Amended Written Closure Plan

Comanche Station - Active CCR Landfill

Public Service Company of Colorado
Denver Colorado

October 17, 2016

June 20, 2022 - Revision 1

Table of Contents

List of Tables

List of Figures

Appendices

Table of Abbreviations and Acronyms

Abbreviation	Definition
ADF	Ash Disposal Facility
amsl	above mean sea level
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
cm/sec	Centimeters per Second

1.0 General Information

Comanche Station is a 1,450-megawatt coal-fired, steam turbine power plant owned and operated by Public Service Company of Colorado (PSCo), an Xcel Energy company. The Station is located at 2005 Lime Road, Pueblo, Colorado 81006 approximately 3 miles south of Colorado Highway 50 in Pueblo County, Colorado.

The Station's Ash Disposal Facility (ADF) is located on the southwest corner of the Comanche Station property (see **Figure 1**). The land surface elevations range from approximately 4,830 feet above mean sea level (amsl) in the southwest and northwest corners of the Site to approximately 4,800 feet amsl in the southeast corner of the Site.

The ADF is an active, coal combustion residuals (CCR) disposal unit that began construction and operation in 1987 and has remained in continuous operation since that time. The ADF is operated under an Engineering Design and Operations Plan developed pursuant to Colorado Department of Health and Environment Solid Waste Regulations.

The ADF was originally permitted as an approximately 280-acre engineered ash monofill consisting of eight disposal cells. With the final coal unit ceasing operations planned for no later than the end of 2034, the updated ADF configuration will consist of only three disposal cells encompassing 94-acres, which is sufficient to handle future disposal requirements given the reduced anticipated coal generation lifespan. Approximately 13.0 acres of the ADF will be used for surface water control structures, access roads, and borrow area. The wastes accepted at the ADF consist primarily of coal ash (fly ash and bottom ash), with smaller quantities of water treatment sludge, process water pond sediment, coal impurities, and excavation soils. Cell 2 is the current active disposal area.

In accordance with 40 Code of Federal Regulations (CFR) 257 Disposal of Coal Combustion Residuals from Electrical Utilities (CCR Rule) §257.102(b), owners of CCR disposal units are required to publish a written closure plan that, *"…describes the steps necessary to close the CCR unit at any point during the active life of the CCR unit consistent with recognized and generally accepted good engineering practices."*

This closure plan fulfills the requirements of 40 CFR §257.102(b).

2.0 Description of Closure Plan – 257.102(b)(1)(i-iii)

The ADF originally consisted of a total of eight permitted cells, but only three cells are anticipated to be constructed and utilized. Cell 1 was constructed prior to the CCR rule with a bottom liner consisting of 18-inches of compacted clay with a permeability of $2x10^{-7}$ centimeters per second (cm/sec). The eastern portion of Cell 2 ('Cell 2 East') was constructed in 2018 with a CCR Rule compliant composite bottom liner consisting of a geosynthetic clay liner overlain by a 60-mil HDPE geomembrane. The remaining cells will also be constructed with a CCR Rule compliant bottom liner. The western portion of Cell 2 ('Cell 2 West') is anticipated to be constructed in 2024 and Cell 3 is anticipated to be constructed in 2032. The ADF has an estimated remaining 13-year life expectancy upon completion of Cell 3 and will provide CCR and non-CCR disposal capacity through approximately 2037, based on the estimated ash production rates and volume of additional disposal

materials related to impoundment closures, coal pile removal, and ash removed during plant decommissioning as indicated in **Table 1** below.

The cells are constructed and filled in phases and the configuration is such that the final top deck of Cells 2 and 3 overlap Cell 1, and final cover installation will be done at completion of all fill activities, (i.e., 'final waste grades'). However, upon reaching interim operating grade for each cell, an intermediate cover consisting of 1 foot of soil will be placed on the top of the ash material. PSCo will initiate final closure activities once final grades for each of the three cells, or the total ADF area, is reached. The facility will utilize a final cover design meeting the requirements of 40 CFR §257.

Per 40 CFR 257 §102(d)(1)(i), the final cover will have a grade that promotes surface water run-off and minimizes erosion. The slope of the final cover on the top of the ADF will be no less than 5% and the final cover side slopes will be no greater than 25% (4 horizontal feet to 1 vertical foot). A 5% slope will be sufficient to convey any precipitation runoff from the top of the ADF to downchute conveyance structures located at the perimeter of the ADF. Small swales along the tops and sidewalls of the ADF will direct precipitation runoff to the downchute conveyance structures. These design elements are intended to minimize to the maximum extent feasible, post-closure saturation of final cover soils and the potential for sloughing of the final cover system as required by 40 CFR 257 §102(d)(1)(i) - (iii).

