

To: Mr. Lance Hauer  
United Nuclear Corporation (UNC)

From: Jason Cumbers, PE  
Fort Collins, Colorado

Project/File: 233001363

Date: November 30, 2023

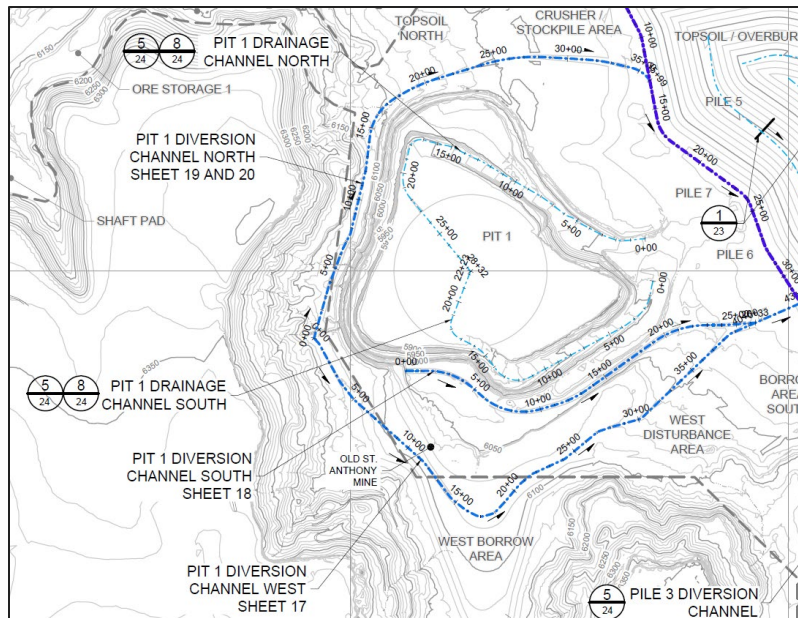
---

**Reference: St. Anthony Mine – Pit 1 Backfill and Design Concept**

This memo summarizes updates to the design for the reclamation of Pit 1 that will be incorporated in the forthcoming design as part of the 90% Closure Closeout Plan (90% CCOP) for the St. Anthony Mine Site (“Site”). The design for long-term stabilization of Pit 1 includes components to maintain the hydraulic sink in the pit, use the existing waste piles as fill in the pit bottom above and below the expressed groundwater, remove loose and eroded materials from the highwall and benches for safety and stability, cover the waste placed in the pit bottom with a revegetated cover that will enhance evapotranspiration, and manage meteoric water in, and around, the pit to minimize erosion from the highwalls and reduce the meteoric runoff water reporting to the pit. Select sheets from the draft updated Pit 1 drawings for the pending 90% CCOP are attached to this memo.

The updated reclamation design includes a series of diversion channels to direct runoff around the pits to Meyer Draw (see Figure 1). Stantec is designing Site stormwater structures assuming runoff flows from a 500-year, 24-hour storm event. With regard to Pit 1 specifically, a series of diversion channels (Pit 1 Diversion Channels North, West, and South) are included in the design to divert meteoric runoff water around Pit 1 eastward to Meyer Draw.

**Reference: St. Anthony Mine Pit 1 Backfill and Design Concept**



**Figure 1 Pit 1 Drainage/Diversion Channel Layout 30% CCOP (Stantec, 2022)**

Within Pit 1, the Pit 1 Drainage Channels North and South are designed to manage peak stormwater flows from the 500-year 24-hour event coming from the intermediate bench area located along the north edge (and within Pit 1) and along both of the existing haul ramps down into Pit 1. These structures will collect direct precipitation and direct it in a controlled manner across the Pit 1 cover (see Sheets 8 and 24). The grading plan for the Pit 1 cover includes gentle slopes ranging from 0.5% to 2% designed to direct meteoric water toward the center of the pit while preventing erosion from runoff. The basin area in the center of the pit is intended to maximize water surface area and increase the potential for evaporation of any waters that accumulate in the pit area. Currently, the total catchment area with meteoric water reporting back to Pit 1 is 365 acres (0.57 mi<sup>2</sup>). The addition of the Pit 1 Diversion Channels will reduce the catchment area for meteoric water reporting to Pit 1 to 83 acres (0.13 mi<sup>2</sup>), which equates to a 77% reduction in meteoric water reporting to Pit 1.

The process to stabilize the existing Pit 1 water and sediments will include the addition of sodium tri-polyphosphate (STPP) to the Pit 1 water to immobilize uranium and radium prior to relocation and placement of the Pit 1 infill piles in the bottom of the pit. A specification for STPP application will be included with the 90% CCOP. Since the Pit 1 infill piles will be the first materials placed in the pit bottom, these materials will be placed partially below the level of the existing groundwater surface in the pit bottom. Additionally, to mitigate rock fall hazards in the pit bottom, loose and eroded materials will be removed mechanically from the existing pit benches and highwalls. The removed material will be placed in a compacted layer above the layer of compacted Pit 1 infill waste pile material, thus acting as the initial cover layer over the waste. After placement of the loose material from the highwalls, an additional 48 inches of unimpacted borrow soil (including approximately 50% from stockpiled topsoil/overburden materials and 50% from the currently undisturbed West Borrow Area) will be placed to attenuate radon, provide erosion protection, and serve as a growth medium for revegetation. The uppermost 24 inches of the cover profile will consist of the most-preferred plant-growth materials (i.e., North Topsoil Pile and West Borrow Area) for

**Reference: St. Anthony Mine Pit 1 Backfill and Design Concept**

cover/planting media at the site, based on Cedar Creek Associates' 2018 materials characterization study (Cedar Creek, 2018). The cover surface will be seeded for revegetation with a site-specific seed mix of native plants per the revegetation plan included with the Closeout Plan.

The modifications of the Pit 1 design in the 90% CCOP, as compared to the 30% CCOP design, include the following (where applicable, design calculations will be provided with the 90% CCOP):

- The volume estimate for the loose materials on the Pit 1 highwall and benches to be removed and placed in the pit bottom has been revised, based on additional review of the aerial photos and AutoCAD calculations for the materials on the highwall benches. The new removal volume estimate is 50,000 CY which equates to approximately a 14-inch layer (assuming 90% Standard Proctor compaction) to be placed on top of the Pit 1 infill piles in the pit bottom.
- With this volume adjustment, Stantec re-calculated the radon emanation for the Pit 1 soil cover and refined the overall thickness of the soil cover from 6 feet (48 inches of highwall materials plus 24 inches of West Borrow and North Topsoil) to 5.2 feet (24 inches of mixed West Borrow and North Topsoil + 24 inches of Topsoil Overburden + 14 inches of Highwall materials). These three fill layers comprise the cover and will be placed above the disposed mine waste from the Pit 1 Infill piles (see Sheet 26). Radon model results indicate that the revised cover design will reduce radon emanation to values less than 20 pCi/m<sup>2</sup>-s.
- A rockfall berm will be constructed along the highwalls and on the Pit 1 cover to collect potential rockfall off the pit walls and contain it near the outer perimeter of the cover. The variable distance between the highwall and the rockfall berm is based on rockfall and runout analyses previously completed for several locations along the west and southwest portions of the highwall. The rockfall berm will include intermittent breaks to prevent meteoric water from being trapped behind the berm. Additional details have been added to the drawings for a proposed rockfall berm on the Pit 1 cover (see Sheet 8).
- A new detail for the Pit 1 Drainage Channels (North and South) has been added to the details (see Sheet 24). In addition to the channel dimensions, this detail (Detail 8) shows the underlying cover layer thicknesses for sections of the channels that cross the cover surface.

