General Plan of Operations

May 9, 2016

Resolution Copper Mining

TABLE OF CONTENTS

VOLUME I

General Plan of Operations

Tables

Exhibits

VOLUME II

Figures

INTRODUCTION (Section 1)

SITE CONDITIONS (Section 2)

PROJECT DESCRIPTION (Section 3)

PROJECT MITIGATION AND MONITORING (Section 4)

RECLAMATION (Section 6)

VOLUME III

Appendices

ACRONYMS AND ABBREVIATIONS

AAC	Arizona Administrative Code
ABA	Acid Base Accounting
ADEQ	Arizona Department of Environmental Quality
ADOT	Arizona Department of Transportation
ADWR	Arizona Department of Water Resources
AERMOD	American Meteorological Society/Environmental Protection Agency Regulatory Model
AGFD	Arizona Game and Fish Department
AGP	Acid generating potential
AHC	Arizona Hedgehog Cactus
AMA	Active Management Area
AMLRA	Arizona Mined Lands Reclamation Act
amsl	above mean sea level
ANP	Acid neutralizing potential
APP	Arizona Aquifer Protection Permit
ARD	Acid Rock Drainage
ARS	Arizona Revised Statute
ASARCO	American Smelting and Refining Company
ASME	American Society of Mechanical Engineers
ASLD	Arizona State Land Department
AWQS	Aquifer Water Quality Standards
AZPDES	Arizona Pollutant Discharge Elimination System
BADCT	Best Available Demonstrated Control Technology
BHP	BHP Billiton
BLM	Bureau of Land Management
CAP	Central Arizona Project
$CaCO_3$	Calcium Carbonate
CFR	Code of Federal Regulations
CO	Carbon Monoxide
CWA	Clean Water Act
DOT	Department of Transportation
EMP	Explosives Management Plan
EPA	Environmental Protection Agency
EPS	East Plant Site
ESA	Endangered Species Act
Forest Plan	Tonto National Forest Land and Resource Management Plan
FR	Forest Road
FS	US Forest Service
FSM	Forest Service Manual
GHG	Green House Gas
GPA	General Project Area
GPO or Plan	Resolution Copper Project General Plan of Operations
HCT	Humidity Cell Testing
HDPE	High Density Polyethylene
HSE	Health, Safety, and Environment
KCB	Klohn Crippen Berger

LHD	Load, Haul, Dump
LTF	Licensing Time Frame
Magma	Magma, Arizona (also known as Magma Junction, Arizona)
MARRCO	Magma Arizona Railroad Company
MBSC	Migratory Bird Species of Concern
MCL	Maximum Contaminant Level
MIS	Management Indicator Species
MSDS	Material Safety Data Sheets
MSHA	Mine Safety & Health Administration
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NHPA	National Historic Preservation Act
NM	not monitored
NMIDD	New Magma Irrigation & Drainage District
NNP	Net neutralization Potential
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxide
NOAA	National Oceanic & Atmospheric Administration
NPAG	Not-potentially-acid-generating
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NRIS	National Register Information System
O_3	Ozone
PAG	Potentially-acid-generating
Pb	Lead
PCAQCD	Pinal County Air Quality Control District
PGA	Peak Ground Acceleration
PLC	Programmable Logic Control
PMF	Probable Maximum Flood
Project	Resolution Copper Project (or Resolution Project)
RWL	Audubon Society Red Watch List
SAG	Semi-autogenous Grinding
SHPO	State Historic Preservation Office
SO_2	Sulfur Dioxide
SPCC	Spill Prevention, Control, and Countermeasure
SR	State Route
SRP	Salt River Project
SWPPP	Stormwater Pollution Prevention Plan
TMDL	Total Maximum Daily Load
TNF	Tonto National Forest
TSF	Tailings Storage Facility
USCB	US Census Bureau
USFWS	US Fish and Wildlife Service
USGS	United States Geological Survey
WPS	West Plant Site
WRCC	Western Regional Climate Center

WSC	Wildlife Species of Concern
WWTP	Wastewater Treatment Plant
YWL	Audubon Society Yellow Watch List

UNITS

ac	acre
ac-ft	acre feet
bgs	below ground surface
Bt	billion tons
C	Celsius
cm	centimeters
cm/s	centimeters per second
dB	decibel
dB(A)	A-weighted decibels
F	Fahrenheit
ft	feet
ft/s	feet per second
ft^2	square feet
gpd	gallons per day
gpm	gallons per minute
H	horizontal
Ha	hectare
hp	horse power
hr	hour
in	inches
km	kilometers
km^2	square kilometers
kT	kiloton
kV	kilovolt
lb	pound
Leq	Continuous sound level equivalency
L/s	liters per second
m	meters
m^2	square meters
m^3	cubic meters
m^3/s	cubic meters per second
µm	micrometers
µ	microns
mi	miles
mi^2	square miles
mil	one thousandth of an inch
mg/l	milligrams per liter
mm	millimeters
MG	million gallon
Mton	million tons
Mtonne	million metric tons
m/s	meters per second
Mm^2	million square meters
Mm^3	million cubic meters
Mph	miles per hour

Myd^3	million cubic yards
PM_{10}	Particulates with an aerodynamic less than or equal to a nominal 10 micrometers
$PM_{2.5}$	Particulates with an aerodynamic less than or equal to a nominal 2.5 micrometers
ppb	parts per billion
ppm	parts per million
psi	pounds per square inch
T	ton
tonne	metric ton
yd	yard
V	Vertical
yd^3	cubic yards

1. INTRODUCTION

1.1. PROJECT TITLE AND DOCUMENT ORGANIZATION

The proposed underground mine, ore processing operation, and associated facilities and infrastructure described herein are collectively identified as the Resolution Copper Project (Resolution Project or Project). Resolution Copper Mining, LLC (Resolution Copper), is the operating company and the Project's proponent. The name of this document is the Resolution Copper Project General Plan of Operations (GPO or Plan).

This document was prepared pursuant to US Forest Service (FS) regulation (36 Code of Federal Regulations [CFR] 228A) and is being submitted to the FS for review and approval. This Plan was prepared consistent with this regulation and with the FS plans of operation guidelines provided in Appendix C of the document Training Guide for Reclamation and Bond Estimation and Administration for Mineral Plans of Operation Authorized and Administered under 36 CFR 228A (FS 2004).

The GPO is organized into the volumes and sections shown in ***Table 1.1-1***. ***Section 1*** is this Introduction, which contains basic background, scheduling, and permitting information on the Project. ***Section 2*** is Site Conditions, which contains information on existing climate, air, geology, water, soils, and land use. ***Section 3*** is the Project Description, which contains information on existing and proposed project features, infrastructure, equipment and supplies, workforce, and scheduling. ***Section 4*** is Project Mitigation and Monitoring, which contains information on the environmental protection elements of the Project, as well as proposed mitigation and monitoring measures regarding geology, air, water resources, soils, biological and cultural resources, aesthetics, recreation, fire and safety, hazardous materials, transportation, and socioeconomics. ***Sections 5 and 6*** contain the Interim Shutdown and Reclamation Plans, respectively. ***Section 7*** is the Glossary of terms, and ***Section 8*** contains a list of references cited in the document. Finally, ***Volumes II and III*** contain the figures and appendices, respectively.

Table 1.1-1 Organization of the General Plan of Operations

Section	Subsection	Explanation / Contents
Volume I		**General Plan of Operations**
Section 1 - Introduction		Information about the Project; Project owner; Project Background; Proposed Operations; Conformance with the Tonto National Forest Plan; Permits and Approvals; and Project Schedule
Section 2 - Site Conditions		Information on Climate and Air; Geology; Water; Soils; and Land Use
Section 3 - Project Description		Information on Existing Infrastructure; Proposed Mining; Milling and Processing; Transportation; Utilities and other Linear Features; Water Use and Treatment; Workforce and Schedule; Support Facilities; Materials, Supplies, and Equipment; Sanitary and Solid Waste; and Hazardous Materials
Section 4 - Project Mitigation and Monitoring		Information on Environmental Protection Elements of the Proposed Project; Geology; Air; Water Resources; Soils; Wildlife; Aquatic Biology; Vegetation; Cultural Resources; Aesthetics; Recreation; Fire and Safety; Hazardous Materials; Transportation; and Socioeconomics
Section 5 - Plan for Interim Shutdown		Describes interim reclamation requirements and plans to secure access and maintain facilities
Section 6 - Reclamation		Contains provisions for concurrent interim and final reclamation of project related disturbance and facilities
Section 7 - Glossary		Glossary
Section 8 - References		References
Volume II		**Figures**
Volume III		**Appendices**
	Appendix A	Resolution Project Mineral Claim Information
	Appendix B	History of Mining
	Appendix C	Resource Studies Conducted in Support of the Resolution Project
	Appendix D	Emissions Inventory
	Appendix E	Subsidence Management Plan
	Appendix F	Physical Characteristics of Rock Types and Rock Mass Characterization
	Appendix G	Geochemical Characterization Data Summary Report
	Appendix H	Geochemical Characterization of Resolution Tailings
	Appendix I	Site-Specific Seismic Hazard Analyses for the Resolution Mining Company Tailings Storage Facilities Options
	Appendix J	Groundwater Monitoring Well Identifiers
	Appendix K	Road Use Plan
	Appendix L	Emergency Response and Contingency Plan
	Appendix M	Fire Prevention and Response Plan

Table 1.1-1 Organization of the General Plan of Operations

Section	Subsection		Explanation / Contents
		Appendix N	Stormwater Drainage Design Memorandum
		Appendix O	Spill Prevention, Control, and Countermeasure Plan
		Appendix P	Explosives Management Plan
		Appendix Q	Prediction of Solute Chemistry for Tailings
		Appendix R	Overview of Acid Rock Drainage Operational and Post-Closure Water Management Strategies at Resolution Copper Mining for the Protection of Groundwater and Surface Water
		Appendix S	Resolution Copper's Health, Safety, and Environment (HSE) Performance Standards
		Appendix T	MSDS Sheets
		Appendix U	Hydrocarbon Management Plan
		Appendix V	Environmental Materials Management Plan
		Appendix W	Stormwater Pollution Prevention Plan
		Appendix X	Wildlife Management Plan
		Appendix Y	Post Closure Grading Plan for the Resolution Copper Project in Pinal County, Arizona
		Appendix Z	Section 1 Tables and Figures Project Disturbance with Land Exchange

1.2 LOCATION AND PROJECT SUMMARY

Resolution Copper's administrative headquarters are currently located on private land near Superior, Pinal County, Arizona, specifically at Resolution Copper's West Plant Site (WPS). These administrative offices are located immediately north of Superior at 102 Magma Heights, Superior, Arizona. The office is accessed from US 60 by taking the State Route (SR) 177 off-ramp and going north to the end of Magma Heights to the guard gate. The office building is known as the Verde Building (formerly the Magma Copper hospital building). New ore processing facilities (the Concentrator) will be located at WPS in an area disturbed by legacy mining features (i.e., those related to previous mining activity).

Project facilities and attendant infrastructure components are located in north-central Pinal County, and their proposed locations are herein referred to as the General Project Area (GPA) (***Figures 1.2-1 and 1.2-2***). The East Plant Site (EPS) encompasses the proposed underground mine, associated shafts, and surface support facilities. The support facilities, some of which are already in existence, are located in a previously disturbed area and include a mine site where Shaft 9 was constructed in the 1970s. EPS is located approximately 6 road mi (10 road km) east of WPS and is accessed from US 60 by turning south on Magma Mine Road (also known as Forest Road [FR] 469). Magma Mine Road ends at the EPS guard gate. The existing mine site and related surface support facilities are currently located on private lands, and during production will largely expand on private lands. The impacts of the underground mine will be primarily on FS lands, with a smaller portion on state and private lands. Additional area encompassed by the EPS includes the land surface above the ore body, comprised of unpatented mining claims on lands administered by the FS, specifically Tonto National Forest (TNF).

Some of the lands proposed for development of the mine are included in the Land Exchange Proposal (RCM 2015) submitted to the TNF in accordance with the provisions of the Southeast Arizona Land Exchange and Conservation Act (the Act), which is Section 3003 of Public Law 113-291. The Act authorizes and directs an exchange of land between Resolution Copper and the U.S. Subject to the terms of the Act, Resolution would acquire the 2,422-acre Oak Flat parcel (including the 760-acre Oak Flat Withdrawal Area) in exchange for 5,344 acres of private land to be conveyed to the U.S. The land exchange and the GPO are separate proposals. The Act requires that the land exchange and the GPO be considered and evaluated by the Forest Service in a single EIS. In order to support the environmental evaluation of both the GPO and the land exchange, this GPO identifies where mine development would occur on or under public lands included in the exchange. Acreage tables, maps, and figures reflecting the change in land status that would occur if the land exchange is approved are included in ***Appendix Z***.

A copper concentrate filtration plant and concentrate loadout facility (the Filter Plant and Loadout Facility) will be constructed on already disturbed private lands near Magma Junction (Magma), proximate to the existing disturbed Magma Arizona Railroad Company (MARRCO) right-of-way. The MARRCO right-of-way crosses lands owned by Resolution Copper and the FS, as well as other private lands not owned by Resolution and state trust lands administered by the Arizona State Land Department (ASLD). The MARRCO right-of-way will be the site of connecting infrastructure, such as water supply pipelines, dewatering pipelines, concentrate pipelines, and power lines; these features and the existing rail line are referred to collectively as the MARRCO Corridor.

A Tailings Storage Facility (TSF) will be situated west of WPS and north of Queen Station within the TNF. Tailings will arrive at the TSF from WPS via a pipeline that traverses the intervening area (along with other infrastructure) along the Tailings Corridor. The linear infrastructure elements of the Project are primarily located within the Tailings Corridor, within the MARRCO Corridor on private land alongside existing disturbed land, or underground, and include ore conveyors, roads, power lines, copper concentrate pipelines, tailings pipelines, the MARRCO Railroad, and water supply pipelines. These elements connect the Project features and traverse multiple jurisdictions, representing several land ownership types, including private, state, and federal lands.

1.3. PROJECT OWNER AND OPERATOR

1.3.1. APPLICANT

Resolution Copper Mining, LLC
102 Magma Heights
P.O. Box 1944
Superior, Arizona 85273
Telephone: (520) 689-9374
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Email: info@resolutioncopper.com

The Resolution Project will be managed by Resolution Copper Mining, LLC, through its majority member, Resolution Copper Company, a wholly owned subsidiary of Rio Tinto.

1.3.2. APPLICANT CONTACT INFORMATION

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1.3.3. LAND STATUS

As shown in ***Figures 1.3-1 and 1.3-2***, Resolution Copper has located the following facilities on the surface of lands administered by the FS and Resolution Copper-controlled unpatented mining and/or mill site claims on these lands (***Appendix A***).

- Certain pipelines or portions thereof
- Certain power lines or portions thereof (the power lines and associated rights-of-way will be owned and/or controlled by the Salt River Project (SRP)
- MARRCO Corridor (portions of the right-of-way cross TNF land)
- Shaft 12 and associated components (hoist and winder)
- Process Water Pond
- TSF
- Tailings Corridor
- Other roads and infrastructure

Resolution Copper controls unpatented mining claims for the area covering the ore body. Resolution Copper also controls patented mining claims and other private lands where the following facilities and activities will occur:

- Surface facilities at EPS with Shafts 9, 10, 11, 13, and 14, infrastructure, and other buildings
- WPS, including the Concentrator Complex and ancillary and administrative components
- Certain pipelines or portions thereof
- Certain power lines or portions thereof
- Railroad (portions of the right-of-way cross private and ASLD-administered state trust lands)
- Filter Plant and Loadout Facility

Portions of the TSF and the Tailings Corridor are located on unpatented lode claims not controlled by Resolution Copper.

Lands and acreages that would be affected by the proposed land exchange are described in ***Appendix Z***.

1.4. PROJECT BACKGROUND

1.4.1. RESOLUTION PROJECT

In 2004 Resolution Copper Mining LLC became the operator of the Resolution Copper Project after acquiring certain assets, including the West Plant Site and East Plant Site, from BHP Billiton. The 2004 transaction followed three years of work related to the potential mineralization near the East Plant Site. Since 2004, Resolution Copper has steadily worked to investigate and delineate the ore body, develop a Project concept and design, prepare environmental and engineering studies to support the mine permitting effort, and conduct multiple community outreach efforts and public meetings to inform and involve the public as plans were developed. In addition, substantial reclamation of the legacy mining facilities associated with the historical Magma copper mine at WPS has been completed or is in progress. Of particular note is the rehabilitation of the old Superior hospital building, which was completely renovated and is now the administrative office known as the Verde Building. Reclamation of legacy waste rock and tailings facilities and of a legacy concentrator has also been completed.

Resolution Copper has been conducting engineering studies and gathering baseline data for close to 10 years. The Project has completed engineering sufficient to support a mine plan of operations.

Several important prefeasibility- or feasibility-level projects are complete or underway on private lands, rights-of-way, and federal lands, including:

- Construction of a water treatment facility and mine dewatering infrastructure to pump and treat underground mine dewatering water (completed and in operation). This Project was highlighted in a paper supported by the US Environmental Protection Agency (EPA) that examines the changing values and beneficial uses of water within several industrial sectors, including the mining industry (CH2M Hill 2012).
- Construction of a pipeline down the MARRCO right-of-way to deliver treated water from the underground dewatering operations to the New Magma Irrigation and Drainage District (NMIDD) for beneficial use by farmers. This pipeline reduces the amount of groundwater pumping required by the farmers, who benefit from the Project (completed and in operation). This activity was authorized under a Special Use Permit granted by the FS (ID #MES749) on October 29, 2008.

- Exploration and hydrologic drilling to gather baseline hydrology and geologic data, and to expand ore body knowledge (in process) as authorized under the FS-approved Resolution Copper Prefeasibility Plan of Operations (#03-12-02-006), dated October 1, 2010 (Resolution Copper 2010).
- Sinking of additional exploratory shafts on private lands at EPS to access, understand, and gather baseline data on the conditions within the ore zone (in progress).
- Reclamation of other legacy mining facilities at WPS (in progress).
- Drilling to gain information and an understanding of the geology and hydrogeology within the GPA and vicinity.

Resolution Copper has received several approvals from the FS to conduct work in support of the Resolution Project. A summary of the work that Resolution Copper has been authorized to conduct specifically under the jurisdiction of the FS is provided in ***Table 1.4-1***. This work is being conducted in support of the Resolution Project to facilitate activities such as exploration, the collection of environmental baseline data, facility designs, and associated access.

Table 1.4-1 Summary of US Forest Service Approvals

US Forest Service Authorization	Authorization ID	Authorization Period	Description
Special Use Permit	MES749	10/29/2008 - 10/31/2018	To construct a water pipeline from the water treatment plant in Superior to an irrigation canal operated by the New Magma Irrigation and Drainage District near Florence Junction, Pinal County, Arizona. An 18-inch high-density polyethylene pipeline has been constructed within the MARRCO right-of-way that crosses private, FS system, and state lands.
Resolution Project Exploratory Drilling Plan of Operations	01-12-02-002	6/6/2001 -12/6/2002	Activities included: 1) nine combination exploration and groundwater monitoring well sites; 2) one groundwater monitoring well; 3) the improvement and maintenance of six FS system and user-created roads for drill site access; and 4) the placement of aboveground plastic pipe and tanks for potable water transfer and storage. All the approved drill site construction, roadway improvements, and water system construction activities have been completed.
Resolution Prefeasibility Plan of Operations	03-12-02-006	Authorization period varies by prefeasibility activity as shown below	To conduct exploration and hydrologic drilling to gather baseline hydrology, geologic data and to expand ore body knowledge.

Table 1.4-1 Summary of US Forest Service Approvals

US Forest Service Authorization	Authorization ID	Authorization Period	Description
Exploration Drilling (and associated road and drill site construction)		10/4/2010 - 12/31/2019	To conduct exploration and hydrologic drilling to gather baseline hydrology and geologic data, and to expand ore body knowledge.
Deep and Shallow Well Construction (and associated road and drill site construction)		10/4/2010 - 12/31/2019	To conduct exploration and hydrologic drilling to gather baseline hydrology and geologic data, and to expand ore body knowledge.
Tunnel Borehole Drilling (and associated road and drill site construction)		10/4/2010 - 12/31/2021	To conduct exploration and hydrologic drilling to gather baseline hydrology and geologic data, and to expand ore body knowledge.
Groundwater Testing/Monitoring (and associated road maintenance)		10/4/2010 - 12/31/2025	To conduct exploration and hydrologic drilling to gather baseline hydrology and geologic data, and to expand ore body knowledge.
Baseline Hydrologic & Geotechnical Data Gathering Activities Plan of Operations	Submitted June 20, 2013	To be determined	To collect hydrologic, geochemical, and geotechnical data in order to provide baseline information on these aspects of the environment over an area being considered for a potential tailings storage site.

In addition to the FS authorizations summarized in ***Table 1.4-1***, Resolution Copper currently operates under numerous permits and licenses granted by other federal, state, county, and local agencies. A list of Resolution Copper's existing authorizations is provided in ***Table 1.4-2***.

Table 1.4-2 Existing Authorizations for the Resolution Project

Type of Permit	Permitting Agency	Permit ID	Expiration Date	Permit Use
Type 3.02 General Aquifer Protection Permit (East Plant Site Expanded Washbay Vehicle & Equipment)	Arizona Department of Environmental Quality	P-511171	9/5/2017	This general permit allows for discharges of wastewater generated from washing vehicles and equipment at East Plant Site. The washbay is intended for cleaning underground development vehicles and equipment. The initial facility consisted of a single equipment washbay, steam cleaner and a grit chamber. The expanded facility includes the initial components but adds a separate bay for washing vehicles, an oil/water separator and a lift station.
Type 3.02 General Aquifer Protection Permit (East Plant Site Washbay Vehicle & Equipment)	Arizona Department of Environmental Quality	P-106373	8/7/2017	General permit allows for discharges of wastewater generated from washing vehicles and equipment. The washbay is intended for cleaning underground development vehicles and equipment. The washbay is not used for cleaning the interiors of tanks or vessels.
Individual Aquifer Protection Permit (Development Rock Stockpile)	Arizona Department of Environmental Quality	P-106257	Life of facility	Development rock from shaft and underground exploratory activities and the sinking of Shaft 10 will be placed within the area where the existing Non-Municipal Solid Waste Landfill resides.
Individual Aquifer Protection Permit (Superior Mine)	Arizona Department of Environmental Quality	P-105823	Life of facility	For discharges of mine dewatering water from the Superior Mine to the mine water treatment system at West Plant Site. The treated mine water will primarily be conveyed to the New Magma Irrigation and Drainage District for beneficial use as irrigation for crops.
Type 3.02 General Aquifer Protection Permit (North & South Solids Storage Impoundments)	Arizona Department of Environmental Quality	P-105727 Licensing Time Frame (LTF)#53821 South LTF#53822 North	4/11/2016	These permits authorize process water discharges from water treatment facilities and allows for the discharge of treated water into the North and South solids storage impoundments.
Type 2.02 General Aquifer Protection Permit (Loadout Intermediate Rock Stockpiles)	Arizona Department of Environmental Quality	P-101703 LTF#54310	9/28/2016	Resolution Copper intends to temporarily stockpile ore-grade (non-inert) development rock generated during the advancement of exploratory shafts and underground exploration activities.

Table 1.4-2 Existing Authorizations for the Resolution Project

Type of Permit	Permitting Agency	Permit ID	Expiration Date	Permit Use
Type 2.02 General Aquifer Protection Permit (Intermediate Rock Stockpile)	Arizona Department of Environmental Quality	P-101703 LTF#53633	1/6/2016	Resolution Copper is authorized to operate the Intermediate Rock Stockpile for the purpose of staging ore-grade development rock from the advancement of shafts and underground exploration activities.
Area-Wide Aquifer Protection Permit Significant Amendment (West Plant Site)	Arizona Department of Environmental Quality	P-101703	Life of facility	This area-wide Aquifer Protection Permit authorizes the closure of existing Aquifer Protection Permit-regulated facilities at West Plant Site under a compliance schedule.
Multi-sector General Permit	Arizona Department of Environmental Quality	AZMSG-63061	–	Shaft 9 (East Plant Site) authorized to discharge stormwater associated with industrial activities.
Multi-sector General Permit	Arizona Department of Environmental Quality	AZMSG-62880	–	West Plant Site authorized to discharge stormwater associated with industrial activities.
Arizona Pollutant Discharge Elimination System	Arizona Department of Environmental Quality	AZ0020389	1/9/2016	Resolution Copper is authorized to discharge treated mine site stormwater runoff from Outfall 001 and treated seepage pumping and mine dewatering effluent from Outfall 002 from the Superior Operations to Queen Creek, in accordance with effluent limitations, monitoring requirements, and other conditions in the Standard Arizona Pollutant Discharge Elimination System Permit Conditions.
Individual Industrial Reclaimed Water Aquifer Protection Permit	Arizona Department of Environmental Quality	R-511181	8/30/2018	The mine dewatering water and industrial reclaimed water will be mixed with Central Arizona Project water in conveyances of the New Magma Irrigation and Drainage District for agricultural application. The water will be used beneficially to irrigate crops including, but not limited to, alfalfa, barley, Bermuda grass, cotton, sorghum, turf, and wheat fields.
Type 2.02 General Aquifer Protection Permit (East Plant Site Intermediate Rock Stockpile)	Arizona Department of Environmental Quality	511171	7/19/2017	Resolution Copper intends to temporarily stockpile ore-grade (non-inert) development rock generated during the advancement of exploratory shafts and underground exploration activities at East Plant Site.

Table 1.4-2 Existing Authorizations for the Resolution Project

Type of Permit	Permitting Agency	Permit ID	Expiration Date	Permit Use
Individual Aquifer Protection Permit (Non-Municipal Solid Waste Landfill)	Arizona Department of Environmental Quality	50287800	Life of facility	Resolution Copper is authorized to operate a Non-Municipal Solid Waste Landfill. The landfill is approved to accept construction and demolition debris, non-hazardous mine refuse, vegetative waste, non-tire rubber products, solid waste petroleum-contaminated soil, metal-contaminated soil, empty containers, and nonfriable and friable asbestos-containing material.
Special Waste Facility Generator	Arizona Department of Environmental Quality	302437	–	Resolution Copper is authorized to handle wastes designated as "special wastes" by the state.
Drinking Water Division Monitoring Assistance Program	Arizona Department of Environmental Quality	11078	–	Public water system for serving potable groundwater to Resolution Copper employees.
Voluntary Remediation Program	Arizona Department of Environmental Quality	101703	–	Smelter-affected soils closure is being performed under the Voluntary Remediation Program.
Water Storage Permit and New Magma Irrigation and Drainage District Groundwater Savings Facility	Arizona Department of Water Resources	72-545695-RCWR 73-534489-Hohokam 73-593305-Tonopah 73-534888-NMIDD 71-584466-Hieroglyphic 71-569775-AguaFria	–	Water storage permit and New Magma Irrigation and Drainage District Groundwater Savings facility.
Groundwater Rights and Withdrawal Permit	Arizona Department of Water Resources	59-524492	9/20/29	This permit authorizes the withdrawal of groundwater not to exceed 5,000 ac-ft/year.
Groundwater Rights and Withdrawal Permit	Arizona Department of Water Resources	58-130703	–	This permit authorizes the withdrawal of groundwater not to exceed 315 ac-ft/year.
Groundwater Rights and Withdrawal Permit	Arizona Department of Water Resources	58-117402	–	This permit authorizes the withdrawal of groundwater not to exceed 1,490 ac-ft/year.
Special Land Use Permit	Arizona State Land Department	23-115515-08 23-115516-08 23-115517-08 23-115518-08 23-115519-08 23-115520-08	2/7/2014	Geotechnical and hydrological data gathering.

Table 1.4-2 Existing Authorizations for the Resolution Project

Type of Permit	Permitting Agency	Permit ID	Expiration Date	Permit Use
Special Land Use Permit	Arizona State Land Department	23-116886-08 23-116885-08 23-116884-08 23-116883-08	1/29/2015	Authorizes the installation of surface water monitoring equipment.
Special Land Use Permit	Arizona State Land Department	23-109606-21	–	Authorizes one groundwater monitor well and access.
Resource Conservation and Recovery Act	Environmental Protection Agency	AZD001886654	Life of facility	This Environmental Protection Agency ID # is to be listed on transport manifests and other hazardous waste management documents. The Resource Conservation and Recovery Act gives the Environmental Protection Agency the authority to control hazardous waste from the "cradle-to-grave." This includes the generation, transportation, treatment, storage, and disposal of hazardous waste.
Radio License	Federal Communications Commission	007A058154	–	Radio license
Air Quality Control Permit	Pinal County Air Quality Control Division	B31159.000	11/16/2014	This permit pertains to the historical mining (reclamation) and development and exploratory mining exploration facilities operated by Resolution Copper. Resolution Copper shall not use any material, process, or equipment not identified in the permit which will cause emissions of any regulated air pollutant allowed under this permit.
Meteorological and Ambient Air Monitoring Plan	Pinal County Air Quality Control Division	–	–	Resolution Copper operates under a meteorological and air quality monitoring program to support several efforts during the prefeasibility and other mine development phases in support of impact analyses and permitting efforts. The plan was approved by Pinal County on 11/15/2011.
Hazardous Materials Certificate of Registration	US Department of Transportation	061713 552 0541V	6/30/2014	Resolution Copper is certified by the US Department of Transportation hazardous materials as required by 49 Code of Federal Regulations Part 107, Subpart G.
Mine Reclamation Plan	Arizona State Mine Inspector	Resolution Copper Superior Mine	Issue Date July 24, 2014	This plan authorizes the reclamation of surface disturbances at the East and West Plant Sites.

Table 1.4-2 Existing Authorizations for the Resolution Project

Type of Permit	Permitting Agency	Permit ID	Expiration Date	Permit Use
Baseline Hydrologic & Geotechnical Data Gathering Activities Plan of Operations	US Forest Service	Submitted June 20, 2013	To be determined	To collect hydrologic, geochemical, and geotechnical data in order to provide baseline information on these aspects of the environment over an area being considered for a potential tailings storage site.
Special Use Permit	US Forest Service	MES749	10/31/2018	This permit authorizes Resolution Copper to construct a water pipeline from the water treatment plant to an irrigation canal operated by the New Magma Irrigation and Drainage District.
Prefeasibility Plan of Operations	US Forest Service	03-12-02-006	Varies by activity as listed under permit use	Plan of Operations for Resolution Prefeasibility Activities authorizes: • Exploration drilling and associated road and drill site construction through 12/31/19; • Deep and shallow well construction and associated road and drill pad construction through 12/31/19; • Tunnel borehole drilling and associated road and drill site construction through 12/31/21; • Groundwater testing/monitoring and associated road maintenance through 12/31/25.
Resolution Project Exploratory Drilling Plan of Operations	US Forest Service	01-12-02-002	12/6/2002	Activities included: 1) nine combination exploration and groundwater monitoring well sites; 2) one groundwater monitoring well; 3) improvement and maintenance of six US Forest Service system and user-created roads for drill site access; and 4) the placement of aboveground plastic pipe and tanks for potable water transfer and storage. All the approved drill site construction, roadway improvements, and water system construction activities have been completed.

1.4.2. HISTORY OF MINING IN THE GENERAL PROJECT AREA

A comprehensive discussion of the history of mining in the GPA is included as ***Appendix B***. A brief account is provided below.

The modern history of Pinal County, and particularly of the GPA, is largely defined by mining interests and production beginning in the late nineteenth century. During the summer of 1871, a group of prospectors located a deposit of silver ore and recorded a number of claims collectively called the Silver Queen Ledge, which eventually became the Silver Queen Mine and, 30 years later, the Magma Mine (Walker & Chilton 1991). The Silver Queen Mine became valuable not for its silver deposits, but for its large copper deposits. Superior got its name from the Lake Superior and Arizona Mining Company (LS&A), who purchased several claims in the area in 1902 (Walker & Chilton 1991). Superior prospered over the next 5 years, but operations were suspended several times between 1907 and 1911 (Walker & Chilton 1991). William Boyce Thompson and his partner George Gunn acquired interests in the Silver Queen Mine in 1910 for $130,000 and renamed it the Magma Mine. Under its various owners, the Superior underground mine operated off and on from the early 1900s to the mid-1990s.

An ore concentrator was constructed at the Magma Mine by the spring of 1914. The mine processed substantial quantities of copper ore, and the company needed an economical and reliable way to transport their concentrates to the railroad (Walker & Chilton 1991). A 31-mi- (50-km-) long narrow-gauge railroad to Florence, the Magma Arizona Railroad, was completed by the summer of 1915. The narrow-gauge railroad was replaced in 1923 by a standard-gauge railroad. A smelter was built in 1924, allowing the Magma Copper Company to be self-sufficient and process concentrates on site. Also during the 1920s, the Arizona Highways Department constructed a highway through the Queen Creek Gorge, providing direct, improved travel between Superior and Globe for the first time (FS 1930).

In the 1930s, copper prices plummeted and the mine shut down for a brief period and workers' hours were slashed (Collins 1999; Walker & Chilton 1991). With the onset of World War II, the Magma Mine once again swung into full-scale production, and after World War II, the Cold War kept the Magma Mining Company busy supplying copper for the defense industry. The Superior underground mine boasts the first operation-scale refrigeration system for underground mine workings. Adjacent to the Superior townsite, the mine had a full complement of processing and byproduct storage facilities, including a mill, a smelter, a cooling plant, an assay lab, a railroad engine repair and maintenance barn with a turnstile, process and water treatment ponds, mill tailings, smelter slag, and other buildings and infrastructure. The underground workings were accessed via shafts and adits at WPS from 1914 through 1970 and then expanded in the early 1970s to include Shaft 9 and associated mining facilities at EPS.

Near the end of the underground operation's mine life, some additional exploration drilling was conducted from the bottom elevations of the mine. Drill holes barely intercepted a zone of what appeared to be a very deep porphyry-type copper deposit. This situation prompted the aforementioned agreement between the Project's partners and has since resulted in the identification of an important copper deposit. For about 10 years, Resolution Copper has been conducting exploration drilling to continue to characterize the nature and extent of the ore deposit. Efforts are underway on private Resolution Copper lands to rehabilitate and dewater Shaft 9 and to sink a new modern exploratory shaft known as Shaft 10. The completion of these efforts will allow for additional characterization of the ore and surrounding rock and the hydrology of various units, information that is needed to continue to refine the mine design.

1.5. PROPOSED OPERATIONS

Resolution Copper proposes to construct and operate an underground copper mine and associated facilities on a combination of private, federal, and state lands. In general, the Project includes the following features:

- New facilities at WPS, such as a Concentrator, administrative facilities, and a laboratory;
- New facilities at EPS, such as shafts, hoists, and attendant features;
- A TSF and associated tailings pipeline corridor;
- Several pipelines and other infrastructure within and adjacent to the MARRCO right-of-way;
- A Filter Plant and Loadout Facility; and
- A conveyor corridor connecting EPS with WPS located entirely underground beneath unpatented mining claims and private lands.

A schematic showing the sequence of the process flow is shown in ***Figure 1.5-1***. A detailed discussion of the Project process and features is provided in ***Section 3***.

Resolution Copper will use an underground mining method known as panel caving, which is a variation of block caving. Panel caving allows for the mining of very large relatively low-grade underground ore bodies by dividing the deposit into smaller strips, or panels, so that the ore can be removed in a safe and efficient manner. Because the ore body ranges from 5,000 to 7,000 ft (1,500 to 2,130 m) below the surface, an open pit is not economically or logistically feasible. The planned panel caving sequence for ore extraction is described below in ***Section 3.2.9.1***.

The benefits of a panel cave mine at Resolution include limited development rock piles at the surface and no large open pits with terraced pit walls. One consequence of panel cave mines, however, is that surface subsidence or settling above the ore deposit is anticipated. Surface subsidence occurs as the material above the ore body gradually moves downward to replace the ore that has been mined. The settling amount is less than the amount of ore removed due to the bulking of the rock underground.

Ore production from the underground operations will be a nominal 132,000 tons (120,000 tonnes) per day after an extensive construction and ramp-up period. The maximum throughput will be approximately 165,000 tons (150,000 tonnes) per day. Additionally, it is likely that with process improvements throughout the life of the operation, the nominal production rate may increase by 25 percent. There are approximately 607 million cubic yards of in situ ore in the current mine plan.

Ore material will be crushed underground and then transported by conveyor to two production shafts and hoisted to an underground midway offloading station within the two production shafts. The ore will be brought to the surface at WPS and then conveyed to a new Concentrator at WPS where the ore will be processed using traditional copper sulfide recovery techniques. The Concentrator will consist of conventional grinding and flotation circuits, and will result in the production of copper and molybdenum concentrates. The tailings material, the non-economic excess ground rock with a sand-like consistency that remains after concentrates have been removed during ore processing, will be piped as a slurry to the TSF located west of WPS. The TSF is comprised of unpatented mine claims on land administered by the TNF. Molybdenum concentrates will be bagged at the Concentrator and shipped to market via truck. Copper concentrates will be transported as slurry via pipeline to a filtration plant near Magma for final filtering and then routed to a train loadout facility for shipment to domestic and/or global markets for additional processing. There are no plans for an onsite smelter or other secondary refining plants.

The Resolution Project is anticipated to have a total operational life of approximately 40 years, not including initial site construction, which will span approximately 10 years and final reclamation work (demolition, regrading, and revegetation), which could take up to an additional 5 to 10 years. The post-closure for water management monitoring period will be determined during the National Environmental Policy Act (NEPA) process. In total, the Project will have a life span of over 60 years. At the peak of the construction phase, it is estimated that this Project will generate over 3,000 jobs. At full mine production, direct workforce requirements are projected to be around 1,400 employees.

With the exception of the TSF, the Project will be conducted largely from underground and on previously disturbed areas. ***Table 1.5-1*** summarizes some important aspects of the Project disturbance by geographical area. Project disturbance is shown on ***Figures 1.5-2a, 1.5-2b, 1.5-3a, 1.5-3b, 1.5-4a, 1.5-4b, 1.5-5a, and 1.5-5b***.

Table 1.5-1 Description of Project Disturbance

General Project Area	Description of Project Disturbance
West Plant Site (*Figures 1.5-2a through 1.5-2e*)	New facilities, such as the Concentrator, administrative offices, and a laboratory, are located within the previously disturbed plant site on private lands. A process water pond will be constructed on Tonto National Forest lands north of West Plant Site, and a landfill will be constructed on undisturbed private land.
Ore Conveyor/ Infrastructure Corridor (*Figure 1.5-2f*)	This corridor connects East Plant Site with West Plant Site and is located entirely underground beneath unpatented mining claims and private lands. Unpatented mining claims occur on Tonto National Forest lands.
East Plant Site (*Figures 1.5-3a and 1.5-3b*)	Due to space constraints and the fixed nature of the location of the ore body, new facilities, such as shafts, hoists, and attendant features, are located on a combination of previously disturbed and minimally disturbed areas comprising private and federal lands. Subsidence is predicted above the underground mine on private, Tonto National Forest, and state trust lands. This area is all identified as new disturbance.
Tailings Storage Facility and Tailings Pipeline Corridor (*Figures 1.5-4a and 1.5-4b*)	The tailings and tailings pipelines and infrastructure are located on Tonto National Forest lands. There is currently only minor existing surface disturbance in this area from roads and cattle ranching, and its footprint is identified largely as new disturbance.
MARRCO Corridor, Filter Plant, and Loadout Facility (*Figures 1.5-5a and 1.5-5b*)	Several pipelines and additional infrastructure will be placed within and adjacent to the MARRCO right-of-way. The right-of-way is disturbed and contains several other utilities. Some areas of native or regrown vegetation are present. The Filter Plant and Loadout Facility is located on a private parcel adjacent to the right-of-way. The parcel was previously slated for residential development and is partially disturbed.

Table 1.5-2 summarizes the Project's estimated disturbance acreage by surface ownership. ***Table 1.5-3*** itemizes the Project's estimated disturbance acreage by Project feature. Both tables show acreage estimates by land ownership and also break out the previously disturbed fraction.

Table 1.5-2 Summary of Proposed Project Disturbance

Surface Ownership	Minimally Disturbed or Undisturbed[1] (ac)	Previously Disturbed (ac)	Total (ac)
Tonto National Forest	5,544	49	5,593
Resolution Copper	523	644	1,167
State Trust Lands	152	39	191
TOTALS	**6,219**	**732**	**6,951**

[1] Includes lands that have not been disturbed and lands that are largely undisturbed but may contain areas of minimal disturbance, such as small roads or road segments.

Table 1.5-3 Proposed Project Disturbance

Project Feature	Tonto National Forest			Resolution Copper			State Trust Lands		
	Minimally Disturbed or Undis-turbed (ac)	Previously Disturbed (ac)	Total (ac)	Minimally Disturbed or Undis-turbed (ac)	Previously Disturbed (ac)	Total (ac)	Minimally Disturbed or Undis-turbed (ac)	Previously Disturbed (ac)	Total (ac)
Tailings and Tailings Corridor									
Tailings Storage Facility and Borrow Areas	4,016	0	4,016	0	0	0	0	0	0
Borrow Areas/Soil Salvage Stockpile	202	0	202	0	0	0	0	0	0
Tailings Corridor	114	0	114	0	0	0	0	0	0
Roads/Infrastructure	49	0	49	0	0	0	0	0	0
Subtotal	**4,381**	**0**	**4,381**	**0**	**0**	**0**	**0**	**0**	**0**
East Plant Site and Mine Area									
Plant Area	30	4	34	58	35	93	0	0	0
Magma Mine Road	16	0	16	0	0	0	0	0	0
Subsidence	1,068	0	1068	71	0	71	93	0	93
Subtotal	**1,114**	**4**	**1,118**	**129**	**35**	**164**	**93**	**0**	**93**
West Plant Site									
Stockpiles	0	0	0	0	98	98	0	0	0
Concentrator Complex/Yards/Laydown Yards/Process Water Pond	13	0	13	8	197	205	0	0	0
Administration Offices	0	0	0	0	22	22	0	0	0
Roads/Infrastructure	0	12	12	10	93	103	0	0	0
Subtotal	**13**	**12**	**25**	**18**	**410**	**428**	**0**	**0**	**0**
Filter Plant and Concentrate Loadout Facility									
Plant Area	0	0	0	363	190	553	0	0	0
Subtotal	**0**	**0**	**0**	**363**	**190**	**553**	**0**	**0**	**0**

Table 1.5-3 Proposed Project Disturbance

Project Feature	Tonto National Forest			Resolution Copper			State Trust Lands		
	Minimally Disturbed or Undis-turbed (ac)	Previously Disturbed (ac)	Total (ac)	Minimally Disturbed or Undis-turbed (ac)	Previously Disturbed (ac)	Total (ac)	Minimally Disturbed or Undis-turbed (ac)	Previously Disturbed (ac)	Total (ac)
MARRCO Corridor[1]									
Pipeline, Booster Stations, Roads/ Infrastructure	32	33	65	11	9	20	45	39	84
Laydown Areas	4	0	4	0	0	0	14	0	14
Subtotal	**36**	**33**	**69**	**11**	**9**	**20**	**59**	**39**	**98**
TOTALS	**5,544**	**49**	**5,593**	**523**	**644**	**1,167**	**152**	**39**	**191**

[1] Includes areas inside and outside the MARRCO right-of-way.

1.6. CONFORMANCE WITH THE FOREST PLAN

The current TNF Land and Resource Management Plan (Forest Plan) and associated Final Environmental Impact Statement acknowledge that, with the exception of areas that are withdrawn from mineral entry, FS lands are subject to locatable mineral (gold, silver, copper, high-quality stones) exploration and development under the General Mining Act of 1872. Environmental impacts are addressed through the approval of a Plan of Operations by the FS (TNF 1985; 1985a).

The proposed Resolution Project conforms to provisions in the existing 1985 Forest Plan and associated Final Environmental Impact Statement that states that mineral exploration, development, and production projects are acceptable land uses in this area.

1.7. PERMITS AND APPROVALS

Table 1.7-1 provides a list of some of the main anticipated permits and approvals necessary for the Resolution Project.

Table 1.7-1 List of Agencies, Permits, and Approvals

Agency	Item	Description	Term	Conditions
FEDERAL				
Department of Transportation	Hazardous Materials Transportation Registration	Shipment of hazardous materials (manifests)	Annual or 3-year renewal	Labeling, packaging, and shipping
US Environmental Protection Agency	Hazardous Waste – Resource Conservation and Recovery Act ID Number	Waste activities and disposal of hazardous waste	Life	Manifests, reporting, and inspections
US Environmental Protection Agency	National Environmental Policy Act Review Authority (NEPA)	Review authority of draft and final Environmental Impact Statement		
US Environmental Protection Agency	Clean Water Act Review Authority	Review authority under memorandum of understanding with the US Army Corps of Engineers for review of Clean Water Act permit		
US Army Corps of Engineers	Clean Water Act Section 404 Permit/Environmental Impact Statement	Discharge of fill material to waters of the US	5 years	Permit-specific conditions; requirements on environmental protections, compensatory mitigation for unavoidable impacts to waters of the US
Mine Safety and Health Administration	Mine Safety & Health Administration Number	Miner registration number	Life	Operate following Mine Safety and Health Administration rules
US Forest Service	Plan of Operations	US Forest Service reviews the applicant-prepared plan for mining operations on US System lands, which occurs throughout the NEPA process. The final NEPA decision (a Record of Decision) will provide direction to the applicant on the changes that need to be made to the plan for final approval.	Plan-specific	Prepare a plan and manage according to the plan; update as required
US Forest Service	Closure Plan and Financial Assurance	Bonding requirements for operations on Forest system lands	Mine life	Prepare a plan and manage according to the plan; update as required, post financial assurance

Table 1.7-1 List of Agencies, Permits, and Approvals

Agency	Item	Description	Term	Conditions
US Forest Service	NEPA Compliance Review (Environmental Impact Study)	Review of major federal action with Council on Environmental Quality oversight	Project life	Follow the Record of Decision
Bureau of Land Management	Infrastructure Special Use Permits	Approvals for water and power infrastructure	Varies	Permit-specific
Bureau of Land Management	Maintenance of Mining Claims	Maintain and pay fees to hold mining claims	Indefinite	Fees
US Fish and Wildlife Service	Biological Opinion/Section 7 Consultation under the Endangered Species Act with the US Forest Service on the Project Environmental Impact Statement and with the US Army Corps of Engineers for the Clean Water Act 404 Permit/ Environmental Impact Statement	Ensures action of federal agency does not jeopardize continued existence of federally listed species.	Mine life	Mitigation recommendations that may be made part of final Plan or 404 permit
Bureau of Alcohol, Tobacco, and Firearms	Blasting Operator Registration	Registration of all personnel that may handle blasting materials	As needed	Background and fingerprint checks of all persons with access; update as required by federal agencies
Federal Communications Commission	Radio Licenses for Industrial/ Business Pool Conventional Use	Communications equipment must be licensed	10 years	Follow license requirements
US Forest Service in consultation with the State Historic Preservation Office	Section 106 of the National Historic Preservation Act	Consultation with the State Historic Preservation Office and consulting Native American tribes; federal agency must take into account the effects of their undertaking on historic properties and resolve any adverse effects	Permit-specific	Identification of historic properties, adverse effects to historic properties will be avoided, minimized, or mitigated as stipulated in a Memorandum of Agreement
STATE				
Arizona Corporation Commission	Certificate of Environmental Compatibility	Regulates placement of proposed new and upgraded electrical lines	Project life	Follow the Certificate of Environmental Compatibility

Table 1.7-1 List of Agencies, Permits, and Approvals

Agency	Item	Description	Term	Conditions
Arizona Department of Environmental Quality	Aquifer Protection Permit	Approves design of tailings, concentrator, and temporary waste rock facilities to ensure groundwater protection	Project life	Permit will require installation of wells, application of compliance limits; required inspections, monitoring, maintenance, and reporting
Arizona Department of Environmental Quality	Aquifer Protection Permit Closure Plan and Financial Assurance	Bonding requirements for constructing and operating Aquifer Protection Permit -permitted facilities in the state of Arizona	Facility life	Prepare a plan and manage according to the plan; update as required, post financial assurance
Arizona Department of Environmental Quality	Arizona Pollutant Discharge Elimination System General Stormwater Permit	Regulates discharge of stormwater	5 years	Delineated in permit stormwater pollution and prevention plan
Arizona Department of Environmental Quality	Arizona Pollutant Discharge Elimination System Individual Discharge Permit	Regulates discharge of waste water to surface waters	5 years	Permit-specific. The permit will require conditions, including limitations on the amount of pollutants in the discharge, monitoring requirements, and other requirements.
Arizona Department of Environmental Quality	Section 401 State Water Quality Certification	Required for Clean Water Act Section 404 permits to ensure that permitted activity does not result in violations of state water quality standards	5 years	Permit-specific
Arizona Department of Environmental Quality	Solid Waste Management Inventory Number	Landfill and waste area requirements	Life	Monitoring, maintenance, and operations
Arizona Department of Environmental Quality	Hazardous Waste Management Number	Management of hazardous waste	Life	Monitoring, maintenance, and operations
Arizona Department of Environmental Quality	Waste Tire Cell Registration	Management of off-road tires greater than 3 ft in diameter	Life	Annual reporting, cover requirements
Arizona Department of Environmental Quality	Wastewater onsite disposal system (septic) permit	Permit for onsite septic system	Life	Varies
Arizona Department of Transportation	Encroachment Permit	For any activities in Arizona Department of Transportation right-of-way		Requires an Environment Report

Table 1.7-1 List of Agencies, Permits, and Approvals

Agency	Item	Description	Term	Conditions
Arizona Department of Water Resources	Groundwater Withdrawal Permits	Groundwater withdrawal rights	Project life	Groundwater withdrawal
Arizona Department of Water Resources	Safety of Dams Permit	Requirements for jurisdictional dam construction	Project life	Monitoring, maintenance
Arizona Department of Water Resources	Water Storage Permit	Underground storage of Central Arizona Project water		Annual reporting, storage, and Central Arizona Project purchase contracts
Arizona State Mine Inspector	Reclamation Plan	Post-mining land uses and plans for regrading on private lands	Project life	Annual updates and conditions also require financial assurance for closure.
Arizona State Land Department	Hard Rock Exploration Permit	Mineral exploration on state trust lands with private mineral leases	Permit-specific	Stumpage fees; archaeological clearance
Arizona State Land Department	Special Land Use Permit	Mineral exploration on state trust lands with federal mineral estate; data sonde installation for surface water testing and monitoring; compliance with Native Plant Law and Arizona Antiquities Act; impacts from subsidence	Permit-specific	Stumpage fees; archaeological clearance
State Historic Preservation Office	Arizona Antiquities Act	Consultation with the Arizona State Land Department and consulting Native American tribes regarding historic properties (cultural resources). In practice, this is usually coordinated with Section 106 compliance when there is a federal nexus.	Permit-specific	Identification of cultural resources, impacts will be avoided, minimized, or mitigated as stipulated in a treatment plan.
COUNTY				
Pinal County Air Quality Control District	Clean Air Act Class II Permit	Regulates control of air emissions; mobile and stationary emission sources	5 years	Inspections, monitoring, maintenance, and reporting

1.8. PROJECT SCHEDULE

A schedule for the permitting and development of the Resolution Project is shown in ***Table 1.8-1***. Resolution Copper will initiate construction of the surface facilities on private lands and implement underground development activities (i.e., characterization and exploration) within unpatented mining claims for the Resolution Project concurrent with permitting and approvals. Underground development work and surface facility construction are expected to continue for up to 10 years. Construction on federal lands following approval of the Record of Decision is expected to last 9 years, leading to mine and ore processing operations that are projected to last for an estimated 40 years. Upon permanent cessation of mining and related Project activities, the reclamation and closure plans will be implemented. Reclamation and closure work, including the demolition of structures, the rehabilitation and revegetation of land, and the post-closure monitoring contemplated in this GPO, is expected to take 5 to 10 years to complete. Environmental monitoring is expected to continue for a number of years to ensure stable closure. The total Project life, therefore, is approximately 60+ years, depending on market conditions.

Like all mining projects, the life cycle of the Resolution Project will advance through a number of phases. The key phases for the Resolution Project are: 1) Prefeasibility and Baseline Studies; 2) Engineering, Underground Characterization/Exploration, Permitting and Approvals; 3) Construction and Mine Development; 4) Mine and Ore Processing Operations; and 5) Closure and Post Closure.

1.8.1. PREFEASIBILITY AND BASELINE STUDIES

The Resolution Project is currently nearing the end of the Prefeasibility phase. During this phase, Resolution Copper has worked to define the nature and extent of the ore deposit through exploration drilling campaigns and the construction and rehabilitation of mine shafts. In addition, this phase included the initiation of Project engineering as well as extensive resource baseline investigations. This phase is not shown in ***Table 1.8-1***.

1.8.2. ENGINEERING, UNDERGROUND CHARACTERIZATION/EXPLORATION, PERMITTING AND APPROVALS

This phase is currently underway. Important aspects of this phase include the continuation of basic Project engineering, the continuation of baseline studies, the initiation of environmental permitting efforts, and the continuation of exploratory shaft construction and underground ore characterization access development activities (including construction of attendant surface facilities) on private land. Submittal of the GPO triggers a Plan completeness review, following which, the FS will complete the NEPA review process before making a decision on the final GPO.

1.8.3. CONSTRUCTION AND MINE DEVELOPMENT

In this phase, the construction of surface facilities continues on federal lands after the completion of NEPA and the issuance of a final GPO by the FS and after the Project has obtained all necessary permits and approvals. This GPO describes all of the Project features that are proposed for construction.

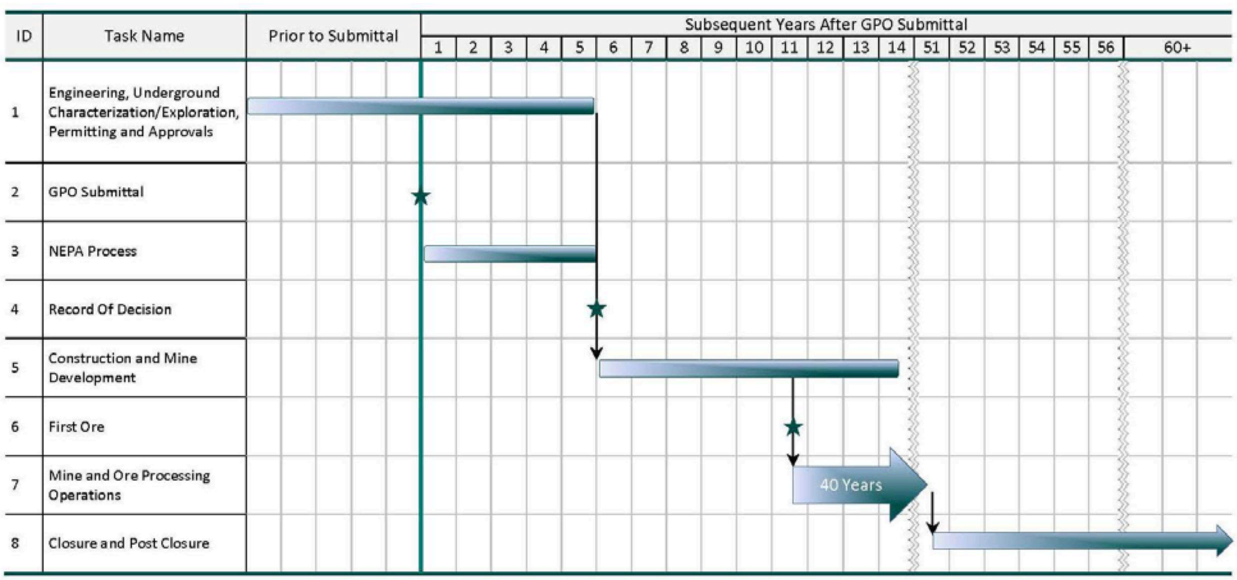
1.8.4. MINE AND ORE PROCESSING OPERATIONS

Overlapping with and then following construction, the Resolution Project will begin to ramp up to full production upon approval of this GPO. This GPO describes all of the proposed copper ore mining and processing activities regardless of land status.

1.8.5. CLOSURE AND POST-CLOSURE

Closure activities are concurrent with operations for some facilities (i.e., the TSF) and begin at the end of the Project's estimated 40-year operational life. The plans for closure and post-closure are provided in ***Section 6*** of this GPO.

Table 1.8-1 Project Schedule



2. SITE CONDITIONS

This section describes the regional and local environments for each of the features associated with the Resolution Project. It contains a brief description of the physical resources and land uses within the General Project Area (GPA). ***Section 4*** contains summaries of the extensive baseline studies conducted for the various areas within the GPA. These studies include those on groundwater, surface water, air, cultural resources, and biological resources; a list of these efforts is provided as ***Appendix C***. These studies will be submitted to the US Forest Service (FS) as standalone technical reports to facilitate the baseline review during National Environmental Policy Act (NEPA).

This section is intended to be descriptive rather than analytical or evaluative and provides a general overview of the regional and local characteristics for each area where Project features are present within the GPA. The location of the GPA within the state of Arizona is depicted in ***Figure 1.2-1***. A more detailed general arrangement of the Project features is presented in ***Figure 1.2-2***.

2.1. CLIMATE AND AIR

2.1.1. CLIMATE

2.1.1.1. *Regional Characteristics*

The regional climate is characterized as semiarid, with long periods of little or no precipitation (WRCC 2012). Precipitation falls in a bimodal pattern: most of the annual rainfall within the region occurs during the winter and summer months, with dry periods characterizing spring and fall. The total average annual precipitation varies between 8.8 in (22.4 cm) and 18.8 in (47.8 cm), with 52 percent of the precipitation occurring between November and April. Although snow may fall at higher elevations, it does not typically accumulate in the region. Precipitation usually manifests as steady, longer duration frontal storm events during the winter months (December through March). Rain events during the summer months (July to early September) are typically of shorter duration with more intensity due to the convective nature of thunderstorms.

2.1.1.2. *Local Climatic Characteristics*

The National Oceanic & Atmospheric Administration's (NOAA) National Climatic Data Center (NOAA 2013) and the Western Regional Climate Center (WRCC 2013) maintain data records for several weather stations, i.e., Miami, Superior, and Chandler Heights, which surround the GPA (***Figure 2.1-1***). ***Table 2.1-1*** provides elevation and location information for these weather stations.

Table 2.1-1 Weather Stations in the Region

Weather Station	Elevation (ft [m])	Latitude	Longitude	Period of Record
Miami	3,560 (1,085)	33°24'N	110°52'W	2/1/1914 to 3/31/2013
Superior	2,859 (871)	33°18'N	111°06'W	7/12/1920 to 8/31/2006
Chandler Heights	1,423 (434)	33°12'N	111°41'W	1/1/1941 to 4/30/2007

Source: NOAA 2013, NOAA 2014

Table 2.1-2 presents a summary of the climatic conditions at each of the Project areas based on the three nearby weather stations. Weather conditions in this region are strongly influenced by elevation; therefore, these data are primarily based on the weather station closest in elevation rather than closest by distance. The data, unless otherwise noted, were derived from the Western Regional Climate Center (2013).

Table 2.1-2 Annual Mean Daily Weather Conditions

Project Area	Elevation (ft [m])	Weather Station	Annual Mean Daily Average Temperature (°F)	Annual Mean Daily Maximum Temperature (°F)	Annual Mean Daily Minimum Temperature (°F)	Annual Mean Total Snow (in)	Annual Mean Total Precipitation (in)	Annual ET* (in)
Filter Plant and Loadout Facility	1,670 (509)	Chandler Heights	73	85	55	0.0	8.8	67
MARRCO Corridor (west of State Route 79)	1,520 (460)	Chandler Heights	73	85	55	0.0	8.8	67
MARRCO Corridor (east of State Route 79)	3,000 (910)	Superior	69	79	59	1.4	18.3	63
Tailings Storage Facility and Tailings Corridor	2,240 (683) to 3,050 (930)	Superior	69	79	59	1.4	18.3	63
West Plant Site	2,680 (820) to 3,400 (1,037)	Superior	69	79	59	1.4	18.3	63
East Plant Site	3,100 (950) to 4,648 (1,417)	Miami	64	77	51	2.6	18.8	55

* Evapotranspiration rate from Yitayew (1990)

For the three weather stations selected as representative of the GPA, the annual average maximum temperature ranged from 77° F (25° C) to 85° F (29° C) and the average minimum temperature ranged from 51° F (11° C) to 59° F (15° C). The total rainfall per year ranged from 8.8 in (22.4 cm) to 18.8 in (47.8 cm) across the three weather stations (WRCC 2013).

2.1.1.3. *Baseline Meteorological Data*

Resolution Copper currently operates two multi-parameter meteorological and air monitoring stations: a station at East Plant Site (EPS) and a station at WPS. From 2002 through 2007, Resolution Copper collected the requisite onsite data at EPS and WPS to characterize the conditions where site operations will occur during the life of the Project (Air Sciences 2012). In 2012, Resolution Copper implemented a more robust monitoring program. The EPS and WPS stations are fully instrumented to collect the following meteorological data: horizontal wind speed, wind direction, wind direction standard deviation, air temperature, vertical temperature difference, relative humidity, solar radiation, barometric pressure, and precipitation. For ambient air data, both the EPS and WPS stations have PM_{10} and $PM_{2.5}$ monitors; the EPS station also contains instrumentation to monitor sulfur dioxide (SO_2), ozone (O_3), and nitrogen oxide (NO_x).

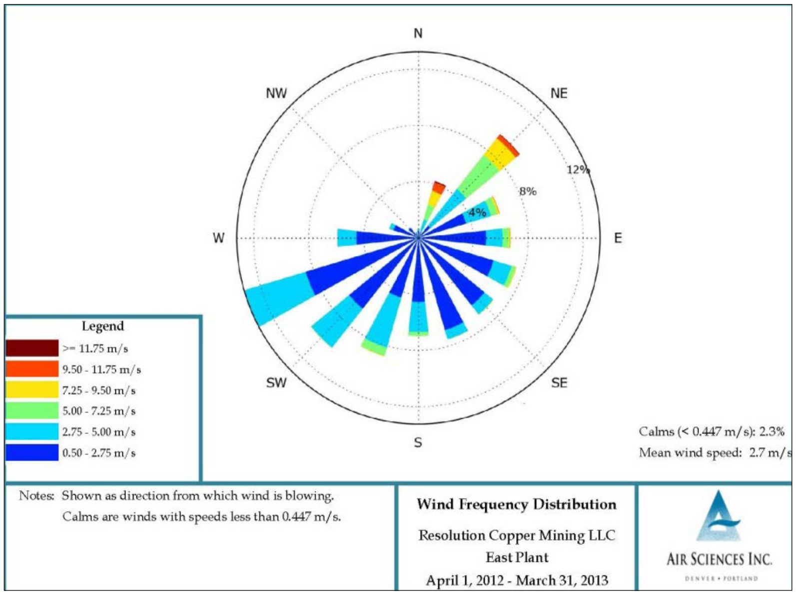
A meteorological and air quality monitoring plan specifying the components and instrumentation for these stations has been submitted and approved by the Pinal County Air Quality Control District (PCAQCD) (Air Sciences 2011). The monitoring program was developed to support several efforts during the prefeasibility and other mine development phases, including environmental assessments and impact analyses, meteorological and air quality data to be processed and used as input for the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) dispersion modeling, and air quality baseline data and AERMOD analyses to be used to support Resolution Copper's application to the PCAQCD for air permit(s). The first complete year of monitoring was performed in accordance with the approved monitoring plan from April 1, 2012, to March 31, 2013. A more detailed description of the sites, quality control, and the parameters collected can be found in the four quarterly data reports issued as part of that monitoring process (Air Sciences 2013a). An annual report was also prepared by Air Sciences in August 2013 that summarizes the quarterly data (Air Sciences 2013).

Graphical summaries of wind, temperature, and precipitation data collected at EPS and WPS during the April 1, 2012, through March 31, 2013, reporting period are presented below. The exhibits are adapted from the 2013 annual report, which provides a more comprehensive summary of all the parameters collected at the two sites (Air Sciences 2013).

2.1.1.3.1. Wind

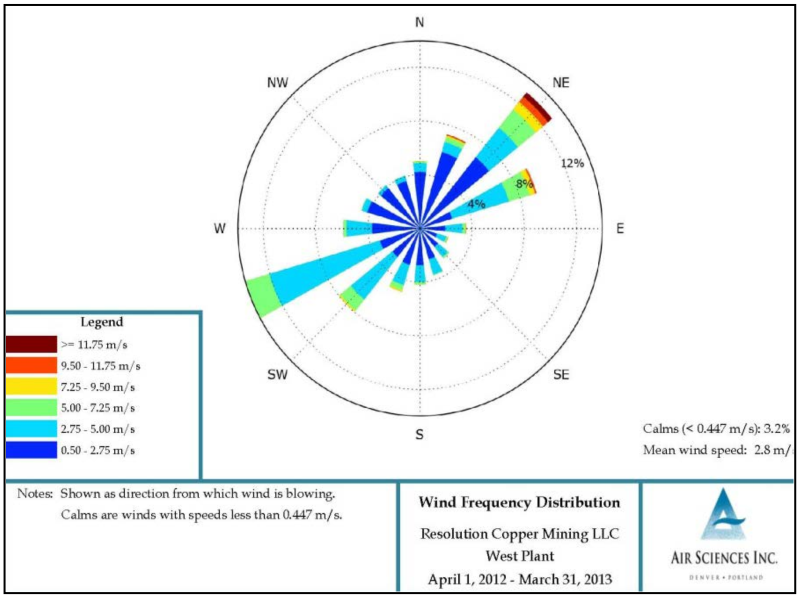
Exhibits 2.1-1 and 2.1-2 are wind rose plots that graphically depict the percentage of winds from 16 directions at EPS and WPS, respectively (Air Sciences 2013). Wind speeds are divided into six subcategories ranging from less than 1.1 mph (0.5 m/s) (the measurement threshold of the instrument) to greater than 26.28 mph (11.75 m/s). The mean wind speeds were calculated to be 6.0 mph (2.7 m/s) at EPS and 6.3 mph (2.8 m/s) at WPS.

Exhibit 2.1-1 Wind Frequency Distribution at East Plant Site



Source: Air Sciences 2013

Exhibit 2.1-2 Wind Frequency Distribution at West Plant Site

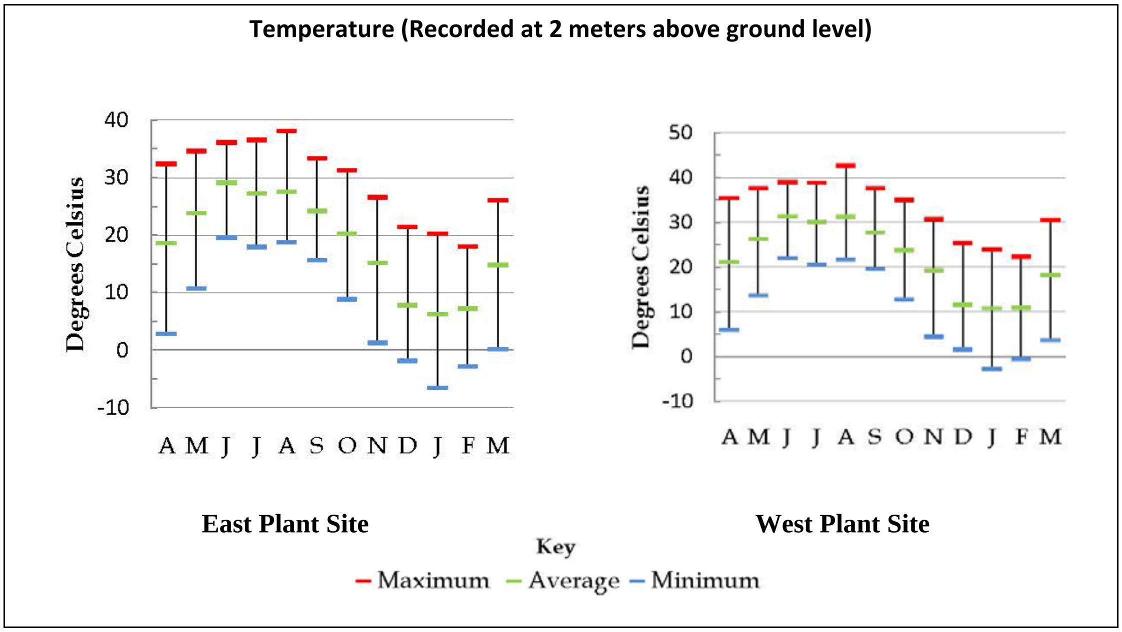


Source: Air Sciences 2013

2.1.1.3.2. Temperature

Exhibit 2.1-3 shows a summary of the maximum, average, and minimum temperatures recorded at the EPS and WPS monitoring stations for the 2013 reporting period. For both sites, maximum temperatures were recorded in August and minimum temperatures were recorded in January. It appears that the monitoring station at WPS generally recorded slightly higher temperatures than the station at EPS.

Exhibit 2.1-3 East Plant Site and West Plant Site – Temperature Summary[1]

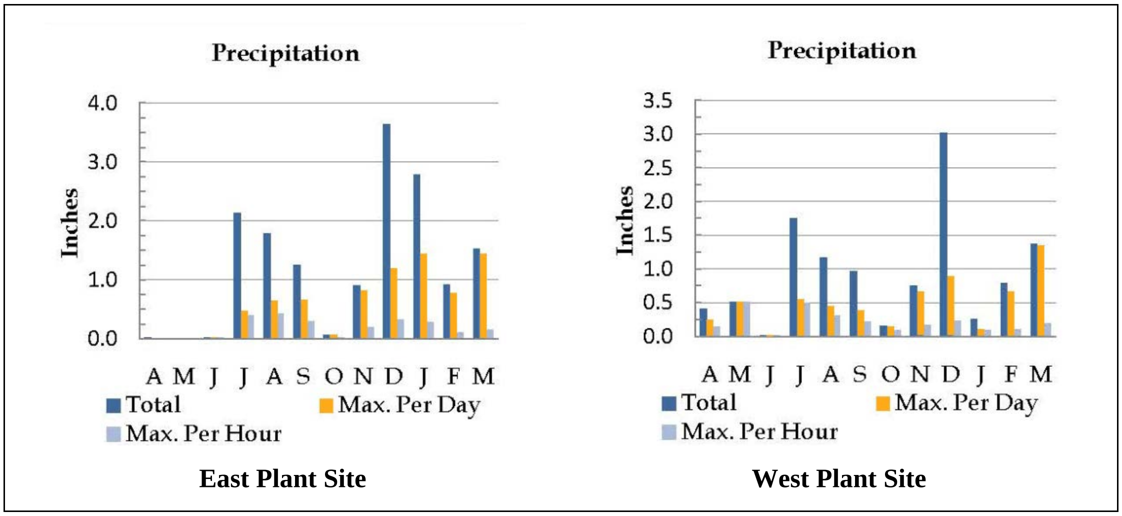


Source: Adapted from Air Sciences 2013
[1] Reporting period is April 1, 2012, through March 31, 2013

2.1.1.3.3. Precipitation

Exhibit 2.1-4 shows a summary of the precipitation data reported for EPS and WPS. The data are presented as maximum daily, maximum hourly, and total inches for each month of the reporting period. At both sites, the greatest amount of precipitation occurred in December. The least amount of precipitation occurred from April through June at EPS and in June, October, and January at WPS.

Exhibit 2.1-4 East Plant Site and West Plant Site – Precipitation Summary[1]



Source: Adapted from Air Sciences 2013
[1] Reporting period is April 1, 2012, through March 31, 2013

2.1.2. AIR

2.1.2.1. *Regulatory Framework*

Federal, state, and local (county) agencies regulate various aspects of air quality within the GPA, but only the federal government has established ambient air quality standards. Meeting the federal standards has, in some cases, been delegated to state or county agencies. The Environmental Protection Agency (EPA) has issued National Ambient Air Quality Standards (NAAQS) for seven "criteria pollutants": carbon monoxide (CO), sulfur dioxide (SO_2), particulates with an aerodynamic diameter less than or equal to a nominal 10 µm (PM_{10}), particulates with an aerodynamic diameter less than or equal to a nominal 2.5 µm ($PM_{2.5}$), ozone (O_3), nitrogen dioxide (NO_2), and lead (Pb). The Clean Air Act requires that each state develop a State Implementation Plan (SIP) describing how these standards will be met. Geographic areas in which air quality meets the NAAQS set for each pollutant are considered in "attainment," whereas areas where such standards are not met are designated as "non-attainment" areas. Once an area is redesignated to attainment, it then qualifies as a "maintenance" area. The state is required to document continued compliance of maintenance areas with NAAQS.

In addition to implementing NAAQS for criteria pollutants, the EPA regulates stringent visibility standards for 156 national parks and wilderness areas designated by Congress as Class I areas (ADEQ 2011). The Clean Air Act mandates the reduction of man-made visibility impairment in all Class I areas for the protection of their scenic values. To reach national visibility goals, the EPA has adopted Regional Haze Rules requiring states to develop a SIP aimed at reducing emissions from sources that have the potential to contribute to visibility impairment in federal Class I areas (ADEQ 2011).

In Arizona, air permitting and the development of SIPs is generally regulated by the Arizona Department of Environmental Quality (ADEQ) under the EPA's delegation of authority to the states, but air permitting in Pinal County is delegated to the PCAQCD. The complete PCAQCD Code of Regulations is available online (PCAQCD 2014).

2.1.2.2. *Anticipated Project Emissions*

Resolution Copper has completed an initial emission inventory for all sources with the potential to emit air pollutants (***Appendix D***). The sources included in the inventory are listed below:

- Mine (East Plant)
- Concentrator (West Plant)
- Tailings
- Filter Plant/Concentrate Loadout

The emission inventory is based on the estimated maximum production-year. For each source, emissions are identified as process, fugitive, or mobile. Process (or point) source emissions are the basis for making certain regulatory determinations—for example, major source status—under the air quality program. The inventory shows that the process emissions from each source individually, as well as the total emissions from all sources combined, are less than the major source threshold of 100 tons per year for all criteria pollutants. Total emissions (process, fugitive, and mobile) will be used for purposes of evaluating ambient air quality impacts. It should be noted that the inventory summary presented below (***Table 2.1-3***) does not account for air contaminant removal due to physical mechanisms in the shaft (e.g., the scrubbing effect of water droplets). Thus projected emissions and resulting air quality impacts to the ambient air from the mine source will be less than as stated in the inventory. The reduction of emissions as a result of these removal mechanisms will be accounted for when air dispersion modeling is conducted to assess ambient impacts.

Hazardous air pollutants, including metals, have also been estimated using the approaches identified above. The total hazardous air pollutants for the Project for all sources combined in a maximum production year are estimated to be far less than the major source threshold of 10 tons per year for any single hazardous air pollutant or 25 tons per year for any combination of hazardous air pollutants. Currently, Resolution Copper is projecting 2.68 tons per year as seen in ***Table 2.1-4.***

As we move forward through the National Environmental Policy Act (NEPA) process, it is likely that the projected totals will change somewhat as a result of further refinement.

Table 2.1-3 Annual Emissions Inventory - Summary Table

	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$	VOC
	ton/yr	*ton/yr*	*ton/yr*	*ton/yr*	*ton/yr*	*ton/yr*
Total-Facility Wide	340.7	75.0	2.4	325.1	59.4	21.9
All Facilities-Process	**11.4**	**35.7**	**0.2**	**72.6**	**26.7**	**4.5**
Major Source Threshold	100	100	100	100	100	100
All Facilities-Fugitive	30.2	5.7	1.9	250.9	31.1	0.2
All Facilities-Mobile	299.1	33.6	0.4	1.6	1.6	17.2
Mine (East Plant)	—	—	—	—	—	—
Process	8.1	33.5	0.2	**59.1**	22.4	3.3
Fugitive	30.2	5.7	1.9	130.3	16.6	0.0
Mobile	82.1	7.6	0.1	0.4	0.4	3.6
Concentrator (West Plant)	—	—	—	—	—	—
Process	3.2	2.2	0.0	**12.7**	4.1	1.1
Fugitive	—	—	—	26.9	3.6	0.1
Mobile	34.8	5.2	0.0	0.2	0.2	3.3
Loadout	—	—	—	—	—	—
Process	—	—	—	**0.8**	0.1	—
Fugitive	23.4	2.7	0.0	0.1	0.1	1.3
Mobile	23.4	2.7	0.0	0.1	0.1	1.3
Tailings	—	—	—	—	—	—
Process	—	—	—	—	—	—
Fugitive	—	—	—	93.6	10.9	0.1
Mobile	158.7	18.2	0.3	0.9	0.9	9.0

Table 2.1-4 Hazardous Air Pollutants Emissions Summary

CAS No.	Pollutant	ULSD[1] Engines ton/yr	Process & Fug. Dust ton/yr	Reagents ton/yr	Diesel Tanks ton/yr	Propane Combustion ton/yr	Total ton/yr	POM[2]
106990	1,3-Butadiene	1.18E-02					**1.18E-02**	
83329	Acenaphthene	1.84E-03					**1.84E-03**	POM
208968	Acenaphthylene	4.31E-03					**4.31E-03**	POM
75070	Acetaldehyde	2.39E-01					**2.39E-01**	
107028	Acrolein	3.03E-02					**3.03E-02**	
120127	Anthracene	9.35E-04					**9.35E-04**	POM
7440382	Arsenic	1.94E-03	2.24E-02			9.45E-08	**2.43E-02**	
56553	Benzo(a)anthracene	6.95E-04					**6.95E-04**	POM
71432	Benzene	5.16E-01			1.13E-06	9.92E-07	**5.16E-01**	
50328	Benzo(a)pyrene	1.34E-04					**1.34E-04**	POM
205992	Benzo(b)fluoranthene	3.65E-04					**3.65E-04**	POM
191242	Benzo(g,h,l)perylene	3.15E-04					**3.15E-04**	POM
207089	Benzo(k)fluoranthene	1.13E-04					**1.13E-04**	POM
7440417	Beryllium	3.82E-03	1.57E-03			5.67E-09	**5.38E-03**	
92524	Biphenyl				1.41E-04		**1.41E-04**	POM
7440439	Cadmium	1.04E-02	7.71E-04			5.20E-07	**1.12E-02**	
7440473	Chromium	3.26E-03	1.24E-01			6.61E-07	**1.28E-01**	
218019	Chrysene	5.68E-04					**5.68E-04**	POM
7440484	Cobalt		1.66E-02			3.97E-08	**1.66E-02**	
53703	Dibenzo(a,h)anthracene	2.80E-04					**2.80E-04**	POM
100414	Ethylbenzene				1.83E-05		**1.83E-05**	
206440	Fluoranthene	3.51E-03					**3.51E-03**	POM
86737	Fluorene	1.27E-02					**1.27E-02**	POM
50000	Formaldehyde	3.80E-01				3.54E-05	**3.80E-01**	
110543	Hexane				1.41E-03	8.50E-04	**2.26E-03**	
193395	Indeno(1,2,3-c,d)pyrene	2.38E-04					**2.38E-04**	POM
7439921	Lead	2.57E-04	4.95E-02				**4.97E-02**	
7439965	Manganese	1.06E-04	1.39E-01			1.79E-07	**1.39E-01**	
7439976	Mercury	3.21E-01	2.65E-01			1.23E-07	**5.86E-01**	
91203	Naphthalene	6.48E-02			7.74E-04	2.88E-07	**6.56E-02**	POM
7440020	Nickel	4.59E-04	2.14E-02			9.92E-07	**2.19E-02**	

Table 2.1-4 Hazardous Air Pollutants Emissions Summary

CAS No.	Pollutant	ULSD[1] Engines ton/yr	Process & Fug. Dust ton/yr	Reagents ton/yr	Diesel Tanks ton/yr	Propane Combustion ton/yr	Total ton/yr	POM[2]
85018	Phenanthrene	2.12E-02			1.76E-04		**2.14E-02**	POM
108952	Phenol				9.01E-05		**9.01E-05**	
129000	Pyrene	2.56E-03					**2.56E-03**	POM
7782492	Selenium	2.30E-04	5.58E-03			1.13E-08	**5.81E-03**	
100425	Styrene				4.50E-05		**4.50E-05**	
108883	Toluene	2.08E-01			4.50E-05	1.61E-06	**2.08E-01**	
1330207	Xylene	1.44E-01			4.08E-04		**1.45E-01**	
95636	1,2,4-trimethylbenzene				1.41E-03		**1.41E-03**	
7783064	Hydrogensulfide			2.57E-02			**2.57E-02**	
106445	p-Cresol			2.50E-05			**2.50E-05**	
79061	Acrylamide			1.48E-02			**1.48E-02**	
106467	Dichlorobenzene					5.67E-07	**5.67E-07**	
7440360	Antimony		1.72E-03				**1.72E-03**	
POM	POM(aggregated)					4.17E-08	**4.17E-08**	POM
POM	*Polycylic Organic Matter Subtotal*	*1.15E-01*	*0.00E+00*	*0.00E+00*	*1.09E-03*	*3.30E-07*	*1.16E-01*	
HAPs[3]	All HAPs	1.98E+00	6.48E-01	4.05E-02	4.51E-03	8.92E-04	2.68E+00	

[1] ULSD - Ultra Low Sulphur Diesel
[2] POM - Polycyclic Organic Matter
[3] Hazardous Air Pollutants

2.1.2.3. *Regional and Local Air Quality Characteristics*

Table 2.1-5 details the attainment status of each of the Project feature areas for each of the criteria pollutants. ***Figure 2.1-2*** shows the boundaries of designated non-attainment areas for Pinal County within the GPA. No Project features within the GPA are currently located within a designated maintenance area.

Table 2.1-5 Attainment Status for Criteria Pollutants by Site

Project Area	CO	SO_2	$PM_{2.5}$	PM_{10}	O_3	NO_2	Pb
Filter Plant and Loadout Facility	Attainment	Attainment	Attainment	Non-attainment	Attainment	Attainment	Attainment
MARRCO Corridor	Attainment	Attainment	Attainment	Non-attainment	Attainment	Attainment	Attainment
Tailings Storage Facility and Tailings Corridor	Attainment	Attainment	Attainment	Attainment	Attainment	Attainment	Attainment
West Plant Site	Attainment	Attainment	Attainment	Attainment	Attainment	Attainment	Attainment
East Plant Site	Attainment	Attainment	Attainment	Non-attainment	Attainment	Attainment	Attainment

Source: ADEQ 2013

As noted above in ***Table 2.1-5***, the Filter Plant and Loadout Facility, portions of the Magma Arizona Railroad Company (MARRCO) Corridor, and most of EPS are within the boundaries of a designated PM_{10} non-attainment area.

The closest federal Class I area to the GPA is the Superstition Wilderness Area located approximately 4 to 18 mi (6 to 29 km) north of the GPA. Ambient monitoring networks sponsored and/or operated by Federal Land Managers are used to characterize the air quality in protected areas. The National Park Service has a long-term air quality dataset for the Tonto National Monument located approximately 22 mi (35 km) north of the GPA that serves to characterize the air quality in the Superstition Wilderness Area. In general, air quality for this area continues to be good, and air pollution levels are lower than in populated areas. The closest regulatory monitoring site to the GPA is located in Queen Valley (Air Quality System Site No. 04-021-8001), which is used to monitor ambient air for the Phoenix Metropolitan Area. While this site is not part of the designated ozone non-attainment area, ozone concentrations have been steadily increasing at this monitor (Air Sciences 2012). The locations of the Superstition Wilderness Area and the regulatory monitoring stations relative to the Project features within the GPA are shown in ***Figure 2.1-2***.

2.1.2.4. *Baseline Ambient Air Quality Data*

One year of comprehensive air quality and meteorological monitoring was completed on March 31, 2013, at EPS and WPS. Quarterly reports were submitted for the last three quarters of 2012 and the first quarter of 2013, and these four quarterly reports may be referenced for a detailed description of the measurement and data quality objectives and results (Air Sciences 2013). Upon completion of the first year of data collection, an annual report was compiled summarizing the first year of baseline data with an early look at pollutant comparisons to the NAAQS (Air Sciences 2013). ***Table 2.1-6*** shows a summary of that annual comparison.

Table 2.1-6 Ongoing Comparison to the National Ambient Air Quality Standards (April 1, 2012, through March 31, 2013)

Pollutant	National Ambient Air Quality Standard		Ambient Air Monitoring		
	Concentration	Averaging Time	Comparison Rule	EPS	WPS
Carbon Monoxide (CO)	35 ppm (40,000 μg/m^3)	1-hr[1]	1-hr Average, 2nd Highest	NM	NM
	9 ppm (10,000 μg/m^3)	8-hr[1]	8-hr Average, 2nd Highest	NM	NM
Nitrogen Dioxide (NO_2)	53 ppb (100 μg/m^3)	Annual	Average	0.6 ppb	NM
	100 ppb (188 μg/m^3)	1-hr[2]	Daily Max 1-hr Average (98th Percentile)	24.4 ppb	NM
Ozone (O_3)	0.075 ppm (150 μg/m^3)	8-hr[3]	8-hr Average, 4th Highest	0.077 ppm	NM
Sulfur Dioxide (SO_2)	0.5 ppm (1,300 μg/m^3)	3-hr[1]	3-hr Average, 1st Highest	(Secondary Standard)	NM
	75 ppb (196 μg/m^3)	1-hr[4]	Daily Max 1-hr Average (99th Percentile)	16.9 ppb	NM
Particulate Matter < 2.5 Microns ($PM_{2.5}$)	12 μg/m^3	Annual[5]	Average	5.6 μg/m^3	2.1 μg/m^3
	35 μg/m^3	24-hr[6]	98th Percentile, 24-hr Average	11.7 μg/m^3	10.9 μg/m^3
Particulate Matter < 10 Microns (PM_{10})	150 μg/m^3	24-hr[7]	24-hr Average, 1st Highest	73.5 μg/m^3	88.4 μg/m^3

NM = Not monitored
[1] Not to be exceeded more than once each year.
[2] To attain this standard, the 3-year average of the 98th percentile of the annual daily maximum 1-hr average must not exceed 100 ppb.
[3] To attain this standard, the 3-year average of the annual fourth-highest daily maximum 8-hr average must not exceed 0.075 ppm.
[4] To attain this standard, the 3-year average of the 99th percentile of the annual daily maximum 1-hr average must not exceed 75.0 ppb.
[5] To attain this standard, the 3-year average of the weighted annual mean $PM_{2.5}$ concentration must not exceed 12 μg/m^3.
[6] To attain this standard, the 3-year average of the 98th percentile of the 24-hr concentrations must not exceed 35.0 μg/m^3.
[7] Not to be exceeded more than once per year on average over 3 years.

2.1.2.4.1. Particulate Matter Less than 10 Microns in Diameter (PM_{10})

As noted previously in ***Table 2.1-5***, the Filter Plant and Loadout Facility, portions of the MARRCO Corridor, and most of EPS are within the boundaries of a designated PM_{10} non-attainment area.

The NAAQS for PM_{10} is 150 μg/m^3 for a 24-hr average concentration. The standard is met when the expected number of days per calendar year within a 24-hr average concentration above 150 μg/m^3 is equal to or less than one (second-high value). The year-to-date (YTD) second-high PM_{10} concentrations recorded at EPS and WPS are 73.5 µg/m^3 and 88.4 µg/m^3, respectively. Both the WPS and EPS second-high values are below the NAAQS of 150 µg/m^3.

2.1.2.4.2. Particulate Matter Less than 2.5 Microns in Diameter ($PM_{2.5}$)

The annual primary and secondary $PM_{2.5}$ standards are met when the annual arithmetic mean concentration is less than or equal to 12.0 µg/m^3. The 24-hr primary and secondary $PM_{2.5}$ standards are met when the 98th percentile 24-hr concentration is less than or equal to 35 µg/m^3.

The YTD arithmetic mean concentrations for EPS and WPS are 5.6 and 2.1 µg/m^3, respectively. Both the EPS and WPS arithmetic mean values are below the NAAQS of 12 µg/m^3.

The 98th percentile concentrations at EPS and WPS are 11.7 and 10.9 µg/m^3, respectively. The 98th percentiles of both the EPS and WPS 24-hr concentrations are below the NAAQS of 35 µg/m^3.

2.1.2.4.3. Nitrogen Dioxide (NO2)

The level of the annual NAAQS for oxides of nitrogen is 53 parts per billion (ppb), measured in the ambient air as NO_2. The annual NAAQS is met when the annual average concentration in a calendar year is less than or equal to 53 ppb.

The level of the 1-hr NAAQS for oxides of nitrogen is 100 ppb, measured in the ambient air as NO_2. The 1-hr NAAQS is met when the 3-year average of the annual 98th percentile of the daily maximum 1-hr average concentration is less than or equal to 100 ppb.

