ENVIRONMENTAL ISSUES ADVISORY COMMITTEE
REGULAR MEETING NOTICE
Thursday, April 29, 2010, 1:00 P.M.

EIAC REGULAR MEETING **COUNCIL CHAMBERS, TOWN HALL**
2735 S. HWY 69 **DEWEY-HUMBOLDT, ARIZONA**

AGENDA

The issues that come before the EIAC Committee are often challenging and potentially divisive. In order to make sure we benefit from the diverse views to be presented, the Committee believes that the meeting be a safe place for people to speak. With this in mind, the Committee asks that everyone refrain from clapping, heckling and any other expressions of approval or disapproval. Please turn off all cell phones. The Committee meeting may be recorded in audio format.

1. **CALL TO ORDER.**
2. **ROLL CALL:** EIAC Committee Members Bob Bowman, Ashley Preston and Chair Treesha deFrance.
3. **CONSENT AGENDA** - All matters listed under the Consent Agenda are considered to be routine by the Town Committee and will be enacted by one motion. At a Committee Member's request only, any item may be removed from the Consent Agenda for separate consideration. If a citizen desires separate consideration of an item, they must approach a Committee Member prior to the meeting and ask that the Committee Member request that the item be removed.

   3.1. Minutes. Minutes from April 27, 2009 Regular Meeting.

4. **REGULAR AGENDA – Unfinished Business** - Discussion and Possible Action on any issue which was not concluded, was postponed, or was tabled during a prior meeting.
5. **REGULAR AGENDA – New Business** - Discussion and Possible Action on matters not previously presented to the Committee.

   5.1. Welcome new member Ashley Preston; Learn about her areas of interest.

   5.2. Remedial Investigation Report, Iron King Mine - Humboldt Smelter Superfund Site.

   5.3. Issues of Concern for next quarterly meeting with ADEQ-EPA in May 2010.

   5.4. EIAC business, including selecting new regular meeting time.

COMMENTS FROM THE PUBLIC. Those wishing to address the Committee need not request permission in advance. For the official record, individuals will state their name. Any such remarks shall be addressed to the Committee as a whole and not to any member thereof. Individuals are limited to speak for three (3) minutes per person unless additional time is granted by the Chair. At the conclusion of all of the unscheduled comments of all interested members of the public and at the discretion of the Chair, individual members of the Committee may respond to criticism regarding the item addressed, may ask the matter be reviewed by Town Staff, or may ask that the matter be placed on a future agenda. The total time for Comments from the Public shall be 30 minutes per meeting.

6. **ADJOURN.**

FOR YOUR INFORMATION
Next EIAC Committee Meeting: To be determined.
Next Town Council Meeting: Tuesday, May 4, 2010 at 6:30 p.m.
Next Planning & Zoning Commission Meeting: Thursday, May 6, 2010 at 6:00 p.m.
Next Town Council Work Session: Tuesday, May 11, 2010 at 3:00 p.m.

CERTIFICATION OF POSTING

The undersigned hereby certifies that a copy of the attached notice was duly posted at the following locations: Dewey-Humboldt Town Hall, 2735 South Highway 69, Humboldt, Arizona, Chevron Station, 2735 South Highway 69, Humboldt, Arizona, Blue Ridge Market, Highway 69 and Kachina Drive, Dewey, Arizona, on the _____ day of _____, 2008, at _____ p.m. in accordance with the statement filed by the Town of Dewey-Humboldt with the Town Clerk, Town of Dewey-Humboldt.

By: _____, Town Clerk's Office.

Town Council of Dewey-Humboldt
Environmental Issues Advisory Committee
Draft Minutes
April 27, 2009, 6:30pm

The meeting was called to order at 6:30pm.

Roll call: EIAC Members present: Len Marinaccio, Mike Randall, Denise Rogers, Bob Bowman (arrived at 6:36).

Announcements: Annual AFOSA Open Space Conference, May 2, 2009, 8:30am, Arcosanti, Cordes Junction, AZ

The minutes of the January 26, 2009 meeting were approved by Denise and seconded by Mike.

There was a brief discussion of the Council changes to the zoning ordinance to prohibit landfills. It was agreed that the issuance of a Conditional Use Permit for a landfill ONLY if the limitations of the Ordinance are amended by legislative change or judicial interpretation was a good call.

The new policies, procedures and committee structure as recently adopted by Council in the Town Council Rules and Procedures were discussed. It was questioned whether staff would provide a "packet" for new Committee members, as is done for new Council members, as there are numerous rules and guidelines (Open Meeting Law, Council Code of Ethics, etc) members are expected to follow. The appropriateness of Council members on boards and committees was discussed with the general sentiment being a goal of Council members as Associate members only.

Len informed us of some additional testing being done by the EPA in relation to the SuperFund site work. Leah Butler was present in the audience and explained that gaps in the data were found and so additional soil and ground and surface water sampling was being carried out this week. She stated Chaparral Gulch was among the areas of interest. Results of the sampling are expected to be published in the fall, along with the risk assessment. She said that contaminants found in the additional residential areas will probably be cleaned up as were the residential areas in 2006. Mike then asked Leah how D-H got listed as "One of the 9 most polluted places in America" (4/20/09, MSN). Leah said they (EPA) found the title of the

article inflammatory and inappropriate. She and ___?___ were interviewed by Gean Weiss of MSN about the site but in no way stated or inferred that it was one of the 9 worst. "The EPA does not rank sites like that". Mike said the Town should ask for a retraction. Bob motioned that the "EIAC advise the Town to ask for a retraction by the author, Gean Weiss, of the MSN, April 20th article". Mike seconded the motion and all agreed.

There was then a brief discussion of the ongoing Kuhles issue and the ongoing lawsuit brought by ADEQ. Len stated the Town was also pursuing issues with Kuhles relating to the demolition of a building without a permit compounded by the fact that the contained asbestos. Mike asked what they did with the rubble and Leah said "I believe it's just sitting there in piles". Leah then stated ADEQ would be at the May 5th Council meeting and we could get more information then. Mike then stated we should all thank Treesha for keeping track of the Kuhles activities and for submitting her April 21 memo to Council and included in our meeting packet.

The public was asked for comments and Garry Rogers talked briefly about findings presented at the March 10-12, 2009 International Scientific Congress on Climate Change meeting. He also gave information about The US Mayors Climate Protection Agreement (as endorsed by the 73rd Annual US Conference of Mayors meeting in 2005). He suggested we urge the Town to become the leader in Yavapai County in sustainable management by joining the 1000 US Mayors (including 10 in Arizona) that have signed the Climate Protection Agreement.

The meeting was adjourned at 7:35.

Signed: _____ Date: _____

EXECUTIVE SUMMARY

This report presents the results of the remedial investigation (RI) activities conducted at the Iron King Mine – Humboldt Smelter Superfund Site in Dewey-Humboldt, Arizona (see Figure ES-1). The U.S. Environmental Protection Agency (EPA) authorized EA Engineering, Science, and Technology, Inc. (EA) to conduct RI activities under Remedial Action Contract Number EP-W-06-004 and Task Order 0034-RICO-09MX.

1. INTRODUCTION

The investigation was conducted in accordance with "*Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*" (Comprehensive Environmental Response, Compensation, and Liability Act).

1.1 PURPOSE

The purpose of the RI Report was to: (1) summarize Site information and data; (2) identify potential source areas; (3) define the nature and extent of contamination; (4) evaluate contaminant migration pathways; and (5) present a summary of human health and ecological risks. These elements also form the conceptual site model (CSM), which is discussed throughout the RI Report. This RI Report will be used as a foundation for the remedial alternative evaluation in the Feasibility Study (FS) and will support remedy selection in the Record of Decision (ROD).

1.2 SITE BACKGROUND

The Site is a combination of sources and releases from two separate facilities: the Iron King Mine property and the Humboldt Smelter property. A portion of the Town of Dewey-Humboldt is situated between the mine and the smelter. Three waterways (Chaparral Gulch, Galena Gulch, and Agua Fria River) also transect the Site.

During the course of the investigation, EPA identified five Areas of Interest (AOI) (see Figure ES-2):

- **Iron King Mine** – Includes the Iron King Mine Proper Area, Iron King Mine Operations Area, Former Fertilizer Plant Area, Salvage Yard, and ancillary associated properties.
- **Humboldt Smelter** – Includes several abandoned buildings, a smelter stack, a tailings pile, a smelter ash pile, and a slag pile.
- **Waterways** – Includes the Chaparral Gulch, Galena Gulch, Agua Fria River, and adjoining drainage channels and outfalls.
- **Off-site Soil** – Includes residential, background, and ancillary properties
- **Ground Water** – Includes shallow alluvium and deep bedrock ground water.

These five Areas of Interest were combined for the purpose of conducting the RI/FS because: (1) off-site migration of particulates from the Iron King Mine and Humboldt Smelter may have overlapping air-depositional areas; (2) mine tailings from the Iron King Mine have migrated onto the Humboldt Smelter property via the Chaparral Gulch; (3) the Agua Fria River and its contributing waterways (e.g., Chaparral Gulch and Galena Gulch) have impacts from both the Iron King Mine and Humboldt Smelter; and (4) ground water has been impacted from both the Iron King Mine and Humboldt Smelter.

Although the RI Report utilizes "off-site" in descriptions of areas, the Site is being evaluated holistically. The phrase "off-site" indicates areas that are located outside of the Iron King Mine or Humboldt Smelter Areas of Interest, but are still considered to be part of the Site. The Site includes all areas where contamination has migrated.

1.2.1 Iron King Mine

The Iron King Mine Area of Interest, located west of Highway 69, occupies approximately 153 acres. The Iron King Mine property is bordered by Chaparral Gulch to the north, Galena Gulch to the south, Highway 69 to the east, and undeveloped land to the west (see Figure ES-2). The Iron King Mine was a periodically active gold, silver, copper, lead, and zinc mine from 1906 until 1969.

1.2.2 Humboldt Smelter

The Humboldt Smelter Area of Interest, located at the east end of Main Street, occupies approximately 189 acres. The smelter is situated less than 1-mile east of the Iron King Mine. The Humboldt Smelter is bordered by the Town of Dewey-Humboldt to the west and north, the Agua Fria River to the east, and the Chaparral Gulch to the south (see Figure ES-2).

1.2.3 Waterways

The Waterways Areas of Interest includes the Chaparral Gulch, Galena Gulch, Agua Fria River, and adjoining drainage channels and outfalls. The Chaparral and Galena Gulches are ephemeral streams that only flow during infrequent episodic high rain events. A tailings dam located on the smelter property within the Chaparral Gulch has retained tailings from both the Iron King Mine and Humboldt Smelter properties. The Chaparral Gulch flows into the Agua Fria River approximately ¼ mile downstream of the Chaparral Gulch dam. The Galena Gulch flows from west to east along the southern boundary of Iron King Mine before it crosses under Highway 69; eventually, the Chaparral Gulch meets with the Agua Fria River south of the Site (see Figure ES-2).

