St. Anthony Mine Closeout Plan

Updated 2019

March 29, 2019

Prepared for:

United Nuclear Corporation and General Electric

Prepared by:

Stantec Consulting Services, Inc.

Rev.	Description	Author		Quality Check		Independent Review	
0	DRAFT	C. Fritz/T. Leeson/ J. Erickson	1/3/2019	S. Downey/J. Cumbers/N. Haws	2/4/2019	M. Davis	2/8/2019
1	DRAFT – address Client comments	C. Fritz/T. Leeson/	3/5/2019 3/26/2019	J. Cumbers	3/8/2019 3/26/2019	M. Davis	3/13/2019 3/26/2019

Limitations

This document entitled St. Anthony Mine Closeout Plan was prepared by Stantec Consulting Services Inc. (“Stantec”) for the account of General Electric (the “Client”). Any reliance on this document by any third party, without Client permission, is strictly prohibited. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF DRAWINGS

LIST OF APPENDICES

Abbreviations

µR/hr	microroentgen per hour
bgs	below ground surface
CAL	cleanup action level
CFR	Code of Federal Regulations
CL	cleanup level
cpm	counts per minute
cy	cubic yard
GE	General Electric
IL	investigation level
mg/kg	milligrams per kilogram
NM	New Mexico
NMED	New Mexico Environment Department
NMMMD	New Mexico Mining and Mineral Division
NRC	US Nuclear Regulatory Commission
pCi/g	picocuries per gram
$pCi/m^2/s$	picocuries per square meter per second
Ra-226	Radium-226
SPLP	synthetic precipitation leaching procedure
SWPPP	Stormwater Pollution Prevention Plan
UMTRCA	Uranium Mill Tailings Radiation Control Act
UNC	United Nuclear Corporation

1.0 PROJECT DESCRIPTION

1.1 PURPOSE

This document was prepared to fulfill the requirements of the closeout plan for the St. Anthony Mine (permit tracking No. MK006RE) in accordance with the New Mexico Mining Act Reclamation Program and the New Mexico Administrative Code (NMAC) 19.10.5. This plan describes the work to be completed to reclaim the permit area. The plan was prepared by a professional civil engineer registered in the State of New Mexico.

This closeout plan updates the plan previously submitted to New Mexico Mining and Minerals Division (MMD) in January 2006. This section includes a general overview of the project and site and sections 2 through 8 describe the closeout activities and the design details to support the proposed plan.

1.1.1 Plan Highlights

- The plan is intended to be implemented using the most appropriate technology and best management practices. The plan is based on site-specific data.
- Pit 1 will be partially backfilled with existing site materials to above the anticipated level of groundwater rebound and Pit 2 will be backfilled to prevent ponding of surface water within the pit. Both pits will be covered with more than 3 feet of non-impacted soil and will be contoured to promote drainage (NMED, 2015).
- Measures are included to safeguard the public from unauthorized entry and to prevent falls from highwalls or pit edges. Site access is through a locked gate controlled by the land owner. A warning sign will be posted at the outer access gate indicating hazards exist and a permanent, protective cattle fence will be placed above the exposed Pit 1 highwall, with additional warning signage attached to the fence at 300-ft intervals.
- Stormwater diversions were designed to minimize negative impacts on site hydrology and provide for public safety. Stantec considered the potential for landslides related to the proposed site layout. Permanent stormwater diversion structures and the channel bank protections were designed to pass, at a minimum, peak runoff from the 100-year 24-hour precipitation event.
- The waste piles to remain in-place were designed to be stable and to limit erosion.
- Temporary roads are included for construction; no permanent roads are planned. Existing roads will be reclaimed and revegetated following closure.
- The disturbed areas including the pit backfill will be stabilized using grading, erosion control measures, and revegetation following excavation with the goals of a self-sustaining ecosystem and preventing soil erosion. A site-specific revegetation, seed mix was developed for the revegetation program.

1.1.2 Post-Mining Land Use

Per the definitions in NMAC 19.10.1.7 (A), land use following closure is intended to be livestock grazing (agricultural) and wildlife habitat, similar to the land located around the permit boundary area currently.

1.1.3 Wildlife and Cultural Resources

A wildlife survey was completed as part of the original closeout plan (Cedar Creek, 2006). Lone Mountain Archaeological Services performed cultural resources surveys of the site and proposed borrow areas in 2006 (LMA, 2006). The cultural resources surveys included a records search of known historic sites in the vicinity of the St. Anthony Mine and a complete pedestrian survey of proposed disturbance areas. The surveys were performed under NMCRIS No. 98419, State Permit No. NM 06-073 and NMCRIS No. 108738, State Permit No. 08-073. Sixteen archaeological sites, one previously reported archaeological site, and numerous isolated occurrences were recorded during the survey. Six of these identified sites and isolated occurrences are located in proximity to soil cleanup areas and one occurrence within a proposed soil borrow area. Because the sites are near the perimeters of the work areas, Stantec proposes establishing a 50-foot buffer around the locations prior to initiating earthwork. A qualified archaeologist will review sites located within soil cleanup areas once the buffers have been established. To comply with 36 CFR 296.18, the locations of the identified sites and isolated occurrences are not shown in this document.

1.2 SITE BACKGROUND AND DESCRIPTION

The St. Anthony Mine Site ("Site") is in Cibola County, New Mexico, in a remote, sparsely populated area on the Cebolleta Land Grant approximately 40 miles west of Albuquerque and 4.6 miles southeast of Seboyeta. Drawing 2 shows the site location. United Nuclear Corporation (UNC) operated the St. Anthony Mine, which comprised an open pit and underground shaft uranium mine, from 1975 to 1981 pursuant to a mineral lease with the Cebolleta Land Grant, the current surface and mineral rights owner. The original lease covered approximately 2,560 acres. This lease was obtained February 10, 1964 and was surrendered by a Release of Mineral Lease dated October 24, 1988. UNC has access to the Site through access agreements with the Cebolleta Land Grant and an adjacent landowner.

The Site includes underground workings comprising one mine shaft and several vent shafts that are now sealed at the surface, two open pits (one containing groundwater), seven piles of non-economic mine materials (now revegetated), numerous smaller piles of non-economical mine materials, and three topsoil and/or overburden piles. No perennial streams occur within the Site, but an arroyo (Meyer Draw) passes through the Site. The two open pits at the Site are in Sections 19 and 30, Township 11 North, Range 4 West, and the entrance to the underground mine is in Section 24, Township 11 North, Range 5 West. Area disturbed during mining encompasses approximately 430 acres and includes roads, building and shaft pads, and former settling ponds along with the open pits and non-economic mine material piles. Drawing 3 shows existing site conditions.

1.2.1 Site Geology

The Site is located on the Colorado Plateau physiographic province, broadly characterized by plateaus of stratified sedimentary rock overlying tectonically stable Precambrian basement. The relatively high relief and dramatic topography of the Colorado Plateau formed as canyons were incised within thick sedimentary sequences. Within the southeastern portion of the Colorado Plateau lies the San Juan Basin, a structural depression encompassing most of northwestern New Mexico and adjoining parts of Colorado and Utah. The strata of the San Juan Basin dip gently to the north (approximately 2 degrees), although small faults and folds alter the dip of the strata locally. The San Juan Basin is truncated on its southeastern margin by the Jemez lineament, a northeasterly trending structural boundary between the Colorado Plateau to the northwest and the Rio Grande Rift to the south and east. The Site is within the Grants uranium district that lies on this transitional margin amidst many prominent Late Cenozoic volcanic fields that demarcate the Jemez lineament and the southeast margin of the San Juan Basin.

Sediments in the Grants area were deposited in various continental environments. During late Permian time, the area now defined by the San Juan basin was an active seaway connecting the central New Mexico Sea with the Paradox basin in Utah. During this time, the Glorieta sandstone and San Andreas limestone were deposited. The region was subsequently uplifted in Laramide time and fluvial, lacustrine, and aeolian sediments of the respective Chinle Formation, San Rafael Group, and Morrison Formation were deposited. Upper Cretaceous strata consist of marine shore zone sandstones, marine shales, and various continental deposits. In ascending order, these are represented by the Dakota Sandstone, Mancos Shale, and the Mesaverde Group.

Stratigraphy of interest at the Site includes the Mancos Formation (Late Cretaceous), the Dakota Formation (Early and Late Cretaceous) and the Morrison Formation (Late Jurassic). The surficial geologic unit at the Site is the Mancos Formation consisting of three sandstone units and interbedded shale units with a maximum thickness of 465 feet. The upper sandstone caps Gavilan Mesa to the south of the pits. The Dakota Formation sandstone is 6 to 20 feet thick in the Site area. The Morrison Formation is approximately 600 feet thick and is comprised of the Jackpile Member (sandstone), the Brushy Basin Member (interlayered mudstone and sandstone), the Westwater Canyon Member (sandstone), and the Recapture member (interbedded claystone and sandstone).

Uranium production at the Site was from the Jackpile Member with each pit penetrating approximately 75 feet into this unit. The Jackpile sandstone varies in thickness in the Site area from 80 to 120 feet and is representative of deposition in a braided stream environment.

2.0 SURFACE SOIL CLEANUP

2.1 CLEANUP ACTION LEVEL

The soil cleanup for the site addresses excavation and removal of soil exceeding the Ra-226 Cleanup Action Level (CAL). The CAL is 6.6 pCi/g for radium 226 (Ra-226) for excavation and removal of soils at the site, which is based on the 5.0 pCi/g Ra-226 health based Cleanup Level (CL) plus the 1.6 pCi/g Ra-226 site background area concentration level as determined by the 2007 Materials Characterization (MWH, 2007), as described in Section 2.2 and Appendix A.

2.2 DATA SUMMARY (2007 AND 2018)

2.2.1 2007 Site Characterization

A Materials Characterization was conducted at the site between April 2006 and July 2007, as described in the Materials Characterization Report (MWH, 2007b). The 2007 Materials Characterization consisted of investigating surface and subsurface materials at various areas (see Drawing 4) within and near the site in accordance with the approved Materials Characterization Work Plan (MWH, 2007a). The purpose of the 2007 Materials Characterization was to determine soil suitability as a growth media and radiological risk. The Materials Characterization included a radiological survey of non-economic materials at the Site, drilling and sampling of non-economic materials and sampling of potential cover material borrow sources. The radiological characterization focused on the borrow and stockpile sources, non-economic materials piles, and mine facilities within the Western Shaft Area.

Several methods were employed in the 2007 Materials Characterization. A gamma exposure rate survey was conducted in each area on a regular grid and judgmental gamma measurements were collected in Pits 1 and 2 to characterize small non-economic piles located within the pits, both using a Ludlum Model 19 µR meter. Following the gamma survey, surface and subsurface soil samples were collected from the ground surface, test pits and drill holes and analyzed for:

- Radiochemical parameters (uranium, gross alpha, radium 226 [Ra-226], thorium 230)
- Metals in leachate (13 metals, gross alpha, Ra-226, Ra-228)
- Agronomic properties

Over 300 gamma measurements were collected at the Site, including the main mine area (the location of the open pits) and the Western Shaft Area. Gamma measurements ranged from 5 to 800 µR/hr with a mean of 55 to 100 µR/hr, depending on the measurement method (i.e., shield or unshielded). The highest gamma measurements (145 to 600 µR/hr) came from the following areas:

- Pile 7
- Crusher Stockpile Area
- West Disturbance Area
- Mine Dump
- Ore Storage Areas 1 and 2

- Ponds 1 and 4
- Shaft Access Road

Gamma measurement (contact shielded) from the background area ranged from 5 to 13 µR/hr (mean 8 µR/hr). Gamma measurements from the borrow areas and the topsoil piles ranged from 4 to 13 µR/hr (mean 7 µR/hr). The Materials Characterization Report (MWH, 2007b) presents measurements from the background reference area and the borrow areas.

Approximately 100 surface and subsurface soil samples were collected for analysis. Results were as follows:

- Ra-226 – non-detect to 611 pCi/g (mean 59.9 pCi/g)
- Uranium – non-detect to 1,660 mg/kg (mean 164.2 mg/kg)
- Thorium – non-detect to 602 pCi/g (mean 45.3 pCi/g)
- Gross alpha – 4.6 to 2,490 pCi/g (mean 248.4)

The mean background concentrations for Ra-226 and uranium were 1.6 pCi/g and 3.8 mg/kg, respectively. The highest Ra-226 concentrations (52.2 to 611 pCi/g) came from the following areas:

- Piles 5, 6 and 7
- Mine Dump
- Ore Storage Area 2
- Ponds 1 through 4
- Shaft Access Road

The SPLP method was used to evaluate the relative potential for leaching metals into groundwater and surface waters. The results of the analyses conducted on SPLP samples are presented in the Materials Characterization Report (MWH, 2007b), and indicated that only gross alpha and Ra-226 exceeded the New Mexico surface water standards (see NMAC 20.6.4) for livestock watering, wildlife and aquatic life and aluminum concentrations exceeded the New Mexico groundwater standard for irrigation (NMAC 20.6.2).

2.2.2 2018 Site Characterization

A Supplemental Radiological Characterization conducted in 2018 included areas within the permit boundary that were excluded from the 2007 Materials Characterization. This supplemental Site characterization was also performed to estimate the outer boundary (lateral extent) of the mine waste or impacted areas. During the 2007 Materials Characterization soils within the areas between the main mine site features (e.g., waste piles) was not characterized and an outer boundary was not determined, as stated in the New Mexico Mining and Minerals Division (NMMMD) letter dated November 24, 2015. The Supplemental Radiological Characterization was conducted in accordance with the Supplemental Investigations Work Plan (Stantec, 2018). Results of the Supplemental Radiological Characterization are presented in the *Summary of Supplemental Materials Characterization* memorandum (Stantec, 2018) and in the *Supplemental Radiologic Characterization Report* (AVM, 2018), which is included in Appendix A. The *Supplemental Radiologic Characterization Report* describes the field investigation methods and detailed results of the investigation (gamma survey measurements, subsurface sampling and analytical results, and a correlation between gamma radiation and Ra-226 concentrations).

The field investigation included static gamma radiologic survey measurements, ex-situ and in-situ gamma radiation soil screening, soil sampling and laboratory analysis. Direct gamma radiation level measurements were conducted using a 2x2 NaI scintillation detectors (Eberline SPA-3 and Ludlum 44-10), paired with a Ludlum 2221 or 2241 scale/rate meter. Gamma measurements were collected along transects spaced 30 feet apart, with the detector held one foot above the ground surface. In addition, gamma measurements were collected in step-out areas (e.g., areas outside the permit boundary) where gamma measurements exceeded the IL for Ra-226.

Based on gamma survey results, 24 locations with the highest Ra-226 levels were selected for subsurface sampling and analysis from test pits. Field personnel conducted ex-situ gamma radiation soil screening from the test pits and collected 44 soil samples for laboratory for analysis. The soil samples were analyzed for Ra-226.

A site-specific correlation was developed using regression analysis for the collimated and bare 2x2 NaI detectors to convert the detector gamma radiation levels (in counts per minute [cpm]) to surface soil Ra-226 concentration (in pCi/g). Fourteen correlation samples were sent to the laboratory for Ra-226 analysis.

The gamma radiation measurements in cpm were converted to Ra-226 concentrations (activity) in pCi/g using the site-specific correlation. The 2007 Materials Characterization was conducted using exposure rate measurements, which were also converted to Ra-226 concentrations using the site-specific correlation.

Results of the gamma surveying indicated that surface soils with Ra-226 concentrations greater than the IL were generally within the permit boundary, except for the access road and some other small areas. The access road extends to the north of the permit boundary and had consistently high gamma measurements (generally between 10 and 100 pCi/g). Other areas where IL exceedances were measured slightly outside the permit boundary included:

- South of Shale Pile 1
- South of Pit 1
- Around the Western Shaft Area
- North of Pit 1

The highest Ra-226 concentrations within the Site were measured in the central portion of the Site adjacent to the west side of Pile 6, within the Crusher/Stockpile, and within Pile 7. There are numerous small waste piles in the area adjacent to Pile 6 where gamma radiation was measured above 100 pCi/g. The gamma radiation levels tended to decrease with increased distance from the piles and towards the permit boundaries. Ponds 1 through 4 in the Western Shaft Area had similarly elevated readings that were generally contained within the pond boundaries. Additionally, the arroyo (Meyer Draw) had readings of approximately 10 to 100 pCi/g in the deepest parts of the channel and readings of 6.6 to 10 pCi/g on the banks and adjacent areas.

2.3 EXCAVATION VOLUMES

The on-site ex-situ soil screening results, laboratory analytical results, and observations made in the test pits (see Section 2.2), were used to estimate the depths of CAL exceedances. These depth estimates were used to interpolate the depth of CAL exceedances for the remainder of the site. The maximum depths of CAL exceedances were 5.0 to greater than 6.5 feet bgs in the following areas:

- 6.5 feet bgs (or greater) between Pile 3 and Pit 2 at Test Pit 24

- 6 feet bgs near Borrow Area South at Test Pit 23
- 5 ft bgs west of the Crusher/Stockpile Area at Test Pits 4 and 5
- 5 to 6 feet bgs between Pit 1 and Pile 6 at Test Pits 11 and 13

Drawings 5 and 6 show the lateral extent (limits of excavation) and depths of CAL exceedances (excavation depths). The excavation surface was interpolated from these depths and the lateral extent.

The ground surface elevations, the lateral extent (outer boundary) of Ra-226 above the CAL, the depths of CAL exceedances (including the mine features characterized in 2007) and the interpolated depths in other areas of the site were used to estimate the volume of mine waste with Ra-226 concentrations above the CAL (6.6 pCi/g). There is a total estimated volume of 10.3 million cubic yards (cy) to be moved to Pits 1 and 2, and approximately 3.2 million cy of that total will come from Pile 4 during regrading of the pile.

2.4 CLEANUP VERIFICATION

Soil exceeding the 6.6 pCi/g CAL will be excavated, hauled and placed onsite in Pit 1 or Pit 2. Excavation control will be performed to support soil excavation. The Site characterization identified an approximate area of 360 acres that exceed the CAL, which includes mine features such as waste ore piles and roads. The assessed lateral and vertical extent of soil excavation exceeding the CAL from approximately 225 acres is shown on Drawings 5 and 6. The other 135 acres of areas with soil exceeding the CAL are primarily within Pile 4, Pile 5, and the Topsoil/Overburden pile. Pile 4 will be stabilized and covered in place, as shown on Drawing 8. An Excavation Control Plan was prepared and is provided as Appendix B.1 to support the excavation and removal of soils that exceed the CAL. Upon completion of the soil excavation and placement, a Cleanup Verification Survey will be performed in the excavated areas to ensure the cleanup to the CAL has been met. A Cleanup Verification Plan was prepared and is provided as Appendix B.2. Standard Operating Procedures (SOPs) for implementing the Excavation Control and Cleanup Verification Plans are provided in Appendix B.3.

3.0 MATERIAL BALANCE

3.1 DATA SUMMARY

Supplementary geotechnical data collected in 2018 added to the data set of material properties collected in 2007. The 2018 boreholes were primarily focused on the existing piles and areas where data was not previously collected. Drawing 4 shows the borehole and test pit locations from both investigations.

3.1.1 Investigation

Stantec conducted a geotechnical investigation at the Site during March and April 2018 to collect subsurface information to characterize soil and rock in the piles and evaluate the suitability of potential borrow sources as cover materials. Field activities comprised drilling and soil sampling of select non-economic waste rock piles and potential borrow areas around the Site and included 51 boreholes advanced using the hollow-stem auger drilling technique. The *St. Anthony Mine Geotechnical Investigation 2018* memo (Appendix C) describes the methods and findings of the investigation.

3.1.2 Geotechnical Testing Results

Daniel B. Stephens & Associates (DB Stephens), a geotechnical testing laboratory in Albuquerque, NM, performed laboratory testing on samples collected during the geotechnical investigation. Tests included sieve analyses, hydrometer, Atterberg limits, moisture and density, standard Proctor compaction, and consolidated undrained triaxial shear. A summary of the sampling program, testing procedures, and results, as well as DB Stephens' complete laboratory testing report, are included with the memo in Appendix C.

3.1.3 Analytical Testing Results

ALS Environmental performed analytical testing on 17 bulk soil samples collected from boreholes in Shale Piles 1 and 2, Pile 4, and the Borrow West area during the geotechnical investigation. Samples were tested for Radium-226 (Ra-226), Uranium, Thorium-230, and Gross-Alpha concentrations. Sample results were used in conjunction with analytical testing results from the 2007 field investigation (MWH, 2007b), to evaluate Ra-226 activity levels throughout the Site, including areas that were not sampled for analytical testing during the 2018 investigation. These results are also included with the geotechnical memo in Appendix C.

3.2 EXCAVATION AND PLACEMENT PLAN

The objective of the excavation and placement plan is to combine the waste piles and other mine-impacted materials within the two open pits and stabilize materials that are to remain within the existing Pile 4. Appendix D includes a material balance summary that describes sources of the existing material volumes on site and links these volumes to the placement locations in one of the two open pits. Drawings 5 and 6 show the removal excavation plan. The existing power lines along the north permit boundary may be an obstacle to proposed earthwork in the area of the Topsoil/Overburden pile and the north end of Pile 4. If UNC determines that the power lines cannot be abandoned, Stantec will either the modify grading plans to work around the existing power poles or the line will be relocated beyond the limits of the earthwork.

Due to the presence of potentially harmful gases encountered during drilling (see Appendix C for additional details), Stantec recommends additional safety precautions be taken during future earthwork at the Site. Special considerations during construction may include the use of personal H_2S detectors by personnel near the earthwork, as well as the use of a 4-gas meter to routinely monitor the work area for elevated gas concentrations. Additional personal protective equipment (PPE) and/or engineering controls may be required under certain circumstances and conditions should be reevaluated prior to the start of earthwork.

