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A TETRA TECH COMPANY

ROSEMONT COPPER WORLD PROJECT

WATER QUANTITY IMPACTS ASSESSMENT

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Prepared for

ROSEMONT COPPER COMPANY

May 2022
Project 4286

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RECORD OF AMENDMENTS

This report has been issued and amended as follows:

Issue	Description	Date	Prepared by	Approved by
0	Final	7/15/22	Dwaine Eddington Brian Giroux	Jeremy Dowling

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amsl	above mean sea level
ATS	Automatic Time Stepping
AWQS	Aquifer Water Quality Standards
COCs	Constituents of Concern
CLN	Connected Linear Network
ET	Evapotranspiration
EOM	end of mining
ft	feet
GHB	General Head Boundaries
GV	Groundwater Vistas
GWSI	Groundwater Site Inventory
HFB	Horizontal flow barriers
in/yr	inches per year
MAE	Absolute Mean Error
MODFLOW	Modular three-dimensional finite-difference ground-water flow model
PET	potential evapotranspiration
RMSE	root mean square error
SFR	Stream Flow Routing
TAMA	Tucson Active Management Area
TVM	Time Varying Materials
USG	Unstructured grid
Wells 55	Arizona Well Registry

EXECUTIVE SUMMARY

This water quality assessment for the Rosemont Copper World Project (the Project) evaluates the regional and Project area hydrogeology associated with the Project's main facilities which include: six open pits, two tailings storage facilities, one waste rock facility, and one heap leach pad. The Project is situated across the Santa Rita mountains, with the Rosemont Pit located east of the ridgeline and the remaining facilities either straddling the ridgeline or located west of the ridgeline. Waste rock will be placed on both sides of the ridgeline and will also be used to backfill three of the open pits. The mining sequence will generally run from west to east, beginning with the Peach and Elgin pits and ending with the Rosemont Pit. The other pits include Heavy Weight, Copper Word and Broadtop Butte.

The Project groundwater model was developed using the three-dimensional groundwater model code MODFLOW-USG. The key objectives of the model were to demonstrate the interaction between the mine facilities and the surrounding surface and groundwater system, to show compliance with Arizona Aquifer Water Quality Standards (AWQS), and to provide guidance for locating Point-of-Compliance (POC) monitoring wells.

The Project groundwater model was constructed by leveraging two existing groundwater models: the West model (Mason and Hipke, 2013) and the East model (Tetra Tech, 2010, and subsequent updates). These existing models provided information that was useful for constructing the Project groundwater model. However, the Project model was developed based on the current conceptual hydrogeology model (Piteau, 2022) and considerations specific to the proposed mining areas and mine sequence plan.

The Project model simulations were performed in two stages. These included a steady-state Calibration Model and a transient Predictive Model. The Calibration Model demonstrates good performance with low mass balance error, low convergence iterations, low run time, and low, evenly distributed residuals.

The Predictive Model was used to predict future groundwater conditions based on phased implementation of the Project mine plan, including the planned open pit mining areas, one heap leach pad, one waste rock facility, two tailing storage facilities, and accessory processing facilities. These elements were implemented in the model incrementally over time based on the mine sequence plan.

The six open pits will all intersect the groundwater table. All pits will require water management (e.g., sump pumps), however only Rosemont Pit is predicted to require active dewatering. Average pit water management or dewatering rates are predicted to range from less than three gallons per minute (gpm) in the Peach and Elgin pits, to less than 30 gpm for Heavy Weight, Copper World and Broadtop Butte pits, to about 300 gpm for the Rosemont Pit. Three pits – Heavy Weight, Copper World and Broadtop Butte – will be backfilled with waste rock material. The other three pits – Peach, Elgin and Rosemont – will form pit lakes post-closure.

During mining and processing of ore, stacking will occur on the TSFs and HLP. Low seepage rates are simulated from these facilities to the groundwater system. Groundwater mounding is predicted, with peak mound heights occurring soon after the final materials are stacked. The groundwater mound beneath TSF-1 is simulated to rise above ground surface, but its growth is limited by a facility underdrain system.

After 200 years post-closure, the rate of groundwater flow to or from each of the backfilled pits is predicted to be very small and within the resolution capabilities of the groundwater model. Peach and Elgin pits are predicted to become flow through pit lakes, but again the predicted flow rates are very small and within the model's margin of error. The Rosemont pit lake is predicted to remain a strong hydrologic sink, owing to the relatively large pit lake surface area and associated evaporation rate that is dominant over groundwater inflows. The 10-ft drawdown isopleth resulting from dewatering is predicted to extend approximately five miles north-south and eight miles east-west, centered roughly on the Rosemont Pit.

Contaminant transport was simulated using particle tracking. A total of 331 particles were released from the center of each pit and the perimeter of each facility. After 200 years post-mining, none of the particles released from Heavy Weight, Copper World, Broadtop Butte and Rosemont pits were transported beyond their respective pit footprints. Less than 15% of the particles released from Peach and Elgin pits, the TSFs the HLP were transported beyond the Pollutant Management Area (PMA) toward the northwest.

An alternative transport model was constructed to demonstrate the potential for pump-back mitigation. All but one of the 211 particles released from Peach and Elgin pits, the TSFs and the HLP were captured by the pump-back system.

Ten Point of Compliance groundwater monitoring wells are recommended for the Project based on the hydrogeologic conceptual model (Piteau, 2022), the results of predictive particle transport modeling, and the locations of proposed Project pits and facilities.

1 INTRODUCTION

1.1 Report Purpose

This report presents a description of known hydrogeologic conditions in the Rosemont Copper World Project (the Project) area and the broader region. The initial sections of this report provide a general overview of regional and local conditions based on prior studies and literature. The later sections of the report focus on the specific hydrogeologic conditions associated with each of the proposed mining areas and facilities that comprise the Project, supported by prior and recently completed site characterization field programs. The report is organized as follows:

- Section 1 provides a brief description of the Project mine plan.
- Section 2 presents a summary of the conceptual hydrogeologic model of the Project area.
- Section 3 describes the approach and methods used for developing the calibrated Project groundwater model.
- Section 4 describes the approach and methods used for developing the predictive Project groundwater model, including implementation of the mining and recovery phases.
- Section 5 presents the locations and rational for recommended point of compliance groundwater monitoring.

1.2 Site Location

The Project is located on private land, approximately 12 miles southeast of Sahuarita, Arizona, in Pima County (Figure 1.1). The Project will consist of six open pits, distributed in the Santa Rita Mountain Range, two tailings storage facilities, a heap leach facility, a waste rock storage facility, a processing facility, and ancillary facilities to support the operation (Figure 1.2).

1.3 Project Description

The Project will be developed as a conventional truck and shovel operation with both a milling and processing plant for sulfide ore, a heap leach pad and associated solvent-extraction and electrowinning plant for oxide ore, and a copper concentrate leach circuit. Six open pits (one primary pit and five satellite pits) will be mined in a general west to east progression. From west to east, the open pit mining areas include Peach, Elgin, Heavy Weight, Copper World, Broadtop Butte and Rosemont. The associated processing facilities will be located on the west side of the Santa Rita Mountains along with two conventional tailings facilities and the heap leach pad. Waste rock storage will occur on both sides of the range. Utilities (power and water lines) will come from the west to service the Project. Fresh water for the Project will come from well fields located near the Town of Sahuarita. The operational life of the Project is about 15 years.

1.4 Site and Mining History

The first recorded mining activity in the Helvetia-Rosemont mining district occurred in 1875, and the mining district was officially established in 1878. Production from mines on both sides of the Santa Rita ridgeline supported the construction and operation of two smelters. Copper production from the district ceased in 1951 after the production of about 227,300 tons of ore.

By the late 1950s, the Banner Mining Company (Banner) had acquired most of the claims in the area and had drilled the discovery hole into the Rosemont deposit on the east side of the ridge. In 1963, Anaconda Mining Co. acquired options to lease the Banner holdings. Over the next ten years, Anaconda carried out an extensive drilling program on both sides of the ridgeline.

In 1973, the Anaconda Mining Co. and Amax Inc. formed a 50/50 partnership to develop the Anamax Mining Co. (Anamax). In 1985, Anamax ceased operations and liquidated their assets. ASARCO Inc. (Asarco) purchased the patented and unpatented mining claims from Anamax's real estate interests in August 1988 and renewed exploration and engineering studies. In 1999, Grupo Mexico acquired the Helvetia-Rosemont property through a merger with Asarco, and in 2004 Grupo Mexico sold the property to a Tucson real estate developer.

In April 2005, Augusta Resources purchased the property from Triangle Ventures LLC and initiated a series of extensive drill programs on the property known as the Rosemont Copper Project, owned and operated by Rosemont Copper Company. Hudbay Minerals acquired Rosemont Copper Company, and its parent company Augusta Resources, in 2014.

2 HYDROLOGIC BACKGROUND AND CONCEPTUAL MODEL

2.1 Hydrographic Setting and Climate

2.1.1 Hydrographic Setting

The Project resides across the Santa Rita mountains, within the Davidson Canyon watershed to east and the Sycamore and Box Canyon watersheds to the north and west (Figure 2.1). Drainages in the Project area are ephemeral, flowing only during storm events.

Groundwater occurs primarily in structurally compartmentalized Mesozoic and Paleozoic bedrock materials across the Project. Hydrogeologic testing has indicated that the principal drainages correspond with fracture zones of increased bedrock transmissivity and groundwater flow. Bedrock materials otherwise possess very low transmissivity and storage properties. Larger groundwater resources are stored in the basin-fill deposits that occur beneath the floor of the Upper Santa Cruz basin to the west and the Rillito basin to the east. These reservoirs serve as the principal aquifers in the basins.

2.1.2 Regional Climate Summary

The climate in the region is of an arid continental desert. Summer high temperatures are above 90 degrees Fahrenheit with significant cooling at night. Late summer is characterized by occasional and scattered monsoonal rainstorms that are often short but of high intensity. Winter is dry and mild with overnight temperatures typically above freezing. The region receives between 16 and 22 inches of precipitation per year (in/yr). Potential evaporation in the regional area is approximately 91 inches per year.

2.1.3 Precipitation and Evapotranspiration

Monthly precipitation data was sourced from the Helvetia Santa Rita NOAA station, which was located adjacent to the Project (31° 52’N and 110° 47’E) at an elevation of 4,300 ft amsl. Precipitation and temperature records span a 34-year period from 1916 to 1950 (Piteau, 2022). Average annual precipitation is 19.73 in/yr.

Evaporation data was taken from the Nogales Pan Station. Annual pan evaporation rates at the Nogales station are 91.2 in/yr. The Climate Engine web application was used to substantiate pan evaporation rates, identifying a potential evapotranspiration (PET) range of 89.3 in/yr – 101.1 in/yr across the Project area after a pan factor of 0.7 was applied (Climate Engine, 2021). Climatic variability is considered in the sensitivity analysis performed on pit lake analyses.

Average monthly precipitation and pan evaporation are listed in Table 2.1 and shown in Figure 2.2.

Table 2.1: Average Monthly Precipitation and Pan Evaporation

Month	Helvetia Precipitation. (in) (1916-1950)	Nogales Pan Evaporation. (in)
January	1.58	3.59
February	1.72	4.46
March	1.14	7.01
April	0.52	9.35
May	0.28	11.91
June	0.67	13.31
July	4.05	10.00
August	4.15	8.28
September	2.19	8.06
October	0.68	7.17
November	1.22	4.49
December	1.52	3.57
Total	**19.73**	**91.20**

Values provided by Piteau (2022)

2.2 Surface Water

All Project mining areas and facilities are in the upper reaches of minor tributaries. There is very minimal contributing catchment up-slope of the site. Stream flows in the region are limited to rainfall runoff and are extremely variable. They range from zero during dry periods to short peaks of several tens of thousands of cubic feet per second (cfs) during monsoon events. The variability in stream flow coincides with the range of weather systems that occur in southern Arizona, including intense short-duration summer monsoonal storms, early fall cyclonic storms with wide-spread, high-intensity precipitation events, winter frontal storms, and runoff of winter snow melt.

At a broader regional level the Project area generally sits within two stream basins: the Rillito Basin to the east and the Upper Santa Cruz Basin to the west (Figure 2.3). The crest of the Santa Rita Mountains is the dividing line between these two basins. Within these basins the principal surface drainages are the Santa Cruz River, Davidson Canyon Wash and Cienega Creek (Figure 2.3).

In the immediate vicinity of the Project area, the ground surface is cut by numerous named and unnamed dry washes, arroyos, gulches, and small canyons (Figure 2.4). Despite the variety of words used to describe to these features, they all are ephemeral drainages that convey surface water runoff resulting from higher intensity precipitation events. They are dry almost year-round.

2.3 Geology

The Project area contains a sequence of Proterozoic metasediments and intrusive rocks overlain by Paleozoic carbonate rocks, quartz sandstone, siltstone, Mesozoic sedimentary and igneous rocks, and Cenozoic Basin-Fill formations and igneous rocks. Granitic intrusive and felsic volcanic activity dominated the late Cretaceous and early Eocene period, which was associated with the emplacement of porphyry copper deposits in the region. Post-mineralization, low angle extensional faulting has been significant throughout the region. For example, the Rosemont deposit has been rotated and dismembered by post-mineral low angle detachment faulting, almost entirely obliterating the structural relationship between the mineralized hosts and the mineralizing stock.

A thorough discussion on the geology of the region surrounding the Project area is provided in Piteau (2022). Regional and Project scale geologic maps are shown in Figures 2.5 through 2.7.

2.3.1 Geologic Units

The principal geologic units in the Project area are described as follows:

- Younger Alluvium of Holocene age which occurs as unconsolidated sediments along the floodplains of the ephemeral washes that are actively being incised.
- Older Alluvium of Late Pleistocene age which occurs as weakly consolidated gravel terraces consisting of medium- to thick-bedded, sandy, pebble-cobble gravel with rare boulders.
- Gila Conglomerate of Pliocene-Miocene age which occurs as medium- to thick-bedded, conglomerate, pebbly sandstone, and sandstone with a calcareous matrix. The clasts consist of granitic rocks, quartzite, limestone, argillite, and rhyolite ash-flow tuff.
- Basin-Fill deposits of Quaternary and Tertiary age, which are poorly permeable in the Project area and moderately permeable toward the deeper parts of the Cienega and Upper Santa Cruz basins. The Basin-Fill deposits of the Upper Santa Cruz Basin are subdivided into lower and upper Basin-Fill units (Mason & Bota, 2006).
    - Upper Basin-Fill deposits consisting of:
        - Fort Lowell Formation (Pleistocene) consisting of unconsolidated to moderately consolidated sediments that grade from a silty gravel near the edges of the basin to a sandy silt and clayey silt that is up to 400 feet thick in the center of the Santa Cruz Basin (Travers and Mock, 1984).
        - The upper beds of the Tinaja Formation (Pliocene) consisting of grey to greyish-brown sandy gravels ranging in thickness of more than 2,000 feet in the center of the Santa Cruz Basin (Travers and Mock, 1984).
    - Lower Basin-Fill deposits formed during the first phase of block faulting (Mason & Bota, 2006)

        - Lower and middle Tinaja Formation (Miocene) consisting of sandy gravels to gypsiferous clayey silt and mudstone.
        - Pantano Formation (Oligocene) consisting of poorly permeable mudflow deposits, sandstone and gravel. Near Davidson Canyon, the Pantano Formation is at least 6,400 feet thick (Travers and Mock, 1984).
- Paleogene to Upper Cretaceous Intrusive and Extrusive Rocks
    - Helvetia Granite (Paleocene) consisting of medium- to coarse-grained quartz diorite and medium- to coarse-grained granodiorite to quartz monzonite composition stocks.
    - Quartz-feldspar porphyry (Upper Cretaceous to Paleogene) consisting of felsic porphyry dikes and stocks.
    - Andesite Porphyry (Upper Cretaceous to Paleogene) consisting of strongly altered, fragmental, fine-grained plagioclase porphyritic andesite or intrusive porphyry.
    - Mount Fagan Rhyolite (Upper Cretaceous) consisting of at least a 5,000-foot thickness of rhyolite ash-flow tuff containing phenocrysts of K-feldspar, plagioclase, quartz, and biotite.
    - Mount Fagan Rhyolite megabreccia (Upper Cretaceous) consisting of up to 3,000-foot blocks and avalanche breccia blocks of fractured Bisbee Group, Fort Crittenden Formation, and andesite lava rocks.
    - Andesite lava (Upper Cretaceous) consisting of up to an 800-foot thickness of andesite lava flows.
- Mesozoic (Cretaceous) sedimentary rocks. The Cretaceous sedimentary rocks unconformably overly Paleozoic rocks on “an irregularly eroded surface” (Darton, 1925).
    - Salero Canyon Formation consisting chiefly of poorly permeable, well-cemented conglomerate and mudstone.
    - Turney Ranch Formation consisting of poorly permeable quartzitic sandstone and red siltstone.
    - Shellenberger Canyon Formation consisting of poorly permeable sandstone, arkosic sandstone, limestone, and siltstone.
    - Bisbee Group, Lower Cretaceous.
        - Apache Canyon Formation consisting of poorly permeable silty limestone, shale, siltstone, and arkosic sandstone.
        - Willow Canyon Formation consisting chiefly of poorly permeable felspathic sandstones and arkosic conglomerate with minor mudstone, silty limestone strata, and andesite flows.
        - Mafic Lava. A series of mafic lava flows within the Willow Canyon Formation and the Glance Conglomerate.

    - Glance Conglomerate consisting of a pebble to boulder conglomerate, locally containing marble and quartzite.

- Paleozoic sedimentary rocks, including:
  - Naco Group, Upper Pennsylvanian to Permian
    - Rainvalley Formation (Permian) consisting of gray, medium- to thick bedded limestone with minor sandstone and siltstone.
    - Concha Limestone (Permian) consisting of medium- to thick-bedded, massive to planar-laminated, amalgamated limestone, and cherty limestone, grading to sandy and dolomitic near the base of the formation.
    - Sherrer Formation (Permian) consisting chiefly of light gray to pink, fine-grained, massive, silty quartzose sandstone with rare laminations.
    - Epitaph Formation (Permian) consisting of a mixed siliciclastic-carbonate unit. The carbonates consist chiefly of limestone, marble, dolomite with local gypsum or anhydrite. The siliciclastic units are thin- to medium-bedded siltstone and silty mudstone, and fine-grained, laminated sandstone.
    - Colina Limestone (Permian) consisting of medium- to thick bedded limestone, marble, dolomite originally consisting of micritic and skeletal wackestone.
    - Earp Formation (Permian-Pennsylvanian) A mixed siliciclastic-carbonate unit consisting of thin- to medium-bedded, planar-laminated siltstone, silty mudstone, and very fine-grained sandstone that is intercalated with light gray to pinkish gray, thick-bedded, micritic limestone and skeletal wackestone.
    - Horquilla Limestone (Pennsylvanian) consisting of thin- to thick-bedded silty limestone and dolomite with more abundant shale interbeds higher in the section.
  - Escabrosa Limestone (Mississippian) consisting of medium- to thick-bedded marble with dolomitic limestone present in the lower portion.
  - Martin Limestone (Devonian) consisting of dolomitic marble, tan sandstone, and shale.
  - Abrigo Formation (Cambrian) consisting of thin- to medium-bedded laminated limestone with siltstone interbeds. Locally, the unit has partly been metamorphosed to calc-silicate hornfels that form resistant outcrops with recessive thin beds, lenses, and laminations (Darton, 1925).
  - Bolsa Quartzite (Cambrian) consisting of medium- to fine-grained, thick- to medium-bedded quartzite or quartzose sandstone, arkosic sandstone, and quartzose conglomerate.
- Precambrian granitic intrusives including the Continental Granodiorite (local in the Project area) consisting of extensive masses of coarse-grained and porphyritic alkali granite, quartz monzonite, or granodiorite.

- Pinal Schist (Precambrian) consisting of gneiss and migmatite. Present as inclusions, roof pendants, and remnants of wall rock adjacent to granitic intrusions.

2.3.2 Geologic Structure

The structure of the Project area is very complex. Most of the host rocks at the Rosemont deposit dip steeply (approximately 55 to 65 degrees) to the east. The principal faults in the area include the nearly horizontal Flat fault and the younger north-striking Backbone fault system. The Flat fault places mostly Mesozoic sedimentary rocks over the older Paleozoic units. The post-mineral Backbone fault system defines the western boundary of the Rosemont ore deposit and separates the mineralized, Paleozoic limestone units on the east from the Proterozoic granodiorite and lower Paleozoic quartzite on the west. The Peach-Elgin deposit is underlain by a thrust fault that juxtaposes Paleozoic and Mesozoic sediments and late-Cretaceous-Paleocene quartz-latite porphyry over Precambrian granodiorite (Anzalone, 1995). The thrust fault has been largely or wholly eroded in the Heavy Weight, Copper World and Broadtop Butte deposit areas.

No evidence exists in the Project area of recent fault activity that cross cuts Quaternary or Holocene talus, colluvium, alluvial fan, or terrace gravels; these alluvial formations typically mask the underlying, older fault contacts where faults are present (Ferguson et al., 2009).

2.4 Hydrogeological Conceptual Model

The groundwater system associated with the Project area is well understood on the basis of previous field investigations and study, new field characterization implemented during 2021, Project specific geologic modeling, and broader regional studies. There is a high degree of confidence in the hydrogeologic conceptual model. Overall, there is very limited groundwater in the Project area.

A summary of the regional and Project area conceptual hydrogeologic model is provided in the following sections. A thorough discussion on the hydrogeology of the Project is provided in Piteau (2022).

2.4.1 Regional Hydrogeology

The Project area is situated in rugged upland topography formed by the northern extension of the Santa Rita Mountains (Figure 2.8). The proposed mining areas and facilities are situated mostly on bedrock outcrops straddling the east and west sides of the north trending ridgeline. The mountain areas hosting the Project descend toward the Santa Rita Basin to the west and Rillito Basin to the east.

Bedrock geology involves Precambrian and Tertiary intrusive batholiths, heavily folded sedimentary bedrock sequences and several generations of faulting. At the east and west Project margins, the bedrock becomes covered by sequences of porous Basin-Fill materials that gradually thicken into the Santa Cruz and Rillito Basins. At distances of several miles from the Project, the Santa Cruz Basin is developed for agricultural and domestic water supply.

Climate is southwest semi-arid with low annual precipitation, flashy monsoon rain storms and high evaporation. Due to the physical location of the Project, there is limited surface or groundwater catchment area up-gradient of the proposed open pits or facilities. Bedrock hydraulics involve low to very low hydraulic conductivity, very low storage coefficients and strong compartmentalization imparted by the complex folding, faulting and intrusive system geometries. Occasional productive fracture zones are encountered but are bounded and limited in extent. As such the bedrock system is a series of compartmentalized aquitards. The bedrock hydraulics, combined with a low recharge setting and lack of contributing catchment areas, mean that bedrock groundwater movement is minimal. The bedrock system has never been developed for water resource purposes, which reflects the ambient conditions. Occasional stock wells are present, and their flow rates are low.

The Basin-Fill deposits in the Santa Cruz Basin have comparatively much higher porosity than the bedrock and relatively increased hydraulic conductivity. However, aside the corridor along the Santa Cruz River, the hydraulic conductivity ranges are modest. As such, most of the basin water resource development is close to the river corridor.

Groundwater levels in the region are influenced by topography as normal (Figure 2.8). The highest groundwater levels occur within the mountain bedrock domains. In the Project area they are up to 5,500 ft amsl. Groundwater levels reduce toward the surrounding basins and are 2,500 ft amsl near the Santa Cruz River to the west, and a similar elevation in the Rillito valley floor to the east. While the regional gradient is from the upland mountain blocks toward the basins, the variability in measured piezometric levels and vertical gradients confirm significant de-coupling and discontinuity in the bedrock system. While the groundwater levels infer a gradient, there is very limited continuity between the mountain bedrock blocks and the basins.

Groundwater recharge in the bedrock system is limited to minor amounts of infiltration into locally fractured bedrock. Due to general exposed bedrock weathering and the presence of discontinuity, some of the recharge will locally emerge as small seeps perched up above regional groundwater levels. Most rainfall in the mountains rapidly runs off toward the deeply incised channels and canyons. Relatively more recharge may occur in the canyon floors and where the topography transitions to the range front and basin margin areas. Small amounts of groundwater discharge occur at lower elevations in the canyons and where geologic barriers favorably coincide with topography, impeding local groundwater movement and creating small surface seepages.

2.4.2 Project Area Conceptual Hydrogeologic Model

The hydrogeologic conditions at the Project open pit mining and facility areas are well characterized by previous and recent investigations and study. In general, conditions are comparable in each proposed mining area. A thorough discussion on the hydrogeology of the Project area is provided in Piteau (2022). The Project area potentiometric surface is shown in Figure 2.9, and locations of hydrogeologic cross sections are shown in Figure 2.10.

For the pit areas west of the ridgeline, which include the Peach, Elgin and Heavy Weight pits, there is very minimal bedrock groundwater. Proactive dewatering measures are not anticipated to support mining operations. Very small rates of pit seepage may occur as the excavations approach ultimate limits but will likely be unnoticed due to evaporative consumption. The bedrock system in each case has negligible storage, very low bulk hydraulic conductivity and geologic structures/contacts that create system boundaries and limits at local scales. There is currently an inferred bedrock hydraulic gradient toward the northwest (Figures 2.9); however, bedrock groundwater flux across the area is small. The hydrogeology of the Peach, Elgin and Heavy Weight pits is shown in Figures 2.11 through 2.13.

The Copper World and Broadtop Butte pit areas are closer to the mountain ridge – Broadtop Butte straddles the topographic divide (Figure 2.9). Again, the groundwater system is very limited by low bulk conductivity and storage, discontinuity and boundaries imparted by geologic contacts and structures. Steeply dipping bedding and major faulting will impart strong east-west limits to the system. Any locally developed continuity along the Backbone Fault will either create a gradient south toward the Rosemont pit during mining or will be limited by cross-cutting east-west faults. Again, hydraulic gradients infer groundwater movement consistent with topography, but the data demonstrate decoupling and discontinuity. The lack of any natural recharge, combined with the bedrock hydraulics, greatly limit any groundwater flux in the area. No significant groundwater inflows are expected during mining and proactive dewatering measures are not anticipated during operations. The hydrogeology of the Copper World and Broadtop Butte pits is shown in Figures 2.12 through 2.16.

The Rosemont Pit is immediately east of the mountain ridge and involves no significant up-gradient surface or groundwater catchment (Figure 2.9). It is the largest and deepest of the proposed mining areas. The mine area is hosted by intrusive sequences and sedimentary bedrock. A package of Willow Creek Formation occupies the upper southeast sector of planned mining. The Backbone Fault strikes northwest through the pit. It combines with prominent northeast striking major structures and cross-cutting east-west faults to the north, to create a strongly bounded geologic framework. The bulk scale properties of the intrusive and sedimentary bedrock sequences involve low hydraulic conductivity and low storage. There are some local scale productive fractures that are characterized as discontinuous. The hydrogeology of the Rosemont Pit is shown in Figures 2.17 through 2.19.

During mining, relatively low amounts of groundwater inflow into the Rosemont Pit will occur due to the rate of excavation combined with the drainage of storage from local fractures and potentially minor amounts of groundwater occurrence in the Willow Creek Formation. It is expected that localized pit scale controls (i.e., dewatering) will be needed to create depressurized conditions in slope sectors that are sensitive to pore pressure. The dewatering measures will include limited numbers of temporary low flow in-pit wells and horizontal drains. There is limited connection between the pit area and surrounding bedrock groundwater and groundwater controls beyond the pit area will not be needed to support mining.

The proposed TSF-1, TSF-2, HLP and Plant Site facilities are located to the west near the transition zone between the steeper mountain terrain and range front. A thin layer of Piedmont Alluvium is present and overlies bedrock comprised of massive intrusive batholith and sedimentary lithologies. The alluvium is porous and has relatively increased hydraulic conductivity compared to bedrock. However, it is unsaturated. The bedrock units have low hydraulic conductivity and low storage. Groundwater gradients are generally toward the northwest (Figure 2.9). Rates of bedrock groundwater movement beneath the facility areas will be very limited due to the low bulk conductivity ranges, compartmentalized nature of the system and low amounts of recharge. The hydrogeology of the Project facilities is shown in Figures 2.20 through 2.23.

3 NUMERICAL GROUNDWATER MODEL

3.1 Introduction

A groundwater model was developed for the Project using the three-dimensional groundwater model code MODFLOW-USG (Panday and others, 2017). The key objectives of the groundwater model are to demonstrate the interaction between the mine facilities and the surrounding surface and groundwater system, to show compliance with Arizona Aquifer Water Quality Standards (AWQS), and to provide guidance for locating Point-of-Compliance (POC) monitoring wells.

The groundwater model was calibrated to the existing hydrogeologic data and honored the conceptual model groundwater conditions. After calibration it was used to predict groundwater conditions during mining and post-closure. The model grid was designed to incorporate the important geologic and structural features that influence groundwater occurrence in the mountains and the two adjacent basins.

The tasks for developing the groundwater model included:

- Model design and construction
- Steady-state calibration
- Predictive simulations
- Transport simulations

The 3D model process incorporated the following components:

- Construction of the numerical groundwater model grid with detail and refinement centered on the mine and facilities.
- Preparation and implementation of topography files for current conditions and phased increments of the mine plan, including the open pit and facility phases.
- Incorporation of the important hydrogeologic units, contacts, structures, and boundaries into the numerical model grid.
- Incorporation of available piezometer data and pumping well records into the model.
- Development of model layers, including external and internal boundary conditions.
- Completion of the calibration and predictions.

Additional discussion of the model construction, calibration and predictions is provided in the report sections that follow.

3.2 Calibration Model Construction

3.2.1 Previous Models

Several groundwater models have been previously constructed in the general area of the Project. Some models were for simulating general water-supply issues related to the Tucson Active Management Area (TAMA) while others were prepared specifically in support of proposed Rosemont projects. These prior models provide information that was useful for constructing the groundwater model described in this report. However, the model described herein was developed based on the conceptual model and considerations specific to the proposed mining areas and mine plan for the Rosemont Copper World Project.

Two pre-existing groundwater models were particularly useful in setting up the composite Project model:

- **Mason and Hipke, 2013 and Mason and Bota, 2006** (the West model). The model is the current TAMA model update. The purpose of this model is to provide insights into water-supply issues in the basin-fill deposits in the Upper Santa Cruz and Avra Valley basins. This model is mainly concerned with water-supply related issues in these valleys. The southeast portion of the West model domain overlaps with portions of the Project model of the Rosemont Project. The West model was available only as a set of MODFLOW input files.
- **Tetra Tech, 2010** (the East model). The model, which includes updates based on subsequent field investigations and analyses (Neirbo Hydrogeology, 2019), was designed for the purposes of investigating mining impacts to the local-scale hydrogeology and is largely focused on the area east of the ridgeline. It was distributed as a Groundwater Vistas file.

Neither of the above models is appropriate for evaluation of the proposed mine plan since both have boundaries and domain limits that fall within or near the proposed mining area. Therefore, while of broad applicability to this project and some areas of the mine plan, neither is purposed to evaluate hydrogeology related to the overall layout of proposed mining areas or facilities.

The pre-existing East and West model domains overlap in an area of about 10 miles by 25 miles. The overlapping active area (within which groundwater flow is simulated) is relatively small. Nevertheless, the overlap provides a useful check that ensures that the two pre-existing models reasonably represent similar conceptual hydrogeological conditions and the numerical representation of these conditions. Thus, the conclusion was drawn that the two models were amenable to combination into a single numerical framework.

Both original models have had numerous internal reviews, reviews by third parties and reviews by regulators. Because of this, each model has a high degree of confidence that they faithfully represent the conceptual model at both the regional and site-scale. Hence, they have the ability to help inform aspects of the new model for the Project. However, in spite of their high degree of confidence, the components in each model were reviewed in detail and compared to the conceptual model before incorporating them into the Project model.

3.2.2 Modeling Strategy

The modelling approach combined aspects of East and West models into a single Rosemont Copper World Project model. Specifically, the Project model parameter ranges, distributions and boundary conditions were derived from the East and West models. Additionally, other important geologic and hydrogeologic details at the scale of the proposed mine plan were added where necessary and appropriate.

Project model simulations were performed in two stages:

- A calibration model. This model is a steady-state model used to establish parameter values (Section 3.3).
- A predictive model. This model is a transient model used to predict potential impacts that may result from the proposed operations (Section 4).

3.2.3 Model Code

The Project model uses MODFLOW-USG. The MODFLOW family of codes have been developed since 1988 and are well accepted by industry and regulators alike. The USG (unstructured grid) version was released in 2013 (Panday and others, 2017) and the latest update is documented in Panday, (2020). The Project model uses the Groundwater Vistas (GV) version 8 graphical user interface (GUI) (Environmental Simulations Inc., 2021).

3.2.4 Model Domain and Grid Discretization

The model domain is defined as a three-dimensional volume of the Earth in which the model simulates groundwater conditions. The domain is usually defined as an area and groundwater conditions considered to a defined depth within that area. The definition of the model domain should consider the natural boundaries of the groundwater flow system and what type of numerical boundary conditions should be assigned along this perimeter (Section 3.2.10).

Ideally, the perimeter of a groundwater model domain should coincide with natural groundwater features whenever possible. These may include groundwater divides, large surface water features and lines parallel to persistent directions of regional groundwater flow. When the groundwater model domain does not coincide with these features, MODFLOW provides for a variety of numerical boundary conditions to represent flow across these boundaries. When there is uncertainty in how to define the model domain in a particular area, good modeling practice seeks to push the domain perimeter far enough away from the proposed area of importance (in this case the proposed mining activity) such that any errors in defining the boundary have little to no impact on the area of interest. Conversely, this is done so that the potential impacts from the activity do not affect the boundary.

The Project model domain combined the entire East model domain with a portion of the West model domain. Perimeter boundary conditions from the two models were reviewed and either adopted or modified as needed (Section 3.2.10).

The Project area straddles two 8th-order surface-water basins (the Upper Santa Cruz and Rillito basins) along the crest of the Santa Rita Mountains (Figure 3.1). The eastern side of the Rillito basin abuts the Upper San Pedro basin along the crest of the Whetstone mountains. The western side of the Upper Santa Cruz basin abuts the Avra basin following the crest of the Sierrita mountains. Groundwater level observations support the assertion that groundwater divides follow these surface water divides.

The Project model domain is centered on the proposed Rosemont Copper World Project facilities (Figure 3.1). The western edge of the model domain coincides with the Santa Cruz River and was chosen because of potential receptors down-gradient to the west from the proposed Project facilities. Although the Santa Cruz River is ephemeral, previous groundwater studies have shown that it acts as a groundwater divide due to downstream flow in saturated alluvium.

The eastern edge of the domain coincides with the boundary between the Rillito and Upper San Pedro surface water basins along the crest of the Whetstone mountains.

The southern edge of the model domain is mostly coincident with the southern edge of the Rillito basin. However, a portion of the southern boundary follows a 10th-order basin boundary and other portions do not coincide with any natural feature. These are represented with a MODFLOW General Head Boundary condition (Section 3.2.10) that simulates underflow into the model domain.

The northern edge of the model domain does not coincide with any natural features. It is represented with a MODFLOW General Head Boundary condition (Section 3.2.10) that simulates underflow into and out of the model domain.

The Project model grid uses a rectilinear grid of cells. The cells are a maximum of 2,640 feet by 2,640 feet in the corners of the grid extents. In the area of the proposed Project facilities, the model cells are 200 feet by 200 feet, allowing finer scales of geologic detail to be incorporated in the main area of focus for the hydrogeologic evaluation. There are 199 rows and 197 columns for a total of 39,203 cells per layer. The Project model grid is shown in Figure 3.2.

The Project model has twelve layers. With twelve layers, there are a total of 470,436 cells in the model. The layers were defined to follow the model layers as defined in the East and West models as closely as possible. However, there are two important differences between the two models. First, the ground surface of the West model did not coincide with the ground surface of the East model in the area where the two models overlapped. The ground surface of the West model was about 500 feet above the ground surface of the East model. Second, the East and West models used different schemes to define layers.

The West model has three layers. Although originally based on a stratigraphic framework of the basin fill in the Upper Santa Cruz and Avra basins, the 2013 version of the TAMA model (Mason & Hipke 2013) was modified to reflect an interpretation of the section encountered in the “Exxon well” (Houser and others, 2005). The model layers of the West model are not flat, nor do they have a constant thickness across the entire domain.

The East model has twelve layers. The layers of East model do not follow stratigraphy. The model layers of the East model are not flat, nor do they have a constant thickness across the entire domain. The layers are based on proportioning the total thickness between the ground surface and an elevation of 1,000 feet amsl.

A review of the surfaces that define the layers in the two models showed that the bottom of layer three in the West model was the same surface as the bottom in layer three of the East model. A workflow was developed to define the Project model layers consistently across the entire model domain. Figure 3.3 shows a cross section through the model domain that illustrates the model layers.

3.2.5 Time Discretization

The calibration model assumes steady-state conditions prior to initiation of mining at the Project. As such, time is not defined. In contrast, the Predictive Model is transient. For more details see Section 4.1.1.

3.2.6 Hydraulic Properties

The graphical user interface, GV, allows material properties to be represented as either zones or matrices. Material properties include hydraulic conductivity, storativity, recharge, evapotranspiration and others.

- Zones are piece-wise areas of constant values. Thus, a “zone” has two attributes: geometry (the three-dimensional distribution within the model) and value (the property value assigned to each zone).

- Matrices assign material properties to each cell in the model. In contrast to zones, a matrix approach allows property values to vary continuously from cell to cell.

The Project model assigns properties as zones. In the Project model, hydraulic conductivity and storativity zone geometry are defined to be exactly the same even though there is no requirement that they must be.

Hydraulic Conductivity

Hydraulic conductivity zone dimensions and initial values were derived from the East and West models, following review of the ranges of values relative to conceptual hydrogeologic understanding. Because the East model used zones, a workflow was developed to “map” the hydraulic conductivity zones of the East model into the Project model’s grid. The initial values for these zones were reviewed for conceptual validity and then copied from the East model.

In contrast, the West model uses a matrix approach to define hydraulic properties. Consequently, a workflow was developed to “bin” the continuous matrix of values into three to four zones on each of the three layers. The initial values were initially benchmarked to the conceptual understanding of the hydrogeologic system and then reassigned a value based on the median value of the bin.

Figures 3.4.1 through 3.4.25 show the distribution of K zones on each layer. The final calibrated values are listed in Appendix A.

Storativity

Storativity was setup in a manner similar to hydraulic conductivity. Again, the ranges applied were benchmarked to the hydrogeologic conceptual understanding of the overall domain and established ranges for the geologic materials in the system.

- Zone geometry was set to be identical to the K zones
- Specific Storage and Specific Yield values were defined based on values from the East and West models.

Figures 3.4.1 through 3.4.25 show the distribution of S zones in each layer. The final calibrated values are listed in Appendix A.

3.2.7 Recharge

Both the East and West models include steady-state recharge as average annual recharge conditions. However, each model approached recharge in slightly different ways.

The recharge distribution in the East model was based on hydrologic soil groups. These soil groups are based on the surface material's runoff generating potential and conversely, the water infiltration potential. The properties that are used to define soil groups include the soil thickness or depth to a restrictive layer, permeability, texture, structure, and degree of swelling when saturated. All are properties that influence runoff responses (NRCS, 2021). The recharge zones in the East model include:

- Zone 2 – Mountain front deposits, soil Group B.
- Zone 3 – Basin fill, soil Group C.
- Zone 4 – Bedrock, high runoff potential, soil Group D.
- Zone 5 – Drainage-channel alluvium, soil Group A.
- Zone 6 – Bedrock, high elevation, soil Group B.

The calibrated recharge rates in the East model range from 0.20 to 0.88 in/yr, which represents 1.1% to 4.9% of mean annual precipitation (18 in/year) (Neirbo Hydrogeology, 2019).

The West model identified the following categories of recharge in their model (Mason and Bota, 2006; Mason and Hipke, 2013):

- Natural Recharge
- Stream Flow Recharge. Rates are constant in space and time.
- Mountain-Front recharge. Rates are constant in space and time.
- Incidental Recharge
- Agricultural Recharge. Rates vary in space and time.
- Effluent Recharge. Not applicable to the Project model area.
- Artificial Recharge (Underground Storage Facilities). Not applicable to the steady-state model.
- Tailings Pond Recharge. Not applicable to the Project model area.

There are three important things to note about the West model recharge. First, any given cell may consist of more than one of the recharge components listed above. For example, the recharge rate in a single cell along the Santa Cruz River may consist of contributions from stream flow recharge and agricultural recharge. Figures in Mason and Bota (2006) and Mason and Hipke (2013) imply that this is the case but there is no documentation available that differentiates the components.

Second, recharge was only defined along the Santa Cruz River and along the mountain front. The rest of the model has zero recharge. It is inferred that these areas have no recharge because evaporation exceeds precipitation (Mason and Bota, 2006; Mason and Hipke, 2013).

Third, it is not known if the original model was defined using the zone concept. A review of the recharge rates from the West model files showed that there were 233 unique rates listed which makes it seem unlikely that the zone concept was used. Rather than having 233 recharge zones brought into the Project model, the recharge information was consolidated into 13 zones. This was done by dividing the entire range of observed recharge rates in the East model (1e-5 ft/d to 1e-2 ft/d) into 13 bins where each bin is ¼ of a log-decade wide.

Figure 3.5 shows the final recharge distribution in the Project model and Appendix B lists the final calibration values.

3.2.8 Evapotranspiration

Both the East and West models include evapotranspiration (ET) and both models only define this process along key streams. The zones in the Project model reflect the spatial distribution of ET in both the West and East models.

In addition to the ET rate, an extinction depth is also defined. The extinction depth for all zones derived from the West model is 25 feet and the extinction depth for the zones derived from the East model varies from 5.7 feet to 17.3 feet. Since the top of the model is defined by the ground surface, it was not necessary to define the ET surface.

Figure 3.6 shows the final distribution of ET zones and the final calibration values are listed in Appendix B.

3.2.9 Horizontal Flow Barrier

Horizontal flow barriers (HFB) in MODFLOW introduce additional flow resistance in the horizontal flow direction. The concept of an HFB is used to represent a “thin” planar feature of low hydraulic conductivity that impedes horizontal flow. They have no affect on vertical flow. HFBs are defined on the faces of cell pairs. The HFB feature is normally incorporated to represent the presence of structural geology features including high angle faults, intrusive dike features or geologic contacts, that may create a relative impedance to groundwater movement when compared to the surrounding host rock materials.

The East model uses an HFB to represent the Davidson Canyon Dike. Neirbo Hydrogeology (2019) describes this feature as:

A northwest-striking quartz-porphyry dike has been mapped on the Mount Fagan and Empire Ranch 7.5' quadrangles (Ferguson and others*, 2001; Ferguson, 2009). One of the longest and most continuous of these dikes perpendicularly intersects the Davidson Canyon Wash approximately 3,000 feet northeast of monitor Well RP-7 and is referred to as the Davidson Canyon Dike in this Flow Model report ... This Tertiary age geologic feature is described in Ferguson (2009) as "felsic porphyry containing 10-30% quartz and feldspar phenocrysts (1-3 mm) and sparse biotite in a fine-grained light-colored matrix, locally flow-foliated. Forms dikes and sills, and a plug-like stock in the northwest corner of the map area."*

The implementation of the HFB follows the definition in the East model as much as possible. Due to the differences between the two model grids, the HFB in the Project model is close, but not in the exact location as it is in the East model (Figure 3.7). The HFB in both models exists on all layers and is vertical. The HFB is divided into six reaches, and within each reach the thickness is set to 100 feet and the hydraulic conductivity unchanged from the East model. The HFB properties for each reach is given in Table 3.1.

Table 3.1 Simulated Properties of the Davidson Canyon Dike

Reach	Thickness (feet)	Hydraulic Conductivity (feet/day)	Hydraulic Characteristic (day^{-1})
1	100	0.0001	1e-6
2	100	0.0001	1e-6
3	100	0.01	1e-4
4	100	130	1.3
5	100	0.01	1e-4
6	100	0.0001	1e-6

3.2.10 Natural and Perimeter Boundary Conditions

In addition to recharge and evapotranspiration, there are a number of other boundary conditions defined for the Project model. These include:

- No-flow cells
- Surface streams
- Springs
- General head boundaries

The distribution of these is shown in Figure 3.7. The boundary locations and conditions have been assigned into the Project model on the basis that they make sense relative to the conceptual hydrogeologic model and understanding of the area.

No-Flow cells

No-flow cells are cells in the model grid that do not participate in the groundwater flow solution. All cells outside of the model domain are defined as no flow cells (Figure 3.7). The bottom of the model is also a no-flow boundary. It represents a very dense low conductivity basement bedrock with relatively very minimal influence on active groundwater movement, gradients, or responses.

Surface streams

The West model represented the Santa Cruz River with the MODFLOW recharge package. The East model represented portions of Cienega and Davidson Creeks with the Stream Flow Routing (SFR) MODFLOW package.

In order to unify and simplify the model inputs, surface streams in the Project model are represented as MODFLOW drains. MODFLOW drains only allow flow to leave the model and once it leaves a particular cell, it is removed permanently from the model. The rate of flow is a function of the difference between the head in the aquifer and the boundary head, and the drain conductance.

The surface stream drains were grouped into reaches to aid in parameter definition and to serve as the basis for post-modeling analysis.

The user defined drain parameters include:

- Hydraulic conductivity – This is set to be 500 ft/day in all cells.
- Thickness – This is set to be 30 feet in all cells. The concept is that the boundary condition represents the entirety of the recent alluvium. This thickness is not precisely known, but this value was used in the East model.
- Width – This is defined as the width of the recent alluvium as depicted on geologic maps. Width was set to a constant value in each reach.
- Length – This was defined based on the actual length of the stream within each model cell.
- Head – This is set to the minimum DEM raster in each model cell, less five feet.

The distribution of the surface streams and the areas of the streams represented by drains are shown in Figure 3.7.

Springs

There are twelve springs represented with MODFLOW drain package in the East model. This is far fewer than the inventory of all springs known within the model domain. Neirbo Hydrogeology (2019) has a discussion of the reasoning for including only these twelve springs as boundary conditions. All these springs, plus an additional nine, were used as head targets (Section 3.3.2).

The seep and spring inventory conducted by Westland (2012) resulted in identification of 104 features. A more recent study by Rosemont (2017) focused on 25 sites. Only two of these have had been observed to have consistently flowing conditions. Another five have possible perennial but limited groundwater flow. Local or perched conditions are likely present at the remaining 16 locations. In addition to site characteristics, radiocarbon isotope age dating was performed on 11 spring sites. The results indicate that ages range from modern (after 1950) to over 11,000 years old (Rosemont, 2014). Definitive source areas and flow paths have not been determined for the springs. A flow path analysis is complicated by the occurrence of several different geologic units along possible flow paths, which results in non-distinct chemical characteristics (Neirbo Hydrogeology, 2019).

Most of the 104 springs identified by Westland (2012) were not included in the model because they were associated with seasonal precipitation and not the regional groundwater flow system. It is inappropriate to include springs as boundary conditions when these springs are perched or otherwise not connected to the regional groundwater flow system. Only the 12 springs that had evidence of persistent flows were interpreted to represent the regional groundwater system and thus, they are the only springs included in the model (Neirbo Hydrogeology, 2019).

The twelve springs were transferred to the Project model. The row-column location is based on surveyed locations (Westland, 2012). The layer where the springs are placed follows the logic used in the East model (Neirbo Hydrogeology, 2019):

- The spring was placed in the uppermost model layer representing the Paleozoic unit if present beneath the spring location.
- If Paleozoic units were not present, the spring was placed in the uppermost model layer representing the Willow Canyon formation (Ksd).
- If neither condition was true in the Project model, the spring was assigned to the same layer as it was in the East model.

The user defined drain parameters include:

- Hydraulic conductivity – This is set to be 100 ft/day in all cells.
- Thickness, width, length – This is set to be 1 foot in all cells.

- Head – This is set to the minimum DEM raster in each model cell.

The springs drains were each assigned a reach number to aid in parameter definition and to serve as basis for post-modeling analysis. The distribution of the spring drains is shown in Figure 3.7.

General Head

General Head Boundaries (GHB, Figure 3.7) are a type of head-dependent boundary condition used in MODFLOW. This boundary type allows flows into or out of the model depending on the difference in head between the aquifer and the boundary head and the conductance defined for the boundary. In general, the manner in how these boundaries are defined follows the method used in the East model (Neirbo Hydrogeology, 2109).

The user defined GHB parameters include:

- Width of the model cell. This is grid dependent and varies from place to place.
- Saturated thickness of the model cell. This is grid dependent and varies from place to place.
- The distance to the GHB head. This is fixed to be 2,640 feet.
- The hydraulic conductivity. This varies from place to place and is equal to the hydraulic conductivity of the cell where the GHB is located.
- The boundary head. This is based on an interpretation of groundwater levels collected during the year 2000 through April 2021 as well as the heads used in the East model. More explanation is contained in the following paragraphs. It is assumed that there are no vertical gradients in the boundary heads at any specific row-column location.
- The GHBs were grouped into reach numbers to aid in parameter definition and to serve as the basis for post-modeling analysis.

The GHB Boundaries are defined in four areas and the manner of how the boundary head is defined varies by area:

The Cienega Creek inflow. The heads along this boundary in the East model were between 4,673 and 4,789 feet amsl. This area was outside the domain of the West model. The boundary head in the Project model is set to a constant value of 4,775 feet amsl in all cells along this boundary in all layers based on an interpretation of observed water levels 2000-2021.

The Santa Cruz inflow. This area is outside the domain of the East model. The West model represented this boundary as a constant head ranging from 3,005 to 3,030 feet amsl but the location of this boundary is some two miles north of the equivalent boundary in the Project model. The boundary head in the Project model is set to a constant value of 3,150 feet amsl in all cells along this boundary and in all layers based on an interpretation of observed water levels 2000-2021.

The Northern boundary in the Upper Santa Cruz 8th-order basin. This area is partly outside the domain of the East model. There is no boundary at this location in the West model. Fortunately, there are abundant observed water levels from 2000-2021 that were used to define the boundary head, especially near the Santa Cruz River. The distribution of heads along this portion of the model perimeter uses a combination of the mapped water levels and the East model boundary heads. The boundary head in the Project model uses a distribution of heads that range from 2,550 feet amsl on the west to 3,050 feet amsl at the divide on the north-central boundary.

The Northern boundary in the Rillito 8th-order basin. This area is within the East model domain and outside of the West model domain. The distribution of heads along this portion of the model perimeter uses a combination of the mapped water levels and the East model boundary heads. The boundary head in the Project model ranges from 3,050 feet amsl on the west side to 3,850 feet amsl on East side, including a local minimum of 3,000 feet amsl where Cienega Creek exits the model.

3.2.11 Pumping

The head targets used for calibration of the West model (Section 3.3.2) are influenced by pumping along the Santa Cruz River. Since the West model targets were used to calibrate the Project model, the Project model needed to include the West model wells. These wells are included for completeness even though they are some distance from the Project area and to ensure coherence with the West model targets. A different set of wells are included in the predictive Project model (Section 4.1.2).

The wells that were included in the West model calibration reflect conditions that were presumed to exist prior to 1940 (Mason and Bota, 2006; Mason and Hipke, 2013). The calibration version of the West model defines 54, steady-state wells along the Santa Cruz River that fall into the active cells of the Project model. Most of these are likely composite locations representing two or more actual pumping wells. Transferring these wells into the Project model involved the following considerations:

- Nine of these wells could be linked with known ADWR Wells 55 (ADWR, 2021a) registry or Groundwater Site Inventory (ADWR, 2021b) wells. The XY-locations of these wells were moved to the location indicated in the database.
- The other 45 wells could not be definitively associated with a known Wells 55 registry or GWSI location. These are likely composite locations representing multiple wells in a given quarter section (West model cell). Their XY-locations were derived from the West model cell center (i.e., model node) coordinates.
- The screened interval was not known. Thus, an algorithm was developed to estimate the screened interval.

- Twelve wells in the West model were reported to be on layers 1 and 2. For these wells, the top of the screen was assumed to be below the top of layer 1 by 25% of the layer 1 thickness. The bottom of the screen was assumed to be above the bottom of layer 2 by 25% of the thickness of layer 2.
- For the remaining 42 wells, the West model placed these wells only in layer 1. The screen was assumed to be in the middle 50% of the thickness of layer 1.
- Steady-state pumping rates from the West model were assigned to the wells in the Project model with no changes.

There were no pumping wells defined for the East model (Tetra Tech, 2010; Neirbo Hydrogeology, 2019). There are over 1,800 exempt and non-exempt wells within the East model domain according to ADWR records. Tetra Tech (2010) and Neirbo Hydrogeology (2019) indicated that groundwater pumping was not included in the East model due to lack the details necessary to accurately represent pumping wells in regional scale flow models. Also, low pumping rates, spatially distributed pumping wells, and lack of observable water-level responses precluded the use of calibrating the model to those data.

Given these reasons, pumping was not included in the Project calibration model in the eastern part of the Project model domain. The Project model uses the MODFLOW well package to represent the pumping wells on the west side.

Figure 3.8 shows the locations of the pumping wells in the Project model.

3.3 Model Calibration

The groundwater model must be calibrated to demonstrate its ability to reasonably replicate the hydrogeologic responses at the Project site. Calibration is a process where model parameters are adjusted until the model output matches field observations. This is necessary to build confidence and credibility in the subsequent prediction of future conditions during and after mining.

Calibration of the Rosemont Copper World Project groundwater model was completed as follows:

- Hydrogeologic zones and domain limits were assigned using hydraulic properties for the major structures, geologic units and contact zones.
- Initial boundary condition parameter values were set using the available data.
- The model was run in steady state to establish the set of conditions that replicate measured groundwater levels.
- The calibration process involved adjusting hydraulic parameters and boundary conditions within established ranges (based on site data and experience) and then comparing the simulated water levels to the water levels measured at target locations. This was done

iteratively until a best achievable match was attained between the simulated and observed water levels.

The model calibration was evaluated on the basis of its ability to:

- Retain the important aspects of the conceptual model at the proposed Project area and regional scales, including compartment and boundary limits and hydraulic parameters.
- Reproduce a global water balance that reflects Project site conditions.
- Provide calibration statistics that comply with modelling standards.

3.3.1 Nomenclature and Definitions

Absolute Mean Error (MAE): is the mean of the sum of the absolute value of the residuals (Equation 1).

1. $MAE = \frac{\sum_{i=1}^{n} |(h_{OBS} - h_{SIM})_i|}{n}$

where h is head (or other measurement) for the observed (OBS) and simulated (SIM) values and n is the number of targets.

Calibration: A process that involves making changes to model parameters until the model output matches field observations. Due to errors from a variety of sources, no model can be perfectly calibrated. Consequently, determining whether or not a particular model is "calibrated" is project specific and depends on the goals of the project.

Location or **Target location**: The point in 3D space where an observation is made. Often, these terms are used to refer to the complete set of observations gathered at a single point over a period of time.

Mean Error (ME): the mean of the residual errors (Equation 2)

2. $ME = \frac{\sum_{i=1}^{n} (h_{OBS} - h_{SIM})_i}{n}$

where h is head (or other measurement) for the observed (OBS) and simulated (SIM) values and n is the number of targets.

Parameter: A value assigned to a model component. This may include, for example, the hydraulic conductivity of a particular model cell. It may also refer to values used to define boundary conditions. In a broader sense, it may refer to the geometry of model zones in addition to the values assigned to those zones.

Residual or **Residual Error (RES)**: The difference between the observed target value and the simulated value (Equation 3). For example, if head is the measurement type

3. $RES = h_{OBS} - h_{SIM}$

where h is head (or other measurement) for the observed (OBS) and simulated (SIM) values and RES is the residual of a single target.

Root Mean Square Error (RMSE): Shown in (Equation 4)

4. $RMSE = \sqrt{\frac{\sum_{i=1}^{n}(h_{OBS}-h_{SIM})_i^2}{n}}$

where h is head (or other measurement) for the observed (OBS) and simulated (SIM) values and n is the number of targets.

Scaled RMSE: The RMSE divided by the range of observed heads. A model that has a scaled RMSE of less than 10% is considered by some to be a well-calibrated model (Anderson and others, 2015).

Standard Deviation (STDEV): Shown in (Equation 5)

5. $STDEV = \sqrt{\frac{\sum_{i=1}^{n}(RES-ME)_i^2}{n}}$

where RES is the target residual, ME is the mean error of the targets, and n is the number of targets.

Target: A single observation of head, flow or other field measurement, made at a known location in 3D space on a specific date and time. The goal of calibration is to recreate this observation via the numerical model.

Weight: An additional term used in statistical analysis of residuals meant to convey the importance, reliability, or uncertainty of an observation.

Weighted Residuals (wRES): A residual scaled by the weighting factor. (Equation 6)

6. $wRES = w \cdot (h_{OBS} - h_{SIM})$

where w is the weight applied to a particular observation.

3.3.2 Calibration Head Targets

Head calibration targets were derived from three sources:

- The East model, representing the Project mining area and the broad far-field system to the east extending a significant distance from the Project area.
- The West model, representing the broad far-field system to the west extending significant distances away from the Project area.
- The 2021 hydrogeological investigation program which focused on the proposed Project satellite pit mining areas and facility locations.

Each target consists of an X-Y location, a model layer, a target value (water level observation), and a weight. The location of these targets is shown in Figure 3.9 and are summarized in Appendix C. There are a total of 536 targets in the Project model.

East Model Targets

There are 491 targets derived from the East model. They represent “pre-mining, average annual, steady-state groundwater conditions” (Neirbo Hydrogeology, 2019).

The East targets were placed in the Project model according to the X- Y-coordinates and the layer given in the East model. Weights ranged from 0.1 to 5 and Neirbo Hydrogeology (2019) has a detailed discussion on the criteria used to assign weights. However, many targets in the East model file had weights greater than one and the justification for using these high weights was not mentioned in the report. During calibration of the Project model, the targets with weights greater than one were causing calibration issues by over emphasizing these targets at the expense of other targets. As such, the weights at these locations were reset to one.

The East model targets included 21 springs. Most of these are located near the Project. However, a few are in the Whetstone Mountains in the eastern part of the Project model domain and two are located on the northern edge of the model domain. Some of these springs coincide with boundary conditions. Section 3.2.10 discusses the reasoning for including these springs and the logic for parametrizing the boundary conditions. Similar logic was used to parameterize the spring targets that did not coincide with boundary conditions.

West Model Targets

There are 24 targets derived from the West model. They represent aquifer conditions as they existed prior to 1940 and these targets agree with pumping adopted from the West model (Section 3.2.11).

In the West model, targets were placed at the cell centers. There was usually enough information in the HOB file (head-observation file) included with the West model MODFLOW files that the target could often be linked to a location from either the Wells 55 registry or GWSI databases. If so, the target was moved to the known location. If not, the target remained at the X-Y- coordinate of the West model cell center. The target layer in the Project model was assumed to be the same as the target layer in the West model. Target values (water levels) from the West model were assumed to be thoroughly vetted. Weights ranged from 0.033 to 1. Mason and Bota (2006) has a detailed discussion on how these weights were derived.

2021 Hydrogeologic Investigation Program

There are 21 targets derived from the 2021 Hudbay drilling program. These are static groundwater levels measured after completing open stand pipes or piezometers at each location (Piteau, 2022).

These targets were placed in the Project model according to the coordinates of each investigation location. The layer was based on either the piezometer sensor elevation or the mid-point of the open stand pipe interval. Weights were all set to 1.

Calibration Head Target Time Frames

Each of the three target sources (East model, West model, and 2021 investigation) are based on targets from different time ranges. However, this did not cause any issues during calibration. First, an analysis of the available data shows that groundwater levels in the eastern part of the Project model domain do not vary significantly over long periods of time. Second, the observed water levels from the 2021 investigation program are generally in line with nearby targets from the East model, confirming that groundwater levels do not vary much in this part of the domain. Third, the targets from the West model are quite some distance from the other targets and they reflect pumping along the Santa Cruz River. The effects of this pumping do not extend anywhere near the East model targets. Thus, it was concluded that the targets from the eastern part of the Project domain and recent drilling were broadly compatible with the targets derived from the West model.

3.3.3 Initial Values and Starting Heads

The process for assigning initial material and boundary condition properties was described in Section 3.2. For the most part, the initial values were derived from either the West or East models and validated with conceptual understanding and established ranges. For components or areas not included in either model, initial values were based on the value of similar materials in the two models or on analogous materials.

Starting heads were solved iteratively. That is, they were adjusted using the following process:

- Make changes to either material properties or boundary conditions.
- Run the model. Save the final heads.

- Rerun the model but use the final heads from the previous step.
- Repeat the previous step as needed until the model converges, usually in one or two iterations.
- Evaluate the results by analysing the calibration statistics and start over with the first step.

Starting heads were frequently modified during the calibration process to be compatible with changes to material properties and boundary conditions.

3.3.4 Calibration Methods

Two calibration methods were employed: Manual calibration and automated calibration using the Parameter ESTimation (PEST) software (Doherty, 2015).

Generally, calibration of the Project model focused on adjusting hydraulic conductivity and to a lesser extent, recharge and evapotranspiration. Most of these adjustments involved changing the property values, but sometimes it involved making a change in the geometry of the zone. During manual calibration, only one or two zones could be adjusted at once because making more changes at once made it difficult to isolate the effect that each change had on the calibration results. After running the model, the calibration statistics were analyzed, and a new set of parameter values were defined for the next model run. The process was then repeated.

PEST is a program designed to automate much of the calibration effort. It can run as a stand-alone program, and it is also integrated with the GV interface. According to the PEST website:

> *PEST, the software package, automates calibration, and calibration-constrained uncertainty analysis of any numerical model. It interacts with a model through the model's own input and output files. While estimating or adjusting its parameters, it runs a model many times. These model runs can be conducted either in serial or in parallel. PEST records what it does in easily understood output files.*

One of the main advantages that PEST has over manual calibration is that it can adjust several parameters simultaneously. Consequently, in a given PEST simulation for the Project model, 200 or more parameters can be estimated at once.

Each PEST simulation involved the following steps:

- Run the model once to establish the initial conditions. Calculate the value of phi (objective function) which is the sum of squared residuals. The goal is to reduce phi which means that the model has produced a better fit to the observations.
- Begin a PEST iteration consisting of two parts:

- Part one, Parameter sensitivity. PEST runs the model once for each estimated parameter. This tells PEST which parameters are the most important contributors to phi.
- Part two, Parameter upgrade vector: PEST runs the model one or more times to determine a parameter upgrade vector which is basically a list of revised parameter values.
- Update the model with the revised values and calculate a new phi value. This ends the PEST iteration.
- Determine if PEST has met various closure criteria. If so, end the simulation. If not, go to the next iteration and repeat.
- If PEST has met any of the iteration closure criteria, run the model one final time with the set of parameters that produced the lowest phi.

Given the steps listed above, any given PEST simulation may involve hundreds of model runs. For the Project model, six PEST simulations were completed. These were interspersed with manual runs. In all, over 10,200 model runs were done during model calibration.

3.3.5 Calibration Results

The results of the calibration were evaluated by a number of industry-standard methods. These include:

- Analysis of weighted residual statistics (Table 3.2)
- Cross plots of simulated value against observed value (Figure 3.10.1)
- Cross plots of residual value against observed value (Figure 3.10.1)
- Histogram of weighted residuals (Figure 3.10.2)
- Maps of residuals at target locations (Figures 3.11.1 and 3.11.2)

Table 3.2 Calibration Statistics Summary

Statistic	All	Focus	Units
Count	536	126	[-]
Minimum observed water level	2590.0	3581.1	ft amsl
Maximum observed water level	5569.9	5569.9	ft amsl
Range in observed values	2979.9	1988.8	ft
Weighted Mean Error	21.0	33.2	ft
Weighted Mean Absolute Error	35.7	52.9	ft
Weighted Root Mean Squared Error	63.2	76.9	ft
Scaled Weighted Root Mean Squared Error	2.12%	3.87%	[-]

Notes:

- All refers to the entire calibration dataset. Focus refers to a subset of targets in and around the various facilities and pits.

The mass balance of the Project calibration model is 0.00%. It converged in 3 iterations and had a total run time 4.82 seconds.

Table 3.2 summarizes the key calibration statistics from the final calibration model. Results from two groups are given:

- All targets, consisting of the entire calibration dataset.
- The Focus Group, consisting of a subset of targets in and near the various facilities and pits.

The weighted mean error for all targets is +21.01. This means that the residuals show a slight bias towards underprediction. This same conclusion can be reached by reviewing the cross plot of Observed vs. Simulated heads (Figure 3.10.1), the cross plot of Observed vs. Residual heads (Figure 3.10.1) and the histogram of weighted residuals (Figure 3.10.2). The scaled weighted RMSE for all targets is 2.12%, well under the acceptable threshold of 5% to 10% cited in the literature (Anderson and others, 2015).

The calibration statistics for the Focus Group (Table 3.2) are slightly worse than the statistics for all targets but they are still within the range that indicates this is a well-calibrated model.

The cross plot of Observed vs. Simulated heads (Figure 3.10.1) shows a very good fit. The slope of the line is 0.998 (1 is a perfect fit), the intercept is 12.4 (0 is a perfect fit), and a coefficient of determination (r^2) of 0.992 (1 is a perfect fit).

The cross plot of Observed vs. Residual heads (Figure 3.10.1) also shows that the model is doing a good job of replicating the observed values. The residuals show a very slight propensity to be under predicted (the intercept is +12.4 ft) but the slope of the line at 0.002, and the coefficient of determination (r^2) at 0.0005, show that the model response is not biased with respect to the magnitude of the observed value.

The histogram of the weighted residuals (Figure 3.10.2) shows an approximately Normal distribution with a mean of +21.01 feet, a median of +5.08 feet and a mode of -5 feet. However, the range of weighted residuals is large, extending from -141.81 feet to +467.28 feet. Given that the site is located in an area of large topographic variability, that the observations possess a wide range of observed water levels (nearly 3,000 feet) and given the relative coarseness of the model grid and layers, these results show an overall good calibration to measured water levels.

Figure 3.11.1 shows the distribution of weighted residuals across the entire domain and Figure 3.11.2 shows the distribution of the weighted residuals of the Focus Group in and around the Project facilities and pits. Inspection of this map does not reveal any significant spatial biases in the magnitude or direction of the residuals. The residuals appear to be randomly distributed across the model domain.

Overall, all of the calibration results indicate that the Project model is well-calibrated and is fit-for-purpose of serving as the precursor for predictive modeling.

4 MODEL PREDICTIONS, MINING AND RECOVERY PHASES

A modified version of the calibrated model (the Predictive Model) was used to predict future groundwater conditions based on phased implementation of the Project mine plan, including the planned open pit mining areas, heap leach pad, waste rock facility, tailings facilities and processing facilities. All of these were added to the model incrementally over time, based on the mine plan. The predictions evaluate the degree of interaction between facilities and the groundwater system.

The overall Predictive Project Model consists of two separate models:

- A base Predictive Model that assumes no mining-related activities will occur. This model includes all the boundary conditions defined in the steady-state calibration model. This model differs from the steady-state calibration model in that regional-scale, transient well pumping was included to represent future water demands.
- A mining Predictive Model that assumes mining-related activities will occur. This model includes all the boundary conditions defined in the calibration model plus the transient, regional pumping defined in the base Predictive Model. This model differs from the base Predictive Model in that it includes mining-related processes such as transient water-supply pumping, transient seepage from the Tailings Storage (TSF-1 and TSF-2) and Heap Leach Pad (HLP), pit dewatering, and pit lake filling.

The distribution and timing of the various mining components represented in the Predictive Model are based on the mine development sequence. Mine plans were being refined during development of the Predictive Model. As such, the Predictive Model as presented herein, represents elements of these evolving mine plans:

- September 2021 – A 20-year mine plan was used to represent the pit progression, the Waste Rock placement, and water-supply pumping.
- November 2021 – A 17-year mine plan was used to represent the buildout of two TSF and one HLP including the seepage from these facilities.

Currently the mine plan for the Rosemont Copper World Project includes 15 operational years.

4.1 Predictive Model Construction

The calibration model was modified to reflect elements of the Project mine sequence plan. The changes included:

- Conversion to a transient model
- Inclusion of predictive pumping wells

- Inclusion of transient seepage terms
- Transient pit dewatering
- Time varying materials
- Simulation of pit lake filling

All other boundary conditions are defined as steady-state processes and remain unchanged from the calibration model.

