FINAL
Feasibility Study Report
Former 15 Skeet Ranges Site – Phase 1 Parcels
Kingman Ground-to-Ground Gunnery Range
Kingman, Mohave County, Arizona
Formerly Used Defense Site (FUDS) Project No. J09AZ0412-01

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ABBREVIATIONS AND ACRONYMS

°F	degrees Fahrenheit
ADEQ	Arizona Department of Environmental Quality
ADWR	Arizona Department of Water Resources
APP	Accident Prevention Plan
ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	contaminant of concern
DoD	United States Department of Defense
ECLR	excess cancer lifetime risk
EM	Engineer Manual
FS	Feasibility Study
FUDS	Formerly Used Defense Site
GRA	General Response Action
GTG	ground-to-ground
HHRA	human health risk assessment
INPR	Inventory Project Report
ISM	incremental sampling methodology
LUC	land use control
LUCIP	Land Use Control Implementation Plan
MEC	munitions and explosives of concern
mg/kg	milligrams per kilogram
MMRP	Military Munitions Response Program
MRS	Munitions Response Site
NCP	National Contingency Plan
n.d.	no date
PAH	polycyclic aromatic hydrocarbon
PRG	preliminary remedial goal
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RD	remedial design
RI	Remedial Investigation
ROD	Record of Decision
ROE	Right-of-Entry
ROW	right-of-way
RSL	Regional Screening Level
SI	Site Inspection

SPP	systematic planning process
SRL	soil remediation level
SSHP	Site Safety and Health Plan
TCRA	time-critical removal action
TMV	toxicity, mobility, or volume
UCL	upper confidence limit
U.S.	United States
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency

EXECUTIVE SUMMARY

This Feasibility Study (FS) Report presents results of the development and evaluation of remedial alternatives for parcels/sub-parcels/rights-of-way in the 15 Skeet Ranges Site (Site) at the Former Kingman Ground-to-Ground (GTG) Gunnery Range in Mohave County, Arizona, with an excess lifetime cancer risk (ELCR) greater than 10^{-6} (i.e., unacceptable risk).

The Kingman GTG Gunnery Range is a Formerly Used Defense Site (FUDS) used during World War II for aerial gunnery training. The current Site use is almost entirely residential parcels or undeveloped parcels zoned for residential uses, some of which are under active development.

Previous investigations and field efforts, including a time-critical removal action and remedial investigation (RI) activities, indicate that debris from clay targets (also called clay pigeons or skeet) used at the skeet ranges containing polycyclic aromatic hydrocarbons (PAHs) and soils with PAH concentrations present at the Site can pose unacceptable risks to human health. Because non-cancer hazard indices and lead concentrations were below target levels in each of the parcels included in the RI, as evaluated in an updated human health risk assessment (HHRA), this FS focuses on carcinogenic PAHs, which had theoretical upper-bound ELCRs greater than 10^{-6} (i.e., unacceptable risk). The HHRA determined the complete pathways for exposure of residents to the PAHs (the contaminants of concern [COCs]) in Site soils include incidental ingestion of soil, dermal contact with soil, and inhalation of fugitive dust.

In 2024, Arizona Department of Environmental Quality (ADEQ) entered into a formal dispute resolution with the United States Army Corps of Engineers (USACE) concerning how to address potential risk from PAHs in residual skeet fragments in surface soil at the Kingman GTG Site. ADEQ was specifically concerned by the intentional potential ingestion of skeet fragments by children and fragments as a continuing source of PAHs to surface soil. As part of the formal dispute, ADEQ and USACE exchanged position papers and formed Tier 1 teams to discuss and resolve the dispute.

On 14 May 2025, USACE and ADEQ signed the Memorandum for Record resolving the formal dispute. The resolution included remediating the Site through a phased approach, developing a quantitative risk assessment and performing community engagement. The phased approach separated the work into two phases. Phase 1 addresses parcels with elevated concentrations of PAHs in soil greater than the target ELCR of 10^{-6} (i.e., unacceptable risk) based on previous sampling data. Phase 2 will address parcels that had concentrations of PAHs in soil less than the ELCR threshold or were not previously sampled. This FS only covers the Phase 1 Parcels.

Skeet fragments, unless co-located with contaminated soil, are not addressed in this FS. Phase 2 will include a supplemental RI and utilize the quantitative risk assessment to evaluate potential exposure to PAHs in residual skeet fragments in surface soil. The summary of the technical approach is documented in the *Dispute Resolution Technical Support Document* (USACE, 2025). Phase 2 Parcels will be captured in a separate FS and Record of Decision (ROD) after additional characterization.

Chemical risk associated with PAHs in soils from degraded skeet at each land parcel or subdivision was calculated as part of the RI. Within each of the RI parcels, ELCRs were calculated for seven carcinogenic PAHs: benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene). Each parcel was categorized as greater than or less than 10^{-6} (note that the highest ELCR value in the surface or subsurface was selected for categorizing each RI parcel). Ninety-seven parcels/sub-parcels/rights-of-way (ROWs) quantified with an ELCR greater than 10^{-6} are addressed in this Phase 1 FS. The presence of skeet fragments was noted at 58 of these 97 parcels/sub-parcels/ROWs.

The following remedial action objectives have been developed for the site:

- Prevent resident ingestion of, dermal contact with, and inhalation of airborne particulates of soil containing PAHs that exceed the project's soil preliminary remedial goals (PRGs; see Table ES-1).
- Remove skeet fragments that are co-located with soil containing PAHs that exceed the PRGs listed in Table ES-1.

For this FS, the focus is on parcels identified with cancer risks greater than 10^{-6} (i.e., unacceptable risk) based on soil only exposure (i.e., Phase 1 Parcels).

Table ES-1. Preliminary Remedial Goals

PAH	PRG (mg/kg)
Benz(a)anthracene	9.2
Benzo(a)pyrene	1.5
Benzo(b)fluoranthene	11
Benzo(k)fluoranthene	180
Chrysene	850
Dibenz(a,h)anthracene	1.5
Indeno(1,2,3-cd)perylene	11

Key:
mg/kg milligrams per kilogram

PAH polycyclic aromatic hydrocarbon
PRG preliminary remediation goal

The PRGs were established based on the HHRA and address potential exposures to PAHs in soil that were identified as being within the acceptable range identified in the National Contingency Plan (NCP) and Defense Environmental Restoration Program of 10^{-6} to 10^{-4} ELCR, but exceeding the point of departure for determining remediation goals of 10^{-6} ELCR. The 10^{-6} ELCR threshold is at the lower end of this established risk range, which is generally used for sensitive populations and residential land uses, and was used in the RI and in line with ongoing residential land use at the Site. The non-quantified risk posed by remaining skeet fragments, as a potential source contributing to PAH exposure at the Phase 1 Parcels, would be addressed through mitigation of exposure to skeet fragments that are co-located with PAH-contaminated soil, as described in the remedial alternatives. The PRGs are site-specific, based on the existing residential land use. The FS identifies general response actions to develop remedial alternatives. Based on the potential risks present at the Site and the technologies available to address them, the following alternatives were identified:

- Alternative 1: No Action
- Alternative 2: Land Use Controls (LUCs) only (distribution of educational materials)
- Alternative 3: LUCs and Excavation up to 2 feet below ground surface (bgs), Installation of Geotextile/Marker Fabric, Off-site Disposal, Backfill, and Site Restoration
- Alternative 4: LUCs and Excavation up to 4 feet bgs, Installation of Geotextile/Marker Fabric, Off-site Disposal, Backfill, and Site Restoration
- Alternative 5: Demolition and Excavation up to 6 feet bgs, Off-site Disposal, Backfill, Site Restoration, and New Structure Construction

Alternatives 2 and 5 were screened out based on not being protective of human health, and not being implementable, respectively. The remaining alternatives were evaluated against seven of the nine feasibility evaluation criteria as defined in the NCP. The remaining two criteria, state acceptance and community acceptance, would be evaluated by addressing comments received after ADEQ and the public have reviewed Site documents (for example, the FS Report and Proposed Plan). The full evaluation will be presented in the Responsiveness Summary of the ROD.

Based on the comparative analysis of the alternatives, Alternative 1 is not an acceptable alternative because it does not meet the threshold criterion of protectiveness.

Alternative 3 is a permanent solution and can be used to remove soil with detections of PAHs greater than the site-specific risk threshold of 10^{-6} ELCR and co-located skeet fragments in accessible areas. This alternative would require removal of existing landscaping and vegetation in

accessible areas, and includes soil removal at each parcel up to 2 feet bgs. Excavation depths would be based on the RI soil sample results. PRGs would be used to compare confirmation sample results. If soil from 1-foot-bgs excavations have PAH concentrations that exceed PRGs, additional material would be excavated down to 2 feet bgs. If the 2 feet excavation confirmation results exceed PRGs, then a permeable geotextile fabric would be placed at the bottom of the excavation as a visual warning barrier to help discourage direct human contact and exposure to COCs at depth. Following completion of soil excavation, clean backfill soils would be imported to restore previous surface grading, and new (replacement) ground cover would be constructed/placed. Additional active measures are not practicable where existing structures or other site features preclude soil removal. Thus, consistent with the NCP, LUCs supplementing soil removal up to 2 feet bgs would be used to prevent or limit exposure to PAHs in subsurface soils. LUCs in the form of educational materials would be required if parcel owners do not grant access for remedial activities.

Alternative 4 is a permanent solution and can be used to remove soil with detections of PAHs greater than the site-specific risk threshold of 10^{-6} ELCR and co-located skeet fragments in accessible areas. This alternative would require removal of existing landscaping and vegetation in accessible areas, and includes removal of soil up to a depth of 4 feet bgs in accessible areas, based on the RI soil sample results. Following initial soil excavation, confirmation sampling would be conducted to ensure PAH concentrations are below PRGs. Confirmation sample results would be compared to PRGs to determine whether a permeable fabric will be placed at the bottom of the excavation as a visual warning barrier to help discourage direct human contact and exposure to COCs at depth. Soil excavation would be conducted as needed until PRGs are met, or to a maximum depth of 4 feet bgs. Following completion of soil excavation, clean backfill soils would be imported to restore previous surface grading, and new (replacement) ground cover would be constructed/placed. Additional active measures are not practicable where existing structures or other site features preclude soil removal. Thus, consistent with the NCP, LUCs supplementing soil removal to 4 feet bgs would be used to prevent or limit exposure to PAHs in subsurface soils. LUCs in the form of educational materials would be required if parcel owners do not grant access for remedial activities.

The present value cost of Alternative 1 is $0. The total present value cost of Alternative 3 is $20,869,000.00, assuming a total of 97 parcels/sub-parcels/ROWs require active remediation (excavation up to 2 feet bgs) and LUCs. The present value cost of Alternative 4 is estimated at $21,911,000.00, assuming a total of 97 parcels/sub-parcels/ROWs require active remediation (excavation up to 4 feet bgs) and LUCs. The recommended alternative will be presented in the Proposed Plan.

1.0 INTRODUCTION

1.1 Project Authorization

This Feasibility Study (FS) Report was prepared by Ahtna Solutions, LLC, (Ahtna) as a part of the Remedial Investigation (RI) and FS process of the 15 Skeet Ranges Site (Site) at the Former Kingman Ground-to-Ground (GTG) Gunnery Range in Mohave County, Arizona (Figure 1-1). This work is performed in accordance with Contract No. W912PL-23-D-0036, Delivery Order No. W912PL-25-F-0051, from the United States (U.S.) Army Corps of Engineers (USACE), Los Angeles District.

The contract work falls under the Defense Environmental Restoration Program, and the Kingman GTG Gunnery Range is a Formerly Used Defense Site (FUDS) under the U.S. Department of Defense's (DoD's) Military Munitions Response Program (MMRP). Under the MMRP, USACE is conducting environmental response activities for the U.S. Department of the Army, which is the DoD's Executive Agent for the FUDS Program. The Arizona Department of Environmental Quality (ADEQ) is the lead regulatory agency for the Site.

The project work is conducted under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan (NCP). This FS Report was prepared according to the U.S. Environmental Protection Agency's (USEPA's) *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (USEPA, 1988). The report generally follows the USACE Engineer Manual (EM) 200-1-15 technical guidance (USACE, 2015),but separates the applicable or relevant and appropriate requirement (ARAR) discussion for the remedial action objectives (RAOs) and includes discussions that are unique to this project, such as the Formal Dispute Section (Section 1.4).

1.2 Purpose

The Site is known to contain soil affected by contaminants of concern (COCs) resulting from World War II training activities. The primary objective of the FS is to identify remedial action alternatives that address the Kingman Phase 1 Parcels that have been identified to have soils with polycyclic aromatic hydrocarbon (PAH) concentrations that pose an unacceptable human health risk (excess lifetime cancer risk [ELCR] greater than 10^{-6} consistent with the risk management decisions made in the Time Critical Removal Action [TCRA]). PAHs are considered health hazards to human and ecological receptors if resuspended particulate matter is inhaled, inadvertently ingested, or contacted with skin (dermal exposure). This FS addresses 97 parcels/sub-

parcels/rights-of-way (ROWs)[1] that pose an unacceptable human health risk due to PAH soil concentrations exceeding the site-specific risk threshold of 10^{-6} ELCR (see Appendix C and Figure 1-5). In addition to PAHs in soil, this FS also addresses the removal of co-located skeet fragments that remain on the surface and in the subsurface soil with preliminary remedial goal (PRG) threshold exceedances of these 97 parcels/sub-parcels/ROWs.

1.3 FUDS Property Overview

The Site is located in Kingman, Arizona, in the southwest section of the Former Kingman GTG Gunnery Range (Figure 1-1). The Site was activated as part of the Army-Air Forces Flexible Gunnery School at Kingman Army Airfield in August 1942. The Site included 15 overlapping skeet ranges encompassing approximately 75 acres. The 15 skeet ranges were constructed side-by-side in an overlapping pattern, with each skeet range laid out in a semicircle pattern (Figure 1-2). The Site was originally designated as part of Munitions Response Site (MRS) 03. Subsequent to the Site Inspection (SI; USACE, 2011), the Site was redesignated in USACE records as a small portion of the much larger (7,936-acre) MRS 01. However, due to legacy and report consistency considerations, sampling records and reports continued to refer to the Site under the MRS 03 name.

The Kingman GTG Gunnery Range FUDS comprises 20,146.24 acres located in the City of Kingman in Mohave County, Arizona. The property was used during World War II for aerial gunnery training. The U.S. Army Air Forces used the property as a military range in association with the school based at Kingman Army Air Field. In 1943, 20,146.24 acres were acquired by the Air Force by transfer and lease. On 4 October 1946, 3,358.52 acres were relinquished to the U.S. Department of Interior, and subsequently, Public Land Order 166 was revoked by Public Land Order 385, dated 25 July 1947. All leases for 16,787.72 acres were terminated between 22 June 1946 and 21 August 1947. Total acres disposed equals 20,146.24. The 15 Skeet Ranges Site (Site) consists of 75 acres within the Small Arms Ranges MRS 01, which is 7,936 acres. The 15 Skeet Ranges Site will be delineated into its own project after the Phase 2 Supplemental RI is completed.

1.4 Formal Dispute

In 2024, ADEQ entered a formal dispute resolution with USACE under the Defense State Memorandum of Agreement concerning how to address potential risk from PAHs in residual skeet fragments in surface soil at the Kingman GTG Site. ADEQ was specifically concerned by the intentional potential ingestion of skeet fragments by children and fragments as a continuing source

[1] Parcel groupings are based on understanding of current ownership, which is subject to change. Although parcel ownership/groupings may change, the data used to determine risk at each sub-parcel will remain based on time-critical removal action (TCRA) and RI findings, until action is taken to reduce risk.

of PAHs to surface soil. As part of the formal dispute, ADEQ and USACE exchanged position papers and formed Tier 1 teams to discuss and resolve the dispute. The main differences between ADEQ and USACE concerning the cleanup approach for the Site were based in three major areas: 1) risk assessment approach for protection of human health from PAHs in skeet fragments; 2) confidence in visual identification and density of skeet fragment locations; and 3) community engagement to support assessing, remediation, and monitoring parcels.

Formal Tier 1 meetings were held in-person between USACE and ADEQ on 19 September 2024 and 4 March 2025. The Formal Tier 1 meetings included discussions about quantitative risk assessments for skeet fragments, confidence in visual identification of skeet fragment locations, and assessing the site in different phases.

On 14 May 2025, USACE and ADEQ signed the Memorandum for Record resolving the formal dispute. The resolution was to complete the following actions:

- Remediation through a phased approach:
  - Phase 1 addresses parcels with elevated concentrations of PAHs in soil that exceed the target ELCR of 10^{-6} based on previous sampling data, to include the removal of co-located skeet fragments on the surface and in the subsurface soil with PRG threshold exceedances.
  - Phase 2 will address parcels that buffer the Phase 1 Parcels that had concentrations of PAHs in soil below the ELCR threshold or were not previously sampled. Phase 2 will also include parcels from a 2014 TCRA (USACE, 2014), the north drainage area, and easements and alleyways not included in Phase 1.
- Quantitative Risk Assessment for Phase 2: USACE and ADEQ developed a risk-based approach to evaluate the potential risk posed by PAHs in skeet fragments as a recurring acute ingestion exposure by children as a residual source of PAHs to surface soil.
- Community Engagement: USACE and ADEQ agreed to work together to facilitate community engagement to support assessing, remediating, and monitoring of the site parcels.

This FS Report only addresses the Phase 1 Parcels.

1.5 Systematic Planning Process Summary

During Phase 1, two Systematic Planning Process (SPP) meetings have taken place. The first meeting (SPP #1) was held on 6 June 2025 in Kingman, Arizona, at the Kingman Airport. In attendance were representatives from USACE, ADEQ, Mohave County, Ahtna (USACE's

contractor), and UXO Pro and The Fehling Group (ADEQ's contractors). The discussion included refining the Conceptual Site Model and a brief discussion of the proposed alternatives for the FS. No changes were discussed for the proposed alternatives during this meeting.

The second SPP meeting (SPP #2) was held on 12 August 2025 in Phoenix, Arizona, at the ADEQ office. In attendance were representatives from USACE, ADEQ, Mohave County, Ahtna, UXO Pro, and The Fehling Group. The discussion included the Institutional Analysis, where ADEQ and Mohave County discussed jurisdiction over the project, and what controls (governmental controls, proprietary controls, educational controls) they could, and would be willing to, support for the project. The results of the Institutional Analysis are discussed further in Section 2.4. Additionally, the proposed alternatives were discussed in detail and reviewed by the attendees through a USACE process called an "Alternatives Panel." Based on the discussion, Alternative 4 was modified.

Meeting minutes and slides for SPP #1 and #2 are included in Appendix A.

2.0 REMEDIAL INVESTIGATION/BACKGROUND

2.1 Background Information

2.1.1 Site Description

Currently, the Site is almost completely developed for residential purposes, which is also the anticipated future land use (Figure 2-1). The Site also contains two commercial properties, several vacant parcels, and a drainage channel located north of Thompson Road. The commercial properties and drainage channel are not included in Phase 1. Current site ownership includes residential property owners. The City of Kingman has jurisdiction of the roads and Mohave County has jurisdiction of ROWs.

The properties north of Thompson Avenue, in the Chaparral Mesa II subdivision, are zoned SD/R1 – single family dwellings. The homes are slab-on-grade homes. Most of these properties have been landscaped and the existing surface soil of the land is not representative of the Site conditions that existed during the time of skeet shooting activities. Within the Chaparral Mesa II subdivision, the ground surface has reportedly been raised several feet by the addition of fill material, resulting in the covering of the original Site surface soil. Moreover, crushed lava rock has been added for landscaping purposes to many of the homes' yards in this area.

The majority of properties south of Thompson Avenue, in the New Kingman subdivision, have not been landscaped. These properties are zoned SD – single family dwellings and consist of mobile homes and vacant parcels.

Residential use of septic tanks and leach fields is a common method for on-site wastewater treatment at the Site south of Thompson Avenue. These systems typically consist of a septic tank that receives and partially treats household sewage, and a leach field (or drain field) that disperses the effluent into the surrounding soil for further natural filtration. The depth of septic tanks in residential settings commonly ranges from 1 to 5 feet below ground surface (bgs), depending on site-specific factors such as soil type, groundwater levels, topography, frost line, and local health department regulations. The City of Kingman's Water Quality Division is working on a grant for this area to connect these properties to city sanitary sewer services, but it is not expected to happen in the immediate future.

2.1.1.1 Physical Profile

The Site is relatively flat, with a drainage channel that extends northeast through the eastern portion. The soils at the site mainly consist of Dutchflat sandy loam and Lostman gravelly sandy loam. Both are well-drained soil with a moderately high capacity to transmit water.

There are no bodies of water on site, and groundwater is fairly deep, with a representative range of approximately 300-600 feet bgs for the Kingman Subbasin, per the (ADWR, n.d.). There are no active or inactive surface water intakes for drinking water supplies within 15 miles of the Kingman GTG Gunnery Range Site.

In Kingman, the summers are typically hot and mostly clear, and the winters are cold and partly cloudy. Temperatures for Kingman usually vary from 32 degrees Fahrenheit (°F) to 96°F. On average, the hot season is June to September, with the hottest month in July, averaging highs of 96°F and lows of 71°F. The cold season is from late November to late February, with an average low of 32°F and a high of 62°F. On average, the region receives less than 10 inches of rainfall annually, lasting from mid-July to mid-March. The most rain falls during the 31 days centered around February 17, with an average accumulation of 1.0 inch (Weather Spark, n.d.). The windier part of the year lasts approximately five months, from February to July, with average wind speeds of more than 8.2 miles per hour (Weather Spark, n.d.).

2.1.1.2 Site History

The Former Kingman GTG Gunnery Range was activated as part of the Army-Air Forces Flexible Gunnery School at Kingman Army Airfield in August 1942. The purpose of the gunnery school was to teach recruits how to shoot down attacking enemy fighter planes using the guns of the B-17 bomber.

The Site historically included 15 overlapping skeet ranges encompassing approximately 75 acres. The skeet ranges were constructed in a side-by-side overlapping pattern, with each skeet range laid out in a semicircle. Clay targets or “pigeons” (skeets) were launched from two structures: a high house, and a low house. The structures were situated along the edge of the semicircle and equipped with six to eight firing positions (or firing platforms) set at various heights and angles. The trainees stood at the northwest portion of the Site and fired toward the southeast. Because of this configuration, the skeet shot fall zone at the Site runs from southwest to northeast. A TCRA conducted in 2014 (USACE, 2014) encompassed most of the fall zone, and some Phase 1 Parcels adjacent to the TCRA parcels may be in the fall zone. It is inferred that the impact fall zone contained the most-abundant and deepest skeet fragment, and farther away from the impact fall zone the skeet will be observed at shallower depths.

No munitions and explosives of concern (MEC) items, or material presenting potential explosive hazards, were reportedly used at the Site. Small arms weapons for training and shotguns equipped with 12-gauge ammunition to fire at the clay pigeons were used at the Site.

2.1.1.3 Summary of Previous Investigations

An *Inventory Project Report* (INPR) was completed for the Kingman GTG Gunnery Range in September 1993 (USACE, 1993). The INPR established the Kingman GTG Gunnery Range as a FUDS with a preliminary site boundary, assigned the FUDS Project Number J09AZ041201.

In 2011, a SI was conducted at the Site (USACE, 2011). The SI confirmed residual fragments/debris from World War II clay pigeons were present on residential parcels located near the firing positions of the Site. During the SI, soil samples were collected from seven parcels within the Site. The laboratory results for PAHs in the soil near the skeet range firing positions revealed that 16 PAH analytes were detected, with seven of those found to be above the ADEQ Soil Remediation Levels (SRLs) for Residential Soil protective for human health (USACE, 2011).

Specific chemicals detected at high levels included the following, with the first seven listed being those detected above allowable ADEQ levels, as mentioned above: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, anthracene, acenaphthene, anthracene, benzo(g,h,i)perylene, fluoranthene, fluorene, 2-methylnaphthalene, naphthalene, phenanthrene, and pyrene. Antimony, lead, and zinc were also confirmed in the soil at concentrations exceeding background levels, but below Arizona SRLs protective for human health (ADEQ, 2009).

Because significant clay pigeon debris was observed during the SI, 55 parcels located within and southeast of the skeet ranges' firing positions were selected for a TCRA. The primary objective of the TCRA was to immediately reduce the highest PAH concentrations to below Arizona residential SRLs at residential properties within the Site (USACE, 2014). USACE and ADEQ agreed to use the SRLs, which are based on a 10^{-6} acceptable risk levels. Since the TCRA, the risk management decisions for the Kingman GTG site have been based on 10^{-6}.

The TCRA was implemented from April 2013 to July 2014. The TCRA remediated the parcels by excavating soil with high levels of PAHs to a depth of 2 feet from the residential parcels and transported off site for disposal (Figure 1-3; USACE, 2014). The intent of the excavation was to remove PAH-contaminated soil to a maximum depth of 2 feet, and place clean fill on the excavated areas. Following soil removal, and before placing fill materials, confirmation samples were collected and analyzed from each property (Figure 1-4). The excavated areas were backfilled with clean fill material and compacted.

From 2014 through 2023, several RIs were conducted at the site. Soil samples were collected from the surface (0–2 inches) and subsurface in 1-foot increments, down to 6 feet, if needed (Figure 1-3). Soil samples were analyzed for PAHs and metals. Skeet fragments were observed on the surface of 84 RI parcels. Human health risk assessments were performed for each parcel investigated, and it was determined that 80 of the 124 parcels had an ELCR greater than 10^{-6} (i.e., unacceptable risk) due to PAHs in soil (Figure 1-5).

2.2 Basis for Remedial Action

World War II-era clay pigeons were constructed with coal tar pitch containing PAHs. PAHs occur naturally in coal, crude oil, and gasoline. PAHs are considered health hazards to human and ecological receptors if inadvertently ingested, or contact with skin occurs (dermal contact), or if sufficient particulate matter is resuspended and inhaled. PAHs can be toxic, but they are not explosives or radioactive.

PAHs slowly leach out over time as the clay pigeons weather, fragment, and degrade, releasing PAH-laden particles and residues into the surrounding soil. Once released, these hydrophobic compounds bind to soil organic matter and fine sediments, gradually accumulating in surface soils and potentially migrating downward through physical mixing, erosion, or adsorption to mobile particulates. Seven PAHs in soil (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene) are greater than the ELCR of 10^{-6} at the Phase 1 parcels, with all seven PAHs being primary risk drivers on at least one parcel.

2.3 Description of Exposure Scenarios Leading to Unacceptable Risk

2.3.1 Contaminants

COCs are PAHs in soil from skeet fragments. The PAHs that present actionable risk (i.e., those that were detected above the ADEQ SRLs for Residential Soil) include benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

2.3.2 Source Areas

Residual skeet fragments have created an unacceptable exposure for PAHs in soils. Historically, the source of PAHs at the Site was the skeet targets used at the Site during World War II. As discussed in Section 2.1.1.2, the Site historically included 15 overlapping skeet ranges, and the trainees stood at the northwest portion of the Site and fired toward the southeast. Because of this configuration, the skeet shot fall zone at the Site runs from southwest to northeast. The 2014 TCRA

encompassed most of the fall zone (USACE, 2014). It is inferred that the impact fall zone contained the most abundant and deepest skeet fragments, and farther away from the impact fall zone the skeet will be observed at shallower depths.

The skeet fragments in surface soil at the Site have been in place since the 1940s at a time when skeet targets were made of coal tar and limestone. The coal tar/limestone matrix of the skeet fragments represent a solid form of a complex and highly concentrated mixture of hydrocarbons including PAHs.

Typically, skeet fragments mechanically break down into smaller particles over time, loading PAH-containing fragment particles into the surrounding soil matrix. The arid climate and alkaline soil of the Kingman GTG Site are likely contributing to a very slow breakdown process for skeet fragments, reducing the loading of PAHs to surface soil. Once fragment particles are small enough to become part of the soil matrix, humans can be exposed to the PAHs in the fragment particles by incidental contact with the surrounding soil.

2.3.3 Receptors and Exposure Pathways

Based on the current and future land use of each sub-area of the Site, potential receptors in these areas include current and future residents, current and future workers at two commercial properties, and construction workers. Future land use is expected to remain the same. Land use was discussed during the Alternatives Panel with USACE, ADEQ, and Mohave County. It is anticipated that any residential activity will not exceed a depth of 2 feet bgs due to the hard pack desert conditions of the site. Residential activities considered included landscaping and gardening. Additionally, there are no in-ground pools in the area, nor is their construction likely due to small lot size and the presence of septic tanks and leach fields. Construction work is not expected to exceed 6 feet bgs; this depth was discussed with representatives from ADEQ and Mohave County who are familiar with the Site and utilities in the area and concurred with the anticipated depths.

Results from previous surface and subsurface sampling and visual skeet observations indicate exposure pathway for human receptors to PAH-contaminated soil is through incidental ingestion, dermal contact, or resuspension and inhalation of particulate matter.

Adverse effects to ecological receptors are not expected.

2.4 Results of the Institutional Analysis

The Institutional Analysis for the Site was conducted during the SPP #2 Alternatives Panel meeting on 12 August 2025. The objective of an Institutional Analysis is to identify and assess government agencies or other entities that have jurisdiction or control over a site and to evaluate their

appropriateness, capability, and willingness to implement and maintain institutional controls for managing long-term risks, especially when contamination or MEC items remain on site. The goal of an Institutional Analysis is to ensure that future land use is consistent with the level of cleanup achieved and that human health and the environment are protected.

2.4.1 Organizations, Entities, Agencies, Landowners, Other Stakeholders

In attendance were representatives from USACE, ADEQ, and Mohave County. A discussion with representatives from the City of Kingman was held on 30 September 2025 regarding their input on the Institutional Analysis. Table 2-1 includes details from the Institutional Analysis; information regarding landowners in Table 2-1 was developed through discussions with USACE, ADEQ, Mohave County, and the City of Kingman.

2.4.2 Agreement and Constraints (Tentative and/or Established) on Response Options

USACE, ADEQ, and the City of Kingman indicated they do not have jurisdiction but could support educational controls including community engagement and educational flyers. Mohave County indicated it may be able to support signage within the Drainage Area because it has jurisdiction in that area, and it would be able to support educational pamphlets sent directly to homeowners, subject to County input and approval.

USACE and ADEQ do not have jurisdiction over governmental controls such as zoning, building codes, and building permits, but would be willing to support these controls. Mohave County has jurisdiction over governmental controls, has a permitting process in place, and is not opposed to implementing additional controls, but any changes to existing controls would need to be approved by the Director and Board of Supervisors and included in the County General Plan. The County expressed concern about potential takings claims if additional restrictions are placed via the permit process. The City of Kingman does have jurisdiction over water and sewer utilities at the Site and would be willing to support government controls, but noted that if any parcels are annexed, they would come in with the same restrictions established while they are part of the County.

USACE, ADEQ, and the City of Kingman do not have jurisdiction over proprietary controls such as environmental covenants, deed restrictions, and deed notices, but would be willing to support these controls. Mohave County has jurisdiction over proprietary controls, has a permitting process in place, and is not opposed to implementing additional controls, but like governmental controls, any changes to existing proprietary controls would need to be approved by the Director and Board of Supervisors and included in the County General Plan. The County expressed concern about potential takings claims if additional restrictions are placed via the permit process. The City of

Kingman noted that if any parcels are annexed, they would come in with the same restrictions established while they are part of the County.

Based on Institutional Analysis discussions, viable land use controls (LUCs) include educational controls (i.e., community engagement and educational flyers) and signage within the Drainage Area. Governmental and proprietary controls may be viable if approved by the Mohave County Director and Board of Supervisors and included in the County General Plan, and may require property owners to be compensated.

2.5 Treatability Studies

The following treatment options were discussed during the SPP #2 Alternative Panel: soil washing, chemical oxidation, and solidification and stabilization. Due to the nature of the PAH contamination, treatment options were determined to have limited effectiveness and would be difficult to implement. For this reason, no treatability studies are recommended for this FS.

2.6 Innovative Technologies

The project team did not identify any innovative technologies that were applicable to the Site.

Table 2-1. Results of the Institutional Analysis

Type of Control	Suitability	USACE	ADEQ	Mohave County	City of Kingman	Landowners
Governmental Control Examples: a. Zoning b. Building codes c. Building permit requirements	a. Already zoned residential (+ one parcel is commercial). b. Subsurface disturbance can't be prohibited via building codes. No impact on mitigating surface contamination risk. c. Could require a building permit for awareness.	**Jurisdiction?** No jurisdiction. **Willing/capable of supporting?** Willing to support.	**Jurisdiction?** ADEQ does not have jurisdiction over governmental controls. Cannot put deed restrictions on residential property; only can put deed restrictions on commercial properties. **Willing/capable of supporting?** ADEQ is capable of supporting these controls, but leadership input is required, and leadership would be unlikely to support.	**Jurisdiction?** The permit process goes through the County, which is already in place – septic tanks/leach fields permit. Will need to evaluate any changes/restrictions. Expressed concern about potential takings claims if additional restrictions are placed via the permit process. **Willing/ capable of supporting?** Not opposed, but the Director and Board of Supervisors would need to approve any governmental controls. Controls would need to be included in the County General Plan, which is reviewed/renewed every five to 10 years.	**Jurisdiction?** Most of the MRS is County jurisdiction – the City has no jurisdiction over building and zoning. Utilities under City jurisdiction are water and sewer. The City and County have delegation authority over water and sewer lines. An annexation is in progress and may include a portion of the MRS – likely adjacent to it. **Willing/capable of supporting?** The City would be willing to support. If parcels are annexed, they would come in with the same restrictions established while they are part of the County.	**Jurisdictions?** No jurisdiction. **Willing/capable of supporting?** Unlikely to support.
Proprietary Control Examples: a. Environmental Covenants b. Deed restrictions c. Deed notices	a. Not suitable for surface/shallow subsurface soil contamination in a residential area. b. Same as above. c. Same as above.	**Jurisdiction?** No jurisdiction. **Willing/capable of supporting?** Willing to support.	**Jurisdiction?** ADEQ does not have jurisdiction over proprietary controls. **Willing/capable of supporting?** ADEQ is capable of supporting these controls, but leadership input required, and leadership would be unlikely to support.	**Jurisdiction?** The permit process goes through county, which is already in place – septic tanks/leach fields permit. Will need to evaluate any changes/restrictions. Expressed concern about potential takings claims if additional restrictions are placed via the permit process. **Willing/capable of supporting?** Not opposed, but the Director and Board of Supervisors would need to approve any proprietary controls. Controls would need to be included in the County General Plan, which is reviewed/renewed every five to 10 years.	**Jurisdiction?** No jurisdiction. **Willing/capable of supporting?** The City would be willing to support. If parcels are annexed, they would come in with the same restrictions established while they are part of the County.	**Jurisdiction?** No jurisdiction. **Willing/capable of supporting?** Unlikely to support.

Type of Control	Suitability	USACE	ADEQ	Mohave County	City of Kingman	Landowners
Educational Control Examples: a. Warning signs/kiosks b. Pamphlets c. Letters/Fact sheets d. Webpages	Not protective on their own but may improve the effectiveness of another alternative by mitigating residual risks. a. Could be placed in the ROW. b. Suitable for educating about handling of skeet fragments. c. Same as above. d. Same as above.	**Jurisdiction?** No jurisdiction. **Willing/capable of supporting?** Willing and able to support.	**Jurisdiction?** ADEQ does not have jurisdiction for warning signs or kiosks. ADEQ can share educational material on its website. **Willing/capable of supporting?** ADEQ is willing to support community engagement and education.	**Jurisdiction?** The County does have jurisdiction over ROW areas and the Northern Flood Control area for signage. **Willing/capable of supporting?** Signs would require approval through the County and would likely not be well received by community members. Could potentially add signs into the County budget but would need approval. The County would be willing to support engagement and educational information sent directly to property owners, subject to approval.	**Jurisdiction?** No jurisdiction. **Willing/capable of supporting?** The City would be willing to support.	**Jurisdiction?** No jurisdiction. **Willing/capable of supporting?** Unlikely to support.

Key:
ADEQ Arizona Department of Environmental Quality
MRS munitions response site
ROW right-of-way
USACE United States Army Corps of Engineers

3.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ARARs are cleanup standards, standards of controls, and other substantive requirements, criteria, or limitations promulgated under federal or state environmental facility citing laws that address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. ARARs, in conjunction with risk-based levels developed in the risk assessment, are employed in directing response actions and establishing cleanup goals. ARARs may include chemical-, location-, and action-specific requirements that shape both remedial goals and the design and implementation of the remedial alternatives. The potential ARARs identified for the Site are included in Table 3-1.

Table 3-1. Potential ARARs

Action	Requirement	Citation	Comment
Staging Piles	Remove or decontaminate all remediation waste, contaminated containment system components, and structures and equipment contaminated with waste and leachate.	40 CFR Part 264.554(j)(1) (i)–(iii)	Potential ARAR if excavation is used. Substantive requirement is to not remove decontaminated items in (i)–(iii).

Key:
ARAR applicable or relevant and appropriate requirements
CFR Code of Federal Regulations
USEPA United States Environmental Protection Agency

4.0 REMEDIAL ACTION OBJECTIVES

The primary objective of any remedial action is the overall protection of human health and the environment. As discussed in the NCP, RAOs must be stated with specific reference to contaminants, the media of concern, the potential exposure pathways, and PRGs. The RAO should be reasonably well defined, but not so specific that the range of alternatives that can be developed is unduly limited.

4.1 Site-Specific Remedial Action Objectives

The RAOs for the Phase 1 Parcels are as follows:

- Prevent resident ingestion of, dermal contact with, and inhalation of airborne particulates of soil containing PAHs that exceed the project's soil PRGs listed in Table 4-1.
- Prevent contact with skeet fragments that are co-located with soil containing concentrations of PAHs that exceed the PRGs listed in Table 4-1.

4.2 Development of Preliminary Remediation Goals

The RIs evaluated potential risks using conservative Regional Screening Levels (RSLs). RSLs, however, are intended for use as screening tools and "RSLs are not cleanup standards and should not be used as cleanup levels" (USEPA, 2025). The characterization of parcels as having unacceptable risk to human health is based on the baseline risk assessment performed as part of the RI and subsequent addenda. The baseline risk assessment identified unacceptable risk by conducting an HHRA for each parcel that evaluated COCs using residential exposure assumptions, calculated exposure point concentrations (95% upper confidence limits [UCLs]), and compared resulting risks to USEPA RSLs. Unacceptable risk was defined as an ELCR greater than 10^{-6}, a noncarcinogenic hazard index greater than 1, or a lead index of 1 or higher. The assessment found that 80 of the 124 parcels investigated exceeded the 10^{-6} carcinogenic risk threshold. No unacceptable noncarcinogenic or lead-related risks were identified, as all hazard indices were ≤1 and lead concentrations were below USEPA residential criteria. The selection of parcels for remedial action is based on the conservative evaluation presented in the RIs.

Confirmation sampling results following remedial action will be compared to numerical cleanup levels established in the Record of Decision (ROD). Proposed numerical PRGs are presented in Table 4-1 for PAHs in soils impacted by skeet fragments. These PRGs were derived using site-specific exposure and uptake factors from specific bioavailability studies performed on the skeet fragments in soil matrices, and USEPA guidance. Detailed calculations and references can be found in Appendix B.

The PRGs were calculated using USEPA RSL equations, exposure assumptions, and toxicity combined with site-specific assumptions concerning the relative bioavailability factor and the age-dependent adjustment factor based on the source of PAHs in skeet fragments made from coal tar and limestone. The assumptions, calculations, and screening levels for the ingestion, dermal absorption, and inhalation exposure routes are presented along with the final PRG concentrations in Appendix B. The recommended PRGs for PAHs in soil of the Kingman 15 Skeet Range Site are presented in Table 4-1.

Table 4-1. Preliminary Remediation Goals

PAH	PRG (mg/kg)
Benz(a)anthracene	9.2
Benzo(a)pyrene	1.5
Benzo(b)fluoranthene	11
Benzo(k)fluoranthene	180
Chrysene	850
Dibenz(a,h)anthracene	1.5
Indeno(1,2,3-cd)perylene	11

Key:
mg/kg milligrams per kilogram
PAH polycyclic aromatic hydrocarbon
PRG preliminary remediation goal

5.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES

5.1 General Response Actions

General Response Actions (GRAs) are broad classes of responses or remedial actions that can potentially achieve the RAOs. Typically, in developing remedial alternatives, combinations of GRAs may be identified to address the RAO fully. GRAs may include treatment, containment, excavation, extraction, disposal, institutional actions, or a combination of these.

The GRAs are medium-specific actions that may encompass many remedial technologies and remedial technology process options. Technologies that pass the preliminary screening process are then used to develop alternatives at the end of this section.

The medium of concern at the Site is soil. As detailed in Appendix C, Table 2, an estimated 607,421 square feet of soil is impacted at the 97 parcels identified during the RI as having an ELCR greater than 10^{-6} (i.e., unacceptable risk). Based on the proposed remediation depths—1 foot below ground surface (bgs) for parcels where PAH exceedances were found at 1 ft bgs or shallower during the RI, and 2 feet bgs for parcels where exceedances were found deeper than 1 ft bgs—a total of 29,410 cubic yards of impacted soil is present at the Site (Appendix C, Table 2).These estimates are conservative as they do not account for known structures or permanent obstructions present on the parcels.

5.1.1 Identification and Screening of Technologies and Process Options

A list of potentially applicable technologies was developed and organized in terms of the GRA categories (Table 5-1). Initial screening of the identified technologies in Table 5-1 was based on effectiveness, implementability, and cost considerations. These criteria are described as follows:

- Effectiveness: Effectiveness is the ability of the technology or process option to perform adequately to achieve the RAOs alone or as part of an overall system.
- Implementability: Implementability refers to the degree of difficulty expected in implementing a particular measure under practical technical, regulatory, and schedule constraints.
- Cost: Relative cost is comparative only and is judged similarly to the effectiveness criterion. It is used to preclude further evaluation of process options high in cost, where other choices perform similar functions with comparable effectiveness but for significantly lower cost.

The screening of technologies is presented in Table 5-1. The technologies and process options considered infeasible based on effectiveness, implementability, and costs are shown in the shaded background. The following is a summary of the technologies screened:

- Institutional Actions
    - Governmental/Proprietary Controls:
        - Deed Restrictions: Issued for property within potentially affected areas to restrict property use. Effectiveness of restrictions depends on awareness, compliance, and enforcement. Implementation requires action by the local governments as USACE does not have jurisdiction over the Site, and landowner acceptance is highly unlikely as restrictions would negatively impact current and future land use. The cost of deed restrictions is unknown. Eliminated as it is considered *not* effective or implementable.
        - Permits: Regulations promulgated to require a permit for excavation/removal activities. Effectiveness of permits depends on awareness, compliance, and enforcement. Implementation requires action by the local governments as USACE does not have jurisdiction over the Site, and landowner acceptance is highly unlikely as restrictions would negatively impact current and future land use. The cost of permits is low. Eliminated as it is considered *not* effective or implementable.
    - Educational Controls
        - Warning Signs: Signs used to inform the people who read them of possible risks, such that they may take suitable actions to avoid it. Signs act as a visual reminder and are placed along the perimeter of the Site with extra signs placed at access points. Effectiveness is limited to potential handling of and intentional ingestion of soil, for those who observe and understand the signs. Landowner acceptance is highly unlikely due to impacts on land use. Potentially implementable in alleyways, easements, and drainage locations. The cost of warning signs is low. Eliminated as it is considered *not* implementable on private parcels.
        - Educational Materials: Production and distribution of educational materials to inform receptors about the nature of the contamination present at the Site. Effectiveness limited to potential handling of, and intentional ingestion of soil, to those who observe and understand the materials. Effective when used to manage residual risk following removal. Readily implementable. Educational materials can easily be distributed to property owners and tenants, local governing bodies, and local utilities. Ensuring

distribution of educational materials to current property owners and residents could pose a challenge if public records are inaccurate or if owners do not share the materials with tenants. The cost of educational materials is low. Retained as it is considered implementable.

- Containment
    - Covers
        - Soil Covers: Place a minimum 2 foot thick cover of "clean" soil over soil with COC concentrations exceeding the remedial goals. Effective as direct exposure to contaminated soil and skeet fragments is eliminated if left undisturbed. Implementability is dependent on the cooperation of individual property owners. Landowner acceptance is highly unlikely because landscaping of the property would be impacted and it is not possible to integrate a 2 foot or more thick soil cover into parcels that are already developed (could not match roads, house foundations, fences, driveways, etc.). The cost of soil covers is moderate. Eliminated as it is considered *not* implementable due to the required cap thickness.
        - Geotextile/Marker Fabric: At ADEQ's suggestion, place a geotextile/marker fabric barrier over soil with COC concentrations exceeding the remedial goals to provide a visual warning barrier and help discourage direct human contact. Effective, but may be less effective if property owners ignore or remove the geotextile/marker fabric when encountered. Effectiveness is also limited by the design lifetime of the fabric and placement on surface or buried (i.e., exposed fabric has a sorter lifespan due to damage from sunlight, weathering, etc.). Effective when combined with excavation and buried after placement. Readily implementable when combined with excavation, but dependent on the cooperation of individual property owners. The cost of geotextile/marker fabric is considered moderate. Retained as it is considered implementable.
        - Asphalt or Concrete Covers: Place an asphalt or concrete cover over soil with COC concentrations exceeding the remedial goals. Effective as direct exposure to contaminated soil and skeet fragments is eliminated. Existing buildings, roads, driveways, etc., serve as a cover, but because USACE did not construct existing pavements and cannot implement LUCs to ensure that they are not disturbed, long term effectiveness cannot be guaranteed. Implementability is dependent on the cooperation of individual property owners. Landowner acceptance is highly unlikely because this would impact landscaping and land use. Implementation would be moderately

difficult at the Site as it is located in a residential area and would require obtaining Rights-of-Entry (ROEs) for each parcel, and working around existing structures and physical barriers (driveways, patios, large trees, septic tanks, and leach fields). The process could take days to weeks per parcel and would require temporary relocation of residents. The cost of asphalt or concrete covers is considered moderate. Eliminated as it is considered due to potentially limited application and implementability.

- Physical Barriers
  - Fences, Barriers, and/or Gates: Security fences, barriers, and/or gates installed around potentially affected areas to limit access. May deter access from the street or neighboring parcels, but overall is not effective as it does not remove, isolate, or reliably prevent day-to-day contact with contaminated soil and skeet fragments within the fenced area as the Site is in a residential area. Existing fences, barriers, or gates exist throughout the site, but because USACE did not construct existing physical barriers and cannot implement LUCs to ensure that they are not disturbed, long term effectiveness cannot be guaranteed. Implementability is dependent on the cooperation of individual property owners. Landowner acceptance of installation and associated access restrictions is highly unlikely because this would impact land use. Implementation would require obtaining ROEs for each parcel, and working around existing structures and physical barriers (driveways, patios, large trees, septic tanks, and leach fields). The process could take days to weeks per parcel. The cost of fences, barriers, and/or gates is low. Eliminated as it is considered *not* effective or implementable.

- Excavation: Excavate soil with COC concentrations exceeding the remedial goals using conventional mechanical equipment and manual digging. Highly effective at removing contaminants and skeet fragments and soil can be easily sampled prior or during excavation to verify that PRGs are met. Implementability dependent on the cooperation of individual property owners. Excavation is well proven but would be moderately difficult to implement at the Site as it is located in a residential area and would require obtaining ROEs for each parcel, working around existing structures and physical barriers (driveways, patios, large trees, septic tanks, and leach fields), removing large quantities of soil, and site restoration. Given the large volume of soil that would need to be excavated, the process could take up to a month per parcel and would require temporary relocation of residents. The cost of excavation is considered moderate. Retained as it is considered implementable and effective.

- Disposal at a Treatment and Disposal Facility: Transport and dispose of soil at a permitted treatment and disposal facility. Effective when combined with excavation as contaminants and skeet fragments are removed and permitted landfills are designed and operated to contain disposed waste. Easily and quickly implementable as nearby landfills are available. The cost of disposal is considered moderate. Retained as it is considered implementable and effective.
- Treatment
    - Biological Treatment
        - Bioremediation: Reduce COCs in soil by metabolizing organics with biological amendments. Limited effectiveness as some PAHs are resistant to bioremediation (i.e., it takes very long time and requires very high level of technology performance). Treatment of skeet fragments effective if enhanced by addition of nutrients, microbes, surfactants, or phytoremediation to improve bioavailability and degradation of recalcitrant, high molecular weight PAHs. Implementability is dependent on the cooperation of individual property owners. Landscaping of the property would be impacted. It would be difficult to maintain treatment over time on third-party-controlled properties. Implementation would be moderately difficult at the Site as it is located in a residential area and would require obtaining ROEs for each parcel, working around existing structures and physical barriers (driveways, patios, large trees, septic tanks, and leach fields), treatment of a large volume of soil, and site restoration. The process could take weeks to months per parcel and would require long-term monitoring. The cost of bioremediation is considered moderate. Eliminated due to limited effectiveness and implementability.
    - Physical/Chemical Treatment
        - Soil Washing: Remove COCs from soil by using mechanical scrubbing with an aqueous washing solution (i.e., water, solvents, surfactants) in a reactor, concentrating the COCs into a smaller volume of liquid for further treatment, and allowing clean soil to be reused. Effective for high concentrations of PAHs of low molecular weight and in soils with low organic matter or clay content. Concentrations vary across the Site but are considered moderate to high, with both low and high molecular weight PAHs present. Soils at the site are generally sandy and gravelly sandy loams with low organic and clay content. Effective at treating skeet fragments if augmented with surfactants or heated solutions and combined with follow-up treatment such as thermal deposition. Can be time-

consuming due to the large soil volumes involved. Implementability is dependent on the cooperation of individual property owners. Landscaping of the property would be impacted. Implementation would be moderately difficult at the Site as it is located in a residential area and would require obtaining ROEs for each parcel, working around existing structures and physical barriers (driveways, patios, large trees, septic tanks, and leach fields), treatment of a large volume of soil, and site restoration. The process could take weeks to months per parcel and would require temporary relocation of residents. The cost of soil washing is considered moderate to high. Eliminated due to limited effectiveness and implementability.

- Chemical Oxidation: Convert inorganic contaminants to non-hazardous compounds using an oxidizing agent. Effective for high concentrations of PAHs of low molecular weight and in soils with low organic matter or clay content. Concentrations vary across the Site but are considered moderate to high, with both low and high molecular weight PAHs present. Soils at the site are generally sandy and gravelly sandy loams with low organic and clay content. Effective at treating skeet fragments if augmented with surfactants. Implementation is dependent on the cooperation of individual property owners. Landscaping of the property would be impacted. It would be difficult to maintain treatment over time on third-party-controlled properties. Implementation would be moderately difficult at the Site as it is located in a residential area and would require obtaining ROEs for each parcel, working around existing structures and physical barriers (driveways, patios, large trees, septic tanks, and leach fields), treatment of a large volume of soil, and site restoration. The process could take days to weeks per parcel and would require long-term monitoring. The cost of soil washing is considered moderate to high. Eliminated due to limited effectiveness and implementability.
- Solidification/Stabilization: Mixing of agents (e.g., cement, fly ash, or lime) with soil to create a solid, less permeable mass so that contaminants are physically bound or enclosed within a stabilized mass, or to introduce chemical reactions between the stabilizing agent (e.g., cement-activated persulfate) and contaminants to reduce their mobility. Effective at reducing the mobility and leachability of COCs and skeet fragments; however. the COCs would not be permanently destroyed, and any chemical or physical stabilization and solidification processes could eventually be reversed by natural processes acting on exposed soils (e.g.,

rain leaching) or disturbance of the treated soils by receptors. Application can be affected by soil composition, water content, and temperature. Implementation is dependent on the cooperation of individual property owners. Chemicals used for stabilization could adversely affect the surrounding ecological setting at the residential yards. Landscaping of the property would be impacted. Implementation would be moderately difficult at the Site as it is located in a residential area and would require obtaining ROEs for each parcel, working around existing structures and physical barriers (driveways, patios, large trees, septic tanks, and leach fields), treatment of a large volume of soil, and site restoration. The process could take weeks to months per parcel and would require long-term monitoring. The cost of solidification/stabilization is considered moderate to high. Eliminated due to limited effectiveness and implementability.

- Low Temperature Thermal Desorption: Volatilize organic contaminants well below oxidation temperatures. Effective for moderate concentrations of PAHs of low molecular weight and in soils with low organic matter or clay content. Concentrations vary across the Site but are considered moderate to high, with both low and high molecular weight PAHs present. Soils at the site are generally sandy and gravelly sandy loams with low organic and clay content. Limited effectiveness at treating skeet fragments as higher temperatures and longer treatment times are required. Effectiveness also depends on size of skeet fragments (i.e., larger fragments require longer treatment times), which vary across the Site. Implementation is dependent on the cooperation of individual property owners. Landscaping of the property would be impacted. Requires an air pollution control system to treat the produced vapors and prevent the release of contaminants or harmful byproducts. Implementation would be moderately difficult at the Site as it is located in a residential area and would require obtaining ROEs for each parcel, working around existing structures and physical barriers (driveways, patios, large trees, septic tanks, and leach fields), and treatment of a large volume of soil. The process could take months years per parcel and would require long-term monitoring. The cost of low temperature thermal desorption is considered high. Eliminated due to limited effectiveness and implementability.

The screening was based on Site conditions and land use, professional experience, published sources, and other relevant documentation. The following technologies/options were retained for further consideration:

- Distribution of educational materials
- Installation of geotextile barriers
- Excavation
- Disposal

5.1.2 Description of Constraints Identified during Institutional Analysis, Previous Investigations, and Stakeholder Coordination

Governmental controls and long-term land use restrictions are highly unlikely to be viable remedial options at the Site. The Institutional Analysis confirmed that while Mohave County *could* consider governmental controls, any implementation would require approval from the Director and Board of Supervisors, as well as formal documentation within the County's General Plan—a process occurring only every five to 10 years. It was also determined that landowners are likely to resist any restrictions impacting property use; therefore, these were not carried forward into the FS alternatives.

Remedial actions at the Site face significant constraints due to the presence of residential properties and associated infrastructure. The presence of homes on 67 parcels would require consideration of public safety during remedial field activities. Remedial alternatives need to be designed to address the safety of residents, including children and pets, and other members of the public.

For soil removal alternatives, operational considerations such as traffic, noise, and dust control would be essential to minimize disruption to the community. Subsurface features like septic tanks and leach fields, as well as existing utilities (water, gas, and electrical), would further restrict the scope of potential remedial activities.

Table 5-1. Summary of Remedial Technologies

GRA	Technology Type	Process Option	Description	Effectiveness	Implementability	Cost	Screening Comments
Institutional Actions	Governmental/ Proprietary Controls	Deed restrictions	Deed restrictions issued for property within potentially affected areas to restrict property use.	Effectiveness depends on awareness, compliance, and enforcement. Residual contaminated soil remains in place and can still be contacted whenever the land is used or disturbed in ways that do not adhere perfectly to the restrictions.	Landowner acceptance of activity restrictions is highly unlikely because this would negatively impact current and future land use. Would require action by the local government. The local government is not opposed to implementation, but the Director and Board of Supervisors would need to approve and controls would need to be included in the County General Plan, which is reviewed/renewed every five to 10 years.	Unknown. Property owners may want compensation for lost use or diminished property value.	Eliminated. Not effective or implementable.
		Permits	Regulations promulgated to require a permit for excavation/removal activities.	Effectiveness depends on awareness, compliance, and enforcement. Residual contaminated soil remains in place and can still be contacted whenever the land is used or disturbed in ways that do not adhere perfectly to the restrictions.	Required only if soil COC concentrations in excess of the PRGs are left in place. Would require action by the local government to implement. The local government is not opposed to implementation, but the Director and Board of Supervisors would need to approve and controls would need to be included in the County General Plan, which is reviewed/renewed every five to 10 years.	Low	Eliminated. Not effective or implementable.
	Educational Controls	Warning signs	Signs used to inform the people who read them of possible risks, such that they may take suitable actions to avoid it. Signs act as a visual reminder and are placed along the perimeter of the Site with extra signs placed at access points.	Proven and routinely used, increases awareness of potential hazards, and generally accepted by regulators. Effectiveness limited to potential handling of and intentional ingestion of soil, for those who observe and understand the signs.	Landowner acceptance of warning signs is highly unlikely because this would negatively impact current and future land use. Potentially implementable to add signs in alley ways, easements, and the drainage location.	Low	Eliminated. Not implementable on parcels.
		Educational materials	Production and distribution of educational materials to inform receptors about the nature of the contamination present at the Site.	Proven and routinely used, increases awareness of potential hazards, and generally accepted by regulators. Effectiveness limited to potential handling of, and intentional ingestion of soil, to those who observe and understand the materials. Effective when used to manage residual risk following removal.	Readily implementable. Educational materials can easily be distributed property owners and tenants, local governing bodies, and local utilities. Ensuring distribution of educational materials to current property owners and residents could pose a challenge if public records are inaccurate or if owners do not share the materials with tenants.	Low	Retained. Implementable.

GRA	Technology Type	Process Option	Description	Effectiveness	Implementability	Cost	Screening Comments
Containment	Covers	Soil covers	Place a minimum 2 foot thick cover of "clean" soil over soil with COC concentrations exceeding the remedial goals to eliminate the direct exposure pathway.	Effective as direct exposure to contaminated soil and skeet fragments is eliminated if left undisturbed.	Dependent on the cooperation of individual property owners. Landowner acceptance is highly unlikely because this would impact landscaping. Not possible to integrate a 2 foot or more thick soil cover into parcels that are already developed (could not match roads, house foundations, fences, driveways, etc.).	Moderate	Eliminated. Not implementable.
		Geotextile/ marker fabric	At ADEQ's suggestion, place a geotextile/marker fabric barrier over soil with COC concentrations exceeding the remedial goals to provide a visual warning barrier and help discourage direct human contact.	Effective, but since the affected areas consist of residential yards, it may be less effective if property owners ignore or remove the geotextile/marker fabric when encountered. Effectiveness also limited by design lifetime of the fabric and placement on surface or buried (i.e., exposed fabric has a sorter lifespan due to damage from sunlight, weathering, etc.). Effective when combined with excavation and buried following placement.	Readily implementable when combined with excavation, but dependent on the cooperation of individual property owners.	Moderate	Retained. Implementable.
		Asphalt or concrete covers	Place an asphalt or concrete cover over soil with COC concentrations exceeding the remedial goals to eliminate the direct exposure pathway.	Effective as direct exposure to contaminated soil and skeet fragments is eliminated. Existing buildings, roads, driveways, etc., serve as a cover. Because USACE did not construct existing pavements and cannot implement LUCs to ensure that they are not disturbed, long term effectiveness cannot be guaranteed.	Dependent on the cooperation of individual property owners. Landowner acceptance is highly unlikely because this would impact landscaping and land use. Implementation would be moderately difficult at the Site as it is located in a residential area and would require obtaining ROEs for each parcel, and working around existing structures and physical barriers (driveways, patios, large trees, septic tanks, and leach fields). The process could take days to weeks per parcel and would require temporary relocation of residents.	Moderate	Eliminated. Potentially limited application and implementability.
	Physical Barriers	Fences, barriers, and/or gates	Security fences, barriers, and/or gates installed around potentially affected areas to limit access.	Not effective as it does not remove, isolate, or reliably prevent day-to-day contact with contaminated soil and skeet fragments within the fenced area as the Site is in a residential area. May deter access from the street or neighboring parcels. Existing fences, barriers, or gates exist throughout the site, but because USACE did not construct existing physical barriers and cannot implement LUCs to ensure that they are not disturbed, long term effectiveness cannot be guaranteed.	Dependent on the cooperation of individual property owners. Landowner acceptance of installation and associated access restrictions is highly unlikely because this would impact land use. Implementation would require obtaining ROEs for each parcel, and working around existing structures and physical barriers (driveways, patios, large trees, septic tanks, and leach fields). The process could take days to weeks per parcel.	Low	Eliminated. Not effective or implementable.

GRA	Technology Type	Process Option	Description	Effectiveness	Implementability	Cost	Screening Comments
Excavation	Excavation	Conventional excavation	Excavate soil with COC concentrations exceeding the remedial goals using conventional mechanical equipment and manual digging.	Highly effective at removing contaminants and skeet fragments. Soil can be easily sampled prior or during excavation to verify that PRGs are met.	Dependent on the cooperation of individual property owners. Excavation is well proven but would be moderately difficult to implement at the Site as it is located in a residential area and would require obtaining ROEs for each parcel, working around existing structures and physical barriers (driveways, patios, large trees, septic tanks, and leach fields), removing large quantities of soil, and site restoration. Given the large volume of soil that would need to be excavated, the process could take up to a month per parcel and would require temporary relocation of residents.	Moderate	Retained. Effective and implementable.
Disposal	Off-site Disposal	Treatment and disposal facility	Transport and dispose of soil at a permitted treatment and disposal facility.	Effective when combined with excavation as contaminants and skeet fragments are removed. Permitted landfills are designed and operated to contain disposed waste.	Easily and quickly implementable. Nearby landfills are available.	Moderate	Retained. Effective and implementable.
Treatment	Biological Treatment	Bioremediation	Reduce COCs in soil by metabolizing organics with biological amendments.	Limited effectiveness for PAHs as some PAHs, including four of the Site's COCs (benzo(a)pyrene, benzo(b)fluoranthene, chrysene, dibenz(a,h)anthracene) are resistant to bioremediation (i.e., it takes very long time and requires very high level of technology performance). Treatment of skeet fragments effective if enhanced by addition of nutrients, microbes, surfactants, or phytoremediation to improve bioavailability and degradation of recalcitrant, high molecular weight PAHs.	Dependent on the cooperation of individual property owners. Landscaping of the property would be impacted. It would be difficult to maintain treatment over time on third-party-controlled properties. Implementation would be moderately difficult at the Site as it is located in a residential area and would require obtaining ROEs for each parcel, working around existing structures and physical barriers (driveways, patios, large trees, septic tanks, and leach fields), treatment of a large volume of soil, and site restoration. The process could take weeks to months per parcel and would require long-term monitoring.	Moderate	Eliminated. Limited effectiveness and implementability.

