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Bureau of Land Management

Willow Master Development Plan

Supplemental Environmental Impact Statement

FINAL

Volume 10: Appendices D.2 to D.3

January 2023

Prepared by:

U.S. Department of the Interior
Bureau of Land Management
Anchorage, Alaska

In Cooperation with:

U.S. Army Corps of Engineers
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
Native Village of Nuiqsut
Iñupiat Community of the Arctic Slope
City of Nuiqsut
North Slope Borough
State of Alaska

Estimated Total Costs Associated
with Developing and Producing this SEIS: \$3,350,000



Mission

To sustain the health, diversity, and productivity of the public lands for the future use and enjoyment of present and future generations.

Cover Photo Illustration: North Slope Alaska oil rig during winter drilling.

Photo by: Judy Patrick, courtesy of ConocoPhillips.

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WILLOW MINE SITE MINING AND RECLAMATION PLAN

Prepared for:

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September 2022

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Introduction

Purpose

The Willow Mine Site is required to supply gravel fill material for future development and operational requirements of the Willow Project. The purpose of this document is to establish an integrated mining and reclamation plan for excavation of material from within the mine site area.

The Willow Mine Site Mining and Reclamation Plan was designed to comply with Required Operating Procedures (ROPs) outlined in the NPRA Integrated Activity Plan Record of Decision (USDOI BLM April 2022). This plan complies with the Mitigation Measures adopted in the Willow Master Development Plan (MDP) Environmental Impact Statement (EIS) ROD (BLM 2020a) specifically measure 3: Blasting Hours, measure 7: Ice Infrastructure, and measure 16: Bird Disturbance. In addition, mitigation measures that apply to the Willow MDP will apply to the gravel mine sites. These include control of fugitive dust (Measure 1: Fugitive Dust Control), project lighting (Measure 5: Project Lighting), invasive species prevention (Measure 12: Terrestrial Invasive Species Protections and Measure 14: Aquatic Invasive Species Protections), and vehicle use planning (Measure 18: Vehicle Use Plans).

Operator and Permittee Information

Operator Information

Operator Name: ConocoPhillips Alaska, Inc.
Mailing Address: P.O. Box 100360, Anchorage, AK 99510-0360
Phone Number: (907) 276-1215
Tax Payer ID No.: 94-2700433

Permittee Information

Permittee Name: ConocoPhillips Alaska, Inc.
Mailing address: P.O. Box 100360, Anchorage, AK 99510-0360
Point of contact (POC): Chris Wrobel
POC phone number: (907) 263-4691

Legal Description

Area 1

Legal Description: Umiat Meridian, Township 10N., Range 3E., Sections 11, 12, 13
Latitude: 70.2301° N
Longitude: 151.2788° W

Area 2

Legal Description: Umiat Meridian, Township 10N., Range 3E., Section 11
Latitude: 70.2359° N
Longitude 151.2987° W

Site Description

The Willow Mine Site is located adjacent to the Tiŋmiaqsiuġvik (Ublutuoch) River on the eastern edge of the Greater Mooses Tooth Unit and on un-unitized lands within the National Petroleum Reserve-Alaska (NPR-A), on the North Slope of Alaska. The site currently consists of tundra typical of Alaska's North Slope. Additional information regarding wildlife present in the vicinity and mitigation efforts to reduce, avoid, or minimize impacts to wildlife is described in the Willow Project Environmental Impact Statement. The Willow Mine Site consists of two distinct areas separated by the Tiŋmiaqsiuġvik River: Area 1 is located south of the confluence between Bills Creek and the Tiŋmiaqsiuġvik River. Area 2 is located on the west side of the Tiŋmiaqsiuġvik River, just northwest of Area 1. There are no existing utilities in the vicinity of the mine site.

To support gravel extraction, a total of approximately 187 acres of seasonal ice pads and 10 acres of multi-season ice pads would be used for:

- Storing gravel mining equipment
- Housing construction equipment
- Overburden stockpiles
- Ice pad around the mine site perimeter

The maximum disturbance, including temporary seasonal and multi-season ice pads is 341.7 acres. After mine site reclamation is complete, the maximum final disturbance of the proposed mine site is 144.7 acres.

Access to the mine site will generally be from the northwest and will utilize seasonal ice roads, a permanent gravel access road is not planned. Access points will vary during each construction season, depending on the phasing and development of the mine site.

Equipment and Device List

- | | |
|----------------------------------|---------------------------|
| • Articulating End Dump | • Excavator, 390 |
| • B-70 | • Light Plant |
| • Break Shack | • Loader, 950 |
| • Compactor, IR-SD150D | • Loader, 966 |
| • Compactor, Mikasa, Double Drum | • Loader, 988 |
| • Compressor, IR-XP-1400 | • Pumphouse, Gorman Rupp |
| • Crane, 4100/4600 Manitowoc | • Trimmer |
| • Crusher, Pioneer | • Tucker |
| • Dozer, 10N | • Welder, Lincoln, SAM400 |
| • Dozer, D8 | • Bus, 44 Passenger |
| • Dozer, D9 | • Tractor, Kenworth |
| • Dozer, D5 | • Truck, 5th Wheel |
| • Drill, Blast Hole, DCM2000 | • Truck, Fuel |
| • Excavator, 330 | • Truck, Mechanics |
| • Excavator, 345 | • Truck, P/U, Crew Cab |

- Truck, Powder
- Truck, Tire
- Truck, Volvo A30
- Truck, Flat Bed
- Truck, Lube
- Truck, Water 135bbl
- Truck, Powder
- Heater, 1.2MM BTU
- Roller, 653
- Shop, Portable
- Envirovac
- Trailer, Break
- Trailer, Float
- Trailer, Lowboy
- Trailer, Office
- Trailer, Tanker, Water, 110BBL
- Trailer, Vac, 250BBL
- Trailer, Soils Lab
- Tire Truck
- Chieftan ATV
- Grader, 14H
- Grader, 16G
- Plate Compactor
- Portable Lab Trailer
- Portable Shop, 18'x60'
- Portable Shop, 20'x50'
- Potable Water Truck
- Pumpers
- Pumphouse
- Snowblower
- Skid Steer
- Surface Miner
- Trimmer
- K-Line End Dump
- Vac Truck (sewage)
- Vibratory Roller
- Water Buffalo
- Welding Machine
- Zoom Boom
- Telehandler

General Overview

This section provides a general overview of mine site features and development before detailed descriptions are presented in subsequent sections.

In general, materials at the mine site consist of an organic surface layer overlying an overburden layer consisting of ice, fine sands, and silt. The yield material is beneath the overburden layer, which consists of gravel and gravelly sands. Overburden material will be removed and stockpiled on ice pads adjacent to the excavation prior to extraction of the yield material. The location of the stockpiles will be based on construction sequencing, topography, and existing tundra vegetation to determine the location with least impact. Overburden will not be stockpiled outside of the mine site excavation and perimeter berm boundary during the summer months, see Reclamation Plan for more information.

While mining operations are in progress, a perimeter ice pad will be installed around the excavation limits of the current season to provide access around the active mining area and to assist with removal of fly rock/debris at the end of each construction season. A 'perimeter berm' composed of overburden will be constructed on undisturbed tundra surrounding the mine areas as described below. The perimeter berm will serve to protect the mine site excavation from surface water flowing into the mine, maintain thermal stability of permafrost adjacent to the mine footprint, and create a physical barrier around the mine site.

Background

ConocoPhillips Alaska Inc. (CPAI) is currently in the planning and design stage for the Willow Project,

which consists of multiple drill sites, a processing facility, and other associated infrastructure within the Bear Tooth Unit. The Willow Project will require approximately 4.6 million cubic yards of gravel material, 4.5 million cubic yards of which would be sourced from the Willow Mine Site. The remaining material will be sourced from the KRU mine site and used for Kuparuk road and dock improvements in support of the Willow Project.

Exploration for a suitable material source for the Willow Project has been ongoing since 2017. These exploration efforts discovered the proposed Willow Mine Site described herein. Results from recent geotechnical efforts have also determined that development of both areas within the Willow Mine Site is necessary to provide sufficient gravel for construction of the Willow Project.

The mine site layout will be designed to optimize material extraction while minimizing footprint with a deep excavation targeting the most suitable construction materials. This site will supply the Willow Project with material for a total duration of 7 years.

Limitations

This reclamation plan assumes that the Willow Mine Site will not be expanded beyond the proposed permit boundary. Final reclamation features will depend on the final configuration and the availability of overburden materials, which are not completely known at this time. A survey of mine site topography and water levels will be performed prior to final completion of reclamation activities. If final available overburden quantities differ from current estimates, the reclamation plan will be reviewed and revised accordingly.

Excavation Overview

Goals

Minimizing environmental impact and protecting worker health and safety during construction and mining is of the highest priority in this plan. The layout of the proposed mine aims to maximize access to the most suitable construction materials while minimizing disturbance to the surface. Gravel extraction is optimized based on analysis of the “Willow 2019 Geotechnical Exploration – Mine Site Engineering Report” geotechnical exploration report released October 1, 2019 by PND Engineers, Inc.

General Description of Work

Excavation of gravel at the Willow Mine Site will occur solely within the permitted footprint. The proposed area is covered by a layer of overburden with a thickness varying between 27 to 36 feet in Area 1 and is approximately 25 feet thick in Area 2. Additionally, some portions of Area 1 have interbedded deleterious layers that separate distinct yield layers. These deleterious layers will need to be mined separately from the yield material and stockpiled; this material is not suitable for use either alone or by mixing with other yield material. Generally, the mine site excavation is expected to take place in two distinct removal activities:

- (1) removal of overburden (organic and inorganic);
- (2) removal of suitable gravel material (likely requiring multiple lifts within Area 1)

Where interbedded deleterious material exists within Area 1, additional removal activities will occur to remove the deleterious material and underlying yield material layer. The Mine Site will be excavated with vertical walls and horizontal benches such that the effective side slope is 3H:1V.

All overburden removal and gravel extraction will occur only during the North Slope winter construction seasons; typically, between December and April. Containment such as “duck ponds” will be in place under all parked or idle equipment present during mining operations.

Overburden material will be removed prior to extraction of the underlying yield material. The overburden consists of a thin (1-2 foot) organic layer overlying an inorganic layer. These layers will be removed separately. The organic layer will initially be loosened by using a rotary drum cutter or similar means to remove shallow material. Once loosened, organic materials will be moved within the mine site by any or all of the following equipment: excavator, dozer, and front-end loader. The material will be loaded into haul equipment and relocated to a location where it will be placed and shaped with equipment similar to that used in the mine site. The exact location of overburden placement will vary based on current construction phase and mine site configuration and is described in more detail in the following paragraphs. Inorganic overburden will be removed by drilling and blasting methods. Once loosened, it will be moved, stockpiled and shaped similarly to the methods described above. Similar equipment will be used to mix a portion of the inorganic overburden with the organic overburden that was removed previously. Mixing will occur at a ratio between 3:1 to 5:1 (inorganic to organic overburden) for use as a cap layer on the thermal berms and described in further detail below.

The overburden removal process will occur incrementally as needed over the construction phase of the Willow Project. The area in which overburden is removed is not expected to substantially exceed the expected area to be mined in a particular season. When the mine is initially opened, some overburden material will be used to form the perimeter berms around the planned mine site area (explained in detail below). Overburden will be stockpiled within the permitted mining footprint or placed within a mine area as part of reclamation. Excess overburden remaining after construction of the perimeter berms may be temporarily stockpiled on ice pads adjacent to the mine site area. No overburden will be stockpiled outside of the permitted mining footprint during the summer months. Further information regarding mine site reclamation efforts and overburden stockpiles is described in detail below (see Reclamation Plan).

Gravel extraction will be performed by using either drilling and blasting methods or surface mining techniques and will occur after overburden is removed in a particular area. After loosening the gravel, the materials will be moved within the mine site by any or all of the following equipment: excavator, dozer, and front-end loader. Stockpiling of gravel is generally not anticipated; however, temporary stockpiles may be needed and would be located within the mine pit or within the footprint of road/pad construction. Blending of materials within the mine site may occur as needed to achieve a desired gradation for project use. The material will be loaded into haul equipment and hauled to the Project site for gravel road and pad construction. Capacity of gravel haul equipment ranges between 25 and 50 cubic yards. The estimated number of trips per day are shown in Appendix A. The number of trips shown

is based on conservative estimates previously developed for the Willow Project EIS and derived from the number of equipment spreads expected to be onsite rather than the estimated gravel quantity to be hauled.

If processing excavated materials is required, processing operations would occur within the Willow Mine Site areas.

Mining operations will occur during winter construction seasons. Construction equipment will be mobilized to the site by the contractor from Deadhorse, Nuiqsut, Kuparuk, Alpine, and Fairbanks for use during a given season. During the winter season, construction equipment will be stored on either gravel pads or seasonal ice pads. When a given winter construction season ends, equipment will be demobilized from the mine site. The layout of the mine upon the completion of each season will vary depending on construction phase. During the first two years, while the overburden is stockpiled, it is anticipated that the excavated portion of the mine site will have high walls as indicated by the Typical Mine Site Section shown in the attached figures. During subsequent years, after the overburden stockpiles have been removed and reclamation has begun, the excavated portion of the mine will be a combination of high walls and reclaimed area as shown in the Typical Thermal Berm Section of the attached figures. Minor sloughing is expected to occur during the summer months at high wall areas; however, this is expected to be contained within the mine site footprint and will stabilize upon installation of the overburden thermal berms.

While active mining is underway during the winter season, workers will be housed in a temporary camp located on a seasonal ice pad or other nearby location. This temporary work camp will be transported to the work site at the beginning of the winter season and demobilized at the end of each winter season. The ice pad will be cleaned of all dirt, debris or otherwise deleterious material as part of camp demobilization. Additional reclamation needs for the tundra located below this ice pad are not anticipated. Wastewater will be treated at the camp and disposed offsite at approved disposal facilities or potentially hauled for reuse at the mud plant. Solid waste will be stored in wildlife-proof containers and be recycled or transported to a landfill in Deadhorse, Fairbanks, or Anchorage. The construction ice pad will be used for placing an Envirovac (bathroom), equipment staging, temporary offices, shops, and materials. Approximately 20,000 gallons of fuel will be stored on the construction ice pad. Fuel storage will be in a double wall tank. Fuel storage locations will be located a minimum of 500 feet away from waterbodies. The fuel storage tank(s) will be located within site-erected secondary containment. The secondary containment will be designed according to the existing regulations from Alaska DEC and EPA. Additional details regarding this containment are dependent on the construction contractor performing the work and the fuel storage equipment they will use. These details will be described in a Spill Prevention, Control, and Countermeasure (SPCC) plan for the Project Site. The SPCC, if necessary, will be developed and provided upon its completion.

Refueling of the fuel storage tanks will occur via tanker truck transporting fuel directly to the work site storage tanks. Fuel for equipment will then be transported from the storage tanks to the mine site via a fuel truck. Fuel will be dispensed into the various equipment in a manner compliant with CPAI refueling standards. These standards will be included in the previously discussed SPCC plan. Lubricants and other

maintenance products required for the work will be stored on the construction ice pad in secondary containment such as a spill pallet. Minor maintenance of equipment will occur onsite while using secondary containment. Major maintenance will occur at the Alpine Fleet Maintenance shop or contractor facilities outside of the Willow Project area.

During the years that the mine site is operational, pumping will be required to minimize ponding within the mine. These dewatering activities will generally occur during the late fall or early winter but may occur during the summer if necessary. A significant volume of discharge during dewatering is not anticipated. Dewatering is expected to occur only during years that mining activities are (or will be) taking place. Discharge water will be pumped to the tundra and discharged through a diffuser. Historical experience indicates that certain tundra types are naturally effective at mitigating erosion and filtering turbidity, if any, from discharged water. Dewatering discharge locations will be monitored throughout each 12-hour shift during dewatering activities to inspect for erosion. Additionally, adaptive management will be implemented as needed to adjust the discharge location and could be varied during progression of the work to prevent oversaturation of the tundra or erosion at any one location. Areas of greater topographic relief will be avoided for use as dewatering discharge locations. Should any erosion or turbidity issues be observed, dewatering activities will utilize an adaptive management approach to adjust the discharge location and diffuser as needed to mitigate negative impacts.

Overburden will be used to construct water diversion berms around the perimeter of the mine to minimize the amount of dewatering that is necessary while the mine site is open. These perimeter berms will prevent surface water from flowing into the mine, help maintain thermal stability of permafrost adjacent to the mine footprint and create a protective physical barrier around the mine site to prevent residents from unknowingly entering the mine site (see figures for perimeter berm details and safety signage). Mine Site Area 1 and Area 2 will each have their own perimeter berms. Perimeter berms will be installed upon the opening of their respective mine area. Rather than installing the perimeter berm incrementally around just the section of the mine to be excavated in a particular season, these perimeter berms will surround the entire mine site area except for locations of the future deep-water area outlet and access locations for mining operations (see Figure 1). Perimeter berms will be installed directly on undisturbed tundra. It is estimated that enough overburden will be generated for completion of both perimeter berms after excavating approximately three (3) acres of mine site area. Once reclamation begins, perimeter berms will be incrementally expanded into thermal berms as part of mine reclamation. Thermal berms will fill the mine excavation side slopes and tie into perimeter berms, which will provide an additional thermal barrier to promote stability of the mine walls.

It is anticipated that approximately 4.7 million in-situ cubic yards of overburden and 4.5 million in-situ cubic yards of yield material will be removed from the entire extent of the proposed mine site area for development of ConocoPhillips' proposed project.

CPAI will make monthly payments based on truck count information. Prior to the extraction of yield material and at the end of each mining season, production quantity development and verification will occur by performing an as-built survey of the mine site. As-built survey will be used to verify and reconcile any discrepancies with truck count information and payment. As-built surveys will be certified

by a registered land surveyor or professional engineer and provided to the BLM within a month of survey completion, in PDF and AutoCAD formats.

Drilling and Blasting Procedures

As mentioned, gravel may be excavated using drilling and blasting methods. Blasting will be limited to the hours between 10 am to 8 pm. Details regarding storage and detonation of explosives are being developed and will be finalized after entering into a contract with a construction contractor to complete this work. The notification and road closure guidelines discussed in the following paragraphs are general and will be fully developed prior to blasting and after a construction contractor is under contract.