4.1.1 Time Setup

The Project model uses a time setup to accommodate the proposed mine development (mining phase) sequence that has activity on both the east and west sides of the Santa Rita ridgeline. The mining Predictive Model uses a single model for both the mining and recovery phases. This simplifies model setup, particle tracking, and fate and transport modeling.

The Project model includes an initial, steady-state stress period. The purpose of this stress period allows the model to converge the starting heads with all the other attributes of the model. The pumping rates applied to this stress period are based on 2019 pumping rates supplied by the ADWR (See Section 4.1.2). Following the initial stress period, the next two stress periods simulate two years prior to mining, followed by 20 years of mining, and 1,000 years of post-mining recovery. The model was setup to simulate 1,000 years post-mining, but the simulated groundwater system reaches a quasi-equilibrium state in just 200 years after cessation of mining. Hence, results reported herein are reported to only 200 years post-mining.

Stress periods are each one-year long through the cessation of mining; then they progressively become longer as shown in Table 4.1. The model simulates a total of 373,278 days (1,022 years) over 72 stress periods.

The model uses the Automatic Time Stepping (ATS) package of MODFLOW-USG to help ensure numerical convergence.

Table 4.1 Stress Period Setup, Predictive Model

Stress Periods	Stress Period Duration	Remarks
1	1 day	Steady-state
2 – 3	1 year	Lead in, starting on 1/1/21
4 – 23	1 year	Mining Phase, 1/1/2023 to 12/31/2042
24 – 33	2 years	Closure Phase, ends 20 years after EOM
34 – 43	5 years	Closure Phase, ends 70 years after EOM
44 – 56	10 years	Closure Phase, ends 200 years after EOM
57 – 72	50 years	Closure Phase, ends 1000 years after EOM

Notes:
- Stress Period Duration is the duration of each stress period in this group.

4.1.2 Pumping

Currently, pumping for a variety of purposes exists along the Santa Cruz River. The nature of how this pumping will evolve over the course of the mining period, let alone 1,000 years into the future is unknown and unknowable. Nevertheless, the Project model includes this pumping because it represents potential receptors.

Future pumping implemented in the Project model needs to reflect the following:

- Future pumping includes estimated “regional” pumping wells, proposed projected-related water-supply wells, and proposed project-related interceptor wells.
- Future pumping will likely see a gradual shift from agricultural purposes to drinking water supply as a result of urbanization along the Santa Cruz River. Water reuse, aquifer storage and recovery, water conservation efforts all contribute to make prediction of future pumping demands uncertain.
- Future pumping should have a reasonable spatial distribution. That is, the density of wells in the future should not be significantly different than they are today.
- Future pumping will likely increase in the intermediate term (20 to 30 years in the future). It is unlikely that future pumping will grow without bounds. This is not realistic.
- The Project model is not designed to evaluate future water demands. Pumping is included in the model because there is a reasonable expectation that pumping will continue into the future. This represents a significant removal of water from the system and that this pumping may be receptors of Constituents of Concern (COCs) that may result from activity at the Project site.

The best sources of information for future pumping are the two existing groundwater models. As discussed above in Section 3.2.11, the East model did not include any pumping wells. In contrast, the West model (Mason and Bota 2006) contains a detailed discussion of the future water demands within the model domain for the period 2000 through 2025. However, the TAMA model files for the predictive period have not been made public by ADWR.

The updated West model (Mason and Hipke, 2013) extended the calibration period through 2010. As noted, a predictive period was not reported.

Montgomery and Associates (2009a, 2009b, and amended and updated in October and November 2009) updated and modified the Mason and Bota (2006) model. The reports contain a discussion of how the 2006 TAMA model was modified with respect to pumping and recharge. Furthermore, they discuss how future pumping was implemented, including pumping not represented in the TAMA model. The historical pumping record was modified in a similar fashion for the Project model to represent future pumping. The pumping record currently under development for a TAMA model update was provided by ADWR (2021c) in the form of a MODFLOW well file. This well file contains vetted and approved pumping rates for wells in the TAMA model through 2019 (hereafter referred to as the Well19 file).

Pumping well attributes include locations in three dimensions and the pumping rate history. The Well19 file is somewhat crude with respect to the former attribute; the wells are located only by row and column indices of the West model grid and there is no screen elevation information in the file, only layers. Although some records have comments which may make it possible to identify a well from either the Wells 55 registry or GWSI (2021) databases, no attempt was made to do this since identification to a specific well was not possible for the vast majority of records in the Well19 file. The majority of the records in the Well19 file appear to be composite wells. Thus, the wells in the Well19 file were transferred to the Project model grid, as is, at the X- Y-coordinate of the West model cell centers.

Pumping wells in the Project model are represented using the Connected Linear Network package (CLN) of MODFLOW-USG (Panday and others, 2017) rather than the conventional MODFLOW well package (McDonald and Harbaugh 1988). As a note, the Well19 file is designed to use the MODFLOW well package. One of the advantages of using the CLN package to represent pumping wells is that multi-layer wells are connected by a high-conductivity conduit. Also, simulated pumping rates are dynamically allocated across model layers intersected by the screen according to the layer transmissivity. To use the CLN package in the Project model, the following assumptions were made for the screen intervals:

- The top of the screen is below the top of the uppermost layer defined in the Well19 file by 25% of the uppermost layer thickness.

- The bottom of the screen is above the bottom of the lowest layer defined in the Well19 file by 5% of the lowest layer thickness.

A total of 151 wells were transferred from the Well19 file to the Project model.

Wells in the Well19 file fell into two categories: 1) wells with pumping in the 2000-2019 timeframe and 2) wells with earlier pumping but none in the 2000-2019 timeframe. This distinction led to the creation of two groups of pumping wells for the purposes of defining future pumping rates:

Group A wells are based on Well19 wells that had any pumping whatsoever in the 2000-2019 timeframe. Group A wells were assumed to exist for the entire duration of the Project model and that these wells are pumped at a constant rate based on their average pumping rate for the 2000-2019 timeframe as defined in the Well19 file. These rates vary from 0.1 gpm to 879 gpm. There are 72 Group A wells. Figure 4.1 shows the distribution of these wells and Figure 4.2 shows the contribution of this group to total pumping.

Group B wells are based on the Well19 file wells that had no pumping in the 2000-2019 timeframe; they are used to represent assumed future pumping locations. These wells are activated in the Project model randomly between stress period 4 (representing mine year 1) and stress period 43 (representing 70 years after the end of mining [EOM]). The initial rate in each well is set to 214 gpm which is the average rate of Group A wells. The pumping rate then declines to zero in stress period 44. There are 44 Group B wells. Figure 4.1 shows the distribution of these wells and Figure 4.2 shows the contribution of this group to total pumping.

The total combined pumping rate of Group A and Group B wells was compared to historical pumping from 1985 through 2019 to ensure that:

- The total pumping at the beginning of the Project model predictive simulation matches the total pumping for 2019 in the Well19 file (approximately 18,800 gpm).
- The total future pumping in the Project model does not exceed about 31,200 gpm. This maximum rate was observed in the historical pumping for the 151 wells transferred to the Project model around 1995.

Group C wells were added to fill in a gap between the southern end of the West Model domain and the southern end of the Project model domain, a distance of approximately six miles. These wells were selected at random from known GWSI database wells with the intention of creating a set of wells that have the same spatial density as the Group A and B wells. This amounted to an additional 24 locations. No attempt was made to ensure that these wells were in unique model cells or to have them identified to any particular activity such as agriculture or housing developments. Figure 4.1 shows the distribution of these wells and Figure 4.2 shows the contribution of this group to total pumping.

The Group C wells were setup in a manner similar to the Group B wells.

- The X and Y coordinates are the same as the record in the database.
- The wells are assumed to be screened in layers 1, 2 and 3 using the same logic described above to determine screen elevations.
- The wells come online between stress period 1 and stress period 43. The wells stay online until the end of the model.
- The pumping rate is held constant at 214 gpm per well in all wells.

Group D wells are the Rosemont owned and operated wells in the Sanrita wellfield northwest of the facilities. These wells are located on three parcels known as the South (two wells), West (three wells), and Vulcan (four wells) properties. Figure 4.1 shows the distribution of these wells and Figure 4.2 shows the contribution of this group to total pumping.

These wells were implemented in the model as follows:

- The X and Y coordinates come from the database.
- Screen elevations are from the database. These are matched against model grid specifications to determine the model layers.
- All wells are assumed to exist from SP3 (one year before mining) through SP25 (four years after EOM) at which point they are assumed to be capped.
- Wells SP-3 and SP-4 (on the Vulcan property) are not used but since they are assumed to exist, they are in the model with a discharge rate of zero.

Pumping rates for these wells are derived from Montgomery & Associates (2018) “Scenario 3” with the following modifications:

- The original Scenario 3 has pumping beginning two years prior to mining. An assumption is made that the facility wells (Group E) will be used for pre-mining needs in stress periods 2 and 3 instead of the Group D wells. Thus, the pumping rate for all Group D wells are set Q = 0 for stress periods 1, 2, and 3. Group D pumping begins in stress period 4 (mine year 1).
- The original Scenario 3 has pumping extending for three years beyond mining from two wells (SS-1 and SS-2). An assumption is made that limited pumping will extends four years (2 stress periods) to be compatible with the Project model stress period setup, but the rates in the second SP are cut in half.

Group E wells consist of six water supply wells located near the facilities. Two are existing wells (PC-2 and PC-8) and four are wells completed in 2021 (PW-1 through PW-4). Figure 4.1 shows the distribution of these wells and Figure 4.2 shows the contribution of this group to total pumping.

These wells were implemented in the model as follows:

- The X and Y coordinates come from the database.
- Screen elevations are from the database. These are matched against model grid specifications to determine the model layers.
- All wells are assumed to exist from stress period 2 (two years before mining) through stress period 23 (EOM) or until they are abandoned prior to being buried by the waste rock facility and TSF-2.
- PW-4 is not likely to be used but since it exists, it is in the model with a discharge rate of zero.
- Each of these wells are designed to pump a constant rate of 25 gpm for their duration.

Group A, B, and C wells are implemented in both the Base Case and Predictive Models. Group D and E wells are present only in the Predictive Model. Pit dewatering is simulated using drain cells as described in Section 4.1.4.

4.1.3 Transient Seepage and Recharge

It is expected that seepage from the two Tailings Storage facilities (TSF-1 and TSF-2) will occur, and that this seepage may reach the groundwater system. In addition, there may be some very minor seepage associated with the HLP.

Maximum discharge rates for each of the three facilities (Table 4.2) were calculated by Rosemont using a water balance approach (Hudbay email communication, February 11, 2022). The seepage rates for the two TSF facilities assumed an underdrain recovery system operating at 98% efficiency. The rate for the HLP was developed based on the assumption that the facility is lined but that the liner has an average of one, 1 cm^2 hole per acre.

Table 4.2 Seepage Setup

Facility	Maximum Discharge (gpm)	Maximum Area (sq ft)	Maximum Recharge Rate (in/yr)	Stress Period (Mine Year) when Maximum Discharge Occurs
TSF-1	132	37,200,000	3.00	18 (15)
TSF-2	46	13,000,000	3.00	16 (13)
HLP	1.5	11,600,000	0.12	12 (9)

Notes:

- The TSF and HLP schedules are based on the November 2021 version of the mine sequence plan (11/04/21).

BADCT (ADEQ, 2004) suggests a maximum of five feet of head over a liner system for tailings or heap leach facilities. Thus, a series of MODFLOW drains were included in the model cells that coincide with the TSF-1 and TSF-2 footprints. These drains were implemented with a conductivity of 1,000 ft^2/d and a boundary head equal to the top of each model cell plus five feet. The drains remove water from the model only when the head in the aquifer exceeds the drain elevation.

A transient seepage schedule for each of the three facilities was developed in two parts. For the mining phase, the maximum discharge was scaled to the evolving footprint area of each facility (Figure 4.3). For the recovery phase, seepage recharge was simulated to steadily decline from the maximum rate at buildout to less than 1% of the maximum rate after 500 years. This decline is based on a power-law relationship presented in Neirbo Hydrogeology (2019)

$$Q = C \cdot t^p$$

where

C is a scaling coefficient that ensures the curve passes through the maximum discharge (Table 4.2),
t is time in mine years,
p is the power law coefficient, set to -1.346.

Figure 4.3 shows the simulated discharge for the three facilities.

Seepage for the WRF is assumed to be the same as the ambient recharge from precipitation and that there is no additional seepage introduced by the placement of the waste rock.

4.1.4 Pit Dewatering

The Predictive Model simulates pit dewatering as a function of the evolving three-dimensional pit advancement and geometry as defined in the September 2021 mine sequence plans. The mine plan consists of pit cuts from all six pits in annual increments.

The three-dimensional configuration of the Rosemont and Broadtop Butte pits, as depicted in the model, is slightly different than the configuration in the September 2021 mine plan. The final pit configuration in the Project model was based on an earlier design. The differences are small and the version in the Project model is more conservative because dewatering is simulated for a slightly longer period than the current mine plan.

The Predictive Model simulates open pit dewatering with drain cells (McDonald and Harbaugh, 1988). Drain cells remove water from the model when the head in the aquifer is above the head defined for the drain. In any given drain cell in any given stress period, the drain head is the elevation of the cut defined by the mine plan for that year or the cell bottom, whichever is less. In addition to drain head, drain cells also possess a conductance term which defines how efficient the drain removes water. Drain conductance is set in all drain cells at 500 ft^2/day. This simulation method is highly effective at removing water within the pit and is likely more efficient than real-world conditions.

4.1.5 Time Varying Materials

The Predictive Model uses the MODFLOW-USG Time Varying Materials package (TVM, Panday 2020) to represent changes in hydraulic properties resulting from pit advancement and geometry and backfilling as defined in the September 2021 mine sequence plan.

At this site, there are only three types of transitions to consider:

- In-situ rock to pit: occurs when a pit is mined, but not subsequently backfilled
- In-situ rock to backfill: occurs when a pit is mined, and immediately backfilled
- In-situ rock to pit to backfill: occurs when a pit is mined, and subsequently backfilled

The pits are represented as “air” and the waste rock properties are based on Tetra Tech (2012). The timing of the transition varies from place to place as a function of the mine plan. Consequently, a unique K and S zone must be defined for every combination of original (in-situ) rock zone and time series of transitions. This results in 421 additional zones being defined in the model.

Within GV, TVM is implemented by defining a time-series of multiplication factors for Kxy, Kz, Ss, and Sy for each zone. The multiplication factor for each property is the ratio of the desired value after the change to the initial value at the beginning of the model.

Table 4.3 summarizes these properties.

Table 4.3 TVM Air and Fill Properties

Material	Kxyz (ft/d)	Kxyz (cm/s)	Ss (ft^{-1})	Sy (-)
Pit/Air	1000	0.35	1e-9	1
Waste Rock	20	7.1e-3	5e-6	0.3

4.1.6 Lake Setup

Since the Heavy Weight, Copper World, and Broadtop Butte pits are planned to be backfilled, there is no possibility for pit lakes to form in these pits. There is the potential for pit lakes to form in the Peach, Elgin, and Rosemont pits. The pit lakes at Peach, Elgin and Rosemont are represented using a modified Hi-K/S approach. This approach is much simpler than using the LAK3 package (Anderson, and others, 2002). The modified approach uses wells to simulate direct precipitation on the lake, lake evaporation, and pit wall runoff.

Simulated pit lake recovery is based on a simple mass-balance approach, as follows:

Pit inflows – Pit outflows = change in storage

The mass balance approach takes advantage of built-in features of MODFLOW-USG. The MODFLOW-USG numerical formulation already accounts for inflows, outflows, and changes in storage, as specified in the mass-balance formulation of the groundwater model.

The first step of the mass balance approach was to modify the properties of pit cells using the TVM package (Section 4.1.5). Pit cell properties differ from groundwater cells in that they represent the characteristics of the open void occupied by a pit lake. The open void of a pit lake does not contain porous media. The drainable (i.e., “fillable”) storage parameter for the pit lake cells (Sy) was increased from typical values for porous media of one to 15 percent to the value of an open void of 100 percent. This means that the pit lake cell volumes below the lake surface are completely occupied by water in the groundwater model.

Compressible storage of the pit lake cells was decreased from typical values for a groundwater system of $1x10^{-6}$ to a value of $1x10^{-9}$ since water in a pit lake is substantially less compressible than the combined water/groundwater system skeleton of the groundwater cells. In addition, the open void occupied by a pit lake does not offer resistance to flow as do groundwater model cells. Therefore, the hydraulic conductivity values of the open pit lake cells were modified to a high value of 1,000 ft/d which allows the specified lake cells to replicate the open void of the pit lake.

Once the properties of the pit lake cells were modified as appropriate, the sources and sinks associated with the pit lake water balance were incorporated and include the following:

- Potential inflows include groundwater inflow, direct precipitation, pit-wall runoff, and catchment runoff; and
- Potential outflows include evaporation and groundwater outflow.

The water budget terms change as a function of stage. The individual components were calculated on 50 ft increments from the stage/volume/area curve developed for each pit. Groundwater seepage is automatically calculated in the model simulation by MODFLOW-USG. The other inflows and outflows were specified independently with a combined source/sink specified flux boundary (MODFLOW-USG CLN and WELL package) that represents the cumulative effect of the water balance. Given that the values of the pit lake water budget are additive, they were summed and included as combined source-sink wells in the model. Separate wells were defined for every stage increment. The wells were designed to be inactive until the pit lake stage reaches each well screen in 50-ft elevation increments.

Direct precipitation

Average annual precipitation applied to the pit lake surface was set to 19.7 inches per year based on Piteau (2022). Precipitation is a function of the pit lake area which increases with rising pit lake levels. This area was calculated as a function of stage from the stage/area relationships. The contribution of precipitation to the pit lake water balance increases with increasing pit lake elevation.

Evaporation

Average annual evaporation applied to the pit lake surface was set to 72.5 inches per year. The value was calculated using pan evaporation data from the Tucson UofA weather station (WRCC, 2021) and a pan coefficient of 0.7 (NOAA, 1982). Evaporation is a function of the pit lake area which increases with rising pit lake levels. This area was calculated as a function of stage from the stage/area relationships. The contribution of evaporation to the pit lake water balance increases with increasing pit lake elevation.

Pit wall runoff

Pit wall runoff occurs from precipitation falling on the exposed pit walls above the pit lake. The majority of precipitation falling directly onto exposed pit wall areas will evaporate. However, some of the runoff will eventually report to the pit lake, either from overland flow or, more frequently, from subsurface interflow. To account for these natural processes, the runoff coefficient was estimated to be 0.25.

The total volume of pit wall runoff is a function of the exposed pit wall area between the pit rim and the pit lake area. This area was calculated as a function of stage from the stage/area relationships. At the very bottom of the pit, the net area contributing to pit wall runoff is at its maximum since the pit lake area is at a minimum. The contribution of pit wall runoff to the pit lake water balance decreases with increasing pit lake elevation.

Catchment runoff

For this project, each of the three pits have upstream catchment areas that would naturally contribute runoff into the pits (Figure 4.4). For any given pit, catchment runoff is assumed to be a constant and related to the area of the catchment beyond the pit rim area, the average annual precipitation falling on the catchment area, and a runoff coefficient assumed to be 0.25. For Peach and Elgin at closure, however, it was assumed that the catchment areas for Peach and Elgin would include an engineered solution that would route catchment runoff away from the pits.

Table 4.4 summarizes the pit lake parameters for the Predictive Model.

Table 4.4 Pit Lake Parameters

Parameter	Peach	Elgin	Rosemont
Mean Annual Precipitation (in/yr)	19.7	19.7	19.7
Mean Annual Evaporation (in/yr)	72.46	72.46	72.46
Pit Bottom Elevation (ft amsl)	3950	4050	3650
Pit Rim Elevation (ft amsl)	4300	4250	5100
Pit Rim Area (ft^2)	1,956,900	1,237,025	14,294,500
Pit Wall Runoff Coefficient (-)	0.25	0.25	0.25
Catchment Area (ft^2)	0	0	12,238,919
Catchment Runoff Coefficient (-)	na	na	0.25

4.2 Model Results

The final Predictive Model was evaluated in terms of its numerical performance. The mass balance error for each time step ranged from -0.02% to +0.04% with 32-time steps (out of 1,815 total time steps) with non-zero errors. No time step encountered convergence issues. The number of outer iterations ranged from 1 to 35 and the maximum number of inner iterations/outer iteration ranged from 2 to 105. The model ran in 1 hours, 8 minutes, 59 seconds. This model is numerically very stable.

4.2.1 Simulated Pit Dewatering

The model presented in this report is not designed to serve as a pit-scale engineering model. As such, it simulates open pit dewatering using the MODFLOW drain package (Section 4.1.4). Actual open pit dewatering methods will likely include a variety of methods such as wells, horizontal drains, and sumps and these will vary by pit. Well locations will target areas that are likely to have higher yields (i.e., fault and fractures zones with enhanced permeability) and may be located inside and outside the open pits. Horizontal drains drilled into the pit walls from pit benches may be used to keep groundwater away from the pit walls. These differences between simulated and implemented dewatering methods will likely mean observed drawdown and flows will be more irregular than the drawdown and flows simulated by the flow model.

Table 4.5 gives the average flow rates predicted by the model for each pit.

Table 4.5 Average Pit Drain Flow Rates

Pit	Average Flow Rate (gpm)
Peach	1.5
Elgin	2.6
Heavy Weight	16
Copper World North	19
Copper World South	6.0
Broadtop Butte	26
Rosemont	296

4.2.2 Simulated Mounding above TSF and HLP

The two Tailings Storage facilities (TSFs) introduce an additional water source into the system. A description of how this was implemented in the model is provided in Section 4.1.3.

The additional water seeping from each TSF causes a mound of water to develop under each facility (Figure 4.5). This mound attains a maximum elevation soon after emplacement of the final material on the stack, then experiences a slow decay.

In contrast, the seepage rate beneath the HLP is so low that a mound does not develop. Instead, the water level beneath the HLP declines over time due to reduced recharge and influence of the local and regional drawdown (Figure 4.5).

4.2.3 Simulated Pit Lake Filling

The groundwater model predicts that pit lakes will form at Peach, Elgin, and Rosemont. The lakes at Peach and Elgin are predicted to be small relative to the size of the pit. They tend to alternate between being terminal and flow-through lakes during water level recovery. In comparison, the pit lake at Rosemont is large and is always a terminal lake.

Peach

Peach begins filling at the beginning of mine year 7 (stress period 10). When filling begins, water levels are at an elevation of 3,950 ft amsl, which is at the bottom of the Peach Pit (Figure 4.6.1). Water levels rapidly rise to an elevation of about 4,051 ft amsl then slowly rise to an elevation of about 4,061 ft amsl before falling back to an equilibrium lake level of about 4,051 ft amsl. The maximum depth of the pit lake is about 111 ft.

The water balance of the pit lake indicates that flows are very small with minor outward seepage, and likely unmeasurable in the field. These flows are within the resolution capabilities of the model and the assumptions of future conditions. The source of this water is pit wall runoff and direct precipitation which exceeds evaporation due to the small surface area of the pit lake. Water levels and flows also reflect a complex interplay of local processes and drawdown from the Rosemont Pit.

Elgin

Elgin begins filling at the beginning of mine year 4 (stress period 7). When filling begins, water levels are at an elevation of 4,050 ft amsl, which is at the bottom of the Elgin Pit (Figure 4.6.2). Water levels rapidly rise to an elevation of about 4,102 ft amsl then slowly fall to an equilibrium lake level of about 4,101 ft amsl. The maximum depth of the pit lake is about 52 ft.

The water balance of the pit lake indicates that flows are very small with minor outward and inward seepage and likely unmeasurable in the field. These flows are within the resolution capabilities of the model and the assumptions of future conditions. The source of this water is pit wall runoff and direct precipitation which exceeds evaporation due to the small surface area of the pit lake. Water levels and flows also reflect a complex interplay of local processes and drawdown from the Rosemont Pit.

Rosemont

Rosemont begins filling at the beginning of mine year 21 (stress period 24). When filling begins, water levels are at an elevation of 3,650 ft amsl, which is at the bottom of the Rosemont Pit. In contrast to Peach and Elgin, the filling history of Rosemont is straightforward (Figure 4.6.3). Water levels rapidly rise at first. The rate of rise slows down as the lake fills. By 200 years after mining stops, the lake stage is stable at about 4,253 ft amsl. The maximum depth of the pit lake is about 603 ft.

The Rosemont Pit is always a terminal lake. Net bedrock flows are always into the lake. Compared to the surface water processes, bedrock flow is the dominate process for filling the lake. During the early stages of pit filling, the net pit lake flows are positive indicating that the sum of precipitation, pit wall runoff, and catchment runoff exceeds evaporation. This changes sign at mine year 67, indicating that evaporation exceeds the other surface water processes.

4.2.4 Simulated Behavior in the Back-filled Pits

All three of the backfilled pits experience some degree of water level rise (Figure 4.7). The amount of the rise is a function of the depth of the pit relative to the pre-mine water table, timing when recovery begins, and superimposed drawdown from ongoing dewatering in nearby pits, especially Rosemont. The assumed porosity of the backfill (30%) also plays a role in attenuating the rise. The predicted water levels in the back filled materials will not return to pre-mine water levels due to the increased amount of storage.

All three pits also experience flows to and from the surrounding bedrock (Figure 4.7). The nature of these flows depends on the height of water in the backfilled waste rock, the hydraulic properties of the surrounding bedrock, and superimposed drawdown from ongoing dewatering in nearby pits, especially Rosemont. In all cases, the flows are very small, well within the resolution capabilities of the model and assumptions of future conditions and are likely unmeasurable in the field.

Heavy Weight

The bottom of Heavy Weight Pit is at 4,150 ft amsl. By 200 years post-mining, the water level is expected to rise to about 4,319 ft amsl, about 169 feet above the old pit floor (Figure 4.7). During the initial pit filling, net flow is from the surrounding bedrock into the backfill. Initial rates fall rapidly until mine year 20. At that point, net flows are still into the backfill, but the rate of change of the rates becomes very small. By 200 years post-mining, the net flow rate is approximately zero reflecting near equilibrium conditions. The flows are very small, well within the resolution capabilities of the model and assumptions of future conditions and are likely unmeasurable in the field.

Copper World

The bottom of Copper World North Pit is at 4,450 ft amsl. By 200 years post-mining, the water level is expected to rise to about 4,544 ft amsl, about 94 feet above the old pit floor (Figure 4.7). Initially, the net flows with the bedrock are directed inwards, towards the backfill but this changes direction around mine year 40. From then on flows are directed from the backfill into the bedrock at an ever-increasing rate. However, the rate of change of the flow slows. The flows are very small, well within the resolution capabilities of the model and assumptions of future conditions and are likely unmeasurable in the field.

The bottom of Copper World South Pit is at 4500 ft amsl. By 200 years post-mining, the water level is expected to rise to about 4,627 ft amsl, some 127 feet above the old pit floor. In contrast with Copper World North Pit, the model predicts that the net flows at Copper World South Pit are always from the backfill into the surrounding bedrock. The net outward flow rate increases over time but the rate of change decreases. The flows are very small, well within the resolution capabilities of the model and assumptions of future conditions and are likely unmeasurable in the field.

Broadtop Butte

The bottom of Broadtop Butte Pit is at 4,850 ft amsl. By 200-years post mining, the water level is expected to rise to about 4,974 ft amsl, some 124 feet above the old pit floor (Figure 4.7). The model predicts that the net flows at Broadtop Butte are always from the backfill into the surrounding bedrock. The net outward flow rate increases over time but the rate of change decreases. The flows are very small, well within the resolution capabilities of the model and assumptions of future conditions and are likely unmeasurable in the field.

4.2.5 Simulated Head Differences

Mine-related activities cause changes to groundwater levels in the vicinity of these activities; decreased water levels (drawdown) in and around open pits due to dewatering and increased water levels (mounds) beneath tailings piles and heap-leach facilities due to increased seepage above ambient recharge rates. Groundwater withdrawals for mine-related water use also cause water levels to decline but so does regional-scale groundwater pumping (Section 4.1.2).

In order to differentiate the head changes due to mine-related activities and those due to regional-scale pumping, two models were prepared:

- A base-case model that includes:
    - Calibrated hydraulic properties (Section 3.2.6)
    - Horizontal Flow Barrier, Davidson Canyon Dike (Section 3.2.9)
    - Ambient recharge (Section 3.2.7)
    - Ambient evapotranspiration (Section 3.2.8)
    - Other natural boundary conditions, surface streams, springs, general heads (Section 3.2.10)
    - Regional pumping, Groups A, B, C (Section 4.1.2)
- A predictive model that includes all the above plus:
    - Mine-related water supply wells, Groups D & E (Section 4.1.2)
    - Transient seepage (Section 4.1.3)
    - Pit dewatering (Section 4.1.4)
    - Time-varying materials (Section 4.1.5)
    - Pit lakes (Section 4.1.6)

Three-dimensional heads are extracted from both models for select times and maps of the head difference are prepared. The head difference maps show head differences that result from mining only. Figure 4.8.1 shows the head differences for four snapshots in time: mine years 10 and 20, and 100- and 200-years post mining.

These maps show the growth and decay of groundwater mounds relative to the pre-mining water table beneath the TSFs. There is virtually no mound developed beneath the HLP due to low seepage rates. The mounds attain a maximum elevation soon after emplacement of the final material on the stack, then experience a slow decay. Drawdown related to Rosemont Pit dewatering accelerates the decay of the mound beneath TSF-2 and a portion of TSF-1.

Figure 4.8a also show the area affected by drawdown due to pit dewatering. The area within the 10-foot drawdown isopleth increases in size after mining stops because the water in this area is filling the Rosemont Pit and, to a lesser degree, Peach, Elgin, and the backfilled pits.

Figure 4.8b shows that a small area of the mound beneath TSF-1 may rise above the original ground surface (approximated by the top of layer 1, see Section 3.2.4) and into the base of TSF-1. The estimated maximum height of this mound is approximately five feet above the top of model layer 1.

4.2.6 Simulated Changes to Springs

A total of 21 springs were used in the calibration model as head targets (Section 3.3.2). Twelve of these were also uses as boundary conditions in both the calibration model and the Predictive Models (Section 3.2.10).

Monitoring points were placed in the Predictive Model at each of the springs and head hydrographs were prepared to show the head changes that each spring experienced during mining and for 200 years after mining stopped (Figure 4.9.1 through 4.9.6). The simulated results presented here are similar to previously reported results (Tetra Tech, 2010; Neirbo Hydrogeology, 2019) which show that mining only cause small flow reductions in the springs.

Figure 4.10 shows the 10-foot drawdown isopleth with respect to key springs near the Project facilities (Section 4.2.5).

4.2.7 Simulated Changes to Stream Flows

There are three streams represented in the model and each are simulated using MODFLOW drain boundary conditions (Section 3.2.10). Each stream is subdivided into a number of reaches to be able to analyze the spatial distribution of flows. Figure 4.11 shows the reaches along Davidson and Cienega Creeks. Each reach is identified with a code consisting of an abbreviated stream name followed by the reach number. The model simulates the amount of flow leaving the model through each boundary reach. This information is extracted from the Predictive and Base Case models and the flows are compared.

The model predicts that there is no flow in the drains representing the Santa Cruz River. Pumping along the river depresses the water table to the point that the drains never interact with the water table. The water table must be higher than the drain head in any given drain cell before the drain can remove water.

The three uppermost reaches of Davidson Creek are dry in both the Predictive and Base Case models. The lower two reaches (DAV23 and DAV24) have constant flows in the Base Case model of about 88 and 75 gpm, respectively. In contrast, the Predictive Model shows that these two reaches have flows that are close to the Base Case flows, but they change slightly from mine year 1 to 200 years post-mining. These changes are almost too small to see in hydrographs of flows (Figure 4.11, upper left of figure). However, a plot of the change in flow (Figure 4.11, lower left of figure) shows that by 200 years after mining, these two reaches have lost about 1.8 and 0.14 gpm, respectively. These differences are very small and are within the resolution capabilities of the model. They are likely unmeasurable in the field.

All reaches of Cienega Creek are flowing except for reach 10. Reach 10 is located on the northernmost row of the model and may be being influenced by GHBs to the east and west. The other reaches have flows that range from 35 to 1,005 gpm. The simulated flows in the Base Case model are constant. Like Davidson Creek, the simulated flows in the Predictive Model change slightly from mine year 1 to 200 years post-mining. These changes are almost too small to see in hydrographs of flows (Figure 4.11, upper left of figure). However, a plot of the change in flow (Figure 4.11, lower left of figure) shows that by 200 years after mining, these reaches have lost as much as 1.5 gpm. The losses increase from the uppermost reaches of Cienega Creek to a maximum in reach 4, then decline in the downstream direction to losses less than 0.01 gpm from reach 6 to reach 9. These differences are very small and are within the resolution capabilities of the Project model. They are likely unmeasurable in the field.

The 10-foot drawdown isopleth (Figures 4.8 and 4.10) never extends far enough east to directly impinge on the stream drains. However, the influence of the drawdown is the likely cause of stream flow reductions.

4.3 Particle Tracking

Particle tracking was done to assess the Discharge Impact Area (DIA). Particle tracking is a simple and easy way of post-processing the flow model results to find flow paths, travel times, and advective transport of solutes. Advective transport is the non-dispersive movement of a non-reactive solute calculated only by the average linear velocity of groundwater. It is an adequate approximation of solute transport.

The particle tracking code that was used for this analysis is mod-PATH3DU, a free program available from SSPA (2021). mod-PATH3DU is similar to previous particle tracking codes except that it was written to work with MODFLOW-USG. GV is capable of pre- and post-processing for mod-PATH3DU.

4.3.1 Particle Tracking Setup

Particle starting positions are specified at specific points in space and time. Once released, they follow an advective flow path defined by the flow field at that point in space and time for the duration of a tracking step. This process is iterated for the new position and next time step until the particle terminates in a boundary condition (such as a well), or the tracking time reaches a user-defined maximum.

Particle release positions and times varied by facility. Release times for particles in each facility is based on when the facility enters “recovery”. For the TSF and HLP facilities, recovery begins on the first day after the last day of material placement at each facility. For pits, recovery begins on the first day after pit drains are turned off.

Starting positions for particles at the TSF and HLP facilities were around the perimeter of these facilities. Starting positions for particles in the pits were in the bottom of the pits in cells that are intersected by the water table at any point during recovery.

Table 4.6 summarizes the particle release parameters for each facility and Figure 4.12 shows the particle starting locations. There are a total of 331 particles.

Table 4.6 Particle Release Parameters

Facility	nP	Starting Location	Starting Time
TSF-1	97	Around the perimeter of the facility, denser on the west and north sides. Particles are placed at the cell centers on layer 1.	t = 6596 days Beginning of mY17 (SP20)
TSF-2	39	Around the perimeter of the facility, denser on the west and north sides. Particles are placed at the cell centers on layer 1.	t = 6941 days Beginning of mY18 (SP21)
HLP	56	Around the perimeter of the facility, denser on the north side. Particles are placed at the cell centers on layer 1.	t = 4019 days Beginning of mY10 (SP13)
PE	5	Cells at the bottom of the pit in layers 2 and 3 that are intersected by the water table at any time during pit filling. Particles are placed at the cell centers.	t = 2924 days Beginning of mY7 (SP10)
EL	14	Cells at the bottom of the pit in layer 3 that are intersected by the water table at any time during pit filling. Particles are placed at the cell centers.	t = 1828 days Beginning of mY4 (SP7)
RO	67	Cells at the bottom of the pit in layers 5 and 6 that are intersected by the water table at any time during pit filling. Particles are placed at the cell centers.	t = 8037 days Beginning of mY21 (SP24)
HW	14	Cells at the bottom of the pit in layers 2 and 3 that are intersected by the water table at any time during pit filling. Particles are placed at the cell centers.	t = 3289 days Beginning of mY8 (SP11)
CW	23	Cells at the bottom of the pit in layers 1, 2 and 3 that are intersected by the water table at any time during pit filling. Particles are placed at the cell centers.	t = 3654 days Beginning of mY9 (SP12)
BT	16	Cells at the bottom of the pit in layer 2 that are intersected by the water table at any time during pit filling. Particles are placed at the cell centers.	t = 4750 days Beginning of mY12 (SP15)

Notes:
- TSF is tailings storage facility; HLP is heap leach pad; PE is Peach Pit; EL is Elgin Pit; RO is Rosemont Pit; HW is Heavy Weight Pit; CW is Copper World Pit; BT is Broadtop Butte Pit
- nP is the number of particles released from the facility.
- Release times are referenced to the beginning of the model.
- mY = mine year, SP = stress period

4.3.2 Particle Tracking Results

Figure 4.13, left side of figure, shows the particle track results for the 331 particles as defined above. Particles were tracked until 200 years after mining ceased (223 years from the beginning of the model). Particles that were released in the Rosemont, Broadtop Butte, Copper World, and Heavy Weight pits (120 particles) did not leave their respective pits within the 200-year timeframe. All but 29 of the 211 particles released from Elgin, Peach, TSF-1, TSF-2 and the HLP were transported beyond the Rosemont property boundaries (which constitute the Pollutant Management Areas [PMA]) towards the northwest along the prevailing groundwater gradients. The 29 points that did not escape the PMA originated in Peach and Elgin pits and these particles stagnated within their pit footprints.

An alternative model was constructed to demonstrate one potential mitigation measure to address particle excursions beyond the PMA. The alternative model considers uses a series of pump-back wells at strategic locations to capture the particles before they migrate outside of the PMA. Table 4.7 summarizes the wells included in the pump-back alternative simulation.

It was assumed that water pumped by these wells will be applied to the top of the TSF facilities where evaporation will remove the water from the system. The model assumes that these wells pump at constant rates until 200 years after mining ends. In actual practice, mitigation pumping will be optimized based on monitoring data from performance and Point of Compliance (POC) monitoring wells.

The pump-back alternative simulation uses the same particles defined above.

Table 4.7 Pump-Back Parameters

Facility	nW	Pumping Specifications	Pumping Period
TSF-1	32	Wells are on the north and west side of the facility at a spacing of approximately 500 feet. Wells are 800 feet deep with 700 ft screens (100 ft bgs to TD, layers 1 to 5). Pumping rate is 20 gpm per well.	my1 to mY200 (SP4 to SP56)
TSF-2	11	Wells are on the north and west side of the facility at a spacing of approximately 500 feet. Wells are 800 feet deep with 700 ft screens (100 ft bgs to TD, layers 1 to 5). Pumping rate is 20 gpm per well.	my1 to mY200 (SP4 to SP56)
HLP	19	Wells are on the north side of the facility at a spacing of approximately 500 feet. Wells are 800 feet deep with 700 ft screens (100 ft bgs to TD, layers 2 or 3 to 5). Pumping rate is 20 gpm per well.	my1 to mY200 (SP4 to SP56)

Notes:
- TSF is tailings storage facility; HLP is heap leach pad
- nW is the number of wells assigned to each facility.
- Pumping Period refers to the time range when the wells are pumping.
- mY = mine year, SP = stress period.
- There were no wells placed for Peach, Elgin, or Rosemont pits.

Figure 4.13, right side of figure, shows the particle track results for the 331 particles in this model. Particles were tracked until 200 years after mining ceased (223 years from the beginning of the model). As before, particles that were released in the Rosemont, Broadtop Butte, Copper World, and Heavy Weight pits (120 particles) did not leave their respective pits within the 200-year timeframe. All but 1 particle of the 211 particles released from Elgin, Peach, TSF-1, TSF-2 and the HLP were captured by the pump-back system.

The alternative presented in this model is one of many possible mitigation measures. No other alternatives were simulated, and the simulation presented above was not optimized in any way.

5 POINT OF COMPLIANCE GROUNDWATER MONITORING

Point of Compliance (POC) wells are required to monitor for Project site discharges. Ten POC groundwater monitoring wells are recommended for the Project based on the hydrogeologic conceptual model (Piteau, 2022), the results of predictive particle transport modeling, and the locations of proposed Project pits and facilities.

The criteria for selecting the proposed POC locations included:

- Downgradient of Project pits and facilities
- Within 750 ft of the Pollution Management Area (PMA)
- Adjacent to surface drainage channel areas
- Site access for drilling, well construction and monitoring activities.

The proposed locations of POC wells are shown on Figure 6.1.

- Four POC wells (POC-01 through POC-04) is located on the north and west property boundaries of TSF-1 in the Santa Cruz basin. Surface management directly down-gradient of each of these wells is in the jurisdiction of the State of Arizona.
- POC-05 is located northwest of a portion of TSF-2. Surface management directly down gradient of this well is in jurisdiction of the State of Arizona.
- POC-06 is located to the northwest of a portion of the Plant area and HLP. Surface management directly down gradient of this well is in jurisdiction of the Bureau of Land Management (BLM).
- Two POC wells (POC-07 and POC-08) are located to the southwest and northwest of portions of the WRF area. Surface management directly down gradient of POC-07 is in jurisdiction of the State of Arizona; surface management directly down gradient of POC-08 is in jurisdiction of the US Forest Service (USFS).
- Two POC wells (POC-09 and POC-10) are located to the east of portions of the WRF area. Surface management directly down-gradient of these wells is in the jurisdiction of the US Forest Service (USFS).

No POC wells are needed at the Rosemont Pit area due to the predicted groundwater capture zone associated with operational pit dewatering and the characterization of a terminal pit lake (sink) during closure.

6 CONCLUSIONS

The Project model was constructed as part of the Aquifer Protection Permit application for the Rosemont Copper World Project. It is based on Piteau's conceptual hydrogeologic model of the Project (Piteau, 2022) as well as two existing groundwater models:

- The West (TAMA) model (Mason and Hipke, 2013).
- The East model (Tetra Tech, 2010).

The West (TAMA) model is published by ADWR and is the latest model in a long line of models going back to the early 1970s, first prepared by the USGS and later, by the ADWR (Mason and Bota 2006). Each new model incorporates new data and updated modeling capabilities. It provides much useful information for the west side of the Project model domain. The East model (Tetra Tech, 2010; Neirbo Hydrogeology, 2019) model is latest update in a series of models extending back to 2009 constructed in support of a previous Rosemont Copper Company Project.

A steady-state version of the Project model was calibrated against 536 head targets. The calibration was evaluated using industry standard methods and was found to be fit for purpose as the basis for constructing the Predictive Model.

The Predictive Model is built in transient mode because it incorporates regional pumping and mining-related activities. The timing of these activities affects the predictions. Model results are projected to 200 years after mining ends.

There are three versions of the Predictive Model:

- A Base Case flow model that only includes estimated transient future regional pumping. This model is used to provide the transient head distribution resulting from regional pumping alone (without Project pumping and seepage). These heads are then used to remove drawdown caused by regional pumping from the mining impact analysis.
- A mining and recovery flow model that includes all mining-related components. These components include pit dewatering and seepage from the tailings storage facilities and the heap leach pad.
- A particle-tracking model that uses the mining and recovery flow model to predict the size of the DIA. A second version includes pump-back wells to demonstrate that the particles can be prevented from transporting beyond Rosemont private land boundaries.

Assessment of the predictive model includes an estimate of the average annual rate of pit dewatering, the size of the mound that builds beneath the tailings storage facilities, the rate and nature of the pit lake filling, drawdown and mounding due to mining-related activities, and the DIA as defined by particle tracking.

7 REFERENCES

Anderson, M. P., Hunt, R. J, Krohelski, J. T., and Chung, K. 2002. Using High Hydraulic Conductivity Nodes to Simulate Seepage Lakes. Groundwater. Vol. 40, No. 2. https://doi.org/10.1111/j.1745-6584.2002.tb02496.x.

Anderson, M.P., Woessner, W.W., and Hunt, R.J., 2015, Applied ground- water modeling—Simulation of flow and advective transport (2nd ed.): Academic Press, Inc., 564 p.

Arizona Department of Environmental Quality (ADEQ), 2004. Arizona Mining Guidance Manual BADCT. Aquifer Protection Program. Publication No. TB-04-01.

Arizona Department of Water Resources (ADWR), 2021a. Well Registry (Wells 55). https://azwatermaps.azwater.gov/wellreg. Downloaded May 2021.

Arizona Department of Water Resources (ADWR), 2021b. Groundwater Site Inventory (GWSI). https://azwatermaps.azwater.gov/gwsi. Downloaded May 2021.

Arizona Department of Water Resources (ADWR), 2021c. Jeff Inwood, personal communication September 13, 2021.

Climate Engine, 2021. https://climengine.page.link/vuzp. Downloaded May 2021.

Doherty, J., 2015. Calibration and Uncertainty Analysis for Complex Environmental Models. Watermark Numerical Computing, Brisbane, Australia. ISBN: 978-0-9943786-0-6. Available at https://pesthomepage.org/

Environmental Simulations, Inc. 2021. Groundwater Vistas, Version 8. https://www.groundwatermodels.com/

Ferguson, C.A., Youberg, A., Gilbert, W.G., Orr, T.R., Richard, S.M., and Spencer, J.E., 2001. Geologic Map of the Mount Fagan 7.5' Quadrangle, Eastern Pima County, Arizona. Arizona Geological Survey Digital Geologic Map 11, November.

Ferguson, C.A., 2009. Bedrock Geologic Map of the Northern Part of the Empire Ranch 7½' Quadrangle, Pima County, Arizona: Arizona Geological Survey Open-File Report OFR-09-05, scale 1:24,000.

Houser, B.B., Peters, L., Esser, R.P., and Gettings, M.E., 2005, Stratigraphy and tectonic history of the Tucson basin, Pima County, Arizona, Based on the Exxon State (32)-1 well: U.S. Geologic Survey Scientific Investigations Report 2004-5076, 37 p.

Mason, D.A. and Bota, L., 2006. Regional Groundwater Flow Model of the Tucson Active Management Area, Tucson, Arizona: Simulation and Application. Modeling Report No. 13. Phoenix, Arizona: Arizona Department of Water Resources, Hydrology Division.

Mason, D. and Hipke, W., 2013. Regional Groundwater Flow Model of the Tucson Active Management Area, Tucson, Arizona: Model Update and Calibration. Modeling Report No. 24. Phoenix, Arizona: Arizona Department of Water Resources, Hydrology Division.

McDonald, M.G. and Harbaugh, A.W., 1988. A Modular Three-Dimensional Finite-Difference Ground-Water Flow Model. Techniques of Water-Resources Investigations, Book 6. U.S. Geological Survey.

Montgomery and Associates (as Errol L. Montgomery and Associates Inc.), 2009a. Second Update to ADWR Model in Sahuarita/Green Valley Area. Project No. 1232.0903. Prepared for Rosemont Copper Company. Submitted to Arizona Department of Water Resources. Tucson, Arizona: Errol L. Montgomery and Associates, Inc. April 27.

Montgomery and Associates (as Errol L. Montgomery and Associates Inc.), 2009b. Groundwater Flow Modeling Conducted for Simulation of Rosemont Copper's Proposed Mine Supply Pumping, Sahuarita, Arizona. Prepared for Rosemont Copper Company. Tucson, Arizona: Errol L. Montgomery and Associates, Inc. April 30.

Montgomery & Associates, 2010. Revised Groundwater Flow Modeling Conducted for Simulation of Proposed Rosemont Pit Dewatering and Post-mining, Volume 1 (Text and Tables) and Volume 2 (Figures). Prepared for Rosemont Copper Company. Report Dated August 30.

Montgomery & Associates, 2018. Scenario 3 Addendum to July 29, 2015 Technical Memorandum, "Updated West Side Groundwater Modeling Results (Operational Scenarios 1 and 2 and Baseline Scenario B)". Technical Memorandum prepared for Hudbay-Rosemont Copper, August 27, 2018.

Natural Resources Conservation Service, United States Department of Agriculture (NRCS), 2021. Geospatial Data Gateway, https://gdg.sc.egov.usda.gov/ accessed May 17, 2021.

Neirbo Hydrogeology, 2019. Groundwater Flow Model, Rosemont Copper Project. Prepared for Hudbay Rosemont Copper Company. October 2019. (Includes *Neirbo Hydrogeology, 2019.*

Rosemont Groundwater Flow Model Changes and Assumptions. Memo prepared for Hudbay-Rosemont Copper Company, April 25, 2019.)

Panday, S., Langevin, C.D., Niswonger, R.G., Ibaraki, M., and Hughes, J.D., 2017, MODFLOW-USG version 1.4.00: An unstructured grid version of MODFLOW for simulating groundwater flow and tightly coupled processes using a control volume finite-difference formulation: U.S. Geological Survey Software Release, 27 October 2017.

Panday, S., 2020; USG-Transport Version 1.5.0: The Block-Centered Transport Process for MODFLOW-USG, GSI Environmental, July 2020.

Piteau Associates, 2022. Rosemont Copper World Project, Hydrogeological Characterization. Prepared for Rosemont Copper Company, May 2022.

Rosemont Copper Company (Rosemont), 2014. Supplemental Water Quality and Isotope Data for Wells and Springs in the Rosemont Area. Technical Memorandum to Jim Upchurch, U.S. Forest Service, June 27.

Rosemont Copper Company (Rosemont), 2017. Manual water-level and spring measurement data, Routine Project measurements through January 2017.

SSPA, 2021. mod-PATH3DU, A groundwater path and travel-time simulator. S.S. Papadopulos and Assoc. Inc., in collaboration with the University of Waterloo. http://mp3du.sspa.com/

Tetra Tech, 2010. Regional Groundwater Flow Model. Prepared for Rosemont Copper Company, November 26.

Tetra Tech, 2012. Infiltration, Seepage, Fate and Transport Modeling Report, Revision 2, Rosemont Copper Project, June 2012.

US Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), 1982. Evaporation Atlas for the Contiguous 48 United States. June 1982.

Western Regional Climate Center (WRCC), 2021. https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?aztucs.

WestLand Resources Inc., 2012. Rosemont Copper Project: Seeps and Springs Survey, 2011-2012. Project No. 1049.14. Prepared for Rosemont Copper Company. Tucson, AZ: WestLand Resources, Inc. July 11.

8 LIMITATIONS

Piteau Associates has exercised reasonable skill, care and diligence in obtaining, reviewing, analyzing and interpreting the information acquired during this study, but makes no guarantees or warranties, expressed or implied, as to the completeness of the information contained in this report. Conclusions and recommendations provided in this report are based on the information available at the time of this assessment.

In preparing the recommendations contained herein, Piteau Associates has relied on information and interpretations provided by others. Piteau Associates is not responsible for any errors or omissions in this information. This report is comprised of text, tables, figures, photos and appendices, and all components must be read and interpreted in the context of the whole report. The report has been prepared for the sole use of Rosemont Copper Company, and no representation of any kind is made to any other party.

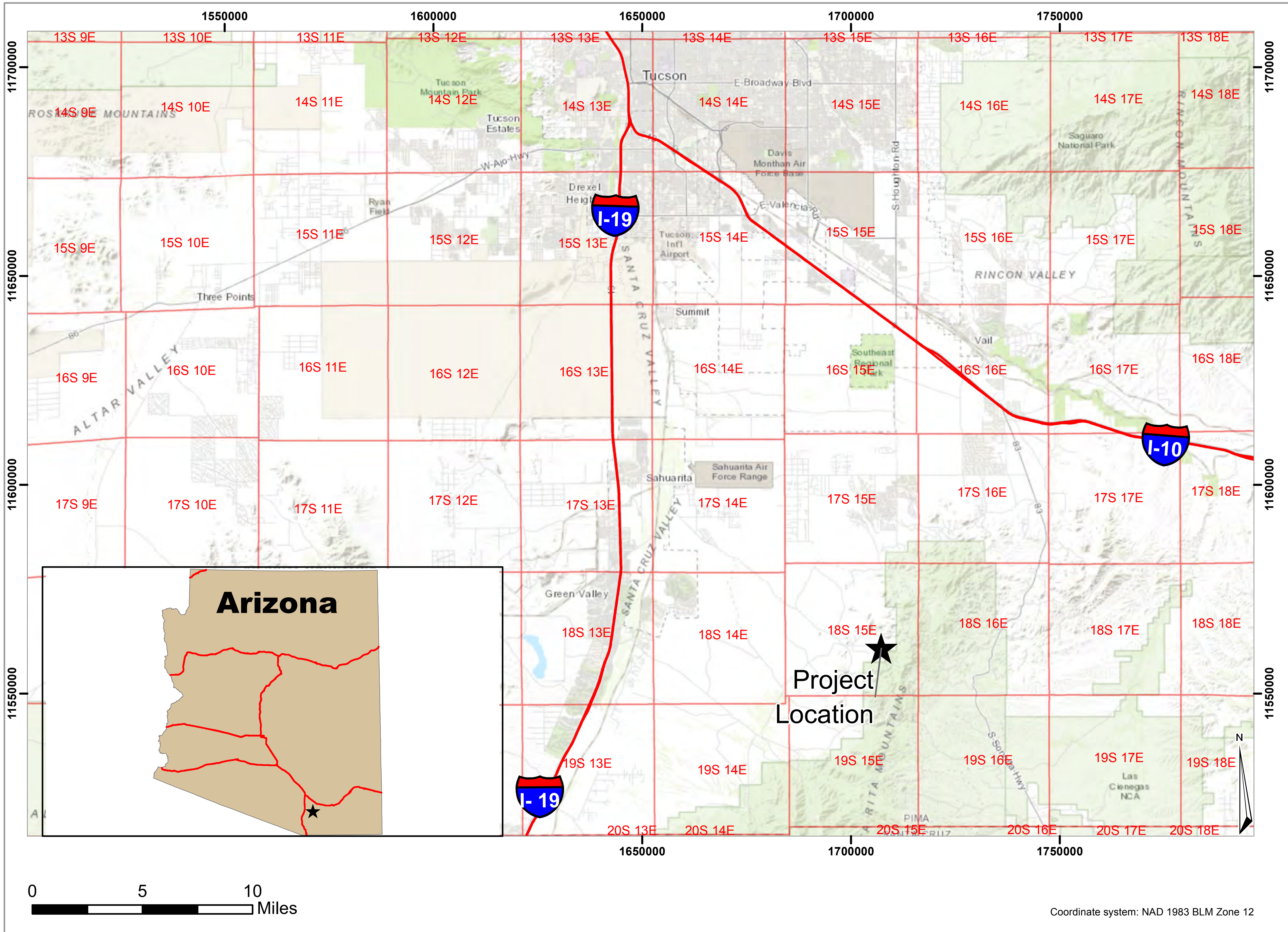
Respectfully submitted,

PITEAU ASSOCIATES USA LTD.

Dwaine Eddington, PhD
Senior Hydrogeologist

Brian Giroux, PG
Senior Hydrogeologist

FIGURES



Project Location

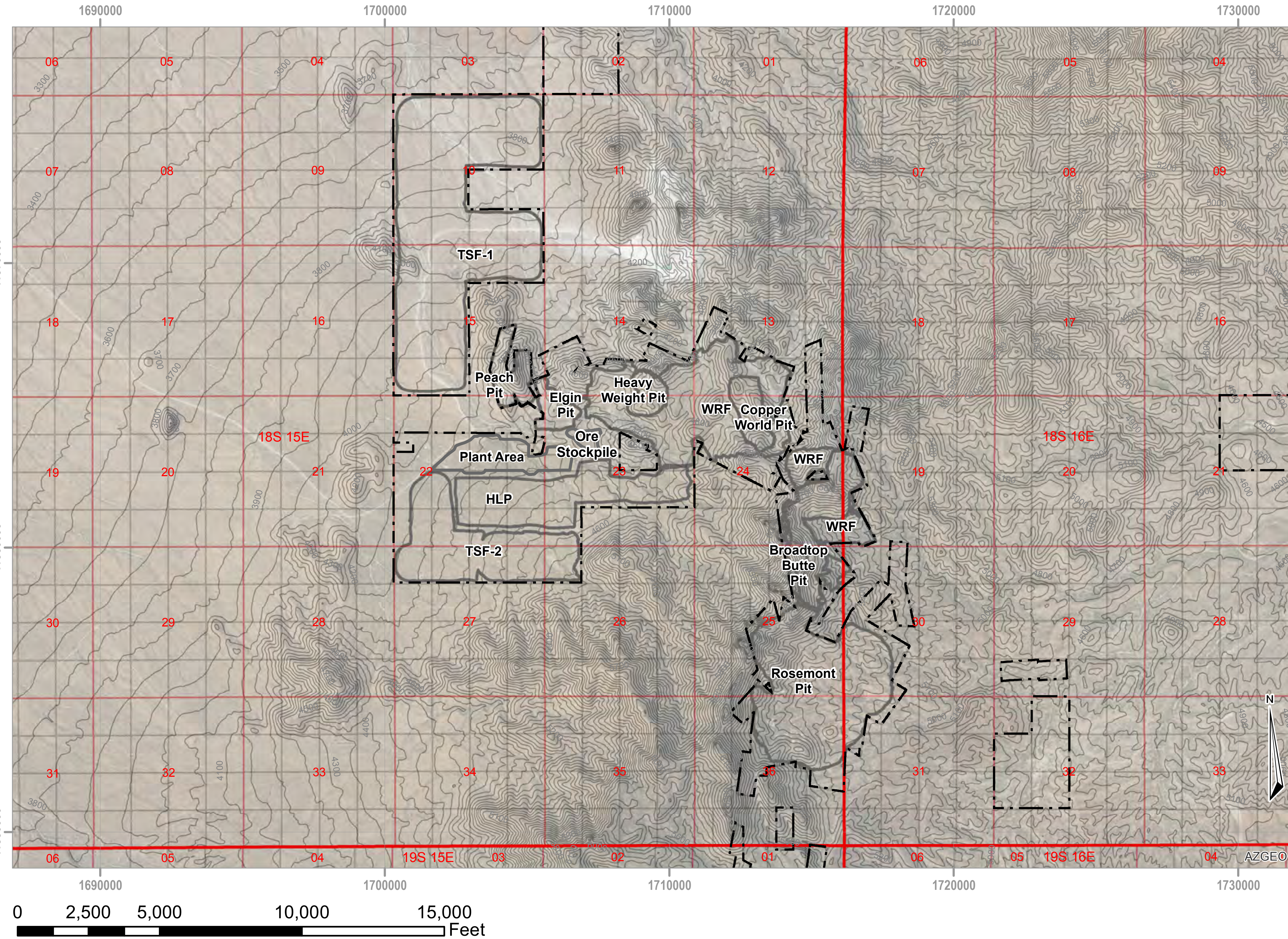
Interstate

PLSS Township

Project Location

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

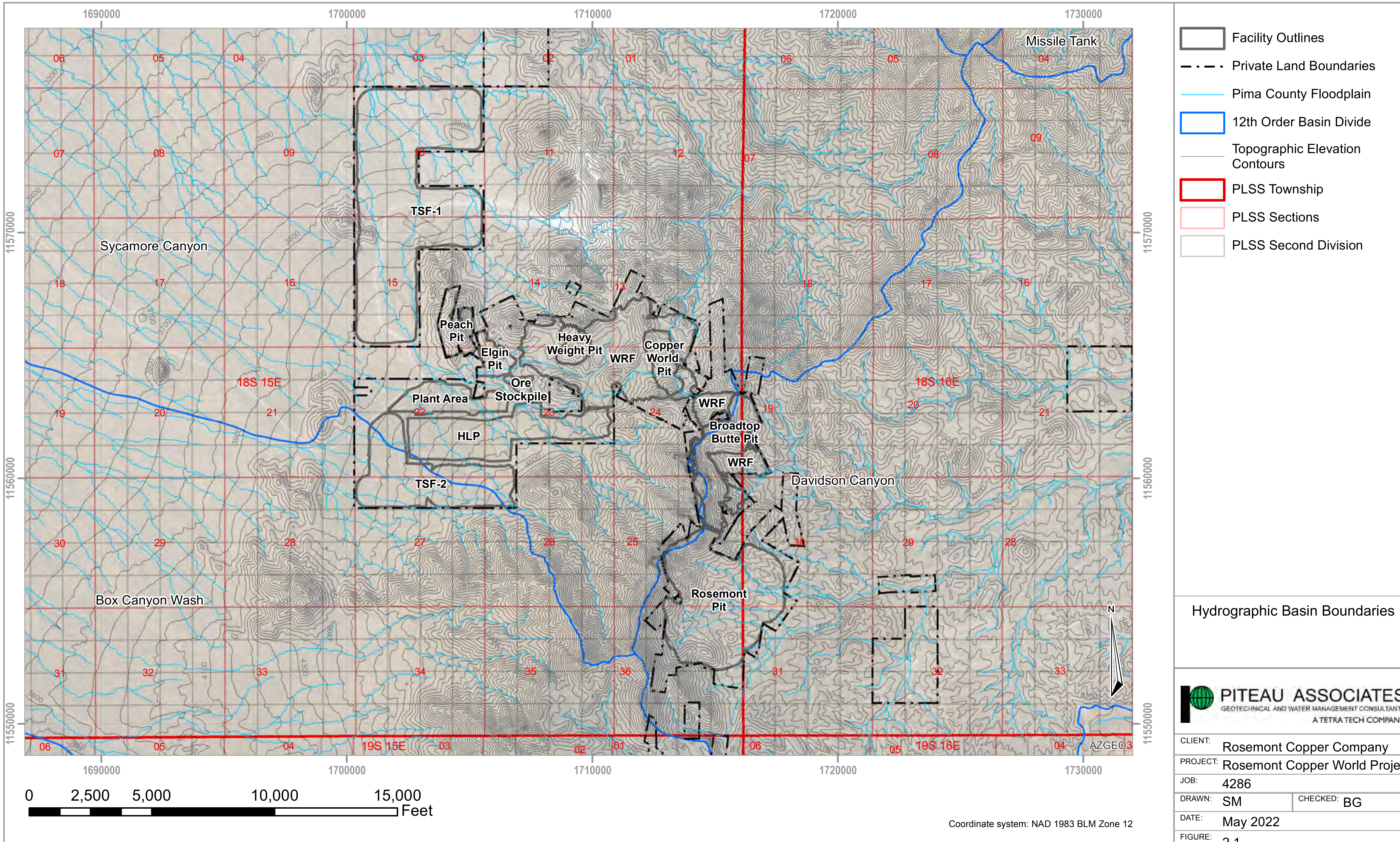
CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	WT/AP
CHECKED:	BG
DATE:	May 2022
FIGURE:	1.1



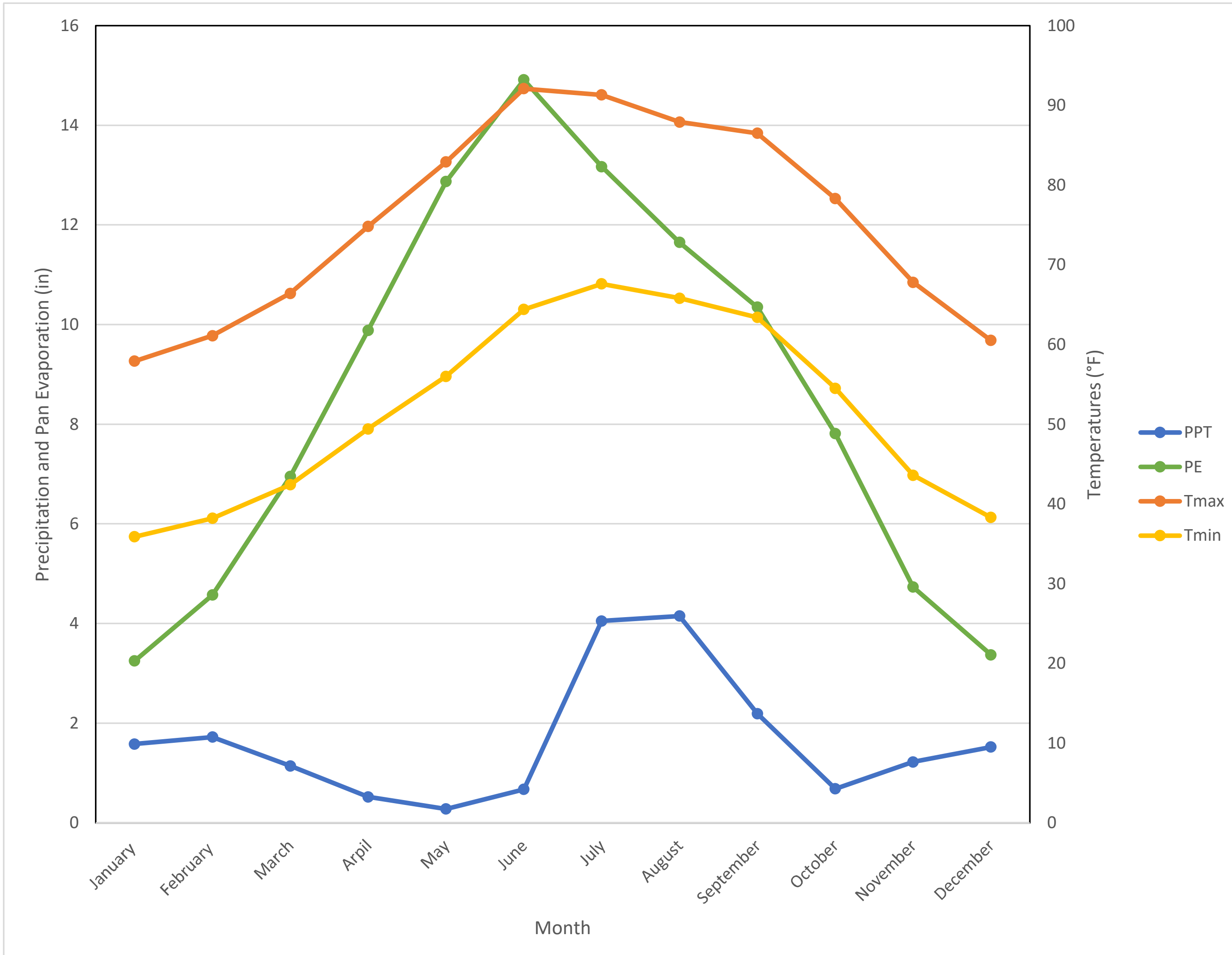
General Layout of Location

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Copper World Project
JOB:	4286
DRAWN: SM	CHECKED: BG
DATE:	May 2022
FIGURE:	1.2



Missile Tank
Sycamore Canyon
Box Canyon Wash
Davidson Canyon
TSF-1
TSF-2
Peach Pit
Elgin Pit
Heavy Weight Pit
Copper World Pit
WRF
Ore Stockpile
Plant Area
HLP
Broadtop Butte Pit
Rosemont Pit
18S 15E
18S 16E
19S 15E
19S 16E
1690000
1700000
1710000
1720000
1730000
11570000
11560000
11550000
0
2,500
5,000
10,000
15,000
Feet
Coordinate system: NAD 1983 BLM Zone 12
AZGEO3
N
Facility Outlines
Private Land Boundaries
Pima County Floodplain
12th Order Basin Divide
Topographic Elevation Contours
PLSS Township
PLSS Sections
PLSS Second Division
Hydrographic Basin Boundaries
PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY
CLIENT: Rosemont Copper Company
PROJECT: Rosemont Copper World Project
JOB: 4286
DRAWN: SM
CHECKED: BG
DATE: May 2022
FIGURE: 2.1



