

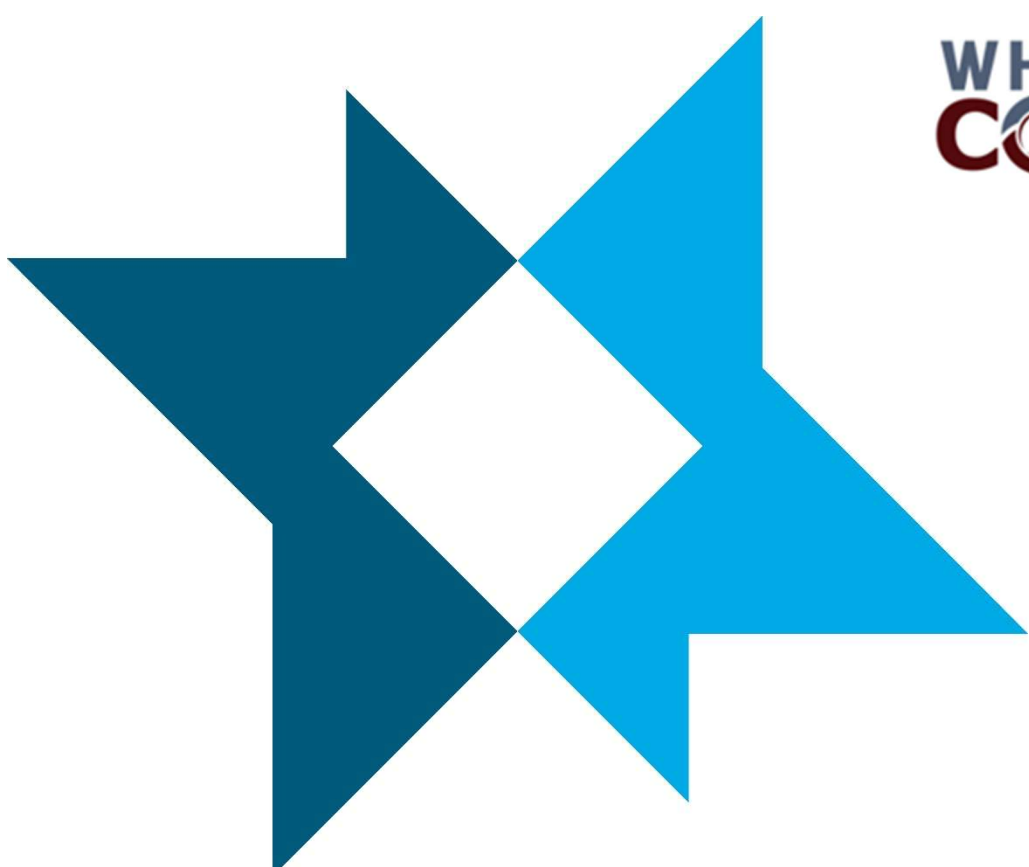


Permit Application

Environmental Impact Assessment

**White Pine North Project
Volume IIK**

Appendices C-3 through D



White Pine Copper LLC

White Pine, Michigan

September 2026

Project I.D.: 23W200

Solving our clients' toughest
science and engineering challenges.

C-3

Groundwater Modeling Report Pre-Feasibility Study Report

White Pine Copper, LLC | White Pine North Project

Groundwater Modeling Report

Pre-Feasibility Study Report

Tetra Tech Project Number: 117-372636-25002

April 14, 2026

Document Control #

108571-EV-03200-22224-001-05

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Acronyms/Abbreviations

Acronym/Abbreviation	Definition
amsl	above mean sea level
ASTM	ASTM International
BMW	bedrock monitoring well
CSS	Composite Scaled Sensitivity
DDH	Diamond Drill Hole
DEM	digital elevation model
DRN	Drain (MODFLOW boundary condition)
EGLE	Michigan Department of Environment, Great Lakes, and Energy
ET	Evapotranspiration
ft	Feet
ft/day	Feet per Day
GHB	General Head Boundary
gpm	Gallons per Minute
HpL	Hydrophysical Logging
Kh	Horizontal Hydraulic Conductivity
Kv	Vertical Hydraulic Conductivity
Kx	Hydraulic Conductivity in the x-direction
Ky	Hydraulic Conductivity in the y-direction
Kz	Hydraulic Conductivity in the z-direction
LOM	Life of Mine
m	Meter
m ³	Cubic Meters
m ³ /day	Cubic Meters per Day
MAE	Mean Absolute Error
MGD	Million Gallons per Day
MODFLOW	Modular Finite-Difference Groundwater Flow Model
MODFLOW 6	MODFLOW Version 6
MW	Monitoring Well
NB	North Basin (Tailings Basin Monitoring Wells)
NOAA	National Oceanic and Atmospheric Administration
PEST	Parameter ESTimation
PFS	Pre-Feasibility Study
RCH	Recharge (MODFLOW package)
RCP	Representative Concentration Pathway
RI	Remedial Investigation

Acronym/Abbreviation	Definition
RMS	Root Mean Square
RMSE	Root Mean Square Error
RO	Range of Observations
RSTD	Residual Standard Deviation
SMI	Shepherd Miller, Inc.
SMW	Shallow Monitoring Well
SP	Stress Period
Ss	Specific Storage
Sy	Specific Yield
TDF	tailings disposal facility
TDS	Total Dissolved Solids
USGS	United States Geological Survey
UTM	Universal Transverse Mercator
WGS	World Geodetic System
WPC	White Pine Copper, LLC

EXECUTIVE SUMMARY

White Pine Copper, LLC developed a regional groundwater flow model for the proposed White Pine North Project to support prefeasibility-level mine design, dewatering system planning, and environmental permitting. The model integrates more than five decades of hydrogeologic investigations, including historical mine data, long-term groundwater monitoring, recent drilling and testing, and updated geologic interpretations of unconsolidated deposits and Precambrian bedrock units. The model domain encompasses the proposed underground mine, surrounding surface-water features, and Lake Superior, and represents groundwater flow within both shallow and deep hydrostratigraphic systems.

The steady-state groundwater flow model was calibrated to observed groundwater-level data from site and regional monitoring wells and demonstrates an acceptable match to observed conditions based on standard calibration metrics. Simulated potentiometric surfaces are consistent with regional topography and established groundwater flow directions toward Lake Superior. The steady-state water balance indicates that recharge is the dominant inflow to the system and that groundwater discharge occurs primarily through drain features and head-dependent boundaries, with negligible mass-balance discrepancy, indicating stable numerical performance.

The transient model reproduces observed groundwater-level trends and hydrograph behavior across multiple model layers and captures the timing and magnitude of groundwater responses over the calibration period. Water-balance results for the March 2025 stress period indicate that inflow to the system is dominated by release from aquifer storage rather than recharge, reflecting slow groundwater redistribution within low-permeability bedrock. This behavior is consistent with the site conceptual model, which identifies limited hydraulic connectivity between deep bedrock and surface-water systems and long groundwater residence times at depth.

Predictive simulations were conducted to estimate groundwater inflows to the proposed underground mine during mining, closure, and post-closure conditions. Mine dewatering was represented using time-varying drain boundary conditions that evolve with mine development. An uncertainty analysis was performed by varying the horizontal-to-vertical hydraulic conductivity ratio of bedrock units to bracket reasonable bounds on predicted inflows. Predicted mine inflows range from approximately 50 to 350 gpm across evaluated scenarios. Based on the lacustrine depositional origin and expected anisotropy of the Nonesuch Formation, a base-case horizontal-to-vertical hydraulic conductivity ratio of 2:1 was selected for dewatering system design, resulting in a conservative maximum predicted inflow of approximately 235 gpm.

Additional predictive scenarios evaluated the potential effects of underground mining on surface-water discharge. Results indicate minimal changes in streamflow, with approximately a five percent change in discharge to the Mineral River and less than one percent change to all other modeled streams. Streams and adjacent wetlands in the Project area are sustained by the shallow groundwater system and surface-runoff processes, which exhibit limited and often intermittent groundwater contribution. Because mine dewatering primarily affects the deep bedrock system and modeled changes in shallow groundwater discharge are minimal, underground mining is not expected to measurably affect stream hydrology or the hydrology of wetlands adjacent to these streams, nor to result in regional-scale impacts to surface-water systems.

Overall, the groundwater flow model provides a technically defensible and internally consistent framework for evaluating groundwater conditions at the White Pine North Project. The model is suitable for prefeasibility-level mine planning, dewatering design, and regulatory review. Key uncertainties related to deep bedrock hydraulic properties were evaluated through sensitivity and uncertainty analyses, and the results support advancement of the Project with respect to groundwater considerations.

1.0 INTRODUCTION AND BACKGROUND

White Pine Copper LLC (WPC), a wholly owned subsidiary of Kinterra Copper USA, LLC, is seeking to develop the White Pine North Copper Project at the site of the former White Pine Mine in Ontonagon County, Michigan. The Project is located approximately 3 miles south of Lake Superior within the historic copper mining district of Michigan's Upper Peninsula, where underground mining and mineral processing occurred from the late 1800s until mine closure in 1997 under a State of Michigan Consent Decree.

The proposed Project includes development of new underground mine workings that are separate from the historic White Pine Mine, construction of on-site processing facilities to produce copper concentrate, and management of tailings through reuse of existing tailings impoundments. A Preliminary Economic Assessment was completed in 2023, followed by initiation of environmental baseline studies and engineering trade-off evaluations in support of prefeasibility and permitting activities.

To support advancement of the Prefeasibility Study and permit applications to the Michigan Department of Environment, Great Lakes, and Energy (EGLE), WPC initiated comprehensive environmental baseline investigations beginning in 2024. Groundwater and surface water data collected from these investigations are in part used to calibrate the Project groundwater flow model. This report presents the groundwater flow modeling at the Project site and surrounding area to support project design, impact assessment, and regulatory review.

1.1 Site Location

The White Pine North Project is located in the western Upper Peninsula of Michigan, approximately 7.5 kilometers (about 3 miles) south of Lake Superior in Carp Lake Township, Ontonagon County (see Figure 1-1). The Project lies east of Michigan State Highway M-64, which runs north-south approximately 0.5 kilometers west of the Project footprint, providing primary access to the site. The nearest population center is the unincorporated community of White Pine, located immediately southwest of the Project across M-64, with the town of Ontonagon approximately 25 kilometers to the northeast (G Mining Services, 2023).

Topographically, the Project is located within the Lake Superior Lake Plain, a gently north-sloping, glacially influenced landscape characterized by shallow relief, widespread wetlands, and numerous small streams that drain toward Lake Superior. Ground surface elevations generally decrease northward toward the lake, and surface drainage patterns are closely linked to glacial deposits and post-glacial reworking. The proximity to Lake Superior exerts a strong influence on local hydrology and climate, which is an important consideration for groundwater-surface water interactions at the site (Foth, 2026a).

1.2 Previous Hydrogeological Investigations at White Pine Mine

Hydrogeological investigations at the White Pine Mine have been conducted over more than five decades, beginning with the proposed solution mining report from Shepherd Miller, Inc. in 1995 (SMI, 1995). Next, a comprehensive Remedial Investigation (RI) in the late 1990s was produced by MFG, Inc. (MFG, 1999) and followed by an extensive, long-term groundwater monitoring program initiated in the mid-2000s. Collectively, these investigations established the site conceptual hydrogeologic framework, defined groundwater flow directions, and generated the long-term groundwater dataset used to support current groundwater modeling.

1.2.1 Early Exploration and Baseline Investigations (1937–1980)

Groundwater and surface water investigations at the White Pine Mine began with extensive mineral exploration drilling between 1937 and 1980. During this period, 692 exploration boreholes were drilled across the site and surrounding area to characterize the ore body and host formations. Of these, 349 boreholes overlie the White Pine Mine footprint. These exploration borings, commonly designated as DDH-xxx (Diamond Drill Holes), penetrated the Copper Harbor Conglomerate and provided early hydrogeologic information on fracture occurrence, water inflows, and stratigraphic

conditions. Boreholes drilled prior to 1974 were not consistently plugged, while later holes were partially or fully cemented in accordance with evolving abandonment practices (SMI, 1995).

1.2.2 Mine Seep and Surface Water Investigations (1970s)

A focused mine seep investigation was conducted in 1976 to evaluate groundwater inflows to underground workings and their connection to surface water systems. This study included mapping and measurement of groundwater seeps within the mine, chloride sampling, and analysis of seasonal variability in inflow rates. Results demonstrated that groundwater inflow occurs primarily through faults, fractures, and surface-to-mine conduits, including exploration boreholes and service openings, rather than through intact rock matrix flow. These findings informed later conceptual models of groundwater–surface water interaction (SMI, 1995).

1.2.3 Monitoring Well Installation and Hydraulic Testing (1994)

A comprehensive hydrogeologic investigation was completed in 1994 to support regulatory evaluation of proposed solution mining. As part of this effort, seven monitoring wells were installed to characterize shallow (SMW-1, SMW-3, and SMW-4) and deep groundwater conditions (BMW-1, BMW-3, BMW4A, and BMW-4B). These wells were used for water-level monitoring, groundwater sampling, slug testing, and packer testing, providing hydraulic property estimates for both the shallow aquifer and deeper bedrock hydrostratigraphic units (SMI, 1995).

1.2.4 Deep Exploration and Regional Characterization (1994)

In July–August 1994, a deep exploration borehole, DDH-508, was drilled northeast of the mine to a depth of approximately 3,000 feet. This borehole is within the footprint of the proposed White Pine North mine. At the time, DDH-508 represented the most comprehensively characterized borehole at White Pine and included detailed core logging, fracture analysis, downhole video inspection, and multiple packer tests. Results confirmed that hydraulic conductivity is strongly controlled by discrete fracture zones and decreases markedly with depth, supporting conceptual separation of shallow freshwater and deep saline groundwater systems (SMI, 1995).

1.2.5 Remedial Investigation (1997–1999)

The foundational hydrogeologic characterization of the White Pine Mine was completed as part of the Remedial Investigation conducted in 1997–1999. The RI established that groundwater occurs within two hydraulically disconnected systems:

- an upper system consisting of unconsolidated glacial and lacustrine sediments underlain by fractured bedrock, and
- a deeper bedrock aquifer system.

The RI also identified localized perched groundwater conditions in portions of the site and documented a regional northward groundwater flow direction toward Lake Superior. Monitoring wells installed during the RI (including early baseline wells such as SMW-1 and MW-35/37/38) continue to serve as reference locations in the current monitoring network and provide critical long-term groundwater elevation and water-quality records (MFG, 1999; Tetra Tech, 2006–2025).

1.2.6 Establishment of the Site-Wide Monitoring Network (2006–2008)

A formal site-wide groundwater monitoring program was implemented beginning in 2006, in accordance with the Remedial Action Plan. During this phase, a comprehensive network of baseline, sentry, affected, and interstitial monitoring wells were constructed and refined.

In 2006, several new monitoring wells were installed and damaged wells were replaced, including MW-1A-R, MW-1B-R, MW-19-R, and newly installed wells MW-41 and MW-42, located north of the tailings basins to improve downgradient

coverage. These wells were installed using hollow-stem auger methods and screened within the shallow groundwater system (Tetra Tech, 2007).

By 2007–2008, the monitoring network included more than 25 shallow monitoring wells, as well as nested interstitial wells within the North No. 1 and North No. 2 tailings basins (NB1-1 through NB1-3 and NB2-1 through NB2-3). During this period, 17 older monitoring wells were formally abandoned because they were no longer required for regulatory monitoring, reflecting an early optimization of the network (Tetra Tech, 2008 and Tetra Tech, 2009).

1.2.7 Baseline Monitoring and Network Refinement (2009–2012)

From 2006 through 2009, wells were sampled up to three times per year to establish baseline groundwater conditions. These data were subsequently used to calculate upper prediction limits (UPLs) for indicator parameters at baseline and sentry wells.

Following completion of baseline monitoring in 2009, the program transitioned to biennial monitoring, with targeted additional sampling in 2010–2012 to support reclassification of certain wells. Notably, MW-41 and MW-42 were reclassified from affected to sentry wells and sampled repeatedly to complete baseline statistical requirements (Tetra Tech, 2011; Tetra Tech, 2012; and Tetra Tech, 2013).

1.2.8 Long-Term Monitoring and Supplemental Investigations (2013–2024)

From 2013 through 2024, groundwater monitoring continued on a biennial basis, with periodic network evaluations and limited supplemental investigations. The overall network configuration remained stable, with the core shallow monitoring system consisting of approximately 20 to 25 active wells, including baseline wells (MW-35, MW-37, MW-38, SMW-1), sentry wells (MW-31, MW-32, MW-36, MW-41, MW-42), affected wells, and interstitial tailings basin wells.

In 2014, previously installed bedrock monitoring wells (BMW-1 and BMW-4) were re-located and inspected, providing limited confirmation of deeper groundwater conditions, although routine groundwater monitoring and modeling efforts continue to focus on the shallow aquifer system (Tetra Tech, 2014).

Several wells were removed from the active network over time due to failure or redundancy, including NB1-2, which silted in between 2015 and 2016, and select wells temporarily inaccessible due to site conditions (Tetra Tech, 2015a; Tetra Tech, 2015b; Tetra Tech, 2017; Tetra Tech, 2018; Tetra Tech, 2020; Tetra Tech, 2023; and Tetra Tech, 2025).

1.2.9 Recent Geologic/Hydrogeologic Characterization (2024–2025)

During 2024–2025, a focused drilling program was completed to address data gaps in the geologic and hydrogeologic framework of the White Pine North Project area. Multiple boreholes were advanced across the site to characterize unconsolidated deposits and underlying bedrock, with depths extending from shallow overburden into deep bedrock units. Sonic drilling was used in unconsolidated materials, transitioning to rotary or coring methods in bedrock. Detailed lithologic logging and sampling supported refinement of stratigraphic interpretations and identification of key hydrostratigraphic units relevant to groundwater flow modeling (Foth, 2026a).

As part of this effort, six new shallow bedrock monitoring wells were installed to improve spatial coverage and vertical resolution of groundwater monitoring. These wells, completed at depths of approximately 90 to 150 feet below ground surface, were strategically located to evaluate vertical hydraulic gradients between overburden and shallow bedrock, assess groundwater–surface water interactions near nearby streams, and establish baseline groundwater conditions at upgradient locations. The new wells were constructed and developed using standard methods to ensure reliable groundwater level and water quality data for model calibration and conceptual site model development (Foth, 2026a).

To further characterize deeper hydrostratigraphic units, the investigation included deep bedrock testing and instrumentation in selected boreholes. Geophysical and hydrophysical logging was conducted to identify fracture zones and flowing intervals, followed by discrete-interval packer testing to estimate hydraulic conductivity and transmissivity within targeted bedrock fractures. One-time groundwater samples were collected from tested intervals to support

hydrochemical characterization. In addition, vibrating wire piezometers were installed at multiple depths in selected boreholes to provide long-term measurements of hydraulic head and vertical gradients in deep bedrock (Foth, 2026a).

1.3 Report Organization

The groundwater model report is organized into the following sections:

- Section 2: Geologic Setting
- Section 3: Climate
- Section 4: Site Conceptual Model
- Section 5: Geologic Framework Model
- Section 6: Groundwater Model Development and Calibration
- Section 7: Flow Model Results
- Section 8: Predictive Model
- Section 9: Limitations and Assumptions
- Section 10: Summary and Conclusions
- Section 11: References

2.0 GEOLOGIC SETTING

The White Pine North Mine area is located along the southern margin of the Midcontinent Rift system in the western Upper Peninsula of Michigan. This rift, formed approximately 1.1 billion years ago, hosts thick successions of Keweenaw Supergroup volcanic and sedimentary rocks that are exposed primarily in the Lake Superior region. The White Pine copper deposits occur within this rift-related sedimentary sequence and are part of the Porcupine Mountains sediment-hosted copper district, which includes the historic White Pine Mine and adjacent undeveloped mineralization to the north and east (Foth, 2026a and MFG, 1999).

Regionally, the rift basin is filled with up to 18 miles of volcanic and clastic sedimentary rocks. In the White Pine area, the stratigraphy of interest belongs to the Oronto Group within the Keweenaw Supergroup, which consists (from youngest to oldest) of the Freda Formation, the Nonesuch Shale, and the Copper Harbor Conglomerate (see Figure 2-1). These units dip gently and form broad folds associated with rift-related tectonism and subsequent compressional deformation (Foth, 2026a and MFG, 1999).

2.1 Unconsolidated Deposits

Unconsolidated deposits overlying bedrock in the project area consist primarily of late Wisconsinan glacial sediments associated with advance of the Ontonagon lobe from the Lake Superior basin approximately 10,200 years before present. Surficial mapping indicates that the dominant deposit is calcareous, red, clay rich fluted till, which is laterally extensive but generally thin and discontinuous (see Figure 2-2). The surface expression of these deposits closely mirrors underlying bedrock topography, reflecting limited sediment thickness and widespread bedrock subcrop and outcrop conditions (Foth, 2026a).

The fluted till is characterized by linear ridges and grooves aligned with former ice flow direction, produced by differential basal glacier movement around subglacial obstructions. Individual flutes are narrow and elongate, with low relief and lateral spacing on the order of hundreds of feet, extending for up to several miles. The till matrix is composed of fine sand, silt, and clay, with grain size and color reflecting derivation from underlying red sandstones and shales, particularly the Freda Sandstone. Where present, tills overlying the Freda Sandstone tend to exhibit similar fine-grained textures and reddish coloration (Foth, 2026a).

In low lying areas, the till is locally overlain or interbedded with thin lenses of sand and gravel or gray to brown till, representing glaciofluvial and glaciolacustrine deposition during periods of ice retreat, stagnation, and meltwater reworking. Post glacial lacustrine sediments associated with ancestral Lake Superior are present in some areas and consist predominantly of fine grained, over consolidated clays deposited during higher lake level stages (MFG, 1999 and Foth, 2026a).

2.2 Bedrock Geology

The Freda Formation (Freda Sandstone) is the uppermost bedrock unit in the area and consists predominantly of red-brown sandstone, siltstone, and mudstone deposited in fluvial environments (see Figure 2-3). It conformably overlies the Nonesuch Shale and is several thousand feet thick regionally. The Freda Formation is generally characterized by low primary permeability, with groundwater flow occurring mainly through secondary fractures near the bedrock surface (Foth, 2026a and MFG, 1999).

The Nonesuch Shale or Nonesuch Formation is the principal host of copper mineralization at White Pine and consists of dark gray to black shale, siltstone, and minor sandstone deposited in a lacustrine setting. Copper mineralization occurs primarily near the base of the Nonesuch Shale and the top of the underlying Copper Harbor Conglomerate. Mineralization

is dominantly stratiform and composed mainly of chalcocite with lesser native copper. The Nonesuch Shale has low matrix permeability and acts as a regional aquitard except where fractured (Foth, 2026a and MFG, 1999).

The Copper Harbor Conglomerate or Copper Harbor Formation underlies the Nonesuch Shale and consists of red-brown conglomerate, sandstone, and siltstone deposited in fluvial and alluvial fan environments. This unit forms the basal portion of the Oronto Group and locally exhibits greater secondary permeability where fractured. The Copper Harbor Formation served as a paleoaquifer that focused copper-bearing fluids upward into the overlying Nonesuch Shale during mineralization (Foth, 2026a and MFG, 1999).

Exposed extensively in the Porcupine Mountains west of White Pine are the Porcupine Volcanics, which are a Middle Proterozoic volcanic unit within the Keweenaw Supergroup of the western Upper Peninsula of Michigan, deposited during late-stage magmatism associated with development of the Midcontinent Rift System. This unit conformably overlies the Portage Lake Volcanics and is overlain and locally interfingered with the Copper Harbor Conglomerate, marking a transition from syn-rift volcanism to post-rift sedimentation. The Porcupine Volcanics comprise a heterogeneous sequence of subaerial basalt, andesite, felsite (rhyolite), and quartz-porphyry lava flows with minor interbedded sandstone, siltstone, and conglomerate, and are distinguished from underlying flood basalts by a higher proportion of intermediate to felsic compositions and a predominance of andesite. Exposed thickness ranges from approximately 750 to 2,500 m, with the base not exposed (Jones et al., 2023).

2.3 Structural Geology

Structurally, the White Pine Mine area lies on the flank of a broad anticline with a northwest-trending axis. The orebody and tailings facilities overlie the northeastern limb of this structure. Several steeply dipping faults occur in the area, including the White Pine Fault on the southeastern flank of the anticline. These faults locally enhance secondary permeability and have been shown to influence groundwater movement, including the upward migration of deep saline formation waters in some locations (MFG, 1999 and Golder and Associates, 2015).

A structural-geophysical interpretation was completed for the White Pine North area using reprocessed airborne magnetic data and integrated subsurface datasets to define the regional brittle fault framework. The analysis focused on identifying laterally continuous magnetic discontinuities interpreted as faults and evaluating their spatial consistency with historical underground mapping and downhole structural data (SRK, 2025).

The mapped fault framework highlights areas where fault zones and associated damage zones may locally enhance fracture permeability, particularly along the dominant N-S and NW-SE structural trends. Conversely, the continuity and cross-connection nature of the fault network also imply potential for hydraulic compartmentalization depending on fault core properties and mineralization (SRK, 2025).

3.0 CLIMATE

The White Pine area is characterized by a humid continental climate influenced strongly by its proximity to Lake Superior. Climatic conditions are defined by long, cold winters; short, cool to mild summers; and relatively even distribution of precipitation throughout the year, with a substantial fraction occurring as snowfall. These conditions exert a strong control on groundwater recharge, surface-water runoff, and seasonal evapotranspiration patterns.

3.1 Temperature

Mean annual temperatures in the White Pine area are low, reflecting northern latitude and lake-moderated conditions. Average winter temperatures commonly remain below freezing, with January being the coldest month, characterized by mean daily lows near 13–15°F and mean daily highs near 22–26°F. Summer temperatures are moderate, with July and August representing the warmest months; average daily highs typically range from the mid-60s to low-70s °F, and average nightly lows are generally in the mid-50s °F. Extreme heat is uncommon, and the overall growing season is relatively short. The moderating influence of Lake Superior suppresses summer heat extremes while prolonging cool conditions into spring and early fall. Further details on temperature at White Pine are provided in Appendix A of Foth (2026a).

3.2 Precipitation

Average annual precipitation in the White Pine area ranges from approximately 30 to 47 inches per year over the past decade, consistent with regional climate normals for Ontonagon County and the southern Lake Superior shoreline. Precipitation is distributed fairly evenly throughout the year, with slightly higher monthly totals during late spring and summer (see Figure 3-1). Summer precipitation typically occurs as rainfall associated with frontal systems and convective storms, whereas winter precipitation is dominated by snowfall.

Figure 3-1 summarizes monthly precipitation at the White Pine North Project area for the period 2015 through 2025 from the Ironwood and onsite meteorological stations. Precipitation exhibits pronounced month-to-month variability, with generally higher totals during late spring and summer and lower totals during winter months. The long-term record indicates no persistent increasing or decreasing trend in precipitation over the 2015–2022 period, with monthly values typically fluctuating within a consistent historical range. Data from the onsite monitoring station available for the more recent period show similar seasonal patterns and magnitudes as the Ironwood station, indicating that precipitation conditions during the latter part of the record are broadly consistent with the longer-term regional climate. Overall, the precipitation record reflects a humid continental climate characterized by episodic rainfall events superimposed on a stable long-term average, supporting the use of long-term average recharge rates in the groundwater flow model.

Snowfall is also a major climatic component, with average annual snowfall commonly exceeding 170 to 180 inches, driven in large part by lake-effect snow processes. Snow accumulation persists through much of the winter and early spring, delaying infiltration and groundwater recharge until seasonal thaw. The snowpack acts as a temporary storage reservoir, releasing water gradually during spring melt events. Further details on precipitation at White Pine are provided in Appendix A of Foth (2026a).

3.3 Evapotranspiration

Potential evapotranspiration (ET) in the White Pine area is relatively low compared to more southern or continental regions, reflecting cool temperatures, moderate summer humidity, and a short growing season. Evapotranspiration is

minimal during winter months due to frozen ground and dormant vegetation. The majority of annual ET occurs during late spring and summer, coincident with peak temperatures and vegetative growth.

Regional water-budget datasets indicate that annual potential evapotranspiration is substantially lower than annual precipitation, resulting in a net positive water balance on an annual basis. This climatic relationship supports groundwater recharge during spring snowmelt and baseflow to incised streams during much of the year, despite low infiltration rates imposed by clay-rich surficial deposits (EPA, 2026).

3.4 Lake Superior Water Levels

Figure 3-2 shows Lake Superior water-level elevations from 2021 through 2025 relative to the long-term average. Over this period, lake levels exhibit seasonal variability superimposed on multi-year fluctuations, with water levels generally oscillating within a narrow range of approximately one meter. Lake levels were above the long-term average during portions of 2022 and 2023, followed by a decline through late 2023 and 2024 to levels near or slightly below the long-term mean. The figure also shows a short-term forecast envelope indicating a modest recovery from recent low levels, while remaining within the historical range of variability. Overall, Lake Superior water levels during the period of record remain relatively stable and do not indicate sustained long-term rising or declining trends, supporting the use of representative average lake levels for groundwater boundary condition specification.

4.0 CONCEPTUAL SITE MODEL

The hydrogeologic conceptual site model for the project area describes a low-yield groundwater system developed within thin unconsolidated deposits and fractured Precambrian bedrock along the southern margin of Lake Superior. Groundwater occurrence, movement, and quality are controlled primarily by secondary permeability in shallow bedrock fractures, the low permeability of surficial sediments, and strong hydraulic and geochemical contrasts with depth. Details on surface water, groundwater, and their interaction are summarized below.

4.1 Surface Water Setting

The Project is located within the Ontonagon High Clay Plain, a glacial lake-bed landform characterized by generally flat topography with a gentle regional slope toward Lake Superior. Surface drainage across the Project area consists of small, incised stream channels with low sinuosity that flow northward to Lake Superior. These streams are part of the Lake Superior watershed and are organized into several small subwatersheds that collectively cover approximately 90.7 square miles. Each subwatershed is composed of short, low-order streams that discharge directly to Lake Superior (Foth, 2026a).

More than a dozen small streams traverse the Project area, exhibiting a parallel drainage pattern indicative of uniform regional slope and fine-grained, low-permeability surficial materials. Soils across the area are dominated by silt loams and clay loams, with sandy loams occurring infrequently. These fine-grained soils limit infiltration and promote surface runoff, resulting in limited groundwater recharge from precipitation (Foth, 2026a).

Hydrologic analysis indicates that the Project area receives an average annual precipitation of approximately 33.0 inches, with average annual runoff of about 16.0 inches. Streamflow response to precipitation is rapid and flashy, reflecting the small watershed size, limited storage capacity, and low permeability soils. Analysis of precipitation and continuous streamflow data indicates that approximately 0.25 to 0.75 inches of precipitation is typically required to generate a measurable increase in streamflow. Hydrographs show rapid rises to peak flow followed by quick initial recession and a more gradual return to background conditions. During extended dry periods, flows commonly decline to low or negligible levels, with estimated baseflows on the order of 0.5 to 2 cubic feet per second at monitored locations (Foth, 2026a).

Surface water quality monitoring conducted to date indicates no apparent temporal trends or consistent seasonal or flow-related correlations. Overall, baseline surface water conditions in the Project area are characterized by numerous small, parallel streams draining to Lake Superior, runoff-dominated hydrology driven by low-permeability surficial soils, rapid stormflow response with limited sustained baseflow, and a stable surface water quality dataset. These characteristics are consistent with limited groundwater contribution to streamflow (Foth, 2026a).

4.2 Groundwater

The groundwater system in the Project area is conceptualized as two hydraulically distinct flow systems: (1) a shallow hydrostratigraphic unit, and (2) a lower (deep) hydrostratigraphic unit. The shallow unit consists of saturated unconsolidated glacial and lacustrine deposits approximately 25 to 75 feet thick (overburden), underlain by shallow fractured Precambrian bedrock that is hydraulically connected to the overburden. This combined shallow system is characterized by low permeability and low yield and contains generally hard groundwater with elevated calcium and magnesium concentrations. Compared to deeper groundwater, the shallow system exhibits lower TDS and salinity, indicating short to intermediate residence times. Locally, groundwater from the shallow hydrostratigraphic unit may be suitable for individual residential use (Foth, 2026a).

The deep hydrostratigraphic unit contains brackish to saline groundwater that is effectively stagnant due to the extremely low hydraulic conductivity of the Precambrian bedrock, density stratification, and contrasts in pressure, temperature, and salinity (Freeze and Cherry, 1979). Groundwater flow within this unit is exceedingly slow, with estimated travel times across the Project area on the order of millennia, and discharge occurring gradually beneath and approaching the Lake Superior shoreline. As a result, recharge entering the deep system today is not expected to migrate appreciable distances over geologic timescales. This behavior reflects the highly inertial nature of the deep groundwater system and its minimal hydraulic connectivity to the shallow flow system. A localized exception to this separation is suggested by elevated chloride concentrations observed in groundwater at bedrock depths greater than approximately 75 feet near the Lake Superior shoreline (Doonan and Hendrickson, 1969).

Topography of the bedrock surface strongly influences the thickness and distribution of unconsolidated deposits. Prominent bedrock outcrops occur west of the Project area in the Porcupine Mountains and to the south along the Trap Range, while structural lows in the bedrock surface are present west of the tailings basins toward the Big Iron River. Unconsolidated deposits were emplaced during glacial retreat in subglacial, glaciofluvial, and glaciolacustrine environments and consist predominantly of clayey glacial till, with subordinate sands and gravels. These materials exhibit low hydraulic conductivity, limiting groundwater transmission. Hydraulic conductivity testing in the overburden yielded values ranging from 0.02 to 1.0 ft/day, with a geometric mean of approximately 0.1 ft/day (Foth, 2026a).

Groundwater flow in shallow bedrock occurs almost entirely through secondary fracture (joint) permeability, with higher fracture densities attributed to glacial loading and unloading. Fracture frequency, permeability, and porosity decrease rapidly with depth. Hydraulic testing in shallow bedrock indicates a geometric mean hydraulic conductivity of approximately 0.3 ft/day, with values ranging from less than 0.001 ft/day to several feet per day within isolated fractures. When considered together, the composite hydraulic conductivity of the shallow hydrostratigraphic unit (overburden plus shallow fractured bedrock) is approximately 0.1 ft/day, reflecting the combined influence of low-permeability glacial deposits and fracture-controlled bedrock flow (Foth, 2026a).

Recharge to the shallow hydrostratigraphic unit occurs primarily through direct infiltration of precipitation, supplemented by lateral groundwater inflow from higher topographic areas to the south. Discharge from the shallow system occurs predominantly along the Lake Superior shoreline, with lesser contributions to baseflow in gaining streams and limited losses through evapotranspiration. Shallow groundwater has a neutral to slightly alkaline pH, with bicarbonate as the dominant anion, providing natural buffering capacity. Total dissolved solids average approximately 150 mg/L, with maximum concentrations below 250 mg/L, and median chloride concentrations of about 41 mg/L. Water quality data indicate a transition from Mg-HCO_3 to Na-HCO_3 facies in overburden and shallow bedrock groundwater, reflecting hydraulic connectivity between these units and fracture-dominated flow with increasing residence time and early-stage cation exchange (Back, 1966; Freeze and Cherry, 1979).

In contrast, groundwater within the deep hydrostratigraphic unit exhibits substantially higher salinity, TDS, and residence times, consistent with long-term isolation and limited circulation. Overall, the shallow groundwater system consists of low-permeability glacial deposits and fractured bedrock that transmit relatively fresh, hard groundwater with short to intermediate residence times and discharge mainly to Lake Superior and local surface waters. The deep system, by comparison, contains highly saline, stagnant groundwater with millennia-scale residence times, minimal connectivity to the shallow system, and flow controlled by the extremely low permeability of the Precambrian bedrock (Foth, 2026a).

4.3 Groundwater/Surface Water Interaction

Shallow groundwater monitoring indicates that groundwater chemistry is broadly similar to surface water for several key constituents, including low specific conductance (approximately 200–500 $\mu\text{S}/\text{cm}$), low sulfate concentrations (typically less than 100 mg/L), generally non-detectable nitrate, and very low dissolved metal concentrations. These similarities are consistent with limited groundwater residence times and shallow flow paths. Historical streamflow investigations (SMI, 1995; MFG, 1999), supported by recent monitoring, indicate that groundwater provides supplemental baseflow to local rivers and perennial streams at an estimated rate of approximately 1.0 gallon per minute

per 100 feet of stream channel. However, baseflow contributions are small, spatially variable, difficult to quantify, and insufficient to sustain flow during extended dry periods, resulting in frequent stream drying (Foth, 2026a).

Field observations from the 1997 Remedial Investigation (RI, 1999) documented that the Mineral River was dry upstream of the town of White Pine but exhibited measurable flow downstream, suggesting that groundwater discharge occurs only when groundwater heads are near or slightly above the streambed elevation. Small changes in local gradient or groundwater levels can therefore determine whether groundwater discharge occurs. Similar conditions were documented by the Holtschlag and Eagle (1985), which observed the Mineral River to be dry during late-summer measurements in three of six study years. These observations indicate that groundwater discharge to streams is often marginal and can be offset by evapotranspiration losses during dry periods (Foth, 2026a).

Although historical investigations indicate that surface water is hydraulically connected to the shallow hydrostratigraphic unit, the strength of this connection is weak. This is evidenced by low baseflow magnitudes, low hydraulic conductivity of the unconsolidated glacial and lacustrine deposits, and limited hydraulic gradients directed toward incised stream channels. Regional groundwater flow is instead dominated by discharge toward Lake Superior. Review of potentiometric surface maps and stream incision depths indicates that only the Iron River, which is more deeply incised and occupies a lower topographic position, maintains relatively consistent groundwater discharge. In contrast, groundwater discharge to the Mineral River and other smaller streams is seasonal and highly dependent on local groundwater head conditions. Regardless of groundwater level, the low transmissivity of the shallow system limits groundwater flux, resulting in poor groundwater–surface water connectivity and frequent seasonal or drought-related stream drying (Foth, 2026a).

5.0 GEOLOGIC FRAMEWORK MODEL

The groundwater flow model is founded on a three-dimensional geologic framework model developed to represent the spatial distribution and geometry of the principal hydrostratigraphic units within the model domain. The geologic framework integrates available site-specific borehole logs, stratigraphic interpretations, and regional geologic information to define the elevations, thicknesses, and lateral continuity of unconsolidated deposits and underlying bedrock units. This framework model provides the structural basis for discretizing the numerical model, guiding the placement of model layers and the assignment of hydraulic properties. By translating the conceptual understanding of site geology into a consistent three-dimensional representation, the geologic framework model ensures that the groundwater flow model grid accurately reflects controlling geologic features and supports defensible simulation of groundwater flow and groundwater-surface water interactions.

5.1 Data Sources

The geologic framework model was developed by integrating regional, site-specific, and publicly available datasets to define land surface, surficial and bedrock geology for the study area. Land surface elevations were derived from a U.S. Geological Survey (USGS) 1-meter digital elevation model (DEM), supplemented by a site-specific tailings surface survey to accurately represent tailings topography (See Figure 5-1). The bottom of the tailings surface was estimated using the 1949 topographic map (USGS, 1949). Bedrock geologic contacts were defined using geologic sections (see Figures 5-2, 5-3, and 5-4) and bedrock mapping (see Figure 2-3) from the USGS geologic map of Ontonagon County (Cannon et al., 2001), historic site reports (SMI, 1995), recent site investigations (Foth, 2026a) and the White Pine North Leapfrog geologic model. Site borehole logs and Quaternary geology mapping from the State of Michigan were used to delineate unconsolidated deposits present at land surface. Aerial photography from Google Earth Pro was used to support identification of surface features and to assist in determining groundwater model boundary conditions, and NOAA bathymetric data were incorporated to represent Lake Superior lakebed elevations (NOAA, 2024). Subsurface control on depth to bedrock was provided by borehole logs and records from the State of Michigan water well database (EGLE, 2024).

5.2 Unconsolidated Deposits

Unconsolidated (surficial) deposits in the geologic framework model were created by compiling available site-specific borehole data, supplemented by the State of Michigan Wellogic water-well records to estimate depth to bedrock and the thickness of unconsolidated materials. Regional bedrock outcrop information was interpreted to provide additional control on areas of thin or absent surficial deposits. These datasets were integrated to construct a geologic model capable of adapting to uncertainty in surficial geology, particularly where data density varies spatially. For modeling purposes, the unconsolidated deposits were classified into distinct material types, including thin coarse-grained till, undifferentiated glacial till, alluvium, and colluvium, with deposit thicknesses derived primarily from site-specific borehole logs and the Wellogic water-well database. This approach provided a spatially consistent representation of surficial materials and depth to bedrock for translation into the groundwater flow model grid.

5.3 Bedrock Geology

Bedrock geology in the geologic framework model was developed by integrating the site-specific Leapfrog geologic model with published USGS geologic cross-sections (Cannon et al., 1995) and bedrock mapping to provide a consistent three-dimensional representation of regional stratigraphy and structure. The plan-view locations of the USGS cross-sections incorporated into the framework are shown in Figure 5-2, while the resulting north-south (A-A') and

north-northwest–south-southeast (B–B’) geologic sections are illustrated in Figures 5-3 and 5-4, respectively. These cross-sections depict the regional bedrock architecture and relative thicknesses of the Freda Sandstone, Nonesuch Formation, Copper Harbor Conglomerate, and underlying volcanic units, including their regional dip and lateral continuity across the White Pine North Project area. Integration of the cross-section interpretations with site-specific drilling data and USGS outcrop and subcrop mapping enabled development of continuous bedrock elevation surfaces and depth-to-bedrock contours, which form the structural basis for discretizing bedrock layers in the groundwater flow model and ensure consistency between site-scale interpretations and regional geologic controls on groundwater flow.

6.0 GROUNDWATER MODEL DEVELOPMENT AND CALIBRATION

The following section describes development of the steady-state and transient groundwater flow model, including model code selection, grid discretization, parameterization, and formulation of boundary conditions used to simulate groundwater flow and groundwater–surface water interactions within the model domain. The section also summarizes the approach used for steady-state and transient flow model calibration.

6.1 Model Code Selection

The groundwater flow model was developed utilizing the MODFLOW suite of modeling codes with the Groundwater Vistas graphical pre- and post-processor (Version 9.19; Environmental Simulations, Inc., 2024). The implementation of the groundwater flow model was carried out with the MODFLOW6 finite-difference code (Langevin, 2017). MODFLOW6 is preferred to other MODFLOW codes because its modern, modular design supports unstructured grids, improved solvers, and integrated simulation of groundwater-surface water interactions, and transport processes within a single, flexible framework suited for complex models.

6.2 Model Grid and Layering

The groundwater flow model domain extends approximately 32.1 kilometers (km) in the north–south direction and 47.1 km in the east–west direction, encompassing an area of approximately 1,512 square kilometers (Figure 6-1). Model coordinates are referenced to the WGS 1984 UTM Zone 16N coordinate system (meters). External model boundaries were positioned sufficiently far from the White Pine and White Pine North mine dewatering areas to minimize boundary effects and, where practicable, were aligned with major geologic structures and surface-water features.

The model grid uses a uniform horizontal discretization of 300 m by 300 m. Laterally, the model domain extends from Lake Superior to the north, the Keweenaw Fault to the south, the Porcupine Mountains to the west, and the Ontonagon River to the east (Figure 6-1). Vertically, the model domain extends from land surface, at a maximum elevation of approximately 563 m above mean sea level (amsl), to a minimum elevation of approximately –1,100 m mean sea level (msl).

From top to bottom, the model includes layers representing tailings, Lake Superior, alluvium and colluvium, glacial till, Freda Sandstone, weathered bedrock, the Nonesuch Formation, the Copper Harbor Conglomerate, and the Porcupine Volcanics. Model Layer 1 includes only the tailings disposal facilities (TDFs) and Lake Superior. Model Layers 2 and 3 mostly represent unconsolidated deposits, while Model Layer 4 represents weathered bedrock. In the Porcupine Mountains and the Trap Hills south of the project area, Model Layers 2 through 4 also include volcanics. Model Layers 5 through 20 represent competent bedrock and the underground mine workings from the White Pine Mine and the proposed White Pine North Mine.

Depths to the base of the Freda Sandstone, Copper Harbor Conglomerate, and Porcupine Volcanics are not well constrained by available drillhole data. Although SMI (1995) reports thicknesses of up to approximately 6,000 feet, 5,000 feet and 8,000 feet for these units, respectively, they were not extended to their full reported thicknesses in the groundwater flow model. Instead, the model bottom was assigned a constant elevation of –1,100 m msl, approximately 100 m below the proposed White Pine North Mine underground workings, to allow for simulated groundwater inflow into underground mine workings from below.

The groundwater model consists of 20 layers, each with variable elevation and thickness. A 30 m thickness of weathered bedrock was assumed based on publicly available regional data for the Upper Peninsula indicating that fractured and weathered Precambrian bedrock commonly extends on the order of 10–30 m below the bedrock surface,

providing a conservative representation (Cannon et al., 2018). Where lithologic units pinch out, a minimum layer thickness of 0.5 meters was assigned to maintain numerical stability. In some cases, multiple lithologic units are represented within a single model layer (for example, the Porcupine Volcanics and Copper Harbor Conglomerate). A summary of model layers, associated lithologies, and minimum, average, and maximum thicknesses is provided in Table 6-1.

6.3 Hydraulic Properties

Three primary datasets were available to characterize horizontal hydraulic conductivity in the region based on aquifer testing: Shepherd Miller, Inc. (SMI, 1995), AECOM (2012), and recent investigations conducted by Foth (2026a, 2026b). Due to the limited availability of field- or laboratory-derived vertical hydraulic conductivity (K_v) data, K_v values for most hydrogeologic units represented in the groundwater model were assumed to be one to ten times lower than the corresponding horizontal hydraulic conductivity, consistent with commonly applied anisotropy assumptions for layered sedimentary and glacial deposits. Hydraulic conductivity values, both horizontal and vertical, were assigned to model layers based on the hydrogeologic unit or units represented within each layer. Calibrated horizontal and vertical hydraulic conductivity values are summarized in Table 6-2 and presented on a layer-by-layer basis in Figures 6-2 through 6-13. The calibrated hydraulic conductivity values are based on the aquifer tests conducted in the region, and the three supporting hydraulic conductivity datasets from those tests are described below. A discussion of storage coefficients is also provided in this section.

6.3.1 Aquifer Testing Types

Specific capacity, slug tests, packer tests, and constant-rate pumping tests provide estimates of horizontal hydraulic conductivity at progressively increasing levels of accuracy and spatial representativeness, reflecting differences in test duration, stressed aquifer volume, and sensitivity to well and formation conditions. Constant-rate pumping tests provide the highest accuracy and most representative aquifer-scale estimates of horizontal hydraulic conductivity because they stress a large volume of the aquifer over sufficient time to evaluate heterogeneity and boundary effects. Packer tests offer intermediate accuracy by isolating discrete depth intervals, making them well suited for defining unit-specific or fracture-controlled hydraulic conductivity, particularly in bedrock, though results remain localized. Slug tests yield lower-accuracy, small-scale estimates that reflect near-well conditions and are sensitive to well construction and skin effects, but they are useful for order-of-magnitude characterization where pumping tests are impractical. Specific capacity methods provide the least accurate estimates, relying on short-duration pumping data and simplified assumptions, and are best suited for reconnaissance-level screening or regional context when benchmarked against more rigorous test results (Woessner et al., 2023).

Slug tests, packer testing, and specific capacity analysis were conducted at White Pine and/or Copperwood mines. Results from these three types of aquifer testing are described below.

6.3.2 Recent Aquifer Testing at White Pine

Recent aquifer testing conducted at the White Pine site characterized hydraulic properties of both unconsolidated deposits and bedrock using a combination of slug tests, discrete-interval pumping tests, hydrophysical logging (HPL), and packer testing. Slug tests were performed in wells completed in unconsolidated deposits and shallow bedrock, while discrete-interval pumping and packer tests were conducted in deeper bedrock intervals to estimate hydraulic conductivity and transmissivity. Results from both historical and recent testing are summarized in Foth (2026a). Where wells were re-tested, hydraulic conductivity estimates from the most recent testing were used in lieu of earlier results.

Slug-test results from wells completed in unconsolidated deposits and shallow bedrock yielded a mean hydraulic conductivity of 3.4×10^{-2} m/day, with all values less than 0.43 m/day, indicating generally low permeability conditions. To further refine characterization of shallow bedrock hydraulic properties, additional HpL and discrete-interval packer testing was conducted in nine exploratory boreholes. HpL results for intervals shallower than 60 m below ground surface and shallow packer-test results are presented in Foth (2026a). Mean hydraulic conductivity values derived from HpL testing were approximately 0.16 m/day, while recent packer testing yielded a mean value of approximately 2.0×10^{-2} m/day. Detailed analyses of bedrock hydraulic testing are provided in a separate technical report (Foth, 2026b).

Hydraulic conductivity estimates derived from all testing methods reported in Foth (2026a) are summarized in Table 5-8 of that report and consistently indicate low aquifer permeability. The mean hydraulic conductivity for the shallow hydrostratigraphic unit, which includes unconsolidated deposits and shallow bedrock wells installed at depths less than 60 m below ground surface, is approximately 0.06 m/day.

6.3.3 Historic Aquifer Testing at White Pine

Historic aquifer testing conducted near the White Pine Mine was evaluated by SMI (1995), who analyzed specific-capacity data from 40 domestic wells completed in the shallow hydrostratigraphic unit. Based on these data, SMI reported a mean hydraulic conductivity of approximately 0.06 m/day. While specific-capacity analyses are generally less reliable for estimating hydraulic conductivity than slug or pumping tests, these results provide a useful order-of-magnitude estimate for consideration during model development.

In addition, laboratory permeability testing of overburden soil samples collected at the North Tailings Dam #2 site yielded hydraulic conductivity values ranging from 7.0×10^{-5} m/day to 0.16 m/day (SMI, 1995). This wide range reflects the variability in the tailings, spanning materials from low-permeability clay to fine-grained sand.

6.3.4 Historic Aquifer Testing at Copperwood Mine

The proposed Copperwood Mine is located in Gogebic County near Wakefield, Michigan, adjacent to the Porcupine Mountains Wilderness State Park, approximately 25 miles west-southwest of the historic White Pine Mine. In-situ hydraulic conductivity testing conducted at the Copperwood site included slug tests in both unconsolidated and bedrock units (AECOM, 2012). Horizontal hydraulic conductivity values for unconsolidated deposits spanned approximately six orders of magnitude, ranging from 1.7×10^{-8} to 1.9×10^{-2} cm/sec (equivalent to approximately 1.5×10^{-5} to 16.0 m/day). Lower hydraulic conductivity values were generally associated with glacial till, while higher values corresponded to subglacial meltwater deposits.

Bedrock hydraulic conductivity testing at Copperwood included slug tests conducted in the Nonesuch Shale and Copper Harbor Conglomerate. Horizontal hydraulic conductivity values for the Nonesuch Shale ranged from approximately 7.9×10^{-5} to 0.6 m/day, while values for the Copper Harbor Conglomerate ranged from approximately 6.0×10^{-5} to 5.6 m/day. Both bedrock units exhibited hydraulic conductivity ranges spanning approximately four to five orders of magnitude.

6.3.5 Storage Coefficients

Storage coefficients used in the transient groundwater flow model were informed by slug and packer testing conducted by Shepherd Miller, Inc. (SMI, 1995), supplemented by regional groundwater studies in Michigan. On-site packer tests yielded storage coefficients on the order of 6.4×10^{-6} to 6.4×10^{-5} , while slug tests produced slightly higher values ranging from approximately 1.0×10^{-4} to 1.5×10^{-4} . These values are representative of confined to semi-confined conditions typical of the bedrock aquifers at the site.

Regional studies conducted as part of the State of Michigan Groundwater Inventory and Mapping Project indicate that unconsolidated deposits in the western Upper Peninsula, including Quaternary alluvium and glacial till, exhibit specific yield values ranging from approximately 0.02 to 0.30. In contrast, bedrock units such as the Freda Sandstone, Nonesuch Shale, Copper Harbor Conglomerate, and Portage Lake Volcanics are characterized by low specific yield (≤ 0.05) and specific storage values ranging from approximately 3.0×10^{-7} to 1.0×10^{-4} 1/m, reflecting confined, fracture-controlled flow behavior and limited primary porosity (Lusch et al., 2006; Johnson, 1967; Cai et al., 2023; and Butler and Burbank, 1929).

Based on these data, four storage-coefficient zones were defined in the model to represent tailings, unconsolidated deposits, and bedrock units. Specific yield values of 0.01, 0.20, and 0.10 were assigned to the tailings, alluvium, and glacial till, respectively. All bedrock units were assigned a specific storage value of $1.0 \times 10^{-4} \text{ m}^{-1}$. This value represents an upper-bound assumption within the published range for consolidated bedrock and shale units and is intended to conservatively bound aquitard storage behavior in the absence of formation specific storage measurements. Use of this higher-end value avoids underestimation of bedrock storage contributions during transient conditions and provides a conservative basis for evaluating groundwater-level and flux responses in the model.

6.4 Boundary Conditions

This section describes the hydrogeologic features and processes represented as boundary conditions in the groundwater flow model. MODFLOW supports three general types of boundary conditions: specified head, specified flux, and head-dependent flux. No specified-head boundaries were applied in the model. Head-dependent flux boundaries were implemented using Drain (DRN) conditions to simulate gaining creeks, streams, or rivers and mine dewatering and General Head Boundary (GHB) conditions to represent groundwater inflow to and outflow from Lake Superior and the onsite tailings basin. Specified-flux boundary conditions were represented by areal recharge through the Recharge (RCH) package. Groundwater withdrawals from domestic wells were not simulated because these wells extract relatively small volumes of groundwater and are located sufficiently far from the White Pine Mine that they do not measurably influence the modeled groundwater system or water balance.

6.4.1 No Flow Boundaries

No-flow boundary conditions were assigned along the western and southern external boundaries of the model (See Figure 6-14). The western boundary is oriented approximately perpendicular to regional groundwater flow toward Lake Superior and is underlain by low-permeability volcanic rocks, supporting the assumption of negligible cross-boundary flow. The southern boundary coincides with the regional Keweenaw Fault, a major reverse (thrust) fault that juxtaposes low-permeability volcanic units against the Jacobsville Sandstone. Based on its lithologic contrasts and fault architecture, the Keweenaw Fault is assumed to act as a regional flow-restricting structural feature and is therefore represented as a no-flow boundary rather than a transmissive hydraulic conduit (Doonan et al., 1970).

6.4.2 Recharge

Recharge is the hydrologic process by which precipitation infiltrates the soil surface, percolates downward through the unsaturated (vadose) zone, and ultimately reaches the water table. In the groundwater flow model, recharge was applied to the uppermost active model layer using the MODFLOW RCH package. The uppermost active layer was selected because Model Layer 1 is used for the tailings basin and Lake Superior, and because streams within the model domain are incised below the surrounding land surface, resulting in dry cells in the upper model layers.

Two recharge zones were defined in the model: one representing unconsolidated deposits and one representing bedrock and volcanic units (see Figure 6-15). Initial recharge to the unconsolidated deposits was set to 4.5 inches per year, based

on site-specific water balance calculations reported by SMI (1995). Recharge estimates reported for the Eagle and Copperwood mine sites are of similar magnitude and indicate that recharge to unconsolidated deposits generally ranges from approximately 3 to 6 inches per year, while recharge to bedrock and volcanic units is lower, typically on the order of approximately 1 to 3 inches per year, reflecting infiltration through fractures, bedrock outcrops, and vertical pathways such as mine shafts and boreholes. Based on these site-specific studies, recharge values applied in the groundwater flow model were selected within these documented ranges. Recharge onto the unconsolidated deposits and bedrock zones varied by month in the transient model based on the change in monthly precipitation as shown in Figure 3-1.

6.4.3 General Head Boundaries

General head boundaries are implemented in the groundwater flow model to represent Lake Superior and the three TDFs (see Figure 6-16). Lake Superior was represented using General Head Boundary (GHB) conditions to simulate head-dependent groundwater exchange between the unconsolidated deposits and the lake. This approach allows groundwater to discharge to or be recharged from Lake Superior in response to modeled hydraulic gradients, without artificially fixing groundwater heads at the shoreline. The GHB hydraulic head was set to the Lake Superior long-term average water elevation of 183.76 m amsl.

The South Pond, North Pond 1, and North Pond 2 TDFs, were represented in the White Pine groundwater flow model using the GHB package to simulate groundwater exchange with the underlying unconsolidated deposits. Hydraulic head values for the GHBs were assigned based on water-level measurements from piezometers installed in North Pond 1 and North Pond 2, as well as reported pond pool elevations for both facilities (Tetra Tech, 2026).

6.4.4 Drains

Drain boundary conditions were used in the groundwater flow model to represent gaining surface-water features and mine dewatering at the White Pine Mine. Gaining stream reaches were simulated using the MODFLOW DRN package because these features function primarily as groundwater discharge points and do not provide recharge to the unconsolidated deposits, consistent with the site conceptual model. This representation is further supported by surface-water monitoring data indicating low and intermittent baseflows across most Project-area streams, with many reaches exhibiting negligible flow during extended dry periods, consistent with weak and episodic groundwater discharge conditions (Foth, 2026a).

Drain elevations for streams were assigned using the USGS DEM in combination with observed staff-gage water-level data collected as part of the surface-water monitoring program. Because gages are located at different absolute elevations along different streams, temporal variability was represented using relative changes in stage rather than raw water-level measurements. Stream-specific stage-change signals were developed from gage records, temporally interpolated to a monthly time series aligned with the model stress-period structure, and applied to drain elevations to represent seasonal fluctuations in surface-water stage while maintaining consistent longitudinal profiles.

Initial drain conductance values were based on the conceptual model of limited hydraulic connectivity between surface water and groundwater, the hydraulic properties of surrounding unconsolidated materials, and the geometry of the incised stream channels. These conductances were subsequently adjusted during model calibration to achieve reasonable agreement with groundwater-level observations in nearby monitoring wells without overstating groundwater-surface water interaction. The spatial distribution of drain cells representing gaining streams is shown in Figures 6-17 through 6-20.

Mine dewatering at the historic White Pine Mine was also represented using the DRN package, reflecting the constant mine pool elevation and the behavior of the underground workings as seepage faces that remove groundwater from the surrounding saturated bedrock. Based on correspondence with Subterra, the operator of the mine dewatering system,

the mine pool elevation is maintained at approximately 183 mamsl. Initial drain conductance values were assigned based on bedrock hydraulic conductivity and were refined during model calibration to match reported annual groundwater extraction rates from the underground mine. Drain cells representing mine dewatering are shown in Figure 6-21 for model layers 6 through 11.

6.5 Stress Periods

The White Pine groundwater flow model was discretized into a total of 114 stress periods to represent both steady-state and transient groundwater flow conditions. The first stress period represents steady-state conditions and was calibrated to average groundwater levels observed between 2015 and 2025. Stress periods 2 through 114 represent monthly transient conditions spanning October 2015 through February 2025. Monthly stress periods were selected to simulate temporal changes in groundwater levels observed in onsite monitoring wells in response to seasonal groundwater recharge and varying surface-water stage conditions. White Pine Mine inflow data were incorporated into the transient simulation by aggregating measured flowmeter data to monthly totals, allowing mine inflows to vary consistently with observed temporal trends over the calibration period.

6.6 Model Calibration

6.6.1 Calibration Procedure

Model calibration was based primarily on discrete observations rather than contoured surfaces. In groundwater flow modeling, reliance on point measurements reduces the potential for interpretive bias that can arise when attempting to match a contoured potentiometric surface (Konikow, 1978; Anderson and Woessner, 1992). Accordingly, observed groundwater-level elevations and water-level changes at individual monitoring wells throughout the model domain, along with measured inflows to the White Pine Mine, were used as the primary calibration targets.

Calibration was further guided by the principle of parameter parsimony, which seeks to achieve an adequate model fit using the fewest necessary parameters. Decisions to introduce additional parameter zones during calibration were informed by site-specific hydrogeologic data. In the absence of clear hydrogeologic justification, simpler parameterizations with fewer zones were favored over more complex alternatives, consistent with recommended modeling practice (Hill and Tiedeman, 2007).

Both steady-state and transient groundwater flow models were calibrated as part of this study. The steady-state model represents long-term average groundwater conditions that do not vary with time and was used to establish reasonable baseline conditions and parameter ranges. The transient model simulates time-varying groundwater responses to changing stresses and boundary conditions and was used to refine parameter values and evaluate the model's ability to reproduce observed system dynamics. This combined calibration approach is widely recommended because steady-state calibration alone may be insufficient for decision-support applications where predictions depend on time-dependent groundwater responses (EGLE, 2025).

6.6.2 Calibration Objectives

The primary objectives of groundwater flow model calibration were to (1) identify model input parameter values that reasonably represent historic hydrogeologic conditions and (2) demonstrate that the model is suitable for predicting future groundwater responses associated with development of the proposed White Pine North Mine.

Quantitative performance objectives were established to evaluate calibration adequacy. These objectives included achieving a steady-state water-balance error of less than 1 percent; attaining a scaled root mean squared error (scaled RMSE) of approximately 10 percent or less for steady-state hydraulic head and approximately 15 percent or less for

transient drawdown calibration targets; and reproducing reported annual groundwater inflows to the White Pine Mine within ± 20 percent of reported annual totals.

Collectively, these performance thresholds balance statistical goodness-of-fit with hydrogeologic reasonableness by ensuring that the model reproduces observed groundwater levels, drawdowns, and integrated fluxes without relying on unrealistic parameter values. Meeting these criteria supports the conclusion that the model is sufficiently calibrated for decision-support applications involving prediction of future groundwater conditions at the White Pine North Mine.

6.6.3 Calibration Statistics

One of the primary criteria for evaluating the calibration of a groundwater flow model is the difference between model-calculated and observed water levels at calibration targets. A residual or model error, e_i , is defined as the difference between the observed and model-calculated hydraulic head observed at a target location:

$$e_i = h_i - \hat{h}_i$$

where h_i is the measured or observed value of hydraulic head and $\hat{h}_i$ is the model-calculated value at target i location. A residual with a negative sign indicates the model-calculated head is higher than the observed value (i.e., over-simulation). Conversely, a positive residual indicates the model-calculated head is lower than the observed value (i.e., under-simulation). Acceptable residuals should be a small fraction of the difference between the highest and lowest heads (i.e., range of observations (RO)) in the model (ASTM, 2002a).

The mean error (i.e., residual mean), $\bar{e}$, is defined as:

$$\bar{e} = \frac{1}{n} \sum_{i=1}^n e_i$$

where n is the total number of data points (i.e., number of residuals). One objective of model calibration is to minimize the residual mean. As both positive and negative residuals are used in this calculation, this value should be as close to zero as possible (i.e., positive and negative errors should balance each other) (ASTM, 2002b). The mean absolute error (i.e., absolute residual mean), MAE, is defined as:

$$MAE = \frac{1}{n} \sum_{i=1}^n |h_i - \hat{h}_i|$$

and is a measure of the average error in the model. A rule-of-thumb is that the MAE should be 10 percent or less of the range of observations for a good calibration (Hill, 1998; EGLE, 2025; MDH, 2018). In addition, during model calibration, it is desired to minimize an objective function defined as the residual sum of squares (RSS):

$$RSS = \sum_{i=1}^n (h_i - \hat{h}_i)^2$$

Second-order statistics give measures of the amount of spread of the residuals about the residual mean. The most common second-order statistic is the residual standard deviation (RSTD) and is defined as:

$$RSTD = \sqrt{\frac{\sum_{i=1}^n (h_i - \hat{h}_i)^2}{(n - 1)}}$$

Smaller values of the standard deviation indicate better degrees of correspondence compared to larger values (ASTM, 2002b). The RSTD can be compared to the range of observations as a further comparison. The scaled RSTD is defined as:

$$\text{Scaled } RSTD = \frac{RSTD}{RO}$$

For head targets, this value shows how the errors relate to the overall gradient across the model domain. This value should be 10 percent or less for a good calibration (Environmental Simulations, Inc., 2024).

Spatial correlation among residuals can indicate systematic trends or bias in the model (ASTM, 2002b). Correlations among residuals can be identified using scatterplots and spatial plots. A scatterplot is a plot of model-calculated versus observed heads to detect trends in deviation. In a perfect calibration, the points will fall on a straight line with a 45-degree slope (i.e., the model-calculated values match the observed values). In reality, there will be some scatter about this line. The degree of scatter about this theoretical line is a measure of the overall calibration quality. A simulation with a small degree of scatter is a better match with the system being modeled than a simulation with a larger degree of scatter. In addition, plotted points in the scatterplot should not all be grouped either above or below the line, this indicates bias in the simulation (either over- or under-simulation) (ASTM, 2002b). A map of the residuals can be plotted in either plan or cross-section view to identify spatial trends in the residuals. Ideally, residuals should be randomly distributed (Spitz and Moreno, 1996).

6.7 Calibration Targets

Calibration targets are field measurements, most commonly groundwater elevations, used to evaluate the ability of a groundwater flow model to reproduce observed conditions within the modeled system. For steady-state calibration, the objective is to represent average groundwater conditions corresponding to long-term recharge and discharge processes. For the transient model calibration, the objective is to reproduce observed temporal changes in groundwater levels from the onsite monitoring wells and the annual groundwater extraction rates from the White Pine Mine.

Water-level elevation data from onsite monitoring wells and other wells located within the model domain were used as targets to calibrate the steady-state and transient groundwater flow model (see Figure 6-22). Water-level data for offsite wells were obtained from the State of Michigan Wellogic database (EGLE, 2024). Because steady-state conditions were simulated, calibration targets were developed by averaging available water-level measurements collected between October 2015 and March 2025. For Wellogic wells, the reported water-level measurement was used. These single measurements may be influenced by drilling disturbance, incomplete well development, or temporary recovery conditions and may not represent stabilized or long-term groundwater elevations. As a result, Wellogic wells were assigned less importance during model calibration than onsite monitoring wells, which provide consistent, multi-year water-level records that more reliably represent long-term aquifer conditions.

The steady-state calibration targets comprise a total of 238 monitoring wells: 212 State of Michigan database wells and 26 onsite monitoring wells. State of Michigan wells are represented in model layers 2 through 5, while onsite monitoring wells are represented in model layers 2 through 4.

Transient calibration targets include 543 groundwater-level change (drawdown) measurements from onsite monitoring wells. In addition, groundwater inflows to the White Pine Mine were incorporated as transient calibration targets by aggregating simulated drain inflows from model layers 6 through 11 and matching these values to annual groundwater extraction rates provided by Subterra.

Water-level calibration targets were not available for competent bedrock zones in the groundwater model. Hydraulic conductivity values at White Pine span several orders of magnitude based on slug tests, packer tests, and specific-capacity analyses, reflecting pronounced lithologic and fracture-controlled heterogeneity as well as uncertainty in field-derived estimates. As a result, model calibration was guided by selecting hydraulic conductivity values within the range of reported aquifer-test results rather than assigning unique values to each individual bedrock model layer (Layers 5–20), given the lack of sufficient bedrock water-level data to support layer-specific calibration. Final selection of horizontal and vertical bedrock hydraulic conductivity values was based on reproducing observed annual groundwater

inflow rates to the White Pine Mine. For bedrock layers below the White Pine Mine, corresponding to the proposed White Pine North Mine area, hydraulic conductivity values were assumed to be approximately one order of magnitude lower, consistent with analysis of hydraulic conductivity data presented in Foth (2026a).

Development of baseflow calibration targets (either steady-state or transient) for streams near White Pine was not performed because groundwater contributions to streamflow are small, spatially inconsistent, and highly sensitive to seasonal groundwater head fluctuations. Local streams are dominated by precipitation-driven runoff and exhibit flashy responses with rapid recession to low or zero flow due to low-permeability glacial and lacustrine deposits, weak hydraulic gradients toward stream channels, and preferential groundwater discharge toward Lake Superior. These conditions preclude reliable separation of groundwater-derived baseflow from surface runoff and result in intermittent or absent baseflow during extended dry periods. Use of streamflow targets would therefore introduce substantial uncertainty and risk bias in calibrated parameters to account for surface-water processes not represented in the groundwater model. Calibration was instead based on groundwater heads, hydraulic response, and mine inflow data, with streamflow observations used qualitatively to confirm limited groundwater–surface water connectivity.

7.0 FLOW MODEL RESULTS

This section presents the results of the groundwater flow model developed for the White Pine area, including simulated groundwater levels and groundwater fluxes relevant to mine inflows and regional flow patterns. Model results are evaluated relative to calibration objectives to assess the model's ability to reproduce observed groundwater conditions and key hydrologic behaviors controlling flow to the White Pine Mine. Results are presented for steady-state and transient conditions and are used to support interpretation of groundwater flow directions, relative contributions of hydrostratigraphic units, and the overall conceptual understanding of the groundwater system.

7.1 Steady-State Flow Model Calibration

Calibration of the groundwater flow model focused on minimizing the residual sum of squares for the 37 onsite monitoring-well calibration targets, achieving a residual mean close to zero, and maintaining a residual standard deviation less than ten percent of the observed range in hydraulic head, consistent with ASTM (2002a) guidance. Model-calculated water-level elevations and residuals for individual calibration targets are summarized in Table 7-1. Overall steady-state statistics, including residual mean, residual standard deviation, and residual sum of squares, are presented in Table 7-2.

ASTM (2002a) recommends that calibration residuals represent a small fraction of the observed range in groundwater elevations across the model domain. Results indicate that 96 percent of residuals for onsite monitoring wells are less than ten percent of the observed head range (i.e., 6.1 m). The single onsite residual exceeding this threshold (MW-30) is attributed to a steep localized horizontal hydraulic gradient beneath Bedell Pond, likely associated with heterogeneity in the unconsolidated deposits and focused infiltration from the pond. For State of Michigan database wells, only three residuals exceed ten percent of the observed regional head range (27.6 m). These wells were included to provide regional spatial coverage and support qualitative matching of groundwater elevations across the model domain, but they were not emphasized in calibration performance assessment due to their distance from the mine and uncertainty associated with single water-level measurements reported on well construction and pump record forms.

Figure 7-1 presents observed versus model-simulated groundwater levels for the calibration dataset with onsite wells differentiated from State of Michigan wells. In a well-calibrated model, data points are expected to plot close to the 1:1 equivalence line and be distributed approximately evenly above and below that line. As shown in Figure 7-1, simulated water levels generally track observed values across the full range of groundwater elevations represented in the model domain, with no systematic deviation at low or high heads, indicating that the model reproduces both regional gradients and local water-level conditions.

Figure 7-2a shows observed groundwater levels plotted against model residuals for onsite wells and State of Michigan wells. An unbiased calibration is indicated by residuals clustered near zero and symmetrically distributed between positive and negative values. The residual plot demonstrates that most residuals are small in magnitude and evenly distributed around zero, with no discernible trend with respect to groundwater elevation, supporting the conclusion that the calibrated groundwater flow model exhibits minimal bias and provides an acceptable representation of observed groundwater conditions. Consistent with this interpretation, Figure 7-2b shows that steady-state calibration residuals are spatially dispersed across the model domain, with both positive and negative residuals occurring throughout the area and no persistent spatial clustering or regional patterns of over- or under-simulation, indicating that model fit is not biased toward any portion of the domain.

Figure 7-3 illustrates the simulated potentiometric surface in the unconsolidated deposits (model layer 2) under steady-state conditions. Groundwater elevation contours closely follow surface topography, with higher hydraulic heads in upland recharge areas associated with the Porcupine Mountains and Trap Hills and progressively lower heads toward

regional discharge boundaries. Contour orientations indicate that shallow groundwater flows away from these uplands and generally converges toward Lake Superior and the Ontonagon River to the east. Variations in contour spacing reflect changes in hydraulic gradient and lateral heterogeneity within the unconsolidated deposits, while the overall pattern is characteristic of a shallow, topography-controlled groundwater system.

Figure 7-4 shows the simulated steady-state potentiometric surface in the competent bedrock (model layer 6). Groundwater elevations generally decrease from higher-head areas in the southern and upland portions of the model domain toward regional discharge boundaries, including Lake Superior, indicating northward regional groundwater flow within the bedrock. Compared to the unconsolidated deposits, the bedrock potentiometric contours are smooth and broadly spaced, reflecting lower hydraulic gradients and a more regionally controlled flow system consistent with the low hydraulic conductivity of the competent bedrock units. At White Pine Mine, the contours exhibit a localized depression associated with mine dewatering, indicating that mine dewatering exerts a localized influence on bedrock groundwater levels and does not substantially alter the broader regional flow pattern.

7.2 Transient Flow Model Calibration

Transient calibration of the groundwater flow model was performed using onsite monitoring-well water-level data, historical mine inflow records, and available surface-water stage information, consistent with recommended practice to rely on the most reliable and informative datasets available for the stated modeling objectives (Hill and Tiedeman, 2007). Figure 7-5 shows the locations of onsite monitoring wells used to evaluate simulated temporal responses, and transient calibration statistics are summarized in Table 7-3. The observed groundwater-level change across the onsite monitoring network over the approximately 10-year calibration period is small (4.2 m), reflecting the absence of significant transient hydraulic stresses such as groundwater pumping. In addition, most offsite wells within the model domain lack repeated water-level measurements, which limits the availability of independent temporal calibration targets across the regional system.

Transient calibration was further constrained by limited availability of surface-water stage data for rivers and creeks near the White Pine Mine. Measured gage-height records were available for only six representative surface-water features, and only during portions of 2024 (August through December) and 2025 (March through October); continuous gage records spanning the full 2015–2025 transient calibration period are not available (Foth, 2026a). As a result, monthly changes in stream water-level elevations over the 10-year simulation were estimated based on gage-height trends observed at these six monitored streams and applied to other creeks and rivers within the model domain that lack site-specific stage data. This approach is appropriate for the regional scale of the model and consistent with the conceptual understanding that surface-water features respond similarly to regional climatic drivers. Nevertheless, the limited spatial and temporal coverage of stream gage data restricts the degree to which transient surface-water/groundwater interactions can be independently constrained using observed stage data alone. Consequently, uncertainty bounds on simulated surface-water stage and related groundwater–surface water exchange are broader than would be expected with a long-term, spatially comprehensive gage network; however, this uncertainty does not affect conclusions regarding regional trends or the magnitude of predicted changes, which remain small and consistent with the site conceptual model.

Under these conditions, conventional scaled error metrics are insufficient indicators of transient model performance because the limited range of observed groundwater-level change and the short duration of available surface-water stage records constrain the ability of these metrics to differentiate model fit (Hill and Tiedeman, 2007). Accordingly, greater emphasis was placed on evaluating model bias, the ability to reproduce the observed range of groundwater-level change, and consistency with the conceptual model of a low-stress, regionally controlled groundwater system. Simulated drawdown residuals are within the observed range of water-level change, and the residual mean is near zero, indicating minimal systematic bias in the simulated transient response.

