

*Draft*  
Engineering Evaluation/Cost Analysis

Upper Pinto Creek Mines  
Tonto National Forest, Arizona

*Prepared for:*  
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## EXECUTIVE SUMMARY

Dawson Federal, LLC (Dawson) and Weston Solutions, Inc. (WESTON®) were contracted by the United States Forest Service (USFS), under contract AG-8371-C-14-0021, to conduct an Engineering Evaluation/Cost Analysis (EE/CA) for the Upper Pinto Creek mines sites located within the Tonto National Forest. The EE/CA was performed in accordance with requirements set forth under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The project included evaluation of five mine sites located in the Upper Pinto Creek watershed: the Ellis Vein, Henderson Ranch Mines, Blue Gate Mine, Unnamed (Cracker Jim) Mine, and the Bronx Mines.

The mine sites came to the attention of the USFS following the completion of a Total Maximum Daily Load (TMDL) study performed by the Arizona Department of Environmental Quality (ADEQ) due to observed concentrations of dissolved copper in Pinto Creek and its tributaries that exceed Arizona Water Quality Standards (AZ WQS). Thus, the primary objective for the EE/CA was to identify potential sources for dissolved copper in Pinto Creek and evaluate removal actions if corrective action was indicated.

### Site Investigations and Distribution of Contamination

Previous environmental investigation at the mines sites include surface water monitoring related to ADEQ's TMDL study. ADEQ concluded the dissolved copper exceedances were mainly attributed to the Gibson mine operations, which is not located on USFS land, and to a lesser extent, the mining areas being addressed in this EE/CA. The USFS performed a Preliminary Assessment/Site Inspection (PA/SI) at the Upper Pinto Creek Mine Sites in 2012-2013 followed by additional investigation performed as part of this EE/CA.

Surface water samples collected during the PA/SI and the EE/CA field activities were compared to AZ WQS, including ADEQ's proposed Site-Specific Standard (SSS) for dissolved copper. Waste rock material present at the mines sites was also sampled and analyzed for total metals and leachability potential using the synthetic precipitation leaching procedure (SPLP). Analytical results indicate copper present in waste rock material associated with several mine features pose a potential source of dissolved copper in the watershed. Additionally, one adit located at Blue Gate Mine and one adit located at Lower Bronx Mine, were observed to be draining during EE/CA field activities. Analytical results from water collected from these mine features indicate both adits likely present a significant source of dissolved copper to the watershed during times of heavy precipitation.

Collected waste rock data was compared to Arizona non-residential Soil Remediation Levels (nrSRLs), Arizona minimum Groundwater Protection Limits (GPLs), and minimum ecological screening criteria. Arsenic was detected in several waste rock piles exceeding the nrSRL and SPLP results indicate arsenic concentrations at limited locations at Blue Gate Mine, Unnamed Mine and Bronx Mine may pose a potential threat to groundwater. Although several metals pose a potential threat to terrestrial ecological receptors, the primary ecological risk to aquatic and terrestrial receptors is from copper.

## Removal Action Goal and Objectives

The overall goal of a potential removal action at the Upper Pinto Creek mine sites is to minimize the risk that contaminants of potential concern (COPCs) pose to human health and/or the environment. The primary COPCs for the Upper Pinto Creek Mine Sites are copper and arsenic with the primary risk coming from contributions of dissolved copper to the Pinto Creek watershed. The removal action scope considers a cleanup, and/or containment level protective of human health and the environment based on each site's potential contribution to dissolved copper to the watershed, as well as current and anticipated future land use. Future land uses are cattle grazing and recreational uses such as hiking and hunting. Removal action objectives (RAOs) for the Site are listed below.

- Reduce the potential for contaminant transport from contaminant source material (waste rock and draining adits) to the surrounding environment.
- Reduce the potential risk from arsenic in waste rock to human receptors.

## Potential Removal Action Alternatives

The list of removal action alternatives shown below were evaluated for each of the mine sites. These alternatives address waste rock only as a source of contamination. Each of the alternatives was evaluated against the criteria of effectiveness, implementability, and cost.

- Alternative 1: No Action – Provides a baseline for comparison and is required under CERCLA guidance.
- Alternative 2: Administrative Controls – Includes limiting access to site features by enclosing the waste rock piles, and adit and shaft features where COPCs exceed the comparative action levels with 8-foot tall, chain-link fencing. Administrative controls include at least one Closure Order warning sign and a lockable gate to allow for controlled access to the areas following installation for each fenced area.
- Alternative 3: Consolidation and On-Site Disposal – Includes excavation, consolidation, and regrading of waste rock material into one on-site repository per mine site. Each repository would be capped with a clean soil cover, graded to match surrounding topography, sloped to resist erosion, and seeded with a native seed mix for revegetation. Where appropriate to further prevent erosion into Pinto Creek, armored storm water aprons would be installed.
- Alternative 4: Excavation and Off-Site Disposal – Includes excavation, transportation, and off-site disposal of waste source materials.