## References

Cedar Creek, 2018. *St. Anthony Mine Materials Characterization*. October.

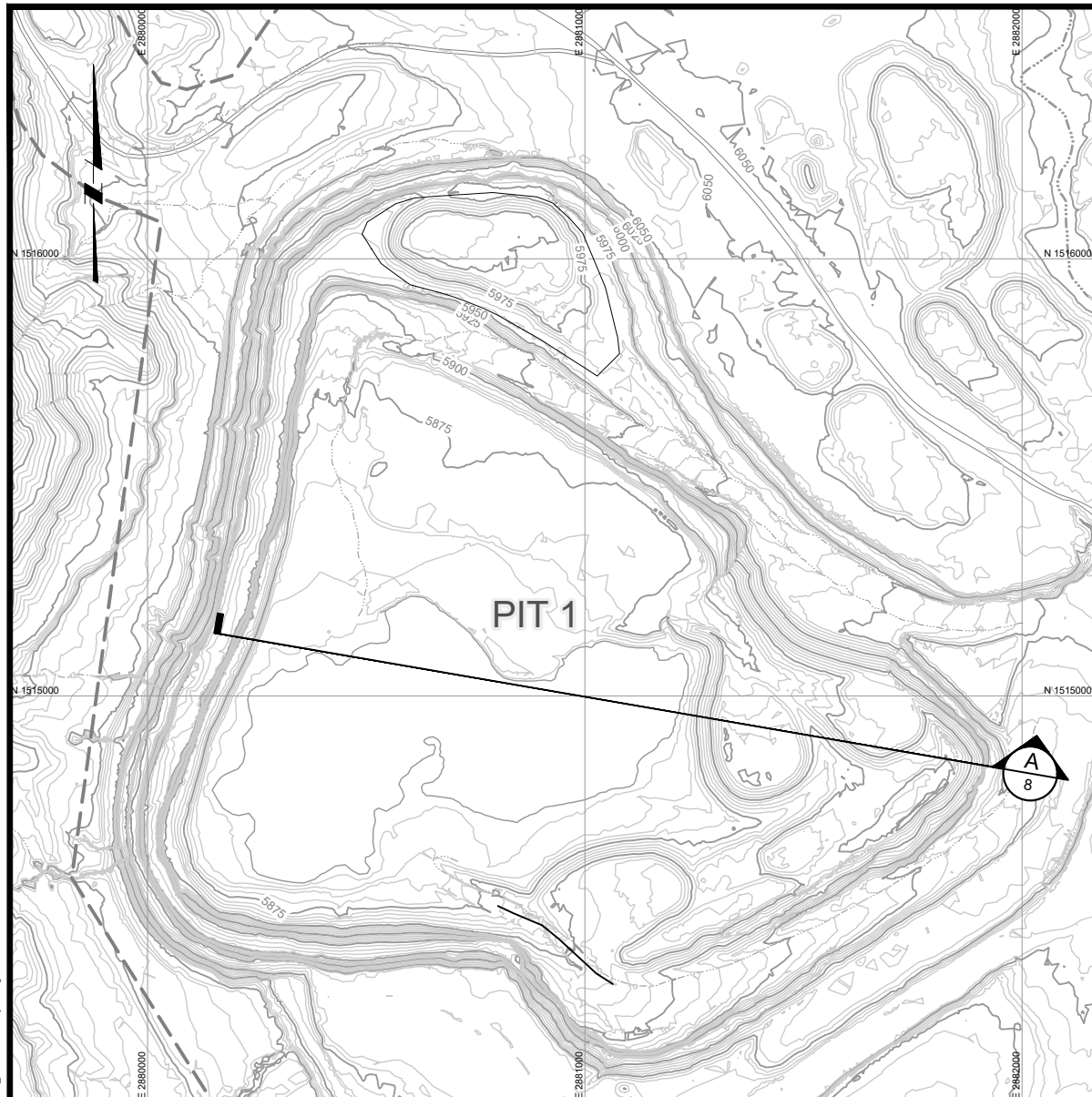
Stantec, 2022. *St. Anthony Mine Site Closure-Closeout Plan (CCOP), 30% Design Report*. October 7.

Regards,

**STANTEC CONSULTING SERVICES INC.**

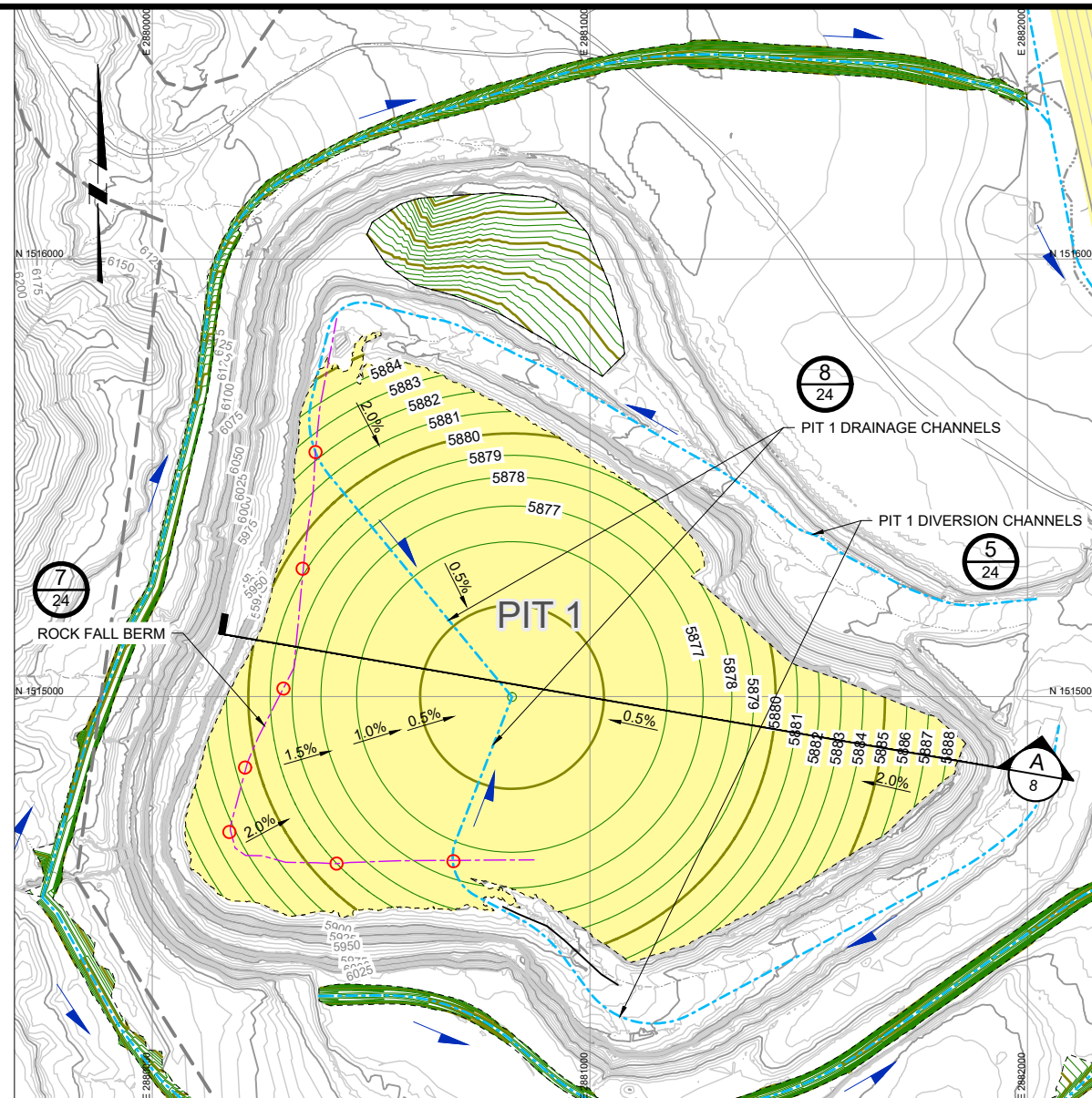
Attachment: Updated Draft Pit 1 Drawings for the St. Anthony Mine 90% Closeout Plan: Sheet 8 Existing and Final Conditions, Sheet 10 Pit 1 Highwall Cross Section A, Sheet 11 Pit 1 Highwall Cross Section B, Sheet 12 Pit Highwall Cross Section C, Sheet 24 Diversion Channel Details (2 of 4), Sheet 26 Cover System Details (4 of 4)