Prior to blasting, a weekly email will be distributed to the Nuiqsut community with information on blasting, gravel haul and related road closures. Additionally, one-hour prior to blasting, a VHF radio announcement will be provided to Nuiqsut residents, informing them of the upcoming blasting at the mine site.

Ice roads dedicated for gravel haul operations are closed to the public because of safety restrictions. Where restricted roads intersect roads that are open to the public, a full-time attendant is present with a traffic signal. The attendant directs traffic to safely cross the intersection to ensure that members of the public don't accidentally turn onto the restricted roads. Traffic control signals are posted at the intersections of the gravel haul ice road and gravel roads open to the public. The intersections are well-lighted with signage posted.

Thirty minutes prior to blasting, adjacent roads are closed and traffic will be stopped. The closure distance varies depending on the road alignment but is a minimum of 1,500 feet. The road will be closed at this time to ensure that any traffic traveling has enough time to safely proceed through the blasting zone. There are positions (blockers) to block access at key locations to ensure traffic does not proceed into the blast zone once the road has been closed. These positions communicate to the Blaster-In-Charge (BIC) that all vehicles have made it through and are clear of the area. After it is confirmed that all traffic has cleared the area, a sweeper vehicle drives the entire length of the blast zone to re-confirm the area is clear.

Once the shot has fired, the BIC must physically verify that all explosives have detonated. Traffic will be released and the road reopened for travel after the BIC gives the "ALL CLEAR." An example timeline of the blast sequence is outlined below:

- **5:00pm** VHF radio announcement to the community
- **5:30pm** Road Closes
- **5:35pm** Sweeper drives the closed blast zone area and provides a positive notification to the BIC that the area is clear.
- **5:45pm** Call for radio silence is given.
- **5:50pm** BIC Delivers the 10min warning and radios each blocker to verify the area is clear.
- **5:55pm** BIC Delivers the 5min warning and radios each blocker to verify the area is clear.
- **5:59pm** BIC Delivers the 1min warning and radios each blocker to verify the area is clear.

- **6:00pm** BIC Delivers “FIRE IN THE HOLE” call and blast is detonated.
- **6:10 – 6:20pm** BIC verifies the “ALL CLEAR” and instructs blockers to release traffic.

Reclamation Plan

Goals

The goal of this reclamation plan is to apply features similar to those used in other areas of Alaska’s North Slope with emphasis on permafrost and tundra stabilization and revegetation.

General Description of Work

Reclamation of the mine site will begin once excavation has progressed enough to provide room within the excavated area for performing both mining and reclamation activities concurrently. Reclamation materials will include overburden removed during mining activities and clean soils generated during other Willow construction activities such as Vertical Support Member (VSM) installations, construction of boat ramps, etc.

The reclamation plan will minimize tundra impact by stockpiling overburden within the mine site footprints when practicable. Stockpiling overburden outside of the mine site footprint will be necessary when space inside the mine site is not available. All stockpiles temporarily placed outside of the permitted area will be placed on ice pads. Following removal of the ice pads and overburden stockpiles, monitoring and treatment of the underlying tundra will be conducted as described in the attached revegetation plan. This methodology is planned to occur at both Areas 1 and 2.

No overburden will be stockpiled outside of the mine site permit boundary during the summer months. If overburden that is stockpiled within the mine site permit boundary remains in place during the summer, it will be stockpiled in a manner that prevents sloughing beyond the permit boundary. As portions of the mine areas are fully developed (no further mining operations are anticipated), overburden will be moved from the stockpiles into these developed areas as part of reclamation. Ongoing mining efforts may be able to place overburden material directly into previously developed mining areas (this will allow for concurrent mining and reclamation efforts).

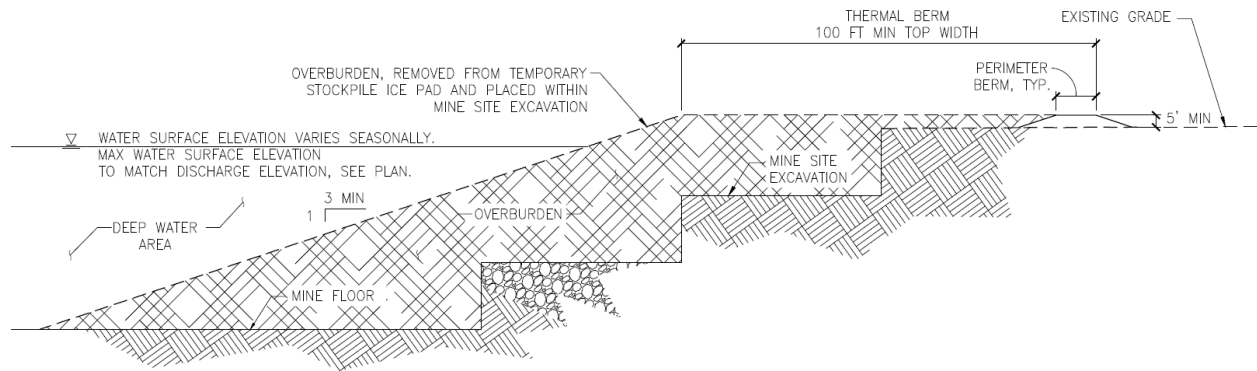
Performing concurrent mining/reclamation efforts will minimize stockpiles outside of the mine area and will reduce double-handling of materials, although in some areas it may still be necessary to temporarily stockpile overburden within the mine site until seasonal mining is complete.

Clean and native material generated during other Willow construction activities such as VSM installations, construction of boat ramps, etc. will be hauled to the mine site as it is generated. Material will be either stockpiled within the mine site footprint or used immediately for reclamation in conjunction with mine site generated overburden (see Reclamation Schedule for more information). All material handling equipment and methods are similar to those described previously.

Placement of overburden for reclamation will occur by expanding the ‘perimeter berms’ such that they are incorporated into the side slope of the mine as a ‘thermal berm’ (as shown below) and in the

attached figures. In areas of the mine that do not have a perimeter berm (i.e., outlet locations), the overburden will be placed along the sidewall to match the natural tundra grade. These berms will be installed to safeguard the stability of the mine walls and create a protective physical barrier around the mine site to prevent local residents from unknowingly entering the mine site. The portion of overburden that consists of mixed organics and inorganics will be used to cap the exposed portion of these thermal berms in a top layer that is a minimum of two feet in thickness.

Proposed Reclamation Section during Deep-Water Recharge



Public Safety

Access to the mine site during operations and reclamation will be strictly limited to those necessary for performance of the work to maintain the safety of the public. Additionally, the perimeter berms constructed around the footprint of each mine area will provide a physical barrier and indication of the mine avoidance area for residents and snow machines. Perimeter berms will be constructed upon opening the mine area (see below description of Perimeter Berms for more information). In addition, safety signage will be installed to provide warning to travelling snow machines (see attached figures for sign details).

Design Elements

Reclamation Area

The reclamation effort will focus on thermal protection of the permafrost near the mine site walls and creation of a deep-water area at the center of the reclaimed mine area. This will occur by placing overburden along the walls to create mine site slopes of 3H:1V. Overburden placement will tie into the perimeter berms that were constructed at the beginning of mine operations.

A project specific Stormwater Pollution Prevention Plan (SWPPP) will be developed for the Willow Project. The scope of the project SWPPP will include the Willow Mine Site and will discuss drainage and erosion control measures relating to mine operations and reclamation. The portion of the SWPPP relevant to the mine site will be provided prior to construction once development of the SWPPP is complete.

Settlement

All areas of overburden placement will be subject to thaw and associated settlement. The degree of settlement is expected to be highly variable and dependent on numerous factors which are difficult to predict or control, including material gradation, ice content of the overburden, thermal exposure and submerged depth. Historical experience indicates that settlement of the overburden after initial placement along the mine site walls may result in limited shallow-water areas which may become potential habitat for waterfowl and shorebirds, depending on the final water surface elevation and thaw consolidation of overburden. However, the creation of this habitat is not the primary objective. Historical mine site reclamation efforts have shown that focus on thermal stability along the mine walls provides greater benefit to the area.

Water Recharge

Prior to mine closure, water levels will be maintained (reduced) via pumping as needed for mine access and operation. Mining operations within the Willow Mine Site are planned to continue for a duration of approximately 7 years and will occur in phases as gravel materials are needed. The entire mine site perimeter berm will be constructed during the first mining season, and will remain in place through the reclamation process.

The perimeter berm is intended to prevent surface water flow into the mine as surface water flows have shown to cause accelerated thermal erosion and thaw degradation. This occurs as a water flow channel cuts into the thaw sensitive overburden and ice wedges.

After mining operations are complete and prior to full recharge, minor erosion may occur along the mine side slopes located within the mine; however, this erosion will be contained within the reclaimed mine site footprint, undisturbed tundra should not be affected, and the erosion will stabilize once the mine site has been fully recharged.

Mine site recharge is expected to occur naturally via precipitation and collection of meltwater from snow drifts within the mine area. The duration required to fully recharge the mine site is unknown at this time but expected to be approximately a decade or more.

Deep-Water Area

The combined deep-water areas are expected to be approximately 125 acres in total. The depth will vary throughout the area. The maximum depth of the deep-water area is expected to be approximately 70 feet in Area 1 and approximately 50 feet in Area 2, with the majority of the area greater than 30 feet in depth in both areas. Overburden material will be used to ensure all mine site slopes are a maximum steepness of 3H:1V.

Material Sources

Overburden removed during mining operations and other Willow construction activities will provide all of the reclamation materials. Revegetation materials and techniques are described in the attached revegetation plan.

Perimeter Berms

The volume of material to be used for construction of the perimeter berms is expected to be approximately 80,000 cubic yards. The berms will be a minimum of 5 ft above existing grade, 15-feet wide at the top, and will have 3:1 side slopes (see attached figures for more information). The top of the perimeter berms will follow a minimum of 5 ft above the natural ground topography.

Access

The access roads into the mine site will be seasonal ice roads. These roads are constructed during the winter months after the tundra has reached the frost depth required for tundra approved vehicle use. Initial construction begins with the compaction of snow cover into a compact base. Ice chips are mined from lakes in locations with grounded ice. Water is hauled from lakes with a depth exceeding that of the naturally occurring ice thickness. Ice chips and water are laid in alternating fashion and graded similarly to that of a traditional gravel road. Once the desired ice road thickness has been achieved, road side delineators and traffic signage will be installed. Equipment used for this work is listed above. The location and layout of these roads will vary season to season as the mine site is developed, but approximate locations are shown in the attached figures. Summer access will be provided via helicopter to perform mine site dewatering as needed. If dewatering is performed during the early winter, access will occur via tucker and rolligon after tundra travel is approved for the applicable season.

Water Level Maintenance

As long as the Willow Mine Site is in operation, the water level in each mine area will be maintained by pumping. This is necessary to prevent movement of water into the active mine areas. After closure of the mine, it is expected that recharge will occur by precipitation and snow drifts collecting within the reclaimed mine footprint. After each mine area is closed and recharged, the water level will be maintained naturally as water can freely drain from the low point of the mine perimeter (see Figure 3). The perimeter berms will not be constructed in these low points, creating outlets that will allow water to flow to the natural tundra. However, overburden will still be used for thermal protection of the mine site walls in these areas during reclamation (see Figure 4). The system of discharge will be similar to discharge that occurs from a natural lake, with water overtopping the lake bank and flowing across tundra to a nearby stream. As with natural lakes in the region, maximum flows are expected to occur once per year during spring break up. Significant releases are not expected during other times of the year. Summer releases are expected to be infrequent and/or insignificant due to low summer precipitation rates typical of the North Slope. The estimated total volume of overflow during spring break up is 28.7 acre-feet for Area 1 and 8.6 acre-feet for Area 2. These values are derived from USDA SNOTEL (snow telemetry) information for Site 1177 in Deadhorse and assumes that all precipitation between October 1st and May 31st is snow. Note that precipitation/snowfall data are not well known for the mine site area and actual volumes may vary from this estimate. This estimate does not account for sublimation/evaporation losses, or any changes due to snow drifting.

The outlet locations will provide for a slow and widely dispersed flow across the natural tundra. The intent is to maintain the natural tundra in the area to the extent possible and utilize an adaptive management approach to address any issues that may arise. Current data indicates that the gradient of

the Area 1 runoff area is between 0.5%-2% for the first 400 feet and gradually increases to 4% slope thereafter. Current Area 2 data indicates that the runoff area gradient for Area 2 is between 0.5%-2.5%. Both runoff areas utilize natural, undisturbed tundra. The approximate lengths of the runoff areas are shown on Figure 3.

CPAI will perform a detailed survey of the outlet area in the field to confirm this design, or to revise it if necessary. The survey will look for existing channels or other features that could be susceptible to erosion. If modification to the area is deemed necessary, the design for the outlet area will be updated and submitted to BLM for approval. Note, drainage from the mine is not anticipated to occur for 10 or more years after completion of mining operations because the reclaimed mine areas are expected to fill slowly. Additionally, the deep-water areas are expected to function as sedimentation ponds. Introducing sediment to the nearby creeks is not expected to occur as a result of overflow drainage from the deep-water areas. This concept uses an adaptive management approach, common at other North Slope rehabilitation sites and mine sites.

Reclamation Schedule

Current plans for the operation and maintenance of the Willow Project indicate that the Willow Mine Site will be active for approximately 7 years. It is expected that mining operations required to meet the Project needs will exhaust the mine site's deposit of yield material. Mining is planned to begin in Mine Site Area 2. Anticipated mining area and volumes for each construction season is shown in the below schedule. Area 1 will be opened during the second year of construction.

Anticipated Mining and Reclamation Schedule

Mine Site Area	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Area 1	NA	Open/Mine	Mine and Reclamation	Mine and Reclamation	NA	NA	Mine and Reclamation
Area 2	Open/Mine	Mine and Reclamation	NA	NA	NA	NA	NA
Approx. Gravel Volumes (CY)	188,000	1,238,500	1,349,500	1,219,000	NA	NA	435,000
Est. Acreage	10	40	41	40	NA	NA	14

To the extent practical, reclamation activities will occur during the operation of the mine. Examples (described above) include constructing the perimeter berm and thermal berms over the excavated walls as space becomes available within the excavated area. Newly excavated walls may remain in place through up to two summer seasons before thermal berms are constructed to cover them as part of reclamation efforts.

Clean-up

Following completion of mining operations and reclamation effort, all equipment and waste materials, including food waste, non-burnable and burnable waste, and other hazardous or solid waste will be removed from the Project site. Waste materials will be brought to a permitted disposal location. Food

and burnable waste will be incinerated at the Alpine Central Processing Facility (ACF) or the Willow Operations Center (WOC). Non-burnable waste will be recycled or transported to a landfill located in Deadhorse, Fairbanks, or Anchorage. Other hazardous or solid waste will be managed under Alaska Department of Environmental Conservation (ADEC) and U.S. Environmental Protection Agency (EPA) regulations in addition to applicable BLM ROPs.

Reclamation Monitoring

Reclamation Construction

A CPAI representative with knowledge of the reclamation intent will monitor the construction of the reclamation features. The individual will work with the construction supervisor to address any issues that may arise and ensure that reclamation efforts are performed in accordance with the intent of this Mining and Reclamation Plan.

Post Construction

After final reclamation activities are completed, a CPAI mining and reclamation representative will monitor the reclaimed site for erosion and thermal degradation in conjunction with other monitoring activities called out in Appendix B – Revegetation Plan. Baseline environmental conditions are described in the Willow Project EIS. Monitoring of vegetated areas is discussed in the attached revegetation plan.

Appendix A – Traffic Counts

Willow Mine Site Plan
Mining and Reclamation Plan

Table 1: Ice Roads & Pads – Vehicle Trips per Year

Vehicle	Vehicle Type	Y1	Y2	Y3	Y4	Y5	Y6	Y7
Bus	Intercity Bus	2,520	5,040	8,820	7,560	10,080	5,040	2,520
Fuel Truck	Single Unit Short Haul Trucks	2,520	5,040	8,820	7,560	10,080	5,040	2,520
K-Line End Dump	Single Unit Short Haul Trucks	5,054	10,080	17,640	15,120	20,160	10,080	5,040
Mechanic Truck	Single Unit Short Haul Trucks	1,260	2,520	4,410	3,780	5,040	2,520	1,260
Pickup	Passenger Trucks	15,120	30,204	52,920	45,360	60,480	30,240	15,120
Truck, Water 135bbl	Single Unit Short Haul Trucks	6,720	13,440	23,520	20,160	26,880	13,440	6,720
Water Buffalo	Single Unit Short Haul Trucks	2,520	5,040	8,820	7,560	10,080	5,040	2,520

Table 2: Gravel Roads & Pads – Vehicle Trips per Year

Vehicle	Vehicle Type	Y1	Y2	Y3	Y4	Y5	Y6	Y7
B-70	Single Unit Short Haul Trucks	16,800	16,800	50,400	33,600	0	0	16,800
Bus, 44 Passenger	Intercity Bus	3,360	3,360	10,080	6,720	0	0	3,360
Truck, 5th Wheel	Combination Short Haul Trucks	560	560	1,680	1,120	0	0	560
Truck, Fuel	Single Unit Short Haul Trucks	1,680	1,680	5,040	3,360	0	0	1,680
Truck, Mechanics	Single Unit Short Haul Trucks	1,680	1,680	5,040	3,360	0	0	1,680
Truck, P/U, Crew Cab	Passenger Trucks	3,920	3,920	11,760	7,840	0	0	3,950
Truck, Powder	Light Commercial Trucks	1,120	1,120	3,360	2,240	0	0	1,120
Truck, Tire	Single Unit Short Haul Trucks	1,120	1,120	3,360	2,240	0	0	1,120
Truck, Volvo A30	Single Unit Short Haul Trucks	3,360	3,360	10,080	6,720	0	0	3,360

NOTE: The vehicle traffic trips provided are based on and consistent with the traffic values in the Willow MDP Supplemental EIS. The ice road and pad vehicle trips include vehicle traffic to support ice road construction and maintenance for gravel mining and gravel haul, as well as other infield construction activities, such as pipeline construction. The equipment listed is typical for the planned scope of work, and the exact equipment information may vary based on the construction contractor's fleet and execution plan.