The ADF will have a final cover consistent with 40 CFR 257 §102(d)(3)(i) – *Closure performance standard when leaving CCR in place* – which requires that the permeability of the final cover system must be less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than 1 x 10^{-5} cm/sec, whichever is less.

For Cell 1, the design specification for the clay liner was 18 inches of on-site clay compacted to 95% standard proctor density, resulting in a hydraulic-conductivity value of 2 x 10^{-7} cm/sec. Prior to the publication of the CCR rule, Cell 1 had undergone partial closure of the exterior slopes concurrent with operations. Slopes were closed with an approved soil cover consisting of an 18-inch infiltration layer and a 6-inch erosion layer.

Areas of Cell 1 that were not closed prior to publication of the CCR rule will have final cover that will consist of 18-inches of compacted soils with a hydraulic-conductivity value of no greater than 2 x 10^{-7} cm/sec or equivalent system utilizing a geomembrane. A 6-inch erosion layer consisting of topsoil suitable to support vegetation, or a synthetic alternative, will be applied.

Cells 2 and 3 will be constructed with a final cover system consisting of a suitable subgrade material (graded and free of deleterious materials), a geomembrane cap that is no more permeable than the liner, and a soil cover suitable to support vegetation, or a synthetic alternative. The existing final cover in areas of Cell 1 which were closed prior to the CCR Rule will be evaluated and may be augmented if necessary.

An on-site soil borrow area is mined for soil to be used for the infiltration soil layers. The soil borrow area is located adjacent to the current active area. Construction phasing consists of borrowing soil from the next cell to be constructed for use in closure of the current cell. If needed, additional borrow materials are available north of the ADF. The on-site soils that are expected to be excavated from the remaining Cell 2 and 3 footprints are described as consisting of unconsolidated colluvium consisting of stiff clays and silts. An evaluation of on-site soils indicates that the soils can be re-compacted to achieve a hydraulic conductivity of 1x10^{-7} cm/sec or less. If needed, off-site borrow areas may be utilized. Each new borrow source is tested prior to being used on-site. As it is encountered, existing on-site topsoil material will be stripped and stockpiled for future use in the final cover system. After topsoil is installed, it will be tracked and seeded. Vegetative cover is an