The 98th percentile of the daily maximum 1-hr average NO_2 concentration at EPS for the year is 24.4 ppb, which is less than the NAAQS 1-hr primary standard of 100. The hourly NO_2 average at EPS is 0.6 ppb, which is below the annual NO_2 NAAQS of 53 ppb. There is no NO_2 monitor at WPS.

2.1.2.4.4. Sulfur Dioxide (SO_2)

The level of the primary 1-hr NAAQS for oxides of sulfur is 75 ppb measured in the ambient air as sulfur dioxide (SO_2). The 1-hr primary standard is met at an ambient air quality monitoring site when the 3-year average of the annual (99th percentile) daily maximum 1-hr average concentration is less than or equal to 75 ppb.

The 99th percentile 1-hr maximum concentration at EPS for the year is 16.9 ppb, which is below the annual SO_2 NAAQS of 75 ppb. There is no SO_2 monitor at WPS.

2.1.2.4.5. Ozone (O_3)

Parts of Pinal County and adjacent Maricopa County have been designated as non-attainment areas for 8-hr ozone by ADEQ; however, as noted previously in ***Table 2.1-5***, no Project features of the GPA are located within a non-attainment area for O_3.

The level of the primary and secondary 8-hr NAAQS for ozone is 0.075 ppm, daily maximum average. The 8-hr primary and secondary standard is met at an ambient air quality monitoring site when the 3-year average of the annual fourth-highest daily maximum 8-hr average O_3 concentration is less than or equal to 0.075 ppm.

The YTD averaged fourth-highest maximum recorded at EPS for the year is 0.077 ppm. This concentration is above the NAAQS 8-hr O_3 standard of 0.075 ppm. Actual comparison to the NAAQS requires 3 calendar years of monitoring data, which have not been obtained at this time. There is no O_3 monitor at WPS.

2.2. GEOLOGY

2.2.1. REGULATORY FRAMEWORK

Metals and other locatable mineral resources on FS lands are managed in accordance with the Mining and Minerals Policy Act of 1970, which states that the Federal Government should "foster and encourage private enterprise in the development of economically sound and stable industries, and in the orderly and economic development of domestic resources to help assure satisfaction of industrial, security, and environmental needs." The administration of locatable mineral resources on FS lands follows direction in regulations at 36 Code of Federal Regulations (CFR) 228 Subpart A. The regulations describe what information is required for a proposal to explore for, develop, and recover locatable minerals; how impacts to resources from a proposed operation will be scoped, assessed, and mitigated; and how reclamation will be bonded and completed during the operation and at its conclusion of activity.

FS direction for the management of locatable minerals also follows the Multiple-Use Mining Act of 1955 and the General Mining Law of 1872, as amended. The Multiple-Use Mining Act of 1955 removed common varieties of minerals, such as sand and gravel, clay, building stone, and cinders, from the category of locatable minerals and provided for multiple uses of the lands and surface resources on mining claims.

The General Mining Law of 1872 (mining law) (30 United States Code [U.S.C.] 22–54) authorizes citizens to stake or "locate" mining claims on federal lands in order to acquire exclusive mineral rights. The mining law consists of five basic elements: discovery of a valuable mineral, location of mining claims, recordation of claims, maintenance (performance of annual requirements on claims), and patenting of a claim, with possible transfer of the surface estate to the claimant. Conditions and requirements for these elements are detailed in Bureau of Land Management (BLM) regulations (43 CFR Chapter 2).

2.2.2. TOPOGRAPHY AND PHYSIOGRAPHY

2.2.2.1. *Regional Characteristics*

The GPA lies within the Basin and Range physiographic province, generally characterized by a series of smooth-floored basins separated by mountain ranges (Chronic 1983). The northeastern edge of the province is a mountainous region that is transitional to the Central Highlands that border the Colorado Plateau province. This mountainous region consists of belts of generally linear ridges and valleys in which the rugged ranges predominate over the valleys. This is in contrast to much of the Basin and Range province and the western portion of the GPA, where broad valleys predominate over relatively narrow mountain ranges. As such, the GPA includes a combination of the nearly flat terrain of the broad basin to the west and the rugged mountainous terrain (the Superstition, Dripping Spring, and Pinal mountains) to the north and east.

Elevations within the GPA range from 1,520 ft (463 m) above mean sea level (amsl) at the western terminus of the MARRCO Corridor to nearly 4,648 ft (1,417 m) at Apache Leap (United States Geological Survey [USGS] National Elevation Data) (***Figure 2.2-1***).

2.2.2.2. *Local Topography*

Project features, including the Filter Plant and Loadout Facility, the MARRCO Corridor, the Tailings Storage Facility (TSF) and Tailings Corridor, WPS, and EPS, span approximately 31.8 mi (51.1 km) from the southwestern corner of the GPA near Magma to the northeastern corner of the GPA at EPS east of Superior, Arizona. The vast majority of the Project activity will take place at EPS, WPS, and the TSF. The following discussion describes the Project features as they occur in geographic order across the study area from southwest to northeast.

2.2.2.2.1. Filter Plant and Loadout Facility

The Filter Plant and Loadout Facility is located approximately 6 mi (10 km) southwest of Florence Junction and adjacent to the MARRCO Corridor. The site is in a relatively flat area southeast of a small ephemeral channel that is ultimately a tributary to the Gila River. The elevation of the site is approximately 1,670 ft (509 m) amsl.

2.2.2.2.2. MARRCO Corridor

The existing MARRCO Corridor extends northeast from Magma past the highway crossing at US 60 east of Florence Junction to WPS, a distance of approximately 27 mi (43.5 km). Elevations in this corridor range from a minimum of approximately 1,520 ft (460 m) amsl at Magma to a maximum of 3,000 ft (910 m) amsl at WPS (***Figure 2.2-1***). The general trend of the corridor is a gradual increase in elevation from west to east, with minor rises and drops over channels. The western terminus of the corridor in the GPA is at Magma near a small ephemeral channel that is ultimately a tributary to the Gila River, but first enters the Queen Creek watershed southwest of the Whitlow Ranch Flood Control Basin. The central part of the corridor is roughly parallel to Queen Creek, with a stream crossing (trestle) at Queen Station. Within the eastern portion, the corridor crosses several named and unnamed tributaries of Queen Creek before reaching the eastern terminus west of Superior at WPS.

2.2.2.2.3. Tailings Storage Facility and Tailings Corridor

The TSF and Tailings Corridor are in a transitional zone on the northeastern edge of the Basin and Range physiographic province. The topography in the vicinity is characterized by a series of parallel ridges formed from the differential erosion of a tilted fault block dipping to the southeast (Spencer and Richard 1995). The ridges are separated by valleys, and thin alluvial deposits are present in the valley bottoms. The valleys are relatively narrow at higher elevations and widen as elevation decreases toward Queen Creek.

The TSF footprint is bounded by Roblas Canyon on the west and Potts Canyon on the east. The area is drained by multiple valleys, including the east fork of Roblas Canyon, Bear Tank Canyon, and Benson Spring Canyon, all of which are ephemeral channels that flow southwest into Queen Creek. Elevations within the TSF footprint range from approximately 2,240 ft (683 m) amsl in the southwestern portion to 2,920 ft (890 m) amsl in the northern extents (***Figure 2.2-1***).

The Tailings Corridor extends 4.7 mi (7.6 km) from the northeastern corner of the TSF to WPS, traversing multiple ridges and valleys. The main valleys from west to east are Potts Canyon, Happy Camp Canyon, and Silver King Wash, which are all ephemeral drainages that flow southwest into Queen Creek. Elevations along the Tailings Corridor range from approximately 2,690 ft (820 m) amsl at the tie-in location on the northeastern side of the TSF to 3,050 ft (930 m) amsl at WPS (***Figure 2.2-1***).

2.2.2.2.4. West Plant Site

WPS is located at the transition from the basin in which Superior itself lies to the mountains north of Superior that border the Central Highlands (***Figure 2.2-1***). The southwestern part of the site, adjacent to the town of Superior, is moderately sloped, with a base elevation of approximately 2,680 ft (820 m) amsl. The site ascends into deeply incised canyons in the rocky slopes along the northern portion of WPS up to an elevation of approximately 3,400 ft (1,037 m) amsl.

2.2.2.2.5. East Plant Site

EPS is located in the mountains immediately east of the town of Superior in a transitional zone on the northeastern edge of the Basin and Range physiographic province that borders the Central Highlands. Elevations range from 3,100 ft (950 m) amsl near Queen Creek to 4,648 ft (1,417 m) amsl at a high point on the Apache Leap escarpment that overlooks Superior. The western edge of this area is generally very steep, with the cliffs of the Apache Leap escarpment rising abruptly above Superior. East of Apache Leap, an area of parallel ridges and valleys trends to the northeast. The northeastern portion of EPS is relatively flat, and most of the drainages flow toward Queen Creek; however, in the southern portion of the site, Rio Rancho Creek drains toward Devils Canyon to the east (***Figure 2.2-1***).

2.2.3. GENERAL GEOLOGY

The regional surface geology in the GPA was previously mapped by others on several Arizona Geological Survey quadrangles (see local geology sections for specific quadrangles) and is shown in ***Figure 2.2-2***. The geologic map units presented in this Plan are generalized, with nomenclature modified to be consistent with the Resolution Copper geologic database. The names and identifiers of the geologic units evolve as mapping of an area progresses. In addition, some authors use generalized units, while others use a more detailed nomenclature. As a result, geologic nomenclature differs slightly between the maps cited in the following sections, the reports that have been prepared by Resolution Copper and their consultants, and the text of this Plan. ***Table 2.2-1*** provides a key to the units that have been generalized and the identifiers used in the current report and in cited maps (Ferguson and Skotnicki 1996; Peterson 1969; Spencer et al. 1998; Spencer and Richard 1995).

A summary of the main geologic units in the GPA is provided below. The geology of each of the principal Project areas is discussed further in ***Section 2.2.3.7***. Geologic units are presented from oldest to youngest; more detail is available in Hehnke et al. (2012). Surface geology is presented in ***Figures 2.2-3 and 2.2-4.***

Table 2.2-1 Generalized Geologic Units

Unit	Map unit from Spencer et al., 1998	Map unit from Spencer and Richard, 1995	Map unit from Ferguson and Skotnicki, 1996	Map unit from Peterson, 1969	Description
d	d	d	d	Qf	Disturbed surficial deposits
Qal	Qy, Qyc	Qal	Qa	Qal	Active stream channel alluvium
QTg	Ql, Qm, Qml, Qo, Qtc, Qly	Qs, Qtc, Qoa	Qao	QTg	Older alluvial fan and terrace deposits
	QTl	Qls, QTls, QTs	—	Qt	Landslide deposits
	Tch	Tx	—	—	Chaos: mixed units
	Tcu, Tsu	Tcg, Tss	Tq	QTg	Conglomerate and sandstone (Gila)

Table 2.2-1 Generalized Geologic Units

Unit	Map unit from Spencer et al., 1998	Map unit from Spencer and Richard, 1995	Map unit from Ferguson and Skotnicki, 1996	Map unit from Peterson, 1969	Description
	Tsm	—	—	QTg	Sandstone and conglomerate interbedded with volcanics
Tal	Tal	Tal	Ts, Tbb, Tsf, Tsl, Tsp, Tsm, Tsh, Tsx, Tsxg,Trx, Tcp, Tcpu	Tal	Apache Leap Tuff
Tvu (includes Tvy and Tvo)	Tb, Tt, Tfp, Tfpt, Tfpi	Tb, Tvx, Tql, Tp, Tr, Tt, Tf, Tdb	Tqb, Teb, Tbb, Tfu, Tful, Tdx, Tru, Trut, Tfi, Tfl, Tdl	QTb	Gila Group volcanic and intrusive rocks and equivalent units (younger than Apache Leap Tuff)
	Trdu, Trdt, Trw, Tdm	Tf, Tt, Tfp, Tfa, Tbl, Tdf, Tda, Tdb	Trd, Tdx, Tr, Tdl, Tau, Tal, Trdl, Ttq, Tt, Ta, Tbcg, Tb, Tdu, Tdub, Tduv	—	Superstition Group volcanic rocks and equivalent units (older than Apache Leap Tuff)
	Tev	—	—	Tr	Older volcanic rocks, eastern area
Tw	Tsl	Tw	Tc, Tx	Tw	Whitetail Conglomerate
TKg	Tg2	Tg	—	qmp, qma	Granitoid stock of Wood Camp Canyon
	TKpg	—	—	qmp, qma	Quartz monzonite porphyry of Government Hill
	Th	—	—	—	Hypabyssal intrusive rocks
	TKdd	—	—	—	Dacite dikes
	Kqd	Kd	—	qd, dp	Diorite porphyry and quartz diorite
Pz	PPn, MCs, Cb	Me, Dm, Cb	—	Pn, Me, Dm, Ꞓb	Naco Formation, Escabrosa Limestone, Martin Formation, and Bolsa Quartzite
pꞒy	Ytd, Yta, Yt	—	—	pꞒt	Troy Quartzite, diabase, and Apache Group sedimentary rocks
	Yd, Yad, Ya	Yd, Ym, Yds, Ydsu, Ydsl, Yp, Ypt	Ya, Yd, Yb, Ym, Yp-q, Yq, Yc, Yr, Yp, Ys	db, pꞒb, pꞒm, pꞒds, pꞒp	Diabase and Apache Group sedimentary rocks
pꞒgu	Yg2	—	—	—	Biotite granite porphyry
	Xgd, Xd, Xh	YXg, YXd, YXgd, YXgm	YXq, YXg, YXge, YXd, Yxv	—	Madera Diorite
pꞒpi	Xp, Xpp, Xpc	Xp, Xps, Xpm, Xpc, Xpcs, Xpq, Xpp	Xp, Xpa, Xpc, Xpq	pꞒpi	Pinal Schist

— = not present or not mapped

2.2.3.1. *Precambrian*

The oldest rocks in the GPA belong to the Pinal Schist (p€pi). Overlying the Pinal Schist are, from oldest to youngest, the Pioneer Formation, Dripping Spring Quartzite, and Mescal Limestone; unnamed basalt flows locally overlie the Mescal Limestone. Together, these units comprise the Apache Group. Troy Quartzite, a Middle Proterozoic unit, unconformably overlies the Apache Group. Its three members are a basal arkose unit, Chediski Sandstone, and an upper quartzite unit (Shride 1967). Diabase sills and dykes intrude all of the sedimentary units. The Apache Group, Troy Quartzite, and diabase are collectively referred to as p€y.

2.2.3.2. *Paleozoic*

Unconformably overlying the Precambrian units are Paleozoic sedimentary rocks (Pz) that include, from oldest to youngest, Bolsa Quartzite, the Martin Formation, Escabrosa Limestone, and Naco Limestone.

2.2.3.3. *Mesozoic*

Laramide volcanic-plutonic activity is expressed in the vicinity of the GPA by the presence of felsic intrusions, including the Silver King quartz diorite north of the town of Superior (TKg).

2.2.3.4. *Cenozoic*

Cenozoic rocks were deposited post-mineralization and include the Whitetail Conglomerate (Tw), Apache Leap Tuff (Tal), and Gila Conglomerate (QTg). The earliest unit, the Oligo-Miocene Whitetail Conglomerate, consists of non-volcaniclastic conglomerate and sandstone, with lesser amounts of avalanche breccia, mudstone, and minor volcanic flows. At EPS, the Whitetail Formation forms an eastward-thickening wedge over the deposit. Apache Leap Tuff is a crystal-rich quartz latite ashflow tuff that overlies the Whitetail Conglomerate and forms the Apache Leap escarpment. The Gila Conglomerate is slightly younger in age and outcrops predominantly west of the Apache Leap escarpment. It is described in ***Section 2.2.3.7.3***.

Quaternary alluvium (Qal) generally lies unconformably on all the other formations. It consists of recent and near-recent stream deposits in basins, fans, terraces, floodplains, and channel deposits. It is composed of gravel, sand, silt, and clay. Although alluvium is present along many of the drainages in the GPA, for clarity, deposits less than approximately 30 ft (10 m) thick and of limited areal extent are not shown on the geologic maps presented in this Plan.

2.2.3.5. *Regional Structure*

The region that includes the GPA has undergone multiple episodes of folding and faulting dating to the Precambrian. An old northeast- to east-northeast-trending structural fabric in east-central Arizona is indicated by the dominant foliation in Pinal Schist, the northeastern trend of the 1.4 billion-year-old (Ga)

Ruin Granite, and regional-scale magnetic anomalies (Hehnke et al. 2012 and references therein). This trend is also reflected in the orientation of most veins in the area (Heidrick and Titley 1982) as well as the distribution and elongation of Laramide intrusions. Thrust faults, folding, and reverse faults typical of Laramide-aged deformation are well documented in the area. At least 5,900 ft (1,800 m) of down-to-the-west movement along Devils Canyon and related faults generated a basin filled with Whitetail Conglomerate and rotated a large block encompassing the Resolution deposit (1-percent copper shell) approximately 25 degrees to the east-northeast.

The present-day geomorphology of the Superior district and immediately surrounding area can be attributed to north- to northwest-trending, down-to-the-west, Basin and Range-style normal faults with Tertiary to Quaternary movement (Hehnke et al. 2012). These include the Concentrator, Main, and Conley Springs faults. The Concentrator fault, which strikes generally north-northwest and dips to the west, displaces the Magma vein to an as-yet-unknown location and defines the western limit of production in the Magma Mine. The Superior Basin is formed by a large east-tilting block bounded by the Elephant Butte fault to the west and the Concentrator fault to the east. The Elephant Butte fault is a major west-side-down normal fault that is located along the western side of Gonzales Pass and crosses Queen Creek east of Queen Valley near Whitlow Ranch Dam (Ferguson and Skotnicki 1996). Regional extension, normal faulting, and tilting ended after Tertiary volcanism and during the deposition of conglomerate and sandstone (QTg) (Spencer and Richard 1995).

2.2.3.6. Geology of the Resolution Deposit

This section presents a summary of the structure and geologic units of the Resolution deposit (1-percent copper shell); further detail is available in Hehnke et al. (2012). A generalized geologic cross-section of the ore body is presented in ***Figures 2.2-5a and 2.2-5b***.

2.2.3.6.1. Structure

The primary faults in the Resolution deposit area are the faults that bound the Resolution block or graben (Resolution Graben). These are the North, South, and West Boundary faults, the Rancho Rio fault, and the eastern part of the Conley Springs fault. Most faults within the Resolution block itself strike north to north-northeast, dip steeply west, and show west-side-down displacement. None of the northerly trending faults defined within the Resolution block have been shown to extend beyond the graben-bounding faults.

2.2.3.6.2. Lithology

A summary of the geologic units of the Resolution deposit is provided below. Geologic units are presented from oldest to youngest; further detail is available in Hehnke et al. (2012). A cross-section of the ore body is presented in ***Figures 2.2-5a and 2.2-5b***.

Precambrian

Pinal Schist (p€pi) units are the oldest rocks in the deposit area and have been observed at depths below the base of the 1-percent copper shell. Overlying the Pinal Schist are units of the Apache Group (pCy), including the Pioneer Formation, Dripping Spring Quartzite, and Mescal Limestone. Basalt flows overlying Mescal Limestone have only been recognized near the South Boundary fault. A thick (> 600 ft [> 200 m]) diabase sill (the lower sill) intrudes between the Pioneer Formation and the Dripping Spring Quartzite, and an upper diabase sill commonly intrudes above the Mescal Limestone where it is up to 300 ft (100 m) thick. Troy Quartzite has not been encountered to date in the Resolution Graben.

Paleozoic

Within the Resolution Graben, the Paleozoic section has been significantly attenuated and in some areas has been completely removed by erosion. The Martin Formation and eroded remnants of the Escabrosa Limestone have been altered to skarn in nearly all drill intercepts reported to date. The Pennsylvanian Naco Group has been completely eroded within the graben area. The Naco Group is, however, present immediately outside the graben.

Mesozoic

Cretaceous sediments and volcaniclastic and volcanic rocks (***Figures 2.2-5a and 2.2-5b***) host the uppermost 17 percent of the 1-percent copper shell and almost all of both the pyrite halo and the advanced argillic zone.

Intrusive rocks attributed to the Laramide Orogeny are hosted in a 3,000-ft- (1,000-m-) wide east-northeast-trending corridor that runs through the center of the deposit. These felsic rocks host approximately 15 percent of the copper mineralization and are predominantly pre- to early-mineral in age. The largest volumetric unit is a rhyodacite porphyry that forms two stocks. The largest stock occurs in the eastern part of the deposit and a smaller stock is recognized in the western part of the deposit.

Breccia Units

Breccia units host about 10 percent of the mineralization within the 1-percent copper shell and occupy the same east-northeast-trending corridor as the felsic intrusions. Three heterolithic breccia types have been recognized.

Cenozoic

Overlying the deposit, the Whitetail Conglomerate (Tw) forms a northeast-thickening succession of predominantly poorly sorted conglomerates that may be up to 4,300 ft (1,300 m) thick. The Apache Leap Tuff (Tal) is approximately 1,100 to 1,600 ft (350 to 500 m) thick in the Resolution deposit area.

2.2.3.7. *Local Geology*

2.2.3.7.1. Filter Plant and Loadout Facility

The geology at the Filter Plant and Loadout Facility has been mapped by Spencer et al. (1998) on the USGS Mesa quadrangle. The site is on Quaternary alluvial deposits (Qal) in the nearly flat part of the basin in the southwestern section of the GPA (***Figure 2.2-2***). The Quaternary alluvial deposits of this area are characterized by Spencer et al. (1998) as moderately dissected alluvial fan and terrace deposits typically consisting of sand to cobbles.

2.2.3.7.2. MARRCO Corridor

The MARRCO Corridor crosses a variety of geologic formations between Magma and WPS. The geology of this region has been mapped on four separate USGS quadrangles: Mesa – Spencer et al. (1998), Florence Junction – Ferguson and Skotnicki (1996), Picketpost – Spencer and Richard (1995), and Superior – Peterson (1969). From Magma to the crossing at US 60, the geology is mapped as Quaternary alluvial deposits (Qal). From the crossing at US 60 to WPS, the corridor crosses areas of Quaternary alluvial deposits (Qal), Quaternary and Tertiary basin-fill deposits (QTg), Tertiary Apache Leap Tuff (Tal), undifferentiated Precambrian intrusive rocks (p₵gu), older Precambrian Pinal Schist (p₵pi), and undifferentiated Tertiary volcanic rocks (Tvu). Many of these units are present in small areas in multiple locations along the corridor (***Figure 2.2-2***).

2.2.3.7.3. Tailings Storage Facility and Tailings Corridor

Figure 2.2-3 shows that the majority of the bedrock in the central TSF area is Tertiary conglomerate (QTg). Older Precambrian Pinal Schist (P₵pi) underlies the southwestern and northeastern portions of the TSF. In the northwestern part of the TSF, surface geology includes younger Precambrian sedimentary rocks, basalt, and diabase (p₵y); Paleozoic sedimentary rocks (Pz); and Tertiary Apache Leap Tuff (Tal). Tertiary volcanic rocks (Tvy), including an area of perlitic rhyolite and tuff, comprise a small section of the surface geology in the eastern part of the TSF. Quaternary alluvial deposits are present along the washes (KCB 2014).

Numerous faults were mapped by Spencer and Richard in the west and north “mixed geology areas.” Regional data suggest that the area has undergone significant extension, leading to normal faulting. The vast majority of the extensional displacement was accompanied by the Concentrator and Roblas Canyon faults, located northwest and northeast of the TSF, respectively (Spencer and Richard 1995). According to Spencer and Richard, the “normal faulting and tilting ended after volcanism and during deposition of conglomerate and sandstone.” Thus the Gila Conglomerate unit is largely undeformed by faulting (KCB 2014).

Klohn Crippen Berger (KCB) staff conducted an investigation of the TSF site in 2013 to determine the geotechnical and hydrogeological characteristics that might affect the design of the TSF (KCB 2014).

They concluded that the majority of the Tertiary conglomerate (QTg) that forms the foundation of the TSF is Gila Conglomerate, which forms northeast-trending ridges and valleys. The Gila Conglomerate unit ranges from sub-horizontally bedded to massive; the bedding orientation was observed to be consistent, with no evidence of joint sets in outcrop, suggesting that it has not undergone significant deformation. Acid reaction occurs in the matrix of the conglomerate material, and clasts are generally non-reactive; therefore, the acid neutralization potential of Gila Conglomerate is dependent on the amount of carbonate present in the matrix. Based on acid base accounting data from samples taken during drilling of the wells at WPS, the neutralization potential of the Gila Conglomerate ranges between approximately 50 and 250 tons (45 and 227 tonnes) of equivalent calcium carbonate ($CaCO_3$) per kiloton of rock (T $CaCO_3$/kT rock) (Golder 2005; 2007).

Potential borrow locations for TSF starter dam construction are identified in ***Figure 2.2-3***. Borrow Areas 2, 5, and 6 are in Gila Conglomerate; Borrow Area 3 is in Apache Leap Tuff; and Borrow Areas 1 and 4 are in Pinal Schist. Borrow areas are further described in ***Section 3.3.10.12***.

The Tailings Corridor crosses a variety of geologic formations between the TSF and WPS (***Figure 2.2-3***). The western terminus of the corridor at the TSF is underlain by Precambrian Pinal Schist (p₵pi). Proceeding eastward, the bedrock changes to younger Precambrian sedimentary rocks, basalt, and diabase until the corridor crosses Happy Camp Canyon, where Tertiary volcanic rocks (Tvy) are exposed. Tertiary Gila Conglomerate (QTg) forms the ridge between Happy Camp Canyon and Silver King Wash. Quaternary alluvial deposits (Qal) are present along the channel in Silver King Wash. Younger Precambrian sedimentary rocks, basalt, and diabase underlie the eastern terminus of the Tailings Corridor at WPS.

2.2.3.7.4. West Plant Site

An extensive area of undifferentiated Quaternary and Tertiary gravel and conglomerate (QTg) underlies the majority of WPS (***Figure 2.2-4***). The Concentrator fault crosses northwest-southeast near the eastern boundary of WPS. Northeast of this fault, the surface geology changes abruptly to include younger Precambrian sedimentary rocks, basalt, and diabase (p₵y), Paleozoic sedimentary rocks (Pz), and Tertiary Apache Leap Tuff (Tal). The southern edge of WPS and the town of Superior lie on Quaternary alluvial deposits (Qal), and the remainder of WPS (the legacy tailings ponds and slag dump) is mapped as disturbed surficial deposits (d) (***Figure 2.2-4***). Extensive studies of the geology of WPS have been completed as part of the Aquifer Protection Permit (APP) Program and additional detail on the geology of the WPS may be found in Golder 2008.

2.2.3.7.5. East Plant Site

Relatively few formations are exposed in the EPS area. Apache Leap Tuff (Tal), the youngest consolidated formation in the area, underlies EPS and forms the Apache Leap escarpment (***Figures 2.2-4, 2.2-5a, and 2.2-5b***). Underlying Paleozoic sedimentary rocks (Pz) and younger Precambrian sedimentary rocks (p€y) are exposed at the foot of the escarpment. Tertiary Whitetail Conglomerate (Tw) is present, with limited exposure below the Apache Leap Tuff west of EPS and also at the toe of the slope on the western side of Apache Leap. A Quaternary alluvial deposit (Qal) overlies the Apache Leap Tuff in a small area northeast of EPS in Oak Flat.

2.2.4. PHYSICAL CHARACTERISTICS OF GEOLOGY

Resolution Copper has been collecting geotechnical data to understand the physical characteristics of the rock types, or rock mass parameters, in the vicinity of the proposed underground mine. This information is used as an input to the mine design and also to predict the extent of subsidence. Subsidence predictions are conducted using a combination of empirical methods, benchmarking, and numerical modeling, which are further described in the Subsidence Management Plan (***Appendix E***). The types of data collected and the methods used for data collection, data analysis, and rock mass characterization are described in ***Appendix F***, but generally, the physical characteristics of the rock types in and around the proposed underground mine are collected through the following activities:

- extensive detailed geotechnical and geophysical core logging of surface drill holes;
- underground shaft mapping using photogrammetry methods;
- underground stress measurements using over-coring and hydro-fracturing techniques;
- rock strength laboratory testing;
- rock mass monitoring and response observations during development activities; and
- historical surface mapping and information from the old Magma Mine.

A summary of the geotechnical data collected to date on the physical characteristics of the rock types, or rock mass parameters, in the vicinity of the proposed underground mine can be found in ***Appendix F***.

2.2.5. GEOCHEMISTRY

2.2.5.1. *Mineralization of the Resolution Deposit*

The Resolution deposit is a large porphyry copper-molybdenum system. Drilling to date indicates a world-class copper-molybdenum deposit at depths of approximately 4,500 to 7,000 ft (1,370 to 2,100 m) below ground surface (bgs) (***Figures 2.2-5a and 2.2-5b***). The deposit was discovered in 1996 by underground drilling from workings of the Magma Mine during exploration for vein-style mineralization. Unlike the Magma Mine, which was a very-high-grade vein-type deposit, Resolution is a lower grade disseminated ore deposit. Although its ultimate size has not been determined, the Resolution deposit as defined by the 1-percent copper shell extends over an area of at least 1.2 mi (2 km) in an east-northeast direction and 0.9 mi (1.5 km) in a north-northwest direction at -2,500 ft (-775 m) elevation (***Figures 2.2-5a and 2.2-5b***). Its thickness is locally greater than 1,600 ft (500 m) (Hehnke et al. 2012).

Mineralization is strongly controlled by lithology, with diabase, limestone, and, locally, breccia being the preferred hosts for the strongest copper mineralization. Quartz-rich sedimentary rocks and Laramide intrusive rocks are preferentially more strongly molybdenum-mineralized. The highest copper grades (> 3 weight percent) are located in the upper central portion of the deposit associated with a large breccia body and hosted primarily in breccia and the upper diabase sill. Locally, copper grades of 1 to 3 weight percent are present in all lithologies, with the exception of the Pinal Schist.

Copper-bearing minerals in the Resolution deposit include chalcopyrite, chalcocite, and bornite. Molybdenum occurs as molybdenite. Sulfide and oxide mineral assemblages vary systematically with alteration zones. From earliest to latest, the vein types and their alteration associations are summarized below.

Potassic Alteration Zone

- Green biotite-anhydrite veinlets with brown biotite halos, hosted in diabase.
- Quartz-anhydrite veins with variable amounts of chalcopyrite, pyrite ± bornite, magnetite, and, locally, traces of molybdenite and carbonate. In the southern sector of the deposit, veins in diabase may display elevated magnetite concentrations. Veins display thin biotite halos.
- Chalcopyrite-rich quartz-anhydrite veins with variable amounts of K-feldspar, pyrite, biotite, sericite, bornite, and molybdenite. Piercement structures and fractures are filled with anhydrite-chalcopyrite-biotite ± sericite.
- Molybdenite-bearing quartz-anhydrite veins with associated chalcopyrite, K-feldspar, pyrite, biotite, sericite, and bornite. Veins display a weak K-feldspar-biotite ± sericite halo.

Phyllic Alteration Zone

- Straight-walled and branching chalcopyrite-pyrite veins. Minor quartz-anhydrite veins with sericite and disseminated chalcopyrite-pyrite halos, commonly reopening older veins and showing incipient bornite replacement of chalcopyrite, especially at vein edges.

Advanced argillic alteration zone

- Chalcocite-bornite-pyrite-dickite ± quartz vein with irregular topaz-silica halos. Older sulfides that are affected by the alteration event are replaced with chalcocite-bornite.

A gross spatial correlation exists between elevated silver grades and advanced argillic alteration, suggesting silver substitution within the chalcocite that accompanies advanced argillic alteration. Skarns displaying late-stage silica-pyrite alteration typically have higher gold and silver grades (Hehnke et al. 2012).

2.2.5.2. *Geochemical Characterization of Geologic Materials in Block Cave Zone*

Resolution Copper has completed a comprehensive effort to characterize the geochemistry of the overburden, development rock, and ore in the block cave zone (***Appendix G***). Testing was conducted in accordance with the requirements of the ADEQ APP Program (ADEQ 2004). The samples selected for testing cover the anticipated range of sulfide mineral contents, acid generation potentials, and acid neutralization potentials and represent the major rock/alteration types in the ore body and in the geologic formations that will remain within and adjacent to the block cave following the closure of the mine.

2.2.5.2.1. Tier 1 and Tier 2 Analytical Methods

Analytical methods used in the geochemical characterization study include Tier 1 (static) tests and Tier 2 (kinetic) tests. The purpose of Tier 1 testing is to assess the potential of a given rock type or alteration assemblage to generate acidic conditions when exposed to air and water. Tier 2 testing involves simulating the chemical weathering of a sample under controlled laboratory conditions and determining the rates at which weathering reactions occur. Tier 2 testing is conducted to confirm the results of Tier 1 testing and to measure the release rates of the principal components such as acidity, alkalinity, and metals.

2.2.5.2.2. Tier 1 (Static) Testing

The Tier 1 testing consisted of 226 samples; 40 percent were classified as ore (i.e., represented rocks or alteration types located within the 1-percent copper shell) and 60 percent were non-ore samples (i.e., represented rocks or alteration types located above or outside the 1-percent copper shell). Tier 1 testing included acid base accounting (ABA), net acid generation testing, synthetic precipitation leaching procedure, and whole rock chemical analysis. A brief description of each method is provided below.

Acid Base Accounting

ABA consists of a series of tests designed to evaluate the balance between potentially acid-generating minerals and acid-neutralizing minerals in a rock or soil sample. Results of ABA tests indicate the potential of a geologic material to generate acidity due to exposure to air and water. ABA results are presented in the following terms:

- Acid generating potential (AGP), which is calculated from the amount of sulfide-sulfur in the sample. AGP is expressed in units of tons of equivalent calcium carbonate ($CaCO_3$) per kiloton of rock (T $CaCO_3$/kT rock).
- Acid neutralizing potential (ANP), which is determined based on the amount of carbonate minerals (particularly calcite) within the sample. ANP does not include potentially neutralizing minerals other than carbonate minerals. ANP is expressed in units of T $CaCO_3$/kT rock.

- Net neutralization potential (NNP) is calculated as the difference between ANP and AGP (NNP = ANP – AGP). NNP is also expressed using units of T $CaCO_3$/kT rock.
- Neutralization potential ratio, which is the ratio of ANP to AGP (neutralization potential ratio = ANP/AGP).

Net Acid Generation Testing

Net acid generation testing is used to assess whether a sample is capable of neutralizing the acidity produced by the complete oxidation of all the sulfide minerals present in the sample.

Net acid generation results are interpreted as follows, based on Stewart et al. (2006):

- Potentially-acid-generating (PAG): Final pH < 4.5
- Not-potentially-acid-generating (NPAG): Final pH > 4.5

Synthetic Precipitation Leaching Procedure

Synthetic precipitation leaching procedure is a procedure used to determine what chemical constituents are likely to initially leach from a geologic material during exposure to precipitation or surface water runoff. Each sample was leached for 24 hours using distilled water that was slightly acidified to simulate the chemical composition of local precipitation. The resulting leachate was analyzed for metals, metalloids, and general chemical parameters.

Whole Rock Chemical Analysis

Whole rock chemical analyses were conducted for the samples using two techniques: 1) strong acid digestion followed by analysis by inductively coupled plasma-mass spectrometry for a full suite of major ions and metals, and 2) a lithium borate fusion followed by x-ray fluorescence spectroscopy for major and minor oxide determinations.

2.2.5.2.3. Tier 2 (Kinetic) Testing

The Tier 2 testing consisted of 47 samples; 35 percent were classified as ore (i.e., represented rocks or alteration types located within the 1-percent copper shell) and 65 percent were non-ore samples (i.e., represented rocks or alteration types located above or outside the 1-percent copper shell). Tier 2 testing included humidity cell testing (HCT), mineralogical analysis, saturated column testing, and grain size analysis. A brief description of each method is provided below.

Humidity Cell Testing

HCTs were conducted to: 1) determine the kinetics of the oxidation reactions that occur when a sample is exposed to water and air, and 2) determine the chemical composition of the resultant leachate. HCTs are designed to accelerate the rates of natural weathering processes and to quantify those rates under ideal laboratory conditions.

Mineralogical Testing

Mineralogical testing was carried out on the geologic material that was used in the HCT tests. Mineralogical testing included:

- Petrographic analysis to identify minerals present, the encapsulation of the minerals (e.g., pyrite or calcite in quartz), mineral morphology, and mineral reaction rims (e.g., the oxidation of pyrite).
- X-ray diffraction to further identify the mineral phases present in the samples.
- Scanning electron microscopy to obtain high-resolution, three-dimensional images of mineral grains or rock samples on a small scale (micron to sub-micron level).

Saturated Column Testing

After completion of the HCT testing, selected columns were converted to saturated flow-through columns. The purpose of the saturated column testing was to investigate the potential for acid and metals release from material left in the mine at the time of closure.

Grain Size Analyses

Grain size analyses were completed on all samples subjected to humidity cell and saturated column testing. Samples were sieved to yield a particle size range between 0.066 and 0.25 in (1.7 and 6.35 mm). Grain size analysis provided a sample-specific distribution of particle sizes within this range. The distribution of particle sizes in a given sample is important because the kinetics of chemical reactions are closely associated with the surface area of each mineral that is exposed to air and water.

2.2.5.2.4. Results of Tier 1 and Tier 2 Testing

The results of the Tier 1 and Tier 2 testing are summarized in this section. More detailed results are presented in ***Appendix G***.

The results of the ABA (using both net acid generation and NNP classifications) indicate that 85 percent of the ore samples and 39 percent of the non-ore samples were PAG. Rock types classified as PAG by both net acid generation and NNP include breccia, diabase, lalite/porphyry, quartzite porphyry, quartzite, fault material, quartz-rich sediment, and volcanics and sediment. Rock types classified as not-potentially-acid-generating (NPAG) or uncertain include andesite, Tertiary Whitetail Conglomerate, Devonian Martin Limestone, and Tertiary Apache Leap Tuff.

The results of the leachate tests (synthetic precipitation leaching procedure) indicate that leachate from several samples had elevated levels of aluminum, iron, manganese, chloride, fluoride, and sulfate. The results of the whole rock chemical analysis showed that the samples were generally elevated in most metals and metalloids when compared to the crustal averages, which is to be expected of rocks associated with an ore deposit.

The results of the HCTs demonstrate that most of the samples that were determined to be PAG during Tier 1 testing produced acidic leachates. Those samples that were classified as having an uncertain potential to generate acid typically did not generate acidic leachate. The petrographic analysis of thin sections indicates that typically 30 to 50 percent of the sulfide grains (pyrite) were encapsulated in silicate minerals; therefore, oxidation of those sulfides is expected to be many orders of magnitude slower than with exposed pyrite.

2.2.5.3. *Geochemical Characterization of the Tailings*

Resolution Copper completed a geochemical characterization program for tailings as part of the Baseline Study work for the Project (***Appendix H***). Geochemical characterization of the tailings will support both the ADEQ APP Program and this General Plan of Operations (GPO) and the NEPA analysis. In addition, Resolution Copper will use the results of the geochemical characterization program to advance the Project's detailed engineering planning for the metallurgical planning and management of the tailings during operation and closure.

Resolution Copper developed five sets of geochemical characterization tests for the tailings:

- Static testing of approximately 150 small-scale samples distributed across the site;
- Static and kinetic testing of Pilot Plant samples representing the early years of production. In addition to the laboratory-scale testing of the Pilot Plant samples, large-scale samples were used in the in situ barrel testing program identified in the final bullet of this introduction;
- Static and kinetic testing of blended ore composites representing early (Years 1 through 15), middle (Years 16 through 30), and late (Years 31 through 40) mine-life production;
- Kinetic testing of samples from borehole RES-007/7A (the primary metallurgical exploration hole); and
- Large-scale barrel tests (with initial sample characterization) for in situ weathering. The barrel tests were conducted using Pilot Plant tailings samples at the Pinto Valley Mine to maintain physical security, allow routine monitoring, and represent the climatological characteristics of any of the sites that might be considered for tailings deposition.

To understand the nature of the Resolution Copper tailings and the meaning of the results, it is important to understand that the metallurgical planning developed three types of tailings: 1) whole tailings, 2) cleaner tailings, and 3) scavenger tailings. Whole tailings are the complete residue of the metallurgical process circuit after copper has been recovered from the ore; cleaner tailings and scavenger tailings are subsets of the whole tailings, as explained below.

- Cleaner tailings are a combined tailings from the rougher scavenger float and cleaner underflow circuits.
- Scavenger tailings are the underflow tailings off the rougher scavenger circuit.

In some projects, and historically for tailings-generation in Arizona, only a single stage of copper extraction is completed, and the whole tailings represent the only waste from mineral processing. However, recent developments in extractive metallurgy have shown that there are several advantages to advancing the metallurgical process to improve recovery and simultaneously to produce beneficiation subsets that can lead to higher copper byproduct and metal recoveries, the more effective environmental management of tailings, and a final closure strategy that reduces risk to groundwater. The additional processing looks to physically separate sulfides and metals from the rest of the inert gangue in the whole tailings. The process, which is described in ***Section 3.3*** of this GPO, ultimately develops two final tailings products. In the terminology of extractive metallurgy adopted for this report, these two products are called cleaner tailings and scavenger tailings.

The cleaner tailings concentrate the sulfides and metals relative to the whole tailings. Consequently, the scavenger tailings are depleted in pyrite and residual metals relative to the whole tailings, and very far depleted relative to the cleaner tailings. Thus the segregation of cleaner and scavenger tailings not only depletes the scavenger tailings of pyrite, but also of metals, which, combined, are important geochemical considerations for groundwater and surface water protection. The design basis for the Resolution Copper process circuits is to remove at least 90 percent of the total residual sulfide (mostly pyrite) as well as other metals from the whole tailings into the cleaner tailings. Because of the total mineralogy of the Resolution Copper ores, this metallurgical process implies that the scavenger tailings will be approximately 85 percent of the total tailings volume and the cleaner tailings approximately 15 percent of the total tailings volume.

The geochemical characterization programs addressed the Tier 1/Tier 2 protocols of ADEQ for the APP Program. Descriptions of the methods and procedures for Tier 1 and Tier 2 tests are included in ***Appendix H***. Tier 1 testing included a static characterization of the samples, e.g., acid-base accounting, net acid generation, static leaching, and whole-rock chemical analyses. Typically, Tier 1 tests are conducted on a large number of samples from a wide range of locations in order to capture the geochemical variability likely to be encountered during the life of the mine. The results from this suite of tests will be used to identify potential geochemical risks, including acid-rock drainage and the existence in the solid phase of specific elements or compounds that constitute potential hazards to human health or the environment.

Tier 2 tests, required of all potential transport materials that could affect aquifer protection, are kinetic tests that simulate the natural weathering of the tailings as they may be exposed to ambient climatic conditions in variably saturated conditions in a tailings management system. The kinetic tests for the Resolution Copper Project encompass two sorts. First, there were American Society for Testing and

Materials-style humidity-cell tests of samples with masses of 2.2 to 4.4 lbs (1 to 2 kg) of tailings; these tests were conducted in laboratory conditions of controlled temperature and generally controlled humidity, with the routine, cyclical application of a fixed aliquot of deionized water as a surrogate for meteoric precipitation. Secondly, 11 samples of tailings were tested in 55-gallon (0.21-m^3) barrels (approximately 220 lbs [100 kg] of tailings per barrel). Of the 11 samples, seven were exposed to ambient weathering conditions at the Pinto Valley site and four were paired samples with artificially charged irrigation (10 gallons [45 liters] per barrel per month) for comparison to the ambient tests. The barrel tests allow Resolution Copper to evaluate the larger scale leaching behavior of the tailings, considering not only more mass and volume, but also the range of uncontrolled, naturally occurring temperature and humidity and rinsing events from precipitation. In addition to the humidity cell and barrel leaching tests, the materials tested in the kinetic tests were characterized with respect to their specific acid-base accounting characteristics, particle-size distribution, whole-rock chemistry, and, for a subset of samples, mineralogy.

The Tier 1 tests showed that whole tailings and cleaner tailings are expected to be net acid-generating over time if allowed to weather in the vadose zone. The work shows that, as planned, the separation of pyrite to the cleaner circuit produces scavenger tailings (85 percent of the total volume) that have total sulfur concentrations of approximately 0.1 weight percent and will not be acid-generating by static test results.

The Tier 2 tests reliably confirm the inferences of the Tier 1 tests with respect to potential acid generation. Whole tailings and cleaner tailings allowed to weather under oxidizing and hydraulically unsaturated conditions would be expected to become acid-generating over time, and the effluents from such weathering would be elevated in total dissolved solids, sulfate, fluoride, and a range of common metals, including aluminum, cadmium, copper, iron, nickel, and zinc (based on the results of the humidity cell testing of the cleaner tailings). The larger scale barrel tests of the cleaner tailings also indicate the potential for elevated concentrations of beryllium, chromium, cobalt, manganese, selenium, uranium, and vanadium. However, the scavenger tailings are confirmed to be largely NPAG and to leach low to non-detect concentrations of solutes. Because the pH of the leachate from the kinetic testing of the scavenger tailings is circum-neutral to slightly alkaline, the concentrations of dissolved metals are low. The coarse (underflow) fraction of cycloned tailings would be relevant to the geochemical behavior of embankments. Laboratory and barrel test Tier 1 and 2 evaluations show that if the underflow fraction were to be developed from whole tailings, the product would be expected to be acid-generating; however, when the underflow product is prepared from desulfurized (scavenger) tailings, the potential embankment materials would be NPAG.

2.2.6. SEISMICITY AND GEOLOGIC HAZARDS

The GPA is characterized by relatively few late Quaternary faults and low rates of seismicity. URS Corporation (***Appendix I***) conducted a site-specific seismic hazard assessment and provided design parameters and a suite of time histories representing design scenario earthquakes for the TSF.

A review of historical earthquakes in the region (1830–2012) was conducted by URS (***Appendix I, Figure 2***). Historical seismicity in the GPA is sparse, with only 17 events within a 62-mi (100-km) radius. The largest and closest event within 62 mi (100 km) of the site is the MM VI event that occurred on June 17, 1922, and was located in the vicinity of the town of Miami, 20 mi (32 km) east-northeast of the GPA. Two other moderate events of M_L 4.1 and M_L 4.4 occurred to the east of the GPA in 1963 and 1969, respectively (***Appendix I, Figures 2, 7, and 8***). The 1963 Globe earthquake was not likely felt in the GPA (***Appendix I, Figure 7***), although the 1969 San Carlos event was likely felt (***Appendix I, Figure 8***). The maximum intensity of these two events was MM VI, with little to no damage reported. The felt area of the 1963 event is estimated at about 2,510 mi^2 (6,500 km^2) (DuBois et al. 1982; ***Appendix I, Figure 7***).

Regional faults located within a 62-mi (100-km) radius that could move in the event of an earthquake were identified (***Appendix I***) and include the Horseshoe fault, the Carefree Fault Zone, Sugarloaf fault, and Whitlock Wash fault (***Appendix I, Figure 3***). Although quite distant (about 285 km southeast of the site), a notable earthquake of M 7.4 occurred on May 5, 1887, in northern Sonora, Mexico (DuBois et al. 1982; Suter and Contreras 2002; ***Appendix I, Figure 9***). This earthquake ruptured the Pitaycachi, Teras, and Otates faults (Suter 2008) and was felt throughout the region and as far away as Albuquerque, New Mexico, and El Paso, Texas. In Phoenix, hanging chandeliers swung in every building (DuBois et al. 1982). An MM VI is estimated for the site (***Appendix I, Figure 9***).

The 5,000-year return-period ground motions (or probability of exceedance of 1 percent in 50 years) were taken as the maximum design earthquake ground motions for the TSF. URS (***Appendix I***) provided the following site-specific seismic design parameters:

1. 5,000-year return-period Peak Ground Acceleration (PGA) and spectral acceleration (Sa) at 0.2-second and 1-second periods uniform hazard response spectra (UHRS):
    a. PGA=0.107 g, SA(T=0.2 s)=0.26 g and Sa(T=1 s)=0.15 g
2. PGAs corresponding to 5,000-year return-period conditional mean spectra (CMS) at short period (0.2 s) and long period (1 s) are:
    a. PGA=0.0987 g for CMS at 0.2 s
    b. PGA=0.014 g for CMS at 1 s
3. Controlling or Scenario Earthquakes corresponding to ground motions at the PGA are lower magnitude local earthquakes. At the period of the proposed tailings embankment, the

controlling earthquake is a long-distance large-magnitude earthquake occurring near the San Andreas fault. Representative local and long-distance earthquake magnitudes and distances are:

a. For PGA, Earthquake Magnitude, M=5.4 and Distance, D=24 mi (38 km)

b. For Sa(T=1), Earthquake Magnitude, M=7.7 and Distance, D=373 km (232 mi)

Both earthquake scenarios were considered in the design.

The minimum design earthquake is the maximum probable earthquake defined as the maximum earthquake that is likely to occur during a 100-year interval (80 percent probability of not being exceeded in 100 years[1]) and shall not be less than the maximum historical event. This design earthquake may apply to structures with a relatively short design life (e.g., 10 years) and is a minimum potential threat to human life or the environment. Where human life is potentially threatened, the maximum credible earthquake should be used. Judgment should be used to establish the appropriate design earthquake, which may range between the maximum probable earthquake and the maximum credible earthquake, taking into account the following factors:

- potential threat to human life or the environment;
- facility life;
- potential future property development downstream of the embankment or earth structure; and
- seismic history in the area.

The geotechnical and seismic criteria selected for the TSF are summarized in ***Table 2.2-2***.

Table 2.2-2 Geotechnical Stability Criteria for the Tailings Storage Facility

Loading Condition	Design Standard	Design Criteria
1. Static	Two-dimensional Limit-equilibrium Factor of Safety with steady state operating pore pressures	FS $\geq$ 1.5
2. Seismic	Design earthquake	5000-yr return period
	Two-dimensional Limit-equilibrium Factor of Safety with operating pore pressures and horizontal seismic coefficient, a_h, equal to 67% of the PGA	FS $\geq$ 1.1 with a_h = 0.07
	Two-dimensional Limit-equilibrium Post-earthquake Factor of Safety	FS $\geq$ 1.2 with cyclically induced pore pressures at end of earthquake shaking
	Seismic dam displacements during design earthquake	< 3.3 ft (1 m) of embankment displacement < 1 ft (0.3 m) of dam displacement for dams incorporating low permeability core or filter zone < 0.5 ft (0.15 m) of displacement for slip planes through or on geomembrane/geotextile liners

Adapted from KCB 2014, Table 2.13

[1] This is equivalent to 10 percent probability in 50 years, which equates to an earthquake with a 475-year return period.

The maximum design earthquake ground motions for the tailings embankments at the TSF site were based on 5,000-year return period ground motions (or a probability of 1 percent in 50 years). Based on the results, liquefaction is unlikely to occur for any of the scenarios analyzed. The modeling assumed that some buildup of pore water pressure during shaking would occur, but not enough to significantly reduce the overall safety factor.

2.3. WATER

2.3.1. SURFACE WATER RESOURCES

2.3.1.1. *Surface Water Occurrence*

2.3.1.1.1. Regional Characteristics

The surface water features in the GPA fall within the Gila River Basin, as shown in ***Figure 2.3-1***. GPA surface hydrology can be subdivided into the following watersheds of the Gila River Basin:

- Upper Queen Creek watershed
    - Telegraph Canyon watershed
    - Arnett Creek watershed
- Middle Queen Creek watershed
- Lower Queen Creek watershed
- Devils Canyon watershed
- Mineral Creek watershed
- Paisano Wash watershed
- Box O Wash watershed

Regional surface water features consist of a network of small to medium drainages that feed into larger channels. Surface water flow is a function of precipitation, evapotranspiration, and runoff/infiltration characteristics.

2.3.1.1.2. Local Surface Water Occurrence

Filter Plant and Loadout Facility

The Filter Plant and Loadout Facility will be located in the Lower Queen Creek watershed, which lies south of the Middle Queen Creek watershed and west of the Upper Queen Creek watershed (***Figure 2.3-1***). The Lower Queen Creek watershed originates at the western boundary of the Upper Queen Creek watershed and flows from northeast to southwest to the Gila River. A small ephemeral (potentially intermittent) channel is present at Magma, and numerous other ephemeral channels are arranged in parallel drainage patterns across the watershed.

The Salt-Gila aqueduct (also known as the Central Arizona Project [CAP]) canal crosses north-south through the watershed approximately 4 mi (7 km) southwest of the Filter Plant and Loadout Facility. Just southeast of the aqueduct is the New Magma Irrigation and Drainage District. The irrigation district consists of a distribution system (open channel canals) that delivers CAP water to approximately 27,000 ac (11,000 ha) of agricultural lands within the district.

No ponds, seeps, or springs are present at the site.

MARRCO Corridor

West of Superior, the MARRCO corridor runs north of and roughly parallel to, Queen Creek for approximately 5 mi (8 km) until it crosses the creek channel near Queen Station (***Figure 2.3-1***). It then continues to run adjacent to Queen Creek for approximately another 2 mi (3 km) on the southern side of the creek until it leaves the creek and continues southwest to Magma. The majority of the length of Queen Creek in the GPA is ephemeral and flows only during runoff events as a result of heavy rains. However, an approximately 2-mi (3-km) reach of Queen Creek begins just west of Superior that is supported by discharge from the Superior Wastewater Treatment Plant (WWTP). This perennial (effluent-dependent) reach of Queen Creek ends approximately 3.9 mi (6.2 km) upstream from the railroad crossing at Queen Station and approximately 2.9 mi (4.6 km) upstream from where the railroad begins to parallel the channel. The railroad passes 1.5 mi (2.7 km) south of the Whitlow Ranch Flood Control Basin, which captures both groundwater discharge and surface water runoff from the Upper Queen Creek watershed. Upon exiting the Queen Creek Valley, the railroad crosses several unnamed ephemeral washes and runs parallel to an unnamed ephemeral channel for approximately 1.9 mi (3 km) on its way to Magma.

No natural ponds are present along the corridor.

Tailings Storage Facility and Tailings Corridor

The TSF is located between Roblas Canyon to the west and Potts Canyon to the east, and includes parts of the Bear Tank Canyon and Benson Spring Canyon watersheds (***Figure 2.3-2***). All the drainages in these basins are ephemeral and flow only in response to precipitation events. The Tailings Corridor will cross several ephemeral washes between the TSF and WPS. These include Potts Canyon, Rice Water Canyon, Happy Camp Canyon, and Silver King Wash, all of which drain southwest toward Queen Creek. The Tailings Corridor does not cross any perennial surface water. Three extant springs are present in the vicinity of the TSF site/Tailings Corridor: Happy Camp, Benson, and Bear Tank Canyon springs (Montgomery & Associates 2013, WestLand 2014a). During the initial investigation of these springs, discharge was observed at Happy Camp and Bear Tank Canyon springs, but not at Benson Spring (Montgomery & Associates 2013). Both of the former springs are at least partially modified for use in stock watering and a stock pond occurs in association with Happy Camp Spring. In addition, three apparently man-made surface water impoundments or depressions are located in the vicinity of the perlite quarries in the northern part of the site (***Figure 2.3-2, Perlite Impoundment***), but based on initial investigations, these impoundments are not believed to be sourced from springs (Montgomery & Associates 2013). Past human alteration of some of the drainage features have created impoundments (cattle tanks) that do hold water for short periods of time following storm events.

West Plant Site and East Plant Site

Surface water features in the vicinity of the town of Superior and the Apache Leap Tuff outcrop have been included in the Resolution Project hydrogeologic characterization effort since 2002. Initial evaluation of surface water conditions included the compilation of existing data on mapped or registered springs and perennial waterways in the region. Field investigations were conducted in order to map the locations of additional features and to assess modern flow rate and water quality. Starting in 2002, a quarterly monitoring program was established (Golder 2006) that currently includes water quality sampling at 37 sites and surface water inventories (mapping the locations of flowing reaches and standing pools) in the Upper Queen Creek, Devils Canyon, and Mineral Creek watersheds (***Figure 2.3-3***). More recently, starting in 2008, selected surface water samples have been analyzed for a variety of radioisotopes and stable isotopes in order to investigate surface water/groundwater interactions (Montgomery & Associates 2010). This work was conducted in addition to the ongoing long-term characterization of baseline hydrochemistry that began in 2002 and is presented in Golder (2006) and Montgomery & Associates (2012a). Additionally, ongoing investigations of riparian vegetation will further document the flow characteristics of the streams (i.e., ephemeral, intermittent, or perennial) located within the GPA and vicinity.

West Plant Site

WPS is located within the Upper Queen Creek watershed, which originates on the slopes of Peachville Mountain and Kings Crown Peak north and northwest of the site. There is no perennial surface water flow on or adjacent to WPS (***Figure 2.3-3***). Upgradient surface flows originating north of the site are diverted to Silver King Wash via the Apex Tunnel, which is located north of the legacy tailings impoundments. Surface water draining off the site flows toward the south and southwest, discharging through a permitted outfall into an ephemeral tributary of Queen Creek. This ephemeral channel passes under US 60 and joins Queen Creek on the western side of Superior. At this point, Queen Creek would be considered intermittent due to the presence of riparian vegetation that depends on the presence of a shallow water table for maintenance. Downstream from the town of Superior WWTP, Queen Creek is effluent-dependent due to discharge from the WWTP.

No natural ponds are present at WPS. Legacy impoundments (tailings ponds) associated with historical ore-processing activities were and are present at WPS, although closure activities have recently reclaimed all but one of these impoundments.

East Plant Site and Surrounding Apache Leap Tuff Outcrop

The Apache Leap Tuff outcrop area drains into three watersheds: Devils Canyon, Upper Queen Creek, and Mineral Creek, all of which ultimately discharge to the Gila River (***Figure 2.3-3***). Surface water in the vicinity of EPS occurs as ephemeral streams or as runoff captured in stock ponds, some of which support riparian vegetation and could be considered intermittent. The northern and western portions of EPS drain into Upper Queen Creek. Most of the southern and eastern portions of EPS and the central northern portion of the Apache Leap Tuff outcrop drain into Devils Canyon. The far eastern edge of the Apache Leap Tuff outcrop drains into the Mineral Creek watershed (Montgomery & Associates 2010).

In the vicinity of EPS, Queen Creek is ephemeral and/or intermittent, although perennial or near-perennial springs provide extremely localized flow in some reaches. Devils Canyon is ephemeral in the upper part of the Devils Canyon watershed; however, in the lower part of the watershed, several perennial reaches that total approximately 1.6 mi (2.5 km) have been identified (***Figure 2.3-3***). Southeast of EPS, Mineral Creek is largely perennial between Government Springs Ranch and the confluence with Devils Canyon (Montgomery & Associates 2012a).

Springs that have been identified in this area are shown in ***Figure 2.3-3***. These springs include:

- Upper Queen Creek Watershed: Pump Station Spring, Boulder Hole, QC22.6E, Blue Spring, Kane Spring, Bored Spring, and Hidden Spring;
- Devils Canyon Watershed: DC8.2W, DCT6.6W, DC6.1E, and DC4.1E; and
- Mineral Creek Watershed: Government Springs (not shown) and MC3.4W.

A few man-made ephemeral ponds are present in the vicinity of EPS. Four reservoirs, or stock tanks, are located within the Queen Creek watershed; one in the northern portion and three northeast of the area. Two very small (unmapped) stock tanks are located within the Rancho Rio Creek sub-watershed (tributary to Devils Canyon). Additional stock tanks and reservoirs are located within the Rawhide Canyon and Iron Canyon sub-watersheds (tributaries to Devils Canyon) and within the Mineral Creek watershed.

No natural ponds are present in the vicinity of EPS.

2.3.1.2. *Surface Water Quality*

2.3.1.2.1. Regulatory Framework

ADEQ has developed a classification system of designated uses for surface waters within the state of Arizona, with specific water quality standards that must be met for each designated use. The water quality of discharges to surface waters is regulated by ADEQ under Arizona Administrative Code (AAC) Title 18, Chapter 11 (R18-11). Discharge quality requirements vary by waterway and depend on the waterway's designated uses.

Runoff, discharges, and surface water flow from each site will ultimately enter a regulated waterway as determined by existing topography and designed stormwater controls. ***Table 2.3-1*** lists the receiving waterway for each site and the designated uses assigned in AAC R18-11-104.

The following surface water reaches in the GPA are listed as impaired (ADEQ 2012; ***Figure 2.3-1***):

1. Queen Creek from its headwaters to the Superior WWTP is impaired for copper and lead; the development of a Total Maximum Daily Load (TMDL) for copper is in progress (estimated draft completion date was to have been June 2012; however, it has not been completed to date).
2. Queen Creek from the Superior WWTP to Potts Canyon is impaired for copper; the development of a TMDL for copper is in progress (estimated draft completion date was to have been June 2012; however, it has not been completed to date).
3. Queen Creek from Potts Canyon to Whitlow Canyon is impaired for copper.
4. Mineral Creek from Devils Canyon to the Gila River is impaired for copper, selenium, and low dissolved oxygen; no TMDL is required due to a consent decree between ADEQ and ASARCO.

Figures 2.3-1, 2.3-2, and 2.3-3 show minor tributaries of Queen Creek as impaired surface waters; however, the actual status of these reaches is non-attaining.

Table 2.3-1 Designated Uses of Receiving Waterways for Each Project Feature

Project Area	Waterway	Designated Use*						
		A&We	A&Ww	A&Wedw	FBC	PBC	AgL	FC
MARRCO Corridor	Queen Creek, downstream of Queen Valley Golf Course	X				X		
MARRCO Corridor	Queen Creek, downstream of Potts Canyon		X		X		X	X
MARRCO Corridor	Queen Creek, downstream of WWTP			X		X		
Filter Plant & Loadout Facility	Queen Creek, downstream of Queen Valley Golf Course	X				X		
Tailings Storage Facility	Queen Creek, downstream of Potts Canyon		X		X		X	X
West Plant Site	Queen Creek, upstream of WWTP		X			X	X	
East Plant Site (SE)	Devils Canyon		X		X		X	X

Table 2.3-1 Designated Uses of Receiving Waterways for Each Project Feature

Project Area	Waterway	Designated Use*						
		A&We	A&Ww	A&Wedw	FBC	PBC	AgL	FC
East Plant Site (NE and NW)	Queen Creek, upstream of WWTP		X			X	X	

*As assigned in Arizona Administrative Code R18-11.
A&We – Aquatic and Wildlife, ephemeral
A&Ww – Aquatic and Wildlife, warm water
A&Wedw – Aquatic and Wildlife, effluent-dependent water
WWTP – Wastewater Treatment Plant
FBC – Full Body Contact
PBC – Partial Body Contact
AgL – Agricultural Livestock
FC – Fish Consumption

2.3.1.2.2. Local Surface Water Quality

Filter Plant and Loadout Facility

No site-specific surface water quality data are available for the Filter Plant and Loadout Facility.

MARRCO Corridor

No site-specific surface water quality data are available for the MARRCO Corridor. The MARRCO Corridor runs parallel to Queen Creek for approximately 5 mi (8 km). Queen Creek from its headwaters to Whitlow Canyon is impaired for copper (ADEQ 2012). The development of a TMDL for copper is in progress for Queen Creek from its headwaters to Potts Canyon.

Tailings Storage Facility and Tailings Corridor

Ephemeral surface water from the TSF and Tailings Corridor drains to Queen Creek, which is impaired for copper from its headwaters to Whitlow Canyon (ADEQ 2012). The development of a TMDL for copper is in progress for Queen Creek from its headwaters to Potts Canyon. Surface water quality has been monitored at three springs and a quarry located in the Upper Queen Creek watershed near the TSF and Tailings Corridor. Bear Tank Spring, Benson Spring, Happy Camp Spring, and Perlite Quarry have been monitored quarterly since February 2013. The locations of these features are presented in ***Figure 2.3-2***. In general, the surface water quality of these surface water features is in compliance with applicable surface water standards; however, background concentrations of the following constituents have been observed at levels above the designated standard: arsenic, copper, lead, and total suspended solids.

West Plant Site

Surface water from WPS drains to Queen Creek upstream of the Superior WWTP. Surface water quality has been monitored at 12 locations in the Upper Queen Creek watershed; monitoring locations are presented in ***Figure 2.3-4***. In general, surface water quality in the Queen Creek watershed is in compliance with applicable surface water standards; however, background concentrations of the following constituents have been observed at levels above the designated standard: arsenic, copper, lead, selenium, dissolved oxygen, and *Escherichia coli* bacteria (*E. coli*) (Montgomery & Associates 2013b).

East Plant Site

Surface water from EPS ultimately discharges to Devils Canyon or Upper Queen Creek; see ***Table 2.3-1*** for the designated uses for each of these waterways. Surface water quality has been monitored by Resolution Copper at 17 locations in the Devils Canyon watershed and 14 locations in the Upper Queen Creek watershed; monitoring locations are presented in ***Figure 2.3-4***. In general, the surface water quality in the Devils Canyon watershed is in compliance with applicable regulations; however, concentrations of the following constituents have been observed to be out of compliance: cadmium, copper, dissolved oxygen, *E. coli* bacteria, iron, lead, and pH (Golder 2006; Montgomery & Associates 2013b). Similarly, the surface water sampled in the upper part of the Queen Creek watershed (headwaters to the town of Superior WWTP) is generally in compliance with applicable surface water standards, with the following exceptions: arsenic, copper, dissolved oxygen, *E. coli* bacteria, iron, lead, pH, and selenium (Golder 2006; Montgomery & Associates 2013b).

2.3.2. GROUNDWATER RESOURCES

2.3.2.1. *Groundwater Rights*

Groundwater Rights have been established based on Articles 4, 5, and 6 of the Groundwater Code, Arizona Revised Statute (ARS) § 45-151, ARS § 45-161, and ARS § 45-191, *et seq.* Groundwater rights are appurtenant under defined conditions and types of uses within the Active Management Area (AMA) boundaries established by Arizona Department of Water Resources (ADWR) (Arizona Laws Relating to Water 2011). The AMA boundaries are shown on ***Figure 2.3-1***. Primary types of uses include municipal, agricultural, and industrial. The following types of groundwater rights have been established by ADWR within the five AMA boundaries in Arizona.

- Type 1 non-irrigation grandfathered right (retired irrigated land)
- Type 2 non-irrigation grandfathered right
- Service area rights

Article 7 of the Groundwater Code allows for groundwater withdrawals based on permits (ARS § 45-511, *et seq.*). Groundwater Withdrawal Permits include:

- Dewatering permits
- Mineral extraction and metallurgical processing permits
- General industrial use permits
- Poor quality groundwater permits

- Temporary permits (emergency electrical energy generation)
- Drainage water permits
- Hydrologic testing permits

ADWR does not issue Groundwater Rights for groundwater use outside the established AMAs. Essentially, groundwater is an unregulated resource in areas outside the AMA boundaries.

2.3.2.2. *Groundwater Occurrence*

2.3.2.2.1. Regional Characteristics

The region in which the GPA is located hosts several distinct groundwater systems:

- Groundwater east of the Concentrator fault, which occurs in three separate local systems: a shallow groundwater system, the Apache Leap Tuff aquifer, and a deep groundwater system.
- Groundwater west of the Concentrator fault in the Superior Basin that is hosted primarily in floodplain alluvium along Queen Creek, but also in the poorly permeable basin-fill sediments and deeper geologic units in the vicinity of the town of Superior.
- Groundwater that occurs west of the Superior Basin in the Queen Valley aquifer and in multiple aquifers in the East Salt River Valley on the western edge of the GPA.

Groundwater occurrence and movement in each of these systems are discussed below as they pertain to specific Project features. The occurrence of groundwater within the region is constrained by the climatic and geologic conditions described above. The semiarid climate limits the amount of surface water available for infiltration, and the physiography controls the water storage and transport characteristics. The groundwater underlying the majority of the GPA is subject to administration by the Phoenix AMA and is located in the East Salt River Valley sub-basin of the AMA.

2.3.2.2.2. Local Groundwater Occurrence

Filter Plant and Loadout Facility

Depths to groundwater in the vicinity of the Filter Plant and Loadout Facility were obtained from the Groundwater Site Inventory (GWSI) database for listed well sites (ADWR 2013) and range from 420 to 540 ft (130 to 160 m) bgs. The regional groundwater flow direction is generally toward the northwest (ADWR 2010).

MARRCO Corridor

Depths to groundwater in the vicinity of the MARRCO Corridor were obtained from the GWSI database for listed well sites (ADWR 2013). For much of this corridor, the groundwater is present in a shallow aquifer within the alluvium along Queen Creek; groundwater levels along the corridor 3 to 4 mi (4.8 to

6.4 km) west of Superior range from 12 to 60 ft (4 to 20 m) bgs. The groundwater flow direction in this part of the corridor generally follows the Queen Creek drainage to the west.

In the portion of the corridor between Florence Junction and Magma, the groundwater is present in deep alluvial units. The depth to groundwater is much greater in this area, ranging from 290 to 560 ft (90 to 170 m) bgs. The regional groundwater flow direction in this area is generally toward the northwest (ADWR 2010).

Tailings Storage Facility and Tailings Corridor

Hydrogeologic studies of the TSF site have included a preliminary hydrogeologic assessment, which involved compiling, reviewing, and summarizing published hydrogeologic data, and assessing hydrogeologic conditions and water uses in the vicinity of the Near West site (Montgomery & Associates 2012); and Phase I field investigations which involved field mapping, surveying of springs, and pilot infiltration testing (Montgomery & Associates 2013b). In addition, a groundwater level monitoring round in the Superior basin was conducted by Resolution Copper (2012) as part of the Queen Creek Corridor Survey, which provided additional useful information for the TSF site. Results of these studies indicated the following hydrogeologic features:

- The site is underlain by unconsolidated to weakly consolidated Quaternary alluvium on the floors of and immediately adjacent to canyons and washes, widespread weakly to well lithified Tertiary conglomerate and sandstone, weakly to well lithified extrusive Tertiary volcanic rocks, well lithified Paleozoic sedimentary rocks, well lithified younger Precambrian sedimentary and igneous rocks, and well lithified older Precambrian schist. The Quaternary alluvial deposits are relatively thin and confined to the drainages. The Tertiary sedimentary and volcanic rocks crop out across most of the site, while Paleozoic and Precambrian rock units crop out along the northern, western, and southern margins of the site.
- With the exception of Quaternary alluvium, permeability for all geologic units at the site would be very small except where fractured. Fracturing of rock units is most evident along and adjacent to mapped faults in the northern part of the proposed west option tailings facility (***Figure 2.2-3***). However, some evidence of fracturing is also observed in rock units in the western and southwestern parts of the site. Results of pilot infiltration testing conducted on exposed bedrock surface confirmed that hydraulic conductivity for the bedrock units tested is very small.
- Three springs occur in the vicinity of the Near West site, including Happy Camp, Benson, and Bear Tank Canyon Springs. Discharge was observed at Happy Camp and Bear Tank Canyon Springs, but not at Benson Spring. Happy Camp and Bear Tank Canyon Springs occur within the Tertiary conglomerate. Benson Spring occurs near the contact between the Tertiary conglomerate and the Pinal Schist.

- Of the numerous wells monitored for the Queen Creek Corridor Survey, four occur in the immediate vicinity of the TSF site. Depth to groundwater level at the Rice Water Well, located within the TSF footprint, was 54.7 ft (16.7 m) bgs in September 2012. Depth to groundwater level measured in the other three wells, which are outside the tailings footprints, ranged from 10.5 to 55.5 ft (33.2 to 16.9 m) bgs in September 2012 (Montgomery and Associates 2013a). The direction of the regional groundwater movement in this area is generally from northeast to southwest (***Figure 2.3-5***).

Results of resistivity surveys, combined with results from previous investigations, indicate the following:

- Results of resistivity surveys do not indicate the occurrence of a phreatic surface or water table within the upper 150 to 300 ft (50 to 100 m) of the subsurface, which is consistent with the general observation that permeability for all geologic units at the site (with the exception of Quaternary alluvium along ephemeral stream channels) would be very small except where fractured.
- Fracturing of rock units is most evident along and adjacent to mapped faults in the northern part of the area, with some evidence of fracturing in rock units in the western and southwestern parts of the TSF area. In these areas, shallow groundwater conditions could occur.
- Where fractured, the rock units provide for local collection and storage of groundwater, and movement of groundwater from recharge areas to discharge areas. However, the extent of these fracture networks may be limited, such that groundwater systems are relatively localized and not integrated into a regional groundwater flow system.
- Discharge at springs indicate the following with respect to the groundwater flow system:
    - Happy Camp Spring occurs in the Gila Conglomerate along the alignment of Roblas Canyon fault. It is possible that Roblas Canyon fault extends through the vicinity of Happy Camp Spring, resulting in fracturing of older rocks such as the volcanic tuff and underlying diabase, and possibly the Gila Conglomerate. Local discontinuities in the Gila Conglomerate may provide a pathway for upward movement of groundwater to land surface; however, results of resistivity surveys do not confirm this.
    - Bear Tank Canyon Spring occurs in the Gila Conglomerate. Although fracturing of the Gila Conglomerate is not apparent in the vicinity of the spring, a lineament extending west-northwest from the spring was identified from Google Earth images and aerial photography. It is possible that this feature represents a discontinuity in the Gila Conglomerate and a pathway for upward movement of groundwater to land surface; however, results of resistivity surveys do not confirm this.
    - Benson Spring occurs in the Gila Conglomerate near the contact with Pinal Schist. Little fracturing was observed in the Pinal Schist compared to other rock units in the study area, and the Pinal Schist may act as a barrier to groundwater movement. Although Benson Spring

was not flowing at the time of surveys, it is assumed to flow seasonally, and may reflect groundwater moving through fracture zones in younger rocks that may be forced upward to land surface at or near the contact with the Pinal Schist.

- Results of these studies, indicate the following with respect to implications for tailings storage at the site:
  - Most areas of the TSF site are underlain by rocks of very small permeability, which would limit tailings water seepage and potential for migration of tailings water.
  - Localized fracture networks of larger permeability occur in some areas, and would act to collect, store, and transmit groundwater. In areas where these fracture networks intersect land surface, potential for tailings water seepage and migration in the subsurface could be larger.
  - Tailings water seepage into these fracture networks would act to increase hydraulic head, which could cause increased discharge from existing seeps or springs outside of the tailings facility and/or potentially cause development of new springs or seeps.
  - Where fractured rock units are in contact with the Pinal Schist south of the proposed west option tailings facility, the Pinal Schist likely acts as a barrier to groundwater movement, and groundwater may be forced upward to land surface at or near the contact with the Pinal Schist.

West Plant Site and East Plant Site

Extensive characterization of the geology and hydrogeology in these portions of the GPA (Montgomery & Associates 2010) indicates that the Concentrator fault, located to the north and east of WPS, acts as a barrier to groundwater movement between the shallow and intermediate-depth groundwater systems underlying WPS and EPS. Less information is available on the deep groundwater systems underlying both areas, but based on a lack of water level response to mine dewatering activities and large differences in hydraulic head across the fault, the hydraulic connection of the deep groundwater systems across the Concentrator fault is limited to where legacy mine workings locally cross the fault.

West Plant Site

Groundwater levels are monitored at 12 APP point of compliance wells on WPS, several of which provide information regarding water levels at multiple elevations at a given location. To the north, within WPS, groundwater occurs under unconfined conditions in the Gila Conglomerate. In this part of the Gila Conglomerate, groundwater levels are on the order of 100 to 175 ft (30 to 50 m) bgs (Golder 2013). In the southern part of WPS, groundwater occurs in an upper, unconfined unit of the Gila Conglomerate and a lower, confined unit of this conglomerate; the upper and lower units are separated by a lenticular mudstone unit. Depth to groundwater in the upper unit is approximately 20 ft (6 m) bgs; in the lower, confined unit, it is on the order of 70 to 85 ft (20 to 25 m) bgs. In addition, groundwater occurs in recent alluvium to the south of WPS and in fractured bedrock (Apache Leap Tuff) on the eastern boundary of the site. Depth to groundwater in the alluvium is on the order of 10 ft (3 m) bgs (Golder 2013); in the fractured bedrock, it is approximately 130 ft (40 m) bgs.

At WPS, the direction of the groundwater flow at the water table (i.e., in the shallow system) is generally toward the southwest. In the confined Gila Conglomerate, below the mudstone, the groundwater flow direction is more directly south (Golder 2013). The hydraulic conductivities of all the units present at WPS are very small, with the exception of some minor Quaternary alluvium present along washes and the southern perimeter of WPS. Groundwater flow rates in the Gila Conglomerate are therefore estimated to be small. Hydraulic conductivity estimated from hydraulic testing is on the order of 3×10^{-9} to 3×10^{-8} ft/s (10^{-7} to 10^{-6} cm/s) in the Gila Conglomerate, 3×10^{-11} ft/s (10^{-9} cm/s) in the mudstone unit, 3×10^{-7} ft/s (10^{-5} cm/s) in the Quaternary alluvium, and 3×10^{-9} ft/s (10^{-7} cm/s) in the fractured bedrock unit (Golder 2013). In the unconfined Gila Conglomerate, above the mudstone unit, the results of groundwater flow modeling suggest that groundwater flow velocities are likely on the order of 6.6 ft per 100 years (2 m per 100 years) (Golder 2013). Groundwater in the shallow, unconfined Gila Conglomerate discharges locally, where the mudstone is at or near the surface, as evidenced by the presence of seeps and evaporite deposits; the groundwater present below the mudstone unit is expected to flow to the south or southwest toward regional discharge areas (Golder 2013).

The deep groundwater west of the Concentrator fault is hosted in low permeability Quaternary and Tertiary basin-fill deposits (QTg), fractured Tertiary volcanic rocks (Tvy), and underlying Apache Leap Tuff (Tal). Note that the abbreviation Tvs is sometimes used in project documents to denote Tertiary volcanic rocks; Tvy and Tvs are equivalent, and the nomenclature Tvy is used in this GPO. Three monitor wells (DHRES-03, DHRES-04, and DHRES-05B) have been completed in the deep groundwater system at WPS at depths of 1,962 ft (598 m), 2,340 ft (713 m), and 4,018 ft (1,225 m) bgs, respectively (***Figure 2.3-4***). The groundwater levels at these wells are on the order of 300 to 500 ft (90 to 150 m) bgs in the deep basin-fill deposits (QTg) and associated volcanic rocks (Tvs). In the deep Apache Leap Tuff (Tal), the groundwater level is approximately 150 ft (46 m) bgs. Based on observations and testing at these wells, the deep basin-fill deposits (QTg), associated volcanic rocks, and underlying Apache Leap Tuff (Tal) are low hydraulic conductivity units, and groundwater flow rates are likely to be low (Montgomery & Associates 2011).

East Plant Site and Surrounding Apache Leap Tuff Outcrop

Groundwater occurrence in the Mine Area and EPS can be broken down into three principal systems (***Figures 2.3-6 and 2.3-7***):

1. **Shallow groundwater system** – The shallow groundwater system consists of several shallow, perched aquifers of limited areal extent hosted in alluvial deposits and the uppermost weathered part of the Apache Leap Tuff. The primary shallow aquifers in this area are located near Top of the World and JI Ranch, and to a lesser degree along some of the major drainages such as Hackberry Canyon (***Figure 2.3-4***). ***Appendix J*** provides a list of the monitoring wells by

landowner and authorizing agency as well as the identifiers used in the previous Resolution Plan of Operations (Plan of Operations Numbers 01-12-02-002 and 03-12-02-006 [RCM 2010]). Groundwater levels are monitored at three locations in the shallow groundwater system. Depth to groundwater is variable due to the influence of precipitation patterns, but is generally on the order of 3 to 20 ft (1 to 6 m) bgs (Montgomery & Associates 2010).

2. **Apache Leap Tuff Aquifer** – The Apache Leap Tuff aquifer is a fractured-rock aquifer hosted in dacite tuff that extends throughout much of the Upper Queen Creek and Devils Canyon watersheds, and the western part of the Upper Mineral Creek watershed (***Figure 2.3-4***). The Apache Leap Tuff aquifer is separated from the deep groundwater system by a thick sequence of poorly permeable Tertiary basin-fill sediments. This aquifer is present throughout EPS and extends over roughly the same area as the Apache Leap Tuff outcrop belt. Groundwater levels in the Apache Leap Tuff aquifer are monitored at 21 locations; depth to groundwater in the Apache Leap Tuff aquifer ranges from about 200 ft (60 m) bgs in the southwestern part of the Devils Canyon watershed to more than 1,200 ft (360 m) near Shaft 9. Depth to groundwater in the EPS area is generally on the order of 300 to 400 ft (90 to 120 m) bgs (Montgomery & Associates 2010). A groundwater level contour map for the Apache Leap Tuff aquifer is shown in ***Figure 2.3-6***. In general, the direction of groundwater movement follows surface drainage patterns, with groundwater moving from areas of recharge near the watershed margins and along the principal drainageways to areas of discharge at Shaft 9, along Devils Canyon, and along Mineral Creek (***Figure 2.3-6***). Hydraulic conductivity in the Apache Leap Tuff aquifer is largely controlled by the extent and hydraulic connectivity of the fractures and is therefore highly variable. Hydraulic conductivity for the Apache Leap Tuff aquifer, estimated from 22 hydraulic tests conducted in the tuff, ranges from 7×10^{-9} to 2×10^{-3} ft/s (2×10^{-7} to 6×10^{-3} cm/s) (Montgomery & Associates 2014).

3. **Deep groundwater system** – The deep bedrock groundwater system is highly compartmentalized and can be divided into two subunits:

   a. *Deep groundwater system east of the Concentrator fault and within the Resolution Graben* – This component of the deep groundwater system lies within the Resolution Graben, which is bounded by a series of regional faults. The deep groundwater system in the Resolution Graben is hydraulically connected to existing mine workings, and a clear response to ongoing dewatering of the mine workings is observed. Groundwater levels are currently monitored at two locations in the deep groundwater system within the Resolution Graben (Wells DHRES-01 and DHRES-02). Prior to the commencement of current dewatering operations at Shaft 9 in March 2009, groundwater levels had recovered to approximately 2,100 ft (640 m) bgs (groundwater levels were still recovering from earlier dewatering that ceased in 1998 when pumping recommenced in 2009) (Montgomery & Associates 2010). Currently, depth to deep groundwater within the Resolution Graben ranges from approximately 3,100 to 3,500 ft (960 to 1,050 m) bgs, with the deepest water level observed at DHRES-02, which is closest to the mine workings.

b. *Deep groundwater system east of the Concentrator fault but outside the Resolution Graben* – Graben-bounding faults appear to limit hydraulic communication between the deep groundwater system outside the graben and the deep groundwater system inside the graben. Outside the graben there have been no observed changes in the groundwater level in response to ongoing mine dewatering activities. Groundwater levels are monitored at six locations in the deep groundwater system outside the Resolution Graben (but east of the Concentrator fault). Depth to deep groundwater in these locations ranges between approximately 160 and 1,150 ft (50 and 350 m) bgs. Hydraulic conductivity for the rock units of the deep groundwater system outside the Resolution Graben, estimated from seven hydraulic tests, ranges from 3×10^{-9} to 2×10^{-6} ft/s (1×10^{-7} to 7×10^{-5} cm/s) (Montgomery & Associates 2014).

2.3.2.3. *Groundwater Quality*

2.3.2.3.1. Regulatory Framework

Groundwater quality standards have been developed by both the EPA and the State of Arizona. The primary EPA standards are defined as Maximum Contaminant Levels (MCLs). In addition, non-enforceable EPA guidelines regulate constituents that may cause cosmetic or aesthetic effects when present in drinking water at elevated concentrations (secondary MCLs). The Arizona Aquifer Water Quality Standards (AWQS) are regulated by ADEQ under AAC Title 18, Chapter 11 (R18-11). In the following discussion, exceedances of MCLs, secondary MCLs, and/or AWQS are provided as a measure of the relative groundwater quality and the degree to which the groundwater has been impacted by natural and/or anthropogenic factors.

2.3.2.3.2. Local Groundwater Quality

Filter Plant and Loadout Facility

No site-specific groundwater quality data are available for the Filter Plant and Loadout Facility. However, the following data from wells in the general area are available:

- Groundwater samples collected by Resolution Copper during the characterization of the western extent of the GPA indicate that although groundwater quality is generally good, several samples exceed secondary MCLs for aluminum, iron, and manganese (Montgomery & Associates 2012c).
- Management plans prepared by ADWR (1999) include some groundwater quality data for the area. The data suggest low-quality groundwater for some parameters, including nitrate, sulfate, and total dissolved solids.

- The ADWR Water Atlas (Volume 8) lists wells in the vicinity exceeding Arizona Drinking Water Standards (DWS) for arsenic, beryllium, cadmium, and lead (ADWR 2010).

MARRCO Corridor

No site-specific groundwater quality data are available for the MARRCO Corridor; however, the data provided in the section above for the Filter Plant and Loadout Facility are applicable to the western portion of the MARRCO Corridor. The data provided for WPS are applicable to the eastern portion of the MARRCO Corridor.

Tailings Storage Facility and Tailings Corridor

Currently, no groundwater quality data are available for the TSF area. However, the characterization efforts proposed to begin in 2014 will yield data for further analysis. Water quality has been monitored at three springs and a quarry located in the Upper Queen Creek watershed near the TSF and Tailings Corridor. Bear Tank Spring, Benson Spring, Happy Camp Spring, and Perlite Quarry have been monitored quarterly since February 2013. The locations of these features are presented in ***Figure 2.3-2***. In general, the water quality of these surface water features is in compliance with applicable surface water standards; however, background concentrations of the following constituents have been observed at levels above the designated standard: arsenic, copper, lead, and total suspended solids.

West Plant Site and East Plant Site

West Plant Site

Resolution Copper currently monitors groundwater quality on a quarterly basis at 11 wells on WPS. Samples are analyzed for trace metals, major ions, and radionuclides. In addition, samples are collected for volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) at one well (SP1&2-Alert-B) (Golder 2013). Currently, groundwater quality monitoring is conducted in accordance with the requirements of the ADEQ APP Program.

Groundwater compositions observed at WPS indicate that the groundwater is impacted locally by sulfide oxidation and/or sulfate dissolution (Golder 2013). However, the majority of the wells and constituents meet Arizona AWQS, with the following exceptions: fluoride in the alluvial unit; nitrite plus nitrate in the fractured bedrock unit; and arsenic and fluoride in the confined Gila Conglomerate unit. In addition, occasional exceedances of the AWQS have been reported for the following constituents: antimony, cadmium, chromium, unadjusted gross alpha, lead, nickel, selenium, and thallium (Golder 2013). Based on statistical analysis of the groundwater chemistry data, pH values for groundwater at WPS are generally neutral to slightly alkaline (Golder 2013).

Based on a single groundwater quality sample collected at Well DHRES-04, water quality in the Tertiary volcanic rocks meets primary EPA and State of Arizona groundwater quality standards (Montgomery & Associates 2010).

East Plant Site

Resolution Copper started hydrochemical sampling of the groundwater in the EPS area in 2004 when characterization samples were collected from the first HRES-series monitor wells. All monitor wells drilled by Resolution Copper, as well as some pre-existing wells in the EPS area, have been sampled for a minimum of four consecutive quarters. Samples are collected for a full suite of common and trace constituents as well as water quality parameters that include pH, electrical conductivity, and temperature.

Groundwater quality in the shallow groundwater system generally meets EPA and State of Arizona groundwater quality standards, with the following exceptions. Several of the samples at the JI Ranch Corral and Middle Wells and the Hackberry Windmill Well (***Figure 2.3-4***) fall below the federal secondary standard for pH and slightly above the federal secondary standards for iron and manganese. In addition, several samples from the Corral Well do not meet federal secondary standards for total dissolved solids and sulfate, and one sample also exceeded federal and state primary standards for nitrate (Montgomery & Associates 2012a).

Groundwater quality in the Apache Leap Tuff aquifer generally meets EPA and State of Arizona groundwater quality standards, with the following exception: a single reported exceedance of the MCL for arsenic. In addition, manganese and iron often exceed the secondary MCL, and there are occasional exceedances of the secondary MCLs for pH and aluminum (Montgomery & Associates 2012a).

Groundwater quality in the deep groundwater system in the EPS area generally meets EPA and State of Arizona groundwater quality standards, with the following exceptions. Within the Resolution Graben, several exceedances of the MCL for fluoride and one exceedance of the MCL for arsenic have been observed. Outside the Resolution Graben, one exceedance of the MCL for arsenic has been observed. All sample locations, inside and outside the graben, exceed secondary federal standards due to slightly elevated levels of iron and manganese. In addition, aluminum, fluoride, pH, and total dissolved solids occasionally exceed secondary MCLs at some locations (Montgomery & Associates 2012a).