The scaled root mean square (RMS) statistics for drawdown targets ranged from approximately 11 to 16 percent, which exceeds benchmarks commonly cited for local-scale models; however, these metrics must be interpreted in the context of the model scale, objectives, and data limitations. The model covers more than 1,500 km² with 300-m grid spacing, such that individual model cells may include both monitoring wells and surface-water features (e.g., streams), and the model is not intended to resolve local-scale heterogeneity or short-term stage fluctuations within individual channels. The adequacy of the transient calibration is therefore evaluated based on the model's ability to reasonably reproduce regional temporal trends and overall system behavior rather than exact matches at individual locations (Hill and Tiedeman, 2007). Given the limited transient stresses, small magnitude of observed groundwater-level change, constrained surface-water stage record, and regional scale of application, the transient calibration is considered appropriate for the model's intended purpose of evaluating the regional groundwater response to mine dewatering.

7.2.1 Potentiometric Surfaces

Figures 7-6 and 7-7 present the simulated potentiometric surface contours for model layers 2 (unconsolidated deposits) and 6 (bedrock), respectively, for March 2025, the final stress period of the transient groundwater flow model. Recharge during this stress period is very similar to the steady-state recharge rate; accordingly, the overall configuration of the potentiometric surface closely resembles steady-state conditions. In both layers, groundwater elevations are highest in upland recharge areas and decrease toward regional discharge boundaries, including Lake Superior and major surface-water features, indicating consistent regional flow directions. In layer 2, contours are strongly influenced by surface topography and display relatively smooth gradients characteristic of a shallow, topography-controlled groundwater system. In contrast, layer 6 exhibits more subdued gradients and broader contour spacing, reflecting the lower hydraulic conductivity and more regionalized flow behavior of the bedrock system. The similarity between the layer 2 and layer 6 contour patterns indicates strong hydraulic continuity at the regional scale and demonstrates that the transient model has reached a quasi-steady condition by the end of the simulation period.

7.2.2 Mine Inflows

Figure 7-8 shows simulated annual mine inflows from the groundwater model compared to observed inflows reported for the historic White Pine Mine. The comparison indicates strong agreement in terms of relative year-to-year variability, with a high correlation coefficient ($r \approx 0.87$), demonstrating that the model reasonably reproduces temporal trends in mine inflow response. On average, the model underpredicts observed inflows by approximately 21 percent. Given the simplified representation of the underground workings as drain features, the buffering effect of a relatively constant mine pool elevation, and the aggregation of transient processes into annual values, the level of agreement achieved is considered appropriate for supporting predictive simulations and impact assessment. The remaining underprediction likely reflects uncertainties in fracture connectivity, simplifications inherent in representing complex workings as drains, operational variability in mine pool management, and the use of annualized inflow data.

7.2.3 Hydrographs

Figures 7-9 through 7-11 present simulated and observed water-level change hydrographs for onsite monitoring wells completed in model layers 2 through 4, respectively. Across all three layers, the model generally reproduces the long-term groundwater-level trends and overall magnitude of water-level change observed in the monitoring data, indicating that the calibrated transient model captures the dominant controls on groundwater response over the simulation period. However, the amplitude of short-term water-level fluctuations at many onsite wells is muted in the simulations relative to observations.

The reduced simulated variability is primarily attributable to the 300-meter model grid spacing and the proximity of many onsite monitoring wells to surface-water features represented as drain boundary conditions. Several wells shown in Figures 7-9 through 7-11 are located within the same model cell as a drain or in an immediately adjacent cell. Under these conditions, simulated heads represent cell-averaged groundwater conditions, which dampen localized drawdown and recovery responses that are evident in the observed hydrographs. As a result, simulated water-level changes at these wells tend to be temporally smoother and smaller in magnitude, even when the overall trend is consistent with observed conditions.

In contrast, wells located farther from surface-water boundaries show improved agreement between observed and simulated water-level changes. For example, MW-37 and MW-41 exhibit simulated water-level changes of up to approximately 3 meters, reflecting their position more than one model cell removed from drain features. As shown in Figures 7-9 and 7-10, these wells demonstrate a closer match in both the magnitude and timing of water-level response, consistent with expectations for transient calibration targets that are less affected by grid-scale averaging and strong boundary controls.

Additional differences between observed and simulated water-level changes, particularly at downgradient wells, reflect the steep hydraulic gradient from the tailings basin toward surrounding monitoring locations. In areas of sharply varying head over short distances, small spatial differences between the modeled representative cell and the actual well location can result in noticeable discrepancies in simulated water-level elevation and change. This sensitivity further limits the ability to simultaneously match both absolute heads and transient amplitudes at all onsite wells.

Overall, the comparison illustrated in Figures 7-9 through 7-11 indicates that residual mismatches between observed and simulated water-level changes are primarily a consequence of model discretization scale, drain boundary representation, and local hydraulic gradients, rather than deficiencies in the conceptual model or hydraulic property assignments. The model is therefore considered suitable for evaluating regional groundwater behavior and long-term mine-related impacts, with localized damping near surface-water features being an expected and defensible outcome of the model design.

7.3 Water Balance

The overall water budget for the calibrated groundwater flow model is summarized in Table 7-4. Under steady-state conditions, the water balance is dominated by recharge ($317,587 \text{ m}^3/\text{day}$), which is primarily discharged through drain features ($238,142 \text{ m}^3/\text{day}$) and head-dependent boundary fluxes ($96,983 \text{ m}^3/\text{day}$), with essentially no mass-balance discrepancy. For the March 2025 transient stress period, total model throughput decreases to $214,002 \text{ m}^3/\text{day}$, and inflow is dominated by release from aquifer storage ($S_y=138,334 \text{ m}^3/\text{day}$; $S_s=24,082 \text{ m}^3/\text{day}$), while drains remain the primary discharge mechanism ($179,815 \text{ m}^3/\text{day}$). This storage-dominated inflow indicates that groundwater discharge during the transient period is supplied primarily by depletion of bedrock storage rather than recharge, reflecting low bedrock hydraulic conductivity, slow system response, and limited hydraulic connectivity between the deep groundwater system and surface-water features.

Both the steady-state and transient water budgets meet the calibration objective of less than 1 percent mass-balance discrepancy, indicating stable numerical performance and supporting confidence in the reported flux terms.

7.4 Flow Model Sensitivity Analysis

Sensitivity analysis was performed to evaluate how uncertainty in estimated aquifer parameters influences model results and calibration performance. This process is a fundamental component of groundwater modeling and is used to quantify uncertainty in calibrated parameters and model predictions (Anderson and Woessner, 1992). During sensitivity analysis, calibrated parameter values are systematically perturbed within reasonable ranges, and the resulting changes in

simulated groundwater levels are evaluated. Parameters that produce the largest changes in simulated heads are considered the most sensitive and exert the greatest influence on model behavior. Sensitivity analysis was conducted by varying one parameter at a time while holding all other parameters constant, allowing individual parameter effects to be isolated and compared (Spitz and Moreno, 1996).

Parameter sensitivities were evaluated using the PEST (Parameter ESTimation) software (Doherty, 2019), which provides a quantitative measure of sensitivity through a metric referred to as composite sensitivity. Sensitivity is defined as the change in a model-predicted value, in this case groundwater head, divided by the change in a model parameter. Because different parameters have different units and magnitudes (e.g., hydraulic conductivity versus storage), direct comparison of raw sensitivities is not meaningful. To allow comparison among parameters, sensitivities were normalized by multiplying each sensitivity by its corresponding parameter value, or by the log of the parameter value when parameters were log-transformed in PEST. The resulting composite scaled sensitivity (CSS) values have consistent units of length and provide a common basis for ranking parameter influence.

Composite scaled sensitivities were used to identify parameters that exert the greatest control on model calibration and predictive performance. Parameters with low sensitivity have limited influence on simulated heads and may be poorly constrained by available calibration data, whereas highly sensitive parameters strongly affect model results and therefore require careful calibration. Use of CSS values allows comparison of parameter influence across different parameter types and magnitudes and provides insight into which parameters dominate model behavior.

Results of the sensitivity analysis indicate that model results are not materially sensitive to reasonable variation in bedrock specific storage, indicating that use of a conservative upper-bound specific storage value does not unduly influence simulated groundwater heads or fluxes. The six most sensitive parameters in both the steady-state and transient models are glacial till and bedrock recharge, the horizontal and vertical hydraulic conductivity of the volcanic units, and the vertical hydraulic conductivity of the competent Freda/Nonesuch and Copper Harbor bedrock. These parameters are most sensitive because groundwater flow within the model domain are jointly controlled by recharge inputs, which govern the volume of water entering the system, and by bedrock hydraulic properties, which regulate regional flow paths, mine inflows, and transient water-level responses. In particular, recharge to surficial till and exposed bedrock directly influences regional heads and White Pine Mine inflow rates, while bedrock hydraulic conductivity controls the rate at which groundwater can migrate toward dewatered mine workings and redistribute vertically between model layers. Because calibration targets in the deeper bedrock are limited, uncertainty in both recharge and bedrock conductivity parameters propagates directly into uncertainty in simulated inflows, resulting in high sensitivity during calibration. These sensitivity results directly informed the uncertainty analysis presented in Section 8 by identifying recharge magnitude and bedrock hydraulic conductivity anisotropy as the dominant sources of uncertainty in predicted mine inflows.

8.0 PREDICTIVE MODEL

Mining, closure, and post-closure conditions were simulated using a transient groundwater flow model to evaluate the hydrologic response to mine development over time. During the mining phase, groundwater inflow rates to the underground workings were simulated by explicitly representing mine dewatering stresses. The closure and post-closure phases were then modeled to evaluate groundwater rebound and to estimate the time required for water levels to recover within the dewatered underground mine workings following cessation of pumping.

8.1 Stress Period Setup for the Mine Plan

The predictive groundwater flow model for the White Pine North Mine was discretized into 37 stress periods (Table 8-1) to represent anticipated changes in groundwater recharge, surface-water conditions, and mine development over the life of the project. Active mining is expected to occur over an approximately 27-year period, followed by closure. Stress-period durations were selected to align with planned mine-layout changes so that mine dewatering stresses evolve consistently with the development sequence.

The mine plan includes a staged, year-by-year development beginning with portal construction at the surface. From the portals, main access declines extend approximately 700 to 800 meters below ground surface, where a 90-degree turn leads into five primary access drives. Two ventilation raises extend to the surface during this phase. From the access drives, mine development continues approximately 2.5 kilometers down-dip to intersect the ore seam. Once at the ore horizon, development follows the ore body, including localized undulations consistent with seam geometry. An additional ventilation raise is constructed to provide full ventilation capacity. Panel access is developed using paired (twin) drives branching from six main access drives, and mining blocks are organized as sequential production stopes, typically consisting of one to six stopes aligned along the ore trend.

8.1.1 Groundwater Recharge and Surface Water

Groundwater recharge was varied on an annual basis in the predictive model using climate projections obtained from the Climate Explorer website (U.S. Federal Government, 2025). The Representative Concentration Pathway 4.5 (RCP 4.5) mean scenario, representing a lower-emissions future climate trajectory, was selected for the predictive simulations. Annual recharge rates were adjusted to reflect projected changes in precipitation under this scenario. Surface-water elevations were also varied annually in proportion to projected precipitation changes under the RCP 4.5 mean scenario, allowing surface-water boundary conditions to respond consistently to future climate variability.

8.1.2 Dewatering Drains

Mine dewatering was simulated using drain boundary conditions assigned to model cells corresponding to the active underground workings. Drains were assigned to individual model layers based on the vertical and horizontal extent of mine development, and their locations and elevations were updated over time to reflect the progression of mining. In total, 1636 drain cells were used to represent mine dewatering throughout the predictive simulation.

The drain layout for each stress period was developed by intersecting the three-dimensional mine geometry with the groundwater model grid. Drain cells were assigned to model cells where active mining was anticipated during each stress period, with the spatial extent of mining at the end of each stress period assumed to apply for the entire stress period. Drain elevations were specified to span the range of elevations associated with active underground workings during each period. The spatial distribution of drain cells by model layer is illustrated in Figure 8-1, which shows the evolving mine dewatering configuration used in the predictive simulations.

8.2 Predictive Model Results

Figure 8-2 shows the simulated groundwater elevation contours in the bedrock during the year 2040, which coincides with the period of maximum mine dewatering at the proposed White Pine North Mine. The potentiometric surface exhibits a localized area of drawdown centered on the active underground mine workings, with groundwater elevations decreasing toward the mine footprint, indicating focused groundwater inflow to the dewatered openings. Contours are more closely spaced in the immediate vicinity of the mine, reflecting locally increased hydraulic gradients induced by dewatering, while remaining broadly spaced away from the mine, consistent with low-gradient, regionally controlled flow in the competent bedrock. Outside the zone of active mining influence, regional groundwater flow patterns remain directed toward major discharge boundaries, including Lake Superior, indicating that maximum dewatering produces a spatially limited perturbation to the bedrock potentiometric surface rather than a widespread regional cone of depression.

The mining-phase simulation also produced annual estimates of groundwater inflow to the underground mine throughout the active mining period. Because groundwater-level calibration data are not available at the depths of the proposed mine workings, an uncertainty analysis was conducted to evaluate the sensitivity of predicted inflows to hydraulic conductivity anisotropy and recharge. This analysis was performed by varying the horizontal-to-vertical hydraulic conductivity ratio ($K_x:K_z$) over values of 1:1, 2:1, and 10:1, which represent plausible lower- and upper-bound conditions for the bedrock system. Results of this uncertainty analysis are presented in Figure 8-3 and show that predicted annual mine inflows generally range from approximately 50 to 360 gpm, with increasing inflow rates associated with lower anisotropy. The 1:1 and 10:1 cases bracket reasonable bounds on inflow uncertainty and provide an appropriate range for evaluating dewatering system performance.

The Nonesuch Formation was deposited in a lacustrine rift-basin environment within the Midcontinent Rift System and consists primarily of fine-grained shale and siltstone deposited under low-energy conditions, which commonly result in anisotropic hydraulic properties. Accordingly, a $K_x:K_z$ ratio of 2:1 was selected as the base-case condition for mine dewatering design, providing a conservative yet reasonable representation of groundwater inflow. Under this base-case scenario, the maximum predicted dewatering rate is approximately 235 gpm.

8.2.1 Climate Change Scenario

A second predictive evaluation assessed the sensitivity of underground mine inflows to future recharge by changing the recharge scenario from RCP 4.5 to RCP 8.5 (a higher emissions scenario) using Climate Explorer precipitation projections. The projected difference in annual precipitation between the two scenarios ranges from approximately -2.9 to +4.3 in./yr, with an average difference of about +0.6 in./yr. Model results indicate that these recharge differences produce negligible changes in predicted mine inflows; therefore, the dewatering predictions are not highly sensitive to the range of projected future precipitation evaluated.

8.2.2 Groundwater Discharge Scenario

A third predictive scenario was evaluated to assess potential changes in groundwater discharge to surface-water drains with and without the proposed underground mine. Model results indicate that mine development results in an approximately five percent change in discharge to the Mineral River and less than one percent change to the remaining streams. Streams and adjacent wetlands within the Project area are supported by the same shallow groundwater system and runoff-dominated hydrologic regime, which exhibits limited and often intermittent groundwater contribution. Because mine dewatering primarily affects the deep bedrock system and modeled changes in shallow groundwater discharge are minimal, underground mining is not expected to measurably affect streamflow or the hydrology of wetlands adjacent to these surface-water features, consistent with the site conceptual model.

9.0 LIMITATIONS AND ASSUMPTIONS

The groundwater flow model developed for the White Pine North Project represents a regional-scale, numerical approximation of a complex hydrogeologic system and is subject to inherent limitations and assumptions typical of groundwater modeling studies. These limitations should be considered when interpreting model results and applying them to mine design, dewatering system sizing, and impact assessment.

The model conceptualization assumes that groundwater flow occurs within two hydraulically distinct systems: a shallow system consisting of unconsolidated deposits and shallow fractured bedrock, and a deep system consisting of competent Precambrian bedrock. Hydraulic properties assigned to these units are based on available site-specific testing, historical investigations, and regional literature values. However, groundwater flow in bedrock is controlled primarily by discrete fractures and fracture zones that cannot be explicitly represented at the model scale. As a result, hydraulic conductivity values assigned to bedrock units represent effective, bulk properties rather than explicit fracture networks, and localized high-permeability features may not be fully resolved.

Model layer geometry and hydrostratigraphic boundaries were developed using available geologic mapping, borehole data, and interpreted cross sections. While these data provide a reasonable representation of regional stratigraphy, uncertainty remains in the lateral continuity, thickness, and degree of weathering of individual units, particularly at depth. Assumed thicknesses of weathered bedrock and competent bedrock units are therefore simplified representations of a more heterogeneous subsurface.

Calibration of the steady-state and transient models is constrained primarily by groundwater-level observations from shallow monitoring wells. Groundwater-level data at the depths of the proposed mine workings are limited, and deep bedrock monitoring data are sparse. Consequently, hydraulic conductivity and storage parameters for deep bedrock units are less well constrained than shallow system parameters, and uncertainty in these properties directly influences predicted mine inflows. This limitation was explicitly addressed through sensitivity and uncertainty analyses; however, predictive results should be interpreted as reasonable estimates rather than precise forecasts.

Recharge was applied as a spatially uniform rate within defined recharge zones and represents long-term average conditions rather than event-scale variability. Seasonal effects, snowmelt dynamics, short-term storm events, and localized focused recharge are not explicitly simulated. Similarly, evapotranspiration is implicitly accounted for through calibration rather than being simulated as a dynamic process. These simplifications are appropriate for a regional groundwater flow model but limit the model's ability to reproduce short-term water-level fluctuations.

Surface-water features and mine dewatering were represented using head-dependent boundary conditions and drain boundary conditions, respectively. These boundary conditions are conceptual representations of groundwater-surface water interaction and mine inflow processes and assume that discharge occurs only when groundwater levels exceed specified elevations. While this approach is widely accepted and appropriate for the study objectives, it does not explicitly simulate surface-water routing, streambed heterogeneity, or unsaturated flow processes. As a result, simulated changes in streamflow should be interpreted as indicative of relative magnitude rather than precise volumetric predictions.

The transient predictive simulations assume that mine development progresses according to the proposed mine plan and that dewatering system performance is consistent with modeled drain elevations and extents. Deviations from the assumed mine layout, sequencing, or operational practices could affect actual groundwater inflows.

Finally, the model was developed to support prefeasibility-level design and regulatory evaluation and is not intended to replace detailed, site-specific engineering analyses or operational monitoring. As additional hydrogeologic data become available, particularly from deep bedrock monitoring and mine development, the model should be refined and updated to reduce uncertainty and improve predictive confidence.

10.0 SUMMARY AND CONCLUSIONS

10.1 Summary

A regional-scale groundwater flow model was developed for the White Pine North Project to support prefeasibility-level mine design, dewatering system planning, and evaluation of potential groundwater and surface-water impacts. The model integrates decades of hydrogeologic investigations, including historical mine data, long-term groundwater monitoring records, recent drilling and testing, and updated geologic interpretations of unconsolidated deposits and Precambrian bedrock units. The model domain encompasses the proposed mine area and surrounding hydrogeologic features, including Lake Superior and local surface-water drainages, and represents groundwater flow within both shallow and deep hydrostratigraphic systems.

The steady-state model was calibrated to groundwater-level observations from a comprehensive network of site and regional monitoring wells and demonstrates an acceptable match to observed conditions based on standard calibration metrics. Residual statistics indicate no systematic bias, and simulated potentiometric surfaces are consistent with regional topographic gradients and established groundwater flow directions toward Lake Superior. Steady-state water-budget results show that recharge is the dominant inflow to the system and that groundwater discharge occurs primarily through drain features and head-dependent boundaries, with essentially zero mass-balance discrepancy.

The transient model was calibrated to observed groundwater-level trends and hydrographs and reproduces the overall magnitude and timing of groundwater-level changes across multiple model layers. Transient water-balance results indicate that, during the March 2025 stress period, inflow to the system is dominated by release from aquifer storage rather than recharge, reflecting slow groundwater redistribution within low-permeability bedrock. This behavior is consistent with the site conceptual model and the long residence times associated with deep groundwater flow.

Predictive simulations were conducted to estimate groundwater inflows to the proposed underground mine during mining, closure, and post-closure periods. Mine dewatering was represented using time-varying drain boundary conditions that evolve with mine development. An uncertainty analysis was performed by varying the horizontal-to-vertical hydraulic conductivity ratio of bedrock units to bracket reasonable bounds on predicted inflows. Predicted mine inflows range from approximately 50 to 350 gpm across the evaluated scenarios, with a base-case maximum inflow of approximately 235 gpm selected for dewatering system design based on depositional and hydraulic characteristics of the Nonesuch Formation.

Additional predictive scenarios were evaluated to assess the potential effects of underground mining on groundwater levels, surface-water discharge, and the hydrology of ponds and wetlands. Model results indicate minimal changes in groundwater discharge to surface-water features, with approximately a five percent change in discharge to the Mineral River and less than one percent change to all other modeled streams. Wetlands within the Project area are supported by the shallow groundwater system and a runoff-dominated hydrologic regime, whereas mine dewatering primarily affects the deep bedrock groundwater system. Consistent with this conceptual understanding and the negligible modeled changes in shallow groundwater discharge, underground mining is not expected to result in measurable changes to wetland hydrology.

10.2 Conclusions

The groundwater flow model provides a technically defensible, internally consistent representation of groundwater flow conditions at the White Pine North Project and is suitable for prefeasibility-level evaluation of mine dewatering requirements and potential hydrologic impacts. Key conclusions from the modeling effort are summarized below:

1. Model performance:
The steady-state and transient models meet established calibration objectives, exhibit stable numerical performance, and reproduce observed groundwater-level patterns and trends without systematic bias.
2. Groundwater flow system:
Groundwater flow is dominated by a shallow system influenced by topography and recharge and a deep bedrock system characterized by extremely low permeability, slow flow, and long residence times. Regional discharge is directed primarily toward Lake Superior.
3. Mine inflows:
Predicted groundwater inflows to the proposed underground mine are controlled primarily by bedrock hydraulic properties. The selected base-case inflow scenario provides a conservative but reasonable basis for dewatering system design.
4. Uncertainty and sensitivity:
Bedrock hydraulic conductivity and storage parameters are the most influential controls on predicted mine inflows. Uncertainty analyses appropriately bracket reasonable inflow bounds for design purposes.
5. Surface-water impacts:
Modeled changes in groundwater discharge to surface-water features are minimal. Because streams and adjacent wetlands are supported by a shallow, runoff-dominated system with limited groundwater contribution and mine dewatering primarily affects the deep bedrock system, underground mining is not expected to measurably affect streamflow or wetland hydrology at the regional scale.
6. Applicability:
The model is appropriate for prefeasibility-level planning and regulatory review. As additional site-specific data become available during project advancement, refinement of the model is recommended to further reduce uncertainty and improve predictive confidence.

Overall, the groundwater modeling results support the feasibility of the proposed White Pine North Project from a hydrogeologic perspective and provide a robust foundation for mine design, dewatering planning, and environmental permitting.

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TABLES

Table 6-1. Model Layer Thickness Summary

Layer	Thickness Min (m)	Thickness avg (m)	Thickness max (m)
1	0.47	9.31	155.52
2	0.50	5.72	42.52
3	0.50	5.72	42.51
4	29.99	30.00	30.00
5	26.26	61.79	104.62
6	26.27	61.79	104.62
7	26.26	61.79	104.62
8	26.26	61.78	104.62
9	26.26	61.78	104.62
10	26.26	61.79	104.61
11	26.27	61.79	104.62
12-20	100	100	100

m - meters

Table 6-2. Hydraulic Conductivity Zones

Zone	Lithological Description	Kx (m/d)	Kz (m/d)
1	Lake Superior	100	100
2	Tailings	1	0.1
5	Undifferentiated Glacial Till	1	0.1
6	Thin Glacial Till	1	1
7	Coarse Glacial Till	1	1
8	Quaternary Alluvium	10	1
11	Weathered Freda and Nonesuch	0.05	0.05
12	Competent Freda and Nonesuch	0.00006	0.00006
16	Weathered Copper Harbor	0.5	0.5
17	Competent Copper Harbor	0.0001	0.0001
21	Weathered Volcanics	0.3	0.3
22	Competent Volcanics	0.0005	0.0005
23	Deep Freda and Nonesuch	0.00000248	0.00000124

m/d – meters/day

Table 7-1. Simulated and Observed Hydraulic Heads

Well ID	Observed Head (m)	Simulated Head (m)
66000000072	336.00	334.89
66000000114	182.00	185.15
66000000115	182.00	185.28
66000000116	190.00	186.35
66000000117	187.00	186.38
66000000118	178.00	185.69
66000000119	187.00	185.47
66000000120	180.00	185.55
66000000125	195.00	187.98
66000000135	229.00	235.13
66000000142	228.00	246.56
66000000148	261.00	263.24
66000000149	267.00	268.73
66000000156	204.00	201.58
66000000185	189.00	186.30
66000000189	191.00	188.20
66000000197	190.00	188.68
66000000198	188.00	190.03
66000000200	267.00	267.29
66000000203	186.00	186.35
66000000215	184.00	210.21
66000000222	296.00	290.86
66000000241	191.00	192.24
66000000246	230.00	246.44
66000000266	247.00	246.80
66000000271	190.00	186.91
66000000278	201.00	197.45
66000000279	204.00	206.29
66000000284	303.00	302.46
66000000309	189.00	209.58
66000000480	363.00	360.44
66000000481	289.00	312.48
66000000484	368.00	356.67
66000000485	366.00	356.67
66000000490	333.00	318.56

Well ID	Observed Head (m)	Simulated Head (m)
66000000491	332.00	317.20
66000000492	326.00	315.89
66000000493	363.00	340.35
66000000505	370.00	356.67
66000000509	327.00	323.81
66000000510	408.00	358.73
66000000512	238.00	258.98
66000000513	300.00	299.67
66000000559	267.00	279.12
66000000560	196.00	195.34
66000000561	181.00	187.94
66000000562	198.00	194.48
66000000563	177.00	184.91
66000000564	172.00	185.91
66000000566	196.00	199.16
66000000567	195.00	194.38
66000000568	202.00	198.34
66000000569	186.00	185.82
66000000572	242.00	243.21
66000000573	263.00	267.03
66000000577	194.00	195.06
66000000578	187.00	188.95
66000000579	213.00	214.32
66000000580	180.00	183.22
66000000581	184.00	185.69
66000000582	181.00	185.05
66000000583	186.00	187.01
66000000589	176.00	187.34
66000000590	164.00	185.93
66000000591	190.00	187.57
66000000592	199.00	195.88
66000000593	199.00	194.97
66000000594	196.00	192.49
66000000595	201.00	198.36
66000000596	195.00	192.43
66000000597	154.00	185.58

Well ID	Observed Head (m)	Simulated Head (m)
66000000598	182.00	184.66
66000000599	206.00	200.64
66000000600	202.00	197.92
66000000601	205.00	198.40
66000000602	211.00	207.75
66000000603	241.00	255.40
66000000605	245.00	251.17
66000000606	259.00	274.18
66000000607	214.00	205.32
66000000608	177.00	183.49
66000000610	183.00	185.82
66000000621	193.00	185.15
66000000623	185.00	185.13
66000000634	185.00	184.65
66000000636	183.00	184.76
66000000638	227.00	229.83
66000000639	218.00	218.38
66000000640	223.00	224.30
66000000641	205.00	209.49
66000000642	204.00	216.06
66000000643	215.00	216.18
66000000689	183.00	187.93
66000000691	292.00	292.40
66000000692	193.00	184.04
66000000696	295.00	307.88
66000000698	304.00	299.80
66000000699	217.00	219.21
66000000705	182.00	187.82
66000000706	185.00	184.89
66000000707	189.00	189.06
66000000708	188.00	184.76
66000000709	183.00	185.82
66000000710	184.00	185.19
66000000711	342.00	343.24
66000000713	183.00	185.47
66000000714	186.00	188.35

Well ID	Observed Head (m)	Simulated Head (m)
66000000715	187.00	184.89
66000000716	187.00	185.04
66000000717	183.00	183.81
66000000718	182.00	183.53
66000000719	189.00	185.03
66000000720	184.00	183.54
66000000721	272.00	277.15
66000000722	185.00	185.71
66000000723	181.00	184.15
66000000724	184.00	183.85
66000000725	184.00	184.92
66000000726	185.00	185.53
66000000727	184.00	184.82
66000000728	183.00	185.06
66000000729	177.00	183.72
66000000730	182.00	184.56
66000000731	183.00	184.34
66000000732	184.00	187.29
66000000733	185.00	187.40
66000000736	186.00	186.70
66000000737	183.00	187.02
66000000739	179.00	185.12
66000000740	184.00	187.12
66000000741	182.00	186.49
66000000742	186.00	185.83
66000000743	195.00	187.39
66000000744	194.00	187.44
66000000745	184.00	185.68
66000000746	190.00	187.76
66000000747	185.00	186.32
66000000748	184.00	186.46
66000000749	184.00	186.22
66000000751	184.00	184.46
66000000752	183.00	185.98
66000000753	183.00	184.65
66000000754	182.00	185.62

Well ID	Observed Head (m)	Simulated Head (m)
66000000755	185.00	186.89
66000000756	187.00	188.20
66000000757	185.00	185.88
66000000758	180.00	184.88
66000000761	188.00	190.16
66000000762	182.00	185.16
66000000763	187.00	185.60
66000000764	183.00	186.45
66000000765	188.00	186.06
66000000773	187.00	189.15
66000000794	199.00	197.55
66000000797	244.00	243.90
66000000808	180.00	183.32
66000000818	215.00	186.85
66000000839	172.00	186.47
66000000847	255.00	263.68
66000000861	210.00	209.88
66000000862	232.00	247.32
66000000871	185.00	186.20
66000000872	187.00	187.81
66000000874	181.00	189.37
66000000877	188.00	188.01
66000000906	203.00	203.95
66000000911	180.00	183.32
66000000915	321.00	323.14
66000000920	211.00	211.26
66000000921	363.00	346.05
66000000923	194.00	193.92
66000000938	255.00	261.20
66000000944	195.00	184.13
66000000945	371.00	352.70
66000000949	183.00	187.41
66000000951	188.00	190.07
66000000963	286.00	291.90
66000000976	184.00	183.48
66000000977	182.00	183.51

Well ID	Observed Head (m)	Simulated Head (m)
66000000989	222.00	222.76
66000000993	301.00	285.90
66000000997	364.00	369.62
66000000999	198.00	200.26
66000001003	229.00	229.43
66000001012	282.00	287.43
66000001016	185.00	185.36
66000001020	189.00	188.02
66000001043	430.00	414.52
66000001055	187.00	185.87
66000001065	185.00	208.85
66000001074	238.00	253.98
66000001076	228.00	221.88
66000001081	396.00	396.85
66000001086	262.00	266.62
66000001092	221.00	222.30
66000001095	194.00	189.23
66000001104	260.00	258.85
66000001110	252.00	263.33
66000001114	187.00	185.26
66000001130	186.00	200.48
66000001135	185.00	185.11
66000001149	191.00	190.61
66000001161	192.00	191.55
66000001162	197.00	196.85
66000001167	193.00	189.06
66000001180	282.00	284.20
66000001181	245.00	255.43
66000001187	200.00	199.00
66000001212	278.00	280.29
66000001219	399.00	389.75
66000001225	183.00	183.54
MW-10	223.45	228.79
MW-18	241.34	246.74
MW-1A-R	217.33	218.91
MW-1B-R	217.25	218.87

Well ID	Observed Head (m)	Simulated Head (m)
MW-23	246.85	246.20
MW-2A	218.04	217.97
MW-2B	218.87	217.92
MW-30	234.59	242.71
MW-31	237.62	240.09
MW-32	235.37	237.50
MW-35	201.66	201.39
MW-36	218.26	218.08
MW-37	213.69	217.54
MW-38	208.17	209.65
MW-3B	220.07	224.43
MW-41	215.79	217.10
MW-42	216.27	215.44
MW-5	217.90	218.57
NB2-3	242.88	242.99
SMW-1	233.65	234.58
MW-3A	220.04	224.47
MW-5SB	216.97	218.95
MW-43	233.23	235.94
MW-44	252.37	255.91
SMW-1SB	232.45	234.82
MW-19R	262.94	260.12

m - meters

Table 7-2. Steady-State Calibration Statistics

Steady-State Calibration Statistic	Value
Residual Mean (m)	-1.2
Absolute Residual Mean (m)	4.9
Residual Std. Deviation (m)	8.0
Sum of Squares (m ²)	15,351.6
RMS Error (m)	8.0
Min. Residual (m)	-31.6
Max. Residual (m)	49.3
Number of Observations	237
Range in Observations (m)	276
Scaled Residual Std. Deviation	2.9%
Scaled Absolute Residual Mean	1.8%
Scaled RMS Error	2.9%
Scaled Residual Mean	-0.4%

m - meters

Table 7-3. Transient Calibration Statistics

Transient Calibration Statistic	Value
Residual Mean (m)	-0.11
Absolute Residual Mean (m)	0.47
Residual Std. Deviation (m)	0.66
Sum of Squares (m ²)	246.58
RMS Error (m)	0.67
Min. Residual (m)	-3.43
Max. Residual (m)	2.32
Number of Observations	543
Range in Observations (m)	4.23
Scaled Residual Std. Deviation	15.5%
Scaled Absolute Residual Mean	11.0%
Scaled RMS Error	15.9%
Scaled Residual Mean	-2.6%

m - meters

Table 7-4 Water Balance Summary

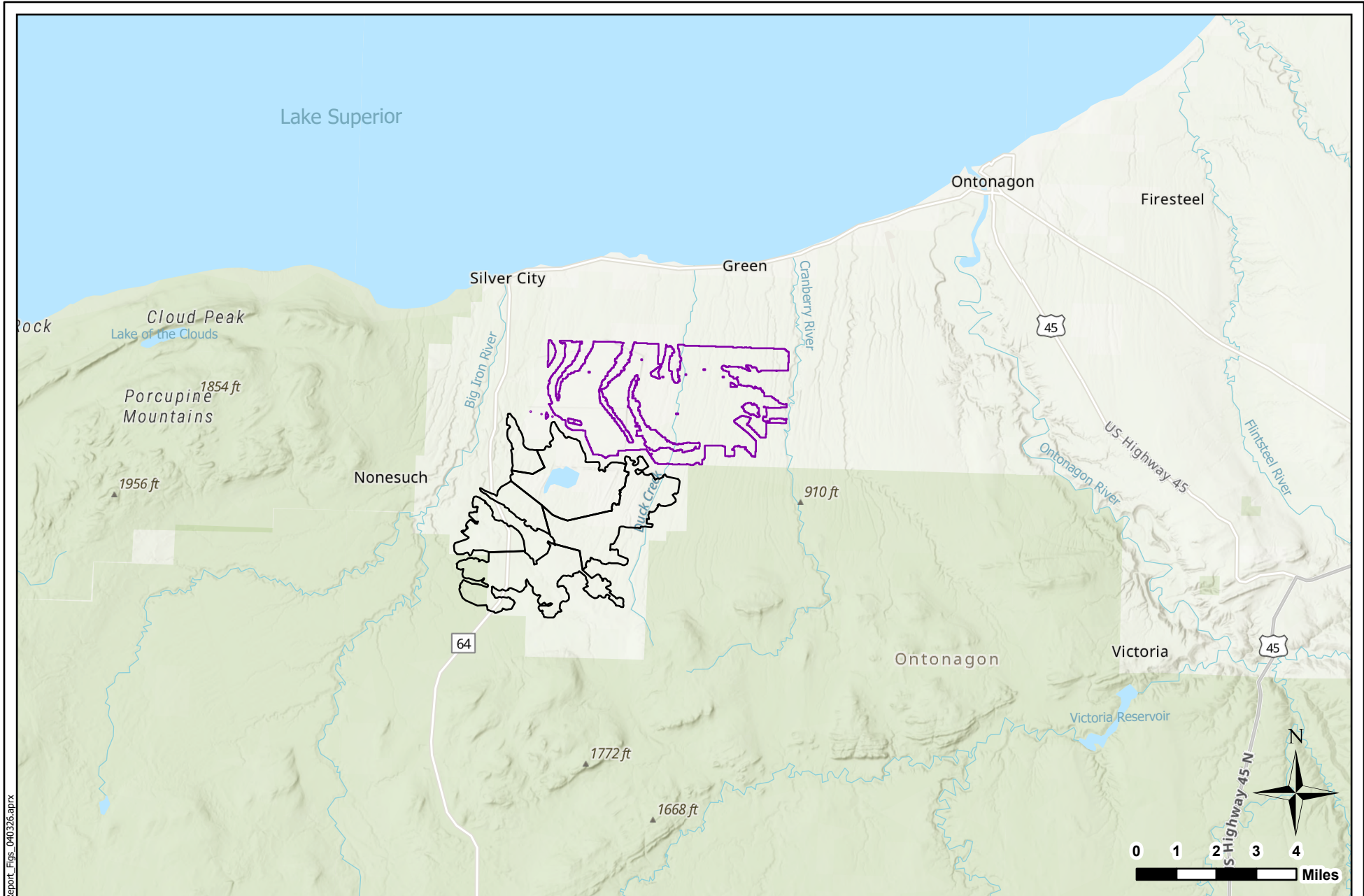
IN	SS Cumulative (m ³ /day)	TR March 2025 (m ³ /day)
Storage - Ss	0	24,082
Storage - Sy	0	138,334
Drains	0	
Head Dependent Boundary	17,351	19,482
Recharge	317,587	32,104
Total IN	335,118	214,002
OUT	SS Cumulative (m ³ /day)	TR March 2025 (m ³ /day)
Storage - Ss	0	2,597
Storage - Sy	0	6,255
Drains	238,142	179,815
Head Dependent Boundary	96,983	25,334
Recharge	0	0
Total OUT	335,124	214,001
IN - OUT	-6.0	1.1
Percent Discrepancy (%)	0.0	0.0

m³/day: cubic meters per day

Table 8-1. Predictive Model Stress Periods

Stress Period	Year	Period Length (days)
1	2025	365
2	2026	365
3	2027	365
4	2028	365
5	2029	365
6	2030	365
7	2031	365
8	2032	365
9	2033	365
10	2034	365
11	2035	365
12	2036	365
13	2037	365
14	2038	365
15	2039	365
16	2040	365
17	2041	365
18	2042	365
19	2043	365
20	2044	365
21	2045	365
22	2046	365
23	2047	365
24	2048	365
25	2049	365
26	2050	365
27	2051	365
28	2052	365
29	2053	365
30	2054	365
31	2055	365
32	2056	365
33	2057	365
34	2058	365
35	2059	365
36	2060	365
37	2061	365

FIGURES



Path: T:\WP\GIS\2026\WP\Report_Figs_040326.aprx

Legend

- White Pine Mine
- Proposed White Pine Mine



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White Pine North
White Pine, MI

Site Location

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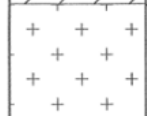
Date: 4/13/2026

Designed By: MIS

Figure No.
1-1

FORMATION NAME AND TYPICAL THICKNESS

AGE

	UNCONSOLIDATED SURFACE DEPOSITS 0 TO 330 FT.	QUATERNARY (~ 10 THOUSAND YEARS)
	FREDA FORMATION UP TO 6000 FT.	PRECAMBRIAN (1062 MILLION YEARS)
	NONESUCH FORMATION 500 TO 700 FT.	
	COPPER HARBOR CONGLOMERATE 350 TO 5000 FT.	PRECAMBRIAN (1087 MILLION YEARS)
	PORCUPINE VOLCANICS AS MUCH AS 8000 FT.	PRECAMBRIAN
	PORTAGE LAKE LAVA SERIES GREATER THAN 15,000 FT.	PRECAMBRIAN (1095 MILLION YEARS)

(FROM BAKER 1978 AND MAUK 1993a)

SMI
SHEPHERD MILLER, INC.

FIGURE 4.2
STRATIGRAPHIC COLUMN
GEOLOGIC UNITS IN THE VICINITY OF WHITE PINE

Date: FEB., 1995
Project: 461
File: FORMTHI

Notes: From SMI 1995



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STRATIGRAPHIC UNITS OF UPPER PENINSULA

Project No.: 117-372636-25002

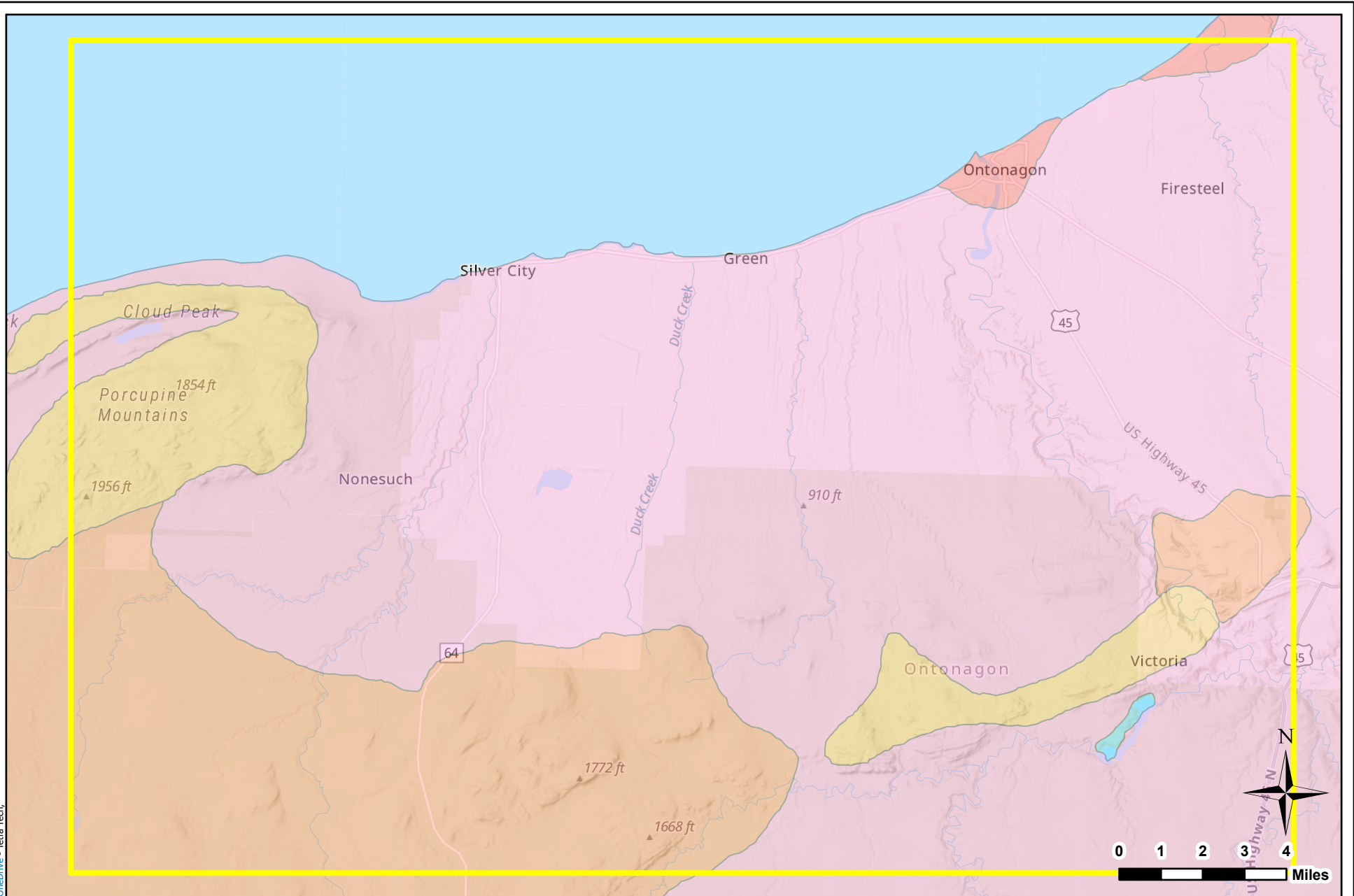
Date: March 6, 2026

Designed By: CS

Figure No.

2-1

Path: C:\Users\CASS.STEGNER\OneDrive - Tetra Tech\



Legend

ModelExtent

Geologic Unit

Coarse-textured glacial till

Lacustrine clay and silt

Lacustrine sand and gravel

Thin to discontinuous glacial till over bedrock

Water



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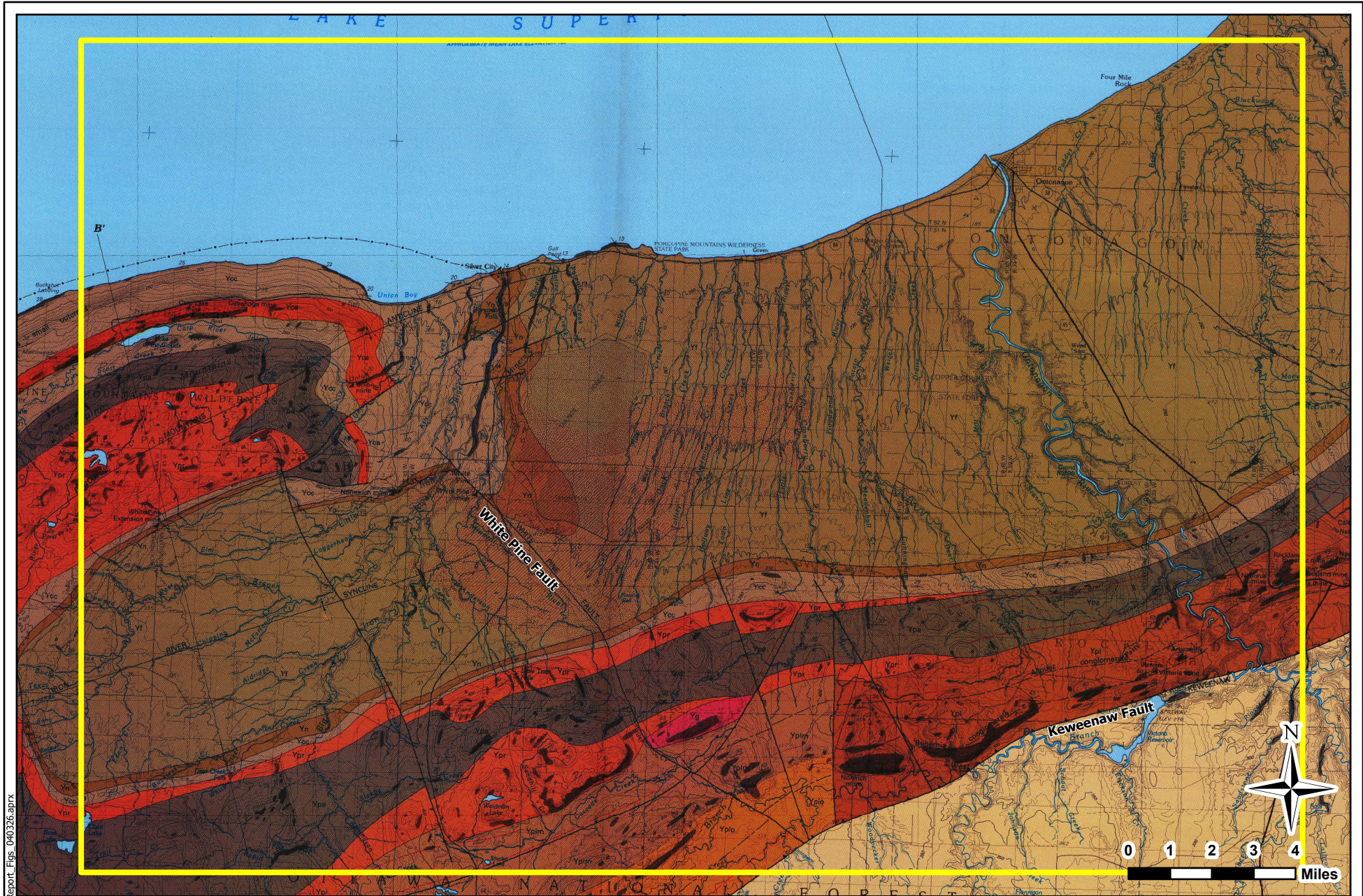
Quaternary Geologic Map

Project No.: 117-37263625002

Date: 3/13/2026

Designed By: CS

Figure No.
2-2



Path: T:\WPIN\GIS\2026\WPIN_Report_Figs_040326.aprx

Legend

	ModelExtent		Copper Harbor Cong. (volcanic)
	Geology (from Cannon et al., 1995)		Porcupine Volcanics - rhyolite
	Yj		Porcupine Volcanics - andesite and basalt
	Yf		Portage Lake Volcanics - basalt
	Yn		Portage Lake Volcanics - massive basalt
	Yn		Portage Lake Volcanics - ophitic basalt
	Yca		Diabase and granophyre
	Yca		



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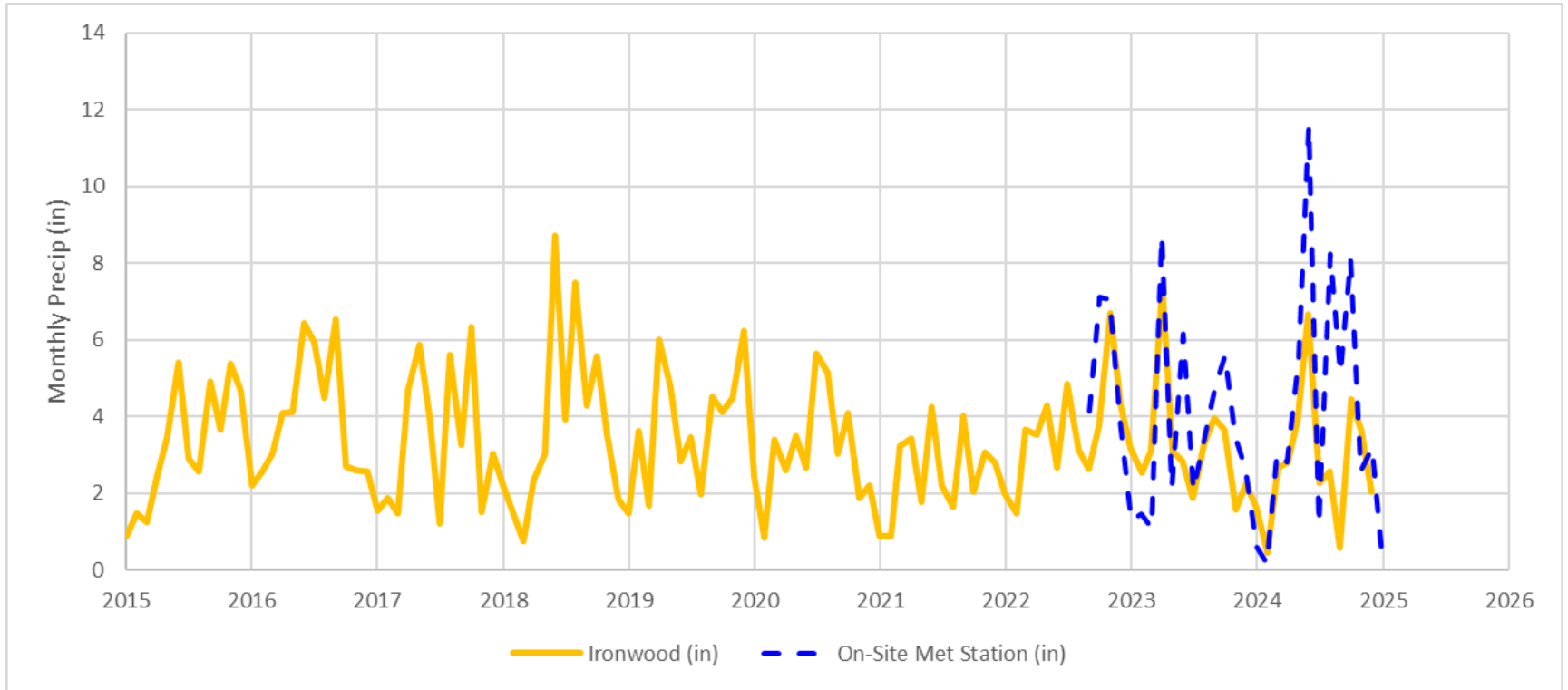
Bedrock Geologic Map

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Date: 4/13/2026

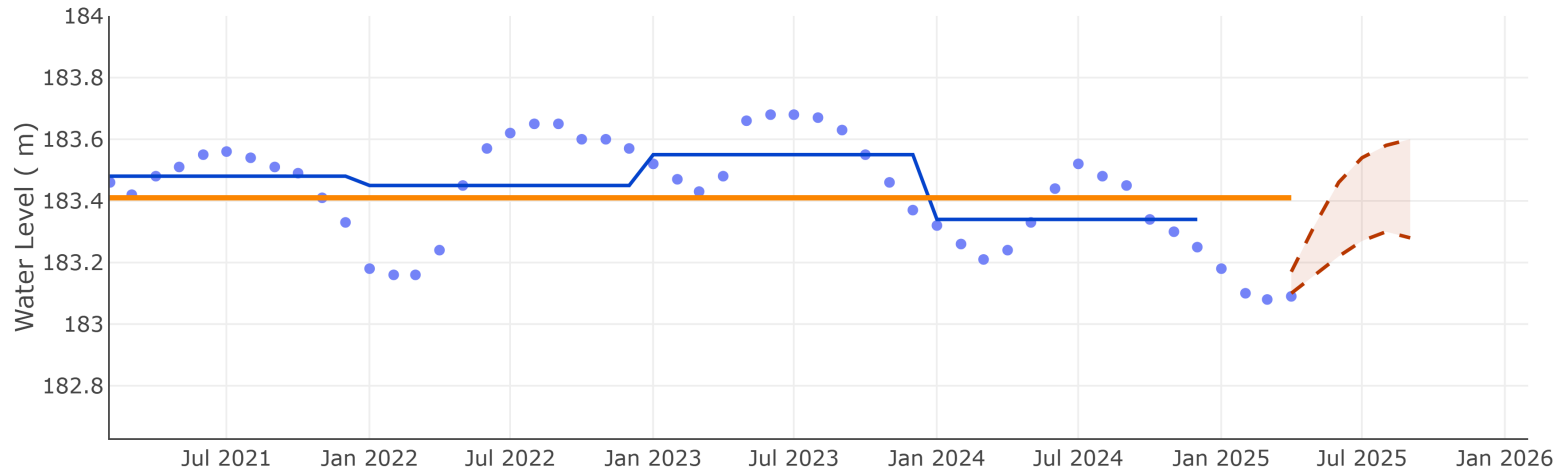
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Figure No.
2-3



 TETRA TECH www.tetrattech.com 1100 South McCaslin Blvd, Suite 150 Superior, Colorado 80027 Phone: (303) 664-4630	WHITE PINE COPPER, LLC		Project No.: 117-372636-25002
	WHITE PINE NORTH WHITE PINE, MI		Date: March 9, 2026
	Average Monthly Precipitation (2015-2025)		Designed By: CS
			Figure No. 3-1

Lake Superior Water Levels



- Long-term average (1918-last year)
- Lake-wide average
- Lake-wide
- - - Current coordinated 0-6 month out forecasts - Upper
- - - Current coordinated 0-6 month out forecasts - Lower



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Lake Superior Water Level Elevations (2021-2025)

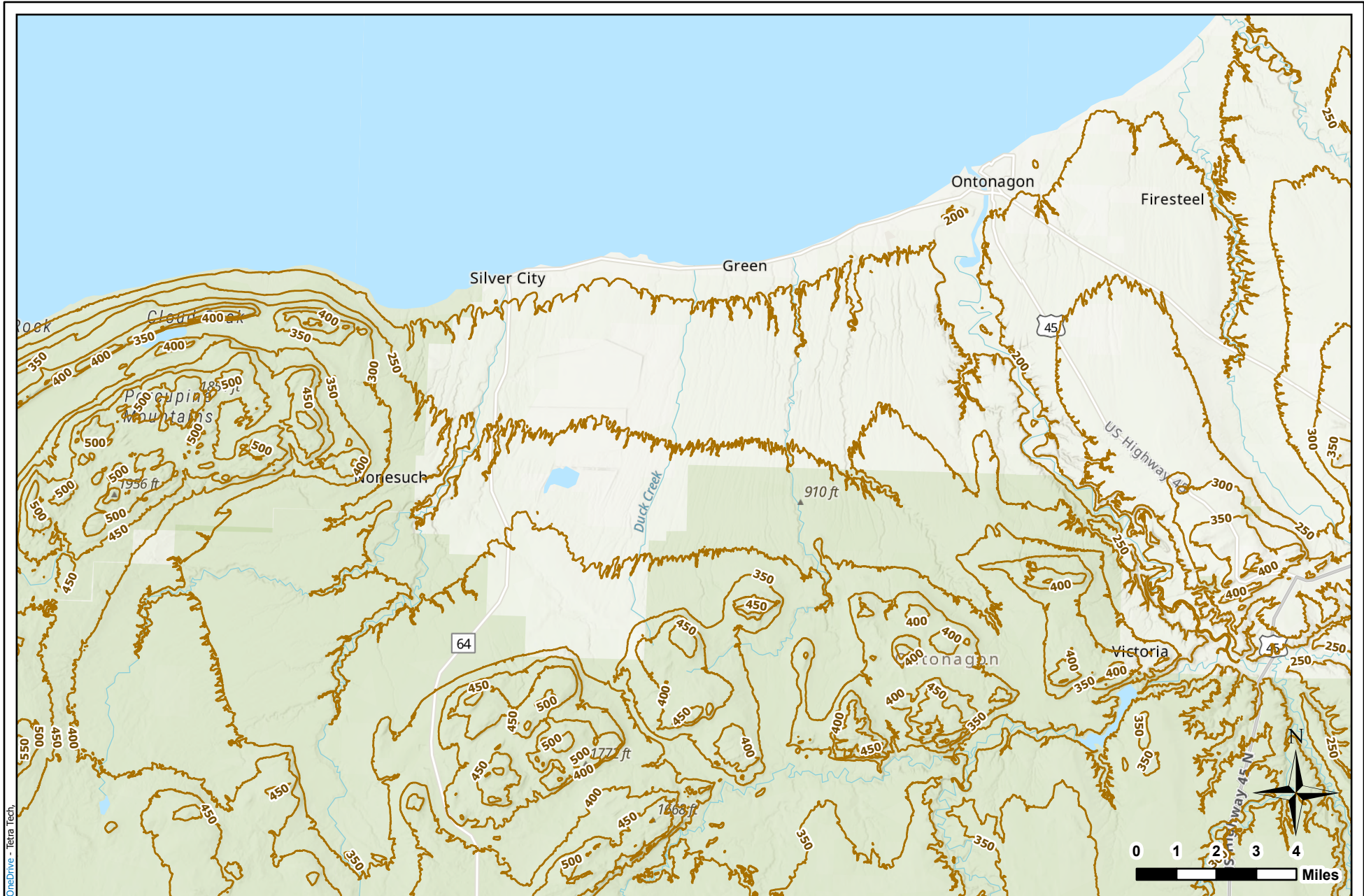
Project No.: 117-372636-25002

Date: March 9, 2026

Designed By: CS

Figure No.

3-2



Path: C:\Users\CASS.STEGNER\OneDrive - Tetra Tech\

Legend

— Topographic Contours (m amsl)



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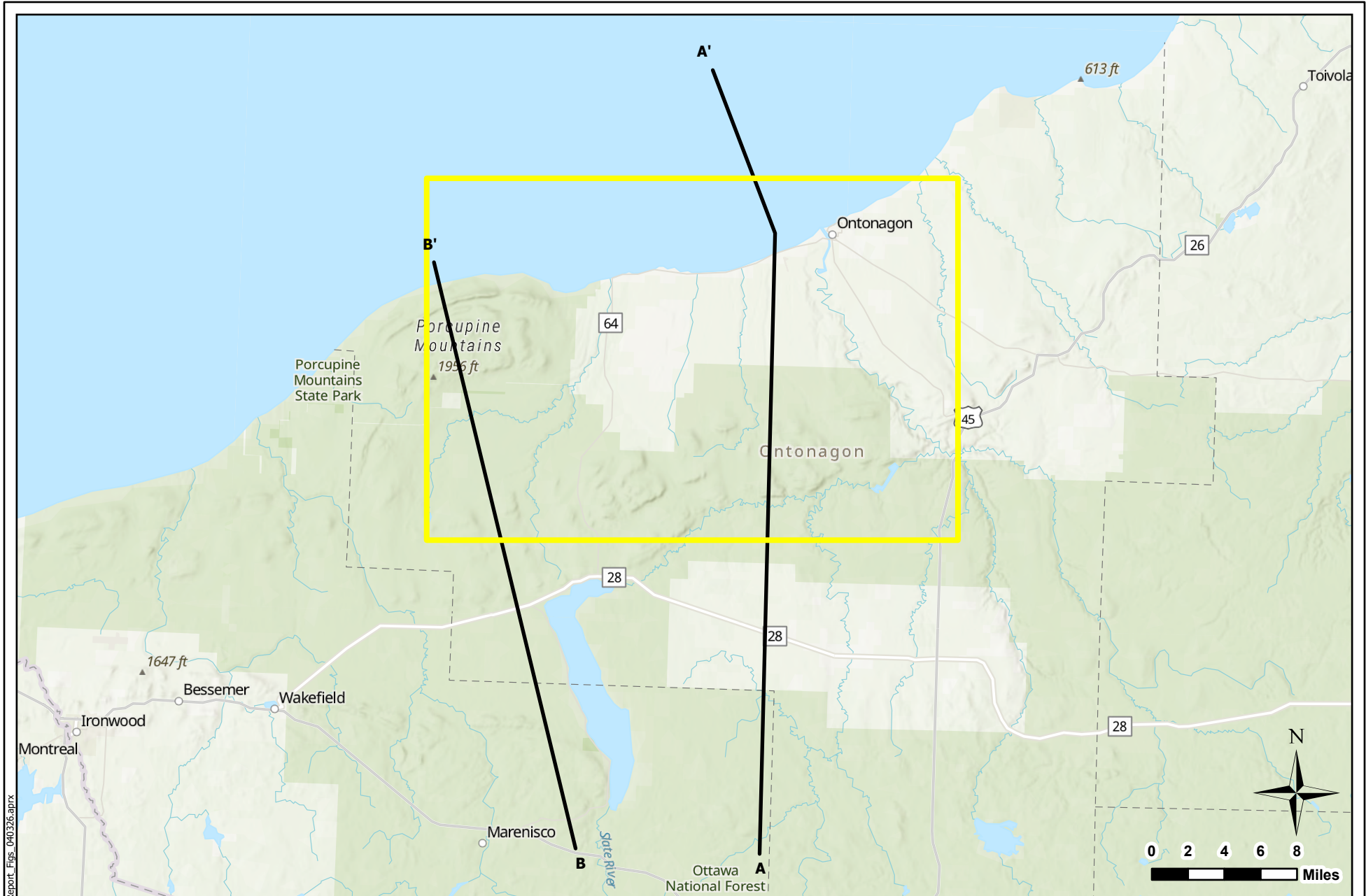
Topography of Model Domain

Project No.: 117-37263625002

Date: 3/13/2026

Designed By: CS

Figure No.
5-1



Path: T:\WP\N\GIS\2026\WP\N_Report_Figs_040326.aprx

Legend

ModelExtent

Cross Section Location

From Cannon et al. (1995)



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Location of USGS Geologic Sections

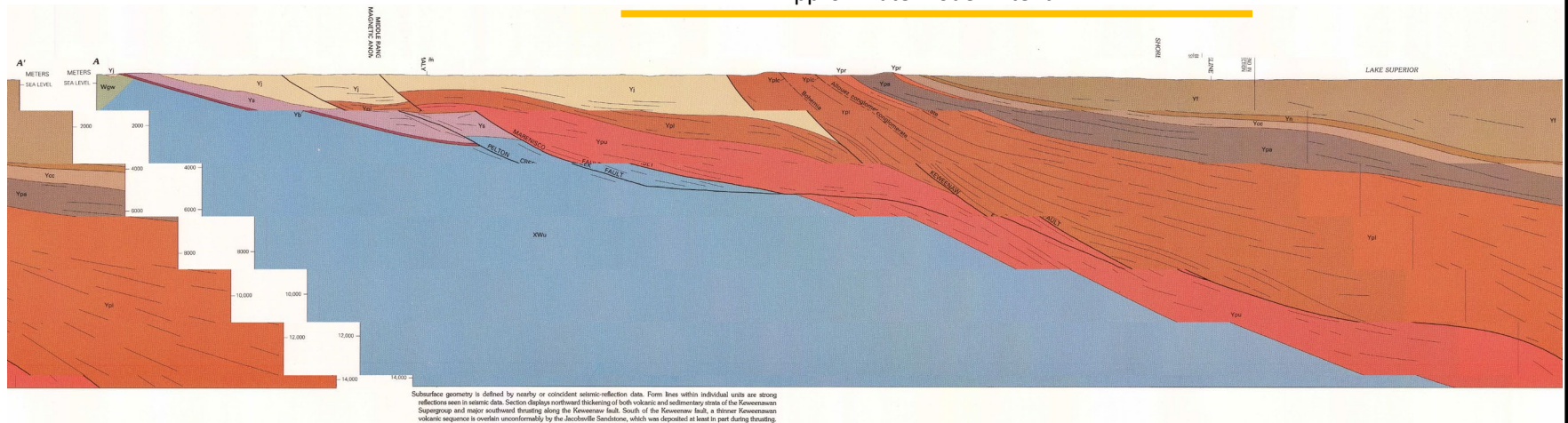
Project No.: 117-37263625002

Date: 4/13/2026

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Figure No.
5-2

Approximate Model Extent



Notes: From Cannon et al. (1995)



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USGS North-South Geologic Section (A-A')

Project No.: 117-372636-25002

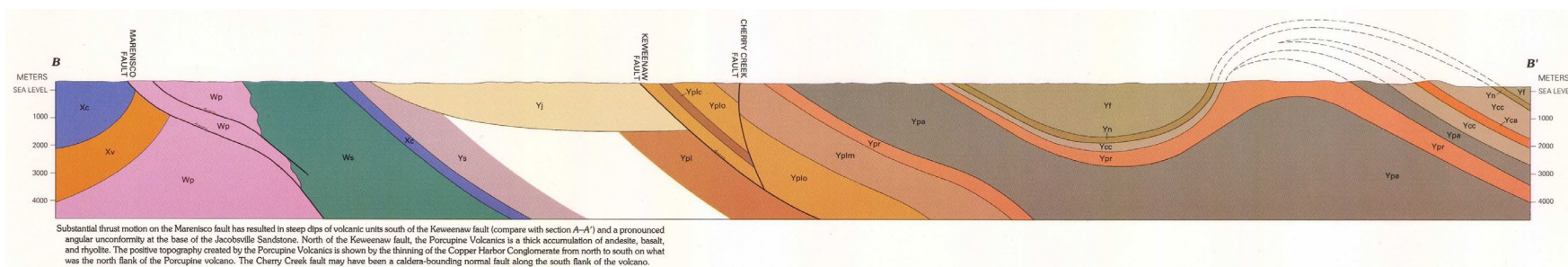
Date: April 13, 2026

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Figure No.

5-3

Approximate Model Extent



Notes: From Cannon et al. (1995)



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USGS North Northwest-South Southeast Geologic Section (B-B')

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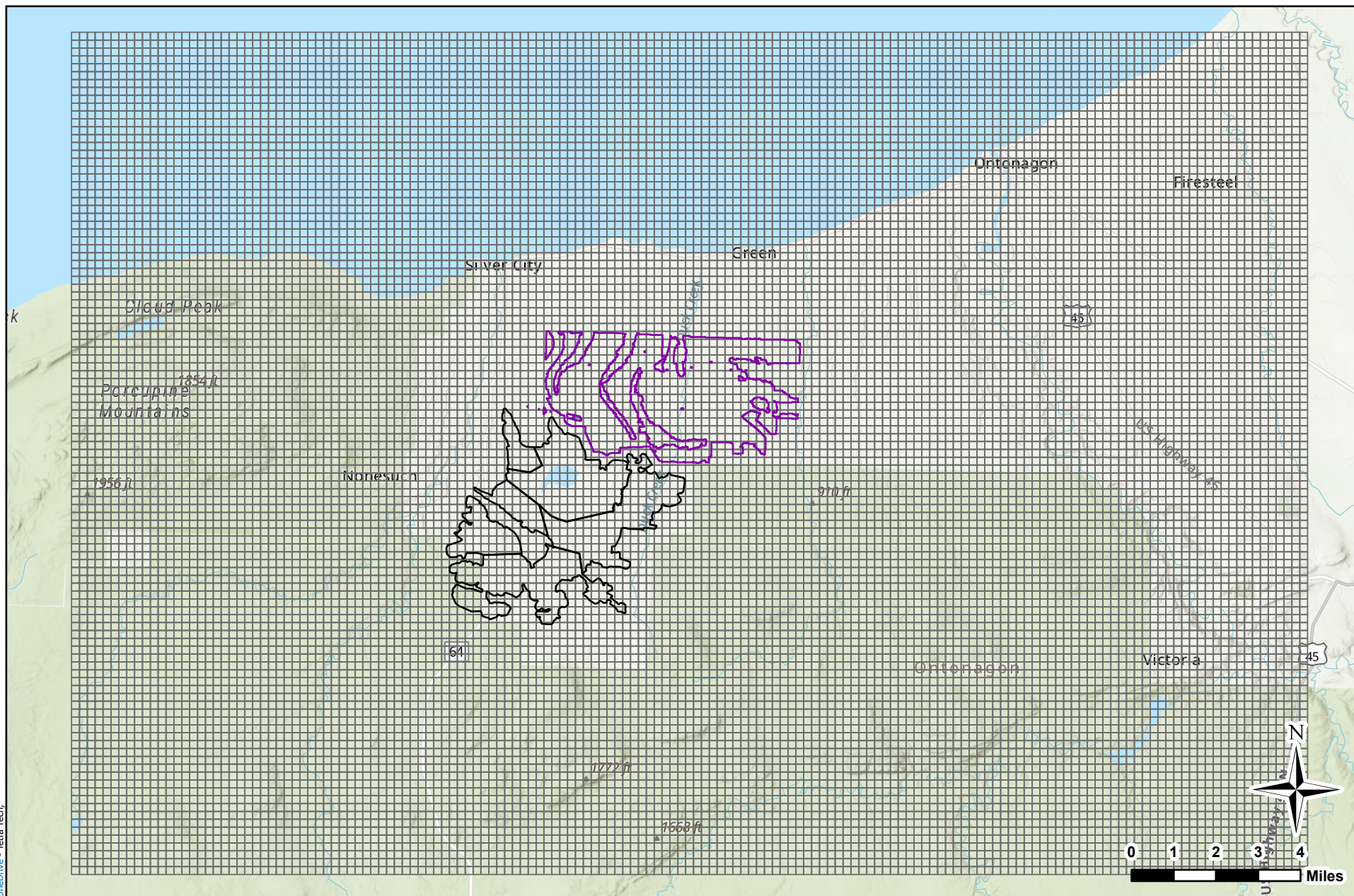
Date: April 13, 2026

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Figure No.

