELLER
SLOUGH
Coal Creek Station
#2
UPA 230KV
#4
#5
#1
WAPA 230KV
UPA-CPA 400 KV-DC
Coulee
Intake Pipeline
Ambient Air Quality Monitoring Station
RIVER
MISSOURI

Figure 2

Figure 3



Cooperative Power Association
Environmental Affairs Department

Site of Coal Creek Station
Underwood, North Dakota

Plant Systems

- Fuel system
- Cooling water system
- Waste water system
- Service water system
- DC substation
- Main plant
- Piezometer well
- Monitoring well
- Property line

Facilities

1 Generation Building
2 General Services Building
3 Precipitator Building
4 Control Area
5 Chimney
6 Scrubber Building
7 Auxiliary Boiler Area
8 Crusher Building
9 Yard Silo Base Building
10 Lignite Yard Silos
11 Emergency Stockout Pile
12 Inactive Lignite Storage
13 Stacker/Reclaimer and Active Storage
14 Transfer Building
15 Conveyor 901
16 Cooling Towers
17 Circulating Water Pumphouse
18 Emergency Basin [illegible]
19 AC-DC Substation
20 South Ash Pond
21 Recycle Pumphouse
22 Main Site Access Road
23 Main Plant Access Road
24 Warehouse
25 Construction Office
26 Crew Building
27 Fan Area
28 Construction Parking Lot
29 Fuel Oil Storage Tank
30 Fuel Oil Pumphouse
31 Sewage Treatment Plant
32 Lignite Storage Runoff Basin [illegible]
33 Maintenance Garage
34 Water Treatment Building
35 No. 2 Fuel Oil Storage Tank
36 Fly Ash Silos
37 Service Water Storage Tanks
38 Fire Booster Pumphouse
39 Makeup Water Pumphouse
40 River Water Basin [illegible]
41 [illegible] KV Transmission Line
42 Security Fencing
43 Lignite Yard Silo Penthouse
44 Holding Pond
45 East Ash Pond
46 Samuelson Slough
47 East Upper Evaporation Pond
48 East Lower Evaporation Pond
49 North Upper Evaporation Pond
50 North Lower Evaporation Pond
51 Fly Ash Disposal Area
52 Fly Ash Runoff Basin
53 Well Pump Building
54 [illegible]

Figure 4

III. GENERAL GEOLOGY AND HYDROLOGY

A. Geology — Overview (BARR Engineering, 1982)

Coal Creek Station is located in an area underlain by the Fort Union Group of sedimentary rocks. These are poorly consolidated silts, clays and sands interbedded in the upper non-marine units with mineable lignite. The only marine formation that subcrops in the area and the oldest is the Cannonball formation. Figure 5 shows the locations of regional cross sections. Figure 6 shows the Cannonball formation. It and the overlying Slope formation are encountered only at the base of deep bedrock valleys. The Slope formation is similar to the upper two nonmarine units, the Bullion Creek and Sentinel Butte formations. The nonmarine sands and the fractured lignites of this sequence are water bearing.

Bedrock topography is thought to reflect preglacial drainage when the Missouri River flowed toward Hudson Bay. The original patterns have been modified, however, due to the tremendous effect of the glaciers on the directions of streamflow.

Bedrock is buried by the Coleharbor formation, an unconsolidated unit of glacial drift. These sediments, which completely fill many bedrock valleys, consist of sandy, silty, clay tills, sand and gravel outwash, and silt and clay lake deposits. In a few places the Coleharbor formation is overlain by the Oahe formation which is primarily made up of recent alluvium.

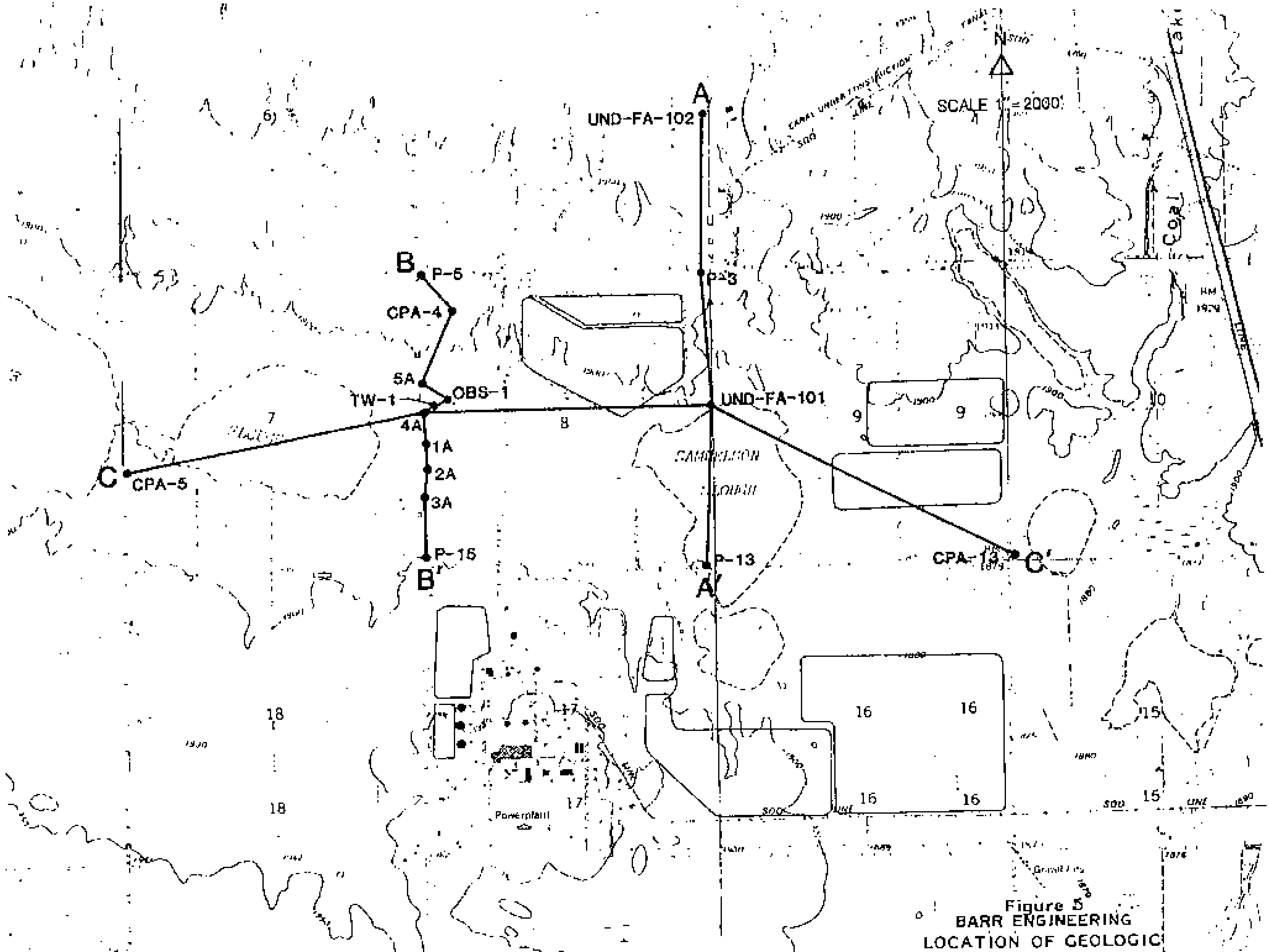


Figure 5
BARR ENGINEERING
LOCATION OF GEOLOGIC
CROSS SECTIONS

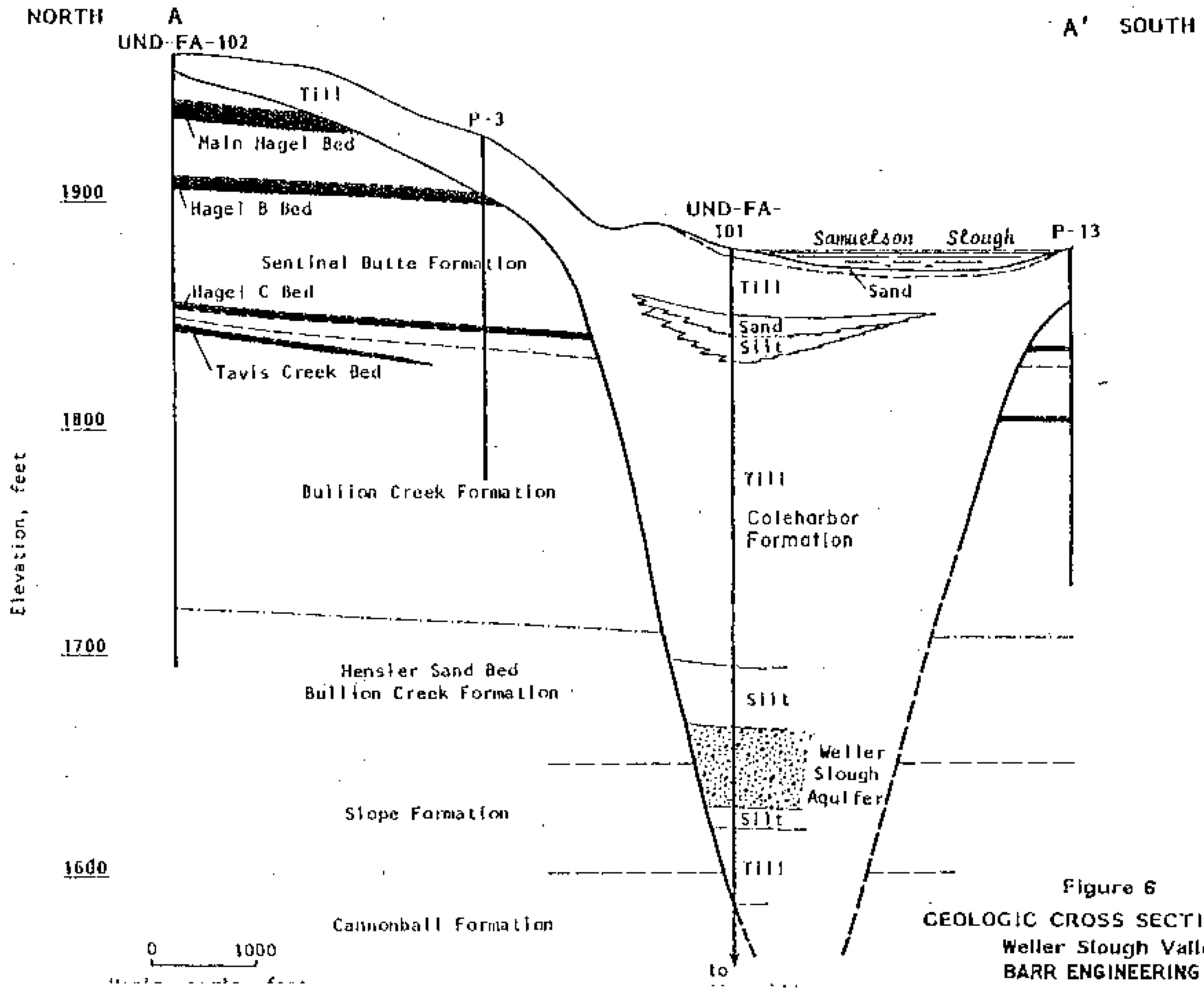


Figure 6
GEOLOGIC CROSS SECTION A-A'
Weller Slough Valley
BARR ENGINEERING

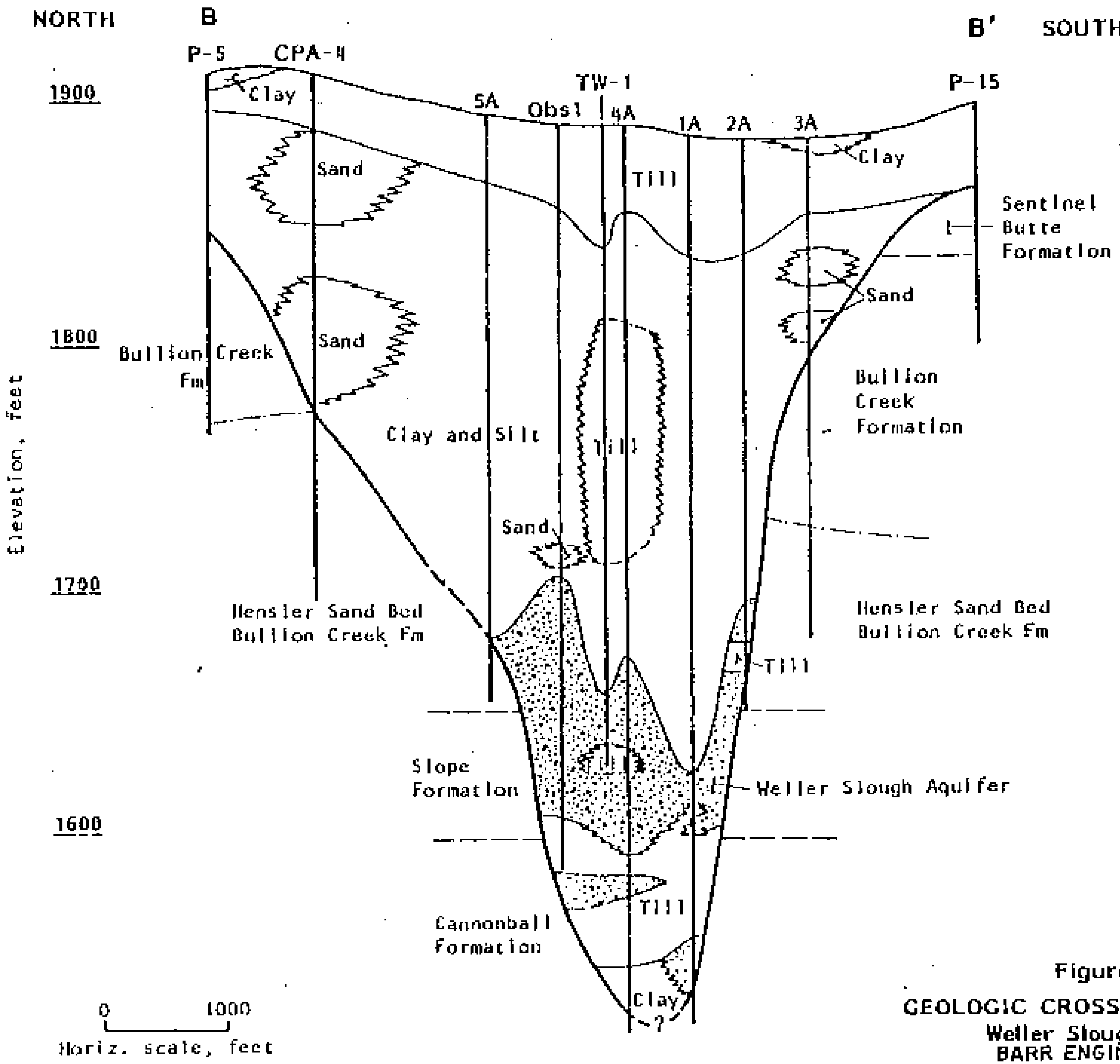


Figure 7

GEOLOGIC CROSS SECTION B-B'

Weller Slough Valley

BARR ENGINEERING

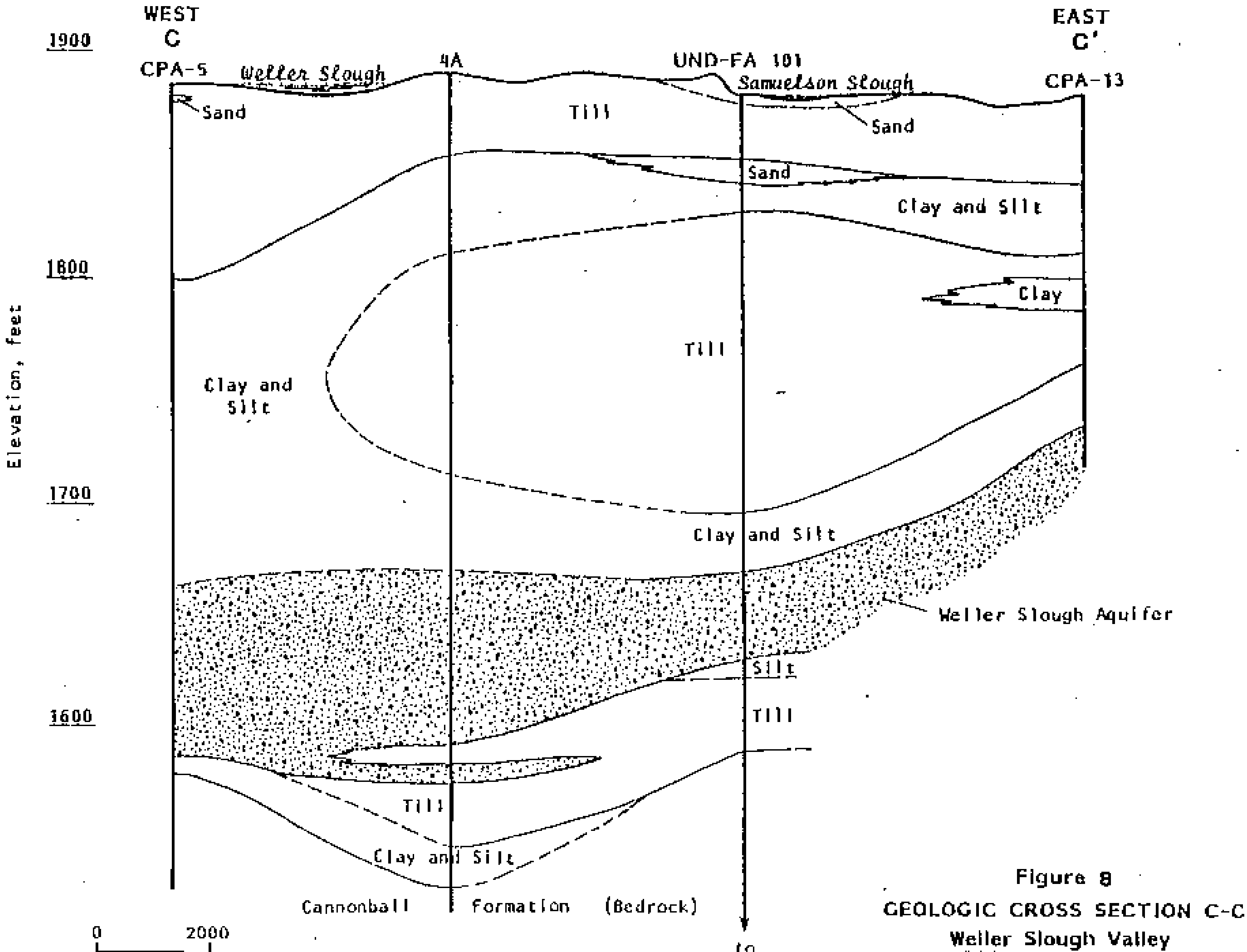


Figure 8
GEOLOGIC CROSS SECTION C-C'
Weller Slough Valley

B. Geology — Site (BARR Engineering, 1982)

The CCS occupies sections 8, 9, 16, and 17 of Township 145N, Range 82W. The underlying Cannonball formation is estimated to be 270 feet thick. Its contact with the Slope formation is probably around elevation 1600. The Slope here is approximately 50 feet thick. The overlying Bullion Creek is 150 to 190 feet thick. Its contact with the Sentinel Butte formation is at elevation 1840. The Sentinel Butte outcrops in the southwest quarter of section 17.

The bedrock topography is dominated across the site by a deep valley. The floor of this valley, referred to as the Weller Slough Valley, may slope toward a now-buried channel of the Knife River, east of Washburn.

The Weller Slough Valley is over 365 feet deep and filled with sediments of the Colcharbor formation. There are three tills interbedded with lake deposits and a thick sand and gravel sequence. The latter comprises the Weller Slough aquifer. It is over 100 feet thick in places and is located near the base of the valley. (See Figures 6-8.)

Some sediments of the Oahe formation are located in a linear deposit oriented north-south through sections 9 and 16. The fine alluvium around Samuelson and Weller Sloughs is also included in this formation.

C. Hydrogeology — General (BARR Engineering, 1982)

Work done in the Falkirk Mine area has shown that within bedrock, groundwater flow is predominantly vertically downwards through the claystone and siltstone beds that act as aquitards. In the more permeable lignite and sand beds, groundwater is thought to flow horizontally toward the Weller Slough and Coal Lake Coulee channels. The Cannonball formation is considered the regional confining stratum, separating the shallower aquifers from the deep bedrock aquifers.

The sands of the Sentinel Butte and Bullion Creek formations are reported to have permeabilities on the order of 10^{-4} cm/sec. The average permeability of the lignite beds in the Sentinel Butte formation is on the same order. The clay and silt aquitards have a mean permeability of 10^{-6} cm/sec.

The tills exhibit a wide range of permeabilities also. Unfractured till shows a range from 10^{-7} to 10^{-8} cm/sec. The permeability of fractured till may be as great as 10^{-4} cm/sec. The sand and gravel units in the valley are reported to have a mean permeability of 10^{-3} cm/sec.

D. Weller Slough Aquifer

The thickness of the Weller Slough aquifer varies from 20 to more than 100 feet in the vicinity of CCS. As mentioned above, confined conditions in the aquifer indicate that the glacial till overlying the aquifer is significantly less permeable than the aquifer sands and gravels. Because the overlying strata are relatively impermeable, it is likely that significant recharge to the Weller Slough aquifer is from bedrock units thought to be discharging at the valley wall interface. Specifically, the Hensler sand and Bullion Creek formation and the entire Slope formation are in direct contact with the sand and gravel units of the Weller Slough aquifer. It has been reported that the Hensler sand may be a regional groundwater sink; however, groundwater movement from the Weller Slough aquifer to the Hensler sand would be unlikely.

Precipitation may infiltrate the upper till soils under certain conditions. However, after evaporation, most of the water is thought to accumulate as runoff to the sloughs. Leakage from the sloughs does not seem to contribute significantly to the recharge of the Weller Slough aquifer. (Groenewald, et. al. 1979)

E. Hydrology

The surface water of interest in the area of CCS includes Samuelson Slough, Weller Slough, Saylor Slough, Gradin Slough and the Legal Drain system. These wetlands and the legal drain represent the confluence of three regional water sheds; one which drains into Weller Slough, one which drains into Samuelson Slough, and the Coal Lake Coulee which drains into Saylor Slough. In addition, the Falkirk Mining Company has been pumping large quantities of mine pit water into the Legal Drain which flows to Samuelson Slough. Weller Slough flows into Samuelson

Slough, and Samuelson Slough, in turn, flows into Saylor Slough. Saylor Slough flows to Gradin Slough, which flows to the Missouri River, six miles south of CCS.

These wetlands are also influenced by the upper level aquifer. This is discussed in some detail in the next section.

IV. SITE SPECIFIC GEOLOGY AND HYDROLOGY

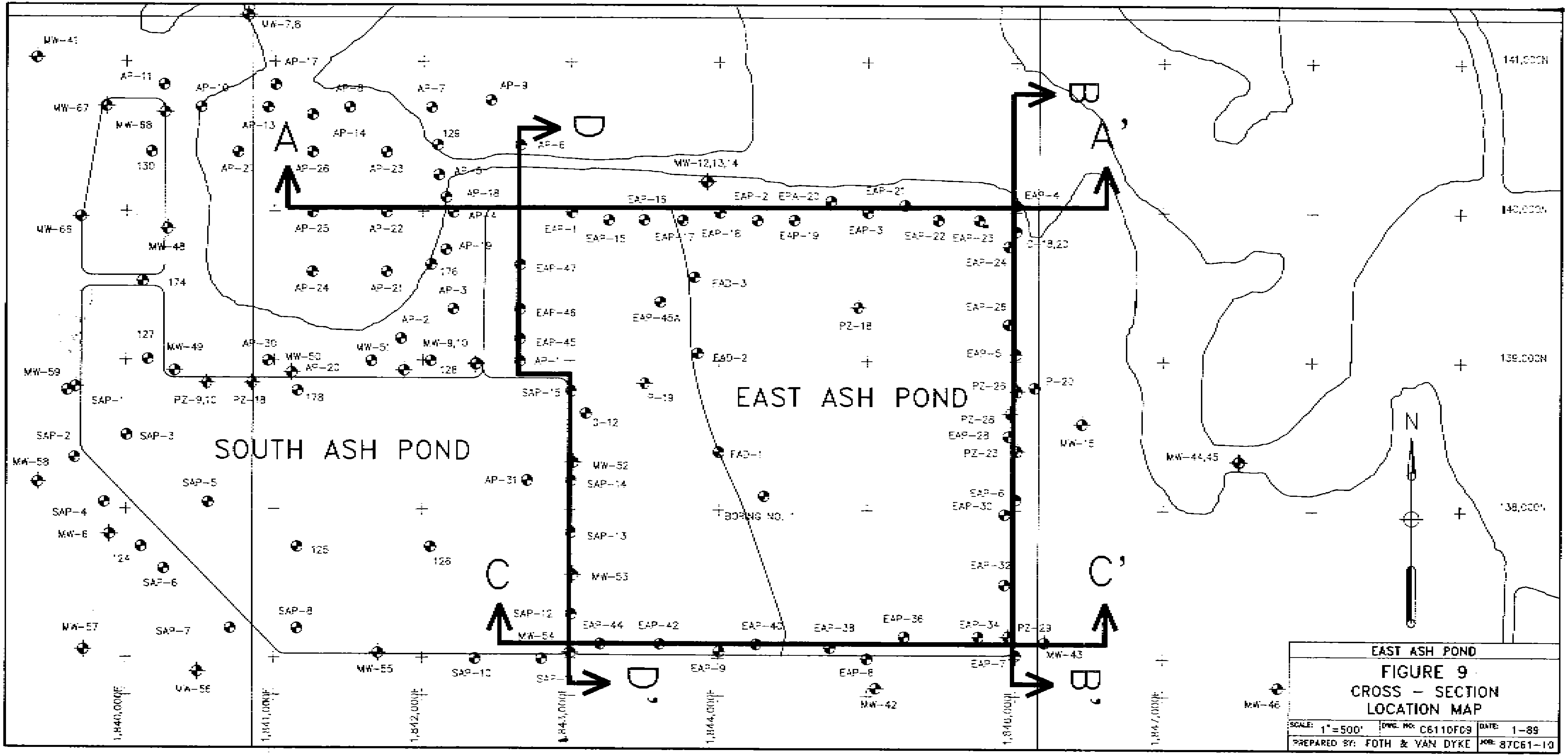
Detailed hydrogeological studies have recently been conducted by Foth & Van Dyke to augment previous efforts to better understand the conditions at the CCS site and to provide a basis for the mitigation of the current groundwater conditions. The results of these studies and analysis are presented in this section.

Site Geology

The site geology indicates near-surface silty clay and sandy clay till with interbedded sand lenses. The Oahe formation, mentioned above in the general discussion of the area geology, is the uppermost unit and is found in some parts of CCS. The surficial deposits of this formation are, by definition, the result of post-glacial drainage patterns. It is reported to be fine to coarse alluvium in a linear deposit going north-south through the middle of sections 9 and 16. This relatively high permeability unit is believed to be beneath parts of the EAP.

The next lower unit is the Napoleon drift of early Wisconsin age. This uppermost glacial unit is typically 15-20 feet of cohesive silty, sandy, lignitic till which is yellow to brown. The gray pre-Wisconsin Mercer drift is deposited below the Napoleon drift.

The subsurface geology in the vicinity of the EAP can best be shown with geological cross sections. The locations of the cross sections are shown on Figure 9. Geological cross sections A-A', B-B', C-C' and D-D' are provided as Figures 10, 11, 12 and 13, respectively.



EAST ASH POND

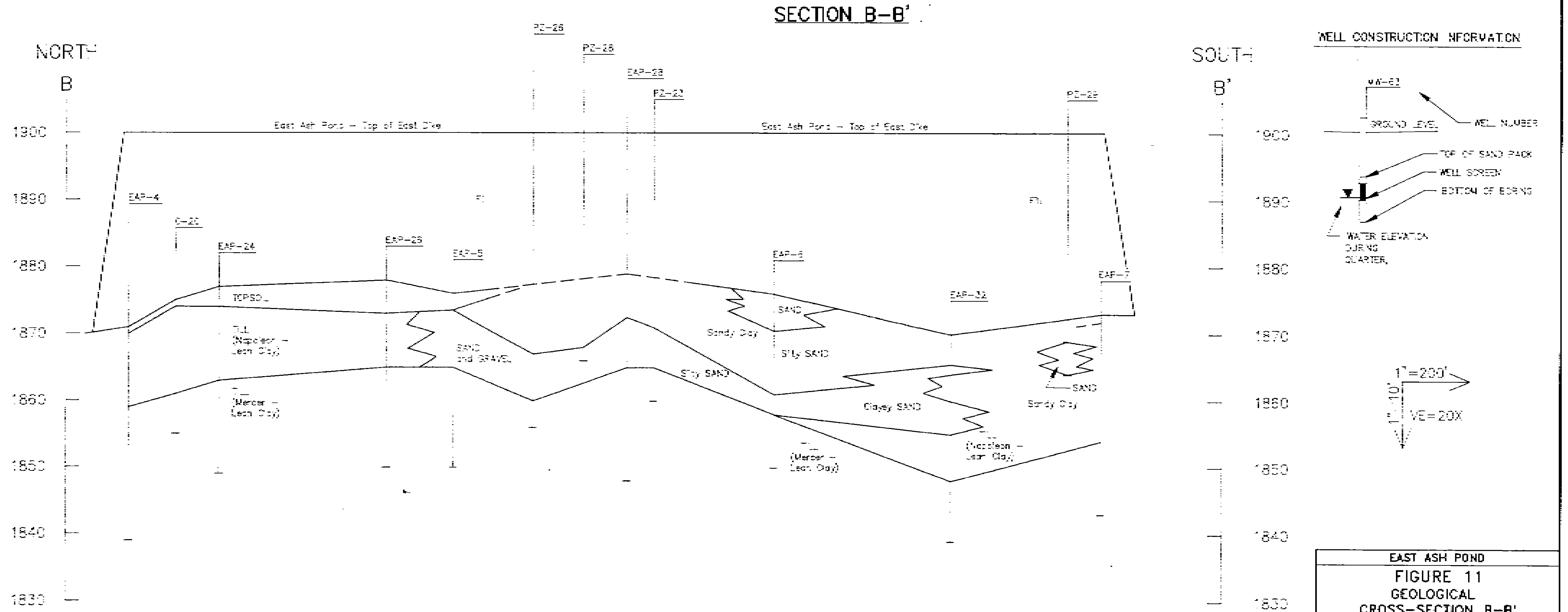
FIGURE 9

CROSS - SECTION LOCATION MAP

SCALE: 1"=500'	DWG. NO. C6110FC9	DATE: 1-89	
PREPARED BY: FOTH & VAN DYKE		JOB: 87C61-10	

EAST ASH POND
FIGURE 10
GEOLOGICAL
CROSS-SECTION A-A'

SCALE: | DWG. NO: C6110F10 | DATE: 1-89
PREPARED BY: FOTH & VAN DYKE | JOB 87C61-10



EAST ASH POND	
FIGURE 11 GEOLOGICAL CROSS-SECTION B-B'	
SCALE: DWG. NO. C6110F11	DATE: 1-89
PREPARED BY: FOTH & VAN DYKE	JOB: 87C61-10

EAST ASH POND			
FIGURE 12 GEOLOGICAL CROSS-SECTION C–C'			
SCALE:	DWG. NO: C6110F12	DATE: 1-89	
PREPARED BY: FOTH & VAN DYKE		JOB: 87C61-10	


SECTION D-D'
NORTH
D
SOUTH
D'
1920
1910
1900
1890
1880
1870
1860
1850
AP-6
EAP-47
EAP-46
AP-1
SAP-15
O-12
MW-52
SAP-13
MW-53
SAP-12
MW-54
East Ash Pond - Top of West Dike
East Ash Pond and South Ash Pond
Top of West Dike
Fill
Fill
Topsoil and Fill
Topsoil and Fill
SAND
(Oahe fm.)
TILL
(Napoleon-Lean Clay)
TILL
(Mercer-Lean Clay)
TILL
(Lean Clay)
TILL
(Lean Clay)
SHALE
SHALE
SANDSTONE
WELL CONSTRUCTION INFORMATION
MW-63
WELL NUMBER
GROUND LEVEL
TOP OF SAND PACK
WELL SCREEN
BOTTOM OF BORING
WATER ELEVATION
DURING
QUARTER,
1"=200'
1"=10'
VE=20X
EAST ASH POND
FIGURE 13
GEOLOGICAL
CROSS-SECTION D-D'
SCALE:
DWG. NO: C6110F13
DATE: 1-89
PREPARED BY: FOTH & VAN DYKE
JOB: 87C61-10

Cross section A-A' (along the north dike) shows an extensive sand lens within the Napoleon glacial unit. A significant sand-filled erosional feature also cuts through both the Napoleon and Mercer glacial units which is interpreted to be the Oahe formation. Cross sections B-B' and C-C', along the east and south dikes, respectively, also show extensive sand lenses within the clayey till. A less extensive sand lens is shown on cross section D-D' along the west dike separating the EAP and the SAP. The sand lenses are highly permeable avenues for horizontal movement of water.

Sand seams of an inch or more in thickness have also been reported in the clayey till. The soil boring methods which have been used, flight augers and/or split spoon sampling at 5-foot intervals, do not allow mapping of these thin sand layers. The sand seams can, however, provide significant horizontal migration paths for water.

The geology of the area provides several mechanisms for potential vertical seepage through the bottom of the EAP. They are: 1) fractured till; 2) exposed sand; 3) loss through bottom soils of moderate permeability, and 4) seepage through test borings which have been improperly abandoned. All of these conditions present mechanisms for vertical migration of water through the pond bottom.

Fractured till is known to exist in the area of CCS and is a significant mechanism for vertical water movement. The effectiveness of this phenomenon may have been modified, however, during liner repair work in the spring of 1980. The project involved re-working some of the bottom materials and placing additional clayey materials in other areas. Vertical fractures in the till can provide significant conduits for water to move from the pond downward into the highly permeable sand seams and lenses which are present beneath the EAP.

Exposed sand has been reported in the bottom of the EAP, most notably during the summer of 1979. This permeable material would allow access to more extensive sand lenses within the till. Records from 1980 show that approximately 118 acres of the EAP were judged to have inadequate clay for a liner. Liner modifications were made that same year to cover the exposed sand areas.

More than 200 shallow grid borings and more than two dozen deep borings have been drilled through the bottom of the EAP. Records of abandonment of the holes by deliberate and extensive filling and compaction are unknown. Many of the borings may have been partially sealed near the surface during liner modifications in the spring of 1980. The liner work is believed to have covered approximately 118 acres of the pond, which leaves the remainder of the 220 acre pond with potentially exposed improperly abandoned bore holes. The bore holes, if not filled with material of a permeability equal to or less than the native material, can provide a significant vertical pathway for water movement.

The significance of the above-listed potential vertical seepage mechanisms can be recognized in relation to a near-surface sand thickness map, Figure 14. The Sand Isopach Map shows the thickness of sandy material found near the surface of the pond bottom. The map

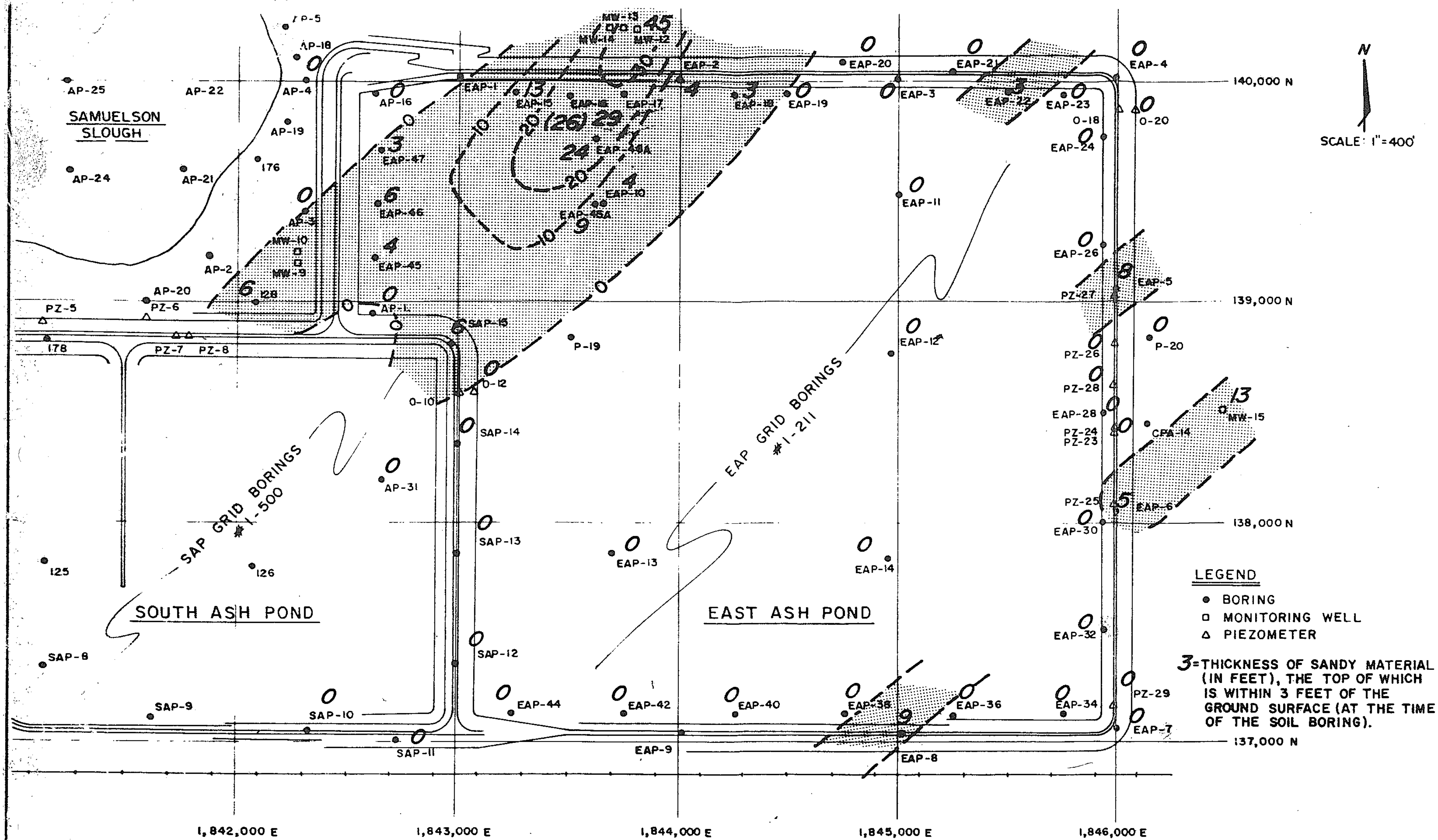


Figure 14

EAST ASH POND STUDY	E.A. HICKOK & ASSOCIATES	MAY 1985
SAND ISOPACH MAP	HYDROLOGISTS - ENGINEERS MINNEAPOLIS - MINNESOTA	6

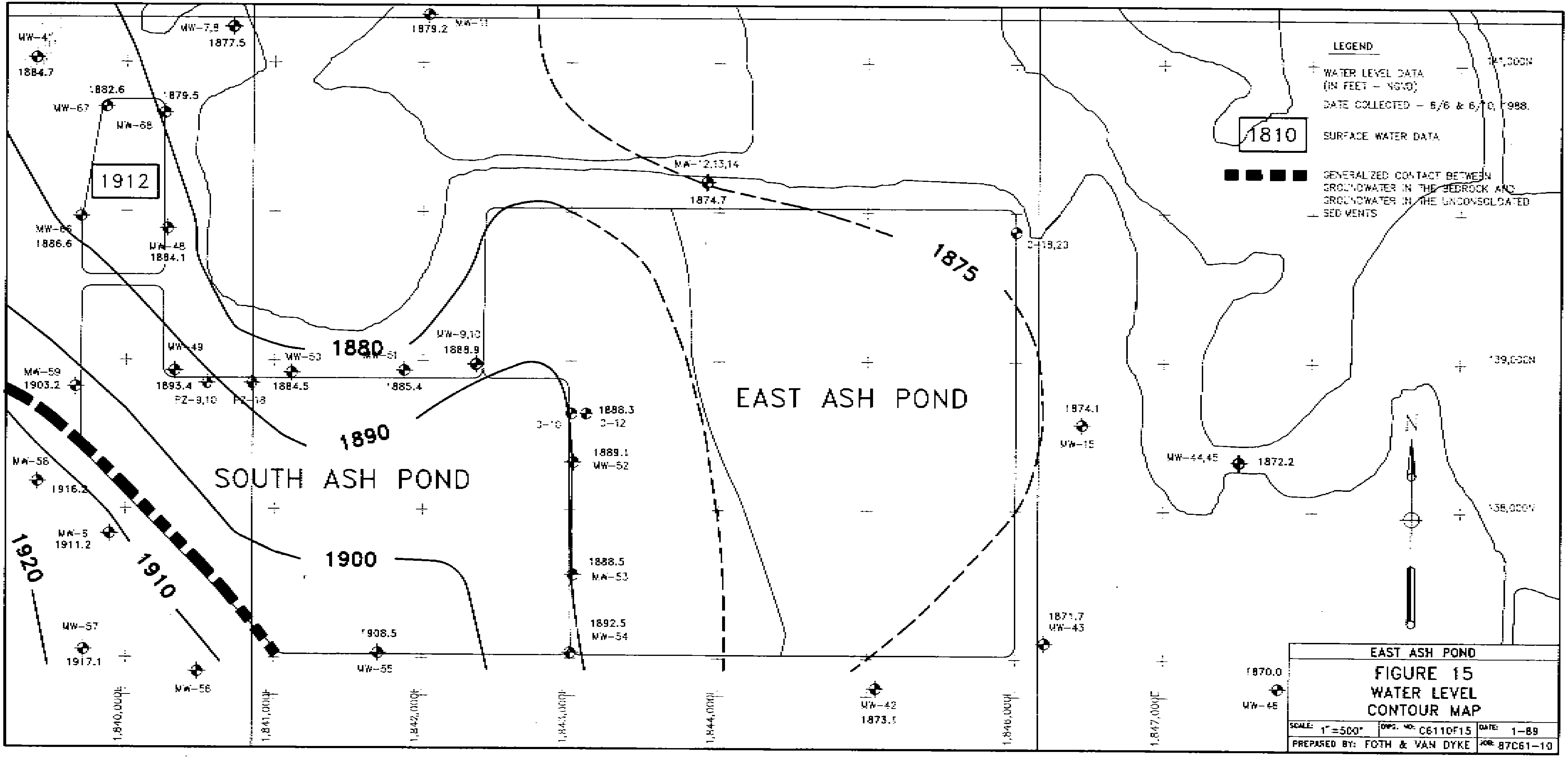
locates sand deposits which are within three feet of the bottom of the pond (at the time of drilling). This map illustrates that minimal vertical seepage depth is necessary to intersect significant sand lenses and sand seams capable of providing horizontal water migration beyond the EAP dikes.

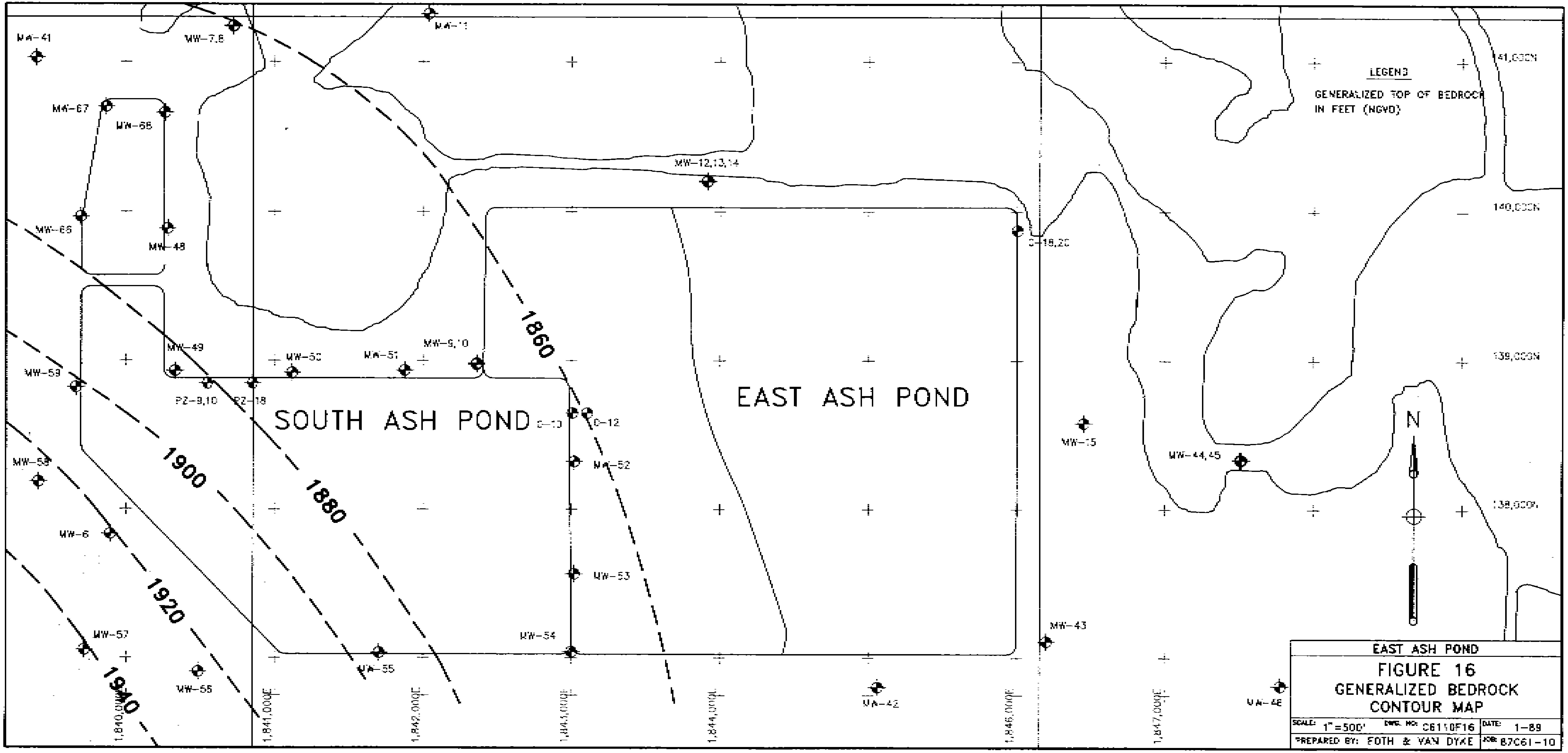
The largest sand lens, probably the Oahe formation, is located in the northwestern part of the EAP. Significant sand lenses are also recognized beneath the east and south dikes. Other unrecognized sand lenses and sand seams may be present throughout the EAP.

