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Department of
Agriculture

Forest Service
Southwestern Region

Final Environmental Assessment

Resolution Copper Mining Baseline Hydrological and Geotechnical Data Gathering Activities Plan of Operations

Tonto National Forest
Globe and Mesa Ranger Districts
Pinal County

January 2016

FINAL ENVIRONMENTAL ASSESSMENT

RESOLUTION BASELINE HYDROLOGICAL AND GEOTECHNICAL DATA GATHERING ACTIVITIES PLAN OF OPERATIONS

January 2016

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TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

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ACRONYMS

AAC	Arizona Administrative Code
ADEQ	Arizona Department of Environmental Quality
ADOT	Arizona Department of Transportation
ADWR	Arizona Department of Water Resources
AGFD	Arizona Game and Fish Department
AMA	Active Management Area
Applicant	Resolution Copper Mining, LLC
ARS	Arizona Revised Statutes
AUM	Animal Unit Month
AZ-WIPWG	Arizona Wildland Invasive Plant Working Group
Arizona Trail	Arizona National Scenic Trail
AZPDES	Arizona Pollution Discharge Elimination System
BANS	Baseline Activities Noise Study
Baseline Activities	Baseline Hydrological and Geotechnical Data Gathering Activities
Baseline Plan	Baseline Hydrological and Geotechnical Data Gathering Activities Plan of Operations
BGEPA	Bald and Golden Eagle Protection Act
BMP	Best Management Practice
CAA	Clean Air Act
CASy	Comment-Analysis System
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CGP	Construction General Permit
CO	carbon monoxide
CWA	Clean Water Act
dB	decibel
dBA	A-weighted decibel
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	United States Environmental Protection Agency
EPM	Environmental Protection Measure
ESA	Endangered Species Act
FONSI	Finding of No Significant Impact
Forest	Tonto National Forest
Forest Plan	Tonto National Forest Plan and Resource Management Plan
Forest Service	United States Forest Service
FR #	Forest Road #
FSH	Forest Service Handbook
FSM	Forest Service Manual
FHWA	Federal Highway Administration
GHG	greenhouse gas
gpm	gallons per minute

HUD	Housing and Urban Development
Hz	Hertz
ISO	International Organization of Standardization
L_{dn}	day night average, or time-weighted, sound level
L_{eq}	equivalent sound level
L_{max}	maximum sound level
MARRCO	Magma Arizona Railroad Company
MBTA	Migratory Bird Treaty Act
MIS	Management Indicator Species
MM - #	Mitigation Measure #
NAAQS	National Ambient Air Quality Standards
NE	northeast
NEPA	National Environmental Policy Act of 1969
NESHAP	National Emission Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act of 1966
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NW	northwest
O_3	ozone
OHV	off-highway vehicle
Pb	lead
PCAQCD	Pinal County Air Quality Control Department
Plan	Plan of Operations
PM_{10}	particulate matter less than 10 microns in diameter
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
project area	Baseline activities area
PSD	Prevention of Significant Deterioration
Resolution	Resolution Copper Mining, LLC
RFFA	reasonably foreseeable future action
ROS	Recreation Opportunity Spectrum
ROW	right-of-way
SE	southeast
SHPO	State Historic Preservation Officer
SO_2	sulfur dioxide
SPCC	Spill Prevention, Control, and Countermeasures
SPL	sound pressure level
SW	southwest
SWPPP	Stormwater Pollution Prevention Plan
TSF	Tailings Storage Facility
U.S.	United States
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service

USGS	United States Geological Survey
VMS	Visual Management System
VQO	Visual Quality Objective
WRCC	Western Regional Climate Center

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CHAPTER 1.0 INTRODUCTION

Resolution Copper Mining, LLC (Resolution or Applicant) has submitted a proposed Plan of Operations for Baseline Hydrological and Geotechnical Data Gathering Activities (Plan) to the Forests Service for approval. The United States Department of Agriculture (USDA) Forest Service prepared this Environmental Assessment (EA) in compliance with the *National Environmental Policy Act of 1969* (NEPA) to consider approval of the proposed plan of operations. This EA discloses direct, indirect, and cumulative environmental effects that would result from Forest Service approval of the plan for the proposed Baseline activities and alternatives. The Proposed Action is to approve the Plan as submitted by Resolution. The Proposed Action is subject to the Project-Level Pre-decisional Administrative Review Process under Title 36 Code of Federal Regulations (CFR) Part 218, Subparts A and B. The Plan is available for review online at: http://www.fs.usda.gov/projects/tonto/landmanagement/projects.

This EA is organized into four parts:

- **Chapter 1, Introduction**: This chapter includes information on the history of the Plan, the purpose of and need for the Proposed Action, scope of the Federal action, and issues identified by the Forest Service and other stakeholders during scoping. This chapter also details how the Forest Service informed the public of the Proposed Action, the public's response, and the process the Forest Service utilized to review and categorize public comments received.
- **Chapter 2, Proposed Action and Alternatives**: This chapter provides a more detailed description of the Proposed Action and the No Action alternative. The chapter includes a review of the screening and analysis performed for potential alternatives to the Proposed Action, Applicant-proposed Environmental Protection Measures (EPMs), and mitigation measures developed during the analysis.
- **Chapter 3, Affected Environment and Environmental Consequences**: This chapter contains a description of the affected environment and potential effects of the No Action alternative and Proposed Action. Within each resource section, the existing environment is described first, followed by a description of the potential effects of taking no action (i.e., No Action alternative), providing a baseline for evaluation. The resource sections close with a description of the potential effects of the Proposed Action, including: direct, indirect, and cumulative effects.
- **Chapter 4, Consultation and Coordination**: This chapter provides a list of preparers of the EA, agencies consulted during the development of the EA, and a summary of Preliminary EA distribution and comment period.

1.1 Project History

Resolution's Plan was originally submitted to the Forest Service in June 2013, and the Forest Service initiated an environmental analysis under NEPA in May 2014. Resolution proposes to collect hydrologic, geochemical, and geotechnical baseline data for an area that it has proposed for a tailings storage facility (TSF) in the *Resolution Copper Mining General Plan of Operations* (MPO), which was submitted to the Forest Service in November 2013 and accepted by the Forest in September 2014 (RCM, 2013). The baseline data is needed to evaluate the plan for the tailings storage facility.

Resolution's Plan includes the following activities:

1) Construct 16 drill sites to accommodate 16 hydrological testing and monitoring wells that would affect approximately 4.21 acres. Fourteen of these drill sites would be co-located with geotechnical drill holes.
2) Complete 41 geotechnical drill holes and piezometer installations that would affect approximately 0.27 acres.
3) Construct 32 geotechnical test trenches at 32 sites that would affect approximately 1.28 acres.
4) Complete roadway improvements to provide access to hydraulic testing and monitoring wells, geotechnical drill holes/piezometers, and trenches on approximately 12.09 miles of existing roads on National Forest System lands that would affect approximately 14.67 acres.
5) Develop two laydown yards for storage of materials during construction that would affect approximately 2.19 acres.
6) Improve and/or maintain temporary access roads on previously disturbed areas for access to drill sites with monitoring wells or piezometers, which would affect 3.94 acres.
7) Utilize short-term temporary access roads to bring a tracked drill rig and a service truck to off-road locations, which would affect approximately 7.07 acres.

1.2 Proposed Project Location

The general location of the project is illustrated on Figure 1-1 (Project Location) with access routes and other project features presented on Figure 1-2 (Baseline Activities and Access). The project area would be located on the Globe Ranger District and Mesa Ranger District of the Tonto National Forest (Forest) in Pinal County, Arizona, approximately one mile northwest of the Town of Superior, in the following townships, ranges, and sections of the Gila and Salt River Baseline and Meridian:

- Township 1 South, Range 11 East in portions of sections 13, 21-28, and 33-36.
- Township 1 South, Range 12 East in portions of sections 19-21, and 28-34.
- Township 2 South, Range 11 East in portions of sections 1-3.
- Township 2 South, Range 12 East in portions of Section 6.

The main access route to the Baseline activities would be U.S. 60 west of the Town of Superior and then existing forest roads to the southern end of the Baseline activities area (Figure 1-2). The Baseline activities area (project area) includes locations of the hydrological testing and monitoring wells, geotechnical/piezometer drill holes, trenches, existing forest roads that would be utilized to support the project, short-term temporary access roads, and previously disturbed areas proposed to be used as temporary access roads. Baseline activities equipment (e.g., drill rigs, service trucks, and pickup trucks) would utilize existing roads and temporary access roads to access the proposed sites for hydrological testing and monitoring wells, geotechnical drill holes/piezometers and trenches.

As shown on Figure 1-2, the northernmost Baseline activities location proposed in the Plan is located south of an intermittent tributary of Roblas Canyon, south of the intersection of forest road (FR) 1903 and FR 1906. The southernmost point of the project area is located at the intersection of U.S. 60 and FR 357,

which parallels Queen Creek. The easternmost point of the project area is located on FR 8 near Silver King Wash, in the Globe Ranger District. The westernmost point of the project area is located along FR 172, southwest of Roblas Butte, in the Mesa Ranger District. A detailed description of the Baseline activities is included in Chapter 2 under the Proposed Action description.

1.3 Forest Land and Resource Management Plan Direction

Administration of National Forest System lands where the project would occur is directed by the *Tonto National Forest Land and Resource Management Plan* (Forest Plan) (Forest Service, 1985) and applicable amendments. The Forest Plan provides forest-wide and management area direction, including direction for minerals management.

> *The mission of the Tonto National Forest is to meet recurring stewardship responsibilities for National Forest lands and resources by: Providing a continuing supply of quality water for National Forest and downstream needs; providing a quality mix of year-round outdoor recreation experience opportunities for personal enjoyment ranging from developed recreation sites to wilderness experiences; archaeological investigations and interpretation; promoting quality wildlife and fish habitat, including preserving habitat for known Threatened and Endangered species; providing for grazing of domestic livestock; providing for the utilization of timber, minerals, and special land uses in a manner that is compatible with other resource production and use, while assuring wise management of cultural and visual resources; expanding public understanding of the environment and resource programs; and coordinating activities with interested City, County, State, and other Federal agencies as well as with individuals and groups.*

The project is located in Forest Plan Management Area 2F on the Globe Ranger District, and Management Area 3I on the Mesa Ranger District. Forest-wide goals for minerals include supporting environmentally-sound mineral development.

1.3.1 Forest Service Mining Regulations

The regulatory framework for activities reasonably incident to locatable minerals operations on National Forest System lands is set forth in 36 CFR 228 Subpart A. The term "operations" is defined in 36 CFR Section (§)228.3(a):

> *Operations. All functions, work, and activities in connection with prospecting, exploration, development, mining or processing of mineral resources and all uses reasonably incident thereto, including roads and other means of access on lands subject to the regulations, regardless of whether said regulations take place on or off mining claims.*

The proposed Plan would provide for groundwater, geochemical and geotechnical data collection, which is necessary to support design and environmental analysis of a proposed TSF, which would be incident to mining and processing of mineral resources at the Resolution Copper ore deposit. Accordingly, the proposed Baseline activities are "operations" as defined in 36 CFR §228.3(a).

The regulations also set forth requirements for environmental protection in 36 CFR §228.8, which state:

> *All operations shall be conducted so as, where feasible, to minimize adverse environmental impacts on National Forest surface resources…*

36 CFR §228.8 also sets forth specific requirements for environmental protection relating to air quality, water quality, solid wastes, scenic values, fisheries and wildlife habitat, roads, and reclamation.

The Plan is not subject to Forest Service special use regulations. Land uses that are reasonably incident to prospecting, exploration, development, mining or processing of mineral resources under 36 CFR 228 Subpart A are exempt from the scope of the Forest Service special use regulations. As set forth at 36 CFR §251.50(a), the scope of the Forest Service special use regulations includes:

> *"[a]ll uses of National Forest System lands, improvements, and resources, except those authorized by the regulations governing…minerals (part 228)."*

1.3.2 Forest Service Mineral Policy

The Forest Service mineral policy is taken directly from the *Mining and Minerals Policy Act of 1970*. Direction from the *Forest Service Manual (FSM) 2800*, Minerals and Geology, Chapter – Zero Code, defines the mission of the Forest Service for minerals management as follows:

> *To encourage, facilitate, and administer the orderly exploration, development, and production of mineral and energy resources on National Forest System lands to help meet the present and future needs of the Nation.*

The objectives of the Forest Service under *FSM 2810* (Mining Claims) are to encourage and facilitate the orderly exploration and development of mineral and energy resources on National Forest System lands to maintain a viable and healthy minerals industry. Therefore, pursuant to *FSM 2810,* the activities proposed in Resolution's Plan are consistent with these objectives, and the activities would be integrated with the planning and management of other National Forest System lands.

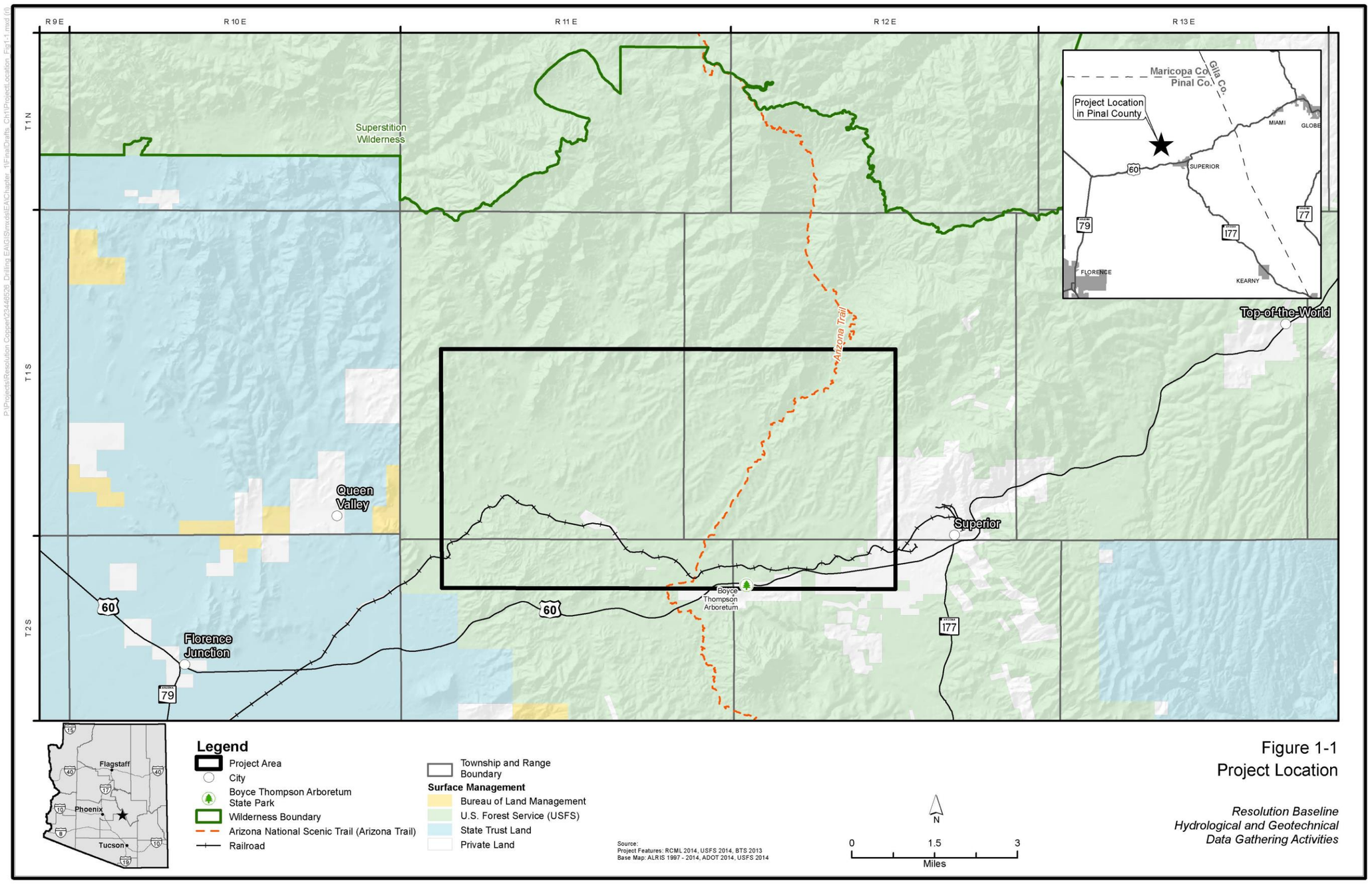

Figure 1-1
Project Location

Resolution Baseline Hydrological and Geotechnical Data Gathering Activities

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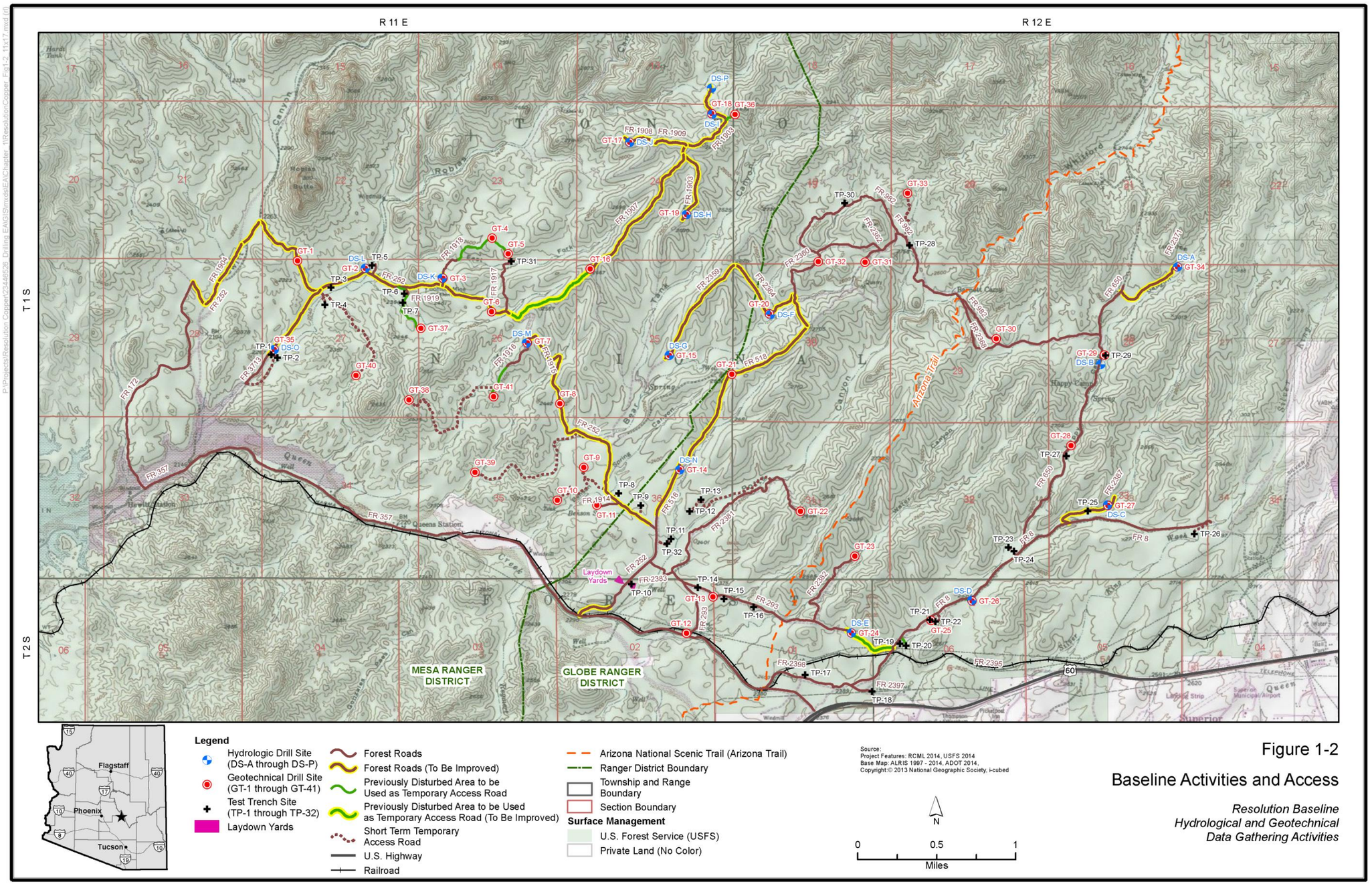

Figure 1-2

Baseline Activities and Access

Resolution Baseline Hydrological and Geotechnical Data Gathering Activities

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1.4 Purpose and Need for Action

The purpose and need of the Proposed Action is to allow collection of hydrological, geochemical and geotechnical data, which will be used to support analysis of a proposed TSF in a subsequent environmental impact statement (EIS) for the proposed MPO. The Proposed Action would provide information needed to meet the requirements of 40 CFR §1502.22, which require the Forest Service to include information in an EIS that is "essential to a reasoned choice among alternatives". The Baseline activities are needed to provide information necessary for evaluation of TSF geotechnical stability and water quality issues in the subsequent EIS for the MPO. Evaluation of geotechnical stability and water quality issues will be critical to support a reasoned choice among alternatives for the proposed TSF in the subsequent EIS for the MPO. The Baseline activities will also provide data that will support Resolution's on-going design efforts for the proposed TSF.

1.5 Scope of the Federal Action

The Council on Environmental Quality (CEQ) regulations at 40 CFR §1508.25 for implementing NEPA define the "scope" of a NEPA analysis as "…the range of actions, alternatives, and impacts to be considered." CEQ's NEPA regulations at 40 CFR Part 1500, public scoping comments, and the context and intensity factors contained at 40 CFR §1508.27 were reviewed and considered in developing the scope of analysis for the Proposed Action.

Mineral development is commonly conducted in progressive steps (FSM 2809.15 (12)), and Forest Service regulations provide for this approach in 36 CFR §228.4(d). Previous plans of operations associated with the Resolution Project include the *Plan of Operations for Kennecott Exploration's Resolution Project* (approved in 2001with amendments in 2001, 2002, 2003 and 2004) and the *Prefeasibility Plan of Operations* (approved in 2010). Each of the previous plans of operations provided data that informed development of the current Plan. Similarly, the Baseline activities will provide data that will inform both the environmental analysis and on-going design for a TSF, which is a component of the proposed MPO (RCM, 2013).

After the Proposed Action is approved and carried out, the mineral development process may continue with environmental analysis for approval of the MPO. Resolution submitted the MPO in late 2013 to request approval of a proposed plan for development of a deep copper ore body, which underlies National Forest System lands east of the town of Superior, Arizona. The proposed MPO addresses construction and operation of an underground mine and ancillary infrastructure, including the proposed TSF, which is located in the area of the Baseline activities. The Forest Service will complete an EIS to consider approval of the proposed MPO. The Forest Service cannot delay the Proposed Action until the EIS for the MPO is conducted, because the Baseline activities are needed for collection of data that are critical to support the EIS for the MPO. The MPO is a reasonably foreseeable future action as discussed in Chapter 3.

1.5.1 Decision Framework

The Forest Supervisor is the deciding officer for the Proposed Action. Based on the analysis in this EA, the Forest Supervisor will first determine if an EIS is required. If an EIS is not required, the Forest Supervisor will issue a final Decision Notice and Finding of No Significant Impact (FONSI). The Forest

Supervisor will also determine if approval of the Plan will be consistent with the Forest Plan, or if an amendment to the Forest Plan will be required.

A FONSI is appropriate if the action proposed by the agency is not likely to significantly affect the environment (40 CFR §1508.27). In gauging significance, the agency must consider both context and intensity. Context recognizes that significance varies depending on whether effects are local, regional, global, or affect a particular subset of the population. Intensity refers to the severity of the effects, and must consider beneficial and adverse effects; whether effects are highly unknown or risky, are highly controversial, or will establish a precedent; the effect on public health and safety, and whether the action violates Federal, state, or local law protecting the environment; effects on unique geographical areas such as historic or cultural resources, areas or objects listed on the National Register of Historic Places (NRHP), parks, prime farmlands, wetlands, wild and scenic rivers, or places of highly scientific value; effects on threatened or endangered species; and whether the action is related to other actions with individually insignificant but cumulatively significant effects.

If it is not necessary to prepare an EIS, the decision will be documented in a Decision Notice and include a determination of consistency with the Forest Plan, NEPA, and applicable laws, regulations, and executive orders. Following issuance of a FONSI and Decision Notice, and resolution of any objections, Resolution would revise the Plan as necessary to conform to the requirements in the Decision Notice. The Plan would be resubmitted to the Forest Service along with a reclamation bond or other acceptable form of financial assurance. The financial assurance would provide for reclamation in accordance with the Decision Notice, the revised Plan, and Forest Service reclamation requirements (36 CFR §228.8 and §228.13) in the event that Resolution failed to complete the reclamation. Once the Forest Service determined that the revised Plan was changed to conform to the Decision Notice and that the financial assurance instrument was acceptable, it would notify Resolution that the Plan is approved.

1.6 Summary of Scoping Period and Native American Consultation

Resolution's Plan was listed on the Forest Service Schedule of Proposed Actions in May 2014. A scoping letter was mailed to interested parties on May 19, 2014. The 30-day period for submitting public scoping comments occurred May 24 through June 23, 2014. The scoping process for the Baseline activities was initiated by publishing a legal notice in the *Arizona Capitol Times*, the newspaper of record on May 23, 2014. A legal notice was also published in the *Arizona Silver Belt* on May 21, 2014. The mailing list included private individuals; federal, state, county, and local agencies; Native American Indian tribes (Tribes); special interest groups; and other interested parties.

The public and several agencies were notified of the scoping period and a public scoping open house through a general scoping letter distributed to 338 people, including 18 federal, state, and local government agencies. In addition, the scoping letter and Plan were posted to the Tonto National Forest website: http://www.fs.usda.gov/projects/tonto/landmangement/projects. The general scoping letter included a description of the Baseline activities, a description of the project location and map, the public scoping timeframe, details of the public open house, and instructions and methods for providing comments.

A public scoping open house was held regarding Resolution's Plan on Tuesday, June 10, 2014, from 5:00 to 7:00 p.m. in the multi-purpose room of the Superior Junior/Senior High School located at 100 West Mary Drive, Superior, Arizona, 85173. The public scoping period for the Baseline activities closed on June 23, 2014.

Twenty representatives of the Tribes were also sent a tribal scoping letter and information on cultural resources.

1.6.1 Native American Indian Tribes Consultation

In recognition of the relationship with Tribes, the Forest Service consults with tribal governments on a government-to-government basis. Pursuant to the National Historic Preservation Act of 1966 (NHPA), the Forest Service initiated tribal consultations by sending a scoping letter to Tribes on May 13, 2014, which announced the scoping period and invited the Tribes to engage in government-to-government consultation. An opportunity to participate in face-to-face meetings with the Forest was also provided. The mailing also included a copy of a cultural resources report prepared as part of the Baseline activities. Ten Tribes received the tribal scoping letter and cultural resources report including Fort McDowell Yavapai Nation, Gila River Indian Community, The Hopi Tribe, Salt River Pima-Maricopa Indian Community, Tonto Apache Tribe, San Carlos Apache Tribe, Yavapai Apache Nation, Yavapai-Prescott Indian Tribe, White Mountain Apache Tribe, and Zuni Pueblo. Eight Tribes responded to the Forest Service letter initiating NHPA Section 106 consultations. Those Tribes included the Tonto Apache Tribe, Yavapai-Apache Nation, White Mountain Apache Tribe, San Carlos Apache Tribe, Hopi Tribe, Gila River Indian Community, Fort McDowell Yavapai Nation, and Yavapai-Prescott Indian Tribe. Those eight Tribes indicated they wanted to continue participating in Section 106 consultations.

The Forest Service met with Hopi Tribe Cultural Preservation Office staff on July 23, 2015 and September 22, 2015 followed with correspondence dated August 21, 2015. The Forest Service met with the White Mountain Apache Tribe, the Tonto Apache Tribe, and the Yavapai Apache Tribes in a series of consultation meetings on August 14, 2015, September 24, 2015, and October 21, 2015. On the latter two of these meetings the Mescalero Apache Tribe attended the meetings and participated in consultation. Consultation was concluded with the tribe's acceptance of a mitigation package proposed by the Forest. The Forest Service met with the Gila River Indian Community and Salt River Pima Maricopa Indian Community on October 15, 2015 and November 6, 2015. The Fort McDowell Yavapai Nation sent two letters to the Forest (June 23, 2014, April 23, 2015) and the Forest Service met with the tribe on November 16, 2015. The San Carlos Apache Tribe sent the Forest Service letters on June 20, 2014, June 23, 2014 and April 13, 2015. The Forest responded August 21, 2014 and April 30, 2015 and offered face to face government consultation with tribal representatives. No consultation with the San Carlos Apache Tribe has taken place to date.

1.6.2 Opportunities for Public Comment

Members of the public and agencies were afforded several methods and opportunities for providing comments during the scoping period, including:

- Comment forms were offered to meeting attendees at the public scoping open house registration table and were also available at each resource area that was set up at the open house. Commenters

could record their comments on these forms and submit them to the Forest Service at the meeting or mail them later.

- Verbal comments were recorded by the court reporter during the public scoping open house and submitted to the Forest Service.
- Comments could be e-mailed to comments-southwestern-tonto@fs.fed.us.
- Individual letters and comment forms could be mailed via U.S. Postal Service to: ID Team Leader, Attention: Resolution Hydrological & Geotechnical Data Gathering Activities, Tonto National Forest, 2324 East McDowell Road, Phoenix, Arizona, 85006.
- Comments could also be faxed to: 602-225-5295.

All comments were given equal consideration, regardless of method of transmittal, and were entered into a Comment Analysis System (CASy) to facilitate the organization, sorting, and analysis of the scoping comments by the Forest Service.

1.7 Scoping Comment Analysis

1.7.1 Comment Organization

A total of 222 scoping comment submissions were received. All comments were entered in the CASy, a database used to organize, analyze, and respond to scoping comments received. The CASy was structured so that comments could be organized into separate issue categories. For each comment received the type of submittal (e.g., letter, e-mail, comment form, fax), the source of the submittal (e.g., agency, special interest group, citizen), and other identifying information were also entered in the CASy.

Public comments received during the open house or submitted during the public scoping period by e-mail, fax, U.S. Postal Service, or private mail service are collectively referred to here as comment letters. Each comment letter was reviewed and analyzed to identify the issues to be addressed in this EA. The Resolution Copper Mining Baseline Hydrological and Geotechnical Data Gathering Activities Preliminary EA Scoping Comment and Response Report addressing individual comments is available on the project website to review specific comments and responses.

1.7.2 Issue Identification

Issue identification served to highlight effects that may occur from the Baseline activities, and provide opportunities to study and potentially reduce adverse effects (Forest Service Handbook [FSH] 1909.15.12.4). CEQ regulations specify that only significant issues are to be analyzed (40 CFR §1501.7[a] [3]). To avoid confusion with the use of the term “significance” in a Finding of No Significant Impact, the term “key issue” is used in this document in place of “significant issue”. Each issue raised during public scoping was placed into one of two general categories (1) non-issues, and (2) key issues. Non-issues included the following criteria:

- Beyond the scope of Baseline activities.
- Unrelated to the decision to be made.

- Already decided by law, regulation, or policy.
- Conjectural in nature or not supported by scientific evidence.
- Routinely addressed during the analysis of potential environmental effects.

Even if comment submissions were categorized as non-issues, they were still considered important. Many non-issues are addressed in the analysis of potential environmental effects (Chapter 3 of this EA) during the course of the NEPA analysis.

Eight key issues were identified during the public scoping period and have been used to formulate alternatives to the Proposed Action, modify the Proposed Action, prescribe mitigation and monitoring measures, and guide the analyses of environmental effects of the Proposed Action and alternatives (Table 1-1).

Table 1-1. Key Issues Identified During Public Scoping Period

Issue Category	Issue Number	Key Issue
Alternatives Development	1	The planned construction and maintenance of U.S. 60 may require the use of an alternate access route, such as FR 357
	2	Additional geotechnical drill sites for the Mescal Limestone, Escabrosa Limestone, and Martin Formation should be considered
Environmental Concerns	3	The short-term temporary access roads should be reclaimed immediately and rendered impassable after the Baseline activities are completed
	4	Improvements to forest roads and previously disturbed areas to be used as temporary access roads for Baseline activities should be minimized
Transportation and Access	5	Maintenance of Hewitt Station Road requires coordination and information for the public and other agencies during construction for traffic control and public safety
	6	Access roads (Forest Roads and Previously Disturbed Areas to be used as Temporary Access Roads) used for the Proposed Action should remain open except as required to promote public safety
	7	Use helicopters to access Baseline activities that are not accessible via existing roads
	8	To protect wildlife and other resources, use only existing roads to access Baseline activities

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CHAPTER 2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 Introduction

This chapter describes the alternatives considered in the analysis for this EA. The Proposed Action (i.e. approve the Plan) is considered along with the No Action alternative; no additional alternatives were analyzed in detail (as explained in Section 2.3). The objective of alternatives development is to determine if there are reasonable alternatives that meet the purpose of and need for the project in a less environmentally damaging manner than the Baseline activities. Alternatives were also developed in response to input received from public and agency scoping. Alternatives that had no obvious advantages, were not practicable, or were unreasonable from a development or cost basis, were not carried through the EA for detailed analysis. In response to issues raised during public scoping, Resolution modified its Plan, which resulted in a reduction of effects to surface resources. Those modifications are reflected in the Proposed Action described below.

2.2 No Action Alternative

The No Action alternative forms a baseline from which the effects of the Baseline activities can be measured. Under the No Action alternative, none of the Baseline activities would be approved and the current multiple use management of National Forest System lands within the project area would continue, as approved by the Forest Service.

Under the No Action alternative, the proposed baseline hydrological, geotechnical and geochemical data would not be collected, and the planned EIS for the proposed MPO would proceed without this data. This would reduce the ability of the Forest Service to accurately and completely evaluate issues associated with the proposed TSF such as the potential for:

- Contamination of surface water and groundwater by mineral processing fluids or leachate draining from the tailings.

- Release of tailings and contaminated water into the environment caused by failure of the tailings dam, which could cause catastrophic public safety and ecological risks.

The No Action alternative would also prevent the Forest Service from complying with 40 CFR §1502.22 which requires federal agencies to include information in an EIS that is “essential to a reasoned choice among alternatives”, and it would prevent the Forest Service from fully evaluating issues associated with compliance with Federal and State water quality standards, including regulations issued pursuant to the Federal Water Pollution Control Act, as required by 36 CFR §228.8(b). Further, the data collected in accordance with the Proposed Action would enable the Forest Service to develop reasonable alternatives for the MPO EIS, as the data will allow evaluation of the proposed TSF to determine if alternative TSFs should be considered.

2.3 Proposed Action

The Proposed Action would approve the Baseline Plan (RCM, 2014) submitted in May 2014, and subsequently modified based on scoping comments. Resolution made specific changes regarding access

roads and sites for the Baseline activities. In addition to changes related to scoping comments, the Forest Service requested that Resolution provide clarification on specific aspects of the Plan. The following changes have been incorporated into the Plan and are part of the Baseline activities.

- Resolution would follow existing FR 1904 and would not utilize the previously disturbed areas to the east of FR 1904. As such, Resolution would not need to use or improve the previously disturbed area that bypasses a portion of FR 1904 near Hewitt Canyon.
- Resolution would forgo the use of and proposed improvements to the previously disturbed area that connects FR 252 to FR 518.
- A trench site near the Arizona National Scenic Trail (Arizona Trail) would be omitted from Baseline activities.
- Hydrologic testing and monitoring well site DS-L and geotechnical drill site GT-2, which is collocated with DS-L, would be slightly relocated, approximately 50 to 75 feet to the east or south, to avoid effects to saguaro cacti.
- Resolution would omit the planned short-term temporary access road that would have extended southwest from FR 252 to TP-4 from the north; that area would be accessed from a closer location off of FR 252 to the west instead.
- TP-3 would be accessed directly from FR 252 instead of from a short-term temporary access road.
- Resolution would forgo road improvements on a stretch of FR 1903 that runs from the intersection of FR 1903 and FR 252 to the intersection of FR 1903, FR 1907, and FR 2359.
- In response to key issue 1 (Table 1-1), Resolution would use FR 357 instead of FR 2395 to access the Baseline activities. As a result, access to the previously disturbed areas that connect to FR 2395 and FR 2397 would no longer be necessary.
- Settling pits will not be used for hydrological testing and monitoring wells.

The proposed Baseline activities are shown on Figure 1-2. Specifically, Resolution's proposed Baseline activities include the following activities:

1) Construct 16 drill sites to accommodate 16 hydrological testing and monitoring wells that would affect approximately 4.21 acres. Fourteen of these drill sites would be co-located with geotechnical drill holes.
2) Complete 41 geotechnical drill holes and piezometer installations that would affect approximately 0.27 acres.
3) Construct 32 geotechnical test trenches at 32 sites that would affect approximately 1.28 acres.
4) Complete roadway improvements to facilitate access to hydraulic testing and monitoring wells, geotechnical drill holes/piezometers, and trenches on approximately 12.09 miles of existing roads on National Forest System lands that would affect approximately 14.67 acres.

5) Develop two laydown yards for storage of materials during construction that would affect approximately 2.19 acres.

6) Improve and/or maintain temporary access roads on previously disturbed areas for access to drill sites with monitoring wells or piezometers, which would affect 3.94 acres.

7) Utilize short-term temporary access roads to bring a tracked drill rig and a service truck to off-road locations, which would affect approximately 7.07 acres.

The total project area for the Baseline activities, including new construction activity associated with hydrological drill sites, geotechnical drill sites, and test trenches; road improvements; use of short-term temporary access roads; and existing road surfaces requiring no improvements, is approximately 75.40 acres. Proposed new construction disturbance would occur on a total of 33.63 acres, all of which would occur on National Forest System lands. The 14 geotechnical drill sites that would be collocated with hydrological drill sites would minimize disturbance on National Forest System lands.

Table 2-1. Acres of Disturbance from Baseline Activities, Access Improvements, and Construction

Baseline Activity	Number of Sites	Miles of Roads	Acres of New Disturbance
Hydrological Testing and Monitoring Well Sites	16	NA	4.21
Geotechnical Drill Sites*	41	NA	0.27
Test Trench Sites	32	NA	1.28
Sub-Total	**89**	**NA**	**5.76**
Access Roads			
Forest Roads	NA	22.39	0.0
Forest Roads (To Be Improved)	NA	12.09	14.67
Previously Disturbed Area to be Used as Temporary Access Roads**	NA	1.29	1.56
Previously Disturbed Area to be Used as Temporary Access Roads (To Be Improved)**	NA	0.98	2.38
Short-Term Temporary Access Roads	NA	5.83	7.07
Sub-Total	**NA**	**42.58**	**25.68**
Construction Staging			
Laydown Yards	2	NA	2.19
Total	**NA**	**NA**	**33.63**

*Fourteen geotechnical drill sites would be co-located within hydrological drill sites; the acres of disturbance for those geotechnical drill sites were included with the hydrological drill sites.

**Previously Disturbed Areas included in estimate of new disturbance for reclamation purposes.

Construction and installation of the Baseline activities is expected to take approximately six months for the 16 hydrological drill sites, nine to ten months for the 41 geotechnical drill sites, and three to four months for the 32 test trenches. Construction and installation would occur concurrently (as appropriate) and would be completed within the first two years of the authorization period. The authorization period is defined as the Forest Service-approved period in which Resolution would

complete the Baseline activities. Resolution has proposed a 10-year period to complete construction, installation, monitoring and reclamation for the Baseline activities. Road maintenance and access to the hydrologic testing and monitoring wells would occur throughout the authorization period. At the end of the authorization period, hydrologic testing and monitoring wells, and piezometers would be reclaimed as described in Section 2.3.5. Additional activities, including installing pumps and instrumentation to perform aquifer testing, would be expected to be completed within two years of the construction of drill sites.

Equipment, materials, and personnel would be mobilized at the two laydown yards located adjacent to FR 252 (Figure 1-2). The laydown yards would only be used within the first two years of the authorization period. The equipment needed to perform the Baseline activities would include vehicles such as drill rigs, water tanks, water trucks, and other support equipment. The types of equipment that would be used for the Baseline activities are listed in Table 2-2.

Table 2-2. Typical Equipment List

Quantity	Equipment	Model or Size
Hydrologic Monitor Well Drilling		
2	Lang DH-90 Series Tophead Rotary Rig or equivalent	24 feet x 52 feet
1	Tank (Associated with Active Drill Rigs)	9,000-gallon
1	Winch Truck	10 feet x 35 feet
1	Heavy duty air compressor	-
1	Water Storage Tank (associated with active drill rigs)	9,000-gallon
1	Portable Driller's Office	8 feet x 15 feet
2	Generators associated with drill rigs	8 feet x 15 feet
1	Front End Loader	10 feet x 30 feet
1	Backhoe	10 feet x 20 feet
1	Cat Grader or equivalent	14M
2	Tracked Excavators	Caterpillar 320
1	Water Truck	10 feet x 30 feet
Geotechnical Core Drilling		
1	BYL Tracked Drill Rig or equivalent*	7 feet x 27 feet
1	Pipe Truck	10 feet x 35 feet
1	Portable Water Storage Tank (associated with active drill rigs)	1,000-gallon
1	1 Ton Driller/Tool Pusher (Light Vehicle)*	1-Ton Flatbed or Pickup truck
1	Cat Bulldozer	D-6
1	Water Truck	10 feet x 30 feet
Geotechnical Test Trenches		
1	Tracked Excavator	Cat 320
1	Cat Bulldozer	D-6
Access Road Improvement		
1	Track Hoe	10 feet x 20 feet
1	Hammer Hoe	10 feet x 20 feet
1	Front End Loader	10 feet x 30 feet
1	Water Truck	10 feet x 30 feet
1	Tracked Jaw Crusher	10 feet x 20 feet
1	Cat Grader or equivalent	14M

* The only equipment that would be used to access geotechnical drill sites located on, or next to, short-term temporary access roads.

2.3.1 Access

The project area is located approximately one mile northwest of the Town of Superior in Pinal County, Arizona (Figure 1-1). The project area would be accessed from FR 357 from its junction with U.S. 60. Figure 1-2 illustrates the forest roads that would be used to access the sites for Baseline activities. In addition to those forest roads, access to sites for Baseline activities would use previously disturbed areas and also short-term temporary access roads. Approximately 34.48 miles of forest roads, 5.83 miles of short-term temporary access roads, and 2.27 miles of previously disturbed areas proposed as temporary access roads on National Forest System lands would be used to access sites.

Access Terms

Forest roads – National Forest Transportation System roads that are designated for motor vehicle use.

Previously Disturbed Areas to be Used as Temporary Access Roads – Unauthorized or user-created roads that are not National Forest Transportation System facilities.

Short-term Temporary Access Roads – Temporary roads created to provide access to sites not served by existing roads or previously disturbed areas that would be used for approximately 48 hours.

Public access would be managed by Resolution work crew members during access improvement construction and maintenance. To the extent practicable, access improvement and maintenance activities would allow continued road use by the public. All signs for access management would comply with the guidelines in the *Manual on Uniform Traffic Control Devices* published by the Federal Highway Administration, Department of Transportation, as per policy found in *FSM 7103.3*.

2.3.1.1 Forest Roads

Forest roads would be improved and/or maintained to meet Level 2 road maintenance standards to provide access for the Baseline activities equipment listed in Table 2-2. FSH 7709.58 contains the Guidelines for Road Maintenance Levels. Level 2 (high clearance vehicles) roads are open for use by high clearance vehicles and only allow low traffic volume and speeds. These roads are typically local and connect collector roadways; have at-grade drainage treatment; are not subject to the requirements of the Highway Safety Act; do not provide surface smoothness; and are not suitable for passenger cars. For the Baseline activities, portions of existing forest roads (see Figure 1-2 and Table 2-1) would be maintained to allow drill rigs and support vehicles to traverse them safely.

Approximately 12.09 miles of forest roads would require improvements. Road improvements would include widening the travel lane of the roads to a maximum of 20 feet, primarily to accommodate the widening of turns to allow access for all equipment (Figure 2-1) or where steep terrain may require cut and fill. In order to minimize disturbance, berms would not be constructed unless required for safety reasons.

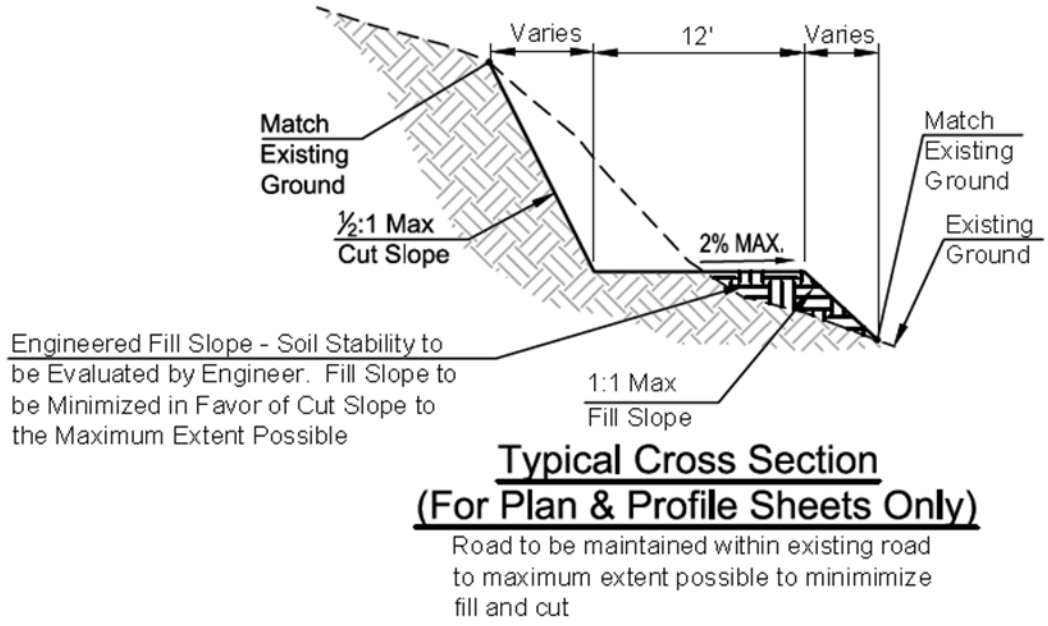


Figure 2-1. Typical Cross Section for Forest Roads and Previously Disturbed Areas to be used as Temporary Access Roads

Forest roads would be maintained to allow access for the Baseline activities. Maintenance along approximately 34.48 miles would include selective vegetation removal such as trimming vegetation along the sides of roads and clearing fallen trees within the existing roadbed. Road maintenance would not add nor remove any materials from the drainage channels.