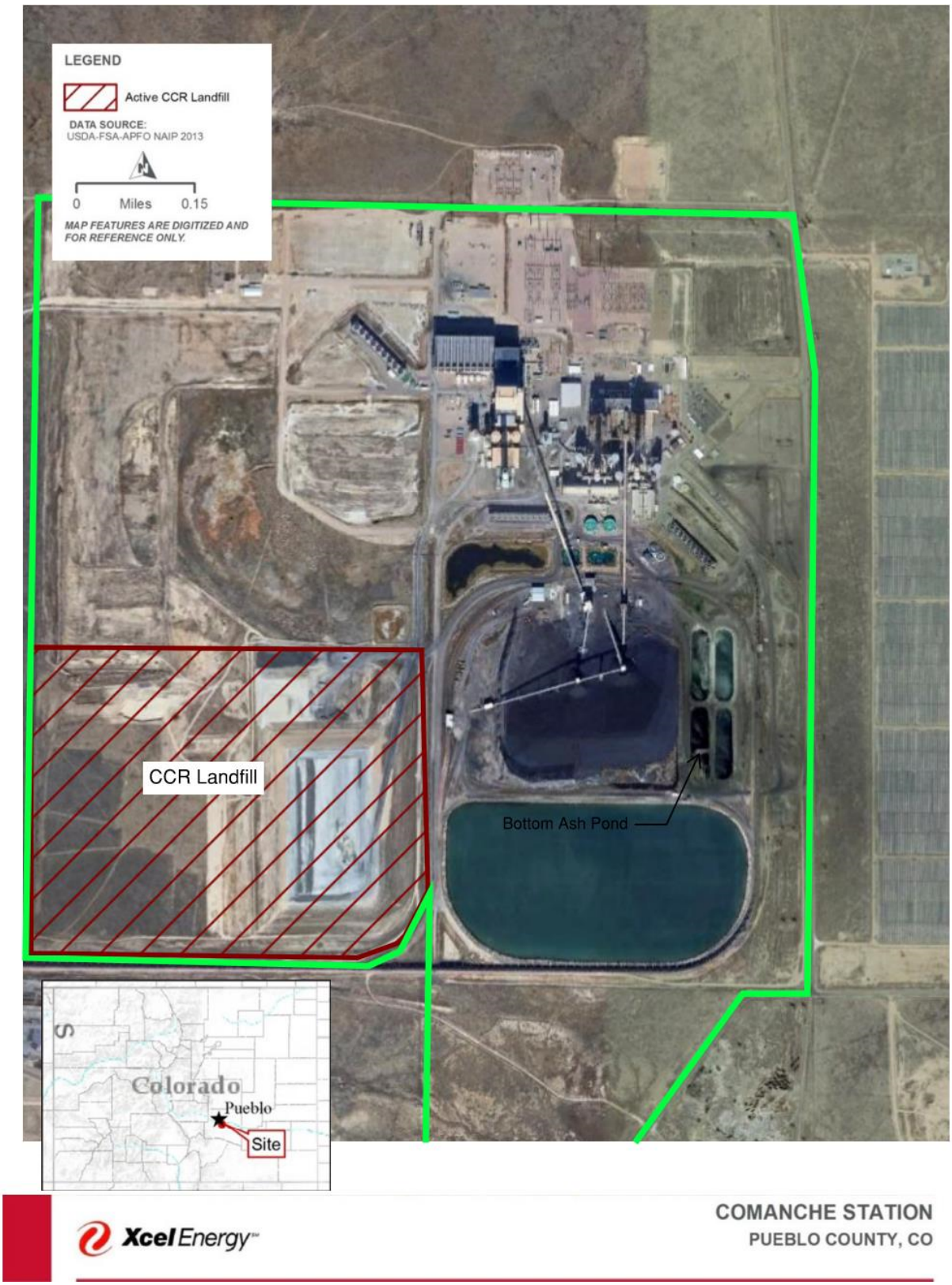


Figure 1. Comanche Power Station – CCR Landfill

important part of the final cover system as it provides long-term stabilization of the slopes, limits erosion due to stormwater runoff, and reduces the potential for wind-blown nuisance dust. Alternatively, an equivalent engineered synthetic turf system, which is suitable for the local climate, may be used as an alternative final closure option. Use of a vegetative cover or synthetic turf system will be employed to minimize maintenance of the Cells 1-3 as required by 40 CFR 257 §102(d)(1)(iv).

3.0 Inventory Estimate –257.102(b)(1)(iv)

In accordance with 257.102(b)(1)(iv) an estimate of the maximum inventory of CCR ever on site over the active life of the CCR Landfill must be provided.

The majority of waste managed at the ADF is fly ash (approximately 90% by volume); bottom ash is also managed in the ADF and comprises about 5% of the volume. Smaller quantities (0.02% by volume) of coal impurities (pyrites, rocks, etc.) are disposed at the ADF. Lime sludge from the process water ponds (approximately 5% by volume) are also managed in the ADF. Small quantities of construction excavation soils are also occasionally disposed at the ADF on a project-by-project basis.

The estimated ash and lime sludge annual generation rates are broken down by Unit in **Table 1**. The averages are based on production records from 2018 to 2022. In addition to these annual volumes, the ADF will also be used to dispose of materials related to the overall plant decommissioning, including residuals from the coal pile and waste from closure of existing impoundments on-site. These materials are anticipated to contribute an additional 200,000 CY. When the ADF is closed in approximately 2037 the estimated final volume of CCR and non-CCR waste will be approximately 13.6 million cubic yards

Table 1. Summary of Waste Streams and Estimated Ash Generation Rates

	Annual Estimated Generation Rates		
Material	**Unit 1 (CY)**	**Unit 2 (CY)**	**Unit 3 (CY)**
Bottom Ash	10,674	10,674	1,617*
Fly Ash	141,412	141,412	137,121
Lime Sludge	8,296	8,296	8,172
Total Generation (CY)	160,382	160,382	146,910
Annual Generation (CY)	**467,674**		
Plant Decommissioning (CY)	200,000		
Estimated CCR and non-CCR (CY)	13,600,000		

* Note: The amount of Unit 3 bottom ash disposed in the landfill is less than that for Units 1 and 2 because the unit has been in operation for less time and the majority of the Unit 3 bottom ash was beneficially used off-site in the production of cement (encapsulated use).

Units 1, 2 and 3 are expected to come offline at the end of 2022, 2025, and 2034 (no later than), respectively. Based on the CCR and non-CCR waste estimated to be disposed based on this schedule and the calculated airspace in the remaining cells, it is anticipated that only a portion of Cell 3 will ultimately be filled at the time of closure.