B. Hydrogeology and Groundwater Flow Pattern

According to recent studies conducted by Foth & Van Dyke, regional groundwater flow in the vicinity of CCS is a subtle expression of the ground surface topography which is influenced by the configuration of the eroded bedrock. A water level contour map is presented as Figure 15. The groundwater contours approximate the bedrock contours shown on Figure 16, except where locally affected by other factors, such as mounding beneath ponds. The water in the uplands is within the poorly consolidated bedrock while the groundwater in the lowlands is found in the glacial till. An approximation of the point of transition between bedrock and glacial till regimes is shown on Figure 15.

Groundwater travels from elevated recharge areas toward several stream valleys and lowlands which ultimately discharge into the Missouri River.


LEGEND
WATER LEVEL DATA (IN FEET - NGVD)
DATE COLLECTED - 6/6 & 6/10, 1988.
1810
SURFACE WATER DATA
GENERALIZED CONTACT BETWEEN GROUNDWATER IN THE BEDROCK AND GROUNDWATER IN THE UNCONSOLIDATED SEDIMENTS
SOUTH ASH POND
EAST ASH POND
1912
1920
1910
1900
1890
1880
1875
MW-7,8
1877.5
1879.2
MW-11
1884.7
1882.6
MW-67
1879.5
MW-68
MW-66
1886.6
MW-48
1884.1
MW-12,13,14
1874.7
MW-49
MW-50
MW-51
MW-9,10
1888.9
MW-59
1903.2
1893.4
PZ-9,10
PZ-18
1884.5
1885.4
1888.3
3-12
1889.1
MW-52
1874.1
MW-15
MW-44,45
1872.2
MW-58
MW-5
1911.2
MW-57
1917.1
MW-56
1908.5
MW-55
1888.5
MW-53
1892.5
MW-54
1871.7
MW-43
1870.0
MW-46
MW-42
N
1,840,000E
1,841,000E
1,842,000E
1,843,000E
1,844,000E
1,846,000E
1,847,000E
139,000N
EAST ASH POND
FIGURE 15
WATER LEVEL CONTOUR MAP
SCALE: 1"=500'
DWG. NO. C6110F15
DATE: 1-89
PREPARED BY: FOTH & VAN DYKE
JOB 87C61-10


LEGEND
GENERALIZED TOP OF BEDROCK IN FEET (NGVD)
SOUTH ASH POND
EAST ASH POND
1860
1880
1900
1920
1940
MW-41
MW-7,8
MW-11
MW-67
MW-66
MW-48
MW-49
MW-50
MW-51
MW-9,10
MW-59
PZ-9,10
PZ-18
MW-58
MW-6
MW-57
MW-55
MW-54
MW-53
MW-52
C-12
MW-12,13,14
MW-15
MW-44,45
MW-43
141,000N
140,000N
139,000N
138,000N
1,841,000E
1,842,000E
1,844,000E
1,846,000E
1,847,000E
N
EAST ASH POND
FIGURE 16
GENERALIZED BEDROCK
CONTOUR MAP
SCALE: 1"=500'
DWG. NO: C6110F16
DATE: 1-89
PREPARED BY: FOTH & VAN DYKE
JOB: 87C61-10

The Missouri River is located six miles south of the CCS ash disposal ponds. Flow direction is altered locally by mining and waste disposal activities.

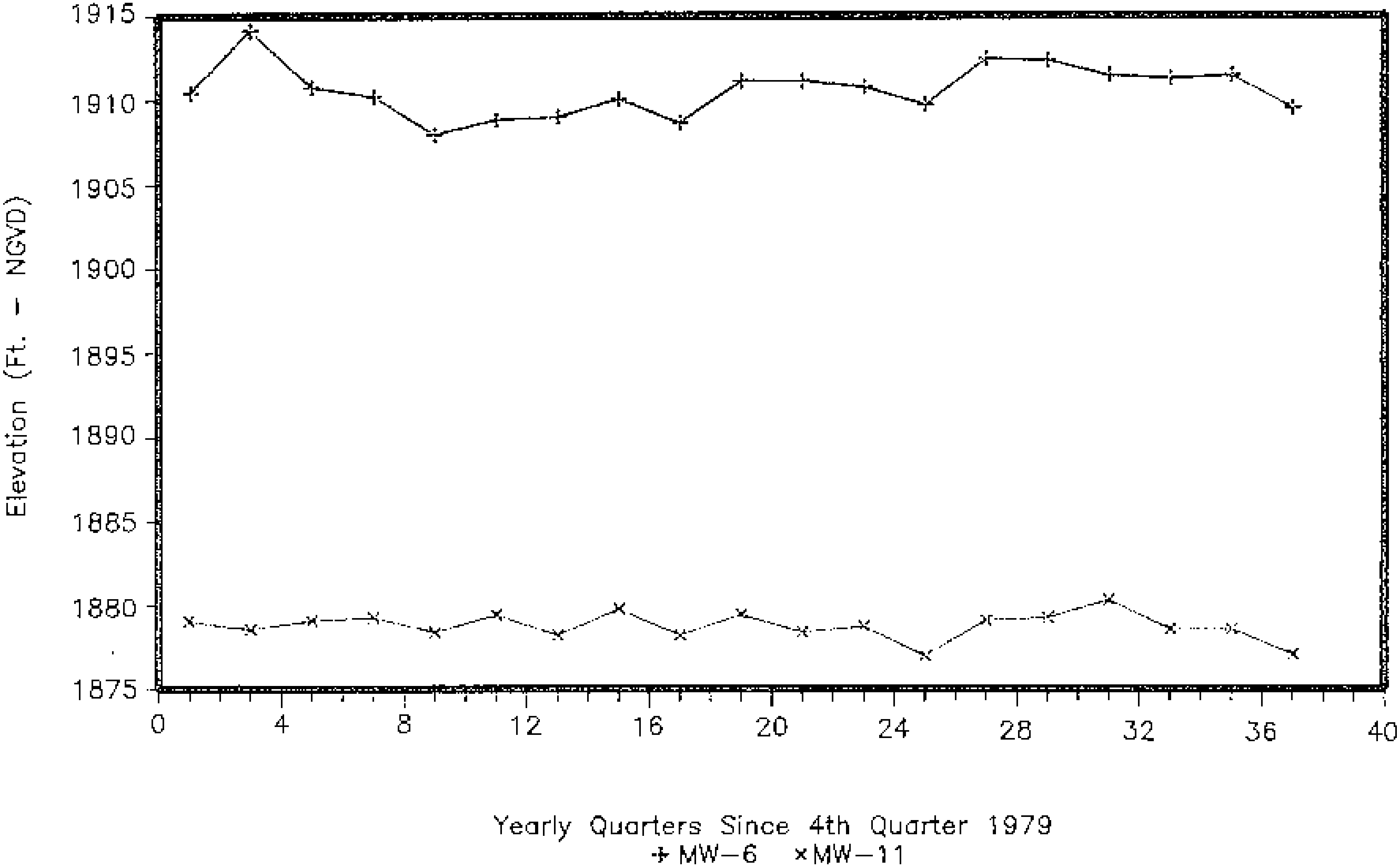
The groundwater flow pattern in the vicinity of CCS follows the wetland and legal drain system. The flow pattern passes through Weller Slough, Samuelson Slough, Saylor Slough, Gradin Slough and continues into the Coal Lake Coulee and/or the Buffalo Creek drainage systems.

As stated above, local influences can modify the regional groundwater flow pattern. A localized influence can be seen on Figure 15 near the EAP, probably associated with the northwest quadrant of the EAP.

The hydrograph shown in Figure 17 shows that the water level in the upland well (MW 6) has a higher elevation than the lowland well (MW 11), as expected. The hydrograph also shows a good correlation in the fluctuation data of the two wells. This indicates that the two wells, and the two aquifers, act as a connected hydrological system. Groundwater levels in the aquifers have generally remained the same during the nine years of plant operation, with the exception of normal seasonal variations, within a range of about four feet.

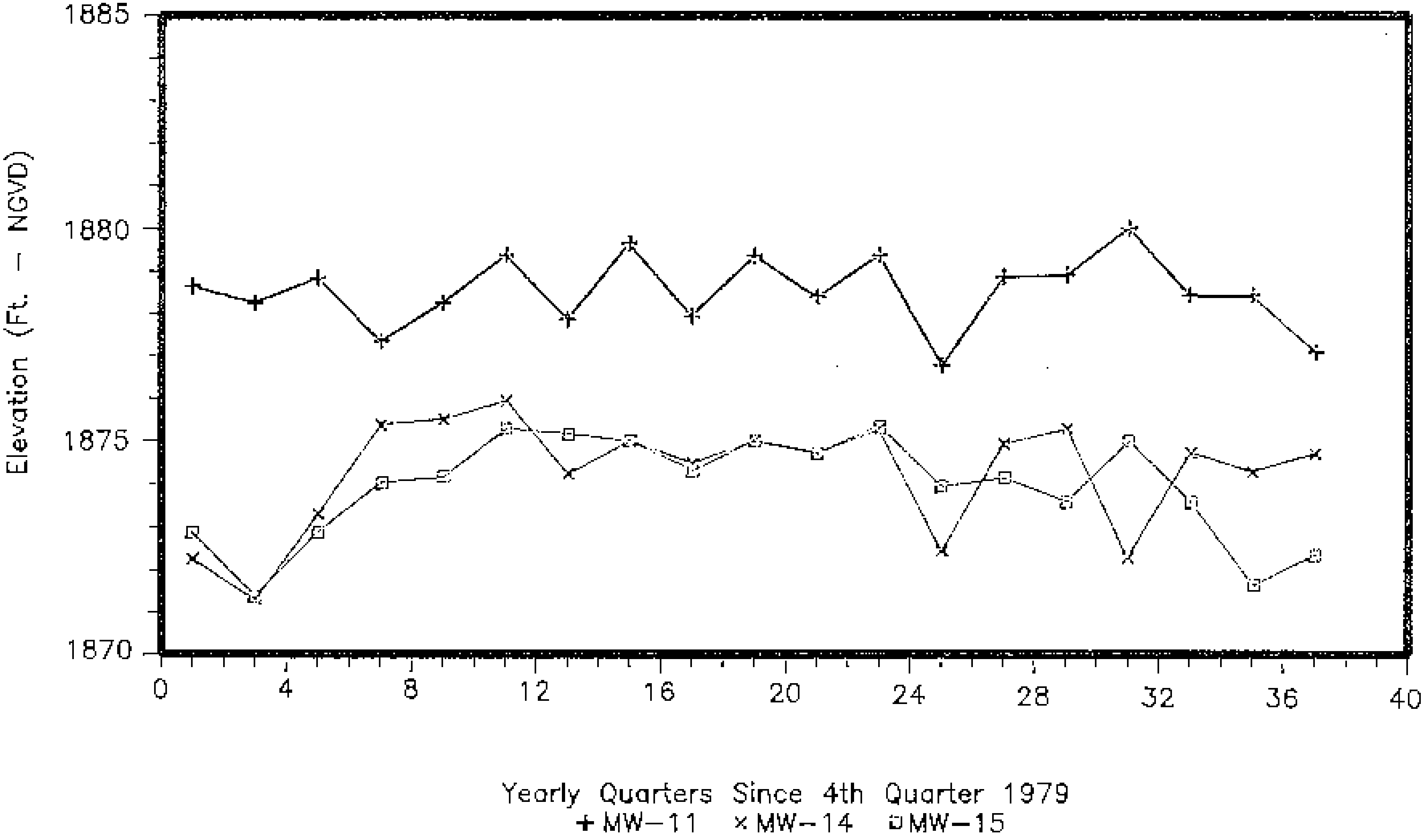
However, water level fluctuations in monitoring wells near constructed ponds are influenced by the ponds. Figure 18 is a hydrograph for MW 11, MW 14 and MW 15. MW 14 is located north of the EAP in an area that is impacted by water level fluctuations in the SAP and EAP. MW 15 is located east of the EAP where it has been locally influenced by loading in the EAP and generally influenced by site wide water level changes. See Figure 19 for monitoring well locations.

FIGURE 17
HYDROGRAPHS: MW-6, MW-11
Coal Creek Station



FOTH & VAN DYKE

FIGURE 18
HYDROGRAPHS: MW-11, MW-14, MW-15
Coal Creek Station



FOTH & VAN DYKE

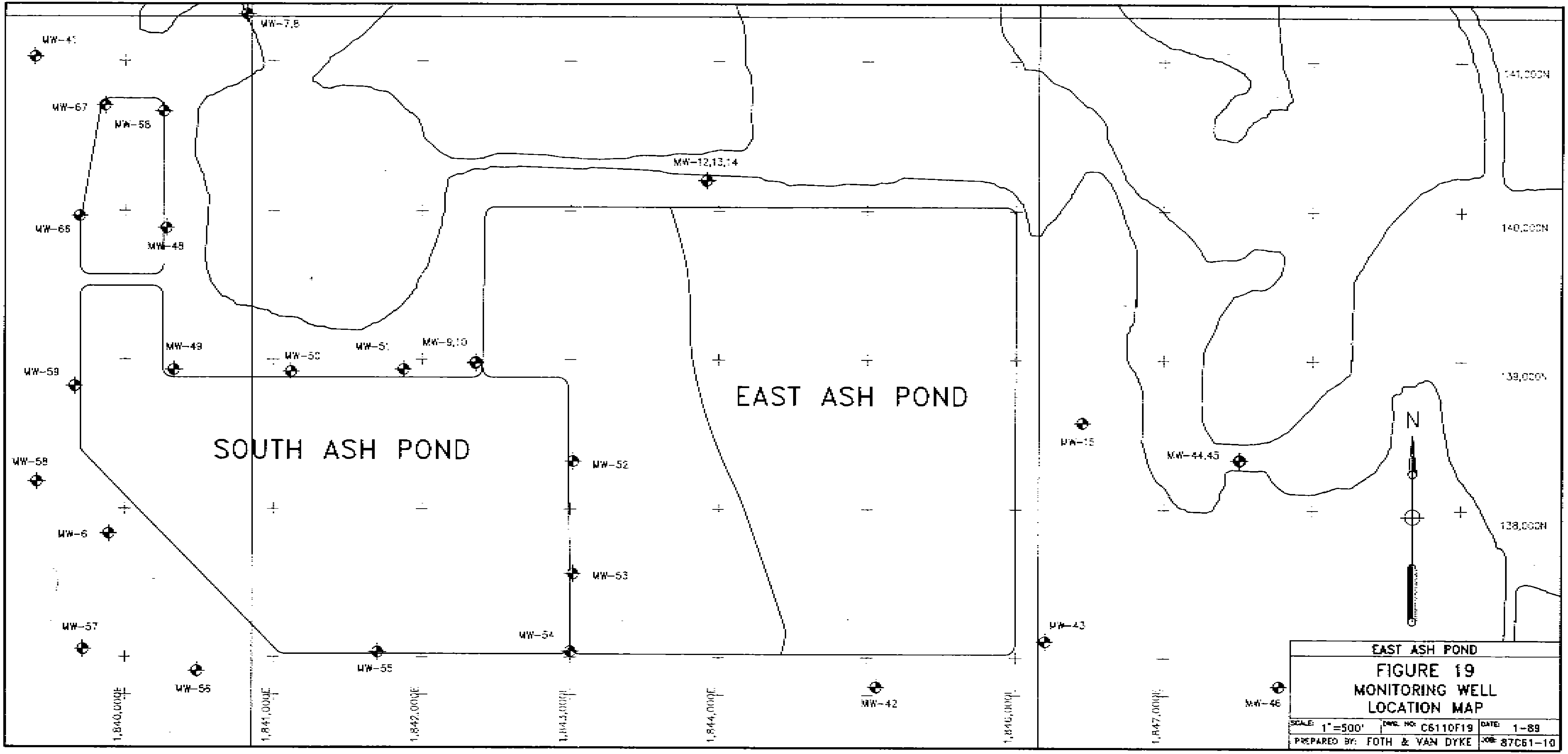


FIGURE 19
MONITORING WELL
LOCATION MAP

Fluctuations in the water level which do not correlate with the regional pattern can be explained by comparison with pond usage, as summarized in Table 7. The hydrograph for MW 11 is provided as a "normal" groundwater fluctuation pattern. Pond induced impacts to groundwater monitoring wells include a lag between the pond activity and a correlative response in the groundwater system at the well.

MW 14 shows a significant water level increase when SAP loading began. Water levels partially decreased when the SAP was taken out of service and the EAP operation began. MW 14 has continued to show elevated water levels with some fluctuations as cycled use of the ponds has taken place. MW 15 had shown a general increase of water levels since plant operation began and it has continued as a part of site wide water level impacts. Water level at MW 14 has decreased along with the regional ground water level in relation to recent drought conditions.

C. Groundwater Quality

A network of groundwater monitoring wells has been in existence at the CCS site since 1979, with sampling and analysis generally occurring twice a year. This monitoring program has documented significant sulfate contamination, and to a lesser extent, boron contamination, in the upper level aquifer in the vicinity of the EAP and SAP. Metals present in the ash and sludge appear to get tied up chemically and have not been found in significant quantities outside of the impoundments. (For more discussion of the chemistry of the sludge and ash, see Section I.) While there are not enough monitoring well locations to distinguish

TABLE 7

Pond Usage Summary
Coal Creek Station

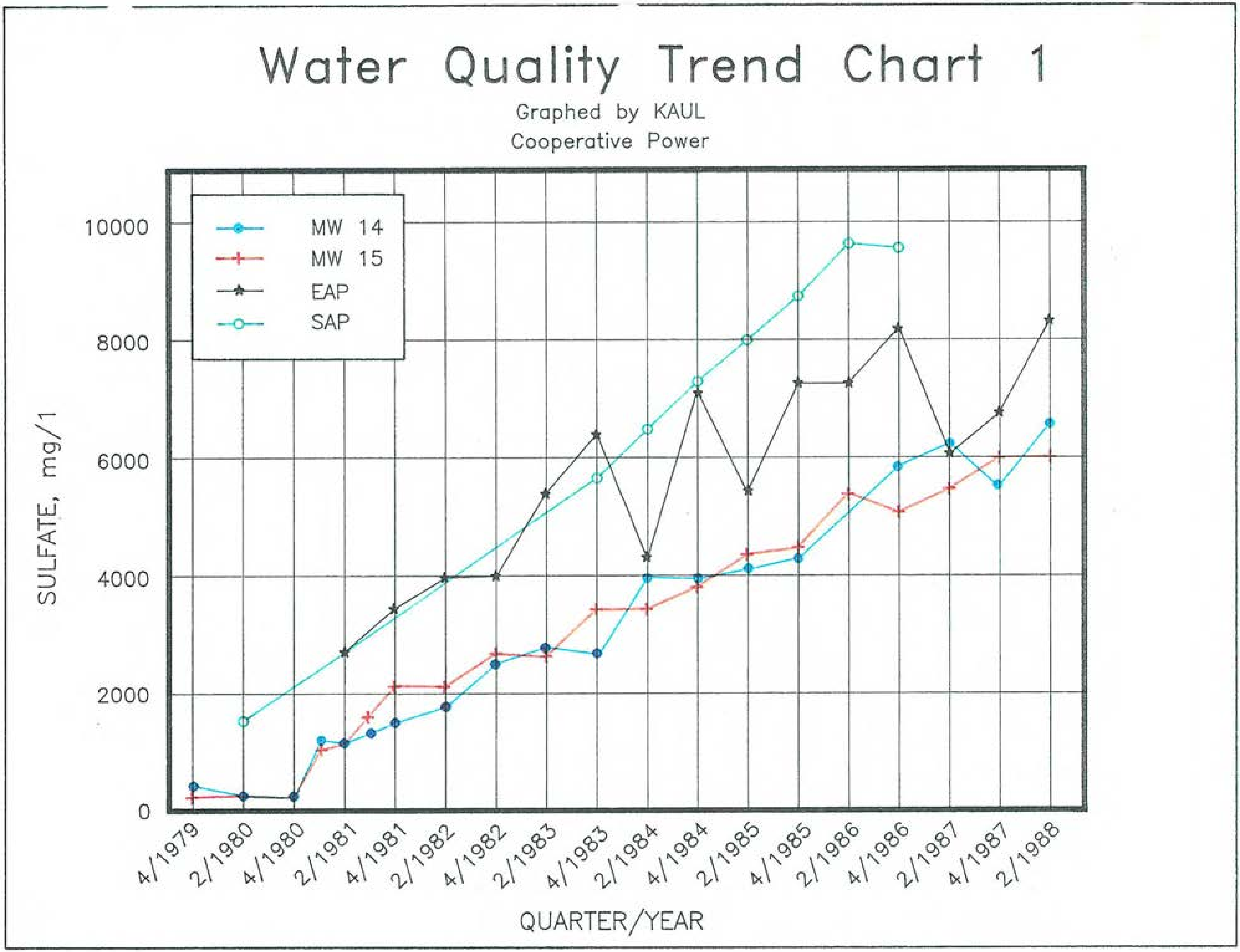
Date	Activity
Spring 1979	- CCS Unit 1 commenced operations. - South Ash Pond was placed in service.
Summer 1979	- Excessive seepage was observed from the South Ash Pond.
July 1980	- East Ash Pond was placed in service.
Summer 1981	- South Ash Pond was repaired.
Spring 1982	- South Ash Pond was returned to service.
Summer 1987	- South Ash Pond was taken out of service. - West portion of the East Ash Pond was placed in service.
Fall 1988	- West portion of the East Ash Pond was taken out of service. - West portion of the South Ash Pond was placed in service.

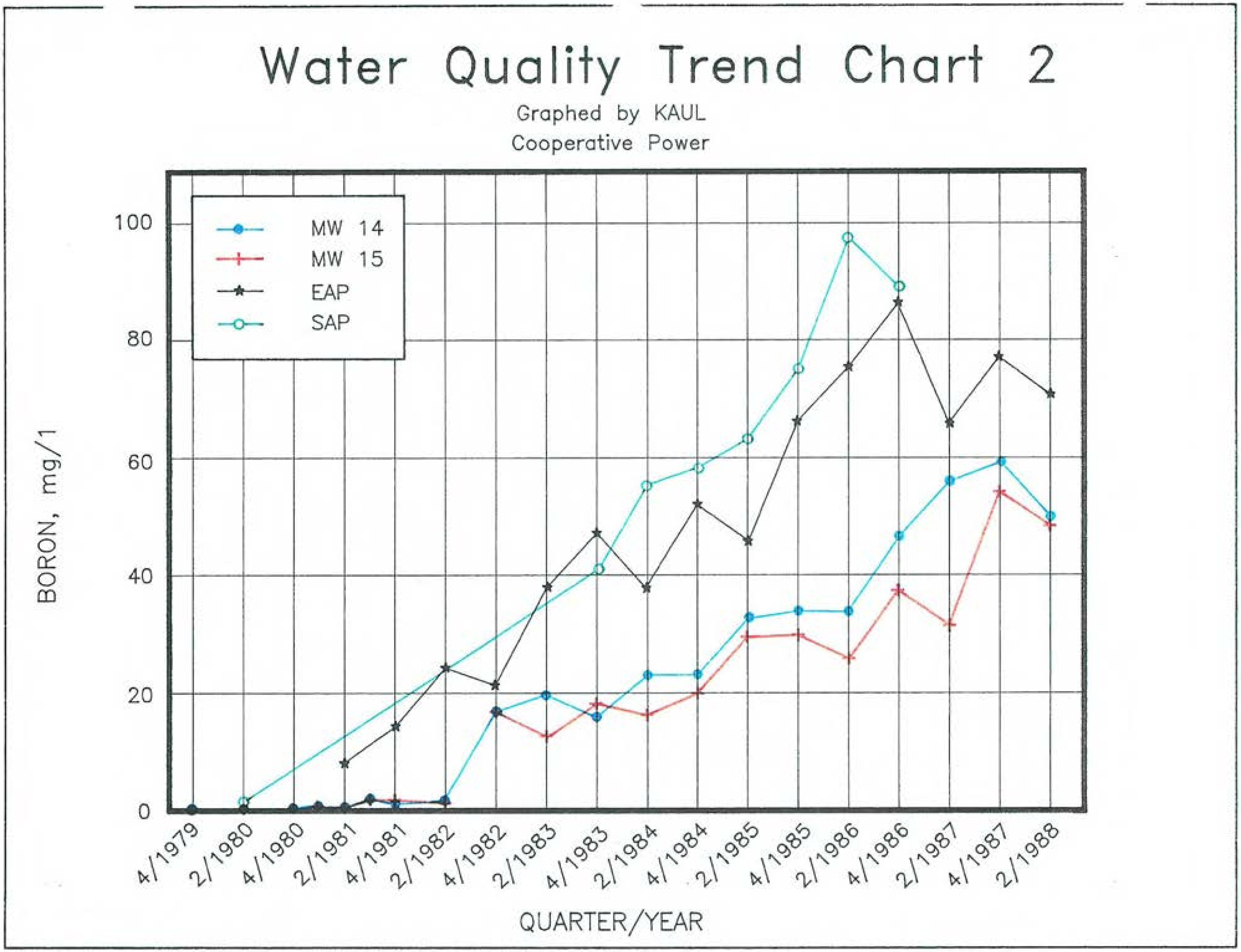
between the effects of the EAP and the SAP, other evidence, especially site geology, is indicative of the EAP's major role in this contamination. It is this contamination that has led to the design and operational modifications proposed in this application.

Data from the groundwater monitoring program is reported to the Department annually and therefore is not included in this application; however, several trend charts are provided as a summary of the data and to illustrate the conditions of the groundwater in the vicinity of the EAP.

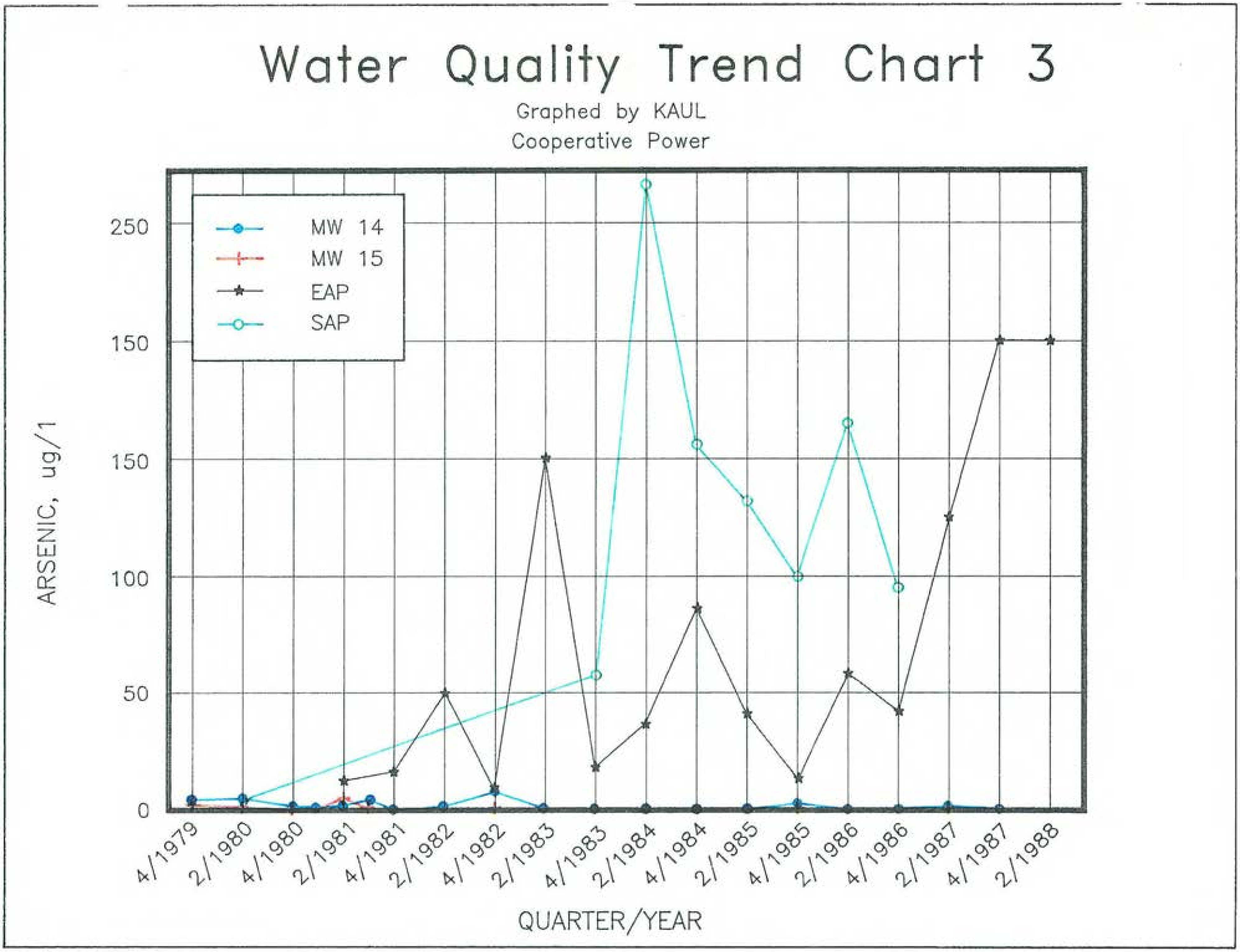
Generally, sulfate is the parameter that is most directly associated with excess pond seepage. Water quality trend chart 1 (Chart 1) shows an historical picture of sulfate concentrations in both the EAP and the SAP, as well as in the two shallow wells located near the EAP. There is a distinct correlation between the EAP and SAP, and the groundwater, with a steady upward trend in the sulfate concentrations, now at a level in the range of 6,000 to 7,000 mg/l, in the groundwater. This compares to 1979 sulfate levels in the groundwater of less than 500 mg/l.

Boron trends at the same locations are shown on Chart 2. Basically, it's the same trend as with sulfate; however, the concentrations are a couple of orders of magnitude less. Chart 3 shows arsenic concentrations, again for the same locations. The results here show that arsenic gets tied up chemically before reaching the shallow aquifer adjacent to the impoundments. Historical data is available for the complete parameter list at the Department. The parameter list is shown as Table 8.


Water Quality Trend Chart 1
Graphed by KAUL
Cooperative Power
MW 14
MW 15
EAP
SAP
SULFATE, mg/1
0
2000
4000
6000
8000
10000
4/1979
2/1980
4/1980
2/1981
4/1981
2/1982
4/1982
2/1983
4/1983
2/1984
4/1984
2/1985
4/1985
2/1986
4/1986
2/1987
4/1987
2/1988
QUARTER/YEAR



Water Quality Trend Chart 2
Graphed by KAUL
Cooperative Power
MW 14
MW 15
EAP
SAP
BORON, mg/1
QUARTER/YEAR
100
80
60
40
20
0
4/1979
2/1980
4/1980
2/1981
4/1981
2/1982
4/1982
2/1983
4/1983
2/1984
4/1984
2/1985
4/1985
2/1986
4/1986
2/1987
4/1987
2/1988



Water Quality Trend Chart 3
Graphed by KAUL
Cooperative Power
MW 14
MW 15
EAP
SAP
ARSENIC, ug/1
250
150
150
100
50
0
4/1979
2/1980
4/1980
2/1981
4/1981
2/1982
4/1982
2/1983
4/1983
2/1984
4/1984
2/1985
4/1985
2/1986
4/1986
2/1987
4/1987
2/1988
QUARTER/YEAR

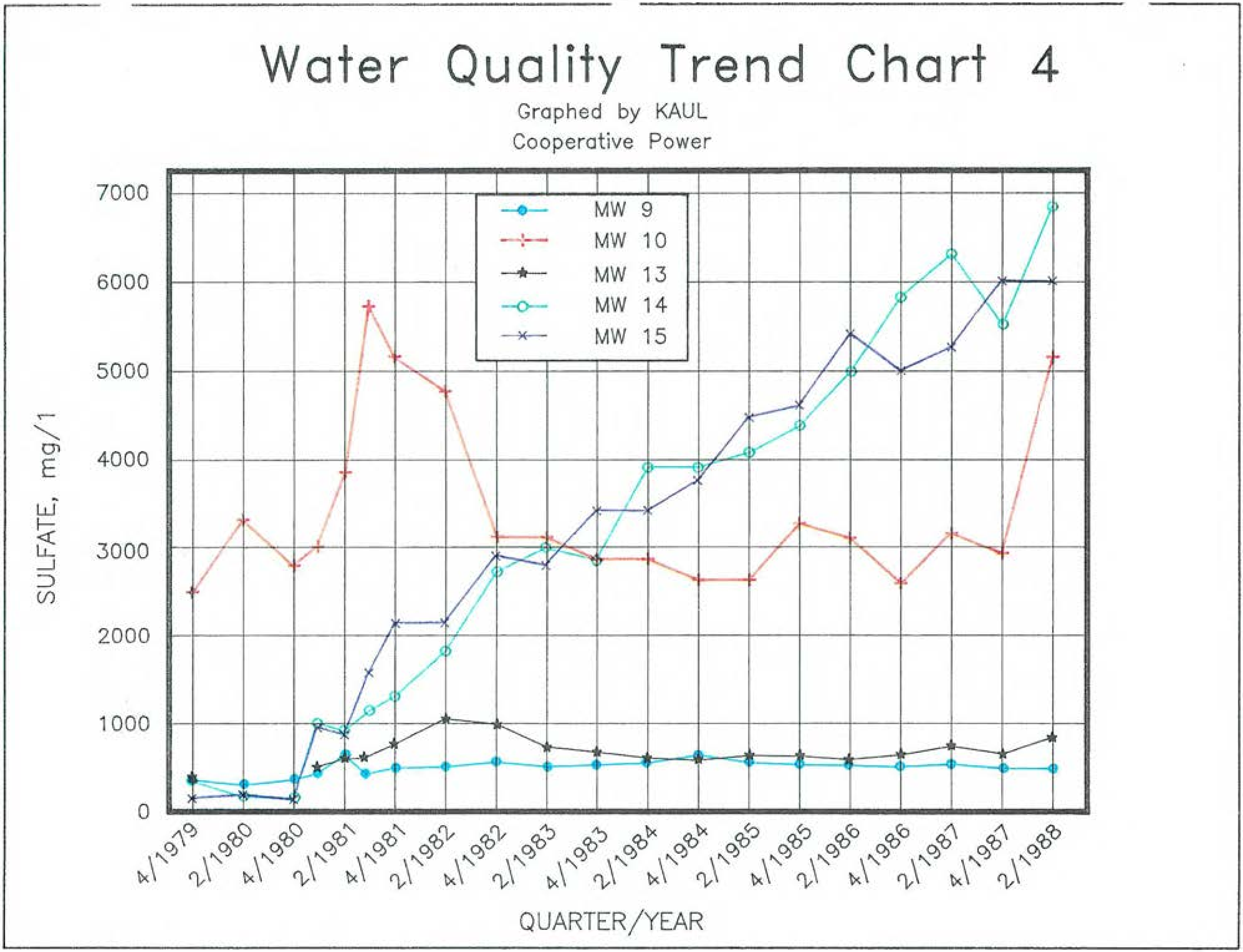

Water Quality Trend Chart 4
Graphed by KAUL
Cooperative Power
MW 9
MW 10
MW 13
MW 14
MW 15
SULFATE, mg/1
7000
6000
5000
4000
3000
2000
1000
0
4/1979
2/1980
4/1980
2/1981
4/1981
2/1982
4/1982
2/1983
4/1983
2/1984
4/1984
2/1985
4/1985
2/1986
4/1986
2/1987
4/1987
2/1988
QUARTER/YEAR

TABLE 8

CCS Water Quality Monitoring
Parameter List

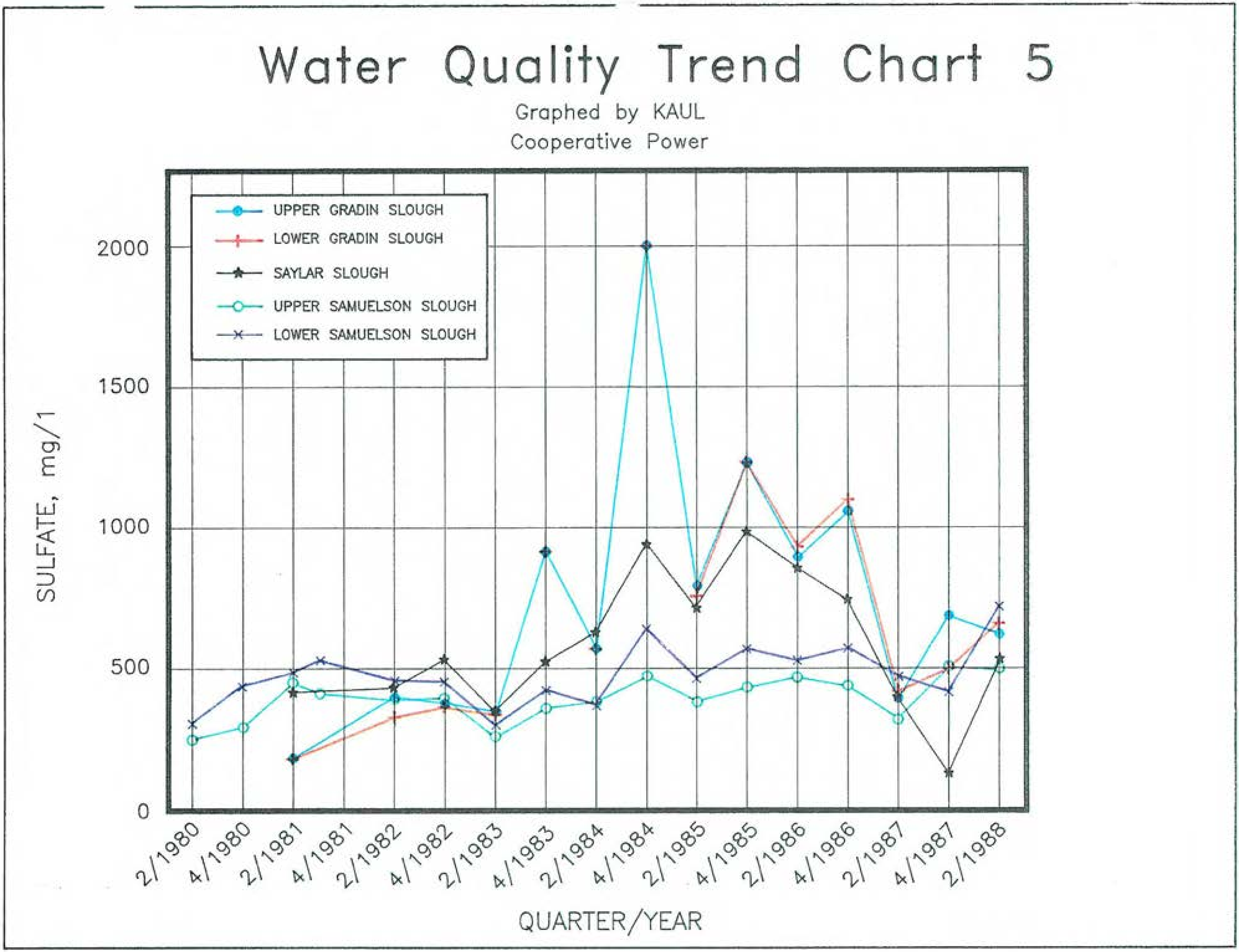
Parameter		Description
PH-FLD	*	pH-Field
PH-LAB	*	pH-Laboratory
SC	*	Specific conductance, umhos/cm @ 25c
TDS	*	Total Dissolved Solids, mg/l
TSS		Total Suspended Solids, mg/l
C-ALK		Alkalinity Carbonate, mg/l as $CaCO_3$
B-ALK		Alkalinity Bicarbonate, mg/l as $CaCo_3$
T-ALK	*	Alkalinity Total, mg/l as $CaCo_3$
NO_3-N		Nitrate-N, mg/l
NH_3-N		Ammonia-N, mg/l
CA	*	Calcium, mg/l
MG	*	Magnesium, mg/l
K	*	Potassium, mg/l
NA	*	Sodium, mg/l
SO_4	*	Sulfate, mg/l
MBAS		Methylene Blue Active Substances, mg/l
CL	*	Chloride, mg/l
FE	*	Iron, mg/l
ZN		Zinc, mg/l
MN	*	Manganese, mg/l
CU		Copper, ug/l
AG		Silver, ug/l
SR	*	Strontium, mg/l
B	*	Boron, mg/l
BE		Beryllium, ug/l
NI		Nickel, ug/l
SE		Selenium, ug/l
HG		Mercury, ug/l
AS	*	Arsenic, ug/l
BA		Barium, mg/l
CD		Cadmium, ug/l
CR		Chromium-VI, ug/l
F	*	Fluoride, mg/l
PB		Lead, ug/l
MD		Molybdenum, mg/l
AL		Aluminum, mg/l
F-COLI		Fecal Coliform Bacteria, # Col./100 ml
CN		Cyanide, mg/l
PHENOL		Phenol, ug/l
BOD		Biochemical Oxygen Demand, mg/l
COD		Chemical Oxygen Demand, mg/l
TOC		Total Organic Carbon, mg/l
TEMP		Temperature, Degrees C
DIS-02		Dissolved Oxygen, mg/l
LEVEL	*	Water Level depth below ground surface, ft.
T-COLI		Total Coliform Bacteria, # Col./100 ml

* Indicates parameters analyzed for at each sampling period, all locations.
All other parameters are done periodically or only at selected locations.

Using sulfate as an indicator, Chart 4 shows that the deep wells in the vicinity of the EAP, MW 9 (screened interval 43 to 53 feet below the surface) and MW 13 (screened interval 45 to 55 feet below the surface), have remained mostly unaffected by the wet impoundments, with a slight perturbation in the early 1980's when the EAP was in service. This is consistent with vertical gradients developed by Foth & Van Dyke which show the EAP area to be mainly a groundwater to surface water discharge area with some influence from the impoundments.

D. Surface Water Quality

Surface water in the vicinity of the EAP is connected hydrologically to the shallow aquifer and thus is affected by contamination of the shallow aquifer. Chart 5 shows historical data for the parameter sulfate, for five sampling locations at three local wetlands. The upward trend in the early 1980's likely shows influence from the EAP and SAP. The trend reverses, however, toward the end of the period, indicative of management practices aimed at minimizing the amount of seepage. These practices included relining the SAP and taking the EAP out of service; and when it was necessary to place the EAP back in service, partitioning it so that only about a half of the impoundment was actually used.



Water Quality Trend Chart 5
Graphed by KAUL
Cooperative Power
UPPER GRADIN SLOUGH
LOWER GRADIN SLOUGH
SAYLAR SLOUGH
UPPER SAMUELSON SLOUGH
LOWER SAMUELSON SLOUGH
SULFATE, mg/1
0
500
1000
1500
2000
2/1980
4/1980
2/1981
4/1981
2/1982
4/1982
2/1983
4/1983
2/1984
4/1984
2/1985
4/1985
2/1986
4/1986
2/1987
4/1987
2/1988
QUARTER/YEAR

V. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Overview

The major design consideration that went into this project was to achieve the minimization or elimination of leachate flowing into the groundwater table. This is to be accomplished in the following ways for all parts of the EAP except the southwest section. The wastes already in the southwestern section of the EAP will be dewatered and subjected to specifications 3-5 below.

1. Elevating the bottom of the disposal area to a minimum of five feet above the water table.

2. Placing five feet of clay on the bottom with a permeability of less than 1×10^{-7} cm/sec.

3. Controlling runoff.

4. Sloping and capping the facility to eliminate infiltration, and thus, any medium for groundwater contamination.

5. Maintaining the closed facility to prevent erosion of the cap.

Not only will the above design considerations minimize leachate that reaches the groundwater table, they will also allow for significant long-term improvement in local groundwater quality.

B. Existing Conditions

A set of construction plans are included with this application. Drawing A-2 shows the existing contours of the EAP area. A partitioning dike separates the EAP roughly into two halves. The west portion of the EAP has recently been taken out of service and is partially full of ash and sludge. Water in the western part has been pumped to other impoundments in order to reduce the hydraulic head and attendant seepage through the bottom of that part of the EAP.

Approximately one-half of the way up the partitioning dike is another, shallower dike which runs across the "neck" of the western portion of the EAP. It is indicated as a "berm" on Drawing A-2. The purpose of this dike was to contain the solids in the southern part of that half of the impoundment and to allow excess water to flow to a pumping station located at the northern end of the impoundment. Thus, most of the solids in the western portion of the EAP are in the southern reaches.

The eastern portion of the EAP has been out of service since 1982. Water that has accumulated in this part of the EAP is periodically pumped to other impoundments.

C. Construction Plans

The proposed design for the EAP calls for the staged development of six waste disposal cells in the EAP. See Drawing A-3 for the sequence of cells proposed for filling the disposal area.

As stated above, the Sequence No. 1 area (southwest corner) is already partially filled. Because the geology in the Sequence No. 1 area is favorable, and because the cost of moving and disposing of this substantial volume of material is very high, estimated to be about $10 million, it is proposed that those materials remain in the EAP. In other words, it is neither practical nor necessary to remove those wastes. However, the wastes in place will be thoroughly dewatered and capped to control runoff and infiltration.

Foth and Van Dyke has estimated the pond bottom to be two feet or less above current groundwater table in the southwest section of the EAP. It is predicted, however, that the water table will drop now that the EAP is out of service and dewatered. This should provide some thickness of unsaturated soil between the water table and the disposed wastes. With a properly sloped final cap of impervious materials, there should be no infiltration or medium for further contamination of groundwater.

Construction to prepare the EAP to receive wastes would begin in the northwest section, where any ash materials will be removed to the Filling Sequence No. 1. area and 12 inches of suitable materials be placed over the wastes and compacted to allow drainage in a northeasterly direction as shown in Drawing A-4.

Additional site construction is required to prepare the EAP to accept wastes. The EAP bottom, exclusive of the southwest corner, will be shaped prior to placement of a clay liner to allow drainage in both a northeasterly and southeasterly direction as shown on Drawing A-4.

Placement of the clay liner will be to the approximate elevations shown on Drawing A-5. Details of the construction of the clay liner and side slopes are shown on Drawing A-3.

The clay material to be placed should be tested to ensure it meets the desired gradation, plasticity and permeability as shown in Table 9. This clay should be compacted to achieve a degree of compaction of 95 percent of Standard Proctor. The maximum thickness of a compacted lift should not exceed eight inches.

The following clay source testing program is planned to determine source suitability for clay soils meeting the specifications of Table 9.

- o Grain size distribution to the .002 millimeter particle size and Atterberg limit testing on samples collected at a rate of one sample for each 10,000 cubic yards of proposed in-place clay.

- o Moisture density curves using the 95 percent of Standard Proctor method on samples collected at a rate of one sample for each 20,000 cubic yards of proposed in-place clay.

- o One test evaluating the relationship between compaction and hydraulic conductivity shall be developed for each borrow source. This shall be accomplished by testing the sample corresponding to each point established on the Proctor curve for hydraulic conductivity.

Sidewall clay placement should also follow the specifications listed in Table 9.

The clay liner sidewall shall be constructed to a minimum thickness of two feet measured perpendicular to the liner.

Clay liner sidewalls shall be constructed by placing clay in compacted lifts of one foot maximum thickness. The completed liner soils shall have a maximum coefficient of permeability of 1×10^{-7} cm/sec.