3.2.1 Pit Backfill Volumes

Pits 1 and 2 will be backfilled using the materials and fill sequencing described in Sections 3.2.3 and 3.2.4. Pit 1 will be partially backfilled above the anticipated groundwater rebound elevation (see Section 3.2.3), whereas Pit 2 will be filled to attain surface drainage from the pit and prevent ponding of surface water. Table 3-1 lists the estimated backfill volumes for the pits. These volumes comprise waste and cover subsoil materials only and do not include the final cover volume placed atop each pit backfill.

Table 3-1. Pits 1 and 2 Backfill Volumes

Facility	Estimated Backfill Volume (cy)
Pit 1	7,215,600
Pit 2	1,980,800

3.2.2 Excavation Volumes

Material will be excavated from the waste storage piles and other mine-impacted facilities at the Site prior to placement in the open pits. Materials transport from the excavation areas to the pits will occur on the proposed haul routes (shown on Drawing 7).

Excavation volumes were estimated by comparing the existing (Cooper, 2011) and pre-mining (Archuleta et al., 2017) ground surface topographies, with the exception of the surface excavation volume which was estimated using the methods described in Section 2.3. Excavations for all facilities except Pile 4 will extend to native, non-impacted ground such that the full in-situ material volume is transported to the pits and the new, exposed ground surface may be directly revegetated. Pile 4 will be excavated to the extent required to satisfy the remaining pit backfill volume requirements not met by the other excavation volumes. Any remaining Pile 4 material will be re-graded in place and covered with topsoil, as discussed in Section 3.2.5.

Approximately 10,349,327 cy of material will be excavated and transported to the pits. Table 3-2 lists individual volumes for each facility. This volume includes approximately 66,487 cy of material currently located within Pit 1 above the final cover elevation, which will be excavated and placed beneath the cover subsoil. Stantec performed volume reduction calculations to account for the compaction of excavated material within the pits (see Appendix D).

A negligible amount (less than 500 cy) of concrete debris, mainly from the remains of structure foundations, is present in the Shaft Pad area. This material is planned to be disposed in Pit 1.

Table 3-2. Storage Pile and Mine-Impacted Material Excavation Volumes

Facility	Estimated Excavation Volume (cy)	Destination
Crusher Stockpile	573,847	Pit 1
Mine Dump	37,658	Pit 1
Ore Storage 1	16,087	Pit 1
Ore Storage 2	12,943	Pit 1
Pile 1	925,912	Pit 1
Pile 2	761,907	Pit 1
Pile 3*	226,900	Pit 1
Pile 3*	1,853,132	Pit 2
Pile 4	3,218,849	Pit 1
Pile 5	633,214	Pit 1
Pile 6	254,375	Pit 1
Pile 7	87,086	Pit 1
Pit 1 Infill	66,487	Pit 1
Shaft Area Access Road	26,401	Pit 1
Surface Excavation	645,000	Pit 1
Topsoil South	368,502	Pit 2
Topsoil/Overburden	661,286	Pit 1
West Disturbance Area	83,575	Pit 1
TOTAL	**10,349,327**	

*Pile 3 excavation is split between Pits 1 and 2

3.2.3 Pit 1 Design

Pit 1 will be partially backfilled to a minimum elevation of 5976 ft, which is approximately 10 feet above the anticipated groundwater rebound elevation on the east side of the pit (INTERA, 2015). Fill along the west side of Pit 1 will be more than 20 feet above the projected rebounded potentiometric surface. The intent of the pit backfill design is to provide an erosionaly-stable cover that will minimize surface water infiltration. The minimum 10-ft buffer is expected to limit recharge infiltration and provide supplementary groundwater storage capacity in case of an increase in the potentiometric surface above 5966 ft without resulting in ponding on the cover surface. Furthermore, the design includes the buffer for materials with the highest measured Ra-226 activities (e.g., West Disturbance Area excavation) to be placed above the expected potentiometric surface to reduce the potential for groundwater contamination.

The backfilled surface of the pit is designed to convey surface water from the southwest to the northeast at a slope of approximately 1 percent, except for a roughly 160-ft-wide area along the northeastern edge of the pit where the ground surface will have a flat elevation of 5976 ft. The backfilled surface of the pit will be graded to a shallow slope to minimize cover erosion due to runoff. The sloped cover is designed to convey the surface water to the eastern flat area. Due to the thickness of the cover and climate conditions, minimal infiltration is expected through the sloping area along the cover surface. The flat area, shown in plan view on Figure 3-1 and Drawing 14, and in profile on Figure 3-2, is expected to retain a percentage of the surface runoff from the rest of the cover area following large storm events. Retained runoff in this area is expected to be removed via evaporation, transpiration, and infiltration into the clean fill beneath this area, or into the fractured rock of the remaining east pit wall. The flat area on the east side is designed with non-impacted fill material between the ground surface and elevation 5966 ft to mitigate contaminant transport into the groundwater via infiltration of retained surface water in the location of the cover where the most infiltration is expected.

The backfill plan is designed to isolate potential contaminants in the mine-impacted materials stored within the backfilled pit, as well as remove excess surface water that collects in the pit from precipitation or runoff from areas upstream of the pit. Figure 3-1 shows surface contours for the regraded pit surface. The thickness of the clean fill proposed above the groundwater rebound elevation on the low side of the backfill, along with the cover surface of native vegetation, and the net positive pan evaporation at the site, will minimize infiltration through mine-impacted soils and back to the groundwater through the cover.

3.2.3.1 Groundwater Recommendations

The estimated future potentiometric surface in Pit 1 is based on the Phase II Abatement report (INTERA, 2015) which states: “Results for the predictive simulation showed that the groundwater head at the Large Pit will eventually rebound to 5966 ft.”

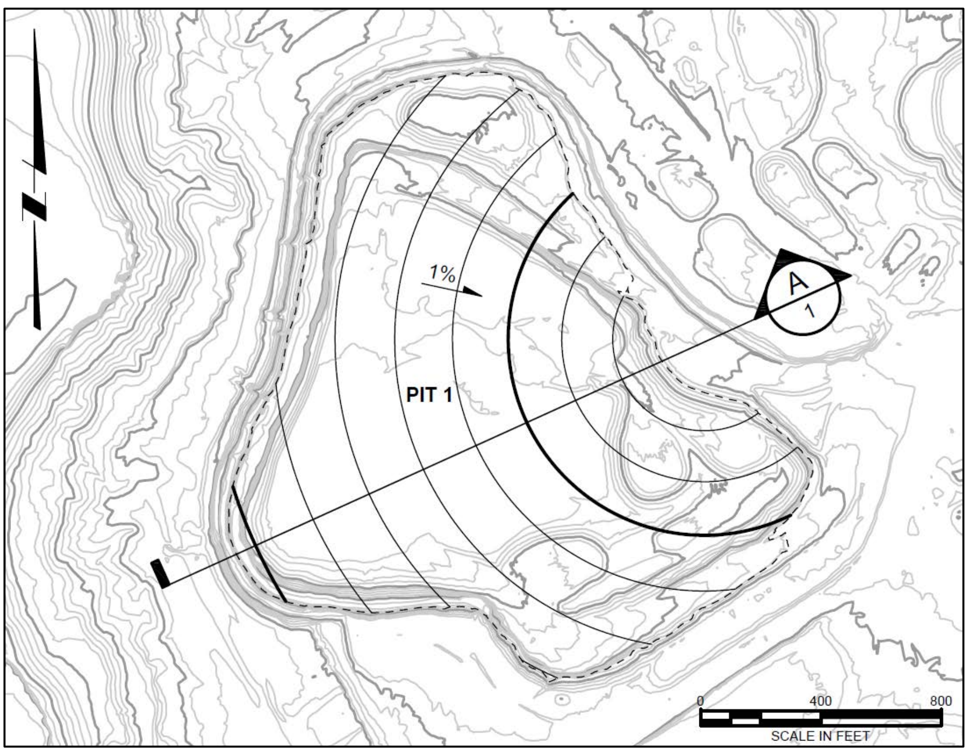


Figure 3-1. Pit 1 Backfill Surface Contours

3.2.3.2 Backfill Placement and Sequencing

The Pit 1 backfill will be placed sequentially by material type from bottom to top in order of increasing Ra-226 activity, with the exception of the non-impacted Topsoil/Overburden pile material which will be placed as subsoil directly beneath the cover. This clean subsoil will provide a rooting medium for cover vegetation while also acting as a barrier against radon emanation from the impacted material below. Placement of the highest-activity material at an elevation higher in the pit will allow the higher activity sources to be located near or above the estimated maximum future potentiometric surface elevation as well as sufficiently deep beneath the surface to limit radon emanation. The Pit 1 backfill cover is designed to minimize infiltration through the cover and into the underlying backfill.

Ra-226 activities were estimated as the 75th percentile of the activity values measured during analytical testing for samples collected during the 2007 and 2018 site investigations. These are summarized in Table 3-2. Because testing data was not available for the Pit 1 Infill, the material was assigned the same Ra-226 activity (117 pCi/g) as the West Disturbance area (the highest-activity material) based on the assumption that it was impacted to a similar degree. This assumption resulted in a conservative estimate of the required cover thickness (see Appendix F) because the combined layer thickness of both materials was evaluated in the cover model using the aforementioned activity value.

Figure 3-2 shows a profile of the pit backfill showing the estimated location of each deposited layer. Table 3-3 lists layer thicknesses.

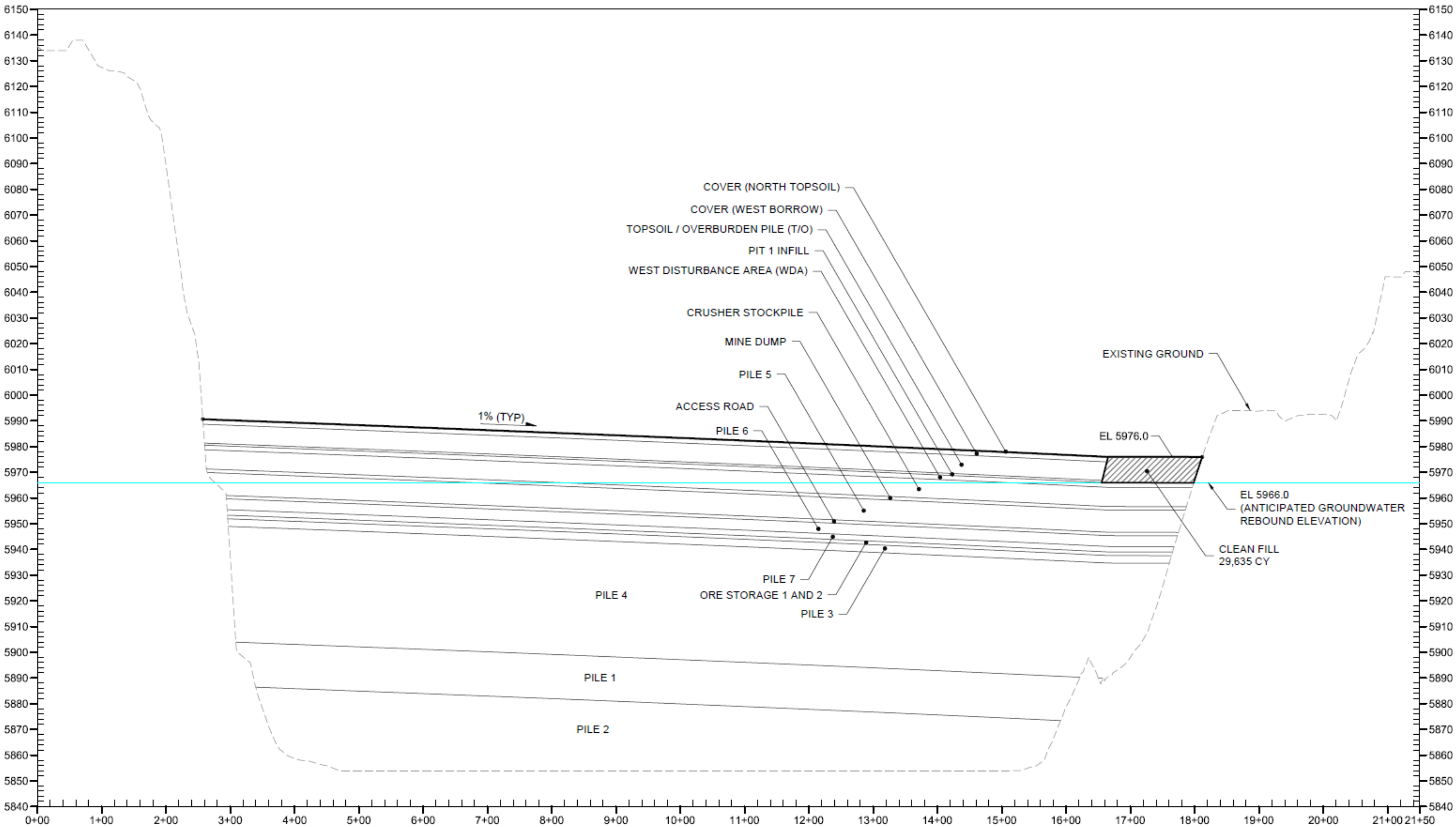


Figure 3-2. Pit 1 Backfill Profile

Table 3-3. Pit 1 Estimated Fill Thickness

Source/Layer	Estimated Thickness (ft)	75th Percentile Ra-226 Activity (pCi/g)
Cover (North Topsoil)	0.33	1
Cover (West Borrow)	1.66	1
Topsoil/Overburden Pile (T/O)	7.3	1
Pit 1 Infill	0.8	117
West Disturbance Area (WDA)	1.8	117
Crusher Stockpile	7.4	98.1
Mine Dump	1.4	74.4
Pile 5	8.6	66.8
Access Road	1.3	52.2
Pile 6	4.2	36.8
Pile 7	2.1	26.9
Ore Storage 1 and 2	1.4	22.8
Pile 3	2.9	20.6
Pile 4	44.9	20.5
Pile 1	17.2	12.7
Pile 2	17.8	2.6

3.2.3.3 Pit 1 Highwall

The top of the highwall in Pit 1 ranges in elevation from 6050 to 6100 feet. Although the Pit 1 backfill will not be placed to the top of the highwall, the reclamation goal of achieving a post-mining land use (grazing) with a self-sustaining ecosystem will not be impacted by the remaining exposed highwall. The site closure will meet the requirements for air, surface, and groundwater protection following implementation. The partially exposed pit wall will not pose a current or future threat to public health or safety under current land ownership by the Cebolleta Land Grant, which prevents public access. As stated in Section 1.1.1, cattle fencing and warning signage will be installed above the highwall as a safety precaution following closure. Fencing and sign details are included on Drawing 20. The permittee is requesting a waiver from MMD to leave in place the remaining portion of the highwall located above the partial pit backfill.

3.2.4 Pit 2 Design

Pit 2 will be backfilled to a minimum elevation of approximately 6040 ft for positive drainage from the pit. As shown in Figure 3-3, the cover will be graded to a slope of approximately 1.5 percent across the full area of the pit to mitigate erosion due to surface runoff. The western highwall and southwestern corner of the pit will be left in place, as these areas were found to not contain mine-impacted materials (see Appendix B) and are not expected to be areas of concern with regards to slope stability.

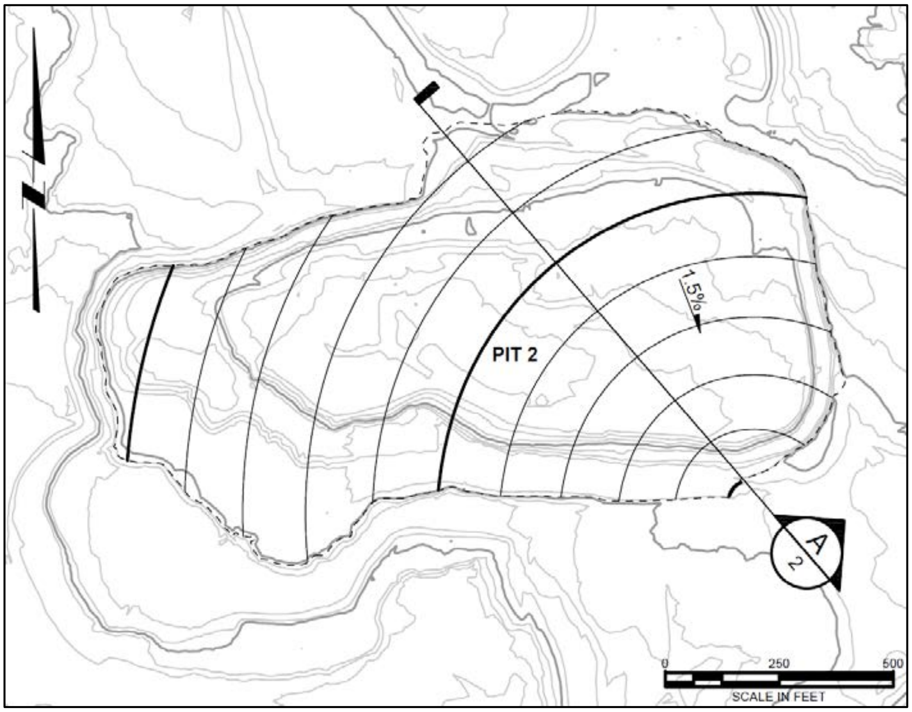


Figure 3-3. Pit 2 Backfill Surface Contours

3.2.4.1 Fill Placement and Sequencing

A profile of the backfilled Pit 2 (Figure 3-4) shows the estimated fill layer elevations and sequencing. The backfill will comprise two layers of waste material underlying the final cover. Pile 3 material will encompass the majority of the backfill volume and is the only mine-impacted material expected to be placed in the pit, with a calculated 75th percentile value for Ra-226 activity of 20.6 pCi/g based on laboratory analytical testing. As noted in Section 3.2.2, the Pile 3 volume transported to Pit 2 constitutes most of the total pile excavation with the remaining amount transported to Pit 1. The remaining fill volume beneath the cover will consist of material from the South Topsoil pile adjacent to the pit, which will be fully excavated and placed as subsoil beneath the cover. Similar to the Pit 1 cover subsoil, the South Topsoil will provide rooting media for cover revegetation while acting as a radon attenuation barrier. Table 3-4 lists layer thicknesses.

Table 3-4. Pit 2 Estimated Fill Thickness

Source/Layer	Estimated Thickness (ft)	75th Percentile Ra-226 Activity (pCi/g)
Cover (West Borrow)	2.0	1
South Topsoil Stockpile	8.3	1
Pile 3	44.3	20.6

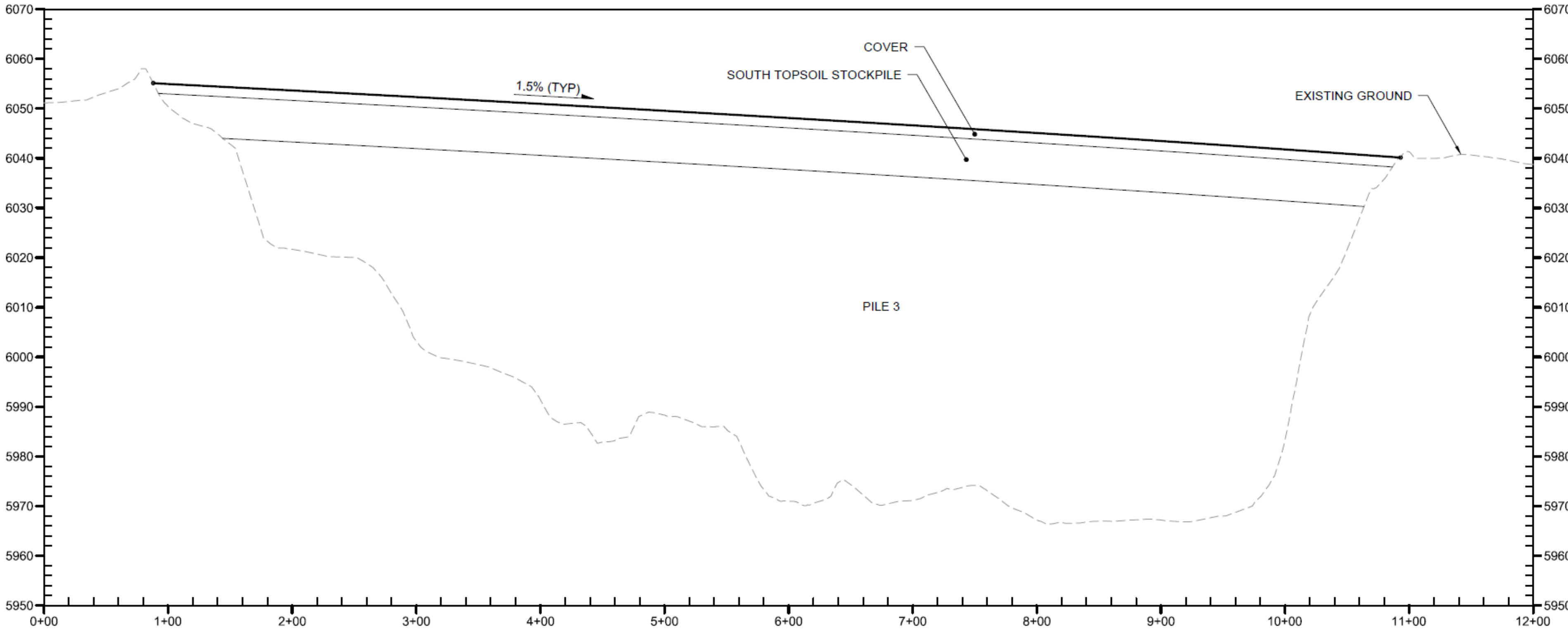


Figure 3-4. Pit 2 Backfill Profile

3.2.5 Pile 4 Design

Pile 4 is considered unstable in its current configuration and will be regraded to stabilize the slopes and prevent erosion into the arroyo. Slope instability and erosion were observed in several locations along the steep slopes of the existing pile, which appears to have been loosely deposited at the angle of repose for the material during past mine operations.