4.0 Area Requiring Final Cover – 257.102(b)1(v)

In accordance with 40 CFR §257.102(b)(1)(v), an estimate of the largest area of the CCR unit ever requiring a final cover must be provided. The ADF's entire CCR disposal area will receive a final cover as described herein. Due to the overlapping configuration of the disposal cells, as shown in Appendix A Closure Plan Drawings, PSCo will install in phases intermediate cover consisting of 1 foot of soil on the top of the ash material in inactive landfill areas and will install the final cover after all cells reach final grade. Therefore, at any given time, the largest area containing CCR that will require a final cover is estimated to be approximately 94 acres (**Table 2**). However, each phase will receive intermediate cover in earlier years as shown in **Table 3**.

Table 2. Summary of Final Cover Areas by Cell

Cell Number	Final Cover Area (Acres)	Approximate Year of Final Closure
Cell 1	39.8	2037*
Cell 2	27.1	
Cell 3	27.1	

* Note: There are currently two proposed plant closure dates in front of the Colorado Public Utilities Commission for approval: 12/31/2034 and 1/1/2031, neither of which have been decided. We are using the 2034 date as our estimate until a decision is made. An additional three years beyond the cessation of ash production on-site has been conservatively added to the schedule. This is to account for disposal of materials in the ADF associated with plant decommissioning activities such as removal of coal pile residuals and on-site impoundment waste.

5.0 Schedule of Closure Activities – 257.102(b)1(vi)

Table 3. Schedule of Closure Activities		
Plans	**Initial**	**Revised**
Written Closure Plan	October 17, 2016	June 20, 2022
Written Post-Closure Plan	October 17, 2016	June 20, 2022
State Closure Plan	September 8, 2017	2022/2023
Task	**Cell Start Date**	**Cell Fill Date**
Cell 1	1987	2019 (interim grade/intermediate cover)
Cell 2 East	2018	2024 (interim grade/intermediate cover)
Cell 2 West	2024	2032 (interim grade/intermediate cover)
Cell 3*	Year 2032	Year 2037* (final waste grade)
Final Closure Procurement	2036	2037
Final Closure	2037	2037
State CQA Report Approval	2037	2037
Closure Completion Notification	2037	2037
Deed Notice	2037	2037
Annual Inspections	Annually	Annually until 2037
Fugitive Dust Plan Updates	Annually	Annually until 2037
Post Closure Inspections and Maintenance	Year 2037	Year 2067 (minimum)

* Note: There are currently two proposed plant closure dates in front of the Colorado Public Utilities Commission for approval: 12/31/2034 and 1/1/2031, neither of which have been decided. We are using the 2034 date as our estimate until a decision is made. An additional three years beyond the cessation of ash production on-site has been conservatively added to the schedule. This is to account for disposal of materials in the ADF associated with plant decommissioning activities such as removal of coal pile residuals and on-site impoundment waste.

6.0 Qualified Professional Engineer Certification – 257.102(b)(4) and 257.102(d)(3)

In accordance with 40 CFR §257.102(b)(4), the owner or operator of the CCR unit must obtain a written certification from a qualified professional engineer that the initial and any amendment of the written closure plan meets the requirements of this section.

In accordance with 40 CFR §257.102(d)(3), the owner or operator of the CCR unit must obtain a written certification from a qualified professional engineer that the design of the final cover system meets the requirements of this section.

I, Brent J. Learch, being a registered Professional Engineer, in accordance with the Colorado State Board of Licensure for Architects, Professional Engineers, and Professional Land Surveyors, do hereby certify to the best of my knowledge, information, and belief, that the information contained in this written Closure Plan dated June 20, 2022, was conducted in accordance with the requirements of 40 CFR §257.102(b) and (d), is true and correct, and was prepared in accordance with recognized and generally accepted good engineering practices.

SIGNATURE:

Colorado PE 0056841

DATE: June 20, 2022

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

Signature/Name/Title: Quinn V. Kilty

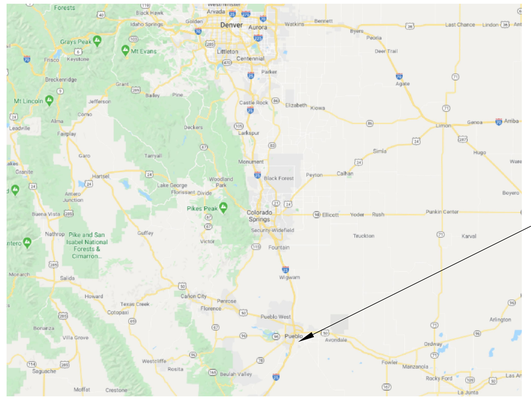
Digitally signed by Quinn V. Kilty
Date: 2022.06.22 21:18:19 -06'00'

Appendix A

Closure Plan Drawings

Xcel Energy®

PUBLIC SERVICE COMPANY
OF COLORADO



General Location Map
NTS

HDR Engineering
1670 Broadway
Suite 3400
Denver, CO 80202-4824
303.764.8800

Construction Drawings For

Xcel Energy

Comanche Station Closure Plan

Project Location Map
1" = 1,000'