Sufficient testing shall be completed on representative clay samples prior to construction to verify the performance of the clay liner based on proposed construction specifications and techniques.

During construction, a quality control program shall be implemented to ensure that the clay liner will function as designed. Table 10 outlines a recommended quality control program for clay liner placement along the side slopes. This program shall be used as a minimum guide in selecting a project quality control program. At a minimum, the final quality control program selected shall be based on the quality of the clay, clay test performance, construction equipment, and construction techniques.

Quality control testing during placement of clay soils on the base of the disposal area should follow the program presented in Table 10, with two exceptions: 1) density tests should be performed on a 200-foot grid pattern on each eight-inch layer of compacted clay soil, and 2) undisturbed laboratory permeability tests should be performed at a frequency of one-per-two-acres per eight-inch compacted lift.

TABLE 9

Clay Soil Specification

Liquid limit	>/= 30
Plasticity index	>/= 15
P200 content	>/= 50%
Clay size fraction	>/= 25%
Compaction	>/= 95% Standard Proctor density
Permeability	</= 1 x 10^{-7} cm/sec

Clay soil shall be free from organic material, boulders, cobbles, excessive amounts of gravel (greater than 3/4") and other deleterious substances.

The total volume of clay necessary for the base lining and the sidewalls of the disposal area is estimated at 1,615,000 cubic yards.

Estimated quantities of clay necessary for the base lining and sidewalls of the individual programmed disposal sequences are:

Sequence No. 2	565,000 cubic yards
Sequence No. 4	702,000 cubic yards
Sequence No. 6	348,000 cubic yards

The above volumes of clay include a 30 percent shrinkage factor.

TABLE 10

Recommended Clay Sidewall Placement Quality Control Program

Test	Frequency
Density	1 per 100 lineal feet of clay sidewall per 12-inch compacted lift
Standard Proctor	1 per each distinct clay type (1 per 20,000 cubic yards minimum)
Atterberg Limits	1 per 10,000 cubic yards
Grain Size	1 per 10,000 cubic yards
Undisturbed Permeability	1 per 500 lineal feet per 10 feet of clay sidewall placement measured vertically

Additional testing shall be completed as needed to assure quality construction.

VI. GROUNDWATER MONITORING

A groundwater monitoring program has been in place at this site since 1979. Several new groundwater wells were added to the monitoring network in 1986 to get more data from the area east, and downstream, of the EAP. As a part of an examination of the hydrology in the vicinity of the SAP, more monitoring wells, still, were added in 1988, this time surrounding the SAP. Figure 19 shows the locations of the wells in the vicinity of the impoundments. Parameters and frequency of sampling have already been established by the Department. The groundwater monitoring program should document steadily improving quality of the local groundwater.

VII. OPERATION AND MANAGEMENT METHODS

A. Site Sequencing

A proposed phasing sequence of the disposal area is illustrated on Drawing Nos. A-6 through A-11. Six filling sequences will be used to provide for a systematic filling sequence; No. 1 from the southwest side of the southwest section of the EAP to the northeast, and No. 2 from the southwest side of the EAP to the north. The third sequence will be over portions of the first two phases as illustrated on Drawing No. A-8. The remaining disposal sequences will be as diagramed on Drawing No. A-3.

The filling sequences are designed to bring portions of the disposal area to final grade as soon as possible. The sequencing also routes surface water drainage away from the working area as described in the next section. The drainage of Sequence Nos. 1 and 2 areas is routed to the northeast corner of the respective disposal cells to allow for removal by pumping as required.

Any contact water will be collected and periodically pumped to the east evaporation pond or south ash pond.

Approximately 22,821,000 cubic yards of air space is available in the EAP disposal area. Filling Sequences Nos. 1, 2 and 3 contain 1,543,000 cubic yards, 3,651,400 cubic yards and 1,114,000 cubic yards of capacity, respectively.

Subsequent sequences available air space are estimated at:

Sequence No. 4	4,383,000 cubic yards
Sequence No. 5	4,151,000 cubic yards
Sequence No. 6	7,979,000 cubic yards

B. Site Filling

Site filling will progress in phases as shown on the drawings and as described in the previous section. The filling of each phase shall consist of a series of lifts. Each lift will be approximately ten feet thick to provide increased compaction. Each lift in the Sequence No. 1 operation shall be sloped to the northeast to route surface water drainage away from the active fill area. Subsequent sequences will route surface water drainage away from active fill areas as shown on Drawing No. A-5.

Access to the fill area for disposal will be provided by access roads entering the disposal area from both the north and the south. The road shall be routed over the compacted fill to the active fill area. The road shall be extended vertically as ash disposal progresses in order to provide ingress and egress for the duration of site filling. Access road grades shall not exceed 10 percent. The access road shall be maintained to provide access to the active fill area during all weather conditions. Access road construction shall consist of materials to provide easy maneuverability of vehicles. The road materials will reduce windblown dust during dry weather conditions and excessive rutting during wet weather conditions.

VIII. RECORD OF SOLID WASTE DISPOSAL ACTIVITY WITH THE COUNTY REGISTER OF DEEDS

A notarized affidavit specifying that this solid waste disposal site is permitted to accept solid wastes for disposal will be filed with the County Registrar of Deeds once the Department issues the permit. Said affidavit shall specify that another affidavit will be filed with the County Registrar of Deeds once the disposal operation is completed and the site is closed. The second affidavit will specify the types of wastes disposed at the facility and other pertinent details. The Department shall be provided with copies of these affidavits.

IX. SITE CLOSURE

A. Short Term Care

Final site grades are shown on Drawing A-11. A 12 percent maximum final slope is proposed, based on previous slope stability experience with ash disposal and discussions with the Department.

As each phase reaches capacity, the final cover shall be constructed on those slopes which reach cover elevations. The function of the final cover is to limit infiltration, route surface water off the disposal area and provide sufficient soil cover for vegetative growth. The final cover will consist of two feet of compacted clay, six feet of spoils material compacted to 90 percent Standard Proctor, 1.5 feet of subsoil, and six inches of topsoil. A detail of the final cover construction is included on Drawing A-3.

An interim cover of six-inch minimum thickness will be placed on those fill slopes that will be regraded during subsequent filling sequences.

Construction of the two-foot-thick clay layer of final cover shall be completed in accordance with specifications outlined in Table 11. Clay for the final cover shall be placed in compacted lifts of eight-inch maximum thickness.

The spoils material, subsoil and topsoil provide frost protection for the clay layer. The soils also provide a medium for vegetative growth.

TABLE 11

Recommended Clay Cover Placement Quality Control Program

Test	Frequency
Density	200-foot grid pattern per 8-inch compacted lift
Standard Proctor	A minimum of 1-per-10,000 cubic yards and 1 each for each major soil type utilized
Atterberg limits	400-foot grid pattern per 8-inch lift
Grain Size	400-foot grid pattern per lift
Undisturbed Permeability	1-per-5-acres per 8-inch lift

All final cover areas and adjacent areas disturbed by construction shall be topsoiled, seeded, fertilized and mulched. Topsoil shall be analyzed to obtain appropriate fertilizer recommendations. Fertilizer, seed, and mulch shall be applied as recommended to provide vegetative cover compatible with regional vegetation.

Table 12 presents final cover construction quantities. At the completion of closure activities, permanent fencing shall be placed around the disposal perimeter. The purpose of the fencing is to limit site access to maintenance and inspection vehicles only. The fencing shall be adequate to prohibit livestock and any unauthorized vehicles from entering the disposal area. A locking gate or gates shall be installed to provide access for maintenance and inspection vehicles.

B. Long Term Care

Following site closure, the disposal area will be inspected at least twice a year for five years.

During each inspection the following items shall be observed.

1. Soil cover. Topsoil, subsoil, and clay cover soils shall be inspected for erosion, differential settlement, vegetation stability and any indication of vegetative stress.

2. Drainage control facilities. Drainage swales shall be inspected for erosion or blockage.

TABLE 12

Estimated Soil Quantities for Final Cover Construction

Total Site

Construction Item	Quantity
2 ft. clay layer*	886,600 cubic yards
6 ft. spoils layer	2,127,000 cubic yards
1.5 ft. subsoil layer	532,000 cubic yards
6 in. topsoil layer	178,000 cubic yards

Estimated Soil Quantities by Sequence Areas

Construction Item	Sequence No.					
	1	2	3	4	5	6
2 ft. clay layer (cubic yards)*	104,000	89,700	58,500	166,400	304,200	163,800
6 ft. spoils layer (cubic yards)	248,000	226,000	135,000	416,000	704,000	398,000
1.5 ft. subsoil layer (cubic yards)	62,000	56,500	34,000	104,000	176,000	99,500
6 inches topsoil layer (cubic yards)	21,000	19,000	11,000	35,000	59,000	33,000

*Clay volume includes a 30 percent shrinkage factor

3. Land surface care. Surface maintenance after closure includes maintaining proper cover soil and vegetation on the site, and the inspection and repair of surface water control structures and monitoring devices.

4. Runoff control. Surface water drainage swales which control surface water runoff should be inspected for erosion and blockage and maintained as needed.

5. Erosion care. Rapidly growing grasses are to be planted on the closed landfill to minimize erosion. Erosion damage to vegetated cover soils could occur due to differential settlement or severe weather conditions. Eroded soils and/or damaged vegetative cover will be replaced if necessary.

6. Settlement. Differential settlement may occur in closed areas, requiring some maintenance. Areas shall be inspected semi-annually for locations that have settled, causing surface water to pond or erosion to occur. These locations are to be regraded and reseeded as soon as possible.

WRK/dkc

2/6/89

ASH POND 92 AND SECTION 16 UPSTREAM RAISE

OPERATIONS PLAN

Submitted to:

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

Submitted by:

Golder Associates Inc.
44 Union Boulevard, Suite 300
Lakewood, Colorado 80228

Distribution:

3 Copies – Great River Energy
4 Copies – North Dakota Department of Health
2 Copies – Golder Associates Inc.

Revision 02
July 8, 2004 043-2226

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ABBREVIATIONS AND ACRONYMS

Al_2O_3	Alumina
amsl	Above mean sea level
CaO	Lime
CCS	Coal Creek Station
CCP	Coal combustion product
cm/sec	Centimeters per second
CPA	Cooperative Power Association
CQA	Construction quality assurance
El.	Elevation
FGD	Flue gas desulfurization
GPS	Global positioning system
GRE	Great River Energy
GWMP	Groundwater Monitoring Plan
HazMat	Hazardous materials
HDPE	High-density polyethylene
HEC-HMS	Hydrologic Engineering Center – Hydrologic Modeling System (USACE)
HSC	Health and safety coordinator
LHRS	Liner head reduction system
LLDPE	Linear low-density polyethylene
LPS	Low permeability soil
MW	Megawatts
NDCC	North Dakota Century Code
NDAC	North Dakota Administrative Code
NDDH	North Dakota Department of Health
NRCS	Natural Resources Conservation Service
PCB	Polychlorinated biphenyls
PPE	Personal protective equipment
QC/QA	Quality control/quality assurance
RCFA	Roller-compacted fly ash
RUSLE	Revised Universal Soil Loss Equation
SiO_2	Silica
SPGM	Suitable plant growth material
SWMP	Storm Water Management Plan
tons/yr	Tons per year
UPA	United Power Association
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
WQMP	Water Quality Monitoring Plan

1.0 INTRODUCTION

This operations plan is intended to assist Great River Energy (GRE) with management of the Ash Pond 92/southwest Section 16 upstream raise and the southeast Section 16 special waste landfill in accordance with the engineering design and the current North Dakota Department of Health (NDDH) solid waste management regulations. The NDDH regulations include the *North Dakota Administrative Code* (NDAC) and the *North Dakota Century Code* (NDCC) (as of May 2004).

In conjunction with this plan, GRE personnel should have the following documents available for review: GRE's Coal Creek Station (CCS) Safety Procedure, the storm water management plan, the water quality monitoring plan, the hydrogeologic characterization report, and the engineering design with its associated engineering drawings.

This plan of operations has been prepared to inform GRE's operators about the design, operations, and maintenance of the Ash Pond 92/southwest Section 16 upstream raise and the southeast Section 16 special waste landfill. Ash Pond 92 and the southern half of Section 16 currently serve as coal combustion product (CCP) placement facilities for CCS. CCS is a coal-fired electric production facility located in McLean County, approximately six miles south of Underwood, North Dakota (Section 16, Township 145 North, Range 82 West). The facility is owned and operated by GRE, which formed in 1999 through the consolidation of Cooperative Power Association (CPA) and United Power Association (UPA). Any inquiries concerning CCS should be directed to:

Great River Energy
Coal Creek Station
2875 Third Street SW
Underwood, North Dakota 58576
(701) 442-3211

Great River Energy
17845 East Highway 10
Elk River, Minnesota 55330
(763) 441-3121

The Ash Pond 92/southwest Section 16 upstream raise, the southeast Section 16 special waste landfill, and Ash Pond 91 discussed in this plan are operated under North Dakota Solid Waste Management Facility Permit No. SP-033.

1.1 CCP Special Waste

The coal or lignite combustion process used in the production of electricity results in the production of CCPs. Though efforts are made to beneficially use the CCPs, a significant portion remains to be landfilled at CCS. Ash Pond 92 and Section 16, located east of the generation facility, as shown in Figures 1-1 and 1-2, serve as placement sites for construction and demolition debris and CCPs produced at CCS. No off-site waste is accepted. Considered nonhazardous special waste, the CCPs produced at CCS are fly ash, bottom ash, flue gas desulfurization (FGD) sludge (scrubber sludge), pulverizer rejects, and economizer ash.

Typically, CCPs arrive at Ash Pond 92 and Section 16 via two methods: trucking and sluicing. CCPs are hauled to the southeast portion of Section 16 using mine haul trucks such as the Caterpillar 773 and 777. The haul trucks are owned by GRE and haul CCPs to these areas using roads within GRE's property. CCPs are also sluiced to the Ash Pond 92 surface impoundment through pipelines on CCS's property. During construction and operation of the upstream raise, GRE intends to combine Ash Pond 92 and the southwest portion of Section 16 into a single surface impoundment (the upstream raise) with continued sluicing of CCPs through pipelines to the containment facilities.

1.2 The Permitted Facilities

Over the life of the facility, southeast Section 16 will likely continue to be operated as a special waste landfill and Ash Pond 92 as a surface impoundment. At some point during operations (currently estimated at three years from the present or about year 2007), Ash Pond 92 and southwest Section 16 are scheduled to combine as a single surface impoundment. At closure, the impoundment will likely be drained, and the three facilities, Ash Pond 92 and the southwestern and southeastern portions of Section 16, ultimately closed as a single special waste landfill.

The anticipated remaining lifespan of the combined footprints of Ash Pond 92 and the southern half of Section 16 is approximately 30 years (year 2033), based on current usage calculations predicting a total capacity of 17,100,000 cubic yards. The designed maximum placement height (top of CCPs) for the closed facility is approximately 105 feet (El. 2,005 feet) with closure grades of less than or equal to 25%. The combined placement area is approximately 185 acres: 126 acres from the southern half of Section 16 and 59 acres supplied by Ash Pond 92. Of Section 16's 126 acres, 74 are in southeast Section 16, and 52 are in southwest Section 16.

2.0 SITE DEVELOPMENT

2.1 Site Characterization

The locations for the Ash Pond 92 surface impoundment and the Section 16 special waste landfill were originally characterized by Burns & McDonnell in 1973, prior to submittal of the initial SP-033 permit. A hydrogeologic study was performed for CCS by Barr Engineering in 1982. Site geology, soils, and hydrology, including drainage and surface water flow, were examined during these prior studies to determine suitability of the sites for placement of CCPs. Three subsurface field investigations were performed by Golder Associates from 2001 to 2003 in support of the upstream raise design. The site characterization information is included in the pending permit modification (originally submitted September 30, 2003) and previous SP-033 permit applications.

2.2 Site Development and Access

2.2.1 Site Development

Ash Pond 92 and Section 16 were zoned "industrial" when these facilities were permitted, and no local permits were required. The Ash Pond 92/southwest Section 16 surface impoundment and the southeast Section 16 special waste landfill are consistent with the current McLean County Zoning Ordinance. The McLean County Zoning and Planning Commission can be contacted at P.O. Box 1108, Washburn, ND 58577, Attn: Lauren Hunze.

GRE's construction sequence and placement plan for Ash Pond 92 and Section 16 is divided into five phases. Phases do not necessarily occur in sequential order from one to five and may occur concurrently. Note that no CCPs will be placed outside of the lined areas of the developed solid waste management units.

- Phase 1 is CCP placement at Ash Pond 92 as a vertical (upstream) raise. Raise construction is designed to occur to approximately El. 1,950 (30 feet above berm grades).
- Phase 2 involves the regrading of in-place CCPs and soil at the southwest portion of Section 16. After regrading of soils, a soil embankment will likely be constructed on the north, south, and east sides of the southwest portion of Section 16 and tie into the Ash Pond 92 raise grades. The floor of the regraded CCPs/soil at the southwest portion of Section 16 will likely be capped/lined with a composite liner system.

- Phase 3 is CCP placement at both Ash Pond 92 and the southwest portion of Section 16 as a vertical (upstream) raise to final placement grades.
- Phase 4 is CCP placement at the southeast portion of Section 16 using current placement practices until final grades are met.
- Phase 5 is CCP placement in the valley between the southeast and southwest portions of Section 16.

Construction sequencing is shown on Drawings 4 through 8. This construction sequencing results in:

- Closure cover grades up to 25 percent,
- An estimated final placement volume for Ash Pond 92 and Section 16 of approximately 17,100,000 cubic yards,
- An ultimate placement boundary of approximately 185 acres,
- A placement height (top of CCPs) of approximately 105 feet (El. 2,005 feet), and
- Combined CCP placement for Ash Pond 92 and the southwest portion of Section 16 surface impoundment to form an "upstream raise" (increasing the height of a structure by constructing embankments within the existing lined embankments).

The permit boundary optimizes the lined footprint of the facilities. The facility lifespan is based on the site receiving an average of 145,000 tons/year of fly ash, 225,000 tons/year of bottom ash, 120,000 tons/year of FGD sludge, and 35,000 tons/year of pulverizer rejects and economizer ash, or a total of 525,000 tons/year of CCPs (based on 2002 estimates).

The phased placement of CCPs is designed to allow for the sequential construction, filling, and concurrent reclamation of the CCP placement facilities. Site development activities associated with each facility are presented in the engineering design. The order of construction activities will remain essentially the same regardless of area size. The following activities will occur as part of the construction activities for each facility/phase:

- Utility locate and clearance, as appropriate,
- Maintain survey control monuments,
- Maintain groundwater monitoring wells,
- Maintain any existing fencing around the CCS placement areas,

- Construct any perimeter channels required for that facility/phase,
- Remove and stockpile topsoil, and
- Construct necessary haul road(s) to the placement area.

Grading within the CCP facilities should be checked and maintained using a global positioning system (GPS). A second point of contact for the GPS system is located within the CCS facility, allowing accuracy to within six inches. Additional surveying may be performed periodically. CCP placement quantities are estimated based on the coal/lignite usage at CCS and the anticipated ash volume resulting from combustion. Accounting for the CCP quantities trucked to other on-site placement facilities or transferred off site for beneficial use, the remaining volume will be sluiced or trucked to the Ash Pond 92/southwest Section 16 surface impoundment or the southeast Section 16 special waste landfill.

2.2.2 Facility Access

The Ash Pond 92/southwest Section 16 surface impoundment and the southeast Section 16 special waste landfill are located approximately ½ mile to 2 miles directly east of the generation facility at CCS (see Figure 1-1). These placement facilities are surrounded by property held by GRE to the north, west, and south. Land located east of the southeast Section 16 special waste landfill is held by a private landowner. Ash Pond 92 and Section 16 are accessed via an on-site road along the northern edge of the CCP placement sites. No public roads are crossed. A guard station and locking gate are located at the main entrance to the CCS generation facility. An additional minor access road to southeast Section 16 is located just north of 3rd Street SW along the road marking the break between Sections 15 and 16. Signs mark the entrance to CCS and the external access road, noting it as private property with unauthorized access prohibited.

Additional internal site haul roads will be developed as required to facilitate traffic flow to the active placement areas and to provide access for maintenance of the entire site. Portions of the entrance area will have an improved surface to facilitate all-weather access to these facilities. Entrance and internal haul roads will be maintained frequently to provide a stable, smooth, and free-draining surface. Road gravel or other suitable materials and equipment, such as a motor grader, will be available on site to repair roads as needed. Included as Figure 2-1 is a map showing haul routes used for transporting CCPs to the southeast Section 16 special waste landfill.

2.2.3 Signage

In accordance with *NDAC* Section 33-20-04.1-02, Subsection 7, permanent signs are posted at the Ash Pond 92/southwest Section 16 surface impoundment and the southeast Section 16 special waste landfill. The signs indicate the name of the facility, the permit number, the name and telephone number of the owner, wastes accepted and not accepted for placement, and any restrictions for blasting, trespassing, burning, hauling, or nonconforming dumping.

2.3 Current Liner

2.3.1 Ash Pond 92/Southwest Section 16 Surface Impoundment

Approximately 59 acres at Ash Pond 92 are lined and in operation for CCP placement. A composite liner and liner head reduction system (LHRS) were installed at the facility in 1989. The floor of the impoundment consists of, from bottom to top, two feet of low permeability soil (LPS), 40-mil high-density polyethylene (HDPE) geomembrane, one foot of sand, one foot of pit-run gravel, and LHRS piping. Construction quality assurance (CQA) was performed by Foth & Van Dyke for installation of the liner and LHRS at Ash Pond 92 in 1989. Documentation of these activities may be found in Foth & Van Dyke (1989, 1990). Damage was sustained to the LHRS while the pond was being cleaned out between 1994 and 1996. Repairs were performed by the Northern Improvement Company of Bismarck, North Dakota in 2002. The damage and repair is discussed in more detail in the SP-033 modification (originally submitted September 30, 2003). The concept of a LHRS is described in greater detail in Section 5.2.4.

Recompacted natural subsoils (glacial tills) act as the hydraulic barrier in the southwest portion of Section 16. Approximately 52 acres have historically received CCPs. Limited quality control/quality assurance (QC/QA) was required when this work was completed in 1980.

2.3.2 Southeast Section 16 Special Waste Landfill

Approximately 74 acres are lined and active at the southeast Section 16 special waste landfill. Prior to CCP placement, a composite liner composed of two feet of LPS liner overlain by 60-mil HDPE geomembrane and nonwoven geotextile was installed in 1994. Earthwork was performed by D. H. Blattner Construction of Minneapolis, Minnesota. CQA services during construction of the LPS liner were performed independently by Braun Intertec Engineering, Inc. of Bismarck, North Dakota. Geosynthetics were installed in 1994 by Serrot Lining Systems, Inc. of Huntington Beach, California. Geosynthetic CQA monitoring was conducted by Golder Construction Services. The CQA report indicated that the installation of the geomembrane and geotextile materials was performed in substantial compliance with the project plans and specifications.

2.4 Future Liner

2.4.1 Ash Pond 92 and Southwest Section 16 (Upstream Raise)

Because the Ash Pond 92 surface impoundment is currently lined, an additional liner installation is not planned prior to construction and operation of the upstream raise. A composite liner is designed for installation ~~at~~in the southwest portion of Section 16~~,~~ upon regrading of in-place soil and CCPs. This liner will ~~dually~~also act as a cover over the existing CCPs. The liner/cover will likely be composed of, from bottom to top, a minimum of 12 inches ~~2 feet~~of LPS compacted to form a soil liner with an in-place maximum hydraulic conductivity of $1x10^{-7}$ cm/sec, as determined by laboratory testing at the time of construction, and 60-mil linear low-density polyethylene (~~HDPE~~LLDPE) geomembrane~~system~~ . This is an alternative liner design that has demonstrated equivalency through engineering calculations to be at least as protective of the environment as the prescriptive liner designs for special waste landfills. The liner will serve to control the migration of water or CCP constituents during the active life of the surface impoundment and, for surface impoundments closed with CCPs in place, during the post-closure period.

The future composite liner at the southwest portion of Section 16 will be fused with the existing composite liner at Ash Pond 92, as shown in Details 1 and 2 on Drawing 13. The future composite liner at the southwest portion of Section 16 will overlap with the composite liner at the southeast portion of Section 16, as shown in Detail 3 on Drawing 13. Fusion of the southeast and southwest Section 16 composite liners is not practical due to existing CCP placement. However, the overlapping composite liners and low permeability of the southwest Section 16 upstream raise containment berm will reduce the potential for horizontal migration of water between the southeast Section 16 special waste landfill and the existing CCPs at southwest Section 16.

An LHRS, as described in Section 5.2.4, is planned for installation over the LLDPE geomembrane liner material at the southwest portion of Section 16. The facility has been designed to accommodate the flow of contact water to a low point (i.e., sump) to allow it to be removed from the CCP placement area. The collection medium consists of a minimum of 18 inches of bottom ash with perforated pipelines to facilitate drainage. Two header pipelines collect the drainage from the perforated pipelines, each flowing to one of two sumps. Appendix A contains an overview figure of the drainage systems for the upstream raise.

The sumps will likely be formed by excavating at the two low points in the subgrade to form recessed collection points. The liner system will be placed in a continuous layer through the sump areas, and riser pipelines will be placed in the sumps. The riser pipelines (perforated within the recessed sump area, non-perforated above the sump) will allow pumps to be lowered into the sumps for dewatering. The sumps will then be filled with drainage aggregate (gravel) to facilitate the flow of liquids to the perforated sections of the riser pipelines.

2.4.2 Southeast Section 16

Current CCP practices will likely continue at the southeast portion of Section 16, until final grades are met. The southeast portion of Section 16 has previously been lined; therefore, no additional liner is required.

3.0 CCP DEPOSITION

CCS is a baseload generation facility for GRE, capable of supplying 1,116 megawatts (MW) of electricity. The largest power plant in North Dakota, CCS consumes approximately 950 tons of lignite per hour (or about 8 million tons per year). The lignite, an intermediate form between peat and sub-bituminous coal, is mined adjacently to GRE's property by The Falkirk Mining Company. Part of the Williston Basin, the Fort Union Formation lignite is roughly 38% water and results in less than 11% ash and less than 1% sulfur by-products. The type of coal, percentage of incombustible matter in the coal, the pulverization process, furnace types, and the efficiency of the combustion process determine the chemical composition of the coal ash. The Fort Union Formation is considered a low-contaminant lignite resource (USGS, 1999).

3.1 Waste Acceptance and Screening

Solid waste placement is limited to the materials identified in the existing permit. The Ash Pond 92/southwest Section 16 surface impoundment and the southeast Section 16 special waste landfill primarily accept construction and demolition debris (as needed) and nonhazardous CCPs produced at CCS. Items not accepted for placement are household garbage, putrescible waste, animal carcasses, waste grain, seed, elevator screenings, sludges or liquids other than ash/scrubber slurry mixture, unrinsed pesticide containers, lead acid batteries, waste oil, PCB waste, hazardous wastes and materials, corrosives, manure, septic tank pumpings, infectious waste, and any other waste that does not conform with Permit SP-033. Waste screening is not an issue due to the nature of the facility.

3.2 CCP Placement at CCS

As discussed in Section 1.0, Ash Pond 92 and Section 16 serve as placement sites for the CCPs specifically produced at CCS. The CCPs produced are inorganic fly ash, bottom ash, pulverizer rejects, economizer ash, and FGD sludge. All fall under the category of nonhazardous special waste. Table 3-1 shows the approximate production and placement rates of CCPs at CCS.

TABLE 3-1 - PRODUCTION AND PLACEMENT RATES OF COAL COMBUSTION PRODUCTS AT COAL CREEK STATION*

CCP Type	Production Rate (tons/yr)	Placement Rate (tons/yr)
Fly Ash	522,000	145,000 (variable)
Bottom Ash	274,000	225,000
FGD Sludge	120,000	120,000
Pulverizer Rejects & Economizer Ash	35,000	35,000

* Based on 2002 data supplied by GRE.

Of the 8 million tons of lignite burned per year by CCS, roughly 11% by weight remains as ash after combustion (CPA/UPA, 1989). The composition of the ash is a function of the type of coal burned, the combustion method, and the emission control devices used.

Approximately 55 to 65% of the total ash produced by CCS during combustion is fly ash. Captured by electrostatic precipitators, the slightly alkaline fly ash is comprised of very fine particles, including glassy spheres, crystalline matter, and carbon. Its principal chemical constituents are silica (SiO_2), lime (CaO), and alumina (Al_2O_3). Once placed, fly ash tends to exhibit self-cementation. The silica and alumina-rich fly ash reacts with the lime and water to form a slow-hardening cement (CPA/UPA, 1989).

Approximately 35 to 45% of the total ash produced by CCS forms bottom ash, economizer ash, and pulverizer rejects. Bottom ash consists of porous angular particles ranging in color from gray to black. FGD sludge is also a product of combustion, and it is white to gray in appearance. The materials are chemically basic with a pH around 12 (CPA/UPA, 1989).

4.0 GENERAL OPERATIONS

The following section presents a discussion of the general operations of the Ash Pond 92/southwest Section 16 upstream raise and the southeast Section 16 special waste landfill. Environmental monitoring (groundwater, surface water, and contact water) is discussed in the requisite monitoring plans and Section 5.0.

The General Provisions, according to *NDAC* Section 33-20-01.1-01, "provide performance criteria and standards for the management of solid waste in a manner that will control nuisance and litter, protect the public health, safety, and welfare, and prevent or minimize injury of environmental resources from exposure to solid waste or constituents of solid waste."

In accordance with *NDAC* Section 33-20-01.1-11, CCPs generated at CCS are placed in landfills and surface impoundments that comply with *NDAC* Chapters 33-20-07.1 and 33-20-08.1, respectively.

4.1 Hours of Operation

CCS operates 24 hours per day, 7 days per week, and CCPs may be placed at any time. Facility operations, including CCP hauling, generally occur between 7:30 a.m. and 3:30 p.m., Monday through Friday.

4.2 CCP Facility Equipment

4.2.1 Functional Requirements

Adequate equipment will be maintained and available for use at Ash Pond 92 and Section 16 during hours of operation to enable continuous CCP placement at the facilities. Vehicles used for the collection and transportation of CCPs at CCS are loaded and moved in such a manner to prevent the contents from falling, leaking, or spilling. If spillage does occur, the spilled CCPs are returned to the vehicle.

Access to adequate backup equipment will also be available to the equipment operators. The operators will be instructed to notify the Operations Manager of any equipment breakdown or malfunction that will impair operations for more than 24 hours. The Operations Manager will seek backup equipment, as needed, and ensure the expedient repair of the malfunctioning equipment.

CCP-handling equipment used in the working area will be required to spread and compact the delivered materials. CCS will have at least one bulldozer for handling and compaction.

Interim and final cover material handling equipment will be required to perform the following activities: excavating, loading, transporting, spreading, compacting, and grading. A tracked excavator and one or more dump trucks, or alternatively, one or more scrapers, may be made available for excavating, loading, and hauling of cover material.

Other equipment available to support the CCP placement operation will include a motor grader, a water truck, a small bulldozer, and one or more pickup trucks. Optional equipment may include a fueling truck and a backhoe. In the event that backup equipment is not available at CCS, it will be obtained from local equipment dealers.

4.2.2 Maintenance

CCS's existing preventative maintenance program will contribute to more fuel-efficient operation, reduced repair work, less downtime, reduced costs, safer equipment operation, and improved operator performance. Servicing of equipment will include general and safety reviews, lubrication, adjustments, and required repairs. Examinations and lubrication will be based on specific time or distance intervals.

Preventative maintenance on equipment at the facilities will be performed at the maintenance building. Local equipment dealers will provide major repairs. Equipment downtime will be monitored, and backup equipment will be provided as necessary.

4.3 Personnel Requirements

4.3.1 Administrative Responsibilities

CCS maintains the administrative responsibility for the continued development and operation of the Ash Pond 92/southwest Section 16 upstream raise and the southeast Section 16 special waste landfill. This responsibility will be delegated to the Operations Manager, who will be responsible for the day-to-day operations of the facilities.

4.3.2 Staffing Requirements

The CCP facilities plan to use the following personnel:

- 1 Operations Manager,
- 6 - 8 equipment operators,
- 1 - 2 laborers, and
- 1 mechanic.

Staff levels may fluctuate. Backup or support employees will be provided on an as-needed basis.

4.3.3 Qualifications

The operation of the facilities will require that supervisory personnel be aware of the importance of protecting the public health and the environment, detecting and minimizing environmental impacts, and maintaining good relationships and communication.

While there are no specific NDDH certification requirements for landfill operators or personnel, personnel involved in CCP handling and operation of the placement facilities at CCS are instructed in specific procedures to help ensure general compliance with the intent of the permits, facility plans, and appropriate NDDH regulations to prevent accidents and environmental-related impacts. Documentation of training will be placed in the facilities' operating records.

4.4 Personnel Training and Safety

GRE's CCS has a comprehensive health and safety program. The Health and Safety Coordinator is responsible for administration of the program, and CCS management is responsible for developing, maintaining, and implementing the health and safety program. All employees are responsible for compliance with all elements of the health and safety program. Appendix B includes the index for CCS's safety procedures.

Equipment necessary to perform facility maintenance, monitoring, and reviews may include:

- Appropriate personal protective equipment (PPE), such as eye protection, steel-toed boots, hard hat, and gloves and coveralls if necessary,
- Heavy equipment, such as haul trucks and bulldozers, for hauling and moving CCPs,
- Basic field equipment, such as shovels and rakes, and
- Equipment for groundwater monitoring and sampling.

Services for CCS personnel, such as shelter, drinking water, telephones, hand washing, and toilet facilities, are available at the CCS generation facility. Two-way radios or mobile phones are used by personnel to maintain communications at the site.

5.0 FACILITY OPERATIONS AND MAINTENANCE PROCEDURES

5.1 Operational Overview

Following approval of the permit modification for Permit No. SP-033 (originally submitted on September 30, 2003), construction/operations will begin at Ash Pond 92 and southwest Section 16 to form a single surface impoundment via the upstream raise. Southeast Section 16 will likely continue to function as a special waste landfill. Operations should include:

- Sluicing or truck-hauling CCPs to the sites and depositing them.
- Placing the CCPs to a slope of up to 25 percent and down to 4 percent. They will be spread and compacted as densely as practical by haul trucks to minimize CCP volume and promote drainage of surface water to a maximum elevation of 2,005 feet above mean sea level (amsl).
- Containing contact water within the lined site footprint and allowing it to evaporate and/or be used for dust suppression.

5.1.1 Site Development Timeline

The estimated timeline for development of Ash Pond 92 and Section 16 is:

- Current conditions (year 2004) (see Drawing 2):
  - Ash Pond 92: Placement consists primarily of sluiced bottom ash.
  - Southwest Section 16: No placement.
  - Southeast Section 16: Placement consists of fly ash, bottom ash, FGD sludge, economizer ash, and pulverizer rejects.
- 2006/2007: Closure of the southwest portion of Section 16 as a special waste landfill, to be accomplished by completion of the intermediate liner/cap at southwest Section 16 [Phase 2] (see Drawing 5). Cap/liner construction also signifies the beginning of construction/operation of the upstream raise at southwest Section 16.
- 2007/2008: Ash Pond 92 completed as an upstream raise to El. 1,950 [Phase 1] (see Drawing 4).
- 2016/2017: Ash Pond 92 & southwest Section 16 (upstream raise) filled to final grades [Phase 3] (see Drawing 6).

- Approximately 2033: Closure of the site – Southeast Section 16 and the valley between southwest Section 16 and southeast Section 16 filled to final grades [Phases 4 & 5] (see Drawings 7 and 8). Surface water controls will be installed at closure (see Drawing 9).

- Approximately 2033 to 2063: Post-closure monitoring and care. The 30-year post-closure period is in accordance with *NDAC* Section 33-20-04.1-09, Part 5.b.

Projected total capacity of CCPs at the upstream raise is 11,200,000 cubic yards. It is anticipated that the upstream raise portion of the facility will reach final grades in approximately 14 years.

Projected total capacity for the southeast portion of the Section 16 special waste landfill is 4,900,000 cubic yards. The projected remaining lifespan for the facility is approximately 30 years.

Projected total capacity for placement of CCPs in the valley between the southeast and southwest portions of Section 16 is 1,000,000 cubic yards, and the projected closure date for this area is approximately 2033. Following closure of the facility, it is not anticipated that further development of the site will be pursued for CCP placement.

5.1.2 Design Requirements

Special Waste Landfills (NDAC Chapter 33-20-07.1)

Southeast Section 16's compliance with the special waste landfill issues outlined in *NDAC* Chapter 33-20-07.1 is as follows:

- "On all areas of the landfill where final cover or additional solid waste will not be placed within six months, eight inches [20.3 centimeters] or more of compacted clay-rich soil material, similar material, or a synthetic cover must be placed to prevent ponding of surface water, to minimize infiltration of surface water, and to control windblown dust."

- Solid waste placement is limited to the wastes identified in the existing permit. The Ash Pond 92 surface impoundment and the Section 16 special waste landfill primarily accept nonhazardous special waste (CCPs) produced at CCS and, periodically, construction and demolition debris. Wastes not accepted for placement are household garbage, putrescible waste, animal carcasses, waste grain, seed, elevator screenings, sludges or liquids other than ash/scrubber slurry mixture, unrinsed pesticide containers, lead acid batteries, waste oil, PCB waste, hazardous wastes and materials, corrosives, manure, septic tank pumpings, infectious waste, and any other waste that does not conform with Permit SP-033.

- CCPs deposited at the facility are spread and compacted as densely as practical to minimize volume and promote drainage of surface water.

- Final cover of the facility will be constructed in accordance with *NDAC* Section 33-20-07.1-02, or as allowed by *NDAC* Section 33-20-07.1-01, Part 4.h., which permits the use of alternative engineered cover designs.

Surface Impoundments (NDAC Chapter 33-20-08.1)

The upstream raise will be in compliance with the surface impoundment requirements of *NDAC* Chapter 33-20-08.1, as follows:

- The upstream raise will comply with the surface water and groundwater protection standards of *NDAC* Chapter 33-20-13.

- New units must have a compacted soil liner of a minimum four feet of 1×10^{-7} cm/sec or lesser hydraulic conductivity or any combination of soil liner thickness, underlying soil thickness, and hydraulic conductivity, or a flexible membrane liner that would control the migration of CCPs or CCP constituents during the active life of the surface impoundment and, for surface impoundments closed with CCPs in place, during the post-closure period. The upstream raise will have a liner meeting these requirements.

- The upstream raise will have embankments designed to maintain their structural integrity under conditions of a leaking liner and capable of withstanding erosion.

- Freeboard in the upstream raise will be equal to or greater than two feet to avoid overtopping from wave action or precipitation.

- While the upstream raise is in operation, it will be reviewed by GRE monthly and after significant storm events to detect evidence of any of the following:

    - Deterioration, malfunctions, or improper operation of control systems.

    - Sudden drops in the level of the impoundment’s contents.

    - Severe erosion, seepage, or other signs of deterioration in embankments or other containment devices.

- Prior to placing the upstream raise into operation or prior to renewed operation after six months or more during which the upstream raise is not in service, a professional engineer will certify that the impoundment’s embankments and liner have structural integrity.

- When a malfunction occurs in the CCP containment system that can cause a release to land or water, the upstream raise will be removed from service and GRE will take the following actions:

  - Shut down the flow of additional CCPs into the impoundment.
  - Stop the leak and contain the CCPs that have been released.
  - Take steps to prevent additional failure.
  - If containment cannot be achieved, reduce the water levels in the impoundment.
  - Clean up released CCPs and any impacted materials.
  - Notify NDDH of the problem within 24 hours after detecting the problem.

- As part of a contingency plan, GRE will specify a procedure for complying with the requirements of the previous item.
- The upstream raise, if removed from service due to a malfunction in the CCP containment system, will not be restored to service unless the portion of the upstream raise that was failing is repaired and the following steps are taken:
  - If the upstream raise is removed from service as the result of actual or imminent embankment failure, a professional engineer must certify the embankment's structural integrity.
  - If the impoundment is removed from service as the result of a sudden drop in the liquid level, the liner will be repaired, and a professional engineer will certify that the repaired liner meets the design specification approved in the permit.
- The upstream raise, if removed from service due to a malfunction in the CCP containment system and not repaired within six months, must be closed in accordance with the provisions of *NDAC* Sections 33-20-04.1-05 and 33-20-04.1-09.

5.1.3 Upstream Raise Construction

CCPs to be accepted during upstream raise construction and operation are fly ash, bottom ash, FGD sludge, economizer ash, and pulverizer rejects, consistent with existing practice. Construction and operations coincide and consist of the following activities (see Drawing 11):

- Place bottom ash containment berms.
- Construct a shell with fly ash paste or roller-compacted fly ash.
- Sluice a bottom ash drain at the perimeter, while sluicing FGD sludge to the interior.
- With adequate foundation, place bottom ash containment berms for the next lift.
- Construct a shell for the next lift with fly ash paste or roller-compacted fly ash.

- Continue sluicing a bottom ash drain at the perimeter, while sluicing FGD sludge to the interior.

- Repeat the procedure until the upstream raise has reached its maximum dimensions.

During construction and operation of the upstream raise, storm water and sluice water will be collected and conveyed to Ash Pond 91 through various systems. These systems include a large bottom ash drain, siphon lines, seepage collection piping, perimeter ditches, crossover culverts, and LHRSs. Appendix A includes an overview of the drainage systems for the upstream raise.

Figure 5-1 shows a conceptual cross-section of the upstream raise upon completion of CCP placement. It is anticipated that the upstream raise should reach final grades in approximately 14 years.

The fly ash outer shell is not a crucial structural design element to the upstream raise. Its primary purpose is to act as a competent work area for placement of deposition lines and to act as a berm for the sluiced deposition of the bottom ash drain. Fly ash placed as either a paste or hauled and compacted will provide adequate strength for this purpose with no CQA requirements. General construction guidelines for fly ash paste and hauled/compacted fly ash are given below:

- Fly ash paste shall be deposited from the fly ash paste pipeline as a low-density slurry. The slurry (paste) shall be allowed to flow out from the discharge between bottom ash containment berms until the fly ash shell area is filled. The extent of deposition from a discharge point shall be determined in the field. After discharge, the slurry (paste) shall then have adequate time to hydrate and gain strength before construction activities resume over the newly constructed fly ash shell.

- Fly ash hauled and compacted to form the fly ash shell shall be moisture conditioned at the fly ash silos as close to the optimum moisture content as practical. Fly ash shall be placed in 18-24 inch loose lifts and compacted by sequential passes of the haul trucks or other compaction equipment that is available. After a portion of the fly ash shell is fully constructed, heavy equipment shall not traffic on it for approximately 24 hours.

The bottom ash drain forms the major structural component of the upstream raise and acts as a dewatering pathway for the sluice water associated with bottom ash and FGD sludge deposition. This bottom ash drain is constructed by slurry deposition, discharging from a single point or multiple points. As needed, low ground-pressure equipment is recommended (such as a CAT D6-LGP dozer) to spread the bottom ash material across the drainage zone. Special care should be taken when equipment or personnel traffic the bottom ash drain, especially at the sludge/bottom ash interface and where bottom ash is being actively deposited. The bottom ash in these areas may have very close perched water tables that may result in localized failures if loaded by equipment or personnel. Before approaching these areas, personnel and equipment must follow appropriate safety measures as determined by the GRE operations management.

5.1.4 SE Section 16 Construction

Operations at the southeast portion of the Section 16 special waste landfill will likely remain essentially the same and will include:

- No change in the type of CCPs placed at the southeast portion of the Section 16 special waste landfill. The facility continues to receive construction and demolition debris and CCPs, which include fly ash, bottom ash, FGD sludge, economizer ash, and pulverizer rejects.
- Following approval of the permit modifications, CCPs may be placed to a maximum slope of 25 percent and a minimum slope of 4 percent.
- Contact water should be contained within the lined facility footprint and collected in a sump on the north side of the facility. The contact water will remain in the sump or flow through a weir and crossover pipeline to a future overflow/evaporation pond to be constructed north of the sump. See Drawing 7 for a plan view and Drawing 13 for details.

5.1.5 Design Considerations

Slope Stability

Slope stability has been evaluated for the three primary facilities included in this operations plan: Ash Pond 92, southwest Section 16 as it becomes part of the upstream raise, and the southeast Section 16 special waste landfill. The three facilities were examined at their full design height to identify critical stability components with respect to geometry and material properties. Noncircular movement along the HDPE liner interface and through the CCP sludge is the most critical section at Ash Pond 92. Southwest Section 16, once joined with the upstream raise, appears weakest through its foundation of underlying CCP deposits, suggesting noncircular movement through the foundation is the most critical. Similar to Ash Pond 92, southeast Section 16 is weakest along the geomembrane (smooth HDPE) interface and through the existing CCP deposition. Noncircular movement along the HDPE liner interface appears most critical for this facility. The static factor of safety was found to be acceptable for the facilities and slip surfaces evaluated.

Piezometers

Piezometers will be used during operations to aid in slope stability analysis by monitoring water levels in the upstream raise embankments. Installation and monitoring details, approximate piezometer locations, and a typical construction schematic are included in the recent SP-033 permit modification (originally submitted September 30, 2003). Prior to the piezometer installations, specifications regarding locations, depths, and materials will be provided to the installation contractor.

The piezometers will likely be installed at two times during upstream raise construction. The first installation will occur when the upstream raise embankments reach El. 1,950 feet amsl, which will likely occur in 2008. Two piezometers will be installed at this elevation: one on the north side of Ash Pond 92, and one on the south side of Ash Pond 92. Both piezometers will be screened between El. 1,915 and 1,935 feet amsl. Appendix C shows the general locations of these piezometers.

The second installation will occur when the upstream raise embankments reach El. 1,965 feet amsl, which will occur in approximately 2012. Three piezometers will be installed at this elevation: one on the north side of Ash Pond 92, one on the south side of Ash Pond 92, and one on the south side of the southwest portion of Section 16. See Appendix C for the location of these piezometers. The two piezometers at Ash Pond 92 will be screened between El. 1,915 and 1,935 feet amsl. The screened interval for the piezometer at southwest Section 16 will be determined by GRE prior to installation.

Water levels in each piezometer will be measured semi-annually, in conjunction with the site's water quality sampling program. The water level data will then be provided to GRE's engineer for evaluation. The engineer will determine if the measured water levels are at expected elevations, based on the construction progress of the upstream raise. Stability of the upstream raise will also be assessed by the engineer. Corrective action will be implemented as necessary if water levels are observed to be higher than expected.

Sluice Water Drainage Systems

The bottom ash drain, siphon lines, and seepage collection piping are the primary systems for conveying sluice water from the upstream raise to Ash Pond 91. Appendix A contains an overview of the drainage systems within the upstream raise.

Sluice water associated with sludge deposition will collect over the sludge deposition area creating a perched pool. Sluice water associated with bottom ash deposition will flow into either the sludge pool or the bottom ash drain. The majority of water collected within the sludge pool will be conveyed to Ash Pond 91 through the siphon lines. A small amount of water will seep into the bottom ash drain from the sludge pool.

