

Final
Preliminary Assessment/Site Inspection

Mingus Area
Verde Ranger District
Prescott National Forest, Arizona

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LIST OF ACRONYMS

1,2-DCE	1,2-dichloroethene
A.A.C.	Arizona Administrative Code
A & We	Aquatic and Wildlife
ADEQ	Arizona Department of Environmental Quality
ADWR	Arizona Department of Water Quality
AOC	analytes of concern
AWQS	Arizona Water Quality Standard
AZGFD	Arizona Game and Fish Department
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COC	Chain-of-Custody
DQI	Data Quality Indicators
DQO	Data Quality Objectives
Eco-SSL	Ecological Soil Screening Level
EPA	United States Environmental Protection Agency
ESA	Environmental Site Assessment
FR	Forest Road
GPL	Groundwater Protection Limit
GPS	global positioning system
HSG	Hydrologic Soil Group
MDL	Method Detection Limit
mg/kg	milligram per kilogram
mg/L	milligram per liter
MQO	Measurement Quality Objective
MS	matrix spike
MSD	matrix spike duplicate
OERR	Office of Emergency Remedial Response
OSC	On-Scene Coordinator
PA/SI	Preliminary Assessment/Site Inspection
PARCC	precision, accuracy, representativeness, comparability and completeness
PBC	partial body contact
PCE	tetrachloroethene, or tetrachloroethylene
PID	photo-ionization detector
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
RL	Reporting Limit
RPD	relative percent difference
rSRL	residential Soil Remediation Level
RV	recreational vehicle

LIST OF ACRONYMS (continued)

SAP	Sampling and Analysis Plan
SPLP	Synthetic precipitation leaching potential
SVOC	semi-volatile organic compound
TAL	Target Analyte List
TCLP	Toxicity Characteristic Leaching Procedure
USFS	United States Forest Service
USGS	United States Geological Survey
VOC	volatile organic compounds
WESTON	Weston Solutions, Inc.
WRCC	Western Regional Climate Center
XRF	x-ray fluorescence

1.0 INTRODUCTION

Weston Solutions, Inc. (Weston[®]) was contracted by the United States Department of Agriculture Forest Service (USFS), under contract AG-8371-D14-0046, to conduct a Preliminary Assessment/Site Inspection (PA/SI) for the Mingus Area site (the “Site”) located within the Prescott National Forest, Arizona (Figure 1 and Figure 2). This PA/SI was conducted per the USFS’ authority under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in general accordance with the outline and content described in the U.S. Environmental Protection Agency (EPA) guidance documents titled: *EPA Guidance for Performing Preliminary Assessment Under CERCLA* (1991); *Guidance for Performing Site Inspections Under CERCLA* (1992); and *Improving Site Assessment: Combined PA/SI Assessments* (1999).

1.1 PROJECT OBJECTIVES

Historically, the Site was subject to “wildcat” dumping, and people from the nearby community often referred to it as “the old dump”. Currently, the public predominantly uses the area for informal dispersed recreational firearms shooting, and as an access point to area hiking trails. Historical dumping activities may have resulted in a release of hazardous substances to the environment.

The Prescott National Forest and other community partners are exploring development of an improved trailhead. Facilities contemplated include hardened parking areas, fencing, access control gates, picnic ramadas, toilets, and a recreational vehicle (RV) host site. This PA/SI was conducted to evaluate if a release has occurred due to historical dumping or recreational shooting activities, that is negatively impacting environment and that may interfere with future Site-use plans. The specific study questions, as presented in the project Sampling and Analysis Plan (SAP) were:

- 1) Has an observed release (based on the CERCLA definition [EPA, 1992]) of analytes of concern (AOCs) occurred in Site soils that can be attributed to the historical and current Site uses?
- 2) Are the AOCs present at concentrations that present an unacceptable human health or ecological risk based on anticipated future land use of the Site resulting in the need for additional investigation or corrective action?
- 3) Is there potential for AOCs to leach from source areas and migrate to other environmental media (e.g., surface water or groundwater)?

1.2 PROJECT SCOPE

The investigation included reviewing available historic information for Areas 1, 2 and 3, and previous data collected (as available) for Mingus Area; excavating test potholes to confirm solid waste was disposed at the Site and determine types of waste buried; and performing sampling and analyses of sediment and soil at each of the areas.

2.0 SITE BACKGROUND

The Mingus Area project includes assessment of three separate sub-areas located within the Prescott National Forest. A description of the Site and available background information for the three sub-areas is summarized in the following sections.

2.1 LOCATION, SITE HISTORY, AND CURRENT CONDITIONS

The project area is located solely within the Verde Ranger District of Prescott National Forest, Yavapai County, Arizona and includes evaluation of three sub-areas totaling approximately 45 acres in size (Figures 1 and 2). The Site is located north of and adjacent to Forest Road (FR) 493, which originates as W. Mingus Ave in Cottonwood, AZ. The Site is approximately 1.2 miles southwest of the Cottonwood Airport, in the northwest quarter of Section 8 and the southwest corner of Section 5, Township 15 North, Range 3 East or approximately N 34.716 latitude, W - 112.058 longitude.

2.1.1 Site History

The Site had been used for “wildcat” dumping in the past, and people often referred to it as “the old dump”. Currently, the public predominantly uses the area for informal dispersed recreational firearms shooting, and as an access point to area hiking trails. Area 3 is used as a landing zone for the Mingus Mountain hang glider site.

No records were found for the Site area during on-line searches of various environmental databases conducted by the USFS during a preliminary investigation of the area (Section 2.5). The following subsections provide available background information for each Site area. The relative locations of each area are shown in Figure 2.

2.1.1.1 Area 1

Area 1 is approximately 21 acres in size and was identified as the preferred area for the proposed trailhead development project (Figure 3). Aerial photographs are available between 1954 and 2012 (USFS, 2014). The area appears to be undisturbed in terms of vegetation, natural tone, and topography from 1954 to 1972. However, in images from 1977 and 1978, Area 1 natural vegetation is absent and the sloping topography appears to have been regraded. In an image from 1992, Area 1 exhibits some re-vegetation and numerous user-created vehicle tracks are evident across the area. By 2012, vegetation has matured and numerous user-created vehicle tracks across the area are visible.

2.1.1.2 Current Conditions

Stormwater has eroded gullies and headcuts in the soil up to approximately 4 feet in width and depth. These headcuts are exposing solid wastes that apparently have been disposed and covered

in the area sometime in the past. The materials observed include general household trash, power equipment and automotive parts, tires, electronics, appliances (USFS, 2014).

On the land surface of Area 1, similar types of solid waste are being randomly disposed. Much of this material is located at the toe of the slope in the northern portions of Area 1. This material is heavily disintegrated from target shooting, and used shell casings were observed across the area. The southeast-facing and northeast facing slopes of Area 1 appear to have been used as backstop areas.

2.1.2 Area 2

Area 2 is 15 acres in size and was identified as a second choice area for the proposed trailhead development project (Figure 3). Based on a review of aerial photographs, the area appears to be undisturbed in terms of vegetation, natural tone, and topography from 1954 to 1968 (USFS, 2014). In images from 1968 and 1972, Area 2 appears to have a cleared perimeter, as well as debris scattered along the top of the hill slope north of the road that follows along the ridge line. By 1977 and 1978, Area 2 appears to no longer have scattered debris along the perimeter outline. In an image from 1992, Area 2 exhibits some re-vegetation and little evidence of vehicle use. By 2012, vegetation has matured and increased vehicle use in the eastern portions of Area 2 is apparent.

2.1.2.1 Current Conditions

The east half of Area 2 generally consists of a network of interconnected user-created roads. No surface staining or solid waste of any significance was observed (USFS, 2014). Subtle indications of the past surface grading on the disposal slope and some visible remnants of broken glass and metal parts were noted on the western portion of Area 2.

2.1.3 Area 3

Area 3 is the northern-most of the three site areas, and is approximately 9 acres in size (Figure 4). Aerial photographs from 1954 to 1972 show the area to be undisturbed in terms of vegetation, natural tone, and topography (USFS, 2014). Several significant changes occurred by 1977. A deep trench approximately 30 feet wide and perhaps 200 feet long is excavated as a long slope from the original surface elevation at the east end deepening to nearly the depth of Blowout Creek at the west end of the trench. The trench generally parallels Blowout Creek and soil is windrowed along the trench sides. An additional stockpile of soil is observed at the easterly part of Area 3, while an area of very light-toned soil (perhaps staining) is noted north of that. In an image from 1978, a second trench appears to have been excavated roughly perpendicular to the first trench noted in the 1977 image. The trench is located in the east portion of Area 3, where the plateau meets the top of the hill northeast of Area 3. Dimensions appear similar to the first trench. By 1992, the trenches observed in the 1977 and 1978 images are no longer apparent, and the area exhibits some re-vegetation and visible user-created tracks across the site. Revegetation has continued based on the 2012 image and user-created vehicle tracks have generally decreased. Hang gliding “landing strips” are visible across the Site.

2.1.3.1 Current Conditions

Area 3 is currently used as a landing zone for the Mingus Mountain hang glider site. No evidence of surface stains or exposed solid waste was observed on the surface. Evidence of target shooting was observed at the southern face of the hillslope leading to the hang glider landing zone.

2.2 AREA POPULATION

The nearest and most populated areas to the project site are the Cottonwood, Camp Verde Sedona, Chino Valley, and Prescott Valley. Based on the 2010 census (American Fact Finder, www.factfinder2.census.gov), the total population of Yavapai County is 211,073. The estimated populations of the nearest populated areas to the Site are:

- Cottonwood (approximately 1 mile) – population 11,265
- Cornville (approximately 7 miles east) – population 3,280
- Clarkdale (approximately 8 miles northwest) – population 4,097
- Camp Verde (approximately 16 miles southeast) – population 10,873
- Sedona (approximately 19 miles northeast) – population of 10,031
- Prescott Valley (approximately 32 miles southwest) – population 38,822
- Chino Valley (approximately 45 miles west) – population of 10,817

2.3 PHYSICAL CHARACTERISTICS

2.3.1 Regional Climate

The climate of the Site is typical of moderately high elevation Arizona desert. Average annual precipitation is 10.55 inches with most occurring during the summer and winter monsoon seasons. The area experiences a bimodal precipitation pattern with short duration, high intensity monsoon thunderstorms in the summer months, and storms that are more prolonged and associated with the passage of low pressure systems off the Pacific Ocean in the winter months. Winter temperatures in the area range from 27.8 °F to 63.7 °F and summer temperatures range from 57.9 °F to 98.4 °F. The average annual high temperature is 77.5 °F (Western Regional Climate Center [WRCC], 2014).