1.2.4 Off-site Soil

The Off-site Soil Area of Interest includes residential, background, and ancillary properties in the vicinity of the Iron King Mine and Humboldt Smelter (see Figures ES-3 and ES-4). Residential properties and the Town of Dewey-Humboldt are located immediately adjacent to and between the mine and smelter. Background areas were mainly located to the south and west of the Iron King Mine and Humboldt Smelter. Additional areas that may be associated with former mining operations were located to the south of Iron King Mine.

1.2.5 Ground Water

Ground water is found in the shallow alluvial and deeper bedrock aquifers in the vicinity of the Site. Both shallow alluvial and deeper bedrock private and municipal wells are used for drinking water and other domestic uses in the vicinity of the Iron King Mine and Humboldt Smelter.

1.3 PREVIOUS INVESTIGATIONS

Site characterization activities at the Site date back to the late 1990s. Previous investigations by the Arizona Department of Environmental Quality (ADEQ) and EPA are as follows:

- Phase 1 Environmental Site Assessment for the Ironite Products Facility
- Phase 1 ESA for the Iron King Smelter/Mill Site
- Preliminary Assessment/Site Inspection (PA/SI) of the Iron King Mine
- Phase 2 Sampling Report for the Iron King Smelter/Mill Site
- PA/SI of the Humboldt Smelter
- Soil Removal Assessment
- Residential Soil Cleanup of Four Properties
- Expanded Site Inspection of the Iron King Mine/Humboldt Smelter.

1.4 REPORT ORGANIZATION

This RI Report is organized to provide a foundation for the remedial alternative evaluation in the FS and support remedy selection in the ROD. The RI Report includes:

- A summary of the RI activities conducted by EPA
- Descriptions of the physical characteristics (e.g., geology, hydrogeology, etc.) of the Site
- An evaluation of the analytical data from previous and recent investigations
- Descriptions of source areas, the nature and extent of contamination, and contaminant migration pathways
- The Human Health Risk Assessment (HHRA)
- The Screening Level Ecological Risk Assessment (SLERA) and Baseline Risk Assessment Problem Formulation (BRAPF)
- Conclusions and Recommendations
- Descriptions of the Community Involvement activities conducted during the RI

2. EPA REMEDIAL INVESTIGATION ACTIVITIES

This section presents a summary of the data collection activities conducted for the EPA RI investigation. Activities can be grouped into three stages (i.e., project planning, data acquisition, and data evaluation), which work interchangeably to ensure that project objectives are satisfied.

2.1 PROJECT PLANNING

The following independent site-specific plans were prepared to present the overall approach for implementing the RI field program:

- Health and Safety Plan specifies employee training, protective equipment, personal air monitoring procedures, medical surveillance requirements, standard operating procedures, and contingency planning procedures.

- Site Management Plan addresses site access, security, contingency procedures, management responsibilities, data management, and waste disposal.

- Sampling and Analysis Plan details the field sampling schedule, sample collection procedures, and analytical methods required to collect sufficient data to perform a RI/FS.

2.2 DATA AQUISITION

Data acquisition was conducted during two field investigation phases. Initial site characterization activities were conducted from August through October 2008. After the data were evaluated, EPA formed a preliminary Conceptual Site Model. Subsequently, EPA determined that data gaps existed that required additional characterization (i.e., data collection). This additional characterization was conducted as part of the data gaps sampling from December 2008 through September 2009. Although data acquisition was conducted during two phases, this distinction was not carried forth in the presentation of data and results in order to provide a holistic representation of the investigation.

The following key activities were conducted by EPA during the investigation:

- Media characterization of soil, sediment, surface water, ground water, and ambient air
- Installation of ground water monitoring wells
- Volumetric estimates of source areas
- Storm water evaluation of drainage pathways
- Cultural Resource and Historic Building Survey
- Aerial Photographic Analysis
- Biological Evaluation
- Riparian Evaluation and Jurisdictional Determination
- Reuse Assessment

Soil, sediment, surface water, ground water, and ambient air were sampled and analyzed to characterize the chemical and physical characteristics of the media. A summary of the Site characterization activities are presented in the RI Report. In addition, the RI Report provides a summary of previous and recent field investigation samples that met data quality assessment goals and are considered of suitable quality.

3. PHYSICAL CHARACTERISTICS

Data on the physical characteristics of the Site and surrounding areas were collected to establish a basis of understanding for the source, nature and extent, and migration pathway analysis. Also, these data were used to identify receptor populations (e.g. adults, children, mammals, insects, plants, etc) for the Human Health Risk Assessment and Screening Level Ecological Risk

Assessment. Finally, the physical characteristics will be used to develop and screen remedial alternatives in the Feasibility Study. Information on the following physical characteristics was presented in the RI Report:

- Surface features
- Geology
- Soils
- Non-native materials
- Geochemistry
- Hydrogeology
- Meteorology
- Surface Water Hydrology
- Cultural and Historical Features
- Demography and Land Use/Reuse
- Ecology

All of these elements are integral to the development of the Conceptual Site Model, which is presented in the RI Report.

4. ANALYTICAL DATA SUMMARY

A summary of the analytical data from previous and recent investigation activities is provided below.

4.1 HISTORIC DATA SUMMARY

The historical dataset included surface water, ground water, and soil data collected since 1988 as documented in the ESI. Ambient air was not sampled during previous investigations. Surface water and ground water concentrations can vary over time. Therefore, no historical surface water or ground water data were incorporated into the RI Report. Historical soil data collected prior to 2002 and some soil data collected since 2002 were not documented adequately to meet data quality assessment goals. Nevertheless, soil data from the following reports were incorporated into the RI Report:

- 2002 Iron King Mine ADEQ PA/SI Report
- 2004 Humboldt Smelter ADEQ PA/SI Report
- 2005 EPA Removal Assessment Report
- 2008 Revised Ironite Environmental Project Work Plan

A summary of the historic soil data that were considered acceptable is provided in the RI Report.

4.2 RI REPORT DATASET SUMMARY

Historical data were combined with EPA RI field investigation data to form the complete RI Report dataset, which is utilized to evaluate the Site. A summary of the RI Report dataset is provided below.

4.2.1 Soil/Sediment Samples

During the RI field investigation, EPA collected soil and sediment samples from 0 to 0.5-feet below ground surface (bgs), surface soil samples from 0 to 2-feet bgs, subsurface soil samples from 2 to 10-feet bgs, and deep soil samples greater than 10-feet bgs. Soil/sediment samples were analyzed for Target Analyte List (TAL) metals, synthetic precipitation leaching procedure (SPLP) metals, hexavalent chromium, volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), pesticides/polychlorinated biphenyls (PCB), pH, perchlorate, asbestos, dioxins/furans, acid base accounting (ABA), and nitrates/nitrite/sulfate analyses.

Soil samples evaluated in the Human Health Risk Assessment were segregated into depth intervals that are congruent with likely exposure. The surface soils/sediment depth interval of 0 to 2-feet bgs was used in accordance with EPA guidance. The subsurface soil depth interval of 2 to 10-feet bgs was used because intrusive construction activities (e.g., construction of basement foundations or pools) may extend to 10-feet bgs. Samples collected greater than 10-feet bgs were not utilized in the Human Health Risk Assessment because humans are not likely to be exposed to material at this depth.

4.2.2 Surface Water and Ground Water Sampling

Filtered and unfiltered water samples were collected to evaluate the amount of total inorganics and metals and dissolved metals in water. Unfiltered (i.e., total) inorganics concentrations were used in the Human Health Risk Assessment because it is unlikely that water would be filtered prior to exposure. Water samples were analyzed for TAL metals, VOCs, SVOCs, explosives, perchlorate, anions/cations/total dissolved solids (TDS), and nitrates/nitrite/sulfate analyses. Analyses that were utilized as supporting environmental information in the Human Health Risk Assessment included some anions/cations.

4.2.3 Ambient Air Sampling

Ambient air samples were collected to determine the sources and migration of airborne contamination and to characterize the nature and extent of particulates from source areas during high wind events. Ambient air samples were analyzed for total suspended particulates (TSP), particulate matter less than 10 microns (PM-10), and inorganics in ambient air. Total suspended particulates data measures the total amount of matter in the air (all dust particles). Particulate matter less than 10 microns data measures the amount of small particulates in the air that can enter the lungs. Inorganics have chemical-specific toxicity criteria, so these ambient air data are included in quantitative risk estimates. However, TSP and PM-10 concentrations do not have chemical-specific toxicity criteria, so these data were not utilized in the Human Health Risk Assessment.

5. REMEDIAL INVESTIGATION RESULTS

5.1 BASIS OF UNDERSTANDING

The preceding sections provided a summary of the Site information and data, which fulfilled the first element of an RI Report. The next three elements serve to: (1) identify potential source

areas; (2) define the nature and extent of contamination; and (3) evaluate contaminant migration pathways.

The source identification, nature and extent discussion, and migration pathway analyses will be supported by the comparison of data to screening levels. Screening levels and chemicals of potential concern (COPC) are discussed in the following sections to provide a basis of understanding for these topics.

5.1.1 Screening Levels

The nature and extent evaluation includes a comparison of data from the Site to established screening levels. Although much of the current or likely future uses of the Site are commercial/industrial, some portions of the Site (e.g., Off-site Soil Area of Interest) includes residential use. Therefore, to provide a consistent basis of comparison across Areas of Interest, residential or domestic use screening levels are used in the nature and extent discussion.

Screening levels are based on conservative estimates of exposure and are not the same as cleanup levels. Screening level exceedances do not automatically designate an area is contaminated or trigger a response action. However, screening level exceedances suggest that further evaluation of the potential risks posed by site contamination is appropriate. The magnitude of exceedance is helpful in evaluating source areas, the nature and extent of contamination, and migration pathways within and amongst the Areas of Interest.

5.1.2 Chemicals of Potential Concern

All chemicals that were detected in soil, sediment, surface water, ground water, and ambient air were considered Chemicals of Potential Concern for this Site. Arsenic, lead, and sulfate have been selected as the primary Chemical of Potential Concern because these inorganics are the most prevalent (in terms of screening level exceedance and magnitude) and generally are co-located with other inorganic chemicals. A thorough understanding of the impacts from these primary chemicals across the Areas of Interest provides a reliable yet concise picture of total inorganic chemical distribution. In addition, sulfate and other critical indicators of geochemical conditions conducive to chemical mobility (e.g., acid mine drainage [AMD]) are discussed, as appropriate throughout these sections.

5.1.3 Source

Source material is a media that includes or contains hazardous substances, pollutants, or contaminants that acts as a reservoir for migration to other media or for direct exposure to humans or the environment. The EPA identifies source material as either a principal threat waste or a low-level threat waste depending on the toxicity and mobility of the material.

- **Principal Threat Wastes** – Source materials that are considered highly toxic or highly mobile and that generally cannot be reliably contained or would present a significant risk to human health or the environment if exposure were to occur. Highly toxic or highly mobile are relative terms. For the purpose of this evaluation, materials that are three or four orders of magnitude greater than their respective screening levels meet this highly toxic threshold. Highly mobile materials are those that have demonstrated the ability for

significant migration due to their proximity to migration pathways or are particularly susceptible to migration due to their physical characteristics (e.g., fine particle size).