2.4. SOILS

General soil survey data for the GPA were collected from the Arizona General Soil Map (Arizona Land Resource Information System 1975) (***Figure 2.4-1***). Six soil associations, two soil thermal regimes, and two soil moisture regimes are represented within the GPA. The general trend is that the soil environment becomes cooler and moister with increasing elevation. Following the topographic and physiographic trends described in ***Section 2.2.2***, the soil regime is hyperthermic arid in the southwestern part of the GPA and transitions to thermic semiarid east of Queen Station.

Site-specific soil data were collected and soil maps were generated from US Department of Agriculture Natural Resources Conservation Service (NRCS) soil surveys for eastern Pinal and southern Gila counties in 2008 and 2009; eastern Maricopa and northern Pinal counties in 2008; and the Tonto National Forest (TNF) and parts of Gila, Maricopa, Pinal, and Yavapai counties in 2010 (NRCS 2013). Soil survey data were not available for the entire GPA. Soil data are not available from the NRCS or the TNF for part of the MARRCO Corridor, the TSF, and the majority of EPS; however, preliminary surface mapping of the TSF area was conducted as part of the TSF design study (KCB 2014).

2.4.1. REGULATORY FRAMEWORK

FS soil resources are defined, protected, and maintained under the Organic Administration Act of 1897, Bankhead-Jones Farm Tenant Act of 1937, Multiple-Use Sustained-Yield Act of 1960, Forest and Rangeland Renewable Resources Planning Act of 1974, and National Forest Management Policy Act of 1976.

Soil resources and reclamation on private lands are managed in accordance with the following:

- Title 27 ARS Chapter 1, Article 4;
- AAC R18-7-201, “Arizona Soil Remediation Levels”: Soil remediation levels would be applied to determine the extent to which reclamation must mitigate any known soil contamination during mine closure; soil remediation levels are also applicable in the event of contamination or spills that occur during active mine life; and
- AAC R18-9-A209, “Aquifer Protection Permit Closure Requirements”: Investigation and characterization of potential soil contamination is a component of closure and contingency plans required under the APP process.

2.4.2. LOCAL SOILS

2.4.2.1. *Filter Plant and Loadout Facility*

The Filter Plant and Loadout Facility site is within the hyperthermic arid soil regime. The majority of the site is mapped as Denure-Mohall Complex (***Figure 2.4-2***). A small area of Mohall sandy loam is mapped in the southeastern corner of the facility near the MARRCO Corridor and a narrow band of Mohall clay loam associated with a small ephemeral channel crosses the northern half of the facility. These three soils are included in the Torrifluvents association (HA-1) (***Figure 2.4-1***).

The Denure-Mohall Complex map unit is made up of 50 percent Denure and similar soils and 40 percent Mohall and similar soils (NRCS 2013). These soils are described as forming on alluvial fan terraces composed of mixed alluvium parent material, deep (< 80 in [< 200 cm]), and well drained. Both the Mohall sandy loam and Mohall clay loam soils are described as having formed on alluvial fan terraces and on basin floors of mixed fan alluvium, deep (> 80 in [> 200 cm]), and well drained.

2.4.2.2. *MARRCO Corridor*

The majority of the MARRCO Corridor is within the hyperthermic arid soil regime; however, just west of Superior, a 1,200-ft (370-m) portion of the corridor lies within the thermic semiarid soil regime. From Magma to Florence Junction, the dominant soil map units are Denure-Mohall Complex and Mohall sandy loam (***Figure 2.4-2***), both of which are described in the Filter Plant and Loadout Facility section above. Additionally, a large unit of Contine loam is located between the Filter Plant site and Magma. The Contine loam map unit is made up of 90 percent Contine and similar soils. These soils are described as forming on fan terraces and basin floors of mixed fan alluvium, deep (> 80 in [> 200 cm]), and well drained.

East of Florence Junction, the largest map units adjacent to the MARRCO Corridor are the Beardsly-Suncity Complex, Rock outcrop-Lajitas complex, and Delnorte-Nahda complex. A large unit of Beardsly-Suncity Complex lies just east of Florence Junction and on both sides of the corridor. The Bearsdly-Suncity Complex is composed of 60 percent Beardsly and similar soils and 40 percent Suncity and similar soils. These soils are described as forming on fan terraces of mixed fan alluvium, having a restrictive layer (duripan) at 8 to 40 in (20 to 100 cm), and well drained.

South of the Whitlow Ranch Flood Control Basin, the MARRCO Corridor passes over large areas mapped as Rock outcrop-Lajitas complex and Delnorte-Nahda complex to the north and south, respectively. The Rock outcrop-Lajitas complex is made up of 45 percent welded tuff rock outcrop and 35 percent Lajitas and similar soils. The Lajitas soil is described as forming in mountains of slope alluvium and/or residuum from volcanic rock, having bedrock at 5 to 20 in (13 to 51 cm), and well drained. The Delnorte-Nahda complex is made up of 50 percent Delnorte and similar soils and 40 percent Nahda and similar soils. These soils form on fan terraces of mixed fan alluvium, have a petrocalcic restrictive layer at 7 to 40 in (18 to 102 cm), and are well to excessively drained.

No soil data are available for the portion of the MARRCO Corridor starting south of the Whitlow Ranch Flood Control Basin and spanning to points north of Picketpost Mountain. West of Superior and south of the MARRCO Corridor between US 60 and Arnett Creek is an area that is dominated by Deloro-Andrada-Sasabe, deep complex and Rock outcrop-Lampshire complex. The Deloro-Andrada-Sasabe, deep complex is made up of 40 percent Deloro and similar soils, 25 percent Andrada and similar soils, and 20 percent Sasabe, deep, and similar soils. These soils form on pediments of mixed alluvium and/or residuum weathered from fanglomerate.

2.4.2.3. *Tailings Storage Facility and Tailings Corridor*

According to the Arizona General Soil Map (ALRIS 1975), most of the TSF is mapped as Lithic Camborthids-Rock outcrop-Lithic Haplargids Association, HA6 (***Figure 2.4-1***). A small portion of the site to the east is mapped as Caralampi-White House Association, TS8.

Preliminary surface mapping of the TSF area was conducted in 2013 as part of the TSF design study (KCB 2014, Appendix I). Alluvium was sampled along Roblas Canyon, Bear Tank Canyon, and Happy Camp Canyon and from Old Alluvium deposits near the southern end of Pott's Canyon. The samples were sent for geotechnical testing to assess the suitability of the materials for dam fill and subdrain construction.

Detailed results, including material type, acid reaction, water content, atterberg limits, soluble salts, specific gravity, and particle-size distribution are presented in KCB 2014, Appendices I and IV. In general, bedrock is exposed over most of the site. Unconsolidated alluvial sediments are generally confined to ephemeral creek channels and valley bottoms, with the exception of "old alluvium" deposits at lower elevations at the southern end of the site (KCB 2014). Additional information on soils and growth media monitoring and analyses may be found in ***Section 4.6.8***. Additional soil data are anticipated to be generated from test trenches constructed during the geotechnical investigation of this area planned for 2015. These data will further inform salvage material quantity estimates, including soil salvage volume by year and stockpile design and placement.

2.4.2.4. *West Plant Site*

The majority of WPS is mapped as Mined Land (***Figure 2.4-2***). Along the northwestern boundary of the site is an area mapped as Caralampi extremely gravelly sandy loam. The northern tip of the site is mapped as Pantak-Cammerman-Rock outcrop complex. An area of Andrada extremely gravelly sandy loam occupies a relatively undisturbed portion of the western side and extends into the center of the site.

Mined Land is described as composed of mine spoil or earthy fill and/or igneous, metamorphic, and sedimentary rock. The Caralampi extremely gravelly sandy loam map unit is made up of 85 percent Caralampi and similar soils formed on fan terraces of mixed loamy and gravelly alluvium over residuum weathered from fanglomerate, well drained, with 20 to 30 in (51 to 76 cm) of soil depth over paralithic bedrock. The Pantak-Cammerman-Rock outcrop complex is made up of 35 percent Pantak and similar soils, 30 percent Cammerman and similar soils, and 25 percent quartzite rock outcrop. Pantak and Cammerman soils form on hills and mountains of loamy and gravelly slope alluvium and/or residuum weathered from quartzite, are well drained, with 6 to 40 in (15 to 102 cm) of soil depth over lithic bedrock. Andrada, extremely gravelly sandy loam, is made up of 85 percent Andrada and similar soils. These soils form on fan terraces of mixed loamy and gravelly calcareous alluvium and/or residuum weathered from fanglomerate, are well drained, with 10 to 22 in (25 to 56 cm) of soil depth over paralithic bedrock.

Portions of WPS include smelter-affected soil surrounding a historical smelter stack that operated from 1924 to 1972. In 2011, a Site Characterization Report for the WPS (Golder 2011b) provided a summary of the existing relevant environmental data to characterize the smelter-affected soil at WPS and a proposed approach for a human health risk evaluation. Resolution Copper is in the process of remediating the smelter-affected soil to human health risk-based site-specific soil remediation level standards in accordance with AAC R18-7-206 under the regulatory authority of the ADEQ Voluntary Remediation Program.

In addition, a number of additional remediation efforts have been completed and/or are ongoing at WPS. Both the Depot Pond and the Mill Sands Pond received clean closure certification under the APP, and a number of other pond features have either been closed, are undergoing monitoring, or are scheduled for closure.

2.4.2.5. *East Plant Site*

Very few soils data are available for EPS. More than half the mapped area in the northern portion of EPS is mapped as Mined Land (see WPS description above). South and east of the Mined Land section of EPS is an area mapped as Rock outcrop-Woodcutter complex, tuff (***Figure 2.4-2***). The remainder of the southeastern portion of EPS is unmapped, but is presumed to be similar to the identified map units. A small area in the southeastern portion of EPS near Rancho Rio Creek is mapped as Rock outcrop-Lampshire complex, chaparral.

Rock outcrop-Woodcutter complex, tuff is composed of 50 percent Rock outcrop, tuff and 40 percent Woodcutter and similar soils. These soils form on mountains of loamy and gravelly slope alluvium and/or residuum weathered from tuff; they tend to be shallow with 6 to 18 in (15 to 46 cm) of soil over lithic bedrock; and well drained. Rock outcrop-Lampshire complex, chaparral is composed of 65 percent Rock outcrop, welded tuff and 30 percent Lampshire and similar soils. These soils form on mountains and hills from slope alluvium and/or residuum weathered from welded tuff; they tend to be shallow, with 6 to 20 in (15 to 51 cm) over bedrock; and well drained.

2.5. LAND USE

The predominance of federal, state, and other public lands in central Arizona constrains available land uses within the Project region. Federal and state lands historically have been associated with mineral exploration and mining. Mining activities have been fundamental to the economy of the area for many years, beginning with the establishment of the Silver King Mine in 1875 and the Magma Mine in the early 1900s. Low-density cattle grazing and public recreation are other land uses in the Project region.

2.5.1. ONGOING MINING ACTIVITY

Mining operations continue to play a major role in driving the region's economy. In addition to the Magma Mine, the following major mines (both active and inactive) are located within a 30-mi (48-km) radius of the GPA in an area known as the Copper Triangle (***Figure 2.5-1***):

- Pinto Valley Mine and Concentrator

- Carlota Mine
- Miami Mine and Smelter Complex
- Ray Mine and Concentrator and Hayden Concentrator and Smelter Complex

At least 31 mines are located in the vicinity of the Copper Triangle, representing a range of mining operations that include copper, gypsum, and marble mining.

2.5.2. RECREATION

Designated and dispersed recreation opportunities are available throughout the region on state trust, TNF, and BLM lands. ***Figure 2.5-2*** illustrates designated recreation sites in the vicinity of the GPA. These include campgrounds, hiking trails, hunting areas, off-road vehicle areas, and other points of interest.

The TNF manages the Oak Flat Campground, which is located approximately 4 mi (6.4 km) east of Superior near Devils Canyon. The campground includes 16 campsites with tables and fire pit grills as well as restroom facilities (TNF 2014). The area surrounding the campground is known for its bouldering opportunities.

The Arizona Trail is a non-motorized 800-mi (1,287-km) north-south trail that is continuous from Mexico, across Arizona, and to Utah. It connects mountain ranges, canyons, deserts, forests, wilderness areas, historic sites, trail systems, and points of interest and serves day hikers, backpackers, equestrians, mountain bicyclists, trail runners, nature enthusiasts, cross-country skiers, snowshoers, and mule and llama packers (Arizona Trail Association 2014). The trail is located approximately 6 mi (10 km) west of Superior. The Picketpost Trailhead is located along the Arizona Trail and US 60 and provides hiking and mountain biking access.

The Legends of Superior Trails—also known as LOST—is an interpretive trail from Superior to Pinal that opened on February 19, 2011. The trail begins just outside of Superior, meanders through FS and Resolution Copper private lands, and finishes by intersecting with the Arizona Trail (TNF 2013). The Pinal Trail begins just north of US 60 and extends northward into the TNF.

The Boyce Thompson Arboretum is a 323-acre Arizona State Park located approximately 4 mi (6.4 km) west of Superior along the southern side of US 60. The arboretum was founded in 1920 and is known as Arizona's oldest and largest botanical garden. The park features a short hiking loop, and guided nature walks are often provided (Arizona State Parks 2014).

Hunting and fishing in Arizona are regulated by the Arizona Game and Fish Department (AGFD). Small game and predator species are likely to be present on all Project sites. The Project sites are located within multiple hunting units (***Figure 2.5-2***), all of which fall within AGFD's Region VI – Mesa: 24B (TSF, WPS, and MARRCO Corridor), 24A (EPS), 37B (MARRCO Corridor), and 25M (Filter Plant and Loadout Facility and MARRCO Corridor) (AGFD 2011). Details regarding the characteristics (common species, occurrence, etc.) of each hunting unit are available electronically from AGFD (AGFD 2011). Fishing is not a significant activity in the GPA because of the limited extent of perennial water. AGFD does not list any of the streams in this vicinity as potential fishing areas and it does not stock any of these streams (AGFD 2011).

TNF, BLM, and ASLD lands in the GPA and vicinity provide the public with dispersed recreation opportunities such as hiking, bicycling, off-road vehicle use, horseback riding, wildlife viewing, camping, and rock hounding. The TSF portion of the GPA provides opportunities for these types of activities due to the presence of rugged terrain and unimproved access roads. In addition, the area surrounding the Oak Flat Campground provides opportunities for dispersed recreation and rock climbing and bouldering activities on Resolution Copper private lands and TNF lands. A multitude of climbing opportunities exist on Resolution Copper private lands and are currently available to the public through a licensing agreement with a local climbing group called the Queen Creek Coalition.

2.5.3. GRAZING

The GPA is located within three TNF grazing allotments: Millsite, Superior, and Devils Canyon (***Figure 2.5-3***). The grazing allotments are further subdivided into pastures. These are summarized for each Project area in ***Table 2.5-1***.

Table 2.5-1 Tonto National Forest Grazing Allotments and Pastures within the General Project Area

Project Area	Grazing Allotment(s)	Pasture Name(s)
Filter Plant and Loadout Facility	None	None
MAARCO Corridor	Millsite	Hewitt
	Superior	Silver Canyon
Tailings Storage Facility	Millsite	Bear Tank, Hewitt
	Superior	Montana Mountain, Silver Canyon, Pilot Plot
Tailings Corridor	Superior	Montana Mountain, Silver Canyon
West Plant Site[1]	Superior	Silver Canyon
East Plant Site	Devils Canyon	Recreation, Southwest, Oak Flat Trap, Rancho Rio

[1] The majority of the West Plant Site is excluded from grazing as shown in ***Figure 2.5-3***

Resolution Copper is the principal company of Integrity Land and Cattle, LLC, a grazing permittee in the Devils Canyon allotment. Integrity Land and Cattle, LLC, currently has 200 head of cattle on the JI Ranch, which is owned by Resolution Copper. JI Ranch is located approximately 5 mi (8.04 km) east of Superior and is outside the GPA.

3. PROJECT DESCRIPTION

The major facilities for the Resolution Project are located at several distinct sites in Pinal County in central Arizona (***Figure 1.2-2, Figure 3.0-1, and Figures 3.0-1a through 3.0-1j***). The main sites and associated primary Project elements include:

- East Plant Site (EPS) – Underground mine, attendant shafts, area impacted by block caving, and surface support facilities;
- West Plant Site (WPS) – New ore processing facilities (Concentrator Complex), rail facilities, ore and development rock stockpiles, ore conveyors from EPS, and administrative facilities;
- Tailings Storage Facility (TSF) and Tailings Corridor;
- Magma Arizona Railroad Company (MARRCO) Corridor – Connecting infrastructure for water pipelines, concentrate pipelines, power, pump stations, and well field;
- Filter Plant and Loadout Facility; and
- Other connecting infrastructure.

3.1. EXISTING ACTIVITIES AND INFRASTRUCTURE

Existing activities and infrastructure are in place at several of the sites associated with the Resolution Project, including facilities that are no longer being used (legacy facilities), facilities currently in use for other purposes, and facilities currently in use or under development for the Resolution Project. Resolution Copper has installed or is in the process of sinking exploratory shafts and installing surface infrastructure on private lands for data gathering to support the design of future mining and ore processing activities. To the extent practical, Resolution Copper will use areas that have been previously disturbed for future facilities. A summary of the currently disturbed areas to be reutilized is provided in ***Section 1.5*** and shown in ***Figures 1.5-2a through 1.5-5b***.

3.1.1. EXISTING ACTIVITIES AND INFRASTRUCTURE AT EAST PLANT SITE

The EPS area includes shafts and support facilities of the previous Magma Mine, an underground copper mining facility that ceased operations in the mid-1990s. Certain facilities at EPS are currently in service in support of the Resolution Project (***Figure 1.5-3b***). Shaft 9 is an existing mine shaft from the previous mining operation that is currently used to support the ongoing installation of new Shaft 10. Shaft 9 will also be deepened to support the development of the Resolution Project. Development rock material excavated from Shaft 10 was loaded from shaft-sinking buckets onto railcars at an underground loading station and transported to WPS via an existing underground tunnel that connects EPS and WPS (the Never Sweat Tunnel). The development rock from Shaft 10 was segregated into not-potentially-acid-generating (NPAG) and potentially-acid-generating (PAG) material based on the initial Shaft 10 pilot hole geochemical characterization study (Logsdon 2007). The NPAG shaft rock was beneficially used as store-and-release cover material to reclaim legacy tailings sites at WPS. Potentially-acid-generating (PAG) shaft rock is stored in a permitted facility under Arizona Department of Environmental Quality's (ADEQ) Aquifer Protection Permit (APP) Program.

An existing dewatering system is present in Shaft 9. Water from Shaft 9 is pumped to WPS for treatment prior to delivery to New Magma Irrigation and Drainage District (NMIDD) for beneficial use (CH2M Hill 2012). An existing potable water system is also located within a tail drift connected to Shaft 9.

Two water sources are available for the EPS potable water system: 1) water from WPS via the Never Sweat Tunnel water line supplied by the Arizona Water Company and 2) groundwater seepage into Shaft 9. The potable water system consists of two existing walled-in dam sumps with two 250-gallons per minute (gpm) pumps. The first sump, Sump 1, acts as a collection point for the groundwater seepage and the second sump, Sump 2, is fed by the Never Sweat Tunnel water line. The water in Sump 1 is then pumped via a submersible pump to Sump 2. The two 250-gpm pumps then deliver the water from Sump 2 via a 6-inch water line to the two existing EPS tanks, where it is then chlorinated and distributed for domestic and fire flow use.

EPS also includes surface support facilities associated with ongoing construction, exploration, and engineering studies including:

- Shaft 9 facilities, including: the head frame that supports the shaft and construction activities, the hoist house that encloses the hoists used to raise and lower the buckets in the shaft, and the winder house that encloses the winches used to raise and lower the galloway in the shaft;
- Shaft 10 facilities, including: the head frame, hoist house, and winder house;
- Decline portal, which provides access to Shaft 10 for personnel and materials, and provides ventilation and refrigeration;
- Batch plant for the preparation of concrete and shotcrete for underground construction;
- Electrical and mechanical building that houses drill core processing and maintenance facilities;
- Compressor building that houses air compressors and water chillers;
- Water chilling plant for Shaft 10;
- Oak Flat electrical substation;
- Existing 115-kV Salt River Project (SRP) electrical transmission lines;
- Dry facility, with showers, lavatories, and locker facilities for employees and contractors;
- General administration building with offices for mine management, operations, engineering, safety, and environmental personnel;
- Storage facilities for materials and equipment;
- Contractors' yards for equipment and material laydown;

- Laydown areas for underground development construction materials and surface (geologic) drilling materials;
- Explosives storage;
- Diesel generators;
- Containment area for the storage of chemicals;
- Parking lots for current employees, contractors, and visitors;
- Security trailer at the main entrance;
- Public access viewing platform with educational materials about the Resolution Project;
- Potable and fire flow water tanks and facilities for water service to the site;
- Surface-mounted utility racks for water, compressed air, and power supply;
- Stormwater management control and containment measures;
- Concrete washout facilities;
- Roads;
- Miscellaneous construction and Project temporary office facilities;
- Helicopter pad;
- Legacy (disused) facilities, including buildings, cooling towers, descalant tank, and wastewater treatment plant (WWTP); and
- US Forest Service (FS) roads: FR 2432, FR 2433, FR 2434, FR 315, and FR 469.

The proposed Resolution Copper mine is located within and beneath the EPS project area. Exploration drilling and groundwater well monitoring are currently ongoing within the underground mine area, as authorized under Plan of Operations No. 03-12-02-006 (RCM 2010).

3.1.2. UNDERGROUND WORKINGS AND PRIVATE HOLDINGS BETWEEN EAST PLANT SITE AND WEST PLANT SITE

Existing underground workings from the previous Magma Mine connect the area between the surface facilities at EPS and WPS. These underground workings between the two sites are within private property owned by Resolution Copper (***Figure 1.3-1***). The majority of the previously used tunnels and shafts are no longer in operation or accessible. The Never Sweat Tunnel is currently used to transport development rock via railcar to WPS from the underground exploratory development activities at EPS (***Figure 1.5-2f***). Dewatering facilities for EPS deliver water through the existing tunnel to a treatment plant at WPS, and potable water is delivered through the tunnel from WPS to EPS. Shaft 6, the only other remaining shaft still in use from previous operations, is used as an exhaust shaft for the Never Sweat Tunnel and has a set of ventilation fans at the surface.

3.1.3. EXISTING ACTIVITIES AND INFRASTRUCTURE AT WEST PLANT SITE

The WPS area encompasses facilities associated with past mining activity at the site and facilities that are currently in operation in support of the Resolution Project, either to support new development or for the closure of legacy facilities (***Figure 1.5-2c through e***). Several existing facilities at WPS are associated with previous mine operations, including Tailings Ponds 1-2, 3-4, 5, 6, and 7 and Shafts 1 through 8. Currently closed and reclaimed non-APP facilities (taken out of operation prior to 1986) include the following legacy features: the upper basin stockpiles, mill, Tailings Ponds 1-2 and 3-4, houses and offices in the upper basin, and the smelter complex. Currently closed and reclaimed APP facilities include the 500-Yard Waste Rock Facility, Smelter Pond, Depot Pond, Settling Pond 2, and Tailings Pond 5. Several additional legacy facilities at WPS are currently in the process of being reclaimed (or will be in the future), including the legacy smelter facility and Tailings Ponds 6 and 7.

The Never Sweat Tunnel ends at WPS at a gated portal. Train cars loaded with development rock from underground development activities at EPS exit this portal and travel across WPS to the loadout area before returning to the tunnel. The development rock is delivered to the Loadout Rock Stockpile under the railroad loadout facility. It is subsequently delivered via dump truck to one of the stockpiles, depending on the characteristics of the rock. Development rock that is inert and NPAG is stockpiled at the site to be used for ongoing construction and the reclamation of existing facilities. Mineralized, reactive rock that is PAG is segregated to the Intermediate Rock Stockpile. This stockpile has a permitted capacity of approximately 498,000 yd^3 (381,000 m^3), or 774,000 tons (702,000 tonnes) under the APP Program. The mineralized development rock in the Intermediate Rock Stockpile will eventually either be used for the first production run of the new Concentrator or moved to the Development Rock Stockpile.

WPS also includes surface support facilities associated with operations at WPS and EPS, including:

- Staging areas for temporary rock storage;
- Borrow areas associated with ongoing closure, redevelopment, and erosion control;
- General administration buildings with offices for mine management, operations, engineering, safety, and environmental personnel;
- High-density sludge treatment system and associated settling tank, equalization tank, and pipelines for the treatment of dewatering water to reduce total dissolved solids, metals, and pH prior to delivery to the NMIDD for beneficial use;
- Permitted and lined sludge-storage impoundments adjacent to water treatment plant;
- Pipeline for delivery of treated water to NMIDD;
- Apex Tunnel for stormwater diversion;
- Parking lots for current employees, contractors, and visitors;
- Security trailer/buildings at the entrances (Main Gate and Lone Tree);

- Arizona Water Company water supply tank (fills Resolution Copper tank);
- Resolution Copper potable water and fire flow supply tank;
- Water supply pipelines;
- SRP Trask electrical substation;
- 115-kV and 230-kV SRP electrical transmission lines;
- Stormwater management control and containment measures;
- Laydown yards;
- Roads;
- Shaft 8 pumps;
- Rail maintenance shop;
- Small substation associated with Never Sweat Tunnel portal;
- Ventilation fans at Never Sweat Tunnel;
- Chemical storage facility at 203 building; and
- FS roads: FR 229 and FR 1010.

3.1.4. EXISTING ACTIVITIES AND INFRASTRUCTURE AT TAILINGS STORAGE FACILITY SITE AND TAILINGS CORRIDOR

The TSF is proposed to be located north of the MARRCO Corridor and west of Superior between Roblas Canyon and Potts Canyon (***Figure 1.5-4a***). The Tailings Corridor will extend 4.7 mi (8 km) from the northeastern corner of the TSF to WPS (***Figure 1.5-4b***). The topography of the area is largely undisturbed, except for dirt roads and the remnants of historical mining and quarry activities at the site. The Tailings Corridor crosses the Arizona Trail, a recreational hiking trail, as well as five existing FS roads: FR 2362, FR 2371, FR 3152, FR 650, and FR 982.

3.1.5. EXISTING ACTIVITIES AND INFRASTRUCTURE ALONG THE MARRCO CORRIDOR

The approximately 28-mi- (45-km-) long MARRCO right-of-way encompasses a swath of land that is generally 200 ft (61 m) wide, although a small portion of it narrows to 50 ft (15 m) through private property west of Superior. The Magma Arizona Railroad historically provided a rail connection between the old Magma Copper Company mines and reduction works in Superior and the Arizona Eastern Railroad (Southern Pacific) at Magma. The railroad no longer transports copper on a regular basis, a result of the closure of the Magma Mine in the mid-1990s. The railroad does, however, remain semi-operational.

While the railroad grade, associated access roads, and utility lines have impacted portions of the MARRCO right-of-way, much of it still retains its natural topography. Currently, several utilities are present within the MARRCO Corridor, including Arizona Water Company facilities and a water pipeline partially buried in the railbed (the water supply for the town of Superior installed in the 1970s); a Resolution-Copper-installed 18-in (46-cm) dewatering line that delivers treated water from the existing water treatment plant at WPS to the NMIDD, which was authorized through a special-use permit by the FS (FS 2008); a buried fiber-optic line; overhead transmission lines; and buried natural gas pipelines. Private land parcels along the railroad, particularly east of Queen Station in Superior proper and near Magma, have been developed. The MARRCO Corridor intersects or runs parallel to portions of US 60, Hewitt Station Road (FR 357), and State Route (SR) 79 (***Figures 1.5-5a and 1.5-5b***).

3.1.6. EXISTING ACTIVITIES AND INFRASTRUCTURE AT FILTER PLANT AND LOADOUT FACILITY

The natural topography at the Filter Plant and Loadout Facility has been altered by previous activities apparently related to unrealized construction plans for a residential community that predate Resolution Copper's involvement with the property. Reviews of historical aerial photos indicate that grading and pond excavation were performed on the southern portion of the parcel between August 2006 and June 2007. Approximately 190 ac have been disturbed as a result of these previous construction activities (***Figure 1.5-5a***).

3.1.7. OTHER EXISTING INFRASTRUCTURE IN THE VICINITY OF THE RESOLUTION PROJECT

Several other existing facilities are located in the vicinity of the Resolution Project, including the Superior Geology Facility, the SRP Superior substation, and SRP power transmission lines (***Figure 1.2-2***).

3.2. MINING

3.2.1. OPERATION OF PITS AND WASTE ROCK DUMPS

The operation of the underground mine is discussed in detail below in ***Section 3.2.9***. As described in that section, the deep, relatively low-grade, and widely disseminated porphyry deposit that makes up the Resolution Project cannot be mined feasibly using open pit mining methods. The underground mining method proposed and described below, panel caving, does not produce any pits.

As described below in ***Section 3.3.9***, once mine production commences, no waste rock will be produced. All material from the mine, including any previously excavated PAG development rock, will be processed as ore at the Concentrator.

3.2.2. TONNAGE OF ORE AND DEVELOPMENT ROCK

Details of the ore body, along with its proposed mining and processing, are described below in ***Sections 3.2.9 and 3.3.1***. The current mine plan includes approximately 607 million yd^3 of an in-situ copper deposit. Development rock generated from underground excavations will be delivered to either the Intermediate Rock Stockpile or the Development Rock Stockpile, or it will be segregated for beneficial use for reclamation or construction. The Intermediate Rock Stockpile will have a capacity of 498,000 yd^3 (774,000 tons [702,000 tonnes]) while the Development Rock Stockpile will have a capacity of 10.3 Myd^3 (16.0 Mtons [14.5 Mtonnes]). Once mine production commences, no waste rock will be produced, and all the material from the mine will be processed as ore in the Concentrator. Further information on development rock is detailed below in ***Section 3.3.9***.

3.2.3. EXPECTED PRODUCTION RATE

After ramp-up, the ore production rate is predicted to be 132,000 tons (120,000 tonnes) per day, 365 days per year, with a maximum throughput of approximately 165,000 tons (150,000 tonnes) per day. Process improvements over the life of the mine could increase the production rate by up to 25 percent. The total mineral resource is estimated to be 1,915 Mton (1,737 Mtonnes). Further details are presented in ***Section 3.2.9.1***.

3.2.4. SEASON OF OPERATION

Mining operations would be run continuously—24 hours per day, 7 days per week, 365 days per year—for the life of the mine. This would include underground mining operations as well as processing operations. Further details are given below in ***Sections 3.2.9 and 3.3.1***.

3.2.5. EQUIPMENT TO BE USED

Resolution Copper will employ a range of conventional underground mobile equipment for its underground mining operations, including equipment for drilling and blasting, production and haulage, a secondary breaking fleet, and miscellaneous maintenance and service vehicles. Approximately 594 pieces of mobile equipment will be used. Further details on the types and quantities of equipment are provided in ***Section 3.2.9.9***. Throughout the document, other types of equipment used in the Project are described:

- Refrigeration and ventilation equipment (***Section 3.2.9.11***);
- Crushing (***Section 3.2.9.7***) and conveyance (***Section 3.2.9.8***) equipment;
- Grinding and processing equipment (***Section 3.3.1.2***); and
- Transmission equipment (***Section 3.5.1.5***).

3.2.6. METHOD OF DUMP CONSTRUCTION

No waste rock dumps are proposed for the Project. Although Resolution Copper will generate development rock from underground excavations during underground characterization and mine development, once mine production commences, no waste rock will be produced; all material from the mine (regardless of copper content) will go to the Concentrator for processing as ore. All development rock produced during mine characterization and development will be transported to either the Intermediate Rock Stockpile or the Development Rock Stockpile, or will be segregated for beneficial use for reclamation or construction. All ore from these stockpiles that is PAG will be removed from the stockpile areas and processed with the ore at the Concentrator. Excavated development rock that is NPAG will be beneficially used for reclamation and construction material. Further details regarding development rock handling and storage are provided in ***Section 3.3.9***.

3.2.7. PIT DEWATERING

As noted above in ***Section 3.2.1*** and detailed below in ***Section 3.2.9***, the proposed underground mining method of panel caving does not produce any pits. An existing dewatering system is present in Shaft 9, and dewatering facilities for EPS to deliver water through the existing tunnel to a treatment plant at WPS prior to delivery to NMIDD for beneficial use (CH2M Hill 2012). Dewatering will be necessary in the underground mine, where the water will be collected in sumps and pumped out. The collected water will be reused in the processing of ore and tailings. Mine dewatering is described further in ***Section 3.6***.

3.2.8. MITIGATION AND MONITORING

Geochemical and stability monitoring and mitigation, as well as monitoring and mitigation for hydrologic impacts, are discussed in a number of places in the document, specifically in ***Appendix E***. Resolution Copper would minimize the potential impact from mining undertaken by its operations and proactively manage subsidence impacts that might result from underground operations. Resolution Copper has been collecting relevant field and laboratory data to understand and predict the impact of subsidence, including prediction of subsidence magnitudes, assessment of subsidence impacts, a monitoring plan to control and provide early identification of impacts, and contingency plans to be implemented if required. This topic is summarized in ***Sections 4.3.1 and 4.3.5***, and detailed in ***Appendix E***.

Hydrologic monitoring and mitigation for the Project include the construction and maintenance of diversion channels to route precipitation runoff away from surface facilities and to capture and contain on-site (contact) stormwater for incorporation back into the process water supply system. These facilities have been sized to handle runoff for at least the 100-yr, 24-hr storm event. For the management of precipitation runoff within the Project sites, all contact water basins will be lined according to Best Available Demonstrated Control Technology (BADCT) standards and emptied after each storm event. Contact water will be reused via incorporation into the water supply system.

To prevent degradation to Queen Creek or to potential waters of the US, Resolution Copper will implement and maintain, as appropriate, the following structural control measures: water bars, culverts, wattles, diversion ditches, stormwater detention basins, stormwater ponds, revegetation, rock armoring, hydro-seeding, jute matting, and other best management practices. In addition, Resolution Copper will continue to implement good housekeeping, maintenance practices, and employee training. Further details regarding hydrologic monitoring and mitigation are presented in ***Section 4.5***.

Reclamation requirements for all Project components and potential impacts are detailed in ***Section 6*** of this General Plan of Operations (GPO).

3.2.9. MINE DEVELOPMENT AND UNDERGROUND OPERATIONS

EPS encompasses the proposed underground mine, associated shafts and ore-handling systems, and surface support facilities. The Project features in the vicinity of EPS are discussed in this section and illustrated in ***Figures 3.0-1i, 3.2-1, and 3.2-2***. Several important surface Project features will be located at the brownfield area of EPS, while the remaining facilities required for production will be expanded onto private lands, with a smaller portion on FS lands.

3.2.9.1. *Block Caving Overview*

Resolution Copper will use the underground mining method known as panel caving, which is a variation of the high-volume underground mining technique known as block caving. The Resolution Project copper deposit is a large, deep (approximately 5,000 to 7,000 ft [1,500 to 2,130 m] beneath the ground surface), relatively low-grade, and widely disseminated porphyry deposit. Surface and open pit mining techniques are not technologically or economically feasible for such deep, dispersed deposits. Traditional underground mining techniques for high-grade vein-type deposits such as those used at Magma Mine are also not feasible.

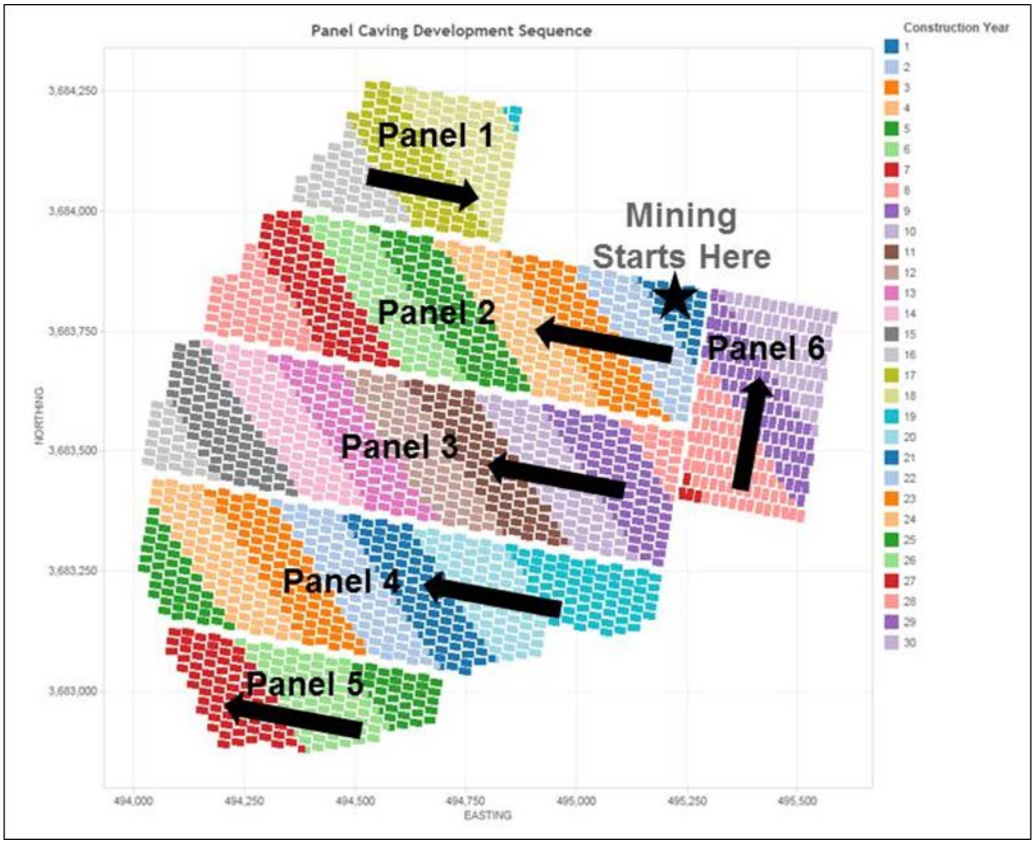
Porphyry deposits are typically lower grade deposits that have to be mined at larger production rates to be economically viable. Typically, large porphyry deposits are mined by open pit mining methods because, on average, they are much lower grade than other copper ore deposit types and are located near the surface. Examples of these deposits within the Copper Triangle include the Ray Mine, Pinto Valley, and the Miami Mine. Other porphyry deposits that are located at depths too deep for open pit mining can be mined by underground methods like panel or block caving.

Mining method selection is based on a combination of the value of the ore (grade), the quantity of the ore (size), and the shape of the deposit, as well as geotechnical and other engineering factors. These factors must be balanced by the economics and costs associated with building and operating the mine. In the case of Resolution Copper, panel caving is the only viable method given these constraints.

In the US, every underground mine that is mining or has mined porphyry deposits is a panel caving operation. These include the Henderson, Climax, Questa, San Manuel, and even the early stages of the Miami and Ray mines. Resolution Copper is unaware of any underground mine that is mining a porphyry deposit by any method other than a caving method.

Block caving is an underground mining system in which ore extraction depends primarily on the action of gravity and internal rock stresses. Caving of the ore is induced by undercutting the ore zone, which removes its ability to support the overlying rock material. Fractures spread throughout the area to be extracted, causing it to collapse and form a cave, which propagates upward throughout the mining process. The sequence of the panel caving is shown in ***Exhibit 3.2-1***. Panel 2 will be the first panel to be mined, followed by Panels 3, 1, 4, 5, and 6. The arrows on ***Exhibit 3.2-1*** depict the direction of the progression for each panel. ***Exhibit 3.2-1*** also depicts the year-by-year construction sequence of each section of the panels. ***Figure 1.5-3a*** shows the area where disturbance from the underlying cave is expected to be expressed at the surface, and ***Exhibits 3.2-2 through 3.2-4*** show the predicted subsidence limits of the cave zone 10, 20, 30, and 40 years after the start of mining (***Appendix E***).

Exhibit 3.2-1 Sequence of Panel Caving



At Resolution Copper, caving of the ore ultimately is predicted to be accompanied by surface subsidence. Subsidence occurs when the underground excavation caves and movement of material connects all the way to the surface where a depression or deformation in the land surface is formed. As ore is removed, the material above the ore body collapses, filling the space that the ore previously occupied. The collapsed material increases in volume from its in situ state after caving in a process called bulking (swelling). The depth of the land surface depression is a function of the bulking factor of the collapsed material and the amount of rock removed below it. The extent of surface disturbance is a function of the rock mass properties, local structure, regional geologic stresses, and the amount of material removed through mining (***Appendix E***).

Exhibit 3.2-2 Predicted Subsidence Limits 10, 20, 30, and 40 Years after Start of Mining

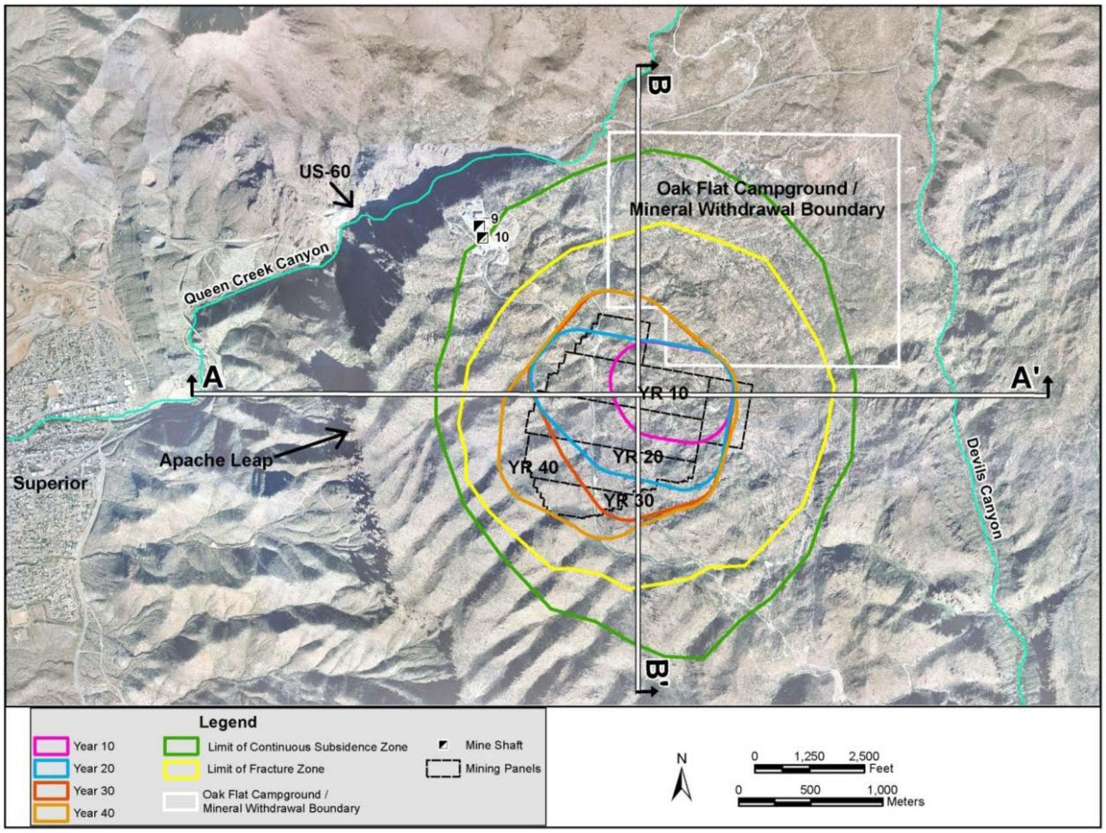


Exhibit 3.2-3 Section A-A', Predicted Subsidence Limits 10, 20, 30, and 40 Years after Start of Mining

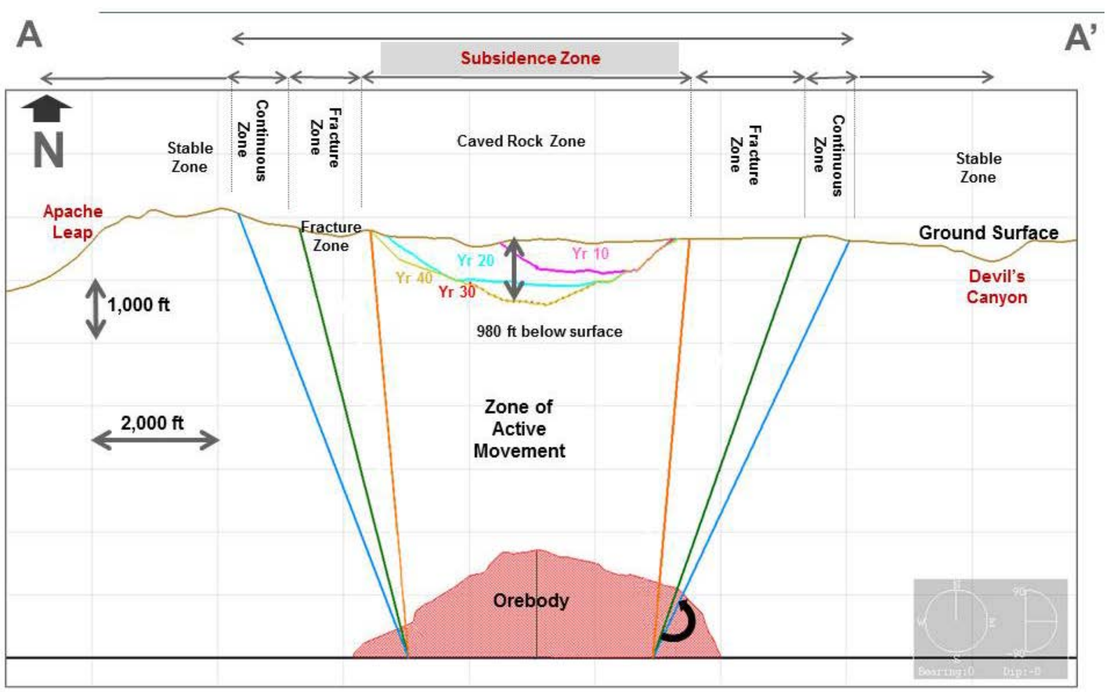
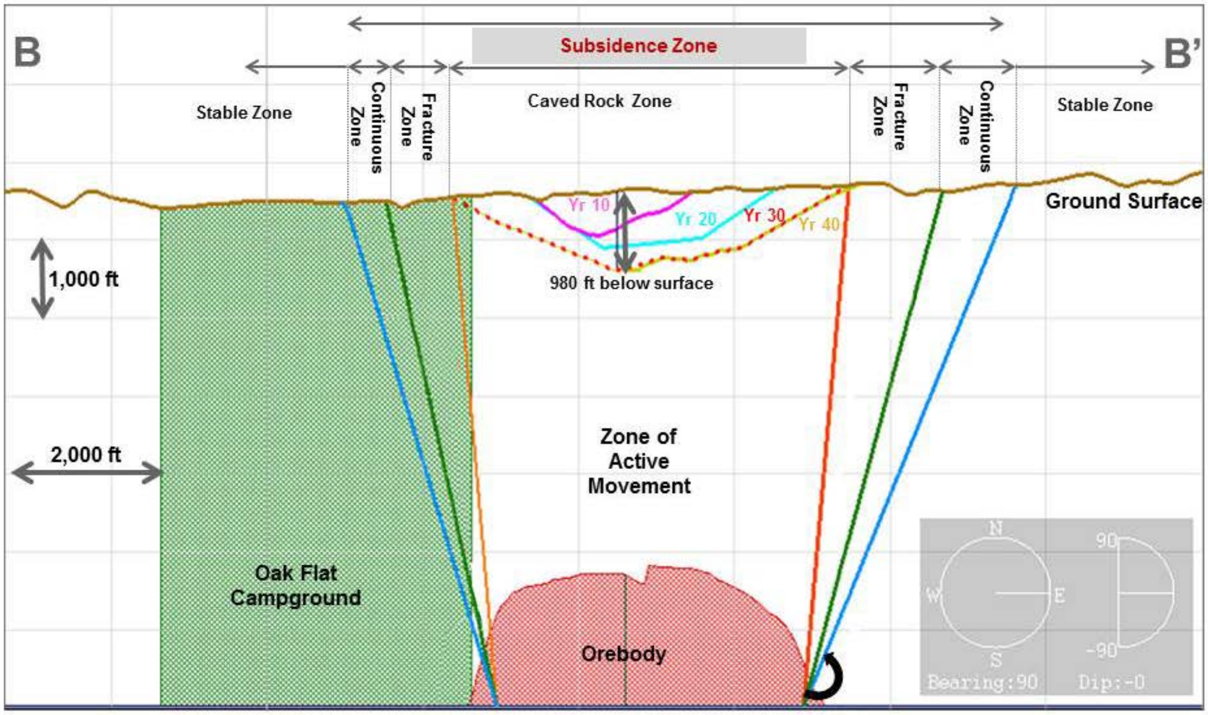
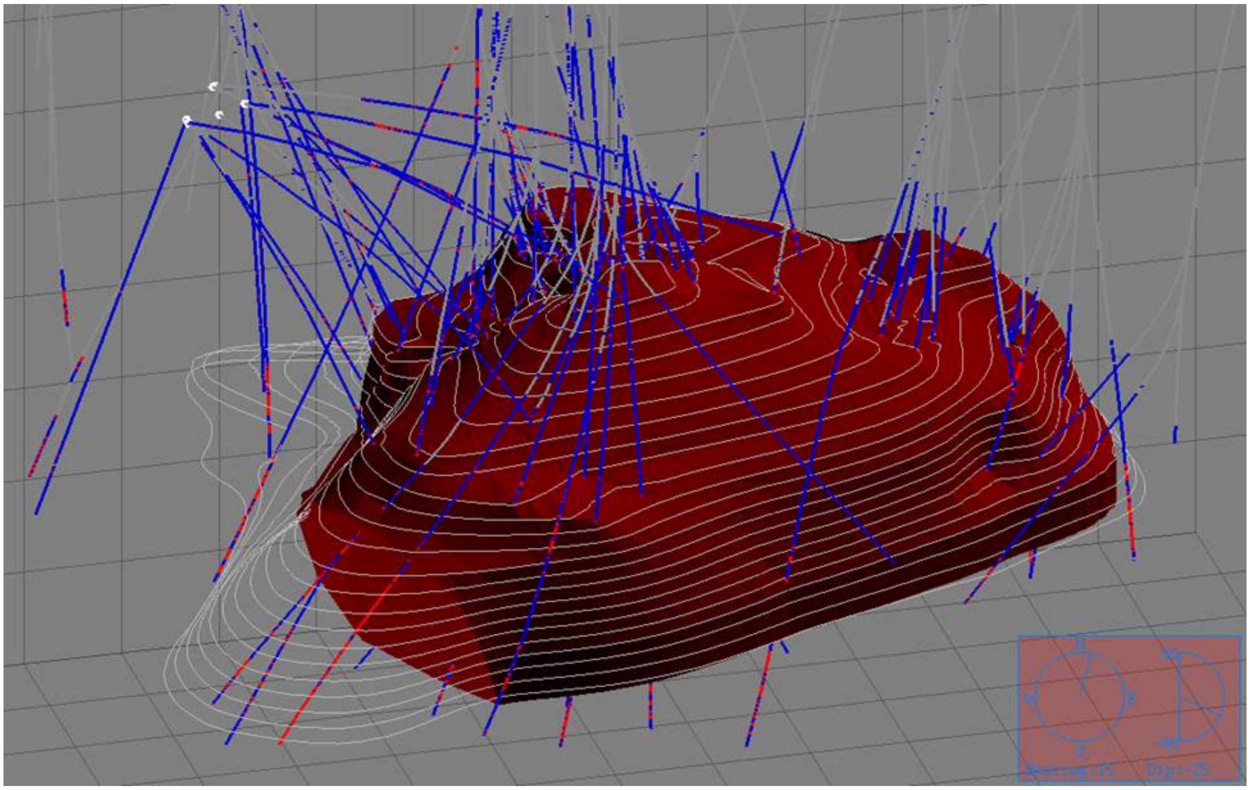


Exhibit 3.2-4 Section B-B', Predicted Subsidence Limits 10, 20, 30, and 40 Years after Start of Mining



Empirical and numerical simulations conducted by Resolution Copper provide potential subsidence predictions covering the Cave Rock Zone, Fracture Zone, and Continuous Subsidence Zone. All modeling simulations for this Project use regional geological and structural geometries, material properties, regional stresses, and mine development/production scheduling to predict the area of surface disturbance induced by the block caving. Ongoing exploratory activities continue to provide information that improves the accuracy and decreases the uncertainty about the controlling parameters of the simulations. Modeling indicates that subsidence is predicted to occur at the land surface above the Resolution ore body and that the maximum extent of the subsidence (the Continuous Subsidence Zone where strains can be measured, but no visible evidence of surface subsidence would be evident) after 40 years of mine life would still be more than 1,500 ft from Apache Leap. Additionally, Apache Leap is predicted to be within the Stable Zone, Resolution Copper's surface mining infrastructure is predicted to be within the outer areas of the Continuous Subsidence Zone, and various portions of the Oak Flat campground are predicted to be within the subsidence area and thus public access will be limited (***Appendix E***). It is important to note that subsidence impacts would be controlled by limiting the lateral extent of the block caving panels and by not mining ore within some sections of the 1-percent copper shell to protect key surface features like Apache Leap (***Exhibit 3.2-5***).

Exhibit 3.2-5 Subsidence Impacts



Subsidence impacts would be controlled by limiting the lateral extent of the block caving panels (shown in red) and not mining ore within some sections of the 1 percent copper shell (shown in white in bottom left corner).

An in-depth discussion of subsidence impacts and associated monitoring is contained within the Resolution Copper Mining, Subsidence Monitoring Plan (***Appendix E***).

The underground mine development work required to set up for panel caving and the transport of ore to the Concentrator Complex requires considerable time and significant underground and surface infrastructure prior to ore extraction. However, once the underground development is complete and the associated infrastructure is constructed, panel caving will allow for progressive ramp up to the planned production rate.

There are approximately 607 million yd^3 of in situ ore in the current mine plan. Resolution Copper plans for a long-term nominal ore production rate of 132,000 tons (120,000 tonnes) per day for a 365-day-per-year operational schedule that will begin after a significant ramp-up period. The maximum throughput will be approximately 165,000 tons (150,000 tonnes) per day. Additionally, it is likely that with process improvements throughout the life of the operation, the nominal production rate may be up to 25 percent higher. The total mineral resource is estimated to be 1,915 Mton (1,737 Mtonnes).

To prepare for ore extraction, Resolution Copper will undertake conventional underground development work that involves the construction of: additional shafts; undercut, extraction, haulage, air intake and exhaust levels; and other underground infrastructure.

3.2.9.2. *Ore Flow Systems Overview*

The Resolution Copper ore extraction and handling system will involve the following steps and related infrastructure (***Figure 3.2-3***):

- Mine Development and Ore[2] Extraction;
- Ore Passes and Chutes;
- Underground Rail Haulage System;
- Underground Crushing Facility;
- Lower Level Underground Conveyor Facility;
- Hoisting;
- Inclined Underground to Surface Conveyor System; and
- Ore Stockpile at WPS.

At the Resolution Copper Mine, ore will be removed from a series of vertical conical-shaped draw points that provide access upward into the ore body. These vertical draw points are known as "drawbells" and allow broken ore to be extracted from the ore column above it. From the draw points, ore will be routed through a series of underground transport and handling systems (including ore passes and chutes, rail transport, crushers, conveyors, and production hoisting shafts). Ore-handling systems outside the mine include transporting the ore from underground at EPS via the Inclined Underground to Surface Conveyor System to the covered Ore Stockpile at the WPS Concentrator Complex. The Concentrator Complex is discussed in ***Section 3.3***. The ore extraction and transport systems are illustrated schematically in ***Figure 3.2-3***.

3.2.9.3. *Undercut Level(s)*

This section of the mine will be the uppermost area established for panel caving and involves the development of a series of parallel (and horizontal) conventional mine drifts that are driven with standard underground techniques, including drilling, blasting, mucking (removal of the rock) and haulage, and ground support (***Exhibit 3.2-6***).

A drill-jumbo will drill a pattern of blast holes on the drift face. Each advance is known as a "round." Once the face has been drilled, the holes will be loaded with explosives and blasted. Blasting will be conducted when a round is loaded with explosives and the area is secured. Various types of explosives

[2] The Resolution Project ore contains copper and molybdenum.

will be used, with the charges being detonated by either blasting cap and safety-fuse or non-electric initiation.

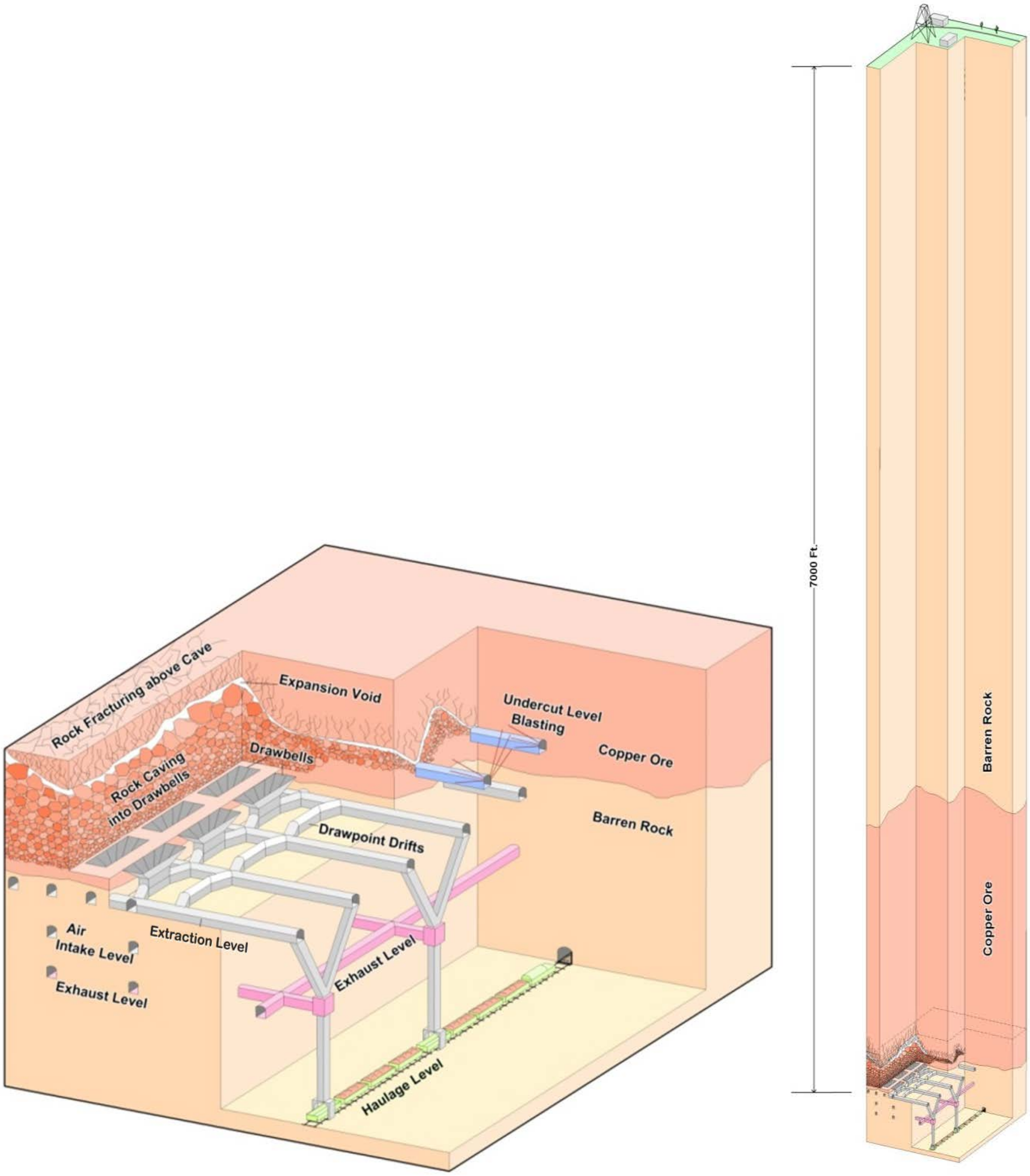
The broken rock will be loaded by load, haul, and dump (LHD) vehicles that are essentially underground front-end loaders. LHDs will deliver the rock material to ore passes for delivery to the rail haulage level.

The mechanical support necessary for rock stability will be installed prior to initiating the next round of drilling activities. Ground control or support can involve a variety of techniques, but rock bolting and the application of shotcrete are commonly used in current underground mines.

Once the undercut drifts are developed beneath the ore zone (and the extraction, ventilation, and rail haulage levels have been established for the designated panel [as discussed below]), Resolution Copper will conduct longhole drilling in a ring pattern upward into the ore zone along the far edge of the undercut (***Figure 3.2-3***). These holes will be loaded with explosives and blasted to remove the pillars beneath the undercut drifts and to form the horizontal slot that will allow the ore to begin caving. The longholes will be drilled at an angle from the top of the pillars of the undercut level, as well as at an angle slightly above the undercut level. The height of the blasted zone will vary, but will typically range from 25 to 82 ft (8 to 25 m).

Undercut blasting is the last step in the development process that initiates the caving. It is critical to remove or fracture all pillars in the undercut level. If pillars are left, they can hinder the proper caving action and cause damage to the other mine workings below the intact areas of the undercut due to an increase in mining-induced stresses to the lower workings.

Exhibit 3.2-6 Conceptual Diagram of Block Caving Process



3.2.9.4. *Extraction Level*

A second series of horizontal drifts and crosscuts are developed below the undercut level. This level involves a series of parallel conventional mine drifts that are driven with the same standard underground techniques described above for the undercut level. The horizontal drifts will vary, but will be spaced 82 to 105 ft (25 to 32 m) apart, depending on geotechnical conditions. The extraction drifts and crosscuts form a herringbone configuration.

Slot raises are driven upwards in the center of the herringbone crosscuts at an approximate grid spacing of 50 to 65 ft (15 to 20 m), depending on geotechnical conditions. These raises commence the drawbell construction process. Each drawbell (funnel-shaped excavation) has a certain area of influence on the broken ore above. Resolution Copper will slightly overlap the upper area of influence for the drawbells to ensure that the entire ore column will move downward as the ore draw occurs to maximize resource recovery.

From the bottom of the drawbells on the extraction level, LHD vehicles will remove the ore material and transport it to the ore passes that feed the underground rail haulage system level. The speed at which the ore moves through the drawbells is effectively controlled by the speed at which the ore is removed by the LHD vehicles from the draw points. As broken ore exits via the drawbells and is removed by LHD vehicles at the draw points, the overlying ore body gradually collapses under its own weight to create more broken rock, and will continue to propagate naturally as long as ore is removed from the draw points, thereby forming a continuous process.

Secondary breaking may be necessary to ensure that rock material flows through the drawbells and is small enough to pass through the ore passes to the rail haulage level. Resolution Copper will maintain equipment and procedures for any secondary breakage that might be needed.

3.2.9.5. *Ore Passes and Chutes*

The LHD vehicles on the extraction level will place the ore collected from the draw points into a series of ore passes that feed grizzly-run material through properly sized grizzlies prior to entering the ore pass. Each ore pass dips at an angle of between approximately 90 and 65 degrees and varies in length depending on the area of the mine. There could be one ore pass or two ore passes to a single chute depending on underground conditions. The chute will feed the railroad cars on the rail haulage level from the various ore passes. The railroad cars will be loaded continuously directly under the chute.

3.2.9.6. *Underground Rail Haulage System*

The rail haulage level will be a series of horizontal drifts located beneath the extraction level. Resolution Copper will use a standard-gauge rail system that will allow bottom-dump railcars to be gravity-loaded with ore delivered from overhead chutes. These railcars will be routed to the dump station above the underground crushing facilities.

Resolution Copper will use electric semi-autonomous locomotives to pull the railcars. The rail system will be a looped configuration, with two parallel drifts spaced on approximately 55-ft (18-m) centers in the production areas. Dedicated rail haulage drifts will be located directly beneath the loading chute, while another drift will be located to bypass the loading area. With this strategically placed double-rail trackage, Resolution Copper will maintain efficient and reliable high-volume underground haulage to the crushing facility. Although rail haulage is currently planned, conveyors or other haulage methods could be adopted if deemed appropriate in the future.

3.2.9.7. *Underground Crushing Facility*

Resolution Copper will use up to three gyratory crushers, installed in parallel beneath the rail haulage level. Each crusher will be supplied with ore from a coarse ore bin located in the rock material above the crusher and fed by the dumping of railcars.

Resolution Copper will use redundancy, such as three crushers, separate ore bins, and multiple conveyors, to allow operational flexibility and efficiency. Even if one of the crushers is undergoing maintenance work, the other crushers can continue to be operated, thus allowing mining operations to continue.

3.2.9.8. *Ore Transport Systems*

A series of conveyor facilities will be utilized to transport ore from the mine and production shafts at EPS to the Ore Stockpile at WPS. The locations and functions of the conveyor sections are provided in ***Table 3.2-1***.

Table 3.2-1 Ore Conveyor Information

Conveyor Location/Function	Delivers From	Delivers To
Lower Level Underground Conveyors: • Fine Ore Bins at Crushers • Belt Tilters at Silos • Skip Loading Area • Skip Discharge Level	Ore feeders in underground crushing level (East Plant Site)	Underground Skip Discharge Level (East Plant Site)
East Plant Site to West Plant Site: Inclined Underground to Surface Conveyor System	Underground Skip Discharge Level (East Plant Site)	Covered Ore Stockpile (West Plant Site) Daylight Point

The discharge from each gyratory crusher will drop into separate crushed (fine) ore bins. Ore from each of the bins will empty onto apron feeders that will discharge onto a series of belt conveyors. The belt conveyor systems will discharge the ore into underground silos. The underground silos (likely three) will be fed via two-belt tilter mechanisms with material being dumped into the third silo if the first two-belt tilters are not activated. Ore material from the silos will be discharged onto vibrating feeders that will load conveyors feeding the skip[3] loading system. The speed of these conveyors can be varied to match

[3] The planned skips to be used at the Resolution Mine will be composite steel-aluminum buckets. Steel cables will be used to hoist the skips from the mine.

the cycle time of the hoisting skips. At the skip discharge level, ore material will be gravity-drawn out of the skip discharge bins with apron feeders that will discharge onto separate short conveyors.

The skip discharge conveyors in the skip discharge level at EPS will feed the Inclined Underground to Surface Conveyor System. This system will consist of two inclined conveyors (both at an inclined angle of approximately 10 degrees) in series within the Conveyor/Infrastructure Tunnel, which will be approximately 2.5 mi (4.1 km) in length. Ore will be transferred from the first conveyor to the second at the point where the tunnel alignment changes from westerly to northerly (***Figure 1.5-2f***). An exhaust raise and ventilation fans will be located here to provide ventilation for the tunnel. The second inclined conveyor in the tunnel will bring material through the surface portal at WPS to the covered Ore Stockpile at the Concentrator Complex. Surface disturbance from the Inclined Underground to Surface Conveyor System will be limited generally to the shafts above the conveyor feed at EPS, an exhaust raise (and ventilation fans) along the conveyor tunnel alignment for ventilation, the tunnel portal at WPS, and the overland portion of the conveyor at WPS, all of which will be located on private land (***Figure 1.5-2f***).

3.2.9.9. *Underground Mobile Equipment*

Resolution Copper will use an array of conventional underground mobile equipment for underground operations as listed in ***Table 3.2-2***. This equipment list may be modified during the Project, depending on need and the site-specific conditions encountered. In total, approximately 594 pieces of mobile equipment would be employed. Details provided on emissions in ***Appendix D***.

Table 3.2-2 Mobile Equipment

DRILLING AND BLASTING
Drilling Jumbos
Production Drills
Explosives Loader Units
PRODUCTION AND HAULAGE
LHD (Load, Haul, Dump Machines)
LHD Generator Trucks
Underground Haul Trucks
Railroad Locomotives
Rail Bottom Dump Cars
SECONDARY BREAKING FLEET
Medium Reach Rigs
Robust Rigs
Mobile Rock Breakers
MISCELLANEOUS MAINTENANCE AND SERVICE VEHICLES
Rock and Cable Bolters
Shotcrete Sprayer and Trucks
Scissor Lifts
Support Trucks: Fuel/Lube, Crane, Water, Shotcrete, Flat Deck, and Service
Graders
Personnel Vans and Other Vehicles

3.2.9.10. *Shafts and Hoist Facilities*

Shafts and hoist facilities will be utilized for access to the underground workings and are integral to ore production and operations at EPS. EPS surface facilities, including existing and planned shafts, are shown in ***Figures 3.2-1 and 3.2-2***. EPS will be constructed in multiple phases to allow for a phased development approach. The first phase will involve constructing and equipping infrastructure on the portion of the EPS that is owned by Resolution Copper. With the phased mine construction, shaft use and air direction will change as the various stages are constructed. The last, full build-out phase will expand the southern portion of the EPS facilities onto FS lands and includes Shaft 12 (***Figure 3.2-2***). The existing and planned shafts (configured for full production) are listed in ***Table 3.2-3***.

Table 3.2-3 East Plant Site Shaft and Hoist Facilities at Full Production

Shaft No.	Purpose	Surface Ownership
9	Upcast Exhaust	Resolution Copper
10	Upcast Exhaust	Resolution Copper
11	Production/Downcast Fresh Air Intake	Resolution Copper
12	Production/Downcast Fresh Air Intake	Tonto National Forest
13	Service/Downcast Fresh Air Intake	Resolution Copper
14	Upcast Exhaust	Resolution Copper

At full production, Shafts 11 and 12 will be production shafts dedicated to hoisting ore and other rock material from the Mine. The primary crushed ore will be transported via the Lower Level Conveyor System to the production shafts and then skip-hoisted within the shafts. Although the production shafts will extend to the surface, ore will only be hoisted about 3,500 ft (1,100 m) to the skip discharge level. Each production shaft will have six high-speed skips, resulting in a total of 12 skips capable of hoisting ore. Once the skips reach the discharge level, the ore will be gravity-fed from doors in the bottom of the skip into the discharge bins. These bins will become the feeder source for the high-speed Inclined Underground to Surface Conveyor System, which will move the ore through the Conveyor/Infrastructure Tunnel to the Ore Stockpile at the WPS Concentrator Complex.

Production Shafts 11 and 12 will also be downcast fresh air intake points for the ventilation system, with a bulk air cooler connection below the land surface for ventilation. These shafts will connect to the skip discharge and ventilation levels.

At full production, Shaft 13 will be a hoisting service shaft with lifts for delivering employees and equipment primarily to the extraction and rail haulage levels. This shaft will also be an intake shaft for the ventilation system, with a bulk air cooler connection below the ground surface.

At full production, Shafts 9, 10, and 14 will be upcast exhaust shafts for the ventilation systems for the Mine. Shaft 9 was used in the previous Magma mining operation at the site as a production shaft, and this shaft is being deepened and rehabilitated. Shaft 10 is currently under construction. Shaft 14 will be located to the east of Shafts 9 and 10 in an area that is currently an employee and contractor parking lot. The upcast exhaust Shafts 9, 10, and 14 will connect in a below-ground manifold at EPS and vent through a series of exhaust fans at the surface. The Conveyor/Infrastructure Tunnel will have an access connection to Shaft 13 and a return connection to Shaft 14, in addition to its connections to production Shafts 11 and 12. The tunnel will act as an exhaust airway using chilled intake air entering Shafts 11, 12, and 13, and it will be exhausted using a surface fan installed in an exhaust raise along its alignment (BBE Morvent 2012). Ventilation and refrigeration systems at EPS are further discussed in the next section.

It should be noted that many of the shafts can be configured in a variety of ways to meet the development and production requirements at various times, while ultimately meeting the final configuration in ***Table 3.2-3***.

3.2.9.11. *Refrigeration and Ventilation Facilities*

Refrigeration and ventilation are vital aspects of the health, safety, and environmental program for underground mining operations. The refrigeration and ventilation systems for the Resolution Project will consist of a network of intake and return airways and equipment required to maintain adequate ventilation and cooling to the underground workings. Ventilation and refrigeration will be provided for all areas of the underground mine to address heat load and ventilation requirements underground. Thermal issues and dust management will be the primary factors in the design of the systems, and the delivery rates supplied to meet the cooling requirements will satisfy normal ventilation needs (BBE Morvent 2012). Exhaust and heat loads from vehicles and mobile equipment (both electric and diesel-driven), workshops, warehouses, pump stations, the refrigeration plant, conveyors, the crusher station, and electrical substations will be addressed via the ventilation and cooling systems. Heat load from broken rock will also be a major consideration in the operation of the cooling systems in the extraction level, rail level, shafts, and conveyor tunnels. The dry bulb temperatures[4] in both manned and remote equipment levels will be managed through the use of moisture application and cooling. Moisture application in the draw points and ore passes will be especially important for both the management of high dry bulb temperatures and dust suppression (BBE Morvent 2012).

The ventilation design also addresses issues such as diesel particulate matter, strata gases, radon, respirable dust (particularly silica), and fibers. Dust control methods such as the use of water sprays and exhausting large volumes of ventilation from high-dust areas to return airways will be implemented. Significant ventilation capacity has been allocated for that purpose in the design (BBE Morvent 2012). Use of personal protective equipment, training, and air sampling will be provided as part of the respirable dust exposure reduction program (see ***Section 4***). The air volumes supplied will comply with

[4] The dry bulb temperature is the temperature of the air measured by a thermometer freely exposed to the air but shielded from radiation and moisture. The dry bulb temperature is usually thought of as the air temperature and is the true thermodynamic temperature.

Mine Safety & Health Administration (MSHA) ventilation requirements for underground mining operations. Dust control management is discussed in more detail in ***Section 3.2.9.12***.

The ventilation and refrigeration system components will be located both at the surface and within the underground workings. At full production, Shafts 11, 12, and 13 will be utilized as downcast fresh air intake shafts, while Shafts 9, 10, and 14 will be utilized as upcast ventilation exhaust shafts, along with the Conveyor/Infrastructure Tunnel exhaust raise. Shafts 11, 12, and 13 will be equipped with high-speed intake airways with booster fans, and Shafts 9, 10, and 14 with underground return airways, for ventilation of the various production and working levels. The surface (primary) refrigeration system will consist of surface bulk air coolers supplying each downcast shaft; closed-circuit air coolers and/or pipe coolers in the Conveyor/Infrastructure Tunnel; a service water refrigeration system to provide chilled water; a central surface refrigeration plant room; and thermal storage via chilled water dam. Heat rejection for all cooling systems will be by multiple cell condenser cooling towers at the surface (BBE Morvent 2012). Ventilation and refrigeration systems at EPS are further discussed in ***Section 3.2.10.6***.

The underground (secondary) refrigeration system will consist of a suite of underground air coolers, a cold water distribution system, and centralized underground refrigeration plant chambers (BBE Morvent 2012). The underground systems will be located near the active mining area and the return ventilation system for heat rejection. Refrigeration equipment will produce chilled water to be pumped in a closed-circuit insulated pipe system to secondary air coolers. The underground secondary air coolers will serve the conveyor ramps, crushers, central ore bin, belt loading, undercut level, intake vent level, and haulage level. Secondary ventilation includes features such as intake and exhaust raises, control regulators, auxiliary fans in the undercut and extraction levels, ductwork and vents, forced ventilation with fans for crosscuts, variable-speed fans for control to suit the presence of equipment and activities, and ventilation at production cross-cuts and drawpoint construction. Ventilation equipment will be installed in local areas to ensure proper airflow to the working faces and the spaces where underground contractors and employees will be working. Air will be captured as close to the working faces as practical, then directed to air exhaust raises. (BBE Morvent 2012).

Ventilation exiting the exhaust shafts will be at or near saturation (100-percent humidity), which will lead to the formation of a moisture plume that may be visible at certain times. The plume will be visible primarily during the cooler winter months when the outside temperature is significantly less than the temperature of the air exiting the exhaust shafts. The plume will be largely made up of water and is estimated to rise to between 165 and 330 ft (50 and 100 m) above the ground surface, with the size and intensity of the plume varying on a diurnal and seasonal basis.

The Conveyor/Infrastructure Tunnel will be developed from the surface at WPS to connect with the skip discharge level underground at EPS. It will be primarily refrigerated with air from the skip discharge level and the WPS surface portal, but will be supplemented by a bulk air cooler installed in the tunnel. The surface refrigeration plant will supply chilled water to the Conveyor/Infrastructure Tunnel and closed-circuit cooling for drives, with heat rejected to the surface through an exhaust raise. Potential dust generated at the skip discharge level will be captured and sent to Shaft 14 through the Conveyor/Infrastructure Tunnel's return connection to Shaft 14 (BBE Morvent 2012).

3.2.9.12. *Dust Control Management*

The management of respirable dust is of particular importance in the design of the ventilation system due to the presence of silica in the ore body and host rocks (BBE Morvent 2012). Analyses of rock core samples from exploration boreholes indicate that the silica content is 20 to 50 percent. Due to the depth of the underground workings, additional exhaust raises dedicated to dust extraction are not feasible; all dust will be suppressed, captured, or directed to return airways. Significant ventilation capacity has been allocated to direct air containing dust to the return airways (BBE Morvent 2012).

Best practices for dust control will be implemented, including the use of water sprays and the allocation of a large volume of ventilation to be exhausted from high-dust areas to return airways, in dedicated duct systems where possible.

Mining controls such as wet drilling and wetting broken rock will be used, and water will be applied to the ore stream to maintain at least 2-percent moisture. Remote loading will be used at the extraction level along with dust-suppression water sprays. Water sprays will be installed in all roadways. Crushers and transfer points will have dedicated ventilation systems (BBE Morvent 2012).

Personal protective equipment will be required along with training in the control of exposure to respirable dust. Air sampling programs will be implemented and monitored. Details about the respirable dust exposure reduction program are found in ***Section 4***.

Service water will be used in all phases of development and production as a cooling medium and dust suppressant. During production, water for dust suppression will come from the Central Arizona Project (CAP) distribution tank at WPS via a 16-in water pipeline through the Conveyor/Infrastructure Tunnel to EPS. The water must be chilled on the surface and supplied underground in an insulated pipe network. Additional detail regarding the water systems and water supply at EPS and in the Mine area is provided in ***Section 3.2.10.12***.

3.2.9.13. *Underground Ancillary Mine Facilities*

A variety of ancillary facilities will be present within the underground Mine workings as required to support the operations. Electrical substations and transmission and distribution systems will provide power to the underground facilities and equipment. Mine operations will be supported by an underground rail shop, workshops, warehouses, a batch plant, and fuel/tire storage. A variety of pump stations and pipelines will be provided for dewatering water and the transfer of process and cooling water.

3.2.10. EAST PLANT SITE MINE SURFACE SUPPORT FACILITIES

The Resolution Project will require surface infrastructure to support underground development and mining. Some of these services and surface support facilities are already in place and have been used for the underground exploration activity; however, many of the existing facilities must be upgraded for mining, and new facilities must be constructed. Prior to construction, surveys will be conducted for exact placement of new facilities. This section describes the surface support facilities and services at EPS. Major surface facilities are shown in ***Figures 3.2-1 and 3.2-2***. A phased approach to EPS construction allows facilities to be initially constructed within Resolution Copper property, followed by the buildout of the EPS facilities that will be placed outside the Resolution Copper property on FS lands.

3.2.10.1. *Site Access Roads, Security Gate, and Internal Roadways*

EPS is currently accessed via Magma Mine Road, south of US 60 (***Figure 3.2-1***). The site entrance will have a security building and gate where Magma Mine Road ends at the EPS entrance, with appropriate security and signage to restrict access to the site by the general public. Visitors to EPS will park at the guard gate outside the site and check in with security prior to gaining access to the site.

Resolution Copper will be responsible for ongoing road and sign maintenance for Magma Mine Road to assure safe and efficient year-round access to EPS. Magma Mine Road will be relocated from its existing alignment in approximately Year 8 of mine operations due to anticipated surface disturbance in the area of the existing roadway. The typical section for the Magma Mine Road Realignment is available in the Road Use Plan in ***Appendix K***. Roadways for small vehicle access and the delivery of materials and equipment will be provided throughout EPS on private property owned by Resolution Copper. All traffic at EPS will be right-hand travel. Transportation both inside and outside EPS is further discussed in ***Sections 3.4.1.2.4 and 3.4***.

3.2.10.2. *Mine Administration and Office Buildings*

Resolution Copper will continue to use the existing administration building at EPS until production commences and concurrently will construct additional mine administrative facilities there. The administration and office buildings will provide office space for reception, mine management, operations, maintenance, engineering, safety, and environmental personnel. Space will also be available for conference and safety training rooms. Generally, these buildings will be constructed of steel and placed on concrete slabs. They will be painted a color that blends with the surrounding terrain (e.g., tan) to the extent practicable.

3.2.10.3. *Employee and Visitor Parking*

Parking will be adjacent to the administration and shift supervisor offices for employees, van pool vehicles, contractors, and visitors. An existing parking lot is located near the mine administration building that includes space for approximately 100 vehicles. This parking lot will be eliminated for the construction of Shaft 14. As the Project transitions from development to mining operations, additional parking spaces will be constructed. Parking will be available for approximately 320 vehicles near the new office buildings.

3.2.10.4. *Safety, Medical, and Training Facilities*

EPS is located close to the towns of Superior and Globe, where hospital and ambulance services are available in case of medical emergencies. The nearest Level-1 trauma centers are Maricopa Medical Center in central Phoenix and the Scottsdale Osborn Medical Center, both of which are approximately 60 mi (100 km) from EPS.

Safety and medical facilities for first responders will be provided at EPS. A stand-alone first aid building near the shaft area will house first aid and safety personnel and provide for first response in emergencies. Resolution Copper will have on-site first responders for medical emergencies and firefighting. EPS includes a helicopter landing pad for emergency evacuation by helicopter.

First aid supplies and kits will be located strategically around EPS, including in surface facilities such as offices, the dry (miner's change facility), and warehouses as well as in the mine safety and shifter areas. First aid supplies will also be located throughout the underground mine. Refuge chamber(s) will be maintained underground according to the standards and regulations of MSHA. Refuge chambers will have first aid supplies and oxygen bottles. Mine safety and shifter facilities will be maintained at the site capable of storing breathing apparatus, gas testers, oxygen booster pumps, and miscellaneous spare parts. Resolution Copper will train and maintain its own mine rescue team on site.

Resolution Copper will have the capability to conduct MSHA new miner and refresher training on site. Training rooms will be provided in the mine administration facilities. A separate training building will be available at EPS for additional training space. Additional detail on safety, training and medical may be found in the Emergency Response and Contingency Plan contained within ***Appendix L***.

3.2.10.5. *Shafts and Hoist Houses*

Six shafts (9, 10, 11, 12, 13, and 14) and associated hoist facilities are located at EPS, as shown in ***Figure 3.2-2***. The shafts will be utilized for ore production, the hoisting of employees and equipment in and out of the mine, and refrigeration and ventilation purposes, as well as for the construction of mine levels during mine development. The purpose and operation of the shafts and hoisting facilities are discussed in detail in ***Section 3.2.9.10***. The uses of the shafts are summarized in that section under ***Table 3.2-3***.

3.2.10.6. *Refrigeration and Ventilation Equipment*

The ventilation and refrigeration system components will be located both at the surface and within the underground workings. Surface facilities for refrigeration and ventilation are shown in ***Figure 3.2-2***.

Surface (primary) refrigeration system components include a surface bulk air cooler supplying each downcast shaft (Shafts 11, 12, and 13), a central refrigeration plant with a service water refrigeration system to provide chilled water, and thermal storage via a chilled water dam (tank). Shafts 9, 10, and 14 will be upcast ventilation exhaust shafts. Many of the shafts can be configured in a variety of ways to meet the development and production requirements at various times, while ultimately meeting the final configuration described here. Heat rejection for all cooling systems will be by multiple-cell condenser cooling towers at the surface. The purpose and operation of the refrigeration and ventilation facilities are discussed in ***Section 3.2.9.11***.

3.2.10.7. *Dry Facility (Miners' Change Facility)*

Resolution Copper will install a new men's and women's change facility (dry) at EPS. The new dry facility will supplement the existing dry facility at the northern end of EPS. These facilities will include lockers, lavatories, and showers.

3.2.10.8. *Surface Maintenance Facilities and Storage Areas*

All types of underground and surface equipment will require periodic maintenance. Resolution Copper will maintain both surface and underground maintenance facilities. The surface maintenance facilities at EPS include a hoist workshop for the maintenance of hoist equipment, trackless workshops for the maintenance of rubber tire equipment, and a lamp room for the charging and repair of headlamps. The surface maintenance facilities will be supplemented by both covered and outside warehousing storage, including:

- Cable storage;
- Laydown areas and yards for ducting, raw materials, heavy equipment, pipes, and associated equipment;
- Rail ballast storage – surface storage area for bedding materials for underground rail construction and maintenance; and
- General stores and general stores yard.

3.2.10.9. *Compressor Facility*

Air compressors will be installed near the mine shafts to supply compressed air for certain underground equipment, such as drills. The compressors will be sheltered from the weather in an enclosed structure, which will also muffle sound.

3.2.10.10. *Batch Plant*

The existing batch plant at EPS will be used to produce concrete and shotcrete for EPS construction during the characterization and development/construction phase. It is possible that the existing batch plant may be upgraded or expanded in the event additional capacity is needed during construction. A typical batch plant can have a variety of parts and accessories, including but not limited to mixers (either *tilt-up* or *horizontal* or in some cases both), cement batchers, aggregate batchers, conveyors, radial stackers, aggregate bins, cement bins, heaters, chillers, cement silos, batch plant controls, and dust collectors.

3.2.10.11. *Wash Bay*

A wash bay will be located next to the trackless workshop for cleaning vehicles and equipment. The facilities at the wash bay will include high-pressure water hoses and an oil-water separator for the vehicle rinse pads. Wash water will be conveyed from the separator to a lift station and then to the Never Sweat Tunnel, where it will be combined with EPS contact water and delivered into the WPS process water system via a 12-in pipeline in the Never Sweat Tunnel.

3.2.10.12. *Fire Water, Service Water Dams, and Pumping Systems*

Mine service water will be supplied from CAP water piped to a storage forebay tank and pump station located at the WPS entrance to the Never Sweat Tunnel. The water will be pumped from the forebay tank through the Never Sweat Tunnel to Shaft 9 and then up to the new EPS Mine Service Water Tank. The refrigeration and ventilation systems will be serviced from chilled water and ice water dams near the cooling towers, which will be sourced from this Mine Service Water Tank. Two additional service water dams will be supplied by the tank to provide service water to the shafts and underground facilities. This mine service water will also be used for dust suppression throughout EPS. In addition to the Mine Service Water Tank, a new Fire Flow Tank and diesel pump station will be constructed to supply fire flow to all EPS facilities. More detail regarding service water systems and water supply at EPS and the Mine area is provided in ***Sections 3.5.3.2 and 3.6***. Additionally, more information on fire prevention and response may be found in ***Appendix M***.

3.2.10.13. *Potable Water and Wastewater Treatment and Disposal Facilities*

Potable water will be supplied to EPS from both the Arizona Water Company system at WPS and the existing potable water system within Shaft 9. The water from WPS will be delivered via a pipeline located in the Never Sweat Tunnel. The potable water for EPS will be delivered to the two existing tanks at the site and pumped as required to supply potable water demands.

A sewage collection system consisting of a combination of gravity and pumped sewer infrastructure will be constructed for the underground mine facilities. The sewage collected in the various mine levels will be pumped to the surface at EPS through a series of progressive cavity high head pumps, where it will be combined with the sewage from the EPS surface facilities for treatment at a packaged WWTP. The WWTP will be an extended aeration biological plant.

Extended aeration or "activated sludge" is a biological process for treating wastewater and separating the solids from the liquid portion of the waste. For this site, the WWTP will be a packaged plant designed by the manufacturer to provide treatment to secondary standards as defined by ADEQ. It will consist of a bar screen, equalization tank, aeration chamber, clarifier, and sludge-thickening tank. The sludge will be thickened in this tank until it can be removed and dewatered by drying beds or a filter press. These processes remove the liquid portion of the sludge and allow the thicker "cake" to dry sufficiently to be taken to a landfill for disposal.

The effluent from the plant will be combined with EPS contact water and delivered into the WPS process water system via a 12-in pipeline in the Never Sweat Tunnel. A pump station will be located at the discharge of the WWTP for the transfer of the treated effluent.

