South32 Hermosa Inc.

Critical Minerals Exploration and Mine Plan of Operations

REVISED: DECEMBER 1, 2023

PREPARED FOR

Coronado National Forest
Sierra Vista Ranger District

BY

South32 Hermosa Inc.

SOUTH32

SOUTH32 HERMOSA INC.
CRITICAL MINERALS EXPLORATION AND MINE PLAN OF OPERATIONS

Prepared for

Coronado National Forest
Sierra Vista Ranger District
300 West. Congress Street
Tucson, Arizona 85701
(520) 388-8300

Prepared by

South32 Hermosa Inc.
1860 East River Road, Suite 200
Tucson, Arizona 85718
(520) 485-1300

SWCA Environmental Consultants
343 West Franklin Street
Tucson, Arizona 85701
(520) 325-9194

Revised: December 1, 2023

CONTENTS

Appendices

Figures

Tables

ACRONYMS AND ABBREVIATIONS

ADEQ	Arizona Department of Environmental Quality
ANCOLD	Australian National Committee on Large Dams
APP	Aquifer Protection Permit
ASARCO	ASARCO LLC
AZPDES	Arizona Pollutant Discharge Elimination System
BADCT	Best Available Demonstrated Control Technology
CFR	Code of Federal Regulations
Forest Service	U.S. Department of Agriculture, Forest Service
FR	Forest Road
GISTM	Global Industry Standard on Tailings Management
gpm	gallons per minute
GWM	groundwater management
HDPE	high-density polyethylene
InSAR	interferometric synthetic aperture radar
IROC	integrated remote operations center
kV	kilovolt(s)
LT-TAR	long-term temporary access road
MSHA	Mine Safety and Health Administration
NAAQS	National Ambient Air Quality Standards
NFS	National Forest System
NPAG	non-potentially acid generating
PAG	potentially acid generating
Plan	Exploration and Mine Plan of Operations
PoO	Exploration and Mine Plan of Operations
RIB	rapid infiltration basin
ROM	run-of-mine
South32 Hermosa	South32 Hermosa Inc.
SPCC	spill prevention, control, and countermeasures
SR	State Route
ST-TAR	short-term temporary access road
SWPPP	Stormwater Pollution Prevention Plan
TAR	temporary access road
TSF	tailings storage facility
UDCP	underdrain collection pond
UniSource	UniSource Energy Services
USFS	U.S. Forest Service
WTP1	Water Treatment Plant 1
WTP2	Water Treatment Plant 2

CHAPTER 1. INTRODUCTION

1.1 PLAN ORGANIZATION

This Critical Minerals Exploration and Mine Plan of Operations (PoO or Plan) is being submitted pursuant to 36 Code of Federal Regulations (CFR) Part 228, Subpart A regulations for proposed operations on or beneath National Forest System (NFS) land administered by the U.S. Department of Agriculture, Forest Service (USFS or Forest Service) as the Coronado National Forest, Sierra Vista Ranger District. Those operations located on or beneath NFS land, which are the activities for which the PoO is being submitted, are referred to herein as the Plan Operations.

Existing and future operations on adjacent private land are described to the extent necessary to provide adequate context for the Plan Operations, which are an expansion of activities on private land. For reference purposes, the Plan Operations and private land activities are collectively referred to as the Hermosa Project (Project).

The PoO consists of the following sections:

- **Chapter 1 – Introduction**. This chapter provides an overview and describes the location of the Plan Operations and Project, the operator, land status, and summarizes acreage disturbed or utilized by Plan Operations on or beneath NFS land.
- **Chapter 2 – Project Description**. This chapter describes the proposed uses of NFS land associated with the Plan Operations. Operations on private land are also described to the extent necessary to provide adequate context to explain the Plan Operations.
- **Chapter 3 – Environmental Protection Measures**. This chapter describes the environmental protection measures incorporated into the PoO to minimize potential environmental impacts to air quality, water quality, scenic values, fisheries and wildlife habitat, and cultural resources, as well as the management of solid waste and public safety.
- **Chapter 4 – Temporary Cessation of Operations**. This chapter describes those measures that would be implemented in the event operations temporarily cease on NFS land.
- **Chapter 5 – Reclamation and Closure**. This chapter describes the proposed strategy that would be used to reclaim and close facilities on NFS land at the end of operations.
- **Chapter 6 – Literature Cited**. This chapter lists the source materials cited in the PoO.
- **Appendix A – Roads Plan**. This appendix describes the improvement, use, and maintenance of roads on NFS land associated with the Plan Operations.
- **Appendix B – Stormwater Management**. This appendix describes the overall stormwater management for Plan Operations, and specifically the drainage designs for facilities on NFS land.
- **Appendix C – Materials Management**. This appendix describes the transportation and use of materials on NFS land, including explosives, hazardous materials, hydrocarbons, and solid wastes.
- **Appendix D** – **TSF2 Design Drawings**. These drawings show the current designs for TSF2, including the TSF2 underdrain collection pond (UDCP), perimeter roads, drainage collection system, and foundations.
- **Appendix E** – **Typical Facility Layouts**. These drawings show a conceptual layout for a typical rapid infiltration basin (RIB) including operational characteristics, a typical exploration drill pad, a typical groundwater management (GWM) well pad, and a typical geotechnical boring pad.

1.2 PLAN/PROJECT OWNER AND OPERATOR

1.2.1 Operator

The Project is owned and operated by:

South32 Hermosa Inc.
1860 East River Road, Suite 200
Tucson, Arizona 85718

Telephone: (520) 485-1300

South32 Hermosa Inc. (South32 Hermosa) is a wholly owned subsidiary of South32 Limited.

The primary contact for information with respect to this Plan is:

[redacted]
South32 Hermosa Inc.
1860 East River Road, Suite 200
Tucson, Arizona 85718

Telephone: (520) 485-1300

1.2.2 Land Status

Plan Operations would occur on or beneath NFS land (Figure 1-1) in the Harshaw mining district, on unpatented claims owned by South32 Hermosa. Surface disturbance of NFS land of less than 500 acres is proposed; see Section 1.3.4 for acreages associated with Plan Operations.

1.3 LOCATION, PROJECT, AND PLAN SUMMARY

1.3.1 Location

The exploration and underground mine Project is located within the Patagonia Mountains in southern Arizona (see Figure 1-1). Elevations near the Project range from 4,000 to 6,500 feet above mean sea level. The Project is in an unincorporated part of central Santa Cruz County, approximately 6 miles southeast of the town of Patagonia, and about 8 miles north of the U.S./Mexico international border. Additional nearby communities include Kino Springs, Nogales, Rio Rico, and Sonoita.

Plan Operations encompass portions of the following areas, relative to the Gila and Salt River Baseline and Meridian:

- Township 22 South, Range 15 East, Sections 25, 26, 27, 33, 34, and 35
- Township 22 South, Range 16 East, Sections 29, 30, 32, and 33
- Township 23 South, Range 15 East, Section 4
- Township 23 South, Range 16 East, Sections 2, 4, 5, 9, 16, and 22

1.3.2 Project Overview

The exploration and underground mine Project will continue the historic production from the region of minerals critical to U.S. priorities using modern, state-of-the-art mining techniques. The primary products from the Project—manganese and zinc—are both identified by the U.S. Geological Survey as critical minerals and are needed for meeting the country's bold decarbonization targets. The development and increased production of domestic supplies of critical minerals is a stated priority of prior and current U.S. administrations, as evidenced by recent directives of the Defense Production Act invoked in 2022, the Infrastructure Investment and Jobs Act of 2021, and the Inflation Reduction Act of 2022 to bolster the production of critical minerals essential for national security, infrastructure, transportation, power generation systems, and environmental initiatives. In fact, the Project is the only advanced manganese development project in North America.

The Project design and operations will represent a new generation of modern mining and will be consistent with South32's Sustainability Policy (South32 2022a) and incorporate numerous environmental protection measures to minimize impact to the environment (as discussed in Chapter 3 of this PoO). These modern mining techniques include the use of: long-hole open stoping for underground mining; primary waste rock deposition and cemented paste backfill in mined stopes; and a lined dry-stack tailings storage facility (TSF) instead of traditional water-intensive slurry tailings. These design choices reduce surface disturbance and environmental impact and enhance stability of the TSF and underground mine, while still allowing efficient extraction of domestic critical minerals. The mine infrastructure is also specifically designed to accommodate future automation and electric vehicles, part of meeting a South32 goal of net-zero operational greenhouse gas emissions by 2050.

A brief summary of the primary Project components is provided below, with additional detail provided in Chapter 2. *Italicized text includes elements specific to Plan Operations (occurring on or beneath NFS land).* Plan Operations are an expansion of underground mining on South32 Hermosa private land, and include additional underground mining, tailings storage, exploration, construction of a primary access road, wells for monitoring and for groundwater management, and recharge basins. Plan Operations are further itemized in Section 1.3.3 following this general Project overview.

1.3.2.1 The Orebody

The subject minerals are hosted in a single orebody comprising sulfide and oxide domains,[1] which require separate processing methods. The first is the sulfide portion of the orebody, with zinc as the primary product and lead and silver as secondary products, and the second is the oxide portion of the orebody, with manganese as the primary product and zinc and silver as secondary products. The sulfide portion of the orebody generally extends from depths of 1,000 to 4,600 feet below ground surface. The oxide portion of the orebody is the oxidized eastern extension of the sulfide portion and is generally shallower, located from the surface to a depth of about 2,000 feet below ground surface. *Exploration activities (both underground and surface) for continued definition and metallurgical testing of the orebody and refinement of mine planning would occur throughout the Project life on both South32 Hermosa private land and NFS land.* The orebody and geology are described in more detail in Sections 2.2 and 2.3.2. Exploration is described in more detail in Section 2.4.

[1] Technical documents supporting the Project commonly refer to the "Taylor" and "Clark" deposits. This nomenclature was used during exploration, concept studies, and feasibility studies. The deposit is a single orebody comprising sulfide and oxide domains, but historically the two domains were investigated and assessed separately, since the beneficiation techniques and resulting products for each domain are different. "Taylor" refers to the sulfide portion of the orebody and may also be used to refer to the infrastructure and facilities that support mining the sulfide ore. "Clark" refers to the oxide portion of the orebody and may also be used to refer to the infrastructure and facilities that support mining the oxide ore.

1.3.2.2 Mining Method

Long-hole open stoping will be used to extract the ore. Once the ore is removed from the stopes,[2] primary crushing of the sulfide ore will occur underground beneath South32 Hermosa private land, and crushed sulfide ore will be hoisted to the surface. Oxide ore will be hauled to the surface by truck through a mine portal (decline) on South32 Hermosa private land, with primary crushing occurring at the surface, also on South32 Hermosa private land. Mine infrastructure will be designed to accommodate future autonomous hauling. Long-hole open stoping is described in more detail in Section 2.5.4.

1.3.2.3 Beneficiation

Beneficiation of the sulfide ore will occur solely on South32 Hermosa private land. Beneficiation for the sulfide ore will use well-established flotation processing techniques; sequential flotation will be used to produce zinc and lead concentrate. Any silver present in the feed ore will also be recovered to the lead concentrate. Zinc and lead/silver concentrate will be hauled from the Project via truck. Crushed oxide ore will be hauled off-site in sealed containers via truck. The crushed oxide ore will cross NFS land and be taken to a facility location on private land distal from the Project for beneficiation. Once crushed oxide ore leaves NFS land it will not again enter NFS land, either before or after beneficiation. To minimize personnel trips to the Project, the main concentrator control room will be part of an integrated remote operations center (IROC) that will also be sited and constructed at a location in Santa Cruz County distal from the Project. Beneficiation is described in more detail in Section 2.5.6.

1.3.2.4 Tailings

After beneficiation of the sulfide ore to produce zinc and lead/silver concentrates, the remaining non-economic material is known as tailings. Tailings will be filtered to remove water, and then will be managed in one of two ways:

1) During the sulfide beneficiation, *approximately half of the tailings will be mixed with cement and used as a cemented paste backfill underground*. Cemented paste backfill is described in more detail in Section 2.5.7.3.

2) Tailings not used as cemented paste backfill will be placed in an aboveground dry-stack TSF. There is an existing lined dry-stack TSF on South32 Hermosa private land (known as TSF1) that was voluntarily constructed by the company to remediate legacy mine tailing deposition and drainage impacting water quality (more detail on TSF1 can be found in Section 2.2.3). [redacted] *A separate lined dry-stack TSF is proposed on adjacent NFS land on unpatented claims (known as TSF2).* The design, construction, and operation of TSF2 is described in more detail in Section 2.5.7.

1.3.2.5 Waste Rock

Rock that is mined but from which a metallic mineral of economic value cannot be extracted at the time that it is mined is known as waste rock (sometimes referred to as overburden). *Waste rock will either be utilized underground to fill mined stopes where geotechnically appropriate to do so, or managed on the surface. Appropriate waste rock may also be used as armoring for the face of the TSFs or as a capillary*

[2] "Stope" is a mining term, referring to a discrete block of ore, usually mined all at one time. Thousands of stopes make up the overall mine.

break on the surface of the TSFs during reclamation. When non-potentially acid generating (NPAG) stockpiles on South32 Hermosa private land are at design capacity, NPAG waste rock may be placed in TSF2. Potentially acid generating (PAG) waste rock brought to the surface would be placed in TSF1 or TSF2. In all cases, the preference will be to place material on South32 Hermosa private land, if there is an appropriate facility available, before it goes onto NFS land. Waste rock is described in more detail in Sections 2.3.4 and 2.5.7.4.

1.3.2.6 Groundwater Management

Groundwater management (GWM) is necessary to reduce hydrostatic pressures to allow underground exploration and mining. GWM wells are on South32 Hermosa private land and proposed on NFS land. Extracted groundwater will be treated to the most stringent applicable surface and groundwater standards before being discharged. The treated water is required to comply with both Arizona aquifer water quality standards and Arizona surface water quality standards. Water Treatment Plant 1 (WTP1), operational since 2018, is authorized to discharge up to 120 gallons per minute (gpm) to Alum Gulch. Water Treatment Plant 2 (WTP2), anticipated to be operational in late 2023, is authorized to discharge up to 4,500 gpm to Harshaw Creek. Both plants are permitted by the Arizona Department of Environmental Quality (ADEQ) under the Aquifer Protection Permit (APP) and Arizona Pollutant Discharge Elimination System (AZPDES) programs to treat specific water sources. WTP1 was designed for low flows associated with the historic workings and runoff from dry-stack tailings, while WTP2 has a higher capacity and was designed to support exploration and production operations. *Part of the treated water would also be routed to RIBs proposed on NFS land, which would be located where recharge would benefit the aquifer by reducing drawdown.* Groundwater management, water treatment, and RIBs are discussed in more detail in Sections 2.3.1 and 2.5.5.

1.3.2.7 Roads and Access

A new permanent Primary Access Road would be constructed on NFS land. Where practicable, the Primary Access Road route would utilize and improve existing Forest Road (FR) segments to connect the Project with State Route (SR) 82. With the exception of two segments of new disturbance totaling about 1.9 miles in length, the Primary Access Road will consist of improvements to existing FR segments currently identified on the Coronado National Forest Motor Vehicle Use Map. The existing FR segments include: Flux Canyon Road (FR 812), approximately 2.6 miles in length; Barriles Tank Road (FR 4653), approximately 2.8 miles in length; and Flux Road (FR4654), approximately 0.2 miles in length. All segments of the Primary Access Road will remain available for public use both during and after completion of the Project, thus the road is not contemplated for reclamation. Following construction, maintenance of the Primary Access Road for the duration of the Project will be accomplished either by Santa Cruz County or their designee (pursuant to an existing maintenance agreement by and between the Coronado National Forest and Santa Cruz County) funded by South32 Hermosa or a new maintenance agreement between the Coronado National Forest and South32 Hermosa.

Temporary roads would be constructed to access other facilities on NFS land, including wells, RIBs, and exploration pads. Current, interim, and long-term secondary access would be provided by Harshaw Road. Harshaw Road traverses South32 Hermosa private land, but will remain open to the public with unrestricted access throughout the life of the Project.

The Primary Access Road and temporary roads are discussed in more detail in Sections 2.4.1 and 2.5.11.

1.3.3 Plan Operations Overview

Plan Operations on or beneath NFS land are an expansion of the operations on South32 Hermosa private land. Specific operations and facilities associated with Plan Operations are listed in Table 1-1. The extent of surface and subsurface Plan Operations are shown on Figure 1-2. Acreages associated with Plan Operations are described in Section 1.3.4.

Table 1-1. List of Plan Operations

Plan Operations Activity
• Surface exploration:
o Continued definition of the orebody both in the area of TSF2 and in other locations. This includes construction of temporary drill pads and access roads. Where future surface disturbance is not contemplated, drill pads and access roads would be reclaimed.
• Underground exploration, mining, and support operations:
o Construction of underground tunnels and infrastructure.
o Underground mining of ore using the long-hole open stoping method, as well as hauling and crushing of ore so it can be brought to the surface.
o Use of approximately half of the tailings stream for mixing of cemented paste backfill (comprising filtered tailings and cement) and delivery via pipe for backfill underground.
o Underground equipment use and maintenance.
o Continued definition of the orebody through exploration drilling from underground workings.
• Storage of tailings and waste rock in a lined dry-stack TSF on NFS land (TSF2):
o Exploration drilling, geotechnical drilling, and test pits to support TSF2 construction.
o Construction, use, and closure of the lined dry-stack TSF2 for storage of both filtered tailings and waste rock, as well as other small quantities of materials such as solids from the WTPs. The lined TSF2 includes infrastructure for management of stormwater runoff and seepage.
o Construction, use, and closure of a UDCP for the lined dry-stack TSF2, including a lined drainage conveyance channel leading to the TSF2 UDCP.
o Transportation and placement of filtered tailings and waste rock materials into TSF2.
o Construction and use of water distribution pipelines and associated TSF2 UDCP to convey UDCP water for treatment.
o Construction and maintenance of fencing and berms as required for worker and public safety, and to restrict public access in certain areas during operations for safety reasons. This includes construction of temporary roads along two planned fence locations for construction and maintenance.
o Construction and use of Project electrical distribution lines, including lines to TSF2 and the TSF2 UDCP.
• Water management activities:
o Construction of GWM wells on the surface and construction of water management infrastructure (sumps, pumps) underground.
o Collection of water for GWM purposes, either by pumping GWM wells or by collection underground.
o Construction, operation, and maintenance of piping and power lines associated with GWM wells.
o Construction of permanent monitoring wells to observe water quality and level and comply with regulatory requirements.
o Recharge of treated water in areas that would benefit the aquifer using RIBs, including water delivery pipelines.
o Construction of stormwater controls to reroute runoff and contain contact water.
• Roads and transportation:
o Geotechnical drilling and/or test pits on NFS land to support construction of the Primary Access Road.

Plan Operations Activity
o Construction of a new and permanent Primary Access Road from the Project to SR 82 (where feasible, limiting new disturbance by improving existing Forest Road segments).
o Construction of temporary access roads (TARs), including 1) those associated with facility access and exploration that would be closed and reclaimed during the operational mine life, causing a short-term temporary disturbance (short-term TARs or “ST-TARs”); and 2) those associated with facility access, GWM wells, monitoring wells, or RIBs that would remain through the operational mine life until closure, involving a long-term disturbance (long-term TARs or “LT-TARs”).
o Upgrade of some existing roads to meet similar criteria used for TARs.
o Transportation of equipment, materials, supplies, and personnel to and from the Project, using existing Forest Roads, Primary Access Road, and TARs.
o Transportation of filtered zinc and lead/silver concentrates off-site in sealed containers.
o Transportation of crushed oxide ore in sealed containers to beneficiation facilities on private land distal from the Project.
• Reclamation and closure activities:
o Salvage and storage of growth media for use in reclamation.
o Closure of the dry-stack TSF2 and TSF2 UDCP upon completion of operations, including placing a closure cap and growth media on TSF2, implementing passive treatment for seepage associated with TSF2, and stormwater management controls.
o Abandonment* of GWM wells, and closure and reclamation of GWM well pads.
o Closure and reclamation of all TARs, exploration drill holes, pads, and RIBs.
o Long-term monitoring activities.

* Well abandonment is a regulated activity that must conform with Arizona Department of Water Resources requirements in Arizona Administrative Code R12-15-816.

Figure 1-1. Project location.

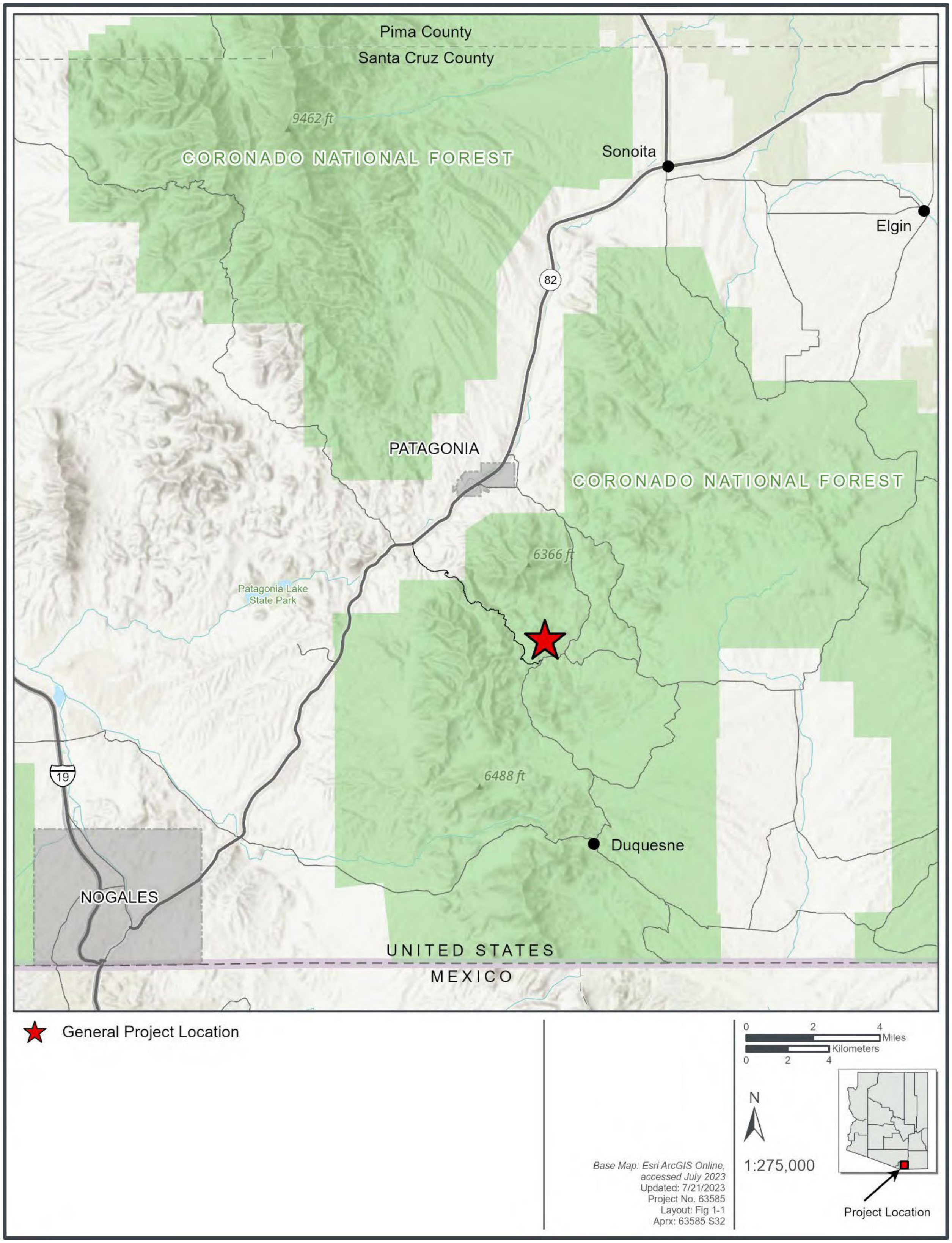
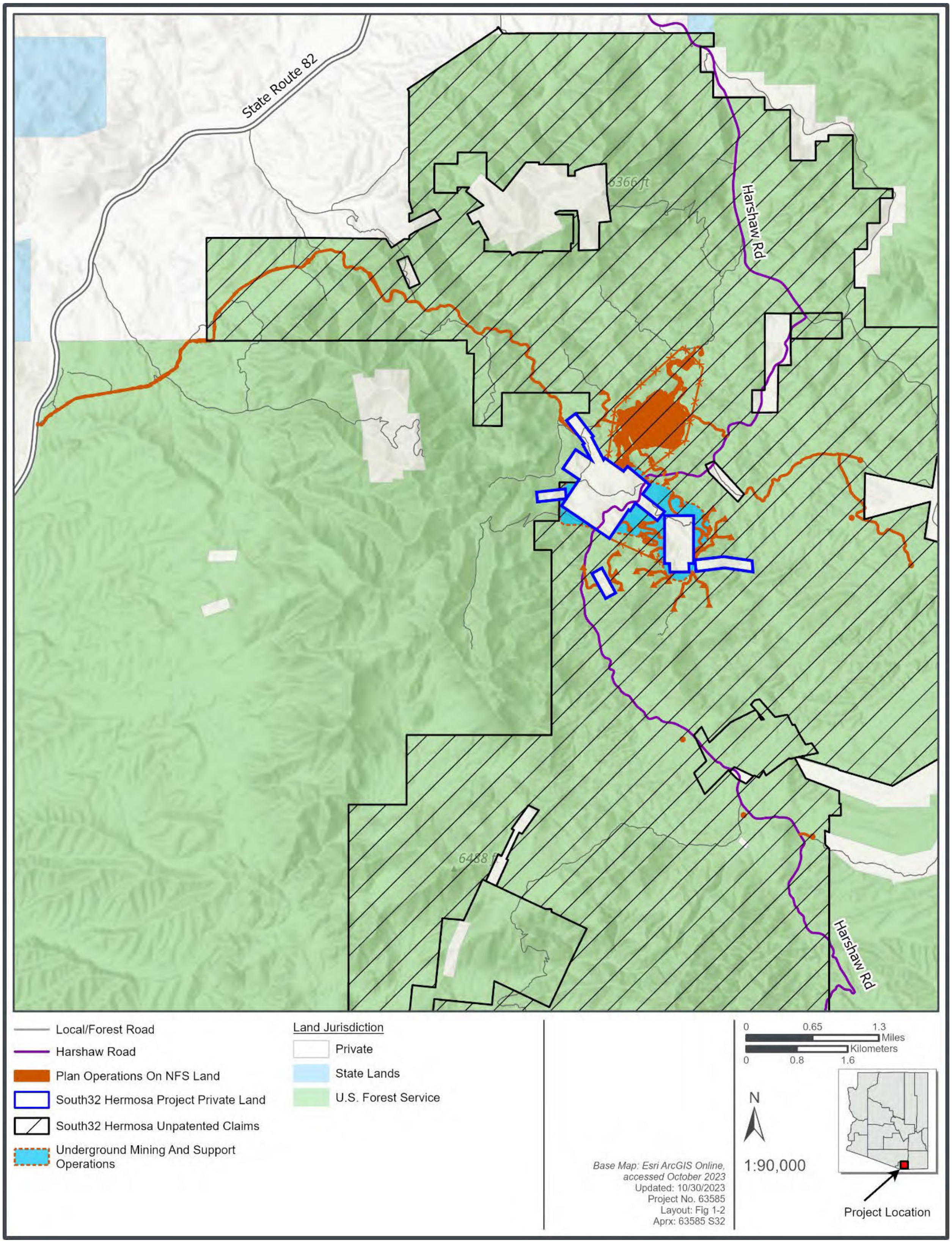


Figure 1-2. Overview of Plan Operations.



1.3.4 Acreage Summary for Plan Operations on NFS Land

Table 1-2. Acreage Summary for Plan Operations on NFS Land

Project Component	Length (feet)	NFS Land (acres)*
Temporary Surface Disturbance (Short-Term†)		
Exploration drill pads (26) (assumes 0.5 acres per pad, 150 × 150 feet, outside the TSF2 footprint)	N/A	13.0
Short-term TARs (ST-TARs) for exploration (assumes 30-foot width)	15,300	10.5
GWM drill pads (6) (assumes 1.5 acres per pad, 300 × 300 feet excluding long-term temporary disturbance)	N/A	9.0
Exploration drill pads (approximately 17) within the TSF2 footprint (no additional disturbance)	N/A	0
Geotechnical investigations at Primary Access Road. No additional disturbance outside road footprint.	N/A	0
Geotechnical investigation at TSF2, borings and test pits within footprint. No additional disturbance.	N/A	0
Laydown areas for Primary Access Road construction (5 areas at 2 acres per area)	N/A	10
Existing access road improvements within existing road prisms	N/A	0
Existing access road improvements to meet ST-TAR criteria	12,500	8.6
Temporary Surface Disturbance (Long-Term†)		
GWM well pads, fenced (6) (assumes 0.5 acres per pad, 150 × 150 feet)	N/A	3.0
Monitoring well pads (2) (assumes 1.4 acres per pad, 250 × 250 feet)	N/A	2.8
GWM long-term TARs (LT-TARs) (assumes 30-foot width, and will accommodate pipelines/power lines)	9,300	6.4
Monitoring well pad LT-TARs (assumes 30-foot width)	2,300	1.6
RIBs (assumes two 18-acre RIBs)	N/A	36
RIB LT-TARs (assumes 30-foot width, and will accommodate pipeline/power lines)	8,600	5.9
TSF2 fence line maintenance access road (assumes 12-foot width)	15,800	4.4
Southern Restriction Area fence line maintenance access road (assumes 12-foot width) ‡	3,100	0.9
Existing access road improvements to meet LT-TAR criteria	8,000	5.5
	Subtotal for Temporary Surface Disturbance	*117.6*
	Contingency Disturbance Acreage (5%)#	*5.9*
	Subtotal for Temporary Disturbance with Contingency	***123.5***
Permanent Surface Disturbance		
Dry-stack TSF2 footprint (including TSF2 UDCP)	N/A	236**
Primary Access Road (primarily assumes 100-foot width§ to accommodate cut, fill, and necessary safety installations such as rockfall protection)	39,700	100.3††
	Subtotal for Permanent Surface Disturbance	*336.3*
	Contingency Disturbance Acreage (5%)#	*16.8*

Project Component	Length (feet)	NFS Land (acres)*
	Subtotal for Permanent Surface Disturbance with Contingency	***353.1***
	Total Acreage of All Surface Disturbance	**476.6**
Underground Plan Operations	N/A	223
Restricted Public Access Areas (No Surface Disturbance)¶		
TSF2 Restriction Area	N/A	229
Southern Restriction Area‡	N/A	114
	Subtotal for Restricted Areas	***343***

* Acreages shown as zero represent disturbance that occurs within a disturbance footprint already counted in the table. For example, the exploration and geotechnical investigations associated with TSF2 are not counted, as the entire footprint of TSF2 is considered disturbed already.

† Short-term temporary disturbance refers to facilities that would be closed and reclaimed during the operational mine life. Long-term temporary disturbance refers to facilities that would remain through the operational mine life until closure.

‡ The Southern Restriction Area is shown on Figure 2-1 and refers to an area where a fence is proposed on NFS land to enclose an area generally bounded on three sides by S32 Hermosa private land. Multiple exploration sites, GWM wells, LT-TARs, and ST-TARs are located within this area, and a single fence is anticipated to provide a higher level of safety for the public than fencing individual Plan Operations within the area.

§ Where feasible, the design of the Primary Access Road limits new disturbance by improving existing Forest Road segments. Of the 7.5 miles that comprise the Primary Access Road, 1.0 mile is realignments of existing roads, 1.9 miles are new roads, and 4.6 miles are existing road reconstruction. Approximately 22 acres of the 100.3-acre Primary Access Road corridor have been previously disturbed.

¶ The fenced acreage represents only those areas with no disturbance from which the public is restricted. For example, the total area within the TSF2 fence line is 434 acres, of which 193.6 acres are undisturbed and 240.4 acres are occupied by the TSF2 footprint and TSF2 fence line maintenance road.

The additional contingency acreage is to account for unanticipated changes that are required based on conditions experienced during site investigation and construction. It is calculated as 5% of the temporary and permanent disturbance. The exact location and nature of operations that would occur within the contingency area is unknown.

** The acreage for TSF2 is based on the planned footprint as well as a 50-foot area around the planned footprint. Potential disturbance that may occur within this adjacent area includes unanticipated changes that are required including but not limited to space needed for equipment laydown during construction, additional space that may be necessary for maintenance, safety, and security during operations, and space needed for implementation of stormwater erosion controls to meet stormwater plan requirements (such as silt fences, wattles, or temporary settling basins). There may also be areas where power lines cross over NFS land without ground disturbance; acreage for these impacts is also included in the event some vegetation management might be required.

†† The acreage for the Primary Access Road is based primarily on a 100-foot width corridor, to account for cut and fill, driving lanes, shoulders, safety berms, and other appropriate safety measures. There are some areas where it is anticipated that cut/fill may necessarily extend beyond the 100-foot corridor, once final designs are complete. These areas are estimated to represent approximately 8,000 linear feet of the 39,700 linear feet of the Primary Access Road. Within these areas, acreage is calculated using a 150-foot corridor width (i.e., an additional 50-foot width).

This page intentionally left blank.

CHAPTER 2. PROJECT DESCRIPTION

2.1 ORGANIZATION OF CHAPTER

This chapter contains details of the Project in its entirety to provide context for Plan Operations. This chapter is organized as follows:

- **Section 2.2 – Geology and History of Mining** provides background on the local geologic conditions, history of mining in the region, and the Project acquisition.
- **Section 2.3 – Project Activities Prior to Commencement of Operations on NFS Land** provides details of activities that will occur on South32 Hermosa private land before any operations on NFS land occur. These activities on South32 Hermosa private land will include exploration (detailed in Section 2.4), site preparation, construction of surface facilities, development of underground infrastructure and concurrent exploration, GWM activities, permitting and expansion of TSF1, mining under South32 Hermosa private land (detailed in Section 2.5), transportation of zinc and lead/silver concentrates and manganese oxide ore from the Project (detailed in Section 2.5), storage of tailings in TSF1, and use of tailings for cemented paste backfill below South32 Hermosa private land (detailed in Section 2.5).

  This section includes:
  - Water Management (Private and NFS Land) (Section 2.3.1)
  - Shaft, Decline, and Underground Infrastructure Development (Private Land) (Section 2.3.2)
  - Surface Support Facilities (Private Land) (Section 2.3.3)
  - Material Characterization (Private and NFS Land) (Section 2.3.4)
- **Section 2.4 – Exploration Activities (NFS Land)** provides details of exploration that would occur on the surface and beneath NFS land and would continue throughout the duration of the Project.
- **Section 2.5 – Underground Mining and Supporting Operations (Private and NFS Land)** provides details of activities once ore is being mined underground below South32 Hermosa private land or NFS land and brought to the surface for beneficiation or transportation. This section also provides details of operations on NFS land including geotechnical investigations to support the final designs of TSF2, Primary Access Road, and RIBs; and the site preparation and construction of TSF2, Primary Access Road, and RIBs after completion of geotechnical investigations. Upon completion of TSF2 construction, filtered tailings will be transported and placed in TSF2. Tailings will also be used as cemented paste backfill. Sulfide ore beneficiation will remain on South32 Hermosa private land and transportation of oxide ore as discussed above will continue but would transition to the Primary Access Road upon completion of its construction. Water management activities will also continue, additional GWM wells would be constructed on NFS land, and the RIBs would be constructed and used for distributed recharge. This section includes:
  - Anticipated Production Rate and Mine Life (Private and NFS Land) (Section 2.5.1)
  - Anticipated Operations Schedule (Private and NFS Land) (Section 2.5.2)
  - Progression of Underground Mining (Private and NFS Land) (Section 2.5.3)
  - Long-hole Open Stoping (Private and NFS Land) (Section 2.5.4)
  - Water Management (Private and NFS Land) (Section 2.5.5)
  - Milling and Beneficiation (Private Land) (Section 2.5.6)
  - Tailings and Waste Rock Management (Private and NFS Land) (Section 2.5.7)

  - Materials and Supplies (Private and NFS Land) (Section 2.5.8)
  - Maintenance during Operations and Public Safety (Private and NFS Land) (Section 2.5.9)
  - Prevention and Control of Fire (Private and NFS Land) (Section 2.5.10)
  - Roads (NFS Land) (Section 2.5.11)
  - Power Generation (Private Land) (Section 2.5.12)
- **Section 2.6 – Project Permits and Approvals** contains details of regulatory permits and approvals that exist or are anticipated for the Project.

Project and Plan Operations are shown on Figure 2-1 (showing the entire Project), along with more detailed figures depicting specific Plan components, including the RIBs (Figures 2-2 and 2-3), and exploration operations (Figure 2-4). The dry-stack TSF2 is depicted in Figure 2-5, along with additional figures depicting the anticipated phasing of TSF2 construction (Figures 2-6, 2-7, and 2-8), and the current existing topography within the future footprint of TSF2 (Figure 2-9).

Figure 2-1. Project site plan and facility locations

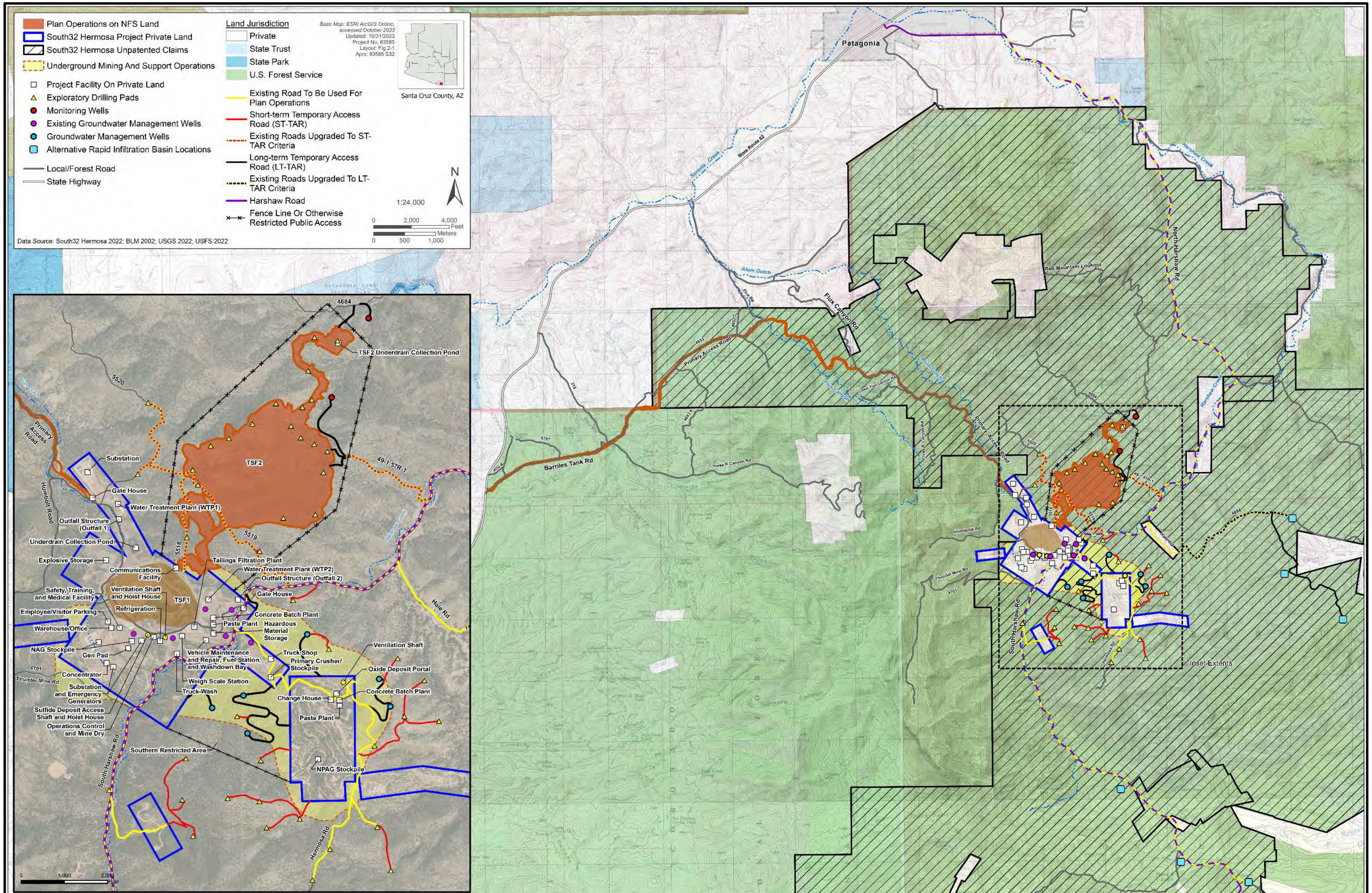


Figure 2-2. Detail of eastern RIB alternatives.

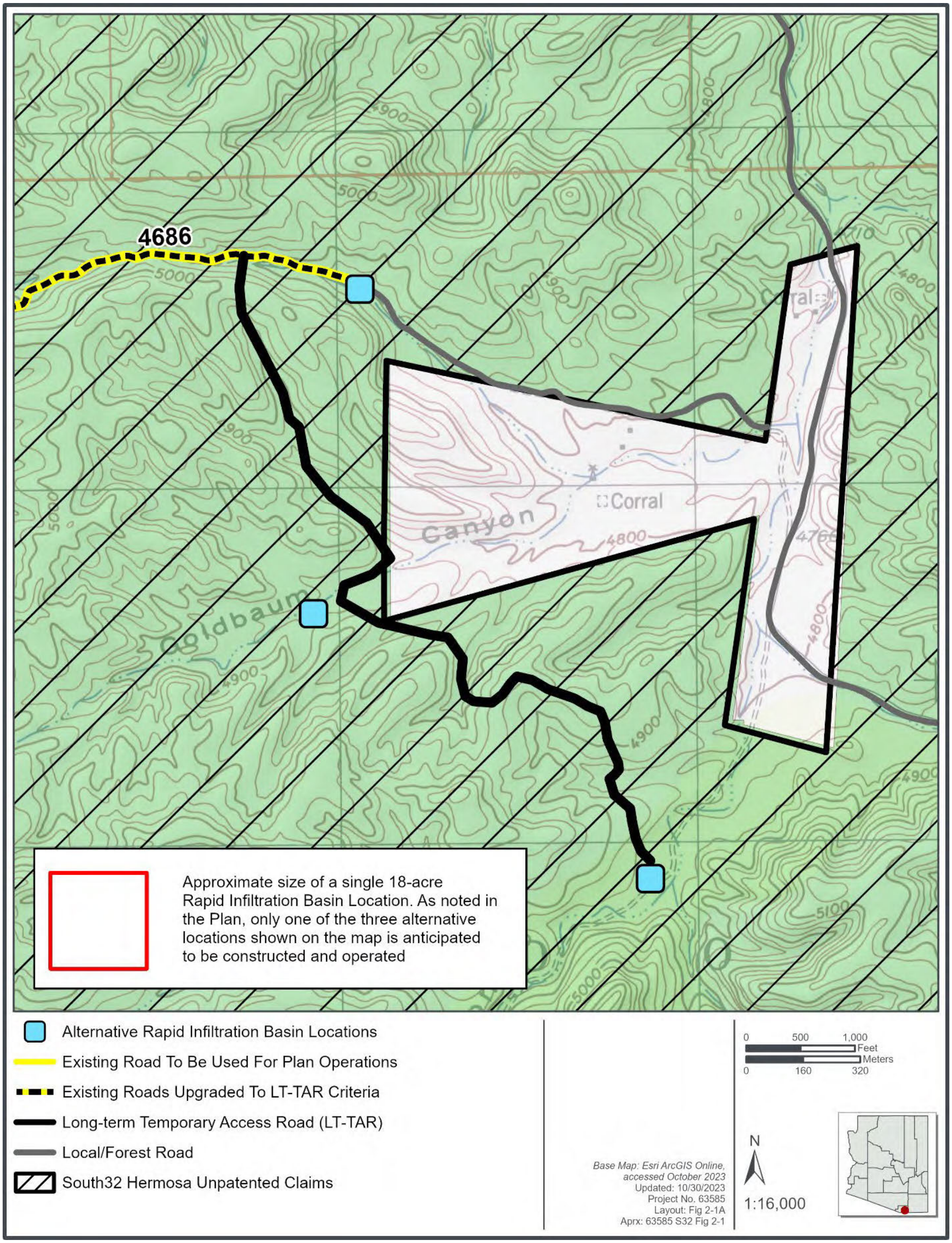


Figure 2-3. Detail of southern RIB alternatives.

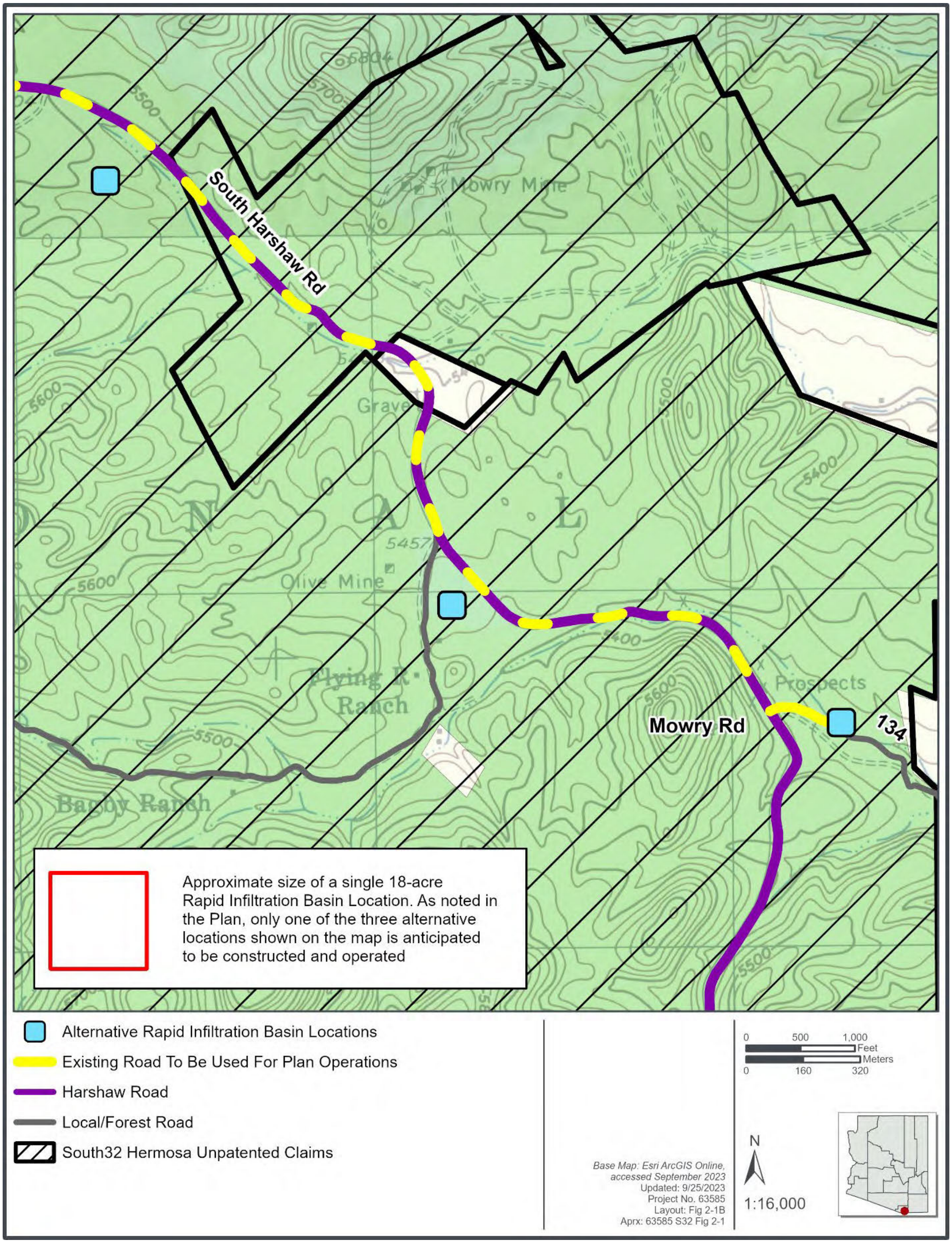


Figure 2-4. Detail of Plan Operations related to exploration.

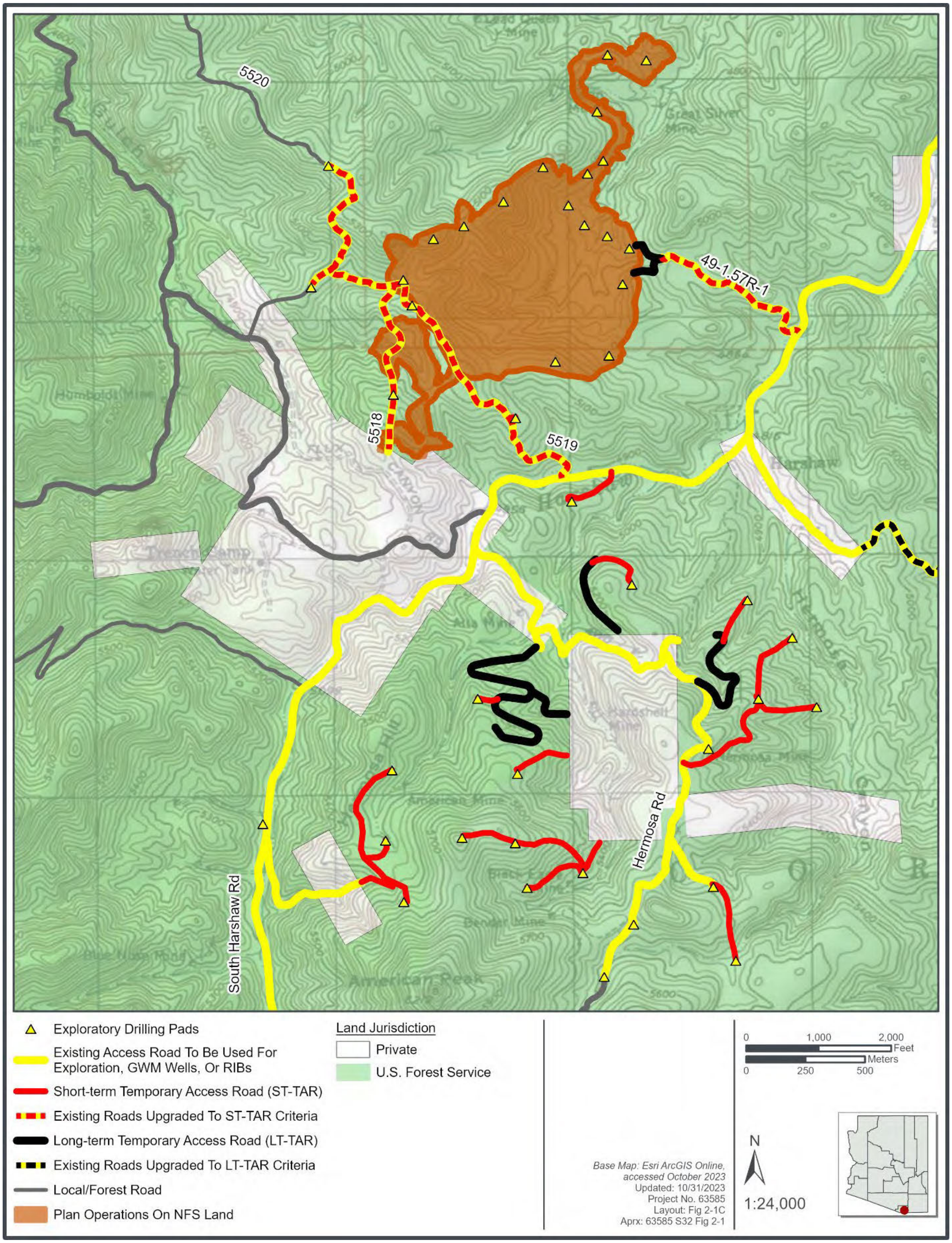


Figure 2-5. TSF2 plan view.

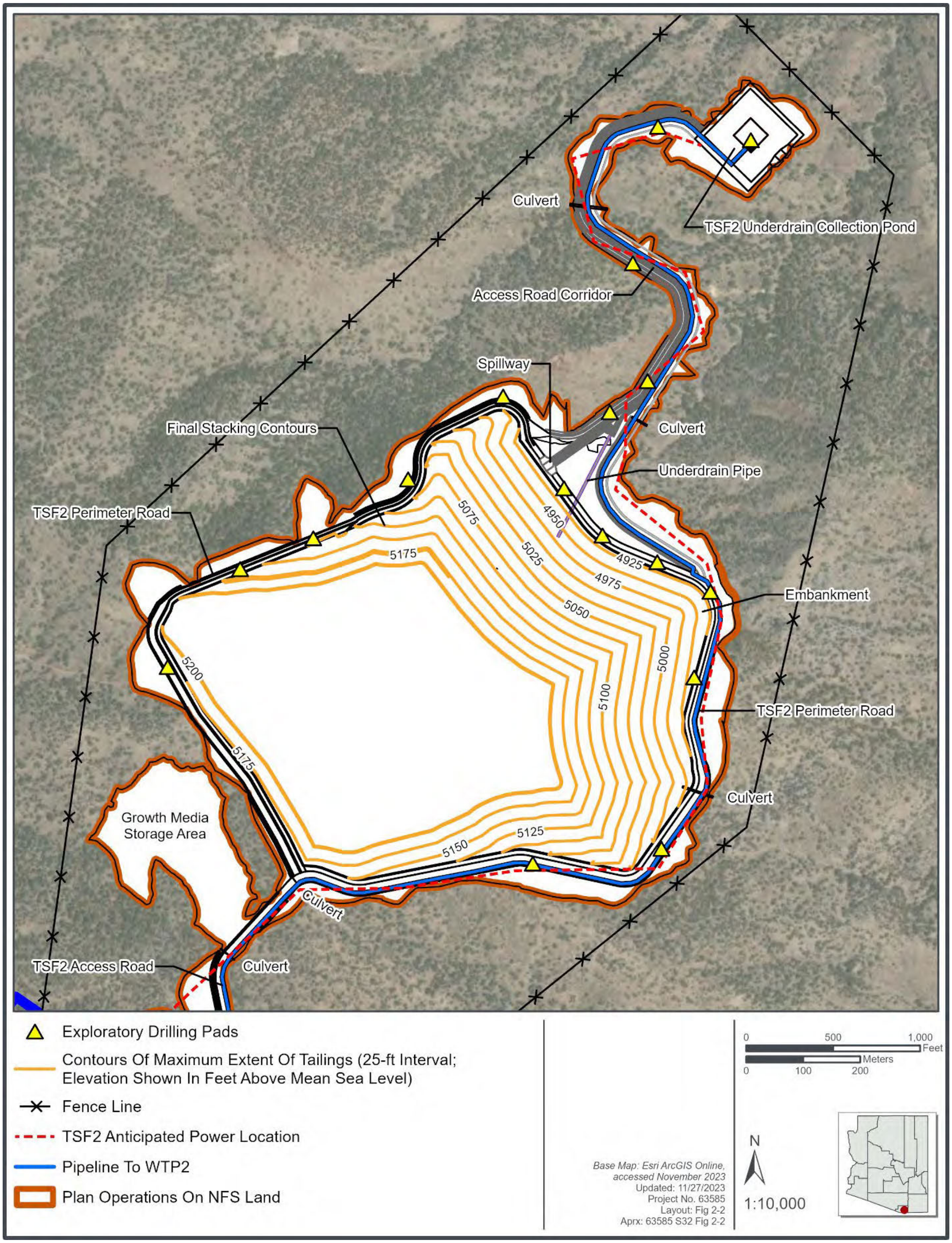


Figure 2-6. TSF2 construction phasing – Starter stage.

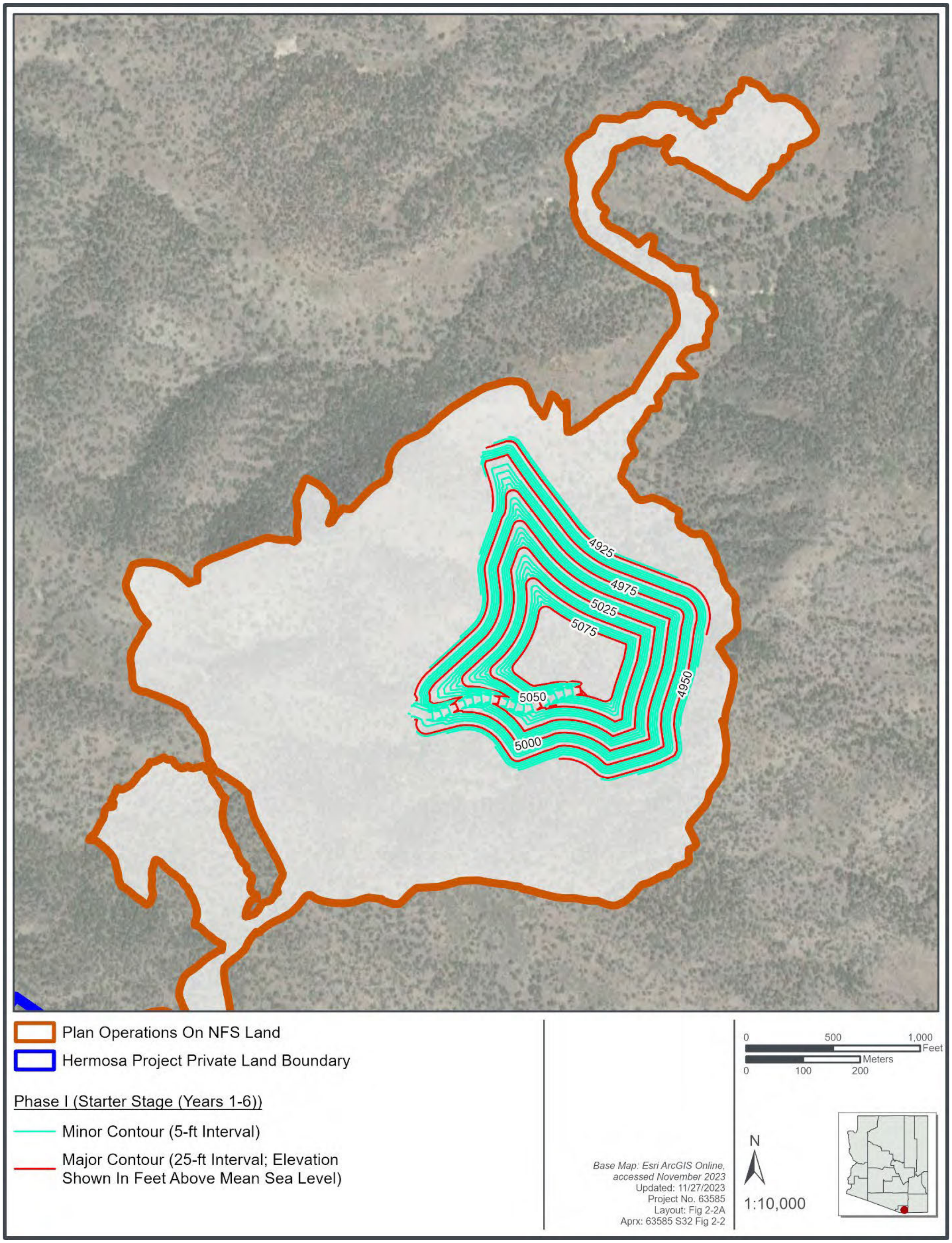


Figure 2-7. TSF2 construction phasing – Intermediate stage.

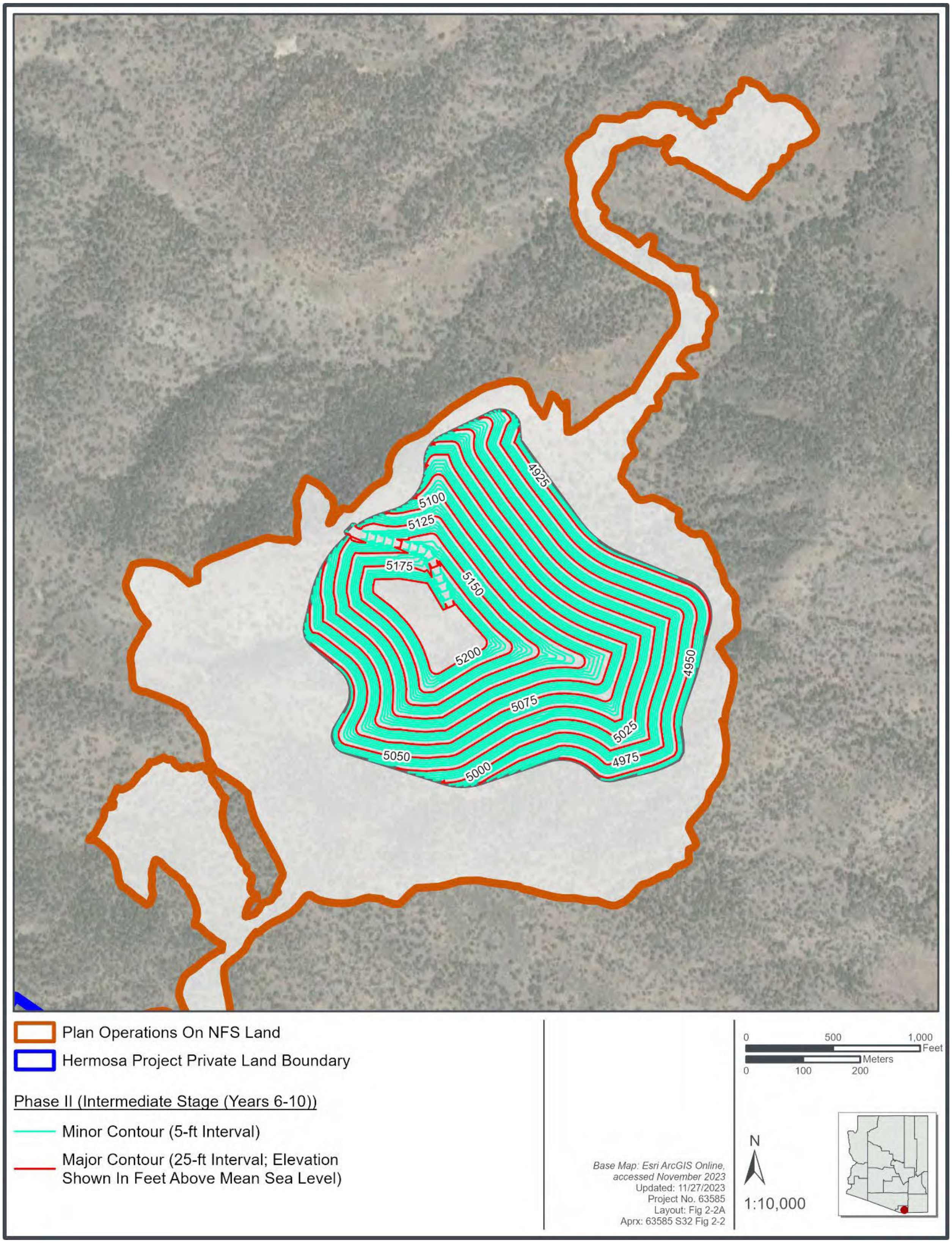


Figure 2-8. TSF2 construction phasing – Ultimate stage.

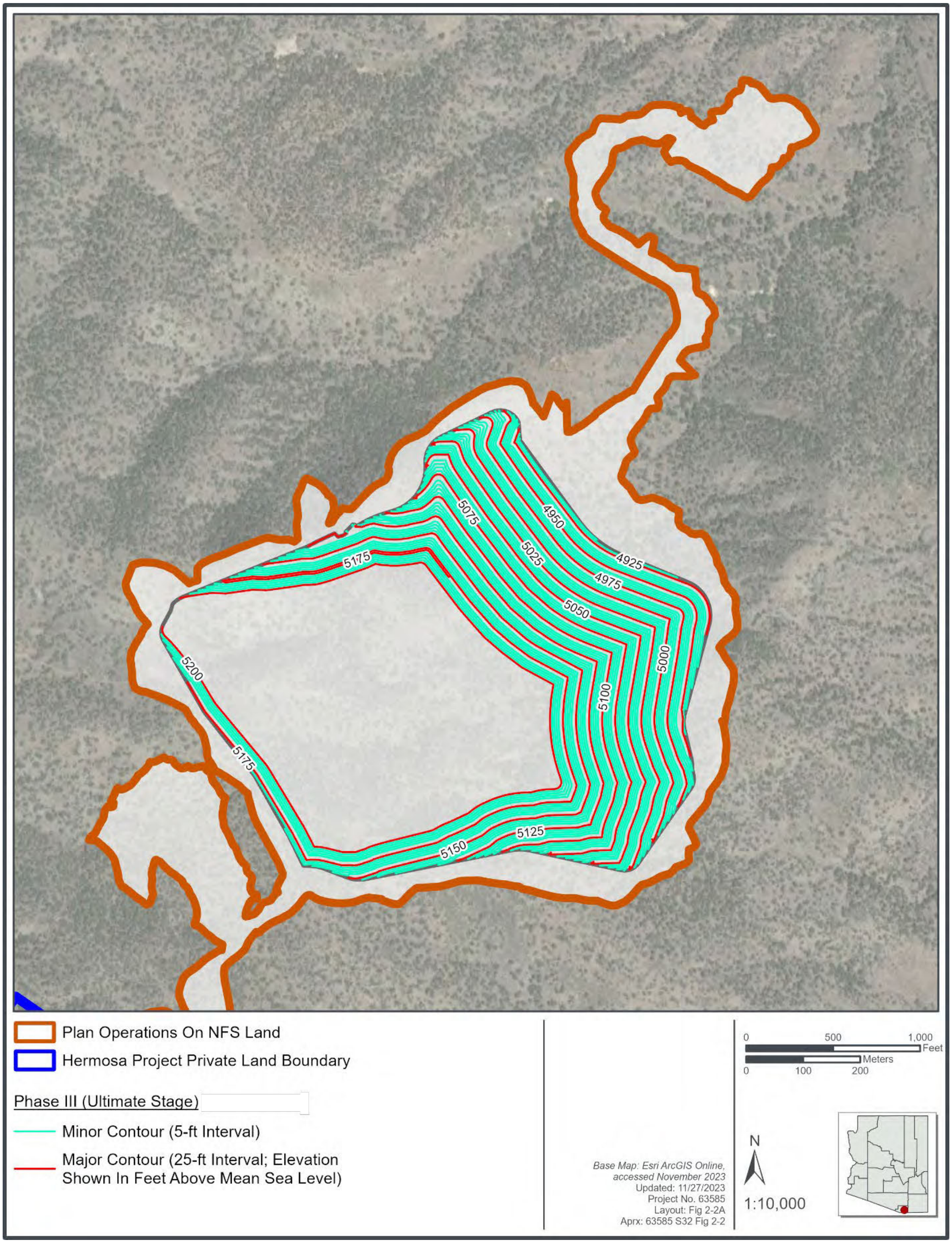
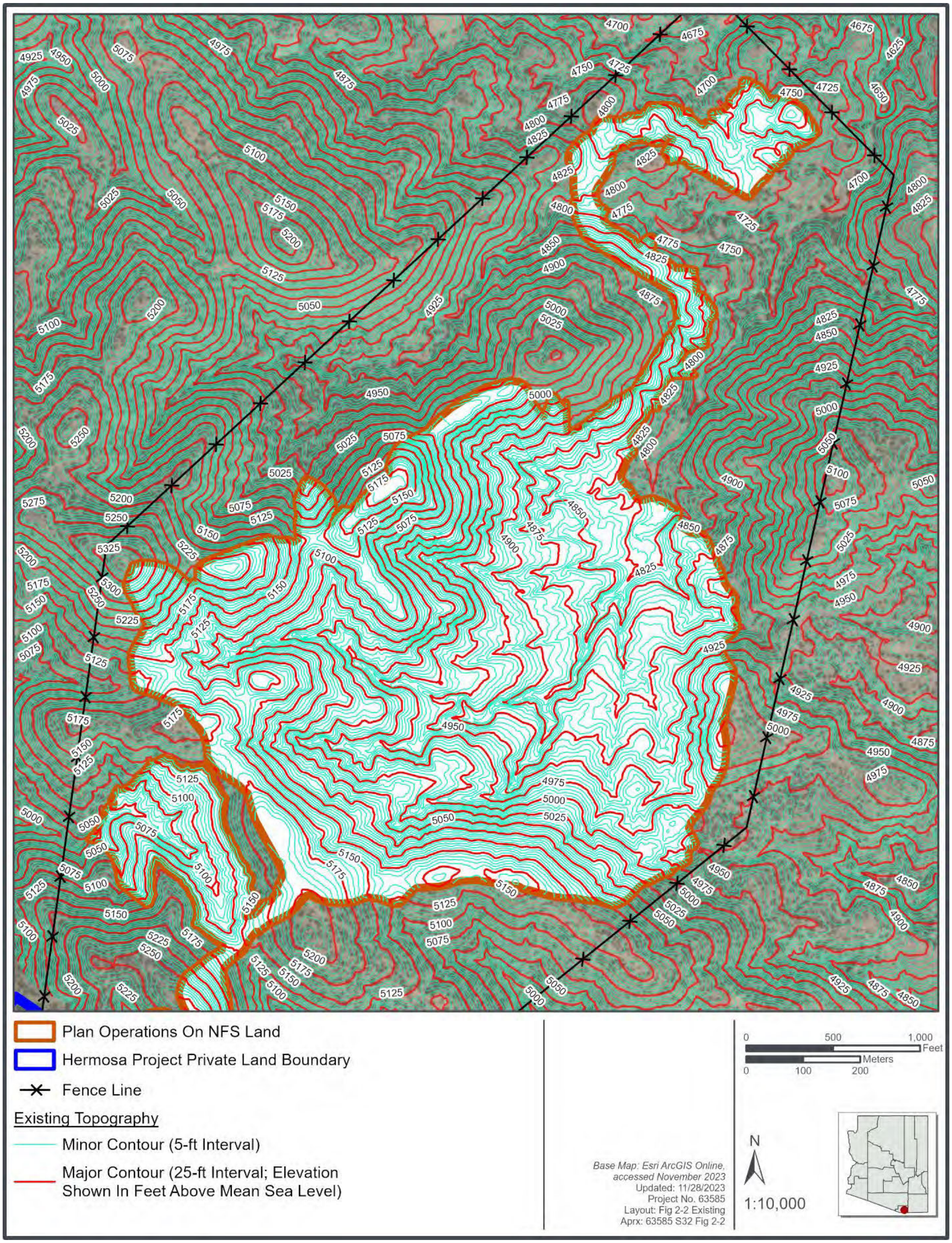


Figure 2-9. Existing topographic contours within the future footprint of TSF2.



2.2 GEOLOGY AND HISTORY OF MINING

2.2.1 General Geology

Cretaceous-age volcanic and intrusive rocks cover much of the area around the Project at the surface. Faulting has created complex site-specific stratigraphy; however, the general stratigraphy in the area is as follows and is shown graphically on Figures 2-10 and 2-11:

Intrusive Rocks (Tertiary / Cretaceous), including quartz-feldspar-porphyry and diorite intrusives.

Trachyandesite of Meadow Valley (Cretaceous), a complex volcanic flow unit.

Hardshell Volcanic Sequence (Jurassic), including five distinct rhyolitic volcanic units, in addition to basal tuffaceous sandstone and breccia units.

Older Volcanic Sequence (Triassic / Jurassic), including predominantly rhyolitic tuffs, porphyry, breccia, and sandstone units.

Concha Formation (Paleozoic), a massive chert-rich limestone-marble.

Scherrer Formation (Paleozoic), including three units comprising calcareous sandstone, limestone, and quartzite.

Epitaph Formation (Paleozoic), a variable limestone and dolomite package consisting of multiple units.

Figure 2-10. Regional geology and geologic cross section A-A'.

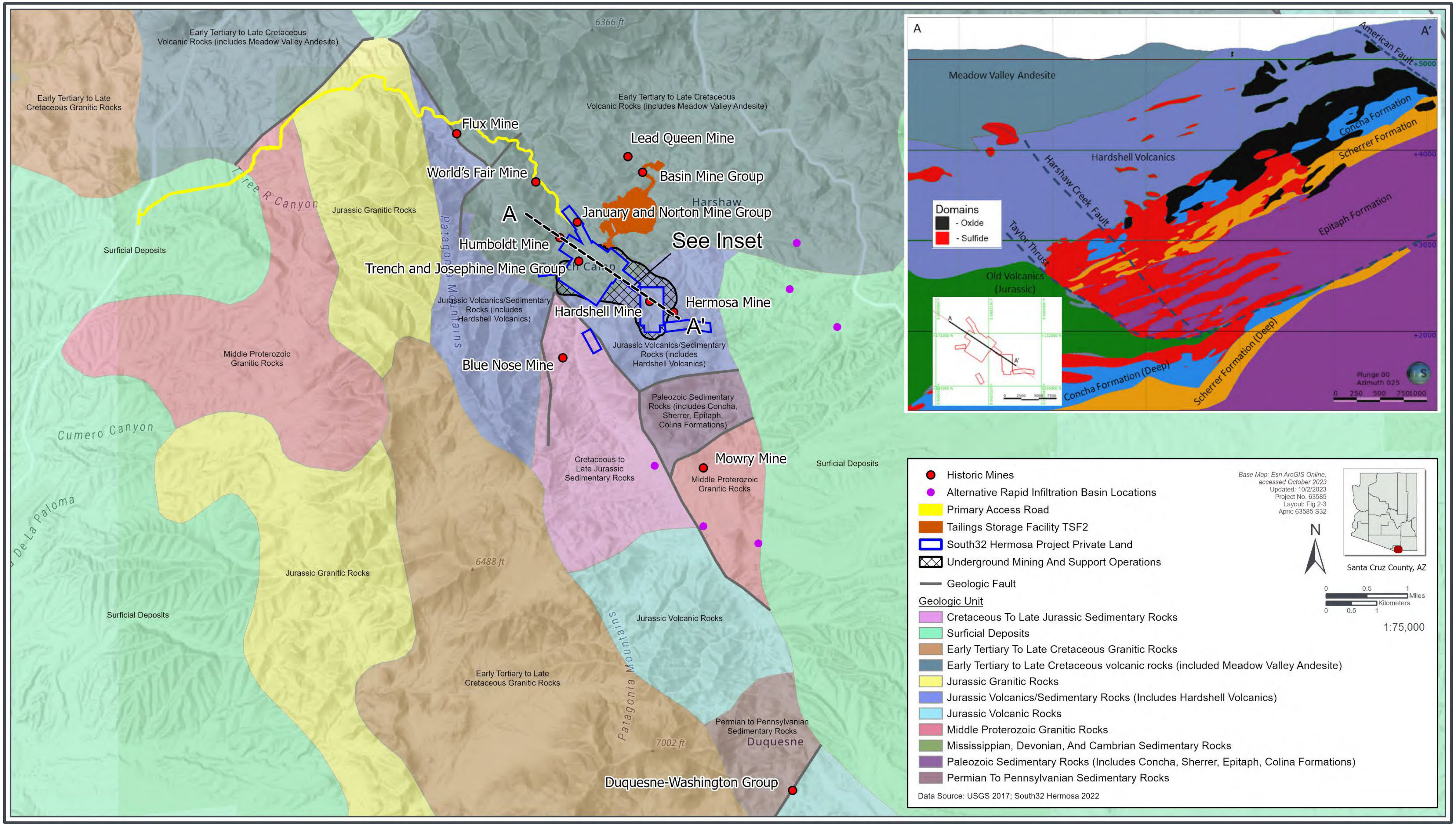
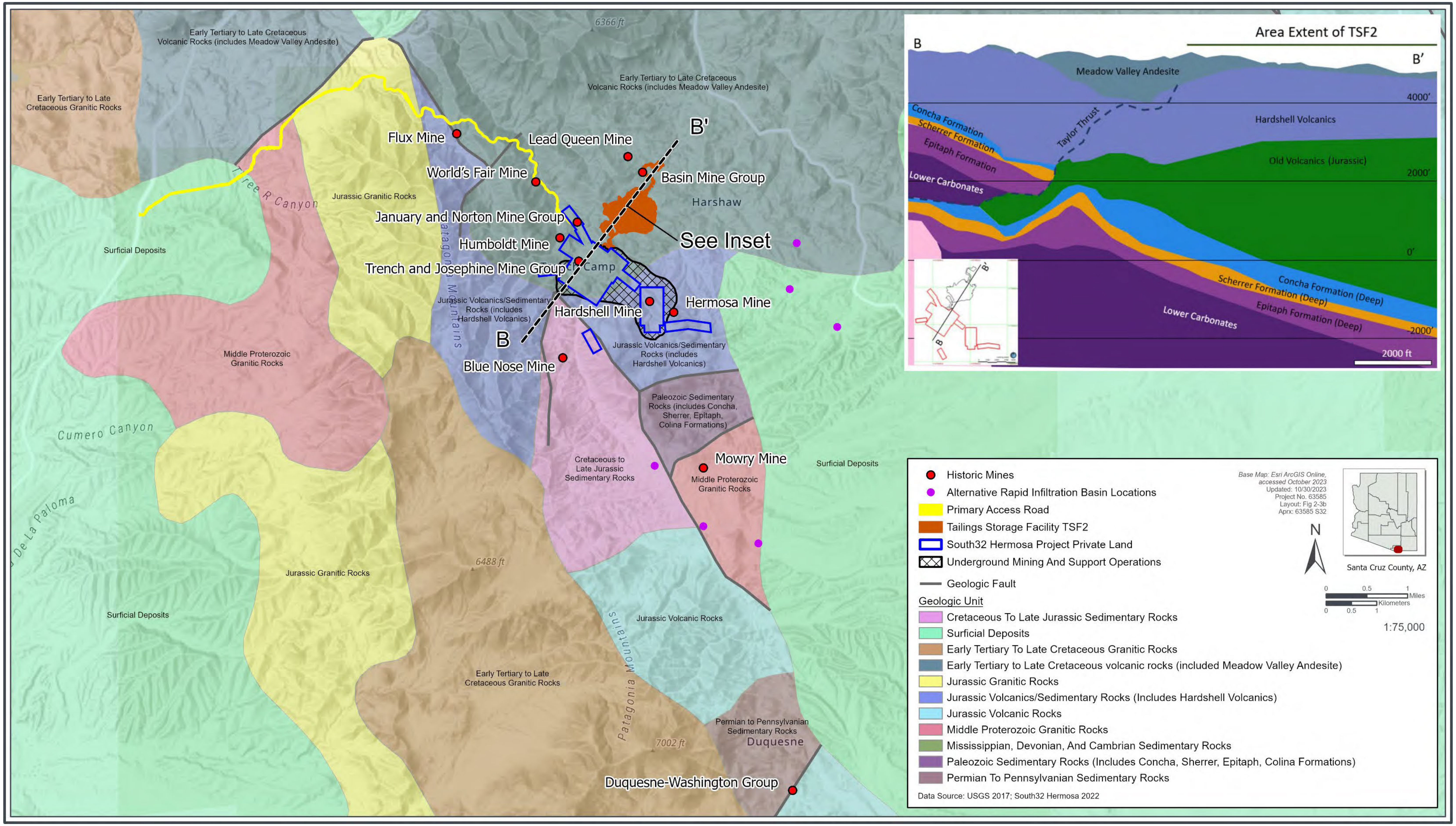


Figure 2-11. Regional geology and geologic cross section B-B'.