2.3.2 Geologic Setting

United States Geologic Survey (USGS) geological mapping of the Prescott National Forest shows that Area 1 and Area 2 are underlain by lacustrine rocks of the Verde Formation, which is generally composed of layers of impure limestone and mudstone. Area 3 is mapped as having fanglomerate bedrock (DeWitt, et al., 2008).

2.3.3 Hydrogeologic Setting

The Site area is situated within the Verde Valley sub-basin of the Central Highlands Planning Area. The principal aquifer is the Verde Formation, which is a thick sequence of tertiary limestones and sandstones that flanks the Verde River from Camp Verde to Cottonwood (Arizona Department of Water Quality [ADWR], 2009). Other aquifers include the carbonate aquifer and an alluvial aquifer located along the Verde River. Groundwater is generally under unconfined conditions although confined conditions may occur in the Verde Formation. All three aquifers are hydraulically connected (ADWR, 2009). Depth-to-water nearest to the Site in 2003 to 2004 ranged from 68 to 81 feet below ground surface (bgs) with most recharge coming from winter precipitation. Groundwater primarily flows toward the Verde River drainage and exits the sub-basin in the southeast through alluvium and volcanic rocks along the river.

2.3.4 Hydrologic Setting

The Site is located within the Verde River Basin. Site drainage is split between two watershed areas. Area 1 is in the Oak Wash watershed and is drained by an unnamed ephemeral wash (Figure 2). Areas 2 and 3 are in the Mescal Gulch watershed with surface runoff flowing to Blowout Creek, an ephemeral to intermittent stream. Drainage in all three site areas appears to flow generally northeast.

2.3.5 Soils and Vegetation

Area 1 has desert shrub vegetation with shallow soil and moderate hill slopes of 16 – 39%. Soil texture is a cobbly, coarse sandy loam. The Hydrologic Soil Group (HSG) is D, having slight plasticity and high runoff rates. It is moderately erosive, alkaline, with limestone parent and bedrock material of the Verde Formation (Robertson, et al., 2000).

Area 2 and Area 3 are also characterized by desert shrub vegetation, but with deep soils and lower slopes of 6-15%. Soil texture is gravely fine loam or Quaternary Alluvium. The HSG is C, with moderate runoff rates. It is moderately erosive, moderately alkaline, alluvial fan parent material.

2.3.5.1 Threatened and Endangered Species

The Arizona Game and Fish Department's (AZGFD) Online Environmental Review Tool was used to provide a preliminary screening of threatened or endangered species within 3 miles of the project vicinity (Appendix A). Site-specific surveys were not completed; therefore, mention of a specific species in that report does not guarantee the species is present within the project area. Conversely, the list presented in the report may not be all-inclusive.

2.4 PREVIOUS INVESTIGATIONS

The USFS conducted a Limited Phase I and Phase II Environmental Site Assessment (ESA) in early 2014. The ESA included environmental records review, site reconnaissance, passive soil gas sampling, lead measurement using a field portable x-ray fluorescence (XRF) analyzer, and field gamma data collection using a Ludlum Model 3 rate meter equipped with a Ludlum Model 44-9 pancake detector probe. As shown in Figure 5, locations of soil gas samplers were concentrated in Area 1 with sporadic coverage in Areas 2 and 3. The USFS report also provides results of laboratory analysis of the samplers (USFS, 2014). Findings of the ESA as reported include:

- Field inspections show that buried solid waste is currently being exposed at the surface and/or in erosion gullies in Area 1.
- Based on historical aerial photography review, a “significant volume” of solid waste was disposed in Area 2 from 1954 to 1968. The majority of solid waste disposal likely ended sometime between 1972 and 1977.
- Based on historical aerial photography review, it was concluded that Area 1 received a majority of the stockpiled solid waste from Area 2 from 1972 to 1977.
- Aerial photography review indicated the excavation of a long and deep trench in Area 3 sometime during 1972 and 1977. A second trench, excavated perpendicular to the first, was excavated sometime between 1977 and 1978. The use or purpose of these trenches is unknown.
- Soil gas survey results indicate “a concentrated plume of chlorinated solvents” in the sub-surface near sample site B-200 based on elevated tetrachloroethene (PCE) results at that location (1,925 nanograms). A secondary plume in the vicinity of B-600 (Area 1) was also indicated by PCE results. A third area with moderate levels of cis-1,2-dichloroethene (1,2-DCE) and trichlorofluoromethane were indicated near F-3 and F-4 in Area 3.
- The soil gas survey detected two common gasoline components (benzene and toluene). Benzene was detected at a maximum of 62 nanograms. In Area 1, elevated levels were noted at A-600, with moderated levels also noted to the northeast at B-200 and B-300. Low-moderate gasoline compound detections are also noted in Area 3.
- Lead was detected in soil at elevated concentrations predominantly in sample rows B and C in Area 1. This coincides with observed current dispersed shooting activities.
- No radiological concerns were identified.

Based on the findings of the ESA, the USFS concluded that Areas 1, 2 and 3 have, either historically or currently, received significant volumes of municipal/commercial/industrial solid wastes. These areas have historically all been highly disturbed with heavy earth moving equipment. Laboratory soil gas results indicated that various chlorinated solvents and gasoline

components are present in the subsurface soils in Area 1 and Area 3. Results of XRF measurements indicate lead has been released to soils on the Site through substantial and unmanaged recreational shooting.

3.0 CURRENT INVESTIGATION

Samples were collected to satisfy the Daily Quality Objectives (DQO) identified in Section 3. Laboratory analytical data was used to determine whether a release of hazardous substances has occurred (per the definition of a release given in CERLCA guidance [EPA, 1992]), and determine the need for additional investigation or action. A Photograph Log, which documents site activities, is in Appendix B.

3.1 SAMPLE LOCATIONS AND METHODOLOGIES

The field investigation included a mixture of biased and systematic soil sampling from excavated potholes and at the surface and near surface in areas with evidence of recreational shooting. Biased sample locations were selected based on soil gas survey results from the USFS Phase II ESA conducted in 2014 to evaluate potential presence of chlorinated solvents and gasoline constituents from buried waste in the subsurface. Potholes were screened for vapors using a photo-ionization detector (PID) during excavation. Biased sediment sample locations were also selected to evaluate potential releases to the adjacent waterways. Systematic soil samples were collected in Areas 1 and 3 to evaluate potential impacts to surface and near-surface soils from recreational shooting. Table 1 presents the sample quantity at each Site area. Sample locations are depicted in Figures 6 through 8 and geographic coordinates for each location are tabulated in Appendix C. Field notes are included in Appendix D.

Table 1 Total Planned and Actual Sample Quantities

Sampling Area	Sample Locations ^a		Total Excavated Soil Samples ^a		Field Duplicates		Total Surface-Near Surface Soil Samples ^a		Field Duplicates	
	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual
Background Soil	6	6	0	0	0	0	6	6	0	0
Background Sediment	4	4	0	0	0	0	4	4	0	0
Sediment	8	8	0	0	0	0	8	8	1	1
Area 1	11/30 ^b	11/30	33	31	3	3	60	60	6	6
Area 2	6/0 ^b	6/0	18	17	2	2	0	0	0	0
Area 3	4/11 ^b	4/11	12	12	1	1	22	22	2	2
Totals	21/59 ^b	21/59	63	60	6	6	100	100	9	9

a Multiple samples were collected at each sample location depending on type of sample collected. Three depth intervals were sampled at excavated soil sample locations (0-1 feet bgs; 2-3 feet bgs; 4-5 feet bgs). Two depth intervals were sampled at surface-near surface sample locations (0-6 inches and 6-12 inches bgs).

b Quantity of sample locations (e.g., 11/30) are presented as number of excavated soil sample locations/number of surface-near surface soil locations.

3.2 BACKGROUND SOIL AND SEDIMENT SAMPLING

Site-specific data was compared to background soil and sediment analytical results per EPA guidance to establish if a release of contaminants has occurred. Six background soil samples and four background sediment samples were collected as shown on Figure 6. The background soil samples consisted of five-point composite samples collected from 0 to 6 inches bgs at non-disturbed areas with similar geologic characteristics.

3.3 SEDIMENT SAMPLING

A total of eight sediment samples (five-point composites) were collected as illustrated on Figure 7. Four sediment samples were collected from Blowout Creek (MBO-1 through MBO-4) to evaluate if contaminants from waste disposed in Area 2 is impacting the creek or if recreational shooting activities at Area 2 and Area 3 are contributing metals contamination to the creek.

Additional sediment samples were collected from the Unnamed Wash (MUN-Sed5, MUN-Sed6, and MUN-Sed8) and a smaller unnamed drainage flowing from Area 1 (MUN-Sed7). These samples are also meant to evaluate if contaminants from waste disposed in Area 2 are impacting the creek, or if recreational shooting activities are contributing metals contamination to the drainages.

Each composite sediment sample was collected from 0 to 6 inches bgs and analyzed for the Target Analyte List (TAL) of metals using EPA Methods 6010B/7471A); volatile organic compounds (VOCs) using EPA Method 8260B; and semi-volatile organic compounds (SVOCs) using EPA Method 8270C. One sample from Blowout Creek (MBO-Sed2) and one sample from the small unnamed drainage (MUN-Sed7) were also analyzed for synthetic precipitation leaching potential (SPLP) and toxicity characteristic leaching procedure (TCLP) for TAL Metals (excluding calcium, magnesium, potassium, and sodium) using EPA Methods 1312/6010B and 1311/6010B, respectively.