GRA	Technology Type	Process Option	Description	Effectiveness	Implementability	Cost	Screening Comments
	Physical/Chemical treatment	Soil washing	Remove COCs from soil by using mechanical scrubbing with an aqueous washing solution (i.e., water, solvents, surfactants) in a reactor, concentrating the COCs into a smaller volume of liquid for further treatment, and allowing clean soil to be reused.	Effective for high concentrations of PAHs of low molecular weight and in soils with low organic matter or clay content. Concentrations vary across the Site but are considered moderate to high, with both low and high molecular weight PAHs present. Soils at the site are generally sandy and gravelly sandy loams with low organic and clay content. Effective at treating skeet fragments if augmented with surfactants or heated solutions and combined with follow-up treatment such as thermal deposition.	Dependent on the cooperation of individual property owners. Landscaping of the property would be impacted. Implementation would be moderately difficult at the Site as it is located in a residential area and would require obtaining ROEs for each parcel, working around existing structures and physical barriers (driveways, patios, large trees, septic tanks, and leach fields), treatment of a large volume of soil, and site restoration. The process could take weeks to months per parcel and would require temporary relocation of residents.	Moderate to High	Eliminated. Limited effectiveness and implementability.
		Chemical oxidation	Convert inorganic contaminants to non-hazardous compounds using an oxidizing agent.	Effective for high concentrations of PAHs of low molecular weight and in soils with low organic matter or clay content. Concentrations vary across the Site but are considered moderate to high, with both low and high molecular weight PAHs present. Soils at the site are generally sandy and gravelly sandy loams with low organic and clay content. Effective at treating skeet fragments if augmented with surfactants.	Dependent on the cooperation of individual property owners. Chemicals used for stabilization could adversely affect the surrounding ecological setting at the residential yards. Landscaping of the property would be impacted. It would be difficult to maintain treatment over time on third-party-controlled properties. Implementation would be moderately difficult at the Site as it is located in a residential area and would require obtaining ROEs for each parcel, working around existing structures and physical barriers (driveways, patios, large trees, septic tanks, and leach fields), treatment of a large volume of soil, and site restoration. The process could take days to weeks per parcel and would require long-term monitoring.	Moderate to High	Eliminated. Limited effectiveness and implementability.

GRA	Technology Type	Process Option	Description	Effectiveness	Implementability	Cost	Screening Comments
		Solidification and stabilization	Mixing of agents (e.g., cement, fly ash, or lime) with soil to create a solid, less permeable mass so that contaminants are physically bound or enclosed within a stabilized mass, or to introduce chemical reactions between the stabilizing agent (e.g., cement-activated persulfate) and contaminants to reduce their mobility.	Effective at reducing the mobility and leachability of COCs and skeet fragments; however, they would not be permanently destroyed, and any chemical or physical stabilization and solidification processes could eventually be reversed by natural processes acting on exposed soils (e.g., rain leaching) or disturbance of the treated soils by receptors. Application can be affected by soil composition, water content, and temperature.	Dependent on the cooperation of individual property owners. Chemicals used for stabilization could adversely affect the surrounding ecological setting at the residential yards. Landscaping of the property would be impacted. Implementation would be moderately difficult at the Site as it is located in a residential area and would require obtaining ROEs for each parcel, working around existing structures and physical barriers (driveways, patios, large trees, septic tanks, and leach fields), treatment of a large volume of soil, and site restoration. The process could take weeks to months per parcel and would require long-term monitoring.	Moderate to High	Eliminated. Limited effectiveness and implementability.
		Low-temperature thermal desorption	Volatilize organic contaminants well below oxidation temperatures.	Effective for moderate concentrations of PAHs of low molecular weight and in soils with low organic matter or clay content. Concentrations vary across the Site but are considered moderate to high, with both low and high molecular weight PAHs present. Soils at the site are generally sandy and gravelly sandy loams with low organic and clay content. Limited effectiveness at treating skeet fragments as higher temperatures and longer treatment times are required. Effectiveness also depends on size of skeet fragments (i.e., larger fragments require longer treatment times), which vary across the Site.	Dependent on the cooperation of individual property owners. Landscaping of the property would be impacted. Requires an air pollution control system to treat the produced vapors and prevent the release of contaminants or harmful byproducts. Implementation would be moderately difficult at the Site as it is located in a residential area and would require obtaining ROEs for each parcel, working around existing structures and physical barriers (driveways, patios, large trees, septic tanks, and leach fields), and treatment of a large volume of soil. The process could take months years per parcel and would require long-term monitoring.	High	Eliminated. Limited effectiveness and implementability.

Note:
Technologies that were eliminated are shown as shaded.
Key:
ADEQ Arizona Department of Environmental Quality
COC contaminant of concern
GRA General Response Action
PAH polycyclic aromatic hydrocarbon
PRG preliminary remedial goal

6.0 DEVELOPMENT AND SCREENING OF ALTERNATIVES

6.1 Development of Alternatives

6.1.1 Rationale for Developed Alternatives

The following alternatives were developed to address PAH-contaminated soils located at Phase 1 Parcels within the Kingman GTG, Former 15 Skeet Ranges. Remedial alternatives were developed to achieve the RAOs, which will ensure that the alternatives are protective of human health and the environment.

Alternatives were developed based on retained treatment technologies and process options (Section 5.0) to address different depths of removal and include LUCs due to excavation constraints. Per CERCLA guidance, a "no action" alternative (Alternative 1) was included as a baseline to evaluation other potential remedies. Per the Defense Environmental Restoration Program Manual requirements (DoD, 2012), an alternative that would achieve unlimited use and unrestricted exposure was also included (Alternative 5).

6.1.2 Summary of Alternatives

The following remedial alternatives were developed using the retained technologies and process options:

- Alternative 1: No Action
- Alternative 2: LUCs Only
- Alternative 3: LUCs and Excavation up to 2 feet bgs, Installation of Geotextile/Marker Fabric (where needed based on confirmation results), Off-site Disposal, Backfill, and Site Restoration
- Alternative 4: LUCs and Excavation up to 4 feet bgs, Installation of Geotextile/Marker Fabric (where needed based on confirmation results), Off-site Disposal, Backfill, and Site Restoration
- Alternative 5: Demolition and Excavation up to 6 feet bgs, Off-site Disposal, Backfill, Site Restoration and New Structure Construction

6.1.3 Alternative Descriptions

6.1.3.1 Alternative 1 – No Action

Alternative 1 is taking no action. The NCP requires that a no-action alternative be retained throughout the FS process as a baseline for comparison to the other approaches. The no-action alternative would leave affected soil in place at the Site. There are no costs associated with Alternative 1.

6.1.3.2 Alternative 2 – LUCs Only

Alternative 2 includes a combination of institutional and educational LUCs. The institutional controls consist of deed restrictions and permit requirements, while the educational controls involve installing warning signs and developing and distributing educational materials.

Given the property is under private ownership, legal and physical mechanisms such as use restrictions and regulatory controls or physical barriers (i.e., fences, paved or gravel ground cover) would not likely be implementable since they would affect the current and future use of the land. Institutional controls such as deed notices, permits, or restrictions on excavation are not considered for the project because these would require action by the local governments as the DoD does not own the property and does not have regulatory jurisdiction over land use. Physical measures (engineering controls) such as fencing, barriers, or gates are also not considered for the same reason. Educational controls are considered implementable. Table 5-1 summarizes the screening of LUCs. For these reasons, educational materials are the only LUCs retained for consideration for the project.

Educational materials would be distributed initially and annually to property owners and tenants on known or potentially affected properties, local governing bodies, and local utilities. These materials would include information on specific areas where impacted soils remain or are suspected to remain, how to identify skeet fragments, the potential risks posed by impacted soils and skeet fragments, the potential presence of a geotextile/marker barrier at excavation depth and its purpose, and contact information to address community concerns. The implementation details of any LUC would be outlined in a Land Use Control Implementation Plan (LUCIP).

Alternative 2 would include all Phase 1 Parcels where PAHs in soil remain in excess of acceptable risk concentrations or there is likely a presence of impacted soils remaining beneath Site structures or in other inaccessible areas (Figure 3-1). A site-specific database of all parcels would be developed and updated periodically (quarterly to semiannually) to track parcel ownership for educational material distribution. Detailed records showing where, when, and to whom materials were distributed would be maintained and checked during Five Year Reviews.

6.1.3.3 Alternative 3 – LUCs and Excavation up to 2 feet bgs, Installation of Geotextile/Marker Fabric, Off-Site Disposal, Backfill, and Site Restoration

Alternative 3 consists of excavation to remove soil with COC concentrations exceeding the site-specific risk threshold of 10^{-6} ELCR (i.e., unacceptable risk) up to a depth of 2 feet bgs at 97 parcels/sub-parcels/ROWs (Appendix C and Figure 3-2). Skeet fragments co-located with the contaminated surface and subsurface soil would also be removed.

There are eight parcels/sub-parcels/ROWs with soils with COCs at depths greater than 2 feet bgs, including (Appendix C):

- Four parcels/ROWs extending to 3 feet bgs
- Two parcels/sub-parcels extending to 4 feet bgs
- Two parcels/ROWs extending to 5 feet bgs

For this alternative to be implementable, the following assumptions were made:

- An ROE would be obtained by USACE for each parcel to allow for soil excavation.
- The excavated soil would not be characteristically hazardous waste.
- The excavated soil would be disposed of as special waste, as in the TCRA previously implemented at the Site (USACE, 2014).

Alternative 3 has the following main components:

- Site-specific plans and reports: site-specific work plans would be prepared prior to excavation activities including a quality assurance planning component, work plan, and field procedures. An Accident Prevention Plan (APP), which includes a Site Safety and Health Plan (SSHP), would be prepared. An RD would be completed.
- The plans would be reviewed by USACE and ADEQ and approved by USACE prior to remedial activities. The estimated time for completing these plans is six months, which includes incorporating review comments and revisions and obtaining property access agreements. USACE would review and approve the Remedial Action Completion Report after remedial action and the final inspection have been completed. The report would include a description of remedial activities, Site maps showing the excavation areas, confirmation soil sample analytical data, and copies of manifests. USACE and regulatory agencies would review and comment on the report and all applicable comments would be incorporated into the Final Remedial Action Completion Report.
- Community relations: USACE would notify property owners of the proposed remedial action per the FUDS handbook policy. Access for remediation would be contingent upon

property owners and USACE signing an ROE agreement. USACE will review ROE database attempts for agreement and continue efforts until such time as the agreement given. Because property owners within the Kingman Project only own or control a portion of the overall property associated with a project, a determination will need to be made whether the project activities can accomplish project goals without accessing that portion of land. If project goals cannot be accomplished, the FUDS District Program Manager shall follow the process for notification to USACE Headquarters. Property owners who have denied access will be contacted at least every five years, as part of the Interim Risk Management process, to attempt to obtain ROE.

- If a property owner is unwilling to consent to access for remedial action, educational materials would be provided to the property owner to notify them of the risks associated with PAHs present at their property.
- Pre-remedial action, community relations outreach would consist of communications by newspaper, local and state government electronic notifications (webpage and/or social media), fact sheet mailings, and public meetings.
- Mobilization, utility locate, and storage/staging/laydown areas: Remediation would be conducted at properties identified in Appendix C and Figure 3-2. Before mobilization for remediation, USACE would ask property owners to move woodpiles, miscellaneous debris, and other movable personal items from the remedial footprint. USACE assumes that it will be possible to remove non-permanent objects as necessary to implement the remedial action. Shrubs and trees (trunk diameter less than 6 inches) to be removed during construction activities would be inventoried for replacement in kind. Utilities within the proposed excavation areas would be marked and, if required, temporarily relocated. Offsets and setbacks pertaining to the extent of excavations and use of geotextile/marker fabric would be decided during the remedial design (RD) phase. Hand-digging would be performed to the extent practicable to prevent the removal of large trees (trunk diameter of 6 inches or more) and damage to underground utilities.
- Storage for equipment, staging for backfill material, and/or laydown areas would be located at USACE-approved properties within or near the neighborhood, following individual owner acceptance. The areas would be secured with a minimum of 6 feet of standard temporary security fence and appropriate signage.
- USACE would set up the Site for the excavation, off-site disposal, and backfilling, which would include a decontamination station and equipment/materials staging areas. Water needed during remedial activities for decontamination and dust suppression would be trucked to the Site and stored. Portable generators would supply electrical power during construction. Construction activities would be conducted during daylight hours, so lighting would not be required.

- Temporary relocation of residents is highly likely due to the risk from heavy machinery and open excavations. Temporary relocation is assumed to be no longer than 30 days per parcel. USACE would coordinate and pay for temporary lodging in suitable local accommodations and a daily per diem to cover meals and incidental expenses for residents during the relocation period. USACE would also provide a hospitality area for daily use of non-relocated residents who may be impacted by noise or other disturbances from remedial action at adjacent parcels.
- Pre-construction and post-construction survey: Pre-construction and post-construction surveys would be performed to allow excavation and restoration to be completed to the appropriate grade and to restore the property to its original, pre-excavated condition, which would have been documented during the RD survey. Site restoration may include topsoil, gravel, and landscaping. Fencing and gates would be removed, as appropriate, to allow construction equipment into the required areas.
- Extents and method of excavation: Soil with COC concentrations exceeding the site-specific risk threshold of 10^{-6} ELCR would be excavated to a maximum depth of 2 feet bgs. Parcels with RI COC exceedances in the top 1-foot bgs would be excavated to a depth of 1-foot bgs (Appendix C and Figure 3-2). For parcels with COC exceedances below 1-foot bgs, soils would be excavated to a depth of 2 feet bgs (Appendix C and Figure 3-2). The lateral extent of the excavation would be defined by the surveyed property boundaries and permanent structures, such as a building, paved areas, decks, sidewalks, small sheds, septic tanks, leach fields, or aboveground pools. The limitations posed by permanent structures would not prevent achievement of RAOs.
- Confirmation sampling: Following excavation and soil removal and before backfilling, confirmation samples would be collected using incremental sampling methodology (ISM). Decision units will be each individual parcel due to limitations with ROEs. The number and size of each grid would be determined by the size of the parcel. Confirmation samples and backfill material would be used to calculate the UCL of the weighted total soil concentrations in the parcel or sub-parcel to verify that soils with COC concentrations that exceed the PRGs have been removed from each parcel or to document the concentrations remaining at the 2-foot depth. Samples will be sent to an approved laboratory and will have expedite turnaround time for results to limit the time with an open excavation.
- If the confirmation samples exceed the PRGs at 2 feet bgs, a geotextile barrier would be installed at the bottom of the excavation to act as a visual warning barrier to help discourage direct human contact and exposure to COCs at depth. All parcel owners would be notified of the confirmation results.
- Excavation areas at each parcel would be in the open yards, landscaped areas, unpaved driveways, and parking areas that are not paved. Excavation would not occur in built-up

areas, such as those covered with pavement, concrete, or structures. Small trees and shrubbery may be removed and replaced. Setbacks for excavation from structures, paved areas, trees, utilities, and other appurtenances would be established to reduce the potential for damage to structures and improvements. Excavation within the setbacks would be done on a case-by-case basis at the discretion of the USACE Site Manager. Inaccessible areas under permanently fixed structures (such as residences, garages, concrete slabs, and parking garages) would not be inspected or remediated.

- Sufficient setback would be needed from structures and foundations to maintain structural integrity. The soil would be sloped at an approximate 45-degree angle (1:1 slopes) away from the edges of rock structures, weak concrete foundations, or other supporting structures to prevent loss of support and potential weakening of these features. Based on Site conditions and on a case-by-case basis, bracing and other measures may be considered to maintain the integrity of the structures and foundation.
- Conventional earthmoving equipment such as excavators, loaders, and dump trucks would be used to excavate the soil. Excavation by hand may be used to minimize damage to structures and large trees. A mini-excavator may be used as needed when excavating within tree canopy and other areas with limited access. Hand-digging would be performed in areas inaccessible by construction equipment.
- Considering the estimated areas of remediation at each parcel and the proposed depth of remediation (Appendices C and D, Figure 3-2), the estimated volume of soil excavated as a part of this alternative would be approximately 29,990 cubic yards. Assuming a 20% increase in volume from fluffing (U.S. Department of the Army, 2000), it is estimated that 50,400 tons would be excavated. Because near-surface soils are dry, a conversion of 1.4 tons per cubic yard was used.
- Upon completion of the excavation, if area(s) have cluster of visible target fragments on the bottom or sidewalls of the excavation, then visible fragments will be scraped up to remove the visible fragment mass. The scraping will be limited to one or two passes, limiting the additional volume of soil excavated to approximately two cubic yards.
- Waste characterization: Prior to excavation, the soil at each parcel would be sampled and characterized for disposal for Resource Conservation and Recovery Act (RCRA) waste characteristics. Analysis for PAHs and lead toxicity characteristic leaching procedure would be completed on soil samples collected from the parcels where excavation would be conducted. Based on the results of the profiled soil during the previous TCRA (USACE, 2014), it is anticipated that excavated soil would be disposed of as special waste.
- Waste transportation and disposal: The excavated soil and materials would be live-loaded (directly loaded to the trucks) and transported to a USACE-approved, permitted disposal facility (i.e., La Paz County Landfill in Parker, Arizona, or other). If the soil is

characteristically hazardous, disposal at a permitted hazardous landfill (i.e., Beatty, Nevada) would be arranged. A water truck would be used on site during excavation activities for decontamination and dust suppression purposes. Air monitoring for dust generation would be performed. The decontamination liquids generated from equipment cleaning would be stored in a tank for disposal. For cost-estimating purposes in this FS, it is assumed that 100% of the soil removed from the Site would be special waste and disposed of as such. Waste characterization results for the decontamination water completed as part of the RI would be used for characterizing and disposing of decontamination water generated during the excavation activities.

- Placement of demarcation material, clean fill material, and restoration: Following confirmation sampling, clean fill material and topsoil would be placed to return the properties to their original grade.
- Excavations would be immediately backfilled after the geotextile fabric is placed at the bottom of the excavation to minimize the risks of an open excavation and potential exposures, and to allow homeowners to return to their properties.
- The final graded surface would be covered with gravel or other suitable cover material of comparable cost, selected in consultation with the property owner. Replacement shrubs and trees would be planted, and fences and gates would be reinstalled or replaced unless otherwise not elected by the property owner. Water services for newly planted shrubs and trees would be provided for up to four weeks following Site restoration.
- LUCs: Educational materials would be mailed annually to properties where COC concentrations exceed the PRGs in the residual soil, including any property where COCs may be present beneath the geotextile barrier, existing structures, or features that were inaccessible for remediation. Educational materials would also be mailed to property owners who deny access for remedial action, though this measure alone would not be protective. Educational materials would be distributed to residents, local governing bodies, and local utilities annually, as described in detail in Section 6.1.3.2. These materials would include information on specific areas where impacted soils exceeding the PRGs remain or are suspected to remain, how to identify skeet fragments, the potential risks posed by impacted soils and skeet fragments, the potential presence of a geotextile/marker barrier at excavation depth and its purpose, and contact information to address community concerns.
- A LUCIP would be prepared to implement and maintain the LUCs. A site-specific database of all parcels would be developed and updated periodically (quarterly to semiannually) to track parcel ownership for educational material distribution. Detailed records showing where, when, and to whom materials were distributed would be maintained and checked during Five Year Reviews. For cost-estimating purposes, it is

assumed that 97 parcels (i.e., the whole Site) would require LUCs in the form of educational controls (educational materials).

Maintenance and monitoring of the LUCs would include the following tasks:

- Conduct periodic (quarterly or semiannual) property reviews using the local government (City of Kingman or Mohave County) online database or other appropriate sources to research property transactions.
- Maintain a current listing of property owners and the properties requiring LUCs as a part of the LUC database. If any parcel is transferred, update the LUC database and the Property Owner Mailing List to ensure new owners are included in the next annual distribution of educational materials.
- Update the LUCIP if there were any property transfers.
- Prepare an annual summary of property transactions.

6.1.3.4 Alternative 4 – LUCs and Excavation up to 4 feet bgs, Installation of Geotextile/Marker Fabric, Off-Site Disposal, Backfill, and Site Restoration

Alternative 4 is similar in all aspects to Alternative 3 except that the excavation to remove soil with COC concentrations exceeding the site-specific risk threshold of 10^{-6} ELCR (i.e., unacceptable risk) would be up to a depth of 4 feet bgs instead of 2 feet bgs (Appendix C and Figure 3-3). As with Alternative 3, initial soil excavation depths would be based on the RI sample results. For parcels with RI COC exceedances in the top 0–1 foot bgs, soils would initially be excavated to a depth of 1 foot bgs (Appendix C and Figure 3-3). Upon reaching this depth of excavation for each parcel, confirmation soil sampling would be conducted as described under Alternative 3. If confirmation results exceed the PRGs, an additional foot of soil would be removed, and additional confirmation samples would be collected. This process would continue until confirmation sample results are below PRGs or to a maximum depth of 4 feet bgs. If confirmation results at 4 feet bgs continue to exceed the PRGs, a permeable geotextile fabric would be placed at the bottom of the excavation as a visual warning barrier to help discourage direct human contact and exposure to COCs at depth.

Prior to implementation of the alternative, an RD would be conducted for the site, as described for Alternative 3. The RD would include documenting existing conditions for each Phase 1, including a survey of all permanent structures, utilities, septic tanks and leach fields, driveways, and sheds and would provide a record of pre-existing conditions. Fencing and other safety measures would be implemented as needed during excavation to protect the site and the public.

6.1.3.5 Alternative 5 – Demolition and Excavation up to 6 feet bgs, Off-Site Disposal, Backfill, Site Restoration and New Structure Construction

Alternative 5 consists of removal of all structures and features (e.g., houses, outbuildings, driveways, trees, fences, septic tanks and leach fields, utilities, etc.) that would interfere with complete removal of impacted soils exceeding the site-specific risk threshold of 10^{-6} ELCR (i.e., unacceptable risk), followed by excavation to remove soil exceeding the site-specific risk threshold of 10^{-6} ELCR (Figure 3-4). Soil would be characterized for disposal prior to excavation. Non-recyclable demolition debris and excavated materials would be directly loaded for off-site disposal at a permitted landfill. Following confirmation sampling, additional excavation and confirmation sampling would be completed as needed to ensure PRGs are achieved, and then the excavated area would be backfilled with certified clean fill material. Site restoration activities would be completed followed by construction of replacement housing structures. LUCs would be required at the Site if property owners deny access for remedial action.

For this alternative to be implementable, the following assumptions were made:

- An ROE would be obtained by USACE to allow for demolition, soil excavation, and reconstruction.
- The excavated soil would not be characteristically hazardous waste.
- The excavated soil would be disposed of as special waste, as in the TCRA previously implemented at the Site (USACE, 2014).

Alternative 5 has the following main components:

- Obtain required demolition permits and planning for relocation of residents during demolition, soil excavation, and new construction.
- Plan for replacement housing construction.
- Temporarily relocate residents.
- Demolish existing structures and features.
- Excavate contaminated soils to the depth of reported COC concentrations exceeding the site-specific risk threshold of 10^{-6} ELCR to a maximum depth of 6 feet bgs.
- Characterize soil for disposal purposes prior to excavation. If the soil is not characteristically hazardous, disposal at a local permitted landfill (i.e., La Paz County Landfill in Parker, Arizona) would be arranged. If the soil is characteristically hazardous, disposal at permitted hazardous landfill (i.e., Beatty, Nevada) would be arranged.
- Conduct confirmation sampling using ISM, as described in Alternatives 3 and 4.

- Conduct additional excavation and confirmation sampling as needed until the confirmation samples do not exceed the PRGs.
- Transport and dispose of the soil at a permitted landfill.
- Identify potential clean import fill borrow sites.
- Backfill the excavation with certified clean import fill material and cover with topsoil.
- Perform new structure and feature construction for replacement housing and site restoration to pre-demolition and excavation conditions.

6.2 Screening of Alternatives

Screening of alternatives, while not mandatory, can be used to reduce the list of alternatives that are carried forward for detailed evaluation.

6.2.1 Screening Process Summary

Two alternatives were screened out during the screening process. Alternative 2 was screened out because it would not be protective of human health (because the exposure pathways would remain in place) and therefore it would not meet the RAO. Alternative 5 was screened out because it would not be implementable, since it is not feasible that USACE would be able to obtain an ROE for home demolitions and rebuilding of homes, and the cost would be insurmountable. Note that the no-action alternative is included in the screening process because it is required by the NCP.

6.2.2 Alternatives Retained for Detailed Analysis

The following alternatives were retained for detailed analysis:

- Alternative 1 – No Action
- Alternative 3 – LUCs and Excavation up to 2 feet bgs, Installation of Geotextile/Marker Fabric, Off-site Disposal, Backfill, Site Restoration
- Alternative 4 – LUCs and Excavation up to 4 feet bgs, Installation of Geotextile/Marker Fabric, Off-site Disposal, Backfill, Site Restoration

7.0 DETAILED ANALYSIS

Section 300.430(e)(9)(iii) of the NCP lists nine criteria against which each alternative must be assessed. The acceptability or performance of each alternative against the NCP criteria is evaluated individually to identify relative strengths and weaknesses. The detailed criteria are as follows:

1. Overall protection of human health and the environment
2. Compliance with ARARs
3. Long-term effectiveness and permanence
4. Reduction of toxicity, mobility, or volume through treatment
5. Short-term effectiveness
6. Implementability
7. Cost;
8. State acceptance
9. Community acceptance

Under Title 40 of the Code of Federal Regulations (CFR) Part 300.430(f)(1)(i) (40 CFR 300430(f)(1)(i)), the first two criteria, protection of human health and the environment and compliance with ARARs, are "threshold criteria" that must be met by the selected remedial action unless a waiver is granted for an ARAR under Section 121(d)(4) of CERCLA. Criteria 3– 7 are "primary balancing criteria," and the trade-offs within this group must be balanced. The preferred alternative, which is protective of human health and the environment, would be ARAR-compliant and provide the best combination of primary balancing attributes. The last two criteria, state and community acceptance, are "modifying criteria," which are evaluated after the FS has been presented to the regulators and the community, allowing for their input. The nine criteria are explained further in the following subsections.

7.1 Protection of Human Health and the Environment

A determination and declaration that the proposed remedial action would meet this criterion must be made in the ROD; therefore, the selected remedy must meet this threshold criterion. The criterion can be satisfied if the risks/exposures at the Site are reduced to levels established by the remedial goals. Overall protection of human health and the environment draws on the assessments of other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

7.2 Compliance with ARARs

Compliance with ARARs is a threshold criterion that must be met by the proposed remedial action unless ARARs are waived under 40 CFR 300.430(e)(9)(iii)(B). The remedial alternative would meet this criterion if the alternative meets all chemical-, action-, and location-specific ARARs. For ARARs that are not met, a determination would be made on whether a waiver is appropriate. The potential ARARs identified for this project are discussed in Section 3.0 and are summarized in Table 3-1.

7.3 Long-Term Effectiveness and Permanence

This criterion addresses the long-term adequacy, reliability, and permanence of the remedial alternative. Components of this analysis include the following:

- The expected long-term reduction in risk posed by the Site
- The magnitude of residual risk remaining from untreated waste or treatment residuals at the conclusion of the remedial activities
- The level of effort needed to maintain the remedy and monitor the area for Site condition changes
- The compatibility of the remedy with the planned future use of the Site

7.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

This criterion addresses the statutory preference for remedial technologies that significantly and permanently reduce the toxicity, mobility, or volume (TMV) through treatment of the waste. The following factors are considered:

- The volume of hazardous materials that would be destroyed or treated
- The degree of expected reduction in TMV
- The degree to which the treatment would be irreversible
- The type and quantity of treatment residuals that would remain following treatment

7.5 Short-Term Effectiveness

Evaluation of the alternatives concerning short-term effectiveness considers the protection of workers and the community during the remedial action, environmental impacts from implementing

the action, and the time required to achieve RAOs. The short-term impacts of alternatives shall be assessed, considering the following:

- Protection of the community during the remedial action, including the effects of dust from excavation, transportation of contaminated materials, and air-quality impacts from on-site treatment
- Potential impacts on workers during the remedial action and the effectiveness and reliability of protective measures
- Potential environmental impacts of the remedial action and the effectiveness and reliability of mitigative measures during implementation
- Time required to achieve remedial response objectives

7.6 Implementability

The technical and administrative feasibility of implementing the remedial action would be addressed. The technical feasibility would be evaluated based on the ease of construction and maintenance, and the reliability of the selected technology. The ease or difficulty of implementing the alternatives is assessed by considering the following factors as appropriate.

- Technical feasibility, including technical difficulties and unknowns associated with the construction and operation of a technology, the reliability of the technology, ease of undertaking additional remedial actions, and the ability to monitor the effectiveness of the remedy
- Administrative feasibility, including activities needed to coordinate with other offices and agencies and the ability and time required to obtain necessary approvals and permits from other agencies (for off-site actions)
- Availability of services and materials, including the availability of adequate off-site treatment, storage capacity, and disposal capacity and services; the availability of necessary equipment, specialists, and provisions to ensure essential additional resources; and the availability of services, materials, and availability of prospective technologies

7.7 Cost

The cost estimates presented in this report were prepared per USEPA guidance (USEPA, 2000) and represent programming-level and order-of-magnitude estimates. These costs are based on conventional cost-estimating guides and prior experience and were prepared following the information available at the time of the estimate. The cost estimates are on a standard, present-worth basis in terms of 2025 dollars. The project's actual costs would depend on true labor and

material costs, actual Site conditions, competitive market conditions, the final project scope, the implementation schedule, and other variable factors.

The cost estimate details are presented in Appendix B and include both capital cost and recurring costs, as follows.

- Capital costs: include those expenditures required to implement the remedial action. Both direct and indirect costs are considered in the development of capital cost estimates. Direct costs include pre-construction and construction costs.
- Pre-construction costs: include costs for access agreements, community involvement, pre-construction property assessments, property owner relocation costs, and Site-specific project plans. Construction costs for equipment, labor, and materials required to implement the remedial action are considered. Indirect costs include those associated with engineering, permitting, construction management, and other services necessary to carry out remedial action.
- Periodic costs: include costs that may be incurred periodically even after the initial remedial activity is complete. These costs include maintenance and monitoring of LUCs, including periodic property reviews (for example, quarterly), updates to the database of parcels requiring LUCs, execution of the LUCIP if any of the parcels are transferred, and periodic updates to the LUCIP. While not a component of the remedy, Five-Year Reviews would be required as soil exceeding the PRGs would be left in place in inaccessible areas, not allowing for unlimited use and unrestricted exposure. The ongoing costs to perform Five-Year Reviews are also considered periodic costs.

7.8 State Acceptance

It is anticipated that ADEQ will provide formal comments during the public comment period on the Proposed Plan for the preferred alternative. USACE would then address these comments in the ROD Responsiveness Summary.

7.9 Community Acceptance

Because the community has not been provided with a formal opportunity to review the detailed analysis of the remedial actions, no formal comments are available to evaluate this criterion. It is anticipated that the community would provide formal comments during the public comment period on the Proposed Plan for the preferred alternative. USACE would then address these comments in the ROD Responsiveness Summary.

A detailed evaluation of the alternatives with respect to the first seven evaluation criteria discussed in Section 7.0 is presented in the following subsections. A remedial alternative evaluation summary of the retained alternative is shown in Table 7-1.

7.10 Alternative 1 – No Action (Baseline Alternative)

As discussed in Section 6.1.3.1, under Alternative 1, no action would be taken to remove or treat soils with COC concentrations exceeding the site-specific risk threshold of 10^{-6} ELCR at the Site. The no-action alternative is required by the NCP and serves as the baseline against which all other remedial alternatives are evaluated.

7.10.1 Protection of Human Health and the Environment

Under this alternative, considering that there would not be any remedial actions that would be implemented, there would not be any measurable reduction in potential human health risks. Because the FS focus area is in a residential setting with direct exposures to soils with COC concentrations exceeding the site-specific risk threshold of 10^{-6} ELCR, this alternative would not protect human health or the environment.

7.10.2 Compliance with ARARs

Compliance with ARARs is not applicable for the no-action alternative because no response actions would be executed.

7.10.3 Long-Term Effectiveness and Permanence

Because the no-action alternative does not include any actions, either administrative or by remediation, the potential risk would persist at the Site because receptors could come into contact with soils with COC concentrations exceeding the site-specific risk threshold of 10^{-6} ELCR. In addition, where soils are exposed, COCs could be released with windborne dust or by stormwater runoff.

7.10.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 1 does not provide treatment processes for TMV reduction of soils with COCs. Because there is no physical treatment process, there would be no treatment residuals. Alternative 1 would not satisfy the statutory preference for treatment.

7.10.5 Short-Term Effectiveness

Short-term effectiveness does not apply to Alternative 1, No Action, because no additional remedial activities would be implemented.

7.10.6 Implementability

There are no implementability concerns associated with the no-action alternative because no remediation activities would be conducted.

7.10.7 Cost

There are no costs associated with Alternative 1. The net present value is $0.

7.10.8 State and Community Acceptance

USACE will evaluate state and community acceptance for Alternative 1 following the state's review of the FS Report and the public comment period.

7.11 Alternative 3 – LUCs and Excavation up to 2 feet bgs, Installation of Geotextile/Marker Fabric, Off-Site Disposal, Backfill, and Site Restoration

The main components of Alternative 3 are described in Section 6.1.3.3.

7.11.1 Protection of Human Health and the Environment

Within the limits of excavation, Alternative 3 would result in removing soil with COCs exceeding the site-specific risk threshold of 10^{-6} ELCR. It would remove the unacceptable risk from exposure to soils exceeding the PRGs. If confirmation results exceed the PRGs at 2 feet bgs, a geotextile barrier would be installed to demarcate where soils with COC concentrations exceeding PRGs are left in place, below 2 feet bgs. This visual barrier would serve as a visual warning to help discourage direct human contact and exposure to soils with COC concentrations exceeding the PRGs. Distribution of educational materials would also prevent direct human contact and exposure to contamination.

Alternative 3 would be protective of human health and the environment by eliminating the direct contact pathway in accessible areas of the property. Because properties may contain COC concentrations exceeding the PRGs beneath the permeable barrier or where existing structures or features prevented excavation of contaminated soil, distribution of educational materials would be required.

7.11.2 Compliance with ARARs

ARARs would be met with Alternative 3 through environmental controls during predesign and construction activities defined as part of the RD. Excavated soil would be characterized for disposal prior to excavation and directly loaded for transport and disposal to avoid stockpiling, and any decontaminated items would not be removed from the site.

7.11.3 Long-Term Effectiveness and Permanence

Alternative 3 would result in removing soil with COCs exceeding the site-specific risk threshold of 10^{-6} ELCR within the limits of excavation to 2 feet bgs. The excavated materials would be replaced with certified clean backfill. A minimum 2-foot clean soil cover is considered protective of the ingestion, dermal, and inhalation exposure pathways of concern, and protective of typical gardening uses of residential properties (USEPA, 2003). Therefore, Alternative 3 provides long-term effectiveness and permanence.

In areas where soil with COC concentrations exceeding the PRGs are left in place below 2 feet bgs, placement of high-visibility, permeable demarcation fabric would serve as a visual warning to reduce the potential risk of contact. Upon establishment of vegetation, erosion of the backfilled clean fill would be minimized.

Educational materials would be distributed to property owners, residents, local government agencies, and local utilities to address properties where COC concentrations exceeding PRGs in the soil remain at depth or beneath existing structures. Educational materials would increase the long-term effectiveness and permanence by minimizing the potential for future disturbance of this soil.

7.11.4 Reduction in Toxicity, Mobility, or Volume through Treatment

Alternative 3 includes excavation, off-site disposal, and backfill, and is not a treatment method. Alternative 3 does not satisfy USEPA's statutory preference for remedial actions that employ treatment technologies as the principal element.

7.11.5 Stort-Term Effectiveness

During excavation and backfill, contaminated particulates may be generated and dispersed into the atmosphere resulting in potential exposure, primarily of site workers, from dermal absorption, inhalation, or incidental ingestion of contaminated soil. The work plan and APP/SSHP, along with monitoring and appropriate use of personal protective equipment, would be implemented to minimize potential exposures. Windblown emissions of contaminated dust and transport of

contamination in surface runoff would be controlled using a water spray or plastic sheeting. Silt fences, trenches, or other structures would be constructed to prevent surface runoff and erosion of contaminated soil. An air monitoring program, including the regular use of a photoionization detector and a particulate counter, would provide a means of determining when additional dust control measures are required.

There would also be short-term impacts associated with noise generation to workers and nearby residents. Appropriate hearing protection would be used to minimize worker exposure. However, efforts would be made to minimize the potential impact to the local community by working during regular business hours, using equipment mufflers, temporarily relocating residents, and providing a hospitality area for use by nearby residents to avoid noise and other disturbances.

Short-term impacts to nearby residents would also include an increase in heavy vehicle traffic. Traffic controls would be implemented, as appropriate, to minimize inconveniences and to avoid roadway accidents. All vehicles that would be transporting soil to the off-site disposal facility would be operated in accordance with federal and state regulations. The haul routes would be coordinated with USACE, the City of Kingman, and Mohave County, prior to the commencement of remedial activities.

Soil excavation activities will temporarily disturb existing landscaping and habitat features within work areas, including removal or damage to turf, ornamental plantings, shrubs, small trees, garden beds, and groundcover, as well as temporary disruption of habitat used by birds, pollinators, and other small wildlife. Excavation and equipment traffic can alter soil structure, increase erosion potential, and expose bare soil until restoration is complete. These effects are expected to be short term and localized and will be minimized through careful delineation of work limits, protection of trees and plantings to the extent practicable, and prompt restoration of disturbed areas following backfilling.

Implementation of this alternative would require approximately six months for the design phase and, due to potential weather limitations, 12–18 months for the construction phase.

7.11.6 Implementability

Excavation and off-site soil disposal are common and reliable remedial activities, and the required personnel and equipment are readily available. Materials (i.e., clean fill, topsoil, and other landscaping-related items) are easily obtained from local vendors. Implementability of this alternative is complicated by the setting (i.e., residential area), the need to excavate around existing structures, removal and then backfill of large quantities of soil, and site restoration.

Administrative implementation of this alternative would require coordination between USACE, property owners, and ADEQ. The most-critical factors of administrative implementation are USACE obtaining ROEs from property owners with coordination from ADEQ, and implementing LUCs, where required. This alternative may be more implementable than other excavation alternatives because approval of ROEs by property owners may be more likely due to smaller excavation volumes at each parcel and shorter completion timeframes.

Upon completing remedial actions, distribution of educational materials would be required at the Site due to soils with COC concentrations exceeding PRGs potentially left in place below 2 feet bgs and under permanent structures. Overall, this element of Alternative 3 is highly implementable; however, ensuring distribution of educational materials to current property owners and residents could pose an implementability challenge if public records are inaccurate or if properties are rented and owners do not share the materials with tenants.

7.11.7 Cost

Costs for Alternative 3 associated with pre-construction, excavation, transportation, and disposal of excavated soil, placement of clean fill and topsoil, restoration, and watering are based on the estimated soil volumes and disturbed surface areas. The cost estimate for Alternative 3 is presented in Appendix D.

The total present value is estimated to be $20,869,000 for Alternative 3. The total capital cost of this alternative is estimated at $20,468,370. The costs include excavation, transportation, and disposal of soil, backfill, and Site restoration. The total present value cost of periodic costs for Five-Year Reviews over 30 years is estimated to be $306,381 and LUCIP updates over 30 years is estimated to be $306,381. Details of the cost estimates, including assumptions, are presented in Appendix D.

7.11.8 State and Community Acceptance

USACE will evaluate state and community acceptance for Alternative 3 following the state's review of the FS Report and the public comment period.

7.12 Alternative 4 – LUCs and Excavation up to 4 feet bgs, Installation of Geotextile/Marker Fabric, Off-Site Disposal, Backfill, and Site Restoration

Alternative 4 is similar in all aspects to Alternative 3 except that the excavation to remove soil with COC concentrations exceeding the site-specific risk threshold of 10^{-6} ELCR (i.e., unacceptable risk) would be up to a depth of 4 feet bgs instead of 2 feet bgs the at 97 parcels/sub-

parcels/ROWs (Appendix C and Figure 3-3). The main differences between Alternatives 3 and 4 are described in Section 6.1.3.4 and their similar main components are described in Section 6.1.3.3.

Considering the estimated areas of remediation at each parcel and the proposed depth of remediation (Appendices C and D, and Figure 3-3), the estimated volume of soil excavated as a part of this alternative would be approximately 32,540 cubic yards. Assuming a 20% increase in volume from fluffing (U.S. Department of the Army, 2000), it is estimated that 54,700 tons would be excavated. Because near-surface soils are dry, a conversion of 1.4 tons per cubic yard was used.

Maintenance and monitoring of the educational controls are the same for Alternative 4 as for Alternative 3, as listed in Section 6.1.3.3.

7.12.1 Protection of Human Health and the Environment

Within the limits of excavation, Alternative 4 would result in removing soil with COCs exceeding the site-specific risk threshold of 10^{-6} ELCR. It would remove the unacceptable risk from exposure to soils exceeding the PRGs. If confirmation results exceed the PRGs at 4 feet bgs, a geotextile barrier would be installed to demarcate where soils with COC concentrations exceeding PRGs are left in place, below 4 feet bgs. This visual barrier would serve as a visual warning to help discourage direct human contact and exposure to soils with COC concentrations exceeding the PRGs. Distribution of educational materials would also prevent direct human contact and exposure to contamination.

Alternative 4 would be protective of human health and the environment by eliminating the direct contact pathway in accessible areas of the property. Because properties may contain COC concentrations exceeding the PRGs beneath the permeable barrier or where existing structures or features prevented excavation of contaminated soil, distribution of educational materials would be required.

7.12.2 Compliance with ARARs

ARARs would be met with Alternative 4. through environmental controls during predesign and construction activities defined as part of the RD. Excavated soil would be characterized for disposal prior to excavation and directly loaded for transport and disposal to avoid stockpiling, and any decontaminated items would not be removed from the site.

7.12.3 Long-Term Effectiveness and Permanence

Alternative 4 would result in removing soil with COCs exceeding the site-specific risk threshold of 10^{-6} ELCR within the limits of excavation to 4 feet bgs. The excavated materials would be replaced with certified clean backfill. A minimum 2-foot clean soil cover is considered protective of the ingestion, dermal absorption, and inhalation exposure pathways of concern, and protective of typical gardening uses of residential properties (USEPA, 2003). Therefore, Alternative 4 provides long-term effectiveness and permanence.

In areas where soil with COC concentrations exceeding the PRGs are left in place below 4 feet bgs, placement of high-visibility, permeable demarcation fabric would serve as a visual warning to reduce the potential risk of contact. Upon establishment of vegetation, erosion of the backfilled clean fill would be minimized.

Educational materials would be distributed to property owners, residents, local government agencies, and local utilities to address properties where COC concentrations exceeding PRGs in the soil remain at depth or beneath existing structures. Educational materials would increase the long-term effectiveness and permanence by minimizing the potential for future disturbance of this soil.

7.12.4 Reduction in Toxicity, Mobility, or Volume through Treatment

Alternative 4 includes excavation, off-site disposal, and backfill, and is not a treatment method. Alternative 4 does not satisfy USEPA's statutory preference for remedial actions that employ treatment technologies as the principal element.

7.12.5 Short-Term Effectiveness

During excavation and backfill, contaminated particulates may be generated and dispersed into the atmosphere resulting in potential exposure, primarily of site workers, from dermal absorption, inhalation, or incidental ingestion of contaminated soil. The work plan and APP/SSHP, along with monitoring and appropriate use of personal protective equipment, would be implemented to minimize potential exposures.

Windblown emissions of contaminated dust and transport of contamination in surface runoff would be controlled using a water spray or plastic sheeting. Silt fences, trenches, or other structures would be constructed to prevent surface runoff and erosion of contaminated soil. An air monitoring program, including the regular use of a photoionization detector and a particulate counter, would provide a means of determining when additional dust control measures are required.

There would be short-term impacts associated with noise generation to workers and nearby residents. Appropriate hearing protection would be used to minimize worker exposure. However, efforts would be made to minimize the potential impact to the local community by working during regular business hours, using equipment mufflers, temporarily relocating residents, and providing a hospitality area for use by nearby residents to avoid noise and other disturbances.

Short-term impacts to nearby residents would also include an increase in heavy vehicle traffic. Traffic controls would be implemented, as appropriate, to minimize inconveniences and to avoid roadway accidents. All vehicles that would be transporting soil to the off-site disposal facility would be operated in accordance with federal and state regulations. The haul routes would be coordinated with USACE, the City of Kingman, and Mohave County, prior to the commencement of remedial activities.

Soil excavation activities will temporarily disturb existing landscaping and habitat features within work areas, including removal or damage to turf, ornamental plantings, shrubs, small trees, garden beds, and groundcover, as well as temporary disruption of habitat used by birds, pollinators, and other small wildlife. Excavation and equipment traffic can alter soil structure, increase erosion potential, and expose bare soil until restoration is complete. These effects are expected to be short term and localized and will be minimized through careful delineation of work limits, protection of trees and plantings to the extent practicable, and prompt restoration of disturbed areas following backfilling.

Implementation of this alternative would require approximately six months for the design phase and, due to potential weather limitations, 12-20 months for the construction phase.

7.12.6 Implementability

Excavation and off-site soil disposal are common and reliable remedial activities, and the required personnel and equipment are readily available. Materials (i.e., clean fill, topsoil, and other landscaping-related items) are easily obtained from local vendors. Implementability of this alternative is complicated by the setting (i.e., residential area), the need to excavate around existing structures, removal and then backfill of large quantities of soil, and site restoration.

Administrative implementation of this alternative would require coordination between USACE, property owners, and ADEQ. The most-critical factors of administrative implementation are USACE obtaining ROEs from property owners with coordination from ADEQ, and implementing LUCs, where required. This alternative may be less implementable than Alternative 3 because approval of ROEs by property owners may be less likely due to larger excavation volumes at each parcel and longer completion timeframes.

Upon completing remedial actions, distribution of educational materials would be required at the Site due to soils with COC concentrations exceeding PRGs potentially left in place below 4 feet bgs, and under permanent structures. Overall, this element of Alternative 4 is highly implementable; however, ensuring distribution of educational materials to current property owners and residents could pose an implementability challenge if public records are inaccurate or if properties are rented and owners do not share the materials with tenants.

7.12.7 Cost

Costs for Alternative 4 associated with pre-construction, excavation, transportation, and disposal of excavated soil, placement of clean fill and topsoil, restoration, and watering are based on the estimated soil volumes and disturbed surface areas. The cost estimate for Alternative 4 is presented in Appendix D.

The total present value is estimated to be $21,911,000 for Alternative 4. The total capital cost of this alternative is estimated at $21,510,125. The costs include excavation, transportation, and disposal of soil, backfill, and Site restoration. The total present value cost of periodic costs for Five-Year Reviews over 30 years is estimated to be $306,381 and LUCIP updates over 30 years, is estimated to be $308,381. Details of the cost estimates, including assumptions, are presented in Appendix D.

7.12.8 State and Community Acceptance

USACE will evaluate state and community acceptance for Alternative 4 following the state's review of the FS Report and the public comment period.

Table 7-1. Evaluation of Retained Alternatives by NCP Criteria

Criteria		Alternative 1: No Action	Alternative 3: LUCs and Excavation up to 2 feet bgs, Installation of Geotextile/Marker Fabric, Off-Site Disposal, Backfill, and Site Restoration	Alternative 4: LUCs and Excavation up to 4 feet bgs, Installation of Geotextile/Marker Fabric, Off-Site Disposal, Backfill, and Site Restoration
Threshold Criteria	**Overall Protection of Human Health and the Environment**	Does not meet criteria. Not protective of human health and the environment because it does not mitigate the risk associated with PAHs in soil at the Site.	Meets criteria. Protective of human health and the environment through the removal of soils exceeding the site-specific risk threshold up to 2 feet bgs. Would also reduce potential human health risks through educational and engineering controls for areas where soils with PAH concentrations exceeding PRGs are left in place.	Meets criteria. Protective of human health and the environment through the removal of soils exceeding the site-specific risk threshold up to 4 feet bgs. Would also reduce potential human health risks through educational and engineering controls for areas where soils with PAH concentrations exceeding PRGs are left in place.
	Compliance With ARARs	Meets criteria. ARARs are not applicable.	Meets criteria. Would comply with ARARs.	Meets criteria. Would comply with ARARs
Primary Balancing Criteria	**Long-term Effectiveness and Permanence**	Does not meet the long-term effectiveness requirements since it does not remove the risk associated with PAHs in soil at the Site.	Would be effective over the long term through permanent removal of soil exceeding the site-specific risk threshold up to 2 feet bgs, and the subsequent installation of a geotextile barrier and annual distribution of educational materials.	Would be effective over the long term through permanent removal of soil exceeding the site-specific risk threshold up to 4 feet bgs, and the subsequent installation of a geotextile barrier and annual distribution of educational materials.
	Reduction of Toxicity, Mobility, or Volume, through Treatment	Does not involve treatment.	Does not involve treatment.	Does not involve treatment.
	Short-term Effectiveness	Does not meet the short-term effectiveness requirements.	Would involve short-term safety risks to workers and the public. Safety risks to workers would be managed using standard industry practices. Public safety risks would be mitigated using exclusion zones, traffic management, and temporary relocation of residents, as necessary.	Would involve short-term safety risks to workers and the public. Safety risks to workers would be managed using standard industry practices. Public safety risks would be mitigated using exclusion zones, traffic management, and temporary relocation of residents, as necessary.
	Implementability	Highly implementable because no remedial actions are conducted.	Implementable. Excavation, installation of geotextile barrier, and educational LUCs are well-established and reliable methods with readily available required services, materials, and coordination.	Implementable. Excavation, installation of geotextile barrier, and educational LUCs are well-established and reliable methods with readily available required services, materials, and coordination.
	Cost Estimate (Net Present Value)	No cost is associated with this alternative because no action would be taken.	$20,869,000	$21,911,000
Modifying Criteria	**State and Community Acceptance**	USACE would evaluate state and community acceptance following the state's review of the FS and the public comment period for the Proposed Plan.		

Key:
The following indicates the significance of the shaded cell colors.

Threshold criteria are pass or fail, and as such, not graded with the color system.	Most Desirable	Significantly Desirable	Moderately Desirable	Least Desirable

ARAR	applicable or relevant and appropriate requirement	PAH	polycyclic aromatic hydrocarbon
bgs	below ground surface	PRG	preliminary remediation goal
FS	Feasibility Study	USACE	United States Army Corps of Engineers
LUC	land use control		

7.13 Comparative Analysis

The following analysis evaluates Alternatives 1, 3, and 4 in relation to one another for each of the first seven evaluation criteria. State and community acceptance would be addressed in the ROD following comments on the FS Report and the Proposed Plan. The purpose of this analysis is to identify the relative advantages and disadvantages of each alternative.

7.13.1 Overall Protection of Human Health and the Environment

Alternative 1, No Action, is not protective of human health and the environment.

Alternative 3 is considered protective of human health. Alternative 3 relies on a combination of excavation, transportation and disposal, backfill of clean fill, restoration, and LUCs, where needed, to meet the RAOs. Alternative 3 is permanent. In the areas where soils with COC concentrations exceeding the PRGs are left in place, a geotextile/ marker fabric would be installed to mark the vertical extent of excavation. LUCs would be needed to educate residents on avoidance of activities in areas that could result in future exposure to PAHs, such as soils below a depth of 2 feet bgs and areas inaccessible for excavation.

Alternative 4 is considered protective of human health. Like Alternative 3, Alternative 4 relies on a combination of excavation, transportation and disposal, backfill of clean fill, restoration, and LUCs, where needed, to meet the RAOs. Alternative 4 is more protective than Alternative 3 as it would remove contaminated soil down to depths of four feet. In the areas where soils with COC concentrations exceeding the PRGs are left in place, a geotextile/marker fabric would be installed to mark the vertical extent of excavation. LUCs would be needed to educate residents on avoidance of activities in areas that could result in future exposure to PAHs, such as soils below a depth of 4 feet bgs and areas inaccessible for excavation.

7.13.2 Compliance with ARARS

Alternative 1 does not involve removal of contaminated soil and no other actions would be undertaken and therefore no action-specific ARARs would be required to be attained. No location- and no contaminant-specific ARARs were determined to be applicable or relevant and appropriate.

Alternatives 3 and 4 would comply with action-specific ARARs through environmental controls during predesign and construction activities defined as part of the remedial design. Soil to be excavated would be characterized for disposal prior to excavation and directly loaded for transport and disposal to avoid stockpiling and any decontaminated items will not be removed from the site.

No location- and no contaminant-specific ARARs were determined to be applicable or relevant and appropriate.

7.13.3 Long-Term Effectiveness and Permanence

Alternative 1 would not provide a permanent solution or long-term effectiveness. Alternatives 3 and 4 are both effective over the long term through source reduction of contaminants and residual risk mitigation using public education and installation of the geotextile barrier. Alternative 4 would be more effective over the long term than Alternative 3 because it involves the removal of a greater quantity of impacted soil.

7.13.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Alternatives 1, 3, and 4 would not reduce the TMV of the soil with COC concentrations exceeding the PRGs through treatment because they do not include treatment as part of the design. None of the alternatives meet the statutory preference for treatment. Available treatment technologies for COCs were eliminated during the identification and screening of technologies discussed in Section 5.0 based on limited effectiveness and implementability.

7.13.5 Short-Term Effectiveness

Alternative 1 would have no short-term impacts on human health and the environment because it does not include implementing remedial action. Alternative 3 would have moderate short-term impacts and Alternative 4 would have the greatest short-term impacts based on the estimated duration of each alternative (12–18 months and 12–20 months, respectively). Impacts from the implementation of either alternative would include short-term risks to workers through exposure to impacted soils. Impacts to residents would include potential temporary relocation and increased noise and construction traffic associated with excavation. Potential impacts to workers would be mitigated through engineering controls, proper protective equipment and adequate monitoring. Noise and traffic would be mitigated with traffic plans, and specific timing of construction activities would be leveraged to reduce short-term impacts.

7.13.6 Implementability

There are no concerns associated with the ability to implement Alternative 1 because no action would be taken. Both Alternatives 3 and 4 would be moderately difficult to implement because both require obtaining ROEs for each parcel, temporary relocation of residents, excavation in a residential area, working around existing structures, moving large quantities of soil, experienced personnel, equipment, and materials/supplies for excavation, backfilling, and site restoration. Alternative 4 would be slightly harder to implement because it would involve more soil removal

and would take longer to reach RAOs. However, services of experienced personnel, equipment, and material/supplies are generally readily available. Obtaining ROEs is expected to have the largest impact on implementability of both Alternatives 3 and 4 because approval by property owners would determine where the remedy can be implemented and the process of obtaining an individual ROE can take anywhere from a few months to a year to complete. Alternative 4 may be less implementable than Alternative 3 because approval of ROEs by property owners may be less likely due to larger excavation volumes at each parcel and longer completion timeframes.

7.13.7 Cost

The estimated cost of each alternative is detailed in Appendix D and summarized in Table 7-2. The assumptions for the cost estimates also are presented in Appendix D. Capital costs, recurring costs (where appropriate), and present worth costs for 30 years have been evaluated. Five-Year Reviews over a 30-year period are included for Alternatives 3 and 4. In accordance with USEPA guidelines, these cost estimates are anticipated to provide an accuracy of +50% to -30% (USEPA, 1988). The no-action alternative has a total present value of $0.

Table 7-2. Summary of Alternative Cost Estimates

Alternative	Total Capital Cost	Total Annual Cost (Present Worth) over 30 years	Total Present Value	Cost Per Parcel/ROW
1 – No Action	$0	$0	$0	$0
3 – Excavation up to 2 feet	$20,468,370	$612,762	$20,869,000	$215,144
4 – Excavation up to 4 feet	$21,510,125	$612,762	$21,911,000	$225,887

Key:
ROW right-of-way

7.13.8 State and Community Acceptance

USACE will evaluate state and community acceptance following the state's review of the FS Report and the public comment period.

8.0 SUMMARY

The objective of this FS Report is to develop and evaluate remedial alternatives that would address human health risks from soils with COC concentrations exceeding the site-specific risk threshold of 10^{-6} ELCR at the Site. Remedial technologies and process options were screened to identify preliminary remedial alternatives. Five alternatives were developed and evaluated:

- Alternative 1 – No Action
- Alternative 2 – LUCs Only (distribution of educational materials)
- Alternative 3 – LUCs and Excavation up to 2 feet bgs, Installation of Geotextile/Marker Fabric, Off-site Disposal, Backfill, and Site Restoration
- Alternative 4 – LUCs and Excavation up to 4 feet bgs, Installation of Geotextile/Marker Fabric, Off-site Disposal, Backfill, and Site Restoration
- Alternative 5 – Demolition Excavation up to 6 feet bgs, Off-site Disposal, Backfill, Site Restoration and New Structure Construction

The comparative analysis of the alternatives included evaluating the threshold criteria and primary balancing criteria. The modifying criteria, state and community acceptance, will be evaluated after the state's review of this FS Report and public comments for the Proposed Plan. The evaluation of the threshold criteria included reviewing the protectiveness of the alternative and compliance with ARARs. An evaluation of long-term effectiveness and permanence; reduction in TMV; short-term effectiveness; implementability; and cost was also conducted across the alternatives.

Based on the comparative analysis of the alternatives, Alternative 1 is not an acceptable alternative because it does not meet the protectiveness threshold criterion. Alternatives 3 and 4 are permanent solutions and could be used to remove soil with COC concentrations that exceed the PRGs in the excavated areas. Alternative 4 would be the most effective over the long term because it would involve the removal of more contaminated soil than Alternative 3. However, Alternative 4 also would have slightly more short-term impacts than Alternative 3 and it would cost over $1 million more. The preferred alternative will be presented in the Proposed Plan.

Because soils containing COC concentrations exceeding the PRGs would be left in place following both Alternatives 3 and 4, Five-Year Reviews would be required.

9.0 REFERENCES

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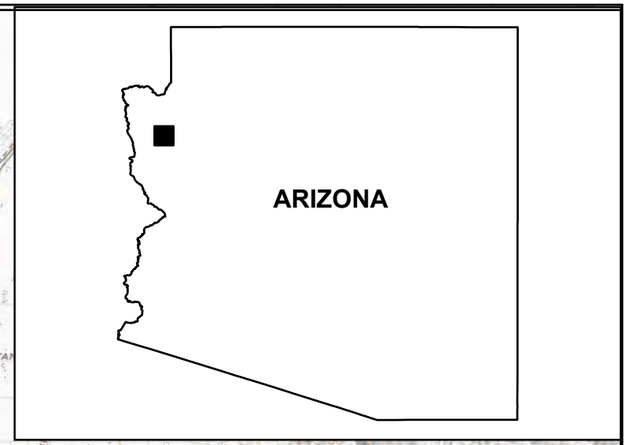
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FIGURES

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USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems; U.S. Census Bureau TIGER/Line data; USFS Road data; Natural Earth Data; U.S. Department of State HIU; NOAA National Centers for Environmental Information. Data refreshed October 27, 2025.

Legend

- Kingman Ground-To-Ground Gunnery Range
- Former 15 Skeet Ranges

N

0 0.38 0.75 1.5 2.25 3 3.75
Miles

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US Army Corps of Engineers
Los Angeles District

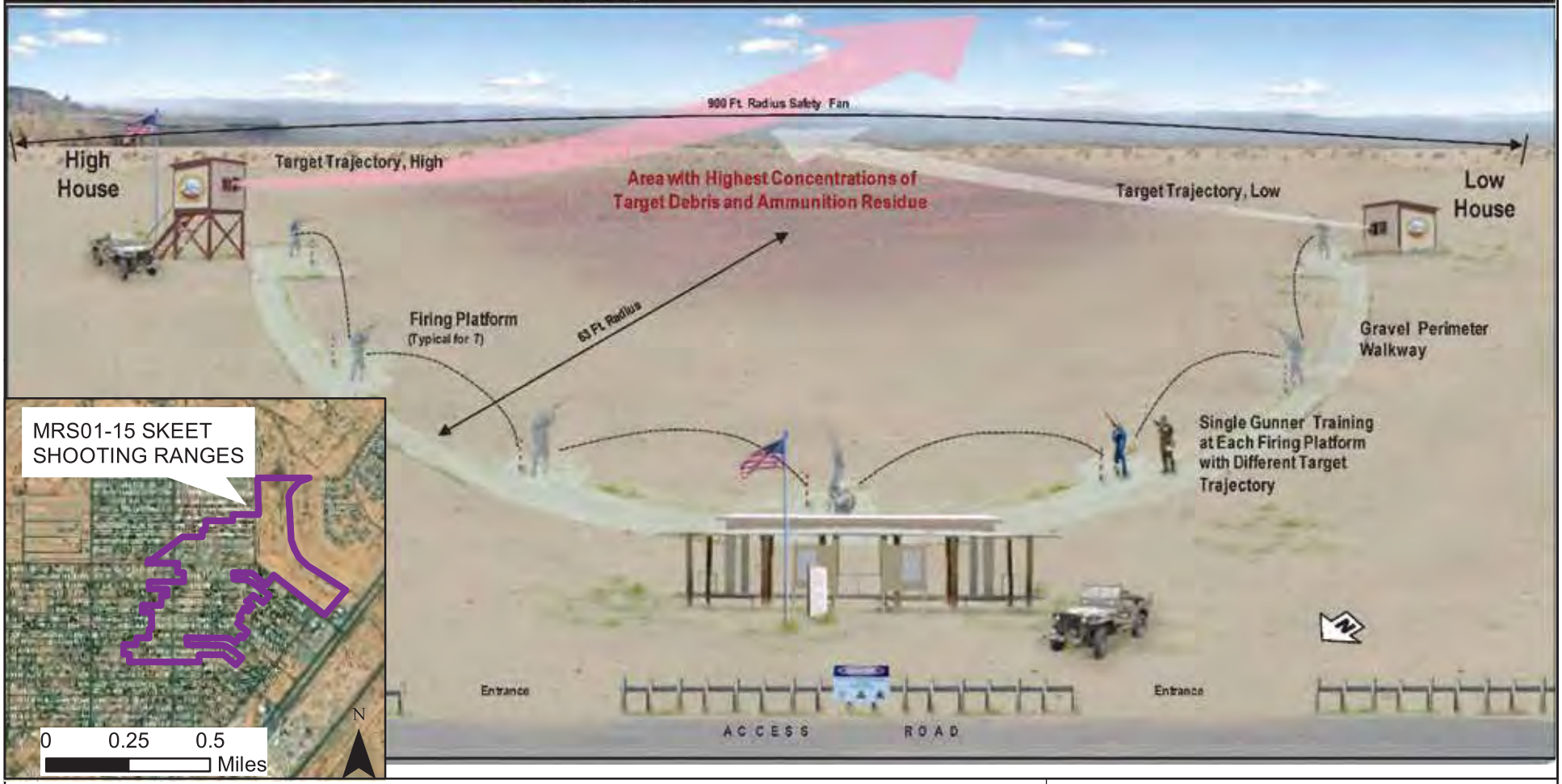
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Community Relations Plan
Former 15 Skeet Ranges, Kingman Ground-to-Ground Gunnery Range
Kingman, Mohave County, AZ

FIGURE 1
Site Location Map

MRS01 - 15 Skeet Ranges

Former Kingman Ground-to-Ground Gunnery Range



Legend

MRS01-15 Skeet Shooting Ranges (Shotfall Zone Boundary)

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Former 15 Skeet Ranges, Kingman Ground-to-Ground Gunnery Range
Kingman, Mohave County, AZ

FIGURE 1-2

Typical Skeet Range

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Parcels 31021063, 31021078, and 31008002 were sampled during the 2019 RI. Subparcels for the above listed parcels were sampled during the 2020 and 2021 Addendum RI.