Tuesday, November 28, 2023 9:27:40 AM K\FREED C:\USERS\K\FREED\STANTEC\ANTHONY - CIVIL\SHEETS\102-29-2020\_STA\_DESIGN\_DRAWINGS\STA\_DD\_PIT1.DWG Layout\Figure



**PIT 1**  
EXISTING CONDITIONS

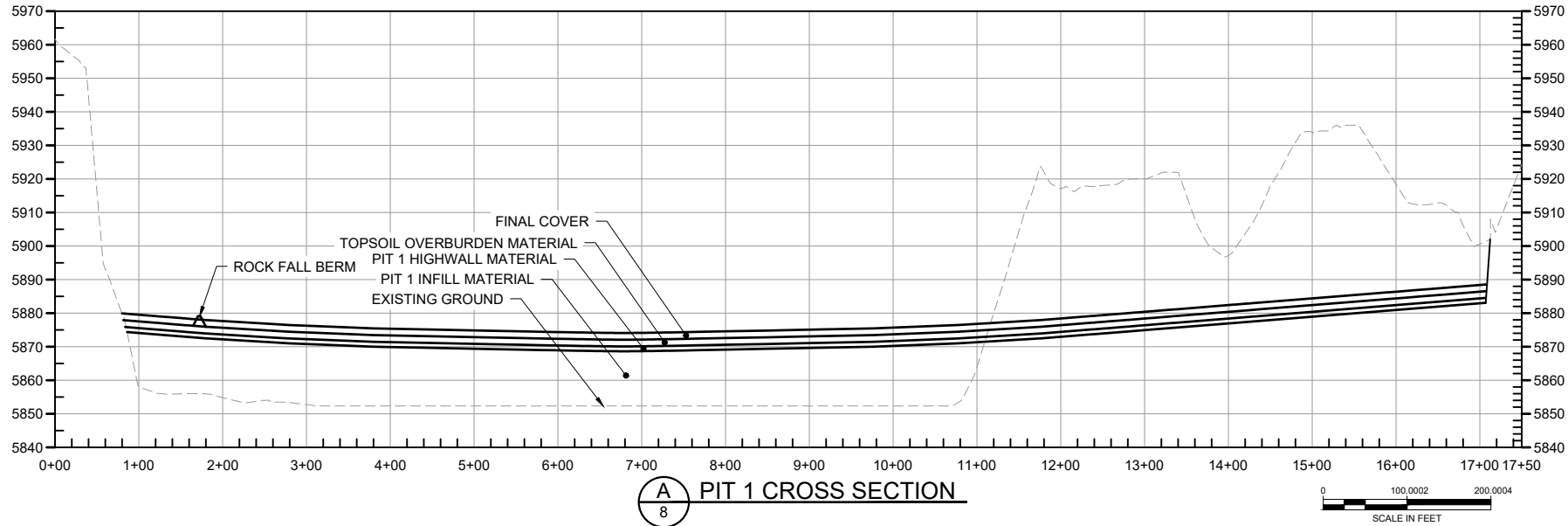
0 200,0004 400,0008  
SCALE IN FEET



**PIT 1**  
FINAL CONDITIONS

0 200,0004 400,0008  
SCALE IN FEET

- LEGEND:**
- 6100 EXISTING GROUND SURFACE CONTOUR & ELEVATION, FEET
  - 6200 PROPOSED FINAL GRADING CONTOUR & ELEVATION, FEET
  - APPROXIMATE MINE PERMIT BOUNDARY
  - GULLEY / DRAINAGE
  - ARROYO
  - EXISTING ROAD
  - EXISTING FENCE
  - EXISTING OVERHEAD ELECTRIC AND POWER POLES
  - FINAL DRAINAGE CENTERLINE
  - AREAS TO BE COVERED
  - ROCK FALL BERM
  - GAP IN ROCK FALL BERM FOR DRAINAGE



**PIT 1 CROSS SECTION**

0 100,0002 200,0004  
SCALE IN FEET

**PRELIMINARY**  
FOR DISCUSSION ONLY

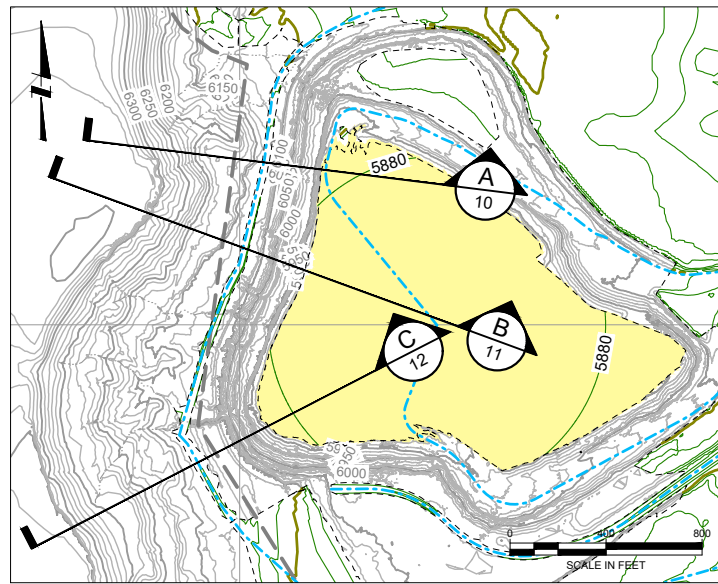
REV	DATE	BY	DESCRIPTION
2	09/2023	KR	90% DESIGN
1	11/2021	KR	30% DESIGN