5-4

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Legend

-  New Mine
-  Old Mine
-  Grid



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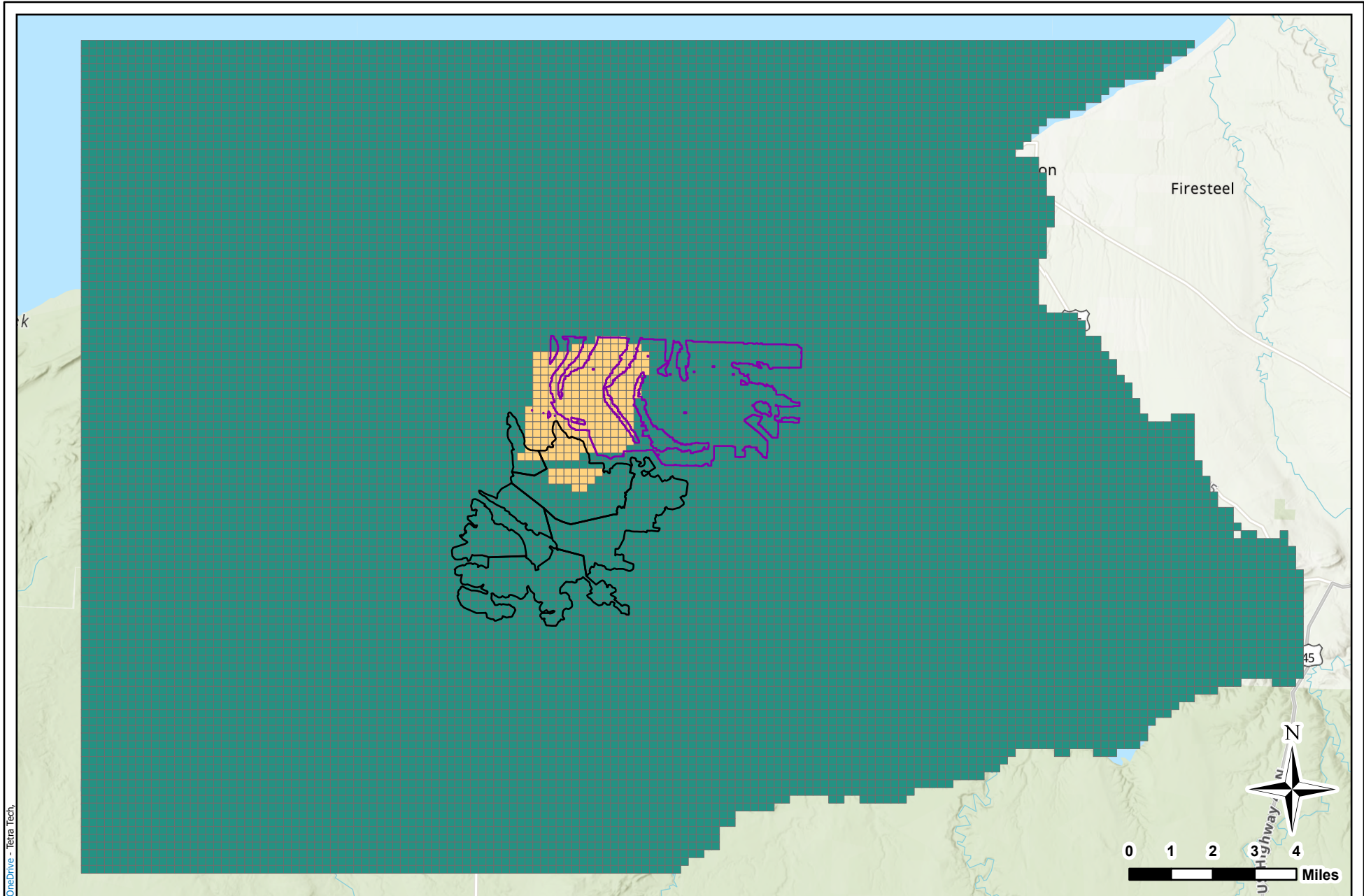
Model Grid

Project No.: 117-37263625002

Date: 3/13/2026

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Figure No.
6-1



Path: C:\Users\CASS.STEGNER\OneDrive - Tetra Tech

Legend

White Pine Mine

Proposed White Pine Mine

Hydraulic Conductivity Zone

1 - Lake Superior (Kh = 100, Kv = 100)

2- Tailings (Kh = 1, Kv = 0.1)

Note: Kh and Kv are in m/day



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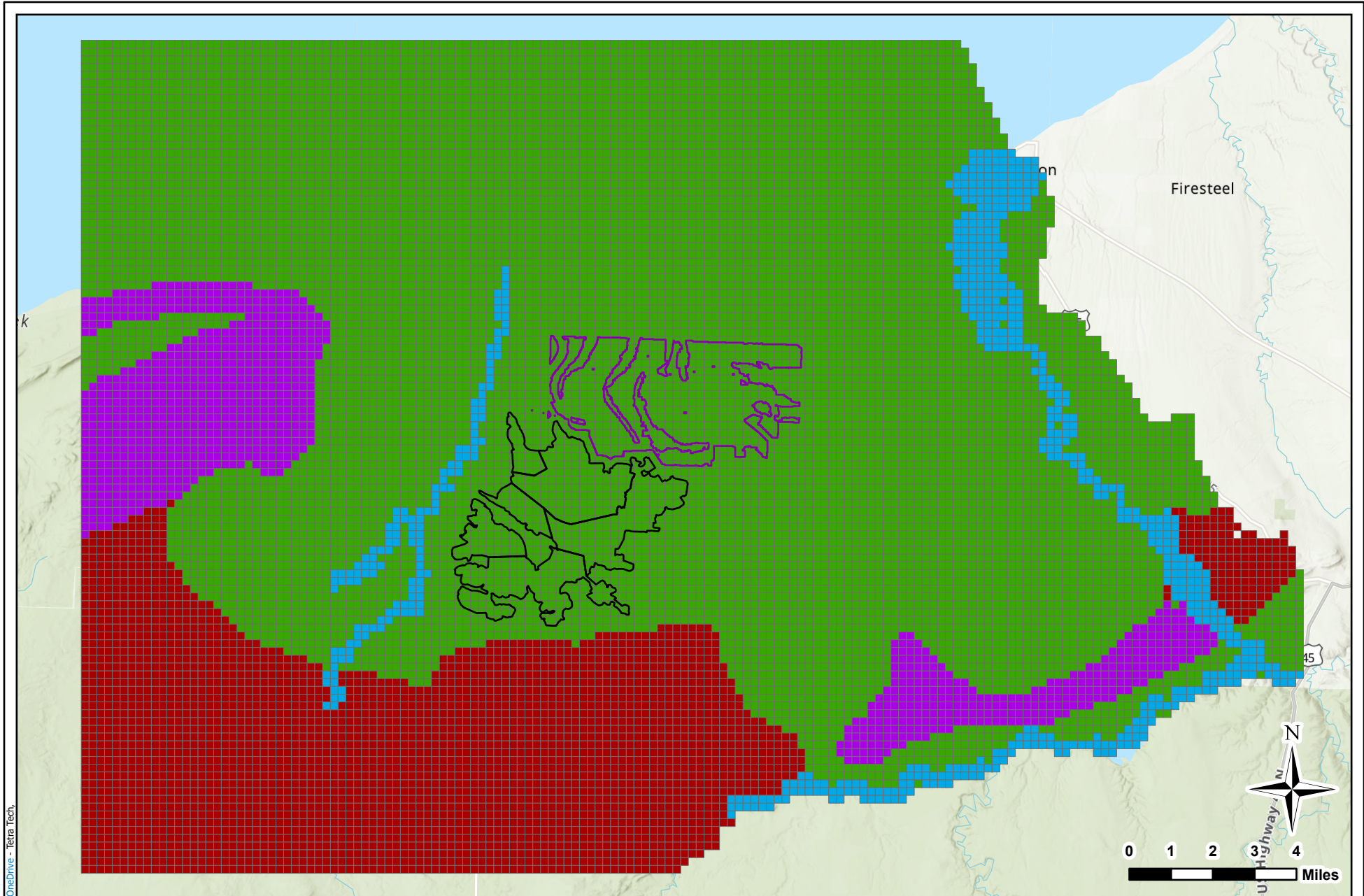
Hydraulic Conductivity Zones for Model Layer 1

Project No.: 117-37263625002

Date: 3/13/2026

Designed By: CS

Figure No.
6-2



Path: C:\Users\CASS.STEGNER\OneDrive - Tetra Tech\

Legend

- White Pine Mine
- Proposed White Pine Mine

Hydraulic Conductivity Zone

- 5 - Undifferentiated Glacial Till ($K_h = 1$, $K_v = 0.1$)
- 6 - Thin Glacial Till ($K_h = 1$, $K_v = 1$)
- 7 - Coarse Glacial Till ($K_h = 1$, $K_v = 1$)
- 8 - Quaternary Alluvium ($K_h = 10$, $K_v = 1$)

Note: K_h and K_v are in m/day



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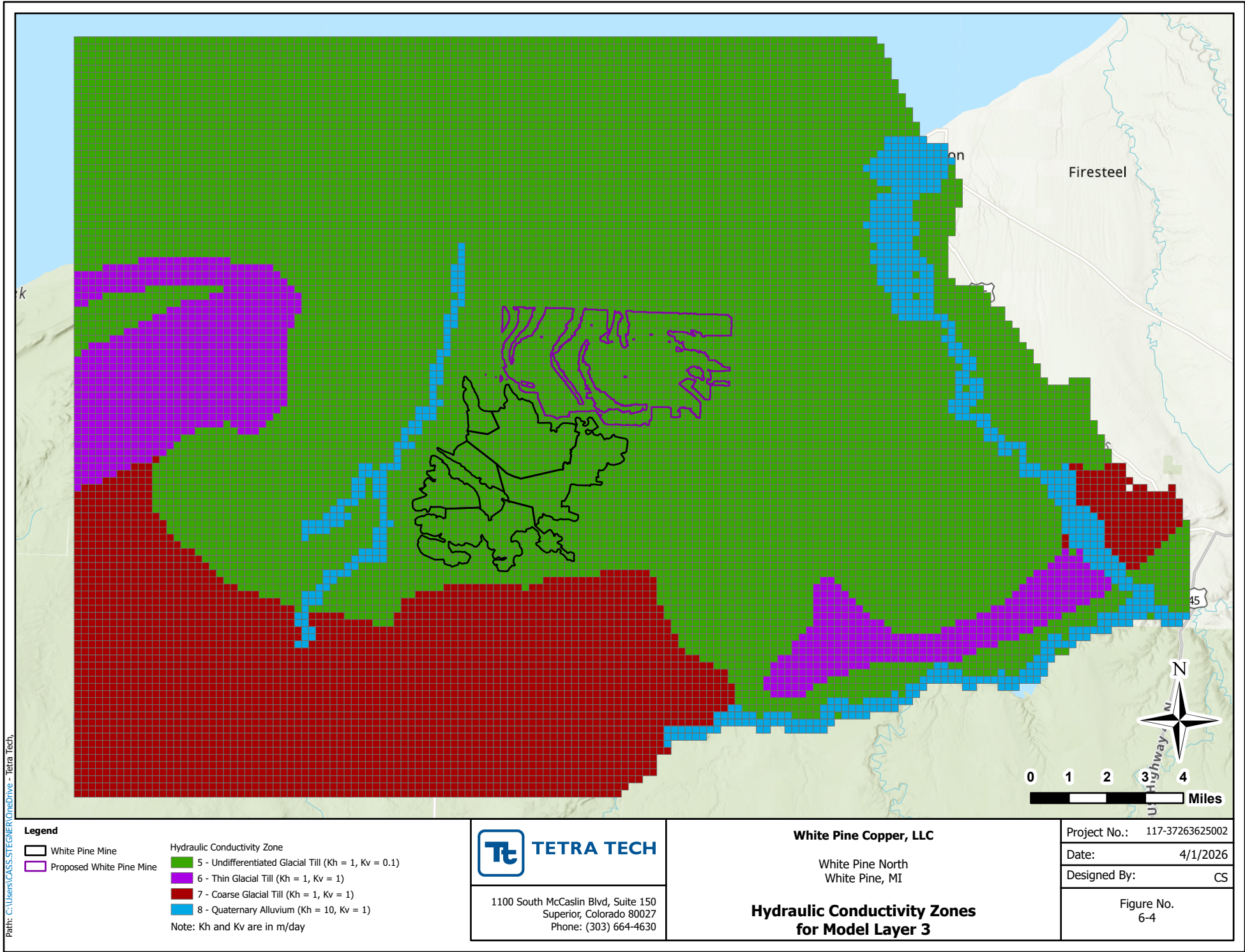
Hydraulic Conductivity Zones for Model Layer 2

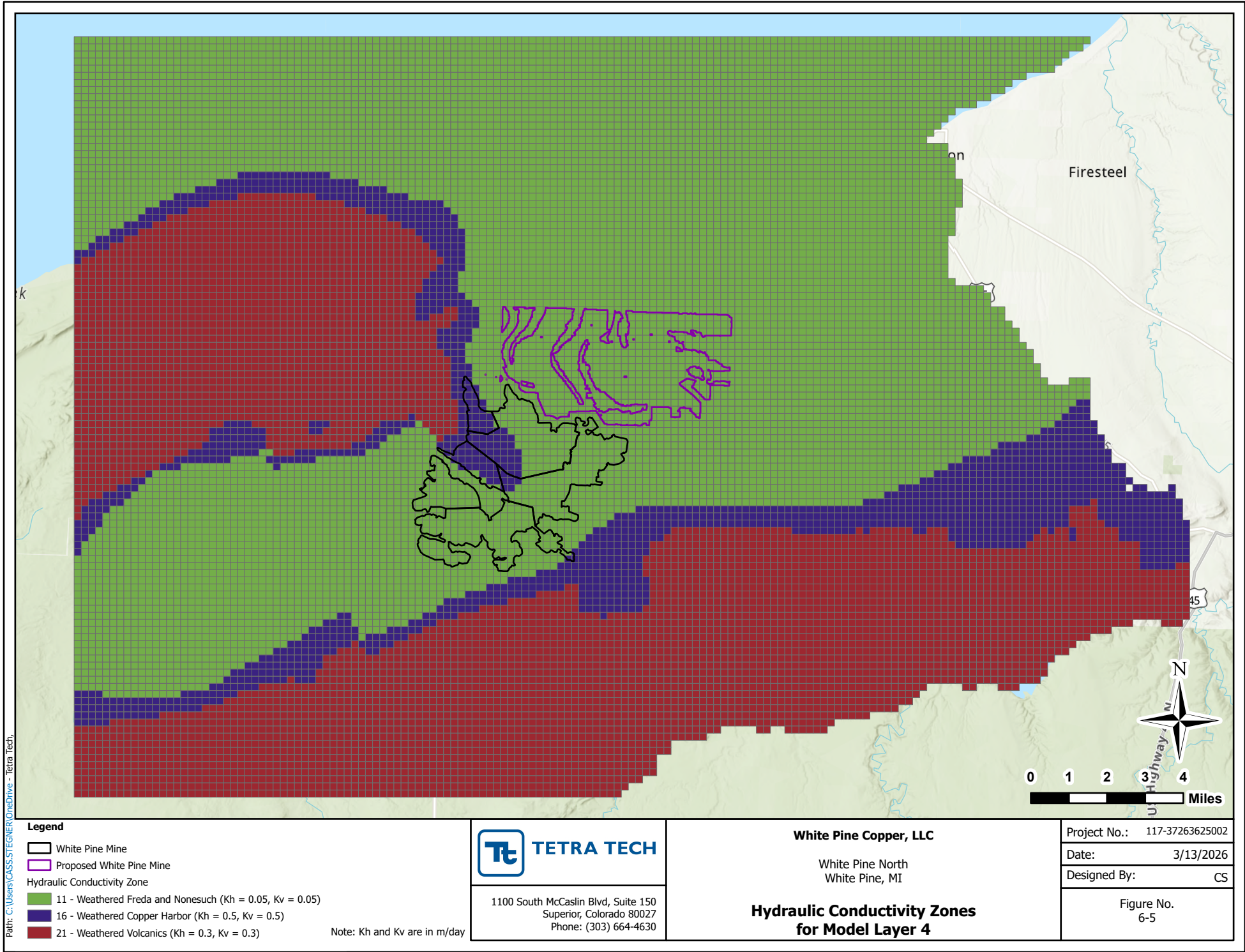
Project No.: 117-37263625002

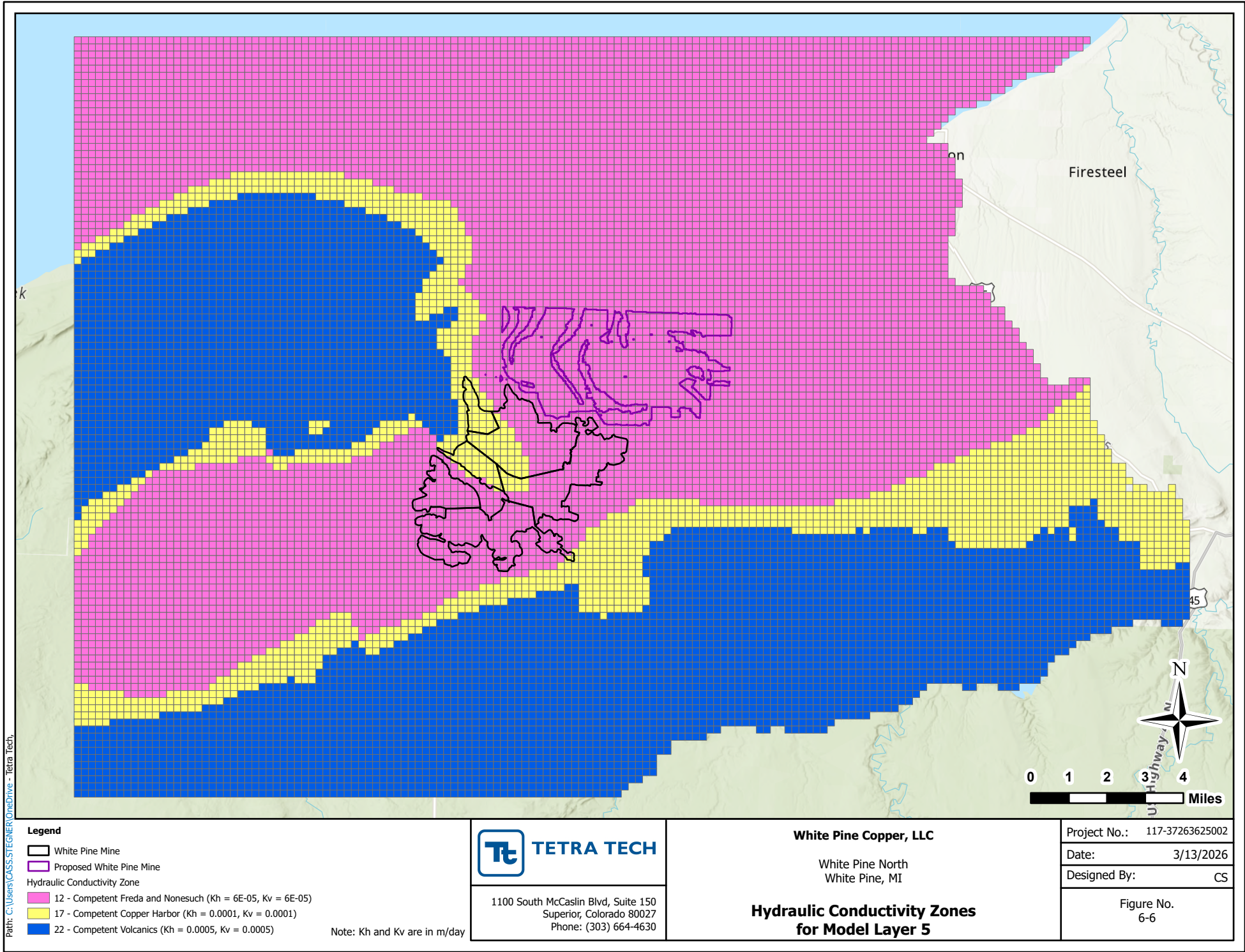
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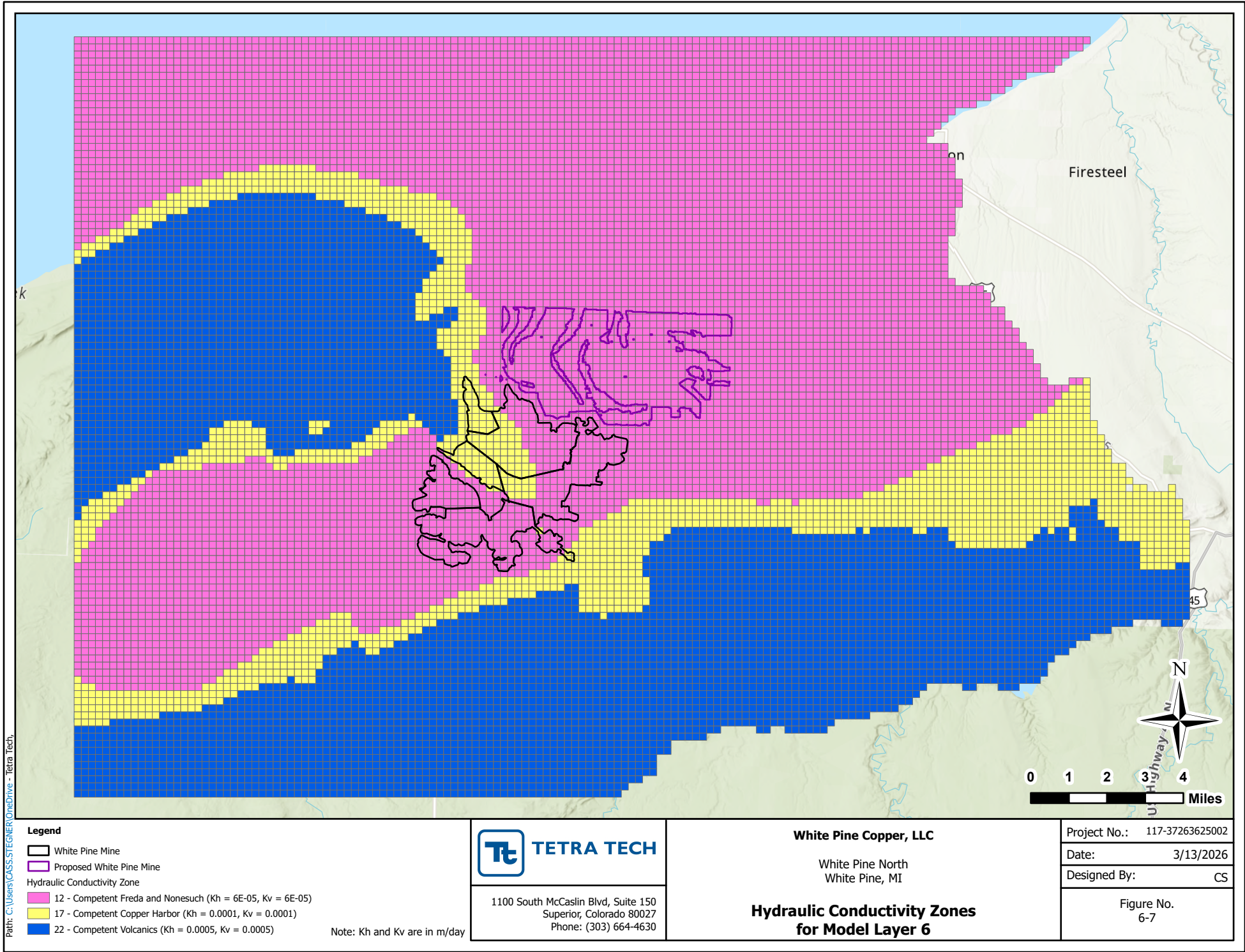
Designed By: CS

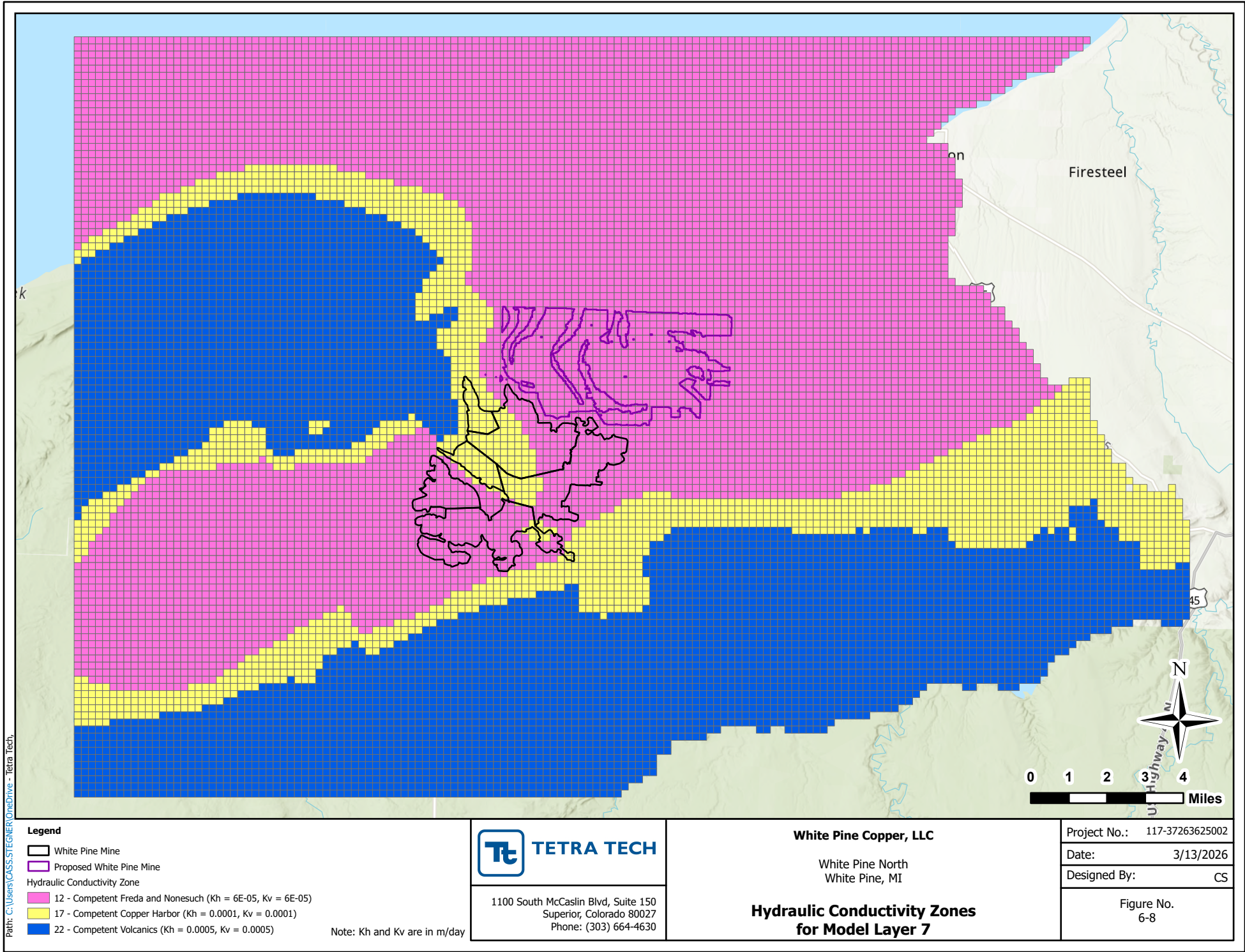
Figure No.
6-3

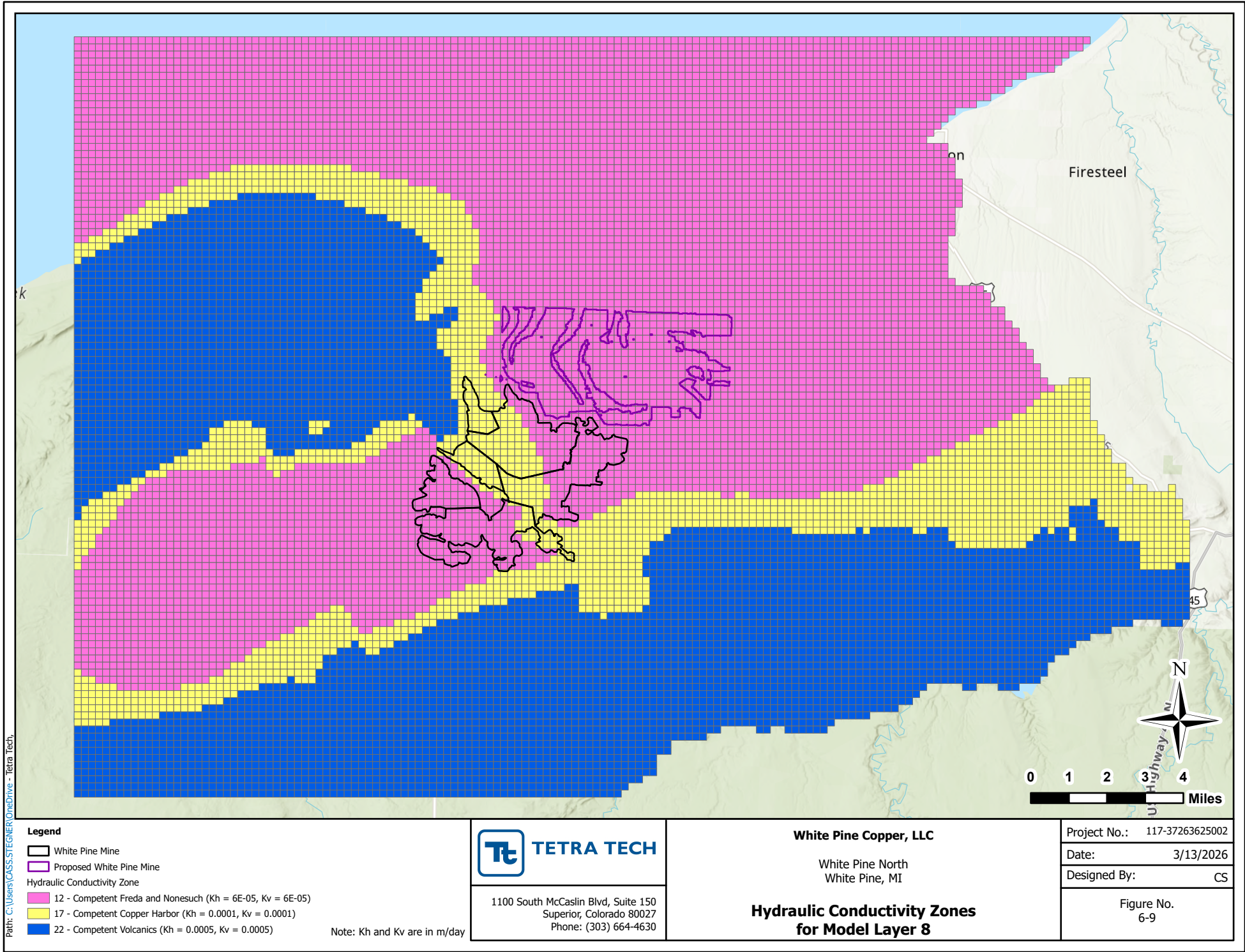


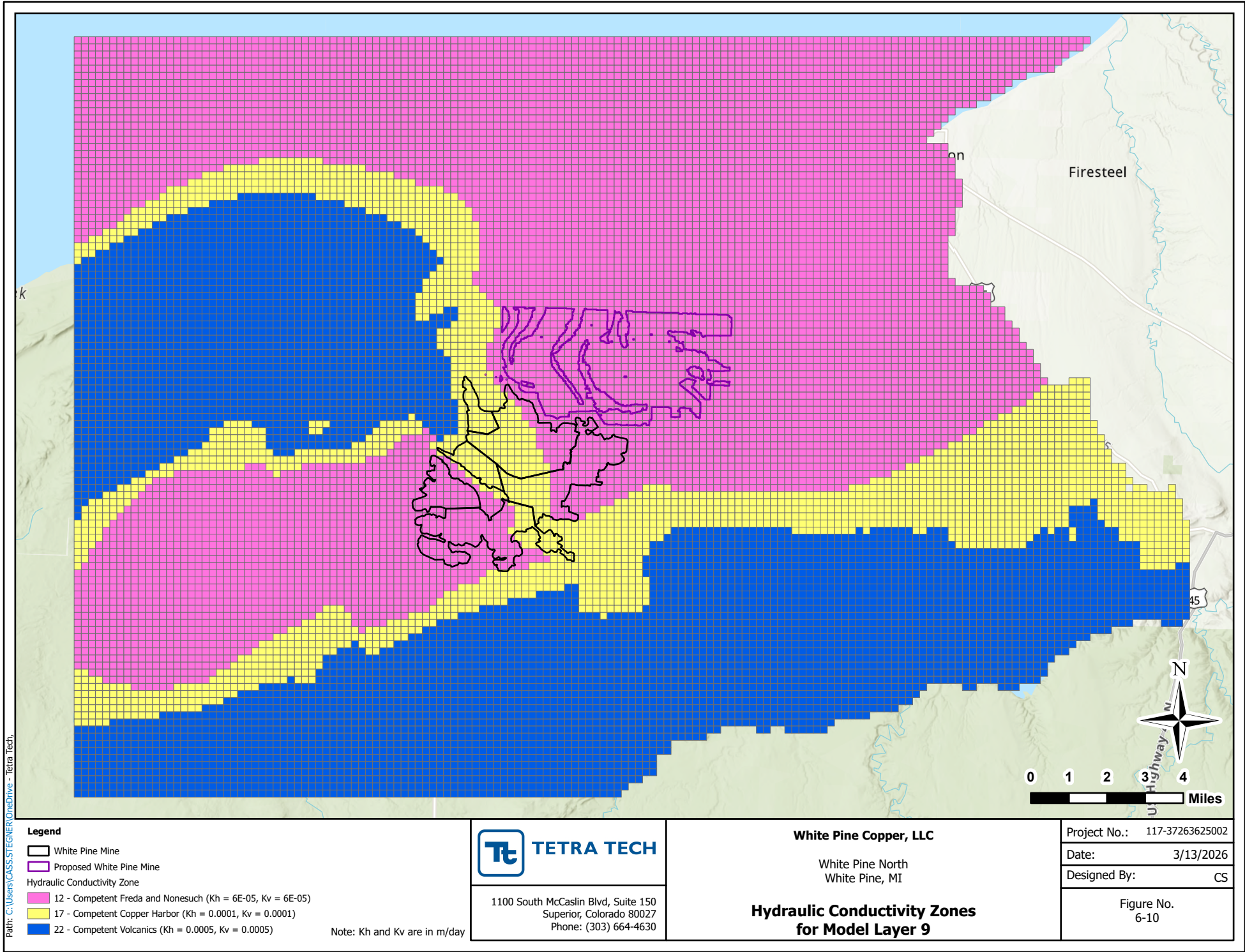


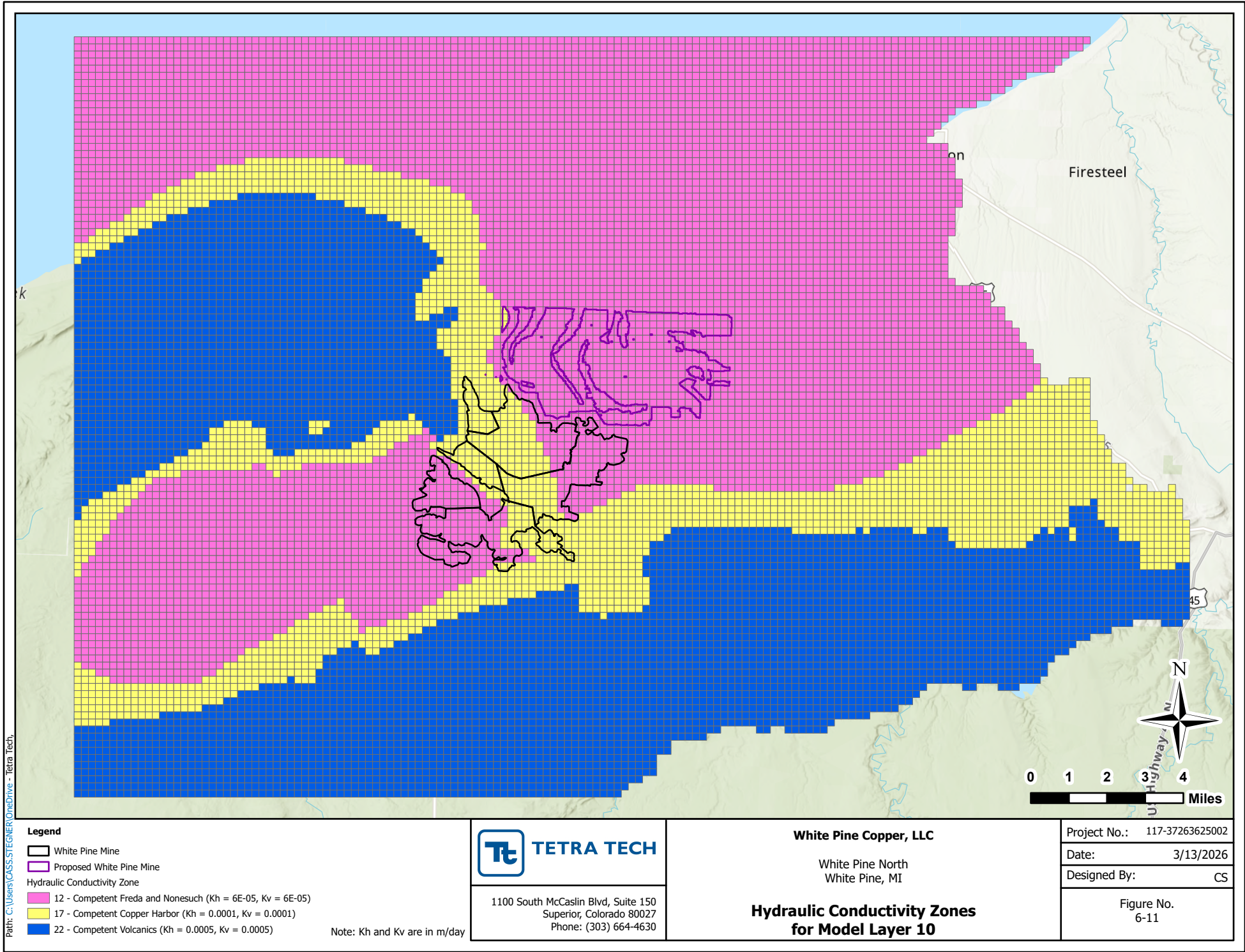


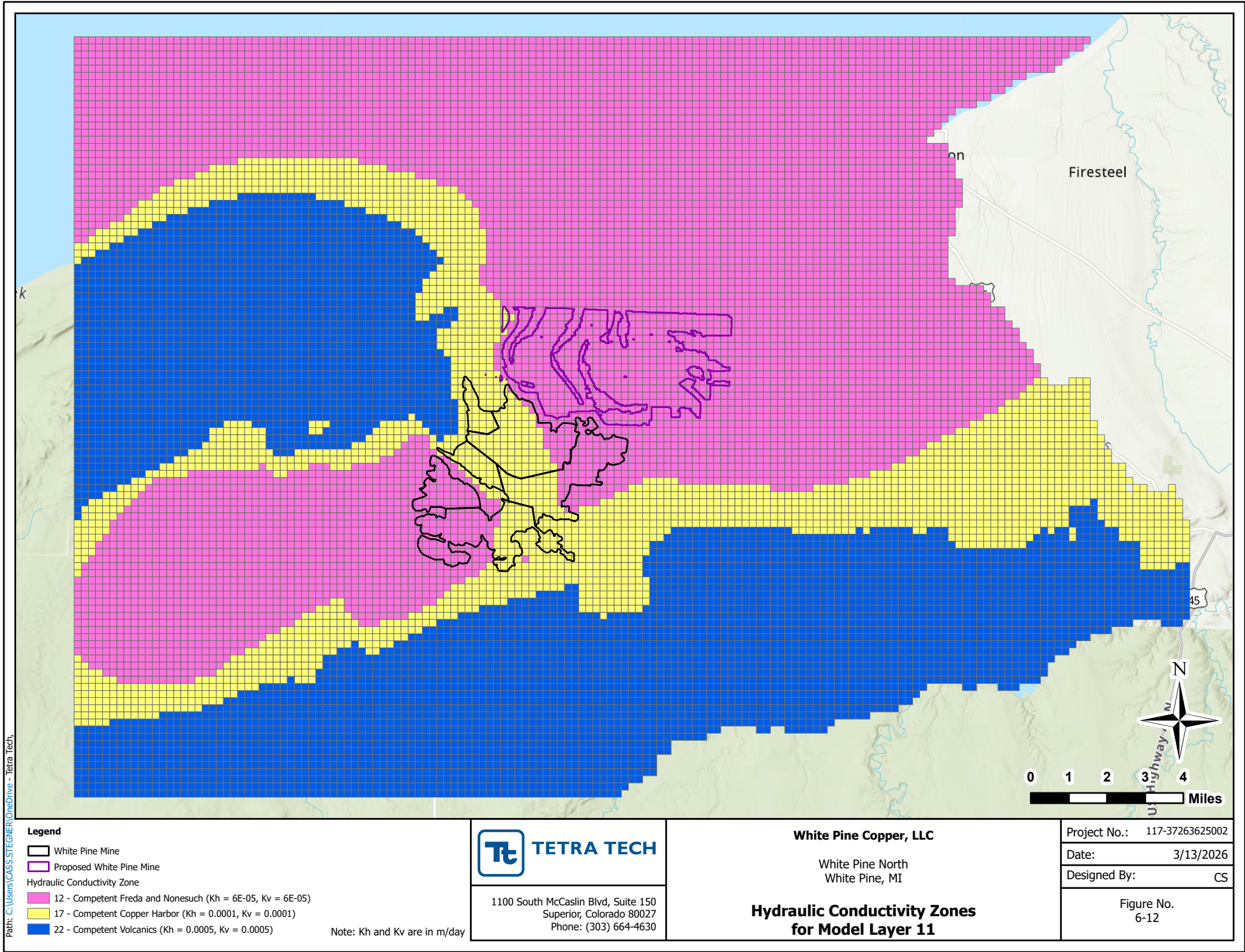


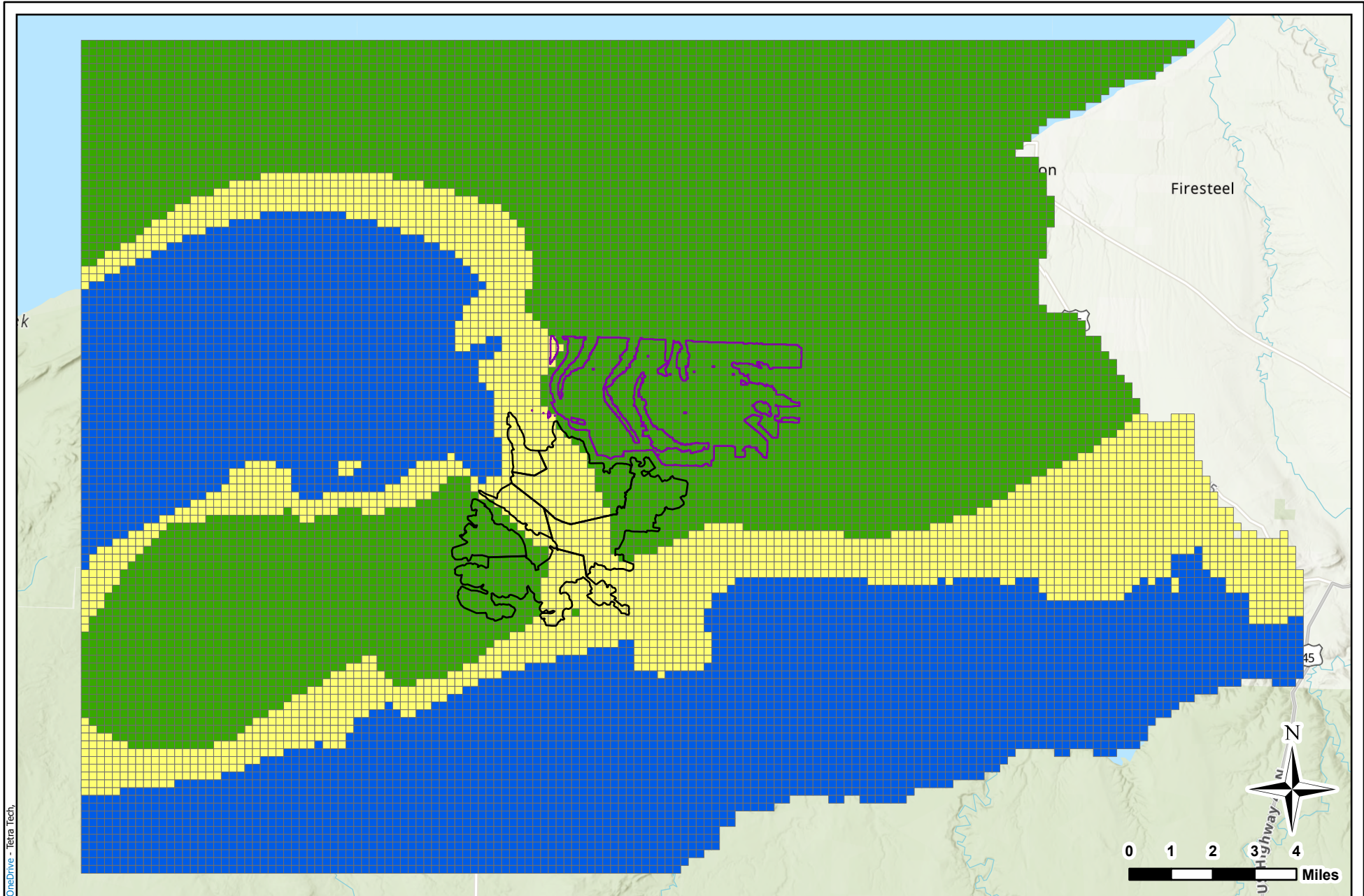












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Legend

White Pine Mine

Proposed White Pine Mine

Hydraulic Conductivity Zone

17 - Competent Copper Harbor ($K_h = 0.0001$, $K_v = 0.0001$)

22 - Competent Volcanics ($K_h = 0.0005$, $K_v = 0.0005$)

23 - Deep Freda and Nonesuch ($K_h = 2.48E-06$, $K_v = 1.24E-06$)

Note: K_h and K_v are in m/day



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Hydraulic Conductivity Zones for Model Layers 12 through 20

Project No.: 117-37263625002

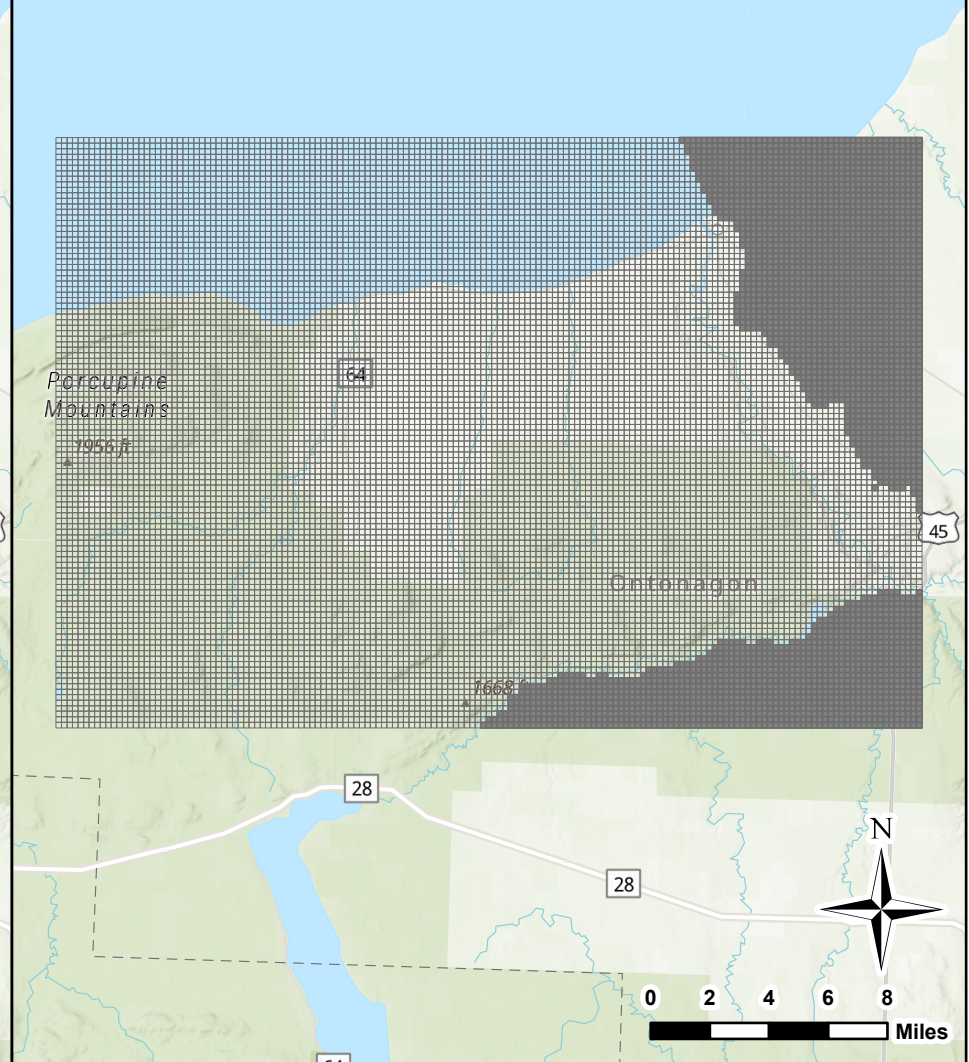
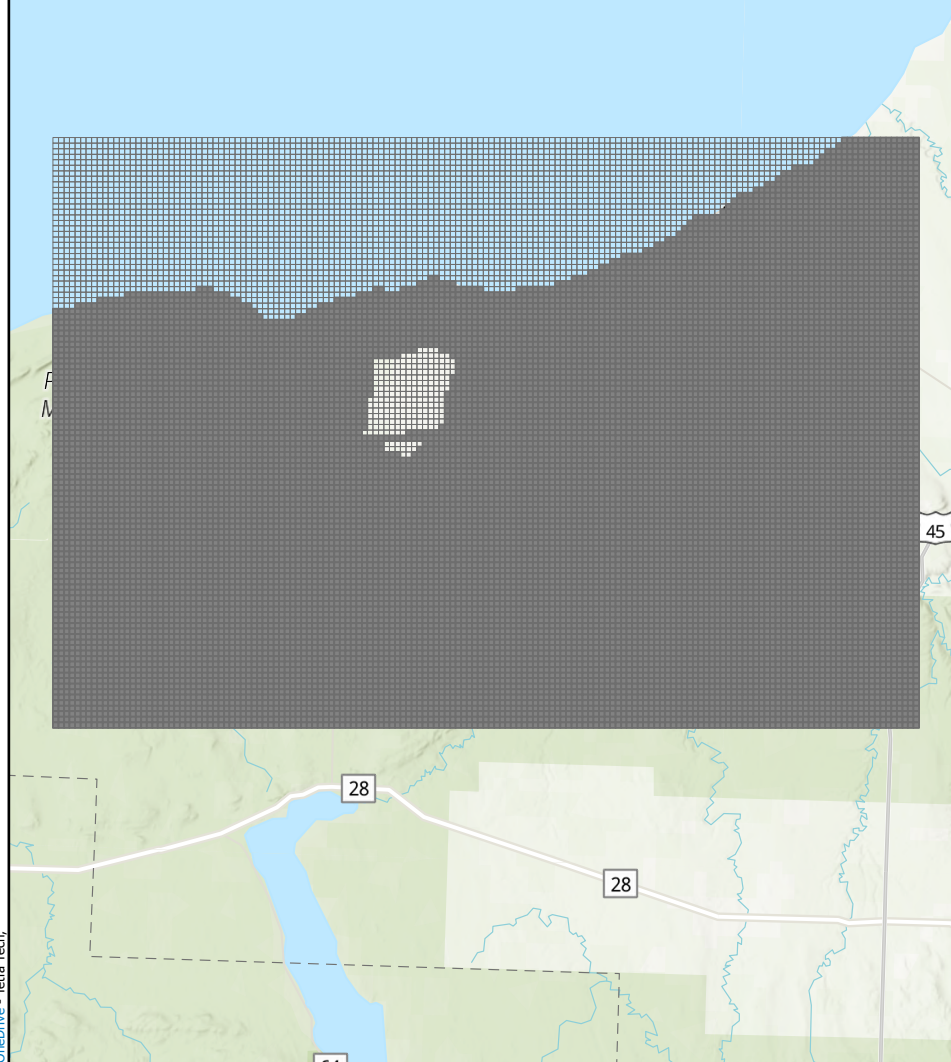
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Figure No.
6-13

Layer 1

Layers 2-20



Legend

- Active Cells
- No Flow Cells



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No Flow Boundary Condition Cells

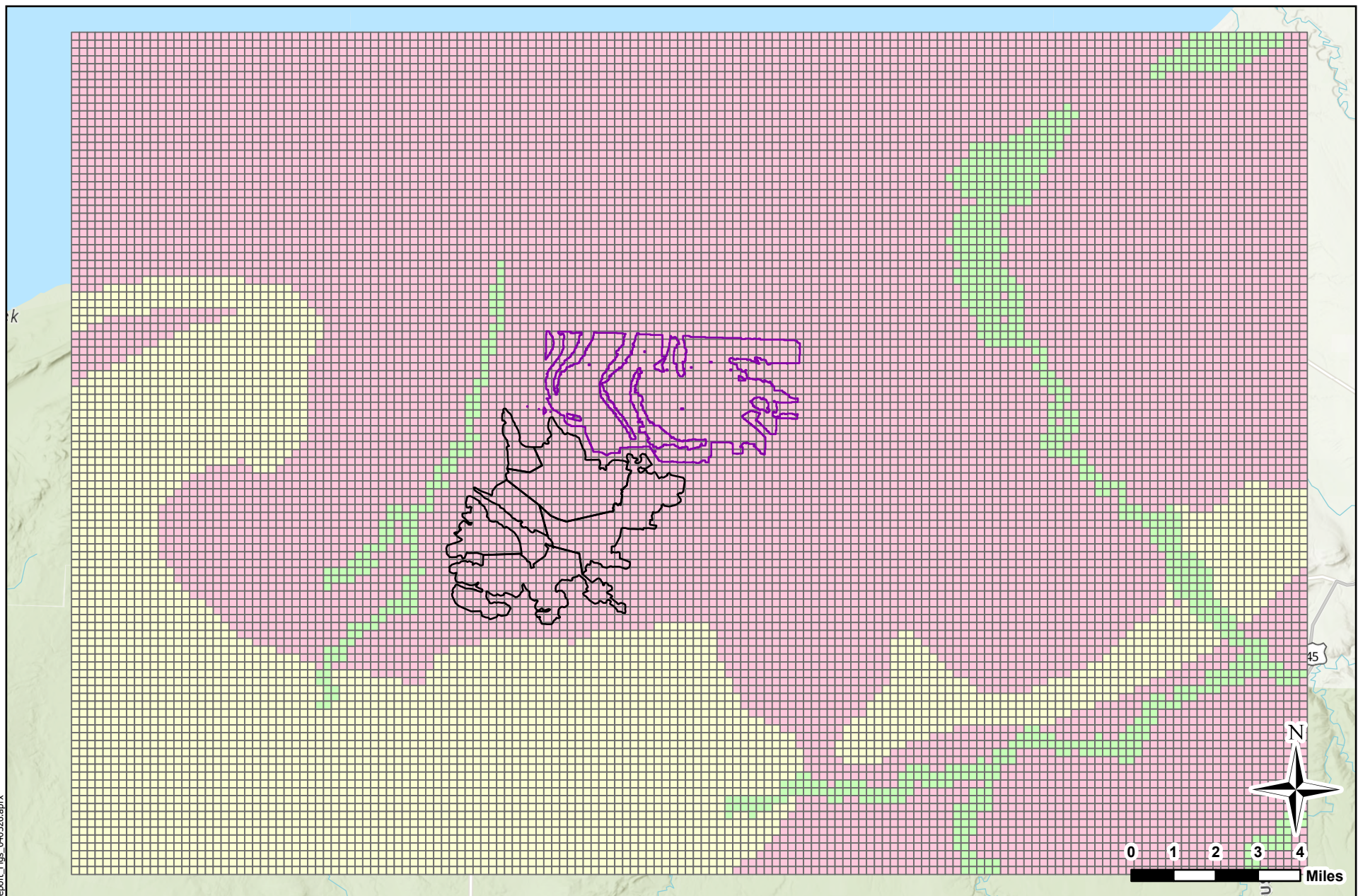
Project No.: 117-37263625002

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Figure No.
6-14

Path: T:\WP\GIS\2026\WP\Report_Figs_040326.aprx



Legend

- White Pine Mine
- Proposed White Pine Mine

Recharge Zones

- Glacial Till (0.000272 ft/day)
- Bedrock (0.00015348 ft/day)
- Quaternary Alluvium (0.0005 ft/day)



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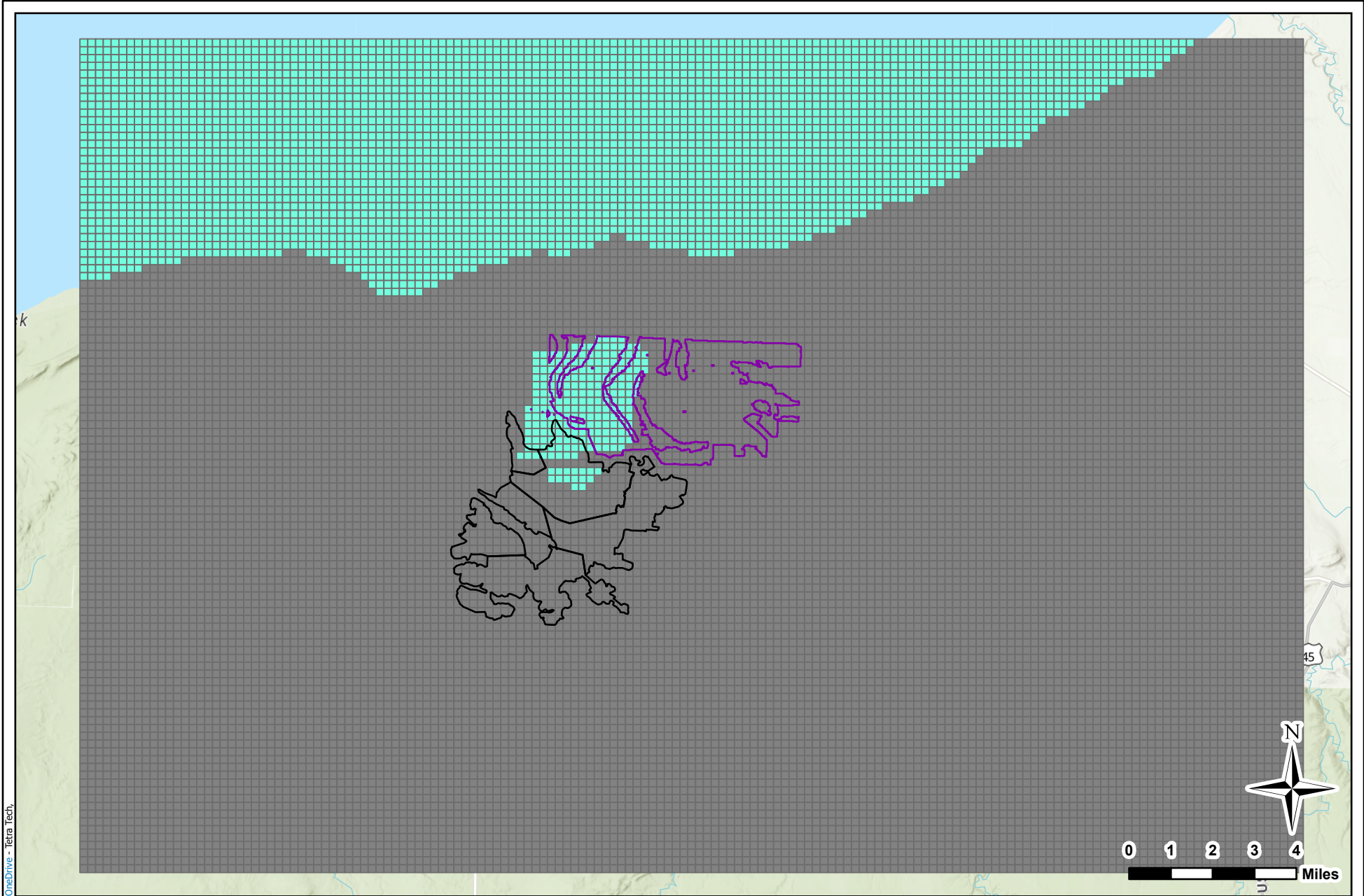
Recharge Boundary Conditions for Uppermost Active Layer of the Model

Project No.: 117-37263625002

Date: 4/13/2026

Designed By: CS

Figure No.
6-15



Path: C:\Users\CASS.STEGNER\OneDrive - Tetra Tech\

- Legend**
- White Pine Mine
 - Proposed White Pine Mine
 - General Head Boundary
 - No Flow



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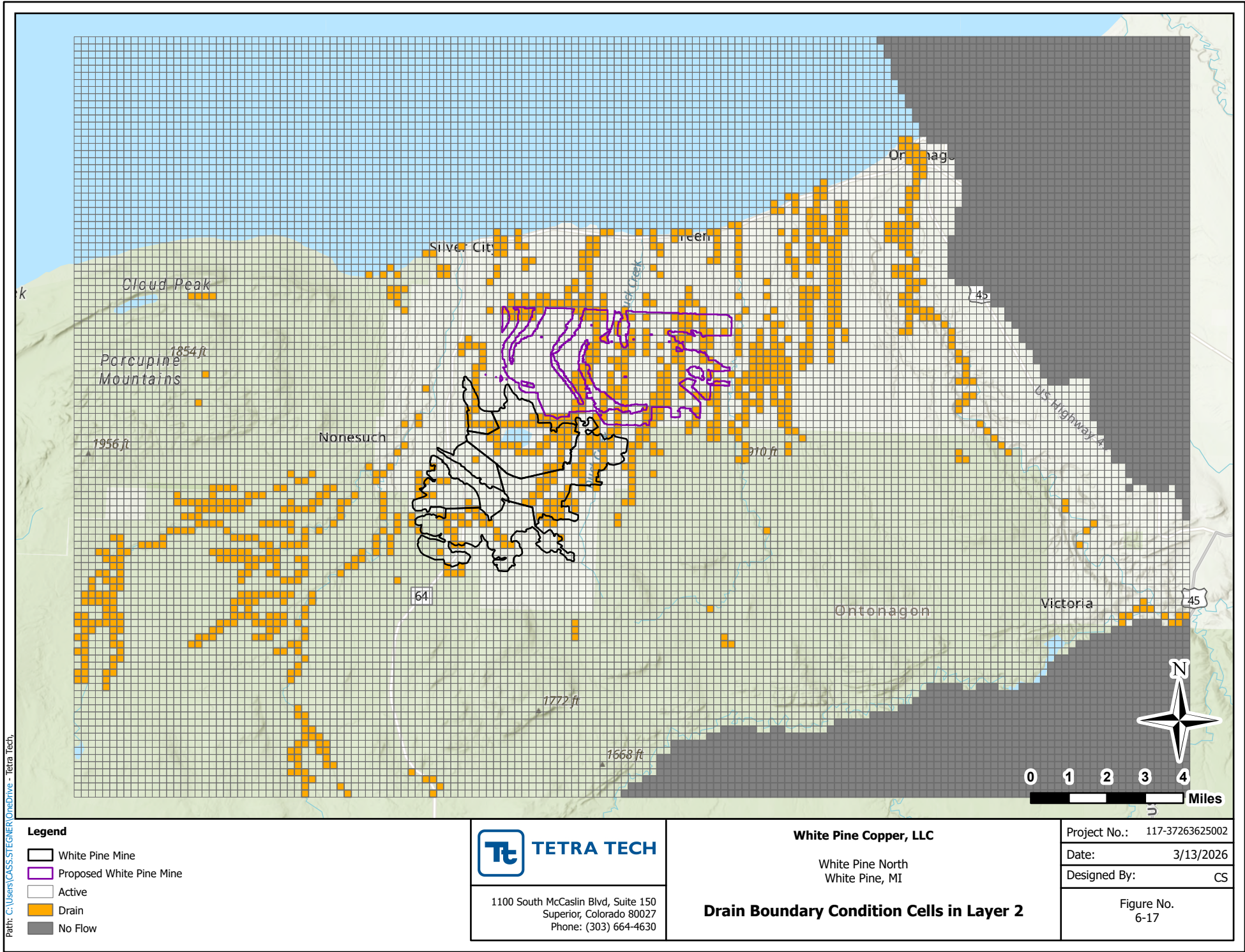
1100 South McCaslin Blvd, Suite 150
Superior, Colorado 80027
Phone: (303) 664-4630

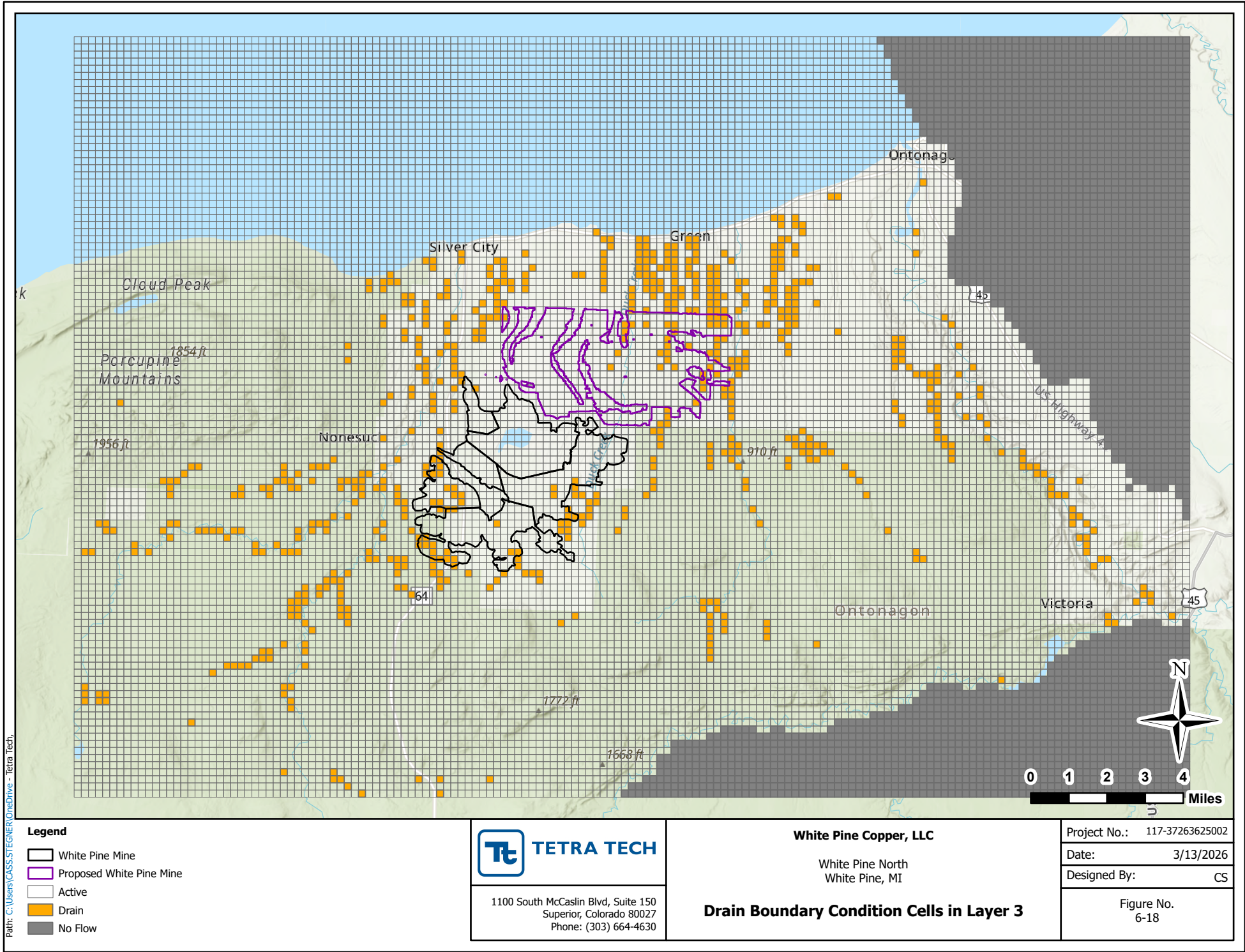
White Pine Copper, LLC

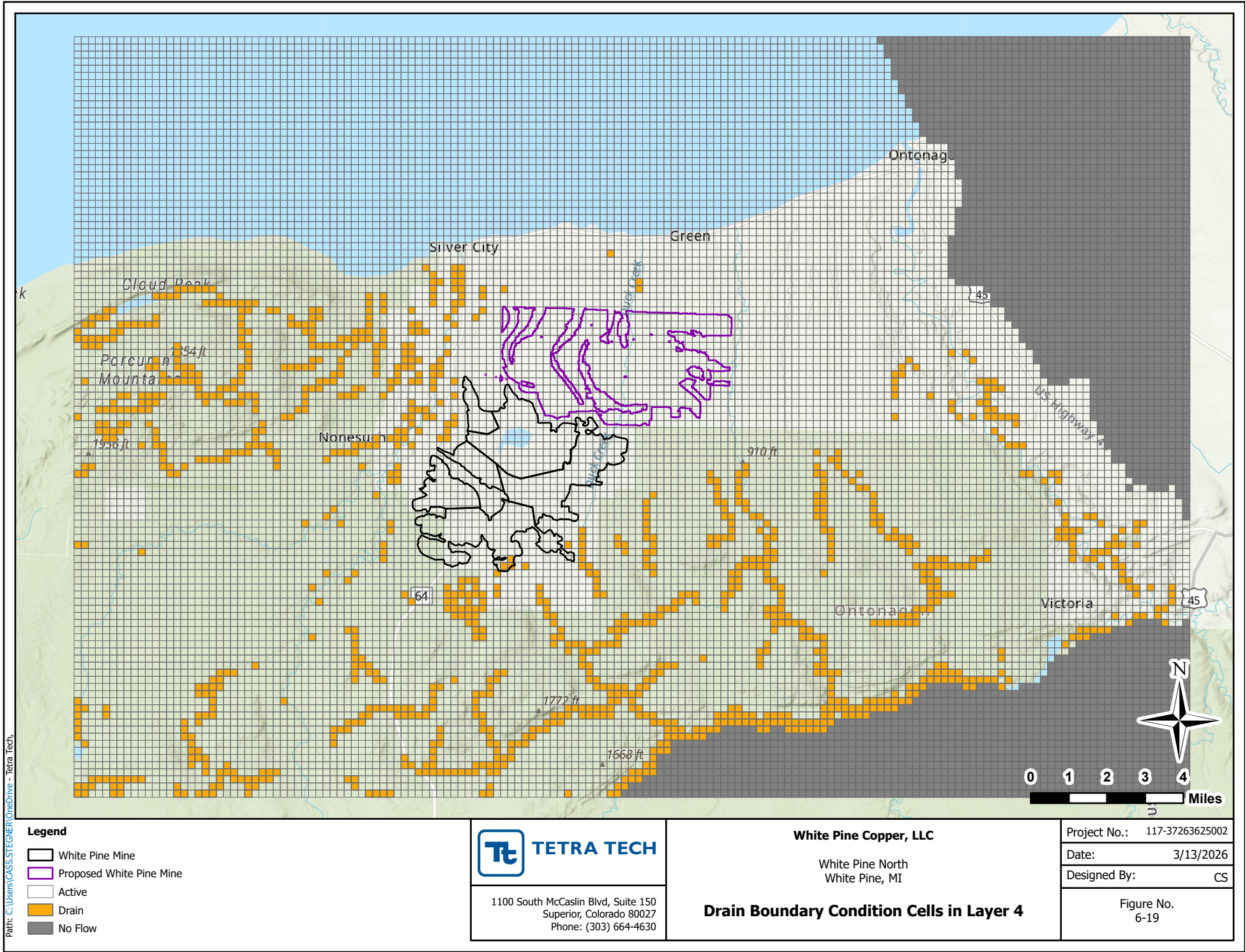
White Pine North
White Pine, MI

General Head Boundary Condition Cells in Layer 1

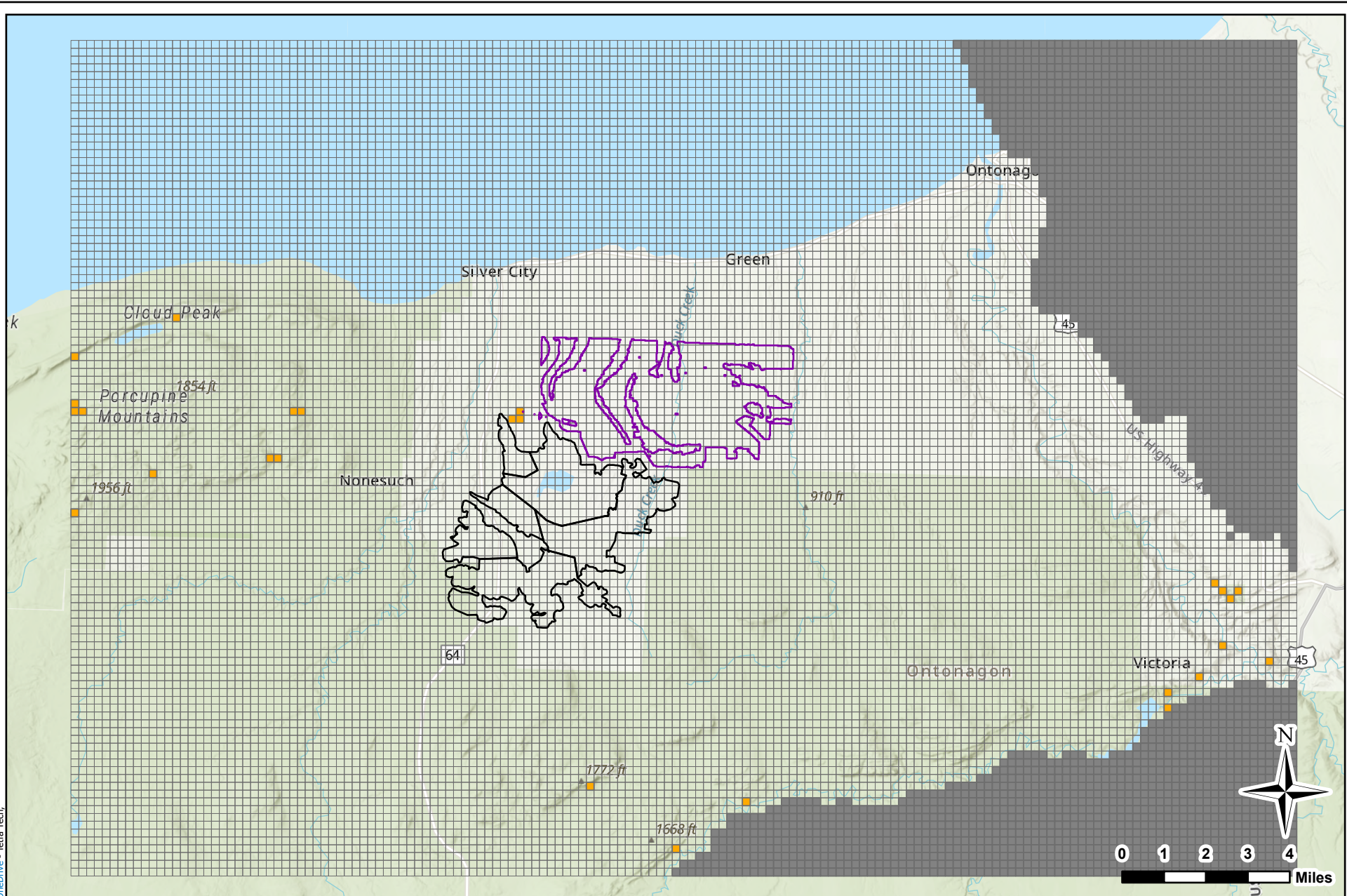
Project No.:	117-37263625002
Date:	3/13/2026
Designed By:	CS
Figure No. 6-16	







