

Nevada
Environmental
Restoration
Project

DOE/NV--1272



Corrective Action Investigation Plan for Corrective Action Unit 560: Septic Systems Nevada Test Site, Nevada

Controlled Copy No.: ____

Revision No.: 0

May 2008

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Environmental Restoration
Project



U.S. Department of Energy
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**CORRECTIVE ACTION INVESTIGATION PLAN FOR
FOR CORRECTIVE ACTION UNIT 560:
SEPTIC SYSTEMS
NEVADA TEST SITE, NEVADA**

U.S. Department of Energy
National Nuclear Security Administration
Nevada Site Office
Las Vegas, Nevada

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CORRECTIVE ACTION UNIT 560:
SEPTIC SYSTEMS
NEVADA TEST SITE, NEVADA**

Approved by: _____ Date: _____

Kevin J. Cabbie
Federal Sub-Project Director
Industrial Sites Sub-Project

Approved by: _____ Date: _____

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Environmental Restoration Project

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List of Acronyms and Abbreviations

ASTM	American Society for Testing and Materials
bgs	Below ground surface
BNA	Base Neutral Acid
CAI	Corrective Action Investigation
CAIP	Corrective Action Investigation Plan
CAS	Corrective Action Site
CAU	Corrective Action Unit
CERCLA	<i>Comprehensive Environmental Response, Compensation, and Liability Act</i>
CFR	<i>Code of Federal Regulations</i>
COC	Contaminant of concern
COPC	Contaminant of potential concern
CP	Control Point
CSM	Conceptual site model
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DQI	Data quality indicator
DQO	Data quality objective
EPA	U.S. Environmental Protection Agency
FAL	Final action level
FFACO	<i>Federal Facility Agreement and Consent Order</i>
ft	Foot
gal	Gallon
GI	Galvanized iron
GPS	Global positioning system

List of Acronyms and Abbreviations (Continued)

HASL	Health and Safety Laboratory
HWAA	Hazardous waste accumulation area
IDW	Investigation-derived waste
in.	Inch
ISMS	Integrated Safety Management System
LCS	Laboratory control sample
MDC	Minimum detectable concentration
mg/kg	Milligrams per kilogram
mi	Mile
mrem/yr	Millirem per year
MS	Matrix spike
MSD	Matrix spike duplicate
N/A	Not applicable
NAD	North American Datum
NAC	<i>Nevada Administrative Code</i>
NAD	North American Datum
NCRP	National Council on Radiation Protection and Measurement
ND	Normalized difference
NDEP	Nevada Division of Environmental Protection
NEPA	<i>National Environmental Policy Act</i>
NNSA/NSO	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office
NRS	<i>Nevada Revised Statutes</i>
NSTec	National Security Technologies, LLC

List of Acronyms and Abbreviations (Continued)

NTS	Nevada Test Site
NTSWAC	<i>Nevada Test Site Waste Acceptance Criteria</i>
NV/YMP	Nevada Yucca Mountain Project
PACM	Presumed asbestos-containing material
PAL	Preliminary action level
PCB	Polychlorinated biphenyl
PET	Potential evapotranspiration
POC	Performance Objective for the Certification of Nonradioactive Hazardous Waste
PPE	Personal protective equipment
ppm	Parts per million
PRG	Preliminary remediation goal
PSM	Potential source material
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RadCon	Radiological control
RBCA	Risk-based corrective action
RBSL	Risk-based screening level
RCA	Radiologically controlled area
RCRA	<i>Resource Conservation and Recovery Act</i>
RESRAD	Residual Radioactive
RL	Reporting limit
RMA	Radioactive material area
RPD	Relative percent difference

List of Acronyms and Abbreviations (Continued)

SDWS	<i>Safe Drinking Water Standards</i>
SNJV	Stoller-Navarro Joint Venture
SSTL	Site-specific target level
SVOC	Semivolatile organic compound
TCLP	Toxicity Characteristic Leaching Procedure
TPH	Total petroleum hydrocarbons
TSCA	<i>Toxic Substance Control Act</i>
UTM	Universal Transverse Mercator
USGS	U.S. Geological Survey
VCP	Vitrified clay pipe
VOC	Volatile organic compound
%R	Percent recovery

Executive Summary

Corrective Action Unit (CAU) 560 is located in Areas 3 and 6 of the Nevada Test Site, which is approximately 65 miles northwest of Las Vegas, Nevada. Corrective Action Unit 560 is comprised of the seven corrective action sites (CASs) listed below:

- 03-51-01, Leach Pit
- 06-04-02, Septic Tank
- 06-05-03, Leach Pit
- 06-05-04, Leach Bed
- 06-59-03, Building CP-400 Septic System
- 06-59-04, Office Trailer Complex Sewage Pond
- 06-59-05, Control Point Septic System

These sites are being investigated because existing information on the nature and extent of potential contamination is insufficient to evaluate and recommend corrective action alternatives. Additional information will be obtained by conducting a corrective action investigation before evaluating corrective action alternatives and selecting the appropriate corrective action for each CAS. The results of the field investigation will support a defensible evaluation of viable corrective action alternatives that will be presented in the Corrective Action Decision Document.

The sites will be investigated based on the data quality objectives (DQOs) developed on January 22, 2008, by representatives from the Nevada Division of Environmental Protection; U.S. Department of Energy (DOE), National Nuclear Security Administration Nevada Site Office; Stoller-Navarro Joint Venture; and National Security Technologies, LLC. The DQO process was used to identify and define the type, amount, and quality of data needed to develop and evaluate appropriate corrective actions for CAU 560.

[Appendix A](#) provides a detailed discussion of the DQO methodology and the DQOs specific to each CAS.

The scope of the corrective action investigation for CAU 560 may include the following activities:

- Remove surface debris and/or materials, as needed, to facilitate sampling.
- Conduct visual surveys at all CASs to identify biasing factors that may include staining, disturbance of native soil, or any other indication of potential contamination.

- Conduct radiological surveys.
- Conduct exploratory trenching to access collection system components and septic tanks, transect leach fields, and expose sampling horizons.
- As practical, conduct video-mole surveys of septic system piping, distribution boxes, manholes, and vent lines to assess physical layout; identify possible residual materials; locate any breaches, and determine whether source drains are plugged or sealed.
- Perform field screening for volatile organic compounds, radioactive contamination, and fecal coliform, when applicable.
- Collect and submit environmental samples for laboratory analysis to determine whether contaminants of concern (COCs) are present.
- Collect samples of source materials to determine the potential for a release.
- If COCs are present, collect samples to define the extent of the contamination.
- Collect quality control samples for laboratory analyses to evaluate the performance of measurement systems and controls.
- Collect samples of potential remediation wastes.
- Stake or flag sample locations in the field and record coordinates through global positioning system surveying.
- Collect samples of investigation-derived waste, as needed, for waste management purposes.

This Corrective Action Investigation Plan has been developed in accordance with the *Federal Facility Agreement and Consent Order* (FFACO) that was agreed to by the State of Nevada; DOE, Environmental Management; U.S. Department of Defense; and DOE, Legacy Management (FFACO, 1996; as amended February 2008). Under the FFAO, this Corrective Action Investigation Plan will be submitted to the Nevada Division of Environmental Protection for approval. Fieldwork will be conducted following approval of the plan.

1.0 Introduction

This Corrective Action Investigation Plan (CAIP) contains project-specific information including facility descriptions, environmental sample collection objectives, and criteria for conducting site investigation activities at CAU 560: Septic Systems, Nevada Test Site (NTS), Nevada.

This CAIP has been developed in accordance with the *Federal Facility Agreement and Consent Order* (FFACO) that was agreed to by the State of Nevada; U.S. Department of Energy (DOE), Environmental Management; U.S. Department of Defense; and DOE, Legacy Management (FFACO, 1996; as amended February 2008).

Corrective Action Unit 560 is located in Areas 3 and 6 of the NTS, which is approximately 65 miles (mi) northwest of Las Vegas, Nevada ([Figure 1-1](#)). Corrective Action Unit 560 is comprised of the seven corrective action sites (CASs) shown on [Figure 1-1](#) and listed below:

- 03-51-01, Leach Pit
- 06-04-02, Septic Tank
- 06-05-03, Leach Pit
- 06-05-04, Leach Bed
- 06-59-03, Building CP-400 Septic System
- 06-59-04, Office Trailer Complex Sewage Pond
- 06-59-05, Control Point Septic System

The Corrective Action Investigation (CAI) will include field inspections, sampling of environmental media, analysis of samples, and assessment of investigation results, where appropriate. Data will be obtained to support corrective action alternative evaluations and waste management decisions.

1.1 Purpose

The CASs in CAU 560 are being investigated because hazardous and/or radioactive constituents may be present in concentrations that could potentially pose a threat to human health and the environment. Existing information on the nature and extent of potential contamination is insufficient to evaluate and recommend corrective action alternatives for the CASs. Additional information will be generated by conducting a CAI before evaluating and selecting corrective action alternatives.

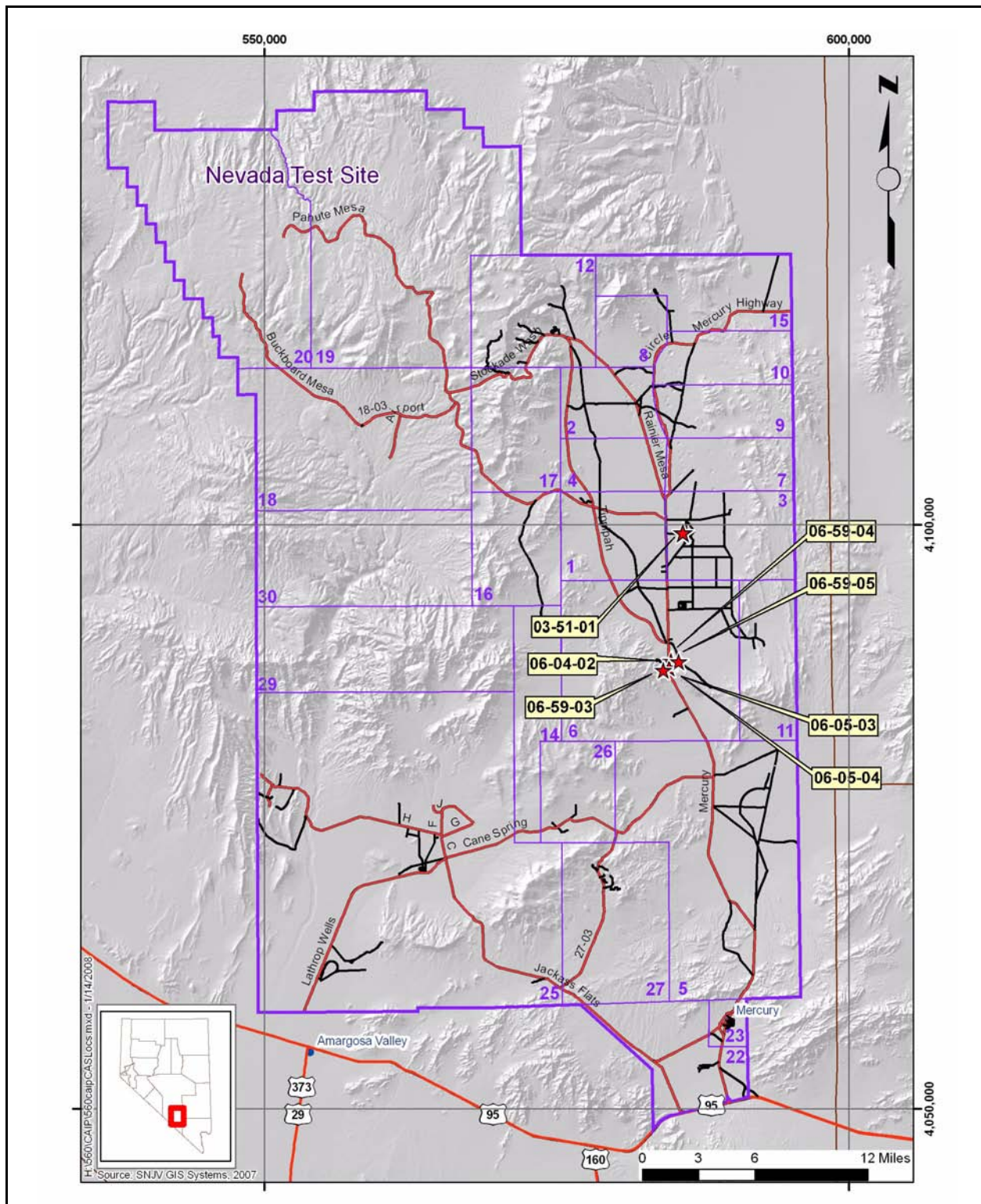


Figure 1-1
Nevada Test Site Map with CAU 560 CAS Locations

1.1.1 Corrective Action Unit 560 History and Description

Corrective Action Unit 560, Septic Systems, consists of seven inactive sites, located in Areas 3 and 6 of the NTS. The seven CAU 560 sites consist of septic tanks, sewage ponds, leach pits/dry wells, leach beds/tile fields, a filter box, distribution boxes, piping connected to these features, and soils surrounding these features. The CAU 560 sites were all used to support nuclear testing conducted in the Yucca Flat area during the 1950s through the 1970s. Operational histories for each CAU 560 CAS are detailed in [Section 2.2](#).

1.1.2 Data Quality Objective Summary

The sites will be investigated based on data quality objectives (DQOs) developed by representatives of the Nevada Division of Environmental Protection (NDEP); DOE, National Nuclear Security Administration Nevada Site Office (NNSA/NSO); Stoller-Navarro Joint Venture (SNJV); and National Security Technologies, LLC (NSTec). The DQOs are used to identify and define the type, amount, and quality of data needed to develop and evaluate appropriate corrective actions for CAU 560. This CAIP describes the investigative approach developed to collect the data needs identified in the DQO process. While a detailed discussion of the DQO methodology and the DQOs specific to each CAS are presented in [Appendix A](#), a summary of the DQO process is provided below.

The DQO problem statement for CAU 560 is: “Existing information on the nature and extent of potential contamination is insufficient to evaluate and recommend corrective action alternatives for the CASs in CAU 560.” To address this question, the resolution of two decisions statements is required:

- Decision I: “Is any contaminant of potential concern (COPC) associated with the CAS present in environmental media at a concentration exceeding its corresponding final action level (FAL)?” For judgmental sampling, any contaminant associated with a CAS activity that is present at concentrations exceeding its corresponding FAL will be defined as a contaminant of concern (COC). A COC may also be defined as a contaminant that, in combination with other like contaminants, is determined to jointly pose an unacceptable risk based on a multiple constituent analysis (NNSA/NSO, 2006a). If a COC is detected, then Decision II must be resolved. If a COC is not detected, the investigation for that CAS is complete.

- Decision II: “If a COC is present, is sufficient information available to evaluate potential corrective action alternatives?” Sufficient information is defined to include:
 - Identifying the lateral and vertical extent of COC contamination in media.
 - The information needed to determine potential remediation waste types.
 - The information needed to evaluate the feasibility of remediation alternatives.

The informational inputs and data needs to resolve the problem statement and the decision statements were generated as part of the DQO process for this CAU and are documented in [Appendix A](#). The information necessary to resolve the DQO decisions will be generated for each CAU 560 CAS by collecting and analyzing samples generated during a field investigation. The presence of contamination at each CAS will be determined by collecting and analyzing samples collected in areas most likely to contain a COC. These sample locations, therefore, can be selected by means of biasing factors used in judgmental sampling (e.g., a stain, likely containing a spilled substance). A judgmental sampling design has been developed for all CAU 560 CASs, due to the presence and significance of biasing factors.

1.2 Scope

To generate information needed to resolve the decision statements identified in the DQO processes, the scope of the CAI for CAU 560 includes the following activities:

- Remove surface debris and/or materials, as needed, to facilitate sampling.
- Conduct visual surveys at all CASs to identify biasing factors that may include staining, discoloration, disturbance of native soil, or any other indication of potential contamination.
- Conduct radiological surveys.
- Conduct exploratory trenching to access collection system components and septic tanks, transect leachfields, and expose sampling horizons.
- As practical, conduct video-mole surveys of septic system piping, distribution boxes, and vent lines to assess physical layout; identify possible residual materials; locate any breaches; and determine whether source drains are plugged or sealed.
- Perform field screening for volatile organic compounds (VOCs), radioactive contamination, and fecal coliform, when applicable.