INDEX OF DRAWINGS

HDR Project No.
10212366

2005 Lime Road
Pueblo, CO 81006

JUNE 2022

NO	REVISION	ZONE	DATE	BY	CHK	ENG
0	ISSUED FOR REVIEW		6/20/2022	MA	BL	SS

NO	REVISION	ZONE	DATE	BY	CHK	ENG

REFERENCE DRAWINGS		
DWG NO.	MANUFACTURER	DESCRIPTION

REFERENCE DRAWINGS		
DWG NO.	MANUFACTURER	DESCRIPTION

Xcel Energy®
PUBLIC SERVICE COMPANY
OF COLORADO

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COMANCHE SEGS
CLOSURE PLAN
COVER SHEET AND INDEX

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1670 BROADWAY, SUITE 3400
DENVER, CO 80202

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SHEET NO
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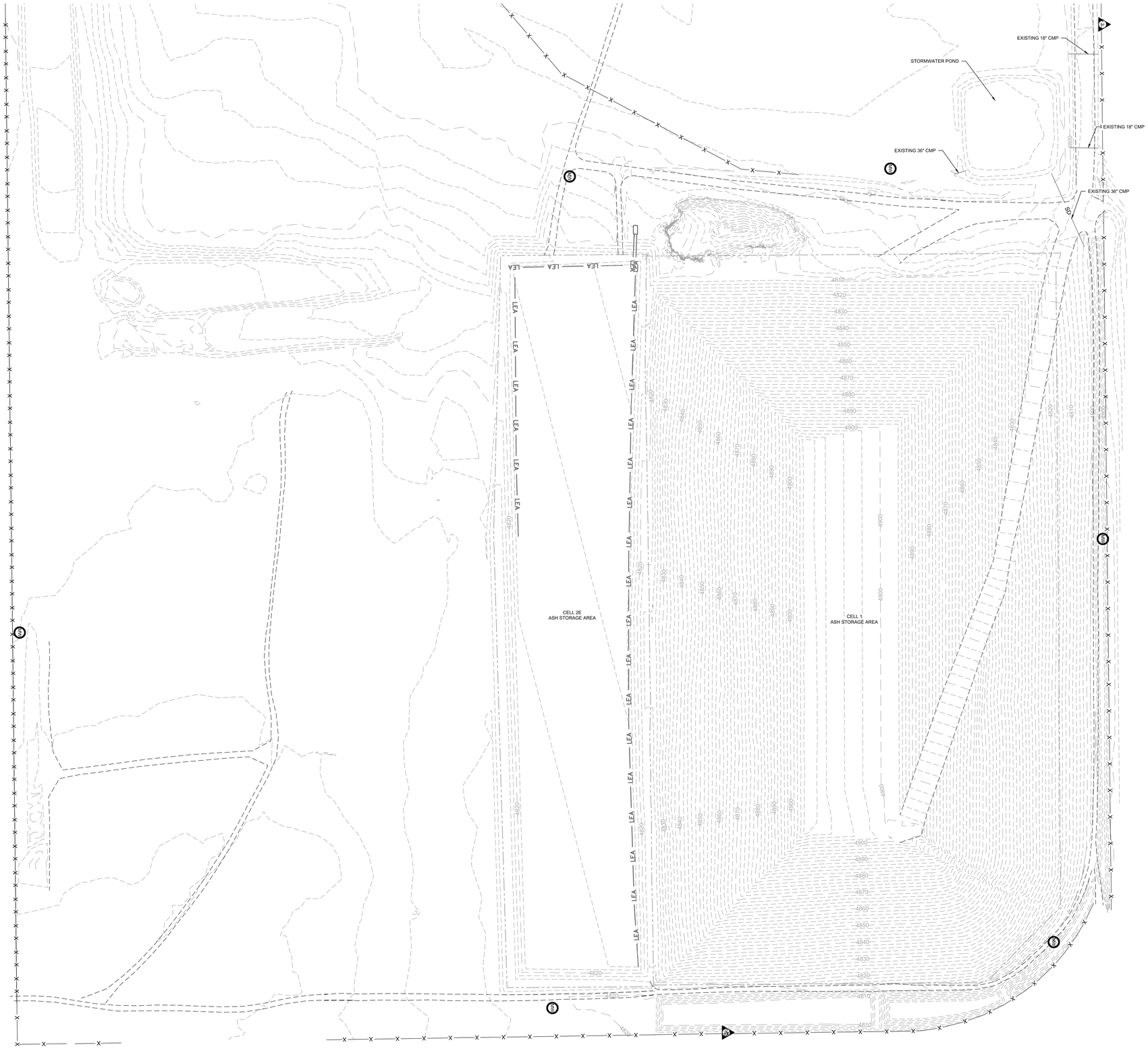