2.2.2 Regional Mining History

The Patagonia and Harshaw mining districts were organized around 1870. The Patagonia mining district includes the southern portion of the Patagonia Mountains. The Harshaw mining district, which includes the Project, was founded a few years after the Patagonia mining district and encompasses roughly 40 to 50 square miles in the northern portion of the Patagonia Mountains.

In the Patagonia mining district, the oldest and best-known mine and camp was the Patagonia or Mowry Mine. The mine was worked intermittently for silver and lead. In the early 1900s, the workforce numbered about 200, and during this time a new concentrator and smelter were built. Around the time of the Great Depression, the mine was largely shut down due to a sharp decrease in metal prices. Today the former town of Mowry is still visible with ruins of buildings and abandoned mine structures.

The Harshaw mining district included the Harshaw Mine and several smaller camps from the late nineteenth and early twentieth centuries, including the Hardshell, World’s Fair, Flux, Standard, and Thunder Mines. These mines produced silver and lead in the early years and later produced copper. In the 1880s, after the installation of the 20-stamp mill to process the silver at the Harshaw Mine, the mine handled 75 tons of ore per day. The mine is notable for its size and the associated town that sprang up next to the mine. During this time, the Southern Pacific Railroad was completed across southern Arizona, which made it feasible to ship ore by wagon to the rail station. The mine’s reserves began to run out about the same time as the railroad arrived, and by early 1882, the Harshaw Mine shut down. Later attempts were made to reopen the mine in 1908 and 1949.

The present-day town of Patagonia was the commercial center and transportation hub for mining in both districts. In the 1900s, the first smelter in Patagonia was built by the Empire Mining and Milling Company, and eventually the rail station was moved to Patagonia. With the start of World War II, the town of Patagonia prospered as there was an increased demand for metals, notably copper, lead, zinc, and molybdenum. Modern exploration continues throughout the Patagonia and Harshaw mining districts today, though no modern mines are currently operational in the districts.

Many of the historic mines in the area are within or border South32 Hermosa private land and unpatented claims (Table 2-1). The former Lead Queen, Flux, World’s Fair, and Blue Nose Mines are within South32 Hermosa’s unpatented claim boundary. Former mines, including the January-Norton, Hardshell, Trench, Josephine, and a portion of the former Hermosa Mine, are on South32 Hermosa private land. The Trench Mine had an extensive history, operating until the late 1940s. The mine produced silver and lead starting in the 1850s using an open-trench method. The mine’s first deep excavation was below ground to a depth of nearly 400 feet. In 1938, a modern reduction mill and a nearby smelter were built. Many of the surrounding mines brought their ore to this site for milling.

Table 2-1. Historical Production from Harshaw District

Mine Name	Production Period	Tons Produced	Dominant Commodity*	Location Related to Project†
Trench and Josephine Mine Group	1850–1890, 1918–1945	237,000	Pb, Zn, Ag, Cu, Au, Mn	Within South32 Hermosa private land
January and Norton Mine Group	1870s–1949	71,000	Zn, Pb, Ag, Cu, Au	Within South32 Hermosa private land
Flux Mine	1850s–1963	850,000	Zn, Pb, Cu, Ag, Au	Within or near the Primary Access Road on South32 Hermosa unpatented claims
Hermosa Mine	1877–1902	70,000	Ag, Mn, Pb, Cu, Au, Mo	Within South32 Hermosa private land

Mine Name	Production Period	Tons Produced	Dominant Commodity*	Location Related to Project†
Mowry Mine	pre-1850–1952	207,500	Pb, Ag, Mn, Zn, Cu, Au	Within or near South32 Hermosa unpatented claims
Duquesne-Washington Group	pre-1880–1966	350,000	Zn, Pb, Cu, Ag, Au	Within or near South32 Hermosa unpatented claims
Hardshell Mine	1896–1964	35,000	Pb, Ag, Mn, Cu, Zn, Au	Within South32 Hermosa private land
Blue Nose Mine	1880s–1956	13,000	Ag, Pb, An, Cu, Ag, Mn	Within or near South32 Hermosa unpatented claims
World's Fair Mine	1880s–1954	13,000	Ag, Pb, Cu, Zn, Au	Within or near the Primary Access Road on South32 Hermosa unpatented claims
Humboldt Mine	1880s–1952	1,200	Pb, Ag, Zn, Cu, Au	Within or near South32 Hermosa unpatented claims
Lead Queen Mine	pre–1900	500	Pb, Ag, Zn, Cu, Au	Within or near South32 Hermosa unpatented claims
Basin Mine Group (including Great Silver Mine)	1880s–early 1900s	100	Ag, Pb, Cu	Within or near TSF2 UDCP on South32 Hermosa unpatented claims

Source: Keith (1975)

* Ag = silver, Au = gold, Cu = copper, Mn = manganese, Mo = molybdenum, Pb = lead; Zn = zinc

† For locations of historic mines with respect to the Project, see Figure 2-10.

2.2.3 Modern-Era Project Mining, Reclamation, and Continued Exploration

Portions of the South32 Hermosa private land were acquired by ASARCO LLC (ASARCO) in 1939. ASARCO completed intermittent drill programs on these lands between 1940 and 1991. ASARCO also identified silver-lead-zinc–bearing manganese oxides in the overlying oxide portion of the orebody between 1946 and 1953. In March 2006, South32 Hermosa's predecessor purchased portions of the Project directly from ASARCO.

In early 2016, South32 Hermosa's predecessor also acquired the January, Trench Camp, and Norton patented claims and then sought approval for inclusion in the ADEQ's Voluntary Remediation Program to address legacy tailings and waste rock deposition in unlined natural basins. The remediation under the State's Voluntary Remediation Program addressed two long-standing regional issues resulting from legacy mining conducted by past mine owners: 1) stormwater overflows from the historic January adit, and 2) leaching of metals from unlined tailings and PAG waste rock causing impacted water discharge into area drainages during heavy rainfall.

Under the Voluntary Remediation Program, South32 Hermosa completed a two-year cleanup effort, costing more than $30 million and requiring 1 million work hours (employees and contractors). As part of the Voluntary Remediation Program, the legacy tailings piles were excavated and placed within a new, lined, permanent dry-stack TSF, known in this PoO as TSF1. Tailings runoff and seepage water from TSF1 is collected through an underdrain collection system and gravity fed to the double-lined TSF1 UDCP. The captured tailings runoff/seepage water and water from the January adit are currently piped to WTP1 for treatment and reuse or discharge.

The design, construction, and operation of TSF1 served as a model for the design of TSF2. In addition to adhering to state and industry standards, the design of TSF2 is informed by the ongoing operation and performance of TSF1, which is on the same substrates, in the same environment, and operates in the same climate as TSF2.

Aside from historic mining and the voluntary remediation, other ongoing activities conducted by South32 Hermosa at the Project include exploration drilling focused on delineating both the oxide and sulfide portions of the orebody, advancement of underground infrastructure for further exploration, construction of WTP1 and WTP2, and the installation, testing, and operation of GWM wells.

2.3 PROJECT ACTIVITIES PRIOR TO COMMENCEMENT OF OPERATIONS ON NFS LAND

This section describes those activities that will take place before operations occur on NFS land. The activities described in this section include both Project and Plan activities. Project activities on South32 Hermosa private land are currently taking place and will continue throughout the PoO approval process. Plan Operations would commence upon Forest Service approval and notice to proceed.

2.3.1 Water Management (Private and NFS Land)

Groundwater management is necessary to reduce hydrostatic pressures to allow the development of underground infrastructure and ultimately to allow excavation for exploration and mining from both private land and NFS land [redacted] For more detail on water treatment, see Section 2.5.5.2.

Underground water management methods will also be used. As various geologic structures are encountered, groundwater is anticipated to be generated in the development workings. A water collection system is planned for the underground workings, which will include sumps, pumps, and piping to manage any water encountered. Groundwater entering the underground workings at the faces or elsewhere within the underground infrastructure will be directed to a series of sumps or other holding features. Once collected, groundwater will be pumped from the sumps to the surface, where it can be treated at WTP2 prior to discharge. Opportunities will be evaluated and implemented to target conduits of groundwater flow for capture and routing to the surface when this method can minimize the inflow quantities entering the active underground workings and enable safer working conditions in the underground environment. These underground water management systems will be located throughout the underground mine as needed, depending on the specific inflows encountered.

Early groundwater management may occur on NFS land before other Plan Operations begin. This could include the installation and operation of up to six GWM wells on NFS land. Infrastructure necessary to support the GWM wells would include TARs, power lines for well pumping, and pipelines to convey pumped water to water management facilities and, ultimately, treatment at WTP2. The GWM well locations on NFS land are contingency sites and would be used if necessary, depending on the efficiency and observed capabilities of the underground water management system (which is preferred to surface wells, where/if practical). Installation of GWM wells on NFS land would not occur before approval of this PoO by the Forest Service.

Once access to the GWM drill pad has been provided, the drilling rig and support equipment will be moved to the pad location. Per Arizona Department of Water Resources well construction requirements, a surface seal will be drilled and constructed which will extend a minimum of 20 feet below grade and will consist of blank steel casing and will be grouted in place with cement. Assuming a mud rotary drilling method, drilling below the surface seal will utilize a tri-cone bit and will utilize drilling mud to maintain borehole stability and facilitate return of drill cuttings to the surface. All drilling fluid will be self-contained on the site within steel tanks and drill cuttings will be stored in removable roll-off bins. Alternative drilling mud management systems could be considered. Depending on the specific lithologic material encountered at the drill pad, drilling rates will vary, however rates between 1 and 5 feet per hour are typical in a hard rock drilling environment. Depending on the anticipated depth of the borehole, drilling deeper and larger diameter GWM wells could require drilling for 3 to 5 months. Most wells would be anticipated to be drilled to approximately 2,000 to 3,000 feet. Screened or perforated intervals would be determined based on site-specific conditions, but in general would likely extend from a depth of approximately 500 feet to the total depth of the well.

Once the drilling has been completed, the borehole is typically logged using borehole geophysical instrumentation (such as electrical, sonic, natural gamma, acoustic televiewer, caliper, and/or magnetic resonance tools). Once logging is complete, well screen and casing are installed into the well. If the well casing is steel, this will require welding to be completed to connect the casing. After casing installation, the annular space between the casing and borehole is filled with gravel material within the screened area, and potentially bentonite and cement as a seal above the screen, within the region of blank casing. Drilling fluid is removed from the newly constructed well by airlifting from the drilling rig, a process which blows air into the well to lift fluid out at the surface.[3] Any airlifted drilling fluid will be handled in the same manner as drilling fluid during drilling activities. This airlifting may also include swabbing the screened intervals with a swabbing tool to agitate the wall cake formed along the borehole walls, and could include the use of various downhole development tools if initial airlifting and swabbing are not effective. Once the drilling fluid has been removed, the drilling rig and associated equipment is demobilized from the pad.

A pumping rig (typically equipped with a crane/pully system) is brought to the pad to continue the development and support the aquifer testing of the well, if required. A pump is installed into the well with a discharge pipe (column pipe) extending to the surface. Depending on the size and anticipated discharge rates from the well, this early development discharge (turbid water) may be stored at the drill site or hauled to South32 Hermosa private land. Typically, later development water would be discharged into a local drainage with erosional support in place to dissipate discharge energy.[4] Once development is complete, aquifer testing is performed (also discharging to a local drainage) to determine optimal flow rates and identify aquifer response to pumping. Monitoring water levels and flow rates during well development and aquifer testing provide information to estimate aquifer characteristics such as hydraulic conductivity and storage properties. Aquifer testing can be specified for various time lengths ranging from several hours to several days. Longer testing provides greater understanding of aquifer characteristics at greater distances from the well. Once aquifer testing is complete, the test pump is removed from the well in anticipation for a permanent pump to be installed.

Other early activities that could occur on NFS lands before other Plan Operations begin include the installation of monitoring wells to satisfy state permitting requirements, as well as TARs needed to access the monitoring wells. Installation of monitoring wells would not occur before approval of this PoO by the Forest Service, but likely would occur before construction of TSF2, and could serve as long-term monitoring locations or points of compliance in accordance with state permitting requirements. Depending on the anticipated depth of the borehole, drilling a shallow monitoring well may require 2 to 4 weeks of drilling.

---

[3] Airlifting works by using a compressor on the drill rig to inject air into the center of the drill pipe. The resulting mixture of air and water in the center of the drill pipe is less dense than the drilling mud or water being circulated outside the drill pipe. The hydrostatic force from the denser fluid outside the drill pipe causes a mixture of drilling mud, water, and solid drill cuttings to be driven up the center of the drill pipe.

[4] Note that discharge of aquifer test water to the ground is typically allowable under Arizona regulations, under General Aquifer Protection Permit:: "A 1.04 General Permit allows any discharge from a facility that, for water quality sampling, hydrologic parameter testing, well development, redevelopment, or potable water system maintenance and repair purposes, receives water, drilling fluids, or drill cuttings from a well if the discharge is to the same aquifer in approximately the same location from which the water supply was originally withdrawn, or the discharge is under an AZPDES permit." (Arizona Administrative Code R18-9-B301.D). The discharge of aquifer test water to a surface drainage is also typically allowable under Arizona regulations, under the Arizona Pollutant Discharge Elimination System (AZPDES) General Permit for De Minimis Discharges to Protected Surface Waters (AZG2021-001).

- For more information in the PoO related to water management, see:
    - Section 4.4.8 – Continuation of monitoring during temporary cessation of operations
    - Section 5.3.3.3 – Decommissioning of GWM and monitoring wells
    - Appendix B – Stormwater management
    - Chapter 3 – Environmental Protection Measures
        - AQ8 – Fugitive dust management
        - WQ7 – Designing for climate change
        - WQ8 – Stormwater design standards
        - SR6 – Designing to reduce visual impacts
        - FW9B – Construction monitoring
        - FW9C – Low impact design
        - CR2 – Siting of facilities to avoid cultural resources
        - PS1-9 – Fire preparedness and prevention

2.3.2 Shaft, Decline, and Underground Infrastructure Development (Private Land)

2.3.2.1 Sulfide Portion of the Orebody

Prior to any mining under NFS land, there will be multiple years of underground exploration, development, and sulfide ore mining under South32 Hermosa private land. Development of infrastructure to support underground mining below South32 Hermosa private land is anticipated to take 2 to 3 years before ore production. The sulfide portion of the orebody will be accessed through two vertical shafts: the Main Shaft and a Ventilation Shaft. Both shafts are located on South32 Hermosa private land and will have a finished diameter of 25 feet and be lined with a 12-inch layer of concrete. The Main Shaft will be used for fresh air intake; access for personnel, materials, supplies, and equipment; hoisting waste rock and sulfide ore to the surface; fuel lines; power cables; and water columns (both service supply and return flow). The Ventilation Shaft will be used to return used air; as a secondary means of egress; for hoisting the initial development waste rock to the surface; and for initial access for equipment. Preparatory development activities include the simultaneous sinking of both shafts using conventional drill, blast, and vertical shaft loading methods.

Mine levels are referenced by elevation above mean sea level in feet (Levels), thus higher-number Levels are closer to the surface. Elevation above mean sea level is used because it allows greater accuracy than referencing depth, given that the surface elevation over the Project area can vary considerably. The Main Shaft will be approximately 3,000 feet deep and will include access to the orebody at the 3680, 2550, and 2390 Levels. The waste rock and ore loading facilities are located near the bottom of the Main Shaft, at the 2390 Level. The Ventilation Shaft will be approximately 2,700 feet deep and will include orebody access at the 3680 and 2550 Levels. [redacted]

Project activities on private land will also include the development of underground infrastructure prior to the use of production drifts and stopes during underground mining. Most underground infrastructure is located in close proximity to the two vertical shafts at the 3680, 2550, and 2390 Levels. A series of permanent development tunnels will connect these infrastructure facilities. Underground facilities below South32 Hermosa private land will include:

- Workshop facilities, fueling locations, and satellite workshop bays for fleet maintenance. Fuel will be delivered underground via vertical pipes placed in a borehole or the Main Shaft on South32 Hermosa private land. Fuel will be sent underground in batches to fill fuel tanks; no fuel will be stored in the pipes between batches. Keeping fuel lines empty when not transferring fuel is best practice for underground mining as it reduces the chances of accidental spills and fire hazards.

The fuel required for the underground will be stored in appropriately designed fuel tanks that are resupplied by the transfer pipes from the surface.

- Warehousing and storage
- Administrative facilities
- Battery charging bays for electric equipment
- Kitchen, offices, electrical, and tire bays
- Station development and laydown areas for logistics
- Excavations for substations, booster fans, explosives magazines, water dams, and pump stations
- Vent station
- Cemented paste backfill delivery system
- Emergency refuge chambers
- Shaft bins, shaft loading arrangements, conveyor and crusher chamber, crusher and loading equipment
- Materials handling system

Ventilation will be managed using a ventilation system that includes fans, ducting, ventilation connections, and vent raises which will be placed to ensure appropriate air flows to the ventilation connections. In addition to the Main Shaft (air intake) and Ventilation Shaft (exhaust), there will be three ventilation raises (two intakes, one exhaust) from the 3680 Level to the surface; these raises will be located on South32 Hermosa private land.

Development of the shafts and infrastructure to support underground mining will involve the delivery and use of explosives for underground blasting. Explosive storage and handling procedures are described further in Appendix C.

Once underground infrastructure is in place, sulfide ore extracted from under South32 Hermosa private land will be brought to the surface for beneficiation on South32 Hermosa private land. The details of all mineral production are described in Section 2.5.

- For more information in the PoO related to underground infrastructure and mining of the sulfide ore body prior to commencement of operations on NFS land, see:
    - Section 4.4.4 – Underground facilities during temporary cessation of operations
    - Section 4.4.5 – Beneficiation facilities during temporary cessation of operations
    - Section 5.3.3.3 – Decommissioning of beneficiation facilities
    - Section 5.3.3.4 – Closure of underground workings
    - Appendix C – Materials management
    - Chapter 3 – Environmental Protection Measures
        - AQ2, FW3, WQ4, CR1, SR3 – Underground mining
        - AQ7 – Engineered controls
        - AQ8 – Fugitive dust management
        - AQ9, FW9D, PS10 – Speed limit
        - SW5 – Hazardous material storage and disposal
        - SW6 – Hazardous material/explosive storage
        - SW9 – Appropriate fuel storage
        - FW8, CR5 – Remote operations

[redacted]

2.3.2.2 Oxide Portion of the Orebody

Prior to any mining under NFS land, there will be multiple years of underground exploration, development, and oxide ore mining under South32 Hermosa private land. Unlike access to the sulfide portion of the orebody, which uses vertical shafts, access to the oxide portion of the orebody will use a sloped decline tunnel. The portal to the decline and the decline itself will be on South32 Hermosa private land. The decline will be 16.5 feet high and 16.5 feet wide and will be constructed in phases. Initially, the decline will be driven a length of approximately 9,800 feet to reach the 3980 Level, in order to focus on high-grade ore zones located in the upper part of the oxide portion of the orebody. Eventually, the decline would be driven down to the 3130 Level in order to mine the lower part of the oxide portion of the orebody. The initial purpose of the decline will be for exploration, but it will remain in place and be converted to become the main access to the oxide portion of the orebody, and will be used for: fresh air intake; access for personnel, materials, supplies, and equipment; transportation of waste rock and oxide ore to the surface; power cables; and water columns (both service supply and return flow).

Initially, two vertical vent raises—along with the decline—will provide air intake and exhaust for the oxide portion of the orebody workings, with the deepest vent raise extending downward to the 3980 Level. An additional vent raise would be added later in the mine life as mining the oxide ore proceeds deeper. All vent raises will be located on South32 Hermosa private land.

Underground infrastructure will be developed before production drifts and stopes are used during underground mining of the oxide portion of the orebody. Underground infrastructure associated exclusively with the oxide portion of the orebody includes sumps and pumps for underground water management (major pumps around Level 4040 and 3200), secondary maintenance bays (around Level 4700), and a powder magazine (around Level 4200). All infrastructure will be located in close proximity to the decline, below South32 Hermosa private land. Underground facilities below South32 Hermosa private land will include:

- Secondary maintenance bays
- Excavations for substations, booster fans, explosives magazines, water dams, and pump stations
- Vent station
- Cemented paste backfill delivery system
- Breakroom
- Electrical and tire bays
- Emergency refuge chambers

Development of the decline and infrastructure to support underground mining will involve the delivery and use of explosives for underground blasting. Explosive storage and handling procedures are described further in Appendix C.

Once underground infrastructure is in place, oxide ore extracted from under South32 Hermosa private land will be brought to the surface for crushing and subsequent transportation in sealed containers. The details of mineral production are described in Section 2.5.

- For more information in the PoO related to underground infrastructure and mining of the oxide ore body prior to commencement of operations on NFS land, see:
  - Section 4.4.4 – Underground facilities during temporary cessation of operations
  - Section 4.4.5 – Beneficiation facilities during temporary cessation of operations

- Section 5.3.3.3 – Decommissioning of beneficiation facilities
- Section 5.3.3.4 – Closure of underground workings
- Appendix C – Materials management
- Chapter 3 – Environmental Protection Measures
  - AQ2, FW3, WQ4, CR1, SR3 – Underground mining
  - AQ5 – Transport controls and trip minimization
  - AQ7 – Engineered controls
  - AQ8 – Fugitive dust management
  - AQ9, FW9D, PS10 – Speed limit
  - SW5 – Hazardous material storage and disposal
  - SW6 – Hazardous material/explosive storage
  - SW9 – Appropriate fuel storage
  - FW8, CR5 – Remote operations

2.3.3 Surface Support Facilities (Private Land)

Prior to any ore beneficiation activities, aboveground support facilities will be constructed. These facilities will be constructed solely on South32 Hermosa private land.

Surface support facilities will include:

- Security gates and guard houses
- Operations control offices and mine/dry change house
- Employee and visitor parking areas
- Safety, training, and medical facilities
- Surface maintenance and storage areas
- Heavy/light vehicle repair shops
- Warehouse facility
- Weigh scale station
- Fuel storage and fuel station
- Truck wash-down area
- Explosive storage
- Shaft and hoist houses
- Refrigeration and ventilation systems
- Concrete batch plants
- Electrical substations and distribution and emergency generators
- Communications facilities
- Stormwater controls

All aboveground sanitary facilities will be constructed on South32 Hermosa private land. Sanitary facilities underground will consist of portable units, such as Eco-Lav, placed at strategic locations. Eco- Lav facilities are self-contained and full flushing. Units are serviced on a prescribed schedule by a small pump truck. Depending on the location within the mine, a local service provider would either enter the underground portion of the mine to service the units, or the units would be sent out to be pumped and cleaned on the surface. The exact service schedule will be based on capacities and hygiene requirements for workers (i.e., some units may be used more frequently than others and require more frequent servicing). Sanitary wastewater from surface and underground will be collected and hauled off-site for disposal at an appropriate licensed facility in accordance with state regulations. No solid waste facilities will be constructed; all solid waste will be hauled to appropriate landfills or facilities for disposal.

Equipment used for general site preparation and construction could include graders, loaders, bulldozers, excavators, backhoes, dump trunks, and water trucks.

- For more information in the PoO related to surface support facilities on South32 Hermosa private land, see:
  - Section 4.4.5 – Beneficiation facilities during temporary cessation of operations
  - Section 4.4.6 – Utilities during temporary cessation of operations
  - Section 4.4.7 – Security during temporary cessation of operations
  - Section 5.3.3.3 – Decommissioning of facilities
  - Appendix C – Materials management
  - Chapter 3 – Environmental Protection Measures
    - AQ8 – Fugitive dust management
    - SR6 – Designing to reduce visual impacts
    - FW9B – Construction monitoring
    - FW9C – Low impact design
    - CR2 – Siting of facilities to avoid cultural resources
    - PS1 to PS 9 – Fire preparedness and prevention

2.3.4 Material Characterization (Private and NFS Land)

There are generally three types of material that will be handled as part of the Project exploration, construction, and mining and require characterization to determine their geochemical and reactive properties:

- *Naturally occurring geologic materials.* This is in-situ rock broken in the mining cycle. Underground, this will be classified as either ore or waste rock (i.e., mine overburden) based on its economic value.
- *Tailings.* The tailings remaining after the beneficiation of sulfide ore contain unrecovered sulfides, acid-neutralizing carbonates, residual pyrite (iron sulfide, FeS_2), and other chemically unreactive materials.
- *Cemented Paste Backfill.* The cemented paste backfill provides structural support for the underground mine workings and binds the tailings in a structural mass that has substantially reduced chemical reactivity.

The characterization of rock and tailings associated with the Project began in 2016, continues to the present, and will continue throughout the life of mine. Data have been gathered specifically to inform material management strategies to avoid negative impacts associated with:

- acid weathering of sulfide mineral-containing rock and tailings (known as acid rock drainage), and
- metal leaching.

Methods used to characterize materials include:

- Acid-base accounting, including acid-generation potential, neutralization potential, neutralization potential ratio, and net neutralization potential
- Net acid-generating pH and analysis of metals released during testing
- Synthetic precipitation leaching procedure
- Meteoric water mobility procedure
- Humidity cell testing
- Leaching Environmental Assessment Framework [LEAF] diffusion test (U.S. Environmental Protection Agency Method 1315)

During operations, ore will be sent through the conveyance network to the beneficiation plant. Waste rock may be used underground to fill open voids and provide local stability,[5] or may be moved aboveground. Waste rock that is excavated and moved aboveground during construction of shafts, declines, drifts, and other underground workings will be characterized for the potential to generate acid when exposed to water (NPAG/PAG) and reactivity (inert/non-inert)[6] as it is developed. Waste rock brought to the surface and identified as PAG will be placed in the lined TSF1. Waste rock brought to the surface and identified as NPAG will be placed in NPAG stockpiles on South32 Hermosa private land and may be used for construction activities or for armoring or top cover on TSF1. Once Plan Operations begin on NFS land, waste rock would be handled in a similar manner, with placement of PAG waste rock in TSF2 and NPAG used for construction activities or for armoring or cover on TSF2. When NPAG stockpiles on South32 Hermosa private land are at design capacity, NPAG may be placed in TSF2. More discussion of the handling of waste rock during mining is included in Section 2.5.7.4.

2.4 EXPLORATION ACTIVITIES (NFS LAND)

Surface and underground exploration originating on NFS lands is described below.

2.4.1 Surface Exploration (NFS Land)

2.4.1.1 Exploration Drilling

South32 Hermosa has identified locations for up to 26 surface exploration drill pads on unpatented lode claims owned by South32 Hermosa on NFS land, each pad being approximately 150 × 150 feet in size. The purpose of this exploration drilling is further defining the orebody and confirming existing mineralization. Access to the exploration drill pads would be via a number of new short-term temporary access roads (ST-TARs) as shown in Figure 2-4 and described in Section 2.4.1.2, as well as a number of

[5] Waste rock used as fill underground is statutorily exempt from the Arizona aquifer protection program: “The following are exempt from the aquifer protection permit requirement…Mining overburden returned to the excavation site, including any common material that has been excavated and removed from the excavation site and that has not been subjected to any chemical or leaching agent or processing of any kind.” (Arizona Revised Statutes 49-250.B.5).

[6] The definition of inert material is found in Arizona Revised Statutes 49-201.22. “’Inert material’ means broken concrete, asphaltic pavement, manufactured asbestos-containing products, brick, rock, gravel, sand, and soil. Inert material also includes material that when subjected to a water leach test that is designed to approximate natural infiltrating, waters will not leach substances in concentrations that exceed numeric aquifer water quality standards established pursuant to Section 49-223, including overburden and wall rock that is not acid generating, taking into consideration acid neutralization potential, and that has not and will not be subject to mine leaching operations.

existing Forest Roads as described in Section 2.5.11 and Appendix A. Existing Forest Roads to be used include:

- Forest Road 4687 (Hermosa Road)
- Forest Road 5518
- Forest Road 5519
- Forest Road 5521

At each drill pad, up to 10 exploration holes may be drilled in multiple directions, depending on the results of the core analyses. The average depth of drill holes would be about 3,500 feet. All holes would be drilled using diamond core drilling. Diamond core drilling involves advancing a diamond-impregnated steel bit into the earth vertically or at an angle and retrieving the intact drilled core at regular intervals. Retrieval of the core is achieved by retracting the core barrel (or tube) via wire-line, either at 5-foot intervals (for 5-foot core barrels) or 10 foot intervals (for 10 foot core barrels). This type of drilling will be performed using a Boart-Longyear LFTM 90 (or equivalent) diamond core drilling rig. The diamond-impregnated core bit spins at a high rate of speed and requires water to cool and lubricate the core bit and to flush cuttings (ground up rock fragments) from the drillhole. All boreholes would be drilled by a drilling contractor licensed by the Arizona Department of Water Resources.

Excess cuttings, drilling mud, and drilling products generated during drilling activities would be temporarily stored in a 300-gallon solids removal unit or on a lined containment area on the pad. At the completion of drilling activities at each pad, the drilling mud, products, and water would be removed from the solids removal unit via hydro-vac. These materials, including excess cuttings, would be removed and managed either in TSF1 or TSF2 in accordance with applicable state and federal laws.[7]

Each drill site would include the borehole location(s), a drill rig, freedom loader (allows for hands-free rod handling), flat tank drill rod truck, pad access and parking areas for support vehicles, a 300-gallon solids removal unit, up to two 5,000-gallon water storage tanks, a 1,500-gallon mixing tank, a 300-gallon injection tub for mixing drilling product, a lined and fenced sump (generally 12-foot by 10-foot, and 10-feet deep), a light plant, portable bathroom, drilling mud and product bags, hydrocarbon storage and containment, spill response supplies, personal and safety supplies and gear, spare parts, and tools. The hydro-vac truck would only be brought to the drill site when needed. A typical exploration drill pad layout is shown in Appendix E. Actual dimensions and layout would vary slightly based on the specific pad.

Water for exploration would be treated water sourced from the mine site; WTP1 and WTP2 are required to meet the most stringent of applicable Arizona surface water and aquifer water quality standards. Roughly 1,000 to 14,400 gallons of water would be used per shift per rig (each shift is 12 hours in duration). Water usage will vary based on drill fluid circulation within the drill hole. Drill fluid circulation can range from 100% return to 0% return due to rock conditions within the drill hole. Competent, solid rock could have 100% circulation (no water loss to the formation) and water usage would be around 1,000 gallons per shift. In drill hole conditions with broken, fractured, or faulted rock, circulation could be 0%. This would require constant drill fluid mixing and the full 14,400 gallons of water per shift.

[7] Applicable laws may include the following: 1) the federal Resource Conservation and Recovery Act and all implementing regulations pertaining to the regulation of solid and hazardous waste. These rules include requirements found in 40 CFR 260–280; 2) the Arizona Solid Waste Statute and all applicable regulations found at 18 Arizona Administrative Code 13; 3) the Arizona Hazardous Waste Statute and all applicable regulations found at 18 Arizona Administrative Code 08; 4) the Arizona Water Quality Statute and any applicable regulations, including the APP requirements found at 18 Arizona Administrative Code 09; and 5) the Federal Toxic Substances Control Act and any applicable regulations including the 40 CFR 761 requirements.

The sump dimensions could vary depending on the borehole characteristics, and would be emptied periodically using a hose connected to a vacuum truck or vacuum trailer. The frequency of emptying the sump depends on the specific hole and the size of the sump. At a minimum, the sump would be emptied once for each borehole, but may be emptied multiple times.

Portable bathrooms would be serviced by a licensed septic company approximately twice per week, using a service truck (F-450 or F-550 size pickup, or equivalent).

No external power sources would be required; the light plants would have internal power sources (built-in generators).

Drill pads would be constructed with berms or stockpiles being placed nearby to store growth media and slash (brush trimmings) for reclamation. Vegetation removed may include trees and brush, and would be used for mulching, erosion control, and reclamation. Nearby trees and woody vegetation may be trimmed if needed for equipment access. Stockpile sizes would vary depending on the amount of growth media or vegetation present that must be removed. Regardless of the size, the stockpiles would be placed adjacent to the drill pads in as close proximity as possible based on the surrounding topography. The pad layout would be optimized based on each specific location to minimize disturbance and vegetation removal while ensuring that directional drilling can be completed. Drilling materials and supplies would vary depending on conditions, but in general include fuel/lubricants for vehicles and equipment, various additives and drilling mud, and materials necessary for proper closure (bentonite or cement). Variation in additives and drilling mud occurs due to circulation and hole quality. Worse quality holes generally need more product and drill muds.

Typical storage and containers for drilling additives on a drill pad are shown in Figure 2-13. The types shown are typical examples of additives and the general types of containers used, but are not exclusive of the specific additives that could be selected. The examples shown include:

- A shale and clay inhibitor, meant to minimize sticky or soft cuttings, which can increase the potential for excess torque and drag on the drill bit.
- A polymer product used to improve filtration control (i.e., reduce water loss to the formation), without causing excessive viscosity in the drill mud. Using a polymer additive supports borehole stability, promotes formation of a proper filter cake, improves core recovery and penetration rates, and reduces drilling friction.
- A bentonite-based product used to improve filtration control, control viscosity of the drill mud, and support borehole stability.

Figure 2-13. Typical containers and storage of drill mud additives on exploration drill pad.

Fuel would be stored on the drill pads in 5-gallon steel safety cans. These cans will be kept in secondary containment that can hold 110% of the largest container volume.

The locations of the exploration drill pads are shown on Figure 2-1. Based on reconnaissance surveys conducted within the exploration area, drill pad locations were identified to minimize overall disturbance to NFS land and surface resources. Consideration was given to the location of the proposed drill pads, the nature of the surrounding terrain and topography, the condition of existing access, and the constraints of the equipment required for the exploratory drilling.

The anticipated workforce during exploratory drilling would consist of approximately:

- 18 personnel working on road and drill pad construction, maintenance, and reclamation,
- 3 personnel per drill rig during active drilling;
- 10 to 12 personnel for supervisory activities; and
- 7 personnel for auxiliary activities such as downhole surveys or portable bathroom maintenance.

At maximum, the exploratory workforce at any one time, assuming 10 drill rigs running at once, would be approximately 70 people.

The equipment to be used for exploratory drilling would be determined at the time of initiation, based on equipment availability, site conditions, and in consultation with drilling contractors. Equipment would be mobilized using appropriate transfer truck (such as flat beds or low boys) and unloaded on South32 Hermosa private land. Once unloaded, the equipment would be driven, tracked, or trammed to the drill site along the roads shown in Figure 2-1. Supplies would be transferred from laydowns on South32 Hermosa private land to the drill pads via pickup truck, flatbed trailer or truck, or forklift. Construction of the road and drill pad would use typical construction equipment, including:

- For drill pad construction, maintenance, and reclamation: bulldozers, excavators (including hammer attachments), blades, loaders, water trucks, over-the-road dump trucks, haul trucks, and hydroseeders;
- For drilling support and water distribution support: LV-90, 260, or 230 drill rigs (or equivalent), rod handler/freedom loaders, rod trucks, gannons, hydro-vac trucks, telehandlers or reach forklifts, and water trucks;

- For equipment and logistical support, service/mechanic trucks, lube/oil trucks, generators, light plants, light duty trucks, flatbed trailers, forklifts, and backhoes;

With respect to schedule for exploratory drilling, it is anticipated that it would take approximately one week to install stormwater and erosion controls, and two weeks to construct 500 feet of ST-TAR and a typical exploratory drill pad, though construction time will depend on the ST-TAR length and topography and the pad location. Drilling and abandonment of exploratory boreholes would take from 2 to 18 months. Once a drill pad is no longer needed, it is anticipated that it would take three weeks to reclaim 500 feet of ST-TAR and the drill pad. Reclamation time will depend on the ST-TAR length, topography, and the pad location.

2.4.1.2 Exploration ST-TARs

Some improvement on existing Forest Roads would be required to allow access for drilling, excavation, and support equipment. Where possible, improvement would be limited to activities that can be conducted within the disturbed area of the existing roadbed (e.g., grading, vegetation trimming, and berm improvements) and would not be considered new disturbance. However, based on existing road conditions, some existing roads likely would require improvement beyond the existing disturbed area. These areas are shown on Figure 2-1 and disturbance is included in Table 1-2, based on an estimated disturbance width of 30-feet (same as other ST-TARs). It is recognized that some of this area is already disturbed by the existing road.

The ST-TARs use would be limited to use by South32 Hermosa, selected drilling and support contractors, and Forest Service personnel, and would not be open for motorized public use. Access to the ST-TARs would be controlled with a temporary entrance gate and signage. ST-TAR construction and improvements would be conducted with best management practices in place to ensure road stability and safety, and to minimize environmental impacts (see Appendix B). ST-TARs would be 13 feet wide with an estimated 30- foot disturbance width to account for cut and fill. Where cut-and-fill slopes are needed for ST-TARs they would be constructed using standard techniques to minimize both the volume of material moved and the area of new surface disturbance. Where the ST-TAR could be located on previously disturbed land, construction would consist of vegetative clearing with little to no earthen excavation or fill. ST-TARs would be constructed using a Caterpillar D6 dozer (or equivalent) and/or John Deere 180 Track Excavator (or equivalent). ST-TAR construction would include vegetation clearing, grading and leveling the roadway. An excavator may be used to extract large boulders if necessary. No drilling or blasting would be used for ST-TAR construction.

Drainage components of ST-TARs would be kept at a minimum because the roads are temporary and would be reclaimed after drilling operations at each associated drill pad are complete. Roadways would be sloped for drainage to reduce erosion, and water bars or rolling dip cross drains would be installed where necessary to prevent concentration of runoff.[8] Specific locations of water bars or rolling dips would be determined in the field based upon actual water flow patterns observed in the local watershed, rainfall intensity, road surface erosion characteristics, and available erosion resistant outlet areas. Berms would not be created along the side of the ST-TARs in order to allow sheet flow to leave the roadway rather than create an eroded channel alongside the road. If needed, additional temporary sediment control measures like silt fences or wattles could be used at locations determined in the field to require additional erosion protection.

The locations of the ST-TARs for accessing exploration drill pads are shown on Figure 2-1. Based on reconnaissance surveys conducted within the exploration area, access route alignments were identified to

[8] A water bar is a mound or hump of earth placed across a roadway. Water bars are used to deflect run-off from the road surface. A rolling dip cross drain is a slight depression built into the road surface that allows water to run from one side of the road to the other. Rolling dip cross drains typically allow water to move without erosion of the road while allowing vehicles to maintain normal speeds.

minimize overall disturbance to NFS land and surface resources. Consideration was given to the location of the proposed ST-TAR alignments, the nature of the surrounding terrain and topography, the condition of existing access, and the constraints of the equipment required for the exploratory drilling.

2.4.1.3 Closure, Abandonment, and Reclamation

After completion, all boreholes would be filled or closed appropriately (known as "abandonment") in compliance with Arizona Department of Water Resources regulations. The specific abandonment procedures are dictated by the conditions encountered in the field. In general, where a borehole may penetrate multiple saturated and permeable zones, care is taken to seal the borehole to prevent any migration of water between different zones via the borehole. This is accomplished by using a sealing material that is no more permeable than the geologic formation (often in the absence of better information, a hydraulic conductivity of 10^{-7} centimeters per second is targeted for sealant materials). Materials considered acceptable by the Arizona Department of Water Resources for sealing boreholes during abandonment include cement grout (including neat cement grout and cement bentonite grout), high-solids bentonite grout (granular or powder mixtures) with a minimum of 15% solids by weight, or high-solids bentonite chips or high-solids bentonite pellets.

Materials or mixtures must be emplaced under sufficient pressure to fill all voids and displace any water from the borehole. A tremie pipe typically is used to emplace the grout from the bottom of the borehole upwards, with the end of the tremie pipe remaining in close proximity to the rising grout surface as the grout is pumped into the well. Any well casings—which would not be present for boreholes—also have to be perforated or removed to allow grout to fill the space between the casing and the formation.

Following the completion of exploration drilling activities at each drill pad, all materials (including equipment, pipes, culverts, riprap, tank, lubricants and other products, cores, plastic sheeting, and any other supplies) would be removed. Drilling mud and associated water would be removed via hydro-vac when drilling activities are completed. Drillhole abandonment would be conducted as described above. Each drill pad and any associated ST-TAR would be regraded to approximately match the surrounding topography and promote seed germination. All disturbed areas would be scarified to loosen compacted areas, promote water infiltration, and improve soil aeration and root penetration prior to the replacement of native soils. Prior to seeding, the seed beds would be prepared by breaking up surface crusts and ensuring that the soil is left in a roughened, de-compacted condition favorable to the retention and germination of the seed. Drill pads and ST-TARs would be seeded in accordance with Coronado National Forest guidelines using approved weed-free seed mixes using native species, described in Section 5.3.3.7. Hand broadcasting, hydroseeding, and/or rangeland seed drill may be used.[9] After reclamation, the ST-TAR alignments would be closed to the public using measures approved by the USFS (i.e., with berms or boulders).

Any drill pad disturbance left open and not active for more than 14 days would be subject to interim reclamation activities (such as installation of stormwater controls, stabilization, or seeding) as described in Section 5.3.1.

As noted in Section 2.4.1.1, up to 10 exploratory drill holes could be drilled from a single drill pad. In general, individual drill holes will be abandoned once they are drilled. At times, due to geology intersected in the borehole, it may be beneficial to leave a drillhole open until drilling is complete for the entire pad. This would be the case if the borehole might need to be re-entered at a later date to extend the

[9] Hand broadcasting is a seeding method useful for small areas and involves personnel tossing seed by hand from a small container or bucket. Hydroseeding is useful to obtain even coverage over wider areas, uses hydraulic pumps and nozzles to spray a slurry onto the ground. The slurry is commonly made up of grass seeds, mulch, water, fertilizer, other biostimulants, and occasionally green dye. A rangeland seed drill is a mechanical device that places seeds in shallow furrows cut by disc as it traverses the ground to be seeded.

hole or wedge off of the hole. If needed, open boreholes would be temporarily capped (with a secured metal plate or similar) to prevent access.

Aside from the TSF2 exploration sites (see Section 2.4.1.5), it is anticipated that 10 or more exploration drill pads could remain active simultaneously, depending on the exploration targets.

2.4.1.4 General Sequence and Timing of Operations for Exploration

The general order of each sequence of operations during road construction, exploration drilling, and reclamation of the surface exploration is:

- Install sediment controls (such as wattles, silt fences, water bars, rolling dip cross drains, etc.);
- Complete improvements on existing Forest Roads;
- Clear and grub ST-TAR alignments and drill pads (including stockpiling growth media and slash from brush clearing adjacent to or in the immediate vicinity);
- Construct ST-TARs;
- Evaluate and install additional sediment controls as needed (similar in nature to those described in the first bullet above);
- Construct exploration drill sites, transport equipment and supplies to the sites, and set up equipment;
- Drill, sample, and log the exploration boreholes;
- Complete/close the exploration boreholes;
- Remove equipment from the exploration drill sites; and
- Reclaim exploration drill pads and associated ST-TARs. Note that drilling on any given pad may occur in phases and not at the same time. If this is the case, the drill pad may remain open and unreclaimed until all planned drilling activities on that pad are completed; however if the pad is inactive for more than 14 days, interim reclamation would conducted. Interim reclamation is described in Section 5.3.1 and is intended to stabilize the surface and prevent erosion. This may be accomplished through installation of stormwater and sediment controls, recontouring, and/or revegetation (such as seeding).

Up to 10 drill pads on NFS land could be active in the first 1-3 years while TSF2 is being investigated and constructed, with additional rigs working on private land as well. Once underground bays are developed, most exploration activities would likely shift underground as described in Section 2.4.2.

2.4.1.5 TSF2 Exploration Sites

In addition to the 26 exploration drill pads shown on Figure 2-1, there would be an additional set of drill pads (approximately 17 total) within the footprint of the future TSF2 and the TSF2 UDCP disturbance. These exploration boreholes would be advanced prior to construction of TSF2 and the TSF2 UDCP for the purposes of geotechnical investigation and, if necessary, to further verify the presence of valuable minerals in conjunction with other provided information. This confirmatory exploration drilling would use the same procedures and techniques as described throughout Section 2.4.1. Because there may be a delay between completion of the exploration drilling and construction of TSF2 and TSF2 UDCP, interim reclamation described earlier in this section and in Section 5.3.1 would take place, even though these locations are within the footprint of planned future disturbance. If the exploration drilling in the area of TSF2/TSF2 UDCP revealed non-mineral characteristics, mill site claims would be located prior to construction and operation of TSF2 and TSF2 UDCP.

Access for the borings within the footprint of TSF2 would use existing roads and long-term temporary access roads (LT-TARs) as shown on Figure 2-20. Any additional access routes would be within the disturbance footprint of TSF2 and are not specifically shown. Existing Forest Roads to be used include:

- Forest Road 49-1.57R-1
- Forest Road 5518
- Forest Road 5519

Given the intensive nature of the TSF2 exploration, it is anticipated that all 17 exploration drill pads within the footprint of TSF2 could remain simultaneously active.

- ➢ For more information in the PoO related to surface exploration, see:
    - Section 5.3.2 – Concurrent reclamation
    - Appendix A – Roads plan
        - Section 4.2 – Design and construction of ST-TARs
        - Section 5.2 – Construction methods for ST-TARs
        - Section 6.2 – Maintenance of ST-TARs
    - Appendix C – Materials management
    - Appendix E – Exploration Drill Pad Typical Layout
    - Chapter 3 – Environmental Protection Measures
        - AQ8 – Fugitive dust management
        - WQ11 – Off-road travel
        - WQ14, SR10, FW11 – Access route alignments
        - SW7 – Preparation of Spill Prevention, Control, and Countermeasures Plan
        - SW8 – Refueling operations
        - SR6 – Designing to reduce visual impacts
        - SR9, FW10 – Concurrent reclamation
        - FW9B – Construction monitoring
        - CR2 – Siting of facilities to avoid cultural resources
        - PS1 to PS9 – Fire preparedness and prevention

2.4.2 Underground Exploration (NFS Land)

Multiple types of samples would be collected underground to further define the orebody, confirm existing mineralization, and provide short-term operational information to optimize day-to-day mining and beneficiation. Drill chip samples would be collected at the mine face during the construction of declines, ramps, and the top and bottom cuts of stopes. These samples would be collected from drill cuttings created during the development. Geological samples would also be collected during production drilling within the stopes before placement of blast holes and blasting.

Underground drilling to take bulk samples and further define the orebody or discover additional ore extensions would also occur separate from the operational sampling. This drilling would take place from within dedicated drilling bays underground. Where feasible, the drilling bays would coincide with existing underground muck[10] bays, depending on availability and location. Drill bays are typically 60 feet long, 15 to 20 feet wide, and 18 feet tall, with structural supports and safety protection, including bolts, mesh,

[10] "Muck" is a mining term that refers to ore or rock that has been broken by blasting.

and shotcrete. Temporary air, water, and power are supplied to the bay prior to drilling, and discharge piping may be put in place to remove cuttings and debris.

The underground drilling equipment would be roughly 10 feet by 5 feet in size, with an additional area taken up with cribbing (temporary wooden supports installed to level and support equipment). Auxiliary equipment includes rod racks, 250-gallon plastic mud mixing tanks (roughly 4 feet in diameter), and tractors or other means to transport equipment and crew and help place the drilling equipment.

2.5 UNDERGROUND MINING AND SUPPORTING OPERATIONS (PRIVATE AND NFS LAND)

[redacted] [redacted]

[redacted]

Mining of both the sulfide and oxide portions of the orebody below South32 Hermosa private land, and beneficiation of sulfide ore on South32 Hermosa private land, will commence after the development of the underground infrastructure described in Section 2.3 and sufficient waste rock is removed to access the orebody.

Upon approval by the Forest Service and notice to proceed, the geotechnical investigation and construction of TSF2 would begin, and underground mining beneath NFS land would occur. [redacted] After TSF2 construction is complete, materials deposition would shift from TSF1 to TSF2 when needed.

Mining of the sulfide and oxide portions of the orebody will take place concurrently. [redacted] During the period when only the oxide portion of the orebody is being mined, tailings deposited at both TSF1 and TSF2 may be reaccessed and removed from those facilities for use in cemented paste backfill underground in completed stopes associated with the oxide portion of the orebody. This is necessary because beneficiation of oxide ore occurs at a facility on private land distal from the Project, and no tailings will be produced at the Project location or placed in the TSFs after the sulfide portion of the orebody is mined out and beneficiation of sulfide ore ceases.

[redacted]

2.5.2 Anticipated Operations Schedule (Private and NFS Land)

Operations at the Project are anticipated to occur for 24 hours per day, 365 days per year, with periodic maintenance or other operational suspensions. Typically, the workforce operates on a three-shift basis, with crews rotating between day shift, night shift, and rostered days off. Typical underground blasting operations happen on average twice per day. Anticipated workforce and traffic trips vary depending on the phase of the Project and are discussed more in Section 2.5.11.6.2. Typical surface blasting operations (during construction of the Primary Access Road and TSF2) are estimated to occur two or three times per week.

[11] "Tonne" is also known as a "metric ton", equal to 1,000 kilograms or about 2,200 pounds. A kilotonne is equal to 1,000 tonnes.

[redacted]

2.5.3 Progression of Underground Mining (Private and NFS Land)

2.5.3.1 Sulfide Portion of the Orebody

The main infrastructure to support underground mining described in Section 2.3, such as the Main Shaft and Ventilation Shaft, will be on South32 Hermosa private land; initial stages of mining and ore production also occur beneath South32 Hermosa private land only. Upon approval of this PoO and notice to proceed from the Forest Service, additional infrastructure would be constructed to extend the lateral development tunnels and infrastructure below NFS land.

As part of the mining process beneath both South32 Hermosa private land and NFS land, temporary tunnels called production drifts are constructed from the development tunnels to access the orebody. The production drifts are used for long-hole drilling, access to stopes, and ore haulage. The production drifts generally are constructed in sublevels with 90 vertical feet between sublevels, and with sublevels connected with ramps. The sublevels allow for access to both the top and bottom of stopes (described further in Section 2.5.4). Stopes are further designated as primary and secondary stopes. Primary stopes will be mined first, and when complete, will be filled with cemented paste backfill (see Section 2.5.7.3) or waste rock (see Section 2.5.7.4). The secondary stopes are interspaced with the primary stopes and are only mined once the primary stopes are filled and structurally supported. These secondary stopes are anticipated to be filled primarily with waste rock.

[redacted]

In addition to stopes, ramps, and production drifts, other underground workings at sublevels beneath NFS land include rock passes, ventilation connections, refuge bays for employee emergency safety, battery bays, electrical bays and substations, logistics laydown areas, ventilation booster fans, water dams and sumps for underground water management, paste delivery equipment, muck bays for development activities, and drill bays for exploration drilling.

Ore is expected to be mined concurrently across multiple mining areas or faces in a phased fashion to target higher-grade mineralization early in the mine life. Ultimately, South32 Hermosa is planning for an all-electric vehicle fleet at the Project for hauling to reduce noise; improve working conditions, safety, and health; and support delivery of South32's operational greenhouse gas reduction targets and goals. To support future autonomous haulage and electrification, the development tunnels would eventually include an autonomous haul loop. The autonomous haul loop would be located on the 2550 Level and generally circles the entirety of the underground workings, below both South32 Hermosa private land and NFS land (see Figure 2-12). The design of the autonomous haul loop would not change whether the vehicles are powered by diesel or battery; only the service bays along the haul loop would have different purposes (i.e., refueling/lube for diesel and charging for battery). Once hauled underground, sulfide ore will be crushed underground beneath South32 Hermosa private land, and material will be hoisted to the surface on South32 Hermosa private land.

There is currently no specific timeline for transitioning to an all battery electric fleet in the mine. Some battery electric vehicles will be used immediately (loaders for production mucking in the stopes). Implementation for other vehicles will be based on the maturity and feasibility of the available equipment from manufacturers, as well as the replacement schedule of any diesel fleet. Specifically, before full implementation of battery electric vehicles, the equipment will need to be able to meet the haulage distances and productivity demands. The design contained in the PoO incorporates design elements that will facilitate the transition to an all battery electric vehicle fleet at the appropriate time. This transition is anticipated to occur through a stepped approach.

- For more information in the PoO related to underground infrastructure and mining of the sulfide ore body, see:
    - Section 4.4.4 – Underground facilities during temporary cessation of operations
    - Section 5.3.3.4 – Closure of underground workings
    - Appendix C – Materials management
    - Chapter 3 – Environmental Protection Measures
        - AQ2, FW3, WQ4, CR1, SR3 – Underground mining
        - AQ7 – Engineered controls
        - AQ8 – Fugitive dust management
        - SW5 – Hazardous material storage and disposal
        - SW6 – Hazardous material/explosive storage
        - SW9 – Appropriate fuel storage

2.5.3.2 Oxide Portion of the Orebody

As noted in Section 2.3, the oxide portion of the orebody (manganese) is accessed using a decline from South32 Hermosa private land that will eventually extend to Level 3130. Initial stages of mining and production first occur beneath South32 Hermosa private land. Additional lateral development tunnels would be constructed to extend workings below NFS land upon approval of this PoO and notice to proceed from the Forest Service.

Mining activities for the oxide portion of the orebody are very similar to those for the sulfide portion of the orebody. Beneath both private and NFS land, temporary tunnels called production drifts are constructed off the development tunnels to access the orebody. The production drifts are used for long-hole drilling, access to stopes, and ore haulage. Generally, the production drifts are constructed in sublevels, with 60 vertical feet between sublevels in the oxide portion of the orebody.

The oxide ore extends from the near-surface down to approximately the 3130 Level. Mining of the stopes in the oxide portion of the orebody generally begins with the stopes near the center of the orebody, then moves upward to the shallower stopes, then finally downward to the deepest stopes (approximately 2,000 feet below ground surface). [redacted]

In addition to stopes and production drifts, other underground workings at sublevels beneath NFS land include ventilation connections, refuge chambers for employee emergency safety, electrical bays and substations, ventilation booster fans, water dams and sumps for underground water management, paste delivery equipment, muck bays for development activities, and drill bays for exploration drilling.

As with the sulfide portion of the orebody, oxide ore is expected to be mined concurrently in multiple mining areas through phases, targeting higher-grade mineralization early in the mine life.

Oxide ore will be hauled from the underground decline using haul trucks to a hopper feeding a primary crusher station on South32 Hermosa private land (Figures 2-15 and 2-16). Once aboveground, oversized material is to be reduced in size using a hydraulic impact rock breaker before entering the primary crusher. Some ore may be temporarily stockpiled in a run-of-mine (ROM) stockpile before being fed to the crusher.

Ore from the primary crusher is transported by a crushed ore transfer conveyor to a crushed ore silo. A water spray-type dust suppression system will be provided on the primary crusher station feed hopper. The crusher and crushed product discharge chute to the transfer conveyor and coarse ore silo is serviced with a dust collection system using a fan and baghouse. Ore from the crushed ore silo will be loaded into sealed containers on transportation vehicles from the discharge gate of the crushed ore silo. The crushed ore will then be trucked across NFS land to a facility on private land distal from the Project for beneficiation. The beneficiation facility is anticipated to be in Santa Cruz County on private land distal from the Project. Once crushed oxide ore leaves NFS land, it will not again enter NFS land either before or after beneficiation.

Oxide ore is planned to be transported in fully sealed containers. While the specific containers have not been selected, such containers are commercially available and widely used in train, ship, and truck transport for a variety of goods, including to ship mine products and grain. These containers are sealed at the site, loaded onto trucks, and the containers remain sealed until arriving at the destination for unloading. This eliminates spillage, dust, and reduces the potential release of material during an unexpected event or accident during transportation. In the event that an accident occurred and oxide ore was released, an emergency response and clean-up crew would be mobilized. Material would be contained and removed with guidance from any applicable regulators, including the Forest Service, if occurring during transportation across NFS land. Generally speaking, a spill of ore material would not be difficult to mitigate. As a solid material, migration from the accident site would not occur and simple excavation and removal of the spilled material would remedy any potential exposure risks to humans or the environment.

Ultimately, to support South32's operational greenhouse gas reduction goals, South32 Hermosa is planning for an all-electric vehicle fleet for over-the-road transport from the Project to the beneficiation facility on private land distal from the Project.

- For more information in the PoO related to underground infrastructure and mining of the oxide ore body, see:
  - Section 4.4.4 – Underground facilities during temporary cessation of operations
  - Section 5.3.3.4 – Closure of underground workings
  - Appendix C – Materials management
  - Chapter 3 – Environmental Protection Measures
    - AQ2, FW3, WQ4, CR1, SR3 – Underground mining
    - AQ7 – Engineered controls
    - AQ8 – Fugitive dust management
    - SW5 – Hazardous material storage and disposal
    - SW6 – Hazardous material/explosive storage
    - SW9 – Appropriate fuel storage

Figure 2-15. Flowsheet for oxide (manganese) ore crushing and transfer.

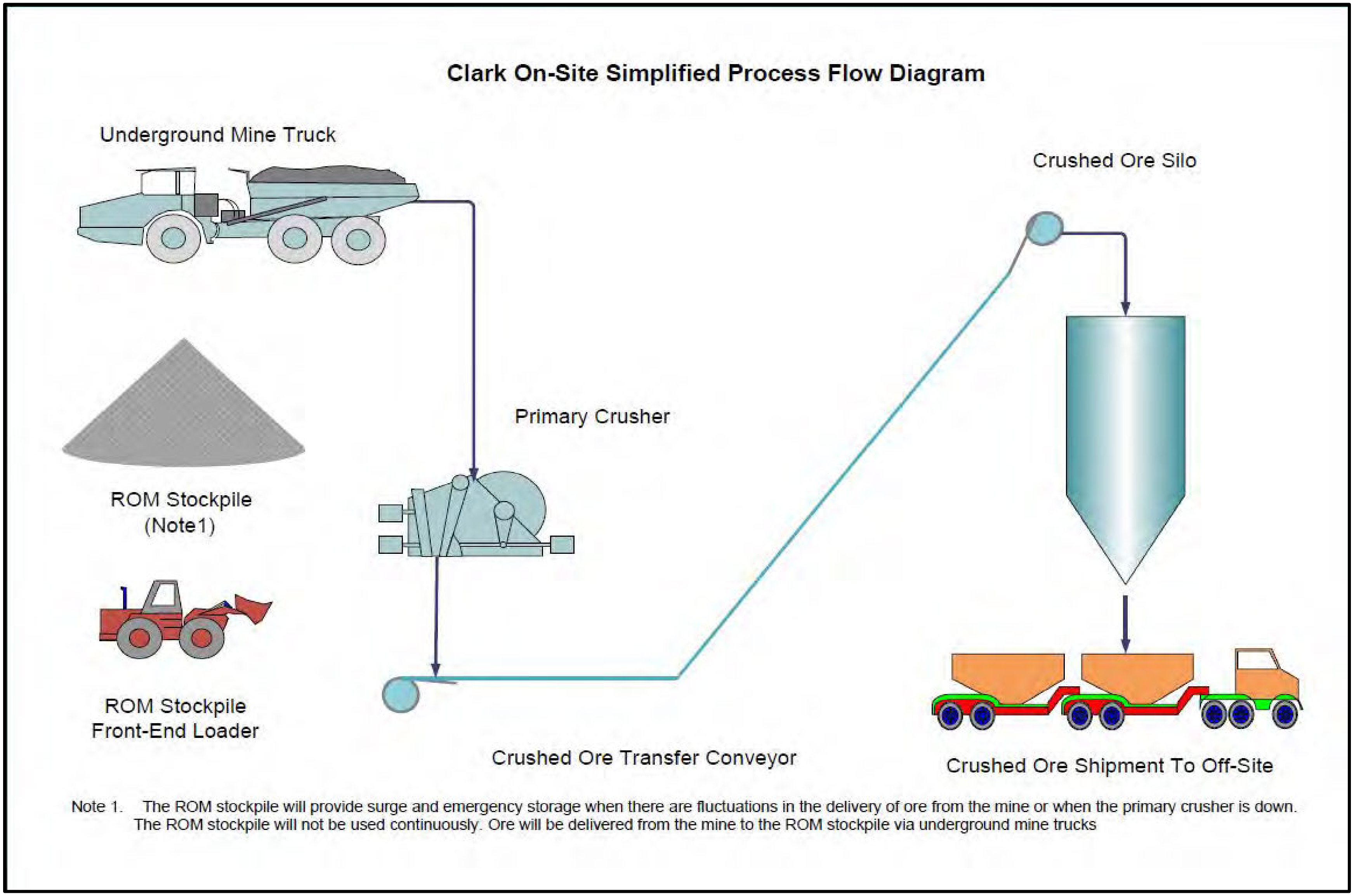
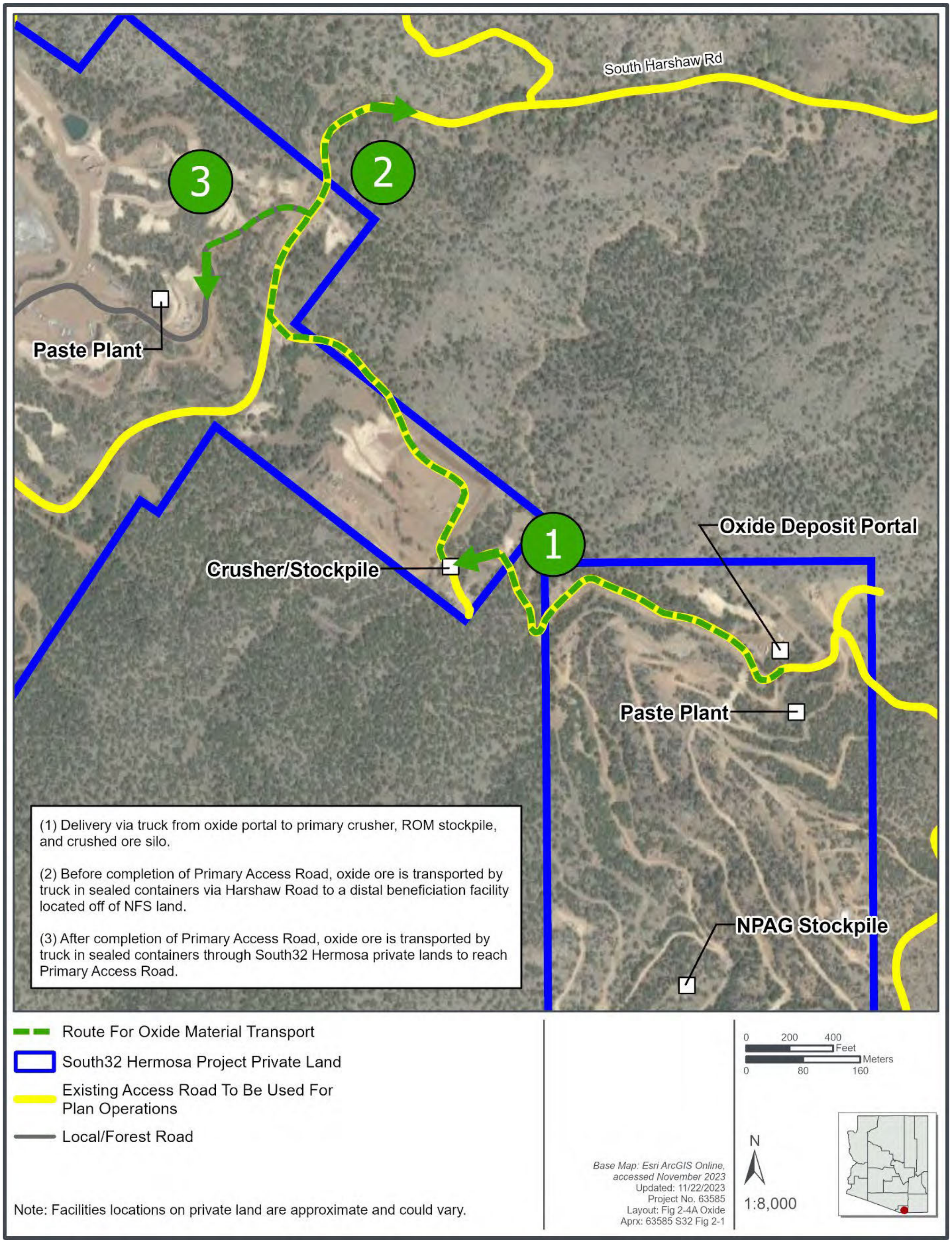


Figure 2-16. Plan view for oxide (manganese) ore crushing and transfer.



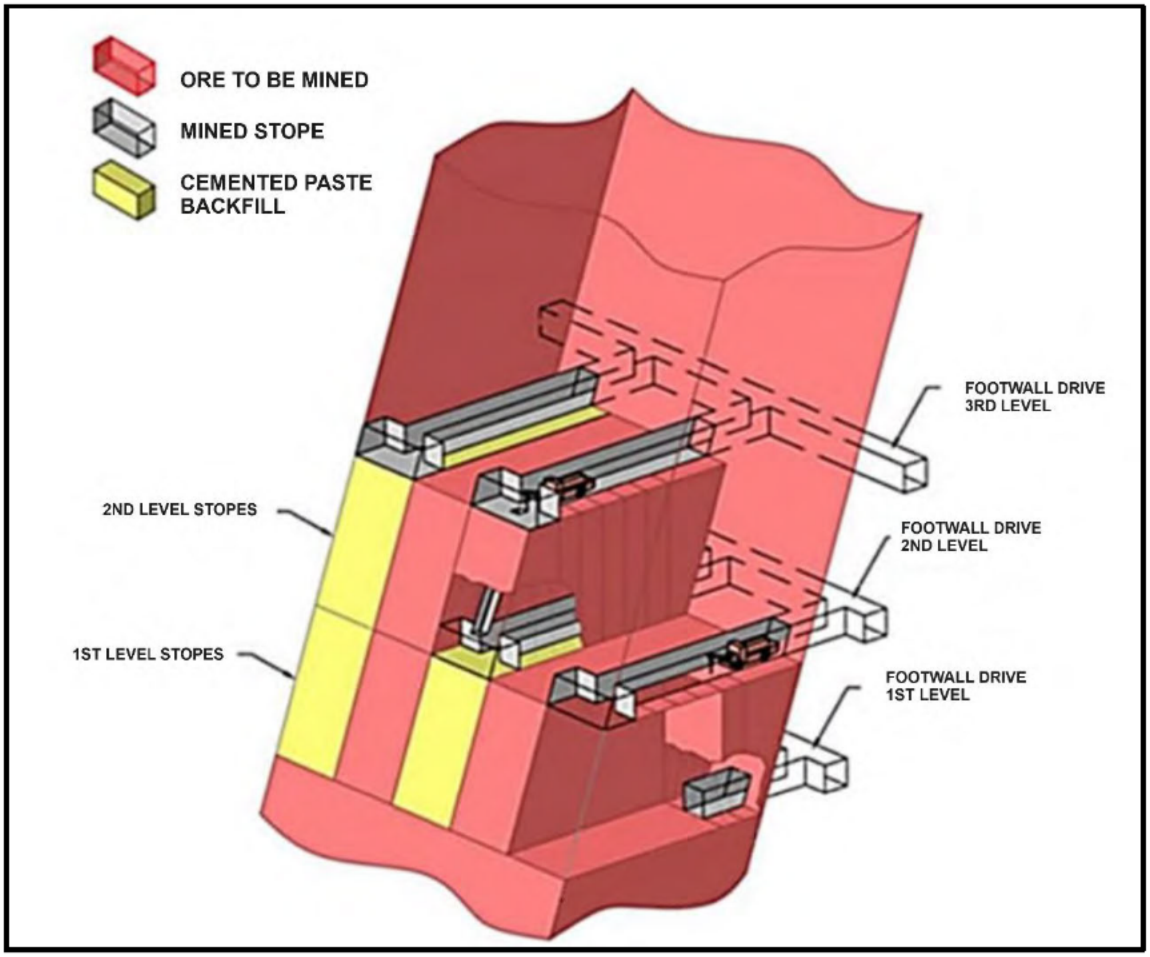
2.5.4 Long-hole Open Stoping (Private and NFS Land)

All practical mining options, including open-pit mining, were internally evaluated by South32 Hermosa against criteria such as practicability, production rate, mining cost, impact to environment, safety, and impact to community. The underground long-hole open stoping mining method was selected for production. The ability to constrain surface disturbance related to mining to South32 Hermosa private land and within a small surface footprint outweighed any benefits of the open pit and other underground scenarios. Scenarios involving open-pit mining are not favorable due to the larger overall disturbance footprint, as well as the high visibility of the pit and waste rock storage areas.

Long-hole open stoping is a highly selective extraction method that focuses on mining the mineralized zones and minimizes creation of waste rock. In this method, blocks of ore called “stopes” are sequentially blasted using emulsion explosives.[12] Blast holes are drilled and loaded with explosives from access drifts above or below the stope to be mined (hence the term “long-hole” blasting). Once blasted, the loose ore is removed from the stope and transported for primary crushing using haul trucks. Stopes vary in size, but full stopes in the sulfide portion of the orebody have dimensions of 90 feet vertical, and 75 × 30 feet horizontal. Full stopes in the oxide portion of the orebody have dimensions of 60 feet vertical, and 35 × 35 feet horizontal. The general stoping process is shown in Figure 2-17.

[12] Emulsion explosives typically comprise an ammonium nitrate solution (an oxidizer) mixed with oil (a fuel). Emulsion explosives are generally safe to store and transport and have a high resistance to water. The emulsion matrix is not capable of detonation by itself, and needs to be sensitized before detonation, either through physical sensitization (such as adding glass microspheres) or chemical sensitization by adding reactive chemical compounds that release gases that permeate the emulsion. Similar to other bulk explosives used in mining, emulsion explosives require a separate blasting detonator to explode.

Figure 2-17. Diagram of stoping process showing sequence of mining and placement of cemented paste backfill.



Support is required in underground workings to protect against rockfall, spalling, and to ensure worker safety. Most mine faces will be covered in mesh or mesh covered in shotcrete. The shotcrete is produced in a surface batch plant on South32 Hermosa private land. The mesh will be anchored using resin bolts or cable bolts, depending on the rock conditions, generally spaced every 4 to 5 feet. Structurally vulnerable areas, such as tunnel intersections, will use additional support such as cable anchors.

All equipment used underground will be placed using the shafts or via the decline on South32 Hermosa private land. Some equipment may be assembled underground at the workshop facilities whereas other equipment will be brought intact.

Equipment required for development and long-hole open stoping methods includes:

- Dump trucks—for hauling production ore with a 63-tonne capacity for the sulfide portion of the orebody and a 30-tonne capacity for the oxide portion of the orebody
- Load haul dump—for mucking production ore in the stopes with an 18-tonne capacity for the sulfide portion of the orebody and a 10-tonne capacity for the oxide portion of the orebody
- Long-hole drill rig—used to drill 3-inch holes up to 177 feet in length
- Drill rig (jumbo)—a twin-boom jumbo drill

- Bolter—used for safety for placement of bolts with 5- to 10-foot lengths
- Cable bolter—used for safety to bolt cables with lengths of up to 82 feet
- Shotcrete and transmixer
- Explosive charging rigs
- Other auxiliary equipment includes scissor-lift utility vehicles, personnel transporters, flatbed trucks, water vehicles, graders, mobile rock breakers, fuel/lubrication vehicles, telehandlers, skid steer loaders, grapple vehicles, and light-duty vehicles.

The mine design supports the use of both autonomous and electric equipment. Unless noted, equipment is currently anticipated to be diesel-powered. Diesel fuel will be delivered via Harshaw Road (before Primary Access Road construction) or via Primary Access Road as described in Section 2.5.11. An estimated 2 to 5 fuel deliveries will happen per day, with fuel delivery trucks typically range from 4,500 to 7,500 gallons in size. However, equipment will periodically be reevaluated to ensure the most efficient equipment is in use at any time during the operations.

- Production load haul dumps will be powered with batteries and will be autonomous.
- The automated loop haul trucks are diesel-powered and will be autonomous.
- The jumbo drill rig, bolter, and long-hole drill rig will all be electric, and will rely on diesel only to tram from one location to another.
- The scissor lifts, explosives trucks, and shotcrete sprayers will also be electric and will rely on diesel engines only to tram from one location to another.

The amount of equipment needed for each area is dependent upon the area being worked, and the stage of development or mining. In general, only one load haul dump or one long-hole drill rig will be working in a stope at a time during operations, and activity will be highest around the shafts and transfer points underground.

- For more information in the PoO related to mining and underground equipment, see:
  - Section 4.4.4 – Underground facilities during temporary cessation of operations
  - Section 5.3.3.4 – Closure of underground workings
  - Appendix C – Materials management
  - Chapter 3 – Environmental Protection Measures
    - AQ2, FW3, WQ4, CR1, SR3 – Underground mining
    - AQ7 – Engineered controls
    - AQ8 – Fugitive dust management
    - SW5 – Hazardous material storage and disposal
    - SW6 – Hazardous material/explosive storage
    - SW9 – Appropriate fuel storage

2.5.5 Water Management (Private and NFS Land)

2.5.5.1 Overall Water Cycle and Water Balance

The overall water cycle and water balance for the Project involves multiple uses, sources, and recycling loops (Figure 2-18). To the extent practicable, water is captured for reuse and management to maximize recycling and minimize the need for raw water input consistent with South32 Hermosa's commitment to water sustainability.

There are four sources of water entering the overall water system for the Project as a whole:

- Groundwater from GWM wells
- Groundwater from underground workings
- Collected contact stormwater/precipitation (stormwater for some non-contact areas of the Project is not required to be retained and will be discharged from the Project during storm events in accordance with applicable permit requirements)
- Potable water hauled to the Project by truck. The exact source is not known at this time, but potable water will not be sourced from or treated at the Project. Water will be sourced from a licensed and permitted facility.

The consumptive uses of water associated with the Project are limited in volume and include:

- Underground entrainment in conjunction with use of cemented paste backfill
- General Project consumptive uses associated with operations such as potable water, sewage handling, dust management, and any necessary fire suppression, construction, refrigeration/cooling, exploration, and sulfide ore beneficiation
- Entrained water that remains in filtered tailings and does not exit TSF1 or TSF2
- Removal as entrained water in zinc and lead/silver concentrates and oxide ore
- Loss of water through direct evaporation

The primary source of water for construction, beneficiation, and other auxiliary uses during mining is groundwater (sourced underground or from the GWM wells). [redacted] Groundwater management would be similar to that described in Section 2.3. During mining, GWM wells and underground water management would occur on and below both South32 Hermosa private land and NFS land. The quantity of water pumped from South32 Hermosa private land is anticipated to be sufficient to satisfy the non-potable consumptive needs of the Project.

During mining it is expected that groundwater recovered from groundwater management will exceed operational use requirements. Excess water will be treated and discharged according to ADEQ AZPDES and APP permits. [redacted] Initially more water is pumped and treated because there is more groundwater available to pump from rock units with higher permeabilities and more storage (this allows for higher pumping rates), and there are fewer site uses of the pumped water, either from demand or consumptive losses. The pumping rates become lower as groundwater is removed from storage and pumping approaches a new equilibrium between pumping and groundwater recharge.

Once consumptive uses are accounted for, there are four points at which water discharges from the Project:

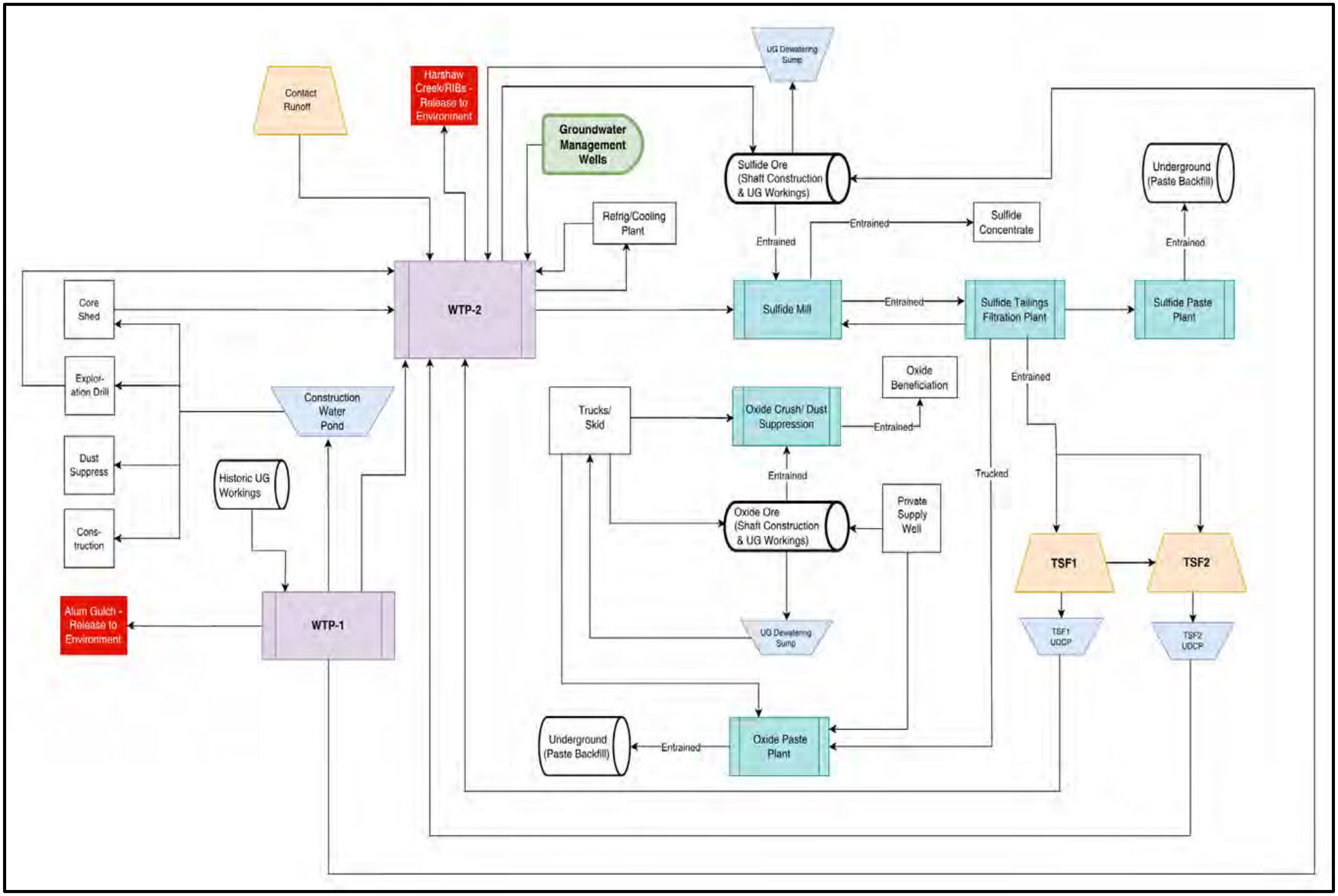
- Discharge of treated water from WTP1 to Alum Gulch, which would in part recharge regional groundwater via natural channels
- Discharge of treated water from WTP2 to Harshaw Creek, which also would in part recharge regional groundwater via natural channels
- Discharge of treated water from WTP2 to the RIBs, to actively recharge regional groundwater in key areas to reduce drawdown impacts

- Disseminated runoff from allowable stormwater discharges into natural surface drainages as per the AZPDES multi-sector general permit program for mining

ADEQ regulates the discharges associated with both the WTPs and stormwater. The discharges will meet strict water quality standards. Regular sampling, operational controls, maintenance, and housekeeping ensure that Project discharges will consistently meet regulatory standards.