- Collect and submit environmental samples for laboratory analysis to determine whether COCs are present.
- Collect samples of source materials to determine the potential for a release.
- If COCs are present, collect samples to define the extent of the contamination.
- Collect quality control (QC) samples for laboratory analyses to evaluate the performance of measurement systems and controls.
- Collect samples of potential remediation wastes.
- Stake or flag sample locations in the field and record coordinates through global positioning system (GPS) surveying.
- Collect samples of investigation-derived waste (IDW), as needed, for waste management purposes.

Contamination of environmental media originating from activities not identified in the conceptual site model (CSM) of any CAS will not be considered as part of this CAU unless the CSM and the DQOs are modified to include the release. If not included in the CSM, contamination originating from these sources will not be sample. If such contamination is present, the contamination will be identified as part of another CAS (new or existing).

1.3 Corrective Action Investigation Plan Contents

[Section 1.0](#) presents the purpose and scope of this CAIP, while [Section 2.0](#) provides background information about CAU 560. Objectives of the investigation, including CSMs, are presented in [Section 3.0](#). Field investigation and sampling activities are discussed in [Section 4.0](#), and waste management issues for this project are discussed in [Section 5.0](#). General field and laboratory quality assurance (QA) (including collection of QA samples) are presented in [Section 6.0](#) and in the Industrial Sites Quality Assurance Project Plan (QAPP) (NNSA/NV, 2002). The project schedule and records availability are discussed in [Section 7.0](#). [Section 8.0](#) provides a list of references.

[Appendix A](#) provides a detailed discussion of the DQO methodology and the DQOs specific to each CAS, while [Appendix B](#) contains information on the project organization.

2.0 Facility Description

Corrective Action Unit 560 is comprised of seven CASs that were grouped together based on the geographical location of the sites, technical similarities (surface/subsurface components of septic and waste water systems), and the agency responsible for closure. Corrective Action Site 03-51-01 contains components of a leach pit system associated with waste water disposal. The remaining six CASs (06-04-02, 06-05-03, 06-05-04, 06-59-03, 06-59-04, 06-59-05) are comprised of septic system components associated with domestic sewage and waste water disposal.

2.1 Physical Setting

The following sections describe the general physical settings of Areas 3 and 6 of the NTS. General background information pertaining to topography, geology, hydrogeology, and climatology are provided for these specific areas of the *NTS region in the Geologic Map of the Nevada Test Site, Southern Nevada* (USGS, 1990); *CERCLA Preliminary Assessment of DOE's Nevada Operations Office Nuclear Weapons Testing Areas* (DRI, 1988); *Final Environmental Impact Statement, Nevada Test Site, Nye County, Nevada* (ERDA, 1977); and the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DOE/NV, 1996).

Geological and hydrological setting descriptions for each of the CASs are detailed in the following subsections based on the hydrogeographic area in which they are located.

2.1.1 Yucca Flat

All seven CASs of CAU 560 are located within the Yucca Flat Hydrographic Area of the NTS. Yucca Flat is a closed basin, which is slowly being filled with alluvial deposits eroding from the surrounding mountains (USGS, 1996).

Topography – Generally, the areas surrounding the CAU 560 CASs are graded and relatively flat, gently sloping to the east towards Yucca Flat Dry Lake Bed; however, CAS 06-59-03 is located on a graded area with eroding hillsides to the west and steep slopes to the south and east.

Vegetation – Generally, at CAU 560 CASs, native vegetation has been cleared from the immediate area.

Surface Soil – The surface soil at CAS 03-51-01 is imported and consists of sand to cobble-sized clasts. Pea gravel is present, and it appears the area was formerly covered by asphalt. The surface soil in Area 6 is native and consists of silt to cobble-sized clasts. Some imported gravel is present in previously disturbed areas and around buildings. The soil is described as a tightly packed, sandy silt that is very dense, containing cobbles and boulders.

Caliche – It is unknown if caliche is present at CAS 03-51-01. In Area 6, some cementation has been detected as thin zones of caliche.

Alluvium – The average thickness of alluvium in the Yucca Flat region is 980 feet (ft), but has been documented to extend as far as 6,560 ft below ground surface (bgs). In the Area 6 Control Point (CP) area, alluvium extends 19 to 21 ft bgs.

Climate – The average annual precipitation at Station UCC on the Yucca Flat dry lake is 6.62 inches (in.) (NOAA, 2002). Annual potential evapotranspiration (PET) has been estimated for the Area 3 RWMS facility, and according to the data, the PET is 62.6 in. (DOE/NV, 1997).

Groundwater – The direction of groundwater flow in Yucca Flat generally is from the northeast to southwest. Within the overlying alluvial and volcanic aquifers, lateral groundwater flow occurs from the margins to the center of the basin and downward into the carbonate aquifer (USGS, 1996). The nearest well to CAS 03-51-01 is U.S. Geological Survey (USGS) Water Well ER-3-2-2, an active observation well located approximately 429 ft southwest of the site. The most recent recorded depth to the water table is approximately 1,603 ft bgs (USGS/DOE, 2007). The nearest active well to CASs 06-04-02, 06-05-03, 06-05-04, 06-59-03, 06-59-04, and 06-59-05 is USGS Water Well ER-6-2, located approximately 2.1 to 2.6 mi northwest of the sites. The most recent recorded depth to the water table is approximately 1,782 ft bgs (USGS/DOE, 2007). The recharge rate to the Yucca Flat area is relatively low (1.76 millimeters per year [USGS, 1996]).

2.2 Operational History

The following subsections provide a description of the use and history of each CAS in CAU 560 that may have resulted in potential releases to the environment. The CAS-specific summaries are designed to describe the current definition of each CAS and illustrate all significant, known activities.

2.2.1 Corrective Action Site 03-51-01, Leach Pit

Corrective Action Site 03-51-01 consists of a leach pit, subsurface piping connected to the leach pit, and the soil surrounding the features. The CAS was originally identified as a leach pit associated with Building 3C-5 of the Area 3 Camp. The septic system received waste water from a sink drain and was designed to release effluent to subsurface soil through the leach pit disposal feature (REECo, 1971). As-built engineering drawings show the leach pit is connected to the sink by 1.25-in. diameter drain line. The leach pit is a 12-in. diameter perforated casing located 1 ft bgs, extending to a total depth of 11 ft bgs. The drain pipe enters the leach pit approximately 2 ft bgs (REECo, 1971). Building 3C-5, Special Measurements Facility, was used by EG&G Measurements, Inc. (H&N, 1990). Specific activities that occurred within the building are unknown. Building 3C-5 was demolished by March 1999 as a part of the Area 3 Camp closure (REECo, 1995). A 2007 geophysical survey detected piping originating at a cut pipe on the concrete pad leading to a leach pit (Weston, 2007). Also, the survey detected potential piping from the leach pit that leads north to a large geophysical anomaly; this piping may be associated with the leach pit system. The geophysical anomaly is in the approximate location of a building called the Diode Repair Facility, as shown in historical as-built drawings (H&N, 1978). [Figure A.2-2](#) shows the locations of former Building 3C-5, the leach pit, and associated piping at CAS 03-51-01.

2.2.2 Corrective Action Site 06-04-02, Septic Tank

Corrective Action Site 06-04-02 consists of a septic tank/leach pit, subsurface piping connected to the tank, and the soil surrounding these features. This CAS was originally identified as a septic tank associated with support/administrative trailers of the Area 6 CP complex; however, an additional drawing indicates that the septic tank may be a leach pit (H&N, Date Unknown b; REECo, 1968). The septic system was designed to route effluent from trailer drains to the septic tank/leach pit. If the CAS feature is a leach pit, then the septic system was designed to release waste to the subsurface soil.

An as-built drawing shows the septic tank connected to multiple trailers by approximately 240 ft of 4-in. diameter vitrified clay pipe (VCP) (REECO, 1968).

Aerial photography and engineering drawings show multiple support trailers located in the immediate area from before 1967 until after 1976 (REECO, 1968; H&N, 1976a). Activities within these support trailers are undetermined, but believed to be administrative. By 1985, all trailers were removed and a large horseshoe-shaped soil berm was constructed to the north of the site. [Figure A.2-3](#) shows the location of the septic tank/leach pit and associated piping at CAS 06-04-02.

2.2.3 Corrective Action Site 06-05-03, Leach Pit

Corrective Action Site 06-05-03 consists of a leach pit, a septic tank, inactive subsurface piping connected to the leach pit and septic tank, as well as the soil surrounding these features. This CAS was originally identified as a leach pit associated with Building CP-160, Site Maintenance Facility. The structures at the CAS include Building CP-160, which is currently active. Building CP-160, Site Maintenance Facility, was constructed in 1967 and was historically used as an electricians shop, a reefer/fitters shop, and an arc welding area (Wuellner, 1994; BN, 2005). This septic system received wastes from commodes, urinals, sinks and floor drains (Wuellner, 1994). The septic system was designed to release effluent to subsurface soil through the leach pit disposal feature.

As-built drawings show the septic tank connected to the leach pit by 210 ft of 4-in. diameter pipe (EBH, 1968a and 1968b). The septic tank is 1,500 gallon (gal), made of 3-in. thick precast concrete, has two chambers, and measures approximately 10.5 ft long and 5 ft wide. The leach pit is a 11.5-ft long, 48-in. diameter perforated casing installed vertically and surrounded by 10 in. of aggregate and underlain by 18 in. of aggregate fill. Depth of burial is not shown on the drawings (EBH, 1968a and 1968b). Plan drawings show the septic tank and leach pit were bypassed; however, a portion of the original piping was re-used (RSN, 1993). Only the inactive/abandoned piping is included in the scope of this CAS. [Figure A.2-4](#) shows the location of the septic tank, leach pit, and associated piping (active and inactive) at CAS 06-05-03.

2.2.4 Corrective Action Site 06-05-04, Leach Bed

Corrective Action Site 06-05-04 consists of a leach bed, a septic tank, a distribution box, subsurface piping connected to the leach bed, septic tank, and distribution box, as well as the soil surrounding these features. This CAS was originally identified as a leach bed associated with Building 162, Site Maintenance Facility. The structures at the CAS include Building CP-162, which is currently active, as well as two large trailers adjacent to the north and south of the leach bed. Building CP-162, Site Maintenance Facility, was constructed in 1979 and was used historically as a woodworking shop, a painting shop, and an electric motor repair shop (Wuellner, 1994; BN, 2005). This septic system received wastes from a water curtain, floor drains, sinks, commodes, and showers (Wuellner, 1994).

The septic system was designed to release effluent to subsurface soil through the leach bed disposal feature. As-built and plan drawings show dimensions of the CAS features (H&N, 1977 and 1979). The septic tank is a two-chambered 1,200 gal model, measuring approximately 8 ft in length. The distribution box is connected to the septic tank by approximately 10 ft of pipe. The distribution box measures 20 in. in diameter and has three individual outfalls to the leach bed. The leach bed is fenced and measures 43 by 18 ft. The leach bed pipe is underlain with 18 in. of aggregate rock. The leach bed pipe is covered by aggregate fill (total depth unknown), a layer of paper, and topped by 12 in. of sand overfill, of which 6 in. are above grade (H&N, 1977 and 1979).

This septic system was bypassed in the mid-1990s and a portion of the original piping was re-used (RSN, 1993). Only the inactive/abandoned piping is included in the scope of this CAS. [Figure A.2-6](#) shows the location of the septic tank, leach bed, distribution box, and associated piping (active and inactive) at CAS 06-05-04.

2.2.5 Corrective Action Site 06-59-03, Building CP-400 Septic System

Corrective Action Site 06-59-03 may consist of a septic tank, a dry well, a filter box, surface and/or subsurface piping connected to the collection feature, as well as the soil surrounding these features. This CAS was originally identified as a septic system associated with Building CP-400. Building CP-400 was active beginning in 1953 and was used as a photo processing lab (H&N, 1959). It is unknown when CP-400 was abandoned; however, the building was demolished June 24, 2003 (Olsen, 2007). This septic system received wastes from a lavatory sink, water closet, dark room sink,

floor drain, and drinking fountain (SM, 1953b; H&N, 1959; REEC Co, 1962). The septic system is designed to release effluent to subsurface soil through the filter box and the dry well disposal feature. Engineering drawings and maps show locations and dimensions of the septic system features (SM, 1952, 1953a, 1953b; REEC Co, 1962).

The filter box is connected to CP-400 by 30 ft of 4-in. diameter VCP. The filter box is constructed of 6-in. thick concrete walls, measuring 6 by 6 ft wide by 5.8 ft in height. The interior of the filter box has approximately 2 ft of void space and 2 ft of sand overlaying 1.3 ft of gravel. The inflow line enters from the north, 1 in. below the top of the filter box; the outfall exits to the south, at the base of the gravel layer. A note states, “Run drain to natural drainage and stop” (SM, 1952).

The septic tank is located approximately 12 ft to the south of CP-400, connected to the building by a length of existing 4-in. diameter VCP. The septic tank is labeled as a prefabricated metal tank with a 500-gal working capacity. The tank measures 46 in. in diameter and approximately 9 in. in length. The outfall line from the septic tank is 1-in. diameter galvanized iron (GI) that extends 5 ft to the east; then turns to the north, and follows the access road to discharge to the CP Hill septic system (CAS 06-59-05). Five feet of the outfall line from the septic tank was removed, and the cut end of the 1-in. GI pipe was capped. The outfall was replaced by 4-in. VCP and directed to a sump (dry well) through an aboveground 4-in. diameter metal pipe (H&N, Date Unknown a; SM, 1953a; REEC Co, 1962).

The dry well is constructed of an open-bottomed circular concrete cylinder with 12-in. thick walls, topped by an angled concrete cover, and surrounded by 4 in. of stones. The interior has a 10-in. diameter, is filled with 5 ft of gravel, and has at least 2 ft of void space. The dry well is 8 ft in depth from the base of inflow pipe, which enters the dry well from the north. In addition, 4-in. VCP was installed that bypassed the septic tank to connect CP-400 directly to the dry well (REEC Co, 1962).

The location of the septic tank is directly below an excavated area, where the surface soil is caving into the septic tank; the locations of the dry well and filter box have not been determined.

[Figure A.2-6](#) shows the suspected locations of the septic tank, filter box, dry well, and associated piping at CAS 06-59-03.

2.2.6 Corrective Action Site 06-59-04, Office Trailer Complex Sewage Pond

Corrective Action Site 06-59-04 consists of a covered sewage pond and connected subsurface piping, as well as the soil surrounding these features. This CAS was originally identified as a sewage pond associated with the Area 6 Office Trailer Complex. The septic system was designed to route effluent to the sewage pond. Historical aerial photos show that the sewage pond and Office Trailer Complex were constructed between 1970 and 1972 (H&N, 1970 and 1972). Specific activities that occurred within the Office Trailer Complex are undetermined. Engineering drawings and maps show locations and dimensions of the septic system features (REECo, 1972; H&N, 1974; H&N, 1976b). The sewage lagoon measures approximately 60 by 60 ft and is connected to the Office Trailer Complex by approximately 200 ft of piping. Engineering drawings identify the piping as 4 or 6 in. in diameter, and as either VCP or asbestos cement pipe (REECo, 1972; H&N, 1974; H&N, 1976b). The pipe was cut at a manhole 150 ft northeast of the sewage pond; the manhole was removed, and the sewage pond was abandoned. A portion of the existing pipe was used to connect the Office Trailers to the domestic sewage lagoons (CAS 06-03-01, Sewage Lagoons [4]) (H&N, 1976b). Historical aerial photos show the sewage lagoon was backfilled before 1976 (H&N, 1976a). Only the inactive/abandoned piping that was not investigated during the CAI at CAS 06-03-01 is included in the scope CAS 06-59-04. The structures at the CAS include Building 06-998652 (Ice House). [Figure A.2-7](#) shows the location of the sewage pond, clean-out, and associated piping at CAS 06-59-04.