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Legend

-  White Pine Mine
-  Proposed White Pine Mine
-  Active
-  Drain
-  No Flow



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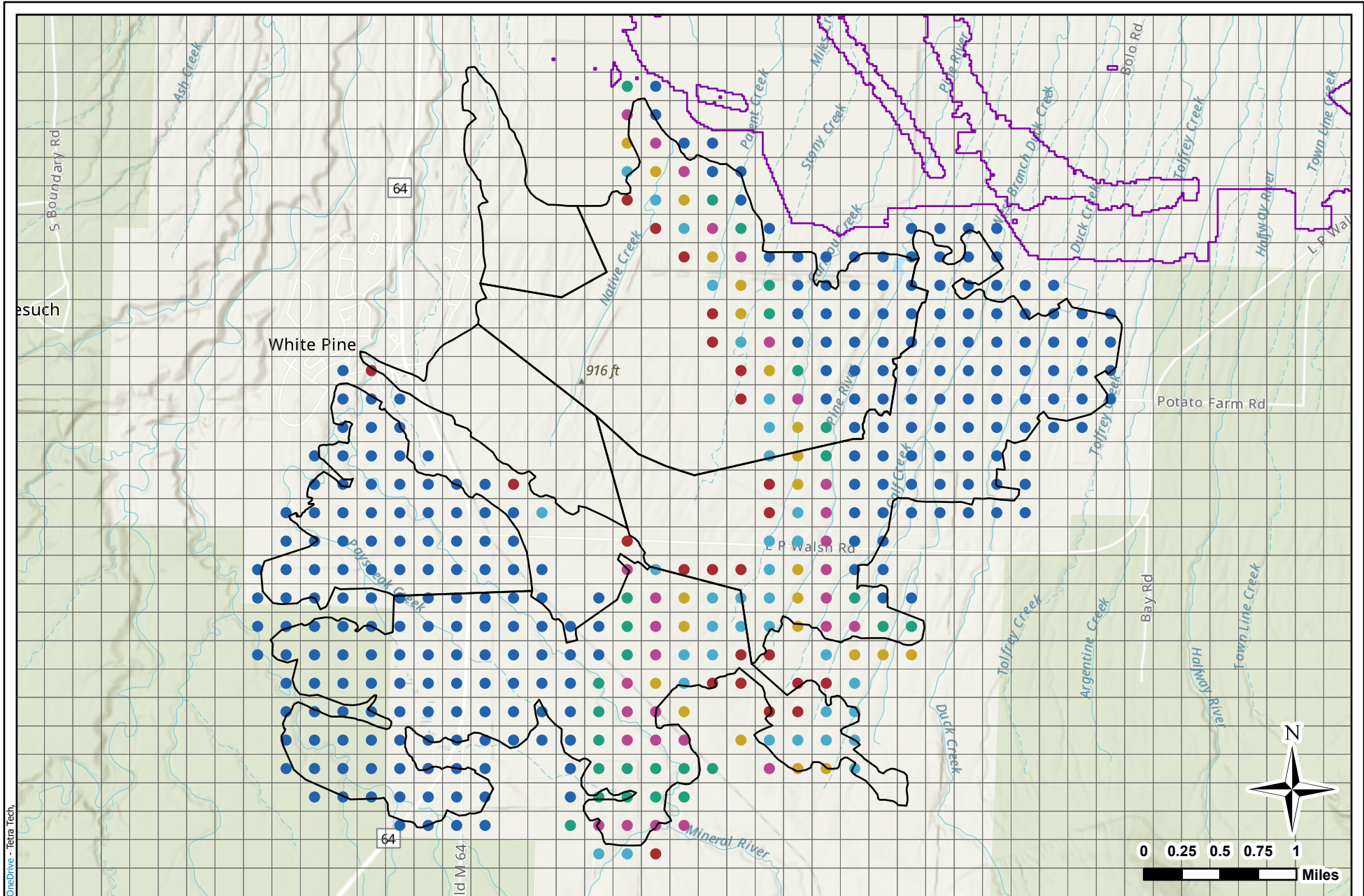
Drain Boundary Condition Cells in Layer 5

Project No.: 117-37263625002

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Figure No.
6-20



Path: C:\Users\CASS.STEGNER\OneDrive - Tetra Tech\

Legend

- Model Grid
- Proposed White Pine Mine
- White Pine Mine
- White Pine Mine Drains by Layer
- 6
- 7

- 8
- 9
- 10
- 11



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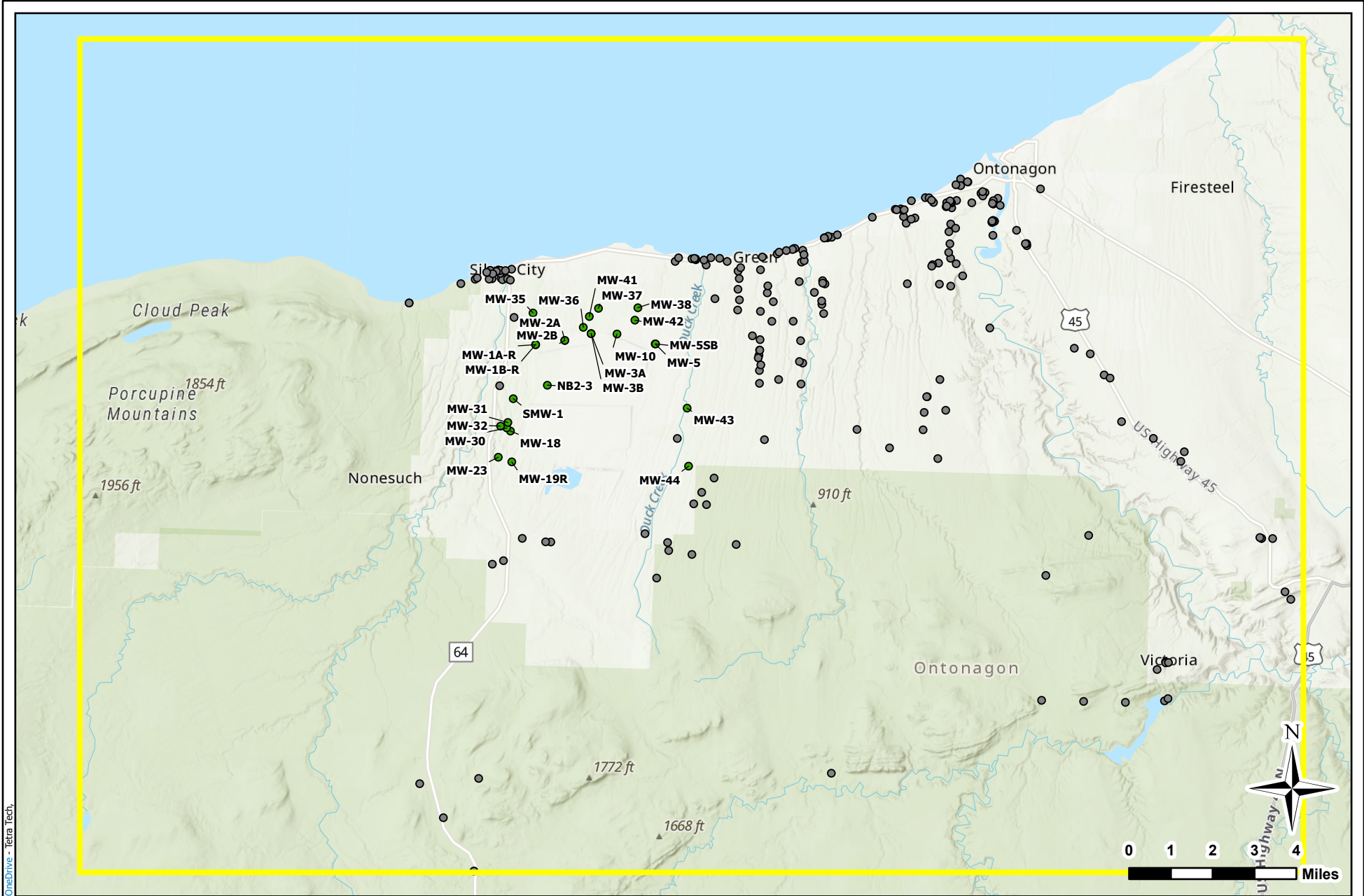
Drain Boundary Condition Cells for the White Pine Mine for Layers 6 through 11

Project No.: 117-37263625002

Date: 3/13/2026

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Figure No.
6-21



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Legend

Model Extent

Targets

- Site Wells
- State Wells



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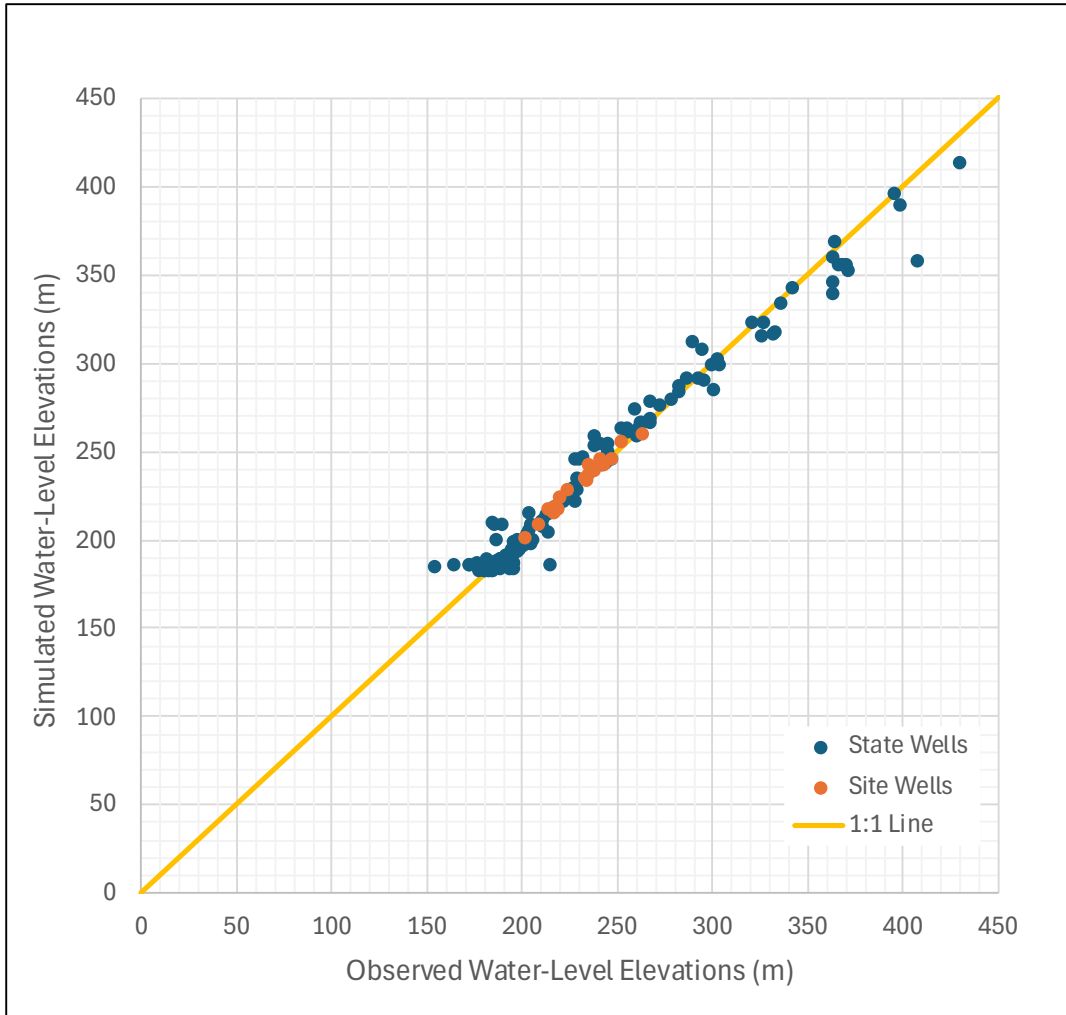
Steady-State Calibration Targets

Project No.: 117-37263625002

Date: 3/13/2026

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Figure No.
6-22



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**Observed vs. Model-Simulated Water Levels for the
Model Calibration**

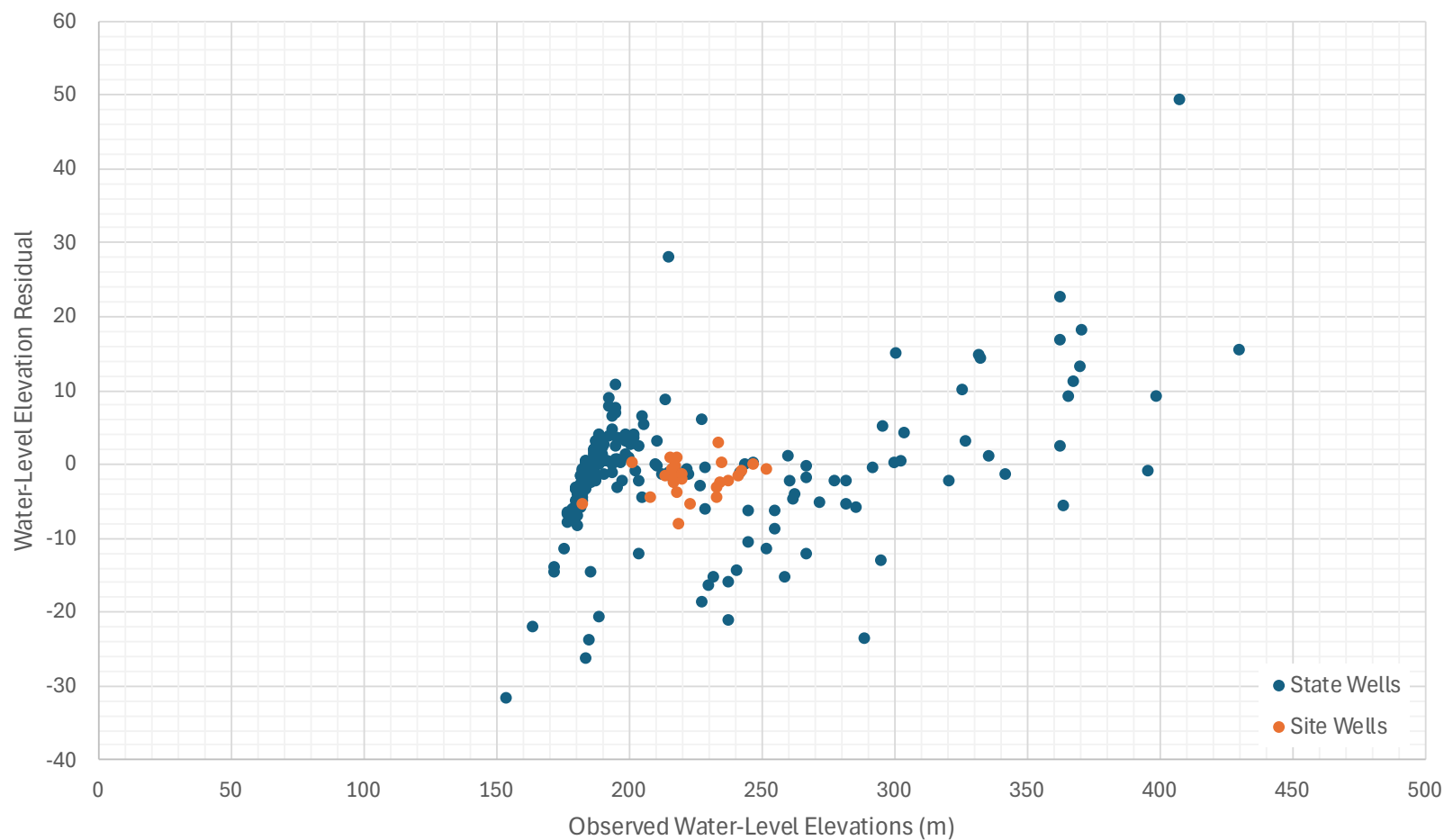
Project No.: 117-372636-25002

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Figure No.

7-1



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Observed Water Levels vs. Residuals for the Model Calibration

Project No.: 117-372636-25002

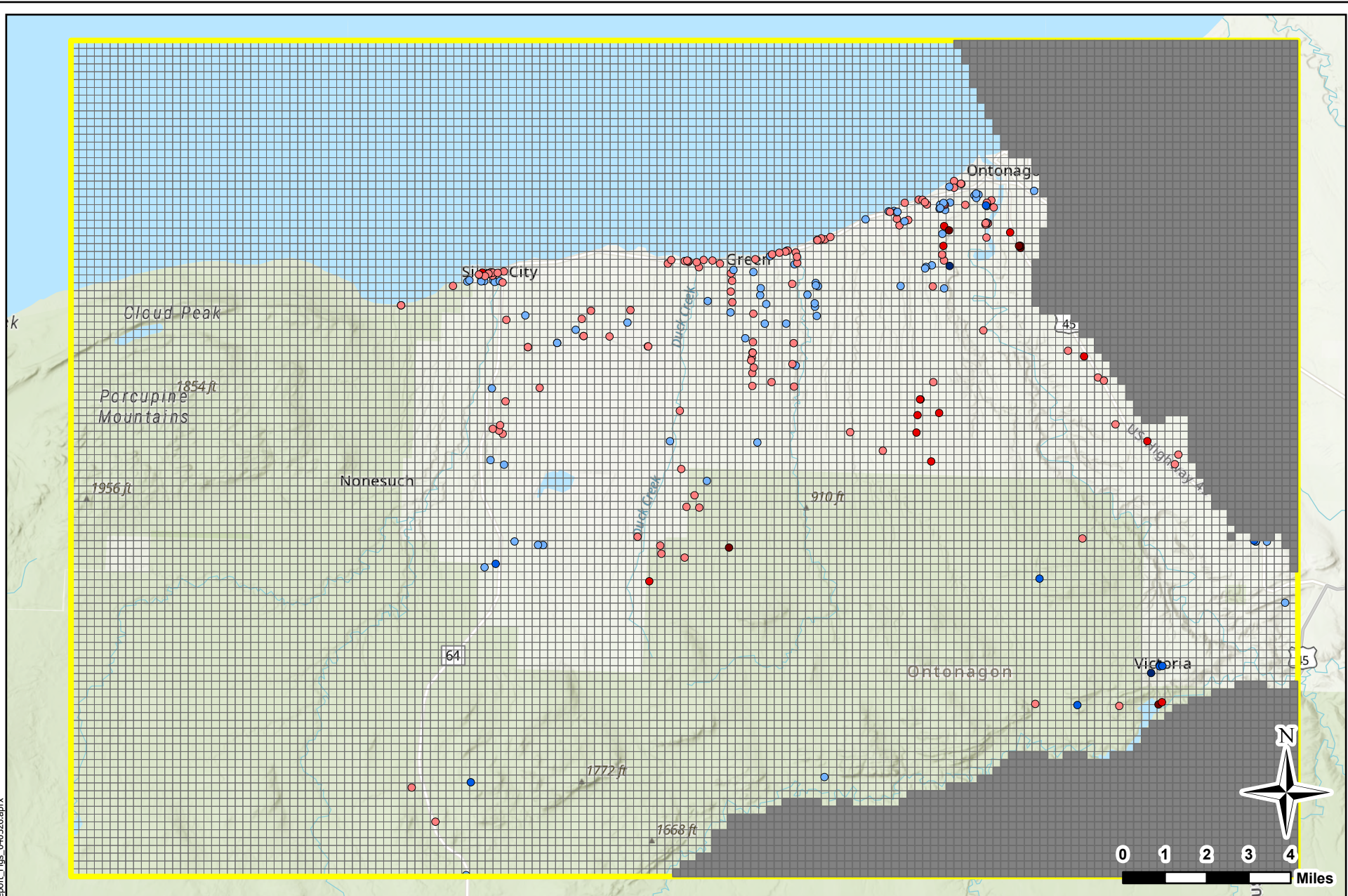
Date: April 13, 2026

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Figure No.

7-2

Path: T:\WP\GIS\2026\WP\Report_Figs_040326.aprx



Legend

	Model Extent	Residual	
	Model Grid		< -20
			-20 to -10
			-10 to 0
			0 to 10
			10 to 20
			> 20



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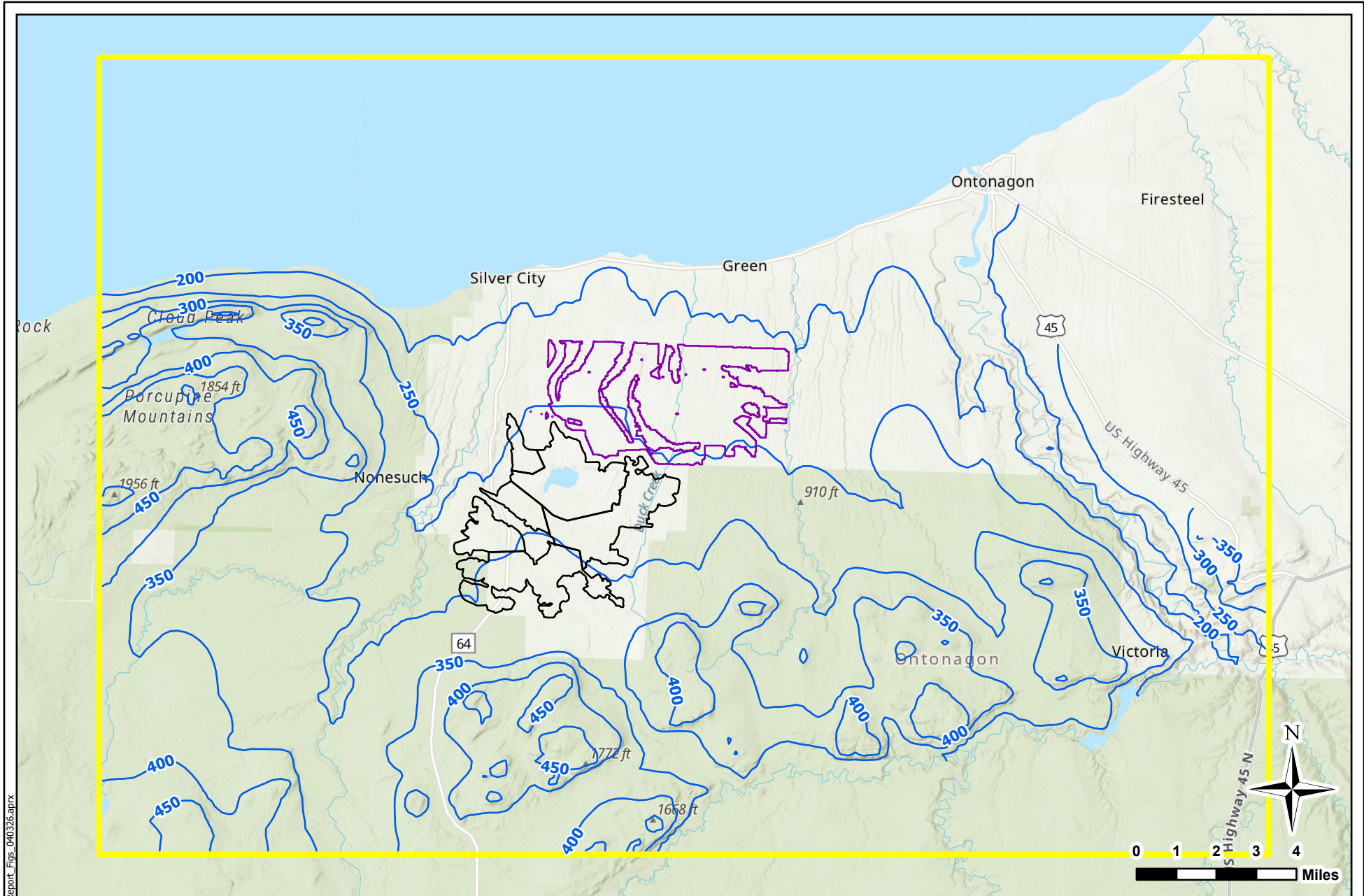
Steady-State Calibration Residuals

Project No.: 117-37263625002

Date: 4/13/2026

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Figure No.
7-2b



Path: T:\WP\GIS\2026\WP\Report_Figs_040326.aprx

- Legend**
- White Pine Mine
 - Proposed White Pine Mine
 - Model Extent
 - Groundwater Elevation Contours (m amsl)



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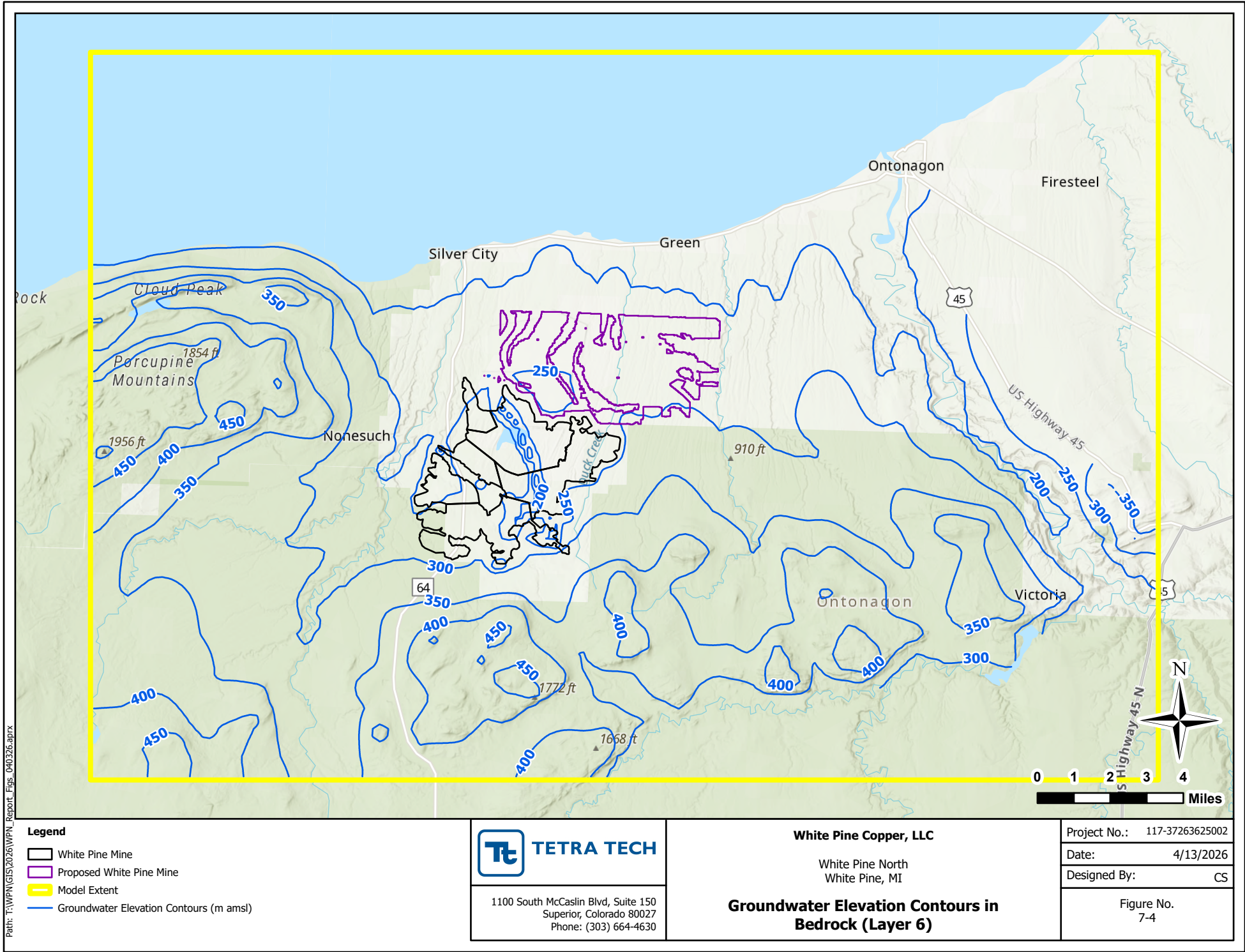
Groundwater Elevation Contours in Unconsolidated Deposits (Layer 2)

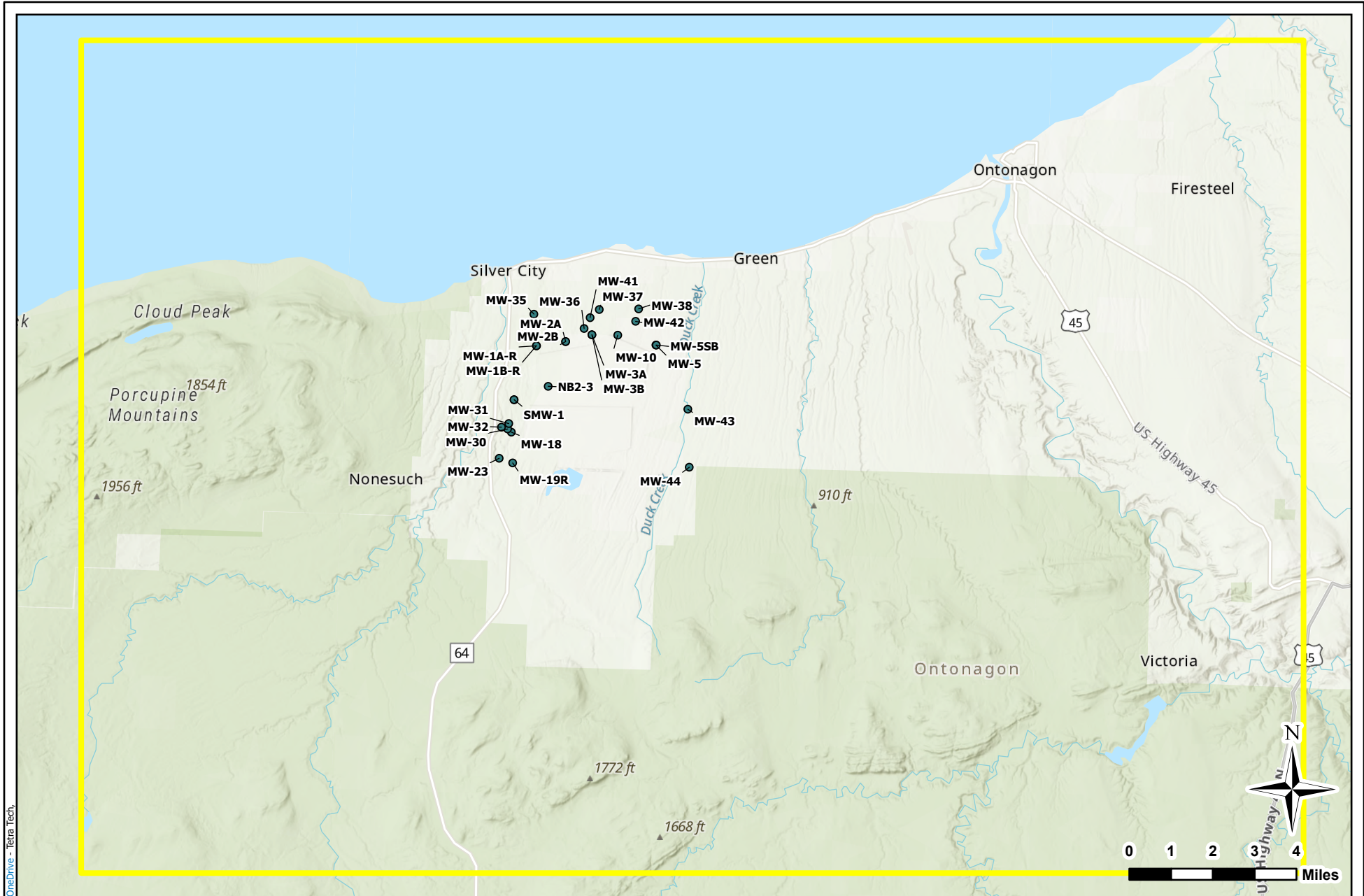
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Figure No.
7-3





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Legend

- Model Extent
- Transient Targets



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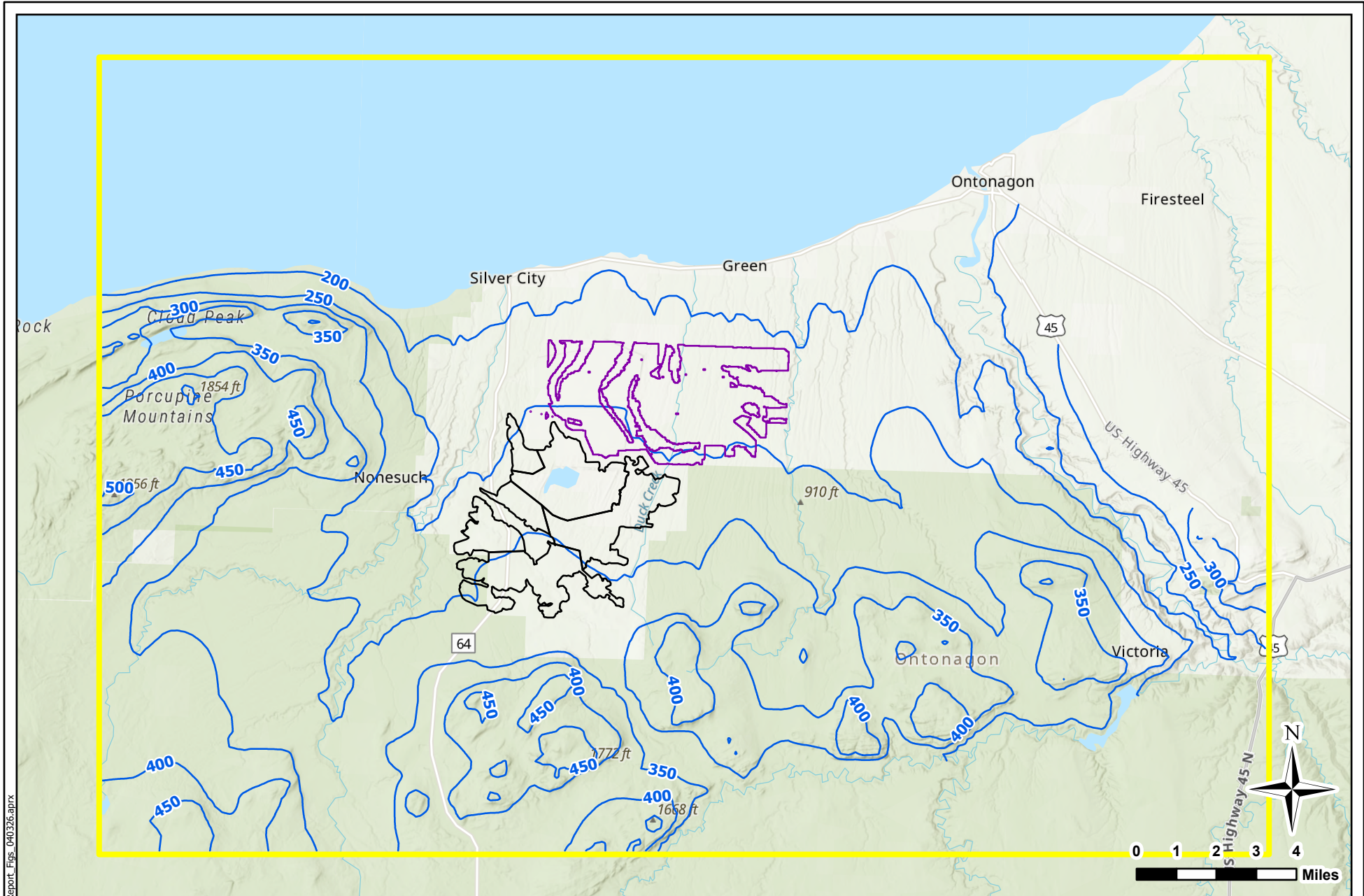
Transient Calibration Targets

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Figure No.
7-5



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- Legend**
- White Pine Mine
 - Proposed White Pine Mine
 - Model Extent
 - Groundwater Elevation Contours (m amsl)



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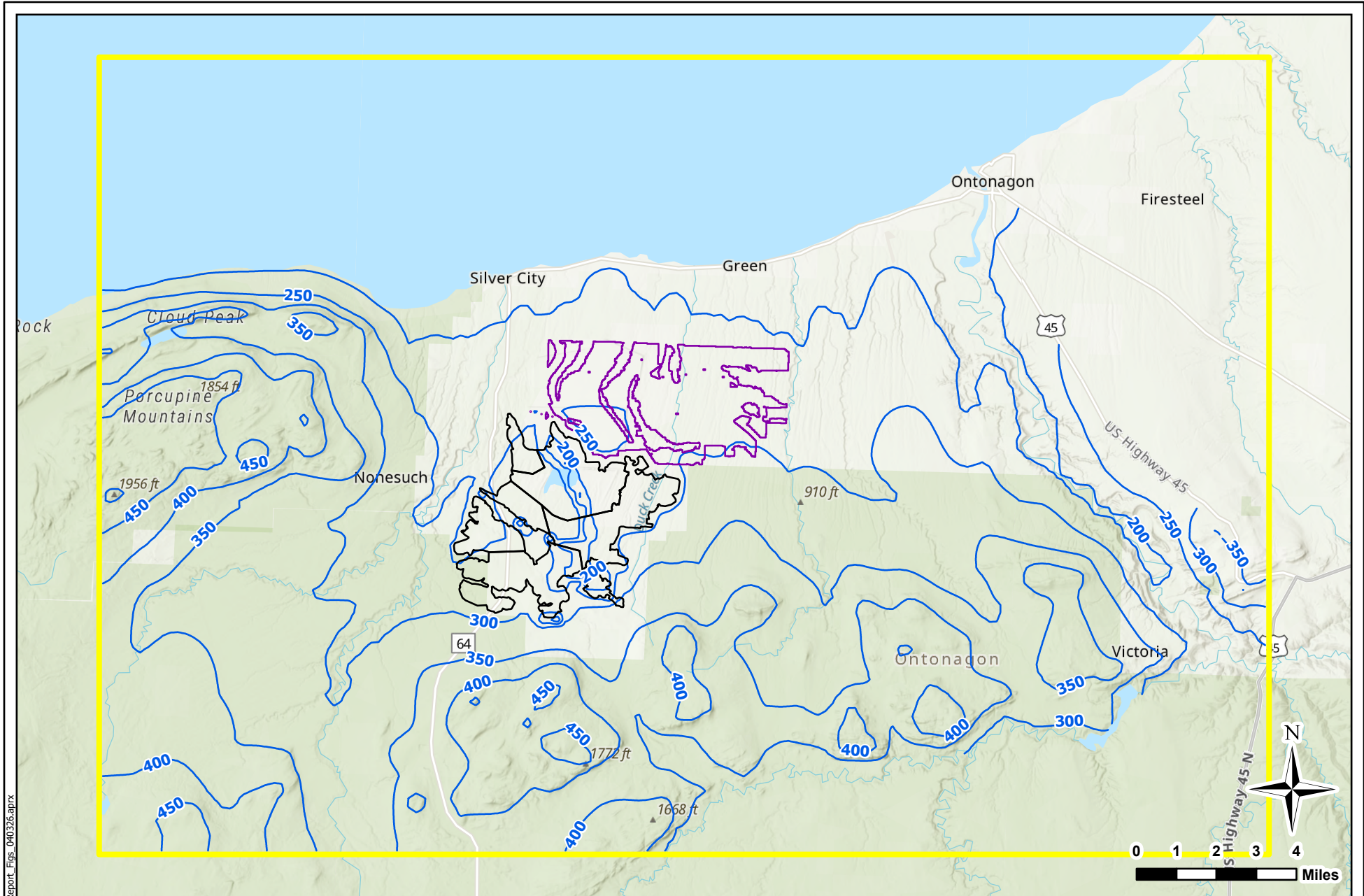
**Groundwater Elevation Contours in
Unconsolidated Deposits in March 2025 (Layer 2)**

Project No.: 117-37263625002

Date: 4/13/2026

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Figure No.
7-6



Path: T:\WP\GIS\2026\WP\Report_Figs_040326.aprx

Legend

- White Pine Mine
- Proposed White Pine Mine
- Model Extent
- Groundwater Elevation Contours (m amsl)



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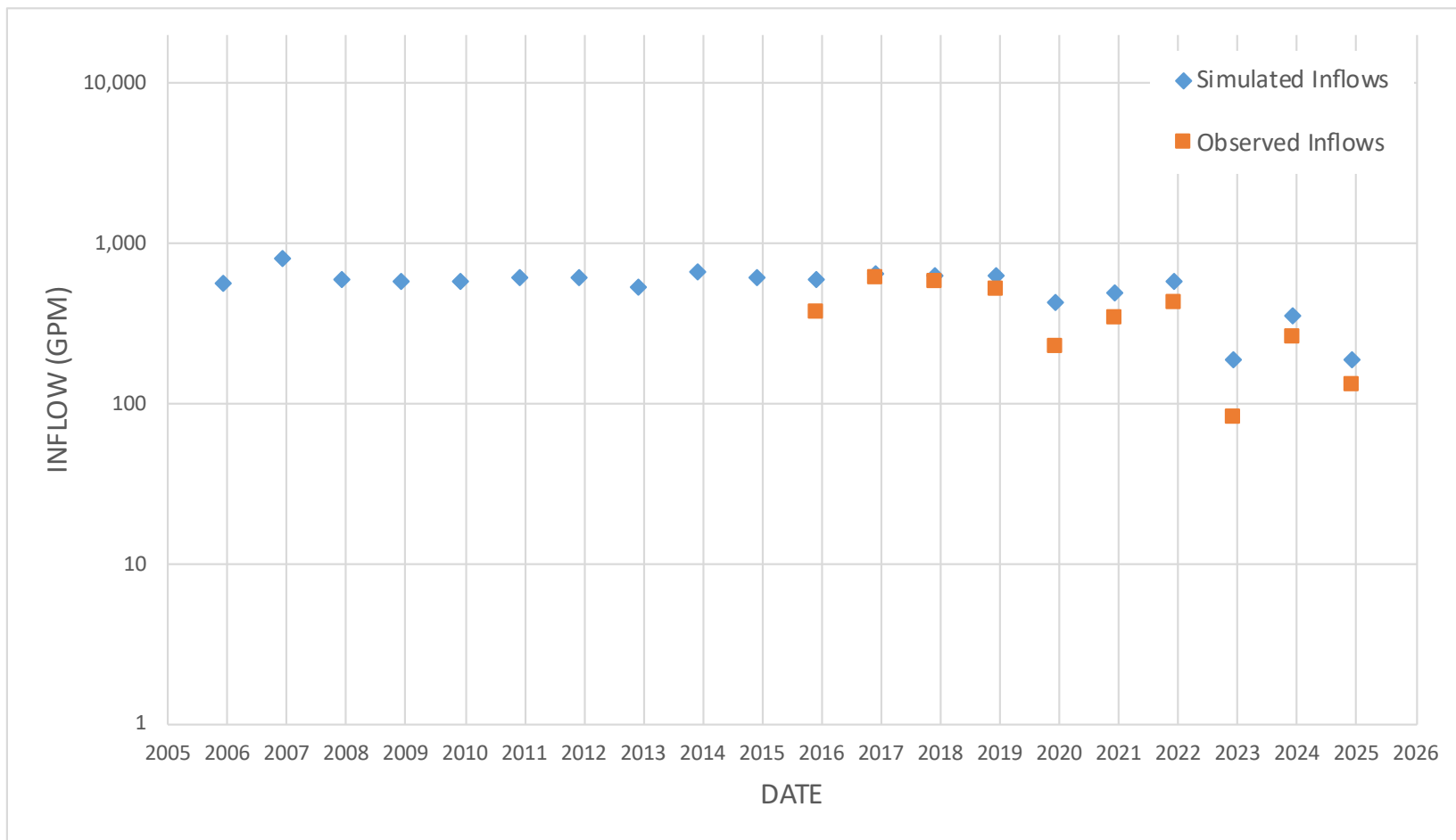
Groundwater Elevation Contours in Bedrock in March 2025 (Layer 6)

Project No.: 117-37263625002

Date: 4/13/2026

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Figure No.
7-7



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**Observed and Simulated White Pine Mine Inflows
for Model Calibration**

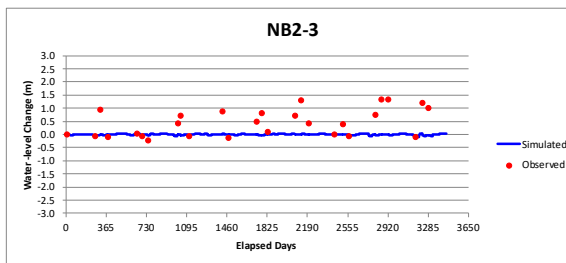
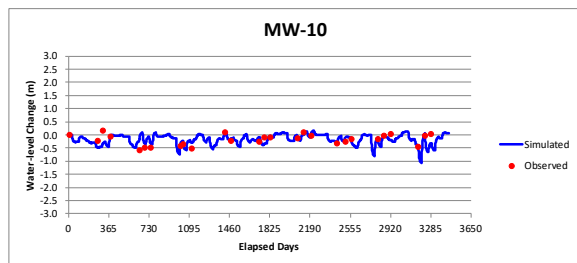
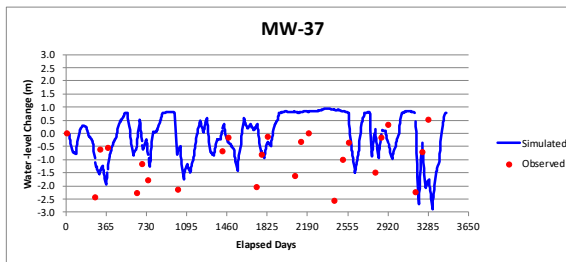
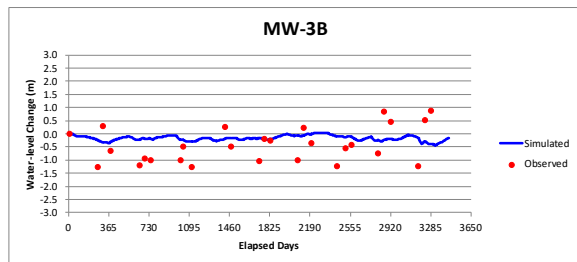
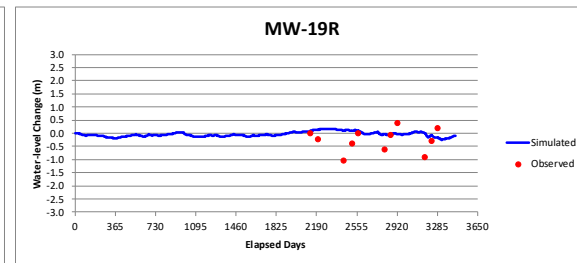
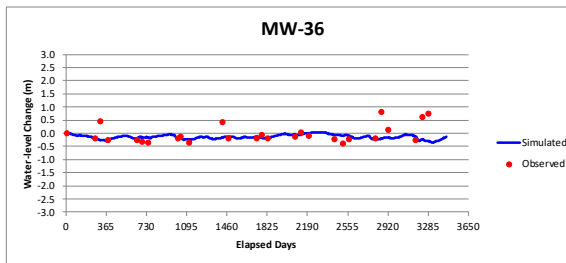
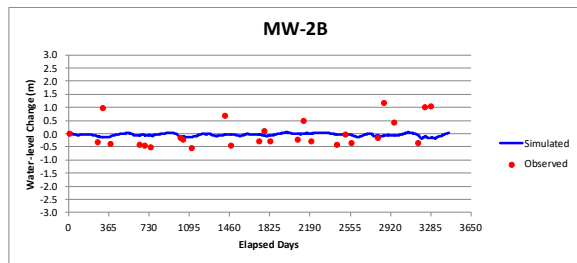
Project No.: 117-372636-25002

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Figure No.

7-8



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Hydrographs for White Pine Monitoring Wells in Layer 2

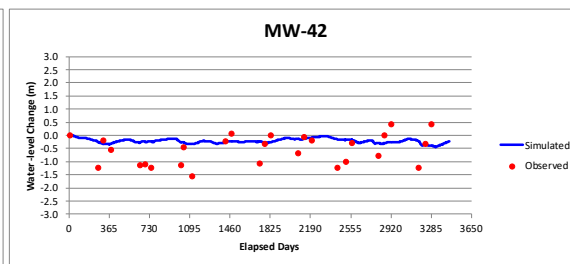
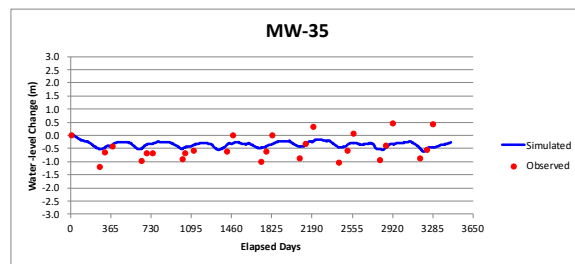
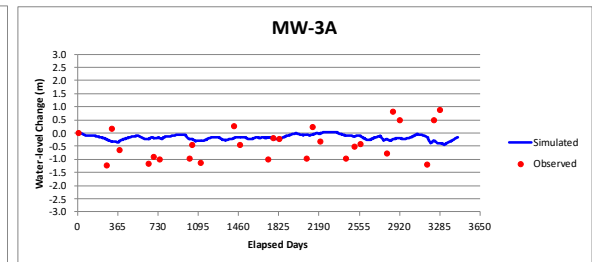
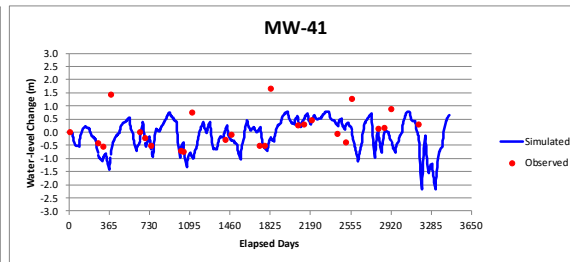
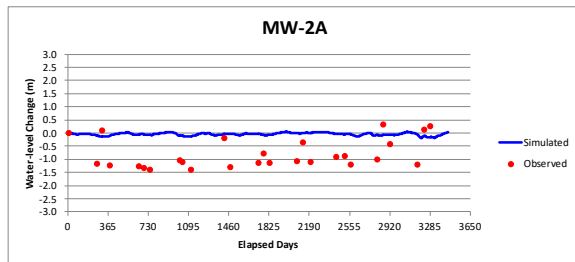
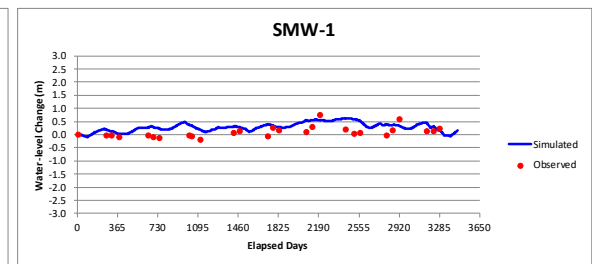
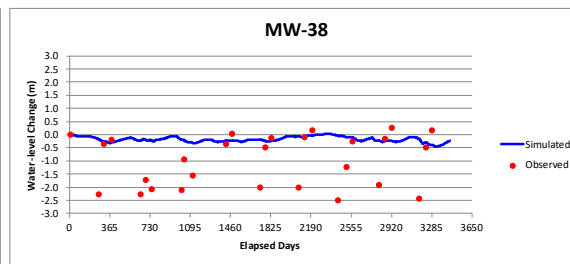
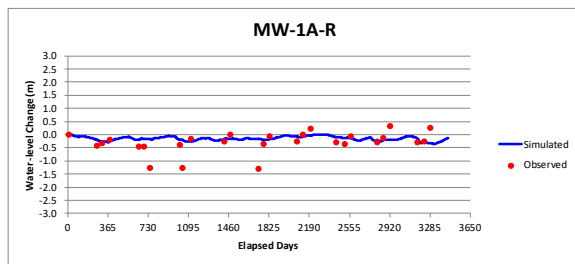
Project No.: 117-372636-25002

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Figure No.

7-9



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Hydrographs for White Pine Monitoring Wells in Layer 3

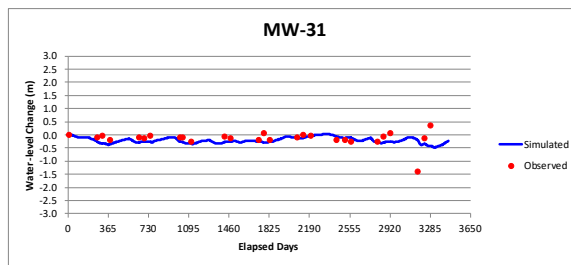
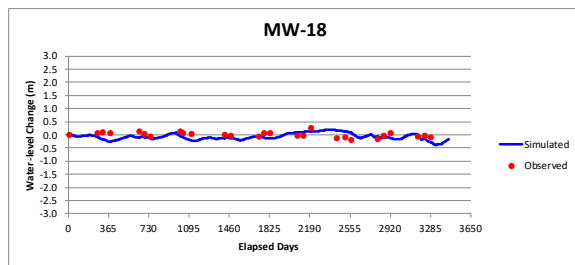
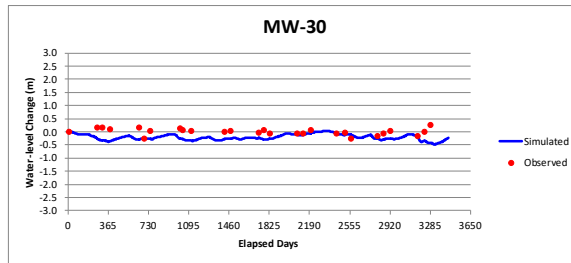
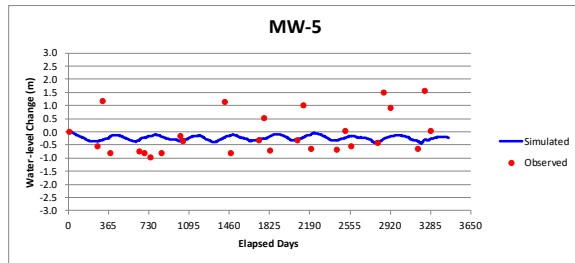
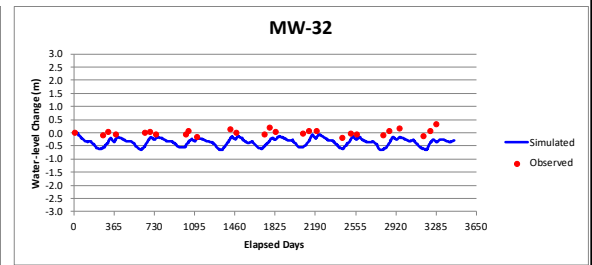
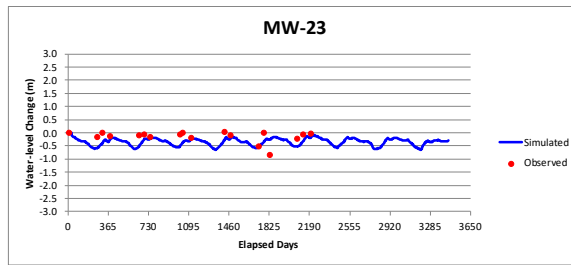
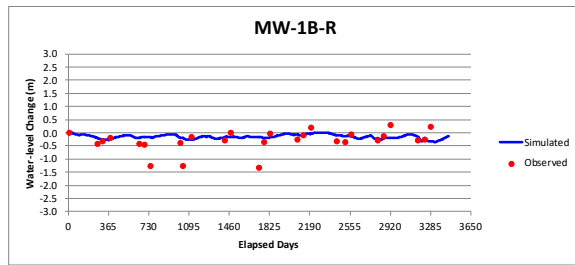
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Figure No.

7-10



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Hydrographs for White Pine Monitoring Wells in Layer 4

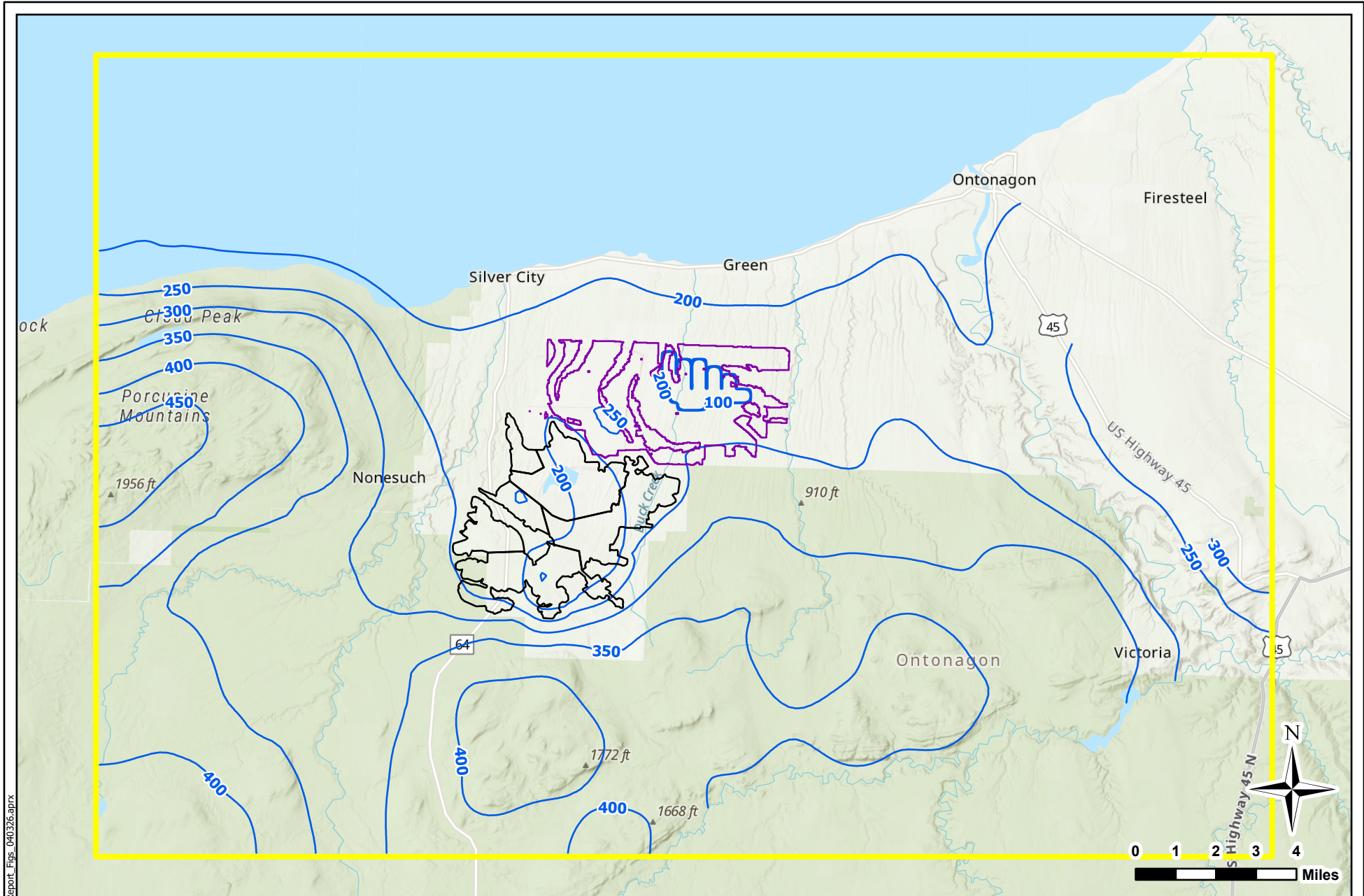
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Date: April 13, 2026

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Figure No.

7-11



Path: T:\WP\GIS\2026\WP\Report_Figs_040326.aprx

Legend

- White Pine Mine
- Proposed White Pine Mine
- Model Extent
- Groundwater Elevation Contours (m amsl)

Note: Contours are from Layer 17



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Maximum Dewatering Groundwater Elevation Contours in 2040

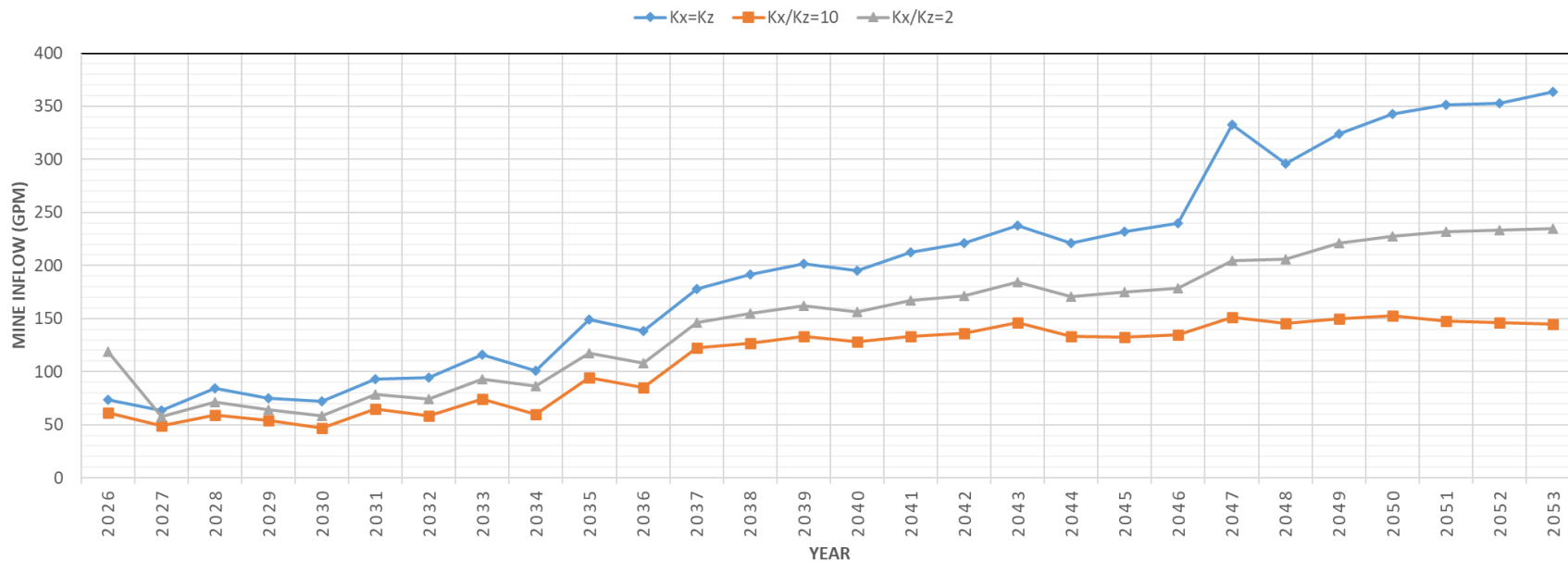
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Figure No.
8-2

WHITE PINE NORTH MINE INFLOWS (2025-2053)



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White Pine North Mine Inflows vs Time

Project No.: 117-372636-25002

Date: April 14, 2026

Designed By: CS

Figure No.

8-3

C-4

**GoldSim Model Construction Memorandum and
GoldSim Years 1-11 Legacy Outfall Model Construction Memorandum**

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De Pere, WI 54115-5095
(920) 497-2500
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August 3, 2026

TO: Project File – 23W200

CC: Steve Donohue, Foth Infrastructure & Environment, LLC
Clinton Roberts, Foth Infrastructure & Environment, LLC

FR: Stephen Lehrke, Ph.D., Foth Infrastructure & Environment, LLC

RE: GoldSim Model Construction

1. Background

The GoldSim modeling platform (GoldSim v15 by the GoldSim Technology Group, LLC [GoldSim]) was used to perform a probabilistic analysis of the project design elements as provided in the operational water balance. The operational water balance details the average flow requirements between the main facility elements including the process plant, tailings disposal facility (TDF), underground mine (UM), ore stockpiles (OSP), and the contact water pond (Bedell Pond). A GoldSim model was constructed incorporating these deterministic design flows with stochastic inputs for precipitation and evaporation. Resulting probability distributions were then obtained for various interest points, including TDF water volumes, available reclaim water for the process plant, flows to the water treatment plant (WTP), and TDF excess capacity outflows.

This memorandum documents the GoldSim model elements and simulation settings. The deterministic operational water balance schematic is included as Attachment 1. Attachment 2 provides figures illustrating the GoldSim outcomes based on a simulated monthly timestep, and Attachment 3 provides similar figures illustrating the GoldSim outcomes when incorporating a daily timestep with deterministic 24-hour storm events.

2. Simulation Settings

The GoldSim simulation encompasses a 26-year duration beginning in January of 2027. The simulation runs on a basic timestep of one month, with reporting steps also at one year. Model results therefore represent either monthly or yearly averages.

A realization of the simulation refers to a single outcome of the stochastic inputs. GoldSim creates many realizations to form distributions of possible model outcomes, providing probabilistic estimates for the various model elements. The GoldSim water balance model incorporates 1,000 realizations into the simulation.

While the primary model was developed with monthly timesteps, an alternative version was also developed utilizing daily timesteps and incorporating defined 24-hour storm events. This is further described in Section 9 below.

3. Climate Model

The climate model consists of stochastic input elements for annual precipitation and annual open water evaporation. The annual precipitation is defined by a regression equation accounting for an assumed precipitation increase over time due to climate change. Inches of precipitation are estimated by the regression equation as:

$$\text{mean annual precipitation} = 0.0295 * \text{Year} - 25.901$$

where "Year" represents the four-digit year value. The stochastic mean annual precipitation input is assumed to be normally distributed with a standard deviation of 6.4 inches.

This equation was determined through climate change analysis incorporating annual precipitation data projected by National Oceanic and Atmospheric Administration (NOAA) Climate Explorer for Ontonagon County, MI using their R85 (high) carbon emissions scenario for years 2005 through 2100. The projected mean annual precipitation equation is the linear correlation equation for the projected data set.

Evaporation is likewise defined by a regression equation incorporating the results of climate change modeling. The equation estimates inches of open water evaporation as:

$$\text{mean annual evaporation} = ((27.37 - 21.61) / 70) * (\text{Year} - 2005) + 21.61$$

again where "Year" represents the four-digit year value. The stochastic mean annual evaporation input is assumed to be normally distributed with a standard deviation of 4.5 inches, being 0.7 times the standard deviation of the annual precipitation, since on average the annual evaporation is approximately 70% of annual precipitation.

The evaporation equation was determined through climate change analysis incorporating monthly temperature data projected by NOAA Climate Explorer for Ironwood, MI using their R85 (high) carbon emissions scenario for years 2005 through 2075. The projected monthly evaporation was estimated using the monthly temperature projection data and Thornthwaite's monthly evaporation vs. temperature calculation methodology. This yielded the projected mean annual evaporation as a linear correlation equating for the projected data set.

Also, through the climate change analysis, a monthly percentage distribution of the annual precipitation and evaporation values was provided. These distributions are shown below in Table 1.

Snowmelt is incorporated into the climate model by accumulating the precipitation over winter months and releasing a percentage during spring runoff. Precipitation is accumulated for the months of December, January, and February. During March, 40% of this accumulation is released, and during April, the remaining 60% is released.

Table 1
Percent of Annual Precipitation and Evaporation by Month

	% of Annual Precipitation Distributed by Month	% of Annual Evaporation Distributed by Month
January	6.3%	0.0%
February	4.1%	0.0%
March	6.2%	0.0%
April	8.2%	5.1%
May	10.7%	11.7%
June	11.2%	17.5%
July	9.7%	20.4%
August	9.4%	19.7%
September	10.4%	15.0%
October	8.8%	8.7%
November	8.3%	1.8%
December	6.7%	0.0%

Prepared by: SGL
Checked by: CER

4. Design Element Dimensions

Design elements contributing to precipitation runoff to Bedell Pond in the GoldSim water balance model include the crushed OSP, temporary OSP, roadways, and industrial site. Dimensions for these elements are taken as:

- ◆ Crushed OSP = 103,520 square feet (ft²)
- ◆ Temporary OSP = 760,780 ft²
- ◆ Roadways = 520,730 ft²
- ◆ Industrial Site = 1,002,230 ft²

Runoff is also captured from the area surrounding Bedell Pond and area around the TDF elements of North Pond 1 (NP1) and North Pond 2 (NP2). These three elements in the model are defined as GoldSim pool elements with calculated inflows and outflows, and in addition, have associated overall capacity definitions. The dimensions for these elements are taken as:

- ◆ Bedell Pond
 - Pond Area = 5 acres (ac)
 - Drainage Area (Excluding Pond Area) = 129 ac
 - Capacity = 79890 cubic meters (m³) (2.11x10⁷ gallons)
- ◆ NP1
 - Pond Area = 274 ac
 - Drainage Area (Excluding Pond Area) = 1,576 ac
 - Capacity = 2,164.3 acre feet (af) (2.670x10⁶ m³ or 7.05x10⁸ gallons)

- ◆ NP2
 - Pond Area = 105 ac
 - Drainage Area (Excluding Pond Area) = 1,792 ac
 - Capacity = 2,168.7 af ($2.675 \times 10^6 \text{ m}^3$ or 7.07×10^8 gallons)

5. Bedell Pond

5.1 Inflows

Bedell Pond inflows occur from runoffs associated with the crushed OSP, temporary OSP, roadways, industrial site, and the Bedell Pond drainage area. Precipitation also is directly captured by the pond area.

- ◆ Volumetric runoff from the crushed OSP, roadways, and pond drainage area is calculated as the associated area times the monthly precipitation. Likewise, the volume entering the pond from direct precipitation is calculated as the monthly precipitation times the pond area.
- ◆ Runoff from the temporary OSP is calculated as:

$$(\text{temporary OSP area}) \times \text{Max}\{(\text{monthly precipitation} - \text{monthly evaporation}), 0\}$$

where evaporation is calculated from the climate model open water evaporation equation described above in Section 3.

- ◆ Runoff from the industrial site is calculated as:

$$(\text{industrial site area}) \times (\text{monthly precipitation}) \times (\text{runoff factor})$$

The “runoff factor” also incorporates loss to evaporation but is defined as a uniformly distributed stochastic input between 0.4 and 0.6.

5.2 Outflows

Bedell Pond outflows are defined as evaporation and water transferred to the TDF by pumping. Since the Bedell Pond element in the GoldSim model is a pool element, outflows are dependent on water being available at the given timestep.

- ◆ Evaporation is calculated from the climate model open water evaporation equation previously described above.
- ◆ Water transferred to the TDF is modeled as being pumped when available with a maximum rate of 1039 GPM (236 cubic meter per hour [m^3/hour]). However, the model indicates that this rate exceeds the normal inflows, resulting in an average rate of approximately 300 GPM ($68 \text{ m}^3/\text{hour}$).

6. Process Plant

The process plant is also defined as a GoldSim pool element in the model, with the inflows matching the outflows at each timestep. Process plant requirements are obtained directly from the operational water balance.

6.1 Inflows

Inflows to the process plant are the flow from the UM (water component of ore), flow from the raw water tank routed from the WTP, deficit water from the TDF (i.e., reclaim water), and freshwater makeup. These inflows are defined from the operational water balance as follows:

- ◆ UM flow to the process plant is deterministic, beginning at 18.5 gallons per minute (GPM) (4.2 m³/hour) and linearly increasing to 92.5 GPM (21 m³/hour) in the fourth year. These flows are taken from item 2 of the operational water balance (Attachment 1), defined as the water component of ore.
- ◆ Flow routed to the process plant from the raw water tank is also deterministic, beginning at 8.4 GPM (1.9 m³/hour) and linearly increasing to 42 GPM (9.5 m³/hour) in the fourth year. An expression element within the GoldSim model is defined to confirm that sufficient flows from the WTP exist to support this rate.
- ◆ The process plant deficit requirement (reclaim water) from the TDF is defined from several deterministic operational water balance items. First, the loss to filtered concentrate, loss to paste thickener, and dilution water to tails are summed. This sum represents the total loss from the process plant and totals 386.6 GPM (87.8 m³/hour) in Year 1 and linearly increases to 1,933 GPM (439.1 m³/hour) in Year 4. The inflows from the UM and raw water tank described above are then subtracted from this total loss to calculate the process plant deficit requirement. The deficit requirement is then drawn from the TDF pool elements of NP1 during the first 11 years, and NP2 thereafter.
- ◆ The final inflow, freshwater makeup, is defined as the remaining difference between the above three inflows (UM, raw water tank, and TDF) and the loss to filtered concentrate, loss to paste thickener, and dilution water to tails as just described. The freshwater makeup inflow is needed when the process plant deficit requirement cannot fully be met from the TDF.

6.2 Outflows

There are three outflows for the process plant GoldSim pool element. These have been defined above as the deterministic operational water balance flows for the loss to filtered concentrate, loss to paste thickener, and dilution water to tails.

7. TDF

The TDF comprises GoldSim pool elements for NP1 and NP2. Inflows and outflows to the elements during the first 11 years are routed to and from NP1, and afterwards routed to and from NP2, with the exception that NP1 outflow to the WTP continues after Year 11 to minimize NP1 excess capacity flows.

7.1 Inflows

- ◆ Volumetric runoff from the drainage area as well as the volume entering the pond from direct precipitation is calculated as the monthly precipitation times the associated areas given in Section 4. The direct precipitation to the pond area does not assume freeze up during the winter months.

- ◆ UM flow to the TDF is deterministic. The operational water balance indicates a flow from the UM to the TDF beginning at 169 GPM (38.4 m³/hour) and linearly increasing to 845 GPM (192 m³/hour) in the fourth year.
- ◆ Water, when available, is pumped to the TDF from Bedell pond with a maximum rate of 1,039 GPM (236 m³/hour) as discussed above in Section 5.2.
- ◆ Process plant flow to the TDF is deterministic, taken as the loss to paste thickener and dilution water flows, beginning at 384 GPM (87.2 m³/hour) and linearly increasing to 1,920 GPM (436 m³/hour) in the fourth year.

7.2 Outflows

- ◆ Evaporation from both the pond area and drainage area runoff is calculated from the climate model open water evaporation equation described above in Section 3.
- ◆ Water entrained in tailings is deterministic, beginning at 133 GPM (30.2 m³/hour) and linearly increasing to 665 GPM (151 m³/hour) in the fourth year.
- ◆ The process plant deficit requirement (reclaim water) as described in Section 6.1 is transferred to the process plant as available.
- ◆ A minimum flow to the WTP, when available, is set to 2,250 GPM for Year 1 through Year 11, and 4,500 GPM for Year 12 through Year 26. This outflow is maintained during all 12 months of the year to reduce excess capacity overflow during times of snowmelt and higher precipitation. Beginning in Year 12, anytime the NP2 outflow to the WTP falls below 4,500 GPM (i.e., WTP extra capacity), the difference is drawn from NP1 (if available), again to reduce NP1 excess capacity overflow.

8. WTP

The WTP in the GoldSim model is represented by a summation element. Flows in the summation during the first 11 years are the minimum flow to the WTP from NP1 and possible excess capacity overflow from NP1. During Year 12 through Year 26, flows in the summation are the minimum flow to the WTP from NP2 and possible excess capacity overflow from NP2, as well as the WTP extra capacity flow from NP1.

9. Simulation Results and Conclusions

9.1 Monthly Timestep

Results of the GoldSim simulation applying the monthly basic timestep are graphically illustrated in Attachment 2. Process plant inflows (Figure A2-1) reflect reclaim water from the TDF meeting the process plant deficit requirement.

Attachment 2 Figure A2-2 through Figure A2-3 show the NP1 inflows, net precipitation and outflows, while Figure A2-4 through Figure A2-5 show the NP2 inflows, net precipitation and outflows. NP1 outflows to the WTP (Figure A2-3) during the first 11 years routinely reach 2,250 GPM following snowmelt but then decrease to approximately 1,800 GPM during the summer months, increase again during the cooler fall months, and finally drop to approximately 1,300 GPM during freeze up. Beginning in Year 12, NP1 outflows to the WTP exceed 2,500 GPM

for short intervals corresponding to times of WTP extra capacity. Intervals of small NP1 excess capacity overflows are observed, also illustrated on Figure A2-7.

NP2 outflows to the WTP beginning in Year 12 (Figure A2-5) routinely reach 4,500 GPM for short intervals following snowmelt but then decrease to below 1,000 GPM during the summer months, then increase again during the cooler fall months and finally drop to approximately 400 GPM during the freeze up. At this time the flows from NP1 are seen to increase to meet the WTP extra capacity, as described above. NP2 does not observe any excess capacity overflow.

9.2 Daily Timestep with 24-Hour Storm Event

An alternative GoldSim model applying a daily basic timestep was developed to assess the impact of a 24-hour storm event. The storm event was defined be a deterministic event of 6.34 inches of precipitation. This event was programmed to occur twice, once for May 1 in Year 8 and then again for August 1 in Year 15. All other model elements as described above were maintained, with the exception of modifying certain formulas to correctly convert precipitation units from monthly to daily. The simulation results are illustrated in Attachment 3.