3.4 AREA 1 SAMPLING

Excavated Soil Sample Locations

Nine locations (MA1-ES3 to MA1-ES11) were excavated as small test potholes to a depth of 5 feet bgs in Area 1 (Figure 7). Two locations (MA1-ES1 and MA1-ES2) were excavated to a depth of 4 feet and 1 foot, respectively, due to encounters with bedrock. Samples were collected at three depth intervals: 0 to 1 foot bgs; 2 to 3 feet bgs; and 4 to 5 feet bgs for a total of 31 samples. Each of these samples was analyzed for TAL Metals (EPA Methods 6010B/7471A), VOCs (EPA Method 8260B) and SVOCs (EPA Method 8270C). A subset of the 31 samples (10 samples) was preselected for analysis of SPLP and TCLP TAL Metals (excluding calcium, magnesium, potassium, and sodium) to evaluate leaching potential. Excavation locations coincide with areas where VOCs were detected during the USFS soil gas survey. The test potholes were used to identify type of waste buried in Area 1.

Surface Soil Sample Locations

An additional 30 sample locations were selected throughout Area 1 for surface soil and near surface soil sample collection (Figure 8). These sample locations were placed at the nodes of a 100-foot by 100-foot grid overlaying Area 1 with the primary purpose of defining the extent of potential lead contamination from recreational shooting. Samples were collected at two depth intervals: surface soil (0 to 6 inches bgs) and near surface soil (6 to 12 inches bgs). A secondary rationale for these samples was to evaluate potential contamination from assorted surface debris in the area.

- **Surface soils** (0 to 6 inches bgs) were analyzed for TAL metals only using EPA Methods 6010B/7471A. Potential for VOCs at these sample locations was not indicated during the USFS soil gas survey and would not be expected at the surface due to volatilization.
- **Near surface soils** (6 to 12 inches bgs) were analyzed for TAL metals (EPA Methods 6010B/7471A), VOCs (EPA Method 8260B), and SVOCs (EPA Method 8270C). Although volatilization is also likely to occur at this depth interval, it would be somewhat lessened than the 0-6 inch depth interval. VOC and SVOC analysis was selected in near surface samples as a conservative measure to supplement data collected from the excavated soil samples to define extent of potential contamination.

A subset of samples from both intervals (nine samples from each depth) was analyzed for SPLP and TCLP TAL metals to evaluate leaching potential. Locations for SPLP and TCLP analysis were selected after total metals analysis was completed. An emphasis for selection was placed on results exceeding the regulatory screening levels described in Section 3.8.

3.5 AREA 2 SAMPLING

Excavated Soil Sample Locations

Four locations (MA2-ES2, MA2-ES3, MA2-ES4, and MA2-ES6) were excavated as small test potholes to a depth of 5 feet bgs in Area 2 (Figure 7). Two locations (MA2-ES1 and MA2-ES5) were excavated to a depth of 3 feet and 4 feet, respectively, due to encounters with bedrock. Samples were collected at three depth intervals: 0 to 1 foot bgs; 2 to 3 feet bgs; and 4 to 5 feet bgs for a total of 17 samples. Each of these samples was analyzed for TAL Metals (EPA Method 6010B/7471A), VOCs (EPA Method 8260B) and SVOCs (EPA Method 8270C). A subset of the 17 samples (five samples) was preselected for analysis of SPLP and TCLP TAL Metals (excluding calcium, magnesium, potassium, and sodium) to evaluate leaching potential. Excavation locations MA2-ES5 and MA2-ES6 coincide with areas where VOCs were detected during the USFS soil gas survey. The remaining locations were selected to confirm presence or absence of buried solid waste throughout Area 2 and evaluate potential contaminants therein.

Surface Soil Sample Locations

No additional surface soil sample locations were planned in Area 2.

3.6 AREA 3 SAMPLING

Excavated Soil Sample Locations

Four locations (MA3-ES1 to MA3-ES4) were excavated as small test potholes to a depth of 5 feet bgs in Area 1 (Figure 7). Samples were collected at three depth intervals: 0 to 1 foot bgs; 2 to 3 feet bgs; and 4 to 5 feet bgs for a total of 12 samples. Each of these samples was analyzed for TAL Metals (EPA Method 6010B/7471A), VOCs (EPA Method 8260B) and SVOCs (EPA Method 8270C). A subset of the 12 samples (four samples) was preselected for analysis of SPLP and TCLP TAL Metals (excluding calcium, magnesium, potassium, and sodium) to evaluate leaching potential. Excavation locations MA3-ES2 through MA3-ES4 coincide with areas where VOCs were detected during the USFS soil gas survey. Location MA3-ES1 was placed in a former trench area that is visible in historical aerial photographs. Because the purpose of the trench area is unknown, this test pit confirms presence or absence of buried solid waste or debris in the trench and will evaluate potential contaminants from buried debris or fill material.

Surface Soil Sample Locations

Evidence of target shooting was noted during the site reconnaissance adjacent to Blowout Creek and on the south facing slope of the Area 3 plateau. A 100-foot by 100-foot grid was placed over the face of the slope leading to Area 3 and an additional 11 sample locations were selected at the center of each grid cell where bullet casings were observed. These locations were sampled at two depth intervals: surface soil (0 to 6 inches bgs) and near surface soil (6 to 12 inches bgs). Samples were analyzed for TAL metals only using EPA Method 6010B/7471A. Two surface soil samples were analyzed for SPLP and TCLP TAL metals to evaluate leaching potential. Locations for SPLP and TCLP analysis were selected after total metals analysis was completed and were based on highest overall concentrations of metals of concern.

3.7 DEVIATIONS FROM SAMPLING PLAN

During the field effort, several minor deviations from the approved project Sampling and Analysis Plan (SAP) were made as described below. Data quality is not affected by any of the described modifications and data generated is considered to fulfill the DQOs established for the project.

Area 1

- Duplicate samples to be collected at MA1-ES7-5 and MA1-S3-1 (as indicated in the SAP) were collected at MA1-ES6-5 and MA1-S4-1, respectively.
- Samples MA1-ES2-3 and MA1-ES2-5 were not collected. This discrepancy was due to the presence of bedrock at MA1-ES2 at a depth 1 foot bgs resulting in termination of the excavation. MS/MSD sample to be collected at MA1-ES2-5 (as indicated in the SAP) was collected at MA1-ES11-1.

- Sample MA1-ES1-4 was collected at a depth of 4 feet bgs rather than 5 feet bgs as identified in the SAP. This discrepancy was due to the presence of bedrock at 4 feet bgs, which resulted in termination of the excavation at 4 feet.

Area 2

- Sample MA2-ES1-5 was not collected. This discrepancy was due to the presence of bedrock at 3 feet bgs, which resulted in termination of the excavation at 3 feet.
- Sample MA2-ES5-4 was collected at a depth of 4 feet bgs rather than 5 feet bgs as identified in the SAP. This discrepancy was due to the presence of bedrock at 4 feet bgs, which resulted in termination of the excavation at 4 feet.

3.8 REGULATORY SCREENING ACTION LEVELS

Potentially applicable regulatory action levels and other risk-based or other criteria used for comparison purposes are listed below and are also included in Data Summary Tables (Appendix E). Exceedances of these action levels do not automatically indicate a response action is warranted. Potential action levels include the following:

- Soil and sediment – Arizona Department of Environmental Quality (ADEQ) Soil Remediation Levels (SRLs) for residential (rSRL) and non-residential (nrSRL) soil (Arizona Administrative Code [A.A.C] R18-7, Appendix A, 2007) and Arizona Minimum Groundwater Protection Limits (GPLs) (ADEQ, 1996). Potential action levels used for comparison of leachate analysis include:
 - SPLP results: The results of SPLP analyses approximate the chemical composition of runoff from the waste rock material. Arizona Water Quality Standards (AZWQS) (A.A.C. R18-11-406, Appendix A) are not regulatory action levels for SPLP results but are included for comparison purposes only to indicate the relative potential to impact surface water. These standards offer a conservative comparison and do not consider standard contaminant fate mechanisms such as dilution and adsorption during contaminant transport. Exceedance of any AZWQS by an SPLP result does not indicate the need for corrective action.
 - TCLP results: Resource Conservation and Recovery Act (RCRA) TCLP limits (40 CFR §261.24).
- Soil and sediment – EPA Ecological Soil Screening Levels (Eco-SSLs), which provide soil concentrations that are expected to be protective of terrestrial plant, invertebrate, avian, and mammalian communities. There are no EPA Eco-SSLs for mercury and thallium. Screening benchmarks used for mercury and thallium are the Los Alamos National Laboratory (LANL) ecological screening levels from the online ECORISK Database (version 3.2, October 2014).

ADEQ rSRLs are included to provide comparison to the most conservative (i.e., most restrictive) regulatory or risk-based action levels available. Current investigation sample results are also being compared to site-specific background concentrations. Observed contamination is documented when a hazardous substance is detected at a concentration equal to or greater than three times the mean background concentration for metals. If an analyte is not detected in background samples, then observed contamination is documented when the sample measurement equals or exceeds the sample quantitation limit (i.e., the laboratory reporting limit [RL]).

4.0 INVESTIGATION RESULTS

The following sections outline the analytical results for the current investigation by mine site. Data summary tables are presented in Appendix E as follows:

- Table E1: Soil and Sediment Sample Results – Metals
- Table E2: Soil and Sediment Sample Results – SPLP Metals
- Table E3: Soil and Sediment Sample Results – TCLP Metals

A summary of observations of each excavated pothole is in Appendix F. This table outlines the types of debris uncovered from each excavation location across Areas 1, 2 and 3.

A total of 160 soil and sediment samples, plus 15 field duplicates, were analyzed for TAL metals (EPA Method 6010B/7471A). A subset of these samples (98 samples plus 10 duplicates) was selected to undergo analysis for VOCs (EPA Method 8260B) and SVOCs (EPA Method 8270C). Additionally, 40 of the total samples (plus three duplicates) were also submitted to the laboratory for SPLP and TCLP leachate analysis of the TAL metals excluding the general soil nutrients of calcium, magnesium, potassium, and sodium (EPA Method 1312/6010B/7470A and EPA Method 1311/6010B/7470A, respectively). All laboratory analyses were conducted by Orange Coast Analytical (Orange Coast) in Phoenix, Arizona. Copies of the laboratory analytical reports are in Appendix G.

4.1 BACKGROUND SOIL RESULTS

On-site samples were evaluated against background samples collected from geologically similar areas near each area location, but outside the influence of dumping and shooting activities. Six background soil samples were analyzed for TAL metals. In accordance with EPA guidance, the arithmetic mean was calculated for each detected metal and multiplied by three for comparison to site data (Table E1, Appendix E).