2.2.7 Corrective Action Site 06-59-05, Control Point Septic System

Corrective Action Site 06-59-05 consists of a septic tank, a tile field, subsurface piping connected to the septic tank and tile field, as well as soil surrounding these features. This CAS was originally identified as a septic tank servicing several buildings within the CP Complex. The septic system was designed to release effluent to subsurface soil through the tile field disposal feature. Dates of activity for this septic system are undetermined. As-built and plan engineering drawings show locations and dimensions of the septic system features (H&N, 1966a; H&N, 1966b; CBA, 1966). The septic tank is located 160 ft east of Mercury Highway and connected to a tile field and a manhole (H&N, 1966a). The septic tank is constructed of 6- to 8-in. thick reinforced concrete and measures approximately 28.5 ft long, 9.3 ft wide, and 7 ft deep (H&N, 1966b). The septic tank has three chambers, each with a vent pipe and a manhole cover. The septic tank outfalls to a tile field that measures 36 ft by 200 ft. The main line, 8-in. diameter VCP, exits the east end of the septic tank and connects to three parallel

lines at 12-ft intervals. The parallel piping is made of 6-in. drain tile and extends 100 ft to the north and south from the main lines. Distal ends of all pipes are plugged (H&N, 1966b). This septic system was abandoned, the existing sanitary sewer line was plugged, and the sewer line was diverted at the manhole to new sewage lagoons (CAS 06-03-03) (CBA, 1966). Only the inactive/abandoned piping not investigated as part of the CAI for CAS 06-03-03 is included in the scope of CAS 06-59-05. [Figure A.2-8](#) shows the location of the septic tank, the tile field, and associated piping at CAS 06-59-05.

2.3 Waste Inventory

Available documentation, interviews with former site employees, process knowledge, and general historical NTS practices were used to identify wastes that may be present. Historical information and site visits indicate that the sites may currently contain waste water and/or septage. Potential waste types include sanitary waste, hydrocarbon waste, *Resource Conservation and Recovery Act* (RCRA) hazardous waste, radioactive waste, and mixed waste. All waste types may be comprised of debris, IDW, decontamination liquids, and soils.

2.3.1 Corrective Action Site 03-51-01, Leach Pit

Corrective Action Site 03-51-01 received waste water from a sink. Solid waste items identified at CAS 03-51-01 include presumed asbestos-containing material (PACM) floor tiles on the surface soil.

2.3.2 Corrective Action Site 06-04-02, Septic Tank

Corrective Action Site 06-04-02 received waste water and/or septage from multiple trailers. No solid waste items have been identified at CAS 06-04-02.

2.3.3 Corrective Action Site 06-05-03, Leach Pit

Corrective Action Site 06-05-03 received wastes from commodes, urinals, sinks and floor drains. No solid waste items have been identified at CAS 06-05-03.

2.3.4 Corrective Action Site 06-05-04, Leach Bed

Corrective Action Site 06-05-04 received wastes from a water curtain, floor drains, sinks, commodes, and showers. No solid waste items have been identified at CAS 06-05-04.

2.3.5 Corrective Action Site 06-59-03, Building CP-400 Septic System

Corrective Action Site 06-59-03 received wastes from a lavatory sink, a water closet, a dark room sink, a floor drain, and a drinking fountain. No solid waste items have been identified at CAS 06-59-03.

2.3.6 Corrective Action Site 06-59-04, Office Trailer Complex Sewage Pond

Corrective Action Site 06-59-04 received waste water and/or septage from the Office Trailer Complex. No solid waste items have been identified at CAS 06-59-04.

2.3.7 Corrective Action Site 06-59-05, Control Point Septic System

Corrective Action Site 06-59-05 received waste water and/or septage from multiple buildings from within the Area 6 CP complex. No solid waste items have been identified at CAS 06-59-05.

2.4 Release Information

Known or suspected releases from the CASs, including potential release mechanisms; and migration routes associated with each of the CASs, are described in the following subsections. Migration of contamination at any of the CAU 560 CASs is not known. Potentially affected media for all CASs include surface and shallow subsurface soil. Exposure routes to site workers include ingestion, inhalation, and/or dermal contact (absorption) from disturbance of contaminated soils, debris, and/or structures. Site workers may also be exposed to direct ionizing radiation by performing activities in proximity to radiologically contaminated materials.

The following subsections contain CAS-specific descriptions of known or suspected releases associated with CAU 560.

2.4.1 *Corrective Action Site 03-51-01, Leach Pit*

The leach pit at CAS 03-51-01 was designed to release effluent to subsurface soil.

2.4.2 *Corrective Action Site 06-04-02, Septic Tank*

Corrective Action Site 06-04-02 was designed to route effluent to either a septic tank or a leach pit. If the CAS feature is a leach pit, then the septic system was designed to release waste to the subsurface soil. If the CAS feature is a septic tank, then the tank may have leaked from any joints or seams during effluent routing or from within the tank itself. If a release occurred from the septic tank, contaminants would have been limited in volume and are expected to be located in the soil within close proximity to the feature.

2.4.3 *Corrective Action Site 06-05-03, Leach Pit*

Corrective Action Site 06-05-03 was designed to release effluent to subsurface soil through a disposal feature (i.e., the leach pit). The septic tank located at this CAS may have leaked from any joints or seams during effluent routing or from within the tank itself. If a release occurred from the septic tank, contaminants would have been limited in volume and are expected to be located in the soil within close proximity to the feature.

2.4.4 *Corrective Action Site 06-05-04, Leach Bed*

Corrective Action Site 06-05-04 was designed to release effluent to subsurface soil through a disposal feature (i.e., the leach bed). The septic tank may have leaked from any joints or seams during effluent routing or from within the tank itself. If a release occurred from the septic tank, contaminants would have been limited in volume and are expected to be located in the soil within close proximity to the feature.

2.4.5 *Corrective Action Site 06-59-03, Building CP-400 Septic System*

Corrective Action Site 06-59-03 was designed to release effluent to subsurface soil through a disposal feature (i.e., the dry well). If the CAS feature is a dry well, then the septic system was designed to release waste to the subsurface soil. The septic tank may have leaked from any joints or seams during effluent routing or from within the tank itself. If a release occurred from the septic tank and

associated lines, contaminants would have been limited in volume and are expected to be located in the soil within close proximity to the features. The outfall pipe from the septic tank was cut and rerouted. This pipe may have leaked from the cut end if it was not properly plugged. If a release occurred from the pipe, contaminants would have been limited in volume; and are expected to be located in the soil within close proximity to the septic tank and cut pipe.

2.4.6 Corrective Action Site 06-59-04, Office Trailer Complex Sewage Pond

Corrective Action Site 06-59-04 was designed to route effluent to the sewage pond. Since it was abandoned, the sewage pond has been filled/covered with material. The sewage pond effluent, likely percolated through the bottom, may have been contained, if lined, or may have overflowed during its operational period. If a release occurred, contaminants would have been limited in volume and are expected to be located in the subsurface soil within close proximity to the sewage pond. As part of the abandonment, the sewer main to the sewage pond was cut. This pipe may have leaked from the cut end if it was not properly plugged. If a release occurred from the cut pipe, contaminants would have been limited in volume; and are expected to be located in the subsurface soil within close proximity to the feature.

2.4.7 Corrective Action Site 06-59-05, Control Point Septic System

Corrective Action Site 06-59-05 was designed to release effluent to subsurface soil through a disposal feature (i.e., the tile field). The septic tank may have leaked from any joints or seams during effluent routing or from within the tank itself. If a release occurred from the septic tank, contaminants would have been limited in volume and are expected to be located in the subsurface soil within close proximity to the feature. Any contents of the tank will be characterized for disposal. The sewer main to the septic tank was cut. This pipe may have leaked from the cut end if it was not properly plugged. If a release occurred, contaminants would have been limited in volume; and are expected to be located in the subsurface soil within close proximity to the cut pipe.

2.5 Investigative Background

The following subsections summarize the investigations conducted at the CAU 560 sites. More detailed discussions of these investigations are in [Sections A.2.1](#) through [A.2.7](#).

2.5.1 Corrective Action Site 03-51-01, Leach Pit

Corrective Action Site 03-51-01 is located near the sites of several atmospheric nuclear tests. Inspection of the 1994 Aerial Flyover gamma survey data indicated that the CAS is not located in the plume from these tests (BN, 1999).

In 2007, a geophysical survey was conducted for the CAS 03-51-01 leach pit. Survey results corroborate the layout of piping and the leach pit, as shown in engineering drawings; a linear signal is shown originating from a cut pipe in the concrete pad trending north to a large anomaly in the location of the leach pit. In addition to these features, a linear signal is shown trending north from the location of the leach pit, terminating at a large subsurface anomaly (Weston, 2007).

No documented sampling or other surveys have been performed at this CAS.

2.5.2 Corrective Action Site 06-04-02, Septic Tank

In 2004, a geophysical survey was conducted for the CAS 06-04-02 septic tank/leach pit. An anomaly, typical of a buried steel septic tank, was detected in the location of the septic tank/leach pit as shown in engineering drawings. Survey results did not corroborate the presence of the buried VCP that likely exists from the tank/leach pit to the pipe surface protrusions (Fahringer, 2004).

No documented sampling or other surveys have been performed at this CAS.

2.5.3 Corrective Action Site 06-05-03, Leach Pit

Samples of septic tank contents (liquids and solids) were collected before April 1994. Liquids were analyzed for oil/grease, semivolatile organic compounds (SVOCs), Base Neutral Acid (BNA), VOC, and total metals panel contaminant levels. Solids were analyzed for Toxicity Characteristic Leaching Procedure (TCLP) metals, TCLP-VOC, TCLP-BNA, total petroleum hydrocarbons (TPH), and oil/grease contaminant levels. Analytical results did not exceed the current regulatory thresholds for any of the constituents with the exception of TPH levels, of up to 3,290 milligrams per kilogram (mg/kg), are above the NDEP limit of 100 mg/kg (Kendall, 1995).

In 2007, a geophysical survey was conducted for the CAS 06-05-03 septic tank and leach pit. The survey detected the leach pit in the location shown in engineering drawings. However, the survey did

not conclusively detect the location of the septic tank. The septic tank may be constructed of material undetectable by the instruments used, the septic tank may have been removed, or the signal was masked by interference from the adjacent metal building. Survey results did not corroborate the presence of the buried VCP that likely exists from the septic tank to the leach pit (Weston, 2007).

No other surveys have been performed at this CAS.

2.5.4 Corrective Action Site 06-05-04, Leach Bed

Samples of septic tank contents (liquids and solids) were collected before April 1994. Liquids were analyzed for oil/grease, SVOC, BNA, VOC, and total metals panel contaminant levels. Solids were analyzed for TCLP metals, TCLP-VOC, TCLP-BNA, TPH, and oil/grease contaminant levels. Analytical results did not exceed the current regulatory thresholds for any constituents with the exception of TPH levels, of up to 1,950 mg/kg, are above the NDEP limit of 100 mg/kg (Kendall, 1995).

In 2007, a geophysical survey was conducted for the CAS 06-05-04 septic tank and distribution box; the survey area did not include the fenced leach bed. The survey did not conclusively detect the location of the septic tank. The septic tank may be constructed of material undetectable by the instruments used or the septic tank may have been removed. Instruments used could not obtain a response from the buried VCP that likely exists between disposal features of the CAS (Weston, 2007).

No other documented sampling or surveys have been performed at this CAS.

2.5.5 Corrective Action Site 06-59-03, Building CP-400 Septic System

In 2006, a geophysical survey was conducted for the area around the concrete pad and site access road CAS 06-59-03. Linear anomalies, typical of subsurface utilities, were detected in the locations of water and septic pipes as shown in engineering drawings. A linear feature extends southeast from the location of the septic tank and is visible exiting off the side of the cliff to the south (Weston, 2006).

No documented sampling or other surveys have been performed at this CAS.

2.5.6 Corrective Action Site 06-59-04, Office Trailer Complex Sewage Pond

In 2004, a geophysical survey was conducted for the CAS 06-59-04 covered sewage pond. The survey detected elevated levels of soil conductivity in the location of the sewage pond. Survey results indicate that no significant metal debris exists within the fill of the covered sewage pond. Instruments used could not obtain a response from the buried VCP that likely exists from the sewage pond to the pipe stick-ups (Fahringer, 2004).

No documented sampling or other surveys have been performed at this CAS.

2.5.7 Corrective Action Site 06-59-05, Control Point Septic System

No previous investigative results have been identified for soils or materials currently present at CAS 06-59-05.

2.5.8 National Environmental Policy Act

The *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DOE/NV, 1996) includes site investigation activities such as those proposed for CAU 560.

In accordance with the NNSA/NSO *National Environmental Policy Act* (NEPA) Compliance Program, a NEPA checklist will be completed before beginning site investigation activities at CAU 560. This checklist requires NNSA/NSO project personnel to evaluate their proposed project activities against a list of potential impacts that include, but are not limited to: air quality, chemical use, waste generation, noise level, and land use. Completion of the checklist results in a determination of the appropriate level of NEPA documentation by the NNSA/NSO NEPA Compliance Officer. This will be accomplished before mobilization for the field investigation.

3.0 Objectives

This section presents an overview of the DQOs for CAU 560 and formulation of the CSM. Also presented is a summary listing of the contaminants reasonably suspected to be present at each CAS (i.e., target contaminants), the COPCs, the preliminary action levels (PALs) for the investigation, and the process used to establish FALs. Additional details and figures depicting the CSM are in [Appendix A](#).

3.1 Conceptual Site Model

The CSM describes the most probable scenario for current conditions at each site and defines the assumptions that are the basis for identifying the future land use, contaminant sources, release mechanisms, migration pathways, exposure points, and exposure routes. The CSM is also used to support appropriate sampling strategies and data collection methods. The CSM has been developed for CAU 560 using information from the physical setting, potential contaminant sources, release information, historical background information, knowledge from similar sites, and physical and chemical properties of the potentially affected media and COPCs. [Figure 3-1](#) depicts a tabular representation of the conceptual pathways to receptors from CAU 560 sources. [Figure 3-2](#) depicts a graphical representation of the CSM. If evidence of contamination that is not consistent with the presented CSM is identified during investigation activities, the situation will be reviewed, the CSM revised, the DQOs re-assessed, and a recommendation made as to how to proceed. In such cases, decision-makers listed in [Section A.3.1](#) will be notified and given the opportunity to comment on and/or concur with the recommendation.

The following sections discuss future land use and the identification of exposure pathways (i.e., combination of source, release, migration, exposure point, and receptor exposure route) for CAU 560.