- **Low-level Threat Wastes** – Source materials that exhibit low toxicity and low mobility and can be reliably contained or would present only a low risk to human health or the environment if exposure were to occur. Generally, materials that do not meet the criteria for principal threat wastes, but do demonstrate significant toxicity (i.e., due to their exceedance of screening levels by one or two orders of magnitude and background levels) and mobility are considered low-level threat wastes.

5.1.4 Nature and Extent of Contamination

EPA performed an analysis of the data to describe the nature and extent of contamination to soil, sediment, surface water, ground water, and ambient air. Chemical concentrations are incorporated with physical characteristics, historical information regarding Site activities, and other evidence to evaluate the nature and magnitude of contamination. Similar evidence is used to delineate the extent of contamination both horizontally and vertically. Spatial and temporal trends were evaluated as they are important in the analysis of migration pathways.

5.1.5 Migration Pathways

The nature and extent of contamination is combined with source identification and physical characteristic information to evaluate migration pathways. The following migration pathways are discussed in the RI:

- **Surface Water Transport** – Contaminant transport of particulates and dissolved phase contaminants via surface water transport occurs primarily during periodic high rain events.

- **Surface Water Partitioning** – Surface water in contact with sediments or suspended solids may partition into the dissolved phase.

- **Air Particulate Migration** – Moderate to high wind events that occur throughout the year carry fine-grained surface materials and particulates from source areas to adjoining Areas of Interest.

- **Leaching to Ground Water** – As water percolates from the surface, through vadose zone soil, to the underlying ground water, it can carry dissolved phase constituents. The vadose zone is the area between land surface and the water table. Additionally, source material in contact with ground water can leach directly to ground water.

- **Ground Water to Surface Water** – Ground water may emanate as surface water at various points around the Site.

5.2 CONCEPTUAL SITE MODEL

The Conceptual Site Model presents a holistic view of the Site, provides a foundation for the evaluation of remedial alternatives, and supports remedy selection. The Conceptual Site Model

incorporates the Site's surface features, potential source areas, nature and extent of contamination, contaminant migration pathways, and ancillary information, as appropriate.

5.2.1 Iron King Mine AOI

The Iron King Mine Area of Interest includes the Iron King Mine Proper Area, Iron King Mine Operations Area, Small Tailings Pile, Former Fertilizer Plant Area, and Salvage Yard. The Iron King Mine Area of Interest contains significant sources of tailings material, which contains high concentrations of arsenic and lead. This source material is either a principal threat waste or low-level threat waste depending on its concentrations (i.e., toxicity), potential for off-site migration (i.e., mobility), and source volume. These source materials are migrating off-site mainly via air particulate migration, surface water transport, and leaching to ground water. Affected nearby exposure areas/Areas of Interest include the Galena Gulch, Chaparral Gulch, Off-site Soil (including residential properties), and Ground Water (see Figure ES-5).

5.2.2 Humboldt Smelter AOI

The Humboldt Smelter Area of Interest includes the Humboldt Smelter Ash Pile, Humboldt Smelter Slag, Humboldt Smelter Tailings Pile, Humboldt Smelter Operations Area, and Humboldt Smelter Off-site Migration. The Humboldt Smelter Area of Interest contains significant sources of tailings, ash, slag, and building debris. These materials are considered principal threat wastes or low-level threat wastes depending on the concentrations of arsenic, lead, or asbestos (i.e., toxicity); potential for off-site migration (i.e., mobility); and source volume. These source materials are migrating off-site mainly via air particulate migration, surface water transport, and leaching to ground water. Affected nearby exposure areas/Areas of Interest include the Agua Fria River, Chaparral Gulch, Off-site Soil (including residential properties), and Ground Water.

5.2.3 Waterways AOI

The Waterways Area of Interest includes the Galena Gulch, Chaparral Gulch, Agua Fria River, and adjoining drainage channels and outfalls. The Waterways Area of Interest contains significant sources of tailings and ash material, which contains high concentrations of arsenic and lead. This source material is either a principal threat waste or low-level threat waste depending on its concentrations (i.e., toxicity), potential for off-site migration (i.e., mobility), and source volume. These source materials are migrating mainly via air particulate migration, surface water transport, and leaching to ground water. Affected nearby exposure areas/Areas of Interest include the downgradient waterways (i.e., Galena Gulch, Chaparral Gulch, and Agua Fria River), Off-site Soil (including residential properties), and Ground Water.

5.2.4 Off-Site Soil AOI

The Off-site Soil Area of Interest includes residential, background, and ancillary properties (e.g. public spaces and commercial properties).

5.2.4.1 Residential, Commercial, and Public Properties

Residential, commercial, and public properties located in the Off-site Soil Area of Interest were sampled to evaluate deposition of metals (e.g. from air or surface water) from suspected source areas. These areas included:

- Off-site Soil Area 02 through Off-site Soil Area 20
- Off-site Soil Area 101 through Off-site Soil Area 148
- Miscellaneous Off-site Area (e.g. collected during the 2005 Removal Assessment)

Arsenic and lead concentrations in surface soil are elevated on properties adjacent to the Chaparral Gulch or downwind of the Iron King Mine and Humboldt Smelter Areas of Interest. These areas are not considered source areas because they do not pose a significant source of contamination to other media or properties. Nevertheless, residential soils are impacted by source materials, including ash and/or tailings. The Off-site Soil Area of Interest is impacted via the air particulate migration and surface water transport migration pathways from the Iron King Mine and Humboldt Smelter Area of Interest.

Based on existing data, yards further away from the Iron King Mine and Humboldt Smelter Areas of Interest are much less likely to be impacted from particulate migration or surface water transport from sources. Conversely, yards closer to the Iron King Mine or Humboldt Smelter Areas of Interest have a higher probability of being impacted. These assertions were supported by the distribution of arsenic and lead in shallow surface soil samples. In addition, the deeper surface soil samples have lower concentrations of arsenic and lead that are near or below background values. This also supports the assertion that lead and arsenic impacts very near the surface are likely due to particulate migration or surface water transport, rather than being attributable to background conditions.

The full extent of residential impacts has not been determined as many yards have not yet been sampled. Additional parcels near the Chaparral Gulch or downwind of the Iron King Mine or Humboldt Smelter AOIs may be impacted by air particulate migration or surface water transport. Additional soil sampling of parcels in the vicinity of these areas will assist EPA in fully evaluating the impacts to residential and public areas (see Figure ES-7).

5.2.4.2 Background Areas

The background areas evaluation included three background areas and native bedrock material that were sampled as part of the EPA RI field investigation, and additional background areas that were sampled during previous field investigations. These datasets demonstrate that concentrations of arsenic and lead vary by soil type and proximity to the Site. Background Soil Type 1 was generally higher in arsenic and lead concentrations than either Background Soil Type 2 or 3. Background Soil Type 1 samples were collected northwest of the Iron King Mine Area of Interest (see Figure ES-4). Background Soil Type 2 samples were collected southwest of the Iron King Mine Area of Interest. Background Soil Type 3 samples were collected south of the Humboldt Smelter Area of Interest. In addition, bedrock samples were collected at various locations throughout the Site. These samples generally contained elevated concentrations of arsenic, demonstrating that the native material in this area contains minerals (e.g., arsenopyrite)

that have elevated concentrations of arsenic. The background concentration of arsenic is above its respective soil screening level.

Historic background dataset Background H-1 was collected in an area that is in an old surface water transport pathway for the Iron King Mine and the Background H-2 dataset was collected downwind from the Iron King Mine. Therefore, these two areas may have some anthropogenic or non-native contributions of metals from Iron King Mine migration pathways.

5.2.5 Ground Water AOI

The Ground Water Area of Interest includes the shallow alluvium and deep bedrock ground water. The general direction of ground water flow is from west to east. As such, ground water flows from under the Iron King Mine Area of Interest into areas under the residential neighborhoods to the east. In addition ground water under the Humboldt Smelter flows either towards the Aqua Fria or towards the Lower Chaparral Gulch.

At the Iron King Mine, sulfate, TDS, arsenic, and lead are present at concentrations in excess of twice their respective standards (i.e., maximum contaminant levels [MCL] or National Secondary Drinking Water Standards [NSDWS]). The presence of soluble metal ions (e.g., sulfate) to solution may be from an anthropogenic (i.e. man-made) mineral substrate (e.g., tailings) or from a natural geologic feature (e.g., ore or bedrock) that is high in sulfate. Although both mechanisms are likely occurring at various degrees throughout the Site, there is little doubt that the sulfate in ground water is at least exacerbated if not wholly attributable to historic mining processes (i.e., ground water contact with the mine shaft/adit material or tailings material).

Ground water in the vicinity of Humboldt Smelter (i.e., MW-01-S and the wells to the north) have chloride as the dominant anion as opposed to sulfate. The source of chloride is likely from a natural geologic feature (i.e., alkali basalt) that is high in chloride, sodium, and potassium; monitoring well MW-01-S was completed in basalts of the Tertiary Hinkley Formation. Although the chloride in ground water is likely due to a natural geologic feature, it is possible that it could be related to historic smelting operations. During smelting operations, chlorination is commonly used to decompose spent cyanide in precious metals leaching operations; it is also used for oxidizing metal sulfides.

Ground water collected from municipal and private wells throughout Dewey-Humboldt reveal the presence of arsenic above the MCL in some residential wells. Elevated arsenic (i.e. arsenic above the MCL) was detected in private and municipal wells upgradient, cross-gradient, and many miles away from the Site. Other chemicals found in private and municipal wells include: sulfate, chloride, and TDS.

Elevated concentrations of arsenic in ground water are localized (i.e., in proximity of ore deposits or residual mine material). This is expected given the low mobility of arsenic under neutral pH conditions. Arsenic concentrations within the Iron King Mine Main Tailings Pile and immediately downgradient are less than the MCL. This indicates that elevated arsenic concentrations found in the Town of Dewey-Humboldt and surrounding area are due to natural geologic formations (e.g. arsenic bearing minerals in local volcanics) and not due to historic

mining or smelting activities. The variability and magnitude of arsenic concentrations in the vicinity of the Site are similar to those throughout Arizona.

5.3 CSM SUMMARY

The CSM for the Iron King Mine – Humboldt Smelter Superfund Site is centered on source media (e.g., tailings, ash, etc.) that migrates to other areas mainly via air particulate migration, surface water transport, and leaching to ground water (see Figure ES-5). Arsenic and lead have been detected in soils/sediments at concentrations in excess of their respective screening levels. At the Iron King Mine and Humboldt Smelter, this is primarily the result of original deposition of source materials (i.e., principal or low-level threat wastes) in the form of tailings, ash, etc. In the Waterway Area of Interest, impacts are largely the result of surface water transport. In the Off-site Soil Area of Interest, impacts are mainly attributed to windborne deposition of fine-grained materials. However, residential parcels in close proximity to the Chaparral Gulch have been impacted by surface water transport. Although arsenic and lead concentrations in some areas are elevated, source attribution in these areas is complicated by elevated background concentrations of these metals. For areas with arsenic and lead concentrations slightly above background concentrations and/or screening levels, it is difficult to determine if the exceedance is due to natural background conditions or to historic mining and smelting activities.