The three-times background concentrations for antimony, arsenic, barium, cadmium, chromium, lead, manganese, nickel, selenium, thallium, vanadium and zinc exceed the most conservative ecological screening value. Additionally, the three times background concentration for arsenic (129 mg/kg) exceeds the AZ rSRL and nrSRL of 10 mg/kg; the total chromium background concentration (263 mg/kg) exceeds the AZ rSRL for hexavalent chromium of 30 mg/kg and the AZ nrSRL for hexavalent chromium of 65 mg/kg; and the vanadium concentration (287 mg/kg) exceeds the AZ rSRL of 78 mg/kg.

4.2 BACKGROUND SEDIMENT SAMPLE RESULTS

Four background sediment samples were analyzed for TAL metals. In accordance with EPA guidance, the arithmetic mean was calculated for each detected metal and multiplied by three for comparison to site data (Table E1, Appendix E).

The three-times background concentrations for antimony, arsenic, barium, cadmium, chromium, copper, lead, manganese, nickel, selenium, thallium, vanadium and zinc exceed the most conservative ecological screening value. The three-times background concentration for arsenic (62 mg/kg) exceeds the AZ rSRL and nrSRL of 10 mg/kg; the total chromium background concentration (223 mg/kg) exceeds the AZ rSRL for hexavalent chromium of 30 mg/kg and the AZ nrSRL for hexavalent chromium of 65 mg/kg; and the vanadium concentration (227 mg/kg) exceeds the AZ rSRL of 78 mg/kg.

4.3 SEDIMENT RESULTS

Eight sediment samples (four located from Blowout Creek and four located from an unnamed ephemeral stream) and one duplicate sample were submitted for TAL metals, SVOCs, and VOCs analysis (Table E1, Appendix E). Two of those samples were also submitted for SPLP and TCLP metals analysis. VOCs and SVOCs were not detected above laboratory RLs in any sample. Metals were not detected in site samples at concentrations greater than background screening levels.

4.4 AREA 1 RESULTS

Much of the trash/debris uncovered from the 10 excavated potholes consisted of miscellaneous scrap metal pieces (wire and sheet metal), wood debris, small plastic bags, bottles and other containers, and intact glass bottles (Appendix F). No trash/debris was visible at locations MA1-ES1 and MA1-ES2 and only a single aluminum can was observed in MA1-ES7. A hot water tank and tires were recovered at location MA1-ES3. In addition, tires were also recovered at locations MA1-ES4, MA1-ES6 and MA1-ES9. Tom Palmer (USFS) hauled tires, a hot water tank, and scrap metal offsite and delivered the items to the Camp Verde, Yavapai County Transfer Station. These items came from excavations MA1-ES3, MA1-ES4, MA1-ES5, MA1-ES9, and MA1-ES10. All other trash and debris uncovered in the other excavations was placed back inside the excavation and buried during backfilling.

4.4.1 Excavated Soil Sample Locations

Thirty-one excavated soil samples and three duplicate samples were submitted from 11 excavated locations for analysis of TAL metals, VOCs and SVOCs analysis (Table E1, Appendix E). Nine of those samples and two duplicate samples were also submitted for SPLP and TCLP metals analysis.

No vapors were measured with the PID during excavation activities and no VOCs were detected above the laboratory RL in any sample. Few SVOCs were detected above laboratory RLs. Butyl benzyl phthalate was detected in sample MA1-ES10-3 at a concentration of 0.14 mg/kg (AZ rSRL is 12,000 mg/kg). Bis-(2-ethylhexyl) phthalate was detected in sample MA1-ES8-3 at a concentration of 3.5 mg/kg (AZ rSRL is 39 mg/kg). No other SVOCs were detected in any sample collected from the test potholes in Area 1. Both of these SVOCs are common plasticizers.

Plastic debris was observed in both of the excavations from which each of these samples was collected.

Unless noted below, an analyzed metal was not detected in site samples or concentrations of detected metals were below background screening levels. The analytical results for the metals exceeding background screening criteria, the AZ rSRLs, and/or EPA Eco-SSLs are as follows:

- Cadmium results range from 0.51 to 12 mg/kg; one sample exceeds the background screening criterion (9.1 mg/kg) and the EPA Eco-SSL for mammals of 0.27 mg/kg.
- Lead results range from 4.8 to 1,000 mg/kg; four samples exceed the background screening criterion (98.4 mg/kg) and the EPA Eco-SSL for plants, avian species, and mammals of 120 mg/kg, 11 mg/kg, and 56 mg/kg respectively. One sample also exceeds the AZ Minimum GPL of 290 mg/kg, the AZ rSRL of 400 mg/kg, and the AZ nrSRL of 800 mg/L.
- Zinc results range from 31 to 870 mg/kg; two samples exceed the background screening criterion (341 mg/kg) and the EPA Eco-SSL for plants, invertebrates, avian species, and mammals of 160 mg/kg, 120 mg/kg, 46 mg/kg, and 79 mg/kg respectively.

4.4.1.1 SPLP Results

The SPLP results are used to evaluate the leaching potential of waste rock material exposed to normal weathering, if left in place. As noted in Section 3.8, there are no specific regulatory action levels for SPLP leachate but the AZWQS are used for comparison purposes to illustrate a conservative estimate of potential impacts to surface water from overland flow of potential leachate. Exceedance of any AZWQS by an SPLP result does not necessarily indicate the need for corrective action.

Ten excavated soil samples and two duplicate samples were submitted for SPLP analysis of TAL metals (Table E2, Appendix E). Only aluminum, iron, manganese, vanadium, and zinc were detected in any sample at concentrations above the laboratory RL. None of the detected concentrations of these metals exceed the AZWQS criteria for ephemeral water.

4.4.1.2 TCLP Results

The TCLP results are used to evaluate leaching potential of material once disposed in a landfill. Under RCRA, if the developed TCLP limits are exceeded, waste material would be identified as hazardous waste. Ten excavated soil samples and two duplicate samples were submitted for TCLP analysis of TAL metals (Table E3, Appendix E). Of the RCRA-regulated metals, only arsenic and barium were detected above laboratory RLs. Detected concentrations were below RCRA TCLP criteria.

Results were also compared to AZWQS for additional illustration of potential affects to surface water from leachate. Copper was detected in TCLP leachate in one sample at a concentration of 0.047 mg/L, which exceeds the acute AZWQS of 0.044 mg/L.

4.4.2 Surface and Near Surface Soil Sample Locations

Sixty soil samples (30 surface and 30 near surface samples) and six duplicate samples were submitted for TAL metals. Near surface soil samples were also analyzed for VOCs and SVOCs. A subset of samples (nine surface and nine near surface) were selected and submitted for SPLP and TCLP metals analysis. The samples selected were determined based on total metals results.

No vapors were measured with the PID during excavation activities and no VOCs were detected above the laboratory RL in any sample. The only SVOC detected in any sample was pentachlorophenol (sample MA1-S1-1 and MA1-S28-1) at a concentration of 0.12 mg/kg and 0.13 mg/kg, respectively (AZ rSRL of 3.2 mg/kg). Both of these detections were assigned J-flags as estimated values because the detection was between the method detection limit (MDL) and the RL. Pentachlorophenol is a restricted-use pesticide. It was once widely used as a wood preservative but is no longer available to the general public.

Unless noted below, an analyzed metal was not detected in site samples or the concentration of a detected metal was below background screening levels. The analytical results for the metals exceeding background screening criteria, the AZ rSRLs, and/or EPA Eco-SSLs are as follows:

- Antimony results range from <0.23 to 730 mg/kg; 22 samples exceed the background screening criterion (2.6 mg/kg) and the Eco-SSL for mammals of 0.27 mg/kg (11 surface soil and 11 near surface soil); eight samples exceed the AZ rSRL of 31 mg/kg (three surface soil samples and five near surface samples); two samples exceed the AR nrSRL of 410 mg/kg (surface and near surface); seven samples exceed the AZ Minimum GPL of 35 mg/kg (four surface soil and three near surface soil); six samples exceed the Eco-SSL for invertebrates of 78 mg/kg (three surface soil and three near surface soil).
- Lead results range from 8 to 48,000 mg/kg; 37 samples exceed the background screening criterion (98 mg/kg) and the Eco-SSL for avian species and mammals of 11 mg/kg and 56 mg/kg respectively (19 surface soil and 18 near surface soil); 31 samples exceed the Eco-SSL for plants of 120 mg/kg (15 surface soil and 16 near surface soil); 23 samples exceed the AZ rSRL of 400 mg/kg (11 surface soil and 12 near surface soil) and of those 23 samples, 20 also exceed the AZ nrSRL of 800 mg/kg (11 surface soil and nine near surface soil). Twenty-six samples exceed the AZ Minimum GPL of 290 mg/kg (12 surface soil and 14 near surface soil); 14 samples exceed the Eco-SSL for invertebrates of 1,700 mg/kg (six surface soil and eight near surface soil).
- Mercury results range from <0.11 to 0.26 mg/kg; five samples exceed the background criterion (<0.11 mg/kg) and the Eco-SSL for avian species of 0.13 mg/kg (three surface soil and two near surface soil).
- Silver results range from <0.53 to 98 mg/kg with detections above the RL occurring in only two samples; one sample exceeds the background criterion (<0.54 mg/kg) and the Eco-SSL for avian species and mammals of 4.2 mg/kg and 14 mg/kg respectively (one surface soil).

- Zinc results range from 31 to 500 mg/kg; one sample exceeds the background criterion (341 mg/kg) and the Eco-SSL for plants, invertebrates, avian species and mammals of 160 mg/kg, 120 mg/kg, 46 mg/kg, and 79 mg/kg respectively (one near surface soil).

4.4.2.1 SPLP Results

Eighteen soil samples (nine surface and nine near surface) were submitted for SPLP analysis (Table E2, Appendix E). Aluminum, arsenic, iron, lead, and vanadium were detected in SPLP leachate. Lead was detected in samples MA1-S9-1, MA1-S18-0, MA1-S18-1, MA1-S23-0 and MA1-S27-0 at concentrations ranging from 0.23 mg/L to 3.2 mg/L, which exceed the AZWQS for partial-body contact (PBC) of 0.015 mg/L. Detected lead concentrations in three of these samples also exceed the AZWQS for aquatic and wildlife (A&We) (acute) of 0.287 mg/L.