2.3.1.2 Previously Disturbed Areas to be used as Temporary Access Roads

Previously disturbed areas to be used as temporary access roads are existing, unauthorized or user-created roads, and are not National Forest Transportation System roads. That is, the Forest Service never took action to create, construct, or manage those roads for public use; they are unauthorized. They were created by the public as a result of cross-country travel, but are not intended for public use. These previously disturbed areas can be indistinguishable from existing forest roads. Approximately 2.27 miles of these previously disturbed areas would be used as temporary access roads to access hydrologic testing and monitoring wells, geotechnical drill sites, and test trenches (Figure 1-2) from Forest Roads.

2.3.1.3 Short-term Temporary Access Roads

Approximately 5.83 miles of short-term temporary access road segments crossing Sonoran desert scrub vegetation would be used to access geotechnical drill sites and test trenches. The tracked drill rig and tracked excavator that would utilize these short-term temporary access roads would use two, approximately 2-foot-wide parallel tracks, with a maximum of 10 feet of disturbance. A service truck and pipe truck would also be used to access the geotechnical drill sites during the construction activity. No cut, fill, or other road construction activity would be required for this short-term temporary access. The short-term temporary access roads would be used for approximately 24 to 48 hours at each site and then reclaimed (see Section 2.3.5). Access to the geotechnical drill sites and piezometers to facilitate monitoring would be conducted by foot. The short-term temporary access roads would also be used at the

end of the monitoring period to provide access for equipment necessary to plug any geotechnical drill holes completed as piezometers in accordance with state standards. Any additional disturbance on short term temporary access roads associated with plugging the piezometers would also be reclaimed as discussed in Section 2.3.5.

2.3.2 Hydrological Testing and Monitoring Well Sites

Hydrology Terms

Transmissivity – The ability of an aquifer to transmit groundwater

Hydraulic conductivity – A coefficient describing the relative ease with which groundwater can move through a permeable layer of rock or soil.

Storage coefficient – Volume of groundwater an aquifer releases from or takes into storage per unit surface area.

(Sacramento State Office of Water Programs, 2012)

Sixteen drill sites would be developed for hydrological testing and monitoring well installation on National Forest System lands (Figure 1-2 and Table 2-1). Each of the 16 hydrological drill sites has an approximate 100-foot by 80-foot disturbance area (Figure 2-2). The actual dimensions of each site and the anticipated surface disturbance from the construction of each drill site could vary because of topographic and site constraints.

Sixteen approximately 600-foot to 2,000-foot deep hydrological testing and monitoring wells would be installed at the drill sites and would be used to gather groundwater data in the project area. Data obtained from the hydrological testing and monitoring wells would include: (1) depth to groundwater level; (2) lithology and geochemistry of drill cuttings; (3) aquifer hydraulic parameters, including transmissivity, hydraulic conductivity, and storage coefficient; and (4) chemical quality of groundwater.

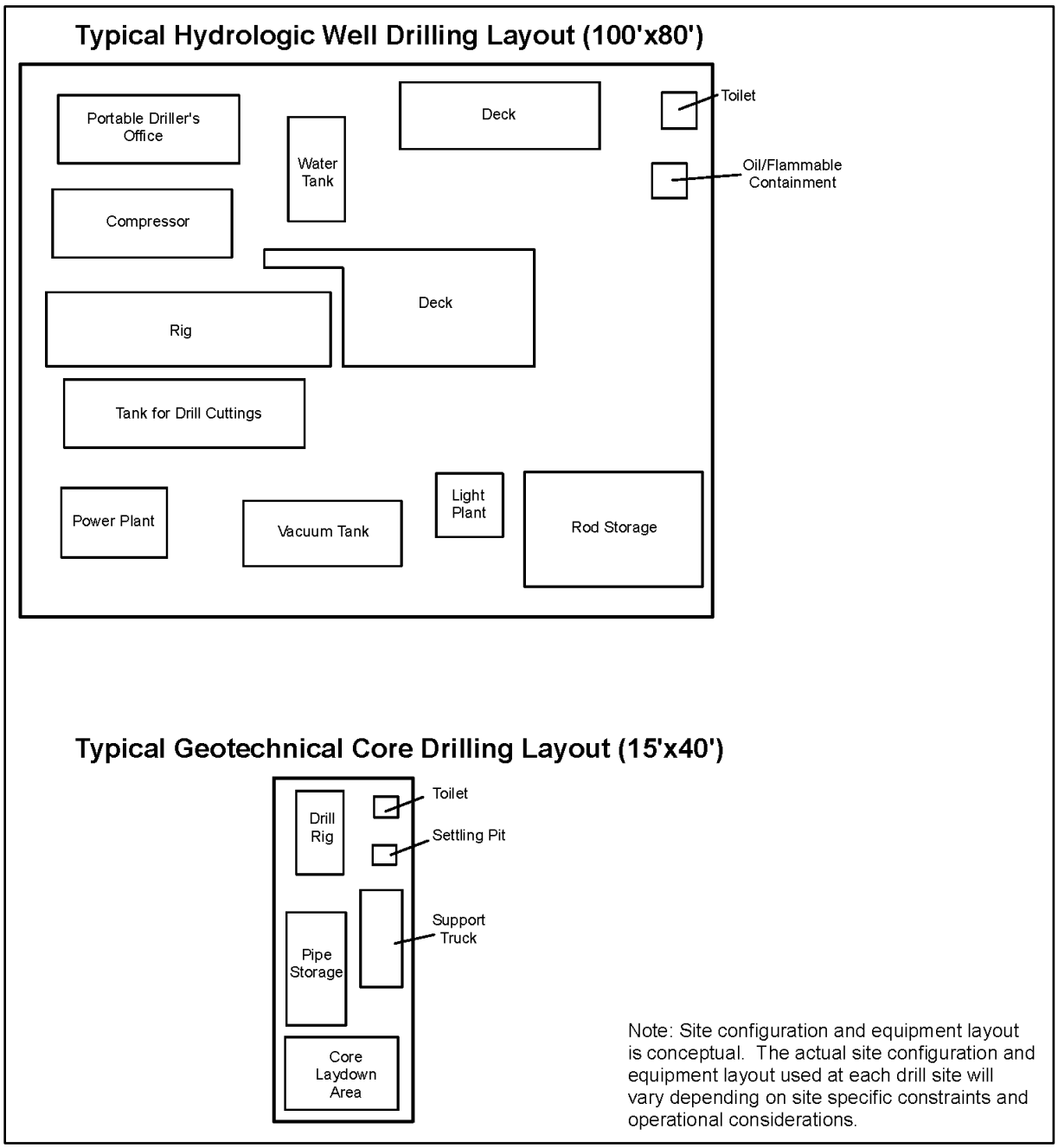
Construction of each hydrological testing and monitoring well would begin with an 18-inch-diameter hole that would be drilled to a minimum 20-foot depth, followed by the placement of a 12 and 3/4-inch-diameter steel surface casing that would be set and cemented into place (Figure 2-2). Once the surface casing is established, the well would be drilled to the required depth using the air assisted reverse-circulation method.

Reverse Circulation Drilling Method

Air-assisted reverse circulation drilling utilizes high-pressure air to cool the drill bit and remove drill cuttings from the borehole. Cuttings are carried quickly to the surface through the inner steel tubing.

Drill cuttings would be collected in large storage tanks (9,000-gallon capacity) constructed within the disturbance area of each drill site. The tanks would be used during drilling operations to hold drill cuttings that are brought to the surface. Resolution would collect excess cuttings generated during drilling activities and dispose of them off of National Forest System lands. These materials would be disposed of at a permitted facility in accordance with applicable State of Arizona regulations.

Figure 2-2. Typical Hydrological Well Drilling and Geotechnical Core Drilling Layout



During drilling and well construction, careful observation of any groundwater entering the borehole would be made. Drilling may be paused periodically to evaluate the quantity and quality of the groundwater encountered by the borehole at depth. Air lift pumping would be used to raise the water to the surface to be evaluated. A hydrogeologist would be onsite to monitor the drilling operations and an industry standard suite of geophysical well logs would be collected before the casing would be installed.

A description of each of the drill sites follows (the acres of disturbance for hydrologic testing and monitoring wells may not match estimated totals due to rounding):

DS-A: Drill Site DS-A would be located adjacent to and accessed via FR 2371 on previously disturbed (used by recreational vehicles for parking and turnaround) National Forest System lands in Township 1 South, Range 12 East, in the Northwest (NW) ¼, Northeast (NE) ¼ , NE ¼ of Section 28. Planned activities include the construction of one groundwater monitoring well (HRES-A), and construction of one geotechnical hole (GT-34). The estimated surface disturbance for this site would be 0.24 acre. The target depth of the hydrological testing and monitoring well would be approximately 1,968 feet.

DS-B: Drill Site DS-B would be adjacent to and accessed via FR 650, and would be located on undisturbed National Forest System lands in Township 1 South, Range 12 East, in the NW ¼, NE ¼, Southwest (SW) ¼ of Section 28. Planned activities include the construction of one groundwater monitoring well (HRES-B). The estimated surface disturbance for this site would be 0.22 acre. The target depth of the hydrological testing and monitoring well would be approximately 656 feet.

DS-C: Drill Site DS-C would be adjacent to and accessed via FR 2387 and located on undisturbed National Forest System lands in Township 1 South, Range 12 East, in the NE ¼, NE ¼, SW ¼ of Section 33. Planned activities include the construction of one groundwater monitoring well (HRES-C), and construction of one geotechnical hole (GT-27). The estimated surface disturbance for this site would be 0.30 acre. The target depth of the hydrological testing and monitoring well would be approximately 1,312 feet.

DS-D: Drill Site DS-D would be accessed via FR 8, then by turning southeast onto a previously disturbed area to be used as a temporary access road for approximately 52 feet. DS-D would be located on previously disturbed (historically used for drilling and now used as a makeshift camp site and parking lot) National Forest System lands in Township 2 South, Range 12 East, in the southeast (SE) ¼, NW ¼ , NE ¼ of Section 6. Planned activities include the construction of one groundwater monitoring well (HRES-D), and construction of one geotechnical hole (GT-26). The estimated surface disturbance for this site would be 0.21 acre. The target depth of the hydrological testing and monitoring well would be approximately 1,312 feet.

DS-E: Drill Site DS-E would be located adjacent to and accessed via FR 293, then by turning southeast onto a previously disturbed area to be used as a temporary access road for approximately 75 feet. DS-E would be located on undisturbed National Forest System lands in Township 2 South, Range 11 East, in the NW ¼, SE ¼, NE ¼ of Section 1. Planned activities include the construction of one groundwater monitoring well (HRES-E), and construction of one geotechnical hole (GT-24). The estimated surface disturbance for this site would be 0.20 acre. The target depth of the hydrological testing and monitoring well would be approximately 1,640 feet.

DS-F: Drill Site DS-F would be located adjacent to and accessed via FR 2364 on undisturbed National Forest System lands in Township 1 South, Range 12 East, in the NE ¼, SW ¼, NW ¼ of Section 30. Planned activities include the construction of one groundwater monitoring well (HRES-F), and construction of one geotechnical hole (GT-20). The estimated surface disturbance

for this site would be 0.26 acre. The target depth of the hydrological testing and monitoring well would be approximately 1,312 feet.

DS-G: Drill Site DS-G would be adjacent to and accessed via FR 2359 and located on undisturbed National Forest System lands in Township 1 South, Range 11 East, in the SW ¼, NW ¼, SE ¼ of Section 25. Planned activities include the construction of one groundwater monitoring well (HRES-G), and construction of one geotechnical hole (GT-15). The estimated surface disturbance for this site would be 0.29 acre. The target depth of the hydrological testing and monitoring well would be approximately 1,312 feet.

DS-H: Drill Site DS-H would be adjacent to and accessed via FR 1903 and located on undisturbed National Forest System lands in Township 1 South, Range 11 East, in the SE ¼, NW ¼, SE ¼ of Section 24. Planned activities include the construction of one groundwater monitoring well (HRES-H), and construction of one geotechnical hole (GT-19). The estimated surface disturbance for this site would be 0.52 acre. The target depth of the hydrological testing and monitoring well would be approximately 1,968 feet.

DS-I: Drill Site DS-I would be adjacent to and accessed via FR 1903 and located on undisturbed National Forest System lands in Township 1 South, Range 11 East, in the NW ¼, NE ¼, NE ¼ of Section 24. Planned activities include the construction of one groundwater monitoring well (HRES-I), and construction of one geotechnical hole (GT-18). The estimated surface disturbance for this site would be 0.20 acre. The target depth of the hydrological testing and monitoring well would be approximately 656 feet.

DS-J: Drill Site DS-J would be adjacent to and accessed via FR 1908 and located on undisturbed National Forest System lands in Township 1 South, Range 11 East, in the SW ¼, NE ¼, NW ¼ of Section 24. Planned activities include the construction of one groundwater monitoring well (HRES-J), and construction of one geotechnical hole (GT-17). The estimated surface disturbance for this site would be 0.32 acre. The target depth of the hydrological testing and monitoring well would be approximately 1,312 feet.

DS-K: Drill Site DS-K would be adjacent to and accessed via FR 1918, and would be located on undisturbed National Forest System lands in Township 1 South, Range 11 East, in the NE ¼, NW ¼, NW ¼ of Section 26. Planned activities include the construction of one hydrological testing and monitoring well (HRES-K), and construction of one geotechnical hole (GT-3). The estimated surface disturbance for this site would be 0.25 acre. The target depth of the hydrological testing and monitoring well would be approximately 1,312 feet.

DS-L: Drill Site DS-L would be adjacent to and accessed via FR 252, and would be located on undisturbed National Forest System lands in Township 1 South, Range 11 East, in the NE ¼, NW ¼, NE ¼ of Section 27. Planned activities include the construction of one groundwater monitoring well (HRES-L), and construction of one geotechnical hole (GT-2). The estimated surface disturbance for this site would be 0.22 acre. The target depth of the hydrological testing and monitoring well would be approximately 1,640 feet.

DS-M: Drill Site DS-M would be adjacent to and accessed via FR 1915, and would be located on undisturbed National Forest System lands in Township 1 South, Range 11 East, in the NE ¼, NW ¼, SE ¼ of Section 26. Planned activities include the construction of one groundwater monitoring

well (HRES-M), and construction of one geotechnical hole (GT-7). The estimated surface disturbance for this site would be 0.23 acre. The target depth of the hydrological testing and monitoring well would be approximately 1,312 feet.

DS-N: Drill Site DS-N would be adjacent to and accessed via FR 518, and would be located on undisturbed National Forest System lands in Township 1 South, Range 11 East, in the NE ¼, SW ¼, NE ¼ of Section 36. Planned activities include the construction of one groundwater monitoring well (HRES-N), and construction of one geotechnical hole (GT-14). The estimated surface disturbance for this site would be 0.21 acre. The target depth of the hydrological testing and monitoring well would be approximately 1,312 feet.

DS-O: Drill Site DS-O would be adjacent to and accessed via FR 3713, and would be located on undisturbed National Forest System lands in Township 1 South, Range 11 East, in the NW ¼, NW ¼, SW ¼ of Section 27. Planned activities include the construction of one groundwater monitoring well (HRES-O), and construction of one geotechnical hole (GT-35). The estimated surface disturbance for this site would be 0.21 acre. The target depth of the hydrological testing and monitoring well would be approximately 1,968 feet.

DS-P: Drill Site DS-P would be adjacent to and accessed via FR 1903, and would be located on undisturbed National Forest System lands in Township 1 South, Range 11 East, in the SW ¼, SE ¼, SE ¼ of Section 13. Planned activities include the construction of one groundwater monitoring well (HRES-P). The estimated surface disturbance for this site would be 0.33 acre. The target depth of the hydrological testing and monitoring well would be approximately 656 feet.

Well construction and drilling activities would be completed in about six months (25 weeks). The additional activities of installing pumps, performing aquifer testing, and installing instrumentation (after the drilling of the testing and monitoring wells) would be completed within the first year of the 10-year authorization period.

Aggregate base may be placed on National Forest Transportation System roads per Forest Service direction. Following the completion of drilling, all materials, including gravel, would be removed from the site. Solids and desiccated drilling muds in the storage tanks would be removed from the site. These inert materials would be disposed of in accordance with applicable laws and regulations.

Any hydrological testing and monitoring wells that do not encounter groundwater would be abandoned immediately in accordance with Arizona Administrative Code (AAC) R12-15-816 and the Arizona Department of Water Resources (ADWR) *Well Abandonment Handbook* (ADWR, 2008). Table 2-3 provides a summary of the ADWR well abandonment requirements. Stormwater Best Management Practices (BMPs) would be implemented during all abandonment activities as necessary and as specified by the Forest Service. At the time of final closure, the hydrological testing and monitoring well would be abandoned in accordance with ADWR regulations and the remainder of the site would be reclaimed (see Table 2-3).

Table 2-3. Hydrological Testing and Monitoring Well and Geotechnical Drill Hole Abandonment Procedures

Type of Drill Hole	Abandonment Timing	Abandonment Procedures
Hydrological Testing and Monitoring Wells	Wells used for long-term monitoring would be plugged at end of 10-year authorization period. In the event that groundwater is not encountered in a planned well, the bore-hole would be plugged immediately after drilling.	Wells completed to specifications would be maintained as long-term groundwater monitoring locations. In the event of a lost hole or insufficient data from a well, the selected well would be abandoned in accordance with ADWR standards.
Geotechnical Drill Holes	After initial testing, drill holes that are not necessary for further analysis would be abandoned according to the Plan.	Once selected for abandonment, these holes would be abandoned in accordance with ADWR standards specified in AAC R12-15-816, including applicable collection fees consistent with AAC R12-15-104.

Geotechnical Terms

Stratigraphy – The study of rock layers, especially their distribution, environment of deposition, and age.

Density – The mass of a substance divided by the volume, often expressed in terms of grams per cubic centimeter

Piezometer – A device used to measure the water level at a specific location in a borehole.

2.3.3 Geotechnical Drill and Piezometer Sites

A total of 41 drill holes would be installed for geotechnical testing and piezometer installation on National Forest System lands (Figure 1-2 and Table 2-1). Each of the 41 geotechnical drill sites would have an approximate 15-foot by 40-foot disturbance area (Figure 2-2). The geotechnical drill holes would be drilled to a maximum depth of 250 feet, and, if groundwater is encountered, piezometers would be installed. The geotechnical drill holes would provide data necessary to understand the baseline soil and bedrock hydrological and geotechnical conditions within the general project area. Data obtained from the geotechnical drill sites would include: (1) stratigraphy; (2) density; (3) geochemistry; (4) hydraulic conductivity; (5) depth to groundwater; and (6) rock strength properties. The amount of disturbance for the geotechnical drill and piezometer sites would be approximately 0.27 acre for 27 of the 41 geotechnical testing and piezometer installation sites. Fourteen geotechnical testing and piezometer sites would be co-located within existing disturbance associated with the hydrological drill sites. A typical equipment list for the geotechnical drilling and piezometer installation drilling is provided in Table 2-2.

The time required for completion of geotechnical drill holes and installation of piezometers would be approximately ten months. Temporary settling pits would be located within the geotechnical drill site disturbance area. Following the completion of all drilling, drill cuttings and desiccated drilling mud in settling pits would be excavated and removed from the geotechnical drill sites. These materials would be disposed of in accordance with applicable state and Federal regulations. At the time of closure of the

piezometers, the boreholes would be abandoned in accordance with ADWR regulations, and the disturbance area would be reclaimed.

2.3.4 Geotechnical Test Trench Sites

A total of 32 geotechnical test trenches would be constructed for the purpose of investigating near-surface soils and the weathered bedrock interface on National Forest System lands. Each of the test trenches would have an approximately 60-foot by 30-foot disturbance footprint for a total of 1.28 acres (see Table 2-1). Where feasible, geotechnical test trenches would be located near forest roads or previously disturbed areas to be used as temporary access roads to minimize surface effects (see Figure 1-2, TP-1 through TP-32).

In each test trench, detailed stratigraphy would be recorded, infiltration tests would be conducted to estimate hydraulic conductivity of shallow surface soils, and samples would be collected. Samples would be collected through various soil and rock horizons to facilitate laboratory testing for soil strength parameters, physical properties, and geochemistry.

The geotechnical test trenching activities would consist of excavating a 50-foot-long by 20-foot-wide trench to a maximum depth of 16 feet using a tracked excavator. When not in use, the tracked excavator would be stationed alongside Forest Roads or within the short-term temporary access roads. Excavation of the test trench would be completed in less than one day. The test trenches would be backfilled immediately upon completion of infiltration testing and within 48 hours of initial excavation. The excavated soils would be replaced in the trench in two-foot-thick layers and compacted by tamping soils with the excavator bucket. After backfilling of all test trenches, each trench site would be re-contoured to approximate original topography and reclaimed (see Section 2.3.5).

2.3.5 Reclamation

Resolution would conduct concurrent and final reclamation of disturbed areas to minimize the effects associated with Baseline activities. For sites that would continue to be used long-term for groundwater monitoring, it may be possible to reclaim a portion of the drill site while still maintaining access to and parking at the hydrological testing and monitoring well. Concurrent reclamation would occur as soon as practicable after installation of the wells and final reclamation of disturbed areas would occur at the end of the authorization period. Important actions in minimizing the effects associated with the project include: (1) reducing, to the extent practicable, the effects associated with ground disturbance for Baseline activities; and (2) stabilizing temporary disturbance areas to an acceptable condition in order to facilitate natural recovery. Reclamation actions implemented by Resolution are designed to restore plant communities to near pre-construction conditions, prevent substantial increases in noxious weeds in the project area, and minimize soil erosion. Typical reclamation actions would include soil stabilization through recontouring, reseeding, and replanting of salvaged plant species temporarily moved during construction (e.g., cactus, agave, etc.).

Concurrent reclamation would include removal of all supplies and non-native materials in addition to the abandonment of geotechnical drill holes and backfilling of test trenches before the equipment left each site, with the exception of the sites used for hydraulic testing and monitoring wells, and piezometers. At sites where hydraulic testing and monitoring wells or piezometers were installed, a portion of the drill site

would be maintained to facilitate periodic groundwater monitoring and testing. Areas disturbed for installation of geotechnical drill holes, test trenches, and laydown yards would be re-graded to approximate original contours, ripped/roughened to alleviate compaction, and seeded with an appropriate native seed mix approved by Forest Service. If the initial seeding is not successful, up to two additional seedings would be attempted.

Short-term temporary access roads would be used for approximately 24-48 hours. These areas would be reclaimed immediately after trench work or drilling was completed. Future access for monitoring purposes would be by foot. The short-term temporary access roads would be reclaimed by repositioning vegetation (i.e., moving vegetation back in place that may have been pushed out of place or moved out of the way temporarily to allow vehicles to pass), and ripping/roughing with hand tools to return the areas to alleviate compaction and seeded with an appropriate seed mix approved by the Forest Service. If the initial seeding is not successful, up to two additional seedings would be attempted.

Forest roads identified as maintenance Level 1 would be brought back to these conditions during reclamation. Maintenance Level 1 roads that were improved would be stabilized by ripping/roughening the roads to alleviate compaction, recontouring the roads to approximate pre-disturbance contours, reseeding the roads (up to three times), maintaining or removing BMPs as directed by the Forest Service, and physically blocking the roads to deter vehicular travel.

Final reclamation would include capping and abandonment of monitoring wells in accordance with ADWR well-abandonment procedures found in AAC R-12-15-816, or other procedures applicable at that time. Disturbed areas would be re-contoured to approximate original contours, the area would be ripped/roughened to alleviate compaction, and seeded with an appropriate native seed mix approved by the Forest Service. If the initial seeding is not successful, up to two additional seedings would be attempted. Final reclamation would occur within the 10-year authorization period.

2.3.6 Applicant-Proposed Environmental Protection Measures

The following Environmental Protection Measures (EPMs) identified by Resolution in its Plan have been proposed to avoid or minimize effects to environmental resources.

Air Quality

AQ-1: Fugitive dust-suppression techniques would be used as necessary, such as applying water during road construction and Baseline activities.

AQ-2: Water would be used in the drilling process, to control fugitive dust production from the drill.

AQ-3: Construction and service vehicles would drive slowly (15 mph or less) on dirt roads and adjust their speed as conditions dictate, to minimize creating a dust trail.

AQ-4: To the extent practicable and consistent with the efficient and safe implementation of the Plan, Resolution would limit project-related traffic on National Forest System lands.

AQ-5: Drill rigs, drilling equipment, pumps and other mobile and stationary sources of air emissions at drilling and test trench sites would be operated within manufacturer specifications and in accordance with applicable regulations to reduce air pollutant emissions. Total diesel fuel used for

drilling activities would be tracked and monitored. Engines utilized in operations would be equipped with the pollution control equipment provided by the manufacturer (e.g., catalytic converters and mufflers). Additionally, pollution-control equipment would be inspected prior to arrival on National Forest System lands to ensure that it is in good working order, and would be maintained in accordance with manufacturer specifications.

Water Quality

WQ-1: The Baseline activities would require water for dust suppression on roads and drilling processes. Water for these activities would come from potable private water sources.

WQ-2: Drill sites are located within the Phoenix Active Management Area and Resolution would comply with ADWR established reporting requirements.

WQ-3: In accordance with ADWR requirements, the strategic installation of bentonite seals and professional drilling practices would minimize the potential effects of drilling activities to the existing groundwater aquifer system.

WQ-4: Resolution would collect excess cuttings and mud generated during drilling activities, and would remove the materials from National Forest System lands. These materials would be disposed of in accordance with applicable state law.

WQ-5: A construction Stormwater Pollution Prevention Plan (SWPPP) would be prepared in accordance with the regulations of the Arizona Pollution Discharge Elimination System (AZPDES) Stormwater Construction General Permit (CGP). Runoff and sediment discharged from areas disturbed to construct drill sites would be controlled with erosion control features such as wattles, silt fence, berms, straw bales, and other BMPs for stormwater management.

WQ-6: Materials used to construct applicable sediment and erosion control features (e.g., straw bales) would be certified noxious weed free.

WQ-7: Sediment control features, such as berms and silt fencing, would be used on fill slopes to catch sediment and keep it from entering drainages.

WQ-8: Sediment control features would be used on temporary stock piles excavated for test trenching activities to catch sediment and keep it from entering drainages.

WQ-9: Road maintenance and construction would avoid drainage channel bottoms to the greatest extent possible. Water bars would be installed to minimize erosion on steep sections of roadway.

WQ-10: Upon completion of drilling and monitoring, drill holes would be abandoned pursuant to AAC R12-15-816(g), and Arizona Revised Statutes (ARS) 45, Chapter 2, Article 10, as administered by ADWR. The drill sites would be re-graded to pre-Baseline activities conditions. An approved Forest Service seed mix would be applied and raked into the soil of disturbed areas. Copies of Arizona Well Drill Reports, Well Log Forms, and Well Abandonment and Completion Reports would be provided to the Forest Service.

Solid Wastes

SW-1: Solids from drilling (e.g., drill cuttings, rock and water) may be pumped and disposed of in accordance with applicable sections of ARS §§27-514 or may be allowed to dry out in the excavated pits to facilitate removal with an excavator. Settling pits shall be pumped of any remaining drilling solids and/or muds and backfilled within five calendar days of completed work at each drill site. When all drilling was completed, the material contained in the pits would be removed from the National Forest System lands and disposed of in accordance with applicable laws and regulations. During reclamation activities, these pits would be covered, graded, and re-vegetated with an approved native seed mix.

SW-2: A portable toilet would be placed at each active drill site and serviced periodically by a contractor. All other wastes, such as paper and food waste would be stored in garbage sacks and removed from the sites daily.

Scenic Values, Recreation, and Other Uses

SVR-1: Good housekeeping practices, timely reclamation of disturbed areas, and minimization of disturbance areas would protect scenic values.

SVR-2: Recreation access would be maintained and no road closures would be necessary during the Baseline activities.

SVR-3: For any proposed use of previously disturbed areas to be used as temporary access roads on National Forest System lands, once activities specified in the Plan were complete, Resolution would reclaim roads consistent with the Forest Service's Travel Management Planning objectives.

SVR-4: Lights used for night work at drill sites would be oriented to the work area or shielded to minimize night light effects on recreational users.

SVR-5: The drilling equipment would be surrounded by tanks, compressors, a portable driller's office, large containers, and topography which may act as barriers to reduce noise levels.

Biological Resources

BR-1: At unoccupied drill sites that have open settling pits, substantial barriers such as cattle fencing would be used to prevent cattle and wildlife from entering.

BR-2: Sonoran Desert Tortoises would be avoided and not handled unless necessary. If encountered within or near a work zone and it is determined necessary to move them out of harm's way, the Arizona Game and Fish Department's *Guidelines for Handling Sonoran Desert Tortoises Encountered on Development Projects*, Revised October 23, 2007, would be followed.

BR-3: In the event that a Sonoran Desert Tortoise is injured, the Tonto National Forest's Minerals Biologist, Mark Taylor, would be contacted at (480) 610-3304 or (602) 225-2246.

BR-4: Project activities would comply with the *Biological Resources Monitoring Plan for Resolution Copper Mining, LLC Plan of Operations: Baseline Hydrologic and Geotechnical Data Gathering Activities on Tonto National Forest*, dated December 2015.

Cultural Resources

CR-1: Ground-disturbing activities would occur outside known NRHP sites and NRHP-eligible sites, and thus such sites would be avoided.

CR-2: A cultural resources monitor would be present during construction near (within 50 meters [164 feet]) NRHP- or NRH-eligible sites.

CR-3: Resolution would follow applicable laws and regulations regarding cultural resources while conducting Baseline activities (e.g., NHPA, Native American Graves Protection Act, and Archaeological Resources Protection Act).

CR-4: If previously unidentified cultural resources were encountered during construction activities, work would cease at the location and the Forest Service would be contacted for instruction before work would continue at that location.

Public Safety

PS-1: Public access to the Baseline activities areas would be managed during roadway improvements and maintenance. To the extent practicable, roadway activities in the Plan would be conducted in a manner that would allow continued use by the public.

PS-2: Signing for roadway access management would comply with the guidelines in the *Manual on Uniform Traffic Control Devices* (FSM 7103.3) for signs and markers.

Fire Prevention

FP-1: For fire prevention measures, the *2013 Fire Restriction Response Plan* (Appendix D of the Plan) would be posted and implemented at each drill site. The *2013Fire Restriction Response Plan* would be used in conjunction with any Forest Service issued Emergency Fire Restriction Orders.

FP-2: Resolution employees and its contractors would take care to thoroughly extinguish smoking materials. Litter would be cleared from ignition sources.

Hazardous Substances/Petroleum Products/Drilling Materials

HS-1: No extremely hazardous substances, as defined by the Comprehensive Environmental Response, Compensation, and Liability Act, Superfund Amendments Reauthorization Act, and Emergency Planning and Community Right-to-Know Act, would be used in the activities described in the Plan.

HS-2: Resolution would follow the Spill Prevention, Control, and Countermeasures (SPCC) Plan (Refer to Appendix F of the Plan). The SPCC Plan details engineering practices used to prevent releases when handling and storing petroleum products.

HS-3: At the active drill sites, containment structures would be used to store oil, oily rags, containers of hydraulic oil, diesel fuel, and other miscellaneous small containers typically found on drill sites.

HS-4: Fuel associated with drill rig and mud-mixing equipment would be held in double-walled fuel tanks or within secondary containment structures.

HS-5: Fire extinguishers would be stored in containment structures.

HS-6: Each active drill rig would maintain sufficient spill clean-up supplies for unforeseen releases.

HS-7: During drilling operations, drill rigs would be parked on top of plastic sheeting overlain by absorbent material. Plastic and absorbent materials would also be used under other gas or diesel motors, and other equipment that may leak oil, as needed.

HS-8: Refuse containers designated for disposal of absorbent materials would be located at each drill rig. This material would be disposed of off-site in accordance with applicable laws and regulations.

2.4 Alternatives Considered but Eliminated

Five action alternatives were developed based on scoping comments received. These alternatives were considered, but not carried forward for further evaluation. The rationale for not carrying these action alternatives forward for detailed analysis is provided below. Alternatives were reviewed to determine if they would meet the purpose of and need for the Baseline activities, were practicable and feasible, and whether they reduced environmental effects relative to the Baseline activities.

2.4.1 Drill Only During Daylight Hours Five Days a Week

This alternative was suggested during public scoping as a way to reduce the potential effects on wildlife, nearby residents, and recreationists from light and noise during Baseline activities. A schedule such as this would more than double the timeline (number of days) for active drilling. This schedule would also result in excessive periods where expensive equipment would sit idle. Lengthening the project timeline would result in increased water usage for dust control, increased traffic, and potentially create additional effects from overland vehicle and foot travel and other general human activity in the project area. This alternative was determined not to be reasonable, and would not reduce overall environmental effects. Therefore, this alternative was eliminated from further consideration.

2.4.2 Prohibit Baseline Hydrological and Geotechnical Data Gathering Activities in Sonoran Desert Tortoise Habitat

This alternative was suggested during public scoping as a way to reduce potential effects on Sonoran Desert Tortoise habitat. The majority of the project area is considered to be Sonoran Desert Tortoise habitat, and has been surveyed for Sonoran Desert Tortoise individuals and indicators of habitation. The results of those surveys and the potential effects on Sonoran Desert Tortoise are addressed in Chapter 3. Prohibiting Baseline activities in Sonoran Desert Tortoise habitat would preclude placement of most of the drill and trench locations resulting in a reduction of effects. However, this alternative was not considered in detail because it does not meet the purpose of and need for this project. It was therefore eliminated from further analysis.

2.4.3 Access by Helicopter

The use of helicopters was considered as an option to access geotechnical sites that would require additional road access through National Forest System lands based on public scoping comments. This alternative would involve conducting geotechnical drilling activities by using a helicopter to access geotechnical drill and test trench sites rather than accessing those sites via tracked rigs with short-term temporary access roads. Equipment and personnel would be transported to the sites by helicopter,

including drill rigs, fuel, water, and supplies. Cuttings, mud, and drill samples would then be removed from the sites by helicopter. Construction of helicopter staging areas would also be required.

The use of helicopters would be less efficient than use of short-term temporary access roads. It would take longer to collect a similar volume of information, requiring multiple helicopter trips, and more overall trips to transport equipment in and out of the sites. Construction of helicopter staging areas at each geotechnical drill and test trench site proposed along a short-term temporary access road would increase the amount of surface disturbance needed to collect data. Helicopter staging areas must meet certain conditions and therefore may not be at the same locations as the geotechnical drill and test trench sites. This would require additional travel between staging areas and Baseline activities sites in addition to the areas needed for staging associated with each site. These additional required actions associated with access by helicopter would extend the project time period. The use of helicopters would result in increased emissions from hydrocarbons, and increased noise, dust (which is much more difficult to control with helicopters than with surface vehicles), and visual effects to the public and recreational Forest users. Safety issues would also be a concern due to the proximity of geotechnical sites to existing roads, trails, and high-voltage power lines.

The use of helicopters does not offer overall reduced environmental effects because it would result in a more intrusive and longer-lasting Baseline activities, with few perceived benefits. Conversely, the short-term temporary access roads would be reclaimed immediately after use (Section 2.3.5), and access to wells for periodic monitoring would be on foot. Therefore, this alternative was eliminated from further consideration.

2.4.4 Add Additional Geotechnical Drill Sites for the Mescal Limestone, Escabrosa Limestone and Martin Formation

Additional geotechnical drill sites for the Mescal Limestone, Escabrosa Limestone, and Martin Formation are not necessary to meet the need of the Proposed Action. Resolution selected the locations for hydrological testing and monitoring wells, geotechnical borings, and trenches. Resolution developed the Plan which currently has four proposed hydrological testing and monitoring wells, DS-I, DS-J, DS-K, and DS-L, which will investigate the limestone sequences in the Apache Group (Mescal) and Paleozoic (Escabrosa, Naco and Martin) units in the project area.

2.4.5 Collect Additional Baseline Data at Other Locations

The planned EIS for the MPO may evaluate other potential locations for the TSF, and an alternative was considered that would require collection of similar baseline data at other locations in addition to the TSF location proposed by Resolution. This alternative was eliminated from detailed analysis, because it is necessary to analyze the data that would be collected in accordance with the Baseline Plan prior to assessing the suitability of the proposed TSF location. The Forest Service plans to conduct this analysis during preparation of the EIS for the MPO. Based on this analysis and consideration of issues identified through public scoping for the EIS, the Forest Service will evaluate whether alternative locations for the TSF should be considered.

2.5 Proposed Mitigation Measures

Mitigation includes specific means, measures, or practices that would reduce or eliminate effects of a proposed action, and may be used to reduce or avoid impacts to environmental resources. Mitigation measures typically address specific agency policies including BMPs, planning guidelines, or other resource specific recommendations. As part of the analysis conducted in Chapter 3, Mitigation Measures (MMs) were proposed to minimize or avoid impacts to resources specific to Baseline activities. Those MMs are listed below and discussed further in Chapter 3 under the appropriate resource. The effectiveness of these mitigation measures are also discussed in Chapter 3.

MM – 1: Wells located within a few hundred feet of drill pads, test trenches, construction laydown yards, roadway improvements, and short-term temporary access roads, would be flagged.

MM – 2: Settling pits would be lined if tanks are not used for short-term storage of the drill cuttings.

MM – 3: Saguaro, barrel, pincushion, hedgehog, ocotillo, and agave species would be avoided where practicable. If it is determined that any of these plants need to be moved to conduct Baseline activities, they would be transplanted away from project-related activities and would be used for reclamation efforts.

MM – 4: Seed mixes to be used in reclamation would be certified weed free of seeds listed on the Forest Service's noxious weed list, and contain only species native to the project area. Seed mixes will be developed from a native species seed list approved by the forest. Three re-seeding efforts will be conducted once annually and applied at a timeframe determined by the forest.

MM – 5: To the extent possible, Baseline activities would be scheduled to occur in areas that do not have established populations of invasive plant species prior to conducting activities in areas with existing, established populations of invasive plant species.

MM – 6: To minimize soil and noxious weed transport, equipment would be cleaned prior to use on National Forest System lands. Cleaning would remove dirt, plant parts, and material that could carry noxious weed seed. Only equipment cleaned and inspected would be allowed to operate in the project area.

MM – 7: Baseline activities would be restricted to approved activity areas to conserve intact Sonoran Desert Tortoise habitat.

MM – 8: Overhanging banks along drainages or side-slopes and/or rock out-crops would be avoided, as practicable to minimize disturbance to Sonoran Desert Tortoise habitat.

MM – 9: Pre-construction surveys would be conducted for Sonoran Desert Tortoise and Gila Monster before ground disturbing activities start. A biological monitor will monitor for Sonoran Desert Tortoise, Gila Monster, and migratory birds during construction and reclamation activities. The monitor will flag Desert Tortoise and Gila Monster shelter sites/burrows for avoidance by project activities. These flagged avoidance areas will be maintained as appropriate during construction. In the event a burrow cannot be avoided, it would be inspected and any tortoises discovered in the burrow would be relocated outside of project activity areas.

MM – 10: A biological monitor would inspect open pits or trenches for Desert Tortoise and Gila Monster prior to backfilling activities and would be responsible for relocating these species out of

harm's way. If a tortoise is detected, it would be moved following the Arizona Game and Fish Department's *Guidelines for Handling Sonoran Desert Tortoises Encountered on Development Projects*, Revised October 23, 2007.

MM – 11: Project crews would be informed of the potential to encounter Sonoran Desert Tortoises and Gila Monster within the project area. Work crews would check below equipment prior to moving, and cover and/or backfill holes that could potentially entrap these species. If these species are encountered, work crews would stop work until the biological monitor has relocated these species out of harm's way.

MM – 12: In the event that Baseline activities were modified in a manner that would result in an effect to a listed species or designated critical habitat, or if a new species was listed or critical habitat was designated which may be affected by Baseline activities, all work shall cease and consultation under Section 7 of the Endangered Species Act (ESA) with the United States Fish and Wildlife Service (USFWS) would be initiated.

MM – 13: To protect cultural resources, proposed geotechnical borings GT-9, GT-10, GT-11 and the associated temporary access routes would not be approved.

MM-14: To protect cultural resources, proposed geotechnical boring GT-31 would be moved 675 feet north along existing road FR 518.

MM-15: To protect cultural resources, proposed groundwater monitoring well DS-B would be moved 80 feet north.

MM – 16: Ensure construction and drilling equipment are properly maintained and feature, as appropriate, factory-installed or approved exhaust mufflers, air intake filters, hoods, enclosures, and other means to minimize noise from engine operation.

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CHAPTER 3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 Introduction

This chapter describes the affected environment (current conditions) and the environmental effects of the No Action and Proposed Action alternatives. The information used to develop this chapter was obtained from resource field studies of the area, publically available information sources, and communication with relevant government agencies and individuals with knowledge of the project area. Pursuant to direction found at 40 CFR §1500.1(b) and 1500.4, the discussions presented are focused on those issues significant to the action being proposed and deserving of study.

The affected environment is comprised of those areas in and adjacent to the project area that are likely to experience effects as a direct or indirect result of the No Action or Proposed Action alternatives. Each resource analyzed in this chapter may have different analysis areas in which the specific resource could be affected. In those analyses, an environmental effect is defined as any change from the present condition of any resource or resource use that may result as a consequence of the action. Effects include ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetics, historic, cultural, economic, social, and health, whether direct, indirect, or cumulative. Effects may also include those resulting from actions which may have both beneficial and detrimental effects; even if on balance the agency believes that the effect will be beneficial (40 CFR §1508.8).

Effects are analyzed by considering the impact of an action on a resource, as well as the impact of the action on a resource in combination with other projects or activities. For the environmental effects analyses, the following definitions of effects were applied (40 CFR §1508.7, 1508.8):

- Direct effects, which are caused by an action and occur at the same time and place.
- Indirect effects, which are caused by an action and are later in time or farther removed in distance, but are still reasonably foreseeable.
- Cumulative effects, which result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions.

An example of a direct effect on soils associated with the Proposed Action would include the excavation of soil to build a drill site. Similarly, an example of an indirect effect would be the potential establishment of an invasive plant species in an area that had been reclaimed after the project had concluded.

The analyses also consider the timeframe over which effects would occur. For the purpose of these analyses, the effects are described in terms of their expected duration, which refers to the permanence and longevity of the impacts. Duration of effects is considered within the following time frames (where applicable to the resource):

- Temporary effects occur during construction and installation, maintenance, and/or decommissioning and persist for less than or equal to two years.
- Short-term effects persist up to five years after disturbance concludes.
- Long-term effects persist for more than five years after disturbance concludes, and continue for a reasonable period after reclamation.

3.1.1 Applying the Forest Plan

As described in Section 1.3, the project area is administered by the Globe and Mesa Ranger Districts of the Tonto National Forest and management activities are addressed in the Forest Plan. As discussed in Section 1.7, the Forest Plan describes management actions that include standards, guidelines, goals, and objectives to achieve resource protection, desired resource conditions, and the availability and suitability of lands for various activities in the Forest (U.S. Forest Service, 1985). Forest-Wide Management Principles apply to all management areas. Forest Plan Management Areas 2F and 3I contain specific direction for the Globe Ranger District and Mesa Ranger District, respectively. For each resource described in Chapter 3, the applicable Forest Plan standards are described and used for assessing potential impacts on that resource. Both ranger districts' Forest-Wide Management Area level standards were considered.

3.2 Cumulative Effects Analysis

A cumulative effect is defined as follows:

> *Cumulative impact is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR §1508.7).*

A cumulative effects analysis considers the cumulative effects of other past, present or reasonably foreseeable future actions, and evaluates whether addition of the incremental effect of the proposed action would trigger a resource to exceed a potential threshold of significance such as violation of a state or federal law imposed for protection of the environment, an adverse effect to sites listed in or eligible for listing on the National Register of Historic Places, or an adverse effect to threatened or endangered species.

Cumulative effects are evaluated in terms of the specific resource, ecosystem, and human community being affected. A cumulative effects analysis boundary is delineated to prevent dilution of the cumulative effects over large areas. Guidance from the CEQ's *Considering Cumulative Effects under the National Environmental Policy Act* was used in identifying geographic and temporal boundaries (Council on Environmental Quality, Presidents Office, 1997). Analysis of the Proposed Action, along with external, public scoping, and internal scoping comments, provided the foundation for identifying the boundaries of the cumulative effects area, and identifying other actions that could lead to cumulative effects. Figure 3-1 shows the cumulative effects assessment area and location of reasonably foreseeable actions which are independent of the Proposed Action.

The geographic cumulative effects boundary is appropriate for the assessed resources because it incorporates areas potentially affected by the Proposed Action. The area evaluated considers potential effects on resources from the Proposed Action to the extent where impacts become non-measureable. The cumulative effect assessment area for most resources includes the Queen Creek watershed upstream of Whitlow Ranch Dam and north of U.S. 60 along with an area south of U.S. 60 in the Oak Flat-Upper Queen Creek subwatershed east of Apache Leap (Figure 3-1). The cumulative effects assessment area comprises 59,006 acres (approximately 92 square miles) including 55,727 acres of Forest Service land; 167 acres of Bureau of Land Management land; 66 acres of state land; and 3,046 acres of private land.

The cumulative effects analysis area is different for noise and climate change as described in Sections 3.14 and 3.15. The cumulative effects analysis area for noise is a 0.5-mile buffer around the project area. This area was chosen for the analysis because noise-related impacts from the Proposed Action when combined with present and reasonably foreseeable activities would not have a detectable effect more than 0.5-mile from the project area. Climate change is not spatially bound and cumulative effects would likely extend beyond the analysis area shown on Figure 3-1.

Cumulative effects are assessed in terms of how the impacts from the alternative would add to impacts of other past, present, and reasonably foreseeable future actions. United States Environmental Protection Agency (EPA) guidance (*Consideration of Cumulative Impacts in EPA Review of NEPA Documents)* also recommends taking the scale of the Proposed Action into account when assessing cumulative effects:

> *… small scale projects that have minimal impacts that are of short-duration would not likely contribute significantly to cumulative impacts" (EPA, 1999).*

The contribution of past and present actions on the environment has been taken into account in the existing environmental condition descriptions (affected environment). Existing conditions reflect the aggregate impact of all prior and ongoing human actions and natural events that have affected the environment, and serve as the baseline for analyzing the effects of future actions.

The temporal boundary of cumulative effects is also considered when determining appropriate reasonably foreseeable future actions. EPA guidance states:

> *Determining the temporal scope requires estimating the length of time the effects of the proposed action will last. More specifically, this length of time extends as long as the effects may singly, or in combination with other anticipated effects, be significant on the resources of concern" (EPA, 1999).*

When reviewing projects to be included in the cumulative effects discussion, projects that were included were determined to overlap in time and space pursuant to CEQ and EPA guidance. For example, the Mesa Vegetation Regeneration and Habitat Improvements project (Table 3-1) was determined to have both geographic and temporal overlap because a portion of the Mesa Vegetation Regeneration and Habitat and Improvements project is located within the Baseline project area (Figure 3-1). It is also possible that implementation of the Mesa Vegetation Regeneration and Habitat and Improvements project could overlap in time with the Baseline project and therefore has the potential to contribute to the cumulative effect of the alternatives.