As noted in Section 3.2.2, approximately 3.1 million cy of material will be excavated from the pile and transported to Pit 1 for backfilling. The remaining volume (approx. 13.5 million cy) will be regraded to the configuration shown on Drawing 8, which will include pushing in-situ pile material into low-lying areas to the south, west, and northwest of the current pile location as fill to maintain consistent slopes on all sides of the pile. The pile footprint will be expanded to accommodate a decrease in the pile slope angle to 20 percent (5H:1V), based on a maximum recommended slope of 4H:1V by ecological consultants (see the Revegetation Plan included in Appendix G) for sustainable plant growth, erosion control, and slope stabilization. Design slopes will also contain bench channels to reduce down-slope drainage distances and convey surface runoff from the pile. The bench and channel designs are discussed in greater detail in Section 4.3.

Regraded waste rock will be covered in its final configuration with an approximately 2.6-ft-thick topsoil cover to mitigate radon emanation from the waste and provide planting media for surface revegetation. Section 5.0 and Appendix F discuss details pertaining to the cover design and calculations.

4.0 SURFACE WATER HYDROLOGY

4.1 FLOW CHARACTERIZATION

4.1.1 Site Hydrologic Setting

As stated in Section 1.2, the site is in a remote, sparsely populated area approximately 40 miles west of Albuquerque. Aside from the St. Anthony mine facilities, the drainage basin is relatively undisturbed, and the native topography, soils and vegetative states are present. The climate of the region, as summarized by measurements taken between 1905 and 2006 at the nearby Laguna, NM weather monitoring station (WRCC, 2019) has an average annual precipitation of 9.89 inches, with the heaviest precipitation falling as thunderstorms during July, August, and September. Pan evaporation rates obtained at the Los Lunas Station between 1962 and 1975 show an average annual evaporation approaching 52 inches (NOAA, 1982), approximately five times the average annual precipitation.

The entire project site is contained within the Arroyo Del Valle arroyo watershed, with total drainage area to the downstream point of discharge on the project site being approximately equal to 30 square miles. The Arroyo Del Valle arroyo is an upper tributary to the Rio San Jose. The landscape of the Arroyo Del Valle is comprised of upland mesas and buttes that flow steeply over rock outcrops and into alluvial valley bottoms that form ephemeral channels (arroyos). Mesas and hillslopes are vegetated with a mixture of grasses, shrubs, and trees. The valley floors have limited vegetation of dispersed grasses and shrubs. The mesas and buttes are comprised of cobbly loam soils with very high runoff potential. Transitions from mesas and buttes to valley floors are dominated by rock outcrops and limited soil cover consisting of sandy clays. The valley floors where ephemeral channels exist consist of well drained clayey soils also with very high runoff potential.

The greatest stormwater runoff rates result from thunderstorms that occur between summer and early fall months. As described by Sabol et al. (1982), typical New Mexico thunderstorms have three phases: (1) a short-duration, low-intensity phase, (2) a higher intensity period, and (3) a longer, low-intensity period. The initial low intensity period fills potential rainfall loss reservoirs such as interception, depression storage in soils, and reducing the water storage capacity of soils. In extreme rainfall events, the short-duration, high-intensity rainfall often exceeds the infiltration capacity of the soil.

4.1.2 Design Discharge

For hydrologic evaluations, Stantec developed hydrologic models to predict flows at various points of interest around the project site for existing and proposed conditions. Modeling was completed using United States Army Corps of Engineers (USACE) Hydrologic Engineering Center's – Hydrologic Modeling System (HEC-HMS) version 4.2.1, build 28.

Stormwater controls were designed on the basis of a design flood event for all stormwater conveyance facilities is the storm with a 1 percent annual occurrence probability (1 in 100-year storm). The study also evaluated the 2-year, 5-year and 10-year storm events under the existing site conditions. Stantec estimated peak discharge values associated with the design flood events at each point of interest on the project site by simulating runoff hydrographs using a center peaking rainfall distribution that included the peak rainfall intensity for every 5-minute interval up to 24 hours.

The stormwater models considered rainfall losses from depression storage and infiltration. The hydrologic model used constant depression storage values consistent with values recommended for regional watersheds. Losses due to infiltration were computed using the Green and Ampt (1911) method which provides physically-based estimates of losses during different storm intensities and storm durations. Appendix E contains further discussion and justification of the methods and assumptions used to develop the peak flow rates used for design of stormwater conveyance facilities.

4.2 NATIVE ARROYO

The Meyer Draw runs through the project site between several mine waste rock piles (see Figure 4-1). The preliminary site design proposes to excavate all piles located Southwest of the Meyer Draw and backfill the excavated mine material into the two pits (Pit 1 and Pit 2). The largest of the piles on site, Pile 4, will be regraded to stable slopes and left in place between the Meyer Draw and a tributary branch of the arroyo located to the east (East Tributary). Since the arroyo runs directly adjacent to the Pile 4, channel stabilization measures have been designed to prevent erosion of the arroyos from destabilizing portions of the regraded Pile 4.

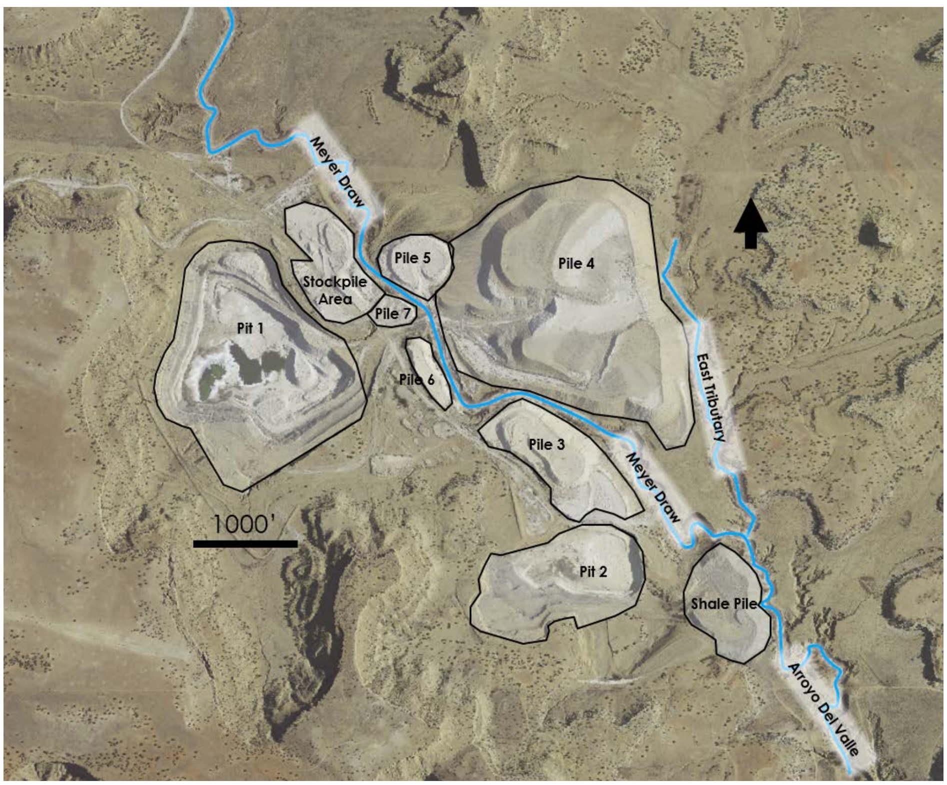


Figure 4-1. Project Site Existing Conditions (Photo Data: 05/31/2011)

The arroyo through the project reach has been heavily influenced by mining activity. As discussed in Attachment E, Stantec believes the arroyo through this reach is vertically unstable and expects channel downcutting to occur over time if preventive measures are not taken. The arroyo downcutting could lead to slope failures adjacent to the regraded Pile 4 located immediately adjacent to the arroyo.

Stantec proposes installing grade control structures along the Meyer Draw arroyo channel to prevent vertical down cutting. The proposed structures will be constructed using roller compacted concrete. The design of the grade control structures is shown on Drawing 18. From the conceptual design, the structures will lower the channel invert a nominal height of 3 vertical feet. Between structures, the channel will slope at 0.75 percent as shown on Drawing 10 and Drawing 11. This proposed bed slope in the channel bottom is supported by measurements of historical arroyo conditions (described further in Appendix E), as well as analytical methods for computing stable channel slopes.

To protect against horizontal channel movement, Stantec proposes a layer of riprap with a median stone diameter (D_{50}) of 12 inches along the base of Pile 4 for Meyer Draw and 9 inches along the base of Pile 4 at the East Tributary branch of the arroyo (See Detail 3 and Detail 4 on Drawing 16). Corresponding riprap gradations of 5 inches (D_{15}) to 20 inches (D_{100}) for the Meyer Draw and 4 inches (D_{15}) to 15 inches (D_{100}) for the East Tributary are expected, though these ranges are subject to change during the development of final construction specifications. Appendix E provides further discussion and methods used to evaluate facilities proposed to be installed along the arroyos.

4.3 PILE 4 BENCH CHANNELS AND DOWNDRAIN

The proposed closure plan for Pile 4 is to push the pile material to the borders of the Meyer Draw and the East Tributary arroyos that flanks the southwest and eastern edges of the pile. From the arroyo edges, the pile will be sloped at a design grade of 20 percent (5H:1V). The pile slopes will be broken by benches that capture and convey rainfall runoff from the Pile interbench slopes. The maximum length of the interbench slopes will be 400 feet. Stormwater conveyance channels constructed on the stockpile benches will extend from the North face of the pile at approximately 2 percent grade toward an armored downdrain channel at the Southern end of the stockpile (see Figure 4-2, see also Drawing 9). The bench channel cross sections will be triangular with 6-inch riprap armoring near the channel invert and vegetation lining on the outer portions (see Detail 1 on Drawing 16). The downdrain channel will convey flow at a slope that decreases from approximately 11 percent at the upstream portion to approximately 5 percent at the downstream portion. The downdrain channel will be riprap-lined with a trapezoidal cross section (see Detail 2 on Drawing 16). The downdrain will convey flow off the stockpile and will discharge near the confluence of the Meyer Draw and East Tributary arroyos.

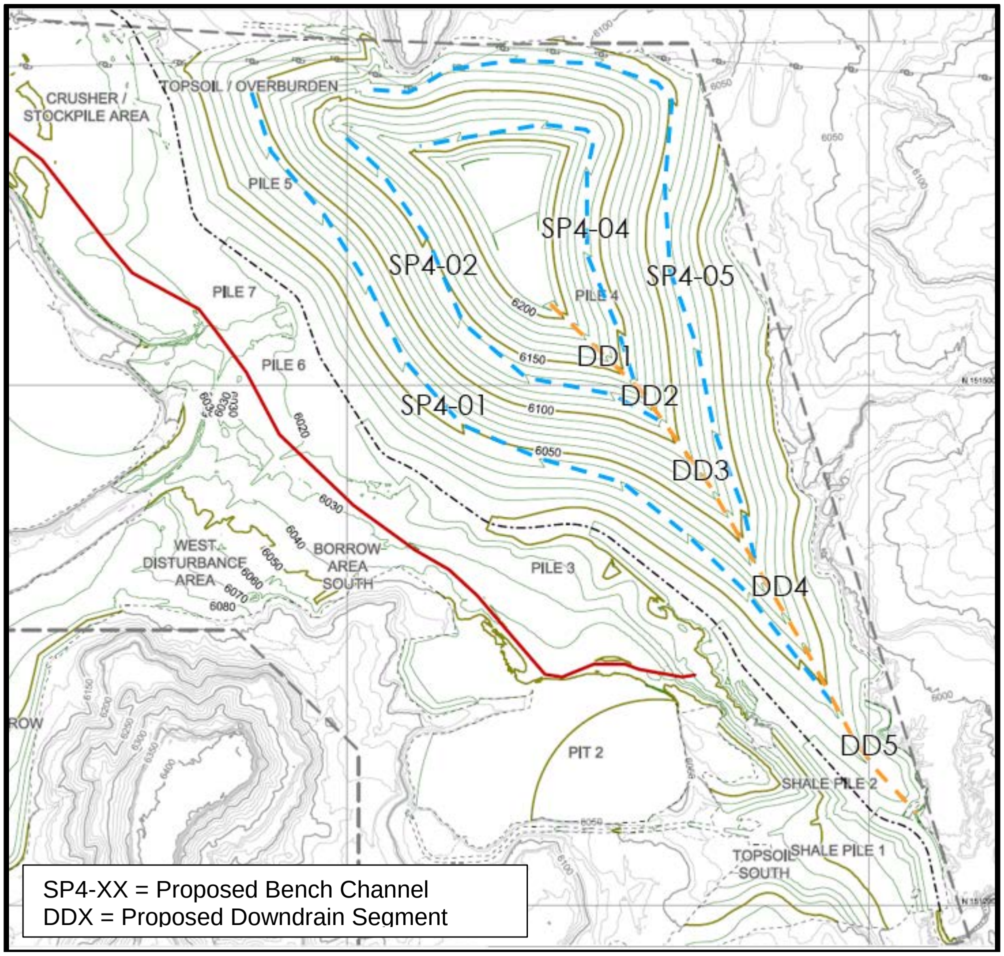


Figure 4-2. Plan View of the Proposed Stockpile 4

Appendix E provides further discussion and explanation of design methods used to evaluate riprap sizing and the erosional resistance of the vegetation lining.

4.4 PIT DIVERSION CHANNELS

As discussed above, the two large pits (Pit 1 and Pit 2) will be backfilled with excavated waste rock material. The backfilled waste rock will be covered with clean material borrowed from elsewhere on the site. Diversion channels were designed to capture surface runoff water from the drainages upgradient of Pit 1 and Pit 2 to prevent this water from cascading down the pit walls and onto the backfilled waste material, which could cause scour of the cover material (potentially exposing waste rock material and/or interrupting vegetation growth). The diversion channels will also minimize water volumes in the pit areas. The diversion channels utilize a combination of trapezoidal channels excavated below existing grade and berms constructed on side hills at existing grade. The diversions will direct flow around the pit areas and into the Meyer Draw channel. Drawings 12 and 13 show the diversion channel alignments for Diversion Channel 1 and Diversion Channel 2, respectively. Median riprap diameters ranging in size between 3 inches and 18 inches will be installed (where necessary) to prevent scour/erosion along the diversion channel alignment.

Appendix E provides further discussion and explanation of design methods used to evaluate riprap sizing and the erosional resistance of the vegetation lining.

5.0 SOIL COVERS

5.1 DESIGN CRITERIA

The soil covers for Pits 1 and 2 and Pile 4 are designed to:

- Achieve revegetation performance criteria required by the MMD.
- Limit radon emanation (flux) to less than 20 pCi/m^2/s for the covers on the pits and Pile 4. Where radon emanation is modeled to be below 20 pCi/m^2/s, direct revegetation of the top surface will be evaluated. Radon emanation will be modeled using the U.S. Nuclear Regulatory Agency (NRC) 1989 RADON model. Data from the field investigations will be used in the modeling, as well as the evaluation of vegetation.
- Maintain erosional stability under the design storm flow.

Based on comments provided on the INTERA Stage 2 Abatement Plan (NMED, 2015), the minimum cover thickness on the Pit 1 backfill is required to be 3 feet of non-mine impacted material.

5.2 COVER MATERIALS

Soil will be borrowed from the West Borrow and Lobo Tract borrow areas to be used as cover soils for the backfilled open pits and regraded Pile 4. Additional cover soil will be excavated from the North Topsoil pile just north of Pit 1. Drawing 3 shows borrow area locations; the borrow areas are described in the following sections. Appendix C describes the soils encountered in each area during the geotechnical investigation and summarizes material properties and classifications.

5.2.1 Lobo Tract Borrow

UNC acquired the Lobo Tract as a soil borrow source for the project. The borrow area is just north of the mine permit boundary and east of the access road to the Site within a wide valley-bottom flood plain. Meyer Draw forms the base of the valley prior to flowing south through the Site. Soil samples were collected from potential borrow sources on both sides of the arroyo during the 2018 geotechnical investigation. Analytical testing results from the 2007 materials characterization indicated Ra-226 concentrations of approximately 1 pCi/g or less, confirming the potential use of the area as a source of clean, non-impacted borrow material.

Approximately 780,000 cy of borrow material is available within the Lobo Tract Borrow East area delineated on Drawing 5, located to the east of the arroyo. The outlined area contains the best quality borrow material for use as soil cover compared to areas closer to the rock outcroppings along the eastern edge of the valley. Approximately 286,000 cy of additional borrow material is available, if necessary, from the Lobo Tract Borrow West area shown to the west of the arroyo on Drawing 5. The Lobo Tract Borrow East area may be expanded further north within the boundaries of Lobo Tract for contingency volume, although this would increase haulage distances and ground disturbance.

5.2.2 West Borrow Area

The West Borrow Area is outside of the UNC mine permit boundary to the south of Pit 1 and contains alluvial deposits with depths as great as 30 to 40 ft. The proximity of this area to Site facilities, especially Pit 1, makes it desirable as a potential borrow source and Stantec expanded the scope of the 2018 site investigation to include the area. Measured Ra-226 concentrations were less than 1.2 pCi/g for soil samples collected during 2018, indicating the area contained non-impacted materials suitable for soil cover. Approximately 620,000 cy of soil is available for excavation in this area.

5.2.3 North Topsoil Pile

The North Topsoil pile is immediately above the northern Pit 1 highwall and presumed to contain topsoil excavated from the Pit 1 overburden during initial mining operations. The soil contained Ra-226 concentrations less than 1 pCi/g during the 2007 materials characterization and is expected to be a clean source of borrow material. Cedar Creek Associates, Inc. (Cedar Creek), a Stantec subcontractor who developed a Site revegetation plan (see Section 7.0) listed the North Topsoil pile as the most-preferred material for cover or planting media. Approximately 43,500 cy of material is available for excavation from the pile.

5.3 COVER DESIGN

As previously stated, one of the primary objectives of placing a soil cover over the backfilled pit was to reduce radon flux from the pit surface to less than 20 pCi/m^2-s. Radon attenuation was analyzed using the NRC RADON model (NRC, 1989), which uses the physical and radiological characteristics of the waste and overlying materials to calculate the rate of radon emanation through the cover. Appendix F describes the methods used to develop the model input parameters and summarizes the model results.

Erosional stability was analyzed for a vegetated cover surface using the Temple Method as recommended in Design of Erosion Protection for Long-Term Stabilization published by the NRC (Johnson, 2002). This method uses physical characteristics of the cover material and expected vegetation properties to calculate the factor of safety against erosion due to the peak runoff from the design storm. Appendix F describes the methods used to develop the model input parameters and summarizes the results. Stantec used a reference factor of safety of 1.5 for erosional stability with vegetation established.

5.3.1 Pit 1

The Pit 1 cover is contoured to slope gently to the east side of the backfilled pit at a slope of 1 percent. Per Cedar Creek's recommendations, the cover thickness will be 24 inches to create more favorable growth conditions for successful revegetation. The uppermost portion of the cover will come from the North Topsoil pile, which contains sufficient volume for a 4-inch layer across the full pit surface, whereas the bottom 20 inches of the cover will be sourced from the West Borrow area. As discussed in Section 3.2.3, the cover will be placed directly over a subsoil layer consisting of Topsoil/Overburden material, which should assist both the plant growth and radon attenuation capabilities of the soil cover. Detail 13 on Drawing 19 shows a profile of the Pit 1 cover.

5.3.1.1 RADON Modeling

The resulting flux for the proposed Pit 1 cover design was 16.2 pCi/m^2-s, indicating the cover will effectively reduce radon emanation below the threshold value.

5.3.1.2 Erosional Stability

The resulting factors of safety against erosion for the maximum length (1,400 feet) of the 1 percent (100H:1V) cover slope included for the Pit 1 design are 5.2 for poor vegetation conditions and 16.0 for fair vegetation conditions. Appendix F describes the methods used to develop the model input parameters and summarizes the results.

Erosional stability of the Pit 1 cover near the western highwall is of concern given the presence of several erosional features that cut through the upper portions of the highwall and convey surface runoff into the pit. Cascading flow of water over the highwall onto the cover surface below could result in considerable erosion of cover soils and render the cover ineffective. Because the proposed Pit 1 diversion channel does not extend along the full length of the highwall, a 12-foot-wide diversion berm is proposed above the highwall to convey runoff to a large erosional feature that exists near the southwest corner of the pit. Placement of a 30-foot-diameter splash pad is proposed at the base of the erosional feature to protect the cover surface from the concentrated flow of water. An armored swale will then convey water from the splash pad across the pit surface to the retention area on the east side of the pit. Drawing 14 shows the proposed locations of the berm, splash pad, and swale, as well as a representative cross-section of the berm.

5.3.2 Pit 2

The surface of Pit 2 is sloped to drain out of the backfilled pit to the east at a slope of 1.5 percent. A 24-inch soil cover will be placed atop the subsoil material from the South Topsoil pile and the underlying Pile 3 waste rock. The full cover depth will consist of clean borrow material from the West Borrow area. Detail 14 on Drawing 19 shows a profile of the Pit 2 cover.

5.3.2.1 RADON Modeling

As with the Pit 1 cover, the NRC RADON model was used to calculate radon attenuation for the Pit 2 cover design. Appendix F discusses the development of model input parameters. The proposed cover configuration resulted in a calculated rate of emanation of 3.8 pCi/m^2-s, which is below the threshold value of 20 pCi/m^2-s.

5.3.2.2 Erosional Stability

The resulting factors of safety against erosion for the 1,440-foot-long 1.5 percent (100H:1.5V) cover slope included in the Pit 2 design is 3.5 for poor vegetation conditions and 10.5 for fair vegetation conditions. Appendix F describes the methods used to develop the model input parameters and summarizes the results.

Although a portion of the northwestern Pit 2 highwall will remain exposed after the pit is backfilled, erosion of the cover surface at the base of the highwall is not a concern, unlike Pit 1. The height of the highwall is much less than that of Pit 1 such that any cascading flow of water is expected to impact the cover with considerably less force. Additionally, the area above the northwest highwall generally slopes to the north, carrying surface runoff away from the open pit, and no major erosional features are evident on the existing highwall in this area. The proposed Pit 2 diversion channel is expected to provide sufficient protection against cover erosion along the southwestern and southern edges of the pit.