DRAWN	K. REED
CHECKED	C. FRITZ
APPROVED	J. CUMBERS

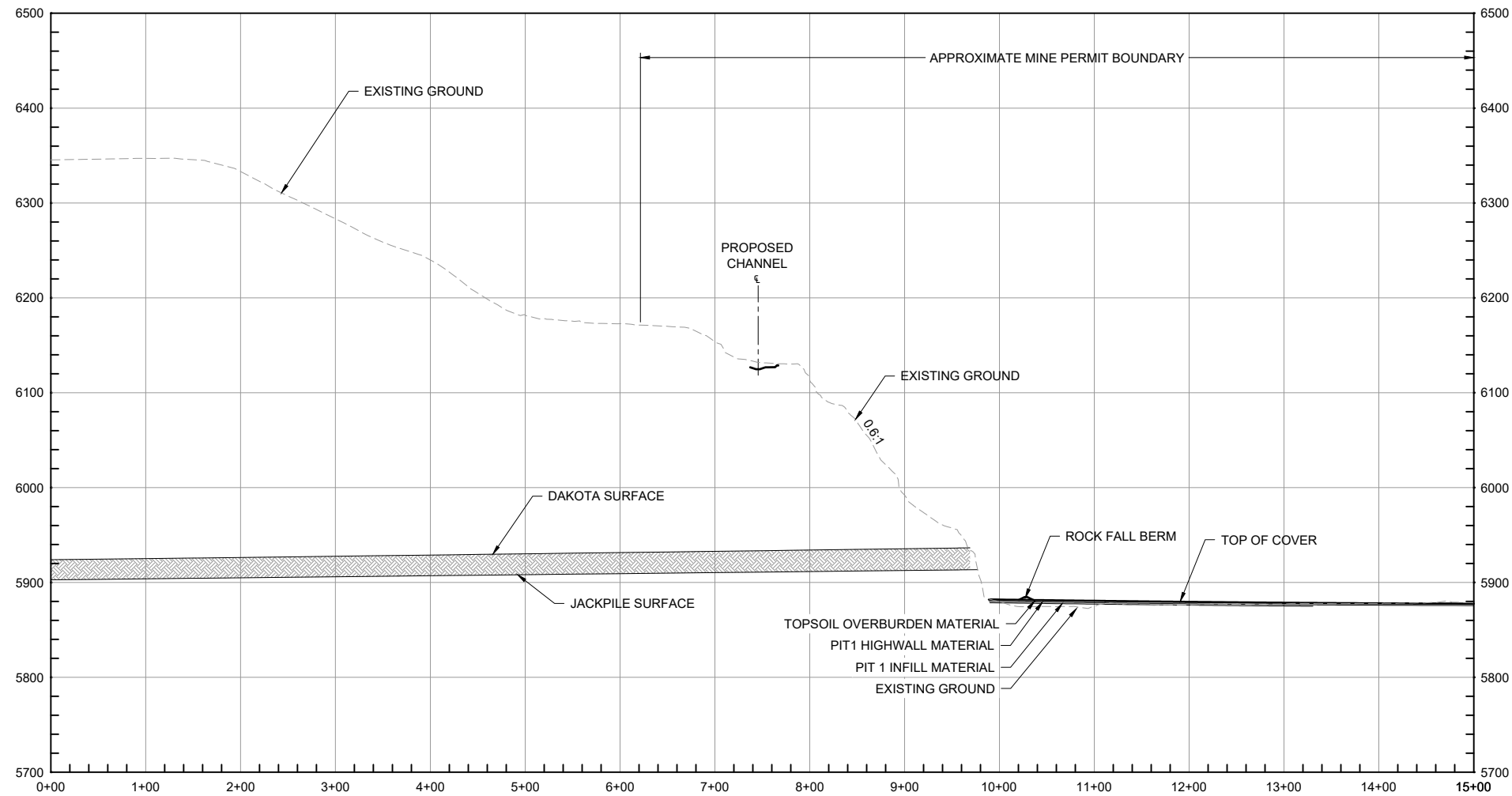
- DRAWING REFERENCES:**
- All coordinates in New Mexico State Plane West, NAD83, Feet (U.S. Survey).
  - Elevations/Topo.
  - On site Cooper Aerial, 05/09/2011, (050911-1000overview3d.dwg)
  - Supplemental Off Site: USGS DEM 10m
  - Township and Section lines: rgis.unm.edu, 08/04/2014
  - Parcels and Cibolaleta Land Grant: Cibola County, cibolacountynm.com, 02/15/18
  - Permit Boundary: (1008506X001.dwg)



UNITED NUCLEAR CORPORATION  
ST. ANTHONY MINE; CIBOLA COUNTY, NEW MEXICO  
PIT 1 EXISTING AND FINAL CONDITIONS



- LEGEND:**
- 6100 EXISTING GROUND SURFACE CONTOUR & ELEVATION, FEET
  - 6200 PROPOSED FINAL GRADING CONTOUR & ELEVATION, FEET
  - APPROXIMATE MINE PERMIT BOUNDARY
  - FINAL DRAINAGE CENTERLINE
  - AREAS TO BE COVERED



**A**  
10 CROSS SECTION A

**PRELIMINARY**  
FOR DISCUSSION ONLY

Tuesday, November 28, 2023 9:28:11 AM K:\REED C:\USERS\KREED\STANTEC\ANTHONY - CIVIL\PROJECTS\2023\2023\_03\_20\_2020\_STA\_DESIGN\_DRAWINGS\STA\_DD\_PROP\_GRADING.DWG Layout10 PIT 1 HIGHWALL CROSS SECTION A

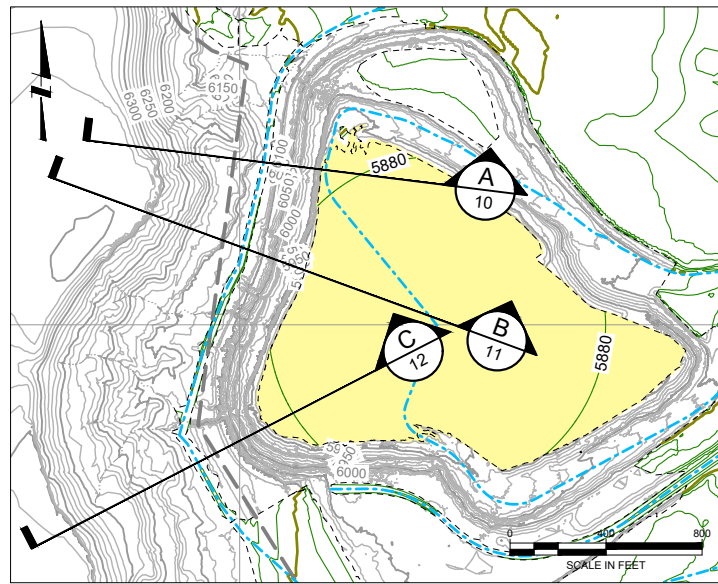
REV	DATE	BY	DESCRIPTION
2	09/2023	KR	90% DESIGN
1	11/2021	KR	30% DESIGN
0	03/2020	CF	PRELIMINARY DESIGN