[redacted] there is a 5- to 10-year time period between the end of mining and when discharge from the Project is estimated to reach zero gpm. Note that zero discharge does not mean zero flow, rather it means that rates of flow from TSF2 fall to a level that can be passively treated instead of actively treated at WTP2. The flow able to be passively treated is currently estimated as less than 25 gpm (see Section 2.5.5.2). However, the water treatment capability would not be dismantled/removed until the ability to passively treat flows has been demonstrated in practice, which may extend beyond this time frame.

Figure 2-18. Overall water cycle for the Project.



[redacted]

Stormwater will be managed, as appropriate, using the types of structural control measures described in Appendix B – Stormwater Management. In addition to using structural controls for managing stormwater, South32 Hermosa will continue to implement non-structural controls such as good housekeeping,[13] maintenance practices, regular sampling, and employee training. These best management practices (BMPs) are intended to prevent the potential for pollutant exposure to stormwater discharging facilities. Typical structural and non-structural controls are fully described in the Stormwater Pollution Prevention Plan (SWPPP) for South32 Hermosa private lands, that will be expanded to include all operations, including those on NFS land.

As described in Appendix B, different types of stormwater control structures would be used to control non-contact and contact water from the Project. Non-contact water is stormwater runoff generated during precipitation events from upstream watersheds, or precipitation falling within the Project but allowed under the required stormwater permit to be discharged. This water would be diverted around the Project or passed

[13] "Good housekeeping" is a term used by ADEQ in the AZPDES Mining Multi-Sector General Permit (Section 2.2.1.2.2). The term is applicable to exposed areas that are potential sources of pollutants. Good housekeeping includes such measures as sweeping or vacuuming at regular intervals, keeping materials orderly and labeled, storing materials in appropriate containers, cleaning up spills and leaks promptly using dry methods (e.g., absorbents) to prevent the discharge of pollutants, using drip pans and absorbents under or around leaky vehicles and equipment (or store vehicles indoors where feasible), keeping trash receptacle lids closed when not in use and ensure that containers without lids that could leak have other controls in place, and keeping exposed areas free of waste and garbage.

through appropriate BMPs and discharged through permitted stormwater outfalls.[14] Contact water is stormwater runoff from direct precipitation on TSF2 and other portions of the Project that has come into contact with any tailings, non-inert overburden, raw material, intermediate product, finished product, byproduct, or waste product. Precipitation falling on TSF2 is considered contact water and would be captured as part of the lined underdrain system for TSF2, contained in the UDCP, and treated at WTP2; this stormwater could then be incorporated into Project water supply.

- For more information in the PoO related to water management, see:
  - Section 4.4.3 – Stormwater management during temporary cessation of operations
  - Section 5.3.3.3 – Decommissioning of water infrastructure
  - Appendix B – Stormwater management plan
  - Appendix D – TSF2 Design Drawings
  - Appendix E – RIB Typical Layout
  - Chapter 3 – Environmental Protection Measures
    - AQ8 – Fugitive dust management
    - WQ7 – Designing for climate change
    - WQ8 – Stormwater design standards
    - SR6 – Designing to reduce visual impacts
    - FW9B – Construction monitoring
    - FW9C – Low impact design
    - CR2 – Siting to avoid cultural resources
    - PS1 to PS9 – Fire preparedness and prevention

2.5.5.2 Water Treatment and Recharge Facilities

2.5.5.2.1 WTP1 AND WTP2

Two water treatment plants have been constructed on South32 Hermosa private land. Both plants require permits from ADEQ under the APP and AZPDES programs to treat specific water sources to levels at or below the applicable water quality standards. These permits have been issued to South32 Hermosa by ADEQ. WTP1 treats mine drainage water from historic workings, stormwater, and seepage and/or runoff from historic dry-stack tailings. The WTP1 treatment process consists of pH adjustment followed by liquid/solids separation. This process includes various elements including: an equalization tank, a multi-flow tank (consisting of reaction, flocculation, and clarifier compartments), an ultrafiltration unit, a pH adjustment tank, a moving bed biofilm reactor, an electroreduction circuit (for selenate removal), a thickening tank, a filtrate tank, and a filter press.

WTP1 was designed for low flows associated with the historic workings and TSF1 dry-stack tailings, while WTP2 has a higher capacity and was designed to support exploration and production operations such as water from GWM well pumping and underground workings (see Figure 2-18). WTP2 became operational in September 2023. These sources will be piped or otherwise delivered directly to WTP2. WTP2 effluent can be routed to the operations, discharged to Harshaw Creek through Outfall 2 in accordance with AZPDES and APP permits, or recharged in the RIBs (the locations of the discharge points Outfall 1 and Outfall 2 are shown on Figure 2-1). WTP2 consists of two treatment circuits or steps. Step 1 treatment removes suspended solids and uses pH adjustment, the addition of ferric flocculant and sulfide reagents (if required), and clarification to precipitate metals (including selenide) and separate solids. Step 2 uses a patented ion exchange and electroreduction process to remove selenate from the water treated by Step 1.

[14] "Outfall" is both a commonly used term and a regulatory term used by ADEQ in the AZPDES Mining Multi-Sector General Permit. It refers to a point where stormwater is discharged from a mining site. In the case of this Project, the discharge is to existing natural drainages.

The ADEQ regulates the discharges associated with both the WTPs and stormwater. The discharges will meet strict water quality standards.

Both WTP1 and WTP2 will produce solid residuals,[15] and after being filtered these solids will be deposited within TSF1 or TSF2.

2.5.5.2.2 RAPID INFILTRATION BASINS

Recharge of regional groundwater will occur by passive recharge through the channels of Alum Gulch (from the discharge from WTP1) and Harshaw Creek (from the discharge from WTP2). To reduce the impacts associated with orebody depressurization which also results in lowering groundwater elevations within the aquifer, both RIBs and passive recharge from natural channels will be utilized to achieve broader distribution of recharge locations. RIBs located on NFS land are anticipated to be an effective method of additional recharge.

RIBs generally consist of a series of open basins, where water is discharged and allowed to infiltrate into the subsurface. The use of multiple basins within each of the RIB locations allows periodic maintenance to occur on individual basins without disrupting recharge activities. Six alternative RIB locations are shown on Figure 2-1; it is anticipated that two of these locations would be selected and constructed as part of Plan Operations (one to the east of the Project and one to the south of the Project).

In general, each of the two recharge basin locations (east and south) would include two or more wide, flat-bottomed, excavated basins (see Appendix E, showing an example with two basins within a single RIB location). The excavated basins would be filled with water to between 12 and 18 inches in depth (see Appendix E). Infiltration volumes and rates would be monitored to maintain optimal recharge rates using flow meters, transducers, and staff gages. The optimal rates would be determined based on both the preliminary hydrologic characteristics for the site, as well as observed performance of the recharge basin. As rates begin to decline within a recharge basin, water would be moved to an adjacent basin within the same RIB location (east or south) and the previous recharge basin would be allowed to dry. Depending on the condition of the basin, this drying phase of the basin operation would permit periodic maintenance of the basin. This may include scarifying the bottom of the basin, fixing side berms, and removal of volunteer vegetation from within the basin. The multiple recharge basins at each of the two RIB locations (east and south) would ultimately operate in rotation; as some basins are filling, others may be drying, and others would undergo maintenance. This rotational operation of the recharge basins would allow for improved long-term performance of the individual basins by maintaining higher infiltration rates, reducing evapotranspiration losses to plants, and allowing periodic dissipation of groundwater mounding beneath the individual recharge basins.

Although only two recharge basin locations would be utilized, six alternative locations were selected based on the available geologic and hydrologic information for the region. The selected locations are generally within unconsolidated sediments of Quaternary alluvium and appear to have favorable sediment characteristics at the surface with sands and gravels visible. Additionally, each of the sites are topographically favorable for basin construction, with most sites having less than 5 degrees of slope. Multiple alternative locations in each region were identified to allow flexibility in selecting the final locations after further site investigations (as described below) are completed.

[15] South32 Hermosa will make an accurate hazardous waste determination under 40 CFR 262.11 for all solid wastes generated by Project activities and operations and will manage all wastes, including solid residuals generated by WTP1 and WTP2, accordingly. Note that certain regulatory exclusions are found in the federal and Arizona hazardous waste regulations, including the exclusion found at 40 CFR 261.4(b)(7) for mining extraction and beneficiation wastes. This exclusion is limited to solid wastes “uniquely associated” with the mining industry and not “ancillary activities”.

Hydrologic characterization and infiltration tests would be conducted to determine RIB effectiveness at each of the six alternative locations. The hydrologic characterization would include a preliminary geophysical surface survey which would likely incorporate both direct current resistivity and refraction seismic methods. The geophysical methods would assist in characterizing the subsurface sediments and depths to consolidated material. Based on the results of the geophysical surveys, boreholes would be drilled to further characterize sedimentary material. During drilling, infiltration testing would be completed within the boreholes at various depths to determine vertical infiltration within the vadose zone (comparable to single ring infiltrometer/falling head tests within the drill string). Double ring infiltrometer tests would be conducted to determine near surface infiltration rates. Designs for the basins, including the number of basins within each RIB location (east and south), would be finalized after the completion of site investigations based on the hydrologic characteristics of the near surface and vadose zones (e.g., depth to water, presence of confining units, vertical permeability testing of sediments, etc.).

Upon selection of final two RIB locations (one east and one south), LT-TARs and pipelines would be built to service each RIB, and the RIBs themselves would be constructed. The pipelines would be placed alongside the access road, within the disturbance area identified in Table 1-2; note that pipelines may be buried or aboveground, depending on the topography, geology, and anticipated exposure to the public. The recharge basins would be excavated to the design dimensions (based on hydrologic characterization results). Depending on the final design, near surface sediments would be removed for the creation of a broad, flat-bottomed basin. Sediment excavated to create the basin would be used to construct berms along the perimeter of the basin.

[redacted] he capacity of the RIBs would be based on preliminary hydrologic characterization of the recharge areas. It is currently anticipated that basins would be designed to accommodate recharge rates of 12 inches per day. However, actual recharge rates would vary depending on specific soil and hydrologic characteristics at each basin site. Once recharge operations begin, the operation of each of the two RIB locations (basin use and rotation) would be adjusted based on observed performance of the individual basins. It is anticipated that discharge volumes to the recharge basins would begin slowly and increase gradually to understand operational performance of the basins.

Benefits of using the RIBs include a reduction in the aerial extent of drawdown within the aquifer as well as reduction or elimination of impacts to some seeps and springs and groundwater wells in the Patagonia Mountains. In addition, undertaking recharge activities in relatively close proximity to the Project should enhance groundwater recovery within the region after completion of mining and GWM activities.

The selection of the two strategic RIB locations (one east and one south) was based on preliminary hydrologic modeling and anticipated changes in water table elevation. The identification of three alternative locations within each of the strategic areas (to the east and to the south) allows for more specific siting that would be of the most benefit to regional groundwater conditions, informed by the hydrologic characterization.

2.5.5.2.3 PASSIVE TREATMENT OF TSF DRAINAGE

GWM wells would cease to pump upon completion of the Project, as would most water treatment through WTP1 and WTP2. It is expected that the post-closure underdrain flows from TSF2 would be minimal. TSF2 is designed to keep seepage and head on the liner low, and the seepage would further reduce when the TSF2 is covered during closure, though some gravity drainage may occur. The estimated flow is expected to reduce to <25 gpm within 5 to 10 year, based on the TSF2 design.

At closure, a passive treatment system to treat TSF2 draindown would be designed, tested, and installed in lieu of treatment through WTP2. Flows would continue to be monitored, collected and transmitted to WTP2 until the passive treatment system was installed, functional, and demonstrated to be capable of treating the amount of draindown observed.

Final design based on observed conditions and field tests would take place during the first year of closure. This would allow the engineer to evaluate post-closure underdrain water chemistry and expected flow rate ranges to effectively design the passive treatment system. A typical passive treatment system would utilize an evaporation cell. Evaporation cells are generally limited by the natural evaporation rate of the area, and evaporating larger flows require larger treatment cells. However, other methods of enhancing evaporation can also be evaluated, including the use of sprayers or misters. These variables would be evaluated during the design and testing period.

If the effluent cannot be effectively treated by evaporation, the active treatment system would continue to be operated to treat these flows. It is expected that ongoing post-closure underdrain flows from TSF2 would be minimal because the inherent design of the dry-stack facility, regrading to promote positive drainage, and closure cap would minimize infiltration. This expectation of very low underdrain flow post-closure is supported by actual underdrain flows that are currently being observed for TSF1.

The current approach to siting an appropriate passive treatment system is to reduce the TSF2 UDCP size post-closure by reducing the north embankment height, filling the remaining pond storage area with a passive treatment substrate that effectively addressed the remaining underflow water chemistry, and siting an effluent delivery system that feeds the bottom of the substrate. The specific mix of substrate will be developed through observation of the pilot scale evaporation cells during the post-closure period for a duration of one year. Results of the pilot scale testing, post-closure effluent chemistry variability, and flow rate variability would form the design basis for the permanent passive treatment system to be sited. As cited above, until an effective passive treatment approach can be demonstrated, active treatment of underdrain flows would continue.

The existing aquifer protection permit dictates a similar approach of using an evaporation cell for any stormwater or seepage associated with TSF1 after closure. All stormwater/seepage associated with passive treatment at TSF1 would take place on South32 Hermosa private lands.

- For more information in the PoO related to water treatment and recharge, see:
    - Section 4.4.2 – Water treatment plants WTP1 and WTP2 during temporary cessation of operations
    - Section 5.3.3.3 – Decommissioning of water infrastructure
    - Appendix D – TSF2 Design Drawings
    - Appendix E – RIB Typical Layout
    - Chapter 3 – Environmental Protection Measures
        - AQ8 – Fugitive dust management
        - WQ2 – Use of lined dry-stack tailings
        - WQ9 – WTP1/WTP2 operations
        - WQ11 – Off-road travel
        - WQ14, SR10, FW11 – Access route alignments
        - SR6 – Designing to reduce visual impacts
        - FW6 – Recycling and filtration
        - FW7 – Use of RIBs
        - FW9B – Construction monitoring
        - FW9C – Low impact design
        - CR2 – Siting to avoid cultural resources
        - PS1 to PS9 – Fire preparedness and prevention

2.5.6 Milling and Beneficiation (Private Land)

2.5.6.1 Sulfide Ore Milling and Beneficiation Activities

Once brought to the surface, all milling and beneficiation of sulfide ore occurs on South32 Hermosa private land. The flowsheet shown in Figure 2-19 depicts sulfide ore beneficiation and adheres to conventional methods including a primary crusher, crushed ore bins, comminution circuit, sequential flotation circuit (lead/silver followed by zinc), thickening, and filtration. None of the process steps shown in the flowsheet require ore to be transferred across NFS land; all sulfide ore beneficiation steps occur solely on South32 Hermosa private land. Tailings are split into two separate circuits to produce either a filter product that will be deposited in TSF1 or TSF2, or that will be reprocessed into cemented paste backfill for use in the underground workings.

- For more information in the PoO related to sulfide ore beneficiation, see:
  - Section 4.4.5 – Beneficiation facilities during temporary cessation of operations
  - Section 5.3.3.3 – Decommissioning of beneficiation facilities
  - Appendix C – Materials management
  - Chapter 3 – Environmental Protection Measures
    - AQ7 – Engineered controls
    - AQ8 – Fugitive dust management
    - SW5 – Hazardous material storage and disposal
    - SW6 – Hazardous material/explosive storage
    - SW9 – Appropriate fuel storage
    - SR6 – Designing to reduce visual impacts
    - FW6 – Recycling and filtration
    - FW7 – Use of RIBs
    - FW8, CR5 – Remote operations
    - FW9B – Construction monitoring
    - FW9C – Low impact design
    - CR2 – Siting to avoid cultural resources
    - PS1 to PS9 – Fire preparedness and prevention

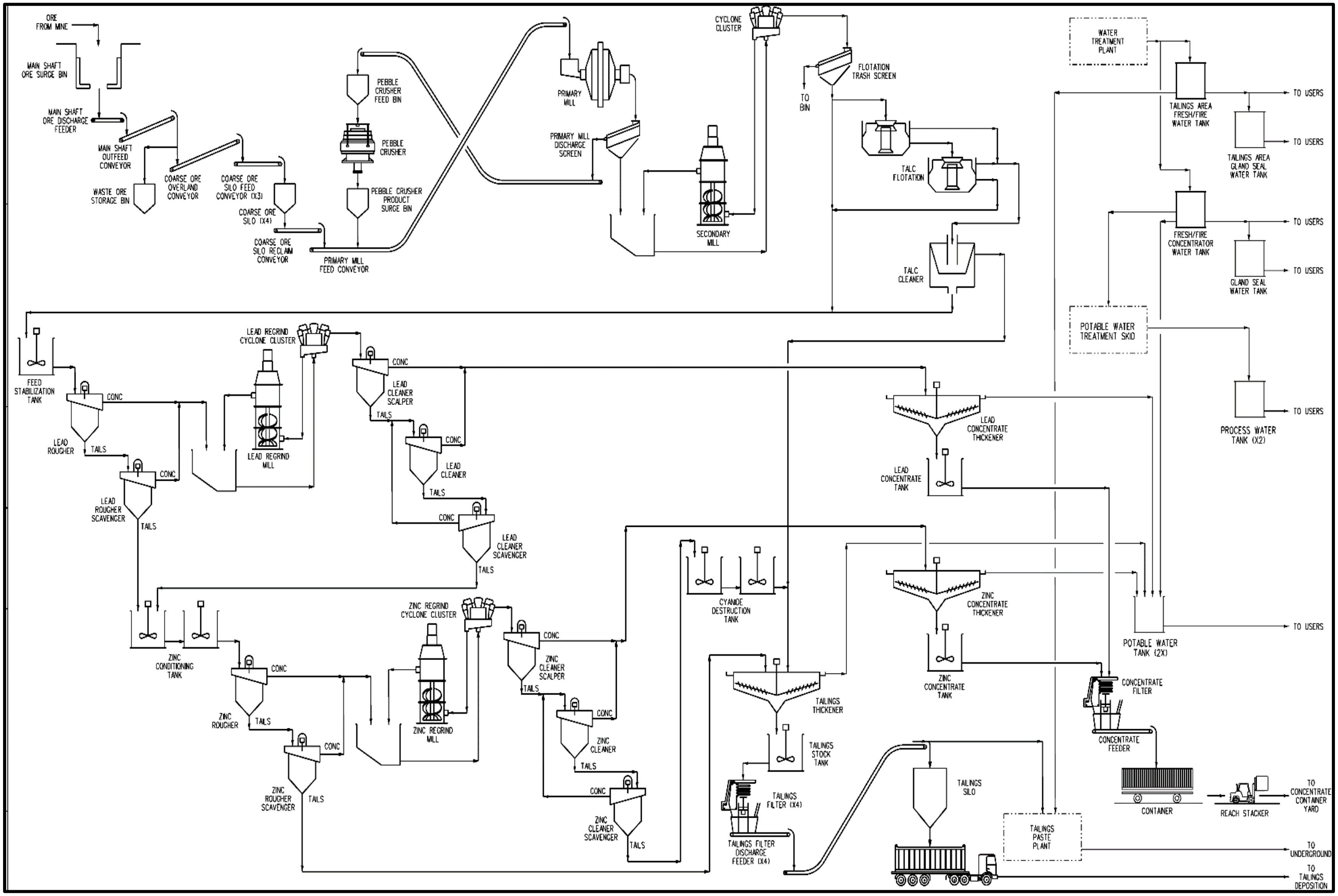
2.5.6.1.1 ORE HANDLING

Primary crushing of sulfide ore will occur underground on South32 Hermosa private land. Ore from the underground primary crusher will be hoisted to the surface and deposited in an ore bin adjacent to the shaft. Ore is then delivered, via overland conveyor, to coarse ore storage silos, which provide ore to the primary mill conveyor and provide surge storage. The primary mill conveyor transports ore from the silos to the grinding circuit. The crushed ore overland conveyor and the primary mill conveyor are planned with appropriate dust control systems as well as operational systems for safety, cleanup, and maintenance.

2.5.6.1.2 GRINDING

Ore from the primary mill conveyor is discharged into the primary mill, also on South32 Hermosa private land. Water and reagents, primarily depressants, are added to the ore for the grinding circuit to aid in grinding and later flotation of the minerals. After grinding, the ore will pass over a discharge screen and be sorted by size. Screen oversize material will be conveyed to a pebble crusher and returned to the mill. Screen undersize material will be pumped to hydrocyclones for size classification. Hydrocyclone undersized material will advance to the flotation process while hydrocyclone oversized material will be ground in a secondary, vertical stirred mill.

Figure 2-19. Flowsheet for sulfide ore beneficiation.



2.5.6.1.3 PRE-FLOAT, FLOTATION, AND CONCENTRATE PRODUCTION

Some ore may contain talc. If talc content is high enough, pre-flotation cells are used to reject the talc so that it does not complicate or foul subsequent beneficiation. Rejected talc will be part of the tailings stream. After the pre-flotation cells, ore material continues to the flotation process.

Flotation reagents including collectors, frothers, depressants, and activators are used during this sequential flotation process to aid in metal recovery. Two separate metal recovery circuits are used to produce zinc and lead/silver concentrates. Once concentrates are produced and metals are recovered to the extent practicable, the products will be shipped off-site in enclosed containers. While the specific containers have not been selected, such containers are commercially available and widely used in train, ship, and truck transport for a variety of goods, including mine products and grain. These containers are sealed at the site, loaded onto trucks, and the containers remain sealed until arriving at the destination for unloading. This eliminates spillage, dust, and reduces the potential release of material during an unexpected event or accident during transportation. Concentrates will be delivered via Harshaw Road (before Primary Access Road construction) or via Primary Access Road as described in Section 2.5.11. Any remaining material (tailings) will be managed in TSF1, TSF2, or used for cemented paste backfill.

The zinc and lead/silver circuits are sequential. Each operates similarly, starting with a rougher flotation cell, where reagents are added to create a stable froth for flotation. The rougher flotation cells are followed by regrinding of material, before passing on to cleaner flotation cells. After all reprocessing loops are completed, there are three outputs from the zinc and lead/silver circuits: zinc concentrate, lead/silver concentrate, and tailings.

To produce concentrates, material from each of the metal circuit cleaner cells enters a concentrate thickener. Flocculants will be added to the thickeners to aid in solid-liquid separation. Thickener overflow (water) will be recycled back into the process water stream. Thickener underflow (solids) will enter a concentrate tank where they are stored and agitated until they can be processed through the concentrate filter system.

A single concentrate filter will alternate between filtering zinc or lead/silver concentrate slurry. The filter is a pressure filter which uses pressure to “squeeze” the concentrate between plates, eliminating the excess water from the concentrate. Target moisture for the concentrate is 8% which will be acceptable for transportation off-site. Concentrates drop from the filter onto a conveyor that places concentrate directly into concentrate containers that will be sealed and used for shipping.

2.5.6.1.4 REAGENTS

Reagents are used to assist in the flotation cells by making the minerals more amenable to collection, suppressing other minerals, or making conditions stable for the physical separation process. All reagents would be transported to the Project in sealed containers, in compliance with any appropriate regulations. The reagents used for beneficiation on private land may include, but are not limited to:

- **Activators—**used to cause minerals to become hydrophobic. In this case copper sulfate will be added to the zinc circuit to ensure zinc will float after it is depressed earlier in the process.
- **Collectors—**used, in simplest terms, to make minerals more hydrophobic. Aerophine 3418A and Aero-5100 are planned for use currently in both flotation circuits and will be added at various locations in both circuits.
- **Depressants—**used to increase the selectivity of flotation by rendering certain minerals hydrophilic and prevent their flotation. In this case depressants will primarily be used to ensure the success of lead flotation and will be placed in the circuit during grinding at both the primary

grinding mill and in the lead regrind mill. Zinc sulfate will be used to depress zinc, and zinc cyanide will be used to depress iron.

- **Frothers**—used to make froth sturdy enough to support minerals. Currently, methyl isobutyl carbinol and Oreprep-X-133 used in a 50:50 blend is planned for use in both flotation circuits.
- **Flocculants**—used to make solids settle in solution.

2.5.6.2 Integrated Remote Operations Center

The main concentrator control room will be part of an integrated remote operations center (IROC), which will be located on private lands distal from the Project. While the location has yet to be determined, no use of NFS land or crossing of NFS land to access the IROC is anticipated. The IROC will house personnel administering and facilitating beneficiation, maintenance, engineering, and other functions to ensure the seamless integration of operational activities. A South32 Hermosa private land control room facility will be located at the mine site for use as an emergency backup (for example, if power were disrupted at the IROC). The IROC is also a key component that will support future automation of other Project operations, including transport.

2.5.7 Tailings and Waste Rock Management (Private and NFS Land)

2.5.7.1 TSF2 Design and Construction (NFS Land)

2.5.7.1.1 TAILINGS DISPOSITION

Tailings produced from the beneficiation of the sulfide ore will be deposited in TSF1 or TSF2. The oxide ore is crushed and transported across NFS land to a beneficiation facility on private land distal from the Project. Once crushed oxide ore leaves NFS land it will not again enter NFS land either before or after beneficiation. See Section 2.5.3.2 for more detail on oxide ore transportation. Tailings associated with the oxide ore would be produced and placed in a facility at or near the distal beneficiation facility, not on NFS land. The distal oxide ore beneficiation facility has not yet been located, but is anticipated to be in Santa Cruz County. No use of NFS land is anticipated.

Tailings remaining after the beneficiation of sulfide ore will be filtered to remove water, and then will be managed in one of three methods:

- Approximately half of the tailings will be mixed with cement and used as an engineered cemented paste backfill while sulfide operations are ongoing, as described in Section 2.5.7.3. Note that since no tailings are produced at the Project location from the oxide ore, tailings from the sulfide ore beneficiation are used for cemented paste backfill in both the sulfide and oxide stopes. [redacted]
- The existing TSF1 will be expanded from its present footprint (remaining wholly on South32 Hermosa private land), through appropriate permitting, and operated to accept filtered production tailings placed/stacked by mechanical means (mobile equipment), rather than deposited as a slurry, which is how traditional wet tailings are placed. [redacted] Filtered tailings will be hauled to TSF1 via articulated haul trucks, dumped, spread with a dozer to a nominal thickness not to exceed 12-inches (loose) in depth, and compacted through selective routing of the haulage equipment and dedicated

smooth drum vibratory compactors. As necessary, the filtered tailings will be moisture conditioned using a tractor and a disc to facilitate drying prior to compaction. If required, lime treatment will occur by spreading quick lime (~1% by dry weight) over the surface of the filtered tailings and discing the lime into the wet tailings lift to expedite drying. Tailings moisture content at the time of compaction must be within 3% of the optimum moisture content as determined by ASTM D698 (Standard Proctor). Once the required moisture content is achieved, the filtered tailings will be compacted to a minimum of 93% of the maximum dry density also derived from ASTM D698.

- TSF2 will be required when the existing TSF1 is at capacity. The TSF2 design and operations will be very similar to the operational TSF1. Specifically:
  - TSF2 will also be a lined, dry-stack facility with a similar stormwater and seepage collection system (described in detail in this section and in Section 2.5.7.2.3).
  - The TSF2 design includes an 18-inch protective layer to be placed on the liner to ensure equipment does not damage the liner or the collection system (described in detail in this section).
  - TSF2 will utilize the same equipment and placement methods (described in detail in this section). As it has already been done with the legacy tailings during the Voluntary Remediation Program, the filtered tailings will be placed by truck in TSF2, spread with a dozer in 12-inch loose lifts, moisture-conditioned with a tractor and disc to the optimum moisture content, and compacted to 93% of the maximum dry density.

[redacted] Total planned area of disturbance on NFS land is shown on Figure 2-1 and described in Table 1-2. Design criteria for TSF2 are summarized in Table 2-3. Note that the description of TSF2 is an initial design, subject to further engineering and permitting refinements and site-specific geotechnical drilling confirmations. None of the further refinements would modify the footprint disturbance area.

2.5.7.1.2 TAILINGS STORAGE FACILITY DESIGN

The design, construction, and operation of the dry-stack TSF2 would adhere to ADEQ's APP standards, as well as recognized international industry standards, such as the Global Industry Standard on Tailings Management (GISTM) and Australian National Committee on Large Dams (ANCOLD) guidelines (2019). South32 has committed to implement the GISTM (International Council on Mining and Metals 2020) at all its operations. The design and operation of TSF2 will comply with the GISTM, striving to achieve the ultimate goal of zero harm to people and the environment, with zero tolerance for human fatality, following guidelines on the rights of project-affected people, use of an integrated knowledge base, risk-based design and operation, governance, emergency response, and access to information.

The design of TSF2 was based on the results of a detailed Failure Modes and Effect Analysis (FMEA) and the definition of As Low As Reasonable Practicable (ALARP) measures to eliminate or minimize the risks, as required by GISTM. Key personnel have been appointed and have been directly involved with the design of the facilities, such as the Engineer of Record, Responsible Tailings Facility Engineer, Accountable Executive, and Independent Reviewer. A Tailings Management System has also been established in compliance with GISTM.

Table 2-3. Design Parameters for TSF2 and TSF2 UDCP

Design Parameter	Value (Applicable Standard)
Factors of Safety	
Static conditions	1.5 (ANCOLD)
Pseudostatic conditions	1.0 (BADCT)
Post-seismic conditions	1.0 – 1.2 (ANCOLD)
Seismic Design Events	
Maximum Credible Earthquake (deterministic assessment) peak ground acceleration	0.13 g (BADCT, ANCOLD, GISTM)
Operations and closure (active care) 2,000-year (probabilistic assessment) peak ground acceleration	Conservatively use passive-closure design criteria during active care (ANCOLD)
Passive closure 10,000-year (probabilistic assessment) peak ground acceleration	0.22 g (ANCOLD, GISTM)
External Conveyance Structures	
Peak flow	100-yr/24-hr storm
Freeboard	1 foot
Erosion protection	Riprap, bedrock, or vegetated
Internal Conveyance Structures/Containment	
Peak flow	100-yr/24-hr storm (BADCT); 100-yr/72-hr storm (ANCOLD)
Freeboard	2 feet (BADCT); 1.64 feet (ANCOLD)
TSF2 Spillway	
Peak flow	Probable Maximum Flood (ANCOLD)
Freeboard	None
TSF2 UDCP	
Peak storage capacity	100-yr/72-hr storm (ANCOLD) 100-yr/24-hr direct precipitation, plus TSF2 seepage (BADCT)
Freeboard	1.64 feet (ANCOLD) 2.0 feet (BADCT)
Emergency spillway	Able to pass the Probable Maximum Flood (ANCOLD)
Facility Slope	3.0H:1V, compound slope
Tailings Target Percent Moisture	11.8

Notes: ANCOLD = Australian National Committee on Large Dams; BADCT = ADEQ Best Available Demonstrated Control Technology; GISTM = Global Industry Standard on Tailings Management (International Council on Mining and Metals). All ANCOLD and GISTM design criteria are based on initial rankings of “High C” and “Significant”.

2.5.7.1.3 TAILINGS STORAGE FACILITY CONSTRUCTION

Geotechnical Confirmation

Upon approval of this PoO, a geotechnical investigation would be conducted within the footprint of TSF2 in order to confirm geotechnical parameters to inform the final design of TSF2. The proposed geotechnical investigation includes 17 boreholes and test pits (locations shown on Figure 2-20). One purpose of the geotechnical investigation is to confirm the anticipated subsurface conditions as currently understood. It is anticipated that natural subsurface conditions below TSF2 will consist of a thin veneer of colluvium and residual soils overlying highly fractured bedrock that grades relatively quickly to competent rock. Residual deposits will generally be located on the upper portions of the slopes and colluvium deposits within hillside swales. Limited occurrences of alluvial deposits are in the drainage bottoms, though in many cases the drainages are incised into the native rock. The residual soils will be derived from weathering of the andesite bedrock, and the colluvium deposits will be similar in nature with the exception that they have been reworked during downgradient transportation. The soils are expected to be spatially variable, and generally consist of low to medium plasticity clay, silty and clayey sand, and sandy gravel. Practical refusal (i.e., the inability to advance any deeper) due to hard rock is expected to be approximately 0 to 25 feet below ground surface, with outcropping rock present in numerous areas. Bedrock is expected to be highly weathered to fresh andesite with weathering and related decomposition decreasing with depth. The rock hardness is expected to vary from weak to strong, and the near surface rock is expected to be intensely to highly fractured with multiple rubblized zones. Based on existing data, as well as similarities to the TSF1 site, fine-grained soil deposits or near surface groundwater are not expected in the construction area for TSF2 and its appurtenant facilities.

Boreholes (of varying depth) would be advanced using either hollow stem auger (for unconsolidated deposits) and wire line coring techniques (continuing into competent rock for some borings), or sonic drilling. The final selection of the most appropriate drilling equipment would be completed after discussion with candidate drilling contractors and South32 Hermosa's drilling services team. A typical geotechnical boring pad layout is shown in Appendix E. Boreholes are planned to assess the type and consistency of overburden materials, the depth to rock, and the condition of the rock near the overburden / rock transition. Laboratory sampling and testing of overburden and bedrock would be completed to confirm engineering characteristics of these materials (including rock mass characterization). Drilling mud, drill cuttings and/or excess grout would be contained and placed at established disposal areas on South32 Hermosa private lands. Depending on the travel distance, ground conditions, development of the TARs, and borehole depth, approximately one borehole can be completed on a daily basis (i.e., equipment set up, borehole fully drilled, and borehole abandoned).

Drilling and borehole abandonment would be conducted in accordance with Arizona Administrative Code R12-15-801 et seq. and Arizona Revised Statutes Title 45, Chapter 2, Article 10, as administered by the Arizona Department of Water Resources. All boreholes will be abandoned prior to demobilization from site but not necessarily at the end of each shift. For safety, open holes will be covered with plywood and ballasted (as required) until abandonment is complete. Abandonment will include backfilling of all boreholes in accordance with Arizona Administrative Code R12-15.

Similarly, test pits would be excavated to assess near surface conditions and to obtain samples of near surface soil and rock for laboratory testing. Test pitting is a much quicker method of assessing near surface soils and bedrock. There are anticipated to be more test pits than boreholes, as they are a more efficient method of assessing near surface soils and bedrock and provide confirmation of the degree of continuity of near surface conditions and identification of material borrow sources.

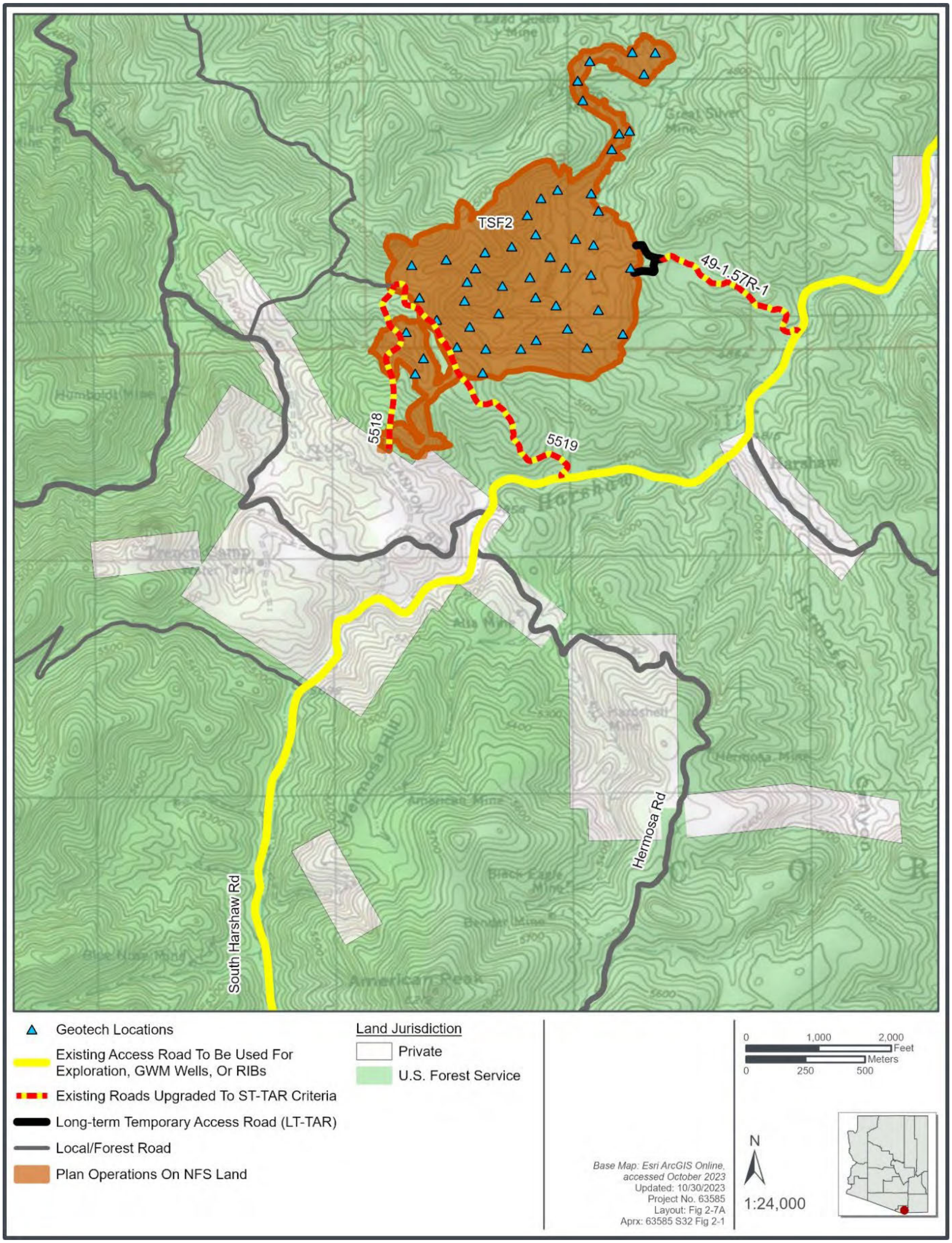
The geotechnical test pits require excavation of an approximate 3-foot wide rectangular trench using a track-mounted excavator (approximating up to 45 cubic yards of soil) until competent bedrock is reached or otherwise to refusal. The excavation depth would depend on the subsurface conditions and the ability of the machine to excavate through the materials. The maximum depth of the test pit would be approximately 20 feet below ground surface and all test pits would be approximately 20 feet long. Materials excavated from the hole would be temporarily placed in a stockpile next to the hole, and samples of the materials would be collected as determined necessary by the field engineer/technician. Soil samples would be collected in 5-gallon buckets, marked, secured with a lid, and transported off site to a geotechnical laboratory for testing. The field engineer/technician would complete a test pit log for each site identifying materials encountered and associated depths. A typical geotechnical test pit layout is shown in Appendix E.

Upon completion of work, the test pit would be backfilled with the stockpiled materials and the area uniformly smoothed with the bucket to re-establish the pre-excavation ground contour. Depending on the travel distance and the ground conditions, approximately five test pits can be excavated and subsequently backfilled on a daily basis. No test pits would be left open overnight.

Access for the borings and test pits would use existing roads and LT-TARs as shown on Figure 2-20. Any additional access routes would occur within the disturbance footprint of TSF2.

All of the geotechnical investigation locations are within the area of disturbance of TSF2. However, because there may be a delay in TSF2 construction in order to process the geotechnical information and finalize the design, similar to the exploratory boreholes, any geotechnical testing locations not active for more than 14 days would be subject to interim reclamation (see Section 5.3.1), which could include stormwater/sediment controls, recontouring, and/or revegetation.

Figure 2-20. Geotechnical borehole locations within the footprint of TSF2.



TSF2 Construction

The initial phase of clearing and grubbing[16] would occur prior to or in conjunction with the mobilization for the geotechnical investigation. Salvaged growth media would be moved to a stockpile for use during subsequent reclamation. The same growth media stockpile would expand over time as TSF2 construction and soil salvage progresses through the starter, intermediate, and ultimate phases described below. This stockpile would be sited near the southwest edge of TSF2 and would be placed on native ground and configured with external slopes that are 3 horizontal:1 vertical. Once placed, the stockpile would be stabilized using a seed mix consisting of native plant species developed in coordination with Coronado National Forest. TSF2 would be constructed in phases as shown in Figures 2-6 through 2-8: starter, intermediate (beginning approximately 6 years after the starter phase), and ultimate (beginning approximately 10 years after the starter phase). The ultimate phase represents the maximum extent of tailings placement during the life of the Project. The clearing and grubbing would proceed in phases as well, clearing only the specific portion of the area being constructed at that time.

After clearing and grubbing, the subgrade would be prepared by grading the area to establish a suitable foundation, then placing a compacted low-permeability soil layer or a geosynthetic clay layer, depending upon the location in the TSF2 footprint. The choice of which technique is the most appropriate at any given location within the TSF2 footprint will be informed by the geotechnical investigation. The locations where geosynthetic clay liner would be used within the TSF2 footprint are defined primarily through slope stability analysis. This is because the interface strength between a low permeability soil layer and the overlying geomembrane differs from the interface strength between a geosynthetic clay liner and the overlying geomembrane.

The compacted low permeability soil layer is prescribed with a minimum 12-inch thickness and a maximum hydraulic conductivity of $1x10^{-6}$ centimeters per second. The CETCO geosynthetic clay liner product considered in the design is 7 millimeters thick and has a hydraulic conductivity value of $5x10^{-9}$ centimeters per second. Based on an equivalency calculation, the 7 millimeters thick geosynthetic clay liner would require a maximum hydraulic conductivity value of $3.8x10^{-8}$ centimeters per second in order to satisfy the prescriptive standard of 12 inches of a low permeability soil layer with a hydraulic conductivity value of $1x10^{-6}$ centimeters per second. The typical TSF2 basin section showing the low permeability soil layer or the geosynthetic clay liner can be referenced in Appendix D (see Section U on Drawing B610). A composite liner system consisting of a 60-mil geomembrane liner would then be placed overlying the prepared subgrade.

Before the first filtered tailings are placed, an 18-inch-thick protective layer would be placed on the geomembrane liner to ensure that the equipment placing tailings does not damage the geomembrane liner or the collection system. The protective layer would also facilitate long-term drainage of the tailings. The protective layer is assumed to be created from crushing/screening non-PAG waste rock material, excavated or cut material during TSF2 construction, and/or a construction material borrow source identified within the TSF2 footprint. The protective layer would consist of acceptable natural silty sands, sandy silts, gravel, silty/sandy gravel or similar. The protective layer material would be free of large gravel particles (greater than 1½ inches in diameter), debris or any other material that has the potential to damage the underlying geomembrane. The protective layer would have a maximum plasticity index of 10 as determined by ASTM D4318, and a material gradation as determined by ASTM D6913.

To reduce head on the composite liner system, the underdrain system would consist of drainage pipes that sit directly on the geomembrane liner and range in size from 4 to 24 inches, dependent upon location. The underdrain system would be sited within the protective layer and serves to expedite dewatering of the

[16] "Grubbing" is the removal of trees, shrubs, stumps, or other debris from a site prior to work.

protective layer that resides immediately above the geomembrane. The piping would be encased in a drainage rock layer that is twice the thickness of the pipe, then the rock and pipe would be wrapped in a geotextile layer (see Appendix D, Section U on Drawing B610). The purpose of the geotextile layer is to restrict the amount of fine sediments that may enter the drainage pipes. The functional life of the geotextile around underdrain piping extends well beyond the operational life of the facility. It should be noted that the geotextile is a precautionary element to prevent fines migration into the underdrain system. The facility would have approximately 10 piezometers located to monitor any potential head on the geomembrane liner. A plan view of the TSF2 underdrain collection piping can be referenced in Appendix D (see Drawing B310). Typical TSF2 underdrain collection pipe sections can be referenced in Appendix D (see Sections P, Q, R, and T on Drawing B610). The integrated collection system would deliver any water that drains or runs off from TSF2 to the lined UDCP for storage and conveyance to WTP2 for treatment prior to discharge or reuse. More detail on the operation of the underdrain system is found in Section 2.5.7.2.3.

- For more information in the PoO related to tailings storage facility design and construction, see:
  - Section 4.4.1 – Management of TSF2 during temporary cessation of operations
  - Section 5.3.3.2 – Closure and reclamation of TSF2 and TSF2 UDCP
  - Section 5.3.3.6 – Growth media
  - Appendix B – Stormwater management for TSF2
  - Appendix C – Materials management
  - Appendix D – TSF2 Design Drawings
  - Chapter 3 – Environmental Protection Measures
    - AQ3 – TSF2 design to reduce fugitive emissions
    - AQ8 – Fugitive dust management
    - WQ1, FW2 – TSF2 siting out of drainages
    - WQ2, SR2, FW4 – Use of lined dry-stack tailings
    - WQ3 – Use of available waste rock for TSF2 armoring
    - WQ5, CR4, FW5 – Use of tailings for cemented paste backfill
    - WQ7 – Designing for climate change
    - WQ8 – Stormwater design standards
    - WQ10 – Growth media removal
    - WQ11 – Off-road travel
    - WQ14, SR10, FW11 – Access route alignments
    - SW5 – Hazardous material storage and disposal
    - SW6 – Hazardous material/explosive storage
    - SW9 – Appropriate fuel storage
    - SW7 – Preparation of Spill Prevention, Control, and Countermeasures Plan
    - SW8 – Refueling operations
    - SR1 – TSF2 siting close to existing disturbance
    - SR6 – Designing to reduce visual impacts
    - SR7 – Outdoor lighting plan
    - SR9, FW10 – Concurrent reclamation
    - FW9B – Construction monitoring
    - FW9C – Low impact design
    - CR2 – Siting of facilities to avoid cultural resources
    - CR6 – Cultural resource training and avoidance
    - CR7 – Inadvertent discovery
    - PS1 to PS9 – Fire preparedness and prevention

2.5.7.2 TSF2 Operations (NFS Land)

2.5.7.2.1 TAILINGS PRODUCTION

Filtered Tailings Production and Transportation

Tailings from the mill will enter a tailings thickener (on South32 Hermosa private land) where flocculants will be added to aid in solid-liquid separation. Overflow (water) from the thickener will be recirculated back to the process through the process water circuit. Underflow (solids) from the thickener will be processed through tailings filters which will be used to dewater the tailings. The tailings will have an optimum moisture content of 11.8% moisture content. Since dry-stack filtered tailings have much of the water removed, the material behaves much like moist soil and would be trucked to TSF2 and placed as an engineered fill using mechanical equipment. After filtration, the filtered tailings would be loaded into articulated haul trucks (with tailgate) via loadout bin. The haul trucks would be utilized to transport the filtered tailings from the filtration plant to TSF1 or TSF2. The haul trucks would be traveling a relatively short distance, at low speeds, and on a haul road which would be continuously inspected and maintained by South32 Hermosa. Although the haul trucks would have an open top, fugitive dust is not anticipated due to the fact the filtered tailings would be moist. In addition, the filtered tailings would be dewatered to a moisture content resistant to liquefaction during transport.

Filtered Tailings Quality Control

It is expected the tailings moisture will vary. Production tailings that do not meet technical criteria for placement in TSF2 (+/- 3% of optimum moisture content) will be considered off-specification tailings. Off-specification tailings could occur due to various contingencies:

- Mechanical: Equipment failure and/or maintenance
- Process: Inability of filtration plant to dewater tailings sufficiently
- Weather: Excessive precipitation (rain or snow)
- Placement: Un-trafficable surface, non-conformance with technical specifications, transport equipment issues

Management of off-specification tailings may include the following:

- Use of alternative placement areas, such as directing 100% of the filtered tailings to the cement paste plant.
- Management within TSF1 or TSF2, such as physical manipulation of the filtered tailings with conventional equipment (requiring favorable weather and open placement area) or use of amendments such as lime.
- Management within the beneficiation facility, such as the temporary storage in the stock tank, tailings silo, or recirculation.
- Placement in standalone off-specification tailings storage areas, all of which are on South32 Hermosa private land: including four off-specification tailings storage silos adjacent to the filtration plant and an intermediate tailings stockpile that would be primarily utilized to temporarily manage filtered tailings that do not meet South32 Hermosa's specifications. The intermediate tailings stockpile utilizes a composite liner system consisting of a 60-mil double-sided textured high-density polyethylene (HDPE) geomembrane overlying a geosynthetic clay liner. There would be a 5-foot-thick protective layer (rock) over the liner to prevent damage during placement and

removal of filtered tailings. The intermediate tailings stockpile has capacity for 3 days of tailings production.

In addition, operational controls against inadvertent placement of off-specification tailings in TSF1 or TSF2 will include:

- Monitoring—Measurement of moisture content within the tailings filtration plant, using automated moisture analyzers on the discharge of each tailings filter.
- Construction quality assurance—ensure defined specifications and standards are followed. There would be full-time Construction Quality Assurance (CQA) on site during filtered tailings placement. The CQA entity would observe filtered tailings placement, obtain samples for laboratory testing, and perform field compaction testing with a nuclear densometer or similar equipment. The CQA entity would be responsible for verification that the filtered tailings placement meets the requirements defined in the Technical Specifications.
- Transportability (the ability to move tailings from the filtration plant to TSF1 or TSF2)—trucking is not feasible with overly wet tailings, which would liquefy due to the vibrations during transport, nor can overly wet tailings be moved via conveyor within the filtration plant itself; therefore, tailings will be dry enough for transportability.
- Trafficability (the ability for tailings haul trucks to drive on top of the tailings in TSF1 or TSF2)—trucks are not able to transit on overly wet tailings and would get stuck, thus identifying any off-specification tailings that have been inadvertently placed.
- Annual cone penetration tests—to determine geotechnical properties of tailings and delineating their stratigraphy. Annual piezocone penetration testing would be performed to confirm that the filtered tailings, placed under fulltime CQA oversight, meet the intent of the design. The piezocone penetration testing would consist of pushing an electro-piezocone into the filtered tailings mass at multiple locations. These piezocone soundings would be advanced to define geotechnical parameters. If an area is identified that does not meet the design intent, remedial actions could be undertaken such as installation of wick drains, remove and replace in-place filtered tailings, or rock buttress placement.
- Instrumentation—piezometers to measure water level inside dry stack.
- Inspections—daily and monthly by South32 Hermosa personnel, quarterly by Engineer of Record.
- Independent reviews—required by GISTM: Independent Technical Reviewer, tailings dam safety reviews.

2.5.7.2.2 DEPOSITION OF TAILINGS AND OTHER MATERIALS IN TSF2

TSF2 is anticipated to be constructed in three distinct phases as shown in Figures 2-6 through 2-8. Operations during each of these phases are similar.

While mining and beneficiation of sulfide ore occurs, filtered tailings would be loaded into haul trucks from the sulfide beneficiation facilities on South32 Hermosa private land and trucked to TSF2. Filtered tailings would be unloaded, spread with a dozer in 12-inch loose lifts, moisture-conditioned with a tractor and disc to the optimum moisture content, and compacted to a minimum of 93% of the maximum dry density (as determined by the Standard Proctor American Standard Test Method D698). The filtered tailings would be compacted with a pad foot and/or smooth drum vibratory compactor capable of achieving compaction through the full thickness of the lift.

If the surface exhibits excessive deflection, the material would require stabilization through moisture correction and additional compaction. In instances where the filtered tailings placement surface shows excess deflection under haul traffic, the cause of the unstable condition would be assessed through scarification and/or test pitting to determine the cause. In the case of overly wet filtered tailings, the material would be scarified in place, disced to reduce moisture content, and recompacted. If moisture reduction cannot be accomplished in a timely manner, through discing alone, the filtered tailings may be treated with quick lime and mixed thoroughly. Once moisture content is reduced sufficiently, the tailings would be recompacted to a minimum of 93% of the maximum dry density and within 3% of the optimum moisture content in accordance with ASTM D698 (Standard Proctor).

There would be settlement monuments installed on the crest of the TSF2 perimeter road to monitor any potential settlement on the embankment located at the downstream toe of the filtered tailings. Settlement monuments would consist of a 6-foot-long piece of reinforcing steel driven into the crest of the TSF2 perimeter road/embankment. The top of the reinforcing steel is capped at the surface and housed in 4-inch-diameter ABS pipe hand packed with pea gravel. The settlement monuments would be surveyed to establish the initial crest elevation and periodically thereafter as part of the operational monitoring program to determine if the TSF2 perimeter road/embankment is experiencing settlement that might impact containment. A TSF2 instrumentation plan view as well as details of the typical settlement monument can be referenced in Appendix D (see Drawing B302).

Remote sensing (interferometric synthetic aperture radar [InSAR]) would also be used to monitor conditions. InSAR satellite monitoring of design element geometry is used to detect displacement. InSAR uses radar images of the Earth's surface that are collected from orbiting satellites. Two radar images of the same area collected at different times from similar vantage points in space can be compared against each other to identify slight changes that correspond to changes in elevation. These data are particularly valuable as an early detection system for embankment settlement, or slope geometry changes.

Placed tailings would be protected from weather-related degradation by making sure the tailings are well compacted prior to precipitation events. In addition, the filtered tailings placement surface would be maintained to provide positive drainage away from both active and completed work areas to minimize the potential of rewetting in place compacted tailings. Grading of the tailings placement surface would be accomplished during material placement through the use of a motor grader during the compaction process. Grading of the active fill surface is not anticipated to include stormwater diversion channels. A stormwater diversion channel would be constructed along the edge of the haul ramp to convey stormwater runoff from the top of the dry stack to the base. If ponding is observed on the tailings surface, action would be undertaken to correct the grading.

A robust tailings management plan would be implemented to manage filtered tailings placement. The tailings management plan would be used to provide supervision and operators with a decision tree and defined procedures to manage upset conditions and/or off-specification tailings, the ultimate goal of which would be a stable tailings mass in TSF2 and continuity of operations. Placement of filtered tailings will be temporarily suspended during precipitation events if the materials and installation cannot comply with the technical specifications. It is expected that placement of filtered tailings would be most difficult during the monsoonal season due to frequent precipitation events. The design anticipates inclement weather challenges with filtered tailings placement and provisions have been devised to address material placement during wet weather. An upset tailings management plan has been developed that allows temporary dry storage for filtered tailings, at the filtration plant, to avoid placement during inclement weather. The plan also has a provision to place tailings in temporary stockpiles on the stacking surface or near the beneficiation facility. The plan also includes quick lime amendment to expedite moisture reduction in the filtered tailings as required. Small placement areas will also be used to quickly spread tailings and compact them prior to precipitation events.

TSF1 is permitted to accept other materials aside from tailings, and it is anticipated that TSF2 would be permitted under an applicable APP in a similar manner. Through the life of the Project, TSF2 would also accept PAG waste rock (see also Section 2.5.7.4), residual solids from the WTP1 and WTP2, solids resulting from core cuttings, sediment from stormwater basins, and drilling solids.

2.5.7.2.3 TSF2 WATER COLLECTION SYSTEM AND UDCP DESIGN AND OPERATION

The TSF2 collection system would manage stormwater that directly falls on the facility and any seepage that might occur from the base of the facility with an underdrain collection system. The underdrain collection system is described in detail in Section 2.5.7.1. The underdrain collection system delivers stormwater and seepage to the downgradient side of TSF2, which has an embankment that captures any seepage and stormwater collected from TSF2. Water collected in the underdrain collection system would be transferred from TSF2 to the TSF2 UDCP via concrete encased outlet pipes which would be routed under the embankment/perimeter road. The outfall pipe work communicates with a geomembrane-lined open channel downstream of TSF2 which outlets into the TSF2 UDCP. Plan views showing the location of the 36-inch-diameter HDPE concrete encased outlet pipes can be referenced in Appendix D (see Drawings B230 and B310). A profile and section of the reinforced concrete pipe encasement can be referenced in Appendix D (see Drawings B234 and B610, respectively). Plan views of the UDCP access corridor (geomembrane-lined open channel) can be referenced in Appendix D (see Drawings B240 and B245 and a typical section can be referenced on Drawing B270). A plan view of the UDCP can be referenced in Appendix D (see Drawing B800 and sections and details on Drawings B810 and B815).

During storm events over the design standard for containment (at a minimum the 100-year, 24-hour storm), there is a concrete spillway built into the embankment that would deliver overflow water to the lined channel and the TSF2 UDCP. The TSF2 UDCP is designed to contain stormwater runoff and direction precipitation over the pond area from the 100-yr/24-hr storm event while maintaining a minimum of 2 feet of freeboard. This provision satisfies the state of Arizona prescriptive requirement. In addition, the TSF2 UDCP is designed to contain stormwater runoff and direction precipitation over the pond area from the 100-yr/72-hr storm event while maintaining a minimum of 1.64 feet (0.5 meter) of freeboard. This provision satisfies South32 Hermosa requirements to comply with industry standards. The stormwater design standards for TSF2 and TSF2 UDCP are discussed more in Appendix B. The TSF2 UDCP also employs an emergency spillway designed to safely pass routed peak flows from the probable maximum flood. A plan view of the TSF2 UDCP can be referenced in Appendix D (see Drawing B800 which has a table detailing the various design criteria).

The TSF2 UDCP liner system consists of geonet sited between two 60-mil double sided textured HDPE geomembrane layers overlying 6 inches of low permeability soil layer or a geosynthetic clay liner. The pond will have a leak collection and recovery system, where a gravel filled sump will be placed in the low point of the pond, between the geomembrane liners. In the event of seepage through the primary liner, a 4-inch-diameter perforated plastic collection pipe is sited along the interior toe of the pond slopes to collect and convey any seepage flows to the leak collection and recovery system sump. Any potential leaks will be detected by automated water level actuation switches that will turn the leak collection and recovery system submersible pump on to evacuate the zone between the two geomembrane liners. The switch and pump are housed in a sloping decant consisting of an HDPE pipe that extends down the slope of the pond between the primary and secondary geomembrane liners and terminates in the leak collection and recovery system sump. A plan view of the TSF2 UDCP can be referenced in Appendix D (see Drawing B800 and sections and details of the leak collection and recovery system on Drawing B810).

During operations, any stormwater and seepage that is collected in the TSF2 UDCP would be pumped to WTP2 for treatment. A redundant pumping system would also be installed for use during emergencies or maintenance. After operations, TSF2 will be capped with growth media. Meteoric runoff from the closure cap would be directed into the drainage downstream of TSF2. Underdrainage flow from the base of TSF2 would be collected in the underdrain collection system and directed to a passive treatment system located downstream of TSF2 (described in Section 2.5.5.2). The TSF2 UDCP would be utilized until the passive treatment system is constructed and is able to effectively treat the underdrainage flow. After the passive treatment system is established, TSF2 UDCP would be decommissioned. This is described in Section 5.3.3.2.

For safety, public access will be restricted from the vicinity of TSF2 and the TSF2 UDCP. The anticipated fence that will restrict public access to TSF2 and the TSF2 UDCP is shown on Figures 2-1 and 2-5 (more detail on fencing, safety and security can be found in Section 2.5.9.2).

TSF2 and the TSF2 UDCP will require facility access roads for operations, maintenance, surveillance, and support activities, as well as power lines and pipelines to operate the pumping system. A TSF2 perimeter road would run along the entirety of the perimeter of TSF2. The TSF2 perimeter road provides light vehicle and haul road access, passive slope stability resistance at the toe of the dry stack, as well as contact water containment. The perimeter road was designed considering the following parameters:

- 2.5H:1V upstream (internal) side slope.
- 2.0H:1V downstream (external) side slope in fill (2.5H:1V if over 30 vertical feet).
- 1.5H:1V downstream (external) side slope in cut (2.0H:1V if over 30 vertical feet).
- Haul Road: 56.5-foot width measured from internal to external edge of road: 38.5-foot driving width with 6 inches of wearing course, (2) 3-foot-high safety berms, and 10 percent maximum grade.
- Light Vehicle Road: 25-foot width measured from internal to external edge of road: 16-foot driving width with 6 inches of wearing course, (2) 1.5-foot-high safety berms, and 15 percent maximum grade.
- Stormwater diversion channel along the external perimeter of the TSF to capture and convey non-contact meteoric water around the TSF.

Plan views of the TSF2 perimeter road can be referenced in Appendix D on Drawings B210 (starter), B250 (intermediate), and B260 (ultimate). Typical TSF2 perimeter road sections can be referenced in Appendix D on Drawings B272 and B274.

All of the access roads associated with TSF2 and TSF2 UDCP are incorporated into the footprint shown in Figures 2-1 and 2-5, and are part of the TSF2 acreages shown in Table 1-2. The various access roads associated with TSF2 can be referenced in plan view in Appendix D, see Drawings B105 (General Arrangement), B200 (TSF2 Access Road), B210 (TSF2 Starter), B240 (Underdrain Collection Pond Access Road Corridor), B245 (Underdrain Collection Pond Access Road Corridor), B260 (TSF2 Ultimate), and B800 (Underdrain Collection Pond). Sections and details for the various access roads can be referenced in Appendix D on Drawings B270, B272, B274, and B810. In general, the access road have varying widths, grades, safety berm heights, etc. based on the anticipated largest vehicle and use.

The pipeline utilized to transfer water from TSF2 UDCP to WTP2 would be buried and designed to minimize impact to USFS property. Pipeline alignment would typically follow the road alignment for easy maintenance and to minimize disturbance. Pipelines outside of lined containment would be pipe-in-pipe (double containment) to provide secondary containment should the primary pipeline fail. Plan views showing the pipeline alignment can be referenced in Appendix D (see Drawings B200, B210, B240, B245, and B800). Sections of the pipeline can be referenced in Appendix D (see Drawings B270, B272, and B274).

- For more information in the PoO related to TSF2 operation and TSF2 UDCP operation, see:
  - Section 4.4.1 – Management of TSF2 during temporary cessation of operations
  - Section 5.3.3.2 – Closure and reclamation of TSF2 and TSF2 UDCP
  - Section 5.3.3.6 – Growth media
  - Appendix B – Stormwater management for TSF2
  - Appendix C – Materials management
  - Appendix D – TSF2 Design Drawings
  - Chapter 3 – Environmental Protection Measures
    - AQ3 – TSF2 design to reduce fugitive emissions
    - AQ4, SW1 – TSF2 siting top reduce haul distances
    - AQ8 – Fugitive dust management
    - WQ1, FW2 – TSF2 siting out of drainages
    - WQ2, SR2, FW4 – Use of lined dry-stack tailings
    - WQ3 – Use of available waste rock for TSF2 armoring
    - WQ5, CR4, FW5 – Use of tailings for cemented paste backfill
    - WQ6 – UDCP redundancy
    - WQ7 – Designing for climate change
    - WQ8 – Stormwater design standards
    - WQ10 – Growth media removal
    - WQ11 – Off-road travel
    - WQ14, SR10, FW11 – Access route alignments
    - SW5 – Hazardous material storage and disposal
    - SW6 – Hazardous material/explosive storage
    - SW9 – Appropriate fuel storage
    - SW7 – Preparation of Spill Prevention, Control, and Countermeasures Plan
    - SW8 – Refueling operations
    - SR1, FW1 – TSF2 siting close to existing disturbance
    - SR6 – Designing to reduce visual impacts
    - SR7 – Outdoor lighting plan
    - SR9, FW10 – Concurrent reclamation
    - FW9B – Construction monitoring
    - FW9C – Low impact design
    - CR2 – Siting of facilities to avoid cultural resources
    - CR6 – Cultural resource training and avoidance
    - CR7 – Inadvertent discovery
    - PS1 to PS9 – Fire preparedness and prevention

2.5.7.3 Reuse of Tailings as Cemented Paste Backfill (Private and NFS Land)

Underground mining activities that remove subsurface material have the potential for lowering of the ground surface, or subsidence, if the rock located close to the surface is not stable and strong enough to retain its position above the voids left by mining. GWM pumping increases the potential for subsidence because groundwater in the subsurface rock interstices helps support the rock layers above. After extraction of the underground material, significant mined voids in the sulfide and oxide portions of the orebody beneath both South32 Hermosa private land and NFS land will be filled with cemented paste backfill or waste rock in order to minimize the possibility of subsidence.

Cemented paste backfill is an engineered backfill made of tailings, cement, and water designed for strength to make future excavations safe and to minimize the possibility of ground subsidence. During sulfide operations, approximately half of the tailings from the sulfide ore will be returned underground as part of the cemented paste backfill, reducing the volume to be placed in TSF1 and TSF2 located at the ground surface. To create the cemented paste backfill, tailings from the flotation process will be dewatered by a thickener and pressure filters to a target of 10%–15% moisture. A portion of the tailings filter cake will be directed to a paste plant where it will be mixed in a continuous mixer with water, thickener underflow, and cement binder to make cemented paste backfill. The final paste backfill will target 72%–77% solids.[17] Instrumentation such as flow meters, density gages, and moisture meters will be used to control paste backfill composition.

[redacted] Since there is no beneficiation of oxide ore on South32 Hermosa private land, no tailings are available for cemented paste backfill. However, cemented paste backfill will still be used to fill the oxide ore stopes for structural stability. During this time period, mobile equipment would re-excavate dry-stack tailings from TSF2 and deliver tailings via haul truck to the paste plant. Cemented paste backfill will be mixed in three surface paste plants that will be on South32 Hermosa private land and delivered underground via boreholes on South32 Hermosa private land using a hydraulic pump. Once mixed and transported via pumping, the paste will be placed behind an engineered bulkhead (paste wall) or substantial waste rock plug constructed or placed at the stope entrance and then allowed to cure for 14 days. Once cured, stopes above and next to the filled area can be mined (see Figure 2-17).

For the sulfide portion of the orebody, the paste delivery boreholes extend from the surface of South32 Hermosa private land and terminate on the 3680 Level. Four additional boreholes at the 3680 Level will be used to transfer the cemented paste backfill to the rest of the mine workings as required. The cemented paste backfill can be moved along pipelines by gravity or using additional hydraulic piston pumps along access points or boreholes. The boreholes and pipelines are underground and will be located both beneath South32 Hermosa private land and NFS land to ensure cemented paste backfill can be placed appropriately dependent upon operational needs. For the oxide portion of the orebody, the cemented paste backfill will be delivered down a shallow borehole to the decline and then follow the ventilation infrastructure in a series of inter-level borehole piping.

The benefits of cemented paste backfill include:

- enhancing the safety and stability of the mine by reducing open voids
- reducing the risk of surface subsidence
- reducing the amount of tailings managed in surface facilities
- improving the efficiency of ore extraction

In addition, waste rock will be used to backfill mine voids where geotechnically appropriate to do so. This will reduce the amount of material that will require management in surface waste rock stockpiles and provide stability to underground workings.

- ➢ For more information in the PoO related to use of tailings for cemented paste backfill, see:
    - o Chapter 3 – Environmental Protection Measures
        - ▪ WQ5, CR4, FW5 – Use of tailings for cemented paste backfill

[17] Percent solids = Mass of solids / (Mass of solids + mass of liquids) * 100%

2.5.7.4 Deposition of Waste Rock (Private and NFS Land)

Waste rock will be handled or utilized in three possible ways. In all cases, the preference will be to place material on South32 Hermosa private land, if there is an appropriate facility available, before it goes onto NFS land.

- Waste rock brought to surface and identified as PAG will be placed in the lined TSF1 or TSF2 along with the filtered tailings and other authorized materials (e.g., residues from water treatment).
- Waste rock brought to surface and identified as NPAG will be placed in NPAG stockpiles on South32 Hermosa private land. After completion of TSF2, the appropriate waste rock may be used as armoring of the exposed face of TSF2 to prevent stormwater and wind erosion, for other construction uses around the Project, or placed in TSF1 or TSF2 when NPAG stockpiles on South32 Hermosa private land are at design capacity. At closure the NPAG waste rock would also be used for the closure cover on the top of TSF1 and TSF2.
- A portion of the waste rock will be managed underground as rock backfill where geotechnically appropriate to do so. Rock backfill will only be used in situations where the void being filled will not be exposed again. In this case the void will be surrounded on all sides by either cemented paste backfill or the in-situ rock mass.

As the dry-stack tailings stacking progresses, waste rock armoring would be placed on the exterior slopes of the dry-stack TSF2 to provide erosion protection as an ongoing part of the tailings stacking operation. The armoring berm material would be sourced from either mine waste rock or suitable cut material, as necessary. The armoring would be placed as an approximately 5 feet high berm around the perimeter of TSF2. As the tailings level reaches the top of a given rock berm, a new 5-foot high berm would be established, as shown in Drawing 600 in Appendix D. The new berm would coalesce with the berm beneath it in a manner that produces a continuous armoring face on the external dry stack tailings slope. The armoring berms are intended to decrease the potential for wind and water erosion of the exposed external tailings slopes. Additionally, the rock armoring would act as a capillary break between the tailings and the growth media cover placed at closure. The armoring berms material properties are shown in Table 2-4.

Table 2-4. Material Properties for TSF2 Armoring Berms

Sieve Size (square openings)	Percent Passing (by dry weight)
8-inch	100
4-inch	80–100
1.5–inch	50–90
0.75-inch	40–80
0.187-inch	25–60
0.0165-inch	10–35
0.0029-inch	0–10

The total quantity of armoring material is anticipated to be approximately 670,000 cubic yards. There is anticipated to be adequate NPAG waste rock available in the stockpiles on South32 Hermosa private land when TSF2 begins construction to use for the armoring. If NPAG waste rock is not available, any type of rock would be suitable for armoring as long as it meets the material properties identified in Table 2-4.

2.5.8 Materials and Supplies (Private and NFS Land)

2.5.8.1 Materials

During operations, South32 Hermosa will use a variety of materials and supplies. The handling of these materials will be conducted in accordance with applicable regulations and facility plans. Transportation of materials, supplies, and equipment for all Project activities would take place across NFS land. The presence of materials on NFS land would be limited to transportation and use as needed for Plan Operations, with all materials storage occurring on South32 Hermosa private land. Anticipated management procedures are included in Appendix C – Materials Management.

2.5.8.2 Hazardous Materials

A variety of materials used in operations may be considered hazardous. Hazardous materials are generally considered any solid, liquid, or gaseous material that is radioactive, toxic, explosive, flammable, corrosive, or otherwise physically or biologically threatening to health. Hazardous materials are more specifically defined in transportation regulations, and are generally considered materials capable of posing risk to health, safety, and property when transported in commerce. Materials that are typically considered hazardous include such things as diesel fuel, gasoline, propane, oil and other lubricants, compressed natural gas (for generators), antifreeze, solvents, gases used for welding, lab chemicals, reagents used for beneficiation, and water treatment plant chemicals.

Further details on the transport, storage, and use of hazardous materials can be found in Appendix C – Materials Management. Hazardous materials would be transported across NFS land, but no hazardous materials storage or disposal would occur on or beneath NFS land, though fuel and other chemicals may be temporarily stored on exploration drill pads during active drilling. The disposal or recycling of hazardous materials will be done through qualified vendors in a manner that is consistent with applicable local, state, and federal regulations. Use of hazardous materials on NFS land may include use of fuel to operate equipment on or beneath NFS land, including refueling.

2.5.8.3 Explosives and Blasting

South32 Hermosa has developed an explosive management approach as outlined in Appendix C for the storage, handling, transporting, use, and disposal of explosives to ensure that the practices follow local, state, and federal regulations and manufacturers’ recommendations.

Explosives would be used in the underground development and mining that would take place beneath NFS land and would also be used at the surface in the construction of the Primary Access Road and TSF2, as needed. Explosives used in both aboveground and underground development and mining would be handled in accordance with all applicable regulations. South32 Hermosa anticipates the use of an emulsion or gel product, along with detonating cord, cast primers, and blasting caps. Explosives will be transported to the Project by the explosives distributor and will follow the provisions of the U.S. Department of Transportation. Explosives will also be transported within the Project and mine areas in vehicles specifically equipped to transport explosives and by personnel trained in the handling of explosives and with a valid federal explosives license.

Explosives will be stored aboveground and underground on South32 Hermosa private land in secured and approved magazines. Magazines will be designed to meet all regulations including fire codes; Bureau of Alcohol, Tobacco, Firearms and Explosives security standards; and Mine Safety and Health Administration (MSHA) and industry standards. There will be no explosives stored on or beneath NFS land.

- For more information in the PoO related to materials and supplies, see:
  - Section 4.3 – Site-wide measures to manage materials during temporary cessation of operations
  - Appendix C – Materials management
  - Chapter 3 – Environmental Protection Measures
    - AQ1 – Remote operations
    - AQ5 – Transport controls and trip minimization
    - AQ9, FW9D, PS10 – Speed limit
    - AQ10 – Primary access road resurfacing
    - WQ11 – Off-road travel
    - SW2 – Solid waste disposal
    - SW3 – Garbage disposal
    - SW4 – Inert waste disposal
    - SW5 – Hazardous material storage and disposal
    - SW6 – Hazardous material/explosive storage
    - SW7 – Preparation of Spill Prevention, Control, and Countermeasures Plan
    - SW8 – Refueling operations
    - SW9 – Appropriate fuel storage

2.5.9 Maintenance during Operations and Public Safety (Private and NFS Land)

The most important commitment South32 makes is that everyone goes home safe and well at the end of every shift. A Health, Safety and Security Management Plan will be utilized for the current and ongoing operations on South32 Hermosa private land and will be updated and expanded to cover all Project activities. This plan has been developed to ensure that there is continued improvement in Healthy, Safety and Security performance and that legal and other safety requirements are met. The primary objectives of the plan are to ensure an inclusive workplace, well-designed work activities, continuous improvement and the prevention of work-related injury, illness, and fatality. This system will be implemented through workforce education and participation, leading-edge systems and processes, proactive and supportive relationships with our community stakeholders, and a bottom-up led reporting culture. General standing safety rules for the Project include that all operations and equipment will be maintained in a safe and serviceable condition.

2.5.9.1 Emergency Management

An Emergency and Crisis Management Plan will be implemented for current and ongoing operations on South32 Hermosa private land and will be updated and expanded to cover all Project activities. A competent person will be present at all times to take charge in case of an on-site emergency. A competent person is someone who is in a supervisory role and is either a direct employee or acting as an agent of South32 Hermosa (such as certain contractors). The competent person will be tasked with ensuring that work activities are happening efficiently and incidents are responded to quickly and in alignment with appropriate management plans. Suitable and dependable communication systems will be used so that employees, contractors, and the public, as needed, can be advised in the event of an emergency.

During all shifts, an individual capable of providing first aid will be available. This will apply to both South32 Hermosa personnel and contractors working on the Project. The individual will be trained to perform patient assessment and artificial respiration; control bleeding; and treat shock, wounds, burns, and musculoskeletal injuries. Adequate first-aid materials will be conveniently located in all work areas and basic first-aid kits will be available in all light vehicles. Where corrosive chemicals or other harmful substances are stored, handled, or used, personal protective equipment, eye wash stations, and water or neutralizing agents will be made available.

The Project also has an on-site emergency medical services clinic. The clinic is staffed 24/7 with Arizona State-certified paramedics for emergency medical assistance. The facility has limited ability to transport injured persons. If medical evacuation is necessary, the Project will use Patagonia Volunteer Fire & Rescue.

Underground mine rescue and recovery capabilities will be in place that meet MSHA 30 CFR 49(A) requirements. Underground emergency refuge chambers will be provided with means of voice communication with rescue personnel.

2.5.9.2 Restricted Access for Safety

South32 Hermosa staff will implement project security measures to protect workers, property, neighbors, and other assets from injury, harm, and damage from criminal, hostile, or malicious acts by implementing suitable security provisions to manage identifiable project security needs. Fences and signs will be used to restrict access and to ensure public and employee safety. On NFS land, this includes restricted public access at the following locations:

1. Within the fence surrounding TSF2 (see Figures 2-1 and 2-5)
2. Within the Southern Restriction Area (see Figure 2-1), an area which encompasses multiple Plan components that can be collectively, rather than individually, fenced
3. Within the immediate areas surrounding all GWM wells and RIBs, which would be fenced

Project identification and “No Trespassing” signs will be posted along all fenced areas for safety and security. Anticipated signage spacing will be approximately 150 meters along the fence line (and at corners).

Fencing will be pursuant to all Forest Service specifications for security and wildlife safety. At this time, it is anticipated that fencing along most of the perimeter where complex terrain does not prohibit access would consist of three-strand wire fences subject to Forest Service requirements. In areas where the public presence is higher, such as near Harshaw Road or the Primary Access Road, the fence sections are anticipated to be enhanced to be a minimum 6-foot-high chain-link/barbed-wire fence, in order to provide additional protection against the public entering the property, if determined necessary. Metal gates will likely be utilized where fencing crosses roads; gates will be locked and only South32 Hermosa or other authorized personnel will have access.

The TSF2 fence line and the Southern Restriction Area fence line would require associated access roads for installation and maintenance. The roads would be 12 feet wide with turning points approximately every 0.5 mile where topography allows. The maintenance roads would be restricted to light vehicle use.

In addition to the security presence at the guard houses (discussed below), routine security patrols and security cameras will be utilized. Staffing will consist of four to five guards on each shift. The routine security patrols will include the patrol of remote locations onsite and routine checking of access points along the perimeter fence. A single roving security officer will drive throughout the entire site multiple times a day.

Monitoring wells and exploration drill pads will not be fenced but signs and barriers will be utilized to restrict access for public safety. For the Project in general, fencing is placed at any areas where complex terrain does not already inhibit access. There will be managed access to the Project. The main access points are two guard houses on South32 Hermosa private land where Project access roads intersect Harshaw Road (one on each side). These guard houses are not on Harshaw Road itself, which will remain open and unrestricted (see Appendix A – Roads Plan). Aside from the guard houses there are anticipated to be three other locked gates (unmanned), including where the Primary Access Road enters South32 Hermosa private land. Turnarounds will be placed where Forest Roads terminate at the Project boundary.