5.3.3 Pile 4

Following removal of the portion of Pile 4 used for Pit 1 backfill, the remaining mine-impacted waste material will be regraded and stabilized in place, as discussed in Section 3.2.5. Therefore, a soil cover is required for radon attenuation and revegetation of the pile surface. A combination of topsoil from the West Borrow and Lobo Tract borrow areas will be placed directly over the Pile 4 waste either as a single, mixed layer of the two materials or as separate lifts. Detail 15 on Drawing 19 illustrates the Pile 4 cover geometry.

5.3.3.1 RADON Modeling

For the pit covers, the RADON model was used to calculate the radon flux for a given cover thickness. Conversely, the objective of the Pile 4 cover design was to evaluate the cover thickness required to meet the threshold flux of 20 pCi/m^2-s. Based on the parameter inputs described in Appendix F for the Pile 4 cover and waste materials, the optimal cover thickness calculated by the model was 2.6 ft.

5.3.3.2 Erosional Stability

The resulting factors of safety against erosion for the critical slopes of the Pile 4 regrade design, a slope 400 feet-long at 5H:1V, is 1.6 for poor vegetation conditions and 5.8 for fair vegetation conditions. Appendix F describes methods used to develop the model input parameters and summarizes the results. Because the factor of safety is less than 2 for the poor vegetation conditions, active maintenance following large storm events may be required for repairs on the Pile 4 slopes until stable vegetation is established.

6.0 RECLAIMED GRADING PLAN

6.1 CONCEPT

Once the surface impacted materials are excavated and placed into one of the Pits, the ground surface will be graded to establish positive and stable drainage toward the arroyo. Drawing 8 shows the proposed grading plan following removals, including the proposed the grading of the two pits and Pile 4. Shallow removal excavations in the vicinity of the existing piles will be shaped to allow positive drainage. Deeper removal excavations may require clean borrow to establish positive drainage following completion. Disturbed areas will be reseeded with the approved reclamation seed mix following cleanup verification. Temporary erosion controls methods, such as rock check dams or biodegradeable erosion control netting, may be installed to stabilize the disturbed areas where erosion is expected prior to establishment of vegetation.

7.0 REVEGETATION

7.1 SELF-SUSTAINING VEGETATION ECOSYSTEM

Stantec contracted Cedar Creek in 2018 to update the site Revegetation Plan in support of this closeout plan for UNC's St. Anthony Mine. The updated Revegetation Plan is informed by previous vegetation sampling conducted in 2005 (Cedar Creek, 2006), a growth media characterization effort and general site survey conducted in 2018, and Stantec's experience successfully reclaiming uranium sites with similar conditions and challenges. Appendix G includes the Cedar Creek growth media characterization report and the site revegetation plan. Drawing 15 shows approximate extents of the areas to be reseeded following earthwork.

8.0 SCHEDULE AND PERMITS

8.1 FUTURE CONSIDERATIONS

The closeout plan will be implemented following approval by the MMD. Stantec will prepare an updated surety estimate once the MMD provides feedback on the overall design concept and indicates that the plan is approvable. The previous closeout plan cost estimate was submitted in September 2010 (MWH, 2010). Upon MMD approval of both the closeout plan and the surety cost estimate, UNC will prepare construction permit applications and select a construction contractor. A proposed schedule is listed below:

- Closeout plan submitted to MMD and NMED – March 2019
- Agreement between GE/UNC and MMD on the overall concept – April 2019
- Surety estimate, final design, and construction schedule submitted to MMD – July 2019
- MMD approval of the closeout plan – September 2019

In conjunction with preparing the updated surety estimate, several design items will be optimized. For the final design, Stantec plans to complete the following additional details:

- Identify a quarry capable of supplying the channel armoring materials (roller compacted concrete, riprap, granular filter material) outlined for use in the design drawings.
- Optimize the channel design armoring elements by refining channel hydraulic evaluations using a 2-dimensional hydraulic model.
- Optimize design of grade control structures to minimize the excavation and material volumes necessary to provide adequate protection along the arroyo.
- Present designs for channel filters to be installed beneath riprap revetments. The channel filter system may utilize granular filters (as depicted in the design drawings) or manufactured geotextiles specifically designed for surface water drainage applications.
- Evaluate potential for sediment aggradation in the lower sloping reaches of the diversion channels and, if necessary, propose design upgrades to prevent aggregation and/or provisions to allow for sediment accumulation (such as local increases in channel freeboard).
- Optimize sizing of the Pit 1 western diversion berm, splash pad apron and swale on the cover.

8.2 PERMITS

Stantec anticipates that a National Pollutant Discharge Elimination System (NPDES) construction permit will be required prior to construction. An updated Stormwater Pollution Prevention Plan (SWPPP) will be prepared prior to construction as part of that permit application.

9.0 REFERENCES

Archuleta, C.M., Constance, E.W., Arundel, S.T., Lowe, A.J., Mantey, K.S., and Phillips, L.A., 2017, The National Map seamless digital elevation model specifications: U.S. Geological Survey Techniques and Methods, book 11, chap. B9, 39 p., https://doi.org/10.3133/tm11B9.

Cedar Creek, 2006. Vegetation and Wildlife Evaluations/Revegetation Recommendations. May.

Cooper Aerial Surveys Co. (Cooper), 2011. Aerial Survey. May 9.

Green, W.H. and G. Ampt, 1911. Studies of soil physics, part I – the flow of air and water through soils. J. Ag. Sci. 4:1-24.

INTERA, 2015. *St. Anthony Mine Stage 2 Abatement Plan* – Cibola County, New Mexico. February 9 (Modified).

Johnson, 2002. NUREG-1623 Design of Erosion Protection for Long-Term Stabilization. Final Report, September.

Lone Mountain Archaeological Services, Inc. (LMA), 2006. *Cultural Resource Survey of 342 Acres for St. Anthony Mine Reclamation Cibola County New Mexico.* April.

MWH, 2010. *St. Anthony Mine Closeout Plan*, July.

MWH, 2007a. *St. Anthony Mine Materials Characterization Work Plan*, May.

MWH, 2007b. *St. Anthony Mine Materials Characterization Report*, October.

New Mexico Environment Department, 2015. *St. Anthony Mine – New Mexico Environment Department conditional approval for "St. Anthony Mine Stage 2 Abatement Plan, Cibola County, New Mexico"*. May 7.

U.S. Nuclear Regulatory Commission (NRC), 1989. Calculation of Radon Flux Attenuation by Earthen Uranium Mill Tailings Covers, Regulatory Guide 3.64.

NOAA, 1982. National Oceanic and Atmospheric Administration (NOAA) Technical Report NWS 34. Mean Monthly, Seasonal, and annual pan evaporation for the United States. December.

Sabol, G.V., T.J. Ward, and A.D. Seiger, 1982. Phase II – Rainfall Infiltration of Selected Soils in the Albuquerque Drainage Area. Accessed online February 2016 at: http://www.fcd.maricopa.gov/pub/library.aspx

Stantec, 2018. Supplemental Investigations Work Plan. February 23.

WRCC, 2019. Western Regional Climactic Data Center. Climate data recorded at the Laguna, New Mexico weather station (294719). Accessed on the web at: https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?nm4719

ST. ANTHONY MINE

Closeout Plan - Design Drawings

Prepared For

UNITED NUCLEAR CORPORATION AND GENERAL ELECTRIC COMPANY

REV	DATE	BY	DESCRIPTION
0	02/2019	KR	PRELIMINARY DESIGN

DESIGNED K. REED

CHECKED C. FRITZ

APPROVED J. CUMBERS

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

Stantec

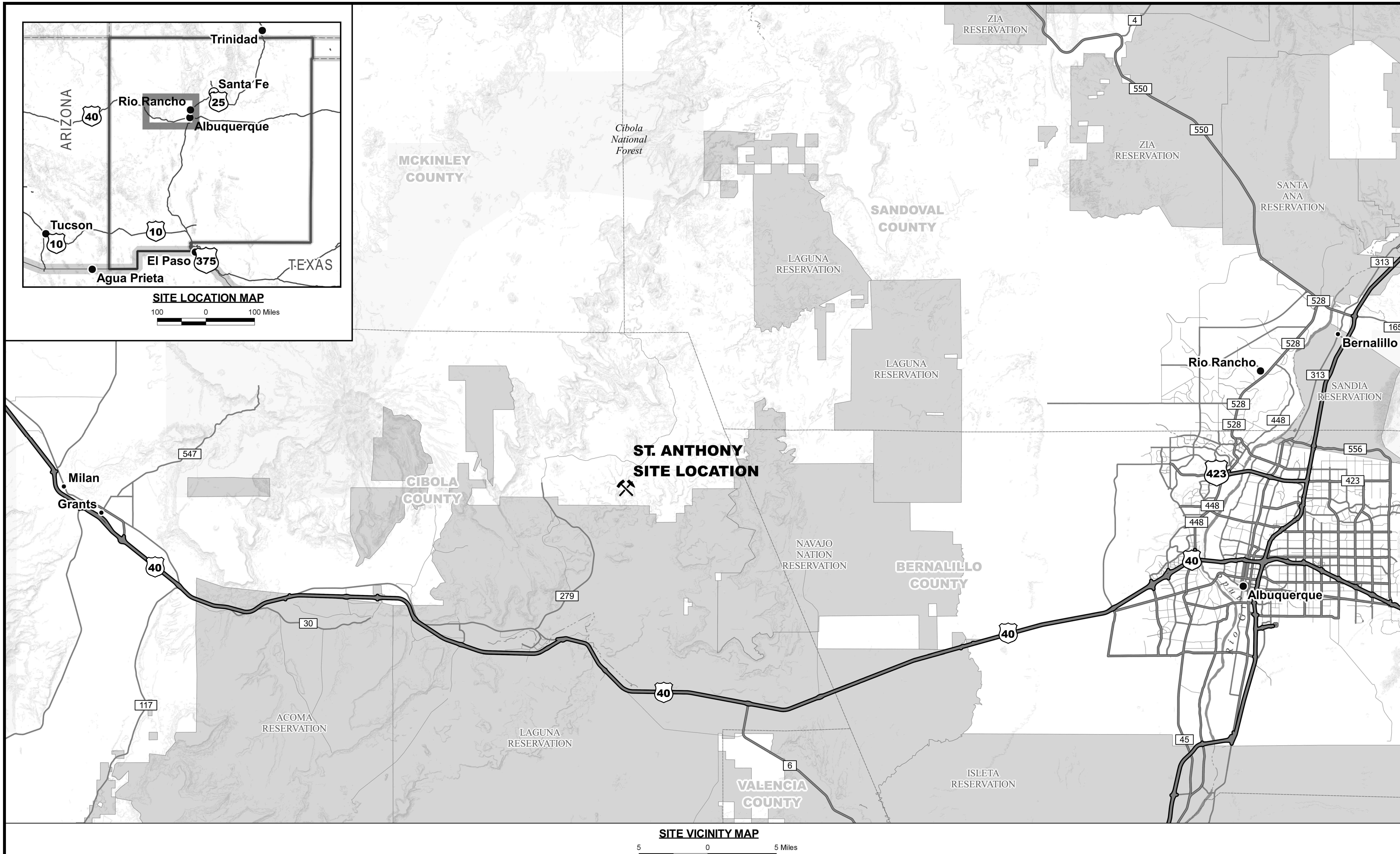
UNITED NUCLEAR CORPORATION
ST. ANTHONY MINE; CIBOLA COUNTY, NEW MEXICO

COVER SHEET

SHEET 1

233001076

Thursday, March 07, 2019 2:35:18 PM KWREED C:\PWWORKDIR\D0491540\STA_PDD_COVER.DWG Layout:Cover



Thursday, March 07, 2019 2:35:24 PM KWREED C:\PWWORKDIR\D0491540\STA_PDD_LOCATION.DWG Layout:Figure

REV	DATE	BY	DESCRIPTION
0	02/2019	KR	PREMILINARY DESIGN

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

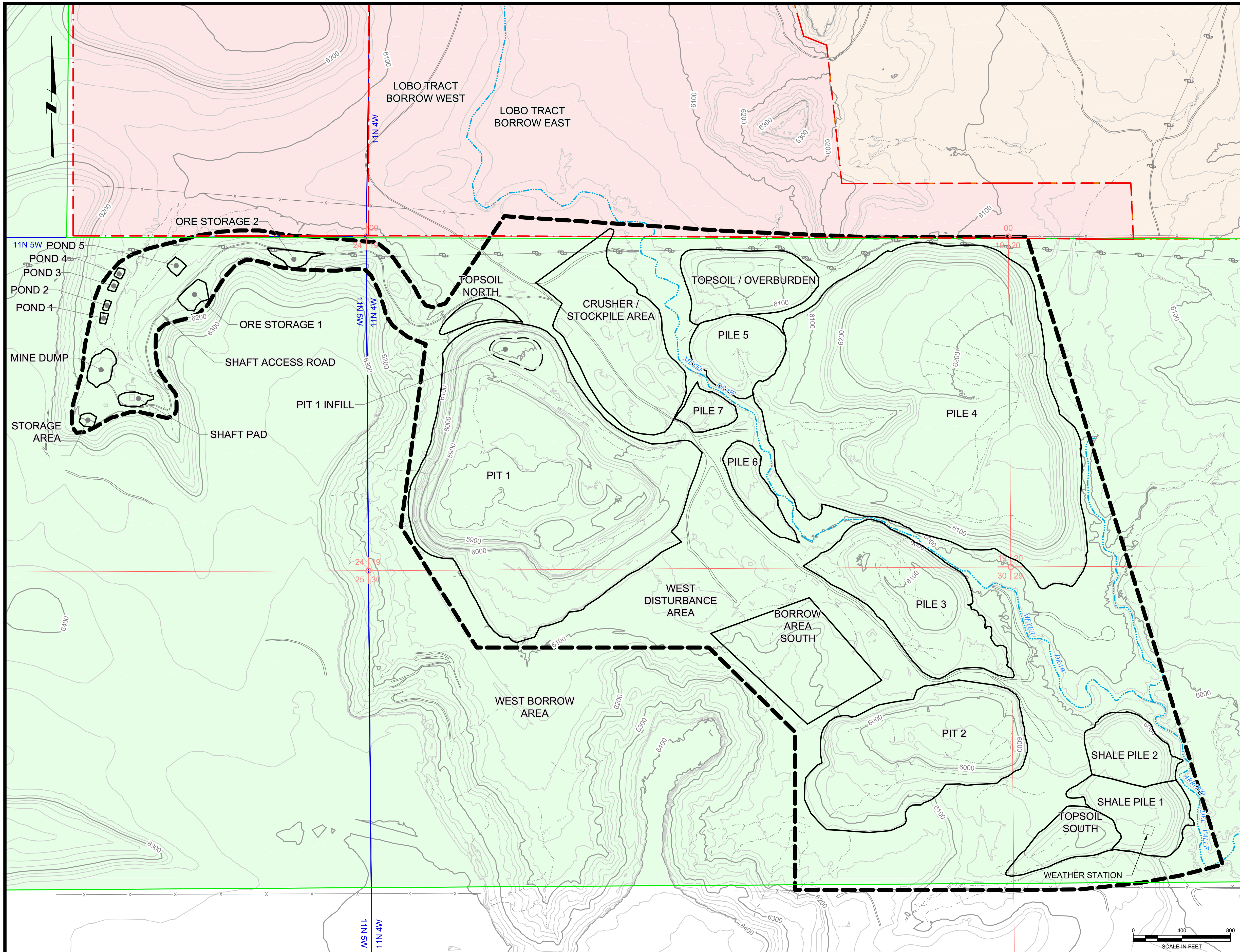
Stantec

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

SITE LOCATION

SHEET
2

233001076



LEGEND:

6100	EXISTING GROUND SURFACE CONTOUR & ELEVATION, FEET
	GULLEY / DRAINAGE
	ARROYO
	EXISTING ROAD
	EXISTING FENCE
	EXISTING OVERHEAD ELECTRIC AND POWER POLES
11N 5W	TOWNSHIP LINE AND NUMBER
25	SECTION LINE AND NUMBER
	CEBOLLETA LAND GRANT
	PARCEL - LOBO PARTNERS,LLC
	PARCEL - UNITED NUCLEAR CORP (UNC)
	UNC MINE PERMIT BOUNDARY
	FACILITY OUTLINES

REV	DATE	BY	DESCRIPTION
0	02/2019	KR	PRELIMINARY DESIGN

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

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

Stantec

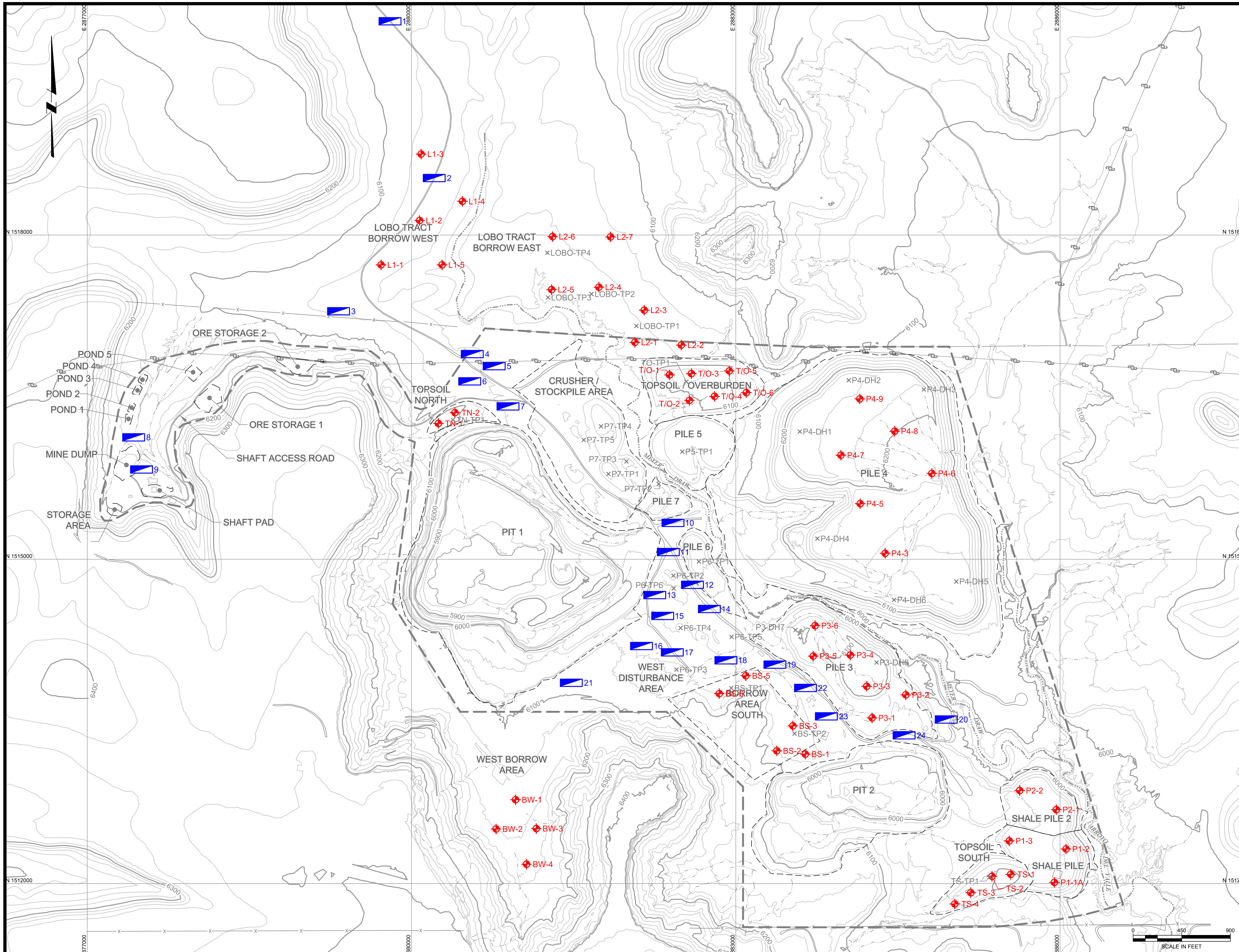
UNITED NUCLEAR CORPORATION
ST. ANTHONY MINE; CIBOLA COUNTY, NEW MEXICO

SITE LAYOUT
EXISTING CONDITIONS

SHEET 3

233001076

Thursday, March 07, 2019 2:35:58 PM KWREED C:\PWWORKDIR\D0491540\STA_PDD_SITE LAYOUT.DWG Layout:Site Layout



LEGEND:

6100	EXISTING GROUND SURFACE CONTOUR & ELEVATION, FEET
	GULLEY / DRAINAGE
	ARROYO
	EXISTING ROAD
	EXISTING FENCE
	EXISTING OVERHEAD ELECTRIC AND POWER POLES
	UNC PERMIT BOUNDARY
	FACILITY OUTLINES
×P4-DH2	EXISTING SAMPLING LOCATIONS (MWH, 2007)
P4-6	BOREHOLE (STANTEC, 2018)
10	TEST PIT (STANTEC, 2018)