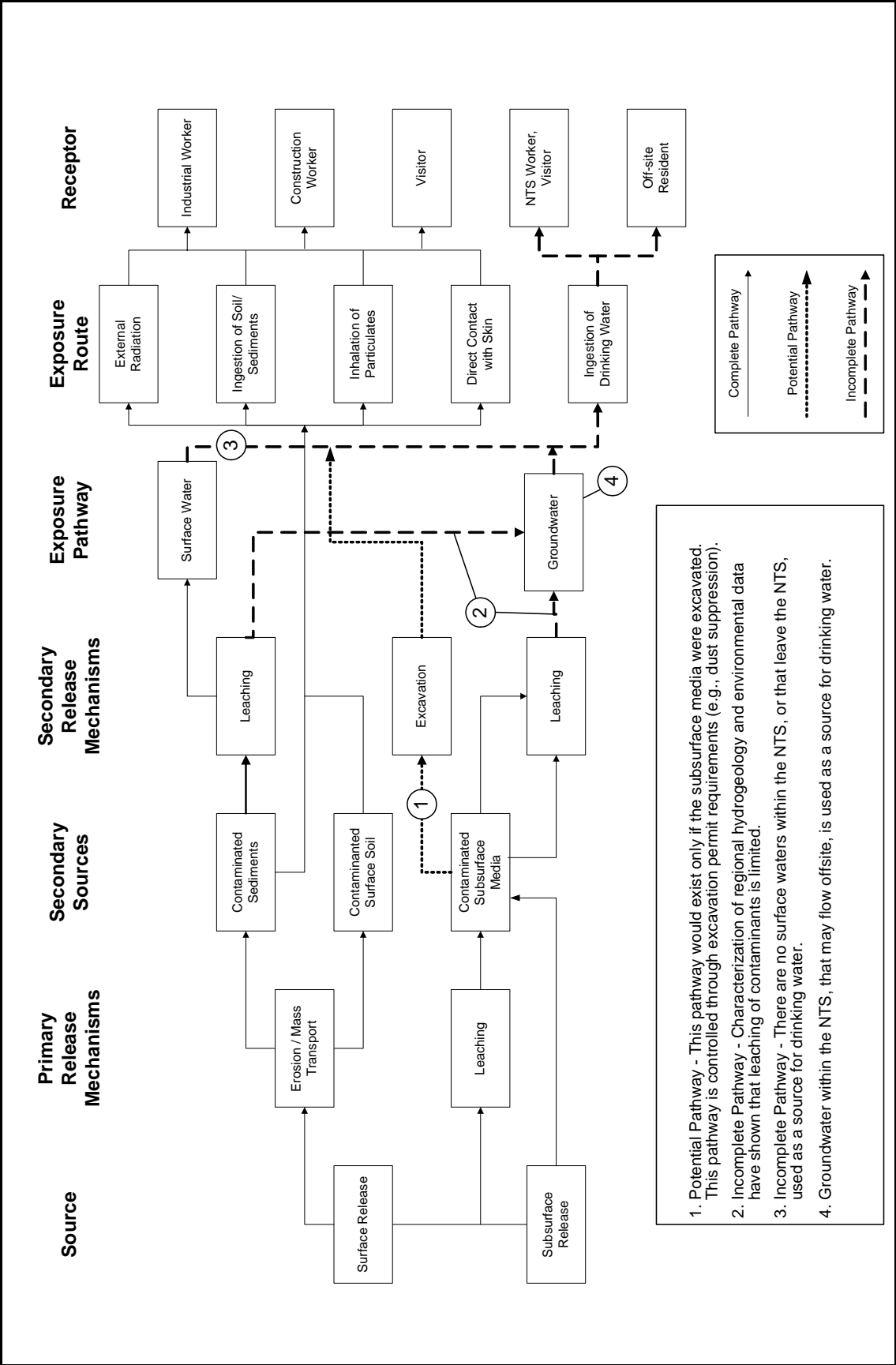


Figure 3-1
Conceptual Site Model Diagram

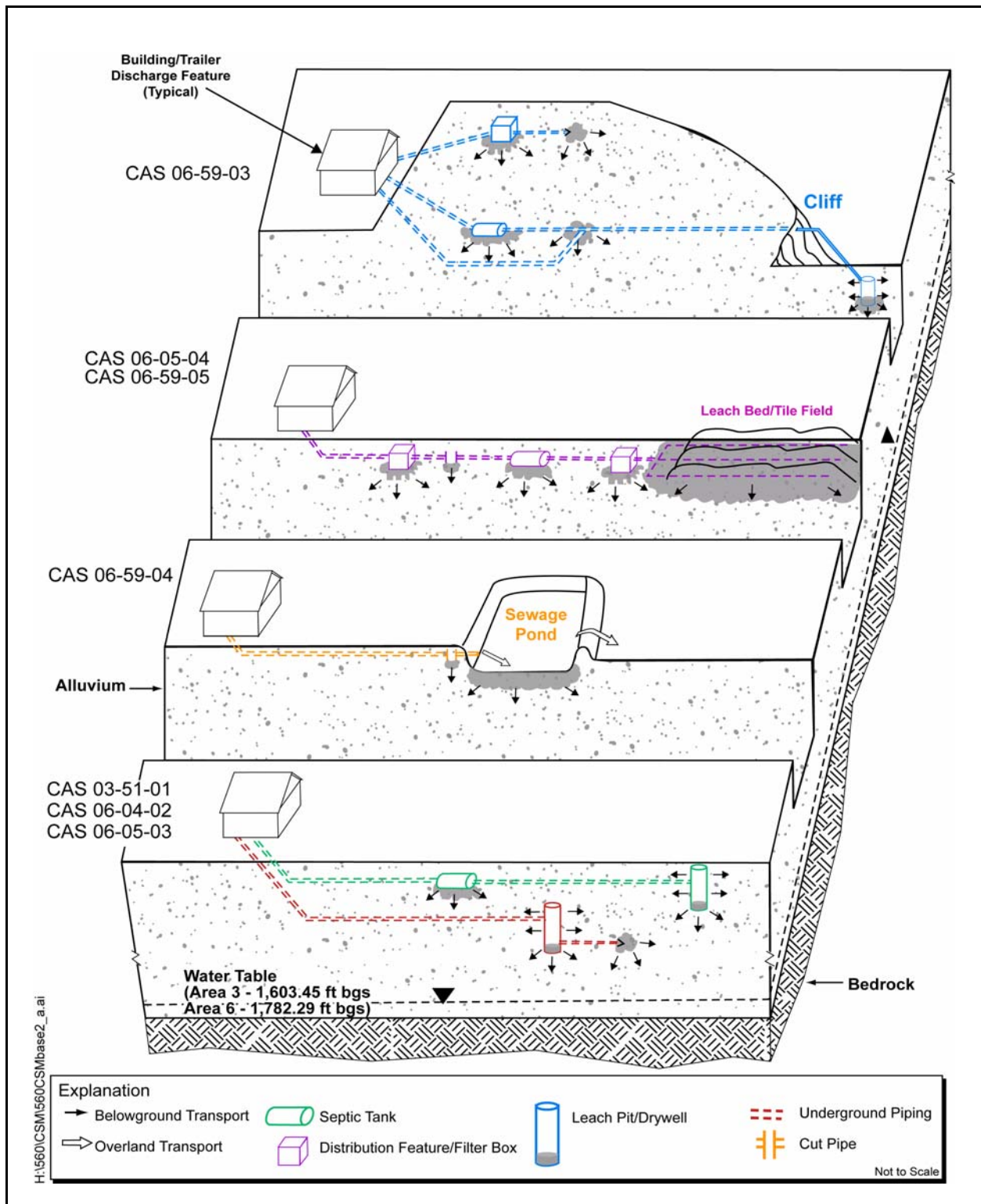


Figure 3-2
Conceptual Site Model for CAU 560

3.1.1 Land-Use and Exposure Scenarios

Corrective Action Site 03-51-01 is located in the land-use zone described as the “Nuclear and High Explosives Test Zone” which is designated for additional underground nuclear weapons tests and outdoor high-explosive tests. This zone includes compatible defense and nondefense research, development, and testing activities (DOE/NV, 1998).

Corrective Action Sites 06-04-02, 06-05-03, 06-05-04, 06-59-03, 06-59-04, and 06-59-05 are located in the land-use zone described as the “Defense Industrial Zone” within the NTS. This area is designated for stockpile management of weapons, including production, assembly, disassembly or modification, staging, repair, retrofit, and surveillance. This zone also includes permanent facilities for stockpile stewardship operations involving equipment and activities such as radiography, lasers, material processing, and pulsed power (DOE/NV, 1998).

All land-use zones where the CAU 560 CASs are located dictate future land use and restrict current and future land use to nonresidential (i.e., industrial) activities.

Exposure scenarios for the CAU 560 CASs have been categorized based on current and projected future land uses: All area 6 CASs are within the Industrial Complex and therefore are categorized as Industrial Areas. This exposure scenario assumes industrial use of a site. This scenario addresses exposure to industrial workers continuously exposed to contaminants in soil during each workday for an entire career (225 days per year, 8 hours per day for a duration of 25 years).

Occasional Use Area for CAS 03-51-01. This exposure scenario assumes exposure to industrial workers who are not assigned to the area as a regular worksite but may occasionally use the site for intermittent or short-term activities. A site worker under this scenario is assumed to be on the site for an equivalent of 8 hours per day, 10 days per year, for 5 years.

3.1.2 Contaminant Sources

The contamination sources for the CSM are:

- Designed releases to subsurface soil through a disposal feature (i.e., leach bed, leach pit, dry well).

- Leaks, due to breaches and disconnects.
- Spills.
- Overtopping.

3.1.3 Release Mechanisms

Release mechanisms for the CSM include designed releases to subsurface soil, through a disposal feature, accidental spills and leaks from piping, and disposal features.

3.1.4 Migration Pathways

Subsurface migration pathways at the CASs are expected to be predominately vertical, although spills or leaks at the ground surface may also have limited lateral migration before infiltration. The depth of infiltration (shape of the subsurface contaminant plume) will be dependent upon the type, volume, and duration of the discharge as well as the presence of relatively impermeable layers that could modify vertical or horizontal transport pathways, both on the ground surface (e.g., concrete) and in the subsurface (e.g., caliche layers).

Migration pathways include the lateral migration of potential contaminants across surface soils/sediments and vertical migration of potential contaminants through subsurface soils.

Contaminants released into the Yucca Flat Dry Lake are subject to much higher transport mechanisms than contaminants released to other surface areas. Surface migration pathways at the CASs are expected to be minor as all the CASs have shallow surface slopes and the potential release sites are not located in or near drainages.

Migration is influenced by physical and chemical characteristics of the contaminants and media. Contaminant characteristics include, but are not limited to: solubility, density, and adsorption potential. Media characteristics include permeability, porosity, water saturation, sorting, chemical composition, and organic content. In general, contaminants with low solubility, high affinity for media, and high density can be expected to be found relatively close to release points. Contaminants with high solubility, low affinity for media, and low density can be expected to be found further from release points. These factors affect the migration pathways and potential exposure points for the contaminants in the various media under consideration.

Infiltration and percolation of precipitation serves as a driving force for downward migration of contaminants. However, due to high PET (annual PET at the Area 3 Radiological Waste Management Site has been estimated at 62.6 in. (Shott et al., 1997) and limited precipitation for this region (6.67 in. per year [Winograd and Thordarson, 1975]), percolation of infiltrated precipitation at the NTS does not provide a significant mechanism for vertical migration of contaminants to groundwater (DOE/NV, 1992). In addition, liquids released as a waste component may also have provided a hydraulic driver for percolation and migration of contaminants.

3.1.5 Exposure Points

Exposure points for the CSM are expected to be areas of surface contamination where visitors and site workers will come in contact with soil surface. Subsurface exposure points may also exist if construction workers come in contact with contaminated media during excavation activities.

3.1.6 Exposure Routes

Exposure routes to site workers and military personnel include ingestion, inhalation, and/or dermal contact (absorption) from disturbance of, or direct contact with, contaminated media. Site workers and military personnel may also be exposed to direct ionizing radiation by performing activities in proximity to radiologically contaminated materials.

3.1.7 Additional Information

Information concerning topography, geology, climatic conditions, hydrogeology, floodplains, and infrastructure at the CAU 560 CASs are available and are presented in [Section 2.1](#) as they pertain to the investigation. This information has been addressed in the CSM and will be considered during the evaluation of corrective action alternatives, as applicable. Climatic and site conditions (e.g., surface and subsurface soil descriptions) and specific structure descriptions will be recorded during the CAI.

3.2 Contaminants of Potential Concern

The COPCs for CAU 560 are defined as the list of constituents represented by the analytical methods identified in [Table 3-1](#) for Decision I environmental samples taken at each of the CASs. The constituents reported for each analytical method are listed in [Table 3-2](#).

**Table 3-1
Analytical Program^a**

Analyses	03-51-01	06-04-02	06-05-03	06-05-04	06-59-03	06-59-04	06-59-05
Organic Contaminants of Potential Concern (COPCs)							
Total Petroleum Hydrocarbons-Diesel-Range Organics	X	X	X	X	X	X	X
Polychlorinated Biphenyls	X	X	X	X	X	X	X
Semivolatile Organic Compounds	X	X	X	X	X	X	X
Volatile Organic Compounds	X	X	X	X	X	X	X
Pesticides	X	X	X	X	X	X	X
Inorganic COPCs							
Resource Conservation and Recovery Act Metals	X	X	X	X	X	X	X
Total Beryllium	X	X	X	X	X	X	X
Radionuclide COPCs							
Gamma Spectroscopy ^b	X	X	X	X	X	X	X
Isotopic Uranium ^b	Contingent depending on review of gamma spectroscopy results, or may be submitted if field-screening levels are exceeded during aliquot field screening.						
Isotopic Plutonium ^b							
Strontium-90 ^b							
Potential Remediation Waste Requirements							
Toxicity Characteristic Leaching Procedure (TCLP) Metals ^c	X	X	X	X	X	X	X
TCLP Volatile Organic Compounds ^c	X	X	X	X	X	X	X
TCLP Semivolatile Organic Compounds ^c	X	X	X	X	X	X	X
TCLP Pesticides ^c	X	X	X	X	X	X	X

^aThe contaminants of potential concern are the constituents reported from the analytical methods listed.

^bResults of gamma analysis will be used to determine whether further radioanalytical analysis is warranted.

^cTotal analysis may be used to determine if TCLP analysis is needed.

X = Required analytical method

Table 3-2
Constituents Reported by Analytical Methods

VOCs	SVOCs	TPH	PCBs	Metals	Isotopic Radionuclides
1,1,1-Trichloroethane	2,3,4,6-Tetrachlorophenol	TPH - Diesel-Range Organics	Aroclor 1016	Arsenic	Plutonium-238
1,1,1,2-Tetrachloroethane	2,4-Dimethylphenol		Aroclor 1221	Barium	Plutonium-239/240
1,1,2,2-Tetrachloroethane	2,4-Dinitrotoluene		Aroclor 1232	Beryllium	Strontium-90
1,1,2-Trichloroethane	2,4,5-Trichlorophenol		Aroclor 1242	Cadmium	Uranium-234
1,1-Dichloroethane	2,4,6-Trichlorophenol		Aroclor 1248	Chromium	Uranium-235
1,1-Dichloroethene	2-Chlorophenol		Aroclor 1254	Lead	Uranium-238
cis-1,2-Dichloroethane	2-Methylnaphthalene		Aroclor 1260	Mercury	
1,2-Dichloroethane	2-Methylphenol		Aroclor 1268	Selenium	
1,2-Dichloropropane	2-Nitrophenol		Pesticides	Silver	
1,2,4-Trichlorobenzene	3-Methylphenol ^a				
1,2,4-Trimethylbenzene	4-Chloroaniline				
1,2-Dibromo-3-chloropropane	4-Methylphenol ^a				
1,3,5-Trimethylbenzene	4-Nitrophenol				
1,4-Dioxane	Acenaphthene				
2-Butanone	Acenaphthylene				
2-Chlorotoluene	Aniline				
2-Hexanone	Anthracene				
4-Methyl-2-pentanone	Benzo(a)anthracene				
Acetone	Benzo(a)pyrene				
Acetonitrile	Benzo(b)fluoranthene				
Allyl chloride	Benzo(g,h,i)perylene				
Benzene	Benzo(k)fluoranthene				
Bromodichloromethane	Benzoic Acid				
Bromoform	Benzyl Alcohol				
Bromomethane	Bis(2-ethylhexyl) phthalate				
Carbon disulfide	Butyl benzyl phthalate				
Carbon tetrachloride	Carbazole				
Chlorobenzene	Chrysene				
Chloroethane	Dibenzo(a,h)anthracene				
Chloroform	Dibenzofuran				
Chloromethane	Diethyl Phthalate				

^aMay be reported as 3,4-methylpenol

^bMay be reported with VOCs

PCB = Polychlorinated biphenyl

SVOC = Semi-volatile organic compound

TPH = Total petroleum hydrocarbons

VOC = Volatile organic compound

The list of COPCs is intended to encompass all of the contaminants that could potentially be present at each CAS. These COPCs were identified during the planning process through the review of site history, process knowledge, personal interviews, past investigation efforts (where available), and inferred activities associated with the CASs. Contaminants detected at other similar NTS sites were also included in the COPC list to reduce the uncertainty about potential contamination at the CASs; because complete information regarding activities performed at the CAU 560 sites is not available.

During the review of site history documentation, process knowledge information, personal interviews, past investigation efforts (where available), and inferred activities associated with the CASs, some of the COPCs were identified as targeted contaminants at specific CASs. Targeted contaminants are those COPCs for which evidence in the available site and process information suggests that they may be reasonably suspected to be present at a given CAS. The targeted contaminants are required to meet a more stringent completeness criteria than other COPCs thus providing greater protection against a decision error (see [Sections A.1.0 through A.7.0](#)). Targeted contaminants for each CAU 560 CAS are identified in [Table 3-3](#).