Table 3-1 presents information on the reasonably foreseeable actions that may have a cumulative effect on resources because they are expected to have direct or indirect effects which overlap in time and space with the Proposed Action. The locations of these projects are shown on Figure 3-1, to the extent possible. These projects are included because, when combined with the Proposed Action or No Action alternative, there could be a discernable effect on resources and/or Forest management. CEQ (1997) guidance states:

> *For cumulative effects analysis to help the decision maker and inform interested parties, it must be limited through scoping to effects that can be evaluated meaningfully.*

If the Proposed Action does not result in direct or indirect impacts on a resource or Forest Management Area, it would not contribute to a cumulative effect on that resource.

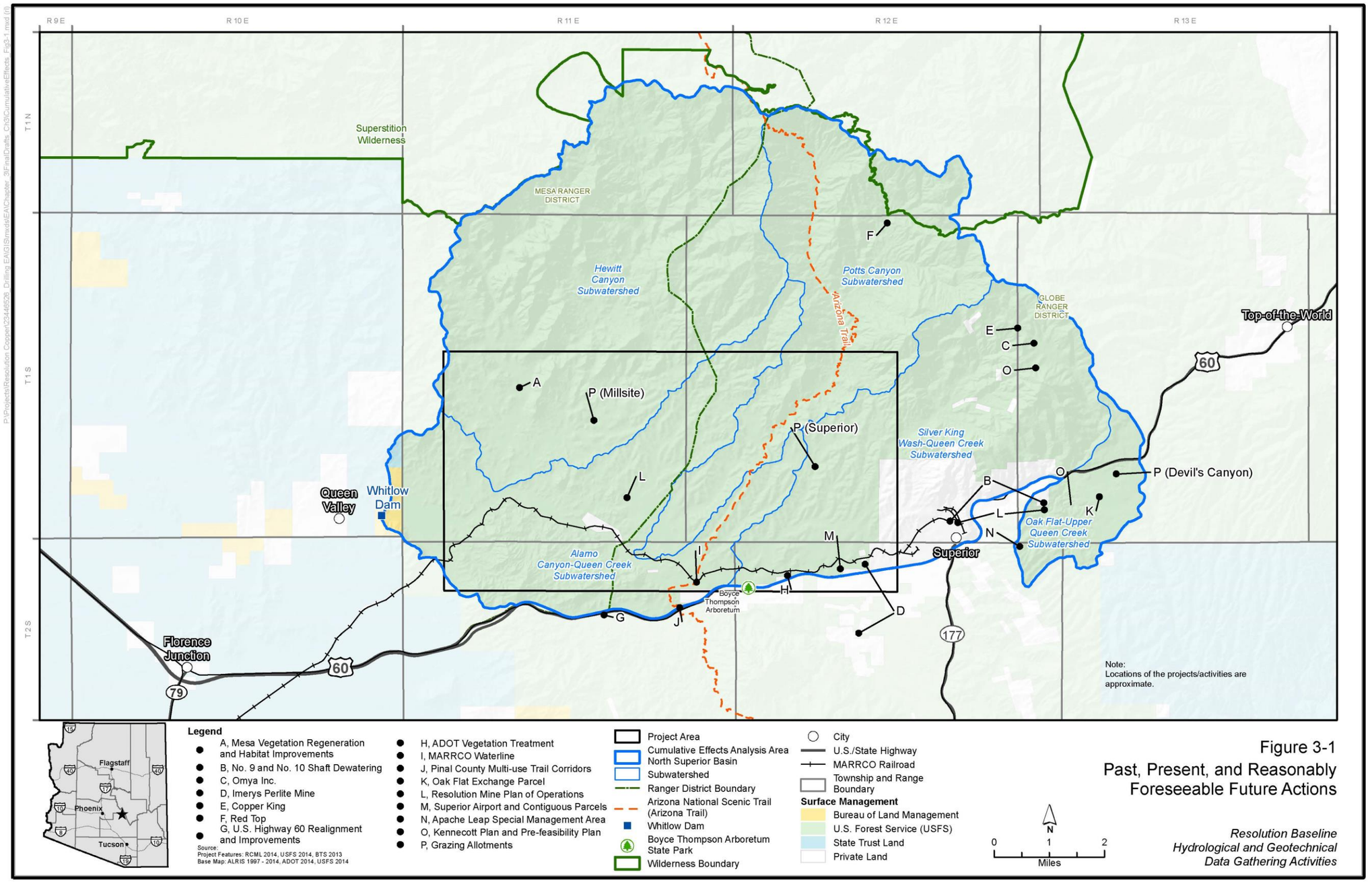

Figure 3-1
Past, Present, and Reasonably Foreseeable Future Actions

Resolution Baseline Hydrological and Geotechnical Data Gathering Activities

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Table 3-1. Projects Included in the Cumulative Effects Analysis

Project or Activity Name	Activity or Project Type	Spatial Relationship to the Proposed Action	Resources with Potential Cumulative Effects
Vegetation Management			
Mesa Vegetation Regeneration and Habitat Improvements	The purpose of this project is to re-vegetate and make improvements to areas on the Mesa Ranger District that are primarily used for off-highway vehicle (OHV) recreation. The re-vegetation of approximately 30 acres in areas along heavily used forest roads improves wildlife habitat by constructing barriers along FRs 143 and 401, and constructing vehicle enclosures in Sycamore Creek, Mesquite, and Hewitt Station.	FR 172, FR 357, FR 1857 rehabilitation corridors, and OHV staging areas. See A on Figure 3-1.	Water, soils, vegetation, noxious weeds and invasive species, wildlife, range, cultural, recreation, visual, air quality, and noise.
Range			
Rangeland Improvements	Three livestock water developments on the Millsite grazing allotment. The Environmental Quality Incentives Program funded developments consist of pumping water from two existing windmills and a private well to three new water storage tanks and then conveying the water to two new troughs.	The proposed rangeland improve-ments are within the Millsite allotment, which overlaps the western portion of the project area.	Water, soils, vegetation, noxious weeds and invasive species, range, travel management, visual, air quality, and noise.
Grazing Allotments	On-going use of grazing allotments (Millsite, Superior, and Devil's Canyon)	Millsite and Superior are within the Project area. Devil's Canyon is within the cumulative effects analysis area. See P on Figure 3-1	Water, soils, vegetation, noxious weeds and invasive species, range, travel management, and air quality.
Mineral Development			
Plan of Operations for Kennecott Exploration's Resolution Project	Kennecott Exploration, a subsidiary of Rio Tinto, was authorized to conduct exploration drilling. This Plan of Operations was approved in 2001 with amendments in 2001, 2002, 2003 and 2004.	Oak Flat Upper Queen Creek Subwatershed. See O on Figure 3-1.	Water, soils, vegetation, noxious weeds and invasive species, wildlife, recreation, travel management, visual, and air quality.
Resolution Pre-Feasibility Activities, Approved Plan of Operations	Resolution was authorized in May 2010 to gather and evaluate geologic, geotechnical, and hydrologic data to support pre-feasibility studies for exploration of a deep copper ore deposit.	FR 2458 and Oak Flat Upper Queen Creek Subwatershed. See O on Figure 3-1.	Water, soils, vegetation, noxious weeds and invasive species, wildlife, recreation, travel management, visual, and air quality.
Resolution General Plan of Operations (MPO)	The MPO proposed to develop an underground copper mine with associated surface facilities on both private and National Forest System lands.	Overlap with project features including the proposed tailings storage facility, West Plant site, East Plant site, Magma Arizona Railroad Company (MARRCO) corridor, and tailings pipeline corridor. See L on Figure 3-1.	Water, soils, vegetation, noxious weeds and invasive species, wildlife, recreation, visual, cultural, travel management, range, air quality, and noise.

Table 3-1. Projects Included in the Cumulative Effects Analysis

Project or Activity Name	Activity or Project Type	Spatial Relationship to the Proposed Action	Resources with Potential Cumulative Effects
No. 9 and No. 10 Shaft Dewatering	Resolution drains water from the No. 9 shaft into the No. 10 shaft where it is combined with water from the No. 10 shaft and then pumped via tunnel to a water treatment facility on Resolution's West Plant Site (then conveyed via the MARRCO water line, as described below). The water is pumped at an approximate rate of 1,000 gallons per minute (gpm).	Water treatment occurs at Resolution's West Plant Site, just west of the Town of Superior. See B on Figure 3-1.	Water.
Omya Inc.	Omya Inc.'s Superior Limestone Quarry, of which approximately 75 acres occurs on National Forest System lands, is currently being administered under an Interim Management Plan, and is in "Temporary Shutdown" status until February 28, 2016 (Besich-Lira, 2013).	FR 2458 and FR 342 cross Queen Creek. See C on Figure 3-1.	Water, soils, range, travel management, recreation, visual, and air quality.
Imerys Perlite Mine	Imerys Performance Minerals' proposed action would consolidate previous Plan of Operations and Special Use Permit authorizations, including continued operation of the existing sedimentation basin; use of segments of FR 229, FR 989, and FR 2403 for hauling; and mining at two unpatented claims.	U.S. 60, FR 989, and FR 2403 are used to access the mine and FR 229 is used to access the mill site. See D on Figure 3-1.	Water, soils, travel management, recreation, visual, and air quality.
Copper King	Proposed mineral exploration project.	The proposed project is located on the eastern edge of Silver King Wash-Queen Creek Subwatershed. FR 650 is used for access. See E on Figure 3-1	Water, recreation, travel management, visual, and air quality.
Red Top	Proposed mineral exploration project.	The proposed project is located in Potts Canyon Sub-watershed. FR 650 is used for access. See F on Figure 3-1.	Recreation, travel management, visual, and air quality.
Transportation and Access			
Travel Management Planning	The Forest is in the process of implementing the Travel Management Rule which calls for establishing a system of roads, trails, and areas designated for motorized vehicle use and determining suitable locations for dispersed camping.	Travel management decisions may apply to roads in the project area.	Water, soils, vegetation, noxious weeds and invasive species, wildlife, recreation, air quality, and visual.
Arizona Department of Transportation (ADOT) U.S. 60 Realignment and Improvements	ADOT improvements planned along U.S. 60 from Florence Junction to Globe include construction of new eastbound lanes between Reymert Wash and Queen Creek and a new bypass north of the Boyce Thompson Arboretum. This project also includes relocation of a natural gas pipeline parallel to U.S. 60.	Use of U.S. 60 and FR 357 could overlap with the project area. See G on Figure 3-1.	Soils, vegetation, noxious weeds and invasive species, wildlife, cultural, travel management, recreation, visual, air quality, and noise.
ADOT Vegetation Treatment	ADOT plans to conduct annual treatment programs, using EPA approved herbicides to contain, control, or eradicate noxious, invasive, and native plant species that pose safety hazards or threaten native plant communities on road easements and National Forest System lands up to 200 feet beyond the road easement on the Forest.	Proposed vegetation treatments along U.S. 60 could overlap with the project area. See H on Figure 3-1.	Soils, vegetation, noxious weeds and invasive species, travel management, recreation, visual, air quality, and noise.

Table 3-1. Projects Included in the Cumulative Effects Analysis

Project or Activity Name	Activity or Project Type	Spatial Relationship to the Proposed Action	Resources with Potential Cumulative Effects
Land Use			
MARRCO Waterline	Resolution has constructed a water pipeline within the MARRCO right-of-way (ROW) to transport water collected from the No. 9 Shaft and treated at an existing water treatment facility on Resolution's property to an irrigation canal operated by New Magma Irrigation and Drainage District near Florence, Arizona (Dentzer, 2012).	Use of FR 357 for waterline maintenance and operation could overlap with the project area. See I on Figure 3-1.	Soils, vegetation, noxious weeds and invasive species, travel management, recreation, and visual.
Land Exchange	Federal Parcel – Superior Airport Contiguous Parcels; Action is speculative - may be purchased by the Town of Superior;	Adjacent to existing Superior airport – partially within cumulative effect analysis area, south of U.S. 60. See M on Figure 3-1.	No environmental effects from administrative change in land ownership.
Land Exchange	Federal Reversionary Interest – Superior Airport; Action is speculative - may be purchased by the Town of Superior	Includes existing Superior airport – partially within cumulative effect analysis area, south of U.S. 60. See M on Figure 3-1.	No environmental effects from administrative change in land ownership.
Land Exchange	Federal Parcel – Oak Flat	Adjacent to East Plant Site. See K on Figure 3-1.	No environmental effects from administrative change in land ownership (proposed mining effects addressed in Mineral Development Section of this table).
Land Exchange	Apache Leap Special Management Area – Section 3003 of P.L. 113-291 requires establishment of Apache Leap Special Management Area	East of Superior – partially within cumulative effect analysis area. See N on Figure 3-1.	Unknown - No formal proposal exists for Apache Leap Special Management Area
Recreation			
Pinal County Multi-use Trail Corridors	Trail corridors have been established to link existing trail networks, such as the Arizona National Scenic Trail, within and adjacent to the county to provide a regionally-connected trail system using existing public infrastructure. U.S. 60 is a potential connection to Gila County as a multi-use, non-motorized trail. In addition, a proposed looping OHV trail corridor is proposed to parallel a portion of U.S. 60.	Parallel to U.S. 60 corridor from Florence Junction to Gila County, which could overlap with the project area. See J on Figure 3-1.	Soils, vegetation, noxious weeds and invasive species, travel management, recreation, visual, and noise.
Safety Hazard Remediation			
Abandoned Mine Lands Remediation Project	Closure of small abandoned mines using methods that may include backfill, polyurethane foam and backfill, and bat-friendly grates or cupolas.	Closure locations being identified and may be located within the project area.	Wildlife, cultural, recreation, and travel management.

3.2.1 Development of the Deep Copper Ore Body

In response to comments on the Preliminary EA, development of Resolution's deep copper ore body has been added as a reasonably foreseeable future action for the cumulative effects analysis, because Resolution Copper has submitted a proposed plan of operations for the project. Approval of the proposed *Resolution Copper General Plan of Operations* (RCM, 2013) generally referred to as the Mine Plan of Operations (MPO), will be addressed in a subsequent EIS. In the EIS for the MPO, alternatives may be developed that do not conform to the proposed facilities and disturbance figures presented in the MPO. So, while development of Resolution's deep copper ore body is reasonably foreseeable, some of the features (e.g. the tailings storage facility) may ultimately be in a different location, configured differently, or constructed with a different process. Accordingly, there is a high degree of uncertainty in the geographic location and configuration of the proposed facilities.

Resolution's MPO also includes a schedule for approval of the MPO by the Forest Service and development of the deep copper ore body. This proposed schedule includes approximately five years for NEPA analysis of the proposal and issuance of a Record of Decision (ROD). This schedule is uncertain, because NEPA analyses and subsequent issuance of RODs for similar large scale mining proposals on National Forest System lands have required substantially more time. For example, completion of the Rosemont Copper EIS on Coronado National Forest required seven years (starting in 2007), and the ROD has not yet been issued. Similarly, completion of the EIS for the proposed Montanore Mine on Kootenai National Forest required eleven years (starting in 2004), and the ROD has not yet been issued. Accordingly, it is possible that completion of the EIS and issuance of a Record of Decision for the MPO may take longer than the five-year period proposed in the MPO. This would reduce the potential for overlap in time between the projects, and decrease the potential for cumulative effects.

Although the geographical location, final configuration and schedule for MPO activities is uncertain, it is necessary to evaluate the potential overlap in time and space of the MPO and Baseline activities to facilitate cumulative effects analysis for the Baseline EA. To be conservative, the Forest Service has assumed that the facility location and configuration will be as proposed in the MPO, and that the EIS and ROD will be completed in five years. Based on these assumptions, there is potential overlap in time and space between activities included in the Proposed Action and in the MPO.

To evaluate potential overlap in time or space of the Proposed action with development of Resolution's deep copper ore body, a comparison of scheduled activities for both projects was prepared, assuming that implementation of the Proposed Action and the MPO NEPA process begin at approximately the same time (i.e. the EIS for the MPO commences at the same time that Baseline activities begin). The locations of the proposed mine facilities were plotted in relationship to the cumulative affects analysis area (Figure 3-1) to determine which facilities overlap in space. To determine temporal overlap, the MPO permitting, construction, and operation schedule were compared with the 10-year schedule for the Proposed Action. This information was used in analyzing cumulative effects in the resource sections that follow.

3.3 Water Resources

This section describes existing conditions and potential effects on water resources, including aquifers, water wells, springs, watersheds, streams, and water quality. Existing conditions have been characterized based on a review of data from the U.S. Geological Survey (USGS) and ADWR, as well as the 2012/2014 Arizona Integrated 305(b) Assessment and 303(d) Listing Report (Sutter, Condon, & Bierly, 2014), the Queen Creek Corridor Survey (Montgomery & Associates, 2013), and other published data and reports.

3.3.1 Regulatory Framework

The regulatory framework for surface water resources is established by the Clean Water Act (CWA) and ARS Title 49. The CWA (33 United States Code [U.S.C.] Section 1250 et seq.) is the foundation for surface water quality protection. The objective of the CWA is to restore and maintain the chemical, physical, and biological integrity of domestic waters (i.e., waters of the U.S.). The CWA provides that states may receive delegated authority for controlling point and non-point source water pollution, designating uses for surface water bodies within state boundaries, and adopting water quality standards to protect those designated uses. Section 402 of the CWA established the National Pollutant Discharge Elimination System (NPDES) program, which prohibits point source discharge of pollutants to waters of the U.S. unless authorized by an NPDES permit. Effective December 2002, the EPA delegated implementation of the NPDES program to the state of Arizona. The ADEQ administers both individual and general AZPDES in accordance with ARS Title 49-255. The general permit known as the Arizona Construction General Permit (CGP) authorizes storm water discharges for multiple types of facilities without requiring site-specific applications for individual AZPDES permits. In order to obtain coverage under the CGP, an operator must submit a Notice of Intent and prepare a site-specific SWPPP.

Groundwater in the project area is regulated by the state of Arizona. The ADWR regulates and manages groundwater quality and quantity to ensure a long-term, sufficient, and secure water supply. Under ARS Title 45, portions of the state have been designated "Active Management Areas" (AMA) for groundwater. In an AMA, groundwater rights and uses are regulated because of a history of groundwater overdrafts (Holub, 2014). The project area is located in the Phoenix AMA (ADWR, 2010). The state of Arizona regulates well construction under AAC Title 12, Chapter 15, Article 8. These regulations outline minimum construction standards for monitoring wells and specify proper methods for well abandonment.

The Forest Plan establishes practices and guidelines for the long-term management of National Forest System lands. Protection of groundwater and surface water resources for this project would be achieved by following the Forest Plan guidance. Several Forest-Wide Management Prescriptions have been established for water resources, including guidelines to minimize effects on water resources from ground-disturbing activities, improve watershed conditions, and avoid disturbance of stream channels to minimize effects on riparian vegetation (U.S. Forest Service, 1985).

3.3.2 Existing Conditions

Climate

The climate of the project area is characterized as arid to semi-arid, with summer temperatures exceeding 100°F at lower elevations, and winter temperatures occasionally dropping below freezing. Precipitation typically occurs in two seasons, with strong, short-duration thunderstorms during July through September,

and longer-duration storms of moderate intensity during November through March. Annual precipitation in the project area varies by elevation from about 12 to 20 inches per year (ADWR, 2010). However, since 1995, the region has been in a prolonged drought with average annual precipitation of 15.8 inches, which is approximately 3.5 inches below the long-term average (Montgomery & Associates, 2013).

Groundwater Resources

The analysis area for groundwater resources is the Superior Basin north of Queen Creek (Figure 3-1). Named for the Town of Superior, the Superior Basin is formed by a large eastward-tilting fault block that is bounded to the west and east by two large regional faults – the Elephant Butte fault and the Concentrator fault (Figure 3-2). The western part of the basin is dominated by an extensive outcrop belt of low permeability Pinal Schist, while the eastern basin is filled with a sequence of generally eastward-dipping rock layers including younger Precambrian and Paleozoic sedimentary rocks, and Tertiary volcanic rocks and basin-fill sediments. Quaternary floodplain alluvium occurs along the modern drainages in the basin, including Queen Creek. Rocks of the Superior Basin generally yield small amounts of groundwater to wells, with the exception of wells completed in the floodplain alluvium (Montgomery & Associates, 2013). Tertiary volcanic rocks may yield moderate amounts of water to wells in some areas. Groundwater effects from the Proposed Action would not extend into the southern Superior Basin (south of Queen Creek) due to the groundwater discharge zone present along Queen Creek.

The youngest water-bearing interval in the Superior Basin is Quaternary alluvium associated with the modern floodplains of Queen Creek and its tributaries. The floodplain alluvium comprises unconsolidated sand and gravel with some finer-grained sediments. The floodplain alluvium has moderate-to-high permeability, and, where saturated, represents the most productive aquifer in the Superior basin. The floodplain alluvium receives recharge predominantly from infiltration of surface water runoff. In Queen Creek, downstream from the Town of Superior, the floodplain alluvium also receives recharge effluent from the Superior wastewater treatment plant (Figure 3-3) and from dewatering pumping at the Imerys Perlite Mine. Downstream from the U.S. 60 bridge crossing near the Boyce Thompson Arboretum, the thickness of the alluvium is generally 30 to 40 feet or less (Montgomery & Associates, 2013).

The Superior Basin also contains Tertiary basin fill deposits ("Tsy" on Figure 3-2) that may yield some water to wells. The basin-fill deposits are predominately Tertiary conglomerate composed of gravel and sub-rounded cobbles to boulders with minor amounts of fine-grained material. Large clasts within the conglomerate are derived from source rocks in the mountainous upland areas, including Pinal Schist, the Apache Group, Paleozoic carbonate and clastic strata, and Tertiary volcanic rocks. The permeability of the Tertiary conglomerate is generally low due to its poor sorting and high degree of consolidation. However, several wells in Queen Valley derive water from the Tertiary basin fill conglomerate, indicating that the formation may contain localized zones of higher permeability (Montgomery & Associates, 2013).

The Tertiary basin fill deposits are underlain by the Tertiary Picket Post volcanic unit ("Tv" on Figure 3-2). This volcanic unit occurs at shallow depths throughout the Superior Basin and consists of tuffs, felsic lava flows, and basalts. In the Superior area, the volcanic unit is inter-bedded with the Tertiary basin fill. The permeability of the volcanic unit is generally low except where it is extensively fractured.

The Tertiary Apache Leap tuff constitutes another potential water-bearing interval within the Superior Basin. The tuff crops out in the Oak Flat Campground Withdrawal area east of Superior, but is buried below ground surface throughout most of the Superior Basin due to displacement along the Concentrator fault. A cross-section prepared by Montgomery & Associates (2013) shows that the tuff is present at depth beneath the Tertiary conglomerate and Picket Post volcanic unit on the eastern side of the basin. It also crops out in isolated areas near the western basin margin. The Apache Leap tuff consists of massive, pinkish-gray, moderately to strongly welded crystal-rich ash-flow tuff. It typically has low primary permeability, but may produce water through secondary porosity in the form of fracture networks.

Outflows from the groundwater system in the Superior Basin primarily occur through evapotranspiration, groundwater pumping, and groundwater discharge. A potentiometric surface map for basin (Montgomery & Associates, 2013) shows that groundwater primarily flows to the west, with the main discharge area concentrated around Queen Creek. Groundwater discharge exits the Superior Basin at Whitlow Ranch Dam, where underflow in the floodplain alluvium is forced to the surface and flows through a culvert at the base of the dam. Although a small amount of groundwater may bypass the dam by moving through fractured rock beneath and adjacent to the alluvium, the permeability of these rocks is likely small; thus, the dam effectively acts as the principal groundwater discharge point for the entire Superior Basin.

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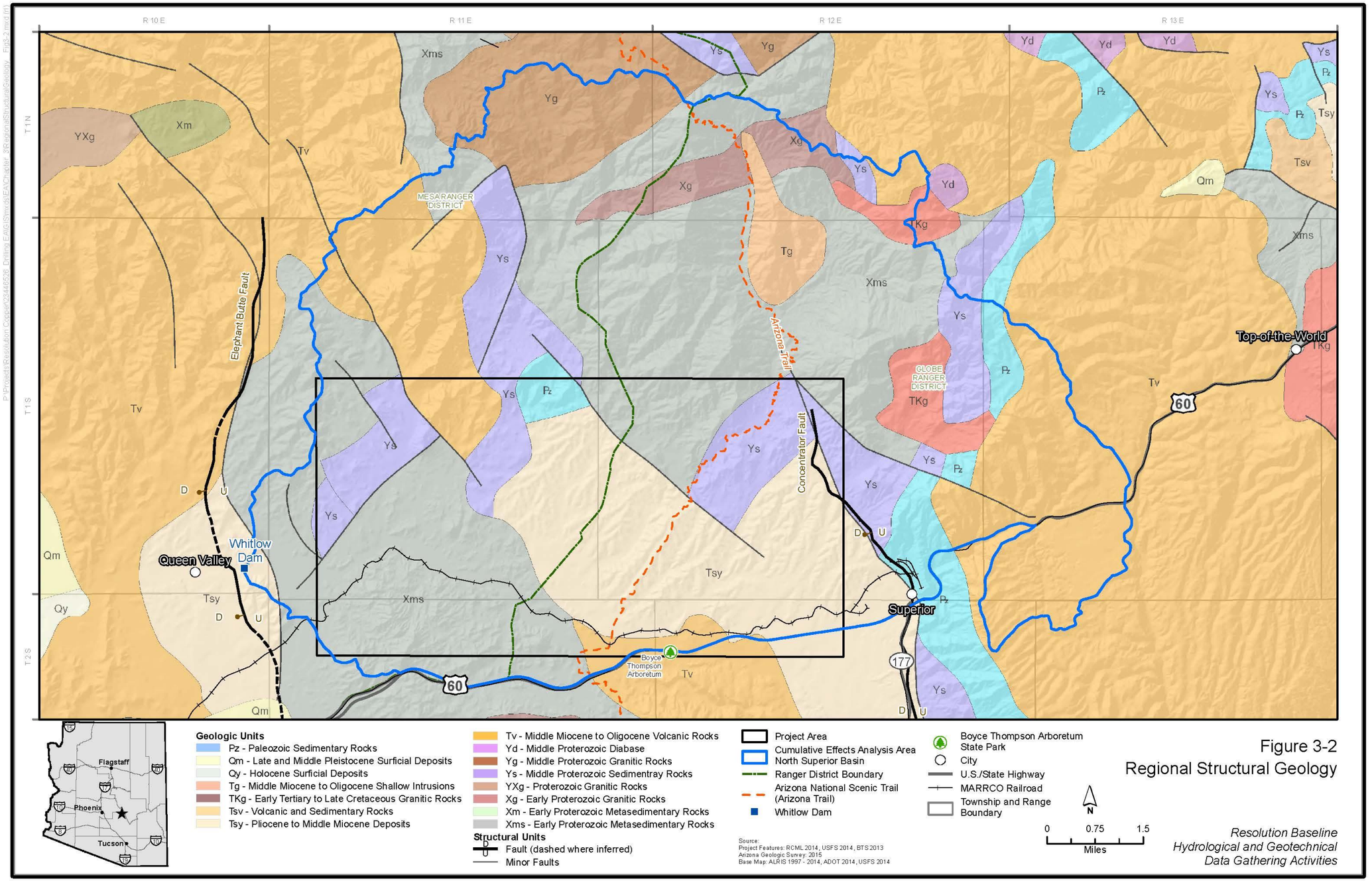

Figure 3-2
Regional Structural Geology

Resolution Baseline Hydrological and Geotechnical Data Gathering Activities

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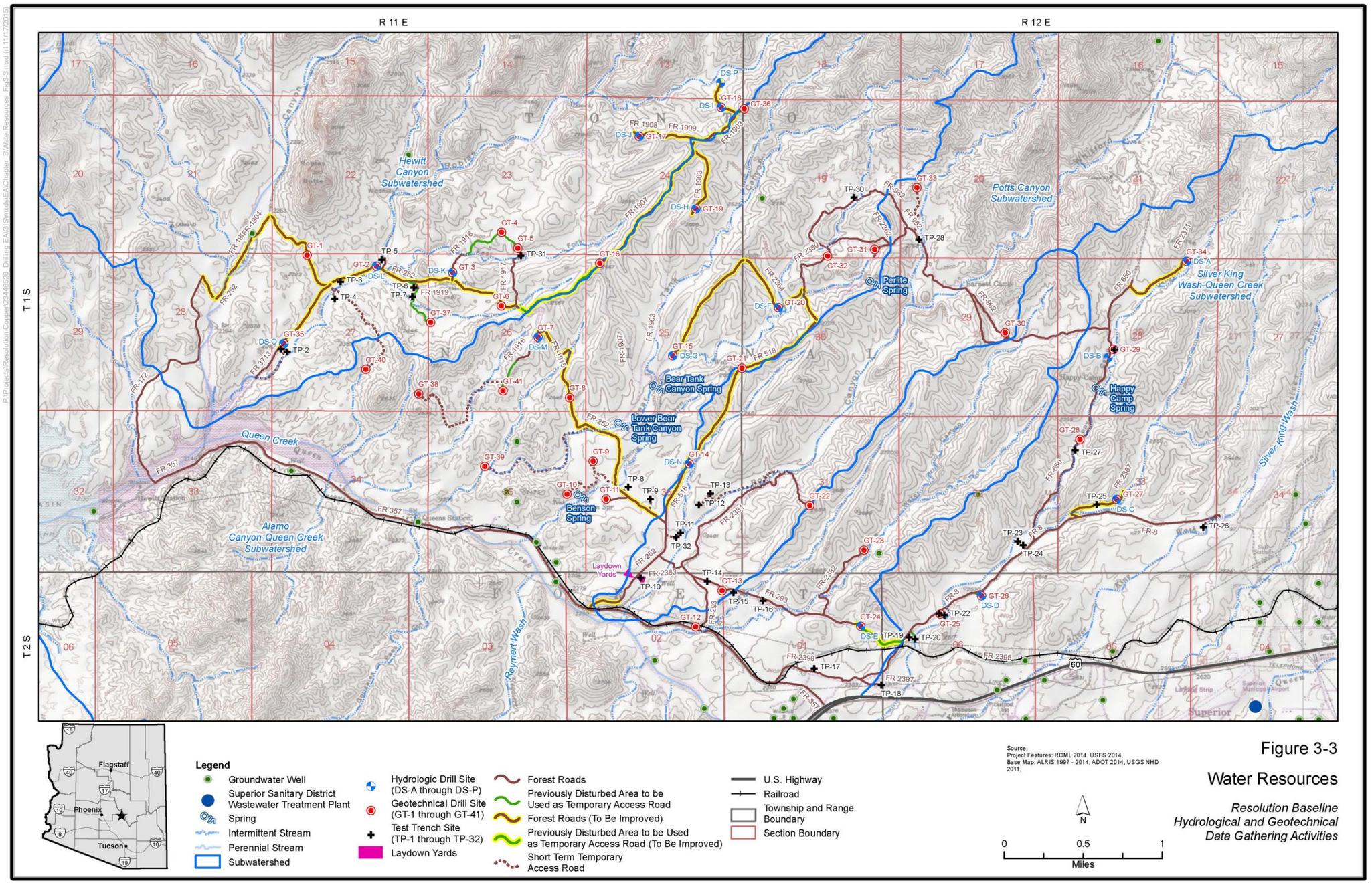

Figure 3-3

Water Resources

Resolution Baseline Hydrological and Geotechnical Data Gathering Activities

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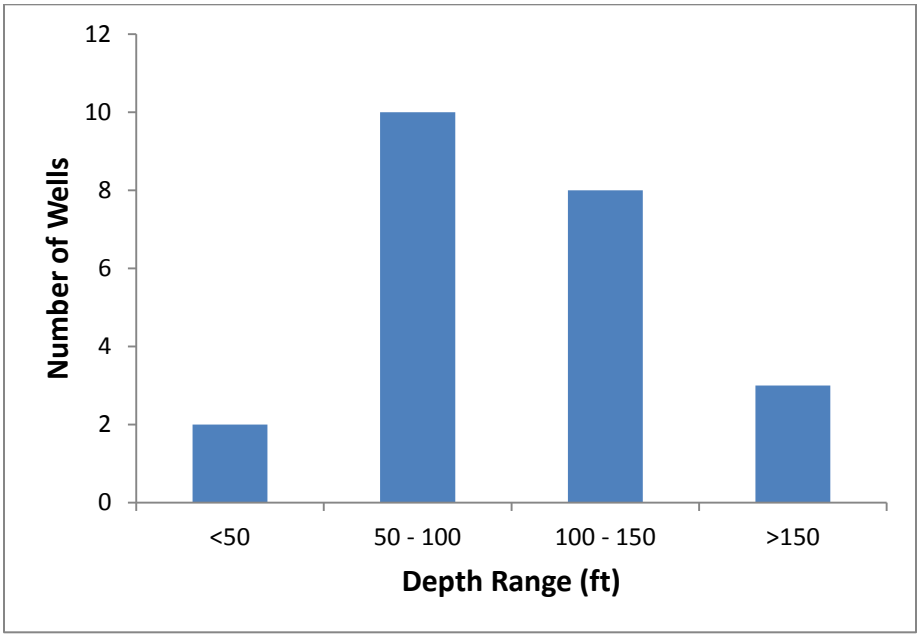
There are also several springs within or in the vicinity of the project area, including Bear Tank Canyon Spring, Benson Spring, Happy Camp Spring, Lower Bear Tank Canyon Spring, and Perlite Spring (Figure 3-3). Many of these springs are located in valleys near existing forest roads.

A review of Arizona's Wells-55 database (ADWR, 2014) indicates that there are approximately 35 registered water wells within the project area footprint. Figure 3-4 shows the distribution of depths for wells with depth information recorded in the database. The majority of wells have depths ranging from 50 to 150 feet below ground surface.

Figure 3-4. Distribution of Well Depths in the Project Vicinity



Based on information contained in the Wells-55 database, depth to groundwater in the project area ranges from about 10 to 200 feet below ground surface. Over half of the recorded water level depths fall between 35 and 50 feet. The median depth to water among wells with water level records is 42 feet below ground surface. Seventeen of the 35 well records in the Wells-55 database also include the flow rate that the well was pumped at following installation. The pumping records show that well yields from the basin fill aquifer are highly variable, ranging from 5 to 500 gpm. The median tested pumping capacity is 25 gpm.

Site-specific water quality information is not readily available. In general, groundwater within the aquifers of the Basin and Range Province contains total dissolved solids concentrations below 1,000 milligrams per liter, except where the groundwater is influenced by evaporites (Robson & Banta, 1995). Although the Superior Basin was not specifically evaluated, a groundwater quality study of several alluvial basins in south-central Arizona found a calcium-bicarbonate groundwater signature for other similar basins in the area (Gellenbeck & Coes, 1999).

Surface Water Resources

The analysis area for surface water is the same as the groundwater analysis (i.e., the Superior Basin north of Queen Creek). This area is located in the Middle Gila River watershed (Hydrologic Unit Code

15050100) (U.S. Geological Survey, 2014a) and is drained by Queen Creek, a tributary of the Gila River. Queen Creek originates near Fortuna Peak and flows west from the Town of Superior before exiting the Superior Basin at Whitlow Ranch Dam. The creek is typically intermittent throughout its mountainous headwaters, although small reaches of perennial flow exist in the basin near Picketpost Mountain and the Boyce Thompson Arboretum (Brown, Carmony, & Turner, 1981) (ADWR, 2010). A portion of the perennial flow is likely sustained by permitted discharges from the Superior wastewater treatment plant and the Imerys Perlite Mine (Montgomery & Associates, 2013). Downstream of Whitlow Ranch Dam, Queen Creek becomes a typical desert wash, continuing in a westerly direction across the desert lowland in a broad, well-defined channel. Any surface water flow that passes through the dam typically percolates into the stream alluvium within a few miles downstream of the dam location.

The USGS and U.S. Army Corps of Engineers maintain a gaging station on Queen Creek downstream of Whitlow Ranch Dam. From 2003 to 2013, the monthly flow rate at that station averaged 6.9 cubic feet per second (U.S. Geological Survey, 2014b). The highest flow rate on the creek typically occurs during the winter in January, February, and March, with the flow steadily decreasing throughout the spring until the onset of summer thunderstorms in July and August. The lowest flows in the creek typically occur in October and November.

The project area is also drained by several intermittent tributaries to Queen Creek, including Hewitt Canyon, Roblas Canyon, Bear Tank Canyon, Benson Spring Canyon, Potts Canyon, Rice Water Canyon, Happy Camp Canyon, and Silver King Wash (Figure 3-3). These tributaries flow southwest from their mountainous headwaters before joining Queen Creek near the central axis of the Superior Basin. Bear Tank Canyon, Benson Spring Canyon, and Happy Camp Canyon contain springs that occur at topographic breaks within the canyons.

In the project area, Queen Creek and several of its tributaries do not meet state surface water quality standards for their designated use, and are listed as impaired due to elevated dissolved copper concentrations. The copper impairment applies to the entire reach of Queen Creek from its headwaters downstream to Whitlow Canyon. The segment of Queen Creek above the Town of Superior wastewater treatment plant is also listed as impaired for total lead and selenium concentrations on the 2012/2014 Arizona 303(d) Impaired Waters List (Sutter, Condon, & Bierly, 2014).

3.3.3 Environmental Consequences

3.3.3.1 Methodology

The following sections describe potential environmental effects of the No Action alternative and Proposed Action on water resources. Effects have been evaluated by considering whether the Proposed Action would result in both short- and long-term changes to the baseline condition for water quality and water quantity within the analysis area. The analysis only considers changes to water quality and water quantity that are directly or indirectly related to the alternatives, and not those due to natural variation, which may exert a strong influence on water resources in an arid to semi-arid environment such as the project area. The Applicant-proposed EPMs for water quality (Section 2.3.6) discussed in this section are included in the Plan.

3.3.3.2 Effects from No Action

Under the No Action alternative, the Plan would not be approved and no action or activity would take place. No effects associated with the Proposed Action to water resources would occur.

3.3.3.3 Effects from the Proposed Action

Groundwater

The Proposed Action consists of a hydrological and geotechnical investigation that poses limited potential to impact groundwater quality and quantity. The types of project activities that could affect groundwater resources include the following:

- Intrusive activity (i.e., drilling) that intersects the groundwater system or is located close to existing groundwater wells or springs.
- Surface-disturbing activity near existing groundwater wells and springs.
- Groundwater use associated with drilling and well testing procedures.
- Generation of investigation-derived waste.

Intrusive Activity

The groundwater monitoring wells and geotechnical drill holes planned generally would be drilled into or through saturated geologic formations that comprise the groundwater system in Superior basin. Deep boreholes drilled through the groundwater system could create a preferred pathway for groundwater in deeper formations to migrate upward and intermingle with the shallow parts of the system. This action could indirectly affect water quality in the groundwater system if the deeper formations contain poor quality water. Resolution would reduce the potential for this by installing at least 20 feet of surface casing across the uppermost portion of each monitoring well, and by grouting the borehole annular space with bentonite slurry across the un-screened sections of the wells. In some cases, more than 20 feet of surface casing would be used to prevent intermingling of shallow groundwater and lower geologic horizons.

Open boreholes could also indirectly affect groundwater quality by acting as a preferred pathway for surface spills to migrate into the subsurface. The potential for subsurface contamination would exist as long as the wellbore remained open, but would diminish once the well had been completed and a proper surface seal had been established. If no monitoring well or piezometer would be constructed in a boring, the open borehole would also act as a preferred pathway for vertical migration of contaminants until properly abandoned. The AAC (Title 12, Chapter 15, Article 8) includes regulatory requirements for well construction and abandonment (see also Section 2.3.2 for borehole abandonment procedures). Provided that Resolution follows these requirements, the potential for long-term effects due to downward migration of contaminants through the wellbores would be low.

The potential for groundwater quality effects during drilling would be reduced by using environmentally friendly drilling fluids, including air, water, and possibly bentonite or a polymer (if needed). Water for drilling would be obtained from a private, potable water source and supplemented with formation water generated during the drilling process. The use of potable water and native groundwater for drilling would further reduce the potential for groundwater quality effects.

The project would be designed to reduce the potential for accidental spills that could infiltrate into the subsurface and impact groundwater quality. In accordance with the project-specific SPCC, secondary containment structures would be used at active drill sites to store small quantities of fuel and/or lubricants. Large volumes of fuel associated with rig operations also would be held in fuel tanks with secondary containment structures. During drilling operations, drill rigs and other fuel storage containers/tanks (i.e., generators) that pose a risk of leaking fuel or oil would be parked on top of plastic sheeting overlain by absorbent material. Spill-cleanup supplies would be kept at each active drill site to handle any small incidental spills that may occur.

Surface Disturbing Activity

In general, surface disturbance associated with the Proposed Action would not affect groundwater quality because the depth to groundwater in the project area typically ranges from about 35 to 50 feet below ground surface (Section 3.2.2). Therefore, surface disturbing activities would not intersect the saturated zone within the groundwater system. Groundwater quality effects could result from an accidental spill of fuel, hydraulic fluid, or lubricants from grading equipment, particularly if the spill goes undetected or occurs close to an existing groundwater well or spring. Resolution would reduce the potential for accidental spills by implementing an SPCC Plan that contains provisions to rapidly contain and clean-up accidental spills before the spilled material infiltrates into the subsurface.

In general, existing groundwater wells located near project access roads or drill sites would not be affected unless struck by a vehicle or construction equipment. Mitigation measure MM – 1 was developed to reduce the potential for damage to existing wells by requiring the proponent to flag any wells located within a few hundred feet of drill pads, test trenches, laydown yards, roadway improvements, and short-term temporary access roads. Although damage to existing wells is unlikely, MM – 1 would further reduce the potential for damage to existing wells by increasing the likelihood that a vehicle or equipment operator would be aware of existing wells in areas of operations.

Increased runoff and erosion caused by the short term temporary access roads (Figure 3-3) could indirectly affect the water quality of springs. The potential for impacts would be managed by implementing required provisions of the CGP to manage storm water runoff. In accordance with the CGP, the proponent would develop a site-specific SWPPP, which would outline requirements for erosion control features such as wattles, silt fence, berms, and straw bales.

Groundwater Use

Groundwater quantity could be locally affected in the short term by removing groundwater from storage during drilling, well development, aquifer testing, and groundwater sampling. Effects from these activities cannot be quantified because it is difficult to estimate how much water would be removed from storage, and how much water is currently available within the groundwater system. However, in typical hydrogeologic practice, the drilling and testing of monitor wells is considered to have minimal effects on groundwater supplies because it removes an infinitesimal fraction of the available groundwater within an aquifer.

Water from private sources that would be used for drilling and dust suppression is sourced from groundwater wells located near Florence Junction, several miles west of the Superior Basin (Pineda, 2014). As a result, the Proposed Action would not affect groundwater supplies in the project area.

Generation of Waste

The Proposed Action calls for temporary storage of drill cuttings within the footprint of each drill pad in either storage tanks or temporary settling pits. If settling pits are used to store saturated drill cuttings, deep formation water could leak through the bottom of the pits and mix with shallow groundwater, if present. Shallow groundwater quality could subsequently be affected if the deep formation water has high dissolved solids content. Effects from groundwater mixing would be mitigated by lining the settling pits or using tanks in place of pits for short-term storage of drill cuttings.

Resolution would avoid potential long-term groundwater quality effects from drill cuttings by disposing the cuttings at a permitted, off-site disposal facility in accordance with applicable laws and regulations.

Purge water from the deep monitoring wells would either be discharged to ground surface under the AZPDES *De Minimis* General Permit (ADEQ, 2010), or captured in settling pits and disposed of offsite if the water quality does not meet requirements for discharge under the *De Minimis* General Permit. Managing the purge water in this way would help avoid potential groundwater quality impacts from infiltration of deep formation water into the shallow groundwater system.

Surface Water

The types of project activities that could affect surface water resources include:

- Surface-disturbing activity for the construction of drill pads, test trenches, and laydown yards.
- Surface-disturbing activity resulting from improvements to existing forest roads, previously disturbed areas proposed to be used as temporary access roads, and proposed short-term temporary access roads.
- Management of drill cuttings and purge water generated during investigation activities.

Surface Disturbing Activity

Surface disturbance for drill pads, test trenches, access roads, and laydown yards could indirectly affect surface water quality by removing stabilizing vegetation and increasing soil erosion. Sediment from disturbed areas or soil stockpiles could be transported downslope via wind and water erosion and deposited in surface water drainages. Increased sediment loads in these drainages could affect downstream water quality and lead to water quality impairments. Water quality effects would increase if more runoff occurred from the disturbed areas during precipitation events, leading to even greater quantities of eroded sediment being deposited in downstream drainages.

Resolution would limit water quality effects from erosion and runoff by implementing required provisions of the AZPDES CGP and by developing a project-specific SWPPP. As part of the SWPPP, erosion and runoff from drill pads would be controlled with features such as wattles, silt fences, berms, water bars, and straw bales. Erosion control features would also be used at the down gradient toe of fill slopes and

around soil stockpiles to trap eroded sediment and prevent it from entering drainages. By implementing these measures and reclaiming the disturbed areas at the conclusion of the project, Resolution would limit the potential for short- and long-term water quality effects resulting from increased erosion and runoff.

Several of the forest roads and temporary access roads included in the Proposed Action cross surface water drainages. Road improvements near these crossings could affect the hydrology and channel characteristics of the adjacent streams, especially where culverts are used for the crossing. Road improvements and road maintenance could also indirectly affect surface water quality through increased erosion from the road surface. Surface water effects at stream crossings would be reduced through implementation of the project-specific SWPPP. Resolution's Plan also states that road engineering would avoid drainage channel bottoms to the greatest extent possible, helping to further reduce effects.

The project would be designed to reduce the potential for accidental spills that could flow into drainages and affect surface water quality. In accordance with the project-specific SPCC Plan, secondary containment structures would be used for fuel tanks and small-quantity chemical storage. During drilling operations, drill rigs would be parked on top of plastic sheeting overlain by absorbent material. Spill-cleanup supplies would be kept at each active drill site to handle any small incidental spills that may occur.

Managing Drill Cuttings and Purge Water

Water for drilling and dust suppression would be supplied by a private source from groundwater wells located outside of the Superior Basin (Pineda, 2014). Thus, the Proposed Action would have no effect on surface water quantity within the project area.

Drill cuttings stored in settling pits could affect surface water quality if the settling pits overflowed during a large rain event or as a result of drilling activities. Longer-term surface water quality effects from drill cuttings would be avoided by disposing the cuttings off site at the completion of the Proposed Action.

Although it is unlikely that contaminated groundwater would be encountered in the piezometers, a mitigation measure was developed to further reduce the potential for adverse effects from discharge of poor quality groundwater. Mitigation measure MM – 2 requires that settling pits would be lined if tanks are not used for short-term storage of the drill cuttings. Managing the purge water in this way would help avoid potential surface water quality impacts by limiting discharges of poor quality groundwater into nearby stream channels.