- For more information in the PoO related to public safety, see:
    - Section 4.3 – Site-wide measures during temporary cessation of operations
    - Section 4.4.7 – Security and safety during temporary cessation of operations
    - Section 5.3.3.3 – Fencing during closure
    - Appendix C – Materials management
    - Chapter 3 – Environmental Protection Measures
        - AQ1 – Remote operations
        - AQ5 – Transport controls and trip minimization
        - AQ8 – Fugitive dust management
        - AQ9, FW9D, PS10 – Speed limit
        - AQ10 – Primary access road resurfacing
        - SW5 – Hazardous material storage and disposal
        - SW6 – Hazardous material/explosive storage
        - SW7 – Preparation of Spill Prevention, Control, and Countermeasures Plan
        - SW8 – Refueling operations
        - SW9 – Appropriate fuel storage
        - PS1 to PS9 – Fire preparedness and prevention

2.5.10 Prevention and Control of Fire (Private and NFS Land)

2.5.10.1 Employee Training and Response Protocols

All employees, contractors, and subcontractors will be trained in fire prevention procedures prior to beginning work. All mine employees, contractors, and subcontractors will be required to learn basic fire suppression tasks and fire extinguisher use. This will be supplemented by specialized training on the various suppression systems, and use of monitors and hydrants.

South32 Hermosa will conduct emergency response and contingency planning with appropriate agencies, and these results will be incorporated into emergency response plans. These plans will identify emergency preparedness and emergency contact protocols for fire response. Procedures will include:

- Standing procedural requirement to obtain an “authority to work” permit for any hot work,[18]
- Precautionary requirements for blasting and welding,
- Requirements for mechanized equipment to reduce the risk of fire ignition,
- Procedures for avoiding vehicle parking in brush, grass, or wildland areas unless on a designated roadway,
- Fire watch to monitor work areas for ignition events (sparks or fires),
- A competent person will be accountable for ensuring the controls described above are in place and effective. As noted earlier in the PoO, a competent person is someone who is in a supervisory role and is either a direct employee or acting as an agent of South32 Hermosa (such as certain contractors).

[18] “Hot work” is generally defined as work involving electric or gas welding, cutting, brazing, or similar flame or spark-producing operations.

- Implementation of a lightning trigger-action-response plan, including lightning detection systems, that includes site-wide communication through site radio systems.

2.5.10.2 Equipment

Adequate fire control and prevention equipment will be available throughout the Project. A fire water system will be provided for workshop areas such as lube and fuel bays, welding bays, and offices and storage areas. Underground, fire water tanks will be located adjacent to these areas. The fire water tanks will be equipped with an alarm system that is triggered any time the fire water pumps are used (including testing) to ensure that fire water is only used to fight fires and will be available during a fire. The main workshop facility underground will be equipped with fire doors and a fire suppression system.

All mobile equipment will be equipped with an adequate fire suppression system or adequate fire extinguisher. Light vehicles will all be equipped with a properly rated fire extinguisher and first-aid kit.

All internal combustion engines will be equipped with spark arrestors. Spark shields will be used for any hot operations near brush, grass, or wildland areas. Water trucks will be available when necessary to wet down work sites where work near brush, grass, and wildland areas is not avoidable.

2.5.10.3 Wildfire Response

In the Project vicinity, wildfires can occur whenever grassy fuels are dry. They are more common and can be more severe in the drier months of April, May, and June and again in September and October. Wildfires are driven by wind. The higher the wind speed, the faster the rate of spread.

Smoke generated by wildfires is also of great concern. Smoke can cause respiratory problems and death. Smoke particles can also affect vehicle and generator engines causing them to malfunction or stop. Smoke can enter the ventilation system for the underground workings.

Accidental ignition of wildfire is a risk not only from Project activities but can occur anywhere in the vicinity and result in a safety threat to personnel and Project infrastructure. Ignition can be human-caused (such as sparks from vehicles on roads and recreational vehicles, improperly attended or extinguished campfires, or shooting) and also can occur from lightning, especially during the active summer monsoon season.

South32 Hermosa maintains specific wildfire trigger-action-response procedures, that include emergency action procedures for the Project for brush or grass fires. These procedures detail the responsibilities of all levels of personnel (site security, health and safety personnel, site supervisor, and emergency response team), coordination procedures with public agencies including the USFS, evacuation/shelter-in-place criteria, and all-clear criteria.

- For more information in the PoO related to fire safety and response, see:
  - Chapter 3 – Environmental Protection Measures
    - PS1 – Design for fire control
    - PS2 – Emergency preparedness
    - PS3 – Equipment maintenance
    - PS4 – Employee training and certification
    - PS5 – Firearms
    - PS6 – Emergency planning
    - PS7 – Hot work permits
    - PS8 – Lightning plan

- PS9 – Spark prevention

2.5.11 Roads (NFS Land)

Information regarding the construction, use, and maintenance of roads on NFS land is contained in Appendix A – Road Plan. Pertinent information is included in this section, with the exception of detailed maps. For a detailed map of the Forest Roads [FRs] currently used and proposed to be used for the Project, see Appendix A, Figure A1. For detailed maps of the Primary Access Road route, see Appendix A, Figures A2 through A9.

In addition to the use of existing FRs, there are three types of roads associated with Plan Operations on NFS land: permanent roads, long-term TARs (LT-TARs), and short-term TARs (ST-TARs). As noted previously, ST-TARs have short-term temporary disturbance that would be closed and reclaimed during the operational mine life. The LT-TARs have long-term temporary disturbance that would remain through the operational mine life until active mining ends, and in some cases through closure and post-closure to facilitate monitoring activities. Permanent roads would remain after closure in perpetuity.

- Permanent roads: Primary Access Road.
- LT-TARs: GWM well access, groundwater monitoring well access, RIB access, other facility access roads such as to access to TSF2.
- ST-TARs: exploration access

2.5.11.1 Current and Proposed Uses of Forest Service Roads

Primary access to the Project currently uses Harshaw Road from its intersection with SR 82. Upon approval of the PoO, a new Primary Access Road will be developed, including upgrading the maintenance level of existing segments of Flux Canyon Road (FR 812), Flux Road (FR 4654), and Barriles Tank Road (FR 4653). Upon completion, the new Primary Access Road will be used for all Project activities described in the PoO, including large truck traffic. Prior to PoO authorization and completion of Primary Access Road construction, South32 Hermosa will continue to utilize Harshaw Road and a newly constructed road segment known as the Cross Creek Connector (specifically sited to minimize truck traffic through the town of Patagonia) for access to SR 82 and SR 90. The Cross Creek Connector is shown on Figure A1 in Appendix A and is currently under construction on Santa Cruz County land. This road is not located within the boundaries of the Forest Service. South32 Hermosa purchased private land in Santa Cruz County and transferred the land to the County to facilitate the construction of the Cross Creek Connector. The obligations for construction, operation and maintenance of the Cross Creek Connector road are set forth in the deed transferring the land to the County and in that same deed, South32 Hermosa reserved certain rights for itself relative to construction and use of the road. Upon completion of the Primary Access Road, South32 Hermosa will relinquish its reserved easement for the Cross Creek Connector and the road will become an integrated public park amenity. Harshaw Road would remain in use throughout the life of the mine, even after completion of the Primary Access Road but only for a limited number of employee trips and for emergency access. Harshaw Road is currently maintained by Santa Cruz County and this is anticipated to continue.

Hardshell (FR 5521) and Hermosa (FR 4687) Roads traverse the southern portion of the Project and are and will be used by South32 Hermosa to access exploratory drilling areas, well sites, and support facilities. Both roads are administrative and do not appear on the current Coronado National Forest Motor Vehicle Use Map (USFS 2022).

A summary of the FRs that intersect the Project footprint, and South32 Hermosa's current and proposed use of those roads, is presented in Table 2-5. A road overview map can be found in Appendix A as Figure A1.

Table 2-5. Forest Road Summary

ID	Maintenance Level*	Name	Project Usage	Notes
USFS Motor Vehicle Use Map Roads[a]				
FR 49	3	South Harshaw	Current main access for South32 Hermosa private land	Intersects FR 58
FR 58	3	North Harshaw	Current main access for South32 Hermosa private land	A portion traverses through South32 Hermosa private property, but is open to the public and will remain open and unrestricted
FR 134	2	Mowry	RIB Access	Intersects FR 58
FR 215	2	Three R Canyon	None	Intersects FR 4653
FR 812	2	Flux Canyon	A portion of this road would be used for future primary access for the Project	Closed at South32 Hermosa private land boundary
FR 4653	2	Barriles Tank	A portion of this road would be used for future primary access for the Project	Intersects FR 4654 and SR 82
FR 4653C	2	none	None	Intersects FR 4653
FR 4654	2	Flux	A portion of this road would be used for future primary access for the Project	Intersects FR 4653
FR 4685	2	Humboldt	None	Intersects FR 812
FR 4686	2	Hale	RIB access	Intersects FR 58
FR 4701	2	Thunder Mine	None	Intersects FR 49
FR 5785	2	Lower Flux Mine	None	Intersects FR 812
FR 5787	2	Arena	None	Intersects FR 4653
USFS non-Motor Vehicle Use Map Roads[b]				
FR 49-1.57R-1	-	none	Exploration, monitoring well, and construction access	Intersects TSF2 and FR 49
FR 4653B	2	none	None	Intersects FR 4653
FR 4687	2	Hermosa	Internal and exploration access	Intersects FR 5521

ID	Maintenance Level*	Name	Project Usage	Notes
FR 5518	2	none	Exploration access, will be closed and returned to administrative status after TSF2 is constructed.	Intersects FR 5519
FR 5519	2	none	Exploration access, will be closed and returned to administrative status after TSF2 is constructed.	Intersects FR 49, FR 5518, and FR 5520
FR 5520	2	none	None	Closed at mine site boundary, intersects FR5519 and FR 812
FR 5521	2	Hardshell	Internal and exploration access	Intersects FR 49

Notes: a – USFS (2022); b – USFS (2011).

* Level 2 (High-Clearance Vehicles) – Roads are open for use by high-clearance vehicles and have low traffic volume and speed. These roads typically are local and connect collector roadways; have at-grade drainage treatment; are not subject to the requirements of the Highway Safety Act; do not provide surface smoothness; and are not suitable for passenger cars. Level 3 (Suitable for Passenger Cars) – Roads typically have low speed and a single lane with turnouts and spot surfacing. These roads have low to moderate traffic volume, typically connect to arterial and collector roads, and may include some dispersed recreation roads (USFS 1999).

2.5.11.2 Public Use of Forest Roads

South Harshaw Road (FR 49) traverses through the Project on South32 Hermosa private land and will remain open and unrestricted for public use during and after Plan Operations. Temporary detours may be utilized during improvement or maintenance activities. Any closures or detours would be communicated appropriately to both the Coronado National Forest and the public beforehand to minimize traffic disruptions and conflicts.

The closed section of Flux Canyon Road (FR 812), FR 5520, and FR 5521 on South32 Hermosa private land will remain closed.

All other non-administrative FRs appearing on the Motor Vehicle Use Map will remain open for public use during mine operations, although Flux Canyon Road (FR 812), Lower Flux Mine Road (FR 5785), Flux Road (FR 4654), Barriles Tank Road (FR 4653), and some roads intersecting the new Primary Access Road may be temporarily closed during construction. The new Primary Access Road, once constructed, will be open to public use and is anticipated to remain open after Plan Operations as well.

2.5.11.3 Primary Access Road (Permanent)

2.5.11.3.1 DESIGN AND GEOTECHNICAL CONFIRMATION

Upon approval of the PoO, development and construction of a new Primary Access Road (to and from SR 82) including upgrading the level of service along segments of Flux Canyon Road (FR 812), Flux Road (FR 4654), and Barriles Tank Road (FR 4653) would be undertaken. With the exception of two segments of new disturbance roughly 1.9 miles in length, the Primary Access Road will consist of improvements to existing FR segments currently identified on the Coronado National Forest Motor Vehicle Use Map. The existing FR segments include: Flux Canyon Road (FR 812), approximately 2.6 miles in length; Barriles Tank Road (FR 4653), approximately 2.8 miles in length; and Flux Road (FR4654), approximately 0.2 miles in length. Full details of the Primary Access Road alignment, including detailed maps, are included in Appendix A – Roads Plan. Prior to PoO authorization and completion of Primary Access Road construction, South32 Hermosa will continue to utilize Harshaw Road and a newly constructed road segment known as the Cross Creek Connector (specifically sited to minimize truck traffic through the town of Patagonia) for access to SR 82 and SR 90. All segments of the Primary Access Road will remain available for public use both during and after completion of the Project, thus the road is not contemplated for reclamation.

The final Primary Access Road and bridge design requires geotechnical verification requiring drilling and trenching. Trenching using an excavator or backhoe would consist of cutting a trench, up to 5 feet in length, and 3 to 5 feet in depth. The soil borings would be collected with a truck- or track-mounted drill rig using continuous flight hollow-stem augers. Some areas may require Tubex drilling techniques, especially for bridge locations, where getting to specific depths is more critical.[19] Where rock coring is required, it would be performed with HQ3 wire-line rock coring methods. Track-mounted boring equipment is commonly utilized, but truck-mounted equipment can also be used depending on the terrain and ease of access. A four-wheel drive service truck would be used as a support vehicle. The operational area in which the track- or truck-mounted rig operates is 30 feet by 30 feet. Minimal disturbance is required if the ground is flat, but steeper ground may require some leveling. A typical geotechnical drill pad layout is shown in Appendix E. Additional geophysical testing such as seismic refraction may also be used to assess geologic conditions along the route.

Boring depths would vary depending on the rock type and type of infrastructure for which the boring data is being collected. For roadways, boring depths are approximately 5 feet below finished grade in cut areas, or the approximate depth of fill in fill areas. For the bridge area, boring depths are at least 10 feet below the rock socket depth (in rock) and 20 feet below tip depth (in soil). In areas where slope stability needs to be evaluated, boring depths are approximately 15 feet below the finished grade of the roadway.

In some areas, helicopter support may be required to advance the geotechnical borings. This is anticipated primarily in the Flux Canyon area, where no current access roads exist. Helicopter support would only be used as a contingency, with the preference to access geotechnical sites from the ground. If needed, the helicopter would likely stage out of Tucson. The helicopter would be used to transport the borehole drill rig components, tooling, and likely water, in order to support the boring operation. When delivering supplies to borehole sites, the helicopter would land on South32 Hermosa private lands, pick up supplies, and then sling them (i.e., carry them underneath the helicopter) to the borehole site. For borehole rig relocation, the helicopter would come directly from the staging area to the borehole site. It is anticipated that personnel would be able to walk to the sites and would not need to be transported via helicopter. It is estimated that six borings on six individual locations would be needed within this area and would take approximately two weeks to complete the work. A total of 12 helicopter trips within the two weeks would be needed to mobilize and demobilize the borehole rig from one location to the next. Each of those helicopter trips would include moving the borehole rig and ancillary equipment (water tank, drill mud, tools, generator, compressor, borehole rods, etc.). It is estimated that 4 to 5 hours of helicopter time would be needed for each trip equating to a total of 48–60 hours of helicopter time for the entire program. The support helicopter is most likely to be a Bell 206 L-4 Lone Ranger or Astar B3 (or equivalent). Since the helicopter does not need to land at the borehole sites, and is only slinging materials, no vegetation removal would be required for the helicopter. No landing is anticipated on NFS land, unless in the event of an emergency.

In each borehole, samples are planned to be obtained with standard penetration test samplers and/or ring-lined barrel samplers at approximate intervals of 2.5 feet in the upper 10 feet and at intervals of 5 feet thereafter. Bulk samples of auger cuttings would be collected from the borings at selected depth intervals. Where rock coring is performed, the field engineer or geologist would record the recovery and rock quality designation (RQD) of the recovered rock core and would obtain representative samples for further laboratory evaluation. The boring team would prepare field boring logs as part of standard drilling operations including sampling depths, penetration distances, and other relevant sampling and core

[19] Tubex drilling techniques are used for loose overburden, and allow casing to be advanced simultaneously with drilling the borehole.

information. The field logs would include visual classifications of materials encountered during drilling, and an interpretation of subsurface conditions between samples. Final boring logs would be prepared from the field logs and would represent the geotechnical engineer's interpretation and include modifications based on observations and the results of laboratory testing.

At each location, the following typical process would be followed:

- Staking of borehole location in the field;
- Clear, grub, and level the pad (including stockpiling growth media and slash from brush clearing adjacent to or in the immediate vicinity);
- Evaluate and install additional sediment controls, as needed;
- Mobilization of geotechnical borehole rig to the pad;
- Complete field investigation with boring and collection of borehole samples;
- Backfill the boring void;
- Demobilize the geotechnical borehole rig from the pad;
- Reclaim geotechnical borehole pads.

These geotechnical testing locations fall within the eventual area of disturbance of the Primary Access Road and interim reclamation would be conducted at these sites to accommodate the period between investigation and return of lab testing, analysis and reporting. Interim reclamation is described in Section 5.3.1 and is intended to stabilize the surface and prevent erosion. This may be accomplished through installation of stormwater and sediment controls, recontouring, and/or revegetation (such as seeding).

The full geotechnical investigation for the Primary Access Road is estimated to take 4 to 6 weeks of field efforts, followed by 14 to 17 weeks for lab testing, engineering analysis, and reporting.

2.5.11.3.2 CONSTRUCTION

When the geotechnical investigation is complete and the Primary Access Road design is finalized, the associated existing FRs would be reconstructed including installation of new culvert crossings, cut/fill associated with widening and straightening of some portions of the roads for safety and to accommodate truck traffic, installation of rockfall protection, grading, and resurfacing according to final construction specifications. Resurfacing treatments could include asphalt, soil-cement base, and/or chip-sealing. Depending on final design, drainage crossings could be improved with the installation of culverts, at-grade crossings, and water bars. If any fill operations within drainages that are determined to be waters of the U.S. are to occur, a Clean Water Act Section 404 permit would be obtained from the U.S. Army Corps of Engineers prior to commencing work.

Two all-new road segments would be constructed as part of the Primary Access Road, including a runaway truck ramp and a bridge over Flux Canyon connecting Flux Canyon and Flux Roads. A turn around area would be constructed approximately 0.2 miles west of the boundary of South32 Hermosa private land, near the intersection of Flux Canyon Road (FR 812) and Humboldt Canyon Road (FR 4685). The western end of Barriles Tank Road would be realigned to intersect SR 82 at a 90-degree angle for safety, and the northbound and southbound approaches of the highway would be widened to accommodate turning and acceleration/deceleration lanes. The bypassed segments of original road alignments would be reclaimed by scarifying the road surface and reseeding with a seed mix developed in coordination with USFS.

The new Primary Access Road would be approximately 7.5 miles long and would be constructed entirely on NFS land. When complete, the new Primary Access Road would consist of two 14-foot-wide travel lanes with 5-foot-wide shoulders on each side. The average cut-and-fill width over the length of the new access road is approximately 68 feet; however, a construction corridor width of 100 feet is being assumed to ensure adequate space is available for rock protection or unanticipated cut/fill due to geotechnical conditions encountered. Disturbance in some areas is anticipated to require utilization of NFS land beyond a 100-foot corridor to be determined based on the final designs, required cut/fill, and selected construction techniques. In these areas, it is anticipated that up to a 150-feet wide corridor will be required. Those expanded areas are shown in Appendix A and represent approximately 1.5 miles of the Primary Access Road. These expanded areas are included in the disturbance acreage in Table 1-2.

The Project will be regulated as a mine site by the MHSA, including roadways. The Primary Access Road, LT-TARs, and ST-TARs may need to comply with MSHA road safety requirements. This includes a maximum grade of 15 percent, and the use of roadside berms (typically installed to one half of the equipment tire height) or other appropriate safety barriers. Exceptions are made for tracked vehicles.

Construction of the road would be done with typical construction equipment (dozers, trucks, loaders, excavators, scrapers, drills, and support equipment) and blasting of rock may be required in some segments to attain full road width. A bridge, culverts, and low-water crossings would be installed at identified drainage systems along the route of the road. Retaining walls may be installed along steep, narrow road segments with the purpose of securing the road, minimizing cut and fill volumes and minimizing disturbance. Guardrails and/or integrated safety barriers would be installed along segments of the road outside of the shoulder width where steep embankments, bridge piers and retaining walls pose a safety risk to traffic. Roadside reflectors would be installed along the road to delineate the roadway at night. The intersection with State Route 82 would require modification of State Route 82 to include acceleration/deceleration lanes and left/right auxiliary turn lanes. Additional activities that could occur within the construction corridor include replacement or movement of existing utility poles.

A summary of the Primary Access Road lengths and disturbance estimates arranged by construction type (realigned, new, and reconstructed) is presented in Table 2-6.

When complete, the Primary Access Road would be open for permanent public use and would connect with SR 82. Once the Primary Access Road is constructed, Harshaw Road would be used to provide secondary access to the Project for emergency purposes and a limited number of trips for employee transit, which would be minimized due to bussing and the IROC operations. Harshaw Road traverses South32 Hermosa private land and that road segment will also remain open to the public and unrestricted for the duration of and after the Project. The Primary Access Road would also be available for public use during and after the Project.

Table 2-6. Primary Access Road Disturbance Estimate Summary

Construction Type	Length (feet)	Estimated Disturbance (acres)
Realigned	5,300	13.2
New	10,100	26.6
Reconstructed	24,300	60.5
Total	**39,700**	**100.3**

Note: The acreage described in the PoO (see Table 1-2) includes 5% contingency acreage to account for unanticipated changes that are required based on conditions encountered during site investigation and construction. The exact location and nature of operations occurring within the contingency area is unknown. The acreages shown in this table are based primarily on a 100-foot corridor, but with some areas anticipating a larger disturbance for cut/fill and assuming a 150-foot corridor.

Prior to construction of the Primary Access Road, construction of infrastructure and facilities would be occurring on South32 Hermosa private land as well as sulfide ore mining and beneficiation and oxide ore mining. Traffic on Harshaw Road would include:

- Zinc and lead/silver concentrate, using on-highway haul trucks
- Oxide ore, using on-highway haul trucks
- Personnel, using personal vehicles or buses
- Compressed natural gas for on-site generation, using fuel delivery trucks
- Diesel fuel, using fuel delivery trucks
- Explosives, using emulsion delivery/powder trucks
- Raw materials (sand, gravel, aggregate) and other materials and supplies including potable water, cement, tires, and chemicals, using on-highway haul trucks

After construction of the Primary Access Road, traffic on the Primary Access Road is estimated to involve the following during typical operations on South32 Hermosa private land and NFS land:

- Zinc and lead/silver concentrate, using on-highway haul trucks
- Oxide ore, using on-highway haul trucks
- Personnel, using personal vehicles or buses
- Compressed natural gas for on-site generation, using fuel delivery trucks
- Diesel fuel, using fuel delivery trucks
- Explosives, using emulsion delivery/powder trucks
- Raw materials (sand, gravel, aggregate) and other materials and supplies including potable water, cement, tires, and chemicals, using on-highway haul trucks.

After construction of the Primary Access Road, only minor personnel traffic is anticipated to use Harshaw Road.

2.5.11.3.3 MAINTENANCE

Maintenance activities would be conducted on an as-needed basis and would include shoulder grading, repairing potholes and periodic resurface treatments, and selectively trimming vegetation alongside the road to allow vehicle clearance. Shoulder grading would be accomplished using a motor grader. A Cooperative Road Maintenance Agreement currently exists between Santa Cruz County and the Coronado National Forest. Under this agreement, Santa Cruz County is responsible for maintenance for a number of major roads that cross the NFS land, including Harshaw Road, Duquesne Road, and Flux Canyon Road (including some existing segments of the Primary Access Road). The Cooperative Road Maintenance Agreement identifies the appropriate maintenance level to be maintained for each road. After construction of the Primary Access Road, it is likely an amendment to the agreement could be executed providing for maintenance of the new segments of the Primary Access Road on NFS land, funded by South32 Hermosa, or a new maintenance agreement could be executed between the Coronado National Forest and South32 Hermosa.

- For more information in the PoO related to the Primary Access Road, see:
  - Appendix A – Roads plan
    - Section 4.1 – Design and construction of Primary Access Road
    - Section 5.1 – Construction methods for Primary Access Road
    - Section 6.1 – Maintenance of Primary Access Road
  - Appendix C – Materials management
  - Chapter 3 – Environmental Protection Measures
    - AQ1 – Remote operations
    - AQ5 – Transport controls and trip minimization
    - AQ8 – Fugitive dust management
    - AQ9, FW9D, PS10 – Speed limit
    - AQ10 – Primary Access Road surfacing
    - WQ11 – Off-road travel
    - SW2 – Solid waste disposal
    - SW3 – Garbage disposal
    - SW4 – Inert waste disposal
    - SW7 – Preparation of Spill Prevention, Control, and Countermeasures Plan
    - SW8 – Refueling operations
    - SR5 – Minimization of Forest Service access restrictions
    - SR6 – Designing to reduce visual impacts
    - FW9B – Construction monitoring
    - FW9C – Low impact design
    - CR2 – Siting of facilities to avoid cultural resources
    - PS1 to PS9 – Fire preparedness and prevention

2.5.11.4 LT-TARs

2.5.11.4.1 DESIGN

A number of LT-TARs would be constructed within the boundaries of the Project to provide access to specific facilities (facility access LT-TARs). On NFS land, these facilities include the TSF2 perimeter road, and the TSF2 and TSF2 UDCP access roads. Other existing FRs are also used currently by Project personnel and would continue to be used to access various parts of the Project. However, based on existing road conditions, some existing roads likely would require improvement beyond the existing disturbed area. These areas are shown on Figure 2-1 and disturbance is included in Table 1-2, based on an estimated disturbance width of 30-feet (same as other LT-TARs). It is recognized that some of this area is already disturbed by the existing road.

New LT-TARs would be constructed where necessary for monitoring wells and GWM wells (well site access LT-TARs) and RIBs (RIB access LT-TARs). Based on reconnaissance surveys, access route alignments were identified to minimize overall disturbance to NFS land. Consideration was given to the location of the proposed well sites, the nature of the surrounding terrain and topography, the condition of existing access, and the constraints of the equipment required for drilling. Locations for LT-TARs for well site and RIB access are shown on Figure 2-1.

LT-TARs would be closed to public use and would typically be 15-feet wide driving lane with a nominal disturbance width of 30 feet. The 30-foot corridor is anticipated to account for the 15-feet driving lane, cut and fill, safety berms, other appropriate safety measurements, as well as any pipelines and power lines. For GWM wells, both power lines and pipelines would be installed within the same road corridor. For RIBs, pipelines would be installed in the same road corridor.

2.5.11.4.2 CONSTRUCTION

LT-TARs would be constructed utilizing best management practices to ensure road stability and safety and to minimize environmental impacts. LT-TARs would be constructed in a similar manner and with the same equipment used for the Primary Access Road; however, geotechnical investigation would not be required. Some resurfacing may be required. Resurfacing treatments could include asphalt, soil-cement base, and/or chip-sealing. Clearing, site prep, and reclamation would be similar to that described for ST-TARs in Section 2.4.1. The general order of each sequence of operations during LT-TAR construction is:

- Install sediment controls;
- Clear well site access road alignments and drill pads (including stockpiling growth media and slash from brush clearing adjacent to or in the immediate vicinity);
- Construct LT-TARs;
- Construct well sites and or RIBs, transport equipment and supplies to the sites, and set up equipment;
- Drill, complete, and equip the wells and/or construct the RIBs;
- Remove drilling/construction equipment from the well sites and/or RIBs;
- Conduct reclamation activities for temporarily disturbed areas using stockpiled growth media and slash and reseed using an approved mix of native vegetation species.

When no longer needed, temporary access roads for the wells and RIBs would be decommissioned and reclaimed by scarifying the road surface and reseeding with a seed mix developed in coordination with the USFS. Growth media and slash may be used in the reclamation if needed. Road locations are indicated on Figure 2-1 and a summary of the road lengths and estimated disturbance is presented in Table 2-7.

Table 2-7. Temporary Access Roads Disturbance Estimate Summary

Road Type	Length (feet)	Estimated Disturbance (acres)
Facility access (LT-TAR)	N/A	N/A
Monitoring well (LT-TAR)	2,300	1.6
GWM well (LT-TAR)	9,300	6.4
RIBs (LT-TAR)	8,600	5.9
Existing roads requiring upgrades to LT-TAR criteria	8,000	5.5
Subtotal for LT-TARs	*28.200*	*19.4*
Exploratory (ST-TAR)	15,300	10.5
Existing roads requiring upgrades to ST-TAR criteria	12,500	8.6
Subtotal for ST-TARs	*27,800*	*19.1*
Total	**56,000**	**38.5**

Note: The acreage described in the PoO (see Table 1-2) includes a 5% contingency acreage to account for unanticipated changes that are required based on conditions experienced during site investigation and construction. The exact location and nature of operations occurring within the contingency area is unknown. Facility access roads are incorporated into the footprint of TSF2 and acreage is not calculated separately.

2.5.11.4.3 MAINTENANCE

Maintenance of LT-TARs that are associated with existing FRs would be limited to activities to address erosion and washouts of the road surface that can be conducted within the disturbed area of the existing roadbed (i.e., grading and berm improvements) and is not considered new disturbance. Maintenance of LT- TARs and ST-TARs that are newly constructed (or existing roads upgraded to LT-TAR or ST-TAR criteria) would also be conducted within the disturbed area of the new roadbed and would not create additional disturbance. Maintenance would be accomplished using a motor grader, and environmental protection measures would be implemented during maintenance, such as fugitive dust control and avoidance of surface waters, as described in Chapter 3. Vegetation alongside the roads may be selectively trimmed as necessary to allow vehicle clearance. Existing FRs used for access would be maintained to the current level of maintenance designated by the Coronado National Forest's Huachuca Mountains Ecosystem Management Area, Transportation Analysis Plan (2001). LT-TARs would be maintained to USFS Level 2, High-Clearance Vehicles (USFS 1999). Fugitive dust generated by vehicles traveling on natural-surfaced roads would be controlled as needed by application of water from a spray bar-equipped truck.

- For more information in the PoO related to LT-TARs, see:
    - Section 5.3.2 – Concurrent reclamation
    - Section 5.3.3.3 – Decommissioning facilities during closure
    - Section 5.3.3.6 – Salvage of growth media for road closure
    - Appendix A – Roads plan
        - Section 4.2 – Design and construction of LT-TARs
        - Section 5.2 – Construction methods for LT-TARs
        - Section 6.2 – Maintenance of LT-TARs
    - Appendix C – Materials management
    - Chapter 3 – Environmental Protection Measures
        - AQ8 – Fugitive dust management
        - WQ10 – Grow media removal
        - WQ11 – Off-road travel
        - WQ14, SR10, FW11 – Access route alignments
        - SW7 – Preparation of Spill Prevention, Control, and Countermeasures Plan
        - SW8 – Refueling operations
        - SR6 – Designing to reduce visual impacts
        - SR9, FW10 – Concurrent reclamation
        - FW9B – Construction monitoring
        - FW9C – Low impact design
        - CR2 – Siting of facilities to avoid cultural resources
        - PS1 to PS9 – Fire preparedness and prevention

2.5.11.5 ST-TARs (Exploration Access Roads)

The construction and reclamation of exploration ST-TARs are previously described in Section 2.4.1.

- For more information in the PoO related to ST-TARs, see:
    - Section 5.3.2 – Concurrent reclamation
    - Appendix A – Roads plan
        - Section 4.2 – Design and construction of ST-TARs
        - Section 5.2 – Construction methods for ST-TARs
        - Section 6.2 – Maintenance of ST-TARs
    - Appendix C – Materials management

- Chapter 3 – Environmental Protection Measures
    - AQ8 – Fugitive dust management
    - WQ11 – Off-road travel
    - WQ14, SR10, FW11 – Access route alignments
    - SW7 – Preparation of Spill Prevention, Control, and Countermeasures Plan
    - SW8 – Refueling operations
    - SR6 – Designing to reduce visual impacts
    - SR9, FW10 – Concurrent reclamation
    - FW9B – Construction monitoring
    - FW9C – Low impact design
    - CR2 – Siting of facilities to avoid cultural resources
    - PS1 to PS9 – Fire preparedness and prevention

2.5.11.6 Traffic Management

2.5.11.6.1 EXISTING TRAFFIC CONDITIONS

The regional highway transportation network in the Project vicinity includes Interstate 10, Interstate 19, SR 82, SR 83, and SR 90. SR 82 is the closest highway to the Project and it connects to Interstate 19 at Nogales to the southwest and Sonoita and SR 83 to the northeast. SR 83 and SR 90 continue north to intersect with Interstate 10 southeast of metropolitan Tucson.

Total vehicle traffic, consisting of both large trucks and passenger cars on SR 82 near Patagonia, has increased by about 8% since 2011 (Arizona Department of Transportation 2022). In 2021, about 2,200 vehicles per day used SR 82 between Patagonia and Sonoita. Trucks currently make up about 10% of all traffic northeast of Patagonia. In 2021, about 2,000 vehicles per day used SR 82 between Patagonia and Nogales. Trucks currently make up about 22% of all traffic southwest of Patagonia (Arizona Department of Transportation 2022).

2.5.11.6.2 PROJECT TRAFFIC

The number of direct employees anticipated at the Project is summarized in Table 2-8. The workforce is anticipated to vary over time; Table 2-8 presents the anticipated peak number of employees.

Table 2-8. Approximate Direct Project Workforce

Operational Component	Number of Employees	Examples of Anticipated Activities
Project activities on South32 Hermosa private land prior to PoO approval	400	Advancement of shafts, lateral development of underground workings, installation of underground material handling system and ventilation/ refrigeration system, and mining.
Plan Operations – Exploration	Minimal	Exploration will continue throughout the mine life, and typically will involve drill crews and support staff.
Plan Operations – Construction	600	Initial work including geotechnical investigations along the Primary Access Road and at TSF2, and installation of GWM wells and associated infrastructure including pipelines, power lines, and well site access roads. Construction activities including installation of surface infrastructure and buildings, clearing, cut/fill, and construction work on the Primary Access Road and clearing, foundation preparation, and construction of TSF2 and RIBs.
Full Project Operations – Steady State	700	Mining beneath NFS land and South32 Hermosa private land; beneficiation activities on South32 Hermosa private land; other ancillary and ongoing activities.

Note: Workforce quantities shown do not include remote employees at IROC or oxide ore beneficiation facilities.

[redacted]

[redacted]

[redacted]

2.5.12 Power Generation (Private Land)

Line power is currently supplied to the Project by a 13.2-kilovolt (kV) power line owned and operated by UniSource Energy Services (UniSource), which will continue to supply power in the future. UniSource has indicated that the existing 13.2-kV line does not provide sufficient capacity to meet the load requirements of proposed service requests, or any future service requests, and does not have the ability to be upgraded to a level that would meet Project requirements.

Existing line power will be supplemented by natural gas– and diesel-fueled generators that will operate on South32 Hermosa's private land to provide the full power needed to operate the Project. The Project is anticipated to require between 27 to 58 generators (depending on size) that will be on the portion of South32 Hermosa private land supporting mining of the sulfide ore, and two or three generators and one backup generator on the portion of South32 Hermosa private land supporting mining of the oxide ore. A small number of additional diesel generators will also be used, five of which will be for emergency power. No power generation facilities would be on NFS land.

Additional power lines will be constructed within the Project boundaries to provide power to TSF2 and the TSF2 UDCP, and to the GWM wells. These internal power lines are anticipated to be overhead 13.8-kV power lines that lie within the corridors identified for permanent access roads or within the planned footprint shown for TSF2. The internal power line associated with TSF2 is shown in Figure 2-5.

UniSource has obtained Arizona Corporation Commission (ACC) approval (ACC Decision No. 79005 docketed June 28, 2023) for siting a proposed 138-kV overhead transmission line, in part across NFS land, to serve the Project and support service reliability of all of UniSource customers in the San Rafael Valley, Washington Camp, and Lochiel areas of southern Arizona. Anticipating the future potential for expanded line power service, South32 Hermosa included an alternative scenario in its air quality permit for the Project that could, if implemented, replace most of the generators on South32 Hermosa private land with line power from the 138-kV line (see Section 3.3 for more details on the replacement).

The ACC-approved corridor for the 138-kV segment traversing NFS land generally follows existing utility corridors including the El Paso Natural Gas/Kinder Morgan natural gas pipeline alignment and the existing 13.2-kV transmission line along Flux Canyon Road, to minimize impacts to surface resources. The utility corridor alignment is also similar to that of the Primary Access Road. The poles supporting the transmission line would be self-weathering steel monopoles with a height of 75 to 110 feet, with spans averaging between

750 and 1,000 feet. The siting of the poles would blend into the landscape and incorporate screening by vegetation and topographic relief to the extent practicable. The eastern terminus of the 138-kV transmission line would connect a future switchyard (known as the Rio Rico switchyard) to a new UniSource substation (known as the Harshaw substation) on South32 Hermosa private land. The Harshaw substation would step down power to 13.2-kV distribution to existing customers in the San Rafael Valley and other private inholdings near Washington Camp and Lochiel. The UniSource Harshaw substation would also distribute 138-kV power to a separate Hermosa Project substation. The Hermosa Project substation would step down power to 69-kV distribution to the Project (concentrator and main shaft).

Without the UniSource transmission line, natural gas usage is estimated to eventually require about 16.8 million cubic feet per day, delivered by truck to the Project.

- For more information in the PoO related to power generation and utilities, see:
  - Section 4.4.6 – Utilities during temporary cessation of operations
  - Section 5.3.3.3 – Decommissioning facilities during closure
  - Chapter 3 – Environmental Protection Measures
    - AQ1 – Remote operations
    - AQ8 – Fugitive dust management
    - AQ12 – Potential to replace compressed natural gas generators
    - WQ14, SR10, FW11 – Access route alignments
    - SR6 – Designing to reduce visual impact
    - FW9B – Construction monitoring
    - FW9C – Low impact design
    - CR2 – Siting of facilities to avoid cultural resources
    - PS1 to PS9 – Fire preparedness and prevention

2.6 PROJECT PERMITS AND APPROVALS

Anticipated regulatory permits and approvals associated with the Project and Plan Operations are summarized in Table 2-10. Current activities on South32 Hermosa private land are conducted under existing state permits, some of which will be modified to facilitate new or expanded facilities.

Table 2-10. List of Agencies, Permits, and Approvals Required for Plan Operations

Agency	Permit	Permit Description
FEDERAL		
U.S. Army of Corps of Engineers	Clean Water Act Section 404	Section 404 of the Clean Water Act regulates the discharge of dredged or fill material into waters of the U.S. Section 404 is regulated by the U.S. Army Corps of Engineers, and the U.S. Environmental Protection Agency reviews regulated fill activities in conjunction with the U.S. Army Corps of Engineers. A 404 permit may be required for any dredge or fill associated with Project components, if jurisdictional waters are determined to be present at those locations.
U.S. Environmental Protection Agency	Underground Injection Control Permit	Permit for Class V wells for injection of non-hazardous fluids into or above underground sources of drinking water. This permit may be required for the cemented paste backfill. Note that the ADEQ is in the process of taking over this program.
U.S. Forest Service (USFS)	Exploration and Mine Plan of Operations (PoO)	A PoO is required to be submitted for operations on USFS-administered land (36 CFR 228 Subpart A). As part of approving a PoO, the USFS must also comply with the National Environmental Policy Act, National Historic Preservation Act, Endangered Species Act, and other applicable federal laws, regulations, and policies.

Agency	Permit	Permit Description
STATE		
Arizona Department of Environmental Quality (ADEQ)	Air Quality Permitting	ADEQ regulates and has jurisdiction over air quality permits in Santa Cruz County. South32 Hermosa submitted an air permit application to ADEQ on October 21, 2022. The permit application and associated documents demonstrate how the Project will comply with all applicable requirements and includes an air quality modeling report demonstrating that the Project will not interfere with the attainment or maintenance of any National Ambient Air Quality Standards (NAAQS).
ADEQ	Aquifer Protection Permit (APP)	The APP program applies to any facility that discharges (or has the potential to discharge) pollutants to groundwater. This includes discharges to the land surface or vadose zone with the potential to reach groundwater. There is a current valid APP for private land facilities (P-512235). TSF1 will undergo substantial expansion and the APP will be amended to allow storage of production tailings. On NFS land, TSF2 and RIBs will also require APP coverage.
ADEQ	Arizona Pollution Discharge Elimination System (AZPDES)	The AZPDES program authorizes discharges from point sources to surface waters of the state. Point-source discharges of stormwater may be authorized by general permit; most other point-source require authorization via individual permit. South32 Hermosa has been issued an AZPDES permit for point-source discharges from WTP1 and WTP2 (Permit No. AZ0026387). South32 Hermosa also has received authorization under the AZPDES mining multi-sector general permit for stormwater at the site, which authorizes discharge from stormwater runoff (AZMS81380), and has developed the required Stormwater Pollution Prevention Plan (SWPPP) for these discharges. Planned surface disturbance and facilities on NFS land will require coverage for stormwater runoff to protected surface waters under a valid AZPDES permit.
ADEQ	Resource Conservation and Recovery Act Subtitle C Site Identification Form	Hazardous waste is regulated under Resource Conservation and Recovery Act Subtitle C. This includes notification requirements for any facility determined to generate, transport, recycle, treat, store, or dispose of hazardous waste.
ADEQ	State Water Quality Certification, Clean Water Act Section 401	This certification is for state issuance of a Section 401 State Water Quality Certification for an activity or project requiring a federal permit or license, that may result in a discharge to waters of the U.S.
Arizona Department of Transportation	Encroachment Permit	Arizona Department of Transportation requires encroachment permits for any improvements within their right-of-way. This often applies to collection of field survey data as well as construction activities. An encroachment permit is anticipated for the upgraded intersection with SR 82 and proposed acceleration and deceleration improvements within the SR 82 right-of-way.
Arizona State Mine Inspector	Reclamation Plan- annual renewal	Arizona state law requires that mined land reclamation plans be submitted by all metalliferous and aggregate mining units and exploration with surface disturbances greater than 5 acres on private land within the state of Arizona. After approval of the mined land reclamation plan, the Arizona State Mine Inspector requires appropriate financial assurance and may conduct inspections of the mine. South32 Hermosa has an approved reclamation plan for exploration activities on its private land (Site ID# 13-03295; Mine ID# 02-03398). A modified reclamation plan or new reclamation plan would be required for mining activities.

Note: Other permits or authorizations not explicitly listed in this table may be required and will be obtained when needed to maintain compliance with all applicable federal, state, and local laws and regulations.

CHAPTER 3. ENVIRONMENTAL PROTECTION MEASURES

3.1 INTRODUCTION

This section is intended to provide an overview of the environmental protection measures that have been implemented or will be implemented to reduce or eliminate adverse effects on resources that may result from Plan Operations on NFS land. Final environmental protection measures and mitigations will be identified following the completion of analysis in the National Environmental Policy Act process and in the other federal and state permits and approvals needed prior to the start of construction or operations.

Environmental stewardship and conservation are an integral part of South32 Hermosa's mine development strategy for next-generation mining. South32 Hermosa is committed to minimizing its impact on the environment. Under South32's Sustainability Policy commitments, the Project must conform to established internal standards that help reduce its environmental impacts, as discussed in the following sections. Key aspects of South32 Hermosa's mine development strategy include the following:

- **TSF2 Siting.** The location of TSF2 on NFS land was determined by South32 Hermosa using environmental, socioeconomic, and technical decision criteria. Environmental criteria included such factors as drainages and aquatic features, watershed area, habitat including endangered species concerns, air quality, and cultural resources. Socioeconomic criteria included such factors as effects on Forest Roads, recreation, visual resources, and proximity to downstream infrastructure or residents. Technical criteria included factors such as use of natural topography to aid containment, fault locations, and constructability, as well as factors related to operational complexity, such as proximity to mining and seepage control.

- **Primary Access Road Siting.** Based on community feedback, a portion of the Primary Access Road alignment was moved parallel to an existing gas line, thereby avoiding a rural residential neighborhood located west/northwest of the Project.

- **Integrated Remote Operations Center.** South32 Hermosa has adopted the philosophy of minimizing the number of personnel trips to the Project as much as practical. To achieve this goal, reduce traffic-related air pollutant emissions from employee trips, and fulfill commitments to the community to minimize traffic to the mine site, the main concentrator control room will be part of an IROC. The IROC will be sited and constructed at a location in Santa Cruz County distal from the Project. The IROC will house a variety of key functions to ensure the seamless integration of activities and to facilitate optimization of the entire value chain. An on-site control room facility will be maintained for use as an emergency backup. The concentrator will also utilize a higher-than-standard level of instrumentation and automation to minimize the need for operator intervention.

- **Dry-stack Tailings.** As part of voluntary cleanup of legacy mine waste, South32 Hermosa built one of the nation's first new lined, dry-stack tailings facilities, limiting the surface disturbance and achieving the highest standard of safety and water conservation. That existing facility on South32 Hermosa private land will be expanded and a second, lined dry-stack facility will be constructed on NFS land using the same proven principles. The use of an impermeable liner with a seepage collection system minimizes potential impacts to aquifer water quality. Dry-stack tailings with target moisture contents of 11.8% are similar to engineered fill, rather than a slurry, greatly reducing any potential for failure or migration of tailings.

- **Underground Mining Method and Use of Paste Backfill.** The Project will use an underground mining method that will also involve backfilling the stopes with cemented paste backfill as mining progresses. This advanced method greatly reduces the volume of stored tailings on the surface while minimizing the potential for subsidence.
- **Limited Surface Disturbance Footprint.** The surface disturbance footprint for the Plan Operations is less than 500 acres. Approximately 25% of this acreage represents temporary disturbance only.
- **Designing for Autonomous Equipment.** The design of the underground infrastructure specifically supports the use of autonomous equipment, minimizing the need for personnel in heavy-equipment work areas, increasing efficiency, and reducing greenhouse gas emissions.
- **Water Management**
  - In the interest of protecting and conserving natural resources, South32 Hermosa will closely monitor and measure water activities at the Hermosa Project. The Project will require far less water than most mines today, and South32 Hermosa is working with the community to explore beneficial reuse of the groundwater that needs to be relocated away from the orebody for safety, including recharge to the aquifer using RIBs to offset the effects of drawdown in the aquifer and potential impacts to groundwater-dependent ecosystems. The Project is being designed to eliminate the need for perpetual water treatment beyond the life of the mine.
  - Consistent with the South32 Sustainability Policy, Project processes were designed to maximize metallurgical recoveries of desired metals while minimizing impacts to the environment, including water and reagent use as well as tailings management including reuse.
- **Electrified Transport.** Application of low-carbon design principles includes planning for an all-electric vehicle fleet powered by renewable energy to reduce noise, improve working conditions, safety, and health, and support delivery of South32's greenhouse gas reduction targets and goals.
- **Community Preservation Zone and Interim Construction and Use of Bypass Road.** Based on community feedback, South32 Hermosa developed a Community Preservation Zone to exclude industrial activities from the downtown Patagonia area. Further, to minimize traffic through Patagonia, South32 Hermosa purchased private land in Santa Cruz County and transferred the land to the County to facilitate the construction of a temporary bypass road around the Town (known as the Cross Creek Connector) and long-term use of the land as a park now owned by Santa Cruz County. Upon completion of the Primary Access Road, South32 Hermosa will relinquish its reserved easement for the Cross Creek Connector and the road will become an integrated public park amenity.
- **Subsidence Monitoring.** South32 Hermosa will monitor ground subsidence utilizing satellite-based InSAR and/or light detection and ranging (LiDAR) technology throughout the mine life, in order to identify any potential impacts in a timely manner to allow evaluation of changing conditions and possible adjustment of mining procedures.

In addition to these key mine development strategies, South32 Hermosa is applying low-carbon design principles in the Project's design and engineering plans in order to reduce greenhouse gas emissions. South32 Hermosa foresees using automation and technology to minimize impact on the environment to help achieve South32's long-term goal of achieving net-zero greenhouse emissions by 2050. An additional component of this goal is the use of renewable energy. The mine designs will enable power supply from renewable energy, which could underpin new renewable energy capacity and infrastructure across the local region.

3.2 ENVIRONMENTAL PROTECTION PROGRAM

The Project's environmental protection program is predicated on operating in compliance with applicable federal and state regulatory programs, and in particular permits and authorizations in place for the Project. Table 2-10 lists the majority of the permits and authorizations under which the Project will operate. All operations on NFS land are required to be conducted to minimize adverse environmental impacts on Forest Service surface resources where practicable including adherence to requirements detailed under applicable federal regulations. Environmental protection measures and mitigation also will be further identified during the National Environmental Policy Act process and implementation of appropriate measures will be required in the authorization.

In addition to Project-specific permits and Forest Service requirements, the Project will follow South32's Sustainability Policy, a set of internal standards for all South32 exploration, major projects and operations. These standards provide an environmental management framework to ensure appropriate focus and accountability, improvement, and standardized processes to avoid and/or minimize environmental harm. The general commitments are modeled on the International Organization for Standardization 14001 Environmental Management System Standard and complement the International Council on Mining and Metals Sustainable Development Principles and Performance Expectations.

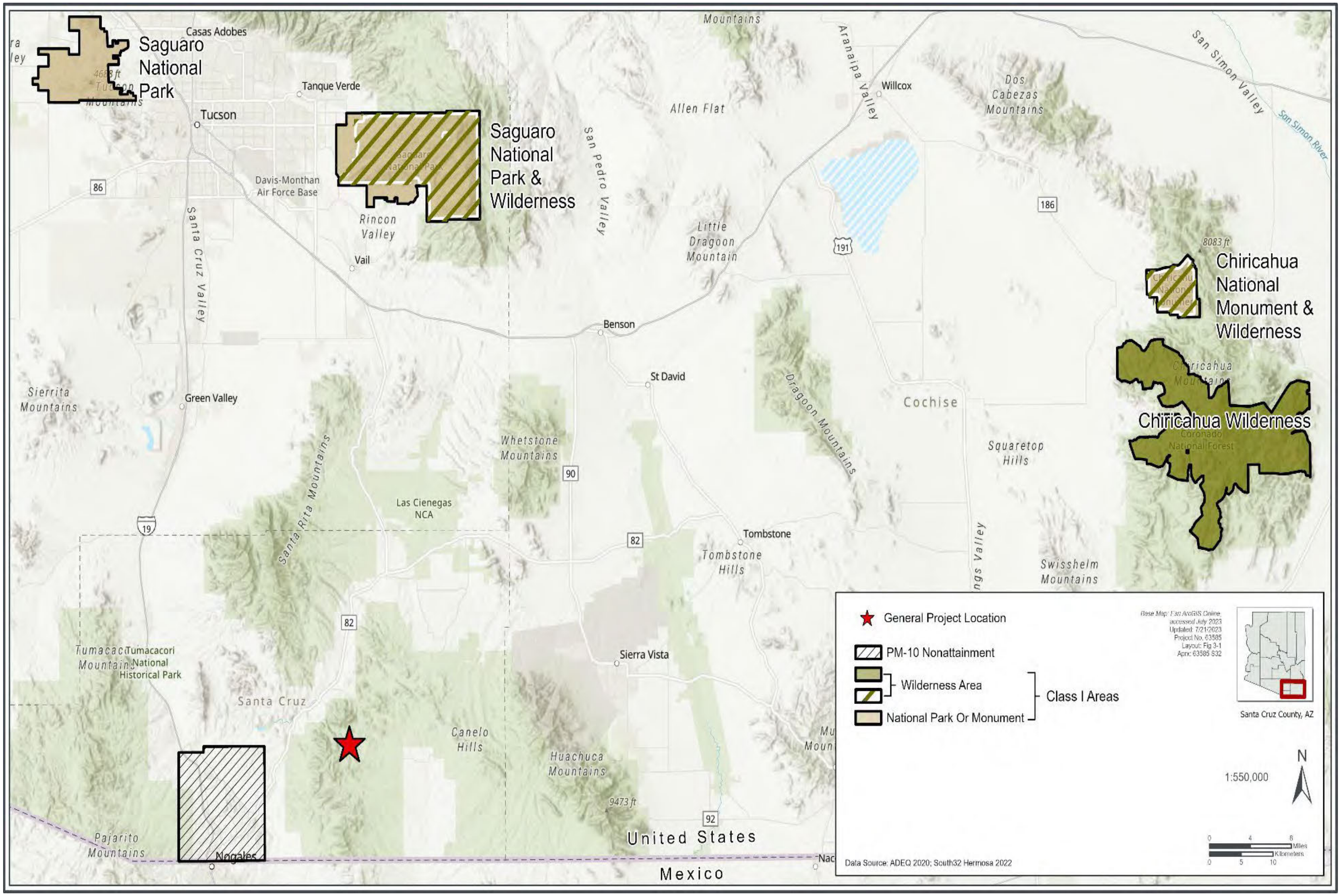
Where necessary, this chapter identifies specific environmental protection measures to address potential impacts that are of concern.

3.3 AIR QUALITY

Air quality within a region can be measured in comparison to the National Ambient Air Quality Standards (NAAQS), for criteria pollutants as defined in the Clean Air Act (42 United States Code 7409). Regional nonattainment status is determined in the cases when the NAAQS are exceeded. Portions of Santa Cruz County near Nogales have been designated as being in nonattainment for particulate matter with a diameter of 10 microns or less (PM_{10}). However, the Project is outside of the nonattainment area and is not affected by these designations (ADEQ 2022). Class I areas are granted special protection under the Clean Air Act and analysis may be required to demonstrate the Project will not impact these areas. The nearest Class I areas are shown in Figure 3-1.

South32 Hermosa has collected site-specific baseline meteorological data near the Project from 2018 to present. Measurements include wind speed, temperature, precipitation, humidity, solar radiation, and atmospheric pressure. These monitoring data have been used to support the air quality permit and development of environmental protection measures.

Figure 3-1. Locations of nonattainment and Class I areas.



3.3.1 Environmental Protection Measures[20]

AQ1 – Remote operations. The incorporation of the IROC facility into the mine design and the automation of underground equipment will limit employee trips to the site and reduce air emissions from mobile sources. The Project design further supports future greenhouse gas reductions, including planning for the use of autonomous vehicles and electrification of the fleet, and designing the Project to enable power supply from renewable energy.

AQ2 – Underground mining. Underground mining will be combined with cemented paste backfill of mined stopes. This reduces the size of facilities needed for surface management of waste rock and tailings and the potential for dust generation from those facilities.

AQ3 – TSF2 design to reduce fugitive emissions. Surface compaction of dry-stack tailings and armoring the face of TSF2 will serve to limit dust generation, compared to traditional slurry tailings facilities, that have deposition of fine-grained sediments on the exposed surface, which contributes to windblown dust when dry.

AQ4– TSF2 siting to reduce haul distances. In part, TSF2 was sited to optimize proximity to both mining and beneficiation facilities, reducing the amount of fuel use and emissions.

AQ5 – Transport Controls and Trip minimization. Dust associated with oxide material will be managed by containerized transport and the use of roads will be minimized to the extent practicable by using buses to transport staff and encouraging contractors and staff to minimize trips to and from the Project on a daily basis.

AQ6 – Air emissions tracking. In addition to the Class I permit requirements, South32 Hermosa will identify and minimize air pollutants (and their potential impacts). The Project will implement monitoring programs to assess operating performance, verify compliance with adopted performance criteria, facilitate reporting requirements, and quantify the material emissions sources that have the potential to cause adverse environmental or community health impacts.

AQ7 – Engineered controls. Engineered control equipment will be used (e.g., dust collectors) at crushing and process areas requiring dust and/or emission controls, as determined to be necessary to prevent excessive emissions. These include selective catalytic reduction (SCR) and oxidation catalysts (OxCat) for the natural gas generators, various dust collectors, use of bin storage for ore, fully enclosed loading areas for concentrate, and the use of sealed containers for concentrate and oxide ore. All engines and other equipment will be subject to a federal standard (e.g., New Source Performance Standards, National Emission Standards for Hazardous Pollutants, etc.) and will comply with all applicable requirements.

AQ8 – Fugitive dust management. Although the majority of mining operations would occur underground, fugitive dust would be produced and potentially fugitive emissions would emanate from mining surface operations (hauling, stockpiling, blasting, drilling etc.), particularly on windy days. In order to reduce fugitive dust, South32 Hermosa will implement fugitive dust control measures, including the following:

- South32 Hermosa will review National Weather Service forecasts weekly and provide site-wide notice to personnel if wind gusts greater than 25 miles per hour are anticipated so that surface activities such as material handling can be paused or modified during high-wind events, as practicable.

[20] For convenience of referring to and tracking these environmental protection measures, each has been given a unique identifier (i.e., “AQ1”). These are numbered sequentially under each resource topic (AQ, WQ, SW, SR, FW, CR, PS).

- A mobile water truck will apply water sourced from the Project water supply to exposed surfaces, primarily active storage areas and internal haul routes.
- A dust suppressant application may be used where appropriate. South32 Hermosa will maintain adequate dust suppressant and/or watering capacity, including backup quantities in the event of breakdown, to control fugitive dust. South32 Hermosa will also evaluate new technologies or methods in dust suppression for their technical and economic feasibility as they become commercially available.
- South32 Hermosa will assign appropriate personnel and/or contractors the responsibility to control fugitive emissions in their operating areas through operating practices and control measures. If dust-generating activities are observed, South32 Hermosa personnel will ensure that all applicable operational practices and control measures described in the dust control plan are implemented.
- If visible fugitive dust cannot be prevented or controlled by more efficient application, operation, or maintenance of these practices and measures, the activity or activities generating excessive dust will be minimized or ceased, and efforts to stabilize fugitive dust sources will continue.

AQ9 – Speed limit. Traffic speed on the Primary Access Road would be controlled by use of signage, periodic radar verification, and a GPS-based vehicle tracking system for South32 Hermosa vehicles to monitor speed limits.

AQ10 – Primary Access Road surfacing. The Primary Access Road would be surfaced to reduce wear and the production of dust. Resurfacing treatments could include such treatments as asphalt, soil-cement base, and/or chip-sealing.

AQ11 – Employee training. South32 Hermosa will provide environmental training to all new employees as their job function demands, including responsibilities and procedures for minimizing fugitive dust. Refresher training will be provided to existing employees annually.

AQ12 – Potential to replace compressed natural gas generators. The ADEQ air quality permit will authorize and regulate all emissions from on-site power generation. However, the air permit will include an alternative operating scenario to facilitate future use of expanded line power when and if it becomes available for the Project. Once expanded line power is utilized, fewer natural gas engines would be required (approximately 80% of the engines could be retired from use). There is a potential to reduce emissions by up to 85% under this scenario.

3.4 WATER QUALITY

The Project has been designed with the recognition that water is a valuable shared resource that requires integrated and effective management to ensure its availability and suitability for shared use. South32 Hermosa's commitment to water stewardship is further enumerated in the South32 Sustainable Development Report 2022 (South32 2022b).

South32 Hermosa has collected site-specific baseline data on water resources near the Project since 2012. Water resources field data include: measurement of groundwater levels and groundwater chemistry; periodic monitoring of seeps, springs, and streams for flow and presence/absence of water; water quality sampling of seeps, springs, and streams; and aquatic surveys including vegetation plots, flow presence/absence, and observations of fauna. These monitoring data have been used to support TSF2 siting to avoid impacts to surface waters, design water management to minimize regional water impacts, and develop the environmental protection measures described below.

3.4.1 Surface Water

The western portion of the Project and the Primary Access Road are in the Middle Sonoita Creek (Hydrologic Unit Code-12, 150503010206) watershed and the eastern portion of the Project is in the Harshaw Creek (Hydrologic Unit Code-12, 150503010203) watershed. Major drainages near the Project include Harshaw Creek, Alum Gulch, and Flux Canyon, all of which are non-perennial except for small segments along each drainage with persistent flow.

The ADEQ has designated a portion of Harshaw Creek as impaired for copper and pH, but this reach of Harshaw Creek is roughly 0.25 mile upstream of the discharge point for WTP2. None of the drainages downstream from WTP2 (Harshaw Creek) are designated as impaired. The portion of Alum Gulch receiving water from WTP1 is designated as impaired for cadmium, copper, lead, zinc, and pH.

3.4.2 Groundwater

Consolidated rock is predominant throughout most of the Patagonia Mountains and surrounding mountain ranges. Alluvium is present as narrow deposits along canyons and in stream valleys. Regionally, basin fill and alluvium are found in thick, wide deposits in the Santa Cruz River Basin, San Rafael Valley, and Sonoita Creek Basin.

Shallow groundwater occurs within alluvium, basin fill, and open voids of the underlying fractured bedrock. Regional fracture sets associated with several principal cross faults likely have higher permeability than surrounding bedrock. Conversely, large, low-permeability igneous intrusions (e.g., the porphyry intrusion at Red Mountain, the granodiorite intrusion on west side of the Patagonia Mountains, and the monzonite intrusion at Mount Benedict) are anticipated to impede the flow of groundwater. At local scales, groundwater flow in bedrock is controlled by fracturing associated with geologic structure, and in some cases dissolution cavities. In addition to the preferential flow in fractures and dissolution cavities, historic underground mine workings also likely serve as conduits for localized groundwater flow.

Groundwater in wells completed in alluvium, basin fill, volcanic, igneous, and limestone near the Project range from calcium-sulfate dominant waters to calcium-bicarbonate dominant waters. Total dissolved solids concentrations in the groundwater study area range from about 100 milligrams per liter to 4,300 milligrams per liter and vary by geology type. Within the Patagonia Mountains, groundwater discharges to the surface as seeps along drainages including Humboldt Canyon, Hermosa Canyon, Harshaw Creek, Alum Gulch, and Flux Canyon. Most seeps create either small, isolated pools or have estimated seepage rates less than 1 gpm. Some water samples collected at seeps and springs in the Patagonia Mountains exhibit evidence of impacts from historic mining and/or from the presence of naturally occurring sulfide minerals.

3.4.3 Environmental Protection Measures

WQ1 – TSF2 siting out of drainages. TSF2 has been sited to avoid dredge and fill of potentially jurisdictional waters of the U.S.

WQ2 – Use of lined dry-stack tailings. To protect water quality, TSF2 was designed as a lined dry-stack facility. Lined, dry-stack facilities reduce the potential for seepage because of the use of filtered tailings and have a reduced risk of failure compared to traditional slurry tailings facilities. The design of a lined facility allows the seepage collection system to capture any seepage or stormwater contacting the tailings for routing to the UDCP for treatment by WTP2, reducing the risk of discharge from seepage or contact stormwater to the aquifer.

WQ3 – Use of available waste rock for TSF2 armoring. The use of available waste rock for armoring TSF2 reduces the potential exposure of stormwater to PAG materials.

WQ4 – Underground mining. Underground mining will be combined with cemented paste backfill of mined stopes, reducing the size of surface waste rock and tailings management facilities, thus minimizing the size of TSF2 and allowing the facility to remain out of potentially jurisdictional waters of the U.S.

WQ5 – Use of tailings for cemented paste backfill. The use of tailings in cemented paste backfill further reduces the volume of tailings requiring storage and closure management.

WQ6 – UDCP redundancy. A redundant pumping system would be installed in the UDCP for use during emergencies or maintenance, reducing potential for discharge of untreated water.

WQ7 – Designing for climate change. A physical impact of climate change assessment was conducted across South32's mining asset portfolio, including the Project. The assessment produced site-specific data regarding estimated changes to climate parameters using a range of local and international data. Predicted changes in precipitation and evaporation from the assessment were considered in the water balance and stormwater design. Annual precipitation is anticipated to decrease in future years, while rainfall from specific design storms is predicted to increase. Evaporation is expected to increase due to increases in solar radiation, temperature, and wind speed. The assessment was incorporated into the operational designs for TSF2, the TSF2 UDCP, and stormwater conveyance structures, and for the passive-closure design for TSF2 and the TSF2 UDCP.

WQ8 – Stormwater design standards. In addition to incorporating anticipated climate change effects into the design of stormwater controls for TSF2 and TSF2 UDCP, the designs are also based on application of multiple regulatory and industry standards, including ADEQ Best Available Demonstrated Control Technology (BADCT), ANCOLD, and GISTM. Sizing of stormwater controls was evaluated independently against each standard, and the standard yielding the most conservative result was selected, ensuring that stormwater controls will not be undersized.

WQ9 – WTP1/WTP2 operations. Discharges from operations will be controlled to meet strict water quality standards set by the AZPDES permit and APP permit. For both WTP1 and WTP2, regular sampling, operational controls, maintenance, and housekeeping ensure that discharges from the Project will not exceed any regulatory standard.

WQ10– Growth media removal. Removal of growth media material during site preparation will be scheduled for the dry months to the extent practicable to reduce the potential for erosion and soil loss.

WQ11 – Off-road travel. Off-road vehicle travel will be prohibited where practicable, and if necessary the use of appropriately designed tracked equipment will be prioritized to reduce the potential for erosion and high soil losses.

WQ12 – Off-site sewage treatment. Sewage would be managed entirely off-site by a licensed facility.

WQ13 – Hydrologic closure monitoring. To ensure long-term protection of water quality, post-closure activities on both South32 Hermosa private land and NFS land are anticipated to include monitoring of reclamation success and site stability, as well as hydrologic monitoring (water levels and water quality sampling), as required under applicable permits.

WQ14 – Access route alignments. Based on reconnaissance surveys conducted within the exploration area, access route alignments were identified to minimize overall disturbance to NFS land and surface resources, reducing the potential for erosion and soil loss.

3.5 SOLID WASTE / HAZARDOUS MATERIALS

3.5.1 Environmental Protection Measures

Project handling of solid waste is described further in Appendix C. Overall, no disposal of sanitary, solid waste, or hazardous waste would occur on or beneath NFS land, and all generated non-hazardous solid waste will be disposed of on private land in a manner consistent with local, state, and federal regulations. Specific environmental protection measures include the following:

SW1 – TSF2 siting to reduce haul distances. TSF2 was sited in part for proximity to mining and beneficiation facilities, reducing the amount of fuel use and the need for fuel transportation and hauling.

SW2 – Solid waste disposal. Solid waste will be disposed of in a distal permitted construction landfill not associated with the Project.

SW3 – Garbage disposal. Garbage and food waste will be hauled to a local landfill for disposal. On-site burning of garbage or refuse will be prohibited.

SW4 – Inert waste disposal. Wood and inert wastes such as concrete will be hauled to a local landfill for disposal, unless a facility is properly permitted on South32 Hermosa private land.

SW5 – Hazardous material storage and disposal. The disposal or recycling of hazardous materials will be done through qualified vendors in a manner that is consistent with applicable local, state, and federal regulations.

SW6 – Hazardous material/explosive storage. No hazardous materials and explosive storage or disposal would occur on or beneath NFS land, except temporary storage of materials to support drilling activities, or temporary storage of explosives during construction activities. Hazardous materials will be stored in designated facilities with appropriate secondary containment and be properly segregated.

SW7 – Preparation of Spill Prevention Control and Countermeasures plan. To prevent any spills from occurring or migrating, South32 Hermosa has developed a spill prevention, control, and countermeasures (SPCC) plan for the Project and will implement spill response procedures focused on prevention. Spill response procedures outline specific tasks and procedures for spill prevention, equipment fueling, materials storage, preventative maintenance, spill contingency and response actions, spill reporting, and cleanup and management. This SPCC plan will be updated as necessary throughout the Project and to include activities on NFS land. The plan and procedures will be kept on-site at all times and personnel will be responsible for following these procedures.

SW8 – Refueling operations. As a priority, and to the extent that it is practicable to do so, all surface heavy equipment and support vehicles will be fueled at the staging areas on South32 Hermosa private land. The fueling of drill rigs, support vehicles, and portable field equipment involved in dedicated work away from the staging areas will be accomplished using National Fire Protection Agency 1192, American National Standards Institute 119.2 rated pickup-borne fuel tanks of limited capacity that are equipped with electric fuel pumps (or similar allowable equipment). These portable tanks are typically used by construction and contracting personnel. Actual fueling will take place over a portable containment vessel of sufficient size to capture any spillage. Spill kits containing leak pans, rags, granular sorbents, and/or blotters will be maintained at the staging areas and on fueling pickup trucks to be used to clean any leaks, spillage, or drips. Any used absorbent material will be contained within a labeled lidded barrel for proper disposal.

SW9 – Appropriate fuel storage. Construction and operations equipment will use petroleum products, including diesel fuel or gasoline, motor oil, and hydraulic oil. A limited amount of fuel will be contained in the fuel tanks of the equipment used during construction and operations. Otherwise, all hydrocarbons will be stored on South32 Hermosa private land in closed containers that are compatible with the stored material and properly labeled. Hydrocarbon containers that are 55 gallons or greater must be placed in some form of secondary containment. Typical secondary containment includes the use of double-walled tanks, concrete and earthen secondary containments, contractor building walls, and catchment basins. Secondary containment will typically be designed to contain 110% of the largest container and designed with sufficient free board to contain rainfall from a 25-year, 24-hour storm event. All storage areas will be regularly inspected and appropriate spill response equipment will be available.

3.6 SCENIC VALUES AND RECREATION

The surrounding Patagonia Mountains offer a variety of year-round recreational opportunities, including on NFS land. Recreators in the area desire experiences including hiking, mountain biking, viewing natural features and wildlife, relaxing, driving for pleasure, nature study, birding, picnicking, visiting historic sites, camping, off-highway vehicle riding, and hunting. Cooler temperatures in the summer promote increased recreation in these areas. Two specific special use permits near the Project are Circle Z Ranch, which has an outfitter/guide special use authorization for horseback riding near Barriles Tank southwest of the town of Patagonia, and the annual Spirit World 100 gravel cycling race, which uses trail routes near the Project.

3.6.1 Environmental Protection Measures

SR1 – TSF2 siting close to existing disturbance. In part, TSF2 was sited to optimize proximity to mining and existing areas of disturbance to reduce conflicts with recreationists and potential impacts to scenic resources.

SR2 – Use of lined dry-stack tailings. TSF2 was designed as a lined dry-stack facility. Dry-stack facilities have a smaller footprint compared to traditional slurry tailings facilities, with less impact on scenic resources and thereby ensuring continued availability of large tracts of undeveloped areas for dispersed recreation.

SR3 – Underground mining. Underground mining will be combined with cemented paste backfill of mined stopes, reducing the size of surface waste rock and tailings management facilities, as well as eliminating the presence of an open mine pit and associated large waste rock facilities that would have higher impact to scenic resources and thereby ensuring continued availability of large tracts of undeveloped areas for dispersed recreation.

SR4 – Use of tailings for cemented paste backfill. The use of tailings in cemented paste backfill reduces the facility footprint and amount of tailings requiring surface storage, thereby ensuring continued availability of large tracts of undeveloped areas for dispersed recreation opportunities. Over time, this also allows the amount of tailings stored in TSF2 to be reduced prior to closure and minimizes the size of the facility that would permanently affect scenic resources and recreation in the area.

SR5 – Minimization of Forest Service access restrictions. The area of NFS land not impacted by surface disturbance but for which public access would be restricted for safety is limited to only areas in direct proximity of facilities on NFS land. This maintains public access to adjacent areas for recreational activities. Harshaw Road will remain open for public use and recreational access would be further improved with the construction of the Primary Access Road, which will facilitate public access to surrounding NFS land.

SR6 – Designing to reduce visual impacts. Project components will be planned/designed to minimize visual changes that would contrast with scenic values. Consideration of scenic values will be given when designing road improvements or placing new roads and other infrastructure.

SR7 – Outdoor lighting plan. South32 Hermosa will develop and implement an outdoor lighting plan to reduce impacts from artificial night lighting, reducing illumination levels where appropriate while still meeting MSHA requirements for lighting sufficient to provide safe working conditions.

SR8 – Paint colors. When painting Project components, South32 Hermosa does and will continue to use paint colors that are consistent with the natural surroundings, as practicable, to minimize visual changes that would contrast with scenic values.

SR9 – Concurrent reclamation. Implementing reclamation where practicable during operations would reduce impacts to scenic resources. Potential areas where concurrent reclamation could be applied include the lower benches of TSF2, exploration drill pads and ST-TARs, and areas temporarily used for construction and laydown.

SR10 – Access route alignments. Based on reconnaissance surveys conducted within the exploration area, access route alignments were identified to minimize overall disturbance to NFS land and surface resources, reducing the impacts to scenic resources.

3.7 FISH AND WILDLIFE

South32 Hermosa has collected site-specific baseline data for biological resources near the Project since roughly 2012, including general habitat descriptions, general wildlife surveys, migratory bird and avian surveys, bat roost surveys, small mammal surveys, noxious weed and invasive species surveys, and other species-specific surveys. Species surveys include those for Bartram's stonecrop (*Graptopetalum bartramii*), Chiricahua leopard frog (*Rana chiricahuensis*), Coleman's coralroot (*Hexalectris colemanii*), Gila topminnow (*Poeciliopsis occidentalis*), lesser long-nosed bat (*Leptonycteris yerbabuenae*), Mexican spotted owl (*Strix occidentalis lucida*), monarch butterfly (*Danaus plexippus plexippus*), northern goshawk (*Accipiter gentilis*), Sonora tiger salamander (*Ambystoma mavortium stebbinsi*), Patagonia eyed silkmoth (*Automeris patagoniensis*), and yellow-billed cuckoo (*Coccyzus americanus*). Additional surveys of aquatic and riparian areas have been conducted since 2012 and 2019, respectively. These monitoring data have been used to support mine design and develop environmental protection measures.

3.7.1 Terrestrial Habitat

The Project is within the Madrean Evergreen Woodland and Semidesert Grassland biotic communities, as described and mapped by Brown (1994). Common tree species in the Project vicinity include Arizona white oak (*Quercus arizonica*), Emory oak (*Q. emoryi*), Mexican pinyon (*Pinus cembroides*), and alligator juniper (*Juniperus deppeana*), interspersed with grass species, including plains lovegrass (*Eragrostis intermedia*) and bullgrass (*Muhlenbergia emersleyi*). Trees are slightly more concentrated on north-facing slopes and along drainages. Overstory vegetation along the drainages consists primarily of Arizona white oak, Emory oak, silverleaf oak (*Q. hypoleucoides*), Chihuahua pine (*Pinus leiophylla*), Mexican pinyon, and juniper (*Juniperus* spp.). Grass species near the western portion of the Primary Access Road are often interspersed with trees and shrubs and include black grama (*Bouteloua eriopoda*), blue grama (*B. gracilis*), curly mesquite (*Hilaria belangeri*), tobosagrass (*Pleuraphis mutica*), and giant sacaton (*Sporobolus wrightii*).

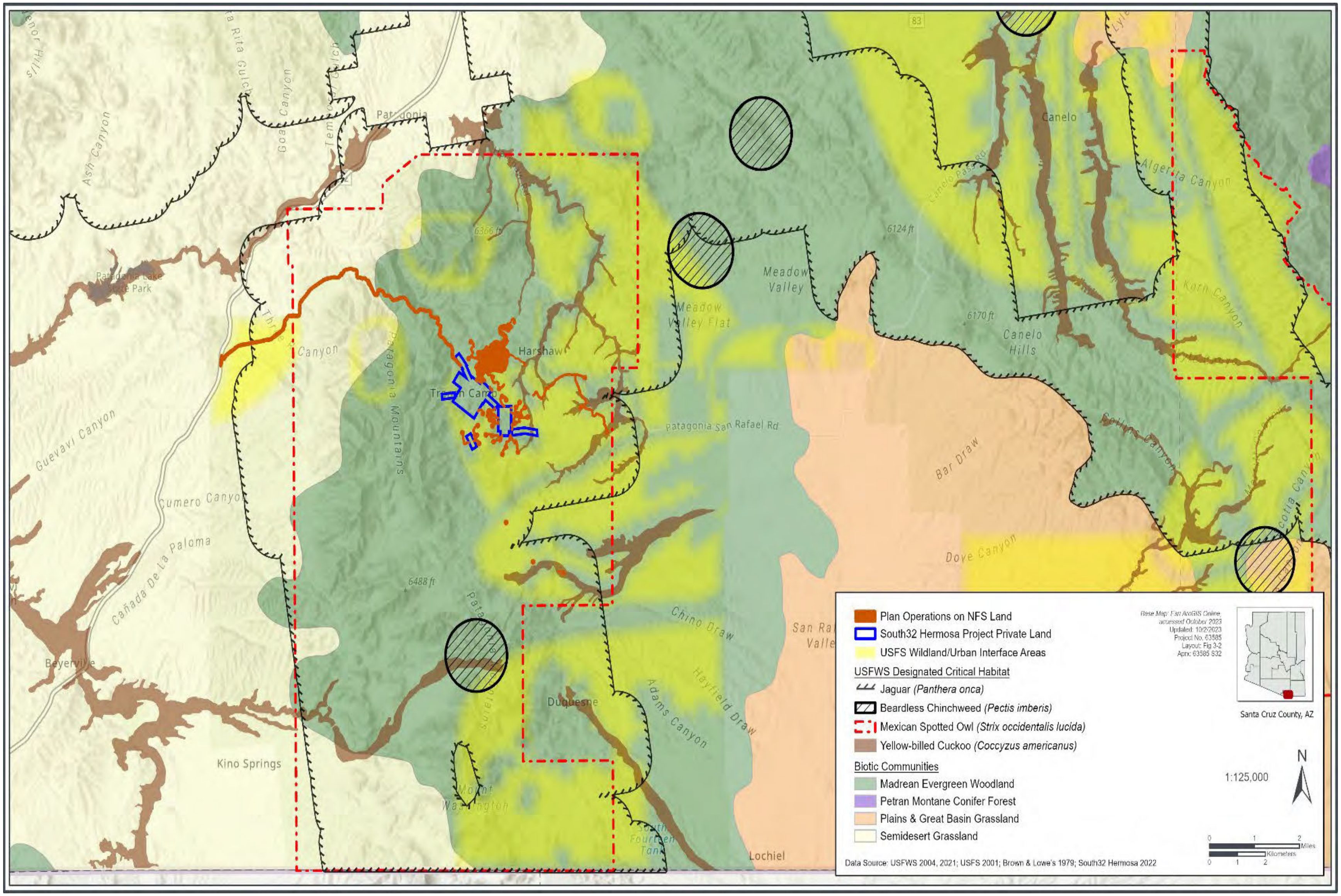
3.7.2 Aquatic Habitat

Aquatic habitat near the Project can be present in lentic and lotic systems, seasonally depending on precipitation levels, while persistent flow is present along certain segments of Harshaw Creek, Flux Canyon, and Alum Gulch, as well as at various springs, seeps, livestock tanks, and mine adits.

3.7.3 Special-status Species Habitat

Special-status species include threatened and endangered species protected under the Endangered Species Act and USFS sensitive species managed by the Coronado National Forest under procedures outlined in Forest Service Manual 2672.1 (USFS 1990) that identifies species that are at risk of becoming listed under the Endangered Species Act. Together, these species are referred to as “special-status species”. Habitat for special-status species exists in the Project vicinity, and baseline surveys have been conducted for special-status species. Critical habitat for several threatened or endangered species is also present near the Project (Figure 3-2).

Figure 3-2. Special-status species habitat near the Project.



3.7.4 Environmental Protection Measures

FW1 – TSF2 siting close to existing disturbance. TSF2 was sited in part for proximity to both mining and beneficiation facilities and existing disturbance areas, thereby reducing potential impacts to wildlife from habitat fragmentation, and reducing the potential for traffic/wildlife conflicts.