Table 3-3
Targeted Contaminants for CAU 560

CAS	Chemical Targeted Contaminant(s)	Radiological Targeted Contaminant(s)
06-05-03, 06-59-04	Total petroleum hydrocarbons	None
06-59-03	Silver	None
03-51-01, 06-04-02, 06-05-04, 06-59-05	None	None

3.3 Preliminary Action Levels

The PALs presented in this section are to be used for site screening purposes. They are not necessarily intended to be used as clean-up action levels or FALs. However, they are useful in screening out contaminants that are not present in sufficient concentrations to warrant further evaluation; therefore, streamlining the consideration of remedial alternatives. The risk-based corrective action (RBCA) process used to establish FALs is described in the *Industrial Sites Project Establishment of Final Action Levels* (NNSA/NSO, 2006a). This process conforms with *Nevada Administrative Code* (NAC) Section 445A.227, which lists the requirements for sites with soil

contamination (NAC, 2006c). For the evaluation of corrective actions, NAC Section 445A.22705 (NAC, 2006d) requires the use of American Society for Testing and Materials (ASTM) Method E 1739-95 (ASTM, 1995) to “conduct an evaluation of the site, based on the risk it poses to public health and the environment, to determine the necessary remediation standards (i.e., FALs) or to establish that corrective action is not necessary.”

This RBCA process, summarized in [Figure 3-3](#), defines three tiers (or levels) of evaluation involving increasingly sophisticated analyses:

- Tier 1 Evaluation - Sample results from source areas (highest concentrations) are compared to action levels based on generic (non-site-specific) conditions (i.e., the PALs established in the CAIP). The FALs may then be established as the Tier 1 action levels or the FALs may be calculated using a Tier 2 evaluation.
- Tier 2 Evaluation - Conducted by calculating Tier 2 Site-specific Target Levels (SSTLs) using site-specific information as inputs to the same or similar methodology used to calculate Tier 1 action levels. The Tier 2 SSTLs are then compared to individual sample results from reasonable points of exposure (as opposed to the source areas as is done in Tier 1) on a point-by-point basis. Under Tier 2 or Tier 3, TPH concentrations will not be used for risk-based decisions. Rather, the individual chemicals of concern will be compared to the SSTLs.
- Tier 3 Evaluation - Conducted by calculating Tier 3 SSTLs on the basis of more sophisticated risk analyses using methodologies described in Method E 1739-95 that consider site-, pathway-, and receptor-specific parameters.

This process includes a provision for conducting an interim remedial action if necessary and appropriate. The decision to conduct an interim action may be made at any time during the investigation and at any level (tier) of analysis. Concurrence of the decision-makers listed in [Section A.3.1](#) will be obtained before any interim action is implemented. Evaluation of DQO decisions will be based on conditions at the site following completion of any interim actions. Any interim actions conducted will be documented in the investigation report.

The FALs, and basis for selection, will be proposed in the investigation report, and compared to laboratory results in the evaluation of potential corrective actions.

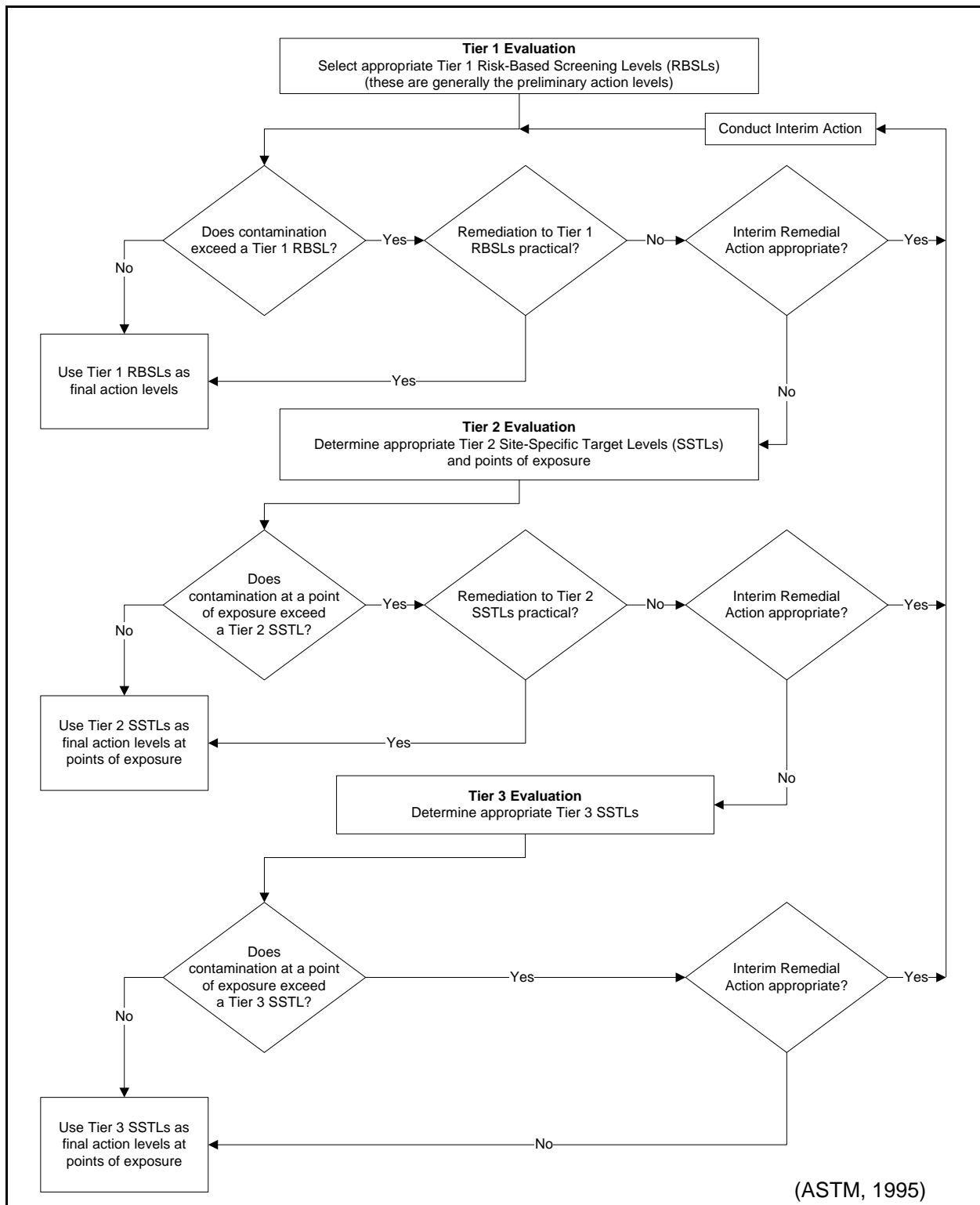


Figure 3-3
Risk-Based Corrective Action Decision Process

3.3.1 Chemical PALs

Except as noted herein, the chemical PALs are defined as the U.S. Environmental Protection Agency (EPA) *Region 9 Risk-Based Preliminary Remediation Goals (PRGs)* for contaminant constituents in industrial soils (EPA, 2004). Background concentrations for RCRA metals will be used instead of PRGs when natural background concentrations exceed the PRG, as is often the case with arsenic on the NTS. Background is considered the mean plus two standard deviations for sediment samples collected by the Nevada Bureau of Mines and Geology throughout the Nevada Test and Training Range (formerly the Nellis Air Force Range) (NBMG, 1998; Moore, 1999). For detected chemical COPCs without established PRGs, the protocol used by the EPA Region 9 in establishing PRGs (or similar) will be used to establish PALs. If used, this process will be documented in the investigation report.

3.3.2 Total Petroleum Hydrocarbon PALs

The PAL for TPH is 100 parts per million (ppm) as listed in NAC 445A.2272 (NAC, 2006e).

3.3.3 Radionuclide PALs

The PALs for radiological contaminants (other than tritium) are based on the National Council on Radiation Protection and Measurement (NCRP) Report No. 129 recommended screening limits for construction, commercial, industrial land-use scenarios (NCRP, 1999) using a 25 millirem per year (mrem/yr) dose constraint (Murphy, 2004) and the generic guidelines for residual concentration of radionuclides in DOE Order 5400.5 (DOE, 1993). The NCRP PALs are based on the construction, commercial, and industrial land-use scenario provided in the guidance. All PALs are appropriate for the NTS based on future land-use scenarios as presented in [Section 3.1.1](#).

3.4 Data Quality Objective Process Discussion

This section contains a summary of the DQO process that is presented in [Appendix A](#). The DQO process is a strategic planning approach based on the scientific method that is designed to ensure that the data collected will provide sufficient and reliable information to identify, evaluate, and technically defend the recommendation of viable corrective actions (e.g., no further action, clean closure, or closure in place).

The DQO strategy for CAU 560 was developed at a meeting on January 22, 2008. The DQOs were developed to identify data needs, clearly define the intended use of the environmental data, and to design a data collection program that will satisfy these purposes. During the DQO discussions for CAU 560, the informational inputs or data needs to resolve problem statements and decision statements were documented.

The problem statement for CAU 560 is: “Existing information on the nature and extent of potential contamination is insufficient to evaluate and recommend corrective action alternatives for the CASs in CAU 560.” To address this question, the resolution of two decisions statements is required:

- Decision I: “Is any COC present in environmental media within the CAS?” If a COC is detected, then Decision II must be resolved. Otherwise, the investigation for that CAS is complete.
- Decision II: “If a COC is present, is sufficient information available to evaluate potential corrective action alternatives?” Sufficient information is defined to include:
 - Identifying the volume of media containing any COC bounded by analytical sample results in lateral and vertical directions.
 - The information needed to determine potential remediation waste types.
 - The information needed to evaluate the feasibility of remediation alternatives.

The presence of a COC would require a corrective action. A corrective action may also be necessary if there is a potential for wastes that are present at a site to impose COCs into site environmental media if the wastes were to be released. To evaluate the potential for septic tank contents to result in the introduction of a COC to the surrounding environmental media, the following conservative assumptions were made:

- That any containment would fail at some point and the contents would be released to the surrounding media.
- That the resulting concentration of contaminants in the surrounding media would be equal to the concentration of contaminants in nonliquid waste.
- That any contaminant in the liquid waste exceeding the RCRA toxicity characteristic concentration can result in introduction of a COC to the surrounding media.

Nonliquid waste containing a contaminant exceeding an equivalent FAL concentration would be considered to be potential source material (PSM) and would require a corrective action. Liquid waste with contaminant concentrations exceeding an equivalent toxicity characteristic action level would be considered to be PSM and would require a corrective action.

Decision I samples will be submitted to analytical laboratories for the analyses listed in [Table 3-1](#). Decision II samples will be submitted for the analysis of all unbounded COCs. In addition, samples will be submitted for analyses as needed to support waste management or health and safety decisions.

The data quality indicators (DQIs) of precision, accuracy, representativeness, completeness, comparability, and sensitivity needed to satisfy DQO requirements are discussed in [Section 6.2](#). Laboratory data will be assessed in the investigation report to confirm or refute the CSM and determine whether the DQO data needs were met.

To satisfy the DQI of sensitivity (presented in [Section 6.2.8](#)), the analytical methods must be sufficient to detect contamination that is present in the samples at concentrations less than or equal to the corresponding FALs. Analytical methods and target minimum detectable concentrations (MDCs) for each CAU 560 COPC are provided in [Tables 3-4](#) and [3-5](#). The MDC is the lowest concentration of a chemical or radionuclide parameter that can be detected in a sample within an acceptable level of error. Due to changes in analytical methodology and changes in analytical laboratory contracts, information in [Tables 3-4](#) and [3-5](#) that varies from corresponding information in the QAPP will supersede the QAPP (NNSA/NV, 2002).

Table 3-4
Analytical Requirements for Radionuclides for CAU 560

Analysis ^a	Matrix	Analytical Method	Minimum Detectable Concentration (MDC) ^b	Laboratory Precision	Laboratory Accuracy (%R)
Gamma-Emitting Radionuclides					
Gamma Spectroscopy	Aqueous	EPA 901.1 ^c	< Preliminary Action Levels	RPD 35% ^e	Laboratory Control Sample 80-120%R
	Nonaqueous	HASL-300 ^d		ND ^f -2<ND ^f <2	
Other Radionuclides					
Plutonium-238	All	HASL-300 ^d	< Preliminary Action Levels	RPD 35% ^e ND ^f -2<ND ^f <2	Laboratory Control Sample 80-120%R
Plutonium-239/240	All	HASL-300 ^d			
Strontium-90	All	HASL-300 ^d			
Uranium-234	All	HASL-300 ^d			Chemical Yield 30-105%R (not applicable for tritium and gross-alpha/beta)
Uranium-235	All	HASL-300 ^d			
Uranium-238	All	HASL-300 ^d			Matrix Spike Sample 61-140%R (tritium and gross alpha/beta only)

^aApplicable constituents are listed in [Table 3-2](#).

^bThe MDC is the lowest concentration of a radionuclide present in a sample and can be detected with a 95% confidence level.

^c*Prescribed Procedures for Measurement of Radioactivity in Drinking Water* (EPA, 1980).

^d*The Procedures Manual of the Environmental Measurements Laboratory*, HASL-300 (DOE, 1997a).

^eND is not RPD; rather, it is another measure of precision used to evaluate duplicate analyses. The ND is calculated as the difference between two results divided by the square root of the sum of the squares of their total propagated uncertainties. *Evaluation of Radiochemical Data Usability* (DOE, 1997b).

^f*Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan) with Guidance* (EPA, 2000).

EPA = U.S. Environmental Protection Agency

HASL = Health and Safety Laboratory

ND = Normalized difference

RPD = Relative percent difference

%R = Percent recovery

Table 3-5
Analytical Requirements for Chemical COPCs for CAU 560

Analysis ^a	Matrix	Analytical Method (SW-846) ^b	Minimum Detectable Concentration (MDC) ^c	Laboratory Precision	Laboratory Accuracy (%R)
ORGANICS					
Total Volatile Organic Compounds	All	8260B	< Preliminary Action Levels	Lab-specific ^d	Lab-specific ^d
TCLP Volatile Organic Compounds	Leachate	1311/8260B	≤ Regulatory Limits	Lab-specific ^d	Lab-specific ^d
Total Semivolatile Organic Compounds	All	8270C	< Preliminary Action Levels	Lab-specific ^d	Lab-specific ^d
TCLP Semivolatile Organic Compounds	Leachate	1311/8270C	≤ Regulatory Limits	Lab-specific ^d	Lab-specific ^d
Polychlorinated Biphenyls	All	8082	< Preliminary Action Levels	Lab-specific ^d	Lab-specific ^d
Total Petroleum Hydrocarbons-Diesel-Range Organics	All	8015B (modified)		Lab-specific ^d	Lab-specific ^d
Pesticides	All	8081A		Lab-specific ^d	Lab-specific ^d
TCLP Pesticides	Leachate	1311/8081A	≤ Regulatory Limits	Lab-specific ^d	Lab-specific ^d
INORGANICS					
Metals	All	6010B	< Preliminary Action Levels	RPD 35% (nonaqueous) ^e 20% (aqueous) ^e	Matrix Spike Sample 75-125%R ^b
Mercury	Aqueous	7470A			
	Nonaqueous	7471A	≤ Regulatory Limits	Absolute Difference ^f ±2x RL (nonaqueous) ^f ±1x RL (aqueous) ^f	Laboratory Control Sample 80-120%R ^f
TCLP Metals	Leachate	1311/6010B			
TCLP Mercury	Leachate	7470A			

^aApplicable constituents are listed in [Table 3-2](#).

^b*Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846)* (EPA, 1996).

^cThe MDC is the lowest concentration that can be reliably achieved within specified limits of accuracy and precision.

^dRPD and %R performance criteria are developed by the analytical laboratory according to approved procedures.

^e*Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan) with Guidance* (EPA, 2000).

^f*USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA, 2004a).

RL = Reporting limit

RPD = Relative percent difference

TCLP = Toxicity Characteristic Leaching Procedure

%R = Percent recovery

4.0 *Field Investigation*

This section contains a description of the activities to be conducted to gather and document information from the CAU 560 field investigation.