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0 1" 2"

LEGEND:

- EXISTING MAJOR CONTOURS (10')
- EXISTING MINOR CONTOURS (2')
- CELL BOUNDARY
- ACCESS ROAD
- EXISTING FENCE
- STORMWATER CULVERT
- EXISTING LEACHATE COLLECTION LINES
- CONTROL POINT
- MONITORING WELL

COMANCHE GENERATING STATION SURVEY CONTROL POINTS

ID	NORTHING	EASTING	ELEVATION
3	561,705.05	2,264,495.39	4,801.29
102	559,270.31	2,263,586.29	4,819.24

CONTRACTOR TO CONFIRM LOCATION AND ELEVATIONS WITH THE COMPANY PRIOR TO CONSTRUCTION.

NO	REVISION	ZONE	DATE	BY	CHK	ENG
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PUBLIC SERVICE COMPANY OF COLORADO

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COMANCHE SEGS

CLOSURE PLAN
EXISTING CONDITIONS

HDR ENGINEERING INC.
1670 BROADWAY, SUITE 3400
DENVER, CO 80202

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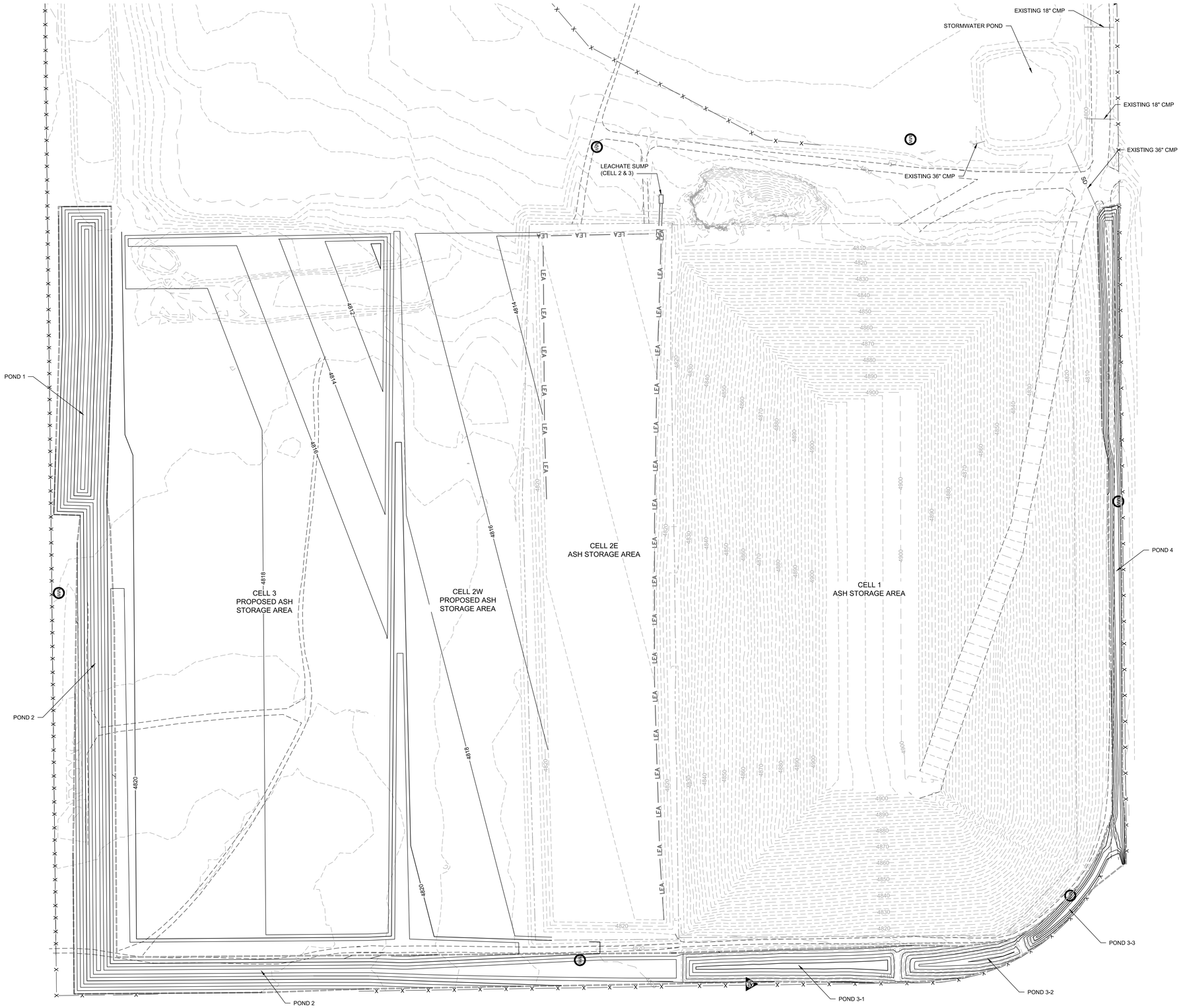
SHEET NO 2
REV A