FW2 – TSF2 siting out of drainages. TSF2 was sited to avoid dredge and fill of surface water features, reducing potential impacts to habitat associated with drainages.

FW3 – Underground mining. The use of underground mining minimizes the overall footprint of the Project and disturbance to species habitat.

FW4 – Use of lined dry-stack tailings. TSF2 was designed as a lined dry-stack facility. Dry-stack facilities have a smaller footprint compared to traditional slurry tailings facilities, thereby reducing impacts to species habitat.

FW5 – Use of tailings for cemented paste backfill. The use of tailings in cemented paste backfill further reduces the amount of surface tailings storage and reduces overall footprint and impact to species habitat. Over time, this also allows the amount of tailings stored in TSF2 to be reduced prior to closure and minimizes the size of the facility requiring future reclamation.

FW6 – Recycling and filtration. The Project has been designed so that water consumption would be reduced, by incorporating multiple recycling loops and filtering for both tailings and concentrates. Reducing overall water use allows more water to be returned to the environment.

FW7 – Use of RIBs. To further reduce regional groundwater impacts, South32 Hermosa has designed for the treated water from WTP2 to be discharged into RIBs. This would actively recharge regional groundwater in key areas to reduce drawdown effects and potential impacts on groundwater-dependent ecosystems. Continued implementation of a groundwater monitoring program would inform the location and effectiveness of recharge in reducing drawdown effects.

FW8 – Remote operations. Remotely siting the IROC and oxide ore beneficiation facility will minimize trips to and from the Project, thereby reducing the potential for traffic conflicts with wildlife.

FW9 – Biodiversity management. South32 Hermosa manages biodiversity by evaluating potential impacts to biodiversity and identifying controls and best management practices to avoid, minimize, rehabilitate, and offset those impacts and work to achieve South32 Hermosa's goal of preventing long-term loss of biodiversity values and ecosystem services. Additionally, South32 Hermosa complies with relevant federal, state, and local environmental regulations, including but not limited to the Endangered Species Act, the National Forest Management Act, the Clean Water Act, the Migratory Bird Treaty Act, the Arizona Native Plant Law, and Arizona Department of Agriculture regulations regarding noxious weeds. Measures implemented pursuant to this plan to avoid or minimize impacts to sensitive fish and wildlife resources include:

- **FW9A – Environmental awareness training.** South32 Hermosa and contractor staff will receive training to provide guidance and direction on handling of nuisance wildlife while maintaining ecosystem services provided, such as pollination (e.g., bees), and predator/prey dynamics (rattlesnakes, coyotes, bears). Awareness training also provides guidance and direction on recognition of sensitive resources and proper implementation of project-specific avoidance/minimization measures or best management practices.

- **FW9B – Construction monitoring.** Ongoing monitoring of Plan construction activities ensures proper implementation of avoidance/minimization measures and best management practices designed to protect sensitive resources, including avoidance of active bird nests, aquatic sites, and individuals or populations of sensitive species.

- **FW9C – Low impact design.** Infrastructure improvements incorporate design features that promote biodiversity plan goals by minimizing impacts to sensitive wildlife species or populations. Examples include: dark sky measures to reduce or minimize artificial night lighting to reduce impacts to migrating birds, bats, and moths; design considerations of bridges and culverts that can maintain habitat connectivity and reduce wildlife-vehicle collisions; fencing designed to address wildlife concerns; and avian protection measures included in the design, construction, and maintenance of overhead electric transmission and distribution lines that can minimize or eliminate impacts to avian birds of prey (raptors).

- **FW9D – Speed limit.** Traffic speed on the Primary Access Road would be controlled by measures including use of signage, periodic radar verification, and a GPS-based vehicle tracking system for South32 Hermosa vehicles to monitor speed limits. This is anticipated to reduce conflicts between mine-related traffic and wildlife, including movement of wildlife through habitat ranges.

- **FW9E – Wildlife surveys.** South32 Hermosa will continue to conduct wildlife surveys to monitor baseline conditions prior to Plan Operations.

- **FW9F – Bat exclusion.** South32 Hermosa will conduct bat exclusion surveys prior to impacting previous/historic mine workings with bat habitat potential.

- **FW9G – Noxious and invasive weeds.** During active operations, South32 Hermosa would monitor disturbed areas on NFS land where there is a risk of spread of undesirable invasive plants and noxious weeds. South32 Hermosa would also implement measures to prevent the spread of noxious and invasive weeds from vehicles/equipment between work locations. If areas of invasive and/or noxious weeds are identified, they would be treated as soon as they are identified. Monitoring reports summarizing noxious weed control efforts would be periodically submitted to the Forest Service.

FW10 – Reclamation practices. Successful reclamation practices include measures to monitor and control noxious and invasive weeds. Weed-free seeds to be used in reclamation on NFS land would be purchased from a licensed seed dealer before being placed on the growth media. Newly reclaimed areas would be monitored for weeds and invasive plants for the first 5 years after reclamation. If areas of invasive and/or noxious weeds are identified, they would be treated as soon as they are identified. Monitoring reports summarizing noxious weed control efforts would be periodically submitted to the Forest Service. Concurrent reclamation will be implemented where practicable during operations to restore habitat sooner for cover and prey species. Areas where concurrent reclamation could potentially be applied include the lower benches of TSF2, exploration drill pads and ST-TARs, and areas temporarily used for construction and laydown.

FW11 – Access route alignments. Based on reconnaissance surveys conducted within the exploration area, access route alignments were identified to minimize overall disturbance to NFS land and surface resources, reducing disturbance of habitat.

3.8 CULTURAL RESOURCES

Class III cultural resources surveys of the Project area and surrounding South32 Hermosa unpatented claims began in 2012 and cover 100% of the Project area. Cultural resources survey data have been used to support mine facility design to prioritize avoidance, where feasible, of National Register of Historic Places–eligible or -listed historic properties.

Environmental protection measures and mitigation related to any affected cultural resources will be further identified in the course of the National Environmental Policy Act process, and during the Coronado National Forest consultation process under Section 106 of the National Historic Preservation Act.

3.8.1 Environmental Protection Measures

CR1 – Underground mining. The use of underground mining minimizes the overall footprint of the Project and potential disturbance to cultural resources, including eliminating the presence of an open pit.

CR2 – Siting of facilities to avoid cultural resources. Where feasible, Project facilities were sited to avoid National Register of Historic Places–eligible cultural resources identified during extensive site surveys.

CR3 – Use of lined dry-stack tailings. TSF2 was designed as a lined dry-stack facility. Dry-stack facilities have a smaller footprint compared to traditional slurry tailings facilities, with less potential disturbance to cultural resources.

CR4 – Use of tailings for cemented paste backfill. The use of tailings in cemented paste backfill further reduces the amount of tailings requiring storage at the surface and reduces overall footprint and potential disturbance to cultural resources.

CR5 – Remote operations. Remotely siting the IROC and oxide ore beneficiation facility minimizes the number of traffic trips required to and from the Project, reducing potential for inadvertent damage of cultural resources.

CR6 – Cultural resource training and avoidance. To minimize the potential for illegal collection, vandalism, and inadvertent damage of cultural resources, as part of its environmental training program, South32 Hermosa ensures that Project personnel and contractors are instructed on cultural resource avoidance and protection measures, including applicable statutes protecting cultural resources. Cultural resources identified through prior survey efforts will be avoided or mitigated where practicable.

CR7 – Inadvertent discovery. An inadvertent discovery plan will be developed for Plan Operations. If cultural resources are identified during Plan Operations, activity in the area of the discovery would cease immediately. The Forest Service and appropriate tribal entities would be notified and the resource would be evaluated, as would any necessary subsequent actions. Human remains, funerary objects, or items of cultural patrimony found on NFS land would result in cessation of activities in the vicinity of the discovery. The location of the discovery would not be publicly disclosed and the remains would be secured and preserved in place. Handling of Native American human remains, funerary objects, or items of cultural patrimony found on NFS land would be handled in accordance with the Native American Graves Protection and Repatriation Act. Non-Native American human remains would be handled as specified by the appropriate agency or agencies. Inadvertent discoveries on South32 Hermosa private land follow a similar plan that incorporates all applicable state laws and regulations.

3.9 PUBLIC SAFETY AND FIRE

An Health, Safety and Security Management Plan has been developed for the current and ongoing operations on private land and will be updated and expanded to cover all Project activities. This will include a specific Fire Safety Plan. This plan has been developed to ensure that there is continued improvement in Health, Safety and Security performance and that legal and other safety requirements are met. The primary objectives of the plan are to ensure an inclusive workplace, well-designed work activities, continuous improvement, and the prevention of work-related injury, illness, and fatality. This system will be implemented through workforce education and participation, leading-edge systems and processes, proactive and supportive relationships with community stakeholders, and a bottom-up led reporting culture.

3.9.1 Environmental Protection Measures

PS1 – Design for fire control. Adequate fire control and prevention equipment will be available throughout the mine site. A fire water system will be provided for workshop areas such as lube and fuel bays, welding bays, and offices and storage areas. Underground, fire water tanks will be located adjacent to these areas. The fire water tanks will be equipped with an alarm system that is triggered anytime the fire water pumps are used (including testing) to ensure that fire water is only used to fight fires and will be available during a fire. The main workshop facility located underground will be equipped with fire doors and a fire suppression system. During closure, the fire equipment will remain in place until all other equipment is removed.

PS2 – Emergency preparedness. All mobile equipment will be equipped with an adequate fire suppression system or adequate fire extinguisher. Light vehicles will all be equipped with a properly rated fire extinguisher, round-nosed shovel, and a first-aid kit.

PS3– Equipment maintenance. All equipment will be maintained in safe and serviceable condition.

PS4 – Employee training and certification. All employees will maintain appropriate training and certifications, including required annual MSHA training. All employees, contractors, and subcontractors will be trained in fire prevention procedures prior to beginning work. All mine employees, contractors, and subcontractors will be required to learn basic fire suppression tasks and fire extinguisher use. This would be supplemented by specialized training on the various suppression systems on-site, and use of monitors and hydrants.

PS5 – Firearms. No firearms, or any item designed or intended as a weapon, are or will be allowed on the site.

PS6 – Emergency planning. South32 Hermosa will conduct emergency response and contingency planning with appropriate agencies, and these results will be incorporated into emergency response plans. These plans would identify emergency preparedness and emergency contact protocols for fire response.

PS7 – Hot work permits. South32 Hermosa has a standing procedural requirement to obtain an "authority to work" permit for any hot work. This ensures that fire conditions are understood and that personnel are aware of precautionary requirements for blasting and welding, requirements for mechanized equipment to reduce the risk of fire ignition, procedures for avoiding vehicle parking in brush, grass, or wildland areas unless on a designated roadway, procedures for establishing a fire watch when working in fire-prone areas, and with the sole responsibility of monitoring for fires and post-work checking of work areas.

PS8 – Lightning plan. South32 Hermosa has implemented a lightning trigger-action-response plan, including lightning detection systems that include site-wide communication through site radio systems.

PS9 – Spark prevention. All internal combustion engines will be equipped with spark arrestors. Spark shields will be used for any hot operations near brush, grass, or wildland areas. Water trucks will be available when necessary to wet down work sites where work near brush, grass, and wildland areas is not avoidable.

PS10 – Speed limit. Traffic speed on the Primary Access Road will be controlled by measures including use of signage, periodic radar verification, and a GPS-based vehicle tracking system for South32 Hermosa vehicles to monitor speed limits. Limiting speeds is anticipated to reduce any potential for traffic conflicts between mine and public vehicles.

CHAPTER 4. TEMPORARY CESSATION OF OPERATIONS

4.1 PLAN FOR TEMPORARY CESSATION OF OPERATIONS

This plan for temporary cessation of operations describes the procedures that South32 Hermosa will implement to maintain the Project in a condition that is consistent with applicable state and federal regulations and requirements for protection of the environment, safety of personnel, and preservation of equipment in the event of either a temporary suspension of mining, production, or other operations or placement into standby status. Unplanned temporary cessation of operations will be deemed to have occurred when facility operations have ceased for a duration exceeding 6 months. During a temporary cessation, certain measures will be taken with respect to the following:

- Personnel
- Site-wide procedures
- Facility-specific procedures

Procedures are discussed in this chapter if they are related to operations on or below NFS land or have the potential to affect operations on or below NFS land. Procedures for facilities located solely on South32 Hermosa private land are not included here.

4.2 PERSONNEL

Care and maintenance activities are required during cessation periods so that operations may be efficiently resumed when appropriate. South32 Hermosa would maintain personnel at the Project for the care and maintenance of equipment and infrastructure, and to provide for ongoing environmental compliance. Groundwater management activities would continue as required, and water treatment plant operations would also continue. Environmental compliance activities performed by South32 Hermosa personnel (such as monitoring, sampling, inspections, and reporting) are required by both Arizona and federal regulations even during reduced, suspended, or standby operations.

4.3 SITE-WIDE PROCEDURES

South32 Hermosa would implement the following procedures as appropriate in the event of a temporary cessation of operations.

- **Measures to maintain the Project in a safe condition:** Because personnel would remain on the Project, compliance with MSHA and Arizona State Mine Inspector safety regulations and protocols, including regular required MSHA and Arizona State Mine Inspector inspections, would continue. The security measures described in Sections 2.5.9, 2.5.10, and 3.9 would remain in effect. Warning signs would be posted to emphasize hazards associated with open excavations, underground mine openings, and buildings or facilities where chemicals, petroleum products, or reagents are stored (all of which would be on South32 Hermosa private land). Activities and operations required to provide underground access for inspections would continue during temporary cessation, but access would be limited to authorized personnel only for inspections.
- **Measures to stabilize excavations and workings:** Excavations anywhere within the Project, including under NFS land, would be stabilized by inspecting and maintaining walls and slopes and preventing stormwater erosion or runoff into these areas. There would be no unauthorized access to excavations and openings. Compliance with MSHA and Arizona State Mine Inspector safety regulations and inspections would continue. Temporary excavations (e.g., stopes, etc.) opened prior

to the cessation of operations would be stabilized via cemented paste backfill, bolting, and/or application of shotcrete during the cessation of operations as needed. Permanent excavations (decline, shafts, development tunnels, underground facilities) would remain open, subject to appropriate MSHA and Arizona State Mine Inspector regulations, inspections, and stabilization measures.

- **Measures to manage regulated materials:** Regulated materials (such as hazardous materials) would be managed in accordance with applicable state and federal regulations. Depending upon the length of the cessation period, some regulated materials that would be used during the cessation period would be managed in the same way as in normal operations. Regulated material not required would be returned to the vendors. Aboveground storage tanks would be managed as required by the SPCC plan. Other structures used to store regulated materials would be emptied or maintained as appropriate. None of these storage areas would be on NFS land.
- **Measures to maintain access and utilities:** Roads would be maintained as necessary to allow access to Project facilities. Utilities, such as electricity, water, and fuel that are needed during the cessation period, would continue to function.
- **Measures to manage water systems:** Facilities designed to divert, convey, store, or treat water would be maintained during the cessation period. This would include groundwater management facilities, the water treatment plants (WTP1 and WTP2), and various stormwater controls or best management practices. Operation and maintenance of these facilities would continue as required by applicable state and federal permits.
- **Written Notification:** Pursuant to 36 CFR 228.10, upon cessation of operations, South32 Hermosa would file a statement with the Coronado National Forest Sierra Vista District Ranger which includes: verification of intent to maintain the structures, equipment, and other facilities; the expected reopening date; and an estimate of extended duration of operations. A statement would be filed every year in the event operations are not reactivated.

4.4 FACILITY-SPECIFIC PROCEDURES

4.4.1 Tailings Storage Facilities (TSF1 and TSF2)

No additional tailings would be generated or placed in TSF1 and TSF2 facilities during a cessation of operations. Reclamation and seeding of the slopes would continue if appropriate during temporary cessation. Regular monitoring of TSF1 and TSF2 stability and water levels would continue as per the APP and other permits or programs. Seepage and runoff would continue to be collected and treated, and all stormwater controls would continue to operate. Maintenance activities would continue to control potential dust emissions or repair erosion as necessary. For TSF2, collected seepage and stormwater would continue to be routed to the TSF2 UDCP, treated at WTP2, and used or discharged.

4.4.2 Water Treatment Plants (WTP1 and WTP2)

Pursuant to the AZDPES and the APP, WTP1 would remain operational during temporary cessation of operations to maintain compliance with permit requirements. WTP2 would continue to operate to support groundwater management and treatment of TSF1 and TSF2 runoff and seepage as needed.

4.4.3 Stormwater Management

Stormwater management would continue pursuant to the stormwater management procedures described in Appendix B and the Stormwater Pollution Prevention Plan (SWPPP) to protect the receiving waters and to prevent damage to the Project infrastructure, including TSF1 and TSF2. Best management practices will be maintained as required throughout the cessation of operations.

4.4.4 Mine

The mine area encompasses the underground mine, associated shafts/declines and ore handling system, and surface support facilities. As mentioned above, excavations anywhere within the Project will be stabilized by controlling unauthorized access, preventing stormwater erosion or runoff into these features, and operating the groundwater management system.

Ore handling system and surface support facilities that would not be active during temporary cessation would be disengaged and maintained as appropriate. Any previously produced PAG waste rock would be stored within TSF1 or TSF2. Previously produced NPAG waste rock would be placed in an NPAG stockpile.

Mine personnel would only be required for preservation and maintenance of equipment.

The following systems would remain operational during a temporary cessation of operations:

- Power distribution to support ventilation and lighting
- Groundwater management systems
- Service water distribution
- Shaft and hoist house would remain operational and would be inspected and maintained for the duration of the cessation period. The portal and decline would remain open and would be inspected and maintained for the duration of the cessation period.
- Cemented paste backfill may be used as needed but likely not widely used.
- Ventilation system
- Required stability or geotechnical monitoring

4.4.5 Beneficiation Facilities

The sulfide ore beneficiation facilities are on South32 Hermosa private land and will not be operational during a temporary cessation but will be maintained as appropriate. All sulfide ore already on the surface would be sent for beneficiation prior to putting the facilities into care and maintenance.

Cleared material from the concentrator will generally be sent to the tailings thickener and filter plants. Unused reagent may be returned to the vendor for an extended period of cessation of operations. Partially used process reagents will be stabilized by sealing the containers and ensuring they are stored in an appropriate location where secondary containment is provided.

4.4.6 Utilities

Electrical power lines and cables on the Project would remain in place during cessation of operations to provide power to the facility. The following would remain operational:

- Substation and site electrical distribution
- Emergency power generation

4.4.7 Safety and Security

Safety provisions would remain in place during a cessation of operations and would include public access restrictions, applicable personal protective equipment, and following MSHA, Arizona State Mine Inspector, and South32 Hermosa safety protocols. The security guard houses would remain on South32 Hermosa private land at the entrance of the Project, as described in Section 2.5.9.

4.4.8 Environmental Monitoring

Provisions of applicable permits and other regulatory requirements would continue to be met during cessation of operations. This would include monitoring, sampling, inspections, notifications, and report submittals.

CHAPTER 5. RECLAMATION AND CLOSURE

5.1 INTRODUCTION

This chapter describes anticipated reclamation activities for operations on NFS land. A detailed Reclamation and Closure Plan will be developed during the National Environmental Policy Act process and submitted to the USFS for review prior to approval of the Final PoO.

The reclamation practices and standards described below were developed using guidance from multiple agencies and sources. These represent guidance that is applicable to the Project as a whole, including facilities on both South32 Hermosa private land and NFS land. However, the activities described here apply only to Plan Operations on NFS land. Any reclamation and closure activities on South32 Hermosa private land would occur under appropriate state regulations and permits, such as APP or Arizona State Mine Inspector Mine Land Reclamation Permit.

The actual closure approach employed may be modified to accommodate any requirements in place at the conclusion of operations, including requirements developed during the USFS review of the PoO. The detailed Reclamation and Closure Plan will include sufficient detail to support the reclamation cost estimate for stabilization, rehabilitation, and reclamation.

5.2 RECLAMATION GOALS AND OBJECTIVES

The reclamation goals and objectives will ensure that surface resources impacted by mining and ancillary use activities minimize the environmental impacts resulting from the activities and ensure disturbed lands are returned to a use that is consistent with long-term USFS land and resource management plans. These closure objectives include the following:

- Stabilize disturbed surfaces, in order to minimize erosion by both water and wind, and prevent any subsequent damage to closed facilities;
- Control water runoff to ensure downstream flows in the watershed and prevent damage to closed facilities;
- Prevent exposure of tailings and PAG rock stored in the TSF2 facility;
- Return disturbed areas to a safe, stable, productive, and self-sustaining condition; and
- Where applicable, rehabilitate any impacted terrestrial and aquatic wildlife habitat to restore functioning conditions.

The reclamation objectives have been designed to comply with applicable USFS regulations and other permit requirements including ADEQ requirements under the air quality permit, APP and AZPDES permits, Arizona State Mine Inspector closure requirements, applicable industry best practices and standards (ANCOLD, GISTM), and South32 Hermosa internal standards.

5.3 GENERAL RECLAMATION PROCEDURES

The reclamation of the operations causing surface disturbance will be completed through interim reclamation practices, concurrent reclamation where feasible, and final reclamation after operations have been completed. The following section describes the general assumptions and the reclamation practices that will be employed to reclaim particular Project components.

The reclamation procedures outlined in this plan are based on conditions that are currently anticipated at the end of mine life. Technical studies related to closure planning are still in development at this time and may influence the methodology chosen to complete the reclamation. As these studies become available, it will be prudent to reevaluate this plan and make adjustments to enhance reclamation as needed.

5.3.1 Interim Reclamation

Interim reclamation refers to temporary practices that are implemented during mining, prior to implementation of permanent reclamation (either concurrent reclamation or final reclamation). Disturbed areas may be temporarily reclaimed to control erosion and stabilize the surface during times when they are not needed for active operations, such as growth media stockpiles. Temporary stormwater and sediment controls will be implemented as described in Appendix B to control impacts to stormwater runoff. These areas may also be contoured and revegetated. Interim reclamation meets the reclamation goals and objectives by stabilizing disturbed surfaces temporarily while not in use, in order to minimize erosion and downstream impacts from sedimentation.

5.3.2 Concurrent Reclamation

Concurrent reclamation will be implemented in disturbed areas where the areas are no longer needed for active operations and can be reclaimed permanently. Concurrent reclamation differs from interim reclamation. Interim reclamation is temporary with the expectation that areas would be redisturbed, whereas concurrent reclamation is intended to be permanent, even though it occurs prior to mine closure. Areas where concurrent reclamation may be implemented include exploration drill holes, pads, and ST- TARs as exploration activity is completed and conditions are suitable to complete reclamation. The lower slopes of TSF2 could be concurrently reclaimed, but the need to remove tailings material for cemented paste backfill may prevent this. Concurrent reclamation meets the reclamation goals and objectives by permanently stabilizing and revegetating disturbed surfaces, which allows these areas to return to a safe, stable, productive, and self-sustaining condition, while also preventing erosion and downstream impacts from sedimentation, and in the case of TSF2, preventing the exposure of tailings materials.

5.3.3 Final Reclamation

Final reclamation will commence once the recoverable minerals have been exhausted or at an earlier practicable time during operations. Closure activities may commence at different times for different facilities, but closure activities for all facilities are anticipated to begin within 1 year of the conclusion of operations. Final closure activities are expected to be completed approximately 6 years after mining has ceased. The final reclamation processes have been grouped by Project component and are outlined below. The details below ensure that each facility meets the reclamation goals and objectives. Stabilization and revegetation of disturbed areas allows these areas to return to a safe, stable, productive, and self-sustaining condition, while also preventing erosion and downstream impacts from sedimentation. In the case of TSF2, reclamation serves these functions as well as preventing the exposure of tailings and PAG waste rock to the environment. After Project activities have ceased and final reclamation has been completed, the stable, revegetated surfaces of many reclaimed areas would again become functional terrestrial habitat.

5.3.3.1 Closure Materials

The following types and sources of earthen materials will be used for fill to establish grade, construction of the reclamation covers, and rock armoring. Four types of earthen materials are required with general characteristics as follows:

- **Cover material (growth media):** This material will be used for construction of revegetated covers on TSF2. Cover material should contain a range of particle sizes (i.e., fines for water holding capacity and rock fragments for erosion resistance) and suitable chemical composition.
- **Armor rock:** This material will be used for riprap in channels and other erosion control features, as well as being used on the TSF2 cover. This rock should be durable, angular if possible, blocky in shape, and available in sizes from coarse gravel to cobbles and boulders. This rock may also be used as mass grading fill to bring surfaces to the proper grade for drainage.
- **Structural fill (Riprap):**[21] This material will be required for channels, v-ditches, TSF covers, and other structures where additional stability is required. Structural fill must have a specific gradation that allows for a high degree of compaction.
- **Structural fill (Gravel):** This material will be required for channels, v-ditches, TSF covers, and other structures where additional stability is required. Structural fill must have a specific gradation that allows for a high degree of compaction.
- Low-permeability fill (clay/silt) is another material that could be used during closure, but at this time the closure designs do not require this material.

5.3.3.2 TSF2 and TSF2 UDCP Reclamation

The following represents a conceptual closure plan for TSF2. The final reclamation and closure plan would be informed by analysis and specific requirements that develop through the Forest Service approval process. After initial grading for positive drainage, TSF2 will be capped with up to 1 to 2 feet of growth media underlain by a 1-foot capillary break created by the rock armor berms placed during construction. The growth media placed over TSF2 will then be seeded. The side slopes of TSF2 will have a 3H:1V compound slope with 2.5H:1V open slopes broken every 25 feet in vertical elevation rise by a 12.5-foot side bench. The compound slope configuration will aid in reducing meteoric water runoff velocities, thereby reducing the propensity for erosion of the closure cap on the sides of TSF2. The top of TSF2 will be graded to form a swale that flows to an outfall along the haul road, where flows from the top of the reclaimed TSF2 will be directed to the base of TSF2. Flows at the base of TSF2 from this outfall and from the TSF2 slope area will be collected in a closure channel (inside of the TSF2 perimeter berm) and conveyed around base of TSF2 where they will be directed, via the TSF2 spillway to a permanent stormwater diversion channel that then will discharge to natural drainages.

The TSF2 UDCP which captures tailings seepage or contact water will also be reclaimed. It is expected after closure of TSF2, that the post-closure underdrain flows from TSF2 to the TSF2 UDCP will be minimal because the closure cap will minimize infiltration and little water is expected to be entrained within TSF2 at closure. Once the flows have decreased to a negligible level, a passive treatment system will be constructed in the TSF2 UDCP area (such as an evaporation cell). Active treatment of the underdrain flows will be continued until the effectiveness of the passive treatment system has been demonstrated; this time frame has been estimated to be approximately 5 to 10 years after the beginning of closure. However, the water treatment capability would not be dismantled/removed until the ability to passively treat flows has been demonstrated in practice, which may extend beyond this time frame. At the end of the passive system’s life, the sediments, liner layers, and low-permeable soil associated with UDCP and the channel connecting it to TSF2 will be removed and properly disposed. The UDCP is anticipated to be largely constructed in bedrock, and this depression will be backfilled with common fill, mounded for positive drainage (2 percent slope), and revegetated.

[21] “Riprap” is loose stone, generally of larger diameter, that is used for protective armoring for structures like stormwater channels.

The current approach to siting an appropriate passive treatment system is to reduce the TSF2 UDCP size post-closure by reducing the north embankment height, filling the remaining pond storage area with a passive treatment substrate that effectively addresses the remaining underflow water chemistry, and siting an effluent delivery system that feeds the bottom of the substrate.

The specific mix of substrate would be developed through observation of pilot scale evaporation cells during the post-closure period for a duration of 1 year. Results of the pilot scale testing, post-closure effluent chemistry variability, and flow rate variability would form the design basis for the permanent passive treatment system to be sited. As cited above, until an effective passive treatment approach can be demonstrated, active treatment of underdrain flows would continue.

5.3.3.3 Decommission Facilities and Structure Removal

GWM wells and monitoring wells constructed on NFS land would be abandoned as per Arizona Department of Water Resources regulations when the wells are no longer needed. RIBs would be regraded to approximate the original, natural contours and revegetated. Power lines and pipelines associated with GWM wells and RIBs would be removed from aboveground and underground, and the materials disposed of in appropriate facilities. Well site and RIB LT-TARs would be reclaimed as the well closures are completed unless the Forest Service requests the road not be reclaimed. Reclaimed well site and RIB access roads would be regraded to drain and then scarified and revegetated.

The existing fence around TSF2 would be left in place during the post-closure period, and then removed at the end of the monitoring period (see Section 5.3.3.9 for details on monitoring). Fences around closed GWM wells would be removed as reclamation is completed. The fence encompassing the Southern Restriction Area and fencing around RIBs would also be removed. The fence line maintenance roads associated with TSF2 and the Southern Restriction Area would be reclaimed in a manner similar to well site and RIB access roads, and would be regraded to promote positive drainage, scarified, and revegetated.

Stormwater structures would be removed when they are no longer needed and the reclamation in the area has stabilized. Reclaimed areas with stormwater structures would be regraded to drain, scarified, and revegetated.

All Project ST-TARs and LT-TARs would be reclaimed once the roads are no longer needed unless the Forest Service requests that a particular road be left in place. The Primary Access Road is permanent and will not be reclaimed. It is contemplated that Santa Cruz County would maintain the Primary Access Road, possibly pursuant to an amendment to the existing Forest Service/County Cooperative Road Maintenance Agreement. The TSF2 perimeter road and TSF2 UDCP access road will be retained to provide access to these facilities for inspection and maintenance until no longer needed, including removal of the safety berm. Reclaimed roads would be regraded to drain, scarified, and revegetated.

5.3.3.4 Closure of Underground Workings

There would be no ventilation shafts, portals, or raises constructed on NFS land. Underground workings located under NFS land would be closed. All non-hazardous materials are anticipated to be left underground unless the salvage value warrants removal. Any hazardous material would be brought to the surface for disposal in an appropriate waste facility. Temporary underground workings (mined stopes) would be backfilled with waste rock or cemented paste backfill as previously described. Permanent underground workings, including the shafts, decline, vent raises, and development tunnels, may not be backfilled but would be permanently sealed with an engineered cap or plug. Any areas being fully abandoned will have their accesses permanently barricaded. Upon closure, roughly 20% of the underground workings would remain open, with the rest filled with cemented paste backfill or rock fill. Wildlife surveys would be conducted as appropriate prior to closure to inform the design, if necessary.

With respect to equipment, any hazardous material associated with the equipment (i.e., fuel, lubricants) would be removed and brought to the surface. Whether the inert equipment itself would be brought to the surface would depend on salvage value which would be determined at the time of closure. Generally, all equipment that can be safely and practically removed, will be. It is anticipated that most mobile equipment will likely be brought out of the mine. Equipment typically left underground could include shaft infrastructure, station infrastructure, the crusher, ore bins and conveyors, shop cranes and lifts.

Underground water management would cease once underground workings are closed and all materials and infrastructure removed. No long-term pumping of water from underground workings would continue after closure. As part of the closure plans, specific plans for post-closure groundwater quality and groundwater management would be designed and implemented. These would draw upon the best available information developed concerning material characterization and predictions of hydrologic recovery of the aquifer.

5.3.3.5 Recontouring/Regrading

Disturbed areas, except for TSF2 and roads that will remain, will be recontoured to be free draining (about 2 percent slope), depending on surrounding topography, with access routes maintained through the post-closure period. Additional fill material will be placed into the cut areas as needed, and then spread and compacted using loaders, dozers, track hoes and/or other equipment. The upper 12 inches of regraded soil will not be compacted in order to promote root penetration during vegetation. It is anticipated that the regraded contours will approximate the original contour of the site and return natural drainage patterns to the extent practicable.

5.3.3.6 Growth Media

Stockpiling and storage of growth media has been previously described (see Section 2.5.7.1). Use of growth media during closure includes:

- TSF2 will receive up to 1 to 2 feet of growth media, and growth media may also be worked into the waste rock armor berms at the time they are placed;
- LT-TARs may receive growth media, but if site conditions indicate it would be appropriate, LT- TARs may be scarified, stabilized, and revegetated without use of growth media;
- Similarly, closed GWM or monitoring wells and pads may receive a cap of growth media, or may be scarified, stabilized, and revegetated without use of growth media; and
- Other disturbed areas would be assessed similarly, and could receive growth media or be scarified, stabilized, and revegetated without use of growth media.

5.3.3.7 Seeding or Plantings

The Forest Service-approved seed mix provided in Table 5-1 or another approved seed mix will be used to revegetate all reclaimed surface areas. This seed mix is composed of a diverse variety of native, warm- and cool-season species to accommodate a broader season for reclamation activities. The seed mix will support the post-mining grazing and wildlife habitat land use. The mix also include a tackifier (similar to Quickguard), which is a sterile, non-native triticale that will establish quickly, to provide erosion control but will not persist or reseed in successive years. Periodically this seed mix will be reviewed and updated as needed. Forest Service approval will be obtained prior to implementing any changes or substitutions. Broadcast, drill, and/or hydro seeding methods will be used, at an application rate that is determined to be applicable and effective. See Section 2.4.1.3 for more information on seeding methods used during reclamation.

Table 5-1. Reclamation Seed Mix

Species	Common Name	Pounds Applied Per Acre
Aristida purpurea	purple three-awn	0.15
Bouteloua curtipendula	sideoats grama	3.00
Bouteloua gracilis	blue grama	0.90
Bouteloua rothrockii	Rothrock's grama	0.90
Eschscholzia mexicana	Mexican poppy	1.00
Leptochloa dubia	green sprangletop	1.20
Lesquerella gordonii	Gordon's bladderpod	1.00
Plantago insularis	Indianwheat	3.00
Schizachyrium scoparium	little bluestem	1.50
Setaria vulpiseta	plains bristlegrass	1.35
Sporobolus cryptandrus	sand dropseed	3.00
Triticum aestivum X secale cereale	common wheat	3.00
Total		**20.00**

Note: Application rate for broadcasting seed = 20 bulk pounds per acre; application rate for hydroseeding = 40 bulk pounds per acre

5.3.3.8 Noxious and Invasive Plant Management

Successful reclamation practices include measures to monitor and control noxious and invasive weeds. Weed-free seeds to be used in reclamation on NFS land would be purchased from a licensed seed dealer before being placed on the growth media.

During active operations, South32 Hermosa would monitor disturbed areas on NFS land where there is a risk of spread of undesirable invasive plants and noxious weeds. Newly reclaimed areas would also be monitored for weeds and invasive plants for the first 5 years after reclamation. If areas of invasive and/or noxious weeds are identified, they would be treated as soon as they are identified. Forest Service approval would be obtained prior to initiating weed control measures on NFS land, including for any use of herbicides or pesticides. Monitoring reports summarizing noxious weed control efforts would be periodically submitted to the Forest Service.

5.3.3.9 Closure and Post-closure Monitoring

A monitoring plan will be implemented to address post-closure maintenance, monitoring, and a physical inspection of remaining structures once the closure activities have been completed. Post-closure monitoring is expected to continue for 30 years or until monitoring shows that physical and geochemical stability and revegetation goals are met. The monitoring and inspections will be typically carried out twice a year during this 30-year period or as outlined below.

Post-closure inspection will include the following:

- Physical inspections of structures remaining during the post-closure period such as fencing, roads, and TSF2 will be completed twice a year for the first 6 years or until passive treatment can be implemented and reduced to once every 3 years for the next 30 years. This includes walking/flying a drone along the entire perimeter of the fence and documenting the condition of the fence, warning signs, and the entrance gate. Any maintenance issues will be noted, and maintenance will be completed as soon as practicable.

- Inspect the condition of the soil cover for animal burrows, erosion characteristics in the cover or diversion channels, and any changes in the health of the vegetation.
- Surface water diversions and conveyance channels will be checked to see that there are no obstructions, breaches, or erosion issues.
- Reclamation success monitoring will include monitoring to ensure that the desired vegetation species have been reestablished, are self-sustaining and renewing, and that the revegetation cover is trending toward and/or matching the vegetation cover found in adjacent naturally vegetated areas. The general state of the vegetation, density, and diversity will be monitored.
- Inspect for signs of subsidence (cracks, sedimentation characteristics).
- Post-closure hydrologic monitoring will include surface and groundwater monitoring, as required by state permit requirements through the AZPDES and APP programs. The exact details of the monitoring requirements will be documented in a closure monitoring plan, including duration of sampling, frequency of sampling, locations to be sampled, and analytes to be monitored. It is likely that the extent and frequency of the monitoring programs will be reduced as the closure process advances.

5.3.3.10 Post-closure Report

An annual report will be prepared to present the results of the closure monitoring, physical inspection, and data collected during the inspections. Reports will be delivered to the Coronado National Forest Sierra Vista District Ranger and will include information on stability of reclamation features, results from environmental monitoring, and vegetation surveys.

5.3.4 Reclamation Financial Assurance

Operators conducting Plan Operations under the Final PoO approved by the Forest Service are required to furnish a bond or other financial assurance in an amount specified by the USFS. A reclamation cost estimate will be prepared following appropriate guidance to estimate costs to stabilize, rehabilitate, and reclaim areas disturbed by the operations. Reclamation financial assurance estimates are typically reassessed periodically throughout the mine life to reflect changing conditions.

CHAPTER 6. LITERATURE CITED

Arizona Department of Environmental Quality (ADEQ). 2022. *Best Available Demonstrated Control Technology Guidance Manual.* Available at: https://azdeq.gov/APP/ComplianceAssistance.

Arizona Department of Transportation. 2022. Traffic Monitoring Data. Available at: https://azdot.gov/planning/data-and-information/traffic-monitoring. Accessed September 8, 2022.

Australian National Committee on Large Dams (ANCOLD). 2019. *Guidelines on Tailings Dams, Planning, Design, Construction, Operation and Closure,* Revision 1, July. Available at: https://www.ancold.org.au/wp-content/uploads/2019/07/Tailings-Guideline-Addendum-July-2019.pdf.

Brown, D.E. (ed.). 1994. *Biotic Communities: Southwestern United States and Northwestern Mexico*. Salt Lake City: University of Utah Press.

International Council on Mining and Metals. 2020. Global Industry Standard on Tailings Management (GISTM). Available at: https://www.icmm.com/en-gb/our-principles/tailings/global-industry-standard-on-tailings-management.

Keith, S.B. 1975. Index of Mining Properties in Santa Cruz County Arizona. *University of Arizona State Bureau of Mines Bulletin* Issue 191.

South32. 2022a. *Sustainability Policy*. Available at: https://www.south32.net/docs/default-source/general-library/corporate-governance/2017/sustainability-policy-(english).pdf?sfvrsn=31407225_23. Accessed May 2023.

———. 2022b. *Sustainable Development Report 2022*. Available at: https://www.south32.net/docs/default-source/annual-reporting-suite/2022/sustainable-development-report-2022.pdf?sfvrsn=c351fe82_3. Accessed May 2023.

U.S. Forest Service (USFS). 1990. *Forest Service Manual, Series 2600 – Wildlife, Fish, and Sensitive Plant Habitat Management*. U.S. Department of Agriculture. Available at: https://www.fs.usda.gov/cgi-bin/Directives/get_dirs/fsm?2600

______. 1999. Forest Service Handbook (FSH). Series 7000 - Engineering. U.S. Department of Agriculture. Available at: http://www.fs.fed.us/im/directives/dughtml/fsh7000.html.

______. 2001. Coronado National Forest Huachuca Mountains Ecosystem Management Area Transportation Analysis Plan. Available at: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5295151.pdf. Accessed August 2020.

———. 2022. Coronado National Forest Motor Vehicle Use Map GIS data, dated May 4, 2022. Available at: https://www.fs.usda.gov/detailfull/r3/landmanagement/gis/?cid=stelprdb5201889&width=full. Accessed August 2022.

This page intentionally left blank.

APPENDIX A

Roads Plan

CONTENTS

Tables

Figures

1. INTRODUCTION

This Roads Plan describes:

- South32 Hermosa's requirements for access to areas used during operations described in the Exploration and Mine Plan of Operations (PoO), use of existing Forest Roads (FRs), and any planned improvements to those roads.
- Public use of FRs in the area.
- Design, construction, and maintenance standards for new permanent and temporary roads.

2. CURRENT AND PROPOSED PROJECT USE OF FOREST ROADS

Primary access to the Project currently uses Harshaw Road from its intersection with State Route (SR) 82. Upon approval of the PoO, a new Primary Access Road will be developed, including upgrading the maintenance level of existing segments of Flux Canyon Road (FR 812), Flux Road (FR 4654), and Barriles Tank Road (FR 4653). Upon completion, the new Primary Access Road will be used for all Project activities described in the PoO, including large truck traffic. Harshaw Road would remain in use throughout the life of the mine, but only for a limited number of employee trips and for emergency access. Harshaw Road is currently maintained by Santa Cruz County and this is anticipated to continue.

Hardshell (FR 5521) and Hermosa (FR 4687) Roads traverse the southern portion of the Project and are and will be used by South32 Hermosa to access exploratory drilling areas, well sites, and support facilities. Both roads are administrative and do not appear on the current Coronado National Forest Motor Vehicle Use Map (U.S. Forest Service [USFS] 2022).

There are three types of new roads associated with Plan Operations: permanent roads, long-term temporary access roads (LT-TARs), and short-term temporary access roads (ST-TARs). ST-TARs have short-term temporary disturbance that will be closed and reclaimed during the operational mine life. The LT-TARs have long-term temporary disturbance that will remain through the operational mine life until closure. Permanent roads would remain after closure in perpetuity.

- Permanent road: Primary Access Road
- LT-TARs: groundwater management (GWM) well access, groundwater monitoring well access, rapid infiltration basin (RIB) access, other facility access roads such as to access tailings storage facility 2 (TSF2).
- ST-TARs: exploration access. A summary of the FRs that intersect the Project footprint, and South32 Hermosa's current and proposed use of those roads is presented in Table A1. A road overview map can be found as Figure A1.

Table A1. Forest Road Summary

ID	Maintenance Level*	Name	Project Usage	Notes
USFS Motor Vehicle Use Map Roads[a]				
FR 49	3	South Harshaw	Current main access for South32 Hermosa private land	Intersects FR 58
FR 58	3	North Harshaw	Current main access for South32 Hermosa private land	A portion traverses through South32 Hermosa private property, but is open to the public and will remain open and unrestricted
FR 134	2	Mowry	RIB Access	Intersects FR 58
FR 215	2	Three R Canyon	None	Intersects FR 4653
FR 812	2	Flux Canyon	A portion of this road would be used for future primary access for the Project	Closed at South32 Hermosa private land boundary
FR 4653	2	Barriles Tank	A portion of this road would be used for future primary access for the Project	Intersects FR 4654 and SR 82
FR 4653C	2	none	None	Intersects FR 4653
FR 4654	2	Flux	A portion of this road would be used for future primary access for the Project	Intersects FR 4653
FR 4685	2	Humboldt	None	Intersects FR 812
FR 4686	2	Hale	RIB access	Intersects FR 58
FR 4701	2	Thunder Mine	None	Intersects FR 49
FR 5785	2	Lower Flux Mine	None	Intersects FR 812
FR 5787	2	Arena	None	Intersects FR 4653
USFS non-Motor Vehicle Use Map Roads[b]				
FR 49-1.57R-1	-	none	Exploration, monitoring well, and construction access	Intersects TSF2 and FR 49
FR 4653B	2	none	None	Intersects FR 4653
FR 4687	2	Hermosa	Internal and exploration access	Intersects FR 5521
FR 5518	2	none	Exploration access, will be closed and returned to administrative status after TSF2 is constructed.	Intersects FR 5519
FR 5519	2	none	Exploration access, will be closed and returned to administrative status after TSF2 is constructed.	Intersects FR 49, FR 5518, and FR 5520
FR 5520	2	none	Exploration access	Closed at mine site boundary, intersects FR5519 and FR 812
FR 5521	2	Hardshell	Internal and exploration access	Intersects FR 49

Notes: a – USFS (2022); b – USFS (2011).

* Level 2 (High-Clearance Vehicles) – Roads are open for use by high-clearance vehicles and have low traffic volume and speed. These roads typically are local and connect collector roadways; have at-grade drainage treatment; are not subject to the requirements of the Highway Safety Act; do not provide surface smoothness; and are not suitable for passenger cars. Level 3 (Suitable for Passenger Cars) – Roads typically have low speed and a single lane with turnouts and spot surfacing. These roads have low to moderate traffic volume, typically connect to arterial and collector roads, and may include some dispersed recreation roads (USFS 1999).

3. PUBLIC USE OF FOREST ROADS

South Harshaw Road (FR 49) traverses through the Project on South32 Hermosa private land and will remain open and unrestricted for public use during Plan Operations. Temporary detours may be utilized during improvement or maintenance activities.

The closed section of Flux Canyon Road (FR 812), FR 5520, and FR 5521 on South32 Hermosa private land will remain closed.

All other non-administrative FRs appearing on the Motor Vehicle Use Map will remain open for public use during mine operations, although Flux Canyon Road (FR 812), Lower Flux Mine Road (FR 5785), Flux Road (FR 4654), Barriles Tank Road (FR 4653), and some roads intersecting the new Primary Access Road may be temporarily closed during construction.

4. DESIGN AND CONSTRUCTION OF NEW ROADS

4.1. Primary Access Road

The new Primary Access Road would be approximately 7.5 miles long and constructed entirely on National Forest System (NFS) land (Figures A2–A9). Construction of the new Primary Access Road would include realigning and straightening some existing road segments to accommodate truck traffic, two all-new road segments, a new bridge over Flux Canyon, and reconstruction of the remaining road segments to smooth and widen the road. The western end of Barriles Tank Road would be realigned to intersect SR 82 at a 90-degree angle for safety, and the northbound and southbound approaches of the highway would be widened to accommodate turning and acceleration/deceleration lanes. When complete, the new Primary Access Road would remain open for public use and, where feasible, would consist of two 12-foot-wide travel lanes with 3-foot-wide shoulders on each side. The average cut-and-fill width over the length of the new access road is approximately 68 feet; however, a construction corridor width of 100 feet is being assumed to ensure adequate space is available for rock protection or unanticipated cut/fill due to geotechnical conditions encountered. Some areas are anticipated to potentially expand beyond the 100-foot corridor to accommodate greater cut/fill, which would be confirmed during the geotechnical investigation; these areas are shown in Figures A2–A9; the assumed corridor width in these areas (representing about 8,000 linear feet of the Primary Access Road) is 150 feet. A summary of the Primary Access Road lengths and disturbance estimates arranged by construction type (realigned, new, and reconstructed) is presented in Table A2.

The final Primary Access Road and bridge design requires geotechnical verification requiring drilling and trenching. Trenching using an excavator or backhoe would consist of cutting a trench, up to 5 feet in length, and 3 to 5 feet in depth. The soil borings would be collected with a truck- or track-mounted drill rig using continuous flight hollow-stem augers. Some areas may require Tubex drilling techniques, especially for bridge locations, where getting to specific depths is more critical. Where rock coring is required, it would be performed with HQ3 wire-line rock coring methods. Track-mounted boring equipment is commonly utilized, but truck-mounted equipment can also be used depending on the terrain and ease of access. A four-wheel drive service truck would be used as a support vehicle. The operational area in which the track- or truck-mounted rig operates is 30 feet by 30 feet. Minimal disturbance is required if the ground is flat, but steeper ground may require some leveling. Additional geophysical testing such as seismic refraction may also be used to assess geologic conditions along the route. Roughly 60 geotechnical investigation locations are proposed along the route of the Primary Access Road, and approximate locations are shown in Figures A2–A9.

Boring depths would vary depending on the rock type and type of infrastructure for which the boring data is being collected. For roadways, boring depths are approximately 5 feet below finished grade in cut areas, or the approximate depth of fill in fill areas. For the bridge area, boring depths are at least 10 feet below the rock socket depth (in rock) and 20 feet below tip depth (in soil). In areas where slope stability needs to be evaluated, boring depths are approximately 15 feet below the finished grade of the roadway.

In some areas, helicopter support may be required to advance the geotechnical borings. This is anticipated primarily in the Flux Canyon area, where no current access roads exist. Helicopter support would only be used as a contingency, with the preference to access geotechnical sites from the ground. If needed, the helicopter would likely stage out of Tucson. The helicopter would be used to transport the borehole drill rig components, tooling, and likely water, in order to support the boring operation. When delivering supplies to borehole sites, the helicopter would land on South32 Hermosa private lands, pick up supplies, and then sling them (i.e., carry them underneath the helicopter) to the borehole site. For borehole rig relocation, the helicopter would come directly from the staging area to the borehole site. It is anticipated that personnel would be able to walk to the sites and would not need to be transported via helicopter. It is estimated that six borings on six individual locations would be needed within this area and would take approximately two weeks to complete the work. A total of 12 helicopter trips within the two weeks would be needed to mobilize and demobilize the borehole rig from one location to the next. Each of those helicopter trips would include moving the borehole rig and ancillary equipment (water tank, drill mud, tools, generator, compressor, borehole rods, etc.). It is estimated that 4 to 5 hours of helicopter time would be needed for each trip equating to a total of 48–60 hours of helicopter time for the entire program. The support helicopter is most likely to be a Bell 206 L-4 Lone Ranger or Astar B3 (or equivalent). Since the helicopter does not need to land at the borehole sites, and is only slinging materials, no vegetation removal would be required for the helicopter. No landing is anticipated on NFS land, unless in the event of an emergency.

In each borehole, samples are planned to be obtained with standard penetration test samplers and/or ring-lined barrel samplers at approximate intervals of 2.5 feet in the upper 10 feet and at intervals of 5 feet thereafter. Bulk samples of auger cuttings would be collected from the borings at selected depth intervals. Where rock coring is performed, the field engineer or geologist would record the recovery and rock quality designation of the recovered rock core and would obtain representative samples for further laboratory evaluation. The boring team would prepare field boring logs as part of standard drilling operations including sampling depths, penetration distances, and other relevant sampling and core information. The field logs would include visual classifications of materials encountered during drilling, and an interpretation of subsurface conditions between samples. Final boring logs would be prepared from the field logs and would represent the geotechnical engineer's interpretation and include modifications based on observations and the results of laboratory testing.

At each location, the following typical process would be followed:

- Staking of borehole location in the field;
- Clear, grub, and level the pad (including stockpiling growth media and slash from brush clearing adjacent to or in the immediate vicinity);
- Evaluate and install additional sediment controls as needed;
- Mobilization of geotechnical borehole rig to the pad;
- Complete field investigation with boring and collection of borehole samples;
- Backfill the boring void;
- Demobilize the geotechnical borehole rig from the pad;
- Reclaim geotechnical borehole pads.

These geotechnical testing locations fall within the eventual area of disturbance of the Primary Access Road and interim reclamation would be conducted at these sites to accommodate the period between investigation and return of lab testing, analysis and reporting. Interim reclamation is described in Section 5.3.1 and is intended to stabilize the surface and prevent erosion. This may be accomplished through installation of stormwater and sediment controls, recontouring, and/or revegetation (such as seeding).

The full geotechnical investigation for the Primary Access Road is estimated to take 4 to 6 weeks of field efforts, followed by 14 to 17 weeks for lab testing, engineering analysis, and reporting.

Table A2. Primary Access Road Disturbance Estimate Summary

Construction Type	Length (feet)	Estimated Disturbance (acres)
Realigned	5,300	13.2
New	10,100	26.6
Reconstructed	24,300	60.5
Total	**39,700**	**100.3**

Note: The acreage described in the PoO (see Table 1-2) includes a 5% contingency acreage to account for unanticipated changes that are required based on conditions encountered during site investigation and construction. The exact location and nature of operations occurring within the contingency area is unknown. The acreages shown in this table are based primarily on a 100-foot corridor, but with some areas anticipating a larger disturbance for cut/fill and assuming a 150-foot corridor.

4.2. LT-TARs and ST-TARs

LT-TARs and ST-TARs would be closed to public use and will typically be 13 feet (ST-TAR) to 15 feet (LT-TAR) wide with a nominal disturbance width of 30 feet to accommodate the driving lane, cut and fill, safety berms, other appropriate safety measures, and any pipelines or power lines. Road locations are indicated on Figure 2-1 of the PoO and a summary of the road lengths and estimated disturbance is presented in Table A3.

As noted in Table A3, based on existing road conditions, some existing roads likely would require improvement beyond the existing disturbed area. These areas are shown on Figure 2-1 and disturbance is included in Table 1-2, based on an estimated disturbance width of 30-feet (same as other LT-TARs and ST-TARs). It is recognized that some of this area is already disturbed by the existing road.

Table A3. Permanent and Temporary Access Roads Disturbance Estimate Summary

Road Type	Length (feet)	Estimated Disturbance (acres)
Monitoring well (LT-TAR)	2,300	1.6
GWM well (LT-TAR)	9,300	6.4
RIBs (LT-TAR)	8,600	5.9
Existing roads requiring upgrade to LT-TAR criteria	8,000	5.5
Subtotal	*28.200*	*19.4*
Exploratory (ST-TAR)	15,300	10.5
Existing roads requiring upgrade to ST-TAR criteria	12,500	8.6
Subtotal	*27,800*	19.1
Total	**52,200**	**38.5**

Note: The acreage described in the PoO (see Table 1-2) includes a 5% contingency acreage to account for unanticipated changes that are required based on conditions experienced during site investigation and construction. The exact location and nature of operations occurring within the contingency area is unknown.

4.3. Drainage Improvements

Depending on final design, drainage crossings would be improved with the installation of culverts, at-grade crossings, and water bars. If any fill operations within drainages that could be potential waters of the U.S. are to occur, a Clean Water Act Section 404 permit would be obtained from the U.S. Army Corps of Engineers prior to commencing work. Final designs and construction techniques would be determined based on the results of the geotechnical investigation, however current designs call for typical construction approaches:

- The bridge over Flux Canyon would be similar to the typical bridge design shown in Figure A10.
- Typical drainage crossing techniques that would be used include pipe culverts (Figure A11), box culverts (Figure A12), and at-grade ford crossings with cut-off walls for erosion protection (Figure A13).

4.4. Environmental Protection Measures

Environmental protection measures for special-status species, cultural resources, erosion control, noxious and invasive species, and other resources associated with road use and construction are described in Chapter 3 of the PoO.

5. CONSTRUCTION METHODS

5.1. Primary Access Road

When the geotechnical investigation is complete and the Primary Access Road design is finalized, the associated FRs will be reconstructed including installation of new culvert crossings, cut/fill associated with widening and straightening of some portions of the roads, grading, and resurfaced according to final construction specifications. Resurfacing treatments could include such treatments as asphalt, soil-cement base, and/or chip-sealing. An all-new road segment would be constructed including a runaway truck ramp and a bridge over Flux Canyon connecting Flux Canyon and Flux Roads. A turn around area would be constructed approximately 0.2 miles west of the boundary of South32 Hermosa private land, near the intersection of Flux Canyon Road (FR 812) and Humboldt Canyon Road (FR 4685). The bypassed segments of original road alignments would be reclaimed by scarifying the road surface and reseeding with a seed mix developed in coordination with USFS.

Construction of the road would be done with typical construction equipment (dozers, trucks, loaders, excavators, scrapers, drills, and support equipment) and blasting of rock may be required in some segments to attain full road width. A bridge, culverts, and low-water crossings would be installed at identified drainage systems along the route of the road. Retaining walls may be installed along steep, narrow road segments with the purpose of securing the road, minimizing cut and fill volumes and minimizing disturbance. Typical retaining wall designs are shown in Figure A14. Guardrails and/or integrated safety barriers would be installed along segments of the road outside of the shoulder width where steep embankments, bridge piers and retaining walls pose a safety risk to traffic. Roadside reflectors would be installed along the road to delineate the roadway at night. The intersection with State Route 82 would require modification of State Route 82 to include acceleration/deceleration lanes and left/right auxiliary turn lanes. Additional activities that could occur within the construction corridor include replacement or movement of existing utility poles.

The Project will be regulated as a mine site by the Mine Safety and Health Administration (MHSA), including roadways. The Primary Access Road, LT-TARs, and ST-TARs may need to comply with MSHA road safety requirements. This includes a maximum grade of 15 percent, and the use of roadside berms (typically installed to one half of the equipment tire height) or other appropriate safety barriers. Exceptions are made for tracked vehicles.

5.2. LT-TARs and ST-TARs

LT-TARs and ST-TARs would be constructed in a similar manner and with the same equipment used for the Primary Access Road; however, it is anticipated that geotechnical investigation would not be required. Some resurfacing may be required. Resurfacing treatments could include asphalt, soil-cement base, and/or chip-sealing. A typical LT-TAR road cross-section is shown in Figure A15. When no longer needed, temporary access roads for the exploratory drilling sites would be decommissioned and reclaimed by scarifying the road surface and reseeding with a seed mix developed in coordination with the USFS. Growth media may be used in the reclamation if needed.

6. MAINTENANCE

6.1. Primary Access Road

Maintenance activities would be conducted on an as-needed basis and would include shoulder grading, repairing potholes and periodic resurface treatments, and selectively trimming vegetation alongside the road to allow vehicle clearance. Shoulder grading would be accomplished using a motor grader. A Cooperative Road Maintenance Agreement currently exists between Santa Cruz County and the Coronado National Forest. Under this agreement, Santa Cruz County is responsible for maintenance for a number of major roads that cross the NFS land, including Harshaw Road, Duquesne Road, and Flux Canyon Road (including some existing segments of the Primary Access Road). The Cooperative Road Maintenance Agreement identifies the appropriate maintenance level to be maintained for each road. After construction of the Primary Access Road, it is likely an amendment to the agreement could be executed providing for maintenance of the new segments of the Primary Access Road on NFS land.

6.2. LT-TARs and ST-TARs

Maintenance of LT-TARs and ST-TARs that are associated with existing FRs would be limited to activities to address erosion and washouts of the road surface that can be conducted within the disturbed area of the existing roadbed (e.g., grading and berm improvements) and is not considered new disturbance. Maintenance of LT-TARs and ST-TARs that are newly constructed would also be conducted within the disturbed area of the new roadbed and would not create additional disturbance. Maintenance would be accomplished using a motor grader, and environmental protection measures would be implemented during maintenance, such as fugitive dust control and avoidance of surface waters, as described in Chapter 3. Vegetation alongside the roads may be selectively trimmed as necessary to allow vehicle clearance. Existing FRs used for access would be maintained to the current level of maintenance designated by the Coronado National Forest's *Huachuca Mountains Ecosystem Management Area*, *Transportation Analysis Plan* (2001). LT-TARs and ST-TARs would be maintained to USFS Level 2, High-Clearance Vehicles (USFS 1999). Fugitive dust generated by vehicles traveling on natural-surfaced roads would be controlled as needed by application of water from a spray bar-equipped truck.

7. LITERATURE CITED

U.S. Forest Service (USFS). 1999. Forest Service Handbook (FSH). Series 7000 - Engineering. U.S. Department of Agriculture. Available at: http://www.fs.fed.us/im/directives/dughtml/fsh7000.html.

———. 2001. *Coronado National Forest Huachuca Mountains Ecosystem Management Area Transportation Analysis Plan*. Available at: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5295151.pdf. Accessed August 2020.

———. 2011. Coronado National Forest, Sierra Vista Ranger District Transportation Analysis Plan Huachuca Ecological Management Area Map, March 14, 2011. Available at: https://www.fs.usda.gov/detail/coronado/landmanagement/projects/?cid=stelprdb5350845. Accessed August 2022.

———. 2022. Coronado National Forest Motor Vehicle Use Map GIS data, dated May 4, 2022. Available at: https://www.fs.usda.gov/detailfull/r3/landmanagement/gis/?cid=stelprdb5201889&width=full. Accessed August 2022.

Figure A1. Overview of existing roads near the Project.

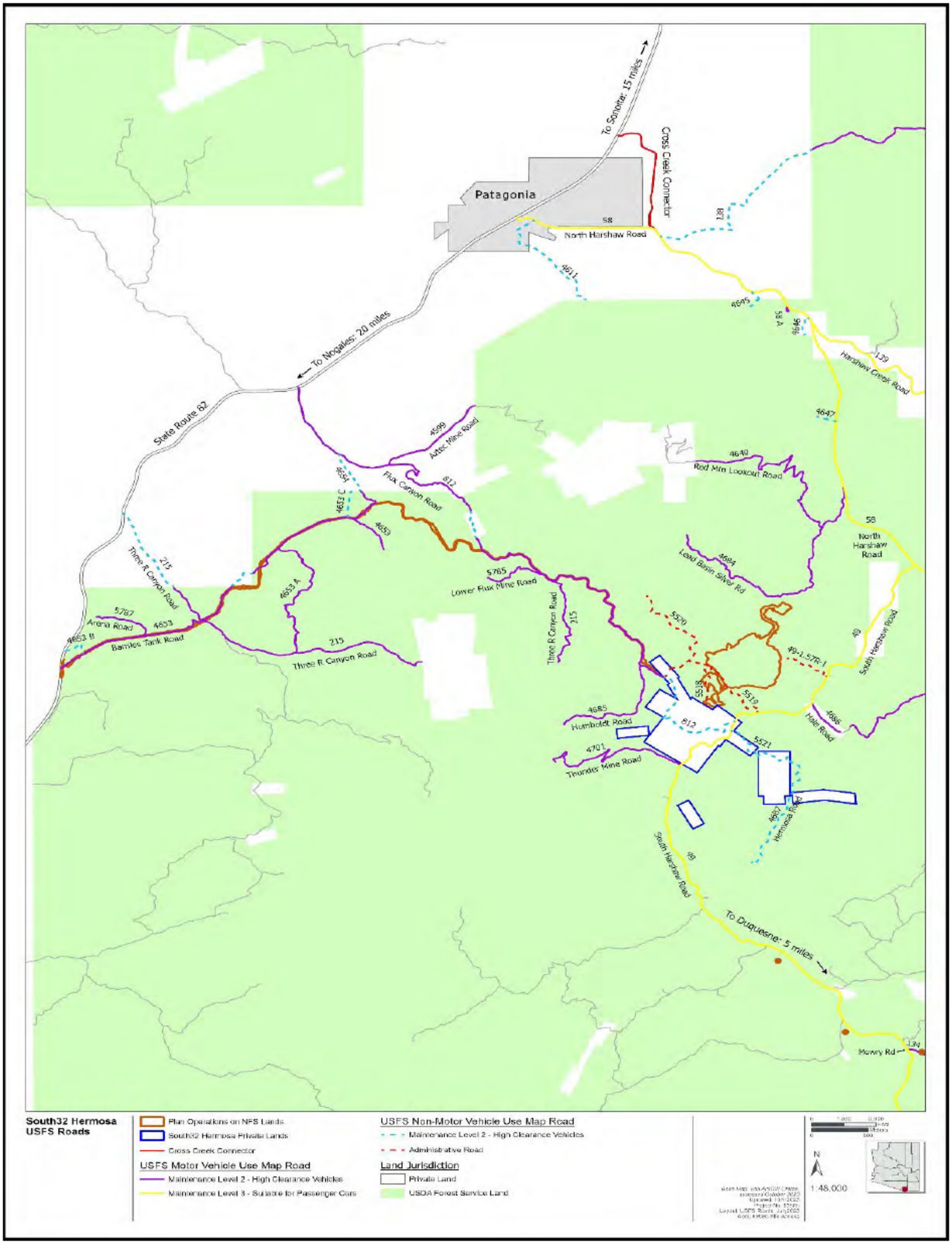


Figure A2. Primary access road alignment (map 1 of 8).

Figure A3. Primary access road alignment (map 2 of 8).

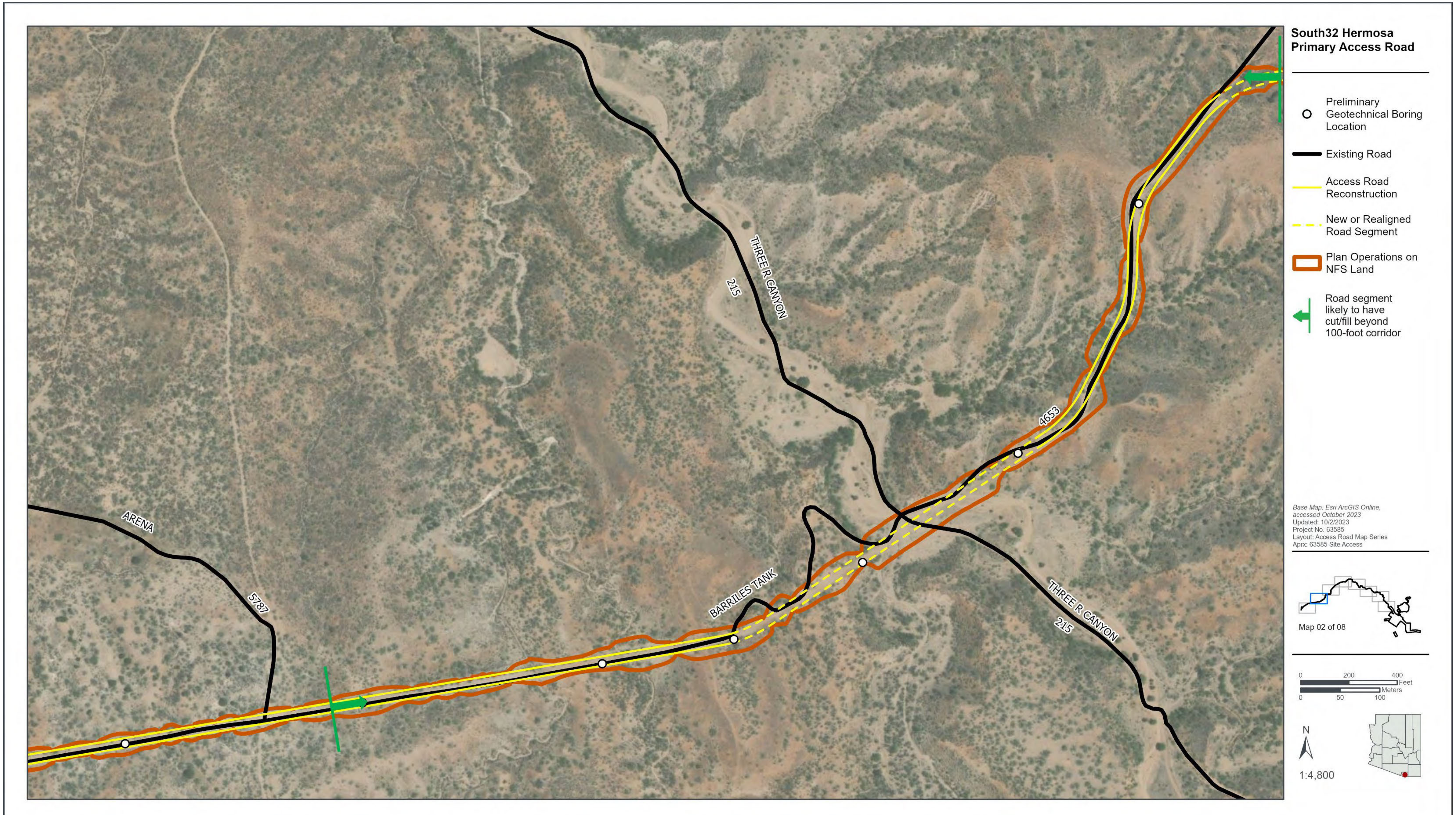


Figure A4. Primary access road alignment (map 3 of 8).

Figure A5. Primary access road alignment (map 4 of 8).

Figure A6. Primary access road alignment (map 5 of 8).

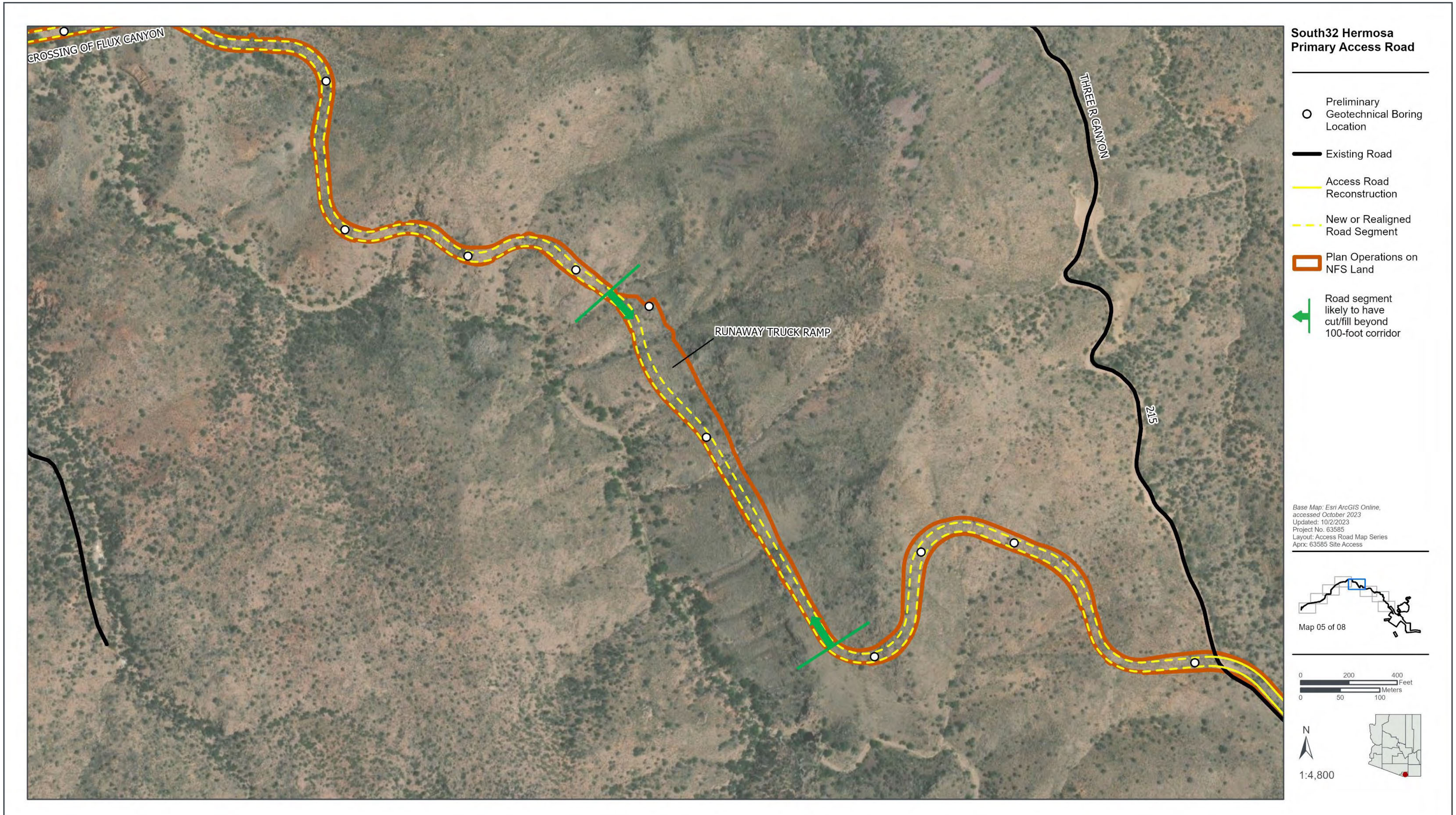


Figure A7. Primary access road alignment (map 6 of 8).

Figure A8. Primary access road alignment (map 7 of 8).

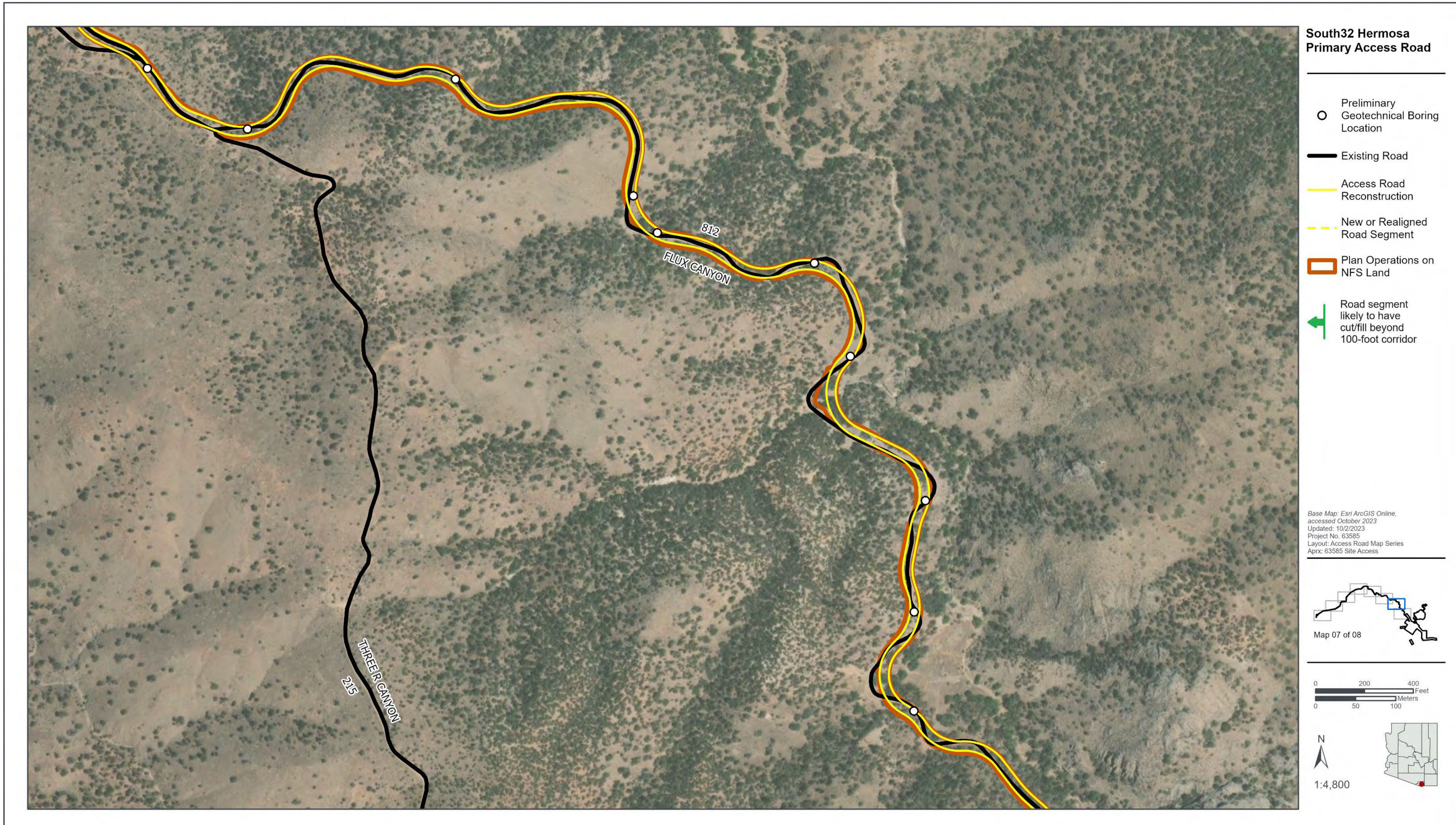
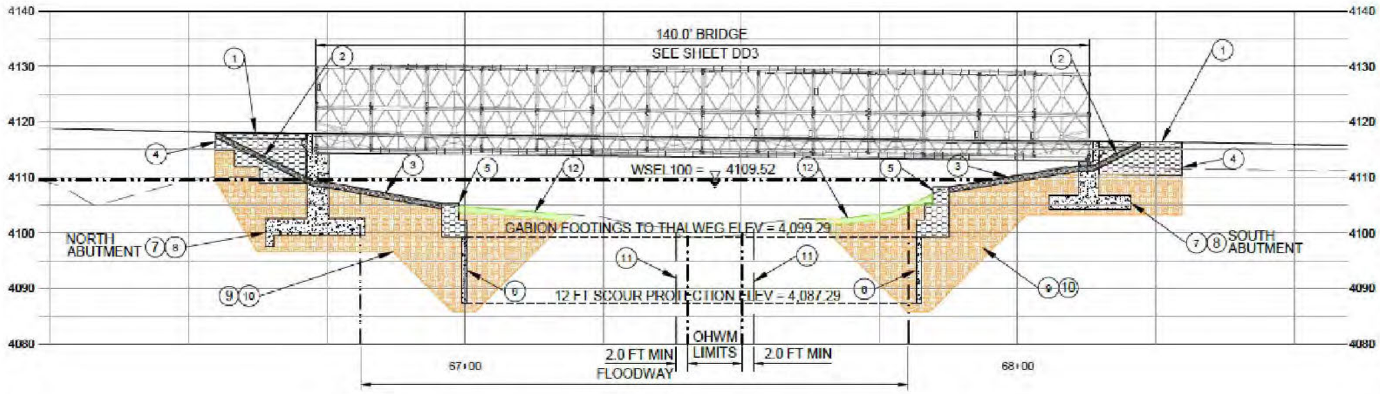


Figure A9. Primary access road alignment (map 8 of 8).

Figure A10. Typical design approach used for bridge crossing.



TYPICAL BRIDGE

Figure A11. Typical design approach used for pipe culvert drainage crossings.