Microsoft, Vantor, Esri, HERE, IPC

Legend

- Parcel APN and Address
- ROE request letters sent (no response, undeliverable, or refused) and door-todoor ROE request efforts
- Right-of-Entry Received (not sampled)
- Parcels Sampled 2014-2017 (Eco RI)
- Parcels Sampled 2019 (NOREAS RI)
- Parcels Sampled 2020 and 2021 (NOREAS RI Addendum)
- Parcels Sampled 2022 (NOREAS Addendum #2)
- TCRA 2013-2014 (Ahtna and Eco)
- Reinvestigated TCRA Parcels 2022 (NOREAS Addendum #2)
- Investigation Area Boundary

*Parcel 32404643 was sampled at 2 feet bgs during the TCRA, and later was sampled at 3-foot and 4-foot depth intervals during the 2014-2017 RI field investigations.

Parcels 32404639 and 32404640 were investigated on the surface in the 2014 -2017 RI. The subsurface was investigated during the 2019 RI.

APN - Assessor Parcel Number
RI - Remedial Investigations
ROE - right-of-entry
TCRA - Time-Critical Removal Action

N

160 80 0 160 320 480 Feet

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FIGURE 1-3
Parcels Sampled During TCRA, RI, and RI Addenda (April 2013 - July 2022)

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Legend

- 32405169 Parcel #
- MRS01-15 Skeet Shooting Ranges (Shotfall Zone Boundary)
- TCRA Parcels PAHs concentrations Exceeding Remedial Goals (RGs)

CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
E, C & W - east, central, & west
PAHs - polycyclic aromatic hydrocarbons
RGs - Remedial Goals
TCRA - time critical removal action

N

150 75 0 150 300 450 Feet

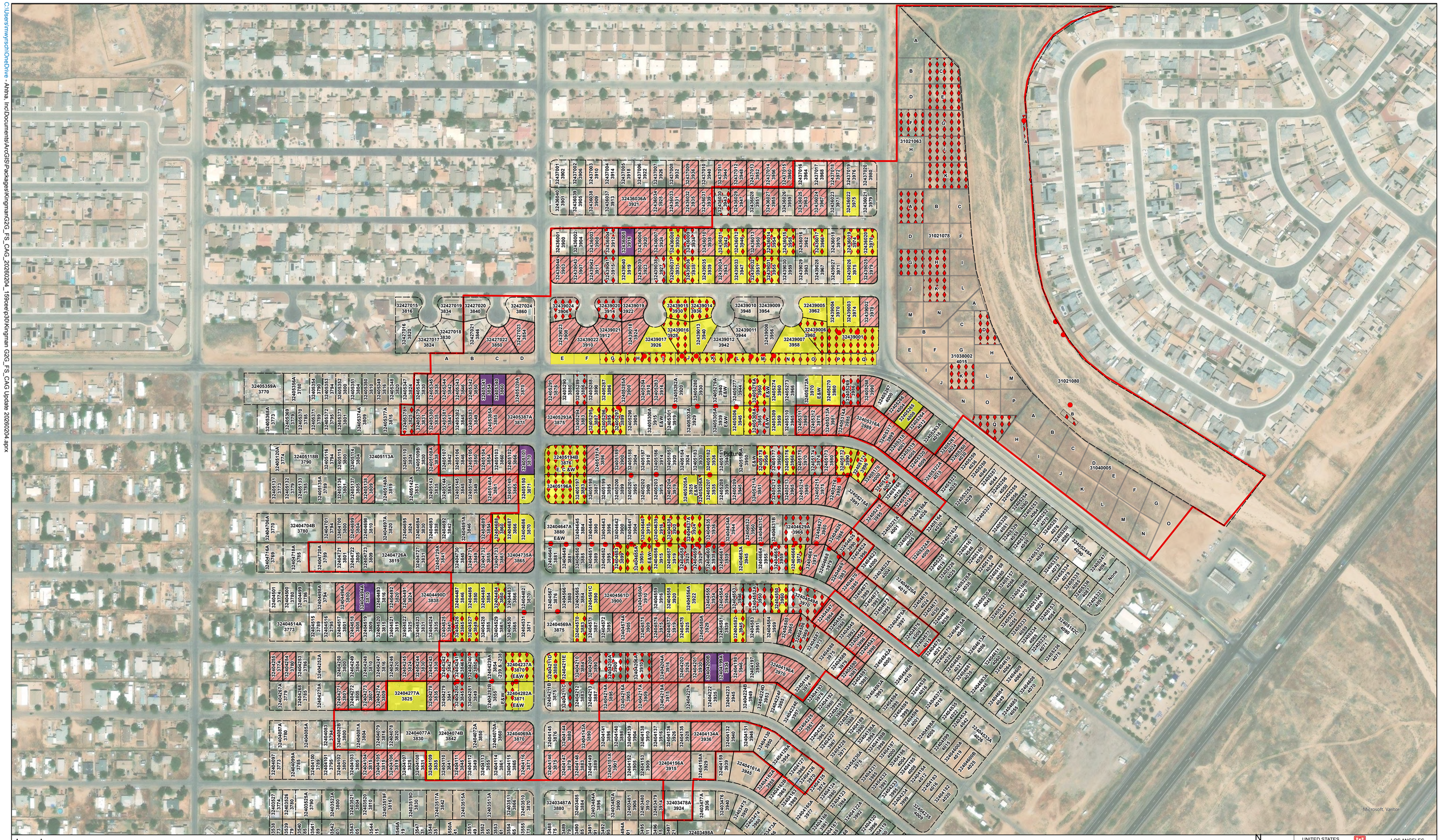
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FIGURE 1-4
TCRA Parcels PAHs Concentrations and CERCLA Risk Management Target Levels

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Legend

- Investigative Area Boundary
- 32405169 / 4004 — Parcel # and Address
- ROE request letters sent (no response, undeliverable, or refused) and door-to-door ROE request efforts
- Right-of-Entry Received (not sampled)
- Skeet Fragments Observed in Parcel
- Skeet Fragment Location

RI Parcels - Incremental Lifetime Cancer Risk (ILCR)

- Above $10^{(-6)}$

Note:
The locations of visually observed skeet on the surface are denoted with red dots. These locations include the July 2017 reconnaissance.

All other parcels denote the observation of skeet in any DU surface or subsurface with a diamond symbol, and do not indicate the exact observed locations. Refer to the individual parcels reports for details regarding surface skeet locations.

E, C & W - east, central, & west
ILCR - Incremental Lifetime Cancer Risk
ROE - right-of-entry
RI - Remedial Investigations

N

160 80 0 160 320 480 Feet

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FIGURE 1-5
Visually Observed Skeet Fragments and Highest Risk Factor Reported (April 2013 to July 2022)

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Packard Ave

Lass Ave

Tommie Dr

Rose Dr

E Snavley Ave

Thompson Ave

Lum Ave

E Ryan Ave

E Hearne Ave

Trommie Dr

Delvin Ave

E Shaeffer Ave

John L Ave

Microsoft, Vantor, Esri, HERE, Garmin, iPC

Legend

32405169 / 4004 — Parcel APN and Address

Zoning

- Right-of-way
- Commercial - Vacant
- Single Family Residential - Mobile Home
- Single Family Residential - Vacant
- Single Family Residential, Special Development - Slab-on-Grade Home

E, C & W - east, central, & west

N

150 75 0 150 300 450 Feet

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Former 15 Skeet Ranges, Kingman Ground-to-Ground Gunnery Range
Kingman, Mohave County, AZ

FIGURE 2-1
Phase 1 Zoning

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Legend

- Parcel # and Address (e.g. 32405169 / 4004)
- Skeet Fragment Location
- Skeet Fragments Observed in Parcel
- Alternative 2 RI Parcels - Proposed Land Use Control (LUC)

Notes:
The locations of visually observed skeet on the surface are denoted with red dots. These locations include the July 2017 reconnaissance, and parcels north of Thompson Ave and east of Rose Dr.

All other parcels denote the observation of skeet in any DU surface or subsurface with a diamond symbol, and do not indicate the exact observed locations. Refer to the individual parcels reports for details regarding surface skeet locations.

E, C & W - east, central, & west
LUC - Land Use Control

N

160 80 0 160 320 480 Feet

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Feasibility Study Report
Former 15 Skeet Ranges, Kingman Ground-to-Ground Gunnery Range
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FIGURE 3-1
Alternative 2: LUCs Only

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Legend

- Parcel APN and Address (e.g. 32405169 / 4004)
- Skeet Fragment location*
- Skeet Fragments Observed in Parcel
- LUC and Excavation to 1 ft bgs.
- LUC and Excavation to 2 ft bgs.

Note:

* The locations of visually observed skeet on the surface are denoted with red dots. These locations include the July 2017 reconnaissance, and parcels north of Thompson Ave and east of Rose Dr.

** All other parcels denote the observation of skeet in any DU surface or subsurface with a diamond symbol, and do not indicate the exact observed locations. Refer to the individual parcels reports for details regarding surface skeet locations.

APN - Assessor Parcel Number
ft bgs - feet below ground surface
E, C & W - east, central, & west
LUC - Land Use Control

N

150 75 0 150 300 450 Feet

Esri, HERE, Garmin, (c) OpenStreetMap contributors, Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community. Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

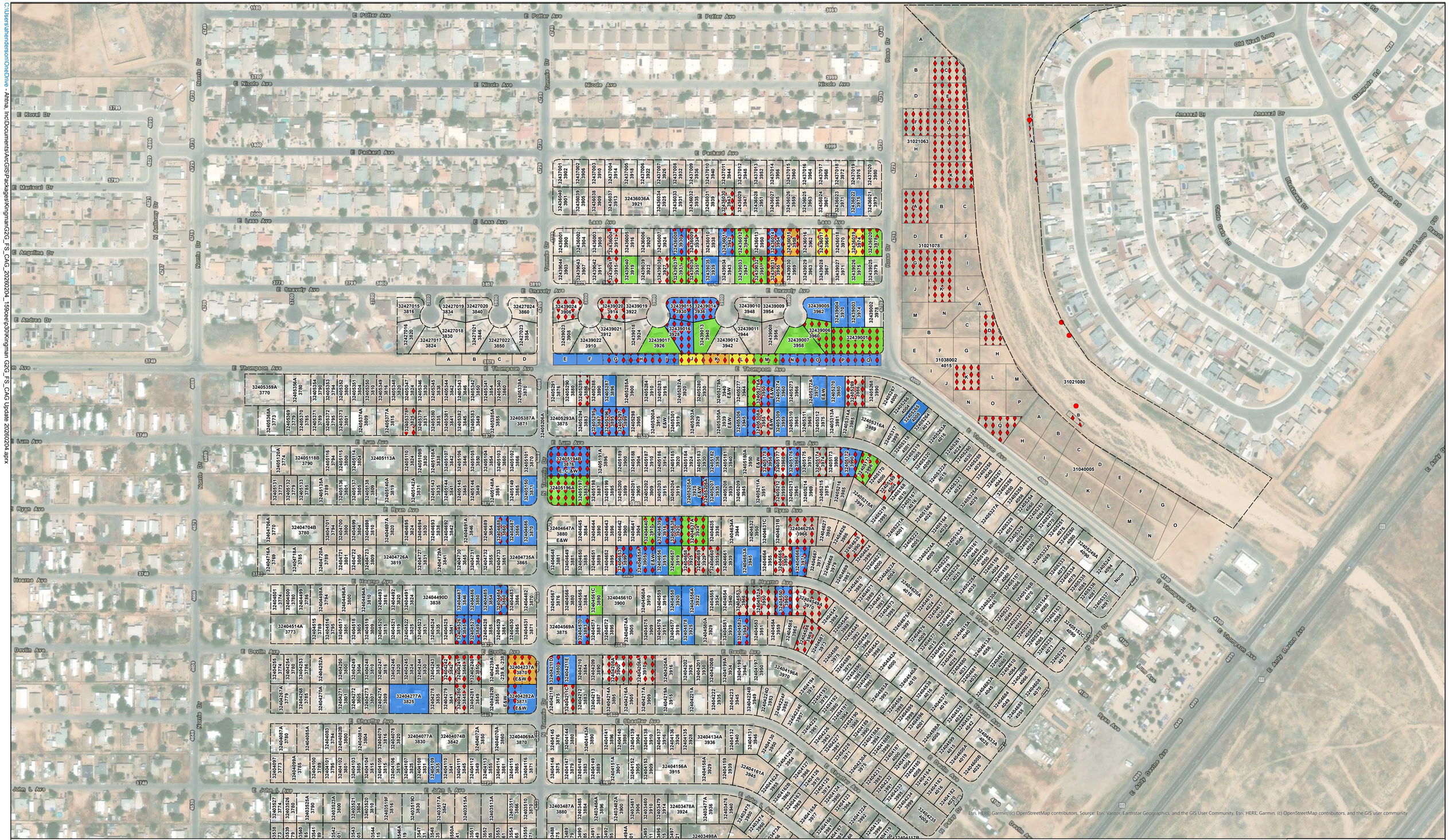
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Kingman, Mohave County, AZ

FIGURE 3-2

Alternative 3: LUCs and Excavation up to 2 ft bgs, Installation of Geotextile/Marker Fabric, Off-site Disposal, Backfill and Site Restoration

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Legend

- 32405169 / 4004 — Assessor Parcel Number and Address
- Skeet Fragment location*
- Skeet Fragments Observed in Parcel
- Excavations to 1 ft bgs
- Excavations to 2 ft bgs
- Excavations to 3 ft bgs
- Excavations to 4 ft bgs

Note:
*The locations of visually observed skeet on the surface are denoted with red dots. These locations include the July 2017 reconnaissance, and parcels north of Thompson Ave and east of Rose Dr.

All other parcels denote the observation of skeet in any DU surface or subsurface with a diamond symbol, and do not indicate the exact observed locations. Refer to the individual parcels reports for details regarding surface skeet locations.

Alternative 4 includes LUCs and site restoration.

APN - Assessor Parcel Number
ft bgs - feet below ground surface
E, C & W - east, central, & west
LUC - Land Use Control

N

150 75 0 150 300 450 Feet

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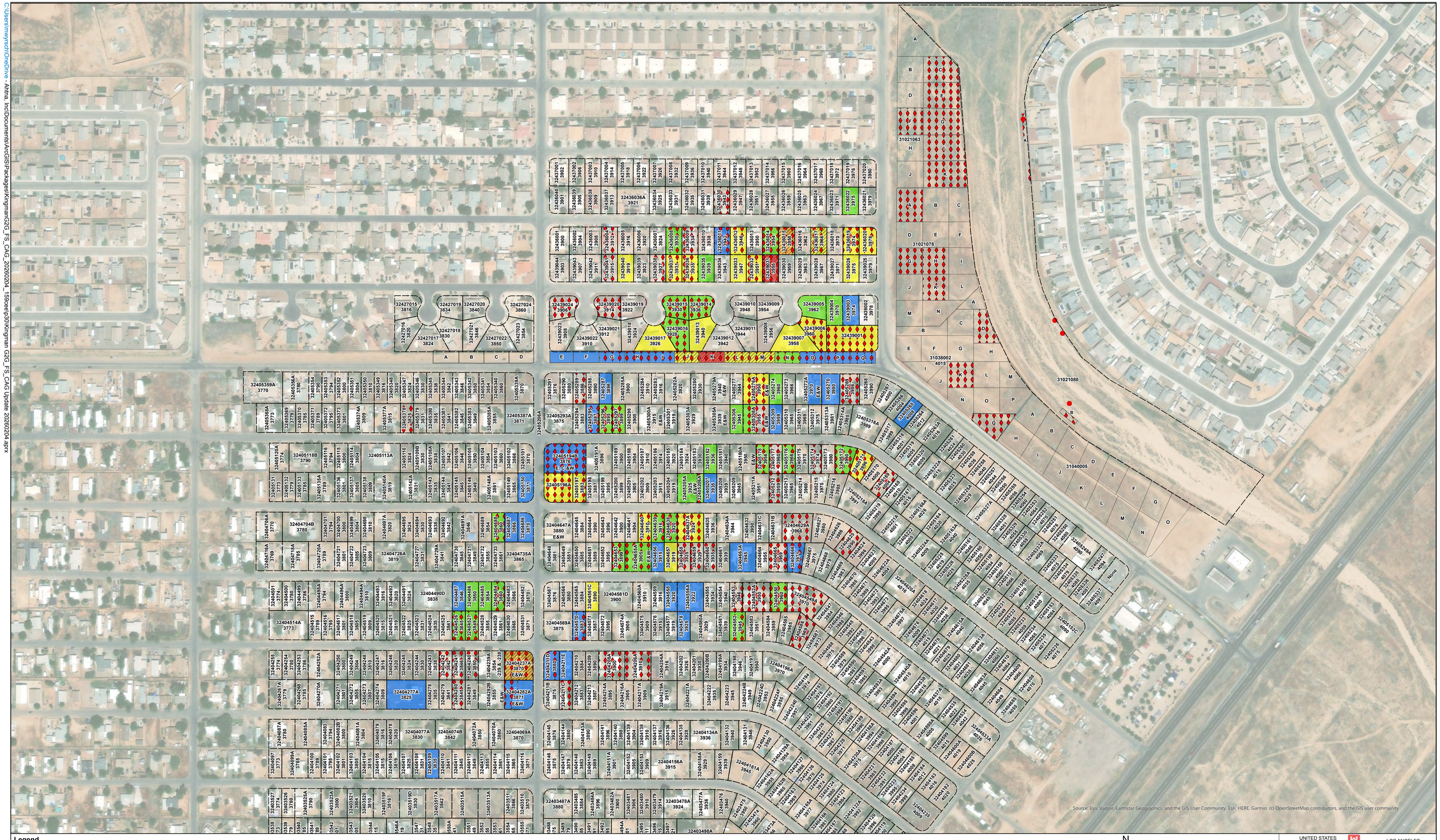
Feasibility Study Report
Former 15 Skeet Ranges, Kingman Ground-to-Ground Gunnery Range
Kingman, Mohave County, AZ

FIGURE 3-3

Alternative 4 : LUCs and Excavation up to 4 feet bgs, Installation of Geotextile/Marker Fabric, Off-site Disposal, Backfill, and Site Restoration

Ahtna

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Legend

- Assessor Parcel Number and Address (32405169 / 4004)
- Skeet Fragment location*
- Skeet Fragments Observed in Parcel
- Excavations to 1 ft bgs
- Excavations to 2 ft bgs
- Excavations to 3 ft bgs
- Excavations to 3.5 ft bgs
- Excavations to 4.5 ft bgs
- Excavations to 5.5 ft bgs

Note:
The locations of visually observed skeet on the surface are denoted with red dots. These locations include the July 2017 reconnaissance, and parcels north of Thompson Ave and east of Rose Dr.

All other parcels denote the observation of skeet in any DU surface or subsurface with a diamond symbol, and do not indicate the exact observed locations. Refer to the individual parcels reports for details regarding surface skeet locations.

Alternative 5 includes new construction.

APN - Assessor Parcel Number
ft bgs - feet below ground surface
E, C & W - east, central, & west

N

150 75 0 150 300 450 Feet

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Feasibility Study Report
Former 15 Skeet Ranges, Kingman Ground-to-Ground Gunnery Range
Kingman, Mohave County, AZ

FIGURE 3-4

Alternative 5 : Demolition, Excavation up to 6 feet bgs, Off-Site Disposal, Backfill, Site Restoration and New Structure Construction

APPENDICES

APPENDIX A

Meeting Minutes
First Systematic Project Planning Meeting — June 2025
Feasibility Study/Proposed Plan/Record of Decision
Former 15 Skeet Ranges portion of the Small Arms Ranges
Kingman Ground-to-Ground Gunnery Range
Kingman, Mohave County, Arizona
FUDS Project No. J09AZ041201

DATE/TIME: June 6, 2025, at 9:00 AM PDT

LOCATION: Kingman Airport Conference Room/Teams Meeting

ATTENDEES:

Name	Organization	E-Mail Address
Randy Tabije	USACE	Roland.R.Tabije@usace.army.mil
Lisa Schutzberger	USACE	Lisa.A.Schutzberger@usace.army.mil
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Katie Crane	USACE	Katie.L.Crane@usace.army.mil
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Megan Haberman	Ahtna	mhaberman@ahtna.net

SUMMARY:
Representatives of the U.S. Army Corps of Engineers (USACE), Arizona Department of Environmental Quality (ADEQ), UXO Pro, The Fehling Group, Mojave County, and Ahtna Solutions, LLC (Ahtna) met via Microsoft Teams and in person on June 6, 2025 for the first Systematic Project Planning (SPP) Meeting to provide a project overview and address future activities for the Feasibility Study (FS)/Proposed Plan (PP)/ Record of Decision (ROD) at the Former 15 Skeet Ranges portion of the Small Arms Ranges at the Kingman Ground-to-Ground Gunnery Range in Kingman, Mohave County, Arizona under Contract No. WP912PL17C0006. These minutes summarize discussions in the order of the attached meeting presentation (Attachment A). A list of successful community outreach and involvement activities at Arizona Superfund sites, provided by ADEQ, is included as Attachment B. For presentation topics that received no further discussion, no additional notes are provided.

1. Introduction (Slides 1-3)
Rachel Kerr called the meeting to order, welcomed everyone, and requested all attendees introduce themselves, including their organization and roll. Following introductions, Ms. Kerr then started the meeting with a safety moment on heat stress and heat stroke. No discussion occurred.

2. Meeting Goals (Slide 4)

Rachel Kerr presented the meeting goals. No discussion occurred.

3. FUDS Program and CERCLA Overview (Slides 5-9)

Lisa Schutzberger provided an overview of the Formerly Used Defense Sites (FUDS) Program and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process. Ms. Schutzberger noted that Kingman is a 2 on the Munitions Response Site Prioritization Protocol (MRSPP) scale. No discussion occurred.

4. Project Location and Scope (Slides 10-12)

Rachel Kerr provided an overview of the project location and scope.

Ms. Kerr reminded everyone that the focus is on Phase I. Katie Crane stated that the light and dark orange shaded parcels on the map are for Phase II, but parcels that have not been sampled yet will be prioritized. Randy Tabije asked which parcels would be a priority. Ms. Kerr stated that the dark orange parcels would be the priority since they have not been sampled. No additional discussion occurred.

5. Revised FS – Conceptual Site Model (Slides 13-16)

Rachel Kerr provided an overview of the Conceptual Site Model.

Dan Sola, Katie Crane, and Jesse Laurie discussed the presence and debris size of skeet fragments in the undeveloped areas of the range, with Dan noting that large skeet fragments are common in undeveloped areas. Mr. Laurie noted that skeet fragments in undeveloped areas could be from recent uses. Glenn Hoeger commented that new skeet does not contain petroleum products as other binding agents are used, and that skeet used prior to the 1970's would have a higher concentration of polycyclic aromatic hydrocarbons (PAHs) due to coal tar used as the binding agent. Mr. Hoeger described the history of the gunnery range, how skeet was used, and why the undeveloped sites have a higher presence of skeet fragments. No additional discussion occurred.

6. Revised FS – Previous Response Action & Investigations Phase I Parcels (Slides 16-19)

Rachel Kerr reviewed the previous response action and remedial investigations at the site.

Natalie Romanoff mentioned that the parcels in the drainage area also have a $>10^{-6}$ risk and stated that these parcels would be part of Phase II after discussions between USACE and ADEQ.

Ms. Romanoff asked if there was a way to confirm that Rights of Entry (ROEs) were obtained for certain parcels, noting that several parcels with ROEs were not sampled during the Remedial Investigations. Katie Crane stated that she would look into the ROEs. Ms. Kerr stated that the purple hashed parcels on the map did not have ROEs.

Ms. Romanoff inquired whether parcels located north of Thompson (Tommy Drive and Snavely) and the north side of Snavely were hashed. Ms. Kerr confirmed that those parcels were hashed. Ms. Romanoff stated that those parcels are incorrectly labeled as samples were collected at those sites; however, ADEQ did not receive the data until much later, and the maps were not updated, nor was the data incorporated into the Feasibility Study done by the previous contractor. The current maps are outdated, and they need to be updated to incorporate the new data.

Jesse Laurie suggested removing the background of the slides when presenting detailed figures to improve readability. No additional discussion occurred.

7. Revised FS – General Response Actions Phase I Parcels (Slides 21-22)

Rachel Kerr reviewed the Feasibility Study general response actions.

Jesse Laurie commented that USACE cannot apply Land Use Controls (LUCs) to private property, but the state or city can issue an ordinance to apply LUCs. Dan Sola provided information regarding the state's declaration of environmental use restrictions (DEURs), which cannot be placed on residential parcels. Mr. Sola stated that only the County or City would be able to place any property restrictions or ordinance.

8. Revised FS – Alternatives (Slides 23-28)

Rachel Kerr provided an overview of the Feasibility Study alternatives.

Katie Crane commented that warning signs would not be a feasible LUC. Jesse Laurie noted that this is the purpose of evaluating the alternatives, to determine what is or is not feasible. Glenn Hoeger mentioned that educational material like flyers can be used to help educate the residents on the dangers of skeet fragments.

Mr. Hoeger mentioned that the excavations for Alternatives 3 and 4 would not occur underneath structures, and efforts would need to be made to minimize material left in the buffer areas. Dan Sola asked if excavation depths would be based on any data. Ms. Kerr stated that confirmation samples would be collected. Ms. Kerr confirmed that Alternatives 3 and 4 include a geotextile fabric.

Mr. Sola mentioned that the excavations need to be practical around foundations, trees, and septic tanks.

Barb Boschert inquired whether landscaping would be excavated. Ms. Boschert agreed that the alternatives must be detailed enough not to destroy property and landscaping.

Mr. Hoeger stated that the field crews must use reasonable judgment when excavating and that the descriptions of the alternatives need to be detailed enough to properly excavate skeet fragments, including guidance/decision matrix for field crews. Ms. Boschert stated crafting the messaging to the community is important. Jesse Laurie mentioned that it is important to emphasize the purpose of the excavation is to reduce the risk of PAHs in the soil. Mr. Sola agreed and Mr. Hoeger stated that while the purpose is to reduce the PAH risk, fragments in large caches need to be removed as much as possible.

Natalie Romanoff mentioned that some properties have septic tanks or leach fields and that records generally lack details on these systems. Luke Brazdys commented in the Teams chat that most of the septic tanks in the area are 1 to 5 feet deep and in open areas. Mr. Sola mentioned that inquiring about septic tank depths would be a great question for the questionnaires. Ms. Romanoff stated that the Water Quality Division is working on a grant for this area to get people on city services, but it will not happen in the immediate future. Mr. Laurie mentioned that the excavation limits of Alternative 4 might need to be adjusted based on the presence of septic tanks or leach fields.

Mr. Laurie asked if the state thought it was necessary to include Alternative 5 since it is not feasible. Ms. Romanoff mentioned that it is part of CERCLA and is necessary to evaluate unlimited use alternatives. Katie Crane commented that it could be removed later in the process when the PP is completed. Ms. Romanoff stated that the extremes are required in the DoD manuals. No additional discussion occurred.

9. Project Schedule (Slides 29-31)

Rachel Kerr reviewed the project schedule.

Randy Tabije proposed the week of August 11, 2025 for the second SPP Meeting. ADEQ and USACE personnel agreed. Jesse Laurie inquired on the meeting location and Mr. Tabije stated the meeting would be held in Phoenix, with August 11, 2025 being a travel day, having the meeting on August 12 and possibly 13, 2025 if needed. No further discussion occurred.

10. Questions/Discussion (Slide 32)

Rachel Kerr opened the floor for discussion.

Natalie Romanoff stated that one community outreach event was that afternoon/evening and inquired when next community outreach event would occur, asking if it would follow the PP. Ms. Romanoff stated that these events need to be coordinated with the city, not the county. Ms. Kerr stated that the project includes a public meeting for the PP and two community events each year, and that the next event may be another First Friday booth in 4-6 months. Ms. Romanoff mentioned that ADEQ might have its own booth at these events, and she will discuss it with ADEQ's Community Engagement group. Lisa Schutzberger stated that it is not currently budgeted in the contract to do back-to-back community outreach events; however, it should be budgeted after Phase I. Ms. Romanoff stated that ADEQ cannot speak for USACE, and all outreach must be coordinated with ADEQ's internal community outreach group.

Ms. Schutzberger inquired whether there were other opportunities for community events, such as a fair or rodeo. Luke Brazdys mentioned in the Teams chat that there is a flea market on Route 66 every weekend. Barb Boschert stated that outreach does not need to wait for community events, and that an open house, or multiple open houses at different times and locations, could be held to inform the public. Ms. Romanoff shared her screen to present examples of a community outreach conducted by the U.S. Environmental Protection Agency (EPA) and ADEQ at Arizona Superfund Sites (Attachment B), including examples of newsletters, questionnaires, postcards, and other mailers or publications/websites. The following discussion occurred:

- Ms. Boschert stated that frequent meetings with the local government were very effective, and suggested weekly meetings when there are active projects to provide quick updates and address concerns. She stated that presentations at town councils or open houses are effective, and that mailers should be sent close to scheduled events.
- Ms. Boschert mentioned that requests can be sent to have information added to a local government's website. Ms. Boschert mentioned that the FUDS website for Kingman is outdated and missing information. Natalie Romanoff shared an example website that was used on a previous project that could be used to update the Kingman website.
- Ms. Romanoff stated that the Airport hangar could be used for an open house.
- Ms. Boschert stated that community concerns and feelings have been smoothed at sites like Iron King due to consistent community outreach. She recommended talking to school districts and pursuing ROE campaigns, and noted that ADEQ can do a lot to assist these efforts and provide advice.

- Mr. Tabije asked about violence at community events. Ms. Boschert stated that ADEQ has not experienced physical violence at these events, but there has been some verbal altercations during door knocking.
- Ms. Romanoff stated that she will share the digital document that contains a list of successful community outreach and involvement activities at Arizona Superfund sites. Ms. Kerr stated that this document would be included in the minutes.

11. Action Items

The following were identified as action items following the meeting:

- USACE will verify which parcels had ROEs.
- Ahtna/USACE will confirm status (whether sampled or not) of parcels located north of Thompson on the north side of Snavely and incorporate data in to the FS.
- Ahtna will remove backgrounds of detailed figures in future meeting presentations in order to improve readability.
- USACE will include questions about residential septic tanks/leach fields in future questionnaires.

Rachel Kerr thanked everyone for their time and stated that the next SPP meeting would be held on August 12 and/or 13, 2025. No additional discussion occurred.

The meeting was adjourned at approximately 10:50 AM PDT.

Attachment A: Meeting Presentation

KINGMAN GROUND-TO-GROUND GUNNERY RANGE

Feasibility Study/ Proposed Plan/Record of Decision, Former 15 Skeet Ranges

FUDS Project No. J09AZ0412-01
USACE Contract No. W912PL17C0006

Systematic Project Planning Meeting #1

June 6, 2025



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MEETING PARTICIPANTS

Name	Organization	Role
Janice Opperman	U.S. Army Corps of Engineers (USACE)	Contracting Officer's Representative
Randy Tabije	USACE	Regional Project Manager
Lisa Schutzberger	USACE	Project Manager
Katie Crane	USACE	Technical Lead
Glenn Hoeger	USACE	EMCX Toxicologist
Cory Koger	USACE	Project Toxicologist
Debra Flores	USACE	Real Estate
Karin Harker	Arizona Department of Environmental Quality (ADEQ)	Federal Projects Unit Manager
Natalie Romanoff	ADEQ	Project Manager
Dan Sola	ADEQ	Principal Hydrogeologist
Steve Willis	UXO Pro	ADEQ Support Contractor
Kurt Fehling	The Fehling Group	ADEQ Support Risk Assessor
Luke Brazdys	Mohave County	Environmental Engineering Manager
Scott Holtry	Mohave County	Director of Development Services
Tami Ursenbach	Mohave County	Director of Economic Development
Tim Walsh	City of Kingman	City Manager
Jesse Laurie	Ahtna	Director of Operations
Rachel Kerr	Ahtna	Program Manager
Michala Wyrsch	Ahtna	Assistant Project Manager
John Gatto	Ahtna	Risk Assessor

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SAFETY MOMENT

- Heat Stress vs Heat Stroke
- Preventative Measures:
  - Drink plenty of water
  - Wear sunscreen and proper attire
  - Find shade or cool area
  - Avoid alcohol or caffeine
  - Watch out for each other



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MEETING GOALS

- Provide an overview of the Formerly Used Defense Sites (FUDS) Program and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Process
- Discuss the Project Location and Scope
- Discuss the Revised Feasibility Study (FS) for Phase 1 only
  - Conceptual Site Model (CSM)
  - Previous Response Action and Investigations
  - General Response Actions
  - Alternatives
- Review Project Schedule
- Schedule Systematic Project Planning (SPP) Meeting #2 – Alternatives Panel

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FUDS PROGRAM & CERCLA OVERVIEW

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FUDS PROGRAM OVERVIEW

- Congress provides spending authority for DoD to cleanup properties that **was:**
  - Under the Jurisdiction of the Secretary (DoD and Secretaries of each Military Departments),
  - Owned by, leased by, or otherwise possessed by the United States, and
  - Transferred control of the properties prior to 17 October 1986.
- FUDS Properties are no longer owned by the Secretaries.
- The U.S. Army is DoD's lead agency for the FUDS program
- USACE executes the FUDS Program on DoD's and Army's behalf.
- Property must be eligible and is based on the ownership and jurisdiction criteria above.
- Eligible Projects are based on additional criteria, importantly, contamination of the site occurred because of DoD's use.
- Historical property owners are Army, Air Force, Navy, Marines, DLA, and other defense agencies.


An improvised moving skeet-shooting trainer used in early 1942

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FUDS PROGRAM OVERVIEW

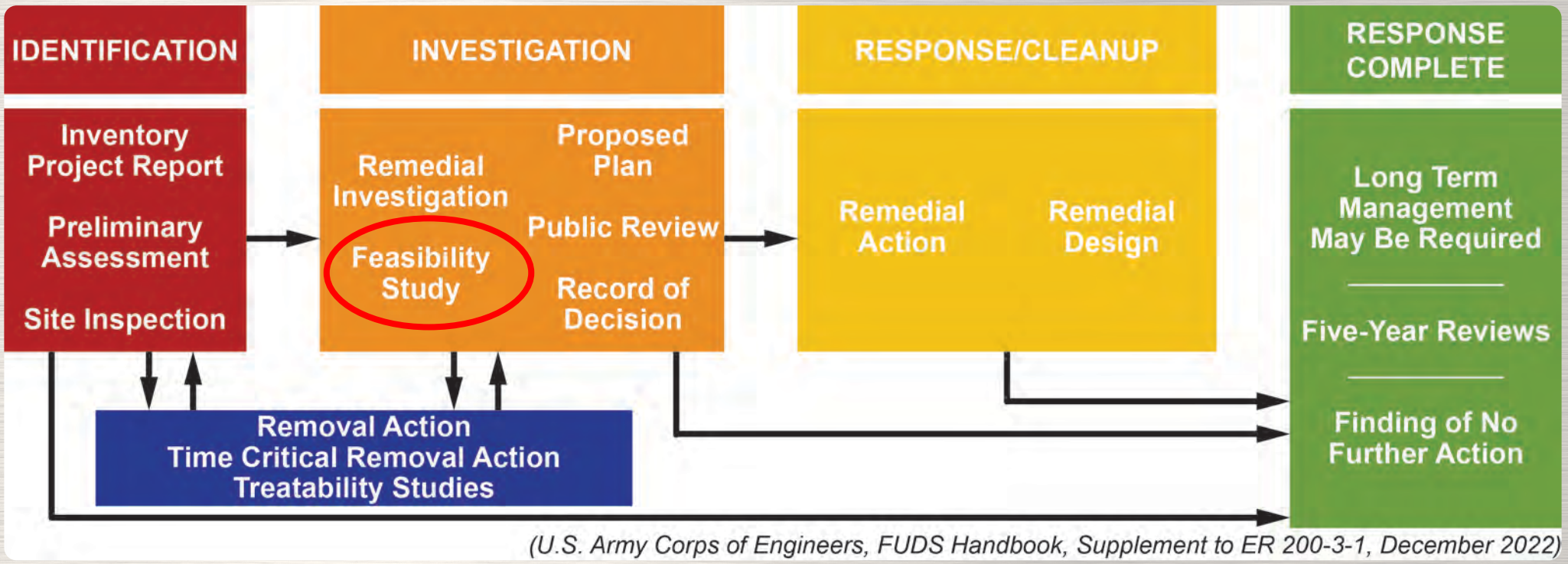
- FUDS Program has:
  - 7 Divisions
  - 13 Districts
- SPL's AOR includes:
  - Southern California,
  - Southern Nevada,
  - Arizona, and
  - New Mexico



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CERCLA PROCESS

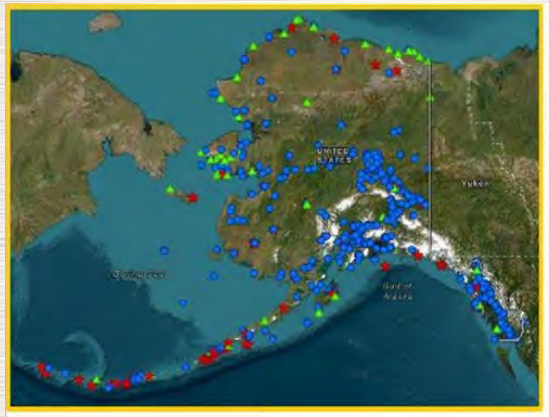


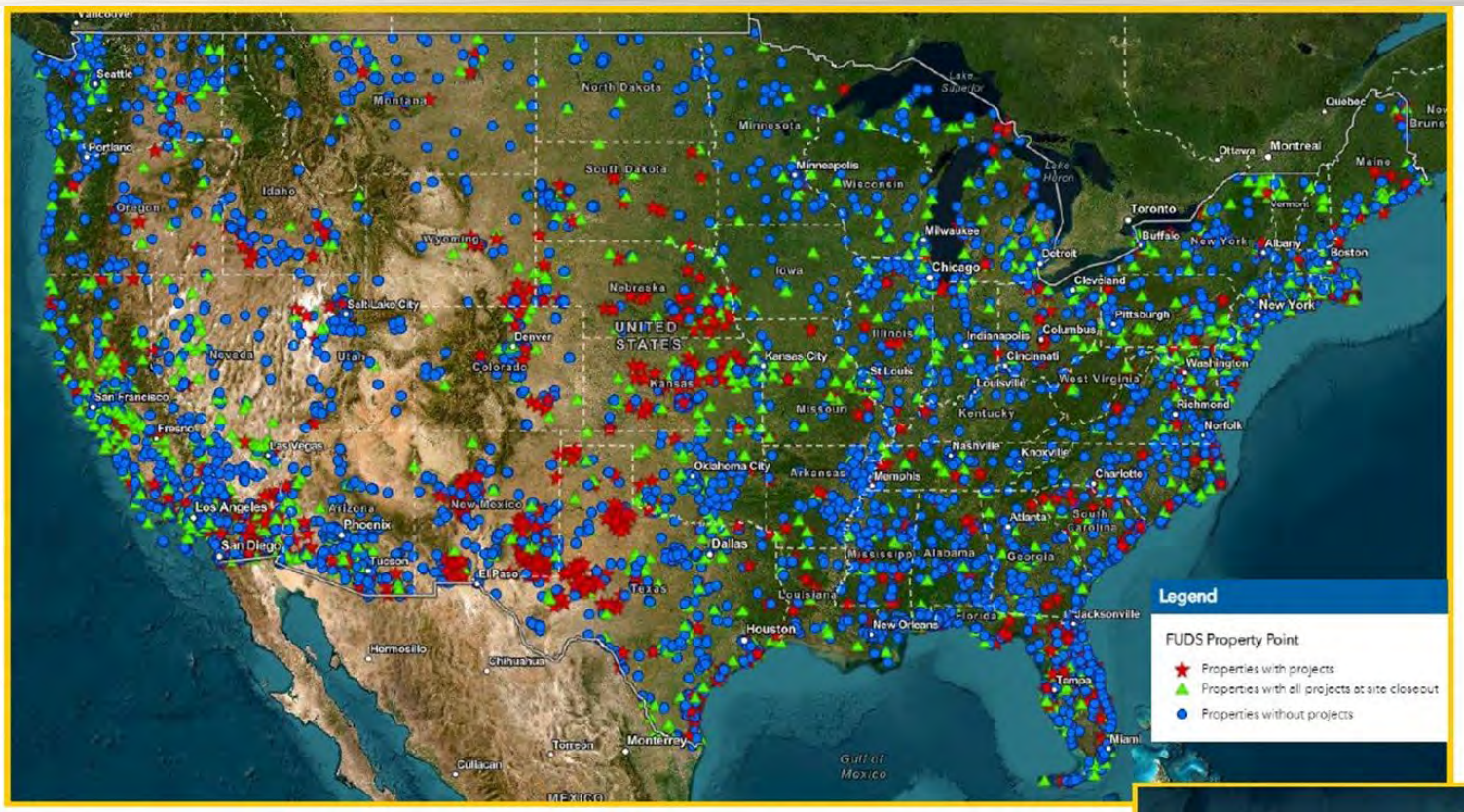
(U.S. Army Corps of Engineers, FUDS Handbook, Supplement to ER 200-3-1, December 2022)

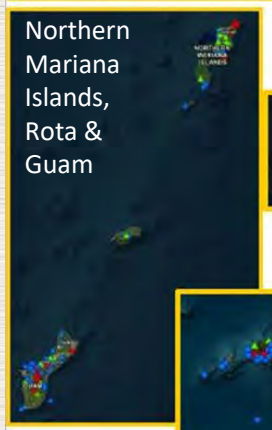
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FUDS UNIVERSE






Northern Mariana Islands, Rota & Guam


American Samoa


Hawaii

From the Public GIS App on the FUDS Portal at:
https://fudsportal.usace.army.mil/#


Puerto Rico & US Virgin Islands

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PROJECT LOCATION & SCOPE

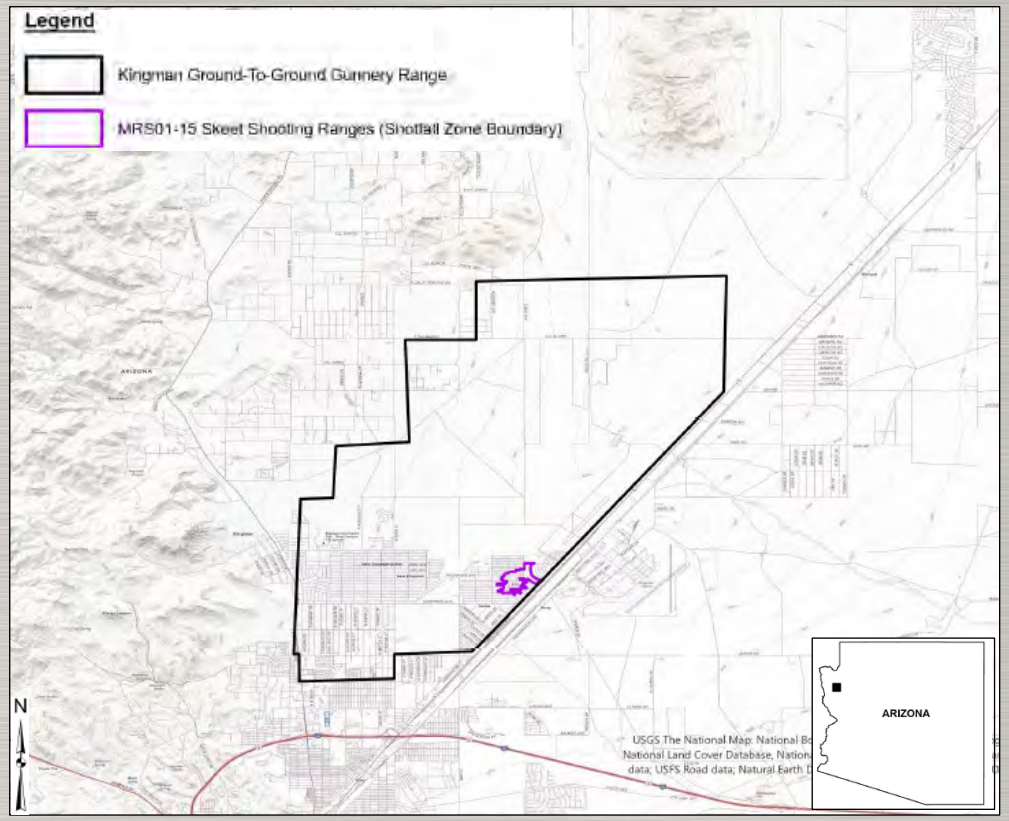
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PROJECT LOCATION

Kingman Ground-to-Ground Gunnery Range

- Consists of 20,146.24 acres located in the City of Kingman in Mohave County, Arizona
- Acquired by the Army Air Force[1] in 1943 by transfer and lease.
- Used during World War II for aerial gunnery training, in association with the school based at Kingman Army Air Field.
- All governmental leases were terminated between 22 June 1946 and 21 August 1947.
- Present uses of the property include residential, commercial, agricultural, and cattle grazing, on private and publicly owned properties.
- Previous investigations indicate debris from clay targets used at the skeet ranges were made from limestone with coal tar containing high concentrations of polycyclic aromatic hydrocarbons (PAHs).



Notes:

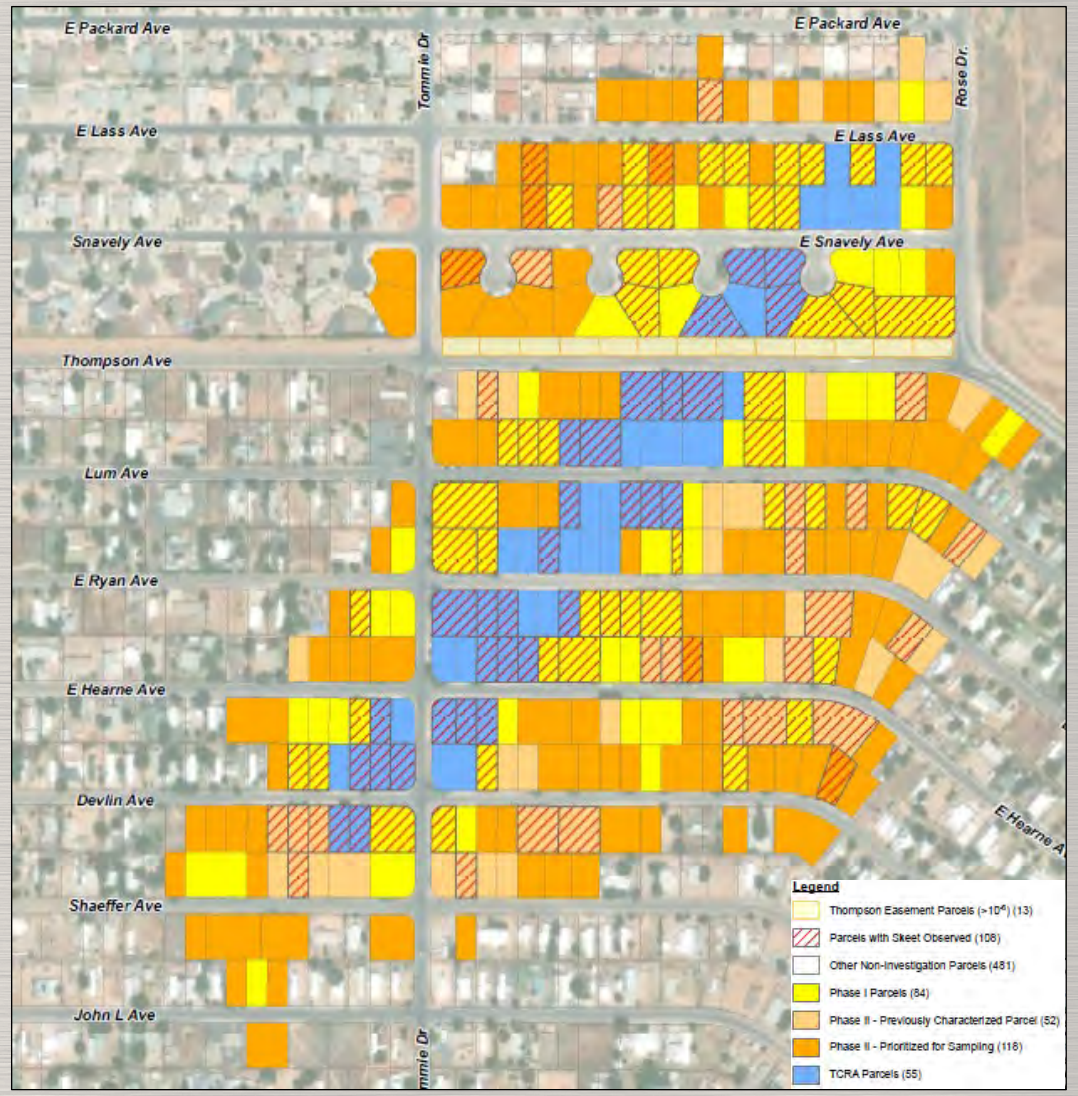
[1] US Air Force was not established until 1947.

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PROJECT SCOPE

- Finalize the FS Report, Proposed Plan (PP), and Record of Decision (ROD) Phase I parcels for residential parcels and the Thompson Avenue easement, where there is an unacceptable risk (i.e., excess lifetime cancer risk (ELCR) greater than 10^{-6}) based on concentrations of PAHs in soil.



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REVISED FS – CONCEPTUAL SITE MODEL

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CONCEPTUAL SITE MODEL

- **Land Use**
  - Current land use is almost entirely residential
  - Anticipated future land use is residential
- **Primary Concern**
  - PAHs in surface and subsurface soils
  - Potential exposure to PAHs from abundant and scattered skeet debris

CONCEPTUAL SITE MODEL

- **Development Implications and Containment Distribution**
  - Upper 2-feet of soil has been disturbed
  - PAH soil contamination buried
- **Four transport mechanisms**
  - Initial deposition from shooting range
  - Erosional redistribution from natural drainage
  - Redistribution and burial from construction and utility service
  - Granular convection movement and residential and municipal soil disturbance

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CONCEPTUAL SITE MODEL

- **Site Investigation Results and Observations**
  - Remedial Investigation (RI) soil samples were collected at the surface (0 to 2 inches) and subsurface (0 to 1, 1 to 2, and as needed from 2 to 3, 3 to 4, and 4 to 5 ft bgs). PAH screening level exceedances included:

Exceedance Depth (ft bgs):	0.167	1.0	2.0	3.0	4.0	5.0
No. of Parcels with Exceedance:	43	30	22	4	2	2

  - PAH concentrations near the skeet range firing positions were over 1,000 times greater than allowable under Arizona State regulations
  - Antimony, lead, and zinc were present in the soil at concentrations exceeding background levels, but below Arizona soil remediation levels protective for human health
  - Significant skeet debris observed

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REVISED FS – PREVIOUS RESPONSE ACTION & INVESTIGATIONS PHASE I PARCELS

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TCRA, RI, & RI ADDENDA

- **Time Critical Removal Action (TCRA)**
  - Primary objective was to immediately reduce the highest PAH concentrations to below Arizona residential Soil Remediation Levels (SRLs) at residential properties.
  - Conducted April to May 2013 and October 2013 to July 2014.
  - Included soil excavation, backfill with clean fill material, and compaction at 55 residential parcels.
  - Confirmation samples were collected at each property before placing clean fill materials. Results exceeded project action levels at 50 of the 55 parcels.
  - Skeet fragments observed on the surface and/or subsurface in 30 of the 55 TCRA parcels during 2022 inspections.
  - The TCRA was not the final remedy. USACE and ADEQ agree that the TCRA parcels need to be addressed further, but that task is not included in this contract and the Phase I FS does not include the TCRA parcels.

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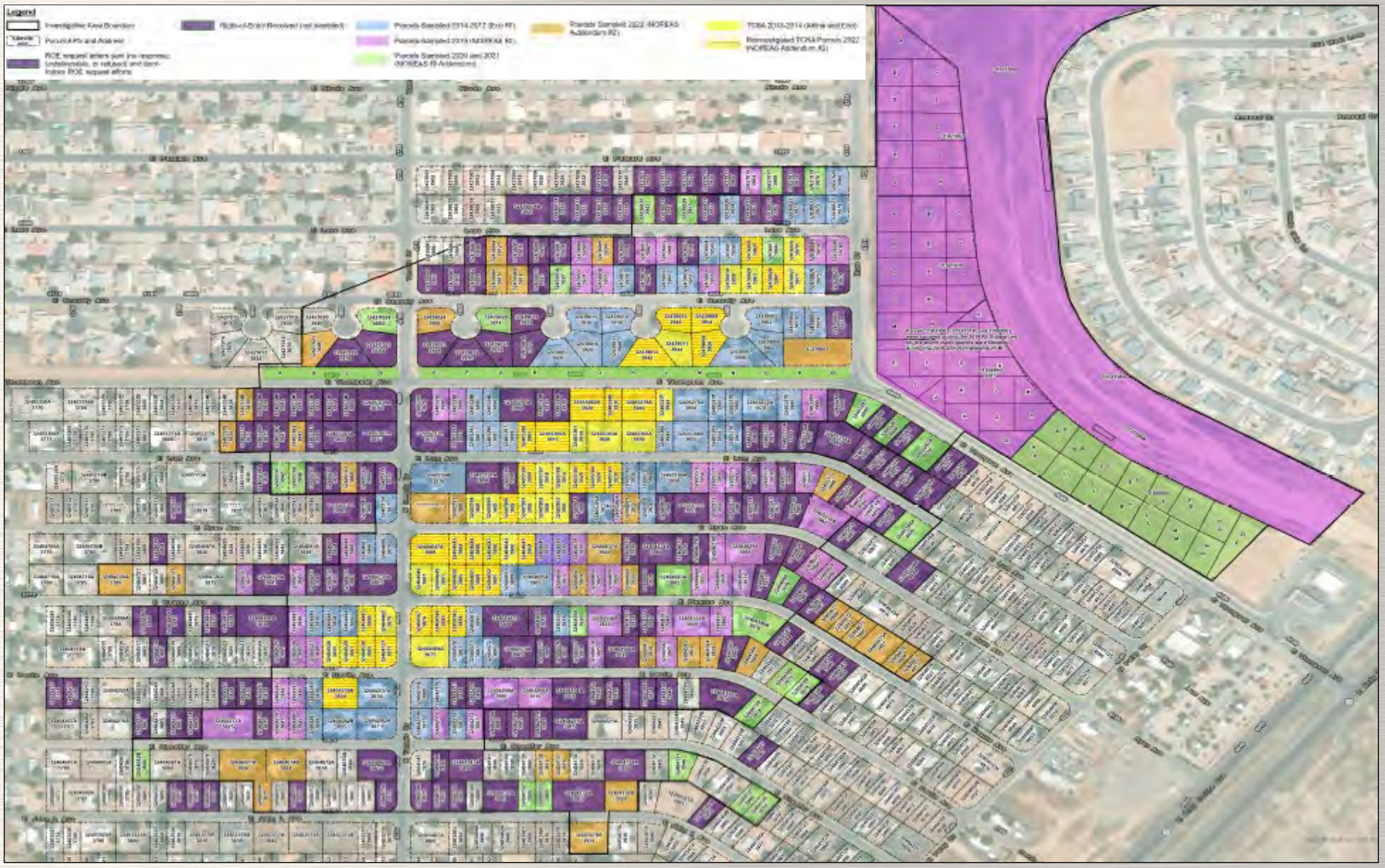
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TCRA, RI, & RI ADDENDA

- **RI and RI Addenda**
  - Conducted between December 2014 and April 2023
  - Investigation of 268 parcels and 22 sub-parcels/sub-easements
  - Collected soils samples using incremental sampling methodology and analyzed for PAHs
  - Human health risk assessment determined an unacceptable health risk at 97 parcels with PAH ELCR $>10^{-6}$
  - Samples were not collected beneath homes or structures

TCRA, RI, & RI ADDENDA

- **Investigation Summary**



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REVISED FS – GENERAL RESPONSE ACTIONS PHASE I PARCELS

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GENERAL RESPONSE ACTIONS

No Action	A baseline alternative was evaluated because it is required by National Oil and Hazardous Substance Pollution Contingency Plan (NCP). However, no action does not achieve the remedial action objectives (RAOs).
Land Use Controls	Restricts access to soil and notifies residents and workers of contamination to render human contact pathway incomplete. Process options of land use controls that can be implemented by USACE are production and distribution of educational materials.
Containment	Containment technologies for soil consist of low permeability caps. Caps over the soil render the human contact pathway incomplete. Process options include the use of soil, asphalt, or concrete covers.
Excavation	Use of mechanical and/or hand equipment to remove contaminated soil from the site. Traditional technology that has been used as a part of TCRA at the Site. Required prior to implementation of ex situ treatment or disposal options.
Disposal	Disposal of treated or untreated soil at an offsite location would reduce the potential for exposure. Disposal involves placement of waste materials in designated facilities that have been designed and are operated for such purpose. As a part of the TCRA, soils were disposed of at a local landfill.
Treatment	Treatment of contaminated soil may reduce the toxicity, mobility, or volume of contaminants, thereby eliminating the risks. Treatment of contaminated materials may be performed in situ or ex situ at an offsite location following a removal action by excavation.