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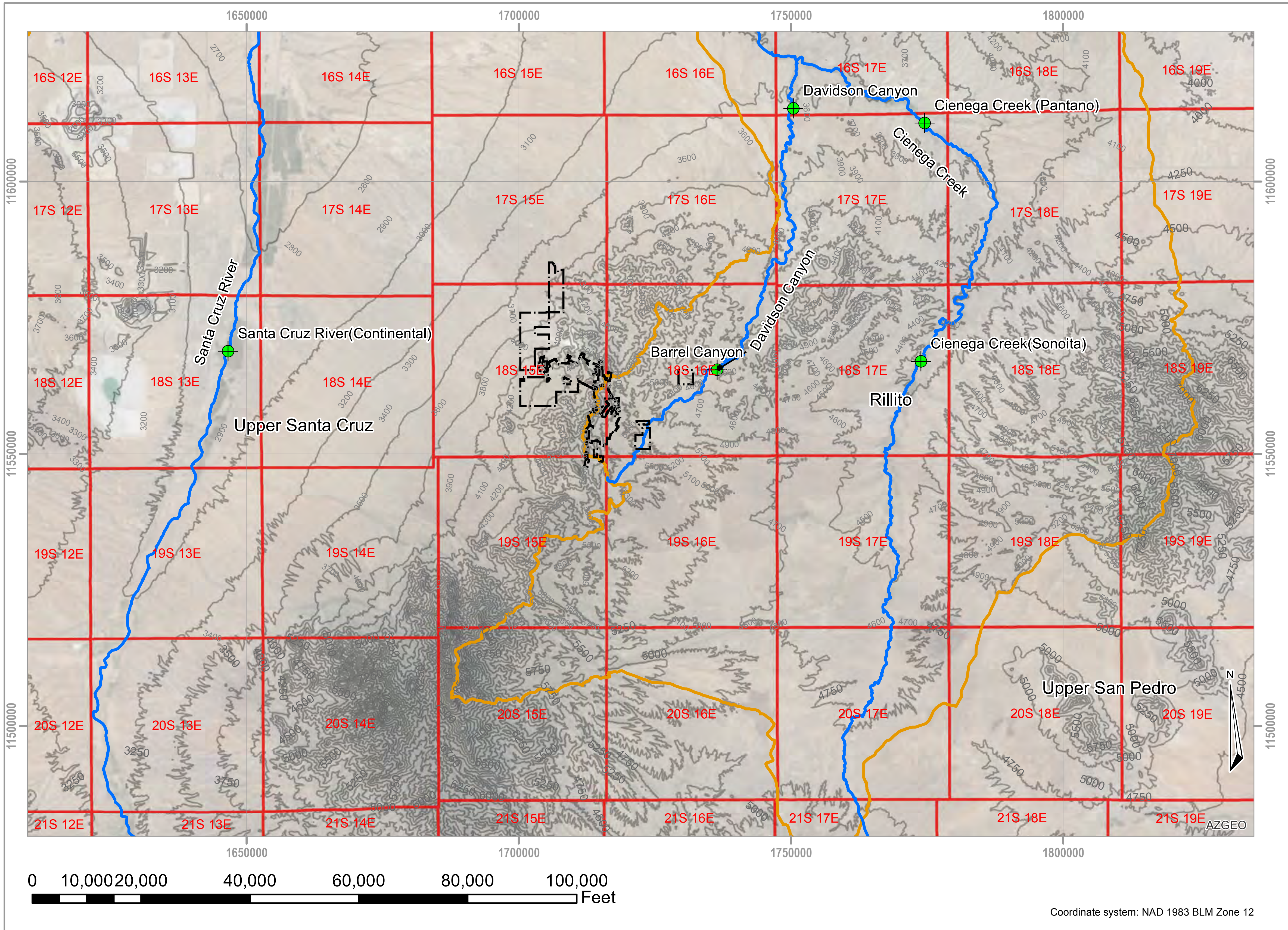
Monthly Precipitation, Pan Evaporation, and Minimum and Maximum Temperatures

CLIENT:	Rosemont Copper Company	PROJECT:	Rosemont Copper World Project
JOB #:	4286	DRAWN:	KL
		CHECKED:	BG
DATE:	May 2022	FIGURE:	2.2



Gage Stations

Private Land Boundaries

Topographic Elevation Contours

Key Streams

8th Order Basin Divides

PLSS Township

Regional Surface Water Features

PITEAU ASSOCIATES
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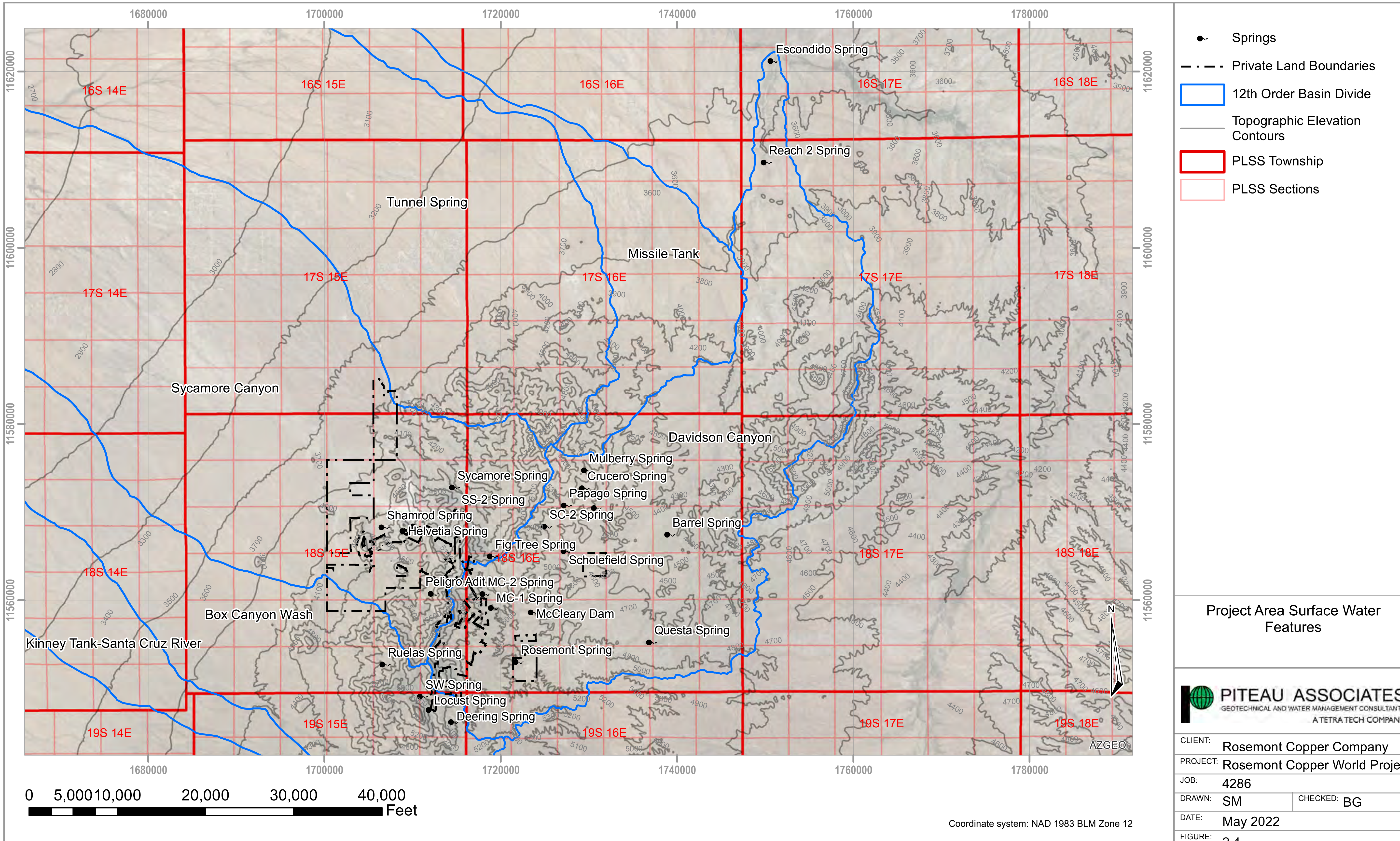
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	SM
CHECKED:	BG
DATE:	May 2022
FIGURE:	2.3



Springs
Private Land Boundaries
12th Order Basin Divide
Topographic Elevation Contours
PLSS Township
PLSS Sections
Project Area Surface Water Features
PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY
CLIENT: Rosemont Copper Company
PROJECT: Rosemont Copper World Project
JOB: 4286
DRAWN: SM
CHECKED: BG
DATE: May 2022
FIGURE: 2.4
Escondido Spring
Reach 2 Spring
Tunnel Spring
Missile Tank
Sycamore Canyon
Davidson Canyon
Mulberry Spring
Crucero Spring
Papago Spring
Sycamore Spring
SS-2 Spring
SC-2 Spring
Shamrod Spring
Helvetia Spring
Barrel Spring
Fig Tree Spring
Scholefield Spring
Peligro Adit
MC-2 Spring
MC-1 Spring
McCleary Dam
Box Canyon Wash
Kinney Tank-Santa Cruz River
Questa Spring
Ruelas Spring
Rosemont Spring
SW Spring
Locust Spring
Deering Spring
16S 14E
16S 15E
16S 16E
16S 17E
16S 18E
17S 14E
17S 15E
17S 16E
17S 17E
17S 18E
18S 14E
18S 15E
18S 16E
18S 17E
18S 18E
19S 14E
19S 15E
19S 16E
19S 17E
19S 18E
1680000
1700000
1720000
1740000
1760000
1780000
11620000
11600000
11580000
11560000
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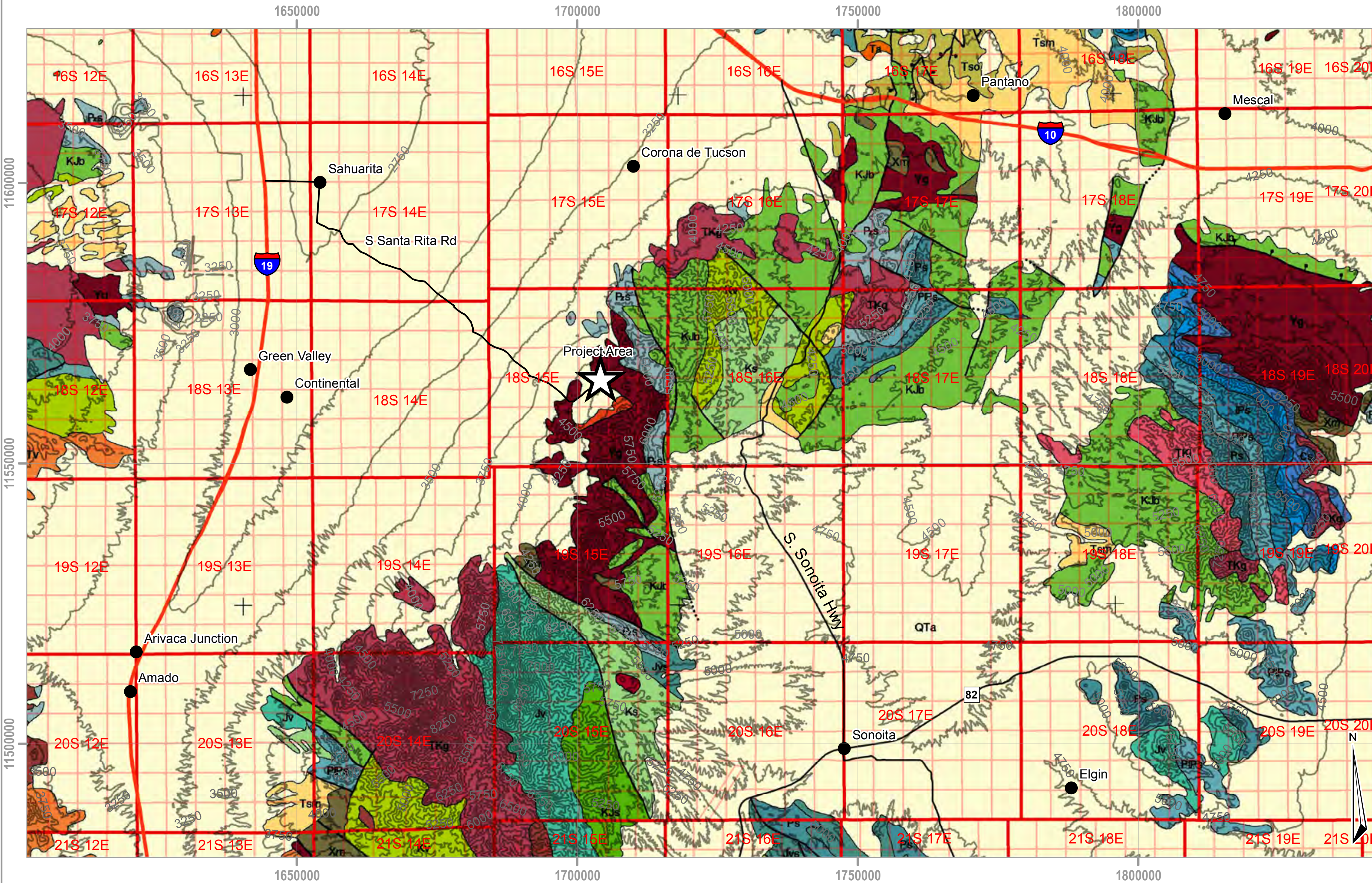
5,000
10,000
20,000
30,000
40,000
Feet
N
AZGEO
Coordinate system: NAD 1983 BLM Zone 12



QTa Alluvium and sedimentary rocks
Tsm Sedimentary rocks
Ta Andesitic volcanic rocks
Tso Sedimentary rocks
TKg Granitoid rocks
TKi Intrusive rocks, undiv.
Ks Sedimentary rocks
KJb Bisbee Group rocks
KJs Sedimentary rocks, undiv.
Jvs Volcanic and sedimentary rocks
Jv Volcanic rocks
Pzs Sedimentary rocks, undiv.
P|s Sedimentary rocks (Naco Group, undiv.)
Ps Sedimentary rocks (Upper Naco Group)
|s Sedimentary rocks (Lower Naco Group)
MDs Sedimentary rocks (Escabrosa and Martin Fm.)
Yg Granite
Xm Metamorphic rock, undiv.

Coordinate system: NAD 1983 BLM Zone 12

0 1 2 4 6 8 10 Miles

- Towns
- Topographic Elevation Contours
- Roads
- Highways
- Interstates
- PLSS Township
- PLSS Sections

SOURCE: Peterson, J. A., et al., 2001.

Geology Map - Regional

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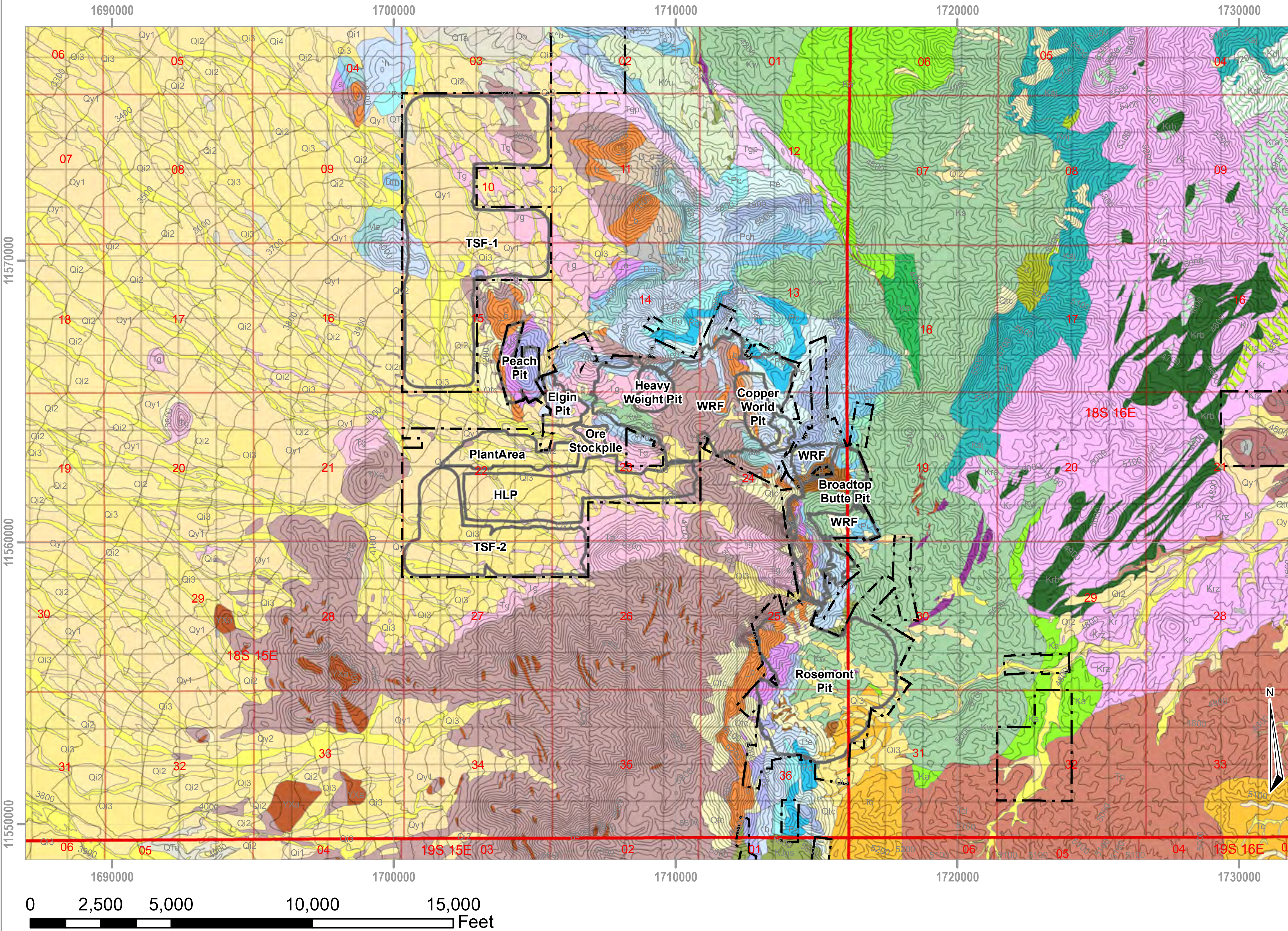
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	MB/SM CHECKED: BG
DATE:	May 2022
FIGURE:	2.5



Coordinate system: NAD 1983 BLM Zone 12

- Facility Outlines
- Private Land Boundaries
- Topographic Elevation Contours
- PLSS Township
- PLSS Sections
- PLSS Second Division

Geology legend and references on Figure 2.7

Geology Map - Project Area

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A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN: SM	CHECKED: BG
DATE:	May 2022
FIGURE:	2.6

d	Disturbed Ground

Surficial Deposits

Qtc	Talus and Colluvium
Qy3	Deposits in active channels
Qy2	Deposits in low terraces and active fans
Qy1	Deposits in low terraces and young fans
Qy	Young alluvial deposits, undivided
Qyx	Eroded fine deposits
Qi4	Deposits in young intermediate deposits and alluvial fans
Qi3	Deposits in intermediate terraces and relic alluvial fans
Qi2	Deposits in higher intermediate fans and terraces
Qi1	Deposits in highest intermediate fans and terraces
Qo	Deposits in highest preserved alluvial fans
QTa	Old alluvial fan deposits

Bedrock Units

Tc	Gila Conglomerate (Miocene)
Tcl	Unit of Adobe Tank (Gila Group)
Tp	Pantano Formation (Oligocene to Miocene)
TKs	Lower Pantano megabreccia (U. Cretaceous - Oligocene)
Tgp	Porphyritic granite of Sycamore Canyon
Tg	Helvetia granite
TKp	Fine grained felsic porphyry (Tertiary - U. Cretaceous)
Kr	Rhyolite of Mt. Fagan
Krz	Heterolithic mesobreccia
Krg	Heterolithic megabreccia
Kra	Andesite megabreccia
Krb	Bisbee group megabreccia
Krc	Well-rounded conglomerate megabreccia
Kaj	Andesitic lava
Kai	Andesitic porpyry
Kd	Crystal-rich dacite ash-flow tuff
Kdl	Dacitic lava
Kfc	Fort Crittenden Formation
Kfcv	Fort Crittenden Formation, volcanic facies
KJr	Rhyolite Intrusions

Bisbee Group

Kt	Turney Formation
Ks	Shellenburg Formation
Ksl	Lower Shellenburg Formation
Ka	Apache Canyon Formation
Kw	Willow Canyon Formation
Kwm	Willow Canyon Formation, mafic lava
KJg	Glance Conglomerate
KJgs	Glance Conglomerate (quartz sandstone-carbonate dominant)
KJgg	Glance Conglomerate (granite dominant)
K^u	Undifferentiated Mesozoic clastic rocks
J^g	Gardner Canyon Formation
JPs	Quartz sandstone

Naco Group

Pr	Rainvalley Formation
Pch	Concha Limestone
Psu	Sherrer Formation, upper division
Psl	Sherrer Formation, lower division
Pe	Epitaph Formation, undivided
Pc	Colina Limestone
*Pe	Earp Formation
*h	Horquilla Limestone

Me	Escabrosa Limestone
MDu	Escabrosa Limestone and Martin Limestone, undifferentiated
Dm	Martin Formation
D_u	Martin Limestone and Abrigo Formation, undifferentiated
Pz	Marble, hornfels and skarn
_a	Abrigo Formation
_b	Bolsa quartzite
YXa	Megacrystic granite
YXg	Continental Granodiorite

Geologic Sources:

Johnson, B.J., Pearthree, P.A., and Ferguson, C.A., 2016, Geologic map of the Corona de Tucson 7 ½' Quadrangle, Pima County, Arizona: Arizona Geological Survey Digital Geologic Map DGM-115, scale 1:24,000.

Ferguson, C.A., Youberg, A., Gilbert, W.G., Orr, T.R., Richard, S.M., and Spencer, J.E., 2019, Geologic Map of the Mount Fagan 7.5' Quadrangle, Eastern Pima County, Arizona: Arizona Geological Survey Digital Geologic Map DGM-11, version 2.0, map scale 1:24,000

Ferguson, C.A., Johnson, B.J., Pearthree, P.A., Spencer, J.E., Shipman, T.C., and Cook, J.P., 2019, Geologic Map of the Helvetia 7.5' Quadrangle, Pima County, Arizona. Arizona Geological Survey Digital Geologic Maps, DGM-144, 1 map sheet, map scale 1:24,000.

Cook, J.P., Ferguson, C.A., 2019, Geologic Map of Empire Ranch 7.5' Quadrangle, Pima County, Arizona Arizona Geological Survey Digital Geologic Maps, DGM 143, 1 map sheet, map scale 1:24,000.

Legend for Geologic Maps

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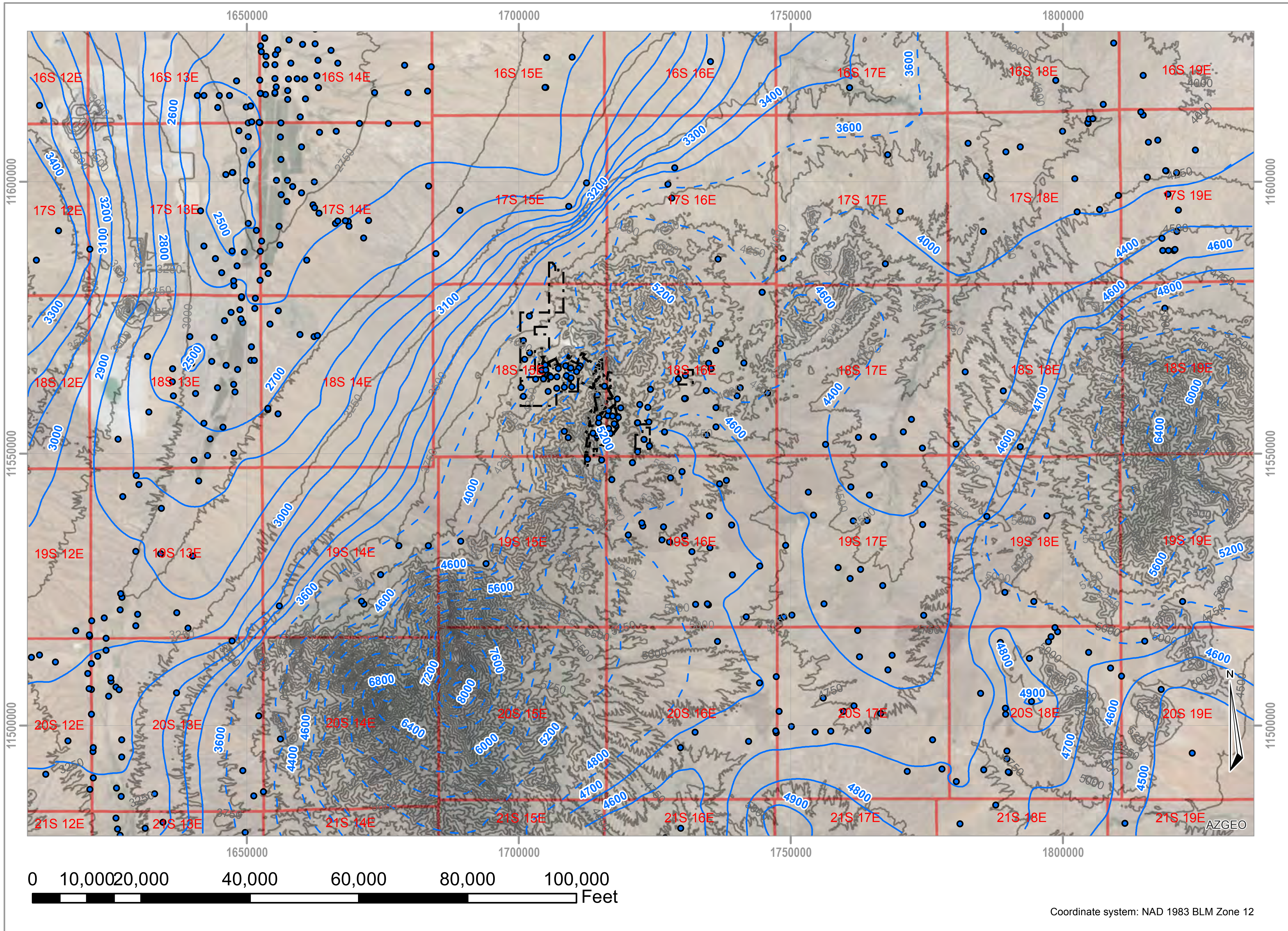
CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	MB
CHECKED:	BG
DATE:	May 2022
FIGURE:	2.7



Regional Potentiometric Surface

PITEAU ASSOCIATES
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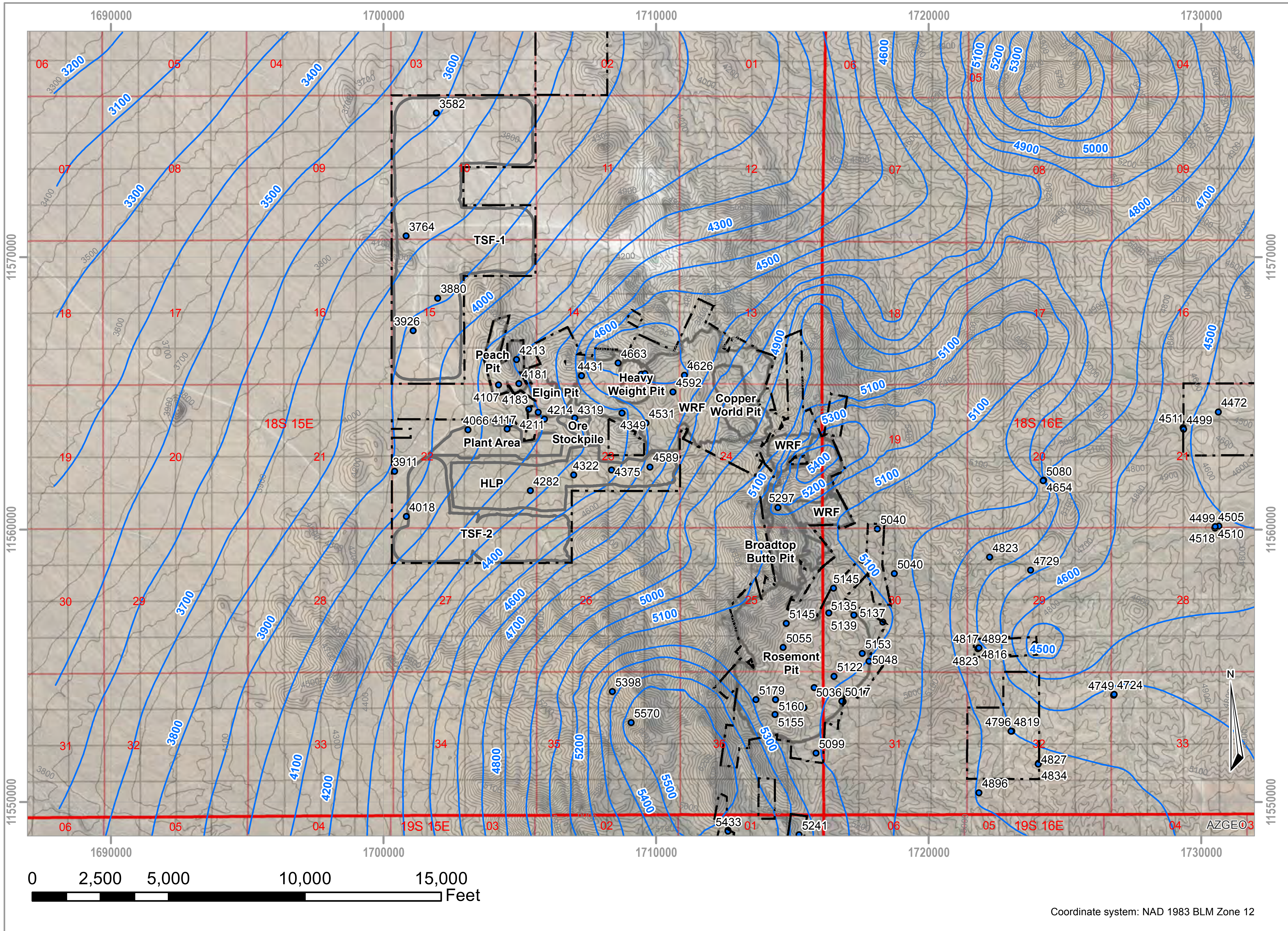
A TETRA TECH COMPANY

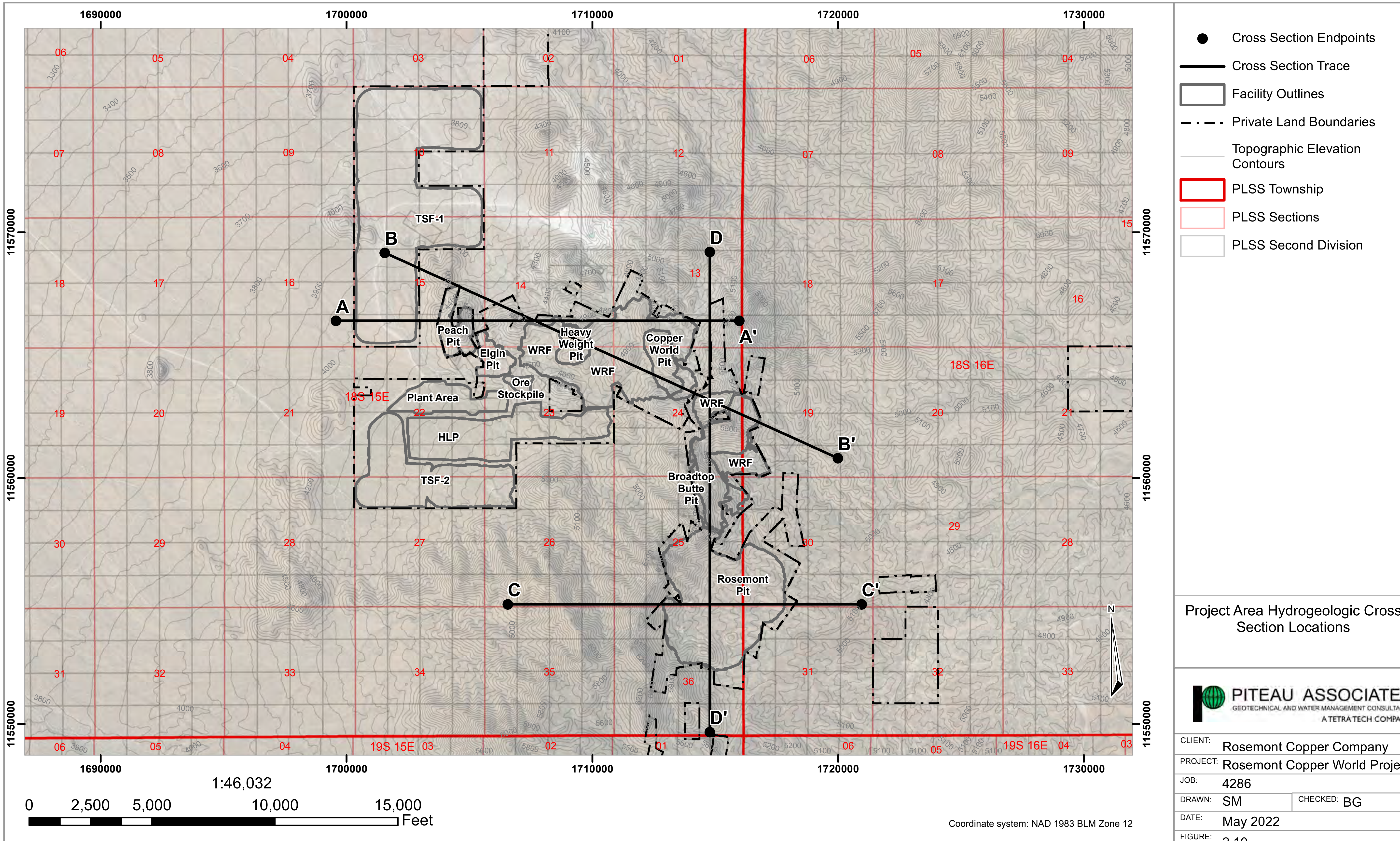
CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	SM/AP
CHECKED:	BG
DATE:	May 2022
FIGURE:	2.8



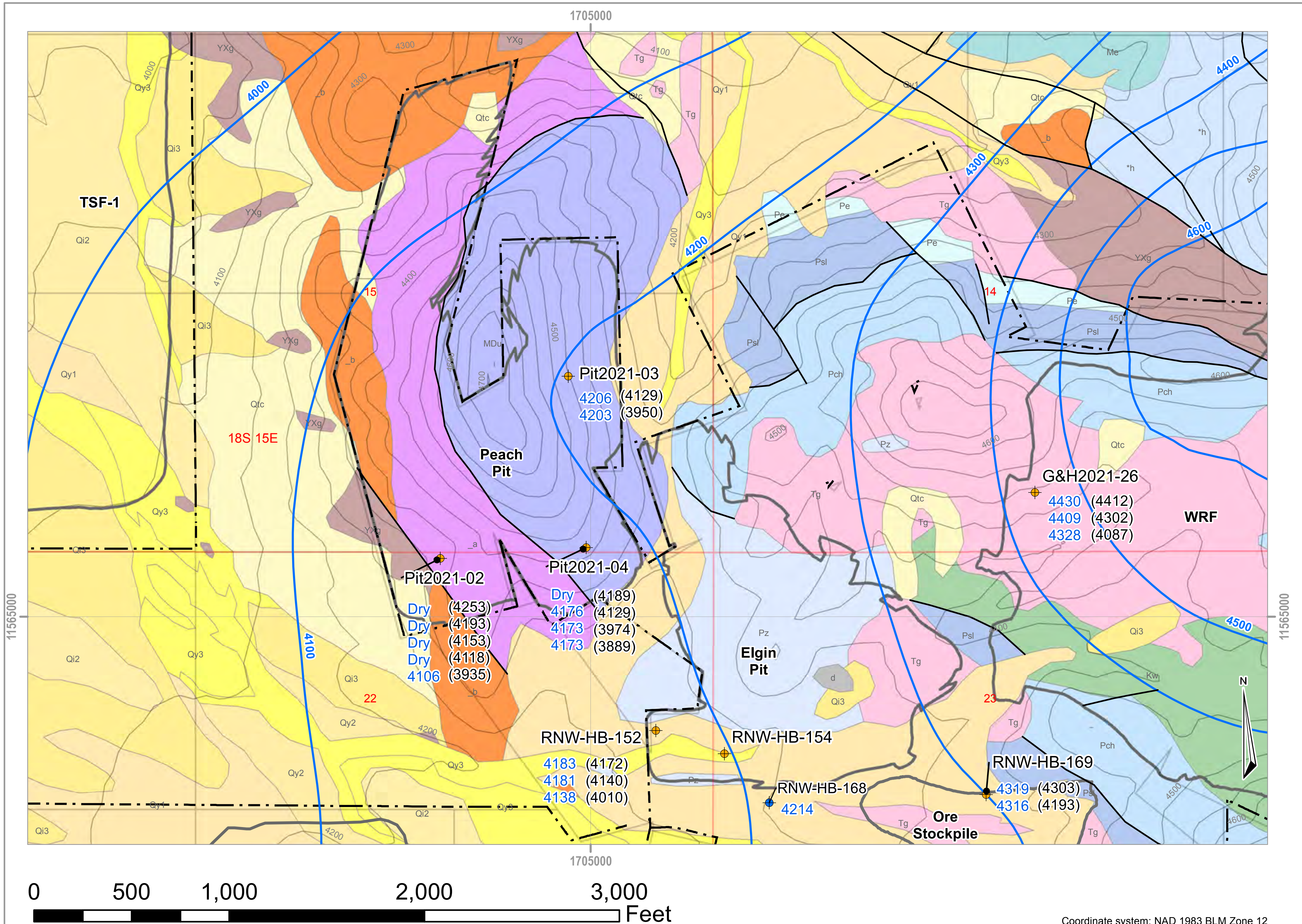
Project Area Potentiometric Surface

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN: SM/AP	CHECKED: BG
DATE:	May 2022
FIGURE:	2.9



1690000
1700000
1710000
1720000
1730000
11570000
11560000
11550000
A
A'
B
B'
C
C'
D
D'
TSF-1
Peach Pit
Heavy Weight Pit
Copper World Pit
Elgin Pit
WRF
Ore Stockpile
Plant Area
HLP
TSF-2
Broadtop Butte Pit
Rosemont Pit
18S 15E
18S 16E
19S 15E
19S 16E
N
1:46,032
0
2,500
5,000
10,000
15,000
Feet
Coordinate system: NAD 1983 BLM Zone 12
Cross Section Endpoints
Cross Section Trace
Facility Outlines
Private Land Boundaries
Topographic Elevation Contours
PLSS Township
PLSS Sections
PLSS Second Division
Project Area Hydrogeologic Cross Section Locations
PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY
CLIENT: Rosemont Copper Company
PROJECT: Rosemont Copper World Project
JOB: 4286
DRAWN: SM
CHECKED: BG
DATE: May 2022
FIGURE: 2.10



OSPs and Monitoring Wells

VWPs

3000 Piezometric Elevation (ft amsl)

(3000) Sensor Elevation (ft amsl)

Facility Outlines

Private Land Boundaries

Faults

Local Groundwater Elevation Contours

Topographic Elevation Contours

PLSS Township

PLSS Sections

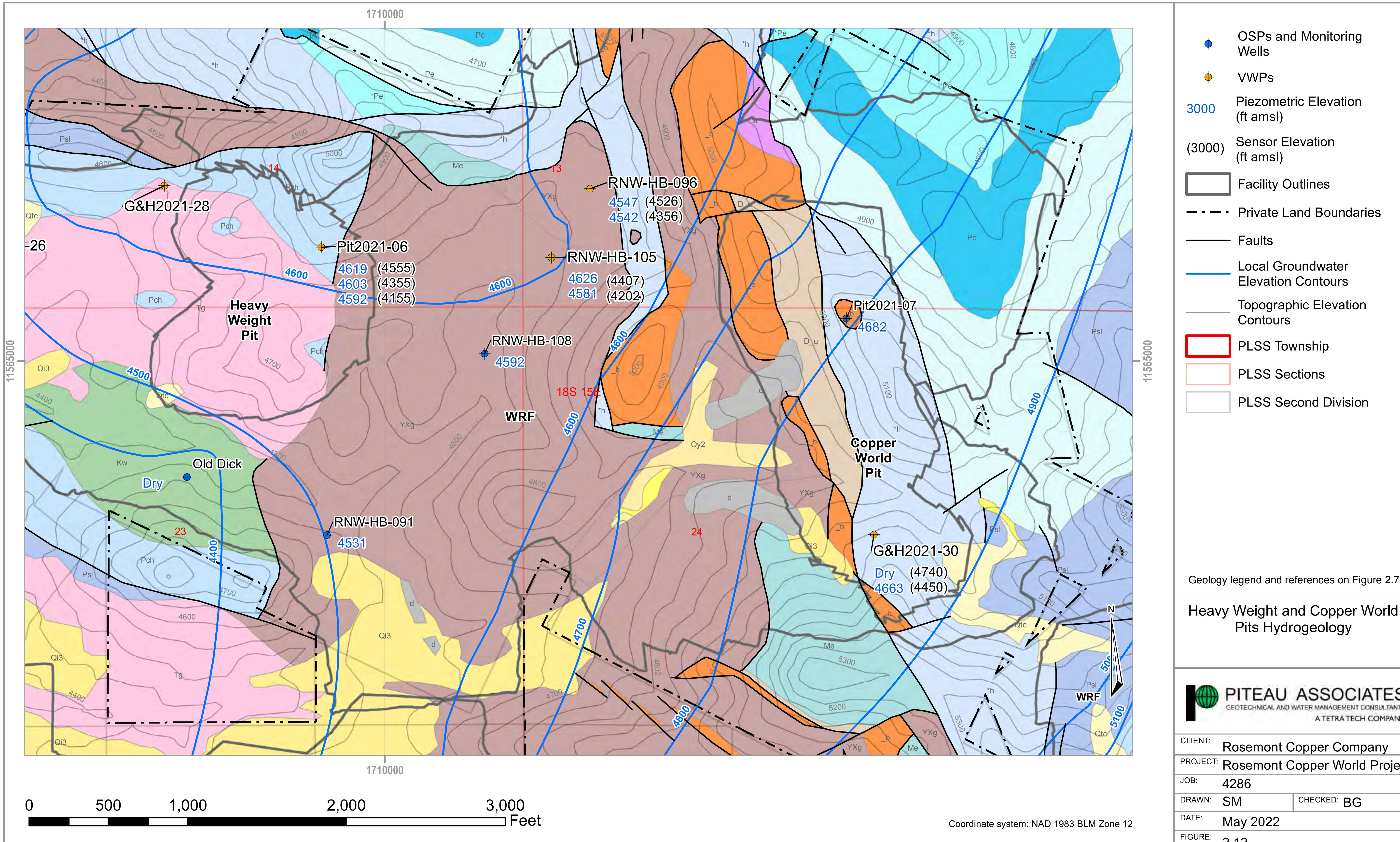
PLSS Second Division

Geology legend and references on Figure 2.7

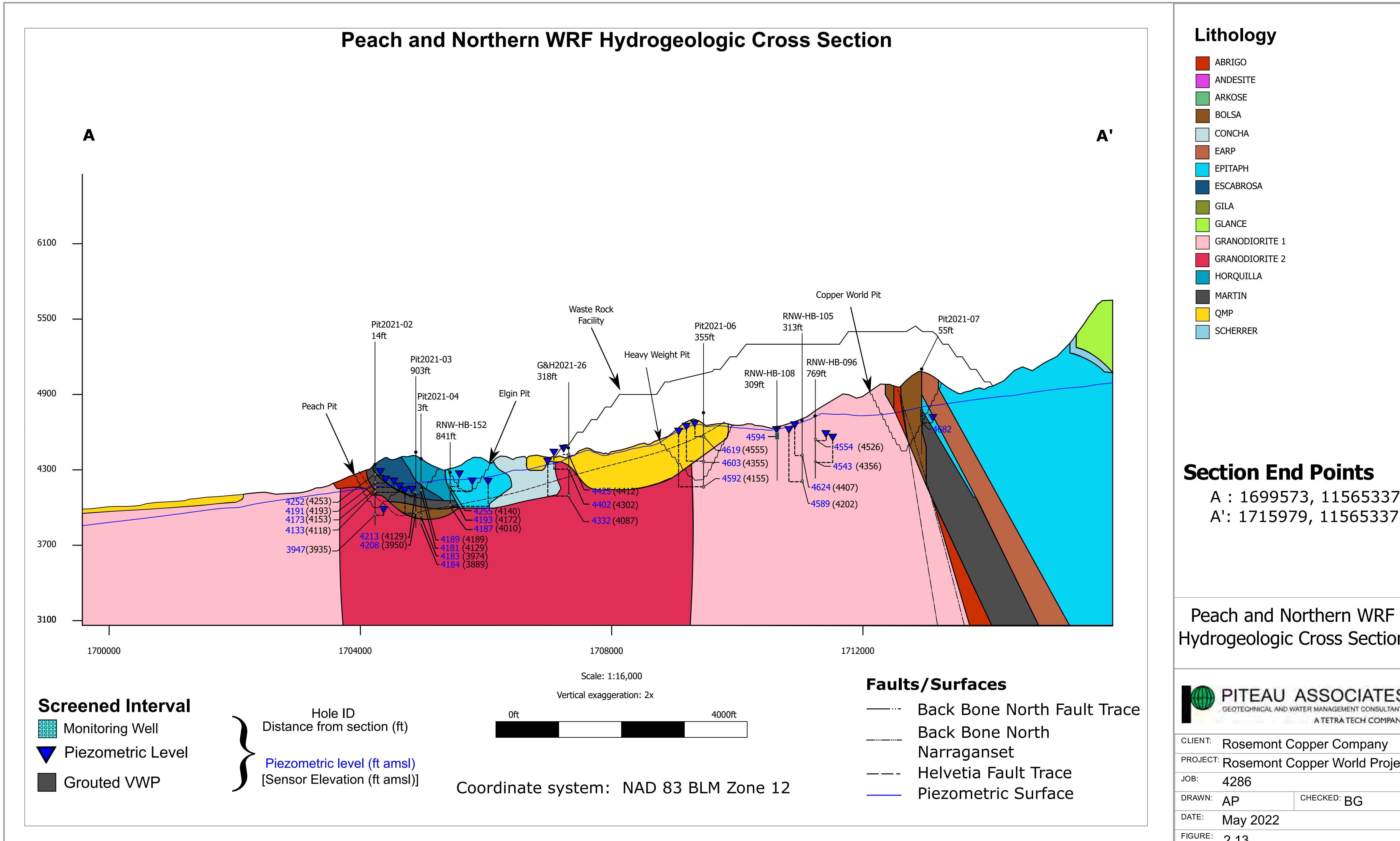
Peach and Elgin Pits Hydrogeology

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	SM
CHECKED:	BG
DATE:	May 2022
FIGURE:	2.11

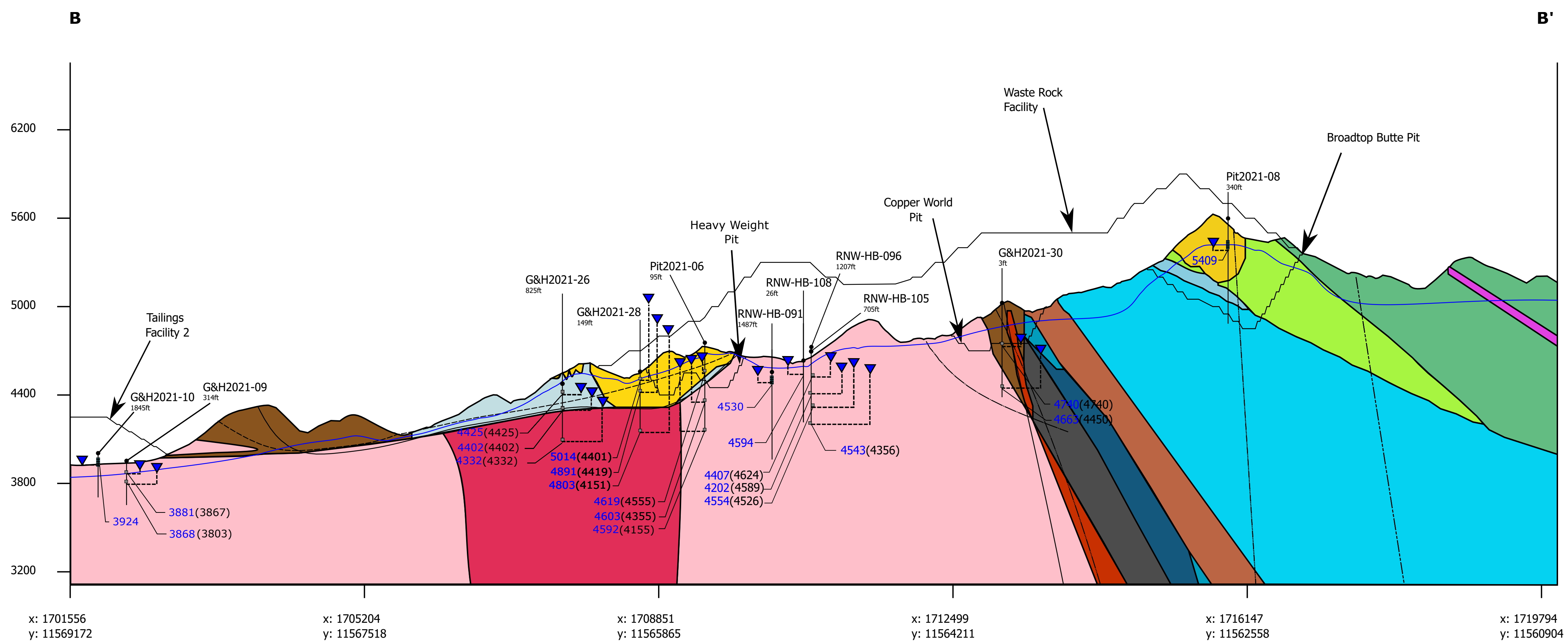


1710000
1565000
G&H2021-28
Pit2021-06
4619 (4555)
4603 (4355)
4592 (4155)
RNW-HB-096
4547 (4526)
4542 (4356)
RNW-HB-105
4626 (4407)
4581 (4202)
RNW-HB-108
4592
Pit2021-07
4682
Heavy Weight Pit
WRF
18S 15E
Old Dick
Dry
RNW-HB-091
4531
Copper World Pit
G&H2021-30
Dry (4740)
4663 (4450)
-26
14
13
23
24
4400
4500
4600
4700
4800
4900
5000
5100
N
0 500 1,000 2,000 3,000 Feet
Coordinate system: NAD 1983 BLM Zone 12
OSPs and Monitoring Wells
VWPs
3000 Piezometric Elevation (ft amsl)
(3000) Sensor Elevation (ft amsl)
Facility Outlines
Private Land Boundaries
Faults
Local Groundwater Elevation Contours
Topographic Elevation Contours
PLSS Township
PLSS Sections
PLSS Second Division
Geology legend and references on Figure 2.7
Heavy Weight and Copper World Pits Hydrogeology
PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY
CLIENT: Rosemont Copper Company
PROJECT: Rosemont Copper World Project
JOB: 4286
DRAWN: SM
CHECKED: BG
DATE: May 2022
FIGURE: 2.12



Peach and Northern WRF Hydrogeologic Cross Section
A
A'
6100
5500
4900
4300
3700
3100
1700000
1704000
1708000
1712000
Peach Pit
Pit2021-02
14ft
Pit2021-03
903ft
Pit2021-04
3ft
RNW-HB-152
841ft
Elgin Pit
G&H2021-26
318ft
Waste Rock
Facility
Heavy Weight Pit
Pit2021-06
355ft
RNW-HB-108
309ft
RNW-HB-105
313ft
RNW-HB-096
769ft
Copper World Pit
Pit2021-07
55ft
Scale: 1:16,000
Vertical exaggeration: 2x
0ft
4000ft
Screened Interval
Monitoring Well
Piezometric Level
Grouted VWP
Hole ID
Distance from section (ft)
Piezometric level (ft amsl)
[Sensor Elevation (ft amsl)]
Coordinate system: NAD 83 BLM Zone 12
Faults/Surfaces
Back Bone North Fault Trace
Back Bone North Narraganset
Helvetia Fault Trace
Piezometric Surface
Lithology
ABRIGO
ANDESITE
ARKOSE
BOLSA
CONCHA
EARP
EPITAPH
ESCABROSA
GILA
GLANCE
GRANODIORITE 1
GRANODIORITE 2
HORQUILLA
MARTIN
QMP
SCHERRER
Section End Points
A : 1699573, 11565337
A': 1715979, 11565337
Peach and Northern WRF Hydrogeologic Cross Section
PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY
CLIENT: Rosemont Copper Company
PROJECT: Rosemont Copper World Project
JOB: 4286
DRAWN: AP
CHECKED: BG
DATE: May 2022
FIGURE: 2.13

Heavy Weight, Copper World, Broadtop Butte and Central WRF Hydrogeologic Cross Section



Lithology

- ABRIGO
- ANDESITE
- ARKOSE
- BOLSA
- CONCHA
- EARP
- EPITAPH
- ESCABROSA
- GILA
- GLANCE
- GRANODIORITE 1
- GRANODIORITE 2
- HORQUILLA
- MARTIN
- QMP
- SCHERRER

Section End Points

B: 1701556, 11569172

B' : 1719991, 11560815

Screened Interval

- Monitoring Well
- Piezometric Level
- Grouted VWP

Hole ID
Distance from section (ft)

Piezometric level (ft amsl)
[Sensor Elevation (ft amsl)]

Scale: 1:18,000

Vertical exaggeration: 2x

0ft 4000ft

Coordinate system: NAD 83,BLM Zone 12

Faults/Surfaces

- Graben Fault
- Back Bone North
- Back Bone North CW
- WE BT Fault
- Helvetia Fault
- Piezometric Surface

Heavy Weight, Copper World, Broadtop Butte and Central WRF Hydrogeologic Cross Section

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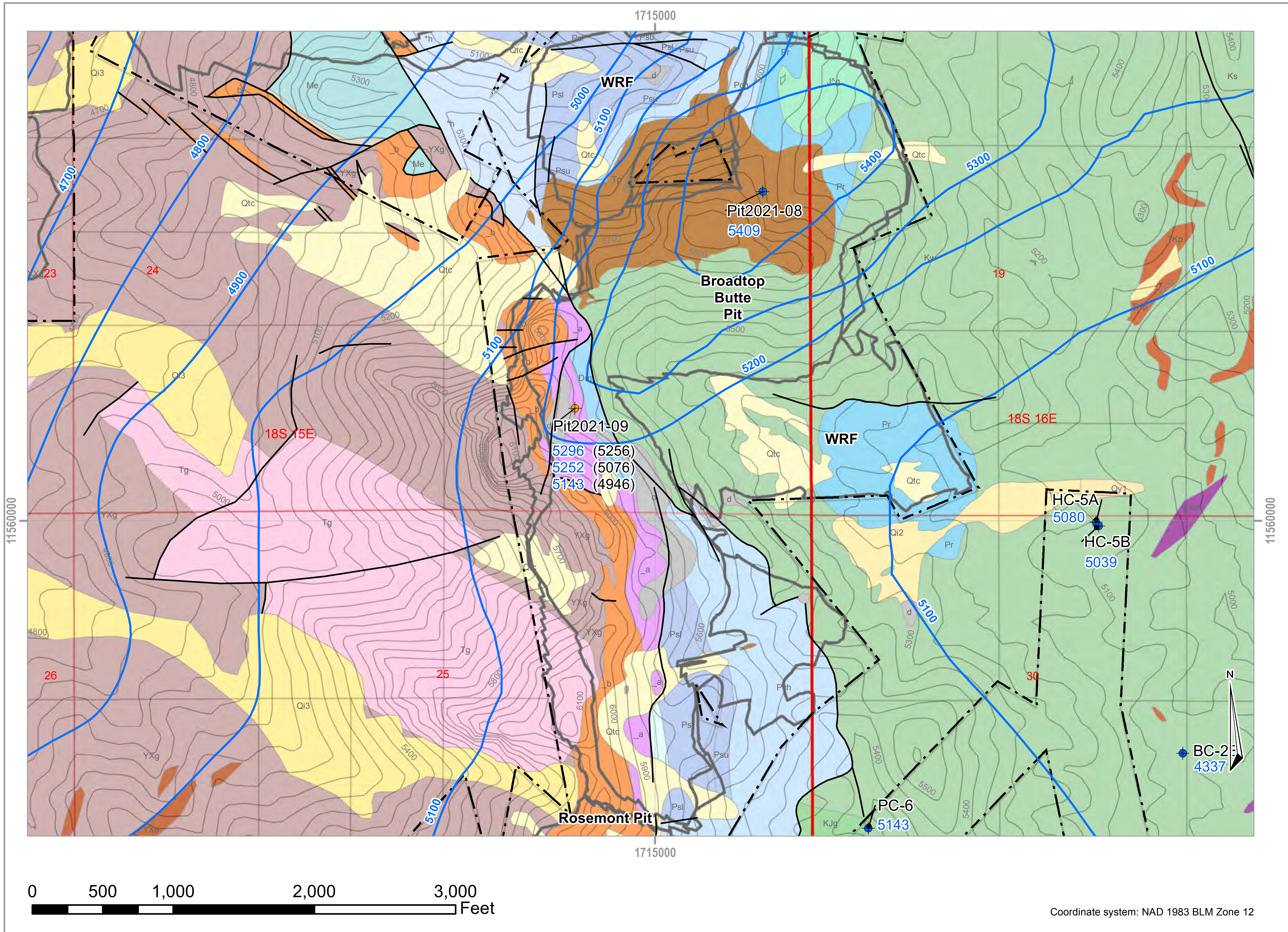
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN: AP	CHECKED: BG
DATE:	May 2022
FIGURE:	2.14



Broadtop Butte Pit Hydrogeology

PITEAU ASSOCIATES
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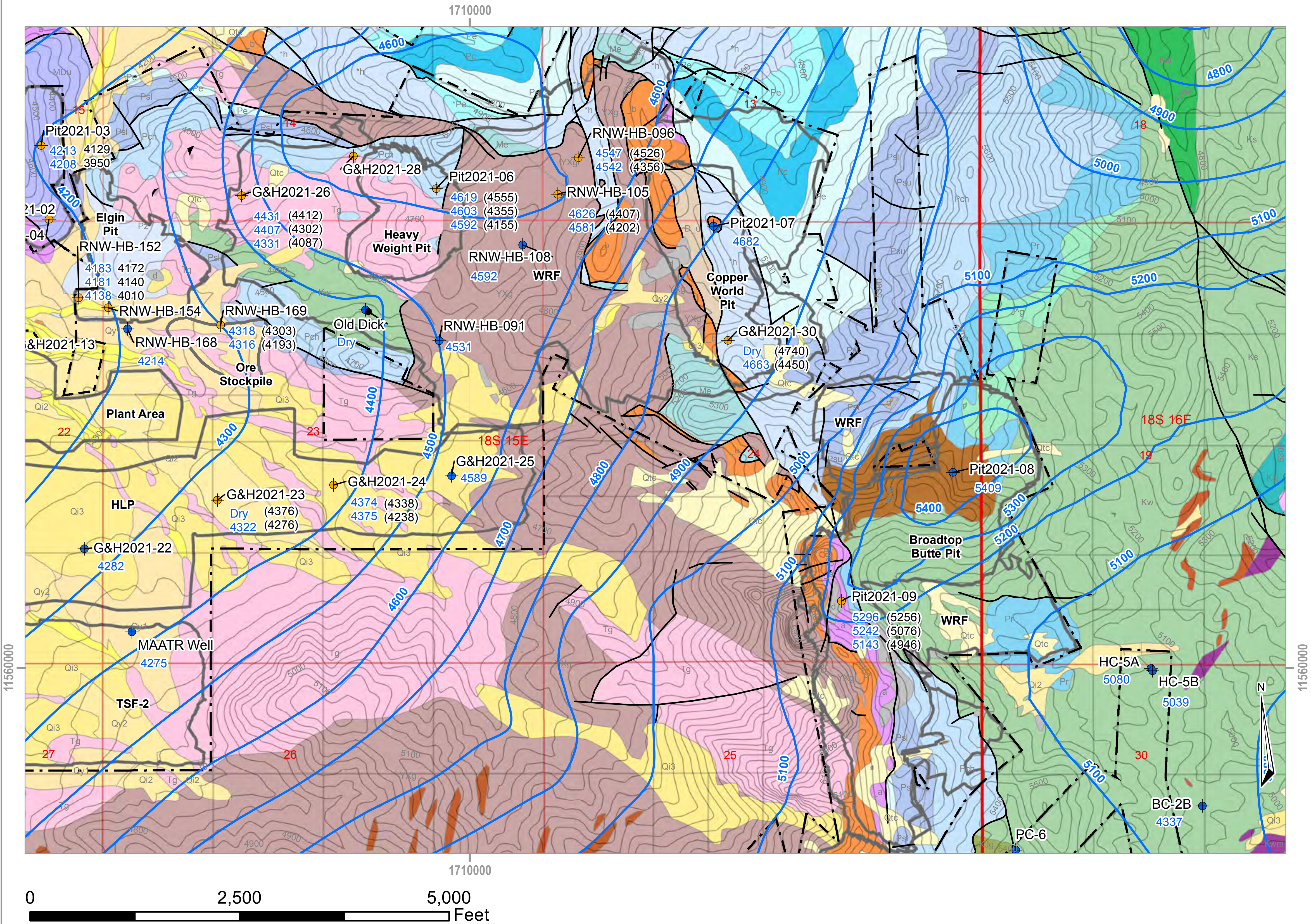
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	SM
CHECKED:	BG
DATE:	May 2022
FIGURE:	2.15



OSPs and Monitoring Wells

VWPs

3000 Piezometric Elevation (ft amsl)

(3000) Sensor Elevation (ft amsl)

Facility Outlines

Private Land Boundaries

Faults

Local Groundwater Elevation Contours

Topographic Elevation Contours

PLSS Township

PLSS Sections

PLSS Second Division

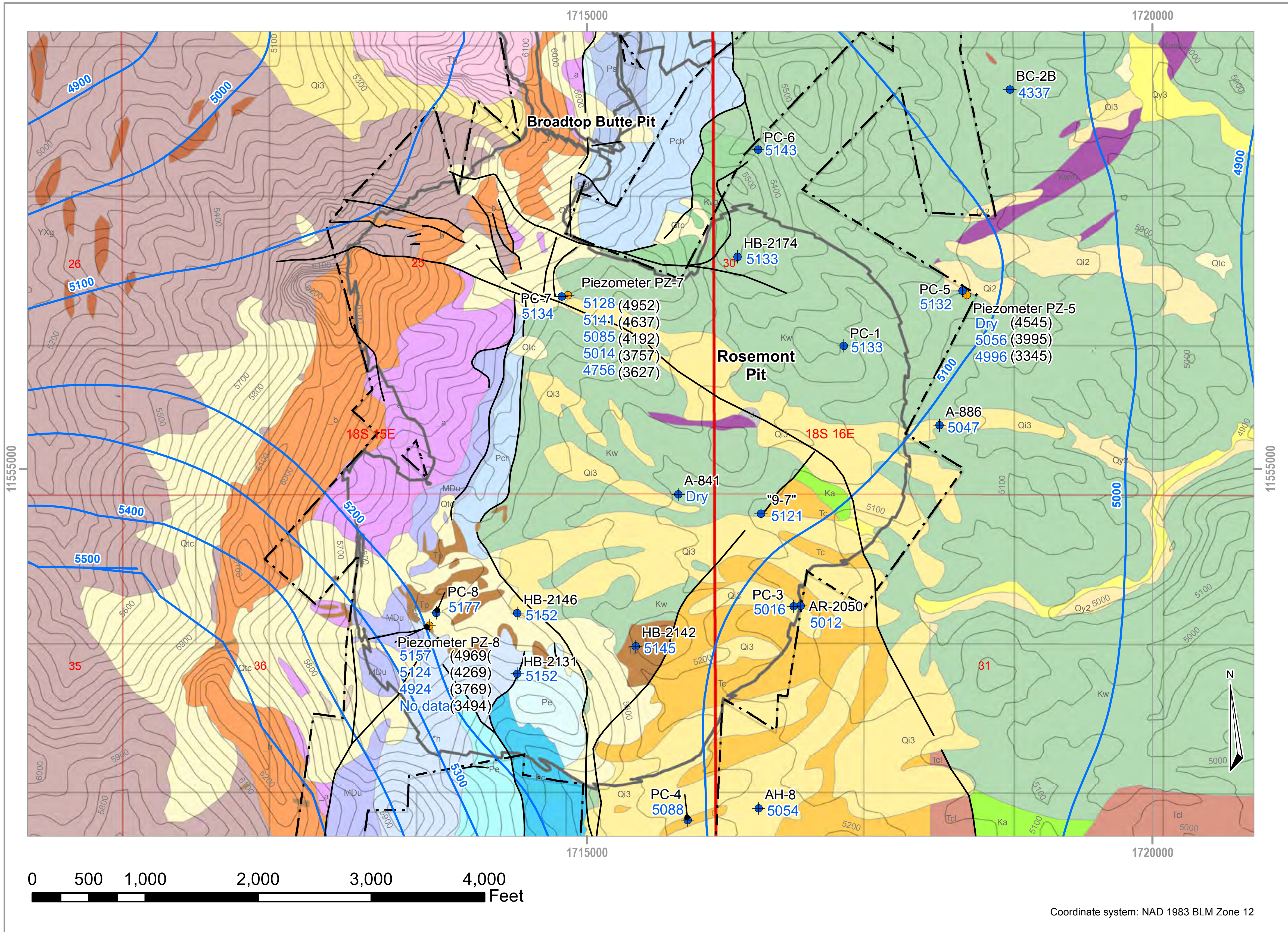
Geology legend and references on Figure 2.7

Coordinate system: NAD 1983 BLM Zone 12

Waste Rock Facility (WRF) Hydrogeology

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN: SM	CHECKED: BG
DATE:	May 2022
FIGURE:	2.16



OSPs and Monitoring Wells

VWPs

3000 Piezometric Elevation (ft amsl)

(3000) Sensor Elevation (ft amsl)

Facility Outlines

Private Land Boundaries

Faults

Local Groundwater Elevation Contours

Topographic Elevation Contours

PLSS Township

PLSS Sections

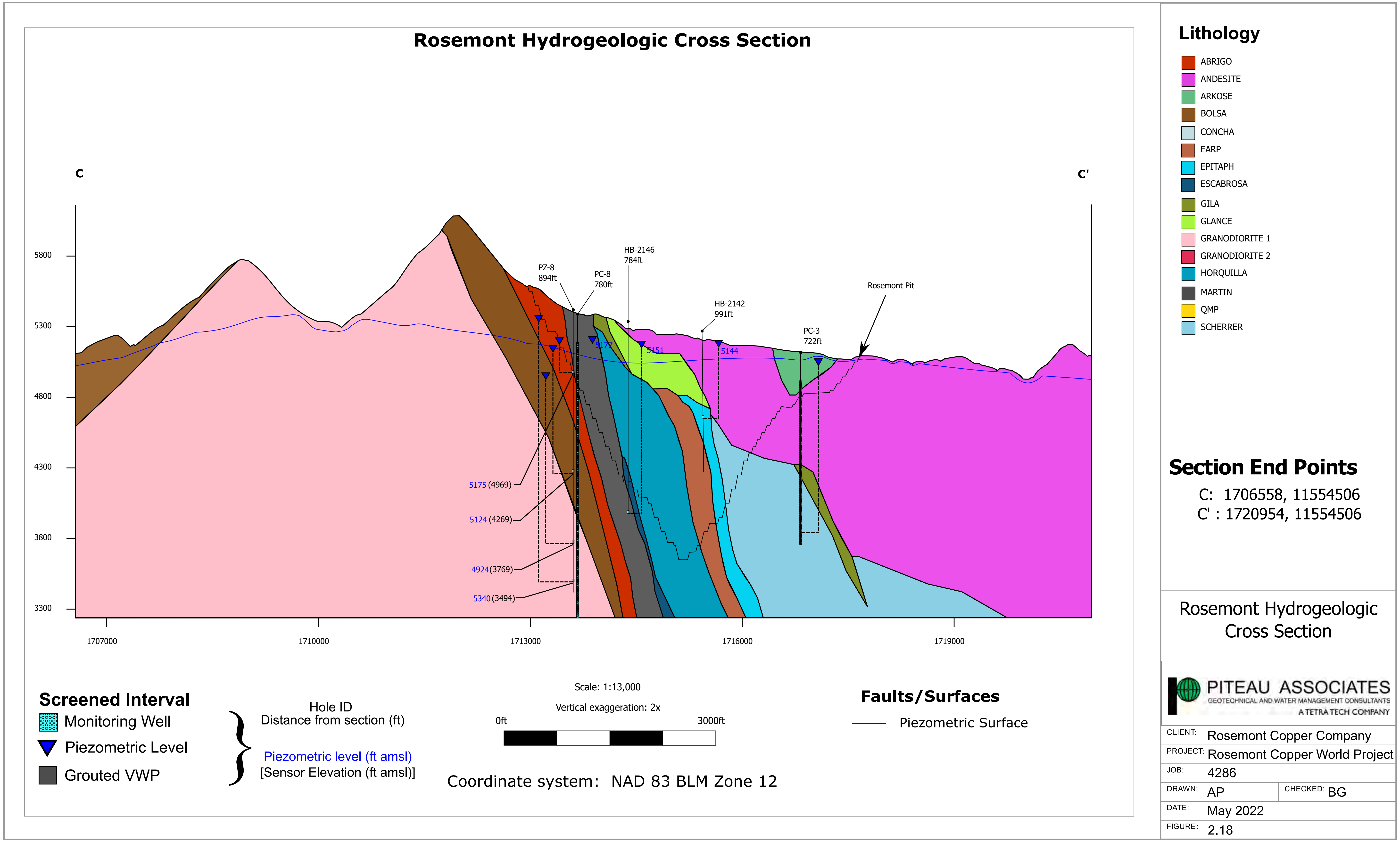
PLSS Second Division

Geology legend and references on Figure 2.7

Rosemont Pit Hydrogeology

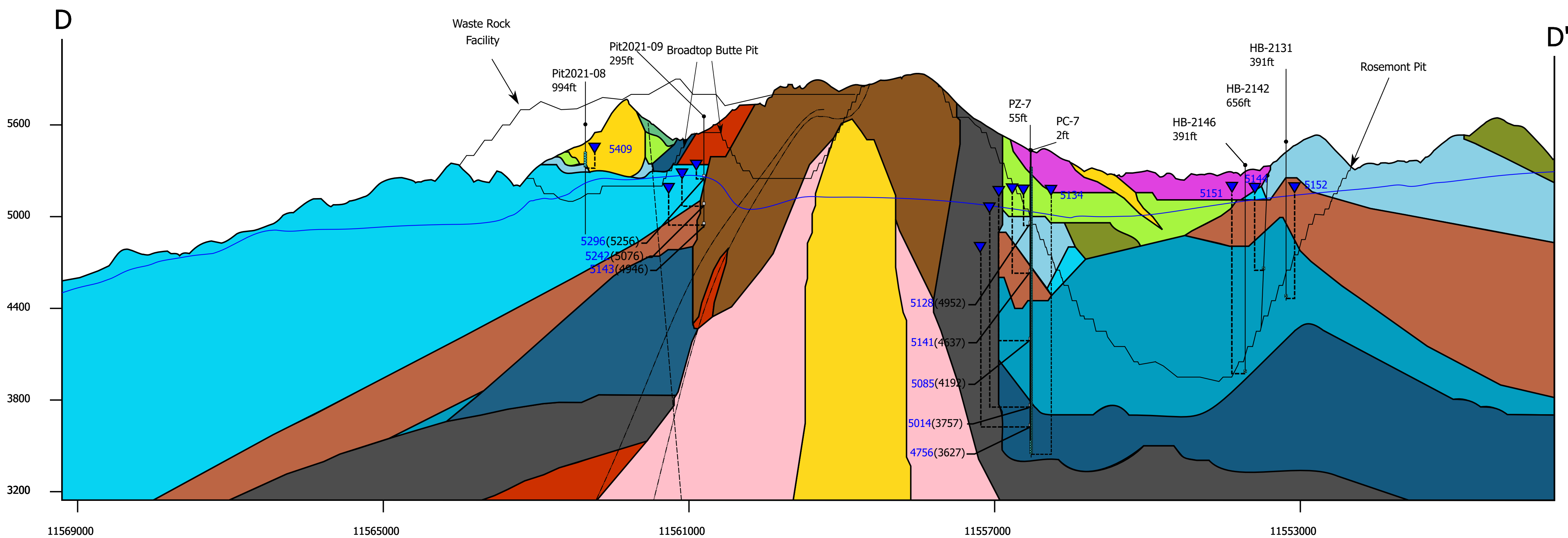
PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	SM
CHECKED:	BG
DATE:	May 2022
FIGURE:	2.17