Appendix B – Revegetation Plan

REVEGETATION PLAN FOR THE PROPOSED WILLOW GRAVEL MINE SITE, NATIONAL PETROLEUM RESERVE-ALASKA

Prepared for **ConocoPhillips Alaska, Inc.**

by **ABR, Inc.—Environmental Research and Services**

Revised September 14, 2022

INTRODUCTION

ConocoPhillips Alaska, Inc. (CPAI) is proposing to develop a gravel mine site to support operations associated with the Willow Project, which is located in the northeast portion of the National Petroleum Reserve in Alaska (NPR-A). The structure of this plan complies with the requirements of the Bureau of Land Management Mining Plan checklist.

The location planned for the mine site is approximately 6 miles northwest of the community of Nuiqsut and near the Tinmiaqsiugvik (Ublutuoeh) River. The maximum area to be disturbed is estimated at 341.7 acres, including 2 excavated pits with a combined area of 144.7 acres, approximately 10 acres of multi-season ice pads (ice pads that will remain in place for 1–2 growing seasons), and approximately 187 acres of seasonal ice pads (see Figure 3 in Mining and Reclamation Plan). Vegetation in the vicinity is mostly tussock tundra and moist sedge-shrub tundra; fresh sedge marsh and wet sedge meadow tundra are present in lesser amounts. Access to the site will be primarily via a winter ice road, with minor helicopter access during summer to dewater the pit. Excavated overburden will be stored on multi-season ice pads within the mine site permit boundary, before being used to construct a perimeter berm and a thermal barrier/berm around each mine area (i.e., pit). Berms will not be constructed in the water discharge areas on the northwest side of Mine Area 1 and near the southeast corner of Mine Area 2 (see Figure 3 in Mining and Reclamation Plan).

Overburden placement for the thermal berm will tie into the perimeter berms that were constructed at the beginning of mine operations. The perimeter berm is intended to serve 2 purposes: to minimize surface drainage into the pit during active mining and to enhance safety

for people traveling in the area by providing a physical barrier around the pit. The purpose of the thermal berm is to prevent the degradation of permafrost by covering the walls of the pit and the tundra between the mine walls and perimeter berm with insulating material (3H:1V slopes). The upper portion of the thermal berm side slope may be constructed at a less steep angle to aid vegetation establishment and improve habitat for waterfowl. The berms will remain in place after mining is complete.

This revegetation plan is intended to accompany the Mining and Reclamation Plan. The plan focuses on the thermal berms, but also addresses the possibility that revegetation may be needed for tundra affected by the multi-season ice pads. The deep-water pits are not included in the revegetation plan, as the water in the pits is expected to be too deep to support rooted plants.

Due to uncertainties about how site conditions will develop over time, flexibility is needed with respect to the objectives and scheduling. This flexibility will allow response to unanticipated site changes while maintaining the overall rehabilitation goals and objectives. This adaptive management approach will allow for revisions to the schedule and treatment approaches as needed to address changing site conditions.

GOALS AND OBJECTIVES

THERMAL BERMES

The primary rehabilitation goal for the berms is to promote thermal stability of the sidewalls and shorelines of the flooded pits. The objective of the revegetation effort is to promote the establishment of indigenous vegetation in selected locations where conditions are suitable, to the extent feasible while achieving the primary rehabilitation goal.

To provide sufficient insulation value to achieve the primary goal, the final surface elevation of the berms will be approximately 5 feet above the grade of nearby tundra. The top 2–3 feet of material on the berms will consist of a mixture of organic and mineral overburden, to improve soil properties, including water holding capacity. However, soil moisture is not expected to be adequate to support substantial vegetation cover, for several reasons:

- Due to the thickness of the berms, there will be no hydrological connection between the plant rooting zone and the local groundwater supply.
- Rainfall during the growing season on the North Slope is low, and water loss through evaporation typically exceeds input from precipitation.

- Water from spring snowmelt will mostly be lost to runoff because the soil is frozen at that time of year and roots are unable to absorb moisture.

Thus, the potential for vegetation to establish on most of the berm area will likely be limited for the foreseeable future, as a direct consequence of leaving a thick layer of insulating material in place to protect the thermal stability of the shorelines and sidewalls. Accordingly, the proposed performance standards for vegetation are modest, consistent with similar rehabilitated North Slope sites: 1) total live cover of indigenous vascular plants $\geq 10\%$ and 2) ≥ 5 indigenous vascular species present with $\geq 0.2\%$ cover each. Plant cover will be measured using the any-hit metric, where one “hit” is recorded for each vascular plant species present at each sampling point. This metric ensures that growth forms potentially excluded by sampling only the top canopy (e.g., small forbs, dwarf shrubs) are included in cover estimates. The target is to achieve these standards within 10 years after the activities described in the Mining and Reclamation Plan are completed (see Table 1). These levels of cover and diversity are not intended to indicate that vegetation development on the berms is complete; rather, achieving these standards will indicate that recovery is on a positive trajectory and no additional treatment or monitoring is needed.

TUNDRA AFFECTED BY ICE PADS

The revegetation objective for tundra affected by the multi-season ice pads is to promote the re-establishment of a plant community similar to that present before the ice pads were constructed, through natural recovery and/or plant cultivation treatments. The condition of the underlying tundra will be assessed near the end of the second growing season after the ice pads have melted, to determine whether the impacts warrant further monitoring and/or revegetation treatment. If treatments are applied to any tundra areas affected by the ice pads, the proposed performance standard for these areas is total live cover of vascular plants $\geq 50\%$ of that in adjacent undisturbed tundra that is representative of pre-disturbance conditions (reference tundra). Plant cover will be measured using the any-hit metric (see details above under THERMAL BERMS). The target is to meet this standard within 10 years after removal of overburden from the ice pads is complete (see Table 2). This level of vascular plant cover is not intended to indicate that vegetation recovery on tundra affected by ice pads is complete; rather, achieving the standard will indicate that recovery is on a positive trajectory and no additional treatment or monitoring is needed.

REVEGETATION TREATMENTS

THERMAL BERMES

Site conditions, including soil moisture and natural colonization by indigenous plants, will be assessed near the end of the second growing season after activities described in the Mining and Reclamation Plan are complete (Year 2), to allow time for the surface to stabilize (see Table 1). The results of this assessment will be used to finalize planning of plant cultivation treatments for the berms. As explained above, conditions are expected to be too dry for substantial plant establishment on most of the berm area, due to the need for a thick insulating layer to protect thermal stability. Moist soil conditions may develop along the shoreline on the southeast, southwest, and/or northeast sides of Area 1, providing a more favorable environment for plant growth. Soil moisture may also be moderate on the lower (approximately 1 foot) portion of the berm side slope, due to capillary rise from groundwater in the adjacent tundra. To increase the potential for successful revegetation, plant cultivation treatments may vary within the thermal berms to reflect variation in site conditions, particularly soil moisture. Treatments would be applied in Year 4, allowing seed of suitable species to be collected in Year 3.

Seed of indigenous North Slope plants is not available commercially but can sometimes be provided in limited quantities by the Alaska Plant Materials Center (APMC) or can be obtained by collecting from nearby natural populations. Species used near the shoreline or in other areas with wet soil likely will include sedges such as *Carex aquatilis* (water sedge), *C. maritima* (curved sedge), and *Eriophorum angustifolium* (tall cottongrass) and/or willows (*Salix* spp.). Forbs such as *Epilobium latifolium* (river beauty), *Artemisia* spp. (sage), and *Oxytropis* spp. (oxytrope) and/or the evergreen shrub *Dryas integrifolia* (entire-leaf mountain avens) may be seeded on the drier portions of the berms. Seeding likely will not be needed on the lower portion of the outer side slope; conditions in this area are expected to be favorable for natural colonization from the adjacent tundra. If time permits, seeds will be sent to the APMC for cleaning and germination testing, which will allow for the accurate calculation of seeding rates for each species (i.e., live seeds applied per unit area). Cleaned seed will be stored in a freezer at ABR (Fairbanks, AK) until needed.

In addition to seed, locally collected plugs of wetland vegetation (e.g., *C. aquatilis*) may be transplanted in locations where the moisture regime is suitable for wetland vegetation to establish. Plugs of the aquatic emergent grass *Arctophila fulva* (pendant grass) may be

transplanted if areas with shallow standing water develop within the berm areas. Stem cuttings of willows (*Salix* spp.) may be transplanted at selected locations where soil conditions are moist to wet.

All seeds or live plant materials would consist of indigenous species collected from native populations on the North Slope. Depending on the locations of source populations, appropriate permits would be obtained from the Bureau of Land Management (BLM), the Alaska Department of Natural Resources (DNR) and/or the North Slope Borough (NSB).

This plan does not include seeding commercially available native-grass cultivars on the berms. There are several reasons to avoid this revegetation technique:

- Seeding grasses is not expected to contribute to thermal stability; the insulation value of intact tundra vegetation is provided by the surface mat of decomposing organic matter, which requires decades to develop. The living canopy and standing dead plant material have a negligible effect on the soil heat balance.
- These grasses require high nutrient levels. Unless fertilizer application is repeated every 3–5 years, they typically begin to die back, resulting in a canopy consisting primarily of dead plant material.
- Heavy grass cover, living and/or dead, may inhibit the development of a plant community dominated by local tundra species.
- All commercially produced seed may include a small percentage of weed seed, creating a risk of introducing non-native and potentially invasive plant species. Management of invasive species for the Willow project will be addressed in a separate plan.

TUNDRA AFFECTED BY ICE PADS

The revegetation approach for tundra affected by ice pads will vary depending on the severity of the impacts, which will be assessed separately for each ice pad. If impacts are negligible, no treatments will be applied. Areas where impacts are noticeable, but vegetation is largely intact, will be treated with fertilizer to promote natural recovery. If any tundra areas show sufficient impacts that natural recovery is not expected to meet the performance standards within 10 years, fertilizer and plant cultivation treatments will be applied. Depending on site conditions (e.g. hydrology, remaining vegetation cover), treatments could include seeding indigenous tundra plants such as *C. aquatilis* and *E. angustifolium* and/or transplanting tundra plugs. All seeds or live plant materials would consist of indigenous species collected from local populations, under

appropriate permits from DNR, BLM, and/or NSB. This plan does not include seeding commercially available native-grass cultivars, for the reasons explained above (THERMAL BERMS).

MONITORING

Development of stable landforms and diverse plant communities on rehabilitated North Slope sites frequently requires many years. Therefore, this plan includes a multi-year monitoring period to assess whether the revegetation objectives have been met.

THERMAL BERMS

Qualitative assessments of surface stability and vegetation response are planned for Years 2, 3, 4, 7 and 10 after activities described in the Mining and Reclamation Plan are complete (Table 1). Permanent photo points will be established in Year 2 and photographs will be taken from the same points in each monitoring year, to allow tracking of visible changes over time. Quantitative vegetation monitoring will be conducted in Years 4, 7 and 10 to assess progress toward meeting the performance standards.

TUNDRA AFFECTED BY ICE PADS

An initial qualitative assessment of site conditions and vegetation health will be conducted in Year 2 after activities described in the Mining and Reclamation Plan are complete (Table 2), to assess whether any revegetation treatments are needed. Permanent photo points will be established to allow tracking of visible changes over time. The qualitative assessment, including repeat photographs from the permanent photo points, will be repeated in Years 3, 4, 7, and 10. If revegetation treatments (fertilizer or plant cultivation) are applied to any tundra areas affected by the ice pads, quantitative vegetation monitoring will be conducted in Years 7 and 10 to assess progress toward meeting the performance standard.

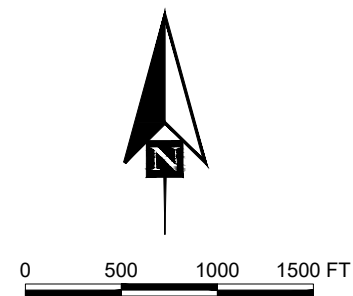
Table 1. Schedule for revegetation treatments and site monitoring for the thermal berms, Willow Mine Site, National Petroleum Reserve-Alaska. For each mine area, Year 2 is defined as the second growing season after activities described in the Mining and Reclamation Plan are complete.

Schedule	Treatment and Monitoring
Year 2	<ul style="list-style-type: none"> • qualitatively assess site conditions, including soil moisture, surface stability and natural colonization by indigenous plants • establish permanent photo points for tracking visible changes over time
Year 3	<ul style="list-style-type: none"> • qualitatively assess site conditions, including soil moisture, surface stability and natural colonization by indigenous plants • take repeat photographs from permanent photo points • collect seed of indigenous vascular species for use in Year 4
Year 4	<ul style="list-style-type: none"> • qualitatively assess surface stability and natural colonization by indigenous vegetation • apply plant cultivation treatments (seeding and transplanting plugs) if needed • collect and apply additional seed if needed • take repeat photographs from permanent photo points • quantitatively monitor vegetation cover and diversity
Year 7	<ul style="list-style-type: none"> • qualitatively assess surface stability and vegetation response • take repeat photographs from permanent photo points • quantitatively monitor vegetation cover and diversity
Year 10	<ul style="list-style-type: none"> • qualitatively assess surface stability and vegetation response • take repeat photographs from permanent photo points • quantitatively monitor vegetation cover and diversity

Table 2. Schedule for revegetation treatments and site monitoring for tundra affected by multi-season ice pads, Willow Mine Site, National Petroleum Reserve-Alaska. Year 2 is defined as to the second growing season after removal of the overburden from each ice pad is complete.

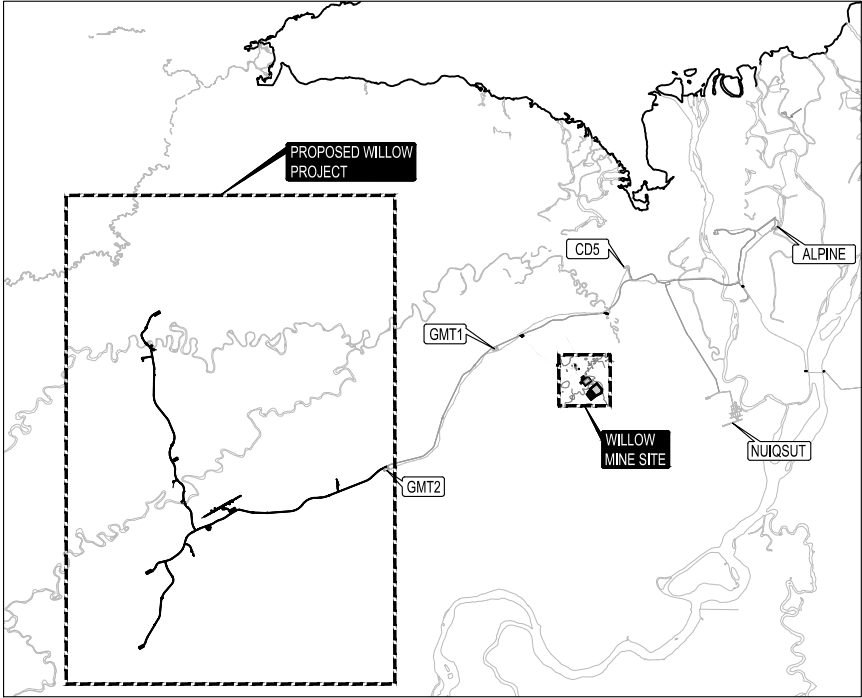
Schedule	Treatment and Monitoring
Year 2	<ul style="list-style-type: none"> • qualitatively assess surface stability and vegetation response; determine whether any areas require treatment • establish permanent photo points for tracking visible changes over time
Year 3	<ul style="list-style-type: none"> • qualitatively assess surface stability and natural vegetation recovery • take repeat photographs from permanent photo points • apply fertilizer to any areas that will be treated with fertilizer only • if needed, collect seed of indigenous vascular species for use in Year 4
Year 4	<ul style="list-style-type: none"> • qualitatively assess surface stability and natural vegetation recovery • apply plant cultivation treatments (seeding and transplanting plugs) if needed • collect additional seed if needed • take repeat photographs from permanent photo points
Year 7	<ul style="list-style-type: none"> • qualitatively assess surface stability and natural vegetation recovery • take repeat photographs from permanent photo points • quantitatively monitor vegetation response in any treated areas and in reference tundra
Year 10	<ul style="list-style-type: none"> • qualitatively monitor site stability and vegetation response • take repeat photographs from permanent photo points • quantitatively monitor vegetation response in any treated areas and in reference tundra

Figure 1 – Willow Mine Site Overview Plan and Vicinity Map

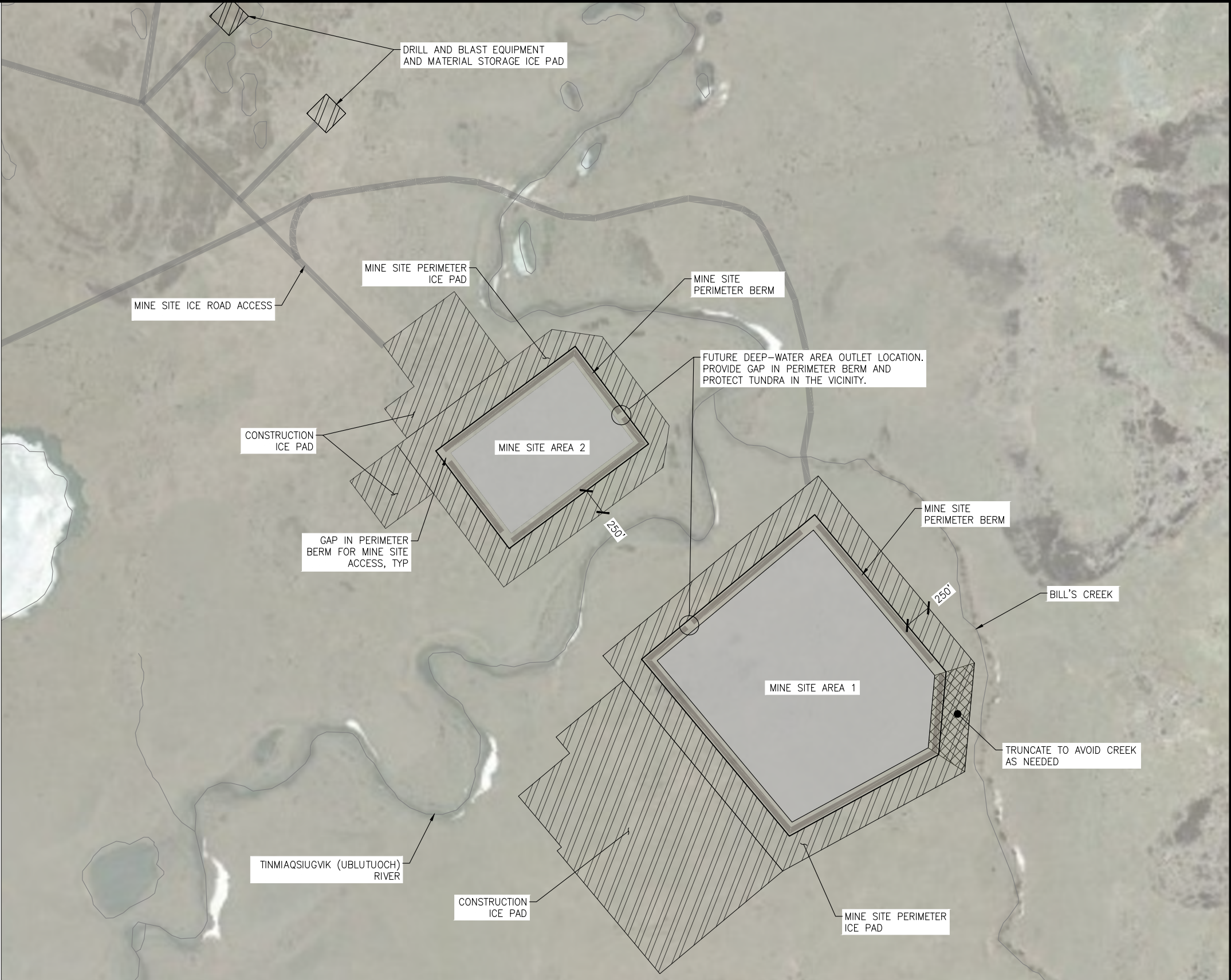


WILLOW MINE SITE QUANTITIES	
MINE SITE AREA 1 FOOTPRINT	104.3 AC
MINE SITE AREA 1 QUANTITY OF GRAVEL (AVAILABLE)	3.6 MMCY
MINE SITE AREA 2 FOOTPRINT	40.4 AC
MINE SITE AREA 2 QUANTITY OF GRAVEL (AVAILABLE)	0.9 MMCY
COMBINED MINE SITE FOOTPRINT	144.7 AC
COMBINED SEASONAL ICE PAD FOOTPRINT	187± AC
COMBINED MINE SITE QUANTITY OF GRAVEL (AVAILABLE)	4.5 MMCY