DRAWN K. REED  
 CHECKED C. FRITZ  
 APPROVED J. CUMBERS

- DRAWING REFERENCES:**
- All coordinates in New Mexico State Plane West, NAD83, Feet (U.S. Survey).
  - Elevations/Topo:
    - On site Cooper Aerial, 05/09/2011, (050911-1000overview3d.dwg)
    - Supplemental Off Site: USGS DEM 10m
  - Township and Section lines: rgis.unm.edu, 08/04/2014
  - Parcels and Cebolleta Land Grant: Cibola County, cibolacountynm.com, 02/15/18
  - Permit Boundary: (1008506X001.dwg)

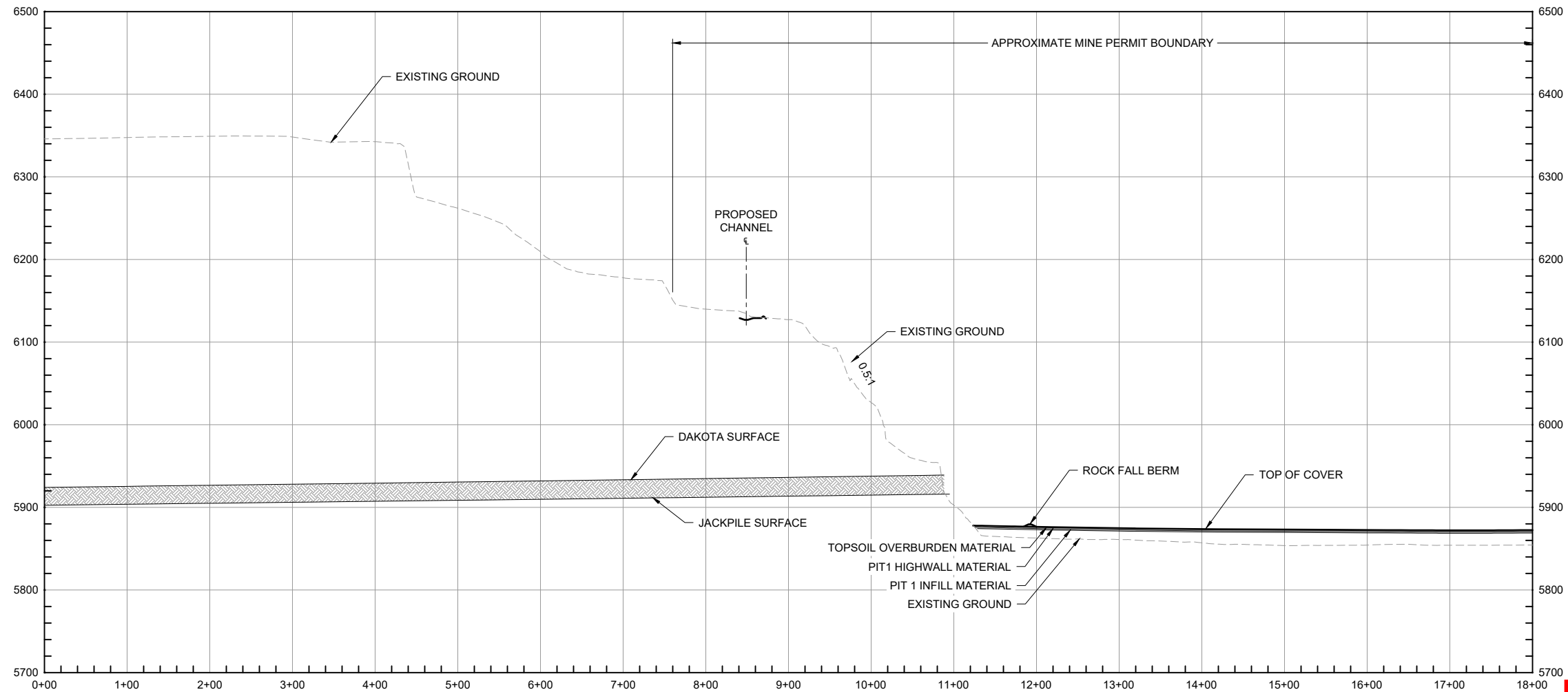


UNITED NUCLEAR CORPORATION  
 ST. ANTHONY MINE; CIBOLA COUNTY, NEW MEXICO  
 PIT 1 HIGHWALL CROSS SECTION A



**LEGEND:**

	EXISTING GROUND SURFACE CONTOUR & ELEVATION, FEET
	PROPOSED FINAL GRADING CONTOUR & ELEVATION, FEET
	APPROXIMATE MINE PERMIT BOUNDARY
	FINAL DRAINAGE CENTERLINE
	AREAS TO BE COVERED



**B** CROSS SECTION B  
11

**PRELIMINARY**  
FOR DISCUSSION ONLY

Tuesday, November 28, 2023 9:28:29 AM K\FREED C:\USERS\K\FREED\STANTEC\STANTON\ANTHONY - CIVIL\PROJECTS\2023\2023\_09\_28\_2020\_STA\_DESIGN\_DRAWINGS\STA\_DD\_PROP\_GRADING.DWG Layout11 PIT 1 HIGHWALL CROSS SECTION B

REV	DATE	BY	DESCRIPTION	DRAWN	CHECKED	APPROVED
2	09/2023	KR	90% DESIGN	K. REED		
1	11/2021	KR	30% DESIGN		C. FRITZ	
0	03/2020	CF	PRELIMINARY DESIGN			J. CUMBERS

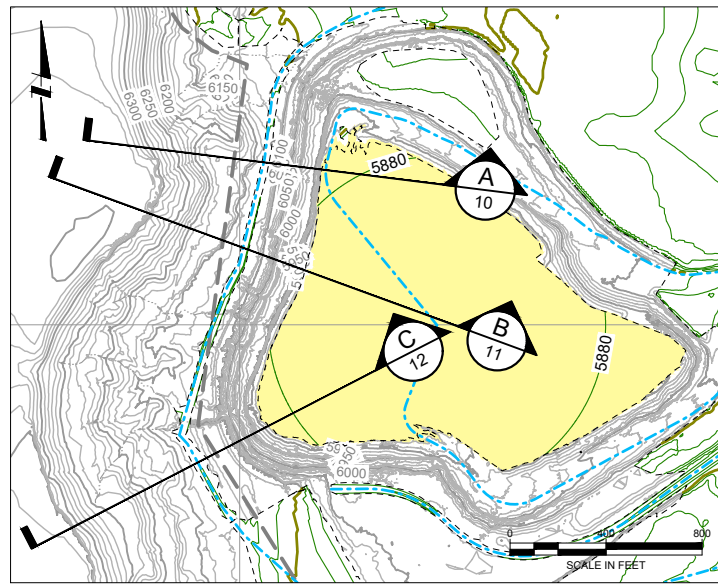
**DRAWING REFERENCES:**

- All coordinates in New Mexico State Plane West, NAD83, Feet (U.S. Survey).
- Elevations/Topo.
- On site Cooper Aerial, 05/09/2011, (050911-1000overview3d.dwg)
- Supplemental Off Site: USGS DEM 10m
- Township and Section lines: rgis.unm.edu, 08/04/2014
- Parcels and Cebolleta Land Grant: Cibola County, cibolacountynm.com, 02/15/18
- Permit Boundary: (1008506X001.dwg)