Rosemont Hydrogeologic Cross Section
C
C'
5800
5300
4800
4300
3800
3300
1707000
1710000
1713000
1716000
1719000
PZ-8
894ft
PC-8
780ft
HB-2146
784ft
HB-2142
991ft
PC-3
722ft
Rosemont Pit
5177
5151
5144
5175 (4969)
5124 (4269)
4924(3769)
5340(3494)
Screened Interval
Monitoring Well
Piezometric Level
Grouted VWP
Hole ID
Distance from section (ft)
Piezometric level (ft amsl)
[Sensor Elevation (ft amsl)]
Scale: 1:13,000
Vertical exaggeration: 2x
0ft
3000ft
Coordinate system: NAD 83 BLM Zone 12
Faults/Surfaces
Piezometric Surface
Lithology
ABRIGO
ANDESITE
ARKOSE
BOLSA
CONCHA
EARP
EPITAPH
ESCABROSA
GILA
GLANCE
GRANODIORITE 1
GRANODIORITE 2
HORQUILLA
MARTIN
QMP
SCHERRER
Section End Points
C: 1706558, 11554506
C' : 1720954, 11554506
Rosemont Hydrogeologic Cross Section
PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY
CLIENT: Rosemont Copper Company
PROJECT: Rosemont Copper World Project
JOB: 4286
DRAWN: AP
CHECKED: BG
DATE: May 2022
FIGURE: 2.18

WRF, Broadtop Butte, and Rosemont Hydrogeologic Cross Section



Lithology

- ABRIGO
- ANDESITE
- ARKOSE
- BOLSA
- CONCHA
- EARP
- EPITAPH
- ESCABROSA
- GILA
- GLANCE
- GRANODIORITE 1
- GRANODIORITE 2
- HORQUILLA
- MARTIN
- QMP
- SCHERRER

Section End Points

D: 1714775, 11569205

D': 1714775, 11549675

Screened Interval

- Monitoring Well
- Piezometric Level
- Grouted VWP

Hole ID
Distance from section (ft)

Piezometric level (ft amsl)
[Sensor Elevation (ft amsl)]

Scale: 1:16,000

Vertical exaggeration: 2x

0ft 4000ft

Coordinate system: NAD 83,BLM Zone 12

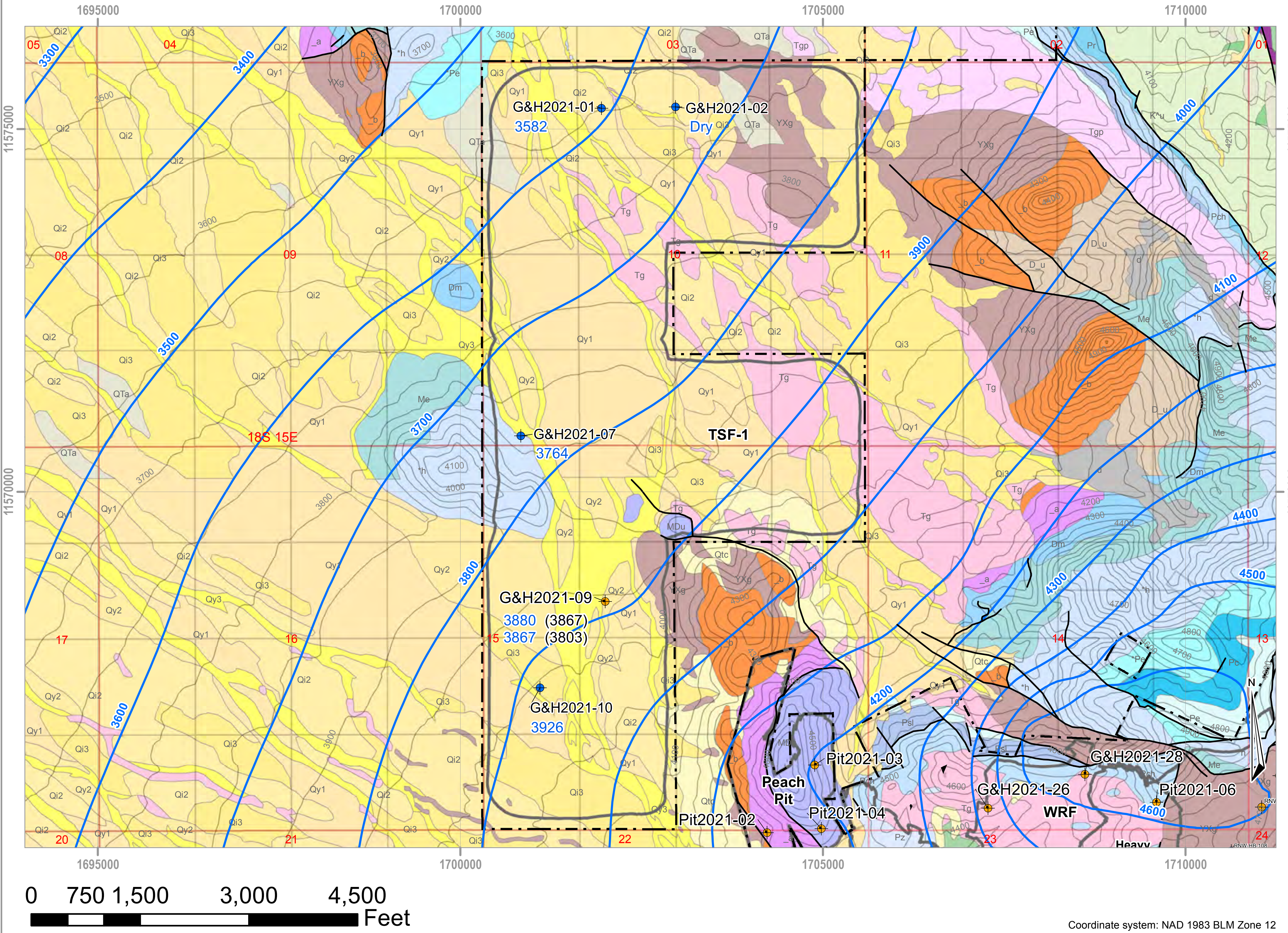
Faults/Surfaces

- Backbone North CW
- Backbone North
- WE BT
- Piezometric Surface

WRF, Broadtop Butte, and Rosemont Hydrogeologic Cross Section

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	AP
CHECKED:	BG
DATE:	May 2022
FIGURE:	2.19



Coordinate system: NAD 1983 BLM Zone 12

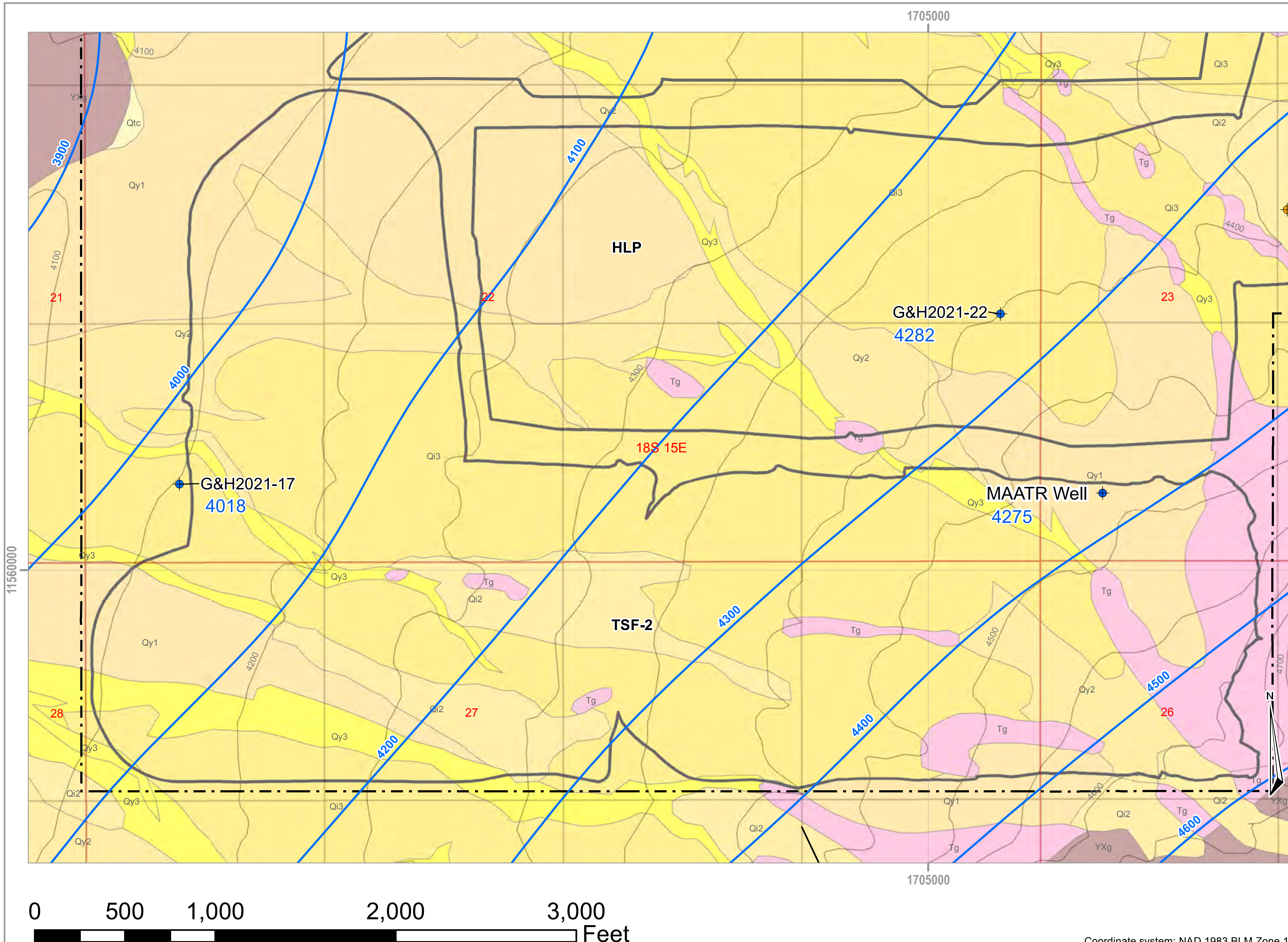
- OSPs and Monitoring Wells
- VWPs
- 3000 Piezometric Elevation (ft amsl)
- (3000) Sensor Elevation (ft amsl)
- Facility Outlines
- Private Land Boundaries
- Faults
- Local Groundwater Elevation Contours
- Topographic Elevation Contours
- PLSS Township
- PLSS Sections
- PLSS Second Division

Geology legend and references on Figure 2.7

Tailings Storage Facility 1 (TSF-1) Hydrogeology

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	SM
CHECKED:	BG
DATE:	May 2022
FIGURE:	2.20



OSPs and Monitoring Wells

VWPs

3000 Piezometric Elevation (ft amsl)

(3000) Sensor Elevation (ft amsl)

Facility Outlines

Private Land Boundaries

Faults

Local Groundwater Elevation Contours

Topographic Elevation Contours

PLSS Township

PLSS Sections

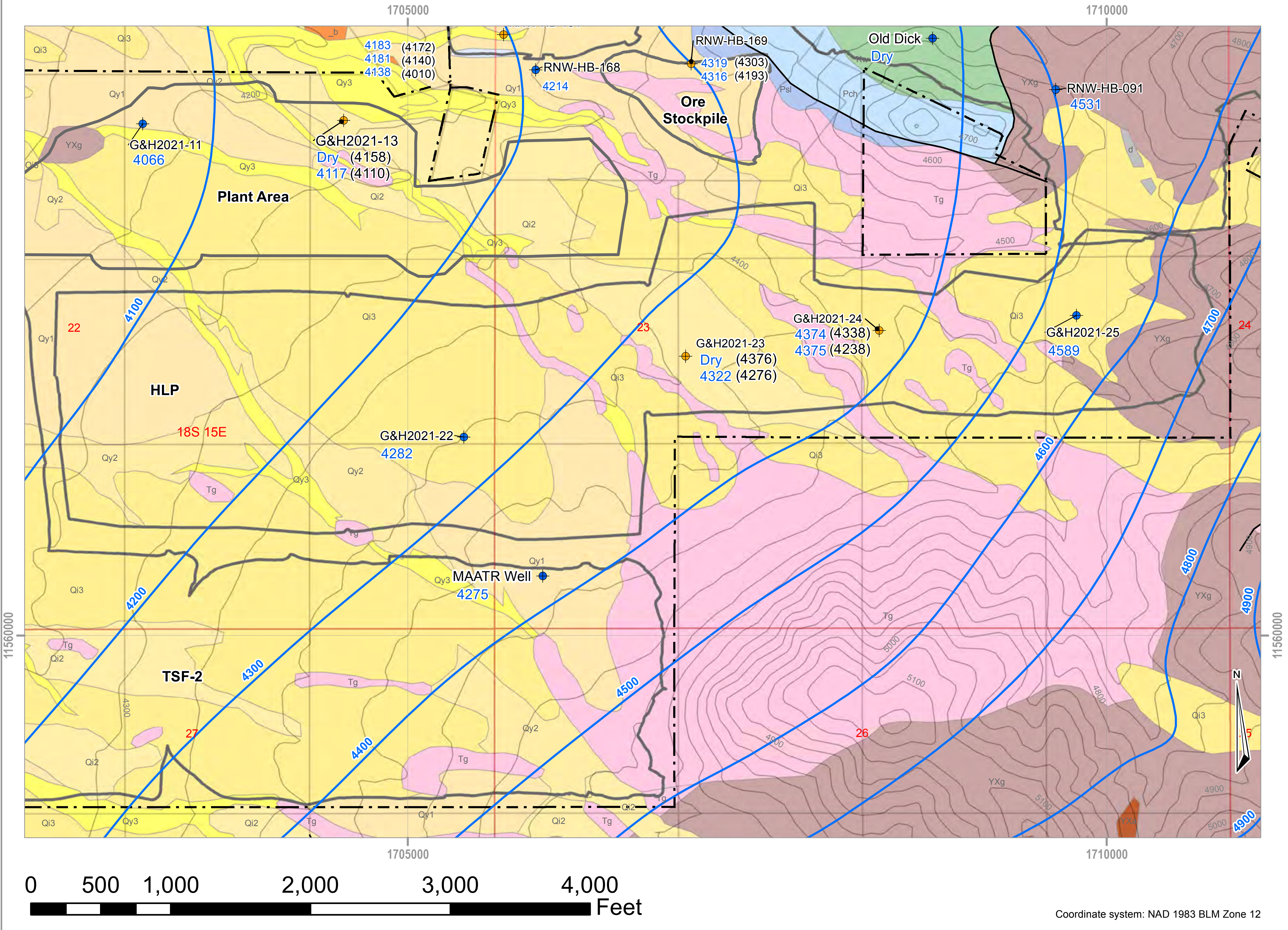
PLSS Second Division

Geology legend and references on Figure 2.7

Tailings Storage Facility 2
(TSF-2) Hydrogeology

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN: SM	CHECKED: BG
DATE:	May 2022
FIGURE:	2.21



OSPs and Monitoring Wells

VWPs

3000 Piezometric Elevation (ft amsl)

(3000) Sensor Elevation (ft amsl)

Facility Outlines

Private Land Boundaries

Faults

Local Groundwater Elevation Contours

Topographic Elevation Contours

PLSS Township

PLSS Sections

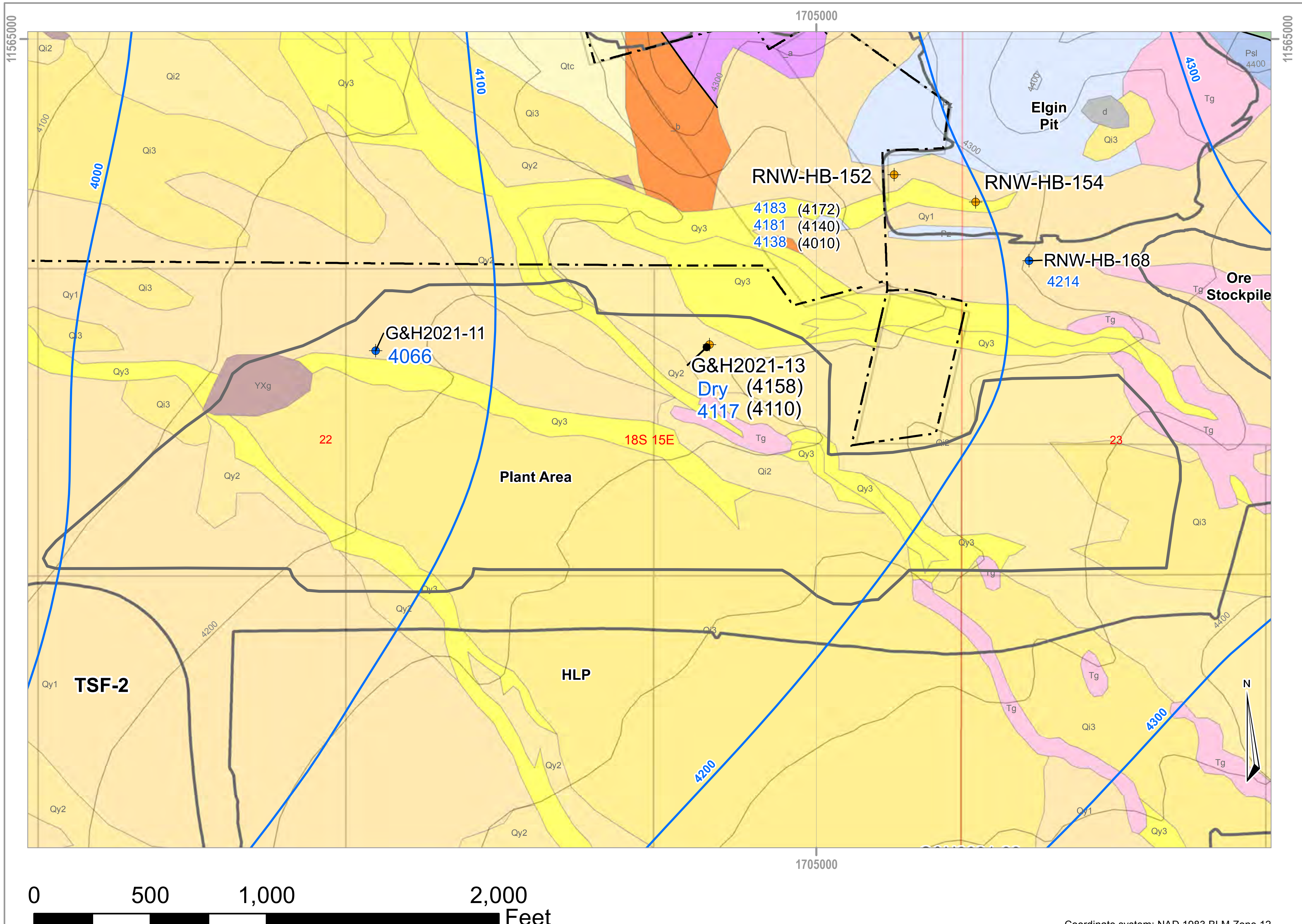
PLSS Second Division

Geology legend and references on Figure 2.7

Heap Leach Pad (HLP) Hydrogeology

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN: SM	CHECKED: BG
DATE:	May 2022
FIGURE:	2.22



OSPs and Monitoring Wells

VWPs

3000 Piezometric Elevation (ft amsl)

(3000) Sensor Elevation (ft amsl)

Facility Outlines

Private Land Boundaries

Faults

Local Groundwater Elevation Contours

Topographic Elevation Contours

PLSS Township

PLSS Sections

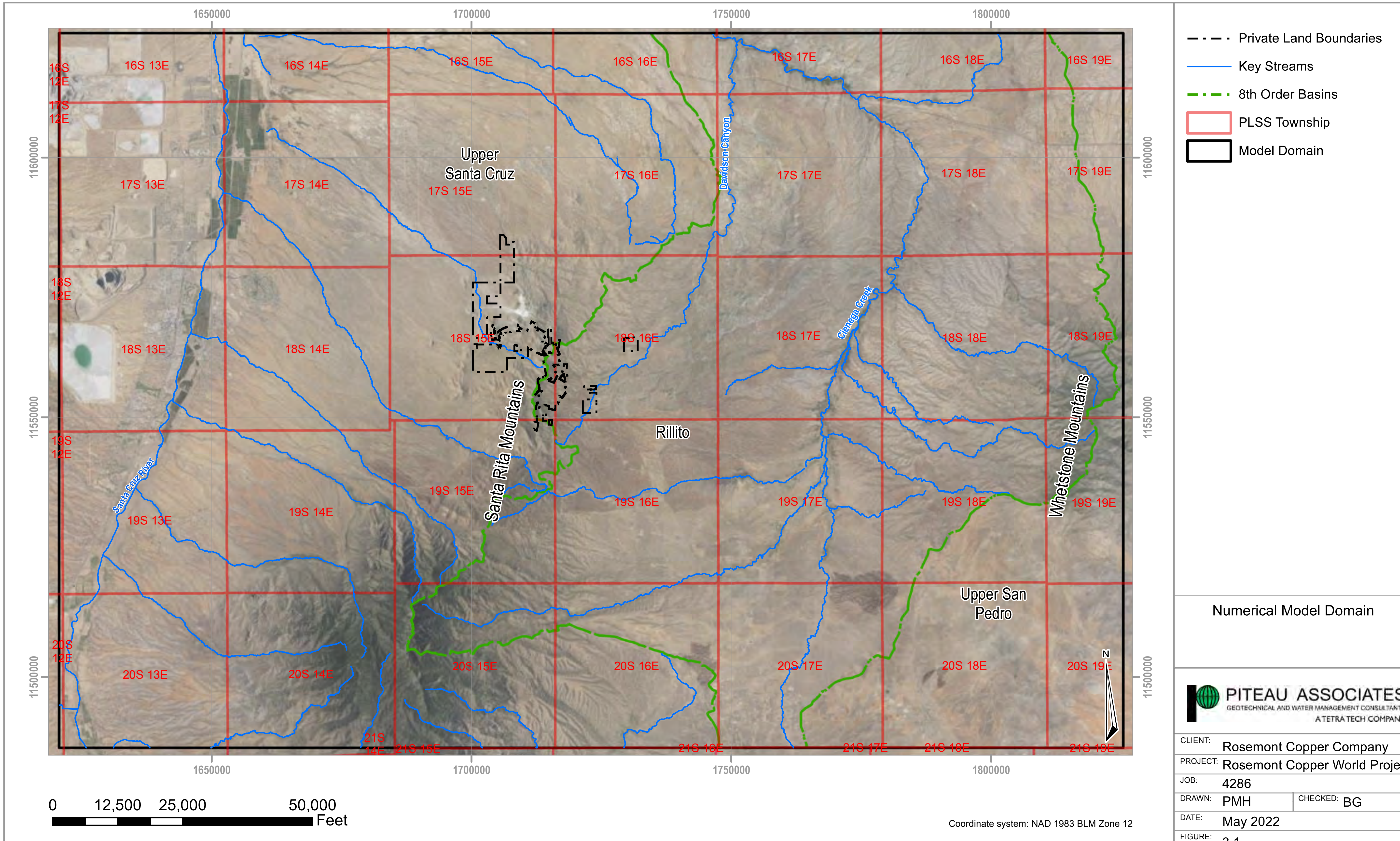
PLSS Second Division

Geology legend and references on Figure 2.7

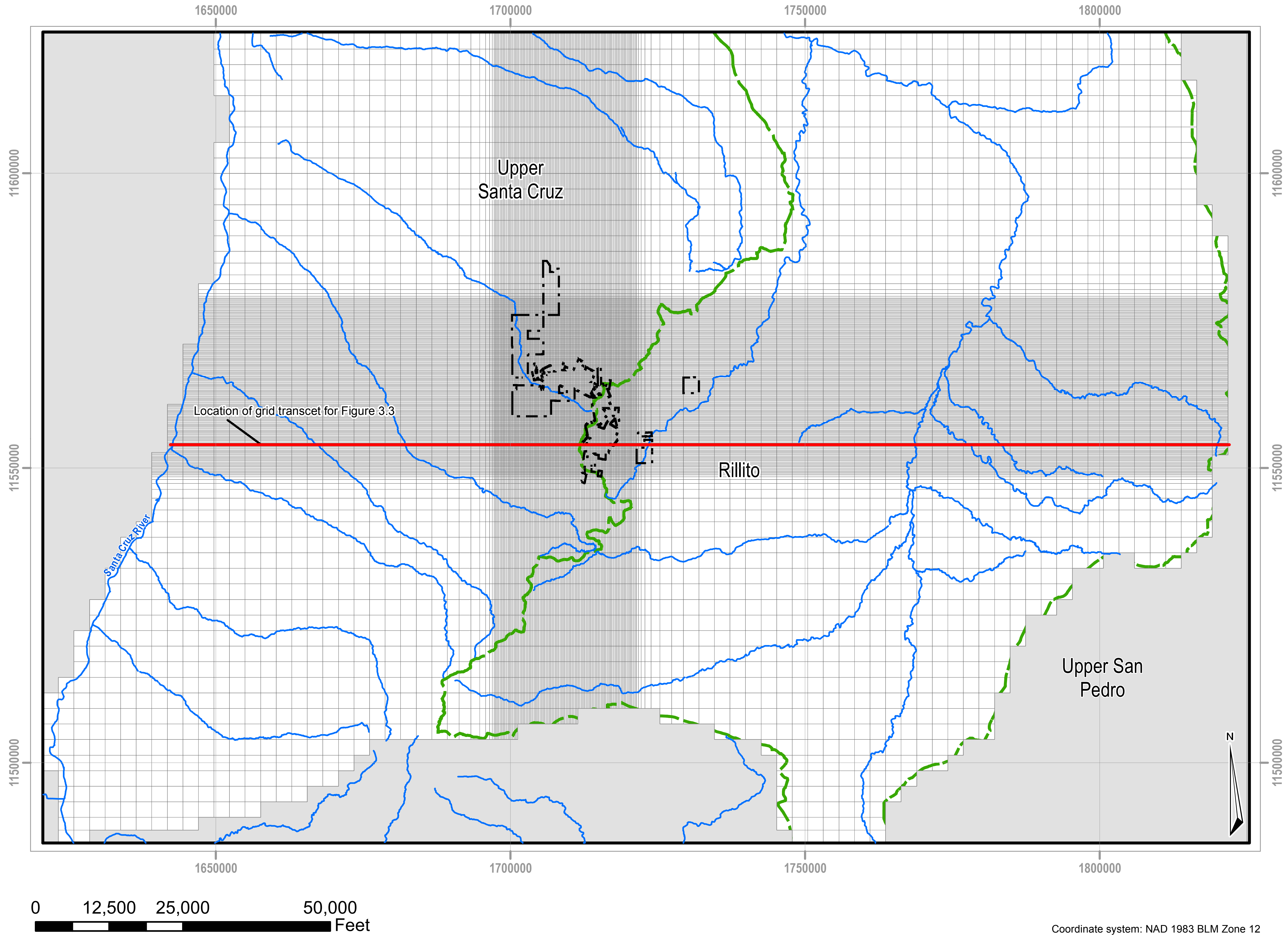
Plant Area Hydrogeology

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	SM CHECKED: BG
DATE:	May 2022
FIGURE:	2.23



Private Land Boundaries
Key Streams
8th Order Basins
PLSS Township
Model Domain
1650000
1700000
1750000
1800000
11600000
11550000
11500000
Upper Santa Cruz
Santa Rita Mountains
Rillito
Whetstone Mountains
Upper San Pedro
Santa Cruz River
Davidson Canyon
Cienega Creek
16S 13E
16S 14E
16S 15E
16S 16E
16S 17E
16S 18E
16S 19E
17S 13E
17S 14E
17S 15E
17S 16E
17S 17E
17S 18E
17S 19E
18S 13E
18S 14E
18S 15E
18S 16E
18S 17E
18S 18E
18S 19E
19S 13E
19S 14E
19S 15E
19S 16E
19S 17E
19S 18E
19S 19E
20S 13E
20S 14E
20S 15E
20S 16E
20S 17E
20S 18E
20S 19E
0 12,500 25,000 50,000 Feet
Coordinate system: NAD 1983 BLM Zone 12
N
Numerical Model Domain
PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY
CLIENT: Rosemont Copper Company
PROJECT: Rosemont Copper World Project
JOB: 4286
DRAWN: PMH
CHECKED: BG
DATE: May 2022
FIGURE: 3.1

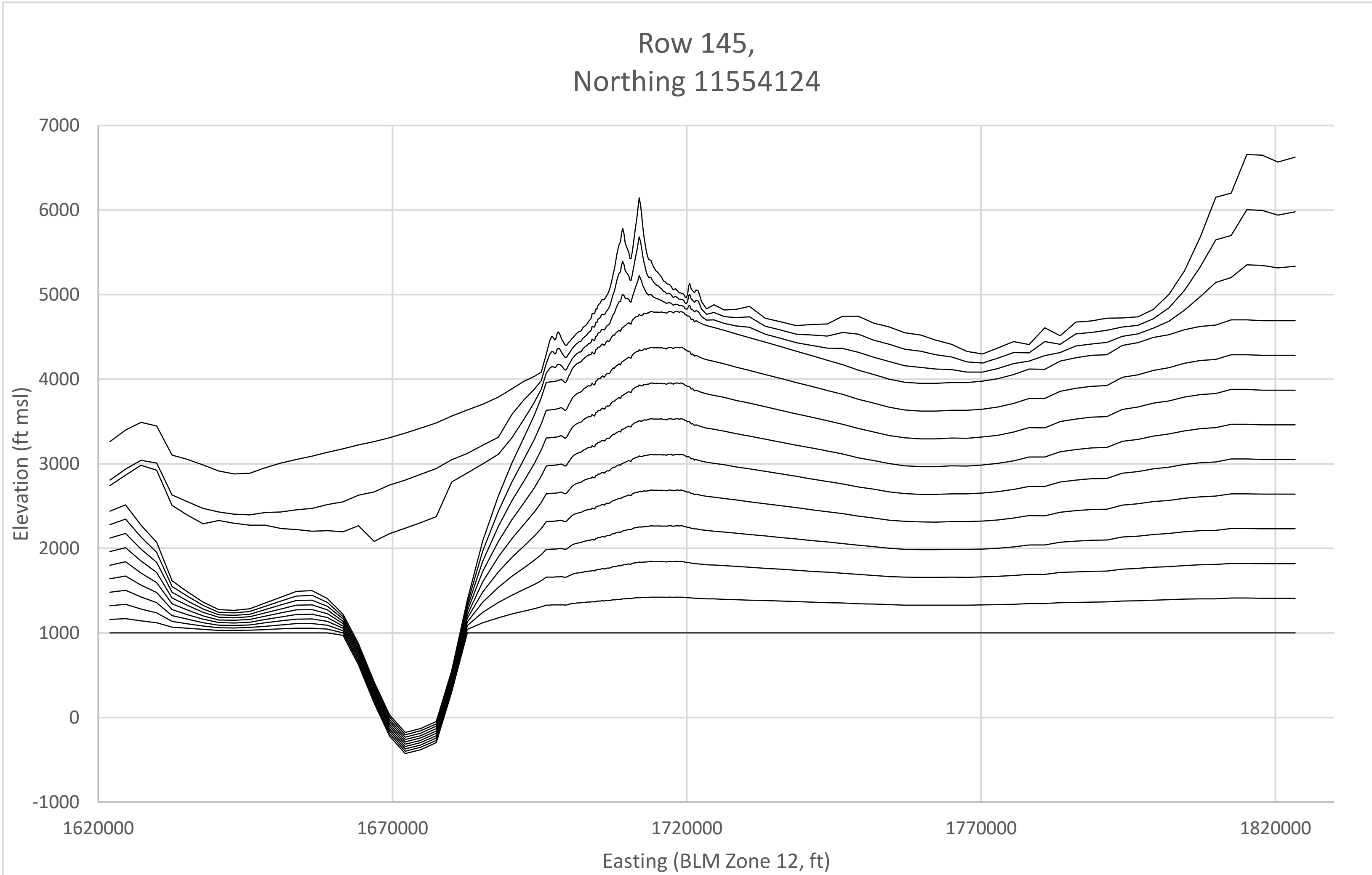


Private Land Boundaries
Key Streams
8th Order Basins
No Flow Cell
Model Grid
Model Domain

Numerical Model Grid

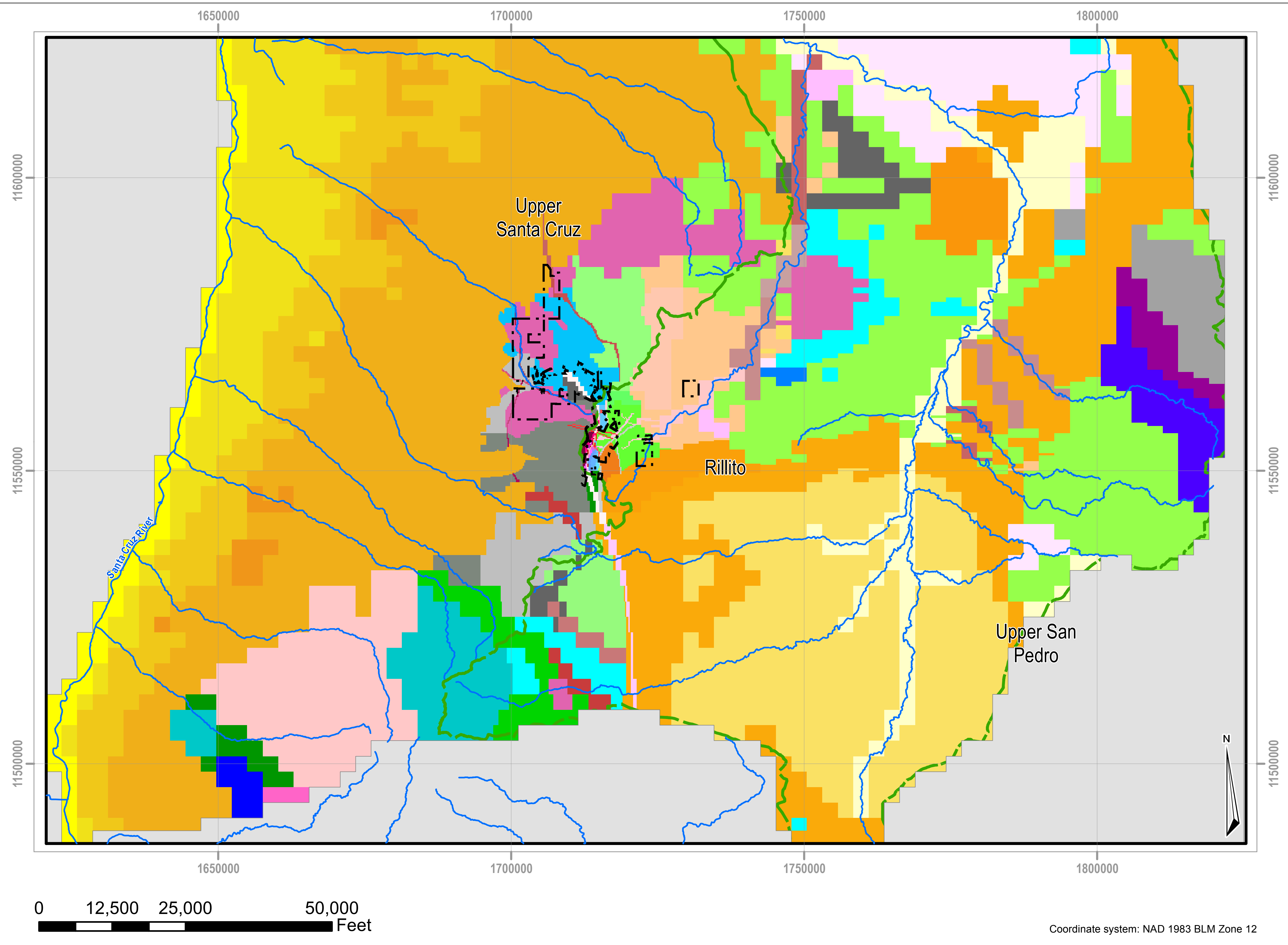
PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	PMH
CHECKED:	BG
DATE:	May 2022
FIGURE:	3.2



PITEAU ASSOCIATES
Geotechnical and Water Management Consultants
A TETRA TECH COMPANY

Model Layers Along an East-West Transect					
CLIENT:	Rosemont Copper Company	PROJECT:	Rosemont Copper World Project		
JOB #:	4286	DRAWN:	DE	CHECKED:	BG
DATE:	May 2022	FIGURE:	3.3		

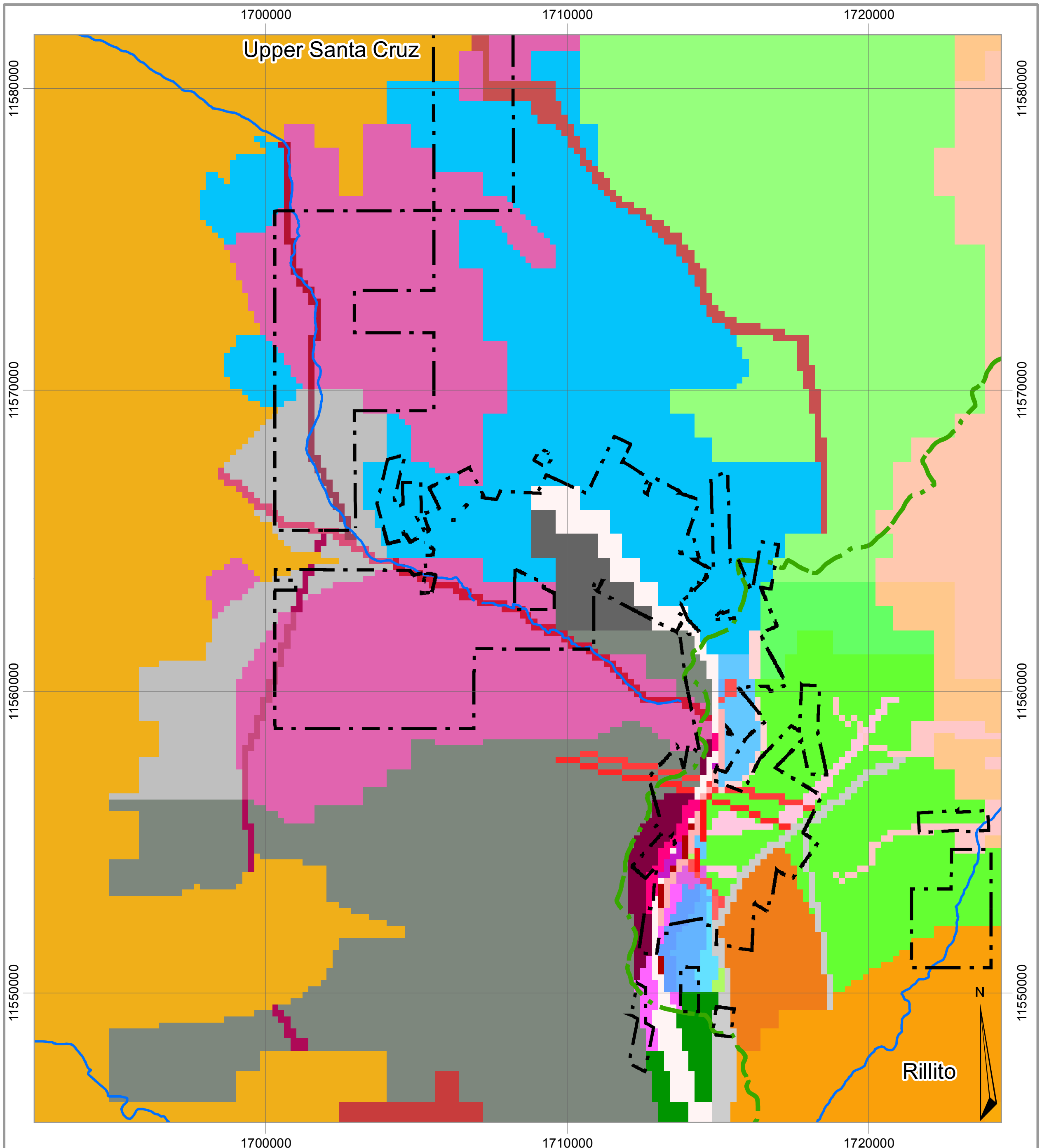


Private Land Boundaries
Key Streams
8th Order Basins
No Flow Cell
Model Domain
See Figure 3.4.25 for K Zones Legend

Model K Zones, Layer 1

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN: PMH	CHECKED: BG
DATE:	May 2022
FIGURE:	3.4.1



Private Land Boundaries

Key Streams

8th Order Basins

See Figure 3.4.25 for K Zones Legend

Project Area K Zones, Layer 1 Inset

1:63,000

0 5,000

Feet

Coordinate System:
NAD 1983 BLM Zone 12N

PITEAU ASSOCIATES
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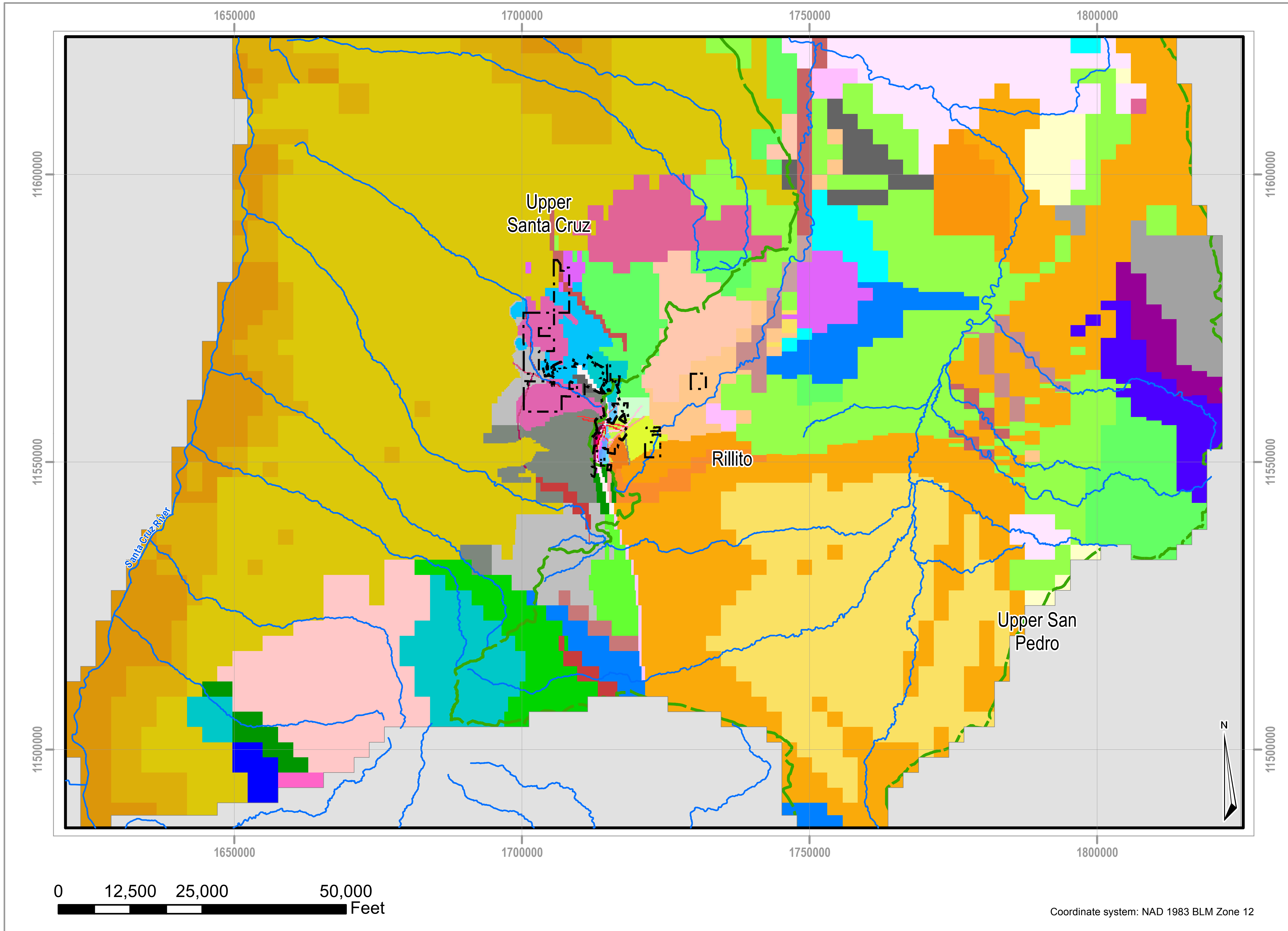
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	PMH
CHECKED:	BG
DATE:	May 2022
FIGURE:	3.4.2

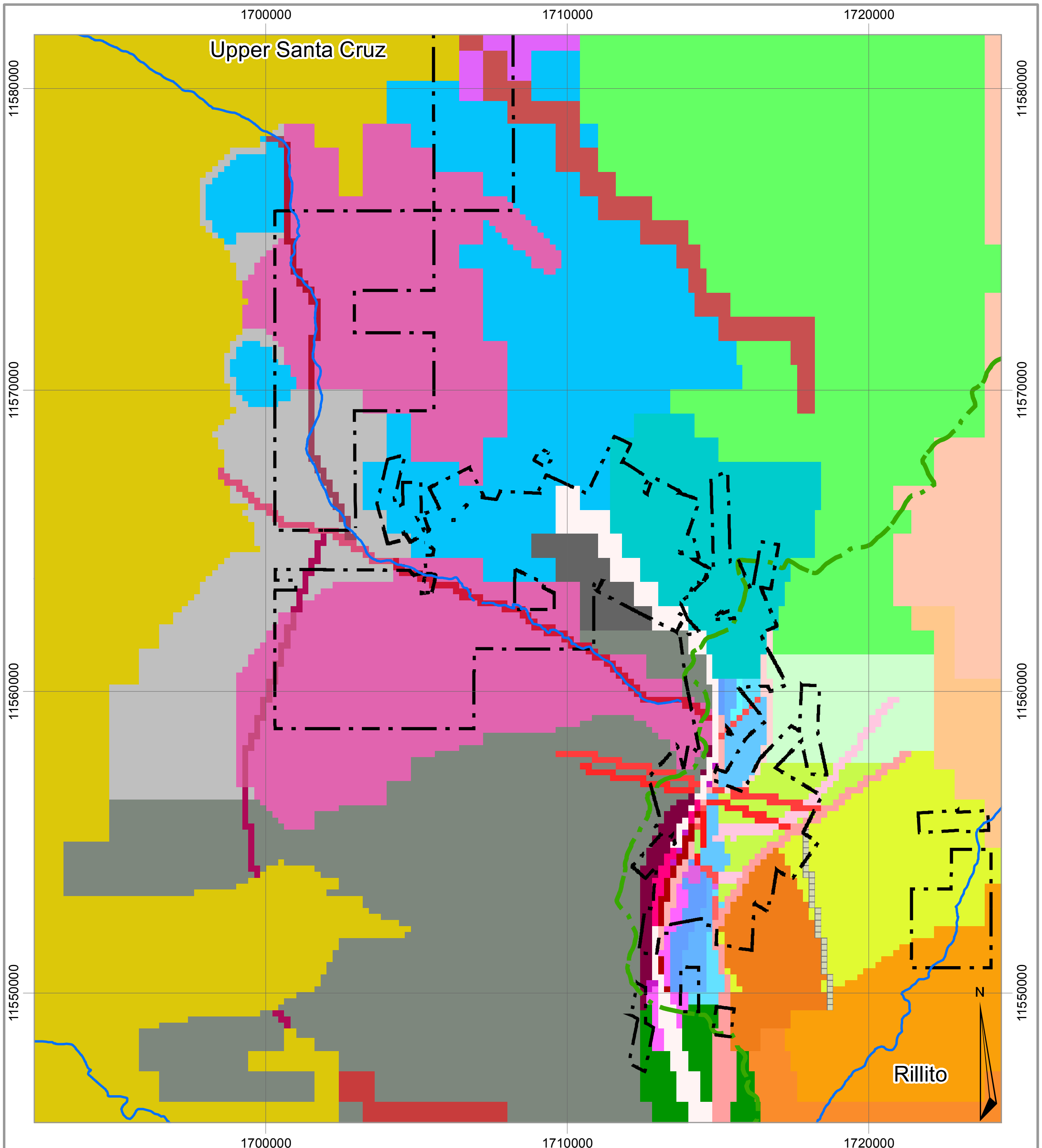


Private Land Boundaries
Key Streams
8th Order Basins
No Flow Cell
Model Domain
See Figure 3.4.25 for K Zones Legend

Model K Zones, Layer 2

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT: Rosemont Copper Company
PROJECT: Rosemont Copper World Project
JOB: 4286
DRAWN: PMH
CHECKED: BG
DATE: May 2022
FIGURE: 3.4.3



- Private Land Boundaries
- Key Streams
- 8th Order Basins

See Figure 3.4.25 for K Zones Legend

Project Area K Zones, Layer 2 Inset

1:63,000

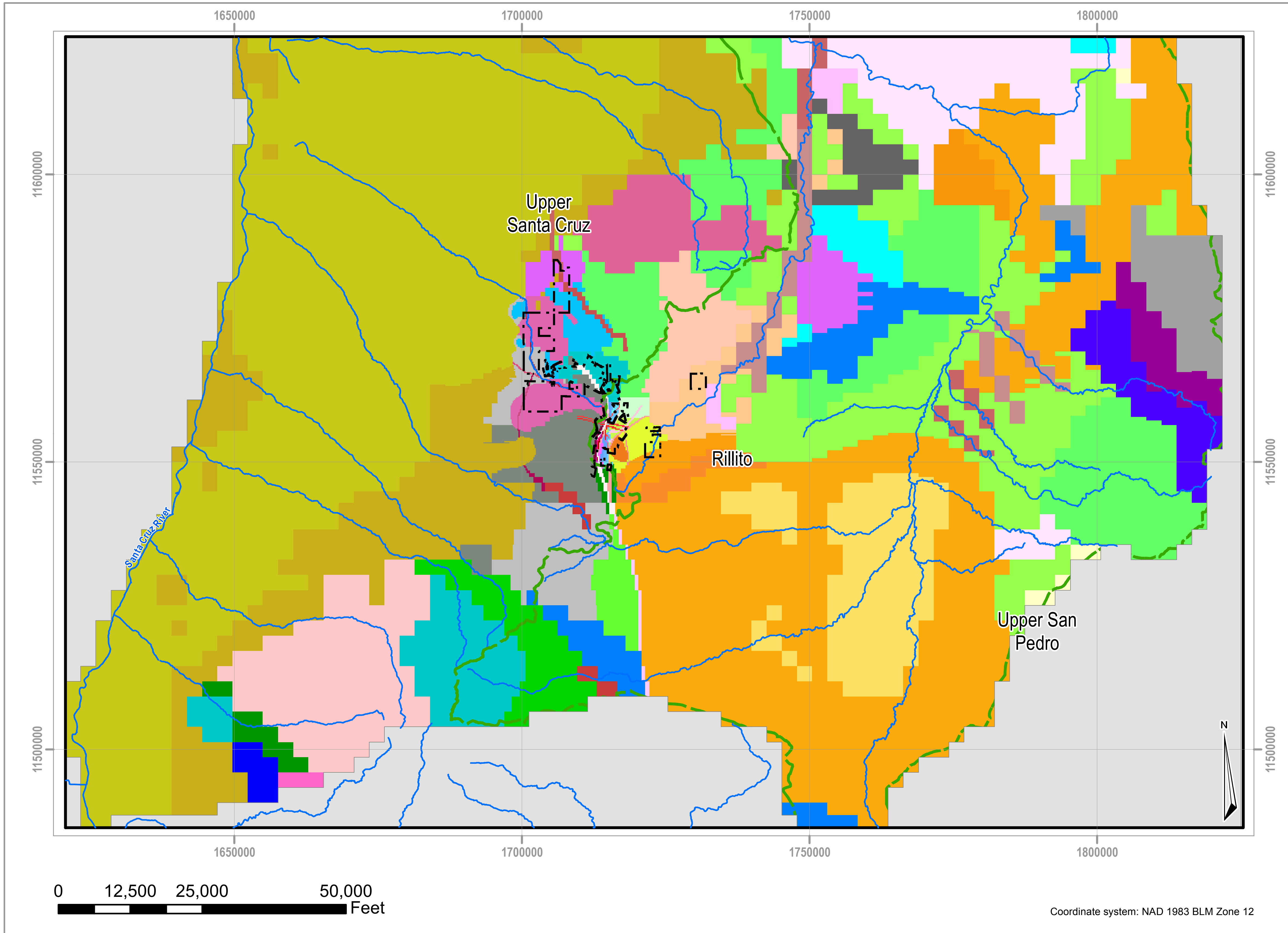
0 5,000

Feet

Coordinate System:
NAD 1983 BLM Zone 12N

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

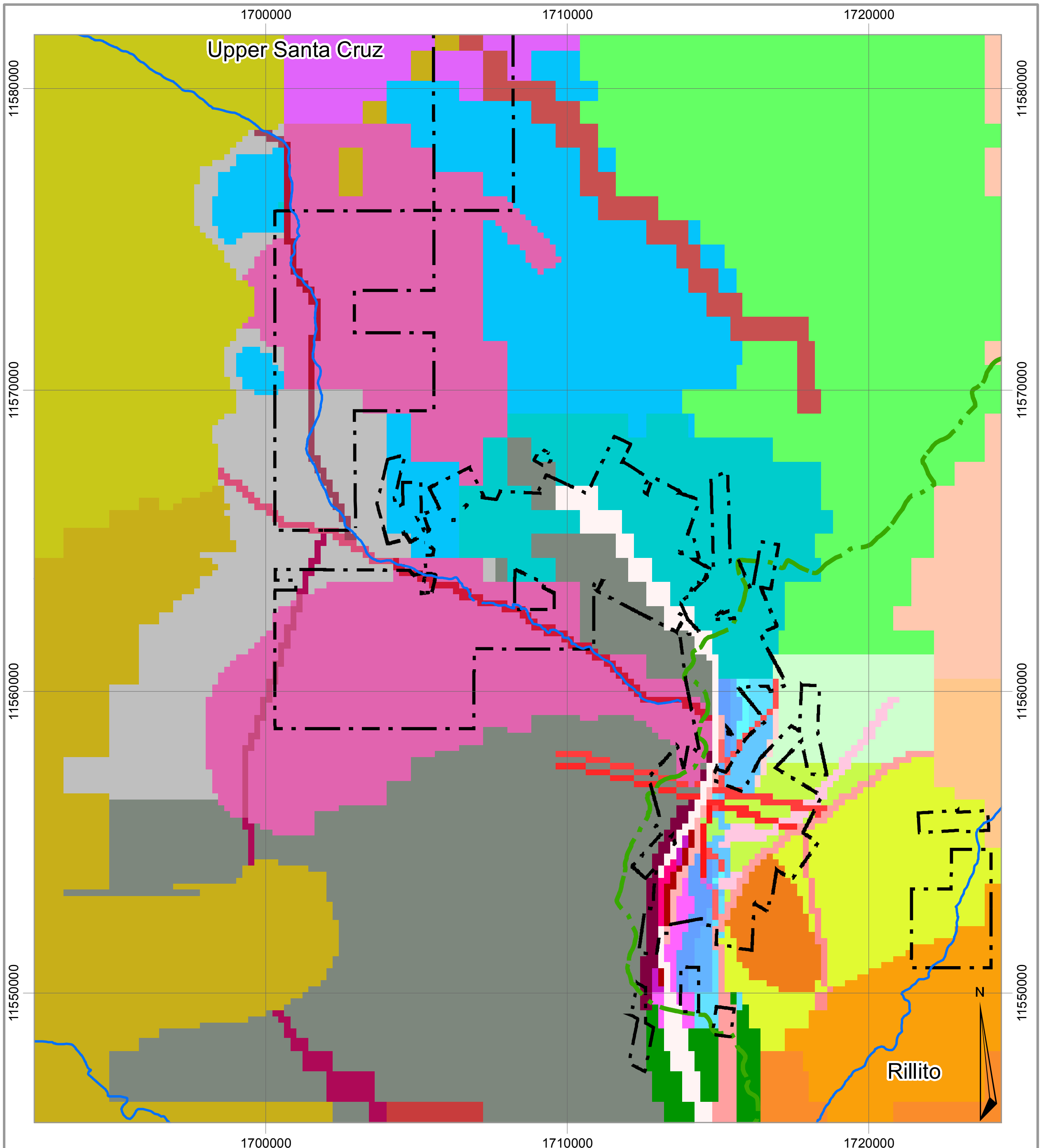
CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	PMH
CHECKED:	BG
DATE:	May 2022
FIGURE:	3.4.4



Model K Zones, Layer 3

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	PMH
CHECKED:	BG
DATE:	May 2022
FIGURE:	3.4.5



- Private Land Boundaries
- Key Streams
- 8th Order Basins

See Figure 3.4.25 for K Zones Legend

Project Area K Zones, Layer 3 Inset

1:63,000

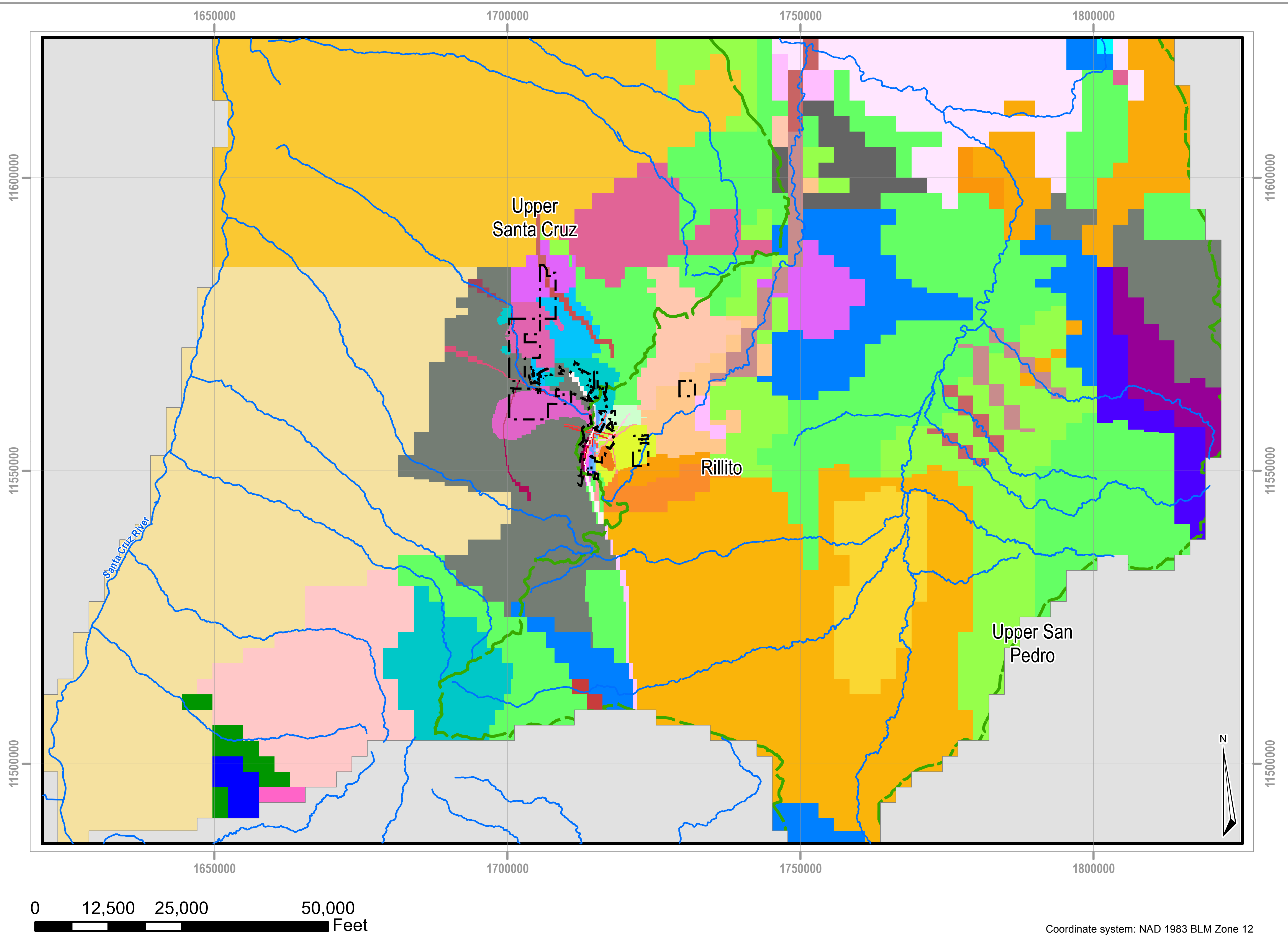
0 5,000

Feet

Coordinate System: NAD 1983 BLM Zone 12N

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

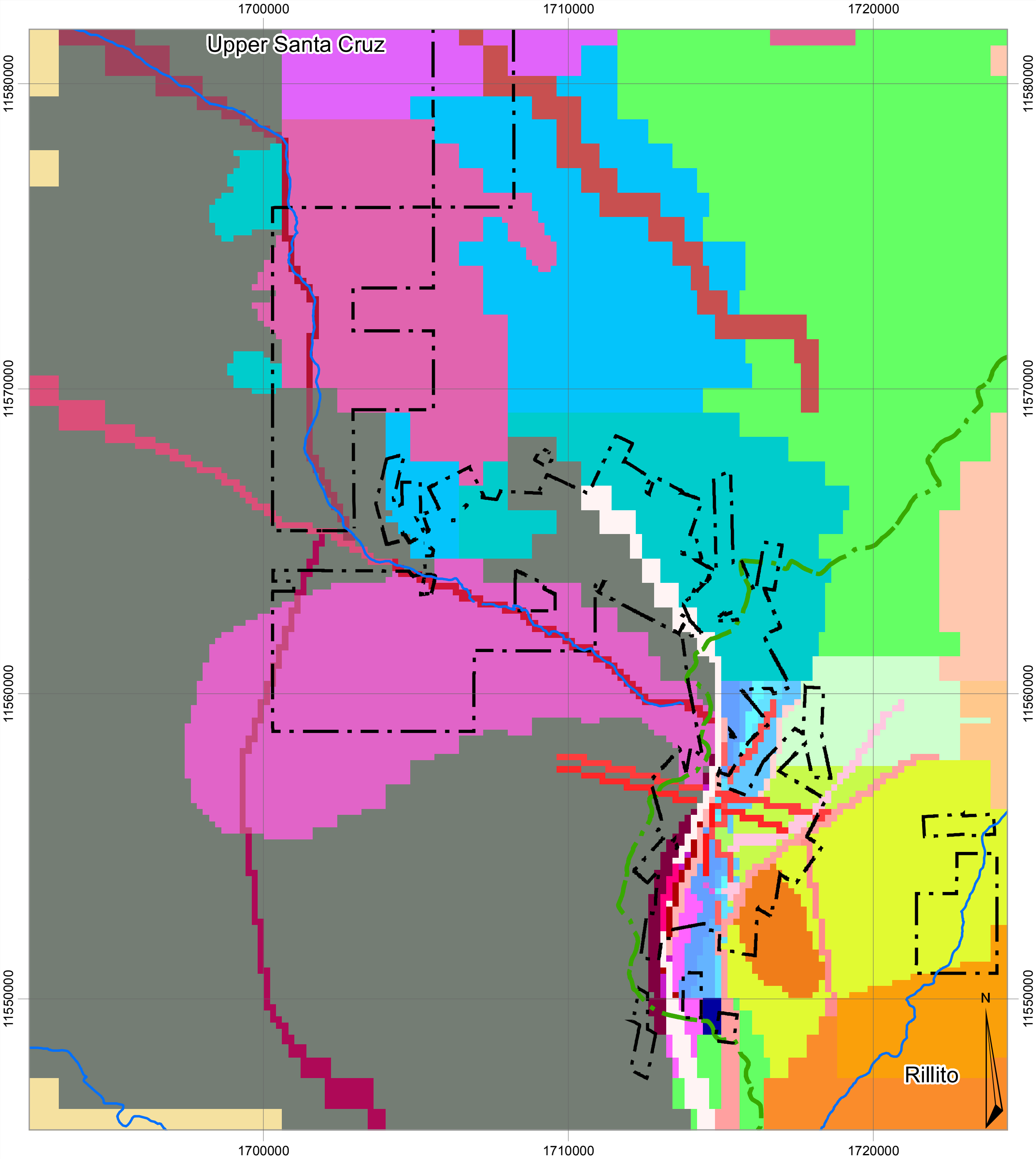
CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	PMH
CHECKED:	BG
DATE:	May 2022
FIGURE:	3.4.6



Model K Zones, Layer 4

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN: PMH	CHECKED: BG
DATE:	May 2022
FIGURE:	3.4.7