Surface water and ground water have been impacted as a result of standard geochemical processes that occur when natural waters come in contact with materials with a high leaching potential. This geochemical reaction, known as Acid Mine Drainage generation, results in a localized decrease in the pH of water as well as the release of metals (e.g., arsenic, lead, etc.), and anions (e.g., sulfate, chloride, etc.), as well as an increase in the TDS. As the pH of the water becomes more neutral, the metals become less mobile, while the sulfate and TDS concentrations remain high.

Ambient air in the vicinity of the Iron King Mine and Humboldt Smelter Areas of Interest have higher concentrations of arsenic and/or lead than the background station or Humboldt In-Town station near the Humboldt Elementary School; these elevated concentrations demonstrate that the Iron King Mine and Humboldt Smelter Areas of Interest are sources of contamination for downwind (e.g., residential) properties. Although the limit of particulate migration is subject to uncertainty, arsenic and lead in residential yard surface soil near the Iron King Mine and Humboldt Smelter Areas of Interest are higher than further downwind (e.g., near the Humboldt Elementary School). This is consistent with the information obtained from the Humboldt In-town air sampling station near the Humboldt Elementary School, which had concentrations of arsenic and lead similar to background. These lines of evidence demonstrate that although arsenic and/or lead particulate migration from the Iron King Mine and Humboldt Smelter Areas of Interest is occurring, the extent of air particulate migration is a few to several blocks from the source areas. Although National Ambient Air Quality Standards for lead and PM-10 were exceeded at the Humboldt Smelter, it should be noted that none of the maximum concentrations in the air samples exceeded the Health-Based Guidelines for Acute (i.e., Shorterm) Exposure.

Ground water has been impacted by arsenic, lead, sulfate, chloride, and TDS. Because of their low mobility, impacts from both arsenic and lead are localized. However, ground water downgradient of the Iron King Mine is impacted from sulfate-dominated TDS as a result of contact with tailings or from a natural geologic feature that is high in sulfate. Although both

mechanisms are likely occurring at various degrees throughout the Iron King Mine Area of Interest, there is little doubt that the sulfate in ground water is at least exacerbated if not wholly attributable to historic mining processes (i.e., contact with mine adit material or tailings material). Also, ground water in the vicinity of the Humboldt Smelter is impacted from chloride-dominated TDS from a natural geologic feature or as a result of smelting operations at the Humboldt Smelter. There are a few wells within the Iron King Mine and Humboldt Smelter Areas of Interest that are impacted by arsenic from their proximity to ore deposits or residual mine material. However, elevated arsenic concentrations found in wells within the Town of Dewey-Humboldt and surrounding area are due to contact with natural geologic formations. The variability and magnitude of arsenic concentrations in the vicinity of the Site are similar to those throughout Arizona.

6. HUMAN HEALTH RISK ASSESSMENT

The following sections present the methodology and summary of results for the HHRA.

6.1 INTRODUCTION

The role of the human health risk assessment is to quantify the risks associated with potential exposure to hazardous substances at a site in the absence of any remedial action or control, including institutional controls. Institutional controls are legal or administrative tools used to maintain protection of human health and the environment at sites (e.g. property use restrictions). Therefore, a Human Health Risk Assessment was performed to estimate the probability and magnitude of potential adverse human health effects from exposure to contaminants associated with the Site assuming no remedial action was taken. It provides the basis for taking action and identifies the exposure areas, exposure pathways, and contaminants that may be considered for remedial action.

The Human Health Risk Assessment contains the following information: the objectives, the methodology for data grouping and identification of Chemicals of Potential Concern, the exposure assessment, the toxicity assessment, the site-specific risk assessment results, and the uncertainty analysis.

6.2 OBJECTIVES

This Human Health Risk Assessment was conducted to estimate potential human health risks associated with possible exposure to site-related chemicals under current and potential future land use. It was conducted in the absence of remedial, engineering, or institutional controls and without regard to future remedial action. The specific objectives of this Human Health Risk Assessment are to:

- Estimate potential human health risks associated with current and potential future land use conditions
- Identify the environmental media, Chemicals of Potential Concern, and pathways that pose the most risk.

To accomplish these objectives, the following framework was used to estimate potential risk to human health:

- **Selection of Chemicals of Potential Concern –** Groups analytical data by exposure area and medium for the selection of Chemicals of Potential Concern.

- **Exposure Assessment** – Estimates the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures, and the pathways (e.g., ingestion of contaminated soil) by which humans are potentially exposed.

- **Toxicity Assessment** – Determines the types of adverse health effects associated with chemical exposures, and the relationship between the magnitude of exposure (dose) and severity of adverse effects (response).

- **Risk Characterization and Uncertainty Analysis** – Summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of human health risks.

The Human Health Risk Assessment was performed on human health exposure scenarios that estimated the reasonable maximum exposure (RME) to Chemicals of Potential Concern. The reasonable maximum exposure is defined as the highest contaminant exposure that is reasonably expected to occur at a Site. The reasonable maximum exposure is estimated for individual exposure pathways and then summed across multiple pathways as appropriate. The intent of the reasonable maximum exposure is to develop a conservative (i.e., safe) estimate of exposure that is still within the range of possible exposures.

6.3 COPC IDENTIFICATION

Chemicals of Potential Concern are chemicals that are carried through the quantitative exposure and risk estimate portions of the Human Health Risk Assessment. All chemicals that were detected in soil, sediment, surface water, ground water, and ambient air data are Chemicals of Potential Concern. The only restriction used in the selection of Chemicals of Potential Concern was the removal of four inorganics (i.e., calcium, magnesium, sodium, and potassium) that are considered essential nutrients by EPA.

6.4 EXPOSURE ASSESSMENT

An exposure assessment identifies potential human receptors that could be exposed to site-related chemicals as well as the routes, magnitude, frequency, and duration of the potential exposures. The exposure receptors that are evaluated in this Human Health Risk Assessment include:

- Commercial/Industrial Workers
- Construction Worker
- Adult/Child Recreation/Trespasser
- Adult/Child Resident.

Although some of the exposure scenarios are not current (e.g., residential exposure to the Humboldt Smelter Ash Pile), no distinction was made between current and future exposure scenarios because the exposure parameters are identical. Therefore, exposure scenarios in this Human Health Risk Assessment are considered protective of current/future exposure.

According to EPA guidance, a complete exposure pathway consists of four elements:

- A source and mechanism of chemical release
- A retention or transport medium/media
- A point of potential human contact with the medium (i.e., exposure point)
- An exposure route at the exposure point (e.g., ingestion, inhalation, dermal contact, etc.).

If any of these elements is missing, except when the source itself is the exposure point, then the exposure pathway is considered incomplete. For example, if receptor does not have contact with the source of contamination or transport medium (e.g. surface water), then the exposure pathway is considered incomplete and is not quantitatively evaluated for risk.

6.5 TOXICITY ASSESSMENT

The purpose of a toxicity assessment is to evaluate whether Chemicals of Potential Concern are likely to cause adverse health effects in exposed individuals and provide an estimate of the increased likelihood or severity of the adverse effect. The toxicity assessment was accomplished via a hazard identification and dose-response assessment.

6.6 RISK CHARACTERIZATION

The final step in the Human Health Risk Assessment is the characterization of the potential risks associated with exposure to chemicals detected at a site. The Human Health Risk Assessment evaluated the Site for potential cancer risks and noncancer hazards from soil, sediment, surface water, ground water, and ambient air.

Most of exposure areas within the Iron King Mine, Humboldt Smelter, and Waterway Areas of Interest have cancer risks greater than 1E-04 (1 in 10,000) or noncancer hazards greater than 1 for all four categories of receptors (i.e., commercial/industrial worker, construction worker, adult/child recreational/trespasser, and adult/child resident). Information from the EPA's reuse assessment was incorporated into the Human Health Risk Assessment to present the cancer risk and noncancer hazards for the most likely exposure scenario for each area. The areas where soil/sediment have a cancer risk greater than 1E-04 (1 in 10,000), a noncancer hazard greater than 10, or a lead PRG 99th percentile exceedance are the areas that warrant an evaluation of remedial alternatives (see Figure ES-6). It should be noted that Background Soil Type 1 has a cancer risk of 1E-04 (1 in 10,000) and a noncancer hazard of 5, which demonstrates the importance of background to the overall discussion of risk estimates. Because Background Soil Type 1 (i.e., BgD) is interpreted as being the dominant soil type at the Iron King Mine, Humboldt Smelter, and Off-site Soil Areas of Interest, additional samples will be collected from this soil type to ensure this soil type has been fully characterized. In addition, the surface water associated with these exposure areas has cumulative risks greater than 1E-04 (1 in 10,000) due to elevated concentrations of arsenic. Because surface water concentrations are highly dependent

on the underlying substrate, the remedial alternatives for impacted surface water should consider both soil/sediment and associated surface water.

The Human Health Risk Assessment evaluated data from 65 parcels in the Off-site Soil Area of Interest for adult/child residential exposure to soil. The 65 parcels included 17 residential parcels that were sampled in 2005 as part of the EPA Removal Assessment, 45 residential parcels that were sampled in 2008 and 2009, and the Humboldt Elementary School playground (3 parcels). Of the 65 parcels:

- 23 have a cancer risk greater than 1E-04 (1 in 10,000) or noncancer hazards greater than 10
- 36 have an exceedance of the lead PRG 99th percentile.

After analysis and review of the results, EPA determined that many residential yards have levels of arsenic and lead that could increase the potential for health effects over the long-term. These areas warrant an evaluation of remedial alternatives (see Figure ES-7). It should be noted that the Humboldt Elementary School playground in the Town of Dewey-Humboldt does not warrant further evaluation based on a toxicological review of the data. Furthermore, the levels of Chemicals of Potential Concern in the Humboldt Elementary School playground are similar to background concentrations of these chemicals. It should also be noted that many of the residential parcels have cancer risks or noncancer hazards similar to Background Soil Type 1, which has a cancer risk of 1E-04 (1 in 10,000) and a noncancer hazard of 5. Therefore, the evaluation of remedial alternatives for off-site areas should consider the contribution of background risks to the discussion of overall risk estimates.

Most of the ground water locations have cumulative risks greater than 1E-04 (1 in 10,000) due to elevated concentrations of naturally-occurring arsenic in ground water. The remaining locations have risks between 1E-04 (1 in 10,000) to 1E-06 (1 in 1,000,000). In addition, many of the locations have arsenic exceedances of the EPA Maximum Contaminant Level. EPA's Maximum Contaminant Levels are enforceable drinking water standards that apply to public water systems (i.e. systems that serve 15 locations or 25 people more than 6 months out of the year).

Wells within the Iron King Mine and Humboldt Smelter Areas of Interest are impacted by arsenic from their proximity to ore deposits or residual mine material. These locations warrant an evaluation of remedial alternatives. However, elevated arsenic concentrations found in private and municipal wells within the Town of Dewey-Humboldt and surrounding area are a result of contact with natural geologic formations and are not indicative of impacts from historic mining and smelting operations. The variability and magnitude of arsenic concentrations in the vicinity of the Site are similar to those throughout Arizona.