REVISED FS – ALTERNATIVES

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ALTERNATIVE 1

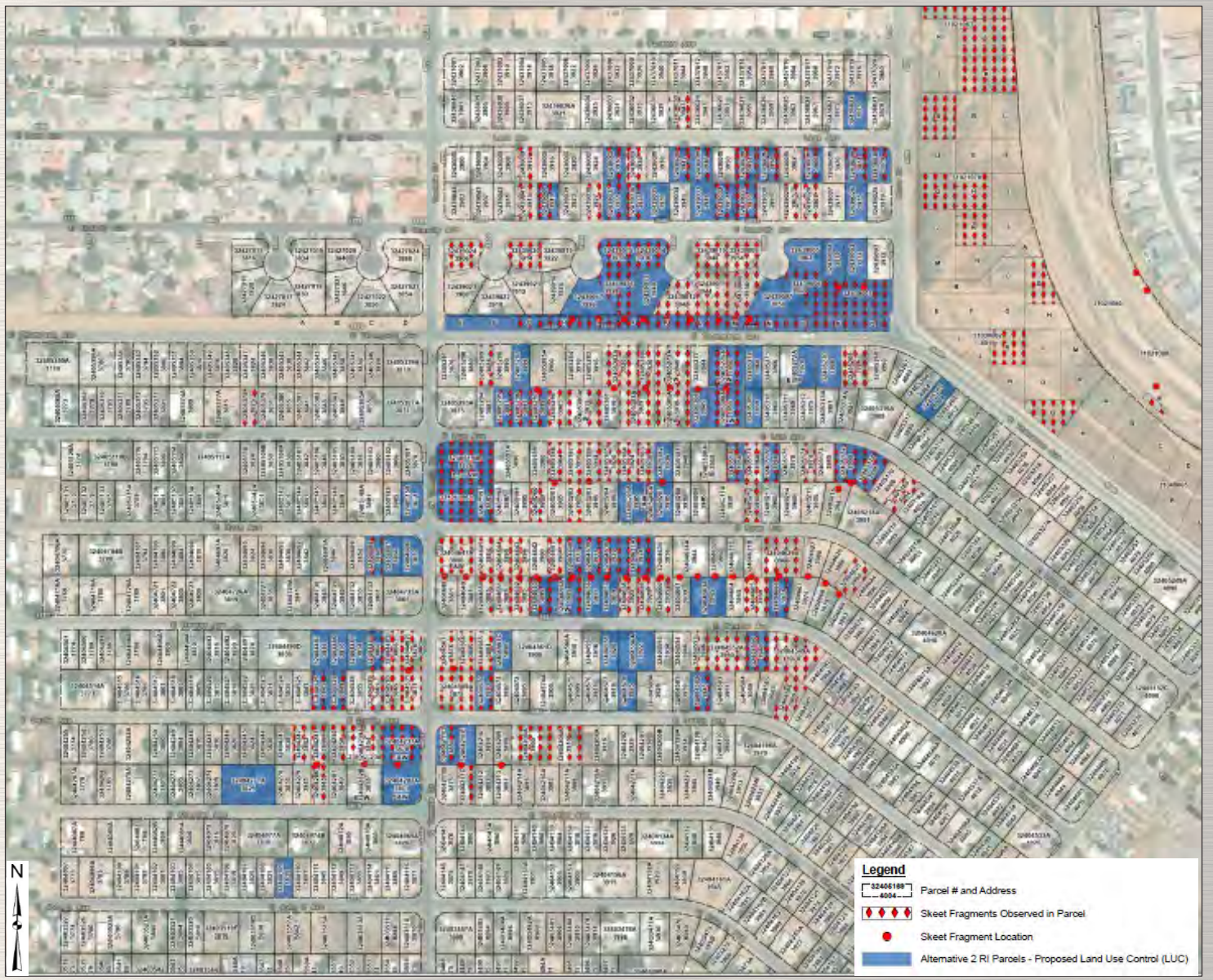
- No Action

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ALTERNATIVE 2

- LUCs Only – Warning signs and educational materials

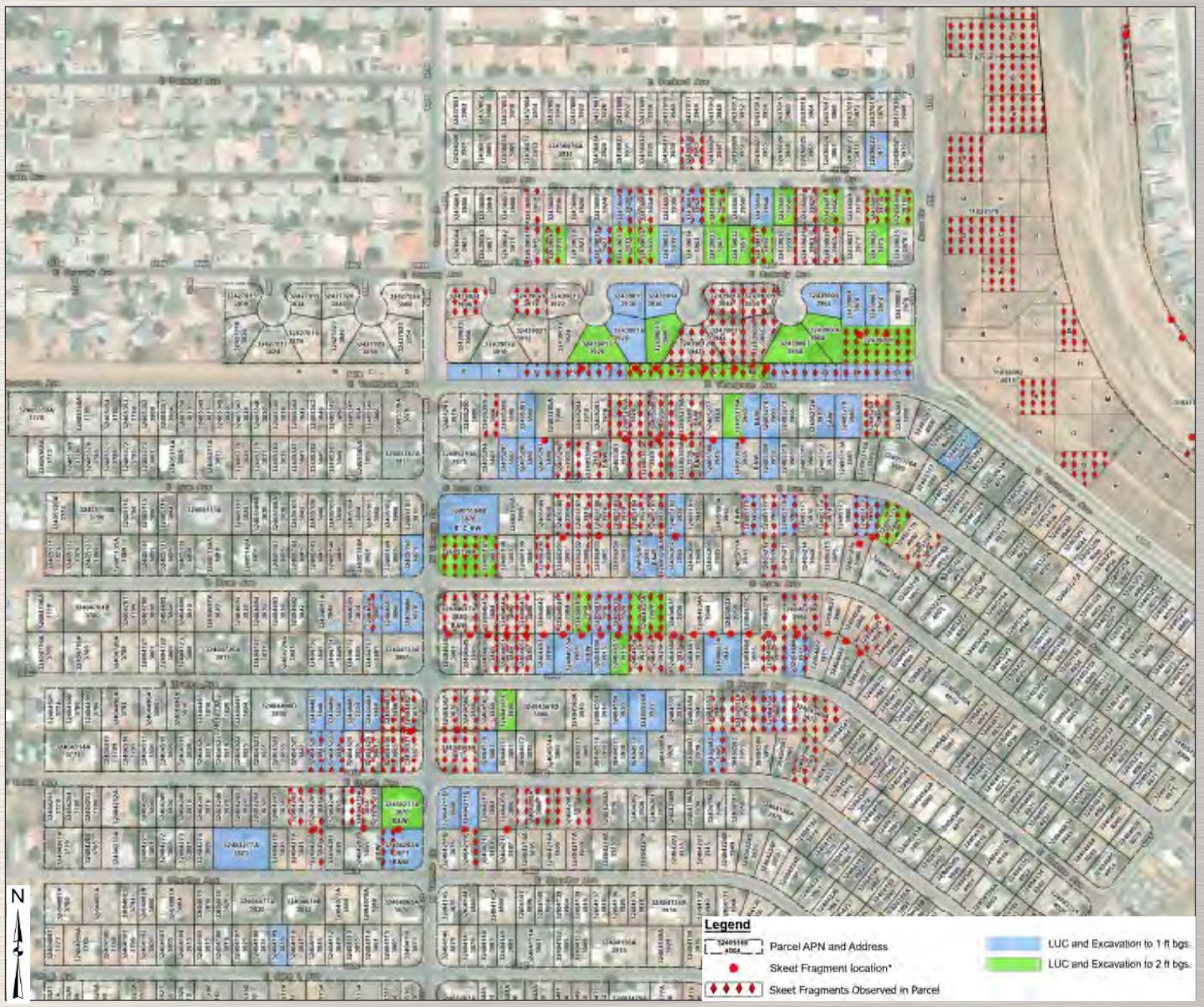


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ALTERNATIVE 3

- LUCs
- Excavation up to 2 feet below ground surface (bgs)
- Installation of Geotextile and Marker Fabric
- Offsite Disposal, Backfill, and Site Restoration

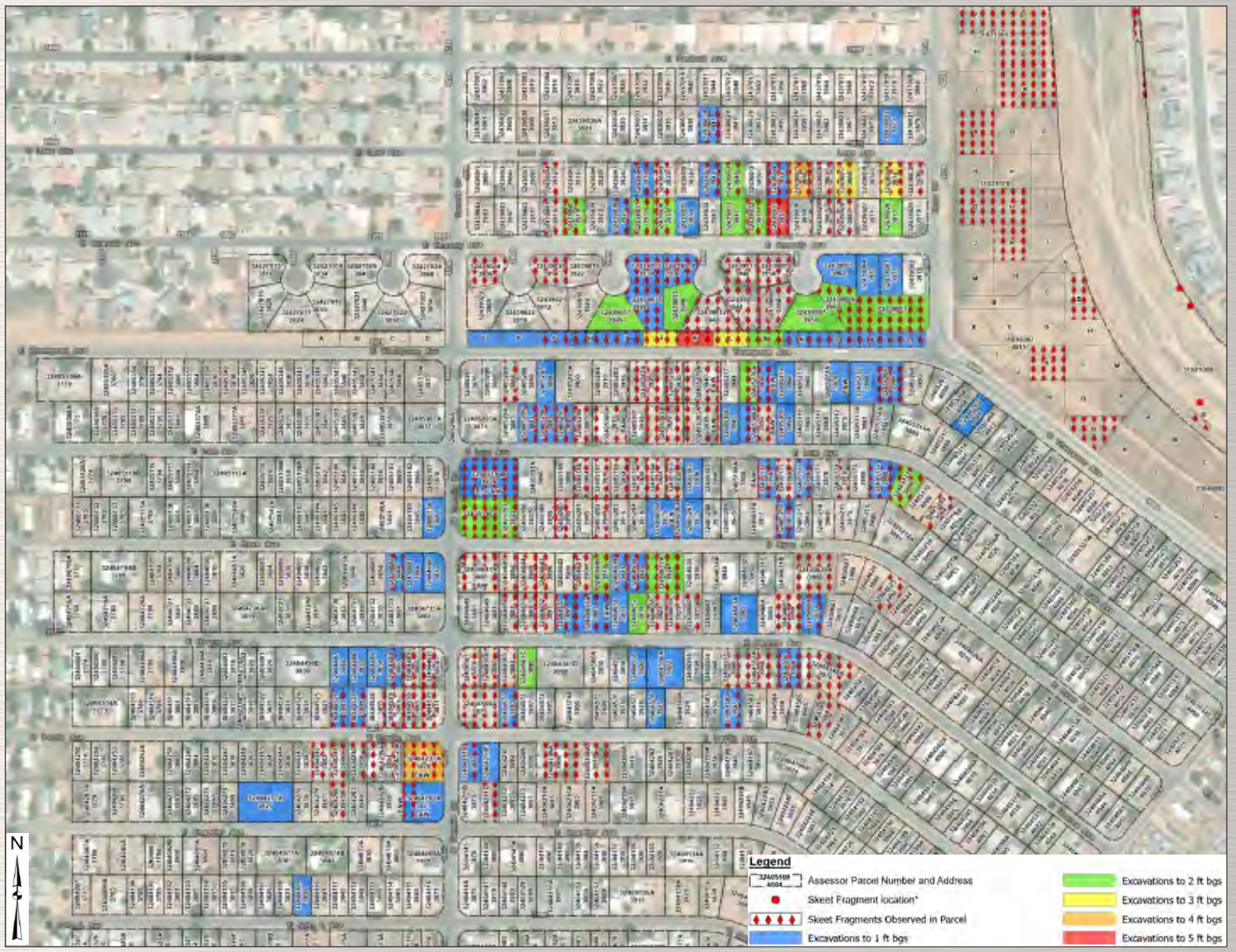


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ALTERNATIVE 4

- LUCs
- Excavation up to 6 feet bgs
- Installation of Geotextile and Marker Fabric
- Offsite Disposal, Backfill, and Site Restoration

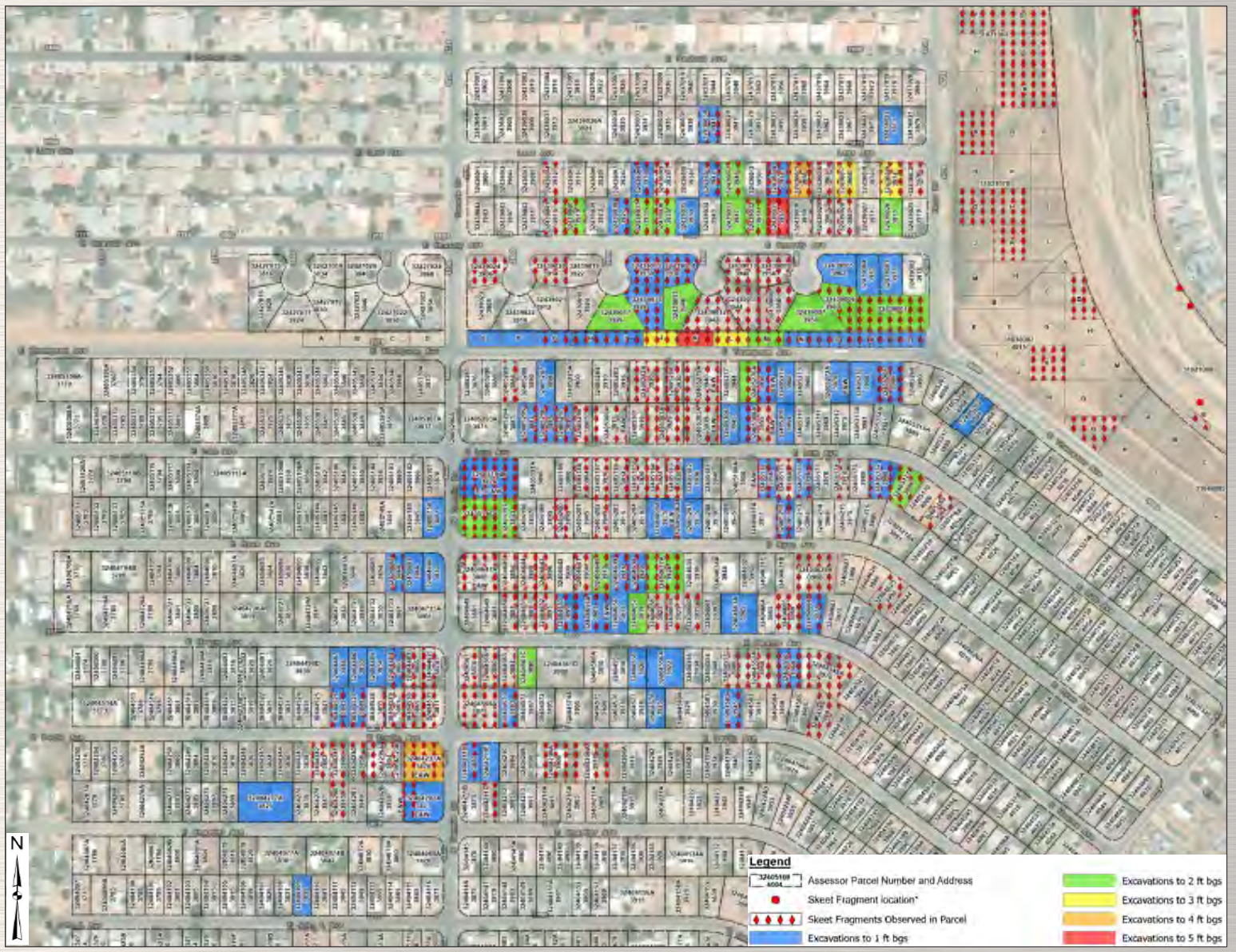


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ALTERNATIVE 5

- Excavation up to 6 feet bgs
- Demolition
- Offsite Disposal, Backfill, and Site Restoration
- New Structure Construction



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PROJECT SCHEDULE

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PROJECT SCHEDULE

May-Jun 2025	• Prepare revised FS – USACE review and approval
Jun 2025	• First SPP Meeting (in person)
Jul-Aug 2025	• Regulatory review of Draft Final FS
Jul or Aug 2025	• Second SPP Meeting – Alternatives Panel (in person)
Aug-Sep 2025	• Prepare Final FS – USACE review and ADEQ backcheck
Sep 2025	• Final FS
Oct-Dec 2025	• Draft Proposed Plan (PP) – USACE review and approval
Jan-Mar 2026	• Regulatory review of Draft Final PP
Apr-May 2026	• Prepare PP for public comment – USACE review and ADEQ backcheck

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PROJECT SCHEDULE



- PP public notice, public comment period, and public meeting
- Prepare Final PP – USACE review and ADEQ backcheck
- Final PP
- Draft Record of Decision (ROD) – USACE review and approval
- Third SPP Meeting (virtual)
- Regulatory review of Draft Final ROD
- Prepare Final ROD – USACE review and ADEQ backcheck
- Final ROD and public notice

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QUESTIONS/DISCUSSION

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Attachment B: ADEQ Handout – Successful Community Outreach and Involvement Activities at Arizona Superfund Sites

Successful Community Outreach and Involvement Activities at Arizona Superfund sites

1. Regular stakeholder engagement with Town/City Council
    a. Meetings (held biweekly during field activities, monthly during non field activities)
    b. Presentations (milestone updates)
2. Regular public communications
    a. Statements in local Town/City newsletter (monthly)
    b. Open Houses (annually, milestones)
    c. Community Update Mailers / Handouts - safety warnings, Q & A's, status updates (as needed)
    d. Public facing website
    e. Community Events (annually / as needed)
3. Regular state representative engagement (monthly to quarterly updates)
4. Multiple information sources
    a. Fact Sheets
    b. Postcards
    c. Website
        i. Site-specific webpages should be robust and current
        ii. Include specific tools such as
            1. Downloadable information and forms, like ROEs
            2. Interactive sampling and remedy status map
        iii. Make sign-up for sampling or remedy easily accessible
        iv. Highlight upcoming events and activities
        v. Provide responses to frequently asked questions
        vi. Include federal agency and ADEQ contact information
5. Outreach to local school districts and community groups, if appropriate
6. ROE door knocking campaigns
    a. Pull representation from federal, state, and town/city agencies
    b. Provide a tool to record real-time updates - ROE received, ROE denied, or no response
    c. Distribute flyers or doorhangers, leave access agreement form, contact information for questions
    d. Have a local drop off location &/or mail in option (free return)

Iron King Mine-Humboldt Smelter EPA Superfund Site Dewey-Humboldt, AZ

Examples of Community Outreach and Involvement

SAFETY CONCERNS AT THE FORMER HUMBOLDT SMELTER PROPERTY





The recent monsoon has caused the remaining Humboldt Smelter stack and flue chamber to start failing. Another section of the top of stack has fallen. The only thing holding up the stack right now is the ladder and the last of the flue chamber. If the rest of the flue chamber falls, the stack will go with it.

At the June 13, 2021 Town Council Study Session, Councilmembers and community members raised concerns about the safety hazards at the former Humboldt Smelter property and actions to keep people away from the privately-owned property.

The EPA is currently discussing this issue and trying to come up with actions that could be quickly taken. They will keep the Town updated on the conversations and the possible next steps.

In the meantime, we encourage everyone to talk with their neighbors about following posted warnings and asking their teenagers and children to stay away from these dangerous areas. If you see anyone near the smelter building, notify the Yavapai Sheriff's office at 928-771–3260. (EPA fact sheet September 2020)

STAY SAFE DURING STORMS

The following are tips from Arizona Public Service (APS):

Avoid touching wiring during a thunderstorm. Stop using computers or wired video games and unplug any expensive electronics when a storm is approaching. Only unplug electronics before a thunderstorm; do not touch wires if you can hear thunder.

Stay informed. If you experience an outage, visit aps.com/outage to report it and stay updated on when APS expects to have the power back on. Also, follow @apsFYI on Twitter from your smartphone. In the event of a prolonged, large-scale outage, APS will tweet to keep you up to date.

Know the difference between a watch and a warning. A watch means severe weather could occur. A warning means severe weather is about to occur or has been reported.

Plan ahead. Create an emergency supply kit that contains non-perishable foot items, water, a first-aid kit, a battery -operated radio, a portable cell phone charger or car cell phone charger, flash-lights, extra batteries and any necessary medication. Also, know your APS account number so you can report an outage without speaking to a customer associate.

Stay away from all downed lines. Treat any downed line as though it is energized; keep at least 100 feet away. In the case of a downed line, immediately call 911, then APS at 602-371-7171.



FOR DEWEY-HUMBOLDT WEBSITE AND TOWN NEWSLETTER (August 8, 2023):

The U.S. Environmental Protection Agency (EPA) is busy responding to public comments received on the proposed plan for cleanup and then making the selection of the final cleanup alternative for the Iron King Mine / Humboldt Smelter Superfund site. In the meantime, we are conducting some additional sampling and other activities that will help us to design the cleanup action, which is the next step in the cleanup process. The Arizona Department of Environmental Quality (ADEQ) will be supporting EPA by assisting in these field work activities. ADEQ will have crews in the area assessing land conditions, collecting soil samples, and visually inspecting various areas near the mine and smelter and surrounding properties. Workers may be intermittently on the site or in town until the end of 2023. Any noise and/or dust issues are expected to be minimal. Permission to access private properties has been given by respective landowners.

Please note that some work at the smelter property may involve the use of digging equipment. ADEQ will use dust suppression during any such activity. In addition, ADEQ will repair any damage it may cause to the protective covering (called Posi-Shell) that has been placed on top of the dross waste at the smelter, to make sure it remains effective. The cover forms a hard crust that keeps the waste from entering the air on an interim basis until the final cleanup is performed.

For more information, please contact:

Jeff Dhont
EPA Project Manager
(415) 972-3020
dhont.jeff@epa.gov

Georgia Thompson
EPA Community Involvement Coordinator
(415) 972-3048
Thompson.georgia@epa.gov

Katelyn Kane-DeVries
ADEQ Project Manager
(602) 771-0167
Kane-devries.katelyn@azdeq.gov

Barbara Boschert
ADEQ Community Involvement Coordinator
(602) 771-8007
boschert.barbara@azdeq.gov

EPA

Iron King Mine - Humboldt Smelter Superfund Site
Open House

Community members are invited to attend one of the EPA's open house sessions to learn more about the EPA's **residential** soil sampling and cleanup.

Wednesday, May 14, 12-3pm or **5-8pm**

The Barn at Mortimer Farms
1484 Old Black Canyon Highway
Dewey, Arizona 86327

Community members can stop by any time during either session to speak with EPA representatives. Families are welcome!

These info sessions will focus on the residential phase of cleanup.

EPA Site Profile Page
epa.gov/superfund/ironkingmine

Latest EPA Fact Sheet

U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION 9
IRON KING MINE-HUMBOLDT SMELTER SUPERFUND SITE
75 Hawthorne Street (SFD 8-1)
San Francisco, CA 94105-3901

Office Use Only

Consent for Access to Real Property
Iron King Mine-Humboldt Smelter Superfund Site

Property

Address: _____

Parcel Number(s): _____
Residential street address and/or county parcel number in Dewey-Humboldt, Yavapai County, Arizona

Consent

I, property owner and/or tenant, consent and grant access to the United States Environmental Protection Agency (EPA), its officers, employees, representatives, agents, and contractors, to the above-referenced property for the following purposes:

- To collect, preserve, transport, and analyze sediment, soil, and/or water samples from the property.
- To take other actions related to the evaluation, sampling, and analyses of releases of hazardous substances, pollutants or contaminants to the environment.
- Restoration of landscaping features to a similar condition that existed prior to work performed by EPA.
- To take response actions as necessary and within the authority of EPA as related to the Iron King Mine - Humboldt Smelter Superfund site.

Sampling results for my property will be available to me as the property owner and/or tenant. I understand that the sampling data may indicate a cleanup on my property is necessary to protect long term health. In this case, EPA will provide and discuss with me a cleanup plan prior to cleanup. The soil sampling results will be published in publicly available investigation report(s) that may be used as a basis for taking cleanup actions. Personally identifiable information will be kept private.

Authority

The legal authority by which EPA is conducting environmental actions is pursuant to its response and enforcement responsibilities under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, also known as Superfund), 42 U.S.C. Section 9601, *et seq.* CERCLA give EPA the authority to address releases or threatened releases of hazardous substances that may endanger public health or the natural environment.

Tenant or Lessee

_____ _____ _____
Print Name | Phone | Email

_____
Tenant Signature and Date (if applicable)

Property Owner

_____ _____ _____
Print Name | Phone | Email

_____ _____ _____ _____
Owner's Mailing Address | City | State | Zip

_____
Owner Signature and Date

Information provided will be used to verify consent, contact owner about developments, cleanup plans and provide sample results.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

Office Use Only

HOME OCCUPANT QUESTIONAIRE

Parcel number(s): _____ Date: _____

Property Address: _____

Dwelling Type: ○ Single Family ○ Mobile Home ○ Multi-Family ○ Other_____

Do You: ○ Own ○ Rent ○ Lease ○ Other_____

Owner Name(s):_____

Owner Phone #_____ Owner Cell #_____

Owner email_____ Owner Work #_____

Please indicate the best way and time to communicate with you. _____

Tenant Name(s): _____

Tenant Phone #_____ Tenant Cell #_____

Tenant email_____ Tenant Work #_____

Please indicate the best way and time to communicate with you. _____

Please complete to the best of your knowledge:

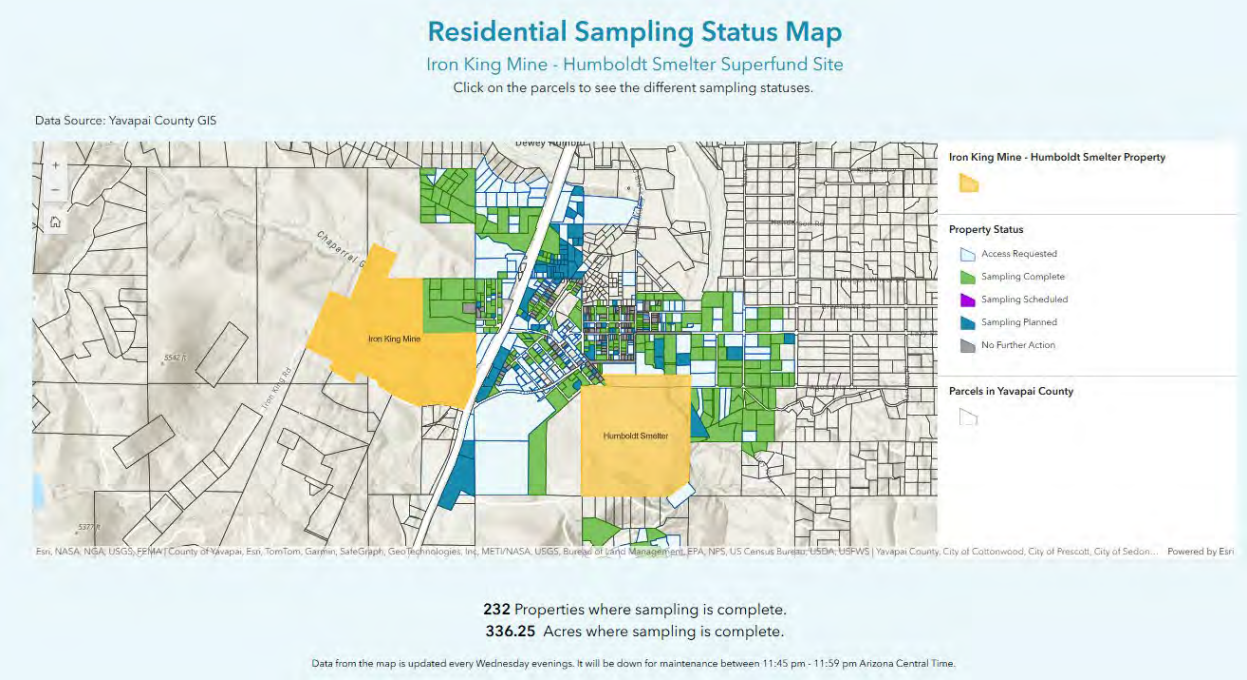
Is there anything the sampling team should be aware of during sampling (e.g., gates, dogs etc)?

Has fill been brought onto the property? ○ Yes ○ No ○ Unknown - Source of Fill: _____

Is fill suspected to be mine/smelter material? ○ Yes ○ No ○ Unknown

Has there been any excavation or moving of soils, such as septic or water line installation on the property?

○ Yes ○ No ○ Unknown - If Yes, where and when? _____



EPA example for Iron King Mine
(https://experience.arcgis.com/experience/c37b8129bf304fa0ad034d3ebf2a4626)



MAY 15, 2019
6:00 – 7:30 PM

COMMUNITY WORKSHOP

Vision for the Humboldt Smelter Property

The Town of Dewey-Humboldt and the U.S. Environmental Protection Agency (EPA) are hosting a workshop to hear the community's ideas for the future of the former Humboldt Smelter property. EPA has the opportunity to consider the community's reuse goals as they evaluate cleanup options for the site.

HUMBOLDT ELEMENTARY SCHOOL
2750 CORRAL ST, HUMBOLDT, AZ 86329

Please Join Us!

What Would You Like to See at the Humboldt Smelter Property?

What's Your Vision for the Future of Dewey-Humboldt?

Invite Your Neighbors!

QUESTIONS?
Please contact:
Yolanda Sanchez
US. EPA

Phone:
415-972-3880

Email:
sanchez.yolanda@epa.gov

SEMS-RM DOCID # 100018625

EPA Iron King Mine / Humboldt Smelter

U.S. Environmental Protection Agency • Region 9 • San Francisco, CA • October 2019

Keep Children Away from Former Smelter and Mine Properties 1
EPA is taking action to control dust at the smelter property 2
EPA to visit the community in November 2
The Iron King Mine/Humboldt Smelter Superfund site 3

Keep Children Away from Former Smelter and Mine Properties

The United States Environmental Protection Agency (EPA) was recently alerted that people, many of whom are children and teenagers, are playing in and around the Iron King Mine **tailings** pile and former Humboldt Smelter property. (*Note: See page 3 for more information on words in* **bold**.)

These two dangerous, contaminated properties in Dewey-Humboldt are part of the Superfund site. The former Iron King Mine created the orange tailings pile, just west of Highway 69. The former Humboldt Smelter left behind various smelter wastes and the brick smelter stack and nearby building, just east of Main Street. People should also avoid the Agua Fria River next to the smelter. The **slag** formed on the cliffs could break off and fall to the area below, creating a safety hazard.

Please follow posted warnings and talk with your children about staying away from these areas. If you see people or children near the smelter building or tailings pile, notify the Yavapai Sheriff's office at (928) 771–3260.

The smelter stack and nearby building are unstable and unsafe. Anyone near these structures is in danger of severe injury or death, should these structures collapse. Also, the smelter contains sharp cliffs, crevasses, and other fall hazards.

Both properties contain chemical hazards from toxic metals that could pose a health risk. Trespassers are likely to contact waste material including mine tailings, which contain high levels of arsenic and lead.



Figure 1: Former Iron King Mine tailings pile



Figure 2: Smelter with tailings pile in background



Figure 3: Smelter slag hanging over Agua Fria River

IRON KING MINE - HUMBOLDT SMELTER SUPERFUND SITE

U.S. Environmental Protection Agency | Region 9 | Dewey-Humboldt, AZ | March 2023

EPA RECOMMENDS SITE CLEANUP OPTION WITH 2023 PROPOSED PLAN

This fact sheet provides a very brief overview of EPA's full Proposed Plan for the preferred cleanup option for the Iron King Mine - Humboldt Smelter Superfund site in Dewey-Humboldt, Arizona (known as the IKHS site). Superfund is a cleanup program to address threats to human health and the environment at sites with contamination.

For the next 60 days, EPA invites public comment on the full Proposed Plan and the supporting studies and documents that form the basis for the proposal. The fully detailed Proposed Plan is available on our website at epa.gov/superfund/ironkingmine. After considering the information submitted during the public comment period, EPA will select a cleanup option for the IKHS site. The preferred option may change as a result of public comments. The public is encouraged to review and comment on the Proposed Plan.

The Site Problem

Decades ago, the Iron King Mine and Humboldt Smelter left behind millions of tons of mining wastes, including mine tailings, smelter dross, and other types of wastes and contaminated soils.

- The Iron King Mine operated from the early 1900s to about 1970. It extracted zinc, silver, lead and gold, and left behind a pile of about 4 million cubic yards of orange mine tailings with high levels of arsenic and lead.
- The Humboldt Smelter and two older facilities at the same location operated from the late 1800s until about 1937. They crushed copper and lead ores and melted them in furnaces to make pure metal. Wind carried away lead and other metals from the smelter smokestacks. Wastes called dross and slag, and soils contaminated with lead and other metals, remain near the former furnaces on the smelter property.

Wastes from both operations washed into water drainages that lead to the Agua Fria River, contaminating soils and surface water. Wastes contain arsenic and lead at levels that can pose a health threat to people and wildlife. Soils at some residential properties were also contaminated by the IKHS site.



Major areas of the site where mine and smelter wastes and soil contamination are located.

Disclaimer: Map image is the intellectual property of Esri and is used herein under license. Copyright © 2020 Esri and its licensors. All rights reserved. Sources: Esri, World Imagery: Maxar, Microsoft, Coconino County, County of Yavapai, © OpenStreetMap, HERE, Garmin, SafeGraph, GeoTechnologies, Inc., METI/NASA, USGS, Bureau of Land Management, EPA, NPS, US Census Bureau, USDA, Tetra Tech, Inc. and the 2022 Feasibility Study.

OPPORTUNITY TO COMMENT

Public Hearing:
March 29, 2023
6:30 p.m.

Location:
Humboldt Elementary School
2750 Corral Street
Humboldt, AZ 86329

Public Comment Period:
March 15 - May 13, 2023

To learn more about commenting on the Proposed Plan, please see the end of this fact sheet.

Part of EPA's Final Cleanup Plan: Residential Soil Testing and Cleanup

EPA's final cleanup plan for the overall Superfund site includes cleanup on some residential properties. EPA will be asking residents' permission to sample soil in their yards for contamination such as arsenic and lead. EPA will evaluate results to determine if cleanup is needed. Residents will not have to pay for sampling and results will be provided to the property owner.

Introduction

In Dewey-Humboldt, the former Iron King Mine and Humboldt Smelter left behind millions of tons of mine waste (tailings, dross waste, slag and waste rock) at and near the former mine and smelter and in the Chaparral Gulch that lies between them. These wastes contain toxic levels of metals like arsenic and lead. Windblown tailings from the mine and the smelter smoke stack also contaminated some surrounding residential properties between 80 and 125 years ago. In 2006, 2011, and 2017 EPA cleaned up 47 yards with the highest levels of contamination after collecting thousands of samples from almost 600 properties.

On October 20, 2023, the U.S. Environmental Protection Agency (EPA) issued a **Record of Decision (ROD)** – a final remedy, or cleanup, plan – and responded to public comments on the remedy plan. In the ROD, EPA lowered the cleanup levels for arsenic and lead compared to the cleanup levels we used in earlier cleanups. We did this based on new information about the toxicity of lead and arsenic and to be more protective of health. The ROD can be found at epa.gov/superfund/ironkingmine.

The parts of the cleanup covered in the ROD include efforts to address both residential areas and non-residential industrial areas with mine and smelter waste. These include:

- Sampling of certain residential yard soils that may still be affected by site contamination
- Cleanup where needed in residential yards and in industrial areas based on the new and more protective cleanup levels
- Movement of mine and smelter wastes and contaminated soils to permanent waste repositories (large, stable, and permanently covered holding cells)
- Preventing water from contacting and transporting mine waste
- Preventing contamination from leaving the site into drainages or the Agua Fria River
- Regular and ongoing inspection of the repositories to ensure they remain effective

This Fact Sheet Covers

- **EPA's Overall Cleanup and Next Steps**
- **Steps for Residential Soil Sampling**
- **Frequently Asked Questions**
  - Why is EPA doing this new work?
  - Will EPA request access to my property?
  - What are the benefits of giving EPA access to your property?
  - What does sampling and cleanup include?
  - Will I be charged or will my property ownership change?
  - What will happen with the results of sampling or cleanup?
- **Who can I contact if I have questions?**

Iron King Mine-Humboldt Smelter
Understanding Your Soil Sampling Report

Sampling to test for lead and arsenic levels in the soil at your property was recently conducted by the Arizona Department of Environmental Quality (ADEQ) on behalf of the United States Environmental Protection Agency (EPA). The soil sampling was conducted as part of the Remedial Design process at the Iron King Mine-Humboldt Smelter Superfund site. ***Incremental Sampling Methodology*** was used to obtain the soil samples.

Incremental Sampling Methodology:

Sampling areas were developed by determining an entire parcel's size, then dividing the parcel into one-quarter acre sampling areas referred to as residential decision units (RDUs). In each RDU a "composite" soil sample was obtained at two different depths, one from ground surface to six inches (referred to as Horizon A) and one from six inches to 12 inches (referred to as Horizon B). The term "composite" means that multiple subsamples, or "increments", were collected in a grid pattern across the RDU at each depth, first in Horizon A and then in Horizon B. After sampling each Horizon, the subsamples in each Horizon were combined to form one sample for each separate Horizon, or depth. This sampling method was used to ensure that representative results were obtained in the RDU for each Horizon. By combining soil subsamples across the entire RDU in a grid pattern, a reliable and defensible decision can be made regarding the cleanup of that RDU.

Sample results:

Each Horizon in an RDU is typically represented by a single sample result. However, you may see three results for one Horizon. These results are referred to as "replicates". This means an RDU Horizon had three *composite* samples taken, instead of one, to confirm consistency for the project. In your report, if you see replicate samples, the three samples were averaged together to provide one result in the referenced figures (if applicable, see Table A-3 of the attached package for calculated average concentrations).

Soil cleanup levels:
Lead - 200 milligrams per kilogram (mg/kg)
Arsenic (East of the Agua Fria River) - 79 mg/kg
Arsenic (West of the Agua Fria River) - 48

EPA

Iron King Mine - Humboldt Smelter Superfund Site Cleanup

U.S. Environmental Protection Agency | Southwest Pacific Region | January 2024

Part of EPA's Final Cleanup Plan: Residential Soil Testing and Cleanup

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SEMS-RM DOCID # 100032065

IRON KING MINE - HUMBOLDT SMELTER SUPERFUND SITE

U.S. Environmental Protection Agency | Region 9 | Dewey-Humboldt, AZ | March 2023

EPA RECOMMENDS SITE CLEANUP OPTION WITH 2023 PROPOSED PLAN

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For the next 60 days, EPA invites public comment on the full Proposed Plan and the supporting studies and documents that form the basis for the proposal. The fully detailed Proposed Plan is available on our website at epa.gov/superfund/ironkingmine. After considering the information submitted during the public comment period, EPA will select a cleanup option for the IKHS site. The preferred option may change as a result of public comments. The public is encouraged to review and comment on the Proposed Plan.

The Site Problem

Decades ago, the Iron King Mine and Humboldt Smelter left behind millions of tons of mining wastes, including mine tailings, smelter dross, and other types of wastes and contaminated soils.

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Wastes from both operations washed into water drainages that lead to the Agua Fria River, contaminating soils and surface water. Wastes contain arsenic and lead at levels that can pose a health threat to people and wildlife. Soils at some residential properties were also contaminated by the IKHS site.



Major areas of the site where mine and smelter wastes and soil contamination are located.

Disclaimer: Map image is the intellectual property of Esri and is used herein under license. Copyright © 2020 Esri and its licensors. All rights reserved. Sources: Esri, World Imagery: Maxar, Microsoft, Coconino County, County of Yavapai, © OpenStreetMap, HERE, Garmin, SafeGraph, GeoTechnologies, Inc., METI/NASA, USGS, Bureau of Land Management, EPA, NPS, US Census Bureau, USDA, Tetra Tech, Inc. and the 2022 Feasibility Study.

OPPORTUNITY TO COMMENT

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Humboldt Elementary School
2750 Corral Street
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To learn more about commenting on the Proposed Plan, please see the end of this fact sheet.

Iron King Mine / Humboldt Smelter Superfund Site

Recent Questions and Answers: EPA's Upcoming Sampling and Cleanup of Residential Properties

March 2024

EPA sampled and did cleanup at residential properties before. What is this new work?

EPA's previous sampling and cleanup work at residential properties cleaned up soil that had the highest levels of site-related contamination. EPA is now sampling and cleaning up properties with levels of contamination that remain above the new lower cleanup levels in EPA's Record of Decision, a final cleanup plan for the Superfund Site. EPA has lowered the cleanup levels we used in earlier cleanups, because new science has become available indicating that lead and arsenic are more toxic than was known in the past. The lower levels will lead to cleanup that is more protective of health.

What contaminants is EPA testing for?

Similar to previous sampling, EPA will be sampling for arsenic, lead, and other metals at levels that can be associated with the Superfund site.

Why does it benefit me to provide EPA permission to access my residential property for sampling and cleanup?

Providing access will allow EPA to collect soil samples to determine the current levels of arsenic, lead, and other heavy metals in your soil. This new information, and any sampling results EPA may have obtained in prior years, will be compared to the new cleanup levels to determine whether a cleanup is necessary. If so, performing a cleanup will help to protect the long-term health of those living at your property by addressing your exposure to arsenic or lead above the new, more protective, cleanup levels in soil.

If a cleanup is necessary and no cleanup is done, contamination may remain in the soil on your property. This will be documented in the Superfund Site cleanup completion report.

Will EPA obtain my consent to perform sampling and cleanup work on my property?

Yes. EPA will respect the decision of individual residential homeowners regarding their property access at this Site, although EPA has certain authorities with regard to property access under the Superfund law.

Will I be charged for sampling and cleanup work?

No. This work will be paid for by the EPA's Superfund program at no cost to you.

Iron King Mine-Humboldt Smelter Superfund Site - Assessment Activities Frequently Asked Questions

During the summer through the end of 2023, the Arizona Department of Environmental Quality (ADEQ) will have contractors present at the Iron King Mine-Humboldt Smelter Superfund site.



What is happening? ADEQ is supporting the Environmental Protection Agency (EPA) by engaging contractors to conduct additional land assessment work.



Why is the land assessment work being done? This work will provide information needed to continue the site through the Superfund process..

How long will crews be present? We anticipate this work to be conducted from mid-summer to late 2023.

Iron King Mine-Humboldt Smelter EPA Superfund Site Dewey-Humboldt, AZ

Website page examples

Superfund Site:

Superfund Home
This Site's Home Page
Site Contacts
Cleanup Activities
Operable Units
Cleanup Progress
Health & Environment
Stay Updated, Get Involved
Redevelopment
Site Documents & Data
View Site on Map

IRON KING MINE - HUMBOLDT SMELTER DEWEY-HUMBOLDT, AZ

Cleanup Activities

On this page:

- Background
- What Has Been Done to Clean Up the Site?
- What Is the Current Site Status?
- Sampling and Monitoring
- Emergency Response and Removal
- Enforcement Information

On related pages:

- Operable Units
- Cleanup Progress

Background

The former operations of the Iron King Mine and the Humboldt Smelter led to wastes and contamination in soils, sediments, and surface drainages within the town of Dewey-Humboldt, Arizona. EPA placed the Iron King Mine/Humboldt Smelter (IKHS) site on the Superfund list (the "National Priorities List") in 2008.

Between the early 1900s and about 1970, the former Iron King Mine mined rock ores of zinc, silver, lead, and gold. Peak production was during the World War II era. These operations left behind a pile of about four million cubic yards of orange mine tailings with high levels of arsenic and lead. Tailings

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This Site's Home Page
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IRON KING MINE - HUMBOLDT SMELTER DEWEY-HUMBOLDT, AZ

Health & Environment

On this page:

- What Are the Risks at the Site?
- Contaminant Information
- Performance Measures

What Are the Risks at the Site?

At IKHS, EPA is focused on arsenic and lead as the primary contaminants of concern. These two metals occur naturally in the environment. They can also cause health effects over long periods of time if people are exposed to soils, dust, or water at high enough levels.

Stay Away from the Mine and Smelter Properties

People should stay away from the former Iron King Mine property and the former Humboldt smelter property. Both properties are dangerous and contain chemical hazards from toxic metals that could pose a health risk. Trespassers are likely to contact waste material including mine tailings, which contain high levels of arsenic and lead.

The former Iron King Mine created the orange tailings pile, just west of Highway 69. The former Humboldt Smelter left behind various smelter wastes as well as the brick smelter stack and nearby building, just east of Main Street. People should also avoid the Agua Fria River next to the smelter plateau. The slag formed on the cliffs could break off and fall to the area below, creating a safety hazard.

site's information repository at the Dewey Humboldt Town Library.

Public Meetings and Presentations

Over the past 10 years, EPA has held numerous meetings for the public. EPA also host our own community meetings at appropriate points in the Superfund process, and we will present at other community meetings when invited.

More recently, EPA has been presenting updates to publicly open meetings of the Dewey Humboldt Town Council. Town Council agendas, minutes, and videos can be found at: www.dhaz.gov/2162/Town-Council EXIT . These meetings typically include a presentation followed by input and discussion from the Town Council or the community. EPA plans to continue to present at the Town Council and to coordinate with the Town Manager to keep the town aware of developments regarding the project.

Town Newsletter and Town Webpage

EPA periodically provides brief site updates and announcements through the Dewey-Humboldt Town Newsletter. Issues of the Town of Dewey-Humboldt Newsletters can be found at this link: www.dhaz.gov/2358/Newsletters EXIT

In response to a request from Town Council, the Town of Dewey-Humboldt created a special webpage on its website for periodic EPA updates on IKHS. EPA's most recent updates on this webpage can be found at: www.dhaz.gov/CivicAlerts.aspx?AID=200 EXIT

Top of Page

Community Resources

Community members might find helpful information at the following resources:

- Town of Dewey-Humboldt EXIT
- Arizona Department of Environmental Quality (ADEQ)'s site webpage EXIT

Top of Page

Public Participation Opportunities

EPA recognizes that communities have the right to be involved in the decisions that affect their lives. 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.

At the IKHS site, EPA's wants the public to participate throughout the cleanup process, including the investigation phase and the remedy selection phase. EPA and ADEQ have a number of ways for the community to become more knowledgeable about and involved with the IKHS site.

Community Involvement Plan

The Iron King Mine/Humboldt Smelter Superfund Site Community Involvement Plan provides a detailed explanation of how EPA and ADEQ will encourage public participation in the cleanup decision-making process. It is a flexible plan that organizes both EPA's and ADEQ's efforts, and it can change based on new community needs. A hardcopy of the IKHS Community Involvement Plan can be found at the site's information repository at the Dewey Humboldt Town Library.

Fact Sheets

EPA periodically issues fact sheets to provide information on a wide variety of topics. EPA will mail these fact sheets to all mailing addresses within approximately 2 miles of the site. Several fact sheets are available in the documents "factsheet" section of this website and hardcopies can be found in the site's information repository at the Dewey-Humboldt Town Library.

Public Meetings and Presentations

Over the past 10 years, EPA has held numerous meetings for the public. EPA also host our own community meetings at appropriate points in the Superfund process, and we will present at other community meetings when invited.

Superfund Site:

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Announcements and Key Topics

EPA Requests Property Owner Consent to Sample and Perform Cleanup of Contaminated Soils at Residential Properties in Dewey-Humboldt, AZ

EPA is conducting residential soil sampling to test for contaminants from historic mining and smelter operations in Dewey Humboldt, AZ. EPA will continue to seek consent for access to sample soils and perform residential cleanup. To submit a consent for access form or learn more about this phase of the cleanup, please see our geoplatform hubsite.

Updated print materials can be found at the Superfund information repository in the Dewey-Humboldt Library. For more information, please see our latest soil sampling fact sheet and recent community questions and answers

Meeting Minutes
Systematic Project Planning Meeting #2 — August 2025
Feasibility Study/Proposed Plan/Record of Decision
Former 15 Skeet Ranges portion of the Small Arms Ranges
Kingman Ground-to-Ground Gunnery Range
Kingman, Mohave County, Arizona
FUDS Project No. J09AZ041201

DATE/TIME: August 12, 2025, at 9:00 AM PDT

LOCATION: ADEQ Conference Room, 1110 West Washington Street, Phoenix, Arizona/Teams Meeting

ATTENDEES:

Name	Organization	E-Mail Address
Randy Tabije	USACE	Roland.R.Tabije@usace.army.mil
Lisa Schutzberger	USACE	Lisa.A.Schutzberger@usace.army.mil
Glenn Hoeger	USACE	Glenn.C.Hoeger@usace.army.mil
Katie Crane	USACE	Katie.L.Crane@usace.army.mil
Julie Burdey	USACE	Julie.A.Burdey@usace.army.mil
Cory Koger	USACE	Cory.S.Koger@usace.army.mil
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Steve Willis	UXO Pro	steve@uxopro.com
Kurt Fehling	The Fehling Group	kfehling@thefehlinggroup.com
Scott Holtry	Mohave County	
Luke Brazdys	Mohave County	brazdl@mohave.gov
Kelly O'Meara	Ahtna	komeara@ahtna.net
Jesse Laurie	Ahtna	jlaurie@ahtna.net
Rachel Kerr	Ahtna	rkerr@ahtna.net
Clarence Winzer	Ahtna	cwinzer@ahtna.net
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SUMMARY:

Representatives of the U.S. Army Corps of Engineers (USACE), Arizona Department of Environmental Quality (ADEQ) and their consultants, UXO Pro and The Fehling Group, as well as Mojave County, and Ahtna Solutions, LLC (Ahtna) met via Microsoft Teams and in person on August 12, 2025 for the second Systematic Project Planning (SPP) Meeting to conduct an Alternatives Panel for the Feasibility Study (FS) for the Former 15 Skeet Ranges portion of the Small Arms Ranges at the Kingman Ground-to-Ground Gunnery Range in Kingman, Mohave County, Arizona under Contract No. W912PL23D0036. These minutes summarize discussions in the order of the attached meeting presentation (Attachment A). For presentation topics that received no further discussion, no additional notes are provided. The meeting sign-in sheet is included in Attachment B.

1. Introduction (Slide 1-3)

Rachel Kerr called the meeting to order, welcomed everyone, and requested all attendees introduce themselves, including their organization and role. Those who attended the meeting via Microsoft Teams were introduced by Ms. Kerr. Ms. Kerr began the meeting with a safety moment discussing back to school safety and more specifically traffic safety near schools and crosswalks. No discussion occurred.

2. Meeting Objectives (Slide 4)

Rachel Kerr presented and identified the meeting's overall objectives. No discussion occurred.

3. Formal Dispute History (Slide 5)

Randy Tabije provided an overview on the formal dispute history at the 15 Skeet Range Site which included a review of the January 2024 FS where remedial alternatives were presented based on the removal of visible skeet in the area. Mr. Tabije continued to present that in June 2024 ADEQ initiated a formal dispute resolution. No discussion occurred.

4. Dispute Resolution (Slide 6)

Randy Tabije stated a Memorandum for the Record had been signed by both ADEQ and USACE on May 14, 2025. Mr. Tabije and Dan Sola provided more details on the resolution including that remediation would be completed using a two-phased approach. Mr. Tabije noted USACE is emphasizing community engagement and responding to questions received by the Kingman community.

Mr. Sola noted the Phase 1 and Phase 2 approach includes the methods used in risk assessment for parcels and how parcels were evaluated for risk regarding skeet target fragments and polycyclic aromatic hydrocarbons (PAHs) in soils. Mr. Sola added that Phase 1 remediation is based on mutually agreed upon sites as determined by previously collected Remedial Investigation (RI) data. No additional discussion occurred.

5. Site Overview - Location and History (Slides 7 - 9)

Rachel Kerr presented an overview of the Kingman Ground-to-Ground Gunnery Range location and history with more specific detail included on the focus of the FS and the 15 Skeet Ranges Site within the Ground-to-Ground Gunnery Range Munitions Response Site. Ms. Kerr stated that land use in the 15 Skeet Ranges Site was almost entirely residential in terms of zoning. No discussion occurred.

6. Site Overview – Previous Response Actions and Investigations (Slides 10-12)

Rachel Kerr presented an overview of previous response actions and investigations that have occurred in the 15 Skeet Ranges Site. Ms. Kerr presented the actions taken during the Time Critical Removal Action (TCRA) at 55 parcels from April to May of 2013 and from October 2013 to July of 2014. Ms. Kerr described the results from the TCRA exceeded project action levels at 50 of the 55 parcels. No discussion occurred.

Ms. Kerr reviewed the RI and RI Addenda conducted between December 2014 and April 2023.

Natalie Romanoff noted that the RI was based solely on investigation of soils. No additional discussion occurred.

Ms. Kerr presented a summary of the Right of Entry (ROE) details on the specific parcels investigated during the TCRA, RI, and RI Addenda. Ms. Kerr stated that the dark purple parcels were parcels where ROE was received but no samples were collected and that red parcels were parcels where ROE were not granted.

Lisa Schutzberger inquired if time had run out on dark purple parcels where ROE was granted but parcels were not sampled. Ms. Kerr stated she did not know the answer but noted that there are only several of

these parcels and they are mostly on the edges of the former 15 Skeet Ranges. No additional discussion occurred.

7. Site Overview – Conceptual Site Model (Slides 13 - 20)

Rachel Kerr presented the Conceptual Site Model including Phase 1 land use, primary concerns, contaminants, and transport mechanisms.

Land Use

Ms. Kerr provided an overview of current land use as it related to Phase 1 parcels, noting that all but one parcel is zoned as residential. Ms. Kerr provided specifications on the types of residential properties that exist in the area as well as whether those properties were vacant or occupied. Ms. Kerr noted anticipated exposure depths for residential land use is 2 ft and is a maximum of 6 ft for construction use, and stated that future land use is not expected to change.

Katie Crane asked meeting attendees if they agreed with the anticipated future land use. Karin Harker asked if the question is only related to Phase 1 parcels. Ms. Kerr confirmed the discussion applies only to Phase 1 parcels and does not include the Post Office or laundromat parcels.

Ms. Harker inquired if an excavation depth of 2 ft made sense for remediation. Dan Sola responded that the rules for excavation depth were arbitrary and are based on previous remediation at other Superfund sites.

Ms. Harker then stated that a means for applying land use controls (LUCs) to residential properties did not exist and noted that cyclic LUC reviews may be reduced if remediation extended past 2 ft depth. Ms. Harker also noted that at another Superfund site, remediation is to 5 ft depth to reduce LUCs. Mr. Sola asked whether this alternative made sense and Ms. Crane asked if there is no exposure deeper than 2 ft due to the land use, then is it worth going deeper? Natalie Romanoff stated a barrier could be used as part of land use controls and would need to be maintained and be a part of the Five-Year Review process. Mr. Sola inquired whether the cost of remediation to a depth of 2 ft was effective in terms of remediation goals from a feasibility standpoint. Kurt Fehling stated that in residential areas, LUCs are generally considered down to a 10 ft excavation depth to account for swimming pools. No additional discussion occurred.

Primary Concern

Ms. Kerr stated that the primary concern is PAHs in surface and subsurface soil, and exposure to PAHs from abundant and scattered skeet debris. No additional discussion occurred.

Contamination

Ms. Kerr noted the number of Phase 1 parcels that exceed the 10^{-6} incremental lifetime cancer risk (ILCR) based on RI PAH concentrations. Ms. Kerr reviewed maximum depths of PAH detections above RI project action levels, as well as minimum, average, and maximum concentrations for PAHs detected during the RI. Ms. Kerr presented cross sections of the maximum depth of PAHs above the RI project screening level for Snavely, Thompson, Ryan, Hearne, and Devlin Avenues.

Ms. Crane noted that the cross sections were important to visually compare where PAHs exposure existed and to what depth along with the type of land use along each cross section.

Mr. Sola noted the importance of the presentation slides that included east to west cross sections of Phase 1 parcels along the streets presented. Glenn Hoeger noted that when looking at cross sections for Snavely and Thompson avenues, where concentrations exceed the project screening level at deeper depths, these

parcels line up with the TCRA parcels and the skeet fragment fall-zone of the former 15 Skeet Ranges site. Mr. Hoeger noted that to the east and west higher concentrations of PAHs are shallower. Mr. Hoeger asked Mr. Sola to comment on these trends and Mr. Sola agreed with Mr. Hoeger's conclusions. Mr. Hoeger noted that the cross sections strengthened confidence in the Conceptual Site Model (CSM) for the vertical distribution of skeet fragments in subsurface soil from 1 to 6 feet below ground surface (bgs) at the TCRA parcels. Excavations for building foundations, fence footers, landscaping, and utilities including septic/leach fields were conducted in surface soil of the TCRA parcels impacted by high densities of skeet fragments, excavation backfill included fragments down to depths as deep as 6 feet. Parcels further away from the skeet fragment fall zone have relatively low densities of fragments primarily in surface soil due to street and easement grading, as well as conveyance in stormwater runoff. No additional discussion occurred.

Transport Mechanisms

Ms. Kerr presented the four transport mechanisms. No discussion occurred.

8. Site Overview – Institutional Analysis (Slides 21 - 23)

Rachel Kerr introduced the objectives of Institutional Analysis and clarified that the analysis needs to be completed before the completion of the FS.

Ms. Kerr led discussion with meeting attendees on controls included in Institutional Analysis including governmental, proprietary, and educational controls.

Governmental Controls

Ms. Kerr led the discussion on governmental controls by providing examples and discussing the suitability of these controls. Ms. Kerr stated that USACE has no jurisdiction on these controls but would be willing to support implementation. Ms. Kerr asked ADEQ meeting attendees if ADEQ had jurisdiction and whether they were willing or capable of supporting these controls.

Natalie Romanoff specified that ADEQ does not have any control over residential properties. Dan Sola added that although ADEQ can put a Declaration of Environmental Use Restriction (DEUR) on commercial properties, ADEQ cannot put deed restrictions on residential properties and would not have a mechanism for enforcement. No further discussion occurred.

Ms. Kerr inquired with Mohave County meeting attendees if they had jurisdiction to implement governmental controls and were willing and capable of supporting implementation. Luke Brazdys, representing Mohave County, expressed that the biggest concern for the County is the permits they issue for septic tanks and leach fields and various other excavations. Mr. Brazdys stated that remedial action excavations could damage the existing septic system in the area. Ms. Kerr asked if Mohave County could require building permits. Mr. Brazdys confirmed the County does but specified that if modifications were to be put in place that Scott Holtry would need to be included in the decision as Director of Development Services. Ms. Kerr asked if the county would be willing to support these changes. Mr. Brazdys responded that they are not opposed to supporting them, but Development Services would need to approve. Karin Harker asked Mr. Brazdys if Mohave County has a General Plan. Mr. Brazdys confirmed that the County has a general plan and stated documentation was forwarded to some of the meeting attendees already. Ms. Harker asked how often the General Plan is renewed. Mr. Brazdys was unable to recall when it will be renewed but stated it is not on an annual basis. Ms. Harker reiterated that ADEQ does not have jurisdiction to oversee these types of LUCs. Mr. Brazdys noted that he could obtain a General Plan from Matthew Gunderson who oversees planning and zoning and noted that there is construction being completed to

the north of the Phase 1 parcels. Ms. Harker noted that much of the responsibility exists with the property owner.

Glenn Hoeger asked if the County has limitations on excavations in leach fields and added that leach fields are unlikely to be exposure pathways. Mr. Brazdys stated that many parcels in the area have septic tanks or leach fields that were constructed 30 – 40 years ago and that swimming pools are unlikely in the area. Mr. Hoeger asked whether there was a pathway for exposure. Mr. Brazdys responded, saying that past construction and excavation to a depth of 10 ft in these leach fields is unlikely. Katie Crane asked Mr. Brazdys about the total depth of the leach fields in question. Mr. Brazdys responded that they are shallow, being less than 3 ft in depth and in most areas 1-2 ft in depth. Ms. Harker asked if the septic tanks were also shallow. Mr. Brazdys responded that the tanks should be fairly shallow and that a lot of the mapping associated with septic tanks and leach fields is not available..

Cory Koger inquired about the normal depth of frost in Kingman. Mr. Sola responded by saying less than 1 ft in depth. Mr. Koger stated that leach fields would not need to be deep. Mr. Sola asked what types of inspections may be needed for leach field or septic tanks if the top soil was to be scraped off. Ms. Harker asked what type of material may be above the tank. Mr. Sola responded that the material is likely clay and that an inspector may be needed. Mr. Koger noted that the types of inspections required need to be included in the FS. Mr. Sola asked Mr. Brazdys what data may be available. Mr. Brazdys responded that some data may exist. Mr. Sola inquired with Mr. Brazdys about what happens to leach field tanks and septic tanks when a home is sold and whether these tanks are pumped out upon selling the home. Mr. Brazdys answered that during the transfer to the next owner the tank is typically pumped and inspected. Mr. Sola noted that this dataset may be useful, and Mr. Brazdys responded that the dataset may be incomplete. Mr. Sola stated that from personal experience, it costs about $250 to have a leach field or septic tank located.

Ms. Kerr asked Mr. Brazdys about the City of Kingman's jurisdiction with regard to utilities. Mr. Brazdys responded that the county does have jurisdiction but added that the city may have small sections that are their jurisdiction, especially utilities. Ms. Kerr noted that reaching out to the City would be needed to determine true jurisdiction for these controls.

Ms. Kerr stated that landowners have no jurisdiction over governmental controls and are unlikely to support them. No further discussion occurred.

Proprietary Controls

Ms. Kerr presented and led the discussion on proprietary controls by providing examples and discussing the suitability of these controls. Ms. Kerr stated that USACE has no jurisdiction on these controls and asked the ADEQ meeting attendees about their jurisdiction and whether they would be willing and capable of supporting these controls.

Mr. Sola and Ms. Harker stated that like governmental controls, ADEQ cannot put deed restrictions and deed notices on residential properties. Ms. Kerr asked if ADEQ leadership would support such controls. Ms. Harker responded that they would likely not support such controls. No additional discussion occurred.

Ms. Kerr asked Mr. Brazdys whether Mohave County had the jurisdiction to and would be willing and capable of supporting these controls. Mr. Brazdys responded that the county's response for proprietary controls would be the same as their response for governmental controls. Mr. Harker added that property owners have almost full control over their property, making it difficult to implement LUCs.

Ms. Kerr stated that landowners have no jurisdiction over proprietary controls and are unlikely to support them. No additional discussion occurred.

Educational Controls

Ms. Kerr presented and led the discussion on educational controls by providing examples and discussing the suitability of these controls. Ms. Kerr stated that USACE is willing and able to support educational controls and asked ADEQ meeting attendees about their jurisdiction and whether they would be willing and capable of supporting these controls.

Ms. Romanoff stated that in general ADEQ would be willing to support educational controls and community engagement. Ms. Kerr inquired if the state has jurisdiction regarding these controls. Ms. Harker noted that educational controls could be shared via the ADEQ website, but ADEQ does not have jurisdiction for warning signs/kiosks.

Jess Laurie stated that at some Formerly Used Defense Sites (FUDS), ADEQ hands over authority to the specific county Department of Environmental Quality (DEQ). Ms. Harker stated that Mohave County does not have a DEQ and that jurisdiction rested with the state. Mr. Laurie suggested that perhaps Mohave County could provide information on their website regarding the removal of soil or when working around the FUDS site. Mr. Hoeger stated that at some Superfund sites there is notification that the homeowner is within a Superfund site and asked if a similar means of disseminating information exists for FUDS sites. Ms. Romanoff stated that FUDS notifications are only made when a site is in the Interim Risk Management (IRM) Program. Ms. Romanoff stated that if this FUDS site is split out, which ADEQ would prefer, stakeholders would be notified. Mr. Laurie stated that the FUDS designation shows up on a comprehensive title search but frequently gets missed and explained that FUDS has a GIS site/database that the County could link with the county development website database or even provide overlays for increased transparency. Ms. Romanoff noted that ADEQ has discussed with the County and USACE has shared information, so the County now has answers. Ms. Crane added that USACE is working on adding this database to the active website and is considering separating the Phase 1 and Phase 2 parcels in the IRM Program. Lisa Schutzberger asked Randy Tabije how often IRM notifications are made. Mr. Tabije stated that IRM notifications are made once every five years. No additional discussion occurred.

Ms. Kerr asked Mr. Brazdys if Mohave County had the jurisdiction to and be willing and capable of supporting these controls. Mr. Brazdys had stepped out from the meeting and would return momentarily. Ms. Kerr stated that the meeting would pivot back to this discussion when Mr. Brazdys returned. No additional discussion occurred.

The meeting recessed from 1035 to 1045 for a short break.

At 1055, Ms. Kerr returned to the institutional analysis and asked Mr. Brazdys about whether Mohave County would have jurisdiction and be supportive of education controls. Mr. Brazdys responded that educational outreach would likely be supported, though a signage proposal may not be supported or well received. Ms. Kerr asked Mr. Brazdys if Mohave County would have jurisdiction in non-ROW/flood control areas. Mr. Brazdys stated that this would fall under the Department of Public Works. Ms. Kerr then asked if Mohave County would be supportive of signage on these properties. Mr. Brazdys stated that signs would require approval and would likely not be well received and that the County would be receptive to disseminating educational materials and support engagement. No additional discussion occurred.