Occupancies at EPS will exceed the design value used to size the WWTP at various points throughout construction. Therefore during construction, portable toilets will be provided at a rate of one per 50 people.

3.2.10.14. *Water Catchment Areas*

The contact water catchment areas to the east of the EPS surface facilities will act as retention basins for stormwater runoff from the parking lots, rooftops, and other impervious areas at EPS. Contact water from these basins will be pumped to the process water system at WPS along with effluent for process water use. Stormwater facilities are sized for the 100-yr, 24-hr storm (5.03 in [13.5 cm]), with 20 percent excess capacity within the basin volume for freeboard. Details are provided in ***Section 4.5.2.1***. and in the Stormwater Drainage Design Memorandum, ***Appendix N***.

3.2.10.15. *Fuel Storage*

Resolution Copper plans to use both aboveground and underground tanks for the storage of diesel fuel at EPS. Two surface diesel storage tanks, each with a 1,000-gallon (3.8-m^3) capacity, will be located near the entrance to the EPS surface facilities. The underground diesel storage tank will have a 20,000-gallon (75.7-m^3) capacity. The diesel will power various emergency generators that will be used for lighting, critical communications systems, and powering the Shaft 13 auxiliary cage in the event of a power outage. Some mobile underground mining and surface support equipment will use diesel fuel. Piping will extend from the diesel tanks to a fueling station adjacent to the tanks.

During the construction phase, diesel fuel will be delivered underground by fuel cubes in Shafts 9 or 10 and/or a fuel line in Shaft 9. Fuel cubes will be stored in the fuel storage facility (fuel bay) until they are empty, at which time they will be sent back to the surface. At full production, fuel will be transferred underground by a fuel line in Shaft 13. The fuel will be transferred into a permanent fuel bay. The underground fuel bay will have containment for spillage, fire suppression, and fire doors.

Fuel lines will be double-walled to detect leaks and will be installed in Shaft 9 for mine development and in Shaft 13 for the life of the mine operation. The fuel lines will be drained empty after every transfer. This is accomplished by installing a smaller tank on the surface than the one underground. Interlocked programmable-logic-controlled valves will prevent the surface tank from transferring fuel unless there is sufficient room in the underground tank.

The delivery of fuel to EPS via a pipeline from WPS was considered, but rejected for safety reasons. The long-distance transport of fuels through highly pressurized fuel lines in an underground setting is hazardous. Fuel will be delivered to the site on a regular basis. Resolution Copper will contract with local or regional suppliers to deliver the required fuel. A receiving station for fuel delivery trucks will be located near the storage tanks. Both the dispensing pumps and the receiving station will be on concrete pads, with any spills collected in a sump within the containment area. Resolution Copper will continue to update and maintain the Spill Prevention, Control, and Countermeasure (SPCC) Plan (***Appendix O***), and all fuel storage will be in compliance with those requirements. The fuel delivery trucks will travel on Magma Mine Road when delivering the fuel and will enter EPS for deliveries. See ***Section 3.9.1*** for the amounts projected to be used and stored at the site.

3.2.10.16. *Explosives Storage*

Explosives will be used in both underground development and production activities in accordance with all applicable regulations. Explosives will be transported to the site by contract transporters approved by the US Department of Transportation (DOT) and holding the requisite federal licenses.

Surface explosives magazines will be located in a series of separate, remote, and fenced (locked) magazines, away from the main surface facility site as shown in ***Figure 3.2-2***. Explosives magazines will be designed and constructed to meet all applicable fire codes; Bureau of Alcohol, Tobacco, and Firearms security standards; and MSHA and industry safety standards.

Although explosives will not be stored underground long term, smaller quantities of explosives will be delivered underground from the main surface magazine to the blasting area for immediate use. Explosives used underground will be handled and used in accordance with all applicable federal and state regulations, following manufacturers' recommendations, by trained and certified personnel. MSHA regulates underground explosives storage, transport, and use in Title 30 Code of Federal Regulations (CFR), Part 57 – Safety and Health Standards – Underground Metal and Nonmetal Mines, Subpart E – Explosives. MSHA recognizes US DOT and Bureau of Alcohol, Tobacco, and Firearms regulations and enforces them at sites over which it has jurisdiction. Further details regarding explosives storage and management can be found in the Explosives Management Plan, ***Appendix P.***

3.2.10.17. *Electrical Substations, Distribution, and Emergency Generators*

An existing 115-kV substation (Oak Flat) is located at the northern end of EPS. It will be upgraded or reconstructed to the east of the existing facility for pre-production activities and for backup power for the Underground Mine area. A new 230-kV Oak Flat substation will be constructed north of the production shafts. This substation will supply 230-kV power to the Production Power Substation at the northern edge of the production site. Off-site electrical transmission and distribution is discussed in detail in ***Section 3.5.1***. From the main substation locations, the power supply will be distributed via the on-site electrical grid to serve the electrical loads for substations and equipment.

In addition, an Alternate Power Substation and diesel-powered Emergency Generators will be located at EPS. The Emergency Generators will be capable of back-feeding the main distribution system and are sized to operate the service auxiliary hoist in Shaft 13, partial mine cooling/ventilation, and other essential services. The Emergency Generator system will have sufficient capacity to supply the total essential mine load with one of the generators out of service for maintenance.

3.2.10.18. *Communications*

Resolution Copper will maintain multiple methods of communication for the site, including phone lines, leaky feeder radio, cell phones, and voice-over internet protocol, with the associated computer network, dispatch, and central control system to support communications infrastructure. The site will include a system for communicating with and locating miners in case of emergency. Underground communications equipment will be strategically located throughout the underground workings in conformance with MSHA standards. The communications system plans will be modified as technology improves.

3.3. MILLING AND PROCESSING

Several important Project features will be located at the brownfield area of WPS, including rail facilities, development rock stockpiles, new ore processing facilities (Concentrator Complex), conveyor systems, and associated surface infrastructure to support the underground development and mining occurring at EPS. Prior to construction, surveys will be conducted for exact placement of new facilities and infrastructure. This section provides information on the surface mining infrastructure and surface support services at WPS. These WPS project features are shown in ***Figures 3.0-1g, 3.3-1a, 3.3-1b, 3.3-1c, and 3.3-1d***.

3.3.1. PROCESS OPERATIONS AND FACILITIES

3.3.1.1. *Process Overview*

Resolution Copper plans to use conventional sulfide processing techniques for the ore from the proposed underground mining operation (***Figures 3.3-1a, 3.3-1b, 3.3-1c, 3.3-1d, and 3.3-2***). Ore will be delivered via conveyor to the new Concentrator Complex at WPS. The Concentrator is expected to process a nominal 132,000 tons (120,000 tonnes) per day of ore for approximately 40 years, but it is likely that, with process improvements throughout the life of the operation, the nominal production rate will increase. The maximum throughput will be approximately 165,000 tons (150,000 tonnes) per day. However, maximum production rates may be up to 25 percent higher than the nominal rate.

Copper and molybdenum will be recovered by grinding and froth flotation, with the principal recovered minerals being the sulfide copper minerals bornite, chalcocite, and chalcopyrite. Ore is initially crushed underground at EPS to approximately plus-or-minus 6 in (15 cm), skipped in the production shafts to a transfer point located approximately 3,500 ft (1,000 m) below surface, and then loaded onto the Inclined Underground to Surface Conveyor System. This conveyor system transports the ore from EPS to WPS at the covered Ore Stockpile in the Concentrator Complex (***Figures 3.2-3 and 3.3-1a***). The Ore Stockpile is used as a surge stockpile and will be located in a covered facility.

Bench-scale flotation testing work completed on ore samples has determined that average metal recovery will range from approximately 90 to 91 percent for copper and will average approximately 75 percent for molybdenum. The concentrate produced will have average copper and molybdenum grades of approximately 29 to 31 and 52 percent, respectively. The following sections provide information on the planned ore processing at WPS based on ore composition and production. A schematic of the ore process as described in the following sections is provided in ***Figure 3.3-2***. Some variation of the process is expected based on the scale and timing of ramp-up to 132,000 tons (120,000 tonnes) per day, changing ore grades, recovery, and/or market demand.

3.3.1.2. *Concentrator Operation and Support Facilities*

3.3.1.2.1. Ore Storage and Delivery

The WPS Conveyor will deliver ore containing 2 to 5 percent moisture from the WPS Transfer Station into a covered Ore Stockpile building (***Section 3.2.9.8***). The Ore Stockpile is a surge facility for the mining operation to allow for short-term shut-downs of either the Mine or Concentrator operations while still maintaining the other facility in operation. This stockpile effectively disconnects the hoisting production shafts from the conveyors that transport the ore to the Concentrator Complex. With this disconnect, Mine operations can continue even if the Concentrator is shut down, provided there is room at the stockpile to continue to receive ore from the Mine. Similarly, as long as there is ore material in the stockpile, Resolution Copper can continue to deliver ore to the Concentrator when the Mine ore delivery system is not operating.

The building will have a live storage capacity of approximately 132,000 tons (120,000 tonnes) of ore with a total capacity of 441,000 tons (400,000 tonnes). The ore will be reclaimed by gravity onto reclaim feeders beneath the stockpile, which will deliver it to the Concentrator Complex where it will be conveyed directly into the grinding circuit and delivered to the Semi-Autogenous Grinding (SAG) mills.

3.3.1.2.2. Grinding

The grinding circuit will be designed to process a nominal 132,000 tons (120,000 tonnes) per day of ore based on 92 percent equipment availability for 24 hours per day, 7 days per week, and 365 days per year. The grinding circuit will be contained within a fully enclosed building and will be designed to reduce the ore from 80 percent passing 156 mm to 80 percent passing 160 microns as feed to the flotation circuit.

Crushed ore will enter the grinding circuit from apron feeders at the covered Ore Stockpile (***Figure 3.3-2***). It will be ground as a slurry with the addition of water to its desired product size in a two-stage grinding circuit utilizing two SAG mills and four ball mills, or three SAG mills and six ball mills, to achieve the overall nominal tonnage of 132,000 tons per day. Parallel SAG mills will operate in closed circuit with a trommel screen. The undersized material from the trommel screen will be fed to the ball mill circuit primary grinding sump. Oversized materials (pebbles) will be transported by belt conveyors to a vibrating screening plant with discharge screens. The undersized material from the vibrating screening plant reports to the ball mill circuit primary grinding sump, and the screened oversized material returns to the SAG mills via belt conveyor.

Secondary grinding will be performed in two ball mills operated in parallel for each SAG mill. Each ball mill will operate in closed circuit with hydrocyclone classifiers (cyclones). SAG mill and trommel screen undersize in the primary grinding sump will be pumped to the cyclones. Cyclone underflow will be fed to the ball mills. Ball mill discharge will be combined with trommel and vibrating screening plant undersize and pumped via the primary grinding sump back to the cyclones. Cyclone overflow, the final grinding circuit product, will be delivered to the flotation circuit.

The final design and drawings for the Concentrator Complex may be modified to a different number of SAG mills, ball mills, and flotation cells to achieve the same processing rate as described.

3.3.1.2.3. Bulk Copper-Molybdenum Flotation

Ore and water slurry from the cyclones will be processed in the bulk copper-molybdenum flotation circuit (***Figure 3.3-2***). During this process, the minerals in the copper-molybdenum slurry are further concentrated using reagents and air to float the copper and molybdenum to the surface of the slurry for recovery.

Cyclone overflow, at approximately 30 percent solids with a target size of 80 percent passing 160 microns, will pass to the flotation circuit via a splitter box. In the splitter box, flotation reagents will be added and the flow will split to two banks of flotation cells per SAG mill. The reagents attach to the desired copper and molybdenum minerals, which are recovered in froth from the top of the flotation cells. Copper and molybdenum minerals are recovered from the rougher and scavenger cells in a series of cells in each of the rougher/scavenger banks. Normally, the first few cells produce a rougher concentrate. The rougher concentrate contains recovered copper and molybdenum sulfide minerals and gangue. This concentrate flows by gravity to the regrind and cleaner circuits to prepare the minerals for further flotation processing. The last few cells produce a scavenger concentrate containing pyrite that is pumped to the pyrite thickener.

The rougher concentrate regrind circuit utilizes vertimills connected to the SAG mill circuit to grind the rougher concentrate to 80 percent passing 40 microns to help separate the copper and molybdenum minerals from the remaining gangue material in the cleaner flotation circuit. The regrind circuit discharge is pumped to the cleaner circuit, which is made up of the first cleaner and cleaner scavenger/flotation tank cells, the second cleaner flotation tanks cells, and the third cleaner column cells. The cleaner circuit product, which contains the copper and molybdenum sulfide minerals, is pumped to thickener tanks (bulk thickeners) prior to reporting to the molybdenum flotation circuit to separate the molybdenum and copper sulfides.

Flotation reagents are used in the flotation cells to facilitate the separation of the mineralized material from the barren ground rock material. Flotation reagents will be added to both the rougher circuit and the cleaner circuit on an as-needed basis. A list of the reagents used in flotation is provided in ***Section 3.3.1.3***.

Bulk copper-molybdenum flotation generates two types of tailings: scavenger tailings and cleaner tailings. Scavenger tailings are the tailings product that will be produced from the rougher/scavenger circuit described above; they are mostly devoid of sulfide minerals and residual metals concentrations. The scavenger tailings report to the tailings thickeners at WPS. Cleaner tailings are the tailings produced in the copper-molybdenum cleaner circuit, also described above. The cleaner tailings are enriched in sulfide minerals, predominantly pyrite, and contain residual metals that are pumped to the pyrite thickener at WPS. The scavenger tailings thickener underflow and pyrite thickener underflow are pumped separately to the tailings head tank, and are handled differently in the tailings placement process. A description of the tailings handling process, water balance, and containment/storage capacities of the water systems is provided in ***Sections 3.3.10 and 4.5.2***.

3.3.1.2.4. Molybdenum Circuit

The copper-molybdenum concentrate is recovered from the bulk thickeners for copper and molybdenum separation. Thickener overflow (water) will be pumped to the copper concentrate thickener. Thickener underflow (high-density mineral slurry) will be pumped to a fully enclosed building that houses the molybdenum flotation circuit.

The molybdenum flotation circuit will consist of rougher flotation mechanical cells, cleaner mechanical and column cells, and a regrind circuit. Reagents will be added to the molybdenum plant feed slurry to facilitate the separation of the molybdenum from the copper sulfide and other gangue in the molybdenum flotation cells. The underflow from the molybdenum flotation circuit cells is the final copper concentrate.

Molybdenum concentrate will report from a filter feed tank to a molybdenum concentrate filter. Molybdenum filter cake will discharge to a dryer equipped with a baghouse. The dried concentrate will report to concentrate storage bins and subsequently into a molybdenum packaging system for loading super sacks or other product containers. The molybdenum super sacks or other containers will be loaded onto trucks for shipment to customers.

3.3.1.2.5. Copper Concentrate Dewatering, Transport, and Loading

Copper concentrate slurry will be dewatered and thickened in a copper concentrate thickener. Thickener overflow (water) will be pumped to the process water system. Thickener underflow (thickened mineral slurry) will be pumped via pipelines within the MARRCO Corridor to the Filter Plant and Loadout Facility located between Florence Junction and Magma (***Figure 1.2-2***).

The Filter Plant and Loadout Facility is briefly summarized here, with additional discussion provided in ***Section 3.3.11***. At the filter plant, concentrate will be piped directly into a series of agitated copper concentrate stock tanks. Concentrate from the stock tanks will be pumped to a building containing automatic filter presses where the moisture content of the concentrate will be reduced. Concentrate will be filtered to approximately 8 to 10 percent moisture in the filter cake. Filtrate water will be combined with CAP water at the Filter Plant and Loadout Facility for delivery back to WPS for process and service water use.

The copper concentrate filter cake from the pressure filters will discharge directly onto conveyors that will transport the concentrate to a covered concentrate stockpile for subsequent loading (via front-end loader) onto railcars or trucks. The concentrate will be transported offsite to smelters for further processing. It is expected that between 6,000 and 7,000 wet tons per day (5,500 and 6,500 wet tonnes per day) of concentrate will be shipped out for smelting, subject to rail scheduling. This number will vary depending on the copper content of the ore.

3.3.1.3. *Reagent Storage and Handling*

The reagents used in sulfide mineral processing require careful handling and mixing. Trained reagent technicians will be responsible for the mixing and handling of reagents. These handling activities will occur within the lime plant and the enclosed reagent building adjacent to the Concentrator Complex. Typical reagents and their delivery, storage, and use are further discussed in ***Section 3.9.2***. The reagent storage and handling facilities include spare storage and mixing facilities for other reagents as needed.

3.3.1.4. *West Plant Site Support Facilities*

The Resolution Project will require ancillary facilities and infrastructure at WPS to support the Concentrator and TSF operations. The existing WPS includes limited support infrastructure, but many new facilities will be constructed to support the new operations. This section describes and provides information on the support facilities and infrastructure at WPS. Major surface facilities are shown in ***Figures 3.3-1a, 3.3-1b, 3.3-1c, and 3.3-1d***.

3.3.1.4.1. Site Access Roads, Security Gate, and Internal Site Roadways

WPS is currently accessed via Magma Heights Road within the town of Superior, north of US 60. The site entrance has an existing security building and gate where Magma Heights Road ends at the WPS entrance. A new security building and gate will be located at the new main entrance to WPS off Main Street. This entrance will be used to access the administration buildings and Concentrator Complex at WPS. The site includes fencing and signage to restrict access to the site. Visitors to WPS will park at the guard gate outside the site perimeter fence and check in with security prior to gaining access to the site. A truck staging area and truck scale will be located near the entrance to WPS.

An alternative entrance to WPS will be accessible via Silver King Mine Road (FR 229). This access will be secured to restrict public access and will be used for construction and access to the substation. Visitors will be required to check in at an entrance with a security building and gate prior to accessing the site via the Silver King Mine Road entrance. The section of FR 229 between US 60 and private property owned by Resolution Copper will be reconstructed in order to allow construction and mine equipment to access this entrance. Details of the reconstruction are provided in the Road Use Plan in ***Appendix K***.

Roadways for small vehicle access, the delivery of materials and equipment, access to the Concentrator Complex, and the handling of development rock will be provided throughout the site. All traffic at WPS will be right-hand travel. Transportation both inside and outside WPS is further discussed in ***Sections 3.4.1.2.3 and 3.4.2***.

3.3.1.4.2. Administration Buildings

Resolution Copper will continue to use existing administration buildings at WPS and will also construct a new administration building at the site. The existing buildings have been renovated from previous uses. The administration and office buildings at WPS will provide office space for reception, mine management, document control, operations, engineering, safety, and environmental personnel. Space will also be available for conference and safety training rooms, a metallurgical laboratory, a first aid clinic, and a change house facility (dry). The new administration building will be accessed via a new entrance to WPS off Main Street in the town of Superior. Other offices to support the Concentrator Complex will be located within the various site buildings.

The laboratory area in the new administration building will consist of a sample preparation area, wet laboratory, metallurgical laboratory, environmental laboratory, and offices. An overhang will be provided at the eastern end of the building to receive materials into the sample preparation area. The sample preparation area will contain sample crushers, pulverizers, sample splitters, and a dust collection system to capture and contain any dust generated from these operations. The analytical laboratories will contain the wet laboratory, a reagent storage area, balance rooms, and analytical equipment. The laboratories will have systems to properly collect and manage waste chemicals. Disposal of the chemical or laboratory wastes will follow appropriate regulatory requirements depending on the waste generated.

The new men's and women's dry at the new administration building will include lockers, lavatories, and showers. A medical facility at the new administration building will house first aid supplies and personnel, and provide for first response in emergencies. A garage for emergency vehicles will also be available.

3.3.1.4.3. Employee and Visitor Parking

Parking will be provided at several locations at WPS. The main parking area will be constructed along the entrance road south of the Concentrator Complex and new administration building. This new parking area will provide space for approximately 650 additional vehicles. A shuttle may be utilized to transport employees and contractors from this parking area to the Concentrator Complex and to EPS, if necessary.

A parking lot is currently located near the existing mine administration building. Additional parking will be provided adjacent to the new administration building. A small parking area with space for approximately 10 vehicles will be located near the guard house outside the site perimeter.

3.3.1.4.4. Safety, Medical, and Training Facilities

WPS is located close to the cities of Superior and Globe where hospital and ambulance services are available in case of medical emergencies. The nearest Level-1 trauma centers are Maricopa Medical Center in central Phoenix and the Scottsdale Osborn Medical Center, both of which are approximately 60 mi (100 km) from WPS. Resolution Copper has an emergency services agreement with the town of Superior, and safety and medical facilities for first responders will be provided at WPS. A first aid facility will be located at the new administration building to house first aid and safety personnel and provide for first response in emergencies. A garage will also be available for emergency vehicles. Resolution Copper will have on-site first responders for medical emergencies and firefighting. First aid supplies and kits will be located strategically around WPS, including in or near office buildings, the Concentrator Complex, and warehouses. Training rooms will be provided in the mine administration facilities. Resolution Copper will have the capability to conduct new miner and refresher training on site. Helipad sites will be located at EPS, WPS, and the Filter Plant and Loadout Facility to transport individuals by helicopter to advanced medical facilities if the need arises. Please see the Emergency Response and Contingency Plan (***Appendix L***) and the Fire Prevention and Response Plan (***Appendix M***) for further details.

3.3.1.4.5. Maintenance Shops and Warehouse

The surface maintenance facilities at WPS will include workshops for the maintenance of light equipment, rubber tire equipment, and rail equipment. Storage facilities will include a warehouse and several large laydown yards for materials. See ***Section 3.9*** for further description of the materials to be stored.

3.3.1.4.6. Fuel Storage and Wash Bay

Resolution Copper plans to use aboveground tanks for the storage of diesel fuel at WPS. The primary diesel fuel tank will be located north of the warehouse next to a truck wash bay, with the storage of smaller quantities in various tanks throughout the site. Dump trucks and other mobile and surface support equipment will use diesel fuel. Diesel will also power the various emergency generators that will be used for lighting and critical communications systems in the event of a power outage. Piping will extend from the diesel tank to a fueling station adjacent to the tank. The diesel storage tank at WPS will have a 15,000-gallon (57-m^3) capacity (Air Sciences 2013). Spill prevention, control and countermeasures are provided in ***Appendix O***.

Fuel will be delivered to the site on a regular basis. Resolution Copper will contract with local or regional suppliers to deliver the required fuel. A receiving station for fuel delivery trucks will be located near the storage tanks. Both the dispensing pumps and the receiving station will be on concrete pads, with any spills collected in a sump within the containment area. Resolution Copper will continue to maintain its SPCC Plan, and all fuel storage will be in compliance with those requirements. The fuel delivery trucks will enter the site from the Main Street gate when delivering fuels. See ***Section 3.9*** for the amounts projected to be used and stored.

A wash bay will be located next to the fuel station at WPS for cleaning vehicles and equipment. The facilities at the wash bay will include high-pressure water hoses and an oil-water separator for the vehicle rinse pads.

3.3.1.4.7. Other Facilities at the Concentrator Complex

Air compressors will be installed near the Concentrator to supply compressed air for equipment at the Concentrator Complex. The compressors will be sheltered from the weather in an enclosed structure that will also muffle sound.

The Concentrator Complex will also include a building for storing and handling reagents, a lime plant, the flotation electrical building, and the stockpile electrical building.

3.3.1.4.8. Refrigeration and Ventilation Facilities

Surface facilities for refrigeration and ventilation are generally located at EPS. These are discussed in detail in ***Section 3.2***. The Never Sweat Tunnel is ventilated between EPS and WPS from Shaft 6. The

Conveyor/Infrastructure Tunnel will be supplied refrigerated air from the skip discharge level at EPS and tunnel portal at WPS. A new exhaust raise and ventilation fans will be constructed at WPS to vent air from the Conveyor/Infrastructure Tunnel.

3.3.1.4.9. Water Treatment Plant

WPS includes an existing high-density treatment system for the treatment of mine dewatering water to reduce total dissolved solids, metals, and pH prior to delivery to the NMIDD. During operations, mine dewatering water will be incorporated into the tailings thickeners, but the facility will remain in place for interim closure purposes as described in ***Section 5***.

3.3.1.4.10. Tanks and Pumping Systems

Process water for WPS use will be stored in the 50-million-gallon (190,000-m^3) Process Water Pond. This pond will receive water from the CAP well field and CAP canal, filtrate from the Filter Plant, reclaim water from the TSF, and contact water pumped from the local contact water ponds. Overflow water from the tailings, copper, and pyrite thickeners will drain or be pumped to the Tailings Thickener Overflow Tank for pumping back to the Process Water Pond where it will be recycled.

The Process Water Pond will be located north of the Concentrator Complex at a higher elevation than the facilities at WPS. This arrangement will allow the pond to serve the WPS facilities through gravity flow, thus removing the need for a pump station. An emergency overflow and a diversion ditch will be provided to route any potential overflows to a contact water pond south of the Concentrator Complex. The pond will be constructed so that it is double-lined with leak detection and collection in accordance with the ADEQ BADCT requirements (***Figure 3.3-1d***).

Predicted Process Water Pond water quality is shown in Table 5.1 of ***Appendix Q***. The predicted annual average solute concentrations show that pH will average about 6.8 to 7.1 in Years 1 to 3, then generally increasing to range between 8.0 and 8.5 during the remaining years. Predictions of sulfate chemistry show average annual concentrations that range between 1900 mg/L and 3400 mg/L, depending on the rate of lime addition during ore processing, but generally increasing toward the end of mine operations due to evaporation from the TSF. Additional details on predicted water quality are provided in ***Appendix Q***.

Service water will consist of water from the CAP canal, CAP well field, and filtrate from the Filter Plant. It will be transported to WPS through the 36-in (91-cm) water supply pipeline. The service water that will be used at WPS will be routed from this 36-in (91-cm) water supply pipeline through a 36-in (91-cm) CAP water supply line to the CAP Water Distribution Tank. This tank is located near the Ore Stockpile and is at a higher elevation than the Concentrator Complex. The CAP Water Distribution Tank will provide makeup water via gravity to the Tailings Diverter Box for use in the Concentrator Complex. It will also provide gland water throughout WPS and fresh water to the Molybdenum Plant.

Fire flow will be provided by a fire water system specifically constructed for the WPS facilities. The Fire Water Tank will be located at the same site as the CAP Water Distribution Tank and will be filled from the same CAP Water Tank supply line. The Fire Water Tank will be kept full in case of emergency and will be equipped with a pumping station for pressurizing the fire distribution system.

Mine service water will be routed from the 36-in (91-cm) water supply line through a 16-in (41-cm) pipeline to the Mine Water Tank located near the WPS entrance to the Never Sweat Tunnel. Mine service water will also be pumped from the Mine Water Tank through a water pipeline located within the Never Sweat Tunnel to EPS for use in the dust-suppression and refrigeration and ventilation systems.

Details regarding process water systems and water supply at WPS are provided in ***Sections 3.5.3.2 and 3.6***.

3.3.1.4.11. Potable Water and Wastewater Disposal Facilities

Potable water for WPS will be supplied from the Arizona Water Company Superior system to the existing Resolution Copper 500,000-gallon water tank located within WPS. This tank is equipped with a level control valve that automatically opens when the tank drops to a certain preset level and closes once the tank is full. It is also equipped with a chlorination system that provides consistent chlorine dosing to reduce the potential of system contamination. The tank currently provides both potable water and fire flow to the existing administration buildings at WPS. The potable water supply from the tank will be extended to serve the Concentrator Complex and all new buildings via gravity where possible. However, a new pump station may be required at the existing tank to supply adequate pressure to some or all of these new facilities. Fire flow supply to the new facilities will be available via the Fire Water Tank as previously discussed in ***Section 3.3.1.4.10***.

The current wastewater disposal at WPS is via gravity sewers that discharge to the town of Superior wastewater collection system for treatment at the municipal treatment plant facility. During operations, the treated effluent from a new wastewater treatment plant at WPS will be reused in the Concentrator as process make-up water. During construction, portable toilets will be provided at a rate of one toilet per 50 people.

3.3.1.4.12. Retention and Contact Water Ponds

Contact water basins will be built to act as storage facilities for contact stormwater from WPS (***Figure 3.3-1c***). The basins are sized to contain the 100-yr, 24-hr storm (5.03 in [13.5 cm]), with 20 percent excess capacity within the basin volume for freeboard. Details are provided in ***Section 4.5.2*** and in ***Appendix N***.

3.3.1.4.13. Electrical Substations and Distribution

The existing 115-kV Trask substation is located within WPS and the existing 230-kV Superior substation is present west of WPS. A new 230/34.5-kV WPS substation will be constructed northeast of the existing Superior substation to supply power to the Concentrator Complex and WPS facilities. The power supplied from the existing 115-kV substation at Trask will be replaced with a 34.5-kV overhead transmission line to a new 34.5/4.16-kV transformer. Electrical transmission and distribution for WPS is discussed in detail in ***Section 3.5.1***. New substations will be constructed at WPS as required for equipment loads, and from the substation locations the power supply will be distributed via the on-site electrical grid to serve the electrical loads for all equipment.

3.3.1.4.14. Communications

Both telephone and internet communications currently exist at WPS. These facilities will be extended as required to the new facilities. In addition, Resolution Copper will maintain multiple methods of communication, including leaky feeder radio, cell phones, voice-over internet protocol with the associated computer network, dispatch, and a central control system to support communications infrastructure. The site will include a system for communicating with and locating miners in emergencies. Underground communications equipment will be strategically located throughout the underground workings in conformance with MSHA standards. The communications system plans will be modified as technology improves.

3.3.1.4.15. Temporary Construction Facilities

Temporary construction facilities will be provided for the construction phase of WPS at a location immediately south of the Intermediate Rock Stockpile. The temporary facilities will include approximately 20 ac of contractor and subcontractor laydown yards. The temporary construction area will also house all the contractor and subcontractor construction trailers and will include parking spaces.

3.3.2. ORE HANDLING

At full production, Shafts 11 and 12 will be dedicated to hoisting ore and other rock material from the mine. The primary crushed ore will be transported via the Lower Level Conveyor System to the production shafts and then skip-hoisted within the shafts. Once the skips reach the discharge level, the ore will be gravity fed into discharge bins, which will become the feeder source for the high-speed Inclined Underground to Surface Conveyor System. This system will move the ore through the Conveyor/Infrastructure Tunnel to the covered Ore Stockpile at the WPS Concentrator Complex. The Ore Stockpile is a surge facility that allows mining operations to continue during short-term shut-downs of either the Mine or Concentrator while still maintaining the other facilities in operation. The building will have a live storage capacity of approximately 132,000 tons (120,000 tonnes) of ore with a total capacity of 441,000 tons (400,000 tonnes). The ore will be reclaimed by gravity onto reclaim feeders beneath the stockpile, which will deliver the ore to the Concentrator Complex where it will be conveyed directly into the grinding circuit and delivered to the SAG mills. Ore handling is further described in ***Sections 3.3.1.2.1 and 3.2.9.8***.

3.3.3. EXPECTED PRODUCTION RATE

After ramp-up, the ore processing rate is predicted to be 132,000 tons (120,000 tonnes) per day, 365 days per year, with a maximum throughput of approximately 165,000 tons (150,000 tonnes) per day. The Concentrator is expected to process a nominal 132,000 tons (120,000 tonnes) per day of ore for approximately 40 years, but process improvements throughout the life of the operation could increase the nominal production rates of both ore production and ore processing. Further information is provided in ***Section 3.3.1***.

3.3.4. SEASON OF OPERATION

Mining operations would be run continuously, 24 hours per day, 7 days per week, 365 days per year, for the life of the mine. This would include underground mining operations as well as processing operations. Further details are given in ***Sections 3.2.9 and 3.3.1***.

3.3.5. EQUIPMENT TO BE USED FOR CONVEYANCE-CRUSHING-AGGLOMERATION AND PROCESSING

Resolution Copper will employ an underground rail haulage system that uses electric semi-autonomous locomotives to pull railcars fed by ore chutes from the various ore passes. The railroad cars will be loaded continuously directly under the chutes. The rail system will be a looped configuration, with two parallel drifts (see ***Section 3.2.9.6***). Resolution Copper will use up to three gyratory crushers, installed in parallel beneath the rail haulage level. Each crusher will be supplied with ore from a coarse ore bin located in the rock material above the crusher and fed by the dumping of railcars (see ***Section 3.2.9.7***).

A series of conveyor facilities will transport ore from the mine and production shafts at EPS to the covered Ore Stockpile at WPS. The building will have a live storage capacity of approximately 132,000 tons (120,000 tonnes) of ore with a total capacity of 441,000 tons (400,000 tonnes). The ore will be reclaimed by gravity onto reclaim feeders beneath the stockpile, which will deliver it to the Concentrator Complex. This system and the equipment used are described in ***Section 3.2.9.8***.

The grinding circuit will be contained within a fully enclosed building and will be designed to reduce ore from 80 percent passing 156 mm to 80 percent passing 160 microns as feed to the flotation circuit. The crushed ore will enter the grinding circuit from apron feeders at the covered Ore Stockpile. The ore will be ground as a slurry with the addition of water to its desired product size in a two-stage grinding circuit utilizing two SAG mills and four ball mills, or three SAG mills and six ball mills, to achieve the overall nominal tonnage of 132,000 tons per day. Secondary grinding will be performed in two ball mills operated in parallel for each SAG mill. Cyclone overflow, the final grinding circuit product, will be delivered to the flotation circuit. Ore and water slurry from the cyclones will be processed in the bulk copper-molybdenum flotation circuit. During this process, the minerals in the copper-molybdenum slurry are further concentrated using reagents and air to float the copper and molybdenum to the surface of the slurry for recovery. Further details regarding the grinding and processing equipment are provided in ***Section 3.3.1.2.***

No agglomeration is proposed.

3.3.6. SCHEMATIC OF PROCESS CIRCUIT

A schematic of the ore processing flow diagram is presented in ***Figure 3.3-2***. A full description of the ore processing circuit is discussed above in ***Section 3.3.1***, including ore storage, delivery, and grinding; the bulk copper-molybdenum flotation circuit; the molybdenum flotation circuit; and copper concentrate dewatering, transport, and loading process.

3.3.7. DESIGN OF PROCESS FACILITIES

The new ore processing facilities (Concentrator Complex), conveyor systems, and associated surface infrastructure to support the underground development and mining facilities will be located at the brownfield area of WPS. A full description of the process facilities is presented above in ***Section 3.3.1***, including ore delivery and grinding; the bulk copper-molybdenum flotation circuit; the molybdenum flotation circuit; and copper concentrate dewatering, transport, and loading process.

3.3.8. MITIGATION AND MONITORING

Hydrologic monitoring and mitigation for the Project include the construction and maintenance of diversion channels to route precipitation runoff away from the surface facilities and to capture and contain on-site (contact) stormwater for incorporation back into the process water supply system. These facilities have been sized to handle runoff for at least the 100-yr, 24-hr storm event, with the exception of the TSF, which has been sized for the 100-yr, 30-day storm event, and the TSF diversion channels, which have been sized for the probable maximum flood. For the management of precipitation runoff within the Project sites, all contact water basins will be lined according to BADCT standards and will be emptied after each storm event. Contact water will be reused via incorporation into the water supply system.

The TSF will be managed to minimize dust generation and acid rock drainage (ARD). Fugitive dust emissions will be monitored during operations at the TSF and actively managed with sprinklers and dust suppressants as necessary. Where practicable, the outer slopes of the TSF will be progressively reclaimed (see ***Section 4.4.3***). Resolution Copper will implement best management practices and other protection measures to prevent and minimize impacts from ARD and to limit impacts to groundwater and surface water (see ***Section 4.5***).

Geochemical monitoring and mitigation involve the management and segregation of PAG rock in the Intermediate and Development Rock stockpiles, and the management of the TSF. Based on the ore geochemical characterization work, the majority of the material from characterization and underground development will be PAG and will be stored in the two permitted stockpiles under the ADEQ APP Program. Once mine production commences, no waste rock will be produced, and all material from the stockpiles that cannot be beneficially used in reclamation will be processed as ore at the Concentrator. Stockpiles will be removed and concurrently reclaimed as outlined in ***Section 6.*** Further discussion on mitigation and monitoring is provided on ***Sections 4 and 6***.

3.3.9. DEVELOPMENT ROCK HANDLING AND STORAGE

Underground characterization and mine development involve a high level of construction activity as the undercut and extraction infrastructure is created. As a result, Resolution Copper will generate development rock from underground excavations. Development rock material will be transported from EPS to WPS for storage via rail through the Never Sweat Tunnel. The development rock will be delivered to the Loadout Rock Stockpile under the railroad loadout facility at WPS and subsequently hauled via dump truck to either the Intermediate Rock Stockpile or the Development Rock Stockpile, or will be segregated for beneficial use for reclamation or construction (***Figures 3.3-1a and 3.3-1b***). The stockpiles have been permitted to contain both inert and reactive materials (such as sulfides), and thus both stockpiles will be characterized as PAG (Golder 2010; 2011; 2011a). However, to the extent possible, NPAG shaft development rock will be segregated and beneficially used as store-and-release cover material for reclamation or construction material. “Store-and-release” or evapotranspiration covers minimize infiltration into the underlying material by acting as a sponge to store water from precipitation events until it is evaporated or transpired by plants growing in the cover material. This is the same practice and approach that was used for the Shaft 10 rock, where NPAG material was used to reclaim legacy tailings sites at WPS. Based on the ore geochemical characterization work, a large majority of the material from characterization and underground development will be PAG and will be stored at permitted stockpiles under the ADEQ APP Program in two stockpiles called the Intermediate Rock Stockpile and the Development Rock Stockpile.

The Intermediate Rock Stockpile will have a capacity of 498,000 yd^3 (774,000 tons [702,000 tonnes]) while the Development Rock Stockpile will have a capacity of 10.3 Myd^3 (16.0 Mtons [14.5 Mtonnes]).

Once mine production commences, no waste rock will be produced, and all material from the Mine (regardless of copper content) will go to the Concentrator for processing as ore. The previously excavated development rock that is PAG will be removed from the stockpile areas and processed with the ore at the Concentrator. Excavated development rock that is NPAG will be beneficially used for reclamation or construction material.

3.3.10. TAILINGS STORAGE FACILITY PROJECT FEATURES

Tailings are the processed non-economic component that results from copper ore processing. Tailings material is essentially ground rock that, depending on the milling process, ranges in size from clay or silt to coarse sand. The solids density[5] of tailings likewise varies depending on the grind, mineralogy, and transport rheology. For conventional thickened tailings, the solids density generally ranges from 35 to 65 percent solid during transport and discharge. Deposition methods are dependent on a number of factors, including:

- Water balance;
- Tailings rheology (grain size and specific gravity) and transport distances to storage facility;
- Seismic and geotechnical conditions;
- Volumes; and
- Environmental and closure considerations.

Tailings represent a significant volume of material that must be transported and stored in a geotechnically and geochemically safe and manageable manner. In the case of the Resolution Project, approximately 1.5 billion tons (1.4 billion tonnes) or 1.3 billion yd^3 (1.0 billion m^3) of tailings will be produced. The projected cumulative tailings volume that will be produced over the life of the Project is presented in ***Exhibit 3.3-1 and Table 3.3-1***, which also identifies the volume of both scavenger and cleaner tailings. This section provides a discussion of the tailings site alternatives evaluated, a description of the selected tailings site, tailings physical and geochemical characteristics, TSF construction methods, operation, the tailings distribution system, the reclaim water system, support and service roads, electrical distribution, rock quarries and borrow sources, and reclamation and closure.

[5] Solids density is defined as the percentage of dry weight of tailings solids relative to the total combined weight of tailings solids and process water in the final tailings slurry.

Exhibit 3.3-1 Projected Tailings Volume Over Time

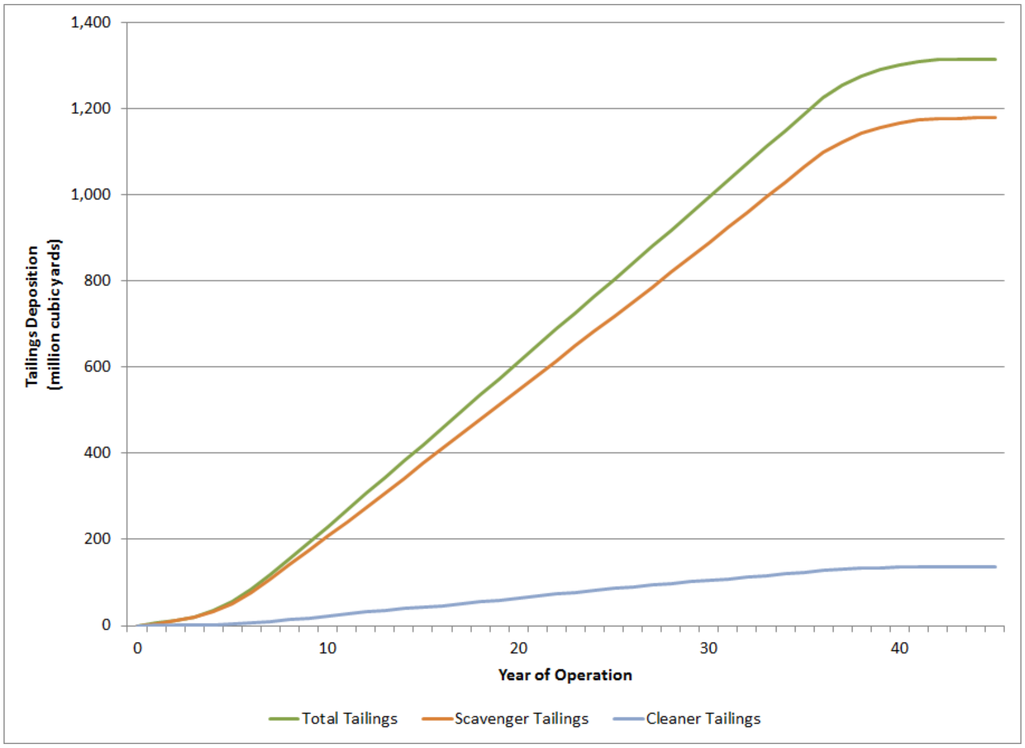


Table 3.3-1 Projected Tailings Volume by Year of Operation

Year	Scavenger Tailings yd^3/year*	Cleaner Tailings yd^3/year*	Scavenger Tailings Cumulative yd^3	Cleaner Tailings Cumulative yd^3	Total Tailings Cumulative yd^3
1	5,174,521	381,017	5,174,521	381,017	5,555,539
2	6,980,012	509,098	12,154,533	890,115	13,044,648
3	7,049,588	528,230	19,204,121	1,418,346	20,622,466
4	13,405,701	1,086,506	32,609,822	2,504,851	35,114,673
5	19,502,964	1,750,422	52,112,785	4,255,273	56,368,058
6	25,532,596	2,474,396	77,645,381	6,729,669	84,375,050
7	30,059,598	3,120,778	107,704,979	9,850,447	117,555,426
8	33,875,532	3,877,850	141,580,512	13,728,297	155,308,809
9	33,368,521	4,220,099	174,949,033	17,948,396	192,897,429
10	33,123,795	4,554,815	208,072,828	22,503,211	230,576,040
11	33,178,617	4,765,817	241,251,446	27,269,029	268,520,474
12	33,604,318	4,680,152	274,855,763	31,949,181	306,804,944
13	32,905,574	3,988,536	307,761,338	35,937,717	343,699,054
14	34,620,256	3,677,254	342,381,593	39,614,970	381,996,563
15	34,801,978	3,574,170	377,183,572	43,189,140	420,372,712
16	34,557,016	3,737,740	411,740,588	46,926,880	458,667,468
17	34,185,228	4,011,037	445,925,816	50,937,917	496,863,733
18	33,859,430	4,312,045	479,785,246	55,249,962	535,035,208
19	33,623,611	4,573,680	513,408,857	59,823,642	573,232,499
20	33,539,439	4,715,209	546,948,295	64,538,851	611,487,146
21	33,754,652	4,605,962	580,702,948	69,144,813	649,847,761
22	34,080,793	4,328,235	614,783,741	73,473,048	688,256,789
23	34,124,728	4,174,855	648,908,469	77,647,903	726,556,372
24	34,042,578	4,167,610	682,951,047	81,815,513	764,766,560
25	33,940,625	4,251,441	716,891,672	86,066,955	802,958,627
26	34,071,081	4,218,262	750,962,753	90,285,216	841,247,969
27	34,406,409	4,031,354	785,369,162	94,316,571	879,685,732
28	34,790,910	3,721,139	820,160,072	98,037,710	918,197,782
29	34,920,627	3,549,276	855,080,699	101,586,986	956,667,685
30	34,795,191	3,633,140	889,875,890	105,220,127	995,096,017
31	34,712,218	3,779,989	924,588,108	109,000,116	1,033,588,224
32	34,827,914	3,798,092	959,416,022	112,798,208	1,072,214,230
33	34,827,914	3,798,092	994,243,936	116,596,300	1,110,840,237
34	34,827,914	3,798,092	1,029,071,850	120,394,392	1,149,466,243
35	34,827,914	3,798,092	1,063,899,765	124,192,485	1,188,092,249
36	34,827,914	3,798,092	1,098,727,679	127,990,577	1,226,718,255
37	24,565,113	2,622,504	1,123,292,791	130,613,080	1,253,905,872
38	19,004,003	2,084,818	1,142,296,795	132,697,899	1,274,994,693
39	13,804,940	1,637,757	1,156,101,735	134,335,655	1,290,437,390

Table 3.3-1 Projected Tailings Volume by Year of Operation

Year	Scavenger Tailings yd^3/year*	Cleaner Tailings yd^3/year*	Scavenger Tailings Cumulative yd^3	Cleaner Tailings Cumulative yd^3	Total Tailings Cumulative yd^3
40	10,346,679	1,274,484	1,166,448,414	135,610,139	1,302,058,553
41	6,708,647	828,456	1,173,157,060	136,438,596	1,309,595,656
42	3,045,196	399,335	1,176,202,257	136,837,931	1,313,040,187
43	1,275,415	191,784	1,177,477,671	137,029,715	1,314,507,386
44	630,803	102,194	1,178,108,474	137,131,908	1,315,240,383
45	181,043	29,769	1,178,289,517	137,161,677	1,315,451,194

* Estimated from average consolidated dry density

3.3.10.1. *Tailings Site Alternatives Evaluated*

Resolution Copper evaluated a number of potential tailings locations within a practicable radius of the proposed Mine site. Alternative tailings locations that were evaluated included an option to store the tailings in the open pit at the Pinto Valley Mine west of Miami and north of US 60, Gila County, Arizona, and a facility designed for an Arizona State Land Department (ASLD) property located east of SR 79 between Florence and Florence Junction (US 60), in Pinal County, Arizona. Although both of these alternate tailings locations offered distinct advantages, they were not selected for the Plan due to land tenure issues. The Pinto Valley Mine was originally the first choice for a tailings disposal site, as it would have allowed for a brownfield tailings solution, but it has been re-activated, employing hundreds of people with a long mine life. A tailings facility on Arizona state trust land is not possible because of existing and competing plans for city development in this area.

As such, Resolution Copper re-evaluated other tailings locations within a reasonable approximately 20-mi radius of the proposed Mine site. The initial high-level screening criteria included favorable topography and sufficient storage capacity. Tailings locations resulting from this initial screening were identified for further analysis and discussion with the communities that surround the Project area. All of these initial tailings alternatives are located on FS land (***Figure 3.3-3***) and include Hewitt Canyon, Whitford Canyon, Silver King Canyon, Telegraph Canyon, Lower West (between the Roblas Canyon Drainage and the Potts Canyon Drainage), and Lower East (between the Potts Canyon Drainage and the Silver King Canyon Drainage).

Resolution Copper completed a preliminary environmental and engineering evaluation for each of these alternatives. The evaluation included the likely presence of cultural resources and threatened and endangered species; recreation and land use; proximity to communities; land ownership; predominant wind direction; proximity to wilderness areas; visibility; geology; groundwater and surface water hydrology, including the presence of significant surface and groundwater resources; environmental performance; and reclamation method. With this information, Resolution Copper developed some preliminary designs and layouts of the selected tailings alternatives.

Because Resolution Copper has placed considerable value on community input, it coordinated the formation of a Community Working Group to share concerns and ideas on tailings and other issues related to the Resolution Project. The group is made up of representatives of local groups in Superior and Queen Valley, including Project opponents. Meetings of the Community Working Group were facilitated by a third party, John Godec of Godec, Randall and Associates, Inc., who has expertise in bringing people of diverse backgrounds and interests together to discuss and resolve issues. The issue of tailings was brought up early in the formation of the group, with the goal of obtaining community input into identifying the most viable and least objectionable site for tailings disposal.

The group identified siting criteria that were likely of greatest importance to their respective communities, including visibility, reclamation, surface water avoidance, groundwater protection, recreation, and general way of life in the communities. The siting criteria were compared to Resolution Copper's siting considerations and applied to a number of tailings locations. Group members selected their top two tailings locations (with the exception of one opposition member, who did not want to be a part of the vote). The group unanimously selected the Arizona state land option as the most favorable tailings site, with the understanding that there are competing interests for that land and that it is not owned by Resolution Copper; the majority of the group then selected a site on FS land called "Lower West." The tailings option (TSF) presented in this Plan is the "Lower West" site. Located on FS land, it is considered the most viable and least objectionable by the Community Working Group and Resolution Copper (RCM 2013).

3.3.10.2. *Tailings Placement Overview*

Based on all the information identified above, the Lower West TSF site (***Figure 3.3-3a***) was chosen for the GPO because it provides advantages over the other assessed locations, including:

- Lesser visual and environmental impacts to local communities in Queen Valley and Superior;
- Favorable geology for seepage control and long-term care and custody;
- Avoidance of higher value recreation lands and significant surface and groundwater resources;
- Least impacts to ephemeral drainages;
- Favorable topography for tailings life of mine deposition and staging (disturbance as needed);
- Low local seismic potential on bedrock foundation; and
- Plausible and favorable land tenure.

Also, the design of the TSF landform at the Lower West area will allow for the facilitation of concurrent reclamation and closure to industry-accepted and regulatory standards in parallel with operations staged throughout the Project life.

Tailings will be delivered from the Concentrator as thickened slurry to the TSF. The two tailings streams that are separated as part of the flotation process are scavenger tailings and cleaner tailings.

Geochemical testing in accordance with the ADEQ APP Program (ADEQ 2004) has shown the scavenger tailings to be largely NPAG with low metals concentrations and the cleaner tailings to be PAG (***Appendix H***). The slurry will consist of tailings mixed with process water. Process water quality is discussed in ***Section 3.3.1.4.10*** and is described in more detail in ***Appendix Q***.

For the NPAG scavenger tailings, a preferred embankment and deposition method has been identified as potentially viable according to the data compiled to date. With all options, embankment construction will start along the southwestern region of the facility, with tailings discharged from slurry lines to the north through spigots (***Figure 3.3-3b***; Year 2). The decantation process will start with solids settling to the north ending at the reclaim pond with pumps, which will recycle water back to the Concentrator Complex. The tailings reclaim pond area and the water volume by year are shown in ***Table 3.3-2***. Two reclaim ponds will be located in the East TSF, one for scavenger tailings and the other for cleaner tailings, from startup until Year 11, at which time the two ponds will merge. In Year 11, the West TSF pond will be formed and operate concurrently with the East TSF pond through Year 17, when these two ponds will merge and operate as a single pond through the remaining life of the Mine.

Table 3.3-2 Tailings Reclaim Pond Area and Water Volume by Year

Year	Pond Area Scavenger and Cleaner (acres)	East Tailings Storage Facility Operating Pond Volume (million gallons)	West Tailings Storage Facility Operating Pond Volume (million gallons)
0	0		
1	115	204	0
2	130	275	0
3	124	278	0
4	159	532	0
5	186	782	0
6	220	1,032	0
7	248	1,224	0
8	209	1,395	0
9	261	1,392	0
10	250	1,397	0
11	381	793[a]	1,199
12	354	793[a]	1,215
13	400	793[a]	1,190
14	399	793[a]	1,252
15	359	793[a]	1,258
16	317	793[a]	1,249
17	247	793[a]	1,236
18	618	1,413	0
19	672	1,416	0
20	590	1,420	0
21	582	1,423	0

Table 3.3-2 Tailings Reclaim Pond Area and Water Volume by Year

Year	Pond Area Scavenger and Cleaner (acres)	East Tailings Storage Facility Operating Pond Volume (million gallons)	West Tailings Storage Facility Operating Pond Volume (million gallons)
22	563	1,422	0
23	576	1,417	0
24	616	1,414	0
25	692	1,414	0
26	542	1,417	0
27	450	1,421	0
28	442	1,421	0
29	412	1,418	0
30	421	1,417	0
31	425	1,421	0
32	431	1,426	0
33	424	1,426	0
34	421	1,426	0
35	429	1,426	0
36	429	1,426	0
37	387	1,003	0
38	358	779	0
39	329	571	0
40	Calculated [b]	528 [a]	0
41	Calculated [b]	528 [a]	0
42	Calculated [b]	528 [a]	0
43	Calculated [b]	528 [a]	0
44	Calculated [b]	528 [a]	0
45	Calculated [b]	528 [a]	0

[a] Extra pond volume was provided for the East TSF from Year 11 through Year 17 and from Year 40 through Year 45 to maintain saturation of the cleaner tailings.

[b] Pond areas are calculated using the ultimate TSF volume-area-elevation curve. Beach areas are calculated by subtracting pond areas from the rest of the contributing areas.

The preferred embankment construction method identified for the scavenger tailings uses an upstream construction method that allows for concurrent reclamation and rehabilitation. The tailings will be discharged through large-diameter spigots along the rim of the southern embankment (***Figure 3.3-3b***) and form a flatly sloped beach, with supernatant water flowing to the reclaim pond area downstream of the proposed embankment area. From the point of discharge, the tailings will segregate from coarser to finer gradation as they flow downstream (***Figure 3.3-7a***). Periodically, the coarse component of the tailings adjacent to the embankment will be excavated and used to raise the embankment in an offset upstream fashion (***Figure 3.3-7d***). Because the facility is placed and aligned on a shallow grade, the finer material and pond will segregate upslope and consolidate, providing a layer of higher density, lower permeability material along the foundation of the facility above bedrock (in effect slime sealing)

(***Figures 3.3-7a and 3.3-7b***). The design slope of the upstream raise is relatively flat at 5H:1V. Compaction of the fill is not required for stability, but may be needed in places for equipment access. Nominal compaction may be allowed at a later design stage if tests demonstrate no significant decrease in permeability. Permeability is important for drainage, which in turn is important for stability. Compaction, if used, is unlikely to exceed 93 percent Standard Proctor (American Society for Testing and Materials D698).

The method for the storage and containment of the PAG cleaner tailings is consistent with both methods of scavenger tailings construction and operation. The cleaner tailings will be deposited initially in an upstream location within the scavenger cell of the TSF behind an engineered embankment (***Figure 3.3-4***). The preferred method of deposition and storage will be through subaqueous discharge and confinement. The separate pond and embankment for the cleaner tailings will be constructed at a fixed upstream area of the facility within the main TSF and centered above a low-permeability Gila Conglomerate unit. Cleaner tailings will be deposited upstream within the pond area in a saturated state. The cleaner tailings pond will be separate from the scavenger tailings pond until the scavenger tailings slimes (fines) and pond merge and overtake the cleaner tailings pond relatively early in Project life, around Year 8 of operations. Once the ponds merge, the cleaner tailings will be hydraulically placed using discharge pumps within the scavenger slimes (fines), where they will remain saturated and will be continuously encapsulated within the much larger mass of inert scavenger tailings during operation (***Figures 3.3-5 and 3.3-6***). At closure, the cleaner tailings produced during the last few years of mine life will be covered to minimize exposure to oxygen and ARD generation (***Figures 3.3-7, 3.3-7a, 3.3-7b and 3.3-10***).

The Plan calls for the TSF to expand first vertically and then horizontally (***Figures 3.3-3b through 3.3-7***). Developing the Project in stages allows for operational flexibility and limits land disturbances to incremental periods of need matched to potential future options and requirements. This provides flexibility in decision making to assess changes in practice and risks as they relate to land tenure, technological developments, changes in environmental practice, and cost opportunities. ***Table 3.3-3*** shows the TSF footprint by year.

Table 3.3-3 Tailings Storage Facility Footprint by Year

Year	Acres	Year	Acres	Year	Acres
1	185	16	2,560	31	3,469
2	322	17	2,647	32	3,489
3	417	18	2,604	33	3,510
4	556	19	2,791	34	3,512
5	670	20	2,900	35	3,542
6	798	21	2,983	36	3,556
7	900	22	3,058	37	3,554
8	1,062	23	3,115	38	3,562
9	1,223	24	3,195	39	3,568
10	1,343	25	3,242	40	3,572
11	1,790	26	3,299	41	3,572
12	1,999	27	3,371	42	3,572
13	2,140	28	3,406	43	3,572
14	2,294	29	3,437	44	3,572
15	2,380	30	3,447	45	3,572

The TSF will be designed to manage and limit both infiltration and seepage through a combination of:

- Tailings deposition and downstream control on low-permeability materials;
- Seepage collections and cutoff systems on the downgradient side of the facility;
- Water monitoring wells and collection trenches; and
- Upstream surface water collection and diversions away from the tailings.

Additional discussion on groundwater and surface water management is found in ***Section 4***.

Fine scavenger tailings (or slimes) will be deposited over the top of the cleaner tailings through the end of the mine life. Wind erosion of the scavenger fines will be prevented through a combination of measures. Fugitive dust emissions will be monitored during operations at the TSF and will be actively managed with sprinklers and dust suppressants as necessary. In addition, the outer slopes of the TSF will be progressively reclaimed where practicable. The dust management plan for the TSF is depicted in ***Figure 3.3-10b***. Additional details on dust management are contained in ***Section 4.4.3*** and in KCB 2014, Volume I.

During final closure, the remaining cleaner tailings will be covered by recirculating and/or mechanically placing scavenger tailings over the top of them. The facility will then be closed with an engineered and vegetated "store-and-release" evaporative cover. Due to the segregation of the NPAG tailings from the PAG tailings, it is possible that the store-and-release cover could be achieved by the direct seeding of the scavenger tailings. However, the addition of cover material may be required over some portions of the impoundment, particularly in the cleaner tailings areas with the least amount of scavenger cover.

At the point of closure in Year 40, the facility will consist of a four-sided perimeter embankment dam with an ultimate crest elevation of 2,805 ft (855 m) above mean sea level (amsl). Maximum dam height will be on the southern embankment at approximately 574 ft (175 m) with a 5:1 exterior slope angle (***Figures 3.3-7 and 3.3-7a***) to help blend into the natural terrain.

Construction (and closure) could require up to approximately 21 Myd^3 (16 Mm^3) of general and engineered fill from local borrow sources to cover the life of the Project. Borrow sources will be required to supply general and engineered fill for the starter dams, filters, and drains. The majority of the borrow sources are located within the facility footprint and will be directly placed as they are mined. Three potential borrow areas (Borrow Areas 4, 5, and 6 [***Figure 3.3-3a***]) are located on Tonto National Forest (TNF) land outside the TSF footprint. These are being studied and could be used in the later years of the Project as final store and release cover material for the cleaner tailings at closure (***Section 6***). Borrow sources are discussed in more detail in ***Section 3.3.10.13*** and in KCB 2014, Volume I, Appendix XIII.

Surface and groundwater water management structures will be constructed between the facility and the watersheds at Roblas and Potts canyons and the main downstream confluence at Queen Creek (***Figures 3.3-4, 3.3-5, 3.3-6, and 3.3-7***). This water control system will consist of cutoff walls (grout curtain) keyed into low-permeability geologic units, seepage collection ponds, and piping and pumps to contain and return any seepage from the TSF (***Figures 3.3-7a, 3.3-7c, 3.3-7d, and 3.3-8***). The TSF is contained within one main watershed (Queen Creek); therefore, multiple levels of containment can be put in place for the protection of water resources. Collected water will be pumped back to the TSF or directly to the Concentrator Complex as part of the process water reclaim system. Upstream surface water north, west, and east of the TSF will be diverted to the extent possible around the facility to Roblas and Potts canyons through diversion channels constructed before startup (***Figures 3.3-3a, 3.3-4, 3.3-8, and 3.3-8a***). This non-contact water will be diverted downstream to Queen Creek, where it would have otherwise flowed.

The diversion channels will be sized to convey the peak probable maximum flood flow, which is the greater peak flow of the general Probable Maximum Flood (PMF) 72-hr or local PMF 6-hr storms. Diversion design flows range from 3,500 to 12,000 ft^3/s (100 to 340 m^3/s). The diversion channels will increase the catchment area of the receiving channels by less than 10 percent, presented in KCB 2014, Figure 3.1. Channel upgrades are not expected, but their need will be assessed in future design stages. The diversion channels will be sloped at a minimum of 1 percent to ensure no aggradation over time. Access to the channels for maintenance will be provided. The diversion channels will be constructed in bedrock. Construction details will be developed in future design stages. As described above, additional details on mitigation and monitoring are contained in ***Section 4***.

3.3.10.3. *Tailings Site*

The TSF site is located approximately 5 mi (8 km) west of WPS as shown in ***Figures 3.3-3a, 3.3-3b, and 3.0-1e***. The facility is confined by ridgelines that separate the two main drainages to the east (Potts) and west (Roblas). The TSF will consist of two main cells—referred to as the east cell and the west cell—which will be confined to the north by a ridgeline through the first 20 years of operation. These cells will eventually merge into a single TSF. Surface drainage and diversion to the north will require the excavation of three channels along the northwestern and northeastern ends of the facility to divert upstream water from tertiary drainages into either the eastern or western drainages outside the facility (***Figure 3.3-4***). The total surface area of the facility at closure will be 3,583 ac (1,450 ha).

The southern embankment of the facility will be located a minimum of approximately 1,200 ft (500 m) upslope of Queen Creek along a north-facing ridgeline (***Figure 3.3-7***). The natural drainages that flow and merge beneath the TSF footprint and below the embankment will act as underdrains with direct feed to seepage collection ponds and cutoff walls designed to collect underflow and surface runoff from the facility. The locations of the seepage collection ponds are presented in ***Figures 3.3-3a through 3.3-7.*** Typical sections of the seepage collection dams are presented in ***Figures 3.3-7a through 3.3-7d***. The locations of the underdrains and underdrain details are provided in ***Figure 3.3-9***. (Additional details on the design of the seepage collection system can be found in KCB 2014, Appendix IV.) The contained seepage and stormwater will be pumped back to the tailings pond to be reused.

The topography of the Near West site is characterized by a sequence of ridges and valleys. Ephemeral channels typically exist in the valley bottoms, which transport precipitation and flood waters. The ephemeral channels are founded in bedrock and contain alluvial soil of varying thickness.

Resolution Copper will take advantage of these existing channels to depress the phreatic surface in the tailings embankment, collect and direct seepage to the seepage collection ponds, and limit infiltration into the subsurface by reducing the hydraulic head at the tailings/foundation interface. Alluvial deposits will be stripped from the channels to expose the bedrock below. This alluvium may be used as embankment fill and/or drain material. Highly permeable engineered rockfill drains with adequate flow capacity will then be constructed in the channels.

Given the low permeability of the Gila Conglomerate measured in nearby areas and the low hydraulic head expected in the rockfill drains, infiltration rates into the foundation will be low. Fate-and-transport modeling to be conducted as part of National Environmental Policy Act (NEPA) analysis will assess the impacts to the groundwater beneath and adjacent to the TSF. This assessment will estimate infiltration rates, particle tracking, and travel times as well as provide a quantitative assessment of the potential chemical composition of the discharge from the TSF. The study will also predict groundwater quality adjacent to the proposed TSF during operations and post-closure.

3.3.10.4. *Geology and Geotechnical Considerations*

The bedrock geology of the TSF site foundation was mapped from the surface. The vertical stratigraphy from younger to older consisted of:

- Gila Conglomerates and Sandstones;
- Basalt;
- Perlitic Rhyolite;
- Apache Rhyolite;
- Escabrosa Limestone;
- Martin Siltstones, Sandstones, and Conglomerates;
- Bolsa Quartzite;
- Diabase;
- Mescal Limestone;
- Dripping Springs Quartzite; and
- Pinal Schist.

Approximately 80 percent of the TSF footprint will be within the Gila Conglomerate (QTg – Quaternary and Tertiary basin-fill deposits) and Pinal Schist (P₠pi – Older Precambrian Pinal Schist) (***Figures 2.2-3***). The northern limits and dam locations were selected to confine the tailings to this location and to minimize the earthworks and disturbances in establishing the upstream drainage control. This drainage control will consist of three diversion channels cut across the ridgelines that divert upstream runoff to the east or west into Potts or Roblas canyons (***Figure 3.3-4***). To minimize or eliminate seepage to regional groundwater, the seepage dams upstream from Queen Creek are founded on very-low-permeability bedrock Pinal Schist. The drainage channels have shallow fluvial deposits. The material from the natural drainages will be processed and replaced to serve as underdrains below the embankment to reduce the phreatic level in the embankment fill to enhance stability and limit infiltration into the foundation. The seepage collection dams located in these natural drainages, downstream of the main embankment, will be keyed into the low-permeability bedrock below the fluvial deposits to minimize seepage downstream.

No apparent seeps or springs were identified within this terrain. The springs and seeps identified upstream within the Gila Formation or along the sandy, less cemented zones near the Pinal Schist-Gila contact appeared to be near-surface and local. As is found with the Gila Formation within the Superior district and the WPS, Gila Conglomerate located within the TSF footprint also contains acid neutralizing capacity. This is further discussed in ***Section 2.2.3.7.3.***

The downgradient or southern perimeter embankment dam will generally be founded in very-low-permeability, high-strength Pinal Schist and Gila Conglomerate (***Figure 2.2-3***). The eastern embankment will be buttressed by a ridgeline separating Bear Tank Canyon from Potts Canyon and is generally founded in Gila Conglomerate with a small section of Tertiary volcanic rocks (Tvu) exposed in the far northeastern corner of the facility. The western embankment will be buttressed against a ridge of Apache Rhyolite (p€y – younger Precambrian sedimentary and intrusive rocks, undifferentiated) and Gila Conglomerate, with the drainage slopes and floor founded in a combination of Pinal Schist, Dripping Springs Formation (p€y – younger Precambrian sedimentary and intrusive rocks, undifferentiated), and Diabase (p€y – younger Precambrian sedimentary and intrusive rocks, undifferentiated). Within the drainage channels are fluvial deposits of shallow depth. The embankments will be keyed to bedrock below these fluvial deposits, and the natural drainages will be used as underdrains for head reduction within the tailings mass (***Figures 3.3-8, 3.3-8a, and 3.3-9***). The surface water management structures (seepage collection dams) will be located within these tertiary drainages downstream from the embankments and keyed into bedrock for the collection and return of seepage water back to the TSF (***Figures 3.3-3a through 3.3-7c***).

3.3.10.5. *Tailings Characteristics*

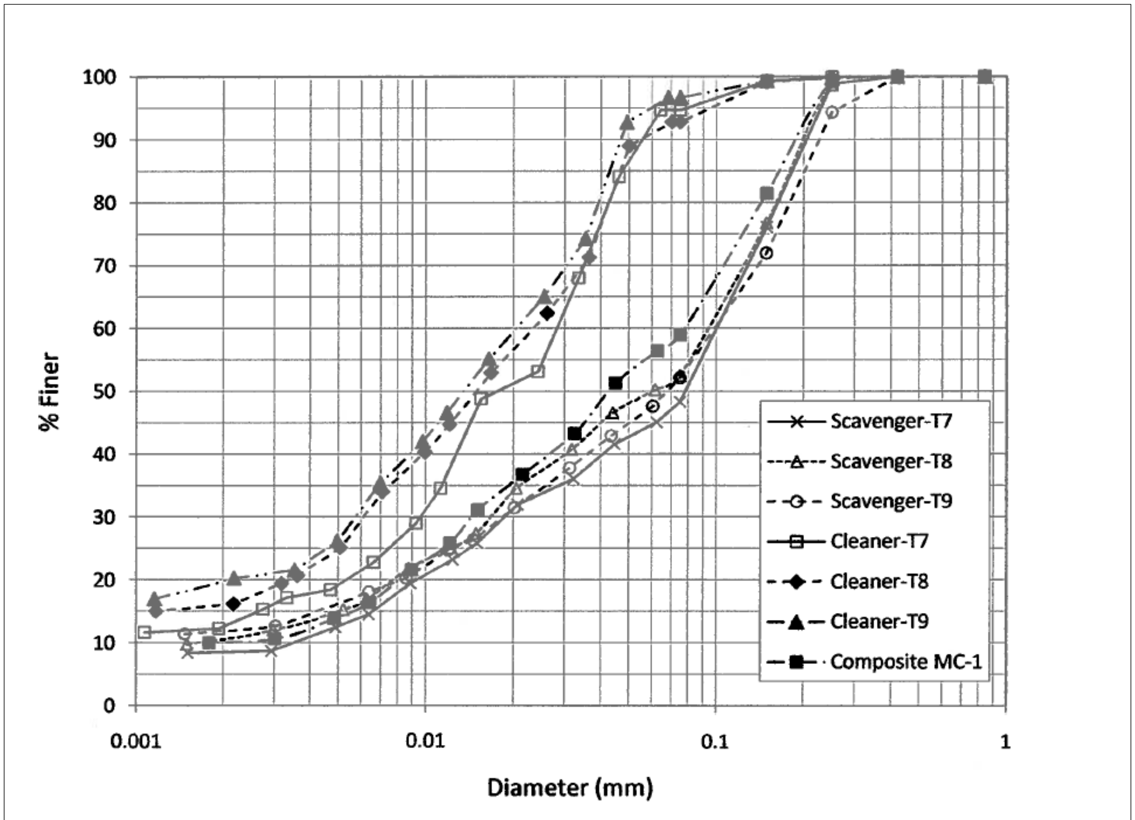
The properties of the scavenger and cleaner tailings are given in ***Table 3.3-4 and Exhibit 3.3-2***. Testing was performed on tailings produced from Resolution ore by a mill pilot plant. Specific gravity and particle size distributions are based on the testing of scavenger and cleaner tailings by Klohn Crippen Berger (KCB 2014), and final average consolidated density and average hydraulic conductivity are based on the testing of scavenger and cleaner tailings by KCB (2011).

Table 3.3-4 Tailings Properties

Tailings Stream	Specific Gravity	Particle Size Distribution		Deposition Method	Final Average Consolidated Density (lb/ft^3 [tonne/m^3])	Average Hydraulic Conductivity[1] (ft/s [cm/s])	Acid-generating Potential
		Percent Fines < 74µ	Percent Clay < 2µ				
Scavenger	2.67	50–65	< 7	Thickened deposition at 65% solids density	87.4 (1.40)	2×10^{-6} to 2×10^{-7} (5×10^{-5} to 5×10^{-6})	NPAG[2]
Cleaner	3.54	95–100	< 9	Subaerial or subaqueous deposition at 55% solids density	106 (1.70)	3×10^{-6} to 3×10^{-7} (1×10^{-6} to 1×10^{-7})	PAG[3] Lag time[4] = 3 months

[1] Where applicable, hydraulic conductivity represents the range between a void ratio of 1.0 near the tailings surface and a void ratio of 0.4 at the base of the tailings deposit.
[2] NPAG denotes not-potentially-acid-generating.
[3] PAG denotes potentially-acid-generating.
[4] Lag time is the time for the leachate to reach a pH less than 5.

Exhibit 3.3-2 Particle Size Distribution of Scavenger, Cleaner, and Composite Tailings Samples



Using the particle size distribution data available, the total amount of sand and finer material (slimes) deposited in the scavenger tailings over the life of the Project is 626 million tons and 765 million tons, respectively. Applying the average weight percentage of silt-sized and smaller particles to the total scavenger tailings tonnage results in a rough estimate of slimes production by year. The results of this calculation are presented in ***Table 3.3-5***. As the tailings design is developed through the NEPA process and information is collected through operations, the sand/slimes split may be refined.

Table 3.3-5 Distribution by Year of Fine and Coarse Particles for Scavenger Tailings

Year	Scavenger Production		Fines Production[1]		Coarse Production[2]	
	Mtonnes	Mtons	Mtonnes	Mtons	Mtonnes	Mtons
1	5.5	6.1	3.0	3.4	2.5	2.7
2	7.5	8.2	4.1	4.5	3.4	3.7
3	7.5	8.3	4.2	4.6	3.4	3.7
4	14.3	15.8	7.9	8.7	6.5	7.1
5	20.9	23.0	11.5	12.7	9.4	10.4
6	27.3	30.1	15.0	16.6	12.3	13.6
7	32.2	35.5	17.7	19.5	14.5	16.0
8	36.3	40.0	19.9	22.0	16.3	18.0
9	35.7	39.4	19.6	21.7	16.1	17.7
10	35.5	39.1	19.5	21.5	16.0	17.6
11	35.5	39.1	19.5	21.5	16.0	17.6

Table 3.3-5 Distribution by Year of Fine and Coarse Particles for Scavenger Tailings

Year	Scavenger Production		Fines Production[1]		Coarse Production[2]	
	Mtonnes	Mtons	Mtonnes	Mtons	Mtonnes	Mtons
12	36.0	39.6	19.8	21.8	16.2	17.8
13	35.2	38.8	19.4	21.4	15.8	17.5
14	37.1	40.8	20.4	22.5	16.7	18.4
15	37.3	41.1	20.5	22.6	16.8	18.5
16	37.0	40.8	20.3	22.4	16.6	18.3
17	36.6	40.3	20.1	22.2	16.5	18.2
18	36.2	40.0	19.9	22.0	16.3	18.0
19	36.0	39.7	19.8	21.8	16.2	17.9
20	35.9	39.6	19.7	21.8	16.2	17.8
21	36.1	39.8	19.9	21.9	16.3	17.9
22	36.5	40.2	20.1	22.1	16.4	18.1
23	36.5	40.3	20.1	22.1	16.4	18.1
24	36.4	40.2	20.0	22.1	16.4	18.1
25	36.3	40.0	20.0	22.0	16.3	18.0
26	36.5	40.2	20.1	22.1	16.4	18.1
27	36.8	40.6	20.3	22.3	16.6	18.3
28	37.2	41.0	20.5	22.6	16.8	18.5
29	37.4	41.2	20.6	22.7	16.8	18.5
30	37.2	41.1	20.5	22.6	16.8	18.5
31	37.2	41.0	20.4	22.5	16.7	18.4
32	37.3	41.1	20.5	22.6	16.8	18.5
33	37.3	41.1	20.5	22.6	16.8	18.5
34	37.3	41.1	20.5	22.6	16.8	18.5
35	37.3	41.1	20.5	22.6	16.8	18.5
36	37.3	41.1	20.5	22.6	16.8	18.5
37	26.3	29.0	14.5	15.9	11.8	13.0
38	20.3	22.4	11.2	12.3	9.2	10.1
39	14.8	16.3	8.1	9.0	6.6	7.3
40	11.1	12.2	6.1	6.7	5.0	5.5
41	7.2	7.9	3.9	4.4	3.2	3.6
42	3.3	3.6	1.8	2.0	1.5	1.6
43	1.4	1.5	0.8	0.8	0.6	0.7
44	0.7	0.7	0.4	0.4	0.3	0.3
45	0.2	0.2	0.1	0.1	0.1	0.1
TOTAL	**1,261**	**1,390**	**694**	**765**	**568**	**626**

Note: Assuming 55 percent of scavenger tailings will be fines (KCB 2011).
[1] Fines defined as particles less than 0.075 mm in diameter.
[2] Coarse defined as particles 0.075 mm and greater in diameter.

3.3.10.5.1. Scavenger Tailings

Average consolidated tailings densities are estimated from large strain consolidation modeling (KCB 2011). Consolidated densities represent conditions at the end of deposition, assuming passive drainage to the reclaim ponds or through the underdrain system within the tailings pile. Rates of deposition that can result in under-consolidation and the generation of excess pore water pressures in the tailings are relatively low and decrease with facility height through the life of the operation. The scavenger tailings deposition rates for each stage are:

- Stage I (Year 1 through Year 10) East Cell Raise – 23.7 ft/yr (7.2 m/ yr);
- Stage II (Year 11 through Year 18) West Cell Raise – 21.9 ft/yr (6.7 m/yr); and
- Stage III (Year 19 through Year 43) Combined TSF Raise – 8.12 ft/yr (2.5 m/yr).

The hydraulic conductivities for the various tailings gradations are estimated from laboratory testing and large strain consolidation modeling (KCB 2011). Friction angles are estimated based on the testing of similar tailings at other facilities in the Southwest. The effects of under-consolidation due to rate of rise and elevated pore pressures in the tailings were also considered. Consolidated densities and hydraulic conductivity are estimates based on experience with whole and cyclone sand at Kennecott Utah Copper and other similar grind circuits, gradations, and deposition methods.

Based on this information and a seismic assessment, it was determined that the embankments could be constructed of decanted scavenger tailings. Further assessing worst case, elevated pore water pressure values were added to the model within the tailings pile to assess conditions if the underdrainage were ineffective. The model indicated a high factor of safety above the standard requirements. The addition of the underdrains elevated the factor of safety well above the standards or best practice guidelines required for both static and seismic conditions. The typical seismic design assumption will be reviewed in subsequent design phases, further assessing variability in the physical properties of the decanted, placed, and compacted tailings under dynamic loading.

3.3.10.5.2. Cleaner Tailings

The cleaner tailings delivery pipelines will follow the ridgelines and cleaner tailings will be deposited from spigots located on the crest of the cleaner starter dam into a pond (***Figures 3.3-3b through 3.3-7***) or from ridges or access berms located in the reclaim pond in the center of the facility (***Figure 3.3-9***).

The cleaner tailings will be held horizontally and separately from the scavenger tailings by an engineered starter dam (Years 0 through 8) centrally located above the Gila Conglomerate (***Figures 3.3-3b and 3.3-4***). In Year 9, the east cell cleaner and scavenger tailings will merge, forming a combined reclaim pond confined to the east cell (***Figures 3.3-3b and 3.3-5***). Once merged, the scavenger tailings slime level will be maintained above the cleaner pond. Scavenger tailings that are discharged from the embankment crest will naturally segregate, with the finer material being deposited near the reclaim pond surrounding the cleaner tailings. This margin will be overlapping locally, but will generally fix the cleaner tailings to a central location within the facility. Where the cleaner tailings and scavenger tailings overlap at the margins, the scavenger tailings will be both above and below the cleaner tailings, but the bulk of the cleaner tailings will be progressively covered by scavenger slimes. The cleaner tailings will be discharged centrally to minimize the potential for ARD by placing the tailings directly above low-permeability Gila Conglomerate and maintaining the cleaner tailings in a saturated state during operations and closure through encapsulation.

Some of the advantages of this tailings deposition scheme in mitigating potential geochemical impacts are:

- The PAG cleaner tailings will be maintained in a saturated state and progressively covered with scavenger tailings during operations to prevent oxidation infiltration and potential acid generation.
- The cleaner tailings will be encapsulated in and covered by the finer scavenger tailings slimes that segregate during deposition and collect in the reclaim pond-cleaner discharge zone. The low hydraulic conductivity of the tailings slimes will reduce the rate of oxygen infiltration into and fluid migration out of this zone. Encapsulation will also help to ensure that high saturation levels are maintained in the tailings by maintaining the water level required to fully cover the cleaner tailings in one central pond.
- Encapsulation within the net neutralizing and fine-grained scavenger tailings inhibits and attenuates seepage from the cleaner tailings to any downgradient environmental receptors.
- As a result of the encapsulation of the cleaner tailings by scavenger tailings and their placement on low-permeability Gila Conglomerate with acid-neutralization capacity (resulting in the attenuation of constituents along the Gila formation pathway), a long lag time would exist before seepage from the cleaner tailings would reach any potential receptors.
- The final capping of the cleaner tailings with “store-and-release” cover provides a buffer between surface runoff and oxygen ingress and the cleaner tailings.
- The cleaner tailings are deposited on the Gila Conglomerate, which has a low bulk permeability and possesses demonstrated acid-neutralization capacity.

Further details are provided in ***Section 4.5.4*** and in ***Appendix R***.

3.3.10.5.3. Geochemical Characterization of Tailings

Geochemical characterization studies consistently demonstrate that cleaner and whole tailings are PAG, meaning that, if allowed to weather in an oxidizing environment, they may be expected to generate acidic conditions and produce drainage with elevated metals and sulfate above surface and groundwater quality standards. The acid-generating potential of cleaner tailings has long been recognized by Resolution Copper, and the current tailings management strategy includes the emplacement and storage of cleaner tailings under saturated conditions; the encapsulation of the cleaner tailings by high-moisture-content, very-fine-grained scavenger tailings; and, ultimately, the covering of the tailings with an engineered cover to prevent exposure to oxidizing conditions.

Geochemical characterization indicates that scavenger tailings with very low sulfide sulfur content are largely NPAG and are unlikely to leach metals or sulfate at concentrations of environmental concern (***Appendix H***).

The tailings design and management plan incorporates a design that is intended to limit oxygen ingress into the cleaner tailings mass to prevent and minimize ARD. This is accomplished in two ways during operations: upon initial deposition, the cleaner tailings will be placed subaqueously beneath the reclaim pond; this will ensure that the cleaner tailings are saturated and that they remain so until they drain. Post-placement, the cleaner tailings will be progressively covered and sealed by a thick sequence of scavenger tailings slimes. The fine-grained nature of the overlying, NPAG scavenger tailings will protect the saturation state of the underlying cleaner tailings. Even with drainage, the very-fine-grained scavenger slimes will remain at or close to tension saturation, and the ingress of oxygen will be limited by the very low diffusion rates of oxygen under high levels of saturation. Furthermore, the small concentration of sulfide sulfur present in the scavenger tailings will act to consume diffusing oxygen, but will not be sufficient to generate acidic seepage. After operations cease and during closure, Resolution Copper will place a store-and-release cover over the top of the remaining cleaner tailings mass to further reduce oxygen ingress by diffusion (by increasing the diffusional length and providing some small, additional oxygen-reaction to low concentrations of pyrite) and limit the influx of water that could carry solute as eventual seepage, while maintaining sufficient saturation in the cleaner tailings to prevent their oxidation.

It should be noted that the results of the geochemical testing performed to date simply pertain to the likely geochemical reactivity of the tailings materials were they to be exposed to oxidizing conditions. These tests do not predict the composition of the discharge from the TSF or the quality of the groundwater adjacent to the impoundment.

3.3.10.6. *Tailings Embankment*

The main tailings embankment will be an upstream-constructed scavenger tailings embankment with a 60-ft- (18-m-) wide (average width) compacted zone on the outer 5H:1V slope (***Figures 3.3-7 through 3.3-8a***). At the ultimate crest elevation of 2,804 ft (855 m) amsl, the maximum embankment height will be 575 ft (175 m) and the final crest length or circumference will be approximately 32,000 ft (9,800 m). Starter dam construction would start 1 year before start of operations, with preparatory site work starting 3 years before start of operations (***Figures 3.3-3b through 3.3-8***). The Scavenger and Cleaner Starter dams would be designed for the 24-hr 100-yr and Half 30-day PMF storm events, respectively.

Starter dams will be constructed in the valley bottoms using compacted general borrow fill. Starter dams are necessary to contain the initial tailing deposition and are also used for the layout of tailings distribution pipelines and reclaim water pipelines. Subsequent upstream berm raises will be constructed from compacted tailings taken locally from the upstream beach deposits using mobile equipment. A network of underdrains in the existing drainage pathways will be installed under the embankment to reduce the water level in the embankment. A water-level monitoring system for the embankments will be installed during operation for dam safety requirements and to optimize subsequent underdrainage and raise construction. The details of the upstream tailings embankment are presented in ***Figure 3.3-9***. A portion of the eastern side of the facility is abutted against a ridge that separates Bear Tank and Potts canyons. This embankment will require a 65-ft- (20-m-) wide local blanket drain upstream of the initial deposition berm to depress the phreatic surface for stability. Details of the local blanket drain are presented in ***Figure 3.3-9***. Additional information may be found in KCB (2014).

Seepage analysis was performed to determine the phreatic surface in the embankment for the stability analysis (KCB 2014). The seepage performance of the tailings embankment was assessed using a two-dimensional finite element model. The model assumed embankment cross-sections with a 5H:1V outer slope constructed of 60 ft of freely draining compacted tailings material. A 1 percent slope of “wetted” tailings beach was assumed, with surface wetting starting 328 ft (100 m) from the embankment crest. The results are summarized below:

- The phreatic surface is generally a minimum of 16 ft (5 m) below the tailings surface;
- The starter dams will be designed to maximize drawdown of the phreatic surface in the tailings and to prevent a seepage face from developing on the embankment slope; and
- In local areas, the starter dam will be augmented with a blanket drain to achieve acceptable drawdown of the phreatic surface.

Liquefaction and post-earthquake stability analyses were carried out, and the results of the analysis are given in KCB (2014, Volume II, Appendix V). The analysis was based on the seismic design parameters from the site-specific seismic hazard assessment in ***Appendix I***. 5,000-year return period ground motions (or a probability of exceedance of 1 percent in 50 years) were taken as the maximum design earthquake ground motions for the tailings embankments at the Near West site. Additional information may be found in ***Section 2.2.6***. Based on the results of the analysis, liquefaction is unlikely to occur for any of the scenarios analyzed. Some buildup of pore water pressure during shaking will occur, which is taken into account in the stability analysis. For the stability analysis, the tailings friction angles were reduced based on the Ru values calculated from the ProShake analyses.

The stability analyses yielded a post-earthquake factor-of-safety target above the minimums of 1.2 and 1.5 as defined in BADCT guidance under the ADEQ APP Program (ADEQ 2004). The post-earthquake stability of the embankment will be designed to exceed this factor of safety.

Static and pseudo-static stability analyses in KCB (2014, Volume II, Appendix VII) indicate that a tailings embankment with 5H:1V slopes meets and exceeds all factors of safety criteria for static and pseudo-static dynamic loading. Additional information may be found in KCB (2014, Volume II, Appendix VII).

3.3.10.7. *Tailings Storage Facility Construction*

The TSF is a staged facility; therefore, construction and expansion will be periodic throughout the 40-year life of the facility. The facility will be marked out in periods or phases set to storage volumes and lateral expansion requirements. Construction through these stages includes lateral starter dam expansions, upstream starters, mechanical additions, and seepage collection systems. Prior to construction, surveys will be conducted for exact placement of TSF components.

The construction stages are:

- Phase 1: Year -2 through Year -1: Construction and Layout;
- Phase 2: Year 1 through Year 8: East Cell Scavenger and Cleaner Storage and Seepage Collection Systems;
- Phase 3: Year 9 through Year 18: West Cell Scavenger Storage and Seepage Collection Systems;
- Phase 4: Year 19 through Year 38: Combined Cell Expansion and North Embankment; and
- Year 38: Start of Beach Closure.

During the first part of the construction phase, two starter dams will be constructed for the separated scavenger and cleaner tailings placement areas (***Figure 3.3-4***). The cleaner embankment will be designed and constructed to hold approximately 8 years of cleaner tailings prior to the merging of deposition. The starter embankments will be constructed using borrowed and engineered fill with a minimum 2H:1V downstream slope and a minimum 2.5H:1V upstream slope.

Year 1 through Year 8 construction will focus on starter embankments, raises, and seepage collection for the east cell scavenger and cleaner tailings (***Figure 3.3-5***). This will include the lateral construction of starter berms to the north and west of the cell and the addition of pipelines and spigots as the facility is raised from approximately 2,350 ft (716 m) to 2,585 ft (788 m) elevation amsl.

In Year 9, construction of the west cell scavenger facility will begin (***Figure 3.3-5***). An initial starter facility and pipeline will be constructed to deposit scavenger tailings only within this cell. Expansion and sustained construction will be staged to match the upstream requirements as the tailings are raised in the cell. This construction will include seepage collection ponds and mechanical extensions matched to lateral expansion to the west and north. The west cell will continue to operate independently of the east cell through Year 19, at which time the facilities will merge at the 2,605 ft (794 m) elevation amsl.

Year 19 through Year 23 will be a period of minimum construction. Tailings discharge pipes and spigots will be constructed around the circumference of the facility in the early years of this stage (***Figure 3.3-6***). Further construction of the northwestern cleaner containment embankment will be required when tailings rise to the 2,625 ft (800 m) elevation amsl in Year 21.

In Year 25, the northeastern scavenger starter berm will be constructed when tailings reach the 2,680 ft (815 m) elevation amsl. This embankment will enclose the facility on all sides, ending lateral expansion.