- - Private Land Boundaries
- - 8th Order Basins
— Key Streams

See Figure 3.4.25 for K Zones Legend

Project Area K Zones, Layer 4 Inset

1:63,000

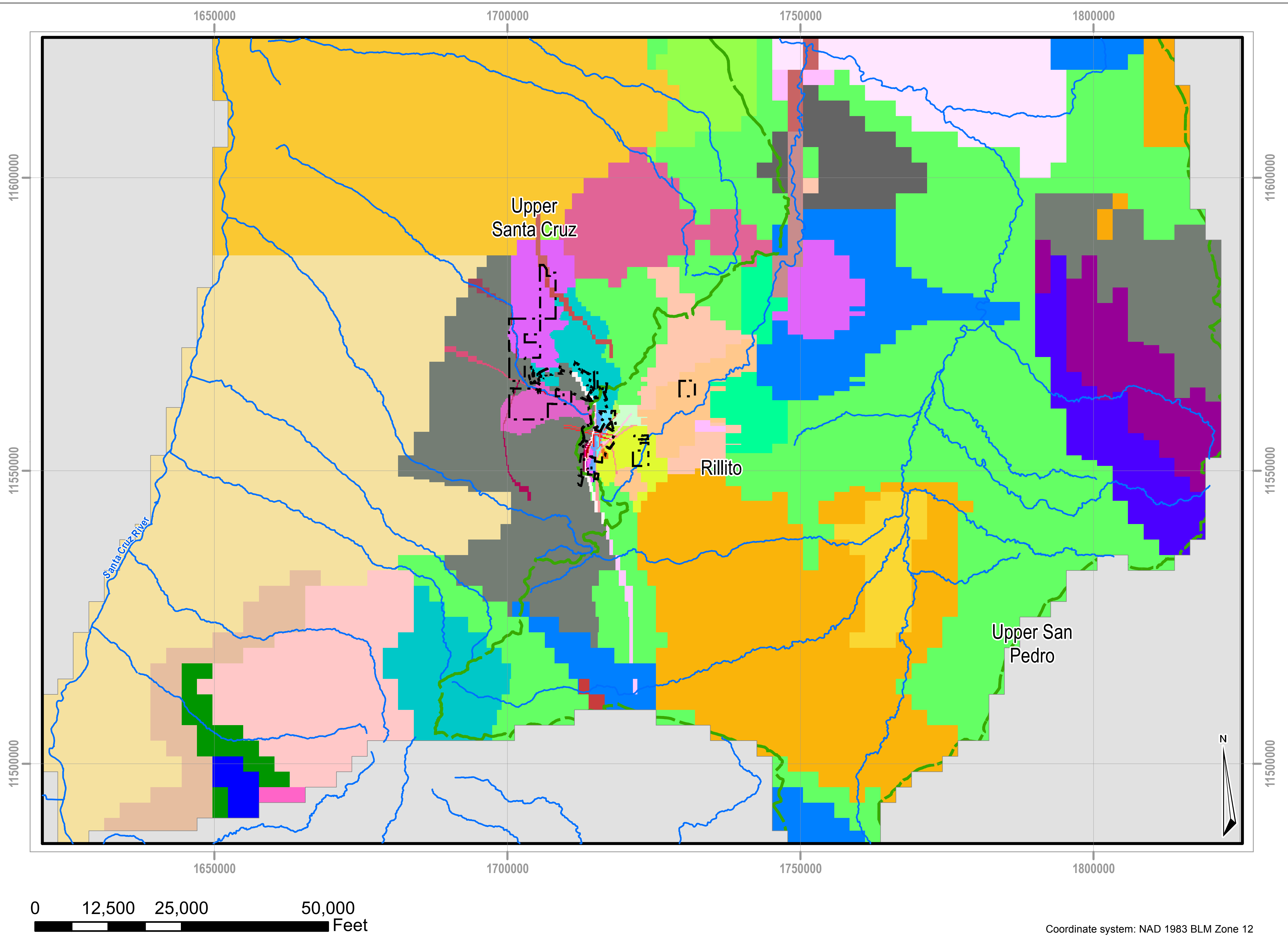
0 5,000

Feet

Coordinate System: NAD 1983 BLM Zone 12N

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

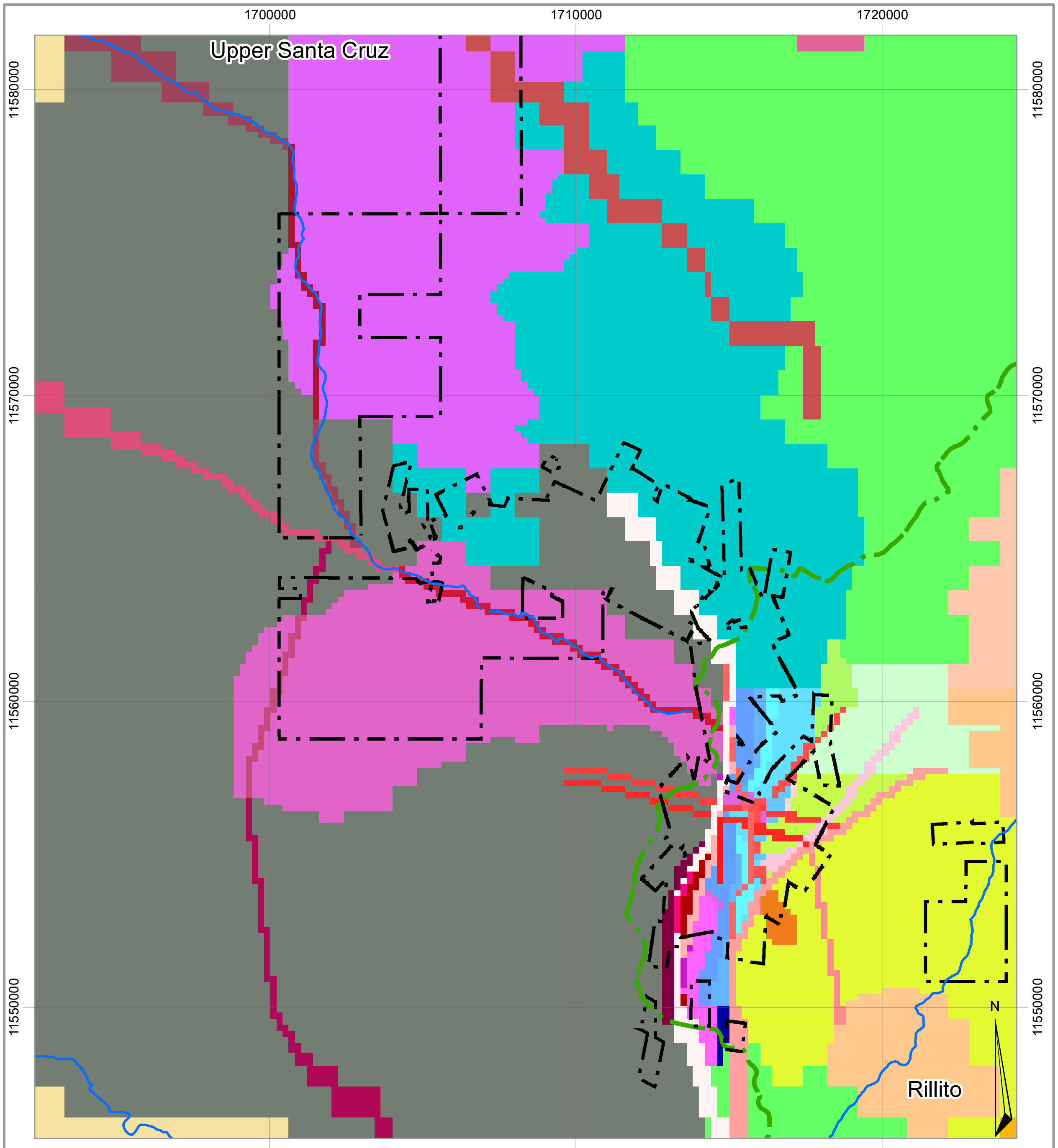
CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN: PMH	CHECKED: BG
DATE:	May 2022
FIGURE:	3.4.8



Model K Zones, Layer 5

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	PMH
CHECKED:	BG
DATE:	May 2022
FIGURE:	3.4.9



- Private Land Boundaries
- Key Streams
- 8th Order Basins

See Figure 3.4.25 for K Zones Legend

Project Area K Zones, Layer 5 Inset

1:63,000

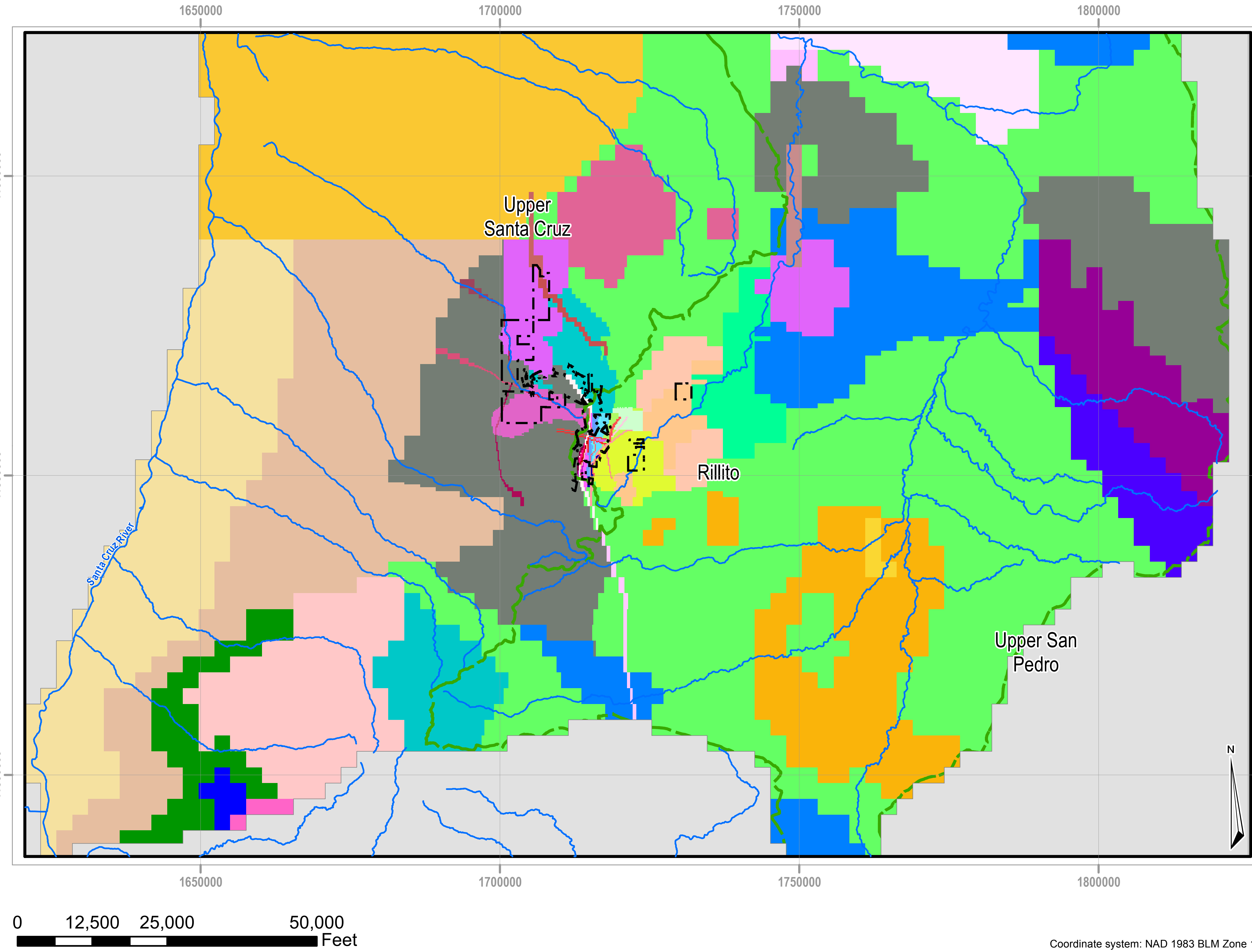
0 5,000

Feet

Coordinate System: NAD 1983 BLM Zone 12N

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	PMH
CHECKED:	BG
DATE:	May 2022
FIGURE:	3.4.10

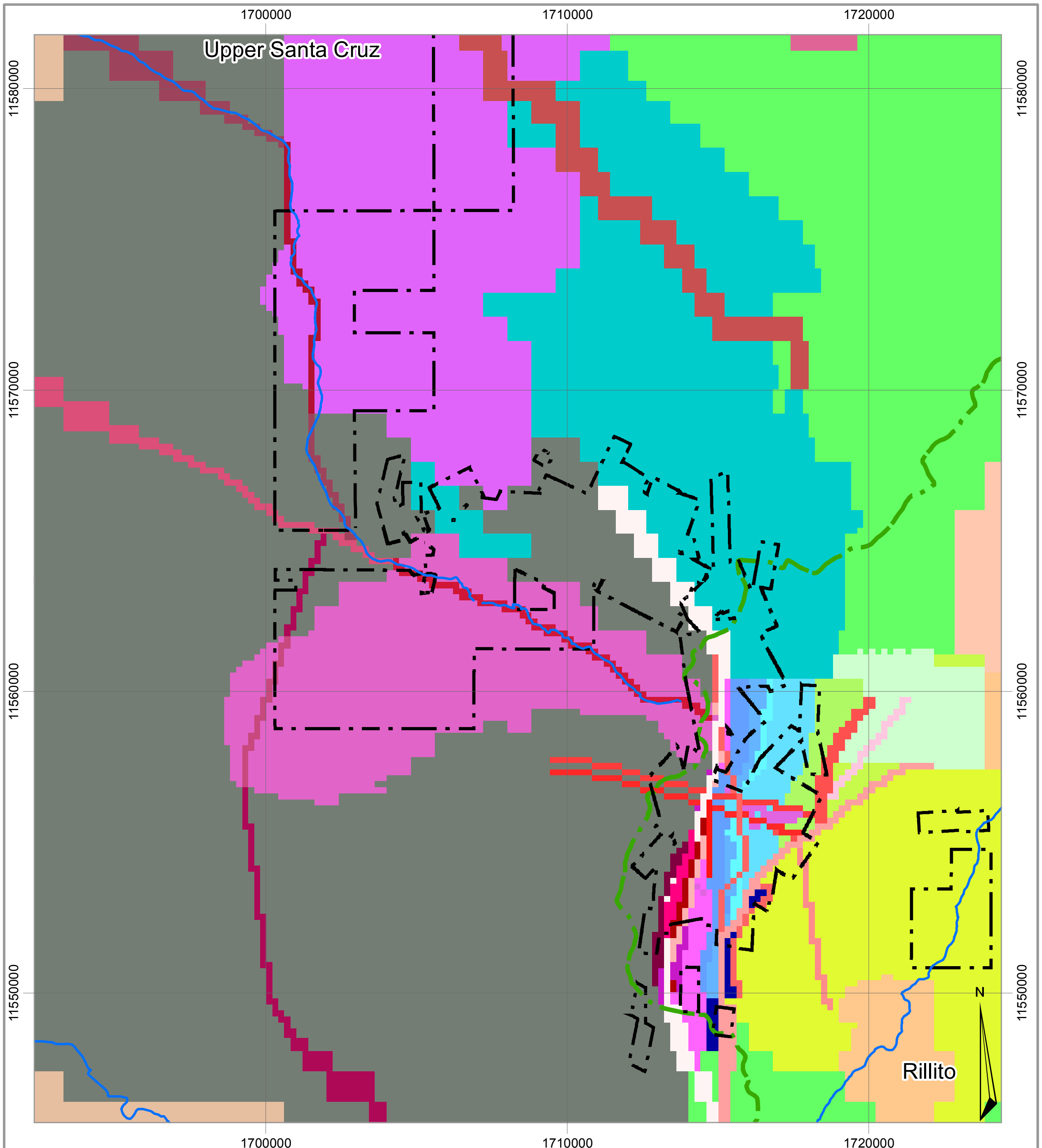


Private Land Boundaries
Key Streams
8th Order Basins
No Flow Cell
Model Domain
See Figure 3.4.25 for K Zones Legend

Model K Zones, Layer 6

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	PMH
CHECKED:	BG
DATE:	May 2022
FIGURE:	3.4.11



Private Land Boundaries

Key Streams

8th Order Basins

See Figure 3.4.25 for K Zones Legend

Project Area K Zones, Layer 6 Inset

1:63,000

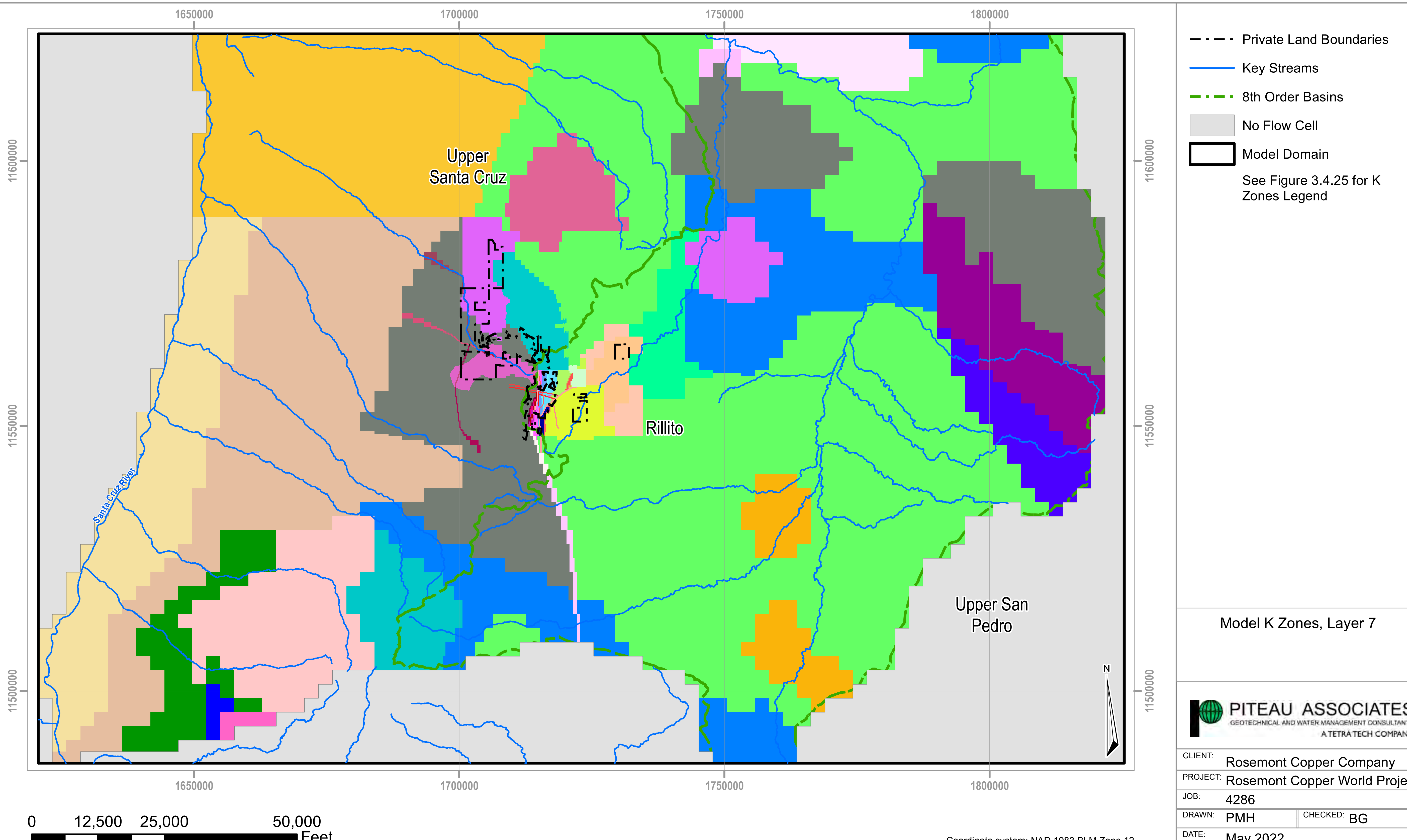
0 5,000

Feet

Coordinate System: NAD 1983 BLM Zone 12N

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

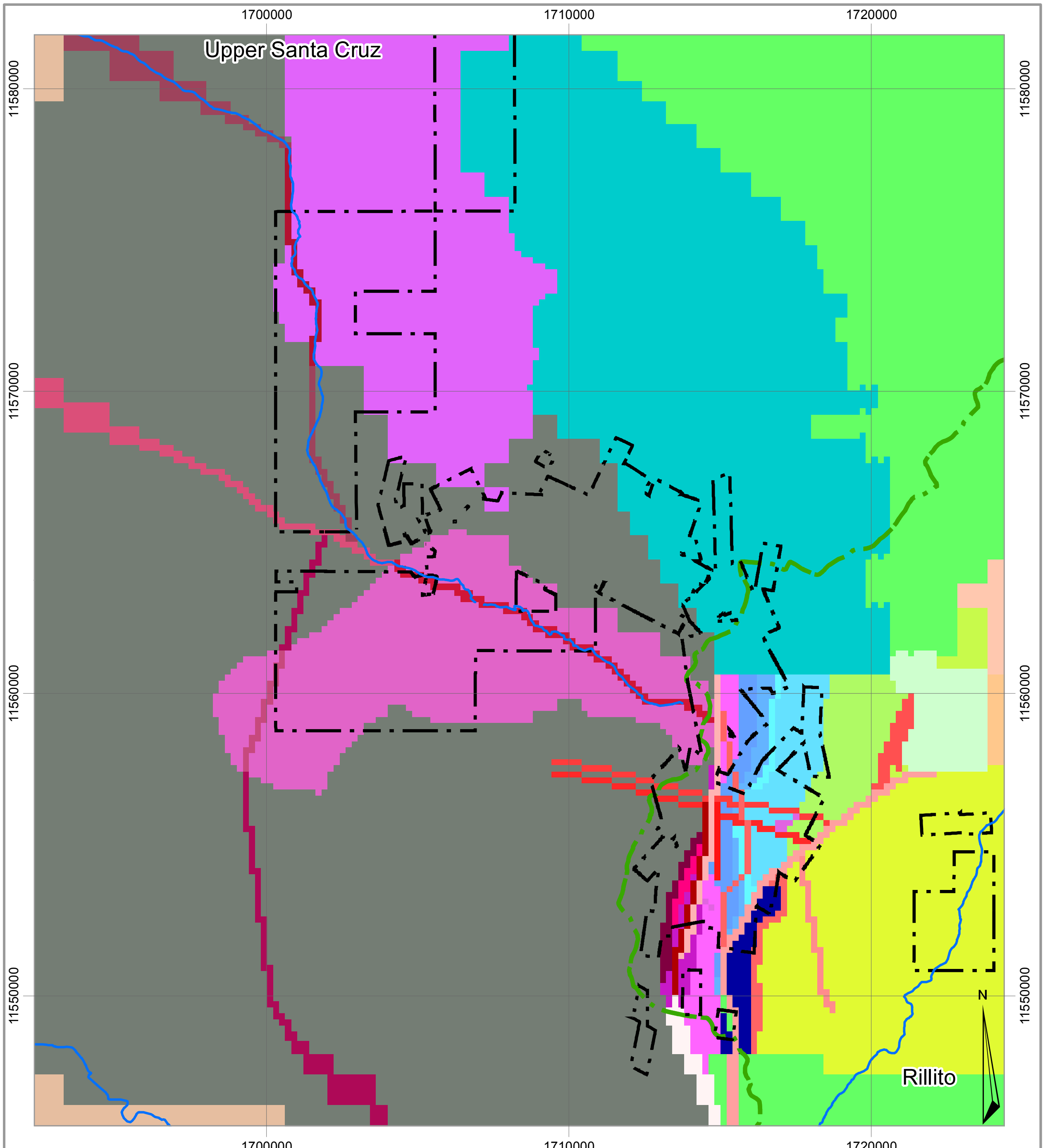
CLIENT:	Rosemont Copper Company
PROJECT:	Rosmeont Copper World Project
JOB:	4286
DRAWN: PMH	CHECKED: BG
DATE:	May 2022
FIGURE:	3.4.12



Model K Zones, Layer 7

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	PMH
CHECKED:	BG
DATE:	May 2022
FIGURE:	3.4.13



Private Land Boundaries

Key Streams

8th Order Basins

See Figure 3.4.25 for K Zones Legend

Project Area K Zones, Layer 7 Inset

1:63,000

0 5,000

Feet

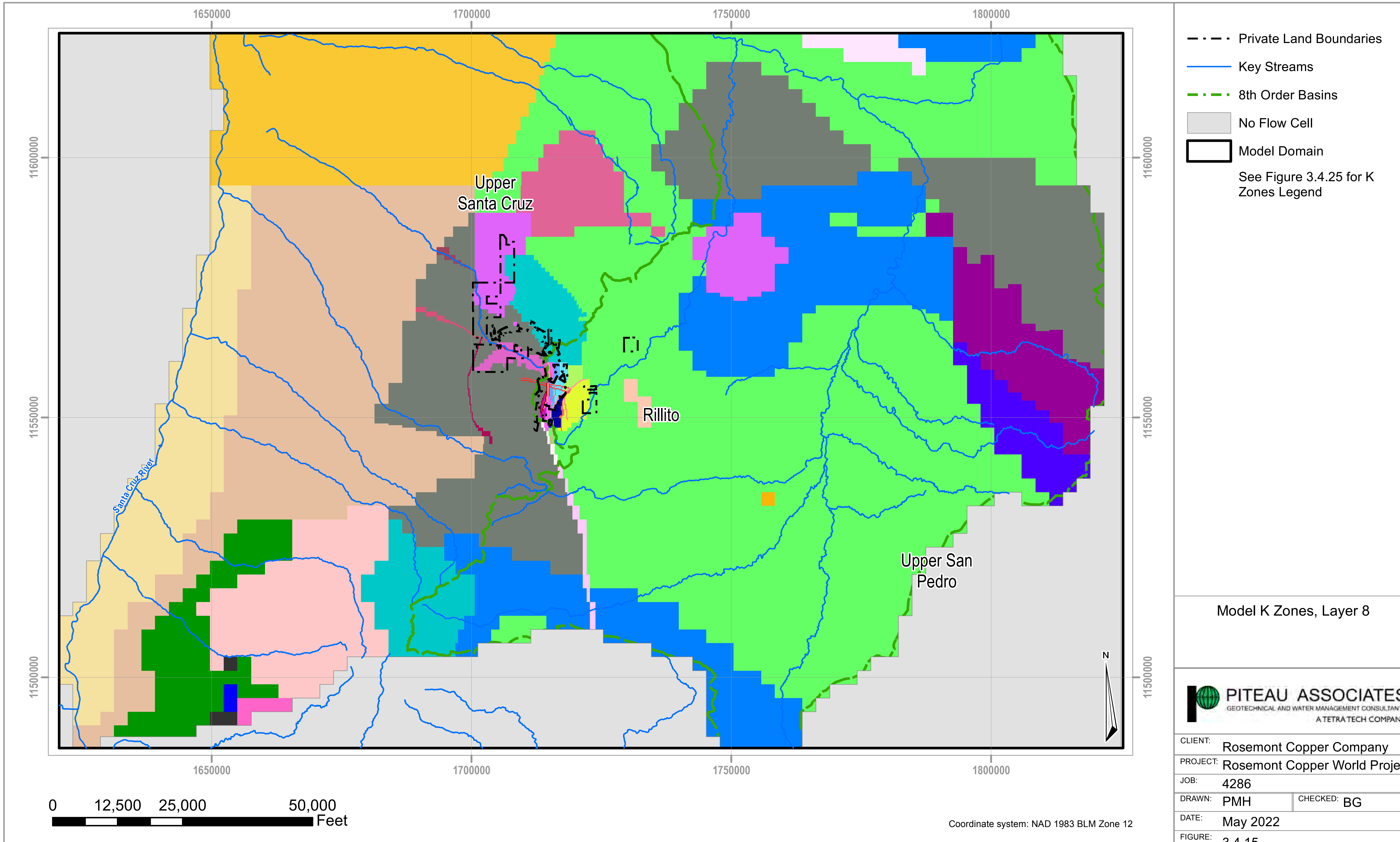
Coordinate System: NAD 1983 BLM Zone 12N

PITEAU ASSOCIATES

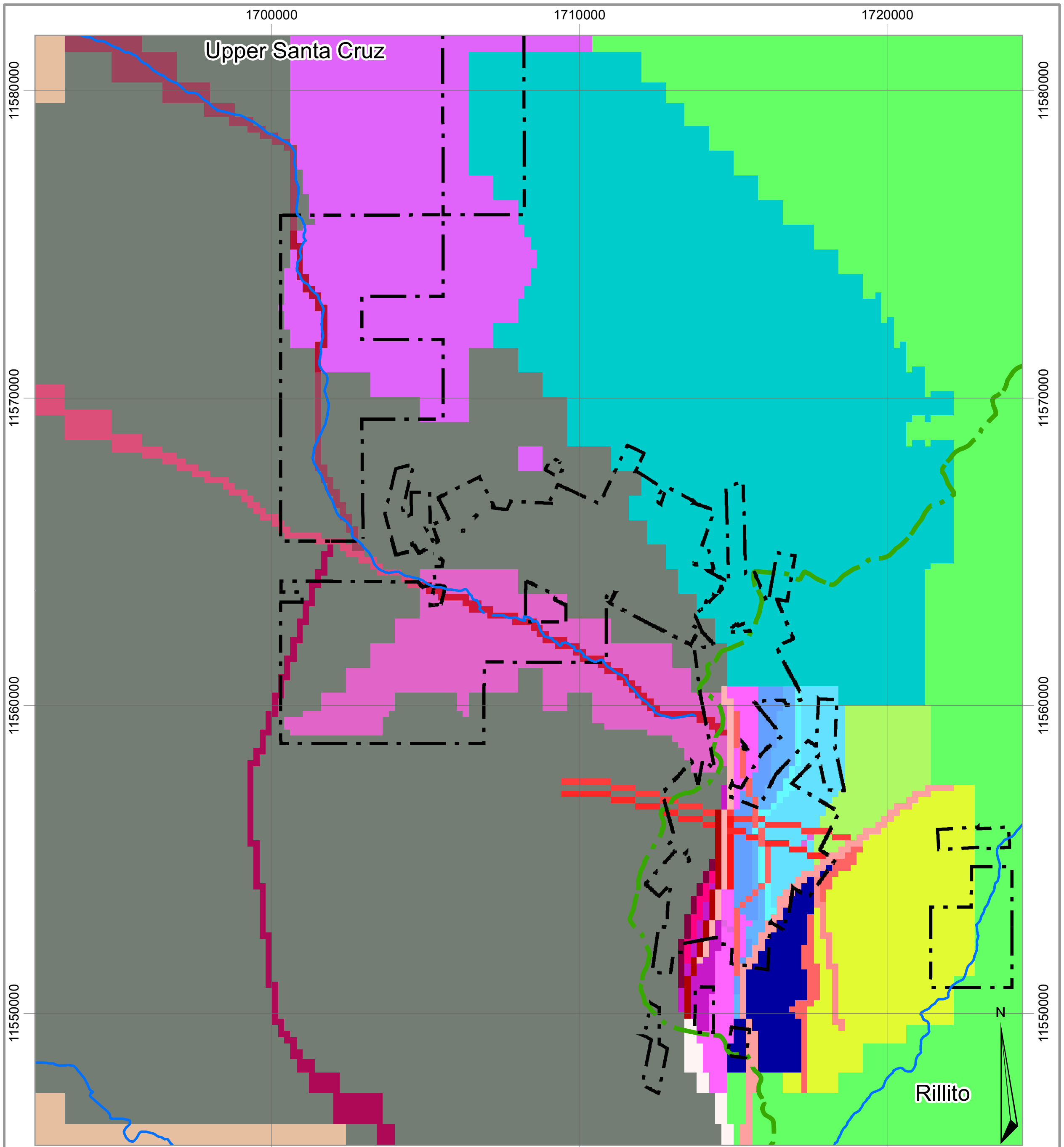
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS

A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	PMH
CHECKED:	BG
DATE:	May 2022
FIGURE:	3.4.14



1650000
1700000
1750000
1800000
11600000
11550000
11500000
Upper
Santa Cruz
Rillito
Upper San
Pedro
Santa Cruz River
N
0
12,500
25,000
50,000
Feet
Coordinate system: NAD 1983 BLM Zone 12
Private Land Boundaries
Key Streams
8th Order Basins
No Flow Cell
Model Domain
See Figure 3.4.25 for K Zones Legend
Model K Zones, Layer 8
PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY
CLIENT: Rosemont Copper Company
PROJECT: Rosemont Copper World Project
JOB: 4286
DRAWN: PMH
CHECKED: BG
DATE: May 2022
FIGURE: 3.4.15



- Private Land Boundaries
- Key Streams
- 8th Order Basins

See Figure 3.4.25 for K Zones Legend

Project Area K Zones, Layer 8 Inset

1:63,000

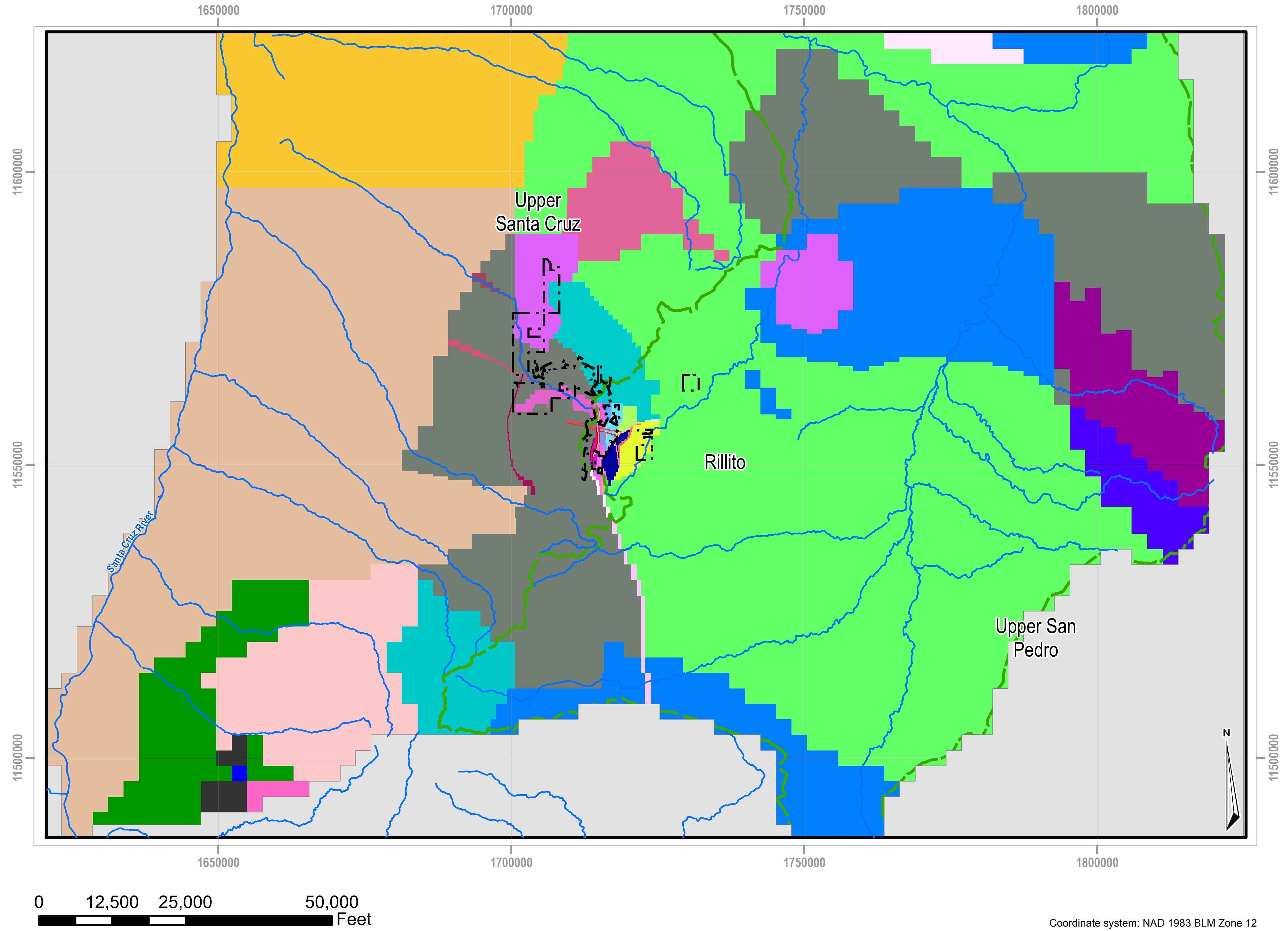
0 5,000

Feet

Coordinate System: NAD 1983 BLM Zone 12N

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	PMH
CHECKED:	BG
DATE:	May 2022
FIGURE:	3.4.16

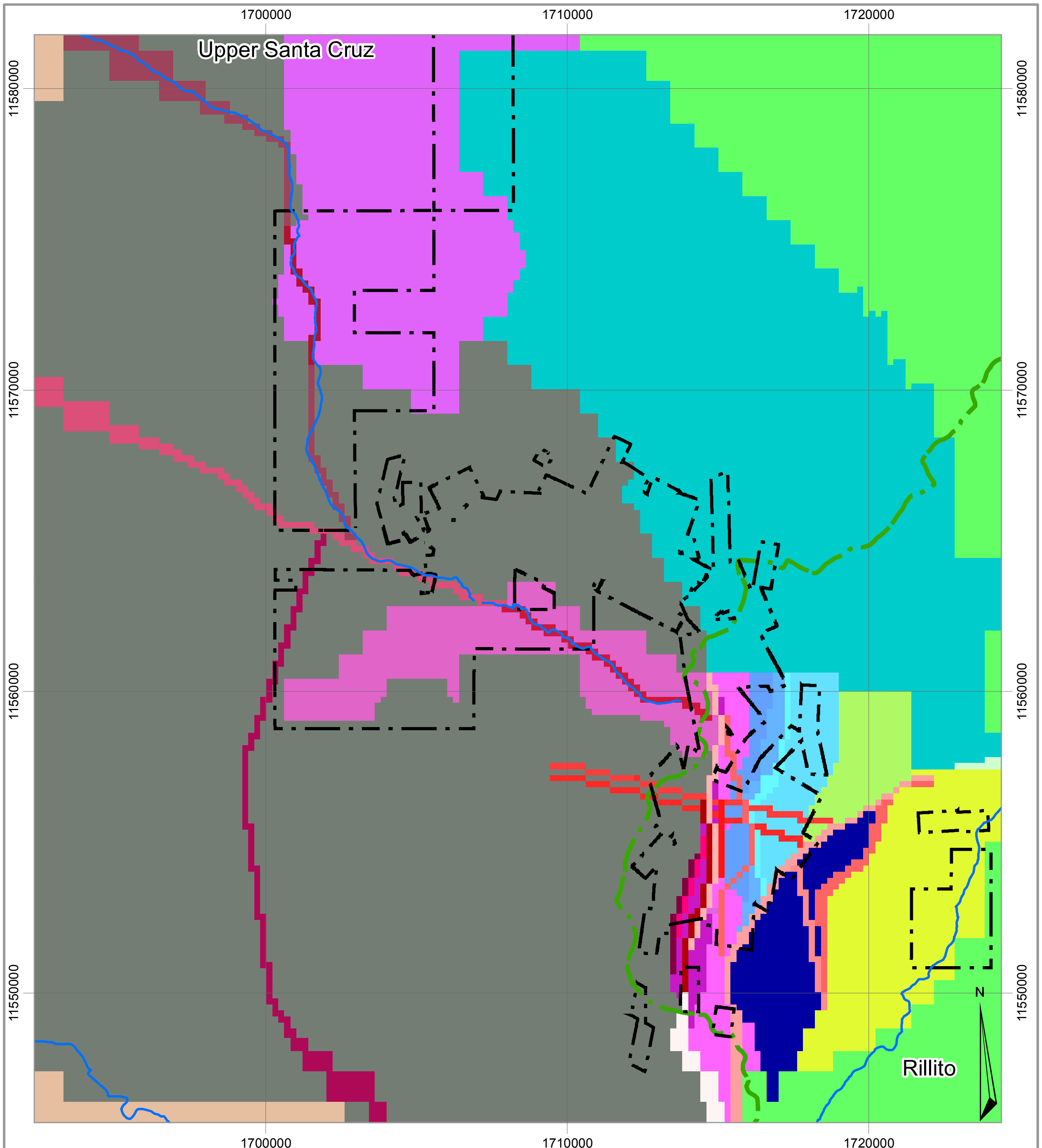


Private Land Boundaries
Key Streams
8th Order Basins
No Flow Cell
Model Domain
See Figure 3.4.25 for K Zones Legend

Model K Zones, Layer 9

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	PMH
CHECKED:	BG
DATE:	May 2022
FIGURE:	3.4.17



- Private Land Boundaries
- Key Streams
- 8th Order Basins

See Figure 3.4.25 for K Zones Legend

Project Area K Zones, Layer 9 Inset

1:63,000

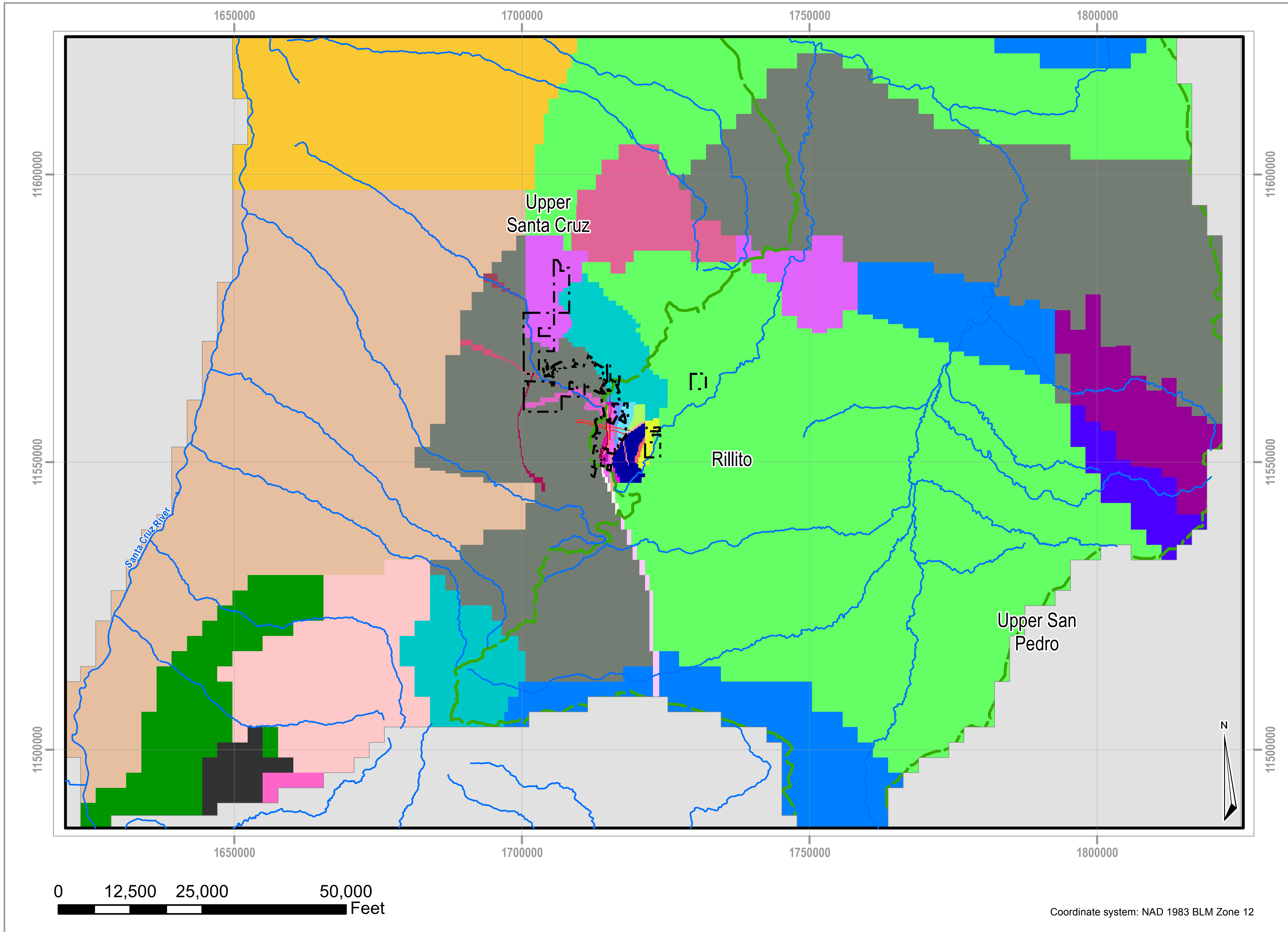
0 5,000

Feet

Coordinate System:
NAD 1983 BLM Zone 12N

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

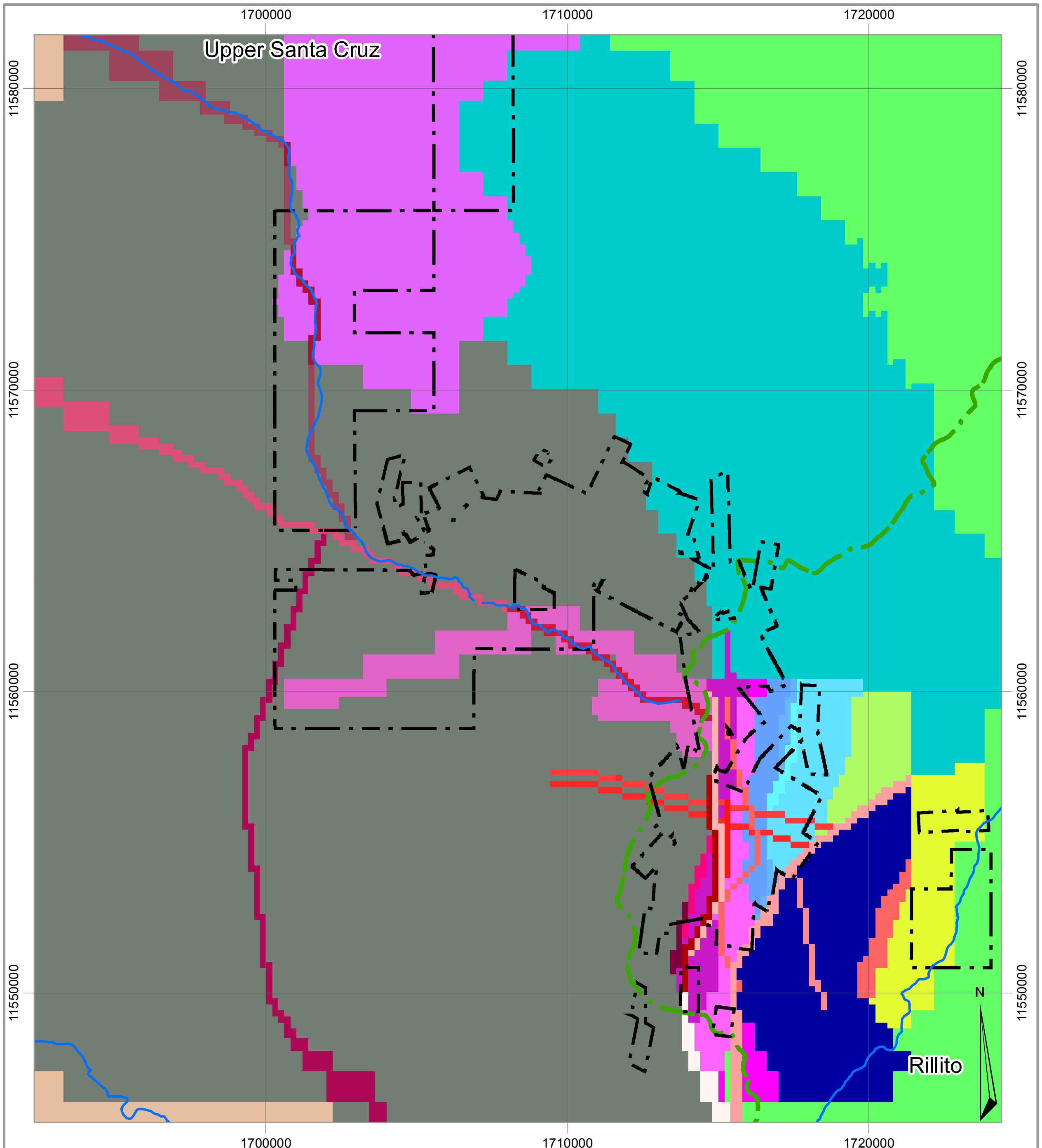
CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	PMH
CHECKED:	BG
DATE:	May 2022
FIGURE:	3.4.18



Model K Zones, Layer 10

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN: PMH	CHECKED: BG
DATE:	May 2022
FIGURE:	3.4.19



- Private Land Boundaries
- Key Streams
- 8th Order Basins

See Figure 3.4.25 for K Zones Legend

Project Area K Zones, Layer 10 Inset

1:63,000

0 5,000

Feet

Coordinate System: NAD 1983 BLM Zone 12N

PITEAU ASSOCIATES
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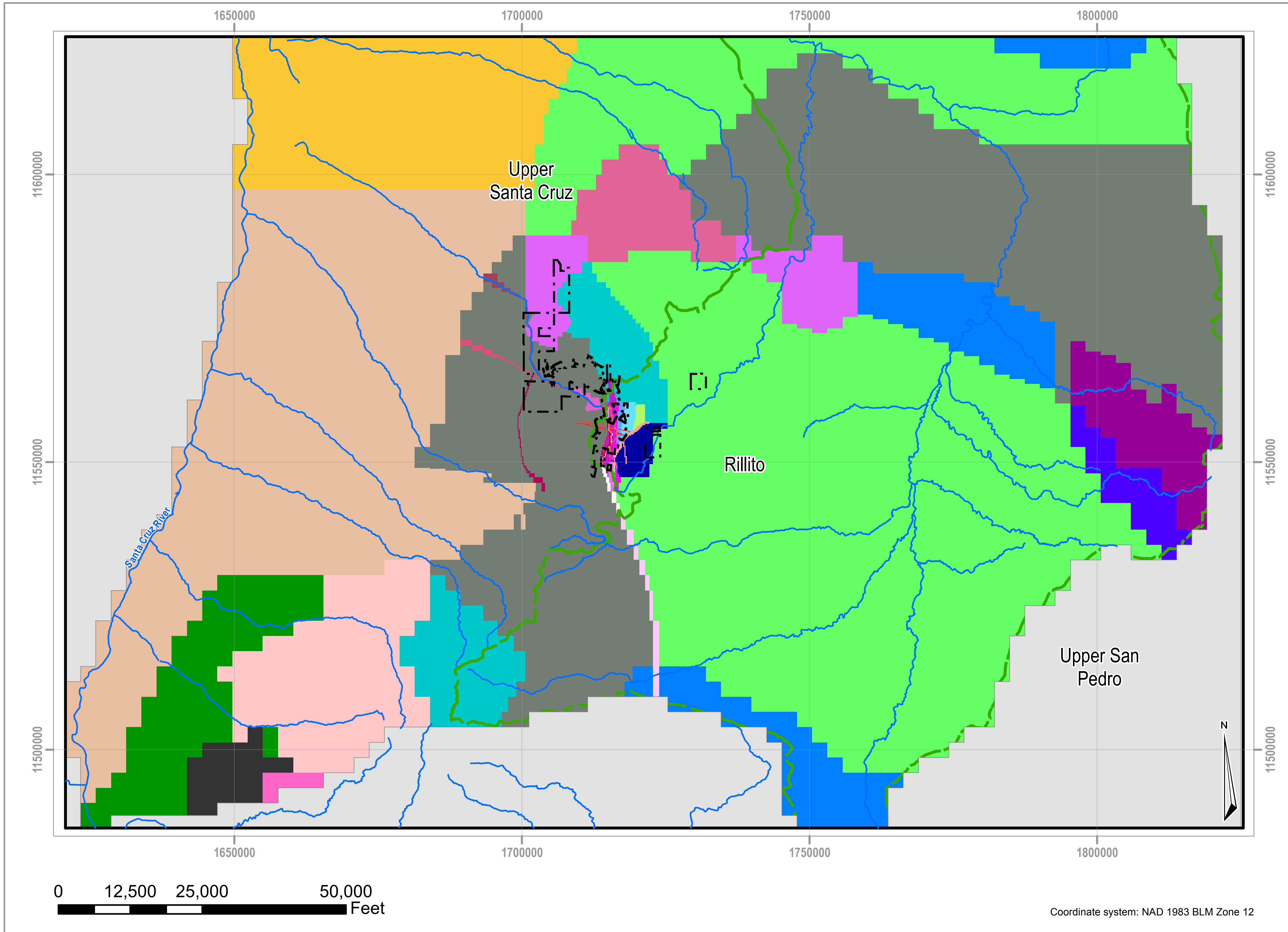
A TETRA TECH COMPANY

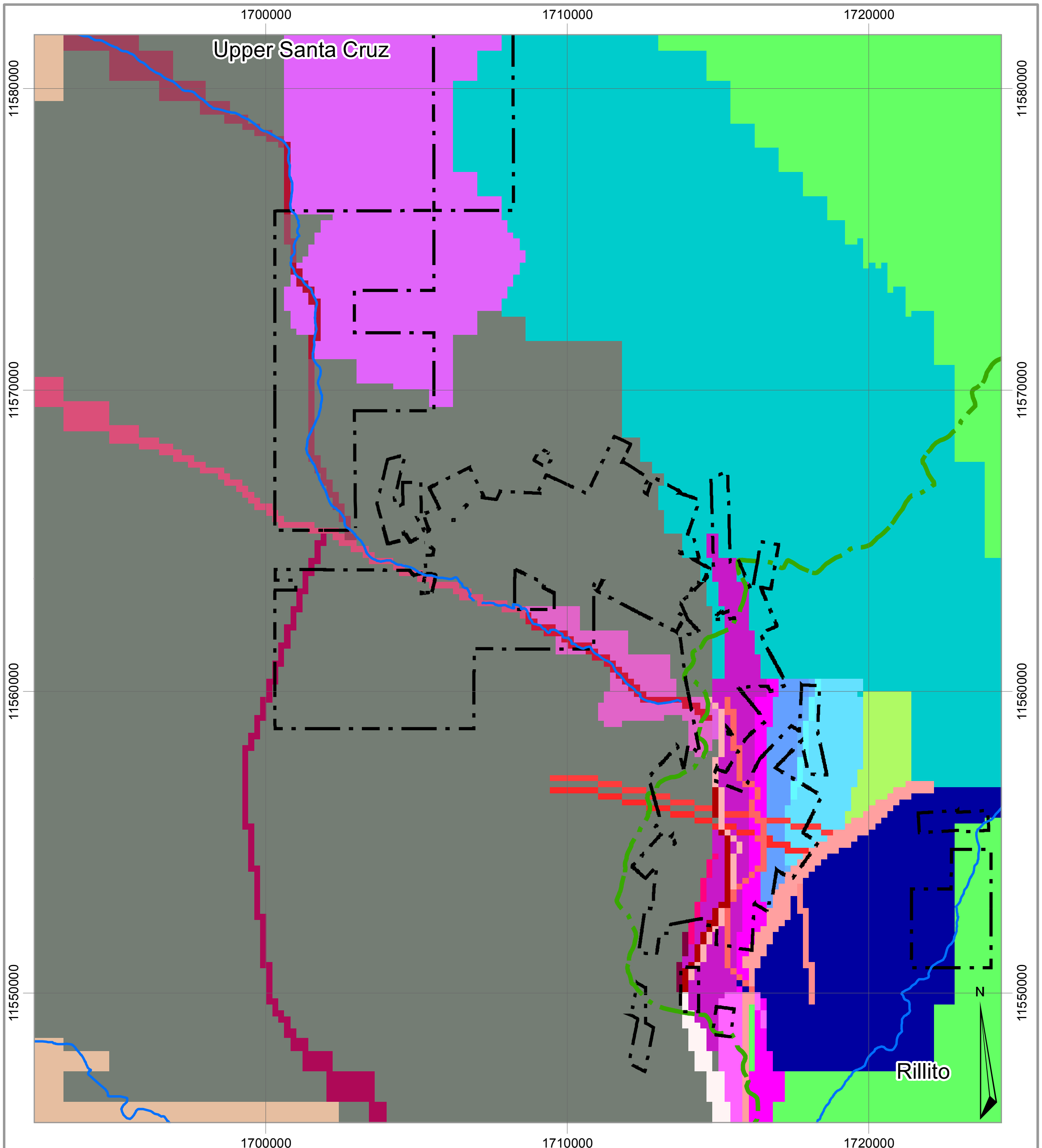
CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	PMH
CHECKED:	BG
DATE:	May 2022
FIGURE:	3.4.20



Model K Zones, Layer 11

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN: PMH	CHECKED: BG
DATE:	May 2022
FIGURE:	3.4.21



Private Land Boundaries

Key Streams

8th Order Basins

See Figure 3.4.25 for K Zones Legend

Project Area K Zones, Layer 11 Inset

1:63,000

0 5,000

Feet

Coordinate System: NAD 1983 BLM Zone 12N

PITEAU ASSOCIATES
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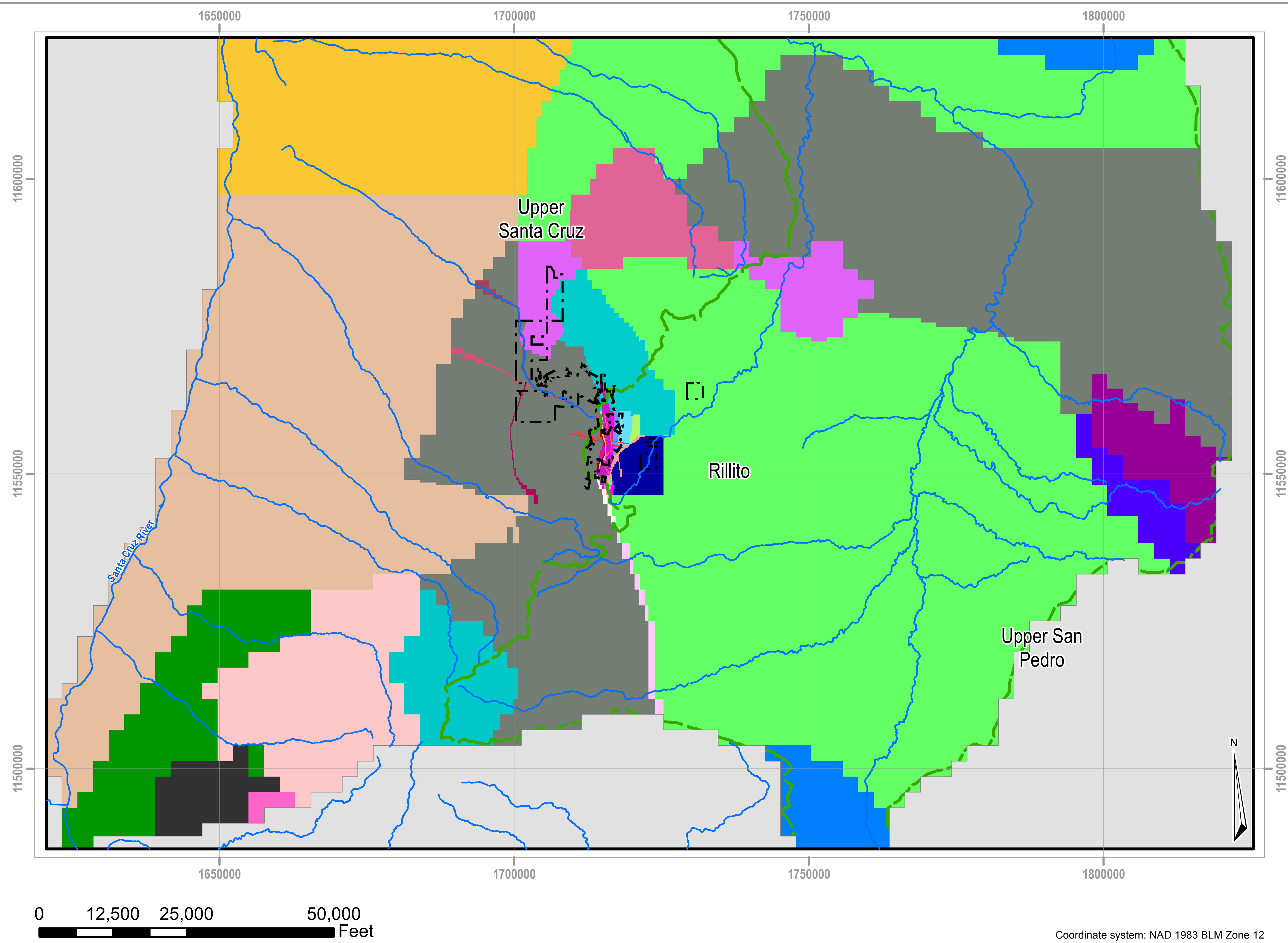
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN: PMH	CHECKED: BG
DATE:	May 2022
FIGURE:	3.4.22

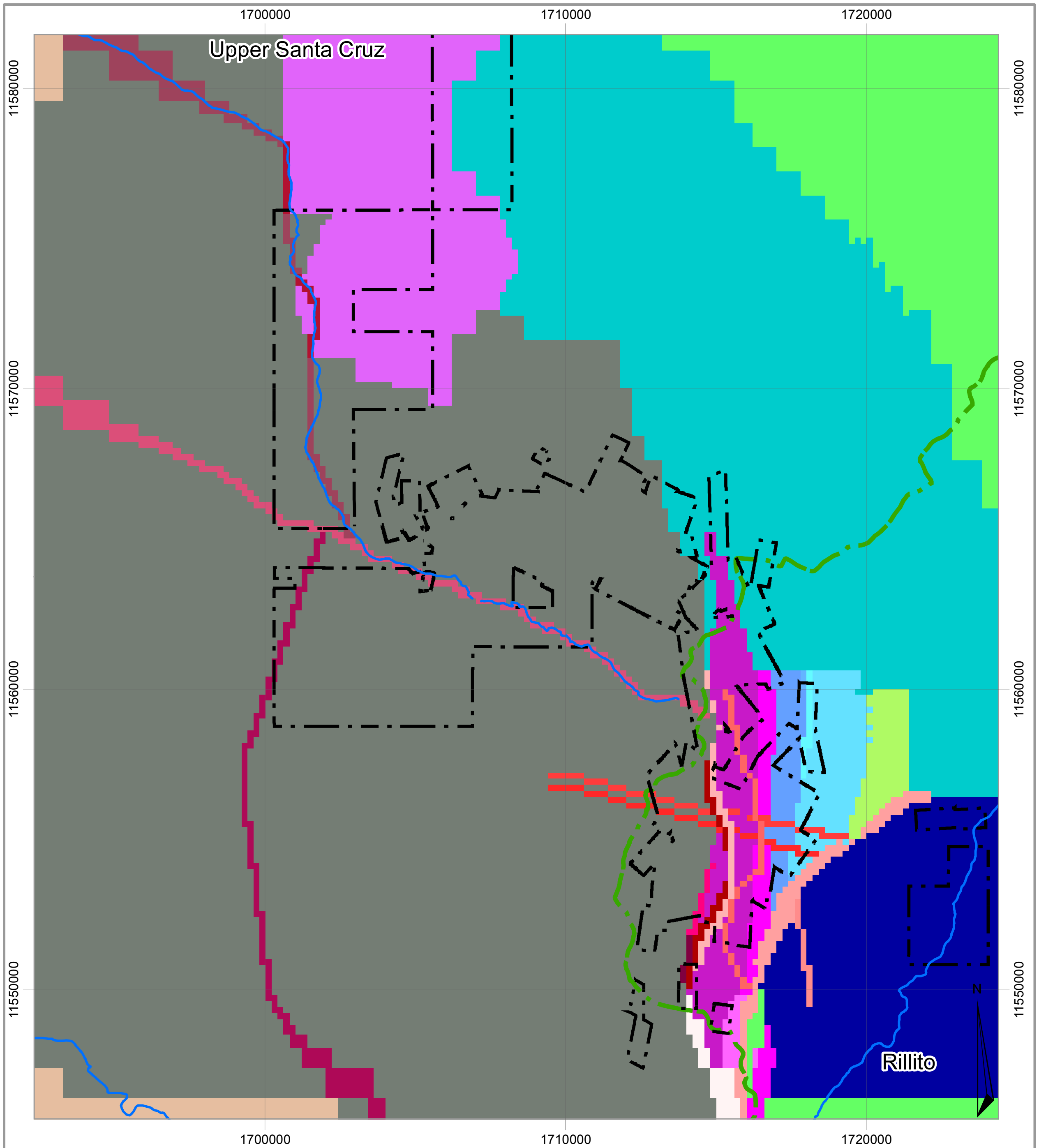


Private Land Boundaries
Key Streams
8th Order Basins
No Flow Cell
Model Domain
See Figure 3.4.25 for K Zones Legend

Model K Zones, Layer 12

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	PMH
CHECKED:	BG
DATE:	May 2022
FIGURE:	3.4.23



- Private Land Boundaries
- Key Streams
- 8th Order Basins

See Figure 3.4.25 for K Zones Legend

Project Area K Zones, Layer 12 Inset

1:63,000

0 5,000

Feet

Coordinate System: NAD 1983 BLM Zone 12N

PITEAU ASSOCIATES
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A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN: PMH	CHECKED: BG
DATE:	May 2022
FIGURE:	3.4.24

See Table A.1 for unit descriptions and K and S values.