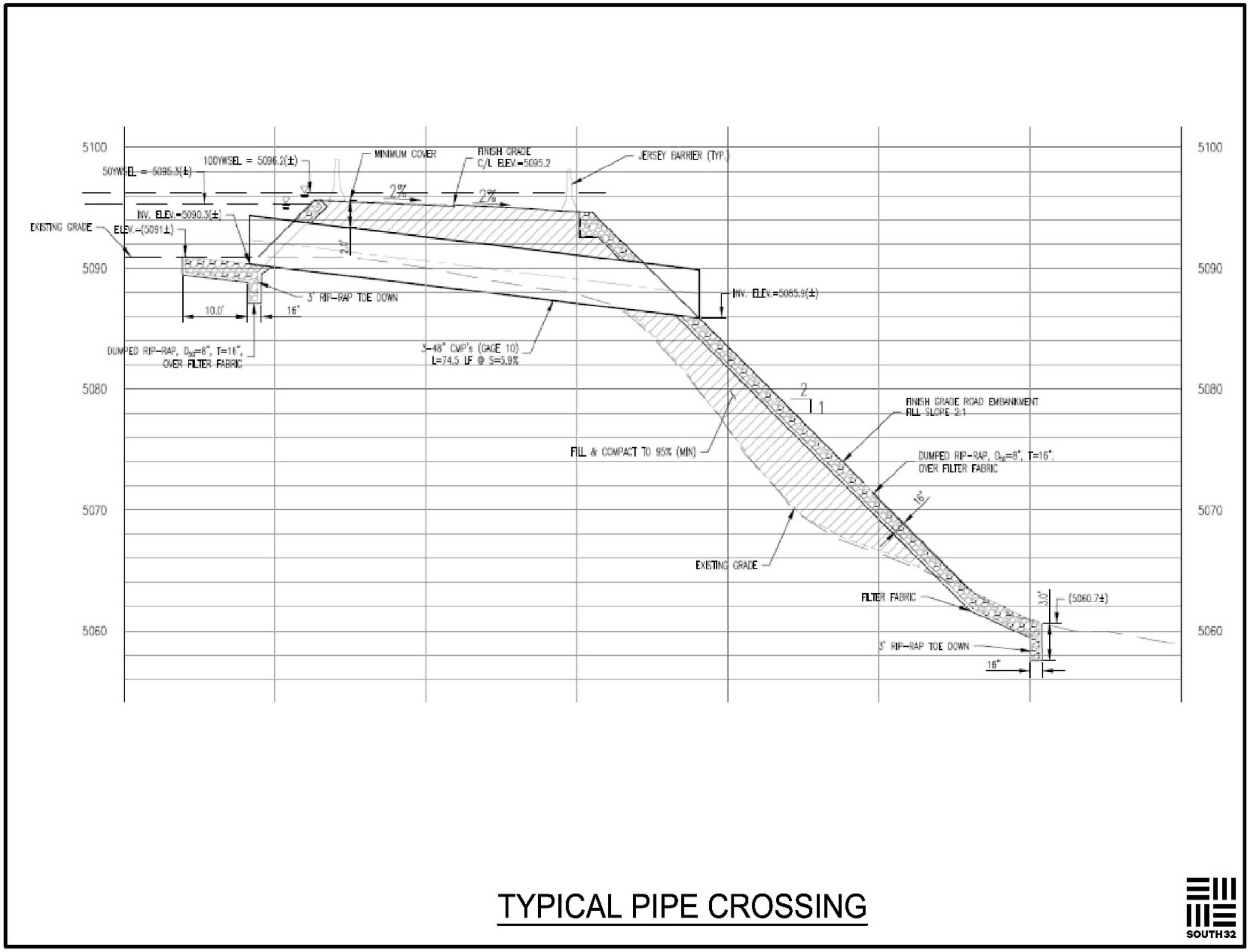
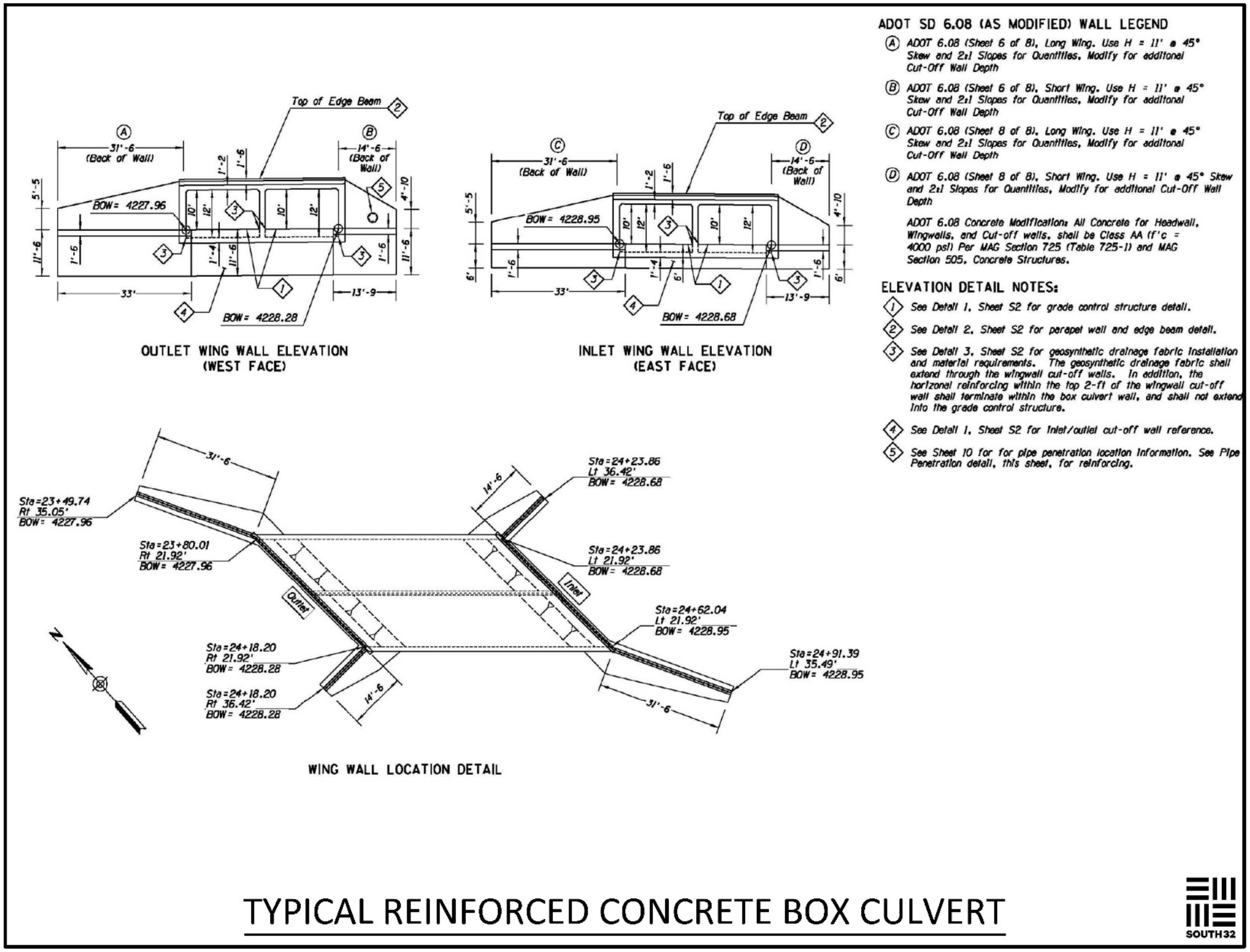


Figure A12. Typical design approach used for box-culvert drainage crossing.



P:\Jobs\505 Flux Canyon Haul Route\CAD\C3D\Exhibits\2023-10-19_FCR Exhibits for MPO\505-FCR - Exhibit 3 - CULVERT CROSSINGS.dwg, 10/20/2023 9:38:13 AM, DWG To PDF.pc3

Figure A13. Typical design approach used for at-grade ford crossing (with cutoff walls for erosion control).

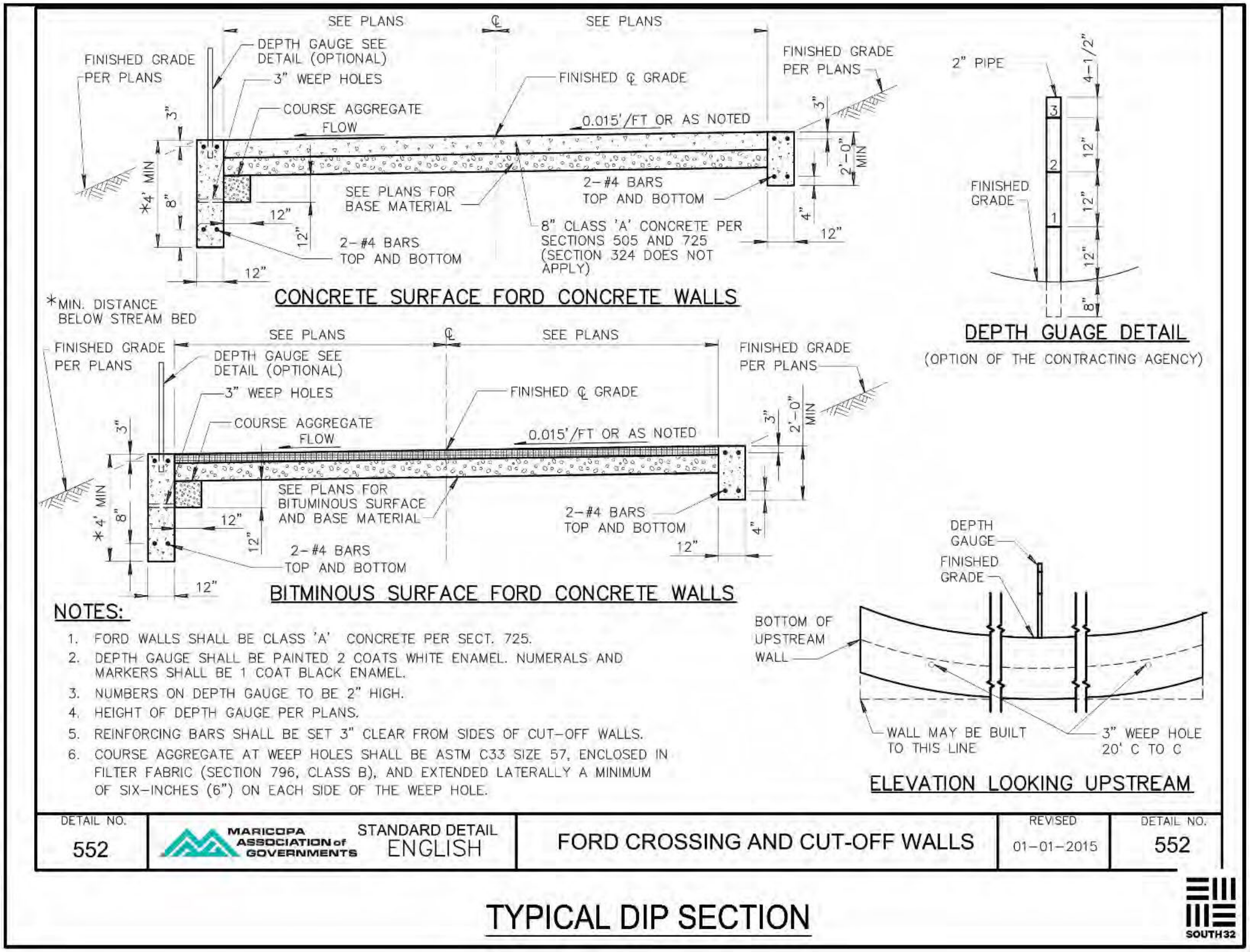


Figure A14. Typical design approach for retaining walls for various cut/fill conditions.

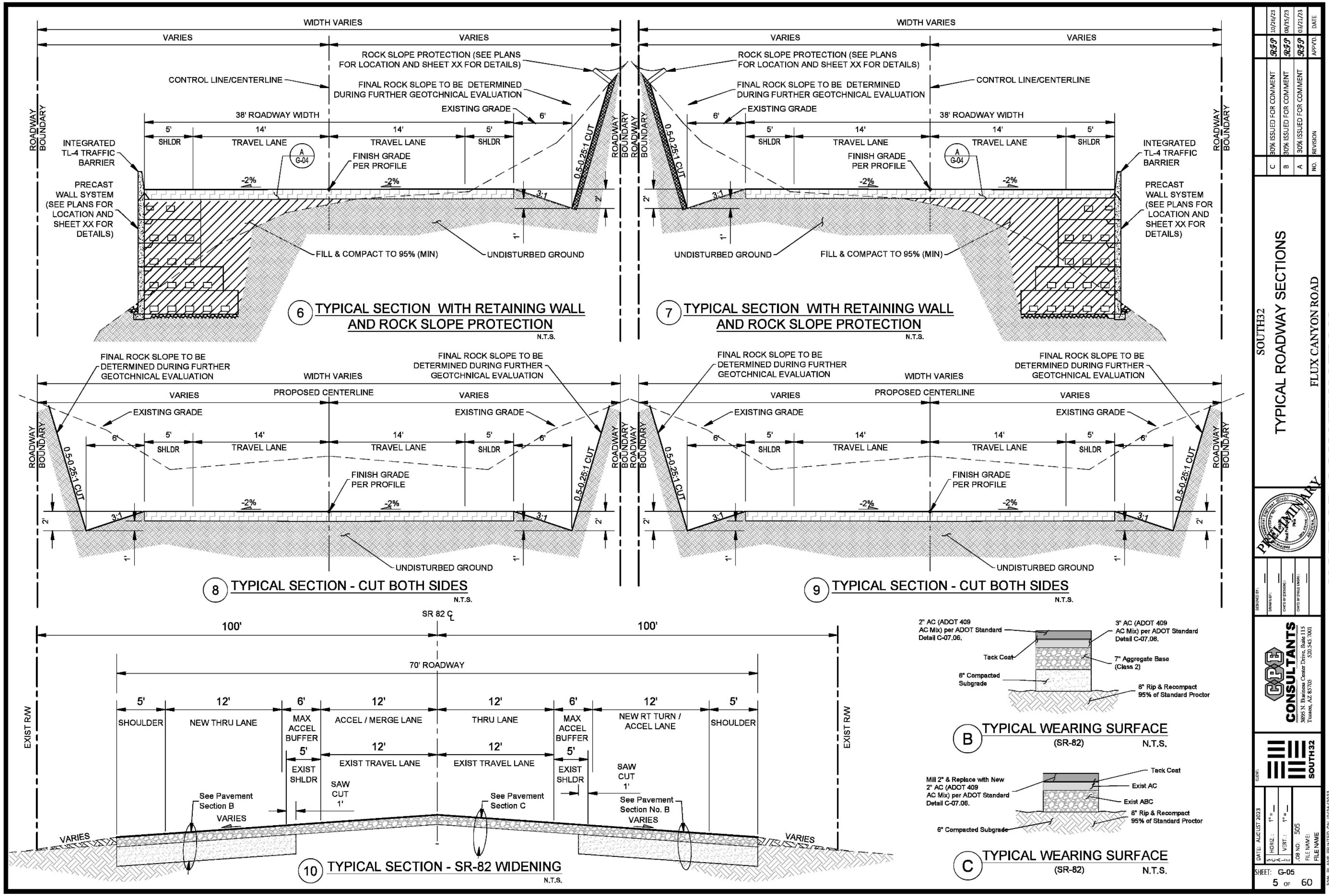
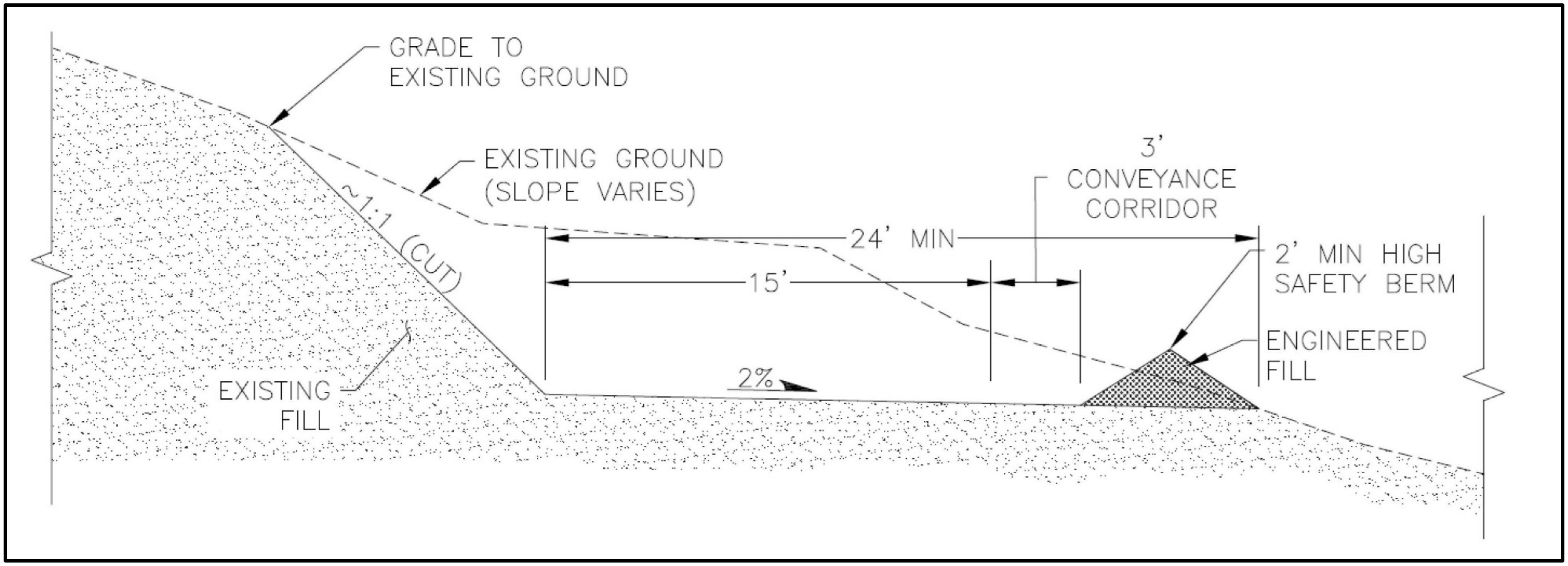


Figure A15. Typical LT-TAR road cross-section.



APPENDIX B

Stormwater Management

CONTENTS

Tables

Figures

1. INTRODUCTION

This appendix to the PoO provides details regarding the preliminary design, layout and strategies for stormwater management associated with the activities proposed on NFS land (Plan Operations). This should not be considered a static plan. Management of stormwater is anticipated to evolve over the course of the Project as further mine design work is completed, and permits are obtained.

The stormwater management system will be implemented to preserve the environmental setting in the proximity of the development of TSF2, the TSF2 UDCP, the Primary Access Road, and downstream receiving points. Stormwater management structures are designed to prevent run-on to TSF2 by conveying external meteoric flows around TSF2 to natural drainages downstream of the disturbance area. Stormwater running off the disturbance areas such as TSF2 and adjacent features will be controlled and treated before leaving the Project. The stormwater management system described would be advanced through the design process and incorporated into the Project's Stormwater Pollution Prevention Plan (SWPPP).

The stormwater management systems will be designed to meet applicable regulatory and industry guidance. Similar control measures have been used in the construction of existing stormwater management systems at the Project, which have proven effective to date in controlling stormwater discharges. Pertinent guidance may include the following:

- ADEQ Best Available Demonstrated Control Technology (BADCT) under the Aquifer Protection Permit program (ADEQ 2004)
- Arizona Pollutant Discharge Elimination System (AZPDES) General Permit For Stormwater Discharges Associated With Industrial Activity – Mineral Industry To Protected Surface Waters (AZMSG2019-002) Sector G: Metal Mining (ADEQ 2019)
- Australian National Committee of Large Dams (ANCOLD) guidelines (ANCOLD 2019)
- Global Industry Standard for Tailings Management (GISTM) guidelines (International Council on Mining and Metals 2020)

2. STORMWATER MANAGEMENT FOR TSF2

2.1. Design Storm Events

Various design storm events are used to guide the sizing and design of stormwater control structures. These criteria are consistent with applicable guidance and regulatory requirements. Determination of precipitation associated with the various frequency storm events described below was obtained from the National Oceanic and Atmospheric Administration (NOAA) precipitation Frequency Data Server.

100-yr/24-hr Design Storm

The 100-year, 24-hour (100-yr/24-hr) design storm is a criteria used to size stormwater control structures under the ADEQ APP program BADCT. The 100-yr/24-hr precipitation depth used for the design of TSF2 is 4.88 inches.

100-yr/72-hr Design Storm

ANCOLD considers the 100-yr/72-hr storm design storm as a criteria used to size stormwater control structures. The 100-yr/72-hr precipitation depth used for the design of TSF2 is 6.07 inches.

1,000-yr/24-hr Design Storm

GISTM standards rely on the 1,000-yr/24-hr design storm as a criteria for active stormwater control structures during operations. The 1,000-yr/24-hr precipitation depth used for the design of TSF2 is 6.53 inches.

Probable Maximum Precipitation Storm Precipitation Depth

Precipitation values for the general (72-hour) and local (6-hour) probable maximum precipitation design storms are also considered in the design standards from ANCOLD. The general probable maximum precipitation (72-hour) depth used for the design of TSF2 is 20.81 inches, and the local probable maximum precipitation (6-hour) depth is 14.63 inches. The GISTM standards rely on the 1/10,000 storm event as a criteria for passive (post-closure) stormwater control; the 10,000-year storm is considered identical to the probable maximum precipitation. The probable maximum flood is the runoff event that results from the probable maximum precipitation storm event.

2.2. Stormwater Management Approach and Design Criteria for TSF2

Different types of stormwater control structures will be used to control non-contact and contact water from the Project. Non-contact water is stormwater runoff generated during precipitation events from upstream watersheds, or precipitation falling within the Project but allowed under the required stormwater permit to be discharged. Contact water is stormwater runoff from direct precipitation on TSF2 and other portions of the Project that has come into contact with any non-inert overburden, raw material, intermediate product, finished product, byproduct, or waste product. An overview of stormwater management for TSF2 is shown in Figure B1. Design criteria for TSF2 and UDCP containment and conveyance are described in Table B1.

Non-contact water will be routed around the Project through external conveyance structures. Some non-contact water may still be detained in sediment control ponds prior to release to natural drainage paths or streams to allow settlement of suspended solids; this water may also be sent to WTP2 for treatment depending on water quality.

Contact water collected from TSF2 and the associated UDCP, which would be the only contact water generated on NFS land, would be controlled in a similar manner as currently used by South32 Hermosa for TSF1. TSF2 is designed with a perimeter road that fully encompasses a synthetically lined TSF2 basin area. The basin area utilizes an underdrain collection system on top of the geomembrane liner consisting of an 18-inch-thick protective layer and drainage pipes encased in a crushed rock layer that is all wrapped in a geotextile. The basin is designed to safely collect and convey contact water to an embankment located on the down gradient side of TSF2. Under normal conditions, collected seepage and contact stormwater would gravity flow through a concrete-encased underdrain below the embankment to a geomembrane-lined channel that conveys the seepage/stormwater to the TSF2 UDCP. If a storm event produces stormwater runoff greater than the capacity of the underdrain collection system, the stormwater runoff will be directed to the operational spillway constructed as part of the TSF2 embankment that will direct excess flows to the external TSF2 UDCP.

External Conveyance Structures

External stormwater conveyance structures would be located upstream and along the periphery of TSF2 to collect and convey surface water flows around TSF2 to a stormwater outfall downgradient of TSF2. These structures may include armoring to minimize erosion and sediment transport as needed. Design criteria for these structures are summarized in Table B1.

Internal Stormwater Conveyance Structures and Underdrain Collection Pond

Internal conveyance structures would be located at the perimeter of the TSF2 stacking to convey surface water runoff from TSF2 to the underdrain collection system and/or spillway. An open channel would be used to convey contact surface water runoff from the concrete-encased underdrain outlet and the TSF2 spillway to the TSF2 UDCP. The conveyance channel is sized to convey peak flow from the probable maximum flood. The UDCP would be used to temporarily manage contact water (stormwater runoff and seepage) from TSF2 until it is pumped to WTP2. Design criteria for these structures are summarized in Table B1.

The external TSF2 UDCP is sized to contain underdrainage flows from TSF2 basin, direct precipitation runoff from the TSF2 footprint, and direct precipitation over the lined pond area. The TSF2 UDCP has an emergency spillway that will allow water to discharge downstream if the design capacity of the UDCP is exceeded. Table B1 provides design criteria for this structure. Additional design criteria exist for dams that are under the jurisdiction of the Arizona Department of Water Resources dam safety program. However, based on the current designs for the dam height and volume of TSF2 UDCP, the dam would not be considered jurisdictional and these requirements would not be applicable to the UDCP.

Temporary Construction Structures

Temporary construction structures are sized to convey the peak flow utilizing a trapezoidal or triangular cross section. The channel depths are determined from the flow depths calculated using Manning's formula for open channel flow.[22]

Additional Stormwater Protection Measures

Armoring of the exterior slopes of TSF2 will reduce the potential for wind and water erosion. Armoring material would be initially placed as berms that are approximately 5 feet high around the perimeter of TSF2 as the filtered tailings are being placed. As the tailings level reaches the top of a given armoring berm, a new 5-foot-high berm will be placed on top of TSF2, and the new berm will coalesce with the berm beneath it in a manner that produces a continuous armored face on the external filtered tailings.

Clearing of vegetation would be limited to the TSF2 footprint. Areas between the TSF2 footprint and the TSF2 fence would not be disturbed unless necessary. This will maintain existing natural vegetation and undisturbed soils, thereby reducing the need for physical stormwater controls.

Post-Closure Stormwater Management

During closure, a closure cover would be placed on TSF2 consisting of growth media and/or waste rock. Once this closure cover is in place and functional, stormwater runoff from precipitation falling on TSF2 is no longer considered contact water. After closure, the internal stormwater conveyance structures will remain in place around the periphery of TSF2 to route stormwater runoff from TSF2 to the down gradient side of the TSF and discharge to the natural drainage. Any long-term seepage from TSF2 would continue to be collected in the underdrain system and would gravity flow to a passive treatment system.

[22] When designing conveyance structures—i.e., channels—it is necessary to first identify the type of channel that will be used. Common channel types are triangular (having a "V"-shape) and trapezoidal (having a flat bottom and sloped sides). Once the channel type is known, the depth of water resulting from a given flow rate can be calculated. Manning's formula for open channel flow is one method of doing this. In addition to the channel dimensions, inputs to Manning's formula include the channel slope and roughness of the channel material.

With respect to treatment, there is a 5- to 10-year time period between the end of mining and when discharge from the Project is estimated to reach zero gallons per minute (gpm). Note that zero gpm discharge refers specifically to water leaving the Project site. It does not mean that no flow would occur from TSF2. Zero discharge from the Project is achieved when rates of flow from TSF2 fall to a level that can be passively treated (through evaporation) instead of being actively treated at WTP2 and then discharged to Harshaw Creek or the RIBs. The flow able to be passively treated is currently estimated as less than 25 gpm (see Section 2.5.5.2). However, the water treatment capability would not be dismantled/removed until the ability to passively treat flows has been demonstrated in practice, which may extend beyond this time frame.

Climate Change Considerations

To meet GISTM requirements, climate change was considered in the sizing of the stormwater conveyance structures and the UDCP. Adjustments (increases) were made to the design storms to account for anticipated climate change scenarios: 2030 (7.0% increase), 2050 (13.0% increase), and 2090 (27.4% increase). For TSF2, the 2050 adjustment was used to modify the climate data for operational conditions, and the 2090 adjustment was used to modify the climate data for post-closure designs.

Selection of Design Criteria

As shown in Table B1, there are multiple regulatory and industry standards for the design of stormwater control structures. Each standard applies a different approach to sizing stormwater structures. During the design process, each of the design criteria shown in Table B1 is assessed independently, using the applicable design storms after being adjusted for climate change. The results are then compared, and the standard requiring the greatest sizing is used for the design. This is considered the most conservative design, with the intent of ensuring that stormwater controls are not undersized. In practice, this approach means that all of the various standards listed in Table B1 are met by the selected design.

In general, the selected design during operations is usually dictated by the 1,000-year/24-hour storm with 2-feet of freeboard,[23] and the probable maximum flood with no freeboard, and the selected design during closure is dictated by the probable maximum flood (equivalent to the 10,000-year storm event). The stormwater conveyance structures that will be in place during both operations and after closure are sized from the beginning to meet the criteria for passive closure.

[23] ”Freeboard” is an engineering term, referring to a safety factor that provides additional capacity in a pond or basin beyond the volume anticipated to be needed. Freeboard is expressed as an additional height above the anticipated water level.

Table B1. Design Criteria for TSF2 Stormwater Management Structures and TSF2 UDCP

Feature	BADCT	ANCOLD	GISTM
TSF2 Internal conveyance (containment)	100-year / 24-hour 2-foot freeboard (min)	100-year / 72-hour 1.64-foot freeboard (min)	Not specified
TSF2 internal conveyance (spillway)	Not specified	Probable maximum flood (no freeboard requirement)	Active care: 1/1,000 Passive care: 1/10,000 (no freeboard requirement)
TSF2 external conveyance	100-year / 24-hour 1-foot freeboard (min)	Not specified	Active care: 1/1,000 Passive care: 1/10,000 (no freeboard requirement)
TSF2 UDCP internal storage (containment)	100-year / 24-hour 2-foot freeboard (min)	100-year / 72-hour 1.64-foot freeboard (min)	Not specified
TSF2 UDCP internal conveyance (emergency spillway)	Not specified	Probable maximum flood (no freeboard requirement)	Active care: 1/1,000 (no freeboard requirement)
TSF2 UDCP external conveyance	100-year / 24-hour 1-foot freeboard (min)	Not specified	Active care: 1/1,000 (no freeboard requirement)

Notes:

ANCOLD = Australian National Committee on Large Dams. The design standards shown are for the “High C” Dam Failure and Spill Consequence Classification. This classification is derived from the number of people potentially at risk and the severity of damage or loss.

BADCT = ADEQ Best Available Demonstrated Control Technology

GISTM = Global Industry Standard for Tailings Management. The design standards shown are for the “Significant Consequence” Classification. This classification is derived from number of people potentially at risk, the potential loss of life, impact on environment, disruption to health, social and cultural aspects as well as infrastructure and economic loss.

2.3. Stormwater Management for Primary Access Road

Stormwater controls for the Primary Access Road would include construction stormwater protection and design features to minimize stormwater impacts during operation. During construction, temporary structural controls would be established, similar to those described above. The goal of these controls is to dissipate flow velocity and physically retain sediment within the construction footprint to the extent practicable. Possible controls include wattles, silt fences, sand bags, berms, temporary sediment basins, benched slopes, soil binders, erosion control blankets or mats, slope transitions, slope drains, check dams, and stabilized vehicle ingress/egress (rock pads). Vegetation removal within the 100-foot construction corridor would be limited to only those areas necessary for construction.

Other good-housekeeping or best management practices would also be implemented during construction of the Primary Access Road, including:

- Using water trucks for dust suppression during soil-disturbing activities.
- Keeping construction-related materials and debris out of drainageways and channels.
- All temporary waste would be stored in containers that have lids that are properly secured at all times and kept in a designated containment area.
- Employees are instructed to pick up trash and dispose of it in the appropriate containers. Dumpsters and trash cans are kept covered except while materials are being added, and precautions are taken against access by wildlife. Trash may also be identified and disposed of during weekly SWPPP inspections.
- Restricting vehicle access on undisturbed areas where practicable.
- Compacting soils on roadways and on graded surfaces.
- Using gravel surfaces when practicable.
- Cleaning of equipment would take place on South32 Hermosa private land.

After construction, permanent stabilization would be implemented to reduce erosion and sediment transport prior to removal of temporary control measures. The road itself would have a durable surface that would prevent erosion, such as asphalt, soil-cement base, and/or chip-sealing. Side slopes and other disturbed areas would have riprap, rock cover, soil-cement, or other hardscape, or would be seeded and revegetated. Specific standards for final stabilization of disturbed areas would be developed to determine when revegetation is successfully complete.

The road design would incorporate structural controls to reduce stormwater impacts during operations. These could include using dikes, swales, curbs, or berms to route water away from road areas; installing waterbars or other velocity dissipation devices in ditches; incorporating rolling dips and road sloping; or using ditching to direct stormwater to outfall locations protected by vegetation, riprap, or other structural controls.

2.4. Additional Erosion and Sediment Control Measures

In addition to the structural controls described above, below are examples of additional erosion and sediment control measures that South32 Hermosa will implement when appropriate and that will be described in detail in the future SWPPP. These measures would apply to facilities such as LT-TARs, ST-TARs, exploration drilling pads, RIBs, and GWM well pads.

- Removal of growth media material will be scheduled for the dry months when practicable to reduce the potential for erosion and high soil losses.
- Cut-and-fill slopes for facility access roads and well site access roads will be designed to prevent soil erosion. Drainage ditches with cross-drains will be constructed where necessary. Disturbed slopes will be revegetated, mulched, or otherwise stabilized to minimize erosion as soon as practicable following construction.
- Road embankment slopes will be graded and stabilized with vegetation or rock as practicable to prevent erosion.
- Runoff from roads and other structures will be handled through best management practices, including sediment traps, settling ponds, berms, sediment filter fabric, wattles, etc. Design of these features will be based on an analysis of local hydrologic conditions.
- Off-road vehicle travel will be prohibited.
- During construction and operations, diversions will be constructed around the affected areas to minimize erosion. Several best management practices, including check dams, dispersion terraces on TSF2, and silt fences, also will be used during construction and operations.
- Pipeline areas will be revegetated or otherwise stabilized to minimize erosion.
- At all stormwater discharge locations, stabilization controls will be installed to prevent erosion. Stabilization controls could include riprap, erosion control mats, wattles, and sediment filter fabric.

2.5. Inspection and Maintenance

Inspections and maintenance are integral to ensuring that all stormwater control structures continue to operate as intended. The inspection schedule and requirements will be at least as stringent as the requirements of the multi-sector general permit for mining (AZMSG2019-002).

Inspection

Inspections will include all disturbed areas, active construction areas, discharge locations, and areas used for storage of materials that are potentially exposed to precipitation. Inspectors will look for evidence of and the potential for pollutants entering the drainage system.

Inspections will be conducted as required by stormwater permits after major storm events and/or at the end of the rainy seasons in early October and in late March for the detection of excessive erosion and down drainage sedimentation. Each year, at least one of the inspections will be conducted while a discharge is occurring at one or more outfalls when practicable and subject to safety protocols, to assess control measure functionality. Inspections will be conducted by qualified persons who are knowledgeable in the principles and practices of erosion and sediment controls.

Monitoring will be conducted in accordance with stormwater permit requirements.

Maintenance

Maintenance ensures that stormwater control measures continue to function as intended. If maintenance issues are identified, maintenance will be performed before the next anticipated storm event or as soon as feasible but no later than 14 days from discovery.

3. LITERATURE CITED

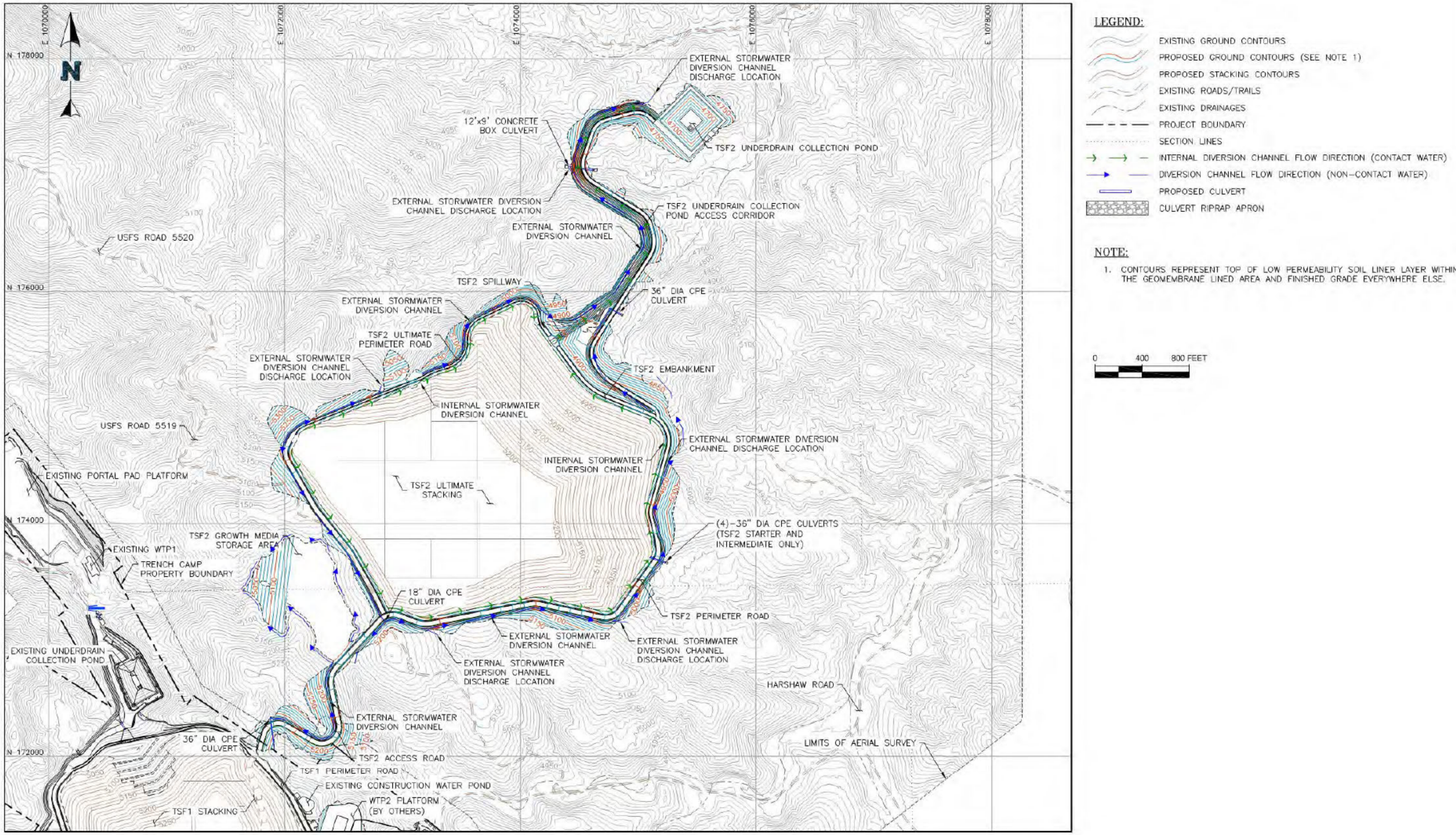
Arizona Department of Environmental Quality (ADEQ). 2004. Arizona Mining Guidance Manual BADCT. Aquifer Protection Program. Publication No. TB-04-01. Available at: https://static.azdeq.gov/wqd/badctmanual.pdf.

———. 2019. Arizona Pollutant Discharge Elimination System General Permit for Stormwater Discharges Associated with Industrial Activity – Mineral Industry to Protected Surface Waters (AZMSG2019-002) Sector G: Metal Mining. Available at: https://static.azdeq.gov/permits/azpdes/msgp_mining_permit.pdf.

Australian National Committee of Large Dams (ANCOLD). 2019. *Guidelines on Tailings Dams, Planning, Design, Construction, Operation and Closure*, Revision 1, July. Available at: https://www.ancold.org.au/wp-content/uploads/2019/07/Tailings-Guideline-Addendum-July-2019.pdf.

International Council on Mining and Metals. 2020. Global Industry Standard on Tailings Management (GISTM). Available at: https://www.icmm.com/en-gb/our-principles/tailings/global-industry-standard-on-tailings-management.

Figure B1. Conceptual stormwater management design for TSF2.



APPENDIX C

Materials Management

CONTENTS

Tables

1. INTRODUCTION

This appendix to the PoO provides details on procedures for the operational handling of the transportation, storage, use, and disposal of materials with the potential to cause environmental harm if not managed appropriately. The management details provided herein are compatible with but do not replace any state or federal laws or regulations that are applicable. The three types of materials discussed in this appendix are:

- Hydrocarbons
- Explosives
- Hazardous Materials

These materials management procedures should not be considered static. Operational plans for these materials are anticipated to evolve over the course of the Project as further mine design work is completed.

This information supports the Plan Operations for operations on NFS land. The details provided in this appendix are largely applicable only to South32 Hermosa private land, as no storage or disposal of hydrocarbons, explosives, or hazardous materials will occur on NFS land. However, transportation of these materials will cross NFS land on USFS roads, and there will be some limited use of materials on or beneath NFS land. This specifically includes the use of explosives for subsurface mining, the use of explosives at the surface during the construction of the Primary Access Road and TSF2, and the use of hydrocarbons to fuel equipment and vehicles operating on NFS land.

Some anticipated materials, including quantities and transportation methods, are shown in Table C1; this table should not be considered a complete list of all materials and supplies associated with Plan Operations.

Table C1. Materials and Supplies Anticipated for Plan Operations

Material Supply	Activity On or Beneath NFS Land	Delivered Form
Diesel fuel	Use	Liquid
Gasoline	Use	Liquid
Propane/compressed natural gas	Transportation	Liquid
Oil/lubricants	Use	Liquid
Antifreeze	Use	Liquid
Zinc sulfate	Transportation	Bulk bags; granular form
Copper sulfate	Transportation	Bulk bags; granular form
Zinc cyanide	Transportation	Isotainer; granular form
Frother (methyl isobutyl carbinol, F-549, X-133)	Transportation	Liquid; bulk delivery by truck
Zinc collector (Solvay 5100)	Transportation	Liquid; bulk delivery by truck
Lead collector (3418A)	Transportation	Liquid; bulk delivery by truck
Sodium metabisulphite (SMBS)	Transportation	Bulk bags; granular form
Lime	Transportation	Solid
Explosives (emulsion product)	Transportation; subsurface use; surface use	Solid
Explosives (blasting detonator)	Transportation; subsurface use; surface use	Solid
Flocculant	Transportation	Solid; bulk bags, powder form
Dust suppressant	Transportation; surface use	Liquid

Material Supply	Activity On or Beneath NFS Land	Delivered Form
Construction material deliveries	Transportation	Solid
Equipment delivery	Transportation	Solid
Lead/silver concentrate	Transportation	Solid (19.7-tonne truck)
Zinc concentrate	Transportation	Solid (19.7-tonne truck)
Oxide ore	Transportation	Solid (24-tonne truck)
Oxide ore supplies	Transportation	Solid

2. HYDROCARBON MANAGEMENT

2.1. Purpose and Scope

The intent of the hydrocarbon management procedures is to provide South32 Hermosa employees and its contractors with direction regarding the safe handling, transportation, storage, use and disposal of hydrocarbons. These management procedures be followed by all South32 Hermosa employees and at any South32 Hermosa–controlled site, including on NFS land after approval of the Final PoO. Proper management techniques for hydrocarbons will result in environmental protection, reduced consumption, and compliance with state and federal hydrocarbon regulations. This direction is to be used in conjunction with the Project-specific SPCC plan, SWPPP, and Project Emergency Response Plans that will be developed or updated prior to Final PoO approval.

2.2. Hydrocarbon Product Control and Safety Data Sheets

In order to facilitate access to safety data sheets for hydrocarbons stored and used on the Project, all safety data sheets must be entered into the Internet-based repository system, MSDSOnline. Any hydrocarbons not currently found in the South32 Hermosa system must first be approved by the South32 Hermosa Health, Safety and Security and South32 Hermosa Environment Department. If the request is approved, the safety data sheet must be entered into the database prior to bringing the hydrocarbon on the Project. Training must be provided for all employees that may use or come into contact with the product.

2.3. Hydrocarbon Transportation

Transport of hydrocarbons will take place on or across NFS land, using USFS roads, and once constructed, the Primary Access Road.

All hydrocarbons deliveries and/or removal must be done by an approved transport vendor with the appropriate licensing, permits, and vehicle placarding for the product(s) involved. Personnel trained on oil handling and the contents of the SPCC plan will supervise oil deliveries (on South32 Hermosa private land, none would occur on NFS land) for all new suppliers, and periodically observe deliveries for existing suppliers. Loading/unloading activities will be observed closely at all times by personnel familiar with the activity. All deliveries must be promptly offloaded at their designated storage location and storage location must have appropriate secondary containment.

Fuel Loading/Unloading Bulk Storage Containers

There will be no bulk storage of hydrocarbons or unloading of hydrocarbons on NFS land.

South32 Hermosa personnel or contractors responsible for receiving bulk petroleum product containers will be trained in container visual inspection, fuel loading/unloading and spill response procedures.

Before unloading any fuel or draining tanks, ensure that the following steps are followed:

- The parking brake of the transport must be set, the wheels chocked, and the truck turned off unless the engine is needed to operate a pump.
- The Project's storage container must be assessed for adequate storage volume. Ensure that there is adequate spill containment material in the immediate area.
- All hoses must be checked for leaks and wet spots. Drainage valves on the secondary containment system must be closed. Verification must be made that the valve alignment is properly set and that the pumping system is functioning properly.
- Prior to connecting to the fuel transfer point, ensure that the offloading system is adequately grounded.
- Turn off cell phone.
- Test the overfill alarm to ensure it works.
- Verify compartment contents are the same as the tank label.

During the offloading process ensure that the following steps are followed:

- The delivery driver must remain in the immediate vicinity and on the ground to be able to detect possible spills.
- All systems, hoses, and connections must be inspected periodically.
- Frequent visual observations should be made for leaks. Sounds and smells should also be assessed for potential issues.
- Keep internal and external valves on the receiving tank open along with the pressure relief valves.
- Monitor flow meter to determine flow rate, gallons transferred and liquid level in the receiving tank to prevent overflow.

After the offloading process ensure that the following steps are followed:

- Pump must be turned off.
- Close the valves before disconnecting the hose.
- Remove the wheel chocks.

2.4. Hydrocarbon Storage

There will be no bulk storage of hydrocarbons on NFS land, though some temporary hydrocarbon storage may occur on exploratory drill pads during active drilling.

All hydrocarbons to be stored at the Project must be stored in closed containers that are compatible with the stored material and the containers must be properly labeled. Hydrocarbon storage must be stored in a manner so there is no risk of discharge to streams, drainages, or the environment.

Hydrocarbon containers that are 55 gallons or greater must be placed in some form of secondary containment. Typical secondary containment includes the use of double-walled tanks, concrete and earthen secondary containments, contractor building walls, and catchment basins. Secondary containment will typically be designed to contain 110% of the largest container and designed with sufficient free board to contain rainfall from a 25-year, 24-hour storm event.

Storage Area Inspections

All storage areas will be inspected to monitor for leaks and the structural integrity of the storage containers on a routine basis.

Routine inspections – Routine visual inspections of all work areas and equipment shall include:

- Inspection of tank and piping integrity.
- Inspections for stained soil, due to leaks, in storage areas and around vehicle parking areas.
- Inspection of secondary containment areas to ensure that there is no water accumulation or signs of leakage.
- Equipment will be checked for signs of leakage.
- Concrete containment areas for adequate capacity.

Monthly inspections – The key elements covered in the monthly inspections are:

- Checking the bulk storage tanks and piping for signs of damage.
- Checking the concrete containment areas for signs of damage or instability.
- Inspecting each tank foundation for signs of instability.
- Inspecting tank foundation to assure that all sides of the tanks are visible and not leaking.
- Verifying the overfill protection system is working on tanks.
- Checking the inventory of the spill kits.

2.5. Spill Prevention

Spill Response

Spill kits, absorbent materials, empty drums and shovels will be available in hydrocarbon storage and delivery areas, and throughout the Project in the event of small, incidental releases. All employees will be trained regarding the location of these supplies and proper spill response measures.

Spill response procedures differ depending on if a spill is considered minor, major or uncontrolled. Minor spills are less than 25 gallons, can be easily contained, typically pose no significant harm or threat to human health or the environment and are not likely to reach surface waters. Major spills are 25 gallons or greater or could reach an adjacent drainage. An uncontrolled discharge is one that cannot be safely controlled or cleaned up by South32 Hermosa, is large enough to spread beyond the immediate source location, has the potential to enter navigable waters of the United States, requires special training or equipment for cleanup or there is a danger of fire or explosions. A spill within a secondary containment structure is not considered a discharge.

Response procedures are as follows:

- Responders must first characterize the type of spill, source, amount and the extent of the release.

    - If the release material is considered hazardous, do not enter the area and stay upwind of the release area.
- Assess the situation for fire or explosion hazard. Only trained personnel should respond to a release. Untrained personnel should report the release and take no further action until trained personnel respond.
- Trained personnel should take measures to contain and stop the release if it can be done safely. Personnel responding to releases should ensure that proper personal protective equipment is used when responding. Personal protective equipment may include a hardhat, boots, safety glasses, gloves, and/or respirators.
    - Eliminate potential spark sources.
    - Attempt to shut off all valves and pumps or right containers to stop release.
    - Ensure all valves in the containment area are closed.
- Response to a minor discharge:
    - Notify the designated responsible manager for the Project.
    - Under direction of the designated responsible manager for the Project contain the spilled material and place the material in a properly labeled container.
    - Complete a spill reporting form and file with the appropriate Project contacts immediately.
- Response to a major discharge:
    - The response to a major discharge is the same as a minor discharge.
    - Notification is required to one or more regulatory agencies of the discharge and correction actions taken to control and clean up the discharge. Follow the notification and response procedures identified for the Project.
- Response to an uncontrolled discharge:
    - All workers must immediately evacuate the discharge area.
    - If the designated responsible manager for the Project is not present, the senior South32 Hermosa on-site person must notify the designated responsible manager for the Project of the spill and has the authority to initiate the notification and response.

Spill Reporting and Incident Termination

Once a release has been contained and cleaned up, a designated emergency coordinator is responsible for replenishing all spill response equipment to ensure that there is adequate material available in the event of another spill. A spill reporting form must be completed immediately following any size spill. In the event of a major discharge, South32 Hermosa must complete an appropriate discharge notification form. South32 Hermosa will notify the required agencies in the event of a reportable discharge.

Disposal

There will be no storage of spent absorbent materials used in hydrocarbon spill response on NFS land.

Discharged material will be containerized until proper disposal can be arranged. The material will be removed from the Project by a licensed disposal contractor. The containers must be labeled and stored closed unless adding more waste. The South32 Hermosa Environmental Department will coordinate all waste disposal and is responsible for all required tracking.

Used oil is transported off the Project for recycling by an authorized transporter and recycler.

2.6. Training

Any employee or contractor who is responsible for the handling of hydrocarbons on South32 Hermosa–controlled property is required to complete general hydrocarbon training. New personnel will receive this training before beginning work. Annual refresher trainings are held for all Project personnel. This training will cover hydrocarbon transport, storage, and spill response which includes SPCC training.

Transport carriers will be briefed on the facility layout and will be required to have the necessary equipment to respond to a discharge. Personnel trained on oil handling and the contents of the SPCC plan will supervise hydrocarbon deliveries.

All training records will be kept with the South32 Hermosa designated training coordinator.

3. EXPLOSIVES MANAGEMENT

3.1. Purpose and Scope

The objective of the explosives management procedures is to describe the standards and procedures to be used in the transportation, handling, storage, use, and disposal of explosives to ensure a safe environment for the Project's employees, contractors, and neighbors. Explosives management will also ensure that South32 Hermosa's standards are compliant with Bureau of Alcohol, Tobacco, Firearms and Explosives 27 CFR Regulations, MSHA 30 CFR Regulations, and Arizona State Mining Code and the manufacturer's recommendations. Explosives management provides the system, processes, and procedures that must be followed when dealing with explosives to ensure a safe environment.

A responsible person who has obtained a federal explosives license or permit from the Bureau of Alcohol, Tobacco, Firearms and Explosives will be responsible for the receiving of explosives at the Project. State law requires that anyone who stores, transports, or uses explosives obtain a Department of Construction Services license. In addition to that license, a permit may also be required from the same agency to store or transport explosives.

3.2. Explosives Transportation

Transport of explosives would take place on or across NFS land, using USFS roads, and once constructed, the Primary Access Road.

This section outlines the steps and procedures that must be followed when transporting explosives to the Project and while on the Project. These measures follow Bureau of Alcohol, Tobacco, Firearms and Explosives 24 CFR Regulations, MSHA 30 CFR Regulations and the Arizona Mining Code as well as the manufacturers' recommendations. Explosives will be transported to the mine by the explosive distributor and shall follow the provisions of the U.S. Department of Transportation regulations outlined at 46 CFR Parts 171-179 and 390-397. The following are general policies and procedures that are applicable to the transportation of explosives.

Vehicles

All vehicles transporting explosives must be equipped, maintained, and inspected to manage the risk of fire or explosion. On-site vehicles must meet or be equipped with the following:

- Vehicles must be maintained in sound operating condition.

- Equipped with sides and enclosures higher than the explosive materials being transported or have the explosive material secured to a non-conductive pallet.
- Explosives shall not be transported in the passenger areas and must be transported in a cargo area.
- Equipped with at least two multipurpose dry-chemical fire extinguishers or one such fire extinguisher and an automatic fire suppression system.
- Posted with appropriate warning signs showing the content and hazards. Signs must be visible from all sides of the vehicle.
- The cargo compartment must either be locked or attended unless the vehicle is parked at the blast site and unloading is in progress.
- The vehicle cannot be taken to a shop or repair facility if it is transporting explosives.
- The vehicle must be secured with the brakes set, the wheels chocked, and the engine shut off unless powering a device used in the loading process.
- Vehicles transporting explosives cannot have any sparking material exposed in the cargo area.

Hoists

Transportation of explosives underground via the hoist must follow these procedures:

- No explosives material shall be transported during a mantrip.
- Explosive materials transported on a shaft conveyance shall be placed within a container that prevents the cargo from shifting and be secured so that it cannot come into contact with sparking material.
- The shaft operator shall be contacted prior to transporting any explosives.

Delivery

Explosive transports will be taken immediately to the designated storage location or to the blast site.

Separation of Explosives

Explosives and detonators shall be transported in separate vehicles or in the same vehicle providing there is a hardwood partition at least 4 inches thick, a laminated partition, or equivalent. Detonators in quantities over 1,000 shall be kept in the original containers as shipped from the manufacturer.

3.3. Explosives Storage

Bulk storage of explosives will not take place on or beneath NFS land.

Prior to the storage of any on-site explosives, the person in charge of the storage area shall prepare a comprehensive Storage and Security Plan to ensure that the procedures for storage of explosives and storage locations meet all Bureau of Alcohol, Tobacco, Firearms and Explosives 27 CFR Regulations, MSHA 30 CFR Regulations and the Arizona State Mining Code as well as the manufacture’s recommendations. The following policies and procedures shall be implemented for explosives storage.

Underground Explosives Storage Facilities

The main underground storage facility for the sulfide portion of the orebody will be located near the shaft on 2550 Level. A smaller magazine complex may be required on the 3680 Level to support the extended development on that horizon long before ramp access from the 2550 Level is provided. The main underground explosives storage facility for the oxide portion of the orebody will be off the decline near 4200 Level. The underground facility on the 2550 and 4200 Levels will include three bays excavated from a bypass drift so that an accidental detonation will not directly impact an access or travelway. The three bays will provide for the separate storage of bulk explosives, detonators, and explosives accessories. Bulk explosives will be stored in a large tank designed for explosives. Storage space for emulsion transport containers and associated lifting equipment is provided at the entrance to the emulsion bay. Fire extinguishers are located on the rib near the entrance to each storage area. All explosives storage facilities are located beneath South32 Hermosa private land.

Aboveground Explosives Storage Facilities

Any aboveground storage areas will be designed with adequate spacing and protections as required by appropriate regulations and safety guidelines.

General Conditions Applicable to All Explosives Storage Facilities

Storage of explosives, either belowground or aboveground, must follow these procedures:

- Explosive magazines shall be structurally sound, non-combustible, and bullet proof.
- All magazines will be kept locked when unattended.
- The magazines interior will be constructed with non-sparking material, ventilated to control dampness and excessive heat, and kept clean and dry.
- The magazine will be lighted and heated with devices that do not create a fire or explosion hazard. The electrical switches and outlets will be located outside of the magazine.
- The magazines must be posted with appropriate placards or other warning signs that indicate the content and possible hazards. Signs must be visible from all sides.
- Detonators and explosives shall be stored in separate magazines.
- Packaged blasting agents shall be stored in magazines or other facilities used to store only blasting agents.
- Bulk blasting agents shall be stored in bins or tanks that are weather resistant and locked, attended, or otherwise inaccessible to unauthorized entry.
- Areas around aboveground explosive storage areas must be clear of rubbish, brush, dry grass, and trees for 25 feet in all directions.
- Other combustibles shall not be stored within 50 feet of the explosive storage facility.

Powder Boxes (Day Boxes)

Daily operational storage of explosives must follow these procedures:

- Boxes will be structurally sound, weather resistant, equipped with a lid, and constructed with only non-sparking material on the inside.

- Boxes will be posted with warning signs indicating the contents and potential hazards.
- Boxes will be locked or attended when carrying explosives.
- Boxes will be emptied at the end of the shift, with the contents returned to a magazine or other facility, or attended.
- Detonators must be kept in separate boxes from explosives or blasting agents.

Explosive Storage Practices

These general explosive storage practices must be followed for all explosive storage:

- Explosive material will be stored so that the oldest may be used first.
- Explosive material will be stored according to brand and grade so that it is readily identifiable and will be stacked in a stable manner no more than 8 feet high.
- Detonators will not be stored in magazines with other explosive materials.
- Blasting agents, when stored with explosives, will be separated from explosives, safety fuse, and detonating cord to prevent contamination.
- Detonating cord is an explosive and shall be stored, transported, and handled according to explosive regulations.

3.4. Explosives Use

Use of explosives would take place for subsurface mining on NFS land. There may also be aboveground use of explosives on NFS land for construction of the Primary Access Road and TSF2.

Any person handling or using explosives will hold a valid federal license and will be familiar with the Project's Blasting Plans and Procedures. The Blasting Plans and Procedures will be compliant with Bureau of Alcohol, Tobacco, Firearms and Explosives 27 CFR Regulations, MSHA 30 CFR Regulations, and the Arizona State Mining Code as well as the manufacturer's recommendations. The following policies and procedures shall be implemented for explosives use.

General Explosives Requirements

These general operational practices must be followed for all explosive use:

- Smoking and use of open flames shall not be allowed within 50 feet of explosives materials.
- Explosives and blasting agents shall be kept separate from detonators until loading begins.
- Only trained and experienced personnel shall handle or direct explosives.
- Inexperienced personnel shall work only under the direct supervision of trained and experienced personnel in the handling and use of explosives.

Initiation Systems

Initiation systems must comply with these requirements:

- Use of non-electric detonators shall be in compliance with 30 CFR 57.6500–6501.
- Use of electrical detonators shall comply with 30 CFR 57.6400–6407.

Hot Hole Blasting

In the event that heat or chemical reaction could cause premature detonation, written procedures and training will be initiated that are in compliance with 30 CFR 57.6902.

3.5. Explosives Disposal

There will be no disposal of explosives on NFS land.

A comprehensive explosives disposal plan and procedures will be implemented that comply with Bureau of Alcohol, Tobacco, Firearms and Explosives 27 CFR Regulations, MSHA 30 CFR Regulations, and the Arizona State Mining Code as well as the manufacturer’s recommendations.

3.6. Inventory Management

Comprehensive inventory plans and procedures will be prepared to be compliant with Bureau of Alcohol, Tobacco, Firearms and Explosives 27 CFR Regulations, MSHA 30 CFR Regulations, and the Arizona State Mining Code as well as the manufacturer’s recommendations.

3.7. Training

Comprehensive training plans and procedures will be prepared to be compliant with Bureau of Alcohol, Tobacco, Firearms and Explosives 27 CFR Regulations, MSHA 30 CFR Regulations, and the Arizona State Mining Code as well as the manufacture’s recommendations.

All South32 Hermosa employees receive general training regarding explosives during their annual MSHA Refresher Training.

4. HAZARDOUS MATERIALS MANAGEMENT

4.1. Purpose and Scope

The objective of hazardous materials management is to provide guidance regarding the proper handling, storage, and disposal of hazardous materials and hazardous waste to protect the environment and to ensure compliance with applicable laws and regulations.

The information provided is meant to provide guidance in the safe handling of hazardous materials and to help reduce the risk of release into the environment. When a question arises regarding handling, storage, or disposal of hazardous materials, the specific statutes and rules should be consulted, and this document should only be used as a guideline.

4.2. Hazardous Materials Assessment

The purpose of hazardous materials management is first to identify potential hazardous materials. Once hazardous materials are identified, an assessment of potential contamination risks would be completed. This evaluation should identify the measures needed to ensure proper transport, storage, use, transfer, and disposal measures for hazardous materials to minimize the risk of adverse impacts to human health or the environment.

4.3. Hazardous Materials Transportation

Transport of hazardous materials would take place on or across NFS land, using Forest Roads, and once constructed, the Primary Access Road.

Transport of hazardous materials across NFS land would only be done by vendors that are specifically registered to handle hazardous products and waste. Transportation of hazardous materials on the Project would only be completed in vehicles that are specifically equipped for the transport of these materials and by personnel that have been specifically trained regarding the transport and hazards of these materials.

4.4. Storage and Handling

Storage of hazardous materials would not take place on NFS land, though some temporary chemical storage may occur on exploratory drill pads during active drilling.

Hazardous materials containers must be compatible with the material to be stored and must be stored closed at all times and clearly marked with the container's contents and hazards.

Hazardous material containers will be stored in adequate secondary containment structures to ensure that the material cannot be discharged to streams, drainages, or the environment. The containment structure's drain valves will remain closed and locked except while draining uncontaminated rainwater. Product spillage in the containment structure will be cleaned up immediately. The containment structure must be able to contain 110% of the largest single container. The Project's SPCC plan and SWPPP provide more detail about the secondary containment structures and their locations.

4.5. Inspections

Hazardous material storage areas are inspected on a routine basis to monitor for leaks, spillage, and structural integrity of the containers and the secondary containment storage areas. The inspection procedures are outlined in the SPCC plan and SWPPP.

4.6. Disposal

Disposal of hazardous materials or waste will not take place on NFS land.

Prior to waste disposal, each waste stream should be characterized through a baseline analysis and information obtained from the safety data sheet. Only vendors that are qualified to handle the disposal/recycling of a particular waste stream would be contacted for disposal/recycling. Depending on the Project's generator status, ensure that the waste is disposed of within the regulatory time frame.

4.7. Recordkeeping and Reporting

Generators of hazardous waste must obtain a Resource Conservation and Recovery Act identification number prior to transporting wastes off of the Project for disposal.

4.8. Training

Persons responsible for the handling of hazardous waste must have specialized training prior to being assigned to an area where these materials are stored/used. The training must meet the requirements of

OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) regulations, U.S. Department of Transportation hazardous materials regulations, and Resource Conservation and Recovery Act regulations.

5. POLLUTION PREVENTION AND WASTE MINIMIZATION

Pollution prevention and waste minimization are one of the best avenues to minimize the amount of hazardous materials generated at a Project and include the following:

- Purchase only the amount needed for the job.
- Substitute non-hazardous materials whenever feasible.
- Recycle all wastes when feasible.
- Reuse products whenever feasible.

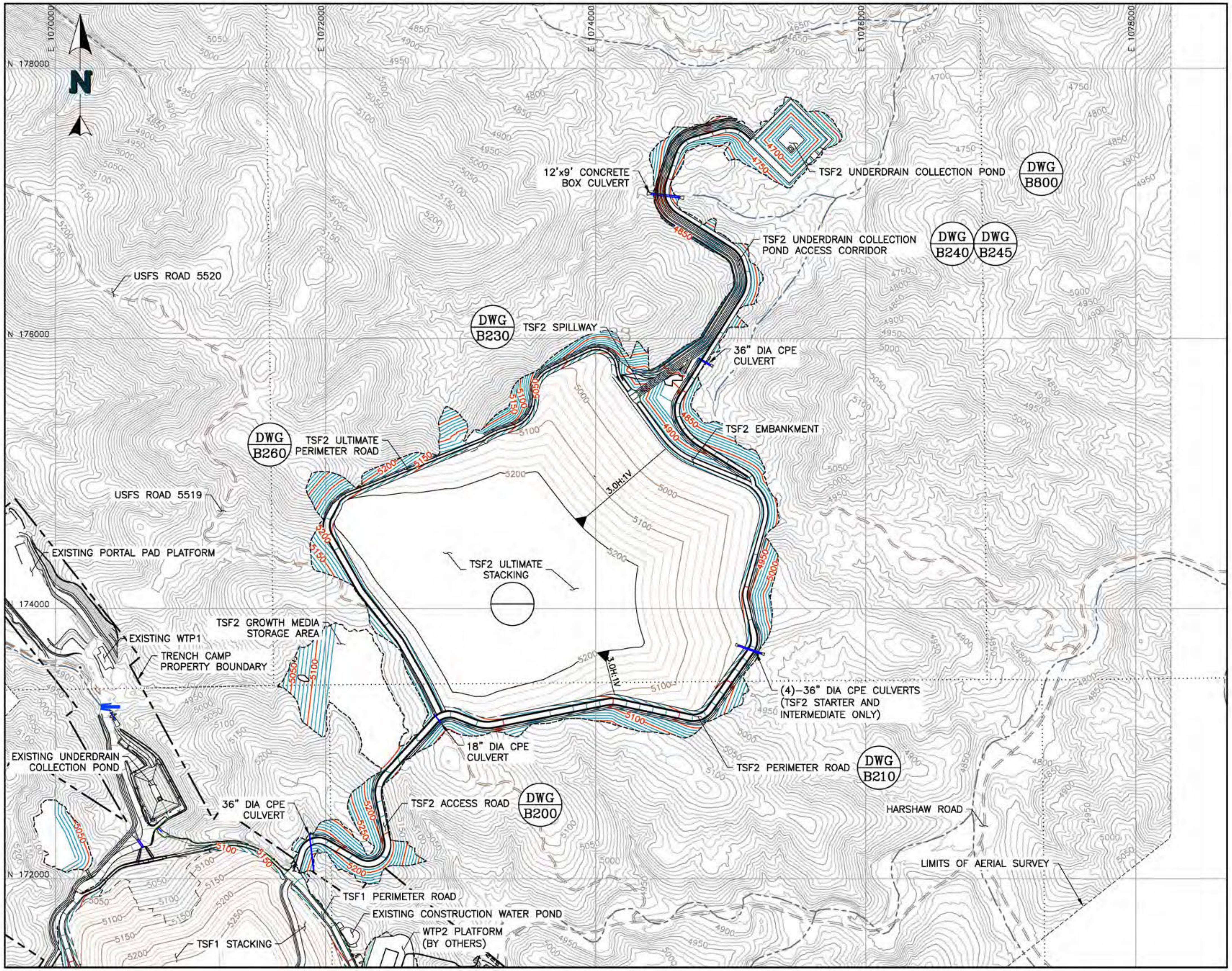
6. WASTE MANAGEMENT

Wastes will be evaluated to determine if they should be considered hazardous and require special handling, or if they are non-hazardous (solid waste). Hazardous waste will be handled as described previously in this section.

Solid wastes, garbage, and food wastes will be hauled to a local landfill for disposal. South32 Hermosa will prohibit burning of garbage or refuse on the Project. Wood and inert wastes such as concrete will be hauled to a local landfill for disposal, unless a facility is properly permitted on South32 Hermosa private land.

Appendix D

TSF2 Design Drawings



LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED GROUND CONTOURS (SEE NOTE 1)
- PROPOSED STACKING CONTOURS
- EXISTING ROADS/TRAILS
- EXISTING DRAINAGES
- PROJECT BOUNDARY
- SECTION LINES
- EXISTING FENCE
- CULVERT (PROPOSED OR EXISTING)

NOTE:

1. CONTOURS REPRESENT TOP OF LOW PERMEABILITY SOIL LINER LAYER WITHIN THE GEOMEMBRANE LINED AREA AND FINISHED GRADE EVERYWHERE ELSE.

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM APRIL 9-10, 2018 AERIAL SURVEY DATA PROVIDED BY SOUTH32. DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

REV	DATE	DESCRIPTION	TECH	ENG
0	7/10/23	ISSUED FOR FEASIBILITY	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: JEP
DRAWN BY: JEP

DISCLAIMER

NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.

NewFields

CLIENT: SOUTH32

PROJECT: HERMOSA FEASIBILITY STUDY

TITLE: TSF2 GENERAL ARRANGEMENT

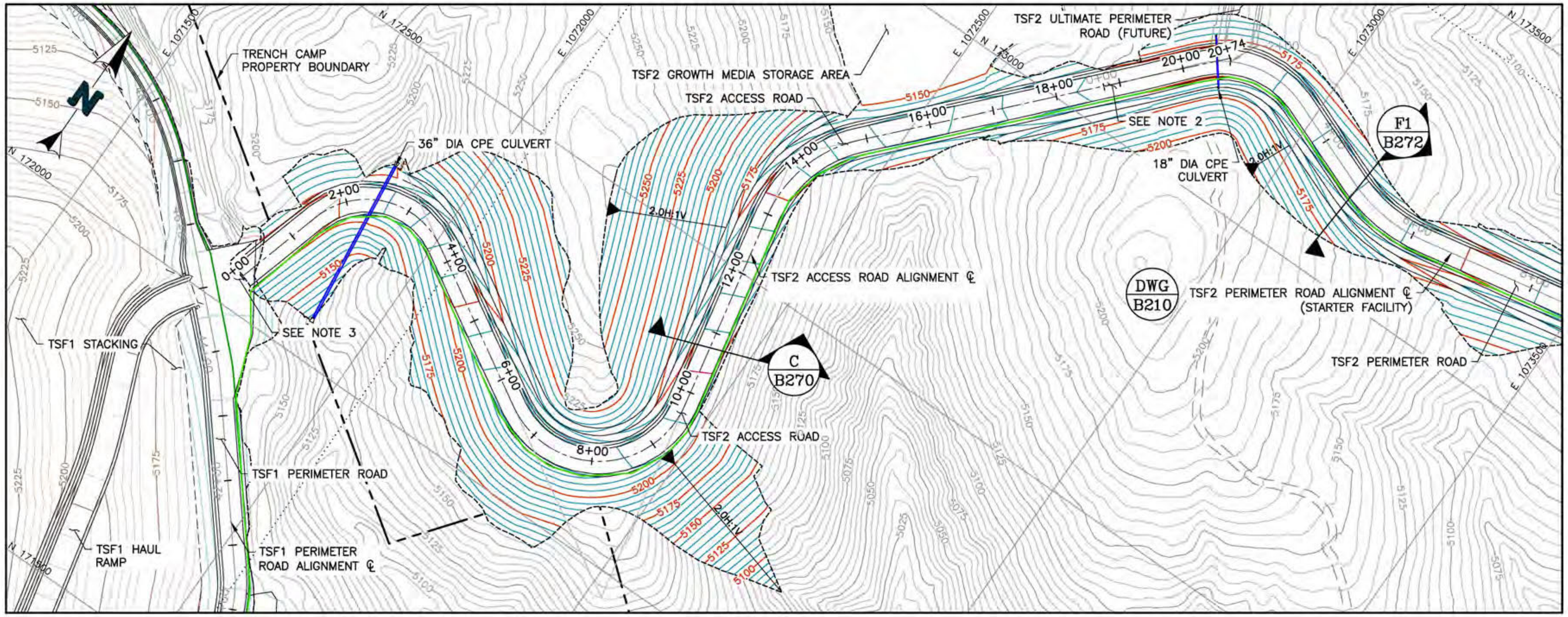
FILENAME: 14.033.102M

DRAWING NO.: B105

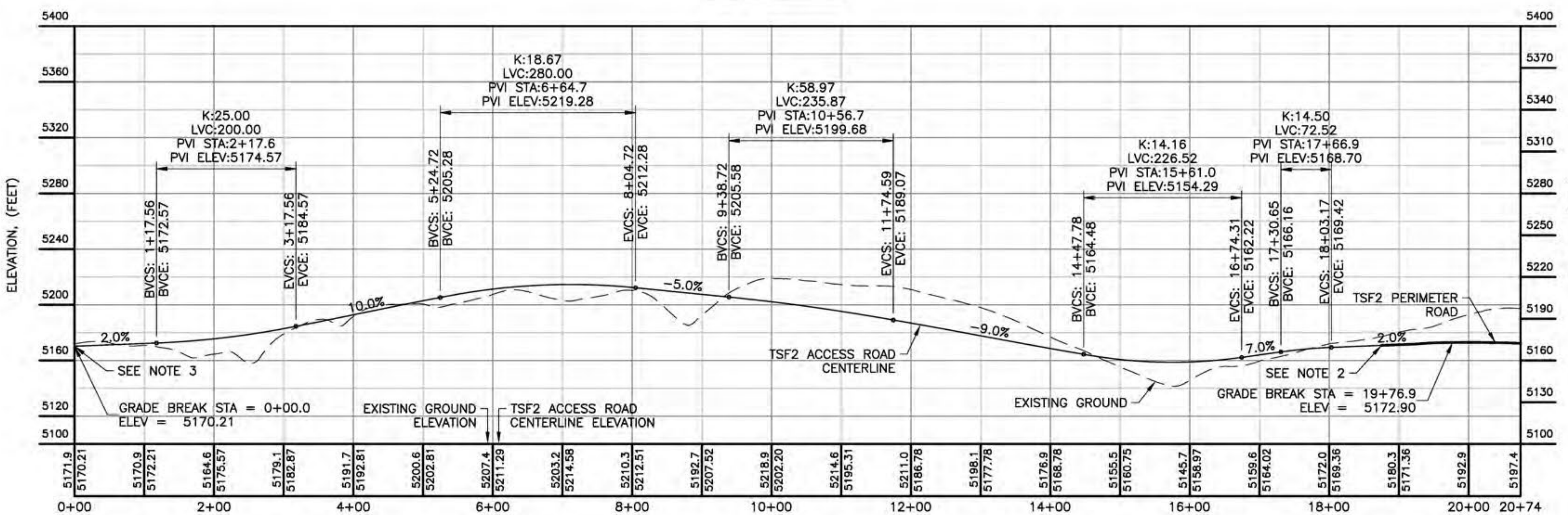
REVISION: 0

P:\Projects\0014.033 Hermosa Project Feasibility Study\A-CAD\DWGS\14.033.102M.dwg—9/20/2023 1:17 PM

Drawing modified 9/29/23 for submittal to Coronado National Forest



0 100 200 FEET



0 100 200 FEET HORIZONTAL
0 50 100 FEET VERTICAL
2X EXAGGERATION

LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED GROUND CONTOURS
- TSF1 GROUND CONTOURS
- TSF1 STACKING CONTOURS
- EXISTING ROADS/TRAILS
- PROPERTY BOUNDARY
- PROPOSED CULVERT
- UNDERDRAIN COLLECTION POND RECLAIM PIPE

NOTES:

2. APPROXIMATE TIE-IN LOCATION
   TSF2 PERIMETER ROAD STA 0+00
   TSF2 ACCESS ROAD STA 18+75
3. APPROXIMATE TIE-IN LOCATION
   TSF2 ACCESS ROAD STA 0+00
   TSF1 PERIMETER ROAD STA 45+00

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM APRIL 9-10, 2018 AERIAL SURVEY DATA PROVIDED BY SOUTH32. DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

REV	DATE	DESCRIPTION	TECH	ENG
0	7/10/23	ISSUED FOR FEASIBILITY	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: JEP
DRAWN BY: JEP

DISCLAIMER

NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.

NewFields

CLIENT: SOUTH32

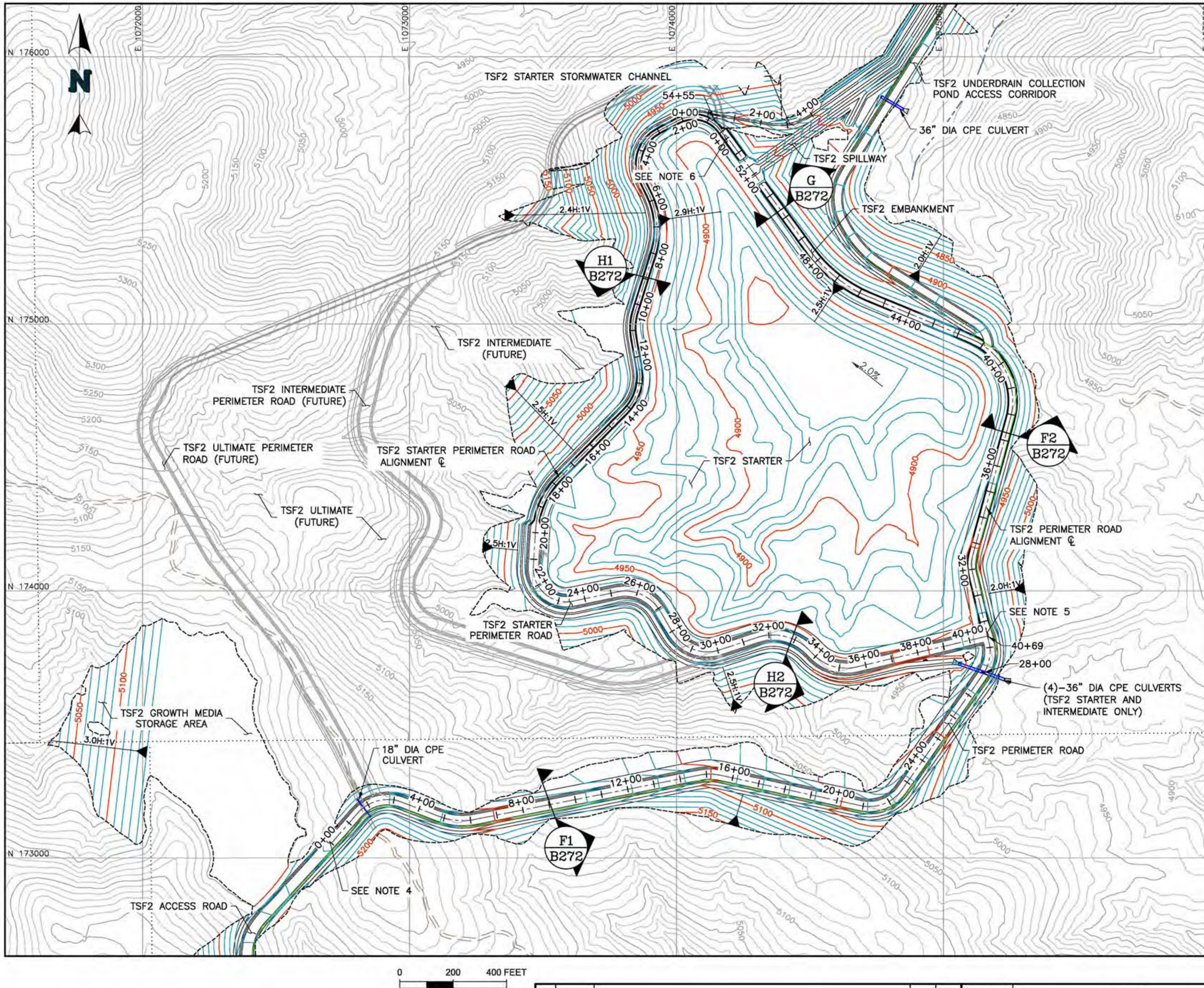
PROJECT: HERMOSA FEASIBILITY STUDY

TITLE: TSF2 ACCESS ROAD PLAN AND PROFILE

FILENAME: 14.033.104P
DRAWING NO.: B200
REVISION: 0

P:\Projects\0014.033 Hermosa Project Feasibility Study\A-CAD\DWGS\14.033.104P.dwg—9/20/2023 2:10 PM

Drawing modified 9/29/23 for submittal to Coronado National Forest



LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED GROUND CONTOURS (SEE NOTE 1)
- EXISTING DRAINAGES
- EXISTING ROADS/TRAILS
- SECTION LINES
- PROPOSED CULVERT
- UNDERDRAIN COLLECTION POND RECLAIM PIPE (SEE NOTE 7)

NOTES:

1. CONTOURS REPRESENT TOP OF LOW PERMEABILITY SOIL LINER LAYER WITHIN THE GEOMEMBRANE LINED AREA AND FINISHED GRADE EVERYWHERE ELSE.
4. APPROXIMATE TIE-IN LOCATION
   TSF2 PERIMETER ROAD STA 0+00
   TSF2 ACCESS ROAD STA 18+75
5. APPROXIMATE TIE-IN LOCATION
   TSF2 PERIMETER ROAD STA 29+45
   TSF2 STARTER PERIMETER ROAD STA 40+69
6. APPROXIMATE TIE-IN LOCATION
   TSF2 PERIMETER ROAD STA 53+65
   TSF2 STARTER PERIMETER ROAD STA 0+00
7. RECLAIM LINE RUNS FROM THE PROPOSED UNDERDRAIN COLLECTION POND TO WTP2.