4.4.2.2 TCLP Results

Eighteen soil samples (nine surface and nine near surface) were submitted for TCLP analysis (Table E3, Appendix E). Antimony, arsenic, barium, copper, lead, manganese, and zinc were detected in at least one TCLP leachate sample. Concentrations of copper and lead exceeded at least one of the AZWQS. Lead is the only RCRA-regulated metal detected at concentrations exceeding the RCRA TCLP limit. The following metals were detected at concentrations exceeding one or more potential action level:

- Copper results range from <0.020 to 0.088 mg/L; two samples exceeded the AZWQS for A&We (acute) of 0.044 mg/L (two surface soil).
- Lead results range from <0.080 to 77 mg/L; 14 samples exceed the AZWQS for A&We (acute) of 0.287 mg/L (eight surface soil and six near surface soil); 16 samples exceed the AZWQS for PBC of 0.015 mg/L (nine surface soil and seven near surface soil); four samples exceed the Federal RCRA – TCLP criterion of 5 mg/L (two surface soil and two near surface soil).

4.5 AREA 2 RESULTS

Much of the trash/debris uncovered from the six excavated potholes in Area 2 consisted of miscellaneous scrap metal pieces (wire and sheet metal), wood debris, various ceramic pieces, small plastic bags, bottles and other containers, and shattered glass bottles (Appendix F). A buried automobile was partially exposed and observed in the northeast portion of Area 2. The area was not excavated as no investigative excavations were planned at that location.

No trash/debris was visible at locations MA2-ES1, MA2-ES5, and MA2-ES6. A hot water tank was recovered at location MA2-ES2. Several pieces from what appeared to be a kitchen stove were recovered at location MA2-ES3. Evidence of burning can be seen by the discoloration of the soil and the melted glass bottles recovered at the excavated potholes, specifically at excavation

MA2-ES2. Anne Fischer, USFS On-Scene Coordinator (OSC), removed glass pieces, ceramic

pieces, and other various glass jars uncovered from excavation MA2-ES1 for delivery to the USFS archaeologist for dating. All other trash and debris uncovered in the other excavations were placed back inside the excavation and reburied during backfilling.

4.5.1 Excavated Soil Sample Locations

Seventeen excavated soil samples and two duplicate samples were submitted from six excavated locations for TAL metals, VOCs and SVOCs analysis. Five of those samples and one duplicate sample were also submitted for SPLP and TCLP metals analysis.

No vapors were measured with the PID during excavation activities and no VOCs were detected in any sample analyzed for these constituents. Pentachlorophenol was detected in sample MA2-ES5-1 at a concentration of 0.12 mg/kg (AZ rSRL of 3.2 mg/kg). This result was between the MDL and the RL and was therefore estimated (assigned a J flag by the laboratory).

Unless noted below, an analyzed metal was not detected in site samples or the concentration of a detected metal was below background screening levels (Table E1, Appendix E). The analytical results for the metals exceeding background screening criteria, the AZ rSRLs, and/or EPA Eco-SSLs are as follows:

- Antimony results range from <0.22 to 7.7 mg/kg; two samples exceed the background criterion (2.6 mg/kg) and the Eco-SSL for mammals of 0.27 mg/kg.
- Cadmium results range from 0.3 to 13 mg/kg; two samples exceed the background criterion (9.1 mg/kg) and the Eco-SSL for avian species and mammals of 0.77 mg/kg and 0.36 mg/kg respectively.
- Lead results range from 1 to 880 mg/kg; eight samples exceed the background screening criterion (98.4 mg/kg) and the EPA Eco-SSL for plants, avian species, and mammals of 120 mg/kg, 11 mg/kg, and 56 mg/kg, respectively. Seven samples also exceed the AZ Minimum GPL of 290 mg/kg. Six samples exceed the AZ rSRL of 400 mg/kg and one sample exceeds the AZ nrSRL of 800 mg/L.
- Mercury results range from <0.11 to 0.69 mg/kg; eight samples exceed the background criterion (<0.11 mg/kg) and the Eco-SSL for avian species of 0.13 mg/kg. Two samples exceed the Eco-SSL for invertebrates of 0.5 mg/kg.
- Zinc results range from 21 to 22,000 mg/kg; eight samples exceed the background criterion (341 mg/kg) and the Eco-SSL for plants, invertebrates, avian species, and mammals of 160 mg/kg, 120 mg/kg, 46 mg/kg, and 79 mg/kg respectively.

4.5.1.1 SPLP Results

Five excavated soil samples and one duplicate sample were submitted for SPLP analysis of the TAL metals (Table E2, Appendix E). Aluminum, barium, iron, vanadium, and zinc were

detected in leachate derived from at least one sample. None of these metals were detected at concentrations exceeding the AZWQS screening criteria.

4.5.1.2 TCLP Results

Five excavated soil samples and one duplicate sample were submitted for TCLP analysis of the TAL metals (Table E3, Appendix E). Arsenic, barium, cadmium, copper, lead, manganese, and zinc were detected in leachate from at least one sample. No RCRA metals were detected at concentrations exceeding the RCRA TCLP limits. Concentrations of copper, lead, and zinc exceeded at least one of the AZWQS as follows:

- Copper results range from <0.02 to 0.056 mg/L; one sample exceeds the AZWQS for A&We (acute) of 0.044 mg/L.
- Lead results range from <0.08 to 0.15 mg/L; one sample exceeds the AZWQS for PBC of 0.015 mg/L.
- Zinc results range from <0.08 to 5.2 mg/L; one sample exceeds the AZWQS for A&We (acute) of 2.00 mg/L.

4.5.2 Surface and Near Surface Soil Sample Locations

No surface and near surface soil sample were collected at Area 2.

4.6 AREA 3 RESULTS

No visible trash/debris was discovered from the four excavated potholes at Area 3, with the exception of one small glass bottle and minimal plastic bags recovered from location MA3-ES2 (Appendix F). All excavation locations were backfilled after documentation and sampling.

4.6.1 Excavated Soil Sample Locations

Twelve excavated soil samples and one duplicate sample were submitted from four excavated locations for TAL metals, VOCs and SVOCs analysis. Four of those samples and one duplicate sample were also submitted for SPLP and TCLP metals analysis. No vapors were measured with the PID during excavation activities and no VOCs or SVOCs were detected above laboratory RLs. No metals were detected in site samples at concentrations exceeding background screening levels (Table E1, Appendix E).

4.6.1.1 SPLP Metals

Four excavated soil samples were submitted for SPLP analysis (Table E2, Appendix E). Only aluminum and iron were detected at concentrations above the laboratory RLs. No AZWQS have been established for these metals.

4.6.1.2 TCLP Metals

Four excavated soil samples were submitted for TCLP analysis of the RCRA metals (Table E3, Appendix E). Aluminum, barium, iron, and manganese were detected at concentrations greater than the laboratory RL. No RCRA metal was detected at a concentration exceeding the RCRA TCLP limit. No metal was detected at a concentration exceeding the AZWQS.

4.6.2 Surface and Near Surface Soil Sample Locations

Twenty-one soil samples (eleven surface and eleven near surface) and two duplicate samples were submitted for TAL metals analysis (Table E1, Appendix E). None of the samples were selected for SVOC and VOC analysis. Two surface samples were also selected and submitted for SPLP and TCLP metals analysis. The samples selected were determined based on total metals results.

Unless noted below, an analyzed metal was not detected in any of the Area 3 samples or the concentration of a detected metal was below background screening levels. The results for the metals that exceed background screening criteria, the AZ rSRLs, and/or EPA Eco-SSLs are as follows:

- Antimony results range from 0.74 to 5 mg/kg; two samples exceed the background criterion (2.6 mg/kg) and the Eco-SSL for mammals of 0.27 mg/kg (surface and near surface).
- Lead results range from 12 to 440 mg/kg; three samples exceed the background criterion (98.4 mg/kg) and the Eco-SSL for plants, avian species, and mammals of 120 mg/kg, 11 mg/kg, and 56 mg/kg, respectively (two surface soil and one near surface soil). One sample exceeds the AZ Minimum GPL of 290 mg/kg and the AZ rSRL of 400 mg/kg (surface soil).
- Mercury results range from <0.11 to 0.21 mg/kg; seven samples exceed the background criterion (<0.11 mg/kg) and the Eco-SSL for avian species of 0.13 mg/kg (six surface soil and one near surface soil).

4.6.2.1 SPLP Metals

Two surface soil samples were submitted for SPLP analysis (Table E2, Appendix E). Concentrations of copper and lead exceed at least one AZWQS. Aluminum, arsenic, barium, chromium, copper, iron, lead, manganese, nickel, and vanadium were detected in SPLP leachate. Only copper and lead were detected at concentrations exceeding an AWQS as follows:

- Copper results range from <0.020 to 0.31 mg/L; one sample exceeds the AZWQS for A&We (acute) of 0.044 mg/L
- Lead results range from 0.12 to 0.36 mg/L; one sample exceeds the AZWQS for A&We (acute) of 0.287 mg/L; both samples exceed the AZWQS for PBC of 0.015 mg/L.

4.6.2.2 TCLP Metals

Two surface soil samples were submitted for TCLP analysis (Table E3, Appendix E). Arsenic, barium, copper, and manganese were detected at concentrations greater than the laboratory RL. No RCRA metal was detected at a concentration exceeding the RCRA TCLP limit. Lead results range from <0.08 to 0.35 mg/L; one sample exceeds the AZWQS for A&We (acute) and PBC of 0.287 mg/L and 0.015 mg/L, respectively.