Alternative 3 is the recommended alternative for the Ellis Vein and Unnamed Mine sites and Alternative 4 is the recommended alternative for the Bronx Mine sites. Either Alternative 3 or Alternative 4 is recommended for Blue Gate and Henderson Ranch Mine sites, dependent on final USFS decision. This recommendation assumes that actions at Blue Gate and Henderson Ranch occur concurrently to realize cost efficiencies incurred due to the proximity of the sites.

None of the three action alternatives above would be completely effective for Blue Gate Mine or Lower Bronx Mine due to the presence of draining adits at those locations. Additional assessment will be required to evaluate the underground workings, current conditions of the adits, and water quality of released water from the adits to fully develop corrective alternatives for these potential source areas. Full evaluation and comparative analysis of identified alternatives (as prescribed by CERCLA) for the draining adits will not occur until after the additional assessment has been completed. The final removal actions identified for Blue Gate and Lower Bronx must address both the waste rock at the sites and the draining adits. Potential corrective actions that may be applicable to the adits as a source of contamination include:

- Passive Treatment Systems – Potentially could include use of zeolite gabion walls constructed in the creek bed downstream of the inflow point.
- Bulkhead Construction (Adit Closure) – Would require additional engineering, safety controls for further adit/shaft investigation (entrances), partial reconstruction (i.e., shoring openings for safe access), and construction of a redundant (2) concrete and rock bulkhead at each adit to prevent further discharge of water from the adits. At Bronx Mine this may also include a polyurethane foam (PUF) closure and bulkhead construction in the adjoining shaft, which may eliminate potential of outside infiltration into the workings and subsequent discharge from the Bronx adit.
- Combined Passive Treatment and Mine Feature Closures – Combines mine feature closure with downstream passive treatment systems.

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## LIST OF ACRONYMS

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µg/L	micrograms per liter
95UPL	95 percent upper prediction limit
A&Wc	Aquatic and Wildlife, cold water (Arizona designated surface water uses)
A&We	Aquatic and Wildlife, ephemeral (Arizona designated surface water uses)
A&Ww	Aquatic and Wildlife, warm water (Arizona designated surface water uses)
A.A.C.	Arizona Administrative Code
ABA	Acid Base Accounting
ADEQ	Arizona Department of Environmental Quality
ADOT	Arizona Department of Transportation
AgI	Agricultural irrigation (Arizona designated surface water uses)
AgL	Agricultural livestock watering (Arizona designated surface water uses)
ARAR	applicable or relevant and appropriate regulations
A.R.S.	Arizona Revised Statutes
AWQS	Aquifer Water Quality Standard
AZ WQS	Arizona Water Quality Standard
BMP	Best Management Practice
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
COC	Chain-of-Custody
COPC	contaminant of potential concern
CWA	Clean Water Act
CY	cubic yards
Dawson	Dawson Federal, LLC
DQI	Data Quality Indicators
DQO	Data Quality Objectives
Eco-SSL	ecological soil screening level
EE/CA	Engineering Evaluation/Cost Analysis
EPA	United States Environmental Protection Agency
FBC	full body contact
FC	fish consumption
FR	Forest Road
GPL	Groundwater Protection Limit
HUC	Hydrologic Unit Code
MCL	Maximum Contaminant Concentration
mg/kg	milligram per kilogram
MRDS	Mineral Resources Data System
NAD	North American Datum
nrSRL	Arizona non-residential soil remediation level
O&M	operation and maintenance
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
PA/SI	Preliminary Assessment/Site Inspection
PBC	Partial Body Contact (Arizona designated surface water uses)
PPE	personal protection equipment
PRP	Potentially Responsible Party

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## LIST OF ACRONYMS (continued)

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PRSC	post-removal site control
PUF	polyurethane foam
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
RAO	Removal Action Objective
RCRA	Resource Conservation and Recovery Act
RPD	relative percent difference
rSRL	Arizona residential soil remediation level
SAP	Sampling and Analysis Plan
SCEM	Site Conceptual Exposure Model
SPLP	synthetic precipitation leaching procedure
SSS	Site-Specific Standard
t CaCO <sub>3</sub> /kt	tons calcium carbonate per kiloton of material
TAL	Target Analyte List
TBC	To-Be-Considered
TCLP	toxicity characteristic leaching procedure
TMDL	Total Maximum Daily Load
USC	United States Code
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UTM	Universal Transverse Mercator
WESTON	Weston Solutions, Inc.
WRCC	Western Regional Climate Center