Water flowing into the bottom ash drain from bottom ash deposition or the sludge pool will move laterally and vertically to the water table within the bottom ash drain. The water table within the bottom ash drain will be maintained below the freeboard level of Ash Pond 92 by using the buried crossover pipe between Ash Pond 91 and Ash Pond 92. This pipe will allow the water level in Ash Pond 91 to control the water level within Ash Pond 92. Seepage collection piping is installed to aid in the lateral flow of water from the bottom ash drain to the crossover pipe.

Site Facilities

All systems discussed in this section and related appurtenances and structures will be operated and maintained in a manner that facilitates their proper use.

An adequate water supply, from several on-site sources, will be available on the property for the purpose of dust control and extinguishing fires. Potable water, hand washing, and sanitary facilities are available at the main CCS generation facility.

All utilities necessary for the operation of Ash Pond 92 and Section 16 are either currently available or will be extended/installed as needed. These utilities will likely be maintained throughout the operational life of the facilities.

Spreading and Compaction

Hauled CCPs will be compacted when practical and as needed. Proper compaction conserves airspace, achieves high CCP density, improves CCP stability, allows for easier and more economical covering, and creates a more aesthetic operation.

When practical, CCPs will be unloaded and spread over the active area by a bulldozer such a Caterpillar D8. Compaction may be achieved by making a pass over the spread CCPs with a haul truck. The nature of the CCPs (silt-like properties) limits final compaction. A water truck is available to suppress fugitive dust as needed. Areas will be graded to facilitate drainage of runoff and minimize infiltration and standing water.

Interim Cover Material Placement and Management

On areas of the facilities where final cover or additional CCPs will not be placed within six months, eight inches (20.3 centimeters) or more of compacted clay-rich soil material, similar material, or a synthetic cover will be placed to prevent ponding of surface water, to minimize infiltration of surface water, and to control windblown dust. The interim cover will be monitored and maintained as needed to minimize erosion and infiltration of precipitation.

5.2 Facility Operation Control Systems

5.2.1 Surface Water Control System

Proper drainage should be maintained to:

- Provide trafficable roads,
- Prevent contact water (i.e. water that has contacted CCPs) runoff from leaving the active area,
- Divert surface water run-on from areas upgradient of the facilities around the sites,
- Permit CCP placement during inclement weather,
- Prevent run-on to the active area, and
- Prevent discharge of pollution from the site.

Water that has not contacted CCPs will be considered clean surface water and diverted to the site's storm water channels. Surface water or precipitation entering active CCP placement areas will be treated as contact water.

Permanent perimeter drainage channels will be constructed as defined in the storm water management plan. Temporary drainage berms will be placed as necessary as the filling operation progresses. These drainage berms should be adapted to changes as dictated by daily operations. Perimeter channels and other surface water features will be cleaned of debris and silt buildup as required to maintain proper drainage. At the Operations Manager's discretion, temporary drainage berms may be installed to divert surface water away from the CCP facilities, stockpiles, and roads.

Temporary erosion control measures will be used on an as-needed basis to control excessive soil erosion. Typically, these may include erosion control matting, mulch, straw/hay, bale dams, and silt fences, which are typical "best management practices." Temporary surface water control structures will be operated until final cover and final surface water control structures are installed and the vegetative cover provides stability against erosion. The final surface water control structures are described in Section 6.1.3.

Routine maintenance will be conducted on any temporary structures to verify proper operation. Drainage structures will be checked monthly and more frequently during wet weather periods or major storm events to ensure that they are not filled with debris or sediment and will function properly. If erosion damage has occurred to a drainage structure, it will be repaired as soon as possible.

5.2.2 Contact Water Controls

Operations for the upstream raise (Ash Pond 92 and Southwest Section 16) and the southeast portion of Section 16 will include containment of contact water within the lined site footprints. The adequacy of contact water controls to contain and convey runoff has been evaluated for a 25-year, 24-hour design storm event. The HEC-HMS software, developed by United States Army Corps of Engineers (USACE), was used to determine routing of surface water runoff from the upstream raise and facility slopes and the peak inflow that will report to perimeter ditches. Perimeter ditches will be excavated into the CCPs and designed to contain runoff from the upstream raise and Section 16 and allow it to percolate into the CCPs and/or through culverts and weirs to ponding areas.

The contact water control analysis reveals that the peak water level in any perimeter ditch due to the design storm event at Ash Pond 92, the southwest portion of Section 16, or the southeast portion of Section 16 will not be higher than the top of the liner. The results indicate that the designed contact water control features will be adequate to control the contact water from a 25-year, 24-hour design storm event.

5.2.3 Southeast Section 16 Sump

An engineered LHRS was not constructed at southeast Section 16 prior to CCP placement. However, the liner grades slope to the northeast corner, and a sump was developed along the north side of the facility.

In addition to the liner slope, zones of highly permeable bottom ash have been placed within the southeast Section 16 with at least one ash zone connected to the sump by a PVC pipeline.

The purpose of the sump is to collect contact water resulting from a storm event and any water draining from the placed CCPs. Water collected by the northeast sump will pond within the sump or gravity flow through a weir and crossover pipeline to a future overflow/evaporation pond to be constructed north of the sump. If the water level within the sump or overflow/evaporation pond becomes too high, water will be pumped from the sump or pond to Ash Pond 91. The northeast sump and the overflow/evaporation pond will be active during the life of southeast Section 16 and through the post-closure period, as necessary.

The northeast sump is designed to be a passive, low-maintenance system based on gravity flow and evaporation. During routine monitoring, the sump and overflow/evaporation pond will be evaluated, and repairs/maintenance will be performed as required.

5.2.4 Upstream Raise Liner Head Reduction System

As discussed in Section 2.3 and 2.4, an LHRS has been constructed at Ash Pond 92 with a similar design planned for southwest Section 16. These two systems have been designed with a hydraulic barrier constructed over the liner. This design allows water to be pumped out of the LHRS faster than it can pass through the CCPs and hydraulic barrier into the drainage layer, reducing the hydraulic head acting on the liner during closure.

Water will be pumped out of the Ash Pond 92 LHRS using a sump located at the middle of the north boundary and out of the southwest Section 16 LHRS using the sumps in the northwest or southeast corners of the facility. Using gravity flow, the water is directed into the sumps through the LHRS drainage medium and pipeline network. It will the be diverted to on-site evaporation ponds or Ash Pond 91.

The two LHRSs will not be operational during active sludge and bottom ash placement within the upstream raise and special waste landfill. They will be activated once CCP placement is complete as part of the process to drain the upstream raise and reduce the head in the special waste landfill (as needed). Periodic review and maintenance will be performed on the sump riser pipelines and discharge lines before and during closure. During closure, the sump pumps and associated electrical equipment will be reviewed and maintained as specified by the manufacturer.

5.2.5 Other Facility Procedures

Survey Control

Boundaries and/or monuments on the Ash Pond 92/southern Section 16 property have been established. Surveys certifying grades have been performed by a North Dakota-registered professional land surveyor. Elevation and construction staking will be established as needed by qualified site personnel or contractors. If established survey control monuments are disturbed over the life of the permitted facilities, these monuments will be replaced or re-established by a North Dakota-registered professional land surveyor.

Temporary benchmarks and alignment stakes will be used throughout operations of the CCP placement facilities. These temporary stakes will be used to control the construction of each phase and the construction of drainage channels, roads, the LHRS, composite liners, and final cover.

Boundary Control

Access to the active CCP placement facilities and other areas within the CCS property boundary will be restricted to prevent unauthorized entry. Portions of the CCS permit boundary are fenced. A manned gate at the CCS entrance controls access to GRE's property and to the Ash Pond 92/southwest Section 16 surface impoundment and the southeast Section 16 special waste landfill.

5.2.6 Environmental Controls

The purpose of environmental monitoring will be to monitor the environmental performance of the CCP placement facilities during operations and the post-closure period. Environmental monitoring includes groundwater and surface water monitoring. CCS's water quality monitoring plan (WQMP) and storm water management plan (SWMP) present details of these activities.

Dust Control

Dust control is important to deter traffic accidents, reduce equipment maintenance, and protect the health and comfort of neighbors, CCS personnel, and visitors. The following activities will be used as dust control measures:

- Application of water (along with possible dust suppressants) as needed to haul roads, fill, and construction areas using an on-site water truck.
- The entrance road to CCS has a sealed surface (e.g., bituminous or similar surface).
- Primary interior haul roads will be surfaced, and they will be periodically graded with a motor grader.

If water is applied, a water truck will apply it at an application rate that will not cause erosion or significant water/CCP interaction. Dust control efforts may be supplemented through the use of commercially available dust suppressant agents or calcium chloride, if needed.

Litter Control

Litter at the permitted facilities is disposed in collection containers at Ash Pond 92 and southern Section 16. Site personnel will perform policing of the site, perimeter fencing, and access roads during their daily activities.

Odor Control

Odor control is not a concern for Ash Pond 92 and Section 16 due to the relatively inert nature of CCPs. Through control of the incoming waste stream and controlled cleaning locations of hauling vehicles and containers, odor will be monitored by CCS personnel. Reports of odor, regardless of the on-site source, should be addressed immediately.

Vector Control

Vectors include rodents, flies, mosquitoes, birds, dogs, and other animals, including insects, capable of transmitting disease and/or destroying the facilities' covers. CCS personnel will prevent or control on-site populations of vectors using techniques appropriate for the protection of human health and the environment. If a vector problem should arise, an assessment will be made of the operating conditions to see what conditions favorable to the existence of the vectors are being maintained. The necessary corrective actions will be taken.

Noise Control

Ash Pond 92/southwest Section 16 and southeast Section 16 will continue to be constructed and operated to minimize the level of equipment noise audible from the facilities. The location of the two placement facilities is remote, away from residential areas.

Measures to limit noise include maintaining proper mufflers on vehicles and providing ear protection devices for CCS personnel that work near equipment. Tree planting and/or earthen berms may also be used to reduce traffic noise at CCS.

Erosion Control

CCS personnel will control erosion from the site by use of engineering controls that may include earthen berms, surface water collection channels, and surface water retention/detention ponds.

Heavy equipment or construction equipment will be restricted to those areas necessary to construct facilities/structures shown on the design drawings and any future permitted design plans. Also, other physical controls, such as hay bales and silt fences may be used, as necessary, by GRE personnel.

Illegal Dumping

Signs will be posted at the Ash Pond 92/southwest Section 16 surface impoundment and the southeast Section 16 special waste landfill stating the penalties for illegal dumping. If illegal dumping occurs, the McLean County Sheriff's Department (and, depending on the circumstances, NDDH) will be notified, and reasonable efforts made to identify and prosecute the offenders. Cleanup of illegal dumping will be performed by CCS with possible NDDH assistance.

5.3 Monitoring Periods

There are three primary monitoring periods for the Ash Pond 92/southwest Section 16 surface impoundment and the southeast Section 16 special waste landfill: CQA during soil and geomembrane liner installation, monitoring during the operational life, and closure/post-closure monitoring.

Soil and geomembrane liner will be placed at southwest Section 16 prior to it joining Ash Pond 92 as a single surface impoundment. Standard soil liner CQA is required during placement of the compacted LPS liner, which generally includes grain size analysis, Atterberg limits, Proctor compaction, permeability testing, and field moisture and density testing. Geomembrane liner CQA includes monitoring of trial seams, field seams, panel placement, and nondestructive and destructive CQA field testing. Associated paperwork and as-built placement drawings will be filed in the facility's operating record and with NDDH.

Semi-annual monitoring (spring and fall) of southeast Section 16's special waste landfill will be performed and recorded during the facility's active life. This may include:

- Observation of the CCP placement area to look for spillage and confirm that only CCPs or construction and demolition debris have been placed;
- Evaluation of erosion, differential settlement, and surface water control structures;
- Assessment of the water and air near the site, such as ponding and excessive fugitive dust;
- Review of access to the site (review fencing, trails, and road access) and appropriate signage; and
- Assessment of the condition of the 15 nearby monitoring wells (6 near Ash Pond 92 and 9 near Section 16).

Logs will be compiled during each semi-annual review and filed in the operating record for southeast Section 16. An example of the suggested inspection log is included as Appendix D.

Similar reviews will be held for the Ash Pond 92/southwest Section 16 surface impoundment. However, NDAC 33-20-08.1 requires monthly reviews of surface impoundments with additional reviews performed after storms.

Closure activities for Ash Pond 92 and southeast Section 16 will be monitored and recorded. Post-closure reviews will be conducted no less than annually to monitor groundwater, to note signs of erosion, settlement, and adequate vegetation at the site, and to note maintenance required for the facility cover or access restrictions. The closure and post-closure plans are discussed in more detail in Sections 6.0 and 7.0, respectively. Further information about the original design, construction, and plan of operations for Ash Pond 92 and the southeast Section 16 special waste landfill may be found in the current permit modification (originally submitted September 30, 2003) and previous SP-033 permits.

5.4 Environmental Monitoring

5.4.1 Groundwater Quality Monitoring (*NDAC* Section 33-20-13-02)

Groundwater quality monitoring is required by *NDAC* Section 33-20-13-02. A groundwater monitoring program (GWMP) in the vicinity of the Ash Pond 92/southwest Section 16 surface impoundment and the southeast Section 16 special waste landfill has been in place since 1979. In the current WQMP, the Ash Pond 92 surface impoundment is included in Subdivision DI, and Section 16 is included in Subdivision DII. Six wells in Subdivision DI and nine wells in Subdivision DII are monitored and reported on an annual basis. Appendix E contains an overview of the existing monitoring wells near the facilities. The wells are monitored twice per year for field and laboratory parameters. Parameters analyzed include: boron, chloride, sulfate, pH, specific conductivity, temperature, and water level.

Groundwater analysis will continue as outlined in the current GWMP and WQMP. A water quality monitoring report is submitted to the NDDH annually. This report includes current year monitoring results, trends in water quality, and statistical analyses performed on the data.

5.4.2 Storm Water Compliance

The Ash Pond 92/southwest Section 16 surface impoundment and the southeast Section 16 special waste landfill are contained within the managed watershed covered by GRE's Storm Water Permit NDR02-0000. GRE monitors storm water discharges in accordance with its existing SWMP, and water quality data are submitted to NDDH.

5.5 Contingency Plans

These contingency plans cover general CCP placement facility operations, including work associated with the CCP placement, placement of soil cover, and related activities. The emergency conditions discussed in this section are general and cannot cover every possible emergency situation. Therefore, site personnel should always be aware of potential problems.

Communication between CCS personnel and outside individuals and agencies will typically be maintained through the use of telephone services. If telephone service is interrupted, mobile phones will be used. Communications at CCS will be maintained through the use of two-way radios.

5.5.1 CCS Contingency Plans

Temporary Closure of the Upstream Raise or Southeast Section 16

Should the upstream raise or southeast Section 16 special waste landfill or the combined facility be temporarily closed, CCP placement will be diverted to other facilities on the CCS property. Sluiced CCPs will be diverted to Ash Pond 91. There the CCPs will either be allowed to dry and then trucked to a dry special waste landfill or left in place within the pond. If the facilities stay closed beyond 180 days, interim cover standards apply as discussed in Section 5.1.5.

Piezometers

As discussed in Section 5.1.5, water levels in the piezometers will be measured twice annually, in conjunction with the facilities' water quality sampling program. The water level data will be evaluated by GRE's engineer to determine if the measured water levels are at expected elevations, based on the construction progress of the upstream raise. The stability of the upstream raise will be assessed by the engineer based on the water levels with corrective action implemented as necessary if water levels are observed to be higher than expected.

Freeboard

As noted in the NDAC Chapter 33-20-08.1 concerning surface impoundments, freeboard in the upstream raise should be equal to or greater than two feet to avoid overtopping from wave action or precipitation. If the freeboard in the upstream raise falls under the two-foot requirement, CCP placement in the facility will be halted. GRE operations will then take actions, such as pumping the LHRS system or transferring CCPs to another facility, to achieve the required freeboard within the upstream raise. Contact water will be maintained within the existing contact water controls. The wet CCPs will be transferred to an appropriate facility such as Ash Pond 92 or 91 and allowed to drain prior to trucking them to another special waste landfill at CCS. More specific emergency repairs are discussed in Section 5.1.2.

Seepage

During construction and closure of the upstream raise, the soil embankments around the perimeter of the upstream raise should be monitored for seepage during the monthly inspections. Should seepage be identified, GRE's Operations Manager will define the level of concern and course of action. Steps could include temporary closure of the facility, contacting GRE's engineer to perform field investigations or install instrumentation to aid in stability analyses of the facility, and possible halted construction of the facility. An appropriate remediation effort will be determined by CCS and the engineer to minimize the seepage. More specific emergency repairs are discussed in the design discussion in Section 5.1.2.

Pipelines, Pumps, and Distribution Systems

The CCPs placed in the upstream raise are dependent on an effective pipeline distribution system. This system, with its associated pumps, joints, and supports, will be monitored during the monthly inspections of the facilities. Pumps will be maintained according to the manufacturer's recommendations.

Monitoring personnel should watch for leaks, insufficient or unstable pipe supports, damp areas above buried pipes, etc. along the pipeline and distribution systems. Any necessary maintenance or remediation will be performed, as needed, to continue the system's efficiency. Should a significant failure of the pipeline or pumping system occur, the emergency repair procedure outlined in Section 5.1.2 will be followed to return the system and upstream raise to service.

Sluice Water Drainage Systems

As outlined in Section 5.1.5, the sluice water drainage systems present in the upstream raise are of a redundant design, allowing water to be removed from the CCP placement area using several methods. Should one of the drainage systems fail during the operational period or dewatering period of the upstream closure, the freeboard and seepage measures described above and in other parts of this operations plan will be followed to maintain the integrity of the raise. GRE operations management will take measures to repair or replace the faulty system in a timely manner. The adjustment will be noted in the operating record for the facility. Measures to control the water level within the facility could include adding additional siphon lines, actively pumping the LHRS system (discussed further in Section 5.2.4), or controlled contact water diversion structures to divert the water into neighboring Ash Pond 91.

Extreme Events

In any engineering design or industrial facility, all possible contingencies cannot be considered. These may include significant earth motions or explosions near the surface impoundment, severe weather exceeding the standard of practice design considerations for the facilities, or other improbable events that could affect the CCP placement facilities. The Ash Pond 92/southwest Section 16 upstream raise and the southeast Section 16 special waste landfill will be operated in accordance with the operating procedures outlined in this manual and by the NDAC and NDCC. Should an unplanned extreme event occur, GRE's

Operations Manager will determine the level of concern for the safety and stability of the facilities and decide the appropriate course of action. Outside resources, such as a licensed professional engineer or the NDDH, may be contacted if the situation warrants it.

5.5.2 General Emergency Procedures

If an emergency situation should occur, a prompt and appropriate response will be implemented to prevent personal injury (or administer proper care in the event an injury has already occurred) and to limit the extent of property damage. Knowledge and awareness of potential hazards is useful when identifying causes and conditions of an emergency. GRE's existing safety procedures incorporate the following elements:

- Personnel training to respond to fire, poisoning, accidental injury and damage, and life-threatening occurrences,
- Safety equipment maintenance to help ensure proper working order and designated locations,
- Planned initial responses, responsibilities for actions are assigned, and planned responses and actions are routinely reviewed, and
- A current emergency response directory.

The emergency response program is coordinated through CCS personnel and the facility's health and safety coordinator (HSC). The initial response plan for CCS will be as follows:

1) Notify the CCS office (Operations Manager) about the nature of the emergency,
2) Provide assistance at the scene, if needed,
3) Notify emergency departments (e.g., ambulance, police, etc.), and
4) Prepare necessary reports.

Personnel in the CCS office will perform notification of the emergency departments and GRE. If evacuation is necessary due to fire or a hazardous waste incident, the evacuation procedures will depend on the nature of the emergency.

Fire Protection

The potential for fire or explosion to occur at the facility is minimal due to the properties of the CCPs placed at the facilities and will be further minimized by following applicable safety guidelines. No open burning or smoking will be allowed. CCS vehicles and equipment will be maintained regularly to ensure they are not emitting sparks or leaking flammable liquids.

If there is a fire, however, it will be extinguished using on-site materials and equipment, with assistance from the local fire department, if necessary. Water, soil, or other suitable materials will be used to extinguish the fire as deemed necessary by the facility personnel and/or the local fire department. CCS has an emergency response system in place and will follow the defined procedures.

Fire extinguishers will be maintained at the equipment/maintenance buildings and on pieces of heavy equipment. Equipment operators will utilize the fire extinguishers on their machines to control small fires. Personnel will be trained in the use of these extinguishers and advised of their locations by the HSC. The extinguishers will be examined regularly by the fire extinguisher supplier. Except for equipment-mounted extinguishers, each fire extinguisher location is indicated by a sign. Employees shall be familiar with both the location and the operation of fire protection equipment in the vicinity of their work area. Employees shall know the classes of fire equipment in the vicinity of their work area. Employees shall also know the classes of fire (descriptions follow), their burning characteristics, and the proper extinguishing agent to be used.

a) Class "A" fires involve ordinary combustibles such as wood and paper. Extinguishing agents include water, soda-acid, and multipurpose dry chemical.

b) Class "B" fires involve oils and flammable liquids. Extinguishing agents include CO_2 and dry chemical.

c) Class "C" fires involve electrical equipment. Extinguishing agents include CO_2 and dry chemical.

d) Class "D" fires involve combustible metals and require specific dry powder extinguishing agents.

In the event of a fire, personnel will take the following steps:

- Minor fires around the office building, maintenance area, or placement facilities should be extinguished with fire extinguishers located on site and on each piece of operating equipment.

- In the event of a large fire, CCS will halt placement operations in the vicinity of the fire and take necessary steps to protect the public welfare. The site will be closed to CCP hauling vehicles; only emergency vehicles will be allowed in the area. Site personnel will initiate measures for control of the fire as described above, and seek assistance to the extent necessary.

- All fire events and the actions taken to extinguish them will be made part of the Operating Record.

Hazardous Substance

If it is suspected that the Ash Pond 92/southwest Section 16 surface impoundment or southeast Section 16 special waste landfill has received a hazardous or dangerous substance not allowed in the current permit, CCS personnel will proceed according to the emergency steps listed at the beginning of this section and determine whether the area should be closed to all but trained site personnel and emergency response crews. The Operations Manager will immediately notify NDDH. The suspicious material will be isolated from personnel by cordoning off the area and keeping individuals upwind until the substance and its characteristics have been identified by trained emergency personnel, and the appropriate safety measures can be taken. If the material is hazardous, NDDH will be notified and the local HazMat responder summoned.

Explosions

If an explosion occurs, further explosions will be prevented by isolating the source of the explosion and removing any possible ignition sources. Anyone injured by the explosion will be removed from the immediate area, given first aid, and an ambulance summoned if necessary. Site personnel will determine whether the fire department should be contacted. If necessary, depending on the severity and location of the explosion and the number of site personnel required to attend to the situation, the site may be closed to all except emergency vehicles.

High Winds or Tornadoes

Tornadoes and severe thunderstorms are not uncommon in the area. If a tornado warning is issued, individuals present on site (employees and visitors) will be directed to seek shelter in the nearest sturdy building or in a low-lying area such as a ditch. Instructions will be given to remain there until the all clear signal is given. Once the severe weather has passed, the site will be reviewed for signs of damage to critical operating systems.

Snow and Ice

If excessive snow and/or ice accumulates on the haul roads, on-site equipment will be used to maintain trafficable roads. If the weather is too severe for the on-site equipment to maintain the haul roads, the Ash Pond 92/southwest Section 16 surface impoundment and southeast Section 16 special waste landfill will be closed until road conditions improve.

Medical Emergency, Vehicle Accident, or Property Damage

In the event of an injury, medical emergency, or vehicle accident, the procedures outlined at the beginning of this section will be followed. Appropriate emergency contact(s) will be immediately summoned for assistance. While awaiting the arrival of emergency response personnel, site personnel trained in first aid (and CPR, if relevant and if personnel with CPR training are available) will attend to the victim(s). Vehicle accidents or property damage without accompanying injuries will be reported to the police and/or vehicle owners as required by applicable laws.

Downed Power Line or Power Interruption

Should a power pole or line be downed by severe weather, vehicle contact, or other incident, the appropriate personnel should be notified immediately, and site personnel and visitors will be directed to stay away from the power lines. If electrical power is interrupted for an extended period during closure activities, generators will be used as needed. The Operations Manager will be responsible for ensuring that the portable power supply systems are maintained if necessary for facility operations.

Equipment Failure

Backup or rental equipment will be made available as necessary in the event of equipment breakdown. Failed equipment will be repaired as soon as possible and returned to operation. Backup equipment for short-term situations should be made available through either reallocating other on-site equipment or obtaining equipment from off-site sources. Longer-term replacement equipment would be provided through rental or purchase.

Groundwater Impacts

The 15 active groundwater monitoring wells around the Ash Pond 92/southwest Section 16 upstream raise and the southeast Section 16 special waste landfill will be used to aid in determining if groundwater has been impacted due to CCP placement at the facilities. Groundwater impacts, as determined by CCS and the NDDH, will be handled as approved by GRE and the NDDH.

Other Releases

Dust and particulate matter originating from winds, vehicular traffic, and operational equipment will be controlled by facility personnel. During dry periods, operators may use water to minimize the amount of dust generated by the facility. Windblown debris will be collected and placed in collection containers at the site.

Operations for the Ash Pond 92/southwest Section 16 upstream raise and southeast Section 16 special waste landfill will include containment of contact water within the lined site footprints. Contact water will be allowed to evaporate and/or be used for dust suppression. Contact water may also be pumped to Ash Pond 91 (just west of Ash Pond 92) or the evaporation pond to be constructed north of the Section 16 facility.

Temporary erosion control measures will be used on an as-needed basis to control excessive soil erosion. Typically, these may include erosion control matting, mulch, straw/hay, bale dams, and silt fences (best management practices). Routine maintenance will be conducted on any temporary structures to verify proper operation. Drainage structures will be checked on a regular basis and more frequently during wet weather periods or major storm events to help ensure that they are not filled with debris or sediment and will function properly. If any erosion damage has occurred to a drainage structure, it will be repaired as soon as possible.

6.0 CLOSURE

6.1 Closure Design

6.1.1 Special Waste Landfills

Prior to closure of Ash Pond 92 and the southwest portion of Section 16, the upstream raise will be drained of “free water,” and the site will be closed as a combined special waste landfill in conjunction with southeast Section 16. Closure will utilize an appropriate engineered cover design, as allowed by *NDAC* Section 33-20-07.1-02. Final CCP grades are shown on Drawing 8, and final cover grades are shown on Drawing 9.

Drainage of the upstream raise will be accomplished through the bottom ash perimeter drain and the LHRS (Section 5.2.4). Water will flow out of the placed bottom ash by gravity into the LHRS. Water will flow out of the FGD sludge into the LHRS due to gravity and consolidation of the sludge. Upon completion of slurry deposition within the upstream raise, the LHRS will be activated and water will be pumped from the three sumps under the raise.

Consolidation analysis indicates that the sludge zone may undergo substantial consolidation (drainage) prior to final cover placement and that steady-state conditions (end of consolidation) will likely occur within six months of final cover placement. The piezometers within the embankments of the facility will continue to be monitored to review the phreatic change within the upstream raise.

The LHRS, in conjunction with the large bottom ash zone, will act as a drain for the consolidating sludge, decreasing the time needed for consolidation. After consolidation reaches steady state, “free water” may still exist within the sludge. This water will flow out of the sludge and into the bottom ash drain and LHRS until the sludge material reaches field capacity.

The LHRS will remain active through the closure process and into the post-closure period. FGD sludge produced at CCS will dewater rather rapidly, and minimal amounts of water will report to the LHRS sumps after approximately five years from closure. It is anticipated that the LHRS system will require less pumping as time progresses from closure. “Free water” that drains from the upstream raise will be conveyed to either Ash Pond 91 or an evaporation/overflow pond to be constructed north of the southeast portion of Section 16.

6.1.2 Ash Pond 91

Ash Pond 91 will be closed as either a surface impoundment (*NDAC* 33-20-08.1-02) or a special waste landfill (*NDAC* 33-20-07.1-02). The closure standards of *NDAC* 33-20-04.1-09 will also be followed, unless revised standards are in effect at the time of closure.

If Ash Pond 91 is closed as a surface impoundment, GRE will "remove all standing liquids, waste and waste residues, the liners and leak detection system, and any underlying and surrounding contaminated soil." The site will then be "reclaimed by regrading the site, replacing all suitable plant growth material, and properly revegetating the site." If all impoundment materials are not removed, GRE will "treat remaining liquids, residues, and soils by removal of liquids, drying, or other means and then close the impoundment."

If Ash Pond 91 is closed as a special waste landfill, the site will be drained of free water and closed with a final cover constructed in accordance with *NDAC* Section 33-20-07.1-02, or as allowed by *NDAC* Section 33-20-07.1-01, Part 4.h., which permits the use of alternative engineered cover designs.

6.1.3 Final Surface Water Controls

Final surface water controls for Ash Pond 92 and Section 16 have been designed for a 100-year, 24-hour design storm event. The controls include terrace channels, down-chute channels, outlet channels, and hydraulic jump basins that have been developed to minimize erosion and control surface water runoff. Typical surface water control details are shown on Drawing 12. Final grades with the surface water plan are shown on Drawing 9.

The HEC-HMS software developed by the USACE was used to determine routing of surface runoff from the final cover system and peak flows that will occur in each runoff channel. Peak flows were used to size the channels and determine the required channel lining, based on the maximum velocity in the channels.

Based on the results from HEC-HMS, terrace channels will be grass-lined V-notch channels with outside slopes of 3H:1V, inside slopes ranging from 20H:1V to 4H:1V, and a depth of approximately 24 inches. The down-chute and outlet channels will be trapezoidal with 3H:1V side slopes, a 12- to 16-foot wide bottom, and a depth of 24 inches. These down-chute channels will be lined with articulated concrete block, such as Tri-Lock®. Special attention must be given to the installation of this lining to prevent the creation of erosion pathways at the interface between terrace channels and down-chute channels.

At the toe of the outlet channels, a hydraulic jump basin is required to dissipate energy when slopes ranging from 15 to 60 percent change to zero percent. The minimum hydraulic jump length ranges from 5 to 11 feet. The length of the hydraulic jump basin, 10 to 20 feet, will be approximately twice the minimum required hydraulic jump length. The hydraulic jump basin will be constructed of articulated concrete block, such as Tri-Lock®, or a concrete slab. Downstream from the hydraulic jump basin, existing grass-lined channels will convey water further from the site.

6.1.4 Cover Erosion

Cover erosion has been evaluated using the Revised Universal Soil Loss Equation (RUSLE) to determine the maximum slope lengths allowable for final cover at Ash Pond 92 and Section 16. Results from the RUSLE analysis indicate that the maximum side slope length between surface water control benches is approximately between 170 and 500 feet, depending upon the side slope. These slope lengths are controlled by the regulatory limits in soil loss after one year from placement of final cover. Surface water control benches for the final closure cover grades have been designed at intervals smaller than the allowable maximum intervals determined by the RUSLE analysis.

6.2 Cover Material Placement and Management

6.2.1 Routine (Concurrent Reclamation) Site Closure

The facility will be closed in accordance with NDAC 33-20-04.1-09-4 when CCP placement at the facility is completed. As the owner and operator, GRE will perform phased site closure when practical, placing soil cover as appropriate according to area size, elevation grades, and similar concerns. Figure 6-1 illustrates possible phased closure areas during the life of the facilities.

Construction of the final cover system over each phase or area will occur after placement operations are complete within each phase or area. The closure activities will include the application of the final cover and construction of surface water controls. A report indicating that closure was in compliance with the Closure Plan and signed by a North Dakota-registered Professional Engineer will be submitted to NDDH after the closure of the facility. This report will also be placed into the operating record of the Ash Pond 92/southwest Section 16 upstream raise and the southeast Section 16 special waste landfill.

6.2.2 Closure Notification & Certification

Notification and certification for the closure of the Ash Pond 92/southwest Section 16 upstream raise and the southeast Section 16 special waste landfill will include the following:

- Prior to final closure operations, submit written notification to the NDDH that the facility/facilities will be closing.
- Within 30 days after the date the facility receives its final volume of CCPs, CCS shall begin implementation of the closure plan unless an extension is granted by the NDDH in accordance with NDAC 33-20-04.1-05.
- Within 180 days from receipt of the final volume of CCPs, closure operations of each phase of the facility/facilities shall be completed in accordance with the closure plan, or if necessary, obtain an extension from the NDDH in accordance with NDAC 33-20-04.1-05.
- Following closure of each segment, submit a report certified by a Professional Engineer registered in the state of North Dakota verifying that closure has been completed in accordance with the approved closure plan. Place a copy of the report in the facilities' operating records.

6.2.3 Final Cover Components

The final cover system is described in detail in the engineering design of the permit application and is briefly discussed in this section.

At closure, the Ash Pond 92/southwest Section 16 upstream raise and southeast Section 16 will become a single special waste landfill. As practical, when a phase of the facility has been filled to final grade, the final cover will be placed over that area. Final cover of the facility will be constructed in accordance with *NDAC* Section 33-20-07.1-02, or as allowed by *NDAC* Section 33-20-07.1-01, Part 4.h., which permits the use of alternative engineered cover designs. In accordance with NDAC 33-20-07.1-01 and 33-20-07.1-02, the prescribed final cover consists of the following layers, listed from the top down:

- 6 inches of suitable plant growth material (SPGM),
- 12 inches of clay-rich, plant root zone soil,

- 18 inches of clay-rich, protective LPS material, and
- 24 inches of clay-rich LPS cap.

A North Dakota Registered Professional Engineer or a person working under their direct supervision will observe the placement of the final cover.

The surface of the final cover will be sloped up to 25 percent on the side slopes and at approximately 4 percent 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.). Drawings 10 through 12 show cross-sections depicting the liner, LHRSs, and final cover. The location and thickness of the final cover will be surveyed and made part of the operating record.

Closure and post-closure of the Ash Pond 92/southwest Section 16 upstream raise and the southeast Section 16 special waste landfill will be performed in accordance with NDAC 33-20-04.1-09.

6.2.4 Vegetation

Vegetation enhances evapotranspiration and reduces erosion, thus playing an important part in surface water control. Vegetation also provides wildlife habitat. Because the intended final land use following closure is wildlife habitat, vegetated areas at the site should provide a suitable habitat for native wildlife species. The Ash Pond 92/southern Section 16 final cover will be vegetated following construction to enhance erosion control and minimize infiltration, as well as provide habitat. Soil stockpiles left in place and other disturbed areas also will be vegetated following their completion or as operationally necessary. Vegetation activities will include preparing the soil surface, applying fertilizer if necessary, seeding, and mulching.

Preparation of the final cover soil surface for seeding will involve scarifying the soil to a depth of about 6 inches using a farm tractor and disc or chisel plow.

Perimeter channels will be prepared for seeding as they are constructed, and the final cover surface will be prepared for seeding after it is installed. Other disturbed areas will be prepared for seeding as operationally necessary. Whenever possible, seeding should be performed during the fall or spring to take advantage of optimum soil moisture and temperature conditions for seed during germination and establishment. If required, fertilizer will be applied uniformly according to specifications prior to ripping, seeding, and mulching.

Just prior to planting, the final cover should be prepared by as described above to leave a firm but friable seedbed. Planting may be accomplished by drilling, broadcasting, or hydroseeding. If a drill is used, seed depths will vary by species, but are generally in the range of 0.25- to 0.75-inch deep. If large and small seeds, legume seeds, or trashy seeds are included, a drill seeder equipped with separate seed boxes that can be calibrated to place the seed at the appropriate depth and agitators to ensure good mixing should be used. If seed is broadcast applied, the surface should be lightly scarified with a chain drag or walking with a dozer following seeding to cover the seed and provide good soil-to-seed contact.

A revegetation specialist, the local County Extension Agent, the North Dakota Department of Agriculture, and/or the local U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) office will be consulted for recommended strains, seed origins, and adaptability. The species should include a diverse mixture of native sod-forming and bunchgrasses and forbs and should also include legumes. Seed will be applied by the method and rate and during the dates recommended by the above groups.

Following seeding, the soil surface is susceptible to wind and water erosion until germination has occurred and seedlings have become established. Consequently, seeded surfaces will be mulched with certified noxious-weed-free straw at a rate of two tons/acre, and subsequently crimped in using a crimper pulled by a tractor or dozer. If hydraulic seeding methods are used, hydromulch should be applied at a rate of two tons/acre.

Seeded areas require close attention for early stand development. Weeds may be controlled by mowing or herbicide application. After early August, either mowing should be discontinued or grasses should be mowed high enough to avoid cutting the new grasses when they are developing their root system. Five years after vegetation has been established, mowing operations may not need to be performed.

If chemicals are used for weed control, they must be federally and locally registered. Application must be in strict accordance with authorized registered uses, label directions, and other federal or state requirements.

The soil survey and segregation of SPGM has changed since the original site characterization. The current topsoil stockpile for the cover over Ash Pond 92 and Section 16 is located immediately north of the River Water Holding Basin. Additional soil resources needed for these sites will be obtained from private sources or from The Falkirk Mining Company. GRE will coordinate with Falkirk to identify possible soil stockpiles during operations and closure of Ash Pond 92 and Section 16. Soil identified for use at these facilities may be used sparingly for other plant needs, if necessary.

7.0 POST-CLOSURE

7.1 Post-Closure Care and Maintenance Plan

Following closure, Ash Pond 92 and Section 16 will continue to be monitored and maintained. Post-closure care will include the following:

- Cover will be monitored for signs of erosion, settlement, and adequate vegetation. Cover maintenance will be performed as necessary.
- Unauthorized access to the site will continue to be prohibited via fencing, locking gates, restricted access, etc.
- Groundwater will continue to be monitored for 30 years following closure, in accordance with *NDAC* Section 33-20-04.1-09, Part 5.b.

If Ash Pond 91 is closed as a special waste landfill, post-closure care for the site will be consistent with that described for Ash Pond 92 and Section 16. Post-closure care is not required if Ash Pond 91 is closed as a surface impoundment in accordance with *NDAC* Section 33-20-08.1-02, Part 1 (also see *NDAC* 33-20-04.1-09, Part 5).

CCS will conduct post-closure care in accordance with NDAC 33-20-04.1-5. The liner and LHRS, final cover, surface water controls, groundwater monitoring system, landscaping, and access controls (gate(s) and fencing) will be maintained throughout the post-closure period. Post-closure care will occur for at least 30 years immediately following the closure of the facility to ensure that the facility does not endanger human health or the environment.

Post-closure property uses will be conducted such that the final cover, liner, or other engineered components of the facilities will not be disturbed, unless the disturbance will not endanger human health or the environment and is approved by the NDDH.

Following the post-closure care period, CCS will notify the NDDH and have a certification prepared by a North Dakota-registered professional engineer verifying that post-closure care has been completed in accordance with this document. This certification will be placed into the operating record.

Any inquiries concerning the facility during the post-closure period should be directed to:

Great River Energy
Coal Creek Station
2875 Third Street SW
Underwood, North Dakota 58576
(701) 442-3211

Great River Energy
17845 East Highway 10
Elk River, Minnesota 55330
(763) 441-3121

The following sections describe the post-closure review and monitoring activities, as required by NDAC 33-20-04.1-09-5.

7.2 Facility Review

During the post-closure period, annual reviews of the facility will be made in the spring. These reviews will be conducted with the aim of ensuring that the liner, LHRS, final cover, surface water features, landscaping, and access controls are functioning as designed during the post-closure period. The final cover will be reviewed by visual examination for signs of excessive settlement, seepage, and erosion gullies.

The annual reviews will include the following checklist items:

- the final cover will be examined and repairs and revegetation will occur for any damage due to erosion, settlement, and subsidence,
- any evidence of damage to the liner and LHRS will be noted,
- mowing in spring or fall,
- woody growths to be removed,
- groundwater monitoring wells will be examined and repaired as required,
- surface water features will be repaired, if necessary, and cleared of debris so that flow is not impeded, and,
- any perimeter fencing will be repaired, as required, to prevent unauthorized access to the facility.

All repairs will be made in accordance with this document and any accompanying CQA requirements.

7.3 Post-Closure Monitoring

7.3.1 Groundwater Monitoring

During post-closure, groundwater monitoring will be conducted in accordance with the GWMP in effect at the time of closure, unless/or until an alternative plan is submitted to and approved by NDDH. The groundwater monitoring network will be maintained throughout the post-closure period. If groundwater impact does occur during the post-closure period of the facility, NDDH will be notified and appropriate actions taken, and the actions taken placed in the operating record. The results of monitoring will be placed into the operating record and submitted to NDDH. Groundwater will continue to be monitored for 30 years following closure, in accordance with *NDAC* Section 33-20-04.1-09, Part 5.b.

7.3.2 Post-Closure Sump Operations

Water collected from the southeast Section 16 sump and the Ash Pond 92 and southwest Section 16 LHRS sumps is expected to be minimal during the post-closure period. After closure, water from the southeast Section 16 sump will gravity flow into the evaporation pond just north of the sump. If required, a pump may be placed in the sump's riser and water pumped to an alternative location. The southeast Section 16 sump and evaporation pond will be reviewed and maintained during the post-closure period.

After closure of the Ash Pond 92 and southwest Section 16 upstream raise, water will be pumped from the LHRS sumps to Ash Pond 91. As less water reports to the LHRS sumps, instrumentation will be installed so that pumps are only activated if an elevated head exists within the pumps and stop when a lower head is reached. Pumps and associated electrical equipment will be maintained as specified by the manufacturer.

8.0 RECORDKEEPING AND REPORTING

8.1 Recordkeeping and Reporting

8.1.1 Operating Record

CCS will comply with the recordkeeping requirements of NDAC Section 33-20-04.1-04. These regulations currently require special waste landfills to maintain an operating record that must include, at a minimum, the following:

- Permit preapplication, if applicable,
- Permit application,
- Amended permit application, if applicable,
- Permit issued by the NDDH and any modifications,
- Site characterization,
- Any site demonstrations,
- Documentation of training,
- Plan of operations,
- Facility inspection logs,
- Records of notice,
- As-built drawings and certifications showing the topography, pertinent design features, extent of CCPs, and other appropriate information,
- Groundwater monitoring plan, monitoring data, and statistical interpretations,
- Records of the weight or volume of CCPs,
- Closure plan,
- Post-closure plan,
- Financial assurance instruments for closure and post-closure,
- Annual reports, and

- Notices of intent to close and completion of post-closure.

NDAC Section 33-20-04.1-04 also requires that any deviations from this section, the permit, or the facility plans must be included in the operating record. Information will be furnished upon request at reasonable times to NDDH representatives.

8.1.2 Annual Report

In addition to maintaining the operating record, CCS prepares annual reports for the Ash Pond 92/southwest Section 16 surface impoundment and the southeast Section 16 special waste landfill. In accordance with NDAC Section 33-20-04.1-04, annual reports include, but are not limited to, the following information:

- The name and address of the facility,
- The calendar period covered by the report,
- Annual quantity for each category of CCPs in tons or volume,
- Identification of occurrences and conditions that prevented compliance with the permit and the *NDAC*, Article 33-20, and
- Other items identified in the facility plans and permit.

Annual reports are submitted by GRE to the NDDH by the first day in March each year.

8.1.3 Additional Records

Additional records pertaining to the day-to-day operation of the CCP placement areas will also be kept at the CCS office. As a minimum, these records will include the following items:

- Major operational problems, complaints, or difficulties,
- Vector control efforts, and
- Dust and litter control efforts.

8.1.4 Access and Dispersement of Facility Records

Information contained in the operating record will be furnished upon request to NDDH or made available at any reasonable time for review. NDDH files pertaining to CCP facilities and related activities will be open to the public and will be available according to the North Dakota Open Records Act.

Copies of reports and the entire operating record will be maintained in at CCS. In addition, copies of reports, plans, specifications, and portions of the operating record that pertain to the daily operation of the Ash Pond 92/southwest Section 16 surface impoundment and the southeast Section 16 special waste landfill will be maintained at CCS.

At a minimum, recordkeeping will be performed and the operating records maintained on site or at a NDDH-approved location near the site within North Dakota during the life of the facilities. Post-closure recordkeeping will continue during the 30-year post-closure period as described in NDAC 33-20-04.1-09.