Closure will include progressive reclamation on the exterior slopes completed in conjunction with operations and embankment raises. With the reduction of tailings discharge around Year 38, the beach surface will be confined and initiate selective reclamation of the beach and pond area. By Year 40, it is anticipated that more than 80 percent of the beach surface will have been covered with erosion protection and the start of revegetation. Final surface closure excluding the pond and seepage collection system is expected to be completed by Year 48 (***Figure 3.3-10***).

3.3.10.8. *Tailings Storage Facility Operation*

Similar to the construction staging plan, facility operations will be managed in incremental operational stages. Since the facility overlies a series of canyons, the staged approach involves a combination of lateral and vertical expansion as production volumes increase and the facility grows in size.

The tailings deposition method will not change throughout the life of the facility. The method of transport will be thickened tailings through a pipeline from the Concentrator (tailings thickeners) discharged through spigots off the upstream embankments. Decantation of tailings will occur through gravity separation, with water ultimately reclaimed at the downstream pond or at the northern and central areas of the facility.

Cleaner tailings will be transported and initially contained in a separate upstream pond (***Figure 3.3-4***). In Year 8 of operation, the scavenger slime elevation will match that of the cleaner tailings, and the ponds will merge (***Figure 3.3-5***). The cleaner tailings will be kept in a subaqueous state throughout the life of the Project to prevent oxidation and acid generation from occurring.

Starting in Year 10, the majority of the scavenger tailings will be deposited in the west cell tailings storage area (***Figure 3.3-5***). This will require an expansion of the facility to the west into the valleys and canyons east of Roblas Canyon. Approximately 15 to 20 percent of the scavenger tailings will continue to be deposited in the east cell storage facility to match the raise of the cleaner tailings and to maintain equilibrium water levels for subaqueous disposal. This separate scavenger cell with secondary reclaim system will merge with the east cell in Year 18 (***Figure 3.3-6***). Once the cells merge, and tailings discharge and reclaim pond operations are combined, the TSF will rise vertically at approximately 8 ft per year until the end of the Project life.

3.3.10.9. *Tailings Delivery and Distribution System*

Three tailings delivery and distribution system configurations will be required throughout the operation of the TSF.

3.3.10.9.1. Scavenger and Cleaner Separation – Year 1 through Year 10

The delivery and distribution system is shown in ***Figures 3.3-4 and 3.3-5***. Scavenger tailings will be placed initially behind a general fill starter dam. Thereafter, the scavenger tailings will be deposited from berms on the embankment crest. A separate starter dam will be constructed from general fill for the cleaner tailings to a crest height of 140 ft (43 m).

The cleaner tailings delivery pipelines will follow the ridgelines and the cleaner tailings will be deposited from spigots located on the crest of the cleaner starter dam into a pond or from ridges or access berms located in the reclaim pond in the center of the facility. Deposition locations and areal extents are shown in KCB (2014, Figures 4.3 to 4.13 and Appendix XII [on an annual basis]). The cleaner tailings will be deposited below water where possible, but at times may have beach above water.

The cleaner tailings will be deposited using discharge pumps below the pond water level along the crest of the cleaner starter dam until the end of Year 8, at which point the tailings will be discharged from pipelines extending into the TSF along upstream ridges. A 132-million-gallon (MG) (0.5-Mm^3) pond will be maintained to keep the cleaner tailings covered with water and saturated. A minimum lateral scavenger beach above water of 492 ft (150 m) is required for embankment stability and flood storage.

3.3.10.9.2. East and West Cell Development – Year 11 through Year 18

Scavenger tailings deposition will begin in the west cell in Year 11 (***Figure 3.3-5***). This cell of the TSF will be designed with a minimal volume reclaim pond based on a 20-day retention period. The western reclaim will be pumped to the primary reclaim pond in the east cell. Cleaner tailings will continue to be deposited into the east cell reclaim pond, which will be maintained with a pond volume of 790 MG (3 Mm^3). From Year 13 to the end of Year 18, scavenger tailings will be typically distributed 20 percent and 80 percent between the east and west cells and allocated to match the elevation and cover requirements of the cleaner tailings. The ratio will increase in Year 15 when the scavenger tailings will be divided 40 percent and 60 percent between the east and west cells (respectively) to fix the pond location centrally and maintain submergence of the cleaner tailings. In Year 18, 10 percent of the scavenger tailings will be deposited from spigots along the ridges within the limits of the northeastern crest of the east cell (***Figure 3.3-6***). This deposition method will confine the eastern tailings pond to the center of the east cell to decrease the lateral spread of the cleaner tailings.

3.3.10.9.3. Combined Cell Development – Year 19 through Year 43

At the end of Year 18, the east and west cells will reach the same embankment elevation. In Year 19, the joined cells will be raised together, increasing the scavenger beach length to a minimum of 1,650 ft (500 m). This matches optimum beach length for embankment stability and flood storage. In Year 20, the east and west cells will coalesce, with decantation and water reporting to a single reclaim pond (***Figure 3.3-6***). From Year 29 through Year 43, cleaner tailings will be deposited from a pipeline along access berms constructed of rock fill end-dumped and pushed out to the point of discharge within the impoundment (***Figures 3.3-7 and 3.3-9a***). This pipeline and scavenger tailings deposition from the north will fix the cleaner tailings to the center of the TSF and directly above the low-permeability Gila Conglomerate.

3.3.10.10. *Reclaim Water Systems*

Two barge pump stations will be installed on the TSF to dewater the surface of the tailings. During initial operation (Years 1 through 8), the flows from the tailings will be conveyed through approximately 8 mi (13 km) of aboveground pipeline from the TSF to the Process Water Pond at WPS (***Figures 3.3-4***). Later, during Years 9 through 40, the pipeline will be relocated to the north to allow for the expanding footprint of the TSF and to keep the discharge cleaner lines and reclaim lines along the same access corridor (***Figures 3.3-5 through 3.3-7***).

Several cutoff walls (grout curtain) and associated seepage collection ponds downstream from the TSF will function as containment to collect seepage and stormwater from the tailings impoundment (***Figures 3.3-3a through 3.3-7d***). The collected water will be directed through natural drainages as well as from installed drain collection points from the underdrains as the tailings impoundment expands laterally throughout the life of the Mine. Pumps will be installed in the seepage collection ponds, and the collected water will be pumped back to the interior of the TSF through seepage water pipelines routed up the tailings embankment (***Figures 3.3-4 through 3.3-7***). Each seepage collection pond will have its own pump and seepage return line connected to a reclaim pump station that will transport seepage water from the pond back to the TSF.

The impoundments created by the seepage collection pond cutoff walls will retain water from runoff and precipitation in addition to the seepage from the tailings impoundment. The dams will be constructed to contain impacted flows, seepage, and runoff, thus preventing any flows from leaving the site. The amount of seepage from the TSF will vary over the years, depending on the height of the tailings. Seepage and stormwater will be collected and managed during operations for use in the process waster system and will drastically decline at closure and during the post-closure monitoring period. Seepage collection design details are contained in KCB (2014, Volume II, Appendix VI). The closure strategy employed for the upstream diversions, drainage system, seepage collection, and store-and-release cover will combine to maximize draindown over the shortest possible time frame where evaporation ultimately exceeds seepage. The closure strategy employed for the upstream diversions, drainage system, seepage collection, and store-and-release cover will combine to maximize draindown over the shortest possible time frame where evaporation ultimately exceeds seepage.

3.3.10.11. *Tailings Storage Facility Support and Service Roads*

The TSF will be accessed from WPS via a service road adjacent to the tailings pipeline (***Figure 3.3-a***). Access to the TSF will also be available from Hewitt Canyon Road (FR 357) and FR 8 off of US 60 for use during construction to accommodate large deliveries and emergency access (***Figures 3.0-1e through 3.0-1h***). FR 357 and FR 8 provide access to several existing FS roads that will be utilized for general access to the TSF and/or as major haul routes from borrow areas to the TSF. These roads include FR 172, FR 1904, FR 252, FR 293, FR 2381, FR 2383, FR 2386, FR 650, and FR 982. Some will require reconstruction to provide access for mine equipment. The roads and details for their reconstruction can be found in ***Appendix K***. A separate service road will be constructed around the periphery of the TSF for access to power distribution, seepage collection ponds, and pumps (***Figures 3.0-1e and 3.0-1f***). All discharge and reclaim lines will be accessed via service roads constructed on the embankments within the facility footprint. An access road to the upstream diversion area will be constructed early in the Project. This road will be used after Year 21 for access to the northern embankments and the reclaim and discharge systems.

Offices and maintenance facilities will be located east of the TSF (***Figure 3.3-3a***).

3.3.10.12. *Electrical Substation and Distribution*

A new 34.5-kV Tailings Substation will be constructed near the offices and maintenance facilities (***Figure 3.3-3a***). Power will be supplied from an overhead 34.5kV-power line originating at the WPS substation and will follow the Tailings Corridor. A substation with a 500-kVa transformer 34.5-0.48/0.277 kV will provide power for the offices and maintenance facilities. The 34.5-kV line will continue around the toe of the dam to feed the various seepage pumps and the reclaim water pumps. At each seepage pump a pole mounted transformer (75 kVA maximum) will provide 480-volt power to operate the pump. The barge-mounted reclaim water pumps will be fed from a skid-mounted 1000-kVA, 34.5-4.16/2.4 substation. The substation will be relocated to suit the location of the reclaim barge.

3.3.10.13. *Rock Quarries or Borrow Sources*

Six borrow areas have been identified: three are within the TSF, two are located entirely outside the TSF, and one is outside of the TSF but abuts the boundary. Different rock types have been targeted for different borrow requirements. Excluding construction of the northern embankments and final beach reclamation, all borrow for starter construction has been identified from sources within the footprint of the facility. Closure borrow requirements will be sourced from one of the borrow areas outside the TSF footprint. Any processing plants, if needed, would be mobile and move around to locations within the tailings footprint at the area where borrow material is to be placed.

Estimates of borrow requirements by year, material types, and intended uses are provided in KCB (2014, Volume I, Appendix XIV). Once the field drilling program is complete, Resolution Copper will refine estimates of the total volume of borrow material available within and outside the TSF. Borrow areas entirely outside the footprint include areas to the southwest and to the east of Potts Canyon. Depending on the availability of material within the TSF footprint—to be determined by field drilling—these may not be required.

Borrow areas outside the TSF would be accessed from existing FRs (***Figure 1.5-4a; Appendix K***). Although the majority of the borrow material for the tailings starter dams would come from within and directly adjacent to the TSF footprint (Borrow Areas 1 through 4), if additional material is needed for construction or reclamation, borrow areas well outside the footprint would be used (Borrow Areas 5 and 6). To access Borrow Areas 1 through 4, the haul routes inside the TSF footprint will require the widening of several existing FRs. If Borrow Areas 5 and 6 are needed, FRs 2381, 2386, 650, and 982 will also need widening. Additional details on the proposed use of FRs for accessing borrow areas are provided in ***Appendix K***.

Borrow excavation within the TSF facility will be covered by tailings. Borrow pits outside the footprint of the TSF that are potentially removed would be recontoured and reclaimed as part of closure.

3.3.10.14. *Reclamation and Closure*

The preliminary reclamation and closure plan is shown in ***Figure 3.3-10***. Embankment reclamation is to be completed progressively as the embankments rise upstream. This progressive reclamation will commence during Stage 1 of the staging plan, with completion inside the end of Project life at approximately Year 38. The embankment will be directly revegetated or, if needed, covered with borrow material and revegetated as shown in ***Figure 3.3-10***. A schedule of the areas that will be reclaimed each year is presented in ***Table 3.3-6***. In concept, the embankments will be reclaimed in sequential periods throughout operations, with top cover and final closure starting in Year 37. The level of engineering information and detail will be refined through the NEPA review process, and as such may change. Additional diversion channels will be constructed on the tailings embankment slopes and on the natural ground to divert embankment surface runoff around the seepage collection dams (***Figures 3.3-10 and 3.3-10a***). Further details are provided in ***Section 6*** of this GPO.

Table 3.3-6 Tailings Storage Facility Reclaimed, Unreclaimed, Exposed Tailings, and Tailings Pond Areas by Year

Year	RECLAMATION AREA			UNRECLAIMED AREA			EXPOSED TAILINGS			TAILINGS POND AREA		
	m^2	Mm^2	Acres	m^2	Mm^2	Acres	m^2	Mm^2	Acres	m^2	Mm^2	Acres
1	0	0	0	749,828	1	185	194,016	0	48	465,592	0	115
2	90,220	0	22	1,214,434	1	300	651,284	1	161	527,166	1	130
3	35,984	0	9	1,651,226	2	408	1,009,033	1	249	501,415	1	124
4	50,558	0	12	2,198,714	2	543	1,318,834	1	326	645,193	1	159
5	108,483	0	27	2,602,116	3	643	1,548,988	2	383	752,721	1	186
6	123,645	0	31	3,106,378	3	768	1,749,178	2	432	890,451	1	220
7	181,504	0	45	3,458,847	3	855	1,850,484	2	457	1,005,389	1	248
8	194,084	0	48	4,102,068	4	1,014	2,464,518	2	609	846,034	1	209
9	201,122	0	50	4,746,995	5	1,173	2,680,570	3	662	1,057,152	1	261
10	224,795	0	56	5,210,674	5	1,288	3,038,074	3	751	1,010,532	1	250
11	176,468	0	44	7,065,876	7	1,746	3,403,541	3	841	2,411,979	2	596
12	39,961	0	10	8,049,444	8	1,989	4,253,902	4	1,051	2,245,766	2	555
13	162,913	0	40	8,497,582	8	2,100	4,471,171	4	1,105	2,393,008	2	591
14	206,579	0	51	9,078,195	9	2,243	4,833,909	5	1,194	2,429,089	2	600
15	225,460	0	56	9,407,345	9	2,325	4,973,034	5	1,229	2,322,733	2	574
16	315,262	0	78	10,044,694	10	2,482	5,890,853	6	1,456	2,132,065	2	527
17	0	0	0	10,710,266	11	2,647	6,349,347	6	1,569	1,885,507	2	466
18	138,374	0	34	10,397,728	10	2,569	5,364,228	5	1,326	2,501,322	3	618
19	195,140	0	48	11,100,480	11	2,743	5,747,635	6	1,420	2,719,499	3	672
20	157,934	0	39	11,576,194	12	2,861	6,201,436	6	1,532	2,387,087	2	590
21	317,119	0	78	11,754,085	12	2,904	6,410,325	6	1,584	2,357,273	2	582
22	158,001	0	39	12,218,986	12	3,019	6,794,581	7	1,679	2,278,800	2	563
23	0	0	0	12,606,471	13	3,115	6,495,673	6	1,605	2,333,190	2	577
24	474,002	0	117	12,455,041	12	3,078	6,655,516	7	1,645	2,495,919	2	617
25	0	0	0	13,120,033	13	3,242	6,539,349	7	1,616	2,803,076	3	693
26	0	0	0	13,350,819	13	3,299	7,378,491	7	1,823	2,194,720	2	542
27	0	0	0	13,640,278	14	3,371	7,558,321	8	1,868	1,823,097	2	450
28	481,252	0	119	13,303,742	13	3,287	7,734,889	8	1,911	1,791,245	2	443

Table 3.3-6 Tailings Storage Facility Reclaimed, Unreclaimed, Exposed Tailings, and Tailings Pond Areas by Year

Year	RECLAMATION AREA			UNRECLAIMED AREA			EXPOSED TAILINGS			TAILINGS POND AREA		
	m^2	Mm^2	Acres	m^2	Mm^2	Acres	m^2	Mm^2	Acres	m^2	Mm^2	Acres
29	0	0	0	13,910,638	14	3,437	7,984,873	8	1,973	1,666,905	2	412
30	0	0	0	13,948,775	14	3,447	7,493,338	7	1,852	1,705,360	2	421
31	491,217	0	121	13,547,878	14	3,348	7,568,021	8	1,870	1,720,997	2	425
32	0	0	0	14,118,215	14	3,489	7,624,718	8	1,884	1,743,420	2	431
33	0	0	0	14,205,675	14	3,510	7,739,899	8	1,913	1,715,699	2	424
34	0	0	0	14,211,415	14	3,512	7,264,882	7	1,795	1,704,436	2	421
35	492,020	0	122	13,843,475	14	3,421	7,358,513	7	1,818	1,734,885	2	429
36	0	0	0	14,391,055	14	3,556	7,411,499	7	1,831	1,737,459	2	429
37	0	0	0	14,382,060	14	3,554	7,330,103	7	1,811	1,566,515	2	387
38	243,345	0	60	14,169,975	14	3,501	7,477,239	7	1,848	1,450,639	1	358
39	0	0	0	14,439,120	14	3,568	7,621,862	8	1,883	1,331,816	1	329
40	0	0	0	14,455,280	14	3,572	7,697,637	8	1,902	1,272,201	1	314
41	0	0	0	14,455,280	14	3,572	7,766,960	8	1,919	1,202,878	1	297
42	0	0	0	14,455,280	14	3,572	7,821,141	8	1,933	1,148,697	1	284
43	0	0	0	14,455,280	14	3,572	7,826,523	8	1,934	1,143,315	1	283
44	0	0	0	14,455,280	14	3,572	7,826,510	8	1,934	1,143,328	1	283
45	0	0	0	14,455,280	14	3,572	7,822,796	8	1,933	1,147,042	1	283
Closure	14,455,280	14	3,572	0	0	0	0	0	0	1,147,042	1	283

Note: All areas are two-dimensional; actual areas will be approximately 5 percent higher.

3.3.11. FILTER PLANT AND LOADOUT FACILITY

The Filter Plant and Loadout Facility will be constructed approximately 7 mi (11 km) northeast of Magma Junction in an area that has already been largely disturbed and cleared (***Figures 3.0-1 and 3.0-1b***). Prior to construction, surveys will be conducted for exact placement of the facility. The site will be accessed primarily from the west via East Skyline Road. Secondary access will be provided from SR 79 via an access road in the MARRCO Corridor. The facilities will be located northwest of and adjacent to the existing MARRCO rail line and will contain a rail loop approximately 2.5 mi (4 km) long leading to and from the plant. The concentrated copper slurry will be pumped from WPS to the filtration plant in two 8-in high-density polyethylene (HDPE)-lined steel pipelines (***Figure 3.3-11***).

The Filter Plant will include a control room, three concentrate stock tanks, up to six concentrate filters, a filtrate clarifier, and compressors. The concentrate will be pumped to the stock tanks and then to the filters. The filtered concentrate will feed via conveyor to the adjacent loadout facility. The filtrate (water) will be separated in the filters and sent to the filtrate clarifier for thickening. The underflow from the clarifiers will be returned to the head of the Filter Plant. The overflow from the clarifier will be sent to the overflow tank and then pumped to the filtrate polishing filters. The reject from the polishing filters will be sent back to the clarifier. From the polishing filters, the filtrate will be pumped into the 3-MG (11,400-m^3) CAP Water Tank at the Filter Plant Site Pump Station. The filtrate will be mixed with makeup water (direct CAP and/or well-recovered CAP from banked water) and pumped within the water conveyance system to both the Mine Service Water Tank at EPS and the CAP Water Distribution Tank at WPS.

At the Loadout Facility, a covered stockpile with a capacity of approximately 110,000 tons (100,000 tonnes) will store the concentrate from the Filter Plant. Concentrate will be loaded into four hoppers that use belt feeders to load the concentrate into railcars. From the Loadout Facility, the concentrate will be shipped southwest into Magma where it will be loaded onto container cars for delivery via the Union Pacific Railroad to an off-site smelter.

The 3-MG (11,400-m^3) tank and pump station will be located at the southeastern corner of the site near the intersection of East Skyline Road and the MARRCO Corridor. Access to the tank and pump station will be from a gate at East Skyline Road. Additional detail about the water delivery systems is provided in ***Sections 3.5.3.2 and 3.6***.

3.3.11.1. *Filter Plant and Loadout Support Facilities*

3.3.11.1.1. Site Access Roads, Security Gate, and Internal Roadways

The Filter Plant and Loadout Facility will be accessed primarily via East Skyline Road, east of San Tan Valley. The site entrance will have a security building and gate where East Skyline Road meets the Filter Plant entrance. Appropriate security and signage will restrict access to the site. An internal roadway will provide access to the Filter Plant from the entry gate. A second roadway will provide access to the Filter Plant from the MARRCO Corridor through an access point (the MARRCO Access) near the southeastern corner of the site.

3.3.11.1.2. Employee and Visitor Parking

Parking will be provided north of the Loadout Facility. This parking area will provide space for approximately 20 vehicles.

3.3.11.1.3. Potable Water and Wastewater Treatment and Disposal Facilities

Potable water will be supplied to the Filter Plant and Loadout Facility from the Arizona Water Company offsite water system along the MARRCO Corridor.

Wastewater from the facility will be routed to an on-site septic tank and leach field.

3.3.11.1.4. Retention and Contact Water Basin

The contact water basin west of the Loadout Facility will act as storage for contact stormwater from the Filter Plant and Loadout Facility and the area north of the plant. Water from this basin will be incorporated into the CAP water tank.

3.3.11.1.5. Concentrate Containment Basin

A concrete-lined concentrate containment basin will be provided near the southeastern corner of the Filter Plant and Loadout Facility site. This basin will allow for the emergency storage of concentrate if the pipeline needs to be emptied. The basin is sized to contain the full volume of both pipelines upstream that report to the Filter Plant and Loadout Facility with a minimum of 1-ft (0.3-m) freeboard. Additional containment basins will be placed along the MARRCO Corridor at intervals as required for the containment of additional upstream sections of the concentrate pipelines (***Section 3.5.3.2.3***).

3.3.11.1.6. Electrical Substation and Distribution

A new SRP substation will be constructed east of the Filter Plant building to supply power to the Filter Plant and Loadout Facility. Electrical transmission lines will run from the MARRCO Corridor along the eastern side of the site to the substation. From the substation, the power supply will be distributed via the on-site electrical grid to serve the electrical loads for all equipment. Off-site power supply to the Filter Plant and Loadout Facility is discussed in ***Section 3.5.1.4***.

3.3.11.1.7. Communications

Resolution will maintain multiple methods of communication for the site, including phone lines, cell phones, and voice-over internet protocol, with the associated computer network to support communications infrastructure.

3.4. TRANSPORTATION

3.4.1. ACCESS

3.4.1.1. *Major Transportation Routes*

This section outlines the transportation systems for Pinal County that provide direct or indirect access to Project areas. Regional transportation corridors are depicted in ***Figure 3.4-1***. Transportation corridors that provide access to the region include one federal and four state highways, and several county and local roads. The highways are:

- US 60, which runs east and west between the Phoenix Metropolitan Area and Globe and on to points east;
- SR 79, which runs north from Florence, creating a T-intersection with US 60 at Florence Junction west of Superior;
- SR 177, which runs north from Winkelman, creating a T-intersection with US 60 in Superior;
- SR 88, which runs north of the Miami/Globe area into the Salt River basin; and
- SR 24, a planned corridor from southeastern Maricopa County to Florence Junction west of Superior.

The nearest federal Interstate system highway, I-10, is located approximately 40 mi (65 km) west of Florence Junction. County and local roads within the region are either paved or unimproved. Side roads that allow access onto adjacent public lands are present within each of the Project sites located on public lands. Some of these roads are paved for a short distance, while others are unimproved or have more limited accessibility.

The Williams Gateway Freeway (SR 24) is a planned transportation corridor intended to provide access from southeastern Maricopa County to northeastern Pinal County. Currently, the only portion of the Project that has been initiated is a 1-mi stretch beginning at Loop 202 (San Tan Freeway) near the Phoenix-Mesa Gateway Airport and ending at Ellsworth Road. Construction of this phase of the Project is expected to be completed in 2014. Additional phases of the Project, east of Ellsworth Road, are currently suspended. No funding has been identified for the portion of the corridor planned for Pinal County (ADOT 2013).

3.4.1.2. *Project Access Routes*

3.4.1.2.1. Filter Plant and Loadout Facility and MARRCO Corridor

Access to the Filter Plant and Loadout Facility is provided from SR 79 (***Figure 3.4-2***). This route serves Florence and connects to US 60 at its northern terminus and SR 77 at its southern terminus.

The MARRCO Corridor crosses private, TNF, and ASLD-administered state trust lands between Superior and Magma. Hewitt Station Road (FR 357) parallels much of the corridor along Queen Creek and will be the main access road to the corridor. Access to public lands is available from side roads off of US 60 and along Hewitt Station Road (FR 357).

3.4.1.2.2. Tailings Storage Facility and Tailings Corridor

The TSF and Tailings Corridor areas are located west of WPS and north of US 60 on TNF land north of Queen Creek. Access to the TSF area is provided by FS roads off of US 60 (***Figure 3.4-2***). The existing FS roads that will provide access to the TSF and surrounding borrow areas include FR 172, FR 1904, FR 2381, FR 2386, FR 252, FR 357, FR 650, FR 8, and FR 982 (***Figure 1.5-4a***). Segments of these roads will be reconstructed and maintained as necessary to provide access for required construction equipment. Existing FS roads that traverse the TSF include FR 1903, FR 2359, FR 2360, FR 2361, FR 2362, FR 2363, FR 2364, FR 2366, FR 2380, FR 252, FR 518, and FR 982. Segments of the existing FS roads within the footprint of the TSF will be decommissioned with its construction. A new road around the perimeter of the tailings footprint will be constructed to provide access around the entire toe and surrounding facilities within the TSF area. Existing roads and trails outside the footprint will accommodate continued recreational use in the vicinity of the TSF.

A service road will be constructed alongside the entire Tailings Corridor. Once constructed, FS roads will no longer be used to access the corridor. However, the Tailings Corridor crosses five existing FS roads: FR 2362, FR 2371, FR 3152, FR 650, and FR 982. Public access will be restricted across three of these: FR 2362, FR 2371, and FR 982. Special crossings will be constructed to maintain access on FR 650 and FR 3152 north of the Tailings Corridor. FR 650 will bypass under the Tailings Corridor via a box culvert or similar structure, and FR 3152 will bypass over the pipeway of the Tailings Corridor and cross the service road at grade.

Specific details and typical sections for the reconstruction, decommissioning, limited-access designation, and roadway crossings for each FS road are provided in ***Appendix K***.

3.4.1.2.3. West Plant Site

WPS is located immediately north of Superior, Arizona. US 60 runs east-west through Superior; it is identified as a minor arterial highway east of Superior and a principal arterial highway west of Superior. US 60 between mileposts 214.5 and 240.5 is a designated scenic road—the Gila-Pinal Scenic Road—by the Arizona Department of Transportation (ADOT; ADOT undated). SR 177 is identified as a major collector highway, which means that the highway carries a higher volume of traffic than minor collector highways (PCCP 2012). The existing main entrance to WPS is afforded by a surface street (Magma Heights) within the town of Superior. A new security building and gate will be located at the new main entrance to WPS off Main Street. An alternative entrance to WPS will be accessible via Silver King Mine Road (FR 229) off of US 60.

FR 229 will be reconstructed for mine and construction equipment use between US 60 and the Resolution Copper private property boundary. This segment on TNF land will remain open for public use; however, public access will be prohibited on the private property owned by Resolution Copper. The portion of FR 229 on private property will be decommissioned. An alternative route by way of FR 8 and FR 3152 will be available to the public to access FR 229 north of WPS. This will require the reconstruction of FR 3152 to widen and upgrade the road to the same maintenance level as the existing Silver King Mine Road.

Segments of an additional road within the WPS project area will be designated as limited access or decommissioned. This road is FR 1010 and accesses WPS near the Process Water Pond. The public will not be able to access those portions of this road that are within the Project area or on private property. Typical sections for the reconstruction of FS roads and details regarding the lengths of the roads to be reconstructed, designated limited access, or decommissioned are provided in the Road Use Plan in ***Appendix K***.

3.4.1.2.4. East Plant Site

EPS is accessible via Magma Mine Road, a paved road that traverses portions of three different FS roads: FR 469, FR 315, and FR 2432. Magma Mine Road originates at US 60 as FR 469 approximately 3 mi (5 km) east of Superior, Arizona. US 60 is designated as a scenic highway by ADOT (ADOT undated).

FR 469 accesses EPS and connects with several FS roads that traverse EPS. The following is a list of the roads within the proposed footprint of EPS: FR 2432, FR 2433, FR 2434, FR 2435, FR 2438, FR 315, FR 3153, FR 3791, and FR 469. Public access will be cut off to the segments of these FS roads within the EPS project area and on private property owned by Resolution Copper. Segments within the EPS disturbance area will be decommissioned. The EPS disturbance area will encompass a portion of Magma Mine Road, so the road will be relocated in approximately Year 8 of mine operations. Public access to public lands in the vicinity of the EPS project area will be maintained via SR 77 on the western side, US 60 on the north, and FR 315 on the south, which all connect to other access roads in the area. Details for the Magma Mine Realignment and the specific lengths of the roads to be decommissioned or cut off from public access are provided in ***Appendix K***.

3.4.2. TRAFFIC

The transportation of personnel, materials, and equipment is discussed in this section in terms of two phases of the Resolution Project: construction and operations. The construction phase will be different for each facility; however, overall Project construction across all Project components and facilities is expected to last for 9 years and considers all activity prior to the operations phase, including actual construction activities as well as non-construction activities (e.g., administrative support and maintenance activities). The operations phase of the Project is expected to last approximately 40 years. For each phase, transportation numbers are presented for each of the Project sites, including EPS, WPS, the TSF, and the Filter Plant and Loadout Facility. Personnel transportation estimates are based on the anticipated staffing requirements for the Resolution Project as previously described in ***Section 4.9***. Material and equipment transportation estimates are based on the expected delivery requirements for each facility.

3.4.2.1. *Construction Phase*

3.4.2.1.1. East Plant Site

Personnel

The construction phase for EPS is expected to last approximately 13 years (5 years of construction on private lands before the Record of Decision and 8 years of post-decision construction on private and public lands). Personnel will be bused to EPS from a parking area at the core storage facility near WPS. Average daily personnel were calculated assuming a shift rotation factor of 0.66 to account for off-shift personnel. Average personnel trips per day to the site were calculated from average daily personnel assuming a 1.7 divisor to account for carpooling. Average personnel trips per day throughout the 13-year construction period will range from 31 to 437 (***Table 3.4-1***).

Table 3.4-1 East Plant Site Construction Phase Personnel Trips

East Plant Site	**Pre-decision Administration and Construction Activities on Private Land**					**RECORD OF DECISION**	**Post-decision Administration and Construction Activities on Private and Public Land**							
Subsequent Years after GPO Submittal	**1**	**2**	**3**	**4**	**5**		**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Total Personnel	78	179	216	247	434		601	791	1,054	1,123	1,122	980	822	854
Average Daily Personnel[1]	52	119	143	164	287		397	523	696	742	741	647	543	564
Average Personnel Trips/Day[2]	31	70	85	97	169		234	308	410	437	436	381	320	332

[1] Assumes 0.66 shift rotation factor to determine average daily personnel from total personnel.
[2] Assumes 1.7 carpooling divisor to determine average trips/day from average daily personnel.

Materials

Construction activities at EPS are expected to last approximately 13 years. Construction materials consist of fuel, underground concrete, underground production consumables, construction steel, other construction materials, and construction concrete, as shown in ***Table 3.4-2***. Construction materials were tabulated by total unit quantity and the number of units per shipment. The total number of truck shipments to EPS for construction materials was determined to be 70,341. Construction materials will be delivered over a 13-year period. Assuming that the shipments are distributed evenly, the average number of shipments per day will be about 21, or a peak of 25 shipments per day.

Table 3.4-2 Mine Construction Materials including Surface and Underground

Mine Construction Materials	Unit	Quantity	Units/ Shipment	Total Shipments	Duration Years	Average Trucks/ Year	Average Trucks/Day	Max Trucks/Day
Fuel	gallon	13,300,000	8,900	1,494				
Underground Concrete	yd^3	197,000	13	15,154				
Underground Production Consumables	truck	28,000	NA	28,000				
Construction Steel	ton	55,000	22	2,500				
Construction Material	yd^3	125,000	14	8,929				
Construction Material	yd^2	47,000	25	1,880				
Construction Concrete	yd^3	161,000	13	12,385				
Totals				**70,341**	**9**	**7,816**	**21**	**25**

Equipment

The major process equipment for EPS is summarized in ***Table 3.4-3***. Major equipment was tabulated by quantity and number of units per shipment. The total number of truck shipments to the site for major equipment is estimated to be 606. Major process equipment will be delivered over a 4-year period. Assuming that the shipments are distributed evenly, the average number of shipments per day will be about one.

Table 3.4-3 East Plant Site Major Equipment

Mine Equipment	Quantity	No. of Shipments/Unit	Total Shipments	Duration Years	Max Trucks/Day
Crushers and Related Equipment	78	1.3	101		
Conveyor Feeders	34	4.3	146		
Conveyors and Related Equipment	49	1.6	78		
Rail Dump Stations	3	5	15		
Locomotives and Railcars	98	0.9	88		
Ventilation Equipment	73	0.9	66		
Hoisting Equipment	9	9.3	84		
Dewatering Equipment	27	0.5	13		
Batch Plants	2	7.0	14		
Totals			**606**	**4**	**1**

3.4.2.1.2. West Plant Site and TSF

Personnel

The construction phase for WPS is expected to last approximately 13 years. Average daily personnel were calculated assuming a shift rotation factor of 0.66 to account for off-shift personnel. Average personnel trips per day to the site were calculated from average daily personnel assuming a 1.7 divisor to account for carpooling. The average trips over the 13-year construction period are shown in ***Table 3.4-4***. The average personnel trips per day during construction are expected to range from 45 to 1,098.

Table 3.4-4 West Plant Site and Tailings Storage Facility Construction Phase Personnel Trips

West Plant Site	**Pre-decision Administration and Construction Activities on Private Land**					**RECORD OF DECISION**	**Post-decision Administration and Construction Activities on Private and Public Land**							
Subsequent Years after GPO Submittal	**1**	**2**	**3**	**4**	**5**		**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Total Personnel	113	124	134	134	124		136	136	136	173	427	938	2,126	2,827
Average Daily Personnel[1]	75	82	89	89	82		90	90	90	115	282	620	1,404	1,866
Average Personnel Trips/Day[2]	45	49	53	53	49		53	53	53	68	166	365	826	1,098

[1] Assumes 0.66 shift rotation factor to determine average daily personnel from total personnel.
[2] Assumes 1.7 carpooling divisor to determine average trips/day from average daily personnel.

Materials and Equipment

Construction activities for facilities at WPS are expected to last approximately 13 years during the overall construction phase of the Resolution Project. Construction materials and estimated materials and equipment delivery trips for WPS, the TSF, the Tailings Corridor, the MARRCO Corridor, and the Filter Plant and Loadout Facility are shown in ***Tables 3.4-5 and 3.4-6***. At the peak of construction, there would be a maximum of about 72 truck shipments per day to WPS and 11 to the TSF. During construction ramp-up and ramp-down, there would be a maximum of about 48 truck shipments per day to WPS.

Table 3.4-5 West Plant Site, Tailings Storage Facility, and Filter Plant Loadout Materials and Mechanical Equipment (Concentrator)

Concentrator	Unit of Measure	Quantity	No. of Units/Shipment	Total Shipments	Duration Years	Avg Trucks/Day	Max Trucks/Day
Concrete	yd^3	163,231	22	7,367	3		
Rebar	tons	16,993	20	857	3		
Structural Steel	tons	16,490	11	1,496	3		
Handrails/Stairs	ft	48,799	88	553	3		
Grating	ft^2	697,499	1,345	518	3		
Prefab Buildings	ea	10	0.20	50	2		
Liner Plates	tons	311	5.51	56	2		
Chutes/Launders, Boxes	ea	198	1.25	158	2		
Tanks	ea	67	0.75	90	3		
Small-diameter Pipe	ft	1,079,066	591	1,827	3		
Large-diameter Pipe	ft	842,518	177	4,756	3		
Electrical Equipment	ea	420	2.00	210	3		
Overhead Transmission Line	ft	76,740	2,624	29	3		
Mechanical Equipment[1]				840	3		
TOTAL				**18,807**			
Year 1				6,582		18	54
Year 2				8,463		23	70
Year 3				3,761		10	31

[1] Includes all major process equipment (e.g., SAG mills, ball mills, flotation cells).

Table 3.4-6 West Plant Site, Tailings Storage Facility, and Filter Plant Loadout Materials and Mechanical Equipment (Tailings)

Tailings	Unit of Measure	Quantity	Unit of Measure/Freight Load	Total Shipments	Duration Years	Avg Trucks/Day	Max Trucks/Day
Tailings Equipment				92	3		
Large-diameter Pipe	feet	32,915	192	171	1		
Valves	ea	176	8	21	1		
Concrete	yd^3	50,070	22	2,276	2		
Asphalt	yd^3	9,741	23	424	2		
Structural Steel	tons	100	11	9	2		
TOTAL				**2,993**			
Year 1				1,047		3	9
Year 2				1,347		4	11
Year 3				599		2	5

3.4.2.1.3. Filter Plant and Loadout Facility

Personnel

The construction phase for the Filter Plant and Loadout Facility is expected to last approximately 2 years. Average trips to the site per day for the transport of personnel were determined by dividing staffing estimates by a factor of 1.7. Over the 2-year construction period, the average trips per day are expected to be 59. Construction materials and estimated equipment delivery trips are discussed in ***Section 3.4.2.1.2***.

Materials and Equipment

The materials to be used during the construction phase for the Filter Plant and Loadout Facility are included above in ***Section 3.4.2.1.2***.

3.4.2.2. *Operations Phase*

3.4.2.2.1. East Plant Site

Personnel

The operations phase for EPS is expected to last approximately 40 years. Average trips to the site per day for the transport of personnel were determined from total personnel assuming a shifting factor of 0.66 and a 1.7 divisor to account for carpooling. Average trips per day range from 72 to 332 (***Exhibit 3.4-1***).

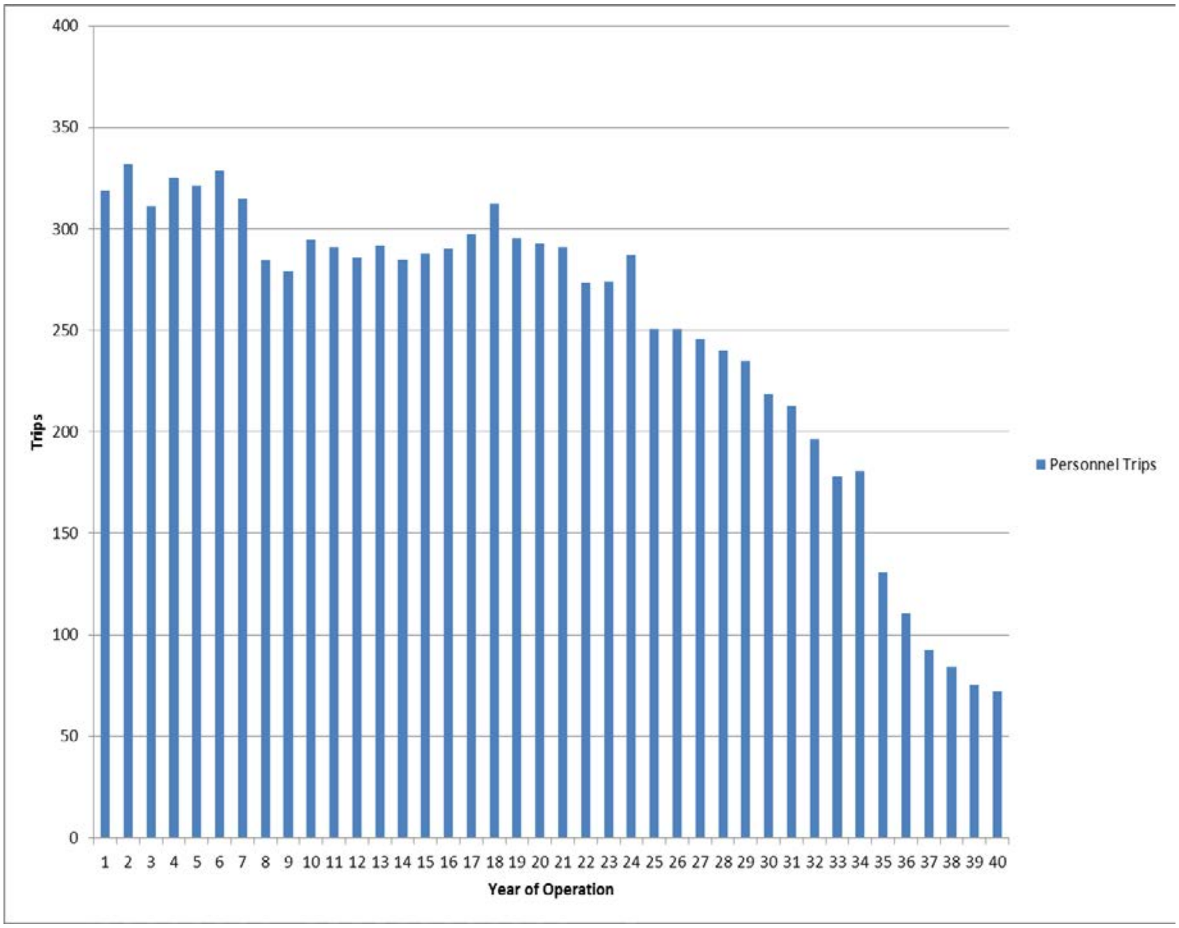
Materials

The materials required for operations at EPS include fuel, concrete, and underground production consumables as shown in ***Table 3.4-7***. Operations materials were tabulated, and the total number of truck shipments to the site were determined to be 221,993. Operations materials will be delivered over a 40-year period. Assuming that the shipments are distributed evenly, the average number of shipments per day will be about 17, with a peak of 20 shipments per day.

Table 3.4-7 East Plant Site Operations Materials Quantities and Trips

Mine Construction Materials	Unit	Quantity	Units/ Shipment	Total Shipments	Duration Years	Average Trips/ Year	Average Trips/ Day	Max Trips/ Day
Fuel	gallon	45,000,000	9,000	5,000				
Underground Concrete	yd^3	670,000	13	51,538				
Underground Production Consumables	ton	3,640,000	22	165,455				
Totals				**221,993**	**36**	**6,166**	**17**	**20**

Exhibit 3.4-1 East Plant Site Operations Phase Personnel Trips



3.4.2.2.2. West Plant Site and Tailings Storage Facility

Personnel

The operations phase for WPS, the TSF, and the Filter Plant and Loadout Facility is expected to last approximately 40 years. Personnel requirements for the operations phase include employees and contractors. Average trips to the site per day for the transport of personnel were determined by multiplying staffing estimates by a shifting factor of 0.6 to determine average daily personnel and dividing average daily personnel by a factor of 1.7 to account for carpooling. Over the 40-year operations period, the average trips per day is expected to be 335.

Materials

The materials required for Concentrator operations at WPS include SAG mill balls, ball mill balls, regrind mill balls, lime, sodium hydrosulfide, and miscellaneous reagents as shown in ***Table 3.4-8***. Additionally, molybdenum concentrate shipments will leave the site regularly. Operations materials and molybdenum concentrate shipments were tabulated, and the average number of truck shipments to/from WPS was determined to be 235,040. Operations materials will be delivered to the site, and molybdenum concentrate shipments will be made from the site over a 40-year period. Average shipments per week will be about 113, with approximately 19 trips per day and a maximum of 11 trips per hour. Assumptions for these calculations are included as footnotes to ***Table 3.4-8***.

Table 3.4-8 West Plant Site Operations Materials Quantities and Trips

Material	Unit	Quantity per Year[7]	Trips/Week	Trips/Day	Trips/Hour
SAG Mill, Ball Mill, and Regrind Mill Balls[1]	tons	50,011	40	8	4
Molybdenum Concentrate[2]	tons	24,145	26	4	2
Lime[3]	tons	27,359	22	3	2
Sodium Hydrosulfide[4]	tons	21,000	17	3	2
Miscellaneous Reagents[5,6]	tons	6,260	8	2	1
Total		**128,776**	**113**	**19**	**11**

1 Assumes 24 tons/truck, delivery 5 days/week, delivery mid-morning and mid-afternoon, 5 trucks/delivery, 1 hour/ delivery.
2 Assumes 18 tons/truck, 7 days/week, 3 trucks loaded in 1 hour mid-morning and mid-afternoon.
3 Assumes 24 tons/truck, delivery 7 days/week, delivery day and evening.
4 Assumes 24 tons/truck, delivery 7 days/week, delivery day and evening.
5 Includes Sodium isopropyl xanthate (SIPX), Methyl isobutyl carbinol (MIBC), Dithiophosphate/monothiophosphate, MCO, flocculants, and anti-scalant.
6 Assumes 15 tons/truck, delivery 5 days/week.
7 Based on average year over life of Mine.

3.4.2.2.3. Filter Plant and Loadout Facility

Personnel

The operations phase for the Filter Plant and Loadout Facility is expected to last approximately 40 years. Personnel requirements for the operations phase include administrative and professional staff and hourly staff. Average trips to the site per day for the transport of personnel were determined by dividing staffing estimates by a factor of 1.7. Over the 40-year operations period, the average trips per day is expected to be 18.

Concentrate Shipment

Copper concentrate production will average approximately 2.2 million tons per year over the life of the Project, with peaks of up to 3.0 million tons per year. At an average moisture content of 9 percent, transported copper concentrates will average 2.4 million tons per year, with peaks of up to 3.3 million tons per year.

Typical train sets are expected to be 100 cars at 110 tons per car, resulting in a train set carrying 11,000 tons of filtered copper concentrate. The Filter Plant and Loadout Facility will receive on average

220 train sets per year (0.6 train sets per day) and up to 300 train sets during the peak production years (0.8 train sets per day).

The rail loop at the Filter Plant and Loadout Facility will be capable of receiving one train set, and the track spurs at the intersection of the MARRCO and Union Pacific railroads are capable of storing additional cars to meet the concentrate transportation requirements.

Resolution Copper will own the railcars. A contract rail company will be used to transfer the empty and full railcars between the Filter Plant and Loadout Facility and the Union Pacific line on a daily basis, a distance of about 7 miles.

3.5. POWER/UTILITIES AND OTHER LINEAR PROJECT FEATURES

3.5.1. FACILITIES NEEDED FOR POWER

3.5.1.1. *Power Demand*

Power demands at the various sites associated with the Resolution Project will require the construction of electrical transmission facilities and substations to serve the Project. The three primary consumers of power for underground ore mining and processing are the operation of the hoist motors that hoist the ore out of the mine; the ventilation and cooling of the underground workings; and the operation of the grinding and flotation machinery housed in the Concentrator Complex. A new electrical power supply will also be required for the pumping facilities that bring water from the source to WPS and for the Filter Plant and Loadout Facility. Power supply is also required for business operations in the offices and shops for lighting, equipment, heating and cooling, and other uses.

The power demand for the mining and Concentrator Complex operations was modeled for eight transmission configurations and evaluated based on three study criteria: 1) power flow performance; 2) cost; and 3) environmental, maintenance, operations, and reliability factors. The transmission configuration that provides the greatest balance between the three study criteria was selected by SRP, the power provider for the Resolution Project (***Figures 3.0-1a through 3.0-1j***).

The power demands for the Filter Plant and Loadout Facility and water system have been developed and reviewed separately from the power supply for the mining and ore processing (Concentrator Complex) operations.

3.5.1.2. *Power Sources*

SRP is the intended supplier for all power for the mining and ore processing operations, including ventilation and cooling, the hoists, Concentrator Complex operations, the conveyors, the pump stations, and the Filter Plant and Loadout Facility. SRP, an agricultural improvement district, is organized and exists under the laws of the State of Arizona. SRP owns and operates electric, irrigation, and water supply systems. They provide retail and commercial electric service to approximately 1 million customers in the SRP exclusive retail electric service area located in portions of Maricopa, Gila, and Pinal counties, Arizona.

3.5.1.3. *Power Flow Analysis*

A power flow analysis was performed for the proposed mining operations to study the impacts of the Resolution Project on the SRP 115-kV system located in the region near Superior, Arizona. For this analysis, use or upgrade of the existing 115-kV system was deemed insufficient and new 230 kV circuits were identified to meet the expected large loads as well as the need for two separate electrical supplies to the mine to increase the safety and reliability of underground operations.

The locations identified for the new and existing power lines and the substations needed to support the power demands for the Resolution Project are shown in ***Figures 3.0-1b through 3.0-1j***.

3.5.1.4. *Electrical Power Supply Facilities*

3.5.1.4.1. East Plant Site and West Plant Site Area

The existing Oak Flat 115-kV substation is located at EPS. With the need for 230 kV to supply the mine, a new 230-kV substation will be sited to the southwest of the existing 115-kV substation. Two 230-kV transmission mains will supply the new Oak Flat 230-kV substation. One transmission main will be a single 230-kV line approximately 3.45 mi (5.55 km) long from Superior to EPS (***Figures 3.0-1g*** **and** ***3.0-1i***). The second 230-kV transmission main will run from the existing Silver King substation to the new Oak Flat 230-kV substation. This power line will be a single 230-kV transmission main approximately 3.55 mi (5.71 km) long following the existing 115-kV power line from the existing Silver King substation to EPS (***Figures 3.0-1i and 3.0-1j***). Where feasible, structure locations and span lengths will be aligned with the structures on the existing corridor.

A new 230/34.5-kV substation will be constructed at WPS to provide all power to the WPS facilities. A 0.5-mi (0.8-km) double-circuit 230-kV connection will be constructed from the new WPS substation to the existing 500-kV and 230-kV lines on the western side of WPS (***Figure 3.0-1g***). A redundant supply will be provided to WPS from the Silver King substation via EPS (***Figures 3.0-1g, 3.0-1i, and 3.01j***). The power supplied from the existing 115-kV Trask substation at WPS will be replaced by a 34.5-kV overhead transmission line to a new 34.5/4.16-kV transformer. A 34.5-kV pole-mounted transmission line will be located within the Tailings Corridor to the TSF substation. A lower voltage transmission line (the preliminary design is for 4.16-kV) will be used for power around the TSF. To accommodate the location of the new facilities at WPS, a portion of the existing 115-kV power line from Superior to Silver King is being rerouted within the boundary of WPS.

3.5.1.4.2. Filter Plant and Loadout Facility

The power supply for the Filter Plant and Loadout Facility and supply water pumping facilities will be double-circuit 69-kV power lines on tubular steel poles. The 69-kV power lines will run approximately 4.7 mi (7.6 km) to the Filter Plant and Loadout Facility from the existing Abel substation near the CAP canal crossing of the MARRCO Corridor (***Figures 3.0-1a and 3.0-1b***). A 12-kV power line, on the same pole as the 69-kV power lines, will run along the MARRCO Corridor to provide power to the recovery wells located within the MARRCO Corridor (***Figure 3.0-1c***). A new 69-kV substation will be located at the Filter Plant and Loadout Facility. From the Filter Plant and Loadout Facility, one 69-kV line and the 12-kV line will continue northeast to the Queen Valley Pump Station (***Figure 3.0-1d***). The 69-kV and 12-kV lines will be located within a new 50-ft (15-m) easement adjacent to the northern side of the MARRCO Corridor.

3.5.1.5. *Transmission Equipment*

This section provides a general description of the electrical transmission facilities that will be used for the Resolution Project. Similar transmission line structures and line construction hardware will be used in all power supply scenarios, with slight variations depending on the nature of the terrain in the alignment and the power line configuration.

Structures will be either lattice steel towers or tubular steel poles erected to the height required to accommodate electrical clearances per the National Electric Safety Code. For 230-kV power lines on level terrain, the tower height does not typically exceed 140 ft (43 m), but environmental and terrain features unique to this Project will ultimately determine what constitutes adequate structure height.

The various routes and scenarios evaluated for this Project include hilly and rocky terrain. The character of the terrain played a large role in the selection of the structure locations. Site access limitations, condition of existing soil/rock, and the topography of the alignment area were all carefully considered when the most appropriate structure locations were determined.

Double-circuit structures will be constructed such that three-phase conductors or bundles for each circuit can be installed on opposite sides of the pole. In locations where the line direction changes, especially at sharp turns or in locations where vertical clearances require a horizontal arrangement, phase attachments may be separated into separate pole structures due to structural capacity limitations.

The foundations for the transmission line structures will be auger-drilled reinforced concrete piers. A lattice tower typically has four legs, each attached to a concrete foundation set into the ground. Steel pole structure footings are typically comprised of a steel-reinforced concrete foundation referred to as an "anchor-bolt foundation" onto which the steel pole is bolted.

3.5.1.6. *Construction and Maintenance Practices*

Generally, the electric easements will vary between 50 and 100 ft (15 and 30 m) wide depending on the size of the line and the requirements for construction, maintenance, and electrical clearances. The disturbance footprint required for each of the transmission structures will be limited to the area immediately surrounding the structure. The lattice towers will have the largest disturbance and will require an approximately 80-by-80-ft (24-by-24-m) disturbance/maintenance area. The maximum temporary disturbance area for the structures during construction will be approximately 150 by 150 ft (46 by 46 m).

Wherever possible, existing roads will be used to construct the transmission facilities. In some areas, access roads may be cleared on an as-required basis to ensure adequate access for construction and maintenance activities. Staging areas immediately surrounding line structures may be necessary depending on specific site access. Permanent access roads will be provided along the transmission line alignment in drivable terrain.

3.5.2. COMMUNICATIONS

Resolution Copper will maintain multiple methods of communication for EPS, WPS, and the Filter Plant and Loadout Facility, including phone lines, leaky feeder radio, cell phones, and voice-over internet protocol, with the associated computer network, dispatch, and central control system to support communications infrastructure. Included in these methods will be a system for communicating with and locating miners in case of emergency. Underground communications equipment will be strategically located throughout the underground workings in conformance with MSHA standards. Both telephone and internet communications currently exist at WPS. These facilities will be extended as required to the new facilities. The communications system plans will be modified as technology improves. Additional information on communications may be found in ***Sections 3.2.10.18, 3.3.1.4.14, and 3.3.11.1.7***.

3.5.3. OTHER LINEAR PROJECT FEATURES

3.5.3.1. *MARRCO Corridor*

Resolution Copper owns the MARRCO railroad, which includes approximately 30 mi (48 km) of track from Magma Junction to the town of Superior (***Figures 3.0-1a through 3.0-1g***). The MARRCO rail line was originally constructed in 1915 as a narrow-gauge line that served the Magma Mining Company until the mid-1920s, when it was upgraded to the current standard-gauge line. The rail line lies within a 200-ft (61-m) right-of-way for the majority of the corridor from Magma to Superior, although there is a small portion of the right-of-way that narrows to 50 ft (15 m) through private property west of Superior. The track varies from centered in the right-of-way to offset by approximately 20 ft from the centerline.

The southwestern portion of the MARRCO Corridor from Magma to northeast of Florence Junction is in an area of gently sloping terrain. The MARRCO Corridor in this area is open and relatively flat across the width of the right-of-way. The segment of the railroad alignment from northeast of Florence Junction to Superior runs through more rugged, mountainous terrain where the corridor is generally not flat or uniformly graded across the width of the right-of-way.

The MARRCO right-of-way currently includes Arizona Water Company facilities (water plant site, well, and a 12-in [30.5-cm] water main) as well as an 18-in (45.7-cm) water line from WPS to the NMIDD. In addition to the Arizona Water Company pipeline, other utilities present within the right-of-way include a buried Qwest fiber optic line, a buried El Paso Natural Gas pipeline, and overhead electric transmission and telephone lines.

The MARRCO rail line will be used to carry copper concentrate from the Filter Plant and Loadout Facility (located approximately 6.7 mi [11 km] northeast of Magma Junction) to Magma to be transferred to the Union Pacific Rail Road. The portion of the railroad line from the Filter Plant and Loadout Facility southwest to Magma will be upgraded to handle the increase in load weight from the concentrate. This section will be reconstructed from the existing 70-lb (32-kg) rail line and ties to 136-lb (62-kg) rail line and ties. In addition, improvements to the Magma connection to the Union Pacific Rail Road line will be required. The railroad alignment from the Filter Plant and Loadout Facility to the town of Superior will not require rail upgrades.

The MARRCO right-of-way from the Filter Plant and Loadout Facility to the Queen Creek Pump Station will not require significant modifications (i.e., grading) for the installation of the concentrate and water pipelines (***Section 3.5.3.2***). The pipelines will generally be buried a minimum of 3 ft (1 m) alongside the track (similar to the existing pipelines), and the right-of-way corridor will be cleared of vegetation from the track ballast to the right-of-way boundary for the pipeline installation. The water pipelines will be installed on the surface alongside the track (similar to the existing pipelines).

The section of the railroad alignment from the Queen Creek Pump Station to WPS is within more rugged, mountainous terrain. Locations within the MARRCO Corridor with deteriorating rock slopes and rockslides will require some grading and slope stabilization prior to concentrate and water pipeline installation. Where necessary, the slopes will be cut back to create 1.5H:1V maximum slopes for safety and stability. Welded wire netting, shotcrete, or other methods will be required in certain areas to keep the grading and slope stabilization within the existing right-of-way limits where possible. The pipelines will generally be installed above ground alongside the track.

3.5.3.2. *Water, Slurry, and Product Transport Infrastructure*

The Resolution Project, with underground mine, stockpiles, Concentrator Complex, TSF, and associated facilities, will require an array of delivery pipelines and associated pump stations and storage facilities to transport liquids and slurries throughout the processes. ***Figure 1.5-1*** provides an overview of the process flow for the overall Project. ***Figures 3.0-1a through 3.0-1j*** show the source and delivery point for each of the pipelines discussed in this section. A detailed description of the water supplies and water balance for the Resolution Project is provided in ***Section 3.6***. Several important Project pipeline and infrastructure features will be located within existing disturbed, brownfield areas.

3.5.3.2.1. Water Sources and Systems

The primary water source for the Project (supply water) will be CAP water. The water supply will be pumped from wells in order to recover banked CAP water, or will be extracted directly from the CAP canal. The supply water will also include filtrate from the Filter Plant.

As part of Resolution Copper's water supply system, a pipeline will be installed from a CAP pump station located at the intersection of the MARRCO alignment and the CAP canal. In 2006, Resolution Copper began purchasing and banking renewable excess CAP water via delivery to the New Magma Irrigation District. At the NMIDD, farmers use CAP water from the canal for irrigation purposes, which reduces groundwater pumping. Additionally, groundwater in the area is further replenished from irrigation water that seeps into the ground. When water is delivered for mining operations, Resolution Copper will obtain CAP water from the banked credits and will continue to purchase excess CAP water while available. The supply water delivery system will be designed for a split between banked CAP water recovered from wells in the vicinity of the MARRCO and/or Filter Plant and within the Phoenix Active Management Area and CAP water withdrawn directly from the CAP canal. The CAP water from the canal or from the recovery well field will be delivered to a 3-MG (11,400-m^3) CAP Water Tank at the Filter Plant and Loadout Facility, where it will be combined with filtrate from the Filter Plant and Loadout Facility for delivery to the CAP Water Distribution Tank at WPS. The exact location of the banked CAP water recovery wells will be determined after an impact assessment is conducted as prescribed under the requirements of Arizona Department of Water Resources (ADWR).

A series of pump stations and pipelines will convey the water approximately 22 mi (36 km) from the Filter Plant and Loadout Facility to WPS (***Figures 3.0-1a through 3.0-1j***). Pump stations will be designed to convey 12,000 gpm (760 L/s) with three 6,000-gpm (380-L/s) booster pumps (one standby). The CAP Water Supply pipeline will be a 36-in- (91.4-cm-) diameter steel pipe throughout the alignment. The wall thickness of the pipe will be adjusted in accordance with the working pressure of the pipeline along the various sections of the alignment.

In addition to the makeup supply water, Resolution Copper will maximize beneficial use of mine dewatering water, recycled process water, and reclaim water from the TSF. Mine dewatering water will be used within the Concentrator as process water. Filtrate from the Filter Plant will supplement the CAP water delivered to WPS and EPS. Additionally, decant water from the TSF (reclaim water) and tailings and concentrate thickeners at WPS will be recycled and reused in the processes.

CAP Canal Water Pump Station and Well Field Collection System

The first section of the water supply pipeline will be located within the MARRCO Corridor from the CAP canal to the Filter Plant and Loadout Facility. CAP water will be pumped directly from the canal via a pump station constructed on a bridge structure over the canal (***Figure 3.0-1a***). The pipeline will consist of approximately 4.2 mi (6.8 km) of 36-in- (91.4-cm-) diameter steel pipe. The pipeline will be located above ground on the southern side of the MARRCO Corridor within the existing right-of-way. The pipeline will discharge into the 3-MG (11,400-m^3) CAP Water Tank at the Filter Plant and Loadout Facility (***Figure 3.0-1b***).

In addition to the pump station over the CAP canal, banked CAP recovery wells will be located in a well field in the vicinity of the MARRCO Corridor (***Figures 3.0-1a through 3.0-1c***). The current recovery well field design consists of approximately 30 wells with a capacity of approximately 400 gpm (25 L/s) each along the MARRCO Corridor between the CAP canal and SR 79. However, the final configuration of the recovery wells will depend on an impact assessment under the ADWR program. The wells will pump to a common above-ground well collector pipeline that will feed into the 3-MG water tank at the Filter Plant and Loadout Facility (***Figure 3.0-1b***).

Filter Plant CAP Water Tank and Pump Station

The Filter Plant Site CAP Water Tank and Pump Station will be located at the southeastern corner of the Filter Plant and Loadout Facility site. This facility will include a 3-MG (11,400-m^3) tank that will accept flows from the CAP canal, recovery wells, and Filter Plant filtrate (***Figure 3.0-1b***) and a 12,000-gpm (760-L/s) pump station. The discharge pipeline will be approximately 9.9 mi (15.9 km) of 36-in- (91.4-cm-) diameter steel pipe. From the Filter Plant Site CAP Water Pump Station, the pipeline will be above ground on the southern side of the MARRCO Corridor to SR 79, where the pipeline will cross to the northern side of the rail alignment. The CAP water supply pipeline will continue above ground and within the MARRCO Corridor to the Queen Valley Pump Station (***Figure 3.0-1d***).

Queen Valley Pump Station

The 12,000-gpm (760-L/s) Queen Valley Pump Station will be located on the northern side of the MARRCO Corridor between US 60 and Hewitt Station (***Figure 3.0-1d***). The Queen Valley Pump Station power supply will come from a 69-kV line served by the existing SRP Abel substation (***Figure 3.0-1a***). The discharge pipeline will be approximately 15.0 mi (24 km) of 36-in- (91.4-cm-) diameter steel pipe located on the northern side of the MARRCO Corridor except for a small portion through private land where the pipeline will be on the southern side of the alignment. The pipeline will be above ground with expansion loops spaced approximately every 3,280 ft (1,000 m). The pipeline will follow the MARRCO Corridor from the Queen Valley Pump Station into WPS. Once the MARRCO Corridor enters WPS, the pipeline will diverge from the rail alignment and run north to the CAP Water Distribution Tank.

West Plant Site Forebay and Pump Station

A storage forebay tank and pump station will be constructed at the WPS entrance to the Never Sweat Tunnel to supply mine service water to EPS. A 16-in (40.6-cm) water pipeline will supply the forebay tank via the CAP water pipeline. The 16-in line will T-off from the CAP water pipeline near the contractor laydown yard before the pipeline turns north to deliver water to the CAP distribution and Fire Water tanks. From the forebay tank, the water is pumped through a 16-in (40.6-cm) pipeline along the Never Sweat Tunnel to Shaft 9. The water is then pumped from Shaft 9 to the Mine Service Water Tank at EPS, where it is available for distribution to the dust-suppression and refrigeration and ventilation systems (***Figures 3.0-1g and 3.0-1i***).

3.5.3.2.2. Filtrate Water Return

The processing of copper concentrate at the Filter Plant will result in a filtrate water supply that will be recycled and returned to WPS for service water use. Filtrate water pipelines will convey the filtrate to the 3-MG (11,400-m^3) CAP Water Tank located at the Filter Plant and Loadout Facility (***Figure 3.0-1b***), where the filtrate will be mixed with the recovery well and/or CAP water. From this site, the water will be pumped east along the MARRCO Corridor to WPS via the pipelines and pump stations discussed in ***Section 3.5.3.2.1***.

3.5.3.2.3. Concentrate Lines

During ore processing, a concentrate/slurry is formed, separating the copper minerals from the tailings. This copper concentrate will be pumped from WPS to the Filter Plant and Loadout Facility (***Figures 3.0-1b through 3.0-1g***). The slurry will be filtered to remove excess water, and the filtered concentrate will be shipped out to off-site smelters, as described in ***Section 3.3.1.2.5***.

Copper concentrate slurry will be pumped through two 8-in (20-cm) HDPE-lined schedule-40 steel pipelines from the Concentrator at WPS to the Filter Plant and Loadout Facility located approximately 25 mi (40 km) to the southwest. Each pipeline will have a pump station with two pumps each (one backup).

The concentrate pipeline alignment will follow the same alignment as the CAP water pipeline along the MARRCO Corridor to the Filter Plant and Loadout Facility. The concentrate pipelines will, for the most part, be located above ground and in a containment ditch within the MARRCO Corridor for approximately 15 mi (24 km) between WPS and the Queen Valley Pump Station and will generally be buried for approximately 10 mi (16 km) between the Queen Valley Pump Station and the Filter Plant and Loadout Facility (***Figures 3.0-1b through 3.0-1g***). The pipelines will be buried a minimum of 3 ft (1 m) in underground sections and may also be buried where required along the aboveground section at access roads or other crossings. The concentrate pipelines will be double contained at the Queen Creek crossing and routed through sleeves underneath all highway crossings (US 60 and SR 79). Due to the high pressures in the concentrate lines, pressure dissipation systems will be constructed on each line near the Filter Plant and Loadout Facility. Additional information on concentrate line protections may be found in ***Section 4.14.4***.

3.5.3.2.4. Tailings Pipelines

Tailings generated at the Concentrator will be thickened and conveyed (either by gravity or pumped) as a slurry through tailings pipelines from WPS to a tie-in point near the northeastern corner of the TSF (***Section 3.3.10.2***). The scavenger tailings will be conveyed in a 48-in (122-cm) inside diameter concrete pipeline and the cleaner tailings will be conveyed in a 24-in (61-cm) inside diameter concrete pipeline. The tailings pipelines will be constructed from short sections using typical industry standard practices such as rubber sealed slip joints, and will generally be located above ground and in a containment canal within the Tailings Corridor, providing secondary containment (***Figure 3.0-1h***).

The scavenger tailings will be conveyed in 28-in- (71-cm-) diameter steel pipelines from the tie-in point at the northeastern corner of the TSF and will follow ridgelines to the TSF embankment crest (***Figures 3.3-3a through 3.3-7***). From the embankment crest, the scavenger tailings will be distributed along the TSF crest in 32-in- (81-cm-) diameter HDPE-pipelines. During operation, the scavenger tailings line will contain approximately 11,500 yd^3 of slurry (5,300 tons of solids and 2.1 ac-ft of water) at 50 percent full (operational level). Where possible, the pipelines will be routed to stay 30 ft (10 m) below the ridge crests and within the ridgelines of the TSF, such that any pipe breakage or leakage will drain into the interior of the TSF.

The cleaner tailings will be conveyed in 18-in- (46-cm-) diameter HDPE pipelines from the tie-in point at the northeastern corner of the TSF and will follow ridgelines to additional pipe segments arranged for deposition in the interior of the TSF (***Figures 3.3-3a through 3.3-7***). In later years of the mine life, cleaner tailings deposition berms will be built into the tailings pond to allow the tailings to discharge into the desired areas. The cleaner tailings line will contain approximately 1,400 yd^3 of slurry (971 tons of solids and 0.71 ac-ft of water) at 50 percent full (operational level).

Pipeline leaks would be contained within a trapezoidal pipeway secondary containment channel as shown in Section A-A provided on ***Figure 3.0-1h***. The tailing lines will be designed to split from the main pipeway section where longitudinal slopes exceed 0.7% and be routed through concrete drop boxes to control flow velocities. Leaks will still be contained in these areas in the same manner as the main pipeway by using a secondary containment channel and berms as seen in Sections B-B provided on ***Figure 3.0-1h***. Box culverts would be used to contain flows where road crossings are necessary and a steel secondary containment will be provided for containment over the pipe bridge as seen in Section C-C on ***Figure 3.0-1h***. Tailings pipeline protection measures and monitoring systems are described in ***Section 4.14.4***.

3.5.3.2.5. Reclaim Water Systems

As part of Resolution Copper's water management, process water will be recycled and reused in operations, reducing the amount of supply water required from offsite sources. The main use for recycled process water will be at the Concentrator and thickeners. The purpose of the thickeners is to remove excess water; therefore, process water will be directed to the thickeners only if they need to be filled or if additional water is needed to optimize operating efficiency. The process water sources will consist of flows from the TSF, copper concentrate thickeners, the molybdenum thickener, and tailings thickeners.

The TSF pond water will be reclaimed back to WPS by a floating barge located in the tailings pond near the center of the TSF (***Figures 3.3-3a through 3.3-7***). The pipeline will follow ridges or access berms to the north of the facility. Details of the reclaim system will be determined in future design stages.

Water that reports to the seepage collection ponds will be individually pumped up the embankment slopes and discharged back into the TSF on the crest of the embankment where it will flow to the reclaim pond. Details of the seepage return system are provided in KCB (2014, Appendix XII).

3.6. WATER USE AND TREATMENT

Water use, reuse, and water management will be key aspects of the Resolution Project because of the water-intensive nature of copper mining and processing. The largest overall requirement for water use will be in ore processing (the Concentrator processes), although the majority of the water used in the Concentrator processes will be recycled. The largest consumptive water use will be the void fill water incorporated in the tailings during the tailings deposition process (maintaining saturation of the cleaner tailings) as well as evaporative losses. Dewatering will be necessary in the underground mine, and the collected water will be reused in the processing of ore and tailings. Other water uses include dust control/suppression, equipment wash-down, potable use, and fire protection. A more detailed description of the water balance for the Resolution Project is provided in the following sections.

To get the mine up to full operation, water will be needed for construction and development, Concentrator startup, mine and Concentrator operations, and reclamation activities. These water demands will vary throughout the years of mine operation as well as seasonally, due primarily to the water required for the construction of the tailings and the increased tailings evaporation rate as the TSF surface area increases. The water balance analysis was conducted for Years 1 through 8, Years 20 through 34, and Years 35 through 45 (***Figures 3.6-1a through 3.6-1c***).

3.6.1. WATER BALANCE, SOURCES, AND MANAGEMENT

3.6.1.1. *Sources*

Several sources supply water for the Resolution Project. The primary water source for Concentrator Complex startup and operations will come from renewable water sources and not fresh groundwater: the CAP canal and/or the banked CAP recovery wells located in the vicinity of the MARRCO/Filter Plant and Loadout Facility. Both the CAP Canal Pump Station and the CAP recovery well systems will be designed for a maximum of 12,000 gpm (760 L/s) each. To allow Resolution Copper flexibility in operations and redundancy for outages, the water sources may be used interchangeably and the flows can be split between the sources. Other minor water supplies will come from mine dewatering and precipitation inflow.

A current estimate of the total quantity of water needed for the life of the mine is 500,000 ac-ft. Resolution Copper has acquired approximately 312,000 ac-ft of renewable long-term storage credits from the CAP, which it has banked for future use at the NMIDD in accordance with state water banking statutes. This quantity represents approximately 62 percent of the total water required for the life of the mine. Since the banked water originated from renewable supplies (surface water), Resolution Copper is in a unique position among Arizona copper mining operations in that it has secured over half of its anticipated Project water needs using renewable supplies long before the start of operations.

Resolution Copper has also purchased approximately 37,000 ac-ft of renewable long-term storage credits from the Gila River Water Storage LLC, a partnership between the Gila River Indian Community and the Salt River Project, to bring renewable water supplies to central Arizona so that growth and development in the areas surrounding the Community's reservation is done in a sustainable manner.

In addition to the renewable long-term storage credits, Resolution Copper has also been recommended by ADWR to receive an allocation of CAP Non-Indian Agricultural water from the Bureau of Reclamation in the amount of 2,238 ac-ft/year. If approved, this water would be available to Resolution Copper to store during pre-production years and to use directly off of the CAP canal during production years. Resolution Copper expects to have this water available for delivery and storage by 2016.

The Non-Indian Agricultural water allocation and the renewable long-term storage credits from the CAP and the Gila River Water Storage LLC constitute the current water supply portfolio. These renewable water supplies will provide for over 65 percent of Resolution Copper’s water supply needs over the life of the mine, equivalent to the full requirements for the first 27 years of mine life. Acquisition of the balance of the renewable water supply needed for the full projected 40 years of operations (approximately 170,000 ac-ft, which will not be required for many decades) is expected to be an ongoing process that will continue during permitting, construction, and likely into production.

3.6.1.2. *Reclaim/Reuse*

Maximizing water reuse is critical to the Resolution Project from a physical resource and cost perspective. Reuse and reclaim water supplies will be used for mine operations to the greatest extent possible, including water from mine dewatering, tailings dewatering, seepage collection, overflow water from the copper/molybdenum thickeners and tailings thickeners, and concentrate filtrate. Once the Concentrator is operating at full capacity, the reuse and reclaim water systems will supply the majority of the Concentrator water needs. Other water sources will provide makeup water to replace consumptive uses associated with the Mine, Concentrator, and TSF. Water demand will vary during the year, with peak demand during the summer months (before the monsoon season), when dust suppression needs and evaporation are greatest. The use of various water supplies and the balance between reuse and consumptive uses are discussed in the following sections.

3.6.1.3. *Water Uses and Water Balance*

The Mine will be operated to maximize internal water reuse, only bringing in outside water supplies to make up for consumptive losses within the system. Once in full operation, the Mine and Concentrator operations will have approximately 9,730 gpm (614 L/s) of consumptive losses that will need to be replaced. At maximum production, it is possible that the Mine may use up to 12,400 gpm (782 L/s); seasonal variations will also occur. Based on the water requirements for the Resolution Project, the quantity of supply from various sources of process, service, reuse, and reclaim water for Years 1 through 7, Years 8 through 36, and Years 37 through 45 are shown in ***Figures 3.6-1a through 3.6-1c***. The supply, slurry, reclaim, inflow, and losses expected for water uses during Years 1 through 7, Years 8 through 36, and Years 37 through 45 are also presented for each facility in ***Tables 3.6-1 through 3.6-3***.

Table 3.6-1 Annualized Flows Years 1 through 7 (acre-feet/year)

	CAP and Recovery Wells	3 MG Storage	Seepage Collection Ponds	Filter Plant and Loadout Facility	Tailings Storage Facility	West Plant Site	East Plant Site
Process Water	-	-6,309	–	-342	–	6,729	-78
Slurry	–	–	–	416	8,409	-8,825	–
Reclaimed Water	–	–	-130	–	-2,420	2,550	–
Lost Water	–	–	–	-74	-6,491	-490	-1,760
Inflow/Groundwater	-6,309	6,309	130	–	925	35	1,839

Table 3.6-2 Annualized Flows Years 8 through 36 (acre-feet/year)

	CAP and Recovery Wells	3 MG Storage	Seepage Collection Ponds	Filter Plant and Loadout Facility	Tailings Storage Facility	West Plant Site	East Plant Site
Process Water	–	-16,038	–	-774	–	16,147	665
Slurry	–	–	–	942	19,496	-16,296	–
Reclaimed Water	–	–	-272	–	-4,481	4,753	–
Lost Water	–	–	–	-168	-16,967	-497	-3,246
Inflow/Groundwater	16,038	16,038	272	–	1,972	35	2,580

Table 3.6-3 Annualized Flows Years 37 through 45 (acre-feet/year)

	CAP and Recovery Wells	3 MG Storage	Seepage Collection Ponds	Filter Plant and Loadout Facility	Tailings Storage Facility	West Plant Site	East Plant Site
Process Water	–	-6,096	–	-199	1,765	4,528	2
Slurry	–	–	–	242	5,013	-5,255	–
Reclaimed Water	–	–	-396	–	396	1,179	–
Lost Water	–	–	–	-434	-8,030	-487	-1,655
Inflow/Groundwater	6,096	6,096	396	–	1,743	35	1,654

3.6.1.3.1. Ore Processing

The majority of water use at the Resolution Project will be for ore processing activities, including creating slurry conditions to facilitate the delivery of tailings to the TSF and ultimately consumption for tailings void fill and evaporation losses. Other consumptive uses in ore processing include losses in concentrate following concentrate filtration and evaporative and dust-control uses throughout the processes.

However, the intent of the Resolution Project is to operate the Concentrator as a closed-circuit facility for reducing losses of water. To the greatest extent practicable, water will be recycled directly within the Concentrator operation rather than discharging to the TSF. Initially, water will need to be added to the ore in the grinding process. Following grinding and thickening, the ore will be pumped through a series of flotation cells. Once concentrated, the concentrate will be piped as slurry (45 to 60 percent solids) to the Filter Plant, where the water will be removed and returned to the Concentrator. Similarly, scavenger and cleaner tailings will be pumped as slurry (55 to 65 percent solids) to the TSF. For the life of the Project, there will be separate tailings thickening facilities for the cleaner and scavenger tailings.

The Resolution Project ore processing facility will be operated in three stages:

- Concentrator startup (charging the system);
- Normal operation; and,
- Concentrator closure.

When the Concentrator is first started, very little water will be present in the circuit. Water from the CAP canal, the CAP well field, and mine dewatering will be used to charge the system during the first year of Concentrator operation. During this period, little water will be in the TSF as the decant pool takes shape. Annualized flows for Years 1 through 8 are presented in ***Table 3.6-1***.

After startup, the Resolution Project Concentrator will attain full operational status, and makeup water needs will stabilize. Nearly half the total water used in the Concentrator process will be recycled from the Concentrator facility and the TSF. However, due to evaporation and the retention of residual water within the tailings (i.e., void fill to help maintain saturation of the cleaner tailings), makeup water will still be required in the process to maintain Concentrator operations.

Once sufficient water volume is attained in the TSF, water will be returned from this facility to the Process Water Pond and then back to the Concentrator. Although there will be water losses in the ore processing system such as void fill, concentrate moisture, and evaporation, the makeup water requirements will stabilize once tailings reclaim reaches equilibrium. In tailings water reclaim, seasonal precipitation and evaporation will play a large role in determining the amount of water recycled to the Concentrator. As the Project approaches the final cessation of operations, as much water as practical will be drawn from the TSF to reduce the size of the decant pond. Annualized flows for Years 20 through 34 and Years 35 through 45 are presented in ***Tables 3.6-2 and 3.6-3***, respectively.

Water used to transport the concentrate to the Filter Plant and Loadout Facility will be removed using a filter press system. The filtrate water will be recycled back to the supply water system. As with the handling of water through the TSF, there will be evaporative losses as well as some residual loss in the concentrate associated with the Filter Plant operations.

3.6.1.3.2. Underground Operations

Another use of water at the Resolution Project will be for underground mining purposes. Inflow and infiltration into the mine will be used for process makeup at the Concentrator. Fresh makeup water will be used for dust suppression and the refrigeration system in the Mine area. Evaporation associated with the primary ventilation systems will cause water loss, and there will be water loss due to blow-down, vaporization, and evaporation in the refrigeration systems for the surface and underground refrigeration plants. Underground operations and drilling will require water for dust control, the removal of drill cuttings, and the cooling of drill bits.

3.6.1.3.3. Surface Dust Control

Although many of the main access roads into the sites will likely be paved, Resolution Copper will provide dust control on many unpaved roads as well as at the various stockpile and materials handling locations.

3.6.1.3.4. Potable Water

Water will be necessary for potable and sanitary use at the Resolution Project sites. Potable water will be used at the administration and service buildings, at the Concentrator Complex at WPS, in the underground and aboveground office and maintenance complexes at EPS, and at the Filter Plant and Loadout Facility. Water demands will be based on the fixture units and employee loading at each facility. Potable demands at WPS and EPS will be supplied by the domestic system operated by the Arizona Water Company, the local water supplier serving the town of Superior. Potable water supply at EPS will be supplemented by the existing on-site potable supply system. Potable water at the Filter Plant and Loadout Facility will be supplied by a separate potable water system operated by the Arizona Water Company.

3.6.1.3.5. Fire Protection

Fire protection supplies will generally be incorporated into the process water systems at the sites, although separate fire supply storage tanks may be provided at certain locations. Capacity will be made available in the total system for adequate water storage for the fire pump systems and firefighting. Resolution Copper plans to construct and maintain fire supply storage tanks and pump stations on site at the WPS Concentrator Complex and administration building area, the EPS mine office complex, and the Filter Plant and Loadout Facility. Final building material types will determine the number of gallons of water to be stored for firefighting and fire protection purposes at each site. Additional information on fire prevention and response may be found in ***Appendix M***.

3.6.2. TRANSPORT, STORAGE, AND TREATMENT FACILITIES

The Resolution Project will require an array of delivery pipelines and associated pump stations and storage facilities to transport liquids and slurries throughout the processes (see ***Figures 3.0-1a through 3.0-1j***). Several Project pipeline and infrastructure features will be located within existing disturbed, brownfield areas. The primary water source for the Project (supply water) will be CAP water. The supply water will also include filtrate from the Filter Plant.

As described above in ***Section 3.5.3.2,*** the supply water delivery system will be designed for a split between banked CAP water recovered from wells in the vicinity of the MARRCO Corridor and/or the Filter Plant and within the Phoenix Active Management Area and CAP water withdrawn directly from the CAP canal. The CAP water will be delivered via a series of pump stations and pipelines to a 3-MG

(11,400-m^3) CAP Water Tank at the Filter Plant and Loadout Facility, where it will be combined with filtrate from the Filter Plant and Loadout Facility for delivery to the CAP Water Distribution Tank at WPS.

In addition to the makeup supply water, Resolution Copper will maximize the beneficial use of mine dewatering water, recycled process water, and reclaim water from the TSF. Mine dewatering water will be used within the Concentrator as process water. Additionally, decant water from the TSF (reclaim water) and the tailings and concentrate thickeners at WPS will be recycled and also reused in the Concentrator as process water. ***Section 3.5.3.2*** provides further details about these facilities.

Potable water will be supplied to EPS from both the Arizona Water Company system at WPS and the existing potable water system within Shaft 9. The water from WPS will be delivered via a pipeline located in the Never Sweat Tunnel. The potable water for EPS will be delivered to two existing tanks at the site and pumped as required to supply potable water demands.

A sewage collection system consisting of a combination of gravity and pumped sewer infrastructure will be constructed for the underground mine facilities. The sewage collected will be pumped to the surface at EPS through a series of progressive cavity high head pumps, where it will be combined with the sewage from the EPS surface facilities for treatment at a packaged WWTP. The WWTP will be an extended aeration biological plant designed to provide treatment to secondary standards as defined by ADEQ. It will consist of a bar screen, equalization tank, aeration chamber, clarifier, and sludge-thickening tank. The sludge will be thickened in this tank until it can be removed and dewatered by drying beds or a filter press until it is sufficiently dry to be taken to a landfill for disposal. The effluent from the plant will be combined with EPS contact water and delivered into the WPS process water system via a 12-in pipeline in the Never Sweat Tunnel. A pump station will be located at the discharge of the WWTP for transfer of the treated effluent. Further details are provided in ***Section 3.2.10.13.***

3.6.3. DISCHARGE

Mine operations are designed to maximize internal water reuse, which is a critical component of the Resolution Project from a physical resource and cost perspective. The water use and treatment facilities to be used in the Resolution Project are therefore designed to discharge no water. The exception will be during the interim shutdown as described in ***Section 5.***

3.7. WORKFORCE AND SCHEDULE

The Resolution Project is expected to be in full production for approximately 40 years. At full production, the Project is expected to support approximately 3,800 employees through direct, indirect, and induced jobs. Direct jobs will number approximately 1,430; indirect jobs, about 935; and induced jobs, more than 1,350. Prior to full production, a lengthy construction phase is expected, which will last for 13 years. Following the cessation of mining, closure and reclamation activities will commence.

Workforce requirements will vary throughout the life of the Project. The following sections describe the expected workforce requirements based on the construction and operations phases of the Project, facility locations, and activities.

3.7.1. CONSTRUCTION PHASE

Approximately 3,800 employees and contractors will be needed during the peak of the construction phase immediately prior to full production. The first 5 years of construction are anticipated to occur prior to approval of the Project, and the employment during this period is projected to peak at a workforce of 558 employees and contractors. The remaining 8 years of the construction phase (post-Project approval) will require a continual increase in the workforce until a peak employment of 3,800 jobs is reached immediately prior to full production.

Exhibits 3.7-1 through 3.7-3 show the expected workforce required for the pre-approval and post-approval periods of the construction phase with a breakdown by site and personnel requirements. The personnel required during the construction phase has been broken down by employees and contractors. Workforce requirements for EPS and the Mine area peak at Years 9 and 10 during the construction phase at approximately 1,200 jobs; and peak employment requirements for the construction of WPS and the TSF reach approximately 2,800 jobs in Year 13.

Exhibit 3.7-1 Construction Phase Personnel – All Locations

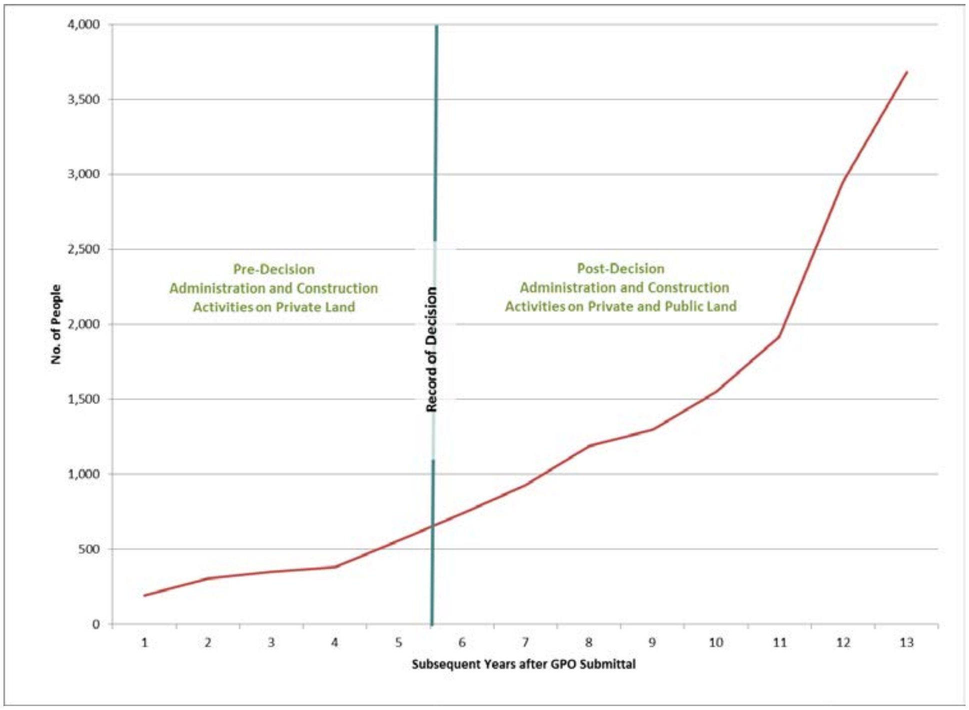


Exhibit 3.7-2 Construction Phase Personnel – East Plant Site and Mine Area

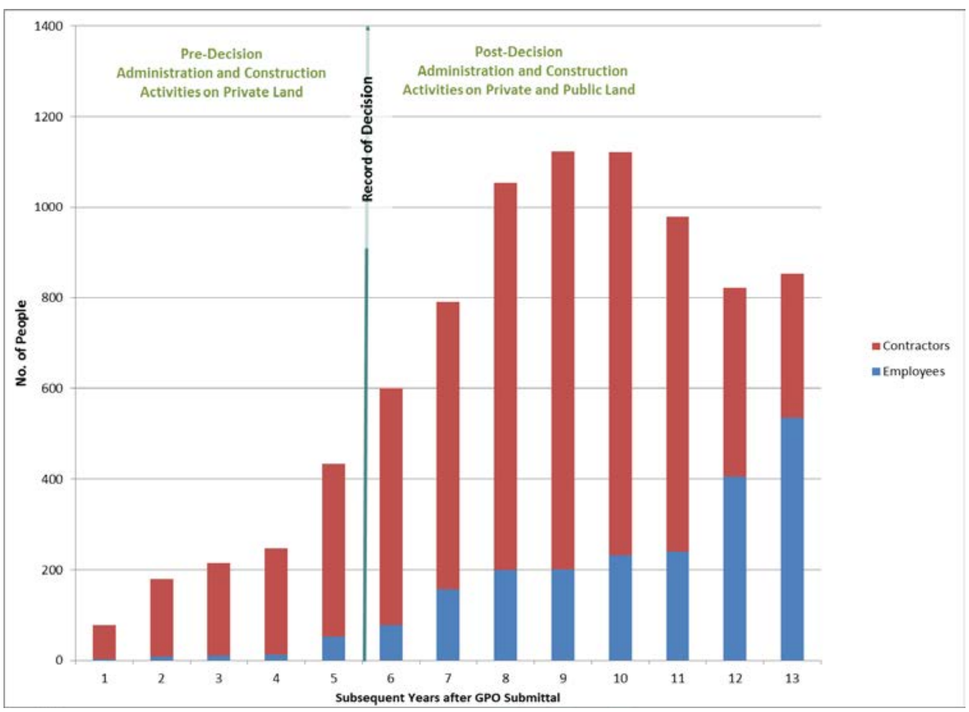
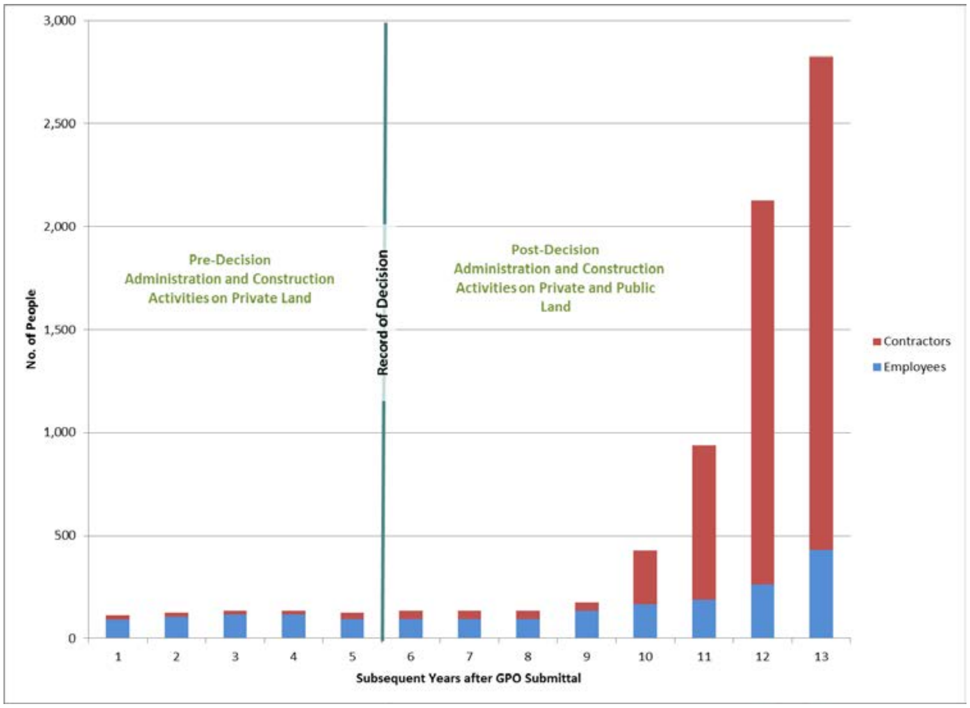


Exhibit 3.7-3 Construction Phase Personnel – West Plant Site and Tailings



3.7.2. OPERATIONS PHASE

The estimated staffing requirements for the operations phase of the Project are approximately 1,400 direct employees (1,200 employees and 200 contractors). These will be split between WPS, EPS, the TSF, and the Filter Plant and Loadout Facility.