Mitigation Measures

MM – 1: Wells located within a few hundred feet of drill pads, test trenches, construction laydown yards, roadway improvements, and short-term temporary access roads, would be flagged.

MM – 2: Settling pits would be lined if tanks are not used for short-term storage of the drill cuttings.

3.3.3.4 Cumulative Effects

The cumulative effects analysis area for water resources is the Queen Creek watershed upstream of Whitlow Ranch Dam and north of U.S. 60. It also includes a small area south of U.S. 60 in the Oak Flat-Upper Queen Creek subwatershed east of Apache Leap (Figure 3-1). Under the Proposed Action, some

degree of cumulative water resource impacts could be possible in combination with other present and reasonably foreseeable future actions. Potential contributors to cumulative water resource effects (both negative and positive) include vegetation management, range, mineral development, and transportation and access as described in Table 3-1.

The Proposed Action would contribute minimal and short-term effects to cumulative effects on water resources. The Mesa Vegetation Regeneration and Habitat Improvements Project would re-vegetate approximately 30 acres in the Mesa Ranger District along heavily used forest roads. The re-vegetation would stabilize previously disturbed areas and provide a positive effect to surface water quality by reducing erosion and runoff in the cumulative effects analysis area. Likewise, Travel Management Planning by the Forest Service could contribute to positive water quality effects by limiting motor vehicle use to designated areas to avoid landscape degradation and reduce erosion. The addition of rangeland improvements and continuing use of grazing allotments would contribute negligibly to cumulative impacts.

The mineral development projects identified in Table 3-1 could result in a greater degree of water quality effects compared to the Proposed Action. Resolution's proposed MPO, the Pre-feasibility Activities, the OMYA Superior Limestone Quarry (permitted but currently in temporary shutdown), Imerys Perlite Mine, and proposed Copper King and Red Top projects may affect water quality by disturbing soil and native vegetation. Increases to sedimentation of surface waters may result from erosion caused by this disturbance. Each of these projects would be conducted in accordance with state and federal requirements for water quality protection.

Although the geographical location, final configuration, and schedule for Resolution's MPO activities are uncertain, for this analysis it has been assumed that there is potential overlap in time and space between the Proposed Action and activities included in the MPO. The drivers for cumulative water quality effects associated with the MPO include the mining and milling of copper ore and the establishment of a tailings facility in the cumulative effects analysis area. Impacts from the MPO will be analyzed in more detail in a separate EIS before such operations are approved.

The TSF would be required to obtain an Aquifer Protection Permit (APP) from ADEQ. The purpose of an APP is to protect groundwater quality by controlling discharges from mining operations. Obtaining an area-wide APP is generally an effective way to protect groundwater quality at large mining operations with multiple discharge points; however, local water quality impacts may still occur. These effects would be confined to the pollutant management area established by the APP, and would not likely violate state or federal water quality standards.

The No. 9 and No. 10 shafts operated by Resolution (Figure 3-1), and future proposed shafts associated with the MPO, are (or would be) located on the east side of the Concentrator fault. This fault represents a hydraulic barrier between the shafts and the groundwater system west of the fault where the Project Area is located (Figure 3-2). Thus, groundwater impacts from dewatering the shafts would not contribute to cumulative effects in the Project area. Likewise, cumulative effects from the Proposed Action would not extend east of the Concentrator Fault.

As a result of the Proposed Action, the areas used for temporary access roads and wash crossings would increase; however, the previously disturbed areas to be used as temporary access roads and the short-term temporary access roads would receive minimal surface disturbance. In addition, maintenance of forest

roads could result in less soil disturbance and less sediment delivery into the Queen Creek watershed. Over time, areas disturbed by the Proposed Action would be reclaimed and vegetation would regenerate. Overall, the Proposed Action would not significantly contribute to cumulative water resource effects in the analysis area. Direct and indirect water resource impacts from the Proposed Action would not be significant because the proponent would follow permit provisions for storm water management and would comply with state and federal requirements for protection of water quality. The nature of the Proposed Action is to characterize hydrologic conditions and water quality in the project area, not to exploit or diminish water resources. For these reasons, no significant cumulative water resource effects are anticipated.

3.4 Soil Resources

3.4.1 Regulatory Framework

Soil and watershed resources would be managed using Forest Plan standards for soils and erosion including the following Forest-Wide Management Prescriptions that are applicable to the project:

- Minimize excavation with a balanced earthwork design; the area of cut slopes should be minimized in order to reduce erosion and slope instability.
- Construction should take place only when soil conditions are not too wet.
- Large cut and fill slopes should be stabilized.
- Minimize impacts on soil and water resources from ground disturbing activities.
- Mitigate any adverse effects of planned activities on soil and water resources through the use of BMPs.

Soils and particularly soil erosion would also be managed through the use of Applicant-proposed EPMs identified in Section 2.3.6 and BMPs set forth in the SWPPP.

3.4.2 Existing Conditions

The analysis area for soils is the project area, and specifically the areas where activities for the Proposed Action would occur including the forest roads, temporary access roads, and previously disturbed areas to be used as temporary access roads. This analysis area was selected because the activities for the Proposed Action including the use of the roads, would directly impact soils in the project area.

Most of the soils on the Forest formed on sedimentary rocks including sandstone, limestone, and conglomerate and are generally medium and fine textured throughout their profiles. Soil depths for these soils are generally shallow and moderately deep in most upland positions, but are deeper in low-lying areas. In areas of the Forest not covered by sedimentary rocks, a large number of soils are derived from granite. These soils tend to be medium to coarse textured and moderately to highly erosive. Recently developed soils (Entisols) are found in fluvial stream systems and are generally coarse textured and rocky throughout their profile (U.S. Forest Service, 2014b).

Soils in the project area are typical of desert to desert mountain landscapes found in southern and central Arizona. Topography is rolling hills to mountainous, with gentle to steep gradient slopes. According to

the Natural Resources Conservation Service online soil mapping tool, the Web Soil Survey, project area information is not available digitally. However, the area near U.S. 60 adjacent to the project area was available digitally. The soils in the project area are described using the available information near U.S. 60 as a surrogate, because the soils near U.S. 60 are similar to those found in the project area. In addition, the Travel Management Tonto National Forest Soils Report (U.S. Forest Service, 2014b) was used as a resource to describe soils at a general Forest planning level. In general, the soils in the project area can be described as moderately to well-drained. The soils in the washes can be described as excessively drained. Soil productivity is limited by the dry climate. Approximately 70 percent of the Forest is underlain by soils with moderate to high erosion risk (U.S. Forest Service, 2014b).

3.4.3 Environmental Consequences

3.4.3.1 Methodology

Effects have been evaluated by considering the potential for the Proposed Action to cause erosion and/or sedimentation. The key indicator for this analysis is the acreage of soil disturbance associated with the Proposed Action. The intensity of the effects is based on the Proposed Action disturbing soils at moderate to high risk for erosion in the project area. Analysis of the duration of impacts considers both the overall time interval of the project and the length of time during which effects to soils could be detected.

3.4.3.2 Effects from No Action

Previous soil disturbance associated with existing Forest Roads, residences, transmission lines, ranching facilities (i.e., tanks), pipelines, and the railroad would remain in their present condition. In the short term, erosion and soil loss from these previously disturbed areas would not change from the current condition. There would be no new soil disturbance under the No Action alternative. Therefore, there would be no direct or indirect effects to soils.

3.4.3.3 Effects from the Proposed Action

Direct effects to soils would include soil disturbance and potential compaction from drill pad and laydown yard, drilling, trenching, and road improvement and maintenance activities. Indirect effects would include soil erosion due to wind and water, which would be minimized through the use of Applicant-proposed EPMs, BMPs set forth in the SWPPP, and reclamation. Approximately 75.40 acres of soils would be disturbed by the Proposed Action, including the use of access roads, although only 33.8 acres would be new disturbance. The Proposed Action would be conducted on soils identified to have moderate to high erosion classes. Rock outcrop areas are also included in the high erosion class although those areas typically have minimal soil development.

The Proposed Action could result in compaction of soils within the project area, especially on any roads that would be used on a fairly continual basis during project development and implementation. Several of the locations proposed for groundwater monitoring would be accessed by foot following initial installation. Because these sites would be monitored on a quarterly basis for ten years there would be local compaction of soils to these sites (i.e., inadvertent trail formation) increasing the likelihood that water would run off these compacted areas and create small erosional features. Also, the forces generated by wheeled or tracked vehicles repeatedly traveling over the soil could harm, destroy, and remove the protective layer of vegetation, duff, and biological crusts, exposing and detaching bare soil susceptible to

accelerated erosion. However, the areas that would be compacted by the Proposed Action are expected to return to pre-disturbance conditions after seasonal storm events.

Implementation of specific Applicant-proposed EPMs identified in Section 2.3.6, Forest-Wide Management Prescriptions identified above in Section 3.4.1, and the use of BMPs for the Proposed Action would lessen the likelihood for adverse effects on soils. As an example Forest-Wide Management Prescription, construction would not take place when soil conditions are too wet. Once construction activities are completed, use of forest roads and temporary access roads would be minimal (e.g., access just for monitoring). Efforts would also be made to minimize the amount of surface disturbance by using existing access roads wherever appropriate and feasible.

Reclamation activities to help prevent erosion, including recontouring and reseeding, would be conducted as activities are completed at each site. Test trench sites would be reclaimed immediately following data gathering activities and monitoring well and piezometer locations would be mostly reclaimed following development activities and completely reclaimed by the end of the authorization period.

EPMs, Forest-Wide Management Prescriptions, BMPs and the temporary duration of surface-disturbing activities would minimize the potential impacts from compaction and erosion. For these reasons, direct and indirect effects on soils from the Proposed Action would be minor.

3.4.3.4 Cumulative Effects

The cumulative effect analysis area for soils is shown in Figure 3-1. This area was chosen for the analysis because it is within the Superior Basin and encompasses perennial and intermittent streams where effects from other past, present, and reasonably foreseeable actions could have impacts on soil resources. Potential contributors to cumulative soil effects (both negative and positive) include vegetation management, range, mineral development, transportation and access, land use, and recreation as described in Table 3-1.

The Proposed Action would contribute to cumulative soil resource effects (including localized increases in soil compaction, erosion, and sedimentation potential); however, many of these effects would be offset by other present and reasonably foreseeable future actions in the cumulative effect analysis area (Table 3-1). For example, restoring vegetation (Mesa Vegetation Regeneration and Habitat Improvements Project) and closing user-created roads and trails along forest roads (Travel Management Planning) would create a long-term improvement of soil conditions, although there may be short-term adverse impacts during implementation. The reclamation would stabilize previously disturbed areas and help offset effects on soil stability from increased erosion and runoff associated with the Proposed Action. Likewise, by limiting surface disturbance by vehicles (Travel Management Planning), disturbed areas tend to re-vegetate over-time, resulting in greater protective surface cover, which reduces water flow, erosion, and sediment delivery into connected washes and intermittent streams. Livestock grazing activities (past and ongoing) have affected soil conditions including compacting and eroding soils, but approaches to minimize these impacts will be considered during reauthorization of grazing permits. Planned roadway improvements to U.S. 60 and planned trail corridors may remove soil from production in local areas. Although new roads are designed to minimize and mitigate impacts, newly constructed roads have been known to produce erosion and to temporarily influence soil conditions off site. Planned trail corridors

(non-motorized and motorized) would connect regional trails using existing infrastructure although new improvements may remove soil from production and produce erosion.

Four of the mineral development projects identified in Table 3-1 could result in a greater degree of soil resource effects compared to the Proposed Action. The OMYA Superior Limestone Quarry and the Imerys Perlite Mine affect soil resources by compacting soils (use of roads for mining activities), disturbing native vegetation, and creating erosion potential. The Pre-feasibility Activities would affect soils through data gathering activities similar to the Proposed Action. Likewise the construction and initial operations of Resolution's MPO, which were determined to overlap in time with the Proposed Action, could disturb approximately 796 acres as depicted on Figure 3-5, Figure 3-6 and Table 3-2. Industry BMPs and Applicant-proposed EPMs would be used to decrease the potential for erosion and sedimentation.

Table 3-2. Resolution Proposed MPO Facilities and Acres of New Disturbance

Facility	Acres of New Disturbance (minimally disturbed or undisturbed)
Tailings Storage Facility Surface Disturbance*	448
MARRCO Corridor**	348
Total Project Area (see Figure 3-6)	**796**
West Plant Site	18
East Plant Site and Magma Mine Road	104
Total Cumulative Area	**918**

*Construction through year 2 of MPO including ancillary infrastructure
**Within cumulative effects analysis area only

ADOT's Vegetation Treatment project could also increase cumulative impacts to soil resources by creating the potential for soil erosion and sedimentation by removing vegetation that may have held soils in place during wind or rain events. Native vegetation would be re-established as part of the project and effects to soil resources would be temporary.

In addition, maintenance of forest roads as part of the Proposed Action would result in less soil erosion and less sediment delivery into connected washes and streams. Over time, reclamation of disturbed areas and the regeneration of vegetation would increase soil stability. Implementation of Applicant-proposed EPMs and use of BMPs for projects within the cumulative effects analysis area (Table 3-1) would serve to further reduce impacts.

Within the cumulative effects assessment area for the Proposed Action, past, present, and reasonably foreseeable future actions could result in additional surface disturbance in discrete locations/areas. Potential impacts from the Proposed Action to soil resources have been determined to be negligible. Therefore, there are no project-related impacts to be added to any present or reasonably foreseeable future actions, including Resolution's proposed MPO, which would contribute to cumulative impacts. Subsequently, no significant cumulative effects to soil resources are anticipated.

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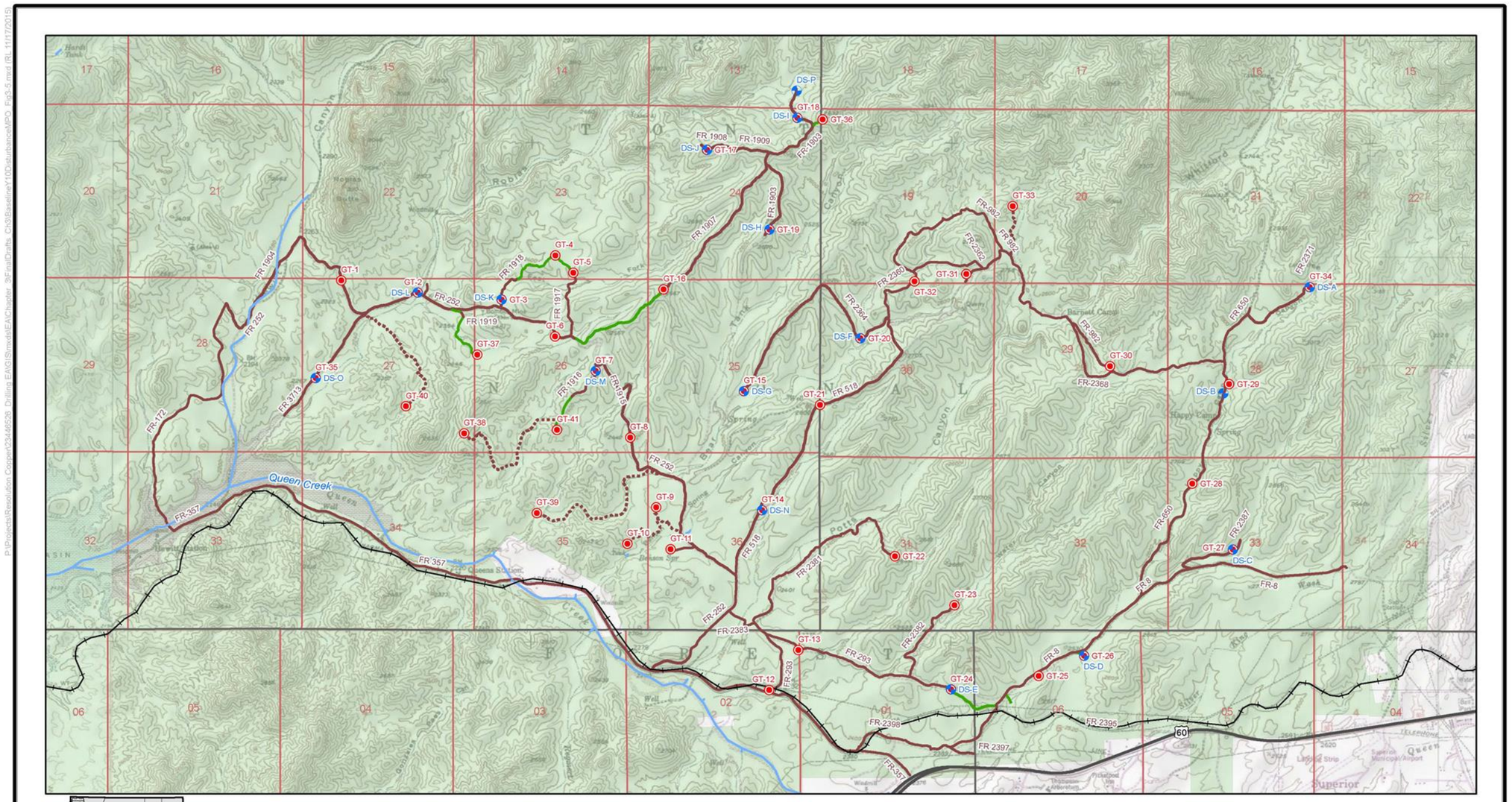

Legend

- Geotechnical Drill Site (GT-1 through GT-41)
- Hydrologic Drill Site (DS-A through DS-P)
- Forest Roads
- Previously Disturbed Area to be Used as Temporary Access Road
- Short Term Temporary Access Road
- U.S. Highway
- Railroad
- Township and Range Boundary
- Section Boundary

Stream/River

- Perennial Stream

Surface Management

- U.S. Forest Service (USFS)
- Private Land

Source:
Project Features: RCML 2014, USFS 2014,
Base Map: ALRIS 1997 - 2014, ADOT 2014, USGS NHD 2011,

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Figure 3-5

Baseline Disturbance at Year 10 of Baseline Operation

Resolution Baseline Hydrological and Geotechnical Data Gathering Activities

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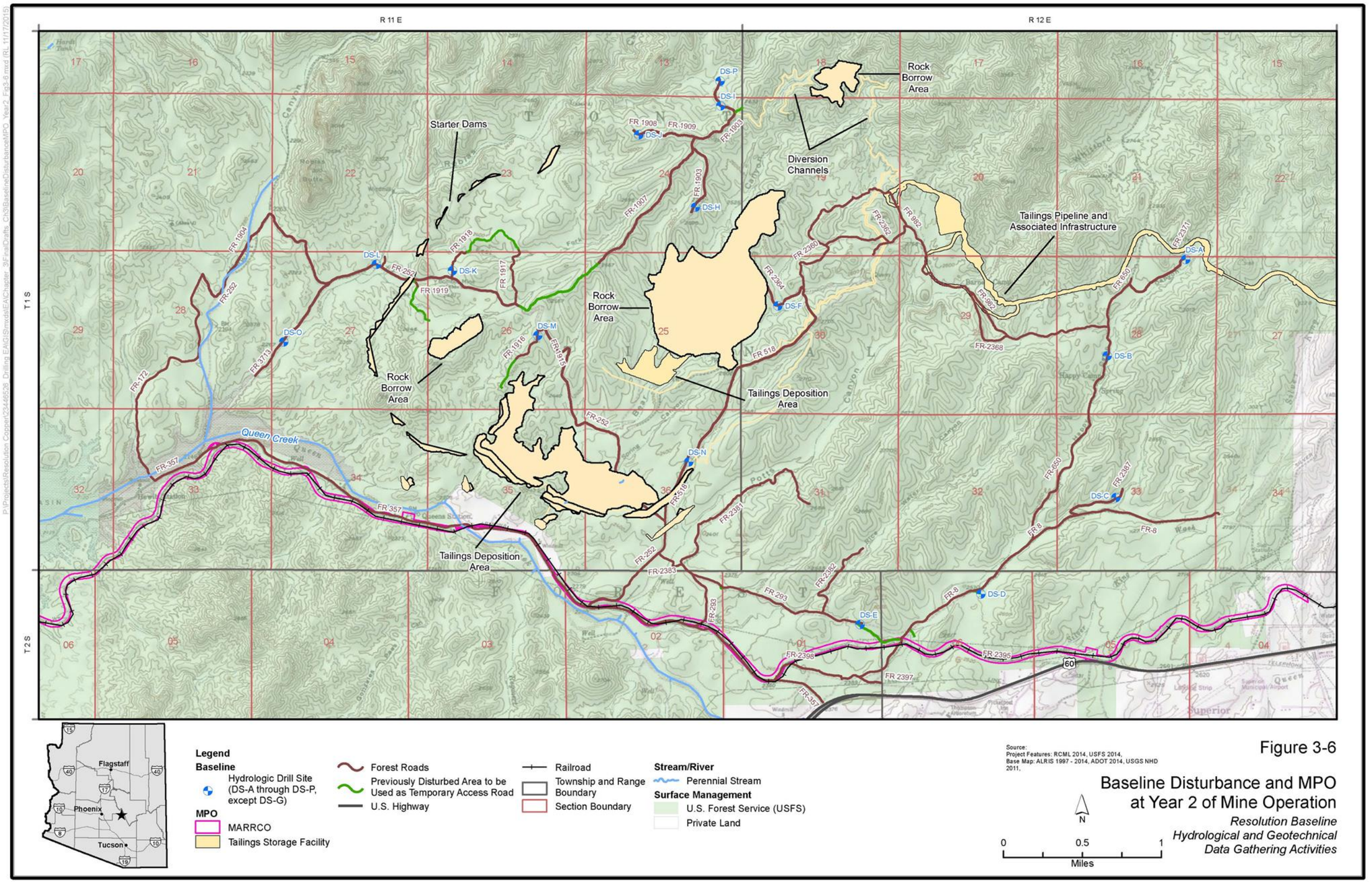

Figure 3-6

Baseline Disturbance and MPO at Year 2 of Mine Operation

Resolution Baseline Hydrological and Geotechnical Data Gathering Activities

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3.5 Vegetation Communities and Fire Regimes

3.5.1 Regulatory Framework

The Forest Plan does not include specific vegetation management direction for Management Areas 2I and 3F; however, the Forest Plan does emphasize managing for a variety of renewable natural resources including wildlife habitat improvement, livestock forage production, and dispersed recreation. The Forest Plan also includes an emphasis on improving and managing riparian areas (as defined by FSM 2526) to benefit riparian dependent resources.

The Forest Plan has been amended (U.S. Forest Service, 1985) to address management of wildland fire in all management areas. Wildland fires are managed consistent with resource objectives and appropriate suppression response. Fire management objectives include providing a mosaic of vegetation age classes within the total vegetation type, which provides for a mix of successional stages and allows fire to resume its natural ecological role within ecosystems. Wildland fires or portions of fires would be suppressed when they adversely affect Forest resources, endanger public safety, or have potential to damage buildings, houses, or other important infrastructure.

3.5.2 Existing Conditions

Vegetation in the project area shown on Figure 3-7 is part of the Arizona Upland subdivision of the Sonoran Desert scrub biotic community as mapped by Brown & Lowe (1980) and described by Brown & Lowe (1994). Vegetation associations were mapped during a 2013 survey of the project area (WestLand Resources, Inc., 2014e and 2015a). Descriptions of fire regimes for the vegetation communities are general because of fire's tremendous variability over time and space (Whelan, 1995).The vegetation communities in the project area are within the desert fire regime, except for riparian vegetation, which does not have a specific fire regime. Seasonal weather and grazing influence the potential for fire and influence fire behavior in the desert fire regime. A wet year produces large quantities of annual grasses and forbs, which provide fuel to carry fire (Gottfried, Alford, & Brock, 2005). Due to the distance between plants and the sparse undercover, only after unusually wet growing seasons is there enough ground cover in the Sonoran desert to carry fire (Brooks & Pyke, 2001). Regrowth of Sonoran desert vegetation following fire depends on the fire intensity and moisture. During the first three years after a fire, the ground cover of grasses, forbs, and non-native species such as red brome and filaree increase (Brown & Minnich, 1986).

Within the Sonoran Desertscrub biotic community, seven plant associations are described. The plant associations found in the project area are described in the following sections.

3.5.2.1 Crucifixion-thorn Shrubland

Crucifixion-thorn shrubland has an isolated occurrence in the project area on a hill with loamy soil west of Bear Tank Canyon. In this association, the taller shrubs, crucifixion-thorn shrubs (*Canotia holacantha*), have a sparse herbaceous layer underneath. These plants grow to heights of over ten feet in some cases; form a dense colony, appearing from a distance as a homogenous stand. Foothill paloverde (*Parkinsonia microphylla*), creosotebush (*Larrea tridentata*), and jojoba (*Simmondsia chinensis*) are found within the shrub layer, while understory shrubs include white ratany (*Krameria grayi*) and snakeweed (*Gutierrezia sarothrae*).

3.5.2.2 Jojoba-Paloverde Shrubland

Jojoba-paloverde shrubland is the most common association present within the project area (WestLand Resources, Inc., 2015a). This association is represented by foothill paloverde with an understory of jojoba and/or other shrubs and cacti. In many areas, saguaros (*Carnegiea gigantea*) are common. West- to north-facing aspects have fewer foothill paloverde than east- and south-facing aspects, while dense stands of jojoba occupy west-facing aspects. Flat-top buckwheat (*Eriogonum fasciculatum*), turpentine bush (*Ericameria laricifolia),* brittlebush (*Encelia farinosa),* snakeweed, and various cacti can occur in the understory. On alluvial terraces with relatively deep, calcareous soil, creosotebush may form a near-monoculture. Ocotillo (*Fouquieria splendens*) and mesquite (*Prosopis* sp.) are sometimes present in low numbers. Cactus species include teddybear cholla (*Opuntia bigelovii*), staghorn cholla (*O. acanthocarpa*), Engelmann pricklypear (*O. engelmannii*), and chainfruit cholla (*O. fulgida*).The perennial vines Arizona swallow-wort (*Cynanchum arizonicum*) and slender janusia (*Janusia gracilis*) occur in some higher elevation areas.

3.5.2.3 Jojoba-Paloverde/Triangleleaf Bursage Shrubland

Within the project area, this association occurs near FR 1918 (WestLand Resources, Inc., 2015a). Soils derived from Precambrian rock support dense patches of triangleleaf bursage (*Ambrosia deltoidea*), although jojoba is also present in low numbers. These sites occasionally support dense concentrations of saguaros. Fairyduster (*Calliandra eriophylla*), creosotebush (*Larrea tridentata*), and desert lavender (*Hyptis emoryi*) can occur in this association as well. There are smaller inclusions of limestone in this association that support several perennial forbs on limestone derived substrate including desert zinnia (*Zinnia acerosa*), woody crinklemat (*Tiquilia canescens*), and desert trumpet (*Eriogonum inflatum*), as well as the graminoid fluffgrass (*Dasyochloa pulchella*).

3.5.2.4 Rock Outcrop

The Rock outcrop association occurs on exposed Paleozoic sedimentary rocks and has a distinctive mix of plants including hopbush (*Dodonaea viscosa*), several species of buckwheat (*Eriogonum fasciculatum, E. wrightii*), lemon verbena (*Aloysia wrightii*), turpentine bush (*Ericameria laricifolia*), and Coulter's brickellbush (*Brickellia coulteri*). Arizona spikemoss (*Selaginella arizonica*) covers the exposed bedrock in places.

3.5.2.5 Mesquite-Catclaw Acacia Wash Shrubland

This association is widespread throughout the drainages in the project area (WestLand Resources, Inc., 2015a). While other shrubs may be present, Mesquite-catclaw acacia (*Senegalia greggii*) are common in areas of ephemeral water flow. Blue paloverde (*Parkinsonia florida*) also frequently occurs near drainages. Shrub species along channels or on terraces include desert hackberry (*Celtis ehrenbergiana*), wolfberry (*Lycium* sp.), desert willow (*Chilopsis linearis*), arrowweed (*Pluchea sericea*), graythorn (*Ziziphus obtusifolia*) and buttonbush (*Cephalanthus occidentalis*). Commonly occurring cacti include chainfruit cholla, staghorn cholla, prickly pear (*Opuntia spp.*) and barrel cactus species (*Ferocactus wislizenii* and *F. cylindraceus*). In the vicinity of the project area, Happy Camp Canyon, Roblas Canyon, Rice Water Canyon, Potts Canyon, and Whitford Canyon support individuals, discontinuous patches, or narrow bands of medium to large Fremont cottonwoods (*Populus fremontii*) and Goodding's willow (*Salix gooddingii*).

3.5.2.6 Ocotillo-Paloverde/Mixed Cacti Shrubland

This association occurs within the project area on areas of shallow Tertiary volcanic bedrock, such as on the hilltops near Perlite Spring (WestLand Resources, Inc., 2015a). Ocotillo and foothill paloverde are co-dominant with an understory of brittlebush, mariola (*Parthenium incanum*), and white ratany (*Krameria grayi*). Barrel cactus species occur in these areas in greater abundance than in the surrounding areas. Arizona spikemoss (*Selaginella arizonica*) and the limestone-loving Cochise cloakfern (*Astrolepis cochisensis*) are often found on these outcrops, along with a diverse mix of limestone-affiliated plants, including ayenia (*Ayenia microphylla*), red grama (*Bouteloua trifida*), desert rosemallow (*Hibiscus coulteri*), Parry's false prairie-clover (*Marina parryi*), and milkwort (*Polygala* sp.). Sotol (*Dasylirion wheeleri*), uncommon in the area, is restricted to north-facing aspects on these limestone outcrops.

3.5.2.7 Single Whorl Burrobush Thicket Shrubland

Within the project area, this association is limited to very broad washes (principally Queen Creek) with intermittent fluvial processes, such as rapid sheet and gully flow that scour the channel bottoms (WestLand Resources, Inc., 2015a). The vegetation ranges from sparse and patchy to moderately dense, and typically occurs along the banks, but may occur within the channel. The vegetation is dominated by singlewhorl burrobush (*Ambrosia monogyra*) while other shrubs present include desert broom (*Baccharis sarothroides*), desert willow, and an occasional Fremont cottonwood (*Populus fremontii*). Mesquite-catclaw acacia, desert hackberry, wolfberry, and saltcedar (*Tamarix* sp.) occur as dense thickets on the low terraces.

3.5.3 Environmental Consequences

3.5.3.1 Methodology

The analysis of effects to vegetation focuses on the potential direct and indirect impacts on vegetation caused by construction of drill sites, test trenches, the laydown yards, and access roads as described for the Proposed Action. Figure 3-7 shows the analysis area used for this evaluation. The analysis area also includes the vegetation of surrounding areas and the locations where invasive plant species and noxious weeds could be introduced and spread from the Proposed Action (indirect effects). The ecological effects of fire are influenced by the time of year; the quantity, condition, and distribution of the fuel; the prevailing climatic conditions; the duration and intensity of the fire; the slope, aspect, and elevation; and the type of vegetation and soil.

3.5.3.2 Effects from No Action

Under the No Action alternative, the Plan would not be approved, and no action or activity would take place. No effects to vegetation associated with the Proposed Action would take place.

3.5.3.3 Effects from the Proposed Action

The direct effects of the Proposed Action would be the removal of vegetation to improve 14.36 miles of access roads (12.09 miles of forest roads and 2.27 miles of previously disturbed areas to be used as access roads) and 7.95 acres for hydrological drill sites, geotechnical drill sites, test trenches, and the laydown yards. Removal of existing vegetation and disturbance of desert soils could indirectly alter the species composition in the vegetation communities. Other direct effects would be from vehicles using the

5.83 miles of short-term temporary access roads and crushing vegetation, and trampling plants at the drill sites and other activity areas during construction and monitoring. Table 3-3 shows the acres of disturbance from the Proposed Action by vegetation community. Species composition in areas disturbed by activities for the Proposed Action, access road improvements, and the short-term temporary access roads could result in local long-term changes in the vegetation community composition and structure.

Table 3-3. Potential Natural Vegetation Types in the Analysis Area and Disturbance Acres

Potential Natural Vegetation Type	Acres within the Analysis Area	Acres of Disturbance				
		Access Roads[1]	Hydrological Drill Sites	Geotechnical Drill Sites	Test Trenches	Laydown Yards
Crucifixion-thorn shrubland	6.78	0.00	0.00	0.00	0.00	0.00
Jojoba-paloverde shrubland	12,842.65	20.45	3.72	0.21	0.88	2.19
Jojoba-paloverde/ triangleleaf bursage shrubland	401.46	1.01	0.25	0.03	0.00	0.00
Mesquite-catclaw/acacia wash shrubland	866.91	4.06	0.24	0.03	0.40	0.00
Ocotillo-paloverde/ mixed cacti shrubland	459.49	0.10	0.00	0.00	0.00	0.00
Rock outcrop	23.69	0.00	0.00	0.00	0.00	0.00
Single whorl burrobush thicket shrubland	644.47	0.05	0.00	0.00	0.00	0.00
Total	**15,245.45**	**25.67**	**4.21**	**0.27**	**1.28**	**2.19**

Source: WestLand Resources, Inc., 2015a.
Notes: [1]Access roads include the acres of disturbance from forest road improvements, previously disturbed areas to be used as temporary access roads, and short-term temporary access roads.

Direct effects to herbaceous vegetation would be expected to be short-term; however, the removal of shrubs and trees from the vegetation community would persist for more than ten years. Most large shrubs or trees would be avoided, minimizing the loss of mature vegetation and helping retain the vegetation community structure. Retaining existing vegetation would provide canopy cover that would help improve recruitment of native vegetation species (Butterfield, Betancourt, Turner, & Briggs, 2010). While the Proposed Action would remove or crush individual plants, regional populations and area-wide habitat for vegetation resources would persist. The intensity of these longer-term indirect effects on the vegetation community would depend on the amount of canopy cover in adjacent undisturbed areas, soil compaction, and the intensity of the disturbance (Abella, 2010).

Reclamation activities for temporary access roads, drill sites, test trenches, and laydown yards would reestablish native vegetation on the 18.96 acres disturbed as a result of the Proposed Action. See Section 3.6.3 for impacts on vegetation communities from invasive plants species. Implementation of specific Applicant-proposed EPMs (see Section 2.3.6) would improve reclamation success, and help retain the species composition of the vegetation community and the desert fire regime. In areas where disturbance would remove non-native plant species, reclamation could result in a local increase in native species within the vegetation community composition.

Implementation of specific environmental commitments would help protect native vegetation from disturbance, and reclamation would reduce negative impacts due to invasive plants. Reclamation activities outlined in Section 2.3.5 would be implemented at each hydrological and geotechnical drill site, test trench site, and temporary access road as data collection activities were completed. The short-term temporary access roads would be ripped/roughed with hand tools and seeded with a Forest-approved seed mix. Final reclamation would be completed for all activities within two years, with the exception of the monitoring wells and piezometers, which would be reclaimed within ten years. The EPMs described in Chapter 2 and mitigation measures listed below would reduce effects on vegetation.

Effects from the Proposed Action on vegetation would be minor and long-term in areas where vegetation was removed. In areas were vegetation was crushed by vehicles or people, the effect on vegetation would be minor and short-term.

Mitigation Measures

MM – 3: Saguaro, barrel, pincushion, hedgehog, ocotillo, and agave species would be avoided where practicable. If it is determined that any of these plants need to be moved to conduct Baseline activities, they would be transplanted away from project-related activities and would be used for reclamation efforts.

MM – 4: Seed mixes to be used in reclamation would be certified weed free of seeds listed on the Forest Service's noxious weed list, and contain only species native to the project area. Seed mixes will be developed from a native species seed list approved by the forest. Three re-seeding efforts will be conducted once annually and applied at a timeframe determined by the forest.

3.5.3.4 Cumulative Effects

The cumulative impact analysis area is shown in Figure 3-1. This area was chosen for the analysis because it includes the potential for direct and indirect effects on vegetation community composition, structure, and fire regime. The present and reasonably foreseeable future actions described in Table 3-1 that could have cumulative impacts on vegetation communities in addition to the Proposed Action include vegetation management, range, mineral development, transportation and access, land use, and recreation.

Surface disturbance from rangeland improvements, improvements to U.S. 60, ADOT's Vegetation Treatment, the MARRCO waterline, the mineral development projects described in Table 3-1, and the Proposed Action would result in the localized removal of vegetation. Improvements to U.S. 60 would remove vegetation in localized areas near FR 357. Reclamation of areas disturbed by these projects and the 18.96 acres disturbed by the Proposed Action would stabilize soils and result in a localized long-term increase in native vegetation within the area.

The Mesa Vegetation Regeneration and Habitat Improvements Project would reclaim approximately 30 acres in the Mesa Ranger District along FR 143 and FR 401. The reclamation associated with this project in addition to reclamation of 11.01 acres of previously disturbed areas used as temporary access roads and the short-term temporary access roads that would be used for the Proposed Action would reduce disturbance of vegetation adjacent to forest roads.

Activities associated with the proposed MPO (Table 3-1, Figure 3-6) that have the potential to overlap in time and space with the Baseline Plan could disturb approximately 918 acres of vegetation within the cumulative impact analysis area. Much of this disturbance could be long-term, and could increase over time.

Over time, due to reclamation of areas disturbed by the Proposed Action, the stability of vegetation communities would improve. The contribution of the Proposed Action to cumulative effects to vegetation resources would be minor and long term. Because the Proposed Action includes reclamation of disturbed areas, the effect on vegetation would not incrementally add to past effects or to potential effects of future actions described in Table 3-1. Therefore, no significant cumulative effects to vegetation are anticipated.

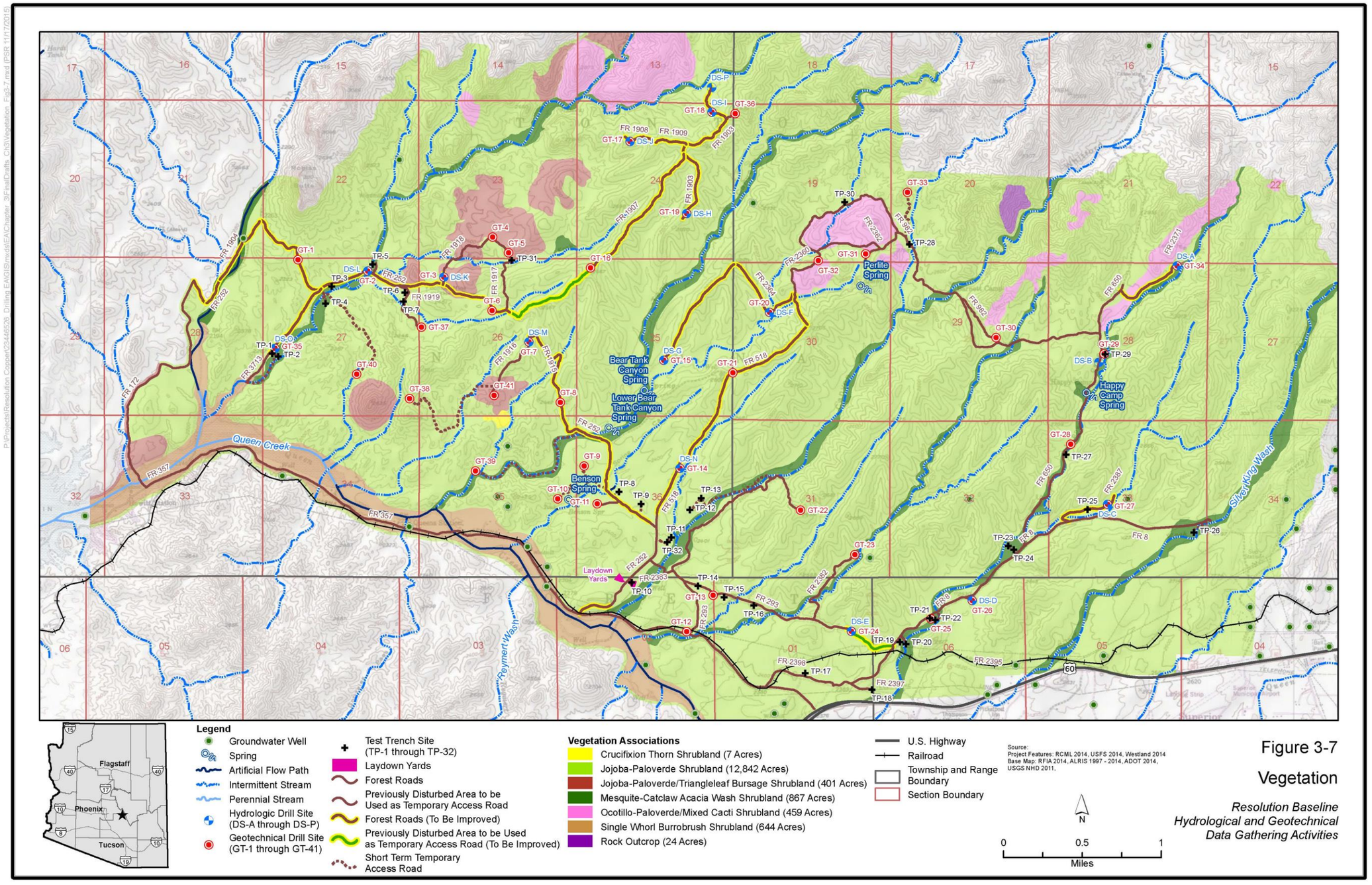

Figure 3-7

Vegetation

Resolution Baseline Hydrological and Geotechnical Data Gathering Activities

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3.6 Invasive Species

3.6.1 Regulatory Framework

There are no standards for invasive species management specified in the Forest Plan. FSM direction for Invasive Species Management is contained in FSM 2900, effective December 5, 2011. This direction sets forth Forest Service policy, responsibilities, and direction for the prevention, detection, control, and restoration of effects from aquatic and terrestrial invasive species (including vertebrates, invertebrates, plants, and pathogens).

Executive Order 13112, Invasive Species, February 3, 1999, Federal Register, establishes the National Invasive Species Council and directs that invasive species be controlled on all federal lands. The Council publishes the USDA *Forest Service Guide to Noxious Weed Prevention Practices* (U.S. Forest Service, 2001).

3.6.2 Existing Conditions

The presence of non-native plant species was noted during a 2013 noxious weed survey (WestLand Resources, Inc., 2014a). The species found during that survey are listed in Table 3-4. The Forest considers these species as invasive non-native plants and manages them based on three classes, as described below.

- **Class A** weeds are of limited distribution in Arizona, or unrecorded in the state. They pose a serious threat. The management goal is eradication.
- **Class B** weeds are of limited distribution in Arizona, common in some places in the state. The management goal is to contain their spread, decrease their population size, and then eliminate.
- **Class C** weeds have spread beyond the Forest's capability to eradicate them. The management goal is to contain the spread to its present size, and then decrease the population if possible.

The Arizona Wildland Invasive Plant Working Group (AZ-WIPWG) is composed of volunteer representatives including the Forest Service that evaluates invasive species based on their potential for ecological impacts (Southwest Biological Science Center, 2014) (U.S. Geological Survey, Colorado Plateau Research Station, 2005). Through a statewide risk assessment process, a non-regulatory list, the *Invasive Non-Native Plants That Threaten Wildlands in Arizona*, categorizes plants according to their relative impacts on ecological processes, species, and native ecosystems (Northham, Backer, & Hall, 2005). The AZ-WIPWG classifies non-native species as high, moderate, and low risk based on the species rates of dispersal, establishment, and potential ecological effects on ecosystems.

Within the 298 areas surveyed for noxious weeds, eight weed species were found. The annual grass, brome (*Bromus sp.*), occurred in 96 percent of the sampled sites. Asian mustard (*Brassica tournefortii*) occurred in 20 percent of the sampled sites. Buffelgrass (*Pennisetum ciliare*), fountain grass (*Pennisetum setaceum*), thistle (*Cirsium* sp.), the non-native annual grass *Schismus* sp., Lehmann's lovegrass (*Eragrostis lehmanniana*), and saltcedar (*Tamarix* sp.) occurred at lower frequencies.

Table 3-4. Noxious and Invasive Plant Species Survey Results

Species	Number of Sample Sites Where Species Was Observed	Percent of Total Sample Sites (n=298) Where Species Was Observed	Forest Weed Class	Arizona Wildland Invasive Plant Working Group Rating
Brome (*Bromus* sp.)	293	96.3	C	Moderate to High
Asian mustard (*Brassica tournefortii)*	59	19.8	C	Moderate
Non-native annual grass (*Schismus* sp.)	50	16.8	C	Moderate
Thistle (*Cirsium* sp.)	26	8.7	A or C depending upon species	Moderate
Lehmann's lovegrass (*Eragrostis lehmanniana)*	5	1.7	C	High
Buffelgrass (*Pennisetum ciliare)*	5	1.7	C	High
Fountain grass (*Pennisetum setaceum)*	1	0.3	C	High
Saltcedar (*Tamarix* sp.)	1	0.3	C	High

Source: WestLand Resources, Inc., 2014a and U.S. Forest Service, n.d.

3.6.3 Environmental Consequences

3.6.3.1 Methodology

The analysis area includes the project area, vegetation of surrounding areas, and the locations where non-native plant species and noxious weeds could be introduced and spread from the Proposed Action.

3.6.3.2 Effects from No Action

Under the No Action alternative, the Plan would not be approved, and no action or activity would take place. No impacts associated with the Proposed Action would take place on invasive species.

3.6.3.3 Effects from the Proposed Action

The risk of transporting new invasive species or noxious weeds into the project area would be moderate to high for the Proposed Action due to the duration of vehicle traffic during access road improvement and construction, and operation of the proposed drill sites, test trenches, and laydown yards. The *Bromus* species was observed in over 96 percent of the sample survey sites and would likely present the highest risk of spread under the Proposed Action. Existing invasive species populations adjacent to access roads would provide the seed source for infestations to spread. Surface disturbance could facilitate the spread and establishment of invasive plants, especially in areas with exposed soil. Once established, these invasive species could out-compete native vegetation and alter wildlife habitats and the fire regime. The risk of invasive plants spreading under the Proposed Action would be moderate to high because the Forest considers eradication of the invasive species present within the area as not feasible. Contractors would

bring people and equipment to the project area from other areas, which could establish populations of invasive plant species. This could introduce either new noxious weeds or invasive plant species, or further distribute existing invasive species populations. The risk of an invasive plant species to spread diminishes with increasing distance from disturbed areas, depending on the species characteristics.

The moderate to high risk of introducing and spreading invasive species would be reduced to a moderate short-term risk by the implementation of the mitigation measures listed below. Through the implementation of EPMs and mitigation measures, the risk of introducing and establishing new occurrences of non-native plants under the Proposed Action was determined to be a minor, short-term risk.

Mitigation Measures

MM – 5: To the extent possible, Baseline activities would be scheduled to occur in areas that do not have established populations of invasive plant species prior to conducting activities in areas with existing, established populations of invasive plant species.

MM – 6: To minimize soil and noxious weed transport, equipment would be cleaned prior to use on National Forest System lands. Cleaning would remove dirt, plant parts, and material that could carry noxious weed seed. Only equipment cleaned and inspected would be allowed to operate in the project area.