9.0 REFERENCES

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FIGURES

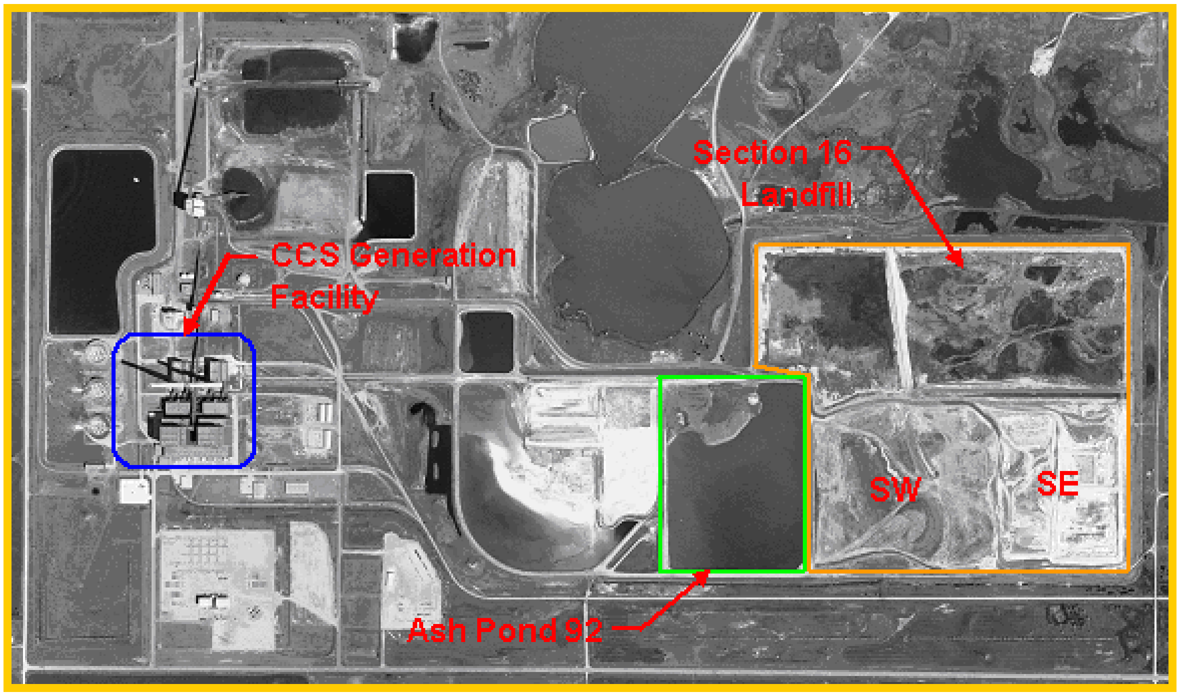


Figure 1-1: Aerial Photograph of Coal Creek Station (July 2001)

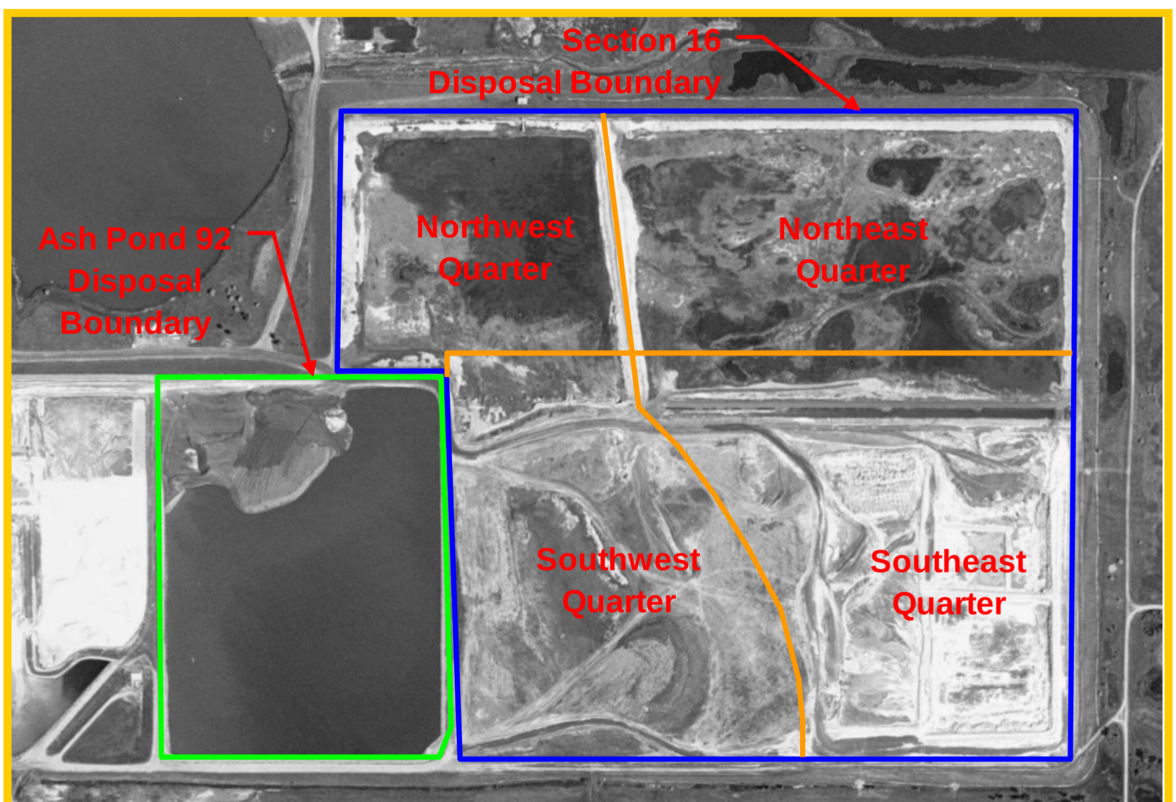
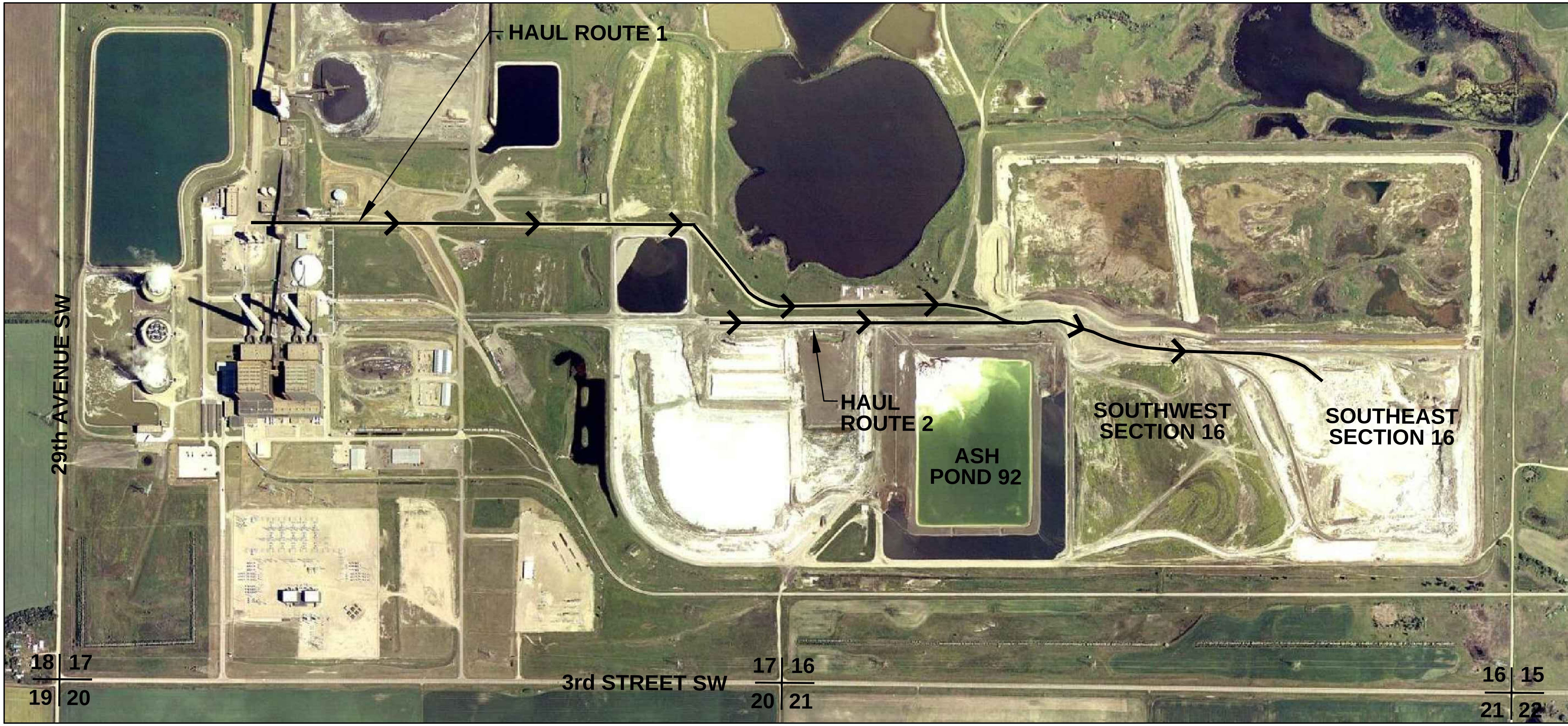


Figure 1-2: Placement Boundaries for Ash Pond 92 and Section 16 (July 2001)



REFERENCE

1. AERIAL PHOTOGRAPH PROVIDED TO GOLDER ASSOCIATES, INC. BY THE FALKIRK MINING COMPANY.
2. AERIAL PHOTOGRAPH FLOWN ON JUNE 30, 2003.
3. SP-033 PERMIT AREA LOCATED IN TOWNSHIP 145N, RANGE 82W.

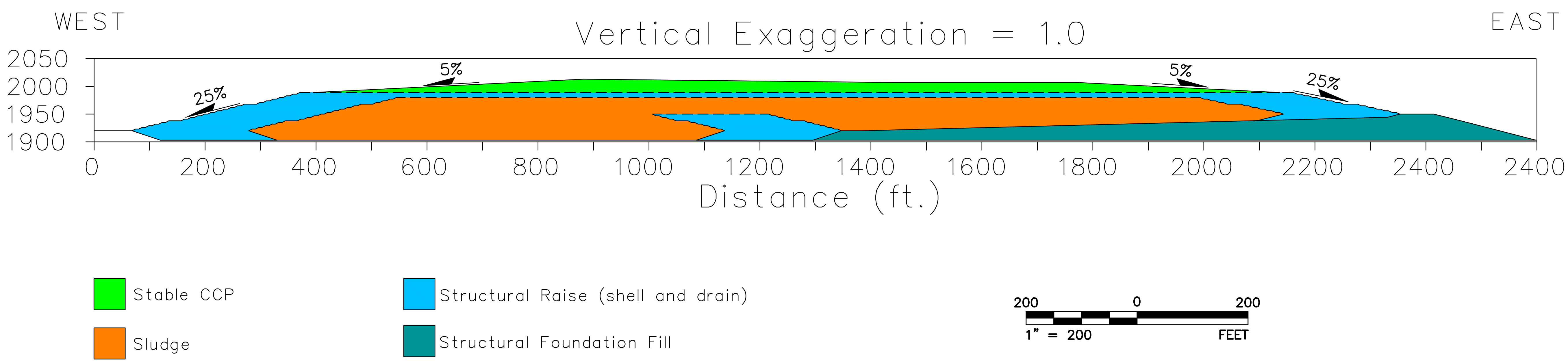
600 0 600 1200
1" = 600' Feet

Golder Associates
Denver, Colorado

FIGURE 2-1
PERMIT SP-033 HAUL ROUTES

SCALE 1" = 600'

PROJECT No. 023-2409 FILE No. 0232409A013.dwg CADD RLB DATE 5/27/03

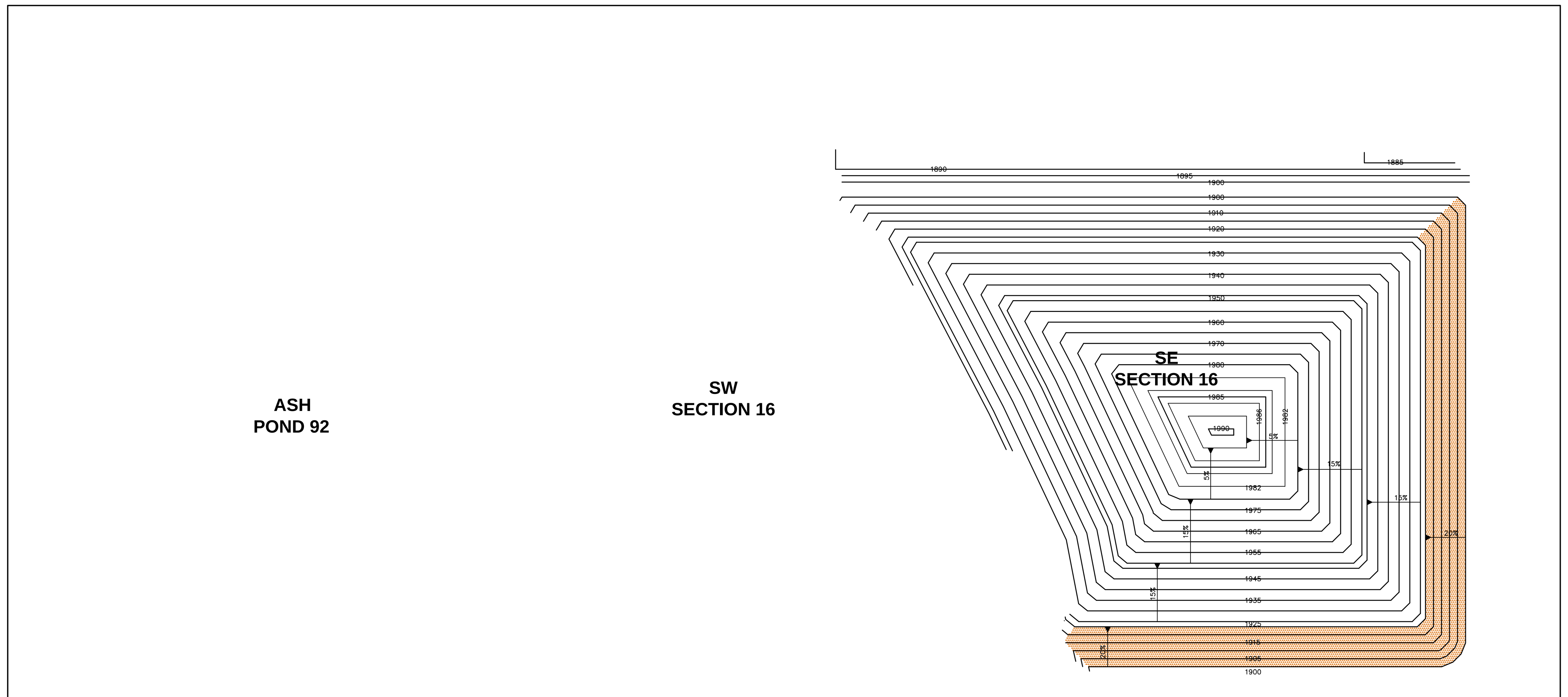


FINAL CROSS SECTION OF THE UPSTREAM RAISE

FIGURE 5-1

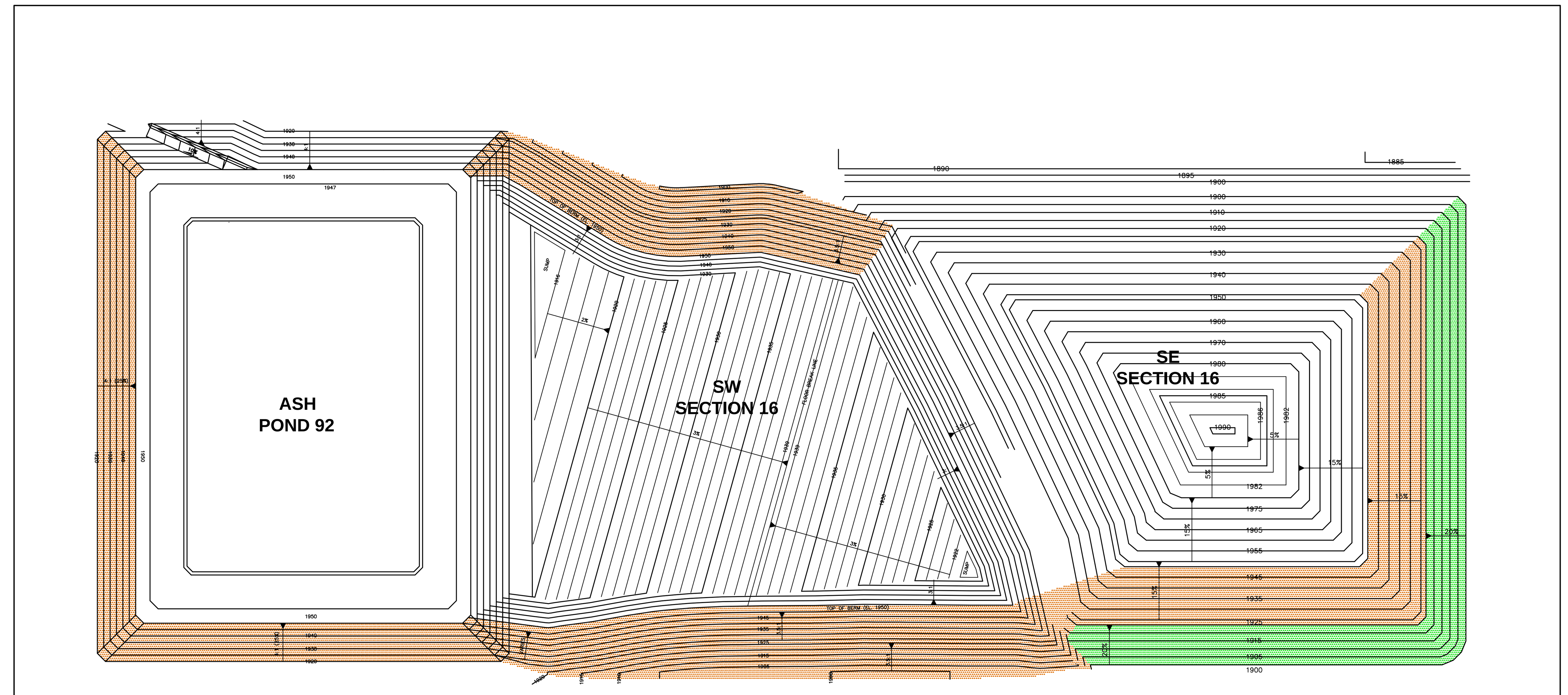
Golder Associates
Denver, Colorado

PROJECT No. 023-2409 FILE No. Raise Xsec.dwg CADD TJS DATE 06/04/03



SE SECTION 16
PLACE COVER ON SOUTH AND EAST SIDES UP TO FIRST SURFACE WATER CONTROL BENCH (EL. 1925)

1/6.1 CONCURRENT RECLAMATION - STAGE 1
SCALE: 1"=300'

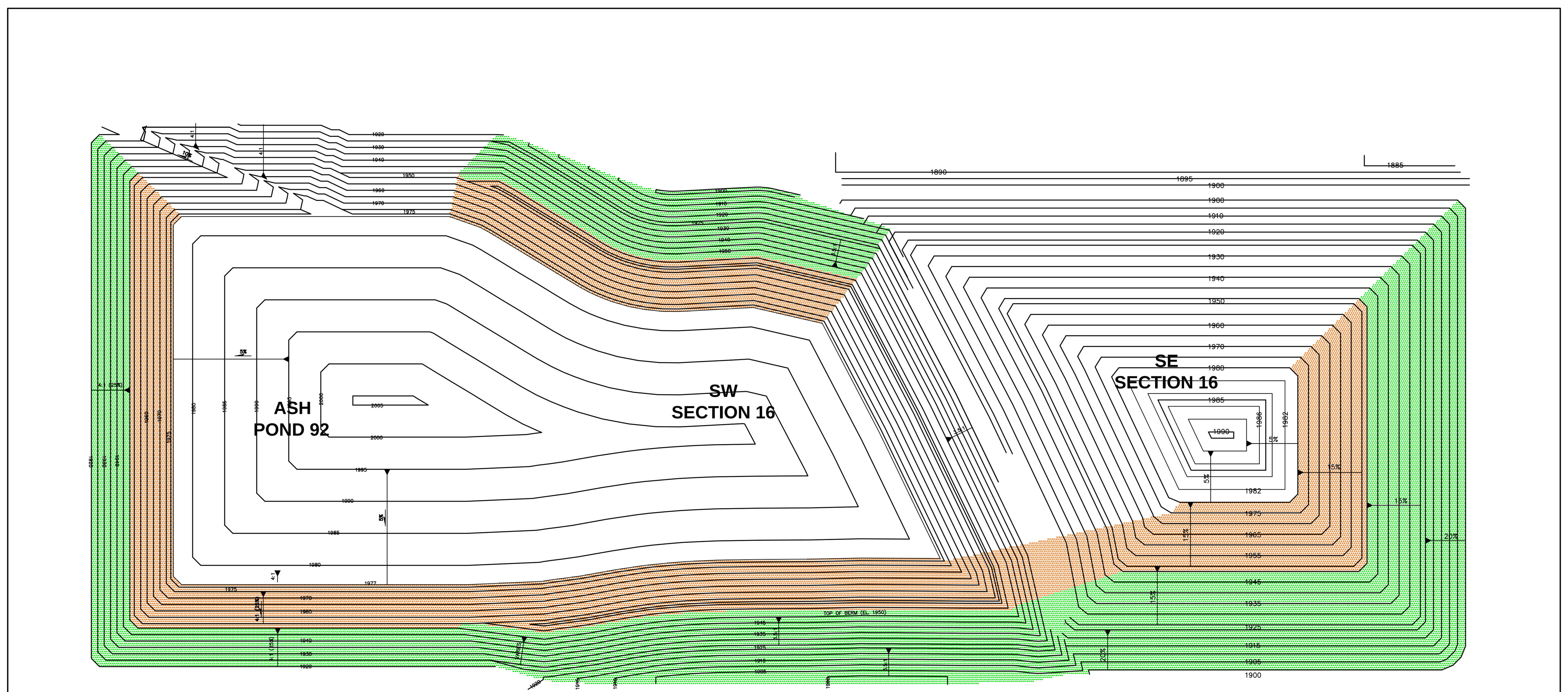


ASH POND 92
PLACE COVER ON SOUTH AND WEST SIDES UP TO FIRST SURFACE WATER CONTROL BENCH (EL. 1950)

SW SECTION 16
NORTH AND SOUTH CONTAINMENT DIKES WILL BE CONSTRUCTED WITH SOIL COVER (EL. 1950)

SE SECTION 16
PLACE COVER ON SOUTH AND EST SIDES UP TO SECOND SURFACE WATER CONTROL BENCH (EL. 1950)

2/6.1 CONCURRENT RECLAMATION - STAGE 2
SCALE: 1"=300'

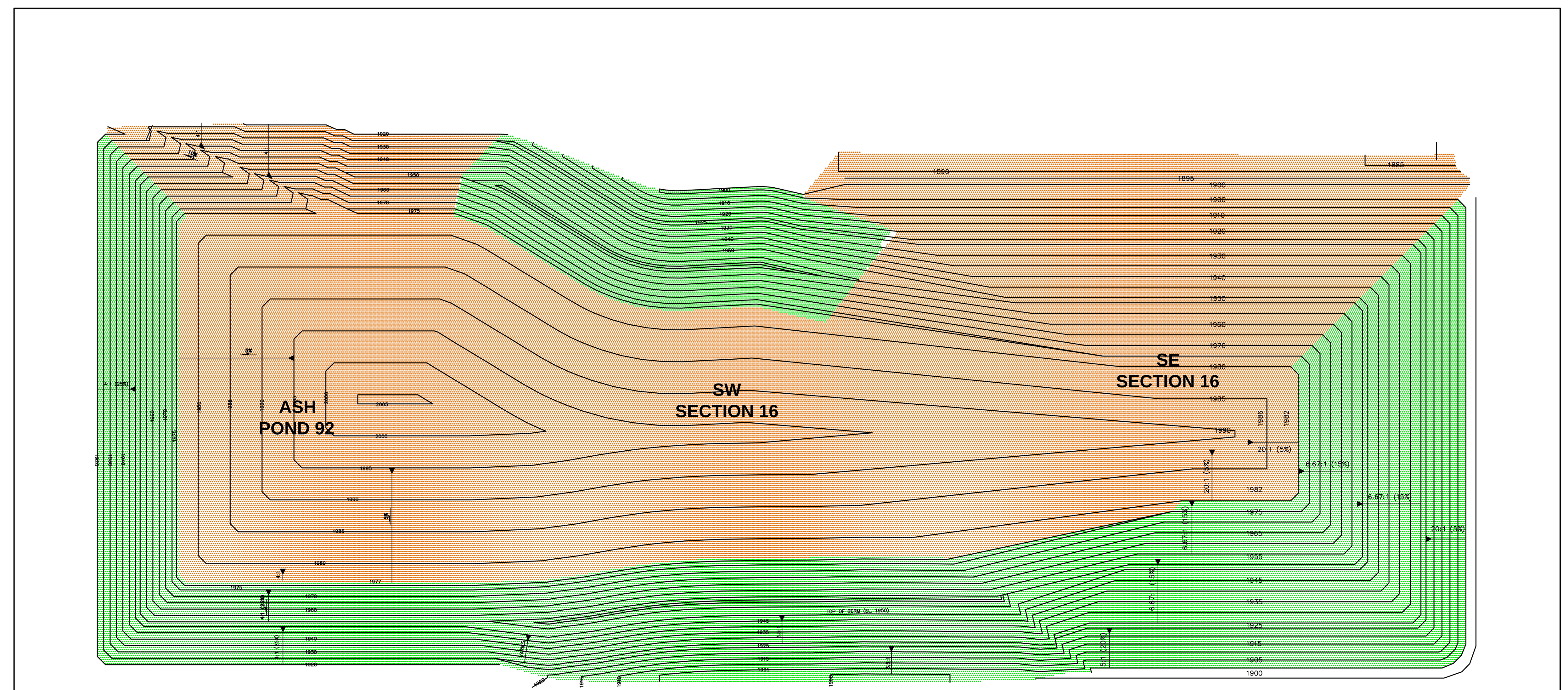


ASH POND 92
PLACE COVER ON SOUTH AND WEST SIDES UP TO SECOND SURFACE WATER CONTROL BENCH (EL. 1975)

SW SECTION 16
PLACE COVER ON NORTH AND SOUTH SIDES UP TO FIRST SURFACE WATER CONTROL BENCH (EL. 1975)

SE SECTION 16
PLACE COVER ON SOUTH AND EST SIDES UP TO SLOPE CROWN (EL. 1980)

3/6.1 CONCURRENT RECLAMATION - STAGE 3
SCALE: 1"=300'



ALL SITES
REMAINING AREA (TOP AND NORTH SIDES) COVERED AS FACILITY REACHES FINAL GRADES AND IS CLOSED

4/6.1 CONCURRENT RECLAMATION - STAGE 4
SCALE: 1"=300'

NOTES
1. THE CONCURRENT RECLAMATION STAGES SHOWN ARE ONLY CONCEPTUAL.

2. IN GENERAL, CONCURRENT RECLAMATION WILL OCCUR WHEN FINISHED SLOPES REACH THE ELEVATION OF THE NEXT SURFACE WATER BENCH. THIS ALLOWS FOR THE SEPARATION OF CLEAN WATER AND CONTACT WATER AT THE SURFACE WATER BENCH.

Golder Associates
Denver, Colorado

GREAT RIVER ENERGY
COAL CREEK STATION
UNDERWOOD, ND

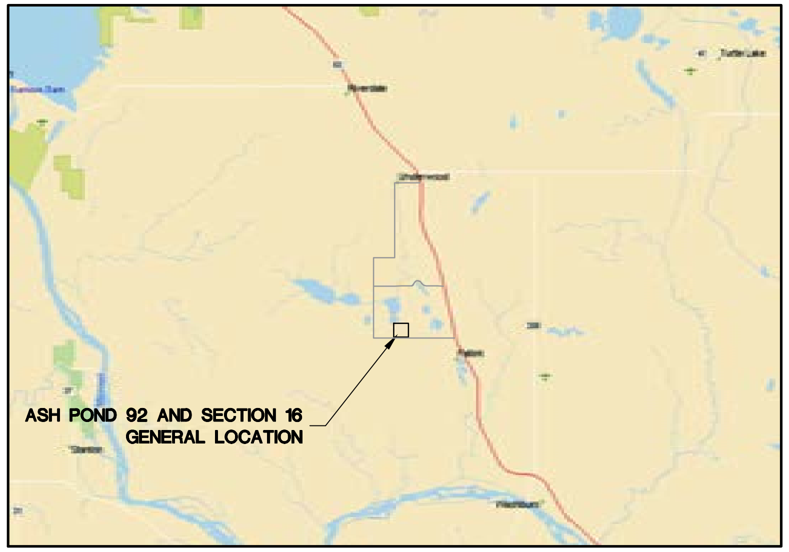
POTENTIAL LOCATIONS/SEQUENCING FOR CONCURRENT RECLAMATION

FIGURE 6-1

PROJECT No. 043-2226 CADD TJS DATE 07/01/04 FILE No. 0432226A003.dwg

DRAWINGS

PERMIT NO. SP-033
PERMIT MODIFICATION



Prepared for:

GREAT RIVER ENERGY

Coal Creek Station
Underwood, North Dakota

Prepared by:

Golder Associates Inc.
44 Union Boulevard, Suite 300
Lakewood, Colorado USA 80228

GOLDER DRAWING NO.	TITLE	REVISION NO.
1	TITLE SHEET	C
2	CURRENT CONDITIONS	C
3	GENERAL SITE PHASES	C
4	PHASE 1: ASH POND 92 RAISE	C
5	PHASE 2: SW SECTION 16 INTERMEDIATE LINER/CAP	C
6	PHASE 3: ASH POND 92 & SW SECTION 16 RAISE	C
7	PHASE 4: SE SECTION 16 LANDFILL	C
8	FINAL WASTE GRADES	C
9	FINAL COVER GRADES & SURFACE WATER PLAN	C
10	CROSS SECTIONS	C
11	DETAIL SHEET 1	C
12	DETAIL SHEET 2	C
13	DETAIL SHEET 3	A
Foth & Van Dyke 1989 Operations Plan	**TITLE**	**DATE**
A-2	EXISTING CONDITIONS	1-18-89
A-3	SITE SEQUENCING	1-18-89
A-5	BASE GRADES	1-18-89
A-11	FINAL GRADES	1-18-89

ENGINEER'S STAMP

REFERENCE DRAWINGS

NO.	REVISION DESCRIPTION (THIS DRAWING IS NOT APPROVED UNLESS LAST REVISION IS HAND WRITTEN)	DATE	BY	CHKD	AP'VD
C	ISSUED FOR DRAFT REVISED PERMIT MODIFICATION	07/09/04			
B	ISSUED FOR PERMIT MODIFICATION	09/24/03	TJS	RRJ	RRJ
A	ISSUED FOR CLIENT REVIEW	06/04/03	TJS	–	RRJ

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DATE
FOR
REVISED
CLIENT
FIELD

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

TITLE
TITLE SHEET

Golder Associates
Denver, Colorado

PROJECT No.		023-2411
DESIGN	TJS	04/29/03
CADD	TJS	04/29/03
CHECK	RRJ	06/02/03
REVIEW	RRJ	06/02/03

FILE No. 0232411A016
SCALE N.T.S. REV. C

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Last Plot: Dec 30, 2010 10:41 By: CSchuettpelz
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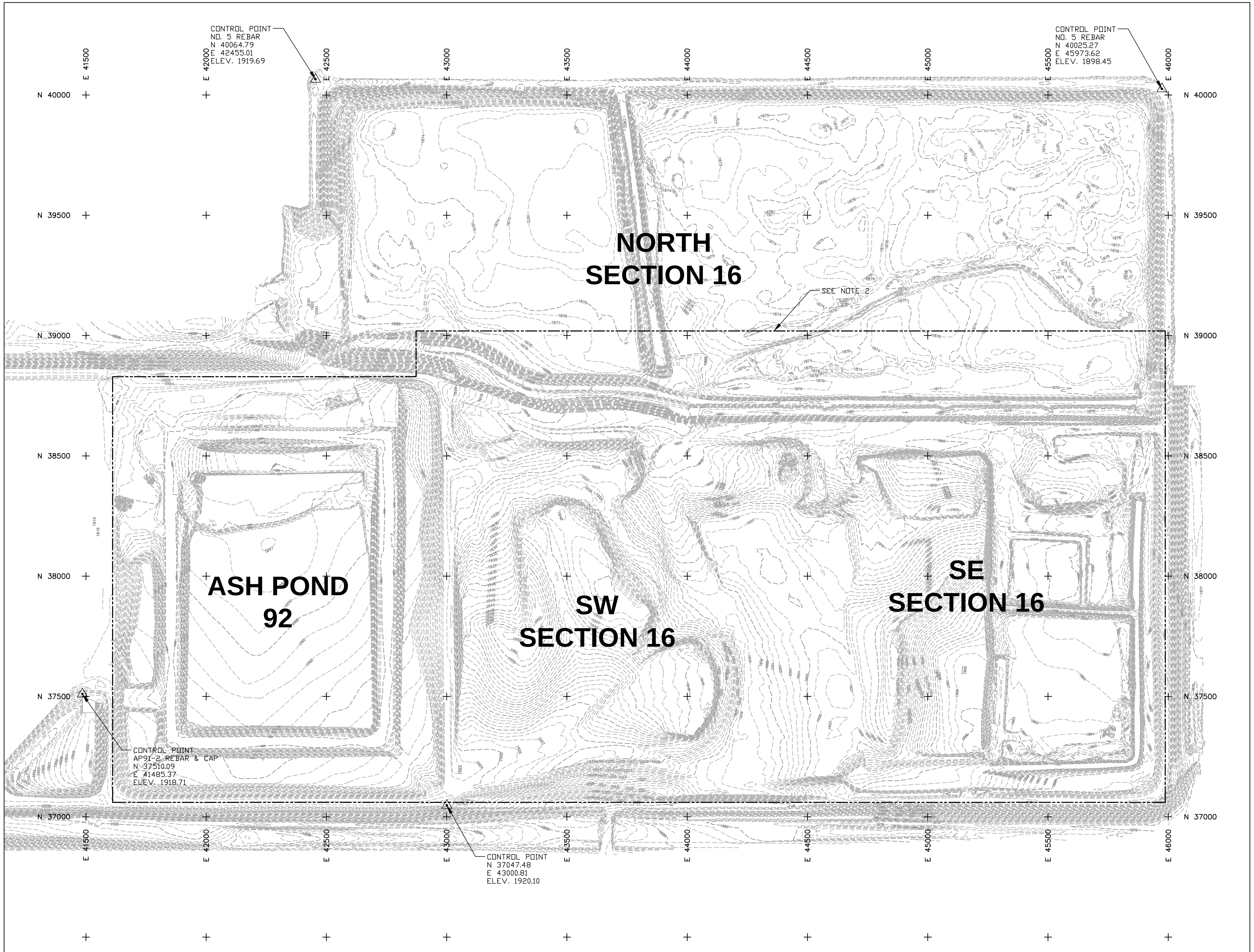

LEGEND

EXISTING GROUND TOPOGRAPHY (SEE REFERENCES)

PROPOSED LIMIT OF CCP PLACEMENT

NOTES

1. GRADES SHOWN REPRESENT RECENT GROUND TOPOGRAPHY CONDITIONS.
2. PROPOSED LIMIT FOR CCP PLACEMENT IS APPROXIMATE.

REGULATORY DESIGN BASIS

1. CONTROL OF RUN–ON AND RUN–OFF DURING OPERATIONS FROM A TWENTY–FIVE–YEAR, TWENTY–FOUR–HOUR STORM EVENT (3.75"), PER SUBDIVISION A OF SUBSECTION 3 OF NDAC SECTION 33–20–04.1–09.
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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 BY INTERSTATE ENGINEERING AND KADRMAS, LEE & JACKSON BETWEEN 1996 AND 2003.
3. ELEVATIONS BASED ON MEAN SEA LEVEL DATUM, CONTOUR INTERVAL IS ONE FOOT.
4. HORIZONTAL DATUM BASED ON NORTH DAKOTA STATE PLANE COORDINATE SYSTEM AS FOLLOWS:

   SITE GRID N = N STATE PLANE COORDINATE MINUS 100,000
   SITE GRID E = E STATE PLANE COORDINATE MINUS 1,800,000
5. ALL PROPERTY SHOWN ON THIS MAP IS OPERATED BY GREAT RIVER ENERGY.

200 0 200
1" = 200 FEET

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

TITLE
CURRENT CONDITIONS

ENGINEER'S STAMP

REFERENCE DRAWINGS

NO.	REVISION DESCRIPTION (THIS DRAWING IS NOT APPROVED UNLESS LAST REVISION IS HAND WRITTEN)	DATE	BY	CHKD	AP'VD
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B	ISSUED FOR PERMIT MODIFICATION	09/24/03	TJS	RRJ	RRJ
A	ISSUED FOR CLIENT REVIEW	06/04/03	TJS	–	RRJ

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FOR
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FIELD

Golder Associates
Denver, Colorado

PROJECT No.		023–2411
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CADD	TJS	04/29/03
CHECK	RRJ	06/02/03
REVIEW	RRJ	06/02/03

FILE No. 0232411A017
SCALE AS SHOWN
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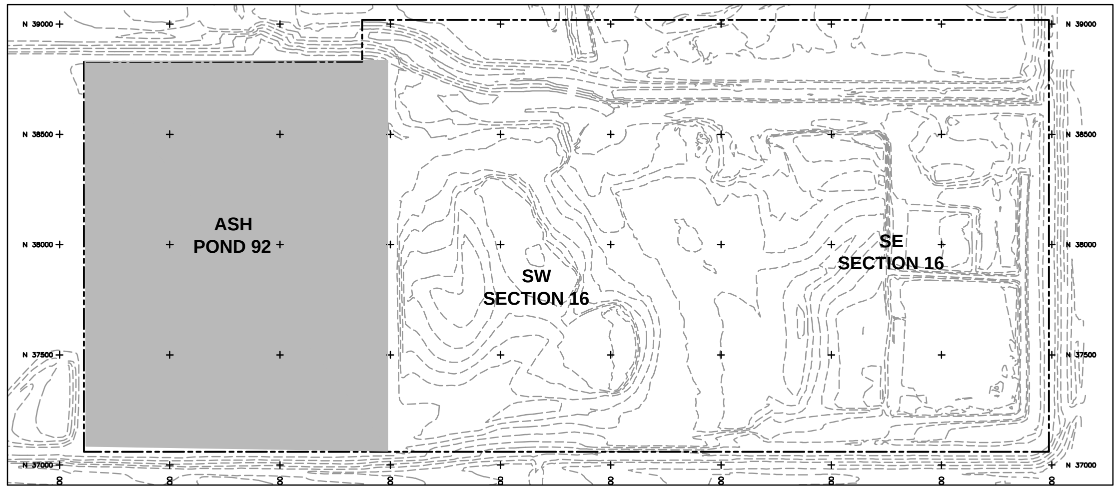
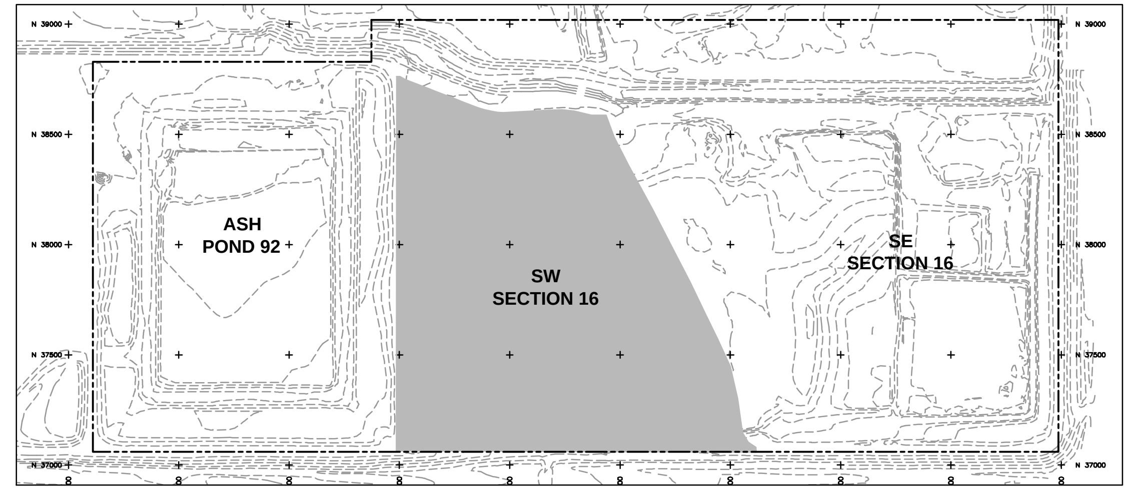


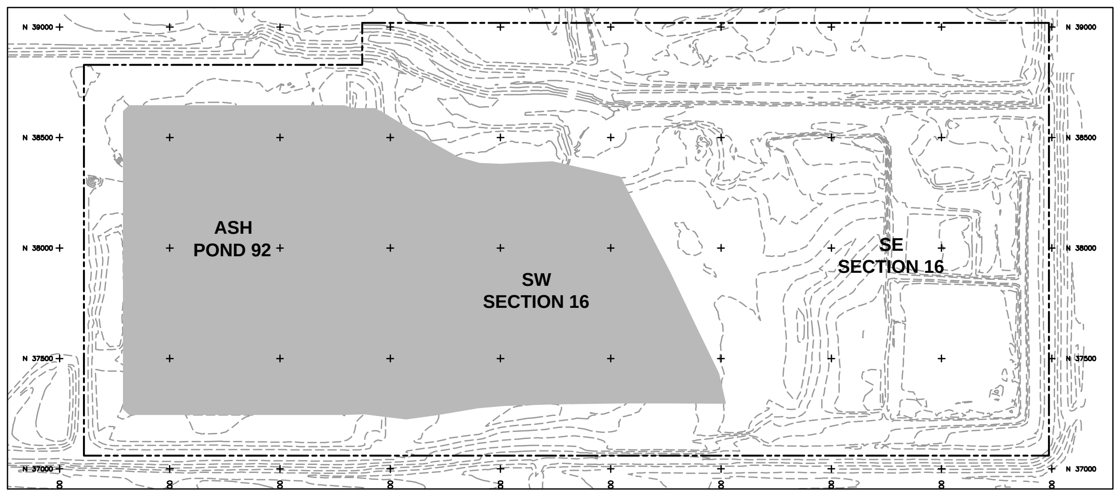
1 PHASE 1: ASH POND 92 RAISE

SEE DRAWING 4 FOR GRADING PLAN



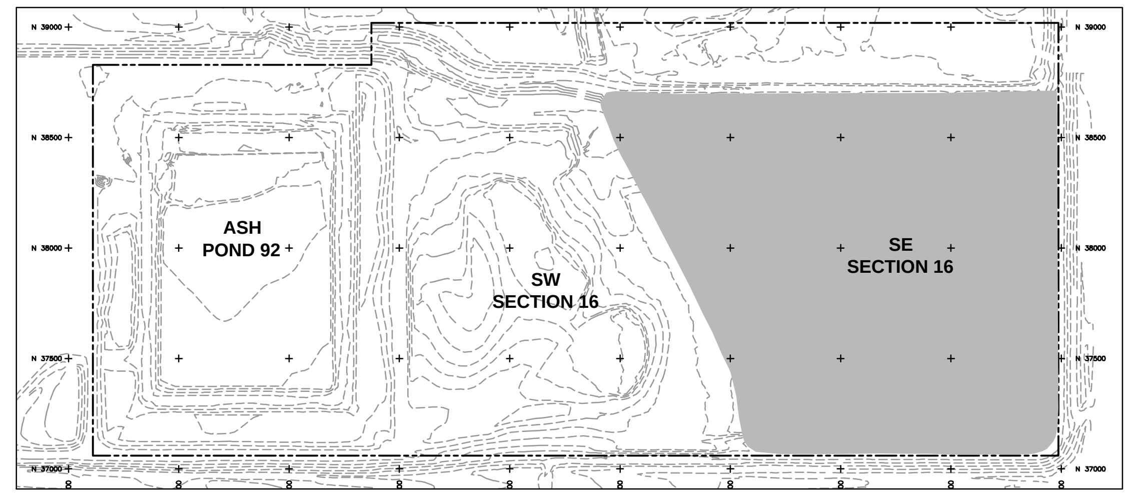
2 PHASE 2: SW SECTION 16 INTERMEDIATE LINER/CAP

SEE DRAWING 5 FOR GRADING PLAN



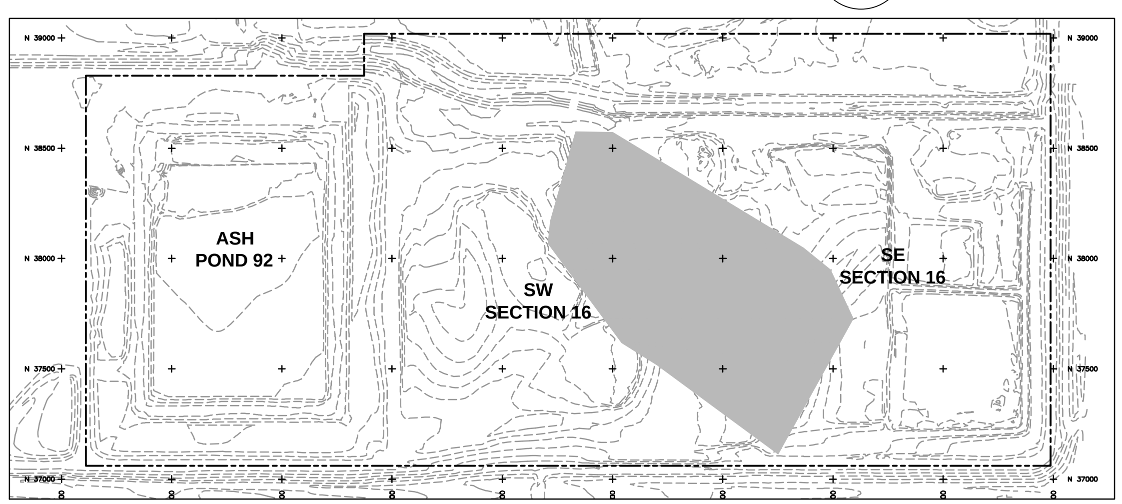
3 PHASE 3: ASH POND 92 & SW SECTION 16 RAISE

SEE DRAWING 6 FOR GRADING PLAN



4 PHASE 4: SE SECTION 16 LANDFILL

SEE DRAWING 7 FOR GRADING PLAN



5 PHASE 5: SW & SE SECTION 16 VALLEY

SEE DRAWING 8 FOR GRADING PLAN

LEGEND

- EXISTING GROUND TOPOGRAPHY (SEE REFERENCES)
- PROPOSED LIMIT OF CCP PLACEMENT
- APPROXIMATE AREA OF PHASE

NOTES

1. GRADES SHOWN REPRESENT RECENT GROUND TOPOGRAPHY CONDITIONS.
2. PROPOSED LIMIT FOR CCP PLACEMENT IS APPROXIMATE.
3. PHASES DO NOT NECESSARILY OCCUR IN SEQUENTIAL ORDER FROM 1 TO 5, AND MAY OCCUR CONCURRENTLY.

REGULATORY DESIGN BASIS

1. CONTROL OF RUN–ON AND RUN–OFF DURING OPERATIONS FROM A TWENTY–FIVE–YEAR, TWENTY–FOUR–HOUR STORM EVENT (3.75"), PER SUBDIVISION A OF SUBSECTION 3 OF NDAC SECTION 33–20–04.1–09.
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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.
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   SITE GRID N = N STATE PLANE COORDINATE MINUS 100,000
   SITE GRID E = E STATE PLANE COORDINATE MINUS 1,800,000
5. ALL PROPERTY SHOWN ON THIS MAP IS OPERATED BY GREAT RIVER ENERGY.