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LEGEND:

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- MONITORING WELL

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COMANCHE SEGS
CLOSURE PLAN
BASE GRADE PLAN

HDR ENGINEERING INC.
1670 BROADWAY, SUITE 3400
DENVER, CO 80202

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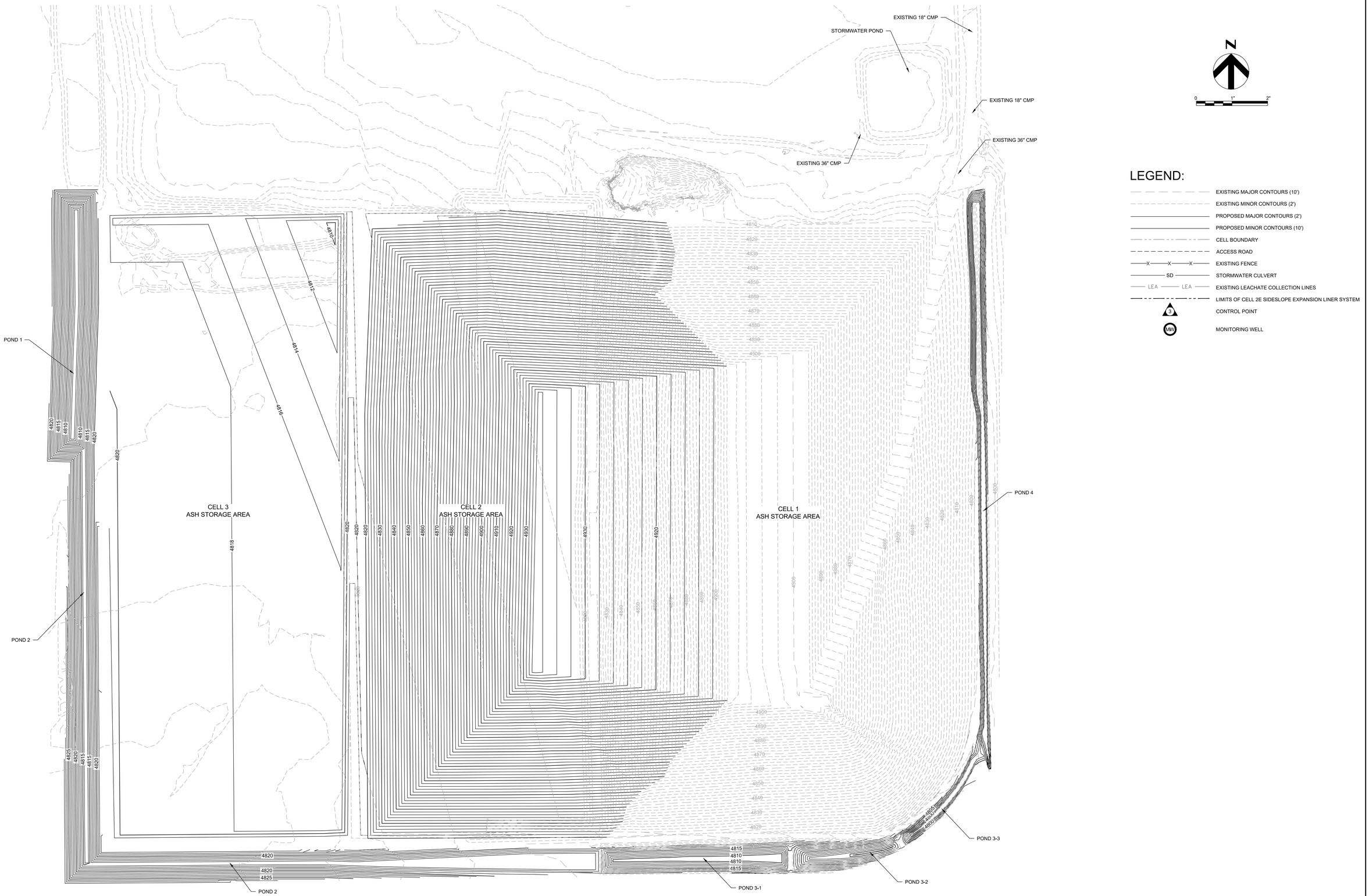