3.6.3.4 Cumulative Effects

The cumulative effect analysis area for noxious weeds and invasive plant species is shown in Figure 3-1. Past, present, and reasonably foreseeable activities that have or could result in impacts to vegetation communities include vegetation management, range, mineral development, transportation and access, land use, and recreation as described in Table 3-1.

The continuation of recreation activities, OHV use and highway vehicles avoiding hazards on forest roads, and the use of Forest Roads to access the MARRCO waterline, could result in the spread of noxious weeds and invasive plant species. Although the individual impacts from these activities would be localized, the spread of noxious weeds and invasive species would have long-term impacts on vegetation communities. Improvements to U.S. 60 would remove vegetation in areas near FR 357; however, reclamation of the disturbed areas would use Forest-approved species. Restoring and reclaiming disturbed areas adjacent to forest roads and Travel Management Planning could result in a long-term improvement to vegetation communities in these areas, which may slow the spread of noxious weeds and invasive species. Mesa Vegetation Regeneration and Habitat Improvements could also result in long-term improvement to vegetation and may slow the spread of noxious and invasive plants.

Livestock grazing occurs throughout the cumulative effect analysis area and could affect vegetation and plant succession, as well as soil and watershed resources in localized areas. However, revisions to the Allotment Management Plans for the two grazing allotments could slow or reduce the introduction and spread of noxious weeds and invasive plant species. Cumulative effects on vegetation resources from the spread of noxious weeds would be long term.

Activities associated with the proposed MPO (Table 3-1, Figure 3-6) that have the potential to overlap in time and space with the Baseline Plan would open up 918 acres of land to the potential for growth the spread of noxious weeds and invasive plant species within the cumulative assessment area. Management of invasive species would be analyzed in the EIS for the MPO, and it is likely that site specific EPMs and/or mitigations would be developed to reduce the potential for adverse effects associated with noxious weeds and invasive species. This would also reduce the potential for cumulative effects associated with noxious weeds and invasive species. Cumulative effects associated with the MPO would result in a localized increase in the amount of vegetation removed and vehicle traffic. Increasing the area where existing vegetation is removed and increased vehicular traffic could increase the rate at which noxious weeds are spread and/or increase the area in which these species become established.

The disturbed areas from the Proposed Action would also increase the areas where vegetation was removed. However, these areas would be reseeded with a Forest-approved seed mix. In addition, maintenance of forest roads could result in a long-term improvement in vegetation community's species composition. Over time, reclaiming areas disturbed by the Proposed Action, and the recovery of vegetation, soils, and channel crossings could improve the stability of vegetation communities. Long term this would decrease the area where noxious weeds establish relative to No Action. For these reasons, and combined with mitigation measures 5 and 6 (Section 3.6.3.3) that would minimize impacts, cumulative effects on noxious weeds from implementation of the Proposed Action would be minimal. The effects of the Proposed Action would be minor and would not appreciatively contribute to the other effects from past, present, and reasonably foreseeable future activities. Therefore, no significant cumulative effects to invasive species are anticipated.

3.7 Wildlife and Special Status Species

3.7.1 Regulatory Framework

Forest-wide standards for special status wildlife are found in the Forest Plan (U.S. Forest Service, 1985). These standards "prioritize identifying and surveying habitat for listed species, identifying management conflicts with listed and candidate species, clearing projects with these species, and initiate consultations with the USFWS in adherence to the ESA." ARS 17-102 stipulates that wildlife is property of the state and may be taken (i.e., hunting and fishing) in accordance with state law or rules of the commission. While these standards apply to Forest-level management, the following section also applies to assessing project-level effects:

> *Wildlife and fish habitat elements will be recognized in all resource planning and management activities to assure coordination that provides for species diversity and greater wildlife and fish populations through improvement of habitat. Ensure that fish and wildlife habitats are managed to maintain viable populations of existing native vertebrate species. Improve habitat for selected species. Cooperate with appropriate State Fish and Wildlife agencies. Prevent destruction or adverse modification of critical habitats for Threatened and Endangered species and manage for a goal of increasing population levels that will remove them from the lists.*

Forest Service policy regarding designation of sensitive species includes those species identified by the Regional Forester (U.S. Forest Service, 2014a) for which population viability is a concern. Species appearing on the sensitive species list can include federally listed species, migratory birds, bald and golden eagles, and management indicator species (MIS). The National Forest Management Act of 1976 directed the Forest Service to identify and actively monitor MIS to assess effects of forest management activities on native biota. The Forest lists 27 MIS (U.S. Forest Service, 2012). Two species, the spotted towhee (*Pipilo maculatus*) and hairy woodpecker (*Picoides villosus*), are each listed twice as indicators of two different plant communities. The species indicator, aquatic macro-invertebrates, is a composite of 29 animal species that are indicators of aquatic environments.

Section 7 of the ESA requires Federal agencies to ensure that any action authorized, funded, or carried out by them is not likely to jeopardize the continued existence of listed, threatened, or endangered species or modify their critical habitat. Under section 7(a)(2), each Federal agency shall, in consultation with the Secretary, insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of designated critical habitat. Consultation is required when a Federal agency determines that any action they authorize, fund, or carry out "may affect" a listed species or designated critical habitat. Information on the section 7 consultation process is available in 50 CFR Part 402 and the Service's Endangered Species Consultation Handbook at *https://www.fws.gov/ENDANGERED/esa-library/pdf/esa_section7_handbook.pdf*. A Section 7 consultation with the USFWS is required if listed species under its jurisdiction or their designated critical habitat could be affected by a proposed action.

Under the Migratory Bird Treaty Act (MBTA), it is unlawful to take, kill, or possess migratory birds. Executive Order 13186, issued on January 11, 2001, further defines the responsibilities of federal agencies to protect migratory birds. The MBTA also makes it illegal for anyone to take or possess (among other activities) the parts, nests, or eggs of migratory birds except under the terms of a valid Federal permit. The USFWS includes as migratory birds "all species native to the United States or its territories, which are those that occur as a result of natural biological or ecological processes" (70 Federal Register 12710, March 15, 2005). Protected migratory birds are listed at 50 CFR 10.13.

The Bald and Golden Eagle Protection Act (BGEPA) was enacted in 1940 (amended several times since then) and prohibits anyone without a permit issued by the Secretary of the Interior from "taking" eagles, including their parts, nests, or eggs. The BGEPA provides criminal penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle or any golden eagle, alive or dead, or any part, nest, or egg thereof."

The BGEPA defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb."

3.7.2 Existing Conditions

The project area for wildlife and special status species is focused on the location of drill sites, test trenches, laydown yards, and access roads described under the Proposed Action. The project area also includes the habitat of surrounding areas and the locations where non-native plant species and noxious weeds could be introduced and spread from associated baseline data gathering activities and access roads

(indirect effects). Special status species surveys were conducted in various habitats throughout the project area (WestLand Resources, Inc., 2013; 2014b through 2014d; 2015a and 2015b) in accordance with Forest Plan standards. The existing conditions for wildlife are described further in the subsections that follow.

3.7.2.1 Wildlife and Wildlife Habitat

Reptiles

A rich reptilian fauna would be expected in the project area in desertscrub and rocky upland habitats. Typical reptiles may include the western banded gekko (*Coleonyx variegatus*), eastern collared lizard (*Crotaphytus collaris*), long-nosed leopard lizard (*Gambelia wislizenii*), desert spiny lizard (*Sceloporus magister*), Regalhorned lizard (*Phrynosoma hernandesi*), tiger whiptail lizard (*Aspidoscelis tigris*), Gila monster (*Heloderma suspectum*), desert nightsnake (*Hypsiglena chlorophaea*), common king snake (*Lampropeltis getula*), gopher snake (*Pituophis catenifer),* glossy snake (*Arizona elegans*), Sonoran coral snake (*Micruroides euryxanthus*), western diamondback (*Crotalus atrox*), Mohave rattlesnake (*Crotalus scutulatus*), black-tailed rattlesnake (*Crotalus molossus*), and Sonoran desert tortoise (*Gopherus morafkai*) (Brennan and Holycross, 2006).

Birds

Birds commonly found in the project area would be mostly migratory species with some non-migratory species. These would include the turkey vulture (*Cathartes aura*), red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), cardinal (*Cardinalis cardinalsi*), barn owl (*Tyto alba*), great horned owl (*Bubo virginianus*), western meadowlark (*Sturnella neglecta*), Harris' hawk (*Parabuteo unicinctus*), Gambel's quail (*Callipepla gambelii*), white-winged dove (*Zenaida asiatica*), greater roadrunner (*Geococcyx californianus*), elf owl (*Micrathene whitneyi*), lesser nighthawk (*Chordeiles acutipennis*), Gila woodpecker (*Melanerpes uropygialis*), western kingbird (*Tyrannus verticalis*), ash-throated flycatcher (*Myiarchus cinerascens*), Say's phoebe (*Sayornis saya*), cactus wren (*Campylorhynchus brunneicapillus*), curve-billed thrasher (*Charadrius vociferus*), Bendaire's thrasher (*Toxostoma curvirostre*), phainopepla (*Phainopepla nitens*), pyrruloxia (*Cardinalis sinuatus*), black-throated sparrow (*Amphispiza bilineata*), and Scott's Oriole (*Icterus parisorum*) (The Birds of North America, 2007).

Mammals

Mammalian species that could inhabit the project area would include upland and rock-dwelling species. These include the desert cottontail (*Sylvilagus audubonii*), black-tailed jackrabbit (*Lepus californicus*), Harris' antelope ground squirrel (*Ammospermophilus harrisonii*), rock pocket mouse (*Chaetodipus intermedius*), Merriam's kangaroo rat (*Dipodomys merriami*), white throated woodrat (*Neotoma albigula*), cactus mouse *(Peromyscus eremicus)*, javelina (*Tayassu tajacu*), mule deer (*Odocoileus hemionus*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), cougar (*Puma concolor*), ringtail (*Bassariscus astutus*), and western spotted skunk (*Spilogale gracilis*) (Hoffmeister, 1986). About 15 species of bat could forage in the vegetation community or locate roost sites in mountainous terrain near the project vicinity (Hoffmeister, 1986).

Game Species

Mule deer are the primary game species in the project area. Other game species that could occur in the project area include black bear (*Ursus amercanus*), dove (*Zenaida spp*), white-tailed deer (Odocoileus virginianus), and Gambel's quail (*Callipepla gambelii*).

3.7.3 Special Status Species

3.7.3.1 Threatened and Endangered Species

There are 20 ESA-listed, candidate, or proposed species in Pinal County (USFWS, 2014). Of the 20 species listed, only the Sonoran desert tortoise, a former candidate species, is present within the project area and was analyzed in a biological evaluation for the Proposed Action (WestLand Resources, Inc., 2015a) The Sonoran desert tortoise was removed from listing consideration on October 6, 2015 due to continued efforts by the Arizona Game and Fish Department (AGFD) and federal agencies to proactively manage the primary threats to the species. However, AGFD retains the Sonoran desert tortoise on its' watch list of Species of Greatest Conservation Need and it remains on TNF Sensitive Species list, and it is analyzed as a special status species for the purposes of this EA (Table 3-5). Gila monster is also considered a Species of Greatest Conservation Need by AGFD but it's no longer on the TNF Sensitive Species list and therefore was not analyzed for this EA. Based on comments from AGFD, gila monster was included in mitigation measures to avoid potential impacts during construction. The southwestern willow flycatcher, an endangered species, and the yellow-billed cuckoo, a threatened species, were considered to have an unlikely potential for occurrence in the project area due to the lack of suitable habitat in the affected area of the project. The Sonoran desert tortoise is the only ESA species analyzed in the environmental effects section. There is no designated critical habitat for listed species within the affected area of the project.

Table 3-5. Special Status Species Occurrence in the Project Area

Species or Species Group	Status	Potential for Occurrence
Invertebrates		
Macro-invertebrates	MIS	**Potential to occur in project area:** Present. Small isolated occurrences of aquatic habitat are present in the project area at three earthen ponds, two stock tanks, and five perennial or intermittent springs. The larger drainages are likely to support ephemeral or seasonally intermittent surface flow. No effects are anticipated at any ponds, tanks, or springs, and there would be no effect on aquatic macro-invertebrates.

Table 3-5. Special Status Species Occurrence in the Project Area

Species or Species Group	Status	Potential for Occurrence
Amphibians		
Lowland leopard frog (*Lithobates yavapaiensis*)	TNF Sensitive	**Potential to occur in project area:** Possible. This species occurs in a variety of perennial to near perennial waters (AGFD, 2014). The Heritage Data Management System has records for this species within three miles of the project area. The project area does not include any perennial creeks or streams and the few, small isolated seeps, springs, and livestock tanks in the vicinity may provide suitable habitat. A past record for the species exists in Benson Spring, but the spring does not provide adequate conditions for this species to currently inhabit that particular site.
Reptiles		
Sonoran desert tortoise (*Gopherus morafkai*)	AGFD Species of Greatest Conservation Need TNF Sensitive	**Potential to occur in project area:** Present. This species primarily occurs in desert rocky foothills and lower bajadas of the Sonoran Desert. The project area falls within the geographic range and habitat. The Heritage Data Management System has records for this species within three miles of the project area and the desert tortoise was observed in the project area (WestLand Resources, Inc., 2014d).
Bezy's night lizard (*Xantusia bezyi*)	TNF Sensitive	**Potential to occur in the project area:** Possible. This species is primarily associated with crevices found in rock outcrops, cliff faces, and boulder fields in Arizona upland desertscrub, semi-desert grassland, interior chaparral, and oak woodland communities. Bezy's night lizards have also been occasionally found in decaying stool (*Dasylirion wheeleri*) and *Yucca* spp., under plant material on the desert floor, and in buildings (Bezy, 2005). The project area contains suitable habitat and is located within the known range of this species
Birds		
Golden eagle (*Aquila chrysaetos*)	BGEPA MBTA	**Potential to occur in the project area:** Possible. Golden eagles are found in a variety of habitats in open country including prairies, arctic and alpine tundra, open wooded country, deserts, and barren areas, especially in hilly or mountainous regions. They nest on rock ledges, cliffs, or in large trees. The species occurs throughout most of Arizona except parts of the lowland desert in the southwestern part of the state. The project area has suitable non-breeding habitat and golden eagles could utilize habitats there.

Table 3-5. Special Status Species Occurrence in the Project Area

Species or Species Group	Status	Potential for Occurrence
Ash-throated flycatcher (*Myiarchus cinerascens**)***	MIS	**Potential to occur in the project area:** Possible. This is a bird that inhabits desertscrub habitats. This species was observed during bird surveys in April, May, and June 2013 in Sonoran desertscrub. It is an MIS for piñon-juniper chaparral or piñon-juniper grassland but not an indicator for desertscrub. No piñon-juniper habitat occurs in the project area.
Bell's vireo (*Vireo bellii*)	MIS MBTA	**Potential to occur in the project area:** Possible. Bell's vireo lives in riparian forests and riparian scrubland. This species was observed during bird surveys in April, May, and June 2013 (WestLand Resources, Inc., 2013) in Sonoran desertscrub outside but near the project area. However, this species is an MIS for cottonwood willow riparian forest and not desertscrub. No cottonwood willow riparian forest habitat occurs in the project area.
Black-throated sparrow (*Amphispiza bilineata*)	MIS	**Potential to occur in the project area:** Present. This is a bird that inhabits desertscrub habitats. This species was observed during bird surveys in April, May, and June 2013 (WestLand Resources, Inc., 2013) in Sonoran desertscrub within the project area. Suitable desert community habitat elements are present within the project area vicinity.
Canyon towhee (*Melozone fusca)*	MIS MBTA	**Potential to occur in the project area:** Present. The canyon towhee inhabits desertscrub habitats. This species was observed during bird surveys in April 2013 (WestLand Resources, Inc., 2013), in Sonoran desertscrub within the project area. Suitable desert community habitat elements are present within the project area vicinity.
Costa's Hummingbird (*Calypte costae*)	MBTA	**Potential to occur in the project area:** Possible. Costa's hummingbird is a species of Sonoran desertscrub and riparian scrubland. This species was not observed within the project area, but it is listed as a common spring resident at the Boyce Thompson Arboretum. The presence of paloverde throughout the project area indicates that the species has the potential to breed within the project area.
Elf Owl (*Micrathene whitney*i)	MBTA	**Potential to occur in the project area:** Present. The elf owl inhabits riparian scrubland and desertscrub dominated by microphyllous woodlands. This species had a single observation during surveys within the project area and is listed as being uncommonly observed at Boyce Thompson Arboretum. Although individuals of this species could be affected by the Proposed Action, effects to the species are unlikely.
Gila Woodpecker (*Melanerpes uropygialis*)	MBTA	**Potential to occur in the project area:** Present. The Gila woodpecker occurs in desertscrub habitats. This species was noted throughout common vegetation associations within the project area and is listed as a common resident at Boyce Thompson Arboretum

Table 3-5. Special Status Species Occurrence in the Project Area

Species or Species Group	Status	Potential for Occurrence
Gilded Flicker (*Colaptes chrysoides*)	MBTA	**Potential to occur in the project area:** Present. The gilded flicker inhabits various desertscrub habitats. This species was noted throughout common vegetation associations within the project area and is listed as an uncommon resident at Boyce Thompson Arboretum.
Gray vireo (*Vireo vicinior*)	MIS MBTA	**Potential to occur in the project area:** Present. The gray vireo inhabits Piñon-juniper woodland. This species was observed as a migrant during bird surveys in April 2013 (WestLand Resources, Inc., 2013) in Sonoran desertscrub in the project area vicinity. However, this species is not an MIS for desertscrub, and no piñon-juniper chaparral or piñon-juniper grassland habitat occurs in the project area for which this species is an MIS.
Hooded oriole (*Icterus cucullatus*)	MIS	**Potential to occur in the project area:** Possible. This species was observed during bird surveys in April and May 2013 (WestLand Resources, Inc., 2013) in Sonoran desertscrub in the project area vicinity. However, this species is not an MIS for desertscrub, and no cottonwood willow riparian forest habitat occurs in the project area.
Lucy's Warbler (*Oreothlypis luciae*)	MBTA	**Potential to occur in the project area:** Present. Lucy's warbler is a species found in riparian scrubland. This species has been detected along washes within the project area and is listed as a common summer resident at Boyce Thompson Arboretum.
Phainopepla (*Phainopepla nitens*)	MBTA	**Potential to occur in the project area:** Present. This species was noted throughout common vegetation associations within the project area, and it is listed as a common resident at Boyce Thompson Arboretum. Although individuals of this species could be affected by the Proposed Action, effects to the species are unlikely. Any unintentional take reasonably attributable to the Proposed Action would not have any measurable negative affect on migratory bird populations.
Violet-green swallow (*Tachycineta thalassina*)	MIS	**Potential to occur in the project area:** Possible. This species was observed as a migrant during bird surveys in April 2013 (WestLand Resources, Inc., 2013) in Sonoran desertscrub in the project area vicinity. However, this species is not an MIS for desertscrub, and no ponderosa pine-mild or mixed conifer with aspen habitat occurs in the project area for which this species is an MIS.

Table 3-5. Special Status Species Occurrence in the Project Area

Species or Species Group	Status	Potential for Occurrence
Mammals		
Pale Townsend's big-eared bat (*Corynorhinus townsendii pallescens*)	TNF Sensitive	**Potential to occur in the project area:** Possible. This species occurs in a wide range of biotic communities from 1,200 to 5,600-foot elevation. It roosts in caves and abandoned mine workings. The species was captured at Boyce Thompson Arboretum in 2001 and 2002 by AGFD and in the vicinity of the project area at Apache Leap and Oak Flat (WestLand Resources, Inc., 2012a). The project area is within the known geographic and elevation range for this species and contains roosting habitat to support this species.
Plants		
Mapleleaf false snapdragon (*Mabrya acerifolia*)	TNF Sensitive	**Potential to occur in the project area:** Possible. This species occurs in rhyolite rock crevices and overhangs on shaded cliffs and rock ledges, generally with north- to east-facing walls at an elevation of 1,800 to 3,350 feet. The Heritage Data Management System has records for this species within three miles of the project area. The project area is within the known geographic and elevation range for this species and cliff habitat is present in the project area.
Pima Indian mallow (*Abutilon parishii*)	TNF Sensitive	**Potential to occur in the project area:** Possible. This species is associated with rocky hillsides and canyon bottoms among rocks and boulders in Sonoran desertscrub at an elevation of 1,720 to 4,900 feet. The Heritage Data Management System has records for this species within three miles of the project area. The project area is within the geographic range of this species and includes suitable habitat.

Source: AZGF 2014, 2013; Bezy, 2005; USFWS, 2014; and WestLand Resources, Inc., 2015d, 2014b, 2013, 2012a.
Notes: TNF = Tonto National Forest; MIS = Management Indicator Species; MBTA = Migratory Bird Treaty Act; BGEPA = Bald and Golden Eagle Protection Act; USFWS = U.S. Fish and Wildlife Service

3.7.3.2 Forest Service Sensitive Species

A review of the Forest Service Region 3 sensitive species list (U.S. Forest Service, 2013) and the AGFD database records identified plants and animals listed as Forest Service sensitive that could occur or that are known to occur in the project area. Some of these species were documented in the species-specific surveys conducted for the project area in 2013 (WestLand Resources, Inc., 2013; 2014b through 2014d; 2015a and 2015b).

3.7.3.3 Management Indicator Species

Forest Service MIS are specified by the Forest (U.S. Forest Service, 2012) and are normally selected to represent habitat types that occur within the Forest boundary and/or because they are thought to be sensitive to National Forest System management activities. Based on an evaluation presented in the MIS report for this project (WestLand Resources, Inc., 2015b) (Table 3-5), eight MIS (and macro-

invertebrates) are likely to occur in the project area. However, only two species (canyon towhee and black-throated sparrow) are MIS for desertscrub. The other MIS species observed in the project area were likely migrants or transients.

3.7.3.4 Migratory Birds

The effects of the Proposed Action to migratory birds were determined by considering the effects of Proposed Action on: (1) Priority Species of Concern listed by Arizona Partners in Flight, (2) Important Bird Areas defined by the Audubon Society, and (3) Important Over-Wintering Areas as identified by USFWS (2008). Arizona Partners in Flight identified Priority Species of Concern by associated vegetation type. Forty bird species were previously identified by the Forest as migratory bird species of concern (U.S. Forest Service, 2011). Table 3-5 presents those species that could be affected by the Proposed Action within the project area or the Boyce Thompson Arboretum, which is an important bird area that could be affected by the project.

3.7.4 Environmental Consequences

This section analyzes the potential effects of the project on wildlife, wildlife habitat, and special status species, Forest Service sensitive species, and MIS.

3.7.4.1 Methodology

The effects analysis for all species, including migratory birds, was completed by comparing the likely presence and extent of habitat with the activities, including disturbance, duration of activities, and sensitivity.

3.7.4.2 Effects from No Action

Under the No Action alternative, the Proposed Action would not be approved and no additional effects would occur to individuals, local populations, and habitats of wildlife, game species, threatened and endangered species, migratory birds, Forest Service sensitive species, and MIS.

3.7.4.3 Effects from the Proposed Action

Wildlife and Wildlife Habitat

The Proposed Action would affect a maximum of 33.63 acres in four vegetation communities (see Table 3-3). Direct effects on wildlife species would include potential for mortality or injury from vehicles, removal of vegetation, disturbance of foraging or denning habitat, and blockage of migration or dispersal corridors. The potential for vehicle mortality would be reduced through mitigation relative to implementing appropriate speed limits.

Disturbance to wildlife species and habitat could include reduced prey resources or reduced use of foraging or denning habitat because of noise, light, and human activity at drill sites, access road improvements and maintenance, and from human activity at monitoring wells. Individual animals could be adversely affected by noise through masking of ambient, natural sounds, physiological effects from stress, or behavioral effects (Corman & Wise-Gervais, 2005). Light may affect behavior, such as mating, migration, sleep, and foraging (International Dark-Sky Association, 2013) or foraging success. Nocturnal prey species may experience higher predation rates. Potential lighting effects on bats include disruption in

commuting behavior from roosts to foraging sites, insect behavior, and delayed emergence from roost sites (Fure, 2013). Indirect effects of lighting would be less pronounced, but could affect habitat within the project area and sensitive receptors nearby, including wildlife and habitat at the Boyce Thompson Arboretum.

Effects to wildlife species would generally be temporary (lasting one to two years), because most data gathering activities and road maintenance would cease after that period. If wildlife habitats were disturbed and required additional time to re-generate, effects could extend to short- or even long-term durations, but that would be unlikely given the limited footprint of the Proposed Action. Some behavior-related effects could persist longer due to the periodic sampling that would occur at the test sites for up to ten years; however, the effects would be minimal and temporary as crews would only access drill sites for monitoring purposes and would then leave.

Special Status Wildlife and Plants

Threatened and Endangered Species

The effects of the Proposed Action on threatened, endangered, candidate, and proposed species are analyzed in detail in *Biological Evaluation Baseline Hydrologic & Geotechnical Data Gathering Activities on Tonto National Forest* (WestLand Resources, Inc., 2015a). The Sonoran desert tortoise was the only species that Westland had analyzed under this category; however, it has since been removed from listing consideration due to proactive conservation measures being implemented by AGFD and federal agencies. The determination of effects to special status species that are known to occur or that could occur as transients in the project area are summarized in Table 3-6.

Table 3-6. Effects of the Proposed Action on Special Status Species Within the Project Area

Species	Effects
Reptiles	
Sonoran desert tortoise (*Gopherus morafkai*) AGFD Species of Greatest Conservation Need TNF Sensitive	The Proposed Action **would be unlikely to have significant direct or indirect adverse effects** on Sonoran desert tortoise or its habitat. The Proposed Action would directly impact about 33.63 acres of habitat, some of which may experience indirect effects from introduced plant species that degrade forage quality. A slightly larger area of habitat would be impacted temporarily by noise and exploration activities. These effects would collectively reduce the quality and quantity of habitat in both the short- and long-term. Desert tortoise was detected in the project area, and a Biological Resources Monitoring Plan has been developed to protect individual tortoises (WestLand Resources, Inc., 2015c). Disturbance to rocky outcrops and washes would be minimized. This species is considered further in the text below.

Table 3-6. Effects of the Proposed Action on Special Status Species Within the Project Area

Species	Effects
Bezy's night lizard (*Xantusia bezyi*) TNF Sensitive	The Proposed Action **would have a negligible impact** on Bezy's night lizard. The Proposed Action would not impact primary habitat that includes rock outcrops, cliff faces, and boulder fields. Secondary habitat that may be used infrequently by this species includes hillsides with sotol and yuccas that are limited in distribution and abundance in the project area, but could occur among about 28.73 acres of desert scrub vegetation that would be disturbed by the Proposed Action. This habitat could be affected temporarily and directly by noise and human activity. Direct loss of sotol or yuccas could result in habitat loss that could last for decades (e.g., it takes up to 80 years to re-establish a similar perennial plant cover) (Abella, 2010). Indirect effects from the potential spread of invasive plant species could further degrade habitat conditions on a localized basis where secondary habitat is disturbed. Night lizards were not detected in the project area.
Amphibians	
Lowland Leopard Frog (*Lithobates yavapaiensis*) TNF Sensitive	The Proposed Action **would not impact** the lowland leopard frog or its habitat because the Proposed Action would avoid affecting the few seep and spring environments that are present in the vicinity of the project. Lowland leopard frogs were not detected in the project area.
Birds	
Bird species are discussed in the text under MIS, MBTA, and Golden Eagle.	Effects described in text.
Mammals	
Pale Townsend's big-eared bat (*Corynorhinus townsendii pallescens*) TNF Sensitive	The Proposed Action **would have a negligible impact** on the pale Townsend's big-eared bat because the disturbance footprint of the Proposed Action would not affect possible primary foraging habitat along wooded riparian areas, seeps, or springs and would not impact roosting habitat (e.g., caves or abandoned mine shafts). The species could potentially but infrequently forage along mesquite-catclaw acacia lined xeric washes that would experience about 4.75 acres of surface disturbance. Pale Townsend's big-eared bats were detected in the project area (WestLand Resources, Inc., 2012a). These areas may have less available forage, but there would otherwise be no other indirect or direct effects to the species.
Plants	
Mapleleaf false snapdragon (*Mabrya acerifolia*) TNF Sensitive	The Proposed Action **would have no impact** on the mapleleaf false snapdragon because the Proposed Action would not occur in habitat for the species (e.g., cliffs or rock ledges). Mapleleaf false snapdragon was not detected in the area.
Pima Indian mallow (*Abutilon parishii*) TNF Sensitive	The Proposed Action **could result in a minor impact** on the Pima Indian mallow or its habitat. The Proposed Action would not occur on rocky hillsides or in canyon bottoms. Pima Indian mallow was not detected in the project area. The disturbance footprint on hillsides would largely be restricted to temporary access roads used to bring a tracked rig to off-road locations. These activities would impact about 21.46 acres of desertscrub where direct effects could result from equipment crushing individual plants or degrading habitat by compacting the substrate or disturbing the surface soil. This could have the indirect effect of increasing the potential for spread and establishment of invasive plant species, but effects to vegetation should recover within a few growing seasons.

Sonoran Desert Tortoise

The total project area occurs within approximately 75.40 acres of potentially suitable habitat for the Sonoran desert tortoise. Direct disturbance would remove or degrade (by fragmenting habitat patches or impeding movement) about 33.63 acres of habitat due to improving existing roads or establishing undeveloped pathways to the drill sites and ground disturbance at the sites themselves. Where the ground surface is disturbed, there would be potential for habitat to be indirectly affected by introduced plant species spreading into the disturbed areas and some areas nearby. This would degrade the quality of habitat in an area that cannot currently be determined due to many factors needed for establishment of propagules. Reclaiming disturbed sites would return the habitat functions to the disturbed areas, but the time for full re-establishment of the pre-disturbance perennial plant cover could take several decades (Abella, 2010).

Noise and vibration from heavy equipment may temporarily change behavior of nearby tortoise. Individuals that are foraging may cease or those near their burrows may take refuge inside. It would be unlikely that the vibration from activities associated with the Proposed Action would be severe and cause a burrow to collapse and trap a tortoise inside. The effects would be widely dispersed across the project area and would be temporary at each site and during travel along access roads.

Disturbances from sampling would continue periodically for the 10-year period of authorization. The disturbances could affect the behavior of individual tortoises while personnel traveled to and from sampling sites and while they conducted sampling. If tortoises were active, they may retreat to their burrows or cease foraging; however, this range of effects would be temporary and normal behavior would resume after personnel left the area.

The Proposed Action would increase the potential for individual tortoises to be harmed or killed by vehicles travelling to the project worksites. This impact would be mitigated by following the general monitoring procedures as outlined in the Biological Resources Monitoring Plan (WestLand Resources, Inc., 2015c) when individual tortoises are encountered during construction activities. Implementation of EPMs (Section 2.3.6) and MMs listed below would reduce the threat to individuals and known or potential burrows. Guidelines for handling desert tortoise (AGFD, 2007) would be used if it were absolutely necessary to move individual tortoises from harm.

Overall, the Proposed Action may impact individual Sonoran desert tortoise or use patterns in the project area due to temporary noise or vibration and longer-term changes to habitat. However, the site-specific effects would be minimal and widely dispersed, and would not result in changes to the viability of the population, long-term changes in use of the project area, nor produce a trend toward Federal listing of the species.

MM – 7: Baseline activities would be restricted to approved activity areas to conserve intact Sonoran Desert Tortoise habitat.

MM – 8: Overhanging banks along drainages or side-slopes and/or rock out-crops would be avoided as practicable to minimize disturbance to Sonoran Desert Tortoise habitat.

MM – 9: Pre-construction surveys would be conducted for Sonoran Desert Tortoise and Gila Monster before ground disturbing activities start. A biological monitor will monitor for Sonoran Desert

Tortoise, Gila Monster, and migratory birds during construction and reclamation activities. The monitor will flag Desert Tortoise and Gila Monster shelter sites/burrows for avoidance by project activities. These flagged avoidance areas will be maintained as appropriate during construction. In the event a burrow cannot be avoided, it would be inspected and any tortoises discovered in the burrow would be relocated outside of project activity areas.

MM – 10: A biological monitor would inspect open pits or trenches for Desert Tortoise and Gila Monster prior to backfilling activities and would be responsible for relocating these species out of harm's way. If a tortoise is detected, it would be moved following the Arizona Game and Fish Department's *Guidelines for Handling Sonoran Desert Tortoises Encountered on Development Projects*, Revised October 23, 2007.

MM – 11: Project crews would be informed of the potential to encounter Sonoran Desert Tortoises and Gila Monster within the project area. Work crews would check below equipment prior to moving, and cover and/or backfill holes that could potentially entrap these species. If these species are encountered, work crews would stop work until the biological monitor has relocated these species out of harm's way.

MM – 12: In the event that Baseline activities were modified in a manner that would result in an effect to a listed species or designated critical habitat, or if a new species was listed or critical habitat was designated which may be affected by Baseline activities, all work shall cease and consultation under Section 7 of the ESA with the USFWS would be initiated.

Forest Service Sensitive Species

Effects of the Proposed Action on Forest Service sensitive species are analyzed in detail in the *Biological Evaluation Baseline Hydrologic & Geotechnical Data Gathering Activities on Tonto National Forest* (WestLand Resources, Inc., 2015a), the impact results of which are summarized in Table 3-5 for species occurring or potentially occurring in the project area.

Migratory Birds and Golden Eagles

The total project area occurs in four types of desertscrub and encompasses about 75.40 acres, all of which could be used by one or more species protected under the MBTA. Direct disturbance would remove or degrade (by fragmenting habitat patches or impeding movement) about 33.63 acres of habitat due to the Proposed Action. Within the disturbance footprint, ground disturbance could result in the take of a nest, eggs, or hatchlings during the breeding season. Because there is no permit for construction projects to allow take of MBTA protected species, effects would be mitigated during the breeding season by conducting nesting bird surveys in the project area no later than one week prior to ground disturbance.

Where ground surface is disturbed, there is the potential for habitat to be indirectly impacted by introduced plant species spreading into the disturbed areas and some areas nearby. This could further degrade the quality of habitat in an area. Reclaiming disturbed sites would return the habitat functions to the disturbed areas, but the time for full re-establishment of the pre-existing perennial plant cover could take several decades (Abella, 2010).

Noise and vibration from heavy equipment could temporarily disturb migratory birds. Individuals would likely fly to a comfortable distance away from the noise and vibration-producing activities. Overall,

project related effects would be widely dispersed across the project area and would be temporary. Periodic long-term, project related activities could also cause temporary disturbance to migratory bird species. Other behaviors such as feeding, courtship, or resting could be disrupted, but such effects would be minimal and temporary and would not deter use of the project area overall. Normal activities and behaviors would resume after personnel and equipment left the area.

Effects to golden eagles would be similar to other MBTA birds except that the project area lacks suitable nesting habitat, but has suitable habitat for foraging, perching, and possibly roosting. This species may avoid areas with surface disturbance or that would be disturbed by noises and activity during the Proposed Action or travel along access roads. These disturbances would be temporary and individuals would resume normal behavior after the activity ceases in an area. The amount of ground disturbance for this species would be negligible due to the large foraging areas used by the species and would not affect foraging opportunities within the project area. Periodic long-term sampling at test sites could induce a golden eagle to flush from a perch site, but such effects would be minimal and temporary and would not deter wildlife use of the project area overall.

The Proposed Action could impact individual migratory birds and golden eagles or alter use patterns at or near the access roads and survey sites due to temporary noise or vibration and longer-term changes to habitat. However, the site specific effects would be minimal and widely dispersed, and would not result in changes to the viability of the population nor cause long-term changes in use of the project area.

Management Indicator Species

A number of MIS could occur in the project area. The only MIS of the desertscrub habitats that occur in the project area are the black-throated sparrow and the canyon towhee. Other birds that are categorized as MIS were also documented as transients or migrants in the project area; these included the violet-green swallow, savanna sparrow, hooded oriole, gray vireo, Bell's vireo, and ash throated flycatcher. These species are not indicators of the desertscrub habitats in the project area, and the project would negligibly affect transitory habitat and would not affect the indicator habitat components associated with these species. These species are also protected under the MBTA, and the types of impacts would not differ from those described in the previous subsection. The effects would not result in population-level changes to the two resident species or the six transient species and would not affect the health trends of the Forest-wide habitats because the extent of effects is limited to the 33.63 acres associated with new ground disturbance. The temporary nature of the Proposed Action would have a minimal impact on the behavior of these species.

There would be no impact to macro-invertebrate indicator species. These species occur in a limited number of small spring or wetland environments that would not be impacted by the Proposed Action.

3.7.4.4 Cumulative Effects

The cumulative effects analysis area for wildlife and special status species is shown on Figure 3-1. Past, present, and reasonably foreseeable future activities that have or could result in effects to wildlife and special status species include: vegetation management, mineral development, transportation and access, and safety hazard remediation projects. Activities associated with the proposed MPO (Table 3-1, Figure 3-6) that have the potential to overlap in time and space with the Baseline Plan would open up 918 acres

of land within the cumulative assessment area. However, the incremental effects to wildlife and special status species that are likely to result from the Proposed Action would be negligible to minimal. Although there could be effects to wildlife and special status species from reasonably foreseeable future activities, there is little likelihood that the effects from the Proposed Action would measurably add to those effects.

Motorized use associated with OHVs and other recreational activities within or adjacent to Sonoran desert tortoise habitat has the potential to influence behavior, survival, reproduction, and distribution of Sonoran desert tortoise, as well as to alter habitat. The use of forest roads and avoidance of hazards could increase access near riparian zones, indirectly increasing sedimentation into streams and damage to riparian vegetation, and increase the potential for spreading invasive plants. The presence and noise of vehicles near nesting sites and foraging areas could disturb migratory birds. However, the incremental effects of additional motorized use under the Proposed Action would be minimal, short-term, and widely dispersed, and significant adverse effects to Sonoran desert tortoise are not expected.

The incremental effect of the Proposed Action when added to past, present and reasonably foreseeable actions is not expected to place wildlife species or special status species at risk of listing under the ESA or result in population-level effects. Potential impacts from the Proposed Action, combined with mitigation measures 7-12 (Section 3.7.3.3), have been determined to be negligible to wildlife and special status species, and would therefore only contribute negligibly to cumulative effects.

3.8 Range

3.8.1 Regulatory Framework

National Forest Service direction on range management is provided in FSM 2200 Range Management and the following handbooks:

- FSH 2209.13 (Grazing Permit Administration Handbook)
- FSH 2209.21 (Range Analysis Handbook)
- FSH 2209.22 (Structural Range Improvement Handbook)
- FSH 2209.23 (Non-structural Range Improvement Handbook)

Applicable Forest-Wide management direction (U.S. Forest Service, 1985) for range management areas is:

> *Emphasize a program of range administration which will bring the range resource under proper management and improve range forage conditions. Investigate, control, minimize, and eliminate unauthorized livestock use as a priority range management job.*

The Forest Plan for Management Areas 2F and 3I identifies specific prescriptions to meet rangeland management program goals. These specific Forest-wide Management Prescriptions provide direction for range management activities to optimize production and utilization of forage allocated for livestock use consistent with maintaining the environment and providing the multiple uses of the range.

3.8.2 Existing Conditions

The analysis area for range conditions and livestock grazing operations includes the portions of the Millsite and Superior allotments that overlap the project area, and the forest roads used to support livestock grazing operations (Figure 3-8). Small areas of private land west of the Town of Superior, along FR 357 near the junction with U.S. 60, are also included in the analysis area. This land is not included in an allotment.

Grazing on Forest Service allotments is administered in accordance with the Terms and Conditions of the Term Grazing Permit. Each permit includes the Annual Operating Instructions and an Allotment Management Plan. The Allotment Management Plan designates the level of use permitted and specifies goals and objectives of management, management strategies, range improvements, and monitoring requirements. Grazing allotments within the Project Area are governed by the Millsite Allotment Management Plan, which covers 44,573 acres, and the Superior Allotment Management Plan, which covers 58,532 acres. There are multiple range improvements within these allotments including fencing, corrals and pens, cattle guards, water pipelines, dirt stock tanks, windmills, water storage tanks, and troughs.

3.8.3 Environmental Consequences

3.8.3.1 Methodology

The effects analysis for rangeland resources considers the following aspects of livestock operations:

- Livestock management activities.
- Number of permitted Animal Unit Months (AUMs).
- Rangeland improvements.
- Forage quality and quantity.

AUMs

Animal Unit Months – One mature (1,000 pound) cow or the equivalent based upon average daily forage allowance of 26 pounds dry matter per day under range conditions (Frost and Ruyle, 1993).

For this analysis, effects are based on differences between current and proposed use of roads during livestock grazing management, potential project-induced livestock mortality, access or disruption to rangeland improvements, and changes in forage quality or quantity. The duration of impacts is based on both the overall time interval of the project and the length of time that these effects can be detected.

3.8.3.2 Effects from No Action

Under the No Action Alternative, the Proposed Action would not be approved, and no action or activity would take place. No impacts on range resources associated with the Proposed Action would occur.

3.8.3.3 Effects from the Proposed Action

The direct effects of the Proposed Action on range consider the availability of livestock forage and changes to livestock operations management using forest roads. The Proposed Action would disturb approximately 33.63 acres of vegetation within the Millsite and Superior allotments. Table 3-7 shows acres of disturbance from these activities in the Millsite and Superior allotments.

Vegetation including livestock forage would be removed to improve 14.36 miles of access roads (12.09 miles of forest roads, and 2.27 mile of previously disturbed areas to be used as temporary access roads), and 7.95 acres for hydrological drill sites, geotechnical drill sites, test trenches, and laydown yards. Other direct effects on forage from vegetation disturbance would be from vehicles using the 5.83 miles of short-term temporary access roads and crushing vegetation, and trampling plants at the drill sites and other activity areas for the Proposed Action during construction and monitoring.

There would be a short-term reduction in forage available for livestock grazing. However, because the disturbance would affect a negligible amount of vegetation as compared to the overall allotment areas, the disturbance would not require a reduction in the permitted or active number of AUMs.

Table 3-7. Acres of Disturbance by Allotment from the Proposed Action

Proposed Action	Acres of Disturbance by Allotment		Total Acres of Disturbance
	Millsite	Superior	
Access Roads Total Disturbance	19.30	6.35	25.65
Forest Roads Maintenance	0.00	0.00	0.00
Forest Road Improvements	11.34	3.32	14.66
Improvements to previously disturbed areas to be used as temporary access roads	1.56	0.82	2.38
Maintenance of previously disturbed areas to be used as temporary access roads	1.38	0.19	1.57
Short-term temporary access roads	5.02	2.02	7.07
Hydrological drill sites	2.78	1.43	4.21
Geotechnical drill sites	0.15	0.12	0.27
Test trenches	0.40	0.88	1.28
Construction laydown yards	0.00	2.19	2.19
Total	**22.63**	**10.97**	**33.60**

Transport of equipment associated with the Proposed Action could temporarily delay livestock management activities. During improvement and maintenance activities on forest roads, public safety requirements could require reducing segments of these roads to one travel lane. This could indirectly result in a temporary delay to planned livestock management and operations when the Proposed Action activities coincide with livestock operations using these roads. To avoid temporary delays, permittees could use a different access road which could indirectly increase the cost of livestock management activities and/or the amount of time permittees spend conducting livestock operations.

Establishing vegetation in reclaimed areas that could also be available for livestock is one aspect of reclamation success. Livestock grazing in reclaimed areas could delay meeting reclamation success standards established by the Forest Service. The reduction of forage resulting from the Proposed Action compared to the total forage available is too small to require altering the number of permitted AUMs occurring within the project area. Vegetation would be reestablished through reclamation (Section 2.3.5) and Applicant-proposed EPMs (Section 2.3.6). Forage would be reestablished as vegetation grows during and after reclamation of the disturbed areas.

Invasive plants can adversely affect forage quality and quantity. Although the risk of spreading invasive plants is moderate to high for species that are prevalent within the area (Section 3.6.3), implementation of the Applicant-proposed EPMs (Section 2.3.6) would help reduce the spread of invasive plant species.

Livestock could drink or attempt to drink fluids in the settling ponds that are established at the hydrological and geotechnical drill sites. Applicant-proposed EPMs would effectively obstruct access to the settling ponds by livestock avoiding potential effects to livestock that may attempt to drink from the ponds. The EPMs would reduce effects on the amount of forage available for livestock. Effects from the Proposed Action on vegetation would be minor and long-term in areas where vegetation was removed. In areas were vegetation was crushed by vehicles or people, the effect on vegetation would be minor and short-term.

3.8.3.4 Cumulative Effects

The cumulative impact analysis area for range is shown in Figure 3-1. This area was chosen for the analysis because it includes the potential for direct and indirect effects on forage and livestock management. In addition to the Proposed Action, the present and reasonably foreseeable future actions that could have cumulative effects on range include vegetation management, range, and mineral development (see Table 3-1).

Surface disturbance from rangeland improvements identified in Table 3-1 and the Proposed Action would result in removal of vegetation and forage. Rangeland improvements would remove a negligible amount of vegetation within the Millsite, Superior, and Devil's Canyon allotments in addition to the 33.63 acres disturbed by the Proposed Action. The Mesa Vegetation Regeneration and Habitat Improvements Project would reclaim approximately 30 acres on the Mesa Ranger District disturbed by OHV use, which could reduce disturbance of vegetation adjacent to forest roads. Long-term, reclamation with subsequent recovery of vegetation could indirectly improve the quality and quantity of forage available to livestock. However, during reclamation activities, the use of forest roads to transport equipment could result in temporary delays in livestock management.

Travel Management Planning could result in the realignment, reconstruction, or decommissioning of forest roads, and alter how much time is required to conduct livestock management activities. The extent of these changes cannot be predicted nor quantified at this time, but effects to livestock management activities are expected to be minor. Mineral development activities would also affect range by local removal of vegetation. For example, the MPO would affect 918 acres of vegetation within the cumulative assessment area. All mineral development activities would be conducted in accordance with the Plans of Operations approved by the Forest Service which would include requirements for reclamation.

Most disturbance to vegetation associated with the Proposed Action would be reclaimed immediately after the disturbance occurred and the revegetation would mature over time, further decreasing the effects of the Proposed Action on vegetation. Although some reasonably foreseeable future actions, such as the MPO would disturb large amounts of vegetation, the incremental effect of the Proposed Action during this period would be negligible when compared to the overall acreage of rangeland available within the Millsite and Superior allotments.

Reclaiming areas disturbed by the Proposed Action, and the anticipated recovery of vegetation, soils, and channel crossings could improve the stability of vegetation communities, to include forage for livestock. However, the incremental contribution of the Proposed Action to these effects would be negligible. Additionally, the implementation of mitigation measures 4-6 would further minimize impacts to range. For these reasons, cumulative effects on range would be long term but minor and therefore no significant impacts to range are anticipated.