The effect of the storm event on the NP1 inflows are seen as precipitation spikes on Figure A3-2, and the effect on the NP2 inflows on Figure A3-4. However, other than these spikes with the NP1 and NP2 inflows, the only general observable impact in the system is seen by comparing the excess capacity overflows shown on Figure A3-7 for the daily timestep and storm event to that shown on Figure A2-7 for the monthly timestep without a programmed storm event. Adding in the 24-hour storm from Year 15 drives the NP1 excess capacity overflow discharge to near 100 GPM during the second half of that year. Note that during Year 15, the process plant is receiving water from NP2. The 24-hour storm in Year 8 (when the process plant is receiving water from NP1) doesn't drive the NP1 overflow discharge noticeably higher than without the storm event.

For NP2, runoff in the GoldSim model does not enter the NP2 pond until Year 12, therefore the Year 8 storm event doesn't have an effect on the NP2 overflow. When the process plant is receiving water from NP2 in Year 15 there also isn't any noticeable NP2 excess capacity overflow discharge from the storm event.

Attachments:

Attachment 1	Deterministic Operational Water Balance Schematic
Attachment 2	GoldSim Results with a Monthly Basic Time Step
Attachment 3	GoldSim Results with a Daily Basic Time Step Incorporating 24-Hour Storm Events

Attachment 1
Deterministic Operational Water Balance Schematic

Year 1 - Paste Thickened Tails

The diagram illustrates the water management system for Year 1, focusing on paste thickened tails. Key components and flow rates are as follows:

- Water Sources:**
 - Fresh Water (Lake Superior)
 - Treated Water (Ontonogan Water Treatment Plant)
 - Industrial Site Runoff Contact Water (Captures fuel station, tire wash, plant site stormwater, water treatment plant, and explosives laydown)
 - Road way stormwater
 - Net precipitation and run-off (1,850 Ac)
 - Net precipitation and run-off (South Basin)
 - Net precipitation and run-off (North Dam 2)
- Water Treatment and Storage:**
 - Raw Water Tank
 - Contact Water Pond (Bedell Pond)
 - Crushed Ore Stockpile Sump
 - Crushed Ore Stockpile
 - Temporary Ore Stockpile Sump
 - Temporary Ore Stockpile
 - Water Treatment Plant
- Processing and Thickening:**
 - Concentrate Thickener
 - Paste Thickener
 - Process Plant
- Tailings Disposal:**
 - Tailings Disposal Facility North Pond 1 (1,850 Ac)
 - Water entrained as pore water in Tailings
 - Discharge to Environment
 - Discharge to Environment under current NPDES
- Flow Rates (gpm):**
 - (1) 168.96 gpm
 - (2) 0 gpm
 - (2) 18.49 gpm
 - (2) 18.49 gpm
 - (3) 383.93 gpm
 - (4) 1370 gpm
 - (5) 132.97 gpm
 - (6) 15.32 gpm
 - (7) 361.92 gpm
 - (8) 112.71 gpm
 - (8) 112.71 gpm
 - (9) 2,010 gpm
 - (10) 1,846.56 gpm
 - (11) 1,534.84 gpm
 - (12) 2.69 gpm
 - (13) 4.2 gpm
 - (13) 4.2 gpm
 - (13) 12.9 gpm
 - (13) 12.9 gpm
 - (14) 21.1 gpm
 - (15) 20.3 gpm
 - (16) 8.39 gpm
 - (16) 8.39 gpm
 - (17) 546 gpm
 - (18) 970 gpm
 - (18) 970 gpm
 - (20) 1830 gpm
 - (21) 84.54 gpm
 - (22) 81.89 gpm
 - (23) 0.91 gpm
 - (24) 71.30 gpm
 - (25) 312.63 gpm
 - (26) 3360 gpm



WHITE PINE COPPER LLC

FIGURE A1-1

Operational Water Balance Year 1

WHITE PINE NORTH

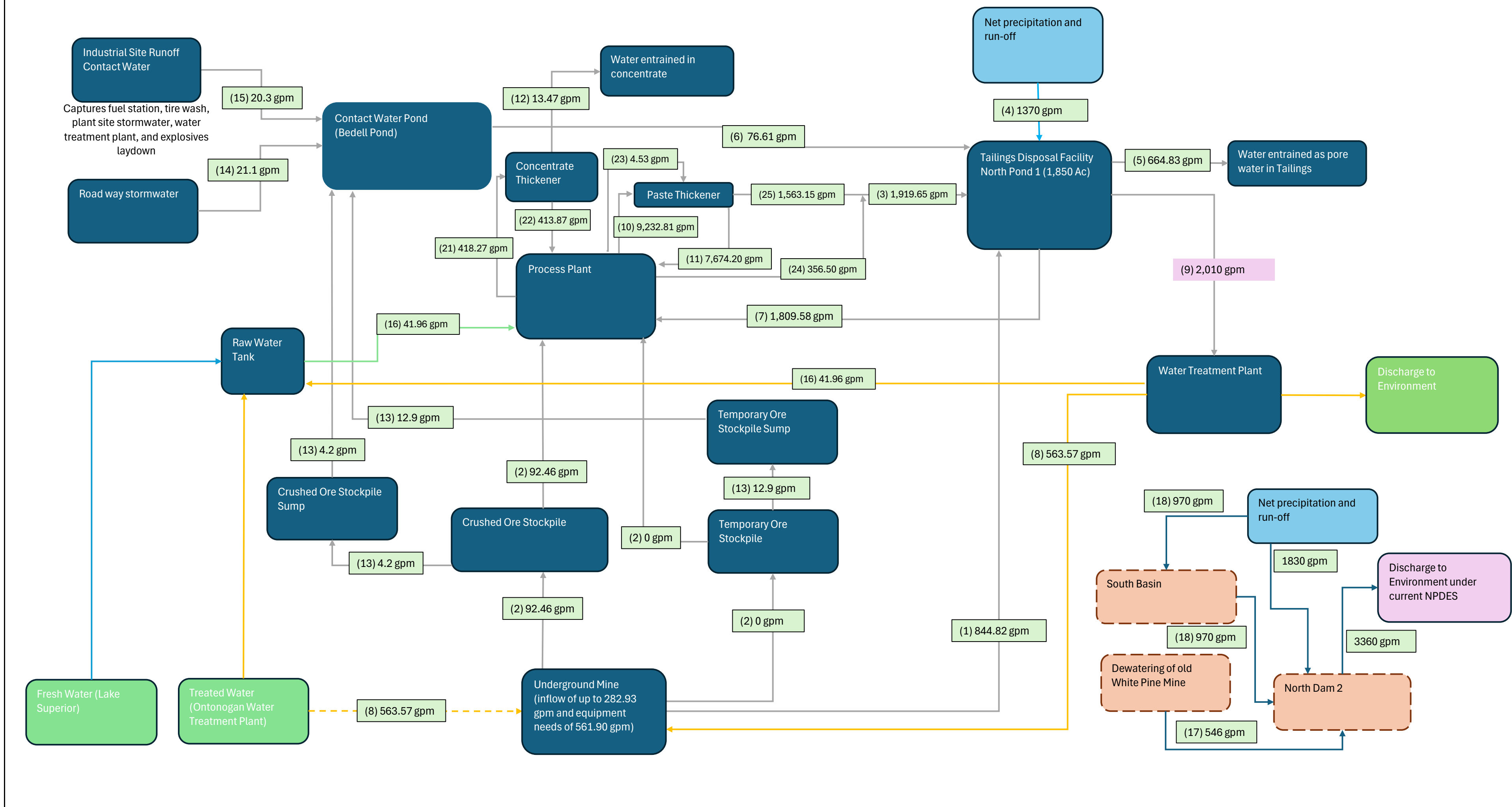
ONTONAGON COUNTY, MICHIGAN

Date: JULY 2026

Revision Date:

Project: 23W200

Year 11 - Paste Thickened Tails



NOTES:
1. Cross reference descriptions listed on reference sheet.

- FRESH WATER = water from Lake Superior
- TREATED WATER = water from water treatment plant
- RAW WATER = FRESH WATER + TREATED WATER
- PROCESS WATER = untreated water, made up of recycled water from process streams (such as conc and thickener o/f, decant from TDF) and water from surface contact water sources



WHITE PINE COPPER LLC

FIGURE A1-2

Operational Water Balance Year 11

WHITE PINE NORTH

ONTONAGON COUNTY, MICHIGAN

Date: JULY 2026

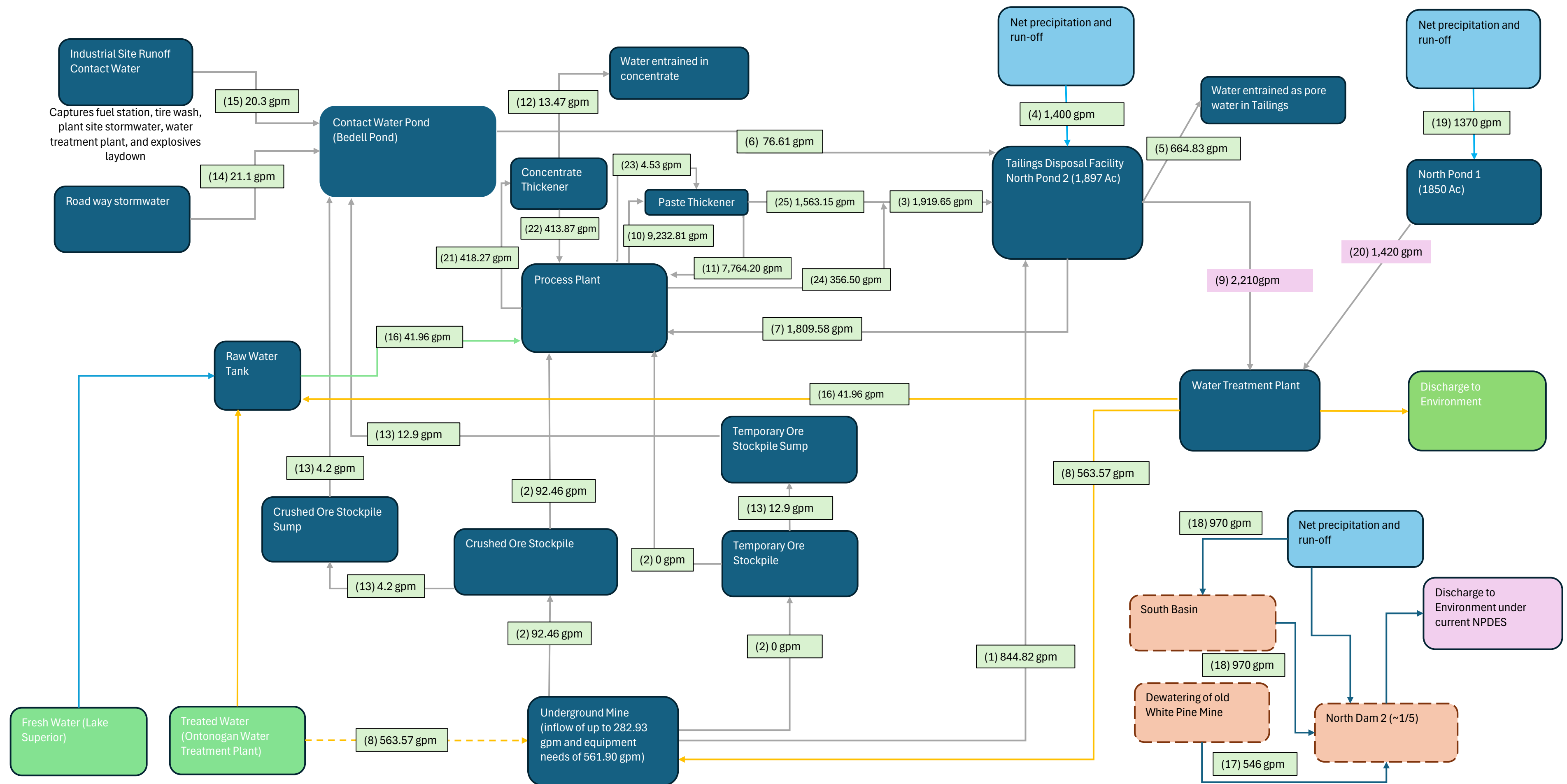
Revision Date:

Drawn By: SGL

Checked By: BDS1

Project: 23W200

Year 12 - Paste Thickened Tails



NOTES:

1. Cross reference descriptions listed on reference sheet.

- FRESH WATER = water from Lake Superior
- TREATED WATER = water from water treatment plant
- RAW WATER = FRESH WATER + TREATED WATER
- PROCESS WATER = untreated water, made up of recycled water from process streams (such as conc and thickener o/f, decant from TDF) and water from surface contact water sources



WHITE PINE COPPER LLC

FIGURE A1-3

Operational Water Balance Year 12

WHITE PINE NORTH

ONTONAGON COUNTY, MICHIGAN

Date: JULY 2026

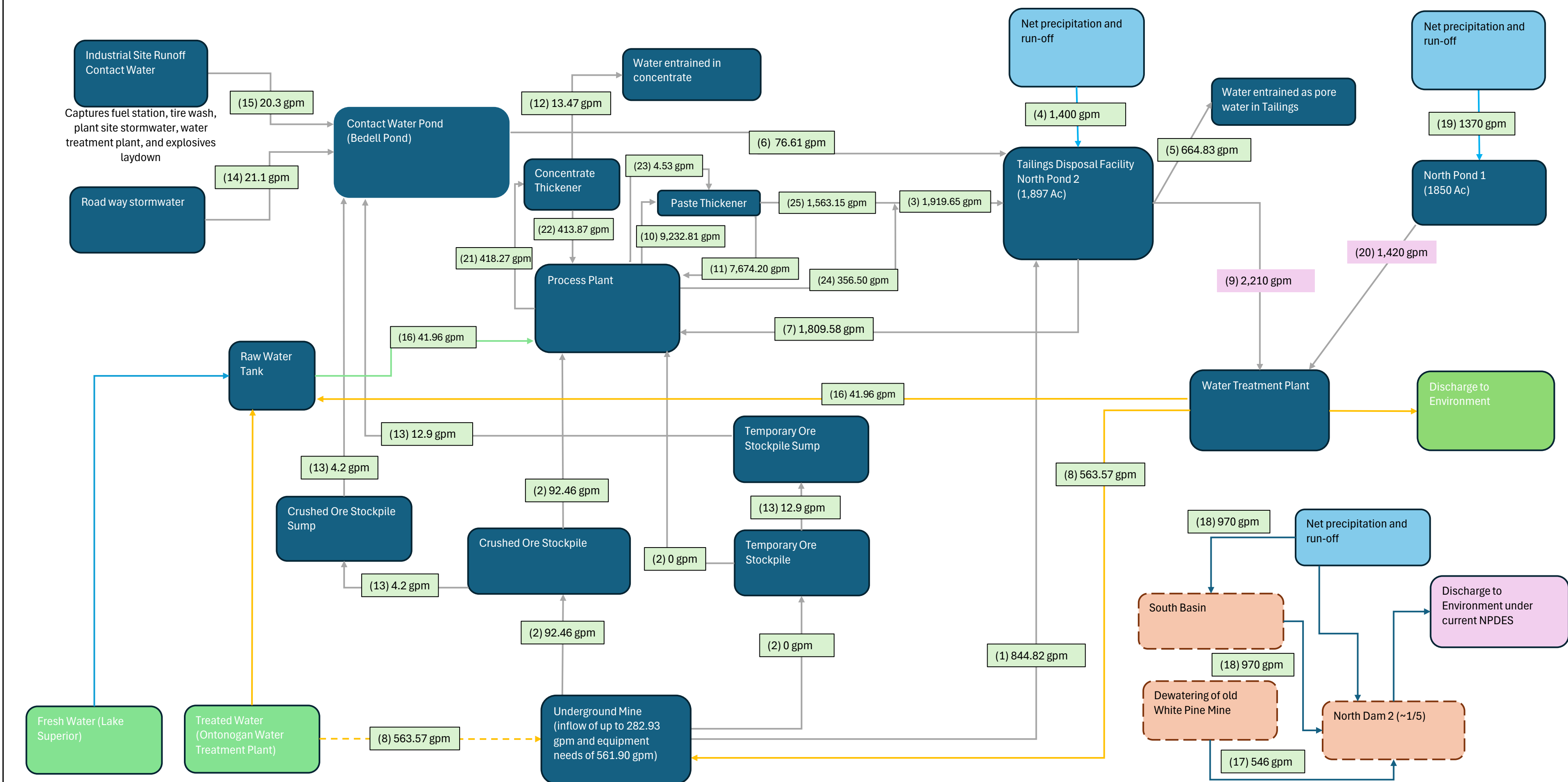
Revision Date:

Drawn By: SGL

Checked By: BDS1

Project: 23W200

Year 26 - Paste Thickened Tails



NOTES:

1. Cross reference descriptions listed on reference sheet.

- FRESH WATER = water from Lake Superior
- TREATED WATER = water from water treatment plant
- RAW WATER = FRESH WATER + TREATED WATER
- PROCESS WATER = untreated water, made up of recycled water from process streams (such as conc and thickener o/f, decant from TDF) and water from surface contact water sources



WHITE PINE COPPER LLC

FIGURE A1-4

Operational Water Balance Year 26

WHITE PINE NORTH

ONTONAGON COUNTY, MICHIGAN

Date: JULY 2026

Revision Date:

Drawn By: SGL

Checked By: BDS1

Project: 23W200

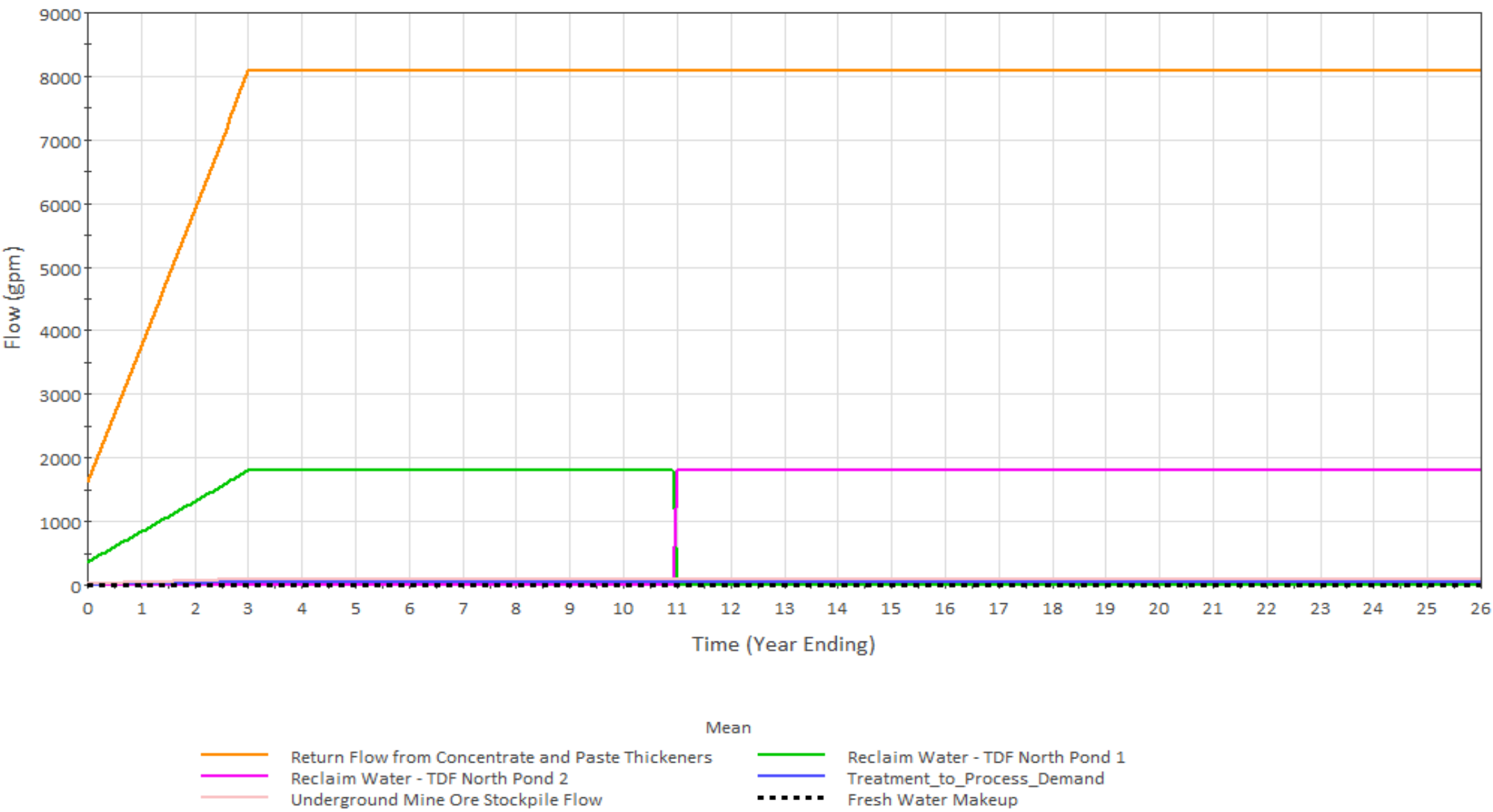
Flow Sheet ID	Description	Source	Reference Volume	Volume (m³/hr)	Volume (gpm)	Year 1 (20% Operation) (m³/hr)	Year 1 (20% Operation) (gpm)
1	UG dewatering based on service water needs (production equipment needs (1900 lpm) + material handling equipment (227 lpm)) + anticipated groundwater inflow (283 gpm or 1071 lpm).	108571-ER-01200-22000-002-03	3198 l/min	191.88	844.82	38.376	168.96
2	Water component of ore based on nominal water balance.	108571-ER-00000-22223-001-02	21 m3/hr	21	92.46	4.2	18.49
3	Flow from thickener to TDF as calculated on water balance sheet.	Operational water balance calculation data tab.	436 m3/hr	436	1919.65	87.2	383.93
4	Annual precipitation onto priority TDF (location based on operating schedule) converted to GPM using understanding from an analogous project in the region.	Based on GoldSim modeling. Document number pending.	NP1 Average over Years 1-25 1370 gpm NP2 Average over Years 12-25 1400 gpm	311.16 or 317.97	1370 or 1400	-	-
5	Water entrained in tailings.	Operational water balance calculation data tab.	151 m3/hr	151	664.83	30.2	132.97
6	Overall contact water flow to TDF calculated by adding Contact Water Pond Inputs. (13)+(14)+(15)	Operational water balance.	17.4 m3/hr	17.4	76.61	3.48	15.32
7	Water returned to from the TDF to the process as outlined in the nominal water balance.	108571-ER-00000-22223-001-02	411 m3/hr	411	1809.58	82.2	361.92
8	On demand, as necessary to meet service water requirements outlined in (1).	108571-ER-01200-22000-002-03	2127 l/min	128	563.57	25.6	112.71
9	As required to keep priority TDF basin within operational levels. Calculated as the balance between inflow and outflow to the TDF. (1)+(3)+(4)+(6)-(5)-(7)	Based on GoldSim modeling. Document number pending.	Average over Years 1-11 2010 gpm Average over Years 12+ 2210 gpm	456.52 or 501.95	2010 or 2210	-	-
10	Water sent to the thickener from nominal mass balance.	108571-ER-00000-22223-001-02	2097 m3/hr	2097	9232.81	419.4	1846.56
11	Tailings thickener recycle flow from nominal mass balance.	108571-ER-00000-22223-001-02	1743 m3/hr	1743	7674.20	348.6	1534.84
12	Water loss to filtered concentrate as shown in nominal water balance.	108571-ER-00000-22223-001-02	3.06 m3/hr	3.06	13.47	0.612	2.69
13	Precipitation capture from crushed ore stockpile and temporary ore stockpile. Based on annual average precipitation, stockpile areas, and watershed modeling provided through sitewide water management plan.	Based on GoldSim modeling. Document number pending.	Temp. Ore Stockpile - 2.93 m3/hr Crushed Ore Stockpile - 0.954 m3/hr	2.93 0.954	12.9 4.2	-	-
14	Precipitation capture from haul roads. Based on annual average precipitation, stockpile areas, and watershed modeling provided through sitewide water management plan.	Based on GoldSim modeling. Document number pending.	4.792 m3/hr	4.792	21.10	-	-
15	Plant site contact water runoff. Based on annual average precipitation and plant site watershed modeling provided through sitewide water management plan.	Based on GoldSim modeling. Document number pending.	4.611 m3/hr	4.611	20.30	-	-
16	Raw water required for process as outlined in nominal water balance.	108571-ER-00000-22223-001-02	9.53 m3/hr	9.53	41.96	1.906	8.39
17	Average of pumping rates from White Pine Mine from approximately 2012-2024.	Historic dewatering data provided by Subterra.	546 gpm	124	545.96	-	545.96
18	Flow from South Basin into North Dam 2 legacy water stream.	Based on GoldSim legacy outfall modeling. Document number pending.	960 gpm	218.04	960.00	-	960.00

Flow Sheet ID	Description	Source	Reference Volume	Volume (m ³ /hr)	Volume (gpm)	Year 1 (20% Operation) (m ³ /hr)	Year 1 (20% Operation) (gpm)
19	Based on the total precipitation falling on North Dam 1 - estimated evaporation.	Based on GoldSim modeling. Document number pending.	NP1 Average over Years 1-25 1370 gpm	311.16	1370.00	-	1370.00
20	Estimated GoldSim requirements for volume of water that needs to be treated to maintain appropriate freeboard levels in North Pond 1.	Based on GoldSim modeling. Document number pending.	Average over Years 12+ 1420 gpm	322.52	1420.01	-	-
21	Water sent to concentrate thickener based on nominal water balance.	108571-ER-00000-22223-001-02	95 m3/hr	95	418.27	19.2	84.54
22	Water returned from concentrate thickener based on nominal water balance.	108571-ER-00000-22223-001-02	94 m3/hr	94	413.87	18.6	81.89
23	Lime to tailings thickener based on nominal water balance	108571-ER-00000-22223-001-02	1.03 m3/hr	1.03	4.53	0.206	0.91
24	Dilution water to tails based on nominal water balance as a reference. Calculated on the operational water balance tab to identify number here in.	Operational water balance calculation data tab.	80.97 m3/hr	80.97	356.50	16.194	71.30
25	Initial paste thickener volume sent to TDF	Operational water balance calculation data tab.	355.03 m3/hr	355.03	1563.15	71.006	312.63

Attachment 2

GoldSim Results with a Monthly Basic Time Step

Process Plant Inflow - Thickened Tailings Option

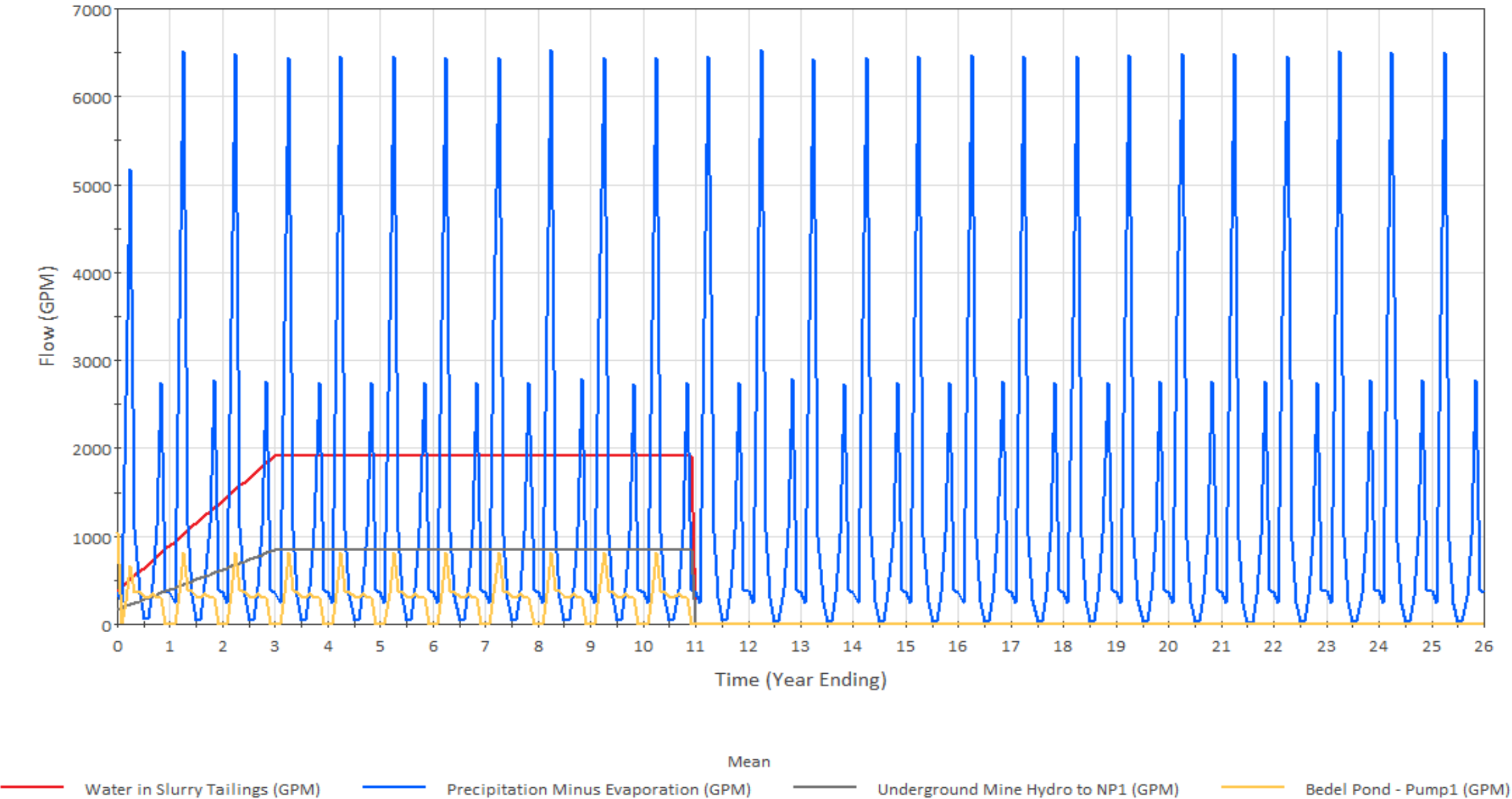


- NOTES:**
- 1. Assumptions made for developing preliminary flow estimates include:
 - Site runoff/contact water and waste rock stockpile runoff water drain to Bedel Pond and do not enter the TDF.
 - Evaporation within both the TDF pond water and TDF dry ground areas is assumed to occur at an average open water evaporation rate of 23 to 25 inches per year based on the climate change model.
 - TDF NP1 has a surface water drainage area of ~1850 Ac., a combined reclaimed water/stormwater detention pond area of ~274 Ac., and a capacity of ~2164 Ac-ft.
 - TDF NP2 Reclaim Area has a surface water drainage area of ~1897 Ac., a reclaimed water pond area of ~105 Ac., and a capacity of ~2169 Ac-ft.
 - TDF capacities are taken at 2% Deposition slope from Table 4 of the 2/17/26 TetraTech Memo regarding *Water Management Philosophy of Operating and Design Storm Conditions*.
 - The initial quantity in both NP1 and NP2 is assumed to be 1/3 the total capacity.
 - Results represent monthly averages over 1000 simulations.



WHITE PINE COPPER LLC		
FIGURE A2-1		
PROCESS PLANT INFLOWS		
WHITE PINE NORTH		
ONTONAGON COUNTY, MICHIGAN		
Date: JULY 2026	Revision Date:	
Drawn By: SGL	Checked By: KBENUSA	Project: 23W200

TDF NP1 Inflows - Thickened Tailings Option



- NOTES:**
- 1. Assumptions made for developing preliminary flow estimates include:
 - Site runoff/contact water and waste rock stockpile runoff water drain to Bedel Pond and do not enter the TDF.
 - Evaporation within both the TDF pond water and TDF dry ground areas is assumed to occur at an average open water evaporation rate of 23 to 25 inches per year based on the climate change model.
 - TDF NP1 has a surface water drainage area of ~1850 Ac., a combined reclaimed water/stormwater detention pond area of ~274 Ac., and a capacity of ~2164 Ac-ft.
 - TDF capacities are taken at 2% Deposition slope from Table 4 of the 2/17/26 TetraTech Memo regarding *Water Management Philosophy of Operating and Design Storm Conditions*.
 - The initial quantity in NP1 is assumed to be 1/3 the total capacity.
 - Results represent monthly averages over 1000 simulations.

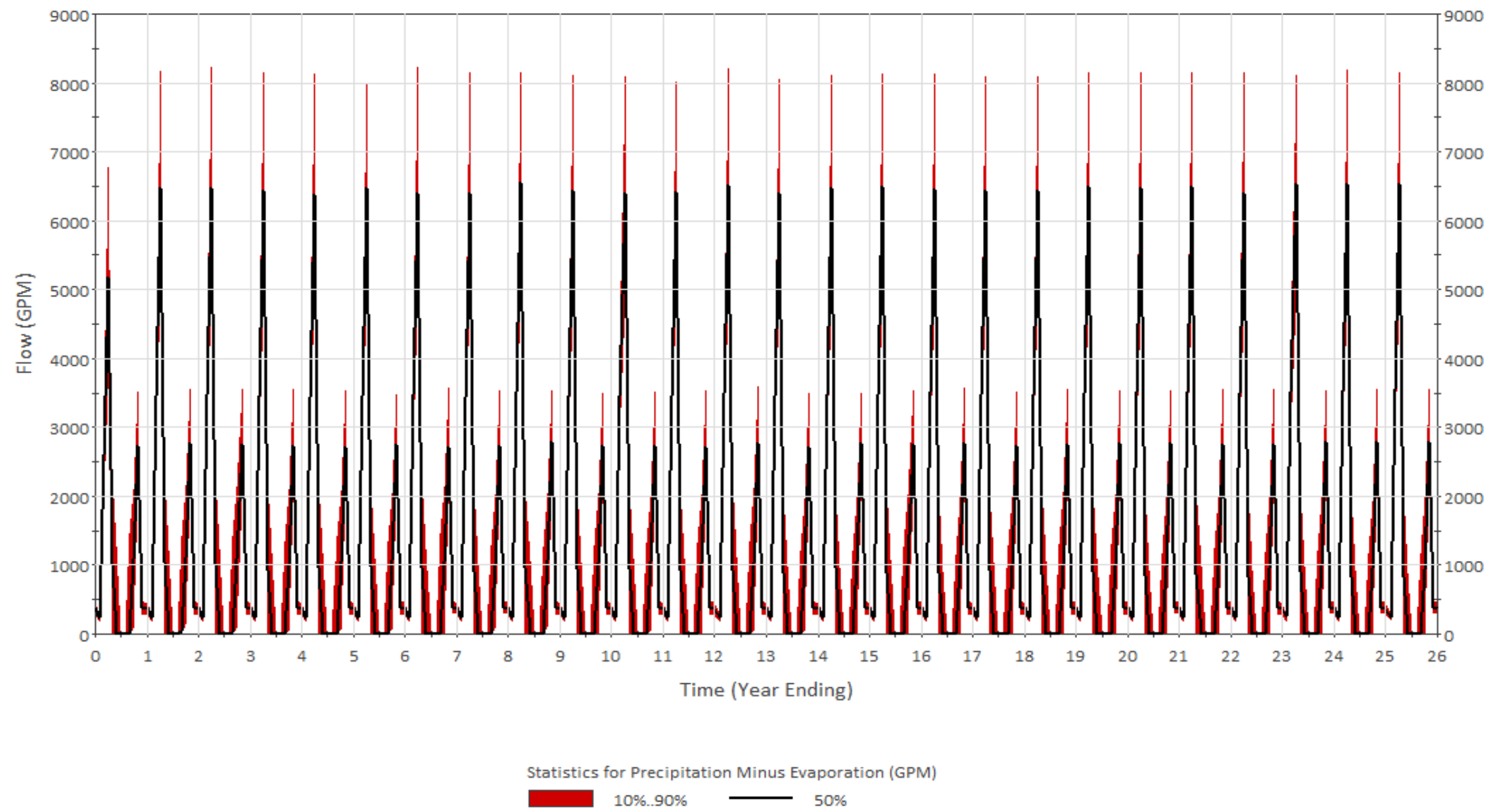
WHITE PINE COPPER LLC

FIGURE A2-2
TDF NORTH POND 1 INFLOWS
WHITE PINE NORTH
ONTONAGON COUNTY, MICHIGAN

Date: JULY 2026	Revision Date:
Drawn By: SGL	Checked By: KBENUSA
	Project: 23W200



TDF NP1 Precipitation and Runoff Minus Evaporation - Thickened Tailings Option



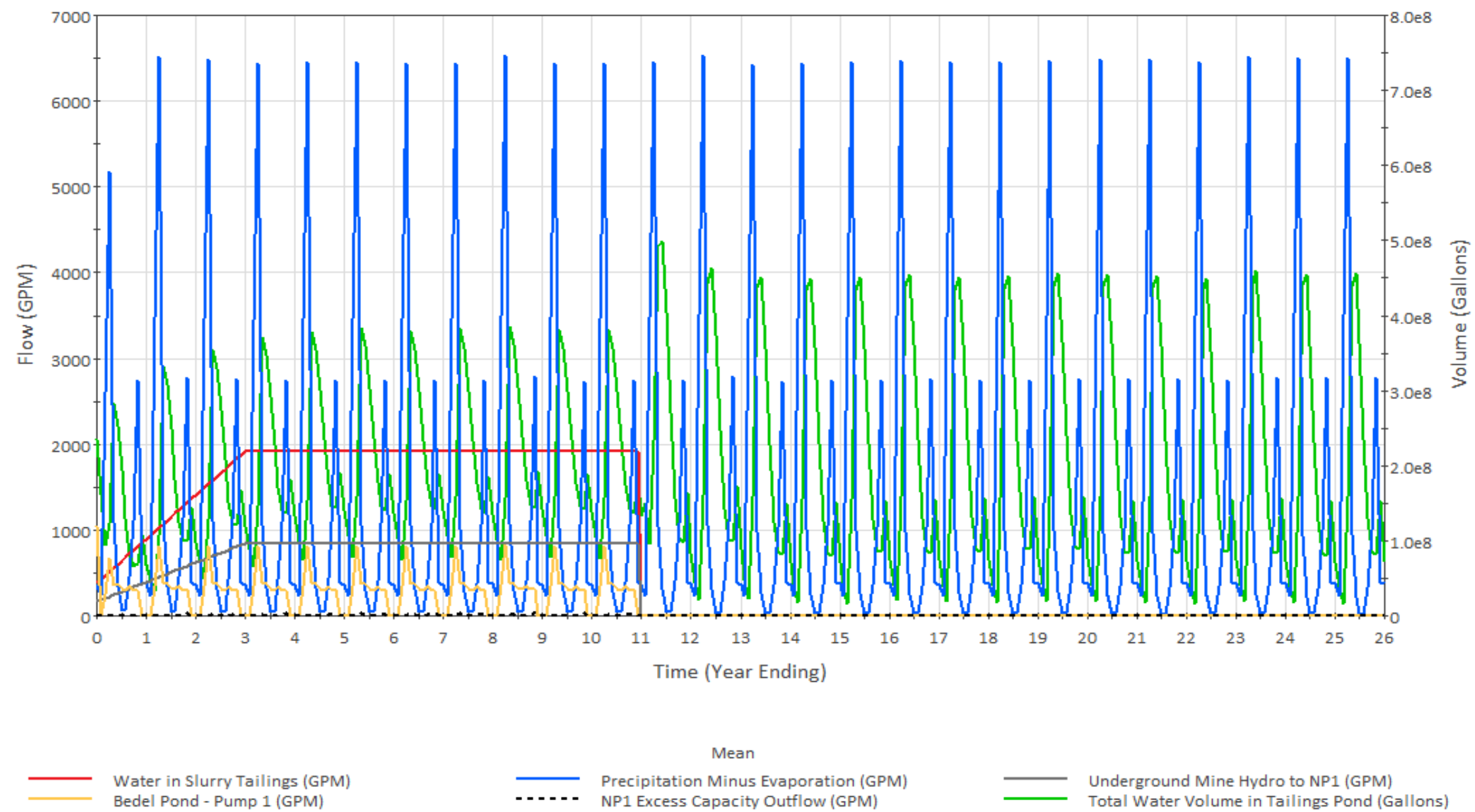
NOTES:

- Assumptions made for developing preliminary flow estimates include:
 - Site runoff/contact water and waste rock stockpile runoff water drain to Bedel Pond and do not enter the TDF.
 - Evaporation within both the TDF pond water and TDF dry ground areas is assumed to occur at an average open water evaporation rate of 23 to 25 inches per year based on the climate change model.
 - TDF NP1 has a surface water drainage area of ~1850 Ac., a combined reclaimed water/stormwater detention pond area of ~274 Ac., and a capacity of ~2164 Ac-ft.
 - TDF capacities are taken at 2% Deposition slope from Table 4 of the 2/17/26 TetraTech Memo regarding *Water Management Philosophy of Operating and Design Storm Conditions*.
 - The initial quantity in NP1 is assumed to be 1/3 the total capacity.
 - Results represent monthly averages over 1000 simulations.



WHITE PINE COPPER LLC		
FIGURE A2-2a		
TDF NORTH POND 1 NET PRECIP P10 AND P90		
WHITE PINE NORTH		
ONTONAGON COUNTY, MICHIGAN		
Date: JULY 2026	Revision Date:	
Drawn By: SGL	Checked By: KBENUSA	Project: 23W200

TDF NP1 Inflows and Total Water Volume in Tailings Pond - Thickened Tailings Option



NOTES:

1. Assumptions made for developing preliminary flow estimates include:
- Site runoff/contact water and waste rock stockpile runoff water drain to Bedel Pond and do not enter the TDF.
 - Evaporation within both the TDF pond water and TDF dry ground areas is assumed to occur at an average open water evaporation rate of 23 to 25 inches per year based on the climate change model.
 - TDF NP1 has a surface water drainage area of ~1850 Ac., a combined reclaimed water/stormwater detention pond area of ~274 Ac., and a capacity of ~2164 Ac-ft.
 - TDF capacities are taken at 2% Deposition slope from Table 4 of the 2/17/26 TetraTech Memo regarding Water Management Philosophy of Operating and Design Storm Conditions.
 - The initial quantity in NP1 is assumed to be 1/3 the total capacity.
 - Water is continuously pumped from the TDF in Years 1 through 11 to the treatment plant when available at a rate of 2250 GPM, with additional outflow routed from the TDF to the treatment plant when TDF capacities are reached. Beginning in Year 12, outflow is routed to the treatment plant to match treatment plant extra capacity.
 - Water entrained as pore water in tailings is modeled as a TDF outflow and not included in the TDF total water volume estimate.
 - Total water volume refers to the total water in NP1 from precipitation and runoff plus total water in slurry tailings (excluding the water entrained as pore water in tailings).
 - Results represent monthly averages over 1000 simulations.

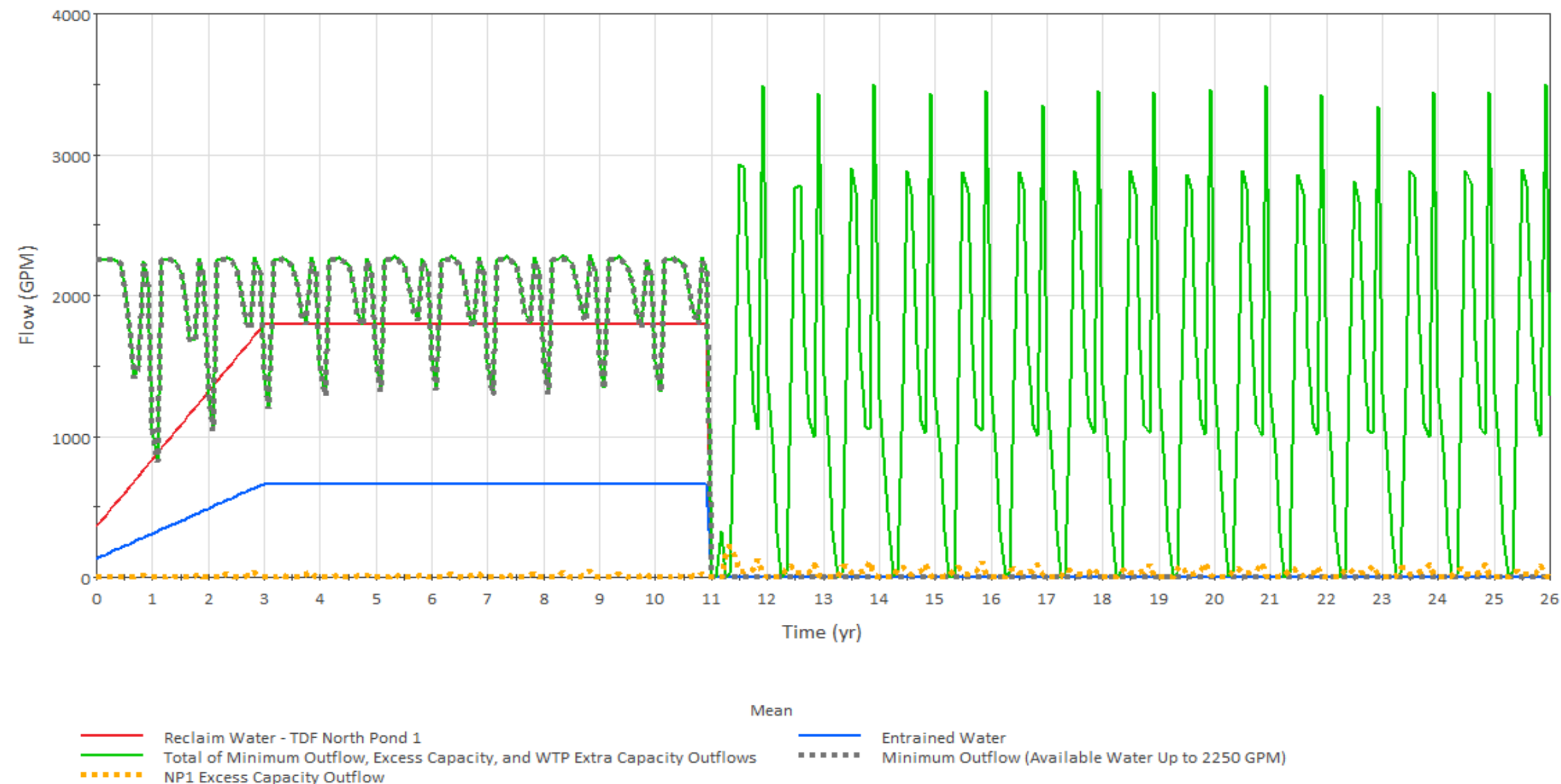


WHITE PINE COPPER LLC

FIGURE A2-2b
TDF NORTH POND 1 INFLOWS WITH TOTAL VOLUME
WHITE PINE NORTH
ONTONAGON COUNTY, MICHIGAN

Date: JULY 2026	Revision Date:
Drawn By: SGL	Checked By: KBENUSA Project: 23W200

TDF North Pond 1 Outflows to Process Plant and Water Treatment Plant - Thickened Tailings Option



NOTES:

- Assumptions made for developing preliminary flow estimates include:
 - Site runoff/contact water and waste rock stockpile runoff water drain to Bedel Pond and do not enter the TDF.
 - Evaporation within both the TDF pond water and TDF dry ground areas is assumed to occur at an average open water evaporation rate of 23 to 25 inches per year based on the climate change model.
 - TDF NP1 has a surface water drainage area of ~1850 Ac., a combined reclaimed water/stormwater detention pond area of ~274 Ac., and a capacity of ~2164 Ac-ft.
 - TDF capacities are taken at 2% Deposition slope from Table 4 of the 2/17/26 TetraTech Memo regarding Water Management Philosophy of Operating and Design Storm Conditions.
 - The initial quantity in NP1 is assumed to be 1/3 the total capacity.
 - Water is continuously pumped from the TDF in Years 1 through 11 to the treatment plant when available at a rate of 2250 GPM, with additional outflow routed from the TDF to the treatment plant when TDF capacities are reached. Beginning in Year 12, outflow is routed to the treatment plant to match treatment plant extra capacity.
 - Water entrained as pore water in tailings is modeled as a TDF outflow and not included in the TDF total water volume estimate.
 - Total water volume refers to the total water in NP1 from precipitation and runoff plus total water in slurry tailings (excluding the water entrained as pore water in tailings).
 - Results represent monthly averages over 1000 simulations.

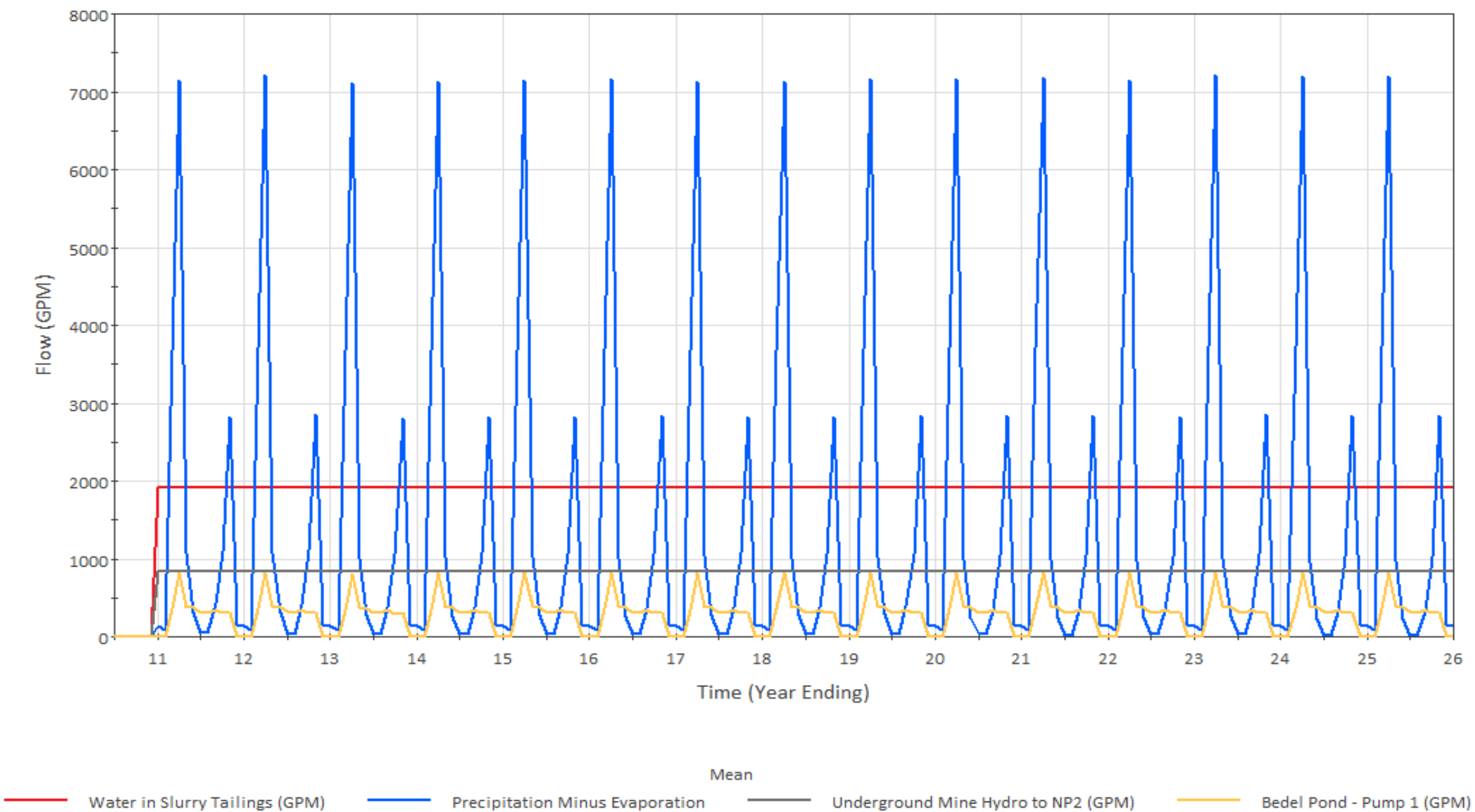


WHITE PINE COPPER LLC

FIGURE A2-3
TDF NORTH POND 1 OUTFLOWS
WHITE PINE NORTH
ONTONAGON COUNTY, MICHIGAN

Date: JULY 2026	Revision Date:
Drawn By: SGL	Checked By: KBENUSA Project: 23W200

TDF NP2 Inflows - Thickened Tailings Option



NOTES:

- Assumptions made for developing preliminary flow estimates include:
 - Site runoff/contact water and waste rock stockpile runoff water drain to Bedel Pond and do not enter the TDF.
 - Evaporation within both the TDF pond water and TDF dry ground areas is assumed to occur at an average open water evaporation rate of 23 to 25 inches per year based on the climate change model.
 - TDF NP2 Reclaim Area has a surface water drainage area of ~1897 Ac., a reclaimed water pond area of ~105 Ac., and a capacity of ~2169 Ac-ft.
 - TDF capacities are taken at 2% Deposition slope from Table 4 of the 2/17/26 TetraTech Memo regarding Water Management Philosophy of Operating and Design Storm Conditions.
 - The initial quantity in NP2 is assumed to be 1/3 the total capacity.
 - Results represent monthly averages over 1000 simulations.

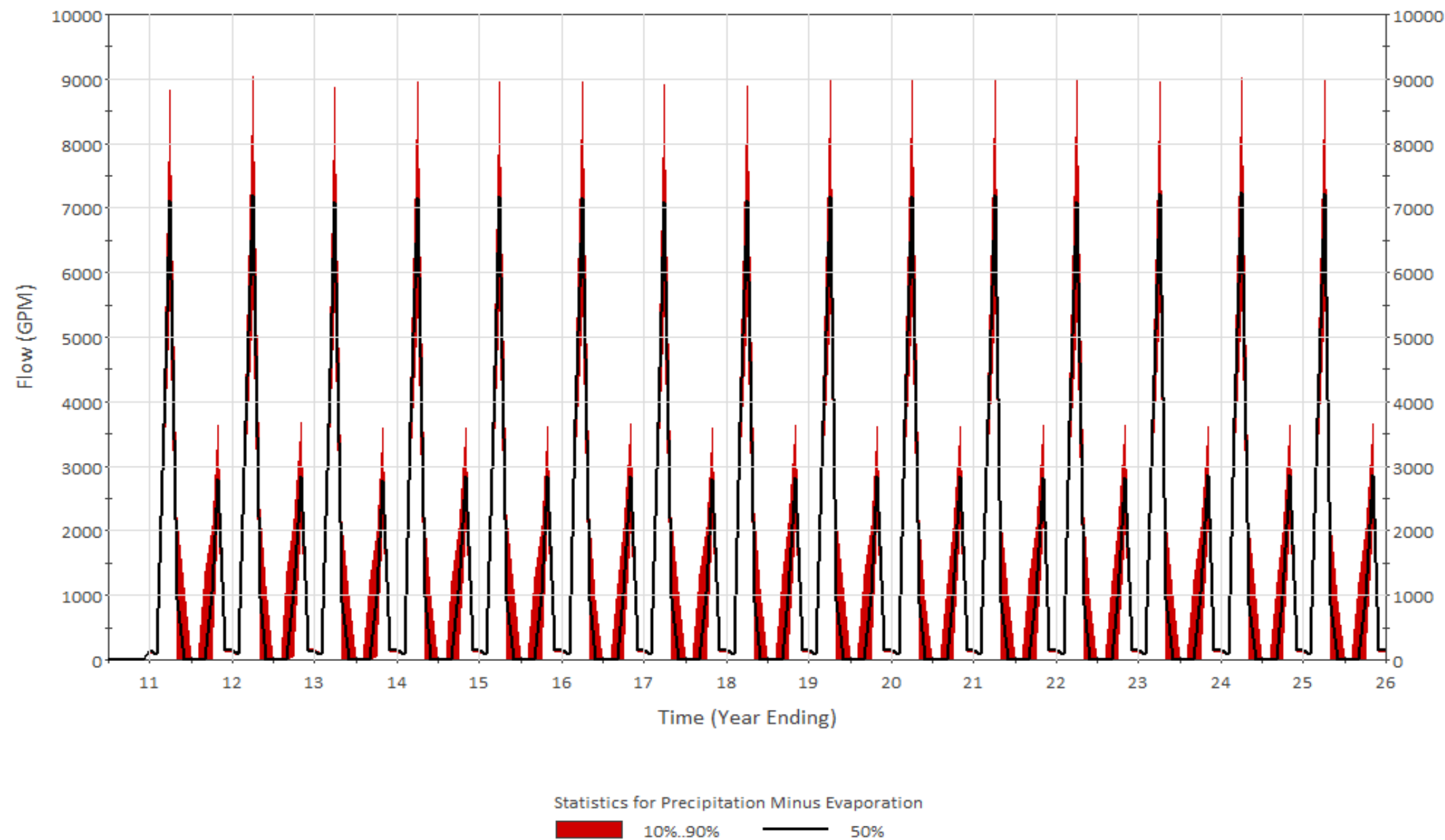


WHITE PINE COPPER LLC

FIGURE A2-4
TDF NORTH POND 2 INFLOWS
WHITE PINE NORTH
ONTONAGON COUNTY, MICHIGAN

Date: JULY 2026	Revision Date:	
Drawn By: SGL	Checked By: KBENUSA	Project: 23W200

TDF NP2 Precipitation and Runoff Minus Evaporation - Thickened Tailings Option

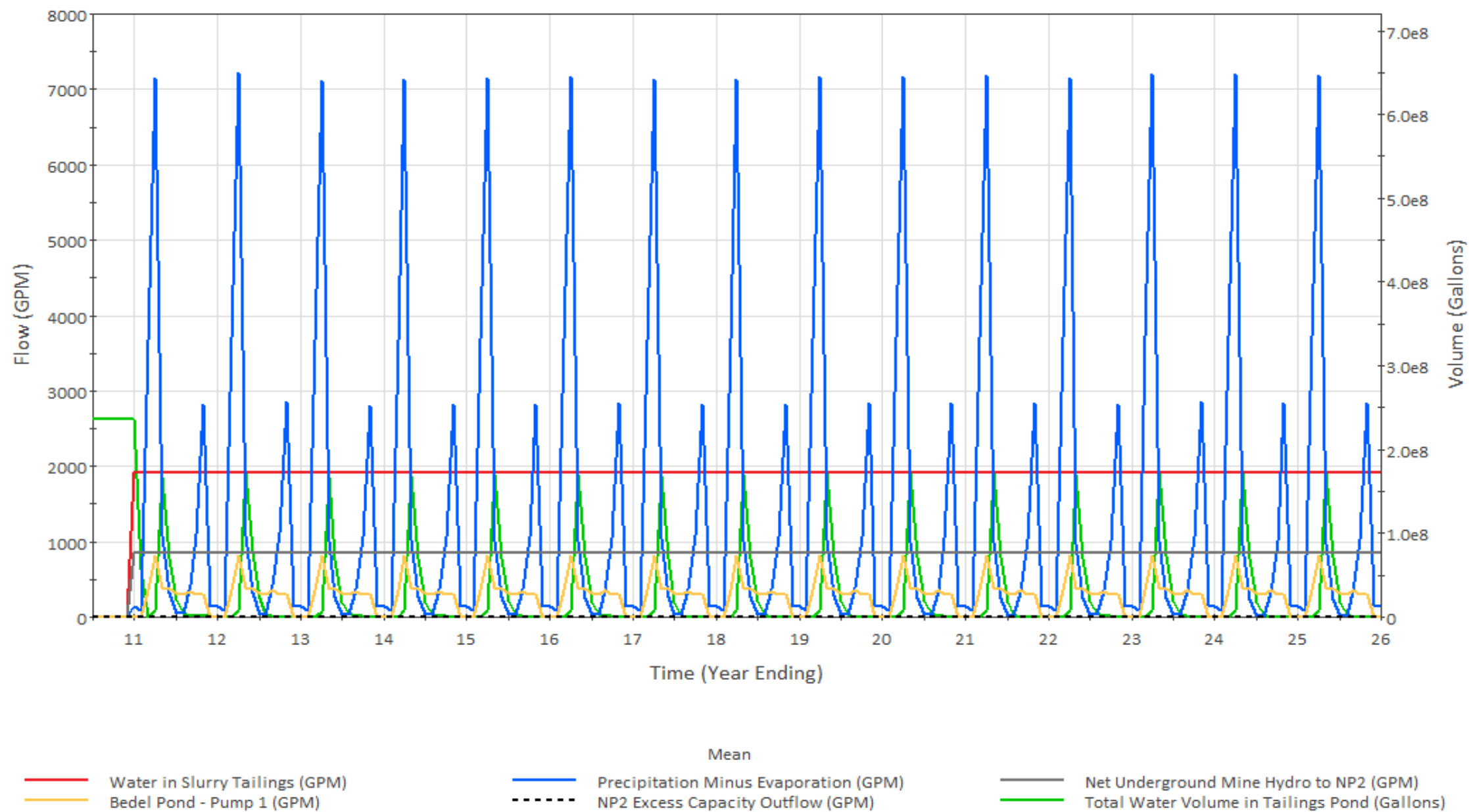


- NOTES:**
- 1. Assumptions made for developing preliminary flow estimates include:
 - Site runoff/contact water and waste rock stockpile runoff water drain to Bedel Pond and do not enter the TDF.
 - Evaporation within both the TDF pond water and TDF dry ground areas is assumed to occur at an average open water evaporation rate of 23 to 25 inches per year based on the climate change model.
 - TDF NP2 Reclaim Area has a surface water drainage area of ~1897 Ac., a reclaimed water pond area of ~105 Ac., and a capacity of ~2169 Ac-ft.
 - TDF capacities are taken at 2% Deposition slope from Table 4 of the 2/17/26 TetraTech Memo regarding Water Management Philosophy of Operating and Design Storm Conditions.
 - The initial quantity in NP2 is assumed to be 1/3 the total capacity.
 - Results represent monthly averages over 1000 simulations.



WHITE PINE COPPER LLC		
FIGURE A2-4a		
TDF NORTH POND 2 NET PRECIP P10 AND P90		
WHITE PINE NORTH		
ONTONAGON COUNTY, MICHIGAN		
Date: JULY 2026	Revision Date:	
Drawn By: SGL	Checked By: KBENUSA	Project: 23W200

TDF NP2 Inflows and Total Water Volume in Tailings Pond - Thickened Tailings Option



NOTES:

1. Assumptions made for developing preliminary flow estimates include:
- Site runoff/contact water and waste rock stockpile runoff water drain to Bedel Pond and do not enter the TDF.
 - Evaporation within both the TDF pond water and TDF dry ground areas is assumed to occur at an average open water evaporation rate of 23 to 25 inches per year based on the climate change model.
 - TDF NP2 Reclaim Area has a surface water drainage area of ~1897 Ac., a reclaimed water pond area of ~105 Ac., and a capacity of ~2169 Ac-ft.
 - TDF capacities are taken at 2% Deposition slope from Table 4 of the 2/17/26 TetraTech Memo regarding Water Management Philosophy of Operating and Design Storm Conditions.
 - The initial quantity in NP2 is assumed to be 1/3 the total capacity.
 - Water is continuously pumped from the TDF in Years 12 through 26 to the treatment plant when available at a rate of 4500 GPM, with additional outflow routed from the TDF to the treatment plant when TDF capacities are reached.
 - Water entrained as pore water in tailings is modeled as a TDF outflow and not included in the TDF total water volume estimate.
 - Total water volume refers to the total water in NP2 from precipitation and runoff plus total water in slurry tailings (excluding the water entrained as pore water in tailings).
 - Results represent monthly averages over 1000 simulations.

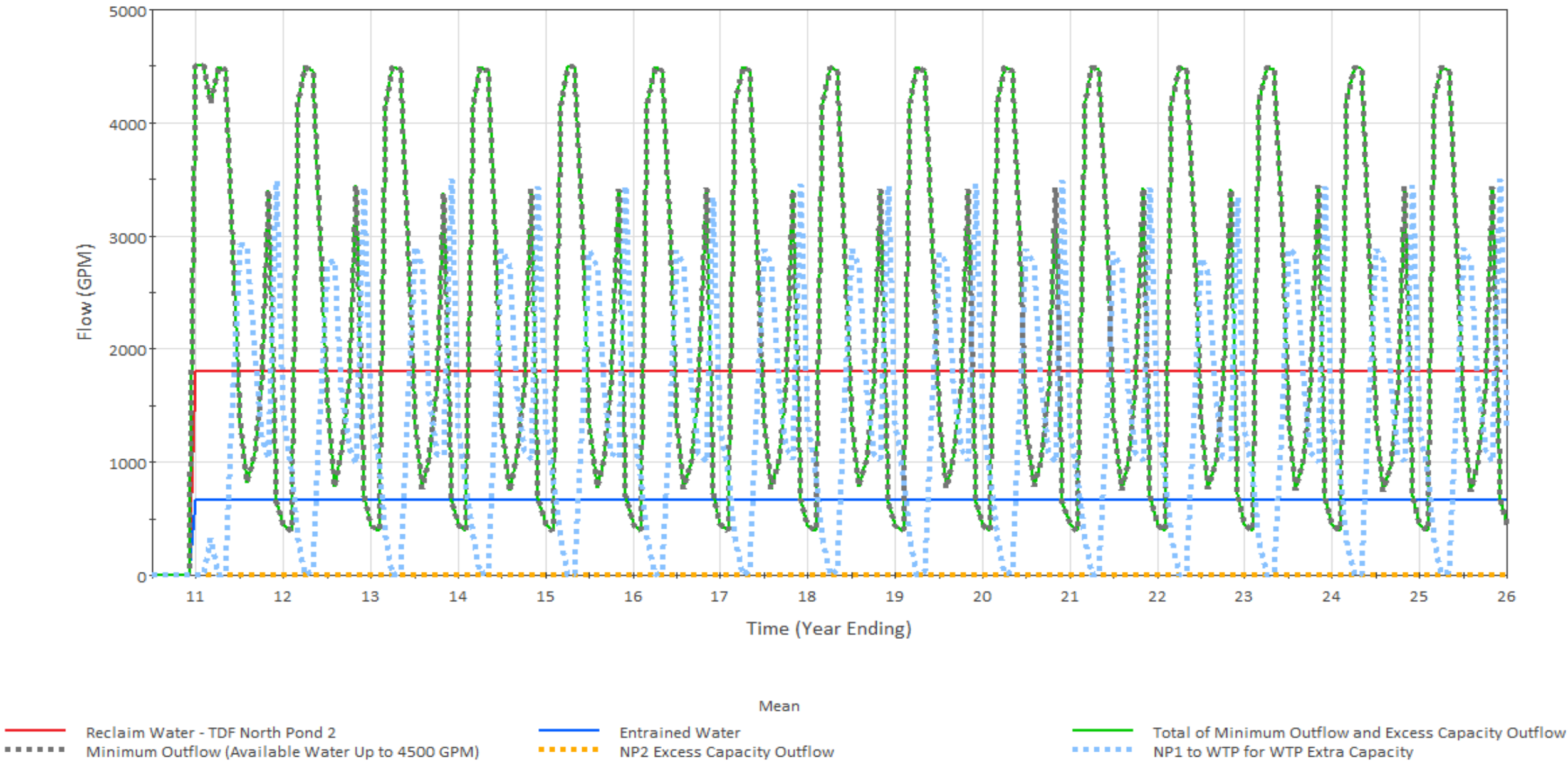


WHITE PINE COPPER LLC

FIGURE A2-4b
TDF NORTH POND 2 INFLOWS WITH TOTAL VOLUME
WHITE PINE NORTH
ONTONAGON COUNTY, MICHIGAN

Date: JULY 2026	Revision Date:
Drawn By: SGL	Checked By: KBENUSA Project: 23W200

TDF North Pond 2 Outflows to Process Plant and Water Treatment Plant - Thickened Tailings Option



NOTES:

- Assumptions made for developing preliminary flow estimates include:
 - Site runoff/contact water and waste rock stockpile runoff water drain to Bedel Pond and do not enter the TDF.
 - Evaporation within both the TDF pond water and TDF dry ground areas is assumed to occur at an average open water evaporation rate of 23 to 25 inches per year based on the climate change model.
 - TDF NP2 Reclaim Area has a surface water drainage area of ~1897 Ac., a reclaimed water pond area of ~105 Ac., and a capacity of ~2169 Ac-ft.
 - TDF capacities are taken at 2% Deposition slope from Table 4 of the 2/17/26 TetraTech Memo regarding Water Management Philosophy of Operating and Design Storm Conditions.
 - The initial quantity in NP2 is assumed to be 1/3 the total capacity.
 - Water is continuously pumped from the TDF in Years 12 through 26 to the treatment plant when available at a rate of 4500 GPM, with additional outflow routed from the TDF to the treatment plant when TDF capacities are reached.
 - Water entrained as pore water in tailings is modeled as a TDF outflow and not included in the TDF total water volume estimate.
 - Total water volume refers to the total water in NP2 from precipitation and runoff plus total water in slurry tailings (excluding the water entrained as pore water in tailings).
 - Results represent monthly averages over 1000 simulations.

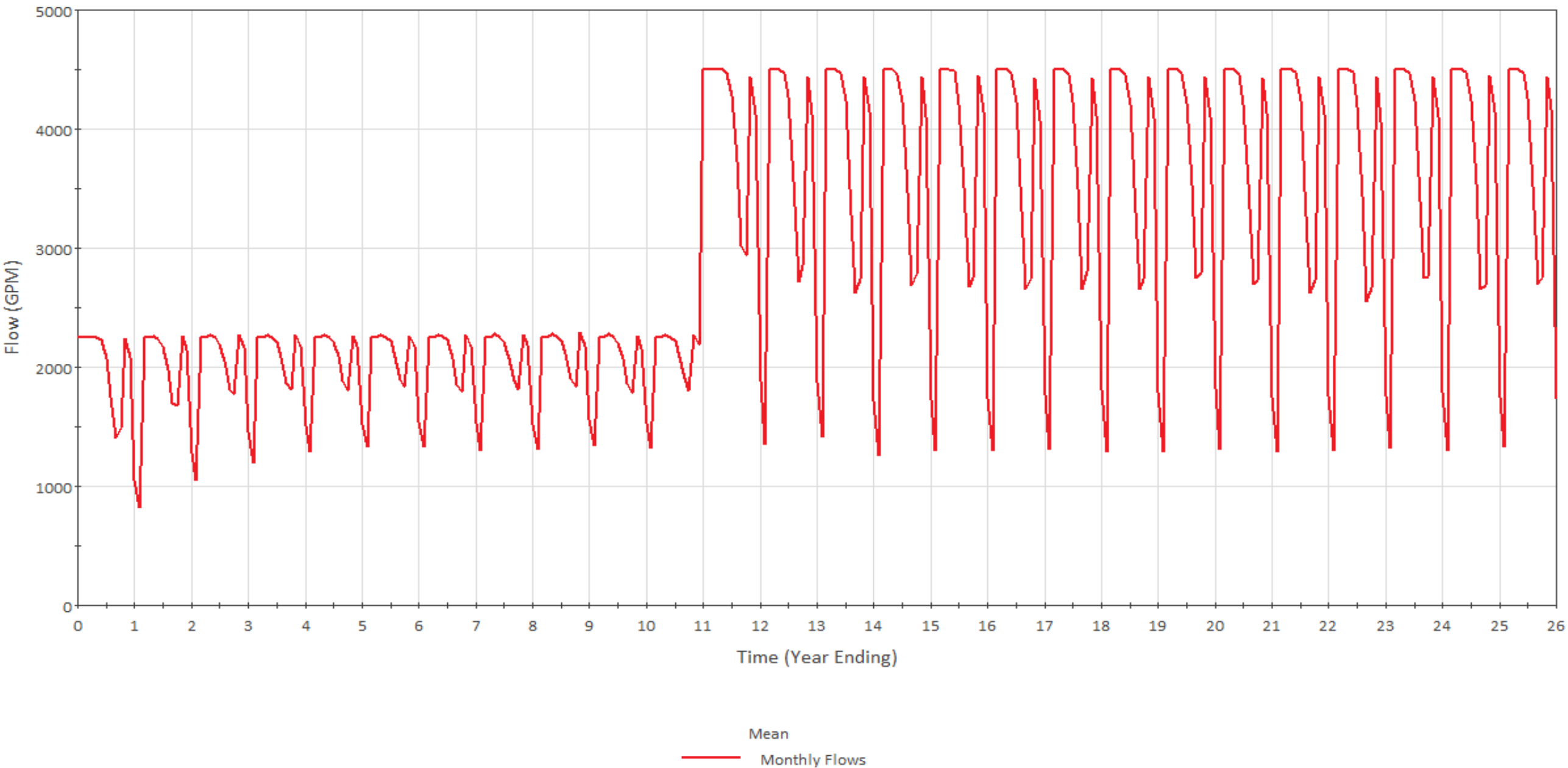


WHITE PINE COPPER LLC

FIGURE A2-5
TDF NORTH POND 2 OUTFLOWS
WHITE PINE NORTH
ONTONAGON COUNTY, MICHIGAN

Date: JULY 2026	Revision Date:
Drawn By: SGL	Checked By: KBENUSA Project: 23W200

Water Treatment Plant Mean Monthly Flows - Thickened Tailings Option



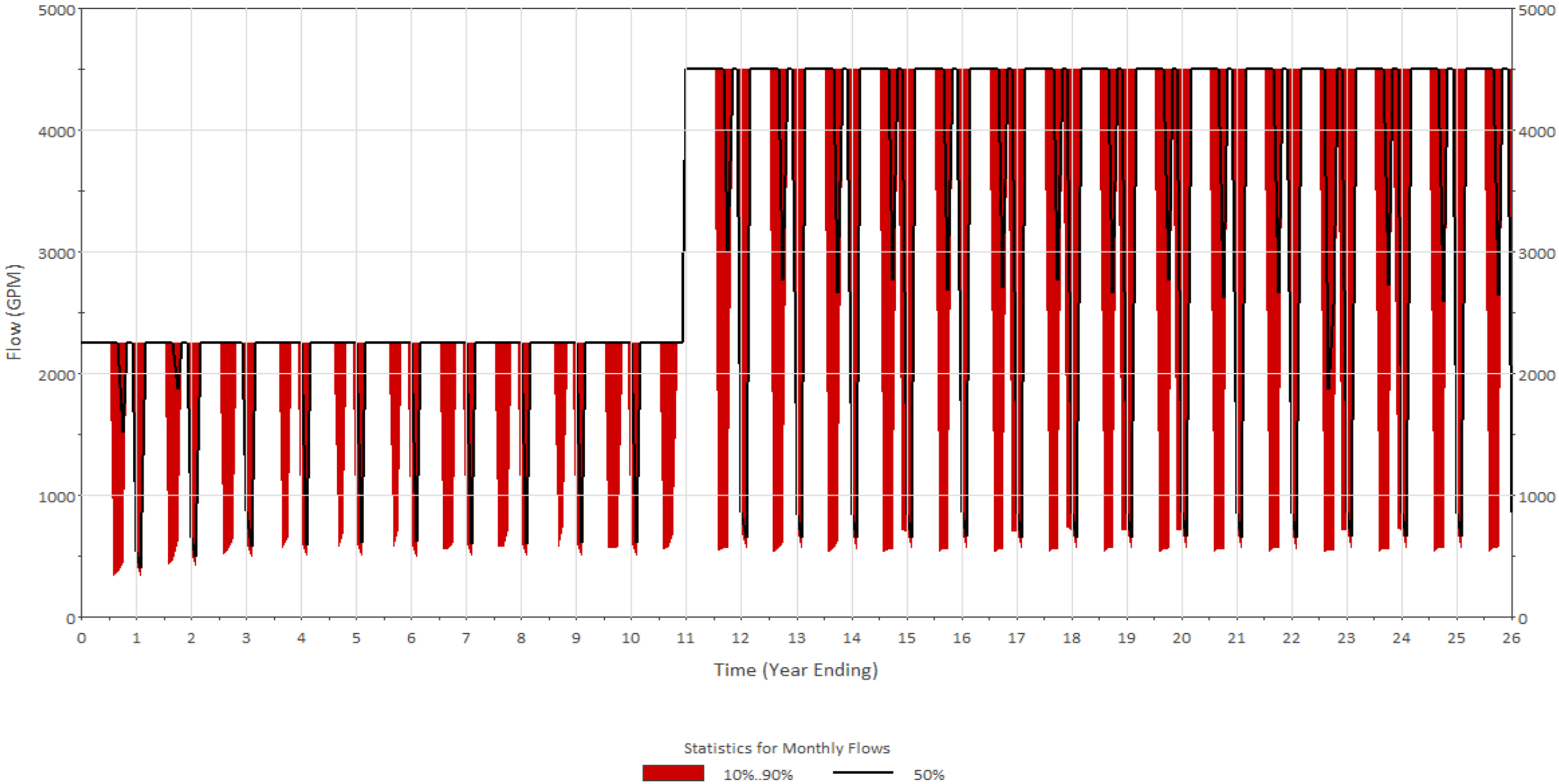
NOTES:

- Assumptions made for developing preliminary flow estimates include:
 - TDF NP1 has a surface water drainage area of ~1850 Ac., a combined reclaimed water/stormwater detention pond area of ~274 Ac., and a capacity of ~2164 Ac-ft.
 - TDF NP2 Reclaim Area has a surface water drainage area of ~1897 Ac., a reclaimed water pond area of ~105 Ac., and a capacity of ~2169 Ac-ft.
 - TDF capacities are taken at 2% Deposition slope from Table 4 of the 2/17/26 TetraTech Memo regarding Water Management Philosophy of Operating and Design Storm Conditions.
 - The initial quantity in both NP1 and NP2 is assumed to be 1/3 the total capacity.
 - Water is continuously pumped from the TDF to the treatment plant when available at a rate of 2250 GPM in Years 1 through 11, and 4500 GPM in Years 12 through 26, with additional outflow routed from the TDF to the treatment plant when TDF capacities are reached. Beginning in Year 12, outflow is also routed from NP1 to the treatment plant to match treatment plant extra capacity.
 - Results represent monthly averages over 1000 simulations.