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM APRIL 9-10, 2018 AERIAL SURVEY DATA PROVIDED BY SOUTH32. DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

REV	DATE	DESCRIPTION	TECH	ENG
0	7/10/23	ISSUED FOR FEASIBILITY	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: JEP
DRAWN BY: JEP

DISCLAIMER

NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.

NewFields

CLIENT: SOUTH32

PROJECT: HERMOSA FEASIBILITY STUDY

TITLE: TSF2 STARTER BASIN GRADING PLAN VIEW

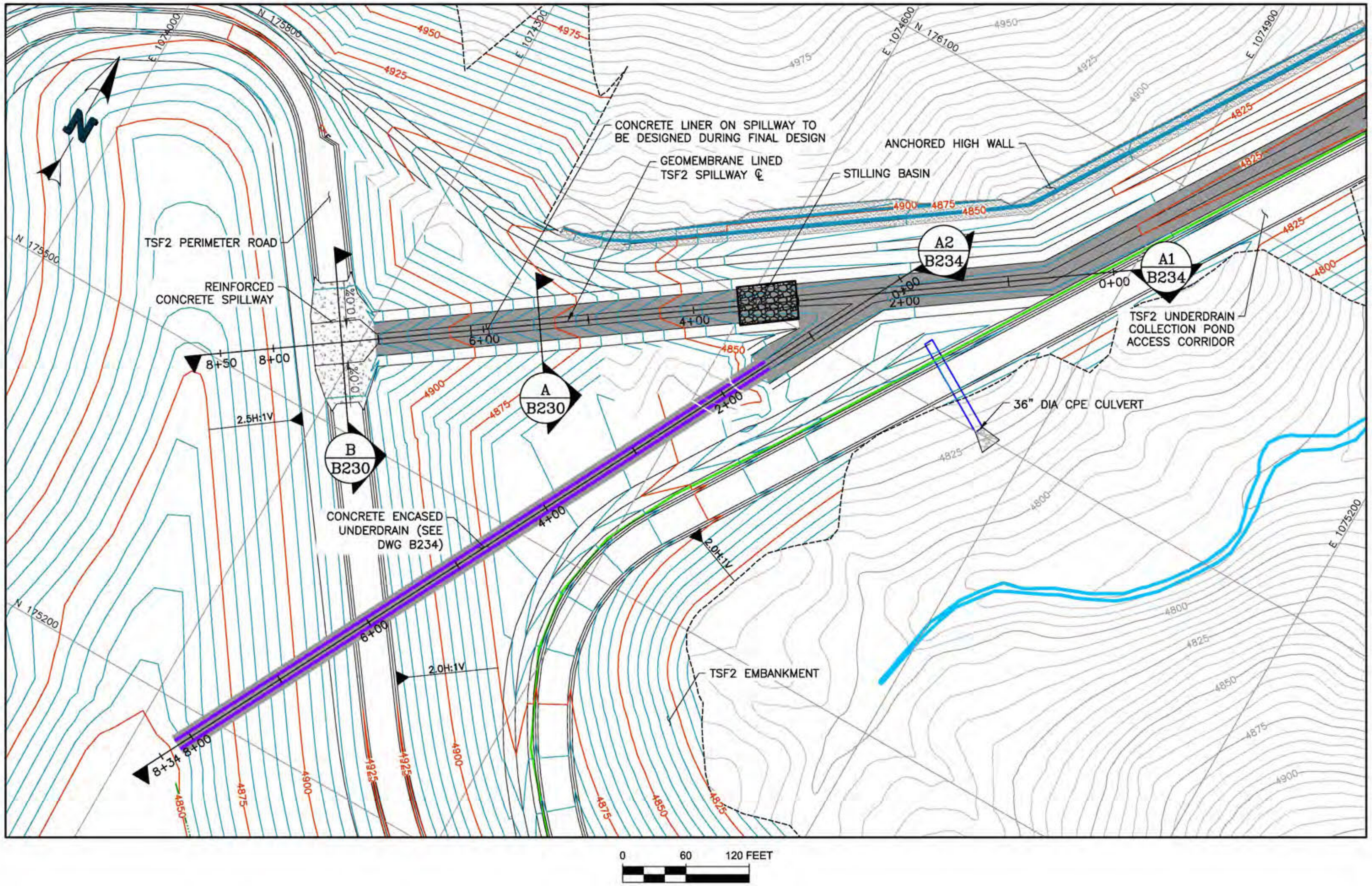
FILENAME: 14.033.105M

DRAWING NO.: B210

REVISION: 0

Drawing modified 9/29/23 for submittal to Coronado National Forest

P:\Projects\0014.033 Hermosa Project Feasibility Study\A-CAD\DWGS\14.033.105M.dwg-9/20/2023 2:07 PM

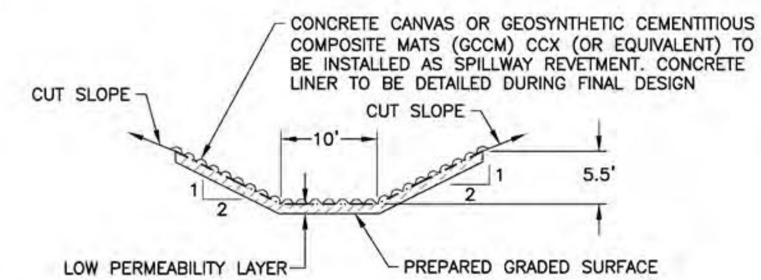


LEGEND:

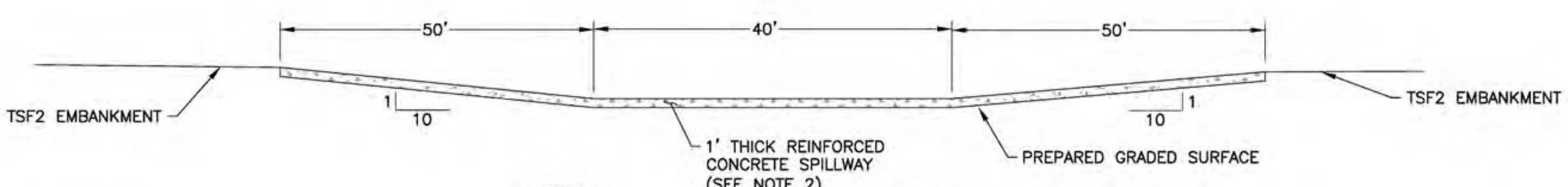
- EXISTING GROUND CONTOURS
- PROPOSED GROUND CONTOURS (SEE NOTE 1)
- EXISTING DRAINAGES (WATERS OF THE US)
- (2) – 36" DIA CONCRETE ENCASED HDPE DR11 UNDERDRAIN PIPES (SOLID)
- PROPOSED CULVERT
- REINFORCED CONCRETE
- GEOMEMBRANE
- ANCHORED HIGH WALL AREA

NOTES:

1. CONTOURS REPRESENT TOP OF LOW PERMEABILITY SOIL LINER LAYER WITHIN THE GEOMEMBRANE LINED AREA AND FINISHED GRADE EVERYWHERE ELSE.
2. CONCRETE TO BE REINFORCED WITH #4 REBAR @ 18" O.C. EW PLACED IN MIDDLE OF SLAB. CONTROL JOINT AT MAX 15' INTERVALS WITH JOINT SEALING COMPOUND. ALL EXPOSED EDGES SHALL HAVE 3/4" CHAMFER.



A B230 TYPICAL SPILLWAY SECTION



B B230 SPILLWAY SECTION AT ROAD CROSSING

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM APRIL 9-10, 2018 AERIAL SURVEY DATA PROVIDED BY SOUTH32. DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

REV	DATE	DESCRIPTION	TECH	ENG
0	7/10/23	ISSUED FOR FEASIBILITY	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: JEP
DRAWN BY: JEP

DISCLAIMER

NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.

NewFields

CLIENT: SOUTH32

PROJECT: HERMOSA FEASIBILITY STUDY

TITLE: TSF2 SPILLWAY PLAN VIEW

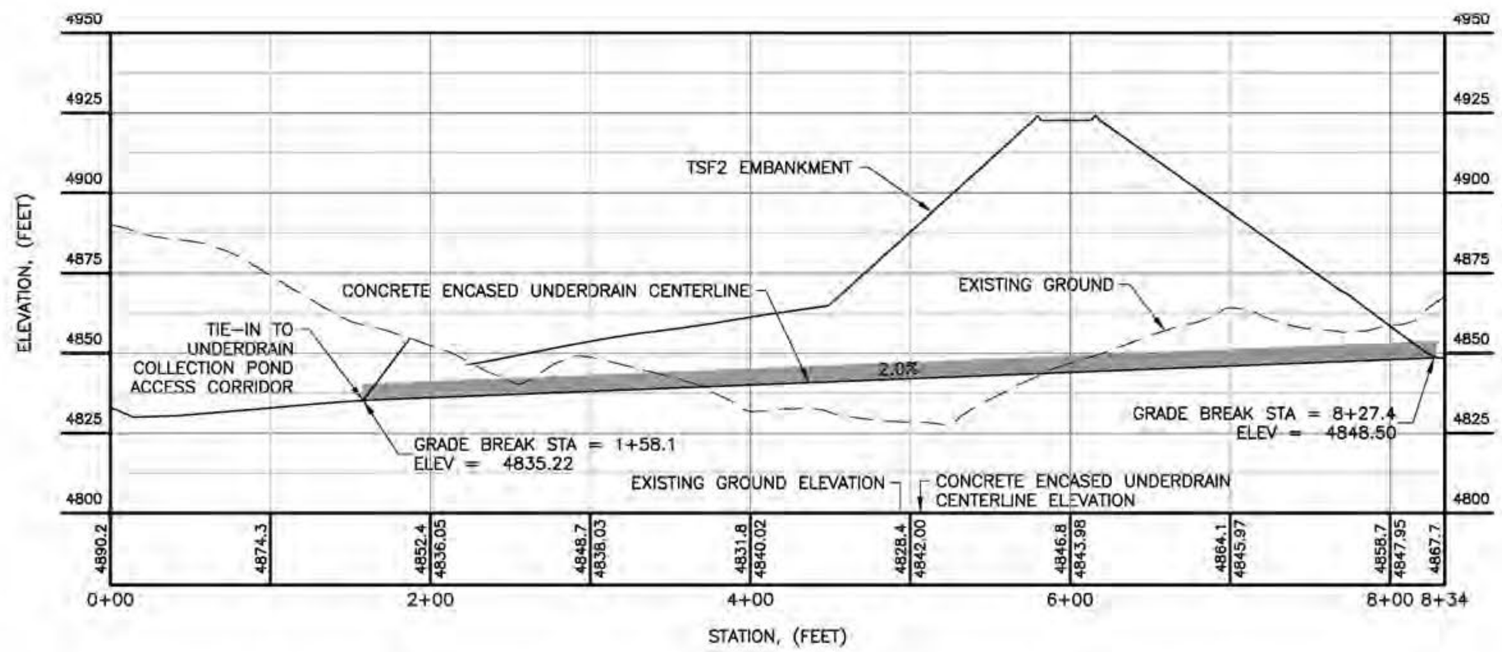
FILENAME: 14.033.109M

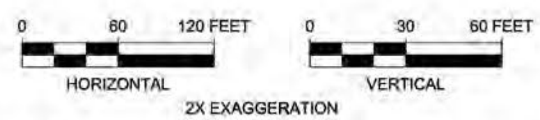
DRAWING NO.: B230

REVISION: 0

P:\Projects\0014.033 Hermosa Project Feasibility Study\A-CAD\DWGS\14.033.109M.dwg-4/5/2023 5:01 PM

Drawing modified 9/29/23 for submittal to Coronado National Forest





A2 / B230 CONCRETE UNDERDRAIN OUTLET SECTION

NOTE:

1. SEE DWG B230 FOR CONCRETE ENCASED UNDERDRAIN PLAN VIEW.

TSF2 SPILLWAY ALIGNMENT TABLE						
	STATION	NORTHING	EASTING	DELTA (D-M-S)	LENGTH (FT)	RADIUS (FT)
BP	0+00.00	175,889.18	1,074,713.89			
EP	8+34.14	175,147.08	1,074,333.02			

REV	DATE	DESCRIPTION	TECH	ENG
0	7/10/23	ISSUED FOR FEASIBILITY	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: JEP
DRAWN BY: JEP

DISCLAIMER

NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.

NewFields

CLIENT: SOUTH32

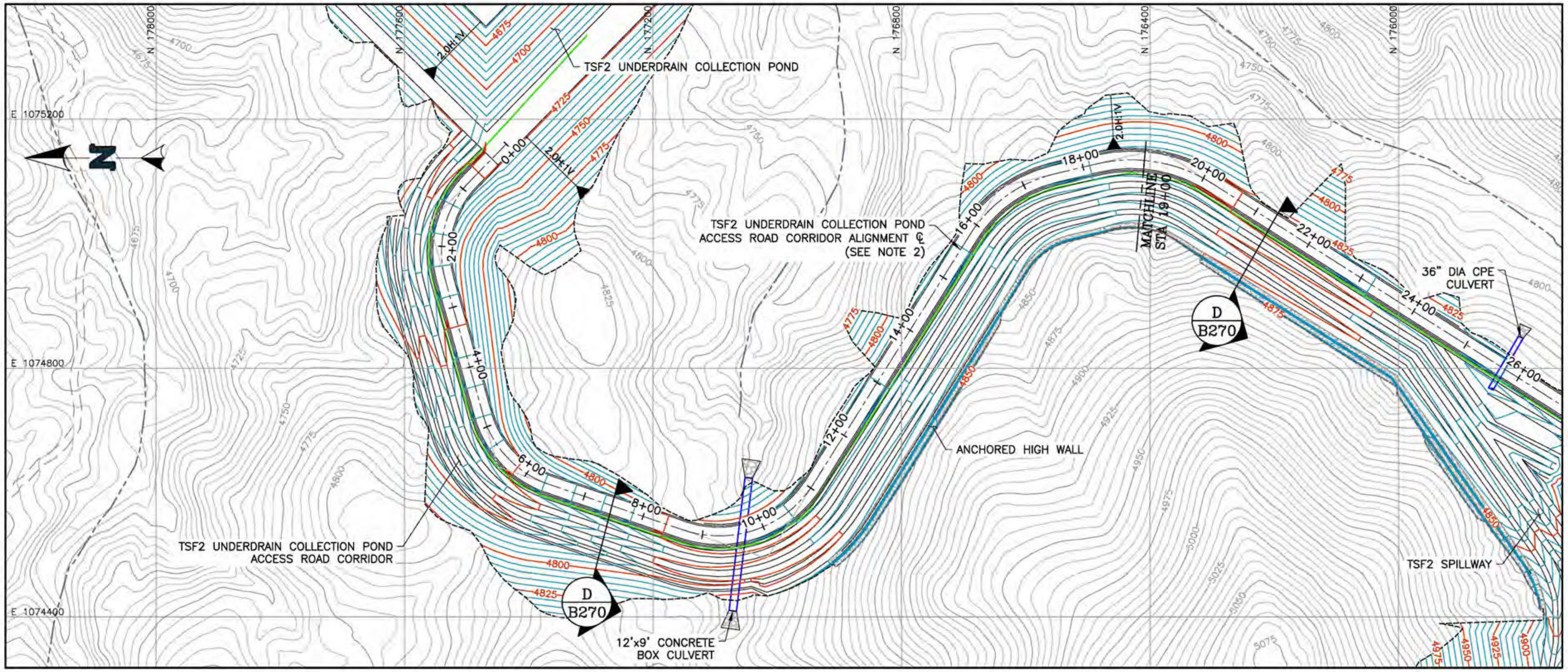
PROJECT: HERMOSA FEASIBILITY STUDY

TITLE: TSF2 CONCRETE ENCASED UNDERDRAIN PROFILE

FILENAME: 14.033.225P

DRAWING NO.: B234

REVISION: 0



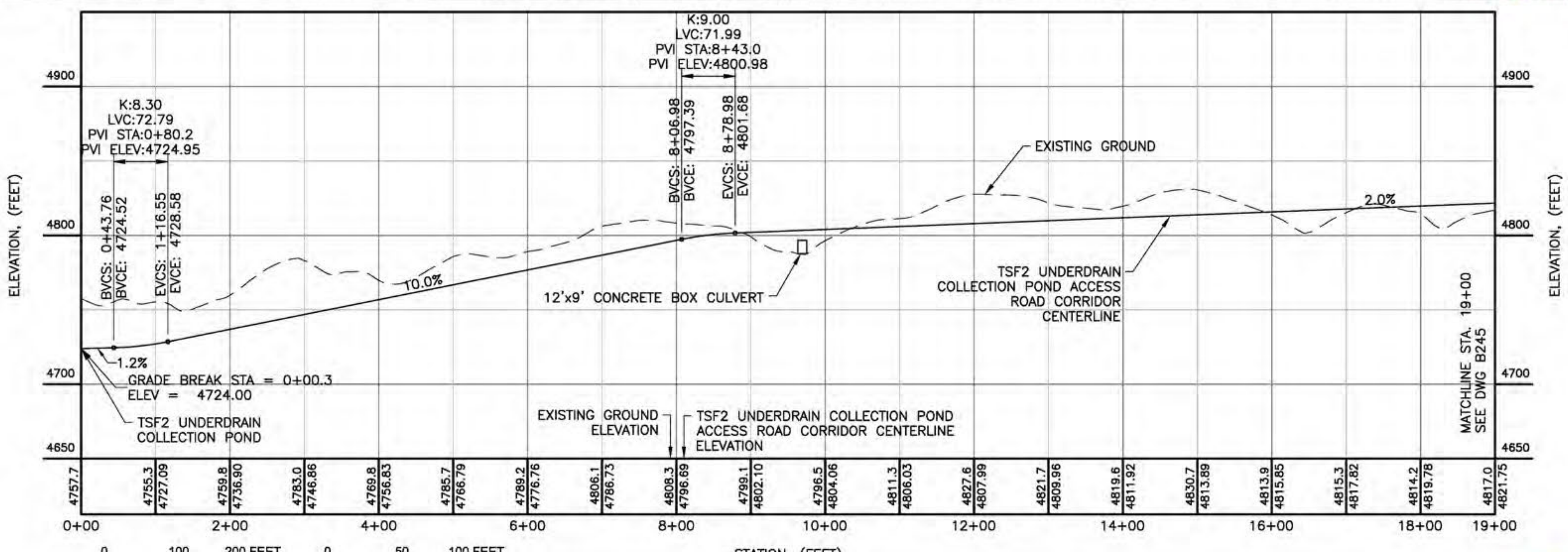
LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED GROUND CONTOURS (SEE NOTE 1)
- EXISTING DRAINAGES
- PROPOSED CULVERT
- UNDERDRAIN COLLECTION POND RECLAIM PIPE (SEE NOTE 3)
- ANCHORED HIGH WALL AREA

0 100 200 FEET

NOTES:

1. PROPOSED CONTOURS REPRESENT TOP OF LOW PERMEABILITY SOIL LAYER WITHIN THE GEOMEMBRANE LINED AREA AND FINISHED GRADE EVERYWHERE ELSE.
2. SEE DWG B245 FOR TSF2 UNDERDRAIN COLLECTION POND ACCESS ROAD CENTERLINE ALIGNMENT TABLE.
3. RECLAIM LINE RUNS FROM THE TSF2 UNDERDRAIN COLLECTION POND TO WTP2.



0 100 200 FEET
HORIZONTAL

0 50 100 FEET
VERTICAL

2X EXAGGERATION

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM APRIL 9-10, 2018 AERIAL SURVEY DATA PROVIDED BY SOUTH32. DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

Drawing modified 9/29/23 for submittal to Coronado National Forest

REV	DATE	DESCRIPTION	TECH	ENG
0	7/10/23	ISSUED FOR FEASIBILITY	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: JEP
DRAWN BY: JEP

DISCLAIMER

NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.

NewFields

CLIENT: SOUTH32

PROJECT: HERMOSA FEASIBILITY STUDY

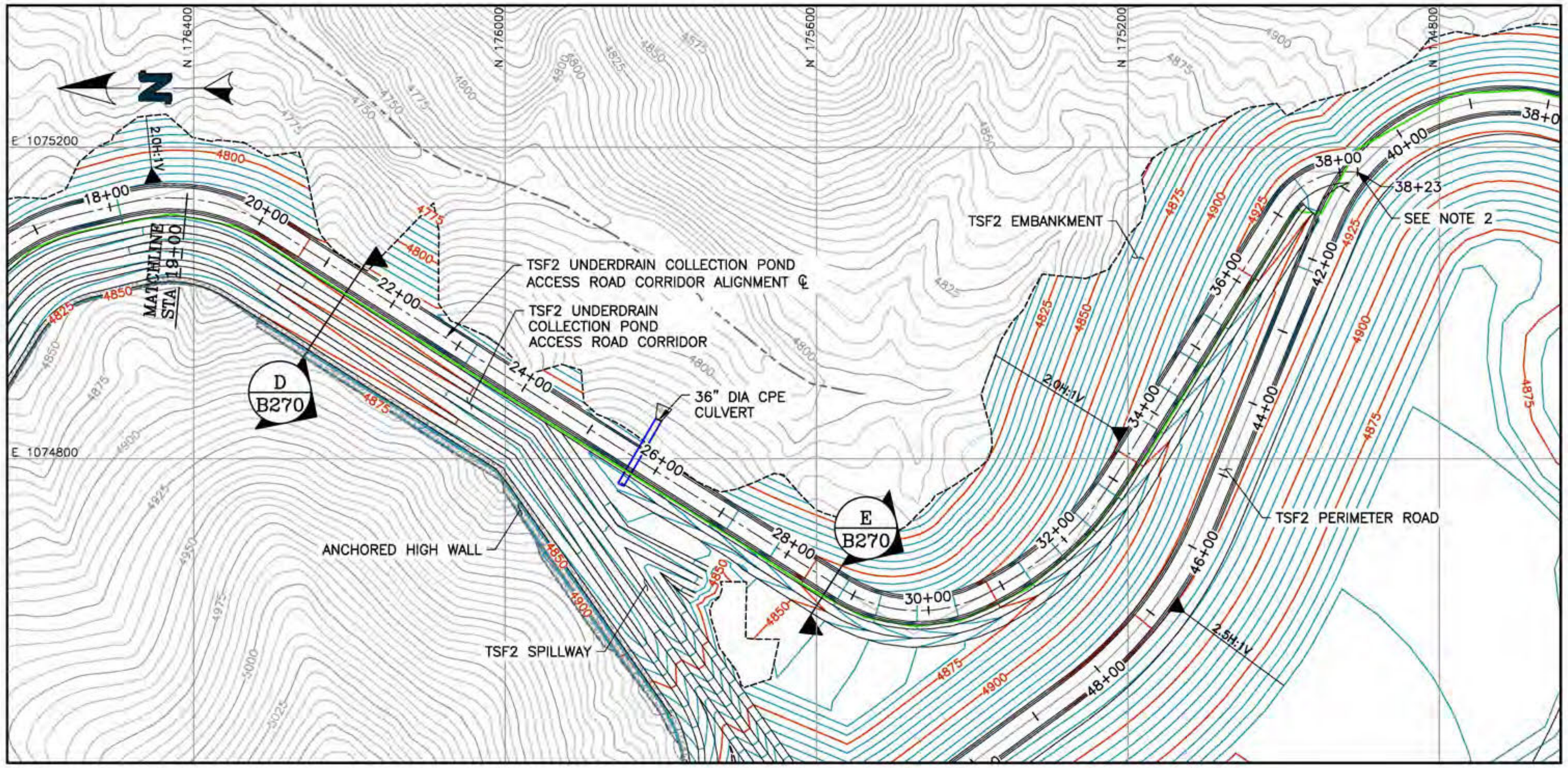
TITLE: TSF2 UDCP ACCESS ROAD CORRIDOR PLAN AND PROFILE (1 OF 2)

FILENAME: 14.033.110M

DRAWING NO.: B240

REVISION: 0

P:\Projects\0014.033 Hermosa Project Feasibility Study\A-CAD\DWGS\14.033.110M.dwg-12/14/2022 10:11 AM

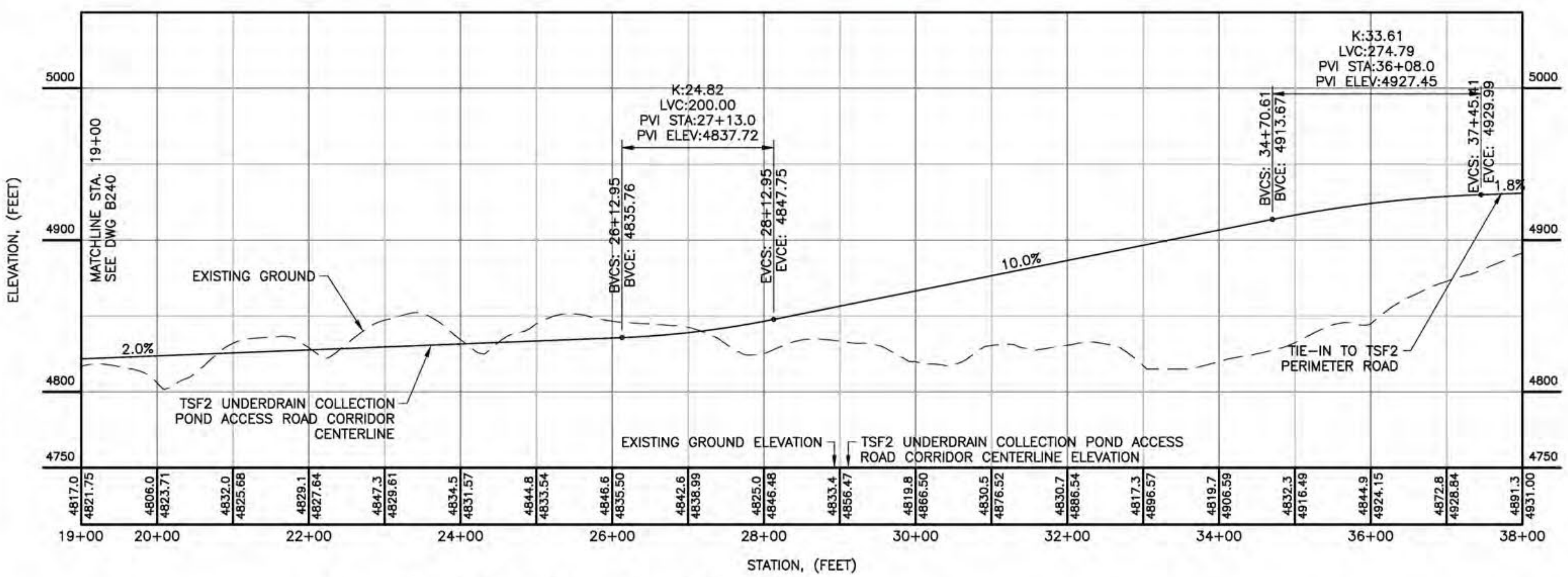


	TSF2 UNDERDRAIN COLLECTION POND ACCESS ROAD CORRIDOR ALIGNMENT TABLE					
	STATION	NORTHING	EASTING	DELTA (D-M-S)	LENGTH (FT)	RADIUS (FT)
BP	0+00.00	177,436.14	1,075,160.16			
PC	0+81.24	177,493.03	1,075,102.17	060-05-59	173.07	165.00
PT	2+54.31	177,534.12	1,074,942.11			
PC	4+79.62	177,473.34	1,074,725.15	055-35-10	160.08	165.00
PT	6+39.70	177,367.54	1,074,613.43			
PC	8+67.89	177,151.48	1,074,540.03	076-35-27	240.62	180.00
PT	11+08.50	176,941.22	1,074,614.61			
PC	15+82.02	176,689.08	1,075,015.41	044-26-07	170.41	219.73
PT	17+52.42	176,553.98	1,075,112.17			
PC	18+22.47	176,485.84	1,075,128.39	045-44-41	192.81	241.49
PT	20+15.28	176,300.68	1,075,097.46			
PC	28+81.90	175,568.59	1,074,633.70	061-12-14	198.39	185.72
PT	30+80.29	175,379.59	1,074,627.92			
PC	30+96.61	175,365.29	1,074,635.80	029-14-49	205.62	402.82
PT	33+02.23	175,217.69	1,074,775.74			
PC	37+08.53	175,002.97	1,075,120.66	058-27-46	103.35	101.29
PT	38+11.88	174,916.33	1,075,168.42			
EP	38+23.00	174,905.22	1,075,168.35			

0 100 200 FEET

LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED GROUND CONTOURS (SEE NOTE 1)
- EXISTING DRAINAGES
- PROPOSED CULVERT
- UNDERDRAIN COLLECTION POND RECLAIM PIPE (SEE NOTE 3)
- ANCHORED HIGH WALL AREA



NOTES:

1. PROPOSED CONTOURS REPRESENT TOP OF LOW PERMEABILITY SOIL LAYER WITHIN THE GEOMEMBRANE LINED AREA AND FINISHED GRADE EVERYWHERE ELSE.
2. APPROXIMATE TIE IN LOCATION
   - TSF2 UNDERDRAIN COLLECTION POND ACCESS ROAD AND PIPE CORRIDOR STA 37+73
   - TSF2 PERIMETER ROAD STA 40+73
3. RECLAIM LINE RUNS FROM THE TSF2 UNDERDRAIN COLLECTION POND TO WTP2.

0 100 200 FEET — HORIZONTAL

0 50 100 FEET — VERTICAL

2X EXAGGERATION

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM A COMBINATION OF MARCH, 2020 AERIAL SURVEY DATA AND APRIL 9-10, 2018 AERIAL SURVEY DATA PROVIDED BY SOUTH32. DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

Drawing modified 9/29/23 for submittal to Coronado National Forest

P:\Projects\0014.033 Hermosa Project Feasibility Study\A-CAD\DWGS\14.033.111M.dwg-9/20/2023 3:45 PM

REV	DATE	DESCRIPTION	TECH	ENG
0	7/10/23	ISSUED FOR FEASIBILITY	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: JEP
DRAWN BY: JEP

NewFields

CLIENT: SOUTH32

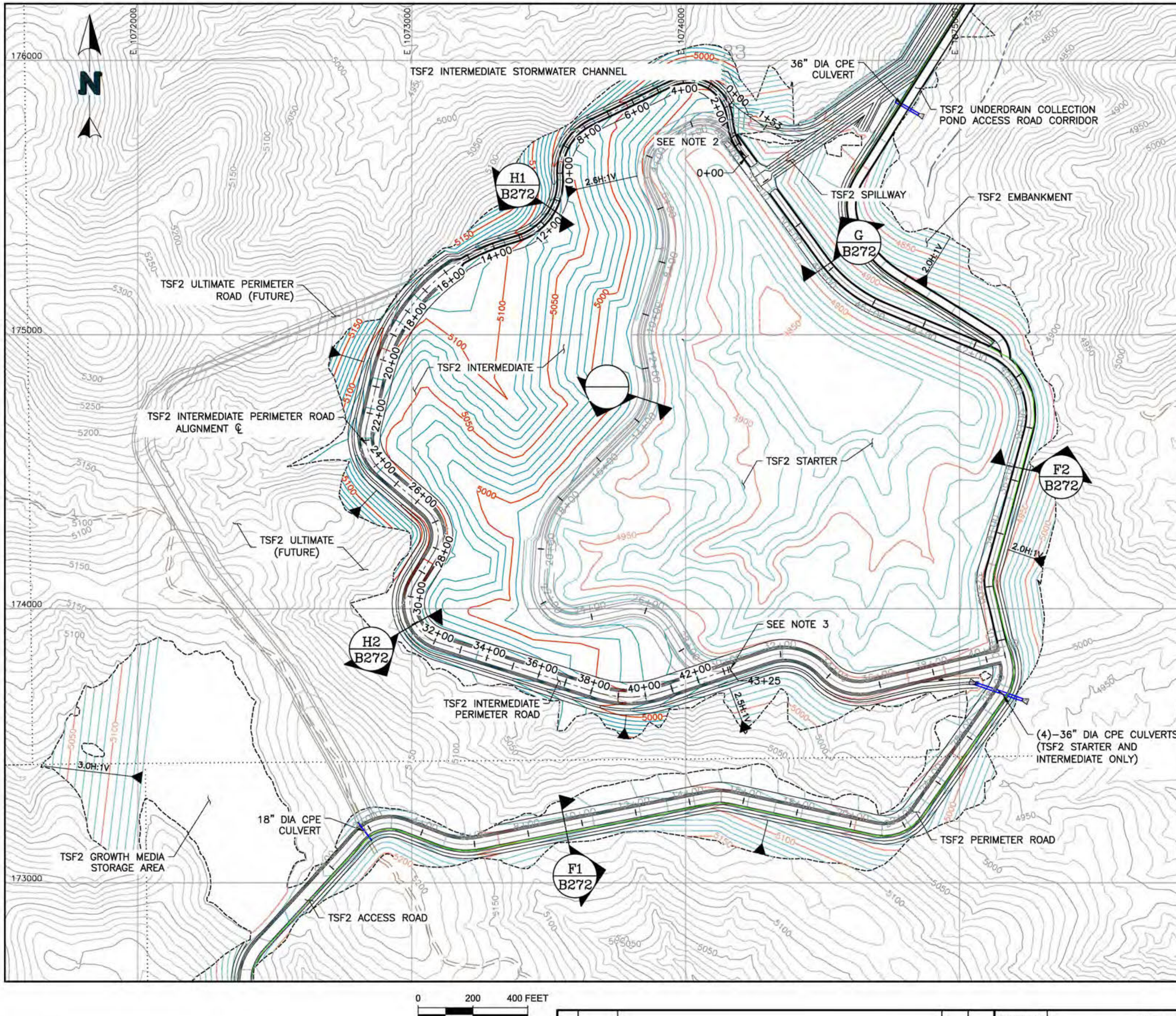
PROJECT: HERMOSA FEASIBILITY STUDY

TITLE: TSF2 UDCP ACCESS ROAD CORRIDOR PLAN AND PROFILE (2 OF 2)

FILENAME: 14.033.111M

DRAWING NO.: B245

REVISION: 0



LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED GROUND CONTOURS INTERMEDIATE (SEE NOTE 1)
- PROPOSED GROUND CONTOURS STARTER (SEE NOTE 1)
- EXISTING ROADS/TRAILS
- EXISTING DRAINAGES
- PROPOSED CULVERT
- SECTION LINES
- UNDERDRAIN COLLECTION POND RECLAIM PIPE

NOTES:

1. CONTOURS REPRESENT TOP OF LOW PERMEABILITY SOIL LINER LAYER WITHIN THE GEOMEMBRANE LINED AREA AND FINISHED GRADE EVERYWHERE ELSE.
2. APPROXIMATE TIE-IN LOCATION
   - TSF2 INTERMEDIATE PERIMETER ROAD STA 0+00
   - TSF2 PERIMETER ROAD STA 53+12
3. APPROXIMATE TIE-IN LOCATION
   - TSF2 INTERMEDIATE PERIMETER ROAD STA 43+25
   - TSF2 STARTER PERIMETER ROAD STA 30+07

TSF2 INTERMEDIATE PERIMETER ROAD ALIGNMENT TABLE

	STATION	NORTHING	EASTING	DELTA (D-M-S)	LENGTH (FT)	RADIUS (FT)
BP	0+00.00	175,648.12	1,074,220.77			
PC	0+35.17	175,676.49	1,074,199.99	029-45-37	103.88	200.00
PT	1+39.05	175,772.17	1,074,162.63			
PC	1+59.37	175,792.36	1,074,160.34	109-13-55	290.80	152.53
PT	4+50.17	175,912.68	1,073,942.66			
PC	7+70.44	175,773.86	1,073,654.04	067-21-36	235.13	200.00
PT	10+05.57	175,583.00	1,073,541.00			
PC	10+15.97	175,572.61	1,073,541.56	076-15-33	292.81	220.00
PT	13+08.79	175,350.30	1,073,385.40			
PC	13+63.19	175,334.59	1,073,333.32	059-57-40	694.43	663.57
PT	20+57.62	174,851.42	1,072,879.06			
PC	22+44.52	174,669.50	1,072,836.22	062-30-46	185.48	170.00
PT	24+29.99	174,501.72	1,072,890.75			
PC	26+44.44	174,361.77	1,073,053.23	080-26-28	175.50	125.00
PT	28+19.94	174,202.34	1,073,078.59			
PC	29+43.86	174,096.32	1,073,014.43	103-45-46	271.65	150.00
PT	32+15.51	173,875.54	1,073,097.86			
PC	38+14.22	173,696.31	1,073,669.12	035-43-41	254.39	407.95
PT	40+68.61	173,698.26	1,073,919.40			
EP	43+24.80	173,778.74	1,074,162.62			

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM APRIL 9-10, 2018 AERIAL SURVEY DATA PROVIDED BY SOUTH32. DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

REV	DATE	DESCRIPTION	TECH	ENG
0	7/10/23	ISSUED FOR FEASIBILITY	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: JEP
DRAWN BY: JEP

DISCLAIMER

NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.

NewFields

CLIENT: SOUTH32

PROJECT: HERMOSA FEASIBILITY STUDY

TITLE: TSF2 INTERMEDIATE BASIN GRADING PLAN VIEW

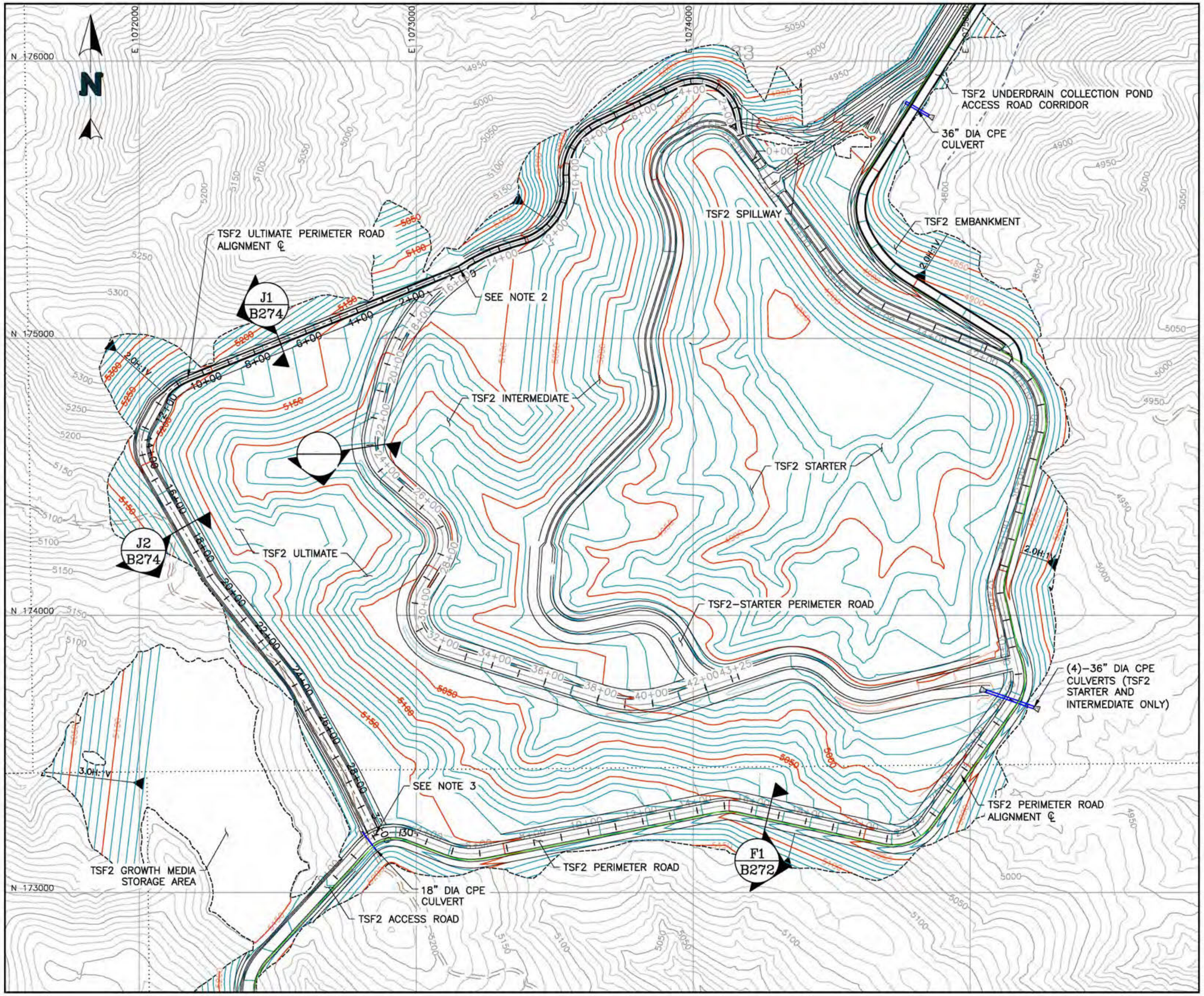
FILENAME: 14.033.112M

DRAWING NO.: B250

REVISION: 0

P:\Projects\0014.033 Hermosa Project Feasibility Study\A-CAD\DWGS\14.033.112M.dwg-9/20/2023 3:49 PM

Drawing modified 9/29/23 for submittal to Coronado National Forest



0 200 400 FEET

LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED GROUND CONTOURS ULTIMATE (SEE NOTE 1)
- PROPOSED GROUND CONTOURS STARTER AND INTERMEDIATE (SEE NOTE 1)
- EXISTING ROADS/TRAILS
- EXISTING DRAINAGES
- PROPOSED CULVERT
- SECTION LINES
- UNDERDRAIN COLLECTION POND RECLAIM PIPE

NOTES:

1. CONTOURS REPRESENT TOP OF LOW PERMEABILITY SOIL LINER LAYER WITHIN THE GEOMEMBRANE LINED AREA AND FINISHED GRADE EVERYWHERE ELSE.
2. APPROXIMATE TIE-IN LOCATION
   - TSF2 ULTIMATE PERIMETER ROAD STA 0+00
   - TSF2 INTERMEDIATE PERIMETER ROAD STA 15+60
3. APPROXIMATE TIE-IN LOCATION
   - TSF2 ULTIMATE PERIMETER ROAD STA 30+14
   - TSF2 PERIMETER ROAD STA 2+08

TSF2 ULTIMATE PERIMETER ROAD ALIGNMENT TABLE

	STATION	NORTHING	EASTING	DELTA (D-M-S)	LENGTH (FT)	RADIUS (FT)
BP	0+00.00	175,251.12	1,073,156.43			
PC	10+56.75	174,855.53	1,072,176.52	039-36-36	155.55	225.00
PT	12+12.29	174,753.92	1,072,062.84			
PC	12+90.87	174,684.81	1,072,025.46	058-10-58	152.32	150.00
PT	14+43.19	174,538.96	1,072,027.21			
PC	19+03.43	174,139.49	1,072,255.77	008-32-48	22.38	150.00
PT	19+25.80	174,120.97	1,072,268.28			
PC	23+71.03	173,771.68	1,072,544.37	008-39-44	22.68	150.00
PT	23+93.70	173,752.89	1,072,557.03			
PC	27+68.66	173,427.07	1,072,742.59	003-40-02	12.80	200.00
PT	27+81.46	173,415.75	1,072,748.56			
EP	30+14.16	173,206.59	1,072,850.55			

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM APRIL 9-10, 2018 AERIAL SURVEY DATA PROVIDED BY SOUTH32. DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

REV	DATE	DESCRIPTION	TECH	ENG
0	7/10/23	ISSUED FOR FEASIBILITY	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: JEP
DRAWN BY: JEP

DISCLAIMER

NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.

NewFields

CLIENT: SOUTH32

PROJECT: HERMOSA FEASIBILITY STUDY

TITLE: TSF2 ULTIMATE BASIN GRADING PLAN VIEW

FILENAME: 14.033.114M

DRAWING NO.: B260

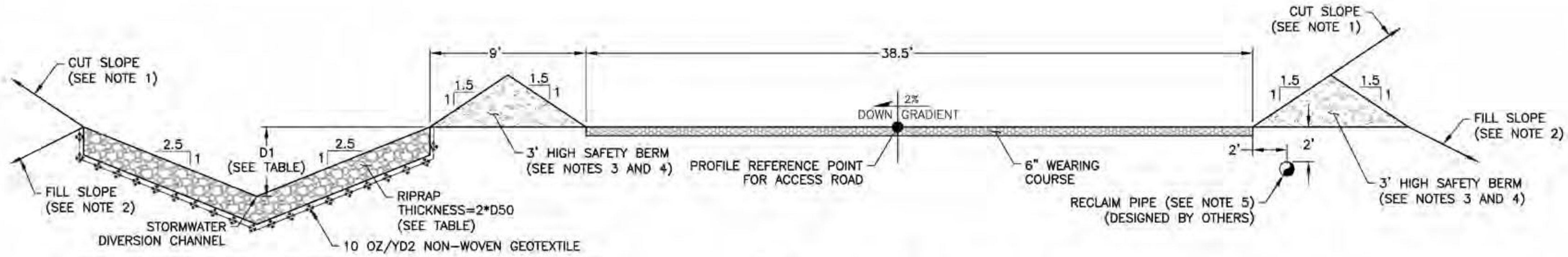
REVISION: 0

P:\Projects\0014.033 Hermosa Project Feasibility Study\A-CAD\DWGS\14.033.114M.dwg-4/18/2023 9:24 AM

Drawing modified 9/29/23 for submittal to Coronado National Forest

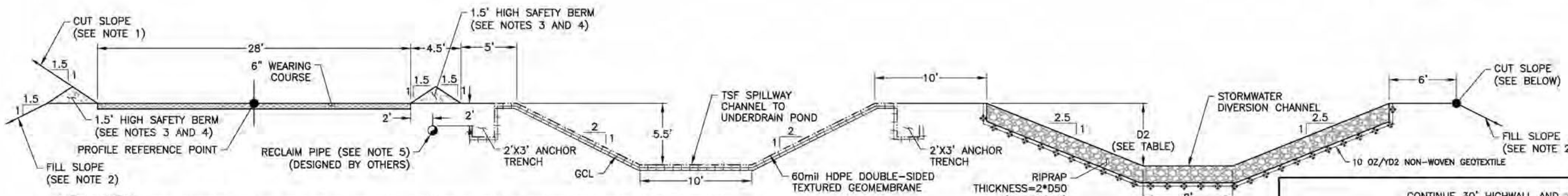
NOTES:

1. CUT SLOPES MAY VARY SUBJECT TO ENGINEERS APPROVAL BASED UPON ACTUAL FIELD CONDITIONS. COMPOUND SLOPES CONSISTING OF A 1.5(H):1(V) CUT SLOPE FOR 30 VERTICAL FEET TO A 15' BENCH SHALL BE USED IN CASES OF EXTENDED CUT SLOPES TO CREATE A 2(H):1(V) COMPOUND SLOPE.
2. COMPOUND FILL SLOPES CONSISTING OF A 2(H):1(V) OPEN SLOPE FOR 30 VERTICAL FEET TO A 15' BENCH SHALL BE USED IN CASES OF EXTENDED FILL SLOPES TO CREATE A 2.5(H):1(V) COMPOUND SLOPE. FILL SLOPES SHALL ALSO BE KEYED INTO THE EXISTING SLOPE.
3. SAFETY BERMS ARE REQUIRED IN ALL FILL SLOPE CONDITIONS AND ONLY IN CUT SLOPE CONDITIONS WHERE A DIVERSION CHANNEL IS PRESENT.
4. BREAKS IN SAFETY BERMS WILL BE PROVIDED EVERY 300' FOR STORMWATER RUNOFF TO ENTER STORWMWATER DIVERSION CHANNEL FROM ACCESS ROAD.
5. RECLAIM PIPE UTILIZED TO PUMP WATER FOR THE TSF2 UNDERDRAIN COLLECTION POND TO WTP2. PIPE IN PIPE CONTAINMENT IS REQUIRED.



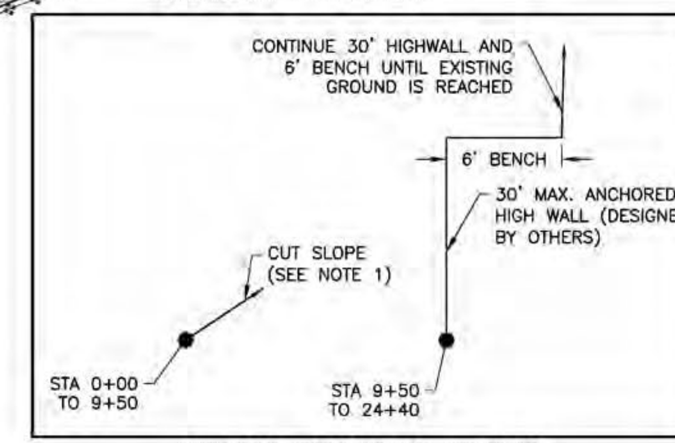
TSF2 ACCESS ROAD (HAUL ROAD) DIVERSION CHANNEL DIMENSIONS		
STATION	DEPTH (D1)	RIPRAP D50 (INCHES)
2+70 TO 14+65	5'	12

C / B200 TSF2 ACCESS ROAD TYPICAL SECTION (HAUL ROAD)

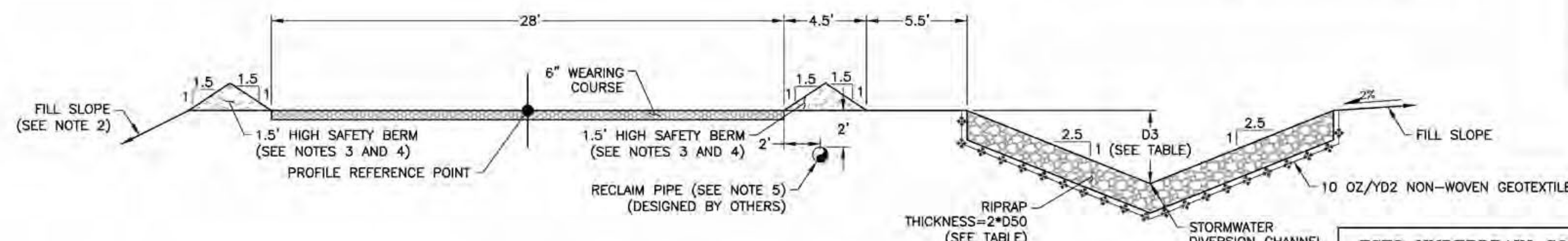


D / B240, D / B245 TSF2 UNDERDRAIN COLLECTION POND ACCESS ROAD CORRIDOR TYPICAL SECTION

TSF2 UNDERDRAIN COLLECTION POND ACCESS ROAD CORRIDOR DIVERSION CHANNEL DIMENSIONS		
STATION	DEPTH (D2)	RIPRAP D50 (INCHES)
1+75 TO 9+50	4'	12
9+50 TO 24+50	6'	15



TYPICAL HIGH WALL SECTION



TSF2 UNDERDRAIN COLLECTION POND ACCESS ROAD CORRIDOR DIVERSION CHANNEL DIMENSIONS		
STATION	DEPTH (D3)	RIPRAP D50 (INCHES)
24+50 TO 38+00	5'	12

E / B245 TSF2 UNDERDRAIN COLLECTION POND ACCESS ROAD CORRIDOR TYPICAL SECTION–EMBANKMENT

REV	DATE	DESCRIPTION	TECH	ENG
0	7/10/23	ISSUED FOR FEASIBILITY	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: JEP
DRAWN BY: JEP

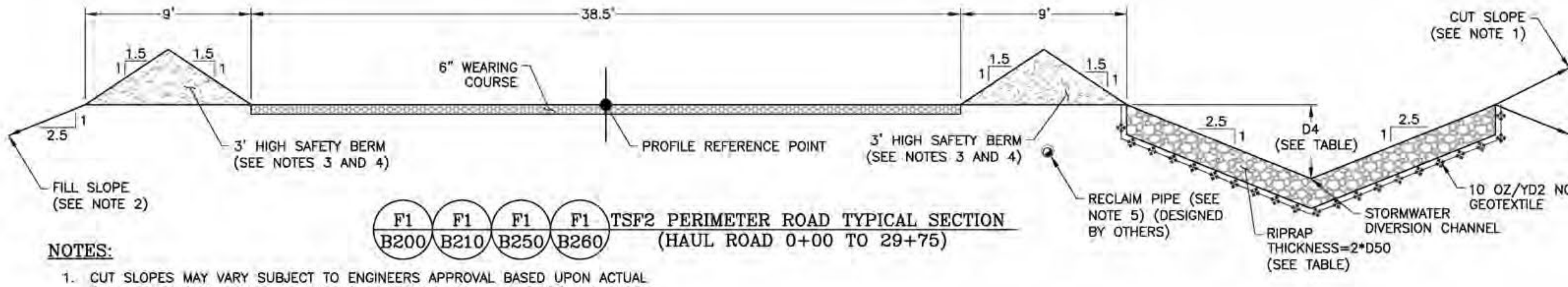
DISCLAIMER
NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.

NewFields

CLIENT: SOUTH32
PROJECT: HERMOSA FEASIBILITY STUDY
TITLE: TSF2 ROAD SECTIONS AND DETAILS (1 OF 3)
FILENAME: 14.033.1160
DRAWING NO.: B270
REVISION: 0

Drawing modified 9/29/23 for submittal to Coronado National Forest

P:\Projects\U014.033_Hermosa_Project_Feasibility_Study\A-CAD\DWGS\14.033.1160.dwg-2/7/2023 11:31 AM

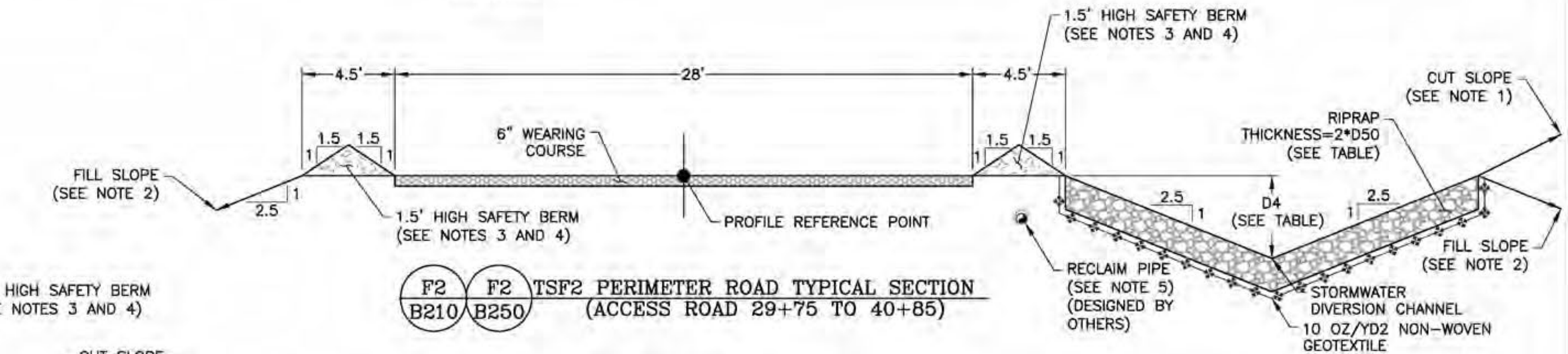


F1/B200, F1/B210, F1/B250, F1/B260 TSF2 PERIMETER ROAD TYPICAL SECTION (HAUL ROAD 0+00 TO 29+75)

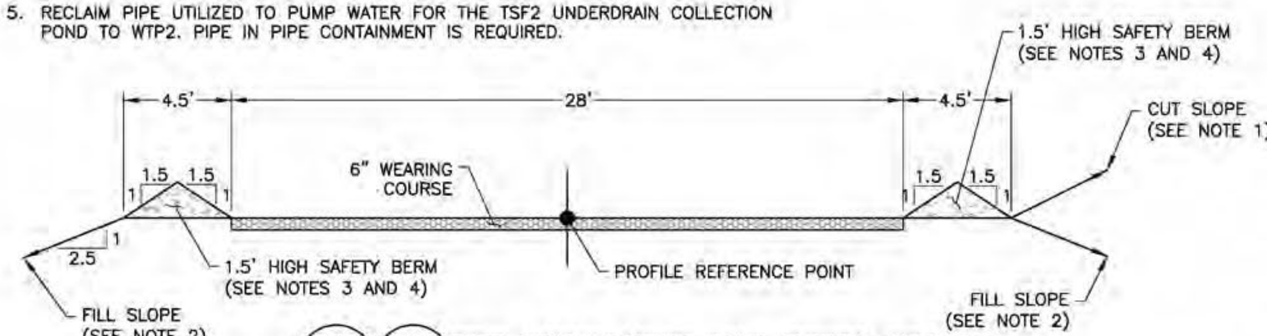
TSF2 PERIMETER ROAD DIVERSION CHANNEL DIMENSIONS		
STATION	DEPTH (D4)	RIPRAP D50 (INCHES)
0+00 TO 29+75	5'	12
29+75 TO 40+85	5'	12

NOTES:

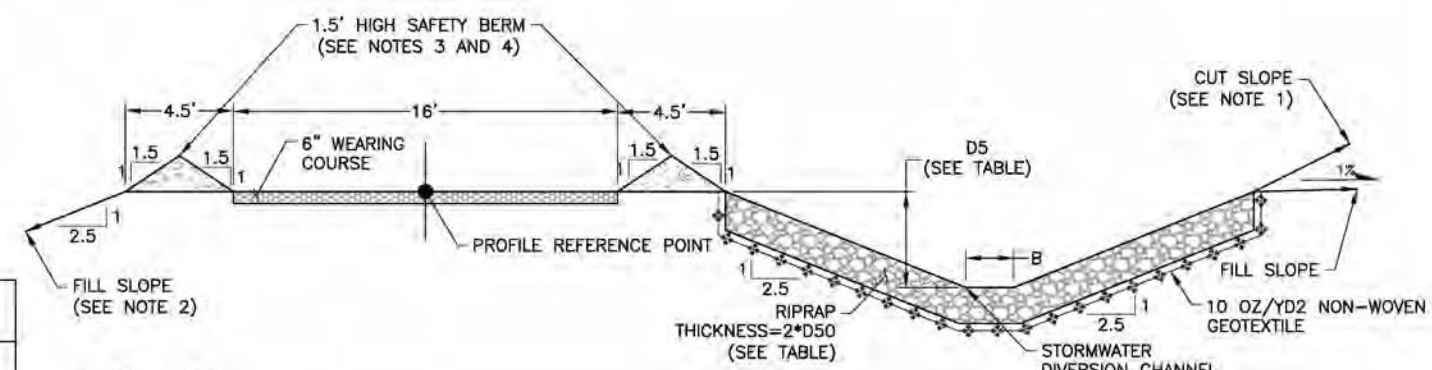
1. CUT SLOPES MAY VARY SUBJECT TO ENGINEERS APPROVAL BASED UPON ACTUAL FIELD CONDITIONS. COMPOUND SLOPES CONSISTING OF A 1.5(H):1(V) CUT SLOPE FOR 30 VERTICAL FEET TO A 15' BENCH SHALL BE USED IN CASES OF EXTENDED CUT SLOPES TO CREATE A 2(H):1(V) COMPOUND SLOPE.
2. COMPOUND FILL SLOPES CONSISTING OF A 2(H):1(V) OPEN SLOPE FOR 30 VERTICAL FEET TO A 15' BENCH SHALL BE USED IN CASES OF EXTENDED FILL SLOPES TO CREATE A 2.5(H):1(V) COMPOUND SLOPE. FILL SLOPES SHALL ALSO BE KEYED INTO THE EXISTING SLOPE.
3. SAFETY BERMS ARE REQUIRED IN ALL FILL SLOPE CONDITIONS AND ONLY IN CUT SLOPE CONDITIONS WHERE A DIVERSION CHANNEL IS PRESENT.
4. BREAKS IN SAFETY BERMS WILL BE PROVIDED EVERY 300' FOR STORMWATER RUNOFF TO ENTER STORMWATER DIVERSION CHANNEL FROM ROAD.
5. RECLAIM PIPE UTILIZED TO PUMP WATER FOR THE TSF2 UNDERDRAIN COLLECTION POND TO WTP2. PIPE IN PIPE CONTAINMENT IS REQUIRED.



F2/B210, F2/B250 TSF2 PERIMETER ROAD TYPICAL SECTION (ACCESS ROAD 29+75 TO 40+85)

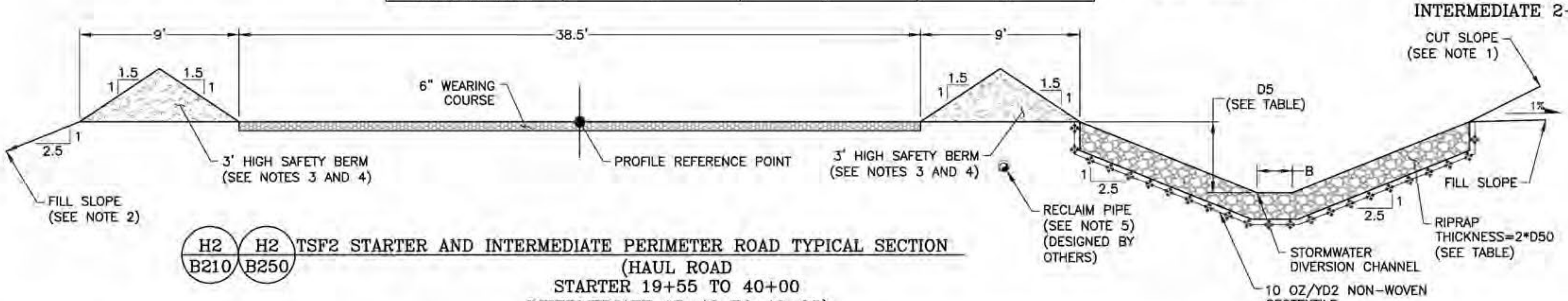


G/B210, G/B250 TSF2 EMBANKMENT ROAD TYPICAL SECTION
STA 40+85 TO 54+09



TSF2 STARTER PERIMETER ROAD DIVERSION CHANNEL DIMENSIONS			
STATION	DEPTH (D5)	BASE WIDTH (B)	RIPRAP D50 (INCHES)
1+00 TO 19+55	6'	5'	15
19+55 TO 29+58	6'	6'	15
29+58 TO 40+00	6'	8'	15

H1/B210, H1/B250 TSF2 STARTER AND INTERMEDIATE PERIMETER ROAD TYPICAL SECTION (LIGHT VEHICLE ACCESS ROAD
STARTER 1+00 TO 19+55
INTERMEDIATE 2+00 TO 15+42)



H2/B210, H2/B250 TSF2 STARTER AND INTERMEDIATE PERIMETER ROAD TYPICAL SECTION (HAUL ROAD
STARTER 19+55 TO 40+00
INTERMEDIATE 15+42 TO 43+25)

TSF2 INTERMEDIATE PERIMETER ROAD DIVERSION CHANNEL DIMENSIONS			
STATION	DEPTH (D5)	BASE WIDTH (B)	RIPRAP D50 (INCHES)
2+00 TO 15+42	3'	5'	12
15+42 TO 43+25	6'	8'	15

REV	DATE	DESCRIPTION	TECH	ENG
0	7/10/23	ISSUED FOR FEASIBILITY	JEP	CMT

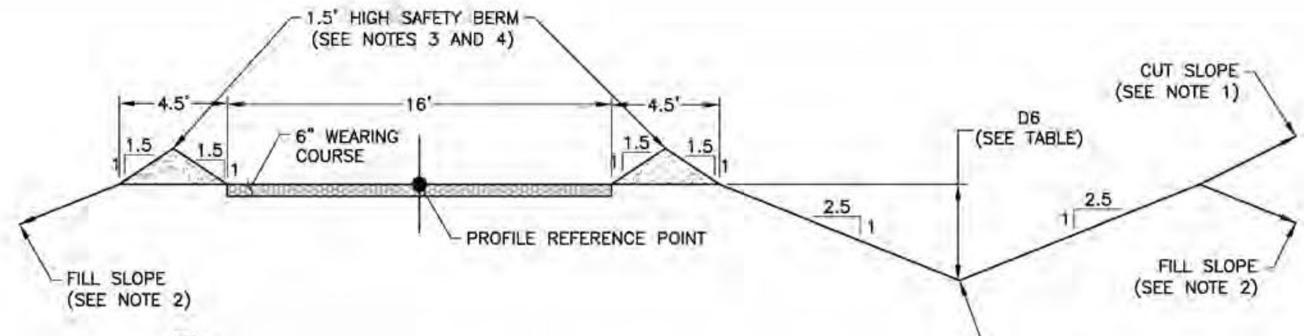
APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: JEP
DRAWN BY: JEP

DISCLAIMER
NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.

NewFields
CLIENT: SOUTH32
PROJECT: HERMOSA FEASIBILITY STUDY
TITLE: TSF2 ROAD SECTIONS AND DETAILS (2 OF 3)
FILENAME: 14.033.117D
DRAWING NO.: B272
REVISION: 0

Drawing modified 9/29/23 for submittal to Coronado National Forest

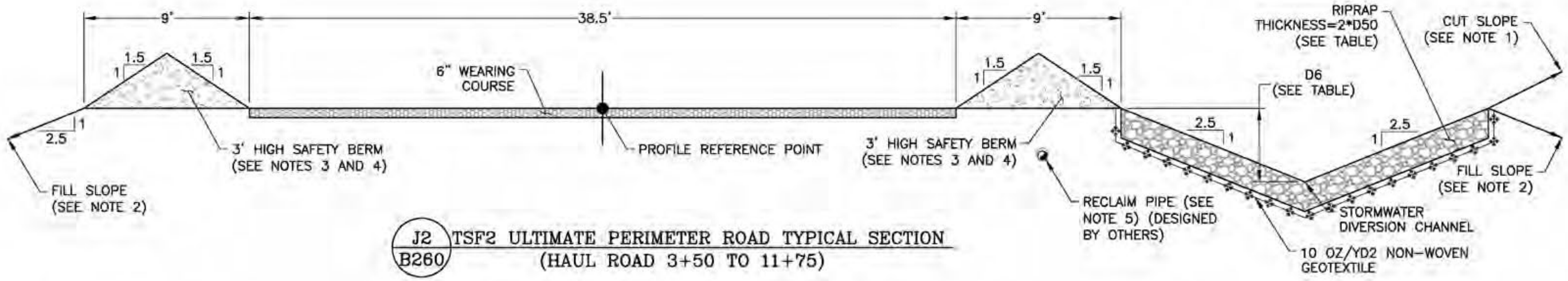
P:\Projects\0014.033 Hermosa Project Feasibility Study\A-CAD\DWGS\14.033.117D.dwg-2/7/2023 11:31 AM



J1 / B260 TSF2 ULTIMATE PERIMETER ROAD TYPICAL SECTION
(LIGHT VEHICLE ACCESS ROAD 11+75 TO 30+00)

NOTES:

1. CUT SLOPES MAY VARY SUBJECT TO ENGINEERS APPROVAL BASED UPON ACTUAL FIELD CONDITIONS. COMPOUND SLOPES CONSISTING OF A 1.5(H):1(V) CUT SLOPE FOR 30 VERTICAL FEET TO A 15' BENCH SHALL BE USED IN CASES OF EXTENDED CUT SLOPES TO CREATE A 2(H):1(V) COMPOUND SLOPE.
2. COMPOUND FILL SLOPES CONSISTING OF A 2(H):1(V) OPEN SLOPE FOR 30 VERTICAL FEET TO A 15' BENCH SHALL BE USED IN CASES OF EXTENDED FILL SLOPES TO CREATE A 2.5(H):1(V) COMPOUND SLOPE. FILL SLOPES SHALL ALSO BE KEYED INTO THE EXISTING SLOPE.
3. SAFETY BERMS ARE REQUIRED IN ALL FILL SLOPE CONDITIONS AND ONLY IN CUT SLOPE CONDITIONS WHERE A DIVERSION CHANNEL IS PRESENT.
4. BREAKS IN SAFETY BERMS WILL BE PROVIDED EVERY 300' FOR STORMWATER RUNOFF TO ENTER STORMWATER DIVERSION CHANNEL FROM ROAD.
5. RECLAIM PIPE UTILIZED TO PUMP WATER FOR THE TSF2 UNDERDRAIN COLLECTION POND TO WTP2. PIPE IN PIPE CONTAINMENT IS REQUIRED.



J2 / B260 TSF2 ULTIMATE PERIMETER ROAD TYPICAL SECTION
(HAUL ROAD 3+50 TO 11+75)

TSF2 ULTIMATE PERIMETER ROAD DIVERSION CHANNEL DIMENSIONS		
STATION	DEPTH (D6)	RIPRAP D50 (INCHES)
3+50 TO 11+75	4'	12
11+75 TO 30+00	3'	NONE

REV	DATE	DESCRIPTION	TECH	ENG
0	7/10/23	ISSUED FOR FEASIBILITY	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: JEP
DRAWN BY: JEP

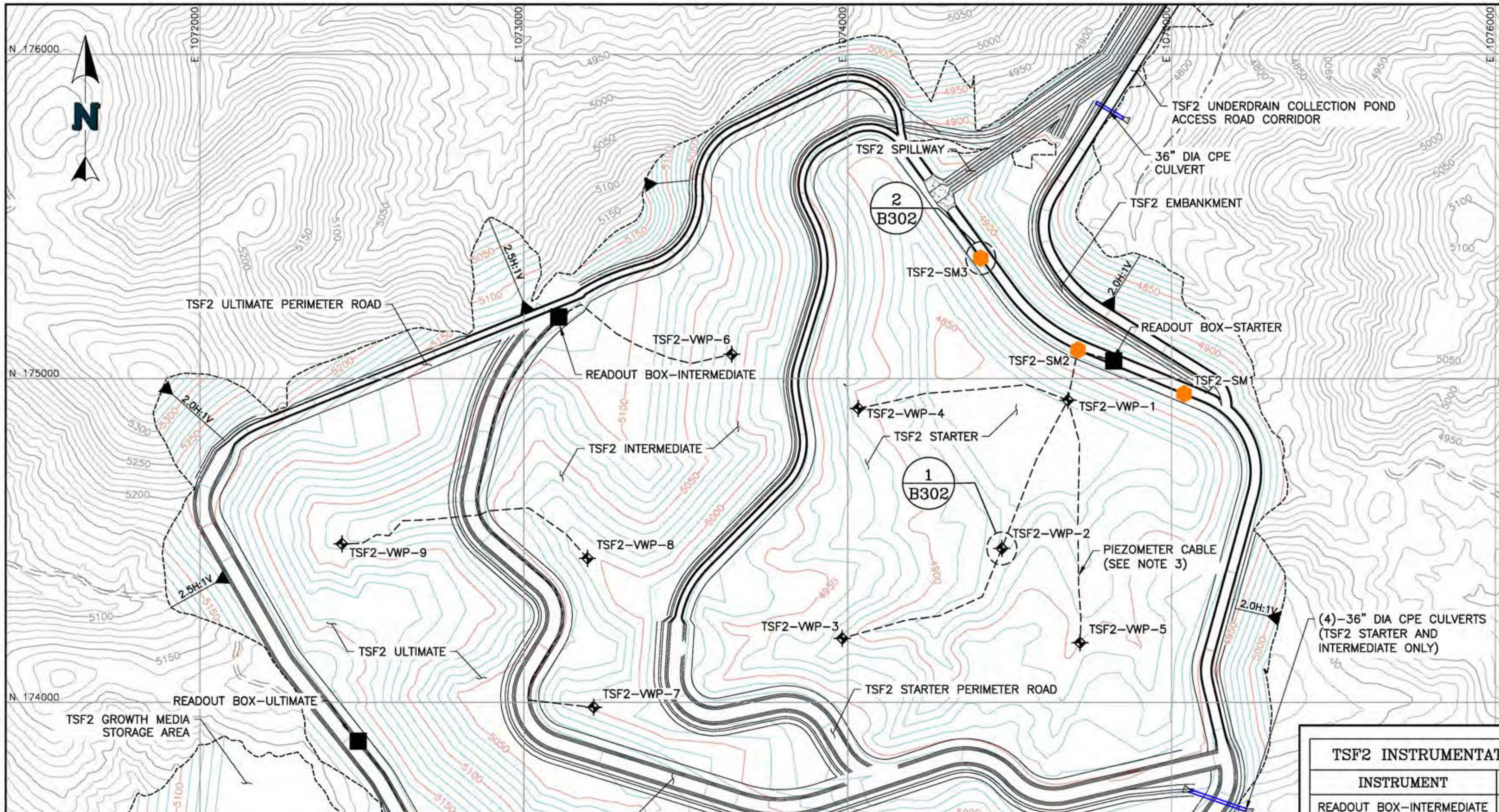
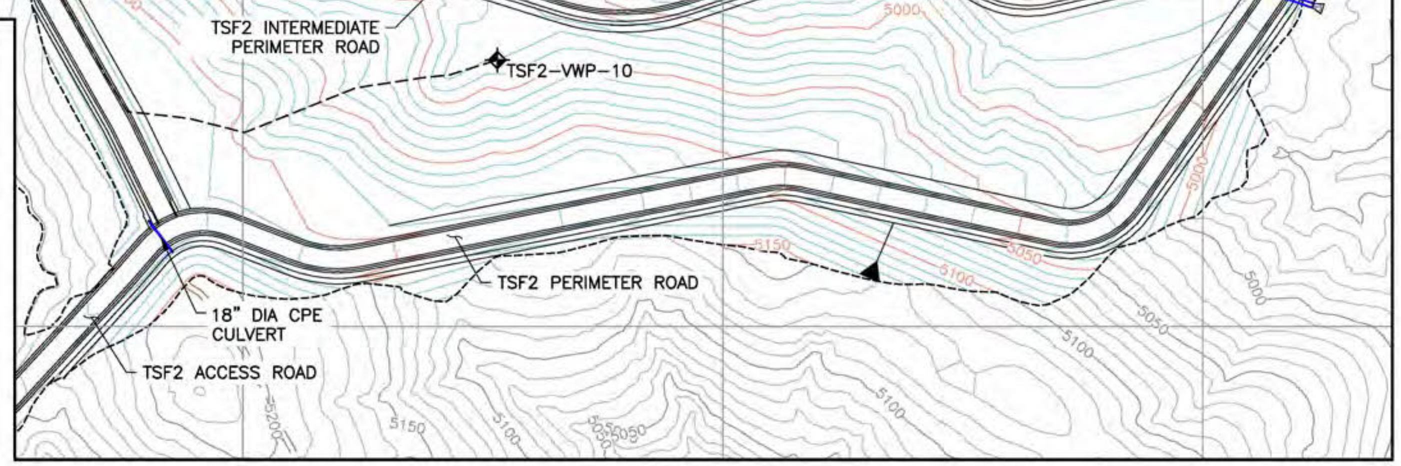
DISCLAIMER
NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.

NewFields

CLIENT: SOUTH32
PROJECT: HERMOSA FEASIBILITY STUDY
TITLE: TSF2 ROAD SECTIONS AND DETAILS (3 OF 3)
FILENAME: 14.033.217D
DRAWING NO.: B274
REVISION: 0

P:\Projects\0014.033_Hermosa_Project_Feasibility_Study\A-CAD\DWGS\14.033.217D.dwg-12/30/2022 1:53 PM

Drawing modified 9/29/23 for submittal to Coronado National Forest

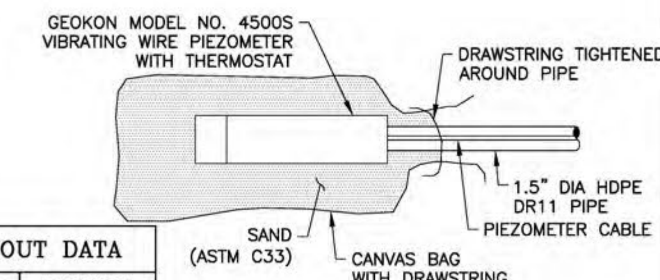



LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED GROUND CONTOURS (SEE NOTE 1)
- EXISTING ROADS/TRAILS
- EXISTING DRAINAGES
- TSF2-P1 — PROPOSED VIBRATING WIRE PIEZOMETER (SEE NOTE 2)
- TSF2-SM1 — PROPOSED SETTLEMENT MONUMENT (SEE NOTE 3)
- PROPOSED PIEZOMETER CABLE

NOTES:

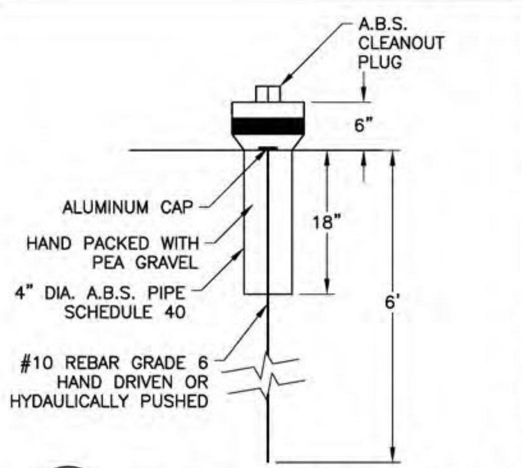
1. PROPOSED CONTOURS REPRESENT TOP OF LOW PERMEABILITY SOIL LAYER WITHIN THE GEOMEMBRANE LINED AREA AND FINISHED GRADE EVERYWHERE ELSE.
2. VIBRATING WIRE PIEZOMETERS TO BE INSTALLED IMMEDIATELY ADJACENT TO THE GEOMEMBRANE SURFACE WITHIN THE DRAINAGE AGGREGATE NEXT TO AN UNDERDRAIN COLLECTION PIPE.
3. THE PIEZOMETER CABLE AND 1.5" DIA HDPE PIPE CONDUIT TO FOLLOW UNDERDRAIN COLLECTION PIPE ALIGNMENT WITHIN THE DRAINAGE AGGREGATE. THE PIEZOMETER CABLE AND CONDUIT SHALL MAINTAIN A MINIMUM OF 1' OF COVER.



1/B302 VIBRATING WIRE PIEZOMETER

TSF2 INSTRUMENTATION LAYOUT DATA

INSTRUMENT	NORTHING	EASTING
READOUT BOX-INTERMEDIATE	175,190.12	1,073,107.83
READOUT BOX-STARTER	175,054.69	1,074,821.07
READOUT BOX-ULTIMATE	173,880.50	1,072,488.54
TSF2-SM1	174,952.58	1,075,038.71
TSF2-SM2	175,088.29	1,074,710.69
TSF2-SM3	175,371.20	1,074,410.84
TSF2-VWP-1	174,932.95	1,074,679.89
TSF2-VWP-2	174,475.42	1,074,475.81
TSF2-VWP-3	174,197.84	1,073,982.87
TSF2-VWP-4	174,907.83	1,074,032.32
TSF2-VWP-5	174,184.25	1,074,717.30
TSF2-VWP-6	175,075.20	1,073,641.93
TSF2-VWP-7	173,985.01	1,073,215.47
TSF2-VWP-8	174,445.00	1,073,196.40
TSF2-VWP-9	174,489.57	1,072,438.30
TSF2-VWP-10	173,555.04	1,073,530.30



2/B302 TYPICAL SETTLEMENT MONUMENT

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM APRIL 9-10, 2018 AERIAL SURVEY DATA PROVIDED BY SOUTH32. DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

REV	DATE	DESCRIPTION	TECH	ENG
0	7/10/23	ISSUED FOR FEASIBILITY	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: JEP
DRAWN BY: JEP

DISCLAIMER

NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.