- NOTES:
1. GRAVEL IS PLANNED TO BE SOURCED FROM BOTH MINE SITE AREA 1 AND AREA 2 TO PROVIDE GRAVEL NEEDED FOR PROJECT.
 2. OVERBURDEN ICE PADS SIZED TO ACCOMMODATE 50% OF ESTIMATED OVERBURDEN QUANTITY.
 3. CONFIGURATION OF ICE ROAD ACCESS, ICE PADS AND MINE SITE RAMP ACCESS IS APPROXIMATE. ACTUAL CONFIGURATION SUBJECT TO CHANGE AS MINE DEVELOPMENT PROGRESSES.



WILLOW MINE SITE VICINITY MAP



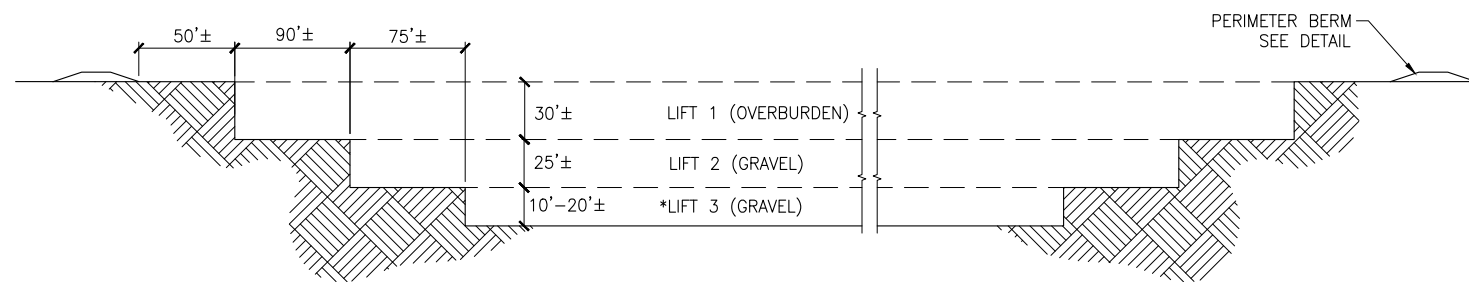
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PROJECT:		WILLOW PROJECT	
TITLE:		MINING AND RECLAMATION PLAN	
DESIGNED BY:		MJD	
CHECKED BY:		DST	
DATE:		9/15/22	
PROJECT NO:		171012	

FIGURE 1

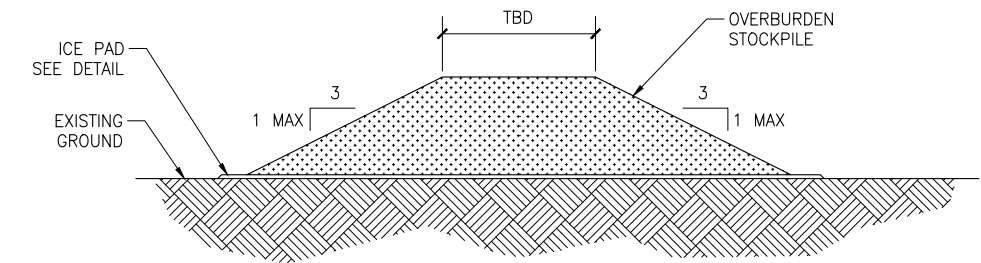
Figure 2 – Willow Mine Site Typical Sections



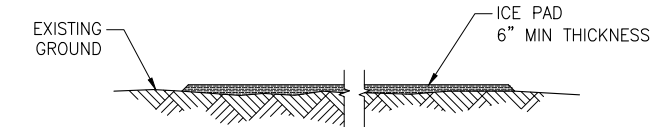
TYPICAL MINE SITE SECTION

NOTES:

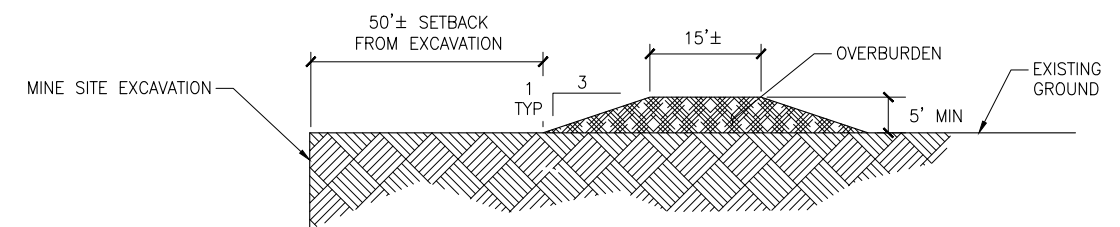
1. LIFT THICKNESSES WILL VARY DEPENDING UPON LOCATION WITHIN MINE SITE.
2. *LIFT 3 (GRAVEL) WILL BE EXCAVATED WHERE BOREHOLE DATA INDICATES SUITABLE GRAVEL FILL MATERIALS. A LAYER OF DELETERIOUS MATERIAL MAY NEED TO BE REMOVED BETWEEN LIFTS 2 AND 3.



**TEMPORARY OVERBURDEN STOCKPILE
TYPICAL SECTION**



TYPICAL ICE PAD



TYPICAL PERIMETER BERM

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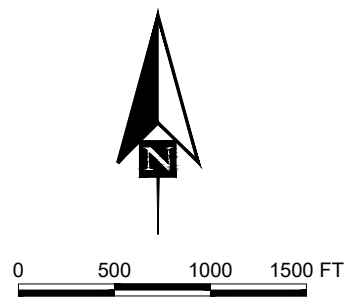
**WILLOW PROJECT
MINING AND RECLAMATION PLAN**

WILLOW MINE SITE TYPICAL SECTIONS

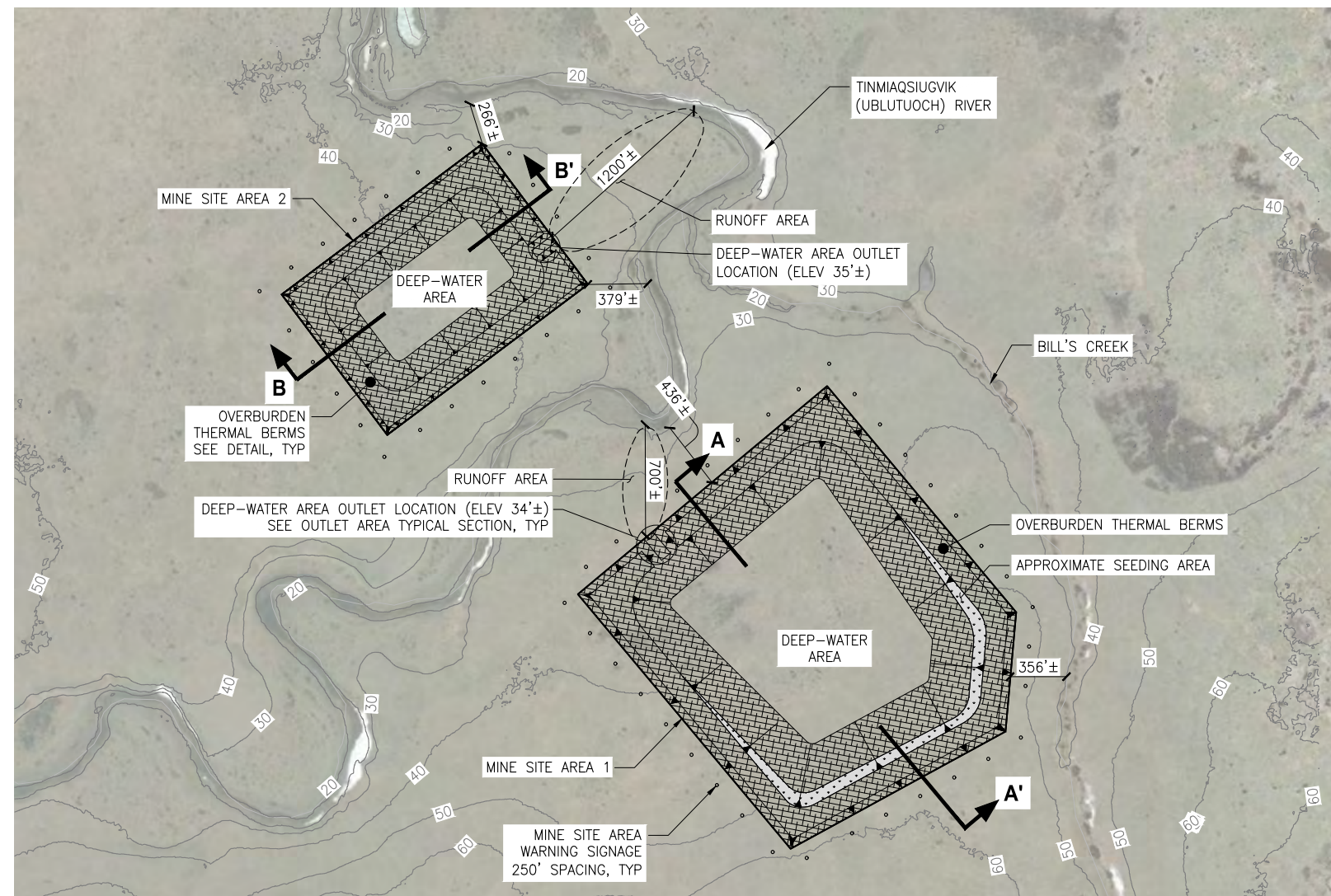
DESIGNED BY: MJG DATE: 9/15/22
CHECKED BY: DST PROJECT NO: 171012

FIGURE 2

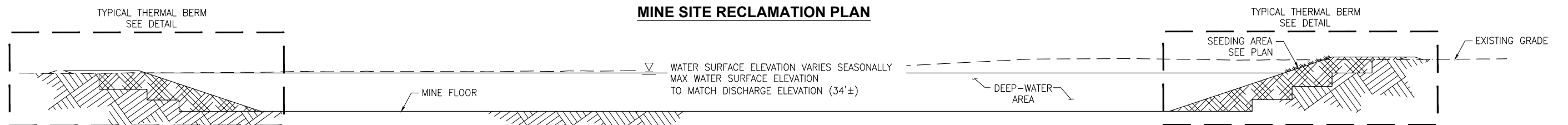
Figure 3 – Willow Mine Site Reclamation Plan and Sections



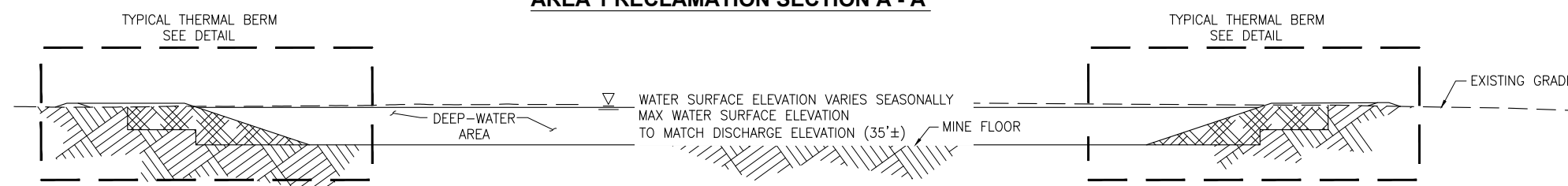
- NOTES:
1. MINIMUM THERMAL BERM TOP WIDTH IS 100 FT. CONSTRUCTED WIDTH OF THERMAL BERMS WILL VARY DEPENDING ON QUANTITY OF OVERBURDEN AVAILABLE AND AMOUNT OF THAW CONSOLIDATION.
 2. DEPTH OF DEEP-WATER AREA WILL VARY BY LOCATION WITHIN THE MINE AREA. IT IS EXPECTED THAT MOST OF THE AREA WILL BE GREATER THAN 30 FT IN DEPTH. THE MAXIMUM EXPECTED DEPTH IS APPROXIMATELY 70 FT.
 3. SEE FIGURE 5 FOR (APPROXIMATE) PROPOSED CONTOURS.



MINE SITE RECLAMATION PLAN



AREA 1 RECLAMATION SECTION A - A'



AREA 2 RECLAMATION SECTION B - B'

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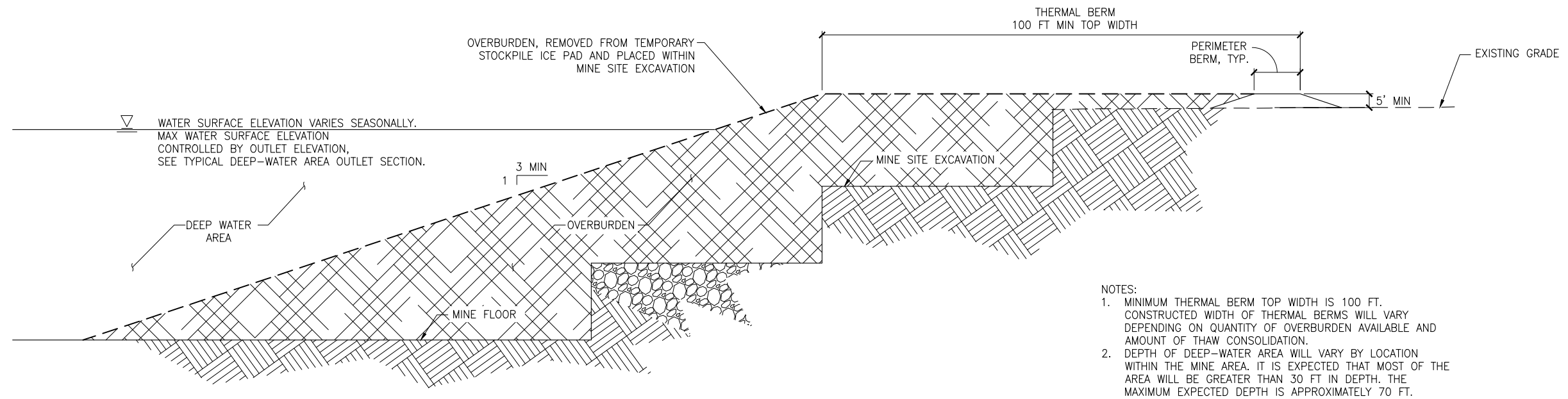
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ENGINEERS, INC.