WHITE PINE COPPER LLC		
FIGURE A2-6		
WATER TREATMENT PLANT INFLOW - AVERAGE		
WHITE PINE NORTH		
ONTONAGON COUNTY, MICHIGAN		
Date: JULY 2026	Revision Date:	
Drawn By: SGL	Checked By: KBENUSA	Project: 23W200

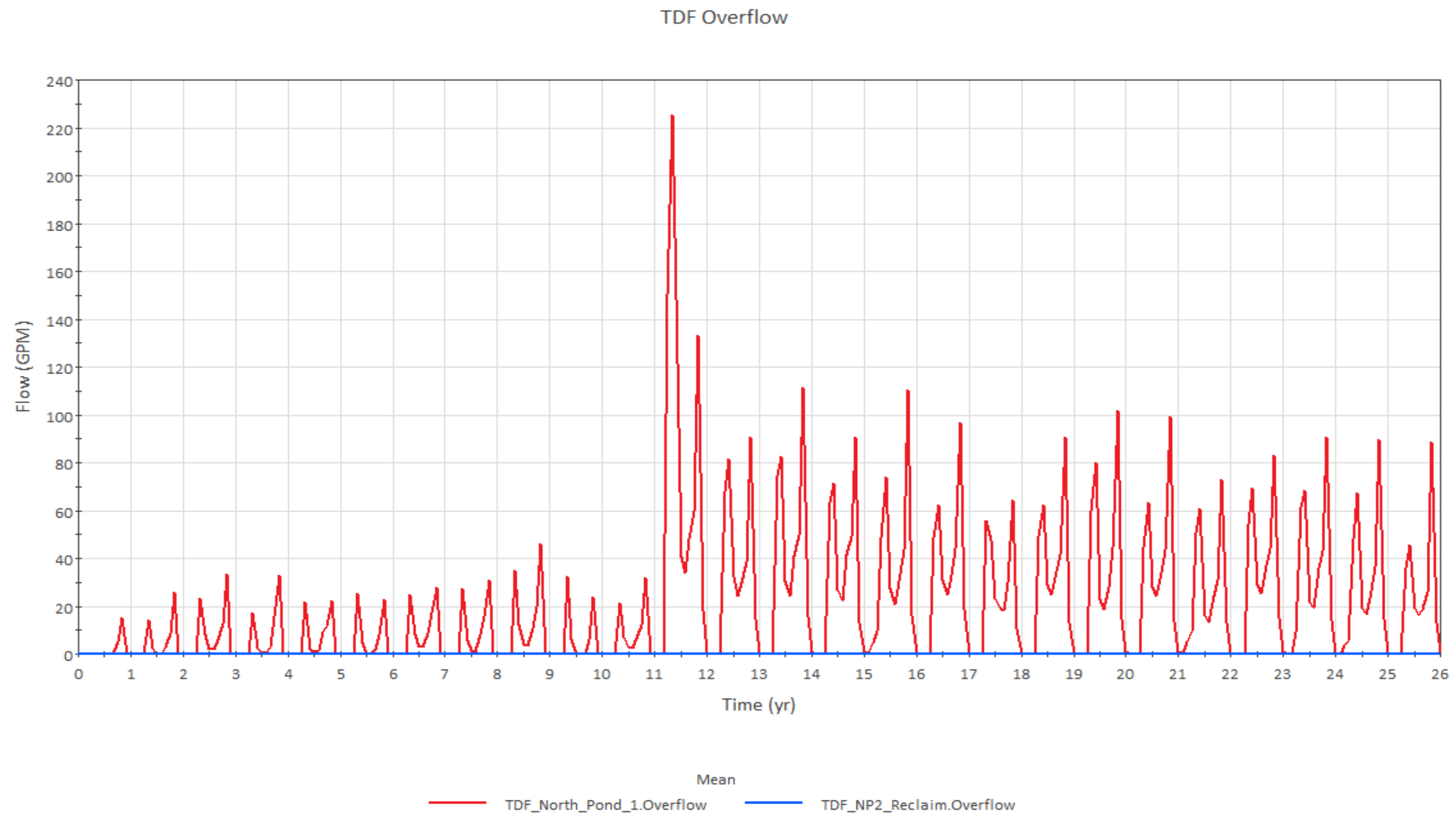
Water Treatment Plant Monthly Flow Statistics - Thickened Tailings Option



- NOTES:**
- 1. Assumptions made for developing preliminary flow estimates include:
 - TDF NP1 has a surface water drainage area of ~1850 Ac., a combined reclaimed water/stormwater detention pond area of ~274 Ac., and a capacity of ~2164 Ac-ft.
 - TDF NP2 Reclaim Area has a surface water drainage area of ~1897 Ac., a reclaimed water pond area of ~105 Ac., and a capacity of ~2169 Ac-ft.
 - TDF capacities are taken at 2% Deposition slope from Table 4 of the 2/17/26 TetraTech Memo regarding Water Management Philosophy of Operating and Design Storm Conditions.
 - The initial quantity in both NP1 and NP2 is assumed to be 1/3 the total capacity.
 - Water is continuously pumped from the TDF to the treatment plant when available at a rate of 2250 GPM in Years 1 through 11, and 4500 GPM in Years 12 through 26, with additional outflow routed from the TDF to the treatment plant when TDF capacities are reached. Beginning in Year 12, outflow is also routed from NP1 to the treatment plant to match treatment plant extra capacity.
 - Results represent monthly averages over 1000 simulations.



WHITE PINE COPPER LLC		
FIGURE A2-6b		
WATER TREATMENT PLANT INFLOW - P10, P50 AND P90		
WHITE PINE NORTH		
ONTONAGON COUNTY, MICHIGAN		
Date: JULY 2026	Revision Date:	
Drawn By: SGL	Checked By: KBENUSA	Project: 23W200



NOTES:

- Assumptions made for developing preliminary flow estimates include:
 - TDF NP1 has a surface water drainage area of ~1850 Ac., a combined reclaimed water/stormwater detention pond area of ~274 Ac., and a capacity of ~2164 Ac-ft.
 - TDF NP2 Reclaim Area has a surface water drainage area of ~1897 Ac., a reclaimed water pond area of ~105 Ac., and a capacity of ~2169 Ac-ft.
 - TDF capacities are taken at 2% Deposition slope from Table 4 of the 2/17/26 TetraTech Memo regarding Water Management Philosophy of Operating and Design Storm Conditions.
 - The initial quantity in both NP1 and NP2 is assumed to be 1/3 the total capacity.
 - Water is continuously pumped from the TDF to the treatment plant when available at a rate of 2250 GPM in Years 1 through 11, and 4500 GPM in Years 12 through 26, with additional outflow routed from the TDF to the treatment plant when TDF capacities are reached. Beginning in Year 12, outflow is also routed from NP1 to the treatment plant to match treatment plant extra capacity.
 - Results represent monthly averages over 1000 simulations.



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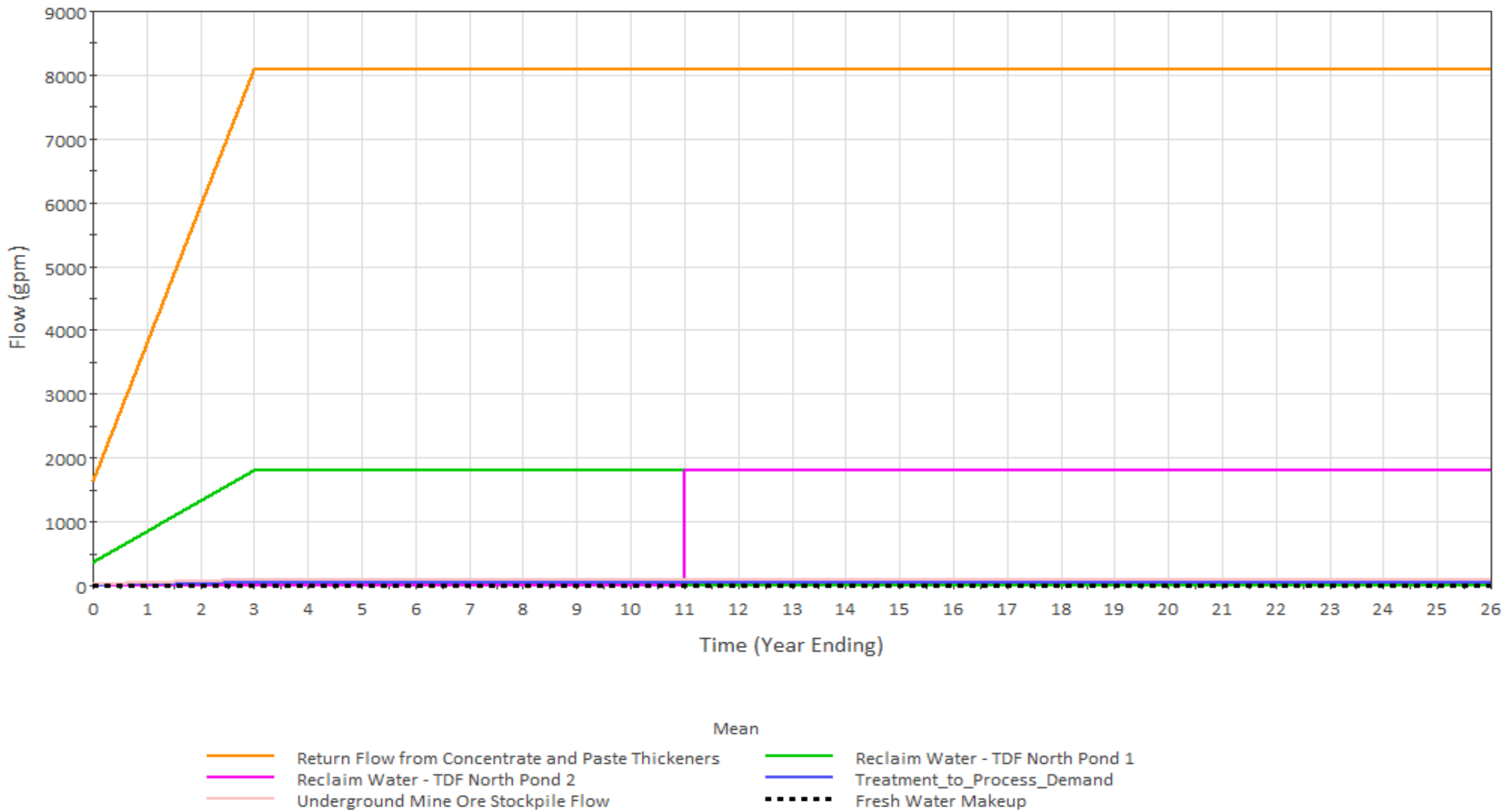
FIGURE A2-7
TDF NP1 AND NP2 EXTRA CAPACITY OUTFLOWS
WHITE PINE NORTH
ONTONAGON COUNTY, MICHIGAN

Date: JULY 2026	Revision Date:
Drawn By: SGL	Checked By: KBENUSA Project: 23W200

Attachment 3

GoldSim Results with a Daily Basic Time Step Incorporating 24-Hour Storm Events

Process Plant Inflow - Thickened Tailings Option



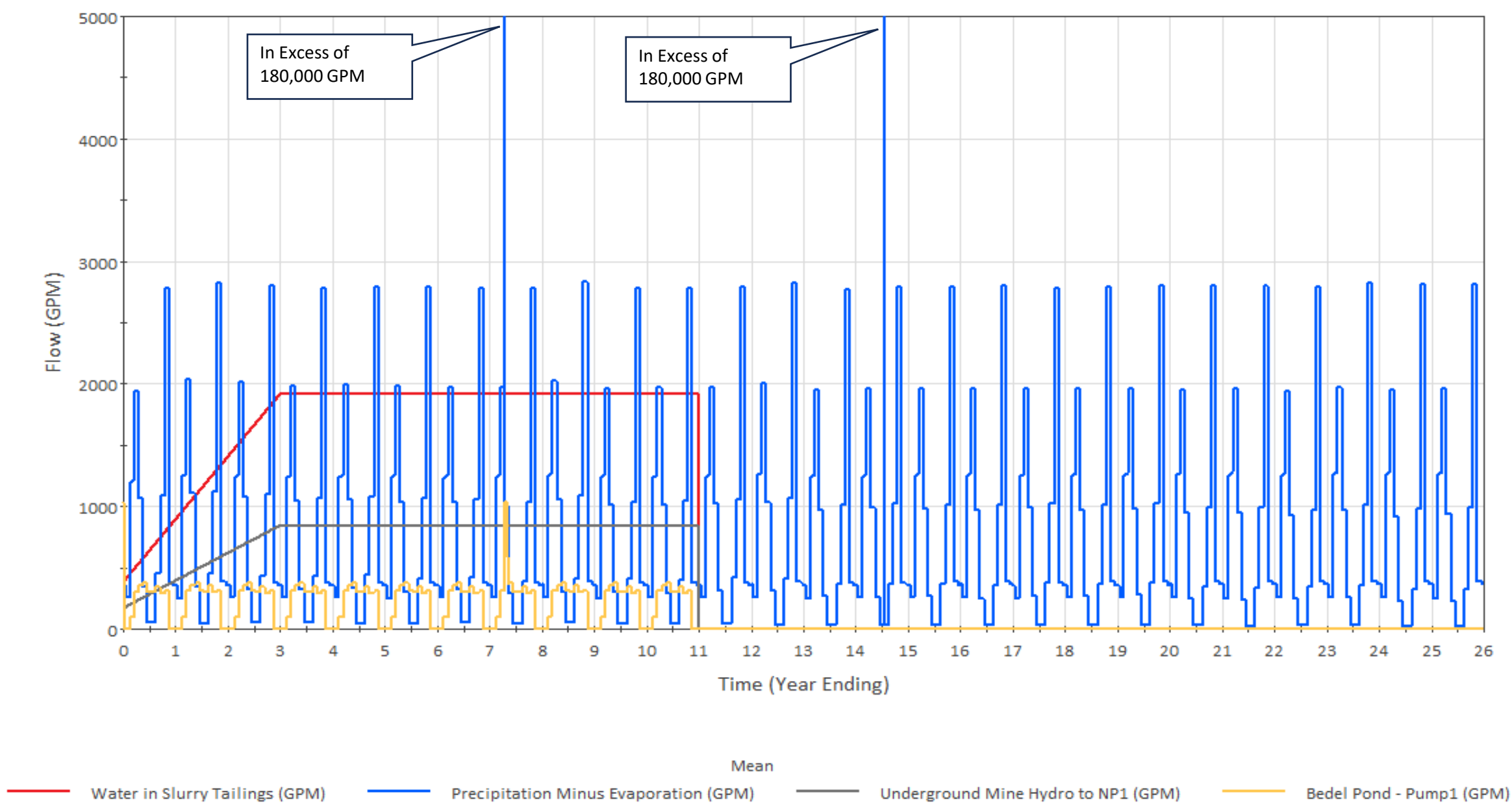
NOTES:

- Assumptions made for developing preliminary flow estimates include:
 - Site runoff/contact water and waste rock stockpile runoff water drain to Bedel Pond and do not enter the TDF.
 - Evaporation within both the TDF pond water and TDF dry ground areas is assumed to occur at an average open water evaporation rate of 23 to 25 inches per year based on the climate change model.
 - TDF NP1 has a surface water drainage area of ~1850 Ac., a combined reclaimed water/stormwater detention pond area of ~274 Ac., and a capacity of ~2164 Ac-ft.
 - TDF NP2 Reclaim Area has a surface water drainage area of ~1897 Ac., a reclaimed water pond area of ~105 Ac., and a capacity of ~2169 Ac-ft.
 - TDF capacities are taken at 2% Deposition slope from Table 4 of the 2/17/26 TetraTech Memo regarding *Water Management Philosophy of Operating and Design Storm Conditions*.
 - The initial quantity in both NP1 and NP2 is assumed to be 1/3 the total capacity.
 - Results represent daily averages over 1000 simulations.
- A 24-hour storm event of 6.34" of precipitation is assumed for May 1 in Year 8 and August 1 in Year 15.



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FIGURE A3-1 PROCESS PLANT INFLOWS WHITE PINE NORTH ONTONAGON COUNTY, MICHIGAN		
Date: JULY 2026	Revision Date:	
Drawn By: SGL	Checked By: KBENUSA	Project: 23W200

TDF NP1 Inflows - Thickened Tailings Option



NOTES:

- Assumptions made for developing preliminary flow estimates include:
 - Site runoff/contact water and waste rock stockpile runoff water drain to Bedel Pond and do not enter the TDF.
 - Evaporation within both the TDF pond water and TDF dry ground areas is assumed to occur at an average open water evaporation rate of 23 to 25 inches per year based on the climate change model.
 - TDF NP1 has a surface water drainage area of ~1850 Ac., a combined reclaimed water/stormwater detention pond area of ~274 Ac., and a capacity of ~2164 Ac-ft.
 - TDF capacities are taken at 2% Deposition slope from Table 4 of the 2/17/26 TetraTech Memo regarding *Water Management Philosophy of Operating and Design Storm Conditions*.
 - The initial quantity in NP1 is assumed to be 1/3 the total capacity.
 - Results represent daily averages over 1000 simulations.

- A 24-hour storm event of 6.34" of precipitation is assumed for May 1 in Year 8 and August 1 in Year 15.

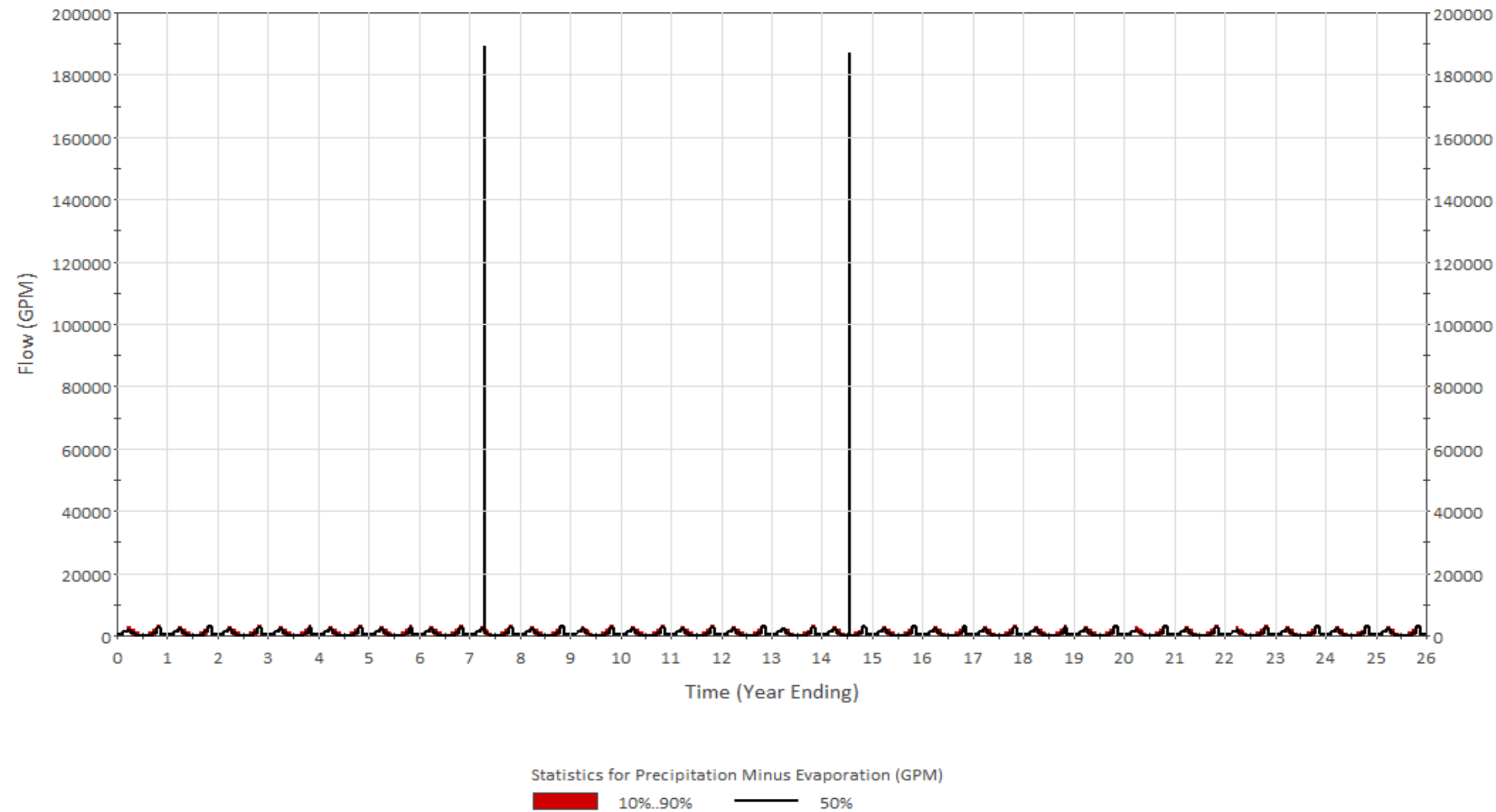


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FIGURE A3-2
TDF NORTH POND 1 INFLOWS
WHITE PINE NORTH
ONTONAGON COUNTY, MICHIGAN

Date: JULY 2026	Revision Date:	
Drawn By: SGL	Checked By: KBENUSA	Project: 23W200

TDF NP1 Precipitation and Runoff Minus Evaporation - Thickened Tailings Option



NOTES:

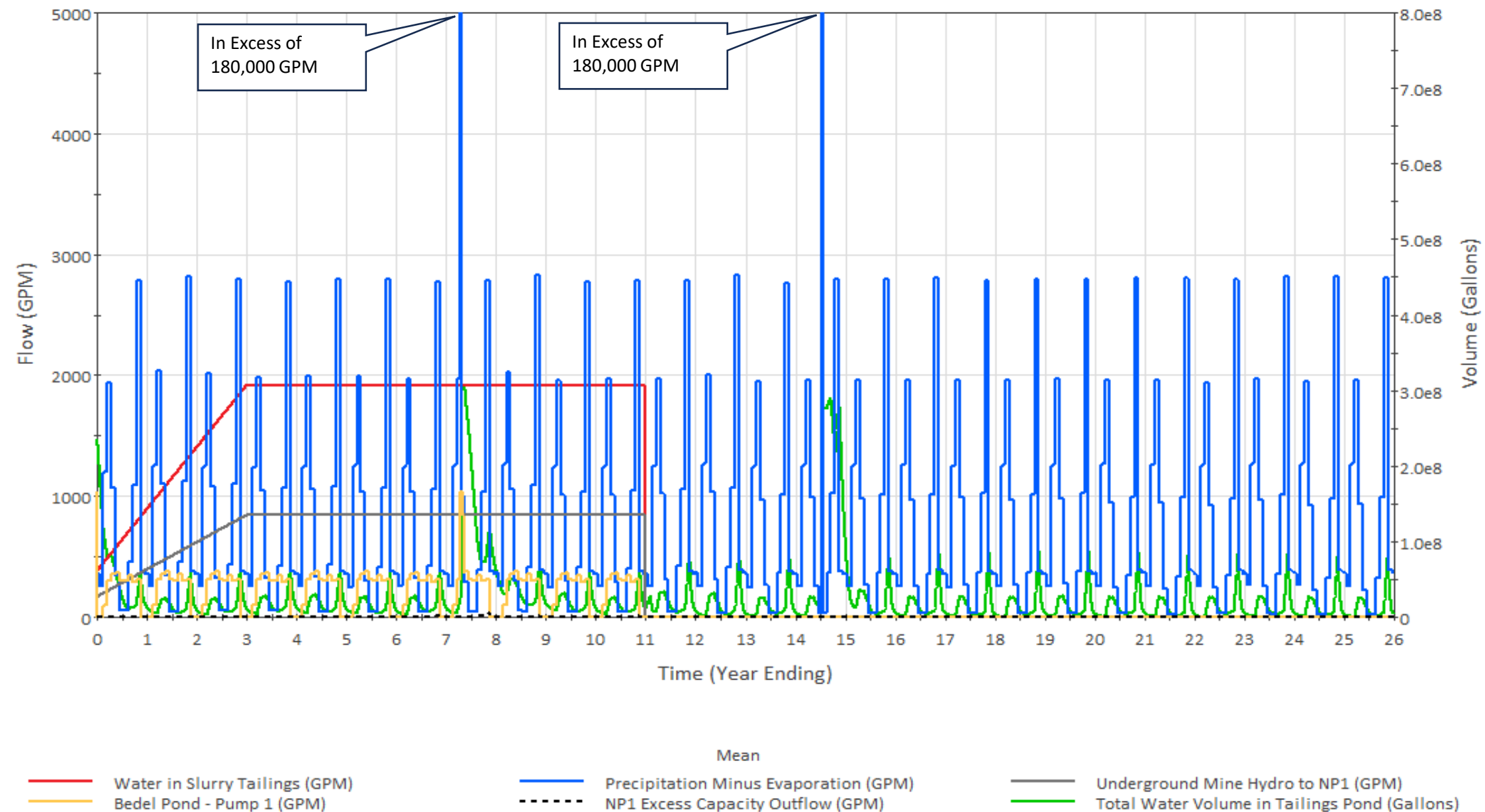
1. Assumptions made for developing preliminary flow estimates include:
- Site runoff/contact water and waste rock stockpile runoff water drain to Bedel Pond and do not enter the TDF.
 - Evaporation within both the TDF pond water and TDF dry ground areas is assumed to occur at an average open water evaporation rate of 23 to 25 inches per year based on the climate change model.
 - TDF NP1 has a surface water drainage area of ~1850 Ac., a combined reclaimed water/stormwater detention pond area of ~274 Ac., and a capacity of ~2164 Ac-ft.
 - TDF capacities are taken at 2% Deposition slope from Table 4 of the 2/17/26 TetraTech Memo regarding *Water Management Philosophy of Operating and Design Storm Conditions*.
 - The initial quantity in NP1 is assumed to be 1/3 the total capacity.
 - Results represent daily averages over 1000 simulations.

2. A 24-hour storm event of 6.34" of precipitation is assumed for May 1 in Year 8 and August 1 in Year 15.

WHITE PINE COPPER LLC		
FIGURE A3-2a		
TDF NORTH POND 1 NET PRECIP P10 AND P90		
WHITE PINE NORTH		
ONTONAGON COUNTY, MICHIGAN		
Date: JULY 2026	Revision Date:	
Drawn By: SGL	Checked By: KBENUSA	Project: 23W200



TDF NP1 Inflows and Total Water Volume in Tailings Pond - Thickened Tailings Option



NOTES:

- Assumptions made for developing preliminary flow estimates include:
 - Site runoff/contact water and waste rock stockpile runoff water drain to Bedel Pond and do not enter the TDF.
 - Evaporation within both the TDF pond water and TDF dry ground areas is assumed to occur at an average open water evaporation rate of 23 to 25 inches per year based on the climate change model.
 - TDF NP1 has a surface water drainage area of ~1850 Ac., a combined reclaimed water/stormwater detention pond area of ~274 Ac., and a capacity of ~2164 Ac-ft.
 - TDF capacities are taken at 2% Deposition slope from Table 4 of the 2/17/26 TetraTech Memo regarding Water Management Philosophy of Operating and Design Storm Conditions.
 - The initial quantity in NP1 is assumed to be 1/3 the total capacity.
 - Water is continuously pumped from the TDF in Years 1 through 11 to the treatment plant when available at a rate of 2250 GPM, with additional outflow routed from the TDF to the treatment plant when TDF capacities are reached. Beginning in Year 12, outflow is routed to the treatment plant to match treatment plant extra capacity.
 - Water entrained as pore water in tailings is modeled as a TDF outflow and not included in the TDF total water volume estimate.
 - Total water volume refers to the total water in NP1 from precipitation and runoff plus total water in slurry tailings (excluding the water entrained as pore water in tailings).
 - Results represent daily averages over 1000 simulations.
- A 24-hour storm event of 6.34" of precipitation is assumed for May 1 in Year 8 and August 1 in Year 15.

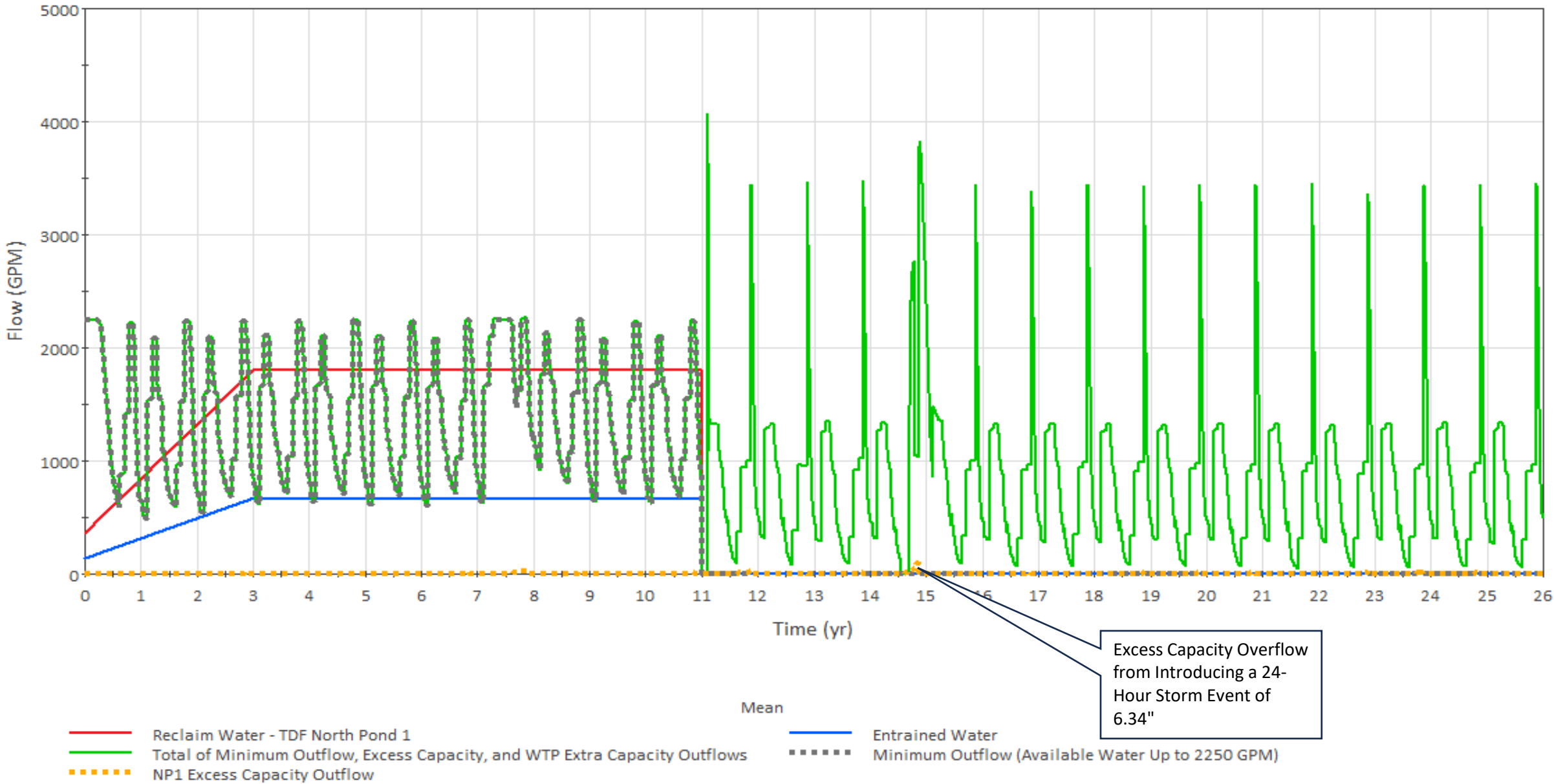


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FIGURE A3-2b
TDF NORTH POND 1 INFLOWS WITH TOTAL VOLUME
WHITE PINE NORTH
ONTONAGON COUNTY, MICHIGAN

Date: JULY 2026	Revision Date:	
Drawn By: SGL	Checked By: KBENUSA	Project: 23W200

TDF North Pond 1 Outflows to Process Plant and Water Treatment Plant - Thickened Tailings Option



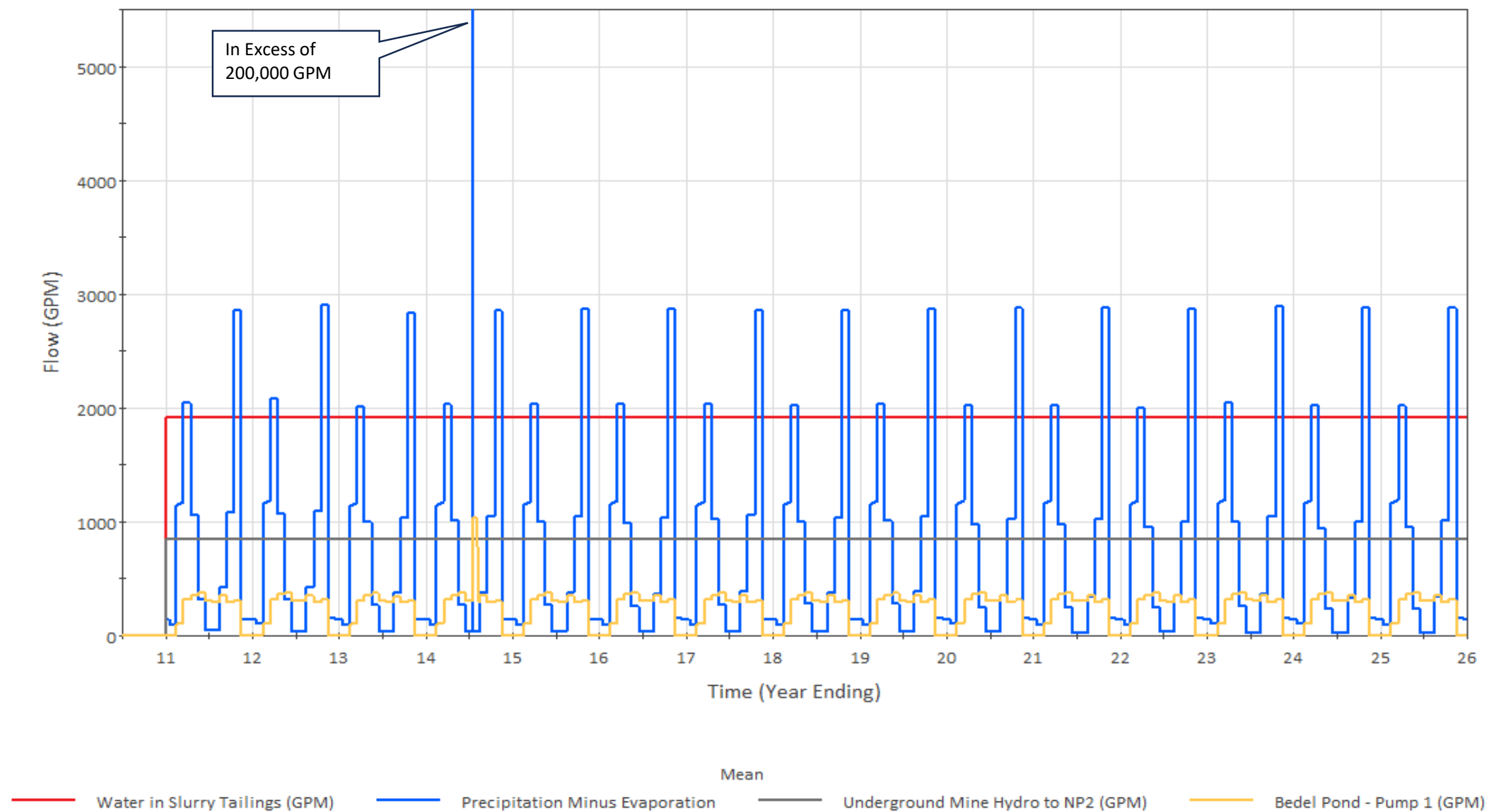
NOTES:

- Assumptions made for developing preliminary flow estimates include:
 - Site runoff/contact water and waste rock stockpile runoff water drain to Bedel Pond and do not enter the TDF.
 - Evaporation within both the TDF pond water and TDF dry ground areas is assumed to occur at an average open water evaporation rate of 23 to 25 inches per year based on the climate change model.
 - TDF NP1 has a surface water drainage area of ~1850 Ac., a combined reclaimed water/stormwater detention pond area of ~274 Ac., and a capacity of ~2164 Ac-ft.
 - TDF capacities are taken at 2% Deposition slope from Table 4 of the 2/17/26 TetraTech Memo regarding Water Management Philosophy of Operating and Design Storm Conditions.
 - The initial quantity in NP1 is assumed to be 1/3 the total capacity.
 - Water is continuously pumped from the TDF in Years 1 through 11 to the treatment plant when available at a rate of 2250 GPM, with additional outflow routed from the TDF to the treatment plant when TDF capacities are reached. Beginning in Year 12, outflow is routed to the treatment plant to match treatment plant extra capacity.
 - Water entrained as pore water in tailings is modeled as a TDF outflow and not included in the TDF total water volume estimate.
 - Total water volume refers to the total water in NP1 from precipitation and runoff plus total water in slurry tailings (excluding the water entrained as pore water in tailings).
 - Results represent daily averages over 1000 simulations.
- A 24-hour storm event of 6.34" of precipitation is assumed for May 1 in Year 8 and August 1 in Year 15.



WHITE PINE COPPER LLC		
FIGURE A3-3		
TDF NORTH POND 1 OUTFLOWS		
WHITE PINE NORTH		
ONTONAGON COUNTY, MICHIGAN		
Date: JULY 2026	Revision Date:	
Drawn By: SGL	Checked By: KBENUSA	Project: 23W200

TDF NP2 Inflows - Thickened Tailings Option



NOTES:

- Assumptions made for developing preliminary flow estimates include:
 - Site runoff/contact water and waste rock stockpile runoff water drain to Bedel Pond and do not enter the TDF.
 - Evaporation within both the TDF pond water and TDF dry ground areas is assumed to occur at an average open water evaporation rate of 23 to 25 inches per year based on the climate change model.
 - TDF NP2 Reclaim Area has a surface water drainage area of ~1897 Ac., a reclaimed water pond area of ~105 Ac., and a capacity of ~2169 Ac-ft.
 - TDF capacities are taken at 2% Deposition slope from Table 4 of the 2/17/26 TetraTech Memo regarding Water Management Philosophy of Operating and Design Storm Conditions.
 - The initial quantity in NP2 is assumed to be 1/3 the total capacity.
 - Results represent daily averages over 1000 simulations.

- A 24-hour storm event of 6.34" of precipitation is assumed for May 1 in Year 8 and August 1 in Year 15.

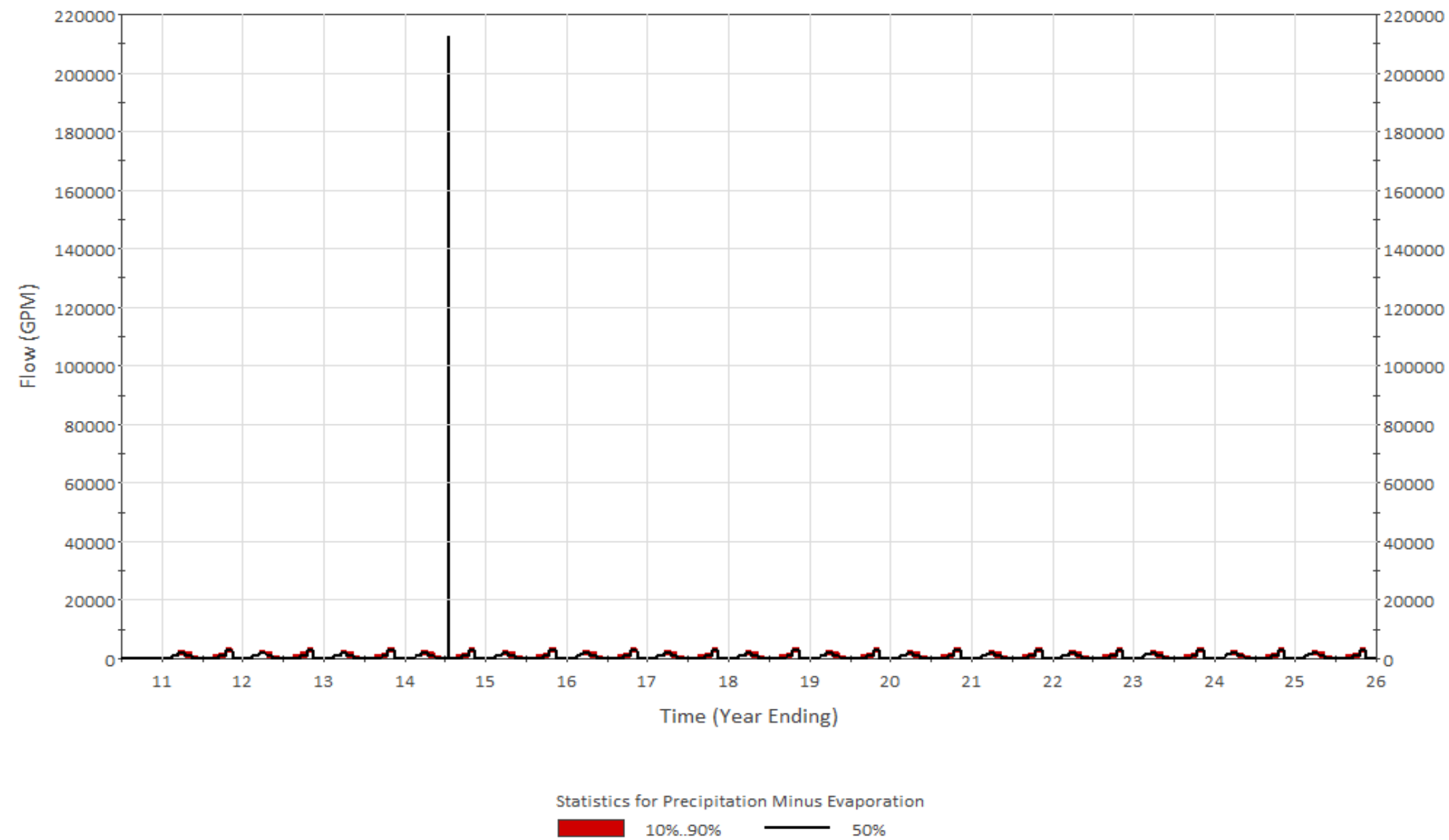


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FIGURE A3-4
TDF NORTH POND 2 INFLOWS
 WHITE PINE NORTH
 ONTONAGON COUNTY, MICHIGAN

Date: JULY 2026	Revision Date:
Drawn By: SGL	Checked By: KBENUSA
	Project: 23W200

TDF NP2 Precipitation and Runoff Minus Evaporation - Thickened Tailings Option

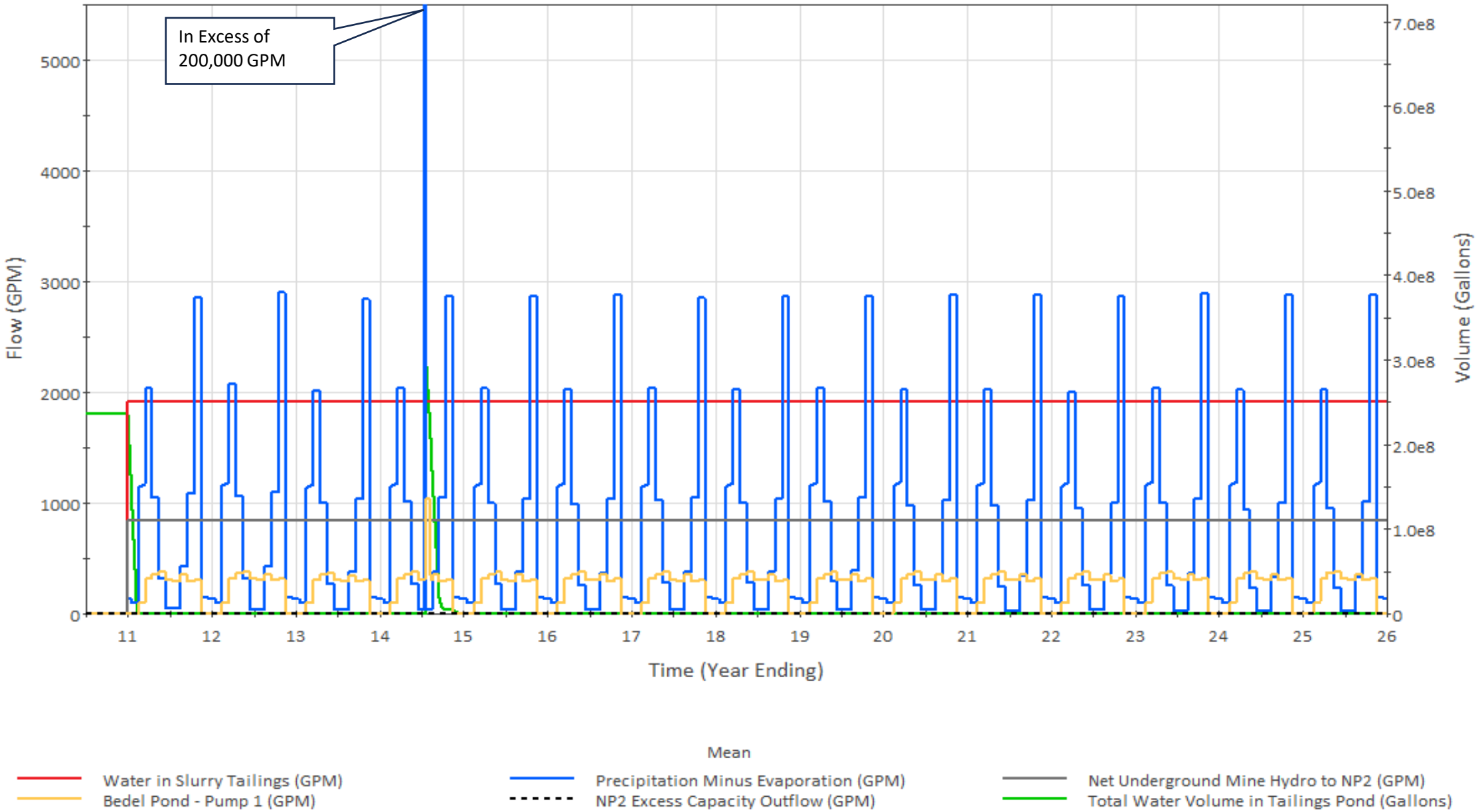


- NOTES:**
- Assumptions made for developing preliminary flow estimates include:
 - Site runoff/contact water and waste rock stockpile runoff water drain to Bedel Pond and do not enter the TDF.
 - Evaporation within both the TDF pond water and TDF dry ground areas is assumed to occur at an average open water evaporation rate of 23 to 25 inches per year based on the climate change model.
 - TDF NP2 Reclaim Area has a surface water drainage area of ~1897 Ac., a reclaimed water pond area of ~105 Ac., and a capacity of ~2169 Ac-ft.
 - TDF capacities are taken at 2% Deposition slope from Table 4 of the 2/17/26 TetraTech Memo regarding Water Management Philosophy of Operating and Design Storm Conditions.
 - The initial quantity in NP2 is assumed to be 1/3 the total capacity.
 - Results represent daily averages over 1000 simulations.
 - A 24-hour storm event of 6.34" of precipitation is assumed for May 1 in Year 8 and August 1 in Year 15.



WHITE PINE COPPER LLC		
FIGURE A3-4a		
TDF NORTH POND 2 NET PRECIP P10 AND P90		
WHITE PINE NORTH		
ONTONAGON COUNTY, MICHIGAN		
Date: JULY 2026	Revision Date:	
Drawn By: SGL	Checked By: KBENUSA	Project: 23W200

TDF NP2 Inflows and Total Water Volume in Tailings Pond - Thickened Tailings Option



NOTES:

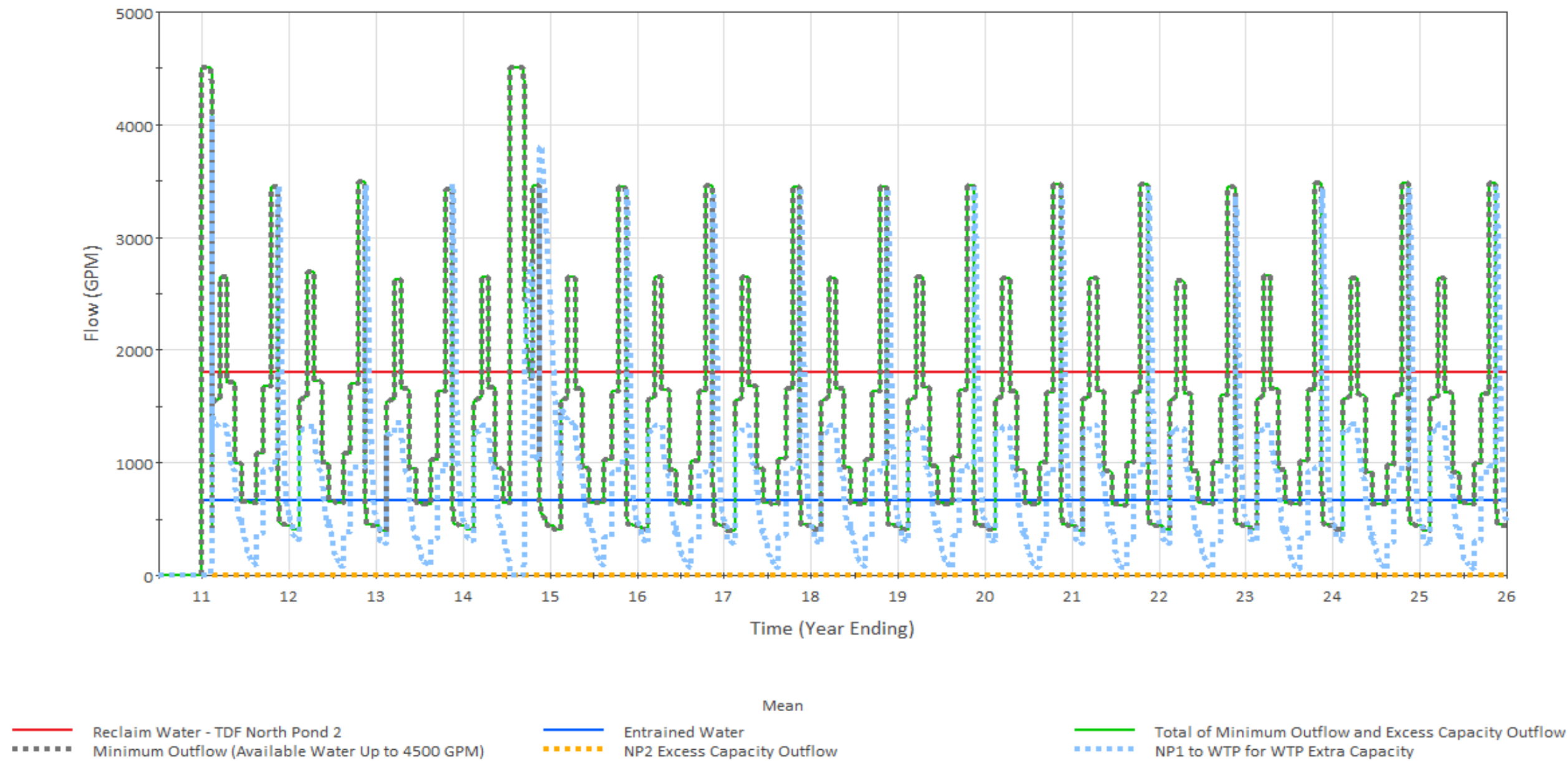
- 1. Assumptions made for developing preliminary flow estimates include:
 - Site runoff/contact water and waste rock stockpile runoff water drain to Bedel Pond and do not enter the TDF.
 - Evaporation within both the TDF pond water and TDF dry ground areas is assumed to occur at an average open water evaporation rate of 23 to 25 inches per year based on the climate change model.
 - TDF NP2 Reclaim Area has a surface water drainage area of ~1897 Ac., a reclaimed water pond area of ~105 Ac., and a capacity of ~2169 Ac-ft.
 - TDF capacities are taken at 2% Deposition slope from Table 4 of the 2/17/26 TetraTech Memo regarding Water Management Philosophy of Operating and Design Storm Conditions.
 - The initial quantity in NP2 is assumed to be 1/3 the total capacity.
 - Water is continuously pumped from the TDF in Years 12 through 26 to the treatment plant when available at a rate of 4500 GPM, with additional outflow routed from the TDF to the treatment plant when TDF capacities are reached.
 - Water entrained as pore water in tailings is modeled as a TDF outflow and not included in the TDF total water volume estimate.
 - Total water volume refers to the total water in NP2 from precipitation and runoff plus total water in slurry tailings (excluding the water entrained as pore water in tailings).
 - Results represent daily averages over 1000 simulations.

- 2. A 24-hour storm event of 6.34" of precipitation is assumed for May 1 in Year 8 and August 1 in Year 15.



WHITE PINE COPPER LLC		
FIGURE A3-4b		
TDF NORTH POND 2 INFLOWS WITH TOTAL VOLUME		
WHITE PINE NORTH		
ONTONAGON COUNTY, MICHIGAN		
Date: JULY 2026	Revision Date:	
Drawn By: SGL	Checked By: KBENUSA	Project: 23W200

TDF North Pond 2 Outflows to Process Plant and Water Treatment Plant - Thickened Tailings Option



NOTES:

- Assumptions made for developing preliminary flow estimates include:
 - Site runoff/contact water and waste rock stockpile runoff water drain to Bedel Pond and do not enter the TDF.
 - Evaporation within both the TDF pond water and TDF dry ground areas is assumed to occur at an average open water evaporation rate of 23 to 25 inches per year based on the climate change model.
 - TDF NP2 Reclaim Area has a surface water drainage area of ~1897 Ac., a reclaimed water pond area of ~105 Ac., and a capacity of ~2169 Ac-ft.
 - TDF capacities are taken at 2% Deposition slope from Table 4 of the 2/17/26 TetraTech Memo regarding Water Management Philosophy of Operating and Design Storm Conditions.
 - The initial quantity in NP2 is assumed to be 1/3 the total capacity.
 - Water is continuously pumped from the TDF in Years 12 through 26 to the treatment plant when available at a rate of 4500 GPM, with additional outflow routed from the TDF to the treatment plant when TDF capacities are reached.
 - Water entrained as pore water in tailings is modeled as a TDF outflow and not included in the TDF total water volume estimate.
 - Total water volume refers to the total water in NP2 from precipitation and runoff plus total water in slurry tailings (excluding the water entrained as pore water in tailings).
 - Results represent daily averages over 1000 simulations.

- A 24-hour storm event of 6.34" of precipitation is assumed for May 1 in Year 8 and August 1 in Year 15.

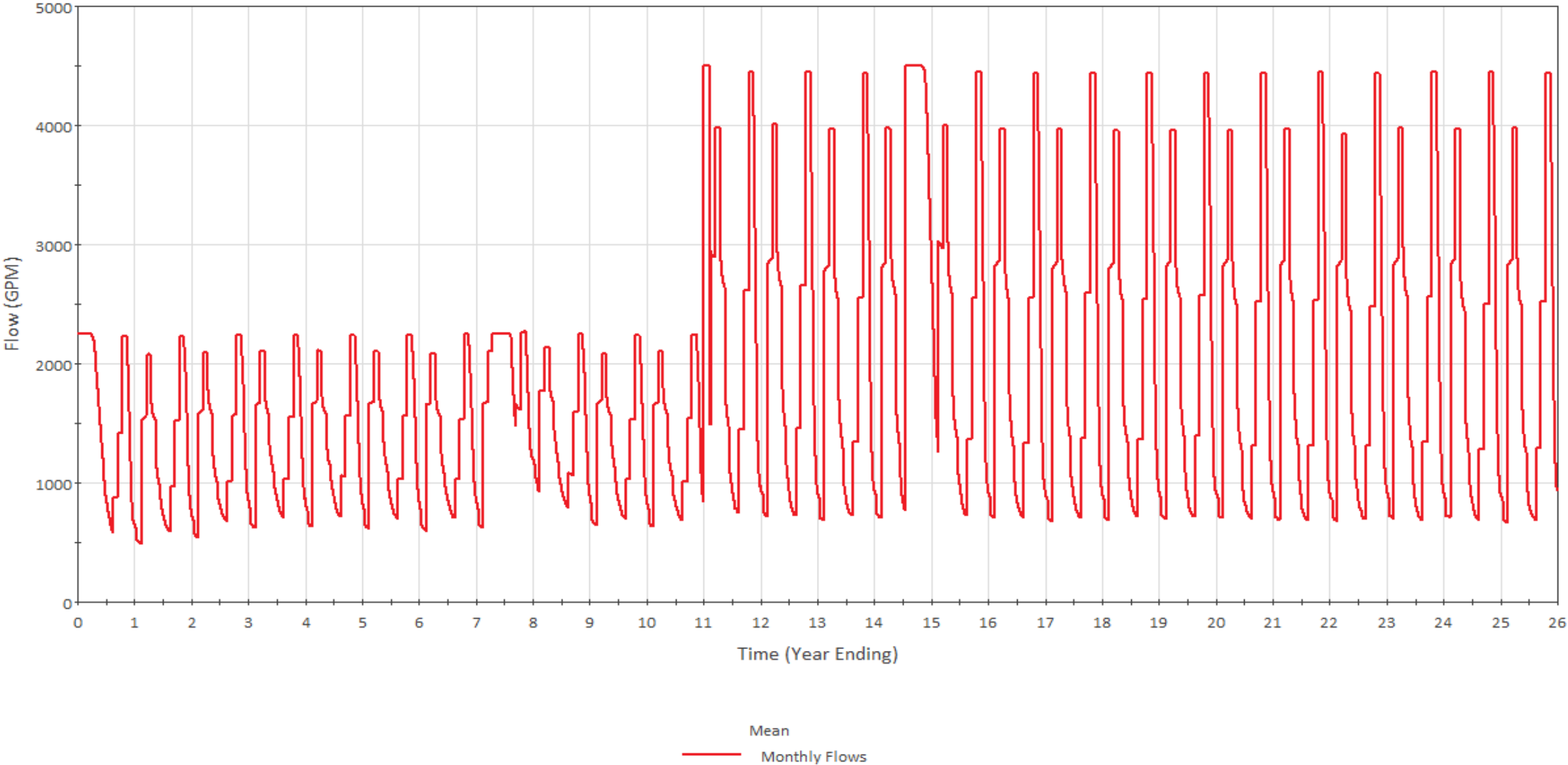


WHITE PINE COPPER LLC

FIGURE A3-5
TDF NORTH POND 2 OUTFLOWS
WHITE PINE NORTH
ONTONAGON COUNTY, MICHIGAN

Date: JULY 2026	Revision Date:	
Drawn By: SGL	Checked By: KBENUSA	Project: 23W200

Water Treatment Plant Mean Monthly Flows - Thickened Tailings Option

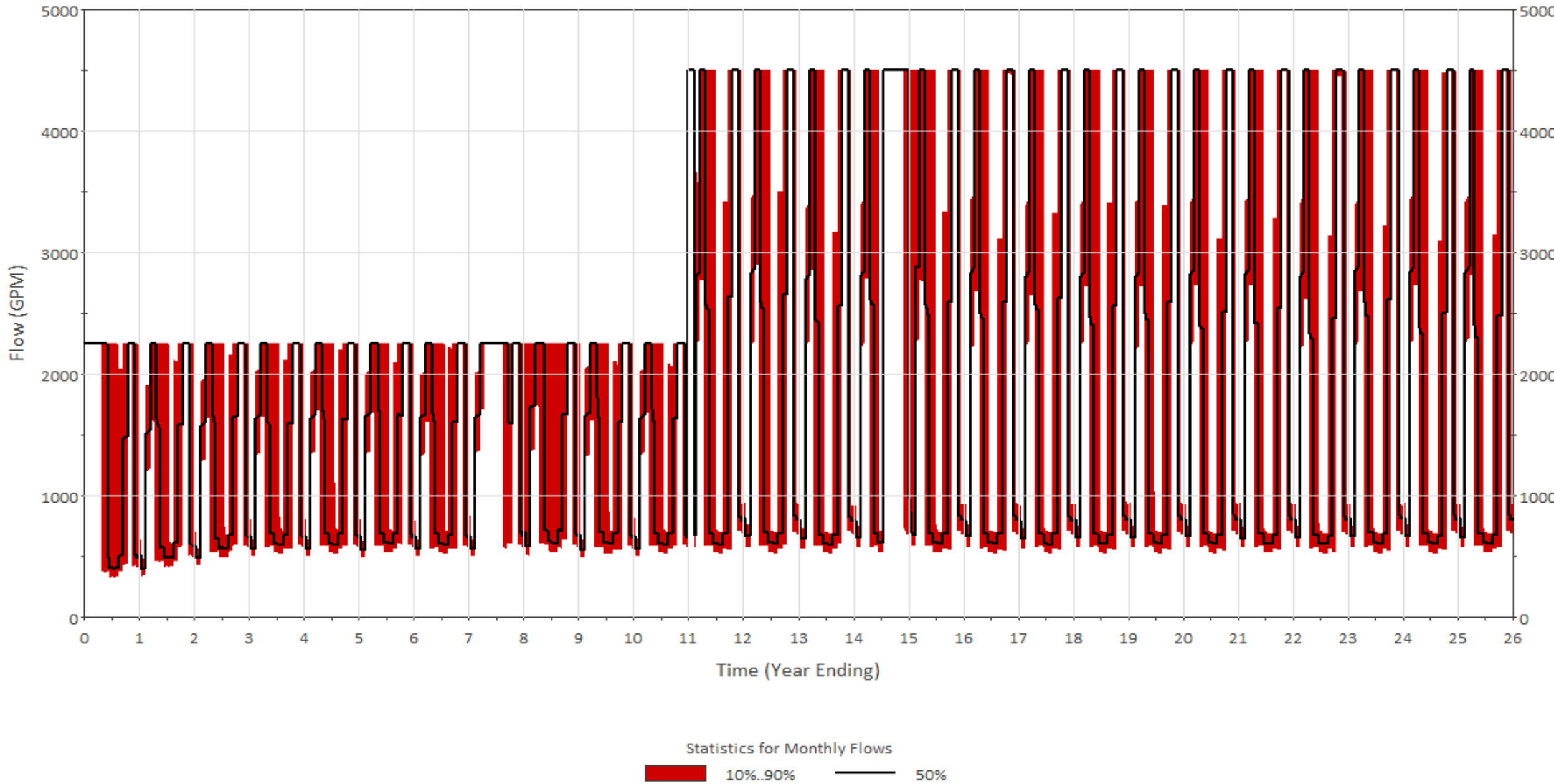


- NOTES:**
- 1. Assumptions made for developing preliminary flow estimates include:
 - TDF NP1 has a surface water drainage area of ~1850 Ac., a combined reclaimed water/stormwater detention pond area of ~274 Ac., and a capacity of ~2164 Ac-ft.
 - TDF NP2 Reclaim Area has a surface water drainage area of ~1897 Ac., a reclaimed water pond area of ~105 Ac., and a capacity of ~2169 Ac-ft.
 - TDF capacities are taken at 2% Deposition slope from Table 4 of the 2/17/26 TetraTech Memo regarding Water Management Philosophy of Operating and Design Storm Conditions.
 - The initial quantity in both NP1 and NP2 is assumed to be 1/3 the total capacity.
 - Water is continuously pumped from the TDF to the treatment plant when available at a rate of 2250 GPM in Years 1 through 11, and 4500 GPM in Years 12 through 26, with additional outflow routed from the TDF to the treatment plant when TDF capacities are reached. Beginning in Year 12, outflow is also routed from NP1 to the treatment plant to match treatment plant extra capacity.
 - Results represent daily averages over 1000 simulations.
 - 2. A 24-hour storm event of 6.34" of precipitation is assumed for May 1 in Year 8 and August 1 in Year 15.



WHITE PINE COPPER LLC		
FIGURE A3-6		
WATER TREATMENT PLANT INFLOW - AVERAGE		
WHITE PINE NORTH		
ONTONAGON COUNTY, MICHIGAN		
Date: JULY 2026	Revision Date:	
Drawn By: SGL	Checked By: KBENUSA	Project: 23W200

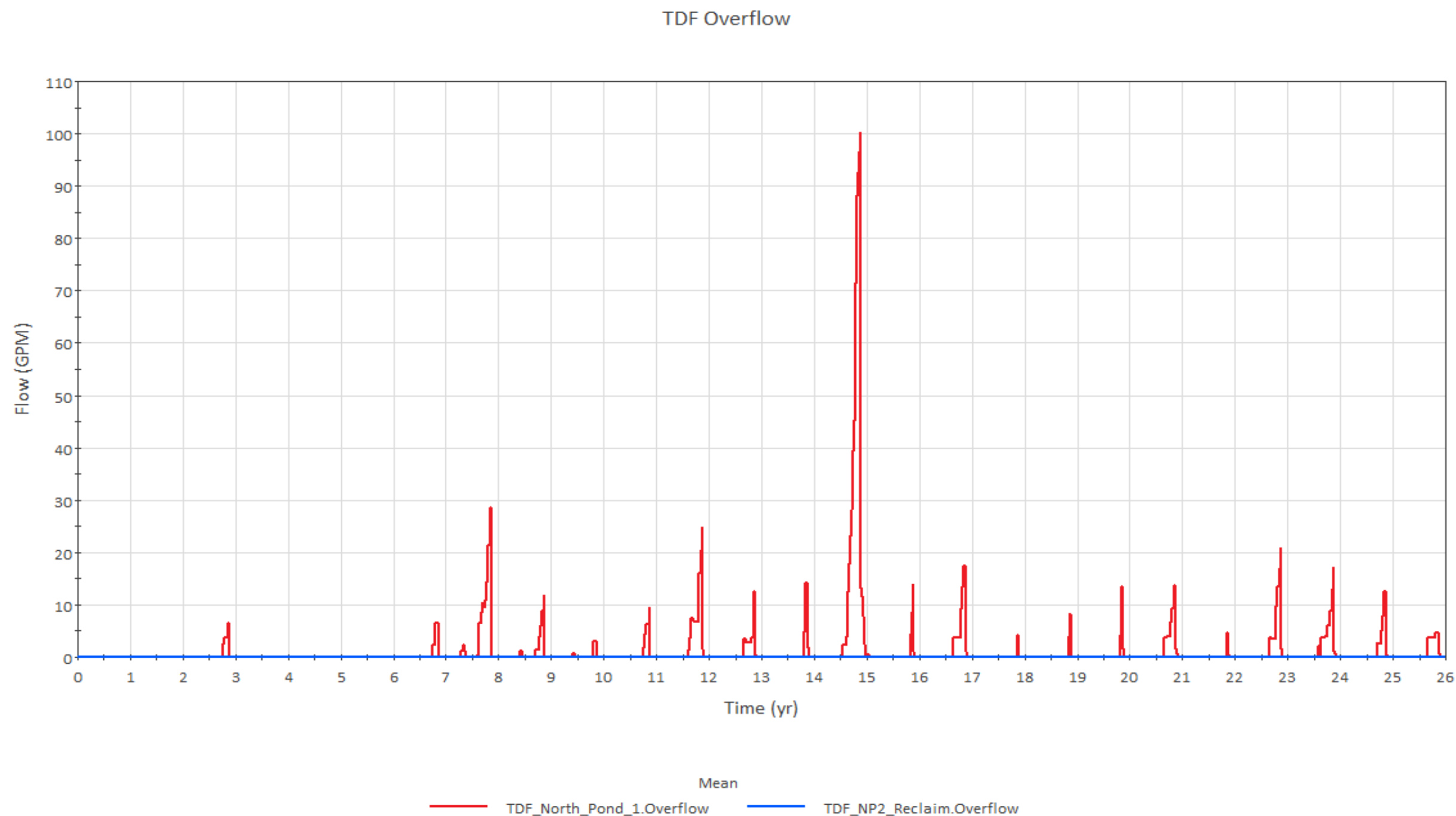
Water Treatment Plant Monthly Flow Statistics - Thickened Tailings Option



- NOTES:**
- Assumptions made for developing preliminary flow estimates include:
 - TDF NP1 has a surface water drainage area of ~1850 Ac., a combined reclaimed water/stormwater detention pond area of ~274 Ac., and a capacity of ~2164 Ac-ft.
 - TDF NP2 Reclaim Area has a surface water drainage area of ~1897 Ac., a reclaimed water pond area of ~105 Ac., and a capacity of ~2169 Ac-ft.
 - TDF capacities are taken at 2% Deposition slope from Table 4 of the 2/17/26 TetraTech Memo regarding Water Management Philosophy of Operating and Design Storm Conditions.
 - The initial quantity in both NP1 and NP2 is assumed to be 1/3 the total capacity.
 - Water is continuously pumped from the TDF to the treatment plant when available at a rate of 2250 GPM in Years 1 through 11, and 4500 GPM in Years 12 through 26, with additional outflow routed from the TDF to the treatment plant when TDF capacities are reached. Beginning in Year 12, outflow is also routed from NP1 to the treatment plant to match treatment plant extra capacity.
 - Results represent daily averages over 1000 simulations.
 - A 24-hour storm event of 6.34" of precipitation is assumed for May 1 in Year 8 and August 1 in Year 15.



WHITE PINE COPPER LLC		
FIGURE A3-6b		
WATER TREATMENT PLANT INFLOW - P10, P50 AND P90		
WHITE PINE NORTH		
ONTONAGON COUNTY, MICHIGAN		
Date: JULY 2026	Revision Date:	
Drawn By: SGL	Checked By: KBENUSA	Project: 23W200



NOTES:

- Assumptions made for developing preliminary flow estimates include:
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 - Water is continuously pumped from the TDF to the treatment plant when available at a rate of 2250 GPM in Years 1 through 11, and 4500 GPM in Years 12 through 26, with additional outflow routed from the TDF to the treatment plant when TDF capacities are reached. Beginning in Year 12, outflow is also routed from NP1 to the treatment plant to match treatment plant extra capacity.
 - Results represent daily averages over 1000 simulations.
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WHITE PINE COPPER LLC

FIGURE A3-7
TDF NP1 AND NP2 EXTRA CAPACITY OUTFLOWS
WHITE PINE NORTH
ONTONAGON COUNTY, MICHIGAN

Date: JULY 2026	Revision Date:
Drawn By: SGL	Checked By: KBENUSA Project: 23W200

2121 Innovation Court, Suite 100
P.O. Box 5095
De Pere, WI 54115-5095
(920) 497-2500
foth.com

August 3, 2026

TO: Project File – 23W200

CC: Steve Donohue, Foth Infrastructure & Environment, LLC
Clinton Roberts, Foth Infrastructure & Environment, LLC

FR: Stephen Lehrke, Ph.D., Foth Infrastructure & Environment, LLC

RE: GoldSim Year 1-11 Legacy Outfall Model Construction

1. Background

A GoldSim model was previously developed to perform probabilistic analysis of the project design elements as provided in the operational water balance. That model encompassed a simulation over a 26-year duration beginning in January of 2027. The main facility elements of the process plant, tailings disposal facility (TDF), underground mine (UM), ore stockpiles (OSP), and the contact water pond (Bedell Pond) were incorporated into the model. Probability distributions of various interest points were assessed including TDF water volumes, available reclaim water for the process plant, flows to the water treatment plant (WTP), and TDF excess capacity outflows.