At 1222, following Scott Holtry joining the meeting via Teams, Ms. Kerr pivoted the discussion back to institutional analysis and asked Mr. Holtry about governmental controls and whether Mohave County had jurisdiction and would be willing and capable of supporting these controls. Mr. Holtry answered by echoing what was stated by Mr. Brazdys and included that based on Proposition 207, if rezoning did occur, it would be considered a “taking” and the County would be responsible for compensating property

owners. Mr. Holtry stated that Mohave County does not want to be responsible for the compensation of these properties. No additional discussion occurred.

Ms. Kerr asked Mr. Holtry whether Mohave County had jurisdiction and was willing and capable of supporting proprietary controls. Mr. Holtry restated Mr. Brazdys response to this question. No additional discussion occurred.

Ms. Kerr asked Mr. Holtry whether Mohave County had jurisdiction and would be willing and capable of supporting educational controls. Mr. Holtry stated that it made sense to educate the current property owners in the affected area but stated that signage would be difficult to implement due to the potential fear it would create. No additional discussion occurred.

9. Preliminary Remedial Action Objectives (Slides 24 – 26)

Rachel Kerr presented the Phase 1 Preliminary Remedial Action Objectives (RAOs) noting that PAHs remedial goals (RG) were in milligrams per kilogram and not micrograms per kilogram as previously displayed in figures. No discussion occurred.

Ms. Kerr reviewed the constraints of remedial action alternatives and noted that there is an expectation that landowners will oppose legal or engineering controls. Ms. Kerr also noted that temporary housing of residents and their pets would be required for remedial action.

Dan Sola stated that resources exist that could provide an idea of what level of engagement should be expected from stakeholders. Katie Crane stated that active engagement will be needed to best obtain rights-of-entry (ROEs). Mr. Sola added that there are ways to have a discussion to better obtain ROE from stakeholders. Karin Harker mentioned that if it is not necessary to have the homeowners relocate then the discussion should be had among meeting attendees. Cory Koger responded that the onsite contractor completing excavation activities would likely be against having homeowners onsite while this work is being completed. No additional discussion occurred.

10. Summary of Remedial Technologies (Slides 27 – 32)

Rachel Kerr reviewed the summary of remedial technologies.

Land Use Controls

Ms. Kerr reviewed institutional controls including deed restrictions and permits. Ms. Kerr noted that these process options have been eliminated from consideration in remediation.

Natalie Romanoff asked if the restrictions being discussed were strictly for LUCs and Ms. Kerr clarified that the discussion only related to deed restrictions. No additional discussion occurred.

At 1055 PDT, Ms. Kerr noted that Luke Brazdys was back online, and the discussion was pivoted back to institutional analysis.

At 1100 PDT, Ms. Kerr returned back to discussing remedial technologies and LUCs by moving to administrative mechanisms. Ms. Kerr discussed warning signs as a process option and stated that they have been eliminated from consideration in remediation. No discussion occurred.

Ms. Kerr reviewed educational materials and noted that this process option is low cost and highly implementable and was therefore retained for further consideration.

Dan Sola stated that the local elementary school could be a good place for public education. No additional discussion occurred.

Ms. Kerr reviewed engineering controls and the process option of fences. Ms. Kerr stated that the effectiveness was considered to be low. Ms. Kerr stated that this option was eliminated from consideration in remediation. No discussion occurred.

Containment

Ms. Kerr reviewed containment including process options: soil covers and asphalt or concrete covers.

Katie Crane noted that geotextile barrier as a process option would fall under containment. Ms. Kerr discussed the geotextile barrier's effectiveness and implementability and noted this would be added to the FS discussion of remedial technologies.

Ms. Kerr continued to review asphalt and concrete covers.

Karin Harker noted that large trucks would be moving in and out of the area being remediated. Ms. Harker asked USACE how it would go about maintaining roadways. Cory Koger responded that a plan for traffic patterns would be in place and that all roadways would be restored to previous conditions.

Ms. Kerr noted that both soil and asphalt or concrete covers were eliminated from consideration in remediation due to the lack of ability to widely implement these controls in a privately owned residential area. No additional discussion occurred.

Removal

Ms. Kerr reviewed the process option of conventional excavation and stated that contaminants could be removed with this option and soils could be easily sampled prior to removal to verify if RGs had been met. Ms. Kerr noted that this process option was retained for future consideration. No discussion occurred.

Disposal

Ms. Kerr reviewed offsite disposal and the process option of transporting and disposing of skeet and soil to a permitted treatment and disposal facility.

Mr. Sola asked if a mobile analytical laboratory was in consideration. Ms. Kerr stated that it was not included in the FS. Mr. Sola and Mr. Koger discussed the feasibility of a mobile analytical laboratory. Mr. Sola added that this method could potentially get more stakeholders to buy in as it could reduce the amount of time an excavation needs to remain open, and residents relocated. Ms. Harker agreed. No additional discussion occurred.

Treatment

Ms. Kerr reviewed physical/chemical treatment process options. Ms. Kerr reviewed soil washing and noted that this option would have limited effectiveness, feasibility, and be difficult to implement causing it to be eliminated from consideration.

Glenn Hoeger stated that fine grain material is what is generally removed by the process of soil washing and that this method would be ineffective for treating PAHs associated with skeet target fragments. No additional discussion occurred.

Ms. Kerr reviewed chemical oxidation and the conversion of inorganic contaminants to non-hazardous compounds using an oxidizing agent. Ms. Kerr noted that this option would have limited effectiveness, feasibility, and be difficult to implement causing it to be eliminated from consideration.

Mr. Hoeger stated that when PAHs are in a limestone and a coal tar matrix, it is less likely that an oxidizing agent would be an effective remediation technology. No additional discussion occurred.

Ms. Kerr reviewed using solidification and stabilization to reduce contaminant mobility. Ms. Kerr noted that this method would have limited effectiveness, feasibility, would be difficult to implement, and would be high in cost causing it to be eliminated from consideration.

Mr. Koger noted that all treatment options are in research development, and none have been scaled up to treat large scale properties. All would be considered pilot studies. No additional discussion occurred.

Ms. Kerr reviewed low-temperature thermal desorption and stated that this option had been eliminated from consideration due to its limited effectiveness and difficulty to be implemented, along with its high cost. No discussion occurred.

Ms. Kerr reviewed bioremediation and stated that this option would reduce PAHs by metabolizing organics with biological amendments. Ms. Kerr stated that this method had been eliminated from consideration due to its limited effectiveness and difficulty associated with implementation. No discussion occurred.

11. Potential Alternatives (Slides 3 – 45)

Rachel Kerr provided an overview of the potential alternatives included in the Phase 1 FS and stated that the focus of the discussion during the meeting would be on the alternatives that are protective and implementable. No discussion occurred.

Non-Protective and Non-Implementable Alternatives

Ms. Kerr reviewed the alternatives that were non-protective including Alternatives 1 (No Action) and 2 (LUCs Only) where no action would be taken and only LUCs implemented, respectively. No discussion occurred.

Ms. Kerr reviewed the non-implementable alternative, Alternative 5 (Demolition and Excavation to 6 ft), which includes demolition of all structures and excavation to 6 ft. Ms. Kerr explained that this alternative would not be possible to implement on private property. No discussion occurred.

Alternative 3 (LUCs and Excavation up to 2 ft)

Ms. Kerr reviewed Alternative 3, which includes LUCs and excavation up to 2 ft. Ms. Kerr stated that excavation would be limited laterally due to physical barriers (e.g., trees, homes, etc.), where buffer zones would be needed. Ms. Kerr explained that confirmation samples would be collected, and permeable geotextile barrier would be installed at the bottom of excavations to demark parcels where deeper soils remain with PAHs concentrations above the risk-based limits. Ms. Kerr reviewed estimated excavated depths per parcel, based on RI findings. Ms. Kerr stated that based on the current data from the RI, it is estimated that eight parcels would need a geotextile layer. No discussion occurred.

Ms. Kerr provided an overview of site-specific constraints related to Alternative 3 including ROEs and structures that may limit the extent of remedial action.

Katie Crane reiterated site specific constraints related to the removal of existing miscellaneous structures and surface storage and the feasibility of being able to implement these LUCs. Ms. Crane noted the complexity of removing these structures and objects from these properties and noted it may be difficult to get property owners to agree to removal. Natalie Romanoff asked if the discussion on whether this option was feasible was occurring. Ms. Crane and Ms. Kerr responded that at this point the feasibility is in part being considered but is only just a general constraint. Karin Harker asked where the soil to backfill excavation will be obtained from. Ms. Kerr stated that the backfill soil source would be determined during remedial design. Ms. Harker stated that the source needs to be similar to the native soil. Dan Sola asked whether the specifics on allowing multiple opportunities to recycle surface storage would be provided to

homeowners. Ms. Romanoff added that options could be provided to homeowners for pickup, including bulk pickup with the County. Ms. Romanoff suggested that adding what homeowners would like to keep could be included in the access agreement and cautioned USACE to be careful that people might not receive their property as "junk". Randy Tabije added that PODS or storage devices could be used, and Ms. Romanoff agreed and added that this idea could increase stakeholder buy in. Ms. Romanoff stated that ROEs need to be specific and very clear regarding what will be moved and should be carefully considered and discussed with property owners. Luke Brazdys added that based on his experience with another county project, it will likely be difficult to get property owners to respond in a timely manner. Lisa Schutzberger asked what would be done if the owner refused to move their property (or allow it to be moved), limited remedial action occurred, and then later they move their property and then want the area remediated – assumption of risk would have to be included in the ROE. No additional discussion occurred.

The meeting recessed from 1155 to 1222 PDT for lunch.

Scott Holtry joined the meeting during the break.

Ms. Romanoff suggested that Ms. Kerr ask Scott Holtry questions regarding IA.

At 1232 PDT, Ms. Kerr continued the discussion of Alternative 3 by reviewing the National Contingency Plan (NCP) criteria evaluation.

Ms. Romanoff stated that compliance with Applicable or Relevant and Appropriate Requirements (ARARs) are typically requested and discussed with ADEQ. Katie Crane explained that USACE is aware of these comments and that the discussion would be for another meeting. Karin Harker asked USACE if they already have a list of ARARs. Ms. Crane stated that ARARs have been compiled and are being reviewed by USACE Office of Counsel. Ms. Romanoff, Ms. Harker, and Mr. Sola agreed that ADEQ will review ARARs following an internal review by USACE counsel. No additional discussion occurred.

Alternative 4 (LUCs and Excavation up to 6 ft)

Ms. Kerr presented Alternative 4 – LUCs and Excavation up to 6 ft. Ms. Kerr explained that with Alternative 4 there would be no geotextile barrier used, and excavation could occur up to 6 ft. Ms. Kerr reviewed estimated excavated depths per parcel, based on RI findings, and noted that all site-specific constraints discussed under Alternative 3 would also apply to Alternative 4. No discussion occurred.

Ms. Kerr reviewed the NCP criteria evaluation for Alternative 4. No discussion occurred.

Summary of Alternatives

Ms. Kerr presented a summary comparing alternatives to the NCP criteria, with a focus on Alternatives 3 and 4 being both protective and implementable.

Mr. Sola asked if Alternative 4 included more than the eight parcels that would be excavated to a depth greater than 2 ft based on data from the RI. Ms. Kerr responded by saying that it does include the assumption that there would be more than eight parcels excavated to that depth. Mr. Sola asked for the specific number of parcels and Ms. Kerr responded that the exact number of parcels would be included in the FS.

Luke Brazdys inquired about how the material going to the landfill would be handled and to which landfill it would be sent. Mr. Brazdys noted concern for dust control at the landfill and the handling of such an influx of material. Mr. Koger stated that excess material could be used as daily cover and Mr. Brazdys responded by saying there may be extra operational costs included if this were done. Ms. Kerr noted that TCRA soils were disposed of at a local landfill and she would need to look into the exact location.

Mr. Sola stated that Alternative 4 is more effective in the long term and that it should be represented as a fully shaded circle on the summary figure. Mr. Sola added that if the plan is to excavate to 2 ft what is the purpose of excavating to 6 ft if there is not an exposure pathway at depths greater than 2 ft. Ms. Harker proposed that a hybrid alternative between Alternatives 3 and 4 could be included. Glenn Hoeger added that it is important to remember that the risk assessment process would be established to determine the final excavation depth, but that native soil is where skeet fragments are most prevalent and would cause the most concern. Mr. Hoeger added that areas where construction occurred and native soil was used as backfill is where skeet fragments are the deepest. Mr. Sola stated that a more robust understanding of the incremental cost of deeper excavation would be needed to determine if the effectiveness is worth the cost. Mr. Koger stated that any excavation greater than 4 ft would cause OSHA standards to kick in and would require those excavations to be fenced in before backfilled, and that deep rooted desert plants would be more affected by excavation.

Mr. Sola stated that a geotextile layer would be an option that he is leaning towards. Ms. Crane asked about the feasibility of a geotextile layer. Ms. Kerr added that it would be difficult to place the geotextile layer near mobile homes. Mr. Sola suggested that an excavation depth of 1 ft near mobile homes may be advantageous.

Mr. Koger stated that analytical turnaround times along with stopping excavation at 2 ft depth would create longer wait times when compared to Alternative 4. Mr. Hoeger added that a possible caveat to Alternative 3 could be that if skeet fragments are visible in the soil, continued excavation may be permitted to increased depths. Mr. Hoeger stated that with this caveat, Alternative 3 could be equally effective compared to Alternative 4. Mr. Hoeger explained that in the TCRA, the majority of visible skeet fragments existed in the target fall zone and native material was very different than fill. Mr. Hoeger stated that one of the challenges is that PAH concentrations can be low in soil with visible fragments and vice versa.

Mr. Sola noted that Alternative 4 reduces overall remediation time as you would not have to wait for sample results and there may be physical indicators of when you can stop excavations. Mr. Sola also noted that if the incremental cost of Alternative 4 compared to Alternative 3 is low enough that it should be further considered. Mr. Hoeger stated that the RGs are different than the screening levels used in the RI and that RGs would likely not be exceeded in deeper soils. Kurt Fehling and Ms. Harker agreed to this statement.

Mr. Brazdys stated that deeper excavations would require mechanical lifting, creating the possibility of compaction of soil and subsidence particularly near foundations of homes.

Ms. Crane asked if the visual indicator of skeet fragments could be used to directly correlate with the possibility of contamination and limit the depth needed for excavation. ADEQ attendees responded that a barrier should be put down to indicate continued possible contamination.

Ms. Romanoff stated that she does not support Alternative 3 due to the restrictiveness of only being able to excavate to 2 ft and the use of geotextile, and she would like to reduce LUCs as much as possible. Ms. Romanoff suggested something between Alternatives 3 and 4. Ms. Crane stated that the RGs allow for excavation to a reasonable depth. Mr. Hoeger then stated that the goal of this meeting and the FS is to reach an agreement on assumptions and determine if the difference in price is justified by the reduction of risk. Mr. Hoeger emphasized that mass reduction is the goal. Mr. Fehling added that Alternative 4 removes the issue of a required geotextile layer that several attendees were opposed to. Mr. Hoeger proposed revising Alternative 4 to have a maximum excavation depth of 4 ft, and to include the option of

geotextile barrier as needed if confirmation samples indicate remedial goal exceedances below 4 ft. Mr. Fehling agreed with Mr. Hoeger that USACE should draft a revised Alternative 4.

Ms. Romanoff requested a recap of the discussion in terms of the plan for reassessing alternatives. Ms. Kerr stated that Alternative 4 would be updated to excavate to a depth of 4 ft with the option for a geotextile layer added as needed. Mr. Koger stated that Alternative 4 should be revised rather than creating a new alternative. Ms. Kerr asked Mr. Hoeger if excavation depths should be based on RI screening levels or RGs. Mr. Hoeger responded that estimated depths must be based on the RI screening levels due to sampling methodology (incremental) used in the RI. Mr. Hoeger asked Mr. Sola for confirmation and Mr. Sola confirmed. No additional discussion occurred.

12. Next Steps (Slides 46 – 47)

Rachel Kerr reviewed the next steps to be taken in Phase 1 and Phase 2. No discussion occurred.

13. Discussion and Action Items (Slide 48)

Rachel Kerr opened the floor for discussion.

Natalie Romanoff asked Randy Tabije and Lisa Schutzberger about the optics of the current FS timeline in relation to the Environmental Protection Agency's (EPA) sewer expansion project in the area. Ms. Romanoff asked if issues would arise from the EPA being ahead of USACE with their project schedule and asked if there would be an issue if the EPA is able to obtain their ROEs before USACE is able to. Ms. Schutzberger noted the projects have different funding streams. Katie Crane asked if there was a timeline for the EPA project. Ms. Romanoff stated there is not a set timeline but EPA is keeping ADEQ updated and USACE needs to look in to options to coordinate with the EPA and County to save money and be efficient. Mr. Tabije responded that it would not necessarily be an issue and that USACE planned to communicate with the EPA.

Cory Koger asked Luke Brazdys about the typical process followed in Mohave County for closure in place of septic systems and Ms. Romanoff asked what the County code was required for closure. Mr. Brazdys responded that it is typically completed by crush-in-place methods or fill with flowable fill. Ms. Romanoff asked Mr. Brazdys if the property owner was responsible for the abatement and removal of the septic system. Mr. Brazdys responded that Mohave County absorbed a portion of the cost of the abatement.

Ms. Romanoff asked USACE attendees about the optics of the EPA and USACE not working together on abatements when considering ROEs. Mr. Brazdys stated that the County is working with the EPA and does not want to delay connecting any homeowners to the sewage system as there have already been multiple failures and there are no other options. Mr. Romanoff stated that it was a priority for ADEQ as well. Ms. Crane then asked if there is digging occurring through contaminated soil, and if yes, potential safety hazard associated with excavation should be made known in order to mitigate exposure during sewer installation. Karin Harker stated it would be great to get multiple government agencies collaborating on the same project and requested she and Mr. Tabije discuss it with their management. Ms. Schutzberger inquired if any public meetings are planned with the EPA. Ms. Romanoff stated that the EPA would like to participate with the Army in any outreach and that ADEQ would like to align efforts between ADEQ, EPA, and USACE. Mr. Tabije responded that USACE is not opposed to working with these other groups but would need to see the EPAs schedule to be able to align funding.

Mr. Tabije reviewed the details of the proposed pilot study and noted that USACE is currently working on the document to go through legal and contracting and they need to evaluate costs and schedule technical meetings. Ms. Romanoff stated that the cooperative agreement makes it possible to expand the scope. Ms. Harker noted that the agreement should include language about liability and inquired if the septic

tank/leach field project could be included with Ms. Romanoff asking if ADEQ would be doing the work. Ms. Romanoff stated that they would need the approval of USACE legal counsel. Mr. Tabije stated that the necessary language would be included in the agreement to remove liability.

Mr. Tabije stated that USACE is aiming to begin Phase 2 next year and that leadership changes have occurred everywhere. Ms. Schutzberger stated USACE is working on ROEs for alleyways, etc.

Ms. Schutzberger noted that the next community outreach event will be the Kingman First Friday's event on November 7, 2025 and noted USACE plans to visit the local swap meet the following morning to evaluate whether it could be an effective venue for future events. Ms. Romanoff stated that she was in communication with ADEQ communications department officials on suggestions for better community outreach. Ms. Romanoff mentioned that the communications department did have comments on outreach posters. Ms. Schutzberger asked if ADEQ had heard feedback from the governor and Ms. Romanoff replied that they have not, and do not expect to. Ms. Romanoff stated that she will be meeting with the community outreach group for ideas on meetings with the community. Ms. Harker asked if USACE would like to continue to collaborate on community outreach. Mr. Tabije responded that USACE is still open to this and receptive to suggestions.

Ms. Schutzberger stated that the Restoration Advisory Board (RAB) solicitation was published and comments were due August 7, 2025 and no interest has been expressed. Ms. Romanoff asked that ADEQ and municipalities (i.e., the County) be included as they are interested in establishing a RAB.

Mr. Tabije asked if there were any other discussion items. Ms. Schutzberger replied in the negative.

Rachel Kerr thanked everyone for their time and mentioned again that the next public outreach event would be on November 7, 2025 in Kingman. No additional discussion occurred.

The meeting was adjourned at approximately 1414 PDT.

Assumptions identified during the meeting:

Assumption	Application
If excavation is greater than 4 ft, OSHA requirements are applicable.	To be incorporated into the remedial design, as needed.
PODs, or other storage devices could be used for temporary storage of property during a remedial action.	To be incorporated into applicable alternative cost analysis and remedial design.
Relocation of residents and pets necessary during excavations.	To be incorporated into applicable alternative cost analysis and remedial design.
Mobile analytical lab may expedite PAH analysis during remedial action and reduce overall duration of remedial action.	To be considered during remedial design.
Native soil pricing to procure for restoration activities	To be incorporated into applicable alternative cost analysis.
Options for pickup of unwanted items, including bulk pickup from the County, maybe be provided to homeowners.	To be incorporated into applicable alternative cost analysis and remedial design.

Assumption	Application
Owner refusal to move large items/structures would limit extent of remedial action.	Noted.
Disposal of excavated soils at landfill may include dust control, daily cover, and other fees.	To be incorporated into applicable alternative cost analysis.
Expedited analytical turnaround times for confirmation samples may reduce overall duration of remedial action.	To be considered during remedial design.
Lifting and compaction of fill near structure foundations is needed.	To be incorporated into applicable alternative cost analysis and remedial design.
Septic tanks/leach fields would limit extent of remedial action.	To be considered during remedial design.
In place closure of septic systems and leach fields may require crushing or flowable fill.	To be considered during remedial design.

Action Items identified during the meeting:

Action Item	Responsible Party	Notes
Contact the City of Kingman to determine jurisdiction for institutional controls.	USACE	To be conducted during the Institutional Analysis and documented in the FS Report.
Determine how often IRM notifications are made.	USACE	
Identify the location of landfill used during the TCRA.	Ahtna	Prior to the end of the meeting, Rachel Kerr confirmed that the landfill used during the TCRA was the Lapaz County Landfill in Parker, Arizona.
Revise Alternative 4 in the FS to have a maximum excavation depth of 4 ft, and to include the option of geotextile barrier as needed if confirmation samples indicate remedial goal exceedances below 4 ft.	Ahtna	
Determine if access agreements had expired for parcels where ROE was granted but parcels were not sampled.	Ahtna	
Determine if there are any indications that future land use will change for any of the parcels.	Ahtna	Contact city planner or other city entity to inquire about future or expected growth.

Action Item	Responsible Party	Notes
Determine if Mohave County Development Services can implement governmental controls (building permits/ septic tanks).	USACE	During the Institutional Analysis, contact Scott Holtry, Director of Development Services. It was noted that implementation would be difficult but not impossible and that the General Plan is reviewed every 5- 10 years with Prop 207 referenced.
Determine if County and USACE can share information regarding a FUDS GIS website/database for title search.	USACE	
Determine if Mohave County Development Services can implement institutional controls (signage).	USACE	During the Institutional Analysis, contact Scott Holtry, Director of Development Services. It was noted that implementation would be difficult but not impossible
Decide the best place to make public education materials available in Kingman.	ADEQ/ USACE	
Review of ARARs following an internal review by USACE counsel.	ADEQ/ USACE	
Determine if team up with EPA is viable while connecting homeowners to sewage system and can align with schedule/ funding.	ADEQ/ USACE	Proposed pilot study could help expand scope and cost.
Determine ROEs for alleyways and other misc. properties.	USACE	
Next community outreach event will be the Kingman First Friday's event on November 7, 2025. USACE plans to visit the local swap meet the following morning to evaluate whether it could be an effective venue for future events	Ahtna/ USACE/ ADEQ	Ahtna will reserve the booth for the event, and relay information to USACE for coordination with ADEQ.

Attachment A: Meeting Presentation

KINGMAN GROUND-TO-GROUND GUNNERY RANGE

Feasibility Study/ Proposed Plan/Record of Decision, Former 15 Skeet Ranges

FUDS Project No. J09AZ0412-01
USACE Contract No. W912PL23D0036

Systematic Project Planning Meeting #2

August 12, 2025



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MEETING PARTICIPANTS

Name	Organization	Role
Janice Opperman	U.S. Army Corps of Engineers (USACE)	Contracting Officer's Representative
Randy Tabije	USACE	Regional Project Manager
Lisa Schutzberger	USACE	Project Manager
Katie Crane	USACE	Technical Lead
Glenn Hoeger	USACE	EMCX Toxicologist
Cory Koger	USACE	Project Toxicologist
James Salisbury	USACE	EMCX
Julie Burdy	USACE	EMCX
Karin Harker	Arizona Department of Environmental Quality (ADEQ)	Federal Projects Unit Manager
Natalie Romanoff	ADEQ	Project Manager
Dan Sola	ADEQ	Principal Hydrogeologist
Steve Willis	UXO Pro	ADEQ Support Contractor
Kurt Fehling	The Fehling Group	ADEQ Support Risk Assessor
Luke Brazdys	Mohave County	Environmental Engineering Manager
Chrystal McKee	Mohave County	
Tim Walsh	City of Kingman	City Manager
Jesse Laurie	Ahtna	Director of Operations
Rachel Kerr	Ahtna	Program Manager
Clarence Winzer	Ahtna	Project Manager
Connor Gray	Ahtna	Staff Scientist

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SAFETY MOMENT

BACK TO SCHOOL SAFETY

- Stop at crosswalks
- Watch for small children
- Avoid distractions while driving
- Slow down/stop for school buses
- Pay attention to increased traffic
  - Includes inexperienced student drivers
- Tell children to use the buddy system



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MEETING OBJECTIVES

- Review Conceptual Site Model and Remedial Action Objective for Phase 1
- Update Institutional Analysis with current stakeholder input
- Identify alternatives to be considered for Phase 1
- Describe alternatives and site-specific constraints
- Ensure Project Delivery Team (PDT) and stakeholder agree on what needs to be included in Feasibility Study (FS)

FORMAL DISPUTE HISTORY

- A Feasibility Study for the entire 15 Skeet Range Site was submitted to ADEQ in 2024
  - The January 2024 FS presented remedial alternatives based on the removal of visible skeet with the intent of removing the exposure pathway rather than estimating an acceptable number of residual skeet fragments in soil.
- In June 2024, ADEQ initiated Formal Dispute Resolution for the following reasons:
  - Risk assessment approach for protection of human health from PAHs in skeet fragments
  - Confidence in identification of density of skeet fragment locations
  - Community engagement to support assessing, remediating, and monitoring parcels

DISPUTE RESOLUTION

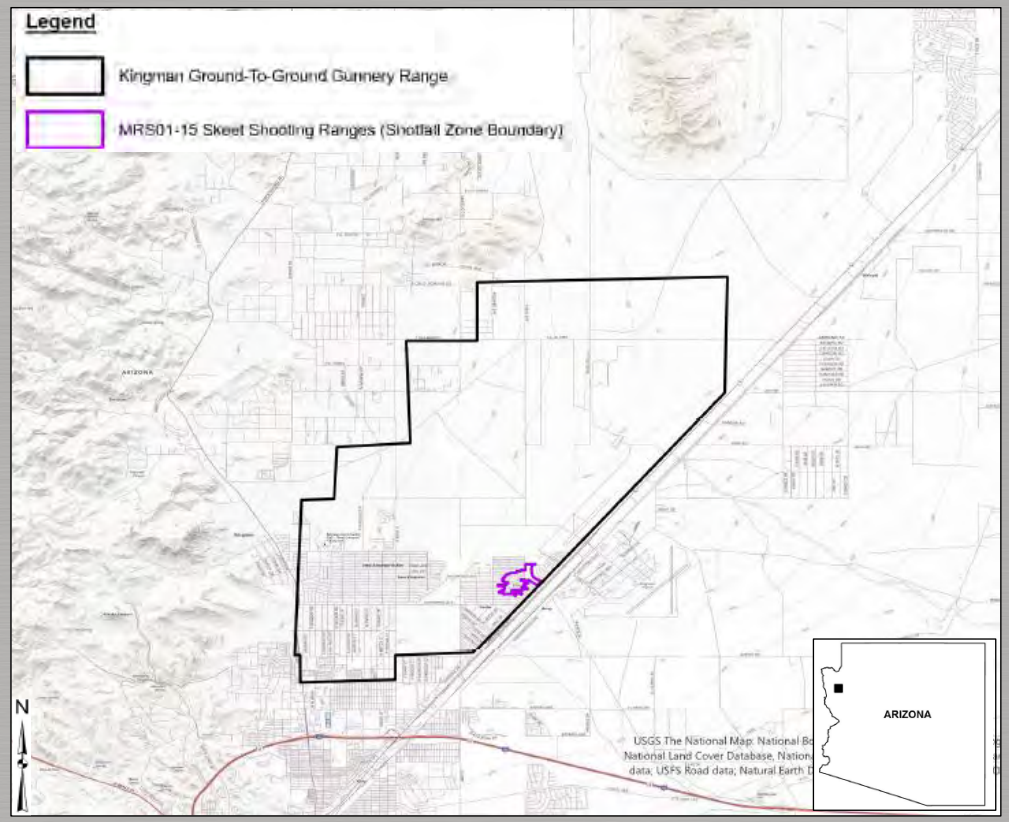
- On May 14, 2025, ADEQ and USACE signed the Memorandum for the Record to resolve the Formal Dispute.
- Resolution included the following:
  - Remediation through a phased approach
    - Phase 1 – includes all parcels with elevated concentrations of PAHs in soil above the risk-threshold as determined by previously collected RI data
    - Phase 2 – concurrent with Phase 1, USACE will conduct a Supplemental RI on additional parcels to establish a threshold risk for PAHs from combined sources of soil and skeet fragments
  - Quantitative Risk Assessment Approach for Phase 2
  - Community Engagement

SITE OVERVIEW

PROJECT LOCATION & HISTORY

Kingman Ground-to-Ground Gunnery Range

- 20,146.24 acres located in Kingman, Mohave County, Arizona.
- Acquired by the Army Air Force[1] in 1943 by transfer and lease.
- Used during World War II for aerial gunnery training, in association with the school based at Kingman Army Air Field.
- All governmental leases were terminated by 21 August 1947.
- Present uses of the property include residential, commercial, agricultural, and cattle grazing, on private and publicly owned properties.
- The 15 Skeet Ranges Site (Site) is the focus of this Feasibility Study and consists of 75 acres within the Kingman Ground-to-Ground Gunnary Range Munitions Response Site (MRS).



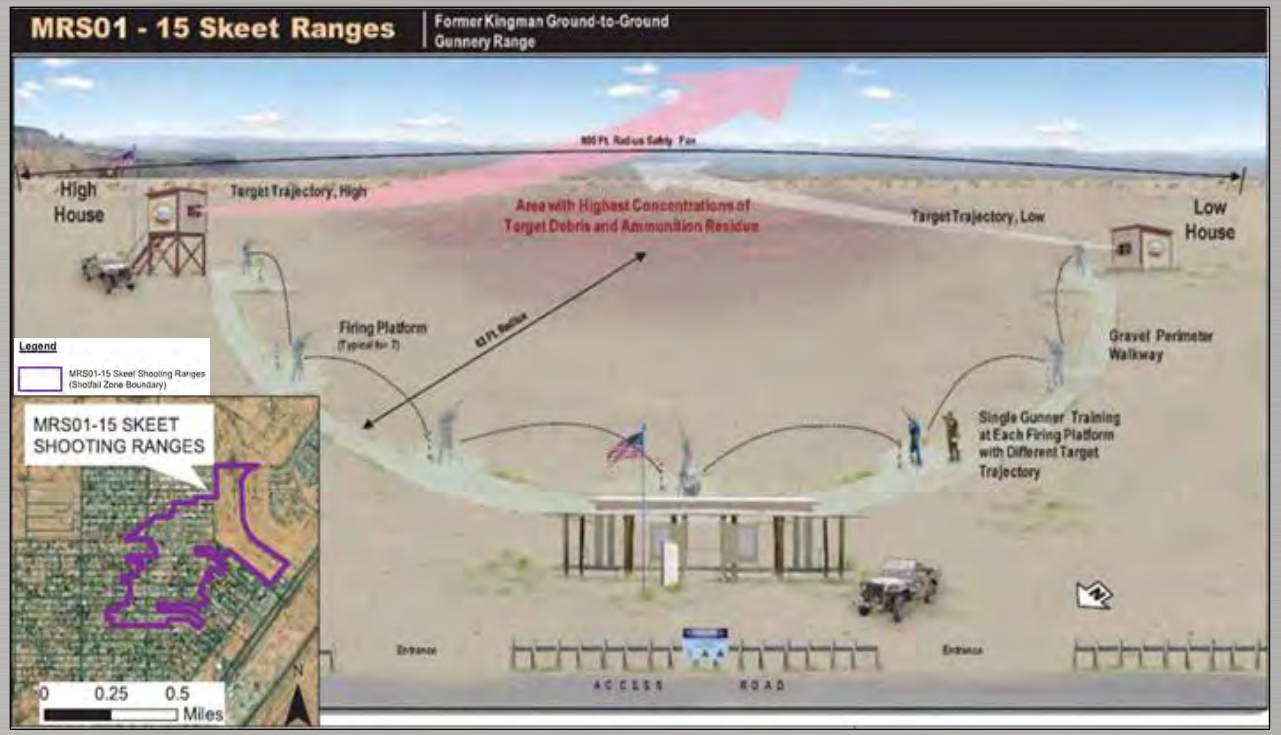
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Notes:

[1] US Air Force was not established until 1947.

15 SKEET RANGES SITE

- Clay targets were launched from two structures, a high house and low house at each of the 15 firing platforms.
- The firing platforms were oriented from the northwest to southwest, and the shooters stood towards the southeast.
- The 15 Skeet Range Site current land use is residential.
- Previous investigations indicate debris from clay targets used at the skeet ranges were made from limestone with coal tar containing high concentrations of polycyclic aromatic hydrocarbons (PAHs).



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PREVIOUS RESPONSE ACTIONS

Time Critical Removal Action (TCRA)

- Primary objective was to immediately reduce the highest PAH concentrations to below Arizona residential Soil Remediation Levels (SRLs) at residential properties.
- Conducted April to May 2013 and October 2013 to July 2014.
- Included soil excavation to 2 feet below ground surface (bgs). Confirmation samples were collected at each property before placing clean fill materials. Results exceeded project action levels at 50 of the 55 parcels.
- Backfill with clean fill material, and compaction at 55 residential parcels.
- Skeet fragments observed on the surface and/or subsurface at 30 of the 55 parcels during 2022 inspections.
- Not the final remedy. USACE and ADEQ agree that the TCRA parcels need to be addressed further, but that task is not included in this contract and the Phase 1 FS does not include the TCRA parcels.

PREVIOUS INVESTIGATIONS

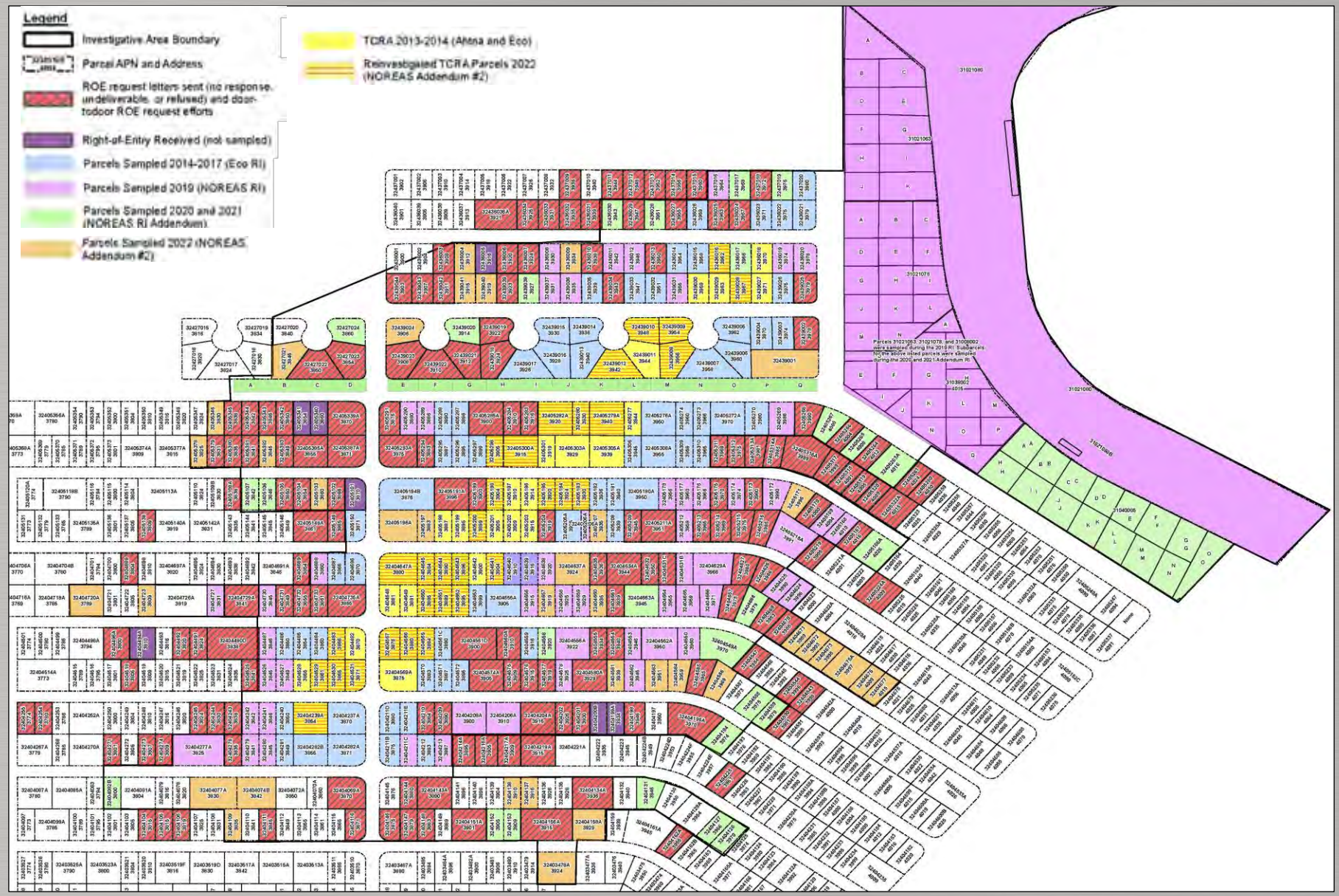
RI and RI Addenda

- Conducted between December 2014 and April 2023
- Investigation of 194 of 284 parcels/sub-parcels/rights-of-way
- Collected soil samples using incremental sampling methodology and analyzed for PAHs
- Samples were not collected beneath homes or structures
- Human health risk assessment determined an unacceptable health risk at 97 parcels with PAH incremental lifetime cancer risk (ILCR) greater than 10^{-6}
- Potential risks to ecological receptors were considered negligible

PREVIOUS RESPONSE ACTIONS & INVESTIGATIONS

Right of Entry (ROE) Summary

- TCRA ROEs – 55 parcels
- RI & Addenda ROEs
  - 2014-2017 – 66 parcels
  - 2019 – 60 parcels
  - 2020-2021 – 31 parcels
  - 2022 – 37 parcels (plus 32 parcels resampled)



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CONCEPTUAL SITE MODEL

Land Use – Phase 1 Parcels

- Current land use is almost entirely residential:
  - North of Thompson Ave is zoned SD/R1 – single family dwellings
    - Thirty (30) slab on grade homes
  - South of Thompson Ave is zoned SD – single family dwellings
    - Thirty-seven (37) mobile homes
    - Sixteen (16) vacant parcels
  - One parcel (32439001; currently vacant) northwest of Thompson Ave and Rose Dr zoned for commercial use (C2)
  - Thirteen (13) rights-of-way on Thompson Ave



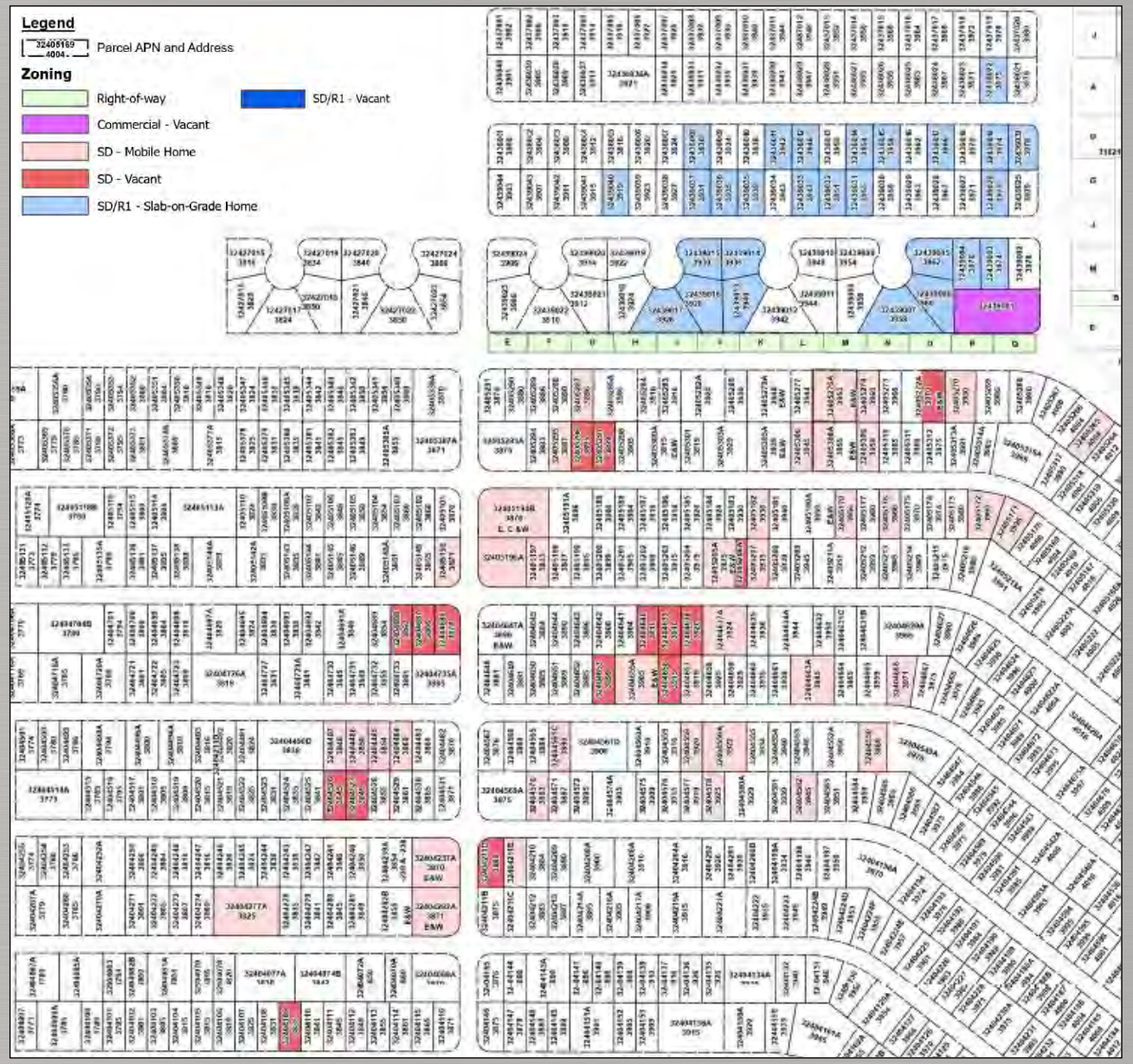
Slab on grade home



Mobile home

CONCEPTUAL SITE MODEL

Land Use – Phase 1 Parcels (Continued)



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CONCEPTUAL SITE MODEL

Land Use – Phase 1 Parcels (Continued)

- Residential use includes gardening, mowing, landscaping
  - Anticipated land use depth is down to 2 feet for gardening and landscaping
- Construction use
  - Anticipated construction depth is up to 6 feet
- Anticipated future land use is not expected to change

Primary Concern

- PAHs in surface and subsurface soils
- Potential exposure to PAHs from abundant and scattered skeet debris

CONCEPTUAL SITE MODEL

Contamination – Phase 1 Parcels

- 97 parcels exceeding the 10^{-6} ILCR based on PAH concentrations
- Maximum depth of PAHs detected during RI were generally 2 ft bgs and above, but deeper samples were not collected at all parcels.

Max Depth PAHs >RI Project Action Limits (ft bgs)	Parcel Count
0.167	38
1	29
2	22
3	4
4	2
5 to 6	2
Total:	**97**



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CONCEPTUAL SITE MODEL

Contamination – Phase 1 Parcels (Continued)

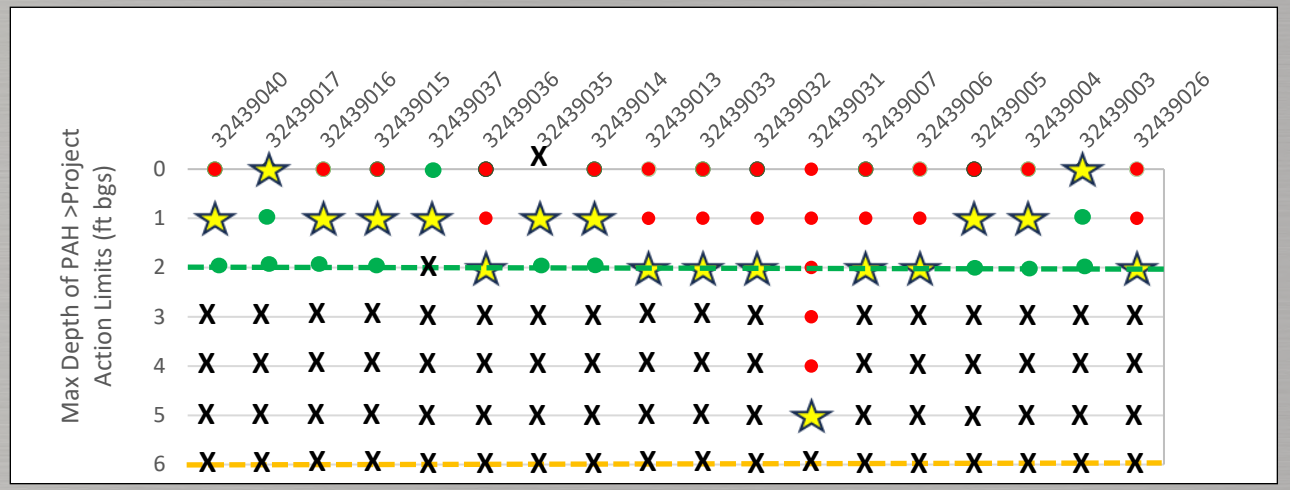
All concentrations in µg/kg	BENZ(A)-ANTHRACENE	BENZO(A)-PYRENE	BENZO(B)-FLUORANTHENE	BENZO(K)-FLUORANTHENE	DIBENZ(A,H)-ANTHRACENE	CHRYSENE	INDENO(1,2,3-CD)-PYRENE
Minimum Concentration (Detection Limit)	3.0	3.2	3.5	1.4	0.6	3.2	2.3
Average Concentration	968.4	1,019.8	1,359.1	574.8	225.1	1,209	762.3
Maximum Concentration	31,400	33,600	43,200	15,000	5,690	38,300	21,500
Screening Level	1,100	110	1,100	11,000	110	110,000	1,100

CONCEPTUAL SITE MODEL

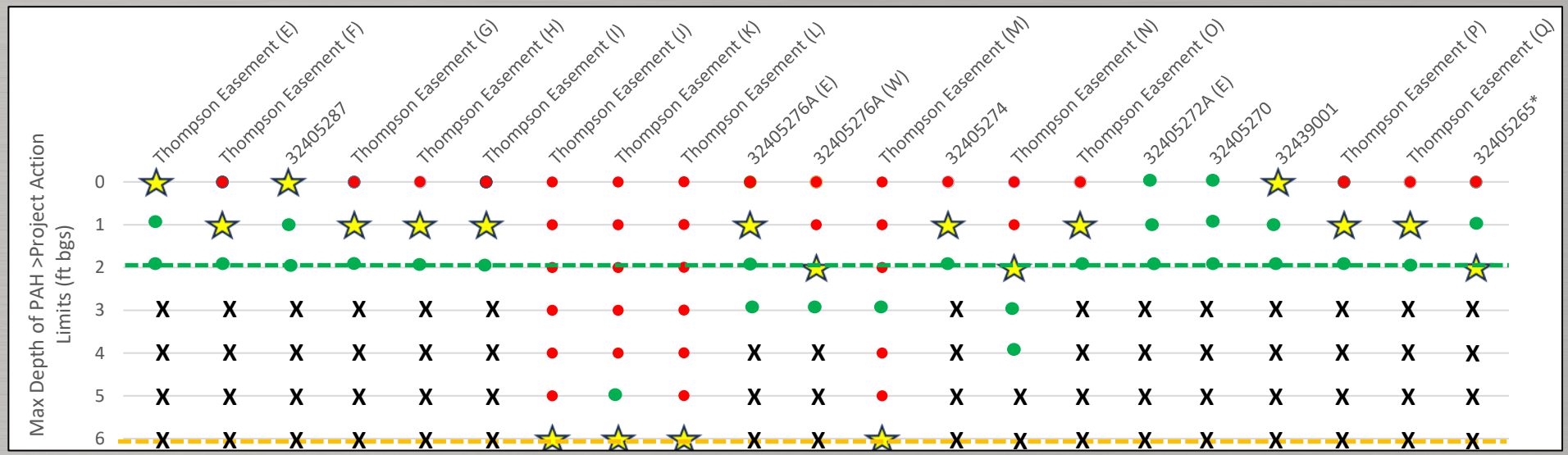
Legend

- PAH > Screening Level
- PAH < Screening Level
- X Not Sampled
- Max Depth of PAH > Screening Level
- Max Residential Receptor Exposure
- Max Construction Receptor Exposure

N



Snavely Ave



Thompson Ave

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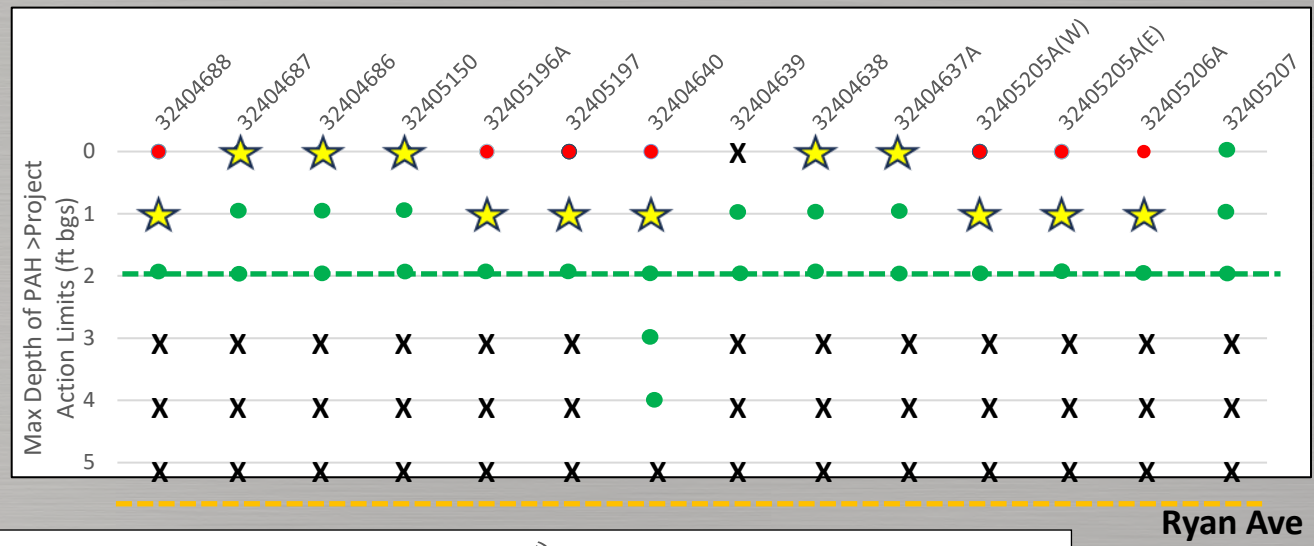
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CONCEPTUAL SITE MODEL

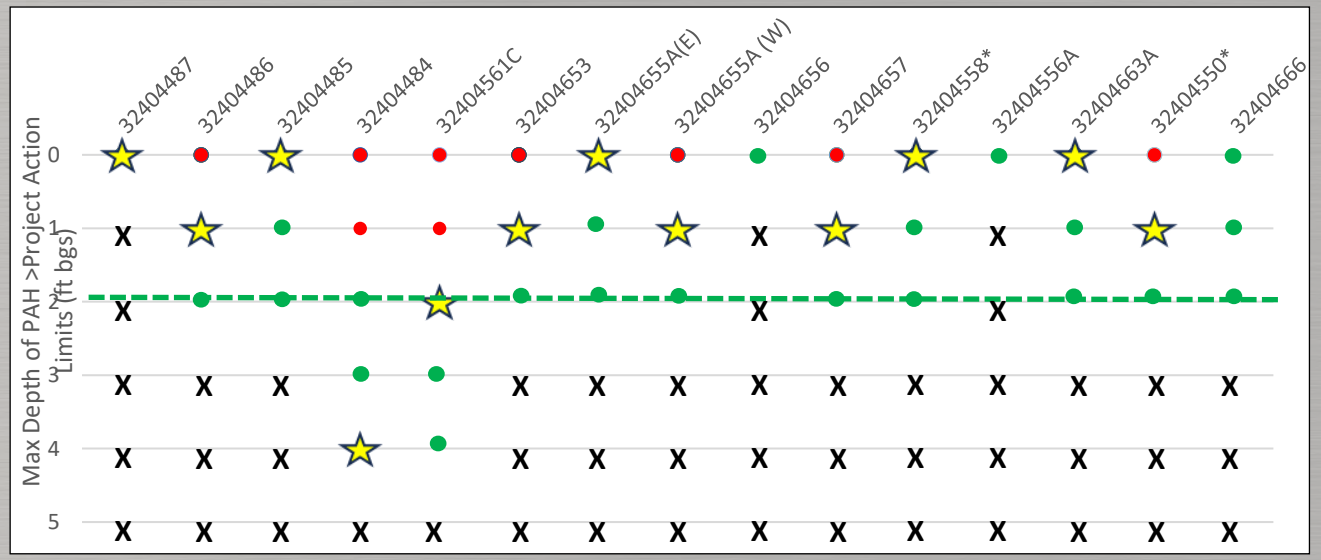
Legend

- PAH > Screening Level
- PAH < Screening Level
- X Not Sampled
- Max Depth of PAH > Screening Level
- Max Residential Receptor Exposure
- Max Construction Receptor Exposure

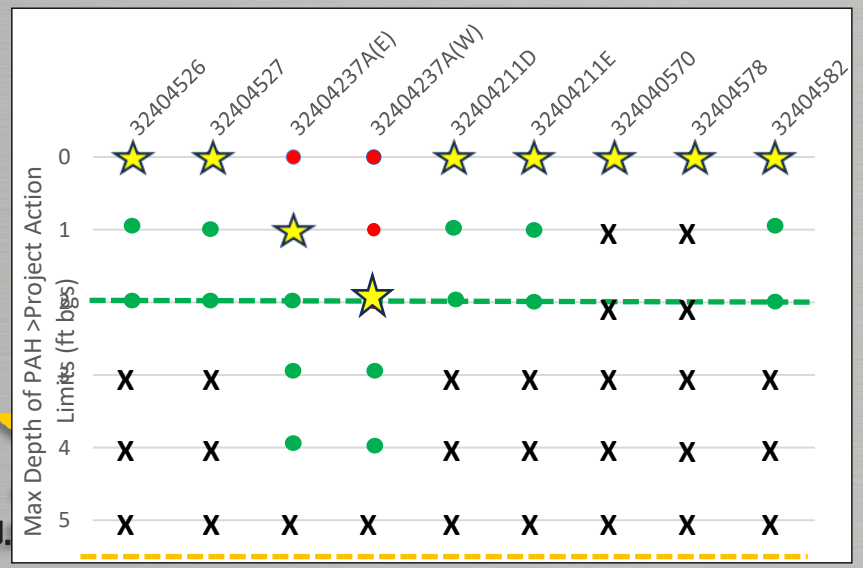
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Ryan Ave



Hearne Ave



Devlin Ave

CONCEPTUAL SITE MODEL

Four Transport Mechanisms

- Initial deposition from shooting range
- Erosional redistribution from natural drainage
- Redistribution related to construction activities after skeet range closure
- Granular convection movement and residential and municipal soil disturbance

INSTITUTIONAL ANALYSIS

- Objectives of the Institutional Analysis:
  - Identify government agencies with jurisdiction over the MRS and other stakeholders (e.g., landowners)
  - Assess their suitability, capability, and willingness to support land use controls (LUCs)
  - Identify feasible LUCs for the MRS
- Done prior to completing the Feasibility Study
- Initiate discussion today in the following slide

INSTITUTIONAL ANALYSIS

For discussion with meeting attendees:

Red text added during meeting discussion

Type of Control	Examples	Suitability (for discussion)		To be discussed			
			USACE	ADEQ	Mohave County	City of Kingman	Landowners
Governmental Control	a) Zoning b) Building codes c) Building permit requirements	a) Already zoned residential (+one parcel is commercial). b) Subsurface disturbance can't be prohibited via building codes. No impact on mitigating surface contamination risk. c) Could require bldg. permit for awareness.	No jurisdiction, but willing to support	Jurisdiction? No jurisdiction – cannot put deed restrictions on res. Property, only comm. (DEUR) Willing/ capable of supporting? Likely yes, but leadership input required (not likely)	Jurisdiction? Permit process goes through county – already in place. Septic tanks/leach fields permit. Will need to evaluate any changes/restrictions. If any changes made, it would be considered a "taking" and the property owner would have to be compensated. Willing/ capable of supporting? Not opposed, but Director and Board of Supervisors would need to approve. General Plan reviewed/renewed every 5-10 yrs. Prop	Jurisdiction? Most in the county jurisdiction. Utilities under city jurisdiction. Willing/ capable of supporting? Need to contact city to discuss.	No jurisdiction, unlikely to support

				leadership input required (not likely)	of Supervisors would need to approve. General Plan reviewed/renewed every 5-10 yrs. Prop 207 – regarding rezoning and just compensation.		
Proprietary Control	a) Environmental covenants b) Deed restrictions c) Deed notices	a) Not suitable for surface/shallow subsurface soil contamination in residential area b) Same as above c) Same as above	No jurisdiction	Jurisdiction? Same as above Willing/ capable of supporting? Same as above	Jurisdiction? Same as above Willing/ capable of supporting? Same as above	Jurisdiction? Willing/ capable of supporting? Need to contact city to discuss.	Unlikely to support
Educational Control	a) Warning signs/kiosks b) Pamphlets c) Briefings d) Letters/Fact Sheets e) Webpages	Not protective on their own but may improve the effectiveness of another alternative by mitigating residual risks a) Could be placed in ROW b) Suitable for educating about handling of skeet fragments c) Same as above d) Same as above e) Same as above	Willing and able to implement	Jurisdiction? Not for warning signs/kiosks. Can share educational materials on website. Willing/ capable of supporting? Would support engagement and education	Jurisdiction? Does have some jurisdiction in ROW/flood control areas (for signage) Willing/ capable of supporting? Would support engagement and education directly to property owners, subject to approval. Signs would require approval and likely not well received. Some budget, but would have to be approved.	Jurisdiction? Willing/ capable of supporting? Need to contact city to discuss.	Unlikely to support signs/kiosks on their property. Would be receptive to educational materials.

PRELIMINARY REMEDIAL ACTION OBJECTIVES

PRELIMINARY REMEDIAL ACTION OBJECTIVES

Phase 1 Preliminary Remedial Action Objectives (RAOs)

- Prevent resident ingestion of, dermal contact with, and inhalation of airborne particulates of soil containing PAHs exceeding the project's soil Preliminary Remedial Goals (PRGs).
- Prevent resident ingestion of, and dermal contact with, skeet fragments that are co-located with contaminated soil remaining in surface and subsurface. For this FS, the focus is on parcels identified with cancer risks above 10^{-6} based on soil only exposure (i.e., Phase 1 parcels). Skeet fragments co-located with contaminated soil will be removed.

PRGs Protective of Human Health

Analyte	Remedial Goal
PAHs	mg/kg
Benz(a)anthracene	9.2
Benzo(a)pyrene	1.5
Benzo(b)fluoranthene	11
Benzo(k)fluoranthene	180
Chrysene	850
Dibenz(a,h)anthracene	1.5
Indeno(1,2,3-cd)pyrene	11

Abbreviations:

mg/kg - milligram(s) per kilogram

PAH - polycyclic aromatic hydrocarbon

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PRELIMINARY REMEDIAL ACTION OBJECTIVES

Constraints on the remedial alternatives

- Educational controls are anticipated to be the only implementable LUCs (i.e., Public Notices and Information Pamphlets/Fact Sheets, Education Seminars and Meetings, and Websites). The landowners are unlikely to allow posting of warning signs.
- Landowners are unlikely to support legal or engineering controls.
- Septic tanks, leach fields, other utilities, structures, and vegetation (i.e., mature trees) will limit extent of remedial action.
- Temporary relocation of residents and pets required for remedial action.