Model K Zones Legend

PITEAU ASSOCIATES
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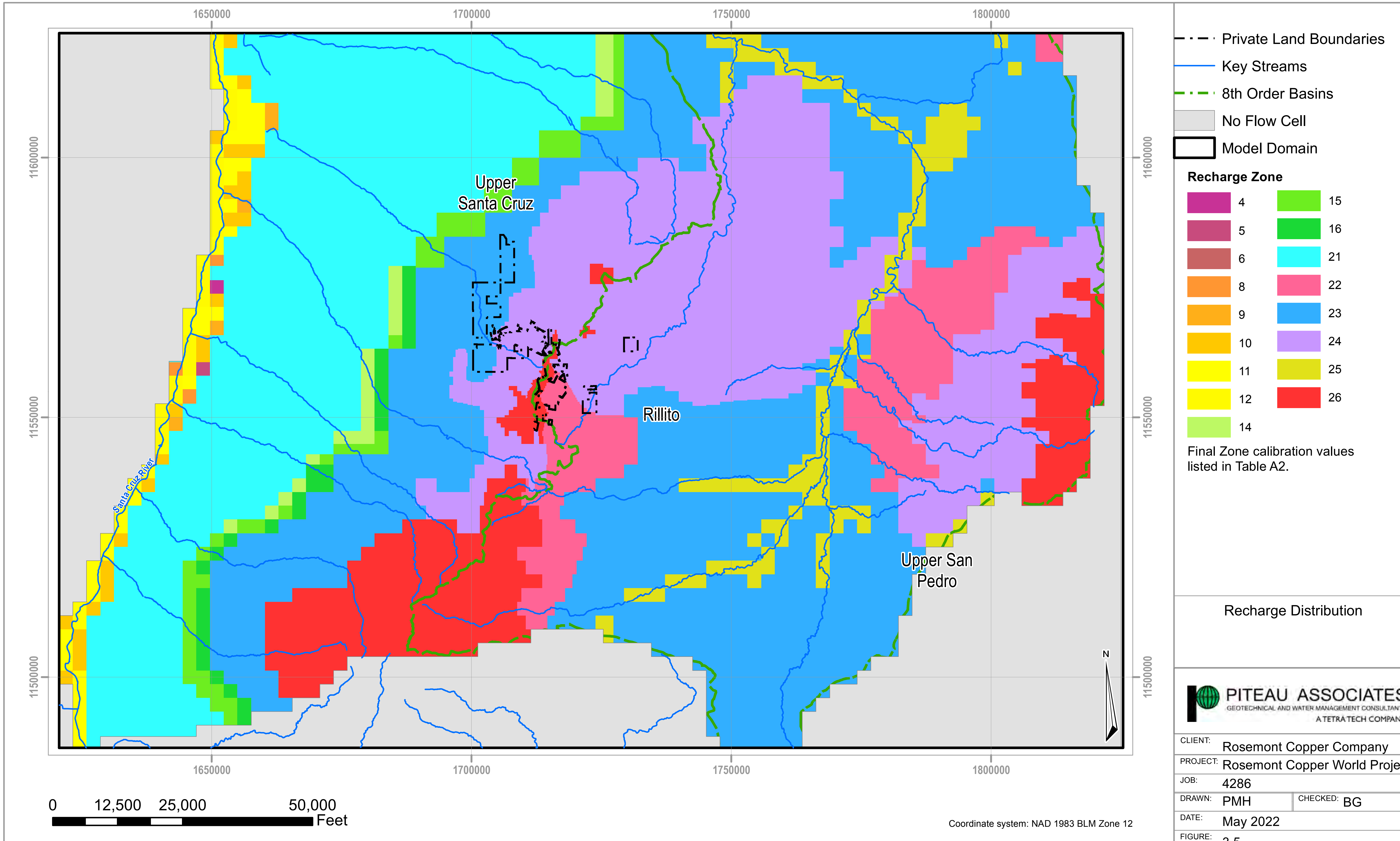
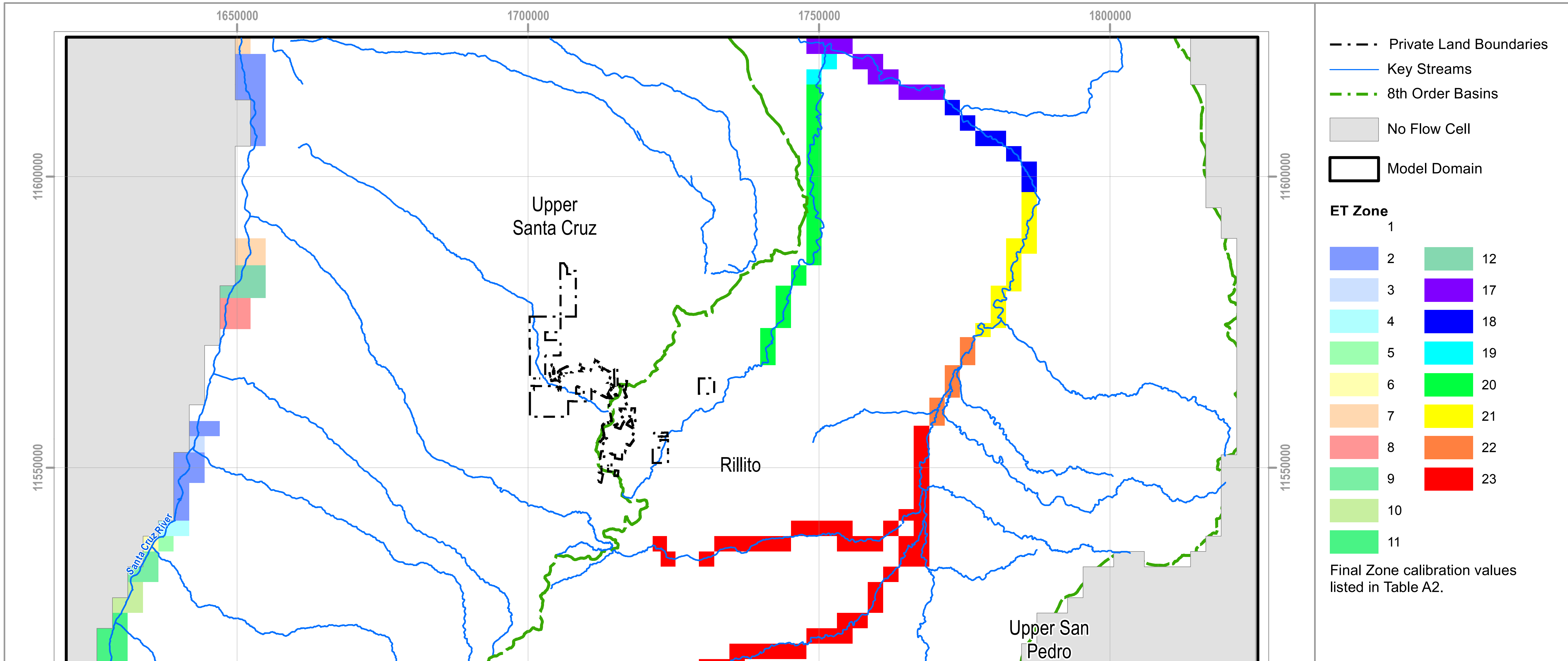
CLIENT:	Rosemont Copper Company		
PROJECT:	Rosmont Copper World Project		
JOB:	4286		
DRAWN:	PMH	CHECKED:	BG
DATE:	May 2022		
FIGURE:	3.4.25		



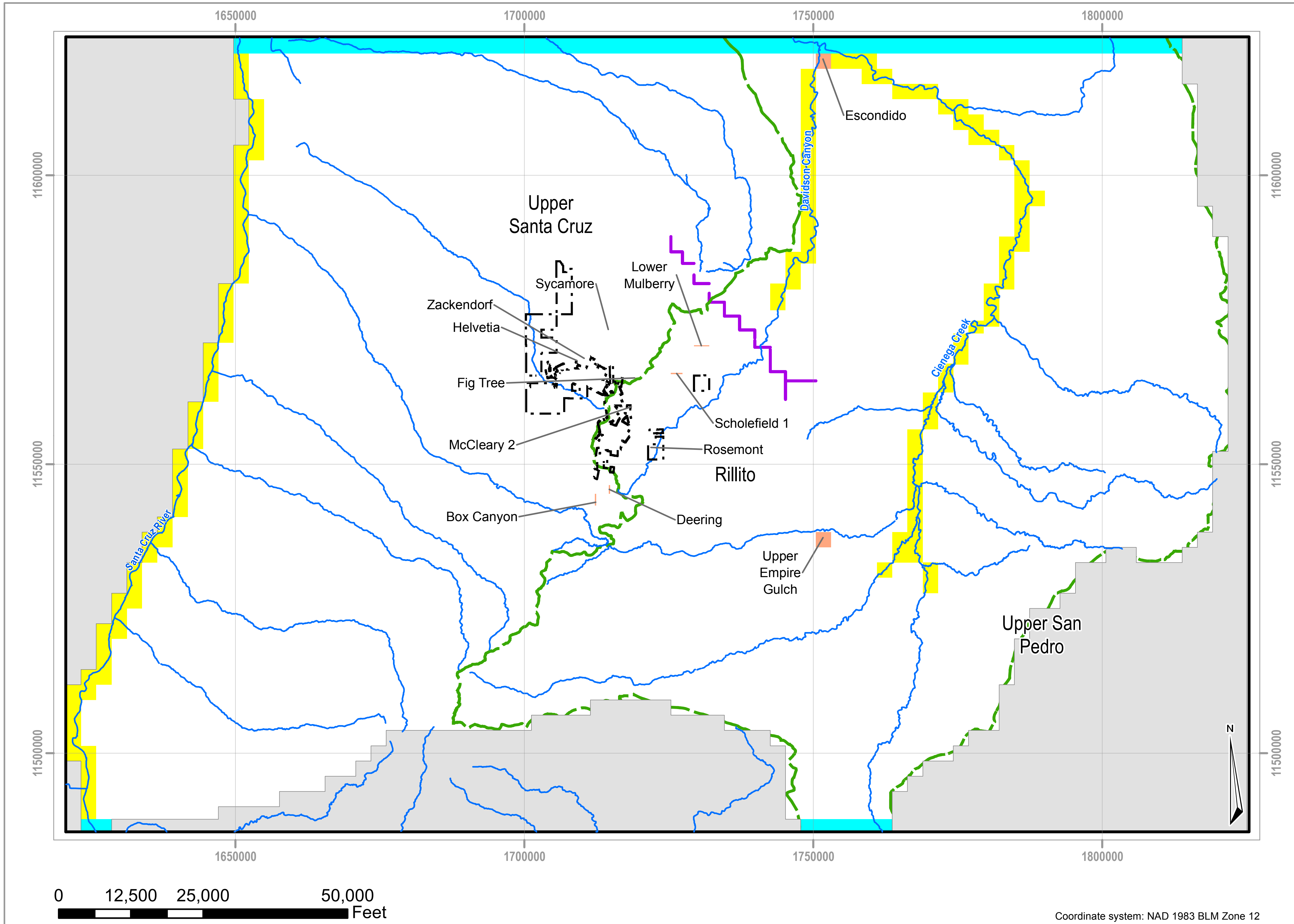
1650000
1700000
1750000
1800000
11600000
11550000
11500000
Upper
Santa Cruz
Rillito
Upper San
Pedro
Santa Cruz River
N
0 12,500 25,000 50,000
Feet
Coordinate system: NAD 1983 BLM Zone 12
Private Land Boundaries
Key Streams
8th Order Basins
No Flow Cell
Model Domain
Recharge Zone
4
5
6
8
9
10
11
12
14
15
16
21
22
23
24
25
26
Final Zone calibration values listed in Table A2.
Recharge Distribution
PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY
CLIENT: Rosemont Copper Company
PROJECT: Rosemont Copper World Project
JOB: 4286
DRAWN: PMH
CHECKED: BG
DATE: May 2022
FIGURE: 3.5



Evapotranspiration Distribution

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN: PMH	CHECKED: BG
DATE:	May 2022
FIGURE:	3.6



Natural Boundary Conditions

PITEAU ASSOCIATES
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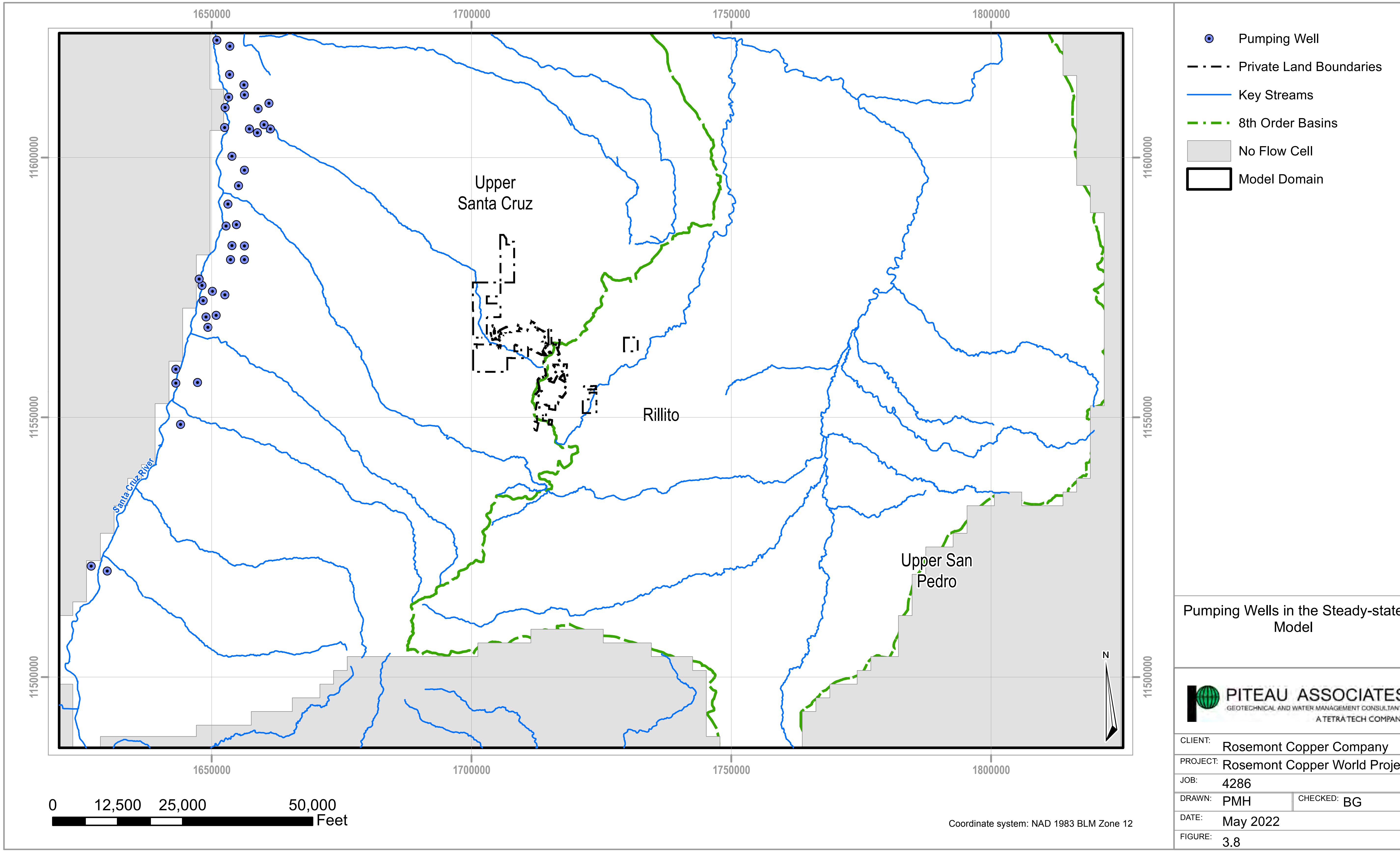
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN: PMH	CHECKED: BG
DATE:	May 2022
FIGURE:	3.7



Pumping Wells in the Steady-state Model

PITEAU ASSOCIATES
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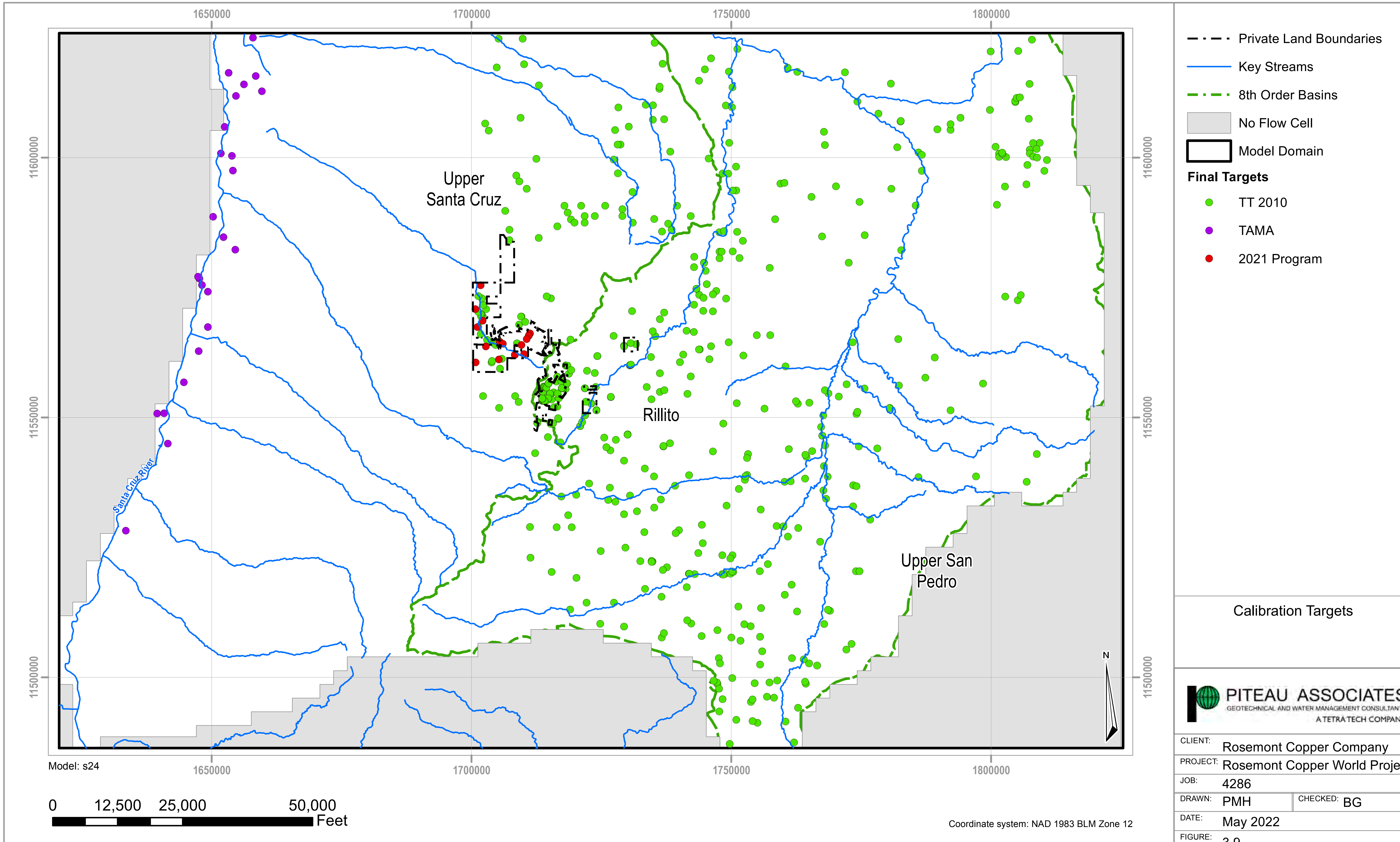
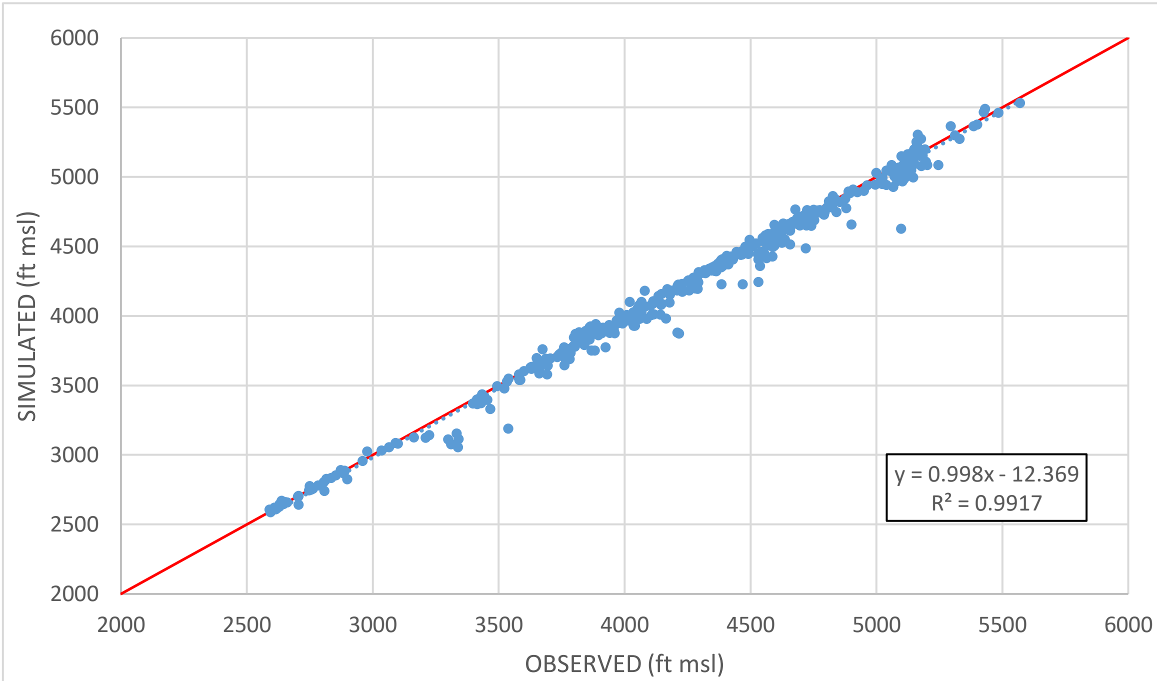
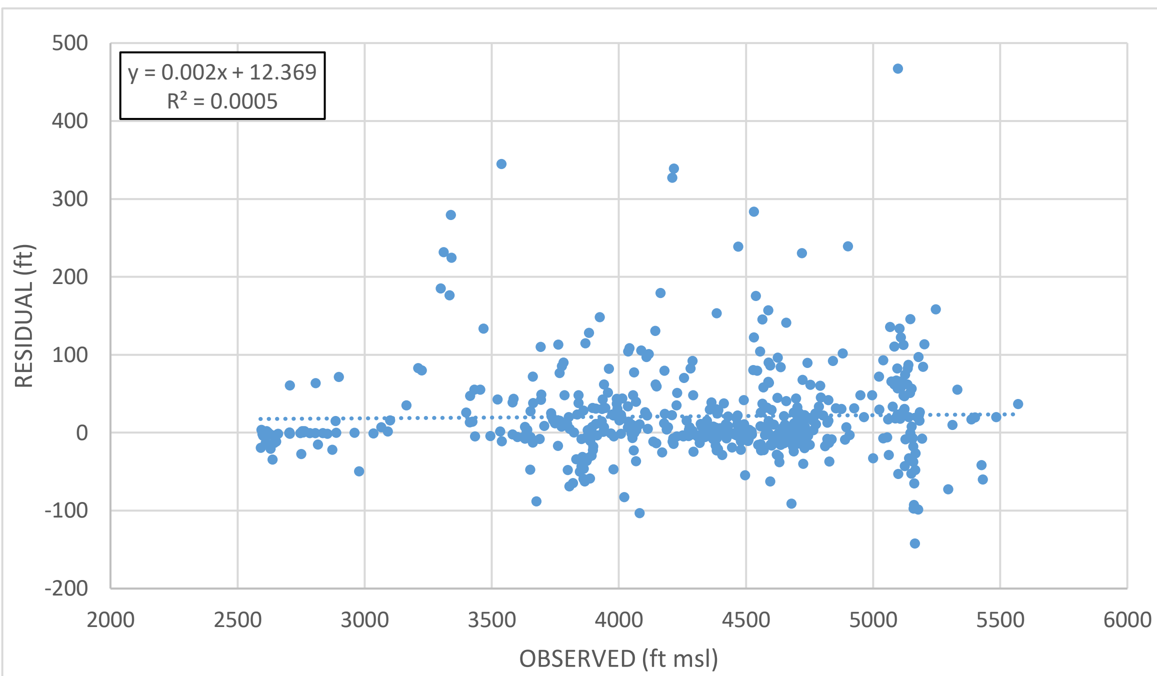
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	PMH — CHECKED: BG
DATE:	May 2022
FIGURE:	3.8



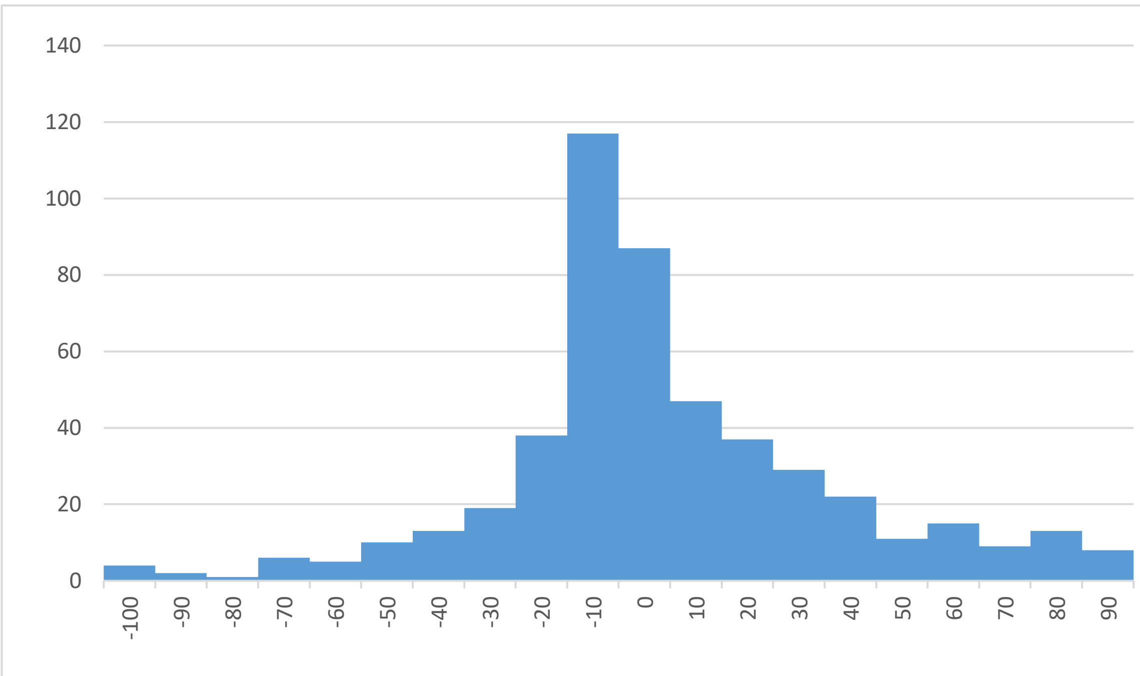
Upper Santa Cruz
Rillito
Upper San Pedro
Santa Cruz River
1650000
1700000
1750000
1800000
11600000
11550000
11500000
N
Model: s24
0
12,500
25,000
50,000
Feet
Coordinate system: NAD 1983 BLM Zone 12
Private Land Boundaries
Key Streams
8th Order Basins
No Flow Cell
Model Domain
Final Targets
TT 2010
TAMA
2021 Program
Calibration Targets
PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY
CLIENT: Rosemont Copper Company
PROJECT: Rosemont Copper World Project
JOB: 4286
DRAWN: PMH
CHECKED: BG
DATE: May 2022
FIGURE: 3.9





Model: s24, Weighted residuals

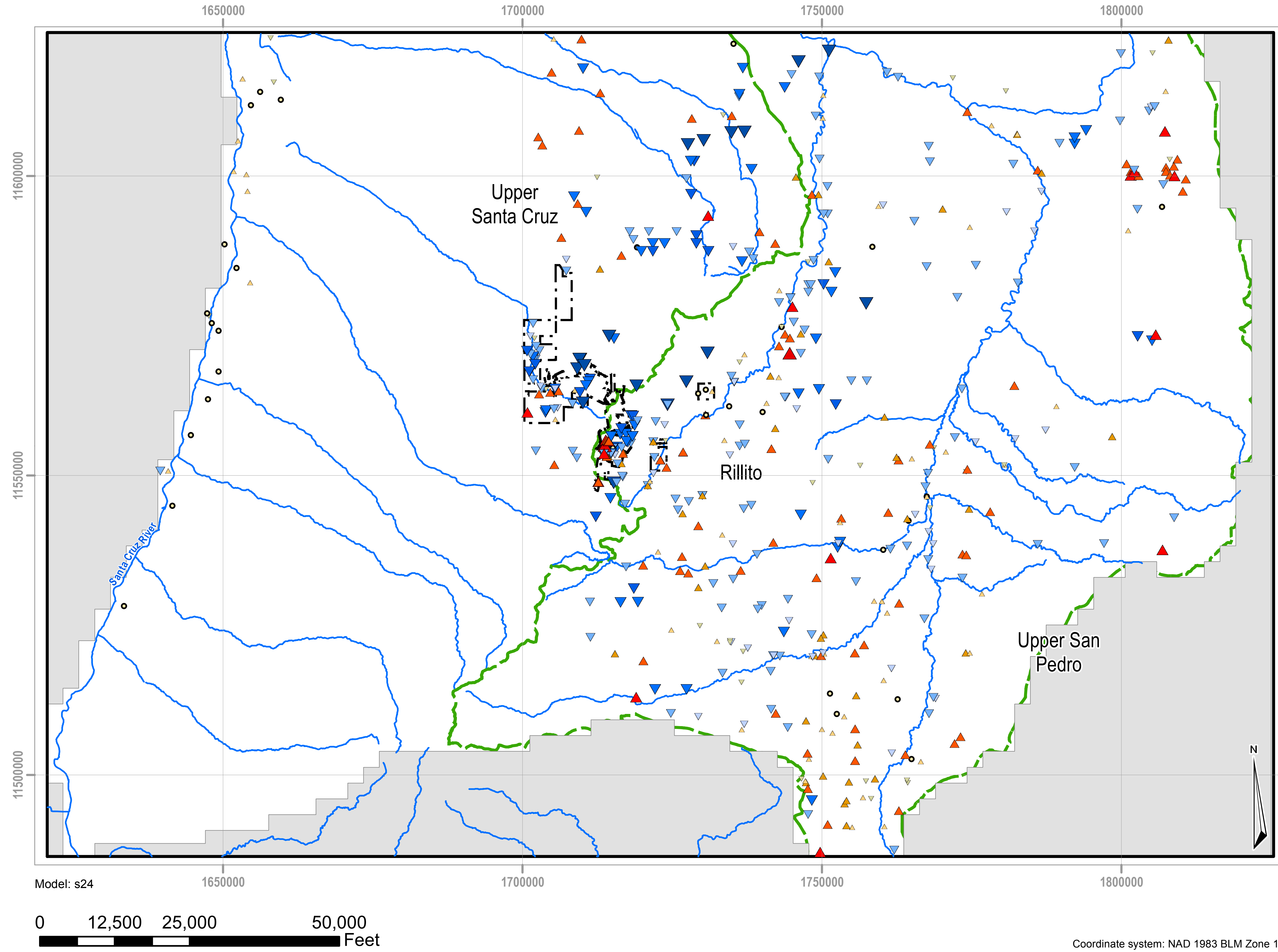
PITEAU ASSOCIATES Geotechnical and Water Management Consultants A TETRA TECH COMPANY	Cross-plots of Observed vs. Simulated and Residual Heads		
	CLIENT: Rosemont Copper Company	PROJECT: Rosemont Copper World	
	JOB #: 4286	DRAWN: DE	CHECKED: BG
	DATE: May 2022	FIGURE: 3.10.1	



Model: s24, Weighted residuals

PITEAU ASSOCIATES
Geotechnical and Water Management Consultants
A TETRA TECH COMPANY

Histrogram of Weighted Residuals			
CLIENT: Rosemont Copper Company		PROJECT: Rosemont Copper World	
JOB #: 4286		DRAWN: DE	CHECKED: BG
DATE: May 2022		FIGURE: 3.10.2	



Private Land Boundaries
Key Streams
8th Order Basins
No Flow Cell
Model Domain

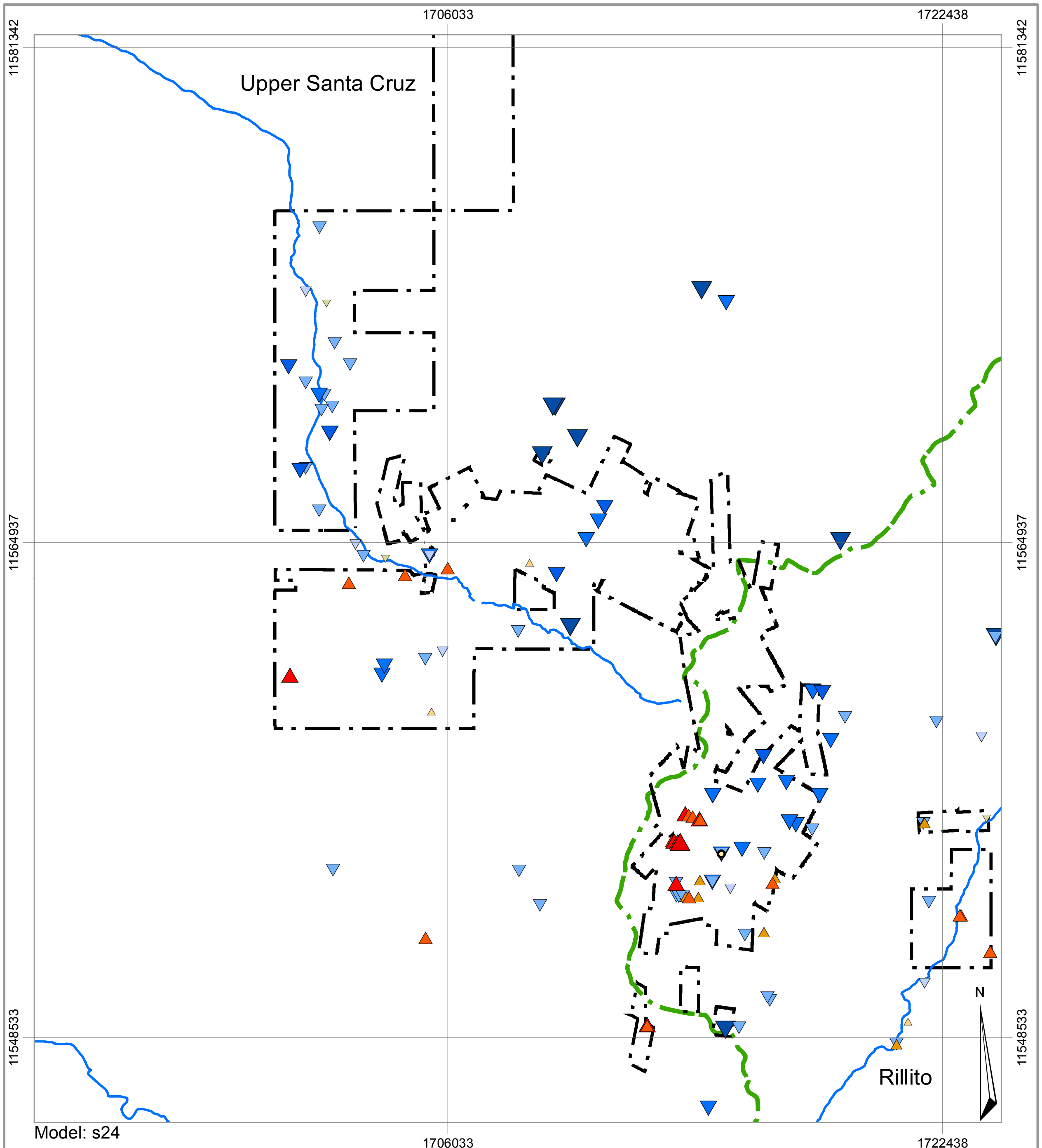
Calibration Residuals (ft)

-150 - -100
-100 - -50
-50 - -10
-10 - -5
-5 - -1
-1 - 1
1 - 5
5 - 10
10 - 50
50 - 100
100 - 150
150 - 500

Model Distribution of Calibration Residuals

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	PMH
CHECKED:	BG
DATE:	May 2022
FIGURE:	3.11.1



Project Area Distribution of Calibration Residuals

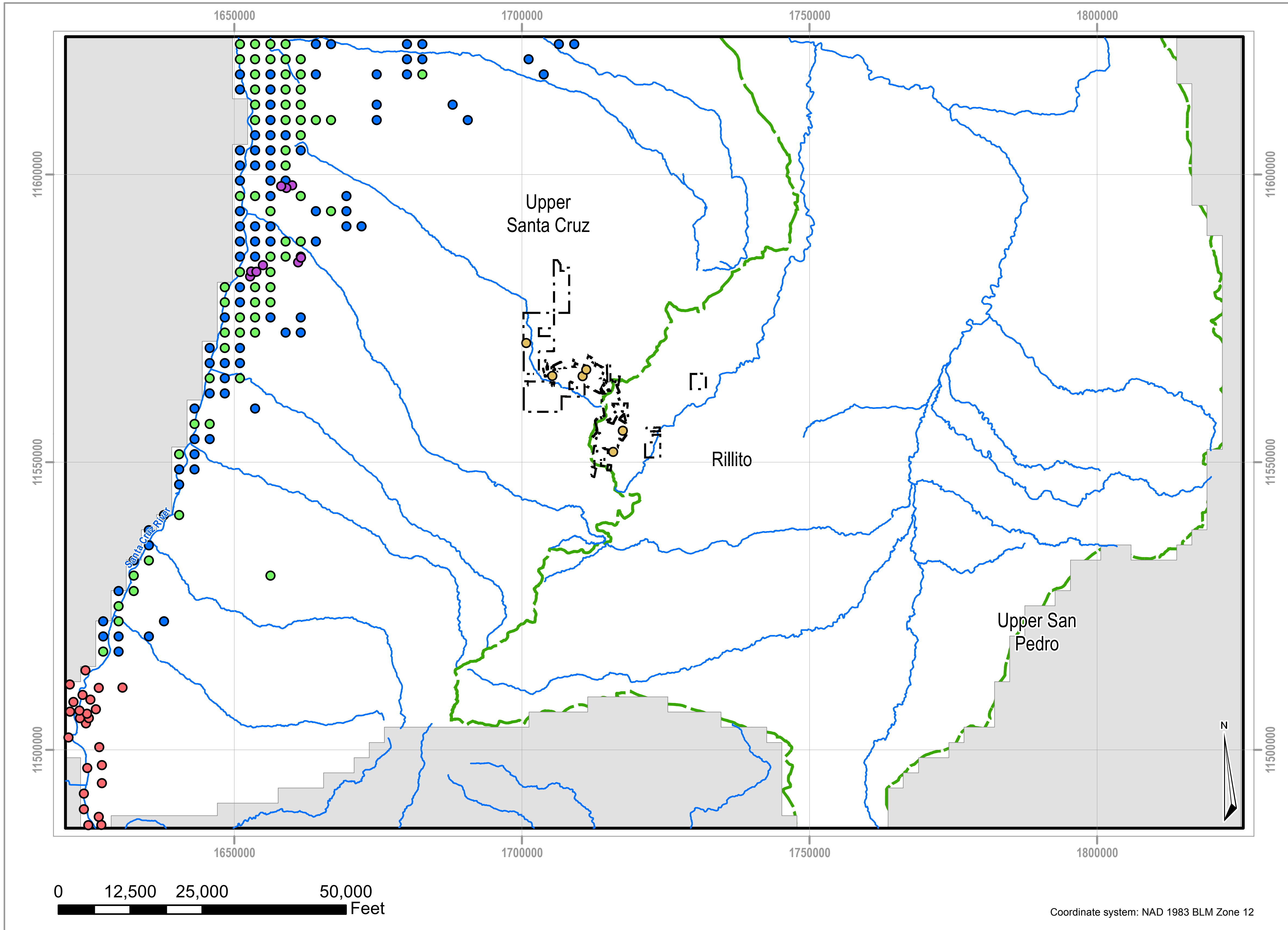
1:63,000

0 5,000 Feet

Coordinate System: NAD 1983 BLM Zone 12N

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

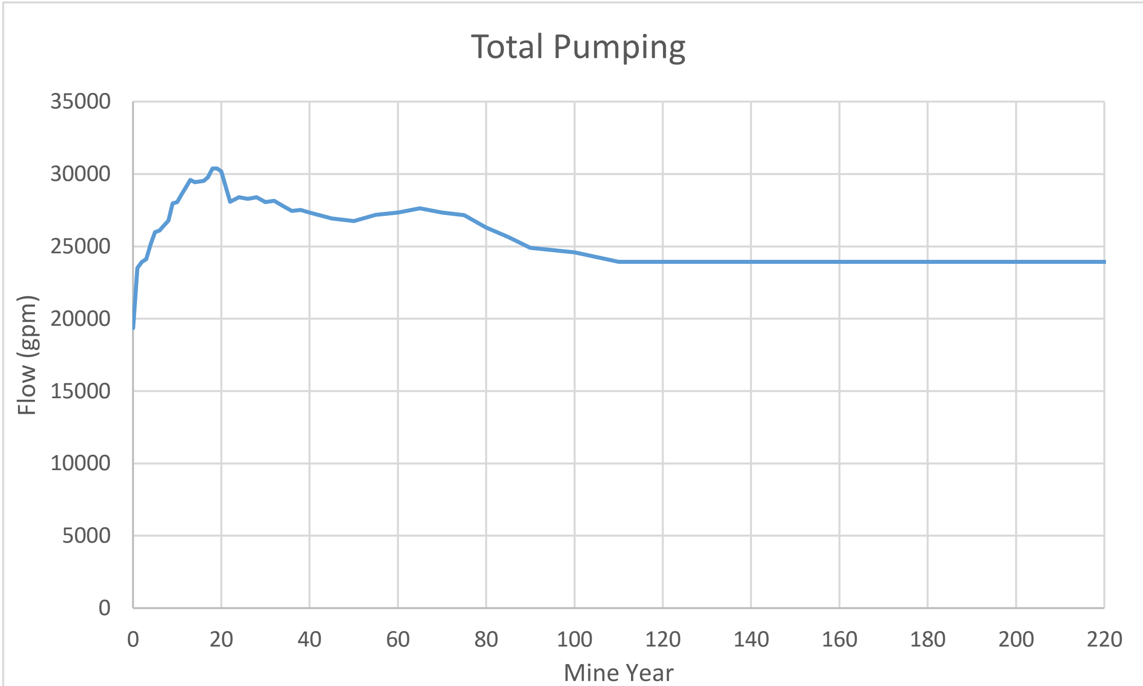
CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	PMH
CHECKED:	BG
DATE:	May 2022
FIGURE:	3.11.2

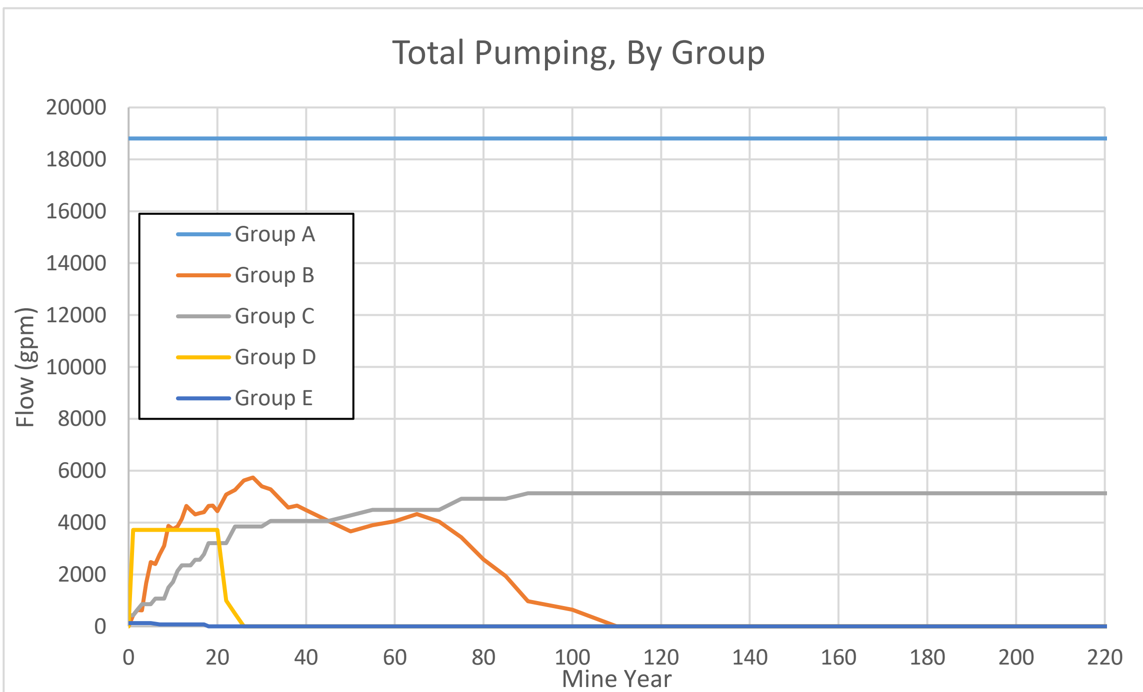


Pumping Wells in the Predictive Model

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN: PMH	CHECKED: BG
DATE:	May 2022
FIGURE:	4.1

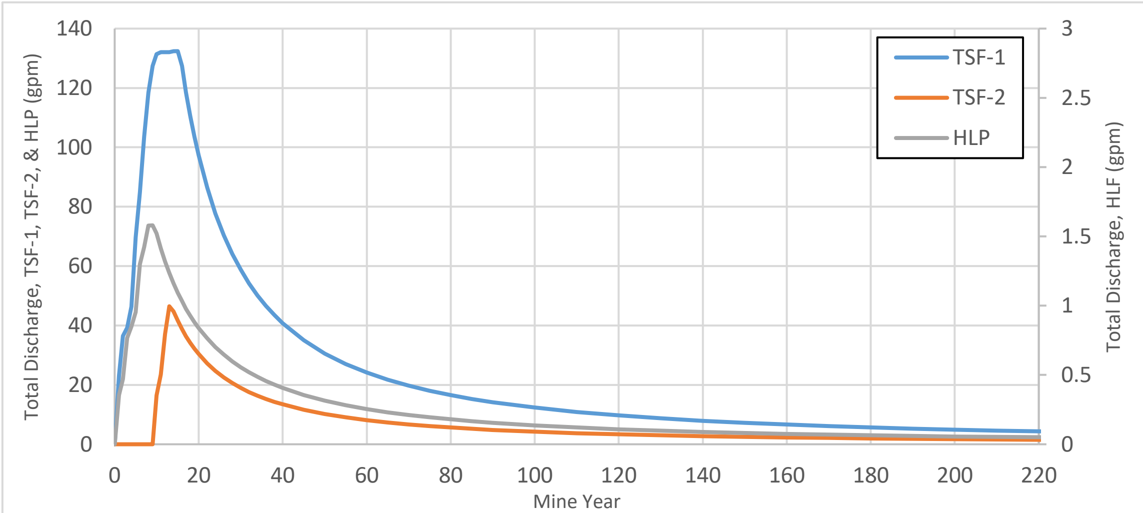


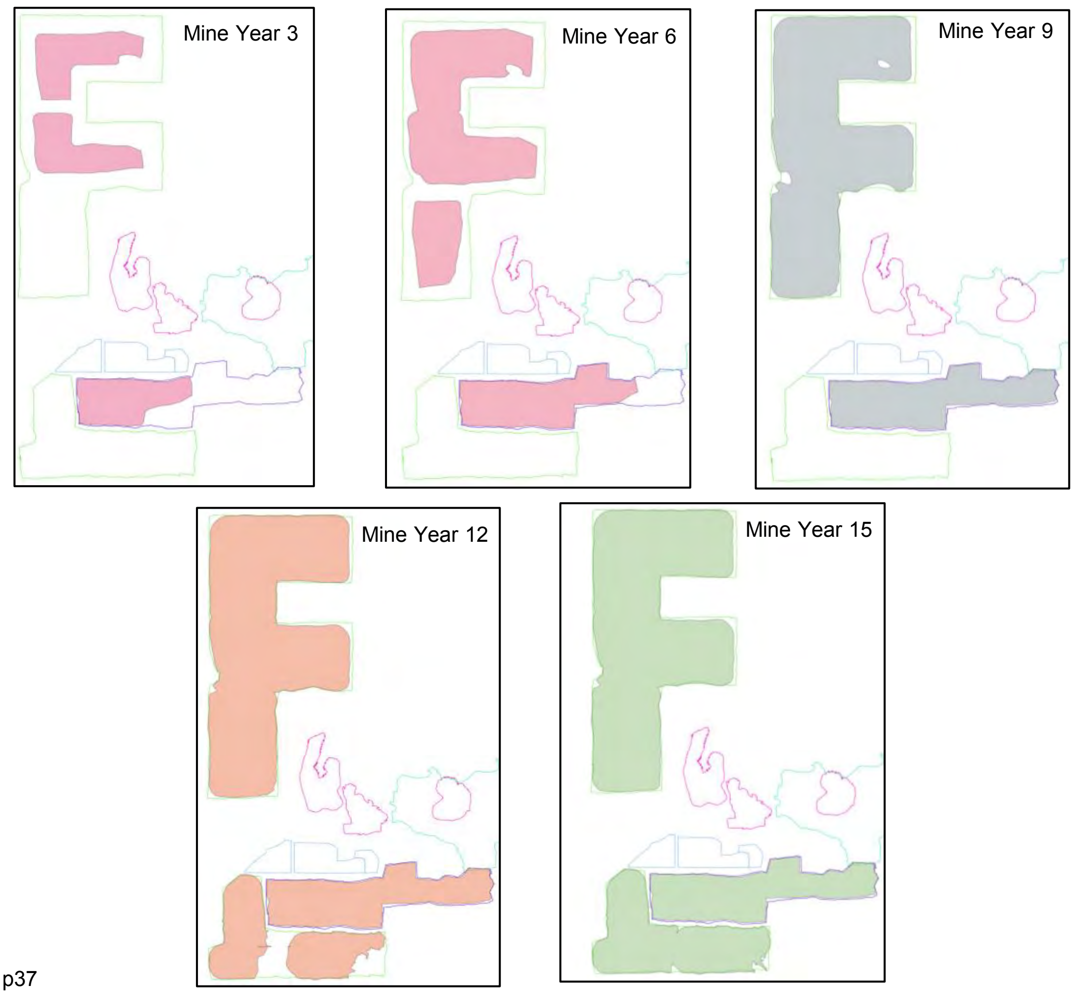


Model p37 & B6. Pumping from Groups D & E do not apply to the Base Case Model

PITEAU ASSOCIATES
Geotechnical and Water Management Consultants
A TETRA TECH COMPANY

Total Pumping Rates and Rates by Group in the Predictive Model			
CLIENT: Rosemont Copper Company		PROJECT: Rosemont Copper World	
JOB #: 4286		DRAWN: DE	CHECKED: BG
DATE: May 2022		FIGURE: 4.2	

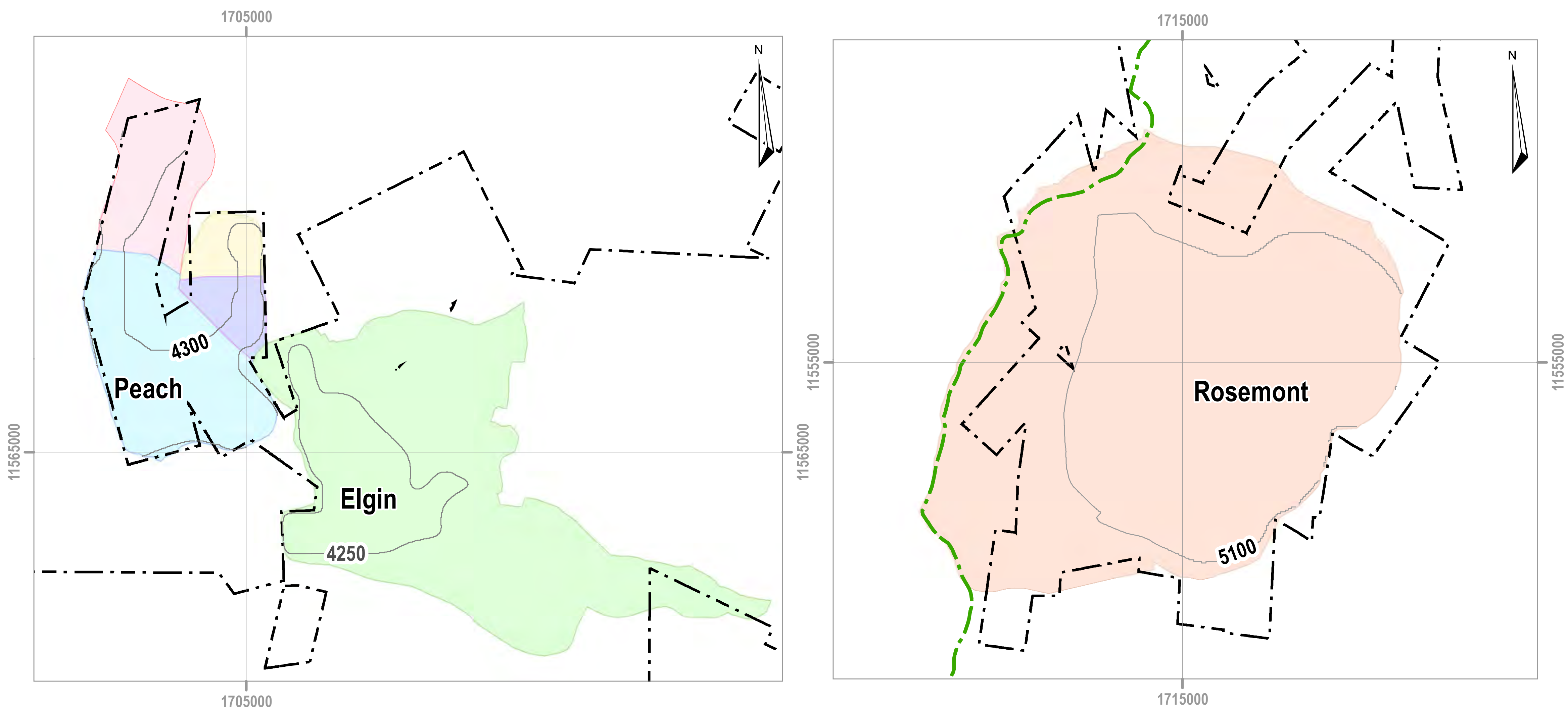




Model p37

PITEAU ASSOCIATES
Geotechnical and Water Management Consultants
A TETRA TECH COMPANY

Seepage Recharge Applied to the TSFs and HLP			
CLIENT: Rosemont Copper Company		PROJECT: Rosemont Copper World	
JOB #: 4286		DRAWN: DE	CHECKED: BG
DATE: May 2022		FIGURE: 4.3	



Private Land Boundaries
Key Streams
Contour

Basin
02C-1
04A-2 & 04A
10B-1
10C-1
10D-1

0 750 1,500 3,000 Feet

*The model assumes that the catchment areas for Peach and Elgin would include an engineered solution that would route catchment runoff away from the pits.

Private Land Boundaries
8th Order Basins
Contour

Basin
12A & 12A-1 &12A-N2

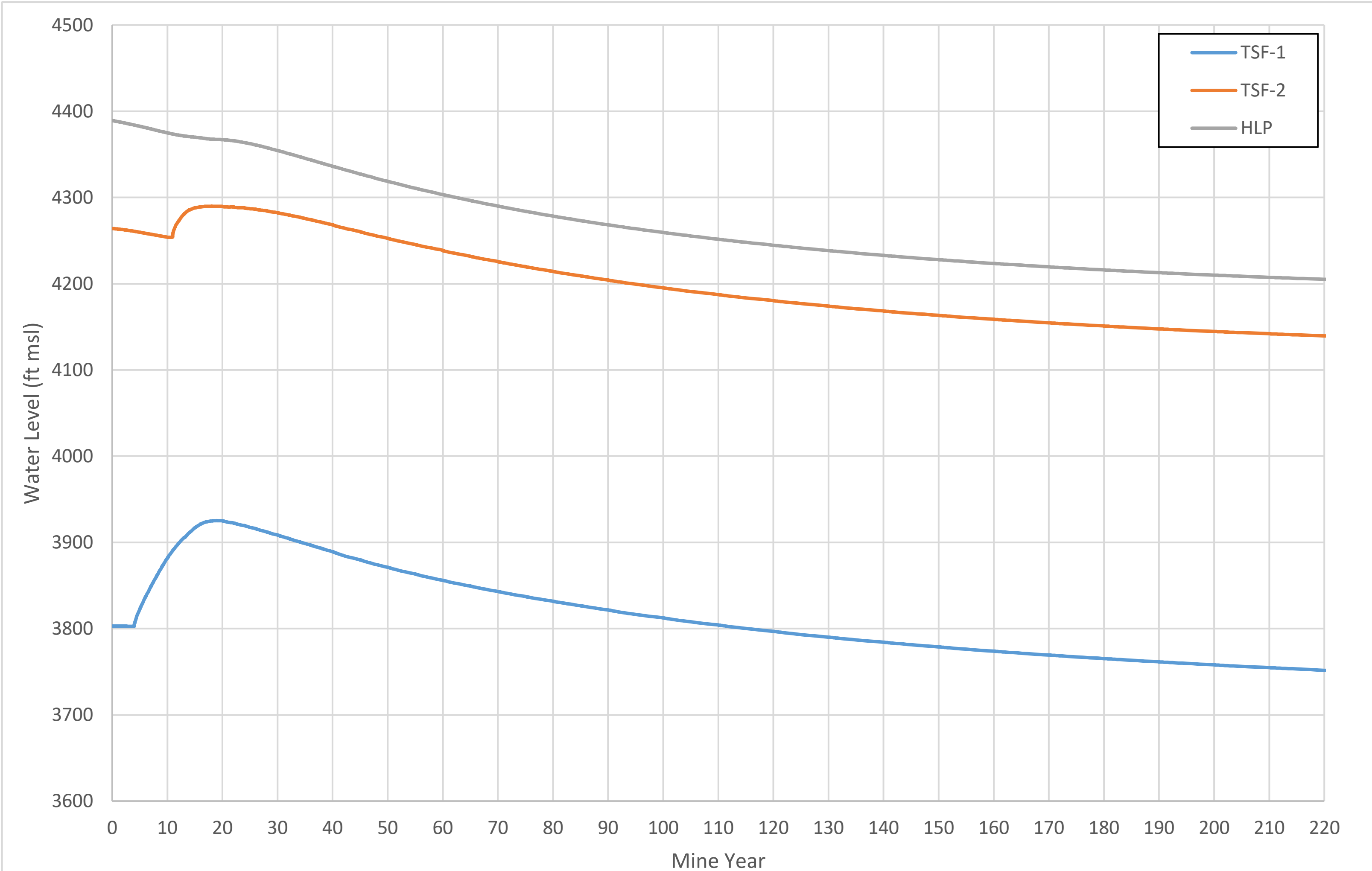
0 1,000 2,000 4,000 Feet

Coordinate system: NAD 1983 BLM Zone 12

Upstream Catchment Areas for Pit Lakes

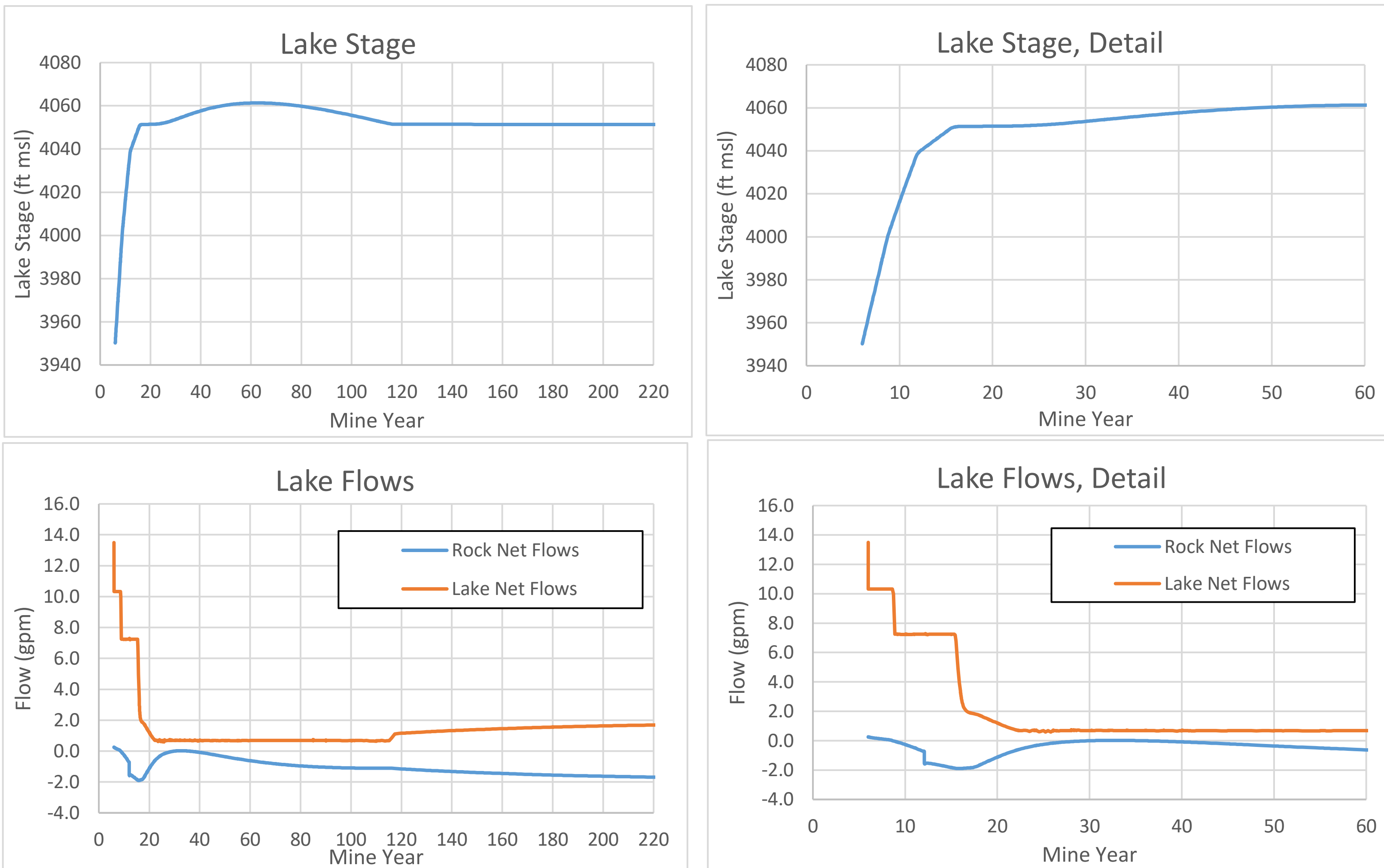
PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	PMH
CHECKED:	BG
DATE:	May 2022
FIGURE:	4.4



Model p37. Points chosen to show greatest rise of of the water table in each facility.