400 0 400
1" = 400 FEET

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

TITLE
GENERAL SITE PHASES

NO.	REVISION DESCRIPTION (THIS DRAWING IS NOT APPROVED UNLESS LAST REVISION IS HAND WRITTEN)	DATE	BY	CHKD	AP'VD
C	ISSUED FOR DRAFT REVISED PERMIT MODIFICATION	07/09/04			
B	ISSUED FOR PERMIT MODIFICATION	09/24/03	TJS	RRJ	RRJ
A	ISSUED FOR CLIENT REVIEW	06/04/03	TJS	–	RRJ

ENGINEER'S STAMP

REFERENCE DRAWINGS

PRINT ISSUE RECORD: DATE / FOR / REVISED / CLIENT / FIELD

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Denver, Colorado

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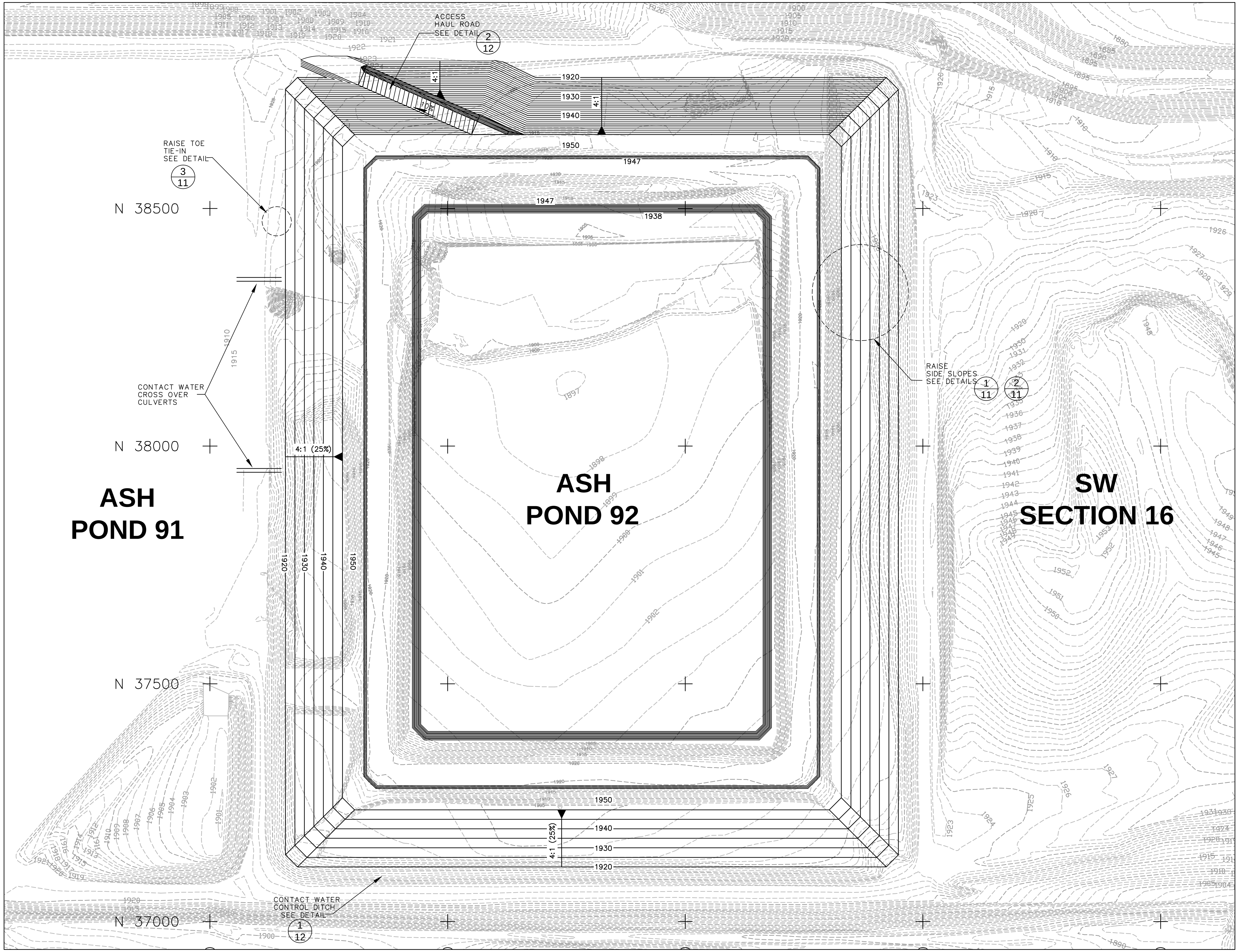

LEGEND

EXISTING GROUND TOPOGRAPHY (SEE REFERENCES)

PROPOSED TOP OF WASTE TOPOGRAPHY

NOTES

1. GRADES SHOWN REPRESENT TOP OF WASTE.
2. OVERALL RAISE SIDE SLOPE GEOMETRY IS 4H:1V (25%).
3. CONTACT WATER WILL BE CONTAINED IN A TEMPORARY PERIMETER DITCH AND WILL BE DIRECTED TO ASH POND 91 OR INTO THE UPSTREAM RAISE.

REGULATORY DESIGN BASIS

1. CONTROL OF RUN-ON AND RUN-OFF DURING OPERATIONS FROM A TWENTY-FIVE-YEAR, TWENTY-FOUR-HOUR STORM EVENT (3.75"), PER SUBDIVISION A OF SUBSECTION 3 OF NDAC SECTION 33-20-04.1-09.
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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.

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   SITE GRID N = N STATE PLANE COORDINATE MINUS 100,000
   SITE GRID E = E STATE PLANE COORDINATE MINUS 1,800,000

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

100 0 100
1" = 100 FEET

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

TITLE
PHASE 1: ASH POND 92 RAISE

Golder Associates
Denver, Colorado

PROJECT No.		023-2411	FILE No. 0232411A019
DESIGN	TJS	05/01/03	SCALE AS SHOWN REV. C
CADD	TJS	05/01/03	4
CHECK	RRJ	06/02/03	
REVIEW	RRJ	06/02/03	

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REFERENCE DRAWINGS

NO.	REVISION DESCRIPTION (THIS DRAWING IS NOT APPROVED UNLESS LAST REVISION IS HAND WRITTEN)	DATE	BY	CHKD	AP'VD
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A	ISSUED FOR CLIENT REVIEW	06/04/03	TJS	–	RRJ

PRINT ISSUE RECORD

DATE
FOR
REVISED
CLIENT
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Last Update: Aug 12, 2004 08:26 By:
Last Plot: Dec 30, 2010 10:52 By: CSchuettpelz
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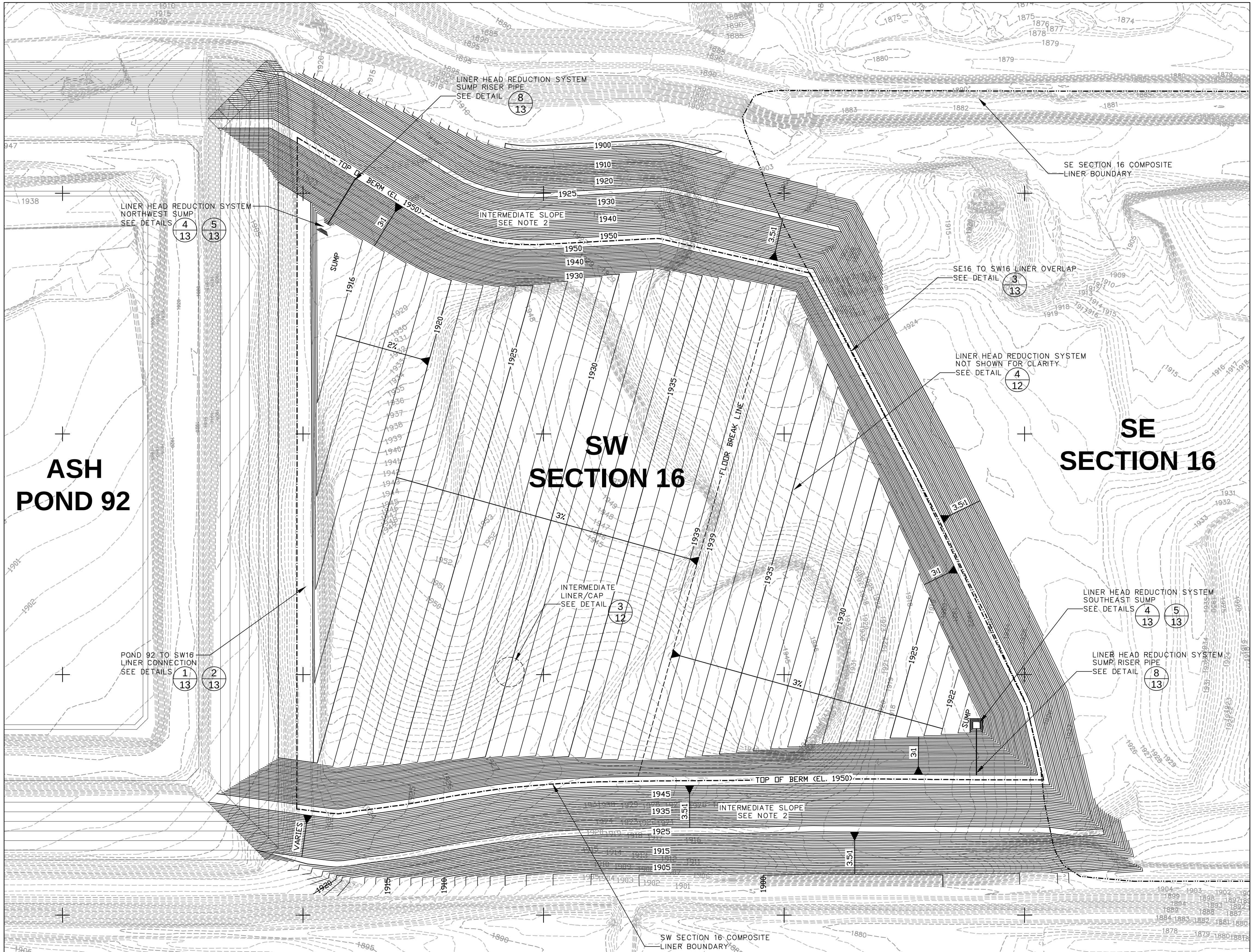

LEGEND

EXISTING GROUND TOPOGRAPHY (SEE REFERENCES)

PREVIOUS PHASE PROPOSED TOPOGRAPHY

PROPOSED CONSTRUCTION TOPOGRAPHY

SW SECTION 16 COMPOSITE LINER BOUNDARY

SE SECTION 16 COMPOSITE LINER BOUNDARY

NOTES

1. SW SECTION 16 GRADES REPRESENT TOP OF CLAY LINER/SOIL DIKE.
2. SW SECTION 16 CONTAINMENT DIKE SLOPES ARE INTERMEDIATE SLOPES AT 3.5H:1V. FINAL CLOSURE SLOPES WILL BE GRADED TO 4H:1V.

REGULATORY DESIGN BASIS

1. CONTROL OF RUN-ON AND RUN-OFF DURING OPERATIONS FROM A TWENTY-FIVE-YEAR, TWENTY-FOUR-HOUR STORM EVENT (3.75"), PER SUBDIVISION A OF SUBSECTION 3 OF NDAC SECTION 33-20-04.1-09.
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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

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2. EXISTING GROUND TOPOGRAPHY PROVIDED BY GREAT RIVER ENERGY. PERFORMED BY INTERSTATE ENGINEERING AND KADRMAS, LEE & JACKSON BETWEEN 1996 AND 2003.
3. ELEVATIONS BASED ON MEAN SEA LEVEL DATUM, CONTOUR INTERVAL IS ONE FOOT.
4. HORIZONTAL DATUM BASED ON NORTH DAKOTA STATE PLANE COORDINATE SYSTEM AS FOLLOWS:

   SITE GRID N = N STATE PLANE COORDINATE MINUS 100,000
   SITE GRID E = E STATE PLANE COORDINATE MINUS 1,800,000

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

100 0 100
1" = 100 FEET

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

TITLE
PHASE 2: SW SECTION 16 INTERMEDIATE LINER/CAP

ENGINEER'S STAMP	REFERENCE DRAWINGS	NO.	REVISION DESCRIPTION (THIS DRAWING IS NOT APPROVED UNLESS LAST REVISION IS HAND WRITTEN)	DATE	BY	CHKD	AP'VD
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		B	ISSUED FOR PERMIT MODIFICATION	09/24/03	TJS	RRJ	RRJ
		A	ISSUED FOR CLIENT REVIEW	06/04/03	TJS	–	RRJ

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Golder Associates
Denver, Colorado

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REVIEW	RRJ	06/02/03	

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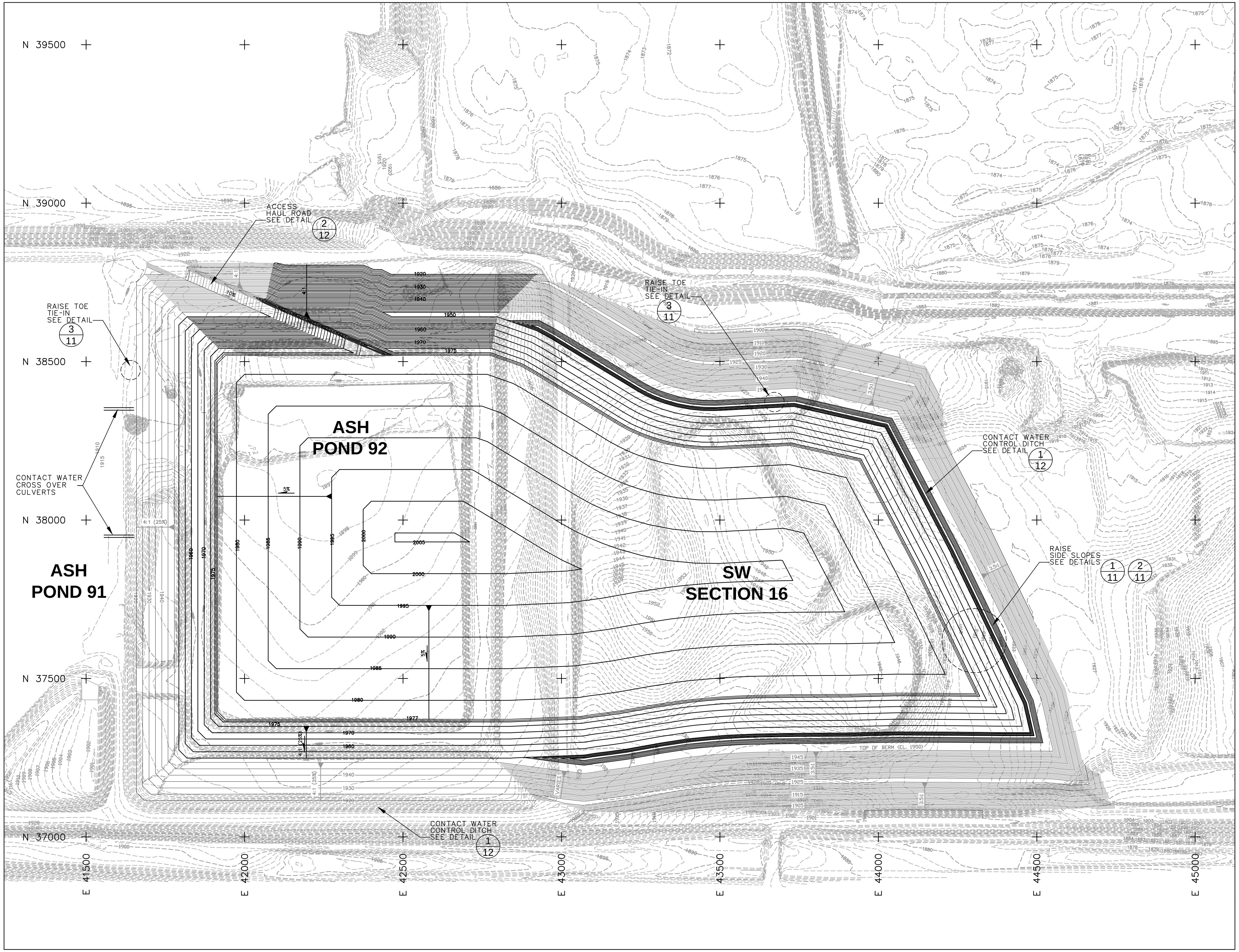

LEGEND

- EXISTING GROUND TOPOGRAPHY (SEE REFERENCES)
- PREVIOUS PHASE PROPOSED TOPOGRAPHY
- PROPOSED TOP OF CCP TOPOGRAPHY

NOTES

1. GRADES REPRESENT TOP OF WASTE/SOIL DIKE.
2. CONTACT WATER COLLECTED IN DITCH AROUND ASH POND 92 AND SW SECTION 16. WATER IS DIRECTED THROUGH CULVERT TO ASH POND 91 OR DOWNWARD INTO UPSTREAM RAISE.

REGULATORY DESIGN BASIS

1. CONTROL OF RUN-ON AND RUN-OFF DURING OPERATIONS FROM A TWENTY-FIVE-YEAR, TWENTY-FOUR-HOUR STORM EVENT (3.75"), PER SUBDIVISION A OF SUBSECTION 3 OF NDAC SECTION 33-20-04.1-09.
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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 BY INTERSTATE ENGINEERING AND KADRMAS, LEE & JACKSON BETWEEN 1996 AND 2003.
3. ELEVATIONS BASED ON MEAN SEA LEVEL DATUM, CONTOUR INTERVAL IS ONE FOOT.
4. HORIZONTAL DATUM BASED ON NORTH DAKOTA STATE PLANE COORDINATE SYSTEM AS FOLLOWS:

   SITE GRID N = N STATE PLANE COORDINATE MINUS 100,000
   SITE GRID E = E STATE PLANE COORDINATE MINUS 1,800,000

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

150 0 150
1" = 150 FEET

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

TITLE
PHASE 3: ASH POND 92 & SW SECTION 16 RAISE

NO.	REVISION DESCRIPTION (THIS DRAWING IS NOT APPROVED UNLESS LAST REVISION IS HAND WRITTEN)	DATE	BY	CHKD	AP'VD
C	ISSUED FOR DRAFT REVISED PERMIT MODIFICATION	07/09/04			
B	ISSUED FOR PERMIT MODIFICATION	09/24/03	TJS	RRJ	RRJ
A	ISSUED FOR CLIENT REVIEW	06/04/03	TJS	–	RRJ

ENGINEER'S STAMP

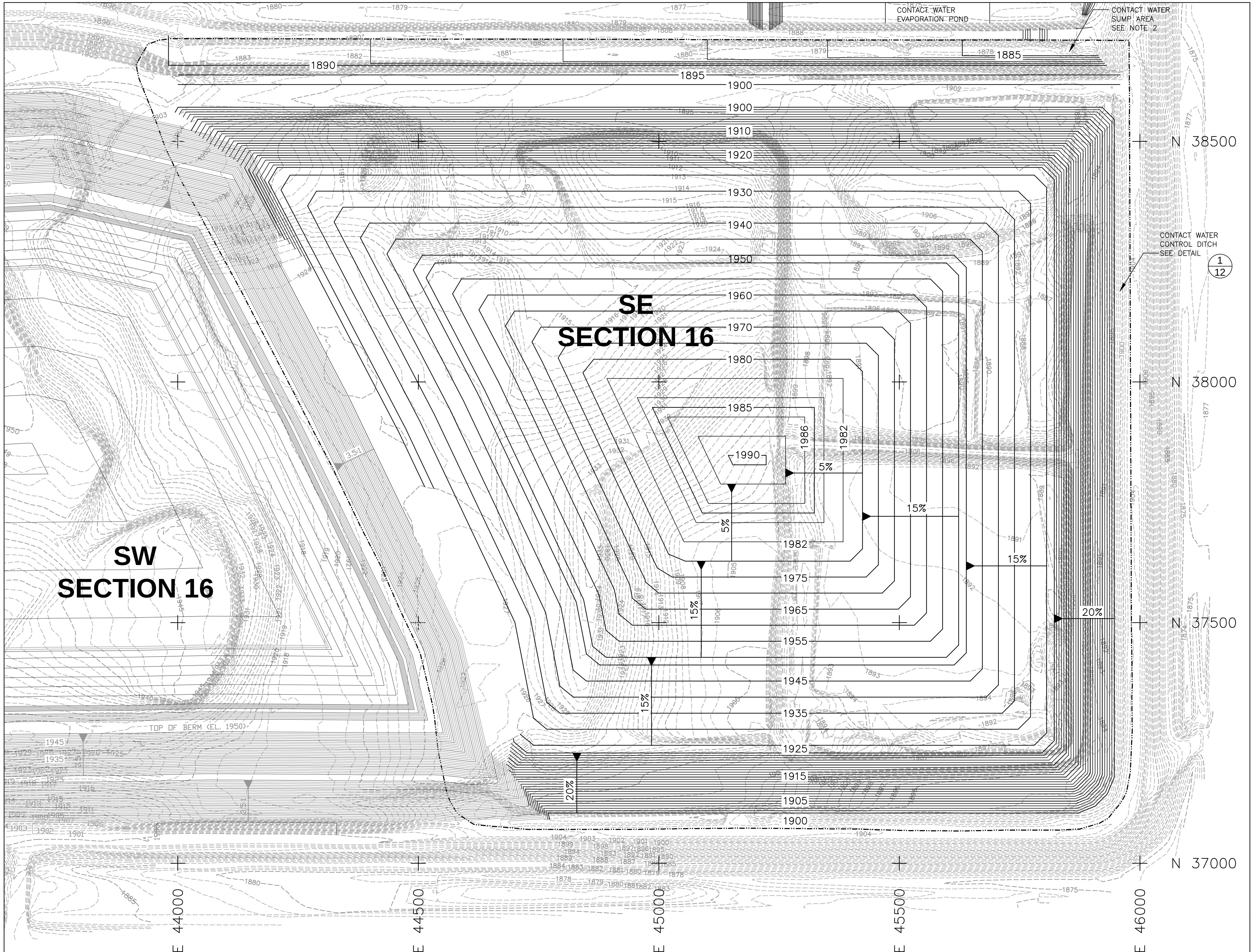
REFERENCE DRAWINGS

PRINT ISSUE RECORD: DATE / FOR / REVISED / CLIENT / FIELD

Golder Associates
Denver, Colorado

PROJECT No.	023-2411	FILE No.	0232411A021
DESIGN	TJS	05/01/03	SCALE AS SHOWN REV. C
CADD	TJS	05/01/03	6
CHECK	RRJ	06/02/03	
REVIEW	RRJ	06/02/03	

Dwg Name: N:\02\023-2411\0232411A021.dwg
Last Update: Jul 14, 2008 16:16
Last Plot: Dec 30, 2010 10:54 By: CSchuettpelz
Machine: NOT SET



LEGEND

- EXISTING GROUND TOPOGRAPHY (SEE REFERENCES)
- PREVIOUS PHASE PROPOSED TOPOGRAPHY
- PROPOSED TOP OF CCP TOPOGRAPHY
- SE SECTION 16 COMPOSITE LINER BOUNDARY

NOTES

1. GRADES REPRESENT TOP OF CCP.
2. CONTACT WATER WILL BE COLLECTED IN PERIMETER TOE DITCH AND DIRECTED TO SUMP IN NE CORNER OF LANDFILL.

REGULATORY DESIGN BASIS

1. CONTROL OF RUN-ON AND RUN-OFF DURING OPERATIONS FROM A TWENTY-FIVE-YEAR, TWENTY-FOUR-HOUR STORM EVENT (3.75"), 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 BY INTERSTATE ENGINEERING AND KADRMAS, LEE & JACKSON BETWEEN 1996 AND 2003.
3. ELEVATIONS BASED ON MEAN SEA LEVEL DATUM, CONTOUR INTERVAL IS ONE FOOT.
4. HORIZONTAL DATUM BASED ON NORTH DAKOTA STATE PLANE COORDINATE SYSTEM AS FOLLOWS:

   SITE GRID N = N STATE PLANE COORDINATE MINUS 100,000
   SITE GRID E = E STATE PLANE COORDINATE MINUS 1,800,000

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

100 0 100
1" = 100 FEET

NO.	REVISION DESCRIPTION (THIS DRAWING IS NOT APPROVED UNLESS LAST REVISION IS HAND WRITTEN)	DATE	BY	CHKD	AP'VD
C	ISSUED FOR DRAFT REVISED PERMIT MODIFICATION	07/09/04			
B	ISSUED FOR PERMIT MODIFICATION	09/24/03	TJS	RRJ	RRJ
A	ISSUED FOR CLIENT REVIEW	06/04/03	TJS	–	RRJ

ENGINEER'S STAMP

REFERENCE DRAWINGS

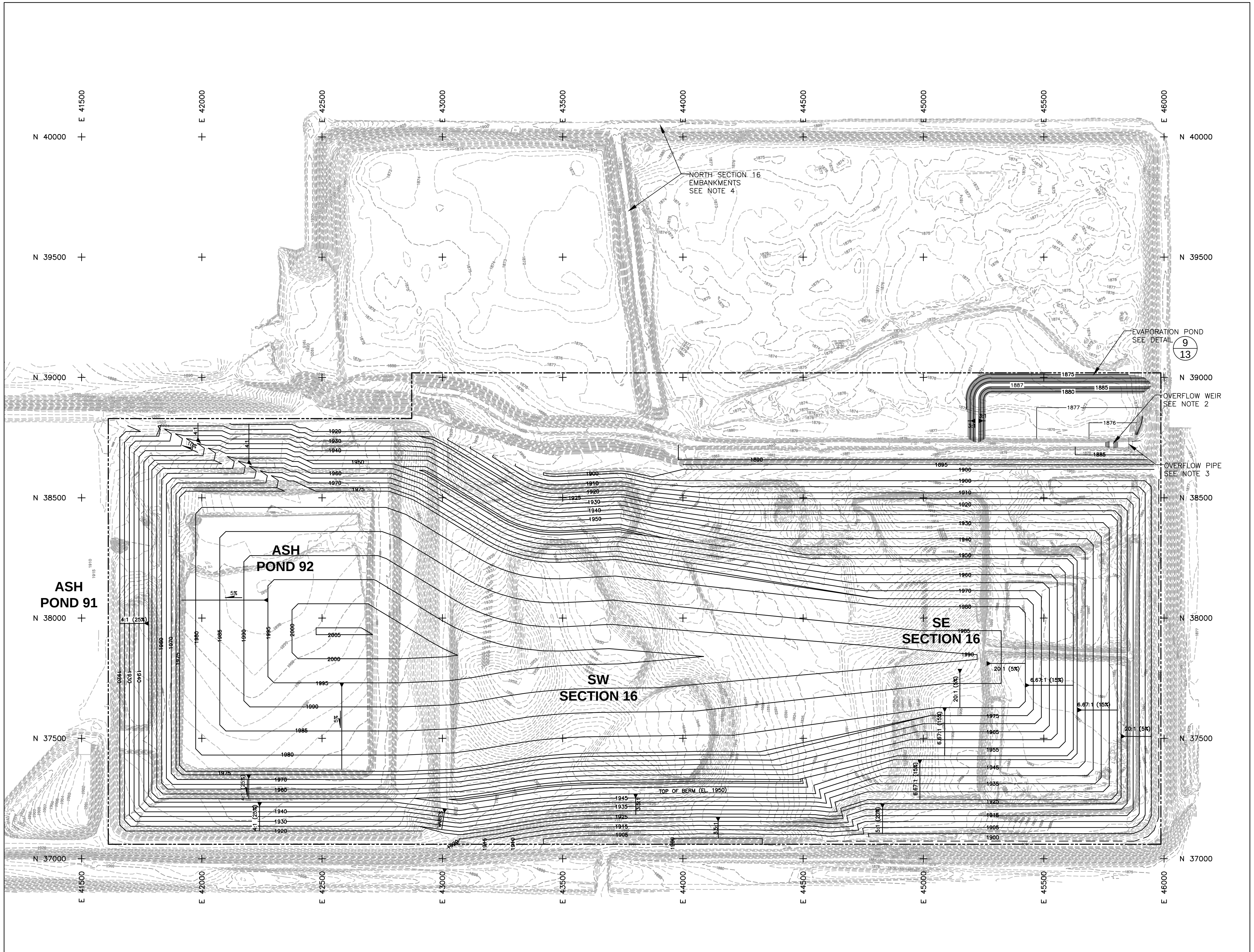
PRINT ISSUE RECORD: DATE / FOR / REVISED / CLIENT / FIELD

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

TITLE
PHASE 4: SE SECTION 16 LANDFILL

Golder Associates
Denver, Colorado

PROJECT No.		023-2411	FILE No. 0232411A022
DESIGN	TJS	05/09/03	SCALE AS SHOWN, REV. C
CADD	TJS	05/09/03	7
CHECK	RRJ	06/02/03	
REVIEW	RRJ	06/02/03	



LEGEND

- EXISTING GROUND TOPOGRAPHY (SEE REFERENCES)
- PROPOSED TOP OF CCP TOPOGRAPHY
- PROPOSED LIMIT OF CCP PLACEMENT

NOTES

1. GRADES REPRESENT TOP OF CCP.
2. A WEIR WILL BE CONSTRUCTED BEWTEEN THE SE SECTION 16 SUMP AREA AND THE SE SECTION 16 OVERFLOW/EVAPORATION POND. SEE CONTACT WATER ENGINEERING WORKSHEET FOR DETAILS.
3. AN OVERFLOW PIPE WILL BE CONSTRUCTED BEWTEEN THE SE SECTION 16 SUMP AREA AND THE SE SECTION 16 OVERFLOW/EVAPORATION POND. THE PIPE WILL CONTAIN A ONE-WAY CHECK VALVE TO ALLOW FLOW TO THE POND BUT NOT FROM THE POND.
4. THE EMBANKMENTS ON THE NORTH HALF OF THE SECTION 16 FACILITY WILL BE REMOVED AND MATERIAL USED AS STRUCTURAL FILL, LOW PERMEABILITY SOIL LINER, AND COVER MATERIAL. AFTER REMOVAL OF EMBANKMENTS, THE NORTH HALF OF THE SECTION 16 FACILITY WILL BE GRADED TO MATCH ORIGINAL AND SURROUNDING TOPOGRAPHY.

REGULATORY DESIGN BASIS

1. CONTROL OF RUN-ON AND RUN-OFF DURING OPERATIONS FROM A TWENTY-FIVE-YEAR, TWENTY-FOUR-HOUR STORM EVENT (3.75"), 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 BY INTERSTATE ENGINEERING AND KADRMAS, LEE & JACKSON BETWEEN 1996 AND 2003.
3. ELEVATIONS BASED ON MEAN SEA LEVEL DATUM, CONTOUR INTERVAL IS ONE FOOT.
4. HORIZONTAL DATUM BASED ON NORTH DAKOTA STATE PLANE COORDINATE SYSTEM AS FOLLOWS:

   SITE GRID N = N STATE PLANE COORDINATE MINUS 100,000
   SITE GRID E = E STATE PLANE COORDINATE MINUS 1,800,000
5. ALL PROPERTY SHOWN ON THIS MAP IS OPERATED BY GREAT RIVER ENERGY.

200 0 200
1" = 200 FEET

ENGINEER'S STAMP	REFERENCE DRAWINGS	NO.	REVISION DESCRIPTION (THIS DRAWING IS NOT APPROVED UNLESS LAST REVISION IS HAND WRITTEN)	DATE	BY	CHKD	AP'VD
		C	ISSUED FOR DRAFT REVISED PERMIT MODIFICATION	07/09/04			
		B	ISSUED FOR PERMIT MODIFICATION	09/24/03	TJS	RRJ	RRJ
		A	ISSUED FOR CLIENT REVIEW	06/04/03	TJS	–	RRJ

PRINT ISSUE RECORD

DATE
FOR
REVISED
CLIENT
FIELD

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

TITLE
FINAL WASTE GRADES

Golder Associates
Denver, Colorado

PROJECT No.		023-2411	FILE No. 0232411A023
DESIGN	TJS	05/23/03	SCALE AS SHOWN REV. C
CADD	TJS	05/23/03	8
CHECK	RRJ	06/02/03	
REVIEW	RRJ	06/02/03	

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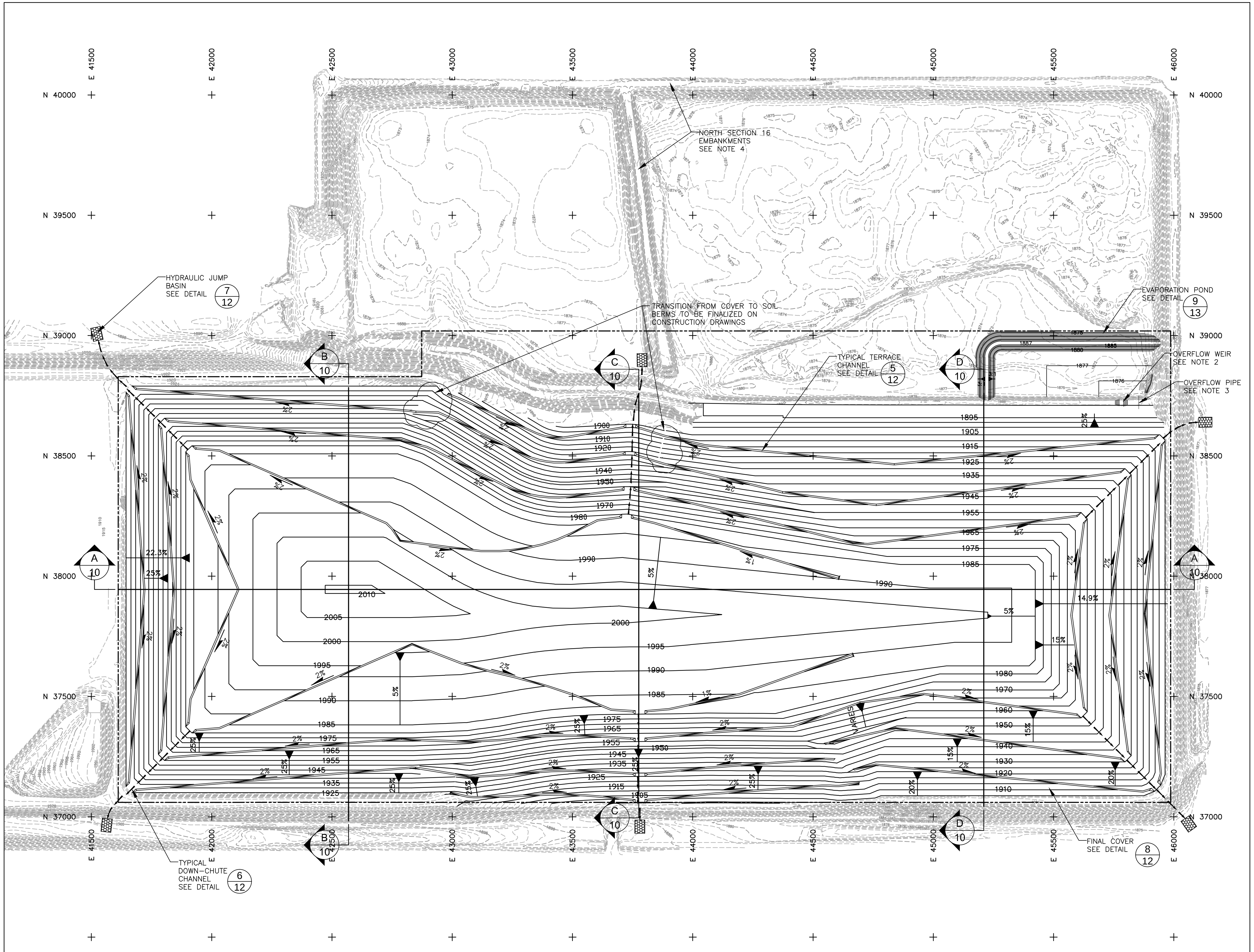
Last Update: Aug 12, 2004 08:33 By:
Last Plot: Dec 30, 2010 10:55 By: CSchuettpelz
Machine: NOT SET



LEGEND

EXISTING GROUND TOPOGRAPHY (SEE REFERENCES)

PROPOSED TOP OF FINAL COVER TOPOGRAPHY

PROPOSED LIMIT OF CCP PLACEMENT

NOTES

1. GRADES REPRESENT TOP OF FINAL COVER.

2. A WEIR WILL BE CONSTRUCTED BEWTEEN THE SE SECTION 16 SUMP AREA AND THE SE SECTION 16 OVERFLOW/EVAPORATION POND. SEE CONTACT WATER ENGINEERING WORKSHEET FOR DETAILS.

3. AN OVERFLOW PIPE WILL BE CONSTRUCTED BEWTEEN THE SE SECTION 16 SUMP AREA AND THE SE SECTION 16 OVERFLOW/EVAPORATION POND. THE PIPE WILL CONTAIN A ONE-WAY CHECK VALVE TO ALLOW FLOW TO THE POND BUT NOT FROM THE POND.

4. THE EMBANKMENTS ON THE NORTH HALF OF THE SECTION 16 FACILITY WILL BE REMOVED AND MATERIAL USED AS STRUCTURAL FILL, LOW PERMEABILITY SOIL LINER, AND COVER MATERIAL. AFTER REMOVAL OF EMBANKMENTS, THE NORTH HALF OF THE SECTION 16 FACILITY WILL BE GRADED TO MATCH ORIGINAL AND SURROUNDING TOPOGRAPHY.

5. SEE THE SURFACE WATER ENGINEERING WORKSHEET FOR FURTHER DETAILS CONCERNING THE SURFACE WATER PLAN.

REGULATORY DESIGN BASIS

1. CONTROL OF RUN-ON AND RUN-OFF DURING OPERATIONS FROM A TWENTY-FIVE-YEAR, TWENTY-FOUR-HOUR STORM EVENT (3.75"), 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.

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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 BY INTERSTATE ENGINEERING AND KADRMAS, LEE & JACKSON BETWEEN 1996 AND 2003.

3. ELEVATIONS BASED ON MEAN SEA LEVEL DATUM, CONTOUR INTERVAL IS ONE FOOT.

4. HORIZONTAL DATUM BASED ON NORTH DAKOTA STATE PLANE COORDINATE SYSTEM AS FOLLOWS:

SITE GRID N = N STATE PLANE COORDINATE MINUS 100,000
SITE GRID E = E STATE PLANE COORDINATE MINUS 1,800,000

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

200 0 200
1" = 200 FEET

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

TITLE
FINAL COVER GRADES AND SURFACE WATER PLAN

NO.	REVISION DESCRIPTION (THIS DRAWING IS NOT APPROVED UNLESS LAST REVISION IS HAND WRITTEN)	DATE	BY	CHKD	AP'VD
C	ISSUED FOR DRAFT REVISED PERMIT MODIFICATION	07/09/04			
B	ISSUED FOR PERMIT MODIFICATION	09/24/03	TJS	RRJ	RRJ
A	ISSUED FOR CLIENT REVIEW	06/04/03	TJS	–	RRJ

ENGINEER'S STAMP

REFERENCE DRAWINGS

PRINT ISSUE RECORD: DATE / FOR / REVISED / CLIENT / FIELD

Golder Associates
Denver, Colorado

PROJECT No.		023-2411
DESIGN	TJS	05/27/03
CADD	TJS	05/27/03
CHECK	RRJ	06/02/03
REVIEW	RRJ	06/02/03

FILE No. 0232411A024
SCALE AS SHOWN REV. C

9

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Last Plot: Dec 30, 2010 10:56 By: CSchuettpelz
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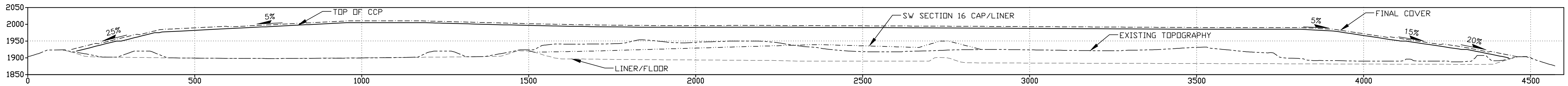

A / 10 CROSS SECTION A-A'

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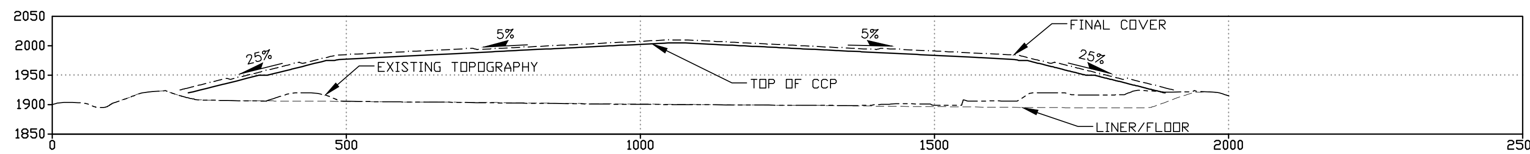
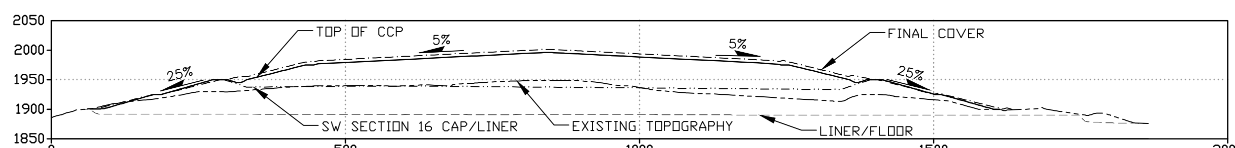


B / 10 CROSS SECTION B-B'

SCALE 150 0 150 FEET
1X VERTICAL EXAGGERATION

LEGEND

- PROPOSED TOP OF FINAL COVER TOPOGRAPHY
- PROPOSED TOP OF CCP TOPOGRAPHY
- PROPOSED TOP OF SW SECTION 16 CAP/LINER
- EXISTING GROUND TOPOGRAPHY
- APPROXIMATE FLOOR TOPOGRAPHY



C / 10 CROSS SECTION C-C'

SCALE 150 0 150 FEET
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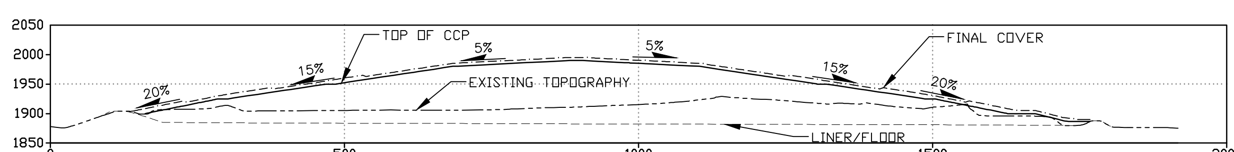

D / 10 CROSS SECTION D-D'

SCALE 150 0 150 FEET
1X VERTICAL EXAGGERATION

ENGINEER'S STAMP	REFERENCE DRAWINGS	NO.	REVISION DESCRIPTION (THIS DRAWING IS NOT APPROVED UNLESS LAST REVISION IS HAND WRITTEN)	DATE	BY	CHKD	AP'VD
		C	ISSUED FOR DRAFT REVISED PERMIT MODIFICATION	07/09/04			
		B	ISSUED FOR PERMIT MODIFICATION	09/24/03	TJS	RRJ	RRJ
		A	ISSUED FOR CLIENT REVIEW	06/04/03	TJS	–	RRJ

PRINT ISSUE RECORD

DATE
FOR
REVISED
CLIENT
FIELD

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

TITLE
CROSS SECTIONS

Golder Associates
Denver, Colorado

PROJECT No.		023-2411	FILE No. 0232411A026
DESIGN	TJS	06/04/03	SCALE AS SHOWN REV. C
CADD	TJS	06/04/03	10
CHECK	RRJ	06/04/03	
REVIEW	RRJ	06/04/03	

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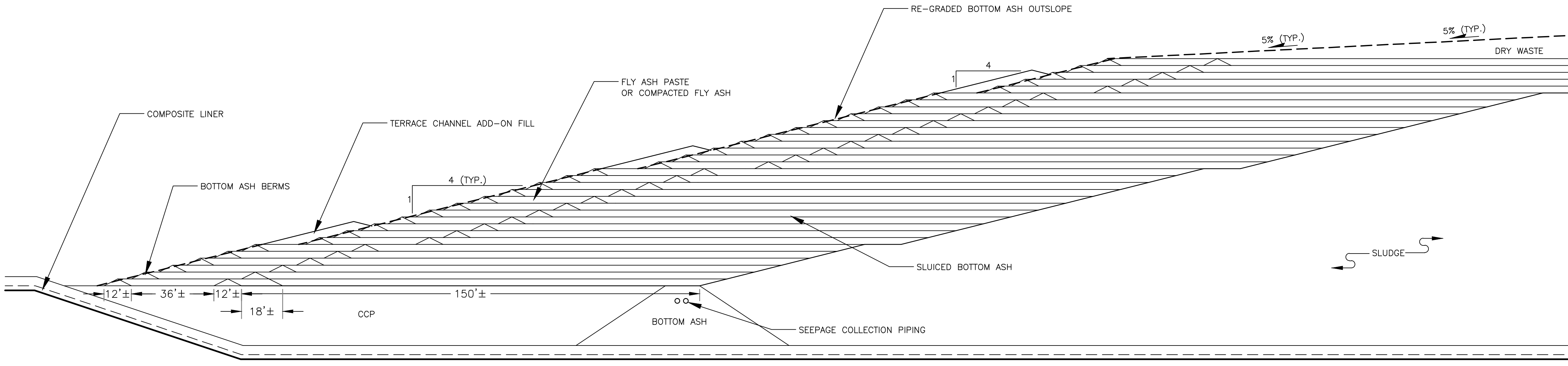
Last Plot: Dec 30, 2010 10:57 By: CSchuettpelz
Machine: NOT SET



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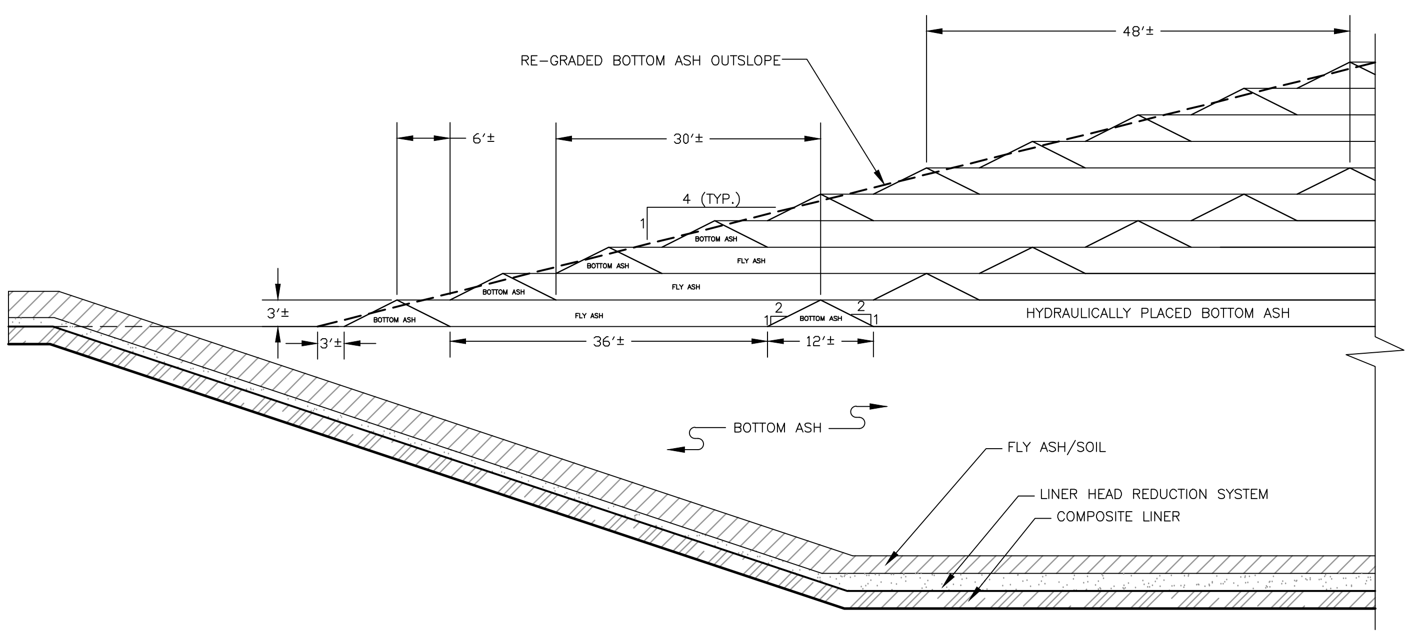
RAISE PROFILE
NOT TO SCALE