WILLOW PROJECT
MINING AND RECLAMATION PLAN
TITLE: **WILLOW MINE SITE RECLAMATION PLAN**
AND SECTIONS

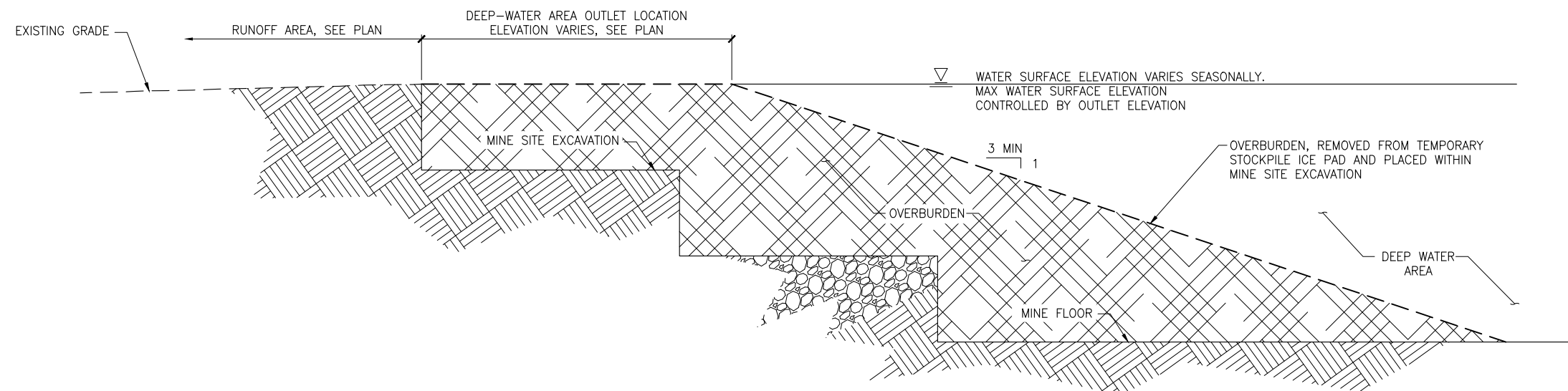
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FIGURE 3

Figure 4 – Willow Mine Site Reclamation Typical Sections



TYPICAL THERMAL BERM SECTION



TYPICAL DEEP-WATER AREA OUTLET SECTION

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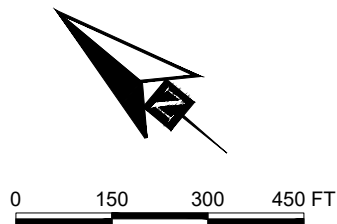
**WILLOW PROJECT
MINING AND RECLAMATION PLAN**

**WILLOW MINE SITE RECLAMATION
TYPICAL SECTIONS**

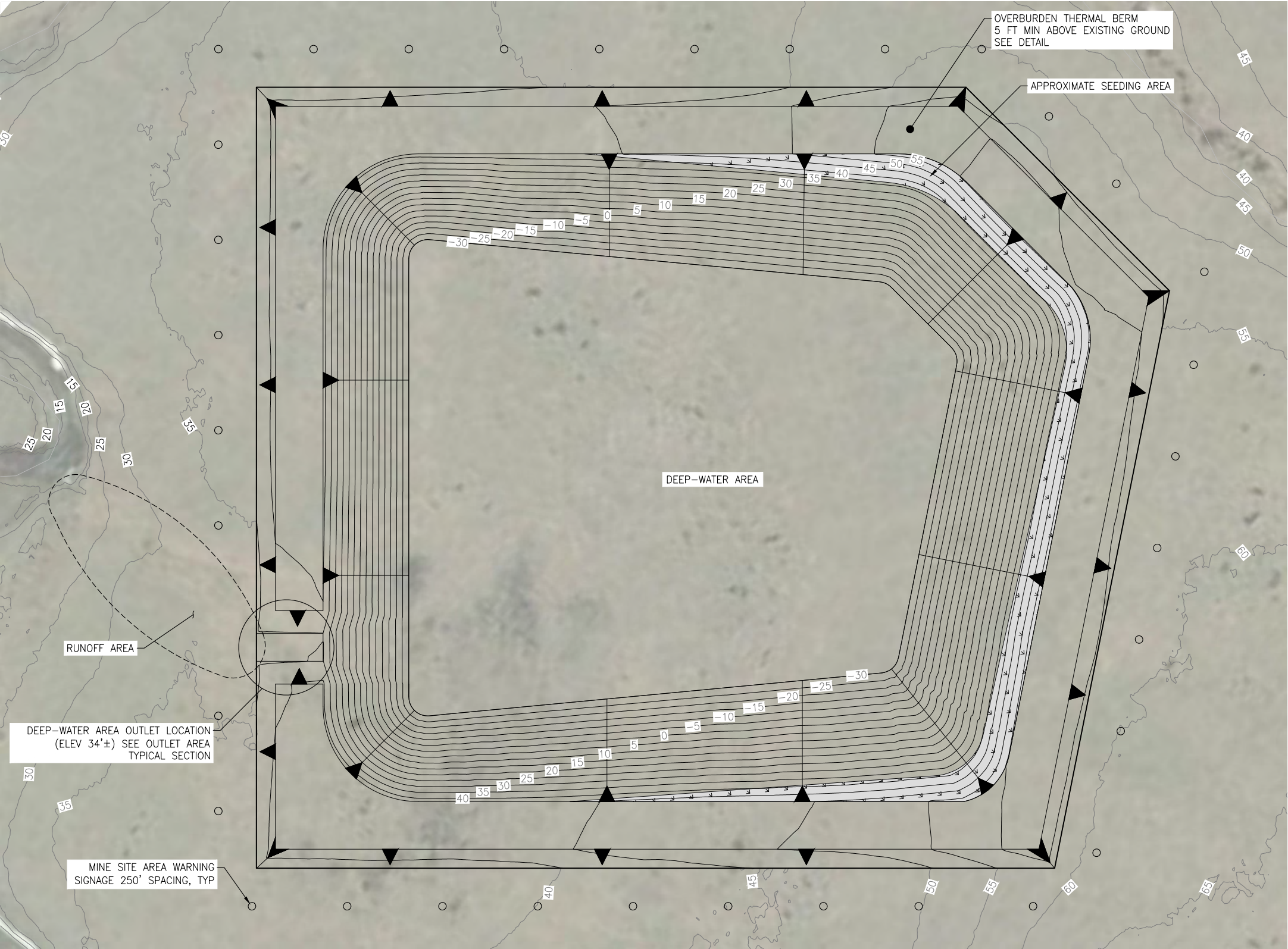
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FIGURE 4

Figure 5 – Willow Mine Site Reclamation Contours



- NOTES:
- 1. PROPOSED RECLAMATION CONTOURS ARE APPROXIMATE.
 - 2. SEE FIGURES 5-1A, 5-1B, 5-1C, AND 5-1D FOR SMALL SCALE VIEW OF PROPOSED RECLAMATION FEATURES.
 - 3. FINAL RECLAMATION FEATURES WILL DEPEND ON THE FINAL CONFIGURATION AND THE AVAILABILITY OF OVERBURDEN MATERIALS, WHICH ARE NOT COMPLETELY KNOWN AT THIS TIME.
 - 4. A SURVEY OF MINE SITE TOPOGRAPHY AND WATER LEVELS WILL BE PERFORMED PRIOR TO FINAL COMPLETION OF RECLAMATION ACTIVITIES.
 - 5. IF FINAL AVAILABLE OVERBURDEN QUANTITIES DIFFER FROM CURRENT ESTIMATES, THE RECLAMATION PLAN WILL BE REVIEWED AND REVISED ACCORDINGLY.



MINE SITE AREA 1 RECLAMATION PLAN

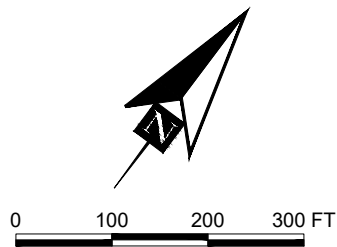


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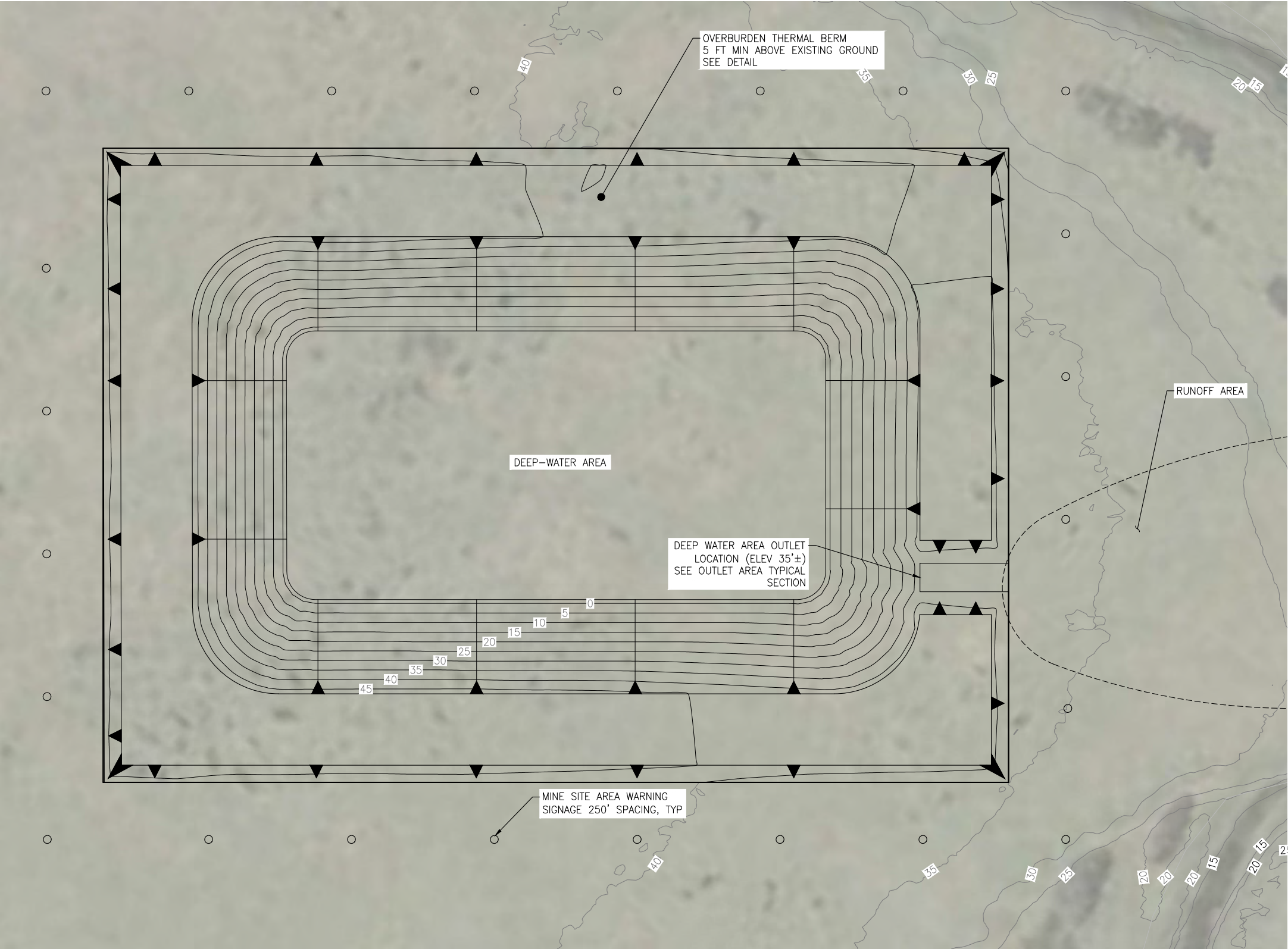


PROJECT: WILLOW PROJECT MINING AND RECLAMATION PLAN			
TITLE: WILLOW MINE SITE RECLAMATION PLAN AREA 1 OVERVIEW			
DESIGNED BY:	MJG	DATE:	9/15/22
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FIGURE 5-1



- NOTES:
- 1. PROPOSED RECLAMATION CONTOURS ARE APPROXIMATE.
 - 2. SEE FIGURES 5-2A, 5-2B, 5-2C, AND 5-2D FOR SMALL SCALE VIEW OF PROPOSED RECLAMATION FEATURES.
 - 3. FINAL RECLAMATION FEATURES WILL DEPEND ON THE FINAL CONFIGURATION AND THE AVAILABILITY OF OVERBURDEN MATERIALS, WHICH ARE NOT COMPLETELY KNOWN AT THIS TIME.
 - 4. A SURVEY OF MINE SITE TOPOGRAPHY AND WATER LEVELS WILL BE PERFORMED PRIOR TO FINAL COMPLETION OF RECLAMATION ACTIVITIES.
 - 5. IF FINAL AVAILABLE OVERBURDEN QUANTITIES DIFFER FROM CURRENT ESTIMATES, THE RECLAMATION PLAN WILL BE REVIEWED AND REVISED ACCORDINGLY.



MINE SITE AREA 2 RECLAMATION PLAN

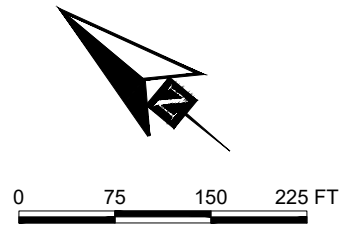


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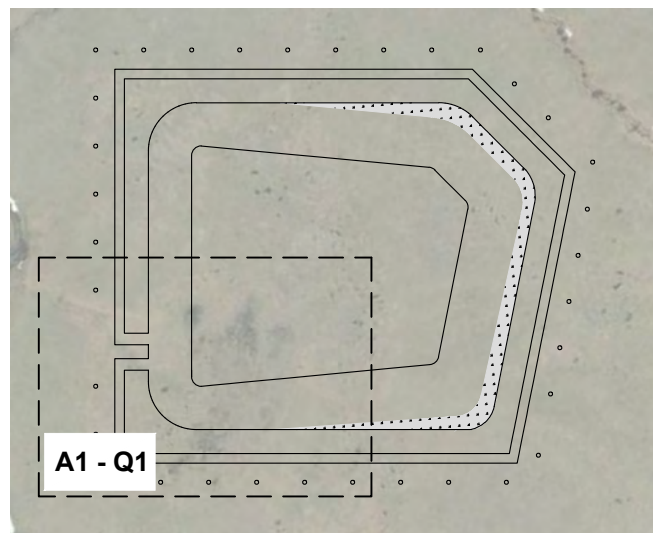


PROJECT: WILLOW PROJECT MINING AND RECLAMATION PLAN			
TITLE: WILLOW MINE SITE RECLAMATION PLAN AREA 2 OVERVIEW			
DESIGNED BY:	MJG	DATE:	9/15/22
CHECKED BY:	DST	PROJECT NO:	171012

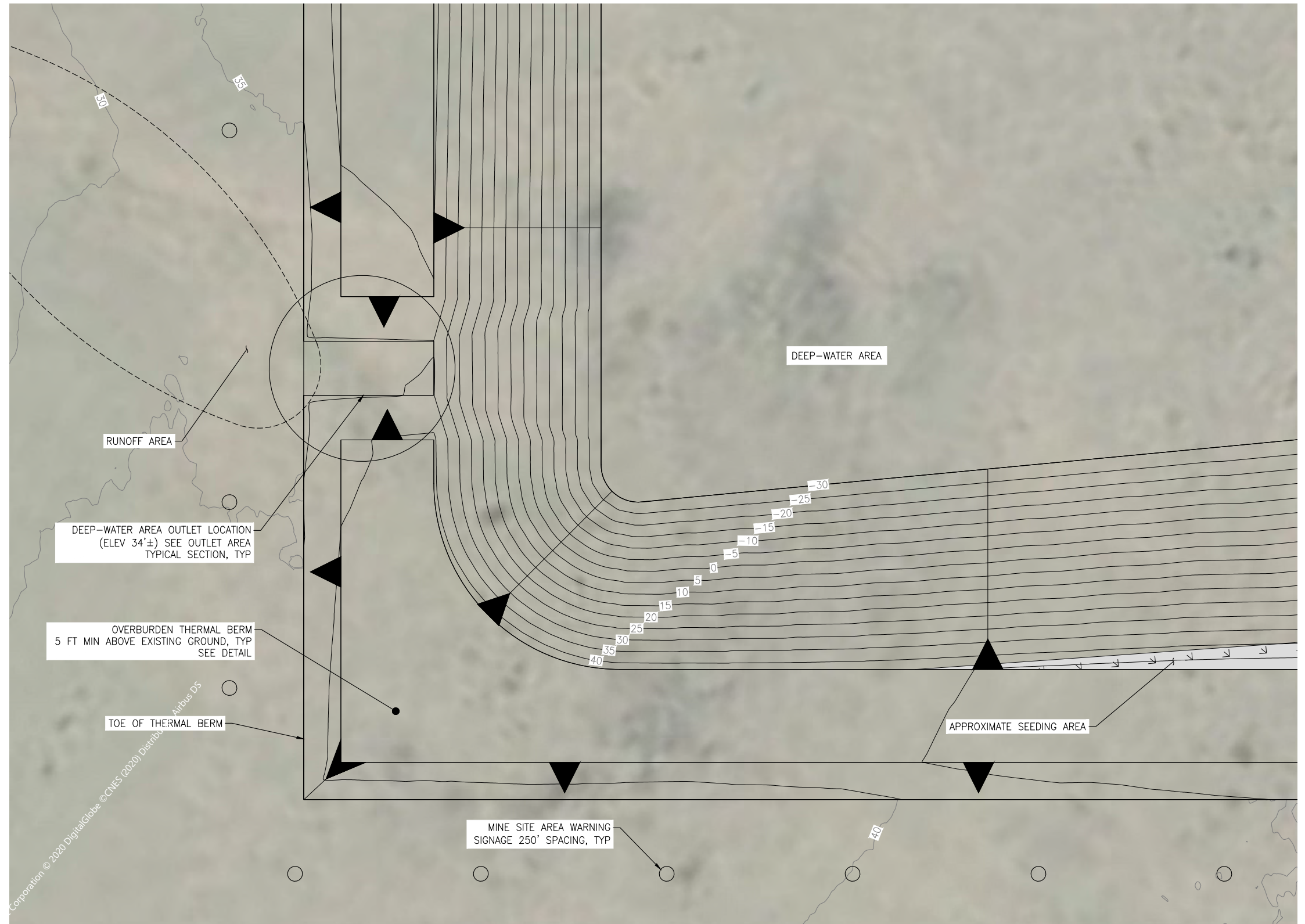
FIGURE 5-2



- NOTES:
1. PROPOSED RECLAMATION CONTOURS ARE APPROXIMATE.
 2. FINAL RECLAMATION FEATURES WILL DEPEND ON THE FINAL CONFIGURATION AND THE AVAILABILITY OF OVERBURDEN MATERIALS, WHICH ARE NOT COMPLETELY KNOWN AT THIS TIME.
 3. A SURVEY OF MINE SITE TOPOGRAPHY AND WATER LEVELS WILL BE PERFORMED PRIOR TO FINAL COMPLETION OF RECLAMATION ACTIVITIES.
 4. IF FINAL AVAILABLE OVERBURDEN QUANTITIES DIFFER FROM CURRENT ESTIMATES, THE RECLAMATION PLAN WILL BE REVIEWED AND REVISED ACCORDINGLY.