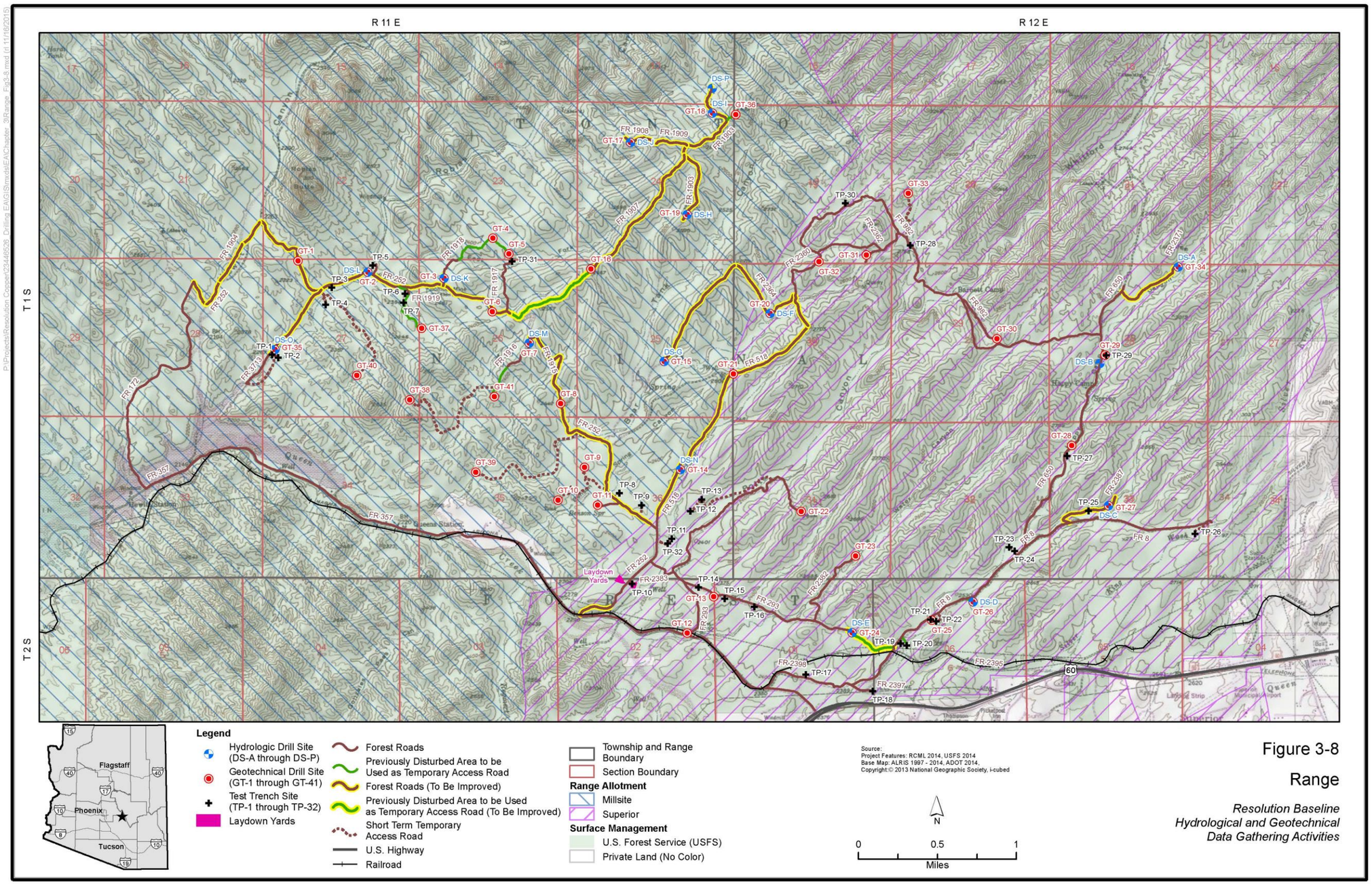

Figure 3-8

Range

Resolution Baseline Hydrological and Geotechnical Data Gathering Activities

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3.9 Cultural Resources

Cultural resources include prehistoric and historic archaeological sites, historic building and structures, and traditional (ethnohistoric) cultural resources and life ways. Traditional cultural resources are associated with cultural practices or beliefs that are rooted in a traditional community's history and are important in maintaining the cultural identity of the community.

3.9.1 Regulatory Framework

In conjunction with assessing effects on the cultural environment pursuant to NEPA, this section discusses the closely related requirements of the NHPA Section 106 (Title 54 United States Code 300101 et seq.), as recommended by the CEQ and ACHP (2013). NHPA Section 106 requires Federal agencies to take into account the effect of their undertakings on any district, site, building, structure, or object included in or eligible for inclusion in the NRHP, in consultation with the State Historic Preservation Officer (SHPO) and other interested parties pursuant to regulations for *Protection of Historic Properties* (36 CFR 800), which implement NHPA Section 106. The Forest implements NHPA Section 106 requirements in accordance with the Region 3 First Amended Programmatic Agreement Regarding Historic Property Protection and Responsibilities, executed in 2010 in accordance with 36 CFR 800.

To be eligible for the NRHP, properties must be at least 50 years old (unless they have exceptional historical importance) and have national, state, or local significance in American history, architecture, archaeology, engineering, or culture. They must possess sufficient integrity of location, design, setting, materials, workmanship, feeling, and association to convey their historical significance, and must meet at least one of the four following criteria.

Criterion A: Are associated with events that have made a significant contribution to the broad patterns of our history.

Criterion B: Are associated with the lives of people significant in our past.

Criterion C: Embody distinctive characteristics of a type, period, or method of construction, or represent the work of a master, or possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction.

Criterion D: Have yielded or may be likely to yield information important in prehistory or history (36 CFR 60).

For the purposes of NHPA Section 106, the Forest Service and SHPO can make determinations of eligibility by consensus.

In addition to NEPA and NHPA, the Forest Service addressed other pertinent laws, regulations, and policies in conducting the cultural analysis presented in this EA, including:

- Archaeological Resources Protection Act of 1979
- Executive Memorandum of April 29, 1994, Government-to-Government Relations with Native American Tribal Governments

- Executive Order 13007, May 24, 1996, Indian Sacred Sites
- Executive Order 13175, November 6, 2000, Consultation and Coordination with Indian Tribal Governments
- Forest Service Manual 2360, Heritage Program Management
- Forest Service Region 3 Tribal Relations Policy

The Federal government also has a trust responsibility related to the welfare of American Indians and their land and resources. Indian trust responsibilities for the Forest Service are defined by executive orders, laws, and treaties that are related to National Forest System lands. While there are no treaties tied to the project area, the Forest Service fulfills trust responsibilities by following laws that protect tribal rights and by making an effort to manage National Forest System lands in a way that accommodates the needs and concerns of Native American groups, while still maintaining a responsibility to all citizens of the U.S.

3.9.2 Existing Conditions

NEPA requires Federal agencies to consider not only the natural environment but also historic and cultural aspects of our nation's heritage. The cultural environment includes those aspects of the physical environment that relate to human culture and society, along with the institutions that form and maintain communities and link them to their surroundings (King & Rafuse, 1994). Archaeological evidence indicates human societies have occupied what is today the southwestern U.S. for more than 13,000 years. The cultural history of the region can be divided into five periods based on changing adaptations and life ways: (1) Paleoindian (11,500-8500 BC), (2) Archaic (8500 BC–AD 1), (3) Formative (AD 1-1450), (4) Protohistoric (AD 1450-1691), and (5) Historic (AD 1691-1964).

Paleoindians were nomadic hunters and gatherers whose prey included large, now extinct game species, such as mammoth and giant bison. Although significant Paleoindian sites have been found in southeastern Arizona, none have been documented in the project vicinity. The extinction of large mammals and the warming and drying climate of the Holocene epoch ushered in the Archaic period, and subsistence strategies shifted to the hunting of smaller game and gathering of a broad spectrum of indigenous plant resources. Early and middle Archaic period sites are rare in the project vicinity and populations seem to have declined during hot, arid conditions of the middle Holocene era. Late Archaic/early Formative period sites are more common and it was during that time that some groups began to grow domesticated crops, which led to development of a village-based farming adaptation characteristic of the Formative period. The Hohokam culture occupied the project area during the middle Formative period (circa AD 650-1150) and their settlements were clustered along streams and adjacent floodplains and alluvial fans, where they farmed. The large and small settlements of the subsequent Salado occupation (circa AD 1150-1450) were more widely distributed across the landscape. When Europeans arrived they documented that the project area was near the boundary of territories occupied by the Western Apache and the Southeastern Yavapai, who often cooperated and intermarried. The nomadic adaptation of those groups left meager evidence in the archaeological record compared to the earlier sedentary adaptation.

Although Spain, and later Mexico, claimed sovereignty over the region from the sixteenth century through the mid-nineteenth century, they did not establish any settlements in Arizona north of Tucson,

except for a mission among the Hopi villages between 1629 and 1680, and a short-lived mission at the Yuma crossing of the lower Colorado River from 1780 to 1781. The U.S. acquired the region in 1848 with the signing of the Treaty of Guadalupe Hidalgo, negotiated at the end of the War with Mexico. Additional land south of the Gila River was acquired in 1854 when the Gadsden Purchase was ratified.

In 1865, the U.S. Army established Fort McDowell in the lower Verde River Valley, and stimulated American settlement by protecting miners and farmers from Apaches and Yavapais and by creating a market for supplies.

American settlement in the project vicinity during the historic period was largely driven by mining after discovery of silver ore in 1875 that led to development of the Silver King Mine. Mining stimulated other pursuits such as ranching and development of numerous camps, settlements, and roads. Major ranches in the middle Queen Creek Valley include the Hewitt Ranch, Whitford Ranch, and Nicholas Ranch. The Forest was established early in the twentieth century to protect the watershed of the Salt River, and after World War II the Forest Service mission shifted to a policy of multiple uses.

Areas that might be disturbed by the Proposed Action were intensively surveyed for cultural resources (Chamorro, 2014; Hooper, 2014). The surveys covered areas 250 feet square (62,500 square feet) for each hydrologic drill and geotechnical test location; 150 feet square (22,500 square feet) for each test trench; and corridors 100 feet wide for forest road improvements and along short-term temporary access roads. The survey covered a total of 494 acres, identified 20 previously recorded archaeological sites, and discovered 25 additional sites and 98 isolated occurrences of artifacts and features that did not warrant designation as sites. The Forest, in consultation with the Arizona SHPO (concurrence dated October 8, 2014), concluded that 18 sites are eligible for the NRHP, and that the remaining 12 sites and the 98 isolated occurrences are not eligible for the NRHP. One site, a historic buried natural gas pipeline, is exempt from Section 106 review. Additional information is needed to complete the eligibility evaluation of the remaining 14 sites, but for the purposes of this assessment of effects, they are considered eligible for the NRHP. Of the sites determined to be eligible or considered eligible, 19 represent the prehistoric occupation of the area, nine represent the historic use of the area, and three sites have both prehistoric and historic components. The cultural affiliation and age of one site has not been determined (Table 3-8). No sites in the project area are listed in the NRHP.

Table 3-8. Archaeological Sites Determined or Considered Eligible for the National Register of Historic Places

Site Type	Number
Prehistoric Sites	
Hohokam village or hamlet	3
Salado farmstead or field house	3
Hohokam or Salado farmstead	1
Hohokam or Salado campsite	4
Hohokam or Salado resource procurement and processing locale	2
Hohokam or Salado field or field check dams	2
Archaic campsite and Salado farmstead	1
Archaic and Hohokam or Salado campsite	2
Prehistoric and Apache campsite	1
Historic Sites	
Road	3
Railroad	2
Ranch house	1
Corral	1
Electrical transmission line	1
Telephone line	1
Sites with Both Prehistoric and Historic Components	
Hohokam or Salado village and historic trash	1
Hohokam or Salado campsite and possible historic tent platform	1
Salado field house and historic mineral processing locale	1
Sites of Unknown Cultural Affiliation and Age	
Three cobble alignments and sparse historic trash that may not be associated	1
Total	**32**

The study area for a recent ethnographic/ethnohistoric assessment prepared for the expansion of U.S. Highway 60 between Superior and Globe overlapped much of the project area for the Resolution Baseline data gathering area. Within the area of overlap, that study identified the historic Pinal Cemetery and historic Silver King Road as cultural resources related to traditional Euro-American settlement of the area, and four rock clusters identified as possible prehistoric or historic burials (Bengston, 2013). Subsequent archaeological testing determined that there were no burials at the four rock clusters (Bruder, 2014), and recommended that the Pinal Cemetery and Silver King Road be considered ineligible for the NRHP. Because the Baseline activities would not affect the cemetery or road, their eligibility was not formally evaluated.

The Forest recently completed another ethnographic/ethnohistoric study to identify traditional cultural resources in the Superior area, including the area of this Proposed Action (Hopkins et al., 2015). That study identified more than 400 places having traditional cultural importance for the Western Apache, Yavapai, Gila River and Salt River Pima-Maricopa Indian Communities, Hopi, and Zuni. The traditional cultural resources include landforms and resource collection areas with traditional place names, other places named in traditional tribal stories, camp sites, ancestral archaeological sites, petroglyph sites, and trails. The tribes also consider traditionally used water sources, plants, animals, and minerals to be

significant. Several of the identified traditional cultural resources are in the Project area. Although formal evaluation of the NRHP eligibility of the identified traditional cultural resources has not been completed, they are considered eligible for the NRHP for the purposes of this assessment of effects.

3.9.3 Environmental Consequences

3.9.3.1 Methodology

The Forest Service works to avoid adverse effects on properties that are listed in or eligible for listing in the NRHP if feasible. Sites for which no eligibility determinations have been completed are considered eligible for the purpose of determining the effects of the Proposed Action. Sites that have been determined not eligible for the NRHP are not afforded protection. Locations of sites that are eligible or unevaluated for the NRHP were compared with a map of the proposed surface disturbance locations. Based on this analysis, Resolution designed the proposed Plan to avoid direct effects to all archaeological sites determined to be eligible or potentially eligible for the NRHP. In addition, the Forest consulted tribes about potential effects on traditional cultural resources identified by a recently completed ethnographic and ethnohistoric study of the Superior area (Hopkins et al., 2015).

3.9.3.2 Effects from No Action

Under the No Action alternative, the Proposed Action would not be approved, and no action or activity would take place. No effects associated with the Proposed Action would occur to cultural resources.

3.9.3.3 Effects from the Proposed Action

Comparing the results of the cultural resources surveys (Chamorro, 2014; Hooper, 2014) with the initial Plan proposed by Resolution indicated that three archaeological sites would be disturbed by the drilling or test trenching, two sites would be disturbed by use of short-term temporary access roads, and three sites would be disturbed by improvements of existing roads that would be used for access. Resolution subsequently modified the Plan to avoid direct effects to those eight sites. Three sites are within 50 feet of areas that would be disturbed but those sites can be avoided, and a cultural resource specialist would monitor all ground disturbing activities to avoid damage to those sites and ensure that any previously unidentified archaeological resources that might be discovered are protected while they are evaluated and treated appropriately (Table 3-9).

Table 3-9. Known Archaeological Sites to be Monitored During Project Activities

Site Number	Site Type
AR-03-12-02-146	Historic Magma Arizona Railroad Mainline
AR-03-12-02-1954	Hohokam or Salado farmstead
AR-03-12-03-776	Hohokam or Salado campsite

Resolution has included Applicant-proposed EPMs (Section 2.3.6) in the Plan to protect NRHP-eligible and potentially eligible archaeological and historical sites from adverse effects during implementation of the Proposed Action.

Tribal consultations were conducted to evaluate potential effects of the Proposed Action on traditional cultural resources identified in the Project area (Hopkins et al., 2015). Based on those consultations, the Forest developed the following mitigation measures:

MM – 13: To protect cultural resources, proposed geotechnical borings GT-9, GT-10, GT-11 and the associated temporary access routes would not be approved.

MM - 14: To protect cultural resources, proposed geotechnical boring GT-31 would be moved 675 feet north along existing road FR 518.

MM - 15: To protect cultural resources, proposed groundwater monitoring well DS-B would be moved 80 feet north.

The Forest has determined that mitigation measures 13-15 would be effective in protecting the traditional cultural resources identified in the Project Area, and the Proposed Action would not have an adverse effect on those traditional cultural resources. The consulted tribes have concurred with that determination. In accordance with the *Region 3 First Amended Programmatic Agreement Regarding Historic Property Protection and Responsibilities* (U.S. Forest Service, 2003) no additional consultation with the SHPO is required.

3.9.3.4 Cumulative Effects

The cumulative impact analysis area for cultural resources is shown on Figure 3-1. This area was chosen for the analysis because it is within the Queen Creek watershed upstream of Whitlow Ranch Dam and north of U.S. 60. It also includes a small area south of U.S. 60 in the Oak Flat-Upper Queen Creek subwatershed east of Apache Leap. Several of the present and reasonably foreseeable future actions outlined in Table 3-1, including vegetation management, mineral development, transportation and access, and safety hazard remediation, could contribute to cumulative effects on cultural resources. The MPO especially has the potential to affect significant cultural resources.

Historical uses of the Forest have affected cultural resources, and future authorized uses that entail terrain disturbance have the potential to affect cultural resources. Future Travel Management Planning could reduce the miles of roads open to vehicle use and thereby reduce the effects of vehicle traffic on cultural resources and inadvertent damage or vandalism facilitated by vehicle access. The Forest would continue to address the effects of any proposed activities on cultural resources and would seek measures to avoid, reduce, or mitigate any identified adverse effects pursuant to Section 106 of the NHPA.

The Proposed Action is not expected to adversely affect any cultural resources listed in or eligible for the NRHP. Therefore, implementation of the Proposed Action would result in no increment to the cumulative effects of past, present, and reasonably foreseeable actions on cultural resources.

3.10 Travel Management and Public Safety

3.10.1 Regulatory Framework

Transportation, Traffic, and Access

Travel, transportation, and road management in the Forest are governed by 36 CFR, Part 212, and FSH 7709.58, as outlined in the Forest Plan as amended (U.S. Forest Service, 1985). The Forest Plan provides direction on road maintenance, construction, and management of the transportation system. Current direction in the Forest Plan includes the following Forest-wide standard for transportation system management:

- Provide a serviceable road and trail transportation system to meet public access, land management, and resource protection needs.

Management Areas 2F and 3I do not have specific management prescriptions related to the forest road transportation system; however, the Forest Service is preparing a Travel Management Plan that would include designations of roads, trails, and areas open to motor vehicle use. The definitions and motor vehicle use designations applicable to the Proposed Action area include:

- **Road** – A motor vehicle route over 50 inches wide, unless identified and managed as a trail.
- **Temporary road or trail** – A road or trail necessary for emergency operations or authorized by contract, permit, lease, or other written authorization that is not a forest road or trail and that is not included in a transportation atlas.
- **Designated road, trail, or area** – A National Forest System road, National Forest System trail, or an area on National Forest System lands, that is designated for motor vehicle use pursuant to Section 212.51 on a motor vehicle use map.

FSH 7709.58 defines and summarizes five road maintenance levels and entrance management strategies according to Forest Service regulations (U.S. Forest Service, 2005). Forest Service Transportation Management Maintenance Levels applicable to the Proposed Action include:

- **Level 1 (Closed to motor Vehicle use)** – Roads that have been placed in storage between intermittent uses. Basic custodial maintenance is performed to prevent damage to adjacent resources and to perpetuate the road for future resource management needs. Roads receiving level 1 maintenance may be of any type, class, or construction standard, and may be managed at any other maintenance level during the time they are open for traffic.
- **Level 2 (High-clearance Vehicles)** – Roads are maintained open for limited passage of traffic. Roads in this maintenance level are primitive type facilities intended for high clearance vehicles. Passenger car traffic is not a consideration.
- **Level 3 (Suitable for Passenger Cars)** – Roads are maintained open and safe for travel by a prudent driver in a passenger car. However, user comfort and convenience is not considered a priority.

- **Level 4 (Suitable for Passenger Cars)** – Roads are maintained open and safe for travel by a prudent driver in a passenger car. Roads in this maintenance level provide a moderate degree of user comfort and convenience at moderate travel speeds.

Public Safety

Public safety, including the use of hazardous materials, is managed using the following guidelines as established in the Forest Plan (U.S. Forest Service, 1985):

- Maintain roads to provide for public safety, commodity haul, and resource protection in accordance with FSMs 7700 and 7730 (U.S. Forest Service, 2009a).

There are no specific management prescriptions established in Management Areas 2F and 3I for public safety. Public safety would also be managed through the use of Applicant-proposed EPMs identified in Section 2.3.6.

3.10.2 Existing Conditions

Transportation, Traffic, and Access

Forest roads provide access to recreation use, recreation facilities, leased properties, and permitted uses such as special use permits, utility line ROWs, grazing allotments, and mining claims. Forest roads are numbered (see Figure 3-8); however, there can be a local name for the same road such as Hewitt Station Road (synonymous with FR 357). U.S. 60 west of the Town of Superior is managed by ADOT and intersects FR 357 near Boyce Thompson Arboretum. As an improved, unpaved road, FR 357 is suitable for passenger cars and is designated as a maintenance Level 4 road. FR 357, also known as Hewitt Station Road, provides access to private residences. Other forest roads shown on Figure 3-8 have attributes that are characteristic of maintenance Level 2 roads, which are primitive unpaved roads ranging from 10 to 20 feet wide with occasional pullout areas for passing vehicles. Some are designated as maintenance Level 1 roads, despite their existing appearance as Level 2 roads, and are currently open to vehicular traffic but will be brought back to maintenance Level 1 conditions as part of the Proposed Action. The roads that would be brought back to maintenance Level 1 conditions after the authorization period are FR 1907, FR 1908, FR 1916, FR 1917, FR 1918, FR 1919, FR 2371, FR 2381, FR 3713 and FR 2364. Once those conditions have been met, maintenance Level 1 roads would not be maintained unless required to minimize resource impacts.

Public Safety

The analysis area for public safety, including the use of hazardous materials, includes project access roads within the Queen Creek watershed. There are no known hazardous materials being used within the project area, although the analysis area has not been inventoried or evaluated for hazardous materials. Abandoned mines exist in the analysis area in the vicinity of DS-K monitoring well which could pose a safety concern. Roads in the project area are used by the public for general recreation activities such as OHV use, hiking, camping, hunting, and to access the Superstition Wilderness Area.

3.10.3 Environmental Consequences

3.10.3.1 Methodology

This section evaluates the effects of the Proposed Action on forest road conditions, traffic, and access to areas and facilities by Forest users and permittees. The potential effects on public safety from the Proposed Action are also analyzed for the potential to create hazards on forest roads or on lands administered by the Forest Service.

3.10.3.2 Effects from No Action

Under the No Action alternative, the Proposed Action would not be approved, and no action or activity would take place. No impacts associated with the Proposed Action to travel management or public safety would occur.

3.10.3.3 Effects from the Proposed Action

Transportation, Traffic, and Access

The Proposed Action would improve approximately 12.09 miles of forest roads and maintain approximately 22.39 miles to meet maintenance Levels 2, 3, and 4 standards. Improving and maintaining the condition of 34.48 miles of forest roads and 8.10 miles of temporary access roads could indirectly increase traffic due to enhanced road conditions. Necessary project-related improvements and maintenance of roads would be short term, and limited by shallow soils, cobble/boulder, and exposed bedrock.

Equipment used to improve and maintain access roads necessary for the Proposed Action could result in temporary delays by other Forest users. While these delays would be temporary, overlapping forest road improvements with construction of hydrological or geotechnical drills sites could collectively have a greater effect on travel throughout the area. Improvements and maintenance activities could indirectly result in localized and temporary increases in traffic. Road improvement and maintenance related delays would be temporary as the Applicant-proposed EPMs (Section 2.3.6) state that access would be maintained with no road closures.

Recreation users that prefer more primitive road conditions would experience temporary effects due to the Proposed Action; however, there are several existing Level 2 forest roads with similar primitive conditions that would not be improved in the project area.

To meet the attributes of maintenance Level 1 roads, the following roads would be reclaimed by Resolution at the end of the authorization period: FR 1907, FR 1908, FR 1916, FR 1917, FR 1918, FR 1919, FR 2371, FR 2381, FR 3713 and FR 2364. Entrances to these roads would be physically blocked, disguised, or signed to deter vehicular traffic. Effects to dispersed recreation users would be minimal because these maintenance Level 1 roads would not be closed to non-motorized uses. Users seeking motorized recreation may experience long term effects because the roads would not be maintained; however, there are several existing forest roads that would remain open to vehicular traffic with similar Level 2 attributes.

Public Safety

During road improvements and maintenance for the Proposed Action, public access would be managed by Resolution work crew members. Signing for traffic control would comply with the guidelines in the Manual on Uniform Traffic Control Devices (FSM 7103.3) for signs and markers (U.S. Forest Service, 2004). Proposed test trenches would be located adjacent to existing roads where possible. In the unlikely event that a site was left unmanned for a short period of time (e.g., hours), barricading (i.e., safety cones, jersey barriers, temporary fencing, and/or yellow caution tape) would be used. It is possible that road construction, drilling, and excavation equipment on and along the access roads could block the sight of oncoming traffic. Effects to the safety of road users would be minimized through safety measures and would be temporary, limited to the period of road work and drill site development.

Resolution lists oil-based materials (e.g., fuel and oil for vehicles) that would be used for the Proposed Action. These materials would be used in vehicles conducting roadway improvements, construction of the monitoring wells, and digging the test trenches (see Appendix F of the Plan –SPCC). Fuel and other oil-based products stored in the vehicles and at the laydown yards would be the only potentially hazardous materials in the project area for the Proposed Action.

Implementation of Applicant-proposed EPMs (Section 2.3.6) would assist with public safety. Consequently, the risk to public safety, human health, wildlife, and the environment from the Proposed Action would be minimized. The Proposed Action is not expected to pose a hazard to the public or result in hazardous materials entering the environment.

3.10.3.4 Cumulative Effects

The cumulative effects analysis area for travel, traffic, and access is shown in Figure 3-1. This area was chosen for the analysis because it encompasses the area in which the Proposed Action and past, present, and reasonably foreseeable future actions could occur that would cumulatively impact travel and public safety. Several of the present and reasonably foreseeable future actions outlined in Table 3-1, including range, mineral development, transportation and access, land use, recreation, and safety hazard remediation could contribute to cumulative effects on travel management, traffic, access, and public safety.

The contribution to cumulative effects from the Proposed Action on travel management, traffic, access, and public safety would include a localized and temporary increase in vehicle traffic, primarily from the construction vehicles listed in Table 3-1. Implementation of the proposed MPO would result in increased vehicular traffic on forest roads, could change forest user access in the vicinity of the project area, and potentially deviate from the travel management plan. The Proposed Action would temporarily cause an increase in traffic, resulting in a minor effect on travel management and access; however, the effects would be temporary and localized. There could be additive cumulative effects on transportation, traffic, and access from the Proposed Action and future traffic. Mineral exploration, rangeland improvements, and recreation activities would use forest roads and contribute to traffic. These ongoing activities could result in temporary traffic increases on forest roads.

Changes to the transportation system roads from Travel Management Planning could also alter the volume of traffic on forest roads if the decisions result in closing roads. Closing some forest roads could

result in access changes for permit and ROW holders as well as general recreation users. The intensity and extent of the effects of Travel Management Planning are uncertain as decisions for specific forest roads are unknown at this time. The contribution to cumulative effects from all the projects listed within the cumulative effect analysis area, with the exception of the MPO, would be temporary and localized during periods of project activity (e.g., increased volume of vehicles during project activities). Implementation of the proposed MPO could potentially create long-term changes to travel within and access to this part of the Forest. These changes would not begin to occur until year six at the earliest, at a time when the Proposed Action travel impacts would be intermittent and negligible. Therefore, the incremental contribution of the Proposed Action to potential cumulative effects would be negligible.

3.11 Recreation

3.11.1 Regulatory Framework

The Forest Service uses the Recreation Opportunity Spectrum (ROS) (U.S. Forest Service, 1982) as a tool to determine recreation management and development strategies. Following ROS assures recreationists have a broad spectrum of choices in the types of settings for each activity such as fishing, camping, or hiking. Current direction in the Forest Plan includes the following Forest-wide Standards and Guidelines for management of recreation resources:

- Maintain and enhance visual resource values by emphasizing recreation resource management which will increase opportunities for a variety of developed and dispersed experiences.
- ROS classes will be managed according to the existing inventory (U.S. Forest Service, 1985).

Management Areas 2F and 3I stipulate that management emphasis should be focused on dispersed recreation (U.S. Forest Service, 1985).

3.11.2 Existing Conditions

Recreation data were collected within a two-mile buffer around the project area (analysis area) through review of aerial photography and existing studies and plans including the Forest Plan and the Pinal County Comprehensive Plan (Pinal County, 2009). Recreation data include recreation uses such as trails, developed recreation facilities, special use permits, and ROS classifications. The ROS classifications for the Forest are dated and may not be consistent with existing conditions (Jones, 2014). There have been no landscape scale changes in the analysis area leading the Forest to expect major changes in recreation use or patterns. ROS is currently being updated although those data are not available for this analysis. Future recreation information for the cumulative effects analysis was collected through review of existing plans for Pinal County and the Forest Service.

The Forest Plan established ROS management standards for recreation based on existing and desired conditions. Table 3-10 defines these classifications.

Table 3-10. ROS Classifications

ROS Classification	Occurs within the Project Area	Description
Primitive (P)	No	Area is characterized by essentially unmodified natural environment of fairly large size. Interaction between users is very low and evidence of other users is minimal. The area is managed to be essentially free from evidence of human-induced restrictions and control. Motorized use within the area is not permitted.
Semi-primitive Non-motorized (SP)	Yes	Area is characterized by a natural or natural-appearing environment of moderate-to-large size. Interaction between users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present but is subtle. Motorized use is not permitted.
Semi-primitive Motorized (SPM)	Yes	Area is characterized by a natural or natural-appearing environment of moderate-to-large size. Interaction between users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present but is subtle. Motorized use is permitted.
Roaded Natural (RN)	Yes	Area is characterized by natural-appearing environments with moderate evidences of sights and sounds of man. Such evidences usually harmonize with the natural environment. Interaction between users may be low to moderate, but with evidence of other users prevalent. Resource modification and utilization practices are evident, but harmonize with the natural environment. Conventional motorized use is provided for in construction standards and design of facilities.
Rural (R)	No	Area is characterized by substantially modified natural environment. Resource modification and utilization practices are to enhance specific recreation activities and to maintain vegetative cover and soil. Sight and sounds of humans are readily evident, and the interaction between users is often moderate to high. A considerable number of facilities are designed for use by a large number of people. Facilities are often provided for special activities. Moderate densities are provided for away from developed sites. Facilities for intensified motorized use and parking are available.
Urban (U)	Yes	Area is characterized by a substantially urbanized environment, although the background may have natural-appearing elements. Renewable resources modification and utilization practices are to enhance specific recreational activities. Vegetative cover is often exotic and manicured. Sights and sounds of humans on-site are predominant. Large numbers of users can be expected, both on-site and in nearby areas. Facilities for highly intensified motor use and parking are available, with forms of mass transit often available to carry people throughout the site.

Recreation Uses

Recreation uses within the analysis area include hiking, biking, camping, picnicking, target shooting, hunting, OHV use, and sightseeing although information is currently unavailable for the amount of use. The Arizona Trail crosses through the analysis area from Picketpost Trailhead (located south of U.S. 60), the only developed Forest recreation facility within the analysis area. The primary recreation travel routes in the project area include U.S. 60, a state-designated scenic road, and several forest roads including

FRs 357, 8, 650, 172, 252, and 3713. All of the forest roads are maintained unpaved roads that provide dispersed recreation access within the Forest. Dispersed recreational activities within the Forest would generally occur throughout the analysis area. Based on field observations, evidence of dispersed recreation (i.e., camping) was noted at the junction of FR 357 and FR 172, and along FR 252. Boyce Thompson Arboretum, an Arizona State Park, is located on private land south of U.S. 60 and is managed by the University of Arizona.

Special Use Permits

Special Use Permits related to recreation within the Forest include commercial recreation services such as horseback riding, hiking, OHV use, and other guided outdoor activities. The Forest Service specifies outfitter/guide service allocations for each Management Area and total service days per year for each type of service. There are five local outfitters that have current Special Use Permits primarily for guided horseback or pack mule rides, day hikes, overnight camping, kayaking, and OHV use activities within the Globe Ranger District and Mesa Ranger District near Superior. Within the analysis area, a local outfitter has a Special Use Permit for commercial recreation services (nonmotorized) along FRs 357, 252, 172, 8, and 1011, and Potts Canyon.

Recreation Opportunity Spectrum (ROS)

The four ROS classes delineated within the analysis area include Semi-primitive Non-Motorized, Semi-primitive Motorized, Roaded Natural, and Urban. The Town of Superior and land use modifications related to mining activities are classified as Urban although the Proposed Action would not occur within this ROS classification. Areas associated with Roaded Natural include Boyce Thompson Arboretum, U.S. 60, Gonzales Pass Canyon, Hewitt Station Road (FR 357), and FR 8. Semi-Primitive Motorized areas include primitive unpaved forest roads within Hewitt Canyon, Bear Tank Canyon, Benson Spring Canyon, Potts Canyon, and Rice Water Canyon. Areas near Robles Canyon are classified as Semi-primitive Non-Motorized and include portions of the Arizona Trail. The majority of activities for the Proposed Action, approximately 95 percent, would occur within areas designated as either Semi-primitive Motorized or Roaded Natural. A very small portion, approximately 5 percent, of activities for the Proposed Action, would occur within an area classified as Semi-primitive Non-Motorized.

3.11.3 Environmental Consequences

3.11.3.1 Methodology

This section describes the potential recreation effects that could result from implementation of the Proposed Action. Recreation effects may be defined primarily as (1) restrictions on existing recreation uses and authorized areas for Special Use Permits, or (2) incompatibility with existing ROS classifications that would result from the development and operation of the Proposed Action. Temporary recreation use restrictions, including access, would result from the construction of access roads and drill sites associated with the Proposed Action. Improvements associated with the development and implementation of the Proposed Action may be inconsistent with certain ROS classifications.

3.11.3.2 Effects from No Action

Under the No Action alternative, the Proposed Action would not be approved, and no action or activity would take place. No impacts associated with the Proposed Action to recreation, or changes in the ROS, would occur.

3.11.3.3 Effects from the Proposed Action

Existing forest roads that provide access within the analysis area are used by recreation users and outfitters with Special Use Permits. Based on the Forest Plan for the 2F and 3I Management Areas, management for dispersed recreation opportunities is a Forest management emphasis. There is one developed recreation site near the Proposed Action and roads available to motorized use would remain available for use during development and implementation. Recreation users may encounter short delays along sections of forest roads under construction but use would not be precluded because the roads would not be closed during the authorization period for Baseline activities. Areas immediately surrounding the drill and trench sites may be temporarily closed to meet requirements for safety during construction; however, these safety perimeters are small and would not impact overall access to Forest lands for recreation activities (see Section 3.12 for visual impacts to recreation users). Dispersed recreation travel through the area would be possible during construction and operation, although recreation users would need to avoid these activities for safety reasons. Hunting activities would be possible within the project area although hunters would need to avoid field personnel working in the area. Overall, effects to recreation use and Special Use Permits would be expected to be temporary because recreation would not be precluded.

The Proposed Action would be consistent with the Roaded Natural and Semi-primitive Motorized ROS classifications because the recreation setting would be similar to the existing condition. A small portion of project activities located within Semi-primitive Non-Motorized ROS areas would not be consistent because motorized use is prohibited; however, there are designated forest roads that are available for public use and ROS data for these affected areas are outdated.

3.11.3.4 Cumulative Effects

The cumulative impact analysis area for recreation is shown on Figure 3-1. This area was chosen for the analysis because impacts from past, present, and reasonably foreseeable future actions within this cumulative impact analysis area could overlap creating cumulative effects. Several of the present and reasonably foreseeable future actions outlined in Table 3-1, including vegetation management, mineral development, transportation and access, land use, recreation, and safety hazard remediation could contribute to cumulative effects on recreational opportunities, experience, and setting.

Cumulative effects from the Proposed Action on recreation would include a localized increase in the amount of vegetation removed and vehicle traffic. Increasing the localized areas where vegetation is removed would reduce the natural appearance and experience for individual recreation users. In addition, the temporary increase in vehicle traffic during road improvements and development of the Proposed Action would temporarily alter the recreation setting. This could alter individual recreation users' experience until vegetation reestablished and traffic subsided.

Historical recreation, mineral exploration, and vegetation management activities have influenced past and present recreation in the cumulative effect analysis area, including the use of roads and development of a recreation site. Future Travel Management Planning could reduce the miles of roads open to vehicle use, resulting in a decrease in opportunities for motorized vehicle recreation. The intensity and extent of the effects of Travel Management Planning on recreation are uncertain as decisions for specific forest roads are unknown at this time. The setting for recreation users on FRs 357, 172, and 1857 would improve long-term as native vegetation became established.

Cumulative effects on recreation opportunities, experience, and setting would be long-term. For all projects except Resolution's proposed MPO, the effects would be minor as they would maintain, or even improve, the recreation resources in the analysis area. Potential effects, both type and location, from the proposed MPO are uncertain as to when and where the impacts would occur. At the earliest, impacts would not commence until year six. Overlap with the Proposed Action's effects would be minimal and decreasing through year ten. The dispersed recreation opportunities available in the project area are similar to those found elsewhere on the Tonto National Forest. Forest users could take advantage of other areas if development of the proposed MPO (such as the tailings storage facility) eventually altered recreation use in the project area. Visitor experience along the Arizona Trail could also be changed in some locations (e.g. near the MARRCO corridor and the proposed tailings corridor), depending on the location and pace of development, but not elsewhere in the Tonto National Forest. The incremental contribution of the Proposed Action to cumulative effects on the recreational experience and the recreation setting would be negligible during the cumulative impact temporal analysis period.

3.12 Visual Resources

The Visual Resources analysis addresses existing visual resources and the potential impacts to Visual Quality Objectives (VQO) based on visibility of the Proposed Action. A description of the regulatory framework, existing conditions (affected visual resource environment), and potential effects (environmental consequences) to visual resources is included in this analysis.

3.12.1 Regulatory Framework

Visual Management System

The Visual Management System (VMS) is an analysis tool for determining effects to scenery from proposed activities. An inventory of the visual resource of Forest Service land provides measureable standards for the management of the resource (U.S. Forest Service, 1974). The text below provides a description of the affected visual resource environment for the Proposed Action.

Characteristic Landscape

Landscape Character Type – Areas of land that have common distinguishing visual characteristics of landform, rock formations, water forms, and vegetative patterns. Its establishment is based on physiographic sections defined by Fenneman (1931). Character types are used as a frame of reference to classify physical features of a given areas as to their degree of scenic quality. Variety Classes classify landscapes into different degrees of variety: A – distinctive, B – common, and C – minimal.

Viewer Sensitivity

Sensitivity Level – Reflects the viewing public's concern for scenic quality. Sensitivity levels are determined for land areas viewed by those who are traveling through the Forest on developed roads and trails, are using areas such as campgrounds and visitor centers, or are recreating at other Forest locations. These travel ways and/or recreation use areas specific to the Proposed Action are referred to as critical viewpoints in this analysis.

Distance Zones – The portions of a particular landscape seen from roads, trails, use areas, and water bodies. The distance zones include foreground (the detailed landscape within ¼ to ½ mile from the observer), middleground (extends from foreground to 3 to 5 miles from the viewer), and background (extends from middleground to horizon from the viewer).

Visual Quality Objectives

Once lands are identified as to the public's concern for scenic quality (sensitivity levels) as well as variety of natural features (variety classes), measureable standards or objectives are developed for the visual management of these lands. The VQOs are designed to accomplish that purpose. They are represented by five terms, which can be defined as visual resource management goals. The definitions for VQOs are presented in Table 3-11.

Table 3-11. Visual Quality Objectives

VQO	Description
Preservation (P)	This visual quality objective allows for ecological changes only. Management activities, except for very low visual impact recreation facilities, are prohibited.
Retention (R)	This visual quality objective provides for management activities which are not visually evident. Under Retention, activities may only repeat form, line, color, and texture frequently found in the characteristic landscape. Changes in their qualities of size, amount, intensity, direction, pattern, etc., should not be evident.
Partial Retention (PR)	This visual quality objective provides for management activities that remain visually subordinate to the characteristic landscape. Activities may repeat form, line, color, or texture common to the characteristic landscapes but changes in their qualities of size, amount, intensity, direction, pattern, etc., should remain visually subordinate to the characteristic landscape. Activities may introduce form, line, color, or texture which are found infrequently or not at all in the characteristic landscape, but they should remain subordinate to the visual strength of the characteristic landscape.
Modification (M)	This visual quality objective provides for management activities that may visually dominate the original characteristic landscape. However, activities of vegetative and land form alteration must borrow from naturally established form, line, color, or texture so completely and at such a scale that its visual characteristics are those of natural occurrences within the surrounding area or character type.
Maximum Modification (MM)	This visual quality objective provides for management activities of vegetative and landform alterations that may dominate the characteristic landscape. However, when viewed as background, the visual characteristics must be those of natural occurrences within the surrounding area or character type. When viewed as foreground or middleground, they may not appear to completely borrow from naturally established form, line, color or texture. Alterations may also be out of scale or contain detail which is incongruent with natural occurrences as seen in foreground or middleground.

Source: U.S. Forest Service, 1974.

In general, VQOs for highly scenic and/or highly sensitive and visible landscapes require the retention of a natural appearance, yet would allow for activities with a low level of visual change. A greater degree of landscape alteration is acceptable in landscapes that are inherently less scenic, seen from a greater distance, or seen from less sensitive locations.

Forest Plan

Current direction in the Forest Plan (U.S. Forest Service, 1985) includes the following Forest-wide Standards and Guidelines for management of visual resources.

- Emphasize VQOs in all resource planning and management activities.
- Manage for VQOs ranging from Preservation to Maximum Modification as defined for each prescription and delineated in the Forest Visual Resource Inventory. Apply design guidelines found in FSHs, National Forest Landscape Management Series.
- Landscape Architecture input is required on all projects affecting visual resources.
- Prescriptions for Management Areas 2F and 3I stipulate that management emphasis should be focused on dispersed recreation (Forest Plan, 1985).

In each Forest Plan, VQOs establish minimum acceptable thresholds for landscape alterations from an otherwise natural-appearing forest landscape. The threshold of effects is exceeded when alterations do not meet the visual intensity and dominance criteria of the VQO. The Forest Service is currently updating its Forest Plan and will transition to the Scenery Management System (U.S. Forest Service, 1995) when the plan is adopted; as a result, VMS was used for this analysis. All lands on the Forest were inventoried in 1985 using the VMS (U.S. Forest Service, 1974) to establish VQOs. Forest-wide maps referred to as visual resource inventory maps were created that show prescribed VQOs for the Forest.

3.12.2 Existing Conditions

A detailed inventory and assessment for visual resources is documented in the *Visual Resource Technical Report for Resolution Baseline Hydrological and Geotechnical Data Gathering Activities Plan of Operations* (URS Corporation, 2014).

Characteristic Landscape

Based on the Baseline project description and previous project experience in similar landscape settings, a 2-mile analysis area was defined for visual resource assessment. The analysis area is within the Basin and Range Province in central Arizona (Fenneman, 1931). The Basin and Range Province is distinguished by isolated, roughly parallel mountain ranges separated by closed desert basins. The Tonto Character type, a sub-delineation of the Basin and Range, is located in central Arizona and comprises two subtypes, the Sonoran Arizona Uplands and the Upper Tonto (U.S. Forest Service, 1989). The topographic character within the analysis area is predominately rolling to mountainous terrain bisected by dry washes. The predominant vegetation identified within the analysis area is the Arizona Upland subdivision of the Sonoran desertscrub community which is composed of a variety of species including paloverde, mesquite, and mixed cacti including saguaro (Brown & Lowe, 1994). The majority of the analysis area is classified as Variety Class B, which are areas of common character types that are not visually outstanding. The

analysis area is primarily characterized by rounded hills and rolling terrain that is bisected by small canyons and dry washes. An isolated area of Class A, which consists of outstanding visual quality, is associated with Queen Creek generally along FR 357 and steep terrain near Robles Butte. FR 293 is an example of Variety Class B with existing transmission lines that modify the setting. Variety Class C does not occur within the analysis area. Man-made alterations are present throughout the analysis area including three existing high-voltage overhead electric transmission lines, residential structures, tanks, small windmills, electric distribution lines, pipelines, a railroad, and several paved and unpaved roads. These are typical alterations within the analysis area that have modified the scenic integrity of the landscape setting.

Viewer Sensitivity

Forest Service sensitivity levels are determined for the land viewed from travel routes and use areas (residential and recreation). The majority of the analysis area is classified as Sensitivity Level 1, high sensitivity, due to several forest roads used for recreation. Critical viewpoints specific to the Proposed Action may include residential areas, recreation use areas, and travel routes (including roads and trails) within the analysis area. These viewpoints are associated with high visual sensitivity or concern for changes in the landscape. Residential viewers within the analysis area are limited to the rural residences along Queen Creek (FR 357). Use areas include Boyce Thompson Arboretum which is an Arizona State Park, Arizona Trail, and Picketpost Trailhead. Boyce Thompson Arboretum State Park is located south of U.S. 60 and west of the Town of Superior. Picketpost Trailhead, located south of U.S. 60, is a developed recreation site with restrooms and hardened parking. This trailhead provides access to the Arizona Trail. Additional recreational use of the area is dispersed recreation such as camping. There are no wilderness areas or designated scenic or wild rivers within the analysis area. Views associated with dispersed recreation exist throughout the analysis area. Dispersed recreation viewers may include hikers, campers, hunters, and others recreating on National Forest System lands. Recreational users including OHVs users, might use travel routes that are primarily concentrated on main forest roads including, but not limited to FRs 357, 3713, 252, 1904, 172, 1903, 293, 518, and 982. U.S. 60 is a state-designated scenic travel route that provides primary access to the mining towns of Superior and Globe from Phoenix. The Arizona Trail, passage #18, is another travel route which traverses the analysis area within the Forest north of the Town of Superior. The Arizona Trail crosses FR 357 within the analysis area where there is a small unpaved parking area for trail users.

Visual Quality Objectives

National Forest System lands affected by the Proposed Action have VQO classifications including Retention, Partial Retention, Modification, and Maximum Modification. The analysis area includes no areas classified as Preservation. A small portion of the Proposed Action, access road improvements only, would occur within an area of Retention. Retention allows for management activities that result in low levels of visual change in order to retain the existing character of the landscape. The majority of the Proposed Action would occur within areas classified as Partial Retention or Modification.