Ground water downgradient of the Iron King Mine is impacted from sulfate-dominated TDS as a result of contact with tailings or from a natural geologic feature that is high in sulfate; these elevated concentrations of sulfate may cause harmful effects (e.g. dehydration). Wells impacted by sulfate-dominated TDS warrant an evaluation of remedial alternatives. The ground water in the vicinity of the Humboldt Smelter is impacted from chloride-dominated TDS from a natural geologic feature or as a result of smelting operations at the Humboldt Smelter; these elevated concentrations of chloride are unlikely to cause harmful effects but should be further evaluated to identify the source of chloride.

7. SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT AND BASELINE RISK ASSESSMENT PROBLEM FORMULATION

This Ecological Risk Assessment (ERA) presents the results of the Screening Level Ecological Risk Assessment and Baseline Risk Assessment Problem Formulation. The Ecological Risk Assessment includes definition of assessment and measurement endpoints; exposure and toxicity assessment; data evaluation; and screening level risk characterization.

7.1 CONCEPTUAL SITE MODEL AND PROBLEM FORMULATION

The Ecological Risk Assessment began with a screening level evaluation which identified that the majority of chemicals detected would require further evaluation in the Ecological Risk Assessment. A conceptual model was developed for the site based on review of site conditions and existing data. This model identified that the Site provides terrestrial and aquatic habitats. The conceptual model identifies arsenic, lead, and other metals associated with mining as the primary Chemicals of Potential Concern, although organic chemicals associated with specific areas may also be Chemicals of Potential Concern.

Based on the conceptual model, assessment endpoints were selected to represent a broad range of ecological receptors within the Site's ecological community. The assessment endpoints included the survival, growth, and reproduction of terrestrial plants, soil invertebrates, aquatic and benthic organisms, herbivorous mammals and birds, insectivorous mammals and birds, predatory mammals and birds, piscivorous birds, and reptiles. Based on expected patterns of site use by wildlife and differences between potential sources of chemicals, the site was divided into five exposure groupings: West Exposure Grouping; East Exposure Grouping; Agua Fria River Exposure Grouping; In-Town West Exposure Grouping; and In-Town East Exposure Grouping.

7.2 MEASUREMENT ENDPOINTS AND DATA EVALUATION

Measurement endpoints were selected to provide a quantifiable means of characterizing risks. The measurement endpoints for plants, soil invertebrates, and aquatic and benthic organisms included comparison of maximum and mean exposure point concentrations to benchmarks. The benchmarks selected are highly precautionary and thus provide a conservative assessment of site risks. Additional endpoints were evaluated for plants utilizing the data available from past habitat surveys to determine whether the plant species list for the site is similar to that off-site, and to identify any signs of vegetative stress.

For higher trophic level wildlife, measurement endpoints were based on the results of food web models that predict the dose of chemicals ingested by wildlife. These doses were compared to benchmarks and off-site background doses. The first measurement endpoint evaluated was a screening level comparison of maximum case scenario doses to no-effects benchmarks. Additional measurement endpoints included comparison of mean case scenario doses to no-effects benchmarks, low effects benchmarks, and background doses. Because of a lack of data available for assessment of reptile and amphibian exposures, measurement endpoints use qualitative means (surrogate receptors) to assess risks to reptiles and amphibians.

To test these measurement endpoints, both site-specific and literature-based information was used to develop exposure and toxicity methods and assumptions for use in estimating risks. These tools were used in the data evaluation to test each measurement endpoint as a line of

evidence. Lines of evidence were combined in a qualitative weight of evidence discussion to determine the potential for risks.

The screening level ecological risk assessment and baseline problem formulation concluded that the Chemicals of Potential Concern identified for the exposure groupings require additional consideration either through risk management or further assessment.

The East Grouping encompasses the Humboldt Smelter Area of Interest, the Chaparral Gulch to the east of Highway 69, and the Agua Fria River. The West Grouping encompasses the Iron King Mine Area of Interest. The assessment found that highly elevated concentrations of metals pose risks to all receptor groups (i.e., terrestrial plants, terrestrial invertebrates, aquatic and benthic organisms, mammals, birds, and reptiles and amphibians). Therefore, cleanup levels should be developed for the evaluation of remedial alternatives for the East and West Groupings.

Benchmark exceedances indicate the potential for risks within the Agua Fria Exposure Grouping; however, benchmarks are based on precautionary data from the scientific literature, and habitat in the Agua Fria River appears relatively healthy. Nevertheless, cleanup levels should be developed for the evaluation of remedial alternatives for risks to aquatic and benthic organisms, birds, and reptiles and amphibians. Although the potential for risk could increase should chemicals continue to migrate from upstream uncontrolled sources, the potential for risk should decrease if upstream sources are controlled and elevated metal concentrations in sediment dissipate to near background concentrations over time. Risk management decisions within the Agua Fria itself should weigh the potential for ecological risk with the intrusiveness of remedial alternatives that may lead to a reduction of the habitat quality.

The In-Town East Exposure Grouping comprises commercial or residential parcels north, east, and west of the Humboldt Smelter. The In-Town West Exposure Grouping comprises four commercial or residential parcels north of the Iron King Mine area and north of Chaparral Gulch. The assessment found that concentrations of metals were somewhat elevated and may pose risks to several receptor groups (i.e., terrestrial plants, terrestrial invertebrates, mammals, and reptiles). However, the assessment also identified that the areas evaluated provide poor habitat due to development and that concentrations of several metals are similar to background values. Further efforts should focus on developing cleanup levels and evaluating habitat quality for use in the evaluation of remedial alternatives for the In-Town East and In-Town West Groupings.

8. DATA GAPS, RECOMMENDATIONS, AND ADDITIONAL CONSIDERATIONS

8.1 DATA GAPS AND RECOMMENDATIONS

Data gaps and recommendations for further characterization were identified based on the results of the RI. These recommendations will facilitate a better understanding of the Site and can be conducted during subsequent phases of the RI and during the Feasibility Study.

- The western dam within the Iron King Mine Main Tailings Pile has already exhibited failure and its stability should be considered in the evaluation of remedial alternatives.

Therefore, an engineering evaluation of the Iron King Mine Main Tailings Pile should be conducted to evaluate the long-term stability of the dam.

- Large portions of the Humboldt Smelter Slag Pile have cleaved off into the Agua Fria River. In addition, cracks and fractures are apparent on the upper surface. Therefore, an engineering evaluation of the Humboldt Smelter Slag Pile should be conducted to evaluate the long-term stability of this material.

- EPA has sampled approximately 65 parcels in the Town of Dewey-Humboldt during the RI. Parcels with elevated arsenic and lead concentrations were located in close proximity to the Iron King Mine and Humboldt Smelter AOIs, or the Middle Chaparral Gulch. Based on existing data, yards further away from the Iron King Mine and Humboldt Smelter Areas of Interest are much less likely to be impacted from particulate migration or surface water transport. Conversely, yards closer to the Iron King Mine or Humboldt Smelter Areas of Interest have a higher probability of being impacted. The full extent of residential impacts has not been determined as many parcels have not yet been sampled. Additional parcels near the Chaparral Gulch or downwind of the Iron King Mine or Humboldt Smelter AOIs may be impacted by air particulate migration or surface water transport. Therefore, additional soil sampling of parcels in the vicinity of these areas will assist EPA in fully evaluating the impacts to residential and public areas. Results from the comprehensive sampling will be used to plan a residential yard cleanup effort. EPA will sample additional residential yards in the area outlined in Figure ES-7. If you live within this area and EPA has not sampled your yard, please contact EPA. EPA will conduct residential yard sampling at no cost to the resident.

- The range of arsenic and lead concentrations in soil demonstrates that there is a great variability in concentrations in the native material of this area. Because background contributions are important to the overall discussion of risk estimates and risk management for the Site, additional background soil characterization is necessary to evaluate the impacts from the Site. The Background Soil Type 1 (i.e., BgD) is interpreted as being the dominant soil type at the Iron King Mine, Humboldt Smelter, and Off-site Soil Areas of Interest. Therefore, additional samples should be collected from this soil type (see Figure ES-4).

- Ground water downgradient of the Iron King Mine is impacted from sulfate-dominated TDS as a result of contact with tailings or from a natural geologic feature that is high in sulfate (see Figure ES-5). The ground water in the vicinity of the Humboldt Smelter is impacted from chloride-dominated TDS from a natural geologic feature or as a result of smelting operations at the Humboldt Smelter. The areas of impacted ground water are not well-defined. Therefore, a well inventory should be conducted to identify wells with the area of potential impact. Ground water samples should be collected from these wells and analyzed for general chemistry parameters. This information will assist in determining the extent of the sulfate and chloride impacts. Additional information about the alluvial and bedrock aquifer characteristics should be gathered from well development records.

- The maximum lead concentration in soil of 18,100 milligrams per kilogram (mg/kg) in Off-site Soil Area 120 is considered an outlier that is likely associated with lead-based paint residue. However, additional characterization of this parcel may be warranted to determine the source of lead.

- The lead concentration in ground water at location GW-999953 was 49.8 micrograms per liter (µg/L), which is likely due to lead pipes. Nevertheless, this location requires further consideration.

8.2 ADDITIONAL CONSIDERATIONS

Additional considerations were identified for local residents, community members, landowners, or potentially responsible parties (PRPs).

- Many private wells in the vicinity of the Site have arsenic concentrations above the EPA Maximum Contaminant Level of 10 µg/L. Although these wells are not considered impacted by the Site, drinking water with arsenic concentrations above the drinking water standard may present a health risk to consumers. Therefore, residents drinking from private wells should have their wells tested and take precautionary measures (e.g., filtering water), as appropriate. Additional information on drinking water from household wells can be found in Appendix I and at the following website:

  http://www.epa.gov/privatewells/pdfs/household_wells.pdf

- Air monitoring was conducted to characterize the nature and extent of contamination and to evaluate human health and ecological risk. Air monitoring demonstrated that particulates containing Chemicals of Potential Concern from the Iron King Mine and Humboldt Smelter Areas of Interest migrate to the residential areas during high wind events. Therefore, it would be prudent for landowners or PRPs to conduct dust suppression activities (e.g., wetting tailings or ash) prior to high wind events to control particulate migration from source areas.

- A Cultural Resource and Historic Building Survey conducted in November 2008 in compliance with Section 106 of the National Historic Preservation Act. This evaluation concluded that the Iron King Mine and the Humboldt Smelter are eligible for inclusion in the National Register of Historic Places under Criterion D. Criterion D is for resources that have yielded information important in prehistory or history. Both properties yielded important information regarding the history of the Big Bug Mining District. Community members may consider forming a workgroup to evaluate options for the long-term management or use for buildings/structures that may have historic value (e.g., smelter), but will not be subject to preservation activities by the EPA.