SUMMARY OF REMEDIAL TECHNOLOGIES

SUMMARY OF REMEDIAL TECHNOLOGIES

GRA	Technology Type	Process Option	Description	Effectiveness	Implementability	Cost	Retained or Eliminated
LUCs	Institutional Controls (ICs)	Deed restrictions	Deed restrictions issued for property within potentially affected areas to restrict property use.	Not effective for all exposure pathways.	Landowner acceptance of activity restrictions highly unlikely as this would negatively impact current and future land use. Would require action by the local government.	Unknown. Property owners may want compensation for diminished property value.	Eliminated – Not effective or implementable
		Permits	Regulations promulgated to require a permit for excavation/removal activities	Not effective for all exposure pathways.	Landowner acceptance of activity restrictions highly unlikely as this would negatively impact current and future land use. Required only if soil COC concentrations in excess of the RGs are left in-place. Would require action by the local City and County government agency to implement.	Low	Eliminated – Not effective or implementable

Legend: Retained | Eliminated

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SUMMARY OF REMEDIAL TECHNOLOGIES

GRA	Technology Type	Process Option	Description	Effectiveness	Implementability	Cost	Retained or Eliminated
LUCs	Administrative Mechanisms	Warning Signs	Signs used to delineate the hazardous area clearly and act as a visual reminder. Placed along the perimeter of the site with extra signs placed at access points.	Not effective for all exposure pathways. Proven and routinely used, increases awareness of potential hazards and generally accepted by regulators. Effectiveness limited to potential handling of, and intentional ingestion of skeet, for those who observe and understand the signs.	Landowner acceptance of warning signs highly unlikely as this would negatively impact current and future land use. Potentially implementable to add signs in alley ways, easements, and the drainage location.	Low	Eliminated – Not implementable on parcels.
		Educational Materials	Production and distribution of educational materials to inform receptors about the nature of the contamination present at the site.	Not effective for all exposure pathways. Proven and routinely used, increases awareness of potential hazards and generally accepted by regulators. Effectiveness limited to potential handling of, and intentional ingestion of skeet, to those who observe and understand the materials.	Yes, readily implementable.	Low	Retained – Implementable
	Engineering Controls	Fences	Security fences installed around potentially affected areas to limit access	Not effective for all exposure pathways.	Landowner acceptance of fence installation and associated access restrictions highly unlikely as this would preclude current and future land use.	Low	Eliminated – Not Effective

Legend: Retained | Eliminated

SUMMARY OF REMEDIAL TECHNOLOGIES

GRA	Technology Type	Process Option	Description	Effectiveness	Implementability	Cost	Retained or Eliminated
Containment	Covers	Soil covers	Place a cover of "clean" soil over soil with COCs above the RGs to eliminate the direct exposure pathway.	Not expected to be effective because of the thickness of the cap required to preclude potential exposure to residents during landscaping and other intrusive activities.	Dependent on the cooperation of individual property owners; landscaping of the property would be impacted.	Moderate	Eliminated – Not implementable
		Asphalt or concrete covers	Place an asphalt or concrete cover to eliminate the direct exposure pathway.	Effective. Existing buildings, roads, driveways, etc. serve as a cover.	Dependent on the cooperation of individual property owners as the landscaping of the property would be impacted.	Moderate	Eliminated – potential limited application. implementability
Removal	Excavation	Conventional excavation	Excavate skeet and soil with COC exceedances using conventional mechanical equipment and manual digging.	All contaminants are removed and soil can be easily sampled prior or during excavation to verify that RGs are met.	Excavation and offsite disposal is relatively simple, well proven, and readily implementable.	Moderate	Retained – Effective and implementable
Disposal	Offsite Disposal	Treatment and disposal facility	Transport and dispose of skeet and soil at a permitted treatment and disposal facility.	Effective. Permitted landfills are designed and operated to contain disposed waste.	Easily and quickly implementable. Nearby landfills are available.	Moderate	Retained – Effective and implementable

Legend:

Retained	Eliminated

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SUMMARY OF REMEDIAL TECHNOLOGIES

GRA	Technology Type	Process Option	Description	Effectiveness	Implementability	Cost	Retained or Eliminated
Treatment	Physical/ chemical treatment	Soil Washing	Remove COCs from soil by exposing soil to an aqueous washing solution in a reactor.	Can be effective for high PAH concentrations. Not effective for soil containing PAHs at low concentrations.	Dependent on the cooperation of individual property owners as the landscaping of the property would be impacted. Given the large volume of soil that would need to be washed, the process could take weeks to months per parcel.	Moderate to High	Eliminated – limited effectiveness, feasibility, and implementability
		Chemical oxidation	Convert inorganic contaminants to non-hazardous compounds using an oxidizing agent.	Not effective for low volumes of soil containing PAHs at low concentrations.	Dependent on the cooperation of individual property owners as the landscaping of the property would be impacted. It would be difficult to maintain treatment over time on third-party-controlled properties.	Moderate	Eliminated – limited effectiveness, feasibility, and implementability
		Solidification and stabilization	Mixing of the soil so that contaminants are physically bound or enclosed within a stabilized mass, or chemical reactions are induced between the stabilizing agent and contaminants to reduce their mobility.	Chemical composition of the COC matrix, presence of skeet, the amount of water present, and ambient temperature can affect the application. These factors can interfere with the process by inhibiting bonding of the waste binding material.	Chemicals used for stabilization could adversely affect the surrounding ecological setting at the residential yards. Landscaping and aesthetics of the residential properties would be affected.	High	Eliminated – limited effectiveness, feasibility, and implementability and high cost

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Legend:

Retained	Eliminated

SUMMARY OF REMEDIAL TECHNOLOGIES

GRA	Technology Type	Process Option	Description	Effectiveness	Implementability	Cost	Retained or Eliminated
Treatment	Physical/ chemical treatment	Low-temperature thermal desorption	Volatilize organic contaminants well below oxidation temperatures.	Not effective for PAHs at low concentrations.	Dependent on the cooperation of individual property owners as the landscaping of the property would be impacted.	High	Eliminated – limited effectiveness, and implementability and high cost
	Biological Treatment	Bioremediation	Reduce COCs in soil by metabolizing organics with biological amendments.	Limited effectiveness for PAHs; not effective for skeet.	Dependent on the cooperation of individual property owners as the landscaping of the property would be impacted. It would be difficult to maintain treatment over time on third-party-controlled properties	Moderate	Eliminated – limited effectiveness, and implementability

Legend:

Retained	Eliminated

POTENTIAL ALTERNATIVES

SUMMARY OF ALTERNATIVES

Alternative	Name	Comment
1	No Action	Base-line. Not Protective.
2	LUCs Only	Not Protective.
3	LUCs and Excavation up to 2 ft	Implementable, evaluated against the seven criteria.
4	LUCs and Excavation up to 6 ft	Implementable, evaluated against the seven criteria.
5	Demolition and Excavation to 6 ft	UU/UE Alternative required by DERP. Not implementable.

NON-PROTECTIVE ALTERNATIVES

Alternative 1 – No Action

- No action would be taken and affected soil would be left in place.
- Required by the National Contingency Plan (NCP) as a baseline for comparison to other alternatives.
- No physical remedial actions and no measurable reduction in potential human health risks.

Alternative 2 – LUCs Only

- Educational material distributed to periodically to residents, local governments, local utilities, and real estate professionals, to increase potential receptors' awareness of hazards.
  - Material would include information on specific areas where impacted soils remain or are suspected to remain, how to identify skeet fragments, the potential risks of impacted soils and skeet fragments, and contact information to address community concerns.
- No physical remedial actions and no measurable reduction in potential human health risks.

NON-IMPLEMENTABLE ALTERNATIVES

Alternative 5 – Demolition and Excavation to 6 ft

- UU/UE alternative that must be considered according to DERP
- Removal of all surface structures and features (i.e., homes, buildings, mature trees, etc.) that would interfere with complete removal of soils with PAHs above acceptable risk concentrations, up to a depth of 6 feet bgs at 97 parcels. Co-located skeet fragments would be removed. No LUCs required.
- Impossible to implement

Alternatives 1 and 2 (not protective), and Alternative 5 (not implementable) will not be discussed further during this presentation to allow focus on protective and implementable alternatives.

ALTERNATIVE 3 – LUCs & EXCAVATION UP TO 2FT

- Excavation to remove soil with PAHs above acceptable risk concentrations, up to a depth of 2 ft bgs at 97 parcels. Co-located skeet fragments would also be removed.
  - Lateral extent of excavations limited by physical barriers (i.e., structures, driveways, patios, large trees, septic tanks and leach fields).
    - Sidewalls sloping at a 45° angle (1:1 slopes) for structure and large tree protection.
    - Excavations offset from building foundations and other structures to maintain structural integrity. Hand tools utilized to address soil near structures and large trees.
    - Excavated materials directly loaded for off-site disposal at a permitted landfill.
      - Estimated soil volume = 29,990 cubic yards
      - Estimated truckloads of soil = 1,874 to 2,999 (16 vs 10 cubic yard truck loads)
    - Confirmation samples collected and permeable geotextile barrier placed at the bottom of excavations to demark where deeper soils remain with PAHs concentrations above risk-based limits.
  - Excavated area backfilled with clean fill material and site restoration activities completed.
- LUCs to include periodic distribution of educational materials to increase potential receptors' awareness of hazards.

ALTERNATIVE 3 – LUCs & EXCAVATION UP TO 2FT

- Estimated* 67 parcels excavated to 1 ft bgs (blue)
- Estimated* 30 parcels excavated to 2 ft bgs (green)
  - Estimated 8 parcels with permeable geotextile barrier

*Note, some parcels were not sampled deeper than one foot; therefore, excavations may need to go to 2 ft depending on confirmation samples.



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SITE-SPECIFIC CONSTRAINTS

- Rights-of-Entry agreements required
- Homes present on 67 parcels will limit extent of remedial action
- Temporary resident relocation may be needed
- Traffic, noise, and dust control required
- Septic tanks and leach fields present will limit extent of remedial action
- Other utilities (i.e., water, gas, electrical) may limit extent of remedial action
- Pets may pose a safety risk and may require temporary relocation with owners





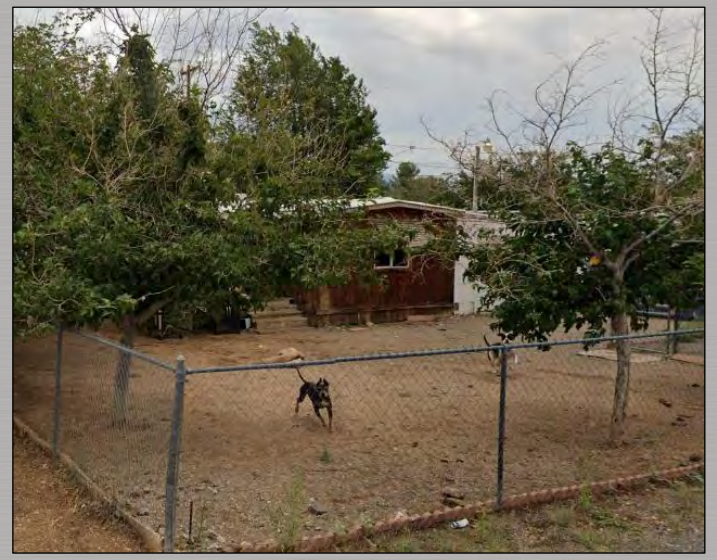


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SITE-SPECIFIC CONSTRAINTS

- Misc. structures (i.e., sheds, car ports, fencing, walls, driveways) and surface storage (i.e., inoperable vehicles, boats, equipment) may limit extent of remedial action
- Vegetation/landscaping (i.e., mature trees) may limit extent of remedial action or require removal and replacement
- Site-specific setbacks based on site conditions and geology would be established during the remedial design







ALTERNATIVE 3 – LUCs & EXCAVATION UP TO 2FT

NCP Criteria Evaluation

- Protection of Human Health and the Environment – Protects human health by eliminating direct contact in accessible areas of the property, except at parcels where access is denied
- Compliance with ARARs – To be analyzed, anticipate compliance
- Long-Term Effectiveness and Permanence – Provides long-term effectiveness and permanence, except at parcels where access is denied
- Reduction of toxicity, mobility, and volume (TMV) through Treatment – Not applicable (no physical treatment process)
- Short-Term Effectiveness – Moderate short-term effectiveness
- Implementability – Highly implementable
- Cost – Total present worth estimate, including restoration: $18,848,000 (for Phase 1 only)
- State Acceptance – TBD
- Community Acceptance – TBD

ALTERNATIVE 4 – LUCs & EXCAVATION UP TO 6FT

- Excavation to remove soil with PAHs above acceptable risk concentrations, up to a depth of 6 ft bgs at 97 parcels. Co-located skeet fragments would also be removed.
  - Same as Alternative 3, but excavation up to 6 ft bgs and no permeable geotextile barrier
  - Estimated soil volume = 32,880 cubic yards
  - Estimated truckloads of soil = 2,055 to 3,288 (16 vs 10 cubic yard truck loads)
- LUCs to include periodic distribution of educational materials to increase potential receptors' awareness of hazards.
- The same site-specific constraints as Alternative 3 would apply.

ALTERNATIVE 4 – LUCs & EXCAVATION UP TO 6FT

- 67 parcels excavated to 1 ft bgs (blue)
- 22 parcels excavated to 2 ft bgs (green)
- 4 parcels excavated to 3 ft bgs (yellow)
- 2 parcels excavated to 4 ft bgs (orange)
- 2 parcels excavated to 5 ft bgs (red)



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ALTERNATIVE 4 – LUCs & EXCAVATION UP TO 6FT

NCP Criteria Evaluation

- Protection of Human Health and the Environment – Protects human health by eliminating direct contact in accessible areas of the property, except at parcels where access is denied
- Compliance with ARARs – To be analyzed, anticipate compliance.
- Long-Term Effectiveness and Permanence – Provides long-term effectiveness and permanence
- Reduction of TMV through Treatment – Not applicable (no physical treatment process)
- Short-Term Effectiveness – Moderate short-term effectiveness
- Implementability – Highly implementable
- Cost – Total present worth, including restoration, estimated: $26,065,033 (for Phase 1 only)
- State Acceptance – TBD
- Community Acceptance – TBD

SUMMARY OF ALTERNATIVES

Criteria	**Alternative 1** (No Action)	**Alternative 2** (LUCs Only)	**Alternative 3** (LUCs and Excavation up to 2 ft bgs, Installation Geotextile and Marker Fabric, Offsite Disposal, Backfill, and Site Restoration)	**Alternative 4** (LUCs and Excavation up to 6 ft bgs, Offsite Disposal, Backfill, and Site Restoration)	**Alternative 5** (Demolition, Excavation up to 6 ft bgs, Offsite Disposal, Backfill, Site Restoration and New Structure Construction)
Threshold Criteria					
Overall Protection of Human Health and the Environment	No	No	Yes	Yes	Yes
Compliance with ARARs	Not Applicable	Yes	Yes	Yes	Yes
Balancing Criteria					
Long-Term Effectiveness and Permanence	Not Applicable	○	◑ to ●	◑ to ●	●
Reduction of Toxicity, Mobility, or Volume by Treatment	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Short-Term Effectiveness	Not Applicable	●	◑	◑	◑
Implementability	Not Applicable	●	●	●	○
Estimated Cost ($ million)	$0	$0.7 M	$18.9 M	$26.5 M	Not evaluated

○ Low ◑ Moderate ● High

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NEXT STEPS

NEXT STEPS

Phase 1

- Complete FS
- Continue public outreach efforts
  - Nov 7, 2025 Kingman First Friday event

Phase 2

- USACE to continue scoping for Phase 2
  - RI Supplemental
  - Public outreach
  - ROE database

DISCUSSION & ACTION ITEMS

Attachment B: Meeting Sign-in Sheet

Ahtna

Anchorage · Monterey
Concord · Tucson

Description: Kingman PR/PP/ROD SPP Mtg #2 Sign-In Sheet

Prepared By:

Page _____ of _____

Date _____

Attendee	Organization	Phone #
Rachael Kerr	Ahtna	916-396-5309
Connor Gray	Ahtna	520-599-7372
Clarence Winzer	Ahtna	512-694-8250
Katie Crane	USACE	801-641-5319
Lisa Schutzberger	USACE	505 525 5002
~~RANDY TABOR~~	USACE	213-300-5752
Cory Koger	USACE	651-785-6421
Steve Willis	Ltro Pro	480-316-3373
Dan SOLA	ADEQ	4803879963
~~KATRIN HARKER~~	ADEQ	602 771 0361
Natalie Romanoff	ADEQ	602-771-0956
Julie Burdey (Teams)	USACE	
Jenice Offerman (Teams)	USACE	
Luke Brazdys (Teams)	Mohave County	
James Salisbury (Teams)	USACE	
~~James Offerman~~		
Kelly O'Meara (Teams)	Ahtna	
Glenn Hoeger (Teams)	USACE	
Jess Laurie (Teams)	Ahtna	
Kurt Fehling (Teams)	The Fehling Group	
Scott Holtry (Teams)	Mohave County	

APPENDIX B

APPENDIX B – Preliminary Remediation Goals for Polycyclic Aromatic Hydrocarbons in Surface Soil impacted by Skeet Fragments at the Kingman 15 Skeet Range Site

1. Purpose

The purpose of this appendix is to describe the approach, assumptions, and calculations used to develop the site-specific preliminary remediation goals (PRGs) for polycyclic aromatic hydrocarbons (PAHs) in surface soil impacted by skeet fragments at the Kingman 15 Skeet Range Site. As part of the remedial investigation (RI) (USACE, 2021) and subsequent addenda (USACE, 2022 and 2023), 84 residential parcels and road right-of-way (ROW) segments at the Site were characterized as having unacceptable risk to human health from PAHs in soil impacted by skeet fragments. The baseline human health risk assessment, conducted as part of the RI, used the United States Environmental Protection Agency (USEPA) Regional Screening Levels (RSLs) for lead, copper, zinc, and PAHs including benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno-(1,2,3-cd)perylene as the basis for calculating both lifetime excess cancer risk (ELCR) and non-cancer hazards. The risk assessment concluded that metals in soil did not pose an unacceptable risk to human health at the Site; however, many residential parcels had ELCRs above the project-specific threshold of 1-in-1 million (1E-06) from exposure to PAHs in soil. These parcels (and road ROW segments) are the subject of this feasibility study (FS).

By using RSLs as the basis to estimate risk, all the default exposure and toxicity assumptions used by the USEPA to calculate the RSLs for residential soil have been incorporated into the risk assessment. RSLs are intentionally calculated using conservative assumptions to provide a chemical concentration in soil that does not pose an unacceptable risk to referenced human population regardless of the source of that chemical or any other site-specific condition that would lead to a reduced exposure. As previously stated, the source of PAHs to soil at the Site is from residual clay target pigeons (skeet) fragments associated with operations of the former skeet ranges in the 1940s. The bioavailability of PAHs in the aged skeet fragment particles in soil, both by the ingestion and dermal absorption exposure routes, has been extensively studied (Forsberg *et al*., 2021, Xia *et al*., 2016, Sorenson *et al*., 2021; Roberts et al., 2016; and Ruby *et al.* 2016).

The approach to developing PRGs for the Kingman 15 Skeet Range Site is to apply current science on the bioavailability and toxicity of PAHs in the limestone/coal tar matrix of skeet fragments to the USEPA RSL default exposure assumptions and calculations.

2. General Assumptions and Equations for PRG Calculations

The USEPA assumptions, equations, and calculated RSL values are detailed on the USEPA RSL webpage: https://www.epa.gov/risk/regional-screening-levels-rsls. The RSLs are organized by exposure medium and receptors. For the Kingman Site, the RSLs of concern are for residential soil. Finally, the equations are organized by the classification of the chemical-specific mechanism of toxicity with PAHs being classified as mutagens. The RSL equations for residential soil address multiple routes of exposure including incidental ingestion of soil adhered to skin surface, dermal absorption of soil adhered to skin surface, and inhalation of soil particulate in dust or volatilized emissions.

2.1 RSL Assumptions

The assumptions used by USEPA in RSL calculations are based on exposure parameters presented in the USEPA (2011) Exposure Factors Handbook and guidance on the hierarchy of human health toxicity values (USEPA, 2003). The toxicity assumptions including the oral cancer slope factors (CSF_o) and inhalation unit risk (IUR) are presented in the November 2024 Generic RSL tables (USEPA, 2024) and the exposure assumptions are presented in the RSLs Users Guide (USEPA, 2025) and summarized below:

Target Risk (TR)	1.E-06
Averaging Time- Lifetime (AT_{res}) days	25550
Exposure Frequency (EF) days/year	350
Exposure Duration (ED_{0-2}) years	2
Exposure Duration (ED_{2-6}) years	4
Exposure Duration (ED_{6-16}) years	10
Exposure Duration (ED_{16-26}) years	10
Soil Ingestion Rate (IRS_{0-6}) mg/day	200
Soil Ingestion Rate (IRS_{6-26}) mg/day	100
Surface Area (SA_{0-6}) cm^2/day	2373
Surface Area (SA_{6-26}) cm^2/day	6032
Adherence Factor (AF_{0-6}) mg/cm^2	0.2
Adherence Factor (AF_{6-26}) mg/cm^2	0.07
Volatilization Factor unlimited source (VF_{ulim}) m^3/kg	Chemical Specific
Particulate Emission Factor (PEF) m^3/kg	1.39E09
Age Dependent Adjustment Factor ($ADAF_{0-2}$)*	4.6
Age Dependent Adjustment Factor ($ADAF_{2-16}$)*	2.1
Age Dependent Adjustment Factor ($ADAF_{16-26}$)*	1
Body Weight (BW_{0-6}) kg	15
Body Weight (BW_{6-26}) kg	80
Correction Factor 1 (CF1) kg/mg	1.E-06
Correction Factor 2 (CF2) µg/mg	1000
Oral Cancer Slope Factor (CSF_o) $(mg/kg\text{-}day)^{-1}$	Chemical Specific
Inhalation Unit Risk (IUR) $(\mu g/m^3)^{-1}$	Chemical Specific
Relative Bioavailability Factor (RBAF) unitless*	Chemical Specific
Age-dependent Adjustment Factor (ADAF) unitless*	Chemical Specific

* - Parameters are based upon site-specific parameters as discussed in Section 3.2.

2.2. RSL Equations for Residential Soil by Mutagenic Mode of Action

The RSL equations for mutagens, such as PAHs, in residential soil are applied in two steps: 1) calculation of screening levels for each of the three exposure routes (ingestion, dermal absorption, and inhalation), then 2) calculation of the RSL by combining the three exposure route screening levels. Each of the exposure route screening level calculations and the combined RSL calculation are presented below.

1) Incidental Soil Ingestion Exposure

The mutagen calculation is based on modifying the CSFo to address the inverse relationship with the cancer potency for PAHs with age resulting in increased cancer potency at younger ages. The Age-dependent Adjustment Factors (ADAFs) are applied to the soil dose calculation at four age intervals: 0-2 years old, 2-6 years old, 6-16 years old, and 16 to 26 years old. Equation 1 provides the calculation for the age-adjusted residential mutagenic soil ingestion rate per the Integrated Farm System Model ($IFSM_{res\text{-}adj}$) soil dose in units of mg/kg as follows:

Equation 1:

$$IFSM_{res-adj} = \left(\frac{EF \times ED_{0-2} \times IRS_{0-6} \times ADAF_{0-2}}{BW_{0-6}}\right) + \left(\frac{EF \times ED_{2-6} \times IRS_{0-6} \times ADAF_{2-16}}{BW_{0-6}}\right) + \left(\frac{EF \times ED_{6-16} \times IRS_{6-26} \times ADAF_{2-16}}{BW_{6-26}}\right) + \left(\frac{EF \times ED_{16-26} \times IRS_{6-26} \times ADAF_{16-26}}{BW_{6-26}}\right)$$

The screening level for the incidental ingestion of PAHs (mutagens) in residential soil ($SL_{res\text{-}soilingmu}$) is calculated by taking multiplying the adjusted soil dose by the chemical-specific CSFo and averaging that exposure over a 70-year life span at a target risk of 1E-06. Equation 2 provides the soil ingestion exposure screening level:

Equation 2:

$$SL_{res-soilingmu} = \frac{TR \times AT_{res}}{CSF_o \times RBAF \times CF1 \times IFSM_{res-adj}}$$

2) Dermal Absorption Exposure

The ADAFs are applied to the soil dose (adherence) calculation at four age intervals in the same manner as described for incidental soil ingestion. Equation 3 provides the calculation for the age-adjusted residential soil adherence per the Dermal Flux and Systematic Uptake Model ($DFSM_{res\text{-}adj}$) in units of mg/kg as follows:

Equation 3:

$$DFSM_{res-adj} = \left(\frac{EF \times ED_{0-2} \times SA_{0-6} \times AF_{0-6} \times ADAF_{0-2}}{BW_{0-6}}\right) + \left(\frac{EF \times ED_{2-6} \times SA_{0-6} \times AF_{0-6} ADAF_{2-16}}{BW_{0-6}}\right) + \left(\frac{EF \times ED_{6-16} \times SA_{6-26} \times AF_{6-26} \times ADAF_{2-16}}{BW_{6-26}}\right) + \left(\frac{EF \times ED_{16-26} \times IRS_{6-26} \times AF_{6-26} \times ADAF_{16-26}}{BW_{6-26}}\right)$$

The screening level for the dermal absorption of PAHs (mutagens) in residential soil ($SL_{res\text{-}soildermmu}$) is calculated by taking multiplying the adjusted soil adherence by the chemical-specific CSFo and dermal absorption factor (ABSd) then averaging that exposure over a 70-year life span at a target risk of 1E-06. Equation 4 provides the dermal absorption exposure screening level:

Equation 4:

$$SL_{res-soildermmu} = \frac{TR \times AT_{res}}{CSF_o \times ABSd \times CF1 \times DFSM_{res-adj}}$$

3) Inhalation Exposure

The evaluation of inhalation exposure to chemicals in ambient air differs from the ingestion and dermal absorption routes of exposure. Rather than calculating a dose, inhalation exposure is measured by time exposed to a specific concentration in ambient air. ADAFs are applied to the frequency and duration of time spent in the residential setting at four age intervals previously described. Equation 5 provides the calculation for the residential age-adjusted inhalation ($IH_{res-adj}$) soil timeframe in units of days as follows:

Equation 5:

$$IH_{res-adj} = (EF \times ED_{0-2} \times ADAF_{0-2}) + (EF \times ED_{2-6} \times ADAF_{2-16}) + (EF \times ED_{6-16} \times ADAF_{2-16}) + (EF \times ED_{16-26} \times ADAF_{16-26})$$

The screening level for the inhalation of PAHs (mutagens) in fugitive dust and volatile emissions from residential soil ($SL_{res-soilinhmu}$) is calculated by taking multiplying the adjusted exposure time in days by the chemical-specific concentration in ambient air associated with an incremental increase in cancer risk (IUR) and the sum of inverse emissions from soil then averaging that exposure over a 70-year life span at a target risk of 1E-06. Equation 6 provides the dermal absorption exposure screening level:

Equation 6:

$$SL_{res-soilinhmu} = \frac{TR \times AT_{res}}{IUR \times CF2 \times \left[\left(\frac{1}{VF_{ulim}}\right) + \left(\frac{1}{PEF}\right)\right] \times IH_{res-adj}}$$

4) Calculation of Preliminary Remediation Goal

The PRGs for PAHs in surface soil at the Kingman 15 Skeet Range Site is based on the cumulation of screening levels calculated for the ingestion, dermal absorption, and inhalation exposure routes Based on Equation 7:

Equation 7:

$$PRG = \frac{1}{\left(\frac{1}{SL_{res-soilingmu}}\right) + \left(\frac{1}{SL_{res-soildermmu}}\right) + \left(\frac{1}{SL_{res-soilinhmu}}\right)}$$

3. Site-Specific Assumptions

The PRG calculations are based on the USEPA RSL assumptions and equations with the exception of the chemical-specific values for RBAFs and ADAFs, because the source of PAHs to soil at the Site are weathered skeet fragments from the 1940s made of coal tar and limestone. The bioavailability of PAHs in the coal tar/limestone matrix of skeet fragments has been well studied

over the past 10 years. Site-specific assumptions for the PAH contamination in soil at the site include assumptions concerning chemical-specific RBAFs and ADAFs. Each of these assumptions are discussed below.

3.1 Relative Bioavailability of PAHs in Soil Impacted by Skeet Fragments

An evaluation of the ingestion of coal tar must be done with an understanding of the absorption, distribution, metabolism, and excretion of PAHs following ingestion. Gastrointestinal (GI) absorption of PAHs is principally influenced by the lipophilic nature of these compounds. GI absorption of PAHs is closely related to mechanisms for digestion of oils and fats including lipolysis and bile production (Rahman, Barrowman and Rahimtula, 1986). Absorption of PAHs along with fats and oils occurs in the small intestines through the formation and uptake of micelles in the presence of bile salts. Multiple investigations of fed and fasted states in both *in vitro* and *in vivo* models demonstrate that the solubility of PAHs is enhanced by the presence of mixed intestinal lipids under fed conditions. GI absorption of benzo(a)pyrene, a six-ring compound, was estimated to range from 38 percent to 58 percent, while anthracene, a smaller three-ring structure, had estimated GI absorption rates ranging from 53 percent to 74 percent (Chang, 1943). Absorption rates generally have an inverse relationship with the PAH dose (concentration in exposure media).

One aspect of GI absorption of lipophilic organic compounds, which affects evaluation of the absorption of PAHs, is enterohepatic circulation. An overview of enterohepatic circulation is presented by Ramesh *et al*. (2004). PAHs are metabolized in the liver and excreted into the intestine via bile. Once in the small intestines, these PAH parent compounds and metabolites are available for re-absorption and return to the liver by the portal circulation. Enterohepatic recirculation extends the residence time of low-level PAHs in the GI tract and highly complicates the evaluation of GI absorption by analysis of PAH concentrations in feces.

Once PAHs are absorbed, they are rapidly and widely distributed through the receptor (IARC, 1983). Initially, un-metabolized benzo(a)pyrene tends to collect in highly perfused tissues including the heart, lungs, liver, and kidneys (Moir *et al*., 1998); however, absorbed PAHs are efficiently and rapidly metabolized, cleared from the systemic circulation, and do not accumulate in tissues (ASTDR, 1995). The principal mechanism for excretion of PAHs and its metabolites is via the bile, to the intestines, and passed in the feces. At early time points, excretion of organic and aqueous benzo(a)pyrene metabolites can be found in the feces (Moir *et al*., 1998 and Ramesh *et al*., 2001). After 24 hours, however, excretion of both organic and aqueous metabolites was principally in the urine (Ramesh *et al*., 2001).

Recent investigations have focused on the effects to GI and dermal absorption of PAHs when dosed in soil from the environment rather than in laboratory preparations using research grade reagents (Forsberg *et al*., 2021; Xia *et al*., 2016; Sorenson *et al*., 2021; Roberts et al., 2016; and Ruby *et al*., 2016). The relative bioavailability factor (RBAF) refers to the relative difference in GI absorption of HPAHs orally administered to test animals using an impacted soil source and GI absorption of HPAHs administered as described in Beland and Culp (1998), which provides the experimental protocol used to establish the existing oral cancer slope factor (CSF_o) for

benzo(a)pyrene presented in the Integrated Risk Information System (IRIS). The RBAF, therefore, provides a basis for modifying the CSF_o for PAHs due to the interference of the source matrix on GI absorption. Forsberg *et al*. (2021) reported the RBAF for BaP in soils impacted by skeet fragments ranged from 8 percent to 14 percent compared to laboratory soil spiked with reagent grade BaP. The authors designed the relative bioavailability study by comparing ingested doses of PAHs and relative concentrations of metabolites in urine. The application of urine analyses of metabolites avoided issues associated with enterohepatic recirculation in the small intestines, which confounds bioavailability studies measuring PAHs in feces. Table B-1 provides the RBAFs for PAHs at the Kingman 15 Skeet Range Site. For the purposes establishing PRGs, the maximum RBAFs reported by Forsberg *et al*. (2021) were selected to calculate the most conservative cleanup goals.

A similar experimental design was conducted by the Forsberg *et al*. (2021) to look at dermal absorption. The authors reported ABSds ranging from 0.58 percent to 1.3 percent for benzo(a)pyrene compared to the default USEPA assumption of 13 percent based on Wester *et al*. (1990). These results were closely affirmed by results reported by Xia *et al.* (2016). Table B-1 provides a summary of ABSd for PAHs at the Kingman 15 Skeet Range Site. Similar to the site-specific RBAFs, the ABSd values are based on the maximum values reported by Forsberg *et al*. (2021) to provide the most conservative cleanup goals.

RBAFs and dermal absorption factors developed by Forsberg *et al*. (2021) are based on studies conducted in 2016 for the Fort Worth District (USACE, 2017) and gained regulatory approval and application of these results to risk-based remediation projects are described in detail in Haney *et al*. (2018).

3.2 Age-dependent Adjustment Factors for PAHs in Soil Impacted by Skeet Fragments

According to USEPA, carcinogenic PAHs exhibit a mutagenic mode of action where early-life exposure to such chemicals can result in a greater contribution to cancers appearing later in life (USEPA 2005). ADAFs, therefore, are used to estimate cancer risks for child receptors.

The USEPA default ADAFs have no toxicological relevance to PAHs, because they are derived from chemicals other than PAHs despite the fact that data on one PAH, benzo(a)pyrene, are presented in Table 8 of the guidance document. As noted in the following quotations, the Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (USEPA 2005) states repeatedly that the default ADAFs should be used only for chemicals for which chemical-specific information is not available:

> "Finally, as the adjustment factors are derived from a weighted geometric mean of the data evaluated, these adjustments will both over-estimate and under-estimate the potential potency for early-life exposure for chemicals with a mutagenic mode of action for carcinogenesis. An examination of the data in the tables demonstrates that some of the ratios were less than one, while others exceeded 10. For this reason, the Supplemental Guidance emphasizes that chemical-specific data should be used in preference to these default adjustment factors whenever such data are available."

> "In general, the [USEPA] prefers to rely on analyses of data, rather than general defaults. When data are available for a susceptible lifestage, they should be used directly to evaluate risks for that chemical and that lifestage on a case-by-case basis."

Data on benzo(a)pyrene are presented in Table 6 of the USEPA (2005) supplemental guidance. Benzo(a)pyrene is the surrogate compound used to evaluate the toxicity and bioavailability of PAHs with high molecular weights and carcinogenic modes of action. Vesselinovitch *et al*. (1975) exposed mice to large single doses of benzo(a)pyrene by intraperitoneal injection at days 1, 15, and 42. Animals exposed on day 1 were newborn animals. A mouse at day 15 is equivalent to a human at 11 months of age. The authors then compared the tumor response of these animals dosed early in life to animals dosed at day 42. They found that the tumor response for animals dosed at days 1 and 15 did not significantly differ, but both differed significantly from the tumor response in animals dosed at day 42. USEPA calculated the cancer potency factors for all the animal groups, and the average ratio of the potency factors of the animals exposed early in life to those exposed later in life was a factor of 4.6. The average ratio of 10, which is the USEPA's default ADAF, is dominated by data on other chemicals, such as pesticides, solvents, and as noted above. The ADAF for 2- to 16-year-old receptors is derived in the same manner as those derived in USEPA (2005). The value of 2.1 is based on one half the difference between 0 and 4.6 on a logarithmic scale.

The following ADAFs apply to PAHs for each of these age groups:

- ADAF for 0-2 years = 4.6;
- ADAF for 2-6 years = 2.1;
- ADAF for 6-16 years = 2.1; and
- ADAF for 16-30 years = 1.

4. PRG Calculations

The PRG were calculated using the USEPA RSL equations, exposure assumptions, and toxicity combined with site-specific assumptions concerning RBAFs and ADAFs based on the source of PAHs being skeet fragments made from coal tar and limestone. The assumptions and calculations are summarized in Table B-1. The screening levels for the ingestion, dermal absorption, and inhalation exposure routes are presented along with the final PRG concentrations. The recommended PRGs for PAHs in soil of the Kingman 15 Skeet Range Site are presented below.

PAH	**PRG (mg/kg)**
Benz(a)anthracene	9.2
Benzo(a)pyrene	1.5
Benzo(b)fluoranthene	11
Benzo(k)fluoranthene	180
Chrysene	850
Dibenz(a,h)anthracene	1.5
Indeno(1,2,3-cd)perylene	11

5. References

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Table B-1: Preliminary Remediation Goals (PRG) for Polycyclic Aromatic Hydrocarbons (PAHs) in Soil at Kingman 15 Skeet Range Site[1]

PAH	CSF_o[2] $(mg/kg\text{-}day)^{-1}$	IUR[2] $(\mu g/m^3)$	RBAF[3]	ABSd[3]	Oral		Dermal		Inhalation		$PRG_{res\text{-}sol\text{-}totmu}$ (mg/kg)
					$IFSM_{res\text{-}adj}$ (mg/kg)	$SI_{res\text{-}soilingmu}$ (mg/kg)	$DFSM_{res\text{-}adj}$ (mg/kg)	$SI_{res\text{-}soildermmu}$ (mg/kg)	$Ih_{res\text{-}adj}$ (days)	$SI_{res\text{-}soilinhmu}$ (mg/kg)	
Benz(a)anthracene	0.1	0.00006	0.23	0.014	95696	1.2.E+01	252169	7.2.E+01	17010	1.1.E+02	9.2E+00
Benzo(a)pyrene	1.0	0.0006	0.14	0.013	95696	1.9.E+00	252169	7.8.E+00	17010	3.4.E+03	1.5E+00
Benzo(b)fluoranthene	0.1	0.00006	0.14	0.036	95696	1.9.E+01	252169	2.8.E+01	17010	3.4.E+04	1.1E+01
Benzo(k)fluoranthene	0.01	0.000006	0.14	0.004	95696	1.9.E+02	252169	2.5.E+03	17010	3.4.E+05	1.8E+02
Chrysene	0.001	0.0000006	0.3	0.005	95696	8.9.E+02	252169	2.0.E+04	17010	3.4.E+06	8.5E+02
Dibenz(a,h)anthracene	1.0	0.0006	0.14	0.013	95696	1.9.E+00	252169	7.8.E+00	17010	3.4.E+03	1.5E+00
Indeno(1,2,3-cd)perylene	0.1	0.00006	0.14	0.036	95696	1.9.E+01	252169	2.8.E+01	17010	3.4.E+04	1.1E+01

Assumptions:

Target Risk (TR)	1.E-06
Averaging Time- Lifetime (AT_{res}) days	25550
Exposure Frequency (EF) days/year	350
Exposure Duration ($ED_{0\text{-}2}$) years	2
Exposure Duration ($ED_{2\text{-}6}$) years	4
Exposure Duration ($ED_{6\text{-}16}$) years	10
Exposure Duration ($ED_{16\text{-}26}$) years	10
Soil Ingestion Rate ($IRS_{0\text{-}6}$) mg/day	200
Soil Ingestion Rate ($IRS_{6\text{-}26}$) mg/day	100
Surface Area ($SA_{0\text{-}6}$) cm^2/day	2373
Surface Area ($SA_{6\text{-}26}$) cm^2/day	6032
Adherence Factor ($AF_{0\text{-}6}$) mg/cm^2	0.2
Adherence Factor ($AF_{6\text{-}26}$) mg/cm^2	0.07
Age Dependent Adjustment Factor ($ADAF_{0\text{-}2}$)[4]	4.6
Age Dependent Adjustment Factor ($ADAF_{2\text{-}16}$)[4]	2.1
Age Dependent Adjustment Factor ($ADAF_{16\text{-}26}$)	1
Body Weight ($BW_{0\text{-}6}$) kg	15
Body Weight ($BW_{6\text{-}26}$) kg	80
Correction Factor 1 (CF1) kg/mg	1.E-06
Correction Factor 2 (CF2) µg/mg	1000

Notes:

1 - PRG calculations based on USEPA Regional Screening Level (RSL) equations and assumptions as presented in the Regional Screening Levels User's Guide (USEPA, 2025).

2 - The oral cancer slope factor (CSF) and inhlation unit risk (IUR) for PAHs are based on USEPA RSL Tables dated November 25, 2024 (USEPA, 2024).

3 - Relative Bioavailability Factor (RBAF) and Dermal Absorption Factor (ABSd) based on literature value for PAHs in limestone/coal tar matrix of WWII-era skeet fragments (Forsberg *et al* ., 2021) approved for use in calculating PRGs (Haney *et al* ., 2019),

4 - Age Dependent Adjustment Factors (ADAFs) based on values published in Appendix B of USEPA Guidance for evaluating early life cancer exposures (USEPA, 2005).

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APPENDIX C

APPENDIX C - TABLE 1
SKEET FRAGMENTS OBSERVANCE AND INCREMENTAL LIFETIME CANCER RISK FOR RI and RI ADDENDUMS PARCELS

Phase I #^	Parcel #	Address	Skeet Observed?	Incremental Lifetime Cancer Risk§	Maximum Depth of PAH Exceedance (feet bgs)
	31021063	E. Thompson Ave.	Yes	$<10^{-6}$	0.167
	31021063A***	E. Thompson Ave.	No	$<10^{-6}$	--
	31021063B***	E. Thompson Ave.	No	$<10^{-6}$	--
	31021063C***	E. Thompson Ave.	Significant skeet	$<10^{-6}$	0.167
	31021063D***	E. Thompson Ave.	No	$<10^{-6}$	--
	31021063E***	E. Thompson Ave.	Yes	$<10^{-6}$	0.167
	31021063F***	E. Thompson Ave.	Yes	$<10^{-6}$	0.167
	31021063G***	E. Thompson Ave.	Significant skeet	$<10^{-6}$	0.167
	31021063H***	E. Thompson Ave.	No	$<10^{-6}$	--
	31021063I***	E. Thompson Ave.	Yes	$<10^{-6}$	0.167
	31021063J***	E. Thompson Ave.	No	$<10^{-6}$	--
	31021063K***	E. Thompson Ave.	Yes	$<10^{-6}$	0.167
	31021078	E. Thompson Ave.	Yes	$<10^{-6}$	0.167
	31021078A***	E. Thompson Ave.	Yes	$<10^{-6}$	0.167
	31021078B***	E. Thompson Ave.	No	$<10^{-6}$	--
	31021078C***	E. Thompson Ave.	No	$<10^{-6}$	--
	31021078D***	E. Thompson Ave.	No	$<10^{-6}$	--
	31021078E***	E. Thompson Ave.	No	$<10^{-6}$	--
	31021078F***	E. Thompson Ave.	No	$<10^{-6}$	--
	31021078G***	E. Thompson Ave.	Yes	$<10^{-6}$	0.167
	31021078H***	E. Thompson Ave.	Yes	$<10^{-6}$	0.167
	31021078I***	E. Thompson Ave.	No	$<10^{-6}$	--
	31021078J***	E. Thompson Ave.	No	$<10^{-6}$	--
	31021078K***	E. Thompson Ave.	Yes	$<10^{-6}$	0.167
	31021078L***	E. Thompson Ave.	No	$<10^{-6}$	--
	31021078M***	E. Thompson Ave.	No	$<10^{-6}$	--
	31021078N***	E. Thompson Ave.	No	$<10^{-6}$	--
	31021080**	E. Thompson Ave.	Yes	$<10^{-6}$	--
	31021080A**	E. Thompson Ave.	Yes	$>10^{-6}$	0.167
	31021080B**	E. Thompson Ave.	Significant skeet	$<10^{-6}$	0.167

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Phase I #[^]	Parcel #	Address	Skeet Observed?	Incremental Lifetime Cancer Risk[§]	Maximum Depth of PAH Exceedance (feet bgs)
	31038002	4015 E. Thompson Ave.	Yes; one fragment only	$<10^{-6}$	--
	31038002A***	E. Thompson Ave.	No	$<10^{-6}$	--
	31038002B***	E. Thompson Ave.	No	$<10^{-6}$	--
	31038002C***	E. Thompson Ave.	No	$<10^{-6}$	--
	31038002D***	E. Thompson Ave.	Yes	$>10^{-6}$	0.167
	31038002E***	E. Thompson Ave.	No	$<10^{-6}$	--
	31038002F***	E. Thompson Ave.	No	$<10^{-6}$	--
	31038002G***	E. Thompson Ave.	No	$<10^{-6}$	--
	31038002H***	E. Thompson Ave.	No	$<10^{-6}$	--
	31038002I***	E. Thompson Ave.	No	$<10^{-6}$	--
	31038002J***	E. Thompson Ave.	No	$<10^{-6}$	--
	31038002K***	E. Thompson Ave.	Yes	$<10^{-6}$	0.167
	31038002L***	E. Thompson Ave.	No	$<10^{-6}$	--
	31038002M***	E. Thompson Ave.	No	$<10^{-6}$	--
	31038002N***	E. Thompson Ave.	No	$<10^{-6}$	--
	31038002O***	E. Thompson Ave.	No	$<10^{-6}$	--
	31038002P***	E. Thompson Ave.	No	$<10^{-6}$	--
	31038002Q***	E. Thompson Ave.	Yes	$<10^{-6}$	0.167
	31040005A***	E. Thompson Ave.	No	$<10^{-6}$	--
	31040005B***	E. Thompson Ave.	No	$<10^{-6}$	--
	31040005C***	E. Thompson Ave.	No	$<10^{-6}$	--
	31040005D***	E. Thompson Ave.	No	$<10^{-6}$	--
	31040005E***	E. Thompson Ave.	No	$<10^{-6}$	--
	31040005F***	E. Thompson Ave.	No	$<10^{-6}$	--
	31040005G***	E. Thompson Ave.	No	$<10^{-6}$	--
	31040005H***	E. Thompson Ave.	No	$<10^{-6}$	--
	31040005I***	E. Thompson Ave.	No	$<10^{-6}$	--
	31040005J***	E. Thompson Ave.	No	$<10^{-6}$	--
	31040005K***	E. Thompson Ave.	No	$<10^{-6}$	--
	31040005L***	E. Thompson Ave.	No	$<10^{-6}$	--

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SKEET FRAGMENTS OBSERVANCE AND INCREMENTAL LIFETIME CANCER RISK FOR RI and RI ADDENDUMS PARCELS

Phase I #^	Parcel #	Address	Skeet Observed?	Incremental Lifetime Cancer Risk§	Maximum Depth of PAH Exceedance (feet bgs)
	31040005M***	E. Thompson Ave.	No	$<10^{-6}$	--
	31040005N***	E. Thompson Ave.	No	$<10^{-6}$	--
	31040005O***	E. Thompson Ave.	No	$<10^{-6}$	--
	32404126***	3970 E. Shaeffer Ave.	No	$<10^{-6}$	--
	32404127***	3966 E. Shaeffer Ave.	No	$<10^{-6}$	--
	32404131***	3946 E. Shaeffer Ave.	No	$<10^{-6}$	--
	32404152_153***	3905_09 E. L. John Ave.	No	$<10^{-6}$	--
	32404194***	3974 E. Devlin Ave.	No	$<10^{-6}$	--
	32404206A**	3910 E. Devlin Ave.	Yes	$<10^{-6}$	0.167
	32404208A**	3900 E. Devlin Ave.	Yes	$<10^{-6}$	1
	32404211B*	3875 E. Shaeffer Ave.	No	$<10^{-6}$	--
	32404211C**	3879 E. Shaeffer Ave.	Yes	$<10^{-6}$	0.167
1	32404211D*	3880 E. Devlin Ave.	Yes	$>10^{-6}$	0.167
2	32404211E*		No	$>10^{-6}$	0.167
	32404212*	3883 E. Shaeffer Ave.	No	$<10^{-6}$	--
	32404213*	3887 E. Shaeffer Ave.	No	$<10^{-6}$	--
3	32404237A(E)*	3870 E. Devlin Ave.	Yes	$>10^{-6}$	1
	32404237A(W)*				4
	32404240*	3850 E. Devlin Ave.	Yes	$<10^{-6}$	1
	32404241**	3846 E. Devlin Ave.	Yes	$<10^{-6}$	0.167
	32404242**	3842 E. Devlin Ave.	Yes	$<10^{-6}$	0.167
4	32404277A**	3825 E. Shaeffer Ave.	No	$>10^{-6}$	0.167
	32404279**	3841 E. Shaeffer Ave.	No	$<10^{-6}$	--
	32404280**	3845 E. Shaeffer Ave.	Yes	$<10^{-6}$	0.167
	32404281*	3849 E. Shaeffer Ave.	No	$<10^{-6}$	--
5	32404282A(E)*	3871 E. Shaeffer Ave.	No	$>10^{-6}$	0.167
	32404282A(W)*		Yes		
	32404282B(E)*	3855 E. Shaeffer Ave.	No	<10-6	--
	32404282B(W)*				
6	32404484*	3860 E. Hearne Ave.	Yes	$>10^{-6}$	1

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SKEET FRAGMENTS OBSERVANCE AND INCREMENTAL LIFETIME CANCER RISK FOR RI and RI ADDENDUMS PARCELS

Phase I #^	Parcel #	Address	Skeet Observed?	Incremental Lifetime Cancer Risk§	Maximum Depth of PAH Exceedance (feet bgs)
7	32404485*	3854 E. Hearne Ave.	No	$>10^{-6}$	1
8	32404486*	3850 E. Hearne Ave.	No	$>10^{-6}$	1
9	32404487**	3846 E. Hearne Ave.	No	$>10^{-6}$	0.167
10	32404526**	3845 E. Devlin Ave.	Yes	$>10^{-6}$	1
11	32404527**	3849 E. Devlin Ave.	Yes	$>10^{-6}$	1
	32404549A***	3970 E. HearneAve.	Yes	$<10^{-6}$	
12	32404550**	3960 E. Hearne Ave.	Yes	$>10^{-6}$	1
	32404552A**	3950 E. Hearne Ave.	Yes	$<10^{-6}$	0.167
	32404553**	3946 E. Hearne Ave.	Yes	$<10^{-6}$	0.167
13	32404556A**	3922 E. Hearne Ave.	No	$>10^{-6}$	0.167
14	32404558***	3920 E. Hearne Ave.	No	$>10^{-6}$	0.167
	32404559*	3919 E. Hearne Ave.	No	$<10^{-6}$	--
15	32404561C*	3890 E. Hearne Ave.	No	$>10^{-6}$	2
16	32404570*	3883 E. Devlin Ave.	Yes	$>10^{-6}$	0.167
	32404571*	3887 E. Devlin Ave.	No	$<10^{-6}$	--
	32404572*	3895 E. Devlin Ave.	No	$<10^{-6}$	--
17	32404578**	3925 E. Devlin Ave.	No	$>10^{-6}$	0.167
18	32404582**	3945 E. Devlin Ave.	Yes	$>10^{-6}$	1
	32404588***	3975 E. Devlin Ave.	No	$<10^{-6}$	--
	32404589***	3979 E. Devlin Ave.	No	$<10^{-6}$	--
	32404624**	3996 E. Ryan Ave.	No	$<10^{-6}$	--
	32404625**	3990 E. Ryan Ave.	Yes	$<10^{-6}$	0.167
	32404629A**	3966 E. Ryan Ave.	Yes	$<10^{-6}$	0.167
	32404631B**	3960 E. Ryan Ave.	No	$<10^{-6}$	--
19	32404638**	3920 E. Ryan Ave.	Yes	$>10^{-6}$	0.167
20	32404639*/**	3916 E. Ryan Ave.	Yes	$>10^{-6}$	0.167
21	32404640*/**	3910 E. Ryan Ave.	Yes	$>10^{-6}$	2
	32404643*	3896 E. Ryan Ave.	No	$<10^{-6}$	--
22	32404653*	3899 E. Hearne Ave.	Yes	$>10^{-6}$	1
23	32404655A(E)*	3905 E. Hearne Ave.	Yes	$>10^{-6}$	0.167

APPENDIX C - TABLE 1
SKEET FRAGMENTS OBSERVANCE AND INCREMENTAL LIFETIME CANCER RISK FOR RI and RI ADDENDUMS PARCELS

Phase I #^	Parcel #	Address	Skeet Observed?	Incremental Lifetime Cancer Risk§	Maximum Depth of PAH Exceedance (feet bgs)
23	32404655A(W)*	3909 E. Hearne Ave.	Yes	$>10^{-6}$	1
24	32404656**	3915 E. Hearne Ave.	No	$>10^{-6}$	0.167
	32404658**	3925 E. Hearne Ave.	Significant skeet	$<10^{-6}$	0.167
	32404659**	3929 E. Hearne Ave.	Yes	$<10^{-6}$	0.167
25	32404663A***	3945 E. Hearne Ave.	No	$>10^{-6}$	0.167
	32404664**	3955 E. Hearne Ave.	No	$<10^{-6}$	--
	32404665**	3959 E. Hearne Ave.	Yes	$<10^{-6}$	0.167
26	32404666**	3971 E. Hearne Ave.	Yes	$>10^{-6}$	0.167
	32404668***	3979 E. Hearne Ave.	No	$<10^{-6}$	--
27	32404686*	3870 E. Ryan Ave.	No	$>10^{-6}$	0.167
28	32404687*	3866 E. Ryan Ave.	No	$>10^{-6}$	0.167
29	32404688**	3860 E. Ryan Ave.	Yes	$>10^{-6}$	1
	32404727**	3831 E. Hearne Ave.	No	$<10^{-6}$	--
	32404730**	3845 E. Hearne Ave.	No	$<10^{-6}$	--
	32405106***	3846 E. Lum Ave.	No	$<10^{-6}$	--
	32405107***	3842 E. Lum Ave.	No	$<10^{-6}$	--
30	32405150*	3871 E. Ryan Ave.	No	$>10^{-6}$	0.167
	32405166A***	4026 E. Lum Ave.	No	$<10^{-6}$	--
	32405168	4010 E. Lum Ave.	No	$<10^{-6}$	--
	32405169**	4004 E. Lum Ave.	Yes	$<10^{-6}$	0.167
31	32405172**	3990 Lum Ave.	Yes	$>10^{-6}$	1
	32405174**	3974 E. Lum Ave.	Yes	$<10^{-6}$	2
32	32405176*	3966 E. Lum Ave.	Yes	$>10^{-6}$	0.167
	32405177**	3960 E. Lum Ave.	Yes	$<10^{-6}$	0.167
33	32405178**	3956 E. Lum Ave.	Yes	$>10^{-6}$	0.167
	32405180A (E)*	3950 E. Lum Ave.	No	$<10^{-6}$	--
	32405180A (W)*			$<10^{-6}$	
	32405181*	3940 E. Lum Ave.	No	$<10^{-6}$	--
34	32405182*	3936 E. Lum Ave.	No	$>10^{-6}$	1
	32405194B(C)*				

APPENDIX C - TABLE 1
SKEET FRAGMENTS OBSERVANCE AND INCREMENTAL LIFETIME CANCER RISK FOR RI and RI ADDENDUMS PARCELS

Phase I #^	Parcel #	Address	Skeet Observed?	Incremental Lifetime Cancer Risk§	Maximum Depth of PAH Exceedance (feet bgs)
35	32405194B(E)*	3876 E. Lum Ave.	Yes	$>10^{-6}$	0.167
	32405194B(W)*				
36	32405205A(E)*	3925 E. Ryan Ave.	No	$>10^{-6}$	1
	32405205A(W)*				
37	32405206A**	E. Ryan Ave.	Yes	$>10^{-6}$	1
	32405208*	3939 E. Ryan Ave.	No	$<10^{-6}$	--
	32405212**	3959 E. Ryan Ave.	Yes	$<10^{-6}$	0.167
	32405218A**	3991 E. Ryan Ave.	No	$<10^{-6}$	--
	32405263A***	4016 E. Thompson Ave.	No	$<10^{-6}$	--
38	32405265***	4008 E. Thompson Ave.	No	$>10^{-6}$	0.167
	32405267***	4000 E. Thompson Ave.	No	$<10^{-6}$	--
	32405269**	3986 E. Thompson Ave.	Yes	$<10^{-6}$	0.167
39	32405270*	3980 E. Thompson Ave.	No	$>10^{-6}$	0.167
40	32405272A(E)*	3970 E. Thompson Ave.	No	$>10^{-6}$	0.167
	32405272A(W)*				--
	32405273*	3966 E. Thompson Ave.	No	$<10^{-6}$	--
41	32405274*	3960 E. Thompson Ave.	No	$>10^{-6}$	1
42	32405276A(E)*	3950 E. Thompson Ave.	Yes	$>10^{-6}$	1
	32405276A(W)*				2
43	32405287*	3896 E. Thompson Ave.	No	$>10^{-6}$	0.167
	32405288*	3890 E. Thompson Ave.	No	$<10^{-6}$	--
	32405289**	3886 E. Thompson Ave.	Yes	$<10^{-6}$	0.167
	32405290	3880 E. Thompson Ave.	No	$<10^{-6}$	--
44	32405295*	3887 E. Lum Ave.	Yes	$>10^{-6}$	0.167
45	32405296*	3895 E. Lum Ave.	Yes	$>10^{-6}$	1
46	32405297*	3899 E. Lum Ave.	Yes	$>10^{-6}$	1
47	32405306*	3945 E. Lum Ave.	No	$>10^{-6}$	1
48	32405308A(E)*	3955 E. Lum Ave	Yes	$<10^{-6}$	1
	32405308A(W)*			$>10^{-6}$	
49	32405309*	3959 E. Lum Ave.	No	$>10^{-6}$	0.167

APPENDIX C - TABLE 1
SKEET FRAGMENTS OBSERVANCE AND INCREMENTAL LIFETIME CANCER RISK FOR RI and RI ADDENDUMS PARCELS

Phase I #^	Parcel #	Address	Skeet Observed?	Incremental Lifetime Cancer Risk§	Maximum Depth of PAH Exceedance (feet bgs)
	32405310*	3965 E. Lum Ave.	No	$<10^{-6}$	--
	32427024***	3860 E. Snavely Ave.	No	$<10^{-6}$	--
50	32436008**	3930 E. Lass Ave.	Yes	$>10^{-6}$	1
51	32436011**	3942 E. Lass Ave.	Yes	$>10^{-6}$	0.167
52	32436012**	3946 E. Lass Ave.	Yes	$>10^{-6}$	2
53	32436014**	3954 E. Lass Ave.	Yes	$>10^{-6}$	1
54	32436015**	3958 E. Lass Ave.	Yes	$>10^{-6}$	4
55	32436017***	3966 E. Lass Ave.	Yes	$>10^{-6}$	3
56	32436019**	3974 E. Lass Ave.	Yes	$>10^{-6}$	3
57	32436020**	3978 E. Lass Ave.	Yes	$>10^{-6}$	2
	32436021*	3979 E. Lass Ave.	No	$<10^{-6}$	--
58	32436022*	3975 E. Lass Ave.	No	$>10^{-6}$	1
	32436023*	3971 E. Lass Ave.	No	$<10^{-6}$	--
	32436026*	3959 E. Lass Ave.	No	$<10^{-6}$	--
	32436028***	3951 E. Lass Ave.	No	$<10^{-6}$	--
	32436030***	3943 E. Lass Ave.	Yes	$<10^{-6}$	--
	32437016**	3964 E. Packard Ave.	No	$<10^{-6}$	--
	32437017***	3968 E. Packard Ave.	No	$<10^{-6}$	--
	32437019***	3976 E. Packard Ave.	No	$<10^{-6}$	--
	32437020*	3980 E. Packard Ave.	No	$<10^{-6}$	--
59	32439003*	3974 E. Snavely Ave.	No	$>10^{-6}$	0.167
60	32439004*	3970 E. Snavely Ave.	No	$>10^{-6}$	1
61	32439005*	3962 E. Snavely Way	No	$>10^{-6}$	1
62	32439006*	3960 E. Snavely Way	Yes	$>10^{-6}$	2
63	32439007*	3958 E. Snavely Way	No	$>10^{-6}$	2
64	32439013*	3940 E. Snavely Cir.	No	$>10^{-6}$	2
65	32439014*	3936 E. Snavely Cir.	Yes	$>10^{-6}$	1
66	32439015*	3930 E. Snavely Plz	Yes	$>10^{-6}$	1
67	32439016*	3928 E. Snavely Plz	Yes	$>10^{-6}$	1
68	32439017*	3926 E. Snavely Plz	No	$>10^{-6}$	2

APPENDIX C - TABLE 1
SKEET FRAGMENTS OBSERVANCE AND INCREMENTAL LIFETIME CANCER RISK FOR RI and RI ADDENDUMS PARCELS

Phase I #^	Parcel #	Address	Skeet Observed?	Incremental Lifetime Cancer Risk§	Maximum Depth of PAH Exceedance (feet bgs)
	32439020***	3914 E. Packard Ave.	Yes	$<10^{-6}$	--
69	32439026*	3975 E. Snavely Ave.	No	$>10^{-6}$	2
70	32439031**	3955 E. Snavely Ave.	Yes	$>10^{-6}$	5
71	32439032*	3951 E. Snavely Ave.	Yes	$>10^{-6}$	2
72	32439033*	3947 E. Snavely Ave.	No	$>10^{-6}$	2
73	32439035*	3939 E. Snavely Ave.	No	$>10^{-6}$	1
74	32439036**	3935 E. Snavely Ave.	Yes	$>10^{-6}$	2
75	32439037**	3931 E. Snavely Ave.	Yes	$>10^{-6}$	2
	32439038***	3927 E. Snavely Ave.	Yes	10^{-6}	0.167
	Thompson Right-of-way A***		No	$<10^{-6}$	--
	Thompson Right-of-way B***		No	$<10^{-6}$	--
	Thompson Right-of-way C***		No	$<10^{-6}$	--
	Thompson Right-of-way D***		No	$<10^{-6}$	--
76	Thompson Right-of-way E***		No	$>10^{-6}$	0.167
77	Thompson Right-of-way F***		No	$>10^{-6}$	0.167
78	Thompson Right-of-way G***		Yes	$>10^{-6}$	0.167
79	Thompson Right-of-way H***		Yes	$>10^{-6}$	0.167
80	Thompson Right-of-way I***		Yes	$>10^{-6}$	0.167
81	Thompson Right-of-way J***		Yes	$>10^{-6}$	3
82	Thompson Right-of-way K***		Yes	$>10^{-6}$	5
83	Thompson Right-of-way L***		Yes	$>10^{-6}$	3
84	Thompson Right-of-way M***		Yes	$>10^{-6}$	2
85	Thompson Right-of-way N***		Yes	$>10^{-6}$	1
86	Thompson Right-of-way O***		Yes	$>10^{-6}$	0.167
87	Thompson Right-of-way P***		Yes	$>10^{-6}$	0.167
88	Thompson Right-of-way Q***		Yes	$>10^{-6}$	0.167
89	32405207****	3935 E. Ryan Ave.	No	$>10^{-6}$	0.167
	32403478A****	3924 E. John Ave.	No	$<10^{-6}$	
	32404074B ****	3842 E. Shaeffer Ave.	No	$<10^{-6}$	
	32404077A****	3830 E. Shaeffer Ave.	No	$<10^{-6}$	

APPENDIX C - TABLE 1
SKEET FRAGMENTS OBSERVANCE AND INCREMENTAL LIFETIME CANCER RISK FOR RI and RI ADDENDUMS PARCELS

Phase I #^	Parcel #	Address	Skeet Observed?	Incremental Lifetime Cancer Risk§	Maximum Depth of PAH Exceedance (feet bgs)
90	32404109****	3835 E. John L Ave.	No	$>10^{-6}$	0.167
	32404137 ****	3916 E. Shaeffer Ave.	No	$<10^{-6}$	
	32404138****	3910 E. Shaeffer Ave.	No	$<10^{-6}$	
	32404158A****	3929 E. John L Ave.	No	$<10^{-6}$	
	32404581****	3939 E. Devlin Ave.	No	$<10^{-6}$	
	32404583****	3951 E. Devlin Ave.	No	$<10^{-6}$	
	32404584****	3959 E. Devlin Ave.	No	$<10^{-6}$	
	32404586****	3969 E. Devlin Ave.	Yes; surface	$<10^{-6}$	--
91	32404637A****	3924 E. Ryan Ave.	Yes; surface	$>10^{-6}$	2
92	32404657****	3919 E. Hearne Ave.	No	$>10^{-6}$	2
	32404660****	3935 E. Hearne Ave.	Yes; surface	$<10^{-6}$	--
	32404671****	3989 E. Hearne Ave.	No	$<10^{-6}$	
	32404672****	3993 E. Hearne Ave.	No	$<10^{-6}$	
	32404673****	3995 E. Hearne Ave.	No	$<10^{-6}$	
	32404675A****	3997 E. Hearne Ave.	No	$<10^{-6}$	
	32404676****	4009 E. Hearne Ave.	No	$<10^{-6}$	
	32404677****	4015 E. Hearne Ave.	No	$<10^{-6}$	
	32404720A ****	3789 E. Hearne Ave.	No	$<10^{-6}$	
	32404723****	3809 E. Hearne Ave.	No	$<10^{-6}$	
	32405103****	3860 E. Lum Ave.	No	$<10^{-6}$	
93	32405171****	3996 E. Lum Ave.	Yes; surface and subsurface	$>10^{-6}$	2
94	32405196A****	3875 E. Ryan Ave.	Yes; surface	$>10^{-6}$	2
95	32405197 ****	3883 E. Ryan Ave.	Yes; surface and subsurface	$>10^{-6}$	2
	32405346 ****	3830 E. Thompson Ave.	No	$<10^{-6}$	
	32405378****	3825 E. Lum Ave.	Yes; surface	$<10^{-6}$	--
	32405382****	3845 E. Lum Ave.	No	$<10^{-6}$	
	32427021****	3846 E. Snavely Ave.	No	$<10^{-6}$	
	32436004****	3912 E. Lass Ave.	Yes; subsurface	$<10^{-6}$	--

APPENDIX C - TABLE 1
SKEET FRAGMENTS OBSERVANCE AND INCREMENTAL LIFETIME CANCER RISK FOR RI and RI ADDENDUMS PARCELS

Phase I #[^]	Parcel #	Address	Skeet Observed?	Incremental Lifetime Cancer Risk[§]	Maximum Depth of PAH Exceedance (feet bgs)
	32436009****	3934 E. Lass Ave.	Yes; surface	$<10^{-6}$	--
96	32439001****	E. Thompson Ave.	Yes; surface and subsurface	$>10^{-6}$	2
	32439024****	3906 E. Snavely Ave.	Yes; surface	$<10^{-6}$	0.167
97	32439040****	3919 E. Snavely Ave.	No	$>10^{-6}$	2
	32439041****	3915 E. Snavely Ave.	Yes; surface	$<10^{-6}$	--

APPENDIX C - TABLE 1
SKEET FRAGMENTS OBSERVANCE AND INCREMENTAL LIFETIME CANCER RISK FOR RI and RI ADDENDUMS PARCELS

Phase I #[^]	Parcel #	Address	Skeet Observed?	Incremental Lifetime Cancer Risk[§]	Maximum Depth of PAH Exceedance (feet bgs)

Notes:

^ Parcel groupings are based on understanding of current ownership, which is subject to change. Although parcel ownership/groupings may change, the data used to determine risk at each sub-parcel will remain based on TCRA and RI findings, until action is taken to reduce risk.