PLAN VIEW LOCATION



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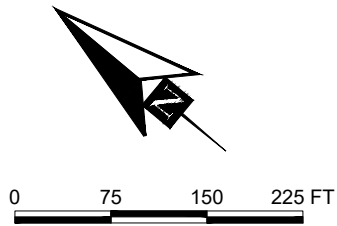


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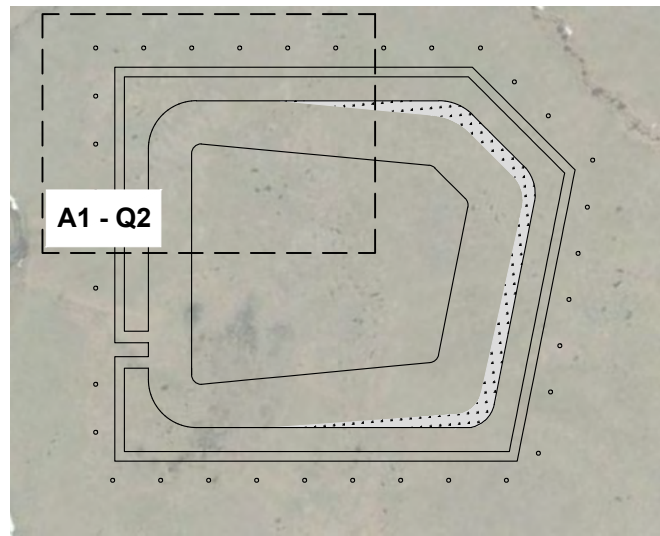
**WILLOW MINE SITE RECLAMATION PLAN
AREA 1 - QUADRANT 1**

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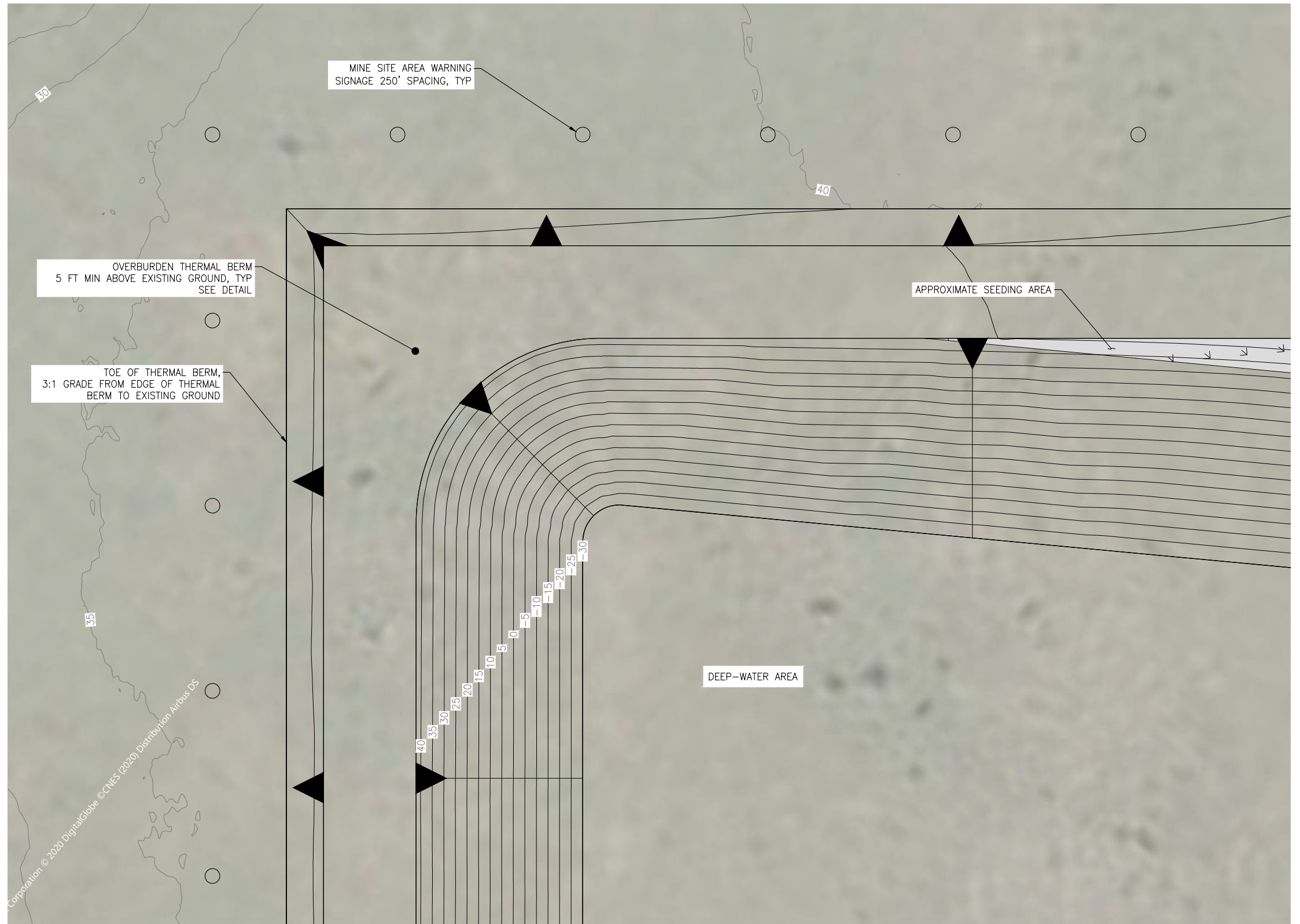
FIGURE 5-1A



- NOTES:
1. PROPOSED RECLAMATION CONTOURS ARE APPROXIMATE.
 2. FINAL RECLAMATION FEATURES WILL DEPEND ON THE FINAL CONFIGURATION AND THE AVAILABILITY OF OVERBURDEN MATERIALS, WHICH ARE NOT COMPLETELY KNOWN AT THIS TIME.
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 4. IF FINAL AVAILABLE OVERBURDEN QUANTITIES DIFFER FROM CURRENT ESTIMATES, THE RECLAMATION PLAN WILL BE REVIEWED AND REVISED ACCORDINGLY.



PLAN VIEW LOCATION



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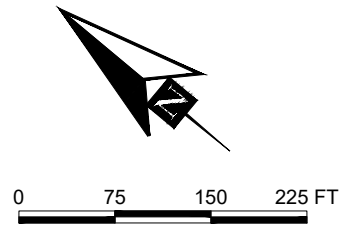


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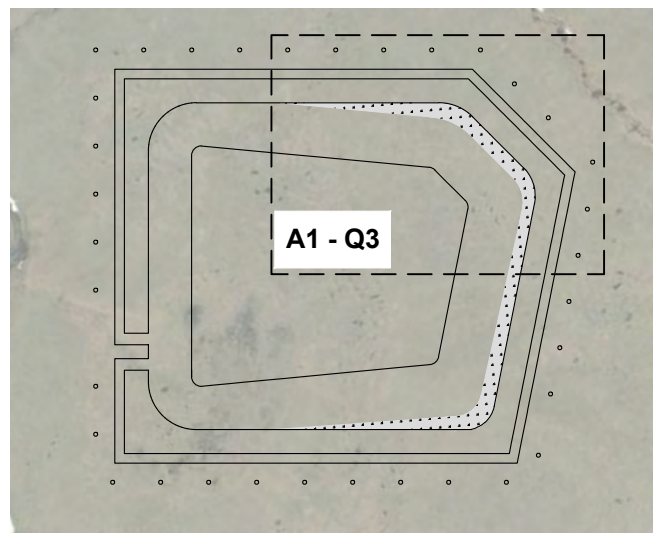
**WILLOW MINE SITE RECLAMATION PLAN
AREA 1 - QUADRANT 2**

DESIGNED BY:	MJG	DATE:	9/15/22
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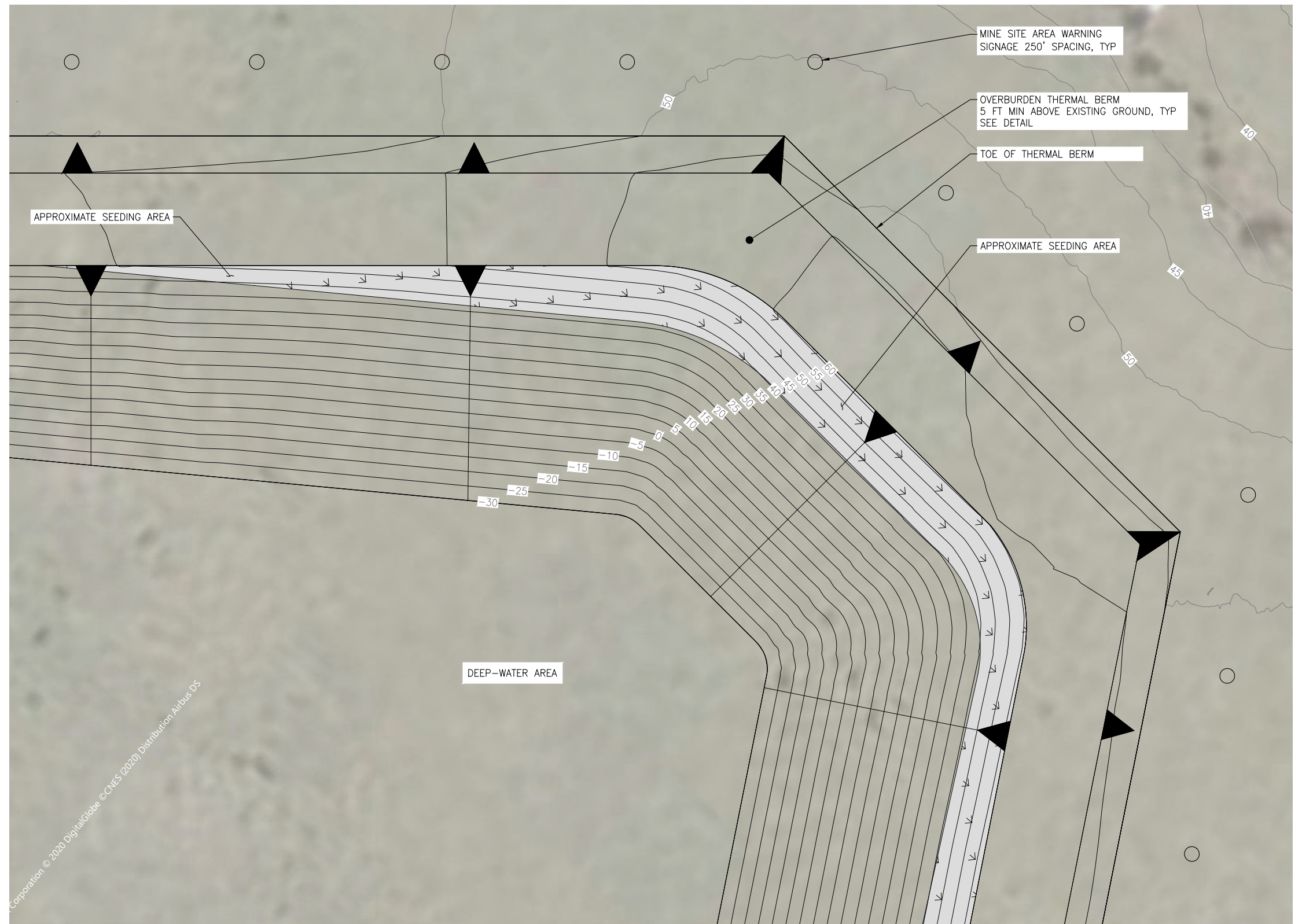
FIGURE 5-1B



- NOTES:
1. PROPOSED RECLAMATION CONTOURS ARE APPROXIMATE.
 2. FINAL RECLAMATION FEATURES WILL DEPEND ON THE FINAL CONFIGURATION AND THE AVAILABILITY OF OVERBURDEN MATERIALS, WHICH ARE NOT COMPLETELY KNOWN AT THIS TIME.
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 4. IF FINAL AVAILABLE OVERBURDEN QUANTITIES DIFFER FROM CURRENT ESTIMATES, THE RECLAMATION PLAN WILL BE REVIEWED AND REVISED ACCORDINGLY.



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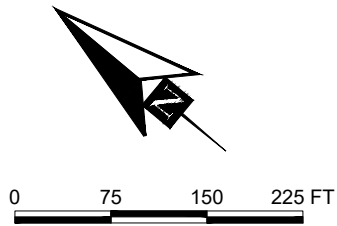


WILLOW PROJECT
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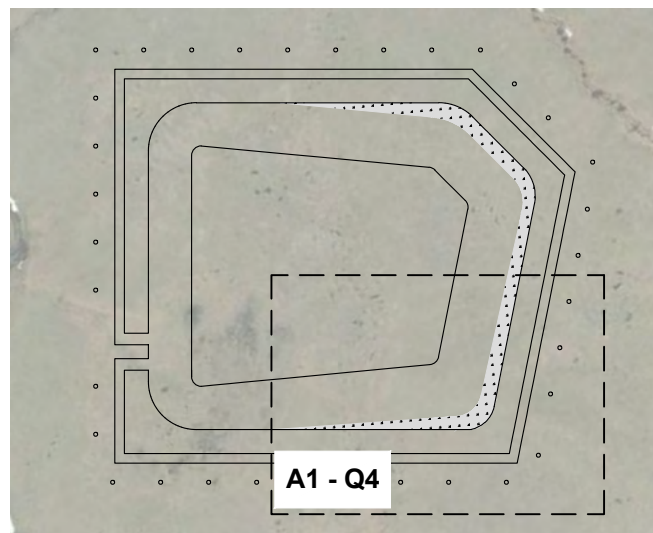
WILLOW MINE SITE RECLAMATION PLAN
AREA 1 - QUADRANT 3

DESIGNED BY:	MJG	DATE:	9/15/22
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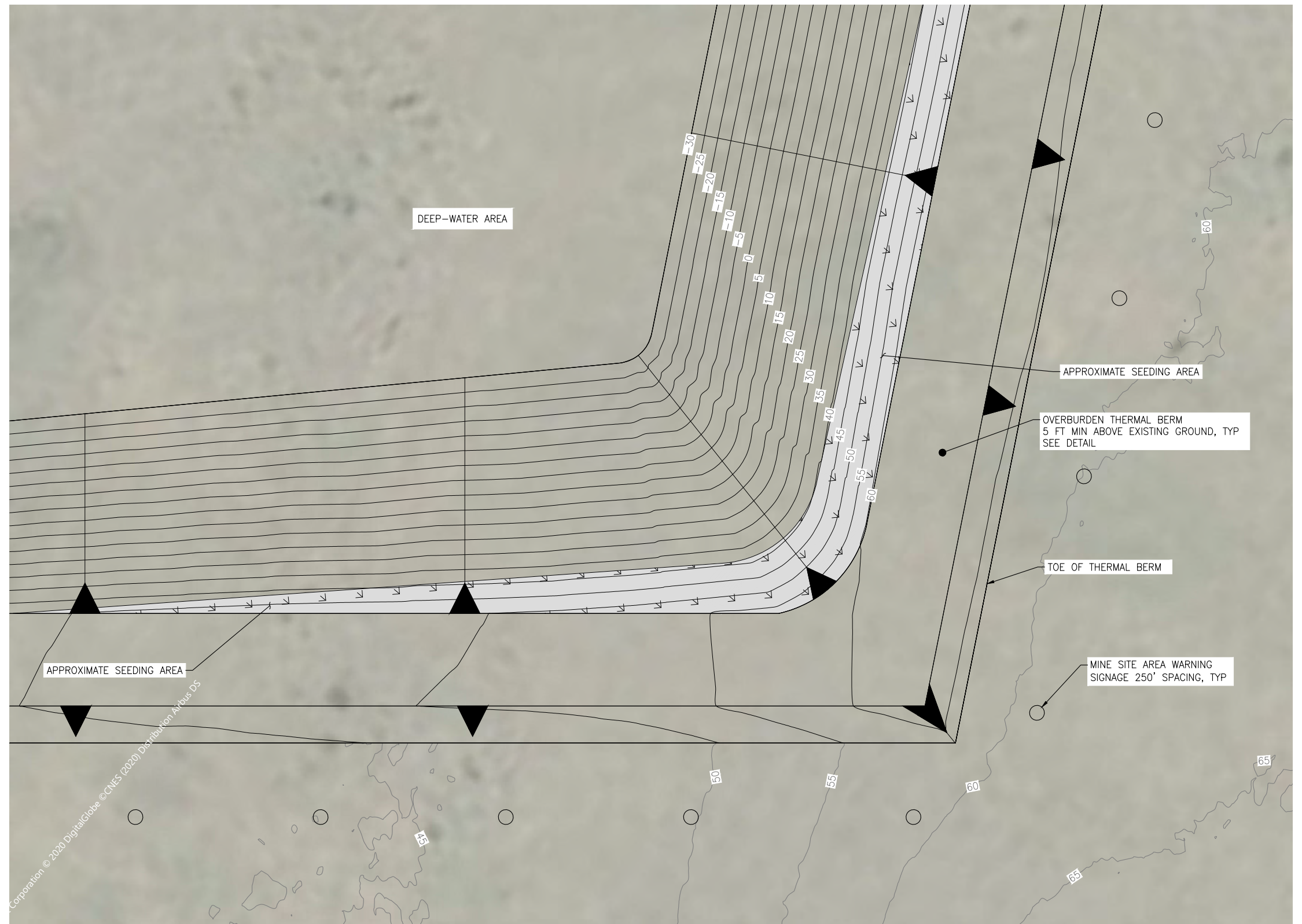
FIGURE 5-1C



- NOTES:
1. PROPOSED RECLAMATION CONTOURS ARE APPROXIMATE.
 2. FINAL RECLAMATION FEATURES WILL DEPEND ON THE FINAL CONFIGURATION AND THE AVAILABILITY OF OVERBURDEN MATERIALS, WHICH ARE NOT COMPLETELY KNOWN AT THIS TIME.
 3. A SURVEY OF MINE SITE TOPOGRAPHY AND WATER LEVELS WILL BE PERFORMED PRIOR TO FINAL COMPLETION OF RECLAMATION ACTIVITIES.
 4. IF FINAL AVAILABLE OVERBURDEN QUANTITIES DIFFER FROM CURRENT ESTIMATES, THE RECLAMATION PLAN WILL BE REVIEWED AND REVISED ACCORDINGLY.