Staffing requirements by site are as follows:

- East Plant Site and Mine Area........................... 800
- West Plant Site and Tailings Storage Facility 570
- Filter Plant and Loadout Facility 30

On average, EPS and mine operation will require 600 employees and 40 contractors. WPS and the TSF operation, on average, will employ approximately 500 employees and 70 contractors. The Filter Plant and Loadout Facility will employ approximately 30 employees. ***Exhibits 3.7-4 and 3.7-5*** show the expected workforce for the operations phase of the Resolution Project.

Exhibit 3.7-4 Operations Phase Personnel – East Plant Site and Mine Area

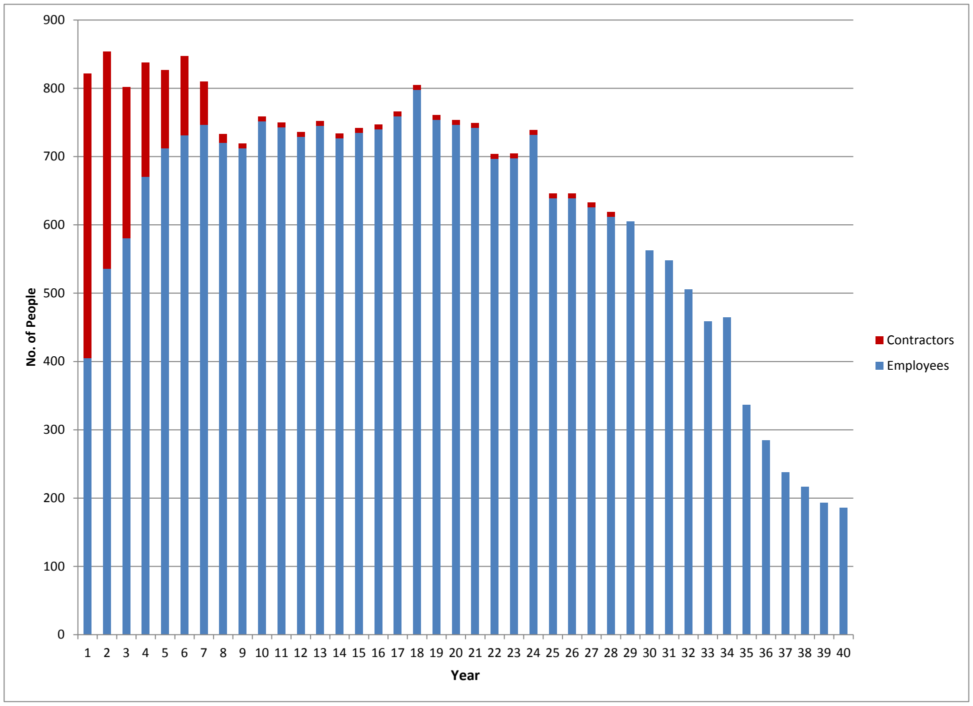
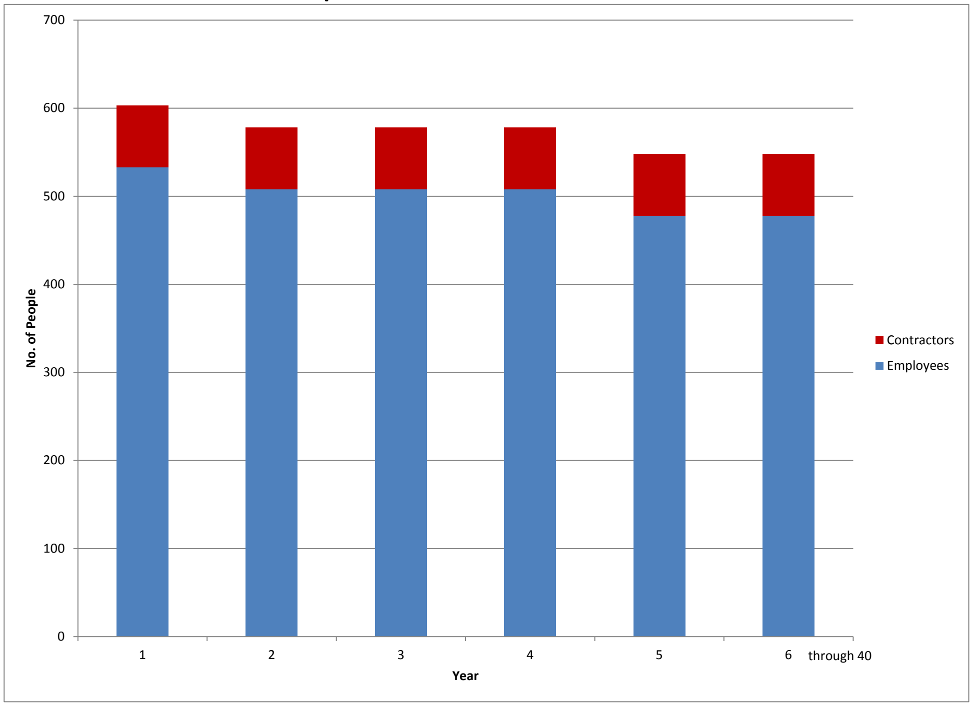


Exhibit 3.7-5 Operations Phase Personnel – West Plant Site



3.7.3. CLOSURE PHASE

As described in ***Section 6***, reclamation (including construction and early development reclamation, interim reclamation, concurrent reclamation, final reclamation, and post-closure care and maintenance) will begin as soon as practicable and continue throughout operations and into the post-closure phase. Final reclamation would start at the end of the 40-year operating mine life and is expected to take 5 to 10 years. Post-closure care and maintenance would occur for a number of years following the completion of final reclamation. This time frame will be further refined during the NEPA process.

The areas to undergo final reclamation upon Project closure would include the mine shafts, surface facility support areas, Concentrator Complex, the TSF and Tailings Corridor, the Filter Plant and Loadout Facility, and those pipeline corridors and site access roads that are not needed for long-term land use purposes. In general, reclamation activities, whether related to construction or final reclamation, would be timed to take advantage of seasonal conditions. Seeding would occur in late June to take advantage of the region's July and August rainy season known locally as the "monsoon season." A detailed reclamation schedule and workforce requirements for the closure phase are currently under development. The schedule will include tables that identify the amount of area that is disturbed and reclaimed each year during operations and closure. Further details on the reclamation schedule can be found in ***Section 6***.

3.8. SUPPORT FACILITIES

A broad range of support facilities will be employed at EPS, WPS, and the Filter Plant and Loadout Facility. Those at EPS are discussed in detail and graphically illustrated in ***Section 3.2.10***, and include:

- Site access roads, a security gate, and internal roadways;
- Mine administration and office buildings;
- Employee and visitor parking areas;
- Safety, medical, and training facilities;
- Shafts and hoist houses;
- Refrigeration and ventilation equipment;
- Dry facility (miners' change facility);
- Surface maintenance facilities and storage areas;
- Compressor facility;
- Batch plant;
- Wash bay;
- Fire water, service water dams, and pumping systems;
- Water catchment areas;

- Fuel storage;
- Explosives storage;
- Electrical substations and distribution, and emergency generators; and
- Communications facilities.

Support facilities at WPS are discussed in detail and graphically illustrated in ***Section 3.3.1.4***, and include:

- Site access roads, a security gate, and internal roadways;
- Administration buildings;
- Employee and visitor parking areas;
- Safety, medical, and training facilities;
- Maintenance shops and warehouse;
- Fuel storage and wash bay;
- Refrigeration and ventilation facilities;
- Water treatment plant;
- Tanks and pumping systems;
- Potable water and wastewater disposal facilities;
- Retention and contact water ponds;
- Communications facilities; and
- Temporary construction facilities.

Support facilities at the Filter Plant and Loadout Facility are discussed in detail and graphically illustrated in ***Section 3.3.11.1***, and include:

- Site access roads, a security gate, and internal roadways;
- Employee and visitor parking areas;
- Potable water and wastewater treatment and disposal facilities;
- Retention and contact water basin;
- Concentrate containment basin;
- Electrical substation and distribution; and
- Communications facilities.

3.9. MATERIALS, SUPPLIES, AND EQUIPMENT

During Project operations, Resolution Copper will use a number of operational, maintenance, and ore processing materials and supplies. In general, the handling of materials and waste streams will be conducted in accordance with applicable regulations and facility plans: Resolution Copper's Health, Safety, and Environment (HSE) Performance Standards, Material Safety Data Sheets (MSDS), and Environmental Materials Management Plan (***Appendices S and T***). Further information on materials handling can be found in the Explosives Management Plan, the Hydrocarbon Management Plan, and Environmental Materials Management Plan (***Appendices P, U, and V***).

Materials and supplies have been broken down for EPS, WPS, and the Filter Plant and Loadout Facility. Major consumables for each of the sites are listed and described below. Delivery frequency and the expected quantities of materials and supplies for construction and operations are discussed below in ***Section 3.4.2***.

3.9.1. EAST PLANT SITE

Major consumables, materials, and supplies to be used at EPS are listed in ***Table 3.9-1***. A description of the delivery and storage methods, as well as the utility of the material or supply, follows the table.

Table 3.9-1 Materials and Supplies – East Plant Site

Material/Supply	Delivered Form	Storage Method
Diesel Fuel	Liquid	Tanks
Propane	Gas	Tanks
Oils/Lubricants	Liquid	Sealed Drums/Totes
Antifreeze	Liquid	Individual Containers
Solvents	Liquid	Individual Containers
Explosives (Emulsion Product)	Solid	Locked Magazines
Explosives (Blasting Detonators)	Solid	Locked Magazines
Welding Cylinders (Argon Gas, Acetylene, etc.)	Gas	Cylinder Storage Corral
Hardware	Solid	General Stores Shelving
Carpentry Supplies	Solid	General Stores Shelving

- Diesel Fuel – Tanker trucks will deliver diesel fuel to the site where it will be transferred to aboveground storage tanks at the surface facilities and in the underground mine. All diesel storage tanks will be of double-walled construction and/or placed in secondary containment in accordance with the facility SPCC plan. Typical secondary containment structures found at the Resolution Copper property include double-walled tanks, earthen berms, and engineered secondary containment structures. Secondary containment at Resolution Copper is typically designed with sufficient freeboard to contain rainfall from a 25-year, 24-hr storm event. During the construction phase, fuel will be delivered to the underground mine storage tank by fuel cubes and/or fuel lines in Shaft 9 or Shaft 10. Fuel cubes will be stored in the fuel storage facility (fuel bay) until they are empty, at which time they will be sent back to the surface. During the production phase, fuel will be transferred to the underground mine through a fuel line in

Shaft 13. The fuel will be transferred into an underground mine fuel bay. The underground mine fuel bay will have containment for spillage, fire suppression, and fire doors. Most mobile underground and surface equipment will be powered by either diesel fuel or electricity.

- Gasoline – Gasoline will not be stored at EPS. Although many of the light and supply vehicles use gasoline, these vehicles will be fueled primarily in the town of Superior.
- Propane – Propane will be delivered by vendors and stored in certified tanks located near the surface facilities. Propane will be used to heat the water used in the showers at the men's and women's change facilities (dry).
- Oils/Lubricants – Various oils and lubricants will be required for equipment maintenance. These products will be delivered by vendors and stored in approved containers located within or directly adjacent to the trackless workshop and hoist workshop. They will also be stored in the underground mine near equipment maintenance facilities sealed in drums or totes. Used petroleum products and solvents will be collected in approved containers, transported off site, and disposed of or recycled through qualified vendors.
- Antifreeze – Antifreeze (50/50 premix) will be required for use in the equipment. Antifreeze will be delivered by vendors in approved containers that will be stored within or directly adjacent to the trackless workshop facility. They will also be stored in the underground mine in sealed containers near equipment maintenance facilities. Used antifreeze will be collected in approved containers, transported off site, and recycled through qualified vendors.
- Solvents – Various types of solvents will be needed for parts cleaning in the trackless workshop and hoist workshop. Chlorinated solvents will be limited to specialized uses and will not be used for general parts cleanings. A solvent recycler will be contracted to routinely replace the solvents in the parts cleaners. The solvents will be stored in approved storage containers within or directly adjacent to the workshops. They will also be stored in the underground mine near equipment maintenance facilities in sealed containers.
- Office Supplies – Various office supplies will be needed for the mine administration offices. These will be delivered by vendors and other package delivery companies. The office supplies will be stored within the administration office building.
- Explosives – Resolution Copper has developed an Explosives Management Plan for the storage, handling, transporting, use, and disposal of explosives at Resolution Copper (included as ***Appendix P***). Explosives at Resolution Copper will be managed by a Federal Explosives License holder, and Resolution Copper anticipates that contractors will perform the proposed future development work for the Project. Currently, Cementation USA is the holder of Federal Explosives License 9-AZ-021-33-3E-00299. Explosives will be stored in secured and approved magazines. Surface explosives magazines will be located in a series of separate, remote, and fenced (locked) magazines away from the main surface facility. Resolution Copper expects to use an emulsion or gel product, along with detonating cord, cast primers, and blasting caps.

Resolution Copper's Explosives Management Plan (***Appendix P***) will ensure that the contractor's policies for transportation, handling, storage, and use of explosives comply with state and federal regulations and manufacturers' recommendations.

- Welding Cylinders – Cylinders of welding gas will be delivered to the site by vendors and stored in approved containers in the cylinder storage corral at the general stores yard. Used cylinders will be collected and refilled by the vendor.
- Hardware – The hardware necessary for operations and maintenance will be delivered to the site by vendors and package delivery companies and stored in the general stores or general stores yard.
- Carpentry Supplies – Carpentry supplies used for operations and maintenance will be delivered to the site by vendors and package delivery companies and stored in the general stores or general stores yard.

3.9.2. WEST PLANT SITE

Major consumables, materials, and supplies to be used at WPS, including those used at the Concentrator Complex, are listed in ***Table 3.9-2***. A description of the delivery and storage methods, as well as the utility of the material or supply, follows the table.

Table 3.9-2 Materials and Supplies – West Plant Site

Material/Supply	Delivered Form	Storage Method
Diesel Fuel	Liquid	Tanks
Oils/Lubricants	Liquid	Sealed Drums/Totes
Antifreeze	Liquid	Individual Containers
Solvents	Liquid	Individual Containers
Office Supplies	Solid	Individual Containers
Propane	Gas	Tanks
Grinding Balls	Bulk	In-ground Bins
Lab Chemicals	Liquid/Solid	Individual Containers
Welding Cylinders (Argon Gas, Acetylene, etc.)	Gas	Cylinder Storage Corral
Hardware	Solid	General Stores Shelving
Carpentry Supplies	Solid	General Stores Shelving

- Diesel Fuel – Tanker trucks will deliver diesel fuel to the site where the fuel will be transferred to above-ground storage tanks at the fuel and oil storage facility. All diesel storage tanks will be of double-walled construction and/or placed in secondary containment in accordance with the facility SPCC plan. Typical secondary containment structures found at the Resolution Copper property will include double-walled tanks, earthen berms, and engineered secondary containment structures. Secondary containment at Resolution Copper is typically designed with sufficient freeboard to contain rainfall from a 25-year, 24-hr storm event. Most mobile surface equipment will be powered by diesel fuel.

- Gasoline – No gasoline will be stored at WPS. Although many of the light and supply vehicles use gasoline, these vehicles will be fueled primarily in the town of Superior.
- Oils/Lubricants – Various oils and lubricants will be required for equipment maintenance. These products will be delivered by vendors and stored in approved containers located within the fuel and oil storage facility. Used petroleum products and solvents will be collected in approved containers, transported off site, and disposed of or recycled through qualified vendors.
- Antifreeze – Antifreeze (50/50 premix) will be required for use in the equipment. Antifreeze will be delivered by vendors in approved containers that will be stored within the fuel and oil storage facility. Used antifreeze will be collected in approved containers, transported off site, and recycled through qualified vendors.
- Solvents – Various types of solvents will be needed for parts cleaning in the maintenance shop. Chlorinated solvents will be limited to specialized uses and will not be used for general parts cleanings. A solvent recycler will be contracted to routinely replace the solvents in the parts cleaners. The solvents will be stored in approved storage containers within or directly adjacent to the shop.
- Office Supplies – Various office supplies will be needed for the administration and other offices. These will be delivered by vendors and other package delivery companies. The office supplies will be stored within the administration building.
- Grinding Balls – Grinding balls, which are used in the SAG milling and ball milling process, will be delivered to the site by vendors in bulk trucks and stored in bins in the grinding ball storage area located adjacent to the Concentrator.
- Lab Chemicals – Lab chemicals will be used in the metallurgical and chemistry labs and will be delivered to the site by vendors and package delivery companies and stored within the lab facility. Lab chemicals will be stored in approved containers. Chemical waste will be collected in approved containers, transported off site, and disposed of through qualified vendors.
- Welding Cylinders – Cylinders of welding gas will be delivered to the site by vendors and stored in the cylinder storage corral at the maintenance shop. Used cylinders will be collected and refilled by the vendor.
- Hardware – The hardware necessary for operations and maintenance will be delivered to the site by vendors and package delivery companies and stored in the general stores or general stores yard.
- Carpentry Supplies – Carpentry supplies used for operations and maintenance will be delivered to the site by vendors and package delivery companies and stored in the general stores or general stores yard.

- Flocculant – Flocculant will be used as a settling agent at the Concentrator and will be delivered to the site by vendors in dry, powder form. Flocculant will be maintained by good housekeeping practices and stored in properly sealed bags or sacks on pallets in a well-ventilated area.

The reagents to be used at the Concentrator are listed in ***Table 3.9-3***. A description of the delivery and storage methods follows the table. As technology improves and reagent requirements vary, other typical mineral-processing reagents may be used in the process.

Table 3.9-3 Reagents

Reagent (brands may vary)	**Delivered Form**	**Storage Method**
Dithiophosphate/monothiosulfate (Cytec 8989; collector) or equivalent copper collector	Bulk truck (liquid)	Storage tank
Sodium Isopropyl Xanthate (SIPX; collector)	Drums (dry)	Drums on pallets
Methyl Isobutyl Carbinol (MIBC; frother)	Bulk truck (liquid)	Storage tank
MCO (non-polar flotation oil; molybdenum collector) or #2 Diesel Fuel	Bulk truck (liquid)	Storage tank
Sodium Hydrosulfide (NaHS; copper mineral depressant)	Bulk truck (liquid 30% concentration)	Storage tank
Flocculant (settling agent)	Bags or super sacks (dry)	Bags or sacks on pallets
Lime (90% CaO; pH modifier)	Bulk truck (dry)	Dry storage silos
Antiscalant (water treatment)	Dry (drums) or liquid (totes)	Drums or totes on pallets
Nitrogen (molybdenum sparge gas)	Vendor or Resolution Copper-owned nitrogen plant	Nitrogen tank

- Lime – Lime will be used in the Concentrator process and will be delivered to the site by vendors in bulk trucks and stored in approved containers/silos in the lime area next to the Concentrator.
- Other Reagents – Reagents for Concentrator operation will be delivered to the site by vendors and stored within the reagents storage area adjacent to the Concentrator. Reagents will be delivered and stored in approved containers, drums (liquid or dry), and bags or sacks.

3.9.3. FILTER PLANT AND LOADOUT FACILITY

Major consumables, materials, and supplies to be used at the Filter Plant and Loadout Facility are listed in ***Table 3.9-4***. A description of the delivery and storage methods, as well as the utility of the material or supply, follows the table.

Table 3.9-4 Materials and Supplies – Filter Plant and Loadout Facility

Material/Supply	Delivered Form	Storage Method
Hardware	Solid	General Stores Shelving
Carpentry Supplies	Solid	General Stores Shelving
Office Supplies	Solid	Individual Containers
Flocculant	Bags or Super Sacks (Dry)	Bags or Sacks on Pallets

- Hardware – The hardware necessary for operations and maintenance will be delivered to the site by vendors and package delivery companies and stored in the Filter Plant storage areas.
- Carpentry Supplies – Carpentry supplies used for operations and maintenance will be delivered to the site by vendors and package delivery companies and stored in the Filter Plant storage areas.
- Office Supplies – Various office supplies will be needed for the administration and other offices. These will be delivered by vendors and other package delivery companies. The office supplies will be stored within the Filter Plant storage areas.
- Flocculant – Flocculant will be used as a settling agent at the Filter Plant and Loadout Facility and will be delivered to the site by vendors in dry, powder form. Flocculant will be maintained by good housekeeping practices and stored in properly sealed bags or sacks on pallets in a well-ventilated area.

3.10.1. SANITARY WASTE

New wastewater treatment plants are proposed at both WPS and EPS. The effluent from the wastewater treatment plant will be diverted into the mine dewatering system, which will be delivered to the Concentrator supply water pipeline for use in the process.

Wastewater from the Filter Plant and Loadout Facility will be routed to an on-site septic tank and leach field. Septic solids will be removed and disposed of off site as needed and in accordance with state laws.

3.10.2. SOLID WASTE AND SPECIAL WASTE

Non-hazardous solid waste and special wastes (e.g., petroleum-contaminated soils) generated by any activities at Resolution Copper will continue to be disposed of in a manner consistent with applicable local, state, and federal regulations and Resolution Copper's Environmental Materials Management Plan. Resolution Copper will continue to manage materials on site to decrease the amount of total waste generated and to ensure that different wastes are not contaminated or combined. A number of recycling programs are already in place.

A variety of professionals at the mine assist in the management of wastes, including safety, industrial hygiene, and environmental technical personnel. Waste is disposed of in the following ways:

- Asbestos and petroleum-contaminated soils waste streams are managed according to waste-handling protocols and disposed of at an approved waste facility.
- Resolution Copper disposes of solid waste, with the exception of garbage and food waste, at a permanent on-site construction landfill.
- Resolution Copper avoids the open burning of garbage and refuse at the Project site. All trash and garbage will be hauled to state-approved landfills. Resolution Copper will store any trash and garbage collected on site in containers prior to removal for disposal at permitted landfills.
- Wood and inert wastes such as concrete will be buried on site as part of final closure and reclamation in selected areas in accordance with applicable county, state, and federal regulations.

3.11. HAZARDOUS MATERIALS

Various hazardous materials will be used in mining, processing, and other operations related to the Resolution Project. Hazardous materials to be used at EPS are listed in ***Table 3.9-1.*** These materials include:

- Diesel fuel;
- Propane, oil, and other lubricants;
- Antifreeze;
- Solvents;
- Explosives (emulsion products and detonators); and
- Gas used for welding (argon, acetylene, etc.).

Similarly, ***Table 3.9-2*** lists the hazardous materials to be used at WPS. These materials include:

- Diesel fuel;
- Oil and other lubricants;
- Antifreeze;
- Solvents;
- Propane;
- Lab chemicals; and
- Gas used for welding (argon, acetylene, etc.).

The reagents to be used at the Concentrator are listed in ***Table 3.9-3*** and include:

- Dithiophosphate/monothiosulfate (Cytec 8989; collector) or equivalent copper collector;

- Sodium isopropyl xanthate (SIPX; collector);
- Methyl isobutyl carbinol (MIBC; frother);
- MCO (non-polar flotation oil; molybdenum collector) or #2 diesel fuel;
- Sodium hydrosulfide (NaHS; copper mineral depressant);
- Flocculant (settling agent);
- Lime (90 percent CaO; pH modifier);
- Antiscalant (water treatment); and
- Nitrogen (molybdenum sparge gas).

Flocculant will be used as a settling agent at the Concentrator and at the Filter Plant and Loadout Facility. It will be delivered to both sites by vendors in dry, powder form. Flocculant will be maintained by good housekeeping practices and stored in properly sealed bags or sacks on pallets in a well-ventilated area.

Lime will be used in the Concentrator process and will be delivered to the site by vendors in bulk trucks and stored in approved containers/silos in the lime area next to the Concentrator. Reagents for Concentrator operation will be delivered to the site by vendors and stored within the reagents storage area adjacent to the Concentrator. Reagents will be delivered and stored in approved containers, drums (liquid or dry), and bags or sacks.

Further detail on the transport, storage, and employment of the hazardous materials used in the proposed Project are provided in ***Section 3.9***. The disposal or recycling of hazardous materials will be done through qualified vendors at approved facilities in a manner consistent with applicable local, state, and federal regulations and Resolution Copper's Environmental Materials Management Plan (***Appendix V***). Further information is provided in ***Sections 3.9 and 3.10***. Expected volumes are not yet available. The following appendices provide additional information on hazardous materials:

- A Spill Prevention, Control, and Countermeasure Plan is included as ***Appendix O***;
- An Explosives Management Plan developed for the Project is provided as ***Appendix P***;
- The MSDSs for the materials planned for use in the proposed Project are included in ***Appendix T***;
- The Environmental Materials Management Plan is included as ***Appendix V***;
- A Hydrocarbon Management Plan is included as ***Appendix U***.

4.1. INTRODUCTION

Environmental stewardship and conservation are key components of Resolution Copper's development strategy. Resolution Copper is committed to minimizing its impact on the surrounding environment and draws on its experience of operating and reclaiming mines all over the world; on advice from environmental experts, both internal and external; and on input from the local community through citizens' working groups and public forums. This approach has helped Resolution Copper develop practical and best practice technological expertise that reduces potential environmental impacts and has also allowed Resolution Copper to form partnerships with conservation groups to further increase awareness and protection of the natural environment. Respect for the environment is an integral part of the Project development strategy, and under the corporate Rio Tinto requirements, Resolution Copper must conform to internal policies and standards that help reduce its environmental impacts; these are described in the following sections. Rio Tinto's environmental standards are provided in ***Appendix S***.

Air

Resolution Copper is required to follow Rio Tinto's Air Quality Control Standard (E2) to identify air pollutant emissions generated during operations in order to minimize the Project's potential impacts to air quality (***Appendix S***). To accomplish this, Resolution Copper evaluates and prioritizes activities according to the significance of their impact and then implements effective measures of design and emissions control to ensure protection of the surrounding ambient air.

Resolution Copper's operations will include fossil fuel use, ore transport, and development rock activities that have the potential to release gases and particulates into the atmosphere. Resolution Copper is committed to reducing potential emissions from proposed operations to the greatest extent practicable. Resolution Copper will continue to review emissions and will apply air quality controls to minimize any potential impact on the environment, on the health of its workers, and on the health of those who live in the surrounding communities. Air permitting in Pinal County is delegated to the Pinal County Air Quality Control District (PCAQCD). The complete PCAQCD Code of Regulations is available online (PCAQCD 2014).

Biodiversity and Land Management

Under the Rio Tinto Land Use Stewardship Standard (E9), Resolution Copper develops and implements management plans, programs, and procedures to ensure sustainable stewardship of the land that it owns, leases, or manages (***Appendix S***). This requires an understanding of the current use and value of the land combined with its potential to fulfill corporate, community, and other stakeholders' expectations of future beneficial land uses.

Sustainable stewardship of the land includes minimizing land disturbance when developing areas as well as reclaiming legacy sites. Resolution Copper has spent over $30 million to date reclaiming the historical Magma Mine, including the rehabilitation of tailings, waste rock, and old facilities such as the Concentrator Complex. To the extent possible, Resolution Copper has placed future facilities within legacy mine areas and other existing disturbances.

The biodiversity in and around Resolution Copper's planned operations includes a multitude of wildlife species, plant species, and the ecosystems of which they are a part. Resolution Copper aims to improve biodiversity on its private lands, and to achieve this, Resolution Copper has formed partnerships with many leading and regional conservation groups, along with a number of local partners and regulators, to help facilitate the development and implementation of biodiversity projects and conservation efforts in the region. These projects include:

- The reclamation of over 129 ac of historical mining-impacted lands with native vegetation to promote the return to a more natural and biodiverse environment;
- Post-reclamation vegetation surveys to assess the status and density of native plant species and improvements in biodiversity after reclamation; and
- A multitude of rehabilitation projects and routine biological surveys on Resolution Copper exchange parcels to improve the quality of the habitat and ecosystems. This work has been accomplished in partnership with the Nature Conservancy and Audubon Arizona.

Ongoing surveys and baseline assessments of Resolution Copper's private lands will provide baseline information to develop future biodiversity planning.

Energy and Climate Change

Resolution Copper recognizes that mining is an energy-intensive industry that relies on the use of fossil fuels. However, Resolution Copper subscribes to the practice of continuous improvement in Green House Gas (GHG) emission minimization, particularly by means of improved efficiency in energy use. Resolution Copper accomplishes this by identifying GHG sources, evaluating and prioritizing them according to significant impacts, and then designing and implementing a GHG and energy efficiency action plan containing the appropriate control, reduction, and mitigation measures.

Resolution Copper recognizes the need to understand and adapt to the physical impacts of climate change, which will affect Resolution Copper's operations through the availability of water resources and the occurrence of extreme weather events. Rio Tinto's corporate GHG Emissions Standard (E4) requires the setting of objectives to track and manage the consumption of fossil fuels for reducing GHG emissions for future operations (***Appendix S***). Current projections for Resolution Copper's planned operations include up to 15 percent of the Project's power needs being met by renewable energy resources. All of the Project's power needs will be supplied by the Salt River Project (SRP).

Copper not only plays an essential role in the operation of computers, smart phones, electronics, and construction, but it is also a metal at the forefront of green energy innovation. Hybrid and electric cars rely on copper, as do renewable energy sources such as solar power, wind farms, and thermal and hydro-electricity. From on-demand water heaters to solar panels and smart wiring, copper will be an integral part of the green homes of tomorrow, helping the United States drive forward into a more energy-efficient future.

Mineral Waste/Acid Rock Drainage

By effectively managing mineral waste and potential Acid Rock Drainage (ARD), Resolution Copper will not only improve environmental performance, but will also reduce long-term operational and reclamation costs. Rio Tinto's standards require that ARD risks associated with operations be effectively identified and managed to prevent or minimize adverse environmental impacts. The term ARD refers to the potential environmental impacts that could result from the oxidation of sulfide minerals such as pyrite. The management of mineral waste and ARD includes the timely and thorough analysis of mineralogy, the early identification and implementation of control (management) strategies, and the integration of controls during mine planning and operational activities.

Resolution Copper is firmly committed to managing ARD and its mineral wastes (drill cuttings, development rock, tailings) in a manner that prevents significant impacts to wildlife and the environment; this will be accomplished in accordance with Rio Tinto's ARD Prediction and Control (E3) and Mineral Waste Management standards (E5) (***Appendix D***). In planning the proposed Project, Resolution Copper has focused on minimizing ARD generation potential by conducting thorough geochemical analyses of the ore, development rock, and tailings to be produced (***Appendices R and H***). Resolution Copper has also developed a segregation process that includes the separation of potentially-acid-generating (PAG) material from not-potentially-acid-generating (NPAG) material to prevent impacts to biological and water resources as well as to maximize beneficial use.

Environmentally sound and effective management of the mining and process wastes generated or handled during operations are of the utmost importance to Resolution Copper. Waste disposal sites are designed to be physically, biologically, and chemically safe. Waste production and disturbed areas will be minimized to the extent practical, and waste reuse (i.e., the processing of development rock or its beneficial use as reclamation material) and progressive rehabilitation will be maximized.

Under the umbrella of Rio Tinto, an important aspect of managing mineral waste and ARD is collaborating with organizations such as the International Network for Acid Prevention, regulators, non-governmental organizations, and competitors within the mining industry to ensure the implementation of industry best practices.

Water

Access to water is critical to Resolution Copper's operations, and best practice management of water is highlighted in Rio Tinto's Water Use and Quality Control Standard (E10) (***Appendix S***). Resolution Copper uses water at every stage of its business. As much as possible, water is recycled and reused, with the focus on tracking and minimizing fresh water and groundwater resources and maximizing the use of impacted water. For example, Resolution Copper currently treats water pumped from its underground mine workings at its water treatment plant and then sends the reclaimed water via pipeline to farmers in the New Magma Irrigation and Drainage District (NMIDD), where the water is used to grow crops. Resolution Copper is planning for the future water needs of the Project by securing and banking renewable Central Arizona Project (CAP) water to meet the large majority of its process water needs through the life of the operation, with the remainder of the operational water needs being met by the use of impacted mine dewatering water. The Project water balance, sources, and management are discussed in more detail in ***Section 3.6.1***.

Noise and Vibration

Resolution Copper is aware of the need to minimize noise and vibration impacts on the surrounding environment and communities, and will do so in accordance with Rio Tinto's Noise and Vibration Control Standard (E6) (***Appendix S***). This includes impacts on biota, people, heritage aspects, and surrounding land uses. Given the historical uses of the property, Resolution Copper has determined that current noise and vibration levels constitute a baseline against which future changes (i.e., increases and decreases) in noise and vibration will be evaluated. Resolution Copper has assessed compliance with local noise regulations and vibration standards by conducting monitoring at or outside facility perimeters. Baseline studies have demonstrated that Resolution Copper currently complies with all regulations and standards, including the amended Pinal County Excessive Noise Ordinance (Ordinance No. 050306-ENO as amended by 031611-ENO-01).

Resolution Copper will conduct additional monitoring as needed prior to and following the implementation of new developments, significant expansions, or changes to existing activities and facilities to assess the adequacy of noise and vibration control measures. Where practical, noise and/or vibration levels will be reduced at the engineering phase of the Project. In the event that monitoring indicates non-compliance or suggests the potential for non-compliance with local noise regulations or vibration standards at a facility, Resolution Copper will evaluate which components of that facility are the key contributors to external noise or vibration and will apply adequate engineering or institutional controls to remedy the situation. Follow-up monitoring will be conducted to verify the efficiency/effectiveness of the implemented control measures.

4.2. ENVIRONMENTAL PROTECTION ELEMENTS OF THE PROPOSED PROJECT

Resolution Copper has developed a set of protection measures to ensure that environmental impacts will be minimized during construction and operations. The objectives of these measures are to reduce or avoid adverse impacts to the environment and to reclaim disturbed areas. This section is intended to provide a general description of the environmental protection measures and monitoring efforts to be employed during the construction and operation phases of the Resolution Project. Many of the proposed environmental protection measures described in this section employ current technology and best management practices, and are based on federal, state, and local laws and regulations as well as Corporate Rio Tinto Policies and Standards associated with mining and ore processing. A list of the required permits and authorizations for the Project is provided in ***Section 1.7, Table 1.7-1***. Final environmental protection measures and mitigations will be identified in the National Environmental Policy Act (NEPA) process and in the other federal, state, and county permits and approvals needed prior to the commencement of operations.

Extensive consideration and attention has been given to the environmental protection elements of the Resolution Project. These integrated elements are described in greater detail in the appropriate Plan sections, and highlights of the environmental protection elements are listed below.

Land Use Stewardship General Mining and Processing:

- A substantial number of the Project features are located on previously mined/disturbed areas or are located underground, including a new efficient Concentrator, mine site support facilities, infrastructure such as pipelines and power lines, the Filter Plant and Loadout Facility, and underground mining infrastructure, including crushing and conveying.
- The Project is located within an existing mining district that has been actively mined for more than a century and is in proximity to other large-scale mining operations.
- The panel caving mining method will result in the generation of minimal or no waste rock. No waste rock will be left on site at closure.
- During full production, ore transport will be via underground conveyor directly to the Concentrator, minimizing surface disturbance and the burning of fossil fuels on site.
- All power will be supplied by the SRP, and approximately 15 percent of the total power needs will come from renewable sources.
- The infrastructure corridor for the water and concentrate pipelines is within an existing and previously disturbed railroad right-of-way.
- Subsidence will be controlled by limiting the lateral extent of the block caving panels and by leaving some sections of the ore deposit out of the mining plan to provide a stable buffer zone of more than 1,500 ft (457 m) between the subsidence zone (continuous) and Apache Leap after

mining has ceased. This will be further refined through continuous monitoring during operations.

Water Conservation and Protection:

- Most of the water supply for the ore processing operations will come from the renewable CAP source, either directly off the canal or from wells that will recover CAP water that has been banked by Resolution Copper for several years. This will result in the limited use of new, fresh groundwater sources.
- The water supply will also include the beneficial reuse of existing low-quality water sources such as impacted underground mine dewatering water.
- Process flows will be largely captured and recycled back into the process.
- To the extent practicable, stormwater flows upgradient of the facilities will be diverted around the disturbed areas and returned to the natural drainage system.
- Pipelines will be placed in existing disturbed areas, and new pipelines will span or avoid surface water drainages by bridges and/or tunneling to the extent practicable.
- The Tailings Storage Facility (TSF) has been sited to avoid major surface water drainages that are tributary to Queen Creek.
- The TSF will include a downgradient seepage capture and collection system keyed into bedrock and has been sited in consideration of the best geologic conditions for containment.
- The TSF has been designed and will be operated based on best practice ARD management and prevention, including the segregation of the PAG tailings from the NPAG tailings, subaqueous deposition, and the storage and confinement of the PAG tailings followed by their encapsulation by the NPAG tailings.
- To the extent practicable, NPAG development rock will be segregated from PAG development rock to maximize and allow for beneficial use (e.g., construction and reclamation).
- Best practice pipeline monitoring, spill prevention, and protection will be implemented.

Air Quality, Visibility, and Noise:

- Mining activities will take place underground, and exhaust fans will be equipped with silencers for noise reduction.
- Primary crushing and conveying will take place underground.
- Active ore stockpiles will be housed in fully covered buildings.
- Water sprays, hoods, and baghouses for dust suppression will be used as appropriate throughout the operation.

- The TSF design and management philosophy will incorporate deposition at 60 to 65 percent solids; best practice dust control, including water sprays; degree of saturation; the occasional use of dust-suppressant polymer; and, in particular, concurrent reclamation.

4.3. GEOLOGY

This section describes, in general terms, the proposed factors of safety; phreatic surface and slope movement monitoring; waste segregation and management for the TSF; and settlement monitoring and waste segregation for EPS. Specific monitoring and mitigation measures will be defined during the NEPA process.

The two areas that require stability controls and monitoring are the tailings and the mine. Details on the TSF design can be found in Klohn Crippen Berger (KCB 2014); subsidence management is described in ***Appendix E***.

4.3.1. TAILINGS STORAGE FACILITY

4.3.1.1. *Factors of Safety Under Static and Pseudo-static Conditions*

The geotechnical stability criteria for the TSF are summarized in ***Section 2.2.6, Table 2.2-2***. The factor-of-safety targets were 1.5 and 1.1 for static and pseudo-static conditions. The static and pseudo-static stability analyses, presented in KCB (2014, Appendix VII), indicate that the tailings embankment with 5H:1V slopes meets and exceeds all factors of safety criteria for static and pseudo static dynamic loading.

4.3.1.2. *Monitoring of Phreatic Surface and Slope Movement*

The TSF embankment will be monitored during operations by piezometers and settlement pins to measure phreatic surface levels in the embankments and foundation soils where possible and to measure the deformation of the structures. The monitoring instruments will be installed on representative sections of the dams shown in ***Figures 4.3-1 and 4.3-2***. ***Table 4.3-1*** summarizes the minimum number of sections and instruments that would be installed. The final locations of the instruments would be determined in the field.

Table 4.3-1 Summary of Dam Instrumentation

Dam	Number of Instrumented Sections	Total Number of Piezometers		Displacement Survey Pins
		Embankment	Foundation	
Upstream Rise	12	63	33	32
North Dam	4	4	4	8
SCD (per dam)	1	1	1	2

Adopted from KCB 2014 Table 9.1

In addition to the instruments described above, seepage from the embankment will be monitored by pumping rates from the seepage collection dams.

The instruments will be read regularly during normal operating conditions. Maximum or minimum warning threshold values will be identified for each instrument. Corrective action will be undertaken if the readings exceed the threshold value. An overall review and evaluation of the monitoring data will be carried out annually (KCB 2014).

4.3.1.3. *Waste Segregation and Management*

Geochemical characterization studies consistently demonstrate that cleaner and whole tailings are PAG, meaning that, if allowed to weather in an oxidizing environment, they may be expected to generate acidic conditions and produce drainage with elevated metals and sulfate above surface and groundwater quality standards. The acid-generating potential of cleaner tailings has long been recognized by Resolution Copper, and the current tailings management strategy includes the emplacement and storage of cleaner tailings under saturated conditions; the encapsulation of the cleaner tailings by high-moisture-content, very-fine-grained scavenger tailings; and, ultimately, the covering of the tailings with an engineered cover to prevent exposure to oxidizing conditions.

Geochemical characterization indicates that scavenger tailings with very low sulfide sulfur content are largely NPAG and are unlikely to leach metals or sulfate at concentrations of environmental concern.

The tailings design and management plan incorporates a design that is intended to limit oxygen ingress into the cleaner tailings mass to prevent and minimize ARD. This is accomplished in two ways during operations: upon initial deposition, the cleaner tailings will be placed sub-aqueously beneath the reclaim pond; this will ensure that the cleaner tailings are saturated and that they remain so until they drain. Post-placement, the cleaner tailings will be progressively covered and sealed by a thick sequence of scavenger tailings slimes. The saturation of the overlying, NPAG scavenger tailings will protect the saturation state of the underlying cleaner tailings. Even with drainage, the very-fine-grained scavenger slimes will remain at or close to tension saturation and the ingress of oxygen will be limited by the very low diffusion rates of oxygen under high levels of saturation. Furthermore, the small concentration of sulfide sulfur present in the scavenger tailings will act to consume diffusing oxygen, but will not be sufficient to generate acidic seepage. After operations cease and during closure, Resolution Copper will place a store-and-release cover over the top of the remaining cleaner tailings mass to further reduce oxygen ingress by diffusion (by increasing the diffusional length and providing some small, additional oxygen-reaction to low concentrations of pyrite) and limit the influx of water that could carry solute as eventual seepage, while maintaining sufficient saturation in the cleaner tailings to prevent their oxidation.

It should be noted that the results of the geochemical testing performed to date simply pertain to the likely geochemical reactivity of the tailings materials were they to be exposed to oxidizing conditions. These tests do not predict the composition of the discharge from the TSF or the quality of the groundwater adjacent to the impoundment. Resolution Copper intends and is developing detailed engineering plans to ensure that the tailings, especially the cleaner tailings, are never exposed to oxidizing conditions.

4.3.2. EAST PLANT SITE

4.3.2.1. *Settlement Monitoring*

Subsidence is a slow and gradual process that is predicted, closely monitored, and controlled. Resolution Copper will aim to minimize the potential impacts of its mining operations and will proactively manage the subsidence impacts that may result from underground operations. This includes the prediction of subsidence magnitudes, the assessment of subsidence impacts, a monitoring plan to control and provide early identification of impacts, and contingency plans to be implemented if required.

Resolution Copper has been collecting relevant field and laboratory data to understand and predict the impact of subsidence. The data will also be used to inform future mining efforts, including the refinement of impact predictions. Resolution Copper's overall strategy for subsidence monitoring and management before, during, and after operations includes the following components:

- Collect extensive data before mining commences to establish a robust baseline program, and collect background data for the area above and within a reasonable perimeter around the mine;
- Continuously monitor the effect of mining on key features (e.g., Apache Leap, Devils Canyon, and Queen Creek Canyon) at key positions relating to the mining front. Early monitoring data will be collected to ensure that the Apache Leap easement is not encroached upon as mining progresses westward. Monitoring equipment will include, but is not limited to, GPS monuments, extensometers, inclinometers, and tilt meters;
- Regularly assess, analyze, and interpret the monitoring data to identify any variations from predictions;
- Provide data that validate the mining-related impacts and impact predictions for ongoing model calibration and refinement;
- Develop threshold and alarm levels for the early warning and detection of subsidence impacts before any impacts occur;
- Supply regular reports to the US Forest Service (FS) and attend periodic review meetings. Such updates will review the monitoring data, monitoring, and model results; and
- Review the requirement to re-assess subsidence effects and identify contingency plans.

Specific protection measures to limit the impacts from subsidence include:

- The placement of Resolution Copper's surface mining infrastructure between the subsidence zone and Apache Leap so that any impacts from subsidence would impact the mine infrastructure before Apache Leap.

As a starting point, Resolution Copper will leave some sections of the ore deposit out of the mining plan to provide a stable buffer zone of more than 1,500 ft (457 m) between the subsidence (continuous) zone and Apache Leap after mining has ceased. This will be further refined through continuous monitoring during operations. Resolution Copper has established a three-dimensional coordinate system over the area of the potential subsidence impact zone, including the area over the proposed mining. The subsidence impact zone will be tracked by established points as mining progresses to monitor and understand the nature and extent of surface subsidence as well as to compare actual subsidence with predicted subsidence. Monitoring will be conducted using a variety of techniques, including GPS, satellite imagery, and laser scanning. Both vertical and horizontal displacement will be documented.

In addition to the aforementioned surface grid subsidence monitoring, Resolution Copper will install:

- Seismic Monitors: used to monitor cave progression by tracking the seismic energy that is released around the cave perimeter as it expands. In the event of significant seismic activity (greater than 4.0 on the Richter scale), seismographs will be developed to determine the nature of the seismic activity and whether it is related to the mining operations. Data will be monitored on a continuous basis, and reporting will be done at a determined interval. The reports will include a summary of the seismic data that presents maximums and averages of seismic activity.
- Displacement Monitors: installed down holes drilled from both the surface and from the underground workings. These will be used to estimate any fracturing of the rock.
- Tilt Meters: highly sensitive instruments that will be installed down shallow holes near the surface and will measure any tilting caused by the cave.

Subsidence monitoring reports will be generated at a determined interval, with all monitoring activities summarized in graphs and tables. Baseline data obtained at the subsidence monitoring sites will be compared with the data obtained during mining operations and after mining has been completed.

Additional information on Resolution Copper's subsidence monitoring approach is contained in the Subsidence Management Plan (***Appendix E***).

4.3.2.2. *Mine Waste Segregation and Management*

Geochemical monitoring and mitigation involve the management and segregation of PAG rock in the Intermediate and Development Rock stockpiles. Based on the ore geochemical characterization work, the majority of the material from characterization and underground development will be PAG and will be stored in the two permitted stockpiles under Arizona Department of Environmental Quality's (ADEQ) Aquifer Protection Permit (APP) Program.

Development rock that is inert and NPAG is stockpiled at the site to be used for ongoing construction and the reclamation of existing facilities. Mineralized, reactive rock that is PAG is segregated to the Intermediate Rock Stockpile. This stockpile has a permitted capacity of approximately 498,000 yd^3 (381,000 m^3), or 774,000 tons (702,000 tonnes) under ADEQ's APP Program. The mineralized development rock in the Intermediate Rock Stockpile will eventually either be used for the first production run of the new Concentrator or moved to the Development Rock Stockpile.

Once mine production commences, no waste rock will be produced, and all material from the stockpiles that cannot be beneficially used in reclamation will be processed as ore at the Concentrator. Stockpiles will be removed and concurrently reclaimed as outlined in ***Section 6***.

4.4. AIR

Resolution Copper will implement appropriate control measures for the management of air pollutants to ensure compliance with applicable state, federal, and local (Pinal County) air quality standards as required under the Clean Air Act. ADEQ generally maintains jurisdiction over the air quality program in Arizona; however, authority over the air quality program in Pinal County has been delegated to PCAQCD to enforce and maintain compliance with the clean air act. Resolution Copper currently operates under a Class II air permit issued by PCAQCD and is bound by the conditions of this permit (Permit No. B31159.000). Resolution Copper's air pollution control measures include the implementation of emission management strategies, the installation of pollution control equipment for specific sources, and required monitoring and reporting in accordance with applicable regulatory and permit requirements.

Estimates of controlled emissions from process sources at anticipated annual production rates indicate that all planned facilities of the Project (EPS, WPS, the Concentrator, the TSF, and the Filter Plant and Loadout Facility) will be permitted as a "synthetic minor source" under the federal Prevention of Significant Deterioration, New Source Review rules (adopted by reference by ADEQ and PCAQCD). Resolution Copper will need to acquire a new Class II air permit from PCAQCD that will contain emission limits, air emission control requirements, routine monitoring and reporting requirements to demonstrate compliance, and a fugitive dust monitoring and prevention plan. The projected air emissions for all facilities with the potential to emit and the associated emission controls are described in the air emission inventory contained in ***Appendix D***.

The performance of Resolution Copper's air quality management program will be continuously evaluated by an ambient air quality monitoring network maintained in proximity to sites of potential emission sources. The following sections generally describe Resolution Copper's air quality protection measures to be implemented during the Resolution Project.

4.4.1. DUST AND AIR QUALITY MANAGEMENT

Resolution Copper will take reasonable precautions to minimize fugitive dust emissions from dust-generating activities as required by Pinal County code (Pinal County Code, Chapter 4, Article 2). Resolution Copper has identified sources of fugitive dust emissions and developed control measures and strategies to be implemented prior to and during dust-generating activities. Fugitive dust emissions will be visually monitored in accordance with required opacity protocols and standards. The following sections describe the general dust management concepts that Resolution Copper will employ for various aspects of Project operations.

4.4.2. ROADS AND TRANSPORTATION

Main access roads to East Plant Site (EPS) and West Plant Site (WPS) will be paved with asphalt, and a dust-suppression program will be implemented for the gravel roads used at Project sites. This control program will involve periodic watering and/or chemical treatment to control fugitive dust generation. A water truck will run periodically in the drier months, wetting the unpaved roads to minimize dust. Roads not paved with asphalt will be maintained regularly by a motor grader to remove any rock, silt, or other debris. Smooth and clean road surfaces are essential not only for minimizing dust, but also for allowing efficient, safe, and economical use of the road. In addition, reasonable speed limits will be set on access roads within the General Project Area (GPA). Controlling speeds on unpaved site roads will help reduce fugitive dust emissions.

In addition, Resolution Copper plans to mine ore using block cave mining methods; therefore, all mining activities will take place underground. Unlike an open pit mine, block cave mining will not result in extensive networks of haul roads or large disturbed areas exposed to wind. This will greatly minimize fugitive dust potential.

4.4.3. TAILINGS STORAGE FACILITY

The Project will require engineering and physical control mechanisms designed to manage and minimize the dust generated at the TSF. First and foremost, tailings will be delivered to the storage facility via distribution pipeline in slurry form at approximately 55 to 65 percent solids. The moisture content in the tailings delivered to the storage facility will be sufficient to ensure that dust is not generated upon deposition. Fugitive dust emissions will be monitored during operations at the TSF and actively managed with sprinklers and dust suppressants as necessary. Additionally, the outer slopes of the TSF will be progressively reclaimed where practicable. The TSF dust management plan is depicted on ***Figure 3.3-10b***, and additional details are contained in KCB (2014). Specific elements of the dust management strategy at the TSF include the following measures:

- Dust emissions from the embankment slopes and tailings beaches will be managed by continuous wetting of the tailings during active deposition.

- Dry surfaces on the exterior embankment will be susceptible to wind erosion during non-active periods. Dust emissions will be actively managed by a number of measures, including:
  - Progressive reclamation of the final outer slopes;
  - Establishment of a temporary vegetative cover on construction areas that will be inactive and exposed for longer than 12 months;
  - Wetting of inactive beaches and dam surfaces with irrigation from sprinkler systems. Other tailings facilities have shown that adequate dust control can be accomplished by the application of 0.1 to 0.2 in (2 to 5 mm) of water over an 8-hr period preceding a windstorm. Water would be obtained from the reclaim pond within the TSF; and
  - Treatment with chemical or polymer dust suppressants, if necessary;
- Regular watering would be conducted on service roads, supplemented with the application of dust suppressants as required.
- Saturation under two reclaim ponds for the scavenger and cleaner tailings for the first 8 years of operations and then one reclaim pond covering the cleaner tailings and scavenger beach tailings through the life of the mine.

4.4.4. ORE PROCESSING, STORAGE, AND TRANSPORT

Unlike an open pit mine, the conveying and crushing systems at the Resolution Copper mine will be located entirely underground. However, these systems will also be equipped with dust-suppression systems such as water sprays and exhaust ventilation at the crushers and conveyor transfer points. All active stockpiles will be maintained under cover. The management of respirable dust in the underground operations of this Project is considered to be of high importance. Due to the depth of the workings, all dust will have to be suppressed, captured, or report to a return airway. In this regard, the use of dust filtration (bag filters or scrubbers) will not be adequate to manage respirable dust concentrations in working areas. The most effective strategy will be to duct or direct contaminated air to return airways. The control of respirable dust and particulates, in general, will likely include the following:

- Normal mining controls such as wet drilling and the wetting of broken rock;
- Water suppression sprays installed in all roadways for routine and controlled wetting;
- Application of water to maintain at least 4 percent moisture in the ore stream;
- Road base maintenance and dust suppression;
- Dedicated exhaust ventilation systems for crushers and transfer points;
- Remote loading of extraction level with an operator on the intake side;
- Limited access to return airways;

- Employee training in the control of exposure to respirable dust, including appropriate Personal Protective Equipment (PPE);
- Ongoing employee medical surveillance, including respiratory system and lung function, by a suitably qualified medical professional;
- At full production, ore and development rock will largely be transported using a series of underground ore transport systems such as rail and conveyors;
- Underground exhaust ventilation will be saturated, and as it is vented to the surface through shafts over a distance of approximately 7,000 ft (2,134 m), the air will cool and condense, creating a scrubbing effect on entrained particulates, which will limit the air emissions being exhausted into the atmosphere; and
- Ore processing in the concentrator will take place within a new enclosed building, and crushing and flotation will be conducted under a wet process to limit air emissions.

4.4.5. CLIMATE AND AIR QUALITY MONITORING

Monitoring efforts and baseline studies of climate and ambient air have been ongoing by Resolution Copper in support of the Resolution Project. Resolution Copper has maintained a meteorological and air quality monitoring program to support several efforts during the prefeasibility and other mine development phases, including: environmental assessments and impact analyses; meteorological and air quality data to be processed and used as input for dispersion modeling utilizing the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD); and air quality baseline data and AERMOD analyses to be used to support Resolution Copper's air permitting efforts.

For the continuous evaluation of ambient air quality, a meteorological and ambient air monitoring program approved by PCAQCD has already been implemented and may continue throughout construction and operations of the Resolution Project as a condition of the Class II air permit. Fugitive emission limits and associated visual monitoring of fugitive emissions will also be required per the Class II air permit.

Resolution Copper currently maintains two meteorological and ambient air monitoring locations, with one each at EPS and WPS. It is anticipated that the EPS monitoring station will sufficiently monitor the area surrounding the mine and associated surface activities, and the WPS monitoring station will monitor the area surrounding the Concentrator and TSF. In addition to the two Resolution Copper-maintained sites, the National Oceanic and Atmospheric Administration (NOAA) maintains three meteorological stations in the GPA surroundings. These stations are located in Miami, Superior, and Chandler Heights. The period of record for the Miami station covers the years 1914–2013, the period of record for Superior runs from 1920–2006, and the period of record for Chandler Heights is from 1941–2007 as shown in ***Section 2.1.1.2, Table 2.1-1***. Data collected at these stations can be accessed through the Western Regional Climate Center online data summaries and include temperature, precipitation, snow fall, wind direction, and evaporation. The locations of Resolution Copper's monitoring stations and the NOAA meteorological stations in relation to Project features are depicted in ***Figure 2.1-1***.

Conditions outlined in Resolution Copper's Class II air permit may require that both the EPS and WPS stations continue to measure meteorological parameters throughout construction and operations. These parameters may include:

- Horizontal wind speed;
- Wind direction;
- Wind direction standard deviation;
- Air temperature;
- Vertical temperature difference;
- Relative humidity;
- Solar radiation;
- Barometric pressure; and
- Precipitation.

In addition to collecting the above-listed meteorological parameters, it is possible that the requirements of the Class II air permit would require ongoing monitoring and collection of ambient air quality data at the EPS and WPS stations to demonstrate compliance with the Clean Air Act for particulate matter less than 10 microns (PM_{10}) and less than 2.5 microns ($PM_{2.5}$) in diameter. Measurements of PM_{10} will be used to monitor airborne dust, whereas measurements of $PM_{2.5}$ will be used to monitor possible air pollution caused by burning fuel such as gas or diesel in vehicles. Additionally, EPS is also equipped to monitor sulfur dioxide (SO_2), ozone (O_3), and nitrogen oxides (NO_x); however, emission of these air pollutants is projected to be small.

The data collected from the Resolution Copper and NOAA monitoring stations will be used to support any future air dispersion modeling work and to characterize ambient concentrations, existing conditions, and potential contributions from sources for any reportable event (as may be required by future permit conditions). Monitoring may be performed at these locations throughout all phases of the Resolution Project to ensure compliance, and data will be periodically summarized and submitted to regulatory agencies as required by the air permit for reporting purposes.

Of particular note, all of Resolution Copper's operational energy needs will be supplied by SRP through the use of existing and new power lines. Approximately 15 percent of the Project's total energy needs will come from renewable sources.

4.5. WATER RESOURCES

This section describes, in general terms, the proposed hydrological environmental protection measures for the Resolution Project. Specific monitoring and mitigation measures will be defined during the NEPA process and during other federal and state groundwater and surface water permitting processes, which will ensure compliance with the Clean Water Act (CWA) and the Safe Drinking Water Act.

The two areas with the greatest potential to impact surface water and groundwater are the tailings and the mine. Details on the water resource protection measures associated with the tailings, development rock, and the mine are contained in ***Appendix R***. Resolution Copper will implement best management practices and other protection measures to prevent and minimize impacts to groundwater and surface water, including:

4.5.1. TAILINGS

- The preferred embankment construction method identified for scavenger tailings. This method uses an upstream construction method that allows for concurrent reclamation and rehabilitation.
- The final reclaimed TSF will be designed with a store-and-release cover that limits the infiltration of precipitation and ultimately reduces long-term seepage from the facility.
- During the placement of the scavenger tailings, the finer material and reclaim pond will segregate upslope and consolidate, providing a layer of high-density, low-permeability material along the foundation of the facility (overlying bedrock), in effect slime sealing the bottom of the TSF.
- Design and installation of a downgradient seepage capture and collection system keyed into bedrock.
- The TSF and associated seepage capture and collection system has been sited to take advantage of natural geological materials, which act as a barrier to flow (Gila Conglomerate and Pinal Schist), limiting impacts to groundwater and downgradient surface water systems. Based on studies by Resolution Copper, Gila Conglomerate also has an acid neutralization capacity.
- Groundwater quality and levels will be monitored at designated compliance monitoring wells located downstream of the seepage recovery dams per the requirements of the APP Program.
- An extensive ore and tailings geochemical characterization program (***Appendices G and H***) has been implemented to understand the acid-generating potential of the development rock, ore, and tailings, and the results have defined the best management practices during construction and operations for these types of materials:
  - To the extent practical, NPAG development rock will be segregated from PAG development rock to maximize and allow for beneficial use (i.e., construction and reclamation).

- In the Concentrator, a pyrite flotation circuit will be installed to segregate tailings into NPAG scavenger tailings and PAG cleaner tailings. In addition to the segregation of pyrite and other sulfides, residual metal will also report to the cleaner tailings. The smaller volume of cleaner tailings will be placed via subaqueous deposition followed by progressive encapsulation by the much larger mass of NPAG scavenger tailings.

4.5.2. MINE

The block cave area and surrounding areas' groundwater protection measures include the following:

- All the remaining mineralized (but non-economic) rock in the block cave area would be overlain by a thick sequence of inert/net neutralizing rock.
- At closure, the bulk of oxygen ingress would cease once the ventilation system is turned off.

Most re-flood waters would have to pass through the overlying post-mineralization rock and would, therefore, carry significant alkalinity to the remaining mineralized rock.

- Permeability in the rock mass surrounding the block cave (within the deep system) at depth is very low.
- The system would take hundreds to thousands of years to re-saturate and would likely be strongly stratified, with the highest quality water on top where the active groundwater flow system is. This is consistent with other re-flooded underground workings and deep pits.

The Subsidence Management Plan, ***Appendix E,*** contains a monitoring and measurement plan for surface water and groundwater features. Additionally, groundwater monitor wells installed in the vicinity could be used to measure depth to water and water quality in the various geologic units during construction, operations, and post-closure. Further details on groundwater protections are detailed in ***Appendix R***.

4.5.3. SURFACE WATER PROTECTION

Surface water control and monitoring will be important components of the Resolution Project to ensure the protection of surface waters within and downstream from the Project. The primary receiving waters for the Project are unnamed ephemeral drainages tributary to Queen Creek. Downstream from the GPA, reaches of Queen Creek are listed as impaired due to high levels of copper between the headwaters and Whitlow Canyon. The reach of Queen Creek from the headwaters to the Superior Wastewater Treatment Plant is additionally listed as impaired for lead (ADEQ 2012). Resolution Copper's surface water protection strategies generally include the diversion of stormwater runoff around or through the Project sites and the capture and containment of on-site (contact) stormwater for incorporation back into the process water supply system.

The protection of surface water quality is governed by the federal CWA, and the regulating authority in Arizona is shared between federal and state agencies depending on the nature of the activity. ADEQ generally regulates surface water quality in Arizona related to the direct discharges of pollutants to waters of the US under the Arizona Pollutant Discharge Elimination System (AZPDES) program (CWA, Section 402), whereas the US Army Corps of Engineers maintains jurisdiction for the discharge of dredge or fill material into waters of the US (CWA, Section 404). Under Section 404 of the CWA, Resolution Copper would reduce to the extent practicable, impacts to waters of the US and implement mitigation measures to offset those impacts (loss of waters). Specifically, the TSF has been sited to avoid the major surface water drainages that feed Queen Creek, including Hewitt, Roblas, and Potts canyons. Also, to the extent practicable, new pipelines will be placed in existing disturbed areas and/or will avoid surface water drainages by bridges and spanning or tunneling. Additionally, as required under NEPA, Resolution Copper will complete a surface water impacts assessment for impacts due to the proposed block cave mine and associated subsidence.

The sections that follow generally discuss the stormwater management and sediment and erosion controls to be implemented during the Resolution Project.

4.5.4. STORMWATER MANAGEMENT

Facilities that discharge pollutants from any point source into waters of the US are required to obtain coverage under the AZPDES permitting program. Permittees are generally required to develop a Stormwater Pollution Prevention Plan (SWPPP) describing the implementation of control measures, inspection of controls, and any required analytical monitoring and reporting. Resolution Copper currently operates under an AZPDES Stormwater Multi-Sector General Permit for existing activities. As such, Resolution Copper has developed and will implement a new or updated/amended SWPPP for the Project (***Appendix W***), which will be prepared in accordance with AZPDES Stormwater (Multi-Sector General Permit-2010) requirements for construction and operations. To prevent degradation to Queen Creek or potential waters of the US, Resolution Copper will implement and maintain, as appropriate, the following types of structural control measures: water bars, culverts, wattles, diversion ditches, stormwater detention basins, stormwater ponds, revegetation, rock armoring, hydro-seeding, jute matting, and other best management practices as outlined by the SWPPP (***Appendix W***)***.*** In addition to using structural controls for managing stormwater, Resolution Copper will continue to implement non-structural controls such as good housekeeping, maintenance practices, and employee training. These management strategies are intended to prevent and minimize the potential for pollutant exposure to stormwater for Resolution Copper's discharging facilities.

The SWPPP (***Appendix W***) for the Resolution Project will be informed by the stormwater drainage design plan for Project facilities (***Appendix N***) and the permitting and NEPA processes. Detailed information on potential pollutant sources, control measures, corrective actions, and any monitoring requirements for the Resolution Project will be maintained in the final SWPPP.

In general, stormwater management for the Project will include the construction and maintenance of diversion channels to route precipitation runoff away from the surface facilities. The stormwater drainage design (***Appendix N***) for the Resolution Project was developed to allow, where possible, for off-site, non-contact stormwater to be diverted around or through the Project sites and for on-site stormwater (contact water) to be captured, contained, and incorporated into the supply water system. The Stormwater Drainage Design Memorandum (***Appendix N***) includes the stormwater management provisions for the various Project sites, including EPS, WPS, the TSF, and the Filter Plant and Loadout Facility.

Stormwater design criteria are summarized and described in the Stormwater Drainage Design Memorandum (***Appendix N***) and KCB (2014). At a minimum, the AQEQ APP Program Best Available Demonstration Control Technology (BADCT) guidelines were used to develop storm event criteria. Water management facilities (e.g., stormwater basins and diversion structures) are intended to have sufficient capacity to handle runoff generated for at least the 100-yr, 24-hr storm event, with the exception of the TSF, which has been sized for the 30-day probable maximum flood (PMF) storm event; the TSF diversion channels, which have been sized for the 6-hr PMF; and the TSF Seepage Collection Dams, which have been sized for the 200-yr, 24-hr storm event. Stormwater basins are sized with a minimum of 1 ft (0.3 m) of freeboard above the design stormwater event high-water mark. The following sections describe the stormwater management facilities and strategies for each of the Project sites.

4.5.4.1. *East Plant Site Stormwater Management Plan*

The EPS full production build-out stormwater design is presented in ***Figure 4.5-1*** and is described in ***Appendix N***. The plant site and adjacent upstream areas are subdivided into 18 catchment areas. Catchment areas containing or impacted by plant site facilities are categorized as on-site, or contact areas. Catchment areas that are upstream of and diverted around the plant site facilities and/or undeveloped are considered off-site or non-contact areas. All non-contact runoff from the catchment areas upstream of EPS will be routed around or through the site via two diversion structures. The following paragraphs describe how the stormwater from off-site and on-site catchment areas will be managed.

The northern diversion channel will collect non-contact runoff from catchment areas to the west and northwest of the site (Catchment Areas A7, A8, A9, A10, and A11). This diversion channel will run on the surface along the base of cut slopes and then convey flows into a buried culvert under the northeastern part of the site to a discharge channel. The discharge channel will direct flow to a new riprap sediment basin at Outfall 1, located just north of Contact Water Basin E2.

The southern diversion channel will collect non-contact runoff from the off-site catchment areas to the south of the plant site (Catchment Areas A12 through A18). This diversion will run on the surface along the southern edge of the plant site, and then direct flows into a buried culvert where the alignment intersects Magma Mine Road. The buried culvert will convey the water along the eastern edge of the site to the discharge channel and to the sediment basin at Outfall 1.

Contact Water Basins E1 and E2 will be located at low points on the eastern edge of the property to capture stormwater flows from the on-site catchment areas. The southern portion of the site will be contained in a single catchment area (A1) that will be graded to flow to Contact Water Basin E1. Contact Water Basins E1 and E2 will be located in an existing drainage. Contact Water Basin E2 will capture overflow from Contact Water Basin E1. Contact Water Basins E1 and E2 will be created by constructing an earthen dam within the existing drainage along the eastern edge of the property. The basins will be lined according to BADCT standards, and Basins E1 and E2 are designed to contain approximately 12 ac-ft (15,000 m^3) and 11 ac-ft (13,600 m^3) of water, respectively. These basins will be emptied after each storm event, and contact water will be reused via incorporation into the process water supply.

The northern portion of the site is comprised of several catchment areas (A2, A3, A4, A5, and A6) that will be graded to flow to Contact Water Basin E3. Contact Water Basin E3 will be constructed by excavating an existing low point. The basin will be lined according to BADCT standards and sized to contain approximately 13 ac-ft (16,000 m^3) of water. Contact Water Basin E3 will be emptied after each storm event, and contact water will be reused via incorporation into the supply water system.

4.5.4.2. *West Plant Site Stormwater Management Plan*

The stormwater design for WPS is shown in ***Figures 4.5-2 through 4.5-4*** and is described in ***Appendix N***. The stormwater design includes three main facilities: the Stockpile, which includes the Development Rock and Intermediate Rock Stockpiles; the Concentrator Complex, which includes the process water pond, ore stockpile facility, tailings thickeners, copper molybdenum and copper concentrator thickeners (thickeners), and the molybdenum plant; and the Ancillary Facilities, which include the administration building, contractor and warehouse laydown yards, and construction and employee parking.

The Development Rock Stockpile and Intermediate Rock Stockpile are two separate rock storage locations between the Concentrator Complex and the Ancillary Facilities. The development rock for these stockpiles will be generated from excavations in Resolution Copper's preparations for mining. The runoff from the stockpiles will be considered contact water since the material is PAG. Once the Concentrator Complex is constructed and mine production commences, no additional waste rock will be produced, and the development rock from the Development Rock Stockpile and the Intermediate Rock Stockpile will be removed to the extent practical and processed with the ore at the Concentrator Complex.

The stormwater design for the stockpiles at WPS is shown in ***Figure 4.5-2***. The stockpiles and adjacent upstream areas are subdivided into 11 catchment areas. Catchment areas containing or impacted by the stockpiles are categorized as on-site or contact areas. Catchment areas that are upstream of and diverted around the Concentrator Complex facilities and/or undeveloped are considered off-site or non-contact areas.

The runoff from the area upstream of the Development Rock Stockpile (Catchment B1) currently flows following the existing topography to the Apex Tunnel. The Apex Tunnel is an existing structure that diverts off-site flows from north of the stockpiles to Silver King Wash west of the site. Therefore, this runoff is considered off-site, or non-contact, water. The runoff from Catchment B1 will continue to flow to the Apex Tunnel until the construction of the Concentrator Complex.

Stormwater in the locations of the stockpiles currently flows following the natural topography to legacy Tailings Pond 6. However, once the stockpiles are in place, the stormwater runoff from them must be contained on site in contact water basins.

Contact Water Basin W1 will be constructed to collect on-site runoff from the northern portion of the Development Rock Stockpile (Catchment A1), from the tailings thickener pad (Catchment A2), and from the eastern hillsides (Catchment A3). The pad for the tailings thickeners will be constructed at this time to provide drainage to Contact Water Basin W1. Basin W1 will be used during mine operations to collect contact water runoff from the Concentrator Complex and is sized for 49.4 ac-ft (61,000 m^3) of water (***Figure 4.5-2***). The basin will be lined according to BADCT standards and will be emptied after each storm event. The contact water will be reused via incorporation into the process water supply. Without the tailings thickener pad, a temporary contact water basin would need to be excavated, lined, and subsequently closed upon the construction of the Concentrator Complex. The northern stockpile diversion channel will direct flows between the tailings thickener pad fill slopes and the Development Rock Stockpile to Basin W1 during this interim period.

Stormwater from the southeastern portion of the Development Rock Stockpile will flow to Basin W2 (Catchment C1). Stormwater from the eastern hillsides (Catchment C2) will flow south along the existing roadway in a new drainage v-ditch through an opening in the roadside safety berm into a culvert that will direct stormwater into Basin W2.

The on-site runoff from the Intermediate Rock Stockpile and upstream hillsides (Catchments C3, C4, and C5) will collect in v-ditches along the toe of the stockpile. The runoff in these v-ditches will enter a culvert at the southwestern corner of the Intermediate Rock Stockpile. From there, it will flow under the existing road into the roadside v-ditch through an opening in the roadside safety berm into a culvert, and finally into Basin W2.

On-site runoff from the western slopes of the Development Rock Stockpile will be directed to flow via the western stockpile berm to Basin W3 (***Figure 4.5-2***). This will ensure the containment of the contact water on the eastern side of the ridge to which the stockpile abuts. This berm will be relocated as necessary to contain water from this part of the stockpile as its footprint changes during operations. The runoff directed by the berm along with the runoff from the southwestern portion of this stockpile makes up Catchment D1, which flows to Basin W3.

Stormwater runoff from the far western portion of the Development Rock Stockpile (Catchment E1) will be captured in Contact Water Basin W5. Basin W5 is sized to contain 8.4 ac-ft (10,400 m^3) of water. The basin will be constructed by excavating a portion of the tailings down into the native grade. The southern embankment slope of the basin that abuts the existing tailings will be stabilized by an earthen fill. The entire basin will be lined according to BADCT standards and will be emptied after each storm event. Contact water will be reused via incorporation into the tailings thickeners.

Basins W2 and W3 are located at low points on the southern edge of the Development Rock Stockpile to capture stormwater flows from the on-site catchment areas. Basin W3 is sized to contain 12.3 ac-ft (15,000 m^3) of water. Basin W2 is sized to contain 30.8 ac-ft (38,000m^3) of water. Both basins will be lined according to BADCT standards and will be emptied after each storm event. The contact water will be reused in the process water system.

The stormwater design for the Concentrator Complex addresses the new facilities located in the northern part of WPS. The Concentrator Complex will be situated north of the Development Rock Stockpile, Intermediate Rock Stockpile, and legacy Tailings Pond 6. The stormwater management for the Concentrator Complex at WPS, once the stockpiles are removed, is shown in ***Figure 4.5-3***. The Concentrator Complex site and adjacent upstream areas are subdivided into 16 catchment areas. Catchment areas containing or impacted by industrial facilities are categorized as on-site or contact areas, and catchment areas that are upstream of and diverted around the Concentrator Complex facilities and/or undeveloped are considered off-site or non-contact areas.

The western diversion channel will run on the surface along the northern and western edges of the site and discharge at the inlet of the Apex Tunnel. Runoff from northernmost non-contact catchment areas B2 and B3 will report to the western diversion channel that will route this portion of the off-site stormwater through a culvert passing between the Process Water Pond and the Ore Stockpile Facility, then south along the western side of the site past the thickeners to the Apex Tunnel.

It is not possible to route all non-contact water around the site because of the layout of the facilities and the topography of the existing terrain. The stormwater that falls in the remaining 14 Concentrator Complex catchments is considered contact water and will be retained on site in five separate high-density polyethylene (HDPE)-lined retention basins. The largest of these five basins is Basin W1, which is located southeast of the Concentrator site. Basin W1 is sized to contain approximately

49.4 ac-feet (61,000 m^3) of water. Basin W4 is located north of the thickeners and is sized to contain approximately 2.2 ac-ft (2,700 m^3) of water. Basins W2 and W3 are located south of the Concentrator Complex and are sized to contain 30.8 ac-ft (38,000 m^3) and 12.3 ac-ft (15,000 m^3) of water, respectively. Basin W5 is located in the drainage west of the Concentrator Complex (Catchment E1) to capture runoff from the area that will have been occupied by the Development Rock Stockpile (see below) and is sized to contain 8.4 ac-ft (10,400 m^3) of water.

The stormwater runoff from the majority of the site (Catchments A2 and A6) flows along the site surface roads and is routed by a series of berms and small channels into Basin W1. Catchment Areas A3, A4, and A5 are located on a west-facing slope and report to the eastern stormwater channel to be routed south into Basin W1. Catchment A7 collects the runoff from a small area of the site and reports to Basin W4.

Stormwater from the eastern hillsides and plant site south of the Concentrator Complex (Catchments C2, C3, C4, C5, and C7) is considered contact water and will be routed via roadway, channel, and culvert to Basin W2. In the event that Basin W1 overflows, an emergency overflow ditch will route excess flows to Basin W2. Contact water runoff from the southern slopes of the Concentrator Complex and legacy tailings area previously occupied by the Development Rock Stockpile will be captured in Basins W2 and W3 (Catchments C6 and D2). A berm at the southern edge of Basin W3 will divert water to this basin and keep it from continuing downstream to legacy Tailings Pond 6.

The Ancillary Facilities are located south of the Development and Intermediate Rock Stockpiles and north of the town of Superior. This area is a mixture of industrial and natural Sonoran Desert. ***Figure 4.5-4*** shows the stormwater management design for the proposed facilities. The Ancillary Facilities and adjacent upstream areas are subdivided into 13 catchment areas. All of these catchments are in areas without mining activity and are considered to be off-site or non-contact areas.

Non-contact Water Basin W6 is located just north of the mill/vehicle maintenance building and south of the truck wash. It is sized to retain approximately 2.4 ac-ft (3,000 m^3) of water. This basin receives all the runoff from surrounding on-site Catchment E1.

Non-contact Water Basin W7 is south of the Administration Building parking lot and receives surface runoff from Catchment F1. This basin is sized to contain 3.6 ac-ft (4,400 m^3) of water.

Non-contact Water Basin W8 is located along Lone Tree Access Road to the west of the town of Superior. It contains all surface water flows from the access road itself (Catchment G1) and two small adjacent undeveloped areas (Catchments G2 and G3). This basin is sized to contain 4.6 ac-ft (5,600 m^3) of water.

Non-contact Water Basin W9 is an HDPE-lined basin designed to handle the stormwater flows from the parking areas near the mine entrance (Catchment H2) and the adjacent hillsides and open areas (Catchments H1 and H3). This basin is sized to contain 7.7 ac-ft (9,500 m^3) of water.

Legacy Tailing Ponds 1 and 2 will remain and receive all runoff from the various laydown yards (Catchments J1, J2, and J3) and the upstream hillsides (Catchment J4). The legacy tailings ponds are sufficiently sized to fully contain the estimated 15.4 ac-ft (19,000 m^3) of runoff required based upon the 100-year, 24-hr rainfall event.

Finally, the runoff from Catchment K1 will pass under Lone Tree Access Road in culverts to off-site storage in the Indian Pond area near Outfall 1 via an existing drainage. The volume from this off-site catchment is estimated to be approximately 12 ac-ft (14,800 m^3) and will be completely contained within the existing Indian Ponds.

Water from Basins W1 through W9, as well as water from the legacy collection facilities, will be incorporated into the water supply system.

4.5.4.3. *Filter Plant and Loadout Facility Stormwater Management Plan*

The stormwater design for the Filter Plant and Loadout Facility is presented in ***Figure 4.5-5*** and is described in ***Appendix N***. Runoff from off-site catchment areas upstream of the site will be routed around or through the site and returned to the existing washes downstream of the facility via the northern diversion channel and culverts. The majority of the area within the Filter Plant and Loadout Facility property boundaries will remain undisturbed, and the runoff is considered non-contact. The non-contact runoff will be allowed to follow pre-development drainage patterns. Contact water from the Filter Plant and Loadout Facilities themselves will be contained on site in contact water basins.

The northern diversion channel conveys off-site flows around on-site Catchment A1 following the northern edge of the property west before turning south along the western edge of the construction laydown yard to Outfall 1 located in the existing wash. Runoff from off-site Catchment B1, the construction laydown yard, will be graded to also flow off-site via Outfall 1. A low point in the roadway will allow flows in Catchment B1 to cross to Outfall 1.

Outfall 2 collects runoff via the existing drainages from catchments east of the property boundary and Catchments C1, C2, C3, and C4. Flows from the east come on site over the Magman Arizona Railroad Company (MARRCO) Access Road and into three culverts under the rail loop. The MARRCO Access Road is graded to allow the flows to cross over it. Two additional culverts allow flows to continue west under the rail loop in Catchments C1 and C2. Lastly, flows from Catchment C3 are directed over the Skyline Access Road into Catchment C4 and to Outfall 2. A small catchment in the southeastern corner of the property (Catchment D1) will be graded to flow off site at Outfall 3. All of these catchments are considered off-site, or non-contact, because they do not come into contact with mining facilities.

On-site Catchment A2 contains the Concentrate Filter Plant, Conveyor, Concentrate Loadout, Clarifier, Ancillary Facilities, an SRP substation, a helipad, and a parking area. These areas are considered on-site catchment areas and will be graded to flow to Contact Water Basin F1. This contact water basin is sized to contain approximately 22 ac-ft (27,000 m^3) of water. The basin will be lined according to BADCT standards and will be emptied after each storm event. Contact water will be reused via incorporation into the supply water system.

On-site Catchment E1 contains the Filter Plant Site, CAP Water Pump Station, and 3-MG CAP Water Tank. These areas are considered on-site catchment areas and will be graded to flow to Contact Water Basin F2. Contact Water Basin F2 is sized to contain 3.4 ac-ft (4,200 m^3) of water. The basin will be lined according to BADCT standards and will be emptied after each storm event. Contact water will be reused via incorporation into the supply water system.

4.5.4.4. *Tailings Storage Facility Stormwater Management Plan*

Stormwater management for the TSF was designed to divert non-contact water around the facility, collect and reclaim surface runoff from the facility, provide storage for the design storm events without discharge, and protect the TSF and diversion structures from erosion from storm events. Stormwater management structures and upstream catchments in the vicinity of the TSF are shown in ***Figure 4.5-6***.

Three diversion channels will be constructed north of the TSF to route the upstream catchments (S1, S2, and S3) around the facility. These diversion channels will be sized to convey the peak PMF flow, which is the greater peak flow of the general PMF 72-hr or local PMF 6-hr storms. The diversion channel design flows range from 3,500 to 12,000 cubic feet per second (100 m^3/s to 340 m^3/s), and diversion channel base widths range from 16 to 50 ft (5 to 15 m) with side slopes of 1H:2V. The slopes of the diversion channels will be 1 percent. With the construction of the three diversion channels, non-contact water will continue to report to Queen Creek.

The entire length of the diversion channels will be cut into competent bedrock (Pinal Schist); therefore, no armoring of the channels is assumed. Local armoring of the diversion channel outlets where diversions tie into existing topography will be accomplished with the installation of riprap sediment basins and/or spillways. The diversion channel layouts are shown in ***Figure 4.5-7***, and the typical cross-sections for the diversions are depicted in ***Figure 4.5-8.*** Additional information on the design of the diversion channels can be found in KCB (2014, Volume II, Appendix VIII).

The stormwater that lands directly on the TSF, or downstream of the diversion channels during the early stages of tailings construction, will be totally contained within the TSF (S4). This water will directly offset supply water needs for tailings void fill and water lost to evaporation. The stormwater that seeps through the tailings will be collected in a series of rockfill underdrains that report to one of 11 seepage collection dams. Each of these dams will have a low-permeability core-and-grout curtain and will be keyed into bedrock to limit seepage to the environment. These seepage dams will also collect all stormwater that runs off of the tailings embankments (S5) and are sized to store the runoff from a 200-year 24-hr storm without discharge. The seepage collection dams are designed with emergency spillways that are sized for the 1,000-year, 24-hr storm. From there, seepage will be pumped back into the TSF. Excess water in the TSF system will be pumped back to the Concentrator Complex as reclaim water.

The calculations and design of all TSF facilities can be found in KCB 2014.

4.5.5. SEDIMENT AND EROSION CONTROL

In general, Resolution Copper will minimize or eliminate erosion and subsequent downstream sedimentation through the installation and maintenance of diversion structures and sediment traps. Disturbed and newly reclaimed areas will generally be examined after major storm events and/or at the end of the rainy seasons in early October and in late March for the detection of excessive erosion and downdrainage sedimentation. Should significant erosion be identified, the area will be regraded, and new and/or additional sediment control measures (sediment traps, silt fences, wattles, straw bale dikes, revegetation, etc.) will be implemented.

In addition to the structural controls described previously, the following techniques will be implemented by Resolution Copper to minimize erosion and sedimentation as appropriate:

- To the extent practicable, vegetation will not be removed except from those areas to be directly affected by Resolution Project activities.
- To the extent practicable, removal of primary growth medium material will be scheduled for the dry months to reduce the potential for erosion and high soil losses.
- Cut-and-fill slopes for access and service roads will be designed to prevent soil erosion. Drainage ditches with cross-drains will be constructed where necessary. Disturbed slopes will be revegetated, mulched, or otherwise stabilized to minimize erosion as soon as practicable following construction.
- Road embankment slopes will be graded and stabilized with vegetation or rock as practicable to prevent erosion.
- Runoff from roads, buildings, and other structures will be handled through best management practices, including sediment traps, settling ponds, berms, sediment filter fabric, wattles, etc. Design of these features will be based on an analysis of local hydrologic conditions.
- Off-road vehicle travel will generally be avoided.
- During construction and operations, diversions will be constructed around the affected areas to minimize erosion. A number of best management practices, including checkdams, dispersion terraces, and filter fences, also will be used during construction and operations.
- Pipeline and conveyor berms will be revegetated or otherwise stabilized to minimize erosion.
- Incidental precipitation falling on disturbed areas will be collected.

- Permanent diversion channels will be designed for long-term stability.
- Reclamation and revegetation will be implemented as soon as practicable for long-term stability.

4.5.6. GROUNDWATER PROTECTION

Groundwater quality in Arizona is regulated under ADEQ's APP Program. ADEQ administers various types of APPs, including Individual Permits, Area-Wide Permits, and General Permits. Resolution Copper currently maintains several APPs for existing discharging facilities and ongoing activities as presented in ***Table 4.5-1***.

Table 4.5-1 Resolution Copper's Aquifer Protection Permits

Type of Permit	Permit ID	Expiration Date	Permit Use
Type 3.02 General Aquifer Protection Permit (East Plant Site Expanded Washbay Vehicle & Equipment)	P-511171	9/5/2017	This general permit allows for discharges of wastewater generated from washing vehicles and equipment at East Plant Site. The washbay is intended for cleaning underground development vehicles and equipment. The initial facility consisted of a single equipment washbay, steam cleaner, and grit chamber. The expanded facility includes the initial components, but adds a separate bay for washing vehicles, an oil/water separator, and a lift station.
Type 3.02 General Aquifer Protection Permit (East Plant Site Washbay Vehicle & Equipment)	P-106373	8/7/2017	General permit allows for discharges of wastewater generated from washing vehicles and equipment. The washbay is intended for cleaning underground development vehicles and equipment. The washbay is not used for cleaning the interiors of tanks or vessels.
Individual Aquifer Protection Permit (Development Rock Stockpile)	P-106257	Life of facility	Development rock from shaft and underground exploratory activities and the sinking of Shaft 10 will be placed within the area where the existing non municipal solid waste landfill resides.
Individual Aquifer Protection Permit (Superior Mine)	P-105823	Life of facility	For discharges of mine dewatering water from the Superior Mine to the mine water treatment system at West Plant Site. The treated mine water will primarily be conveyed to the New Magma Irrigation & Drainage District for beneficial use as irrigation for crops.
Type 3.02 General Aquifer Protection Permit (North & South Solids Storage Impoundments)	P-105727 Licensing Time Frame (LTF)#53821 South LTF#53822 North	4/11/2016	These permits authorize process water discharges from water treatment facilities and allows for the discharge of treated water into the North and South Solids Storage Impoundments.
Type 2.02 General Aquifer Protection Permit (Loadout Intermediate Rock Stockpiles)	P-101703 LTF#54310	9/28/2016	Resolution Copper intends to temporarily stockpile ore-grade (non-inert) development rock generated during the advancement of exploratory shafts and underground exploration activities.
Type 2.02 General Aquifer Protection Permit (Intermediate Rock Stockpile)	P-101703 LTF#53633	1/6/2016	Resolution Copper is authorized to operate the Intermediate Rock Stockpile for the purpose of staging ore-grade development rock from the advancement of shafts and underground exploration activities.