4.1 *Technical Approach*

The information necessary to satisfy the DQO data needs will be generated for each of the CAU 560 CASs by collecting and analyzing samples generated during a field investigation. The presence and nature of contamination at all CASs will be evaluated using a judgmental approach.

If there is a waste present that, if released, has the potential to release significant contamination into site environmental media, that waste will be sampled. If it is determined that a COC is present at any CAS, that CAS will be addressed further by determining the extent of contamination before evaluating corrective action alternatives.

Because this CAIP only addresses contamination originating from the CAU, it may be necessary to distinguish overlapping contamination originating from other sources. For example, widespread surface radiological contamination originating from atmospheric tests will not be addressed in the CAU 560 investigation. To determine whether contamination is from the CAU or from other sources, soil samples may be collected from locations outside the influence of releases from the CAS at selected CASs.

Modifications to the investigative strategy may be required should unexpected field conditions be encountered at any CAS. Significant modifications shall be justified and documented before implementation. If an unexpected condition indicates that conditions are significantly different than the corresponding CSM, the activity will be rescoped and the identified decision makers will be notified.

4.2 *Field Activities*

Field activities at CAU 560 include site preparation, sample location selection, and sample collection activities.

4.2.1 Site Preparation Activities

Site preparation activities conducted by the NTS Management and Operating Contractor before the investigation may include, but not be limited to: relocation or removal of surface debris, equipment, and structures; the construction of hazardous waste accumulation areas (HWAAs) and site exclusion zones; providing sanitary facilities; the construction of decontamination facilities; and temporarily moving staged equipment.

4.2.2 Sample Location Selection

Before collecting investigation samples, the following activities will also be performed:

- Field surveys of soil to identify locations with alpha or beta/gamma levels significantly higher than the surrounding background soil.
- Visual surveys at all CASs within CAU 560 to identify any staining, discoloration, disturbance of native soils, or any other indication of potential contamination.
- Surveys will be used to select sampling locations and screening will be used to select which samples will be submitted for laboratory analysis (and for health and safety reasons).

At all CASs, biasing factors (including field-screening results) will be used to select the most appropriate samples from a particular location for submittal to the analytical laboratory. Biasing factors to be used for selection of sampling locations are listed in [Section A.5.2.1](#) of [Appendix A](#). As biasing factors are identified and used for selection of sampling locations, they will be documented in the appropriate field documents.

The CAS-specific sampling strategy and the estimated locations of biased samples for each CAS are presented in [Appendix A](#). The number, location, and spacing of step-outs may be modified by the Task Manager or Site Supervisor, as warranted by site conditions to achieve DQO criteria stipulated in [Appendix A](#). Where sampling locations are modified by the Task Manager or Site Supervisor, the justification for these modifications will be documented in the Site Supervisor's field logbook.

4.2.3 Sample Collection

The CAU 560 sampling program will consist of the following activities:

- Collect and analyze samples from locations, as described in this section.
- Collect required QC samples.
- Collect waste management samples, as needed.
- Conduct investigative trenching/excavating to identify subsurface features.
- Perform video-mole surveys on subsurface piping, as appropriate.
- Collect soil samples from locations outside the influence of releases from the CAS, if necessary.
- Perform radiological characterization surveys of debris, as necessary, for disposal purposes.
- Record GPS coordinates for each environmental sample location.

During Decision I sampling, the following will be collected:

- Sample below any input/inflow pipe connection to disposal features.
- Sample below any output connection and/or outfall pipe from disposal features.
- Sample at native soil interface below designed release points.
- Sample from the contents of septic tanks and the covered sewage pond to characterize the waste for potential disposal.
- Sample any PSM, if found.
- Sample at any breach or soil staining encountered during surveying of piping related to the disposal features.
- Sample soil adjacent to septic tanks at joints, breaks, or any other location where leaks are likely to have occurred.
- Sample at the base of septic tanks, below inflow and outfall lines.
- Sample at interface soil at transects near proximal and distal ends of pipes comprising the leach bed/tile field.

If biasing factors are present in soils below locations where Decision I samples were collected, subsurface Decision I soil samples will also be collected by hand augering, backhoe excavation, direct-push, or drilling techniques, as appropriate. Decision I subsurface soil samples will be collected at depth intervals selected by the Task Manager or Site Supervisor based on biasing factors to a depth where the biasing factors are no longer present or the spatial boundary is reached.

Decision II sampling will consist of further defining the extent of contamination where COCs have been confirmed. Step-out (Decision II) sampling locations at each CAS will be selected based on the CSM, biasing factors, field-screening results, existing data, and the outer boundary sample locations where COCs were detected. In general, step-out sample locations will be arranged in a triangular pattern around areas containing a COC at distances based on site conditions, COC concentrations, process knowledge, and biasing factors. If COCs extend beyond step-out locations, additional Decision II samples will be collected from locations further from the source. If a spatial boundary is reached, the CSM is shown to be inadequate, or the Site Supervisor determines that extent sampling needs to be re-evaluated, then work will be temporarily suspended, NDEP will be notified, and the investigation strategy will be re-evaluated. A minimum of one analytical result less than the action level from each lateral and vertical direction will be required to define the extent of COC contamination. The lateral and vertical extent of COCs will only be established based on validated laboratory analytical results (i.e., not field screening).

4.2.4 Sample Management

The laboratory requirements (e.g., detection limits, precision and accuracy) to be used when analyzing the COPCs are presented in [Tables 3-4](#) and [3-5](#). The analytical program for each CAS is presented in [Table 3-1](#). All sampling activities and QC requirements for field and laboratory environmental sampling will be conducted in compliance with the QAPP (NNSA/NV, 2002) and other applicable, approved procedures.

4.3 Safety

A site-specific health and safety document will be prepared and approved before the field effort. As required by the DOE Integrated Safety Management System (ISMS) (DOE/NV, 1997), this document outlines the requirements for protecting the health and safety of the workers and the public. The

ISMS program requires that site personnel will reduce or eliminate the possibility of injury, illness, or accidents, and to protect the environment during all project activities. The following safety issues will be taken into consideration when evaluating the hazards and associated control procedures for field activities:

- Potential hazards to site personnel and the public include, but are not limited to: chemicals (e.g., heavy metals, polychlorinated biphenyls (PCBs) and petroleum hydrocarbons), adverse and rapidly changing weather, and motor vehicle and heavy equipment operations.
- Proper training of all site personnel to recognize and mitigate the anticipated hazards.
- Work controls to reduce or eliminate the hazards including engineering controls, substitution of less hazardous materials, and use of appropriate personal protective equipment (PPE).
- Occupational exposure monitoring to prevent overexposure to hazards such as chemicals, and physical agents (e.g., heat, cold, and high wind).
- Radiological surveying for alpha/beta and gamma emitters to minimize and/or control personnel exposures; use of the “as-low-as-reasonably-achievable” principle when addressing radiological hazards.
- Emergency and contingency planning to include medical care and evacuation, decontamination, spill control measures, and appropriate notification of project management. The same principles apply to emergency communications.
- If PACM is identified (CFR, 2006c; NAC, 2006a), it will be inspected and/or samples collected by trained personnel.

4.4 Site Restoration

Following completion of CAI and waste management activities, the following actions will be implemented before closure of the site Real Estate/Operations Permit:

- Removal of all equipment, wastes, debris, and materials associated with the CAI.
- Removal of all signage and fencing (unless part of a corrective action).
- Grading of site to pre-investigation condition (unless changed condition is necessary under a corrective action).
- Site will be inspected and certified that restoration activities have been completed.

5.0 Waste Management

Management of IDW will be based on regulatory requirements, field observations, process knowledge, and laboratory results from CAU 560 investigation samples.

Disposable sampling equipment, PPE, and rinsate are considered potentially contaminated waste only by virtue of contact with potentially contaminated media (e.g., soil) or potentially contaminated debris (e.g., construction materials). Therefore, sampling and analysis of IDW, separate from analyses of site investigation samples, may not be necessary for all IDW. However, if associated investigation samples are found to contain contaminants above regulatory levels, conservative estimates of total waste contaminant concentrations may be made based on the mass of the waste, the amount of contaminated media contained in the waste, and the maximum concentration of contamination found in the media. Direct samples of IDW may also be taken to support waste characterization.

Sanitary, hazardous, radioactive, and/or mixed waste, if generated, will be managed and disposed of in accordance with applicable DOE orders, U.S. Department of Transportation (DOT) regulations, state and federal waste regulations, and agreements and permits between DOE and NDEP.

5.1 Waste Minimization

Investigation activities are planned to minimize IDW generation. This will be accomplished by incorporating the use of process knowledge, visual examination, and/or radiological survey and swipe results. When possible, disturbed media (such as soil removed during trenching) or debris will be returned to its original location. Contained media (e.g., soil managed as waste) as well as other IDW will be segregated to the greatest extent possible to minimize generation of hazardous, radioactive, or mixed waste. Hazardous material used at the sites will be controlled in order to limit unnecessary generation of hazardous or mixed waste. Administrative controls, including decontamination procedures and waste characterization strategies, will minimize waste generated during investigations.

5.2 *Potential Waste Streams*

Waste generated during the investigation activities will include the following potential waste streams:

- Personal protective equipment and disposable sampling equipment (e.g., plastic, paper, sample containers, aluminum foil, spoons, bowls)
- Decontamination rinsate
- Environmental media (e.g., soil)
- Surface debris in investigation area (e.g., PACM floor tiles)
- Field-screening waste (e.g., fecal coliform screening kit materials, disposable sampling equipment, and/or PPE contaminated by field-screening activities)

5.3 *Investigation-Derived Waste Management*

The onsite management and ultimate disposition of IDW will be determined based on a determination of the waste type (e.g., sanitary, low-level, hazardous, hydrocarbon, mixed), or the combination of waste types. A determination of the waste type will be guided by several factors, including, but not limited to: the analytical results of samples either directly or indirectly associated with the waste, historical site knowledge, waste generation process knowledge, field observations, field-monitoring/screening results, and/or radiological survey/swipe results.

Table 4-2 of the NV/YMP RadCon Manual (NNSA/NSO, 2004) shall be used to determine whether such materials may be declared nonradioactive. Onsite IDW management requirements by waste type are detailed in the following sections. Applicable waste management regulations and requirements are listed in [Table 5-1](#).

Table 5-1
Waste Management Regulations and Requirements

Waste Type	Federal Regulation	Additional Requirements
Solid (nonhazardous)	N/A	NRS ^a 444.440 - 444.620 NAC ^b 444.570 - 444.7499 NTS Landfill Permit SW13.097.04 ^c NTS Landfill Permit SW13.097.03 ^d
Liquid/Rinsate (nonhazardous)	N/A	Water Pollution Control General Permit GNEV93001, Rev. 3iii ^e
Hazardous	RCRA ^f , 40 CFR 260-282	NRS ^a 459.400 - 459.600 NAC ^b 444.850 - 444.8746 POC ^g
Low-Level Radioactive	N/A	DOE Orders and NTSWAC ^h
Mixed	RCRA ^f , 40 CFR 260-282	NTSWAC ^h POC ^g
Hydrocarbon	N/A	NTS Landfill Permit SW13.097.02 ⁱ NAC ^b 445A.2272
Polychlorinated Biphenyls	TSCA ^j , 40 CFR 761	NRS ^a 459.400 - 459.600 NAC ^b 444.940 - 444.9555
Asbestos	TSCA ^j , 40 CFR 763	NRS ^a 618.750 - 618.840 NAC ^b 444.965 - 444.976

^aNevada Revised Statutes (NRS, 2003a, b, c)

^bNevada Administrative Code (NAC, 2006a and e)

^cArea 23 Class II Solid Waste Disposal Site (NDEP, 1997a)

^dArea 9 Class III Solid Waste Disposal Site (NDEP, 1997c)

^eNevada Test Site Sewage Lagoons (NDEP, 1999)

^fResource Conservation and Recovery Act (CFR, 2006a)

^gNevada Test Site Performance Objective for the Certification of Nonradioactive Hazardous Waste (BN, 1995)

^hNevada Test Site Waste Acceptance Criteria, Rev. 6-02 (NNSA/NSO, 2006b)

ⁱArea 6 Class III Solid Waste Disposal Site for hydrocarbon waste (NDEP, 1997b)

^jToxic Substance Control Act (CFR, 2006b and c)

CFR = Code of Federal Regulations

DOE = U.S. Department of Energy

N/A = Not applicable

NAC = Nevada Administrative Code

NDEP = Nevada Division of Environmental Protection

NRS = Nevada Revised Statutes

NTS = Nevada Test Site

NTSWAC = Nevada Test Site Waste Acceptance Criteria

POC = Performance Objective for the Certification of Nonradioactive Hazardous Waste

RCRA = Resource Conservation and Recovery Act

TSCA = Toxic Substance Control Act

5.3.1 Sanitary Waste

Sanitary IDW generated at each CAS will be collected, managed, and disposed of in accordance with the sanitary waste management regulations and the permits for operation of the NTS 10c Industrial Waste Landfill.

5.3.2 Low-Level Radioactive Waste

Radiological swipe surveys and/or direct-scan surveys may be conducted on reusable sampling equipment and the PPE and disposable sampling equipment waste streams exiting a radiologically controlled area (RCA). This allows for the immediate segregation of radioactive waste from waste that may be unrestricted regarding radiological release. Removable contamination limits, as defined in Table 4-2 of the NV/YMP RadCon Manual (NNSA/NSO, 2004), will be used to determine whether such waste may be declared unrestricted regarding radiological release versus being declared radioactive waste. Direct sampling of the waste may be conducted to aid in determining whether a particular waste unit (e.g., drum of soil) contains low-level radioactive waste, as necessary.

Low-level radioactive waste, if generated, will be managed in accordance with the contractor-specific waste certification program plan, DOE orders, and the requirements of the current version of the *Nevada Test Site Waste Acceptance Criteria* (NTSWAC) (NNSA/NSO, 2006b). Potential radioactive waste drums containing soil, PPE, disposable sampling equipment, and/or rinsate may be staged at a designated radioactive material area (RMA) or RCA when full or at the end of an investigation phase. The waste drums will remain at the RMA pending certification and disposal under NTSWAC requirements (NNSA/NSO, 2006b).

5.3.3 Hazardous Waste

The CAU will have waste accumulation areas established according to the needs of the project. Satellite accumulation areas and HWAAs will be managed consistent with the requirements of federal and state regulations (CFR, 2006a; NAC, 2006b). The HWAAs will be controlled for access, and will be equipped with spill kits and appropriate spill containment. Suspected hazardous wastes will be placed in DOT-compliant containers. All containerized hazardous waste will be handled, inspected, and managed in accordance with Title 40 *Code of Federal Regulations* (CFR) 265 Subpart I (CFR, 2006a). These provisions include managing the waste in containers compatible with the waste

type, and segregating incompatible waste types so that in the event of a spill, leak, or release, incompatible wastes shall not contact one another. The HWAAs will be covered under a site-specific emergency response and contingency action plan until such time that the waste is determined to be nonhazardous or all containers of hazardous waste have been removed from the storage area. Hazardous waste will be characterized in accordance with the requirement of Title 40 CFR 261 (CFR, 2006a). *Resource Conservation and Recovery Act*-“listed” waste has not been identified at CAU 560. Any waste determined to be hazardous will be managed and transported in accordance with RCRA and DOT requirements to a permitted treatment, storage, and disposal facility (CFR, 2006a).

5.3.4 Hydrocarbon Waste

Hydrocarbon soil waste containing more than 100 mg/kg of TPH will be managed on site in a drum or other appropriate container until fully characterized. Hydrocarbon waste may be disposed of at a designated hydrocarbon landfill (NDEP, 1997b), an appropriate hydrocarbon waste management facility (e.g., recycling facility), or other method in accordance with Nevada regulations.