4.7 LABORATORY DATA REVIEW AND EVALUATION

WESTON reviewed analytical data to ensure the laboratory met Data Quality Indicator (DQI) acceptance criteria as defined in the project SAP. Analytical data evaluation included sample results/detection limits, quality assurance/quality control (QA/QC) sample analyses, and review of any qualifiers applied to data by the laboratory. Soil sample results were reported on a dry-weight basis. All analyses requested on the chain of custody (COC) forms were present in the data packages and copies of the COC forms were included in the laboratory data packages. Extraction and holding times were met by the laboratory. The laboratory data package included a case narrative that identified data qualifiers applicable to the report. The laboratory data package also included information summarizing recoveries for the following analytical QA/QC criteria:

- Method blanks
- Matrix spike (MS) / matrix spike duplicates (MSDs) and field sample duplicates
- Blank spike/laboratory control sample second source check sample
- Surrogates

In general, all of the laboratory Measurement Quality Objectives (MQOs) stipulated for the project were met by the data, with specific qualifications as noted in the laboratory reports and described as follows (Appendix G). Data qualifiers of D1 and D2 were applied by the laboratory to some analytical results. A “D1” qualifier indicates the sample required dilution due to high matrix. A “D2” qualifier indicates the sample required dilution due to high concentration of target analyte. A “J” qualifier indicates the concentration is estimated. Analyte was detected between MDL and RL. A “M1” qualifier indicates that the matrix spike recovery was high; the associated blank spike recovery was acceptable. A “M2” qualifier indicates a matrix spike recovery was low; the associated blank spike recovery was acceptable. A “M3” qualifier indicates the spike recovery value is unusable since the analyte concentration in the sample is disproportionate to spike level; the associated blank spike recovery was acceptable.

Although some qualifiers were assigned to selected data, the data is considered acceptable for use and satisfies the DQOs described in the SAP (WESTON, 2014).

4.7.1 Field Duplicate Evaluation

Field precision was assessed through the collection of field duplicate samples. Field duplicates were collected and submitted for TAL metals, SVOC, VOCs, TCLP, and SPLP analysis. The

sample results were evaluated by calculating the relative percent difference (RPD) of parent and duplicate sample results. The equation for calculating RPD is provided below:

$$RPD = \left(\frac{|Sample - SampleDuplicate|}{0.5 \times (Sample + SampleDuplicate)} \right) \times 100$$

As indicated in the project SAP, an RPD of less than 50% for soil samples, depending upon the chemical being analyzed, is generally considered acceptable. Unless noted below, field duplicate RPDs were within the acceptance criteria. A complete RPD table can be found in Appendix H.

Soil:

- MA1-S4-1-031115/MA1-S4-1-031115-DP – The RPD for antimony was 93%.
- MA1-S4-1-031115/MA1-S4-1-031115-DP – The RPD for lead was 118%.
- MA1-S10-1/MA1-S10-1-DP – The RPD for barium was 98%.
- MA1-S11-0/MA1-S11-0-DP – The RPD for antimony was 193%.
- MA1-S11-0/MA1-S11-0-DP – The RPD for arsenic was 170%.
- MA1-S11-0/MA1-S11-0-DP – The RPD for cadmium was 133%.
- MA1-S11-0/MA1-S11-0-DP – The RPD for lead was 189%.
- MA1-S20-0/MA1-S20-0-DP – The RPD for antimony was 57%.
- MA1-S20-0/MA1-S20-0-DP – The RPD for lead was 70%.
- MA1-S23-1/MA1-S23-1-DP – The RPD for antimony was 126%.
- MA1-S23-1/MA1-S23-1-DP – The RPD for arsenic was 100%.
- MA1-S23-1/MA1-S23-1-DP – The RPD for cadmium was 78%.
- MA1-S23-1/MA1-S23-1-DP – The RPD for lead was 96%.
- MA2-ES5-3/MA2-ES5-3-DP – The RPD for antimony was 62%.
- MA3-S3-1-031115/MA3-S3-1-031115-DP – The RPD for selenium was 68%.

Sediment:

- MBO-SED2-031015/MBO-SED2-031015-DP – The RPD for antimony was 75%.

Most of the instances of poor reproducibility occurred in samples collected in surface and near surface soils to evaluate potential environmental impacts from shooting activities in Area 1. Antimony, arsenic, and lead were the metals most frequently detected as non-compliant in the parent and field duplicate pair. These metals are associated with small arms ammunition and it is possible that small bullet fragments were present in the sample, which contributed to its heterogeneity. Although concentrations of metals identified in the samples above should be considered estimated due to poor reproducibility between the parent and duplicate sample, the data is sufficient to draw conclusions with and to generally satisfy the DQOs.

5.0 MIGRATION PATHWAY ANALYSIS

The following sections describe and discuss the physical conditions, migration pathway targets, releases or potential releases and results of samples collected during the SI. Four migration pathway targets, evaluated based on EPA guidance, are presented:

- Groundwater migration (drinking water)
- Surface water migration (drinking water, human food chain, sensitive environments)
- Soil exposure (resident population, nearby population, sensitive environments)
- Air migration (population, sensitive environments)

5.1 SOURCES OF CONTAMINATION

A contaminant source is defined as an area where a hazardous substance has been deposited, stored, disposed, or placed, plus those soils that have become contaminated from migration of a hazardous substance. Based on the results of sampling conducted as part of this PA/SI, potential sources of contamination primarily consist of recreational, small arms munitions bullet casings and/or fragments present at the land surface in Area 1 and the soil with high concentrations of antimony and lead derived from munitions. Based on the sample results from the excavations, it does not appear that buried trash and debris is a significant source of contamination.

5.2 GROUNDWATER PATHWAY

The groundwater migration pathway evaluates: 1) the likelihood that sources at a site actually have released, or potentially could release, hazardous substances to groundwater; 2) the characteristics of the hazardous substances that are available for a release (i.e., toxicity, mobility, and quantity); and 3) the people (targets) who actually have been, or potentially could be, impacted by the release. For the targets component of the evaluation, the focus is on the number of people who regularly obtain their drinking water from wells that are located within 4 miles of the site. The emphasis is on drinking water usage over other uses of groundwater (e.g., food crop irrigation and livestock watering) because, as a screening tool, it is designed to give the greatest weight to the most direct and extensively studied exposure routes.

5.2.1 Geologic Setting

United States Geologic Survey (USGS) geological mapping of the Prescott National Forest shows that Area 1 and Area 2 are underlain by lacustrine rocks of the Verde Formation, which is generally composed of layers of impure limestone and mudstone. Area 3 is mapped as having fanglomerate bedrock (DeWitt, et al., 2008).

5.2.2 Hydrogeologic Setting

The Site area is situated within the Verde Valley sub-basin of the Central Highlands Planning Area. The principal aquifer is the Verde Formation, which is a thick sequence of tertiary limestones and sandstones that flanks the Verde River from Camp Verde to Cottonwood (ADWR, 2009). Other aquifers include the carbonate aquifer and an alluvial aquifer located along the Verde River. Groundwater is generally under unconfined conditions although confined conditions may occur in the Verde Formation. All three aquifers are hydraulically connected (ADWR, 2009). Depth-to-water nearest to the Site in 2003 to 2004 ranged from 68 to 81 feet bgs with most recharge coming from winter precipitation. Groundwater primarily flows toward the Verde River drainage and exits the sub-basin in the southeast through alluvium and volcanic rocks along the river.

5.2.2.1 Groundwater Targets

The ADWR Well Registry was searched for groundwater wells near the Site (ADWR, 2015). Registered uses of wells in the area include domestic, irrigation, and livestock. Table 2 shows the total number of wells within the identified search radius of each site and the approximate number of wells by listed use.

Table 2 Groundwater Wells Within a 4-Mile Search Radius the Site

Well Type	0- to 1-mile radius	1- to 2-mile radius	2- to 3-mile radius	3- to 4-mile radius
Domestic	3	565	1,091	1,774
Irrigation	0	55	118	147
Livestock	2	2	18	23
Miscellaneous	1	30	111	15
Total Number of Wells	6	652	1,338	1,959

⁽¹⁾ Search radius from center of landfill area.

- 0- to 1-mile radius – The database reported six wells were within a 1-mile radius of the Site. Depth-to-water was reported for only three of the six wells and ranges from 75 to 438 feet bgs in the domestic wells and 750 feet bgs in the stock well.
- 1- to 2-mile radius – The database reported 652 wells were within a 1- to 2-mile radius of the Site. Of the 652 wells, depth-to-water was reported for 532 of the wells and ranges from 1 to 790 feet bgs in the domestic wells, 4 to 550 feet bgs in the irrigation wells, and 29 to 355 feet bgs in the miscellaneous wells. Depth-to-water was not reported in the stock wells.
- 2- to 3-mile radius – The database reported 1,338 wells were within a 2- to 3-mile radius of the Site. Of the 1,338 wells, depth-to-water was reported for 988 of the wells and ranges from 2 to 743 feet bgs in the domestic and miscellaneous wells, 1 to 1,408 feet bgs in the irrigation wells, and 11 to 1,265 feet bgs in the stock wells.

- 3- to 4-mile radius – The database reported 1,959 wells were within a 2- to 3-mile radius of the Site. Of the 1,959 wells, depth-to-water was reported for 1,518 of the wells and ranges from 1 to 530 feet bgs in the domestic and stock wells, 1 to 780 feet bgs in the irrigation wells, and 4 to 43 feet bgs in the miscellaneous wells.

5.2.2.2 Groundwater Pathway Conclusions

Groundwater was not sampled as part of this investigation. The groundwater pathway is evaluated by comparing concentrations of contaminants in soil samples with Arizona Minimum GPLs. VOCs were not detected in any sample and SVOCs were detected in only four different samples at concentrations just slightly above the laboratory RL. Minimum GPLs have not been established for the detected SVOCs (bis-(2-ethylhexyl) phthalate; butyl benzyl phthalate; and pentachlorophenol) and due to the infrequent detection and low concentrations, these compounds are unlikely to present a threat to groundwater and are not discussed further. Additionally, the three detections of pentachlorophenol were between the MDL and the RL and were therefore estimated values.

No potential VOC or SVOC contaminant sources were identified that explain the detections of PCE, 1,2-DCE, or benzene from the USFS' soil gas survey conducted in 2014 (Section 2.4). It is possible that additional buried waste is present below the depth of excavation completed during this investigation that would explain the previous detections of VOCs in soil gas.