A second independent GoldSim model was constructed to better understand how the volume will change at North Pond 2 (NP2) during the first 11 years of the project with respect to discharges through the legacy outfall to the environment. The legacy outfall GoldSim model is a basic simulation of outflows from the South Basin and White Pine Mine into NP2, and the resulting NP2 volume and discharge to the environment during this time period.

2. Simulation Settings

The GoldSim modeling platform (GoldSim v15 by the GoldSim Technology Group, LLC [GoldSim]) was used to perform the probabilistic analysis of the legacy outfall model. The legacy outfall GoldSim simulation encompasses an 11-year duration beginning in January of 2027. The simulation runs on a basic timestep of one month, with reporting steps also at one year. Model results therefore represent either monthly or yearly averages.

A realization of the simulation refers to a single outcome of the stochastic inputs. GoldSim creates many realizations to form distributions of possible model outcomes, providing probabilistic estimates for the various model elements. The legacy outfall GoldSim water balance model incorporates 1,000 realizations into the simulation.

While the primary model was developed with monthly timesteps, an alternative version of the legacy outfall model was also developed utilizing daily timesteps and incorporating defined 24-hour storm events. This is further described in Section 5 below.

3. Climate Model

The climate model in the GoldSim simulations is used to generate precipitation and surface water runoff inflows into the South Basin and NP2. The climate model consists of stochastic input elements for annual precipitation and annual open water evaporation. The annual precipitation is defined by a regression equation accounting for an assumed precipitation increase over time due to climate change. Inches of precipitation are estimated by the regression equation as:

$$\text{mean annual precipitation} = 0.0295 * \text{Year} - 25.901$$

where “Year” represents the four-digit year value. The stochastic mean annual precipitation input is assumed to be normally distributed with a standard deviation of 6.4 inches. During the 11-year simulated time period beginning in January of 2027, the average annual precipitation ranges from 33.9 in/yr to 34.2 in/yr.

This equation was determined through climate change analysis incorporating annual precipitation data projected by National Oceanic and Atmospheric Administration (NOAA) Climate Explorer for Ontonagon County, MI using their R85 (high) carbon emissions scenario for years 2005 through 2100. The projected mean annual precipitation equation is the linear correlation equation for the projected data set.

Evaporation is likewise defined by a regression equation incorporating the results of climate change modeling. The equation estimates inches of open water evaporation as:

$$\text{mean annual evaporation} = ((27.37 - 21.61) / 70) * (\text{Year} - 2005) + 21.61$$

again where “Year” represents the four-digit year value. The stochastic mean annual evaporation input is assumed to be normally distributed with a standard deviation of 4.5 inches, being 0.7 times the standard deviation of the annual precipitation, since on average the annual evaporation is approximately 70% of annual precipitation. During the 11-year simulated time period beginning in January of 2027, the average annual open water evaporation ranges from 23.4 in/yr to 24.3 in/yr.

The evaporation equation was determined through climate change analysis incorporating monthly temperature data projected by NOAA Climate Explorer for Ironwood, MI using their R85 (high) carbon emissions scenario for years 2005 through 2075. The projected monthly evaporation was estimated using the monthly temperature projection data and Thornthwaite’s monthly evaporation vs. temperature calculation methodology. This yielded the projected mean annual evaporation as a linear correlation equating for the projected data set.

Also, through the climate change analysis, a monthly percentage distribution of the annual precipitation and evaporation values was provided. These distributions are shown below in Table 1.

Snowmelt is incorporated into the climate model by accumulating the precipitation over winter months and releasing a percentage during spring runoff. Precipitation is accumulated for the months of December, January, and February. During March, 40% of this accumulation is released, and during April, the remaining 60% is released.

Table 1
Percent of Annual Precipitation and Evaporation by Month

	% of Annual Precipitation Distributed by Month	% of Annual Evaporation Distributed by Month
January	6.3%	0.0%
February	4.1%	0.0%
March	6.2%	0.0%
April	8.2%	5.1%
May	10.7%	11.7%
June	11.2%	17.5%
July	9.7%	20.4%
August	9.4%	19.7%
September	10.4%	15.0%
October	8.8%	8.7%
November	8.3%	1.8%
December	6.7%	0.0%

Prepared by: SGL
Checked by: CER

4. Design Element Dimensions and Flows

Precipitation runoff is captured from the South Basin area and modeled as a pass-through volume directly to NP2. The South Basin dimensions are:

- ◆ South Basin
 - Pond Area = 200 acres (ac)
 - Drainage Area (Excluding Pond Area) = 1,100 ac

NP2 in the model is defined as a GoldSim pool element with calculated inflows and outflows, and in addition, has associated overall capacity definitions. The NP2 dimensions are:

- ◆ NP2
 - Pond Area = 390 ac
 - Drainage Area (Excluding Pond Area) = 2,060 ac
 - Capacity to the discharge pipe invert elevation = 8.582×10^9 gallons (26,337 acre-ft or 32,486,488 m³)
 - Additional capacity to the freeboard elevation = 1.6293×10^9 gallons (5000 acre-ft or 6,167,400 m³)

The NP2 pond area, capacity to the discharge pipe invert elevation and the additional capacity to the freeboard elevation were provided by Tetra Tech (Tetra Tech, 2026).

Stochastic inflows into NP2 are water from the South Basin and direct precipitation onto NP2. A deterministic inflow to NP2 of 546 gpm is defined for dewatering of the White Pine Mine. Evaporation in both the pond areas and drainage areas in the South Basin and NP2 were accounted for in the model by applying the open water evaporation methodology discussed in Section 3 above. At the beginning of Year 1, NP2 is assumed to be filled to one-third of the capacity to the outfall discharge pipe invert elevation.

NP2 inflow average values over the 1,000 GoldSim realizations are illustrated on Figure 1. Inflows peak during spring runoff, taper during the summer months when evaporation is higher due to warmer temperatures and increase again during the cooler months of fall.

Water may discharge from NP2 through the legacy outfall discharge pipe reaching a total peak rate of 156.2 cfs (Tetra Tech, 2024). Using this discharge rate, resulting NP2 water volumes during Years 1-11 are shown on Figure 2. With the assumption of a beginning NP2 volume of one-third the capacity, the outfall discharge elevation is reached by the end of Year 3. The freeboard water elevation is not reached.

5. Daily Timestep with 24-Hour Storm Event

An alternative GoldSim model applying a daily basic timestep was developed to assess the impact of a 100-year 24-hour storm event. The storm event was defined be a deterministic event of 6.34 inches of precipitation. This event was programmed to occur for May 1 in Year 8. All other model elements as described above were maintained, with the exception of modifying certain formulas to correctly convert precipitation units from monthly to daily. The simulation results including the 24-hour storm event for the NP2 inflows are illustrated on Figure 3, and the NP2 water volumes on Figure 4.

The effect of the storm event on the inflows are seen as a precipitation spike on Figure 3 and a discharge spike on Figure 4. The 24-hour storm in Year 8, however, doesn't drive the NP2 volume to reach the freeboard capacity elevation.

6. Conclusions

The NP2 legacy outfall GoldSim model was developed as an independent simulation model for Years 1-11 providing an evaluation of NP2 inflows, volumes, and discharges during that timeframe. The model was based on a monthly timestep utilizing precipitation and open water evaporation estimates from the climate change analysis incorporating annual precipitation data projected by National Oceanic and Atmospheric Administration (NOAA) Climate Explorer. An additional GoldSim model applying a daily basic timestep was developed to assess the impact of a 24-hour storm event, deterministically defined as 6.34 inches of precipitation for May 1 in Year 8.

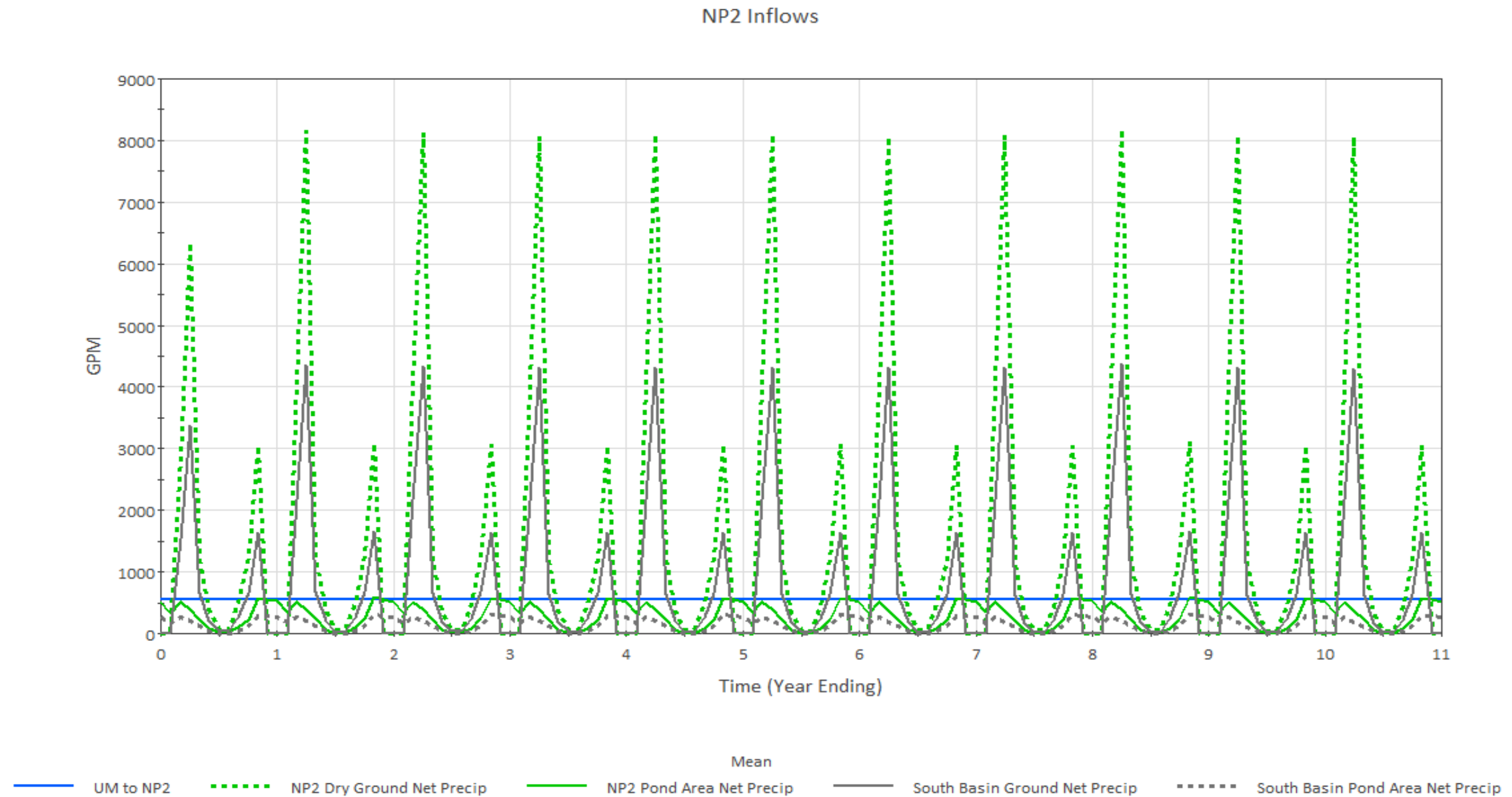
Model inflows to NP2 are precipitation and runoff from the NP2 pond area and drainage area, a deterministic flow of 546 gpm from the White Pine Mine, and pass-through runoff from the South Basin. The legacy outfall discharges up to 156.2 cfs at peak water volumes. Based on the defined inflows and discharges, the NP2 water volume reaches general yearly average steady state conditions of 7.19×10^9 gallons (22,070 acre-ft), discharging a yearly average of 3360 gpm (7.5 cfs) to the environment. While fluctuations are present from spring runoff and varying amounts of evaporation from warmer summer months and cooler falls months, the simulations indicate NP2 volumes remain below the freeboard elevation.

References

Tetra Tech (2024). White Pine Mine Hydrologic Analysis, Table 2-8. Tetra Tech, Lakewood, CO. October 2024.

Tetra Tech (2026). Email communication on May 28, 2026, from Chad Tomlinson
Re: *Pre-operations pond storage volumes*.

Attachments



NOTES:

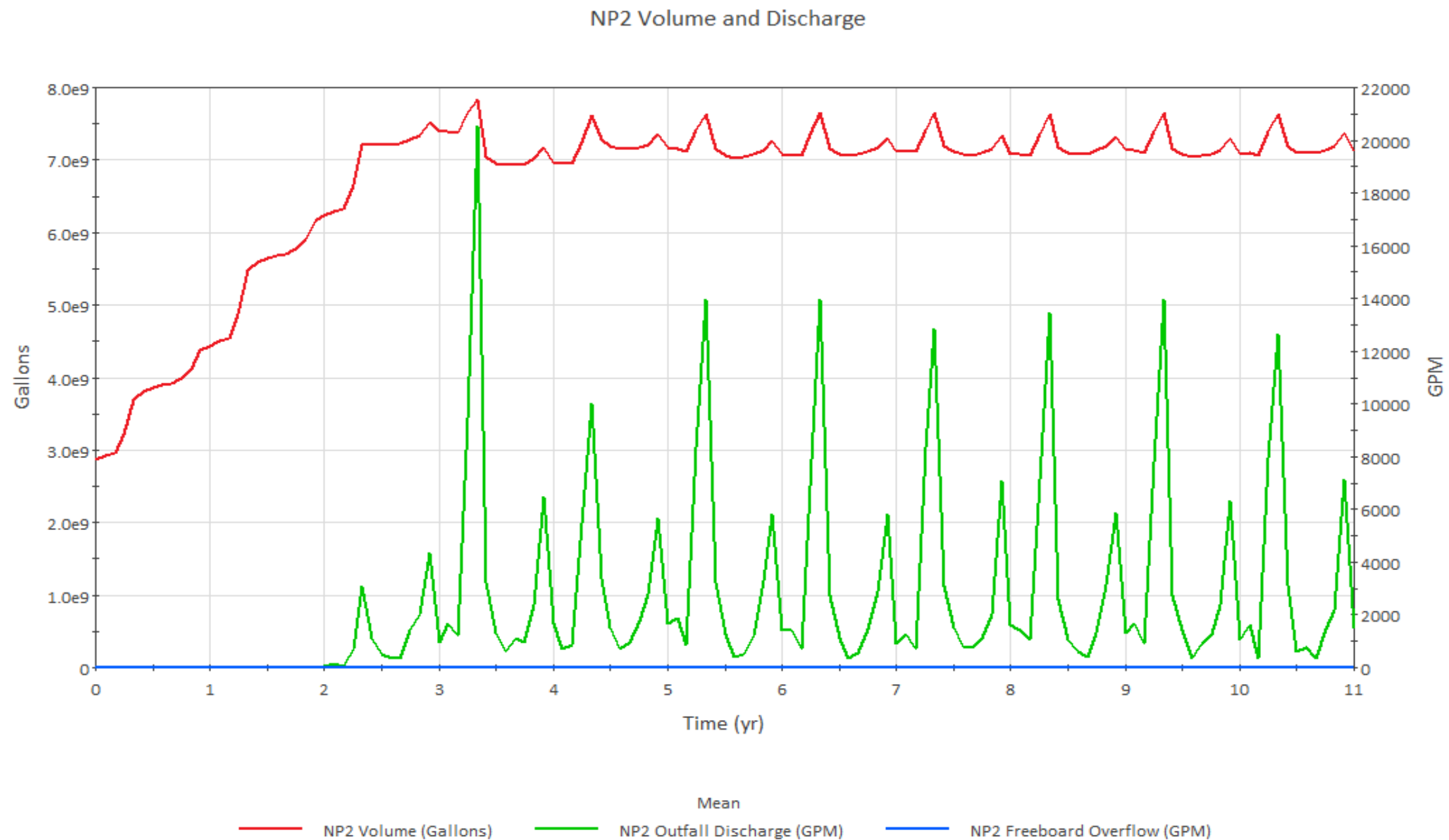
- Assumptions made for developing preliminary flow estimates include:
 - Flow from precipitation onto South Basin is a pass through volume to NP2. The South Basin area is approximately 1300 acres, with 200 acres being pond water and the remaining area being tailings (dry ground).
 - Inflows into NP2 are water from the South Basin, dewatering from White Pine Mine, and direct precipitation onto NP2. The NP2 area is approximately 2450 acres, with 390 acres (1577014 m²) being pond water and the remaining area being tailings (dry ground). The total NP2 pond water volume to the discharge pipe invert elevation is 8.582x10⁹ gallons (32,486,488 m³).
 - Water discharges from NP2 through the legacy outfall discharge pipe at a total peak rate of 156.2 cfs. Above the discharge pipe elevation, an additional capacity of 1.6293x10⁹ gallons (5000 acre-ft) exists to the freeboard elevation.
 - At time 0, NP2 is assumed to be filled to 1/3 of the capacity to the outfall discharge elevation.
 - Evaporation within both the pond water and dry ground areas is assumed to occur at an average open water evaporation rate of 23 to 24 inches per year based on the climate change model.
 - Results are given for the NP2 existing conditions over Years 1 to 11, and represent monthly averages over 1000 simulations.

WHITE PINE COPPER LLC

FIGURE 1
NP2 INFLOWS FOR Y1-11 EXISTING CONDITIONS
WHITE PINE NORTH
ONTONAGON COUNTY, MICHIGAN

Date: JULY 2026	Revision Date:
Drawn By: SGL	Checked By: CER2 Project: 23W200





NOTES:

- Assumptions made for developing preliminary flow estimates include:
 - Flow from precipitation onto South Basin is a pass through volume to NP2. The South Basin area is approximately 1300 acres, with 200 acres being pond water and the remaining area being tailings (dry ground).
 - Inflows into NP2 are water from the South Basin, dewatering from White Pine Mine, and direct precipitation onto NP2. The NP2 area is approximately 2450 acres, with 390 acres (1577014 m²) being pond water and the remaining area being tailings (dry ground). The total NP2 pond water volume to the discharge pipe invert elevation is 8.582x10⁹ gallons (32,486,488 m³).
 - Water discharges from NP2 through the legacy outfall discharge pipe at a total peak rate of 156.2 cfs. Above the discharge pipe elevation, an additional capacity of 1.6293x10⁹ gallons (5000 acre-ft) exists to the freeboard elevation.
 - At time 0, NP2 is assumed to be filled to 1/3 of the capacity to the outfall discharge elevation.
 - Evaporation within both the pond water and dry ground areas is assumed to occur at an average open water evaporation rate of 23 to 24 inches per year based on the climate change model.
 - Results are given for the NP2 existing conditions over Years 1 to 11, and represent monthly averages over 1000 simulations.

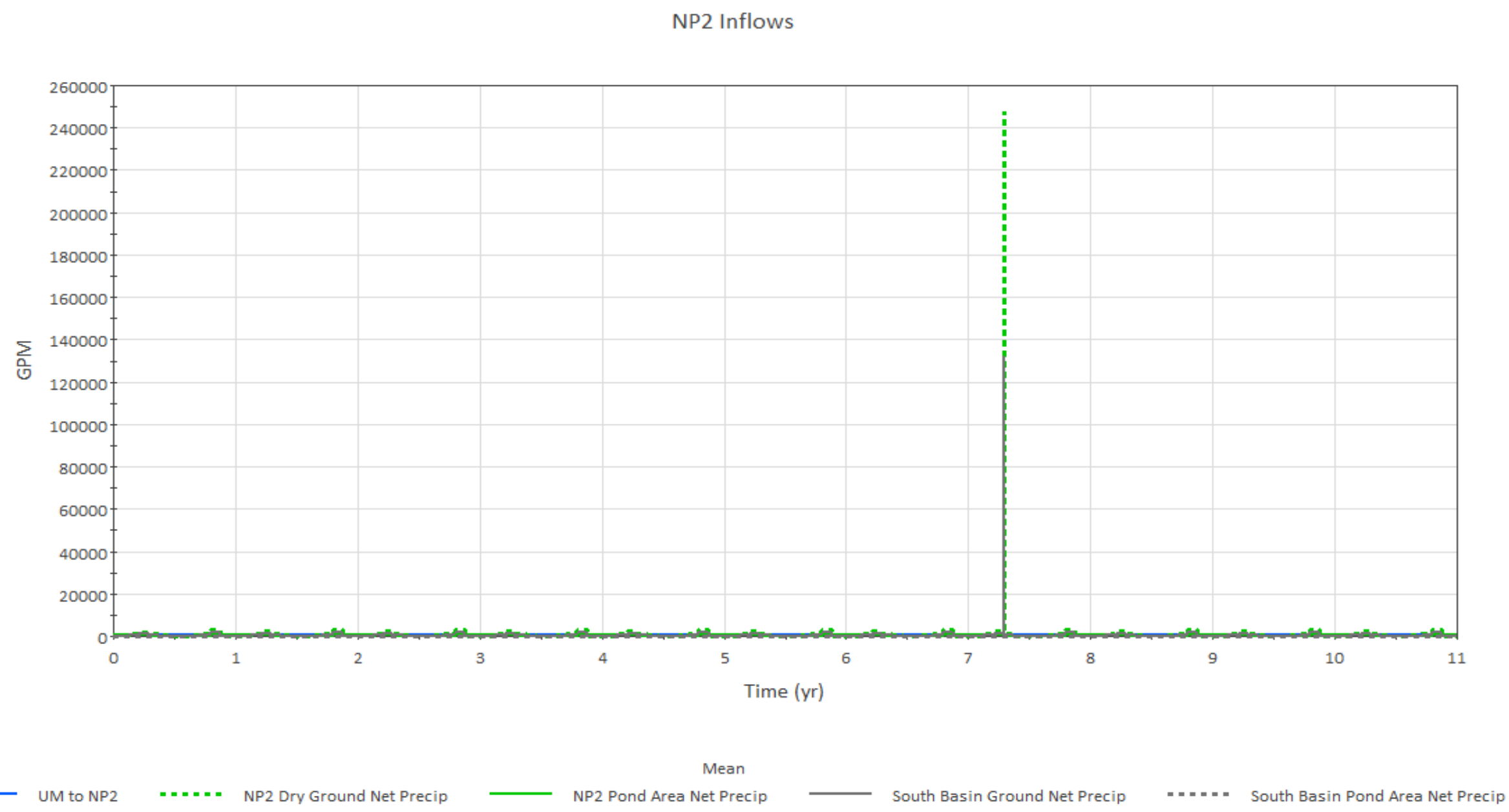


WHITE PINE COPPER LLC

FIGURE 2
NP2 DISCHARGE FOR Y1-11 EXISTING CONDITIONS

WHITE PINE NORTH
ONTONAGON COUNTY, MICHIGAN

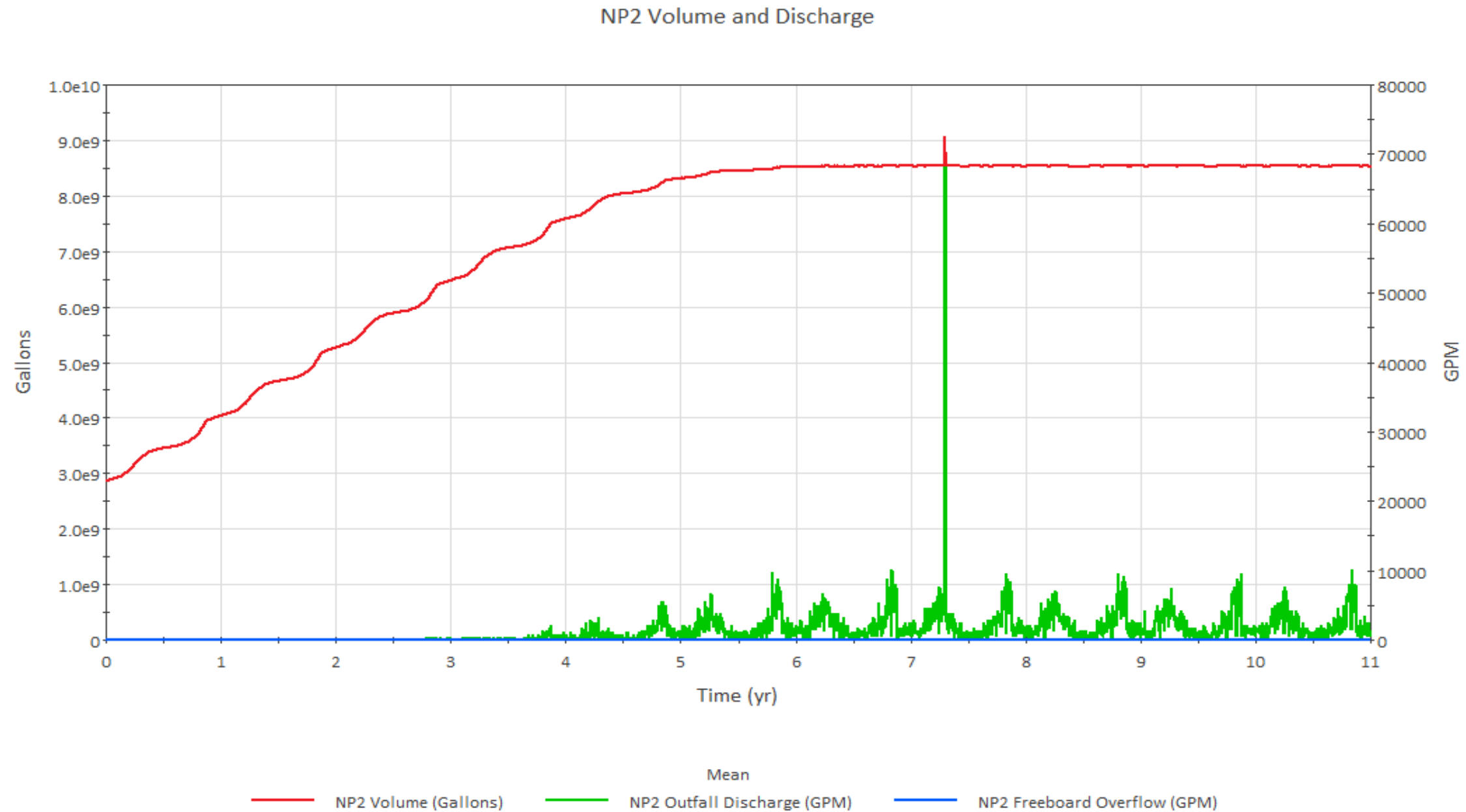
Date: JULY 2026	Revision Date:
Drawn By: SGL	Checked By: CER2 Project: 23W200



- NOTES:**
- 1. Assumptions made for developing preliminary flow estimates include:
 - Flow from precipitation onto South Basin is a pass through volume to NP2. The South Basin area is approximately 1300 acres, with 200 acres being pond water and the remaining area being tailings (dry ground).
 - Inflows into NP2 are water from the South Basin, dewatering from White Pine Mine, and direct precipitation onto NP2. The NP2 area is approximately 2450 acres, with 390 acres (1577014 m²) being pond water and the remaining area being tailings (dry ground). The total NP2 pond water volume to the discharge pipe invert elevation is 8.582x10⁹ gallons (32,486,488 m³).
 - Water discharges from NP2 through the legacy outfall discharge pipe at a total peak rate of 156.2 cfs. Above the discharge pipe elevation, an additional capacity of 1.6293x10⁹ gallons (5000 acre-ft) exists to the freeboard elevation.
 - At time 0, NP2 is assumed to be filled to 1/3 of the capacity to the outfall discharge elevation.
 - Evaporation within both the pond water and dry ground areas is assumed to occur at an average open water evaporation rate of 23 to 24 inches per year based on the climate change model.
 - Results are given for the NP2 existing conditions over Years 1 to 11, and represent daily averages over 1000 simulations.
 - 2. A 24-hour storm event was defined be a deterministic event of 6.34 inches of precipitation. This event was programmed to occur for May 1st in Year 8.



WHITE PINE COPPER LLC		
FIGURE 3		
NP2 INFLOWS ASSUMING 24-HOUR STORM		
WHITE PINE NORTH		
ONTONAGON COUNTY, MICHIGAN		
Date: JULY 2026	Revision Date:	
Drawn By: SGL	Checked By: CER2	Project: 23W200



NOTES:

- Assumptions made for developing preliminary flow estimates include:
 - Flow from precipitation onto South Basin is a pass through volume to NP2. The South Basin area is approximately 1300 acres, with 200 acres being pond water and the remaining area being tailings (dry ground).
 - Inflows into NP2 are water from the South Basin, dewatering from White Pine Mine, and direct precipitation onto NP2. The NP2 area is approximately 2450 acres, with 390 acres (1577014 m²) being pond water and the remaining area being tailings (dry ground). The total NP2 pond water volume to the discharge pipe invert elevation is 8.582x10⁹ gallons (32,486,488 m³).
 - Water discharges from NP2 through the legacy outfall discharge pipe at a total peak rate of 156.2 cfs. Above the discharge pipe elevation, an additional capacity of 1.6293x10⁹ gallons (5000 acre-ft) exists to the freeboard elevation.
 - At time 0, NP2 is assumed to be filled to 1/3 of the capacity to the freeboard elevation.
 - Evaporation within both the pond water and dry ground areas is assumed to occur at an average open water evaporation rate of 23 to 24 inches per year based on the climate change model.
 - Results are given for the NP2 existing conditions over Years 1 to 11, and represent daily averages over 1000 simulations.
- A 24-hour storm event was defined be a deterministic event of 6.34 inches of precipitation. This event was programmed to occur for May 1st in Year 8.



WHITE PINE COPPER LLC

FIGURE 4
NP2 DISCHARGE ASSUMING 24-HOUR STORM
WHITE PINE NORTH
ONTONAGON COUNTY, MICHIGAN

Date: JULY 2026	Revision Date:
Drawn By: SGL	Checked By: CER2 Project: 23W200

Appendix D

**Predictive Model of Water Treatment Plant Influent Chemistry During
Operations**

Predictive Model of Water Treatment Plant Influent Chemistry during Operations

White Pine North Project, Ontonagon County, Michigan, USA
White Pine Copper LLC



SRK Consulting (U.S.), Inc. ■ USPR001955 ■ August 11, 2026



Predictive Model of Water Treatment Plant Influent Chemistry during Operations

White Pine North Project, Ontonagon County, Michigan, USA

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File Name:
WhitePineNorth_WTPInfluentPrediction_USPR001955_Rev02.docx

Suggested Citation:
SRK Consulting (U.S.), Inc. 2026. Predictive Model of Water Treatment Plant Influent Chemistry during Operations. Draft. Prepared for White Pine Copper LLC: Wakefield, Michigan. Project number: USPR001955. Issued August, 2026.

Cover Image:
Aerial view of Bedell Pond and North Dam 2, image from Kinterra Capital website

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SRK Consulting (U.S.), Inc. ■USPR001955 ■August 11, 2026



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Appendix A Input Solution Concentrations

Appendix B Water Balance and Mixing Proportions

Appendix C Predicted Water Treatment Influent Chemistry

Useful Definitions

This list contains definitions of symbols, units, abbreviations, and terminology that may be unfamiliar to the reader.

Unit or Term	Abbreviation
Acid Rock Drainage	ARD
Environment, Great Lakes, and Energy	EGLE
Lower Sandstone	LWSA
Mercury Deposition Network	MDN
Metal Leachate	ML
National Atmospheric Deposition Program	NADP
Net Acid Generation	NAG
North Dam 1	ND1
North Dam 2	ND2
Non-potentially Acid Generating	Non-PAG
Nitrous Oxide Gas	NOx
National Pollution Discharge Elimination System	NPDES
National Trend Network	NTN
Oxidation Reduction Potential	ORP
Potentially Acid Generating	PAG
Potential Constituents of Concern	PCOC
Preliminary Effluent Limits	PEL
Parting Shale	PS
SRK Consulting (U.S.), Inc	SRK
Total Dissolved Solids	TDS
Total Suspended Solids	TSS
Upper Sandstone	UPSA
Wide Laminated Siltstone	WIDE
White Pine Copper, LLC	WPC
The White Pine North Project	WPN or the Project
Water Treatment Plant	WTP

Executive Summary

The White Pine North Project (WPN or the Project) is a proposed underground copper-silver mine located on a brownfields site in Carp Lake Township, Michigan, owned by White Pine Copper, LLC (WPC). WPC, a wholly owned subsidiary of Kinterra Copper USA, LLC, contracted SRK Consulting (U.S.), Inc. (SRK) to predict water treatment plant influent chemistry during the 26 year operational period of the project. Results of the prediction will be used to design a water treatment plant required to meet project objectives.

SRK predicted the future water quality of water treatment plant influent using the geochemical modeling program PHREEQC. The following datasets were used to define eight input solutions used by the program:

- Data provided by WPC for North Dam 1 (ND1) pond water, North Dam 2 (ND2) pond water, and Bedell Pond contact water
- Laboratory results for underground mine water chemistry based on humidity cell tests and assumed nitrogen-based explosive use, process water chemistry based on metallurgical process tests, and barrier wall runoff chemistry based on net acid generation tests (NAG)
- Measured rainwater chemistry from the National Atmospheric Deposition Program and the Mercury Deposition Network (MDN) in Brule River, Wisconsin

The PHREEQC model mixed these input solutions in annual time steps based on the proportions of inflows to ND1 (Years 1 to 11) and ND2 (Years 12 to 26) specified in an operational water balance provided by Foth (Simulation Number 861, June 16, 2026) for average conditions. PHREEQC evaporated water at proportions defined by the water balance, and allowed oversaturated minerals to precipitate (i.e., barite, ferrihydrite, and gibbsite). The resulting solution chemistry was equal to average water treatment plant influent chemistry for a given year and the residual pond water chemistry used at the start of the following year.

The water balance showed that over 45% to 49% of water entering the water treatment plant on an annual basis was derived from beach runoff from either ND1 or ND2, such that, the chemistry of beach runoff strongly influenced model results. The water balance also showed that 47% to 71% of incident rainwater landing on the beach or pond surface would be lost to evaporation, and the removal of fresh water resulted in some degree of evapo-concentration.

To identify potential constituents of concern (PCOC), model results were compared against the proposed site-specific limit for chloride and draft Preliminary Effluent Limits (PEL) for other parameters at the proposed water treatment plant outfall to the Mineral River provided by Foth (July 23, 2026). The model predicted that the water treatment plant influent will have a circumneutral pH between 6.9 and 7.3 s.u. The placement of a barrier wall composed of a mixture of potentially acid generating (PAG) Nonesuch Formation material and non-potentially acid generating Freda Formation material on top of ND1 did not significantly impact the pH of the water treatment plant influent. Multiple conservative assumptions were applied to the reactivity of Nonesuch waste rock (i.e., NAG leachate data used to represent runoff chemistry; all Nonesuch material assumed to be PAG) to predict the lowest possible pH and the maximum possible parameter concentrations.

Model results show concentrations of chloride, copper, mercury, and silver in exceedance of water quality limits. Elevated chloride is driven by the release of saline formation water from ore units (e.g., Parting Shale) added to mine water during underground operations. Except for rainwater, all model inputs have elevated copper concentrations in exceedance of PEL limits (i.e., beach runoff, process water, mine water, and contact water) which resulted in elevated copper in water treatment plant influent. Humidity cell tests on waste rock and tailings by SRK (2026) found little to no evidence of mercury release from site materials. The only sources of mercury are rainwater and ND2 pond water and ND2 beach runoff which are strongly influenced by atmospheric deposition.

The predicted exceedance in silver is believed to be an artifact of the high laboratory reporting limit used for the process water sample and is not indicative of future silver concentrations in water treatment plant influent. The silver concentration was below the laboratory reporting limit in the process water sample, and a concentration equal to half the reporting limit was used in the model. However, the half-reporting-limit concentration exceeded the PEL limit such that the addition of process water caused the predicted silver concentration in water treatment plant influent to exceed the PEL limit. Humidity cell tests on waste rock and tailings samples did not identify mine materials as a potential source of silver.

1 Introduction

The White Pine North Project (WPN or Project) is a proposed underground copper-silver mine near Carp Lake Township, Michigan. The project is owned by White Pine Copper, LLC (WPC), wholly owned by Kinterra Copper USA LLC. WPC contracted SRK Consulting (U.S.) Inc., (SRK), in Reno, Nevada to prepare a geochemical prediction of influent water chemistry to the mine water treatment plant (WTP) during the 26 year operational period. The following report describes model inputs, the modeling approach, and the results of the geochemical prediction. Results of this study will be used to inform the design of the mine WTP.

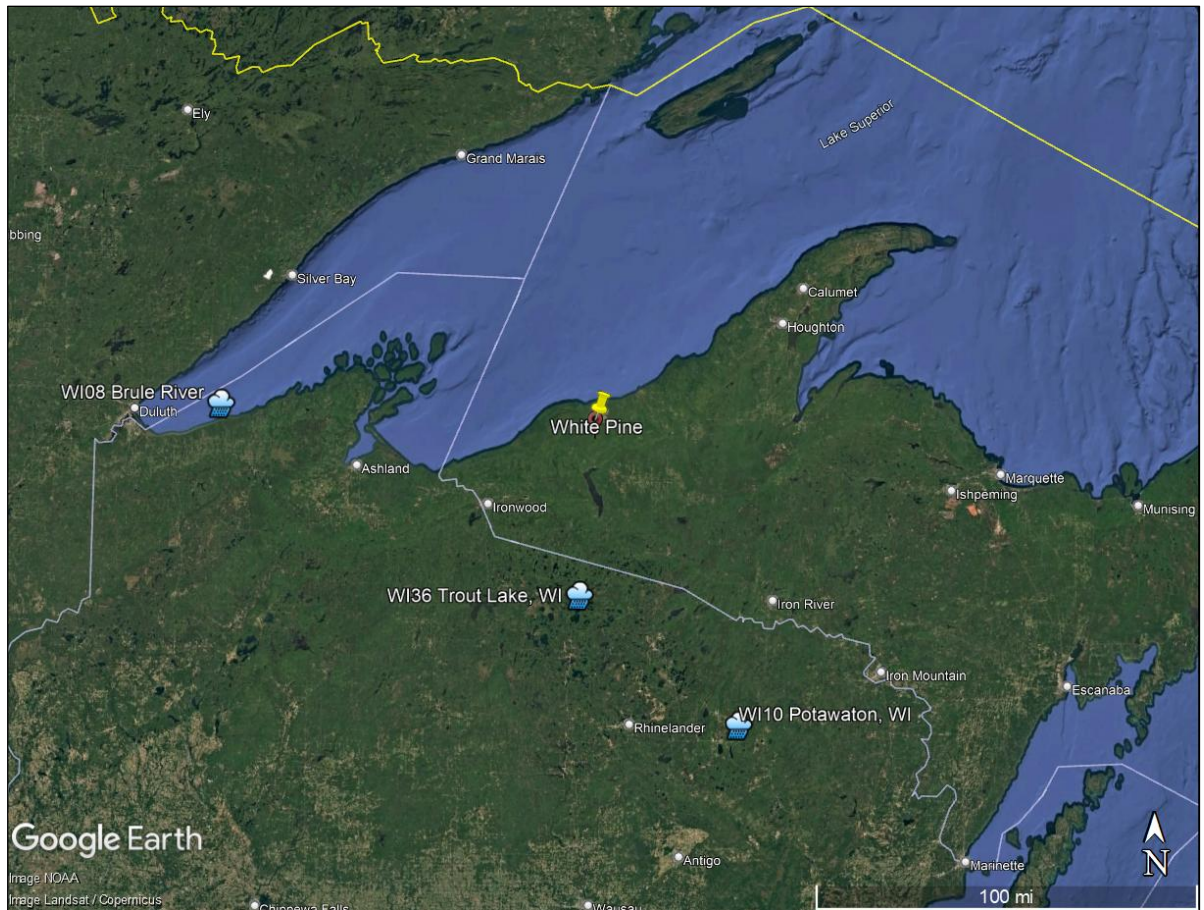
2 Background and Conceptual Flow Models

The Project is located on the western side of the Upper Peninsula of Michigan, approximately 7.5 kilometers (km) (5 miles) south of Lake Superior, near the town of White Pine (Figure 2-1). Most of the surface footprint is occupied by three historic tailings storage facilities, called South Dam, North Dam 1 (ND1), and North Dam 2 (ND2), and Bedell Pond, an industrial stormwater collection basin for the future mill site (Figure 2-2).

Near the Project is the historic White Pine Mine which operated from 1953 to 1995. The historic underground mine was excavated using the same room-and-pillar mining method as the proposed Project. Now in closure, the water level in the flooded White Pine Mine is actively maintained below the surface elevation of Lake Superior to create a regional groundwater sink. At present, legacy water from White Pine Mine is pumped into ND1, combines with ND1 beach runoff and stormwater from the Bedell Pond and drains into the ND1 pond. ND1 pond drains into ND2. The ND2 pond discharges to a perimeter ditch and a series of stilling ponds located to the West and North of ND2. Water then discharges into Perch Creek and finally into the Mineral River, a 30 km long (18.7 mile long) river that flows north into Lake Superior. The Mineral River is classified as a Western Lake Superior Coastal Watershed. Duck Creek and Miles Creek, two streams located just East of Mineral Creek, had reported summer water temperatures of 22.2 °C (72 °F) and 20.6 °C (69 °F) on July 18 and July 19, 2013, respectively (MDEQ 2015).

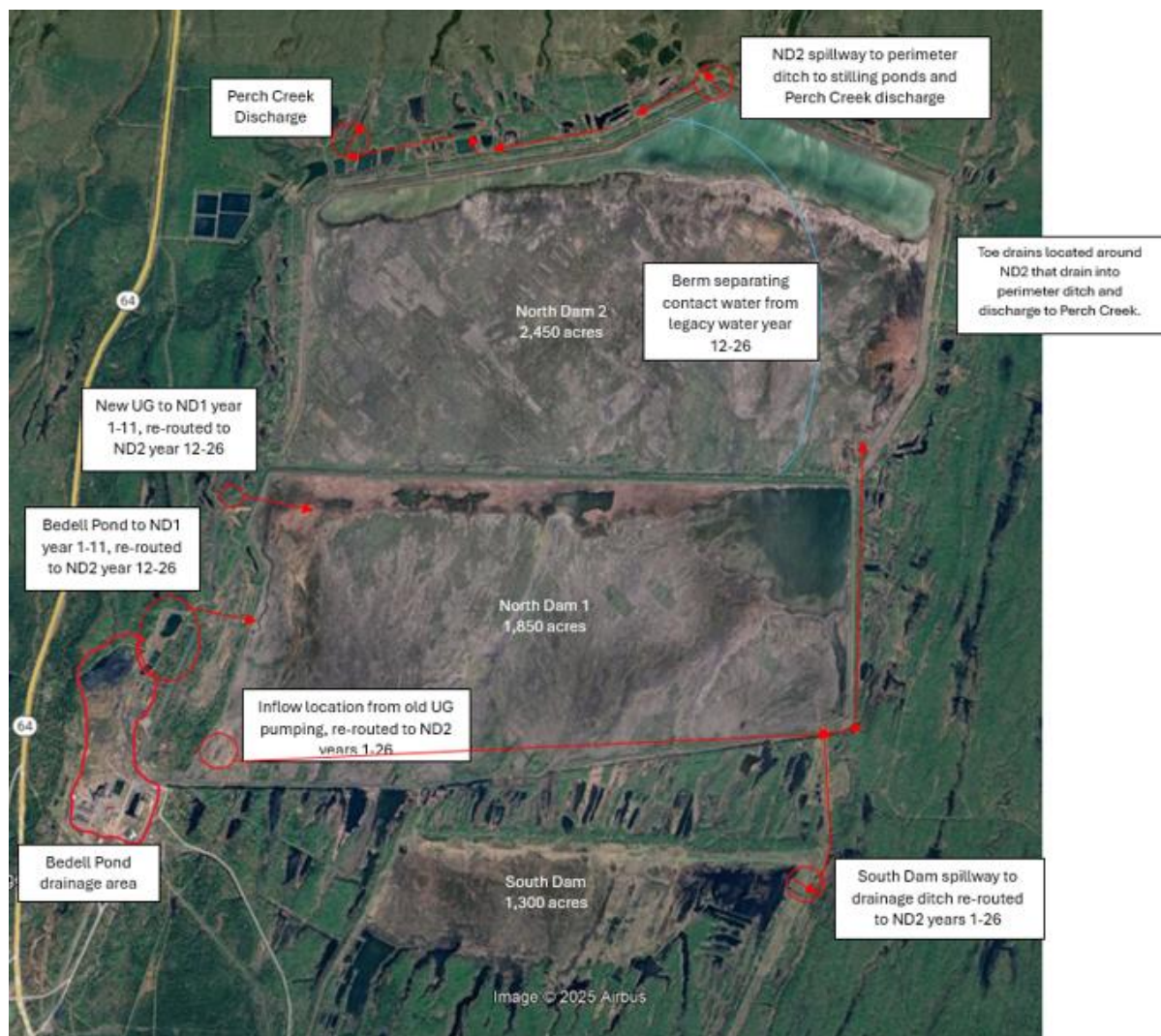
Mining operations will target the Parting Shale ore unit which is located below glacial till, the Freda Formation, the Nonesuch Formation, and several minor ore layers. During development, approximately 1.5 million metric tonnes of waste rock excavated from the Freda and Nonesuch Formation during development of the decline and vent raises 1 and 2 will be reused on ND1 to construct an interior barrier wall required by the proposed deposition plan. For modeling purposes SRK assumed the barrier wall will be a square-shaped feature with the geometry of a flat-topped-pyramid, approximately 2 meters (m) (6.6 feet (ft)), approximately 640 m (2,100 ft) per side, and have a surface area of 418,000 meters squared (4.5 million feet squared). The barrier wall will occupy only 7.7% of the ND1 beach surface area and will be composed of approximately 80% Nonesuch Formation and 20% Freda Formation. Material characterization studies (SRK 2026a) found that some rock from Nonesuch Formation is potentially acid generating (PAG) whereas all rock from the Freda Formation is non-potentially acid generating (Non-PAG).

Figure 2-1: Location Map of the White Pine North Project, Michigan, Showing Locations of MDN Stations



Source: Google Earth

Figure 2-2: Key Surface Features During Operations, Years 1 to 26



Source: WPC

During the first 11 years of operations, a tailings slurry from the mill will be pumped to the beach of ND1. The ND1 pond will slightly increase in volume due to water added from following inflows:

- Runoff from the ND1 beach (Beach Runoff)
- Runoff from the barrier wall (Barrier Wall Runoff)
- Water pumped from the new underground mine (Underground Mine Water)
- Contact water from the mill site via the Contact Water Pond (CWP), formerly Bedell Pond (Contact Water)
- Process water from the liquid fraction of the tailings slurry (Process Water)

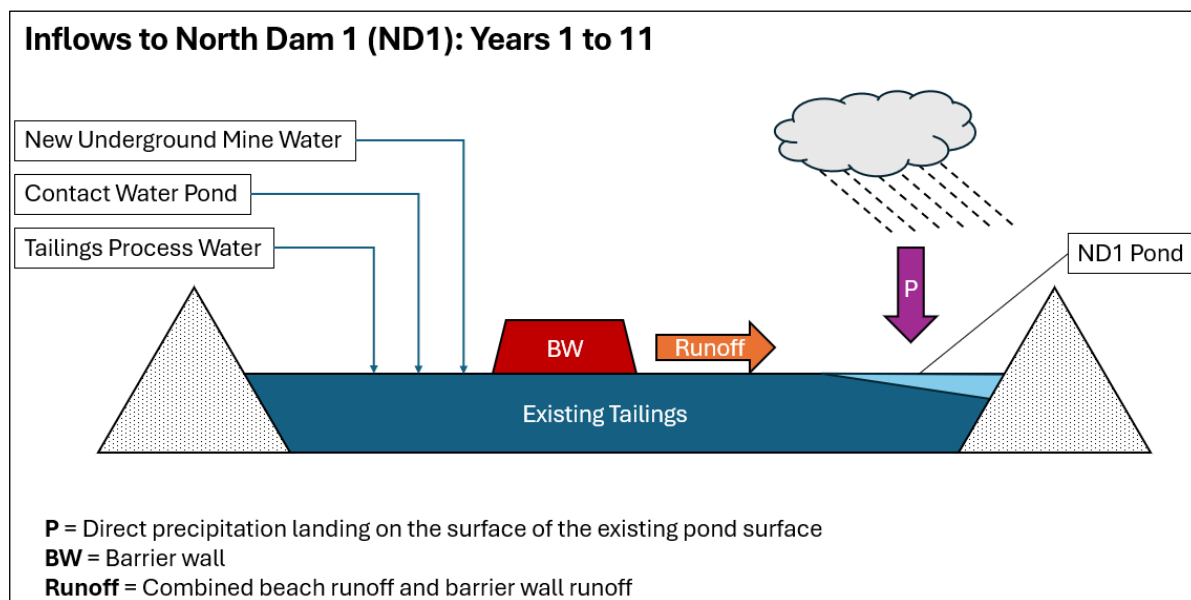
- Rainwater landing directly on the ND1 pond surface (Precipitation)

These inflow mechanisms are represented in a conceptual model of inflows shown in Figure 2-3. Water will be removed from the ND1 by the following four mechanisms:

- Water pumped to the WTP (WTP Influent $_{ND1}$)
- Reclaim water pumped to the Mill (Mill Reclaim)
- Porewater stored in tailings (Porewater)
- Evaporation from the tailings beach, barrier wall and ND1 pond surface

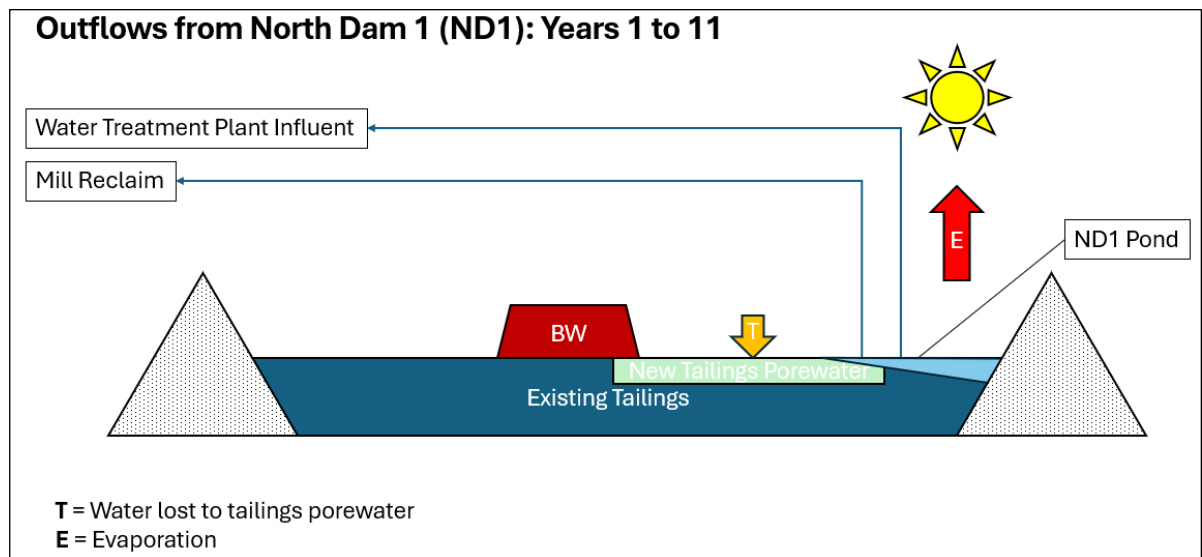
These outflow mechanisms are represented in a conceptual model of outflows shown in Figure 2-4. The difference between the sum of initial pond water during Year 1 and inflows during Year 1, and outflows during Year 1, was equal to the ND1 Pond volume at the end of Year 1 and at start of Year 2. This logic was repeated throughout the model. During Years 1 to 11, 100% of the water added to the WTP will come from ND1 (WTP Influent $_{ND1}$).

Figure 2-3: Conceptual Model of ND1 Inflows During Years 1 to 11



Source: SRK, 2026b

Figure 2-4: Conceptual Model of ND1 Outflows During Years 1 to 11



Source: SRK, 2026b

Prior to the start of Year 12, a low berm will be constructed across ND2 using tailings material (see blue line in Figure 2-2). This berm will separate legacy water added during Years 12 to 26 (to the East of the berm) from ND2 inflows added during Years 12 to 26 (to the West of the berm). Legacy water will continue to follow the same flow path described above and will not contribute to the WTP influent. From Years 12 to 26, the tailings slurry, new underground mine water, and CWP will be added to ND2. The ND2 pond will slightly increase in volume due to water added from following inflows:

- Runoff from the ND2 beach (Beach Runoff)
- Water pumped from the new underground mine (Underground Mine Water)
- Contact water from the mill site via the CWP (Contact Water)
- Process water from the liquid fraction of the tailings slurry (Process Water)
- Rainwater landing directly on the ND2 pond surface (Precipitation)

With the exception of the barrier wall, the same conceptual model used for ND1 inflows is used to represent inflows to ND2 (Figure 2-3).

Water will be removed from the ND2 by the following four mechanisms:

- Water pumped to the WTP (WTP Influent_{ND2})
- Reclaim water pumped to the mill (Mill Reclaim)
- Porewater stored in tailings (Porewater)
- Evaporation from the tailings beach and ND2 pond surface

The same conceptual model used for ND1 outflows was used to represent outflows from ND2 (Figure 2-4). The difference between the sum of initial pond water during Year 12 plus inflows during Year 12, and outflows during Year 12, was equal to the ND2 Pond volume at the end of Year 12 and at start of Year 13. During Years 12 to 26, ND1 will still produce a portion of the water going to the WTP. Water will be removed from the ND1 pond to maintain a constant pond volume. This water will be a combination of beach runoff, barrier wall runoff, and direct precipitation added to the ND1 pond.

The goal of this study was to predict the chemistry of WTP influent on an annual basis for years 1 to 26. The source (i.e., ND1 vs. ND2) of water pumped to the WTP will change halfway through the mine life with the volume contributed from each source derived from the annual water balance. Based on the water balance provided by Foth (2026a), water treatment inflows are as follows:

- Year 1 to Year 11: 100% WTP Influent _{ND1}
- Year 12 to Year 26: 8% to 60% WTP Influent _{ND1} + 40% to 92% WTP Influent _{ND2}

3 Source Term Chemistry

The geochemical model was based on proportional mixtures of eight input solutions and calculated pond water:

- Tailings Process Water (i.e., the liquid fraction of the tailings slurry)
- Rainwater
- Mine Water (i.e., water pumped from the underground mine)
- ND1 Initial Pond Water and Runoff
- Contact Water (i.e., inflow from the CWP stormwater collection basin)
- ND2 Initial Pond Water and Runoff
- Runoff from Nonesuch Formation waste rock within the barrier wall
- Runoff from Freda Formation waste rock within the barrier wall
- Residual pond water remaining at the end of a given time step (calculated by the model)

The following section describes the logic and assumptions used to define the chemistry of each input solution. A summary table of input solutions is provided in Appendix A. Importantly, apart from the calculated pond water, SRK assumed the chemistry of these inputs remained constant over the duration of the 26 year model.

3.1 Water Quality Criteria

To identify potential constituents of concern (PCOC), model results were compared against the proposed site-specific limit for chloride and draft Preliminary Effluent Limits (PEL) for other parameters at the proposed WTP outfall to the Mineral River provided by Foth (July 23, 2026). Parameters with initial and/or predicted concentrations above these values were classified as PCOC.

Table 3-1 provides the combined limit concentrations used in this modeling exercise. These values are used for reference purposes only and should not be interpreted as final operational limit values. Values will be replaced by National Pollution Discharge Elimination System (NPDES) limits once the parameter concentrations are reviewed and approved by Michigan Department of Environment, Great Lakes, and Energy (EGLE).

Table 3-1: Water Quality Limit Values Used for Geochemical Model (Foth 2026b)

Parameter	Value	Unit	Description
pH	6.5 to 9.0	s.u.	PEL
Chloride – Total	200	mg/L	Proposed site-specific, monthly average ¹
Sulfate	371	mg/L	PEL
Ammonia	See footnote ²	mg/L	PEL
Antimony – Total	0.13	mg/L	PEL
Arsenic – Total	0.01	mg/L	PEL
Barium – Total	0.3	mg/L	PEL
Beryllium – Total	0.0036	mg/L	PEL
Boron – Total	7.2	mg/L	PEL
Cadmium – Total	0.0036	mg/L	PEL
Chromium – Total	0.083	mg/L	PEL
Cobalt – Total	0.1	mg/L	PEL
Copper – Total	0.01	mg/L	PEL
Fluoride	2.1	mg/L	PEL
Lead – Total	0.083	mg/L	PEL
Lithium	0.44	mg/L	PEL
Manganese	1.4	mg/L	PEL
Mercury – Total	1.3	ng/L	PEL
Molybdenum – Total	3.2	mg/L	PEL
Nickel – Total	0.042	mg/L	PEL
Phosphorus, Total as P	1	mg/L	PEL
Selenium – Total	0.005	mg/L	PEL
Silver – Total	0.00006	mg/L	PEL
Strontium	36	mg/L	PEL
Thallium	0.0037	mg/L	PEL
Vanadium – Total	0.027	mg/L	PEL
Zinc - Total	0.17	mg/L	PEL

Source: Foth, 2026b

ng/L: nanograms per liter

mg/L: milligrams per liter

¹ Proposed, daily maximum, site-specific chloride limit is 870 mg/L

² See EGLE (2026) for temperature and pH specific, aquatic maximum value

3.2 Tailing Process Water (Solution 1)

Tailings process water is the liquid fraction of the tailings slurry that will be added to ND1 during Years 1 to 11 and ND2 during Years 12 to 26. Paterson & Cooke, of Golden, Colorado, generated a process water sample as part of metallurgical process testing for the Project. The sample was analyzed for major ion concentrations by Colorado Analytics on October 22, 2025. The sample had a laboratory measured pH of 7.84 s.u. Redox conditions were not measured, and an oxidized redox condition (pe = 4.0) was assumed in the model. Following initial analysis, process water was stored for approximately six months and re-analyzed for trace element concentrations on March 13, 2026. The

combined parameter concentrations were assumed to represent Tailings Process Water in the model (Appendix A).

The limitations to using this sample include:

- In general, using a single sample to define a constant input to a model neglects the variability that is likely to occur within a full-scale mill over time. The composition of process water can change over time, sometimes on a weekly or daily basis, depending upon the type of material being sent to the mill and metallurgical reagents added within the mill.
- According to the Chain of Custody form for the March 13, 2026 analysis, the water sample sent to the laboratory had not been preserved. Typically, water samples for metallurgical testing are preserved with concentrated nitric acid at pH 2 which can extend the hold time to approximately 180 days. Without preservation, the hold time for metal analyses was likely exceeded prior to testing, which was at least 142 days after the first test, and the quality of the water sample results from March 13, 2026 may not meet quality assurance / quality control protocols (QA/QC).
- The laboratory was unable to test for low level mercury due to insufficient sample volume. In addition, hold time for low-level mercury, typically 90 days, had been exceeded. Instead, the mercury concentration generated in Week 1 of a humidity cell test (HCT) on a composite tailings sample from the Upper Shale (0.18 ng/L) was used for the process water mercury concentration (SRK 2026a).
- The analytical reporting limit for silver (0.0005 mg/L) was an order of magnitude higher than the detection limit used for HCT's and other analyses referenced in this study. The silver concentration in the March 13, 2026 results was "Not Detected at Reporting Limit". By convention, the silver concentration used for process water in the model was assumed to be half the reporting limit, or 0.00025 mg/L, which exceeded the PEL limit (Table 3-1).

The process water sample exceeded water quality limits for copper and silver (Appendix A) and was a source of these PCOC in the model. Copper exceeded water quality limits in all input waters except rainwater. Silver exceeded water quality limits because SRK conservatively used half the reporting limit concentration for the process water sample. As is, process water was the primary source of silver in any model year, which resulted in predicted silver concentrations that exceeded the PEL (Table 3-1). HCT's on waste rock and tailings samples did not identify mine materials as a potential source of silver (SRK 2026a). Therefore, this finding is likely an artifact of the analytical method for process water and not indicative of future silver concentrations in WTP influent.

3.3 Rainwater (Solution 2)

Site rainwater chemistry was based on major ion concentrations and pH in rainwater measured at Brule River, Wisconsin (WI08), 156 km (97 miles) West of the Project on the Lake Superior shoreline (Figure 2-1). The average concentration of major cations and major anions in 93 rainwater samples collected between December 31, 2019 and October 18, 2022 was used. For pH, measured pH values were converted to activities, the average rainwater activity was calculated, and the average activity was converted back to a pH value. Redox conditions (pe) were calculated based on the average concentrations of nitrate (NO_3^-) and ammonium (NH_4^+) in the sample and the $\text{N}^{-3}/\text{N}^{+5}$ redox pair. These

data were collected as part of the University of Wisconsin's National Atmospheric Deposition Program (NADP), National Trend Network (NTN) (<https://nadp.slh.wisc.edu/>).

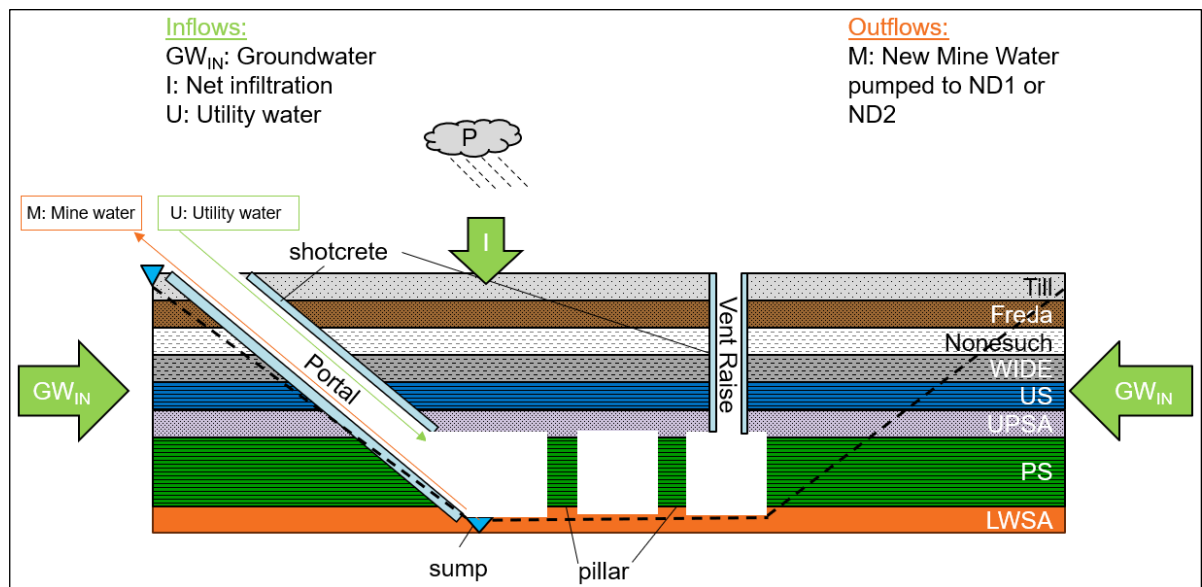
Dissolved mercury concentrations in site rainwater were based on total mercury concentrations in rainwater measured at Brule River, Wisconsin (WI08; Figure 1). The average of 124 total mercury concentrations measured between December 31, 2019 and October 18, 2022 was used. These data were collected as part of the NADP, MDN (<https://nadp.slh.wisc.edu/>). Additional MDN sites near the project are shown in Figure 2-1.

The combined rainwater input chemistry is shown in Appendix A. Although site mercury values may vary slightly, the MDN data is considered a robust input dataset due to the number of sample points included. The average concentration of mercury in rainwater is nearly 14 ng/L, which makes rainwater a significant source of mercury during the prediction.

3.4 Underground Mine Water (Solution 3)

The Project will target the copper-bearing Parting Shale unit in underground mining. During operations, inflows to the underground mine include groundwater, utility water used for mining operations, and infiltration from overlying units (Figure 3-1). In the process of mining, salts present in formation water within the Parting Shale and other mineralized units will add mass to these inflows. In addition, nitrogen species from explosives will also add mass to inflows. Combined influent water will drain to a sump(s) within the underground mine and will be pumped to ND1 during Years 1 to 11 and ND2 during Years 12 to 26. Figure 3-1 provides a conceptual model of inflows and outflow to the underground mine during operations.

Figure 3-1: Conceptual Model of the White Pine North Mine During Operations



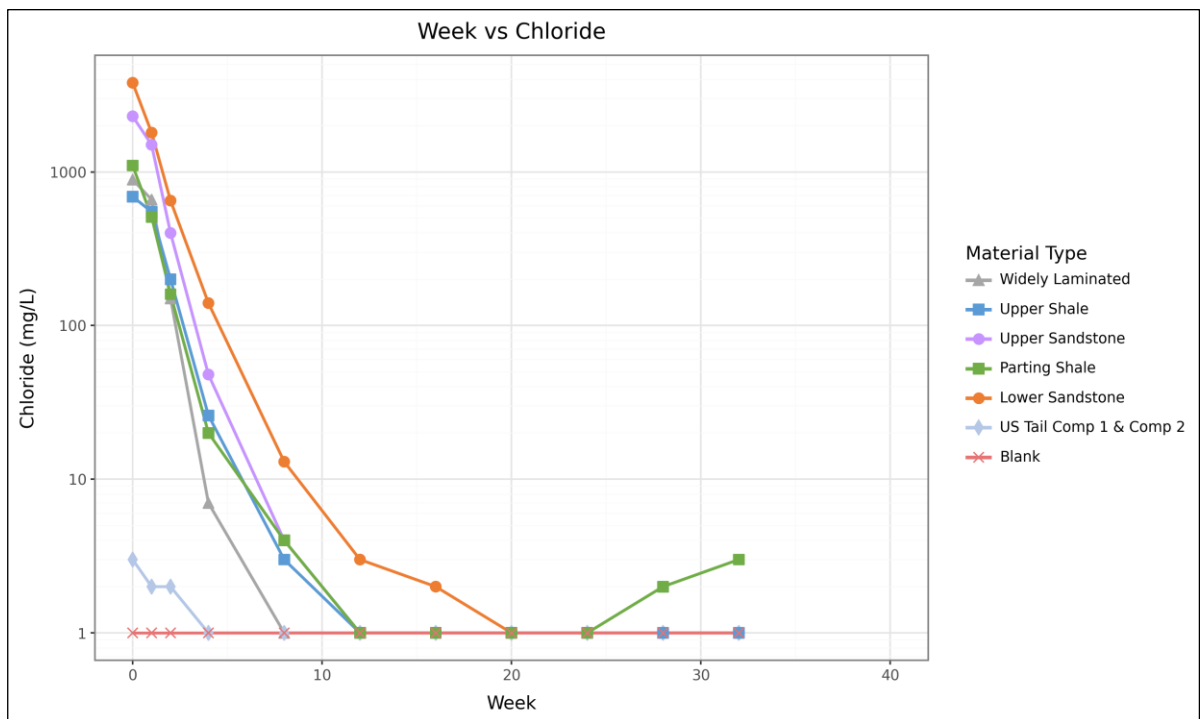
Source: SRK, 2026b

Till = glacial till; Freda = Freda Formation; Nonesuch = Nonesuch Formation, WIDE = Widely Laminated Siltstone; US = Upper Shale ore unit; UPSA = Upper Sandstone; PS = Parting Shale ore unit; LWSA = Lower Sandstone.

SRK conducted 40-week HCT's on representative samples from the Parting Shale and other mineralized units (SRK 2026a). These tests used a 0.5:1 liquid: solid ratio due to the low concentrations expected from the samples. Consequently, the use of unscaled HCT leachate in the predictive model created a conservative, high concentration, input chemistry. Results of chloride concentrations from the first 32 weeks are shown in Figure 3-2. The impact of briny formation water on the salinity of seepage from the Parting Shale and other units during the first 12 weeks of leaching is evident from the initially high concentrations of chloride in HCT leachate.

SRK used the unscaled HCT seepage chemistry from Week 1 to represent mine water pumped to ND1 and ND2 for the duration of the study. This assumes that groundwater and utility water added to the underground mine instantaneously adopt the chemistry of the HCT. Given that most of the underground water comes from fresh utility water interacting with new exposures of rock during drilling, mucking and scaling, this is comparable to de-ionized water washing crushed Parting Shale during the first week of the HCT, and therefore, a reasonable assumption. The solution pH was set equal to the laboratory measured pH at the end of Week 1. Laboratory measured oxidation reduction potential (ORP) at Week 1 was used for the Eh of the input (371 mV) and converted to pe at 22 °C using the Nernst equation.

Figure 3-2: Measured Chloride Concentrations from HCT's



Source: SRK, 2026b

In addition, the incomplete combustion of explosives used during mining contributes to the concentration of nitrate and ammonium in underground mine water. SRK assumed that the explosive will be ammonium nitrate fuel oil (ANFO) composed of 94% ammonia nitrate (NH_4NO_3) and 6% hydrocarbon fuel oil. Upon detonation, most of the ammonium nitrate will become various nitrous oxide gas species (NO_x) and be removed from the system.

However, a portion of the ammonium nitrate will likely be dissolved in the underground mine water due to the following processes:

- Spillage during borehole loading
- Wet or partially flooded boreholes that allow the ammonium nitrate to dissolve into water before detonation
- Half detonated or misfired holes
- Blast residue coating the muck pile and mine walls

These mechanisms lead to nitrogen losses to mine water from ANFO. Revey (1996) states that, without specific controls, 2% to 5% of ANFO may be lost due to spillage or blowback during pneumatic loading underground. Forsyth et al. (1995) reports that losses resulting from spilling during filling of explosive into loading equipment, loading of blastholes and disposal of excess product amount to between 5% to 15% of ANFO use. A more recent study of a Canadian underground mine reported

16.5% of ANFO lost to the environment (Sidenko, 2018). SRK assumed 3% of ammonium nitrate present in ANFO will be added to mine water on an annual basis.

WPC estimates that they will use 6,272 metric tonnes of explosive per year during operations. The underground mine will produce approximately 444.3 million gallons of water per year (Foth 2026a).

Based on these assumptions, SRK estimates the following concentrations of nitrogen species in mine water:

- Nitrate (NO_3^-) = 81.5 mg/L; nitrate-nitrogen ($\text{NO}_3\text{-N}$) = 18.4 mg/L
- Ammonium (NH_4^+) = 23.7 mg/L; ammonium-nitrogen ($\text{NH}_4\text{-N}$) = 18.4 mg/L

These calculations assume the following:

- Ammonium-nitrate in ANFO is composed of 22.5% ammonium and 77.5% nitrate.
- Ammonium-nitrate that does not cleanly detonate completely dissolves into mine water as the ions ammonium and nitrate.
- No oxidation occurs that converts a portion of ammonium into additional nitrate; no volatilization of ammonia occurs at high pH; and no adsorption of either ion occurs onto clay or hydroxide minerals.

The combined chemistry of water pumped from the underground mine is shown in Appendix A. Mine water exceeded the proposed site specific limit for chloride (due to formation water) and the PEL limit for copper (due to copper in the orebody). PEL limits for ammonia were based on pH and temperature (EGLE 2026) and were only considered for the combined WTP influent.

3.5 ND1 Initial Pond Water and Beach Runoff (Solution 4)

WPC analyzed nine samples of pond water collected from ND1 between July 28, 2024, and April 21, 2026. For modeling purposes, SRK assumed that ND1 chemistry represented the following:

- Initial pond water stored in ND1 at the start of operations (Year 1)
- Runoff chemistry from the ND1 beach for Years 1 to 26

SRK notes that ND1 pond water measured between 2024 and 2026 was the product of not only beach runoff, but inflows from Bedell Pond, legacy underground mine, and direct precipitation, and was likely affected by mineral precipitation and evapo-concentration within the pond. These processes may explain differences between the chemistry in ND1 and ND2 pond water (see Appendix A). Direct measurements of runoff from the tailings beach would improve future predictions.

The average concentration of major cations, major anions, trace elements, and field-measured ORP were used to define solution chemistry for the model (Appendix A). The average field-measured ORP was converted to Eh by adding +200 mV and then converted to pe. For pH, field-measured pH values were converted to activities, the average activity was calculated, and the average activity was converted back to a pH value.

The resulting ND1 pond water and beach runoff chemistry is shown in Appendix A. This water exceeded the proposed site-specific limit for chloride and the PEL limit for copper. Chloride exceedance was likely the result of legacy water additions to ND1, whereas copper was likely the result of input solutions plus runoff interacting with historical tailings. Future ND1 runoff chemistry used in the model was further impacted by the placement of a barrier wall on ND1. The combined runoff added to WTP influent was composed of 93% ND1 beach runoff and 7% barrier wall runoff (Section 3.8).

3.6 Contact Water (Solution 5)

Stormwater from the mills site / industrial area is considered contact water and is diverted into the Contact Water Pond, also called Industrial Area (Bedell). During Years 1 to 11, water from the CWP will be discharged into ND1. During Years 12 to 26, water from the CWP will be discharged into ND2. Between October 8, 2006 and April 4, 2026, 237 samples of water from the CWP (Bedell pond) were analyzed for dissolved copper, total copper, total dissolved solids (TDS) and total suspended solids (TSS). No data were collected on pH, redox, major cation concentrations, major anion concentrations, or trace element concentrations other than copper. This represents a large data gap.

To estimate the chemistry of contact water, SRK assumed that the proportion of ions contributing to the TDS concentration in contact water was the same as the proportion of ions contributing to TDS concentrations in ND1 pond water. Except for copper concentration, which was known, this assumption allowed SRK to solve for unknown parameter concentrations in contact water using the following relationship:

$$\frac{\text{Parameter X concentration in Contact Water}}{\text{TDS concentration in Contact Water}} = \frac{\text{Parameter X concentration in ND1 Pond}}{\text{TDS concentration ND1 Pond}}$$

For modeling, SRK assigned contact water the same temperature and pH as ND1 pond water. Redox conditions were based on the estimated concentration of sulfide (H_2S), the estimate concentration of sulfate (SO_4^{2-}), and the $\text{S}^{-2}/\text{S}^{+6}$ redox pair. Data from future samples collected from contact water and tested for a full suite of cations and anions will improve the accuracy of this input.

3.7 ND2 Initial Pond Water and Beach Runoff (Solution 6)

WPC analyzed nine samples of pond water collected from ND2 between July 28, 2024 and April 21, 2026. For modeling purposes, SRK assumed that ND2 chemistry represented the following:

- Initial pond water stored in ND2 at the start of Year 12
- Runoff chemistry from the ND2 beach for Years 12 to 26

SRK notes that ND2 pond water measured between 2024 and 2026 was the product of not only beach runoff, but inflows from ND1 pond water and direct precipitation, and was likely affected by mineral precipitation and evapo-concentration within the pond. The addition of legacy water to ND1 may explain differences between the chemistry in ND1 and ND2 pond water (see Appendix A). Direct measurements of runoff from the tailings beach would improve future predictions.