5.3.5 Mixed Low-Level Waste

Mixed waste, if generated, shall be managed and dispositioned according to the requirements of RCRA (CFR, 2006a) or subject to agreements between NNSA/NSO and the State of Nevada, as well as DOE requirements for radioactive waste. The waste will be marked with the words “Hazardous Waste Pending Analysis and Radioactive Waste Pending Analysis.” Waste characterized as mixed will not be stored for a period of time that exceeds the requirements of RCRA unless subject to agreements between NNSA/NSO and the State of Nevada. The mixed waste shall be transported via an approved hazardous waste/radioactive waste transporter to the NTS transuranic waste storage pad for storage pending treatment or disposal. Mixed waste with hazardous waste constituent concentrations below Land Disposal Restrictions may be disposed of at the NTS Area 5 Radioactive Waste Management Site if the waste meets the requirements of the NTSWAC (NNSA/NSO, 2006b), the NTS NDEP permit for a Hazardous Waste Management Facility (NEV HW0009 [NDEP, 2000]), and the RCRA Part B Permit Application for Waste Management Activities at the Nevada Test Site (DOE/NV, 1999). Mixed waste constituent concentrations exceeding Land Disposal Restrictions will

require development of a treatment and disposal plan under the requirements of the Mutual Consent Agreement between DOE and the State of Nevada (NDEP, 1995).

5.3.6 Polychlorinated Biphenyls

The management of PCBs is governed by the *Toxic Substances Control Act* (USC, 1976) and its implementing regulations at 40 CFR 761 (CFR, 2006b). Polychlorinated biphenyl contamination may be found as a sole contaminant or in combination with any of the types of waste discussed in this document. For example, PCBs may be a co-contaminant in soil that contains a RCRA “characteristic” waste (PCB/hazardous waste), or in soil that contains radioactive wastes (PCB/radioactive waste), or even in mixed waste (PCB/radioactive/hazardous waste). The IDW will be evaluated initially using analytical results for media samples from the investigation. If any type of PCB waste is generated, it will be managed according to 40 CFR 761 (CFR, 2006b) as well as State of Nevada requirements (NAC, 2006a), guidance, and agreements with NNSA/NSO.

5.4 Management of Specific Waste Streams

5.4.1 Personal Protective Equipment

Personal protective equipment and disposable sampling equipment will be inspected visually for stains, discoloration, and gross contamination as the waste is generated, and also evaluated for radiological contamination. Staining and/discoloration will be assumed to be the result of contact with potentially contaminated media such as soil, sludge, or liquid. Gross contamination is the visible contamination of an item (e.g., clumps of soil/sludge on a sampling spoon or free liquid smeared on a glove). While gross contamination can often be removed through decontamination methods, removal of gross contamination from small items, such as gloves or booties is not typically conducted. Any IDW that meets this description will be segregated and managed as potentially “characteristic” hazardous waste. This segregated population of waste will either: (1) be assigned the characterization of the soil/sludge that was sampled, (2) be sampled directly, or (3) undergo further evaluation using the soil/sludge sample results to determine how much soil/sludge would need to be present in the waste to exceed regulatory levels. Waste that is determined to be hazardous will be entered into an approved waste management system, where it will be managed and dispositioned according to RCRA requirements or subject to agreements between NNSA/NSO and the State of

Nevada. The PPE and equipment that is not visibly stained, discolored, or grossly contaminated and that is within the radiological free-release criteria will be managed as nonhazardous sanitary waste.

5.4.2 Management of Decontamination Rinsate

Rinsate at CAU 560 will not be considered hazardous waste unless there is evidence that the rinsate may display a RCRA characteristic. Evidence may include such things as the presence of a visible sheen, pH, or association with equipment/materials used to respond to a release/spill of a hazardous waste/substance. Decontamination rinsate that is potentially hazardous (using associated sample results and/or process knowledge) will be managed as characteristic hazardous waste (CFR, 2006a). The regulatory status of the potentially hazardous rinsate will be determined through the application of associated sample results or through direct sampling. If the associated samples do not indicate the presence of hazardous constituents, then the rinsate will be considered nonhazardous.

The disposal of nonhazardous rinsate will be consistent with guidance established in current NNSA/NSO Fluid Management Plans for the NTS as follows:

- Rinsate that is determined to be nonhazardous and contaminated to less than 5x *Safe Drinking Water Standards* (SDWS) is not restricted as to disposal. Nonhazardous rinsate that is contaminated at 5x to 10x SDWS will be disposed of in an established infiltration basin or solidified and disposed of as sanitary waste or low-level waste.
- Nonhazardous rinsate that is contaminated at greater than 10x SDWS will be disposed of in a lined basin or solidified and disposed of as sanitary waste or low-level waste.

5.4.3 Management of Soil

This waste stream consists of soil removed for disposal during soil sampling, excavation, and/or drilling. This waste stream will be characterized based on laboratory analytical results from representative locations. If the soil is determined to potentially contain COCs, the material will be either managed on site or containerized for transportation to an appropriate disposal site.

Onsite management of the waste soil will be allowed only if it is managed within an area of concern and it is appropriate to defer the management of the waste until the final remediation of the site. If this option is chosen, the waste soil shall be protected from run-on and runoff using appropriate protective measures based on the type of contaminant(s) (e.g., covered with plastic and bermed).

Management of soil waste for disposal consists of placing the waste in containers, labeling the containers, temporarily storing the containers until shipped, and shipping the waste to a disposal site. The containers, labels, management of stored waste, transport to the disposal site, and disposal shall be appropriate for the type of waste (e.g., hazardous, hydrocarbon, mixed).

Note that soils placed back into a borehole or excavation in the same approximate location from which it originated is not considered waste.

5.4.4 *Management of Debris*

This waste stream can vary depending on site conditions. Debris that requires removal for the investigation activities (soil sampling, excavation, and/or drilling) must be characterized for proper management and disposition. Historical site knowledge, waste generation process knowledge, field observations, field-monitoring/screening results, radiological survey/swipe results and/or the analytical results of samples either directly or indirectly associated with the waste may be used to characterize the debris. Debris will be inspected visually for stains, discoloration, and gross contamination. Debris may be deemed reusable, recyclable, sanitary waste, hazardous waste, PCB waste, asbestos-containing material, or low-level waste. Waste that is not sanitary will be entered into an approved waste management system, where it will be managed and dispositioned according to federal, state requirements, and agreements between NNSA/NSO and the State of Nevada. The debris will be either managed on site by berming and covering next to the excavation, by placement in a container(s), or left on the footprint of the CAS and its disposition deferred until implementation of corrective action at the site.

5.4.5 *Field-Screening Waste*

The use of field test kits and/or instruments may result in the generation of small quantities of hazardous wastes. If hazardous waste is produced by field screening, it will be segregated from other IDW and managed in accordance with the hazardous waste regulations (CFR, 2006a). For sites where field-screening samples contain radioactivity above background levels, field-screening methods that have the potential to generate hazardous waste will not be used, thus avoiding the potential to generate mixed waste. In the event a mixed waste is generated, the waste will be managed in accordance with [Section 5.3.5](#).

6.0 *Quality Assurance/Quality Control*

The overall objective of the characterization activities described in this CAIP is to collect accurate and defensible data to support the selection and implementation of a closure alternative for each of the CAU 560 CASs. [Sections 6.1](#) and [6.2](#) discuss the collection of required QC samples in the field and QA requirements for laboratory/analytical data to achieve closure. Unless otherwise stated in this CAIP or required by the results of the DQO process (see [Appendix A](#)), this investigation will adhere to the QAPP (NNSA/NV, 2002).

6.1 *Quality Control Sampling Activities*

Field QC samples will be collected in accordance with established procedures. Field QC samples are collected and analyzed to aid in determining the validity of environmental sample results. The number of required QC samples depends on the types and number of environmental samples collected. The minimum frequency of collecting and analyzing QC samples for this investigation, as determined in the DQO process, include:

- Trip blanks (1 per sample cooler containing VOC environmental samples)
- Equipment rinsate blanks (1 per sampling event for each type of decontamination procedure)
- Source blanks (1 per lot of uncharacterized source material that contacts sampled media)
- Field duplicates (1 per 20 environmental samples or 1 per CAS per matrix, if less than 20 collected)
- Field blanks (minimum of 1 per CAS, additional if field conditions change)
- Laboratory QC samples (1 per 20 environmental samples or 1 per CAS per matrix, if less than 20 collected)

Additional QC samples may be submitted based on site conditions at the discretion of the Task Manager or Site Supervisor. Field QC samples shall be analyzed using the same analytical procedures implemented for associated environmental samples. Additional details regarding field QC samples are available in the QAPP (NNSA/NV, 2002).

6.2 Laboratory/Analytical Quality Assurance

Criteria for the investigation, as stated in the DQOs ([Appendix A](#)) and except where noted, require laboratory analytical quality data be used for making critical decisions. Rigorous QA/QC will be implemented for all laboratory samples including documentation, data verification and validation of analytical results, and an assessment of DQIs as they relate to laboratory analysis.

6.2.1 Data Validation

Data verification and validation will be performed in accordance with the QAPP (NNSA/NV, 2002), except where otherwise stipulated in this CAIP. All chemical and radiological laboratory data from samples that are collected and analyzed will be evaluated for data quality according to company-specific procedures. The data will be reviewed to ensure that all suspected samples were appropriately collected, analyzed, and the results passed data validation criteria. Validated data, including estimated data (i.e., J-qualified), will be assessed to determine whether they meet the DQO requirements of the investigation and the performance criteria for the DQIs. The results of this assessment will be documented in the Corrective Action Decision Document. If the DQOs were not met, corrective actions will be evaluated, selected, and implemented (e.g., refine CSM or resample to fill data gaps).

6.2.2 Data Quality Indicators

The DQIs are qualitative and quantitative descriptors used in interpreting the degree of acceptability or utility of data. Data quality indicators are used to evaluate the entire measurement system and laboratory measurement processes (i.e., analytical method performance) as well as to evaluate individual analytical results (i.e., parameter performance). The quality and usability of data used to make DQO decisions will be assessed based on the following DQIs:

- Precision
- Accuracy/bias
- Representativeness
- Comparability
- Completeness
- Sensitivity

Table 6-1 provides the established analytical method/measurement system performance criteria for each of the DQIs and the potential impacts to the decision if the criteria are not met. The following subsections discuss each of the DQIs that will be used to assess the quality of laboratory data. Due to changes in analytical methodology and changes in analytical laboratory contracts, criteria for precision and accuracy in Tables 3-4 and 3-5 that vary from corresponding information in the QAPP will supersede the QAPP (NNSA/NV, 2002).

6.2.3 Precision

Precision is a measure of the repeatability of the analysis process from sample collection through analysis results. It is used to assess the variability between two equal samples.

Determinations of precision will be made for field duplicate samples and laboratory duplicate samples. Field duplicate samples will be collected simultaneously with samples from the same source under similar conditions in separate containers. The duplicate sample will be treated independently of the original sample in order to assess field impacts and laboratory performance on precision through a comparison of results. Laboratory precision is evaluated as part of the required laboratory internal QC program to assess performance of analytical procedures. The laboratory sample duplicates are an aliquot, or subset, of a field sample generated in the laboratory. They are not a separate sample but a split, or portion, of an existing sample. Typically, laboratory duplicate QC samples may include matrix spike duplicate (MSD) and laboratory control sample (LCS) duplicate samples for organic, inorganic, and radiological analyses.

Precision is a quantitative measure used to assess overall analytical method and field-sampling performance as well as to assess the need to “flag” (qualify) individual parameter results when corresponding QC sample results are not within established control limits.

The criteria used for the assessment of inorganic chemical precision when both results are greater than or equal to 5x reporting limit (RL) is 20 percent and 35 percent for aqueous and soil samples, respectively. When either result is less than 5x RL, a control limit of $\pm 1x$ RL and $\pm 2x$ RL for aqueous and soil samples, respectively, is applied to the absolute difference.

Table 6-1
Laboratory and Analytical Performance Criteria for CAU 560 Data Quality Indicators

Data Quality Indicator	Performance Metric	Potential Impact on Decision If Performance Metric Not Met
Precision	At least 80% of the sample results for each measured contaminant are not qualified for precision based on the criteria for each analytical method-specific and laboratory-specific criteria presented in Section 6.2.3 .	If the performance metric is not met, the affected analytical results from each affected CAS will be assessed to determine whether there is sufficient confidence in analytical results to use the data in making DQO decisions.
Accuracy	At least 80% of the sample results for each measured contaminant are not qualified for accuracy based on the method-specific and laboratory-specific criteria presented in Section 6.2.4 .	If the performance metric is not met, the affected analytical results from each affected CAS will be assessed to determine whether there is sufficient confidence in analytical results to use the data in making DQO decisions.
Sensitivity	Minimum detectable concentrations are less than or equal to respective FALs.	Cannot determine whether COCs are present or migrating at levels of concern.
Comparability	Sampling, handling, preparation, analysis, reporting, and data validation are performed using standard methods and procedures.	Inability to combine data with data obtained from other sources and/or inability to compare data to regulatory action levels.
Representativeness	Samples contain contaminants at concentrations present in the environmental media from which they were collected.	Analytical results will not represent true site conditions. Inability to make appropriate DQO decisions.
Completeness	80% of the CAS-specific COPCs have valid results. 100% of CAS-specific targeted contaminants have valid results.	Cannot support/defend decision on whether COCs are present.
Extent Completeness	100% of COCs used to define extent have valid results.	Extent of contamination cannot be accurately determined.
Clean Closure Completeness	100% of targeted contaminants have valid results.	Cannot determine whether COCs remain in soil.

COC = Contaminant of concern
COPC = Contaminant of potential concern
DQO = Data quality objective
FAL = Final action level

The criteria used for the assessment of radiological precision when both results are greater than or equal to 5x MDC is 20 percent and 35 percent for aqueous and soil samples, respectively. When either result is less than 5x MDC, the normalized difference (ND) should be between -2 and +2 for aqueous and soil samples. The parameters to be used for assessment of precision for duplicates are listed in [Table 3-5](#).

Any values outside the specified criteria do not necessarily result in the qualification of analytical data. It is only one factor in making an overall judgment about the quality of the reported analytical results. The performance metric for assessing the DQI of precision on DQO decisions (see [Table 6-1](#)) is that at least 80 percent of sample results for each measured contaminant are not qualified due to duplicates exceeding the criteria. If this performance is not met, an assessment will be conducted and documented in the investigation report on the impacts to DQO decisions specific to affected contaminants and CASs.

The criteria used for the assessment of organic chemical precision is based on professional judgment using laboratory derived control limits.

6.2.4 Accuracy

Accuracy is a measure of the closeness of an individual measurement to the true value. It is used to assess the performance of laboratory measurement processes.

Accuracy is determined by analyzing a reference material of known parameter concentration or by reanalyzing a sample to which a material of known concentration or amount of parameter has been added (spiked). Accuracy will be evaluated based on results from three types of spiked samples: matrix spike (MS), LCS, and surrogates (organics). The LCS sample is analyzed with the field samples using the same sample preparation, reagents, and analytical methods employed for the samples. One LCS will be prepared with each batch of samples for analysis by a specific measurement.

The criteria used for the assessment of inorganic chemical accuracy are 75 to 125 percent for MS recoveries and 80 to 120 percent for LCS recoveries. For organic chemical accuracy, MS and LCS laboratory-specific percent recovery criteria developed and generated in-house by the laboratory

according to approved laboratory procedures are applied. The criteria used for the assessment of radiochemical accuracy are 80 to 120 percent for LCS and MS recoveries.

Any values outside the specified criteria do not necessarily result in the qualification of analytical data. It is only one factor in making an overall judgment about the quality of the reported analytical results. Factors beyond laboratory control, such as sample matrix effects, can cause the measured values to be outside of the established criteria. Therefore, the entire sampling and analytical process may be evaluated when determining the usability of the affected data.

The performance metric for assessing the DQI of accuracy on DQO decisions (see [Table 6-1](#)) is that at least 80 percent of the sample results for each measured contaminant are not qualified for accuracy. If this performance is not met, an assessment will be conducted and presented in the investigation report on the impacts to DQO decisions specific to affected contaminants and CASs.