Individual soil samples from Area 1 and Area 2 showed concentrations of antimony and lead that exceed the Minimum GPL indicating a potential for these metals to impact groundwater. To further evaluate the potential of these metals to impact groundwater, the leachability of antimony and lead was evaluated through SPLP and TCLP analysis. Antimony was detected in only one out of 43 SPLP samples at a concentration of 0.41 mg/L. This SPLP result corresponded to a total antimony concentration of 640 mg/kg, which was the second highest concentration detected in soil. In TCLP samples, antimony was detected in only four out of 43 samples. Lead was detected in SPLP leachate in only seven out of 43 samples and in 17 out of 43 TCLP samples.

Site-specific GPLs were calculated for antimony and lead based on detected concentrations in the soil and in SPLP and TCLP leachate. The GPLs were calculated using the equation for inorganic contaminants presented in *A Screening Method to Determine Soil Concentrations Protective of Groundwater Quality* (ADEQ, 1996). This screening method uses a simplified approach based on a mixing cell model and the ratio between the site-specific total and leachable metal concentrations based on several default aquifer properties. Default conditions are for unconsolidated, poorly sorted basin-fill deposits containing chiefly sand and silt in an arid environment. Default depth to water is 20 meters (approximately 65 feet). Results of the calculations are shown in Table 3.

According to depth-to-groundwater data available in the ADWR database, shallow groundwater within 1 to 3 miles of the Site is being used for domestic and irrigation purposes. Comparison of site-specific GPLs with total metals results for antimony and lead indicate a potential threat to groundwater from contaminated surface and near-surface soil related to recreational shooting activities in Area 1. Both the SPLP and TCLP results for antimony and lead in Area 1 were

highly variable over the range of total metals concentrations in the samples analyzed, which indicates a high degree of heterogeneity within the sample. As discussed in Section 4.7.1, this heterogeneity could be the result of small bullet fragments incorporated within the soil. The total metals results and leachability analysis of samples collected from Area 2, Area 3, and excavation samples from Area 1 suggest soils in these areas are not likely to present a threat to groundwater.

Table 3 Site-Specific GPLs Compared to Maximum Detections for Selected Metals

Metal	Range of GPLs Based on SPLP Data (mg/kg)	Range of GPLs Based on TCLP Data (mg/kg)	Maximum Detected Concentration in Soil (mg/kg)
Antimony	Area 1: 2,743 Area 2: Not calculated ^a Area 3: Not calculated ^a	Area 1: 38-937 Area 2: Not calculated ^a Area 3: Not calculated ^a	Area 1: 730 Area 2: 7.7 Area 3: 5
Lead	Area 1: 15,282-60,710 Area 2: Not calculated ^a Area 3: 5,370-10,252	Area 1: 399-120,821 Area 2: 7,030 Area 3: Not calculated ^a	Area 1: 48,000 Area 2: 880 Area 3: 440

^a Site-specific GPL not calculated because the metal was not detected in the SPLP or TCLP leachate.

5.3 SURFACE WATER PATHWAY

A release to surface water is documented when a hazardous substance is detected in a downstream water or sediment sample at a concentration significantly above background levels (i.e., detected downstream when not detected upstream; or detected at a concentration greater than or equal background screening criteria when detected upstream; or detected at a concentration greater than the analytical RL if background levels are non-detect).

5.3.1 Hydrologic Setting

The Site is located within the Verde River Basin. Site drainage is split between two watershed areas. Area 1 is in the Oak Wash watershed and is drained by an unnamed ephemeral wash (Figure 2). Areas 2 and 3 are in the Mescal Gulch watershed with surface runoff flowing to Blowout Creek, an ephemeral to intermittent stream. Drainage in all three site areas appears to flow generally northeast.

5.3.1.1 Surface Water Targets

Due to their locations, the Site in this PA/SI has the potential to impact Blowout Creek and the Unnamed Wash. Neither Blowout Creek nor the Unnamed Wash are used for drinking water and therefore do not have any water intakes. Designated uses of ephemeral tributaries are generally considered to be A & We (ephemeral) and PBC (A.A.C. R18-11-105).

A site-specific biological assessment has not been conducted but a review of special status species was conducted using the AZGFD Environmental Online Review Tool (Section 2.3.5.1 and Appendix A). The species identified in Appendix A may not necessarily be present at the project Site.

According to information obtained from AZGFD (Appendix A), designated critical habitat for the endangered Spikedace, Loach minnow, and Razorback sucker may be present within 3 miles downstream of the project site. Habitat for these fish does not include ephemeral waterways; however, surface water drainage from the Site eventually flows into the Verde River, which is perennial. Additional search on the AZGFD website indicates that only the designated critical habitat for the Razorback sucker is present on the Verde River downstream from the Site. The following special status aquatic/riparian dependent species are possible within 3 miles of the project site:

- Roundtail chub (*Gila robusta*)
- Longfin dace (*Agosia chrysogaster*)
- Desert sucker (*Catostomus clarkii*)
- Sonora Sucker (*Coluber bilineatus*)
- Desert Mud Turtle (*Kinosternon sonoriense sonoriense*)
- Lowland leopard frog (*Lithobates yavapaiensis*)

5.3.1.2 Surface Water Pathway Conclusions

The surface water pathway is being evaluated indirectly through the evaluation of sediment at the Site and through evaluation of SPLP and TCLP leachate samples to assess the potential for soil to impact surface water. A contaminant release is indicated when there is an exceedance of identified background screening criteria (Section 3.8). Sediment samples were collected in Blowout Creek and the Unnamed Wash. Sediment samples were analyzed for VOCs, SVOCs, and TAL metals. No VOCs or SVOCs were detected in any sediment sample; therefore, an impact to surface water from these compounds is not indicated. Review of laboratory data for potential impacts to surface water from elevated metals detected at the Site indicates the following:

Blowout Creek

- Metals concentrations of sediment samples from Blowout Creek are generally consistent at both upstream and downstream locations and with background sediment levels. Only selenium was detected in two samples with concentrations exceeding background and one or more ecological screening level.
- Detected metals in SPLP leachate from one sediment sample did not exceed the A&We or PBC AZWQS.
- SPLP and TCLP results in surface soil samples from Area 3 (related to recreational shooting activities) suggest only lead has the potential to impact surface water through potential surface runoff. None of the soil samples analyzed for SPLP and TCLP in Area 2 indicate a potential threat to surface water.

Unnamed Wash

- Metals concentrations in sediment samples from the Unnamed Wash are generally consistent at both upstream and downstream locations and with background sediment levels.
- Detected metals in SPLP leachate from one sediment sample did not exceed the A&We or PBC AZWQS.
- SPLP and TCLP results in surface and near surface soil samples from Area 1 (related to recreational shooting activities) suggest lead and copper have the potential to impact surface water. None of the soil samples analyzed for SPLP and TCLP in Area 2 indicate a potential threat to surface water.

5.4 SOIL EXPOSURE PATHWAYS

For the soil pathway evaluation, the focus is on populations that are regularly and currently present on or within 200 feet of surficial contamination. The four populations that receive the most weight are residents, students, daycare attendees, and terrestrial sensitive environments. Surface and sub-surface soil to 5 feet bgs was collected at each of the three Site areas.

5.4.1.1 Soil Exposure Pathway Targets

There are no regularly occupied residences, schools, daycares, or workplaces within 200 feet of the Site. The closest residences appear to be approximately $\frac{3}{4}$ to 1 mile from Area 1/Area 2 and approximately 2,000 feet from Area 3. Most of the land is currently used for recreational purposes so visitors currently would be exposed to soil media on a limited basis. The USFS is considering future development of an improved trailhead located at the Site. Facilities contemplated include hardened parking areas, fencing, access control gates, picnic ramadas, toilets, and an RV host site. If the area is ultimately developed for these site uses, children and other sensitive receptors have the potential to frequent the Site.

A site-specific biological assessment has not been conducted but a review of special status species was conducted using the AZGFD Environmental Online Review Tool (Section 2.3.5.1). Potential sensitive species are identified in Appendix A. Vegetation in the immediate site area is semi desert grassland. The Site is within the AZGFD Game Management Unit 19A, which includes game species such as the pronghorn antelope, black bear, elk, javelina, mountain lion, mule deer, tree squirrel, and quail.

5.4.1.2 Soil Exposure Pathway Conclusions

The soil exposure pathway is evaluated based on soil samples collected from excavated potholes in the landfilled areas and on surface and near surface soil samples collected in areas with visible recreational shooting debris. Samples were collected from each of the defined areas at the sites as shown in Figures 6 through 8.

- **Area 1 Excavated Soil Samples (surface to 5 feet bgs)** – Only lead and zinc were detected in excavation soil samples at concentrations exceeding background. Lead was detected in one excavation pothole at 3 feet bgs (MA1-ES 9-3) at a concentration exceeding the rSRL and nrSRL. Detected lead concentrations in two excavated potholes exceed the ecological screening criteria for plants, avian species and mammals but not the rSRL.

Area 1 Surface and Near Surface Samples (0 to 12 inches bgs) – Concentrations of antimony and lead detected in several samples exceed the rSRL and/or the nrSRL as well as several ecological screening criteria. Mercury, silver, and zinc were also sporadically detected at concentrations exceeding one or more ecological screening criteria. SPLP and TCLP results suggest antimony, copper, and lead may be present in a mobile form.

Area 2 Excavated Soil Samples (surface to 5 feet bgs) – Concentrations of antimony, cadmium, lead, mercury and zinc were detected in multiple samples at concentrations exceeding background and one or more ecological screening level. Only lead was detected at concentrations exceeding the rSRL and in one sample, the nrSRL. SPLP and TCLP results suggest copper, lead, and zinc may be present in a mobile form.

- **Area 3 Excavated Soil Samples (surface to 5 feet bgs)** – None of the excavated soil samples yielded any results exceeding background concentrations or any of the potential action levels, with the exception of mercury, which was detected at a concentration above background, but below any of the potential action levels.
- **Area 3 Surface and Near Surface Samples (0 to 12 inches bgs)** – Surface and near surface soil samples collected at Area 3 showed concentrations of antimony, lead and mercury detected in four samples at concentrations exceeding background and one or more ecological screening level. Lead exceeds the rSRL in one sample. SPLP and TCLP results suggest copper and lead may be present in a mobile form.

5.5 AIR MIGRATION PATHWAY

For the air pathway, the focus is on populations that are regularly and currently present on or within 200 feet of surficial contamination. The four populations that receive the most weight are residents, students, daycare attendees, and terrestrial sensitive environments.