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COMANCHE SEGS
CLOSURE PLAN
CELL 2 OPERATIONS PLAN

HDR ENGINEERING INC.
1670 BROADWAY, SUITE 3400
DENVER, CO 80202

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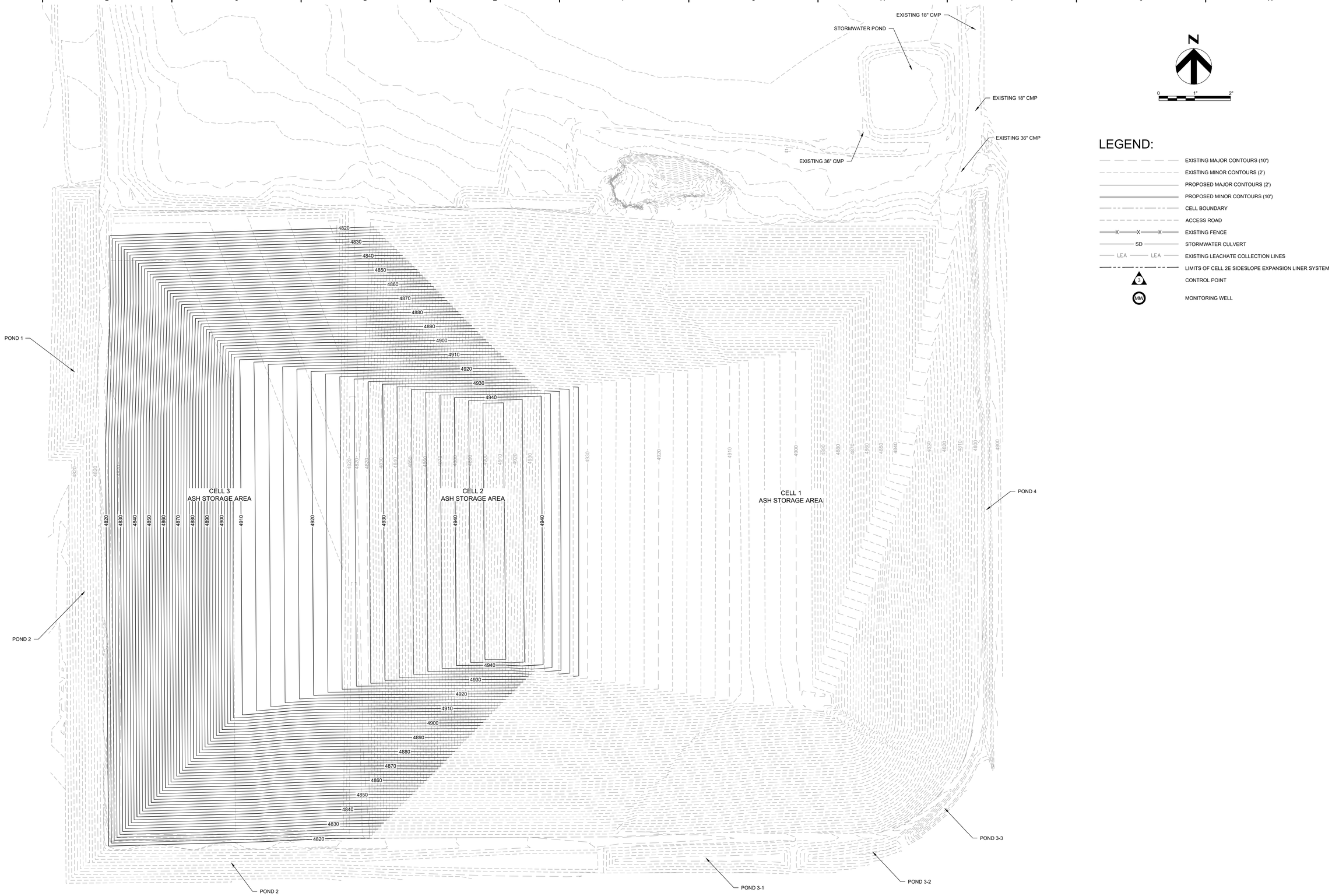

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NO	REVISION	ZONE	DATE	BY	CHK	ENG
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NO	REVISION	ZONE	DATE	BY	CHK	ENG

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COMANCHE SEGS
CLOSURE PLAN
CELL 3 OPERATIONS PLAN

HDR ENGINEERING INC.
1670 BROADWAY, SUITE 3400
DENVER, CO 80202

DWG NO 1
SHEET NO 5
REV A