PLAN VIEW LOCATION



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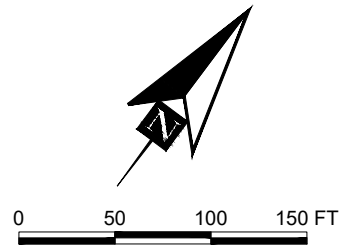


PROJECT: **WILLOW PROJECT
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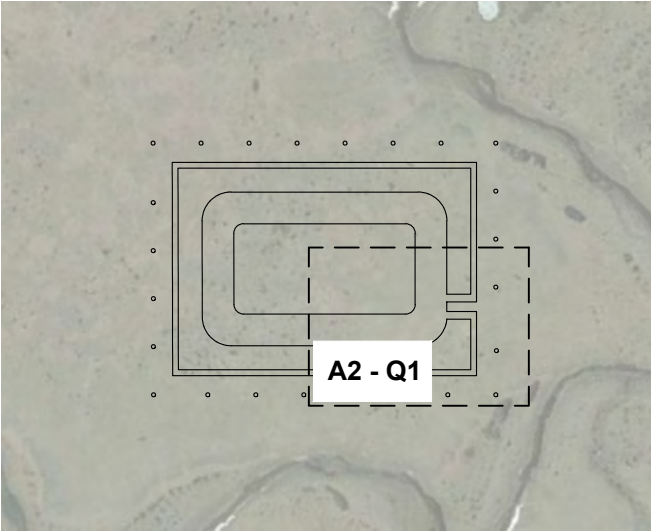
TITLE: **WILLOW MINE SITE RECLAMATION PLAN
AREA 1 - QUADRANT 4**

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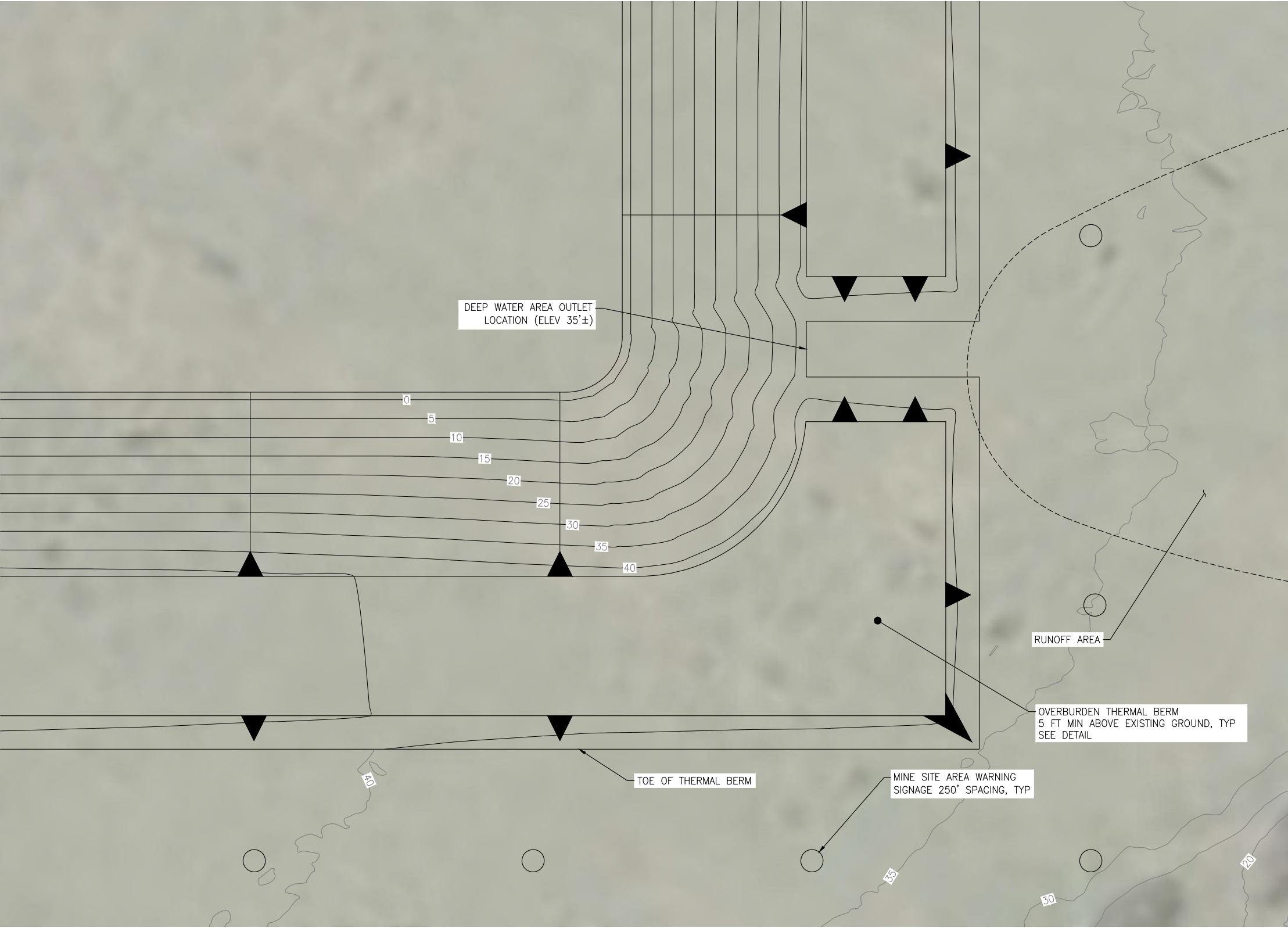
FIGURE 5-1D



- NOTES:
- 1. PROPOSED RECLAMATION CONTOURS ARE APPROXIMATE.
 - 2. FINAL RECLAMATION FEATURES WILL DEPEND ON THE FINAL CONFIGURATION AND THE AVAILABILITY OF OVERBURDEN MATERIALS, WHICH ARE NOT COMPLETELY KNOWN AT THIS TIME.
 - 3. A SURVEY OF MINE SITE TOPOGRAPHY AND WATER LEVELS WILL BE PERFORMED PRIOR TO FINAL COMPLETION OF RECLAMATION ACTIVITIES.
 - 4. IF FINAL AVAILABLE OVERBURDEN QUANTITIES DIFFER FROM CURRENT ESTIMATES, THE RECLAMATION PLAN WILL BE REVIEWED AND REVISED ACCORDINGLY.



PLAN VIEW LOCATION



MINE SITE AREA 2 RECLAMATION PLAN

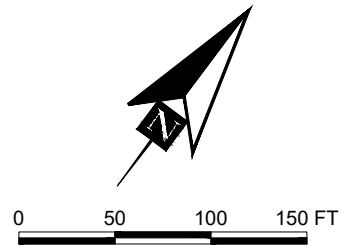
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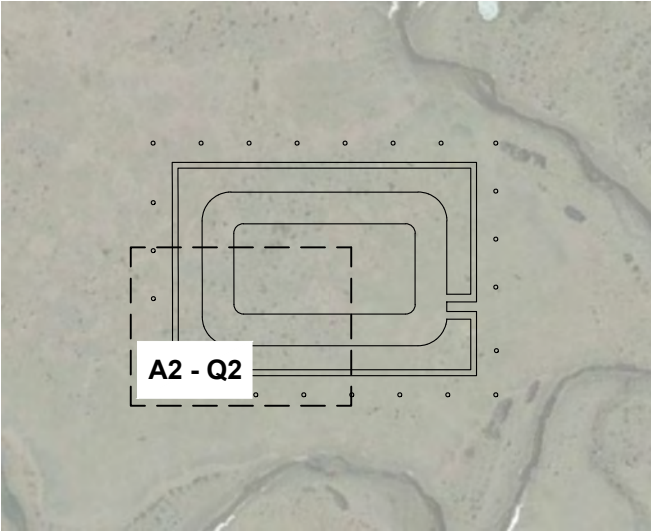
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PROJECT: WILLOW PROJECT			
TITLE: MINING AND RECLAMATION PLAN			
WILLOW MINE SITE RECLAMATION PLAN			
AREA 2 - QUADRANT 1			
DESIGNED BY:	MJG	DATE:	9/15/22
CHECKED BY:	DST	PROJECT NO:	171012

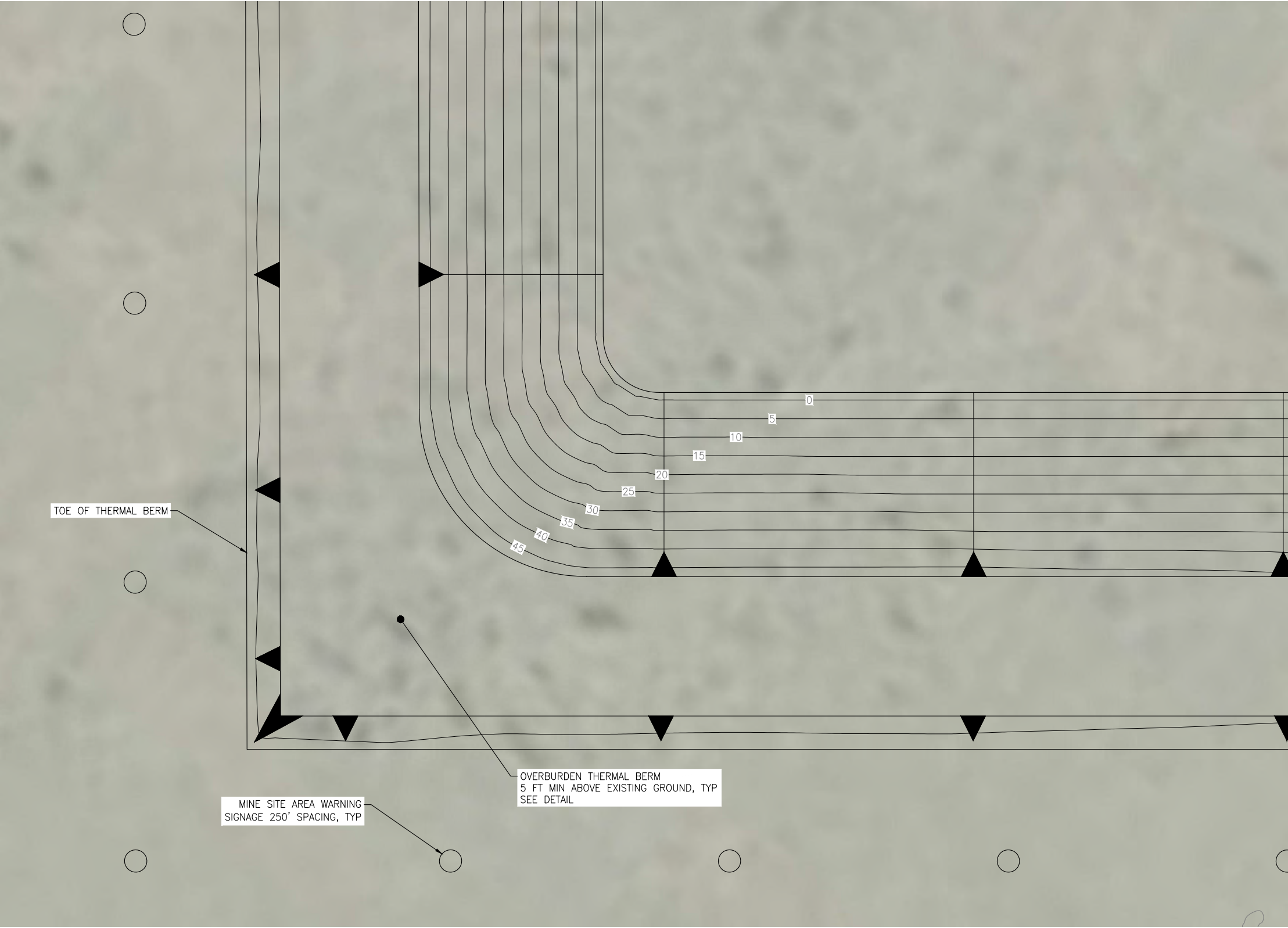
FIGURE 5-2A



- NOTES:
- 1. PROPOSED RECLAMATION CONTOURS ARE APPROXIMATE.
 - 2. FINAL RECLAMATION FEATURES WILL DEPEND ON THE FINAL CONFIGURATION AND THE AVAILABILITY OF OVERBURDEN MATERIALS, WHICH ARE NOT COMPLETELY KNOWN AT THIS TIME.
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 - 4. IF FINAL AVAILABLE OVERBURDEN QUANTITIES DIFFER FROM CURRENT ESTIMATES, THE RECLAMATION PLAN WILL BE REVIEWED AND REVISED ACCORDINGLY.



PLAN VIEW LOCATION



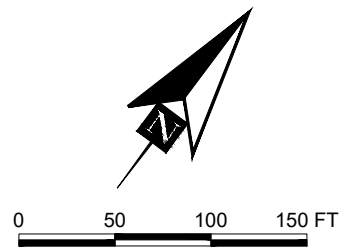
MINE SITE AREA 2 RECLAMATION PLAN



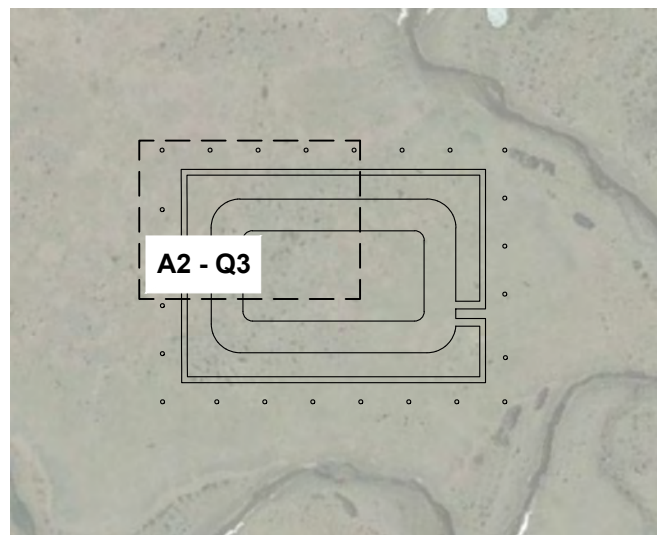
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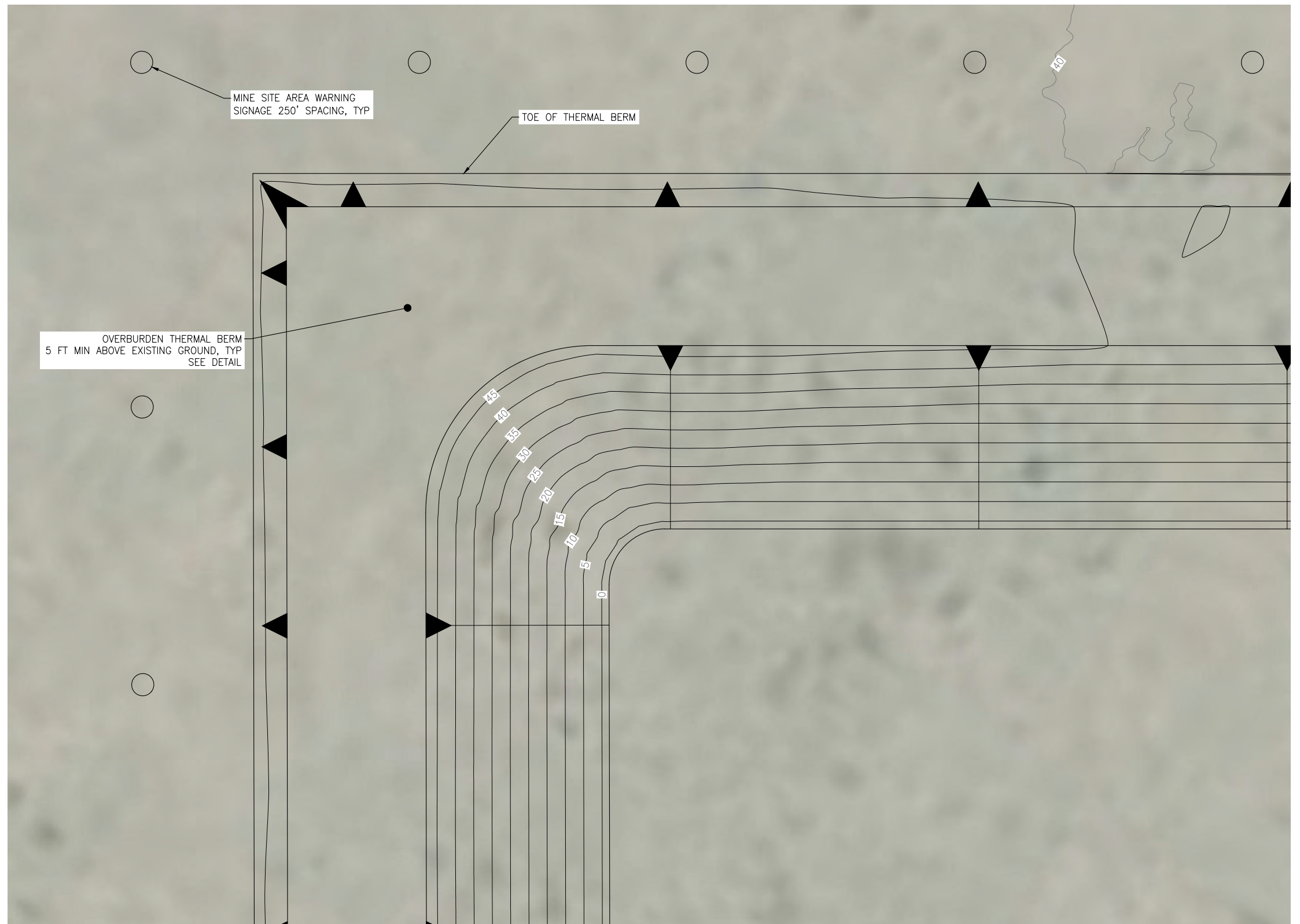
PROJECT: WILLOW PROJECT MINING AND RECLAMATION PLAN			
TITLE: WILLOW MINE SITE RECLAMATION PLAN AREA 2 - QUADRANT 2			
DESIGNED BY: MJG	DATE: 9/15/22	FIGURE 5-2B	
CHECKED BY: DST	PROJECT NO: 171012		



- NOTES:
1. PROPOSED RECLAMATION CONTOURS ARE APPROXIMATE.
 2. FINAL RECLAMATION FEATURES WILL DEPEND ON THE FINAL CONFIGURATION AND THE AVAILABILITY OF OVERBURDEN MATERIALS, WHICH ARE NOT COMPLETELY KNOWN AT THIS TIME.
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PLAN VIEW LOCATION



MINE SITE AREA 2 RECLAMATION PLAN

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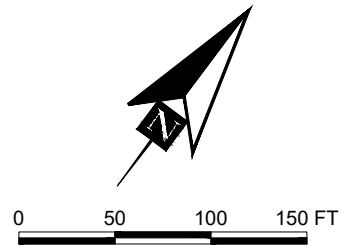
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MINING AND RECLAMATION PLAN**