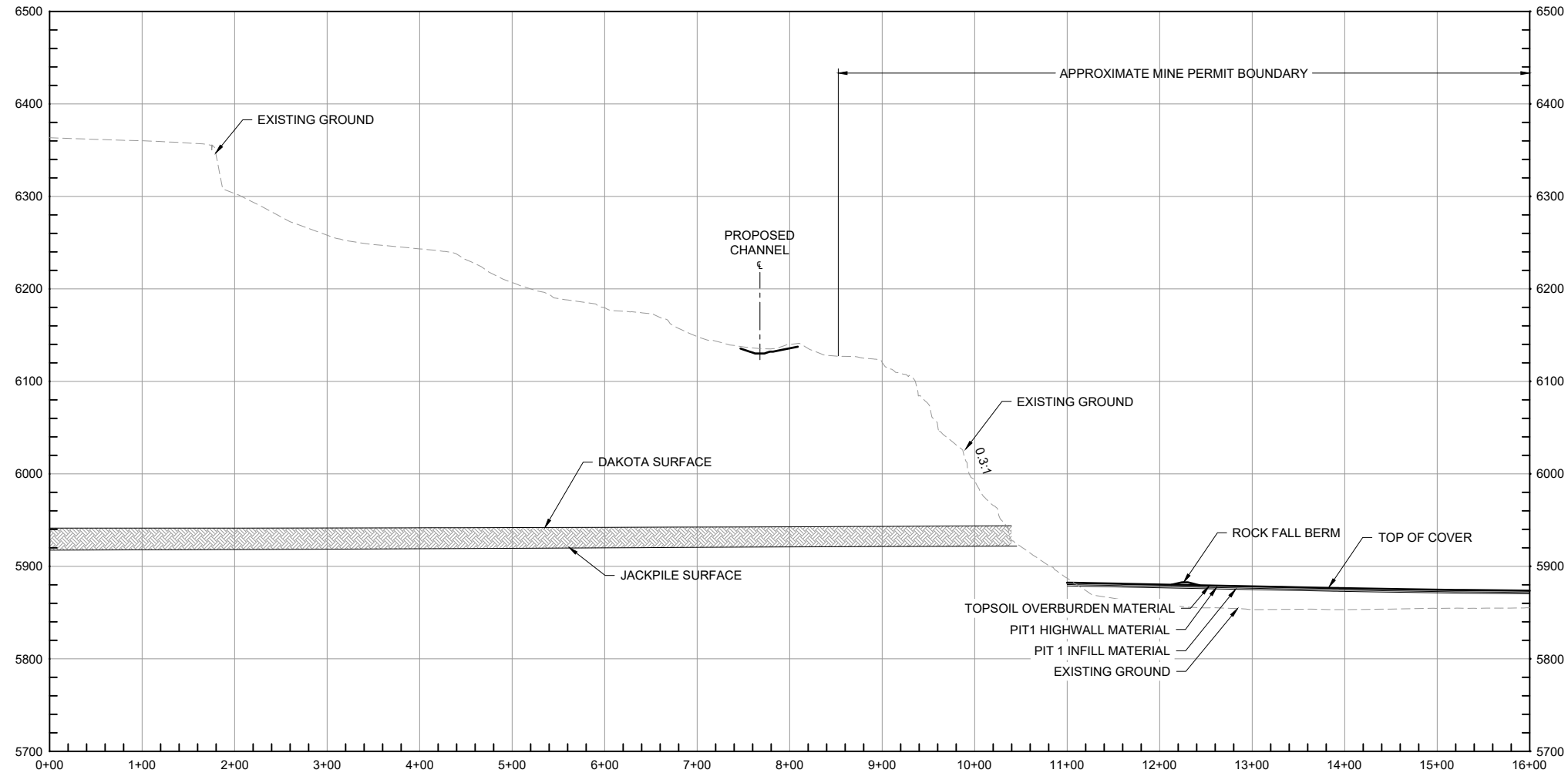
UNITED NUCLEAR CORPORATION  
ST. ANTHONY MINE; CIBOLA COUNTY, NEW MEXICO  
PIT 1 HIGHWALL CROSS SECTION B

SHEET  
11  
233001076



**LEGEND:**

	EXISTING GROUND SURFACE CONTOUR & ELEVATION, FEET
	PROPOSED FINAL GRADING CONTOUR & ELEVATION, FEET
	APPROXIMATE MINE PERMIT BOUNDARY
	FINAL DRAINAGE CENTERLINE
	AREAS TO BE COVERED



**C** CROSS SECTION C  
12

**PRELIMINARY**  
FOR DISCUSSION ONLY

Tuesday, November 28, 2023 9:28:44 AM K\FREED C:\USERS\K\FREED\STANTEC\ANTHONY - CIVIL\PROJECTS\2023\2023\_09\_28\_2020\_STA\_DESIGN\DRAWINGS\STA\_DD\_PROP\_GRADING.DWG Layout12.PIT 1 HIGHWALL CROSS SECTION C

REV	DATE	BY	DESCRIPTION
2	09/2023	KR	90% DESIGN
1	11/2021	KR	30% DESIGN
0	03/2020	CF	PRELIMINARY DESIGN

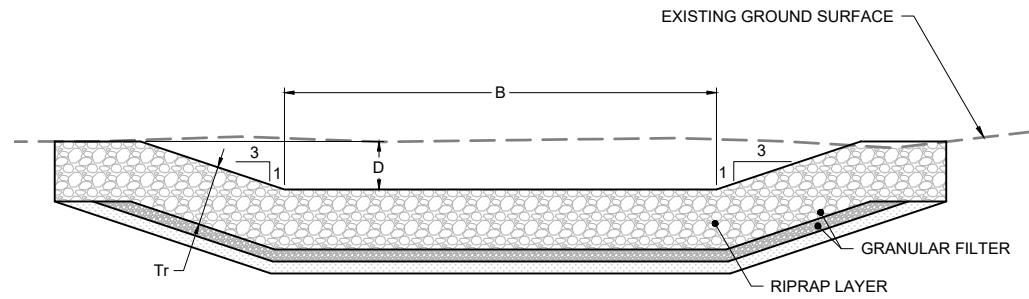
DRAWN K. REED  
CHECKED C. FRITZ  
APPROVED J. CUMBERS

- DRAWING REFERENCES:**
- All coordinates in New Mexico State Plane West, NAD83, Feet (U.S. Survey).
  - Elevations/Topo:
    - On site Cooper Aerial, 05/09/2011, (050911-1000overview3d.dwg)
    - Supplemental Off Site: USGS DEM 10m
  - Township and Section lines: rgis.unm.edu, 08/04/2014
  - Parcels and Cebolleta Land Grant: Cibola County, cibolacountynm.com, 02/15/18
  - Permit Boundary: (1008506X001.dwg)