NewFields

CLIENT: SOUTH32

PROJECT: HERMOSA FEASIBILITY STUDY

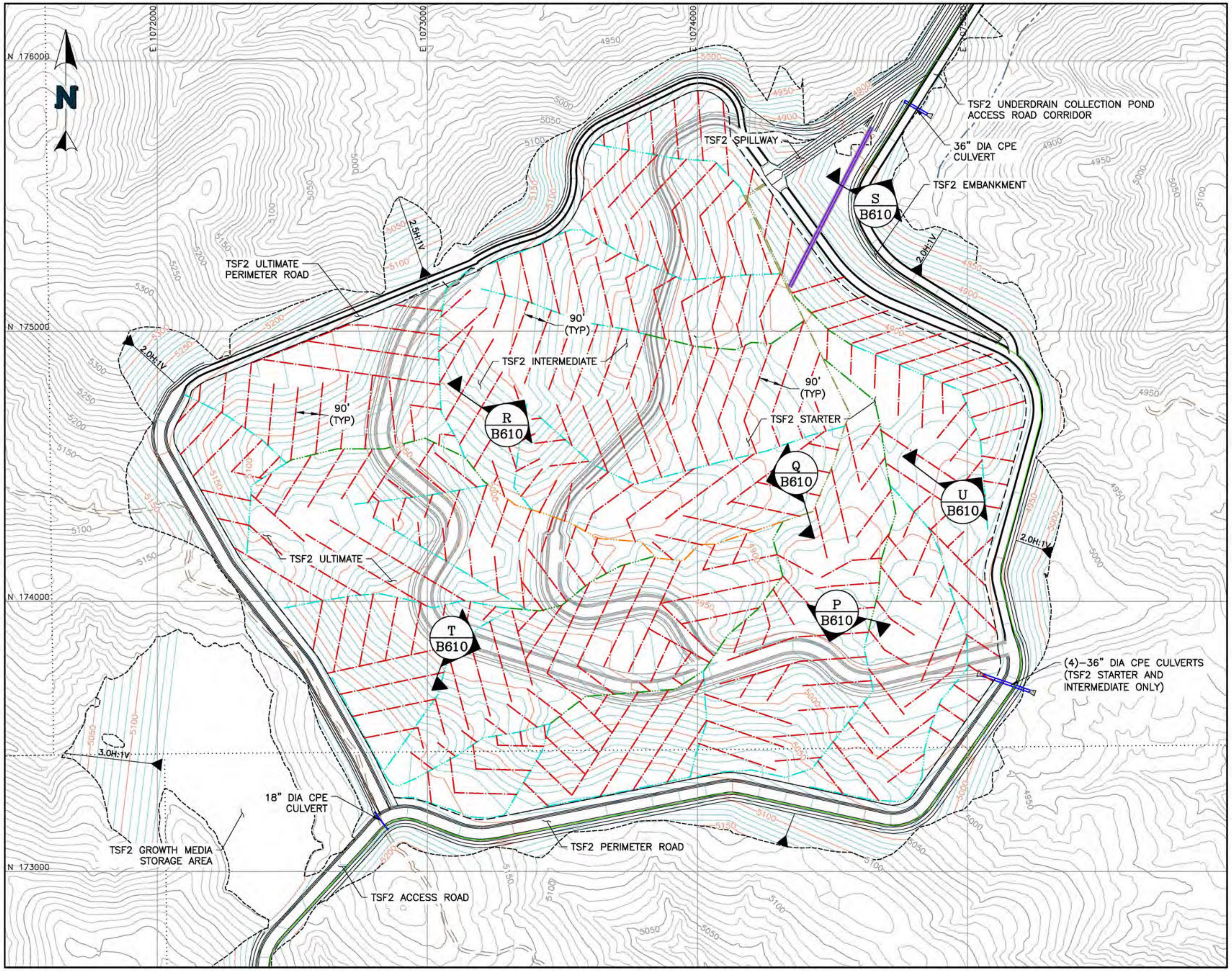
TITLE: TSF2 INSTRUMENTATION PLAN VIEW

FILENAME: 14.033.221M

DRAWING NO.: B302 — REVISION: 0

P:\Projects\0014.033 Hermosa Project Feasibility Study\A-CAD\DWGS\14.033.221M.dwg-4/18/2023 9:27 AM

Drawing modified 9/29/23 for submittal to Coronado National Forest



0 200 400 FEET

LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED GROUND CONTOURS (SEE NOTE 1)
- EXISTING ROADS/TRAILS
- EXISTING DRAINAGES
- SECTION LINES
- PROPOSED CULVERT
- 4" DIA. CPe UNDERDRAIN COLLECTION PIPE (PERFORATED)
- 8" DIA. CPe UNDERDRAIN COLLECTION HEADER (PERFORATED)
- 12" DIA. CPe UNDERDRAIN COLLECTION HEADER (PERFORATED)
- 18" DIA. CPe UNDERDRAIN COLLECTION HEADER (PERFORATED)
- 24" DIA. CPe UNDERDRAIN COLLECTION HEADER (PERFORATED)
- 36" DIA. HDPE DR11 UNDERDRAIN PIPE (SOLID)
- UNDERDRAIN COLLECTION POND RECLAIM PIPE
- CONCRETE ENCASED UNDERDRAIN

NOTES:

1. CONTOURS REPRESENT TOP OF LOW PERMEABILITY SOIL LINER LAYER WITHIN THE GEOMEMBRANE LINED AREA AND FINISHED GRADE EVERYWHERE ELSE.
2. TSF2 ULTIMATE PIPING TO TIE IN TO TSF2 INTERMEDIATE PIPING. TSF2 INTERMEDIATE PIPING TO TIE IN TO TSF2 STARTER PIPING.

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM APRIL 9-10, 2018 AERIAL SURVEY DATA PROVIDED BY SOUTH32. DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

REV	DATE	DESCRIPTION	TECH	ENG
0	7/10/23	ISSUED FOR FEASIBILITY	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: JEP
DRAWN BY: JEP

DISCLAIMER

NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.

NewFields

CLIENT: SOUTH32

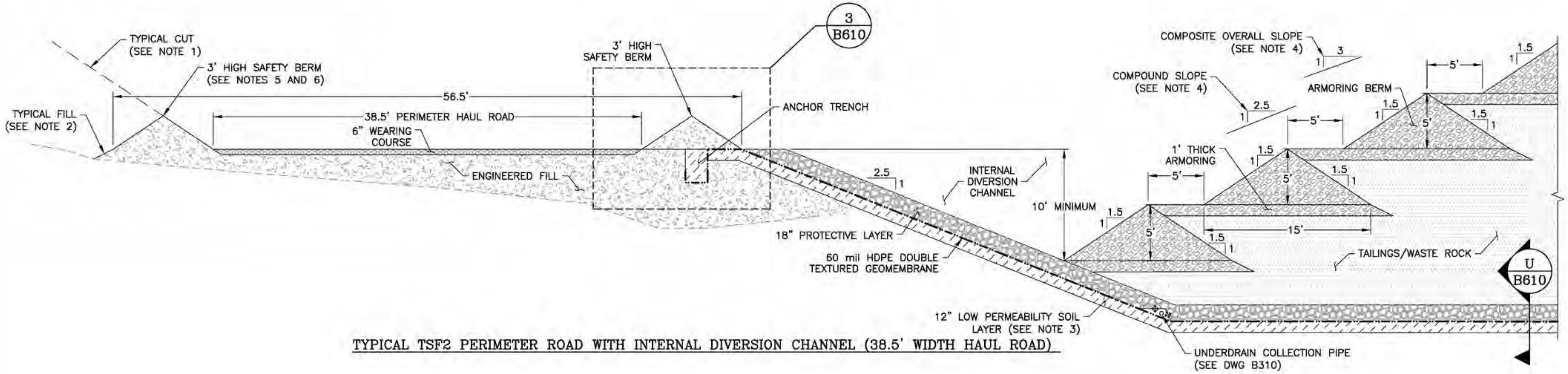
PROJECT: HERMOSA FEASIBILITY STUDY

TITLE: TSF2 PIPING PLAN VIEW

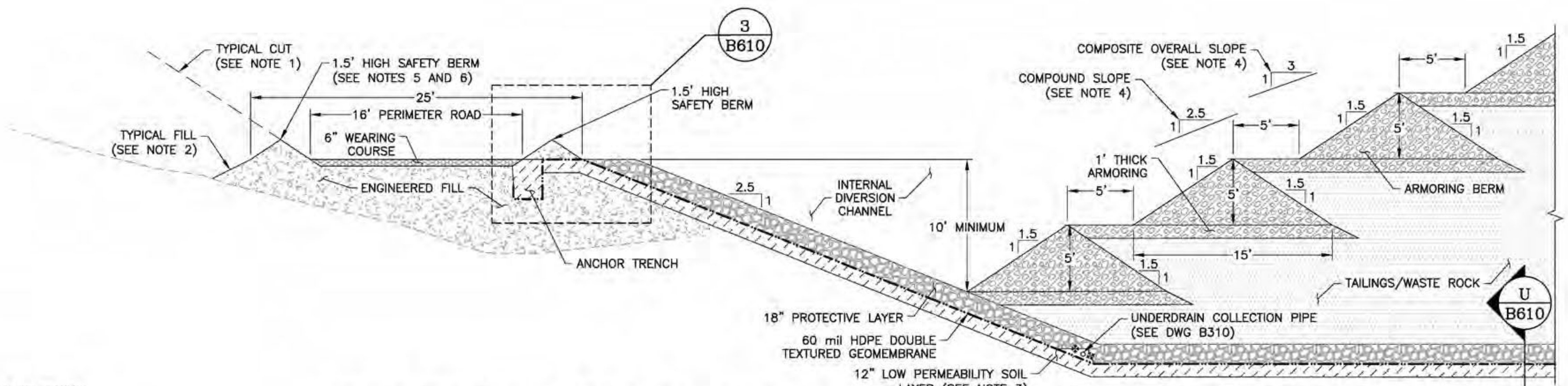
FILENAME: 14.033.119M
DRAWING NO.: B310
REVISION: 0

Drawing modified 9/29/23 for submittal to Coronado National Forest

P:\Projects\0014.033 Hermosa Project Feasibility Study\A-CAD\DWGS\14.033.119M.dwg-4/18/2023 9:28 AM



TYPICAL TSF2 PERIMETER ROAD WITH INTERNAL DIVERSION CHANNEL (38.5' WIDTH HAUL ROAD)



TYPICAL TSF2 PERIMETER ROAD WITH INTERNAL DIVERSION CHANNEL (16' WIDTH LIGHT VEHICLE ACCESS ROAD)

NOTES:

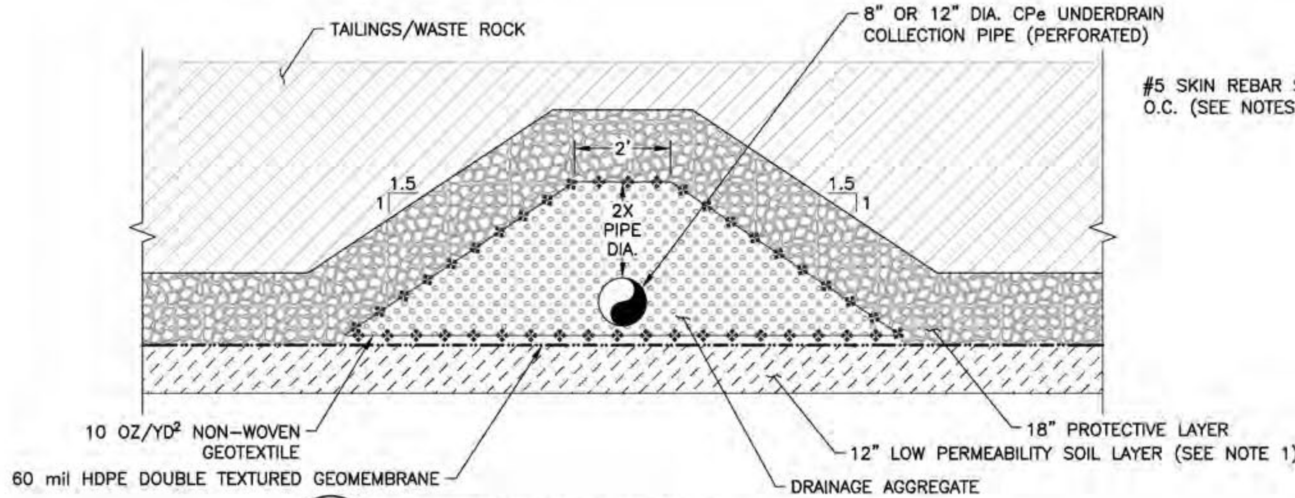
1. CUT SLOPES SHALL BE 1.5(H):1(V) UP TO 30' IN HEIGHT. CUT SLOPES EXCEEDING 30' IN HEIGHT SHALL BE 2(H):1(V) COMPOUND SLOPE UTILIZING A 15' BENCH EVERY 30' VERTICAL HEIGHT.
2. COMPOUND FILL SLOPES CONSISTING OF A 2(H):1(V) OPEN SLOPE FOR 30 VERTICAL FEET TO A 15' BENCH SHALL BE USED IN CASES OF EXTENDED FILL SLOPES TO CREATE A 2.5(H):1(V) COMPOUND SLOPE. FILL SLOPES SHALL ALSO BE KEYED INTO THE EXISTING SLOPE.
3. GCL TO BE USED AS AN APPROVED EQUIVALENT IF SUBSEQUENT GEOTECHNICAL INVESTIGATION RESULTS REVEAL INSUFFICIENT LOW PERMEABILITY SOIL QUANTITY IS AVAILABLE AND SLOPE STABILITY RESULTS SUPPORT ITS USE. SEE DWG B300 FOR POTENTIAL GCL LIMITS.
4. 3H:1V COMPOSITE SLOPE IS COMPRISED OF 25 FT HIGH 2.5H:1V COMPOUND SLOPES IN COMBINATION WITH A 12.5 FT BENCH THAT OCCURS EVER 25 FT IN VERTICAL SLOPE HEIGHT
5. SAFETY BERMS ARE REQUIRED IN ALL FILL SLOPE CONDITIONS AND ONLY IN CUT SLOPE CONDITIONS WHERE A DIVERSION CHANNEL IS PRESENT.
6. BREAKS IN SAFETY BERMS WILL BE PROVIDED EVERY 300'.

REV	DATE	DESCRIPTION	TECH	ENG
0	7/10/23	ISSUED FOR FEASIBILITY	JEP	CMT

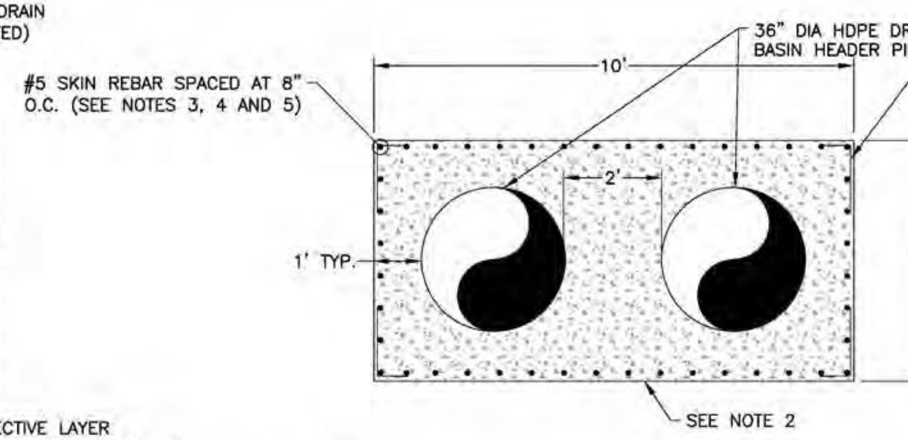
APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: JEP
DRAWN BY: JEP

NewFields

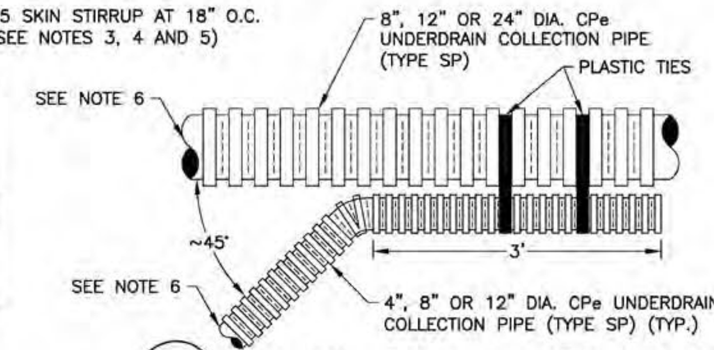
CLIENT: SOUTH32 (AMI)
PROJECT: HERMOSA FEASIBILITY STUDY
TITLE: TSF2 DRY STACK SECTIONS AND DETAILS (1 OF 5)
FILENAME: 14.033.1240
DRAWING NO.: B600
REVISION: 0



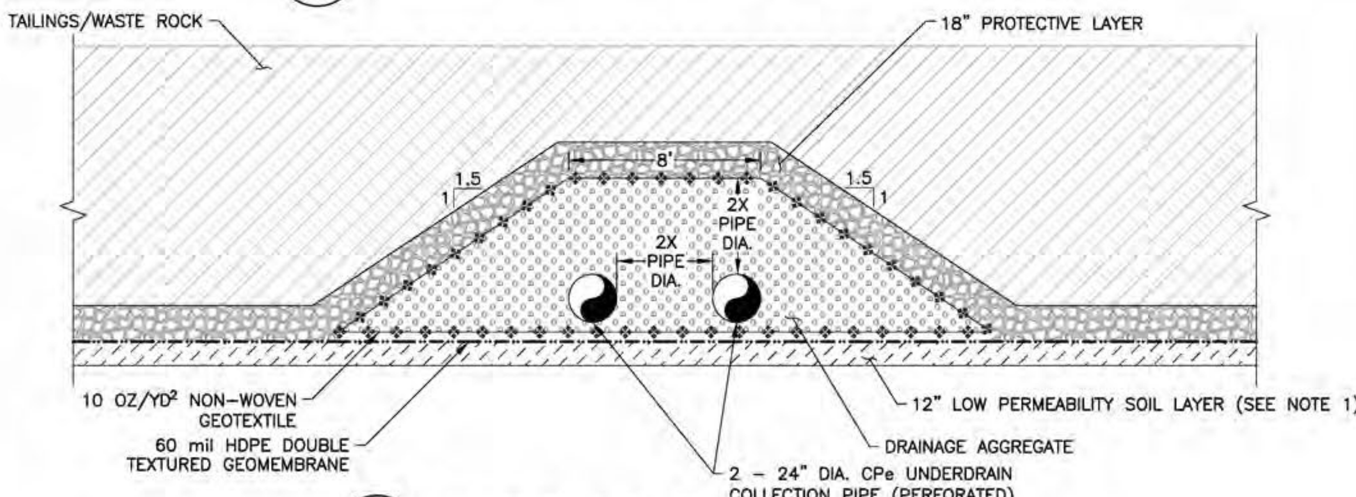
P / B310 UNDERDRAIN BASIN HEADER – 8" OR 12" PIPE



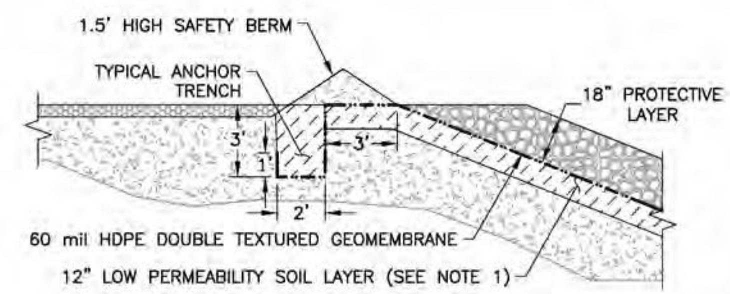
S / B310 REINFORCED CONCRETE PIPE ENCASEMENT



T / B310 UNDERDRAIN COLLECTION PIPE INTERSECTION



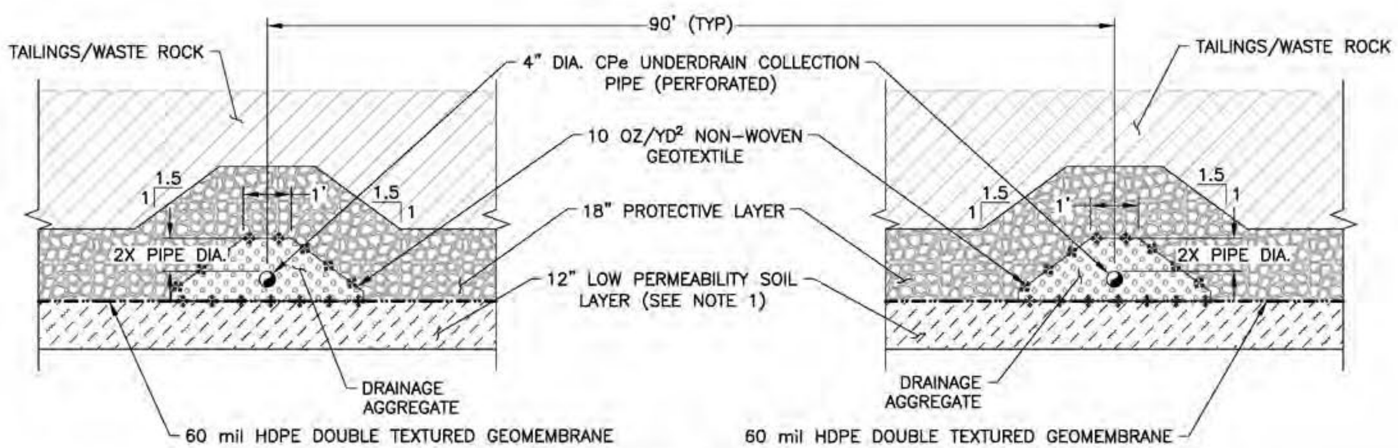
Q / B310 UNDERDRAIN BASIN HEADER – (2) 24" PIPES



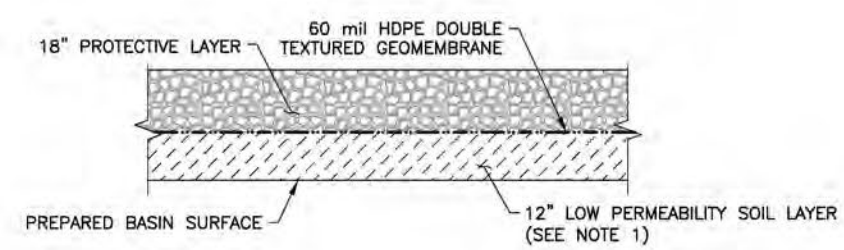
TYPICAL ANCHOR TRENCH ON PERIMETER ROAD BERM

NOTES:

1. GCL MAY BE USED AS AN APPROVED EQUIVALENT IF SUBSEQUENT GEOTECHNICAL INVESTIGATION RESULTS REVEAL INSUFFICIENT LOW PERMEABILITY SOIL QUANTITY IS AVAILABLE AND SLOPE STABILITY RESULTS SUPPORT ITS USE. IF GCL IS USED, GCL WILL BE ANCHORED IN LINER TRENCH. SEE DWG B300 FOR POTENTIAL GCL LIMITS.
2. CONCRETE ENCASEMENT SHOULD BE INCISED INTO THE COMPACTED SOIL AND POURED NEAT TO THE SIDES OF THE EXCAVATION TO PROVIDE AN INTIMATE SOIL AND CONCRETE INTERFACE.
3. ALL REBAR REINFORCING SHALL BE GRADE 60.
4. HEAT MAY NOT BE USED IN BENDING OF REBAR STIRRUPS.
5. BAR LAP SPLICES MUST BE STAGGERED ALONG THE CONCRETE ENCASEMENT.
6. ALL UPSTREAM ENDS OF PIPES TO BE CAPPED.



R / B310 UNDERDRAIN BASIN PIPE – 4" PIPE



U / B310 TYPICAL BASIN SECTION (LOW PERMEABILITY LAYER OR GCL)

REV	DATE	DESCRIPTION	TECH	ENG
0	7/10/23	ISSUED FOR FEASIBILITY	JEP	CMT

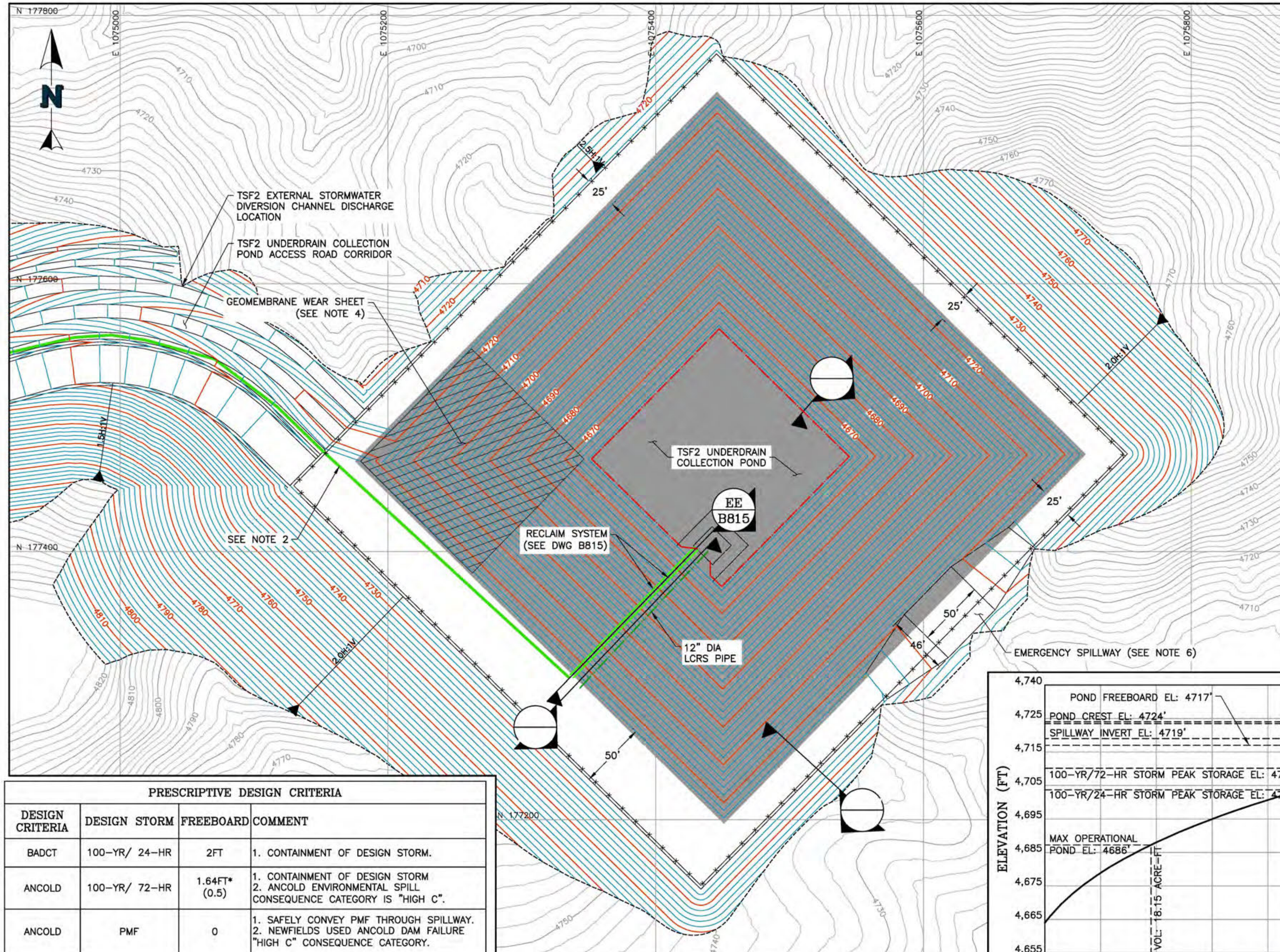
APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: JEP
DRAWN BY: JEP

NewFields

CLIENT: SOUTH32
PROJECT: HERMOSA FEASIBILITY STUDY
TITLE: TSF2 DRY STACK SECTIONS AND DETAILS (3 OF 5)
FILENAME: 14.033.126D
DRAWING NO.: B610
REVISION: 0

Drawing modified 9/29/23 for submittal to Coronado National Forest

P:\Projects\0014.033 Hermosa Project Feasibility Study\A-CAD\DWGS\14.033.126D.dwg—9/20/2023 2:22 PM



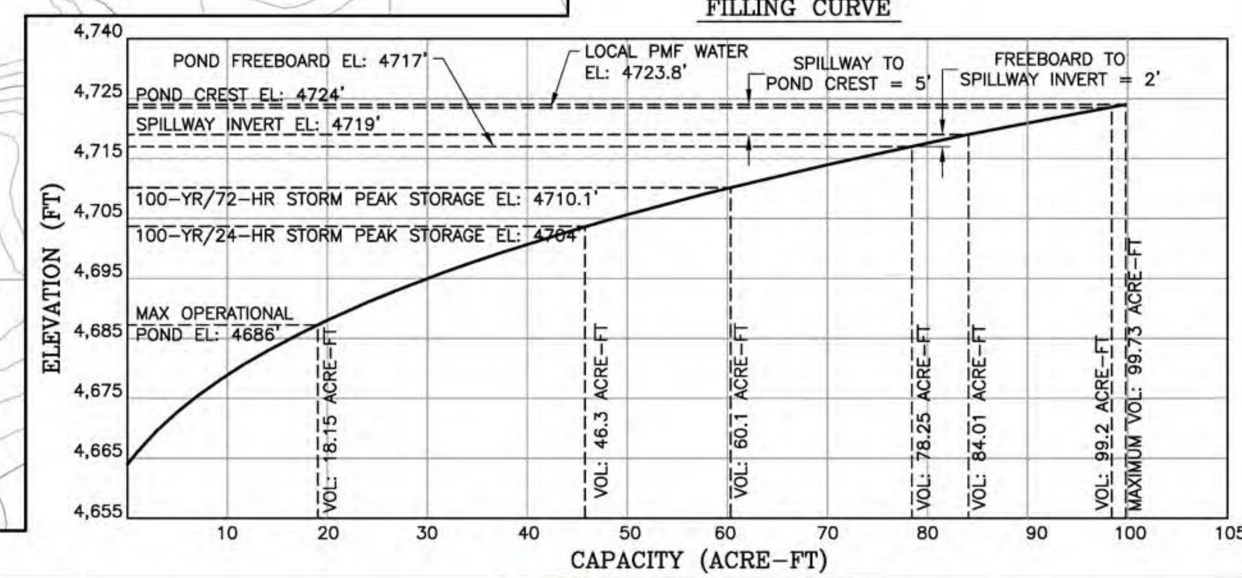
LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED GROUND CONTOURS (SEE NOTE 1)
- 4" DIA. CPE UNDERDRAIN COLLECTION PIPE (PERFORATED)
- UNDERDRAIN COLLECTION POND RECLAIM PIPE TO WATER TREATMENT PLANT (SOLID) (SEE NOTE 5)
- GEOMEMBRANE LIMITS (SEE NOTE 4)
- PROPOSED FENCE
- GEOMEMBRANE WEAR SHEET (SEE NOTE 4)
- 12" DIA. LCRS

NOTES:

1. CONTOURS REPRESENT TOP OF LOW PERMEABILITY SOIL LINER LAYER WITHIN THE GEOMEMBRANE LINED AREA AND FINISHED GRADE EVERYWHERE ELSE.
2. WATER COLLECTED IN THE TSF2 UNDERDRAIN COLLECTION POND TO BE PUMPED TO THE WATER TREATMENT PLANT 2.
3. POND DESIGNED TO CONTAIN VERY LOW SEEPAGE FLOWS EXPECTED FROM THE TSF2 DRY STACK TSF, THE 100YR STORMWATER RUNOFF FROM THE DRY STACK TSF, AND STORM PRECIPITATION DIRECTLY OVER THE POND DURING THE 100YR STORM EVENT.
4. GEOMEMBRANE AND GEOMEMBRANE WEARSHEET TO BE 60 mil HPDE DOUBLE TEXTURED GEOMEMBRANE.
5. TSF2 UNDERDRAIN COLLECTION POND RECLAIM PIPE TO BE BURIED PIPE IN PIPE CONTAINMENT (DESIGNED BY OTHERS).
6. EMERGENCY SPILLWAY TO BE CONSTRUCTED FROM REINFORCED CONCRETE WITH 10H:1V SLOPES FOR LIGHT VEHICLE ACCESS AROUND THE UNDERDRAIN COLLECTION POND.
7. TSF2 UNDERDRAIN COLLECTION POND WAS DESIGNED UTILIZING THE STORAGE GUIDELINES PRESENTED IN BADCT, ANCOLD, AND GISTM.
8. ROUTED PMF WILL FLOW SAFELY THROUGH EMERGENCY SPILLWAY 3.3 FEET DEEP WITH 1.7 FEET FREEBOARD.
9. DESIGN SATISFIES ALL PRESCRIPTIVE DESIGN CRITERIA.

FILLING CURVE



PRESCRIPTIVE DESIGN CRITERIA

DESIGN CRITERIA	DESIGN STORM	FREEBOARD	COMMENT
BADCT	100-YR/ 24-HR	2FT	1. CONTAINMENT OF DESIGN STORM.
ANCOLD	100-YR/ 72-HR	1.64FT* (0.5)	1. CONTAINMENT OF DESIGN STORM 2. ANCOLD ENVIRONMENTAL SPILL CONSEQUENCE CATEGORY IS "HIGH C".
ANCOLD	PMF	0	1. SAFELY CONVEY PMF THROUGH SPILLWAY. 2. NEWFIELDS USED ANCOLD DAM FAILURE "HIGH C" CONSEQUENCE CATEGORY.
GISTM	1,000-YR/ 24-HR	NOT SPECIFIED	1. SAFELY CONVEY 1,000 YEAR STORM THROUGH SPILLWAY.

* USE 2FT FOR FILLING CURVE FREEBOARD
** SEE NOTE 9

REFERENCE:

EXISTING GROUND TOPOGRAPHY DEVELOPED FROM APRIL 9-10, 2018 AERIAL SURVEY DATA PROVIDED BY SOUTH32. DATA PROJECTED TO STATE PLANE ARIZONA CENTRAL NAD 83 FEET, NAVD88.

0 40 80 FEET

REV	DATE	DESCRIPTION	TECH	ENG
0	7/10/23	ISSUED FOR FEASIBILITY	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: JEP
DRAWN BY: JEP

DISCLAIMER

NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.

NewFields

CLIENT: SOUTH32

PROJECT: HERMOSA FEASIBILITY STUDY

TITLE: TSF2 UNDERDRAIN COLLECTION POND PLAN VIEW

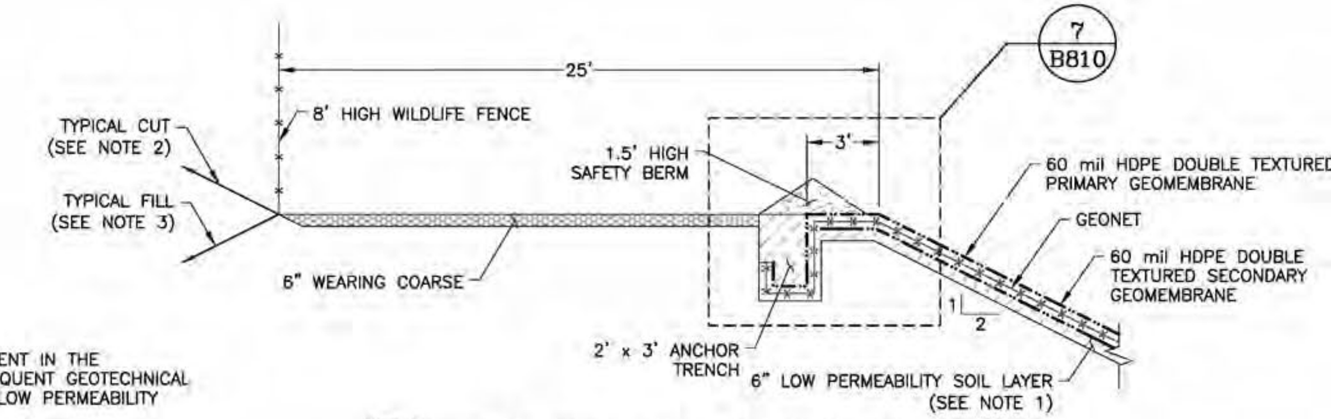
FILENAME: 14.033.130M

DRAWING NO.: B800

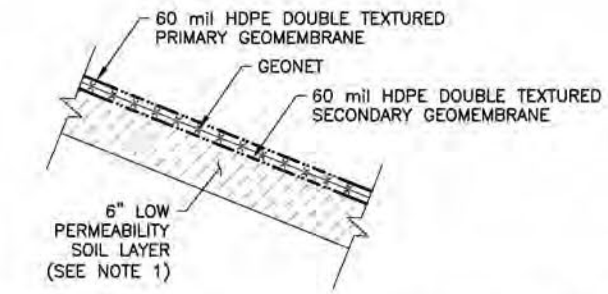
REVISION: 0

P:\Projects\0014.033 Hermosa Project Feasibility Study\A-CAD\DWGS\14.033.130M.dwg-4/5/2023 3:11 PM

Drawing modified 9/29/23 for submittal to Coronado National Forest



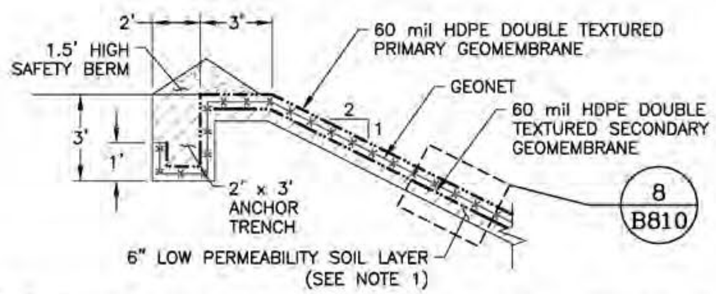
AA / B800 TYPICAL UNDERDRAIN COLLECTION POND CREST



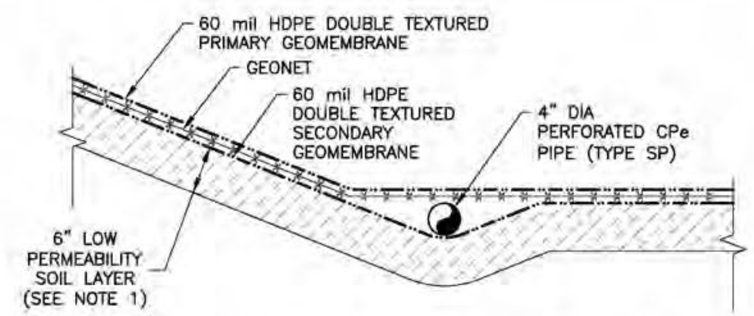
8 / B810 TYPICAL UNDERDRAIN COLLECTION POND GEOMEMBRANE DETAIL

NOTES:

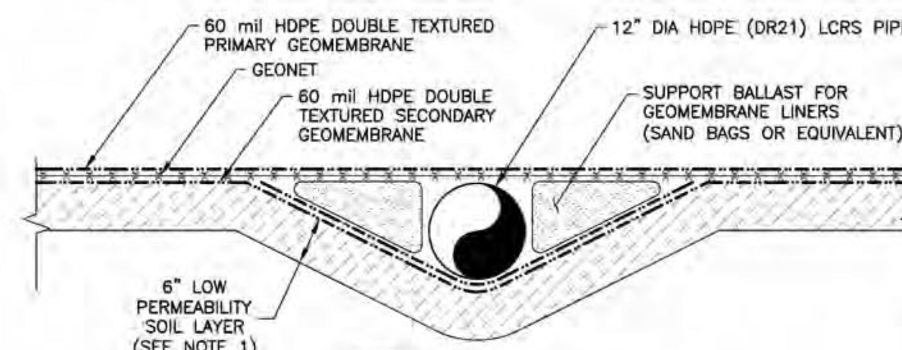
1. GCL MAY BE USED AS AN APPROVED EQUIVALENT IN THE UNDERDRAIN COLLECTION POND IF THE SUBSEQUENT GEOTECHNICAL INVESTIGATION RESULTS REVEAL INSUFFICIENT LOW PERMEABILITY SOIL MATERIAL (LPSL) ON SITE.
2. CUT SLOPES SHALL BE 1.5(H):1(V) UP TO 30' IN HEIGHT. CUT SLOPES EXCEEDING 30' IN HEIGHT SHALL BE 2(H):1(V) COMPOUND SLOPE UTILIZING A 15' BENCH EVERY 30' VERTICAL HEIGHT.
3. COMPOUND FILL SLOPES CONSISTING OF A 2(H):1(V) OPEN SLOPE FOR 30 VERTICAL FEET TO A 15' BENCH SHALL BE USED IN CASES OF EXTENDED FILL SLOPES TO CREATE A 2.5(H):1(V) COMPOUND SLOPE. FILL SLOPES SHALL ALSO BE KEYED INTO THE EXISTING SLOPE.



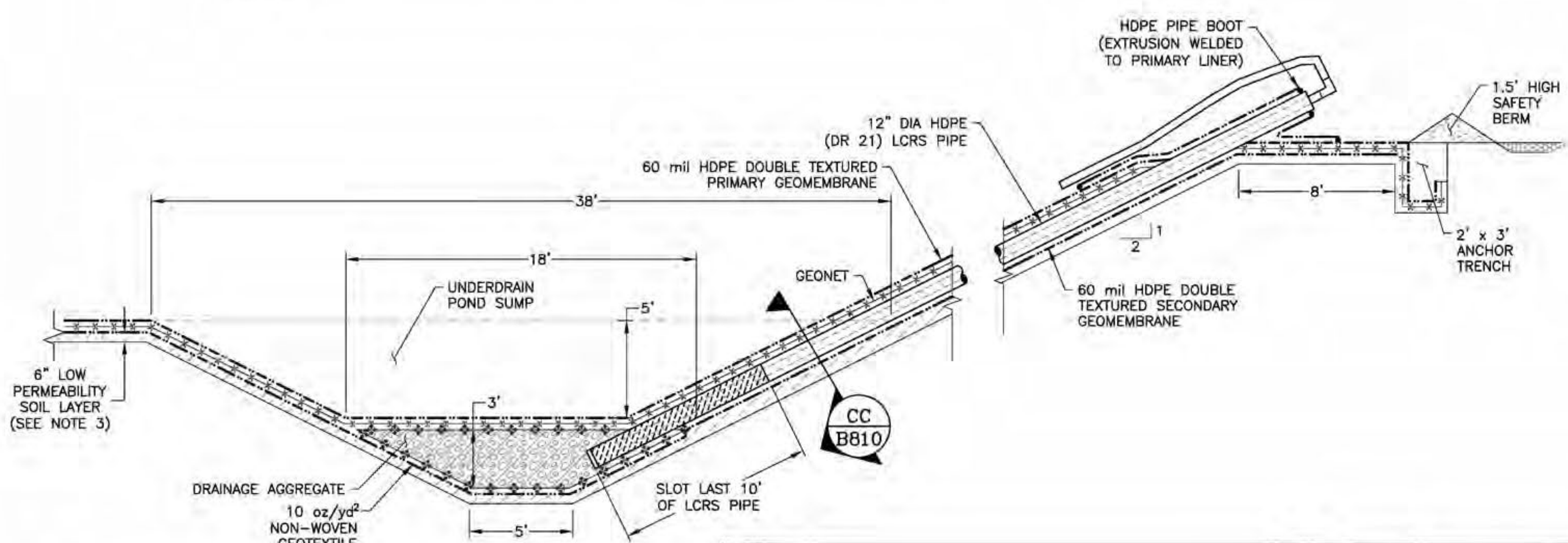
7 / B810 TYPICAL UNDERDRAIN COLLECTION POND ANCHOR TRENCH DETAIL



DD / B800 TOE DRAIN TO LCRS SUMP



CC / B810 LCRS PIPE SECTION



BB / B800 UNDERDRAIN COLLECTION POND LCRS SUMP RISER SECTION

REV	DATE	DESCRIPTION	TECH	ENG
0	7/10/23	ISSUED FOR FEASIBILITY	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: JEP
DRAWN BY: JEP

DISCLAIMER

NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.

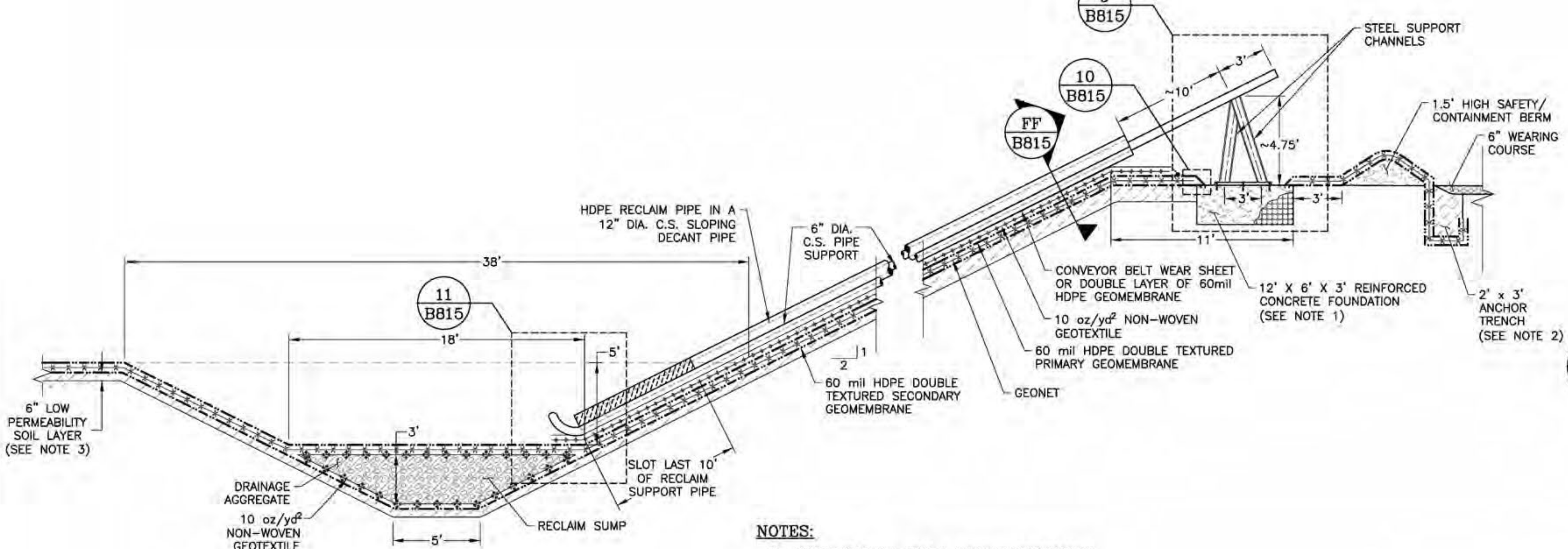
NewFields

CLIENT: SOUTH32

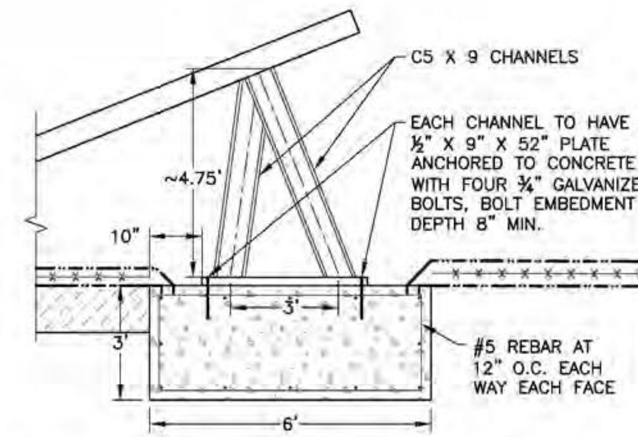
PROJECT: HERMOSA FEASIBILITY STUDY

TITLE: TSF2 UNDERDRAIN COLLECTION POND SECTIONS AND DETAILS (1 OF 2)

FILENAME: 14.033.131D
DRAWING NO.: B810
REVISION: 0



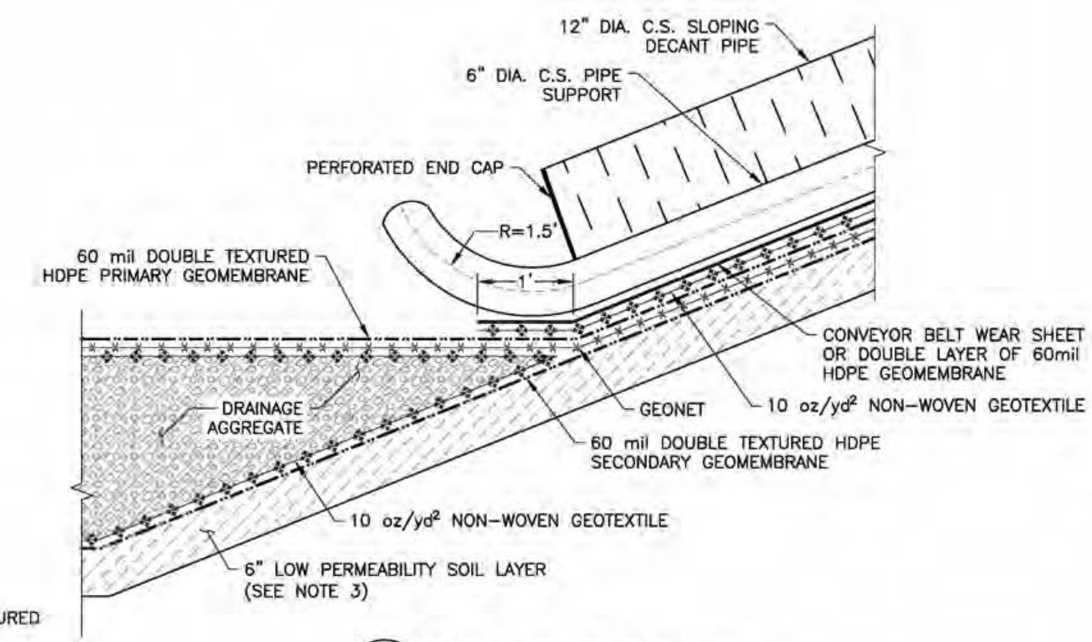
EE
B800
UNDERDRAIN POND RECLAIM SYSTEM



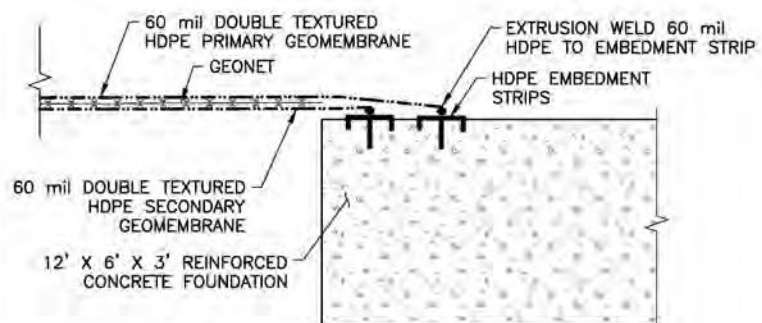
9
B815
RECLAIM SYSTEM CONCRETE ANCHOR DETAIL

NOTES:

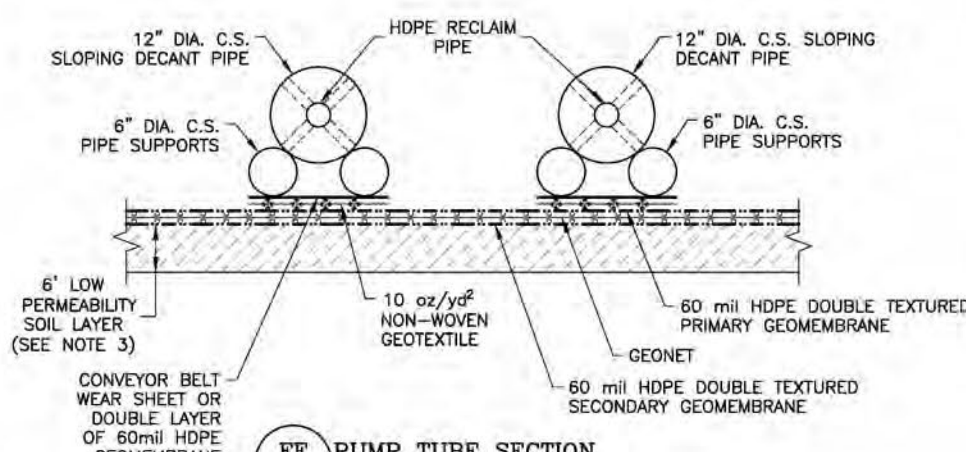
1. CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3000 PSI.
2. SEE TECHNICAL SPECIFICATIONS FOR ANCHOR TRENCH BACKFILL REQUIREMENTS.
3. GCL MAY BE USED AS AN APPROVED EQUIVALENT IN THE UNDERDRAIN COLLECTION POND IF THE SUBSEQUENT GEOTECHNICAL INVESTIGATION RESULTS REVEAL INSUFFICIENT LOW PERMEABILITY SOIL QUALITY ON SITE.



11
B815
SLOPING RECLAIM SYSTEM



10
B815
HDPE EMBEDMENT STRIPS



FF
B815
PUMP TUBE SECTION

REV	DATE	DESCRIPTION	TECH	ENG
0	7/10/23	ISSUED FOR FEASIBILITY	JEP	CMT

APPROVED BY: RMS
CHECKED BY: CMT
DESIGNED BY: JEP
DRAWN BY: JEP

DISCLAIMER
NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.

NewFields
CLIENT: SOUTH32
PROJECT: HERMOSA FEASIBILITY STUDY
TITLE: TSF2 UNDERDRAIN COLLECTION POND SECTIONS AND DETAILS (2 OF 2)
FILENAME: 14.033.132D
DRAWING NO.: B815
REVISION: 0

Appendix E

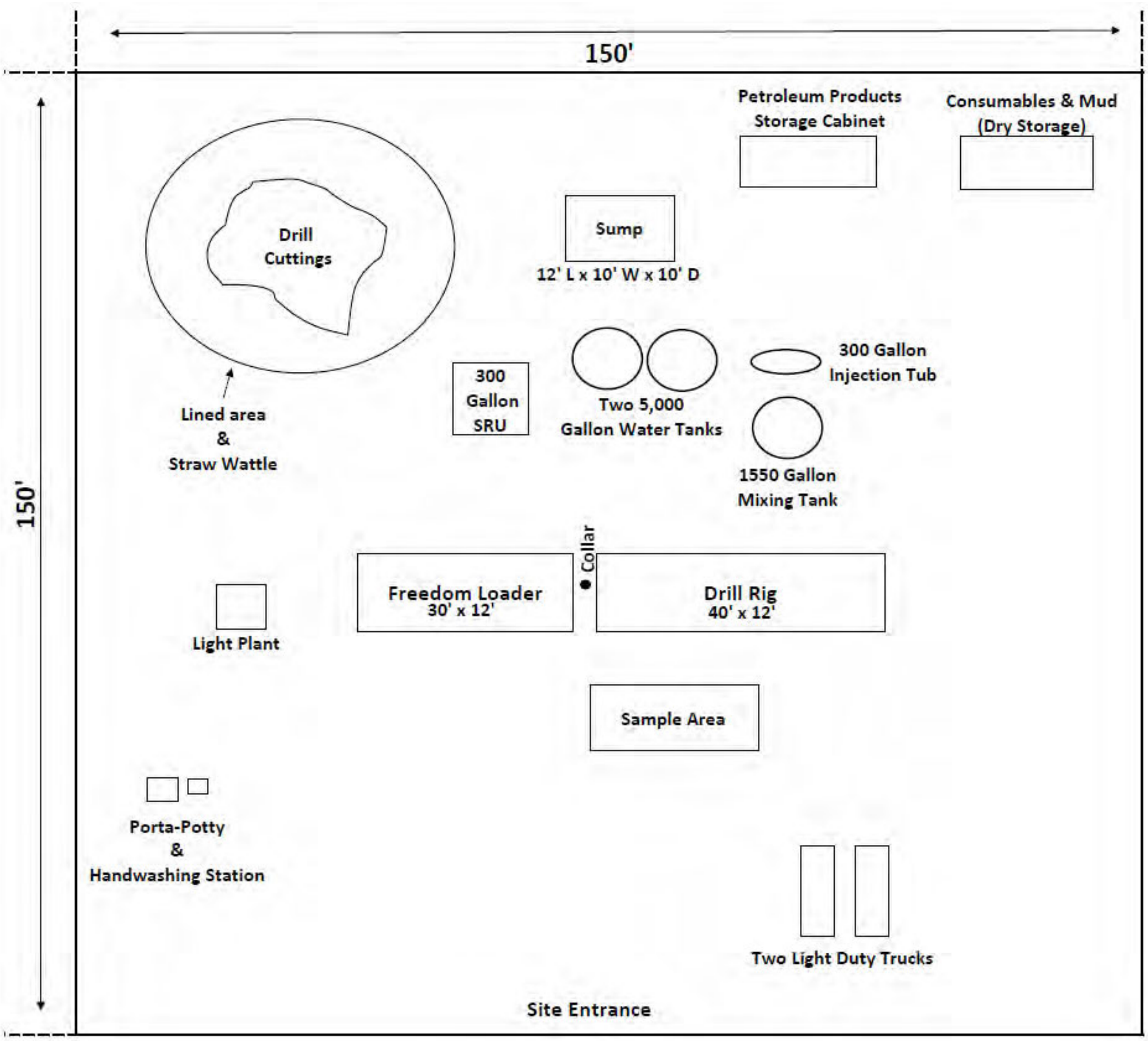
Typical Facility Layouts

This appendix contains typical conceptual layouts for several Plan Operations facilities, including:

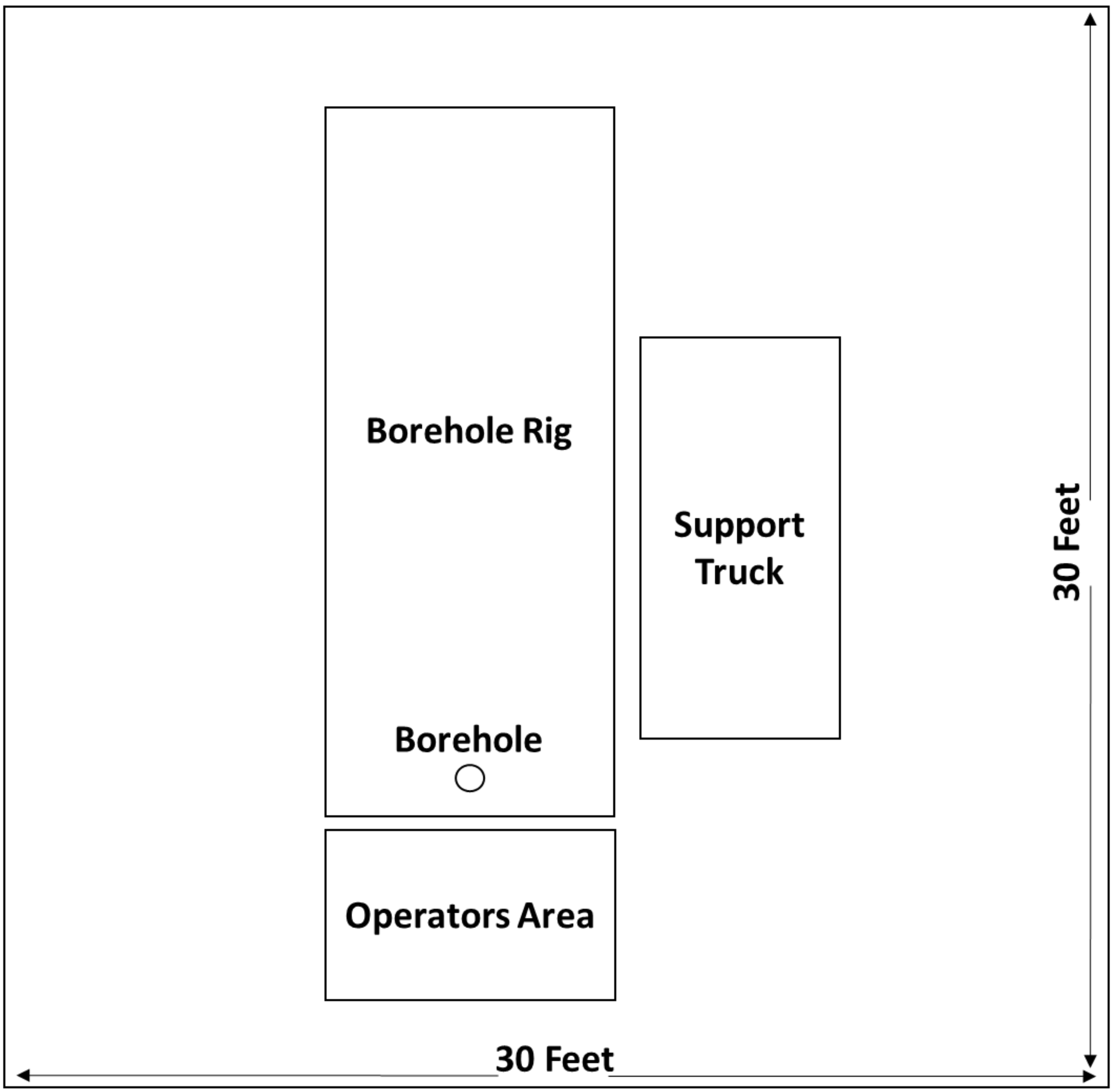
- an exploratory drill pad (1 figure),
- a geotechnical drill pad (1 figure),
- a GWM well drill pad (1 figure),
- a completed GWM well pad (1 figure), and
- a RIB location (3 figures).

These layouts are provided as examples only. While the disturbance acreage is anticipated to be similar for the final operational locations, the exact dimensions and organization of each facility would be determined based on site-specific conditions.

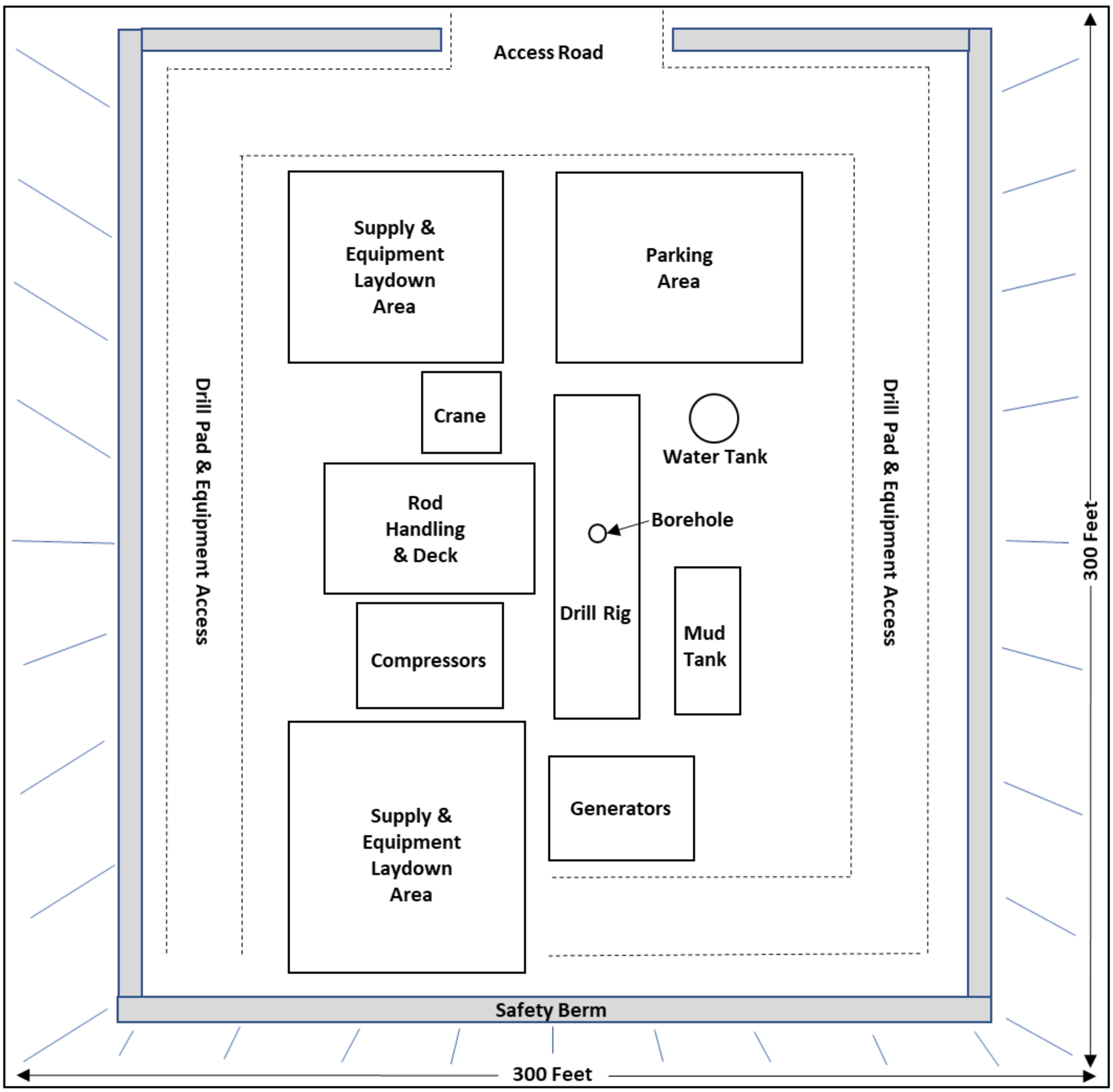
Exploration Drill Pad – Typical Layout



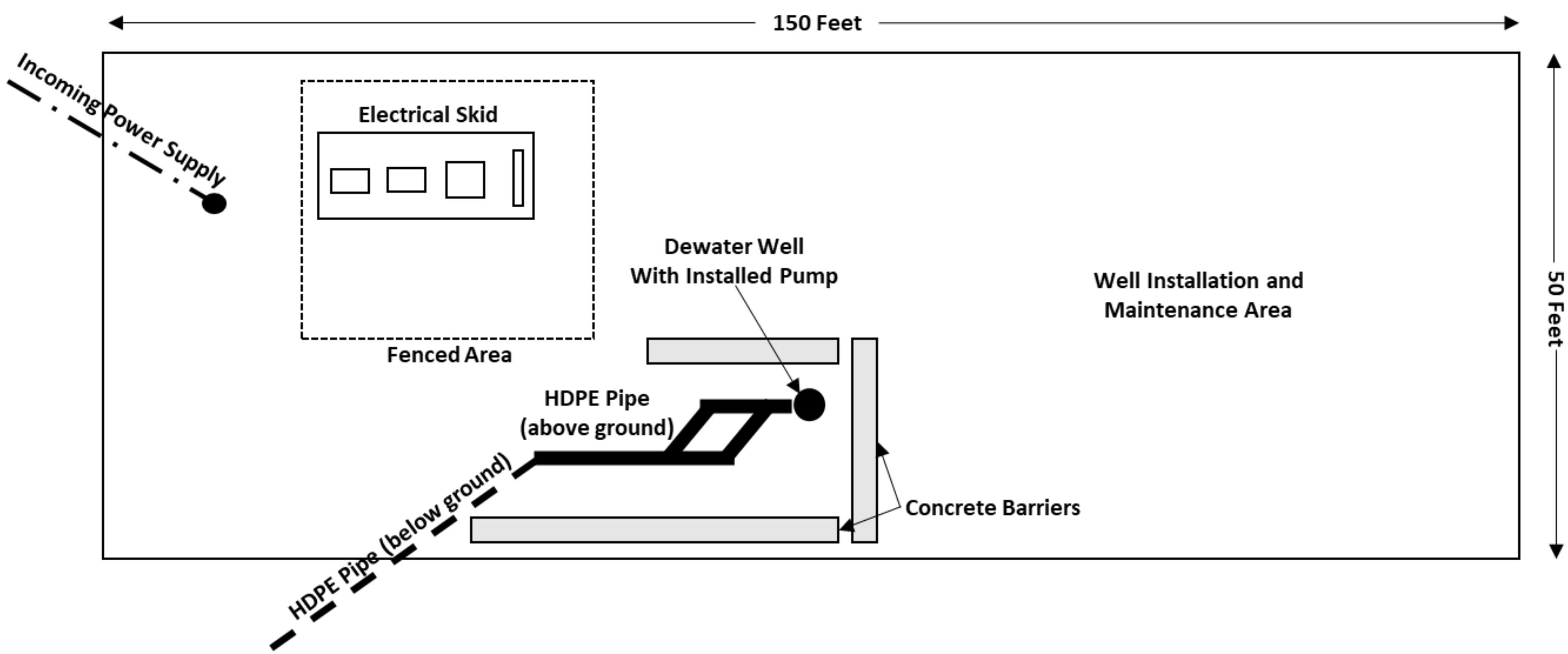
Geotechnical Borehole – Typical Layout

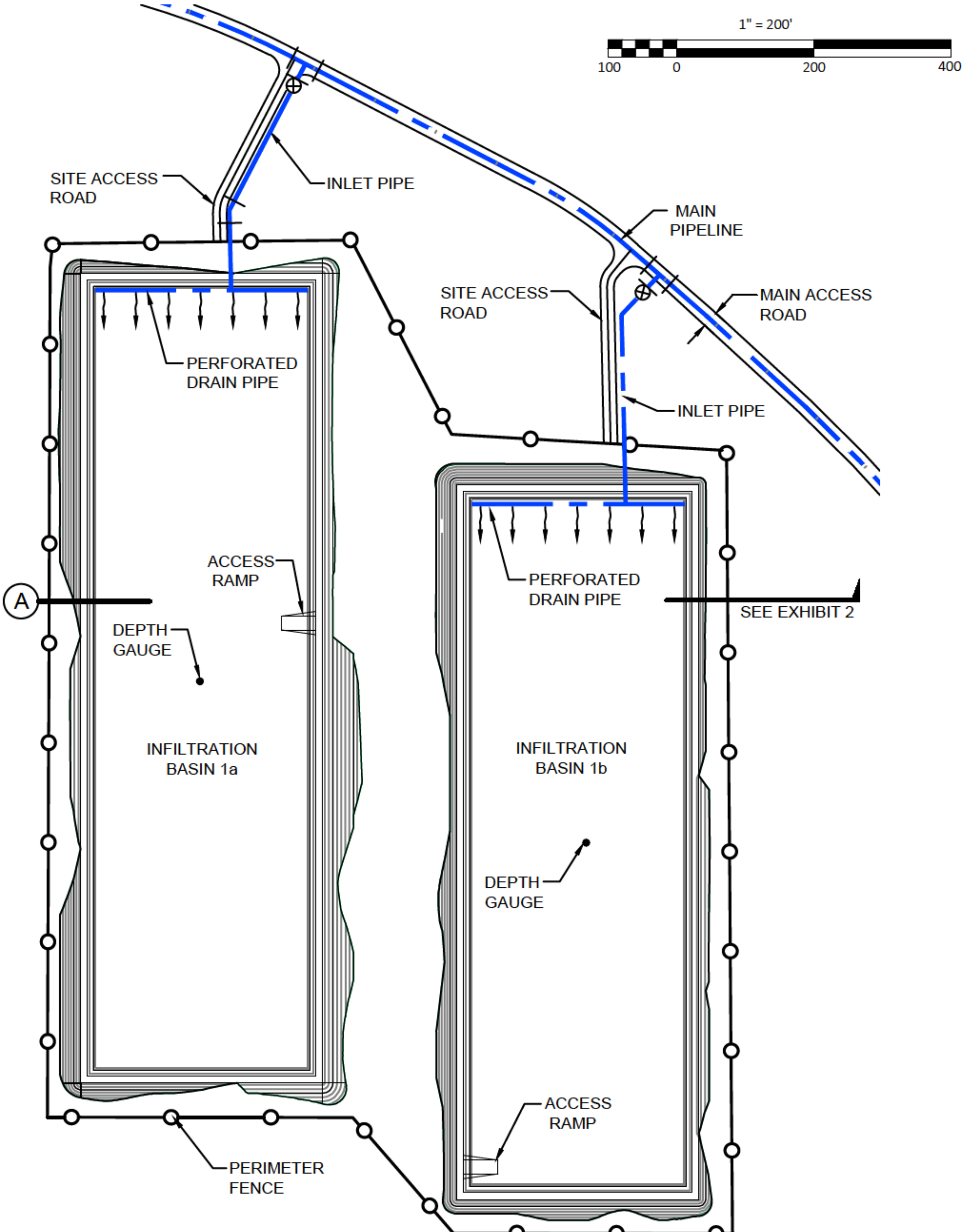


GWM Well Drill Pad – Typical Layout



GWM Completed Well – Typical Layout





SOUTH32

INFILTRATION BASIN TYPICAL DESIGN - PLAN VIEW

EXHIBIT 1

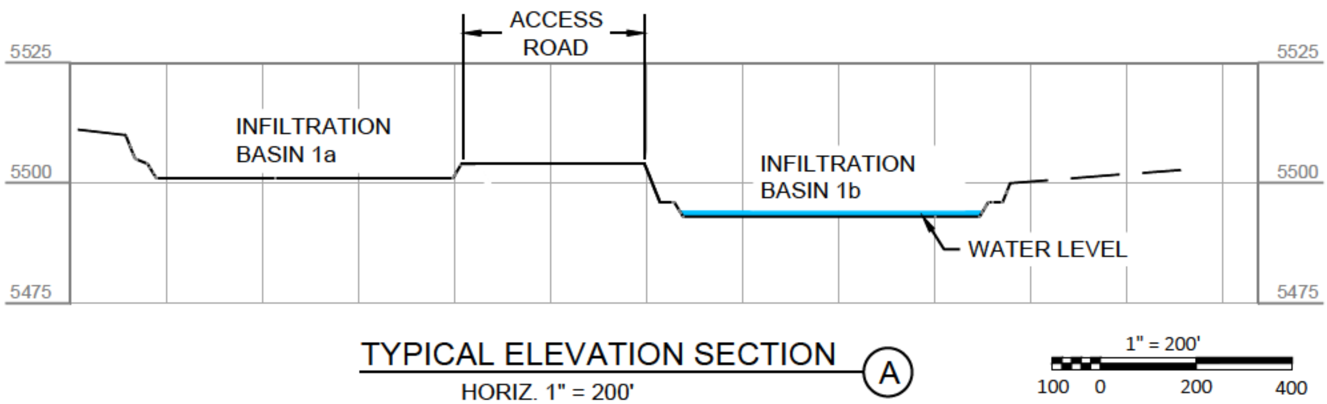
PERCOLATION POND OPERATIONS

RECHARGE INTO INFILTRATION BASIN NO. 1a AND ALLOW WATER TO SEEP INTO THE GROUND. CONTINUE RECHARGING UNTIL THE WATER LEVEL IN THE BASIN RISES TO APPROXIMATELY 12 TO 18 INCHES. THIS INDICATES THAT THE PERCOLATION RATE IS SLOWING DOWN AT THIS TIME, STOP RECHARGING INFILTRATION BASIN NO. 1a AND BEGIN RECHARGING TO INFILTRATION BASIN NO. 1b.

AFTER INFILTRATION BASIN NO. 1a DRIES UP WHERE EQUIPMENT CAN ACCESS THE BOTTOM OF THE BASIN, SCARIFY AND LEVEL, CLEAN THE BERMS AND LET IT CONTINUE TO DRY UNTIL INFILTRATION BASIN NO. 1b IS READY TO BE SHUT OFF.

REPEAT THE PROCESS.

RECHARGE RATES AND TIME FRAMES FOR OPERATING INDIVIDUAL INFILTRATION BASINS WILL BE DEPENDENT ON SPECIFIC SOIL AND HYDROLOGIC CHARACTERISTICS OF EACH INFILTRATION BASIN.



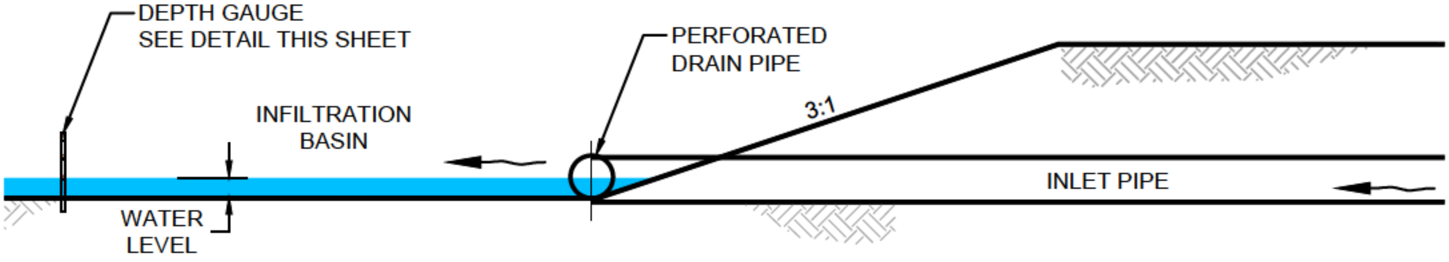
TYPICAL ELEVATION SECTION (A)

HORIZ. 1" = 200'
VERT. 1" = 40'

SOUTH32

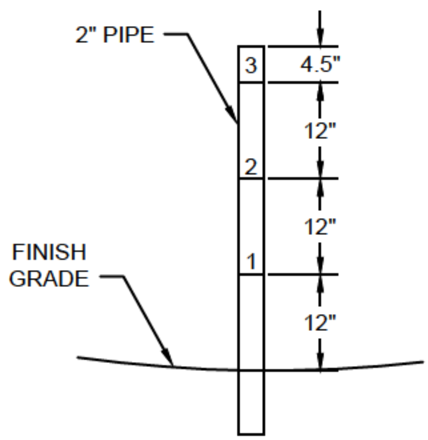
INFILTRATION BASIN TYPICAL DESIGN - ELEVATION VIEW

EXHIBIT 2



TYPICAL INFILTRATION BASIN

NTS



DEPTH GAUGE DETAIL

NTS

SOUTH32

INFILTRATION BASIN TYPICAL
DESIGN - DETAILS

EXHIBIT 3