5.5.1 Regional Climate

The climate of the Site is typical of moderately high elevation Arizona desert. Average annual precipitation is 10.55 inches with most occurring during the summer and winter monsoon seasons. The area experiences a bimodal precipitation pattern with short duration, high intensity monsoon thunderstorms in the summer months, and storms that are more prolonged and associated with the passage of low pressure systems off the Pacific Ocean in the winter months. Winter temperatures in the area range from 27.8 °F to 63.7 °F and summer temperatures range from 57.9 °F to 98.4 °F. The average annual high temperature is 77.5 °F (WRCC, 2014).

5.5.1.1 Air Migration Pathway Targets

As indicated in Section 5.4.1.1, there are no schools, daycare centers, or regularly occupied residences or workplaces within 200 feet of the site and the primary human receptors are recreational visitors. If proposed use as a recreational trailhead is implemented, future receptors such as small children and other sensitive receptors may be targets.

5.5.1.2 Air Migration Pathway Conclusions

The air migration pathway was not evaluated as part of this investigation. Therefore, analytical data cannot be used to draw conclusions.

6.0 INVESTIGATION SUMMARY

The Mingus Area Site is located in the Prescott National Forest, Arizona, and is associated with historical dumping activities and recreational firearms shooting. Objectives of this investigation were to:

- Has an observed release (based on the CERCLA definition [EPA, 1992]) of analytes of concern (AOCs) occurred in Site soils that can be attributed to the historical and current Site uses?
- Are the AOCs present at concentrations that present an unacceptable human health or ecological risk based on current or anticipated future land use of the Site resulting in the need for additional investigation or corrective action?
- Is there potential for AOCs to leach from source areas and migrate to other environmental media (e.g., surface water or groundwater)?

A total of 160 soil and sediment samples, plus 15 field duplicates, were analyzed for TAL metals (EPA Method 6010B/7471A). A subset of these samples (98 samples plus 10 duplicates) was selected to undergo analysis for VOCs (EPA Method 8260B) and SVOCs (EPA Method 8270C). Additionally, 40 of the total samples (plus three duplicates) were analyzed SPLP and TCLP leachate for the TAL metals excluding the general soil nutrients of calcium, magnesium, potassium, and sodium (EPA Method 1312/6010B/7470A and EPA Method 1311/6010B/7470A, respectively). Six soil samples and four sediment samples were collected from background locations; the laboratory analytical results of which were used to calculate the three-times mean background concentration used for comparison.

6.1 CONCLUSIONS

Analytical results were compared to three-times the background concentration per CERCLA guidance to establish if a release has occurred at the Site. Sample analytical results were also compared to risk-based screening criteria including the Arizona SRLs, Arizona GPLs, and the EPA Eco-SSLs for plants, soil invertebrates, avian, and mammalian species. The following summarizes results and findings of the current investigation and conclusions drawn by each area.

Area 1 – Landfilled Area (Excavated Soil Samples)

- Landfilled debris was observed in all Area 1 excavated potholes except MA1-ES1, MA1-ES2, and MA1-ES7. Debris primarily consisted of municipal-type trash, scrap metal, and tires. No evidence of buried drums or other evidence of hazardous waste was observed to the depth of excavation performed (maximum 5 feet bgs).
- VOC and SVOC analytical results in soil samples did not yield any explanations for hits of PCE; 1,2-DCE; or benzene detected during the USFS' 2014 soil gas survey. VOCs were not detected in any soil sampled analyzed; two SVOC compounds (bis-(2-

ethylhexyl) phthalate and butyl benzyl phthalate) were detected but only in a total of four samples. Detected concentrations did not exceed any human health or ecological screening criteria. The phthalates detected are plasticizers and were detected in excavations where plastic trash was observed.

- Detected metals in excavated soil samples are generally less than the three-times background concentration with a few exceptions. Lead and zinc were detected in a limited number of samples at concentrations exceeding background and one or more ecological screening criteria. Only one sample appears to represent a risk to human health. Lead was detected in MA1-ES9-3 at a concentration exceeding both the rSRL and nrSRL.

Area 1 – Recreational Shooting Area (Surface and Near Surface Soil Samples)

- Evidence of recreational shooting such as bullet casings and target remnants was observed across the southeast-facing slope of Area 1, which appears to have been used as the shooting backstop.
- Pentachlorophenol (an SVOC) was detected in two near-surface soil samples (MA1-S1-1 and MA1-S28-1); however, the detected concentrations were estimated (detected between the MDL and RL) did not exceed the rSRL. Pentachlorophenol is a restricted-use pesticide that is no longer available for public use. Other than the two estimated sample detections, no evidence such as empty drums or other labeled containers were observed on the surface or in the landfilled debris.
- The primary contaminants of concern with regard to protection of human health are lead and antimony. Both metals were detected at concentrations exceeding the rSRL and/or nrSRL at multiple surface soil and near surface soil sample locations. Lead and antimony are common contaminants at small arms shooting ranges.
- The primary contaminants of potential ecological concern are antimony, lead, and mercury. Twenty-four sample locations contain one or more of these metals in concentrations exceeding ecological screening criteria.
- A potential risk to groundwater from antimony- and lead-contaminated soil is suggested based on the indicated shallow depth-to-groundwater, a comparison of total metals concentrations to Arizona Minimum GPLs, and on SPLP and TCLP results.
- A potential risk to surface water from surface runoff is indicated based on SPLP and TCLP results.

Area 2 – Landfilled Area (Excavated Soil Samples)

- Landfilled debris was observed in three of the six excavated potholes in Area 2 (MA2-ES2, MA2-ES3, and MA2-ES4). Debris primarily consisted of municipal-type trash, scrap and sheet metal. Corroded metal remnants were observed in MA2-ES2. No evidence of buried drums or other evidence of hazardous waste was observed.

- No VOCs were detected in any sample collected from the excavations and the only SVOC detected was pentachlorophenol in one sample (MA2-ES5-1). No buried debris was observed in this excavation.
- The primary contaminant of concern with regard to protection of human health is lead. Lead was detected at concentrations exceeding the rSRL and/or nrSRL at excavated soil samples collected at MA2-ES2-1, MA2-ES2-3, MA2-ES2-5, MA2-ES3-3, MA2-ES3-5, and MA2-ES4-3.
- The contaminants of potential ecological concern are antimony, cadmium, lead, mercury, and zinc. Eight sample locations contain one or more of these metals in concentrations exceeding ecological screening criteria.
- A potential risk to groundwater or surface water, based on Area 2 analytical results, is not indicated.

Area 3 Landfilled Area (Excavated Soil Samples)

- No buried waste or debris was observed in any of the excavated potholes from Area 3 with the exception of MA3-ES2, which contained one glass bottle and minimal plastic bags.
- No VOCs or SVOCs were detected in excavated soil samples.
- Detected metals in excavation soil samples do not appear to be greater than natural background concentrations.
- A potential risk to groundwater or surface water, based on Area 3 analytical results of excavated soil samples, is not indicated.

Area 3 Recreational Shooting Area (Surface and Near Surface Areas)

- Evidence of recreational shooting, including bullet casings and target remnants, was observed on the southeast-facing slope of Area 3 adjacent to Blowout Creek. Observations indicate the slope has been used as a backstop area. Minimal small arms related contamination was detected in samples collected from the assumed backstop area. Lead was detected in one sample at a concentration exceeding the rSRL.
- The primary contaminants of potential ecological concern are antimony, lead, and mercury. Nine sample locations contain one or more of these metals in concentrations exceeding ecological screening criteria.
- A potential risk to groundwater from contaminated soil in Area 3 was not indicated based on results of SPLP and TCLP data.
- SPLP and TCLP data suggested a potential risk to surface water in Blowout Creek from surface runoff in the shooting area of Area 3.

6.2 RECOMMENDATIONS

The USFS proposes to use the Mingus Area Site as a recreational trailhead to include development of hardened parking areas, fencing, access control gates, picnic ramadas, toilets, and an RV host site. Based on evaluation of Site conditions and collected data, and WESTON's understanding of current and future Site uses, WESTON offers the following recommendations:

- Recreational shooting activities have resulted in an impact to soil and near surface soil in Area 1. To mitigate the risk to human health and potential risks to groundwater and surface water, WESTON recommends conducting a soil removal action to remove the top 6 to 12 inches of soil in the affected area as shown in Figure 9. Soil samples were not collected at depths greater than 12 inches bgs during this PA/SI. Removal of lead-contaminated soil deeper than 12 inches bgs may be needed in some areas based on confirmation sampling completed following initial soil excavation.
- Impacts have also occurred, although to a significantly lesser degree, to the sloped "backstop" area adjacent to Blowout Creek in Area 3. A soil removal action from the slope area only is also warranted to mitigate potential impacts to surface water in Blowout Creek. No additional investigation or action is recommended for the hang glider landing area in Area 3.
- Based on TCLP analysis of lead-contaminated soil in Area 1, removed soil will need to be treated to dispose as non-hazardous waste.
- Based on the analytical results of soil samples in the burial areas of Area 1 and Area 2, the buried solid waste does not appear to be posing a significant threat to human health or the environment. No evidence of buried hazardous waste was observed during excavations; however, excavations did not exceed 5 feet bgs during this investigation. As such, there is no guarantee that solid or hazardous wastes are not buried at greater depths beneath the surface. Additional investigative trenching below 5 feet bgs would provide needed information to further evaluate potential risk of buried wastes that may have been the source of PCE; 1,2-DCE, or benzene detected during the USFS' 2014 soil gas survey.
- If the solid waste is left in place, additional cover material of the burial areas is needed and armoring of Blowout Creek and the Unnamed Wash is suggested to impede future erosion and potential exposure of buried material to the surface.

7.0 REFERENCES

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FIGURES

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APPENDIX A

Arizona Environmental Online Review Tool Report

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APPENDIX B

Photograph Log

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APPENDIX C

Sample Locations and GPS Coordinate Data

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APPENDIX D

Field Notes

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APPENDIX E

Data Summary Tables

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APPENDIX F

Summary of Excavation Observations

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APPENDIX G

Laboratory Analytical Report

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APPENDIX H

Relative Percent Difference (RPD) Table

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