UNITED NUCLEAR CORPORATION  
ST. ANTHONY MINE; CIBOLA COUNTY, NEW MEXICO  
PIT 1 HIGHWALL CROSS SECTION C

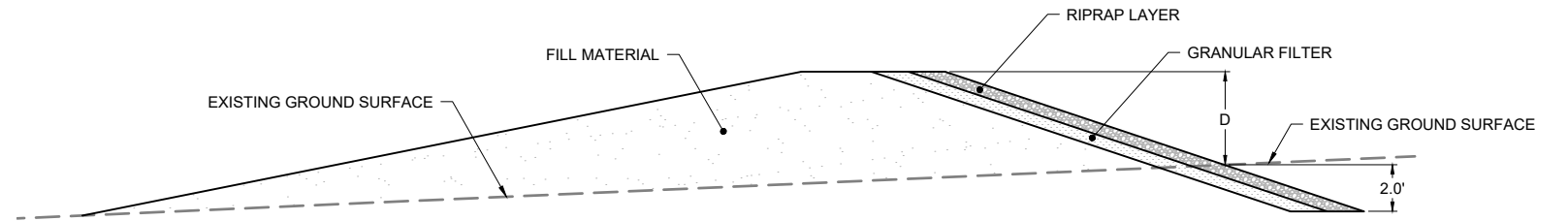
SHEET  
12  
233001076



**5** TYPICAL DIVERSION/DRAINAGE CHANNEL DETAIL  
24 (NOT TO SCALE)

NOTE(S):

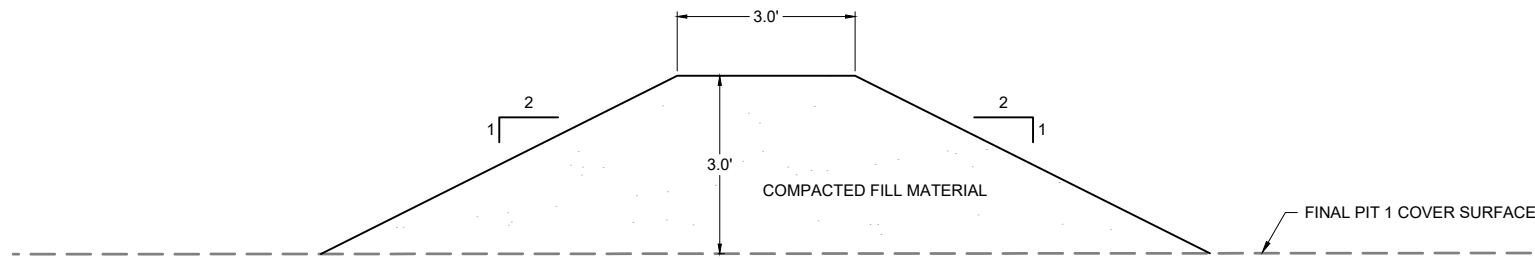
1. REFERENCE TABLE 1 FOR CHANNEL DIMENSIONS.



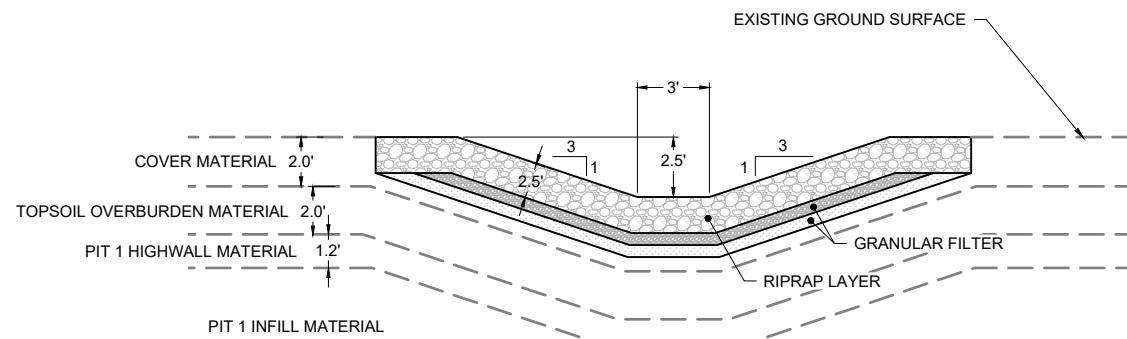
**6** TYPICAL DIVERSION BERM DETAIL  
24 (NOT TO SCALE)

NOTE(S):

1. REFERENCE TABLE 1 FOR CHANNEL DIMENSIONS.



**7** PIT 1 ROCK FALL BERM DETAIL  
24 (NOT TO SCALE)



**8** PIT 1 DIVERSION/DRAINAGE CHANNEL DETAIL  
24 (NOT TO SCALE)

TABLE 1: DIVERSION CHANNEL AND BERM DIMENSIONS

CHANNEL	SECTION	DETAIL REFERENCE	BOTTOM WIDTH,	CHANNEL DEPTH,	MEDIAN RIPRAP	RIPRAP THICKNESS,
			B (FT)	D (FT)	D50 (IN)	TR (FT)
PIT 1 DIVERSION CHANNEL NORTH	0+00 TO 12+00	1	5	4.0	3	0.5
	12+00 TO 25+00	1	5	2.75	9	1.5
	25+00 TO 35+99	1	5	3.25	9	1.5
PIT 1 DIVERSION CHANNEL WEST	5+00 TO 8+00	1	10	2.25	9	1.5
	8+00 TO 27+50	2	0	3.5 (STA 8+00 TO 14+00) 4.0 (STA 14+00 TO 27+50)	6	1.0
	27+50 TO 43+00	1	10	4.25	15	2.5
PIT 1 DRAINAGE CHANNEL NORTH	0+00 TO 19+00	5	3	2.5	9	1.5
	18+00 TO 28+32	8	3	2.75	6	1.0
PIT 1 DRAINAGE CHANNEL SOUTH	0+00 TO 17+00	5	3	2.0	9	1.5
	16+50 TO 22+23	8	3	2.5	3	0.5
PIT 2 DIVERSION CHANNEL	0+00 TO 10+25	2	0	3.0	3	0.5
	10+25 TO 25+85	1	10	3.0	9	1.5
	25+85 TO 28+25	1	15	3.0	15	2.5
PIT 1 DIVERSION CHANNEL SOUTH	-	1	4	2.5	6	1.0
PILE 3 DIVERSION CHANNEL	-	1	5	2.5	9	1.5
PILE 4 NORTH DRAINAGE CHANNEL	-	1	5	2.5	9	1.5