Table 4.5-1 Resolution Copper's Aquifer Protection Permits

Type of Permit	Permit ID	Expiration Date	Permit Use
Area-Wide Aquifer Protection Permit Significant Amendment (West Plant Site)	P-101703	Life of facility	This area-wide Aquifer Protection Permit authorizes the closure of the existing-APP regulated facilities at West Plant Site under a compliance schedule.
Individual Industrial Reclaimed Water Aquifer Protection Permit	R-511181	8/30/2018	The mine dewatering water and industrial reclaimed water will be mixed with Central Arizona Project water in conveyances of the New Magma Irrigation & Drainage District for agricultural application. The water will be used beneficially to irrigate crops including, but not limited to, alfalfa, barley, Bermuda grass, cotton, sorghum, turf, and wheat.
Type 2.02 General Aquifer Protection Permit (East Plant Site Intermediate Rock Stockpile)	511171	7/19/2017	Resolution Copper intends to temporarily stockpile grade (non-inert) development rock generated during the advancement of exploratory shafts and underground exploration activities at East Plant Site.
Individual Aquifer Protection Permit (Non-Municipal Solid Waste Landfill)	50287800	Life of facility	Resolution Copper is authorized to operate a Non-municipal Solid Waste Landfill. The landfill is approved to accept construction and demolition debris, non-hazardous mine refuse, vegetative waste, non-tire rubber products, solid waste petroleum contaminated soil, metal-contaminated soil, empty containers, and non-friable and friable asbestos-containing material.

This section generally describes the groundwater protection components of the existing APPs, including the development rock and intermediate rock storage facilities. Also described are Project components that may be incorporated into the anticipated APP for new Project facilities with the potential to discharge to groundwater during operations. These Project components include the TSF, process water pond, and contact stormwater ponds located at EPS, WPS, and the Filter Plant and Loadout Facility.

Key components of the APP Program are:

- Facilities shall be designed, constructed, and operated to ensure the greatest degree of discharge reduction through the application of BADCT, operating methods, or other alternatives, including practical technologies that permit zero discharge.
- Pollutants discharged shall not cause or contribute to a violation of Arizona Aquifer Water Quality Standards at the designated point of compliance for the facility.
- No pollutants discharged shall further degrade aquifer quality that at the issuance of the permit already violated Arizona Aquifer Water Quality Standards for that pollutant.
- The Permittee must demonstrate the technical and financial capability to construct, operate, and close the facilities.

The following components were incorporated into the Project design to ensure compliance with the APP Program's BADCT requirements:

- Isolation and containment of process waters and containment of contact stormwater in lined facilities;
- Primary and secondary containment structures such as double liners in the process water pond with leak detection and collection and elevated, double-walled, or contained tanks;
- Overflow protection and spill and leak detection systems;
- Management of stormwater runoff to reduce sediment loads in stormwater discharges to pre-mining conditions; and
- Management of process water for zero discharge.

The groundwater protection design is enhanced with significant and ongoing geochemical analysis of the waste rock and tailings material.

4.5.6.1. *Tailings Storage Facility*

Approximately 15 percent of the tailings are PAG. These tailings will be sited on low-permeability Gila Formation central to the facility. The deposited and consolidated tailings will have a very low permeability (3×10^{-8} ft/s [1×10^{-6} cm/s]) and will restrict flow into the TSF foundation. From surface investigation, Resolution Copper has found no indication that a continuous shallow groundwater aquifer exists in the area beneath the TSF. Resolution Copper will implement best practice, proactive ARD management strategies as described in ***Appendix R***. The goal of these strategies will be to minimize ARD risks during operation and ensure that ARD is avoided after closure.

A specific impacts assessment study for evaluating long-term seepage from the TSF will be completed during NEPA. In setting up the seepage impacts assessment, Resolution Copper must comply with the APP's BADCT requirements (see Section 1.1.3.3. of the BADCT Guidance Manual regarding prediction of mass loading to the subsurface and groundwater[ADEQ 2004]). Resolution Copper expects that this work would include three-dimensional groundwater flow modeling to estimate potential seepage rates and particle tracking to estimate potential travel times and potential flow pathways. Depending on the modeled results and baseline data obtained from the tailings characterization work, as well as regulatory review under NEPA and ADEQ's APP Program, additional flow and constituent modeling may be conducted (such as one-dimensional reactive transport along pertinent flow paths and/or three-dimensional flow and transport of one or two reactive constituents).

Analytical data generated from the geochemical testing of tailings will be used, along with metallurgical, engineering, and operating information to generate a solute/water balance, and to conduct fate-and-transport modeling. These analyses are planned pending the completion of the hydrogeologic characterization of the proposed site of the TSF. The goal of the solute/water balance and fate-and-transport modeling is to provide a quantitative assessment of the potential chemical composition of discharge from the TSF as well as the groundwater quality adjacent to the proposed TSF during mining operations and post-closure. The predicted groundwater quality at points of compliance and sensitive receptors will be assessed against water quality standards.

The Arizona BADCT manual does not specify the hydraulic conductivity needed for obtaining individual BADCT (it refers simply to "low hydraulic conductivity" bedrock) (ADEQ 2004). For potentially discharging facilities, individual BADCT is typically achieved through a combination of factors, including site physical characteristics (e.g., the hydraulic conductivity of the underlying bedrock, depth to groundwater, the geochemical properties of the underlying bedrock); climatic conditions; operational approach and methodology (e.g., sulfide segregation); facility design; and discharge control methods (natural or engineered). With respect to the proposed tailings facility, Resolution Copper proposes to use a combination of these factors to demonstrate BADCT, including, at a minimum, an expectation of geochemical reactivity and low to very low hydraulic conductivity of underlying bedrock. Specific BADCT requirements for the TSF are contained in the KCB tailings plan of operations design report (KCB 2014).

4.5.6.2. *Aquifer Protection Permit Program*

Requirements of the APP Program also include inspections of BADCT performance, ambient groundwater monitoring from point of compliance wells, a contingency plan for potential exceedances of aquifer water quality standards, and closure and post-closure strategies. Potential discharging facilities associated with the Resolution Project that may require individual or combined coverage under the APP Program include:

- Contact Water Basins at EPS, WPS, and the Filter Plant and Loadout Facility designed to capture stormwater runoff from process areas;
- A Process Water Pond located north of the Concentrator Complex that will store process water for use in ore processing;
- The TSF that will store tailings void water and reclaim water to be pumped to the Process Water Pond and used for ore processing; and
- Two material stockpiles planned for the Project that require coverage under the APP Program as discharging facilities: an Intermediate Rock Stockpile and a Development Rock Stockpile.

Other material stockpiles planned for the Project include temporary storage stockpiles related to processes and those designed to contain growth media for reclamation purposes. The process-related stockpiles will meet the definition of temporary storage and be managed inside the process areas. The growth media stockpiles will consist of soil and grubbed material as well as inert development rock that will be available for reclamation activities. Neither of these stockpiles will meet the definition of a discharging facility as defined by the APP Program.

Upgradient background and groundwater observation wells have been established in the vicinity of the GPA and at various associated facilities. Many of these wells have been installed to evaluate background conditions prior to the initiation of mining, ore processing, and tailings deposition. The monitoring program and results are described in detail in ***Section 2.3.2***. It is anticipated that many of these wells will continue to be used for groundwater monitoring and some may be used for regulatory compliance monitoring. Additional monitoring wells may also be required for regulatory compliance under the APP Program and/or as an environmental condition or protection measure developed with the final mine plan of operations.

4.5.6.3. *Dewatering and Water Recovery*

In addition to protections from discharges to groundwater, Resolution Copper plans also include protections for impacts due to dewatering and water recovery. To the extent practical, water will be recycled and reused. Resolution Copper's Water Management Plan emphasizes tracking and minimizing fresh water use and maximizing the use of renewable and impacted water. Resolution Copper plans to meet the majority of its process water needs through the life of the operation by securing and banking renewable CAP water credits. The remaining operational water needs will be met through the reuse of impacted mine dewatering water. As required by the Arizona Department of Water Resources (ADWR), Resolution Copper will complete a groundwater impacts assessment for the pumping of banked water credits before a permit is granted for authorization to recover the banked water and for the final location of wells. This process will establish measures to protect third-party well owners from dewatering impacts due to banked water recovery. Additionally, as required under NEPA, Resolution Copper will complete a groundwater impacts assessment, including seeps and springs, for the pumping of dewatering water for the proposed underground block cave mine.

4.6. SOILS

The Resolution Project is in an area largely controlled by bedrock; thus very little soil is present in the area. The soil that is present is poorly developed. General soil types for the Project area are described in ***Section 2.4***. Information on the reclamation of the salvaged soil and growth media stockpiles is provided in the plan for interim reclamation in ***Section 5***. Where available and practicable, growth media will be salvaged from Project areas and stockpiled for use in construction and reclamation. This is described further below by area:

4.6.1. EAST PLANT SITE

No soil salvage is planned at EPS as the surface is bedrock controlled. All material needed for the expansion of the pad to house the additional shafts and associated facilities will be sourced from locally drilled and blasted surface bedrock (Apache Leap Tuff) and placed immediately. No stockpiles are planned for EPS.

4.6.2. WEST PLANT SITE

In addition to the NPAG development rock, a small amount of soil may be recovered from within the footprint of the planned Concentrator Complex and salvaged as possible growth media for future reclamation of the Concentrator Complex facilities. The location of this material will be within Resolution Copper private holdings on WPS.

4.6.3. FILTER PLANT

A small amount of soil may be salvaged and recovered within the footprint of the proposed Filter Plant facilities and used as fill and/or growth media for future reclamation. The location of this material will be within Resolution Copper private holdings at the Filter Plant.

4.6.4. THE MARRCO AND TAILINGS STORAGE FACILITY CORRIDORS

Any small amount of soil from the footprint of the TSF Corridor may be salvaged and directly used at the TSF during construction or stockpiled at Resolution Copper private holdings at WPS. For the MARRCO Corridor, any soil or alluvial fill may be stockpiled at either WPS or the Filter Plant.

4.6.5. TAILINGS

The TSF will require borrow material for a variety of construction and reclamation requirements through the life of the operation and at closure. Construction of the TSF will be staged and concurrently reclaimed to limit the area exposed at any one time. Additional detail on borrow may be found in KCB (2014) and is summarized below:

4.6.6. CONSTRUCTION AND OPERATIONS

Although the area around the TSF is largely bedrock controlled, prior to construction, any small amount of soil would be salvaged and stored within the TSF footprint or placed on Resolution Copper private land. After soil removal, borrow material will be sourced from within the TSF footprint before startup and during operations to minimize ground disturbance in the surrounding area. This material will be directly placed for use as borrow, drains, filters, and riprap. Material from Borrow Areas 1 and 3 (***Figure 2.2-3****)* will be used for starter dam construction and concurrent reclamation, while material from washes will be used for drains and filters (***Exhibit 4.6-1***). Gila Conglomerate (QTg) and Apache Leap Tuff (Tal; ridges near the southern end of the TSF) are also potential sources for drains and filters.

4.6.7. CLOSURE AND RECLAMATION

Borrow sources from outside the TSF footprint will be mostly used to satisfy material requirements for closure and reclamation. The location of each borrow area is shown on ***Figure 2.2-3***. The main rock types used will be Gila Conglomerate and Pi Schist (p₵pi). Gila Conglomerate (Borrow Area 5 and 6) will be used as engineered cover (store-and-release) over the cleaner tailings and tailings beaches (if direct seeding is not possible). Pinal Schist will be used as riprap material for armoring embankment slopes and closure diversion channels (Borrow Areas 1 and 4). Similar to areas within the TSF footprint, the area is largely bedrock controlled, but any small amount of soil would be salvaged and stored within the TSF footprint for use in final reclamation.

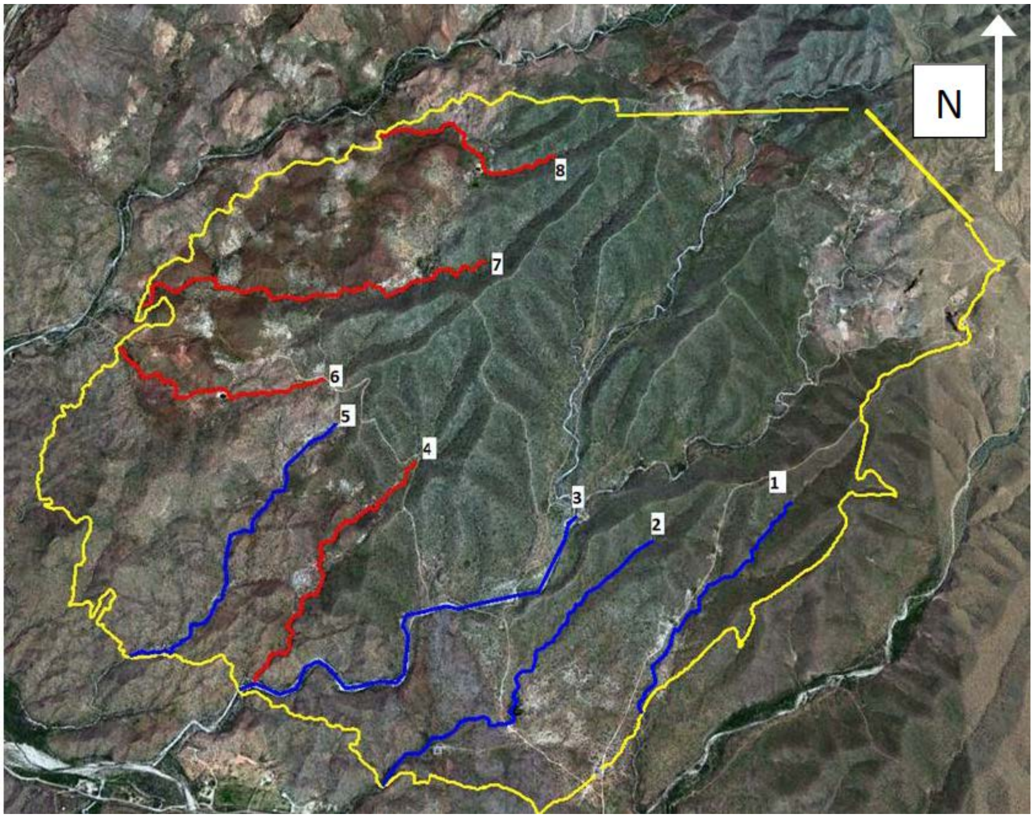
Table 4.6-1 summarizes the borrow sources and the material requirements that each satisfies.

Table 4.6-1 Tailings Storage Facility Borrow Summary

Staging	Geology Unit	Material Type	Structural Component	Borrow Area	Fill Volume Available (Mm^3) *(acre-ft)*[1]
Starter Facility & Operations	Alluvial Sediments	Drains and Filters	Drain Rock and Drain Filters Seepage Dam Filters North Dam Filters	Drainages and washes	0.17 *(137.82)*
	Gila Conglomerate	General Fill	Starter Dams North Dams Seepage Collection Dams	1	36.6 *(29,672.10)*
		Drains and Filters	Underdrain Drain Rock and Filters Seepage Dam Filters North Dam Filters	1	
	Apache Leap Tuff	Riprap	Seepage Dam Armoring Tailings Embankment Slope Armoring (before Year 10) Tailings Embankment Toe Armoring (before Year 10)	3	2.6 *(2,107.85)*
		Drains and Filters	Underdrain Drain Rock and Filter Seepage Dam Filters North Dam Filters	3	
Operations & Closure	Gila Conglomerate	General Fill	Closure Cover for Tailings Beaches and Cleaner North Dams	5 or 6	10.0 *(8,107.13*
	Pinal Schist	Riprap	Tailings Embankment Slope Armoring (after Year 10) Tailings Embankment Toe Armoring (after Year 10) North Dam Armoring Embankment Closure Diversion Channels	1 or 4	2.2 *(1,783.57)*

Note 1: Fill volume is based on cut volume +25 percent. Data source is KCB 2014.

Exhibit 4.6-1 Location of Drainage Channels for Filter and Drain Borrow Material



4.6.8. SOILS AND GROWTH MEDIA MONITORING AND ANALYSIS

In general, Resolution Copper will implement best management practices such as settling basins, covering of stockpiles, runoff diversions, silt fences, and other site-specific measures as determined to control soil erosion during construction activities. These measures will limit soil erosion within the Project area. Erosion-control measures such as hydroseeding will be implemented on areas that have been graded or disturbed. Drainage structures on cut-and-fill slopes will be maintained, repaired, upgraded, or installed as necessary to minimize long-term erosion. Equipment and vehicles will be kept within the limits of the proposed disturbance areas. Routine site inspections will be conducted to assess the effectiveness of and the maintenance requirements for erosion- and sediment-control systems.

Chemical and physical analyses will be conducted on potential growth media, including pH, salinity, cations and cation exchange capacity, organic matter content, sodium absorption ratio, nutrient content, and acid base accounting. Growth media stockpiles would be graded to a stable slope to promote positive stormwater drainage; revegetated to establish a self-sustaining ecosystem; and monitored and treated to control the spread of noxious weeds. Stormwater runoff would be diverted around stockpiles.

Salvage growth media would be inspected and monitored. An annual assessment would be conducted of the volume of growth media to ensure that the predicted volumes required for reclamation are available. Stockpiles will be regularly inspected to ensure that stormwater diversions, storage facilities, and sediment-control measures are performing as designed.

Reclaimed areas will be inspected after storm events to check that minimum cover thickness is maintained. Areas of erosion will be addressed with erosion-mitigation methods (silt fences, wattles, straw bale dikes, and reseeding).

The following techniques will be implemented by Resolution Copper to minimize the erosion of stockpiles and as appropriate:

- To the extent practicable, vegetation will not be removed except from those areas to be directly affected by Resolution Project activities.
- To the extent practicable, Resolution Copper will attempt to salvage saguaros for use in concurrent, interim, and future reclamation. Salvaged plants may be temporarily stored on Resolution Copper private land.
- To the extent practicable, the removal of primary growth medium material will be scheduled for the dry months to reduce the potential for erosion and high soil losses.
- Cut-and-fill slopes for access and service roads will be designed to prevent soil erosion. Drainage ditches with cross-drains will be constructed where necessary. Disturbed slopes will be revegetated, mulched, or otherwise stabilized to minimize erosion as soon as practicable following construction.
- Road embankment slopes will be graded and stabilized with vegetation or rock as practicable to prevent erosion.
- Off-road vehicle travel will generally be avoided.
- Pipeline and conveyor berms will be revegetated or otherwise stabilized to minimize erosion.
- Reclamation and revegetation will be implemented as soon as practicable for long-term stability.

4.7. WILDLIFE

Various baseline biological studies of wildlife have been conducted within and near the GPA to support planning and anticipated permitting efforts for the Resolution Project. Studies include species-specific surveys that were conducted for special-status species of concern that are either present or have the potential to occur within the GPA. A summary of the baseline studies that have been conducted is provided in ***Appendix C***. This section generally describes the regulatory framework for the protection of wildlife species, the common wildlife species expected to occur in the GPA, and the wildlife protection measures that Resolution Copper will implement during the Project. Resolution Copper will continue to conduct biological monitoring as the Project progresses for evaluation against collected baseline data and in accordance with regulatory requirements.

Plant and animal species that have been determined to be threatened or endangered are protected by the federal Endangered Species Act (ESA), which is administered primarily by the US Fish and Wildlife Service (USFWS). The ESA requires federal agencies (e.g., the FS) to use their authority to conserve threatened and endangered species. Section 7 of the ESA requires federal agencies to consult with the USFWS to ensure that the actions they authorize, fund, or conduct are not likely to jeopardize the continued existence of any listed species. Further, the USFWS is required to designate specific areas essential for the conservation of the listed species as critical habitat, if prudent and determinable. If a federal agency determines that a project may affect but is not likely to adversely affect a listed species or designated critical habitat, it must consult with the USFWS in accordance with the provisions of Section 7 of the ESA. Consultation between the FS and the USFWS in accordance with the requirements of the ESA is anticipated for the mining operations proposed for this Plan. Specific conservation measures would be developed based on that consultation.

The Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. 703–712), provides federal protection to all migratory birds. Resolution Copper anticipates that a migratory bird treaty act analysis will be completed to evaluate Project effects to migratory birds and important migratory bird habitat.

In the Forest Service Manual (FSM) 2670.5, the FS defines sensitive species as “Those plant and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by: (a) Significant current or predicted downward trends in population numbers or density; (b) Significant current or predicted downward trends in habitat capability that would reduce a species’ existing distribution” (FS 2005). As described in FSM 2670.22 (FS 2005), the FS is directed to: 1) develop and implement management practices to ensure that species do not become threatened or endangered because of FS actions.; 2) maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands; and 3) develop and implement management objectives for populations and/or habitat of sensitive species. In furtherance of these requirements, Resolution Copper anticipates that Tonto National Forest (TNF) will complete a Biological Assessment and Evaluation for the proposed Project that will evaluate Project effects to Forest Sensitive Species.

The role of Management Indicator Species (MIS) in National Forest planning is described in the 1982 implementation regulations (FS 1982) for the National Forest Management Act of 1976 (36 Code of Federal Regulations [CFR] 219.19(a)(1)). FSM 2620.5 defines MIS as “plant and animal species, communities or special habitats selected for emphasis in planning, and which are monitored during forest plan implementation in order to assess the effects of management activities on their populations and the populations of other species with similar habitat needs which they may represent" (FS 1991). These regulations require that certain vertebrate and/or invertebrate species present in the area be identified as MIS within the planning area and that these species be monitored, as "their population changes are believed to indicate the effects of management activities" (36 CFR 219.19(a)(1)).

The TNF Land and Resource Management Plan (Forest Plan; TNF 1985) guides the long-term management of National Forest System lands on the TNF. In order to meet the intent of planning regulations, 29 wildlife species and one species group (aquatic macroinvertebrates) were identified as MIS in Appendix G of the Forest Plan, and updated in 2012 (TNF 2012). These MIS were selected to monitor the conditions of TNF's ecosystems and the effects of implementation of the Forest Plan on wildlife habitat and species diversity (TNF 1985). Forest-wide trends for all MIS were assessed and reported in the 2002 TNF–wide status report for MIS and later updated in 2005 (TNF 2005). Resolution Copper anticipates that the TNF will complete an MIS analysis to evaluate Project effects on wildlife species identified as MIS and will evaluate the effects the Project would have on habitats within the Forest and develop specific conservation measures to be implemented as part of a final mine plan of operations.

Common wildlife species expected to occur within the GPA would be typical of those associated with the plant communities found within the GPA sites (***Section 4.9***). As described previously, extensive baseline biological studies have been conducted in the GPA and vicinity (***Appendix C***). Wildlife surveys have included group-specific surveys for bats, raptors, song birds, reptiles, and amphibians. A list of the wildlife species observed within the GPA is provided in ***Table 4.7-1***. This list is not intended to be inclusive of all wildlife observed within the GPA, but it provides an overview of the species that have been recorded during baseline biological surveys conducted within the GPA.

Table 4.7-1 Wildlife Species Observed in the General Project Area

Species	Status	Filter Plant and Loadout Facility	MARRCO Corridor	Tailings Storage Facility	West Plant Site	East Plant Site
AMPHIBIANS						
Canyon Tree Frog (*Hyla arenicolor*)	N/A					X
Red-spotted Toad (*Bufo punctatus*)	N/A					X
Tiger Salamander (*Ambystoma tigrinum*)	N/A					X
REPTILES						
Arizona Black Rattlesnake (*Crotalus cerberus*)	N/A					X
Maricopa Leaf-nosed Snake (*Phyllorhynchus browni*)	N/A		X	X		

Table 4.7-1 Wildlife Species Observed in the General Project Area

Species	Status	Filter Plant and Loadout Facility	MARRCO Corridor	Tailings Storage Facility	West Plant Site	East Plant Site
Night Snake (*Hypsiglena torquata*)	N/A					X
Tucson Shovel-nosed Snake (*Chionactis occipitalis klauberi*)	Candidate	X	X			
Black-necked Gartersnake[1]	N/A					X
Reticulate Gila Monster (*Heloderma suspectum suspectum*)	N/A		X	X		X
Sonoran Desert Tortoise (*Gopherus morafkai*)	Candidate, Sensitive, WSC	X	X	X	X	
Sonoran Mud Turtle[1]	N/A					X
B I R D S						
Abert's Towhee (*Melozone aberti*)	MBTA, YWL			X		X
American Kestrel (*Falco sparverius*)	MBTA		X			X
Peregrine Falcon (*Falco peregrinus*)	Sensitive, MBSC, MBTA, WSC			X		X
Anna's Hummingbird (*Calypte anna*)	MBTA					X
Ash-throated Flycatcher (*Myiarchus cinerascens*)	MBTA, MIS			X		X
Bell's Vireo (*Vireo bellii*)	MIS, MBSC, MBTA, RWL			X		X
Bewick's Wren (*Thryomanes bewickii*)	MBTA					X
Black-chinned Hummingbird (*Archilochus alexandri*)	MBTA					X
Black-chinned Sparrow (*Spizella atrogularis*)	MIS, MBSC, MBTA, RWL					X
Black-headed Grosbeak (*Pheucticus melanocephalus*)	MBTA					X
Black Phoebe (*Sayornis nigricans*)	MBTA					X
Black-tailed Gnatcatcher (*Polioptila melanura*)	MBTA					X
Black-throated Sparrow (*Amphispiza bilineata*)	MBTA, MIS			X		X
Blue Grosbeak (*Passerina caerulea*)	MBTA					X

Table 4.7-1 Wildlife Species Observed in the General Project Area

Species	Status	Filter Plant and Loadout Facility	MARRCO Corridor	Tailings Storage Facility	West Plant Site	East Plant Site
Blue-gray Gnatcatcher (*Polioptila caerulea*)	MBTA					X
Brewer's Sparrow (*Spizella breweri*)	MBTA, YWL					X
Bridled Titmouse (*Baeolophus wollweberi*)	MBTA					X
Bronzed Cowbird (*Molothrus aeneus)*	MBTA					X
Brown-crested Flycatcher (*Myiarchus tyrannulus*)	MBTA					X
Brown-headed Cowbird (*Molothrus ater)*	MBTA					X
Bullock's Oriole(*Icterus bullock*)	MBTA					X
Bushtit (*Psaltriparus minimus)*	MBTA					X
Cactus Wren (*Campylorhynchus brunneicapillus*)	MBTA			X		X
Canyon Towhee (*Melozone fuscus)*	MIS, MBSC, MBTA					X
Canyon Wren (*Catherpes mexicanus)*	MBTA					X
Cassin's Kingbird (*Tyrannus vociferans*)	MBTA					X
Common Black-Hawk (*Buteogallus anthracinus*)	MIS, MBSC, MBTA, WSC					X
Common Raven (*Corvus corax*)	MBTA			X		X
Cooper's Hawk (*Accipiter cooperii*)	MBTA		X	X		X
Costa's Hummingbird (*Calypte costae*)	MBSC, MBTA, YWL					X
Crissal Thrasher (*Toxostoma crissale)*	MBTA					X
Curve-billed Thrasher (*Toxostoma curvirostre*)	MBTA			X		X
Double-crested Cormorant (*Phalacrocorax auritus*)	MBTA					X
Elf Owl (*Micrathene whitneyi*)	MBSC, MBTA, YWL		X			X

Table 4.7-1 Wildlife Species Observed in the General Project Area

Species	Status	Filter Plant and Loadout Facility	MARRCO Corridor	Tailings Storage Facility	West Plant Site	East Plant Site
Eurasian Collared Dove (*Streptopelia decaocto)*	N/A					X
Gambel's Quail (*Callipepla gambelii*)	Game		X	X		X
Gilded Flicker (*Colaptes chrysoides*)	MBSC, MBTA, RWL					X
Gray Flycatcher (*Empidonax wrightii*)	MBSC, MBTA					X
Gray Vireo (*Vireo vicinior*)	MIS, MBSC, MBTA, YWL					X
Greater Roadrunner (*Geococcyx californianus*)	MBTA		X	X		X
Great Blue Heron (*Ardea herodias*)	MBTA					X
Great-horned Owl (*Bubo virginianus)*	MBTA		X	X		X
Green-tailed Towhee (*Pipilo chlorurus)*	MBTA					X
Harris's Hawk (*Parabuteo unicinctus*)	MBTA		X			
Hooded Oriole (*Icterus cucullatus)*	MBTA, MIS					X
House Finch (*Haemorhous mexicanus)*	MBTA					X
Hutton's Vireo (*Vireo huttoni)*	MBTA					X
Ladder-backed Woodpecker (*Picoides scalaris)*	MBTA					X
Lark Sparrow (*Chondestes grammacus)*	MBTA					X
Lawrence's Goldfinch (*Spinus lawrencei*)	MBTA, YWL					X
Lewis's Woodpecker (*Melanerpes lewis*)	MBSC, MBTA, YWL					X
Lucy's Warbler (*Oreothlypis luciae*)	MBSC, MBTA, YWL					X
MacGillivray's Warbler (*Geothlypis tolmiei)*	MBSC, MBTA					X
Mourning Dove (*Zenaida macroura*)	MBTA, Game		X	X		X
Northern Cardinal (*Cardinalis cardinalis*)	MBTA			X		X

Table 4.7-1 Wildlife Species Observed in the General Project Area

Species	Status	Filter Plant and Loadout Facility	MARRCO Corridor	Tailings Storage Facility	West Plant Site	East Plant Site
Northern Mockingbird (*Mimus polyglottos)*	MBTA					X
Northern Rough-winged Swallow (*Stelgidopteryx serripennis*)	MBTA					X
Phainopepla (*Phainopepla nitens*)	MBSC, MBTA			X		X
Plumbeous Vireo (*Vireo plumbeus)*	MBTA					X
Red-tailed Hawk (*Buteo jamaicensis*)	MBTA		X	X		X
Rock Wren (*Salpinctes obsoletus)*	MBTA					X
Rufous-crowned Sparrow (*Aimophila ruficeps)*	MBTA					X
Scott's Oriole (*Icterus parisorum)*	MBTA					X
Sharp-shinned Hawk (*Accipiter striatus*)	MBTA					X
Spotted Towhee (*Pipilo maculatus)*	MBTA, MIS					X
Summer Tanager (*Piranga rubra)*	MBTA, MIS					X
Swainson's Hawk (*Buteo swainsoni*)	MBSC, MBTA, YWL					X
Turkey Vulture (*Cathartes aura*)	MBTA		X	X		X
Verdin (*Auriparus flaviceps)*	MBTA					X
Virginia's Warbler (*Oreothlypis virginiae*)	MBTA, YWL					X
Violet-green Swallow (*Tachycineta thalassina)*	MBTA, MIS					X
Warbling Vireo (*Vireo gilvus)*	MBTA, MIS					X
Western Burrowing Owl (*Athene cunicularia hypugaea*)	MBTA		X			
Western Screech-Owl (*Megascops kennicottii*)	MBTA		X			X
Western Scrub-Jay (*Aphelocoma californica)*	MBTA					X

Table 4.7-1 Wildlife Species Observed in the General Project Area

Species	Status	Filter Plant and Loadout Facility	MARRCO Corridor	Tailings Storage Facility	West Plant Site	East Plant Site
Western Tanager (*Piranga ludoviciana)*	MBTA					X
Western Wood-Pewee (*Contopus sordidulus)*	MBTA, MIS					X
White-throated Swift (*Aeronautes saxatalis*)	MBTA					X
White-winged Dove (*Zenaida asiatica*)	Game, MBTA			X		X
Zone-tailed Hawk (*Buteo albonotatus*)	MBTA			X		X
M A M M A L S						
Big Brown Bat (*Eptesicus fuscus*)	N/A					X
Big Free-tailed Bat (*Nyctinomops macrotis*)	N/A					X
Black-tailed Jackrabbit (*Lepus californicus*)	Game			X		
Bobcat (*Lynx rufus*)	Game			X		
California Leaf-nosed Bat (*Macrotus californicus*)	WSC			X		X
Desert Cottontail (*Sylvilagus audubonii*)	Game		X	X		
Coyote (*Canis latrans*)	Game		X	X		X
Desert Mule Deer (*Odocoileus hemionus*)	Game		X	X		
Gray Fox (*Urocyon cinereoargenteus*)	Game			X		
Greater Western Mastiff Bat (*Eumops perotis*)	N/A			X		X
Hoary Bat (*Lasiurus cinereus*)	N/A					X
Javelina (*Tayassuidae* sp.)	Game		X	X		
Mountain Lion (*Puma concolor*)	Game			X		
Pale Townsend's Big-eared Bat (*Plecotus townsendii pallescens*)	Sensitive			X		X
Pallid Bat (*Antrozous pallidus*)	N/A					X

Table 4.7-1 Wildlife Species Observed in the General Project Area

Species	Status	Filter Plant and Loadout Facility	MARRCO Corridor	Tailings Storage Facility	West Plant Site	East Plant Site
Pocketmouse (*Chaetodipus intermedius*)	N/A			X		
Rock Squirrel (*Spermophilus variegatus*)	Game		X	X		
Silver-haired Bat (*Lasionycteris noctivagans*)	N/A					X
Western Red Bat (*Lasiurus blossevillii*)	Sensitive, WSC			X		X
Western Small-footed Myotis (*Myotis ciliolabrum*)	N/A					X
White-nosed Coati (*Nasua narica*)	N/A					X
White-tailed Deer (*Odocoileus virginianus*)	Game			X		X
Woodrat (*Neotoma* sp.)	Game			X		

Species Status Codes with Managing Department shown in Parenthesis:
Endangered, Threatened, or Candidate (USFWS)
Sensitive – Forest Sensitive (TNF)
MIS – Management Indicator Species (TNF)
MBSC – Migratory Bird Species of Concern (TNF)
MBTA – Migratory Bird Treaty Act (USFWS)
WSC –Wildlife Species of Concern (AGFD)
Game – Game Species (AGFD)
RWL –Red Watch List (Audubon Society)
YWL – Yellow Watch List (Audubon Society)
N/A – No current status or no status relevant to managing departments
Sources: TNF 2011; ***Appendix C***
[1] Aquatic or semi-aquatic species.

4.7.1. WILDLIFE MANAGEMENT

Resolution Copper has developed a preliminary Wildlife Management Plan (***Appendix X***) for implementation at the tailings decant pond, non-contact and contact stormwater catchment basins, and process water ponds. The objective of this plan is to discourage wildlife from entering active mining areas at EPS, WPS, the TSF, and the Filter Plant and Loadout Facility. This plan will employ the application of least aggressive management practices to effectively deter wildlife from these areas. Components of the plan include wildlife monitoring, preventative measures, vegetation management, non-lethal harassment techniques, preventative maintenance of facilities, and reporting procedures.

Initially, preventative measures such as perimeter fencing to exclude mammals from entering the ponds and vegetation maintenance to discourage wading birds may be implemented. The effectiveness of these measures will be routinely evaluated by Resolution Copper, and, if necessary, the implementation of non-lethal harassment tactics will follow. Non-lethal harassment devices to deter and disperse wildlife from the ponds and catchment basins may include plastic ball covers, vehicle lights and horns, motion sensor lights, flags, perch deterrents, shell crackers, bird bangers, screamers, distress cries/electronic noise systems, bird scare balloons, propane cannons, and Mylar scare tape. Ongoing preventative maintenance of the ponds and basins during operations will ensure prompt repair of any site fencing and other preventative or harassment devices to discourage wildlife from entering the facility.

In addition to the strategies outlined in the Wildlife Management Plan (***Appendix X***), Resolution Copper will implement the following wildlife protection measures:

- Resolution Copper will minimize disturbance to wildlife habitat by maintaining as compact an operation as practicable. Vegetation will be cleared only in those areas necessary for Project activities.
- During construction and operation, trash and other miscellaneous inert (non-hazardous) garbage will be contained in on-site dumpsters and then hauled to an off-site landfill for disposal.
- Hazardous substances will be stored and handled in a manner to prevent contact with wildlife.
- No hunting or discharge of firearms will be permitted during mine construction or operations within the restricted and fenced property boundaries for the various Resolution Project facilities.
- Electric power transmission and distribution line towers (power poles) that serve the Resolution Project facilities will be designed and constructed to avoid raptor electrocutions.

4.8. AQUATIC BIOLOGY

Resolution Copper has completed numerous surveys and baseline studies to characterize the aquatic biology within and near the GPA. Aquatic biology surveys have targeted several taxa and ecological communities, including aquatic invertebrates and vertebrates and riparian and wetland vegetation, during the period 2003–2012. Many of these aquatic biology surveys have been conducted outside but in the vicinity of the GPA, yet constitute an important baseline from which to monitor future changes in aquatic resources within or near the GPA. These studies are included in ***Appendix C***[6] and will be provided as standalone technical reports to assist in the baseline review and to support planning and anticipated permitting efforts for the Resolution Project. No fish species have been observed in the GPA, but several aquatic and semi-aquatic amphibian and reptile species have been observed in or near the GPA. None of the observed aquatic species are USFWS-listed species. One, the lowland leopard frog (*Rana yavapaiensis*), is a FS Sensitive Species (***Table 4.7-1***).

In the following sections, the aquatic resources for each Project site or facility will be described. A brief summary of aquatic biology survey history is also provided.

4.8.1. FILTER PLANT AND LOADOUT FACILITY

The Filter Plant and Loadout Facility will be located in the Lower Queen Creek watershed, which lies south of the Middle Queen Creek watershed and west of the Upper Queen Creek watershed (***Figure 2.3-1***). All of the potential surface water features within the Filter Plant and Loadout Facility are ephemeral drainages, flowing only briefly in direct response to storm events. No wetlands or other special aquatic sites were identified within the Filter Plant and Loadout Facility (WestLand 2013a). Drainages throughout this area are typical ephemeral desert washes that support a xeroriparian plant community (WestLand unpublished data[7]). Several, shallow artificial basins created in parts of the Filter Plant and Loadout Facility area could presumably hold ponded water for relatively short periods and therefore serve as a seasonal resource of surface water for wildlife (e.g., mammals, summer breeding amphibians). For a more detailed discussion of the potential for surface water features associated with the Filter Plant and Loadout Facility, see ***Section 2.3.1.1.2*** and WestLand (2013a).

Due to a lack of perennial aquatic features capable of supporting special-status species (e.g., fish, amphibians, gartersnakes), no aquatic biology surveys for target species of invertebrates, vertebrates, or vegetation communities have been conducted in the Filter Plant and Loadout Facility area.

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6 ***Appendix C*** includes surveys and baseline studies from 2006 to the present. Some reports or baseline studies cited in this Aquatic Biology Section predate this timeframe and will not be found in ***Appendix C***.

7 Incidental observations while on site during Tucson shovel-nosed snake surveys.

4.8.2. MARRCO CORRIDOR

The MARRCO Corridor does not support perennial or intermittent surface waters, and no natural ponds are present along the corridor. All of the potential surface water features within the MARRCO Corridor are ephemeral drainages, flowing only briefly in direct response to storm events (WestLand 2014a). For a more detailed discussion of the potential for surface water features associated with the MARRCO Corridor, see ***Section 2.3.1.1.2*** and WestLand (2014a). Several artificial stock tanks are located adjacent to the corridor, identified from US Geological Survey 7.5-minute topographic maps and during field surveys (WestLand unpublished data[8]), that likely serve as a seasonal aquatic resource for wildlife (e.g., mammals, summer breeding amphibians).

Due to a lack of perennial aquatic features capable of supporting special-status species (e.g., fish, amphibians, gartersnakes), no aquatic biology surveys for target species of invertebrates, vertebrates, or vegetation communities have been conducted along the MARRCO Corridor.

4.8.3. TAILINGS STORAGE FACILITY AND TAILINGS CORRIDOR

Relatively few aquatic features are present within the TSF, and perennial surface water appears to be minimal (Montgomery and Associates 2013, WestLand 2014). Drainage features within the TSF consist primarily of seven large drainage systems (i.e., Hewitt Canyon, Roblas Canyon, Bear Tank Canyon, Potts Canyon, Rice Water Canyon, Happy Camp Canyon, and Silver King Wash) and their tributaries. All seven drainages are directly tributary to Queen Creek. Although some of the drainages do contain seasonally or perennial wetted areas (associated with the springs described below), these drainages appear to be ephemeral within the TSF; no perennial or intermittent reaches of these drainages have been identified in the TSF. Past human alteration of some of the drainage features has created impoundments (cattle tanks) that do hold water for short periods of time following storm events. No wetlands or other special aquatic sites were identified within the TSF (WestLand 2014).

Six springs and one tinaja (unmapped) were identified within the TSF, based on US Geological Survey 7.5-minute topographic maps, field surveys (Montgomery and Associates 2013; WestLand 2014a; ***Figure 2.3-2***), and personal communication with Mark Taylor of the FS). These features are identified as Perlite Spring, Bear Tank Canyon Spring, Benson Spring, Potts Spring, Happy Camp Spring, Lower Railroad Spring, and an unnamed tinaja. Of these, two (Potts Spring and Lower Railroad Spring) were found to be dry and were considered as no longer extant based on the lack of surface water or soil moisture and the absence of spring-associated plants. Perlite Spring consists of three ponds: the uppermost is contained by an earthen berm and the lower two, within depressions formed as a result of historical perlite quarrying. Montgomery and Associates (2013) could find no evidence of groundwater inflow or seepage, and concluded that the ponds had resulted from the collection and retention of surface water runoff; they did not appear to be sourced by any natural spring-fed seepage

[8] Incidental observations while on site during Tucson shovel-nosed snake surveys.

or inflow. The unnamed tinaja located adjacent to FS road 1903 (Mark Taylor, FS, pers. comm.) could be considered perennial, although its hydrologic source is currently unknown.

The extant springs in the TSF and vicinity are Happy Camp, Bear Tank Canyon, and Benson springs (***Figure 2.3-2***). Happy Camp and Bear Tank Canyon springs were noted by Montgomery and Associates (2013) as having active discharge and some riparian vegetation. Both springs are at least partially modified for use in stock watering, and a stock pond is associated with Happy Camp Spring. Observations of Benson Spring were unable to identify baseflow in the area or a source of seepage from the pools associated with the spring (Montgomery and Associates 2013, WestLand 2012a). Rain events during Montgomery and Associates' (2013) visits to the spring were determined to have contributed a runoff component to the pools, and the area was recommended for continued monitoring of any potential baseflow. In general, all three springs support some riparian vegetation, including individuals and small patches of Fremont cottonwood and Goodding's willow, as well as small patches of seasonally occurring emergent species (e.g., cattails [*Typha* spp.] and sedges at Benson Spring) (WestLand 2012a).

No aquatic biology surveys for target species of invertebrates or vertebrates were conducted in the TSF area. Available surface water in the area was not considered as potential habitat for special-status species, in particular no special-status fish species were considered to have any potential for occurrence. The lowland leopard frog was considered to have a possible potential to occur based on extant surface waters (e.g., small springs, tinajas, and stock tanks) (WestLand 2014a). Surveys for wetland- and spring-associated plants were conducted at the TSF.

4.8.4. WEST PLANT SITE

No perennial surface water flow is present on or adjacent to WPS (***Figure 2.3-3***). All of the drainages are ephemeral and flow only briefly in direct response to storm events (WestLand 2011). No natural ponds are present at WPS, but legacy impoundments (i.e., tailings ponds) associated with historical ore-processing activities were and are present, although closure activities have recently reclaimed all but one of these impoundments. For a more detailed discussion of the lack of surface water features associated with WPS, as discussed in ***Section 2.3.1.1.2*** and WestLand (2011).

Due to a lack of perennial aquatic features capable of supporting special-status species (e.g., fish, amphibians), no aquatic biology surveys for target species of invertebrates, vertebrates, or vegetation communities were conducted at WPS.

4.8.5. EAST PLANT SITE

Surface water runoff in the vicinity of EPS is captured in stock ponds, some of which support riparian vegetation and could be considered intermittent. No natural ponds are present in the vicinity of EPS. For a more detailed discussion of the surface water features associated with EPS, see ***Section 2.3.1.1.2*** and WestLand (2011).

The aquatic features (i.e., drainages, stock ponds) at EPS ranged from ephemeral to intermittent; perennial water sources could not be confirmed (WestLand 2004, 2004a, and 2011). Due to the presence of these aquatic features, amphibian surveys were conducted at EPS that targeted the Chiricahua leopard frog (*Rana chiricahuensis*; listed as threatened with critical habitat by the USFWS) and the lowland leopard frog (*R. yavapaiensis*; listed as sensitive by the FS). No leopard frogs were detected during amphibian surveys at EPS (WestLand 2004, 2004a, and 2012b), but lowland leopard frogs were observed opportunistically outside of EPS in Devils Canyon in 2003 (WestLand unpublished data), in stock tanks to the east of EPS (Crowder and Robinson 2011), and in Mineral Creek to the southeast of EPS (AGFD 2006).

Several additional aquatic features are present in the vicinity of EPS, including man-made stock tanks and Devils Canyon and Mineral Creek and their associated tributaries and springs. Several springs have been identified in the vicinity of EPS, including springs in the Upper Queen Creek Watershed, the Devils Canyon Watershed, and the Mineral Creek Watershed (Golder 2006). Resolution Copper has completed numerous surveys and baseline studies to characterize the aquatic biology in the vicinity of EPS. These studies (among others) are listed in ***Appendix C*** and will be provided as standalone technical reports to assist in the baseline review and to support planning and anticipated permitting efforts for the Resolution Project. In the following section, the baseline aquatic surveys near EPS are briefly summarized, and the species or ecological communities targeted during the surveys are described.

In Devils Canyon and its tributaries, the baseline aquatic resource surveys have focused on riparian and wetland vegetation: phytoplankton, periphyton, zooplankton, and macroinvertebrates (WestLand 2012c); springsnails[9] (WestLand 2013b); and amphibians and reptiles (WestLand 2012a). In Mineral Creek, baseline aquatic resource surveys have focused on streambed physical characteristics (i.e., enumeration of pools and runs as habitat for fish, amphibians, and gartersnakes); riparian vegetation; phytoplankton, periphyton, zooplankton, and macroinvertebrates; fish; and amphibians and reptiles (WestLand 2012b and 2012c).

4.8.6. AQUATIC RESOURCE MANAGEMENT

Aquatic biology resource monitoring and management in the GPA for each Project site or facility are not directly addressed here, but are indirectly addressed in the following sections: Surface Water Protection (***Sections 4.5.3***); Sediment and Erosion Control (***Section 4.5.5***); Ground Water Protection (***Section 4.5.6***); Wildlife Management (***Section 4.7.1***); and Vegetation Management (***Section 4.9.6***). In addition, Resolution Copper will continue to conduct monitoring as the Project progresses for evaluation against collected baseline data and in accordance with regulatory requirements.

[9] Springsnails are macroinvertebrates, but are here separated to distinguish among discrete surveys.

4.9. VEGETATION

Resolution Copper has completed numerous surveys and baseline studies to characterize the vegetation within the GPA. ***Appendix C*** contains a list of these studies, which will be provided as standalone technical reports to assist in the baseline review and to support planning and anticipated permitting efforts for the Resolution Project. This section generally describes the regulatory framework for the protection of plant species, the common plant species expected to occur in the GPA, and the measures that Resolution Copper will implement during the Project for the protection of vegetation. In addition, Resolution Copper will continue to conduct monitoring as the Project progresses for evaluation against collected baseline data and in accordance with regulatory requirements.

The regulatory framework for vegetation is essentially the same as that for wildlife (as described in ***Section 4.7***) in that the ESA, FS Sensitive Species, and MIS also apply to plant species. Invasive plant species, however, are considered separately. The State of Arizona has laws addressing the control and eradication of noxious and invasive weeds and identifying specific species that fall under noxious weed definitions (AAC R3-4-244 and 245). The Arizona Department of Agriculture is responsible for implementing state laws pertaining to noxious and invasive weeds. In addition, the FS also has established policies and practices with regard to noxious and invasive weeds. Resolution Copper will develop a noxious weed control plan for the Project. Prior to ground disturbance, areas will be treated for noxious weeds, where present. Treatment may expand beyond the disturbance area where necessary to control the spread of weeds. Further details regarding the treatment of noxious weeds are provided in ***Section 4.9.7***.

Five biotic communities—the Lower Colorado and Arizona Upland subdivisions of Sonoran Desertscrub, Interior Chaparral, Madrean Evergreen Woodland, and Interior Riparian Deciduous Forest—are present within the GPA (***Table 4.9-1***); however, the majority of the GPA is located within the Lower Colorado and Arizona Upland subdivisions of Sonoran Desertscrub (***Figure 4.9-1***).

Table 4.9-1 Biotic Communities Present in the General Project Area

Project Site	Lower Colorado Subdivision of Sonoran Desertscrub	Arizona Upland Subdivision of Sonoran Desertscrub	Interior Chaparral	Interior Riparian Deciduous Forest	Madrean Evergreen Woodland	Disturbed Areas
Filter Plant and Loadout Facility	X					X
MARRCO Corridor	X	X		X		X
Tailings Storage Facility		X				X
West Plant Site		X				X
East Plant Site			X	X	X	X

Those Project features within the western portions of the GPA that occur in lower elevation areas—the Filter Plant and Loadout Facility, MARRCO Corridor, TSF, and WPS—are within these two communities. The EPS is at a higher elevation and falls mainly within the Interior Chaparral biotic community. Interior Riparian Deciduous Forest is present along some of the main drainages within the Arizona Upland subdivision and the Interior Chaparral, including portions of Queen Creek, Roblas Canyon, Potts Canyon, and small areas near water sources in EPS. Madrean Evergreen Woodland is found in narrow bands within EPS. This biotic community becomes more common at the higher elevations to the east of EPS. Lists of representative plants and animals from these communities are provided in Brown (1994) and in ***Table 4.9-2***. Many common species are likely to be widely distributed across these biotic communities, with the exception of the highly disturbed sites in the existing mining areas (***Figure 4.9-1***). Vegetation within these communities varies throughout the GPA. Descriptions of the plant communities within the GPA are provided below.

Table 4.9-2 Common Plant Species Observed in the General Project Area

Species	Filter Plant and Loadout Facility	MARRCO Corridor	Tailings Storage Facility and Tailings Corridor	West Plant Site	East Plant Site
Arizona sycamore (*Plantanus wrightii*)				X	
Birchleaf mountain mahogany (*Cercocarpus montanus* var. *glaber*)					X
Blue palo verde (*Parkinsonia florida)*	X	X	X	X	
Brittlebush (*Encelia farinosa)*	X	X			

Table 4.9-2 Common Plant Species Observed in the General Project Area

Species	Filter Plant and Loadout Facility	MARRCO Corridor	Tailings Storage Facility and Tailings Corridor	West Plant Site	East Plant Site
Catclaw acacia (*Senegalia greggii)*	X	X	X	X	
Cholla (*Opuntia cacti* spp.)	X	X	X	X	
Coves' cassia (*Senna covesii*)				X	
Creosotebush (*Larrea tridentata)*	X	X	X	X	
Desert broom (*Baccharis sarothroides)*	X	X			
Desert globemallow (*Sphaeralcea ambigua*)				X	
Desert honeysuckle (*Anisacanthus thurberi)*	X	X			
Desert indianwheat (*Plantago ovata*)				X	
Desert marigold (*Baileya multiradiata*)				X	
Desert willow (*Chilopsis linearis)*	X	X	X		
Emory oak (*Q. emoryi*)					X
Engelmann pricklypear (*O. engelmannii*			X		
Fairy duster (*Calliandra eriophylla*)		X	X	X	
Fishhook barrel cactus (*Ferocactus wislizenii*)		X	X	X	
Flattop buckwheat (*Eriogonum fasciculatum*)		X	X	X	
Foothill palo verde (*P. microphylla)*	X	X	X	X	
Fourwing saltbush (*Atriplex canescens*)				X	
Fremont cottonwood (*Populus fremontii*)			X	X	
Goodding's willow (*Salix gooddingii*)			X		
Chainfruit cholla (*O. fulgida)*			X		

Table 4.9-2 Common Plant Species Observed in the General Project Area

Species	Filter Plant and Loadout Facility	MARRCO Corridor	Tailings Storage Facility and Tailings Corridor	West Plant Site	East Plant Site
Hollyleaf buckthorn (*Rhamnus crocea*)					X
Jojoba (*Simmondsia chinensis*)		X	X	X	
Mexican gold poppy (*Eschscholtzia mexicana*)				X	
Needle grama grass (*Bouteloua aristidoides*)				X	
Ocotillo (*Fouquieria splendens*)		X	X	X	
One-seed juniper (*Juniperus monosperma*)					X
Pointleaf manzanita (*Arctostaphylos pungens*)					X
Prickly pear (*Opuntia spp.*)	X	X	X	X	
Purple threeawn (*Aristida purpurea*)				X	
Red barberry (*Mahonia haematocarpa*)					X
Saguaro (*Carnegiea gigantea*)		X	X	X	
Sand dropseed (*Sporobolus cryptandrus*)				X	
Scrub live oak (*Quercus turbinella*)					X
Sideoats grama (*B. curtipendula*)				X	
Skunkbrush (*Rhus trilobata*)					X
Teddybear cholla (*O. bigelovii*)			X		
Tree cholla (*O. arbuscula*)			X		
Triangle-leaf bursage (*Ambrosia deltoidea*)	X	X		X	
Velvet mesquite (*Prosopis velutina*)	X	X	X	X	

4.9.1. FILTER PLANT AND LOADOUT FACILITY

The Filter Plant and Loadout Facility is located on a private parcel (zoned for commercial development) adjacent to the MARRCO Corridor. The parcel contains bare ground, previously disturbed areas with subclimax vegetation such as brittlebush and desert broom, and areas with vegetation that is consistent with the Lower Colorado subdivision of the Sonoran Desertscrub biotic community (***Figure 4.9-1***).

4.9.2. MARRCO CORRIDOR

The biotic communities along the MARRCO Corridor grade between the Lower Colorado and the Arizona Upland subdivisions of Sonoran Desertscrub, with the transition from the former to the latter occurring just east of State Route (SR) 79. Common plant species include foothill palo verde, velvet mesquite, and cacti such as prickly pear and cholla. The corridor also contains areas of bare ground and previously disturbed areas with subclimax vegetation such as brittlebush and desert broom (WestLand 2008). Xeroriparian vegetation is present along the ephemeral reaches of Queen Creek within the corridor. Interior Riparian Deciduous Forest vegetation is present on some portions of Queen Creek, particularly in the vicinity of the Whitlow Ranch Flood Control Basin (***Figure 4.9-1***).

4.9.3. TAILINGS STORAGE FACILITY AND TAILINGS CORRIDOR

The TSF lies within the Arizona Upland subdivision of Sonoran Desertscrub. Vegetation is generally a scrubland of leguminous trees with intervening open areas of shrubs and perennial succulents (***Figure 4.9-1***).

Jojoba and foothill palo verde are the dominant shrubs. Saguaros are scattered across the site at varying densities. Ocotillos occur on the property in areas with suitable soils, although at a lower density relative to jojoba and foothill palo verde. Numerous mixed cacti species are present in the TSF area (***Table 4.9-1***).

Mesquite and catclaw acacia are commonly found along the ephemeral washes in the TSF area. Blue palo verde is also frequently encountered near drainages. Roblas Canyon and Potts Canyon support Interior Riparian Deciduous Forest vegetation, including cottonwood (*Populus fremontii*), Goodding's willow (*Salix gooddingii*), and desert willow, along their intermittent reaches (WestLand 2013). Most of the TSF area is undisturbed except for two historical mine features and existing forest roads.

4.9.4. WEST PLANT SITE

Although much of the site is generally disturbed by former mining and ore-processing activities, WPS is mapped within the Arizona Upland subdivision of Sonoran Desertscrub. Native vegetation typical of this subdivision is found on the steeper slopes at the northern end of the site. No natural aquatic features or riparian vegetation is present. Invasive species associated with disturbed landscapes are present, as are species intentionally planted for landscaping purposes. Many of the mine features found within WPS have been seeded with native species as part of reclamation efforts.

4.9.5. EAST PLANT SITE

EPS is on the drainage divide between Queen Creek and Devils Canyon, and is dominated by the Interior Chaparral biotic community. Much of the proposed plant site that will accommodate surface facilities has already been disturbed by prior mining operations. Elevations in this area are generally between 3,800 and 4,600 ft (1,160 and 1,400 m). Dominant tree species within the vegetated portions of EPS include Emory oak and one-seed juniper (***Figure 4.9-1***).

4.9.6. VEGETATION MANAGEMENT

Resolution Copper will minimize disturbance to vegetation by maintaining as compact a footprint as practicable. Vegetation will be cleared only in those areas necessary for mine, Concentrator and ancillary facilities, and infrastructure. Interim revegetation will be employed where practicable to stabilize slopes and other embankments (i.e., growth medium material stockpiles, long-term tailings facility slopes, and road cuts and fills) that are expected to remain in place until final reclamation. Upon permanent cessation of Project activities, disturbed areas will be stabilized and reclaimed in accordance with the reclamation plan described in ***Section 6***.

Special-status species considered for the Project include those species occurring in Pinal County that are currently listed as Endangered, Threatened, or Candidate species by the USFWS. Of the three ESA-listed special-status plant species for Pinal County, two are listed as Endangered and one is listed as Proposed Endangered. Based on screening analyses, field surveys, occurrence records, and biological evaluations conducted within the GPA, one plant species currently listed as Endangered, the Arizona hedgehog cactus (AHC; *Echinocereus triglochidiatus* var. *arizonicus*), is known to occur in the northwestern portion of EPS. It is likely that a handful of individuals will be impacted by the proposed realignment of Magma Mine Road due to subsidence impacts. Any impacts to AHC will result in the formulation of environmental protection measures and conservation measures based on the outcome of Section 7 consultation between the FS and the USFWS. However, under the Prefeasibility Plan of Operations (03-12-02-006), Resolution Copper has experience implementing these types of environmental protection and conservation measures for AHC.

4.9.7. NOXIOUS WEEDS

Prior to ground disturbance, areas will be treated for noxious weeds where present. Treatment may expand beyond the disturbance area, where necessary, to control the spread of weeds. Reseeding activity will use exclusively certified seed and weed-free straw, and all equipment will be cleaned prior to use on FS lands. TNF approval will be obtained prior to initiating any noxious weed control program on federal land. Noxious weed control will be limited to chemicals and procedures approved by TNF. The purpose of the program will be to control the growth and dissemination of noxious weeds on disturbed sites and soil stockpiles. Monitoring reports summarizing noxious weed control efforts will be periodically submitted to the FS.

4.10. CULTURAL RESOURCES

Cultural resources (or historic properties) consist of buildings, sites, districts, objects, and structures that are listed in or eligible for listing in the National Register of Historic Places (NRHP). Eligible or listed resources are those that have been determined to be significant in history or prehistory according to a set of criteria listed in 36 CFR 60.4 of the National Register Federal Program Regulations. Several federal and state laws address the treatment of cultural resources that are impacted by projects requiring government funding or permitting (defined as federal *undertakings*). Some of the more relevant of these laws include (but are not limited to) the National Historic Preservation Act (NHPA) of 1966, as amended (16 U.S.C. § 470), particularly Section 106 of the NHPA and its implementing regulations (36 CFR Part 800); NEPA (42 U.S.C. § 4321–4347); the Native American Graves Protection and Repatriation Act (25 U.S.C. § 3001); the Arizona Antiquities Act (ARS § 41-841, *et seq.*); and the Arizona State Historic Preservation Act (ARS § 41-861, *et seq.*).

Both NEPA and the NHPA require that federal agencies consider the effects (or impacts) on cultural resources for federally permitted or funded projects. The treatment of cultural resources is coordinated to comply with both the requirements of NEPA and the requirements of the NHPA. Section 106 of the NHPA (36 CFR Part 800.8) specifies how this coordination is carried out. The Native American Graves Protection and Repatriation Act specifies how Native American human remains and items of cultural patrimony found on federal lands will be treated. The Arizona Antiquities Act provides permitting and defines procedures for the treatment of cultural resources on state and other non-federal public lands. It also specifies the procedures for the treatment of burials on these public lands (ARS § 41-844) and on private lands (ARS § 41-865). The Arizona State Historic Preservation Office (SHPO), through the Arizona State Historic Preservation Act, assists land management agencies with their cultural resources responsibilities.

For the Project, the FS will be the lead agency for both NEPA and the NHPA for cultural resources, and in this capacity will consult with the SHPO, the Advisory Council on Historic Preservation, affiliated Tribes, and other consulting parties as part of the Section 106 process on how to avoid, minimize, or mitigate the effects of the undertaking.

All cultural resources reports and related data will be transmitted to the appropriate agencies for review. To comply with Section 106 of the NHPA, all cultural resources (historic properties) that are listed in or eligible for inclusion in the NRHP will be identified, and a Historic Properties Treatment Plan will be prepared for any resources that cannot be avoided by Project activities. Through consultation, a Memorandum of Agreement will be signed and executed by all consulting parties, and this agreement will stipulate all conditions of cultural resources treatment, including the incorporation of the Historic Properties Treatment Plan and the appropriate final curation of all cultural resources-related reports, data, and materials.

4.10.1. CULTURAL RESOURCES IN THE GENERAL PROJECT AREA AND VICINITY

TNF and cultural resources firms have performed Class III archaeological surveys that cover approximately 7,211 ac within the GPA (***Figure 4.10-1***). Thus far, archaeological surveys have resulted in the identification of more than 150 known archaeological sites within the GPA. The eligibility of each site is discussed in the individual cultural resources reports. In addition, multiple cultural resources surveys have been carried out in the Project vicinity on access roads, at drilling sites, and for design configurations related to previously considered alternatives.

As part of NHPA compliance, the lead federal agency (the FS) in consultation with the SHPO will define an Area of Potential Effect that will encompass the area in which direct or indirect effects to cultural resources could occur. Any additional cultural resources surveys will be conducted to fill in any gaps that might exist in the surveyed areas. Final determinations regarding the eligibility of the resources identified within the Area of Potential Effect will be made by the FS in consultation with the SHPO.

The archaeological and historical resources of the general area are well known. Specific reports are listed in ***Appendix C***, but are not available to the general public because of confidentiality restrictions. Information regarding the location of archaeological sites is protected by state and federal laws, including (but not limited to) Arizona Revised Statute (ARS) § 39-125; the NHPA, Title III, § 304; and the Archaeological Resource Protection Act, 16 United States Code 470aa, *et seq*.).

Sites in the GPA range in age from Middle Archaic through historical times (6000 B.C. to A.D. 1960) and consist of a wide range of site types. Native American sites include artifact scatters, habitation sites with collapsed rock-rubble structures, and agricultural sites made up of rock features used to enhance soil and water retention. Both Hohokam and Salado sites are among those that date to the prehistoric era; sites that are identifiable as Apache or Yavapai date to protohistoric (A.D. 1500 to 1691) and historical times (post-A.D. 1691). Euroamerican sites (A.D. 1691 to 1960) represent ranching and mining activities and the other industries that arose along with ranching and mining. Euroamerican sites include home sites, mineral exploration sites, corrals and other ranching features, highways, roads, trails, railroads, and overhead and underground utilities.

Three NRHP-listed historic properties are located in the vicinity of the GPA, but not within its boundaries. These resources are the Boyce Thompson Southwest Arboretum (National Register Information System [NRIS] No. 76000381), The Queen Creek Bridge on abandoned US 60 (NRIS No. 88001679), and the Magma Hotel (NRIS No. 94000981).

The Boyce Thompson Southwest Arboretum is a 1221.45-ac park and research facility located just south of US 60 approximately 2 mi (3.2 km) west of Superior. It was listed on the NRHP in 1976 and is significant under Criteria A (event), B (person), and D (information) in the areas of science, education, and history. The period of significance is 1900 to 1924 and 1925 to 1949. A prehistoric Salado village is also present within the facility.

The Queen Creek Bridge on abandoned US 60 over Upper Queen Creek is part of a Multiple Property Submission for Vehicular Bridges in Arizona. It is located 0.6 mi (1 km) east of Superior and was listed on the NRHP in 1988. It is significant under Criteria A (event) and C (design/construction) in the areas of engineering and transportation. Its period of significance is 1900 to 1924 and 1925 to 1949.

The Magma Hotel is located between 100 and 130 Main Street in Superior, Arizona, and was listed on the NRHP in 1994. It is significant under Criteria A (event) and C (design/construction) in the areas of commerce, community planning, and architecture. The period of significance is 1912 to 1924.

4.10.2. PRESERVATION OF CULTURAL RESOURCES

The GPA is known to contain historic properties that include both prehistoric and historical cultural resources. Projects that have the potential to cause adverse effects to historic properties and that fall under federal jurisdiction are termed federal undertakings. The review of plans for the treatment of historic properties falls under both NEPA and Section 106 of the NHPA. Compliance with these two federal laws is usually coordinated as described in 36 Code of Federal Regulations Part 800.8. In practical terms, the identification of historic properties and the development of treatment plans for the mitigation of any adverse effects are conducted through the Section 106 process in consultation with the SHPO, interested tribal entities, and other consulting parties.

For the Resolution Project, TNF maintains the responsibility for consultations under Section 106 and for the NEPA review. The Project is located within a historical mining area, and relics of past mining ventures still remain. Previous surveys indicate that prehistoric sites are present as well. As part of the NEPA review and Section 106 process, qualified archaeologists will perform Class III (100 percent) cultural resources surveys of the Area of Potential Effect—the area that might be subjected to direct or indirect adverse effects from Project activities. Adverse effects to cultural resources that are listed in or eligible for listing in the NRHP and that cannot be avoided by Project activities will be mitigated through monitoring, testing, data recovery, or a combination thereof.

Resolution Copper will continue to design the overall footprint of the Project to avoid identified cultural resources to the maximum extent practicable.

4.11. AESTHETICS

Some of the important visual receptor locations or key observation points for the activities of the Project include US 60, the Superstition Wilderness, and the town of Superior. Resolution Copper will employ the following visual resource mitigation measures for potential impacts:

- Retain vegetation wherever practicable to screen facilities and to maintain a natural appearance to the extent possible;
- Add vegetated berms and/or plantings and replacement of vegetation where practicable to reduce visual impacts;
- To the extent practicable, locate facilities where they can be screened;
- Design cuts, fills, and clearings to blend into the surrounding topography;
- Use non-reflective earth-tone paints on buildings and structures;
- Monitor fugitive dust emissions and implement fugitive dust control;
- Monitor ambient air for air pollutants with the potential to contribute to regional haze; and
- Reclaim concurrently the outer slopes of the TSF.

Exterior lighting will be kept to the minimum required for safety and security purposes. Lights will be directed downward and hooded where practicable.

4.12. RECREATION

Designated and dispersed recreation opportunities are available throughout the region on state trust, TNF, Bureau of Land Management (BLM), and Resolution Copper private lands as described in ***Section 2.5.2***. To the extent practicable, access to recreational areas in the region of the GPA will not be restricted. Although the Tailings Corridor between EPS and WPS is planned for construction across Silver King Mine Road (FR 229), FR 650, and the Arizona Trail, public access will be maintained. The Tailings Corridor and associated infrastructure will be built to pass over the Arizona Trail, FR 650, and Silver King Mine Road via block culverts (***Figure 3.0-1h***). In addition, Hewitt Canyon Road serves as a major public access route to areas west and north of the TSF. Hewitt Canyon Road will not be restricted by Project activities and will continue to provide public access to these areas. The construction of the TSF will restrict public access to several unimproved FRs that traverse the proposed TSF area; however, existing roads and trails that will not be affected by Project activities will accommodate continued recreational use in the region surrounding the TSF.

The following recreational mitigation measures may also be considered for the Project:

- Promoting environmental awareness as part of new employee training. Hunting and other recreation issues are expected to be explained to employees as part of their training;
- Reducing the impacts of dust along access roads by watering, surfacing, or treatment with approved chemical amendments. Treatment shall focus on the areas adjacent to established recreation sites;
- Improving parking areas and signage for recreational facilities;
- Considering peak recreation use (holidays) when planning Project activities; and

- Partnering with non-governmental organizations to provide or enhance recreational use in Project areas, including those that interpret biological resources and present-day or historical mining activity.

4.13. FIRE AND SAFETY

Health and safety protection is afforded the highest priority in the operation of the Resolution Project. Resolution Copper enforces a company policy of high standards regarding safety awareness and compliance and operates under a focus that all injuries, occupational illnesses, and environmental incidents are preventable (***Appendix S***). These stringent policies not only apply to Resolution Copper employees, suppliers, and contractors, but also extend to the protection of the general public as well.

Resolution Copper has developed Health and Safety Standards for the subjects listed below. Specific procedures pertaining to the tasks that are covered by these standards have been developed and are routinely reviewed and updated to ensure they remain effective and apply to current activities undertaken by Resolution Copper. As the Project progresses into construction and operational phases, procedures will be updated or developed to reflect the progression of the Project. A summary of Resolution Copper's Health and Safety Standards for each subject is provided as ***Appendix S***.

- Particulate and gas/vapor exposures
- Hearing conservation
- Manual handling and vibration
- Hazardous substances
- Radiation
- Thermal stress
- Fitness for work
- Legionnaires' disease
- Travel and remote site health
- Isolation
- Electrical safety
- Vehicles and driving
- Working at heights
- Confined spaces
- Cranes and lifting equipment
- Aviation safety
- Underground
- Management of pit slopes, stockpiles, spoil and waste dumps

4.13.1. MINE SAFETY & HEALTH ADMINISTRATION COMPLIANCE

The Resolution Project will continue to conform to the Mine Safety and Health Administration (MSHA) health and safety rules and regulations. Such MSHA regulations require worker safety training and the maintenance of ground control plans. Training rooms will be provided in the Mine administration facilities for employee and contractor training. Resolution Copper will have the capability to conduct new miner and refresher training on site for Resolution Copper staff. Resolution Copper's Health, Safety, and Environment (HSE) program establishes extensive policies covering aspects of health and safety procedures for all types of operations (***Appendix S***). Every employee and contractor is not only required to obtain MSHA certification, but is also required to complete on-site hazard-recognition training in accordance with the HSE program. In this training, every worker is informed of Resolution Copper's facility-wide health and safety protocols as well as requirements related to their specific job tasks.

EPS and WPS currently fall under MSHA jurisdiction (MSHA ID #0200152). Additionally, the TSF, Filter Plant and Loadout Facility, Tailings Corridor, and MARRCO Corridor will be regulated under MSHA once constructed. Since Resolution Copper currently conducts activities at EPS and WPS under the regulatory guidance of MSHA, the incorporation of additional sites will be folded into the existing training programs and site requirements. Internal operating procedures and plans at a minimum comply with MSHA and other federal, state, and local regulations and in many cases are more stringent than these requirements.

4.13.2. EXPLOSIVES MANAGEMENT

The overall objective of the Resolution Copper Explosives Management Plan (EMP; ***Appendix P***) is to provide comprehensive standards to control the risks associated with the storage, handling, transporting, use, and disposal of explosives at Resolution Copper. The EMP was developed to ensure that Resolution Copper is compliant with the law and provides the safest possible working environment for its employees, contractors, and surrounding neighbors.

The intent of the EMP is to describe how Resolution Copper will manage explosives on site. Currently, Cementation USA is the holder of Federal Explosives License 9-AZ-021-33-3E-00299. The receiving, storage, transportation, use, and disposal of explosives are the responsibility of the license holder. It is anticipated that contractors will perform the future development work at the Resolution Project. Resolution Copper will manage the EMP by ensuring that contractors' policies and procedures comply with Alcohol, Tobacco, and Firearms 27 CFR Regulations, MSHA 30 CFR Regulations, the Arizona State Mining Code, and manufacturers' recommendations as well as the EMP.

The EMP follows the Design-Implementation-Verification cycle, providing standards pertaining to the storage, handling, transporting, use, and disposal of explosives. The EMP will also ensure compliance with the relevant MSHA and State of Arizona regulations. It is to be applied in conjunction with all other management plans and standard operating procedures established at Resolution Copper.

The EMP provides the systems, processes, and procedures to establish and maintain safe work practices when dealing with explosives. This document sets out requirements for the following:

- Roles, responsibilities, and competencies;
- Transporting;
- Security and storage;
- Explosives use;
- Disposal;
- Exclusion zones;
- Segregation;
- Proximity to extraneous ignition sources;
- Inventory management;
- Risk assessment;
- Training;
- Site licensee information; and
- Document control, history, and revisions.

The EMP applies to all Resolution Copper employees, contractors, and subcontractors who work at Resolution Copper. It is the responsibility of the contractor holding the Federal Explosives License to prepare all necessary site-specific explosives policies and procedures in order to be in compliance with this EMP.

4.13.3. FIRST AID AND SAFETY RELATED FACILITIES

WPS and EPS are located close to the cities of Superior and Globe where medical clinic and ambulance services are available in case of medical emergencies. The nearest Level-1 trauma centers are Maricopa Medical Center in central Phoenix and the Scottsdale Osborn Medical Center, both of which are approximately 60 mi (100 km) from the sites. In addition, Resolution Copper will have an on-site emergency response team consisting of first responders with expertise in first aid located at both EPS and WPS. Their primary purpose will be to stabilize patients until advanced medical care can be obtained. In the event of a life-threatening trauma, helipads are located at EPS and WPS to facilitate the transfer of patients to an advanced emergency medical care facility. The helipads have also been, and will continue to be, available for emergencies occurring off Resolution Copper property (e.g., forest fires).

First aid supplies and kits will also be located strategically around EPS and WPS. Some will be located in surface facilities such as offices, the dry facility (miners' change facility), and warehouses, along with the mine safety and shifter areas. First aid supplies will also be located throughout the underground mine.

Refuge chamber(s) will continue to be maintained underground according to the standards and regulations of MSHA. Refuge chambers will have first aid supplies and oxygen bottles. Mine safety and dry facilities will be maintained at the site, capable of storing breathing apparatus, gas testers, oxygen booster pumps, and miscellaneous spare parts. Resolution Copper will train and maintain its own mine rescue team on site. A separate training building will be available near Shaft 12 for additional training space. Additional details on emergency response may be found in ***Appendix L***.

4.13.4. SECURITY

To run effectively, Resolution Copper's operations must be secure. Theft and vandalism could have a negative effect on worker safety and operating efficiency. Therefore, access to the site will be controlled by fencing and security patrols, and by limiting official ingress and egress locations to the property. This practice is currently in place and will be expanded for planned future operations.

4.13.5. PUBLIC SAFETY AND PUBLIC ACCESS (SIGNAGE AND FENCING)

Resolution Copper will control public access through site security and by fencing and/or signage to prohibit unauthorized entry to working areas. Only authorized travel will be allowed into the various areas and facilities used for the Resolution Project. No unauthorized vehicles, personnel, or firearms will be permitted on the site. Operations will be conducted around the clock, and guarded security gates will be located at both the EPS and WPS entrances. All visitors will be required to check in at the guarded gate entrances prior to gaining access to the site. Other guards will conduct mobile patrols of the perimeter to ensure that no one is accessing the site unlawfully. Signs will be posted along any fences and at strategic locations along roads warning people that entering the site is prohibited. Roadways for small vehicle access will be provided throughout EPS and WPS, and traffic will be directed as right-hand travel only.

It is important to protect the public from interfacing with the mine operations and to prevent potential injury. Hazards of a typical mining operation include, but are not limited to, traumatic injury from large equipment, getting entangled in machinery, driving over steep embankments, slipping or falling on uneven ground or slippery surfaces, encountering high-voltage electricity, exposure to chemicals or reagents while not wearing proper personal protective equipment, and exposure to loud noises while not wearing hearing protection.

The perimeter of the subsidence zone will be fenced, bermed, and/or signed to restrict public access and to warn the public of the hazard. The limit of public access would be progressively moved out every 10 years so that the public may continue to access areas that are safe (***Appendix E***).

Resolution Copper will be responsible for ongoing road and sign maintenance for Magma Mine Road to ensure safe and efficient year-round access to EPS. Magma Mine Road will be relocated from the existing alignment in approximately Year 8 of mine operations due to anticipated subsidence in the area of the existing roadway. Management and maintenance of Magma Mine Road is currently accomplished through a maintenance plan as required under the Prefeasibility Plan of Operations.

No camping or hunting will be allowed within fenced areas or areas of activity at the Resolution Project, including the projected area of subsidence over the proposed underground mining activity. The possession of firearms, the discharging of firearms, and hunting will be prohibited within fenced areas around the mine area and related site facilities. For added safety, privately owned lands along Silver King Road (FR 229) will be posted with signage to reduce the likelihood of hunting or target practice in the vicinity of operations.

Most visitors, vendors, and salespeople will come and go from the administration building or an administrative area within the warehouse/receiving building located near the security gate at the entrance of the facility. Supply route drivers will receive site orientation training and be familiarized with their specific loading/unloading locations and procedures.

Employees will be trained to be aware of trespassers in the course of their normal duties and to report any suspicious activity to the safety and property departments. The facilities have been designed to minimize the need for visitors to drive or walk in hazardous areas.

4.13.6. EMERGENCY RESPONSE

Planning for emergencies is a crucial part of current operations at Resolution Copper facilities. Several types of plans address various aspects of emergency planning, including a Spill Prevention Control and Countermeasure (SPCC) plan (***Appendix O***), an Environmental Emergency Response and Contingency Plan (***Appendix L***), a Stormwater Pollution Prevention Plan (***Appendix W***), a Fire Prevention and Response Plan (***Appendix M***), an Environmental Materials Management Plan (***Appendix V***). These plans identify emergency preparedness and emergency contact protocols for any conceivable situation. Employee training is an essential component of emergency preparedness and will be conducted in accordance with all plans. Resolution Copper has established a quick reference guide to emergency response procedures for Resolution Copper staff that consists of the following steps:

- Realize an emergency situation exists (injury, explosion, fire, chemical spill/release, etc.);
- Evaluate the situation and determine the need for additional personnel and equipment;
- Isolate the area;
- Notify the front desk, security, and/or the 911 dispatcher;
- Control the situation to the best of your ability without endangering yourself or nearby personnel and property; and
- If the situation is manageable utilizing personnel and equipment on hand, conduct the following procedures:

- Continue to assess the situation and determine what appropriately trained personnel and equipment are required to safely mitigate the situation;
- Move all unnecessary personnel to a safe area;
- Isolate the area to prevent unauthorized personnel from inadvertently entering the area; and
- Contact Security and/or the 911 dispatch if the situation cannot be mitigated safely with the equipment and personnel on hand.

As previously described, Resolution Copper will have an on-site emergency response team consisting of first responders. In addition, Resolution Copper intends to maintain existing Emergency Services Agreements with the towns of Superior and Queen Valley for emergency police, fire suppression, and ambulance services at EPS, WPS, and the TSF. These services include emergency life support, first aid, cardiac emergency services, and transport to area hospitals. A more detailed and comprehensive plan intended to address emergency situations at Resolution Copper facilities is provided as ***Appendix L***.

4.13.7. FIRE PLANNING AND PROTECTION

A Fire Prevention and Response Plan (***Appendix M***) will be implemented by Resolution Copper to reduce the probability and seriousness of a fire underground or at surface facilities. ***Appendix M*** describes Resolution Copper's general procedures for permitted burns, fire prevention and response, facility plan development, and employee training.

Resolution Copper currently has several policies in place to help prevent fires, including weed control, brush clearing, clearing of fire breaks, strictly enforced no smoking policies, and the careful storage and containment of fuels and other ignitable materials. Planning and prevention of fires is also managed through the appropriate handling and storage of hazardous materials, hazardous waste inspections and recordkeeping, spill prevention and response procedures, proper use of safety equipment, resource management training, fire prevention training, and hazardous materials training.

Fire and smoke alarms will be installed in all employee work areas. Systems and components will be inspected monthly. Annual testing and maintenance will be conducted for systems and components. Records of inspections will be kept on site for a minimum of 5 years.

Adequate and reliable illumination will be installed and maintained for all exits. Battery-powered backup must provide a minimum of 60 minutes of illumination and will be standard for all emergency lighting and exit signs. Maintenance inspections will be conducted on a monthly basis. Emergency and exit lighting systems will be tested annually.

The National Fire Protection Association (NFPA) established NFPA 10, which is the Standard for Portable Fire Extinguishers. NFPA 10 mandates the type, size, placement, and minimum number of extinguishers required for each building. Fire extinguishers will be installed in accordance with this standard.

Fire flow supplies will generally be incorporated into the process water systems at all of the facilities, although separate fire supply storage tanks may be provided at certain locations. Capacity will be made available in the total system for adequate water storage for fire pump systems and firefighting. Resolution Copper plans to construct and maintain fire supply storage tanks and pump stations on site at the WPS Concentrator Complex and administration building area, the EPS mine office complex, and the Filter Plant and Loadout Facility. Final building material types would determine the number of gallons of water to be stored for firefighting and fire protection purposes at each site.

Resolution Copper will not have the capability to fight large fires, but maintains emergency services agreements with local fire departments in Queen Valley and the town of Superior that include as-needed, on-call emergency fire suppression for surface facilities at EPS, WPS, and the TSF (***Appendix M, Attachment 2***). The fire departments are located in proximity to the proposed Project facilities and as such would have prompt response times. Both fire departments have a full fleet of fire trucks for water delivery and application. The agreements do not include any fire suppression services for fires underground. Emergency fire response at the Filter Plant and Loadout Facility will likely be provided by Pinal County.

In general, area evacuations would be coordinated through Resolution Copper's designated emergency response coordinator and supervisors. The methods to communicate the need for an evacuation may include, but not be limited to, the use of fire alarms, air horns, verbal instructions, and phone or email notifications. These would differ slightly depending on specific building and/or work locations. Alternate evacuation routes would be designated by the emergency response coordinator as required. General evacuation plans for each facility are described in ***Appendix M***. Evacuation maps and site plans for each Project facility would be developed and included in the final Fire Prevention and Response Plan.

Of special concern will be the prevention of wildfires. Per the Fire Prevention and Response plan outlined in ***Appendix M***, mine vehicles will be equipped with, at a minimum, fire extinguishers, shovels, and first aid kits. Fire prevention policies have been established and are enforced to minimize fire potential, including the prohibition of parking on vegetated areas and the proper disposal of cigarette butts. Resolution Copper will take additional precautions if work such as vegetation clearing is conducted during the critical dry season. In the event of a wildfire, Resolution Copper will immediately notify the FS.

4.13.8. NOISE CONTROL

Resolution Copper complies with applicable federal, state, and local regulations regarding workers' protection against noise exposure. A hearing conservation program is in place for employees identified as likely exhibiting the following criteria: an exposure of a 95 percent upper confidence limit (UCL) of an 8-hour equivalent continuous sound level (Leq) mean exceeding 85 dB(A) or impulse noise exceeding 140 dB(C) as a part of their daily work activities. Work areas that meet these criteria are clearly marked, and hearing protection is mandatory. This program provides additional training in hearing protection devices (HPD), the recognition of the signs and symptoms of hazardous noise exposure, emergency procedures, and preventative measures. As a part of this program, baseline audiogram and annual follow-up audiograms are required for all workers exposed to the above-listed noise environments.

In addition to protecting employee and contractor health, Resolution Copper is committed to minimizing noise impacts on the surrounding environment and communities, including impacts on biota, people, heritage aspects, and surrounding land uses. Given the historical uses of the property, Resolution Copper has determined that current noise levels constitute a baseline against which future changes (i.e., increases and decreases) in noise will be evaluated. Resolution Copper has assessed its compliance with local noise regulations by conducting monitoring at or outside facility perimeters. Baseline noise surveys have been completed and an assessment of impacts from noise will be completed during the NEPA process. Baseline studies have demonstrated that Resolution Copper currently complies with all regulations, including the amended Pinal County Excessive Noise Ordinance (Ordinance No. 050306-ENO as Amended by 031611-ENO-01). Project design components and noise-control measures that are expected to aid in the reduction of impacts to noise levels include the following:

- Ore will be transported by underground conveyor thereby eliminating noise from truck traffic;
- Tailings and concentrate material will be transported via distribution pipelines;
- Grinding will be conducted within enclosed structures;
- Noise will be managed by considering the timing and location of activities;
- Equipment will be properly maintained to prevent noise emissions caused by wear, age, and dirt buildup;
- Noise reduction designs will be considered in the selection of equipment;
- Mining activities such as primary crushing and conveying will occur underground, and exhaust fans will be equipped with silencers for noise reduction; and
- Secondary crushing will occur in new fully enclosed buildings that have been located to maximize their distance from the town of Superior and make beneficial use of existing terrain to attenuate noise.

During construction and operations, the noise level is expected to increase from current baseline levels as activities requiring the use of heavy equipment increase. This will be particularly true during the construction phase. Resolution will comply with Pinal County and other applicable noise ordinances and regulations.

Resolution Copper will conduct additional monitoring as needed prior to and following the implementation of new developments, significant expansions, or changes to existing activities and facilities to assess the adequacy of noise- and vibration-control measures. Where practical, noise levels will be reduced at the engineering phase of the Project. In the event that monitoring indicates non-compliance or suggests a potential non-compliance with local noise regulations at a facility, Resolution Copper will identify the key contributors to this external noise and implement adequate engineering or institutional controls to assure compliance. Follow-up monitoring may be conducted to verify the efficiency/effectiveness of the implemented control measures

4.14. HAZARDOUS MATERIALS

4.14.1. SPILL PREVENTION CONTROL COUNTERMEASURE PLAN

Fuel and other petroleum products at the site will primarily be stored in aboveground tanks surrounded by containment structures; however, one diesel underground storage tank will be located at WPS. Resolution Copper has developed a preliminary SPCC plan (***Appendix O***) for the Project as required by the Federal Oil Spill Prevention Regulations (40 CFR 112) of the Environmental Protection Agency (EPA). An SPCC plan is required if a facility stores greater than 1,320 gallons of oil and petroleum products above ground. SPCC plans establish procedures to prevent, control, and mitigate the discharge of petroleum products to the environment. Although SPCC plans are developed to reflect specific facility designs, they generally contain the following components:

- Description of site operations;
- Identification of oil and petroleum products on site, including tank storage capacity and containment;
- Tank inspection and testing requirements;
- Leak detection procedures;
- Fueling procedures;
- Unloading and loading procedures for oil and petroleum products;
- Facility drainage systems;
- Spill prevention methods;
- Emergency and spill response and cleanup procedures;
- Spill reporting and notification procedures; and
- Employee training.

Resolution Copper will finalize and implement the SPCC plan (***Appendix O***) in accordance with applicable requirements as the design of the Project evolves and is informed by the NEPA and permitting processes.

4.14.2. HYDROCARBON MANAGEMENT

Resolution Copper has developed a Hydrocarbon Management Plan (***Appendix U***) to ensure that hydrocarbons are stored, dispensed, used, and disposed of properly. Resolution Copper recognizes that properly managed hydrocarbon resources results in environmental protection, properly maintained equipment, and reduced fuel, coolant, and lubricant consumption. The plan addresses the storage, handling, use, disposal, and spill response aspects of hydrocarbon management on site and is intended for use in conjunction with site SPCC, SWPPP, and emergency response plans. The Hydrocarbon Management Plan (***Appendix U***) applies to all individuals working on behalf of Resolution Copper and outlines procedures for the following:

- Hazardous substances and Safety Data Sheets;
- Approval to bring substances on site;
- Spill prevention, including:
  - Hydrocarbon delivery,
  - Fuel loading/unloading bulk storage containers,
  - Hydrocarbon storage, and
  - Inspections;
- Spill response;
- Spill reporting and incident termination;
- Disposal; and
- Training.

4.14.3. HAZARDOUS WASTE MANAGEMENT

A number of materials and chemical reagents will be transported, stored, and utilized at the Resolution Project for use in the mine, maintenance, and mineral-processing operations as detailed in ***Section 3.3.1.3***. Through utilization of these materials, Resolution Copper has the potential to generate hazardous waste streams. The handling and storage of hazardous materials and waste streams will be conducted in accordance with applicable regulations and facility plans (e.g., SPCC and SWPPP), Resolution Copper's standard operating procedures for Health Performance Standards (***Appendix S***), Material Safety Data Sheets (MSDS; ***Appendix T***), and Resolution Copper's Environmental Materials Management Plan (***Appendix V***). The purpose of the Environmental Materials Management Plan is to provide Resolution Copper personnel in all areas of the operation access to procedures for the proper handling and disposal of hazardous materials and hazardous waste so as to protect the environment and to comply with laws and regulations designed to protect the environment.