- Sampling results indicate the presence of elevated levels of arsenic and lead at the Iron King Mine, Humboldt Smelter, and Chaparral Gulch that could present health risks if a person is exposed to these metals over a long period of time. Arsenic can enter the body through breathing and/or ingesting contaminated soil. Therefore, EPA recommends that residents limit or avoid contact with soils and any water in these areas and obey EPA

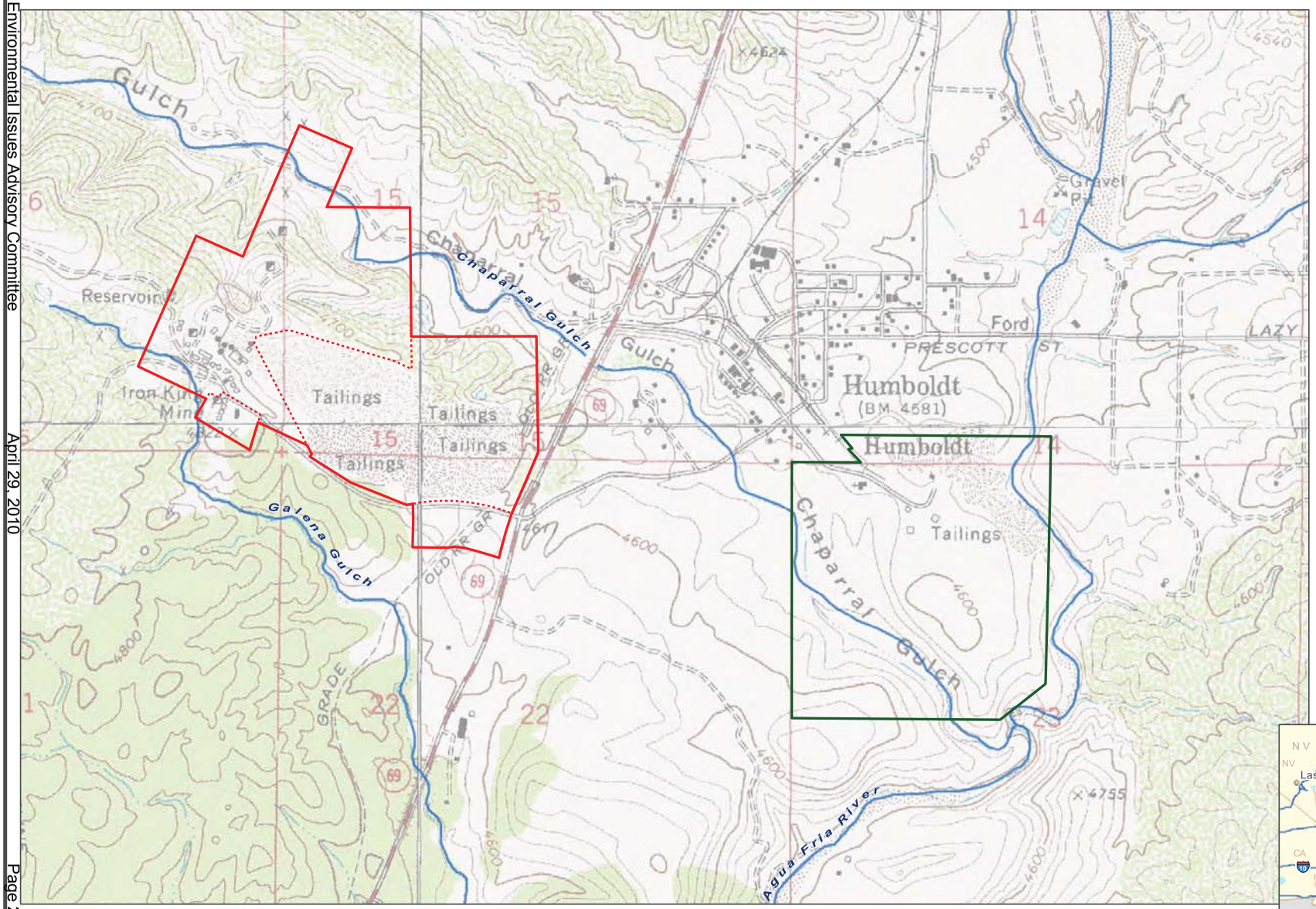
caution signs. Chaparral Gulch is easily accessible to the public as no fences or gates prohibit access. However, EPA advises residents, especially young children, to stay out of this area.

9. COMMUNITY OUTREACH MATERIALS

The EPA recognizes that the public has a right to be involved in the federal government's decision-making process. EPA's experience has been that when the public is involved in EPA's work, the cleanup process results in a better outcome and a more robust remedy. This section explains how EPA has worked with the Dewey-Humboldt community to enhance the completeness and effectiveness of the investigation.

The RI contains a variety of documents and outreach materials geared towards community members who would like more information about specific Site issues (see Appendix I). It includes information about drinking water from household wells, water treatment options, basic information about arsenic, gardening in arsenic-contaminated soils, and ways to protect your health. It also contains a variety of documents and outreach materials meant for the general public as follows:

- Drinking water from household wells
- Arsenic in drinking water
- Water treatment options
- Public health statements on arsenic, lead, and sulfate
- Safe gardening practices
- Local, state, and federal environmental resources and contact information.



Legend

- Iron King Mine
- Humboldt Smelter

Note:
Boundaries are approximate and may be subject to change pending further investigation

0 1,000
Feet

EPA Identification Number: AZ0000309013

Topographic Map Source:
USDA-NRCS-NCGC, 2002
Basemap Source: ESRI StreetMap, 2006

Figure ES-1 – Site Location
Remedial Investigation Report

Remedial Investigation/Feasibility Study
Iron King Mine - Humboldt Smelter Superfund Site
Dewey-Humboldt, Yavapai County, Arizona

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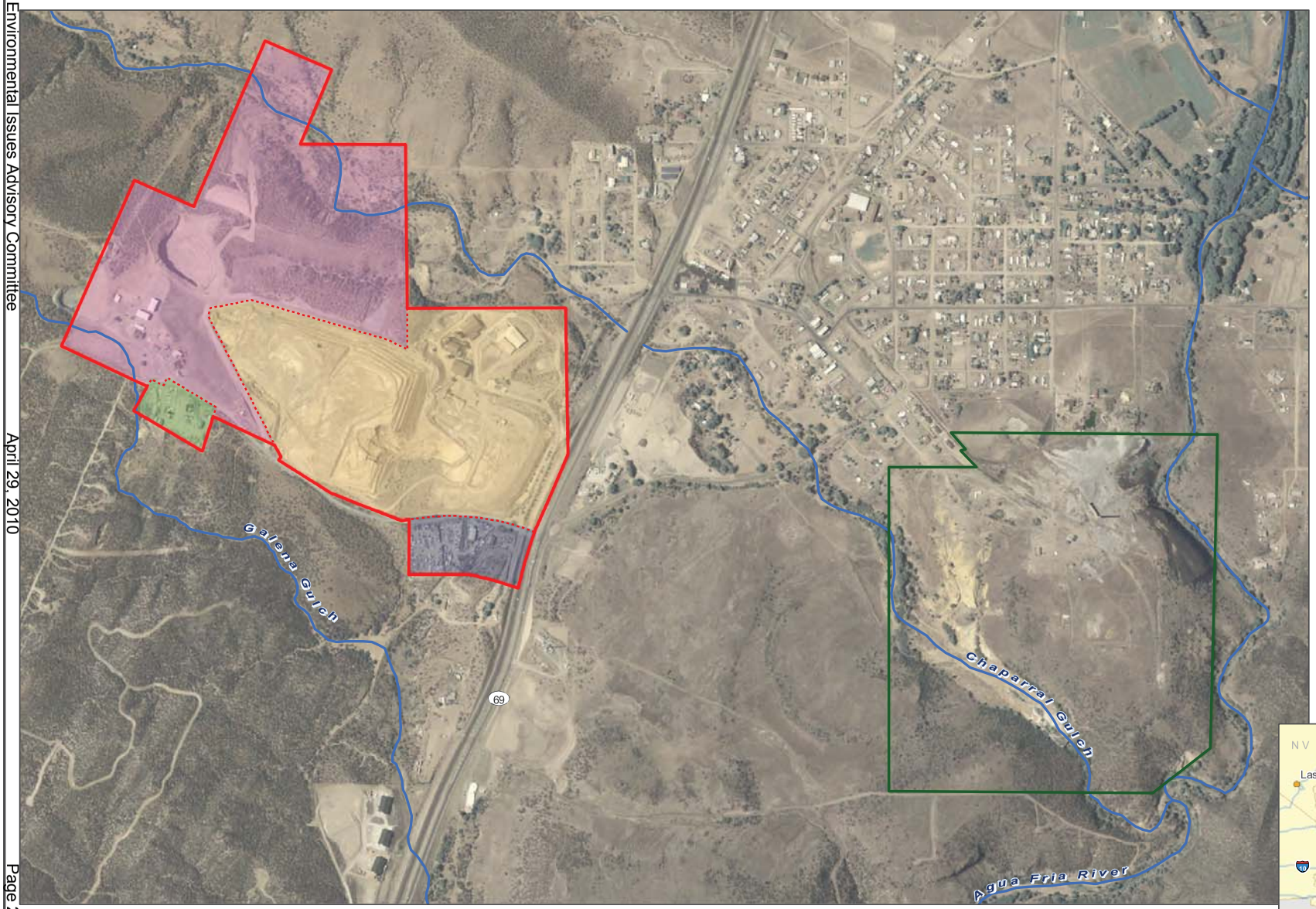

Legend

Five Areas of Interest

Iron King Mine

- Iron King Mine Proper Area
- Iron King Operations Area
- Former Fertilizer Plant Area
- Salvage Yard

Humboldt Smelter

Waterways
Chaparral Gulch, Galena Gulch, Agua Fria River

Off-Site Soil
Area not depicted but includes adjacent properties

Ground Water
Area not depicted but includes ground water from shallow alluvial and deep bedrock

Note:
Boundaries are approximate and may be subject to change

0 500 1,000
Feet

EPA Identification Number: AZ0000309013

Aerial Photo Source: Yavapai County GIS, 2007
Basemap Source: ESRI StreetMap, 2006

Figure ES-2 – Areas of Interest
Remedial Investigation Report

Remedial Investigation/Feasibility Study
Iron King Mine - Humboldt Smelter Superfund Site
Dewey-Humboldt, Yavapai County, Arizona