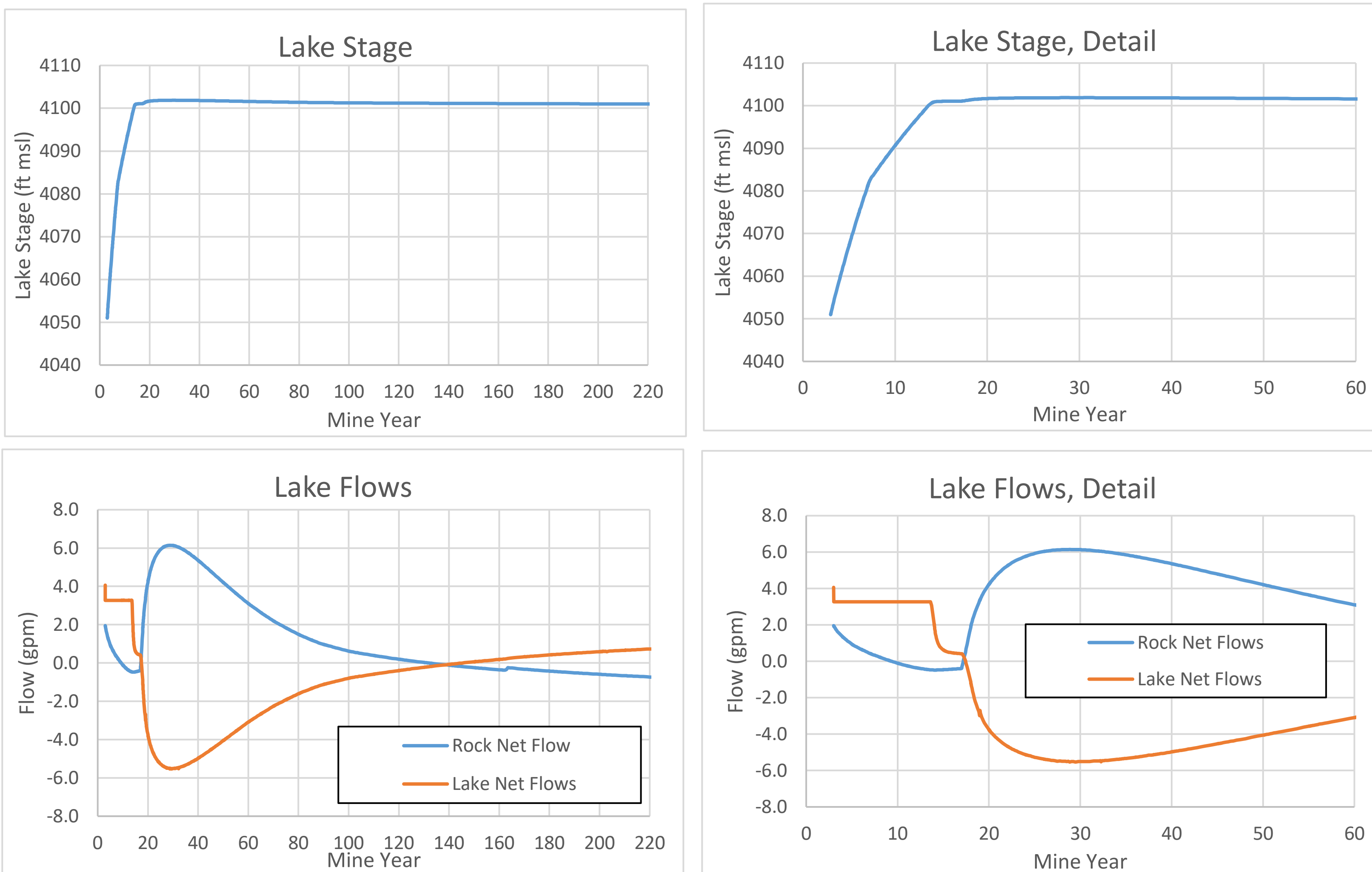
PITEAU ASSOCIATES Geotechnical and Water Management Consultants A TETRA TECH COMPANY	Mound Growth and Decay under TSF-1, TSF-2 and the HLP			
	CLIENT: Rosemont Copper Company	PROJECT: Rosemont Copper World Project		
	JOB #: 4286	DRAWN: DE	CHECKED: BG	
	DATE: May 2022	FIGURE: 4.5		



Model p37

PITEAU ASSOCIATES
Geotechnical and Water Management Consultants
A TETRA TECH COMPANY

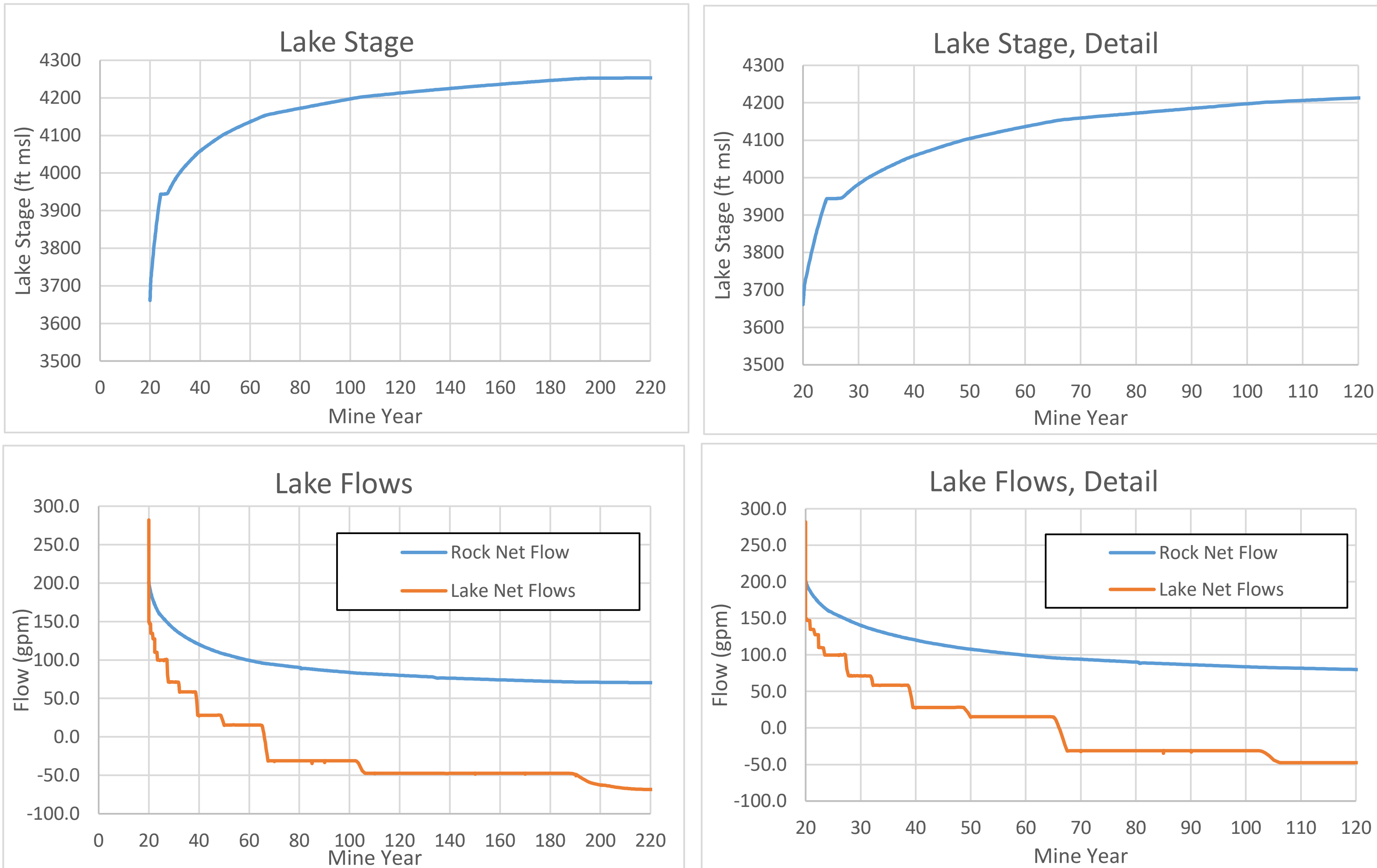
Peach Pit Lake Filling			
CLIENT: Rosemont Copper Company		PROJECT: Rosemont Copper World Project	
JOB #: 4286		DRAWN: DE	CHECKED: BG
DATE: May 2022		FIGURE: 4.6.1	



Model p37

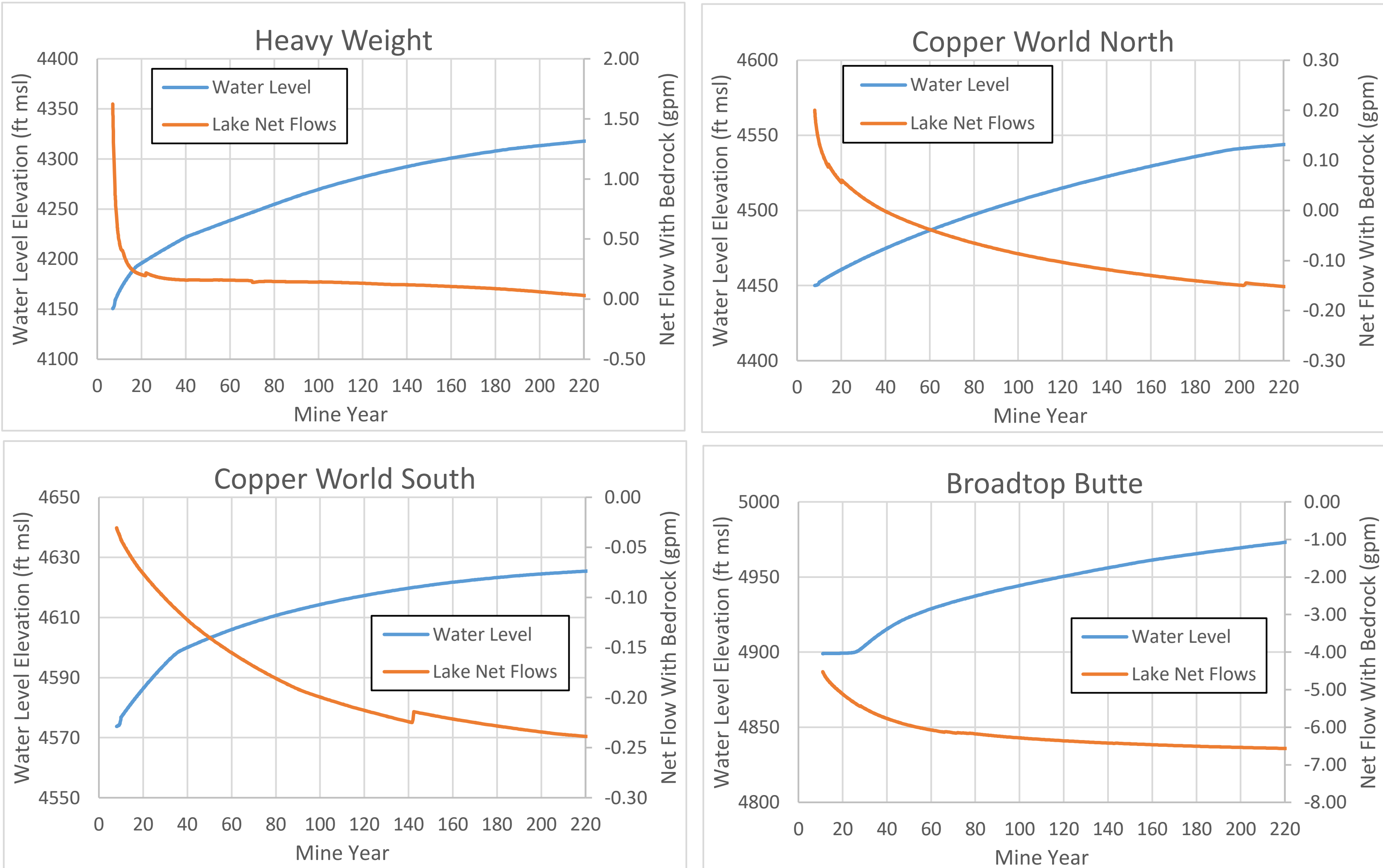
PITEAU ASSOCIATES
Geotechnical and Water Management Consultants
A TETRA TECH COMPANY

Elgin Pit Lake Filling			
CLIENT: Rosemont Copper Company		PROJECT: Rosemont Copper World Project	
JOB #: 4286		DRAWN: DE	CHECKED: BG
DATE: May 2022		FIGURE: 4.6.2	



Model p37

PITEAU ASSOCIATES Geotechnical and Water Management Consultants A TETRA TECH COMPANY	Rosemont Pit Lake Filling		
CLIENT: Rosemont Copper Company		PROJECT: Rosemont Copper World Project	
JOB #: 4286		DRAWN: DE	CHECKED: BG
DATE: May 2022		FIGURE: 4.6.3	

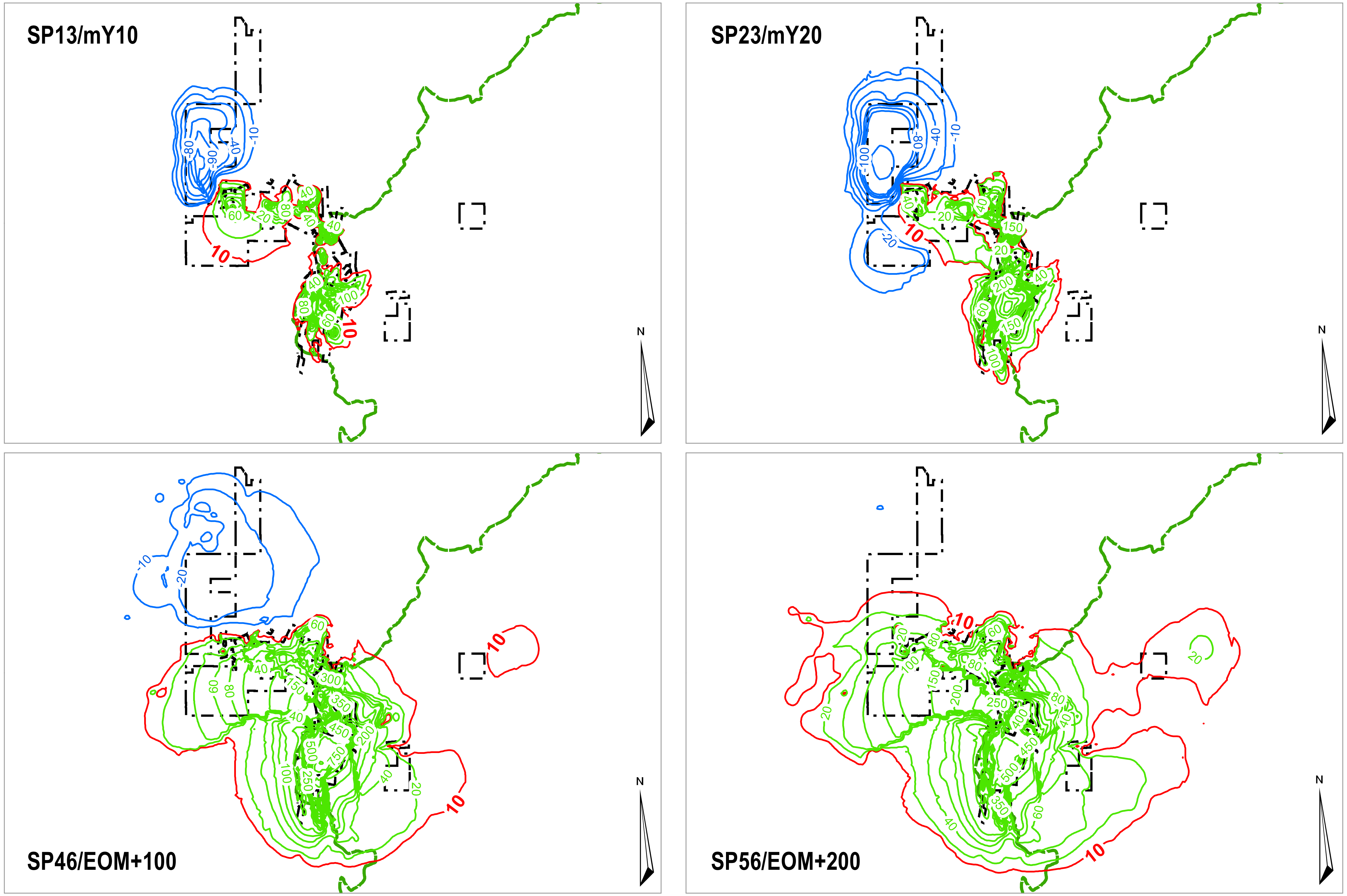


Model p37

PITEAU ASSOCIATES
Geotechnical and Water Management Consultants
A TETRA TECH COMPANY

Backfilled Pits Behavior

CLIENT:	Rosemont Copper Company	PROJECT:	Rosemont Copper World Project		
JOB #:	4286	DRAWN:	DE	CHECKED:	BG
DATE:	May 2022	FIGURE:	4.7		



Models: B6 & p37

0 8,500 17,000 34,000 Feet

Coordinate system: NAD 1983 BLM Zone 12

Private Land Boundaries
8th Order Basins

Simulated Head Difference (ft)

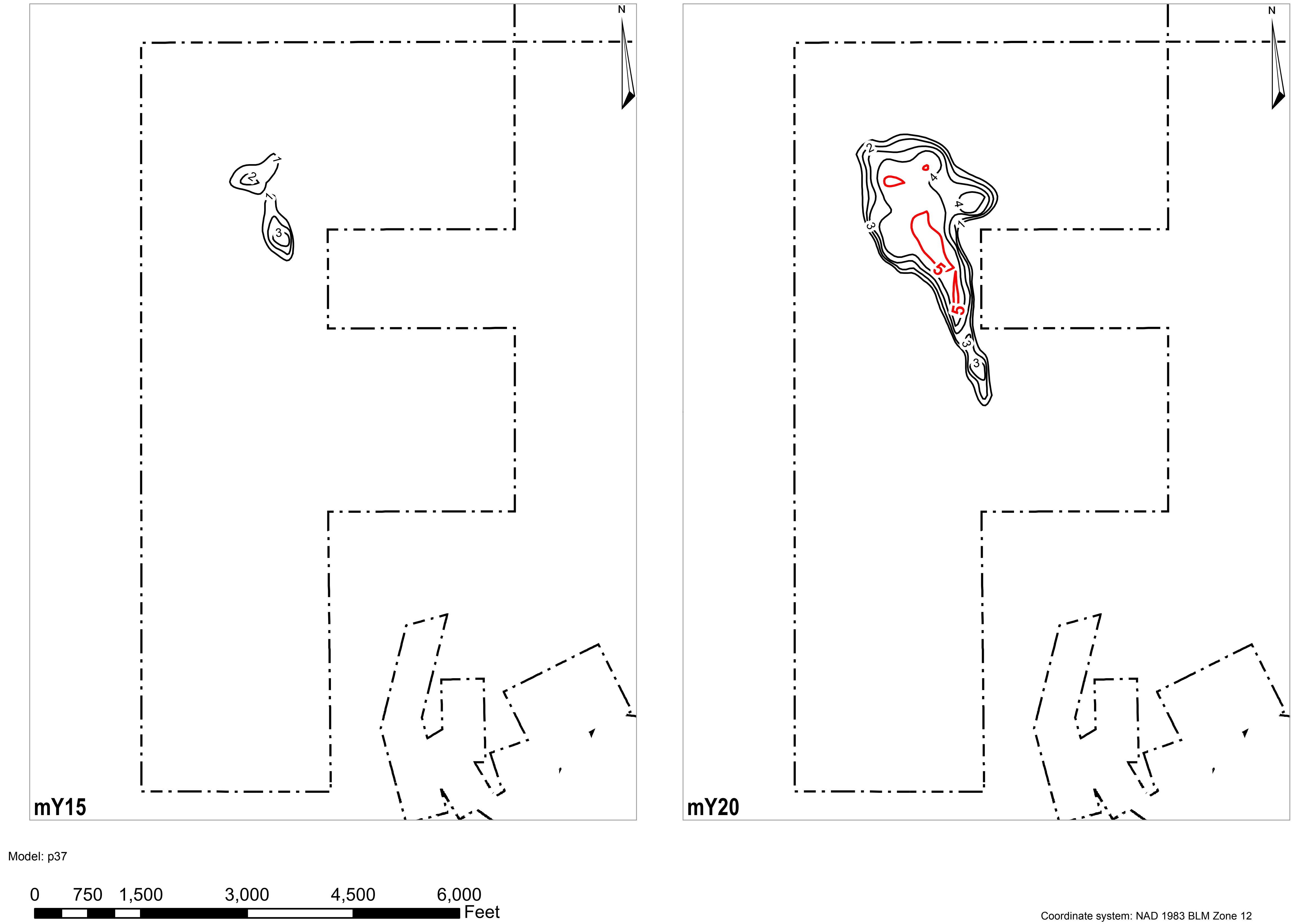
Mounding
Drawdown 10 ft
Drawdown

Contour interval is irregular.

Simulated Head Differences Between the Base Case and Predictive Models

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	PMH
CHECKED:	BG
DATE:	May 2022
FIGURE:	4.8.1



Private Land Boundaries

Mounding Above Ground Contour (ft)

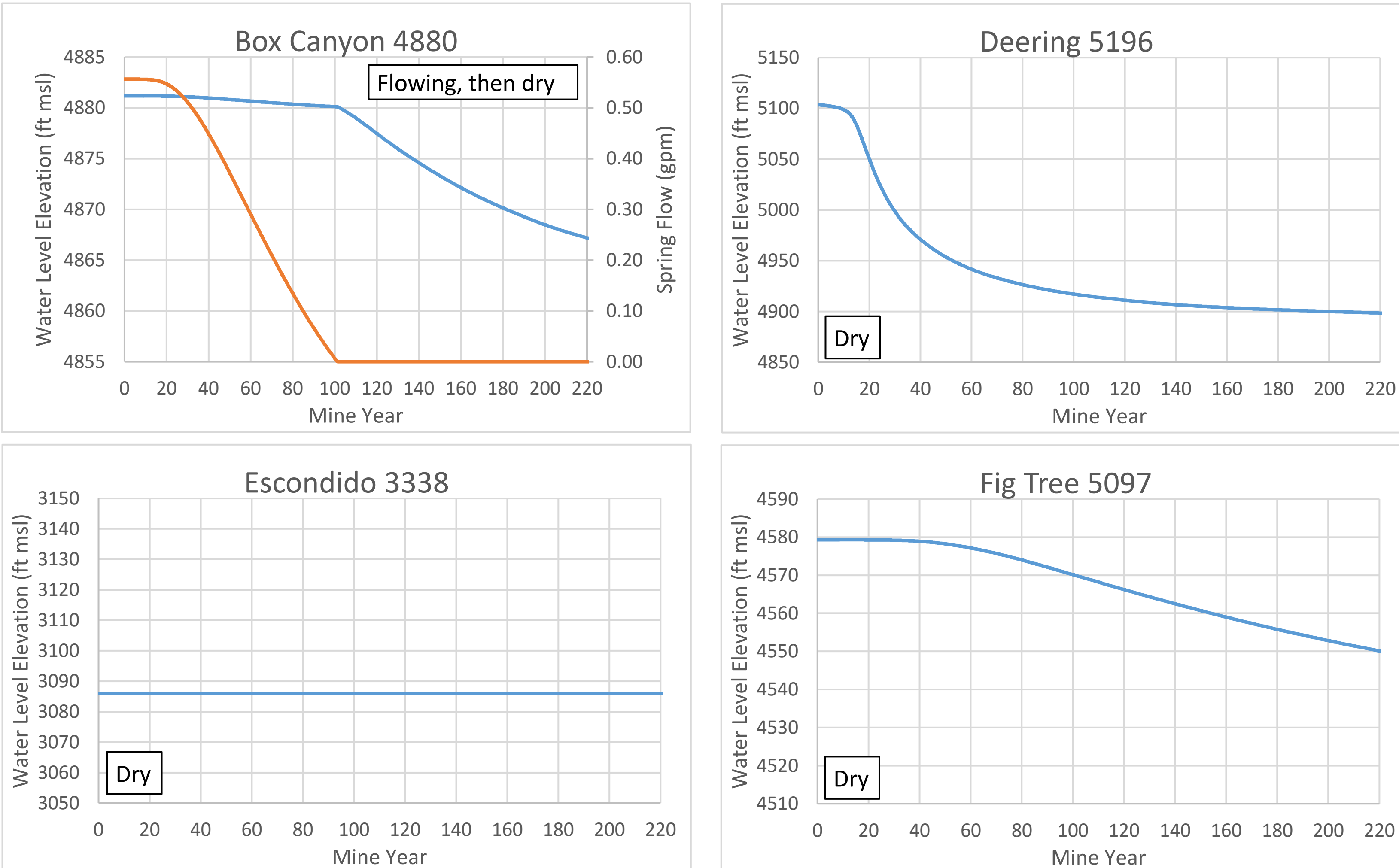
< 5

5

Simulated Mound Above the Ground Surface

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

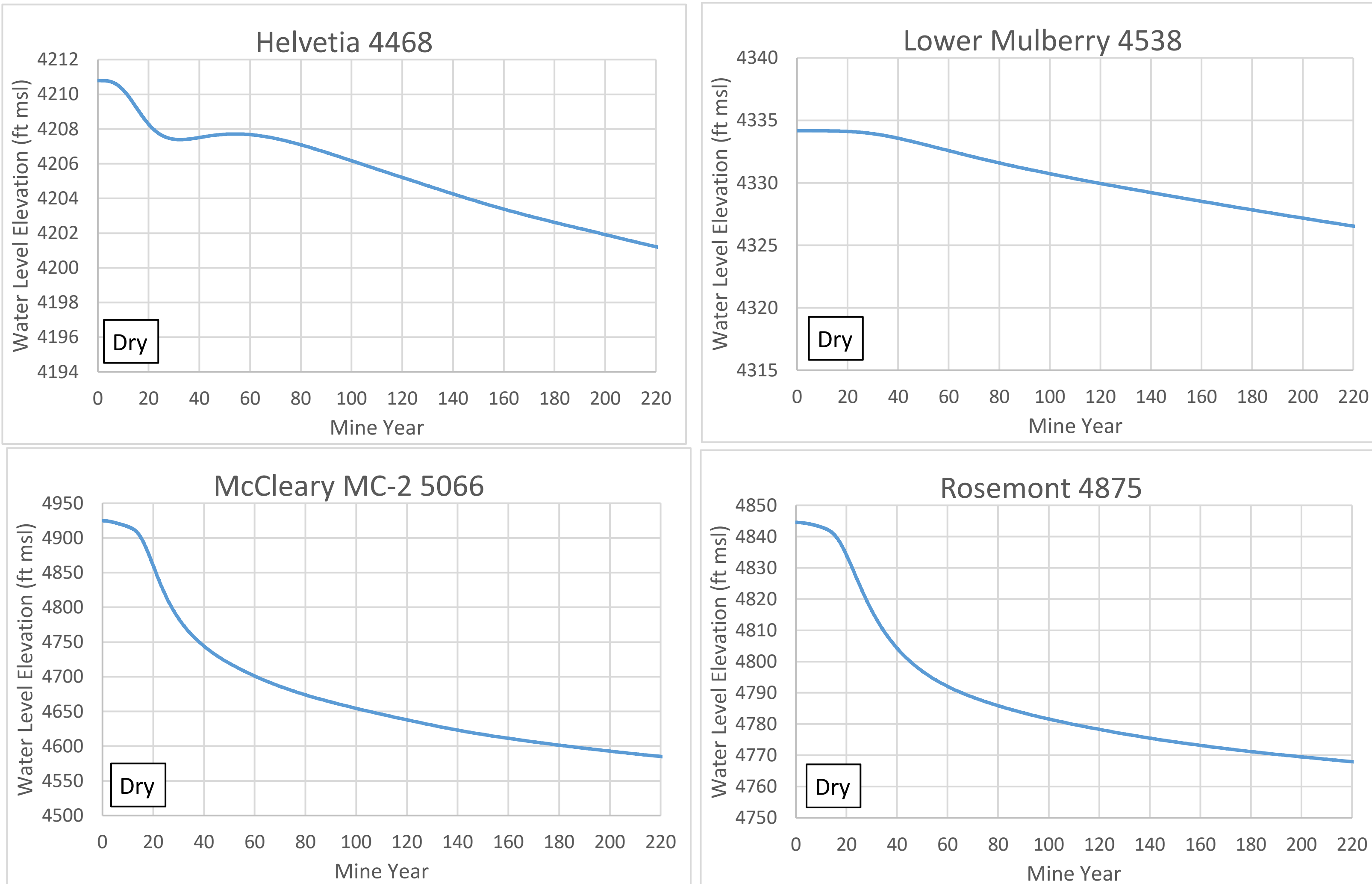
CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN: PMH	CHECKED: BG
DATE:	May 2022
FIGURE:	4.8.2



Model p37. Value next to each spring name represents the spring elevation.

PITEAU ASSOCIATES
Geotechnical and Water Management Consultants
A TETRA TECH COMPANY

Head Hydrographs at Spring Locations			
CLIENT:	Rosemont Copper Company	PROJECT:	Rosemont Copper World Project
JOB #:	4286	DRAWN: DE	CHECKED: BG
DATE:	May 2022	FIGURE:	4.9.1

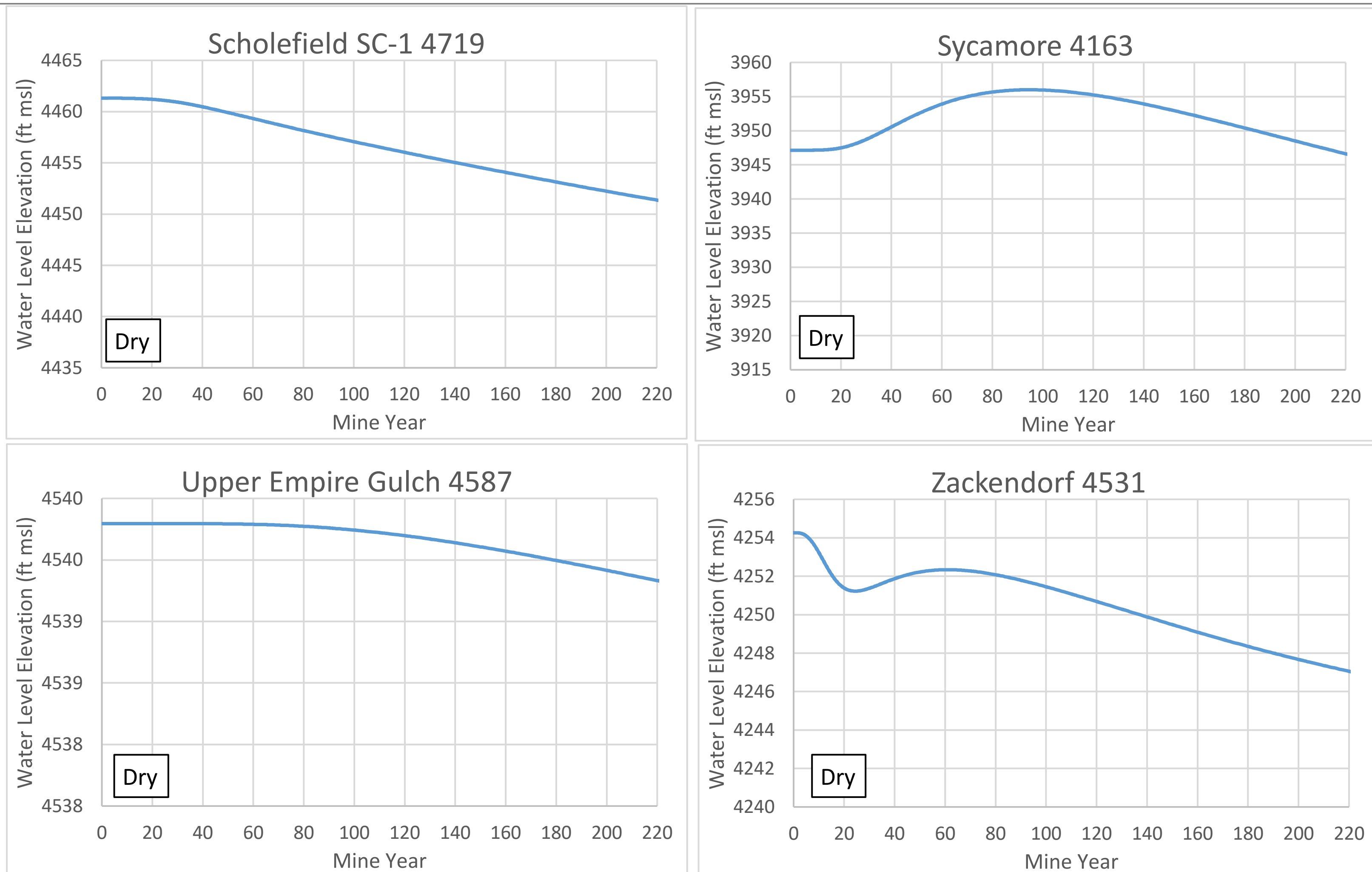


Model p37. Value next to each spring name represents the spring elevation.

PITEAU ASSOCIATES
Geotechnical and Water Management Consultants
A TETRA TECH COMPANY

Head Hydrographs at Spring Locations

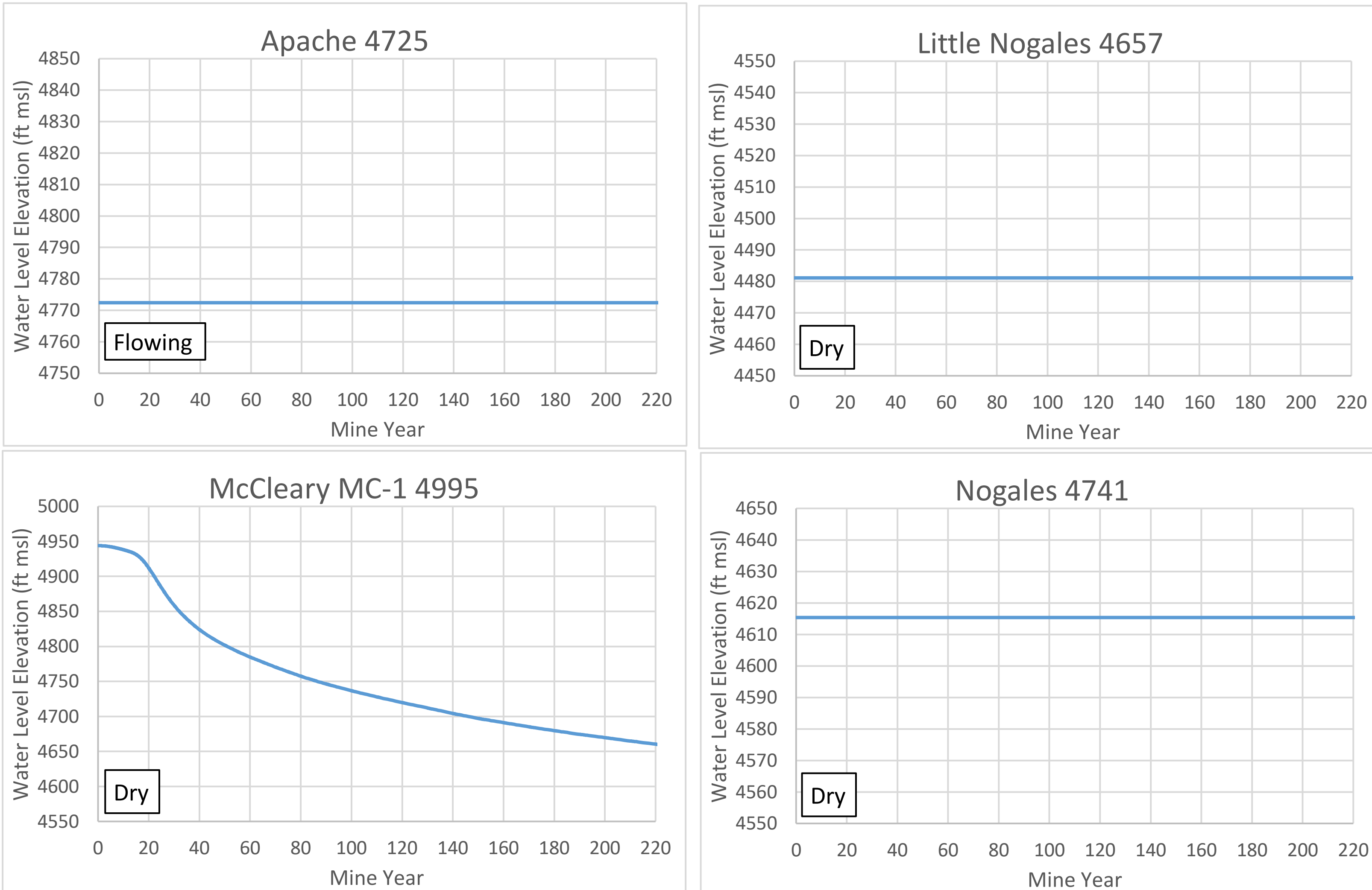
CLIENT:	Rosemont Copper Company	PROJECT:	Rosemont Copper World Project		
JOB #:	4286	DRAWN:	DE	CHECKED:	BG
DATE:	May 2022	FIGURE:	4.9.2		



Model p37. Value next to each spring name represents the spring elevation.

PITEAU ASSOCIATES
Geotechnical and Water Management Consultants
A TETRA TECH COMPANY

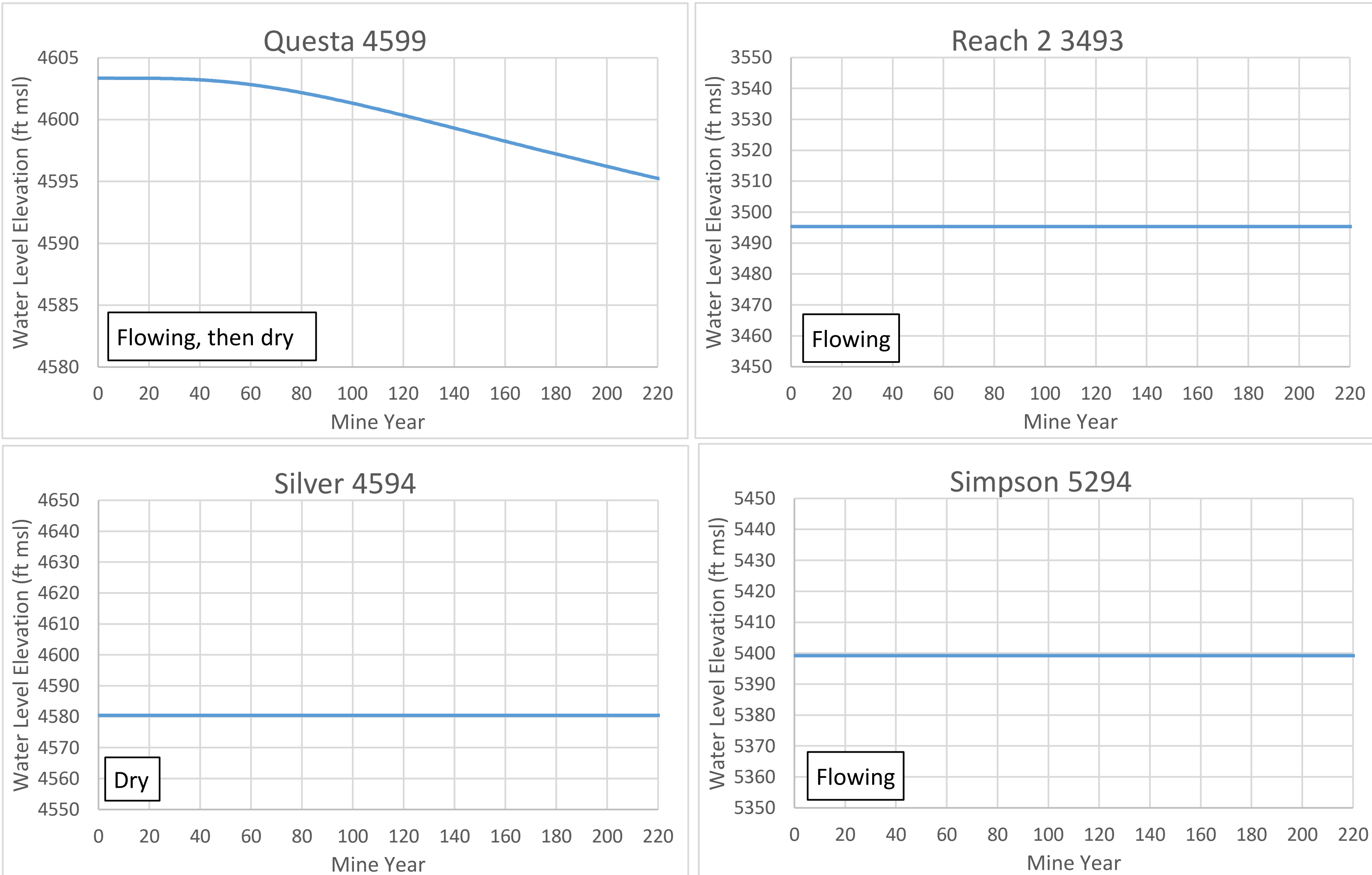
Head Hydrographs at Spring Locations			
CLIENT: Rosemont Copper Company		PROJECT: Rosemont Copper World Project	
JOB #: 4286		DRAWN: DE	CHECKED: BG
DATE: May 2022		FIGURE: 4.9.3	



Model p37. Value next to each spring name represents the spring elevation.

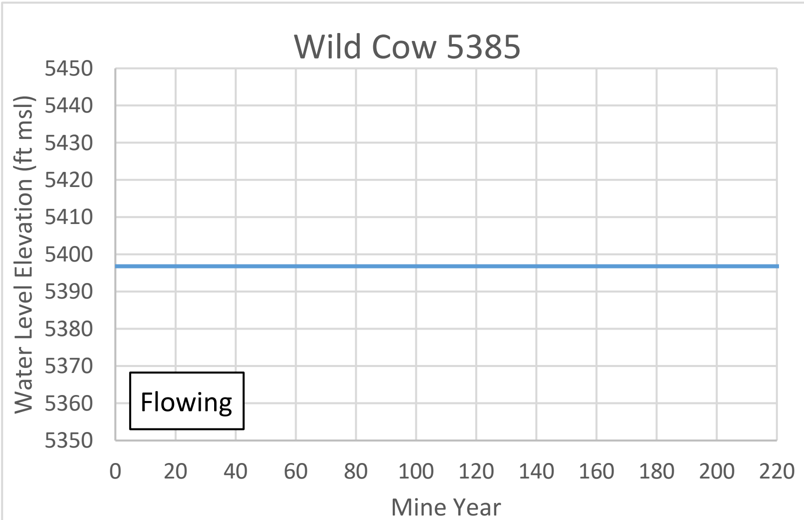
PITEAU ASSOCIATES
Geotechnical and Water Management Consultants
A TETRA TECH COMPANY

Head Hydrographs at Spring Locations					
CLIENT:	Rosemont Copper Company	PROJECT:	Rosemont Copper World Project		
JOB #:	4286	DRAWN:	DE	CHECKED:	BG
DATE:	May 2022	FIGURE:	4.9.4		



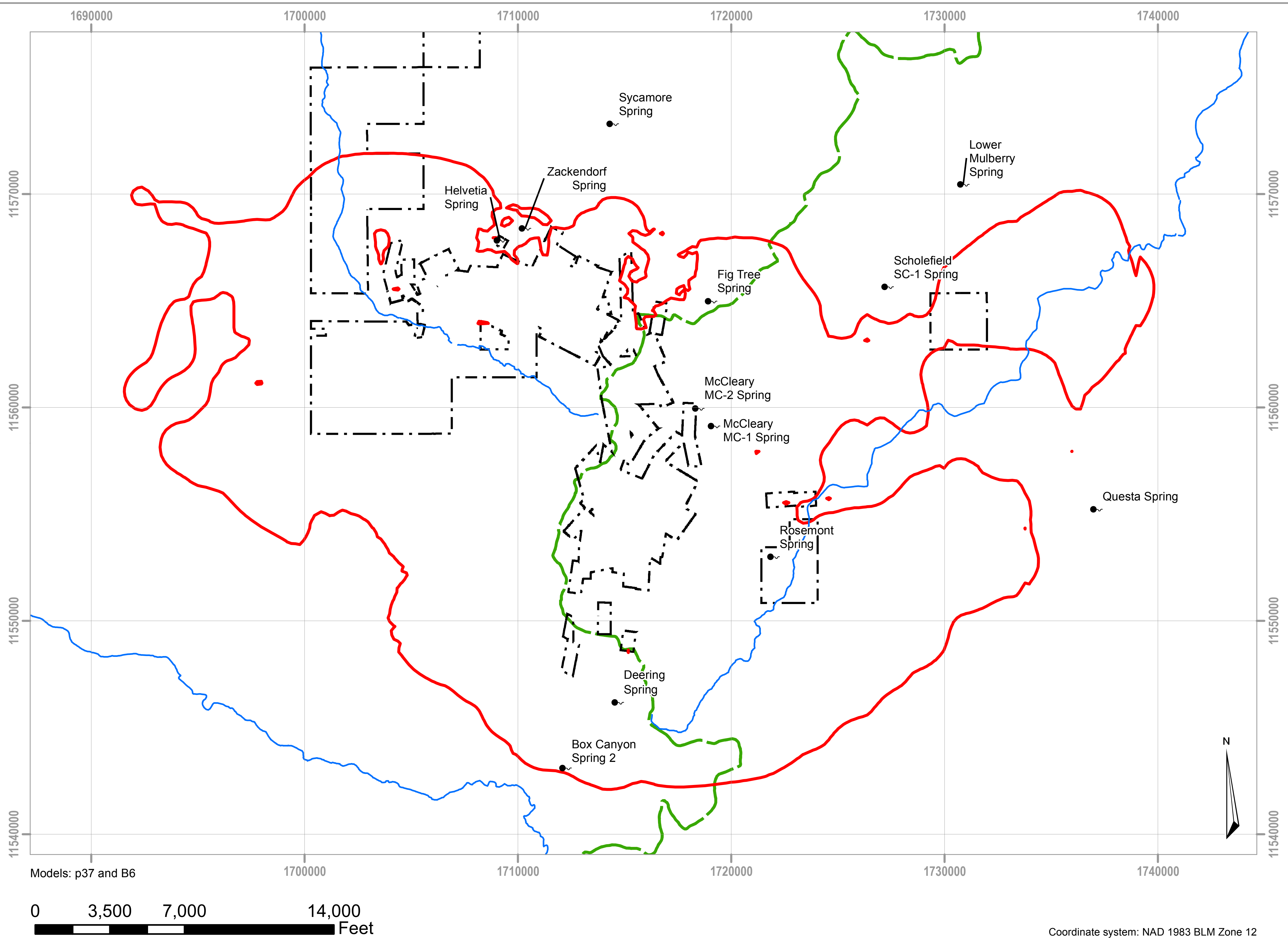
Model p37. Value next to each spring name represents the spring elevation.

PITEAU ASSOCIATES Geotechnical and Water Management Consultants A TETRA TECH COMPANY	Head Hydrographs at Spring Locations			
	CLIENT: Rosemont Copper Company	PROJECT: Rosemont Copper World Project		
	JOB #: 4286	DRAWN: DE	CHECKED: BG	
	DATE: May 2022	FIGURE: 4.9.5		



Model p37. Value next to each spring name represents the spring elevation.

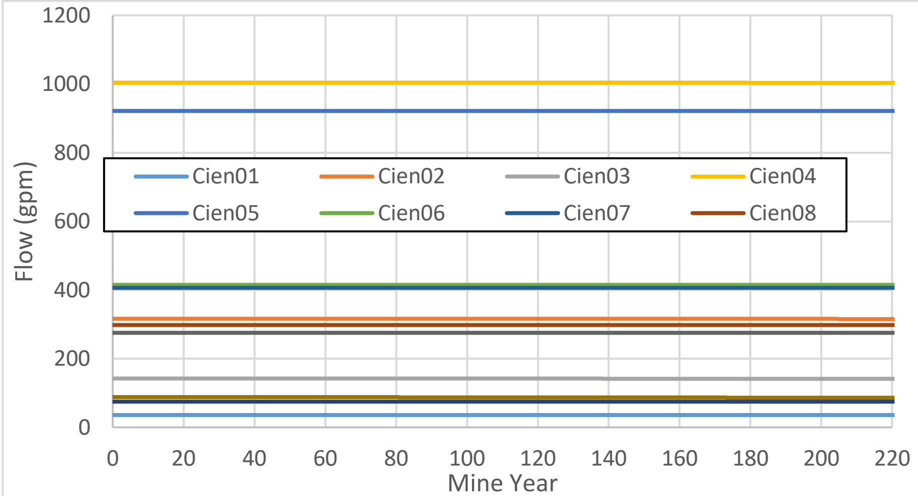
PITEAU ASSOCIATES Geotechnical and Water Management Consultants A TETRA TECH COMPANY	Head Hydrographs at Spring Locations					
	CLIENT:	Rosemont Copper Company	PROJECT:	Rosemont Copper World Project		
	JOB #:	4286	DRAWN:	DE	CHECKED:	BG
	DATE:	May 2022	FIGURE:	4.9.6		

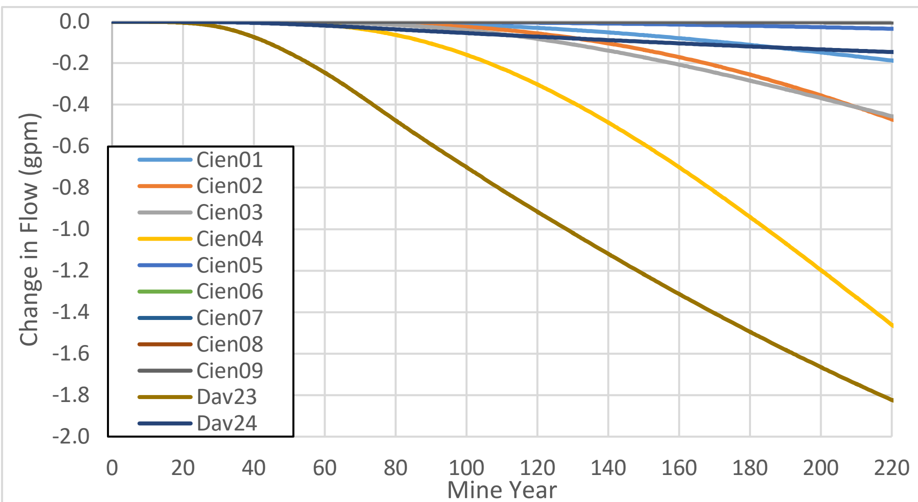


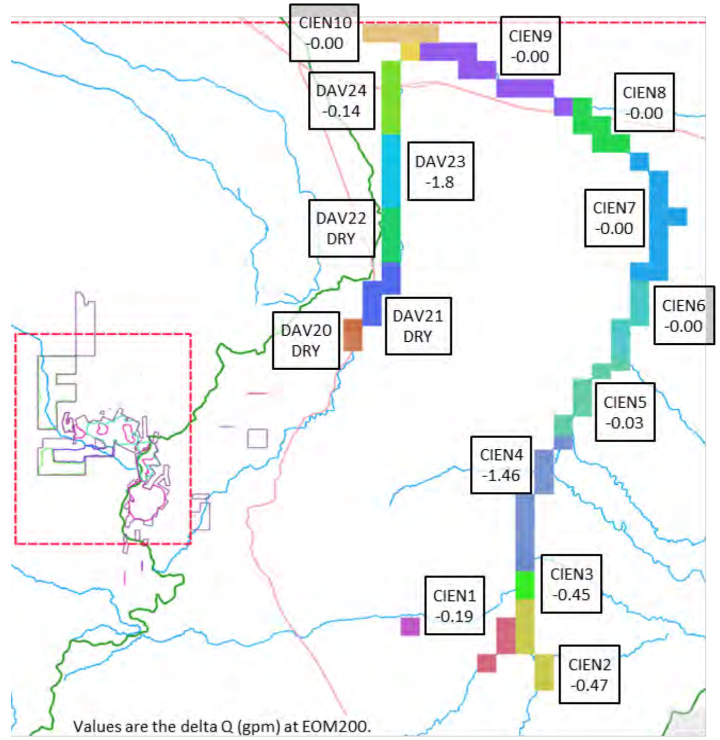
Key Spring Locations and Extent of Predicted 10 ft Drawdown Isopleth

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	DE
CHECKED:	BG
DATE:	May 2022
FIGURE:	4.10

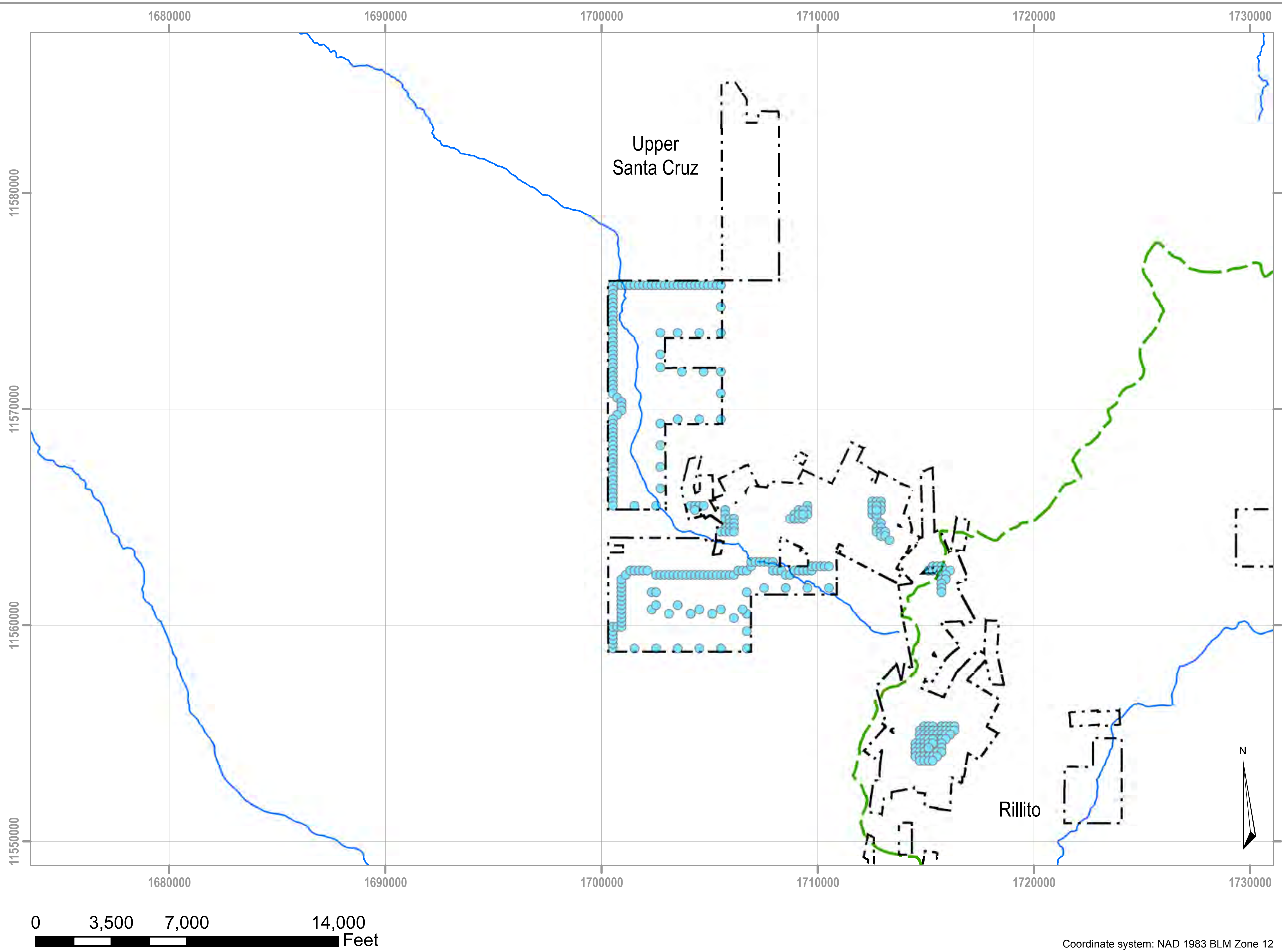






Model p37

PITEAU ASSOCIATES Geotechnical and Water Management Consultants A TETRA TECH COMPANY	Flow Changes in Surface Streams			
	CLIENT: Rosemont Copper Company	PROJECT: Rosemont Copper World Project		
	JOB #: 4286	DRAWN: DE	CHECKED: BG	
	DATE: May 2022	FIGURE: 4.11		



Particle Start

Private Land Boundaries

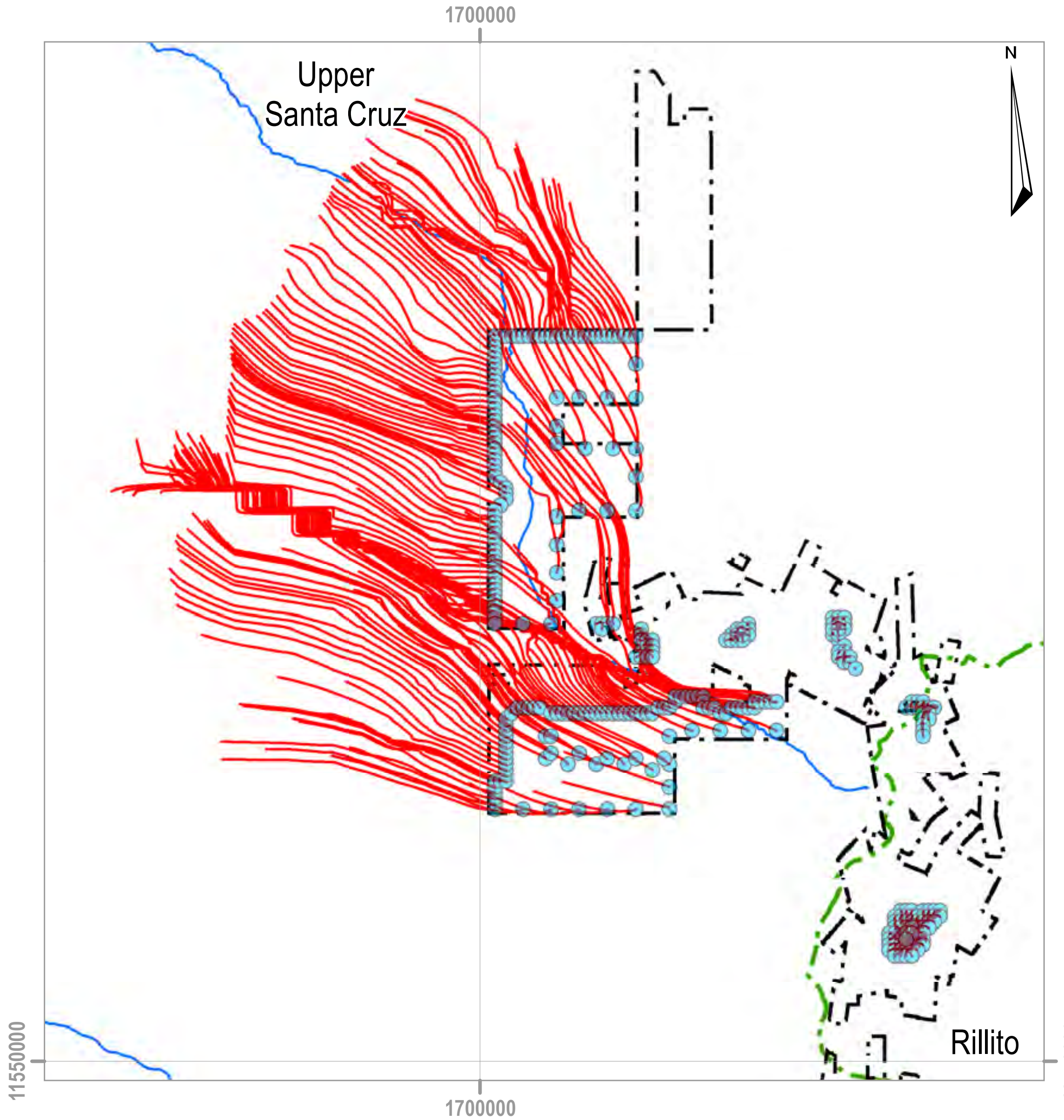
Key Streams

8th Order Basins

Particle Starting Locations

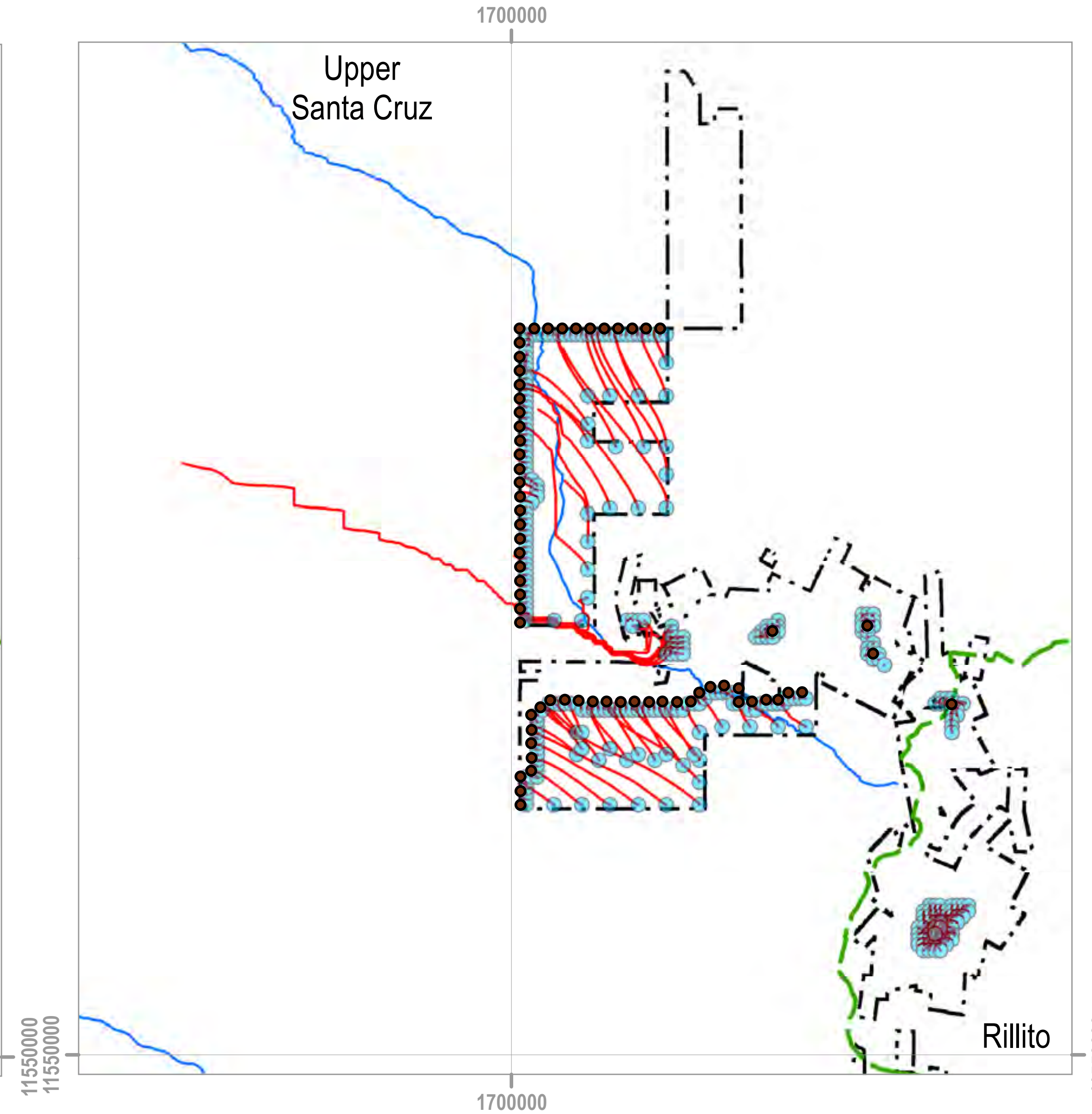
PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company
PROJECT:	Rosemont Copper World Project
JOB:	4286
DRAWN:	PMH
CHECKED:	BG
DATE:	May 2022
FIGURE:	4.12



Discharge Impact Analysis

Model: f37a



Pump-Back Alternative

Model: f37b

0 4,500 9,000 18,000 Feet

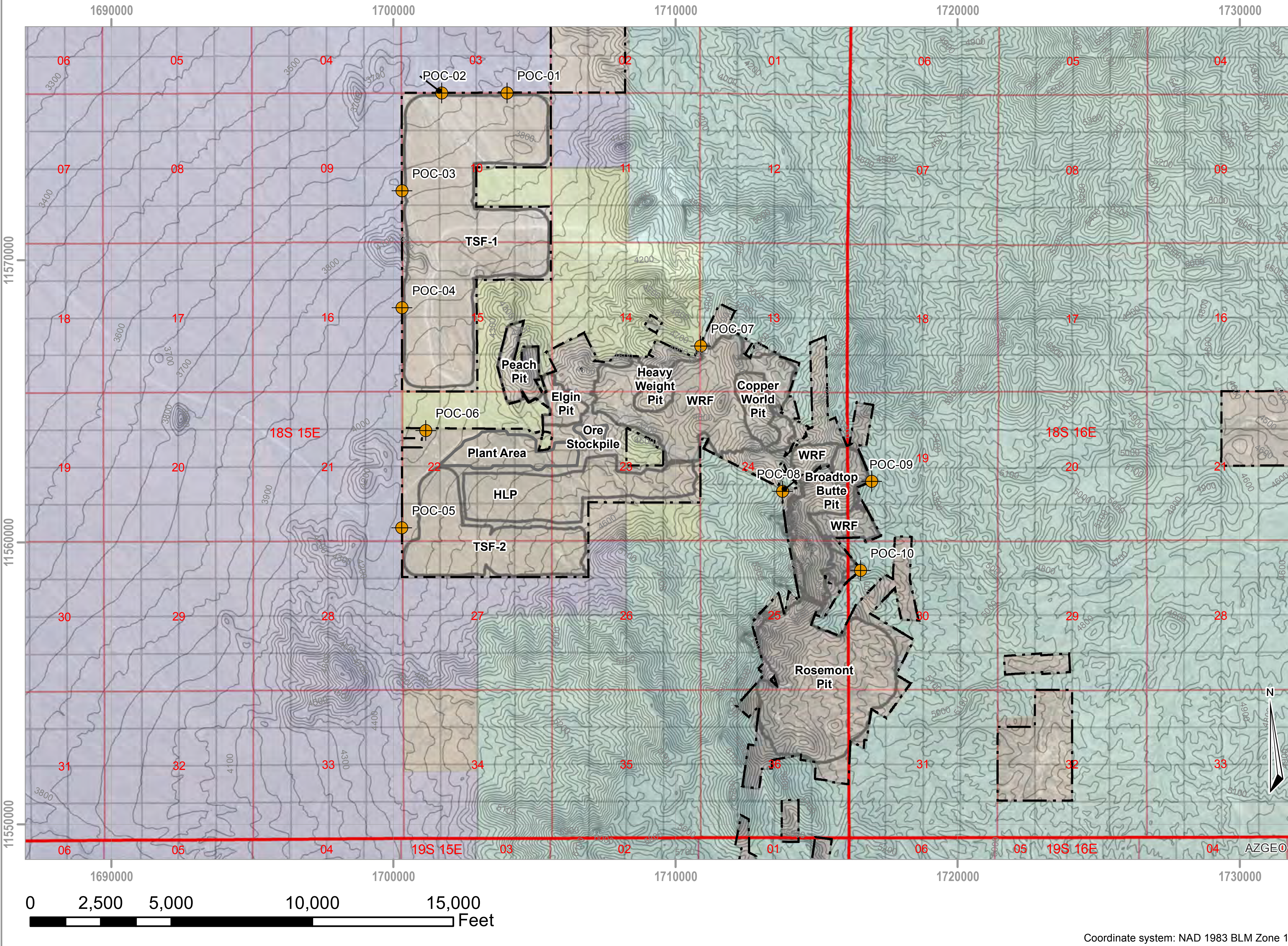
Coordinate system: NAD 1983 BLM Zone 12

- Pump Back Well
- Particle Start
- Private Land Boundaries
- Particle Trace
- Key Streams
- 8th Order Basins

Particle Tracking Results

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company		
PROJECT:	Rosemont Copper World Project		
JOB:	4286		
DRAWN:	PMH	CHECKED:	BG
DATE:	May 2022		
FIGURE:	4.13		



Proposed POC Locations

Facility Outlines

Private Land Boundaries and PMA

Topographic Elevation Contours

PLSS Township

PLSS Sections

PLSS Second Division

BLM

Private

State

USFS

PMA and Proposed Point of Compliance (POC) Wells

PITEAU ASSOCIATES
GEOTECHNICAL AND WATER MANAGEMENT CONSULTANTS
A TETRA TECH COMPANY

CLIENT:	Rosemont Copper Company		
PROJECT:	Rosemont Copper World Project		
JOB:	4286		
DRAWN:	SM	CHECKED:	BG
DATE:	May 2022		
FIGURE:	5.1		

APPENDIX A

Final Calibrated Hydraulic Conductivity and Storativity Values

Appendix A – Final Calibrated Hydraulic Conductivity and Storativity Values

Zone	n	Kxy(ft/d)	Kxy(cm/s)	Kz(ft/d)	Kz(cm/s)	Ss(ft^{-1})	Sy	Units
1	235	3.0E+02	1.06E-01	6.2E+00	2.20E-03	5E-06	0.17	Qal, Active river alluvium
2	510	1.1E+02	3.75E-02	5.0E-01	1.77E-04	5E-06	0.15	Qal, older
3	838	6.3E-01	2.21E-04	1.4E-02	4.76E-06	5E-06	0.10	QTg
4	114	8.2E-03	2.91E-06	8.4E-02	2.98E-05	5E-06	0.10	QTg deep Upper Cienega Basin
5	9663	9.3E-03	3.28E-06	3.5E-01	1.22E-04	5E-06	0.10	QTg Tucson Basin
6	1259	1.9E-01	6.55E-05	1.4E-02	4.86E-06	5E-06	0.05	QTg1 deep Upper Cienega Basin
7	5905	2.3E+00	7.97E-04	9.6E-02	3.38E-05	5E-06	0.05	QTg1 Upper and Lower Cienega Basin
8	1733	1.6E-01	5.48E-05	2.5E-03	8.66E-07	5E-06	0.05	QTg1 Barrel Canyon
9	82	2.5E-02	9.00E-06	3.6E-02	1.28E-05	5E-06	0.05	QTg1 Upper Cienega Creek
10	469	1.6E-03	5.54E-07	3.6E-03	1.28E-06	5E-06	0.05	QTg1 along Davidson Canyon Ridge and Upper Cienega Basin contact with Ksd
12	1220	4.9E-03	1.71E-06	2.9E-02	1.02E-05	5E-06	0.05	QTg2 southeast of Pit, deep
13	19	1.1E+00	3.82E-04	5.2E-01	1.83E-04	5E-06	0.10	Basin fill, West Side, Layer 1
14	7316	1.2E+01	4.36E-03	1.2E+00	4.21E-04	5E-06	0.15	Basin fill, West Side, Layer 1
15	924	3.4E+00	1.20E-03	2.0E+00	7.05E-04	5E-06	0.15	Basin fill, West Side, Layer 1
16	1049	1.5E+01	5.27E-03	8.2E+00	2.89E-03	5E-06	0.20	Basin fill, West Side, Layer 1
17	6262	3.8E-01	1.33E-04	1.2E+00	4.14E-04	5E-06	0.10	Basin fill, West Side, Layer 2
18	1618	1.6E+01	5.74E-03	2.6E-01	9.11E-05	5E-06	0.10	Basin fill, West Side, Layer 2
19	1404	4.6E+00	1.62E-03	1.1E+00	3.85E-04	5E-06	0.10	Basin fill, West Side, Layer 2
20	5285	1.8E-01	6.36E-05	8.0E-03	2.81E-06	5E-06	0.10	Basin fill, West Side, Layer 3
21	2870	4.2E-02	1.49E-05	1.5E-01	5.28E-05	5E-06	0.10	Basin fill, West Side, Layer 3
22	764	7.8E+00	2.73E-03	3.9E-01	1.37E-04	5E-06	0.10	Basin fill, West Side, Layer 3 Not in domain
27	16196	1.3E-01	4.45E-05	4.9E-04	1.72E-07	5E-06	0.05	Tsm, Middle Miocene to Oligocene Basin-fill sedimentary units
28	26164	6.7E-02	2.38E-05	4.9E-04	1.73E-07	5E-06	0.05	Tsy, Pliocene to Middle Miocene Basin-fill sedimentary units
31	647	1.5E-01	5.15E-05	3.0E-01	1.05E-04	1E-06	0.01	Tsp Lower Cienega Creek
32	208	6.4E-04	2.28E-07	2.1E-04	7.36E-08	1E-06	0.01	Tsp Barrel Canyon and lower Davidson Canyon
36	4538	2.0E-03	6.99E-07	5.1E-04	1.79E-07	1E-06	0.01	KTi Mt Fagan area
37	13062	3.1E-02	1.08E-05	3.0E-02	1.06E-05	1E-06	0.01	KTi at surface

Zone	n	Kxy(ft/d)	Kxy(cm/s)	Kz(ft/d)	Kz(cm/s)	Ss(ft^{-1})	Sy	Units
38	10088	2.2E-02	7.81E-06	1.9E-02	6.84E-06	1E-06	0.01	KTi southern facilities
39	78	1.1E-02	3.79E-06	2.0E-02	6.96E-06	1E-06	0.01	KTi Quartz Monzonite Porphyry
40	17858	3.0E-03	1.06E-06	1.8E-02	6.46E-06	1E-06	0.01	KTi at west boundary and Empire Mts
44	2920	9.9E-03	3.51E-06	7.7E-01	2.70E-04	1E-06	0.01	Kv shallow
45	3000	1.2E-03	4.27E-07	4.0E-04	1.42E-07	1E-06	0.01	Kv Mt Fagan, deep
46	148	2.6E+01	9.30E-03	5.7E+00	2.01E-03	1E-06	0.01	Kv Barrel Canyon
47	376	1.1E-02	3.88E-06	3.4E-03	1.20E-06	1E-06	0.01	Kv Andesite
51	1828	1.7E-02	5.83E-06	8.6E-03	3.05E-06	1E-06	0.01	TKg Early Tertiary to Late Cretaceous Granitic Rocks, undivided
52	287	4.7E-03	1.65E-06	9.0E-03	3.16E-06	1E-06	0.01	TKv Early Tertiary to Late Cretaceous Volcanic Rocks, undivided
54	251	3.2E-03	1.11E-06	3.2E-03	1.13E-06	1E-06	0.01	*Ksd surface south of Pit & Ksd surface south Santa Rita Mts*
55	3527	2.6E-01	9.00E-05	2.6E-01	9.00E-05	1E-06	0.01	*Ksd surface south of Rosemont Pit & (minor) pCb shallow*
56	1633	1.5E-02	5.35E-06	1.5E-02	5.36E-06	1E-06	0.01	Ksd surface south of Rosemont Pit
57	6875	7.6E-02	2.69E-05	1.9E-02	6.55E-06	1E-06	0.01	Ksd surface regional
58	68232	5.0E-03	1.76E-06	1.0E-02	3.53E-06	1E-06	0.01	Ksd deep regional
59	2854	6.8E-03	2.41E-06	2.4E-02	8.56E-06	1E-06	0.01	Ksd surface near Rosemont Pit
60	1183	5.6E-03	1.97E-06	4.9E-03	1.74E-06	1E-06	0.01	Ksd in Davidson Canyon
61	287	1.5E-02	5.32E-06	1.1E-02	3.93E-06	1E-06	0.01	Ksd surface south Santa Rita Mts
62	1506	2.5E-04	8.82E-08	2.7E-03	9.54E-07	1E-06	0.01	Ksd Glance
63	618	3.4E-03	1.22E-06	3.0E-04	1.07E-07	1E-06	0.01	Ksd Arkose deep north of Graben Fault
64	7023	1.1E-02	3.86E-06	2.5E-03	8.83E-07	1E-06	0.01	Ksd Arkose deep south of Graben Fault
65	1860	1.0E-04	3.53E-08	5.0E-04	1.76E-07	1E-06	0.01	*Ksd Arkose deep north of Graben Fault*
68	679	9.3E-03	3.28E-06	1.7E-02	6.05E-06	1E-06	0.01	KJs undivided Cretaceous and Upper Jurissic sedimentary rocks
69	2426	2.0E-02	7.20E-06	4.8E-02	1.68E-05	1E-06	0.01	Jvs undivided Jurassic Sedimentary Rocks
70	25	1.0E-02	3.53E-06	1.0E-02	3.53E-06	1E-06	0.01	Jg undivided Jurassic Granitic Rocks Not in domain
76	367	1.1E-02	3.72E-06	2.9E-01	1.02E-04	1E-06	0.01	Ps Scherrer
77	1908	4.7E-04	1.64E-07	8.2E-04	2.90E-07	1E-06	0.01	Pce Colina-Epitaph
78	340	1.5E-03	5.32E-07	2.6E-03	9.28E-07	1E-06	0.01	PPeu Upper Earp
79	638	1.3E-02	4.64E-06	8.4E-04	2.95E-07	1E-06	0.01	PPe Earp
80	1242	1.9E-02	6.68E-06	8.6E-04	3.04E-07	1E-06	0.01	Pnh Horquilla

Zone	n	Kxy(ft/d)	Kxy(cm/s)	Kz(ft/d)	Kz(cm/s)	Ss(ft^{-1})	Sy	Units
81	1139	3.1E-02	1.11E-05	1.5E-02	5.43E-06	1E-06	0.01	Meu Escabrosa upper
82	286	1.6E-03	5.78E-07	3.1E-05	1.08E-08	1E-06	0.01	Mel Escabrosa lower
83	1212	3.4E-02	1.20E-05	1.3E-03	4.72E-07	1E-06	0.01	Dm Martin
84	223	2.3E-02	8.13E-06	5.5E-04	1.94E-07	1E-06	0.01	Ca Abrigo
85	560	2.5E-02	8.90E-06	3.2E-04	1.12E-07	1E-06	0.01	Cb Bolsa Quartzite
88	581	1.2E-02	4.41E-06	6.6E-03	2.33E-06	1E-06	0.01	Pz shallow
89	9548	2.0E-02	7.18E-06	1.1E-02	3.92E-06	1E-06	0.01	Pz shallow north of Pit
90	38117	5.0E-05	1.76E-08	7.1E-04	2.51E-07	1E-06	0.01	Pz north of Pit
91	15064	4.7E-04	1.66E-07	1.7E-03	6.08E-07	1E-06	0.01	Pz deep
92	3233	6.3E-02	2.22E-05	5.0E-06	1.76E-09	5E-06	0.01	Pz deep east of Pit
93	6573	6.6E-03	2.34E-06	7.7E-02	2.71E-05	1E-06	0.01	PP, undivided
94	7901	2.7E-02	9.59E-06	2.8E-03	9.76E-07	1E-06	0.01	MC, undivided
95	154	2.8E-01	9.99E-05	1.6E-02	5.72E-06	1E-06	0.01	Pz, undivided
97	4893	3.6E-02	1.27E-05	3.6E-02	1.27E-05	1E-06	0.01	*pCb shallow*
98	1109	3.4E-02	1.20E-05	3.4E-02	1.20E-05	1E-06	0.01	*pCb shallow*
99	103849	1.1E-04	3.81E-08	2.6E-05	9.25E-09	1E-06	0.01	pCb deep
100	10097	2.6E-03	9.13E-07	2.5E-03	8.99E-07	1E-06	0.01	pCb shallow
101	589	7.1E-03	2.50E-06	4.8E-03	1.69E-06	1E-06	0.01	pCb Empire Mts
102	144	2.4E-04	8.40E-08	5.4E-04	1.91E-07	1E-06	0.01	Xp Pinal Schist
105	480	5.5E-03	1.93E-06	5.4E-03	1.92E-06	1E-06	0.01	*Backbone Fault north*
106	1510	4.8E-04	1.70E-07	4.3E-04	1.52E-07	1E-06	0.01	Backbone Fault north
107	333	4.8E-04	1.69E-07	5.8E-04	2.06E-07	1E-06	0.01	Lower Backbone Fault
108	482	4.8E-04	1.68E-07	4.8E-04	1.69E-07	1E-06	0.01	Upper Backbone Fault
109	389	2.4E-02	8.40E-06	3.8E-02	1.34E-05	1E-06	0.01	Z Fault
110	99	3.6E-04	1.28E-07	1.0E-03	3.66E-07	1E-06	0.01	Imbricate Fault
111	318	3.4E-04	1.20E-07	3.1E-04	1.08E-07	1E-06	0.01	East Graben Clip Fault
112	1128	1.0E-04	3.55E-08	1.0E-04	3.55E-08	1E-06	0.01	Graben Fault
113	116	9.9E+00	3.48E-03	8.8E-02	3.11E-05	1E-06	0.01	Rattlesnake Fault
114	495	2.9E-02	1.03E-05	2.7E-02	9.38E-06	1E-06	0.01	Weigles Fault South

Zone	n	Kxy(ft/d)	Kxy(cm/s)	Kz(ft/d)	Kz(cm/s)	Ss(ft^{-1})	Sy	Units
115	548	1.4E-02	5.02E-06	1.3E-02	4.67E-06	1E-06	0.01	Weigles Fault North
116	214	1.1E-04	3.79E-08	1.1E-04	3.79E-08	1E-06	0.01	Low Angle Fault North of Graben
117	256	7.4E-01	2.60E-04	3.3E-01	1.16E-04	1E-06	0.01	Low Angle Fault South of Graben
120	142	1.5E-02	5.29E-06	1.5E-02	5.29E-06	1E-06	0.01	*(mostly) Graben Fault, (some) East Graben Clip Fault + 4 other zones*
124	380	7.6E+00	2.67E-03	4.2E+00	1.49E-03	1E-06	0.01	Major fault
125	1721	1.2E-01	4.15E-05	3.4E-01	1.20E-04	1E-06	0.01	Minor fault
126	506	5.6E-01	1.97E-04	1.7E-01	6.16E-05	1E-06	0.01	Minor fault
127	148	6.3E+01	2.22E-02	8.7E+00	3.07E-03	1E-06	0.01	Fault south of Santa Rita Mts
128	1096	1.5E+00	5.28E-04	2.8E+00	9.76E-04	1E-06	0.01	Davidson Canyon fault
129	22	9.8E+00	3.44E-03	5.9E+00	2.08E-03	1E-06	0.01	Davidson Canyon fault
130	984	1.7E-01	5.82E-05	5.6E-03	1.98E-06	1E-06	0.01	Facility Fault 1 in pC
131	799	7.5E-02	2.65E-05	6.5E-01	2.29E-04	1E-06	0.01	Facility Fault 1 in KTi
132	1089	2.0E-02	7.06E-06	5.6E-01	1.98E-04	1E-06	0.01	Facility Fault 2 in pC
133	268	2.6E-02	9.05E-06	2.6E-02	9.05E-06	1E-06	0.01	Facility Fault 2 in KTi
134	747	2.5E-02	8.82E-06	2.5E-03	8.82E-07	1E-06	0.01	Facility Fault 3 in pC
135	483	2.5E-02	8.82E-06	2.5E-03	8.82E-07	1E-06	0.01	Facility Fault 3 in KTi

Notes:

- “n” is the number of cells assigned to each zone.
- Colors coincide with the colors used on Figure 3.4.
- Omitted zone numbers were not used in the active model domain.