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RAISE DETAIL
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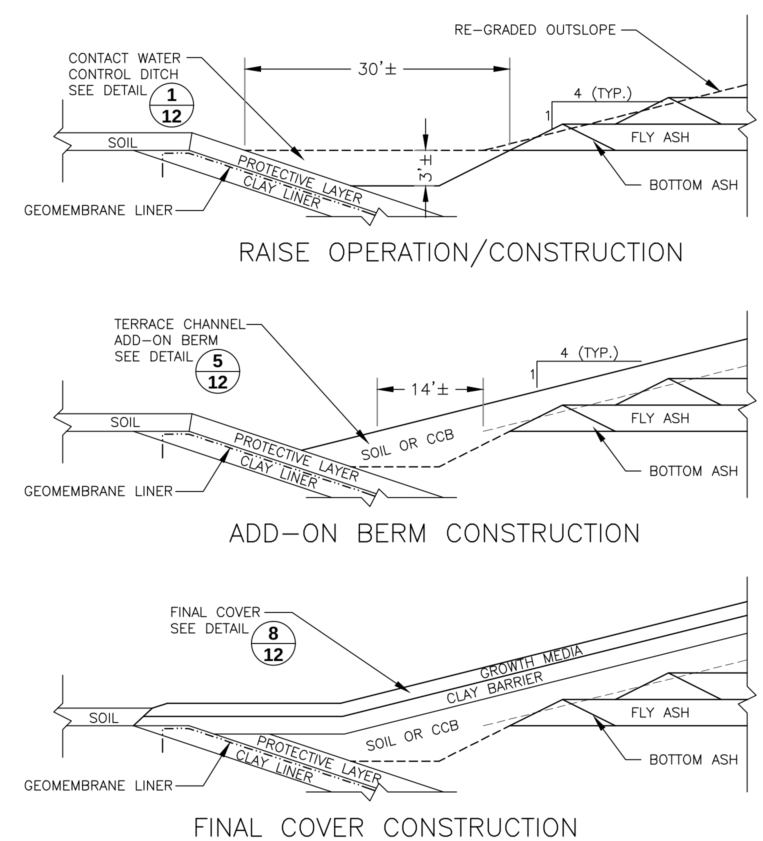

3
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RAISE TOE TIE-IN
NOT TO SCALE

Dwg Name: N:\02\023-2411\0232411A027.dwg
Last Update: Jul 14, 2006 16:16 By: tstong
Last Plot: Dec 30, 2010 10:58 By: CSchaffpelz
Machine: NOT SET

ENGINEER'S STAMP

REFERENCE DRAWINGS

NO.	REVISION DESCRIPTION (THIS DRAWING IS NOT APPROVED UNLESS LAST REVISION IS HAND WRITTEN)	DATE	BY	CHKD	AP'VD
C	ISSUED FOR REVISED PERMIT MODIFICATION	07/09/04			
B	ISSUED FOR PERMIT MODIFICATION	09/24/03	TJS	RRJ	RRJ
A	ISSUED FOR CLIENT REVIEW	06/04/03	TJS	–	RRJ

PRINT ISSUE RECORD

DATE
FOR
REVISED
CLIENT
FIELD

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

TITLE
DETAIL SHEET 1

Golder Associates
Denver, Colorado

PROJECT No.		023-2411
DESIGN	TJS	06/02/03
CADD	TJS	06/02/03
CHECK	RRJ	06/02/03
REVIEW	RRJ	06/02/03

FILE No. 0232411A027
SCALE AS SHOWN REV. C

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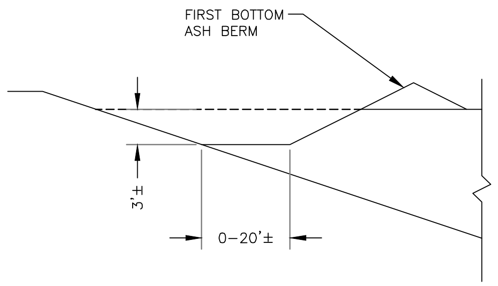
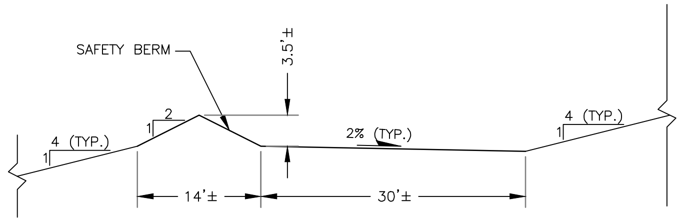


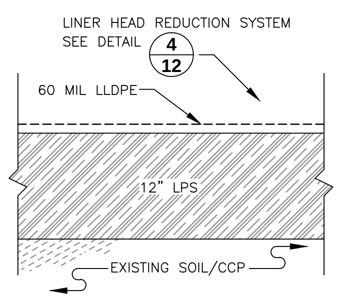
1 / 12 CONTACT WATER CONTROL DITCH

NOT TO SCALE



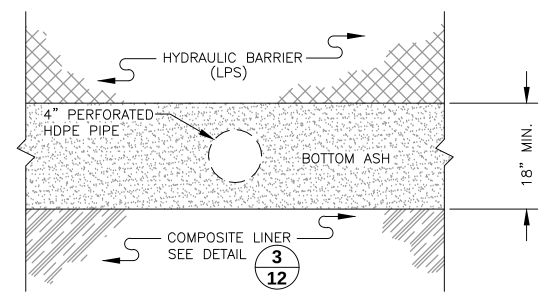
2 / 12 ACCESS HAUL ROAD

NOT TO SCALE



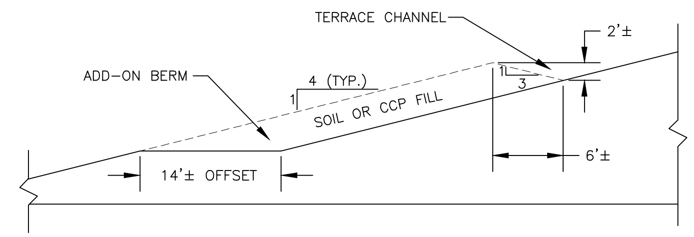
3 / 12 INTERMEDIATE LINER/CAP DETAIL

NOT TO SCALE



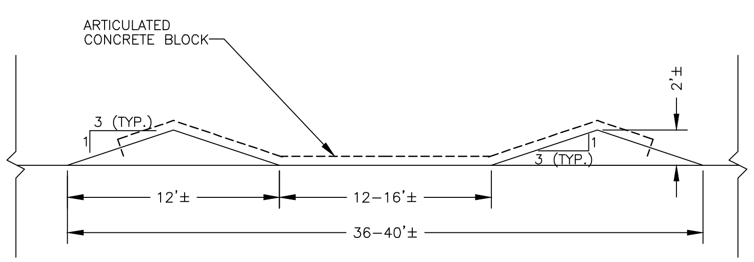
4 / 12 LINER HEAD REDUCTION SYSTEM DETAIL

NOT TO SCALE



5 / 12 TERRACE CHANNEL DETAIL

NOT TO SCALE



6 / 12 TYPICAL DOWN-CHUTE CHANNEL

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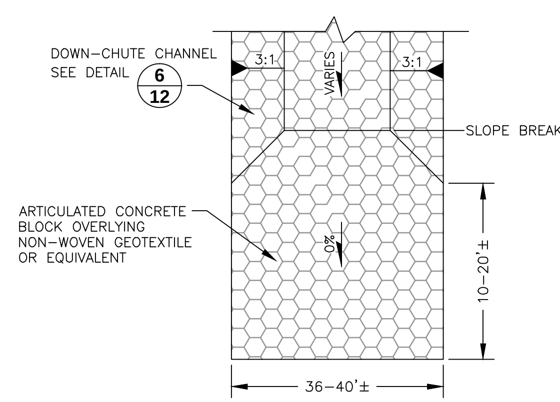
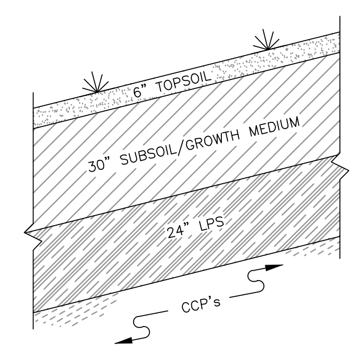


7 / 12 HYDRAULIC JUMP BASIN

NOT TO SCALE



8 / 12 PRESCRIPTIVE COVER DETAIL

NOT TO SCALE

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

TITLE
DETAIL SHEET 2

ENGINEER'S STAMP	REFERENCE DRAWINGS

NO.	REVISION DESCRIPTION (THIS DRAWING IS NOT APPROVED UNLESS LAST REVISION IS HAND WRITTEN)	DATE	BY	CHKD	AP'VD
C	ISSUED FOR DRAFT REVISED PERMIT MODIFICATION	07/09/04			
B	ISSUED FOR PERMIT MODIFICATION	09/24/03	TJS	RRJ	RRJ
A	ISSUED FOR CLIENT REVIEW	06/04/03	TJS	–	RRJ

PRINT ISSUE RECORD

DATE	
FOR	
REVISED	
CLIENT	
FIELD	

Golder Associates
Denver, Colorado

PROJECT No.		023–2411
DESIGN	TJS	05/01/03
CADD	TJS	05/01/03
CHECK	RRJ	06/02/03
REVIEW	RRJ	06/02/03

FILE No. 0232411A028
SCALE AS SHOWN REV. C
12

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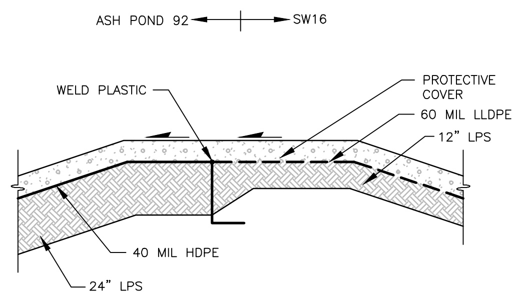
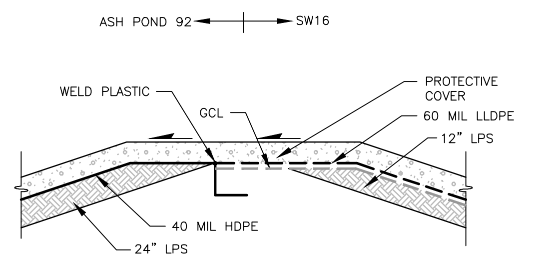
Last Update: Jul 14, 2006 16:16 By: tstong
Last Plot: Dec 30, 2010 10:59 By: CSchuettpelz
Machine: NOT SET



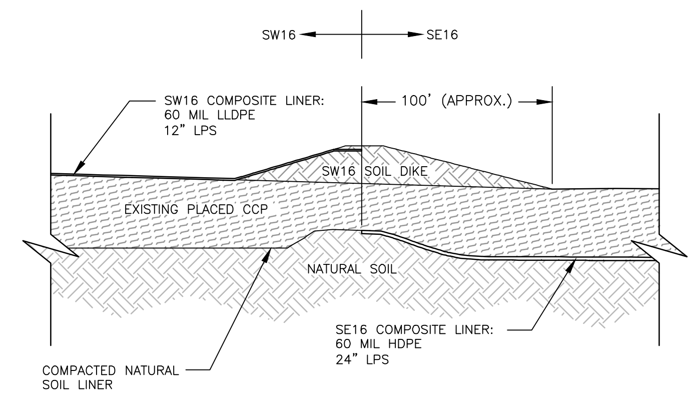
1/13 POND 92 TO SW16 LINER CONNECTION (OPTION 1)

NOT TO SCALE



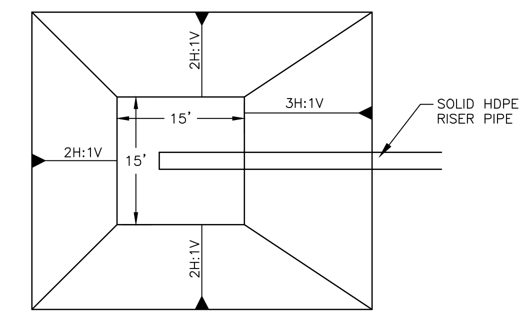
2/13 POND 92 TO SW16 LINER CONNECTION (OPTION 2)

NOT TO SCALE



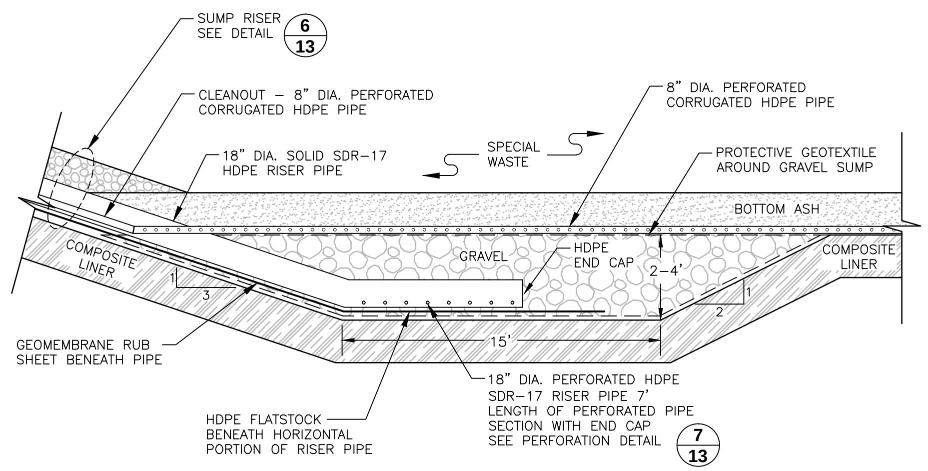
3/13 SE16 TO SW16 LINER OVERLAP

NOT TO SCALE



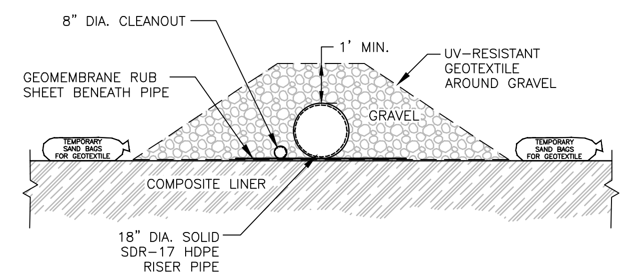
4/13 TYPICAL SUMP AREA PLAN

NOT TO SCALE



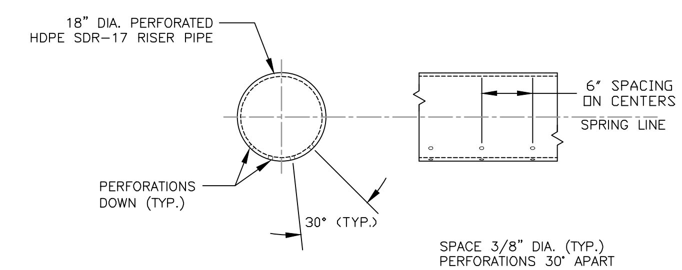
5/13 TYPICAL SUMP DETAIL

NOT TO SCALE



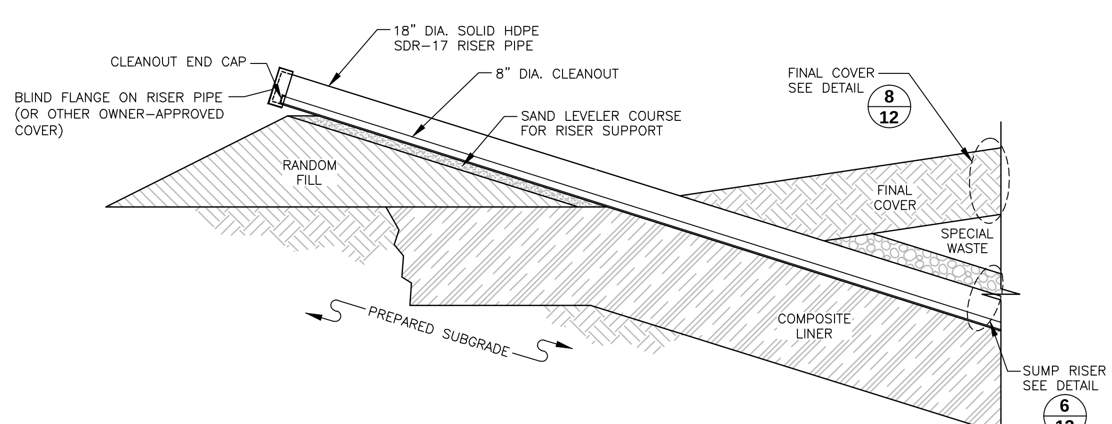
6/13 TYPICAL SUMP RISER DETAIL

NOT TO SCALE



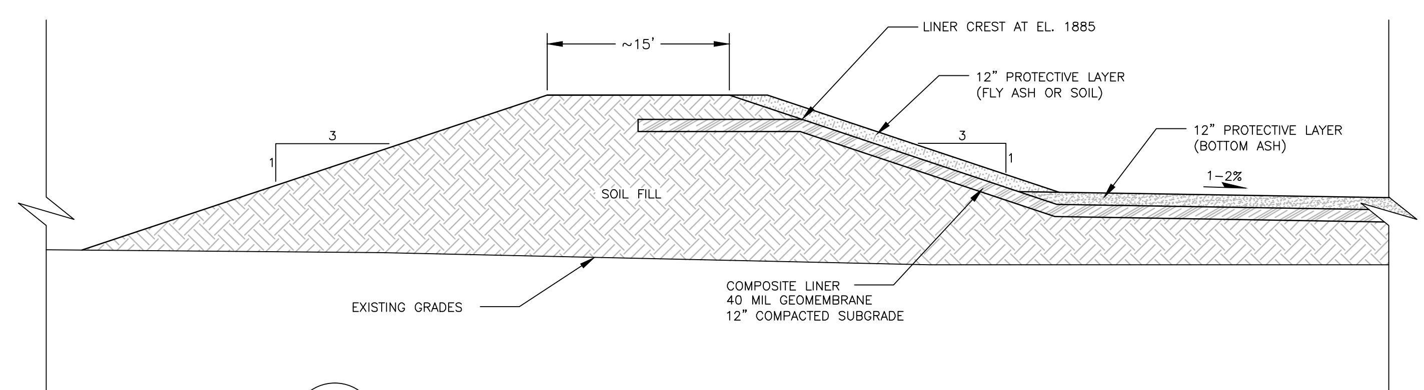
7/13 SUMP RISER PIPE PERFORATION DETAIL

NOT TO SCALE



8/13 TYPICAL TOP OF SUMP RISER PIPE DETAIL

NOT TO SCALE



9/13 SE16 EVAPORATION POND TYPICAL SECTION

NOT TO SCALE

ENGINEER'S STAMP	REFERENCE DRAWINGS	NO.	REVISION DESCRIPTION (THIS DRAWING IS NOT APPROVED UNLESS LAST REVISION IS HAND WRITTEN)	DATE	BY	CHKD	AP'VD
		A	ISSUED FOR DRAFT REVISED PERMIT MODIFICATION	07/09/04			

PRINT ISSUE RECORD: DATE / FOR / REVISED / CLIENT / FIELD

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

TITLE: DETAIL SHEET 3

Golder Associates
Denver, Colorado

PROJECT No.	023-2411		FILE No.	0232411A089
DESIGN	TJS	05/28/04	SCALE AS SHOWN	REV. A
CADD	TJS	05/28/04		
CHECK	MRN	06/02/04	13	
REVIEW	RRJ	07/08/04		

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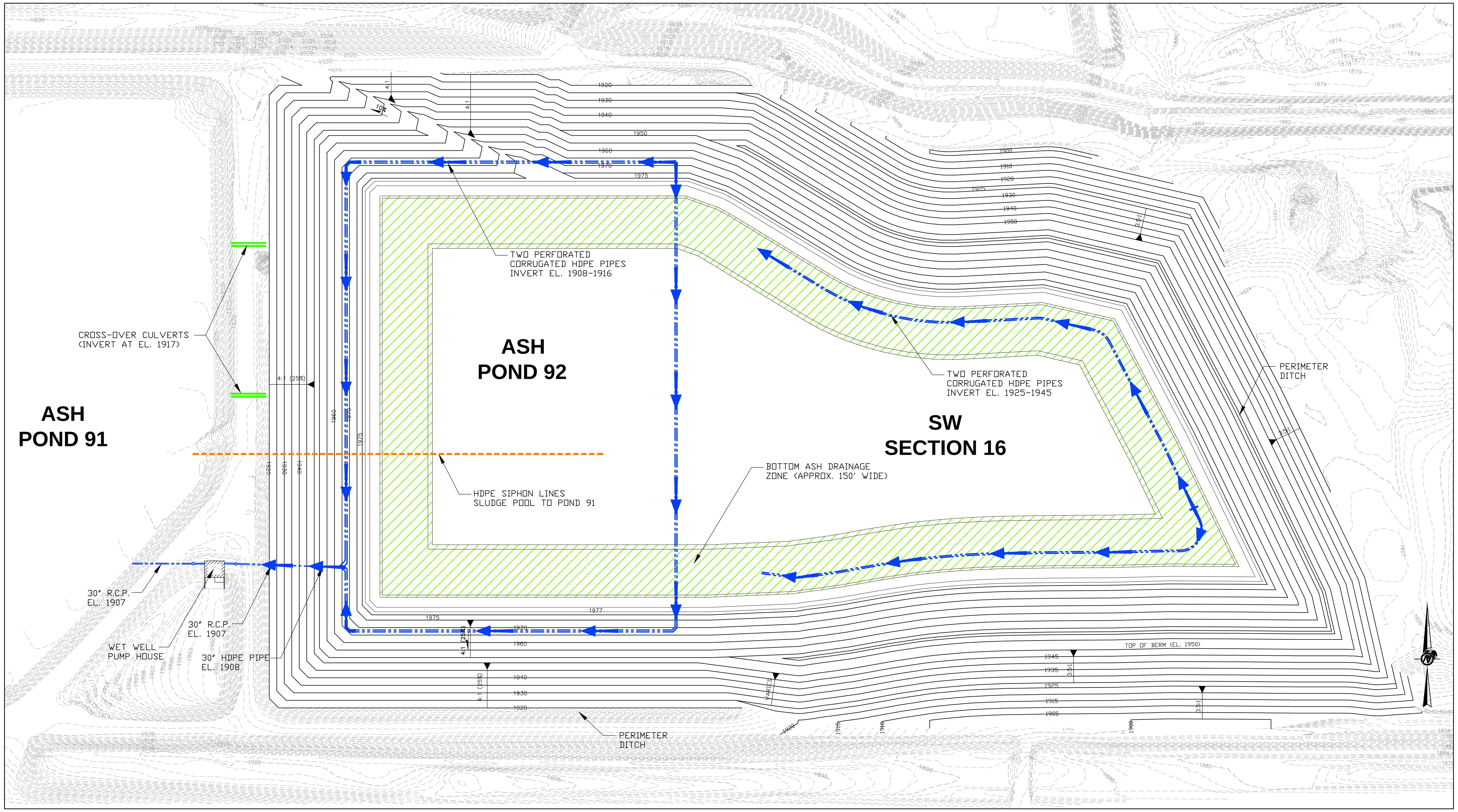
Last Update: Aug. 12, 2004 08:40 By: tsdong
Last Plot: Dec. 30, 2010 11:10 By: CSchuettpelz
Machine: NOT SET

APPENDIX A

UPSTREAM RAISE DRAINAGE SYSTEMS



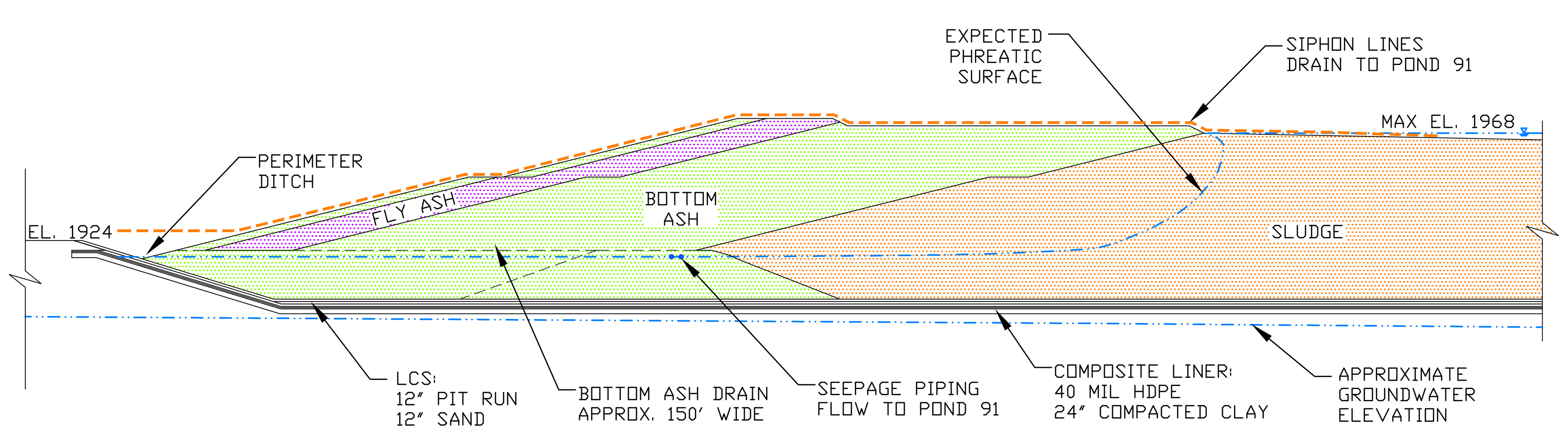
LEGEND

- EXISTING GROUND TOPOGRAPHY
- PROPOSED UPSTREAM RAISE GRADES
- SEEPAGE COLLECTION PIPING
- SIPHON LINES
- CROSS-OVER CULVERTS

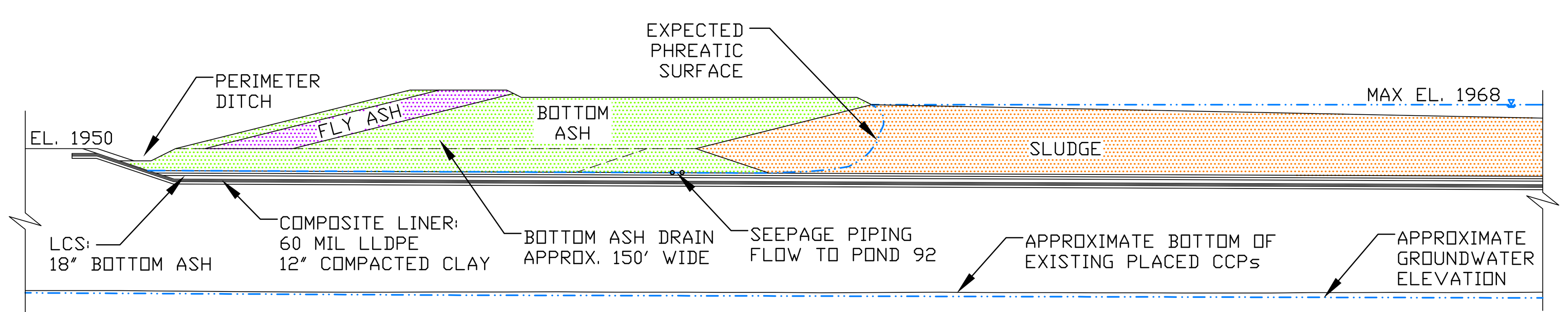
NOTES

1. UPSTREAM RAISE DRAINAGE SYSTEMS ARE DESIGNED TO CONVEY SLUICE WATER AND STORMWATER FROM THE UPSTREAM RAISE TO ASH POND 91.

1 UPSTREAM RAISE PLAN VIEW
SCALE: 1"=150'



2 ASH POND 92 UPSTREAM RAISE TYPICAL SECTION
N.T.S.



3 SW16 UPSTREAM RAISE TYPICAL SECTION
N.T.S.

GREAT RIVER ENERGY
COAL CREEK STATION
UNDERWOOD, ND

UPSTREAM RAISE DRAINAGE

FIGURE 1

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PROJECT No. 043-2227 CADD TJS DATE 05/20/04 FILE No. 0232411A088.dwg

APPENDIX B

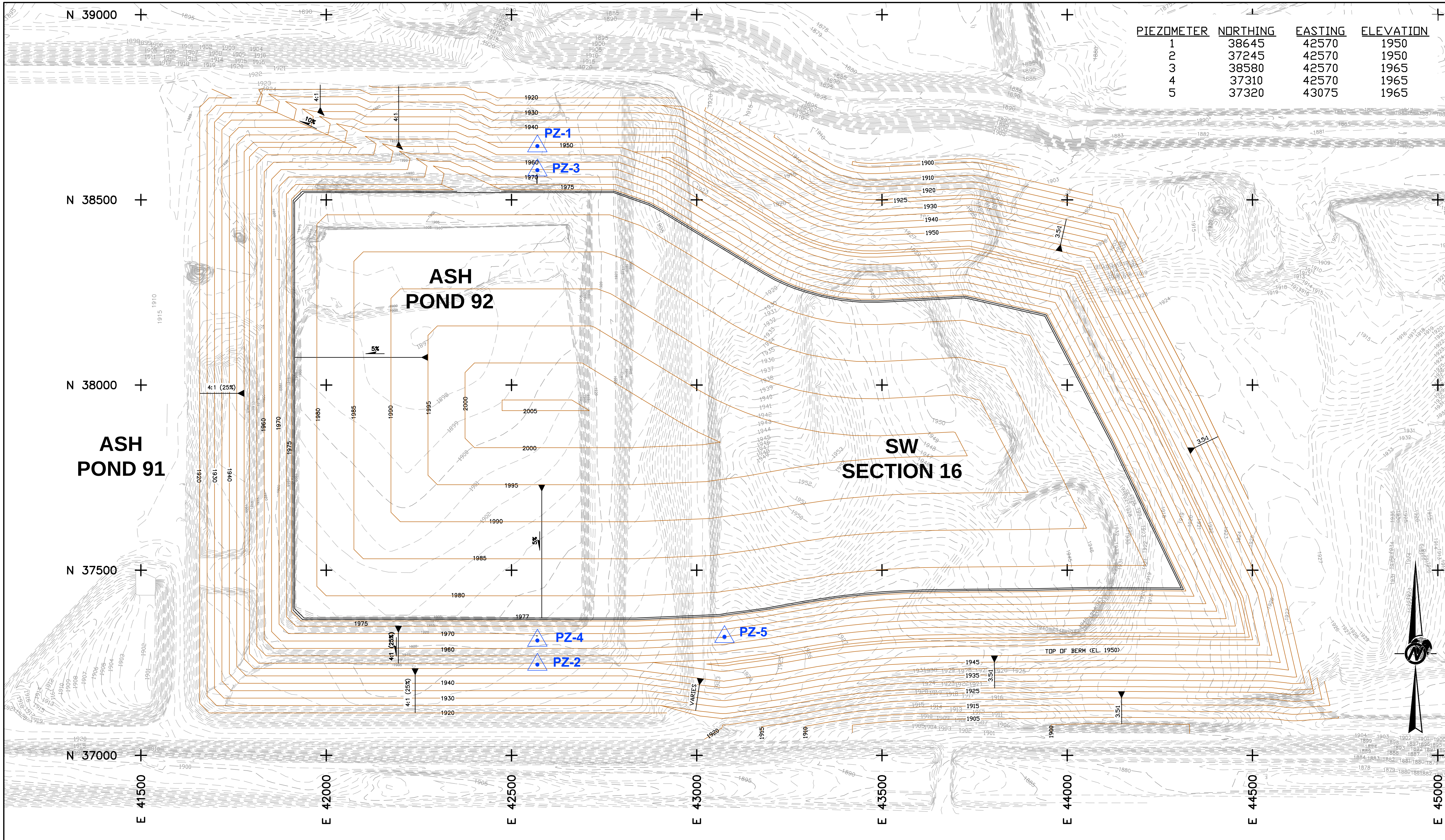
GRE'S CCS SAFETY PROCEDURE INDEX

GREAT RIVER ENERGY
COAL CREEK STATION
SAFETY PROCEDURE INDEX

	TITLE	DATE	REVISION #
	Safety & Health Program – Administrative Manual	8-17-01	4
SF10.01	Employee Safety Committee	12-8-97	6
SF10.02	Weather Response	8-09-02	6
SF10.03	First Aid & Employee Injury Report	04-01-03	10
SF10.04	Clearance Procedure	05-07-04	21
SF10.05	Radiation Emergency	2-2-01	6
SF10.06	Barrier Protection	07/17/03	6
SF10.07	Fire Response	07-25-02	7
SF10.08	Hearing Conservation Program	12-21-00	3
SF10.09	Vehicle Operating Procedure	06-03-03	6
SF10.10	Hazard Communication Program	11/18/02	9
SF10.11	Confined Space Entry	10/27/03	16
SF10.12	Asbestos Handling	03/17/04	10
SF10.13	Respirator Program	9-2-03	7
SF10.14	Emergency Response	12-10-97	2
SF10.15	On/Off-Site Evacuation	10/29/03	3
SF10.16	Process Safety Management	06/01/04	5
SF10.17	Chemical Hygiene	04/16/03	5
SF10.18	Contractor Working Rules	04-01-04	15
SF10.19	Reporting & Investigating Vehicle Accidents	12-10-97	8
SF10.20	Rope Rescue Team	9-30-98	4
SF10.21	Bloodborne Pathogens Exposure Control	06-11-01	4
SF10.22	Stack Elevator Operation	03-05-02	4
SF10.23	Lead Exposure Handling Procedure	12-10-97	2
SF10.24	General Safety Rules	03-12-03	8

APPENDIX C

PIEZOMETER PLAN VIEW



PIEZOMETER	NORTHING	EASTING	ELEVATION
1	38645	42570	1950
2	37245	42570	1950
3	38580	42570	1965
4	37310	42570	1965
5	37320	43075	1965

250 0 250
1"=250' FEET

UPSTREAM RAISE PIEZOMETER LOCATIONS

FIGURE 1

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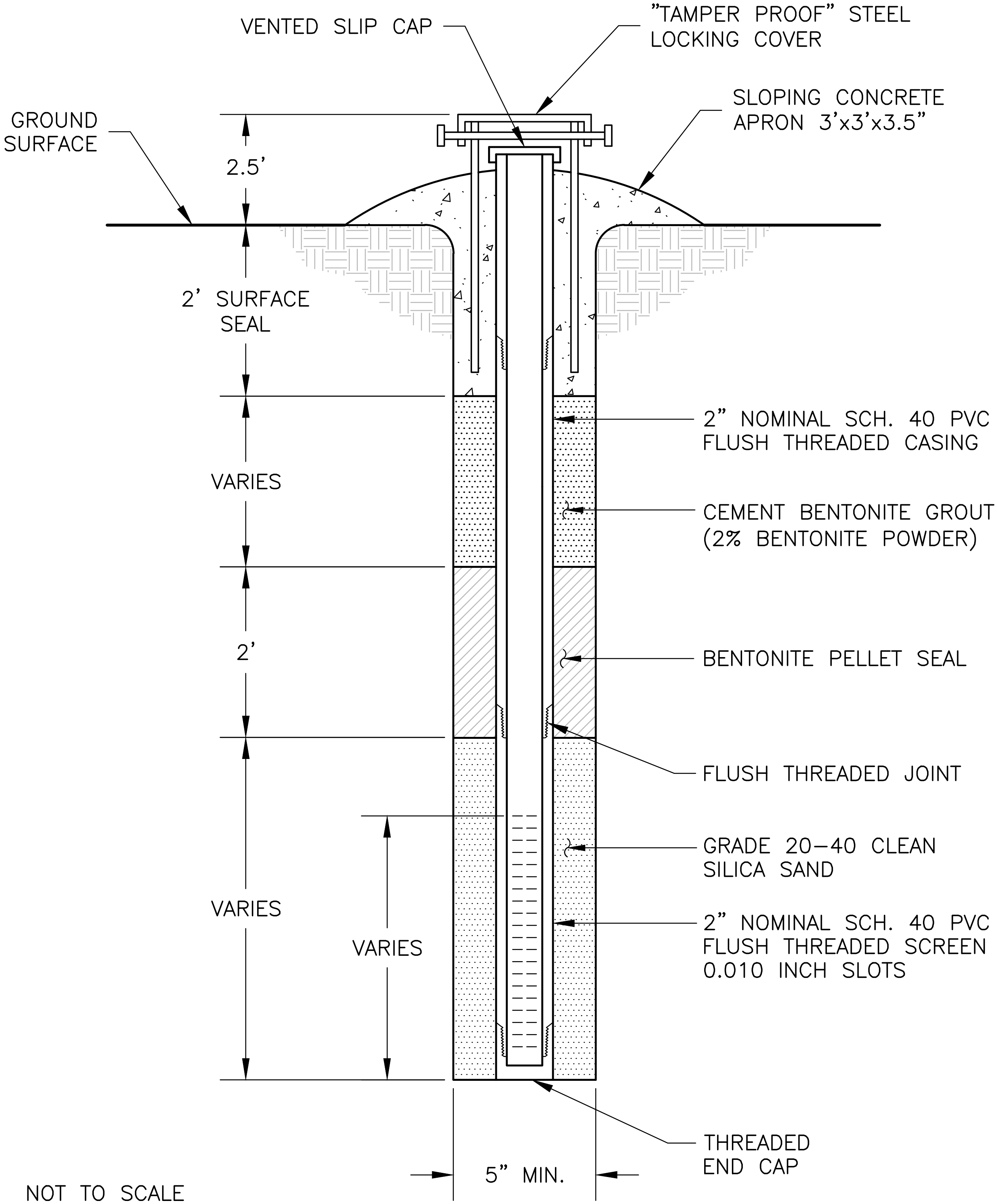
Denver, Colorado

PROJECT No. 043-2226 FILE No.0432226A002.dwg CADD MRN DATE 06/04/04



TYPICAL PIEZOMETER CONSTRUCTION SCHEMATIC

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Denver, Colorado

FIGURE 2

PROJECT No. 043-2226 CADD SB DATE 05/27/04 FILE No. 0432226A001.dwg

APPENDIX D

INSPECTION FORM

GREAT RIVER ENERGY
COAL CREEK STATION
INSPECTION REPORT
CCP DISPOSAL FACILITIES

GREAT RIVER ENERGY®
A Touchstone Energy® Cooperative

Date of Inspection			
Inspector		**Title**	
Inspector		**Title**	
Facility			

Legend:
Y Yes
NB Not observed
NA Not applicable
RA Requires action

Please mark areas of concern on the attached plan view of the facility. Insert comments in Section G.

A. Area Status

Status of Disposal Area	Active	Inactive					Closed
If inactive, how long inactive?							days/months
If greater than 180 days, is interim cover being placed and/or seeded?		Y	NB	NA	RA		
Any changes to the utilities near or servicing the area?		Y	NB	NA	RA		

B. Facility Access

Do all entrances have signs detailing entrance authorization and allowed disposal material?	Y	NB	NA	RA	
Are the roads to the site in good repair?	Y	NB	NA	RA	
How is access controlled to the site (fencing, locked gate, etc.)?					
Are the facility boundaries clearly marked?	Y	NB	NA	RA	
Are there signs of unauthorized access to the site such as trails or gaps in the fencing?	Y	NB	NA	RA	
Is there any evidence of any unauthorized disposal (other than CCPs or construction/demolition debris)?	Y	NB	NA	RA	

C. Site Conditions

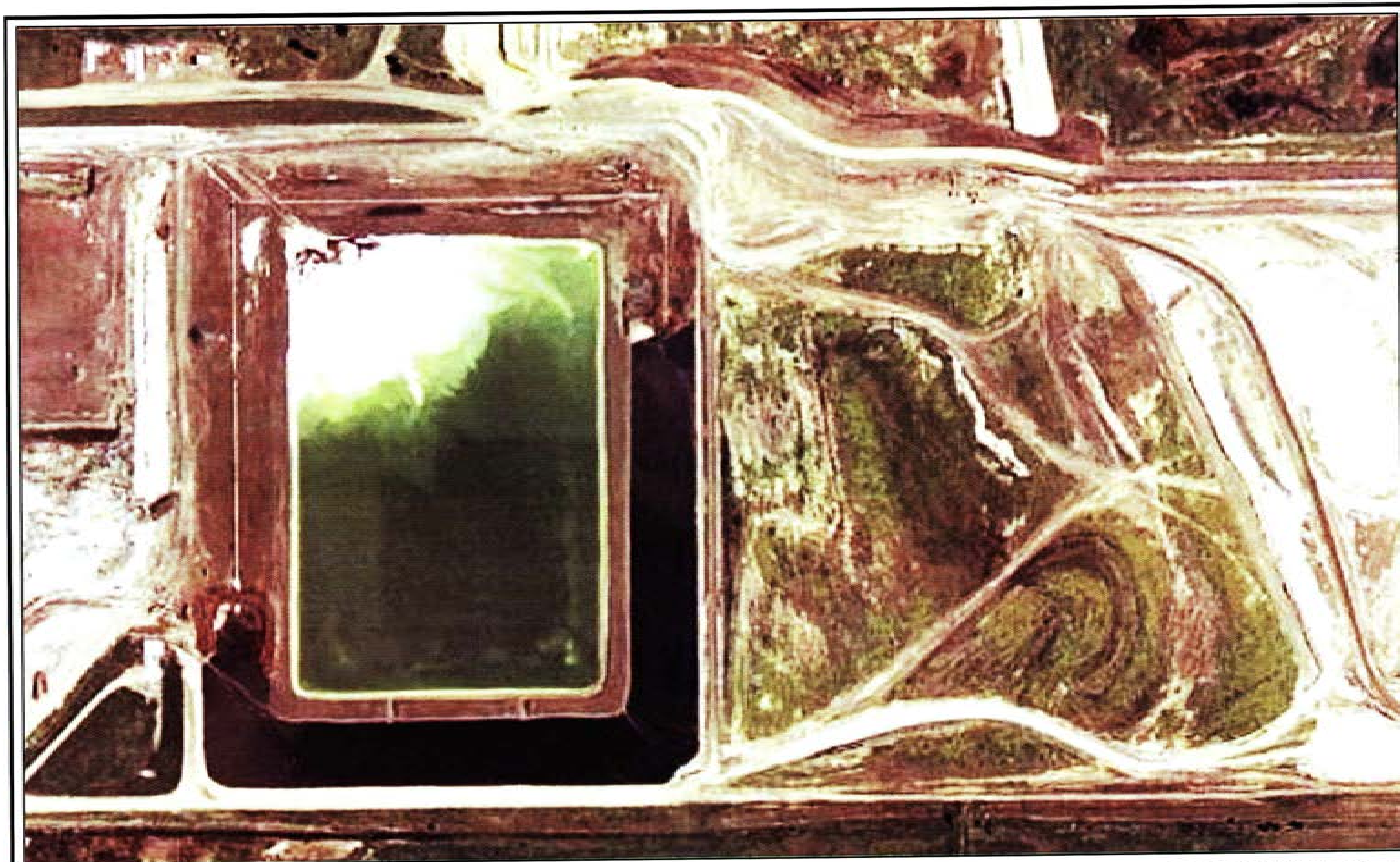
Are there signs of erosion in the disposal area such as gullies, dirt flows, etc.?	Y	NB	NA	RA	
Are there signs of differential settlement in the disposal area such as cracks, sinkholes, etc.?	Y	NB	NA	RA	
Any indication of vegetative stress in or near the disposal area? Are there pockets of dead or dying vegetation in otherwise seeded areas?	Y	NB	NA	RA	
Any noticeable environmental concerns such as: odor, excessive dust or litter, discolored earth or water, infestation by animals, signs of open burning?	Y	NB	NA	RA	

Is there any evidence of spillage or disposal outside of the immediate disposal area?	Y	NB	NA	RA	
Is water ponding within the facility?	Y	NB	NA	RA	
Is there at least two feet of freeboard within the surface impoundment?	Y	NB	NA	RA	
D. Water Control Structures					
Is there any erosion or blockage of the diversion channels? Are the channels clearly defined?	Y	NB	NA	RA	
Are temporary erosion controls in place? Describe.	Y	NB	NA	RA	
Are all surface water control structures and monitoring devices in good condition?	Y	NB	NA	RA	
Are all monitoring wells in good condition?	Y	NB	NA	RA	
Any signs of off-site migration of the contact water?	Y	NB	NA	RA	
Note the condition of any special feature.					
E. Structural Stability					
Any signs of seepage on the downstream face of the embankments? (Signs of wetness, gullies, erosion features)	Y	NB	NA	RA	
Any signs of mass movement such as differential settlement within the impoundment or crest elevation changes along the centerline of the embankment?	Y	NB	NA	RA	
Any signs of sudden change in the liquid levels within the impoundment?	Y	NB	NA	RA	
Any signs of external impacts that may affect the liner integrity or embankment stability for the facility?	Y	NB	NA	RA	
F. Pumps, Pipelines, and Distribution Systems					
Any signs of wetness above buried pipelines or below aboveground pipelines indicating possible leaks or stressed areas of piping?	Y	NB	NA	RA	
On any aboveground pipeline, does the foundation appear unmoved and stable?	Y	NB	NA	RA	
Are the pumps currently operational, and, if so, in apparent good working order?	Y	NB	NA	RA	
When was the last listed maintenance for the pump (if in operation only)?					
G. Facility Overview					
What material is currently being placed at the facility?					

Any housekeeping concerns about the waste placement, coverage, and vegetation for visitors and neighbors?					
Is partial closure of the facility occurring?	**Y**	**NB**	**NA**	**RA**	
Has seed and mulch been applied on the closed areas of the site?	**Y**	**NB**	**NA**	**RA**	
Any visible or exposed soil or geomembrane liner?	**Y**	**NB**	**NA**	**RA**	
Were the concerns from the last inspection addressed and corrected?	**Y**	**NB**	**NA**	**RA**	

H. Comments

Describe any concerns identified above along with an overview of the current operations occurring at the facility. Include documentation of corrective action measures (photographs, plan view map, sketches, etc.) along with any work orders and anticipated dates of completion.