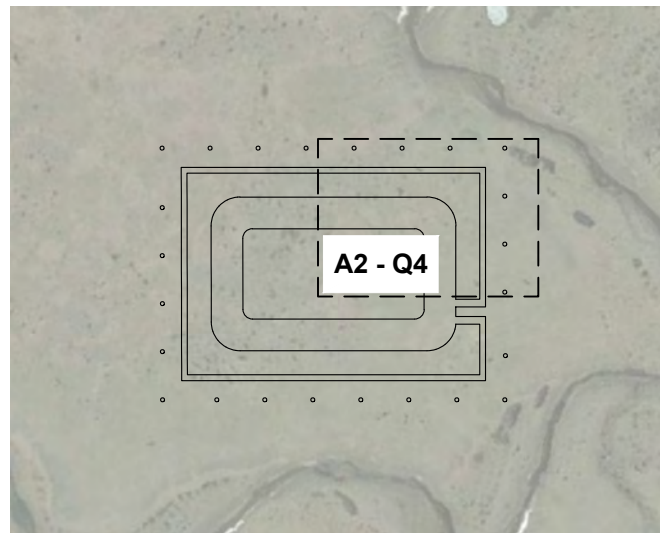
**WILLOW MINE SITE RECLAMATION PLAN
AREA 2 - QUADRANT 3**

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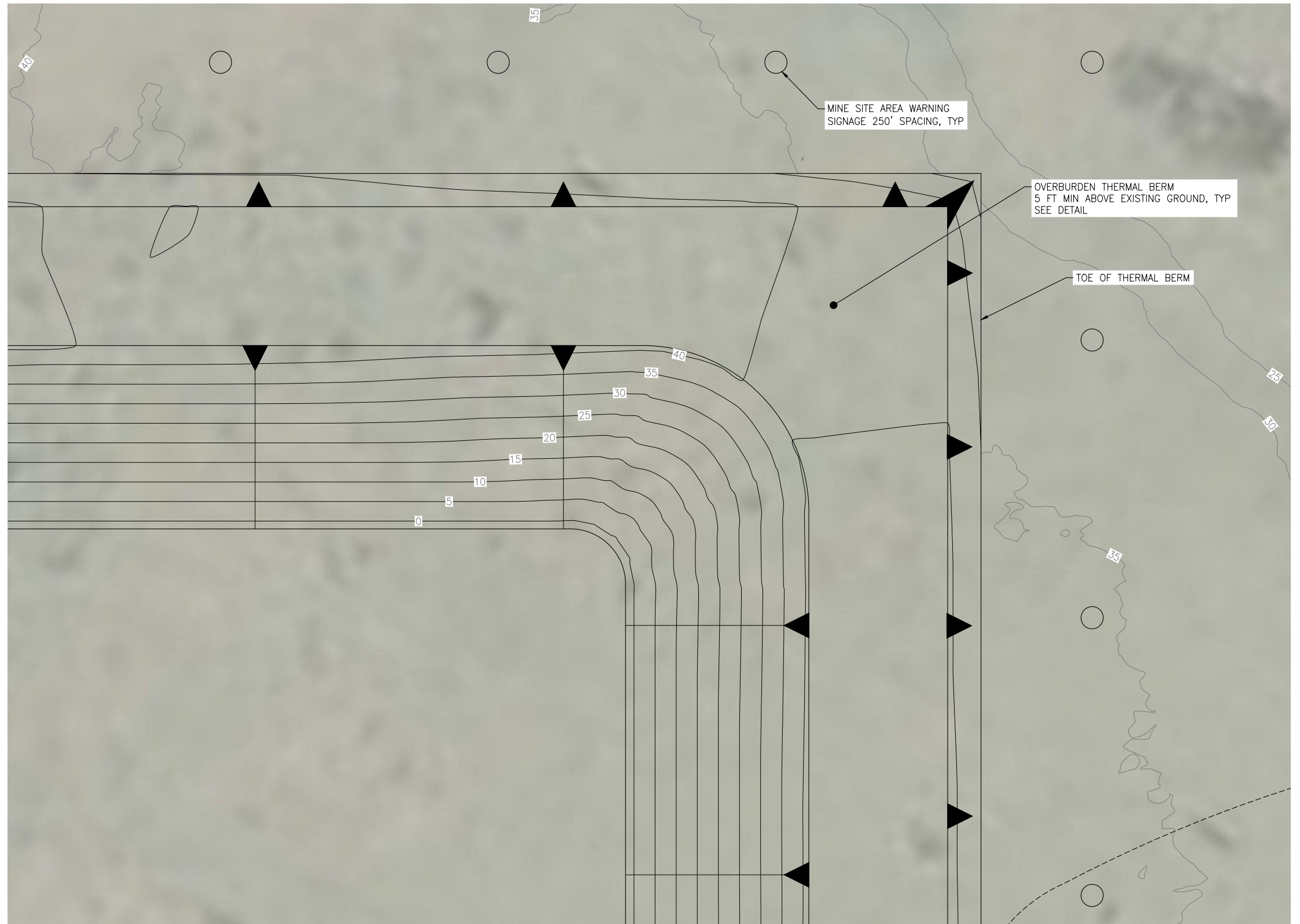
FIGURE 5-2C



- NOTES:
1. PROPOSED RECLAMATION CONTOURS ARE APPROXIMATE.
 2. FINAL RECLAMATION FEATURES WILL DEPEND ON THE FINAL CONFIGURATION AND THE AVAILABILITY OF OVERBURDEN MATERIALS, WHICH ARE NOT COMPLETELY KNOWN AT THIS TIME.
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PLAN VIEW LOCATION



MINE SITE AREA 2 RECLAMATION PLAN

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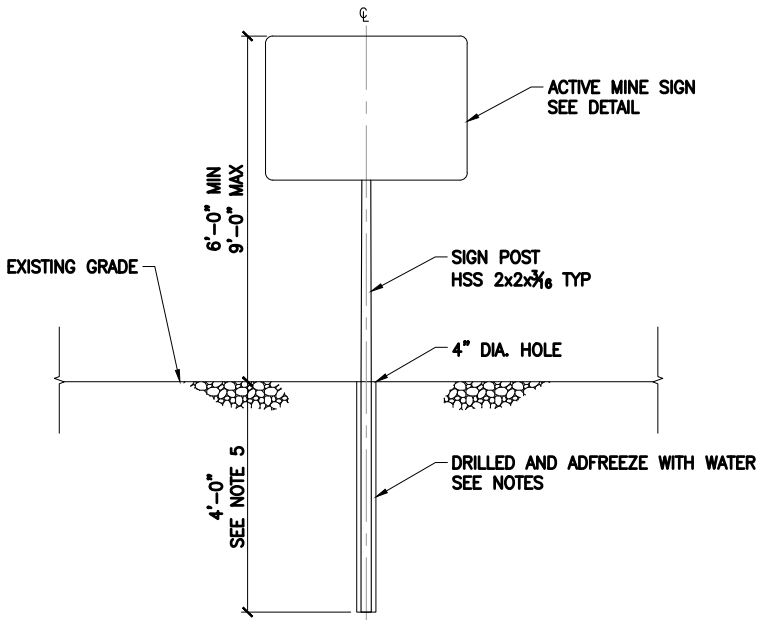
**WILLOW MINE SITE RECLAMATION PLAN
AREA 2 - QUADRANT 4**

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FIGURE 5-2D

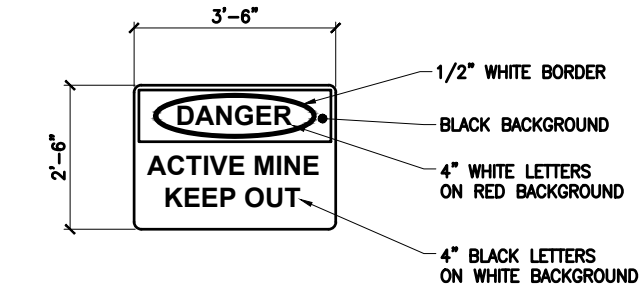
Figure 6 – Warning Sign Detail

- SIGNAGE NOTES:
1. SIGNS SHALL CONSIST OF 0.090" MINIMUM THICKNESS ALUMINUM SHEET WITH TYPE III REFLECTIVE SHEETING. ALUMINUM ALLOY SHALL BE 6061-T6, 5052-H36, OR RECYCLED ALUMINUM MEETING ALLOY 3105 AS SPECIFIED IN ASTM 209.
 2. SIGN DIMENSIONS AND LETTERING SHALL CONFORM TO THE FEDERAL HIGHWAY ADMINISTRATION'S MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES, 2003 (MUTCD). SIGN COLORING SHALL BE AS INDICATED.
 3. SIGNS AND BRACING SHALL BE ATTACHED TO SIGN POSTS WITH 3/8" DIA. A307 GALVANIZED CARRIAGE BOLTS WITH 2" DIAMETER WIND WASHERS, COLORED TO MATCH THE SIGN FACE, BETWEEN THE BOLT HEAD AND THE SIGN FACE AND SECURED WITH NYLOCK NUTS.
 4. SIGNAGE TO BE INSTALLED AFTER PERIMETER BERM IS CONSTRUCTED.
 5. SIGN POST SHALL BE SET IN THE HOLE, LEVELED, AND BACKFILLED WITH DRILL CUTTINGS. WATER SHALL BE POURED IN THE HOLE TO CONSOLIDATE AND FREEZE THE MATERIALS. 4' SIGN POST EMBEDMENT DEPTH SHALL BE USED FOR TEMPORARY SIGNS ONLY (INCLUDING ACTIVE MINE DANGER SIGNS).
 6. SIGNS WILL BE INSTALLED AT A 250 FT SPACING AROUND THE PERIMETER OF THE MINE SITE. COORDINATE WITH OWNER FOR SIGN QUANTITIES, TIMING, AND LOCATIONS PRIOR TO INSTALLATION.



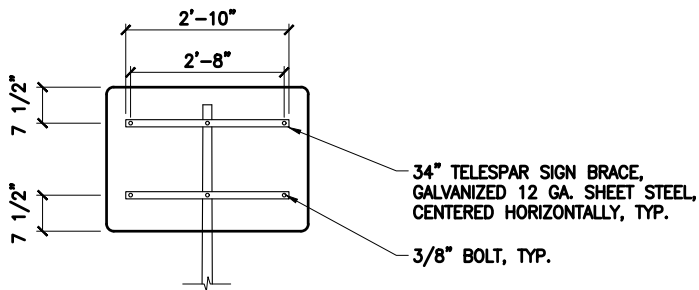
SIGN POST INSTALLATION DETAIL

NTS



ACTIVE MINE DANGER SIGN

NTS



SIGN BRACING

NTS



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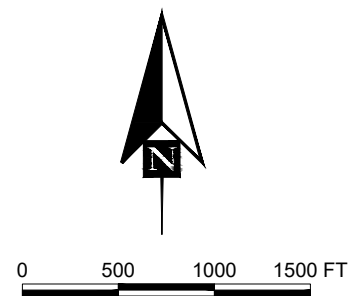
PROJECT: **WILLOW PROJECT
MINING AND RECLAMATION PLAN**

TITLE: **MINE SITE WARNING SIGN DETAIL**

DESIGNED BY:	MJG	DATE:	9/15/22
CHECKED BY:	DST	PROJECT NO:	171012

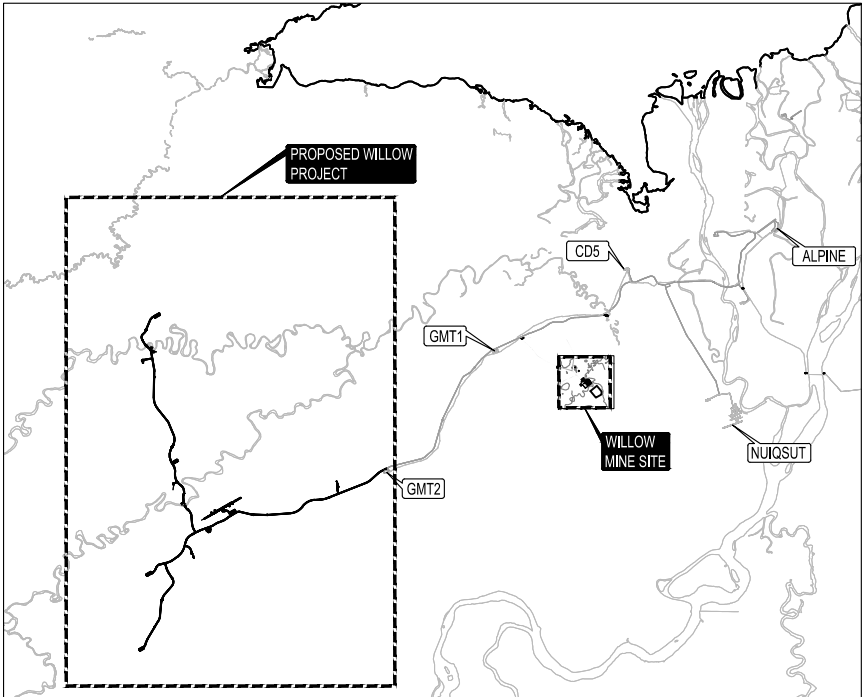
FIGURE 6

Figure 7 – Year 1 Winter Construction Season Mine Site Activity

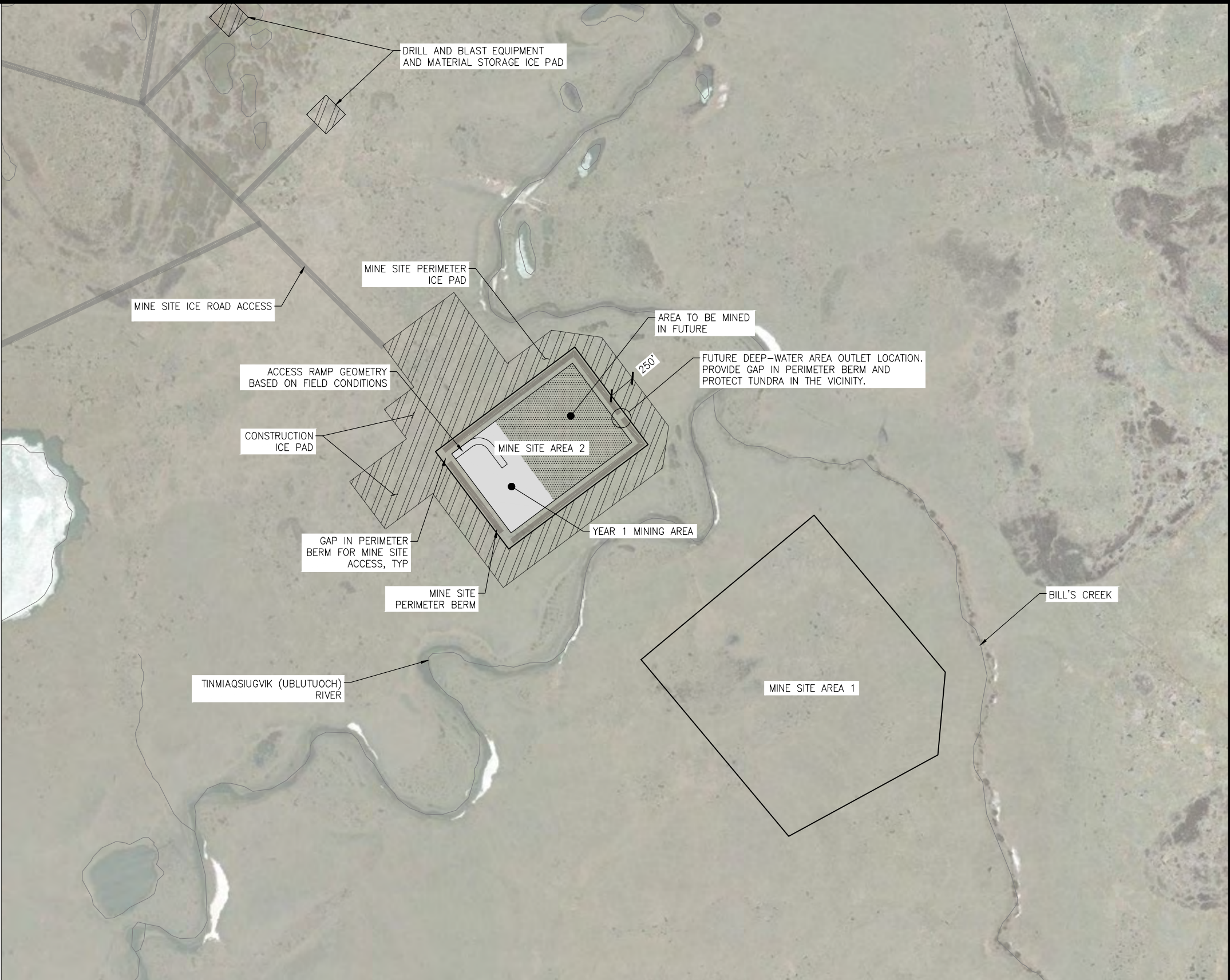


YEAR 1 MINE SITE QUANTITIES	
MINE SITE AREA 1 – YEAR 1 MINING FOOTPRINT	N/A
MINE SITE AREA 1 – YEAR 1 MINING GRAVEL QUANTITY	N/A
MINE SITE AREA 2 – YEAR 1 MINING FOOTPRINT	10.1± AC
MINE SITE AREA 2 – YEAR 1 MINING GRAVEL QUANTITY	188K± CY
YEAR 1 MINE SITE ICE PAD AREA	58.9± AC

- NOTES:
1. GRAVEL IS PLANNED TO BE SOURCED FROM ONLY MINE SITE AREA 2 TO PROVIDE GRAVEL NEEDED FOR THE FIRST CONSTRUCTION SEASON.
 2. ICE PAD AREA DOES NOT INCLUDE ACCESS ROADS.
 3. CONFIGURATION OF ICE ROAD ACCESS, ICE PADS, AND MINE SITE RAMP ACCESS IS APPROXIMATE. ACTUAL CONFIGURATION SUBJECT TO CHANGE AS MINE DEVELOPMENT PROGRESSES.
 4. OVERBURDEN STOCKPILE LOCATIONS WILL BE DETERMINED BASED UPON FIELD CONDITIONS.



WILLOW MINE SITE VICINITY MAP



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PROJECT:		WILLOW PROJECT	
		MINING AND RECLAMATION PLAN	
TITLE:		YEAR 1 CONSTRUCTION SEASON WILLOW	
		MINE SITE ACTIVITY	
DESIGNED BY:	MJG	DATE:	9/15/22
CHECKED BY:	DST	PROJECT NO:	171012

FIGURE 7