APPENDIX B

Final Calibrated Recharge and Evapotranspiration Values

Appendix B – Final Calibrated Recharge and Evapotranspiration Values

Recharge Zone	nR	Recharge, ft/d	in/yr	ET Zone	nE	ET_Rate, ft/d	in/yr	ExD, ft
4	13	2.49E-05	0.11	1	-	0	0	0
5	13	6.81E-05	0.30	2	106	1.03E-02	45.32	25
6	10	1.33E-04	0.58	3	14	8.05E-03	35.30	25
8	46	2.61E-04	1.14	4	3	1.28E-02	56.17	25
9	37	2.05E-03	8.97	5	1	1.39E-02	60.98	25
10	91	4.56E-03	20.00	6	1	1.39E-02	61.08	25
11	126	8.20E-04	3.59	7	8	1.39E-02	60.97	25
12	140	8.43E-04	3.69	8	52	3.08E-02	135.12	25
14	164	8.86E-04	3.88	9	4	3.42E-02	150.00	25
15	325	1.09E-03	4.79	10	4	1.37E-02	60.26	25
16	175	5.96E-04	2.61	11	8	1.16E-02	50.73	25
21	5187	2.83E-05	0.12	12	15	3.19E-02	139.80	25
22	3794	2.00E-04	0.87	17	10	5.48E-03	24.01	14.5
23	9406	2.64E-05	0.12	18	7	4.46E-03	19.56	15.6
24	15497	3.30E-05	0.14	19	2	3.68E-03	16.11	9.1
25	291	3.07E-04	1.35	20	74	1.58E-03	6.91	5.7
26	3888	2.00E-04	0.87	21	49	9.12E-03	39.98	10.0
				22	76	6.14E-03	26.89	17.3
				23	203	5.89E-03	25.84	10.9

Notes:

- nR is the number of cells in each recharge zone. nE is the number of cells in each evapotranspiration zone.
- ExD is the extinction depth.
- Colors coincide with the colors used on Figures 3.5 and 3.6.
- Unlisted zones were not used in the model.
- Colors coincide with the colors used on Figures 3.5 and 3.6.

APPENDIX C

Calibration Targets

Appendix C – Calibration Targets

Name	X	Y	Layer	Observed	Weight	Source
AZ0336	1747332.68	11498730.31	3	4667.00	0.5	East
AZ0338	1747247.38	11499032.15	2	4676.00	0.5	East
AZ0424	1729337.27	11509786.75	3	4730.00	0.5	East
AZ0530	1748218.50	11519842.52	4	4640.00	1	East
AZ0531	1742952.76	11519826.12	2	4701.00	0.5	East
AZ0538	1748822.18	11519947.51	2	4622.00	0.5	East
AZ0549	1737595.14	11521223.75	1	4731.00	0.2	East
AZ0554	1734829.40	11522227.69	3	4709.00	1	East
AZ0564	1734655.51	11522427.82	2	4705.00	0.5	East
AZ0602	1719274.93	11528854.99	1	5178.00	0.5	East
AZ0713	1716725.72	11549757.22	1	5179.00	0.2	East
AZ0714	1716640.42	11549858.92	1	5173.00	0.2	East
AZ0718	1774084.97	11550660.76	2	4351.00	0.5	East
AZ0759	1775613.52	11555600.39	1	4324.00	0.2	East
AZ0760	1733700.79	11555859.58	1	4619.00	0.2	East
AZ0804	1789127.30	11561515.75	4	4348.00	0.5	East
AZ0817	1743940.29	11563064.30	1	4384.00	0.5	East
AZ0818	1743769.69	11563061.02	1	4363.00	1	East
AZ0864	1709612.86	11569438.98	3	4209.00	1	East
AZ0865	1709527.56	11569438.98	2	4214.92	1	East
AZ0867	1702198.16	11569425.85	2	3835.00	0.2	East
AZ0873	1701938.98	11569829.40	2	3802.00	0.2	East
AZ0879	1702798.56	11570839.90	1	3766.00	0.2	East
AZ0895	1743844.87	11573596.77	6	3977.76	0.5	East
AZ0910	1743300.52	11574776.90	1	4060.00	0.2	East
AZ0914	1743300.52	11574776.90	2	4068.00	0.5	East
AZ1154	1786023.62	11600997.38	3	3661.06	1	East
AZ1172	1728661.42	11602516.40	4	3466.00	0.5	East
AZ1173	1728146.33	11602513.12	2	3454.00	0.2	East
AZ1359	1771840.55	11616394.36	1	3532.00	0.5	East
AZ1361	1762716.54	11616463.25	1	3423.00	1	East
AZ1377	1760816.93	11617263.78	2	3413.00	0.5	East
AZ1432	1709845.80	11622877.30	6	2609.02	1	East
AZ5001	1746087.51	11619102.42	5	3340.72	1	East
AZ5002	1736162.90	11613196.91	6	3099.37	0.5	East
AZ5003	1749540.85	11616518.54	2	3397.80	0.5	East
AZ5004	1807850.80	11622661.86	4	3852.48	0.5	East
AZ5005	1805217.94	11620499.80	3	3883.77	0.5	East
AZ5006	1799914.80	11620421.07	3	3908.69	0.5	East
AZ5007	1703307.22	11605186.52	5	2651.00	1	East

Name	X	Y	Layer	Observed	Weight	Source
AZ5008	1702637.93	11606538.22	5	2642.70	1	East
AZ5009	1708628.77	11596564.44	5	2806.80	1	East
AZ5010	1710613.68	11593962.73	5	2897.80	1	East
AZ5011	1707323.00	11586065.75	6	3064.40	1	East
AZ5012	1707323.00	11584126.77	6	3162.90	1	East
AZ5013	1733539.84	11610167.07	5	3089.70	0.1	East
AZ5014	1728284.25	11609602.53	5	2977.40	1	East
AZ5015	1730269.19	11605927.99	4	3298.70	1	East
AZ5016	1727634.65	11605275.10	4	3310.20	1	East
AZ5017	1734868.93	11607250.16	5	3332.70	1	East
AZ5018	1730980.97	11593362.86	3	3674.00	1	East
AZ5019	1739540.88	11590717.98	4	3798.30	1	East
AZ5020	1742195.08	11588759.32	3	3855.70	1	East
AZ5021	1729015.91	11590051.97	2	4040.60	1	East
AZ5022	1729022.31	11588743.44	2	4087.00	1	East
AZ5023	1731017.06	11587440.94	3	4116.00	1	East
AZ5024	1725711.94	11590705.38	4	3931.00	0.2	East
AZ5025	1723743.60	11588736.35	5	4058.20	0.5	East
AZ5026	1721775.10	11588736.35	2	3940.80	1	East
AZ5027	1721781.50	11587417.98	3	4035.00	1	East
AZ5028	1721112.37	11590711.42	4	3840.40	0.5	East
AZ5029	1717860.89	11590702.10	3	3694.00	1	East
AZ5030	1718510.66	11589385.96	3	3785.10	1	East
AZ5031	1716528.87	11586742.13	3	3759.00	1	East
AZ5032	1719166.67	11588070.87	3	3822.00	1	East
AZ5033	1719823.00	11587410.89	3	3959.90	1	East
AZ5035	1778289.07	11608449.33	4	3580.28	0.5	East
AZ5036	1748933.92	11609973.26	4	3522.20	1	East
AZ5037	1749580.25	11602791.47	4	3651.20	1	East
AZ5038	1768021.88	11602351.84	4	3732.00	0.5	East
AZ5039	1748310.56	11596905.64	4	3650.60	1	East
AZ5040	1750899.15	11598214.70	4	3733.90	1	East
AZ5041	1749410.94	11596874.53	2	3687.08	0.5	East
AZ5042	1750931.99	11593634.65	4	3839.90	1	East
AZ5043	1750279.07	11593634.65	1	3795.90	0.5	East
AZ5044	1759450.13	11594976.21	1	3913.00	0.2	East
AZ5045	1765400.52	11592430.58	3	3993.20	1	East
AZ5046	1747699.54	11585629.82	1	3875.66	0.2	East
AZ5047	1747713.25	11581840.55	3	3973.00	1	East
AZ5048	1748145.78	11581835.03	4	4054.61	0.5	East
AZ5049	1750282.15	11581879.92	2	4142.00	1	East

Name	X	Y	Layer	Observed	Weight	Source
AZ5050	1794091.21	11607601.71	3	3781.04	1	East
AZ5051	1809351.70	11602802.86	3	3898.37	0.5	East
AZ5052	1808056.10	11602776.62	3	3937.40	0.5	East
AZ5053	1807433.40	11601438.03	3	3897.30	0.5	East
AZ5054	1807445.86	11600772.01	3	3871.80	0.5	East
AZ5055	1808116.45	11600122.40	3	3845.05	0.5	East
AZ5056	1800850.44	11602045.00	3	3831.79	0.5	East
AZ5057	1801513.82	11600729.38	3	3851.34	0.5	East
AZ5058	1801515.46	11600069.92	4	3804.62	0.5	East
AZ5059	1802835.00	11600066.64	3	3860.70	0.5	East
AZ5060	1786650.56	11597424.02	4	3705.20	1	East
AZ5061	1781935.96	11601971.26	4	3692.00	1	East
AZ5062	1801115.29	11590875.72	2	4007.70	0.5	East
AZ5063	1782720.73	11582120.67	1	3999.28	0.2	East
AZ5065	1810747.66	11599512.16	3	3877.71	0.5	East
AZ5066	1715282.35	11572893.14	5	4178.10	0.5	East
AZ5067	1703973.29	11564408.89	2	4112.60	0.5	East
AZ5069	1702227.69	11554071.52	1	4563.48	0.2	East
AZ5070	1705298.79	11551836.68	1	4826.50	0.5	East
AZ5071	1742857.61	11580836.61	3	3979.00	1	East
AZ5072	1742847.77	11578871.39	4	4034.00	1	East
AZ5073	1745067.99	11578167.02	5	3864.06	0.5	East
AZ5074	1745262.47	11575580.71	3	4067.00	1	East
AZ5075	1747083.56	11574271.10	3	4101.80	1	East
AZ5076	1746473.33	11573624.77	3	4052.10	1	East
AZ5077	1744655.74	11572975.16	4	4057.20	1	East
AZ5078	1742837.93	11571666.67	3	4134.00	1	East
AZ5079	1746470.08	11570373.46	3	4208.20	1	East
AZ5080	1742771.98	11566392.03	2	4227.00	0.2	East
AZ5084	1742211.55	11557834.09	3	4421.80	1	East
AZ5086	1741545.54	11554510.60	2	4479.30	1	East
AZ5087	1757401.57	11578723.75	2	4384.00	1	East
AZ5088	1751578.08	11580606.96	3	4144.00	1	East
AZ5089	1747726.61	11580563.78	4	4012.20	1	East
AZ5090	1749015.75	11572824.80	3	4228.00	1	East
AZ5091	1754898.56	11565790.12	2	4490.70	0.5	East
AZ5092	1757460.93	11565783.56	1	4411.90	1	East
AZ5093	1749495.13	11564370.95	2	4587.80	0.5	East
AZ5094	1752329.66	11561856.40	2	4563.00	1	East
AZ5095	1751037.04	11552683.14	2	4466.20	1	East
AZ5096	1762812.14	11552595.11	2	4317.00	0.5	East

Name	X	Y	Layer	Observed	Weight	Source
AZ5098	1768683.76	11554598.46	1	4274.00	0.5	East
AZ5102	1711253.54	11528883.89	1	5483.20	0.5	East
AZ5105	1736945.34	11544389.64	2	4695.42	0.2	East
AZ5106	1733334.12	11540111.78	3	4671.50	0.2	East
AZ5108	1741875.03	11538854.69	3	4599.00	0.5	East
AZ5112	1718586.22	11531154.27	1	5200.50	0.5	East
AZ5113	1716401.77	11528842.19	1	5329.80	0.5	East
AZ5114	1736450.97	11534177.10	4	4648.51	0.5	East
AZ5115	1739932.68	11528294.16	3	4688.49	0.5	East
AZ5116	1720197.60	11519066.44	1	5060.00	0.2	East
AZ5117	1734649.74	11522134.06	2	4705.00	0.5	East
AZ5118	1748441.90	11548788.78	3	4502.90	0.5	East
AZ5119	1760256.30	11537562.14	2	4454.00	0.5	East
AZ5120	1776715.68	11530281.56	3	4462.04	0.5	East
AZ5121	1750244.63	11523442.11	4	4605.54	0.5	East
AZ5122	1749793.67	11522820.90	4	4606.20	0.5	East
AZ5123	1748278.41	11523435.54	4	4651.63	0.5	East
AZ5124	1748467.19	11519701.48	4	4651.58	0.5	East
AZ5125	1755506.09	11520384.37	3	4558.96	0.5	East
AZ5126	1774001.77	11520406.96	3	4502.00	0.5	East
AZ5128	1727424.87	11514293.93	3	4790.90	1	East
AZ5129	1722136.12	11514313.62	2	4841.10	1	East
AZ5130	1718963.55	11512988.16	1	5098.40	1	East
AZ5131	1724789.40	11510282.71	2	4766.10	1	East
AZ5132	1736592.75	11507583.43	2	4675.00	0.2	East
AZ5133	1760303.51	11515822.15	1	4574.00	0.2	East
AZ5134	1755707.81	11513246.06	3	4617.50	0.5	East
AZ5135	1753732.55	11509783.04	1	4639.00	0.2	East
AZ5136	1755516.65	11507707.21	3	4624.35	0.5	East
AZ5137	1751758.53	11506997.70	1	4650.00	0.2	East
AZ5138	1747604.15	11503655.38	3	4619.46	0.5	East
AZ5139	1747630.29	11497726.91	3	4627.30	0.5	East
AZ5140	1755515.89	11502428.35	3	4635.37	0.5	East
AZ5141	1758851.46	11499337.80	3	4663.52	0.5	East
AZ5142	1764323.75	11498708.23	2	4665.00	0.5	East
AZ5143	1758213.27	11496043.84	2	4700.21	0.5	East
AZ5144	1762822.48	11494075.33	2	4666.52	0.5	East
AZ5145	1753773.92	11495201.21	2	4666.77	0.2	East
AZ5146	1748301.18	11495742.00	4	4752.58	1	East
AZ5147	1750947.76	11491768.91	2	4629.77	0.5	East
AZ5148	1749656.66	11487116.68	2	4677.47	1	East

Name	X	Y	Layer	Observed	Weight	Source
AZ5149	1760428.44	11491463.29	1	4693.00	0.2	East
AZ5150	1772133.40	11505282.78	3	4556.91	0.5	East
DH-1541	1730016.23	11546637.01	3	4774.79	0.2	East
E-1	1749100.13	11532947.41	4	4569.00	1	East
A-841	1715806.94	11554773.48	7	5143.60	0.5	East
A-886	1718120.08	11555406.82	2	5058.22	0.5	East
AH-8	1716522.31	11552019.36	5	5054.79	0.5	East
AR-2050	1716893.86	11553810.50	6	5039.25	1	East
AZ0621	1727693.57	11533720.47	4	4704.75	0.5	East
AZ0652	1735127.95	11538592.52	3	4695.90	0.5	East
AZ1129	1727358.92	11599530.84	1	3584.97	0.2	East
AZ5034	1736646.98	11585711.94	2	4147.31	0.5	East
AZ5081	1741377.95	11566633.86	3	4212.55	0.5	East
AZ5082.2	1740127.95	11560590.55	1	4357.25	0.2	East
AZ5083	1745771.00	11561138.45	1	4411.21	0.2	East
BC-2A	1735331.23	11565589.86	1	4382.73	0.5	East
BC-2B	1735331.23	11565589.86	2	4339.28	0.5	East
C-1	1718744.36	11558374.54	7	5022.32	1	East
C-13	1723747.87	11558500.69	2	4728.91	0.2	East
DC-3A	1744747.17	11579655.32	1	4001.96	0.5	East
DC-3BR	1744740.60	11579652.04	1	4001.47	0.5	East
DH-1445	1708402.23	11554045.28	1	5399.65	0.5	East
DH-1446	1709091.07	11552906.68	1	5569.90	0.5	East
DH-1455	1729341.86	11563728.02	6	4511.60	0.5	East
DH-1490	1736259.84	11558431.76	5	4460.42	0.5	East
DH-1494	1734511.15	11561541.99	1	4422.43	0.1	East
DH-1497	1734596.46	11553412.07	5	4643.49	0.5	East
DH-1537	1721856.30	11550334.65	5	4893.33	0.5	East
DH-1541	1730019.69	11546660.10	4	4771.73	0.5	East
E-6	1736948.82	11544412.73	5	4695.70	1	East
E-7	1761082.68	11543825.46	5	4383.85	1	East
Empire_Windmill	1739133.86	11536817.59	3	4707.40	0.5	East
Enzenberg_well	1720124.67	11535055.77	5	4729.50	0.5	East
Field_well	1730511.81	11534911.42	3	4699.53	0.5	East
G-35	1723912.73	11555784.12	5	4764.30	0.5	East
Gayler	1723058.40	11552589.90	5	4810.37	0.5	East
Gayler2	1723024.93	11552595.14	5	4820.83	0.5	East
HB-2131	1714340.55	11553185.70	4	5154.91	1	East
HB-2142	1715406.82	11553451.44	3	5150.80	1	East
HB-2146	1714396.32	11553750.00	4	5153.17	1	East
HB-2174	1716332.02	11556899.61	3	5135.39	1	East

Name	X	Y	Layer	Observed	Weight	Source
HC-1A	1712646.69	11548955.94	2	5430.31	1	East
HC-1B	1712650.39	11548926.28	3	5425.78	0.8	East
HC-2A	1720921.92	11548313.65	4	4949.25	1	East
HC-2B	1720921.92	11548313.65	6	4888.40	1	East
HC-3A	1721810.43	11555619.39	1	4822.71	1	East
HC-3B	1721831.14	11555643.93	4	4818.57	1	East
HC-3C	1721848.16	11555650.20	5	4819.65	0.8	East
HC-4A	1724229.00	11561804.46	3	4900.01	1	East
HC-4B	1724208.66	11561782.81	5	4648.65	1	East
HC-5A	1718129.95	11560013.94	3	5082.01	1	East
HC-5B	1718146.98	11559986.88	5	5038.33	1	East
HC-6	1715256.46	11548787.73	6	5245.70	1	East
Hidden_Valley_Stock	1731666.67	11564087.93	1	4450.85	0.2	East
Hilltop_Windmill	1726627.30	11536482.94	4	4687.42	0.5	East
HV-1	1729363.52	11563674.54	4	4504.88	1	East
HV-2	1730636.48	11564311.02	4	4477.40	0.5	East
Lorensten	1731850.21	11531932.32	3	4793.50	0.5	East
MAATR_well	1705859.45	11561315.46	2	4276.70	0.5	East
Mulberry_Stock	1736258.60	11568926.61	1	4288.55	0.2	East
Munger	1735150.73	11532680.35	3	4717.47	0.5	East
Oaktree_Windmill	1738182.41	11545029.53	3	4687.02	0.5	East
Old_Dick	1708753.28	11564271.65	2	4358.00	0.1	East
P-899	1722240.81	11558982.94	11	4823.29	0.5	East
PC-1	1717273.62	11556981.63	4	5137.55	1	East
PC-2	1717585.30	11555583.99	5	5150.34	0.5	East
PC-3	1716810.70	11553661.09	5	4998.42	0.5	East
PC-4	1715889.11	11551916.01	5	5095.01	1	East
PC-6	1716515.75	11557840.81	5	5145.07	1	East
Picnic_Well	1730653.22	11560125.00	1	4521.49	0.2	East
Rosemont_Ranch	1726322.18	11534130.58	3	4706.59	0.5	East
RP-2A	1730511.15	11560042.75	1	4509.92	1	East
RP-2B	1730509.91	11560074.34	3	4508.86	1	East
RP-2C	1730516.63	11560105.64	4	4507.41	1	East
RP-3A	1726797.83	11553916.86	4	4749.79	1	East
RP-3B	1726811.68	11553946.19	4	4724.18	1	East
RP-4A	1724034.48	11551414.53	4	4835.42	1	East
RP-4B	1724027.56	11551385.14	5	4825.60	1	East
RP-5	1717111.94	11545177.23	2	5023.58	1	East
RP-6	1734903.94	11566585.40	3	4344.71	1	East
RP-7	1737073.23	11570174.38	3	4249.90	1	East
RP-8	1740731.04	11562054.76	2	4286.71	1	East

Name	X	Y	Layer	Observed	Weight	Source
RP-9	1736270.05	11554884.78	2	4607.96	1	East
Well_9-7	1716541.99	11554625.98	7	5122.01	0.5	East
Windmill	1722621.39	11537247.38	2	4743.83	0.2	East
HB-2110-1-1480	1717379.40	11555671.60	7	5089.68	1	East
HB-2110-2-745	1717379.40	11555671.60	5	5105.77	1	East
HB-2110-3-470	1717379.40	11555671.60	4	5122.23	1	East
HB-2111-1-2248	1715119.40	11554605.10	10	5118.56	1	East
HB-2111-2-1298	1715119.40	11554605.10	6	5118.03	1	East
HB-2111-3-573	1715119.40	11554605.10	4	5145.83	1	East
HB-2126-1-1967	1714815.00	11553681.00	8	5076.53	1	East
HB-2126-2-1407	1714815.00	11553681.00	7	5108.47	1	East
HB-2126-3-737	1714815.00	11553681.00	4	5182.32	1	East
HB-2130-1-1790	1713625.77	11553203.73	7	5122.29	1	East
HB-2130-2-1612	1713700.99	11553199.24	7	5122.07	1	East
HB-2130-3-1317	1713827.85	11553193.62	6	5139.41	1	East
HB-2130-4-1076	1713935.62	11553193.62	5	5126.03	1	East
HB-2130-5-812	1714046.76	11553199.24	4	5123.17	1	East
HB-2154-1-1026	1713478.54	11555052.33	5	5156.56	1	East
HB-2154-2-900	1713545.90	11555041.11	4	5157.69	1	East
HB-2154-3-691	1713658.16	11555024.27	4	5159.63	1	East
HB-2154-4-526	1713745.73	11555015.29	3	5163.64	1	East
HB-2166-1-763	1713907.39	11555948.77	4	5161.20	1	East
HB-2166-2-628	1714024.14	11555906.11	4	5165.20	1	East
HB-2166-3-472	1714156.62	11555858.96	3	5157.32	1	East
HB-2166-4-204	1714383.39	11555780.37	2	5148.65	1	East
HB-2166-5-171	1714412.58	11555771.39	2	5165.71	1	East
PZ-5-1200	1718369.42	11556555.12	6	5108.52	1	East
PZ-5-1900	1718369.42	11556555.12	9	5102.40	1	East
PZ-5-700	1718369.42	11556555.12	5	5094.20	1	East
PZ-7-1245	1714832.68	11556558.40	6	5095.57	1	East
PZ-7-1680	1714832.68	11556558.40	7	5082.65	1	East
PZ-7-1810	1714832.68	11556558.40	8	5071.06	1	East
PZ-7-485	1714832.68	11556558.40	3	5133.50	1	East
PZ-7-800	1714832.68	11556558.40	4	5125.44	1	East
PZ-8-1150	1713608.92	11553635.17	5	5140.67	1	East
PZ-8-1650	1713608.92	11553635.17	7	5117.56	1	East
PZ-8-1925	1713608.92	11553635.17	8	5086.64	1	East
PZ-8-450	1713608.92	11553635.17	3	5176.16	1	East
Box_Canyon_Spring_2	1712247.41	11543108.43	2	4880.10	1	East
Deering_Spring	1714688.35	11546182.58	6	5195.88	1	East
Escondido_Spring	1751194.26	11620844.65	8	3337.75	1	East

Name	X	Y	Layer	Observed	Weight	Source
Fig_Tree_Spring	1719070.50	11564980.00	5	5096.89	1	East
Helvetia_Spring	1709169.98	11567832.84	3	4468.09	1	East
Lower_Mulberry_Spring	1730889.14	11570450.95	7	4537.56	1	East
McCleary_MC-2_Spring	1718467.88	11559962.11	7	5065.77	1	East
Rosemont_Spring	1721994.78	11553010.01	11	4874.94	1	East
Scholefield_SC-1_Spring	1727342.55	11565657.64	8	4718.89	1	East
Sycamore_Spring	1714461.98	11573298.72	5	4163.29	1	East
Upper_Empire_Gulch_Spring	1752614.86	11537970.64	4	4586.67	1	East
Zackendorf_Spring	1710341.24	11568387.30	4	4530.66	1	East
Apache_Spring	1798455.31	11556510.04	1	4724.89	1	East
Little_Nogales_Spring	1802709.88	11573229.36	3	4656.72	1	East
McCleary_MC-1_Spring	1719208.43	11559133.79	5	4994.52	1	East
Nogales_Spring	1805115.35	11572504.30	1	4741.20	1	East
Questa_Spring	1737134.81	11555227.99	1	4599.29	1	East
Reach_2_Spring	1750132.68	11609680.84	1	3493.00	1	East
Silver_Spring	1805700.30	11573519.72	1	4594.47	1	East
Simpson_Spring	1806837.50	11537566.31	1	5294.20	1	East
Wild_Cow_Spring	1808799.48	11542920.70	1	5385.21	1	East
AZ0155	1806965.22	11598569.55	2	3990.00	1	East
AZ0206	1762060.37	11487467.19	1	4786.00	1	East
AZ0249	1755045.93	11491279.53	1	4700.00	0.2	East
AZ0256	1754094.49	11491581.36	2	4674.00	0.2	East
AZ0275	1747696.85	11493375.98	1	4853.00	0.2	East
AZ0297	1754081.36	11495721.78	2	4668.00	0.2	East
AZ0307	1756843.83	11496236.88	2	4675.00	0.2	East
AZ0334	1754504.59	11498854.99	2	4664.00	0.5	East
AZ0337	1757352.36	11498963.25	3	4684.00	0.5	East
AZ0339	1764176.51	11499091.21	2	4668.00	0.5	East
AZ0345	1746601.05	11499333.99	2	4693.00	0.5	East
AZ0348	1750180.45	11499849.08	2	4652.00	0.2	East
AZ0362	1764955.54	11502635.93	2	4628.00	0.5	East
AZ0363	1747841.21	11502670.60	2	4665.00	0.2	East
AZ0367	1763904.20	11503431.76	2	4596.00	0.5	East
AZ0368	1761656.82	11503625.33	2	4651.00	0.5	East
AZ0377	1755951.44	11505019.69	2	4641.00	0.5	East
AZ0391	1773133.20	11506397.64	3	4547.00	0.5	East
AZ0411	1749983.60	11507627.95	2	4657.00	0.2	East
AZ0412	1744281.50	11507913.39	2	4705.00	0.5	East
AZ0416	1737027.56	11508497.38	3	4707.00	0.5	East
AZ0418	1747303.15	11509032.15	2	4655.00	0.5	East
AZ0428	1767851.05	11510213.25	2	4588.00	0.5	East

Name	X	Y	Layer	Observed	Weight	Source
AZ0429	1752480.31	11510160.76	1	4651.00	0.2	East
AZ0431	1742290.03	11510331.36	2	4619.00	0.2	East
AZ0434	1741509.19	11510935.04	2	4729.00	0.5	East
AZ0451	1762660.76	11512618.11	1	4586.00	0.5	East
AZ0454	1768963.25	11512742.78	1	4575.00	0.2	East
AZ0466	1751345.14	11513589.24	1	4642.00	0.2	East
AZ0491	1736574.80	11515465.88	2	4726.00	0.2	East
AZ0508	1733375.98	11516971.78	3	4749.00	0.5	East
AZ0511	1741404.20	11517296.59	1	4762.00	0.2	East
AZ0532	1741827.43	11519924.54	1	4708.00	0.5	East
AZ0533	1749858.92	11519950.79	2	4609.00	0.5	East
AZ0534	1741916.01	11519924.54	1	4719.00	0.2	East
AZ0539	1774659.51	11520383.78	1	4489.00	0.1	East
AZ0542	1750353.62	11520251.44	1	4616.95	0.2	East
AZ0543	1750200.13	11520354.33	4	4642.00	0.5	East
AZ0544	1715410.10	11520259.19	1	5192.00	0.2	East
AZ0546	1736820.87	11520616.80	1	4704.00	0.2	East
AZ0558	1732500.00	11522322.83	2	4707.00	0.5	East
AZ0568	1711348.43	11522979.00	1	5311.00	0.2	East
AZ0576	1743628.61	11523868.11	2	4721.00	1	East
AZ0578	1724885.02	11524248.66	1	4722.15	0.2	East
AZ0581	1729642.39	11524940.94	3	4730.00	0.5	East
AZ0582	1744488.19	11525790.68	1	4685.00	0.2	East
AZ0583	1767099.74	11526069.55	1	4492.00	0.5	East
AZ0587	1760882.55	11527057.09	1	4506.00	0.2	East
AZ0591	1739301.18	11527693.57	2	4712.00	0.5	East
AZ0593	1733261.15	11527880.58	3	4720.00	0.5	East
AZ0601	1758717.19	11529071.52	2	4522.00	0.5	East
AZ0603	1744304.46	11529327.43	2	4701.00	0.5	East
AZ0610	1729366.80	11531302.49	4	4701.00	0.5	East
AZ0629	1717276.90	11534708.01	1	5105.00	0.2	East
AZ0636	1751443.57	11536217.19	3	4495.00	1	East
AZ0639	1773444.88	11536902.89	3	4389.00	0.5	East
AZ0647	1797080.05	11538622.05	2	4924.00	0.5	East
AZ0662	1729340.55	11541607.61	4	4684.00	0.5	East
AZ0669	1753234.91	11542890.42	3	4444.00	0.5	East
AZ0673	1726745.41	11543618.77	3	4705.00	0.2	East
AZ0674	1778077.43	11543992.78	3	4380.00	0.5	East
AZ0677	1725967.85	11544225.72	4	4803.00	0.5	East
AZ0679	1768067.59	11544560.37	1	4355.00	0.2	East
AZ0688	1727775.59	11545643.04	4	4963.00	0.1	East

Name	X	Y	Layer	Observed	Weight	Source
AZ0691	1725531.50	11546040.03	4	4819.00	0.5	East
AZ0702	1767276.90	11548090.55	4	4357.00	1	East
AZ0707	1715692.26	11548845.14	1	5182.00	0.2	East
AZ0710	1721299.21	11549061.68	2	4907.00	0.2	East
AZ0715	1767700.13	11550314.96	4	4321.00	1	East
AZ0719	1792191.60	11551325.46	4	4657.00	0.5	East
AZ0722	1780459.32	11551781.50	3	4376.00	0.5	East
AZ0735	1762427.82	11553024.93	1	4335.00	0.5	East
AZ0746	1770705.38	11553963.25	1	4273.00	0.5	East
AZ0752	1772162.07	11556292.65	2	4265.00	0.5	East
AZ0780	1787335.96	11557568.90	3	4383.00	0.5	East
AZ0790	1705495.41	11559330.71	4	4253.00	1	East
AZ0791	1760419.95	11559783.46	1	4337.00	0.5	East
AZ0794	1730672.57	11560095.14	1	4511.00	0.2	East
AZ0796	1703854.99	11560538.06	2	4289.00	1	East
AZ0822	1746095.80	11563674.54	1	4528.00	0.5	East
AZ0825	1704622.70	11563874.67	3	4146.00	0.5	East
AZ0827	1703241.47	11564478.35	2	4081.00	0.5	East
AZ0831	1782129.27	11565019.69	4	4169.00	0.5	East
AZ0832	1702982.28	11564881.89	1	4061.00	0.2	East
AZ0840	1701774.93	11565990.81	2	3978.00	0.2	East
AZ0852	1701318.90	11567401.57	1	3933.00	0.2	East
AZ0862	1701853.67	11569324.15	1	3860.00	0.2	East
AZ0874	1701768.37	11569829.40	1	3956.00	0.2	East
AZ0877	1701318.90	11570229.66	2	3754.00	0.2	East
AZ0878	1744606.30	11570439.63	3	4080.00	1	East
AZ0885	1702280.18	11571545.28	2	3740.00	0.2	East
AZ0896	1702021.00	11572860.89	2	3638.00	0.2	East
AZ0899	1701318.90	11573261.15	1	3629.00	0.2	East
AZ0953	1772588.58	11579730.97	1	4179.00	0.2	East
AZ0973	1752234.25	11583897.64	1	4107.00	1	East
AZ0978	1712942.91	11584498.03	2	3629.00	0.2	East
AZ0981	1767483.60	11584862.20	1	4226.00	0.2	East
AZ0986	1775669.29	11585095.14	2	4037.00	0.2	East
AZ0990	1751108.92	11585711.94	2	3878.00	0.2	East
AZ0992	1748608.92	11585905.51	1	3895.00	0.5	East
AZ0997	1738526.90	11586177.82	1	4110.00	0.2	East
AZ1016	1737834.65	11587286.75	1	4047.00	0.2	East
AZ1023	1758425.20	11588162.73	2	4049.00	1	East
AZ1025	1735160.76	11588188.98	2	4034.00	0.2	East
AZ1037	1706469.82	11589737.53	5	2815.00	0.2	East

Name	X	Y	Layer	Observed	Weight	Source
AZ1050	1785465.88	11590793.96	3	3773.00	0.5	East
AZ1056	1774694.88	11591456.69	1	3885.00	0.2	East
AZ1069	1780800.52	11594005.91	1	3806.00	0.2	East
AZ1070	1802649.61	11594404.59	4	4007.13	1	East
AZ1073	1770118.11	11594468.50	1	3870.00	0.2	East
AZ1086	1760209.97	11595137.80	4	3941.00	0.5	East
AZ1093	1709210.83	11595426.61	1	2749.47	1	East
AZ1097	1728159.45	11596958.66	2	3691.00	1	East
AZ1100	1810242.78	11597477.03	3	3892.00	0.5	East
AZ1134	1808851.71	11599993.44	3	3885.00	1	East
AZ1136	1745636.48	11599835.96	3	3651.00	0.5	East
AZ1139	1712477.03	11599750.66	6	2762.00	0.5	East
AZ1141	1802173.59	11600729.38	1	3819.00	0.5	East
AZ1151	1786630.58	11600495.41	2	3659.00	0.5	East
AZ1153	1802129.27	11600971.13	2	3991.00	1	East
AZ1156	1738225.07	11601128.61	2	3661.00	0.5	East
AZ1160	1808759.84	11601610.89	2	3886.00	0.2	East
AZ1196	1767837.93	11604963.91	4	3662.00	1	East
AZ1207	1792204.72	11605370.73	3	3775.00	1	East
AZ1209	1789622.70	11605459.32	1	3748.00	0.2	East
AZ1225	1792201.44	11606381.23	4	3766.00	1	East
AZ1230	1782555.77	11606942.26	1	3600.00	0.2	East
AZ1232	1782611.11	11607011.50	3	3625.90	1	East
AZ1236	1807267.06	11607460.63	3	3860.00	1	East
AZ1237	1737083.14	11607365.24	5	3537.00	1	East
AZ1242	1709448.82	11607621.39	6	2637.00	1	East
AZ1253	1799767.06	11609143.70	1	3945.00	0.2	East
AZ1262	1734924.35	11610085.05	5	2872.00	0.1	East
AZ1265	1804654.53	11610668.15	1	3889.93	1	East
AZ1268	1804610.30	11610838.85	1	3908.52	0.5	East
AZ1270	1774271.65	11610748.03	1	3539.00	1	East
AZ1280	1804921.26	11611489.50	1	3894.00	1	East
AZ1282	1805519.57	11611561.19	3	3934.88	1	East
AZ1311	1750242.78	11613487.53	1	3433.00	0.5	East
AZ1312	1736210.63	11613648.29	5	3224.00	0.5	East
AZ1318	1807404.86	11614130.58	2	3880.00	0.2	East
AZ1322	1712965.88	11613891.08	5	2629.00	0.5	East
AZ1325	1780715.22	11614209.32	5	3636.00	1	East
AZ1333	1743782.81	11614780.18	1	3430.00	0.2	East
AZ1373	1744895.01	11616906.17	1	3414.00	0.2	East
AZ1389	1736797.90	11617992.13	4	3209.00	0.5	East

Name	X	Y	Layer	Observed	Weight	Source
AZ1390	1710114.83	11617926.51	5	2705.00	1	East
AZ1422	1735239.50	11622030.84	5	3034.00	1	East
AZ1433	1705200.13	11622867.45	6	2599.00	1	East
AZ4304	1703940.29	11560843.18	3	4281.00	1	East
AZ5000	1704865.49	11617309.71	2	2590.00	1	East
AZ5064	1806792.02	11594849.27	1	3967.21	0.2	East
AZ5097	1765016.40	11552831.36	1	4308.00	0.5	East
AZ5099	1774251.97	11551046.59	2	4293.00	0.5	East
AZ5104	1730016.40	11546660.10	4	4707.00	0.5	East
AZ0645	1761450.13	11537667.32	1	4465.92	0.5	East
AZ5100	1782253.94	11556131.89	2	4357.00	0.5	East
AZ5101	1780455.76	11551758.39	3	4391.00	0.5	East
AZ5107	1746449.28	11543449.74	3	4636.00	1	East
AZ5127	1786036.75	11538471.13	2	4623.00	0.5	East
E-10	1773445.51	11532870.14	4	4466.00	1	East
E-11	1774099.90	11536768.37	3	4405.00	1	East
E-12	1774537.40	11544383.20	5	4385.00	1	East
E-13	1764452.10	11542424.54	6	4380.00	0.5	East
E-14	1766499.34	11502230.97	2	4622.00	1	East
E-3	1755652.13	11532290.65	4	4557.00	1	East
E-4	1753026.44	11542164.96	5	4480.00	1	East
E-5	1762860.89	11528681.10	5	4479.00	1	East
E-8	1764212.93	11538216.44	3	4429.00	1	East
E-9	1765545.60	11543456.20	3	4371.00	1	East
EP-1	1764226.12	11542816.44	5	4370.00	1	East
Frog_Well	1773356.69	11564412.57	1	4176.74	0.5	East
GAC-2	1753045.37	11538878.51	5	4567.00	1	East
GAC-3	1768618.77	11512946.19	4	4582.00	1	East
GAC-4	1757018.11	11521737.60	4	4559.00	1	East
GAC-6	1761610.01	11517804.40	6	4578.00	1	East
North_Canyon_Well	1756394.36	11551689.63	2	4409.00	0.5	East
Sams_Well	1768009.59	11555229.51	1	4210.08	0.2	East
WP-10	1760030.63	11529004.01	1	4505.69	0.2	East
WP-11	1768214.61	11534303.67	1	4428.02	0.5	East
WP-12	1767746.63	11535928.47	1	4419.10	0.5	East
WP-13	1768562.80	11538595.69	1	4398.02	0.5	East
WP-14	1767493.91	11546463.32	1	4328.45	0.2	East
WP-4N	1767495.55	11546463.32	1	4313.04	0.2	East
WP-7	1760030.63	11529004.01	1	4508.10	0.2	East
WP-8	1767830.55	11540604.84	1	4378.06	0.5	East
WP-9	1752728.71	11538672.49	1	4555.97	0.2	East

Name	X	Y	Layer	Observed	Weight	Source
AZ0243	1639537.48	11550711.85	1	2884.00	1	West
AZ0596	1633491.88	11528166.25	1	2959.00	0.165	West
AZ0684	1641596.68	11544930.25	2	2887.00	0.165	West
AZ0720	1640831.08	11550791.05	2	2853.00	0.0825	West
AZ0772	1644659.08	11556731.05	2	2835.00	0.33	West
AZ0815	1647536.68	11562697.45	2	2805.00	0.165	West
AZ0853	1649279.08	11567343.85	3	2783.00	0.165	West
AZ0907	1649279.08	11574128.65	1	2757.00	0.165	West
AZ0920	1648143.88	11575422.25	3	2756.00	0.165	West
AZ0930	1647642.28	11576636.65	1	2754.00	0.33	West
AZ0934	1647378.28	11577032.65	2	2746.00	1	West
AZ0969	1654532.68	11582207.05	1	2705.00	0.165	West
AZ0983	1652288.68	11584609.45	1	2702.00	0.0825	West
AZ1029	1650308.68	11588569.45	1	2703.00	0.0825	West
AZ1109	1654083.88	11597439.85	1	2659.00	0.165	West
AZ1146	1653925.48	11600291.05	1	2645.00	0.33	West
AZ1155	1651760.68	11600792.65	1	2621.00	0.0825	West
AZ1223	1652526.28	11605835.05	2	2628.00	0.33	West
AZ1295	1654691.08	11611801.45	2	2620.00	0.0825	West
AZ1306	1659680.68	11612699.05	1	2616.00	0.0825	West
AZ1323	1656222.28	11614019.05	2	2617.00	0.0825	West
AZ1348	1658492.68	11615629.45	1	2614.00	0.1375	West
AZ1364	1653291.88	11616236.65	2	2597.00	0.1375	West
AZ1434	1657938.28	11623021.45	1	2593.00	0.1375	West
G&H2021-01	1701781.00	11575374.30	1	3581.10	1	2021
G&H2021-07	1700756.90	11570767.40	2	3760.94	1	2021
G&H2021-09_3803	1702125.20	11568569.00	2	3867.70	1	2021
G&H2021-09_3867	1702125.20	11568569.00	1	3880.80	1	2021
G&H2021-10	1701140.10	11567335.00	2	3924.11	1	2021
G&H2021-11	1702757.60	11563613.20	2	4066.43	1	2021
G&H2021-17	1700803.90	11560544.20	2	4020.30	1	2021
G&H2021-22	1705288.80	11561070.80	2	4291.73	1	2021
G&H2021-24_4238	1708372.10	11561990.40	4	4385.80	1	2021
G&H2021-24_4338	1708372.10	11561990.40	4	4389.80	1	2021
G&H2021-25	1710099.00	11562135.90	3	4586.11	1	2021
RNW-HB-091	1709640.60	11563873.80	4	4530.42	1	2021
RNW-HB-096_4356	1711242.00	11566106.00	3	4543.40	1	2021
RNW-HB-096_4526	1711242.00	11566106.00	2	4554.00	1	2021
RNW-HB-105_4202	1711032.00	11565650.00	3	4589.10	1	2021
RNW-HB-105_4407	1711032.00	11565650.00	2	4624.30	1	2021
RNW-HB-108	1710635.00	11565028.00	2	4594.15	1	2021

Name	X	Y	Layer	Observed	Weight	Source
RNW-HB-152_4010	1705429.00	11564496.00	4	4186.90	1	2021
RNW-HB-152_4140	1705429.00	11564496.00	3	4255.20	1	2021
RNW-HB-152_4172	1705429.00	11564496.00	2	4192.70	1	2021
RNW-HB-168	1706030.00	11564099.00	4	4213.50	1	2021

APPENDIX D

Pumping Wells in the Predictive Model

Appendix D – Pumping Wells in the Predictive Model

Group	Name	X	Y	TOPLAY	BOTLAY	Q_0 (cfd)	Q_0 (gpm)	START	END
A	**aPW82-67**	1664221.48	11622651.85	1	2	-38652	-200.8	1	72
A	**aPW82-68**	1666861.48	11622651.85	1	2	-35259	-183.2	1	72
A	**aPW82-73**	1680061.48	11622651.85	1	3	-33946	-176.3	1	72
A	**aPW82-74**	1682701.48	11622651.85	2	2	-59610	-309.7	1	72
A	**aPW82-83**	1706461.48	11622651.85	2	3	-7477	-38.8	1	72
A	**aPW82-84**	1709101.48	11622651.85	2	2	-17146	-89.1	1	72
A	**aPW83-73**	1680061.48	11620011.85	1	3	-21009	-109.1	1	72
A	**aPW83-74**	1682701.48	11620011.85	2	2	-38081	-197.8	1	72
A	**aPW83-81**	1701181.48	11620011.85	2	3	-27898	-144.9	1	72
A	**aPW84-62**	1651021.48	11617371.85	2	3	-86366	-448.7	1	72
A	**aPW84-64**	1656301.48	11617371.85	1	1	-6098	-31.7	1	72
A	**aPW84-67**	1664221.48	11617371.85	1	2	-761	-4.0	1	72
A	**aPW84-71**	1674781.48	11617371.85	2	3	-4349	-22.6	1	72
A	**aPW84-73**	1680061.48	11617371.85	1	3	-22022	-114.4	1	72
A	**aPW84-82**	1703821.48	11617371.85	2	3	-50117	-260.3	1	72
A	**aPW85-62**	1651021.48	11614731.85	1	3	-108238	-562.3	1	72
A	**aPW85-64**	1656301.48	11614731.85	1	2	-24031	-124.8	1	72
A	**aPW86-64**	1656301.48	11612091.85	1	3	-1106	-5.7	1	72
A	**aPW86-71**	1674781.48	11612091.85	1	2	-52984	-275.2	1	72
A	**aPW86-76**	1687981.48	11612091.85	1	2	-224	-1.2	1	72
A	**aPW87-64**	1656301.48	11609451.85	1	3	-51800	-269.1	1	72
A	**aPW87-71**	1674781.48	11609451.85	1	2	-34547	-179.5	1	72
A	**aPW87-77**	1690621.48	11609451.85	1	2	-16	-0.1	1	72
A	**aPW88-63**	1653661.48	11606811.85	1	3	-62063	-322.4	1	72
A	**aPW88-64**	1656301.48	11606811.85	1	3	-42828	-222.5	1	72
A	**aPW88-65**	1658941.48	11606811.85	2	3	-8614	-44.7	1	72
A	**aPW89-62**	1651021.48	11604171.85	1	3	-1970	-10.2	1	72
A	**aPW89-63**	1653661.48	11604171.85	1	3	-59455	-308.9	1	72
A	**aPW89-64**	1656301.48	11604171.85	1	3	-39097	-203.1	1	72
A	**aPW89-66**	1661581.48	11604171.85	1	2	-3245	-16.9	1	72
A	**aPW90-62**	1651021.48	11601531.85	1	3	-9572	-49.7	1	72
A	**aPW90-63**	1653661.48	11601531.85	2	3	-44197	-229.6	1	72
A	**aPW90-64**	1656301.48	11601531.85	1	3	-105611	-548.6	1	72
A	**aPW91-62**	1651021.48	11598891.85	2	3	-80734	-419.4	1	72
A	**aPW91-64**	1656301.48	11598891.85	1	3	-91239	-474.0	1	72
A	**aPW91-65**	1658941.48	11598891.85	1	2	-508	-2.6	1	72
A	**aPW92-64**	1656301.48	11596251.85	2	3	-27888	-144.9	1	72
A	**aPW92-69**	1669501.48	11596251.85	1	2	-234	-1.2	1	72
A	**aPW93-62**	1651021.48	11593611.85	1	3	-81432	-423.0	1	72
A	**aPW93-67**	1664221.48	11593611.85	1	2	-347	-1.8	1	72

Group	Name	X	Y	TOPLAY	BOTLAY	Q_0 (cfd)	Q_0 (gpm)	START	END
A	**aPW93-69**	1669501.48	11593611.85	1	2	-303	-1.6	1	72
A	**aPW94-62**	1651021.48	11590971.85	1	3	-109741	-570.1	1	72
A	**aPW94-63**	1653661.48	11590971.85	1	2	-39299	-204.1	1	72
A	**aPW94-64**	1656301.48	11590971.85	1	3	-115335	-599.1	1	72
A	**aPW94-69**	1669501.48	11590971.85	2	2	-439	-2.3	1	72
A	**aPW94-70**	1672141.48	11590971.85	1	2	-73	-0.4	1	72
A	**aPW95-62**	1651021.48	11588331.85	1	3	-36026	-187.2	1	72
A	**aPW95-63**	1653661.48	11588331.85	1	3	-66964	-347.9	1	72
A	**aPW95-64**	1656301.48	11588331.85	1	3	-93713	-486.8	1	72
A	**aPW95-67**	1664221.48	11588331.85	2	2	-2153	-11.2	1	72
A	**aPW96-62**	1651021.48	11585691.85	1	3	-76146	-395.6	1	72
A	**aPW96-63**	1653661.48	11585691.85	1	3	-117936	-612.7	1	72
A	**aPW96-66**	1661581.48	11585691.85	2	2	-820	-4.3	1	72
A	**aPW97-63**	1653661.48	11583051.85	2	2	-527	-2.7	1	72
A	**aPW98-62**	1651021.48	11580411.85	1	3	-48283	-250.8	1	72
A	**aPW99-62**	1651021.48	11577771.85	1	3	-45634	-237.1	1	72
A	**aPW100-61**	1648381.48	11575131.85	1	3	-30046	-156.1	1	72
A	**aPW100-64**	1656301.48	11575131.85	1	3	-25529	-132.6	1	72
A	**aPW100-66**	1661581.48	11575131.85	2	2	-45552	-236.6	1	72
A	**aPW101-65**	1658941.48	11572491.85	2	2	-1638	-8.5	1	72
A	**aPW101-66**	1661581.48	11572491.85	2	3	-36578	-190.0	1	72
A	**aPW102-60**	1645741.48	11569851.85	1	3	-60736	-315.5	1	72
A	**aPW102-62**	1651021.48	11569851.85	1	3	-3357	-17.4	1	72
A	**aPW103-60**	1645741.48	11567211.85	1	3	-91404	-474.8	1	72
A	**aPW103-61**	1648381.48	11567211.85	2	3	-29282	-152.1	1	72
A	**aPW103-62**	1651021.48	11567211.85	1	3	-25889	-134.5	1	72
A	**aPW104-61**	1648381.48	11564571.85	1	3	-41445	-215.3	1	72
A	**aPW105-60**	1645741.48	11561931.85	2	3	-61673	-320.4	1	72
A	**aPW105-61**	1648381.48	11561931.85	1	3	-61747	-320.8	1	72
A	**aPW106-59**	1643101.48	11559291.85	1	3	-74078	-384.8	1	72
A	**aPW106-63**	1653661.48	11559291.85	1	3	-212	-1.1	1	72
A	**aPW108-59**	1643101.48	11554011.85	1	3	-62767	-326.1	1	72
A	**aPW108-60**	1645741.48	11554011.85	1	3	-41891	-217.6	1	72
A	**aPW109-59**	1643101.48	11551371.85	1	3	-58783	-305.4	1	72
A	**aPW110-58**	1640461.48	11548731.85	1	3	-19998	-103.9	1	72
A	**aPW110-59**	1643101.48	11548731.85	1	3	-48302	-250.9	1	72
A	**aPW111-58**	1640461.48	11546091.85	1	3	-169259	-879.3	1	72
A	**aPW113-57**	1637821.48	11540811.85	1	3	-127324	-661.4	1	72
A	**aPW114-56**	1635181.48	11538171.85	1	1	-468	-2.4	1	72
A	**aPW115-56**	1635181.48	11535531.85	1	3	-76531	-397.6	1	72
A	**aPW116-55**	1632541.48	11532891.85	2	3	-18539	-96.3	1	72

Group	Name	X	Y	TOPLAY	BOTLAY	Q_0 (cfd)	Q_0 (gpm)	START	END
A	**aPW118-54**	1629901.48	11527611.85	1	3	-67819	-352.3	1	72
A	**aPW120-53**	1627261.48	11522331.85	1	3	-142212	-738.8	1	72
A	**aPW120-57**	1637821.48	11522331.85	1	2	-1402	-7.3	1	72
A	**aPW121-53**	1627261.48	11519691.85	1	2	-25776	-133.9	1	72
A	**aPW121-54**	1629901.48	11519691.85	1	1	-8779	-45.6	1	72
A	**aPW121-56**	1635181.48	11519691.85	1	2	-1353	-7.0	1	72
A	**aPW122-54**	1629901.48	11517051.85	1	1	-25322	-131.5	1	72
B	**bPW82-62**	1651021.48	11622651.85	1	3	-41135	-213.7	32	43
B	**bPW82-63**	1653661.48	11622651.85	1	3	-41135	-213.7	24	43
B	**bPW82-64**	1656301.48	11622651.85	1	3	-41135	-213.7	7	43
B	**bPW82-65**	1658941.48	11622651.85	1	3	-41135	-213.7	21	43
B	**bPW83-62**	1651021.48	11620011.85	1	3	-41135	-213.7	12	43
B	**bPW83-63**	1653661.48	11620011.85	1	3	-41135	-213.7	38	43
B	**bPW83-64**	1656301.48	11620011.85	1	3	-41135	-213.7	37	43
B	**bPW83-65**	1658941.48	11620011.85	1	3	-41135	-213.7	40	43
B	**bPW83-66**	1661581.48	11620011.85	1	3	-41135	-213.7	12	43
B	**bPW84-63**	1653661.48	11617371.85	1	3	-41135	-213.7	7	43
B	**bPW84-65**	1658941.48	11617371.85	1	3	-41135	-213.7	44	43
B	**bPW84-66**	1661581.48	11617371.85	1	3	-41135	-213.7	25	43
B	**bPW84-74**	1682701.48	11617371.85	1	3	-41135	-213.7	39	43
B	**bPW85-63**	1653661.48	11614731.85	1	3	-41135	-213.7	5	43
B	**bPW85-65**	1658941.48	11614731.85	1	3	-41135	-213.7	8	43
B	**bPW85-66**	1661581.48	11614731.85	1	3	-41135	-213.7	27	43
B	**bPW86-63**	1653661.48	11612091.85	1	3	-41135	-213.7	8	43
B	**bPW86-65**	1658941.48	11612091.85	1	3	-41135	-213.7	16	43
B	**bPW86-66**	1661581.48	11612091.85	1	3	-41135	-213.7	14	43
B	**bPW87-63**	1653661.48	11609451.85	1	3	-41135	-213.7	20	43
B	**bPW87-65**	1658941.48	11609451.85	1	3	-41135	-213.7	26	43
B	**bPW87-66**	1661581.48	11609451.85	1	3	-41135	-213.7	38	43
B	**bPW87-67**	1664221.48	11609451.85	1	3	-41135	-213.7	36	43
B	**bPW87-68**	1666861.48	11609451.85	1	3	-41135	-213.7	16	43
B	**bPW88-66**	1661581.48	11606811.85	1	3	-41135	-213.7	38	43
B	**bPW89-65**	1658941.48	11604171.85	1	3	-41135	-213.7	7	43
B	**bPW90-65**	1658941.48	11601531.85	1	3	-41135	-213.7	37	43
B	**bPW92-62**	1651021.48	11596251.85	1	3	-41135	-213.7	36	43
B	**bPW92-63**	1653661.48	11596251.85	1	3	-41135	-213.7	44	43
B	**bPW92-66**	1661581.48	11596251.85	1	3	-41135	-213.7	27	43
B	**bPW93-64**	1656301.48	11593611.85	1	3	-41135	-213.7	8	43
B	**bPW93-68**	1666861.48	11593611.85	1	3	-41135	-213.7	7	43
B	**bPW95-65**	1658941.48	11588331.85	1	3	-41135	-213.7	7	43
B	**bPW95-66**	1661581.48	11588331.85	1	3	-41135	-213.7	36	43

Group	Name	X	Y	TOPLAY	BOTLAY	Q_0 (cfd)	Q_0 (gpm)	START	END
B	**bPW96-64**	1656301.48	11585691.85	1	3	-41135	-213.7	39	43
B	**bPW96-65**	1658941.48	11585691.85	1	3	-41135	-213.7	42	43
B	**bPW97-62**	1651021.48	11583051.85	1	3	-41135	-213.7	10	43
B	**bPW97-64**	1656301.48	11583051.85	1	3	-41135	-213.7	12	43
B	**bPW98-61**	1648381.48	11580411.85	1	3	-41135	-213.7	8	43
B	**bPW98-63**	1653661.48	11580411.85	1	3	-41135	-213.7	25	43
B	**bPW98-64**	1656301.48	11580411.85	1	3	-41135	-213.7	26	43
B	**bPW99-61**	1648381.48	11577771.85	1	3	-41135	-213.7	15	43
B	**bPW99-63**	1653661.48	11577771.85	1	3	-41135	-213.7	12	43
B	**bPW99-64**	1656301.48	11577771.85	1	3	-41135	-213.7	4	43
B	**bPW100-62**	1651021.48	11575131.85	1	3	-41135	-213.7	33	43
B	**bPW100-63**	1653661.48	11575131.85	1	3	-41135	-213.7	32	43
B	**bPW101-61**	1648381.48	11572491.85	1	3	-41135	-213.7	11	43
B	**bPW101-62**	1651021.48	11572491.85	1	3	-41135	-213.7	24	43
B	**bPW101-63**	1653661.48	11572491.85	1	3	-41135	-213.7	19	43
B	**bPW102-61**	1648381.48	11569851.85	1	3	-41135	-213.7	11	43
B	**bPW104-60**	1645741.48	11564571.85	1	3	-41135	-213.7	26	43
B	**bPW104-62**	1651021.48	11564571.85	1	3	-41135	-213.7	38	43
B	**bPW107-59**	1643101.48	11556651.85	1	3	-41135	-213.7	21	43
B	**bPW107-60**	1645741.48	11556651.85	1	3	-41135	-213.7	37	43
B	**bPW109-58**	1640461.48	11551371.85	1	3	-41135	-213.7	22	43
B	**bPW113-58**	1640461.48	11540811.85	1	3	-41135	-213.7	16	43
B	**bPW116-56**	1635181.48	11532891.85	1	3	-41135	-213.7	24	43
B	**bPW117-55**	1632541.48	11530251.85	1	3	-41135	-213.7	4	43
B	**bPW117-64**	1656301.48	11530251.85	1	3	-41135	-213.7	24	43
B	**bPW118-55**	1632541.48	11527611.85	1	3	-41135	-213.7	44	43
B	**bPW119-54**	1629901.48	11524971.85	1	3	-41135	-213.7	29	43
B	**bPW120-54**	1629901.48	11522331.85	1	3	-41135	-213.7	10	43
B	**bPW122-53**	1627261.48	11517051.85	1	3	-41135	-213.7	15	43
C	**cAZ0001**	1624238.06	11504601.99	1	3	-41135	-213.7	21	72
C	**cAZ0201**	1626943.00	11486934.62	1	3	-41135	-213.7	21	72
C	**cAZ0208**	1624661.81	11486925.42	1	3	-41135	-213.7	2	72
C	**cAZ0222**	1626476.94	11488338.78	1	3	-41135	-213.7	25	72
C	**cAZ0236**	1623885.41	11489653.00	1	3	-41135	-213.7	18	72
C	**cAZ0268**	1623886.73	11492380.21	1	3	-41135	-213.7	1	72
C	**cAZ0286**	1627032.30	11494196.97	1	3	-41135	-213.7	13	72
C	**cAZ0315**	1624493.44	11496824.19	1	3	-41135	-213.7	5	72
C	**cAZ0326**	1627033.53	11497338.36	1	3	-41135	-213.7	40	72
C	**cAZ0350**	1626568.30	11500459.58	1	3	-41135	-213.7	35	72
C	**cAZ0361**	1621222.59	11502129.06	1	3	-41135	-213.7	36	72
C	**cAZ0385**	1624756.78	11505510.83	1	3	-41135	-213.7	9	72

Group	Name	X	Y	TOPLAY	BOTLAY	Q_0 (cfd)	Q_0 (gpm)	START	END
C	**cAZ0386**	1623202.21	11505511.58	1	3	-41135	-213.7	43	72
C	**cAZ0392**	1624446.23	11506298.96	1	3	-41135	-213.7	25	72
C	**cAZ0397**	1625966.56	11507025.54	1	3	-41135	-213.7	14	72
C	**cAZ0399**	1621475.39	11506623.76	1	3	-41135	-213.7	12	72
C	**cAZ0403**	1623116.44	11506824.70	1	3	-41135	-213.7	20	72
C	**cAZ0417**	1622081.02	11508340.49	1	3	-41135	-213.7	25	72
C	**cAZ0420**	1625017.22	11508743.02	1	3	-41135	-213.7	40	72
C	**cAZ0426**	1623636.05	11509551.67	1	3	-41135	-213.7	12	72
C	**cAZ0435**	1626486.04	11510762.73	1	3	-41135	-213.7	14	72
C	**cAZ0436**	1630587.92	11510791.47	1	3	-41135	-213.7	29	72
C	**cAZ0442**	1621443.50	11511350.98	1	3	-41135	-213.7	6	72
C	**cAZ0475**	1624155.99	11513793.91	1	3	-41135	-213.7	15	72
D	**dSP-1**	1652772.98	11582246.85	1	3	172932	898.3	4	23
D	**dSP-2**	1652952.74	11583119.68	1	3	172932	898.3	4	23
D	**dSP-3**	1655002.98	11584212.47	1	3	0	0.0	na	na
D	**dSP-4**	1653871.58	11583063.31	1	3	0	0.0	na	na
D	**dSS-1**	1661125.32	11584723.78	1	3	95411	495.6	4	25
D	**dSS-2**	1661623.68	11585534.23	1	3	95411	495.6	4	25
D	**dSW-1**	1660094.76	11598086.36	2	3	71558	371.7	4	23
D	**dSW-2**	1659094.22	11597644.36	1	3	71558	371.7	4	23
D	**dSW-3**	1658198.33	11597969.14	1	3	35779	185.9	4	23
E	**ePC-2**	1717573.30	11555449.30	2	6	4813	25.0	2	20
E	**ePC-4**	1715878.90	11551786.60	2	6	4813	25.0	2	20
E	**ePW1**	1710590.41	11564937.50	1	5	4813	25.0	2	8
E	**ePW2**	1711220.33	11566072.67	1	4	4813	25.0	2	9
E	**ePW3**	1705324.68	11564976.87	2	5	4813	25.0	2	20
E	**ePW4**	1700754.48	11570675.68	1	5	0	0.0	na	na

Notes:

- Q_0 is the initial pumping rate.
- START and END refer to the stress periods for when the well is actively pumping.