* RI (December 2014 - February 2017)

** RI (January 2019 - October 2019)

*** RI Addendum (January 2020 - April 2021)

*** RI Addendum #2 (March 2022 - July 2022)

§ Based on PAH concentrations

Phase I parcels

Abbreviations:

--' - Not applicable; No PAH exceedance or visible skeet at parcel

bgs - below ground surface

(E) - east section of subdivided parcel

(C) - center section of subdivided parcel

RI - Remedial Investigation

(W) - west section of subdivided parcel

Phase I Parcel Summary:

Number of Phase I Parcels/Sub-parcels/Rights-of-way with Max Depth of PAH at:

0.167 ft bgs:	38
1 ft bgs:	29
2 ft bgs:	22
3 ft bgs:	4
4 ft bgs:	2
5 ft bgs:	2
Total:	97

Number of Phase I Parcels/Sub-parcels/Rights-of-way with Observed Skeet:

2

APPENDIX C - TABLE 2
SUMMARY OF RI AND RI ADDENDUMS PARCELS' ESTIMATED AREAS OF ATTAINMENT AND VOLUMES
ABOVE ACCEPTABLE INCREMENTAL LIFETIME CANCER RISKS EXCEEDING PRELIMINARY REMEDIAL GOALS

APN or Subdivided APN	Address	Skeet Observed?	CERCLA Risk Management Target Levels or Incremental Lifetime Cancer Risk	Maximum Depth of PAHs Exceedance (feet bgs)	Phase I Proposed Minimum Depth of Remediation (feet bgs)	Area (square feet)	Volume (cubic yards)
31021063A***	E. Thompson Ave.	No	$<10^{-6}$	--			
31021063B***	E. Thompson Ave.	No	$<10^{-6}$	--			
31021063C***	E. Thompson Ave.	Significant skeet	$<10^{-6}$	0.167		12,928	
31021063D***	E. Thompson Ave.	No	$<10^{-6}$	--			
31021063E***	E. Thompson Ave.	Yes	$<10^{-6}$	0.167		14,102	
31021063F***	E. Thompson Ave.	Yes	$<10^{-6}$	0.167		10,000	
31021063G***	E. Thompson Ave.	Significant skeet	$<10^{-6}$	0.167		15,028	
31021063H***	E. Thompson Ave.	No	$<10^{-6}$	--			
31021063I***	E. Thompson Ave.	Yes	$<10^{-6}$	0.167		15,682	
31021063J***	E. Thompson Ave.	No	$<10^{-6}$	--			
31021063K***	E. Thompson Ave.	Yes	$<10^{-6}$	0.167		16,742	
31021078A***	E. Thompson Ave.	Yes	$<10^{-6}$	0.167		10,000	
31021078B***	E. Thompson Ave.	No	$<10^{-6}$	--			
31021078C***	E. Thompson Ave.	No	$<10^{-6}$	--			
31021078D***	E. Thompson Ave.	No	$<10^{-6}$	--			
31021078E***	E. Thompson Ave.	No	$<10^{-6}$	--			
31021078F***	E. Thompson Ave.	No	$<10^{-6}$	--			
31021078G***	E. Thompson Ave.	Yes	$<10^{-6}$	0.167		10,000	
31021078H***	E. Thompson Ave.	Yes	$<10^{-6}$	0.167		10,000	
31021078I***	E. Thompson Ave.	No	$<10^{-6}$	--			
31021078J***	E. Thompson Ave.	No	$<10^{-6}$	--			
31021078K***	E. Thompson Ave.	Yes	$<10^{-6}$	0.167		10,000	
31021078L***	E. Thompson Ave.	No	$<10^{-6}$	--			
31021078M***	E. Thompson Ave.	No	$<10^{-6}$	--			
31021078N***	E. Thompson Ave.	No	$<10^{-6}$	--			
31021080[1]**	E. Thompson Ave.	Yes	$<10^{-6}$	0.167		100,000	
31021080A**	E. Thompson Ave.	Yes	$>10^{-6}$	0.167		6,250	
31021080B**	E. Thompson Ave.	Significant skeet	$<10^{-6}$	0.167		1,353	
31038002A***	E. Thompson Ave.	No	$<10^{-6}$	--			
31038002B***	E. Thompson Ave.	No	$<10^{-6}$	--			
31038002C***	E. Thompson Ave.	No	$<10^{-6}$	--			
31038002D***	E. Thompson Ave.	Yes	$>10^{-6}$	0.167		9,224	
31038002E***	E. Thompson Ave.	No	$<10^{-6}$	--			
31038002F***	E. Thompson Ave.	No	$<10^{-6}$	--			
31038002G***	E. Thompson Ave.	No	$<10^{-6}$	--			
31038002H***	E. Thompson Ave.	No	$<10^{-6}$	--			
31038002I***	E. Thompson Ave.	No	$<10^{-6}$	--			
31038002J***	E. Thompson Ave.	No	$<10^{-6}$	--			
31038002K***	E. Thompson Ave.	Yes	$<10^{-6}$	0.167		10,000	
31038002L***	E. Thompson Ave.	No	$<10^{-6}$	--			
31038002M***	E. Thompson Ave.	No	$<10^{-6}$	--			
31038002N***	E. Thompson Ave.	No	$<10^{-6}$	--			
31038002O***	E. Thompson Ave.	No	$<10^{-6}$	--			
31038002P***	E. Thompson Ave.	No	$<10^{-6}$	--			
31038002Q***	E. Thompson Ave.	Yes	$<10^{-6}$	0.167		9,483	
31040005A***	E. Thompson Ave.	No	$<10^{-6}$	--			
31040005B***	E. Thompson Ave.	No	$<10^{-6}$	--			
31040005C***	E. Thompson Ave.	No	$<10^{-6}$	--			
31040005D***	E. Thompson Ave.	No	$<10^{-6}$	--			
31040005E***	E. Thompson Ave.	No	$<10^{-6}$	--			
31040005F***	E. Thompson Ave.	No	$<10^{-6}$	--			
31040005G***	E. Thompson Ave.	No	$<10^{-6}$	--			
31040005H***	E. Thompson Ave.	No	$<10^{-6}$	--			
31040005I***	E. Thompson Ave.	No	$<10^{-6}$	--			
31040005J***	E. Thompson Ave.	No	$<10^{-6}$	--			
31040005K***	E. Thompson Ave.	No	$<10^{-6}$	--			
31040005L***	E. Thompson Ave.	No	$<10^{-6}$	--			
31040005M***	E. Thompson Ave.	No	$<10^{-6}$	--			
31040005N***	E. Thompson Ave.	No	$<10^{-6}$	--			
31040005O***	E. Thompson Ave.	No	$<10^{-6}$	--			
32404082B***	3800 E. Shaeffer Ave.	No	$<10^{-6}$	--			
32404126***	3970 E. Shaeffer Ave.	No	$<10^{-6}$	--			
32404127***	3966 E. Shaeffer Ave.	No	$<10^{-6}$	--			
32404131***	3946 E. Shaeffer Ave.	No	$<10^{-6}$	--			
32404152***	3905_09 E. L. John Ave.	No	$<10^{-6}$	--			
32404153***	3905_09 E. L. John Ave.	No	$<10^{-6}$	--			
32404194***	3974 E. Devlin Ave.	No	$<10^{-6}$	--			
32404206A**	3910 E. Devlin Ave.	Yes	$<10^{-6}$	0.167		10,470	
32404208A**	3900 E. Devlin Ave.	Significant skeet	$<10^{-6}$	0.167		9,900	
32404211B*	3875 E. Shaeffer Ave.	No	$<10^{-6}$	--			

APPENDIX C - TABLE 2
SUMMARY OF RI AND RI ADDENDUMS PARCELS' ESTIMATED AREAS OF ATTAINMENT AND VOLUMES
ABOVE ACCEPTABLE INCREMENTAL LIFETIME CANCER RISKS EXCEEDING PRELIMINARY REMEDIAL GOALS

APN or Subdivided APN	Address	Skeet Observed?	CERCLA Risk Management Target Levels or Incremental Lifetime Cancer Risk	Maximum Depth of PAHs Exceedance (feet bgs)	Phase I Proposed Minimum Depth of Remediation (feet bgs)	Area (square feet)	Volume (cubic yards)
32404211C**	3879 E. Shaeffer Ave.	Yes	$<10^{-6}$	0.167		6,587	
32404211D*	3880 E. Devlin Ave.	Yes	$>10^{-6}$	0.167	1	6,500	240
32404211E*	3880 E. Devlin Ave.	No	$>10^{-6}$	0.167	1	5,100	190
32404212*	3883 E. Shaeffer Ave.	No	$<10^{-6}$	--			
32404213**	3887 E. Shaeffer Ave.	No	$<10^{-6}$	--			
32404237A (E)*	3870 E. Devlin Ave.	Yes	$>10^{-6}$	1	2	10,500	780
32404237A(W)*				4			
32404240*	3850 E. Devlin Ave.	Yes	$<10^{-6}$	0.167		5,197	
32404241**	3846 E. Devlin Ave.	Yes	$<10^{-6}$	0.167		5,197	
32404242**	3842 E. Devlin Ave.	Yes	$<10^{-6}$	0.167		5,457	
32404277A**	3825 E. Shaeffer Ave.	No	$>10^{-6}$	0.167	1	14,100	520
32404279**	3841 E. Shaeffer Ave.	No	$<10^{-6}$	--			
32404280**	3845 E. Shaeffer Ave.	Yes	$<10^{-6}$	0.167		5,659	
32404281*	3849 E. Shaeffer Ave.	No	$<10^{-6}$	--			
32404282A(E)*	3871 E. Shaeffer Ave.	No	$>10^{-6}$	0.167	1	2,800	100
32404282A(W)*		Yes	$>10^{-6}$			2,800	100
32404282B(E)*	3855 E. Shaeffer Ave.	No	$<10^{-6}$	--			
32404282B(W)*	3855 E. Shaeffer Ave.	No	$<10^{-6}$	--			
32404484*	3860 E. Hearne Ave.	Yes	$>10^{-6}$	1	1	4,800	180
32404485*	3854 E. Hearne Ave.	No	$>10^{-6}$	1	1	5,600	210
32404486*	3850 E. Hearne Ave.	No	$>10^{-6}$	1	1	5,600	210
32404487**	3846 E. Hearne Ave.	No	$>10^{-6}$	0.167	1	5,600	210
32404526**	3845 E. Devlin Ave.	Yes	$>10^{-6}$	1	1	5,600	210
32404527**	3849 E. Devlin Ave.	Yes	$>10^{-6}$	1	1	5,600	210
32404549A***	3970 E. HearneAve.	Yes	$<10^{-6}$	0.167		15,587	
32404550**	3960 E. Hearne Ave.	Yes	$>10^{-6}$	1	1	6,400	240
32404552A**	3950 E. Hearne Ave.	Yes	$<10^{-6}$	0.167		11,160	
32404553**	3946 E. Hearne Ave.	Yes	$<10^{-6}$	0.167		5,113	
32404556A**	3922 E. Hearne Ave.	No	$>10^{-6}$	0.167	1	9,900	370
32404558***	3920 E. Hearne Ave.	No	$>10^{-6}$	0.167	1	5,597	210
32404559*	3919 E. Hearne Ave.	No	$<10^{-6}$	--			
32404561C*	3890 E. Hearne Ave.	No	$>10^{-6}$	2	2	4,100	300
32404570*	3883 E. Devlin Ave.	Yes	$>10^{-6}$	0.167	1	4,800	180
32404571*	3887 E. Devlin Ave.	No	$<10^{-6}$	--			
32404572*	3887 E. Devlin Ave.	No	$<10^{-6}$	--			
32404578**	3925 E. Devlin Ave.	No	$>10^{-6}$	0.167	1	4,900	180
32404582**	3945 E. Devlin Ave.	Yes	$>10^{-6}$	1	1	5,600	210
32404588***	3975 E. Devlin Ave.	No	$<10^{-6}$	--			
32404589***	3979 E. Devlin Ave.	No	$<10^{-6}$	--			
32404624**	3996 E. Ryan Ave.	No	$<10^{-6}$	--			
32404625**	3990 E. Ryan Ave.	Yes	$<10^{-6}$	0.167		5,765	
32404629A**	3966 E. Ryan Ave.	Yes	$<10^{-6}$	0.167		11,308	
32404631B**	3960 E. Ryan Ave.	No	$<10^{-6}$	--			
32404638**	3920 E. Ryan Ave.	Yes	$>10^{-6}$	0.167	1	5,200	190
32404639*/**	3916 E. Ryan Ave.	Yes	$>10^{-6}$	0.167	1	5,600	210
32404640*/**	3910 E. Ryan Ave.	Yes	$>10^{-6}$	2	2	5,600	410
32404643* (also TCRA parcel)	3896 E. Ryan Ave.	No	$<10^{-6}$	--			
32404653*	3899 E. Hearne Ave.	Yes	$>10^{-6}$	1	1	4,300	160
32404655A (E)*	3905 E. Hearne Ave.	Yes	$>10^{-6}$	0.167	1	4,950	180
32404655A (W)*				1		4,950	180
32404656**	3915 E. Hearne Ave.	No	$>10^{-6}$	0.167	1	4,300	160
32404658**	3925 E. Hearne Ave.	Significant skeet	$<10^{-6}$	0.167		5,600	
32404659**	3929 E. Hearne Ave.	Yes	$<10^{-6}$	0.167		5,840	
32404663A***	3945 E. Hearne Ave.	No	$>10^{-6}$	0.167	1	11,182	410
32404664**	3955 E. Hearne Ave.	No	$<10^{-6}$	--			
32404665**	3959 E. Hearne Ave.	Yes	$<10^{-6}$	0.167		7,982	
32404666**	3971 E. Hearne Ave.	Yes	$>10^{-6}$	0.167	1	6,300	230
32404668***	3979 E. Hearne Ave.	No	$<10^{-6}$	--			
32404686*	3870 E. Ryan Ave.	No	$>10^{-6}$	0.167	1	6,500	240
32404687*	3866 E. Ryan Ave.	No	$>10^{-6}$	0.167	1	5,600	210
32404688**	3860 E. Ryan Ave.	Yes	$>10^{-6}$	1	1	5,600	210
32404727**	3831 E. Hearne Ave.	No	$<10^{-6}$	--			
32404730**	3845 E. Hearne Ave.	No	$<10^{-6}$	--			
32405106***	3846 E. Lum Ave.	No	$<10^{-6}$	--			
32405107***	3842 E. Lum Ave.	No	$<10^{-6}$	--			
32405150*	3871 E. Ryan Ave.	No	$>10^{-6}$	0.167	1	5,800	210
32405166A***	4026 E. Lum Ave.	No	<10-6	--			
32405168**	4010 E. Lum Ave.	No	<10-6	--			
32405169**	4004 E. Lum Ave.	Yes	$<10^{-6}$	0.167		5,752	

APPENDIX C - TABLE 2
SUMMARY OF RI AND RI ADDENDUMS PARCELS' ESTIMATED AREAS OF ATTAINMENT AND VOLUMES
ABOVE ACCEPTABLE INCREMENTAL LIFETIME CANCER RISKS EXCEEDING PRELIMINARY REMEDIAL GOALS

APN or Subdivided APN	Address	Skeet Observed?	CERCLA Risk Management Target Levels or Incremental Lifetime Cancer Risk	Maximum Depth of PAHs Exceedance (feet bgs)	Phase I Proposed Minimum Depth of Remediation (feet bgs)	Area (square feet)	Volume (cubic yards)
32405172**	3990 Lum Ave.	Yes	$>10^{-6}$	1	1	6,500	240
32405174**	3974 E. Lum Ave.	Yes	$<10^{-6}$	0.167		5,147	
32405176*	3966 E. Lum Ave.	Yes	$>10^{-6}$	0.167	1	4,500	170
32405177**	3960 E. Lum Ave.	Significant skeet	$<10^{-6}$	0.167		4,700	
32405178**	3956 E. Lum Ave.	Yes	$>10^{-6}$	0.167	1	5,500	200
32405180A (E)*	3950 E. Lum Ave.	No	$<10^{-6}$	--			
32405180A (W)*	3950 E. Lum Ave.	No	$<10^{-6}$	--			
32405181*	3940 E. Lum Ave.	No	$<10^{-6}$	--			
32405182*	3936 E. Lum Ave.	No	$>10^{-6}$	1	1	4,700	170
32405194B(C)*	3876 E. Lum Ave.	Yes	$>10^{-6}$	0.167	1	16,200	600
32405194B(E)*							
32405194B(W)*							
32405205A(E)*	3925 E. Ryan Ave.	No	$>10^{-6}$	1	1	7,300	270
32405205A(W)*							
32405206A**	E. Ryan Ave.	Yes	$>10^{-6}$	1	1	2,800	100
32405208*	3939 E. Ryan Ave.	No	$<10^{-6}$	--			
32405212**	3959 E. Ryan Ave.	Yes	$<10^{-6}$	0.167		5,789	
32405218A**	3991 E. Ryan Ave.	No	$<10^{-6}$	--			
32405263A***	4016 E. Thompson Ave.	No	$<10^{-6}$	--			
32405265***	4008 E. Thompson Ave.	No	$>10^{-6}$	0.167	1	5,920	220
32405267***	4000 E. Thompson Ave.	No	$<10^{-6}$	--			
32405269**	3986 E. Thompson Ave.	Yes	$<10^{-6}$	0.167		7,602	
32405270*	3980 E. Thompson Ave.	No	$>10^{-6}$	0.167	1	7,800	290
32405272A(E)*	3970 E. Thompson Ave.	No	$>10^{-6}$	0.167	1	5,700	210
32405272A(W)*	3970 E. Thompson Ave.	No	$<10^{-6}$	--	--		
32405273*	3966 E. Thompson Ave.	No	$<10^{-6}$	--			
32405274*	3960 E. Thompson Ave.	No	$>10^{-6}$	1	1	5,100	190
32405276A(E)*	3950 E. Thompson Ave.	Yes	$>10^{-6}$	1	2	5,350	400
32405276A(W)*				2		5,350	400
32405287*	3896 E. Thompson Ave.	No	$>10^{-6}$	0.167	1	5,500	200
32405288*	3890 E. Thompson Ave.	No	$<10^{-6}$	--			
32405289**	3886 E. Thompson Ave.	Yes	$<10^{-6}$	0.167		5,974	
32405290**	3880 E. Thompson Ave.	No	$<10^{-6}$	--			
32405295*	3887 E. Lum Ave.	Yes	$>10^{-6}$	0.167	1	4,900	180
32405296*	3895 E. Lum Ave.	Yes	$>10^{-6}$	1	1	5,500	200
32405297*	3899 E. Lum Ave.	Yes	$>10^{-6}$	1	1	5,600	210
32405306*	3945 E. Lum Ave.	No	$>10^{-6}$	1	1	4,300	160
32405308A(E)*	3955 E. Lum Ave	Yes	$<10^{-6}$	0.167	1	5,350	200
32405308A(W)*			$>10^{-6}$	1		5,250	190
32405309*	3959 E. Lum Ave.	No	$>10^{-6}$	0.167	1	4,700	170
32405310*	3965 E. Lum Ave.	No	$<10^{-6}$	--			
32427024***	3860 E. Snavely Ave.	No	$<10^{-6}$	--			
32436008**	3930 E. Lass Ave.	Yes	$>10^{-6}$	1	1	4,800	180
32436011**	3942 E. Lass Ave.	Yes	$>10^{-6}$	0.167	1	4,800	180
32436012**	3946 E. Lass Ave.	Yes	$>10^{-6}$	2	2	4,800	360
32436014**	3954 E. Lass Ave.	Yes	$>10^{-6}$	1	1	4,800	180
32436015**	3958 E. Lass Ave.	Yes	$>10^{-6}$	4	2	4,800	360
32436017***	3966 E. Lass Ave.	Yes	$>10^{-6}$	3	2	6,458	480
32436019**	3974 E. Lass Ave.	Yes	$>10^{-6}$	3	2	5,200	390
32436020**	3978 E. Lass Ave.	Yes	$>10^{-6}$	2	2	5,600	410
32436021*	3979 E. Lass Ave.	No	$<10^{-6}$	--			
32436022*	3975 E. Lass Ave.	No	$>10^{-6}$	1	1	4,900	180
32436023*	3971 E. Lass Ave.	No	$<10^{-6}$	--			
32436026*	3959 E. Lass Ave.	No	$<10^{-6}$	--			
32436028***	3951 E. Lass Ave.	No	$<10^{-6}$	--			
32436030***	3943 E. Lass Ave.	Yes	$<10^{-6}$	0.167		7,228	
32437016**	3964 E. Packard Ave.	No	$<10^{-6}$	--			
32437017***	3968 E. Packard Ave.	No	$<10^{-6}$	--			
32437019***	3976 E. Packard Ave.	No	$<10^{-6}$	--			
32437020*	3980 E. Packard Ave.	No	$<10^{-6}$	--			
32439003*	3974 E. Snavely Ave.	No	$>10^{-6}$	0.167	1	5,700	210
32439004*	3970 E. Snavely Ave.	No	$>10^{-6}$	1	1	5,600	210
32439005*	3962 E. Snavely Way	No	$>10^{-6}$	1	1	7,200	270
32439006*	3960 E. Snavely Way	Yes	$>10^{-6}$	2	2	7,700	570
32439007*	3958 E. Snavely Way	No	$>10^{-6}$	2	2	11,300	840
32439013*	3940 E. Snavely Cir.	No	$>10^{-6}$	2	2	8,400	620
32439014*	3936 E. Snavely Cir.	Yes	$>10^{-6}$	1	1	6,400	240
32439015*	3930 E. Snavely Plz	Yes	$>10^{-6}$	1	1	6,600	240
32439016*	3928 E. Snavely Plz	Yes	$>10^{-6}$	1	1	8,800	330
32439017*	3926 E. Snavely Plz	No	$>10^{-6}$	2	2	9,500	700

APPENDIX C - TABLE 2
SUMMARY OF RI AND RI ADDENDUMS PARCELS' ESTIMATED AREAS OF ATTAINMENT AND VOLUMES
ABOVE ACCEPTABLE INCREMENTAL LIFETIME CANCER RISKS EXCEEDING PRELIMINARY REMEDIAL GOALS

APN or Subdivided APN	Address	Skeet Observed?	CERCLA Risk Management Target Levels or Incremental Lifetime Cancer Risk	Maximum Depth of PAHs Exceedance (feet bgs)	Phase I Proposed Minimum Depth of Remediation (feet bgs)	Area (square feet)	Volume (cubic yards)
32439020***	3914 E. Packard Ave.	Yes	$<10^{-6}$	0.167		10,357	
32439026*	3975 E. Snavely Ave.	No	$>10^{-6}$	2	2	4,300	320
32439031**	3955 E. Snavely Ave.	Yes	$>10^{-6}$	5	2	4,900	360
32439032*	3951 E. Snavely Ave.	Yes	$>10^{-6}$	2	2	5,000	370
32439033*	3947 E. Snavely Ave.	No	$>10^{-6}$	2	2	4,300	320
32439035*	3939 E. Snavely Ave.	No	$>10^{-6}$	1	1	5,200	190
32439036**	3935 E. Snavely Ave.	Yes	$>10^{-6}$	2	2	5,100	380
32439037**	3931 E. Snavely Ave.	Yes	$>10^{-6}$	2	2	5,100	380
32439038***	3927 E. Snavely Ave.	Yes	10^{-6}	0.167		6,457	
Thompson Right-of-way A***		No	$<10^{-6}$	--			
Thompson Right-of-way B***		No	$<10^{-6}$	--			
Thompson Right-of-way C***		No	$<10^{-6}$	--			
Thompson Right-of-way D***		No	$<10^{-6}$	--			
Thompson Right-of-way E***		No	$>10^{-6}$	0.167	1	4,086	150
Thompson Right-of-way F***		No	$>10^{-6}$	0.167	1	4,440	160
Thompson Right-of-way G***		Yes	$>10^{-6}$	0.167	1	4,448	160
Thompson Right-of-way H***		Yes	$>10^{-6}$	0.167	1	4,435	160
Thompson Right-of-way I***		Yes	$>10^{-6}$	0.167	1	4,361	160
Thompson Right-of-way J***		Yes	$>10^{-6}$	3	2	4,404	330
Thompson Right-of-way K***		Yes	$>10^{-6}$	5	2	4,273	320
Thompson Right-of-way L***		Yes	$>10^{-6}$	3	2	4,151	310
Thompson Right-of-way M***		Yes	$>10^{-6}$	2	2	4,162	310
Thompson Right-of-way N***		Yes	$>10^{-6}$	1	1	4,177	150
Thompson Right-of-way O***		Yes	$>10^{-6}$	0.167	1	4,328	160
Thompson Right-of-way P***		Yes	$>10^{-6}$	0.167	1	4,164	150
Thompson Right-of-way Q***		Yes	$>10^{-6}$	0.167	1	4,164	150
32403478A****	3924 E. John Ave.	No	$<10^{-6}$		--		
32404074B****	3842 E. Shaeffer Ave.	No	$<10^{-6}$		--		
32404077A****	3830 E. Shaeffer Ave.	No	$<10^{-6}$				
32404109****	3835 E. John L Ave.	No	$>10^{-6}$	0.167	1	6,106	230
32404137****	3916 E. Shaeffer Ave.	No	$<10^{-6}$		--		
32404138****	3910 E. Shaeffer Ave.	No	$<10^{-6}$		--		
32404158A****	3929 E. John L Ave.	No	$<10^{-6}$		--		
32404581****	3939 E. Devlin Ave.	No	$<10^{-6}$		--		
32404583****	3951 E. Devlin Ave.	No	$<10^{-6}$		--		
32404584****	3959 E. Devlin Ave.	No	$<10^{-6}$		--		
32404586****	3969 E. Devlin Ave.	Yes; surface	$<10^{-6}$	--			
32404637A****	3924 E. Ryan Ave.	Yes; surface	$>10^{-6}$	2	2	10,560	780
32404657****	3919 E. Hearne Ave.	No	$>10^{-6}$	2	2	5,938	440
32404660****	3935 E. Hearne Ave.	Yes; surface	$<10^{-6}$	--			
32404671****	3989 E. Hearne Ave.	No	$<10^{-6}$		--		
32404672****	3993 E. Hearne Ave.	No	$<10^{-6}$		--		
32404673****	3995 E. Hearne Ave.	No	$<10^{-6}$		--		
32404675A****	3997 E. Hearne Ave.	No	$<10^{-6}$		--		
32404676****	4009 E. Hearne Ave.	No	$<10^{-6}$		--		
32404677****	4015 E. Hearne Ave.	No	$<10^{-6}$		--		
32404720A****	3789 E. Hearne Ave.	No	$<10^{-6}$		--		
32404723****	3809 E. Hearne Ave.	No	$<10^{-6}$		--		
32405103****	3860 E. Lum Ave.	No	$<10^{-6}$		--		
32405171****	3996 E. Lum Ave.	Yes; surface and subsurface	$>10^{-6}$	2	2	7,320	540
32405196A****	3875 E. Ryan Ave.	Yes; surface	$>10^{-6}$	2	2	11,916	880
32405197****	3883 E. Ryan Ave.	Yes; surface and subsurface	$>10^{-6}$	2	2	5,376	400
32405207****	3935 E. Ryan Ave.	No	$>10^{-6}$	0.167	1	5,522	200
32405346****	3830 E. Thompson Ave.	No	$<10^{-6}$		--		
32405378****	3825 E. Lum Ave.	Yes; surface	$<10^{-6}$	--			
32405382****	3845 E. Lum Ave.	No	$<10^{-6}$		--		
32427021****	3846 E. Snavely Ave.	No	$<10^{-6}$		--		
32436004****	3912 E. Lass Ave.	Yes; subsurface	$<10^{-6}$	--			
32436009****	3934 E. Lass Ave.	Yes; surface	$<10^{-6}$	--			
32439001****	-- E. Thompson Ave.	Yes; surface and subsurface	$>10^{-6}$	2	2	19,304	1430
32439024****	3906 E. Snavely Ave.	Yes; surface	$<10^{-6}$	0.167			
32439040****	3919 E. Snavely Ave.	No	$>10^{-6}$	2	2	7,105	530
32439041****	3915 E. Snavely Ave.	Yes; surface	$<10^{-6}$	--			
					Total:	**1,044,217**	**30,190**

APPENDIX C - TABLE 2
SUMMARY OF RI AND RI ADDENDUMS PARCELS' ESTIMATED AREAS OF ATTAINMENT AND VOLUMES ABOVE ACCEPTABLE INCREMENTAL LIFETIME CANCER RISKS EXCEEDING PRELIMINARY REMEDIAL GOALS

APN or Subdivided APN	Address	Skeet Observed?	CERCLA Risk Management Target Levels or Incremental Lifetime Cancer Risk	Maximum Depth of PAHs Exceedance (feet bgs)	Phase I Proposed Minimum Depth of Remediation (feet bgs)	Area (square feet)	Volume (cubic yards)
					Total for Parcels/Sub-parcels/Rights-of-way >10-6:	**607,421**	**29,410**

Notes:

[1] Subparcel A and B (31021080A and 31021080B) and main parcel (31021080).

Phase 1 parcel

* RI (December 2014 - February 2017)

** RI (January 2019 - October 2019)

*** RI Addendum (January 2020 - April 2021)

**** RI Addendum (January 2022 - July 2022)

Abbreviations:

--' - Not applicable; No PAH exceedance or visible skeet at parcel

APN - Assessor's Parcel Number

bgs - below ground surface

(E) - east section of subdivided parcel

(C) - center section of subdivided parcel

RI - Remedial Investigation

(W) - west section of subdivided parcel

APPENDIX D

Alternative 3 – LUCs and Excavation up to 2-feet bgs, Installation of Geotextile/Marker Fabric, Offsite Disposal, Backfill, and Site Restoration

Assumptions associated with the cost estimate for Alternative 3 are listed below. The cost estimate is provided in Table D-1.

1. Parcel Area and Excavation Depth Assumptions

Remediation via excavation will take place at 97 parcels/sub-parcels/rights-of-way with an incremental lifetime cancer risk (ILCR) above 10^{-6} (Figure 3-2). Parcel areas used in the cost estimate are listed in Table D-2. These areas are approximate and may vary in the field. Parcel areas do not include areas of impervious surfaces such as built-up areas. Excavation will not be performed under impervious surfaces.

Additionally, consistent with the National Contingency Plan (NCP), land use controls (LUCs) supplementing soil removal to 2-foot below ground surface (bgs) depth would be used to prevent or limit exposure to polycyclic aromatic hydrocarbon (PAHs) in subsurface soils at 97 parcels. LUCs would also be required where property owners deny access. For the purpose of cost estimation, assume access is granted for all 97 parcels/sub-parcels/rights-of-way.

Assumed excavation depths are (see Attachment Table D-2):

- An excavation depth of 1-foot bgs is assumed at 67 parcels/sub-parcels/rights-of-way
- An excavation depth of 2-feet bgs is assumed at 30 parcels/sub-parcels/rights-of-way

2. General Assumptions

i. Property Requirement to include:
   - Access Agreements – Assume two hours per parcel to obtain access agreements (includes no-shows, repeat visits, scheduling meetings). Assume three attempts for each property.
   - Community Involvement – Community outreach/communication via newspaper, television, and fact sheets. Two public meetings. Meeting costs include facility rental, materials printing, transcription, and travel costs.
   - Property assessments to thoroughly locate, document, and inventory site features (i.e., large objects, fencing, trees, landscaping type, etc.), utilities, septic tanks/leach field, document conditions, and create parcel-specific plans, including set-back plans.

ii. Site Specific Project Plans to include, but not limited to:
   - Quality Assurance Project Plan (QAPP) which will include an Accident Prevention Plan (APP) and Site Safety & Health Plan (SSHP)
   - Work Plans
   - Transportation and Disposal Plan
   - Storm Water Pollution Prevention Plan (SWPPP)
   - Environmental Control Plan (ECP)
   - Spill Prevention, Control and Countermeasures (SPCC) Plan
   - Land Use Control Implementation Plan (LUCIP)

iii. Remediation fieldwork of 97 parcels/sub-parcels/rights-of-way to take approximately 18 months.
iv. Thirty parcels/sub-parcels/rights-of-way assumed vacant, with 67 occupied.
v. LUCs to be implemented on all 97 parcels/sub-parcels/rights-of-way, whether or not access is granted for remedial action. Assumptions include:
    - Setup of a Site Information Database (list of property owners and properties requiring LUCs). Assume one hour per parcel with one personnel.
    - Development, production, and distribution of educational materials. Assume two hours per parcel with two personnel.
    - LUC Completion Report
vi. Design, project management, construction oversight costs, and contingencies are estimated based on USEPA 540-R-00-002 A Guide to Developing and Documenting Cost Estimates During the Feasibility Study. Estimate contingency includes 10% scope + 15% Bid = 25%.

3. Property Owner Relocation

Lodging and per diem for 65 parcels, assuming two rooms for 30 days per parcel and four people for 30 days. Providing a hospitality area for use by nearby residents to avoid noise and other disturbances for 180 days.

4. Site Preparation

Mobile office trailer rental with generator and temporary utilities (i.e., water, internet, etc.) required to facilitate site remediation. Office trailer will be located at U.S. Army Corps of Engineers (USACE) approved properties in or near the neighborhood, following individual owner acceptance. Cost includes estimated rent for the property and labor to handle lease.

Private utility location to be conducted at each parcels/sub-parcels/rights-of-way. Cost includes labor to submit utility location tickets to Arizona 811 and coordination with utility providers.

Staging Area includes storage, staging, and laydown areas that will be located at USACE approved properties in or near the neighborhood, following individual owner acceptance. Cost includes estimated rent for the property and labor to handle lease. The areas will be secured with a minimum 6 feet standard temporary security fence and appropriate signage.

Erosion controls (i.e., silt fence, waddle, etc.) to be implemented at each parcels/sub-parcels/rights-of-way.

Debris and large object removal, movement of non-permanent property (e.g., swing sets, aboveground pools, and other miscellaneous items) are the responsibility of the property owner. Storage container rental with lock to be placed in driveway for miscellaneous yard items.

Site clearing and grubbing includes removal of vegetation only (small trees and brush); removal or grinding of stumps and roots; and felling and removal of dead trees, partially dead trees and limbs, and trees and limbs that are a safety hazard to workers.

Preparation and implementation of parcel-specific traffic control plans for each parcel is assumed.

5. Excavation and Disposal

Assume bonding fee of 0.75% of capital costs is required.

Soil excavation may require hand excavation and double handling of material. Excavated material will be direct loaded into the trucks. Assume excavated material transportation and disposal as special waste as in case of the previous Time Critical Removal Action (TCRA).

Assume up to four trees per parcel will be removed (average 12 to 18 inches in diameter) during excavation.

Assume use of a truck mounted soil vacuum excavator to remove soil near sensitive features such as vegetation and building foundations.

6. Sampling/Monitoring Requirements

Air monitoring to be conducted during excavation to include Method TO-13A usings sorbents such as Tenax®, XAD-2® and polyurethane foam (PUF), as well as active photoionization detector (PID) monitoring to detect the presence of PAHs in real-time.

Waste characterization sampling for disposal includes one toxic characteristic leaching procedure (TCLP) sample per 250 cubic yards of material to be disposed. Sampling frequency for clean backfill (which will be procured from a vendor as certified clean of contaminants) includes one sample per 2,500 cubic yards of imported material to verify clean.

One confirmation sample per parcel, with 5% duplicate samples, is assumed. Samples will be collected using incremental sampling methods and will be analyzed for PAHs and metals. All confirmation sample results will be subject to data validation.

7. Site Restoration

Backfill production includes place/spread/compact/grade, setup at each property, and relocate to the next. Backfill includes clean fill and 4 inches of topsoil. Geotechnical compaction testing to be performed at each parcel excavated to 2-feet bgs or greater. Assume one test per parcel per 1 foot lift.

A permeable geotextile barrier would be placed at the bottom of excavations where soils with skeet and/or contaminants of concern (COCs) exceeding the preliminary remedial goals (PRGs) are left in place to demark where deeper soils remain with possible PAHs concentrations above risk-based limits and to help discourage direct human contact and exposure to COCs at depth. Assume eight parcels. Assume MIRAFI HP570 (https://www.solmax.com/us/en/resources/mirafi-hp570-tds) geotextile.

Placement of gravel/decorative rock is assumed to expedite restoration and minimize operation and maintenance (O&M) costs. Trees (up to four trees per parcel) and shrubs will be replaced in lots only where they previously existed. Inventory will be taken before site clearing and grubbing. Following site restoration, watering services will be provided for up to four weeks.

Restoration of roads, including patching, filling potholes, and overlays to add new layer of asphalt where damaged due to excavation equipment is assumed at 10% of parcels.

Property restoration to include removal of temporary construction features (i.e., fencing), and repair or replacement of fencing, sidewalks, and utilities if damaged during the Remedial Action. Restoration of damaged underground utilities, to meet current code, is assumed.

Post-construction property survey to be completed to document the extent of the Remedial Action (i.e., area of excavation) and assure restoration is completed to the appropriate grade and to restore the property to its original conditions. Assume profession survey of each parcel.

8. Post-Construction

Post-construction review to document condition of properties after remedial post-construction activities and ensure site restoration is complete. Assume two personnel, two hours per parcel with two assessment trips.

Remedial Action Completion Report to document remediation and LUC installation at each parcel, including summary of parcel-specific remedial activities, documentation of parcel-specific pre- and post-conditions, sample data, and description of post-remedial action conditions (i.e., risk reduction). Assume one report.

9. Periodic Costs

Periodic costs include LUCIP updates and Five-Year Reviews. Assume 3% escalation fee per year (i.e., 15% every five years). Cost of annual LUC compliance inquiry/survey, to be mailed to all property owners and identified tenants in the project area to provide for reporting new observations of skeet fragments in accessible areas to ADEQ and USACE, assumed in LUCIP update costs.

TABLE D-1. COST ESTIMATE

ALTERNATIVE 3 - LUCs AND EXCAVATION UP TO 2-FEET BGS, INSTALLATION OF GEOTEXTILE/MARKER FABRIC, OFFSITE DISPOSAL, BACKFILL, AND SITE RESTORATION

Item	Quantity	Unit	Unit Cost	Cost	Comments
CAPITAL COSTS					
Property Requirements					
Access Agreements	97	EA	$ 500	$ 48,500	2 hours per property with three attempts per parcel.
Community Involvement	1	LS	$ 50,000	$ 50,000	Unit cost based on past project experience. Outreach via newspaper, television, and fact sheets, and two public meetings. Meeting costs include facility rental, materials printing, transcription, and travel costs.
Property Assessment					
Site Assessment Recon	97	EA	$ 200	$ 19,400	Unit costs based on past project experience of site assessment recon, property walk, pre-remediation site survey, site inventory list, private utility locate, septic and leacahte field locate, site plan, set-back plan, additional community outreach, and GPS rental.
Pre-Construction Property Assessment	97	EA	$ 800	$ 77,600	
Pre-Construction Site Survey	97	EA	$ 1,500	$ 145,500	
Site Inventory List	97	EA	$ 400	$ 38,800	
Site Plan	97	EA	$ 1,000	$ 97,000	
Private Utility Locate	97	EA	$ 600	$ 58,200	
Septic & Leachate Locate	97	EA	$ 200	$ 19,400	
Additional Community Outreach	1	LS	$ 37,500	$ 37,500	
GPS Rental	2	Month	$ 200	$ 400	
Property Owner Relocation Costs					
Lodging (2 rooms for 30 days per occupied parcel)	4,020	Day	$ 110	$ 442,200	2025 GSA Lodging and Per Diem Rates for Mohave County, Arizona (USGSA 2025). 67 occupied parcels.
Per Diem (4 people for 30 days per occupied parcel)	8,040	Day	$ 68	$ 546,720	
Hospitality area (hotel conference room)	180	Day	$ 200	$ 36,000	Unit cost based on estimates from Kingman, AZ hotels.
Site Specific Project Plans					
Work Plans	1	LS	$ 100,000	$ 100,000	Unit cost based on past project experience of Quality Assurance Project Plan (QAPP), Work Plan, APP, SSHP, and LUCIP development and other plans such as Transportation and Disposal Plan, Storm Water Pollution Prevention Plan (SWPPP), Environmental Control Plan (ECP), and Spill Prevention, Control and Countermeasures (SPCC) Plan.
LUCIP	1	LS	$ 50,000	$ 50,000	
Site Preparation					
Mobilization	1	LS	$ 50,000	$ 50,000	Unit cost based on past project experience. Mobilization of all equipment and materials (i.e., excavators, loaders, generators, water, temporary trailers, temporary utility items, signs, backfill material, sod, trees, shrubs, etc.).
Traffic Control	97	EA	$ 5,000	$ 485,000	Unit cost based on past project experience. Includes development and implementation of a parcel-specific traffic control plan.
Office Trailer w/generator	18	MO	$ 6,000	$ 108,000	Unit cost based on past project experience of fencing, signage, trailer, generator, water, internet, construction equipment, storage container rental and materials, rental for onsite storage container to be placed in driveway for miscellaneous yard item storage, etc.
Temporary Utilities	18	MO	$ 3,000	$ 54,000	
Private Utility Locates	97	EA	$ 600	$ 58,200	
Staging Area	18	MO	$ 5,000	$ 90,000	
Erosion Controls	97	EA	$ 600	$ 58,200	
Storage Container Rental	18	MO	$ 900	$ 16,200	
Site Clearing	97	EA	$ 1,000	$ 97,000	

TABLE D-1. COST ESTIMATE
ALTERNATIVE 3 - LUCs AND EXCAVATION UP TO 2-FEET BGS, INSTALLATION OF GEOTEXTILE/MARKER FABRIC, OFFSITE DISPOSAL, BACKFILL, AND SITE RESTORATION

Soil Excavation	29,990	CY	$ 32	$ 959,680	Unit cost based on past project experience.
Item	**Quantity**	**Unit**	**Unit Cost**	**Cost**	**Comments**
Excavation and Restoration					
Air Monitoring	97	EA	$ 600	$ 58,200	Monitoring via Method TO-13A using sorbents such as Tenax®, XAD-2® and polyurethane foam; one sample per parcel. Active PID monitoring.
Lab Analysis for Disposal	120	EA	$ 500	$ 59,980	1 sample per 250 cubic yards. Unit cost based on past project experience.
Confirmation sampling - ISM Sample Compositing	102	EA	$ 250	$ 25,463	1 confirmation sample per parcel, plus 5 duplicate samples added for every 20 samples analyzed. Unit cost based on past project experience.
Confirmation sampling - Laboratory Analysis	102	EA	$ 135	$ 13,750	
Transportation & Disposal Soil	50,400	TN	$ 100	$ 5,040,000	Due to assumed 20% volumetric increase (Department of Army 2000), additional hauling will be required.
General Fill	39,700	TN	$ 35	$ 1,389,500	
Geotechnical Testing	60	EA	$ 1,000	$ 60,000	Compacting testing for all parcels excavated to 2 ft bgs or greater. One test per parcel per 1 foot lift.
Geotextile Fabric	44,686	SF	$ 2.50	$ 111,715	https://www.solmax.com/us/en/resources/mirafi-hp570-tds.
Topsoil Placement	10,700	TN	$ 55	$ 588,500	4 inches thick top soil per parcel. Unit cost based on past project experience.
Lab Analysis for Fill	12	EA	$ 500	$ 5,998	1 sample per 2,500 cubic yards.
Landscaping - Gravel/ Decorative Rock Installation	97	EA	$ 1,500	$ 145,500	Cost based on past project experience. Trees (4 per parcel) and shrubs to be replaced only where they previously existed and only if damaged. Inventory will be taken before clearing and grubbing.
Tree/Shrub Replacement	97	EA	$ 4,000	$ 388,000	
Property Operation & Maintenance (watering)	97	EA	$ 1,500	$ 145,500	Watering services to be provided for up to 4 weeks. Unit cost based on past project experience.
Property Restoration (non-vegetation)	97	EA	$ 1,500	$ 145,500	Cost based on past project experience. Removal of temporary construction features (i.e., fencing) and replacement of other landscape features if required.
Soil Excavation Using Hand Tools	4,469	CY	$ 100	$ 446,860	Time & Expense use of hand tools to excavate around sensitive features and structures. Unti based on 10% of soil excavation total.
Truck Mounted Soil Vacuum Excavator	18	MO	$ 10,000	$ 180,000	Cost based for specialized equipment used on past project experience for non-destructive excavation near sensitive areas.
Road Restoration	10	Per Mile	$ 2,000	$ 19,400	Unit cost based on past project experience and includes patching, filling potholes, and overlays to add new layer of asphalt where damaged due to excavation equipment accessing each property. Assume 10% of parcels will require road restorations.
Post-Construction Property Survey	97	EA	$ 1,500	$ 145,500	Unit cost based on past project experience and includes profession survey of each parcel.

TABLE D-1. COST ESTIMATE
ALTERNATIVE 3 - LUCs AND EXCAVATION UP TO 2-FEET BGS, INSTALLATION OF GEOTEXTILE/MARKER FABRIC, OFFSITE DISPOSAL, BACKFILL, AND SITE RESTORATION

Demobilization	1	LS	$ 50,000	$ 50,000	See mobilization for details.
LUC Implementation including Site Information Database Setup	97	EA (Parcel)	$ 900	$ 87,300	LUC implementation (development, production, distribution of educaitonal materials) (two personnel, 2 hours per parcel) and database setup (1 person, 1 hour per parcel) based on past project experience.
Item	**Quantity**	**Unit**	**Unit Cost**	**Cost**	**Comments**
Post-Construction Review	97	EA	$ 750	$ 72,750	Property walk (two personnel, 2 hours per parcel). Two assessment trips.
Remedial Action Completion Report	1	EA	$ 100,000	$ 100,000	Unit cost based on past project experience.
			Site Remediation Subtotal:	**$ 13,023,000**	
Associated Planning and Construction					
Engineering and remedial	8%	%	$ 13,023,000	$ 1,041,840	% of construction / capital costs (USEPA 2000)
Project Management	8%	%	$ 13,023,000	$ 1,041,840	
Oversight/Construction	10%	%	$ 13,023,000	$ 1,302,300	
Contingency	30%	%	$ 13,023,000	$ 3,906,900	
			Associated Planning and Construction Subtotal:	**$ 7,293,000**	
			Capital Costs:	**$ 20,316,000**	
Bonding	1	EA	$ 152,370.00	$ 152,370.00	Bonding fee of 0.75% of capital costs.
			Total Capital Costs:	**$ 20,468,370**	
PERIODIC COSTS					
Land Use Controls Implementation for 30 Years					
LUCIP Update	1	EA	$ 35,000	$ 35,000	Unit cost based on past project experience (e.g., number of parcels requiring site visits, review of regulations and other interviews, reports at end of year 5, year 10, year 15 year 20, year 25, and year 30, meetings, and updates). LUC updates including annual LUC compliance inquiry/survey, periodic property reviews, updates to the database of sites requiring LUCs, execution of the LUCIP if any of the parcels are transferred, and periodic updates to the LUCIP. Includes 3% per year escalation fee.
LUCIP Update (Second 5-Year)	1	EA	$ 40,250	$ 40,250	
LUCIP Update (Third 5-Year)	1	EA	$ 46,288	$ 46,288	
LUCIP Update (Fourth 5-Year)	1	EA	$ 53,231	$ 53,231	
LUCIP Update (Fifth 5-Year)	1	EA	$ 61,215	$ 61,215	
LUCIP Update (Sixth 5-Year)	1	EA	$ 70,398	$ 70,398	
			Total Periodic Costs for LUC Implentation Plan Updates for 30 Years:	**$ 306,381**	
Item	**Quantity**	**Unit**	**Unit Cost**	**Cost**	**Comments**
Five Year Reviews for 30 Years					
First 5-Year Review	1	EA	$ 35,000	$ 35,000	Unit cost based on past project experience (e.g., number of parcels requiring site visits, review of regulations and other interviews, reports at end of year 5, year 10, year 15 year 20, year 25, and year 30, meetings, and updates). Five-year reviews needed for parcels where access agreements could not be obtained for remediation and those parcels with skeet and/or soil with COCs exceeding the RGs are left in place. Includes 3% per year escalation fee.
Second 5-Year Review	1	EA	$ 40,250	$ 40,250	
Third 5-Year Review	1	EA	$ 46,288	$ 46,288	
Fourth 5-Year Review	1	EA	$ 53,231	$ 53,231	
Fifth 5-Year Review	1	EA	$ 61,215	$ 61,215	
Sixth 5-Year Review	1	EA	$ 70,398	$ 70,398	
			Total Periodic Costs for Five Year Reviews for 30 Years:	**$ 306,381**	

TABLE D-1. COST ESTIMATE
ALTERNATIVE 3 - LUCs AND EXCAVATION UP TO 2-FEET BGS, INSTALLATION OF GEOTEXTILE/MARKER FABRIC, OFFSITE DISPOSAL, BACKFILL, AND SITE RESTORATION

PRESENT VALUE ANALYSIS				
Year	**Cost Type**	**Cost**	**Present Value**	**Comments**
0	Capital Cost	$ 20,468,370	$ 20,468,370	
5	LUCIP Update	$ 35,000	$ 31,238	
10		$ 40,250	$ 32,063	
15		$ 46,288	$ 32,910	
20		$ 53,231	$ 33,779	
25		$ 61,215	$ 34,671	Unit cost based on past project experience (e.g., number of parcels requiring site visits, review of regulations and other interviews, reports, and meetings).
30		$ 70,398	$ 35,587	
5	5-Year Review	$ 35,000	$ 31,238	
10		$ 40,250	$ 32,063	
15		$ 46,288	$ 32,910	
20		$ 53,231	$ 33,779	
25		$ 61,215	$ 34,671	
30		$ 70,398	$ 35,587	
		Total Present Value:	**$ 20,869,000**	

Notes:

1. Assumptions associated with this cost estimate are documented in the subject Appendix A.

CY - cubic yard
EA - each
LS - lumpsum
LUC - land use control
MO - month
LUCIP - Land Use Control Implementation Plan
APP - Accident Prevention Plan
QAPP - Quality Assurance Project Plan
SSHP - Site Safety and Health Plan
TN - tons
ISM - incremental sampling methodology

Total Cost is the sum of both total fixed (non-variable) costs and variable costs incurred for the estimated timeframe for which the specified remedial action alternative is assumed to take place. Present Value is a single number; the amount needed to be set aside at the initial point in time (base year) to assure that funds will be available in the future as they are needed, assuming certain economic conditions (USEPA, 2000). Following estimation of costs for each remedial action alternative, a present value analysis allows for cost comparisons of different remedial actions on the basis of a single cost figure for each alternative. The present value of future payments will be calculated using the following formula:

Where:

PV = present value
x_t = payment in year t (t = 0 for base year)
i = discount rate

$$PV = \frac{x_t}{(1+i)^t}$$

Department of the Army. 2000. Field Manual No. 5-434, Earthmoving Operations. Headquarters, Washington, DC. June.

Office of Management and Budget (OMB). 2024. 2025 Discount Rates for OMB Circular No. A 94. Circular A-94. November.

USEPA. 2000. A Guide to Developing and Documenting Cost Estimates During the Feasibility Study. OSWER Directive 9355.0-75. Washington D.C. July.