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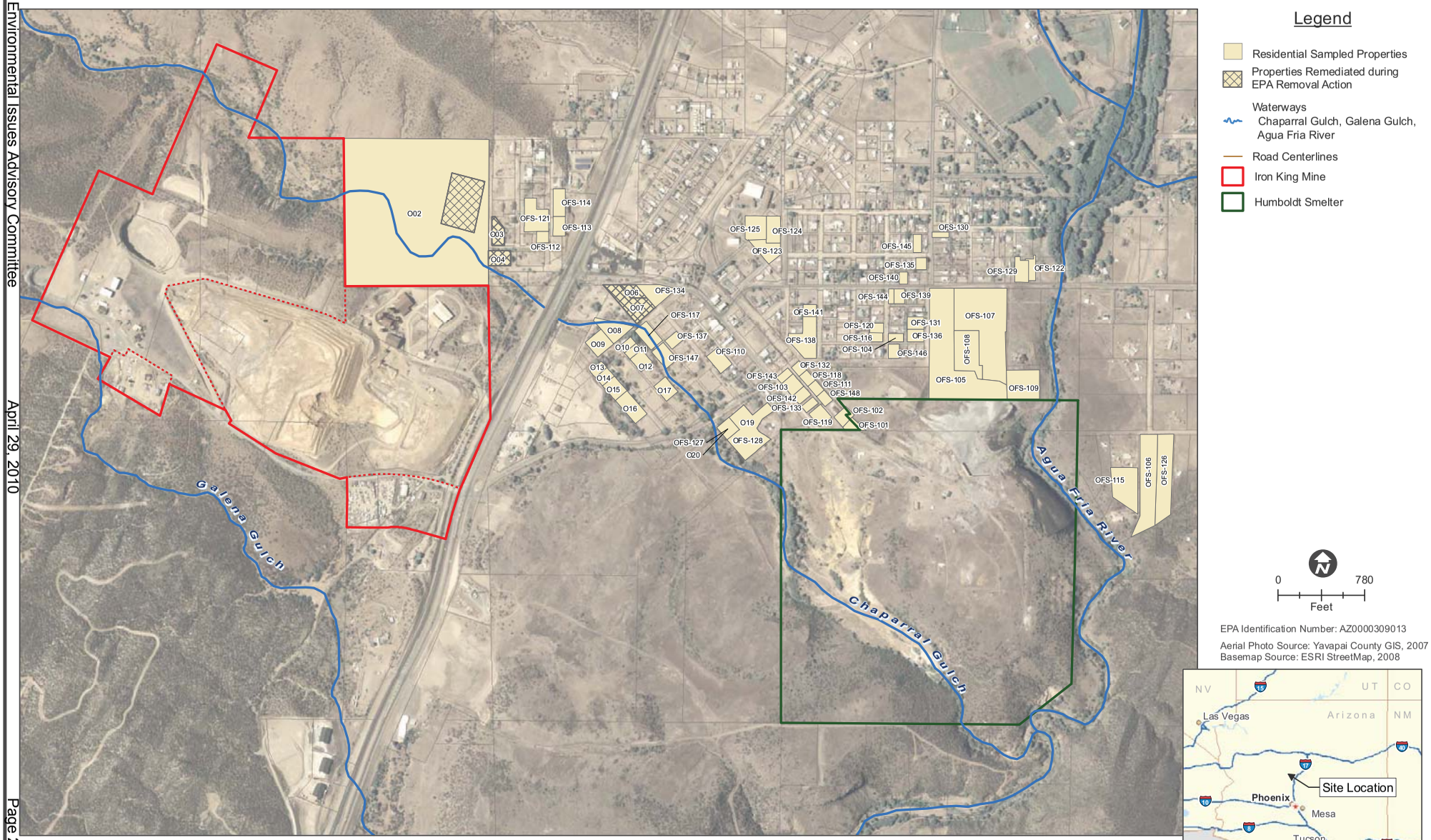

Figure ES-3 – Residential Areas
Remedial Investigation Report

Remedial Investigation/Feasibility Study
Iron King Mine - Humboldt Smelter Superfund Site
Dewey-Humboldt, Yavapai County, Arizona

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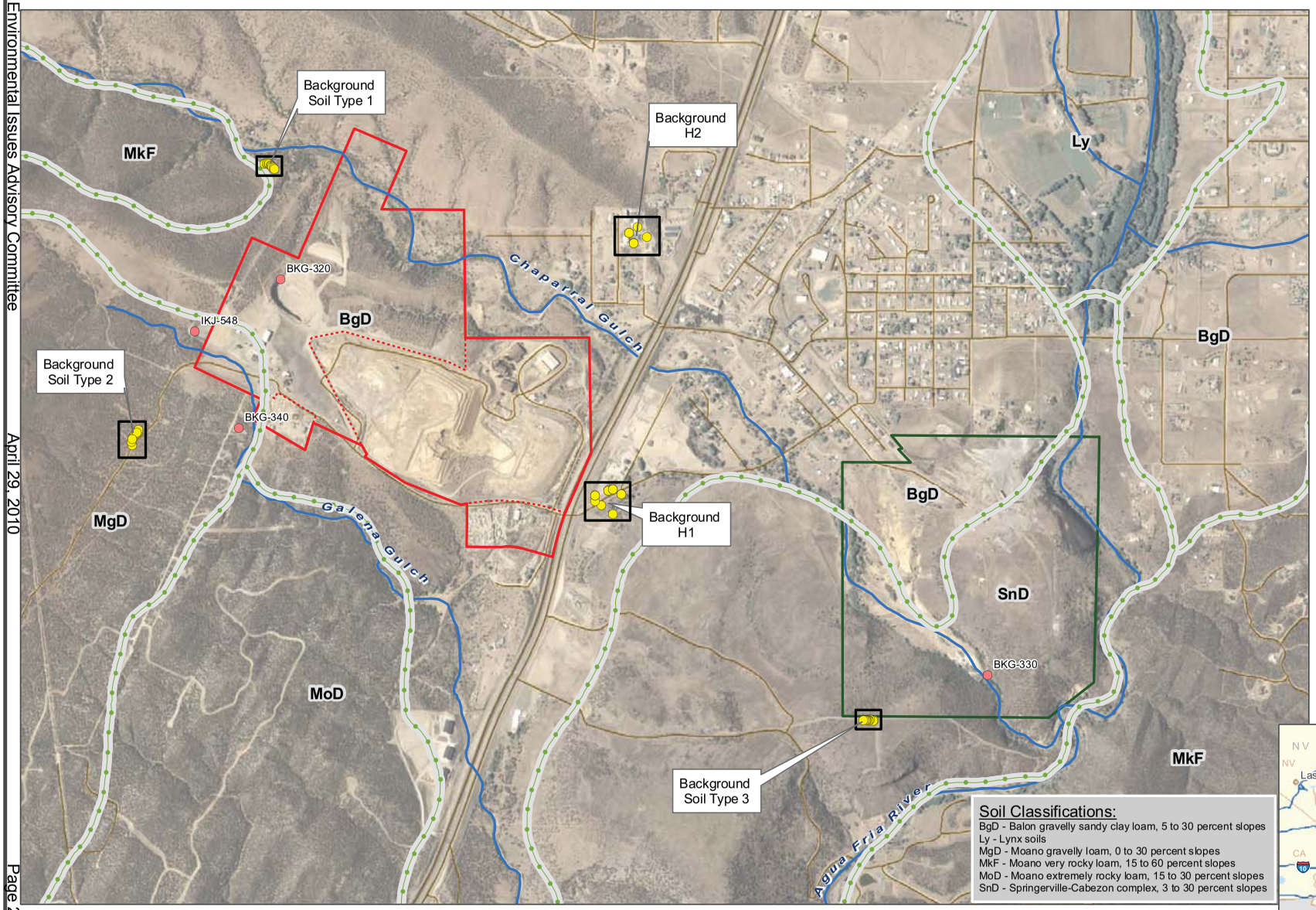

Legend

- Soil Sample Location
- Bedrock Sample Location
- Waterways: Chaparral Gulch, Galena Gulch, Agua Fria River
- Road Centerlines
- Iron King Mine
- Humboldt Smelter
- Soil Classification Area
- BgD Soil Classification Text

0 1,000 Feet

EPA Identification Number: AZ0000309013

Aerial Photo Source: Yavapai County GIS, 2007
Basemap Source: ESRI StreetMap, 2008

Soil Classifications:
BgD - Balon gravelly sandy clay loam, 5 to 30 percent slopes
Ly - Lynx soils
MgD - Moano gravelly loam, 0 to 30 percent slopes
MkF - Moano very rocky loam, 15 to 60 percent slopes
MoD - Moano extremely rocky loam, 15 to 30 percent slopes
SnD - Springerville-Cabezon complex, 3 to 30 percent slopes

Figure ES-4 – Background Areas
Remedial Investigation Report

Remedial Investigation/Feasibility Study
Iron King Mine - Humboldt Smelter Superfund Site
Dewey-Humboldt, Yavapai County, Arizona

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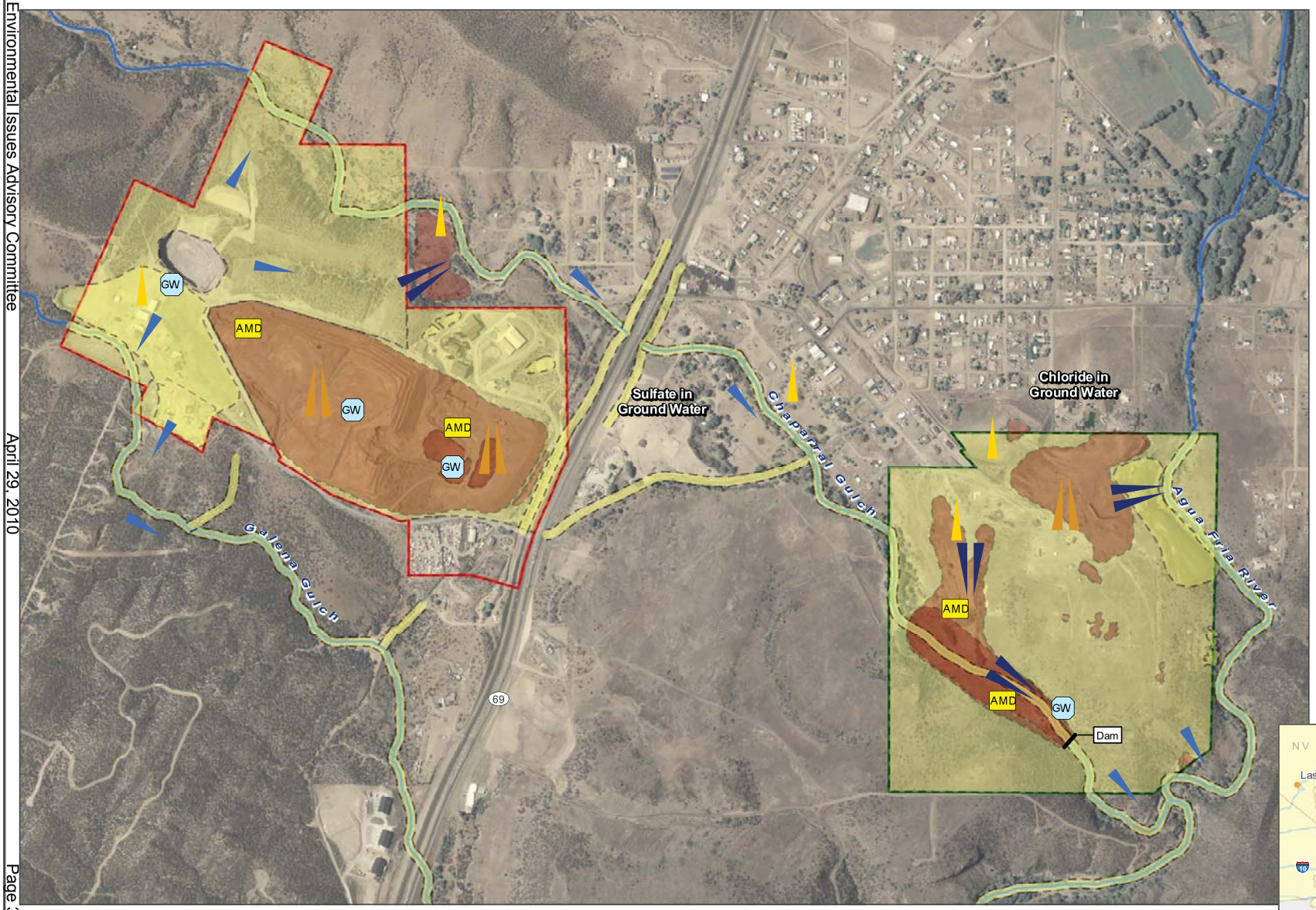