Resolution Copper manages all non-mineral wastes (hazardous and non-hazardous) by following the general procedures described below:

1. Categorize waste;
2. Place in appropriate, labeled containers;

3. Store containers in designated areas;
4. Routinely inspect containers and storage areas;
5. Transport waste following US Department of Transportation (DOT) regulations and dispose waste at approved disposal facilities; and
6. Maintain appropriate waste management documentation/records and submit reports to regulatory agencies.

Once a waste stream is identified as hazardous, Resolution Copper abides by stringent labeling, container, storage, inspection, and transport procedures specific to the waste stream. Resolution Copper provides guidelines for the management of specific waste streams in ***Appendix V.*** Hazardous waste must be placed in containers appropriate for storage, waste accumulation, and transport. All hazardous waste containers must be properly marked with contents, date, and appropriate DOT labels. Generators of hazardous waste are required to complete a hazardous waste determination based on process knowledge and/or sampling and analysis. Generators shipping waste for disposal off-site must obtain an EPA identification number; must utilize transporters and transfer storage and disposal facilities with EPA identification numbers; and must comply with DOT requirements.

4.14.4. PIPELINE PROTECTION MEASURES

The following best practice environmental protection measures will be implemented to prevent leaks and spills from Project pipelines:

- General Water, Concentrate, and Tailings Pipelines
  - There will be adequate (minimum of 3.3 ft [1 m]) separation, both horizontal and vertical, between pipelines and existing utilities and infrastructure.
  - There will be proper pipeline bedding where roads cross pipelines.
  - All pipelines will be fabricated and tested in accordance with the requirements of American Society of Mechanical Engineers (ASME) B31.3 for quality assurance and quality control purposes.
  - The 36-in (0.9 m) water line pipe wall thickness varies from 0.375 to 0.625 in (1 to 1.6 m); wall thickness was calculated in accordance with ASME B31.3 with a 0.0625-in (1.6-cm) corrosion allowance added.
  - Shut-off valves are located at the Filter Plant Pump Station and at the Queen Valley Pump Station supply water and filtrate from the Filter Plant.
  - All pipeline corridors will be driven and inspected at least daily as part of a routine operational inspection and monitoring program.
  - Pressure indicators will be located intermittently along the CAP water supply pipeline and concentrate pipelines.

- Flow indicators (flow meters) will be placed on the CAP water supply pipeline, the concentrate pipelines, and the discharge of the tailings pumps.

▪ Concentrate Pipeline Specifics

- Concentrate pipelines will be buried for approximately half of the total length (between the Queen Valley Booster Station down to the Filter Plant and Loadout facility).
- Concentrate pipelines will have a minimum of 3.3 ft (1 m) of cover over buried sections.
- The buried sections of the pipelines will be coated and wrapped in accordance with American Water Works Association C203.
- Sacrificial magnesium anodes will be installed at determined intervals on the buried sections.
- Aboveground concentrate pipelines will be contained within a secondary containment ditch (between the Queen Valley Booster Station and WPS) to the extent practicable.
- The exposed aboveground sections will be painted with an industrial grade epoxy coating system.
- The concentrate pipelines are 8-in schedule 40 steel pipe with a 0.85-in HDPE lining.
- Concentrate pipeline wall thickness was calculated in accordance with ASME B31.3 with no corrosion allowance because of the protective lining and no credit taken for the pressure capacity of the HDPE.
- Concentrate pipeline pressure and flow characteristics were determined from calculations using the specific gravity and viscosity of the concentrate.
- The concentrate pipeline will be double-contained at Queen Creek crossing and routed through sleeves underneath all highway crossings (US 60 and SR 79).
- Pipe expansion loops will be incorporated along the length of the MARRCO Corridor, approximately one every 0.6 mi (1 km).

▪ Tailings Pipelines Specifics

- The tailings pipelines will generally be located above ground and in a containment canal (secondary containment) within the Tailings Corridor.
- The scavenger tailings will be conveyed in a 48-in (1.2 m) inside-diameter concrete pipeline and the cleaner tailings will be conveyed in a 24-in (0.6 m) inside-diameter concrete pipeline.
- The tailings system is gravity flow in concrete pipeline running approximately 50 percent full.
- Pipeline leaks will be contained within a trapezoidal pipeway secondary containment channel as shown in ***Figure 3.0-1h, Section A-A***.

- The tailing lines will be designed to split from the main pipeway section where longitudinal slopes exceed 0.7 percent and be routed through concrete drop boxes to control flow velocities.
- Leaks will still be contained in these areas in the same manner as the main pipeway by using a secondary containment channel and berms provided in ***Figure 3.0-1h, Section B-B***.
- Box culverts will be used to contain flows where road crossings are necessary, and a steel secondary containment will be provided for containment over the pipe bridge as shown in ***Figure 3.0-1h, Section C-C***.

4.15. TRANSPORTATION

Roads and transportation corridors that provide direct or indirect access to the various Project features of the GPA are described in ***Section 3.4***. Resolution Copper will maintain public access to the areas surrounding the GPA throughout all phases of the Project to the extent practicable. Silver King Mine Road, FR 650, and the Arizona Trail currently serve as the primary access routes for the public to the region east of the TSF, including the area surrounding the Tailings Corridor. Although the Tailings Corridor between EPS and WPS is planned for construction across these routes, public access will not be restricted. To maintain public access to these areas, the Tailings Corridor and associated infrastructure will be built to pass over the Arizona Trail, FR 650, and Silver King Mine Road via block culverts (***Figure 3.0-1h***). In addition, Hewitt Canyon Road serves as a major public access route to areas west and north of the TSF. Hewitt Canyon Road will not be restricted by Project activities and will continue to provide public access to these areas.

The construction of the TSF will restrict public access to several unimproved FRs that traverse the proposed TSF area; however, existing roads and trails that will not be affected by Project activities (e.g., FR 650, Silver King Mine Road, Hewitt Canyon Road, and associated side roads) will accommodate continued recreational use in the region surrounding the TSF.

Public access around the subsidence area at EPS will be maintained via Apache Leap Road on the western side and US 60 on the north, both of which connect to other access roads in the area.

4.15.1. MINIMUM ROAD CONSTRUCTION AND MAINTENANCE STANDARDS

As described in the Road Use Plan (***Appendix K***), the development of Project sites and elements would require the use, maintenance, and/or reconstruction of existing FRs as well as the construction of Proposed New Roads (PNRs). The Road Use Plan is intended to provide general guidance for minimizing impacts to areas, resources, and people adjoining, served by, or otherwise affected by FRs and PNRs proposed for use by Resolution Copper and its agents to access Project sites throughout the duration of the Project. The Road Use Plan was prepared to be consistent with FS regulations for travel management and motor vehicle use on National Forest System lands (36 CFR Parts 212, 251, 261, and

295). The Road Use Plan contains details on the design, construction, and/or maintenance standards for roads under the responsibility of Resolution Copper. FRs will be maintained to meet maintenance levels as defined by the Forest Plan (TNF 1985).

4.15.2. EMPLOYEE TRANSPORT

Project access and employee traffic estimates during the construction and operation phases of the Project are described in ***Section 3.4***. Employee parking areas will be provided at each facility***.*** The EPS and WPS parking areas will be built to accommodate space for the van pool vehicles expected to transport employees during the Project. During the construction of the EPS facilities, personnel will be bused to EPS from a parking area at the core storage facility near WPS. WPS will have several parking areas, and a shuttle may be utilized to transport employees and contractors from this parking area to the Concentrator Complex and EPS if necessary.

4.15.3. EMPLOYEE EDUCATION

Resolution Copper maintains policies and procedures for traffic safety, which are reviewed annually and updated when deemed necessary. All employees and contractors are trained on Resolution Copper's traffic rules, which consist of the following:

- Drive according to conditions but in no case at a greater speed than the posted speed limit;
- Maximum on-site speed limit is 25 mph;
- Do not approach within 50 yards (46 m) of operating heavy mobile equipment without first making positive eye contact;
- Overtaking large equipment is not allowed unless it is clear that they are parked;
- No vehicle shall tow another unless it is engineered to do so;
- The use of cell phones is strictly forbidden, including hands-free devices, while operating heavy equipment and light vehicles. The use of company-provided cell phones is also prohibited while operating personal vehicles, company vehicles off site, and rental vehicles;
- Seatbelts must be worn at all times unless an approved risk assessment demonstrates the absence of risk to the driver and passenger(s);
- Wheel chocks must be used when parking vehicles or mobile equipment in active mining areas unless parked in a ditch, against a berm, or other designed parking control;
- Prior to starting and moving any vehicle or mobile equipment in an active area, the operator shall sound the horn at least once;
- Light vehicles operating in the vicinity of heavy equipment shall be fitted with a "buggy whip." A brightly colored flag shall be attached to the top of the buggy whip for daytime use;
- Any motorcycle entering Resolution Copper property is required to park in designated motorcycle spots. Motorcycles are not permitted beyond these parking lots on Resolution

Copper property. Any person, driver, or passenger riding a motorcycle on property to and from the designated parking lot(s) is required to wear a DOT-approved helmet; and

- No person shall ride in the bed of a truck.

4.15.4. SPILL PREVENTION AND RESPONSE PLAN

Transport of hazardous materials on federal highways is regulated under the Hazardous Materials Transportation Act, which is administered by the Arizona Department of Transportation. This act and DOT regulations establish requirements for vehicles, containers, labeling, driver certification and training, and spill prevention, control, and response. Resolution Copper currently contracts with DOT-approved firms to transport hazardous materials and waste. Resolution Copper's current procedures for the transportation of hazardous materials are described in the Environmental Materials Management Plan (***Appendix V***), and procedures to prevent, control, and mitigate the discharge of petroleum products to the environment are described in the SPCC Plan (**Appendix O**). Resolution Copper will develop and implement a transportation spill prevention and response plan for the Project that complies with federal, state, and local requirements for the transportation of hazardous materials. Any additional requirements needed to address hazards unique to Forest System Roads will also be incorporated into the plan. The plan will generally include the following elements:

- Kind and number of vehicles;
- Types of materials and material containers to be transported;
- Employee busing;
- Use of pilot vehicles;
- Hauling in daylight hours;
- Caravanning of supplies;
- Spill prevention plans;
- Caches of spill response equipment;
- Training requirements for mine employees and drivers, communications equipment, and notification procedures;
- Periodic review of spill response caches and first aid stations to ensure that all emergency first aid and spill response materials are current and stored in the proper place;
- Inspection of radio communications equipment on pilot vehicles and trucks to ensure that they are in working order; and
- Operator and shipping company compliance with the terms of the Spill Response Plan, including the requirements for spill response materials and the training of personnel.

In the event of a spill, employees will refer to the appropriate MSDS (***Appendix T***) and implement the required safety measures and spill cleanup procedures. Regardless of size, spills will be reported to the designated Resolution Copper supervisor. The following actions will be taken in the event of a hazardous spill:

- A designated supervisor will be notified immediately. The supervisor will oversee the response and cleanup of the hazardous materials releases;
- If a hazardous material spill is suspected to be dangerous, Emergency Notification procedures will be implemented;
- Proper Personal Protective Equipment will be utilized;
- As practicable, the release of the material will be stopped or minimized;
- Employees will avoid contact with the spilled material, including avoidance of gases, fumes, and smoke;
- A reputable, licensed company will be used to clean up large spills and dispose of contaminated materials; and
- Contaminated materials will be stored in appropriate and approved containers. Containers will be properly labeled following federal, state, and local requirements.

4.15.5. COMMUNITY NOTIFICATION

Resolution Copper will coordinate with community emergency response teams regarding the transport and use of toxic or hazardous chemicals as required under the Superfund Amendment and Reauthorization Act of 1986. If there is a spill of any quantity of petroleum materials or a reportable quantity of a regulated hazardous material during transport, the appropriate agencies and contracted cleanup response crews will be notified immediately as described in Resolution Copper's Environmental Emergency Response and Contingency Plan (***Appendix L***). Agencies that will receive immediate notification include the National Response Center, the Pinal County Emergency Planning Committee, and the TNF. A complete list of agencies and regulators that may be notified of a hazardous spill that occurs during transport is provided in ***Appendix L, Table 2***.

Information that will be provided to agencies/regulators in the event of a spill includes:

- Name and telephone number of reporter;
- Name and location of the site;
- Date, time, and type of incident (e.g., release, fire);
- Name and estimated quantity of material(s) involved, to the extent known;
- Source of the discharge;
- Description of all affected media;
- Cause of the discharge;
- Extent of any damage or injuries caused by the discharge;

- Possible hazards to human health or the environment off site; and
- Cleanup activities being conducted to contain and control the release.

4.16. SOCIOECONOMICS AND LOCAL COMMUNITY INFORMATION

4.16.1. REGIONAL CHARACTERISTICS

The GPA is located within the geographic area known as the Copper Triangle, which includes the communities of Miami, Globe, Superior, Kearny, Hayden, and Winkelman (***Figure 2.5-1***). The Copper Triangle has a long history of mining, and most of the above-referenced towns originated as mining communities. The San Carlos Apache Reservation is not a Copper Triangle community, but is included for discussion due to its historical ties to Oak Flat. The greater Phoenix Metropolitan Area is included due to its proximity and accessibility to the GPA via US 60. This area will likely serve as a source of goods, services, and labor.

The following sections provide an overview of the demographic characteristics of Pinal and Gila counties, including the communities therein, and the San Carlos Apache Reservation communities of San Carlos, Peridot, and Bylas. A summary of education and training demographics for these communities is provided in ***Table 4.16-1*** and a summary of infrastructure and utilities for these communities is provided in ***Table 4.16-2***.

4.16.1.1. *Pinal County*

Pinal County was formed from portions of Maricopa and Pima counties on February 1, 1875. The county encompasses 5,374 mi^2 (13,919 km^2) in central Arizona (Arizona Department of Commerce [ADC] 2009b). Land ownership in Pinal County is divided as follows (PCCP 2012):

- State of Arizona, 36 percent;
- Private land, 27 percent;
- Indian reservations, 21 percent;
- Federal Government (FS and BLM), 15 percent; and
- Other public land, < 3 percent.

The racial composition in Pinal County in 2010 was primarily White (72.4 percent), followed by Some Other Race (11.5 percent), American Indian and Alaska Native (5.6 percent), Black or African American (4.6 percent), persons of two or more races (3.8 percent), and Asian, Native Hawaiian and Other Pacific Islander (2.1 percent) (USCB 2010). The population of Pinal County increased 109.1 percent, from 179,720 to 375,770, between 2000 and 2010 (USCB 2010). The median age in 2010 was 35.3, with 26.5 percent of residents under the age of 18, 59.6 percent between 18 and 64, and 13.9 percent over 65. The average household size was 2.78 persons (USCB 2010). The majority of Pinal County's population resides within incorporated communities along the I-10 corridor, particularly at its juncture with I-8, and along US 60 east of the greater metropolitan Phoenix area. However, both of these areas are well west of the GPA. Other closer cities with populations exceeding 10,000 include Florence and Eloy. Much of the unincorporated area of Pinal County is rural, with scattered residences and ranches. The communities in Pinal County within or nearest to the GPA include Superior, Kearny, Hayden, and Winkelman.

4.16.1.2. *Gila County*

Gila County was created in 1881 from portions of Maricopa and Pinal counties; later, part of Yavapai County was added (ADC 2009). The county encompasses 4,796 mi^2 (12,400 km^2) in central Arizona (ADC 2009). Land ownership is divided as follows (Gila County Comprehensive Plan [GCCP] 2003):

- FS, TNF, 55.16 percent;
- Apache tribes, 38.01 percent;
- BLM/other Federal Government agencies, 1.77 percent;
- Private lands, 4.07 percent; and
- State of Arizona, 0.98 percent.

The racial composition in Gila County is primarily White (76.8 percent), followed by American Indian and Alaska Native (14.8 percent), Some Other Race (5.3 percent), persons of two or more races (2.0 percent), Asian, Native Hawaiian and other Pacific Islander (0.6 percent), and Black or African American (0.4 percent) (USCB 2010). Between 2000 and 2010, the population of Gila County increased 4.4 percent, bringing the population from 51,330 to 53,597 (USCB 2010). The most recent data show the median age as 47.9 years, with 21.4 percent of residents under the age of 18, 55.4 percent between 18 and 64, and 23.2 percent 65 and over. The average household size was 2.66 persons (USCB 2010).

Gila County is rural, with few major population centers. The communities in Gila County that are within or near the GPA include Globe, Miami, and Claypool.

4.16.2. LOCAL POPULATION AND DEMOGRAPHIC CHARACTERISTICS

4.16.2.1. *Communities in Pinal County*

4.16.2.1.1. Superior

The town of Superior was established in 1882. A mining town, it was named after a successful silver mine that was later used to mine copper. It is located approximately 60 mi (100 km) east of Phoenix. The population increased 3.7 percent from 3,254 individuals to 3,375 between 2000 and 2008 (ADC 2009c). According to the 2010 US Census, the population declined to 2,837 individuals (a drop in population of 12.8 percent from 2000 to 2010). Persons per household in Superior averaged 2.57. The median resident age was 45.0 years. The population of Superior identifies itself as 29.4 percent White, 0.4 percent American Indian or Alaska Native, 2.0 percent two or more races, and 68.2 percent Hispanic or Latino (USCB 2011).

4.16.2.1.2. Kearny

The town of Kearny is located near the Gila River in the Copper Triangle area along with its sister cities, Hayden and Winkelman. Kearny was built by the Kennecott Mining Company in 1958 as a planned community to accommodate the populations of nearby Ray, Sonora, and Barcelona, which were about to be displaced by Kennecott's expanding open pit copper mine. Kearny was officially incorporated in 1959. The total population of Kearny in 2011 was approximately 2,212 (USCB 2011), with an average household size of 2.05 and a median resident age of 49.1 years (USCB 2011). The population of Kearny identifies itself ethnically as 61.0 percent White alone, 37.9 Hispanic or Latino, and 0.1 percent American Indian alone.

4.16.2.1.3. Hayden

The town of Hayden is located in both Gila and Pinal counties, adjacent to the north of Winkelman. The area of Hayden is approximately 1.3 square miles and its population is approximately 962. The majority of the population (89.2 percent) identifies itself as Hispanic or Latino and 10.9 percent identify as White alone (USCB 2011). The base of Hayden's economy is the Hayden smelter, which is part of the Ray Mine complex.

4.16.2.1.4. Winkelman

Like Hayden, Winkelman is a town in both Gila and Pinal counties. According to the US Census Bureau, the town has a total area of 0.7 square miles. The population of the town is approximately 434 persons, almost all of whom live in Gila County. Winkelman is adjacent to Hayden, Arizona. The median resident age in Winkelman is 45.4 years. The population of Winkelman is approximately 81.3 percent White, 6.7 percent Black or African American, 6.0 percent American Indian and Alaska Native, and 11.8 percent some other race. 95.9 percent of the population also identifies itself as Hispanic or Latino (USCB 2011).

4.16.2.2. *Communities in Gila County*

4.16.2.2.1. Globe

The city of Globe, the Gila County seat, was founded in 1876 because of the local water supply and its distribution-friendly location for nearby mining operations. Mining in the Globe District ceased when the Old Dominion Mine flooded in the late 1920s. The copper mining town is located approximately 87 mi (140 km) east of Phoenix. The population of Globe increased from 7,486 in 2000 to 8,032 individuals in 2008 (ADC 2009a). In 2010, the average household size was 2.44, with a median resident age of 41.9 years. Of the residents, 79.6 percent are White, 1.0 percent Black or African American, 4.5 percent the Cherokee Tribal Grouping, and 1.1 percent Asian (USCB 2011). People of Hispanic origin or ethnicity can be of any race, and this issue (ethnicity) is therefore considered separately from race; 39.5 percent of residents self-identify as Hispanic or Latino (USCB 2011).

4.16.2.2.2. Miami

The town of Miami is a copper mining town founded in 1876 by Black Jack Newman. It is located approximately 6 mi (10 km) west of Globe. Miami had a moderate population decrease between 2000 and 2008, from 1,936 to 1,891 individuals (ADC 2009a). In 2011, persons per household averaged 2.45, with a median resident age of 43.0 years. The population of Miami is 81.5 percent White, 16.9 percent some other race, and 0.2 percent American Indian and Alaska Native (USCB 2011).

4.16.2.2.3. Claypool

Claypool is located between the towns of Globe and Miami. The population of Claypool is approximately 2,028 persons. Persons per household averaged 2.5, with a median resident age of 40.7. The population of Claypool identifies itself ethnically as 97.2 percent White, 1.5 percent some other race, and 1.2 percent White and American Indian and Alaska Native (USCB 2011).

4.16.2.3. *San Carlos Apache Reservation*

4.16.2.3.1. San Carlos

San Carlos is located east of the towns of Globe and Miami. Accessible from Route 170, San Carlos is north of Peridot and the San Carlos Reservoir. The population of San Carlos is approximately 5,082 (USCB 2011). The median household income in San Carlos in 2010 was approximately $20,644 (City-data 2013) Persons per household averaged 4.82, with a median resident age of 26.0. Of the residents, 94.1 percent are of American Indian or Alaska Native race, 4.4 percent are of the Navajo tribal grouping, and 1.5 percent are White alone (USCB 2011).

4.16.2.3.2. Peridot

Peridot is located south of San Carlos. The population of Peridot is approximately 1,079 individuals. Persons per household averaged 3.3, with a median resident age of 32.9. Of the residents, 98.1 percent are of American Indian or Alaska Native race and 1.9 percent are Hispanic or Latino (USCB 2011).

4.16.2.3.3. Bylas

Bylas is southeast of the San Carlos Reservoir and is accessible from Highway 70. The population of Bylas is approximately 1,331 individuals. Persons per household averaged 2.9, with a median resident age of 27.9. Of the residents, 99.6 percent are of American Indian or Alaska Native race, 0.4 percent are Black or African American, and 1.9 percent are of the Navajo tribal grouping (USCB 2011).

4.16.2.4. *Greater Phoenix Metropolitan Region*

The Phoenix Metropolitan Area is approximately 50 miles west of the GPA via US 60. As a source of skilled labor and goods and services, it is expected that the Phoenix area will experience economic impacts as a result of the Project. The current population of the Phoenix area is approximately 4,150,083 (4.2 million) persons, with a workforce of 2,431,559 persons. The median household income in 2011 in the Phoenix area was $44, 950 (Greater Phoenix Economic Council 2013).

Table 4.16-1 Education and Training

	Arizona	Superior[1]	Miami[2]	Globe[3]	Hayden[4]	Winkelman[5]	Kearny[6]	San Carlos Apache Communities[7,8]			Greater Phoenix
								San Carlos	Peridot	Bylas	
EDUCATION LEVEL (25 years and over)											
High school or higher	85.0%	71%	63.8%	78.1%	66.6%	61.8%	81.3%	53.9%	53.3%	72.8%	85.4%
Bachelor's degree or higher	26.3%	7%	4.3%	18.9%	3.5%	2.2%	9.4%	2.5%	5.8%	10%	28.1%
Graduate degree	9.6%	2.8%	1.9%	8.5%	0.4%	2.25%	2.7%	1.5%	2.6%	0%	9.9%
EDUCATION AND TRAINING FACILITIES											
Elementary Primary School		John F Kennedy School (260 students)	Bejarano Elementary School (378 students) Los Lomas Elementary School (304 students)	Copper Rim Elementary School (691 students) Holy Angels Elementary School (159 students) Destiny School (254 students)	None	Winkelman Elementary School (184 students)	Ray Elementary School (177 students) Ray Primary School (223 students)	St. Charles School	Peridot Lutheran Elementary Schools in Globe		
Middle School				High Desert Middle School (551 students)	None	Leonor Hambly Middle School (67 students)					
Junior High School		Superior Junior High (66 students)	Miami Junior High (182 students)		None			San Carlos Junior High, Inter-mediate and Senior High Schools			

Table 4.16-1 Education and Training

	Arizona	Superior[1]	Miami[2]	Globe[3]	Hayden[4]	Winkelman[5]	Kearny[6]	San Carlos Apache Communities[7,8]			Greater Phoenix
								San Carlos	Peridot	Bylas	
High School			Miami High School (320 students)	Globe High School (623 students) Liberty High School (67 students)	None	Hayden High School (140 students)					
Senior High School		Superior Senior High (139 students)			None						
Nearby institutions of higher learning		(60-mile radius): Chandler/Gilbert Community College; Mesa Community College; Scottsdale Community College; Arizona State University; Rio Salado College; University of Phoenix-Hohokam Campus	See Superior	See Superior	(75-mile radius): University of Arizona; University of Phoenix Tucson campus; Pima Community College; Eastern Arizona College; Chandler/Gilbert Community College; Mesa Community College; Arizona State University	(65-mile radius): Chandler/Gilbert Community College; University of Arizona; Pima Community College; Mesa Community College; University of Phoenix-Southern Arizona Campus; Arizona State University; Scottsdale Community College	(75-mile radius): University of Arizona; University of Phoenix Tucson campus; Pima Community College; Eastern Arizona College; Chandler/Gilbert Community College; Mesa Community College; Arizona State University				

Sources: City-Data.com, 2012; Elliot D. Pollack & Company, 2011

Table 4.16-2 Community and Regional Infrastructure and Utilities

	Arizona	Superior	Miami	Globe	Hayden	Winkelman	Kearny	San Carlos Apache Communities			Greater Phoenix
								San Carlos	Peridot	Bylas	
State and Federal Highways	Metro areas of Phoenix and Tucson are well served and adequate throughout the rest of the state	Main east-west thorough-fare is US 60	Main east-west thorough-fare is US 60	Main east-west thorough-fare is US 60	Highway 177, which connects to US 60 via state at Superior	Highway 177, which connects to US 60 via state at Superior	Highway 177, which connects to US 60 via state at Superior	Main east-west thorough-fare is US 70, which merges with US 60 at Globe	Main east-west thorough-fare is US 70, which merges with US 60 at Globe	Main east-west thorough-fare is US 70, which merges with US 60 at Globe	Extensive; I-10; I-17; state highways 202 and 51; strong grid of surface streets throughout the area
Air and Rail Transportation	Major airports in Phoenix and Tucson; smaller throughout the state. Union Pacific and Burlington Northern serve Arizona and are fed by smaller lines	Closest major airport is Phoenix; access to Union Pacific and Burlington Northern through feeder railroads. RCML's Magma Railroad (inactive) feeds RCML West Plant	Closest major airport is Phoenix; access to Union Pacific and Burlington Northern through feeder railroads	Closest major airport is Phoenix; access to Union Pacific and Burlington Northern through feeder railroads.	Closest major airport is Phoenix; access to Union Pacific and Burlington Northern through feeder railroads	Closest major airport is Phoenix; access to Union Pacific and Burlington Northern through feeder railroads	Kearney has a small airport, but closest major airport is Phoenix; access to Union Pacific and Burlington Northern through feeder railroads	Closest major airport is Phoenix; access to Union Pacific and Burlington Northern through feeder railroads	Closest major airport is Phoenix; access to Union Pacific and Burlington Northern through feeder railroads	Closest major airport is Phoenix; access to Union Pacific and Burlington Northern through feeder railroads	Major airport (Sky Harbor); Union Pacific and Burlington Northern
Power Supply	Part of regional grid; utilities and co-ops	Arizona Public Service Company serves all of these areas; connected to regional grid; some service in Phoenix provided by Salt River Project.									
Water Supply (from either the Central Arizona Project or wells in the area)		Arizona Water Company	Arizona Water Company	City of Globe Water Department	To Be Developed	Arizona Water Company	City of Kearny Public Works Department (Gila River apportionment)	n/a	n/a	n/a	Mainly provided by municipal government
Waste Disposal		Allied Waste	Republic Services	Republic Services	Waste Management	Republic Services	Republic Services	n/a	n/a	n/a	Municipal governments

http://www.city-data.com/city/Superior-Arizona.html and Economic & Fiscal Impact of Resolution Copper Company – Superior, Arizona (Elliott D. Pollack & Company, September 2011)
[2] http://www.city-data.com/city/Miami-Arizona.html

[3] http://www.city-data.com/city/Globe-Arizona.html
[4] http://www.city-data.com/city/Hayden-Arizona.html
[5]http://www.city-data.com/city/Winkelman-Arizona.html
[6]http://www.city-data.com/city/Kearny-Arizona.html
[7] http://www.city-data.com/city/ San-Carlos-Arizona.html/Peridot-Arizona.html
[8]http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmkdata.com/city/*
*Access dates for all data = June 14, 2012

5. PLAN FOR INTERIM SHUTDOWN

This plan for interim shutdown describes the procedures that Resolution Copper will implement to prevent unnecessary or undue degradation of federal lands in the event of either a temporary suspension of mining, production, or other operations or placement into standby status. This plan addresses personnel requirements, Project-wide procedures, and facility-specific procedures (based on the facilities described in ***Section 3***).

5.1. PERSONNEL

Resolution Copper will maintain personnel on site for mine dewatering, the care and maintenance of equipment and infrastructure, and to provide for ongoing environmental activities, studies, and reclamation. Care and maintenance activities are required during a shutdown so that operations may be efficiently resumed when appropriate. Personnel will remain on site in order to conduct routine maintenance and inspections, and maintain compliance with requirements in environmental permits and mine plans of operation, as well as exercise key equipment and infrastructure. Environmental activities performed by Resolution Copper personnel (such as monitoring, continuing stormwater best management practices, and reporting) are required by both Arizona and federal permits even during reduced, suspended, or standby operations.

5.2. PROJECT-WIDE PROCEDURES

Resolution Copper will implement the following procedures throughout the General Project Area (GPA) as appropriate in the event of a shutdown.

- *Measures to stabilize excavations and workings:* Excavations and workings anywhere within the GPA will be stabilized by inspecting and maintaining walls and slopes, and preventing stormwater erosion of or run-off into these features. Measures to control public access to excavations and workings are described below.
- *Measures to maintain the GPA in a safe condition:* Because personnel will remain on site, compliance with Mine Safety and Health Administration (MSHA)'s safety regulations will continue. Regular MSHA inspections are expected to continue. The security measures described in this General Plan of Operations (GPO) will remain in effect. Public access will be controlled by signing, fencing, gates, or berms to warn the public of hazards associated with open excavations or highwalls, underground mine openings, and unsafe buildings or facilities where chemicals, petroleum products, or reagents are stored.
- *Measures to manage regulated materials:* Regulated materials (such as hazardous materials) will be managed in accordance with applicable requirements. Depending upon the projected shutdown period, some regulated materials (*e.g.*, those stored in small quantities and/or used

consumptively only during operations) may be removed from the GPA. Regulated materials that will be used during the shutdown period will be managed as during operations. Aboveground storage tanks will be managed as required by the Spill Prevention, Control, and Countermeasures (SPCC) Plan (***Appendix O***). Other structures used to store regulated materials will be emptied or maintained as appropriate.

- *Measures to maintain access and utilities*: Roads will be maintained as necessary to allow access to Project site facilities. Utilities, such as electricity, water, and gas that are needed for the operation, will continue to function.
- *Plans for managing water systems:* Facilities designed to divert, convey, store, or treat water will be maintained during the shutdown period. Operation and maintenance of these facilities will continue as required by the Stormwater Pollution Prevention Plan (SWPPP; ***Appendix S***) and other monitoring plans, and will include inspecting diversions, ditches, pipelines, tanks, and sediment ponds to ensure that they are intact and capable of handling design flows. Facilities covered by the Aquifer Protection Permit (APP) (some of which are described in ***Section 3*** of this Plan) will be maintained and monitored as required by the APP. Facilities covered by the Arizona Pollutant Discharge Elimination System (AZPDES) will be maintained and monitored as required by the AZPDES Permit. Additionally, mine dewatering systems will remain in operation and discharged.

Facilities covered by the AZPDES will be maintained and monitored as required by the AZPDES permit. Additionally, mine dewatering systems will remain in operation. Mine dewatering water will be managed with the following methods:

- Treated in the WPS water treatment plant and delivered to the New Magma Irrigation and Drainage District (NMIDD) (for beneficial use as described in section 1.4.1 and ***Table 1.4-2*** per the Individual Industrial Reclaimed Water APP R511181 and Water Storage Permit and NMIDD Groundwater Savings Facility; and/or
- Treated in the WPS water treatment plant and delivered to the TSF for use as supplemental dust control or to maintain pond levels for saturation of the cleaner tailings; and/or
- Discharged per AZPDES permit described in Table ***1.4-2*** per the AZPDES permit AZ0020389.

5.3. FACILITY-SPECIFIC PROCEDURES

5.3.1. EAST PLANT SITE

The East Plant Site (EPS) encompasses the proposed underground mine, associated shafts and ore handling systems, and surface support facilities. As mentioned above, excavations and workings anywhere within the GPA will be stabilized by controlling unauthorized access, preventing stormwater erosion or run-off into these features, and operating the dewatering system. These procedures will be implemented for the underground mine and associated shafts. Ore handling system and surface support facilities that will not be active during temporary shutdown will be disengaged but maintained as appropriate for the expected duration of the shutdown.

5.3.2. WEST PLANT SITE

The West Plant Site (WPS) will include rail facilities, development rock stockpiles, new ore processing facilities (the Concentrator Complex), conveyor systems, water treatment facilities (current plant remains in place), and associated surface infrastructure (including administration buildings) to support the underground development and mining occurring at EPS. Rail facilities, Concentrator Complex, underground conveyor systems, and surface infrastructure that will not be active during temporary shutdown will be disengaged but maintained as appropriate for the expected duration of the shutdown. The existing water treatment plant at the WPS will remain in operation. If the development rock stockpiles are still in place and have not been beneficially used, the development rock stockpiles will remain in place during temporary shutdown and will be monitored as part of the SWPPP inspection program and any APP requirements.

5.3.3. TAILINGS STORAGE FACILITY AND TSF PIPELINE CORRIDOR

Tailings produced from ore processing will be stored in the Tailings Storage Facility (TSF) located approximate 5 mi (8 km) west of WPS. TSF will remain in place during temporary shutdown and will be monitored as part of the SWPPP inspection program and any APP requirements. Water from dewatering or collected seepage may be circulated to maintain saturated conditions over the cleaner tailings and for dust control. Progressive reclamation of the outer embankment slopes will continue. In the event of a temporary shutdown cleaner and scavenger tailings lines would be disengaged but maintained as appropriate for the expected duration of the shutdown. Other utility lines would remain operational including power and water pipelines.

5.3.4. MARRCO CORRIDOR

The Magma Arizona Railroad Company (MARRCO) corridor extends approximately 30 mi (48 km) from Magma Junction to WPS. The corridor includes the railroad track, concentrate pipeline, water supply pipelines, the filtrate water return line, and other utility lines (fiber optics, telephone, natural gas, and electric transmission). In the event of a temporary shutdown, the railroad track, concentrated pipeline, water supply pipelines, and filtrate water return line would be disengaged but maintained as appropriate for the expected duration of the shutdown. The other utility lines would remain operational, including water delivery to NMIDD and the existing Arizona Water Company water delivery pipeline that supplies water to the town of Superior.

5.3.5. FILTER PLANT AND LOADOUT FACILITY

The Filter Plant and Loadout Facility will be constructed approximately 7 mi (11 km) northeast of Magma Junction. The Filter Plant will include a control room, three concentrate stock tanks, up to six concentrate filters, a filtrate clarifier, and compressors, as well as ancillary support facilities. Filtrate from the plant will be pumped to a 3-million-gallon (11,400-m^3) tank at the southeastern corner of the site. The Loadout Facility will consist of a covered stockpile with a capacity of approximately 110,000 tons (100,000 tonnes). In the event of a temporary shutdown, filtrate will be pumped back to EPS and WPS, as is done during operations. The Filter Plant itself will not be active during temporary shutdown and will be disengaged but maintained as appropriate for the expected duration of the shutdown. Concentrate will be shipped off site for further processing, as is done during operations. The stockpile will not remain in place during temporary shutdown. Ancillary support facilities that will not be active during temporary shutdown will be disengaged but maintained as appropriate for the expected duration of the shutdown. Infrastructure required for monitoring the site, such as access roads and security gates and fencing, will be maintained.

6. RECLAMATION

6.1. INTRODUCTION

This section of the General Plan of Operations (GPO) provides the preliminary closure and reclamation plan and is focused on the reclamation of Project components that are proposed for US Forest Service (FS) land.

Resolution Copper estimates that the Resolution Project would have a total operational life of approximately 40 years, not including initial site construction and final reclamation work. Reclamation is projected to take between 5 and 10 years. Post-closure monitoring would continue for a number of years beyond closure.

Reclamation for all facilities described in this GPO that are on FS, state, or private lands falls under the framework of three federal and state regulatory programs:

- FS Plan of Operations requirements,
- Arizona Mined Land Reclamation Act (AMLRA), and
- Arizona Aquifer Protection (APP) Program.

The FS regulations at 36 Code of Federal Regulations (CFR) 228 require that final Plans of Operation include provisions for reclaiming FS lands disturbed by mineral operations and associated activities, including a financial assurance to cover the cost of closure and reclamation, and post-closure monitoring. While FS regulations do not require a reclamation and closure plan separate from the Plan of Operations, FS guidance in the Reclamation Bond Guide (FS 2004) recommends that a separate reclamation plan be prepared for large or complex operations. FS reclamation policy, objectives, and general requirements are provided in Forest Service Manual (FSM) 2840, Minerals and Geology, Reclamation (FS 1990). Both FSM 2840 and the Reclamation Bond Guide provide guidance on the information needed in a reclamation plan and reclamation bond cost estimate. This reclamation plan was developed specifically in response to FS reclamation requirements.

Resolution Copper currently operates on FS lands under a Prefeasibility Plan of Operations (03-12-02-006) as described in ***Table 1.4-1*** and ***1.4-2*** in ***Section 1.4***. Closure and reclamation of drill pads, roads and boreholes for hydrology and exploration are described in this plan (RCM 2010). Financial assurance in the form of a surety bond has been obtained for the associated closure and reclamation of those facilities. During the National Environmental Policy Act (NEPA) process and prior to the issuance of a final mine plan of operation, a final closure plan with the required financial assurance for closure, reclamation, and post closure monitoring will be obtained for facilities on FS and state lands. The current status of reclamation financial assurance is discussed in ***Section 6.14***.

The Arizona Mined Land Reclamation program is administered by the Arizona State Mine Inspector's Office and applies to reclamation of surface disturbance from mining operations on state and private lands in Arizona. The Arizona State Mine Inspector's Office sets reclamation requirements and approves the Project proponent's Mined Land reclamation plan. Additionally, AMLRA requires the Project proponent to submit an estimate of the cost of executing the proposed reclamation plan and financial assurance to cover the cost. Financial assurance is developed from the final approved reclamation plan. Where there is overlap between state reclamation requirements and federal requirements, such as those described above for the FS, the federal requirements and bonding supersede the state requirements on a project-specific basis as long as they are consistent with or more stringent than what would be required by the Arizona State Mine Inspector. The requirements of the ALMRA are provided in Arizona Administrative Code (AAC) R11-2-101 through R-11-2-822. This reclamation plan is prepared in compliance with FS reclamation requirements and meets Arizona State Mine Inspector's closure requirements. Resolution Copper has filed a closure and reclamation plan with the Arizona State Mine Inspector that covers existing legacy mining facilities and new facilities on private lands at both West Plant Site (WPS) and East Plant Site (EPS) (Golder 2014). Financial assurance for the associated reclamation of those facilities is in the form of a surety bond. During NEPA and prior to the issuance of a final mine plan of operation, an updated closure plan with the required financial assurance for closure, reclamation and post closure monitoring will be filed with the Arizona State Mine Inspector to cover facilities on private lands.

Resolution Copper will obtain an APP for new facilities that discharge or have the potential to discharge to groundwater. The APP program is administered by the Arizona Department of Environmental Quality (ADEQ). The APP Program requirements that pertain to closure are provided in AAC R18-9A-208-209. The APP Program requires that a closure/post-closure strategy be drafted and submitted with the APP application to ADEQ for approval. A closure plan must be submitted before closure. In general, the closure/post-closure strategy and plan must include the management of discharges from the APP permitted facilities, maintenance procedures for maintaining aquifer quality, and monitoring. This state program also requires financial assurance, which is developed from the approved closure/post-closure plan. This reclamation plan is prepared in compliance with FS reclamation requirements and meets APP Program closure requirements.

Resolution Copper has an APP that includes a closure and reclamation plan with the ADEQ covering historic facilities with the potential to discharge to groundwater on private lands (ADEQ, 2012a). This plan specifically covers legacy tailings and other facilities at WPS. Financial assurance in the form of a letter of credit has been obtained for the associated reclamation of those facilities. During NEPA and prior to issuance of a final mine plan of operations, an updated APP with the required financial assurance to cover the cost of closure and reclamation and post closure monitoring will be filed with ADEQ to cover facilities with the potential to discharge to groundwater (i.e., Tailings Storage Facility [TSF], process ponds, stormwater ponds) on both FS and private lands. It is recognized that there may be duplicative regulatory oversight for closure, reclamation, and post-closure monitoring of the TSF as it falls under the jurisdiction of both the ADEQ and the FS.

In summary, this reclamation plan has been developed to comply with the requirements of the FS, ALMRA, and APP Program. In addition, the reclamation plan describes surface water management features that would comply with the Arizona Pollutant Discharge Elimination System (AZPDES) permit requirements. The reclamation plan also meets Resolution Copper objectives for reclamation and closure. Resolution Copper recognizes that there will be modifications to this initial reclamation plan as an outcome of the NEPA process and agency decisions.

6.2. RECLAMATION GOALS AND OBJECTIVES

Reclamation is an integral and important component of the Resolution Project. The primary goals of reclamation are to stabilize areas of surface disturbance, to prepare them for a post-mining land use that is compatible with surrounding uses, and to ensure long-term protection of the surrounding land, water, and air resources.

In keeping with the multi-fold objectives of reclamation, Resolution Copper would:

- Implement protections for employees and public health and safety;
- Minimize disturbance to the extent practicable;
- Implement protections for water quality;
- Implement interim and concurrent reclamation as practicable;
- Reclaim mine facilities as soon as practicable after disturbance;
- Where possible and practicable, return the disturbed areas to near-natural conditions;
- Salvage soil resources during surface-disturbing activities so that they can be used for reclamation;
- Design facilities and reclaimed sites for long-term stability;
- Reduce visual impacts;
- Minimize or eliminate long-term air, land, and water management requirements;
- Monitor to ensure that reclamation and closure standards and objectives are met;
- To the extent practicable, reclaim for land uses consistent with the TNF Land and Resource Management Plan (TNF 1985);
- Ensure that reclamation is consistent with the approvals and permits from the FS, ADEQ, Arizona State Mine Inspector, and other relevant regulatory agencies;
- Initiate and complete final reclamation and closure upon permanent cessation of operations; and

- Establish financial assurance with the regulatory agencies to cover the costs of reclamation and closure, including post-closure monitoring.

Reclamation practices, such as those addressed in this reclamation plan, have been developed and successfully implemented at other mining projects and operations in Arizona, as well as throughout the western United States.

Resolution Copper understands that reclamation practices and technology are constantly evolving and improving. Although reclamation practices have become an integral component of mineral development and mining activities, and existing reclamation measures have proven to be successful at other mineral operations, Resolution Copper would take advantage of future opportunities to explore new reclamation technologies or implement improved reclamation measures. Concurrent reclamation is a key component of this reclamation plan, as is monitoring the effectiveness of both concurrent and final reclamation actions. Resolution Copper is committed to adaptive management to make improvements to reclamation and closure based on both the evolution of new technologies and monitoring the success of concurrent and final reclamation.

6.3. POST-CLOSURE LAND USE

One of the main objectives of the FS reclamation policy is to ensure that disturbed lands are returned to a use that is consistent with long-term FS land and resource management plans (FS 1990). Current land uses on FS land surrounding the Resolution Project are described in ***Section 2.5***. Post-closure land uses are expected to be similar. These include recreational uses (hunting, hiking, horseback riding, camping, and rock climbing), traditional uses (gathering traditional materials), and wildlife habitat. An overarching goal of this reclamation plan is to establish specific reclamation practices that would enable these future land uses outside of the subsidence zone. These reclamation practices are described in detail in the following sections and include closing and sealing the mine shafts, removing surface facilities and infrastructure, and establishing self-sustaining vegetative communities using native local species on the disturbed surface facility areas. Where practicable, land surfaces would be regraded to approximate the original pre-mining contour.

6.4. GENERAL RECLAMATION PROCEDURES AND SCHEDULE

Reclamation measures are an integral part of the Resolution Project. The following types of reclamation are scheduled and would be implemented:

- Construction and early development reclamation would take up to 10 years.
- Interim reclamation would take place during three periods: after construction, following startup, and during operations.

  - When construction activities are complete, laydown areas, growth media stockpiles, and not-potentially-acid-generating (NPAG) development rock stockpiles would be reclaimed.
  - Following start-up, when the development rock stockpile has been removed and used in processing, this area would be reclaimed.
  - Throughout operations, the outslopes of the Tailings Storage Facility (TSF) would be seeded for dust control in advance of concurrent reclamation.
- Concurrent reclamation in the TSF would begin in Years 2 to 5 of tailings operations and continue through the end of operations.
- Final reclamation would start at the end of the 40-year operating mine life and is expected to take 5 to 10 years.
- Post-closure care and maintenance would occur for a number of years following the completion of final reclamation. This time frame will be further refined during the NEPA process.

Construction reclamation refers to reclamation efforts on lands disturbed during the course of site development. These efforts include activities that precede final reclamation, such as growth medium removal, stockpiling, and stabilization. In addition, stormwater and sediment-control structures (such as diversion ditches and sediment traps/detention basins) would be constructed to minimize the potential for soil erosion and sediment loading to drainages during operations.

Final reclamation activities would be implemented upon cessation of underground mining and ore processing activities. The areas to undergo final reclamation upon Project closure would include mine shafts, mine surface facility support areas, the Concentrator Complex, the TSF and Tailings Corridor, the Filter Plant and Loadout Facility, and pipeline corridors and site access roads that are not needed for long-term land use purposes.

In general, reclamation activities, whether related to construction or final reclamation, would be timed to take advantage of seasonal conditions. Seeding would occur in late June to take advantage of the region's July and August rainy season known locally as the "monsoon season." A detailed reclamation schedule will be developed through the NEPA process after the alternatives analysis. The schedule will include tables that identify the amount of area that is disturbed and reclaimed each year during operations and closure.

6.4.1. CONSTRUCTION AND EARLY DEVELOPMENT RECLAMATION

This section describes the initial reclamation activities that would occur during the construction and early development phases of the Resolution Project.

Where practicable, growth medium would be removed from areas to be affected by the Resolution Project surface facilities. This material would be stockpiled for use during final reclamation. With the exception of the TSF, all growth medium stockpiles would be placed on private lands at WPS or the Filter

Plant and Loadout Facility depending on the location of the construction and early development. During tailings construction, material within the footprint of the TSF would be used as borrow for the starter dams. At the end of the mine life, material for final reclamation (store and release cover) would be sourced from existing stockpiles at the WPS or borrow areas outside the TSF footprint. Because of the long mine life, growth medium material stockpiles would be contoured and seeded to prevent erosion. During the first normal planting season following the development of the growth medium stockpile, the stockpile would be seeded to support revegetation and bank stabilization.

Each facility may have a different seed mixture to match the surrounding local native vegetation community. Plant species to be selected for the seed mixtures at each facility are listed in ***Table 6.4-1***.

Table 6.4-1 Seed Mixture by Mine Facility and Native Vegetation Community

Mine Facility	Plant Species Common Name	Plant Species Scientific Name
INTERIOR CHAPARRAL SEED MIXTURE		
East Plant Site	Scrub live oak	*Quercus turbinella*
	Pointleaf manzanita	*Arctostaphylos pungens*
	Red barberry	*Mahonia haematocarpa*
	Birchleaf mountain mahogany	*Cercocarpus montanus* var. *glaber*
	Hollyleaf buckthorn	*Rhamnus crocea*
	Skunkbrush	*Rhus trilobata*
	Emory oak	*Quercus emoryi*
	One-seed juniper	*Juniperus monosperma*
	Green sprangletop	*Leptochloa dubia*
	Hairy grama	*Bouteloua hirsuta*
ARIZONA UPLAND SUBDIVISION OF SONORAN DESERTSCRUB SEED MIXTURE		
West Plant Site Tailings Storage Facility Tailings Corridor MARRCO Corridor (east of SR 79)	Purple threeawn	*Aristida purpurea*
	Needle grama grass	*Bouteloua aristidoides*
	Sideoats grama	*Bouteloua curtipendula*
	Sand dropseed	*Sporobolus cryptandrus*
	Desert marigold	*Baileya multiradiata*
	Coves' cassia	*Senna covesii*
	Mexican gold poppy	*Eschscholtzia mexicana*
	Desert indianwheat	*Plantago ovata*
	Desert globemallow	*Sphaeralcea ambigua*
	Fourwing saltbush	*Atriplex canescens*
	Brittlebush	*Encelia farinosa*
	Triangle-leaf bursage	*Ambrosia deltoidea*
	Catclaw acacia	*Acacia greggii*
	Jojoba	*Simmondsia chinensis*
LOWER COLORADO RIVER VALLEY SUBDIVISION SEED MIXTURE		
Filter Plant and Loadout Facility MARRCO Corridor (west of SR 79)	Blue palo verde	*Cercidium floridum*
	Foothills palo verde	*Cercidium microphyllum*
	Velvet mesquite	*Crosopis velutina*
	Triangle-leaf bursage	*Ambrosia deltoidea*
	Desert willow	*Chilopsis linearis*
	Desert honeysuckle	*Anisacanthus thurberi*
	Catclaw acacia	*Acacia greggii*
	Creosotebush	*Larrea tridentata*
	Brittlebush	*Encelia farinose*

6.4.2. INTERIM RECLAMATION

Interim reclamation would be completed on disturbed areas that are not needed, at the time, for active operations. The principal focus of interim reclamation would be to reduce erosion and sedimentation. Interim reclamation would include activities like the reclamation of road or pad cuts and fills. Interim reclamation would allow temporary stabilization of certain sites, such as the TSF during operations, for temporary dust control. The approximate total surface disturbance for all the Project features is detailed in ***Section 1.5***.

Another form of interim reclamation is developing and testing revegetation test plots. Interim revegetation test plots would be tested to determine the appropriateness and effectiveness of the chosen seed mixes and plantings, as well as cover thickness and material type, within the Project area.

The areas that would be subject to interim reclamation would include construction laydown areas, growth media stockpiles, development rock stockpiles designated for processing through the Concentrator, and development rock stockpiles salvaged for beneficial use. Areas would also include access roads used for construction but no longer needed during operations. Additionally, the slope of the TSF might receive temporary reclamation for dust control measures in advance of concurrent reclamation. Additional interim reclamation areas (e.g., visual berms or screens) might be identified during the NEPA analysis.

6.4.3. CONCURRENT RECLAMATION

Final reclamation completed during operations is termed “concurrent” reclamation. Concurrent reclamation differs from interim reclamation in that this reclamation is designed to provide permanent achievement of reclamation goals and performance standards. Resolution Copper would implement concurrent reclamation of the outer slopes of the TSF, where practicable, as the operation progresses. The specific areas subject to concurrent reclamation and reclamation procedures will be developed through the NEPA process. Also, during operations, the amount of concurrent reclamation accomplished each year will be tracked and reported.

6.4.4. FINAL RECLAMATION PRACTICES

The general steps to be used in reclaiming disturbed areas at the Resolution Project are:

- Decommissioning facilities;
- Removing and/or closing structures and facilities;
- Recontouring and regrading;
- Replacing growth media (i.e., store and release cover design for tailings); and
- Seeding and/or direct seedling plantings where appropriate.

These general steps are described in more detail below, and the specific application of these steps to the Project sites is provided in the following sections. A post-closure grading plan is provided as ***Appendix Y***.

In addition to the reclamation of surface disturbances, the final approved reclamation plan would also describe:

- Reclamation practices related to geotechnical stability;
- Reclamation practices for water management structures that would be removed (e.g., culverts and pipelines) and for those that would remain in place after reclamation (e.g., surface water diversions and cutoff walls);
- Management of solid or hazardous waste during demolition as well as potentially impacted soils requiring removal;
- Reclamation practices to bring systems back as close as possible to natural hydrologic systems; and
- Reclamation practices for the protection of surface water and groundwater.

It is important to note that, for the purpose of the reclamation plan and the calculation of financial assurance, all facilities and structures would be planned for demolition and removal. However, it is possible that, prior to the final reclamation of facilities and upon community consultation, some facilities might remain to preserve the historical mining heritage of the region or for another post-mining use.

6.4.4.1. *Decommissioning Facilities*

Resolution Copper would recover and remove salvageable equipment, unused chemical reagents, fuel, instrumentation, furnishings, and other salvageable material not required for reclamation management. These facilities would be decommissioned prior to the removal described below in ***Section 6.4.4.2***. Any mobile or other equipment not needed for future potential uses of the site would be salvaged and removed at this time. Removed equipment would be loaded at the site and then shipped to buyers, recyclers, or approved waste disposal facilities.

6.4.4.2. *Removing and/or Closing Structures and Facilities*

Structures and certain other facilities would be demolished and/or dismantled and removed from the site. This would include office buildings, Concentrator and maintenance structures, filter plant and concentrate loadout buildings; EPS surface facilities and buildings, concentrate and tailings pipelines, water and fuel storage tanks, power lines, and other ancillary structures and facilities. Storage tanks would be emptied, cleaned, demolished, and disposed of off site or salvaged. Demolition is inclusive of building systems and foundations up to approximately 3 ft (1 m) below grade.

Areas would be inspected for evidence of potential soil contamination before the removal of the structures and facilities. Any areas of contamination would be evaluated, excavated, and removed as appropriate. Removed soils would be disposed of on or off site, depending on the results of the evaluation.

Salvageable equipment would be moved to another project, sold, or properly disposed of off site. Unsalvageable portions of any facilities, such as clean concrete pads and foundations, would be broken up and buried on site to a depth of at least 3 ft (1 m).

6.4.4.3. *Recontouring and Regrading*

Compacted areas at East Plant Site (EPS), West Plant Site (WPS), TSF and Tailings Corridor, Filter Plant and Loadout Facility, and MARRCO corridor would be cross-ripped along the topographic contour, regraded, and contoured to provide for erosion control and to blend into the surrounding topography and terrain. These areas would be prepared in a roughened condition for direct seeding or growth medium placement (***Section 6.4.4.4***) followed by reseeding (***Section 6.4.4.5***). Recontouring would also provide collection for seed and seedlings.

Roads would be reclaimed as appropriate. Certain access roads would be maintained: those necessary to support reclamation and closure functions such as access to monitoring stations and remediation Project areas. Dirt or gravel access roads would be recontoured and reseeded as described above. Paved parking lots, access roads, and laydown areas would be demolished and the concrete or asphalt disposed of off site at an appropriately permitted site; these road alignments would be subsequently cross-ripped along the contour and reseeded.

Stormwater management features (retention ponds and diversion channels) would be maintained through closure. When demolition and removal of the surface infrastructure is complete, certain diversion channels and discharge points would be closed in accordance with APP and AZPDES permit requirements. Other diversion channels would be reconfigured to carry water following natural topography through and off the site. These diversion channels may be reconstructed with riprap to minimize erosion. Other channel surfaces would be revegetated to further control water and wind erosion. Where appropriate, stormwater ponds would be filled and culverts would be closed; these areas would be cross-ripped along the contour and reseeded as described above.

The main facility areas after regrading and contouring are shown in ***Figures 3.3-10 and 6.6-1 through 6.6-5***.

6.4.4.4. *Replacing Growth Media*

Reclamation may include the salvage of growth medium during mining and replacement prior to revegetation. Although the proposed operational areas are largely bedrock controlled, small amounts of soil and alluvium may be salvaged. This may include salvage of some saguaros for eventual use in final reclamation. Soils and growth media monitoring and analysis are discussed in more detail in ***Section 4.6.8***.

Seed mixes used for revegetation would be created in accordance with the Native Arizona Plants Act and agreements with the FS. The native seed mixes would be selected from the plant species previously identified for each mine facility in ***Table 6.4-1***. TNF Guidelines for seed mix testing for noxious weeds would be followed (***Section 6.13***). If there are isolated pockets of thicker growth medium material within the area proposed for facilities, such material may be salvaged to ensure a source of growth medium material for reclamation.

6.4.4.5. *Seeding*

Straw mulch or another organic material may be applied to the growth medium to reduce erosion, promote stabilization, and enhance seed germination. Regraded areas would be hydro-seeded or broadcast-seeded with species approved by the FS. The proposed seed mixture is provided in ***Table 6.4-1*** for each designated vegetation community. In some cases seedlings may be planted. The final species selection would be based on a FS listing of reclamation plants, seed availability, and cost.

Fertilizing and seeding would likely be conducted annually in June to take advantage of the July through August rainy season known locally as the "monsoon season."

6.4.5. POST-CLOSURE CARE AND MAINTENANCE

Post-closure care and maintenance would continue for a number of years following the completion of final reclamation. This time frame would be further refined during the NEPA process. Post-closure care and maintenance would focus on water management, land usage, and mitigation requirements. Water management would focus on reaching a steady geochemical state for groundwater surrounding the facilities with the potential to discharge (i.e., TSF, WPS, and Filter Plant and Loadout Facility) as well as reaching a point where net evaporation exceeds seepage at the tailings and reclamation has been completed to allow for stormwater discharge. Further details on post closure groundwater and stormwater management are contained in ***Appendix R*** Land usage would return public and private lands to offer practical future use options. Mitigation sites would be maintained. Resolution Copper would monitor and maintain sites to ensure that erosion is minimized and that vegetation species are re-established. The type and frequency of monitoring would be described in the final reclamation plan to be further developed during the NEPA process.

6.5. EAST PLANT SITE CLOSURE AND RECLAMATION

The EPS structures and facilities (shafts, hoist houses, administrative buildings, maintenance areas, etc.) would be decommissioned and the land surfaces (including paved and graveled areas) would be regraded and reseeded as described above. The EPS post-closure grading plan is shown in ***Figures 6.6-1 and 6.6-2*** and includes the following detail:

- Similar to an open pit at closure, a berm and/or a fence will be constructed, monitored, and maintained along the entire perimeter of the subsidence zone to prevent access. No additional reclamation activities are planned for this area. However, to the extent practicable, surface water diversions will be constructed to move stormwater away from the subsidence zone and into natural drainages.
- All fill slopes shall be laid back to a maximum of 2.5:1 to allow for revegetation with local native species and shaping into a more natural looking land form and blend into the surrounding topography.
- Shaft collars and subcollars will be permanently sealed. Shafts will be decommissioned or salvaged as necessary.
- The North and South Diversion Channels will be relocated as necessary to route flow to existing drainages.
- Contact Water Basins E1, E2, and E3 will be closed per permit requirements.

Buildings that are not designated for salvage would be demolished, along with their foundations, as described above. Aboveground storage tanks would be emptied, cleaned out, demolished, and disposed of off site or salvaged. Steel tanks would be cleaned and salvaged.

The explosives magazines would be decommissioned and removed in accordance with Bureau of Alcohol, Tobacco, Firearms and Explosives procedures. The facility footprint would be recontoured and reclaimed in conjunction with nearby surface facilities.

Water treatment and cooling facilities that are not designated for salvage or disposal would be demolished as described above. Refrigerant and glycol would be removed from the cooling system and disposed of at an approved facility. The bulk coolers and ducts located underground would have the refrigerant and glycol removed and disposed of or salvaged through a third party with facilities and systems approved to handle this duty. Duct and cooling systems underground would be cleaned prior to abandonment as part of the underground closure plan. Materials deemed hazardous or controlled would be removed prior to abandonment.

Headframes and hoists that would not be used during closure monitoring would be decommissioned, disassembled, and salvaged. Shaft collars and subcollars would be permanently sealed at closure. An engineered seal would be constructed, and concrete would be demolished to 3 ft (1 m) below grade. Shafts and conveyances would be decommissioned or salvaged as necessary.

As described above, the subsidence zone would have a berm and/or fence constructed, monitored, and maintained to prevent access. No additional reclamation is anticipated in the block cave zone as equipment and people would not be able to safely access the area to perform reclamation activities. To the extent practicable at closure, surface water diversions would be constructed to move stormwater away from the subsidence zone and into natural drainages. However, it is possible that a post-closure use could be identified for the shafts and underground mine in the field of scientific or educational research (one example of a re-use of a mining property for scientific purposes is the location of the National Science Foundation Deep Underground Science and Engineering Laboratory at the Homestake Mine in South Dakota).

The block cave area would be closed to protect groundwater quality per the following conditions:

- All the remaining mineralized (but non-economic) rock in the block cave area would be overlain by a thick sequence of inert/net neutralizing rock.
- At closure, the bulk of oxygen ingress would cease once the ventilation system is turned off.
- Most re-flood waters would have to pass through the overlying post-mineralization rock and would, therefore, carry significant alkalinity to the remaining mineralized rock.
- Permeability in the rock mass surrounding the block cave (within the deep system) at depth is very low.
- The system would take hundreds to thousands of years to re-saturate and would likely be strongly stratified with the highest quality water on top where the active groundwater flow system is. This is consistent with other re-flooded underground workings and deep pits.

Stormwater management systems at EPS would be maintained through closure. As described above, certain diversion channels and discharge points would be closed in accordance with APP and AZPDES permit requirements, while others would be reconfigured to carry water following natural topography through and off the site.

The Subsidence Management Plan, ***Appendix E,*** contains a post-closure monitoring and measurement plan for surface water and groundwater features. Additionally, groundwater monitor wells installed in the vicinity could be used to measure depth to water and water quality in the various geologic units once mining has ceased. A groundwater monitoring and protection plan for the post-closure period is contained in ***Appendix R***.

6.6. WEST PLANT SITE CLOSURE AND RECLAMATION

The WPS facilities would be decommissioned and the land surfaces would be contoured and graded as necessary to blend into the surrounding topography and terrain, and reseeded with appropriate local species seed mixes. The post-closure grading plans for the northern and southern portions of WPS are shown in ***Figures 6.6-3 and 6.6-4*** and include the following detail:

- All fill slopes shall be laid back to a maximum of 2.5:1.
- The West Diversion Channel, the East Stormwater Channel, and an onsite channel will remain in place to route flow through a new diversion channel to the Apex Tunnel to existing drainages (e.g., Silver King Wash).

- The Process Water pond located at the northern portion of WPS will be closed per APP conditions.
- Contact Water Basins W1 through W5 will be closed per APP requirements.
- The emergency overflow ditch from Contact Water Basin W1 will remain in place.
- Non-contact Water Basins W6 through W9 will be graded to drain.
- Indian Pond, located at the southern portion of WPS, will be graded to drain.

Roads on Resolution Copper private land at WPS would be reclaimed as described above. Certain access roads would be maintained: those necessary to support reclamation and closure functions such as access to monitoring stations and remediation Project areas. The main access road west of the site extending across FS lands to TSF, described in ***Section 6.7***, would likely be considered public and will be reclaimed or maintained in consultation with FS and Arizona Department of Transportation (ADOT). Roadway and stormwater best management practices, such as water bars, culverts, and erosion-control features, would be repaired or removed as appropriate.

Central Arizona Project (CAP) water and firewater tanks located on the eastern side of the concentrator would be emptied, cleaned out, demolished, and disposed of off site or salvaged. Reagent tanks both internal and external to the Concentrator building would be decommissioned, cleaned, demolished, and salvaged. Steel fuel tanks near the Concentrator and fuel station would also be decommissioned, cleaned, demolished, and salvaged. Secondary containment structures would be removed and disposed of in an approved third-party facility specifically regulated to handle hydrocarbon containment materials.

The primary conveyor from the ore discharge pocket would be removed from the ore transport decline. The access raises for ventilation and maintenance shaft accesses would be decommissioned, capped, and reclaimed on the surface. The portal for the decline would be backfilled 100 ft from the portal, and a concrete plug would be installed. The plug would be covered with fill material, and growth medium would be placed to reclaim the portal area to a natural state.

All potentially-acid-generating (PAG) development rock would be processed through the concentrator during the first few years of operations; thus, no acid-generating development rock would remain post-closure. NPAG or inert rock that is not used for construction purposes would be used for reclamation as cover material. The main coarse ore stockpile would include a covered dust-control frame and tripper conveyor assembly during operations. The frame and conveyor would be dismantled and removed. The stockpile and feed system would be dismantled and the ground surface regraded and reseeded as described above.

Buildings on WPS that are not designated for salvage would be demolished. The Concentrator Complex and Vehicle Maintenance Facility are made up of buildings of this type, which typically consist of heavy-duty industrial-finished-steel shell buildings or unique heavy construction. Other examples of buildings of this type are cooling plants, compressor stations, and hoist buildings that typically consist of a heavy-duty industrial-finished-steel shell building. These types of buildings are assumed to include bridge cranes or other heavy equipment requiring specialized equipment for decommissioning or demolition. The Concentrator flotation equipment (pumps and tanks) make up the large and potentially salvageable components within the Concentrator. This equipment would be removed from the Concentrator. The building would be stripped of piping and electrical systems prior to demolition. All insulation and hazardous material would be removed and disposed of at an appropriately permitted facility.

Buildings on WPS that are designated for salvage would be decommissioned as described above. These offices, warehouses, and change facilities typically consist of a medium-duty commercially finished steel shell building or modular structure. At the southern entrance of WPS, the gate house would remain until final reclamation is complete. Some of the structures with historical significance, including the General Manager’s residence (Water Management Offices), refurbished cooling tower, historic headframes and hoists, and the Verde Building (Project Administration), may be left on site and potentially donated to the community or third party for use or preservation.

Two 360-ft- (110-m-) diameter scavenger thickeners, two 295-ft- (90-m-) diameter copper-molybdenum thickeners, a 260-ft- (80-m-) diameter cleaner thickener, and 52-ft- (16-m-) diameter concentrate thickener would be demolished. The components would be removed and the concrete thickening tanks demolished and disposed of at an appropriate facility. The thickeners extend below the ground surface approximately 60 ft (18 m). These excavations would be filled and the surface reclaimed and vegetated.

Stormwater management systems at WPS would be maintained through closure. As described above, certain diversion channels and discharge points would be closed in accordance with APP and AZPDES permit requirements, while others would be reconfigured to carry water following natural topography through and off the site. Specifically, a drainage canal would be designed to carry stormwater along a natural course ultimately reporting to the downstream drainage in Queen Creek. The Apex Tunnel drainage would remain to divert water to the west, away from the northern portion of WPS.

6.7. TAILINGS STORAGE FACILITY CLOSURE AND RECLAMATION

TSF reclamation would be completed concurrently on the outer embankments as they rise upstream. Concurrent reclamation of the TSF layout at the end of operations and following closure is provided as ***Figures 3.3-10 and 3.3-10a***.

Concurrent reclamation would commence during Stage 1 of the staging plan and be completed before the end of Project life at approximately Year 40. Specifically, TSF would be closed through a combination of progressive concurrent reclamation of the embankments and final closure and reclamation of the ponds, beaches, and seepage collection systems. The TSF embankment reclamation would be completed in parallel with the raise schedule as the facility is advanced upstream using segregated tailings, as described in detail below. Reclamation would be continual on the exterior of the embankment through Project life as a dust, erosion, and seepage control measure.

At closure, the embankment would be contoured, riprapped for erosion control, and have growth medium placed as an exterior shell or be directly seeded depending on revegetation success during operations. The embankment would be covered with a combined armor protection-growth medium cover to a minimum depth of 1.5 ft (0.5 m). This may be a much thicker sequence locally where erosion protection is required. The overall slope would be at a relatively shallow angle of 5H to 1V, allowing for easier access for reclamation and erosion control during operation and closure. The shallow slope is also in place to help blend and more closely match the natural surrounding terrain. The materials for the embankment cover would be borrowed and processed locally from within the facility footprint where possible if needed. During the later years (beyond Year 20 and for final closure at year 40 for the store and release cover over the cleaner tailing), borrow material would be supplied by either stockpiled borrow material from within the facility or external borrow sources to the east and north of the facility. Borrow sourcing from outside the facility would primarily be Gila Conglomerate extracted from shallow pits. Those areas outside the TSF footprint would be recontoured and revegatated using an FS-approved seed mix as borrow pits are decommissioned. The embankment would be reclaimed and vegetated as shown in ***Figure 3.3-10***.

During operations, tailings would be segregated with the placement of scavenger NPAG tailings on the periphery and cleaner PAG tailings segregated and placed at the upstream and center of the facility by hydraulic means (subaqueously within the tailings reclaim pond and progressively covered with scavenger slimes). This would contain the PAG cleaner tails locally in a deoxygenated environment. The fine scavenger tailings would be decanted downstream conventionally through an array of spigots on the exterior embankments. The scavenger tailings would segregate from coarse to fine, with the finer downstream tails topping the PAG cleaner tailings through the end of the mine life. This encapsulation method below the reclaim pond surface would reduce the potential for oxidation of the cleaner tailings and thus minimizing the risk of acid generation.

During final closure, the remaining cleaner tailings would be covered by recirculating and/or mechanically placing NPAG scavenger tailings over the top of the cleaner tailings. The facility would then be closed with an engineered and vegetated “store and release” evaporative cover for closure. Due to the segregation of the NPAG and PAG tailings, it is possible that the store and release cover could be achieved by directly seeding the scavenger tailings. However, adding cover material may be required over some portions of the impoundment and in particular the cleaner tailings areas with the least amount of scavenger cover. An engineered cover with a significant thickness of scavenger tailing over the PAG cleaner tailings would be required to fulfill “store and release” requirements. This will be studied further as the development and design stages progress. The surface and beach closure for the scavenger tailings would start in approximately Year 43, coinciding with a reduction in overall tailings placement. The beach reclamation (excluding the cleaner tails and pond) would consist of cover or direct vegetation to be completed at the end of Project life with the goal of a store and release cover system to shed surface water and limit infiltration (***Figure 3.3-10, Detail 2***).

The cleaner tailings and pond would be reclaimed as part of closure. As described above, this would consist of a store and release cover to prevent the infiltration of surface water. The cleaner tailings would be covered by recirculating and/or mechanically placing NPAG scavenger tailings over the top of the tailings prior to a minimum of 3 ft (1 m) cover for final sealing and cover. The cleaner pond area would be recontoured and revegetated using an FS-approved seed mix. Once the area is covered and the cleaners sealed off, diversion channels would be constructed to direct stormwater off the facility in a controlled manner. These diversions would be engineered and riprapped for erosion protection (***Figure 3.3-10, Detail 3***).

Seepage water would be managed and collected into closure until the tailings drain down to a level where evaporation exceeds seepage well up-gradient from the point of compliance at the seepage collection ponds. Depending on the drawdown rate and modeled predictions of final closure seepage volume in a fully reclaimed and vegetated state from the TSF, this reclamation plan would be modified to address the long-term management of water. This could include recirculating seepage back to the reclaim pond until the rate of evaporation exceeds the seepage rate. The final method of post-closure management for seepage collection water would be determined as the Project progresses through NEPA, and would be based on overall expected volumes, anticipated seepage rates, and duration in combination with water chemistry assessment. A typical section for the closure of a seepage collection dam is shown in ***Figure 3.3-10a***.

The stormwater containment system designed for the operational period would have a similar capacity requirement post closure. Once the embankments and beaches are reclaimed and water quality meets discharge criteria, surface water off the closed sections of TSF would be diverted to the diversion channels and directed downstream to Queen Creek. Drainage off of reclaimed or non-impacted areas below the embankments would be diverted around the seepage collection ponds and allowed to pass downstream and downgradient. The seepage dams would be riprapped on the upstream side and vegetated on the downslope using an FS-approved seed mix. Following the seepage control plan, the ponds will remain as evaporative sinks post closure. The post closure monitoring and management plan for tailings contained in ***Appendix R*** further describes the acid rock drainage management and surface and groundwater protections post closure.

TSF would include a perimeter fence and/or berm to prevent access. Post closure, surface water diversion structures that allow upgradient water to pass around TSF would likely remain in place.

The combined maintenance and office building at the TSF would be demolished as described above, with building materials salvaged and demolition debris disposed of properly. Building foundations greater than 3 ft (1 m) deep would be broken up and covered in place. All parking lots and access roads associated with TSF that are paved or asphalt surfaces would be demolished and disposed of off site at an appropriately permitted facility. The surface foundations along with diversions, culverts, and contact ponds would be recontoured to a natural state and vegetated in accordance with the FS-approved reseeding plan. Gravel roads and lots would be reclaimed and vegetated similarly. Drainage and stormwater run-off would be engineered and designed as part of the reclamation plan. The access road from WPS to TSF, following the Tailings Corridor through FS land would likely be considered public and be reclaimed or maintained in consultation with FS and ADOT. Piping and electrical infrastructure would be removed along the Tailings Corridor, leaving only a road and berms.

6.8. FILTER PLANT AND LOADOUT FACILITY AND MARRCO CORRIDOR CLOSURE AND RECLAMATION

Structures at the Filter Plant and Loadout Facility site that are not designated for salvage and/or that would not have a post-mining use would be demolished and the land reclaimed, as described above. The closure of potentially discharging facilities such as tanks and ponds would be completed in accordance with APP and AZPDES requirements. The Filter Plant and Loadout Facility post-closure grading plan is shown in ***Figure 6.6-5*** and includes the following detail:

- The North Diversion Channel will remain in place and route flows to existing drainages.
- Contact Water Basins F1 and F2 will be closed per APP requirements.

The ultimate tenure of the MARRCO Corridor right-of-way would be determined prior to closure. Excluding the concentrate lines, which would be removed as described below, the selected closure strategy would depend on the intended post-closure use of the railroad and utility lines. The MARRCO Corridor passes through rugged terrain in the segment along Queen Creek. Slope stabilization improvements made during construction include slope cut back where possible inside the 200-ft (61-m) right-of-way and welded wire netting, shotcrete, or other stabilization methods where required. During closure, these slopes would be laid back to the extent possible within the right-of-way and reclaimed. The surface would be recontoured and revegetated as described above. Bridge structures across Queen Creek and smaller tributaries would be assessed and either removed or upgraded. Assuming that the railroad would be decommissioned, the rails and ties would be removed; the ballast may also be removed and the railroad bed recontoured and revegetated as described above. Utility lines present along the corridor would be left in place or managed as appropriate during railroad bed reclamation.

6.9. WATER SUPPLY FACILITIES AND PIPELINES

A number of facilities associated with the fresh water supply and distribution such as pipelines, pump stations, and water tanks may have a post-mining use. The 36-inch-diameter fresh water pipeline and associated infrastructure may be transferred to a third-party utility or community if needed for water transport in the Superior Basin. Water supply wells would either be transferred to a third party for usage or abandoned following Arizona Department of Water Resources abandonment procedures.

Facilities that would not have a post-mining use, such as tailings slurry lines (in the Tailings Corridor), concentrate pipelines (in the MARRCO Corridor), and associated pump stations with electrical power, would be decommissioned and removed. Steel pipelines that are buried or on the surface would be scrapped and salvaged. The alignments would be recontoured and reseeded as described above. Along the MARRCO Corridor, pipelines would be salvaged prior to reclaiming the MARRCO railroad bed as described above.

A figure depicting the Tailings Corridor and MARRCO Corridor layout at the end of operations and following closure will be developed and refined through the NEPA process.

6.10. POWER TRANSMISSION FACILITIES

Power transmission facilities that include electrical substations, transmission lines, and power centers may be removed as part of the reclamation program, unless a post-mining use is identified. It should be noted that the Salt River Project (SRP) will own the power lines and may have a post-mining use for ongoing power transmission in the area.

6.11. ROADS AND CORRIDORS

Asphalt and other paved surfaces that would not remain for post-mining use would be demolished and disposed of off site in an appropriately permitted facility. When demolished, asphalt and other paved surfaces must be segregated from other demolition debris. Additionally, bridges and culverts that would not have a post-mining use would be stabilized or removed.

Access roads for construction that are no longer needed during operations will be closed and reclaimed. This will include placing barriers at the entrance to the road such as boulders and berms, roughing and cross-ripping the road along the natural contour, and seeding the area with an approved native seed mix. Roads that would not be used to access post-closure monitoring sites would also be cross-ripped, recontoured, and revegetated. Reclaimed roadbeds would provide open areas and travel lanes for wildlife.

A figure depicting the roads that will be reclaimed at the end of operations and following closure will be provided through the NEPA process.

6.12. RECLAMATION GOALS AND PERFORMANCE STANDARDS

This section describes the reclamation goals for the Resolution Project. In order to ensure that the goals are met, Resolution Copper would develop measurable performance standards based on regulatory requirements and recommendations.

AMLRA establishes performance standards for reclamation: including standards specific to public safety, erosion control and topographic contouring, road revegetation, and soil conservation. The FS does not itself identify specific standards, but does require that all reclamation requirements include measureable performance standards and that performance standards be developed at a minimum for: revegetation; soil and water conservation measures; mass stability of overburden and other waste embankments; concurrent reclamation; and post-mining land configuration. The APP Program contains prescriptive requirements for tailings facilities, process water ponds, and non-process water ponds.

The reclamation goals for the disturbance at the Resolution Project are as follows:

- Regrade the land surface to the pre-disturbed contour outside the subsidence zone and TSF;
- Stabilize the site;
- Establish proactive post-closure water management; and
- Establish a vegetative community for future wildlife use.

Resolution Copper would monitor reclamation success for 5 years following site decommissioning and final reclamation according to FS and Arizona permit requirements. Reclaimed areas would be monitored for soil erosion and revegetation success. Resolution Copper would evaluate vegetative cover and species composition during the first, third, and fifth years after final reclamation. Adjacent undisturbed vegetation communities and vegetation reference areas would be established to serve as a means of comparing Project revegetation with natural vegetation. The reference area would be selected from representative undisturbed plant communities adjacent to the disturbed areas.

The following guidelines would be considered to determine the successful revegetation of disturbed areas:

- Successful establishment of the desired species;
- Evidence of vegetative reproduction processes;
- Evidence of overall site stability; and
- Indication that the revegetation cover of the reclaimed sites is trending toward and/or matching the vegetation cover found in the adjacent reference area.

Additional performance standards would be developed for water management, geotechnical stability, and topography as this reclamation plan is revised through the NEPA process.

6.13. NOXIOUS AND INVASIVE PLANT MANAGEMENT

6.13.1. PLANNING, CONTROL, AND MONITORING

Controlling noxious and invasive weeds would be critical to the success of the revegetation efforts. As necessary, Resolution Copper would initiate and maintain a program to control noxious weeds occurring within the boundary of the Project. Reseeding would use exclusively certified seed and weed-free straw, and heavy equipment brought onto FS lands would be cleaned prior to use to avoid the transport of noxious weeds. FS approval would be obtained prior to initiating any weed control program on federal land. Weed control would be limited to chemicals and procedures approved by the FS. The purpose of the program would be to control the growth and dissemination of noxious weeds on disturbed sites and soil stockpiles.

Seed mixes and other organic fertilizer would be certified weed free prior to placement on the growth medium following FS guidelines. The seed mix testing procedure described below would be used in accordance with FSM 2080 for noxious weed management (FS 2009).

Any seed used on the Tonto National Forest must be purchased from a licensed seed dealer (FS 2009). Each seed lot used alone or in a seed mix would have a certificate, signed by a Registered Seed Technologist or Seed Analyst (certified through either the Association of Official Seed Analysts or the Society of Commercial Seed Technologists), certifying that the seed lot has been tested for the 50-state weeds list, in accordance with the Association of Official Seed Analysts standards within 12 months prior to the date of application. The certificate would include (FS 2009):

1. Name and address of laboratory
2. Date of test
3. Lot number for each kind of seed
4. Name of seed
5. Percentage of germination
6. Percentage of purity
7. Percentage of weed seed content and list of weeds identified
8. Certification that the seed lot meets applicable state and federal laws with regard to prohibited and restricted noxious weeds
9. Certification that seed is free of seeds listed on the Tonto National Forest weed seed list.

During active operations, Resolution Copper would monitor disturbed sites for undesirable invasive plants and noxious weeds after the twice annual rainy seasons (in early October and in late March). Similarly, newly reclaimed areas would be monitored for weeds and invasive plants for the first 5 years after reclamation. Infestations of invasive species would be treated as soon as they are identified, or as soon as weather conditions are appropriate for treatment.

6.14. RECLAMATION FINANCIAL ASSURANCE

As discussed in ***Section 6.1***, the FS land management regulations, APP Program, and AMLRA require Resolution Copper to establish and maintain sufficient financial assurance such that would allow the agencies to properly reclaim areas disturbed by the Resolution Project. The collection and use of this financial assurance by the agencies would only occur if Resolution Copper is unable to meet reclamation and closure obligations under the terms and conditions of the applicable permits and approvals. For facilities on private lands, closure including financial assurance would be covered under the AMLRA. For facilities on FS lands, closure and financial assurance will be covered under the FS land management regulations. Whether on private, state, or federal lands, reclamation and financial assurance for facilities with the potential to discharge to groundwater (tailings storage facilities, process ponds, and stormwater ponds) will be covered under the APP Program.

Currently, financial assurance for reclamation has been accomplished or is in process to fulfill three requirements:

- West Plant Site APP: $15,581,000 irrevocable letter of credit for closure and post-closure monitoring
- Individual APP: $6,334,000 bond for closure and post-closure monitoring
- AMLRA: $6,020,000 bond (in process)

A reclamation cost estimate will be developed on or before the draft Environmental Impact Statement stage and will be refined through the NEPA process. The reclamation cost estimate will be broken down into the following categories (based on FS Reclamation Bond Guidance [FS 2004]):

- Interim operations and maintenance
- Hazardous materials
- Water management
- Demolition, removal, and disposal of structures, equipment, and materials
- Earthwork
- Revegetation
- Noxious weed monitoring and control measures
- Mitigation

Long-term operation, maintenance, and monitoring

Resolution Copper would apply to the agencies for a release of part of or for the entire reclamation bond upon successful completion of reclamation. Reclamation and closure success would be addressed by the standards and performance criteria specified in this reclamation plan, the APP, MLRA, and other permits.

The release of all or a part of the reclamation performance bond would only be made by the appropriate agencies after Resolution Copper's request has been reviewed for completeness and on-the-ground compliance with the predetermined release criteria and monitoring data, and after representatives of the agencies have conducted field and data examinations to ensure that reclamation activities have been implemented successfully and in accordance with applicable FS or state regulations.

Acid-forming materials	Earth materials that contain sulfide minerals or other materials that, if exposed to air, water, or weathering processes, form acids that may create acid drainage (as in potentially-acid-generating or reactive rock).
Acid mine drainage	1. Drainage with a pH of 2.0 to 4.5 from mines and mine wastes. It results from the oxidation of sulfides exposed during mining, which produces sulfuric acid and sulfate salts. The acid dissolves minerals in the rocks, further degrading the quality of the drainage water. 2. Acidic run-off water from mine waste dumps and mill tailings ponds containing sulfide minerals. Also refers to ground water pumped to surface from mines.
Apex Tunnel	An existing structure at the WPS that diverts offsite flows from north of the site to the Silver King Wash west of the site.
Apron feeder	A metal conveyor (or conveyor with metal plates) operated to control the rate of delivery to a standard belt conveyor. The metal-plate construction allows the apron feeder to withstand the weight and force of rock material being dumped from a chute onto a bin.
Belt tilter	A mechanism on a belt conveyor that allows material to be discharged into a bin or silo.
Cave	Caving of the ore is induced by undercutting the ore zone, which removes its ability to support the overlying rock material. Fractures spread throughout the area to be extracted, causing it to collapse and form a cave underground, which propagates upward throughout the mining process.
Crosscut	A passageway driven at an angle to the drifts of a mine. The crosscuts connect the parallel drifts.
Crushers	Machines that reduce large rocks into smaller rocks.
Drift	Mine drifts are horizontal or nearly horizontal underground openings.
Dry	A change house for mine workers. Contains lockers and clothes baskets and is equipped with shower, toilets and sinks.

East Plant Site	Current exploratory shaft sinking site, historic Magma Mine site, future mine site, and area impacted by block caving.
Galloway	Temporary working platform suspended above the bottom of the shaft under construction, to support the ongoing drilling, blasting, and mucking.
Gangue	Commercially worthless material that surrounds, or is closely mixed with a wanted mineral in an ore deposit.
Grizzly	A coarse screening or scalping device that prevents oversized bulk material from entering a material transfer system, such as an ore pass or ore chute. A grizzly is typically constructed of rails, bars or steel beams.
MARRCO Corridor	Magma Arizona Railroad Company railroad corridor that begins at the Union Pacific Line at Magma Junction and continues to the town of Superior. The corridor will be used for water pipelines, concentrate pipelines, power and pump stations.
MARRCO right-of-way	The existing easement through public and private property associated with the MARRCO Railway.
Mineralization	The process or processes by which a mineral or minerals are introduced into a rock, resulting in a valuable or potentially valuable deposit. It is a general term, incorporating various types; e.g., fissure filling, impregnation, and replacement.
NMIDD	New Magma Irrigation & Drainage District is an irrigation and water conservation district—located west of Phoenix, between Queen Creek and the Gila River. It is comprised of 27,410 ac of which 26,900 ac are irrigable.
Ore	The naturally occurring material from which a mineral or minerals of economic value can be extracted at a reasonable profit
SAG	Semi-autogenous Grinding. A type of grinding mill designed to break a solid material into smaller pieces. It is essentially autogenous but utilizes some balls to aid in grinding steel.
Semi-autonomous	Equipment with instrumentation and computer controls to be operated with minimal or no manual oversight.

Skip	A bucket used to hold broken ore and development rock that is hoisted from a mine via a shaft.
Slot raise	A shaft driven upward from a lower level to a higher level.
Store and Release Cover	A reclamation cover that minimizes infiltration into the underlying material by acting like a sponge to store water from precipitation events until it is evaporated or transpired by plants growing in the cover material.
Subsidence	Subsidence occurs when the underground excavation collapses and movement of material connects all the way to the surface where a depression or deformation in the land surface is formed.
Sulfide Enrichment	Enrichment of a deposit by replacement of one sulfide by another of high value, as pyrite by chalcocite.
Tailings	The processed waste component that results from copper ore processing.
Tailings (cleaner)	The tailings produced in the copper-molybdenum cleaner circuit.
Tailings (scavenger)	The tailings product that will be produced from rougher/scavenger circuit.
Tailings Corridor	The corridor that begins at the WPS and ends at the TSF and is used for water and tailings pipelines and access.
Water (CAP)	This water is the fresh make-up water that is drawn either directly from the Central Arizona Project (CAP) canal or through pumping of groundwater available through banking of CAP credits.
Water (effluent)	Wastewater–treated or untreated, that flows out of a treatment plant, sewer, or industrial outfall.
Water (filtrate)	The water removed from the concentrate filtration process.
Water (mine dewatering)	Groundwater that accumulates in underground mine workings and must be pumped out in order to operate the mine.
Water (mine service)	Water used at the mine for the refrigeration and ventilation systems, dust suppression, washdown water, and direct cooling.

Water (potable)	Potable water is defined as “Water that meets the standards for drinking purposes of the State of Arizona and those of the US Environmental Protection Agency’s National Primary Water Regulations”. This water is kept completely separate from the other waters, and is supplied by Arizona Water Company.
Water (process)	Water which comes into direct contact with or results from the production or use of any raw material, intermediate product, finished product, byproduct, or waste product. The Project creates this through milling, grinding, thickener overflows, and other mine processes. Other types of water that come into contact with process water by mixing into the Process Water Pond or at the Tailings Distribution Box are considered process water from that point forward. Process water is re-used and recycled to the greatest extent possible within the mill area. Ore moisture is considered a process water due to its contact with raw materials.
Water (reclaim)	Decanted water pumped from a set of barges in the TSF to the Process Water Pond. Includes TSF stormwater runoff and TSF seepage captured by seepage collection dams.
Water (service)	Fresh water stored at the CAP Water Distribution Tank, used in several ways at the Concentrator Complex. It is used for dust suppression and wash-down water, as well as for gland water.
Water (void)	The tailings consists of a matrix of solid waste material and water. This water, which fills the annular spaces between the solid particles is called void water.
West Plant Site	Current site of water treatment plant, historic Magma Mine Concentrator and Smelter, legacy tailings/waste rock, future site of Concentrator.

8. REFERENCES

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