**PRELIMINARY**  
FOR DISCUSSION ONLY

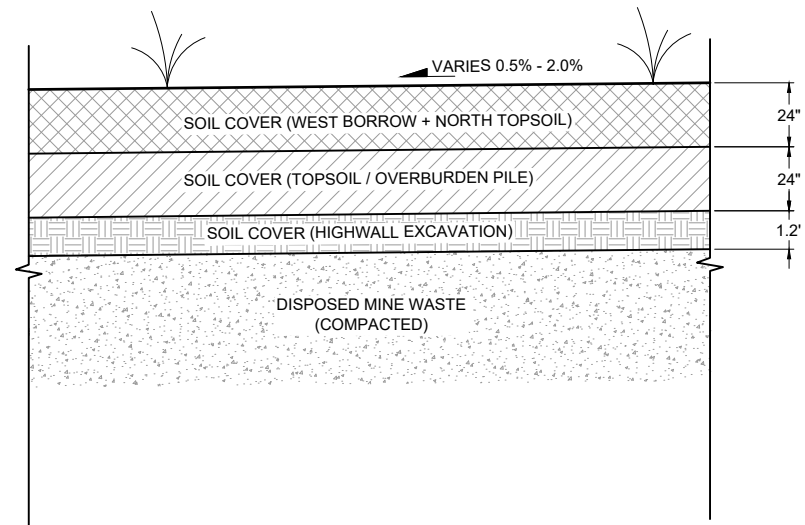
Tuesday, November 28, 2023 9:28:50 AM K:\FREED C:\USERS\K\WREED\STANTEC\ANTHONY - CIVIL\PROJECTS\102-29-2020\_STA\_DESIGN\_DRAWINGS\STA\_DD\_DETAILS.DWG Layout:24 DIVERSION CHANNEL DETAILS (2 OF 4)

REV	DATE	BY	DESCRIPTION	DRAWN	K. REED
2	09/2023	KR	90% DESIGN	CHECKED	C. FRITZ
1	11/2021	KR	30% DESIGN	APPROVED	J. CUMBERS

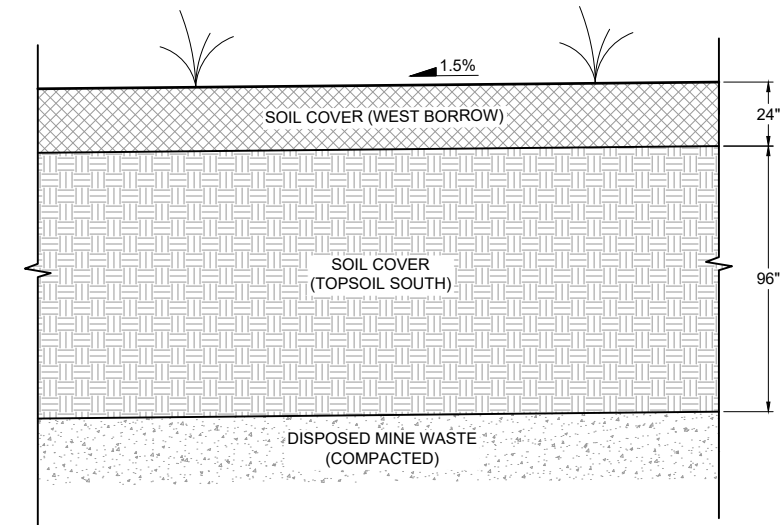


UNITED NUCLEAR CORPORATION  
ST. ANTHONY MINE, CIBOLA COUNTY, NEW MEXICO  
DIVERSION CHANNEL DETAILS (2 OF 4)

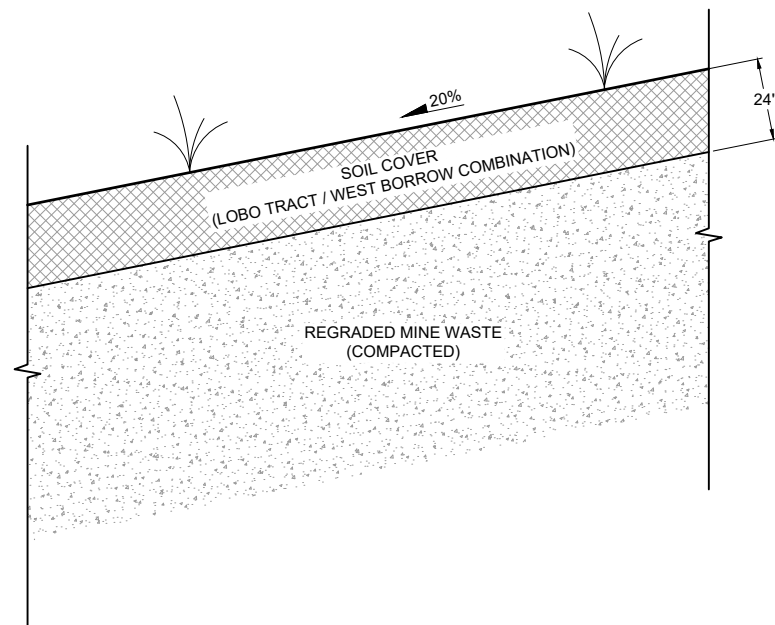




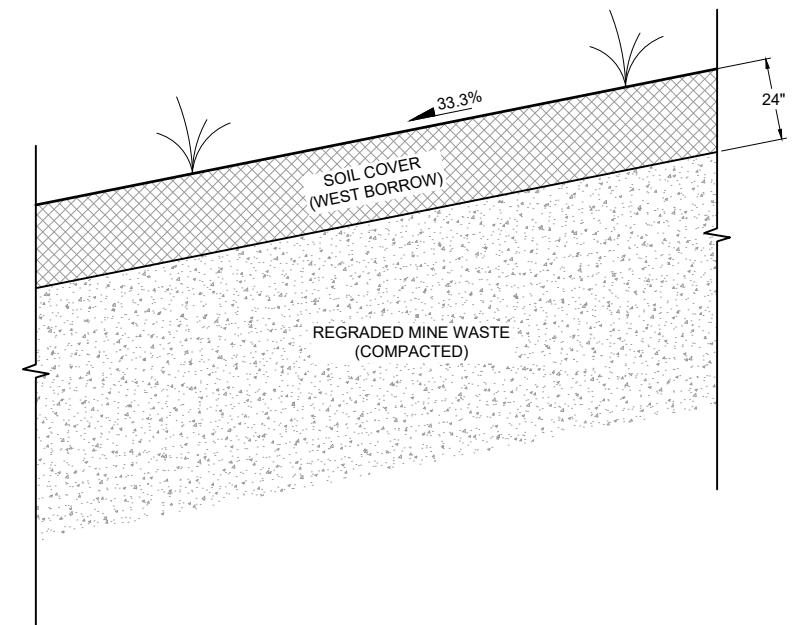
8 COVER DETAIL - PIT1  
26 (NOT TO SCALE)



9 COVER DETAIL - PIT2  
26 (NOT TO SCALE)



10 COVER DETAIL - PILE 4  
26 (NOT TO SCALE)



11 COVER DETAIL - SHALE PILES 1 & 2 AND PILE 3  
26 (NOT TO SCALE)

**PRELIMINARY**  
FOR DISCUSSION ONLY

Tuesday, November 26, 2023 9:28:52 AM K\FREED C:\USERS\K\FREED\STANTEC\STANTHONY - CIVIL\PROJECTS\2020\_02\2020\_STA\_DESIGN\_DRAWINGS\STA\_DD\_DETAILS.DWG Layout:26 COVER SYSTEM DETAILS (4 OF 4)

REV	DATE	BY	DESCRIPTION
1	11/2021	KR	30% DESIGN
0	02/2019	KR	PRELIMINARY DESIGN

DRAWN K. REED  
CHECKED C. FRITZ  
APPROVED J. CUMBERS



UNITED NUCLEAR CORPORATION  
ST. ANTHONY MINE, CIBOLA COUNTY, NEW MEXICO

COVER SYSTEM DETAILS (4 OF 4)

SHEET

26

233001076