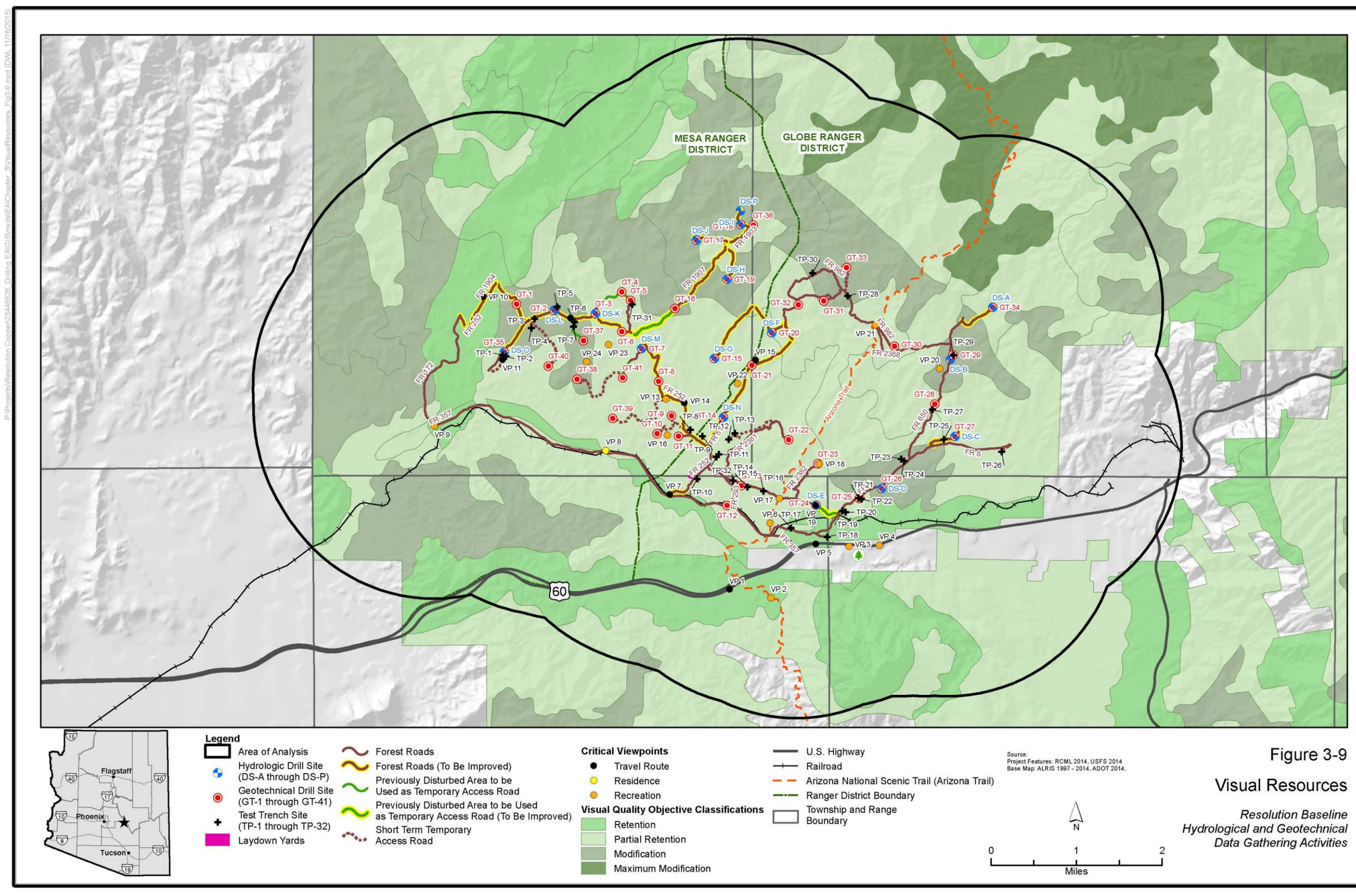

Figure 3-9

Visual Resources

Resolution Baseline Hydrological and Geotechnical Data Gathering Activities

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3.12.3 Environmental Consequences

3.12.3.1 Methodology

The primary purpose of the assessment is to evaluate and characterize the level of visual alteration, or visual contrast, to the landscape that would result from the Proposed Action. Visual contrast is defined as the degree of perceived change that occurs in the landscape due to alterations necessary for a project. Visual contrast for the Proposed Action would primarily result from the removal of vegetation and earthwork necessary for access road improvements and construction of laydown areas, test trenches, and drill sites. Construction equipment and drill rig structures would also introduce structural visual contrast for a short-duration while project activities were under way.

Visual Elements

Form – The shape or structure of something as opposed to the material of which it is composed.

Line – An intersection of two planes. A point that has been extended; silhouette of form. Any of various things that are or may be considered as arranged in a row or sequence.

Color – A phenomenon of light (as red, brown, pink, etc.) or visual perception that enables one to differentiate otherwise identical objects. A hue, as contrasted with black, white, or gray.

Texture – The visual or tactile surface characteristics of something.

The visual contrast assessment was performed by comparing visual elements (e.g., form, line, color, and texture; see text box) of the existing characteristic landscape identified during the inventory with the visual elements associated with the Proposed Action. In this regard, landform and vegetation, water form, and rock form elements of the landscape were evaluated in conjunction with the Proposed Action (i.e., alterations) and assigned degrees of change/contrast ranging from strong to minimal (see text box).

Visual Contrast

Strong – Contrast demands attention and strongly dominates the landscape.

Moderate – Contrast attracts attention but is co-dominant in the landscape.

Low – Contrast can be seen but is subordinate in the landscape.

Minimal – Contrast is barely perceptible in the landscape.

Existing landscape conditions within the analysis area were field verified and effects were evaluated from inventoried critical viewpoints in conjunction with the Proposed Action.

Detailed visual analysis is discussed in the Visual Resource Technical Report (URS Corporation, 2014) and anticipated effects to the characteristic landscape, variety class, sensitivity levels and critical viewpoints, and consistency with VQO designations are subsequently summarized (see Figure 3-9).

3.12.3.2 Effects from No Action

Under the No Action alternative, the Proposed Action would not be approved, and no action or activity would take place. No effects to visual resources associated with the Proposed Action would occur.

3.12.3.3 Effects from the Proposed Action

Characteristic Landscape

The Proposed Action would result in low effects to the characteristic landscape because resulting visual contrast change would be low. Minimal visual contrast is anticipated for short-term temporary access roads because no grading (cutting or filling) would be required for the drill rig to access the drill sites. Vegetation may be crushed, cut back, and possibly removed; however, effects would be low to the

characteristic landscape. EPMs found in Section 2.3.6 and associated with visual resources include reclamation and minimizing disturbance, where feasible, to protect scenic values.

Viewer Sensitivity

Recreation

Boyce Thompson Arboretum would provide slightly superior (i.e., elevated) views of the Proposed Action from visitor parking areas, although the alterations would be completely screened by topography. Effects would be minimal because the Proposed Action, approximately 0.75 miles from Boyce Thompson Arboretum, would not be visible.

Dispersed recreation viewers along Bear Tank Canyon could have unobstructed views of construction disturbance associated with the proposed short-term temporary access road west of FR 252. No cut or fill would be required by the drill rig to access the drill site. Because grading activities are not anticipated for the short-term temporary access roads, disturbance would be limited to crushing vegetation. Using this method of construction, the level of visual contrast would be minimal, resulting in low effects to dispersed recreation viewers. Dispersed recreation viewers along Rice Water Canyon could have unobstructed views of geotechnical drill site GT-23; however, existing alterations include a stock tank, turnout area, and a road located on level terrain. Effects are anticipated to be low due to these existing alterations and minimal level of visual contrast.

Travel Routes

Travel route viewers along U.S. 60 (Gila-Pinal Scenic Road) may have partial to completely screened views of the Proposed Action. Views would be limited due to the angle of observation (generally east/west, with the project located north), screening due to topography and vegetation, and high rate of speed. Effects are anticipated to be minimal due to viewing conditions and existing alterations, including transmission lines, a railroad, an above-ground pipeline, and other forest roads which co-dominate the characteristic landscape setting. Effects would be low for travel route viewers along FRs 252, 1904, and 293 because the level of visual change would be low. Access road improvements include grading the existing roads to smooth out rough rocky areas, and widening narrow segments at select locations to accommodate construction equipment. Vegetation removal would occur where widening is necessary, although the visual contrast would be similar in form, line, and color to the existing roads. In addition to access road improvements, drill sites and trenches are proposed near FR 3713 resulting in low contrast for a short-duration. Effects are anticipated to be low for travel route viewers along FR 3713 where views of the drill rig and test trenches, within 75 to 300 feet of the road, would be partially screened by vegetation. After the authorization period, FR 3713 would be reclaimed as described in Section 3.10 (Travel Management and Public Safety) which would further reduce visual contrast. Implementation of reclamation actions for maintenance Level 1 roads would result in less visual contrast over time because vegetation would re-establish and create a more patchy texture.

There would be minimal effects to trail users along the Arizona Trail at the junction of FR 357 and FR 293 because the Proposed Action, within 0.2 to 0.6 miles, would be completely screened by topography and vegetation. Existing alterations near the Arizona Trail at these locations includes high-voltage transmission lines which co-dominate the characteristic landscape setting. Alterations near Arizona Trail at FR 982 are limited to forest roads. Trail users would have obstructed views of the

Proposed Action, approximately 0.5 mile from this junction, due to screening by topography and vegetation; thus, effects would be anticipated to be minimal.

Residences

Effects to residences associated with Queen Creek along FR 357 are anticipated to be minimal because the Proposed Action would be completely screened by topography. Landform alterations and drill site construction would not be visible from these residences although construction traffic along FR 357 would be visible for a short duration.

Nighttime Lighting

The Arizona Trail at the junction of FR 293 was identified as a "sensitive receptor" in the Baseline Activities Lighting Analysis document (WestLand Resources, Inc., 2014f). The modeling analysis, under worst-case scenario (i.e., not shielded or directed straight down), indicated that the area surrounding the Proposed Action would have limited effects from increased light and stated that the amount of light reaching these areas would be minimal under those conditions. All other recreation receptors, including the Superstition Wilderness, evaluated in the analysis were modeled to have no change in lighting. In practice, the light emitted by the Proposed Action would be shielded and directed straight down toward the work area. Based on the design specifications, it is unlikely that light emitted by the Proposed Action would extend beyond a radius of greater than 90 feet around each light source during typical operations. The conclusion of the lighting analysis noted that lighting is not expected to reach any sensitive receptors or to cause a measurable difference in the ambient lighting in the vicinity of the Proposed Action because it would be shielded and directed downward. In addition, for potential recreation viewers along the Arizona Trail at the junction of FR 293, drill rig DS-E would be completely screened by topography; therefore, direct nighttime lighting from drill rig DS-E would not be perceptible.

Visual Quality Objectives

Consistency with VQO classifications was determined by the evaluation of critical viewpoints described in the *Visual Resources Technical Report* (URS Corporation, 2014). Alterations or disturbance associated with drill sites, trenches, and laydown areas within Forest-designated Partial Retention and Modification areas would be consistent with these management objectives based on the perceptible level of visual contrast from the inventoried critical viewpoints. Additional access road improvements on forest roads and previously disturbed areas to be used as temporary access roads would be similar to existing conditions resulting in low contrast and these alterations would be visually subordinate in the landscape. In addition, the implementation of reclamation actions would reduce the long-term level of visual contrast which is expected to range from minimal to low for the Proposed Action. A small portion of the Proposed Action, access road improvements only, would occur within designated areas of Retention. These access road improvements would be consistent in areas of Retention because the level of visual contrast would be low. The Proposed Action would repeat existing form, line, color, and texture of the characteristic landscape and alterations to the existing road would not be visually evident.

3.12.3.4 Cumulative Effects

The cumulative effects analysis area for visual resources is shown in Figure 3-1. This area was chosen for the analysis because impacts from past, present, and reasonably foreseeable future actions within this

analysis area could overlap creating cumulative effects. Several of the present and reasonably foreseeable future actions outlined in Table 3-1, including vegetation management, range, mineral development, transportation and access, land use, and recreation could contribute to cumulative effects on visual resources.

Effects from the Proposed Action contributing to cumulative effects to visual resources would be minimal and would include a localized increase in the amount of vegetation removed. Increasing the localized areas where vegetation is removed would reduce the natural appearance of the landscape setting. The Mesa Vegetation Regeneration and Habitat Improvements Project would revegetate approximately 30 acres in the Mesa Ranger District along heavily used forest roads, providing a positive cumulative effect. Likewise, Travel Management Planning by the Forest Service could contribute to positive visual effects by limiting motor vehicle use to designated areas to avoid landscape and visual degradation. The U.S. 60 realignment and improvements could also contribute long-term visual effects to the project area.

Three of the mineral development projects outlined in Table 3-1 could result in a greater degree of visual effects compared to the Proposed Action. Resolution's proposed MPO, Pre-feasibility Activities, OMYA Superior Limestone Quarry, and the Imerys Perlite Mine would affect visual resources by disturbing soil and native vegetation, generating mine spoils, and construction and operation of facilities that would alter the characteristic landscape. Reasonably foreseeable effects of Resolution's proposed MPO have the potential to be major, long-term, and would not be consistent with current Visual Quality Objectives. However, Resolution's proposed MPO would not commence until year six at the earliest. Effects of the Proposed Action would be negligible and diminishing from year six through year ten, while the relative impacts from the proposed MPO could be increasing.

Areas disturbed by the Proposed Action would be reclaimed in accordance with the Plan. Most disturbance areas would be reclaimed immediately after the disturbance occurs, and visual effects of the disturbance would gradually decrease as the revegetation matures. The visual effects of the Proposed Action would be negligible, and would not incrementally add to the cumulative effects from past, present, and reasonably foreseeable actions.

3.13 Air Quality

3.13.1 Regulatory Framework

The Forest Plan requires that air resources in the Forest be maintained over time in a manner that meets or exceeds local, state, and Federal air quality standards. Regulatory agencies with jurisdiction over air quality in the project area include the Pinal County Air Quality Control Department (PCAQCD), the ADEQ Air Quality Division, and EPA. Applicable rules and regulatory programs reviewed for this EA include:

- National Ambient Air Quality Standards (NAAQS);
- Prevention of Significant Deterioration (PSD);
- New Source Performance Standards;
- National Emission Standards for Hazardous Air Pollutants (NESHAP);

- PCAQCD dust control rules (Chapter 4, Articles 2 and 3); and
- Title 18 of the AAC, specifically portable source requirements.

Air quality regulations implemented by ADEQ include provisions applicable to construction projects which are considered "temporary sources." A temporary source is defined in the AAC, Title 18, Chapter 2, Article 1, Section 101 (R18-2-101), as a source that is portable and does not qualify as an affected source under the acid deposition rules of the Clean Air Act (CAA). Also, the installation and operation of process, wastewater, and potable water observation wells is specifically included under the definition of insignificant activity as "miscellaneous activities" in AAC Section R18-2-101.68g. The applicability of these two definitions means that the planned drilling activities, which would result in the installation of groundwater testing and monitoring sites, are not subject to stationary source air permitting requirements under the ADEQ rules. It should be noted that items of equipment (specifically generators and equipment engines) used during construction activities are not subject to either the Federal New Source Performance Standards or the regulations promulgated pursuant to the CAA.

3.13.2 Existing Conditions

Climate data from the Western Regional Climate Center (WRCC) in the area of Superior, Arizona indicate that high temperatures range from the 90°F through summer months to 60°F between November and March. Low temperatures during these same periods range from the 70°F to 40°F, respectively. Average annual precipitation in the area yields approximately 18 inches of rain, with less rain falling in April, May, and June (WRCC, 2005). Prevailing winds in the area are typically from west to east, although monsoon storms during the late summer months can result in winds from varying directions.

To maintain or improve ambient air quality, areas that have been designated as non-attainment with applicable air quality standards for criteria pollutants are more strictly regulated. Criteria pollutants include nitrogen oxides (NO_x); sulfur dioxide (SO_2); carbon monoxide (CO); particulate matter (PM_{10} and $PM_{2.5}$); ozone (O_3); and lead (Pb). Ambient air in a non-attainment area either does not meet the primary or secondary NAAQS established for one or more criteria pollutants or contributes to a non-attainment status in a nearby area. The project area for the Proposed Action is classified as attainment with the applicable criteria pollutant standards.

Designated areas of Pinal County in the Miami and Hayden EPA Planning Areas (to the east, northeast, and southeast of the project area) are classified as non-attainment for PM_{10} and SO_2, and PM_{10} and Pb, respectively. The western boundaries of both PM_{10} non-attainment areas are located approximately two miles from the eastern edge of the project area, whereas the SO_2 maintenance area is approximately eight miles away. The EPA has reviewed data submitted for the Miami Planning Area and has determined that it qualifies for redesignation as an attainment area for PM_{10} (ADEQ, 2008). Although the last exceedances of the 24-hour and annual PM_{10} standards in the Hayden Planning Area were in the late 1990s and the EPA has reviewed the State Implementation Plan for the area, a redesignation determination has not been granted. The Hayden Area has operated under a SO_2 Maintenance Plan since 2002; no decision on redesignation has been made by the EPA (ADEQ, 2002). The Hayden Area was redesignated from unclassifiable to nonattainment for Pb in September 2014, based upon data collected at an ADEQ monitoring station near the Globe Highway monitoring site near Hayden and Winkleman, Arizona.

Air quality in Class I areas (e.g., national parks and national wilderness areas) is protected by the PSD regulation. PSD was implemented by EPA to protect public health and welfare, preserve and protect air quality in locations such as national parks, national wilderness areas, and other specifically designated areas; preserve clean air while allowing economic growth; and to allow for public participation in the air quality decision-making process for these protected areas. Approximately three miles northwest of the project area, the Superstition Wilderness is the nearest Class I area. Other Class I areas in the region are Sierra Ancha Wilderness approximately 25 miles north of the Proposed Action, and the Mazatzal Wilderness approximately 50 miles northwest of the Proposed Action.

The ADEQ operates air quality monitors to obtain data on concentrations of air pollutants measured within its jurisdictions. The nearest monitoring site is located at the Queen Valley water tank, approximately 1.5 miles west of the project area's western boundary, north of U.S. 60. A summary of monitoring results for ozone and particulate matter recorded between 2008 and 2013 is provided in Table 3-12.These data are available on EPA's AirData Website in the section named "Table of Annual Summary Data" (EPA, 2014). These data, when compared to the NAAQS, indicate that the fourth maximum value ozone concentrations have been measured slightly above the standard in 2008, 2011, and 2012, and slightly below the standard in 2009, 2010, and 2013. Similarly, PM_{10} and $PM_{2.5}$ concentrations measured at the Queen Valley monitoring site have been well below the applicable NAAQS limits. The EPA establishes and periodically updates the NAAQS to allow areas of the U.S. that both meet and do not meet the standards to be identified. The standards are set at levels that are determined to be protective of human health (including sensitive groups such as those with asthma, children, and the elderly) and the environment. The data in Table 3-12 demonstrate that air quality near the project area currently meets the NAAQS for PM_{10} and $PM_{2.5}$. Although ozone concentrations at the monitoring station have periodically exceeded the standard, the area is classified as attaining the standard.

Table 3-12. Summary of Monitoring Results for Ozone and Particulate Matter

QUEEN VALLEY MONITORING STATION OZONE AND PARTICULATE MATTER RESULTS 2008 – 2013							
Parameter	**Applicable NAAQS Limit**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Ozone (ppm) [1]	0.075	0.08	0.07	0.072	0.078	0.078	0.073
PM_{10} (µg/m^3) [2]	150	60.41	48.81	46.44	102.98	47.21	60.46
$PM_{2.5}$ (µg/m^3) [3]	35	14.3	9.7	6.8	31	17.7	13.5

Source: EPA, 20014
ppm = parts per million
µg/m3 = micrograms per cubic meter
NAAQS = National Ambient Air Quality Standard
[1] 4th highest maximum 8-hour value
[2] 1st highest maximum 24-hour value PM_{10} Local Conditions
[3] 1st highest maximum 24-hour value $PM_{2.5}$ Air Quality Index (AQI) and Speciation

The PCAQCD has established rules to regulate emissions of fugitive dust (particulate matter). Chapter 4, Article 2 of the PCAQCD rules provide standards that identify covered activities and Chapter 4, Article 3 specifically addresses fugitive dust from construction sites. Under this article, land development that disturbs surface areas of greater than 0.1 acre and has the potential to generate dust must provide an earthmoving registration form to the PCAQCD Control Officer, implement control measures to minimize

the generation and airborne transmission of dust, and comply with the universal performance standards in 4-3-090. Control measures described in the rule include:

- Watering
- Using chemical stabilizers/dust suppressants
- Constructing wind barriers or using wind shelters
- Covering haul vehicles
- Reducing speed limits
- Installing a gravel pad at site entrances/exits
- Installing a grizzly to remove dirt and debris from vehicles
- Managing load-in/load-out procedures

The universal performance standards require that dust be managed to prevent "an unreasonable amount of dust" from entering a sensitive area, to maintain the opacity of dust at less than 20 percent measured using EPA Test Method 9, and to prevent visibility impairment that could impact public safety.

3.13.3 Environmental Consequences

3.13.3.1 Methodology

The duration of impact, for purposes of this air quality analysis, relates to the length of time during which air pollutant emissions would be attributable to the Proposed Action. As the predicted emissions associated with the Proposed Action are minimal, construction-related emissions occurring during construction and initial activities are analyzed in this EA. Construction-related emissions are categorized as temporary; therefore, any corresponding effects would be considered either temporary or short-term.

The intensity of air emissions associated with project-related construction activities are not subject to permitting under applicable air quality regulations, with the exception of dust control permitting and controls applicable to operation of certain types of construction equipment. For the purpose of this air quality analysis, any potential effects from construction-related air emissions are considered in the context of existing air quality conditions in the project area.

3.13.3.2 Effects from No Action

Under the No Action alternative, the Proposed Action would not be approved, and no action or activity would take place. No effects associated with the Proposed Action to air quality would occur.

3.13.3.3 Effects from the Proposed Action

An air emissions inventory was prepared in November 2014 by Pinyon Environmental, Inc. (Pinyon, 2014) to estimate project-related emissions from the Proposed Action described in Resolution's Plan. The maximum daily and annual emissions were calculated for three time periods:

- Construction and initial activities during the first year
- Monthly well monitoring during the second year
- Quarterly well monitoring during years three through ten

Construction-related emissions occurring during the first year of the project would include pollutants emitted in exhaust from diesel and gasoline-fueled construction equipment and vehicles, exhaust emissions from portable drilling equipment, and fugitive emission of particulate matter from road vehicles, non-road vehicles and equipment, and other ground-disturbing activities, such as removal of vegetation, grading, drilling and trenching. Emissions associated with monthly and quarterly well monitoring in years two through ten include vehicle exhaust and fugitive dust from road travel generated by vehicles traveling to the monitoring sites for personnel to collect data.

Table 3-13 through Table 3-17 provide a breakdown of estimated air pollutant emissions by activity and source in the first year of the project. The total estimated maximum annual emissions in tons per year for construction and initial activities occurring in the first year are presented in Table 3-18. These data were excerpted from the Pinyon Environmental, Inc. Technical Memorandum dated November 3, 2014.

Table 3-13. Estimated Maximum Annual Portable Source Exhaust Emissions

	Emissions (tons/year)					
Drilling Operation:	**NO_x**	**CO**	**SO_x**	**VOCs**	**PM_{10}**	**$PM_{2.5}$**
Hydrologic/Monitoring	95.16	20.50	6.26	7.77	6.69	6.69
Geotechnical	3.03	0.65	0.20	0.25	0.21	0.21
Total:	**98.19**	**21.15**	**6.46**	**8.02**	**6.90**	**6.90**

Table 3-14. Estimated Maximum Annual Road Vehicle Exhaust Emissions

	Emissions (tons/year)					
Vehicle Type:	**NO_x**	**CO**	**SO_x**	**VOCs**	**PM_{10}**	**$PM_{2.5}$**
Mobilization/Demobilization	0.019	0.024	0.000	0.003	0.001	0.001
Road Improvements	0.038	0.053	0.000	0.006	0.002	0.002
Drilling Operations	1.370	1.872	0.001	0.200	0.082	0.082
Pump Testing	0.001	0.009	0.000	0.000	0.000	0.000
Monthly Water Monitoring	0.000	0.001	0.000	0.000	0.000	0.000
Total:	**1.428**	**1.959**	**0.001**	**0.209**	**0.085**	**0.085**

Table 3-15. Estimated Maximum Annual Non-Road Equipment Exhaust Emissions

	Emissions (tons/year)					
Vehicle Type:	**NO_x**	**CO**	**SO_x**	**VOCs**	**PM_{10}**	**$PM_{2.5}$**
Road Improvements	0.972	1.204	0.001	0.137	0.057	0.057
Pad Construction	0.779	0.965	0.001	0.110	0.046	0.046
Travel on short term temporary access roads	0.003	0.004	0.000	0.000	0.000	0.000
Excavation of Test Trenches	1.107	1.372	0.001	0.156	0.065	0.065
Total:	**2.861**	**3.545**	**0.003**	**0.403**	**0.168**	**0.168**

Table 3-16. Estimated Maximum Annual Construction Fugitive Emissions

Vehicle Type:	Emissions (tons/year)	
	PM_{10}	$PM_{2.5}$
Drilling Site Construction /Use	0.58	0.06
Test Trench Excavation	0.03	0.00
Short-Term Temporary Access Roads	0.10	0.01
Road Improvements	4.03	0.40
Construction Laydown Yard Construction/Use	3.31	0.33
Total:	**8.05**	**0.80**

Table 3-17. Estimated Maximum Road Travel Fugitive Emissions

Vehicle Type:	Emissions (tons/year)	
	PM_{10}	$PM_{2.5}$
Mobilization/Demobilization	0.4	0.0
Road Improvements	2.0	0.2
Drilling Operations	62.7	6.3
Pump Testing	1.0	0.1
Monthly Water Monitoring	0.1	0.0
Total:	**66.2**	**6.6**

Table 3-18. Estimated Total Maximum Annual Emissions Summary

Vehicle Type:	Emissions (tons/year)					
	NO_x	CO	SO_x	VOCs	PM_{10}	$PM_{2.5}$
Portable Source Exhaust	98.2	21.2	6.5	8.0	6.9	6.9
Road Vehicle Exhaust	1.4	2.0	0.0	0.2	0.1	0.1
Non-Road Equipment Exhaust	2.9	3.5	0.0	0.4	0.2	0.2
Construction Fugitive	0.0	0.0	0.0	0.0	8.1	0.8
Road Travel Fugitive	0.0	0.0	0.0	0.0	66.2	6.6
Total:	**102.5**	**26.7**	**6.5**	**8.6**	**81.5**	**14.6**

Table 3-18 shows that exhaust from the portable sources anticipated for use during the first year of the project would contribute the largest quantities of NO_x, CO, and SO_x. The temporary increase in emissions of NO_x could contribute to the formation of ground-level ozone in the project area. In the presence of sunlight, NO_x and volatile organic compounds (VOCs) can react to form ground-level ozone. In 2008, the 8-hour ozone NAAQS was lowered from 0.080 ppm to 0.075 ppm. Summary data for the Queen Valley monitoring site, located approximately 1.5 miles west of the project area (Table 3-12) indicate that the fourth maximum value ozone concentrations were measured slightly above the standard in 2008, 2011, and 2012, and slightly below the standard in 2009, 2010, and 2013. Ozone was measured at concentrations that exceeded the 2008 8-hour ozone NAAQS on 25 days between 2008 and 2013. Based upon the temporary nature of construction-related emissions in the first year of the project during which the majority of air emissions would be expected to occur, and the attainment status for ozone in the project area, no measurable increases in area ozone levels are likely.

Table 3-18 shows that fugitive dust emitted during road travel would contribute the majority of PM_{10} and $PM_{2.5}$. Temporary increases in particulate matter emissions would occur in the project area during drilling and trenching activities. Since PM_{10} and $PM_{2.5}$ concentrations measured at the Queen Valley monitoring site between 2008 and 2013 have been well below the applicable NAAQS standards (see Table 3-12), and the predominant wind direction in the area is toward the east, it is unlikely that temporary construction-related emissions increases would affect air quality and visibility in nearby areas including the Superstition Wilderness area.

To address potential effects and comments received from the public and agencies, and regulatory requirements to manage fugitive dust, the EPMs found in Section 2.3.6 would be implemented. Specifically, the application of water to roads and affected ground surfaces during construction, vehicle speed limits on unpaved roads, and the use of water during drilling activity, will reduce particulate matter emissions. Furthermore, the use of mobile and portable construction equipment with recently manufactured diesel engines and the use of ultra-low sulfur diesel as fuel will minimize nitrogen oxides, carbon monoxide and sulfur dioxide emissions.

3.13.3.4 Cumulative Effects

The cumulative effects analysis area for air quality is shown in Figure 3-1. This area was chosen for the analysis because it is within the Superior Basin and encompasses the perennial/intermittent headwaters of Queen Creek. Several of the present and reasonably foreseeable future actions outlined in Table 3-1, including vegetation management, range, mineral development, and transportation and access could contribute to cumulative effects on air quality.

Fugitive dust and emissions from the improvements to U.S. 60 and other projects included in Table 3-1 could result in localized temporary effects on air quality in the cumulative effects analysis area. Continued mining of the Perlite Mine could contribute to longer-term effects. Construction and operation of Resolution's proposed MPO could also contribute long-term effects.

Cumulative effects to air quality from the Proposed Action would result in a temporary, localized increase in emissions. However, fugitive dust and emissions would be controlled by dust controls and emission controls. For these reasons, the incremental effects to air quality from the Proposed Action when considered with the effects of past, present and reasonably foreseeable future actions would be minimal and temporary. This is especially true for cumulative effects associated with Resolution's proposed MPO. Although the location and types of air quality effects associated with the MPO are uncertain, effects of the MPO would not commence until year six (at the earliest) whereas the majority of the Proposed Action effects would be realized in the first two years. During the period when air quality effects of the Proposed Action overlap in time with the MPO (years six through ten); the incremental effects of the Proposed Action would be negligible.

3.14 Climate Change

3.14.1 Regulatory Framework

As described in *Climate Change 2013: The Physical Science Basis, Summary for Policy Makers*, climate scientists performing research for the Intergovernmental Panel on Climate Change (IPCC) have generally

concluded that unequivocal evidence exists that the earth's climate system has been affected by cumulative increases in emissions of greenhouse gases to the earth's atmosphere (IPCC, 2013). The report states that "the atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased." Examples of impacts associated with changes to the climate system identified in the report include:

- Fewer cold days and nights and more warm days and nights, globally.
- Increased frequency and/or intensity of precipitation events in North America.
- Increases in intensity and/or duration of drought conditions in the Western North Pacific.
- Reductions in spring snow cover due to earlier snow melt in the northern hemisphere.
- Potential lengthening of the monsoon season, along with intensified precipitation.

The concentrations of three greenhouse gases (GHGs), carbon dioxide, methane, and nitrous oxide, measured in the atmosphere in 2011 have increased by 40 percent, 150 percent, and 20 percent respectively, when compared to pre-industrial levels (IPCC, 2013). These increases in emissions are concluded to be attributable to changes in human activities such as fossil fuel combustion, cement production, deforestation, and other land-use changes.

The EPA and the State of Arizona have not promulgated climate change regulations applicable to the Proposed Action.

3.14.2 Existing Conditions

The Forest Service has published a climate change guidance document for NEPA analyses entitled *Climate Change Considerations in Project Level NEPA Analysis* (U.S. Forest Service, 2009b). The report includes direction on considering climate change for projects evaluated under NEPA. The guidance states that the impact of project-related GHG emissions "should be considered in proportion to the nature and scope of the action." Accordingly, the effects of temporary, short-term increases in GHG emissions would likely warrant a qualitative analysis, whereas projects proposing permanent increases in GHG emissions may require a quantitative analysis.

3.14.3 Environmental Consequences

Potential environmental effects of GHG emissions for the alternatives considered in this assessment are discussed in the sections below.

3.14.3.1 Effects from No Action

Under the No Action alternative, the Proposed Action would not be approved, and no new action or activity would take place.

3.14.3.2 Effects from the Proposed Action

GHGs emitted during the Proposed Action would result from the combustion of fuels used to operate portable equipment and road and non-road equipment. Most emissions would be temporary, occurring during the first year of the project when construction and initial activities are scheduled. GHG emissions

during years two through ten of the project would be negligible, because project activity would be limited to monthly and then quarterly monitoring, some of which would be done with pedestrian access to the wells. Based upon the nature of project activities, the size and location of the project area, and the temporary duration of emissions, the Proposed Action would not measurably affect climate change.

3.14.3.3 Cumulative Effects

Every project listed in Table 3-1 would contribute GHG emissions because climate change is not spatially bound. The majority of these projects would be temporary or short-term in nature, with negligible GHG contributions to climate change. Longer-term projects such as Resolution's proposed MPO and the Perlite Mine would contribute longer-term GHG emissions, although these emissions have not been quantified. Potential effects from the proposed MPO are uncertain and would not begin until year six at the earliest. In contrast, GHG emissions from the Proposed Action during years six through ten would be negligible and diminishing. The incremental effect of the Proposed Action, when considered with past, present and reasonably foreseeable future actions would be temporary and the quantity of GHG emissions would be negligible.

3.15 Noise

3.15.1 Regulatory Framework

There are no federal laws, ordinances, regulations, or standards that directly affect the Proposed Action with respect to noise received by residential and other noise-sensitive land uses. However, there are guidelines at the Federal level that direct the consideration of a broad range of noise and vibration issues as listed below:

- Noise Control Act of 1972 (42 United States Code 4910)
- U.S. Department of Housing and Urban Development Noise Guidelines 24 CFR 51, Subpart B

The EPA has not promulgated standards or regulations for environmental noise generated by industrial or mining activity; however, EPA has published a guideline that specifically addresses issues of community noise (EPA, 1974). This guideline, commonly referred to as the "levels document," contains goals for noise levels affecting residential land use of day night average, or time-weighted, sound level (L_{dn}) less than 55 A-weighted decibels (dBA) for exterior levels and L_{dn} less than 45 dBA for interior levels. The Department of Housing and Urban Development (HUD) Noise Guidebook Chapter 2 Section 51.101(a)(8) also recommends that exterior areas of frequent human use follow the EPA guideline of an L_{dn} of 55 dBA (HUD, 1996). In the absence of local noise regulations or policies, when appropriate this EPA guideline is often used as an exterior noise assessment standard for noise-sensitive receivers such as residences.

The Baseline Activities Noise Study (BANS) (WestLand Resources, Inc., 2014g) describes that while the Forest Service does not have noise limits applicable to the Proposed Action, Pinal County sets limits on sound-producing activities within the county in Ordinance 050306-ENO (as amended by 0316111-ENO-01). These county noise limits are grouped by similar zoning district classifications, as shown in Table 3-19.

Table 3-19. Existing Outdoor Ambient Sound Pressure Level Measurements

Zoning District Classification	Noise Limit (L_{eq}, dBA)
(Residential) CR-1A, CR-1, CR-2, CR-3, CR-4, CR-5, OS, MH, RV, MHP, PM/RVP, TR	60 dBA (7 am – 8 pm) 55 dBA (8 pm – 7 am)
(Commercial or Business) CB-1, CB-2	65 dBA (7 am – 10 pm) 60 dBA (10 pm – 7 am)
(Industrial) CI-B, CI-1, CI-2	70 dBA (7 am – 10 pm) 65 dBA (10 pm – 7 am)
(Rural) CAR, SR, SR-1, SH, GR, GR-5, GR-10	65 dBA (7 am – 9 pm) 60 dBA (9 pm – 7 am)

3.15.2 Existing Conditions

Sound is caused by vibrations that generate waves of minute pressure fluctuations in the surrounding air. Sound levels are typically measured using a logarithmic decibel (dB) scale. Sound that causes disturbance or annoyance, or unwanted sound, is often called "noise." The terms sound and noise are used interchangeably in this analysis.

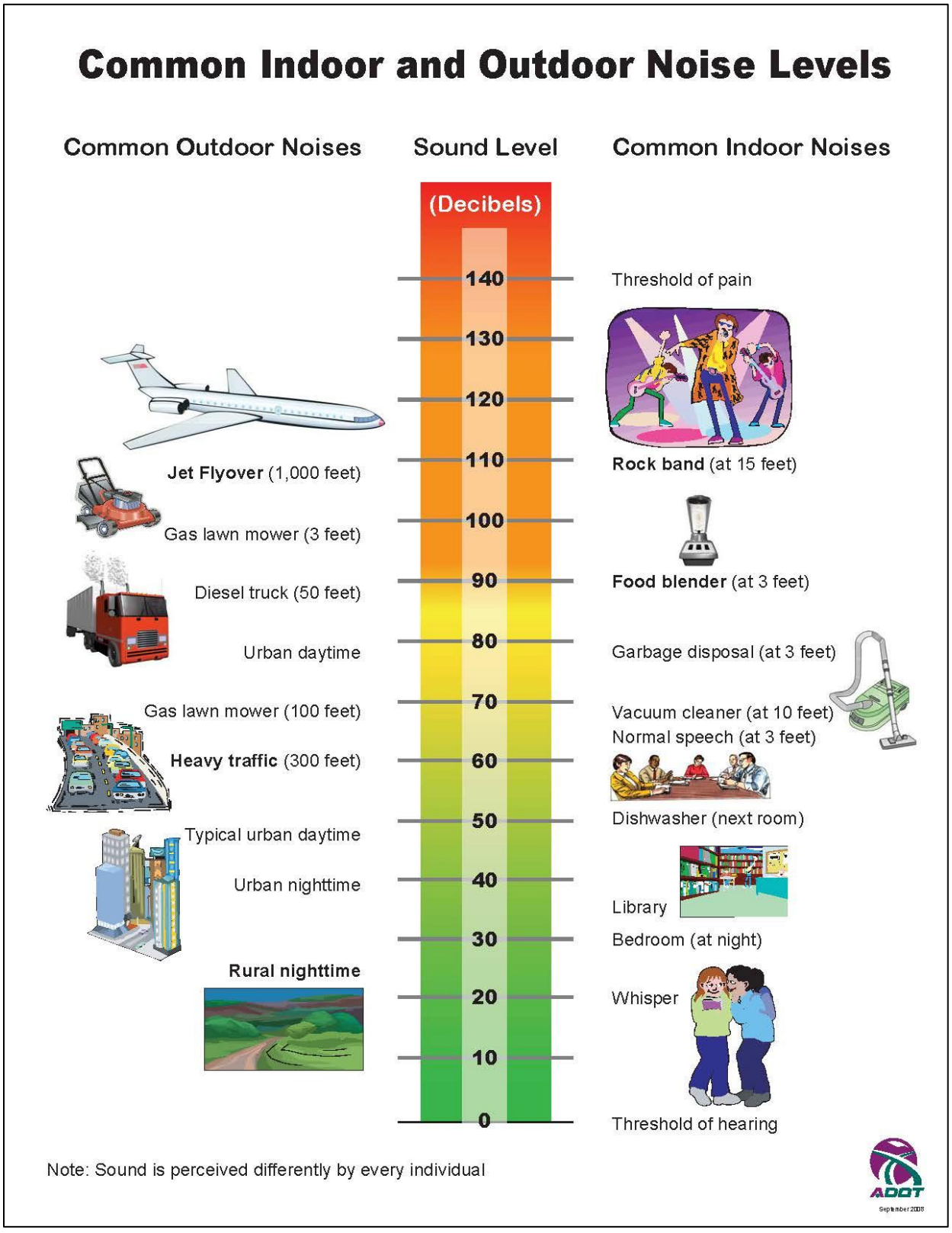
Human hearing varies in sensitivity for different sound frequencies. The ear is most sensitive to sound frequencies between 800 and 8,000 Hertz (Hz) and is least sensitive to sound frequencies below 400 Hz or above 12,500 Hz. Consequently, several different frequency weighting schemes have been used to approximate the way the human ear responds to noise levels. The A-weighting (dBA) descriptor is the most widely used for this purpose. A list of A-weighted decibel sound levels (dBA) for typical sound sources is presented in Figure 3-10.

Varying sound levels are often described in terms of an equivalent constant decibel level. Equivalent sound levels (L_{eq}) are not a simple arithmetic averaging of decibel values over a defined time period but are based on the cumulative acoustical energy associated with the variable sound levels; hence, L_{eq} values sometimes are referred to as energy-averaged sound levels. As a consequence of the calculation procedure, high dB events contribute more to the L_{eq} value than do low dB events. L_{eq} values are used to develop single-value descriptions of average sound exposure over a considered period of time. Such average sound exposure ratings often include additional weighting factors for potential annoyance due to time of day or other considerations. The L_{eq} data used for average sound exposure descriptors are generally based on measured or estimated dB that is A-weighted (i.e., dBA).

Average sound exposure over a 24-hour period is often presented as L_{dn}. L_{dn} values are calculated from hourly L_{eq} values, with the L_{eq} values for the nighttime period (10 pm to 7 am) increased by 10 dB to reflect the greater disturbance potential from nighttime sounds.

Sound level, or amplitude, attenuates with distance as it propagates over a larger area, generally in a spherical spreading pattern, away from a point source where the sound waves were generated. Generally speaking, the sound pressure level emitted from a point source decreases by approximately 6 dBA for each doubling of distance. Sound emitted from a line source or a line of point sources attenuates in a cylindrical spreading pattern and decreases approximately 3 dBA for each doubling of distance.

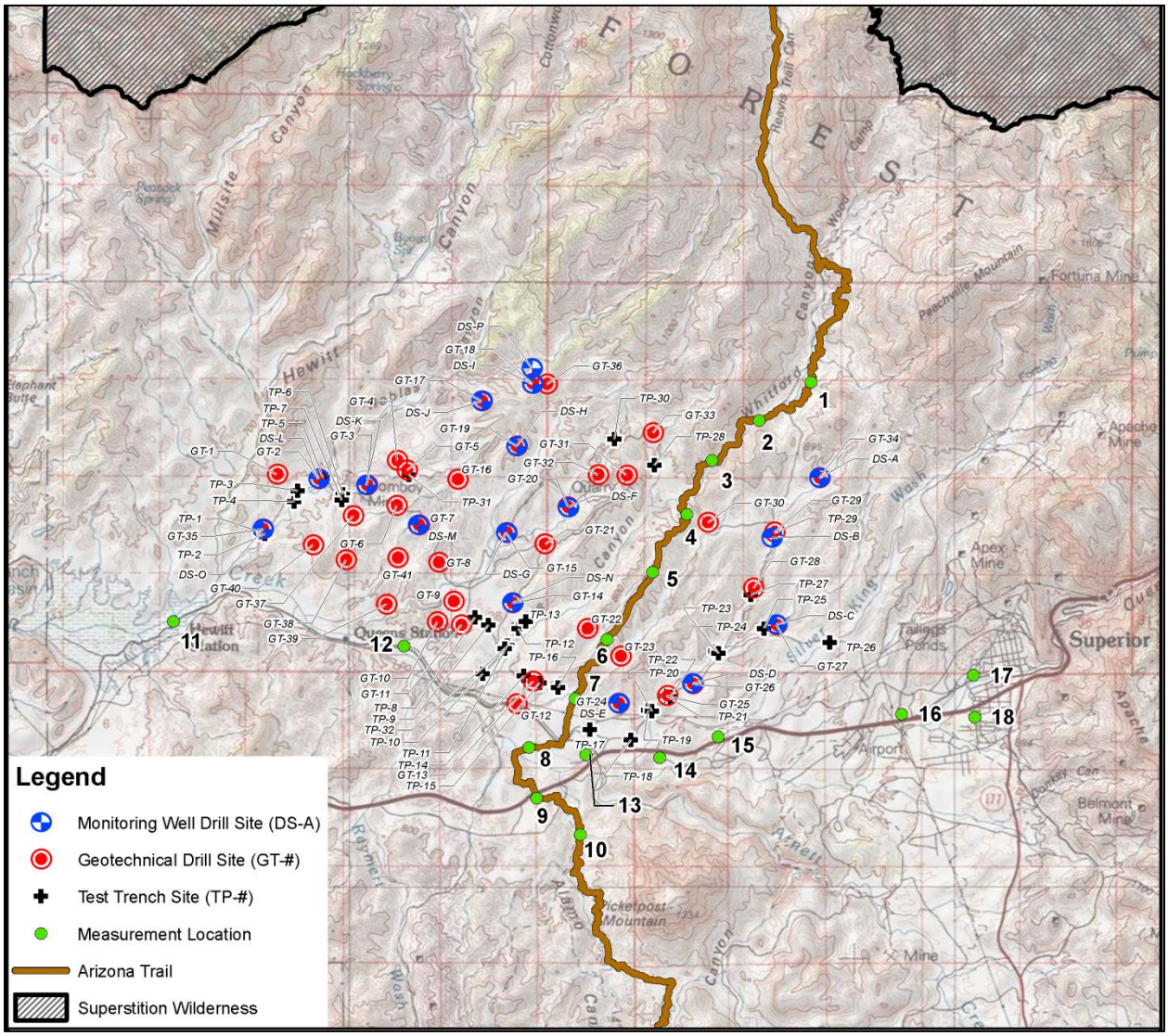
Figure 3-10. Sound Levels of Typical Noise Sources



Source: Arizona Department of Transportation, 2008.

Representative sound pressure level (SPL) measurements of the existing outdoor ambient sound environment in the vicinity of the Proposed Action were conducted at 18 locations, shown in Figure 3-11, from April 9 through 11, 2014. As detailed in the BANS document (WestLand Resources, Inc., 2014g), reported SPL measurements were typically five minutes in duration each, and conducted during various times of the day (7 am to 10 pm) at locations along or in proximity to the Arizona Trail and U.S. 60. Summarized SPL data considered relevant for the noise impact assessment appear in Table 3-20, which is reproduced from Table 7 of the BANS document. Because no rural nighttime (i.e., 10 pm to 7 am) SPL measurements were conducted, the BANS assumed a rural nighttime sound level of 25 dBA that is consistent with the typical level for this environment shown in Figure 3-11.

Figure 3-11. Existing Outdoor Ambient Sound Pressure Level (SPL) Measurement Locations



Source: WestLand Resources, Inc., 2014g.