USGSA. 2025. FY 2025 Per Diem Rates for Kingman, Arizona https://www.gsa.gov/travel/plan-book/per-diem-rates/per-diem-rates-results?action=perdiems_report&fiscal_year=2025&state=AZ&city=kingman&zip=

TABLE D-2. PARCEL DETAILS
ALTERNATIVE 3 - LUCs AND EXCAVATION UP TO 2-FEET BGS, INSTALLATION OF GEOTEXTILE/MARKER FABRIC, OFFSITE DISPOSAL, BACKFILL, AND SITE RESTORATION

APN or Subdivided APN	Address	Skeet Observed?	Incremental Lifetime Cancer Risk	Maximum Depth of Skeet and/or PAHs Exceedance (feet bgs)	Proposed Depth of Remediation (feet bgs)	Area (square feet)	Volume (cubic yards)	Vacant/ Undeveloped/ Easement
32404211D*	3880 E. Devlin Ave.	Yes	$>10^{-6}$	0.2	1.0	6,500	240	Vacant
32404211E*	3880 E. Devlin Ave.	No	$>10^{-6}$	0.2	1.0	5,100	190	
32404237A (E)*	3870 E. Devlin Ave.	Yes	$>10^{-6}$	1	2.0	10,500	780	
32404237A(W)*				4				
32404277A**	3825 E. Shaeffer Ave.	No	$>10^{-6}$	0.2	1.0	14,100	520	
32404282A(E)*	3871 E. Shaeffer Ave.	No	$> 10^{-6}$	0.2	1.0	2,800	100	
32404282A(W)*		Yes				2,800	100	
32404484*	3860 E. Hearne Ave.	Yes	$>10^{-6}$	1	1.0	4,800	180	
32404485*	3854 E. Hearne Ave.	No	$>10^{-6}$	1	1.0	5,600	210	
32404486*	3850 E. Hearne Ave.	No	$>10^{-6}$	1	1.0	5,600	210	
32404487**	3846 E. Hearne Ave.	No	$>10^{-6}$	0.2	1.0	5,600	210	
32404526**	3845 E. Devlin Ave.	Yes	$>10^{-6}$	1	1.0	5,600	210	Vacant
32404527**	3849 E. Devlin Ave.	Yes	$>10^{-6}$	1	1.0	5,600	210	Vacant
32404550**	3960 E. Hearne Ave.	Yes	$>10^{-6}$	1	1.0	6,400	240	
32404556A**	3922 E. Hearne Ave.	No	$>10^{-6}$	0.2	1.0	9,900	370	
32404558***	3920 E. Hearne Ave.	No	$>10^{-6}$	0.2	1.0	5,597	210	
32404561C*	3890 E. Hearne Ave.	No	$>10^{-6}$	2	2.0	4,100	300	
32404570*	3883 E. Devlin Ave.	Yes	$>10^{-6}$	0.2	1.0	4,800	180	
32404578**	3925 E. Devlin Ave.	No	$>10^{-6}$	0.2	1.0	4,900	180	
32404582**	3945 E. Devlin Ave.	Yes	$>10^{-6}$	1	1.0	5,600	210	
32404638**	3920 E. Ryan Ave.	Yes	$>10^{-6}$	0.2	1.0	5,200	190	Vacant
32404639*/**	3916 E. Ryan Ave.	Yes	$>10^{-6}$	0.2	1.0	5,600	210	Vacant
32404640*/**	3910 E. Ryan Ave.	Yes	$>10^{-6}$	2	2.0	5,600	410	Vacant
32404653*	3899 E. Hearne Ave.	Yes	$>10^{-6}$	1	1.0	4,300	160	Vacant
32404655A (E)*	3905 E. Hearne Ave.	Yes	$>10^{-6}$	0.2	1.0	4,950	180	
32404655A (W)*		Yes	$>10^{-6}$	1		4,950	180	
32404656**	3915 E. Hearne Ave.	No	$>10^{-6}$	0.2	1.0	4,300	160	Vacant
32404663A***	3945 E. Hearne Ave.	No	$>10^{-6}$	0.2	1.0	11,182	410	
32404666**	3971 E. Hearne Ave.	Yes	$>10^{-6}$	0.2	1.0	6,300	230	
32404686*	3870 E. Ryan Ave.	No	$>10^{-6}$	0.2	1.0	6,500	240	Vacant
32404687*	3866 E. Ryan Ave.	No	$>10^{-6}$	0.2	1.0	5,600	210	Vacant
32404688**	3860 E. Ryan Ave.	Yes	$>10^{-6}$	1	1.0	5,600	210	Vacant
32405150*	3871 E. Ryan Ave.	No	$>10^{-6}$	0.2	1.0	5,800	210	
32405172**	3990 Lum Ave.	Yes	$>10^{-6}$	1	1.0	6,500	240	

TABLE D-2. PARCEL DETAILS
ALTERNATIVE 3 - LUCs AND EXCAVATION UP TO 2-FEET BGS, INSTALLATION OF GEOTEXTILE/MARKER FABRIC, OFFSITE DISPOSAL, BACKFILL, AND SITE RESTORATION

APN or Subdivided APN	Address	Skeet Observed?	Incremental Lifetime Cancer Risk	Maximum Depth of Skeet and/or PAHs Exceedance (feet bgs)	Proposed Depth of Remediation (feet bgs)	Area (square feet)	Volume (cubic yards)	Vacant/ Undeveloped/ Easement
32405176*	3966 E. Lum Ave.	Yes	$>10^{-6}$	0.2	1.0	4,500	170	
32405178**	3956 E. Lum Ave.	Yes	$>10^{-6}$	0.2	1.0	5,500	200	
32405182*	3936 E. Lum Ave.	No	$>10^{-6}$	1	1.0	4,700	170	
32405194B(C)*	3876 E. Lum Ave.	Yes	$>10^{-6}$	0.2	1.0	16,200	600	
32405194B(E)*								
32405194B(W)*								
32405205A(E)*	3925 E. Ryan Ave.	No	$>10^{-6}$	1	1.0	7,300	270	
32405205A(W)*								
32405206A**	E. Ryan Ave.	Yes	$>10^{-6}$	1	1.0	2,800	100	Vacant
32405265***	4008 E. Thompson Ave.	No	$>10^{-6}$	0.2	1.0	5,920	220	
32405270*	3980 E. Thompson Ave.	No	$>10^{-6}$	0.2	1.0	7,800	290	
32405272A(E)*	3970 E. Thompson Ave.	No	$>10^{-6}$	0.2	1.0	5,700	210	Vacant
32405274*	3960 E. Thompson Ave.	No	$>10^{-6}$	1	1.0	5,100	190	
32405276A(E)*	3950 E. Thompson Ave.	Yes	$>10^{-6}$	1	2.0	5,350	400	
32405276A(W)*		Yes	$>10^{-6}$	2		5,350	400	
32405287*	3896 E. Thompson Ave.	No	$>10^{-6}$	0.2	1.0	5,500	200	
32405295*	3887 E. Lum Ave.	Yes	$>10^{-6}$	0.2	1.0	4,900	180	
32405296*	3895 E. Lum Ave.	Yes	$>10^{-6}$	1	1.0	5,500	200	Vacant
32405297*	3899 E. Lum Ave.	Yes	$>10^{-6}$	1	1.0	5,600	210	Vacant
32405306*	3945 E. Lum Ave.	No	$>10^{-6}$	1	1.0	4,300	160	
32405308A(W)*	3955 E. Lum Ave	Yes	$>10^{-6}$	1	1.0	5,250	190	
32405309*	3959 E. Lum Ave.	No	$> 10^{-6}$	0.167	1.0	4,700	170	
32436008**	3930 E. Lass Ave.	Yes	$>10^{-6}$	1	1.0	4,800	180	
32436011**	3942 E. Lass Ave.	Yes	$>10^{-6}$	0.167	1.0	4,800	180	
32436012**	3946 E. Lass Ave.	Yes	$>10^{-6}$	2	2.0	4,800	360	
32436014**	3954 E. Lass Ave.	Yes	$>10^{-6}$	1	1.0	4,800	180	
32436015**	3958 E. Lass Ave.	Yes	$>10^{-6}$	4	2.0	4,800	360	
32436017***	3966 E. Lass Ave.	Yes	$>10^{-6}$	3	2.0	6,458	480	
32436019**	3974 E. Lass Ave.	Yes	$>10^{-6}$	3	2.0	5,200	390	
32436020**	3978 E. Lass Ave.	Yes	$>10^{-6}$	2	2.0	5,600	410	
32436022*	3975 E. Lass Ave.	No	$>10^{-6}$	1	1.0	4,900	180	
32439003*	3974 E. Snavely Ave.	No	$>10^{-6}$	0.167	1.0	5,700	210	
32439004*	3970 E. Snavely Ave.	No	$>10^{-6}$	1	1.0	5,600	210	
32439005*	3962 E. Snavely Way	No	$>10^{-6}$	1	1.0	7,200	270	

TABLE D-2. PARCEL DETAILS
ALTERNATIVE 3 - LUCs AND EXCAVATION UP TO 2-FEET BGS, INSTALLATION OF GEOTEXTILE/MARKER FABRIC, OFFSITE DISPOSAL, BACKFILL, AND SITE RESTORATION

APN or Subdivided APN	Address	Skeet Observed?	Incremental Lifetime Cancer Risk	Maximum Depth of Skeet and/or PAHs Exceedance (feet bgs)	Proposed Depth of Remediation (feet bgs)	Area (square feet)	Volume (cubic yards)	Vacant/ Undeveloped/ Easement
32439006*	3960 E. Snavely Way	Yes	$>10^{-6}$	2	2.0	7,700	570	
32439007*	3958 E. Snavely Way	No	$>10^{-6}$	2	2.0	11,300	840	
32439013*	3940 E. Snavely Cir.	No	$>10^{-6}$	2	2.0	8,400	620	
32439014*	3936 E. Snavely Cir.	Yes	$>10^{-6}$	1	1.0	6,400	240	
32439015*	3930 E. Snavely Plz	Yes	$>10^{-6}$	1	1.0	6,600	240	
32439016*	3928 E. Snavely Plz	Yes	$>10^{-6}$	1	1.0	8,800	330	
32439017*	3926 E. Snavely Plz	No	$>10^{-6}$	2	2.0	9,500	700	
32439026*	3975 E. Snavely Ave.	No	$>10^{-6}$	2	2.0	4,300	320	
32439031**	3955 E. Snavely Ave.	Yes	$>10^{-6}$	5	2.0	4,900	360	
32439032*	3951 E. Snavely Ave.	Yes	$>10^{-6}$	2	2.0	5,000	370	
32439033*	3947 E. Snavely Ave.	No	$>10^{-6}$	2	2.0	4,300	320	
32439035*	3939 E. Snavely Ave.	No	$>10^{-6}$	1	1.0	5,200	190	
32439036**	3935 E. Snavely Ave.	Yes	$>10^{-6}$	2	2.0	5,100	380	
32439037**	3931 E. Snavely Ave.	Yes	$>10^{-6}$	2	2.0	5,100	380	
Thompson Easement E***		No	$>10^{-6}$	0.167	1.0	4,086	150	Easement
Thompson Easement F***		No	$>10^{-6}$	0.167	1.0	4,440	160	Easement
Thompson Easement G***		Yes	$>10^{-6}$	0.167	1.0	4,448	160	Easement
Thompson Easement H***		Yes	$>10^{-6}$	0.167	1.0	4,435	160	Easement
Thompson Easement I***		Yes	$>10^{-6}$	0.167	1.0	4,361	160	Easement
Thompson Easement J***		Yes	$>10^{-6}$	3	2.0	4,404	330	Easement
Thompson Easement K***		Yes	$>10^{-6}$	5	2.0	4,273	320	Easement
Thompson Easement L***		Yes	$>10^{-6}$	3	2.0	4,151	310	Easement
Thompson Easement M***		Yes	$>10^{-6}$	2	2.0	4,162	310	Easement
Thompson Easement N***		Yes	$>10^{-6}$	1	1.0	4,177	150	Easement
Thompson Easement O***		Yes	$>10^{-6}$	0.167	1.0	4,328	160	Easement
Thompson Easement P***		Yes	$>10^{-6}$	0.167	1.0	4,164	150	Easement
Thompson Easement Q***		Yes	$>10^{-6}$	0.167	1.0	4,164	150	Easement
32404109****	3835 E. John L Ave.	No	$>10^{-6}$	0.167	1.0	6,106	230	Vacant
32404637A****	3924 E. Ryan Ave.	Yes; surface	$>10^{-6}$	2	2.0	10,560	780	
32404657****	3919 E. Hearne Ave.	No	$>10^{-6}$	2	2.0	5,938	440	
32405171****	3996 E. Lum Ave.	Yes; surface and subsurface	$>10^{-6}$	2	2.0	7,320	540	
32405196A****	3875 E. Ryan Ave.	Yes; surface	$>10^{-6}$	2	2.0	11,916	880	

TABLE D-2. PARCEL DETAILS
ALTERNATIVE 3 - LUCs AND EXCAVATION UP TO 2-FEET BGS, INSTALLATION OF GEOTEXTILE/MARKER FABRIC, OFFSITE DISPOSAL, BACKFILL, AND SITE RESTORATION

APN or Subdivided APN	Address	Skeet Observed?	Incremental Lifetime Cancer Risk	Maximum Depth of Skeet and/or PAHs Exceedance (feet bgs)	Proposed Depth of Remediation (feet bgs)	Area (square feet)	Volume (cubic yards)	Vacant/ Undeveloped/ Easement
32405197****	3883 E. Ryan Ave.	Yes; surface and subsurface	$>10^{-6}$	2	2.0	5,376	400	
32405207****	3935 E. Ryan Ave.	No	$>10^{-6}$	0.167	1.0	5,522	200	
32439001****	-- E. Thompson Ave.	Yes; surface and subsurface	$>10^{-6}$	2	2.0	19,304	1430	Vacant
32439040****	3919 E. Snavely Ave.	No	$>10^{-6}$	2	2.0	7,105	530	
					Totals:	**602,247**	**29,990**	**30**

Area of parcels with max depth of sheet/PAH >2 ft bgs: 44,686

Notes:
* RI (December 2014 - February 2017)
** RI (January 2019 - October 2019)
*** RI Addendum (January 2020 - April 2021)
**** RI Addendum (January 2022 - July 2022)

Abbreviations:
APN - Assessor's Parcel Number
bgs - below ground surface
(E) - east section of subdivided parcel
(C) - center section of subdivided parcel
PAH - polycyclic aromatic hydrocarbon
RI - Remedial Investigation
(W) - west section of subdivided parcel

No. Excavations to 1 ft bgs:	**67**
No. Excavations to 2 ft bgs:	**30**
No. of APNs:	**97**

Alternative 4 – LUCs and Excavation up to 4-feet bgs, Installation of Geotextile and Marker Fabric, Off-site Disposal, Backfill, and Site Restoration

Assumptions associated with the cost estimate for Alternative 4 are listed below. The cost estimate is provided in Table D-3.

1. Parcel Area and Excavation Depth Assumptions

Remediation via excavation will take place at 97 parcels/sub-parcels/rights-of-way with an ILCR above 10^{-6} (Figure 3-3). Parcel areas used in the cost estimate are listed in Table D-4. These areas are approximate and may vary in the field. Parcel areas do not include areas of impervious surfaces such as built-up areas. Excavation will not be performed under impervious surfaces.

Additionally, consistent with the NCP, LUCs supplementing soil removal to 2-foot bgs depth would be used to prevent or limit exposure to PAHs in subsurface soils at approximately 89 parcels. LUCs would also be required where property owners deny access. For the purpose of cost estimation, assume access is granted for all 97 parcels/sub-parcels/rights-of-way.

Assumed excavation depths are (see Attachment Table D-4):

- An excavation depth of 1-foot bgs is assumed at 67 parcels/sub-parcels/rights-of-way
- An excavation depth of 2-feet bgs is assumed at 22 parcels/sub-parcels/rights-of-way
- An excavation depth of 3-feet bgs is assumed at 4 parcels/sub-parcels/rights-of-way
- An excavation depth of 4-feet bgs is assumed at 4 parcels/sub-parcels/rights-of-way

2. General Assumptions

i. Property Requirement to include:
   - Access Agreements – Assume two hours per parcel to obtain access agreements (includes no-shows, repeat visits, scheduling meetings). Assume three attempts for each property.
   - Community Involvement – Community outreach/communication via newspaper, television, and fact sheets. Two public meetings. Meeting costs include facility rental, materials printing, transcription, and travel costs.
   - Property assessments to thoroughly locate, document, and inventory site features (i.e., large objects, fencing, trees, landscaping type, etc.), utilities, septic tanks/leach field, document conditions, and create parcel-specific plans, including set-back plans.

ii. Site Specific Project Plans to include, but not limited to:
   - Quality Assurance Project Plan (QAPP) which will include an Accident Prevention Plan (APP) and Site Safety & Health Plan (SSHP)
   - Work Plans
   - Transportation and Disposal Plan
   - Storm Water Pollution Prevention Plan (SWPPP)
   - Environmental Control Plan (ECP)

- Spill Prevention, Control and Countermeasures (SPCC) Plan
- Land Use Control Implementation Plan (LUCIP)

iii. Remediation fieldwork of 97 parcels/sub-parcels/rights-of-way to take approximately 20 months. Assume access is granted for all 97 parcels/sub-parcels/rights-of-way.

iv. Thirty (30) parcels/sub-parcels/rights-of-way assumed vacant, with 67 occupied rights-of-way.

vii. LUCs to be implemented at approximately 89 parcels/sub-parcels/rights-of-way. Assumptions include:

- Setup of a Site Information Database (list of property owners and properties requiring LUCs). Assume one (1) hour per parcel with one (1) personnel.
- Development, production, and distribution of educational materials. Assume two (2) hours per parcel with two (2) personnel.
- LUC Completion Report

v. Design, project management, construction oversight costs, and contingencies are estimated based on USEPA 540-R-00-002 A Guide to Developing and Documenting Cost Estimates During the Feasibility Study. Estimate contingency includes 10% scope + 15% Bid = 25%.

3. Property Owner Relocation

Lodging and per diem for 65 parcels, assuming two rooms for 30 days per parcel and four people for 30 days. Providing a hospitality area for use by nearby residents to avoid noise and other disturbances for 180 days.

4. Site Preparation

Mobile office trailer rental with generator and temporary utilities (i.e., water, internet, etc.) required to facilitate site remediation. Office trailer will be located at USACE approved properties in or near the neighborhood, following individual owner acceptance. Cost includes estimated rent for the property and labor to handle lease.

Private utility location to be conducted at each parcels/sub-parcels/rights-of-way. Cost includes labor to submit utility location tickets to Arizona 811 and coordination with utility providers.

Staging Area includes storage, staging, and laydown areas that will be located at USACE approved properties in or near the neighborhood, following individual owner acceptance. Cost includes estimated rent for the property and labor to handle lease. The areas will be secured with a minimum 6 feet standard temporary security fence and appropriate signage.

Erosion controls (i.e., silt fence, waddle, etc.) to be implemented at each parcels/sub-parcels/rights-of-way.

Debris and large object removal, movement of non-permanent property (e.g., swing sets, aboveground pools, and other miscellaneous items) are the responsibility of the property owner. Storage container rental with lock to be placed in driveway for miscellaneous yard items.

Site clearing and grubbing includes removal of vegetation only (small trees and brush); removal or grinding of stumps and roots; and felling and removal of dead trees, partially dead trees and limbs, and trees and limbs that are a safety hazard to workers.

Preparation and implementation of parcel-specific traffic control plans for each parcel is assumed.

5. Excavation and Disposal

Assume bonding fee of 0.75% of capital costs is required.

Soil excavation may require hand excavation and double handling of material. Excavated material will be direct loaded into the trucks. Assume excavated material transportation and disposal as special waste as in case of the previous TCRA. Assume up to 10% additional cubic yards to be excavated if initial confirmation samples do not meet PRGs.

Assume up to four trees per parcel will be removed (average 12 to 18 inches in diameter) during excavation.

Assume use of a truck mounted soil vacuum excavator to remove soil near sensitive features such as vegetation and building foundations.

6. Sampling/Monitoring Requirements

Air monitoring to be conducted during excavation to include Method TO-13A usings sorbents such as Tenax®, XAD-2® and polyurethane foam (PUF), as well as active photoionization detector (PID) monitoring to detect the presence of PAHs in real-time.

Waste characterization sampling for disposal includes one (1) toxic characteristic leaching procedure (TCLP) sample per 250 cubic yards of material to be disposed. Sampling frequency for clean backfill (which will be procured from a vendor as certified clean of contaminants) includes one sample per 2,500 cubic yards of imported material to verify clean.

One confirmation sample per parcel, with 5% duplicate samples, is assumed. Samples will be collected using incremental sampling methods and will be analyzed for PAHs and metals. All confirmation sample results will be subject to data validation.

7. Site Restoration

Backfill production includes place/spread/compact/grade, setup at each property, and relocate to the next. Backfill includes clean fill and 4 inches of topsoil. Geotechnical compaction testing to be performed at each parcel excavated to 2-feet bgs or greater. Assume one test per parcel per 1 foot lift.

A permeable geotextile barrier would be placed at the bottom of excavations where soils with skeet and/or COCs exceeding the preliminary remedial goals (PRGs) are left in place to demark where deeper soils remain with possible PAHs concentrations above risk-based limits and to help discourage direct human contact and exposure to COCs at depth. Assume two parcels. Assume MIRAFI HP570 (https://www.solmax.com/us/en/resources/mirafi-hp570-tds) geotextile.

Placement of gravel/decorative rock is assumed to expedite restoration and minimize operation and maintenance (O&M) costs. Trees (up to four trees per parcel) and shrubs will be replaced in

lots only where they previously existed. Inventory will be taken before site clearing and grubbing. Following site restoration, watering services will be provided for up to four weeks.

Property restoration to include removal of temporary construction features (i.e., fencing), and repair or replacement of fencing, sidewalks, and utilities if damaged during the Remedial Action. Restoration of damaged underground utilities, to meet current code, is assumed.

Post-construction property survey to be completed to document the extent of the Remedial Action (i.e., area of excavation) and assure restoration is completed to the appropriate grade and to restore the property to its original conditions. Assume profession survey of each parcel.

8. Post Construction

Post-construction review to document condition of properties after remedial post-construction activities and ensure site restoration is complete. Assume two personnel, two hours per parcel with two assessment trips.

Remedial Action Completion Report to document remediation and LUC installation at each parcel, including summary of parcel-specific remedial activities, documentation of parcel-specific pre- and post-conditions, sample data, and description of post-remedial action conditions (i.e., risk reduction). Assume one report.

10. Periodic Costs

Periodic costs include LUCIP updates and Five-Year Reviews. Assume 3% escalation fee per year (i.e., 15% every five years). Cost of annual LUC compliance inquiry/survey, to be mailed to all property owners and identified tenants in the project area to provide for reporting new observations of skeet fragments in accessible areas to ADEQ and USACE, assumed in LUCIP update costs.

TABLE D-3. COST ESTIMATE
ALTERNATIVE 4 - LUCs AND EXCAVATION UP TO 4-FEET BGS, INSTALLATION OF GEOTEXTILE/MARKER FABRIC, OFFSITE DISPOSAL, BACKFILL, AND SITE RESTORATION

Item	Quantity	Unit	Unit Cost	Cost	Comments
CAPITAL COSTS					
Property Requirements					
Access Agreements	97	EA (Parcel)	$ 500	$ 48,500	2 hours per property with three attempts per parcel.
Community Involvement	1	LS	$ 50,000	$ 50,000	Unit cost based on past project experience. Outreach via newspaper, television, and fact sheets, and two public meetings. Meeting costs include facility rental, materials printing, transcription, and travel costs.
Property Assessment					
Site Assessment Recon	97	EA	$ 200	$ 19,400	Unit costs based on past project experience of site assessment recon, property walk, pre-remediation site survey, site inventory list, private utility locate, septic and leacahte field locate, site plan, set-back plan, additional community outreach, and GPS rental.
Pre-Construction Property Assessment	97	EA	$ 800	$ 77,600	
Pre-Construction Site Survey	97	EA	$ 1,500	$ 145,500	
Site Inventory List	97	EA	$ 400	$ 38,800	
Site Plan	97	EA	$ 1,000	$ 97,000	
Private Utility Locate	97	EA	$ 600	$ 58,200	
Septic & Leachate Locate	97	EA	$ 200	$ 19,400	
Additional Community Outreach	1	LS	$ 37,500	$ 37,500	
GPS Rental	2	Month	$ 200	$ 400	
Property Owner Relocation Costs					
Lodging (2 rooms for 30 days per occupied parcel)	4,020	Day	$ 110	$ 442,200	2025 GSA Lodging and Per Diem Rates for Mohave County, Arizona (USGSA 2025). 67 occupied parcels.
Per Diem (4 people for 30 days per occupied parcel)	8,040	Day	$ 68	$ 546,720	
Hospitality area (hotel conference room)	180	Day	$ 200	$ 36,000	Unit cost based on estimates from Kingman, AZ hotels.
Site Specific Project Plans					
Work Plan	1	LS	$ 100,000	$ 100,000	Unit cost based on past project experience of Quality Assurance Project Plan (QAPP)/Work Plan (including APP and SSHP) and LUCIP development and other items such as Transportation and Disposal Plan, Storm Water Pollution Prevention Plan (SWPPP), Environmental Control Plan (ECP), and Spill Prevention, Control and Countermeasures (SPCC) Plan.
LUCIP	1	LS	$ 50,000	$ 50,000	
Site Prepration					
Mobilization	1	LS	$ 50,000	$ 50,000	Unit cost based on past project experience. Mobilization of all equipment and materials (i.e., excavators, loaders, generators, water, temporary trailers, temporary utility items, signs, backfill material, sod, trees, shrubs, etc.).
Traffic Control	97	EA	$ 5,000	$ 485,000	Unit cost based on past project experience. Includes development and implementation of a parcel-specific traffic control plan.
Office Trailer w/generator	20	MO	$ 6,000	$ 120,000	Unit cost based on past project experience of fencing, signage, trailer, generator, water, internet, construction equipment, storage container rental and
Temporary Utilities	20	MO	$ 3,000	$ 60,000	
Private Utility Locates	97	EA	$ 600	$ 58,200	
Staging Area	20	MO	$ 5,000	$ 100,000	

TABLE D-3. COST ESTIMATE
ALTERNATIVE 4 - LUCs AND EXCAVATION UP TO 4-FEET BGS, INSTALLATION OF GEOTEXTILE/MARKER FABRIC, OFFSITE DISPOSAL, BACKFILL, AND SITE RESTORATION

Erosion Controls	97	EA	$ 600	$ 58,200	materials, rental for onsite storage container to be placed in driveway for miscellaneous yard item storage, etc.
Storage Container Rental	20	MO	$ 900	$ 18,000	
Site Clearing	97	EA	$ 1,000	$ 97,000	
Item	**Quantity**	**Unit**	**Unit Cost**	**Cost**	**Comments**
Excavation and Restoration					
Soil Excavation	32,540	CY	$ 32	$ 1,041,280	Unit cost based on past project experience.
Air Monitoring	97	EA	$ 600	$ 58,200	Monitoring via Method TO-13A using sorbents such as Tenax®, XAD-2® and polyurethane foam; one sample per parcel. Active PID monitoring.
Lab Analysis for Disposal	130	EA	$ 500	$ 65,080	1 sample per 250 cubic yards. Unit cost based on past project experience.
Confirmation sampling - ISM Sample Compositing	102	EA	$ 250	$ 25,463	1 confirmation sample per parcel, plus 5 duplicate samples added for every 20 samples analyzed. Unit cost based on past project experience.
Confirmation sampling - Laboratory Analysis	102	EA	$ 135	$ 13,750	
Transportation & Disposal Soil	54,700	TN	$ 100	$ 5,470,000	Due to assumed 20% volumetric increase (Department of Army 2000), additional hauling will be required.
General Fill	44,000	TN	$ 35	$ 1,540,000	
Geotechnical Testing	74	EA	$ 1,000	$ 74,000	Compacting testing for all parcels excavated to 2-ft bgs or greater. One test per parcel per 1 foot lift.
Geotextile Fabric	9,173	SF	$ 2.50	$ 22,933	https://www.solmax.com/us/en/resources/mirafi-hp570-tds.
Topsoil Placement	10,700	TN	$ 55	$ 588,500	4 inches thick top soil per parcel. Unit cost based on past project experience.
Lab Analysis for Fill	13	EA	$ 500	$ 6,508	1 sample per 2,500 cubic yards.
Landscaping - Gravel/ Decorative Rock Installation	97	EA	$ 1,500	$ 145,500	Cost based on past project experience. Trees (4 per parcel) and shrubs to be replaced only where they previously existed and only if damaged. Inventory will be taken before clearing and grubbing.
Tree/Shrub Replacement	97	EA	$ 4,000	$ 388,000	
Property Operation & Maintenance (watering)	97	EA	$ 1,500	$ 145,500	Watering services to be provided for up to 4 weeks. Unit cost based on past project experience.
Property Restoration (non-vegetation)	97	EA	$ 1,500	$ 145,500	Cost based on past project experience. Removal of temporary construction features (i.e., fencing) and repair or replacement of other property features if required.
Soil Excavation Using Hand Tools	4,675	CY	$ 100	$ 467,500	Time & Expense use of hand tools to excavate around sensitive features and structures. Unti based on 10% of soil excavation total.
Truck Mounted Soil Vacuum Excavator	20	MO	$ 10,000	$ 200,000	Cost based for specialized equipment used on past project experience for non-destructive excavation near sensitive areas.

TABLE D-3. COST ESTIMATE
ALTERNATIVE 4 - LUCs AND EXCAVATION UP TO 4-FEET BGS, INSTALLATION OF GEOTEXTILE/MARKER FABRIC, OFFSITE DISPOSAL, BACKFILL, AND SITE RESTORATION

Road Restoration	10	Per Mile	$ 2,000	$ 19,400	Unit cost based on past project experience and includes patching, filling potholes, and overlays to add new layer of asphalt where damaged due to excavation equipment accessing each property. Assume 10% of parcels will require road restorations.

Item	Quantity	Unit	Unit Cost	Cost	Comments
Post-Construction Property Survey	97	EA	$ 1,500	$ 145,500	Unit cost based on past project experience and includes profession survey of each parcel.
Demobilization	1	LS	$ 50,000	$ 50,000	See mobilization for details.
LUC Implementation including Site Information Database Setup	97	EA (Parcel)	$ 900	$ 87,300	LUC implementation (two personnel, 2 hours per parcel, two installation trips) and database setup (1 person, 1 hour per parcel) based on past project experience.
Post-Construction Review	97	EA	$ 750	$ 72,750	Property walk (two personnel, 2 hours per parcel). Two assessment trips.
Remedial Action Completion Report	1	EA	$ 100,000	$ 100,000	Unit cost based on past project experience.
			Site Remediation Subtotal:	**$ 13,686,000**	
Associated Planning and Construction					
Engineering and Remedial	8%	%	$ 13,686,000	$ 1,094,880	% of construction / capital costs (USEPA 2000)
Project Management	8%	%	$ 13,686,000	$ 1,094,880	
Oversight/Construction	10%	%	$ 13,686,000	$ 1,368,600	
Contingency	30%	%	$ 13,686,000	$ 4,105,800	
			Associated Planning and Construction Subtotal:	**$ 7,664,000**	
			Capital Costs:	**$ 21,350,000**	
Bonding	1	EA	$ 160,125.00	$ 160,125.00	Bonding fee of 0.75% of capital costs.
			Total Capital Costs:	**$ 21,510,125**	
PERIODIC COSTS					
Land Use Controls Implementation for 30 Years					
LUCIP Update	1	EA	$ 35,000	$ 35,000	Unit cost based on past project experience (e.g., number of parcels requiring site visits, review of regulations and other interviews, reports at end of year 5, year 10, year 15 year 20, year 25, and year 30, meetings, and updates). LUC updates including annual LUC compliance inquiry/survey, periodic property reviews, updates to the database of sites requiring LUCs, execution of the LUCIP if any of the parcels are transferred, and periodic updates to the LUCIP. Includes 3% per year escalation fee.
LUCIP Update (Second 5-Year)	1	EA	$ 40,250	$ 40,250	
LUCIP Update (Third 5-Year)	1	EA	$ 46,288	$ 46,288	
LUCIP Update (Fourth 5-Year)	1	EA	$ 53,231	$ 53,231	
LUCIP Update (Fifth 5-Year)	1	EA	$ 61,215	$ 61,215	
LUCIP Update (Sixth 5-Year)	1	EA	$ 70,398	$ 70,398	
			Total Periodic Costs for LUC Implentation Plan Updates for 30 Years:	**$ 306,381**	
Item	**Quantity**	**Unit**	**Unit Cost**	**Cost**	**Comments**
Five Year Reviews for 30 Years					

TABLE D-3. COST ESTIMATE
ALTERNATIVE 4 - LUCs AND EXCAVATION UP TO 4-FEET BGS, INSTALLATION OF GEOTEXTILE/MARKER FABRIC, OFFSITE DISPOSAL, BACKFILL, AND SITE RESTORATION

First 5-Year Review	1	EA	$ 35,000	$ 35,000	Unit cost based on past project experience (e.g., number of parcels requiring site visits, review of regulations and other interviews, reports at end of year 5, year 10, year 15 year 20, year 25, and year 30, meetings, and updates). Five-year reviews needed for parcels where access agreements could not be obtained for remediation and those parcels with skeet and/or soil with COCs exceeding the RGs are left in place. Includes 3% per year escalation fee.
Second 5-Year Review	1	EA	$ 40,250	$ 40,250	
Third 5-Year Review	1	EA	$ 46,288	$ 46,288	
Fourth 5-Year Review	1	EA	$ 53,231	$ 53,231	
Fifth 5-Year Review	1	EA	$ 61,215	$ 61,215	
Sixth 5-Year Review	1	EA	$ 70,398	$ 70,398	
Total Periodic Costs for Five Year Reviews for 30 Years:				**$ 306,381**	
Year	**Cost Type**	**Cost**	**Present Value**		**Comments**
0	Capital Cost	$ 21,510,125	$ 21,510,125		Unit cost based on past project experience (e.g., number of parcels requiring site visits, review of regulations and other interviews, reports, and meetings).
5	LUCIP Update	$ 35,000	$ 31,238		
10		$ 40,250	$ 32,063		
15		$ 46,288	$ 32,910		
20		$ 53,231	$ 33,779		
25		$ 61,215	$ 34,671		
30		$ 70,398	$ 35,587		
5	5-Year Review	$ 35,000	$ 31,238		
10		$ 40,250	$ 32,063		
15		$ 46,288	$ 32,910		
20		$ 53,231	$ 33,779		
25		$ 61,215	$ 34,671		
30		$ 70,398	$ 35,587		
Total Present Value:			**$ 21,911,000**		

Notes:

1. Assumptions associated with this cost estimate are documented in the subject Appendix A.

CY - cubic yard
EA - each
LS - lumpsum
LUC - land use control
MO - month
LUCIP - Land Use Control Implementation Plan
APP - Accident Prevention Plan
QAPP - Quality Assurance Project Plan
SSHP - Site Safety and Health Plan
TN - tons
ISM - incremental sampling methodology

Total Cost is the sum of both total fixed (non-variable) costs and variable costs incurred for the estimated timeframe for which the specified remedial action alternative is assumed to take place. Present Value is a single number; the amount needed to be set aside at the initial point in time (base year) to assure that funds will be available in the future as they are needed, assuming certain economic conditions (USEPA, 2000). Following estimation of costs for each remedial action alternative, a present value analysis allows for cost comparisons of different remedial actions on the basis of a single cost figure for each alternative. The present value of future payments will be calculated using the following formula:

Where:

PV = present value
x_t = payment in year t (t = 0 for base year)
i = discount rate

$$PV = \frac{x_t}{(1+i)^t}$$

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TABLE D-4. PARCEL DETAILS
ALTERNATIVE 4 - LUCs AND EXCAVATION UP TO 4-FEET BGS, INSTALLATION OF GEOTEXTILE/MARKER FABRIC, OFFSITE DISPOSAL, BACKFILL, AND SITE RESTORATION

APN or Subdivided APN	Address	Skeet Observed?	Incremental Lifetime Cancer Risk	Maximum Depth of Skeet and/or PAHs Exceedance (feet bgs)	Proposed Depth of Remediation (feet bgs)	Area (square feet)	Volume (cubic yards)	Vacant/ Undeveloped/ Easement
32404211D*	3880 E. Devlin Ave.	Yes	$>10^{-6}$	0.2	1.0	6,500	240	Vacant
32404211E*	3880 E. Devlin Ave.	No	$>10^{-6}$	0.2	1.0	5,100	190	
32404237A (E)*	3870 E. Devlin Ave.	Yes	$>10^{-6}$	1	4.0	10,500	1560	
32404237A(W)*				4				
32404277A**	3825 E. Shaeffer Ave.	No	$>10^{-6}$	0.2	1.0	14,100	520	
32404282A(E)*	3871 E. Shaeffer Ave.	No	$> 10^{-6}$	0.2	1.0	2,800	100	
32404282A(W)*		Yes	$>10^{-6}$			2,800	100	
32404484*	3860 E. Hearne Ave.	Yes	$>10^{-6}$	1	1.0	4,800	180	
32404485*	3854 E. Hearne Ave.	No	$>10^{-6}$	1	1.0	5,600	210	
32404486*	3850 E. Hearne Ave.	No	$>10^{-6}$	1	1.0	5,600	210	
32404487**	3846 E. Hearne Ave.	No	$>10^{-6}$	0.2	1.0	5,600	210	
32404526**	3845 E. Devlin Ave.	Yes	$>10^{-6}$	1	1.0	5,600	210	Vacant
32404527**	3849 E. Devlin Ave.	Yes	$>10^{-6}$	1	1.0	5,600	210	Vacant
32404550**	3960 E. Hearne Ave.	Yes	$>10^{-6}$	1	1.0	6,400	240	
32404556A**	3922 E. Hearne Ave.	No	$>10^{-6}$	0.2	1.0	9,900	370	
32404558***	3920 E. Hearne Ave.	No	$>10^{-6}$	0.2	1.0	5,597	210	
32404561C*	3890 E. Hearne Ave.	No	$>10^{-6}$	2	2.0	4,100	300	
32404570*	3883 E. Devlin Ave.	Yes	$>10^{-6}$	0.2	1.0	4,800	180	
32404578**	3925 E. Devlin Ave.	No	$>10^{-6}$	0.2	1.0	4,900	180	
32404582**	3945 E. Devlin Ave.	Yes	$>10^{-6}$	1	1.0	5,600	210	
32404638**	3920 E. Ryan Ave.	Yes	$>10^{-6}$	0.2	1.0	5,200	190	Vacant
32404639*/**	3916 E. Ryan Ave.	Yes	$>10^{-6}$	0.2	1.0	5,600	210	Vacant
32404640*/**	3910 E. Ryan Ave.	Yes	$>10^{-6}$	2	2.0	5,600	410	Vacant
32404653*	3899 E. Hearne Ave.	Yes	$>10^{-6}$	1	1.0	4,300	160	Vacant
32404655A (E)*	3905 E. Hearne Ave.	Yes	$>10^{-6}$	0.2	1.0	4,950	180	
32404655A (W)*				1		4,950	180	
32404656**	3915 E. Hearne Ave.	No	$>10^{-6}$	0.2	1.0	4,300	160	Vacant
32404663A***	3945 E. Hearne Ave.	No	$>10^{-6}$	0.2	1.0	11,182	410	
32404666**	3971 E. Hearne Ave.	Yes	$>10^{-6}$	0.2	1.0	6,300	230	
32404686*	3870 E. Ryan Ave.	No	$>10^{-6}$	0.2	1.0	6,500	240	Vacant
32404687*	3866 E. Ryan Ave.	No	$>10^{-6}$	0.2	1.0	5,600	210	Vacant
32404688**	3860 E. Ryan Ave.	Yes	$>10^{-6}$	1	1.0	5,600	210	Vacant
32405150*	3871 E. Ryan Ave.	No	$>10^{-6}$	0.2	1.0	5,800	210	
32405172**	3990 Lum Ave.	Yes	$>10^{-6}$	1	1.0	6,500	240	

TABLE D-4. PARCEL DETAILS
ALTERNATIVE 4 - LUCs AND EXCAVATION UP TO 4-FEET BGS, INSTALLATION OF GEOTEXTILE/MARKER FABRIC, OFFSITE DISPOSAL, BACKFILL, AND SITE RESTORATION

APN or Subdivided APN	Address	Skeet Observed?	Incremental Lifetime Cancer Risk	Maximum Depth of Skeet and/or PAHs Exceedance (feet bgs)	Proposed Depth of Remediation (feet bgs)	Area (square feet)	Volume (cubic yards)	Vacant/ Undeveloped/ Easement
32405176*	3966 E. Lum Ave.	Yes	$>10^{-6}$	0.2	1.0	4,500	170	
32405178**	3956 E. Lum Ave.	Yes	$>10^{-6}$	0.2	1.0	5,500	200	
32405182*	3936 E. Lum Ave.	No	$>10^{-6}$	1	1.0	4,700	170	
32405194B(C)*	3876 E. Lum Ave.	Yes	$>10^{-6}$	0.2	1.0	16,200	600	
32405194B(E)*							0	
32405194B(W)*							0	
32405205A(E)*	3925 E. Ryan Ave.	No	$>10^{-6}$	1	1.0	7,300	270	
32405205A(W)*							0	
32405206A**	E. Ryan Ave.	Yes	$>10^{-6}$	1	1.0	2,800	100	Vacant
32405265***	4008 E. Thompson Ave.	No	$>10^{-6}$	0.2	1.0	5,920	220	
32405270*	3980 E. Thompson Ave.	No	$>10^{-6}$	0.2	1.0	7,800	290	
32405272A(E)*	3970 E. Thompson Ave.	No	$>10^{-6}$	0.2	1.0	5,700	210	Vacant
32405274*	3960 E. Thompson Ave.	No	$>10^{-6}$	1	1.0	5,100	190	
32405276A(E)*	3950 E. Thompson Ave.	Yes	$>10^{-6}$	1	2.0	5,350	400	
32405276A(W)*				2		5,350	400	
32405287*	3896 E. Thompson Ave.	No	$>10^{-6}$	0.2	1.0	5,500	200	
32405295*	3887 E. Lum Ave.	Yes	$>10^{-6}$	0.2	1.0	4,900	180	
32405296*	3895 E. Lum Ave.	Yes	$>10^{-6}$	1	1.0	5,500	200	Vacant
32405297*	3899 E. Lum Ave.	Yes	$>10^{-6}$	1	1.0	5,600	210	Vacant
32405306*	3945 E. Lum Ave.	No	$>10^{-6}$	1	1.0	4,300	160	
32405308A(W)*	3955 E. Lum Ave	Yes	$>10^{-6}$	1	1.0	5,250	190	
32405309*	3959 E. Lum Ave.	No	$> 10^{-6}$	0.167	1.0	4,700	170	
32436008**	3930 E. Lass Ave.	Yes	$>10^{-6}$	1	1.0	4,800	180	
32436011**	3942 E. Lass Ave.	Yes	$>10^{-6}$	0.167	1.0	4,800	180	
32436012**	3946 E. Lass Ave.	Yes	$>10^{-6}$	2	2.0	4,800	360	
32436014**	3954 E. Lass Ave.	Yes	$>10^{-6}$	1	1.0	4,800	180	
32436015**	3958 E. Lass Ave.	Yes	$>10^{-6}$	4	4.0	4,800	710	
32436017***	3966 E. Lass Ave.	Yes	$>10^{-6}$	3	3.0	6,458	720	
32436019**	3974 E. Lass Ave.	Yes	$>10^{-6}$	3	3.0	5,200	580	
32436020**	3978 E. Lass Ave.	Yes	$>10^{-6}$	2	2.0	5,600	410	
32436022*	3975 E. Lass Ave.	No	$>10^{-6}$	1	1.0	4,900	180	
32439003*	3974 E. Snavely Ave.	No	$>10^{-6}$	0.167	1.0	5,700	210	
32439004*	3970 E. Snavely Ave.	No	$>10^{-6}$	1	1.0	5,600	210	
32439005*	3962 E. Snavely Way	No	$>10^{-6}$	1	1.0	7,200	270	

TABLE D-4. PARCEL DETAILS
ALTERNATIVE 4 - LUCs AND EXCAVATION UP TO 4-FEET BGS, INSTALLATION OF GEOTEXTILE/MARKER FABRIC, OFFSITE DISPOSAL, BACKFILL, AND SITE RESTORATION

APN or Subdivided APN	Address	Skeet Observed?	Incremental Lifetime Cancer Risk	Maximum Depth of Skeet and/or PAHs Exceedance (feet bgs)	Proposed Depth of Remediation (feet bgs)	Area (square feet)	Volume (cubic yards)	Vacant/ Undeveloped/ Easement
32439006*	3960 E. Snavely Way	Yes	$>10^{-6}$	2	2.0	7,700	570	
32439007*	3958 E. Snavely Way	No	$>10^{-6}$	2	2.0	11,300	840	
32439013*	3940 E. Snavely Cir.	No	$>10^{-6}$	2	2.0	8,400	620	
32439014*	3936 E. Snavely Cir.	Yes	$>10^{-6}$	1	1.0	6,400	240	
32439015*	3930 E. Snavely Plz	Yes	$>10^{-6}$	1	1.0	6,600	240	
32439016*	3928 E. Snavely Plz	Yes	$>10^{-6}$	1	1.0	8,800	330	
32439017*	3926 E. Snavely Plz	No	$>10^{-6}$	2	2.0	9,500	700	
32439026*	3975 E. Snavely Ave.	No	$>10^{-6}$	2	2.0	4,300	320	
32439031**	3955 E. Snavely Ave.	Yes	$>10^{-6}$	5	4.0	4,900	730	
32439032*	3951 E. Snavely Ave.	Yes	$>10^{-6}$	2	2.0	5,000	370	
32439033*	3947 E. Snavely Ave.	No	$>10^{-6}$	2	2.0	4,300	320	
32439035*	3939 E. Snavely Ave.	No	$>10^{-6}$	1	1.0	5,200	190	
32439036**	3935 E. Snavely Ave.	Yes	$>10^{-6}$	2	2.0	5,100	380	
32439037**	3931 E. Snavely Ave.	Yes	$>10^{-6}$	2	2.0	5,100	380	
Thompson Easement E***		No	$>10^{-6}$	0.167	1.0	4,086	150	Easement
Thompson Easement F***		No	$>10^{-6}$	0.167	1.0	4,440	160	Easement
Thompson Easement G***		Yes	$>10^{-6}$	0.167	1.0	4,448	160	Easement
Thompson Easement H***		Yes	$>10^{-6}$	0.167	1.0	4,435	160	Easement
Thompson Easement I***		Yes	$>10^{-6}$	0.167	1.0	4,361	160	Easement
Thompson Easement J***		Yes	$>10^{-6}$	3	3.0	4,404	490	Easement
Thompson Easement K***		Yes	$>10^{-6}$	5	4.0	4,273	630	Easement
Thompson Easement L***		Yes	$>10^{-6}$	3	3.0	4,151	460	Easement
Thompson Easement M***		Yes	$>10^{-6}$	2	2.0	4,162	310	Easement
Thompson Easement N***		Yes	$>10^{-6}$	1	1.0	4,177	150	Easement
Thompson Easement O***		Yes	$>10^{-6}$	0.167	1.0	4,328	160	Easement
Thompson Easement P***		Yes	$>10^{-6}$	0.167	1.0	4,164	150	Easement
Thompson Easement Q***		Yes	$>10^{-6}$	0.167	1.0	4,164	150	Easement
32404109****	3835 E. John L Ave.	No	$>10^{-6}$	0.167	1.0	6,106	230	Vacant
32404637A****	3924 E. Ryan Ave.	Yes; surface	$>10^{-6}$	2	2.0	10,560	780	
32404657****	3919 E. Hearne Ave.	No	$>10^{-6}$	2	2.0	5,938	440	
32405171****	3996 E. Lum Ave.	Yes; surface and subsurface	$>10^{-6}$	2	2.0	7,320	540	
32405196A****	3875 E. Ryan Ave.	Yes; surface	$>10^{-6}$	2	2.0	11,916	880	

TABLE D-4. PARCEL DETAILS
ALTERNATIVE 4 - LUCs AND EXCAVATION UP TO 4-FEET BGS, INSTALLATION OF GEOTEXTILE/MARKER FABRIC, OFFSITE DISPOSAL, BACKFILL, AND SITE RESTORATION

APN or Subdivided APN	Address	Skeet Observed?	Incremental Lifetime Cancer Risk	Maximum Depth of Skeet and/or PAHs Exceedance (feet bgs)	Proposed Depth of Remediation (feet bgs)	Area (square feet)	Volume (cubic yards)	Vacant/ Undeveloped/ Easement
32405197****	3883 E. Ryan Ave.	Yes; surface and subsurface	$>10^{-6}$	2	2.0	5,376	400	
32405207****	3935 E. Ryan Ave.	No	$>10^{-6}$	0.167	1.0	5,522	200	
32439001****	-- E. Thompson Ave.	Yes; surface and subsurface	$>10^{-6}$	2	2.0	19,304	1430	Vacant
32439040****	3919 E. Snavely Ave.	No	$>10^{-6}$	2	2.0	7,105	530	
					Totals:	**602,247**	**32,540**	**30**

Area of parcels with max depth of sheet/PAH >2 ft bgs: 44,686
Area of parcels with max depth of sheet/PAH <2 ft bgs: 557,561

Notes:
* RI (December 2014 - February 2017)
** RI (January 2019 - October 2019)
*** RI Addendum (January 2020 - April 2021)
**** RI Addendum (January 2022 - July 2022)

Abbreviations:
APN - Assessor's Parcel Number
bgs - below ground surface
(E) - east section of subdivided parcel
(C) - center section of subdivided parcel
PAH - polycyclic aromatic hydrocarbon
RI - Remedial Investigation
(W) - west section of subdivided parcel

No. Excavations to 1 ft bgs:	**67**
No. Excavations to 2 ft bgs:	**22**
No. Excavations to 3 ft bgs:	**4**
No. Excavations to 4 ft bgs:	**4**
No. Excavations to 5 ft bgs:	**0**
No. Excavations to 6 ft bgs:	**0**
Total:	**97**

APPENDIX E

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, LOS ANGELES DISTRICT
915 WILSHIRE BLVD, SUITE 1109
LOS ANGELES, CALIFORNIA 90017-3409

June 17, 2026

Subject: Final Feasibility Study Report, Former 15 Skeet Ranges Site-Phase 1 Parcels Kingman Ground-to-Ground Gunnery Range, Kingman, Mohave County, Arizona, Formerly Used Defense Site (FUDS) Project No. J09AZ0412-01

Ms. Tina LePage
Manager Remedial Project Section
Waste Programs Division
Arizona Department of Environmental Quality
1110 West Washington Street, Suite 160
Phoenix, AZ 90017

Dear Ms. LePage:

On behalf of the US Army Corps of Engineers (USACE), we are pleased to submit the Final Feasibility Study (FS) Report for the Former 15 Skeet Ranges Site, Phase 1 Parcels. USACE updated the report based on the 1 May 2026 specific comments to provide clarity and correctness. Please see the attached Responses to ADEQ's Specific Comments.

Additionally, on 19 May 2026, ADEQ submitted potential Applicable or Relevant and Appropriate Requirements (ARARs) but did not request the document be updated. The 19 May 2026 letter and ARARs table, along with this response are now included as Appendix E in the FS.

While no additional ARARs have been added to the FS, the general topics raised by ADEQ will be addressed in the FS and subsequent documents with the following measures:

Staging Piles/Transportation: Contaminated soil and associated skeet target fragments will be removed in Alternatives 3 and 4. Wastes will be characterized and transported appropriately as documented in Section 6.1.3.3 of the FS.

Septic Systems: A Remedial Design will be conducted to document site conditions, including septic systems locations. If a septic system is inadvertently damaged during Remedial Action, USACE will replace and/or fix the damage in accordance with City of Kingman or Mohave County code.

Site Cleanup Goals: As noted in previous correspondence, the Arizona soil remediation levels were developed using the risk target threshold of 10^{-6} excess lifetime cancer risk (ELCR). The site-specific remediation goals presented in the Kingman Phase 1 FS were also calculated using a target ELCR of 10^{-6}. USACE will also provide ADEQ with a memo regarding the bioavailability assumptions.

Aquifer Protections: If a septic system is damaged, USACE will ensure all discharge is remediated and the system is replaced and/or connected to the sewer line, in accordance with City of Kingman or Mohave County Code.

Please find enclosed with this letter, the Responses to ADEQ comments, the ADEQ letter dated 19 May 2026. The Kingman Phase 1 Feasibly Study will be sent through DOD SafeLink as the file is too large to email.

USACE looks forward to continued progress and coordination with projects within the Kingman Ground to Ground Gunnery Range property.

Sincerely,

Lisa Schutzberger

Lisa Schutzberger
FUDS Project Manager
Los Angeles District, USACE

Cc: Kay Chang-Minami, USACE Los Angeles District Acting FUDS Program Manager
Anna Ayala, USACE Los Angeles District Project Management Specialist
Katie Crane, USACE Tech Lead
Randy Tabije, USACE FUDS South Pacific Division Program Manager
Karin Harker, ADEQ FPU Manager
Natalie Romanoff, ADEQ FPU Project Manager

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

1110 W. Washington St.
Suite 160
Phoenix, AZ 85007
602-771-2300

KATIE HOBBS
GOVERNOR

KAREN PETERS
DIRECTOR

May 19, 2026

FPU-26-223(rescinded)

Lisa Schutzberger
Project Manager – USACE LA District
915 Wilshire Blvd.
Los Angeles, CA 90017

RE: Draft Final Feasibility Study Report, Former 15 Skeet Ranges Site – Phase 1 Parcels
Kingman Ground-to-Ground Gunnery Range, Kingman, Mohave County, Arizona Formerly Used Defense Site (FUDS) Project No. J09AZ0412-01

Dear Ms. Schutzberger,

After meeting with the U.S. Army Corps of Engineers (USACE) on May 12, 2026, the Arizona Department of Environmental Quality (ADEQ) wishes to rescind correspondence (FPU-26-223) dated May 1, 2026 submitted to L. Schutzberger of the USACE for the above reference site. Based on the May 12th meeting with USACE, this correspondence will serve as ADEQ's comments on the Draft Final Feasibility Study Report Former 15 Skeet Ranges Site (FS), dated March 2026.

General Comment 1 pertained to potential Applicable or Relevant and Appropriate Requirements (ARARs) to be considered in the FS. ADEQ has documented its State ARARs in a table, attached. Based on the May 12th meeting, ADEQ finds that the FS adequately considered these ARARs and the FS is appropriate. No revision to the FS is requested.

General Comment 2 pertained to the consistency of the Preliminary Remediation Goals (PRGs) with State Soil Remediation Levels (SRLs) and target health risk levels. ADEQ has completed its review and finds the PRGs are consistent with the target risks required by State regulations. ADEQ finds the PRGs are appropriate and consistent with the work completed by the joint technical committee, documented in Appendix B of the FS, whereby medium-specific (i.e. "skeet") risk calculations were based on the coal-tar and limestone mixture comprising skeet fragments – as distinct from polycyclic aromatic hydrocarbon (PAH) mixtures typical in direct petroleum-related soil contamination. No revision to the FS is requested.

General Comment 3 pertained to the flexibility of excavating and collecting additional material if significant skeet material is observed at the base of excavations in the field during remediation. USACE explained that this was considered during the FS process but had not been resolved when the draft was released. ADEQ understands USACE will confer internally and include reasonable steps to collect obvious skeet, within appropriate limits. ADEQ agrees this can be incorporated either into the FS or in subsequent work plans.

The thirteen specific comments are offered for USACE consideration to improve the FS. Specific responses are not requested by ADEQ and can be resolved without delaying the FS. Comments on the costs are similarly offered to improve consistency in the document in anticipation of stakeholder review.

ADEQ shares USACEs commitment to finalize the FS and proceed with the important work of initiating the Phase 1 cleanup.

Sincerely,

DocuSigned by:
Tina LePage
96EF868B3B9D497...

Tina LePage
Manager Remedial Projects Section
Waste Programs Division

cc: Katie Crane, USACE Tech Lead
Glenn Hoeger, USACE Toxicologist
Randy Tabije, USACE FUDS Regional Program Manager
Karin Harker, ADEQ FPU Manager
Dan Sola, ADEQ Principal Hydrogeologist
Steve Willis, UXO Pro, ADEQ Support
Kurt Fehling, The Fehling Group, ADEQ Support
ADEQ Project and Reading File

Item Number	Page & Line Number/Reference	Reviewer Name	Review Comment	Response
3	General Comments	ADEQ	During the SPP #2 meeting, held at ADEQ's Phoenix Office on August 12, 2025, the flexibility of the proposed alternatives was a key point of discussion. Alternatives 3 and 4, which are the inferred preferred options, lack the operational flexibility to incorporate practical, reasonable measures, such as excavation to the next soil excavation horizon, up to the maximum permitted depth, when skeet is encountered, irrespective of the applicable PRGs - a point that has been previously deliberated. This was a topic at the technical committee meetings and, while not resolved, the intent was to find a way to remove obvious skeet containing material if it was practical and not unnecessarily costly. ADEQ understands, based on the RI and reported experience with the TCRA, that these areas are likely small and have a relatively low incremental cost, given the excavation will already be open and disposal options are available. ADEQ welcomes an opportunity to discuss this and find an acceptable process.	Concur. Text has been updated for Alternatives 3 and 4 to include: "Upon completion of the excavation, if area(s) have clusters of visible target fragments on the bottom or sidewalls of the excavation, then visible fragments will be scraped up to remove the visible fragment mass. The scraping will be limited to one or two passes limiting the additional volume of soil excavated to approximately two cubic yards."
4	Pg. 19, Section 5.1.1, first bullet Soil Covers	ADEQ	"Effective as direct exposure to contaminated soil and skeet fragments is eliminated *if left undisturbed* ."	The text and Table 5-1 have been revised.
5	Pg. 33, Section 6.1.3.3, third bullet	ADEQ	"USACE assumes that it will be possible to remove non-permanent objects as necessary to implement the remedial action." Where will these objects be stored? During the August 12, 2025 SPP Meeting, a suggestion was made to store items in POD containers; other suggestions included providing the opportunity for bulk pickup by the County of unwanted items.	Concur. These details will be further worked out during Remedial Design. No changes made to the text.
6	Pg. 34, Section 6.1.3.3, fourth bullet	ADEQ	Confirmation Sampling. Please define the Decision Unit. Please clarify whether a mobile onsite laboratory will be used to determine if the confirmation samples exceed the PRGs, or if the pit will be kept open pending off-site laboratory results.	Revised to include "Decision units will be each individual parcel due to limitations with ROEs." and "Samples will be sent to an approved laboratory, and will have expedited turnaround time for results to limit the time with an open excavation. "
7	Pg. 35, Section 6.1.3.3, fourth bullet	ADEQ	"The excavated soil would be sampled prior to disposal for Resource Conservation and Recovery Act (RCRA) waste characteristics." Please revise this statement for consistency with subsequent text in several sections of the report, which indicate that soil will be sampled "for disposal prior to excavation".	Revised. "Prior to excavation, the soil at each parcel would be sampled and characterized for disposal for Resouce Conservation and Recovery Act (RCRA) waste cahracteristics."

8	Pg. 35, Section 6.1.3.3, fifth bullet	ADEQ	"The excavated soil and materials would be live-loaded (directly loaded to the trucks) and transported to a USACE-approved, permitted disposal facility (i.e., La Paz County Landfill in Parker, Arizona, or other). If the soil is characteristically hazardous, disposal at a permitted hazardous landfill (i.e., Beatty, Nevada) would be arranged." Please clarify the process for sampling and analysis that will determine which facility the soil is transported to. For example, will sampling for waste disposal be conducted at each parcel prior to mobilizing excavation equipment to the site or will samples be submitted to a mobile on-site laboratory prior to excavation?	Waste characterization sampling is described in the 4th bullet on page 35 and has been revised as requested per the previous comment. Additional waste characterization sampling details will be included in the Remedial Action Work Plan and will be in accordance with landfill requirements.
9	Pg. 37, Section 6.1.3.4, Alternative 4	ADEQ	Will additional fencing or other safety measures be required for excavations 4-ft or deeper?	Revised to state that fencing and other safety measures would be implemented as needed during excavation to protect the site and the public.
10	Pg. 39, Section 6.2.1, last sentence	ADEQ	"Note that the no-action alternative is not included in the screening process because it is required by the NCP." Remove the word "not" from this statement.	Revised
11	Pg. 45, Section 7.11.1, last paragraph	ADEQ	Please revise the statement as indicated. "Because properties may contain COC concentrations exceeding the PRGs beneath the permeable barrier or where existing structures or features prevented ~~access to~~ *excavation of* contaminated soil."	Revised
12	Pg. 49, Section 7.12.1, last paragraph	ADEQ	Please revise the statement as indicated. "Because properties may contain COC concentrations exceeding the PRGs beneath the permeable barrier or where existing structures or features prevented ~~access to~~ *excavation of* contaminated soil."	Revised
13	Pg. 53, Table 7-1, Alternative 1, Short-Term Effectiveness	ADEQ	Alternative 1, Short-Term Effectiveness. The text box states, "Does not meet the short-term effectiveness requirements." Please change the color code to red for Least Desirable.	Revised
14	Pg. 54, Section 7.13.1, third paragraph	ADEQ	Please include a discussion explaining why Alternative 4 is more protective than Alternative 3, as indicated in Table 7-1.	Revised to clarify that Alternative 4 is more protective then Alternative 3 as it would remove contaminated soil down to four feet.
15	Figure 3-3, Atlernative 4	ADEQ	The figure indicates that parcel 32439031 and sub-parcel Thompson ROW K are planned for excavation to 5-ft bgs. This requires correction, as Alternative 4 is defined by excavation up to 4-ft bgs. Also, please refer to the comment below regarding the cost estimates for Alternative 4 in Appendix D.	Figure 3-3 has been updated for parcel 32439031 and sub-parcel Thompson ROW K to show excavation to 4-ft bgs.

16a	Appendix D Cost Estimates, Alternative 3 and Alternative 4	ADEQ	Both alternatives assume 67 occupied parcels, yet according to the text, Property Owner Relocation Costs are only established for 65 units. Please explain this discrepancy and adjust the costs, if necessary. Please also review the Quantity cost estimates (4,140). ADEQ's calculation for Quantity is 3900 - 4020, covering 65 - 67 properties (65 x 30d x 2rms = 3,900; 67 x 30d x 2rms = 4,020).	Revised text to 67 parcels and cost to $4,020.
16b	Appendix D Cost Estimates, Alternative 4	ADEQ	Alternative 4 costs assume 89 parcels for LUCs implementation, whereas Alternative 3 applies LUCs to all 97 Phase 1 parcels. Section 7.12 states, “Maintenance and monitoring of the educational controls are the same for Alternative 4 as for Alternative 3”. ADEQ assumes that all alternative 4 parcels, including the 8 parcels that would be excavated below 2-ft., will require LUCs due to inaccessible areas that will not be excavated. Please revise the alternative 4 cost estimate, as necessary.	Revised to 97 parcels.
16c	Appendix D Cost Estimates, Alternative 4	ADEQ	Alternative 4 Parcel Area and Excavation Depth Assumptions. Please correct the following inconsistencies by clarifying the excavation depths, revising the text/tables/figures accordingly, and adjusting the Alternative 4 cost estimate, if necessary. i. Pg. 5 of 8. The fourth bullet indicates excavation depths of 4-ft bgs at 4 parcels/sub-parcels/ROWs. Table D-4 is consistent with the text. However, Figure 3-3 exhibits an inconsistency with Table D-4. Figure 3-3 depicts one parcel (32439031) and one sub-parcel (Thompson ROW K) as planned for excavation to a depth of 5-ft bgs. Based on the text presented in Section 6.1.3.3, ADEQ infers that Alternative 4 involves two parcels/ROW containing soils with COCs at depths exceeding 4-ft bgs, which accounts for the two aforementioned parcels. Please confirm that the total cost estimates for soil excavation are calculated for depths up to 4-ft and do not incorporate the excavation of the two parcels to a depth of 5-ft.	Total cost estimates for soil excavation are calculated for depths up to 4-ft and do not incorporate the excavation of the two parcels to a depth of 5-ft. The proposed depth of remediation is 4-ft bgs maximum and Figure 3-3 has been updated to 4-ft bgs for one parcel (32439031) and one sub-parcel (Thompson ROW K).

16d	Appendix D Cost Estimates, Alternative 4	ADEQ	Alternative 3 cost assumptions include “Restoration of roads, including patching, filling potholes, and overlays to add new layer of asphalt where damaged due to excavation equipment is assumed at 10% of parcels.” This assumption is included in the cost tables for both Alternative 3 and Alternative 4 but is only included in the text description for Alternative 3. Please add to the Alternative 4 description.	Revised. "Restoration of roads, including patching, filling potholes, and overlays to add new layer of asphalt where damaged due to excavation equipment is assumed at 10% of parcels." added to Alternative 4 section 7. Site Restoration, second paragraph.
16e	Appendix D Cost Estimates, Alternative 3 and Alternative 4	ADEQ	According to the SPP Meeting Minutes from August 12, 2025 (page 11, first paragraph), Mr. Cory Koger of the USACE indicated that any excavation exceeding 4-ft would trigger OSHA standards, necessitating that such excavations be fenced prior to backfilling. If the cost associated with the previously raised concern regarding parcels requiring excavation to a depth of 5-ft bgs was included in the cost estimate for Alternative 4, this additional cost should be removed, assuming it was accounted for.	Revised to update one parcel (32439031) and one sub-parcel (Thompson ROW K) to 4-ft bgs. Costs analysis acounted for 4-ft excavations.

Kingman G-G

Proposed State Applicable or Relevant and Appropriate Requirements

Action - Specific ARARs

Action Requirement	Federal Citation	State Citation	ARAR Determination	Comment
Staging Piles / Transportation				
Remove or decontaminate all remediation waste, contaminated containment system components, and structures and equipment contaminated with waste and leachate.	40 CFR Part 264.554(j)(1) (i) - (iii)	A.A.C R18-8-264		Potential ARAR if excavation is used
Generation of RCRA Hazardous Waste. Full requirements must be met for off-site disposal. If waste fails to meet TCLP criteria, waste is characterized as RCRA hazardous waste. This includes packaging, labeling, manifesting, etc.	40 C.F.R. Part 262	A.A.C R18-8-262	State To Be Considered	
Hazardous waste must be transported in a manner so as to protect human health and the environment. Arizona regulation generally incorporates applicable federal regulations.	49 C.F.R. Parts 170-180 (Hazardous Materials Transportation Act, 49 U.S.C. 1801 et seq))	A.A.C. R17-5-209	State To Be Considered	
Septic Systems				
Repair Standards: Mohave County, with delegated authority from ADEQ to regulate septic tanks/sewage systems, requires that if there is an existing sewage collection system, any irreparable damage to a septic system would result in the owner joining the sewage collection system instead of repairing the damaged septic system. Therefore, if USACE irreparably damages a septic tank, USACE should consider that replacing the septic tank may not be an option. If USACE cannot replace the septic tank, USACE would still be able to "make an appropriate settlement", as authorized in its Right of Entry.	None	A.R.S. § 49-107(A) (authorizing ADEQ to delegate authority to a county to enforce and oversee select environmental programs); Mohave County Ordinance No. 2021-04 § 2(A) ("A person replacing a failed septic system . . . shall connect to a sewage collection system if available")	State To Be Considered	

Chemical - Specific ARARs

Action Requirement	Federal Citation	State Citation	ARAR Determination	Comment
Soil Clean up Goals				
The preliminary remediation goals (PRGs) were calculated using USEPA RSL equations, exposure assumptions, and toxicity combined with site-specific assumptions concerning the relative bioavailability factor and the age-dependent adjustment factor based on the source of PAHs in skeet fragments made from coal tar and limestone.	EPA Regional Screening Levels (RSLs) guidance	A.A.C. R18-7-201 through 207; and A.R.S § 49-151 through 159 A.A.C. R18-7-206	Federal To Be Considered	

Kingman G-G

Action - Specific ARARs

Proposed State Applicable or Relevant and Appropriate Requirements

Action Requirement	Federal Citation	State Citation	ARAR Determination	Comment
Arizona Septic System and Cesspool Aquifer Protection Standards				
Remediation Standards: In the event of an accidental discharge from a septic tank as a result of the USACE's remedial activities, USACE must remediate the discharge so that there are no unsanitary conditions left as a result.	None	A.A.C. R18-9-A309(A)(9)(d) ("a person, as defined in A.A.C. R18-9-101, shall not modify the facility so as to create an unsanitary condition or environmental nuisance or cause or contribute to an exceedance of a water quality standard"); A.A.C. R18-9-101(34) (definition of an "onsite wastewater treatment facility"); A.A.C. R18-9-101(36) (definition of a "person")	State To Be Considered	