REV	DATE	BY	DESCRIPTION
0	02/2019	KR	PRELIMINARY DESIGN

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

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

Stantec

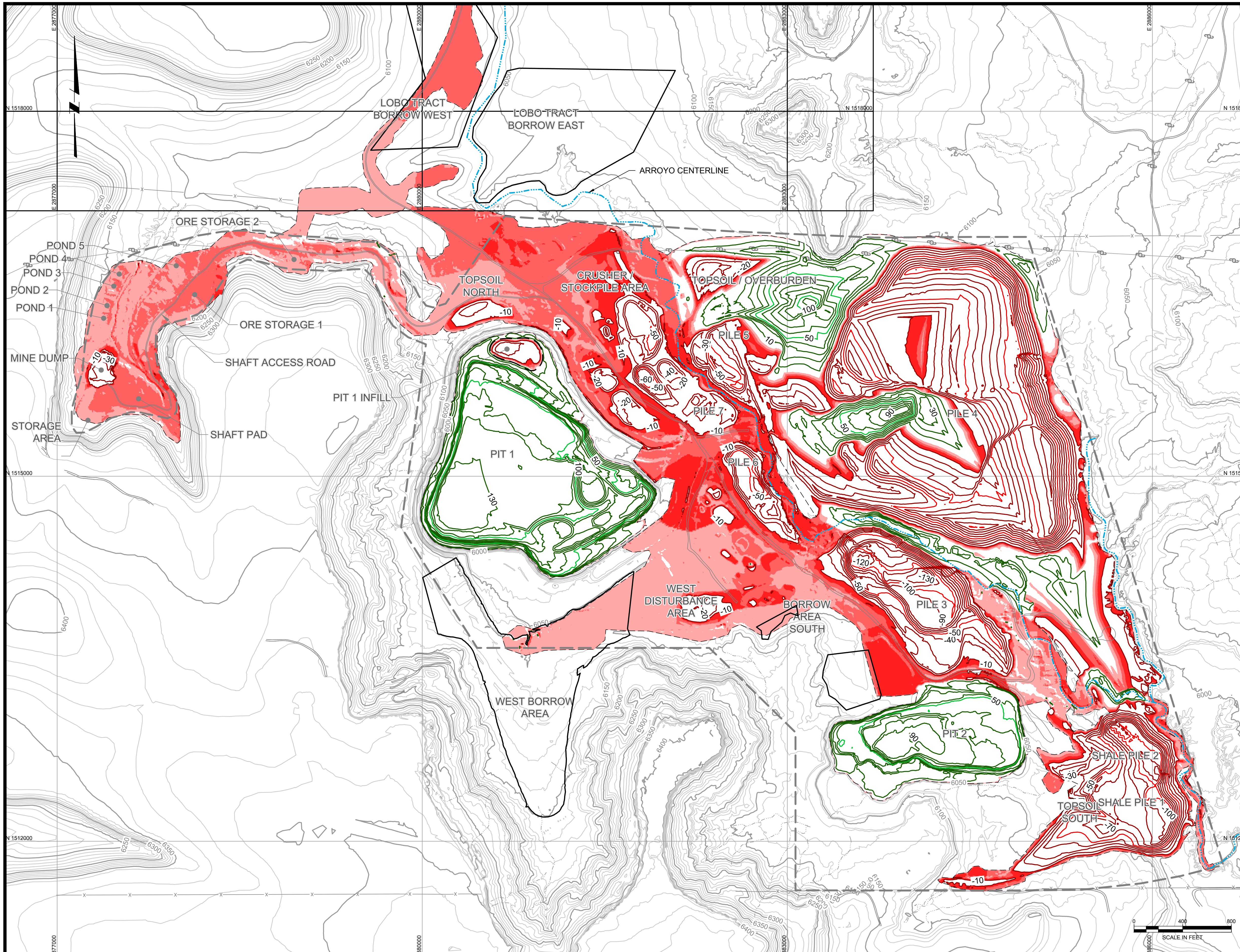
UNITED NUCLEAR CORPORATION
ST. ANTHONY MINE; CIBOLA COUNTY, NEW MEXICO

SURFACE CHARACTERIZATION

SHEET
4

233001076

Thursday, March 07, 2019 2:36:33 PM KWREED C:\PWWORKDIR\0491540\STA_PDD_SURFACE_CHAR.DWG Layout:Figure



LEGEND:

- 6100 — EXISTING GROUND SURFACE CONTOUR & ELEVATION, FEET
- -50 — EXCAVATION DEPTH CONTOUR, FEET
- 50 — FILL DEPTH CONTOUR, FEET
- GULLEY / DRAINAGE
- ARROYO
- EXISTING ROAD
- EXISTING FENCE
- EXISTING OVERHEAD ELECTRIC AND POWER POLES
- UNC MINE PERMIT BOUNDARY
- REMOVAL AREA BOUNDARY
- BORROW AREA BOUNDARY

Removal Excavation Depth Table

COLOR	MAXIMUM DEPTH (FT)	MINIMUM DEPTH (FT)
	5	10
	2	5
	1	0

REV	DATE	BY	DESCRIPTION
0	02/2019	KR	PRELIMINARY DESIGN

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

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

Stantec

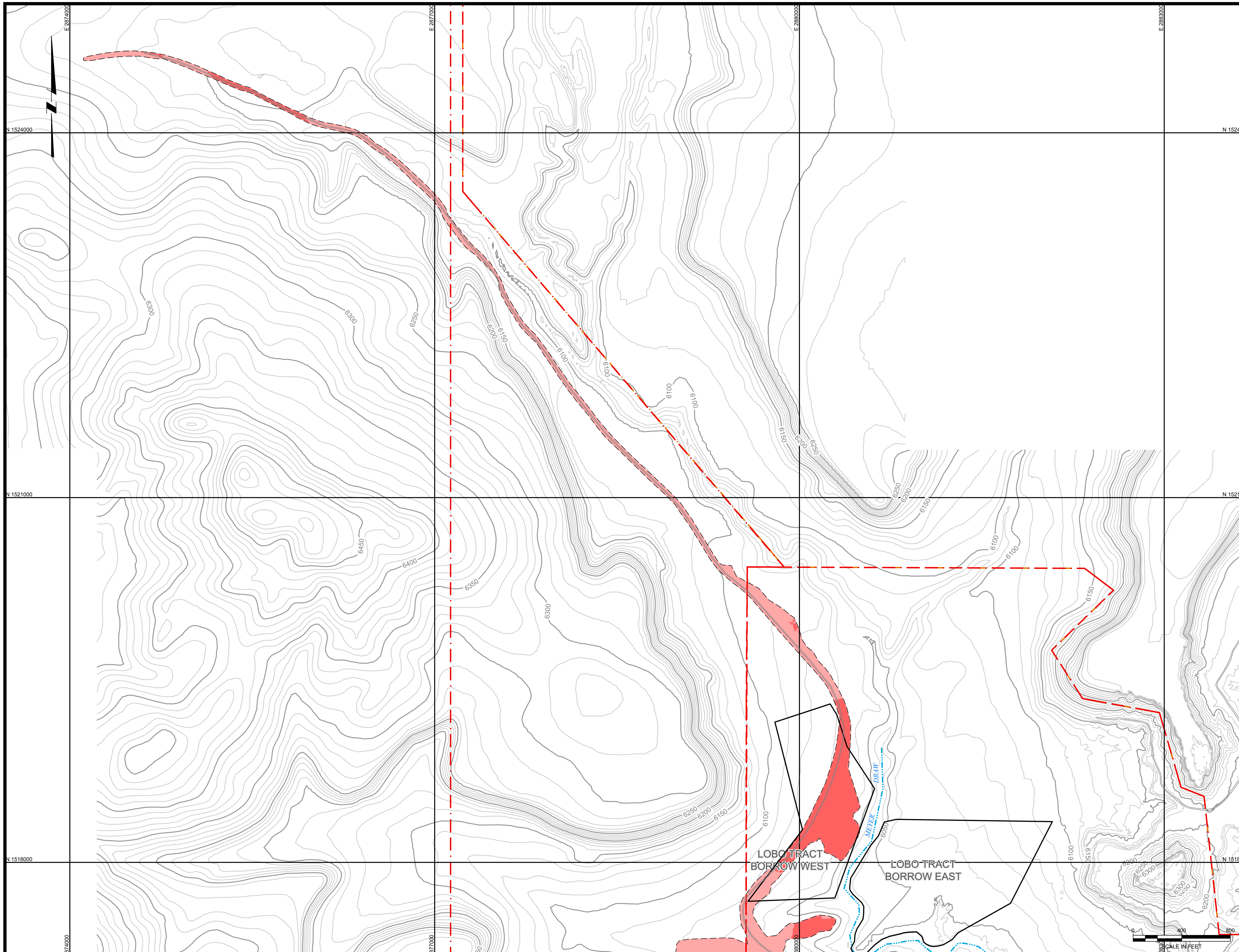
UNITED NUCLEAR CORPORATION
ST. ANTHONY MINE; CIBOLA COUNTY, NEW MEXICO

REMOVAL EXCAVATION PLAN (1 OF 2)

SHEET 5

233001076

Thursday, March 07, 2019 2:37:55 PM KWREED C:\PWWORKDIR\D0491540\STA_PDD_EXCAVATION.DWG Layout:Figure



LEGEND:

6100	EXISTING GROUND SURFACE CONTOUR & ELEVATION, FEET
	GULLEY / DRAINAGE
	ARROYO
	EXISTING ROAD
	PARCEL - LOBO PARTNERS,LLC
	PARCEL - UNITED NUCLEAR CORP (UNC)
	REMOVAL AREA BOUNDARY

Removal Excavation Depth Table

COLOR	MAXIMUM DEPTH (FT)	MINIMUM DEPTH (FT)
	5	10
	2	5
	1	0

Thursday, March 07, 2019 2:38:10 PM KWREED C:\PWWORKDIR\D0491540\STA_PDD_EXCAVATION.DWG Layout:Figure (2)

REV	DATE	BY	DESCRIPTION
0	02/2019	KR	PRELIMINARY DESIGN

DESIGNED K. REED

CHECKED C. FRITZ

APPROVED J. CUMBERS

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

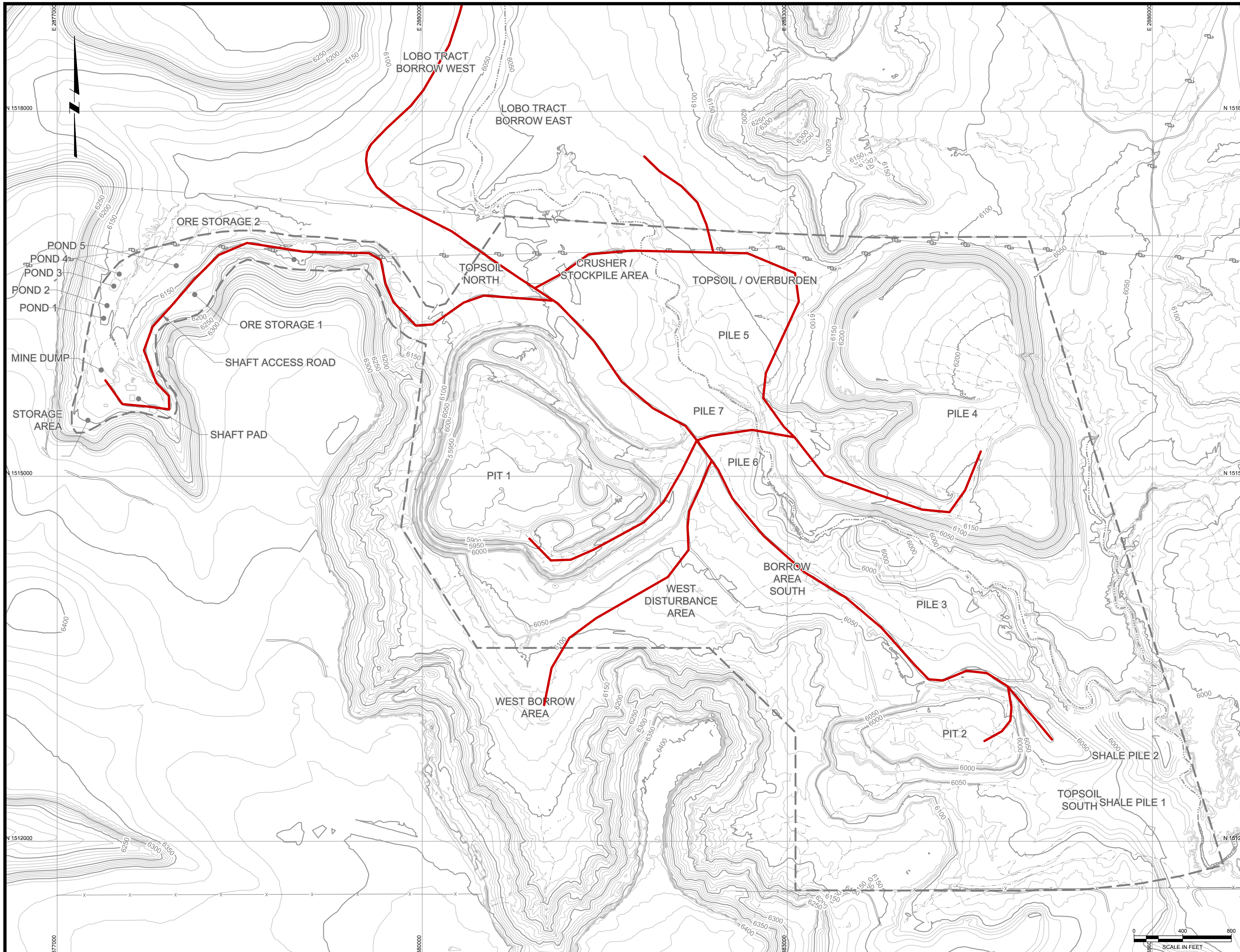
Stantec

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

REMOVAL EXCAVATION PLAN (2 OF 2)

SHEET
6

233001076



LEGEND:

6100	EXISTING GROUND SURFACE CONTOUR & ELEVATION, FEET
	GULLEY / DRAINAGE
	ARROYO
	EXISTING ROAD
	EXISTING FENCE
	EXISTING OVERHEAD ELECTRIC AND POWER POLES
	UNC MINE PERMIT BOUNDARY
	PROPOSED HAUL ROADS

REV	DATE	BY	DESCRIPTION
0	02/2019	KR	

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

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

Stantec

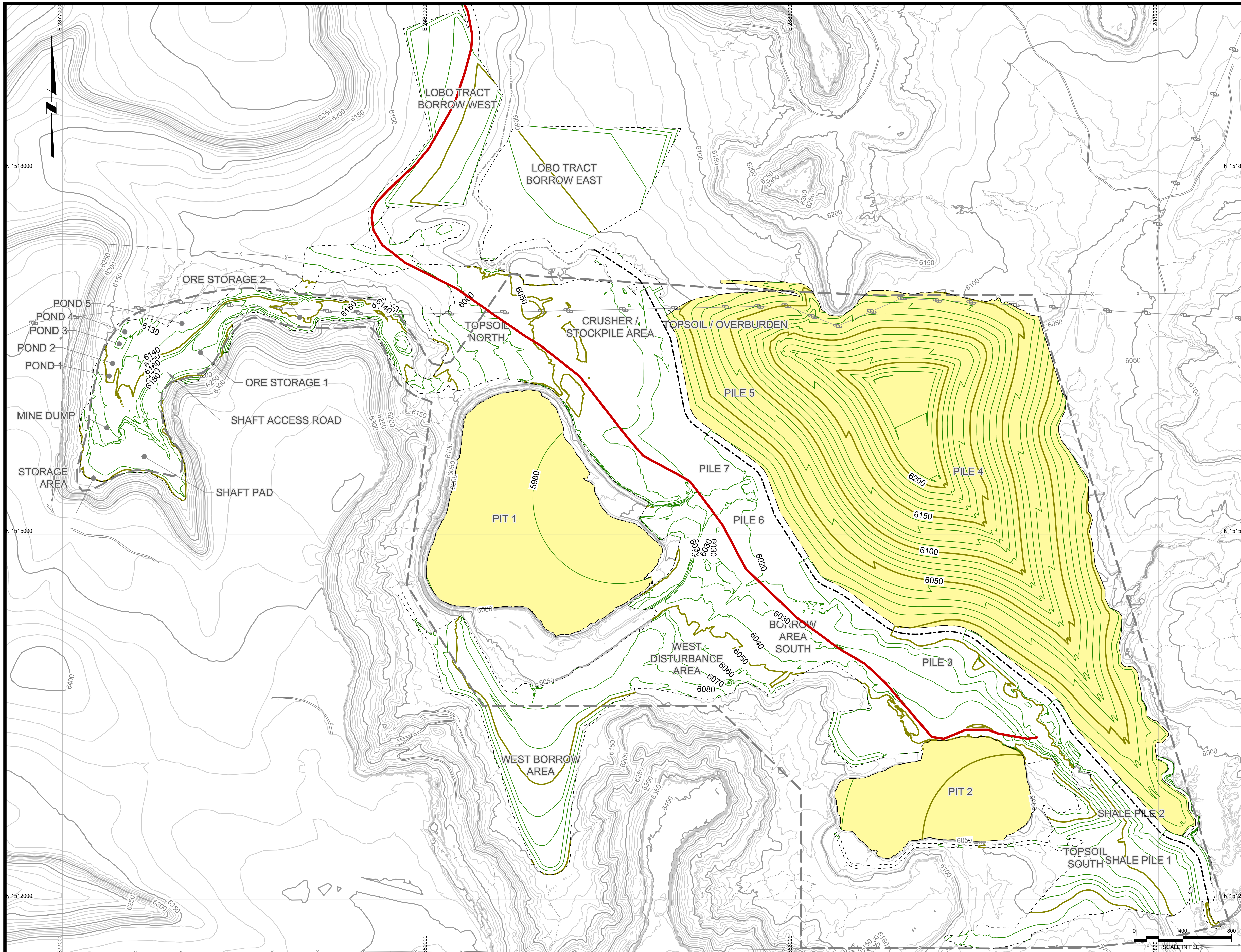
UNITED NUCLEAR CORPORATION
ST. ANTHONY MINE; CIBOLA COUNTY, NEW MEXICO

HAUL ROUTES

SHEET
7

233001076

Thursday, March 07, 2019 2:38:50 PM KWREED C:\PWWORKDIR\D0491540\STA_PDD_HAUL_ROUTES.DWG Layout:Figure



LEGEND:

6100	EXISTING GROUND SURFACE CONTOUR & ELEVATION, FEET
6200	PROPOSED FINAL GRADING CONTOUR & ELEVATION, FEET
	GULLEY / DRAINAGE
	ARROYO
	EXISTING ROAD
	EXISTING FENCE
	EXISTING OVERHEAD ELECTRIC AND POWER POLES
	UNC MINE PERMIT BOUNDARY
	FINAL ACCESS ROAD
	FINAL ARROYO CENTERLINE
	AREAS TO BE COVERED

REV	DATE	BY	DESCRIPTION
0	02/2019	KR	PRELIMINARY DESIGN

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

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

Stantec

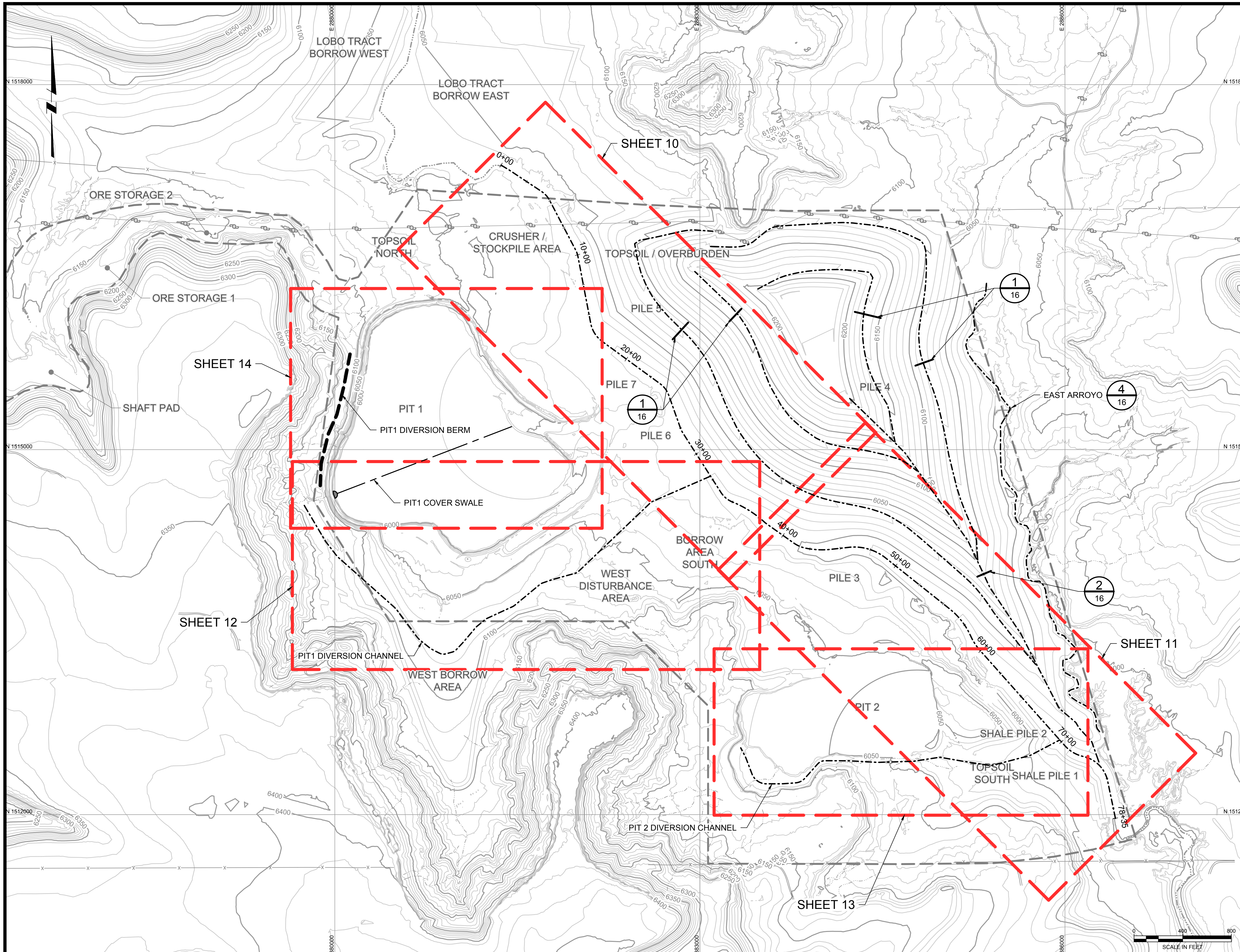
UNITED NUCLEAR CORPORATION
ST. ANTHONY MINE; CIBOLA COUNTY, NEW MEXICO

PROPOSED FINAL GRADING

SHEET 8

233001076

Thursday, March 07, 2019 2:39:31 PM KWREED Layout:Figure



LEGEND:

6100	EXISTING GROUND SURFACE CONTOUR & ELEVATION, FEET
	GULLEY / DRAINAGE
	ARROYO
	EXISTING ROAD
	EXISTING FENCE
	EXISTING OVERHEAD ELECTRIC AND POWER POLES
	UNC MINE PERMIT BOUNDARY

REV	DATE	BY	DESCRIPTION
0	02/2019	KR	PRELIMINARY DESIGN

DESIGNED K. REED

CHECKED C. FRITZ

APPROVED J. CUMBERS

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

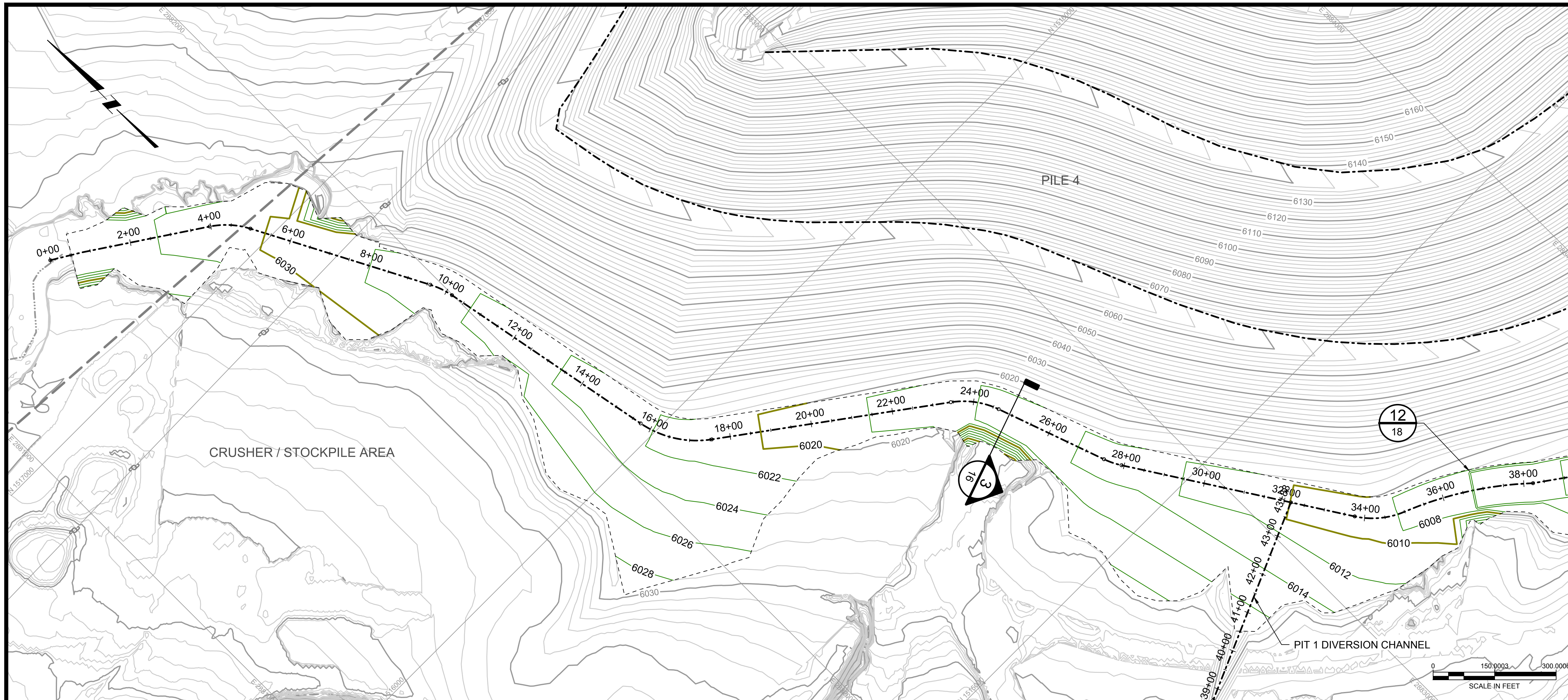
Stantec

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

ARROYO STABILIZATION INDEX

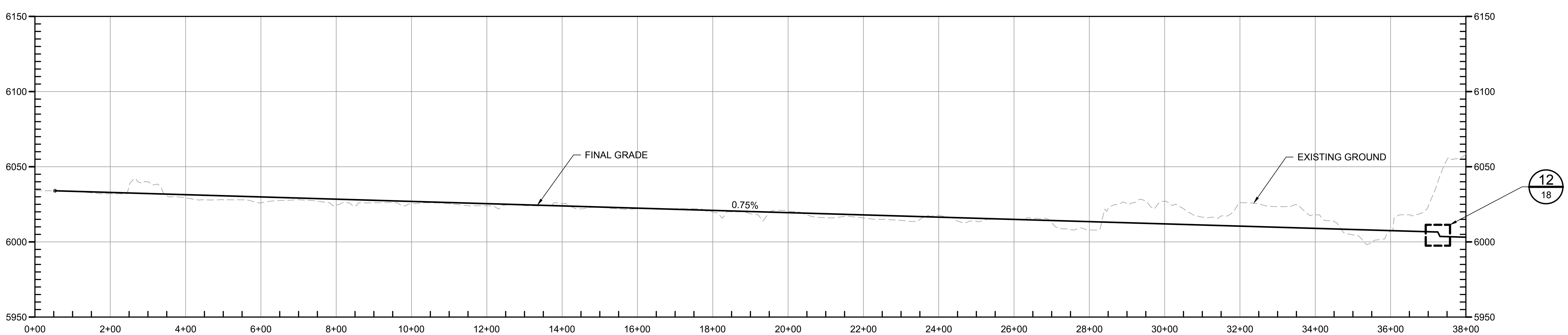
SHEET
9
233001076

Thursday, March 07, 2019 2:40:28 PM KWREED C:\PWWORKDIR\D0491540\STA_PDD_DRAINAGE_INDEX.DWG Layout:Figure



LEGEND:

- 6100 — FINAL CONDITIONS GROUND SURFACE CONTOUR & ELEVATION, FEET
- 6200 — PROPOSED ARROYO CONTOUR & ELEVATION, FEET
- GULLEY / DRAINAGE
- ARROYO
- EXISTING OVERHEAD ELECTRIC AND POWER POLES
- UNC MINE PERMIT BOUNDARY
- PROPOSED DRAINAGE CENTERLINE



REV	DATE	BY	DESCRIPTION
0	02/2019	KR	PRELIMINARY DESIGN

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

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

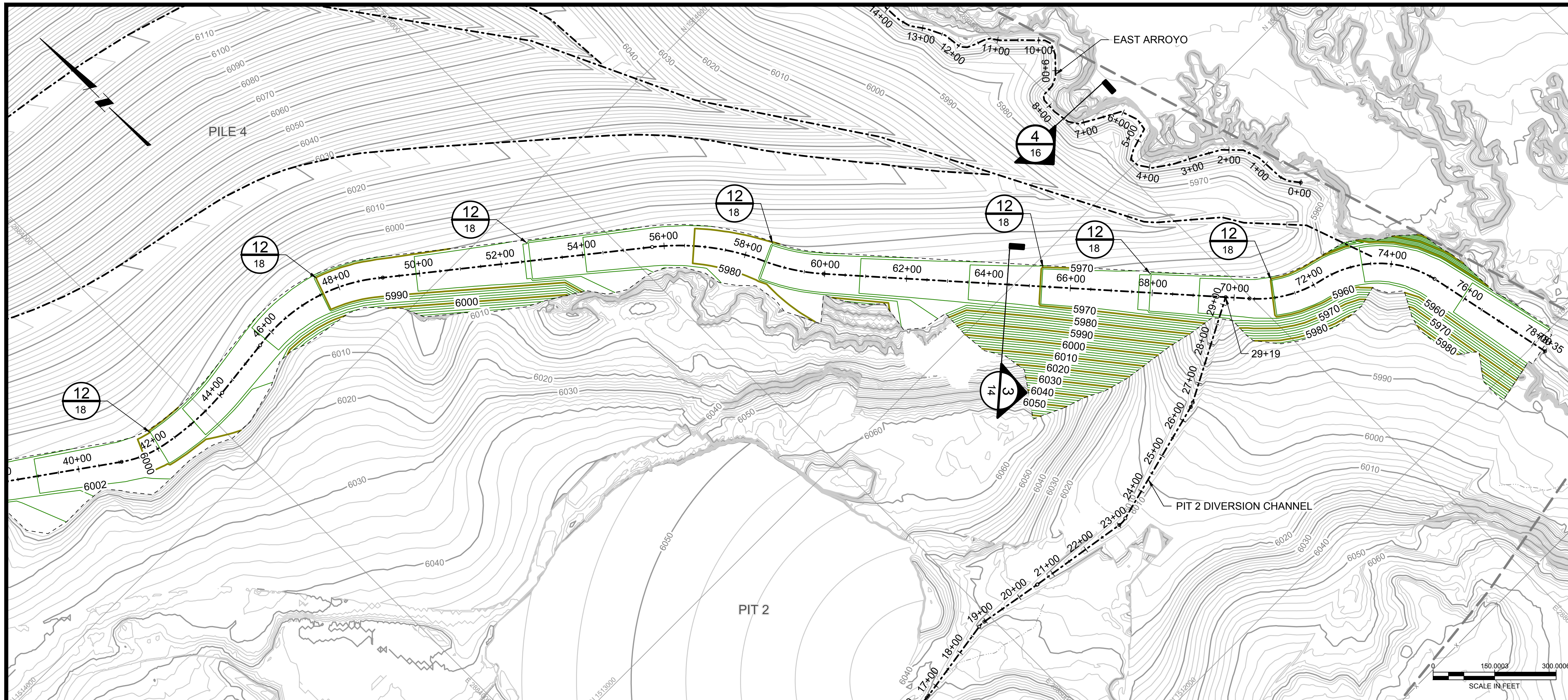
Stantec

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

ARROYO STABILIZATION PLAN AND PROFILE (1 OF 2)

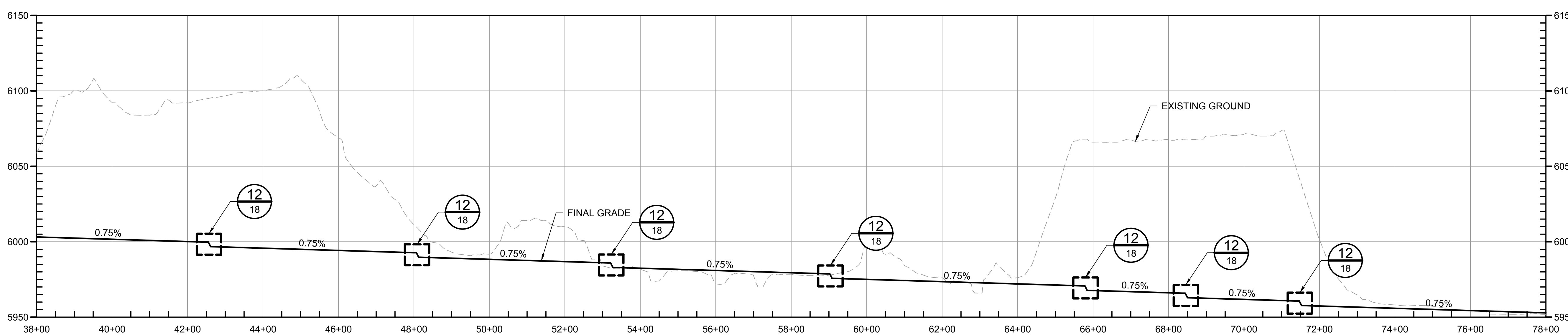
SHEET 10

233001076



LEGEND:

6100	FINAL CONDITIONS GROUND SURFACE CONTOUR & ELEVATION, FEET
6200	PROPOSED ARROYO CONTOUR & ELEVATION, FEET
	GULLEY / DRAINAGE
	UNC MINE PERMIT BOUNDARY
	PROPOSED DRAINAGE CENTERLINE



REV	DATE	BY	DESCRIPTION
0	02/2019	KR	PRELIMINARY DESIGN

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

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

Stantec

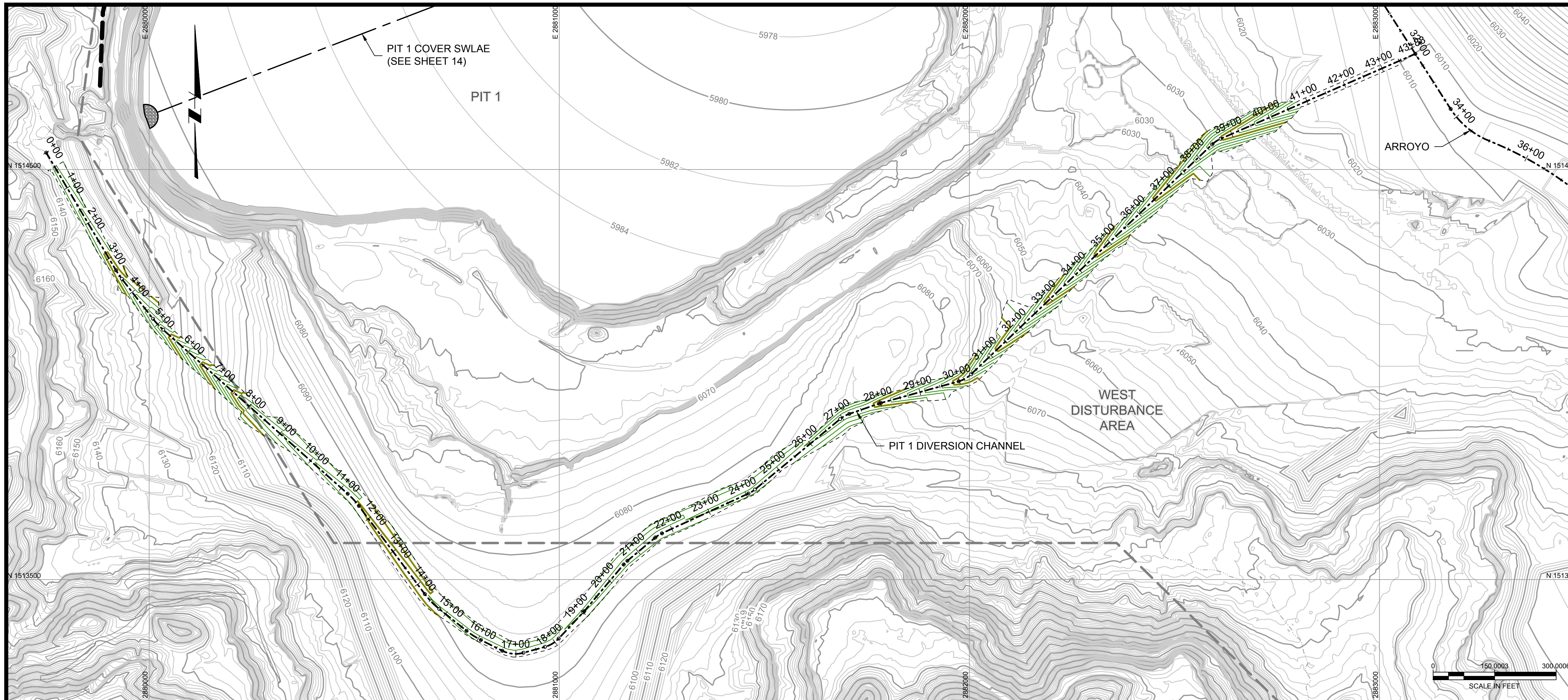
UNITED NUCLEAR CORPORATION
ST. ANTHONY MINE; CIBOLA COUNTY, NEW MEXICO

ARROYO STABILIZATION PLAN AND PROFILE (2 OF 2)

SHEET 11

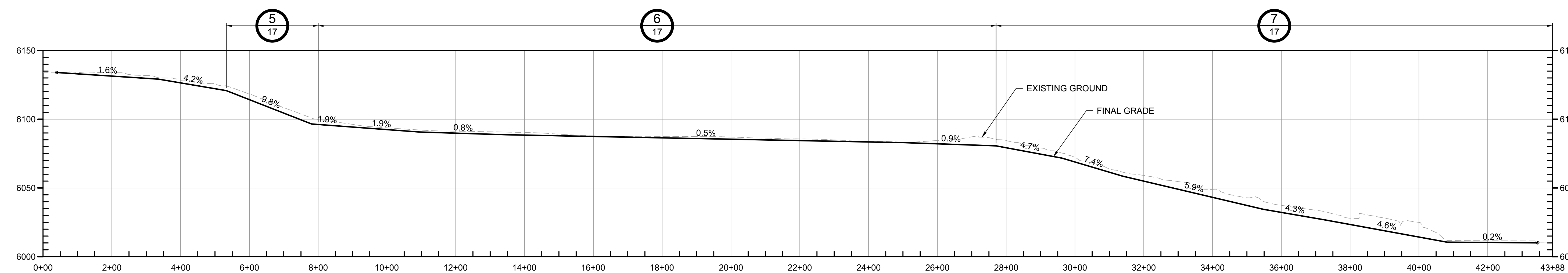
233001076

Thursday, March 07, 2019 2:41:32 PM KWREED C:\PWWORKDIR\0491540\STA_PDD_ARROYO.DWG Layout:Profile (2)



LEGEND:

6100	FINAL CONDITIONS SURFACE CONTOUR & ELEVATION, FEET
6200	PROPOSED DRAINAGE CHANNEL CONTOUR & ELEVATION, FEET
	GULLEY / DRAINAGE
	UNC MINE PERMIT BOUNDARY
	PROPOSED DRAINAGE CENTERLINE



REV	DATE	BY	DESCRIPTION
0	02/2019	KR	PRELIMINARY DESIGN

DESIGNED K. REED

CHECKED C. FRITZ

APPROVED J. CUMBERS

DRAWING REFERENCES:

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

Stantec

unc

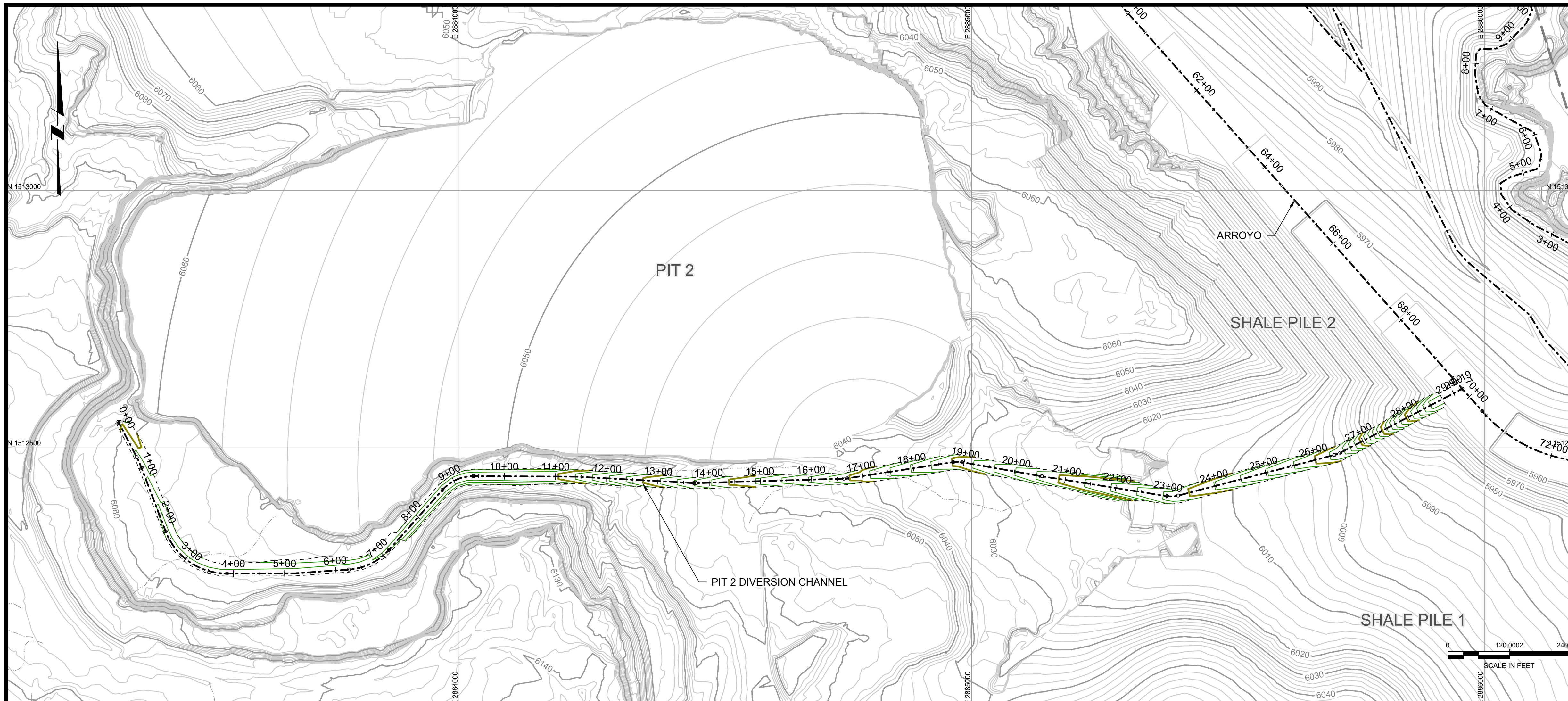
UNITED NUCLEAR CORPORATION
ST. ANTHONY MINE; CIBOLA COUNTY, NEW MEXICO

PIT 1 DIVERSION CHANNEL

SHEET 12

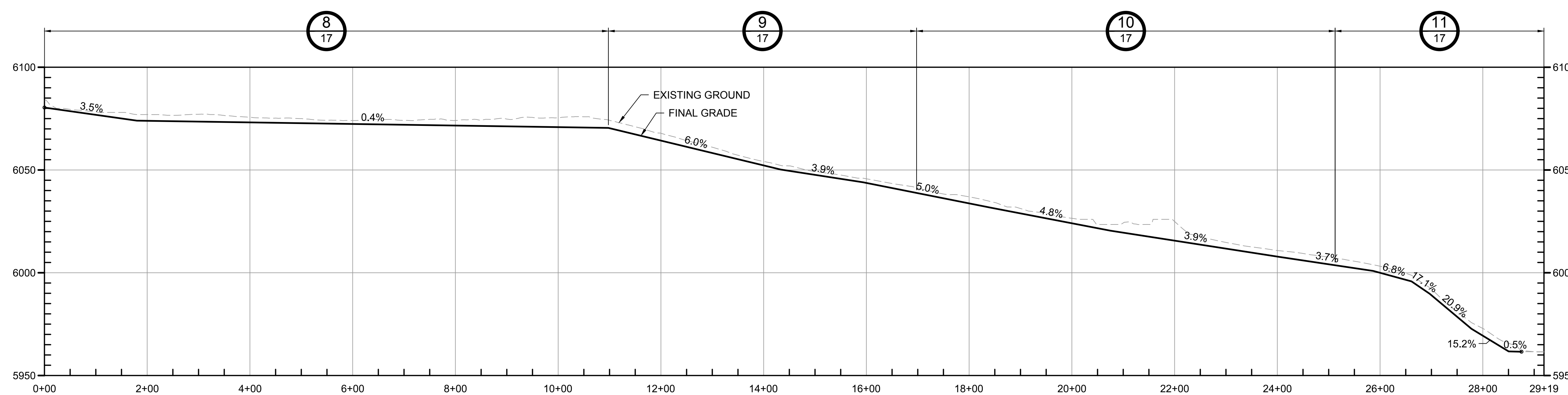
233001076

Thursday, March 07, 2019 2:42:22 PM KWREED C:\PWWORKDIR\0049154\STA_PDD_DRAINAGE_CHANNELS.DWG Layout:Profile (1)