Legend

- Humboldt Smelter
- Iron King Mine
- Areas with Low-Level Threat Waste
- Areas with Principal Threat Waste
- Waterways
  - Chaparral Gulch, Galena Gulch, Agua Fria River

Primary Migration Pathways

- AMD Acid Mine Drainage
- GW Leaching to Ground Water
- Air Particulate, High Degree of Severity
- Air Particulate, Low Degree of Severity
- Surface Water, High Degree of Severity
- Surface Water, Low Degree of Severity

Notes:
1. Boundaries are approximate and may be subject to change.
2. No waste threat level is associated with the following sample gourps: Iron King Mine Glory Hole, Iron King Mine Salvage Yard, Humboldt Smelter Off-site Migration, Off-site Soil Area 02 through 020, Off-site Soil Area 101 through 148, and Ground Water.
3. Off-Site Soil AOI not depicted but includes adjacent properties.
4. Ground Water AOI not depicted but includes on-site and off-site ground water from shallow alluvial and deep bedrock.

0 1,000
Feet

EPA Identification Number: AZ0000309013

Aerial Photo Source: Yavapai County GIS, 2007
Basemap Source: ESRI StreetMap, 2006

Figure ES-5 – Conceptual Site Model
Remedial Investigation Report

Remedial Investigation/Feasibility Study
Iron King Mine - Humboldt Smelter Superfund Site
Dewey-Humboldt, Yavapai County, Arizona

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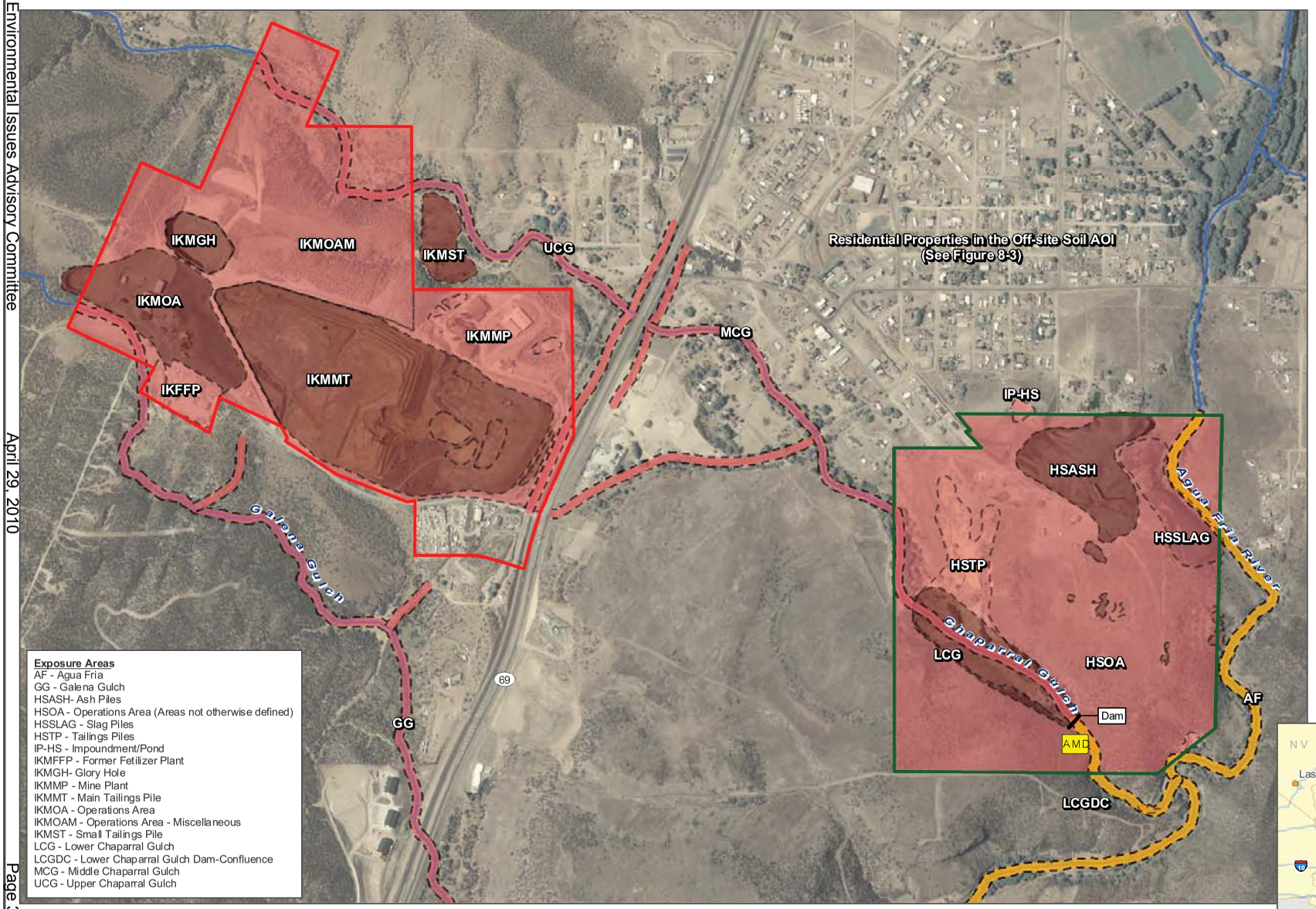

Legend

- AMD — Acid Mine Drainage
- Humboldt Smelter
- Iron King Mine

Soil, Tailings, Terrestrial Sediment, and Aquatic Sediment Areas that are shaded have a cancer risk > 1E-04 or a noncancer hazard > 10. Some areas also have a lead screening level exceedance.

- Aquatic Sediment
- Soil, Tailings and Terrestrial Sediment, 0-2 ft bgs
- Soil, Tailings and Terrestrial Sediment, 0-10 ft bgs
- Waterways: Chaparral Gulch, Galena Gulch, Agua Fria River

Note:
Buildings and structures within the Humboldt Smelter AOI are subject to Remedial Alternatives

0 1,000
Feet

EPA Identification Number: AZ0000309013

Aerial Photo Source: Yavapai County GIS, 2007
Basemap Source: ESRI StreetMap, 2006

Figure ES-6 - Key Site Characteristics
Remedial Investigation Report

Remedial Investigation/Feasibility Study
Iron King Mine - Humboldt Smelter Superfund Site
Dewey-Humboldt, Yavapai County, Arizona

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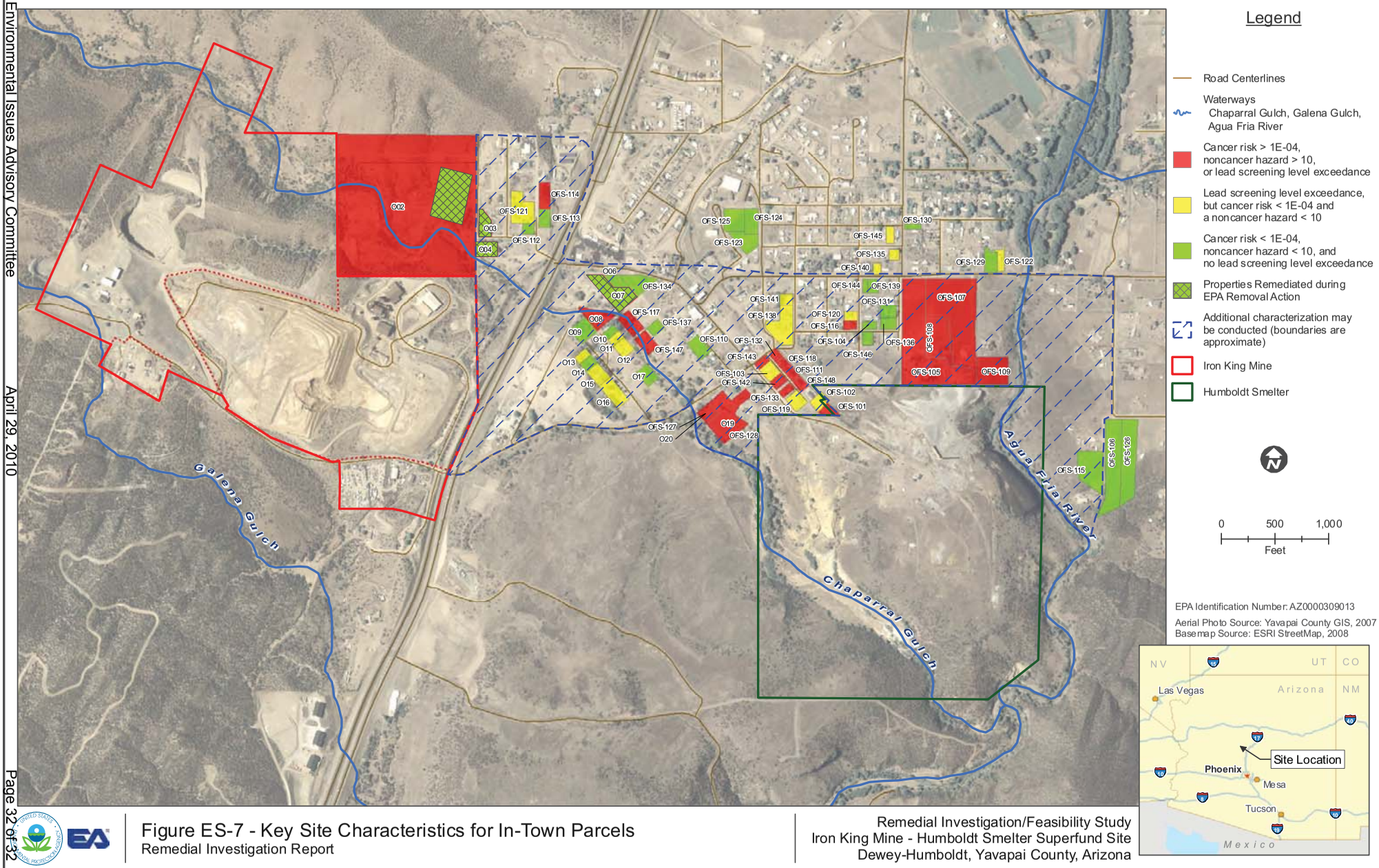

Figure ES-7 - Key Site Characteristics for In-Town Parcels
Remedial Investigation Report

Remedial Investigation/Feasibility Study
Iron King Mine - Humboldt Smelter Superfund Site
Dewey-Humboldt, Yavapai County, Arizona

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