The average concentration of major cations, major anions, trace elements, and field-measured ORP were used to define solution chemistry for the model (Appendix A). The average field-measured ORP was converted to Eh by adding +200 mV and then converted to pe. For pH, field-measured pH values were converted to activities, the average activity was calculated, and the average activity was converted back to a pH value.

The resulting ND2 pond water and beach runoff chemistry is shown in Appendix A. This water exceeded PEL values for copper and mercury. Copper exceedance was likely the result of runoff interacting with historical tailings and/or flow from ND1. Mercury exceedance was likely due to rainwater landing on the tailings beach.

3.8 Barrier Wall Runoff (Solutions 74 and 75)

As discussed in Section 2, waste rock will be generated during the development period from the excavation of the decline and vent raises 1 and 2. Approximately 80% of this waste rock will be composed of Nonesuch Formation and 20% Freda Formation. Geochemical static tests characterized some samples collected from the Nonesuch as PAG whereas all Freda samples were characterized as Non-PAG (SRK 2026a). To mitigate any risk of acid production from the Nonesuch, all waste rock will be placed inside the perimeter of ND1 as a barrier wall.

To generate a conservative (highest concentrations, lowest pH) prediction of water quality from the Nonesuch portion of the barrier wall, SRK assumed the Nonesuch portion would generate acidic runoff with a chemistry equivalent to leachate produced during a NAG test on sample WP002774 collected from drill core WP530. NAG tests are known to overreact samples by oxidizing all sulfide within a sample with hydrogen peroxide, making this a very conservative estimate. Solution 74 in the model was defined using the unscaled NAG leachate results (pH 2.5) from this sample and was used to represent runoff generated from the Nonesuch portion (80%) of the barrier wall (Appendix A). The laboratory ORP value was converted to a standard hydrogen electrode by adding +200 mV and converting to pe at a field temperature of 13 °C.

SRK also assumed that the Freda portion of the barrier wall would generate circumneutral runoff equivalent to the NAG leachate chemistry from sample 243005 collected from drill core SMW-1SB. Solution 75 in the model was defined using the unscaled NAG leachate results (pH 6.0) from this sample and was used to represent runoff generated from the Freda portion (20%) of the barrier wall (Appendix A). The laboratory ORP value was converted to a standard hydrogen electrode by adding +200 mV and converting to pe at a field temperature of 13 °C.

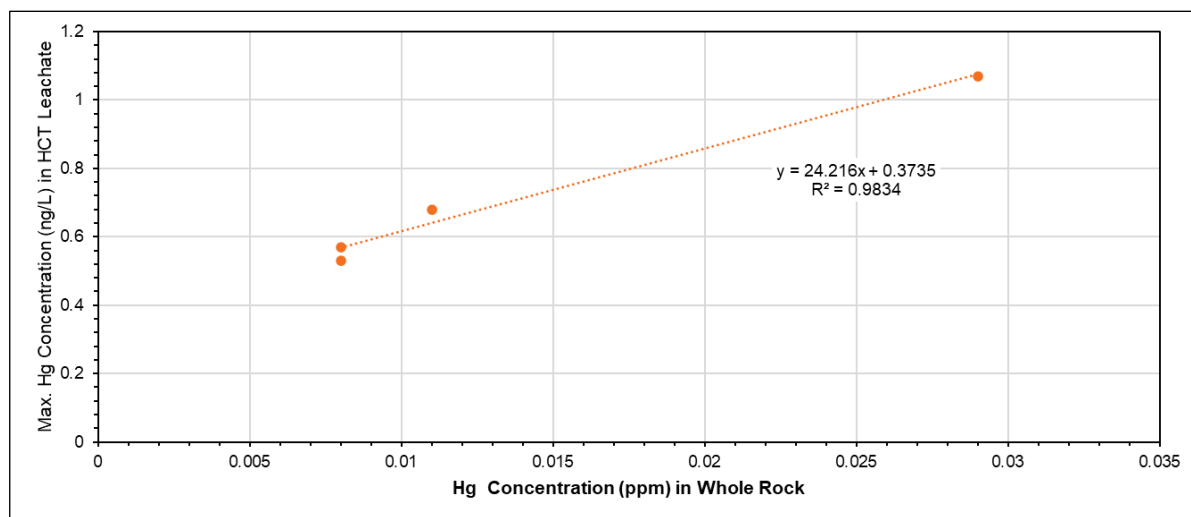
Low level mercury was not measured in NAG leachate tests. To estimate the mercury concentration in runoff from these units, SRK plotted the whole rock mercury concentration (ppm) against the maximum observed mercury concentration (ng/L) measured in from four of the HCT's (Figure 3-3):

- Wide laminated siltstone (WIDE)
- Upper sandstone (UPSA)
- Parting Shale (PS)

■ Lower Sandstone (LWSA)

These data fitted a linear trend line ($R^2 = 0.98$), and the equation for the line was used to calculate the hypothetical mercury concentrations in runoff for each rock unit using the whole rock mercury concentration for the samples used in the NAG test. The resulting mercury concentrations are included in Appendix A.

Figure 3-3: Relationship Between Whole Rock Mercury Concentration and HCT Leachate Maximum Mercury Concentration



Source: SRK, 2026b

Predicted runoff water quality from the Nonesuch waste rock in the barrier wall exhibited acid rock drainage / metal leachate (ARD / ML) with multiple water quality exceedances (sulfate, beryllium, cadmium, cobalt, copper, lead, manganese, nickel, selenium, silver, thallium, and zinc). This was done intentionally to see if a conservative estimate of high concentrations in barrier wall runoff would negatively affect the overall prediction; due to the small proportion of barrier wall runoff in the system, even the conservative estimate did not affect the predicted concentrations of the WTP influent. By contrast, runoff from the Freda waste rock only generated an exceedance for vanadium.

The combined runoff from the barrier wall was generated by the model assuming an 80:20 mixture of waters from the Nonesuch and Freda Formations, respectively (saved as Solution 76). Based on the estimated size and surface area of the barrier wall and ND1 (see Section 2), the combined runoff chemistry added to the ND1 pond during Years 1 to 26 was a mixture of 93% ND1 pond water (Solution 4) and 7% barrier wall runoff (Solution 76).

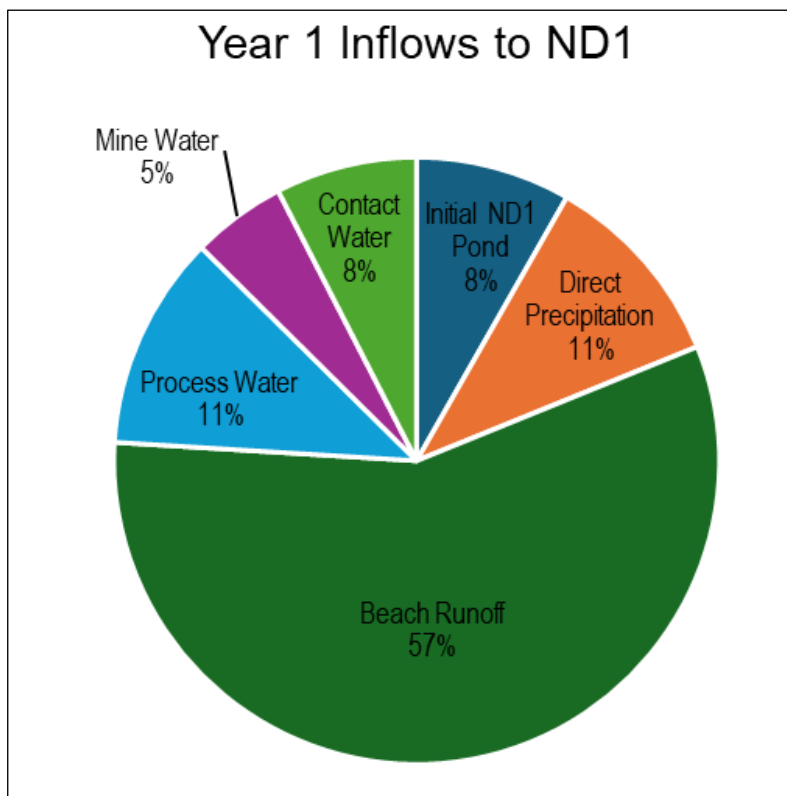
4 Water Balance and Mixing Proportions

Foth (2026a) provided SRK with the results of a single water balance (Simulation 861) representative of average conditions during Years 1 to 26 (Appendix B). The balance included annual volumes for the following inflows plus the initial and final volumes of ND1 and ND2 at each time step:

- Direct Precipitation
- Beach Runoff
- Process Water
- Underground Mine Water
- Contact Water

SRK calculated the total annual inflow volume and tabulated the percentage of each inflow added during each year (Appendix B). Figure 4-1 illustrates the relative proportion of each inflow to the ND1 pond during Year 1 and highlights the significance of beach runoff to the overall water balance and mass load. Subsequent years produced similar proportions of inflows with minor changes due to yearly meteorological variability assumed by Foth (2026a).

Figure 4-1: Proportions of Inflows Added to ND1 During Year 1



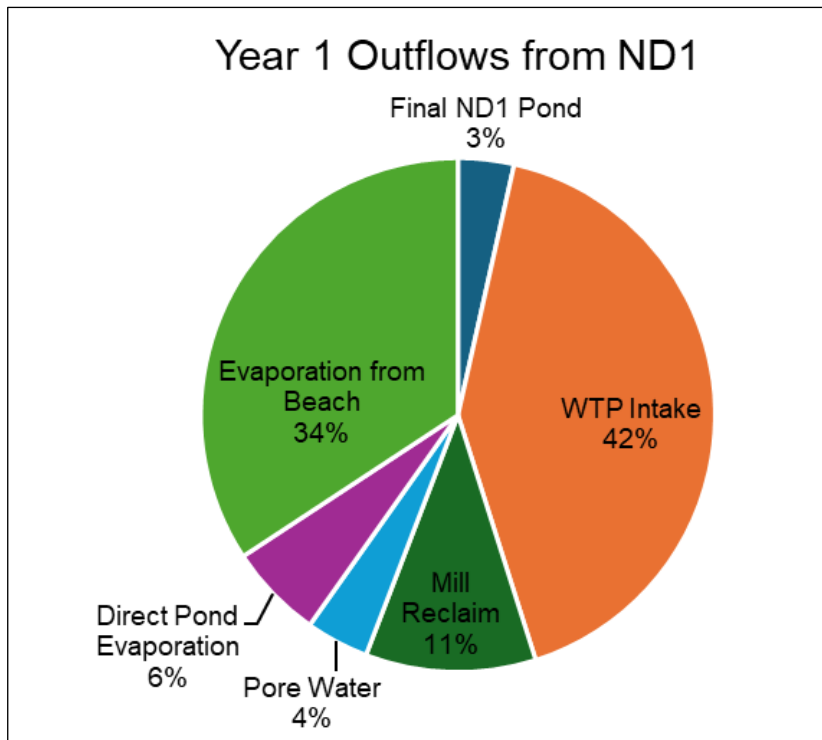
Source: SRK, 2026b

The water balance also included annual outflow volumes for the following outflows:

- WTP Intake
- ND1 Overflow to ND2 (only applicable in Year 24)
- Mill Reclaim Water
- Water Loss to Tailings Porewater
- Direct evaporation from ND1 pond (or ND2 pond)
- Evaporation of Beach Runoff

SRK calculated the total annual outflow volume and tabulated the percentage of each outflow removed during each year (Appendix B). The difference between annual inflows and annual outflows was used to specify the volume of pond water at the end of each year and at the start of the next year. Figure 4-2 illustrates the relative contribution of each outflow from the ND1 pond during Year 1 and highlights the significance of beach evaporation and direct pond evaporation to the overall water balance (40%). Subsequent years produced similar proportions of outflows with minor changes due to yearly meteorological variability assumed by Foth (2026a). Evaporation removes only fresh water and leaves dissolved solute mass behind, a process called evapo-concentration. As such, the evaporation rate used in the water balance directly influenced the predicted water chemistry.

Figure 4-2: Proportions of Outflows Removed from ND1 During Year 1



Source: SRK, 2026b

SRK generated tables of the percentages of each inflow added during each year, the percentage of combined direct and beach evaporation removed each year, and the percentage of pond water remaining at the end of each year (Appendix B). These tables were used in the geochemical model.

SRK provides two observations of the Foth (2026a) water balance:

- On average, 60% of rainwater landing on the tailings beach was lost to evaporation (minimum = 48%; maximum = 67%) and 60% of rainwater landing on the pond surface was lost to evaporation (minimum = 47%; maximum = 70%). This rate of evaporative loss is higher than expected for a humid continental climate.
- Except for Years 1, 4, 7, 9, 10, 18 and 24, annual outflows were equal to, or greater than, annual inflows. As such, the pond volume was zero or negative at the end of each year.

5 Geochemical Modeling

The goal of the geochemical model was to predict the concentrations of parameters in WTP influent pumped from ND1 during Years 1 to 11, and from a mixture of water from ND1 and ND2 during Years 12 to 26. Geochemical modeling was executed using the geochemical speciation computer program PHREEQC, version 3.8.6, released by the United States Geological Survey on January 7, 2026, and available from: <https://www.usgs.gov/software/phreeqc-version-3>.

PHREEQC is a computer program widely used for simulating chemical reactions in mine waters. The program simulates chemical reactions between waters, minerals, gases, and sorption surfaces using thermodynamic equilibrium data (Parkhurst and Appelo, 2013). For this exercise, SRK used the MINTEQA4 thermodynamic database to define the thermodynamic data implemented by PHREEQC with additional thermodynamic data for select minerals sourced from the literature (Table 5-1). The minerals listed in Table 5-1 are likely to achieve solubility equilibrium with mine waters, and the subsequent precipitation of these minerals might control metal concentrations (Nordstrom and Alpers 1999).

Water chemistries from each source term (Section 3) were defined as individual “Solutions” in PHREEQC (see descriptions in Appendix A). To achieve electrical neutrality, an electrical charge imbalance was calculated for each solution. For solutions with a negative initial charge imbalance, a small amount of sodium (+ charge) was added to achieve a neutral charge balance. For solutions with an initial positive charge imbalance, chloride (- charge) was added to achieve a neutral charge balance. Solution descriptions in Appendix A show that these adjustments had a negligible effect on solution composition overall but slightly increased the concentration of sodium or chloride already present in solution.

The modeling process followed four steps:

1. Input solutions (Section 3, Appendix A) were mixed at the proportions defined by volumes in the water balance for a given year (Section 4, Appendix B). Conceptually, this represented mixing all inflows within a given year with the initial pond water present at the end of the prior year.
2. Water was evaporated from the combined solution by removing the mass of fresh water defined by the volume of the combined direct evaporation and beach evaporation during a given year (Section 4, Appendix B).
3. Oversaturated minerals were allowed to precipitate from solution. Table 5-1 provides a list of minerals allowed to precipitate once equilibrium conditions were achieved (modified from Nordstrom and Alpers, 1999).
4. The resulting solution was saved and was equal to the average chemistry of WTP influent, mill reclaim water, tailings pore water, and final pond water for a given year. The volume of water remaining after the removal of WTP influent, mill reclaim water and pore water was equal to the volume of pond water at the end of a given year and at the start of the subsequent year.

PHREEQC calculated the pH, redox conditions (pe), and parameter concentrations at annual time steps for Year 1 to 26. To generate a conservative (highest concentration) prediction, the following reactions were not enabled:

- Surface adsorption onto the surface of iron hydroxide minerals (i.e., ferrihydrite)
- Equilibrium with atmospheric carbon dioxide gas

Additional geochemical assumptions included the following:

- All chemical reactions were assumed to proceed to thermodynamic equilibrium within a given year.
- The chemistry of pond water was assumed to be controlled by abiotic, inorganic chemical reactions. Biological reactions (e.g., photosynthesis by phytoplankton, sulfate reduction by bacteria, etc.) were assumed to be negligible.
- Pond water was assumed to be fully mixed and well oxygenated throughout each year.
- The mixing proportions defined by Foth (2026a), Simulation 861, were assumed to be representative of future conditions.
- The input solutions concentrations (Appendix A) were assumed to be representative and constant for the duration of the 26 year prediction. These inputs were based on the best available data at the time of modeling.
- Minerals removed from pond water by precipitation were assumed to settle to the bottom of the pond and become removed from interactions with the overlying water column. This mass of new sediment was not allowed to react (e.g., re-dissolve or influence equilibrium) with pond water during the subsequent years.
- The results of short-term hydrologic events, such as inflows from an individual rain event or seasonal meteorological patterns, were assumed to be negligible compared to annual average conditions investigated by the model. The model, therefore, predicts an annual, time-weighted-average influent chemistry for a given year, and not daily or monthly chemistry.
- For comparison against PEL limits, dissolved concentrations predicted by the model were assumed to be equal to total concentrations.

Table 5-1: Minerals Allowed to Precipitate From Solution Under Oversaturated Conditions*

Mineral	Formula	Source of Thermodynamic Data
Anglesite	PbSO ₄	MINTEQ.v4
Barite	BaSO ₄	MINTEQ.v4
Basaluminite	Al ₄ (OH) ₁₀ SO ₄	WATEQ4F
Calcite	CaCO ₃	MINTEQ.v4
Cerussite	PbCO ₃	MINTEQ.v4
Chalcanthite	CuSO ₄ ·5H ₂ O	MINTEQ.v4
Epsomite	MgSO ₄ ·7H ₂ O	MINTEQ.v4
Ferrihydrite	Fe(OH) ₃	MINTEQ.v4
Gibbsite	Al(OH) ₃	MINTEQ.v4
Goslarite	ZnSO ₄ ·7H ₂ O	MINTEQ.v4
Gypsum	CaSO ₄ ·2H ₂ O	MINTEQ.v4
Halotrichite	FeAl ₂ (SO ₄) ₄ ·22H ₂ O	Thermoddem v1.10
Manganite	MnOOH	MINTEQ.v4
Pyrolusite	MnO ₂	MINTEQ.v4
Bixbyite	Mn ₂ O ₃	MINTEQ.v4
Birnessite	MnO ₂	MINTEQ.v4
Nsutite	MnO ₂	MINTEQ.v4
Hausmannite	Mn ₃ O ₄	MINTEQ.v4
Melanterite	FeSO ₄ ·7H ₂ O	MINTEQ.v4
Otavite	CdCO ₃	MINTEQ.v4
Rhodochrosite	MnCO ₃	MINTEQ.v4
Schwertmannite	Fe ₈ O ₈ (OH) _{4.5} (SO ₄) _{1.75}	Literature
Scorodite	FeAsO ₄ ·2H ₂ O	Literature
Siderite	FeCO ₃	MINTEQ.v4
Silica (microcrystalline)	SiO ₂	MINTEQ.v4
Smithsonite	ZnCO ₃	MINTEQ.v4
Witherite	BaCO ₃	MINTEQ.v4

Modified from: Nordstrom and Alpers, 1999

* List excludes alunogen and pickeringite which are not included in publicly available, thermodynamic databases.

6 Results and Discussion

Appendix C provides a table of the yearly, time-weighted-average, dissolved parameter concentrations in WTP influent and highlights parameters predicted to exceed the site-specific chloride and PEL limit values (Table 3-1). Figure 6-1 illustrates predicted trends in pH and the PCOC chloride, copper, mercury, and silver. The following sections describe predicted pH, oversaturated minerals, PCOC, and model limitations.

6.1 Predicted pH

Predicted influent pH for Year 1 to 11, when influent was sourced from ND1, was relatively constant at pH 6.9, within acceptable effluent limits (PEL pH 6.5 to 9.0), and was governed by:

- The high percentage of runoff (57%) in WTP influent (Figure 4-1)
- The combination of ND1 beach runoff (pH 7.7; Solution 4) and barrier wall runoff (pH 2.6; Solution 76) which had a combined pH 6.8 (Solution 77)
- Other inflows with circumneutral pH (process water pH 7.8; mine water pH 7.6; and contact water pH 7.7)

Predicted influent pH for Years 12 to 26, when influent was source from ND2 with additional discharge from ND1, was very slightly more basic and showed slightly greater variability, ranging from pH 6.9 to 7.3, within acceptable effluent limits (PEL pH 6.5 to 9.0). Minor changes resulted from:

- The lack of a barrier wall on the surface of ND2
- Annual variability in the site water balance and the volume of water contributed from ND1 to the final composition of WTP influent

Overall, the storage of PAG Nonesuch waste rock in a barrier wall on ND1 did not significantly change the pH of WTP influent. This is due to the relatively small area of the barrier wall relative to the area of ND1. By design, this was a conservative scenario with high-concentration and low pH, assuming all Nonesuch rock had the properties of the most acidic Nonesuch sample collected.

To generate a conservative, highest-concentration prediction, pond water was not allowed to equilibrate with atmospheric carbon dioxide (CO₂). It is not uncommon for natural lakes to be out of equilibrium with respect to carbon dioxide, and this relationship is further modified by photosynthesis and respiration of aquatic organisms not considered here. In SRK's experience, forcing surface water into equilibrium with atmospheric carbon dioxide removes inorganic carbonic acid from solution and generally raises pH up to one pH unit, potentially resulting in an artificially high pH.

6.2 Oversaturated Minerals

Of the 27 minerals allowed to precipitate from solution (Table 5-1), only three minerals were predicted to become oversaturated in pond water, and subsequently, precipitated from solution:

- Barite (BaSO₄)

- Ferrihydrite (FeOH_3)
- Gibbsite (AlOH_3)

Removal of these minerals will place a slight control on the dissolved concentrations of aluminum, barium, iron and sulfate entering the WTP, and may improve water quality with respect to barium and sulfate limits. However, total concentrations are used for the protection of aquatic ecosystems, and the precipitated mass of these elements may still report to the WTP as suspended solids, especially for colloidal iron and aluminum.

The fresh ferrihydrite precipitated from solution will provide surface sites for the adsorption of trace elements. Surface adsorption reactions were not included in the water quality predictions to generate a conservative, highest concentration of dissolved metals reporting to the WTP. In the absence of surface adsorption, there are no predicted controls on copper and other trace elements.

From a WTP design perspective, it is important to note that gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$), manganese oxides and hydroxides, and microcrystalline silica (SiO_2) were not predicted to precipitate from solution. Precipitation of gypsum and silica within WTPs can foul equipment such as filtration systems and membranes. Manganese minerals do not precipitate in this model and require a higher pH than predicted in this model to precipitate.

6.3 Potential Constituents of Concern

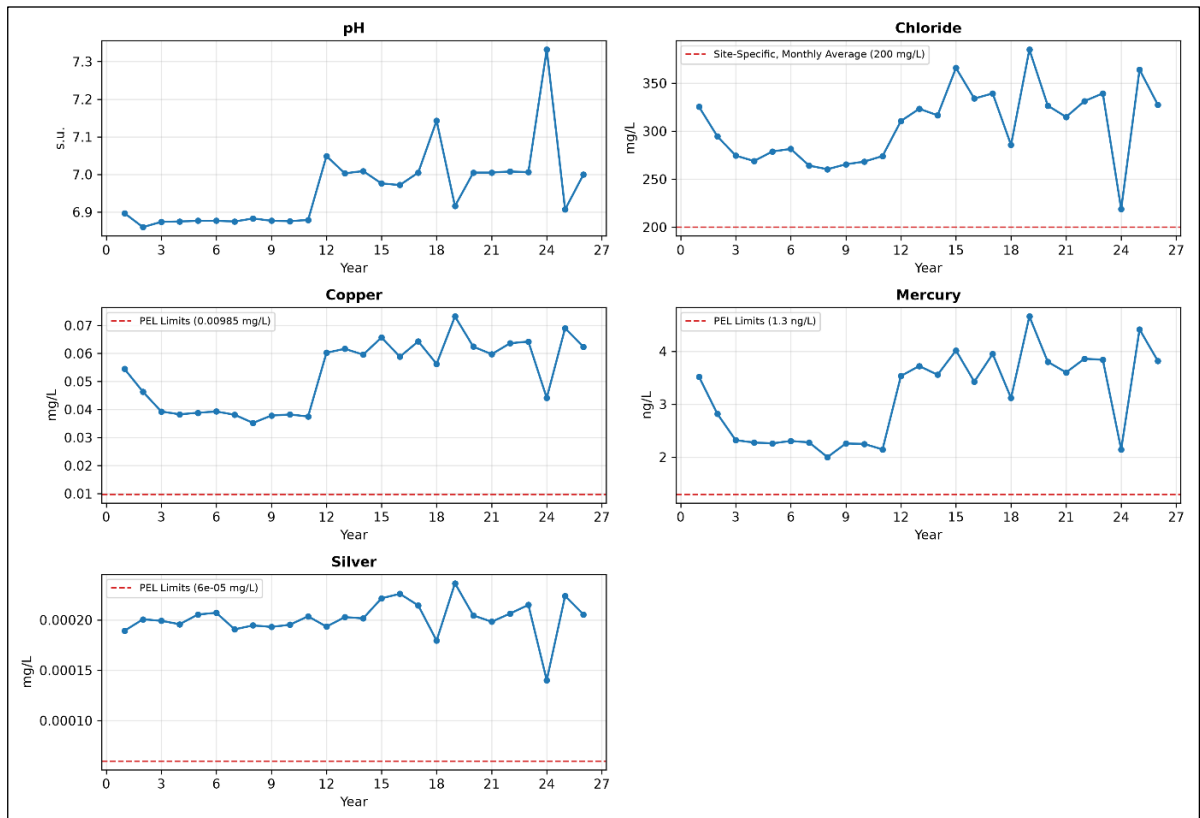
SRK compared predicted annual dissolved concentrations against the site specific, monthly-average limit for chloride and PEL limit values presented in Table 3-1. The following parameters were not predicted to exceed limits in WTP influent during the 26 year prediction:

- pH, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, fluoride, lead, lithium, manganese, molybdenum, nickel, selenium, strontium, sulfate, strontium, thallium, vanadium, and zinc

Four parameters had predicted dissolved concentrations in exceedance of limit values, and Figure 6-1 provides predicted time series plots of each parameter's concentration:

- Chloride
- Copper
- Mercury
- Silver

Figure 6-1: Time Series Plots of Predicted WTP Influent for pH and PCOC That Exceeded the Proposed Site-Specific Chloride Limit and PEL Limit Values (Copper, Mercury, and Silver)



Source: SRK, 2026b

Chloride concentrations in exceedance of the 200 mg/L monthly average site-specific limit resulted from mine water pumped from the underground mine. The Parting Shale ore unit, plus other ore bearing units, contain formation water with naturally elevated concentrations of chloride, sodium, and TDS (SRK 2026a). The continued exposure of fresh surfaces of the Parting Shale during operations, plus the flushing of these surfaces with utility water and groundwater during drilling, mucking and scaling activities (Figure 3-1), is expected to continually load mine water with new formation water containing chloride during operations.

Copper concentrations were elevated in most input solutions (Appendix A). Predicted exceedances in WTP influent resulted from elevated copper concentrations in mine water, beach runoff, and contact water.

Material characterization studies have previously shown that neither waste rock nor tailings are likely to be sources of mercury or silver. Instead, mercury exceedances are a product of rainwater (total mercury concentration of approximately 14 ng/L versus the PEL limit of 1.3 ng/L) landing on the beach and pond surfaces. From a closure and financial perspective, it is important to directly measure mercury concentration in on-site rainwater prior to development, as well as in underground mine water

during development and any other water sources not in contact with meteoric water to demonstrate that the site mercury load is not a product of mining activities or mine materials, and that post-closure mercury mitigation is not the responsibility of WPC.

Exceedances of silver are attributed to one sample of process water from metallurgical testing; however:

- Only one sample of process water was available at the time of modeling
- This sample did not pass SRK's QA/QC criteria due to:
 - The lack of sample preservation reagents noted on the laboratory chain-of-custody form
 - The long-hold time between sample generation and sample analysis (142 days)
 - Insufficient sample volume required for low-level mercury analysis
- The laboratory detection limit for silver was an order of magnitude higher than other laboratory detection limits used for silver in other tests used in this study (e.g., HCT's).
- The reported silver concentration in process water was below the laboratory reporting limit. The silver concentration assigned to process water in PHREEQC was set to half the reporting limit concentration, and this concentration exceeded the PEL limit in Table 3-1.

As a result, the predicted silver concentrations are likely an artifact of analytical procedures and data quality.

The model considered the impact of mine explosives on ammonia concentrations in WTP influent. The source of nitrogen compounds (ammonium and nitrate) to mine water was assumed to be unexploded ANFO which dissolved into underground mine water and was pumped to ND1 and ND2 (see Section 3.4). Reduced nitrogen, N^{-3} , is present as ammonium (a stable, dissolved ion) below pH 9.25, and is present as ammonia (a pungent, dissolved gas) above this pH. PHREEQC predicted the concentration of ammonium whereas water quality toxicity is based on the concentration of ammonia. For this analysis, we assume the concentrations of ammonium and ammonia were equivalent. EGLE (2026) provided Rule 57 Water Quality Values for Ammonia which change as a function of water temperature and pH; in general, the higher the temperature and pH, the lower the water quality limit.

Assuming a water treatment influent of pH of 6.9 s.u. and a maximum influent water temperature equal to the July 2013 temperature in Duck Creek (22.2 °C; MDEQ, 2015), an aquatic maximum value for ammonia of 13 mg/L would apply. Predicted ammonium concentrations in Years 2 to 11 ranged from 7.5 to 9.9 mg/L and did not exceed 4.9 mg/L between Years 12 and 26; therefore, ammonium was not listed as a PCOC.

6.4 Model Limitations

SRK used all available data in this prediction. Confidence in the model is drawn from the similarity between input solutions (Appendix A) and predicted output solutions (Appendix C). Nevertheless, SRK recognizes the following limitations in the model:

- Errors in input data quality and representativeness affect the accuracy of the prediction:
 - The assumption of constant input chemistry over the course of the 26 year model neglects operational and seasonal variability known to occur in mining operations, especially expected variability in mine water chemistry and process water chemistry inputs.
 - Input data for process water is limited to only one sample, and this sample is known to have low data quality (see Section 6.3). Based on HCT results (SRK 2026a), predicted silver exceedances are likely a product the laboratory detection limit and not leachate from site materials.
 - Input data from mine water is limited to the first week of flushing from one solid sample for the Parting Shale used in HCT's. As such, the prediction is contingent on the representativeness of this sample.
 - Beach runoff water has a significant influence on the overall predicted water quality as it represents an average of 45% of water added to ND1 in years 1 to 11 and an average of 49% of water added to ND2 in years 12 to 26. However, direct samples of runoff from the tailings beaches had not been collected at the time of modeling. Instead, it was assumed that the average of nine pond water samples represented runoff. Differences between measured runoff and pond water chemistry, if any, will impact future predictions.
 - At the time of modeling, contact water from Bedell Pond had not been sampled for a full suite of analytes. Data was only available for copper and TDS concentrations. Instead, contact water was approximated using the measured TDS concentrations and the ratio of ions to TDS concentrations in ND1 pond water. This assumes that the distribution of ions in Bedell Pond is proportional to the distribution of ions in ND1 pond water, which may or may not be true. Although contact water represents only 5% of the water added to ND1 and ND2, errors in the assumed water quality could impact predicted values.
- Errors in the assumed geometry of the barrier wall will influence the volume of runoff generated from this feature. Herein, the barrier wall was modeled as a square feature in map view. Changing this to a linear feature with a higher height could decrease the surface area contributing to runoff.
- Use of NAG leachate results for barrier wall runoff likely overestimates the concentration of dissolved parameters in barrier wall runoff. This was intentional and provided a conservative understanding of the effect of possible PAG material stored in the barrier wall on WTP influent. In addition, mercury values had to be estimated for Nonesuch and Freda Formation waste rock.

- Errors in the water balance (Foth 2026a; Simulation 861) affect the prediction accuracy:
 - The water balance assumed 54% to 62% of incident rainwater evaporates. This is higher than expected for a humid continental climate in the Great Lakes region.
 - For most years, the annual volume of outflow from ND1 or ND2 exceeded the annual volume of inflow (Appendix B). This resulted in the removal of pond water and no carry-over mass stored in pond water from one year to the next.
- The model predicts annual, time-weighted-average parameter concentrations. These concentrations may be lower compared to daily and monthly-average concentrations measured in water treatment influent.
- The Draft PEL limit values used in this analysis may differ from the final NPDES permit values issued for the Project.
- PHREEQC predicts dissolved concentrations whereas both PEL limits and the future NPDES limits are based on total concentrations. Future water entering the WTP will contain suspended minerals (part of the total suspended solids) which will increase the total concentration of a parameter relative to the dissolved concentration. Suspended loads and total metal concentrations are also directly impacted by high-intensity rainfall events that are strong enough to erode the tailings beach and entrain historic tailings in WTP influent. Processes influencing total concentrations are not addressed here.
- Assumptions regarding the composition of explosives used underground and the fraction of unexploded ANFO come from the literature. These assumptions directly impact the predicted nitrate and ammonium concentrations in mine water.

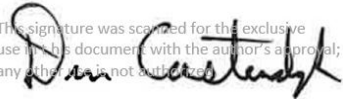
7 Conclusions

SRK prepared a 26 year prediction of WTP influent chemistry during operations of the proposed White Pine North Project. Annual, time-weighted-average, dissolved concentrations are shown in Appendix C. The concentrations of four parameters exceeded site specific chloride and PEL limits in WTP influent: chloride, copper, mercury, and silver. Chloride and copper exceedances are a function of site materials. Mercury exceedances are a product of local rainwater, whereas silver exceedances are believed to be an artifact of the laboratory detection limit used for the process water sample.

Closing

This report, Predictive Model of Water Treatment Plant Influent Chemistry during Operations, was prepared by

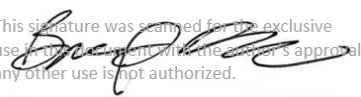
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All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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Appendix A Input Solution Concentrations

White Pine North, Source Term Concentrations

Inflow chemistry comparison (Solutions 1, 2, 3, 4, 5, 6, 74 - Runoff from PAG Nonesuch material in Barrier Wall, and 75 - Runoff from Non-PAG Freda material in Barrier Wall)

Parameter	Unit	Source	PEL Limits	Initial ND1 Pond Water and R1 Runoff	Direct Precip to Pond	Paste Plant (process water)	Underground Mine Water (to ND1)	Contact Water Pond	Initial ND2 Pond Water and R2 Runoff	Runoff from PAG Nonesuch material in Barrier Wall	Runoff from Non-PAG Freda material in Barrier Wall
		Solution		4	2	1	3	5	6	74	75
pH	s.u.		6.5 to 9.0	7.650	5.610	7.840	7.600	7.650	7.652	2.510	6
pe	s.u.			6.180	9.036	4	6.331	-4.223	6.676	11.915	8.989
Temperature	°C			11.450	5.500	19.100	22	11.450	11.450	13	13
Dissolved Oxygen	mg/L										
Ca	mg/L			89.889	0.4203	28.600	120.000	28.739	61.111	40.000	5.780
Mg	mg/L			8.722	0.0604	4.570	2.610	2.829	9.111	7.840	2.810
Na	mg/L			95.778	0.0692	58.300	184.000	31.928	63.444	43.500	42.500
K	mg/L			4.744	0.0421	12.400	11.900	1.513	4.756	6.700	6.410
Cl	mg/L		200*	257.778	0.1084	43.600	510.000	84.362	149.444	5.000	6.500
SO4	mg/L		371.136	33.344	0.5193	52.500	10.000	10.939	26.756	529.000	4.000
NH4	mg/L			0.0965	0.7007	0.0193	23.690		0.0658		
NO3	mg/L			1.108	1.247	0.1106	81.463		0.6579		
HCO3	mg/L			97.261		126.122	17.970	30.039	101.105		50.888
CO3	mg/L			0.2120		0.4562	0.0470	0.0573	0.2103		0.0022
Aluminum	mg/L			0.0125		0.0490	0.0200		0.0242	10.400	0.0250
Antimony	mg/L		0.1304	6.089E-04		0.0034	4.500E-04		6.089E-04	0.0012	0.0017
Arsenic	mg/L		0.0100	5.733E-04		0.0015	0.0025		9.489E-04	0.0055	0.0036
Barium	mg/L		0.2999	0.0950		0.0448	0.1280		0.0799	0.1400	0.0069
Beryllium	mg/L		0.0036	2.328E-04		5.000E-05	3.500E-06		2.328E-04	0.0038	2.500E-05
Boron	mg/L		7.22	0.3932		1.420	0.1700		0.2751	0.0690	0.1040
Bromide	mg/L			2.216		1.250	6.300		1.302		
Cadmium	mg/L		0.0036	8.500E-05		5.000E-05	1.210E-04		1.044E-04	0.0177	1.560E-04
Chromium	mg/L		0.0828	5.500E-04		0.0076	3.100E-04		5.500E-04	0.0380	0.0448
Cobalt	mg/L		0.1003	2.000E-04		0.0093	5.900E-05		2.000E-04	0.1230	2.870E-04
Copper	mg/L		0.0099	0.0204		0.0070	0.0190	0.0332	0.0428	0.4490	0.0040
Fluoride	mg/L		2.11	0.2683		0.7200	0.3100		0.2650	0.2800	0.0300
Iron	mg/L			0.0746		0.0100	0.0035		0.0346	25.000	0.0130
Lead	mg/L		0.0833	9.500E-05		6.000E-04	4.500E-05		9.500E-05	0.0541	8.600E-04
Lithium	mg/L		0.4412	0.0387		0.0500	0.1310		0.0331	0.0486	0.0150
Manganese	mg/L		1.432	0.0842		0.0093	0.0829		0.0135	1.600	0.0662
Mercury	ng/L		1.3	0.682	14.897	0.180	0.300	0.297	1.312	1.300	0.430
Molybdenum	mg/L		3.209	0.0048		0.0582	0.0050		0.0410	0.0282	0.0095
Nickel	mg/L		0.0422	3.150E-04		0.0012	0.0018		3.589E-04	0.1740	0.0018
Phosphorous	mg/L		1.			0.0250	0.0150			0.4670	33.800
Selenium	mg/L		0.0050	5.689E-04		4.000E-04	2.000E-05		6.022E-04	0.0100	4.600E-04
Silver	mg/L		0.00006	6.000E-05		2.500E-04	2.500E-05		6.000E-05	0.0013	2.500E-05
Strontium	mg/L		36.099	1.156		0.4510	2.300		0.7322	0.2800	0.0348
Sulfide	mg/L			1.537				0.4954	1.489		
Thallium	mg/L		0.0037	2.494E-04		2.000E-04	3.200E-05		2.494E-04	0.0020	4.900E-05
Tin	mg/L			6.500E-04		0.0050	3.000E-05		6.500E-04	0.0075	0.0032
Uranium	mg/L			2.582E-04		0.0110	1.000E-06		6.167E-04	0.0104	0.0023
Vanadium	mg/L		0.0271	9.256E-04		0.0010	2.400E-04		0.0010	0.0057	0.0335
Zinc	mg/L		0.1722	0.0035		0.0010	0.0010		0.0035	0.8560	0.0110
Total Dissolved Solids (TDS)	mg/L			594.8	3.2	330.8	971.2	190.9	421.0	672.1	153.1
% Charge Imbalance	%			0	0	0	0	0	0	0	0
Ionic Strength	mol/kg			1.236E-02	8.969E-05	5.895E-03	1.945E-02	4.021E-03	8.518E-03	1.440E-02	2.882E-03
Mass Water	kg			1	1	1	1	1	1	1	1

Cells highlighted in red exceed proposed site specific limits or PEL limits.

* Proposed, monthly-average, site-specific Chloride limit

Appendix B Water Balance and Mixing Proportions

Foth Operational Water Balance (2026a)

Normal WTP Water Balance Simulation (all rates expressed in gallons per year)

Reference Simulation No. 861

	Initial ND1 Pond Volume	ND1 Inflows					ND1 Outflows						Final ND1 Pond Volume	Average ND1 Pond Volume Over Year
		Direct Precip to Pond	Tailings Beach Runoff	Paste Plant (process water)	Underground Mine Water (to ND1)	Contact Water Pond	WTP Intake from ND1	ND1 Overflow	Reclaim to Process Plant	Water loss to pore water	Evaporation of Direct Precipitation	Evaporation of Tailings Beach Runoff		
	gal	gpy	gpy	gpy	gpy	gpy	gpy	gpy	gpy	gpy	gpy	gpy	gal	gal
Year 0 (before operations)														
Year 1	2.35E+08	3.02E+08	1.62E+09	3.25E+08	1.43E+08	2.15E+08	1.18E+09	0	3.05E+08	1.13E+08	1.69E+08	9.74E+08	8.15E+07	2.00E+08
Year 2	8.15E+07	2.41E+08	1.41E+09	5.95E+08	2.62E+08	1.47E+08	1.15E+09	0	5.57E+08	2.06E+08	1.44E+08	8.27E+08	0	9.34E+07
Year 3	0	2.36E+08	1.36E+09	8.64E+08	3.80E+08	1.42E+08	1.00E+09	0	8.10E+08	2.99E+08	1.38E+08	7.94E+08	0	7.98E+07
Year 4	0	2.73E+08	1.55E+09	1.01E+09	4.44E+08	1.63E+08	1.04E+09	0	9.46E+08	3.50E+08	1.49E+08	8.58E+08	9.94E+07	1.51E+08
Year 5	9.94E+07	2.45E+08	1.42E+09	1.01E+09	4.44E+08	1.46E+08	1.13E+09	0	9.46E+08	3.50E+08	1.60E+08	9.21E+08	0	8.44E+07
Year 6	0	2.51E+08	1.44E+09	1.01E+09	4.44E+08	1.48E+08	9.86E+08	0	9.46E+08	3.50E+08	1.62E+08	9.32E+08	0	7.45E+07
Year 7	0	2.88E+08	1.64E+09	1.01E+09	4.44E+08	1.73E+08	1.04E+09	0	9.46E+08	3.50E+08	1.47E+08	8.46E+08	2.24E+08	2.07E+08
Year 8	2.24E+08	2.11E+08	1.24E+09	1.01E+09	4.44E+08	1.30E+08	1.18E+09	0	9.46E+08	3.50E+08	1.22E+08	7.00E+08	0	1.53E+08
Year 9	0	2.75E+08	1.56E+09	1.01E+09	4.44E+08	1.64E+08	1.04E+09	0	9.46E+08	3.50E+08	1.45E+08	8.34E+08	1.35E+08	1.64E+08
Year 10	1.35E+08	2.70E+08	1.56E+09	1.01E+09	4.44E+08	1.64E+08	1.18E+09	0	9.46E+08	3.50E+08	1.48E+08	8.52E+08	1.17E+08	1.85E+08
Year 11	1.17E+08	2.26E+08	1.33E+09	1.01E+09	4.44E+08	1.37E+08	1.12E+09	0	9.46E+08	3.50E+08	1.49E+08	8.59E+08	0	9.01E+07
Year 12	0	2.86E+08	1.62E+09	0	0	0	7.64E+08	0	0	0	1.71E+08	9.81E+08	0	1.72E+08
Year 13	0	2.69E+08	1.55E+09	0	0	0	8.01E+08	0	0	0	1.60E+08	9.19E+08	0	1.66E+08
Year 14	0	2.44E+08	1.41E+09	0	0	0	6.66E+08	0	0	0	1.42E+08	8.17E+08	0	1.33E+08
Year 15	0	2.33E+08	1.34E+09	0	0	0	6.43E+08	0	0	0	1.52E+08	8.73E+08	0	8.42E+07
Year 16	0	1.43E+08	8.59E+08	0	0	0	3.23E+08	0	0	0	9.99E+07	5.75E+08	0	1.83E+07
Year 17	0	2.67E+08	1.49E+09	0	0	0	6.50E+08	0	0	0	1.63E+08	9.39E+08	0	1.12E+08
Year 18	0	3.47E+08	1.97E+09	0	0	0	4.60E+08	0	0	0	2.06E+08	1.19E+09	4.63E+08	2.98E+08
Year 19	4.63E+08	2.29E+08	1.36E+09	0	0	0	1.13E+09	0	0	0	1.50E+08	8.61E+08	0	1.25E+08
Year 20	0	2.77E+08	1.57E+09	0	0	0	7.98E+08	0	0	0	1.64E+08	9.45E+08	0	1.61E+08
Year 21	0	2.59E+08	1.50E+09	0	0	0	8.02E+08	0	0	0	1.51E+08	8.67E+08	0	1.57E+08
Year 22	0	2.89E+08	1.65E+09	0	0	0	7.90E+08	0	0	0	1.70E+08	9.79E+08	0	1.87E+08
Year 23	0	2.54E+08	1.47E+09	0	0	0	6.27E+08	0	0	0	1.60E+08	9.21E+08	0	1.29E+08
Year 24	0	3.80E+08	2.14E+09	0	0	0	1.54E+08	3.82E+08	0	0	1.80E+08	1.03E+09	7.64E+08	4.81E+08
Year 25	7.64E+08	2.10E+08	1.27E+09	0	0	0	1.32E+09	0	0	0	1.40E+08	8.05E+08	0	3.08E+08
Year 26	0	2.70E+08	1.53E+09	0	0	0	8.05E+08	0	0	0	1.64E+08	9.41E+08	0	1.38E+08

	Initial ND2 Pond Volume	ND2 Inflows					ND2 Outflows						Final ND2 Pond Volume	Average ND2 Pond Volume Over Year
		Direct Precip to Pond	Tailings Beach Runoff	Paste Plant (process water)	Underground Mine Water (to ND2)	Contact Water Pond	WTP Intake from ND2	ND2 Overflow	Reclaim to Process Plant	Water loss to pore water	Evaporation of Direct Precipitation	Evaporation of Tailings Beach Runoff		
	gal	gpy	gpy	gpy	gpy	gpy	gpy	gpy	gpy	gpy	gpy	gpy	gal	gal
Year 11 (before operations)														
Year 12	2.36E+08	1.10E+08	1.84E+09	1.01E+09	4.44E+08	1.69E+08	1.54E+09	0	9.46E+08	3.50E+08	6.53E+07	1.12E+09	0	4.77E+07
Year 13	0	1.03E+08	1.76E+09	1.01E+09	4.44E+08	1.62E+08	1.17E+09	0	9.46E+08	3.50E+08	6.12E+07	1.04E+09	0	2.30E+07
Year 14	0	9.36E+07	1.60E+09	1.01E+09	4.44E+08	1.48E+08	1.15E+09	0	9.46E+08	3.50E+08	5.44E+07	9.29E+08	0	1.69E+07
Year 15	0	8.92E+07	1.53E+09	1.01E+09	4.44E+08	1.38E+08	9.06E+08	0	9.46E+08	3.50E+08	5.81E+07	9.92E+08	0	1.03E+07
Year 16	0	5.49E+07	9.77E+08	1.01E+09	4.44E+08	8.71E+07	7.56E+08	0	9.46E+08	3.50E+08	3.83E+07	6.54E+08	0	3.50E+05
Year 17	0	1.02E+08	1.69E+09	1.01E+09	4.44E+08	1.54E+08	1.13E+09	0	9.46E+08	3.50E+08	6.26E+07	1.07E+09	0	1.26E+07
Year 18	0	1.33E+08	2.24E+09	1.01E+09	4.44E+08	2.27E+08	1.59E+09	0	9.46E+08	3.50E+08	7.90E+07	1.35E+09	0	5.24E+07
Year 19	0	8.77E+07	1.55E+09	1.01E+09	4.44E+08	1.41E+08	9.19E+08	0	9.46E+08	3.50E+08	5.74E+07	9.79E+08	0	1.24E+07
Year 20	0	1.06E+08	1.79E+09	1.01E+09	4.44E+08	1.64E+08	1.18E+09	0	9.46E+08	3.50E+08	6.30E+07	1.07E+09	0	2.11E+07
Year 21	0	9.94E+07	1.70E+09	1.01E+09	4.44E+08	1.56E+08	1.17E+09	0	9.46E+08	3.50E+08	5.78E+07	9.86E+08	0	2.05E+07
Year 22	0	1.11E+08	1.88E+09	1.01E+09	4.44E+08	1.72E+08	1.20E+09	0	9.46E+08	3.50E+08	6.52E+07	1.11E+09	0	2.81E+07
Year 23	0	9.74E+07	1.68E+09	1.01E+09	4.44E+08	1.53E+08	1.13E+09	0	9.46E+08	3.50E+08	6.14E+07	1.05E+09	0	1.49E+07
Year 24	0	1.46E+08	2.43E+09	1.01E+09	4.44E+08	2.42E+08	1.90E+09	0	9.46E+08	3.50E+08	6.89E+07	1.18E+09	0	9.63E+07
Year 25	0	8.04E+07	1.45E+09	1.01E+09	4.44E+08	1.31E+08	8.87E+08	0	9.46E+08	3.50E+08	5.36E+07	9.15E+08	0	1.11E+07
Year 26	0	1.04E+08	1.74E+09	1.01E+09	4.44E+08	1.59E+08	1.15E+09	0	9.46E+08	3.50E+08	6.27E+07	1.07E+09	0	1.74E+07

White Pine North Water Balance Proportions (modified from Foth 2026a)

North Dam 1 (ND1) Outflow: Years 1 to 26

		A) Mixing						B) Evaporation	C) RXNs	D) Save Solution	Description
Year	Solution for previous Pond Chemistry	Previous Pond Percent	Direct Precip to Pond	Tailings Beach Runoff	Paste Plant (process water)	Underground Mine Water (to ND1)	Contact Water Pond	Evaporation of Pure Water; bring volume back to 1 L	Precipitate oversaturated Minerals		
	Solution #	See Column B	2	77	1	3	5				
1	4	8%	11%	57%	11%	5%	8%	40%	PHREEQC	7	Year 1 ND1 outflow
2	7	3%	9%	52%	22%	10%	5%	34%	PHREEQC	8	Year 2 ND1 outflow
3	8	0%	8%	46%	29%	13%	5%	31%	PHREEQC	9	Year 3 ND1 outflow
4	9	0%	8%	45%	29%	13%	5%	29%	PHREEQC	10	Year 4 ND1 outflow
5	10	3%	7%	42%	30%	13%	4%	31%	PHREEQC	11	Year 5 ND1 outflow
6	11	0%	8%	44%	31%	13%	5%	32%	PHREEQC	12	Year 6 ND1 outflow
7	12	0%	8%	46%	28%	12%	5%	28%	PHREEQC	13	Year 7 ND1 outflow
8	13	7%	6%	38%	31%	14%	4%	25%	PHREEQC	14	Year 8 ND1 outflow
9	14	0%	8%	45%	29%	13%	5%	28%	PHREEQC	15	Year 9 ND1 outflow
10	15	4%	8%	43%	28%	12%	5%	28%	PHREEQC	16	Year 10 ND1 outflow
11	16	4%	7%	41%	31%	14%	4%	29%	PHREEQC	17	Year 11 ND1 outflow
12	17	0%	15%	85%	0%	0%	0%	60%	PHREEQC	18	Year 12 ND1 outflow
13	18	0%	15%	85%	0%	0%	0%	57%	PHREEQC	19	Year 13 ND1 outflow
14	19	0%	15%	85%	0%	0%	0%	59%	PHREEQC	20	Year 14 ND1 outflow
15	20	0%	15%	85%	0%	0%	0%	61%	PHREEQC	21	Year 15 ND1 outflow
16	21	0%	14%	86%	0%	0%	0%	68%	PHREEQC	22	Year 16 ND1 outflow
17	22	0%	15%	85%	0%	0%	0%	63%	PHREEQC	23	Year 17 ND1 outflow
18	23	0%	15%	85%	0%	0%	0%	60%	PHREEQC	24	Year 18 ND1 outflow
19	24	23%	11%	66%	0%	0%	0%	47%	PHREEQC	25	Year 19 ND1 outflow
20	25	0%	15%	85%	0%	0%	0%	58%	PHREEQC	26	Year 20 ND1 outflow
21	26	0%	15%	85%	0%	0%	0%	56%	PHREEQC	27	Year 21 ND1 outflow
22	27	0%	15%	85%	0%	0%	0%	59%	PHREEQC	28	Year 22 ND1 outflow
23	28	0%	15%	85%	0%	0%	0%	63%	PHREEQC	29	Year 23 ND1 outflow
24	29	0%	15%	85%	0%	0%	0%	48%	PHREEQC	30	Year 24 ND1 outflow
25	30	34%	9%	57%	0%	0%	0%	42%	PHREEQC	31	Year 25 ND1 outflow
26	31	0%	15%	85%	0%	0%	0%	58%	PHREEQC	32	Year 26 ND1 outflow

North Dam 2 (ND2) Outflow: Years 12 to 26

		A) Mixing						B) Evaporation	C) RXNs	D) Save Solution	Description
Year	Solution for previous Pond Chemistry	Previous Pond Percent	Direct Precip to Pond	Tailings Beach Runoff	Paste Plant (process water)	Underground Mine Water (to ND1)	Contact Water Pond	Evaporation of Pure Water; bring volume back to 1 L	Precipitate oversaturated Minerals		
	Solution #	See Column B	2	6	1	3	5				
12	6	6%	3%	48%	26%	12%	4%	29%	PHREEQC	33	Year 12 ND2 outflow
13	33	0%	3%	51%	29%	13%	5%	31%	PHREEQC	34	Year 13 ND2 outflow
14	34	0%	3%	49%	31%	13%	4%	29%	PHREEQC	35	Year 14 ND2 outflow
15	35	0%	3%	48%	31%	14%	4%	32%	PHREEQC	36	Year 15 ND2 outflow
16	36	0%	2%	38%	39%	17%	3%	25%	PHREEQC	37	Year 16 ND2 outflow
17	37	0%	3%	50%	30%	13%	5%	32%	PHREEQC	38	Year 17 ND2 outflow
18	38	0%	3%	55%	25%	11%	6%	33%	PHREEQC	39	Year 18 ND2 outflow
19	39	0%	3%	48%	31%	14%	4%	32%	PHREEQC	40	Year 19 ND2 outflow
20	40	0%	3%	51%	29%	13%	5%	31%	PHREEQC	41	Year 20 ND2 outflow
21	41	0%	3%	50%	30%	13%	5%	30%	PHREEQC	42	Year 21 ND2 outflow
22	42	0%	3%	52%	28%	12%	5%	32%	PHREEQC	43	Year 22 ND2 outflow
23	43	0%	3%	50%	30%	13%	5%	31%	PHREEQC	44	Year 23 ND2 outflow
24	44	0%	3%	57%	24%	10%	6%	28%	PHREEQC	45	Year 24 ND2 outflow
25	45	0%	3%	46%	32%	14%	4%	31%	PHREEQC	46	Year 25 ND2 outflow
26	46	0%	3%	50%	29%	13%	5%	32%	PHREEQC	47	Year 26 ND2 outflow

WTP Influent: Years 1 to 26

Year	ND1 Solution #	ND1 %	ND2 Solution #	ND2 %	Save Solution	WTP Influent Year
1	7	100%	0	0%	48	1
2	8	100%	0	0%	49	2
3	9	100%	0	0%	50	3
4	10	100%	0	0%	51	4
5	11	100%	0	0%	52	5
6	12	100%	0	0%	53	6
7	13	100%	0	0%	54	7
8	14	100%	0	0%	55	8
9	15	100%	0	0%	56	9
10	16	100%	0	0%	57	10
11	17	100%	0	0%	58	11
12	18	33%	33	67%	59	12
13	19	41%	34	59%	60	13
14	20	37%	35	63%	61	14
15	21	42%	36	58%	62	15
16	22	30%	37	70%	63	16
17	23	36%	38	64%	64	17
18	24	22%	39	78%	65	18
19	25	55%	40	45%	66	19
20	26	40%	41	60%	67	20
21	27	41%	42	59%	68	21
22	28	40%	43	60%	69	22
23	29	36%	44	64%	70	23
24	30	8%	45	92%	71	24
25	31	60%	46	40%	72	25
26	32	41%	47	59%	73	26

Appendix C Predicted Water Treatment Influent Chemistry

White Pine North — Predicted WTP Influent Concentrations

Generated from PHREEQC speciation results (final post-precipitation chemistry) | Years 1–9 of 26

Parameter	Unit	PEL Limit	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
		Solution #	48	49	50	51	52	53	54	55	56
pH	s.u.	6.5 to 9.0	6.897	6.86	6.874	6.875	6.877	6.877	6.875	6.883	6.877
pe	s.u.		6.162	6.132	6.113	6.112	6.107	6.108	6.114	6.101	6.112
Temperature	deg C		12.29	13.69	14.6	14.64	14.85	14.82	14.51	15.13	14.63
Dissolved Oxygen	mg/L										
Ca	mg/L		113.42	100.64	92.2195	90.2957	93.3016	94.2635	88.8529	86.6887	89.1335
Mg	mg/L		10.8668	9.2651	8.2272	8.0377	8.2515	8.3366	7.9453	7.5929	7.9404
Na	mg/L		130.63	117.91	109.45	107.13	111.04	112.08	105.34	103.59	105.85
K	mg/L		8.9066	10.1147	10.7012	10.537	11.1978	11.2759	10.1929	10.7755	10.4001
Cl	mg/L	200.00*	325.42	294.65	274.51	268.88	278.84	281.50	264.09	260.33	265.47
SO4	mg/L	371.14	82.4135	75.965	69.1263	67.623	69.7369	70.437	66.6418	64.5816	66.7762
NH4	mg/L		4.6171	7.5087	9.1044	9.0205	9.7945	9.8401	8.5974	9.6697	8.8897
NO3	mg/L		0.000002	0.000004	0.000013	0.000013	0.000017	0.000017	0.000011	0.000024	0.000013
HCO3	mg/L		106.17	98.5425	95.0645	93.295	97.3831	98.2374	91.3424	91.8306	92.1967
CO3	mg/L		0.0433	0.0375	0.0377	0.037	0.0392	0.0396	0.036	0.0373	0.0367
Aluminum	mg/L		0.0012	0.0011	0.0011	0.001	0.0011	0.0011	0.001	0.001	0.001
Antimony	mg/L	0.1303	0.0014	0.0018	0.0019	0.0019	0.002	0.0021	0.0018	0.002	0.0019
Arsenic	mg/L	0.01	0.0015	0.0016	0.0017	0.0017	0.0018	0.0018	0.0016	0.0017	0.0016
Barium	mg/L	0.2999	0.0376	0.0406	0.0444	0.045	0.0447	0.0445	0.0451	0.0471	0.0453
Beryllium	mg/L	0.0036	0.000468	0.000385	0.000315	0.000306	0.000308	0.000312	0.000306	0.000276	0.000302
Boron	mg/L	7.2196	0.6929	0.8082	0.8673	0.8552	0.9112	0.9171	0.8256	0.8795	0.8435
Bromide	mg/L		3.0308	3.0451	3.026	2.9724	3.1234	3.149	2.8957	2.962	2.9341
Cadmium	mg/L	0.0036	0.0011	0.000995	0.000812	0.000789	0.000794	0.000804	0.00079	0.000709	0.00078
Chromium	mg/L	0.0828	0.0049	0.0055	0.0056	0.0055	0.0058	0.0058	0.0053	0.0055	0.0054
Cobalt	mg/L	0.1003	0.0092	0.0095	0.009	0.0088	0.0092	0.0093	0.0087	0.0086	0.0087
Copper	mg/L	0.0098	0.0545	0.0463	0.0393	0.0383	0.0388	0.0393	0.0381	0.0352	0.0378
Fluoride	mg/L	2.11	0.4546	0.5078	0.5325	0.5244	0.5565	0.5605	0.5078	0.5346	0.5173
Iron	mg/L		0.0012	0.0011	0.000993	0.000985	0.000962	0.000966	0.000999	0.000919	0.000983
Lead	mg/L	0.0833	0.0034	0.003	0.0025	0.0024	0.0025	0.0025	0.0024	0.0022	0.0024
Lithium	mg/L	0.4412	0.0632	0.0684	0.0706	0.0695	0.0735	0.0741	0.0674	0.0704	0.0686

Parameter	Unit	PEL Limit	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
		Solution #	48	49	50	51	52	53	54	55	56
Manganese	mg/L	1.4319	0.1899	0.1614	0.1356	0.1321	0.1338	0.1355	0.1316	0.1209	0.1305
Mercury	ng/L	1.3	3.5204	2.8183	2.3188	2.2747	2.2587	2.3048	2.2767	1.9983	2.2567
Molybdenum	mg/L	3.2088	0.0183	0.0256	0.0294	0.0291	0.0313	0.0315	0.0279	0.0307	0.0287
Nickel	mg/L	0.0422	0.011	0.0097	0.0081	0.0079	0.0079	0.008	0.0079	0.0071	0.0078
Phosphorous	mg/L	1	0.5309	0.4609	0.3739	0.3633	0.3646	0.3695	0.3643	0.3249	0.3593
Selenium	mg/L	0.005	0.0013	0.0011	0.000925	0.000902	0.000918	0.000929	0.000896	0.000833	0.000891
Silver	mg/L	0.00006	0.000189	0.000201	0.000199	0.000196	0.000205	0.000207	0.000191	0.000195	0.000193
Strontium	mg/L	36.0986	1.4755	1.3879	1.3248	1.2977	1.3537	1.366	1.2714	1.2705	1.2819
Sulfide	mg/L		0	0	0	0	0	0	0	0	0
Thallium	mg/L	0.0037	0.000412	0.000363	0.000321	0.000313	0.000322	0.000325	0.00031	0.000296	0.00031
Tin	mg/L		0.0021	0.0026	0.0028	0.0028	0.003	0.003	0.0027	0.0029	0.0027
Uranium	mg/L		0.003	0.0045	0.0052	0.0051	0.0056	0.0056	0.0049	0.0055	0.0051
Vanadium	mg/L	0.0271	0.002	0.0018	0.0016	0.0016	0.0016	0.0016	0.0015	0.0015	0.0015
Zinc	mg/L	0.1722	0.0543	0.0465	0.0374	0.0364	0.0364	0.0369	0.0365	0.0324	0.0359
Total Dissolved Solids (TDS)	mg/L		789.14	721.28	674.97	661.26	686.30	692.77	649.29	641.45	653.01
% Charge Imbalance	%		0	0	0	0	0	0	0	0	0
Ionic Strength	mol/kg		0.0162	0.0147	0.0137	0.0134	0.0139	0.014	0.0132	0.013	0.0132
Mass Water	kg		1	1	1	1	1	1	1	1	1

Cells highlighted in red exceed proposed site specific limits or PEL limits.

*Proposed, monthly-average, site-specific Chloride limit

White Pine North — Predicted WTP Influent Concentrations

Generated from PHREEQC speciation results (final post-precipitation chemistry) | Years 10–18 of 26

Parameter	Unit	PEL Limit	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18
		Solution #	57	58	59	60	61	62	63	64	65
pH	s.u.	6.5 to 9.0	6.876	6.879	7.049	7.003	7.009	6.976	6.972	7.005	7.143
pe	s.u.		6.112	6.104	6.47	6.436	6.449	6.429	6.458	6.452	6.518
Temperature	deg C		14.64	15.01	13.25	13.15	13.43	13.29	14.52	13.36	13.5
Dissolved Oxygen	mg/L										
Ca	mg/L		90.0553	91.4981	113.70	117.67	115.10	126.89	120.43	123.52	105.49
Mg	mg/L		8.0206	8.0425	12.3275	12.4928	12.1695	13.29	12.2424	13.0907	11.7806
Na	mg/L		106.93	109.02	134.42	134.58	134.05	154.31	144.56	143.09	129.55
K	mg/L		10.5096	11.2017	10.4119	10.5174	10.6504	11.3072	12.1127	11.2329	10.5878
Cl	mg/L	200.00*	268.24	274.05	310.53	323.30	316.49	365.87	333.97	339.29	285.57
SO4	mg/L	371.14	67.4609	68.2273	78.7573	83.3645	81.2046	90.9104	86.0831	87.2504	69.6346
NH4	mg/L		8.986	9.9484	1.6774	3.6263	3.0743	4.6039	3.2527	3.3055	0.1878
NO3	mg/L		0.000013	0.000021	0.0201	0.0072	0.0123	0.0051	0.0227	0.0117	0.0633
HCO3	mg/L		93.1119	96.2238	132.10	130.82	129.54	137.78	133.87	138.08	133.93
CO3	mg/L		0.037	0.039	0.0783	0.0699	0.0704	0.0705	0.069	0.0751	0.0982
Aluminum	mg/L		0.001	0.001	0.0016	0.0015	0.0015	0.0016	0.0015	0.0016	0.0015
Antimony	mg/L	0.1303	0.0019	0.0021	0.0017	0.0017	0.0017	0.0018	0.0021	0.0018	0.0017
Arsenic	mg/L	0.01	0.0017	0.0018	0.0018	0.0018	0.0018	0.0019	0.002	0.0019	0.0018
Barium	mg/L	0.2999	0.0451	0.0456	0.0504	0.0476	0.0495	0.0465	0.0526	0.0483	0.053
Beryllium	mg/L	0.0036	0.000306	0.000296	0.000449	0.000477	0.000456	0.00052	0.000456	0.000495	0.000377
Boron	mg/L	7.2196	0.8524	0.9132	0.7779	0.7929	0.8068	0.8582	0.94	0.8488	0.7848
Bromide	mg/L		2.9652	3.0995	3.1274	3.2345	3.2185	3.507	3.5645	3.4231	2.9756
Cadmium	mg/L	0.0036	0.000788	0.000761	0.000907	0.001	0.000969	0.0011	0.001	0.0011	0.000657
Chromium	mg/L	0.0828	0.0054	0.0057	0.0047	0.005	0.005	0.0056	0.0058	0.0054	0.0043
Cobalt	mg/L	0.1003	0.0088	0.009	0.0079	0.0087	0.0086	0.0097	0.0097	0.0092	0.0065
Copper	mg/L	0.0098	0.0382	0.0375	0.0602	0.0616	0.0596	0.0657	0.0588	0.0643	0.0563
Fluoride	mg/L	2.11	0.5228	0.5563	0.5394	0.5447	0.55	0.5855	0.6197	0.581	0.5443
Iron	mg/L		0.000985	0.00094	0.0064	0.0077	0.007	0.0081	0.0061	0.0071	0.0045
Lead	mg/L	0.0833	0.0024	0.0024	0.0026	0.003	0.0028	0.0034	0.003	0.0031	0.0019
Lithium	mg/L	0.4412	0.0693	0.0733	0.0716	0.073	0.0733	0.0786	0.0823	0.0776	0.0709

Parameter	Unit	PEL Limit	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18
		Solution #	57	58	59	60	61	62	63	64	65
Manganese	mg/L	1.4319	0.1318	0.1292	0.1438	0.1615	0.1539	0.1807	0.1622	0.167	0.1067
Mercury	ng/L	1.3	2.2486	2.1443	3.5344	3.723	3.5565	4.0179	3.4261	3.9517	3.1172
Molybdenum	mg/L	3.2088	0.029	0.0317	0.0408	0.0381	0.039	0.0391	0.0418	0.041	0.0467
Nickel	mg/L	0.0422	0.0079	0.0076	0.0085	0.0096	0.0091	0.0108	0.0096	0.0099	0.0061
Phosphorous	mg/L	1	0.3627	0.3491	0.3958	0.4547	0.4284	0.5126	0.447	0.4671	0.2721
Selenium	mg/L	0.005	0.0009	0.000888	0.0012	0.0013	0.0012	0.0014	0.0013	0.0014	0.0011
Silver	mg/L	0.00006	0.000195	0.000204	0.000193	0.000203	0.000202	0.000222	0.000226	0.000214	0.000179
Strontium	mg/L	36.0986	1.295	1.3345	1.5114	1.5658	1.5421	1.6937	1.6578	1.649	1.4098
Sulfide	mg/L		0	0	0	0	0	0	0	0	0
Thallium	mg/L	0.0037	0.000313	0.000313	0.000431	0.000449	0.000435	0.000484	0.000447	0.000469	0.00039
Tin	mg/L		0.0028	0.003	0.0024	0.0024	0.0025	0.0026	0.003	0.0026	0.0024
Uranium	mg/L		0.0051	0.0056	0.0037	0.0038	0.004	0.0041	0.005	0.0041	0.004
Vanadium	mg/L	0.0271	0.0016	0.0016	0.002	0.0021	0.002	0.0023	0.0021	0.0022	0.0018
Zinc	mg/L	0.1722	0.0363	0.0348	0.0418	0.0475	0.0448	0.0533	0.0462	0.0488	0.0295
Total Dissolved Solids (TDS)	mg/L		659.73	674.90	800.84	823.52	809.38	912.71	854.34	866.41	753.28
% Charge Imbalance	%		0	0	0	0	0	0	0	0	0
Ionic Strength	mol/kg		0.0134	0.0136	0.0164	0.0168	0.0165	0.0185	0.0175	0.0177	0.0154
Mass Water	kg		1	1	1	1	1	1	1	1	1

Cells highlighted in red exceed proposed site specific limits or PEL limits.

*Proposed, monthly-average, site-specific Chloride limit.

White Pine North — Predicted WTP Influent Concentrations

Generated from PHREEQC speciation results (final post-precipitation chemistry) | Years 19–26 of 26

Parameter	Unit	PEL Limit	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26
		Solution #	66	67	68	69	70	71	72	73
pH	s.u.	6.5 to 9.0	6.916	7.005	7.005	7.008	7.006	7.332	6.907	7
pe	s.u.		6.374	6.438	6.435	6.442	6.454	6.582	6.356	6.434
Temperature	deg C		12.68	13.13	13.19	13.1	13.42	13.89	12.54	13.13
Dissolved Oxygen	mg/L									
Ca	mg/L		139.11	118.95	114.54	120.71	123.52	82.1198	131.46	119.15
Mg	mg/L		14.3934	12.641	12.1306	12.8768	13.0931	9.6685	13.5306	12.6289
Na	mg/L		154.88	136.10	131.29	138.33	143.62	103.16	146.26	135.89
K	mg/L		11.0218	10.6074	10.3298	10.7051	11.2838	9.5556	10.3102	10.6308
Cl	mg/L	200.00*	385.02	326.63	314.79	331.27	339.36	218.71	364.10	327.37
SO4	mg/L	371.14	102.78	84.226	81.1006	85.3116	87.2333	49.393	97.6939	84.5072
NH4	mg/L		4.9098	3.5774	3.5444	3.4396	3.1766	0.0018	4.5983	3.8026
NO3	mg/L		0.000244	0.0075	0.0076	0.0081	0.0128	0.2355	0.000114	0.0066
HCO3	mg/L		139.48	132.28	127.65	134.54	138.39	120.81	130.21	132.04
CO3	mg/L		0.0619	0.0711	0.0683	0.0729	0.0756	0.1332	0.0559	0.0702
Aluminum	mg/L		0.0017	0.0016	0.0015	0.0016	0.0016	0.0015	0.0016	0.0015
Antimony	mg/L	0.1303	0.0017	0.0017	0.0017	0.0017	0.0018	0.0016	0.0016	0.0017
Arsenic	mg/L	0.01	0.0019	0.0018	0.0018	0.0018	0.0019	0.0016	0.0018	0.0018
Barium	mg/L	0.2999	0.0419	0.0474	0.0481	0.0474	0.0486	0.0606	0.0412	0.0472
Beryllium	mg/L	0.0036	0.000618	0.000483	0.000462	0.000491	0.000493	0.000241	0.000588	0.000484
Boron	mg/L	7.2196	0.8348	0.799	0.7799	0.8042	0.8531	0.7012	0.7825	0.8016
Bromide	mg/L		3.682	3.2641	3.1626	3.2976	3.4311	2.4275	3.4726	3.2737
Cadmium	mg/L	0.0036	0.0015	0.001	0.00099	0.001	0.0011	0.000252	0.0014	0.001
Chromium	mg/L	0.0828	0.006	0.0051	0.0049	0.0051	0.0054	0.0032	0.0057	0.0051
Cobalt	mg/L	0.1003	0.0113	0.0088	0.0085	0.0089	0.0092	0.0039	0.0108	0.0089
Copper	mg/L	0.0098	0.0732	0.0624	0.0597	0.0636	0.0642	0.0441	0.069	0.0623
Fluoride	mg/L	2.11	0.5768	0.5498	0.5346	0.5553	0.5834	0.4869	0.5397	0.5508
Iron	mg/L		0.007	0.0076	0.0076	0.0076	0.007	0.0016	0.0065	0.0078
Lead	mg/L	0.0833	0.0043	0.003	0.0029	0.0031	0.0031	0.000682	0.0041	0.003
Lithium	mg/L	0.4412	0.0791	0.0736	0.0715	0.0744	0.0779	0.0617	0.0743	0.0738

Parameter	Unit	PEL Limit	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26
		Solution #	66	67	68	69	70	71	72	73
Manganese	mg/L	1.4319	0.2256	0.1631	0.1565	0.1649	0.1665	0.0457	0.2171	0.1644
Mercury	ng/L	1.3	4.6618	3.8032	3.6006	3.8614	3.8413	2.1443	4.417	3.8173
Molybdenum	mg/L	3.2088	0.0329	0.0385	0.0374	0.0392	0.0412	0.0491	0.0298	0.0383
Nickel	mg/L	0.0422	0.0137	0.0097	0.0093	0.0098	0.0099	0.0022	0.0132	0.0098
Phosphorous	mg/L	1	0.6631	0.459	0.4395	0.4643	0.4652	0.0774	0.6402	0.4634
Selenium	mg/L	0.005	0.0016	0.0013	0.0013	0.0013	0.0013	0.000706	0.0016	0.0013
Silver	mg/L	0.00006	0.000236	0.000205	0.000198	0.000206	0.000215	0.00014	0.000224	0.000205
Strontium	mg/L	36.0986	1.8278	1.5815	1.5272	1.6017	1.6516	1.1145	1.7261	1.585
Sulfide	mg/L		0	0	0	0	0	0	0	0
Thallium	mg/L	0.0037	0.000544	0.000454	0.000436	0.000461	0.000469	0.000291	0.000515	0.000454
Tin	mg/L		0.0026	0.0025	0.0024	0.0025	0.0026	0.0021	0.0024	0.0025
Uranium	mg/L		0.0035	0.0038	0.0037	0.0038	0.0041	0.0039	0.0033	0.0038
Vanadium	mg/L	0.0271	0.0026	0.0021	0.0021	0.0022	0.0022	0.0013	0.0025	0.0021
Zinc	mg/L	0.1722	0.0684	0.0479	0.0459	0.0485	0.0486	0.0099	0.066	0.0484
Total Dissolved Solids (TDS)	mg/L		959.83	832.23	802.37	844.49	867.24	598.89	905.93	833.27
% Charge Imbalance	%		0	0	0	0	0	0	0	0
Ionic Strength	mol/kg		0.0196	0.017	0.0164	0.0173	0.0177	0.0122	0.0185	0.017
Mass Water	kg		1	1	1	1	1	1	1	1

Cells highlighted in red exceed proposed site specific limits or PEL limits.

*Proposed, monthly-average, site-specific Chloride limit.