ASH POND 92 AND SOUTHWEST SECTION 16 (UPSTREAM RAISE)

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Denver, Colorado

FIGURE 1

PROJECT No. 043-2226 CADD JSH DATE 07/08/04 FILE No. 0432226A004.dwg

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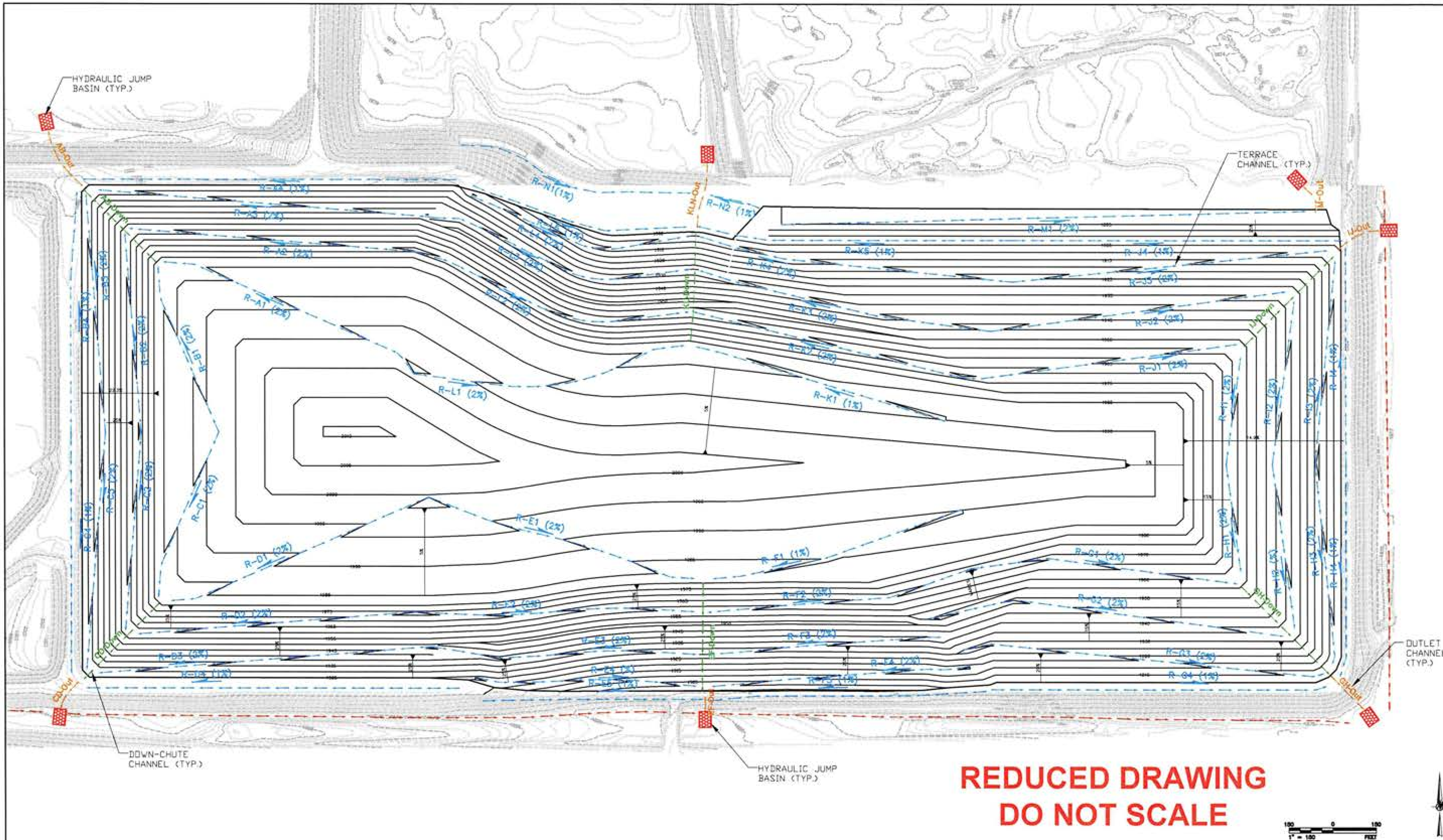
Denver, Colorado

SOUTHEAST SECTION 16

FIGURE 2

PROJECT No. 043-2226 CADD JSH DATE 07/08/04 FILE No. 0432226A004.dwg



LEGEND

EXISTING GROUND TOPOGRAPHY	DOWN CHUTE CHANNELS
PROPOSED TOP OF FINAL COVER TOPOGRAPHY	OUTLET CHANNELS
TERRACE CHANNELS	HYDRAULIC JUMP BASIN
	EXISTING OFF-SITE DRAINAGE

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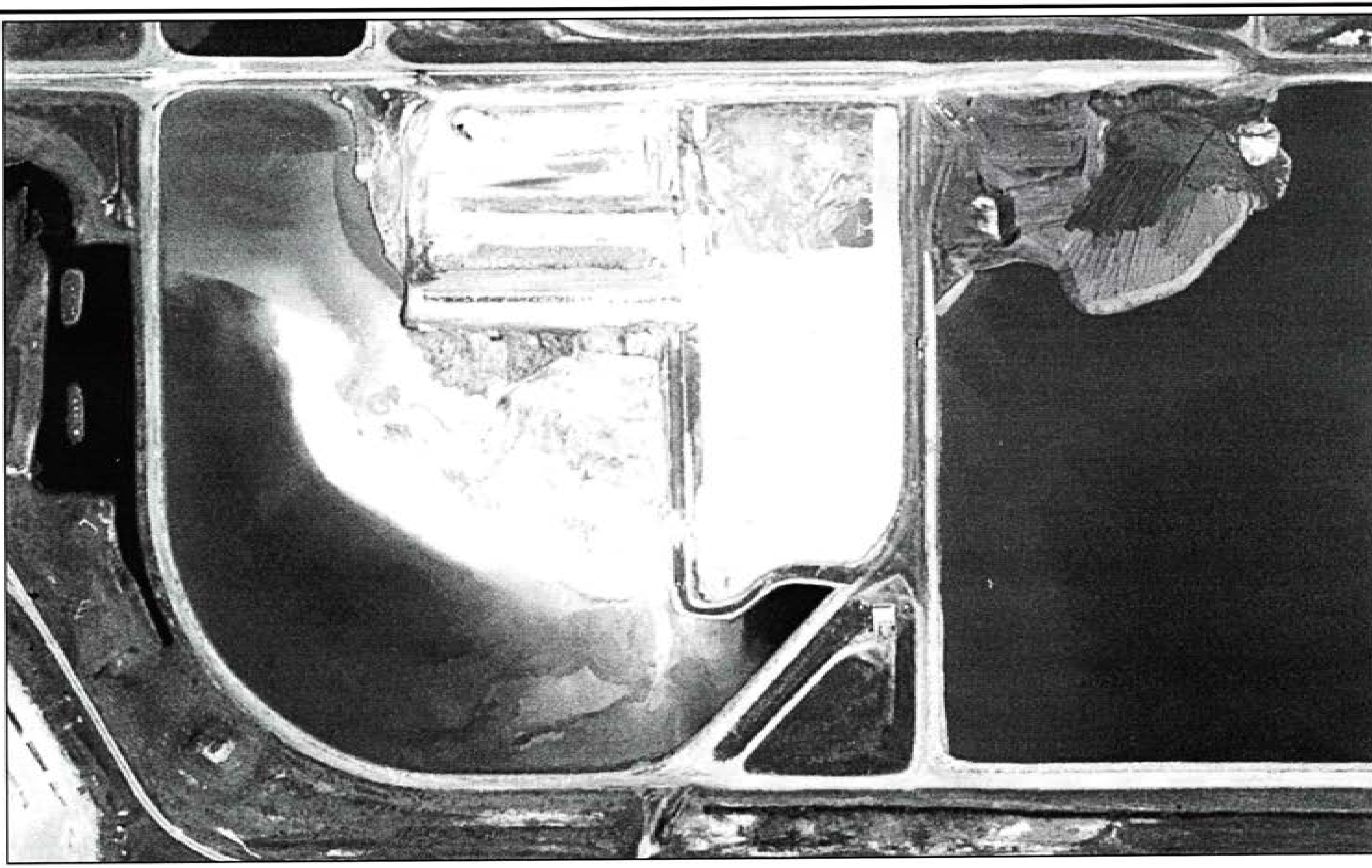
Denver, Colorado

GREAT RIVER ENERGY
COAL CREEK STATION
UNDERWOOD, ND

SURFACE WATER CHANNEL AND BASIN LAYOUT

FIGURE 1

PROJECT No. 023-2406 CADD TJS DATE 08/29/03 FILE No. Section 16.dwg



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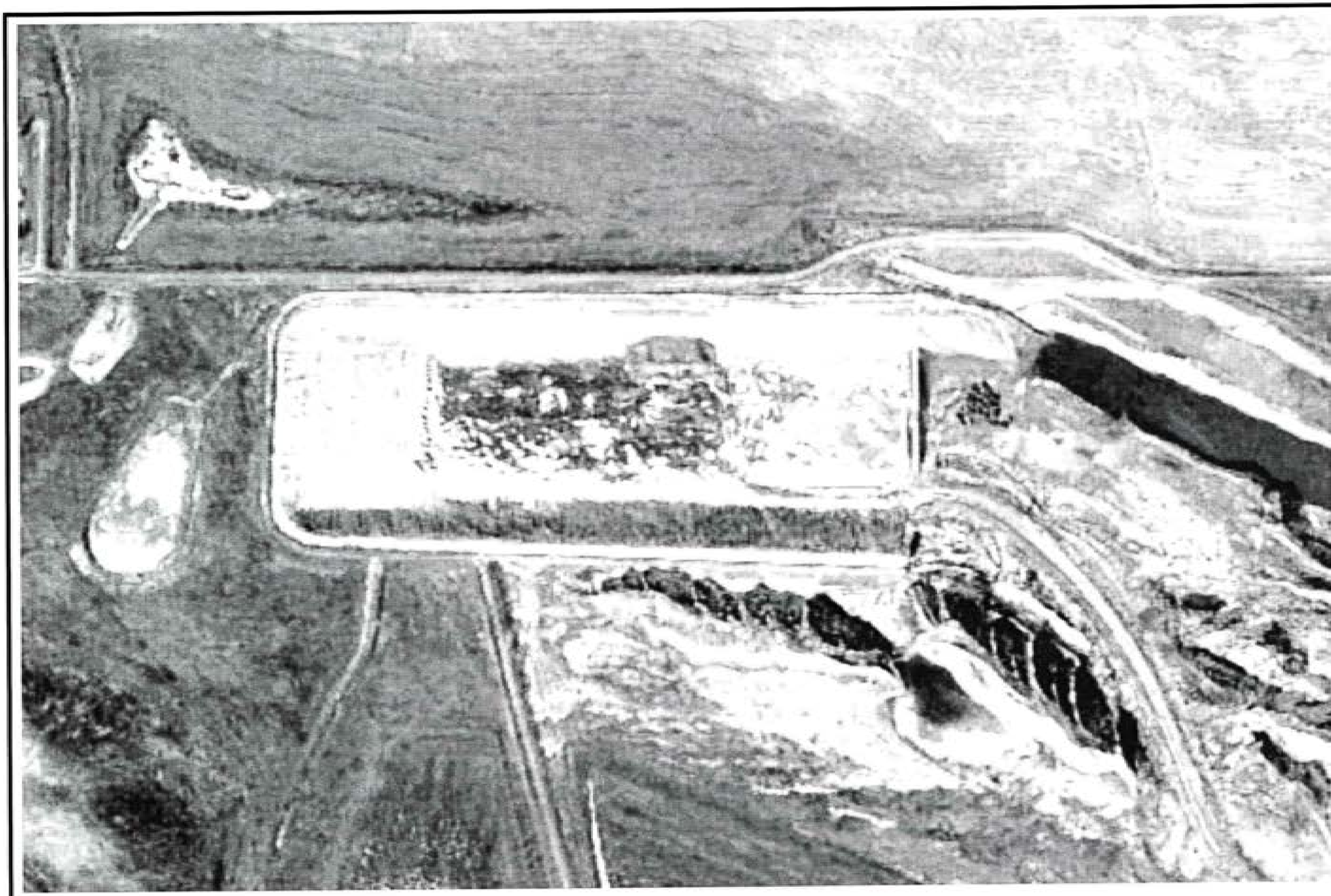
PROJECT No. 043-2226 CADD JSH DATE 07/08/04 FILE No. 0432226A004.dwg

ASH POND 91

FIGURE 3



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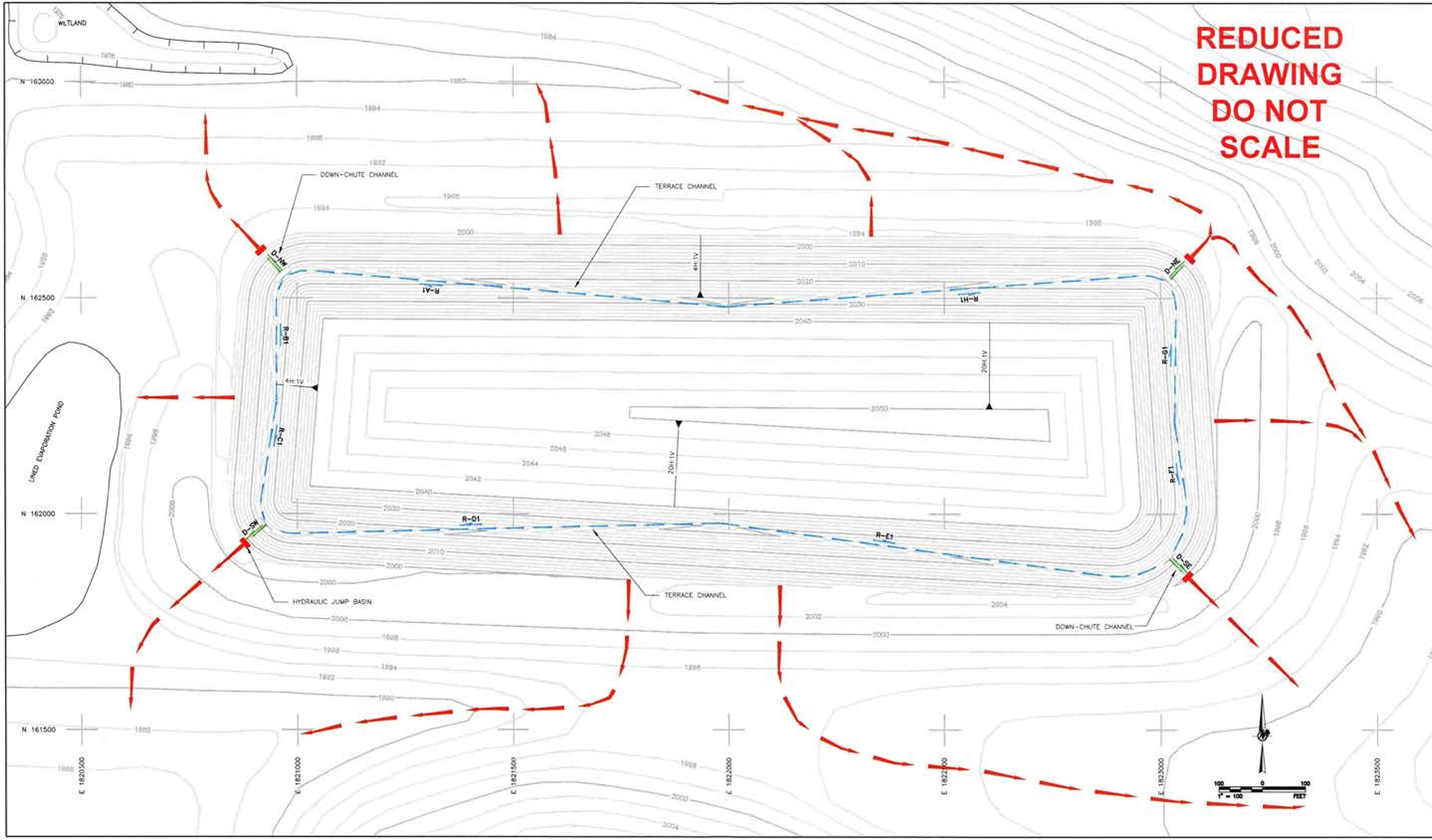
Denver, Colorado

SECTION 26

FIGURE 4

PROJECT No. 043-2226 CADD JSH DATE 07/08/04 FILE No. 0432226A004.dwg



LEGEND

FINAL GROUND TOPOGRAPHY	DOWN CHUTE CHANNELS
HYDRAULIC JUMP BASIN	TERRACE CHANNELS
	DRAINAGE AWAY FROM LANDFILL

GREAT RIVER ENERGY
COAL CREEK STATION
UNDERWOOD, ND

SURFACE WATER CHANNEL AND BASIN LAYOUT

FIGURE 1

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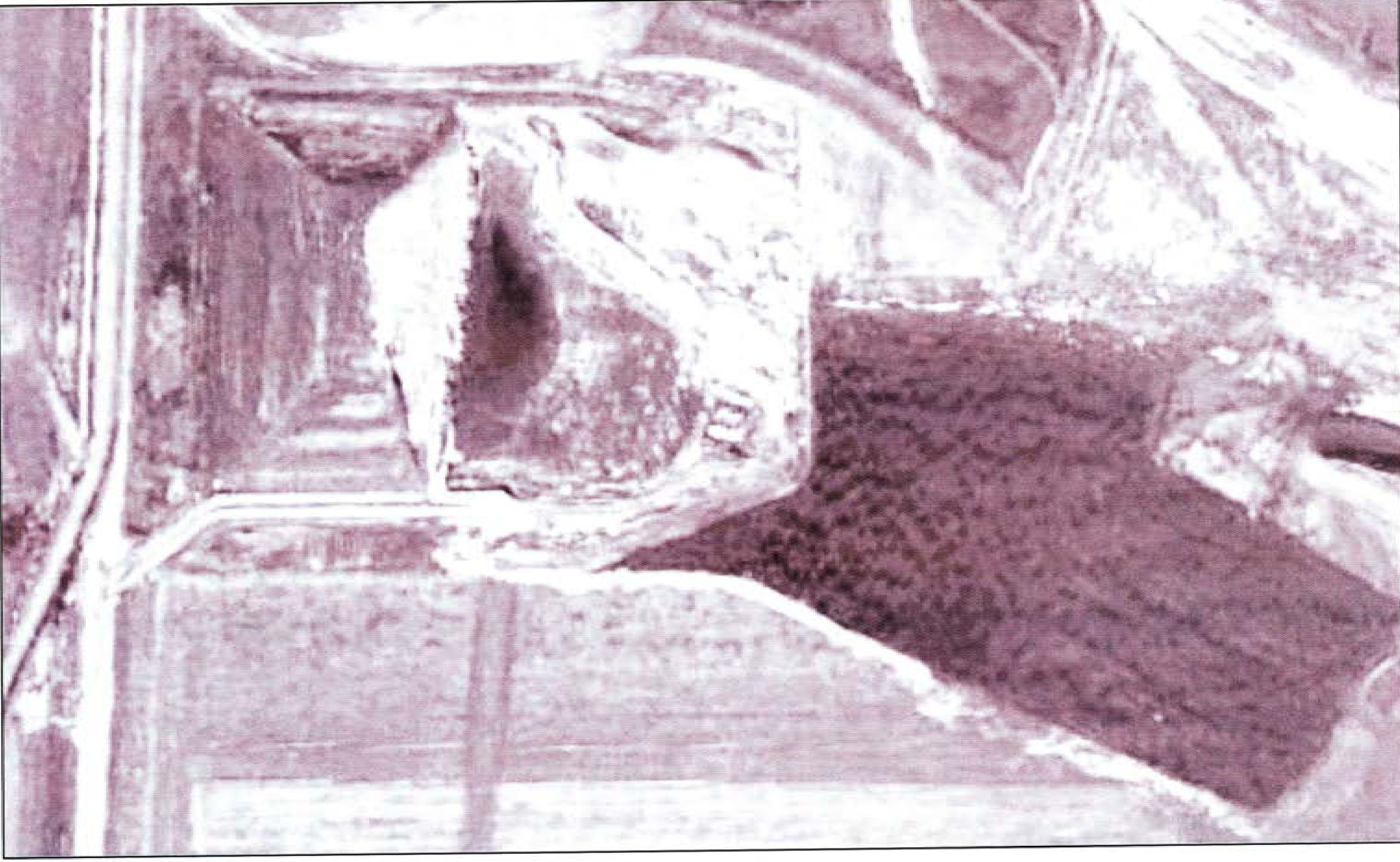
PROJECT No. 023-2413 CADD TJS DATE 04/01/04 FILE No. Section 26.dwg



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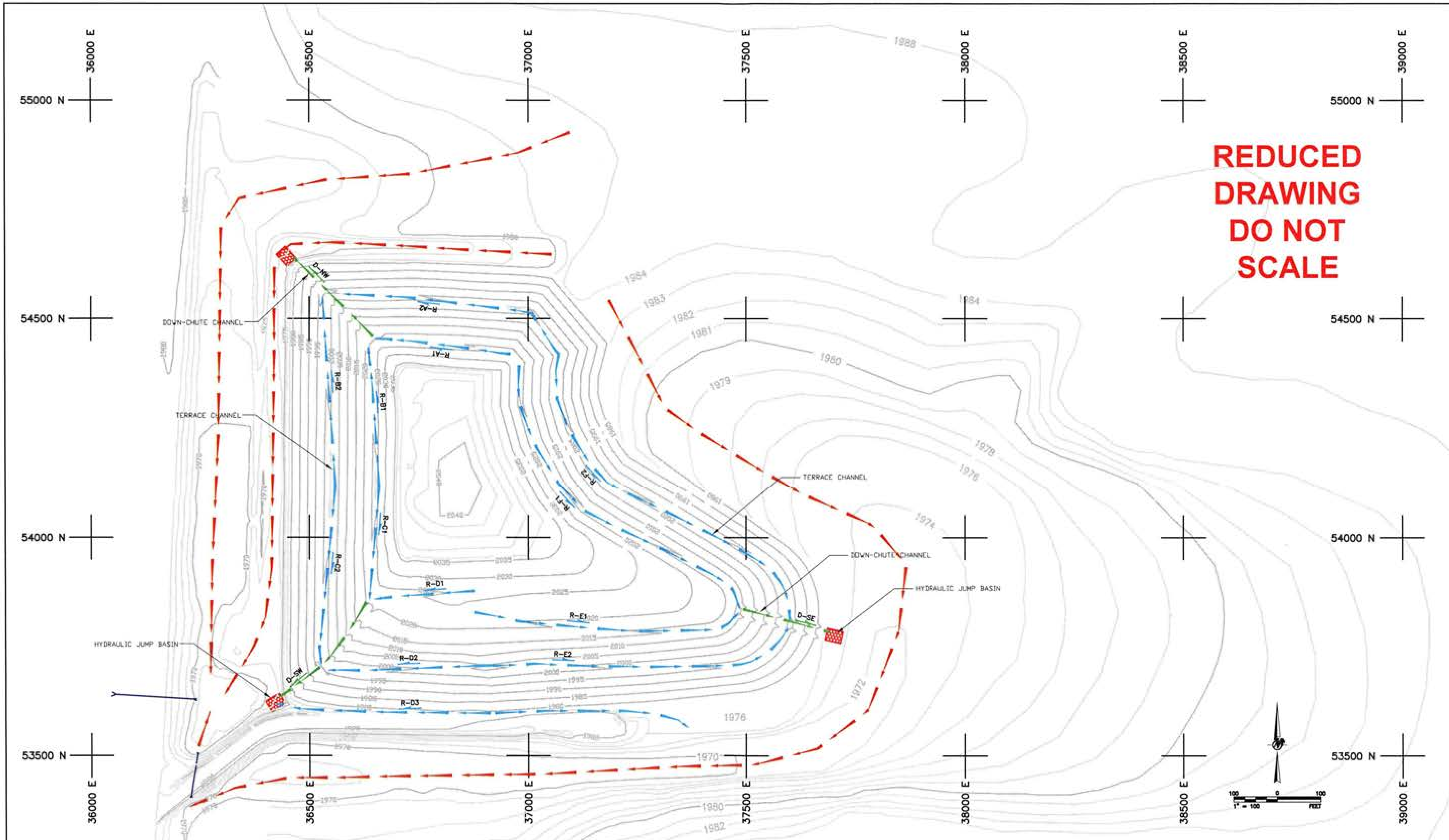
PROJECT No. 043-2226 CADD JSH DATE 08/17/04 FILE No. 0432226A004.dwg

SECTION 32

FIGURE 5



LEGEND

FINAL GROUND TOPOGRAPHY	DOWN CHUTE CHANNELS
HYDRAULIC JUMP BASIN	TERRACE CHANNELS
	EXISTING OFF-SITE DRAINAGE

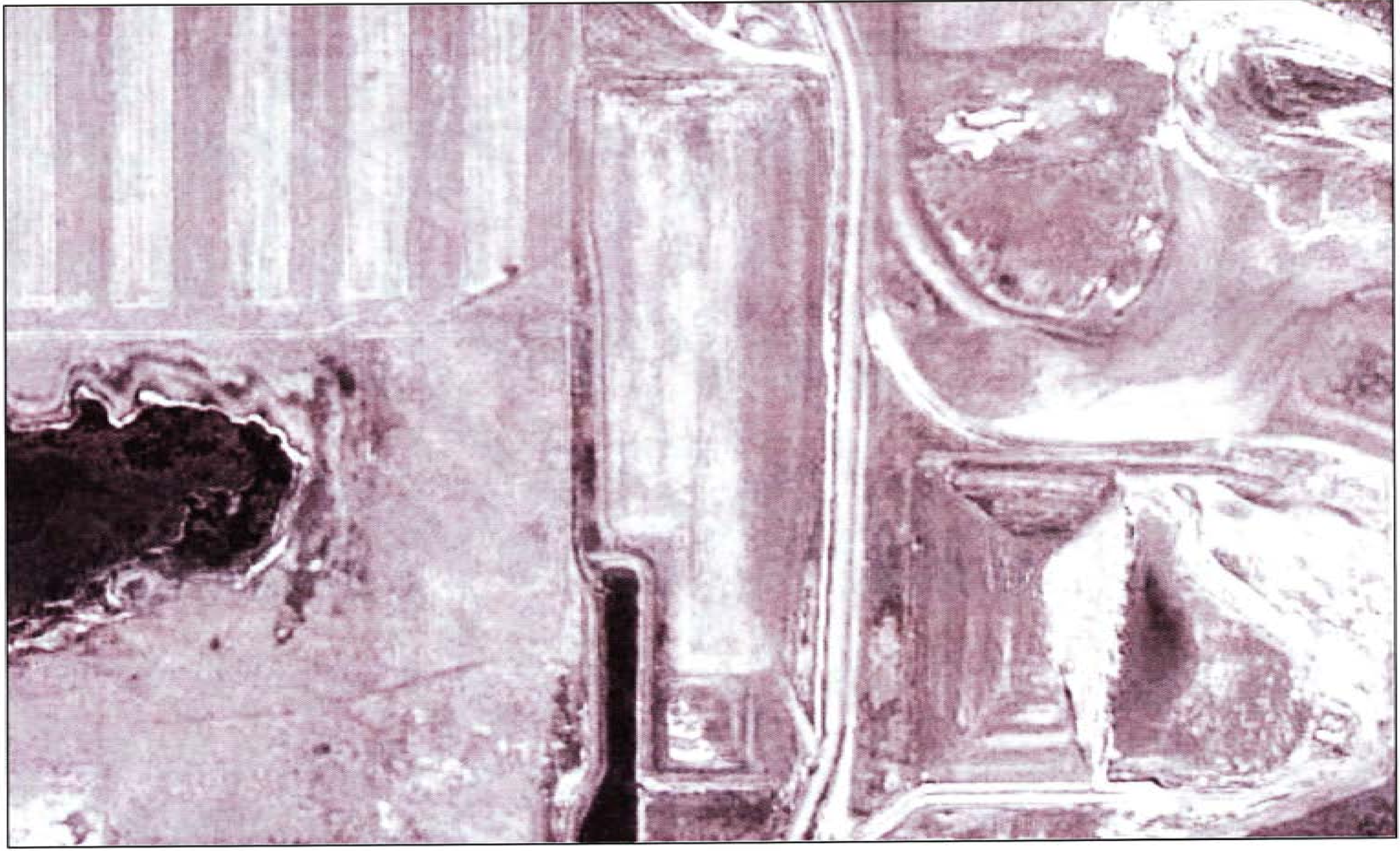
GREAT RIVER ENERGY
COAL CREEK STATION
UNDERWOOD, ND

Golder Associates
Denver, Colorado

SURFACE WATER CHANNEL AND BASIN LAYOUT

FIGURE 1

PROJECT No. 023-2413 CADD T/S DATE 02/17/04 FILE No. Section 32.dwg



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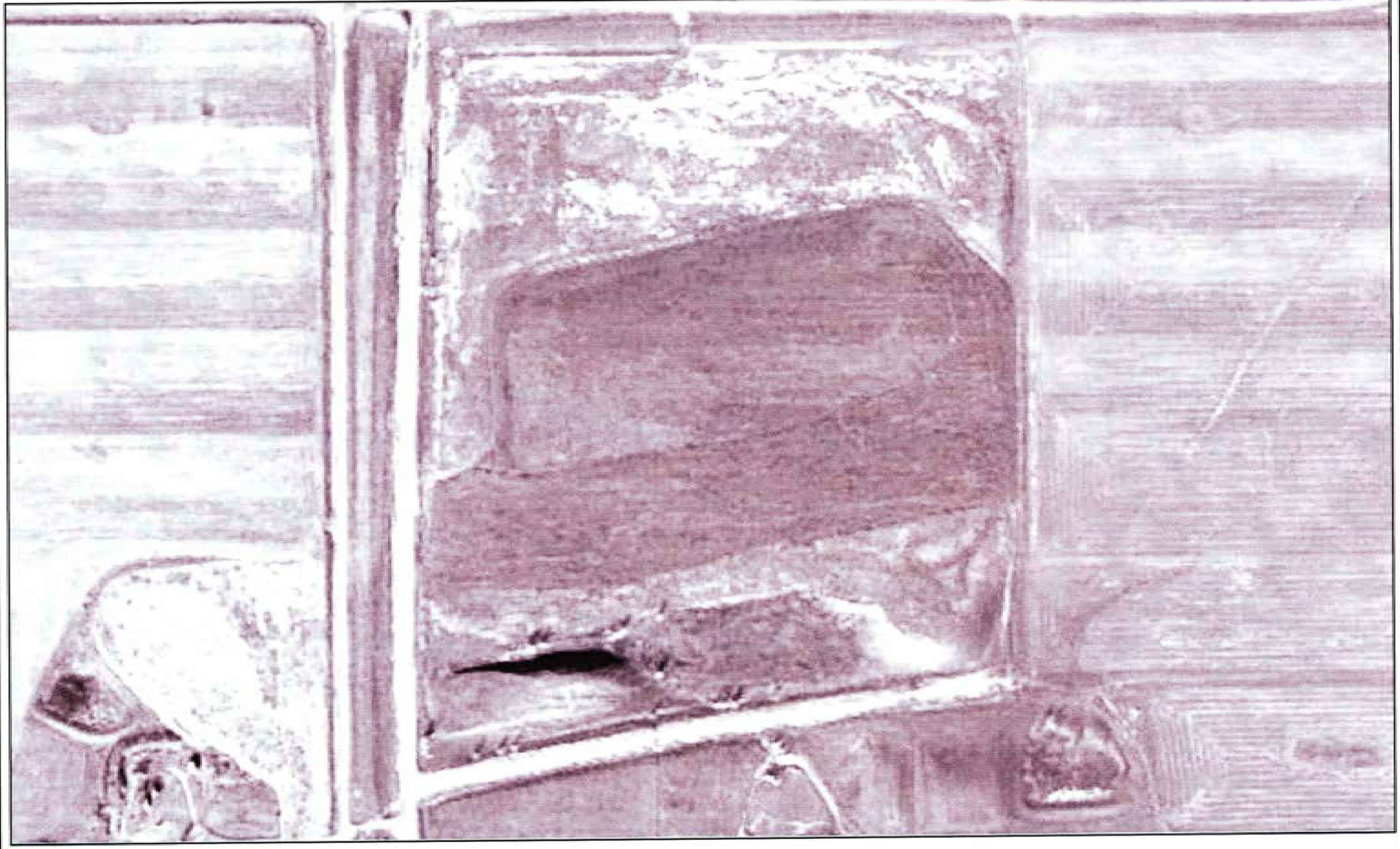
Denver, Colorado

SECTION 31

FIGURE 6

PROJECT No. 043-2226 CADD JSH DATE 08/17/04 FILE No. 0432226A004.dwg



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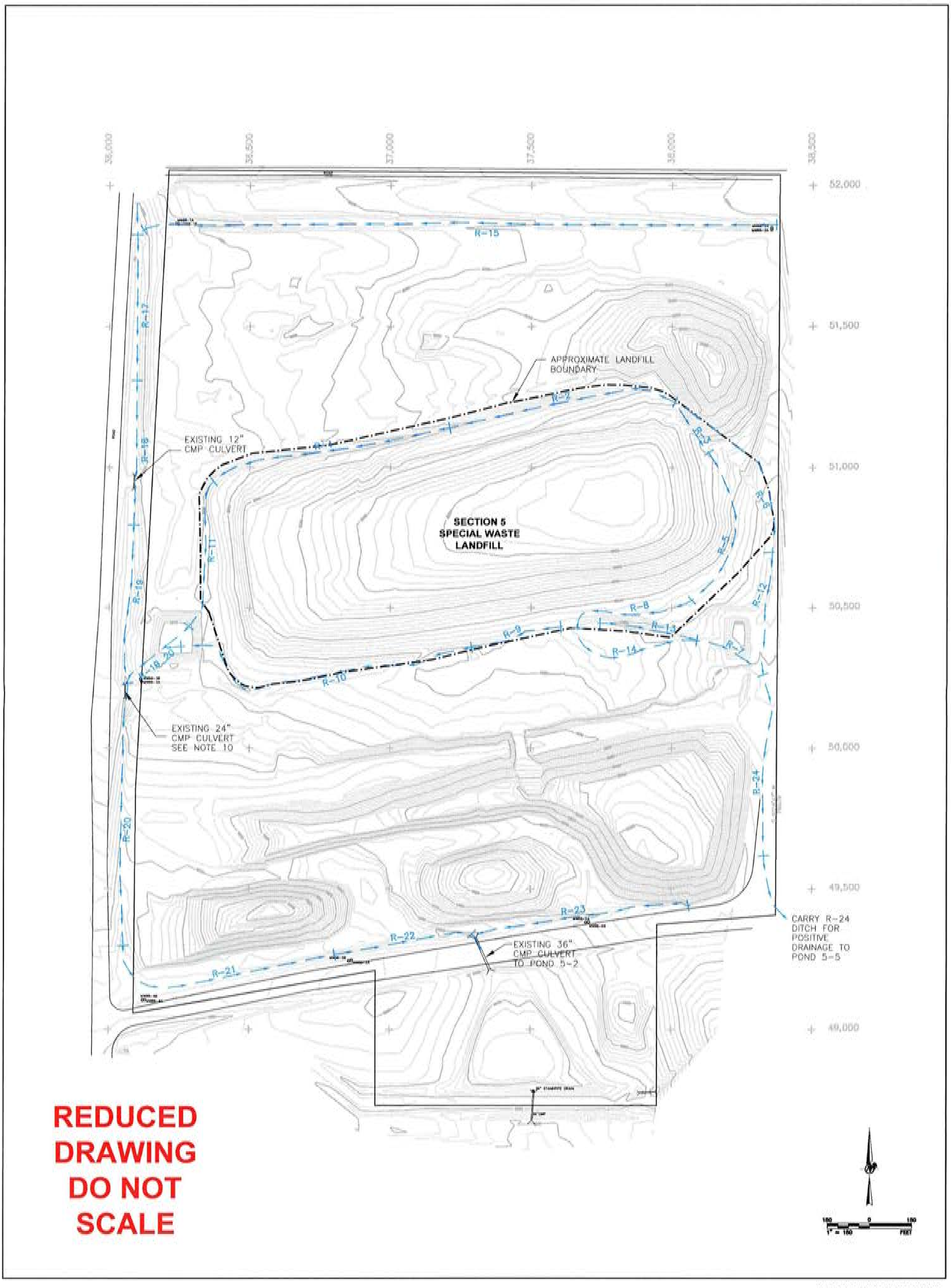
PROJECT No. 043-2226 CADD JSH DATE 08/17/04 FILE No. 0432226A004.dwg

SECTION 5

FIGURE 7



LEGEND

FINAL GROUND TOPOGRAPHY

SURFACE WATER CHANNELS

Golder Associates
Denver, Colorado

GREAT RIVER ENERGY
COAL CREEK STATION
UNDERWOOD, ND

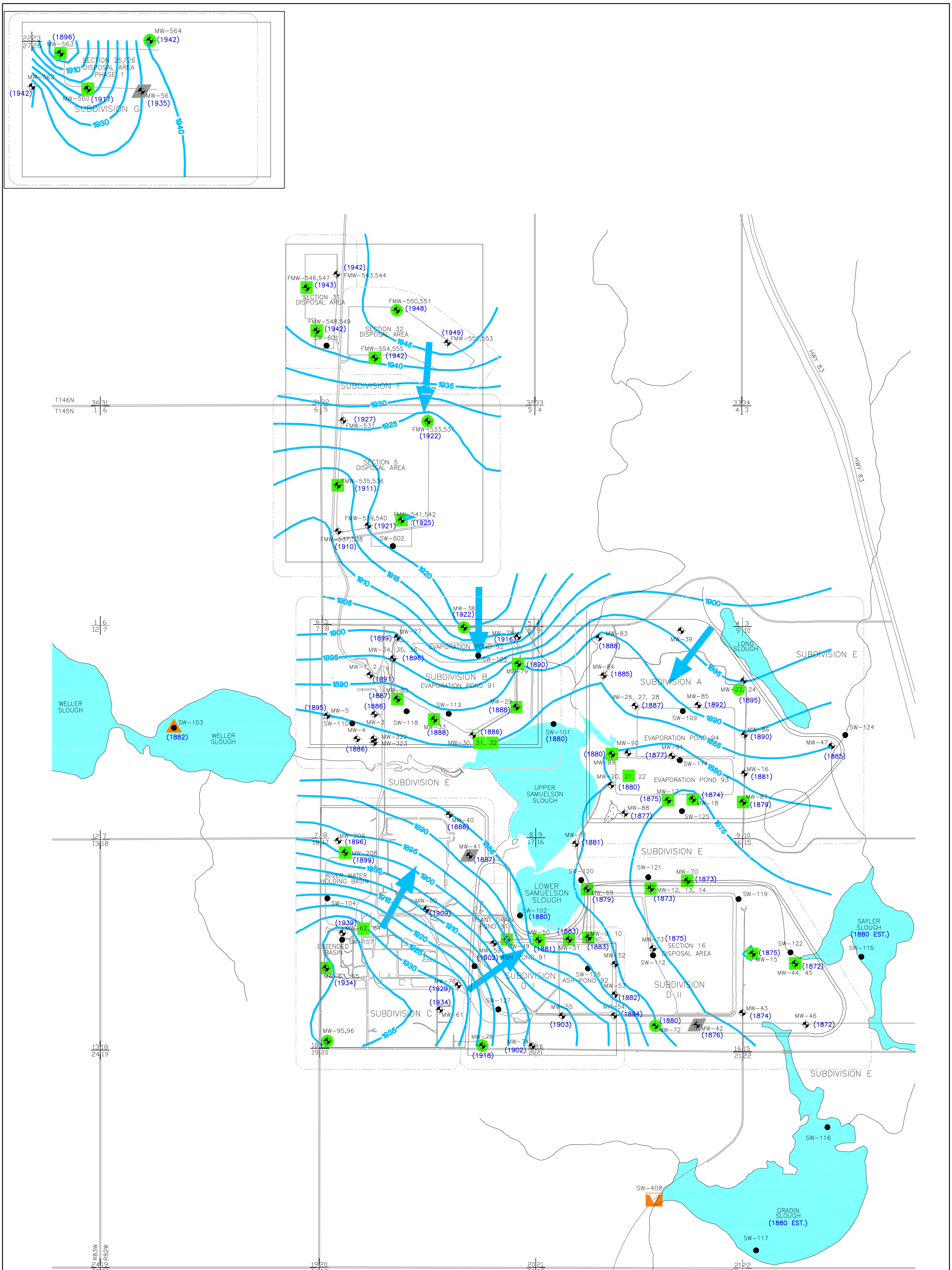
SECTION 5
SURFACE WATER PLAN

FIGURE 1

PROJECT No. 043-2226 CADD TJS DATE 06/29/04 FILE No. Section 5.dwg

APPENDIX E

WATER QUALITY DIAGRAM



LEGEND

- 1890 — POTENTIOMETRIC SURFACE (SEE NOTE 1)
- GENERALIZED DIRECTION OF GROUNDWATER FLOW
- APPROXIMATE FACILITY BOUNDARY
- ABANDONED MONITORING WELL
- REPORTED UPGRADIENT MONITORING WELL LOCATION
- REPORTED DOWNGRADIENT MONITORING WELL LOCATION
- INACTIVE INTERNAL MONITORING WELL LOCATION
- REPORTED SURFACE WATER MONITORING LOCATION (QUALITY AND FLOW)
- REPORTED SURFACE WATER MONITORING LOCATION (QUALITY)
- ABANDONED SURFACE WATER MONITORING LOCATION

NOTES

1. GROUNDWATER/SURFACE WATER ELEVATIONS COLLECTED MAY-JULY 2000.
2. RELATIVE POSITION OF SECTION $\frac{25}{26}$ DISPOSAL AREA (SUBDIVISION G) NOT TO SCALE WITH THE REST OF THE MAP AREA.

Scale in Feet
0 500 1000 2000
1" = 1000'

NORTH

REV.	DATE	DESCRIPTION	DR. BY	APP. BY
5	02/05/04	ISSUED WITH 2003/2003 MONITORING REPORT	KAJ	RRJ
4	10/17/03	FEATURES ADDED, CONTOURS CLARIFIED	KAJ	RRJ
3	12/11/01	SECOND REVISION WATER QUALITY PLAN	RB	RRJ
2	11/1/01	REVISED PLAN	RB	RRJ
1	4/1/01	PROPERTY BOUNDARY WATER QUALITY PLAN	RB	RRJ

CLIENT/PROJECT
GREAT RIVER ENERGY
COAL CREEK STATION
UNDERWOOD, NORTH DAKOTA

TITLE
REVISED 2000 WATER QUALITY MONITORING PLAN

Golder Associates
Denver, Colorado

DRAWN	KAJ	DATE	OCT. 2003
CHECKED	CY	SCALE	AS SHOWN
REVIEWED	MRN	JOB NO.	023-2408
APPROVED	RRJ	DWG. NO.	A025
FILE NO.	0232408A025	REVISION 4	DRAWING 2

Dwg Name: N:\023-2408\0232408B025.dwg
Last Update: Feb 05, 2004 16:39 By: mjuneau
Last Plot: Feb 23, 2004 15:20 By: mjuneau
Machine: CAD_Juneau
IMAGE: GRE.BMP

GREAT RIVER ENERGY
COAL CREEK STATION
INSPECTION REPORT
CCP DISPOSAL FACILITIES

GREAT RIVER ENERGY
A Touchstone Energy® Cooperative

Date of Inspection			**Legend:** Y Yes
Inspector	**Title**		NB Not observed
Inspector	**Title**		NA Not applicable
Facility ASH POND 91			RA Requires action

Please mark areas of concern on the attached plan view of the facility. Insert comments in Section G.

A. Area Status

Status of Disposal Area	**Active**	**Inactive**			**Closed**
If inactive, how long inactive?					**days/months**

If greater than 180 days, is interim cover being placed and/or seeded?	**Y**	**NB**	**NA**	**RA**	
Any changes to the utilities near or servicing the area?	**Y**	**NB**	**NA**	**RA**	

B. Facility Access

Do all entrances have signs detailing entrance authorization and allowed disposal material?	**Y**	**NB**	**NA**	**RA**	
Are the roads to the site in good repair?	**Y**	**NB**	**NA**	**RA**	
How is access controlled to the site (fencing, locked gate, etc.)?	**Y**	**NB**	**NA**	**RA**	
Are the facility boundaries clearly marked?	**Y**	**NB**	**NA**	**RA**	
Are there signs of unauthorized access to the site such as trails or gaps in the fencing?	**Y**	**NB**	**NA**	**RA**	
Is there any evidence of any unauthorized disposal (other than CCPs or construction/demolition debris)?	**Y**	**NB**	**NA**	**RA**	

C. Site Conditions

Are there signs of erosion in the disposal area such as gullies, dirt flows, etc.?	**Y**	**NB**	**NA**	**RA**	
Are there signs of differential settlement in the disposal area such as cracks, sinkholes, etc.?	**Y**	**NB**	**NA**	**RA**	
Any indication of vegetative stress in or near the disposal area? Are there pockets of dead or dying vegetation in otherwise seeded areas?	**Y**	**NB**	**NA**	**RA**	
Any noticeable environmental concerns such as: odor, excessive dust or litter, discolored earth or water, infestation by animals, signs of open burning?	**Y**	**NB**	**NA**	**RA**	

Is there any evidence of spillage or disposal outside of the immediate disposal area?	**Y**	**NB**	**NA**	**RA**	
Is water ponding within the facility?	**Y**	**NB**	**NA**	**RA**	
Is there at least two feet of freeboard within the surface impoundment?	**Y**	**NB**	**NA**	**RA**	
D. Water Control Structures					
Is there any erosion or blockage of the diversion channels? Are the channels clearly defined?	**Y**	**NB**	**NA**	**RA**	
Are temporary erosion controls in place? Describe.	**Y**	**NB**	**NA**	**RA**	
Are all surface water control structures and monitoring devices in good condition?	**Y**	**NB**	**NA**	**RA**	
Are all monitoring wells in good condition?	**Y**	**NB**	**NA**	**RA**	
Any signs of off-site migration of the contact water?	**Y**	**NB**	**NA**	**RA**	
Note the condition of any special feature.					
E. Structural Stability					
Any signs of seepage on the downstream face of the embankments? (Signs of wetness, gullies, erosion features)	**Y**	**NB**	**NA**	**RA**	
Any signs of mass movement such as differential settlement within the impoundment or crest elevation changes along the centerline of the embankment?	**Y**	**NB**	**NA**	**RA**	
Any signs of sudden change in the liquid levels within the impoundment?	**Y**	**NB**	**NA**	**RA**	
Any signs of external impacts that may affect the liner integrity or embankment stability for the facility?	**Y**	**NB**	**NA**	**RA**	
F. Pumps, Pipelines, and Distribution Systems					
Any signs of wetness above buried pipelines or below aboveground pipelines indicating possible leaks or stressed areas of piping?	**Y**	**NB**	**NA**	**RA**	
On any aboveground pipeline, does the foundation appear unmoved and stable?	**Y**	**NB**	**NA**	**RA**	
Are the pumps currently operational, and, if so, in apparent good working order?	**Y**	**NB**	**NA**	**RA**	
When was the last listed maintenance for the pump (if in operation only)?					
G. Facility Overview					
What material is currently being placed at the facility?					

Any housekeeping concerns about the waste placement, coverage, and vegetation for visitors and neighbors?					
Is partial closure of the facility occurring?	**Y**	**NB**	**NA**	**RA**	
Has seed and mulch been applied on the closed areas of the site?	**Y**	**NB**	**NA**	**RA**	
Any visible or exposed soil or geomembrane liner?	**Y**	**NB**	**NA**	**RA**	
Were the concerns from the last inspection addressed and corrected?	**Y**	**NB**	**NA**	**RA**	

H. Comments

Describe any concerns identified above along with an overview of the current operations occurring at the facility. Include documentation of corrective action measures (photographs, plan view map, sketches, etc.) along with any work orders and anticipated dates of completion.

Form Approved By: Diane Stockdill
Revision 0
2/28/05