LEGEND:

- 6100 — FINAL CONDITIONS SURFACE CONTOUR & ELEVATION, FEET
- 6200 — PROPOSED DRAINAGE CHANNEL CONTOUR & ELEVATION, FEET
- GULLEY / DRAINAGE
- UNC MINE PERMIT BOUNDARY
- PROPOSED DRAINAGE CENTERLINE



Thursday, March 07, 2019 2:42:26 PM KWREED C:\PWWORKDIR\0491540\STA_PDD_DRAINAGE_CHANNELS.DWG Layout:Profile (2)

REV	DATE	BY	DESCRIPTION
0	02/2019	KR	PRELIMINARY DESIGN

DESIGNED K. REED

CHECKED C. FRITZ

APPROVED J. CUMBERS

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

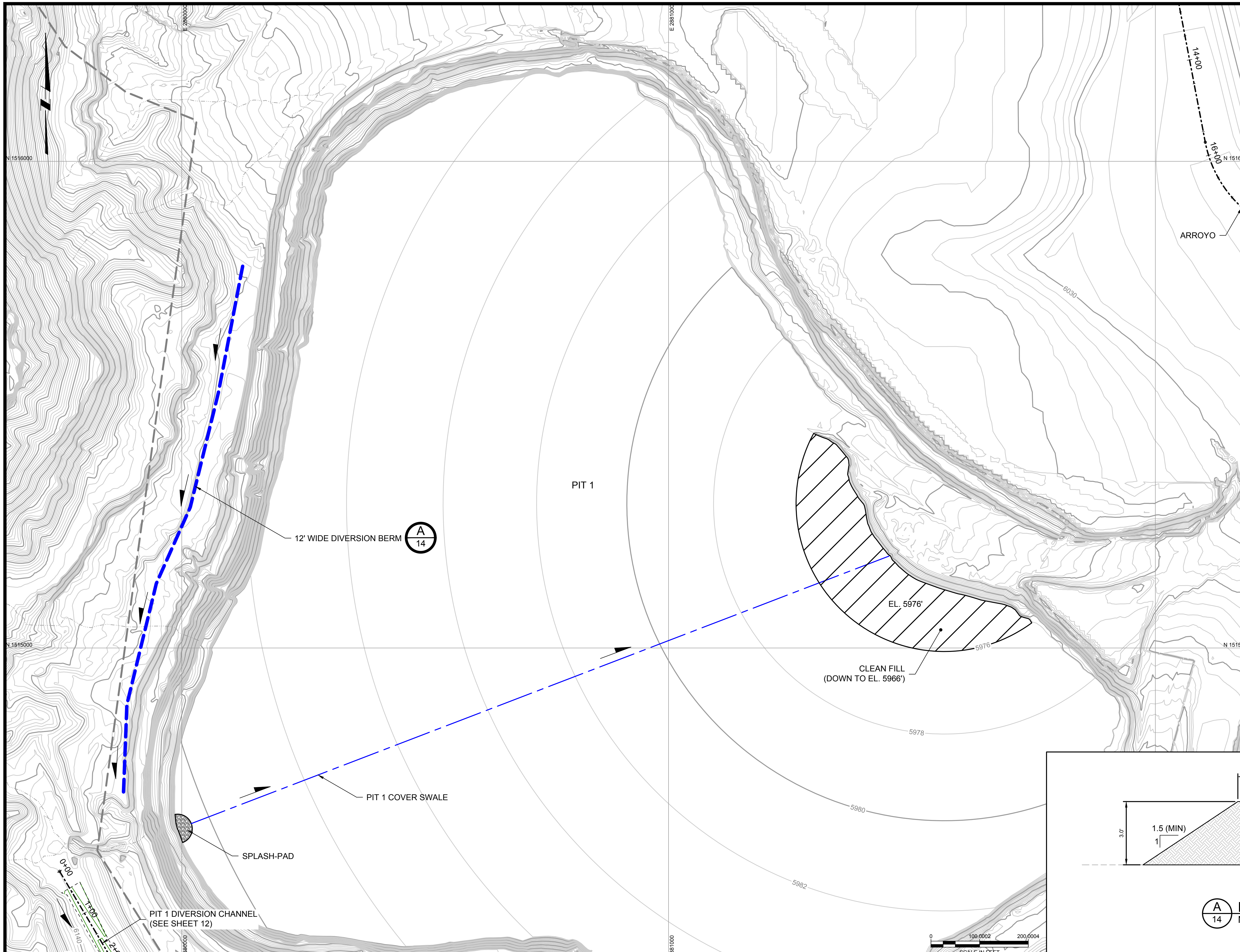
Stantec

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

PIT 2 DIVERSION CHANNEL

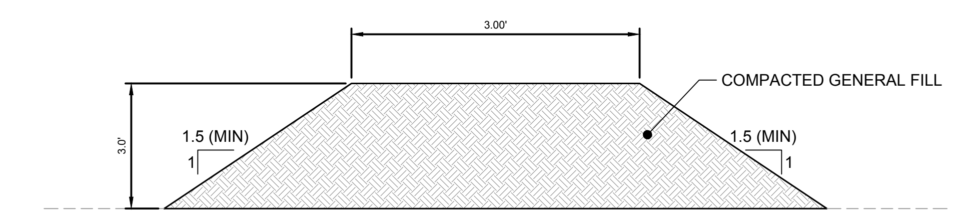
SHEET 13

233001076



LEGEND:

6100	FINAL CONDITIONS SURFACE CONTOUR & ELEVATION, FEET
6200	PROPOSED DRAINAGE CHANNEL CONTOUR & ELEVATION, FEET
	GULLEY / DRAINAGE
	UNC MINE PERMIT BOUNDARY
	PROPOSED DRAINAGE CENTERLINE
	PROPOSED DIVERSION BERM CENTERLINE
	PROPOSED SWALE CENTERLINE



A
14
DIVERSION BERM SECTION
NOT TO SCALE

REV	DATE	BY	DESCRIPTION
0	02/2019	KR	PRELIMINARY DESIGN

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

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

Stantec

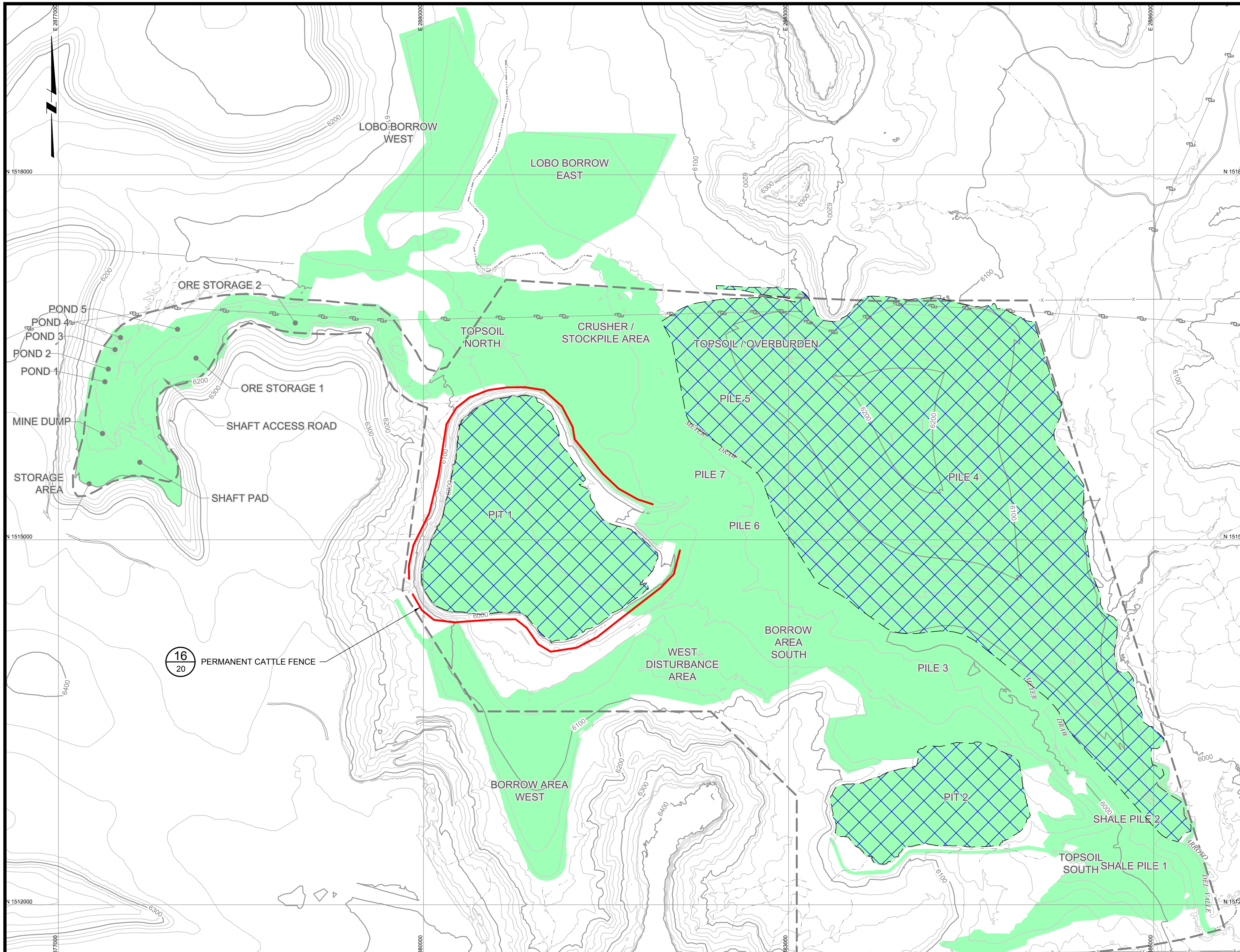
UNITED NUCLEAR CORPORATION
ST. ANTHONY MINE; CIBOLA COUNTY, NEW MEXICO

PIT 1 DIVERSION BERM

SHEET
14

233001076

Thursday, March 07, 2019 2:42:35 PM KWREED C:\PWWORKDIR\D0491540\STA_PDD_DRAINAGE_CHANNELS.DWG Layout:Plan



LEGEND:

6100	EXISTING GROUND SURFACE CONTOUR & ELEVATION, FEET
	GULLEY / DRAINAGE
	ARROYO
	EXISTING ROAD
	EXISTING FENCE
	EXISTING OVERHEAD ELECTRIC AND POWER POLES
	UNC MINE PERMIT BOUNDARY
	AREAS TO BE REVEGETATED
	AREAS TO BE COVERED AND REVEGETATED
	PERMANENT CATTLE FENCE

NOTE(S):

1. NATIVE SEED MIX REQUIRED PER RECOMMENDATIONS OF ECOLOGICAL CONSULTANT.

Thursday, March 07, 2019 2:43:16 PM KWREED C:\PWWORKDIR\049154\STA_PDD_REVEGETATION.DWG Layout:Plan

REV	DATE	BY	DESCRIPTION
0	02/2019	KR	PRELIMINARY DESIGN

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

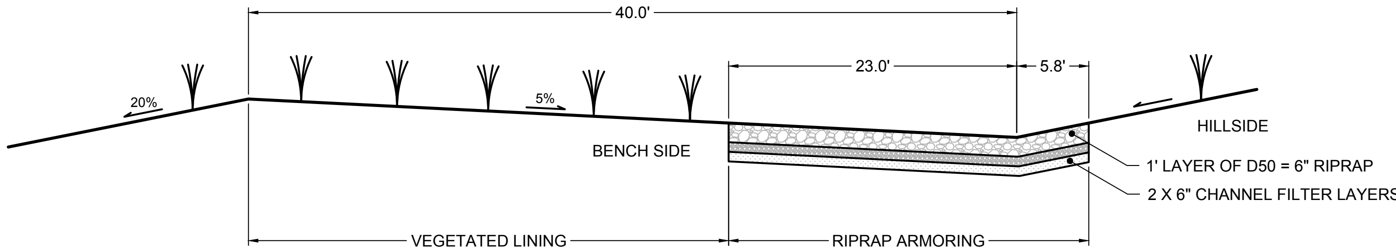
DRAWING REFERENCES:
1. All coordinates in New Mexico State Plane West, NAD83, Feet (U.S. Survey).
2. Elevations/Topo;
 2.1. On site: Cooper Aerial, 05/09/2011, (050911-1000overview3d.dwg)
 2.2. Supplemental Off Site: USGS DEM 10m
3. Township and Section lines: rgis.unm.edu, 08/04/2014
4. Parcels, and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

Stantec

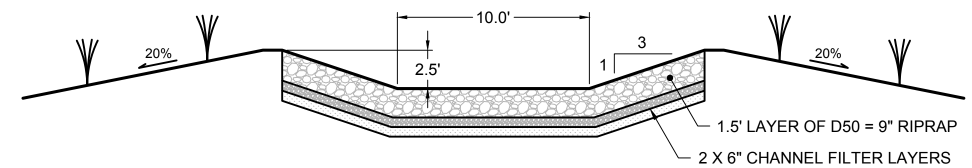
UNITED NUCLEAR CORPORATION
ST. ANTHONY MINE; CIBOLA COUNTY, NEW MEXICO

REVEGETATION PLAN

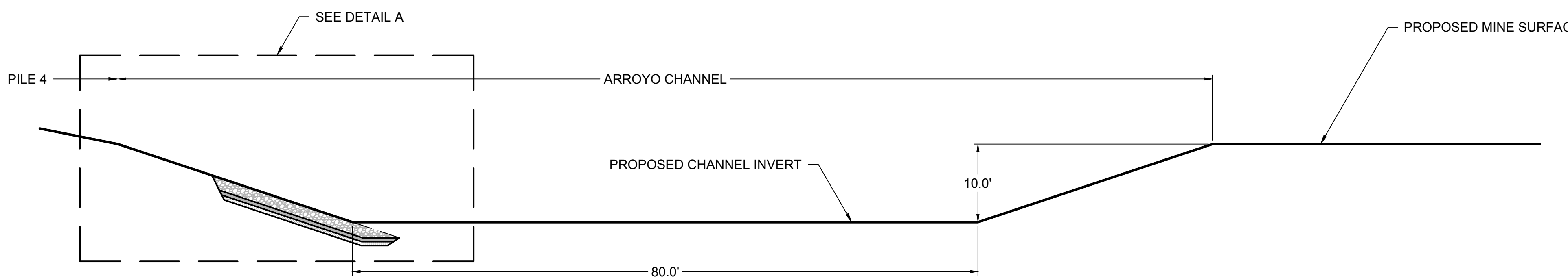
SHEET
15
233001076



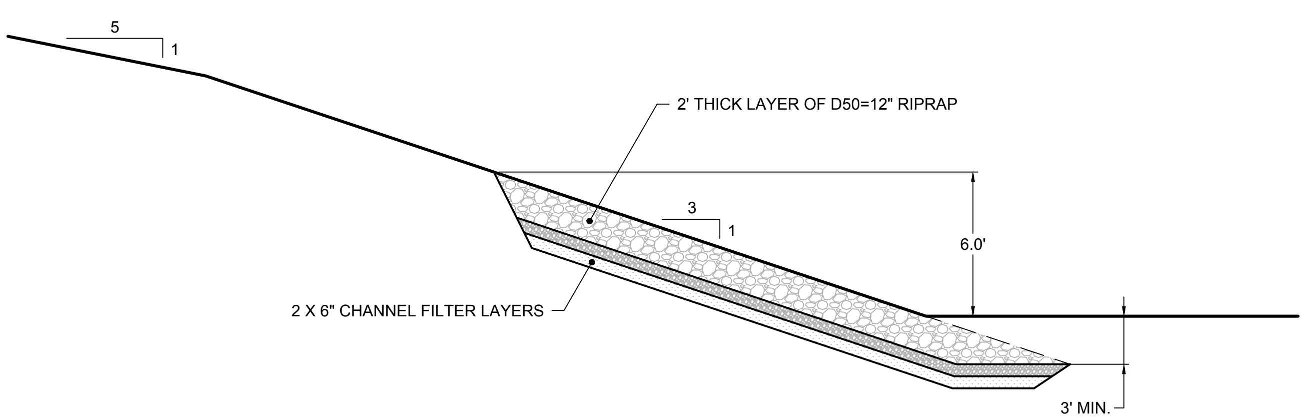
1/16 PILE 4 BENCH CHANNEL
(NOT TO SCALE)



2/16 PILE 4 DOWNDRAIN CHANNEL
(NOT TO SCALE)

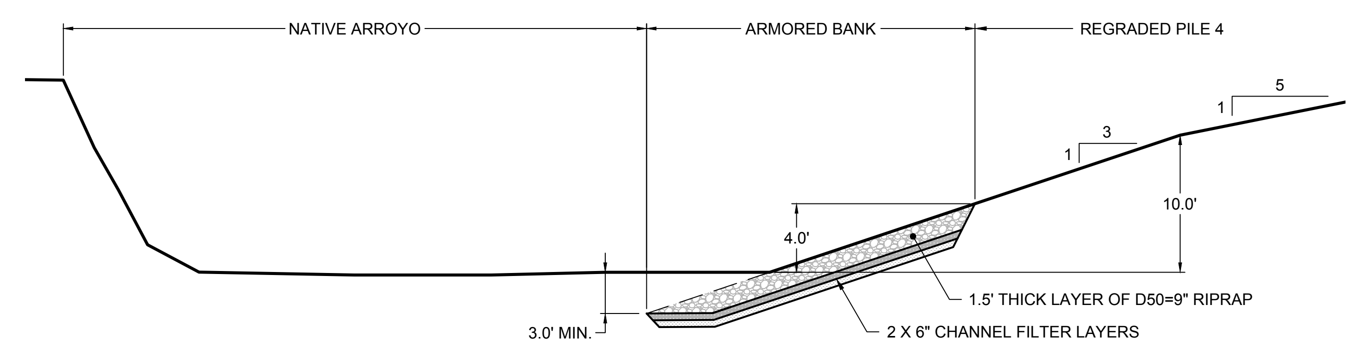


CROSS SECTION



DETAIL A

3/16 MEYER DRAW CHANNEL ARMORING - TYPICAL SECTION
(NOT TO SCALE)



4/16 EAST TRIBUTARY CHANNEL ARMORING - TYPICAL SECTION
(NOT TO SCALE)

REV	DATE	BY	DESCRIPTION		
0	02/2019	KR	PRELIMINARY DESIGN	DESIGNED K. REED	
				CHECKED C. FRITZ	
				APPROVED J. CUMBERS	

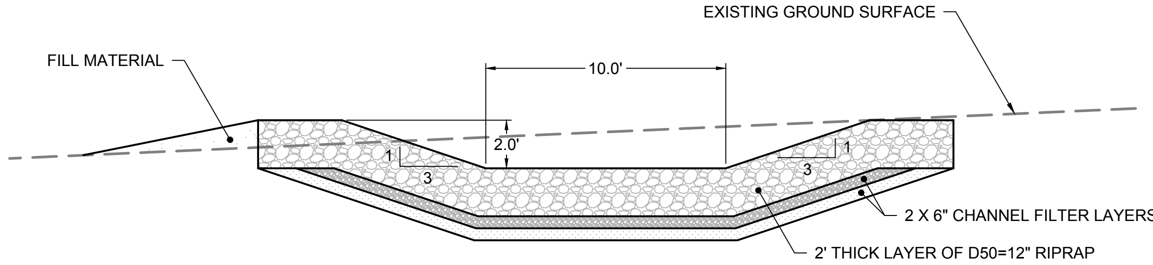
Stantec

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

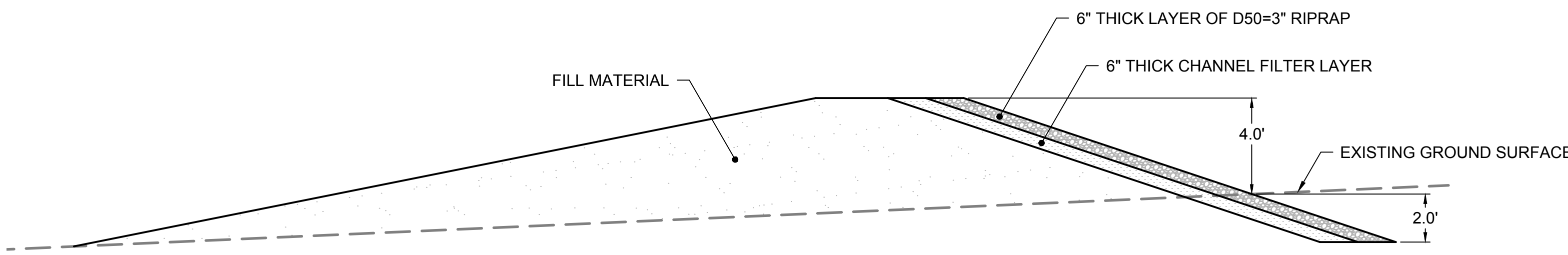
DETAILS (1 OF 5)