Table 3-20. Assignment of Baseline SPL Measurement Averages to Representative Noise-sensitive Receivers

Category	Measurement Location(s)	Average Existing Outdoor *Daytime* Ambient Sound Level (dBA)	Average Existing Outdoor *Nighttime* Ambient Sound Level (dBA)	Representative Receivers
Rural	1-8 and 10-12	38.0	25.0	AZT-1, AZT-2, AZT-3, AZT-5 through AZT-20, SW-1 through SW-4
Along US 60	9 and 13-16	60.1	57.2	AZT-4, R-1, R-2, SUP-1, BTA
Superior	17 and 18	51.8	41.5	SUP-2
Hewitt Station	11	37.9	32.2	HS
Queens Station	12	34.7	35.4	QS

*25dBA estimate from ADOT (2008)

3.15.3 Environmental Consequences

3.15.3.1 Effect Indicators

This analysis compares expected noise caused by project activities to Pinal County noise limits as one of two indicators of effect intensity. The other indicator relates to the estimated decibel increase of the existing outdoor ambient sound environment as a result of implementation of the Proposed Action. With these two indicators, noise effect intensity can be categorized as follows:

- At representative noise-sensitive receiver locations where the predicted aggregate Proposed Action noise does not exceed the county standard and causes less than a detectable increase (i.e., less than 3 dBA) in the ambient sound environment, the effect intensity would be considered *negligible*.
- At receiver locations where the predicted aggregate Proposed Action noise is more than the county noise limit and causes less than a detectable increase (i.e., less than 3 dBA) in the ambient sound environment, the effect intensity would be considered *minor*. Alternately, where the predicted aggregate Proposed Action noise is less than the county noise limit but causes a perceptible (3 to 10 dBA) increase in the ambient sound environment, the effect intensity would also be considered *minor*.
- At receiver locations where the predicted aggregate Proposed Action noise is more than the county noise limit and causes only a perceptible (3 to 10 dBA) increase in the ambient sound environment, the effect intensity would be considered *moderate*. Alternately, where the predicted aggregate Proposed Action noise is less than the county noise limit but would still cause a 10 to 20 dBA increase in the ambient sound environment, the effect intensity would also be considered *moderate*.

- At receiver locations where the predicted aggregate Proposed Action noise is more than the county noise limit and causes more than a 10 dBA increase in the ambient sound environment, the effect intensity would be considered *major*. Alternately, where the predicted aggregate Proposed Action noise is less than the county noise limit but would still cause more than a 20 dBA increase in the ambient sound environment, the effect intensity would also be considered *major*.

Due to the principles of sound propagation, environmental noise effects tend to be direct and localized to a project area and its immediate surroundings, and generally would not extend into a larger region. An example of such a direct effect would be project noise causing annoyance to a nearby noise-sensitive land use. A potential consequential indirect effect of this noise might be socio-economic, as it relates to dwelling occupants and property owners that may leave the area or sell their homes in response to the annoyance.

The duration of effect, for purposes of this noise analysis, relates to the time period of the noise-producing project activity. As Proposed Action activities would not be persistent, the corresponding potential effects would be either temporary or short-term.

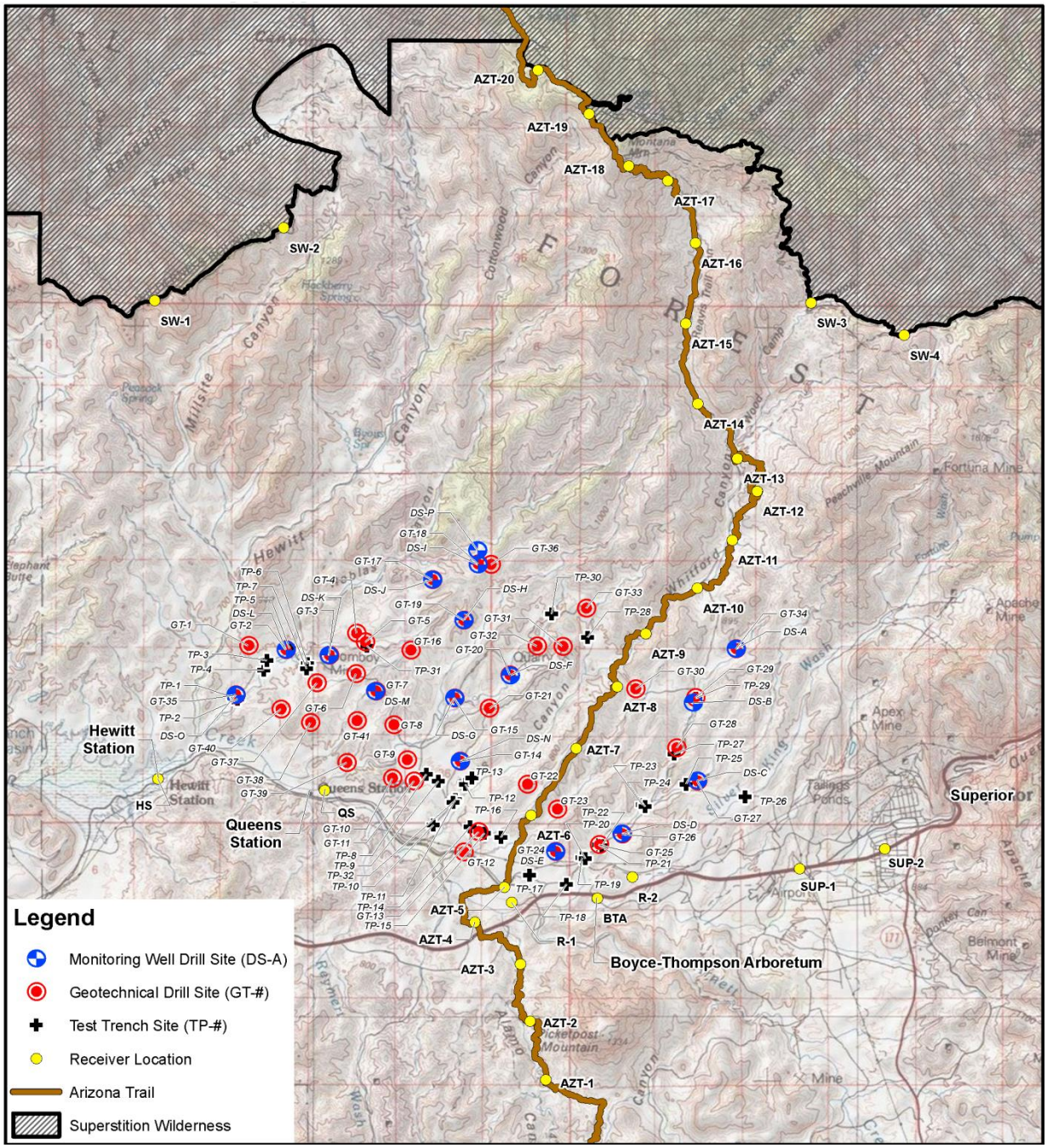
3.15.3.2 Effect from No Action

Under the No Action alternative, the Proposed Action would not be approved and no new effects on the ambient outdoor sound environment from the project would occur.

3.15.3.3 Effect from the Proposed Action

Under the Proposed Action, noise-producing activities would occur and create the potential for noise effects at representative noise-sensitive receiver locations that appear in Figure 3-12 and are consistent with those identified in the BANS document (WestLand Resources, Inc., 2014g).

Figure 3-12. Representative Noise-Sensitive Receiver Locations



Source: WestLand Resources, Inc., 2014g.

This noise effect assessment relies on estimating noise from the Proposed Action including roadway improvements, and comparing those estimates with effect intensity criteria at each of the locations shown in Figure 3-12. These noise-producing activities include:

- Construction of the laydown yards.
- Construction of 16 monitoring wells for groundwater testing.
- Completion of 41 geotechnical drill holes and piezometer installations.
- Construction of test trenches at 32 sites.
- Roadway improvement activities as detailed under the Proposed Action.

The following sections describe the prediction methodologies and present the results of the noise assessment for the Proposed Action.

Noise levels from the two types of drilling, trenching, laydown yard construction, and roadway improvements were estimated using point-source sound propagation and attenuation algorithms consistent with appropriate portions of the International Organization of Standardization (ISO) Standard 9613-2:1996 (ISO, 1996). To calculate the aggregate Proposed Action SPL at a receiver location, the predictive analysis accounts for the sound level of each source, the distance between each source and the receiver, the presence of intervening terrain, and the effects of acoustical absorption due to the air and ground surface conditions through and over which the studied sound travels.

Table 3-21 shows the source sound levels for the five categories of Proposed Action activity, with types of equipment that are consistent with what is presented in the BANS document (WestLand Resources, Inc., 2014g). Where multiple equipment types would be involved and expected to be concurrently operating, the two loudest are logarithmically combined to have a single aggregate sound level for purposes of this analysis. Reference maximum sound level (L_{max}) source levels presented in Table 3-21 are from either the Federal Highway Administration (FHWA) Construction Noise Handbook (FHWA, 2006) or manufacturer specifications.

Based on Proposed Action schedule information, and as detailed in the BANS document (WestLand Resources, Inc., 2014g), noise contribution from the two types of drilling activities and test trench construction sites were evaluated at each of the representative receiver locations for 54 daytime and 17 nighttime scenarios (WestLand Resources, Inc., 2014g). Construction of the laydown yards and roadway improvement activities would only take place during daytime hours and in advance of the drilling and trenching program.

Table 3-21. Roadway Improvement Construction Noise Sources

Project Location	Proposed Action Activity	Equipment Type	L_{max} at 50' (dBA)
Construction Laydown Yard	Construction of yard	Dozer	82.0
Hydrological Drilling Site	Drilling	Drill Rig	79.0
		Air Compressor	78.0
		XQ230 Generator	68.0
	Logarithmic Sum of Loudest Two Pieces of Equipment		81.5
Geotechnical Site	Drilling	Drill Rig	79.0
Test Trench Site	Trenching	Excavator	81.0
	Refilling trench	Dozer	82.0
	Loudest of Sequential Activities		82.0
Existing Roads, Previously Disturbed Areas	Roadway Improvements	Track Hoe	78.0
		Front-end Loader	79.0
		Grader	79.0
	Logarithmic Sum of Loudest Two Pieces of Equipment		82.0

To enable the determination of noise effect intensity at each affected representative receiver location, Table 3-22 presents the following values and information:

- Noise-sensitive receiver location identification as shown in Figure 3-12 (and consistent with the BANS document [WestLand Resources, Inc., 2014g]) and applicable Pinal County noise limit.
- The average existing outdoor ambient sound level prior to the Proposed Action, based on WestLand field survey measurements as described in the BANS document (WestLand Resources, Inc., 2014g).
- The maximum predicted sound level, which represents a logarithmic combination of existing outdoor ambient sound and the loudest of the modeled drilling and trenching combination scenarios.
- The predicted increase over existing outdoor ambient SPL due to Proposed Action noise contribution.
- The number of days during which at least a 3 dBA increase over existing ambient sound level is expected.

Table 3-22. Predicted Daytime Proposed Action Noise and Comparison with Existing Ambient Sound Level

Noise-Sensitive Receiver Location (noise limit, dBA)	Existing Outdoor Average Ambient Sound Level (dBA)	Maximum Predicted Existing + Proposed Action Noise Level (dBA)	Maximum Increase over Existing Ambient (dB)	Number of Days with at least 3 dBA Increase
AZT-1 (65)	38.0	38.1	0.1	0
AZT-2 (65)	38.0	38.4	0.4	0
AZT-3 (65)	38.0	39.6	1.6	0
AZT-4 (65)	60.1	60.1	0.0	0
AZT-5 (65)	38.0	62.9	24.9	15
AZT-6 (65)	38.0	45.1	7.1	37
AZT-7 (65)	38.0	40.2	2.2	0
AZT-8 (65)	38.0	48.3	10.3	6
AZT-9 (65)	38.0	43.6	5.6	1
AZT-10 (65)	38.0	40.0	2.0	0
AZT-11 (65)	38.0	38.7	0.7	0
AZT-12 (65)	38.0	38.2	0.2	0
AZT-13 (65)	38.0	38.1	0.1	0
AZT-14 (65)	38.0	38.0	0.0	0
AZT-15 (65)	38.0	38.0	0.0	0
AZT-16 (65)	38.0	38.0	0.0	0
AZT-17 (65)	38.0	38.0	0.0	0
AZT-18 (65)	38.0	38.0	0.0	0
AZT-19 (65)	38.0	38.0	0.0	0
AZT-20 (65)	38.0	38.0	0.0	0
BTA (65)	60.1	60.2	0.1	0
HS (65)	37.9	38.5	0.6	0
QS (65)	34.7	43.5	8.8	27
R-1 (65)	60.1	60.4	0.3	0
R-2 (65)	60.1	60.2	0.1	0
SUP-1 (60)	60.1	60.1	0.0	0
SUP-2 (60)	51.8	51.8	0.0	0
SW-1 (65)	38.0	38.0	0.0	0
SW-2 (65)	38.0	38.0	0.0	0
SW-3 (65)	38.0	38.0	0.0	0
SW-4 (65)	38.0	38.0	0.0	0

Based on Table 3-22, the following daytime noise effect intensity classifications are apparent as follows:

- At receiver locations AZT-1 through AZT-4, AZT-7, AZT-10 through AZT-20, BTA, HS, R-1, R-2, SUP-1, SUP-2, and SW-1 through SW-4, the effect is considered *negligible*.
- At receiver locations AZT-6, AZT-9, and QS, the effect is considered *minor*.
- At receiver location AZT-8, the effect is considered *moderate*.
- At receiver location AZT-5, the effect is considered *major*.

At location SUP-1, the existing daytime sound environment is already in excess of the county standard and the anticipated noise from the Proposed Action is not expected to raise it by more than a negligible amount.

Table 3-23 presents a similar comparison of noise from the Proposed Action and the existing ambient sound environment at each of the studied receiver locations, but with respect to anticipated nighttime noise-producing activity from the Proposed Action. The aggregate predicted Proposed Action noise levels are based on the nighttime scenario evaluations from the BANS (WestLand Resources, Inc., 2014g).

Table 3-23. Predicted Nighttime Proposed Action Noise and Comparison with Existing Ambient Sound Level

Noise-Sensitive Receiver Location (noise limit, dBA)	Existing Outdoor Average Ambient Sound Level (dBA)	Maximum Predicted Existing + Proposed Action Noise Level (dBA)	Maximum Increase over Existing Ambient (dB)	Number of Days with at least 3 dBA Increase
AZT-1 (60)	25.0	26.3	1.3	0
AZT-2 (60)	25.0	28.4	3.4	4
AZT-3 (60)	25.0	31.6	6.6	23
AZT-4 (60)	57.2	57.2	0.0	0
AZT-5 (60)	25.0	37.5	12.5	59
AZT-6 (60)	25.0	41.1	16.1	99
AZT-7 (60)	25.0	34.3	9.3	115
AZT-8 (60)	25.0	35.1	10.1	101
AZT-9 (60)	25.0	34.0	9.0	66
AZT-10 (60)	25.0	35.6	10.6	33
AZT-11 (60)	25.0	31.3	6.3	27
AZT-12 (60)	25.0	27.8	2.8	0
AZT-13 (60)	25.0	26.6	1.6	0
AZT-14 (60)	25.0	25.6	0.6	0
AZT-15 (60)	25.0	25.0	0.0	0
AZT-16 (60)	25.0	25.0	0.0	0
AZT-17 (60)	25.0	25.0	0.0	0
AZT-18 (60)	25.0	25.0	0.0	0
AZT-19 (60)	25.0	25.0	0.0	0
AZT-20 (60)	25.0	25.0	0.0	0
BTA (60)	57.2	57.3	0.1	0
HS (60)	32.2	33.6	1.4	0
QS (60)	35.4	37.2	1.8	0
R-1 (60)	57.2	57.2	0.0	0
R-2 (60)	57.2	57.3	0.1	0
SUP-1 (55)	57.2	57.2	0.0	0
SUP-2 (55)	41.5	41.6	0.1	0
SW-1 (60)	25.0	25.0	0.0	0
SW-2 (60)	25.0	25.0	0.0	0
SW-3 (60)	25.0	25.0	0.0	0
SW-4 (60)	25.0	25.0	0.0	0

Based on Table 3-23, the following nighttime noise effect intensity classifications are apparent as follows:

- At receiver locations AZT-1, AZT-4, AZT-12 through AZT-20, BTA, HS, QS, R-1, R-2, SUP-1, SUP-2, and SW-1 through SW-4, the effect is considered *negligible*.
- At receiver locations AZT-2, AZT-3, AZT-7, AZT-9, and AZT-11, the effect is considered *minor*.
- At receiver locations AZT-5, AZT-6, AZT-8, and AZT-10, the effect is considered *moderate*.

At location SUP-1, the existing daytime sound environment is already in excess of the county standard and the anticipated noise from the Proposed Action is not expected to raise it by more than a negligible amount.

As indicated in the right-most columns of Table 3-22 and Table 3-23, the aggregate duration of noise associated with the Proposed Action would range from 0 to 115 days during the total 190-day Proposed Action construction and drilling/trenching period. The BANS document provides plots of daily sound level estimates when elevated sound levels associated with Proposed Action activities are expected to occur. These effects would be short-term and would not continue upon completion of the construction and drilling/trenching activities.

While daytime and nighttime noise levels are expected to be compliant with Pinal County thresholds, the magnitude of expected temporary outdoor ambient noise increment at representative noise-sensitive receiver locations where moderate and major impacts are anticipated suggests that some recreationists (under certain conditions) may hear noise from the Proposed Action.

The potential effect of ambient noise level increase on wildlife (e.g., migratory birds and raptors) is discussed in Section 3.7.3.3. In addition, readers should note that "as with many other types of disturbance, the intensity of response by raptors to noise depends largely on the familiarity of the noise" (AMEC Americas Limited, 2005); hence, a degree of habituation or tolerance-like behavior might be expected if the occurrence of noise from the Proposed Action construction activity and drilling/trenching operations is similar to noise generated from previously occurring forest road improvements and maintenance activities. To help reduce this adverse effect on Arizona Trail recreation experience when Proposed Action activities occur near these locations, EMPs (Section 2.3.6) and the following mitigation measure would be implemented.

Mitigation Measures

MM – 16: Ensure construction and drilling equipment are properly maintained and feature, as appropriate, factory-installed or approved exhaust mufflers, air intake filters, hoods, enclosures, and other means to minimize noise from engine operation.

3.15.3.4 Cumulative Effects

The cumulative effects analysis area for noise differs from the analysis area for other resources, and is a 0.5-mile buffer around the project area. This area was chosen for the analysis because noise-related impacts from the Proposed Action would not have a detectable effect more than 0.5-mile from the project area. Several of the present and reasonably foreseeable future actions outlined in Table 3-1, including

vegetation management, range, mineral development, transportation and access, and recreation could contribute to cumulative noise levels.

The Mesa Vegetation Regeneration and Habitat Improvements Project, Rangeland Improvements Project, and the ADOT projects could occur during the same period as development of the Proposed Action. This would introduce additional noise sources into the cumulative effects analysis area through the use of motorized equipment such as chainsaws, vehicles, and heavy equipment operation. These noise levels are anticipated to be low-level, short-term, and would occur in discreet locations at a small scale. They would not combine incrementally to result in levels that would produce a more than negligible effect. The proposed MPO could introduce additional noise sources for a substantial period of time. However, this incremental increase in noise would not commence until year six (at the earliest) of the Proposed Action; when noise generation from the Proposed Action would be at a minimum. The five categories of noise producing activities associated with the Proposed Action and discussed in the previous section will all take place in the first two years of the Proposed Action.

Current and future noise levels created by motorized recreation (including the Pinal County Multi-use Trail Corridors) may combine with development activities from the Proposed Action and other present and future projects. Noise from current and future levels of motorized use (other than from construction equipment that could be used for development of the proposed MPO) is low-level, short-term, and also intermittent. Therefore, cumulative effects to noise levels would be minimal and temporary.

CHAPTER 4.0 CONSULTATION AND COORDINATION

4.1 List of Preparers

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Dautis Pearson	Transportation
Lynell Sutter	Environmental Planner
Patty Renter	GIS Lead
Mark Storm	Noise

Merjent – URS Corporation Subconsultant

Leslie Watson	Senior NEPA Environmental Planner

4.2 List of Agencies, Tribes, Organizations, and Businesses Notified

4.2.1 Federal Agencies

Bureau of Land Management, Phoenix District, Lower Sonoran Field Office
Bureau of Land Management, Phoenix District
Tonto National Forest, Globe Ranger District
Tonto National Forest, Mesa Ranger District
U.S. Army Corps of Engineers, Regulatory Branch, Arizona Section
U.S. Army Corps of Engineers, Los Angeles District, Tucson Project Office
U.S. Department of Agriculture, Forest Service
U.S. Fish and Wildlife Service

4.2.2 Tribal Communities

Fort McDowell Yavapai Nation
Gila River Indian Community
Hopi Tribe
Salt River Pima-Maricopa Indian Community
San Carlos Apache Tribe
Tonto Apache Tribe
White Mountain Apache Tribe
Yavapai-Apache Nation
Yavapai- Prescott Indian Tribe
Pueblo of Zuni

4.2.3 State Agencies

Arizona Department of Agriculture
Arizona Department of Commerce
Arizona Game and Fish Department
Arizona Geological Survey
Arizona Department of Environmental Quality
Arizona State Mine Inspector
Arizona Department of Transportation
Arizona Department of Water Resources
Arizona State Land Department
Arizona State Mine Inspector
Arizona State University
Arizona State University – Polytechnic Campus
Arizona State University – School of Human Evolution & Social Change

4.2.4 Local Agencies

City of Globe, Arizona
Gila County, Arizona
Pinal County, Arizona
Town of Florence, Arizona
Town of Hayden, Arizona
Town of Kearny, Arizona
Town of Miami, Arizona
Town of Queen Creek, Arizona
Town of Superior, Arizona
Town of Winkelman, Arizona

4.2.5 Organizations

Arizona Mining Reform Coalition
Arizona Trail Association
Arizona Wilderness Coalition
Arizona Wildlife Federation
Audubon Arizona
Audubon Society – Maricopa Chapter
AZTEC
Boyce Thompson Arboretum
Bronco Creek Exploration, Inc.
Center Focus Climbing
Center for Biological Diversity
County Supervisors Association of Arizona
Globe-Miami Regional Chamber of Commerce & Economic Development Corporation
Groundwater Awareness League
Inter Tribal Council of Arizona, Inc.
Maricopa Audubon Society
The Nature Conservancy
Queen Creek Coalition
Sierra Club
Soil and Moisture Conservation Program
Sonoran Institute
Southern Gila County Economic Development Corporation
Superior Schools
Superstition Area Land Trust
The Trust for Public Land
United Association of Plumbers & Pipefitters Local 741
Wild Earth Guardians
Wilderness Society

4.2.6 Businesses

Albo Luzman Trucking
American Realty
Apache Mining Corporation
Appleton-Whittell Research Ranch
Archaeological Consulting Services, Ltd.
Arizona Public Service
Arizona Silverbelt
BHP Copper
Carlota Copper Company
Carlota Mine
Center Focus Climbing
Copper Country News
Copper Triangle Mining Services
Cornerstone Lands
Dalton Realty
DC Cattle Company
Dirty SW Offroad Badboys Society
DNH Cattle Co. LLC
East Valley Back Country Horsemen
Environmental Economic Committees
Fort McDowell Adventures
Freeport-McMoRan, Miami Operations
Grefco Inc.
Hewitt Station LLC
Imerys Perlite Mine
Integrity Land and Cattle, LLC
Kalamazoo Materials Inc.
Merele's Automotive
Minefinder Gold
Miracle Executive Services
Montgomery and Interpreter, PLC
New Magma Irrigation and Drainage District
Omya, Inc.
Pinal Cabin Owners Association
Psomas
Resolution Copper Mining
Red Mountain Mining, Inc.
Resolution Copper Mining
Salt River Project
Stewart-Martin
Sullivan Paving
Superior Development Company
The Sparks Law Firm, P.C.
Vision Building Systems
WestLand Resources, Inc.

4.3 Summary of Preliminary EA Distribution

A 30-day public comment period for the Preliminary Environmental Assessment (Preliminary EA) prepared in response to submittal of Resolution Copper Mining's Baseline Hydrological and Geotechnical Data Gathering Activities *Plan of Operations* to the Tonto National Forest occurred March 13 through April 13, 2015. The public comment period was initiated by publication of a legal notice announcing the public comment period in the *Arizona Capitol Times*, the newspaper of record, on March 13, 2015. The same legal notice was published in the *Arizona Silver Belt* on March 18, 2015. Approximately 850 people, including representatives from approximately 93 organizations and government agencies were notified by letter of the Preliminary EA comment period, and of the two open houses to be held by the Tonto National Forest. Additionally, 10 Native American Tribes with cultural affiliation in Arizona were notified of the comment period, and were mailed copies of the Preliminary EA, and the Scoping Comment and Response Report. Written comments were submitted via U.S. postal mail, e-mail, fax, and/or during the two public open houses held on March 25, 2015 at the Superior Junior/Senior High School located in the Town of Superior, Arizona, and March 26, 2015 at the Queen Valley Recreation Center, located in the Community of Queen Valley, Arizona. A court reporter was available at both open houses to take verbal comments, as well as an English-Spanish translator. The Resolution Copper Mining Baseline Hydrological and Geotechnical Data Gathering Activities Preliminary EA Public Comment and Response Report addressing individual comments is available on the project website to review specific comments and responses.

REFERENCES

Abella, S.R. 2010. Disturbance and Plant Succession in the Mojave and Sonoran Deserts of the American Southwest. *International Journal of Environmental Research and Public Health, 7*(4) :1248-1284.

AMEC Americas Limited. 2005. Mackenzie Gas Project Effects of Noise on Wildlife. July. Accessed at http://ulpeis.anl.gov/documents/dpeis/references/pdfs/AMEC_Americas_2005.pdf on November 10, 2014.

Arizona Department of Environmental Quality. 2002. State Implementation Plans, Hayden Sulfur Dioxide (SO_2) Maintenance Plan.

Arizona Department of Environmental Quality. 2008. State Implementation Plans, *Miami PM_{10} Nonattainment Area Limited Maintenance Plan and Request for Redesignation*.

Arizona Department of Environmental Quality. 2010. *Arizona Pollutant Discharge Elimination System General Permit for De Minimus Discharges to Waters of the U.S.* Permit No. AZG2010-001.

Arizona Department of Transportation. 2008. Common Indoor and Outdoor Noise Levels accessed at http://www2.azdot.gov/highways/EPG/EPG_common/ PDF/Noise/Noise_facts2.pdf on September 19, 2013.

Arizona Department of Water Resources. 2008. *Well Abandonment Handbook*. Retrieved June 2014, from ADWR – Water Management/Wells: http://www.azwater.gov/azdwr/WaterManagement/Wells/documents/AbandonmentHandbook2008.pdf

Arizona Department of Water Resources. 2010. *Arizona Water Atlas, Volume 8: Active Management Area Planning Area*. Retrieved June 2014, from ADWR - Statewide Planning/Water Atlas: http://www.azwater.gov/azdwr/StatewidePlanning/WaterAtlas/ActiveManagementAreas/default.htm.

Arizona Department of Water Resources . 2014. *Well Registry Web*. Retrieved June 2014, from https://gisweb.azwater.gov/waterresourcedata/WellRegistry.aspx.

Arizona Game and Fish Department. 2007. Guidelines for handling Sonoran desert tortoise encountered on development projects. Revised October 23, 2007. Available at: http://www.azgfd.gov/hgis/pdfs/Tortoisehandlingguidelines.pdf.

Arizona Game and Fish Department . 2013. *Game Management Unit 24B*. Retrieved September 22, 2014, from Managing Today for Wildlife Tomorrow: http://www.azgfd.gov/h_f/hunting_units_24b.shtml#wt.

Arizona Game and Fish Department . 2014. Unpublished abstracts and maps compiled and edited by the Heritage Data Management Systems (HDMS), Arizona Game and Fish Department, Phoenix, Arizona.

Bengston, Ginny. 2013. *Phase II Ethnographic/Ethnohistoric Assessment, U.S. 60 Superior to Globe Highway Expansion Project, Gila and Pinal Counties, Arizona*. Western Cultural Resource Management, Sparks, Nevada.

Besich-Lira, M. 2013. *OMYA Open House: A peak inside the Superior Plant.* Retrieved September 8, 2014, from Newspaper Archive of the Superior Sun: http://sup.stparchive.com/Archive/SUP/SUP03272013p12.php.

Bezy, R.L. 2005. The Night Lizards (*Xantusia*) of Arizona. Sonoran Herpetologist 18: 14-19.

Brennan, T.C. & Holycross, A.T. 2006. A field guide to amphibians and reptiles in Arizona. Arizona Game and Fish Department, Phoenix. 150 pp.

Brooks, M.L., & Pyke, D.A. 2001. Invasive plants and fire in the deserts of North America. Pages 1-14 in K.E.M. Galley and T.P. Wilson (eds.). Proceedings of the Invasive Species Workshop: the Role of Fire in the Control and Spread of Invasive Species. Fire Conference 2000: the First National Congress on Fire Ecology, Prevention, and Management. Miscellaneous Publication No. 11, Tall Timbers Research Station, Tallahassee, Florida.

Brown, D., Carmony, N., & Turner, R. 1981. *Drainage Map of Arizona Showing Perennial Streams and Some Important Wetlands.* Arizona Game and Fish Department and U.S. Geological Survey.

Brown, D.E., & Lowe, C. 1980. Biotic Communities – Southwestern United States and Northwestern Mexico. Map. General Technical Report RM-78, Rocky Mountain Forest and Range Experiment Station, U.S. Forest Service (Reprinted 1994 by University of Utah Press, Salt Lake City, Utah).

Brown, D.E., & Lowe, C. 1994. Biotic Communities – Southwestern United States and Northwestern Mexico. General Technical Report RM-78, Rocky Mountain Forest and Range Experiment Station, U.S. Forest Service. University of Utah Press, Salt Lake City, Utah.

Brown, D.E., & Minnich, R.A. 1986. Fire and changes in creosote bush scrub of the western Sonoran Desert, California. *American Midland Naturalist*, 411-422.

Bruder, J. Simon. 2014. Memorandum to Arizona Department of Transportation Regarding Second Preliminary Report – Properties Affected by Removal/Replacement of Gas Pipeline. Project Numbers 060-D-(208)A/60 PN 222 H7900 02D. Dated 3 November. EcoPlan Associates, Mesa, Arizona.

Butterfield, B.J., Betancourt, J.L., Turner, R.M., & Briggs, J.M. 2010. Facilitation drives 65 years of vegetation change in the Sonoran Desert. *Ecology, 91*(4), 1132-1139.

Chamorro, Sebastian. 2014. *A Cultural Resources Inventory of 12.92 Acres—An Addendum to the Resolution Project: A Cultural Resources Inventory of Baseline Hydrologic and Geotechnical Data-Gathering Sites and Access Roads in the Foothills of the Superstition Mountains, Northwest of Superior, Arizona*. Cultural Resource Report 2014-58. WestLand Resources, Inc., Tucson, Arizona.

Corman, T.D., & Wise-Gervais, C. 2005. Arizona Breeding Bird Atlas. University of New Mexico Press, Albuquerque. 636 pp.

Council on Environmental Quality and Advisory Council on Historic Preservation. 2013. *NEPA and NHPA: A Handbook for Integrating NEPA and Section 106*. Washington, D.C.

Council on Environmental Quality, Presidents Office. 1997. *Considering cumulative effects under the National Environmental Policy Act.* Washington D.C. : Presidents Office.

Dentzer, M.A. 2012. *The Magma Arizona Railroad*. Retrieved September 5, 2014, from Abandonedrails.com: http://www.abandonedrails.com/Magma_Arizona_Railroad.

Federal Highway Administration. 2006. Construction Noise Handbook accessed at https://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/ on November 10, 2014.

Fenneman. 1931. *Physiography of the Western United States.* McGraw Hill, Book Company Inc. New York and London.

Frost, B., & Ruyle, G. 1993. Range management terms/definitions. *Rangeland Management*(15), 15-25.

Fure, A. 2013. Bats and lighting – six years on. The London Naturalist, No. 91, 2012. pages 69-8.

Gellenbeck, D., & Coes, A. 1999. *Ground-water Quality in Alluvial Basins that Have Minimal Urban Development.* U.S. Geological Survey.

Gottfried, G.J., Alford, E.J., & Brock, J.H. 2005. Effects of fire on Sonoran desert plan communities. In G. J. Gottfried, B. S. Gebow, L. G. Eskew, & C. B. Edminster, *Connecting mountain islands and desert seas: biodiversity and management of the Madrean Archipelago II* (pp. 451-454). Fort Collins, Colorado: U.S. Department of Agriculture, Rocky Mountain Research Station.

Hoffmeister, D.F. 1986. *Mammals of Arizona*. University of Arizona Press, Tucson, Arizona, 602 pp.

Holub, H. 2014. *Summary of Arizona Water Law*. Retrieved September 2014, from http://hughholub.com/waterlaw.htm.

Hooper, John M.D. 2014. *Resolution Project: A Cultural Resources Inventory of Baseline Hydrologic and Geotechnical Data-Gathering Sites and Access Roads in the Foothills of the Superstition Mountains, Northwest of Superior, Arizona*. Cultural Resource Report 2013-48. WestLand Resources, Inc., Tucson, Arizona.

Hopkins et al. 2015. *Ethnographic and Ethnohistoric Study of the Superior Area, Arizona*. Anthropological Research, LLC., Tucson, Arizona.

Intergovernmental Panel on Climate Change. 2013. Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y.].

International Dark-Sky Association. 2013. *Light Pollution and Wildlife*. Available at: http://www.darksky.org/assets/documents/ida_wildlife_brochure.pdf. Accessed on: September 20, 2014.

International Organization of Standardization 9613-2:1996(E). 1996. *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*, 1st ed., 1996-12-15, ISO, Geneva.

Jones, Kimber. 2014. Telephone conversation with Kimber Jones, TNF Landscape Architect (C. Weatherbee, Interviewer). September 10, 2014.

King, Thomas F., & Rafuse, Ethan. 1994. *NEPA and the Cultural Environment: An Assessment and Recommendations.* Prepared for the Council on Environmental Quality. CEHP, Washington, D.C.

Montgomery & Associates. 2013. *Results of the Queen Creek Corridor Survey, Superior Basin, Pinal County, Arizona.*

Northam, Francis E., Backer, Dana M., & Hall, John A. 2005. "Development of a categorized list of invasive non-native plants that threaten wildlands in Arizona." *Final report of the Arizona Wildlands Invasive Plant Working Group. E. Kissel, S. Ernst (eds.). Impact of carbon dioxide, trace gases, and climate change on global agriculture. American Society of Agronomy Special Publication 53.*

Pinal County. 2009. *We Create Our Future: Pinal County Comprehensive Plan*. Adopted November 2009.

Pineda, V. 2014. Telephone Conversation with Val Pineda of the Arizona Water Company. (M. Spansky, Interviewer) September 16, 2014.

Pinyon Environmental, Inc. 2014. Technical Memorandum to WestLand Resources, Inc., "*Resolution Copper Mine Baseline Activities Emissions Inventory*."

Resolution Copper Mining LLC. 2013. General Plan of Operations. Retrieved June 23, 2014, from Resolution Copper Mining: The Resolution Copper Copper Mining Project: http://resolutioncopper.com/the-project/mine-plan-of-operations/.

Resolution Copper Mining LLC. 2014. Plan of Operations. Baseline Hydrologic and Geotechnical Data Gathering Activities on Tonto National Forest.

Robson, S., & Banta, E. 1995. *Ground Water Atlas of the United States, Segment 2: Arizona, Colorado, New Mexico, Utah.* U.S. Geological Survey.

Sacramento State Office of Water Programs. 2012. Glossary of Water and Wastewater Terms. Retrieved April 2, 2014, from Office of Water Programs: http://www.owp.csus.edu/glossary/index.php.

Southwest Biological Science Center. 2014. *Plant Assessments*. Retrieved September 22, 2014, from Southwest Exotic Plant Information Clearinghouse: http://sbsc.wr.usgs.gov/research/projects/swepic/SWVMA/assessments.asp.

Sutter, J., Condon, A., & Bierly, P. 2014. *2012/14 Status of Water Quality Arizona's Integrated 305(b) Assessment and 303(d) Listing Report.* Arizona Department of Environmental Quality, Water Resources Division. Phoenix: State of Arizona. Retrieved from http://www.azdeq.gov/environ/water/assessment/download/CHAPTER%20I-II.pdf.

The Birds of North America Online (A. Poole, Ed.). 2007. Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online.

U.S. Department of Housing and Urban Development. 1996. HUD Noise Guidelines 24 CFR 51 subpart B, March 26.

U.S. Environmental Protection Agency. 1974. *Information on Levels of Environmental Noise Requisite to Protect Health and Welfare with an Adequate Margin of Safety*. Report No. 550/9-74-004, Washington, D.C.

U.S. Environmental Protection Agency. 1999. *Consideration of Cumulative Impacts in EPA Review of NEPA Documents*. May.

U.S. Environmental Protection Agency. 2014. Queen Valley Monitoring Station Data from the AirData Website accessed at http://aqsdr1.epa.gov/aqsweb/aqstmp/airdata/download_files.html#Annual on September 12, 2014.

U.S. Fish and Wildlife Service. 2008. *Birds of Conservation Concern*, December 2008. United States Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, Virginia. 85 pp. Available at: http://www.fws.gov/migratorybirds/NewReportsPublications/SpecialTopics/BCC2008/BCC2008 Accessed August 18, 2014.

U.S. Fish and Wildlife Service. 2014. Information, planning, and conservation system. Environmental Conservation Online System available at: http://ecos.fws.gov/ipac/. Accessed, September 2014.

U.S. Forest Service. 1974. *Agriculture Handbook Number 462, National Landscape Management.*

U.S. Forest Service. 1982. *Recreation Opportunity Spectrum (ROS): Users Guide.*

U.S. Forest Service. 1985 (amended 2006). Tonto National Forest. *Forest Land Management Plan.* Retrieved January 2, 2014, from Tonto National Forest Planning: http://www.fs.usda.gov/detail/tonto/landmanagement/planning/?cid=stelprdb5409035.

U.S. Forest Service. 1989. *Landscape Character Types of the National Forests in Arizona and New Mexico.*

U.S. Forest Service. 1995. *Agriculture Handbook Number 701, Landscape Aesthetics – A Handbook for Scenery Management.*

U.S. Forest Service. 2001. *Guide to Noxious Weed Prevention Practices.*

U.S. Forest Service 2003. *First Amended Programmatic Agreement Regarding Historic Property Protection and Responsibilities Among New Mexico Historic Preservation Officer and Arizona State Historic Preservation Officer and Texas State Historic Preservation Officer and Oklahoma*

State Historic Preservation Officer and The Advisory Council on Historic Preservation and United States Department of Agriculture, Forest Service Region 3. Albuquerque, NM: Region 3, U.S. Forest Service.

U.S. Forest Service. 2004. *Engineering Operations. Forest Service Manual 7100.*

U.S. Forest Service. 2005. Guidelines for Road Maintenance Levels. *Forest Service Handbook 7709.58.*

U.S. Forest Service. 2009a. Travel Management. *Forest Service Manual 7700.*

U.S. Forest Service. 2009b. Climate Change Land Management and Project Planning. *Climate Change Considerations in Project Level NEPA Analysis.* Retrieved December 2015, from: http://www.fs.fed.us/emc/nepa/climate_change/

U.S. Forest Service. 2011. Tonto National Forest Migratory bird species of concern March 2011. List provided by Tonto National Forest.

U.S. Forest Service. 2012. Tonto National Forest Management Indicator Species. May 2012. List provided by Tonto National Forest.

U.S. Forest Service. 2013. Region 3 Regional Forester's Sensitive Species – Animals and Plants List.

U.S. Forest Service. 2014a. *Tonto National Forest sensitive species*. Published: Tonto National Forest, January 2014. Available at: http://www.fs.usda.gov/Internet/ FSE_DOCUMENTS/fsbdev3_018480.pdf.

U.S. Forest Service. 2014b. *Travel Management Tonto National Forest Soils Report*. Retrieved September, 2014, from Tonto National Forest Planning: http://www.fs.usda.gov/detail/tonto/landmanagement/planning/?cid=stelprdb5409035.

U.S. Forest Service. (n.d.). *Invasive Species for the Tonto National Forest.* Retrieved September 2014, from Tonto National Forest: http://www.fs.usda.gov/detailfull/tonto/learning/nature-science/?cid=fsbdev3_018792&width=full.

U.S. Geological Survey, Colorado Plateau Research Station. 2005. SWEPC Team. (K. Thomas, Editor) Retrieved November 11, 2014, from Southwest Exotic Plant Information Clearinghouse: http://sbsc.wr.usgs.gov/cprs/research/projects/swepic/swemp/team.asp.

U.S. Geological Survey. 2014a. *Science in Your Watershed*. Retrieved June 2014, from http://water.usgs.gov/wsc/map_index.html.

U.S. Geological Survey. 2014b. *Water-resources Data for the United States, Water Year 2013.*

URS Corporation 2014. *Visual Resource Technical Report for Resolution Baseline Hydrological and Geotechnical Data Gathering Activities Plan of Operations*.

Western Regional Climate Center. 2005. Western Regional Climate Center Climate Summary accessed at http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?azsupe on September 4, 2014.

WestLand Resources, Inc. 2012a. 2011 Bat Species Survey of the Resolution Copper Mine Study Area. Prepared for Resolution Copper Mining.

WestLand Resources, Inc. 2013. Results of bird surveys conducted at Near West 2013. Prepared for Resolution Copper Mining.

WestLand Resources, Inc. 2014a. Noxious weed survey of the Baseline Activities Area. Prepared for Resolution Copper Mining.

WestLand Resources, Inc. 2014b. Raptor surveys conducted at Near West 2013. Prepared for Resolution Copper Mining.

WestLand Resources, Inc. 2014c. Wildlife camera monitoring report. Prepared for Resolution Copper Mining.

WestLand Resources, Inc. 2014d. Results of Sonoran Desert tortoise survey in the Tonto National Forest near Superior, Arizona 2013. Draft report prepared for Resolution Copper Company.

WestLand Resources, Inc. 2014e. Addendum to the Vegetation Association Map of the Baseline Activities Area, Pinal County, Arizona. Prepared for Resolution Copper Mining.

WestLand Resources, Inc. 2014f. *Baseline Activities Lighting Analysis*.

WestLand Resources, Inc. 2014g. *Baseline Activities Noise Study.* Project No. 807.94, revised October.

WestLand Resources, Inc. 2015a. Biological evaluation baseline hydrologic & geotechnical data gathering activities on Tonto National Forest. Prepared for Resolution Copper Mining.

WestLand Resources, Inc. 2015b. Management Indicator Species report for baseline hydrologic & geotechnical data gathering activities on Tonto National Forest, Pinal County, Arizona. Prepared for Resolution Copper Mining.

WestLand Resources, Inc. 2015c. Biological Resources Monitoring Plan: Baseline Hydrologic & Geotechnical Data Gathering Activities on Tonto National Forest Pinal County, Arizona. Prepared for Resolution Copper Mining.

WestLand Resources, Inc. 2015d. Migratory Bird Treaty act report for baseline hydrologic & geotechnical data gathering activities on Tonto National Forest, Pinal County, Arizona. Prepared for Resolution Copper Mining.

Whelan, Robert J. 1995. The ecology of fire. Cambridge University Press.

GLOSSARY

Airlift pump. A pump used for raising water from a well, consisting of a pipe which surrounds another pipe of smaller diameter. Compressed air is injected into the smaller pipe, causing water to rise up to the larger pipe.

Animal Unit Month (AUM). One mature (1,000 pound) cow or the equivalent based upon an average daily forage allowance of 26 pounds of dry matter per day under range conditions.

Applicant. Resolution Copper Mining, LLC.

Aquifer hydraulic parameters. A term for the measured characteristics of an aquifer that quantify an aquifer's potential to transport and store water. These parameters are established using various aquifer testing, measuring, and monitoring methods.

Aquifer. An underground rock formation composed of such materials as sand, soil, or gravel that can store groundwater and supply it to wells and springs. In aquifers, groundwater occurs in sufficient quantities to be used for drinking water, irrigation, and other purposes.

Borehole. Any long or deep drill hole, often associated with a diamond drill.

Color. A phenomenon of light (seen as red, brown, pink, etc.) or visual perception that enables one to differentiate otherwise identical objects. A hue, as contrasted with black, white, or gray.

Cumulative effects. Effects which result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions.

Designated road, trail, or area. A National Forest System road, National Forest system trail, or an area on National Forest System lands, that is designated for motor vehicle use pursuant to Section 212.51 on a motor vehicle use map.

Direct effect. Effects which are caused by an action and occur at the same time and place.

Drill rig. A machine that creates boreholes and/or shafts to sample sub-surface mineral deposits, to test rock, soil, and groundwater physical properties, and to install tunnels or wells.

Forest. Tonto National Forest.

Forest Plan. Tonto National Forest Plan and Resource Management Plan.

Forest roads. A National Forest System road that is designated for motor vehicle use.

Form. The shape or structure of something as opposed to the material of which it is composed.

Fugitive dust. Particles lifted into the air and caused by man-made and natural activities such as the movement of soil, vehicles, equipment, and wind.

Hydraulic conductivity. A coefficient describing the relative ease with which groundwater can move through a permeable layer of rock or soil.

Indirect effects. Effects which are caused by an action and are later in time or farther removed in distance, but that are still reasonably foreseeable.

Inert material. Material which is passively resistant to any change, particularly a material which is relatively unaffected by the action of heat or water.

Line. An intersection of two planes. A point that has been extended; a silhouette of form. Any of various things that are or may be considered as arranged in a row or sequence.

Long-term effects. Effects which persist for more than five years after disturbance concludes, and continue for a reasonable period after reclamation.

Maintenance levels. The level of service provided by, and maintenance required for, a specific forest road.

Permeability. The capacity of a porous rock, sediment, or soil to transmit a fluid, such as water.

Piezometer. Instrument for measuring the pressure or depth of groundwater.

Plan. Plan of Operations.

Previously disturbed areas to be used as temporary access roads. Unauthorized or user-created roads and are not National Forest Transportation System Roads.

Project area. The area in which Baseline activities would occur.

Purge water. Waste water derived from well installation, well development, groundwater monitoring, sampling, and pumping tests.

Resolution. Resolution Copper Mining, LLC.

Reverse circulation drilling method. Air-assisted reverse circulation drilling utilizes high-pressure air to cool the drill bit and remove drill cuttings from the borehole. Cuttings are carried quickly to the surface through the inner steel tubing.

Road. A motor vehicle route over 50 inches wide, unless identified and managed as a trail.

Settling pits. A location within a geotechnical drill site disturbance area that would be used during drilling operations to hold drill cuttings that are brought to the surface.

Short-term effects. Effects that persist up to five years after disturbance concludes.

Short-term temporary access roads. Roads that provide access to sites not served by existing roads or previously disturbed areas.

Storage coefficient. Volume of groundwater an aquifer releases from or takes into storage per unit surface area.

Stratigraphy. The study of rock layers, especially their distribution, environment of deposition, and age.

Temporary effects. Effects which occur during construction and installation, maintenance, and/or decommissioning and persist for less than or equal to two years.

Temporary road or trail. A road or trail necessary for emergency operations or authorized by contract, permit, lease, or other written authorization that is not a forest road or trail and that is not included in a transportation atlas.

Texture. The visual or tactile surface characteristics of something.

Transmissivity. The ability of an aquifer to transmit groundwater.

Water bar. A ditch or hump hat diverts excess water off the surface to avoid or minimize soil erosion.

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