SHEET 16

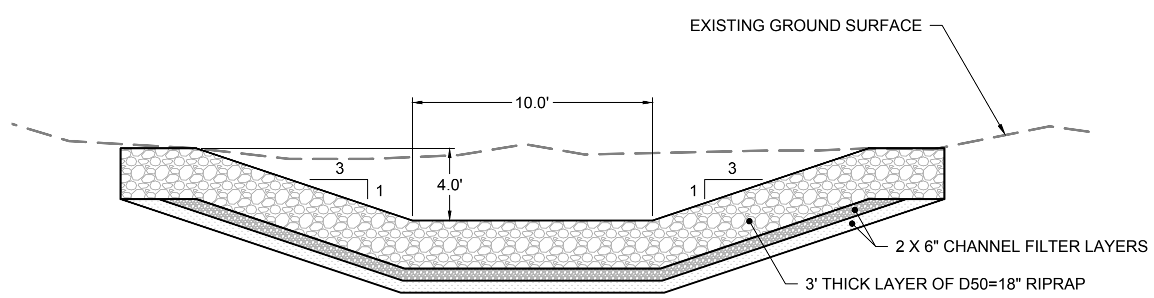
233001076



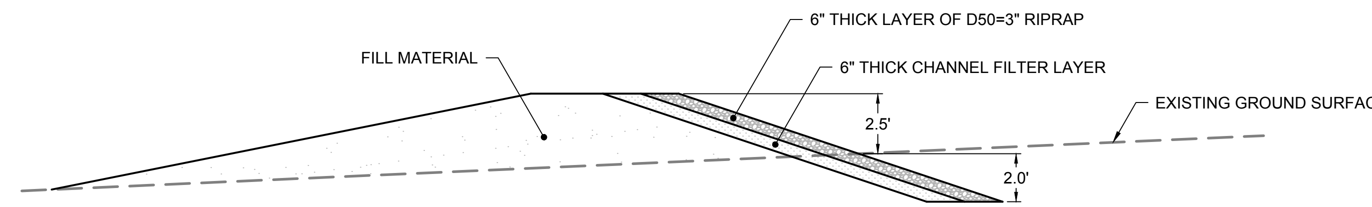
5 / 17 PIT 1 DIVERSION CHANNEL
(STA. 5+00 TO 08+00)



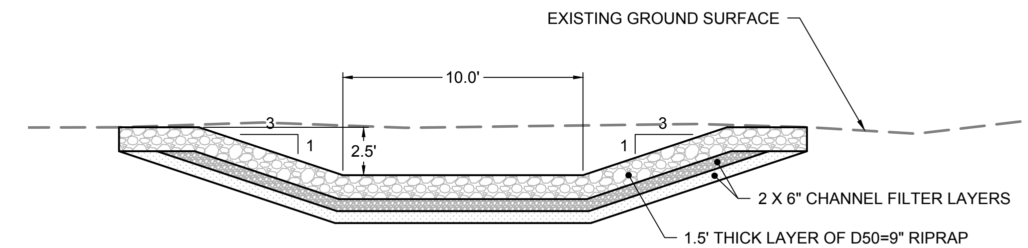
6 / 17 PIT 1 DIVERSION CHANNEL
(STA. 08+00 TO 27+50)



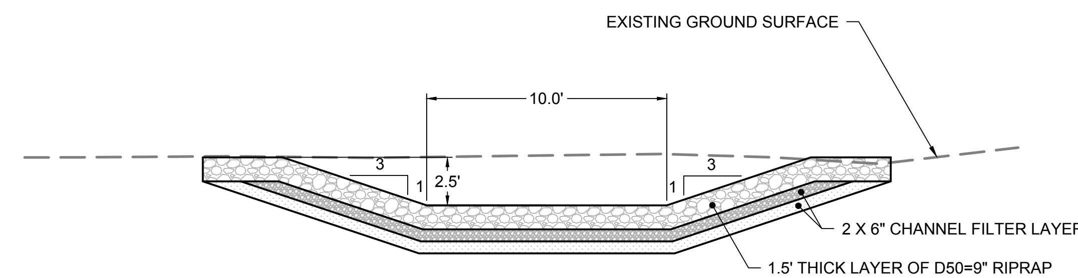
7 / 17 PIT 1 DIVERSION CHANNEL
(STA. 27+50 TO 43+00)



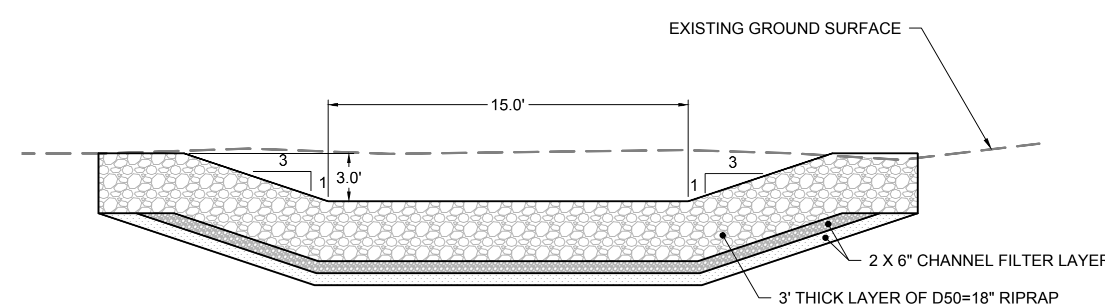
8 / 17 PIT 2 DIVERSION CHANNEL
(STA. 0+00 TO 10+25)



9 / 17 PIT 2 DIVERSION CHANNEL
(STA. 10+25 TO 17+50)



10 / 17 PIT 2 DIVERSION CHANNEL
(STA. 17+50 TO 25+85)



11 / 17 PIT 2 DIVERSION CHANNEL
(STA. 25+85 TO 28+25)

Thursday, March 07, 2019 2:43:25 PM KWREED C:\PWWORKDIR\D0491540\STA_PDD_DETAILS.DWG Layout:Details (2)

REV	DATE	BY	DESCRIPTION
0	02/2019	KR	PRELIMINARY DESIGN

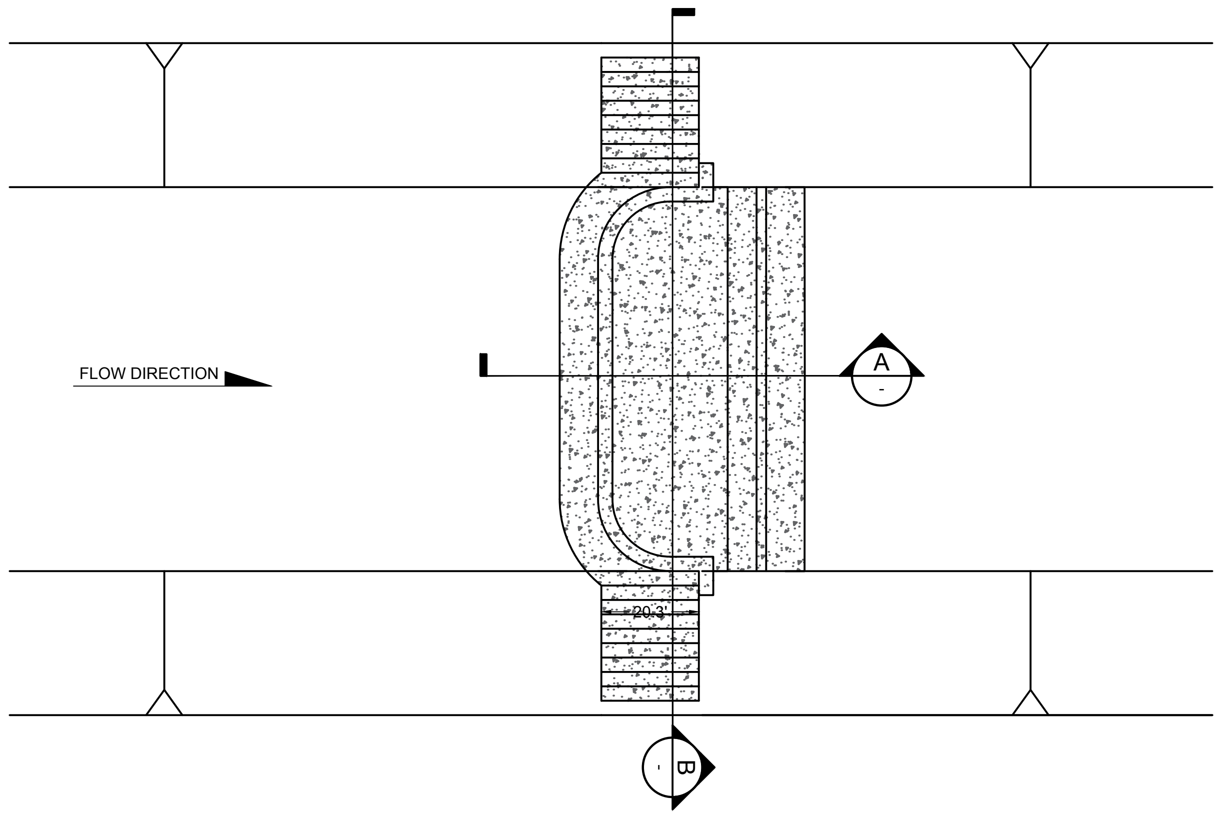
DESIGNED K. REED
CHECKED C. FRITZ
APPROVED J. CUMBERS

Stantec

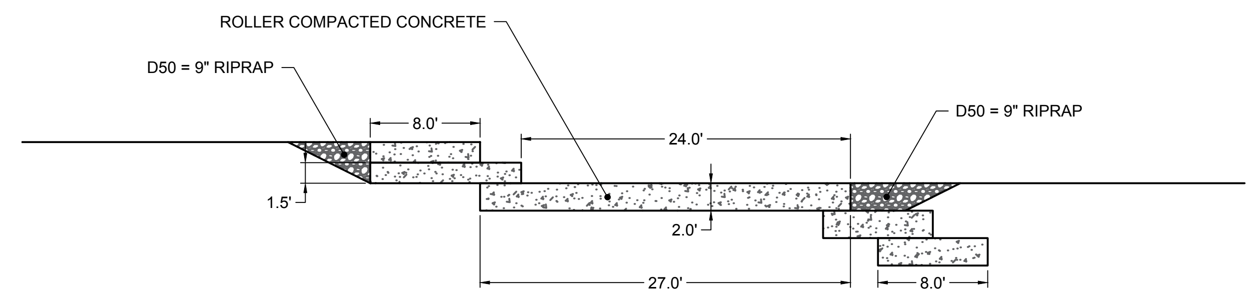
UNITED NUCLEAR CORPORATION
ST. ANTHONY MINE; CIBOLA COUNTY, NEW MEXICO

DETAILS (2 OF 5)

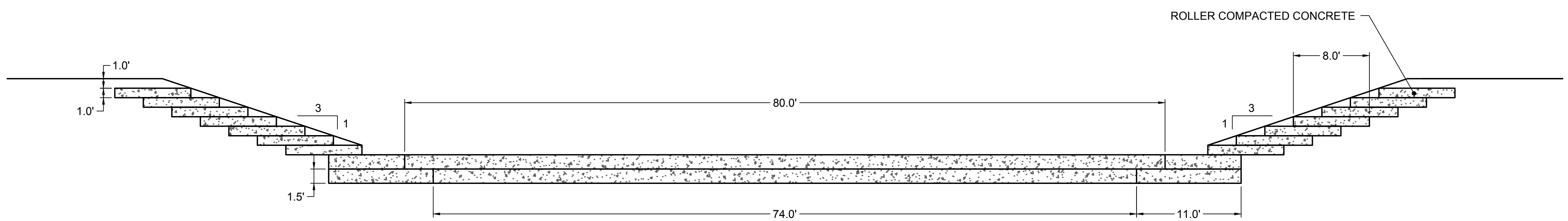
SHEET
17
233001076



PLAN VIEW



CROSS SECTION - A



CROSS SECTION - B

12/18 GRADE CONTROL STRUCTURE
(NOT TO SCALE)

REV	DATE	BY	DESCRIPTION
0	02/2019	KR	PRELIMINARY DESIGN

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

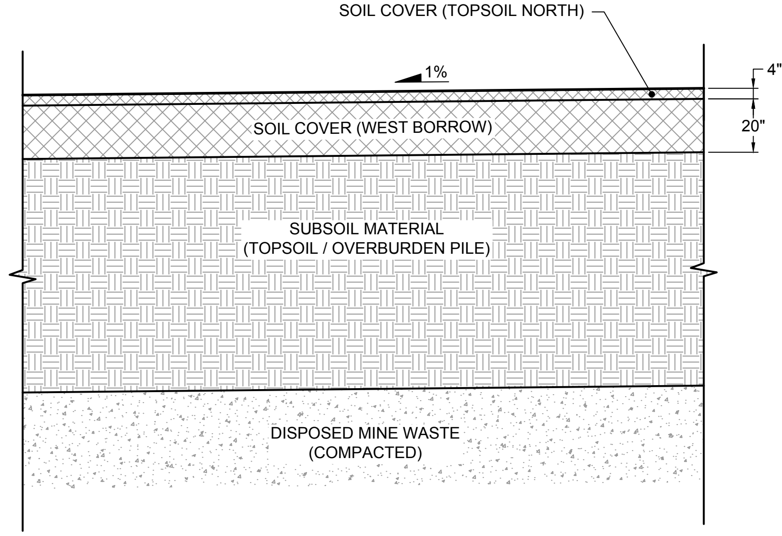
Stantec

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

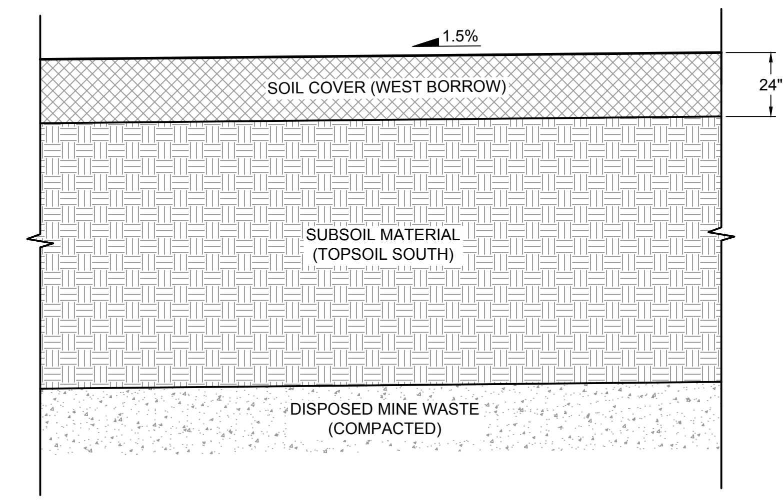
DETAILS (3 OF 5)

SHEET 18

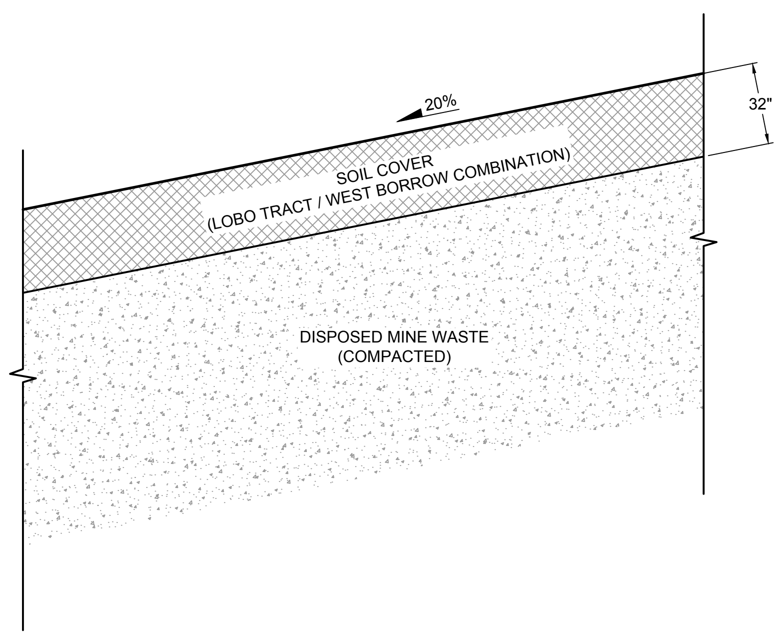
233001076



13/19 COVER DETAIL - PIT1
(NOT TO SCALE)



14/19 COVER DETAIL - PIT2
(NOT TO SCALE)



15/19 COVER DETAIL - PILE 4
(NOT TO SCALE)

REV	DATE	BY	DESCRIPTION
0	02/2019	KR	PRELIMINARY DESIGN

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

Stantec

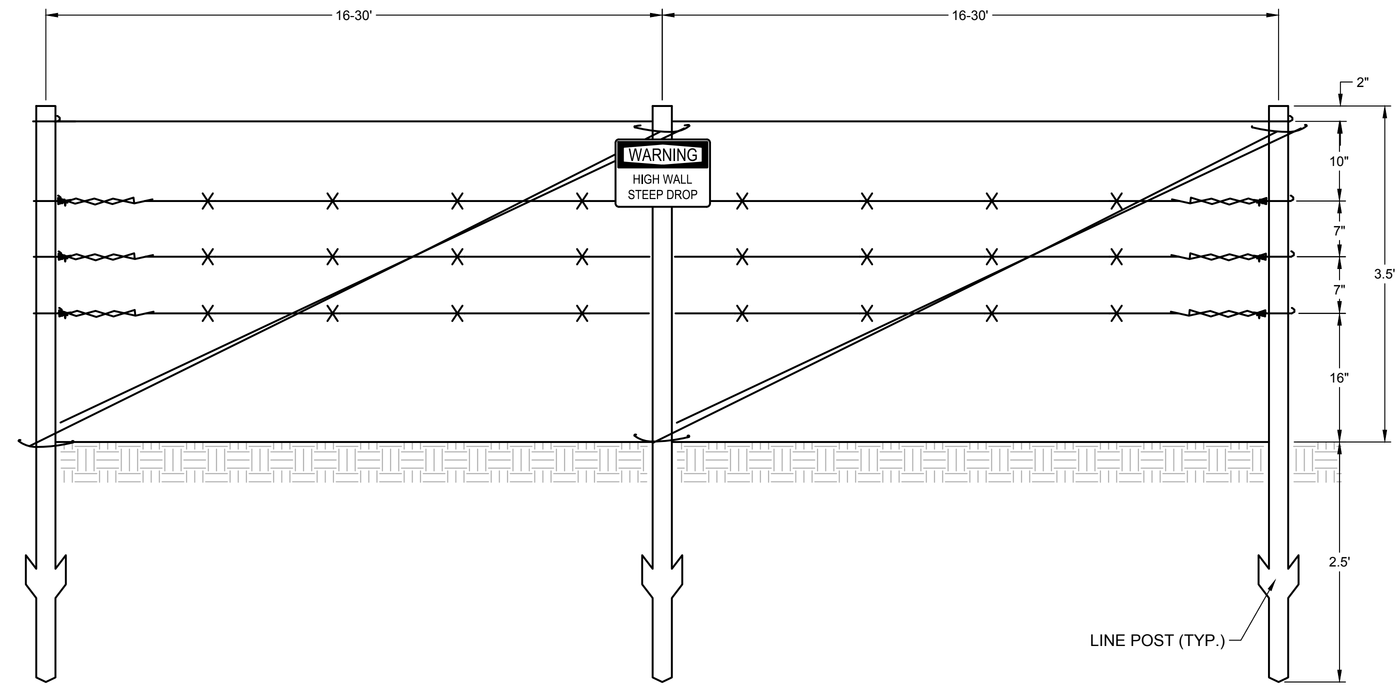
unc

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

DETAILS (4 OF 5)

SHEET 19

233001076



16/20 PERMANENT CATTLE FENCE DETAIL
(NOT TO SCALE)

NOTE(S):

1. CATTLE FENCE WARNING SIGNS (DETAIL 17) TO BE ATTACHED TO FENCE AT 300 FT SPACING, STARTING AT NORTHEASTERN END OF FENCE.
2. ENTRANCE GATE WARNING SIGN (DETAIL 18) TO BE ATTACHED TO OUTER ENTRANCE GATE ALONG ACCESS ROAD.

17/20 CATTLE FENCE WARNING SIGN DETAIL
(NOT TO SCALE)

18/20 ENTRANCE GATE WARNING SIGN DETAIL
(NOT TO SCALE)

REV	DATE	BY	DESCRIPTION

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

Stantec

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

DETAILS (5 OF 5)

SHEET 20

233001076

Thursday, March 07, 2019 2:43:39 PM KWREED C:\PWWORKDIR\D0491540\STA_PDD_DETAILS.DWG Layout:Details (5)

Appendix A STANTEC SITE CHARACTERIZATION MEMO

Appendix B AVM CLEANUP VERIFICATION PLAN

B.1 EXCAVATION CONTROL PLAN

B.2 CLEANUP VERIFICATION SURVEY

B.3 STANDARD OPERATING PROCEDURES (SOPS)

Appendix C GEOTECHNICAL INVESTIGATION MEMO

Appendix D MATERIAL BALANCE CALCULATIONS

Appendix E SURFACE WATER ANALYSIS

Appendix F COVER DESIGN CALCULATIONS

Appendix G AGRONOMIC DATA