6.2.5 Representativeness

Representativeness is the degree to which sample characteristics accurately and precisely represent a characteristics of a population or an environmental condition (EPA, 2002). Representativeness is assured by carefully developing the sampling strategy during the DQO process such that false negative and false positive decision errors are minimized. The criteria listed in DQO Step 6 – Specify the Tolerable Limits on Decision Errors are:

- For Decision I judgmental sampling, having a high degree of confidence that the sample locations selected will identify COCs if present anywhere within the CAS.
- Having a high degree of confidence that analyses conducted will be sufficient to detect any COCs present in the samples.
- For Decision II, having a high degree of confidence that the sample locations selected will identify the extent of COCs.

These are qualitative measures that will be used to assess measurement system performance for representativeness. The assessment of this qualitative criterion will be presented in the investigation report.

6.2.6 Completeness

Completeness is defined as generating sufficient data of the appropriate quality to satisfy the data needs identified in the DQOs. For judgmental sampling, completeness will be evaluated using both a quantitative measure and a qualitative assessment. The quantitative measurement to be used to evaluate completeness is presented in [Table 6-1](#) and is based on the percentage of measurements made that are judged to be valid.

For the judgmental sampling approach, the completeness goal for targeted contaminants and the remaining COPCs is 100 and 80 percent, respectively. If this goal is not achieved, the dataset will be assessed for potential impacts on making DQO decisions.

The qualitative assessment of completeness is an evaluation of the sufficiency of information available to make DQO decisions. This assessment will be based on meeting the data needs identified in the DQOs and will be presented in the investigation report. Additional samples will be collected if it is determined that the number of samples do not meet completeness criteria.

6.2.7 Comparability

Comparability is a qualitative parameter expressing the confidence with which one dataset can be compared to another (EPA, 2002). The criteria for the evaluation of comparability will be that all sampling, handling, preparation, analysis, reporting, and data validation were performed and documented in accordance with approved procedures that are in conformance with standard industry practices. Analytical methods and procedures approved by DOE will be used to analyze, report, and validate the data. These methods and procedures are in conformance with applicable methods used in industry and government practices. An evaluation of comparability will be presented in the investigation report.

6.2.8 Sensitivity

Sensitivity is the capability of a method or instrument to discriminate between measurement responses representing different levels of the variable of interest (EPA, 2002). The evaluation criteria for this parameter will be that measurement sensitivity (detection limits) will be less than or equal to the corresponding FALs. If this criterion is not achieved, the affected data will be assessed for usability and potential impacts on meeting site characterization objectives. This assessment will be presented in the investigation report.

7.0 Duration and Records Availability

7.1 Duration

Table 7-1 is a tentative duration of CAI activities (in calendar days).

Table 7-1
Corrective Action Investigation Activity Durations

Duration (days)	Activity
10	Site Preparation
76	Fieldwork Preparation and Mobilization
55	Sampling
160	Data Assessment
180	Waste Management

7.2 Records Availability

Historical information and documents referenced in this plan are retained in the NNSA/NSO project files in Las Vegas, Nevada, and can be obtained through written request to the NNSA/NSO Federal Sub-Project Director. This document is available in the DOE public reading rooms located in Las Vegas and Carson City, Nevada, or by contacting the DOE Federal Sub-Project Director. The NDEP maintains the official Administrative Record for all activities conducted under the auspices of the FFACO.

8.0 References

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Appendix A

Data Quality Objectives

A.1.0 Introduction

The DQO process described in this appendix is a seven-step strategic systematic planning method used to plan data collection activities and define performance criteria for the CAU 560, Septic Systems field investigation. The DQOs are designed to ensure that the data collected will provide sufficient and reliable information to identify, evaluate, and technically defend recommended corrective actions (i.e., no further action, closure in place, or clean closure). Existing information about the nature and extent of contamination at the CASs in CAU 560 is insufficient to evaluate and select preferred corrective actions; therefore, a CAI will be conducted.

The CAU 560 investigation will be based on the DQOs presented in this appendix as developed by the NDEP and NNSA/NSO representatives. The seven steps of the DQO process presented in [Sections A.3.0](#) through [A.9.0](#) were developed in accordance with *EPA Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA, 2006).

The DQO process presents a judgmental sampling approach. In general, the procedures used in the DQO process provide:

- A method to establish performance or acceptance criteria, which serve as the basis for designing a plan for collecting data of sufficient quality and quantity to support the goals of a study.
- Criteria that will be used to establish the final data collection design such as:
 - The nature of the problem that has initiated the study and a conceptual model of the environmental hazard to be investigated.
 - The decisions or estimates that need to be made and the order of priority for resolving them.
 - The type of data needed.
 - An analytic approach or decision rule that defines the logic for how the data will be used to draw conclusions from the study findings.
- Acceptable quantitative criteria on the quality and quantity of the data to be collected, relative to the ultimate use of the data.

- A data collection design that will generate data meeting the quantitative and qualitative criteria specified. A data collection design specifies the type, number, location, and physical quantity of samples and data, as well as the QA and QC activities that will ensure that sampling design and measurement errors are managed sufficiently to meet the performance or acceptance criteria specified in the DQOs.

A.2.0 Background Information

The following seven CASs that comprise CAU 560 are located in Areas 3 and 6 of the NTS, as shown in [Figure A.2-1](#):

- 03-51-01, Leach Pit
- 06-04-02, Septic Tank
- 06-05-03, Leach Pit
- 06-05-04, Leach Bed
- 06-59-03, Building CP-400 Septic System
- 06-59-04, Office Trailer Complex Sewage Pond
- 06-59-05, Control Point Septic System

The following sections ([Sections A.2.1](#) through [A.2.7](#)) provide a CAS description, physical setting and operational history, release information, and previous investigation results for each CAS in CAU 560. The CAS-specific COPCs are provided in the following sections. Many of the COPCs are based on a conservative evaluation of possible site activities considering the incomplete site histories of the CASs and contaminants found at similar NTS sites. Targeted contaminants are defined as those contaminants that are known or that could be reasonably suspected to be present within the CAS based on previous sampling or process knowledge.

A.2.1 Corrective Action Site 03-51-01, Leach Pit

Corrective Action Site 03-51-01 consists of a leach pit, subsurface piping connected to the leach pit, and the soil surrounding the features. The CAS was originally identified as a leach pit associated with Building 3C-5 of the Area 3 Camp. Structures remaining at the CAS include the concrete pad of former Building 3-C5. Debris at the site includes floor tiles on the concrete pad as well as throughout the immediate vicinity of the concrete pad. [Figure A.2-2](#) shows a site sketch of the CAS.

Physical Setting and Operational History – Corrective Action Site 03-51-01 is located on Yucca Flat in Area 3. Building 3C-5, Special Measurements Facility, was constructed in 1973 and used by EG&G Measurements, Inc. Specific activities that occurred within the building are unknown. The leach pit received waste water from a sink in Building 3C-5. Building 3C-5 was demolished in March 1999 as a part of the Area 3 Camp closure.

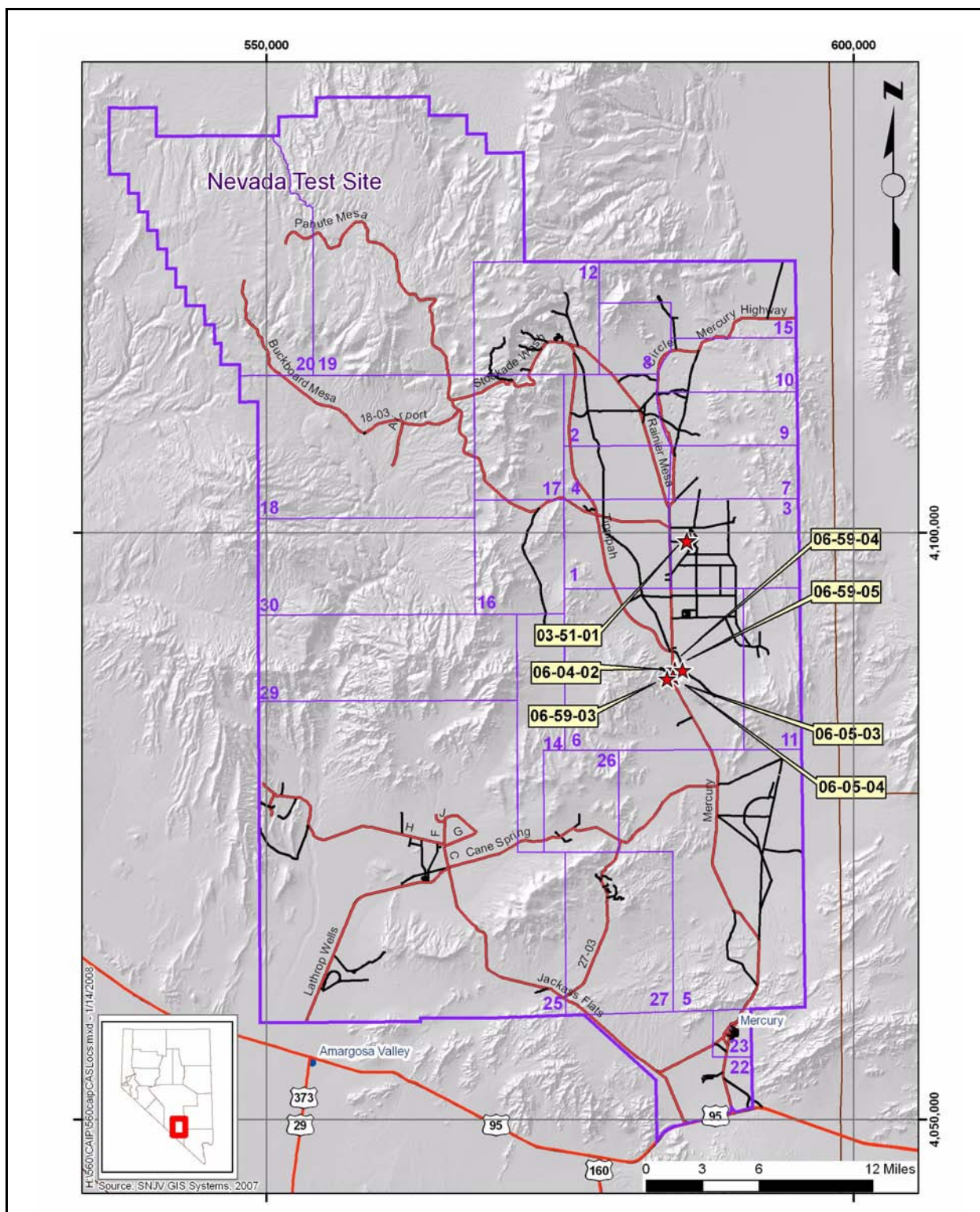


Figure A.2-1
Corrective Action Unit 560, CAS Location Map

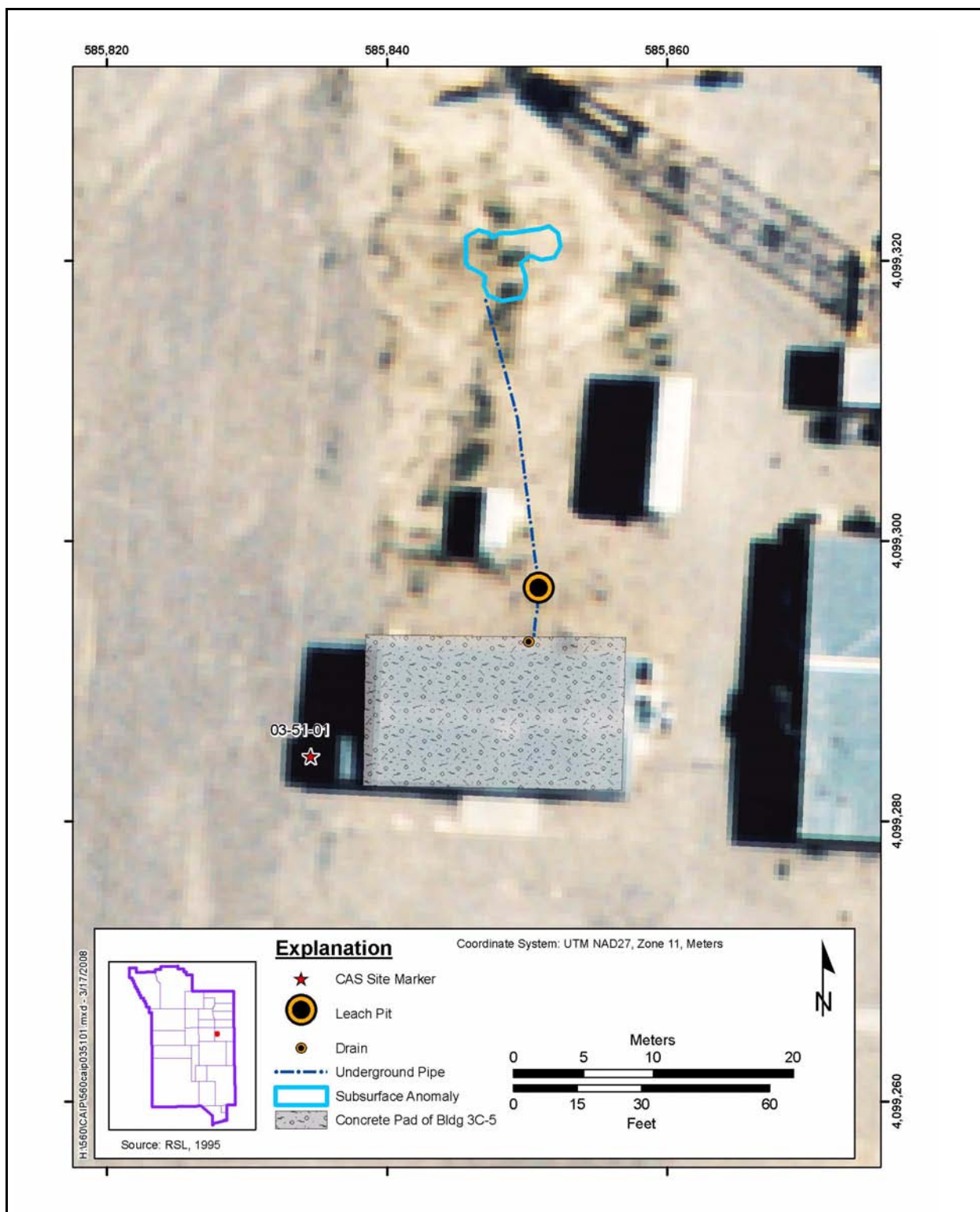


Figure A.2-2
Site Sketch of CAS 03-51-01, Leach Pit

Release Information – The septic system was designed to release effluent from a drain to subsurface soil through the leach pit disposal feature. There is no indication that the subsurface piping is a source of potential contamination. There are no visible soil stains or other biasing factors at any surface locations, although the excavations may reveal subsurface contamination was released through the leach pit or other points where the system may have leaked.

Previous Investigation Results – A 2007 geophysical survey detected piping originating at a cut pipe on the concrete pad leading to a leach pit (Weston, 2007). Also, the survey detected potential piping from the leach pit that leads north to a large geophysical anomaly; this piping may be associated with the leach pit system. No sampling or radiological walkover surveys have been conducted at this CAS.

A.2.2 Corrective Action Site 06-04-02, Septic Tank

Corrective Action Site 06-04-02 consists of a septic tank/leach pit, subsurface piping connected to the tank, and the soil surrounding these features. This CAS was originally identified as a septic tank associated with support/administrative trailers of the CP complex; however, an additional drawing indicates that the septic tank may be a leach pit (H&N, Date Unknown; REECo, 1968). No structures remain at the CAS. Surface features include T-posts marking the location of the septic tank/leach pit, a clean-out, and multiple cut pipes. [Figure A.2-3](#) shows a site sketch of the CAS.

Physical Setting and Operational History – Corrective Action Site 06-04-02 is located on Yucca Flat in Area 6. Multiple support trailers were located in the immediate area from before 1967 until after 1976. Activities within these support trailers are undetermined, but believed to be administrative. By 1985, all trailers were removed and a large horseshoe-shaped soil berm was constructed north of the site.

Release Information – The septic system was designed to route effluent to the septic tank/leach pit. If the CAS feature is a leach pit, then the septic system was designed to release waste to the subsurface soil. If the CAS feature is a septic tank without an outlet pipe or outfall, then the septic system was designed to hold effluent and be pumped. There is no indication that a septic tank or any subsurface piping are sources of potential contamination. There are no visible soil stains or other

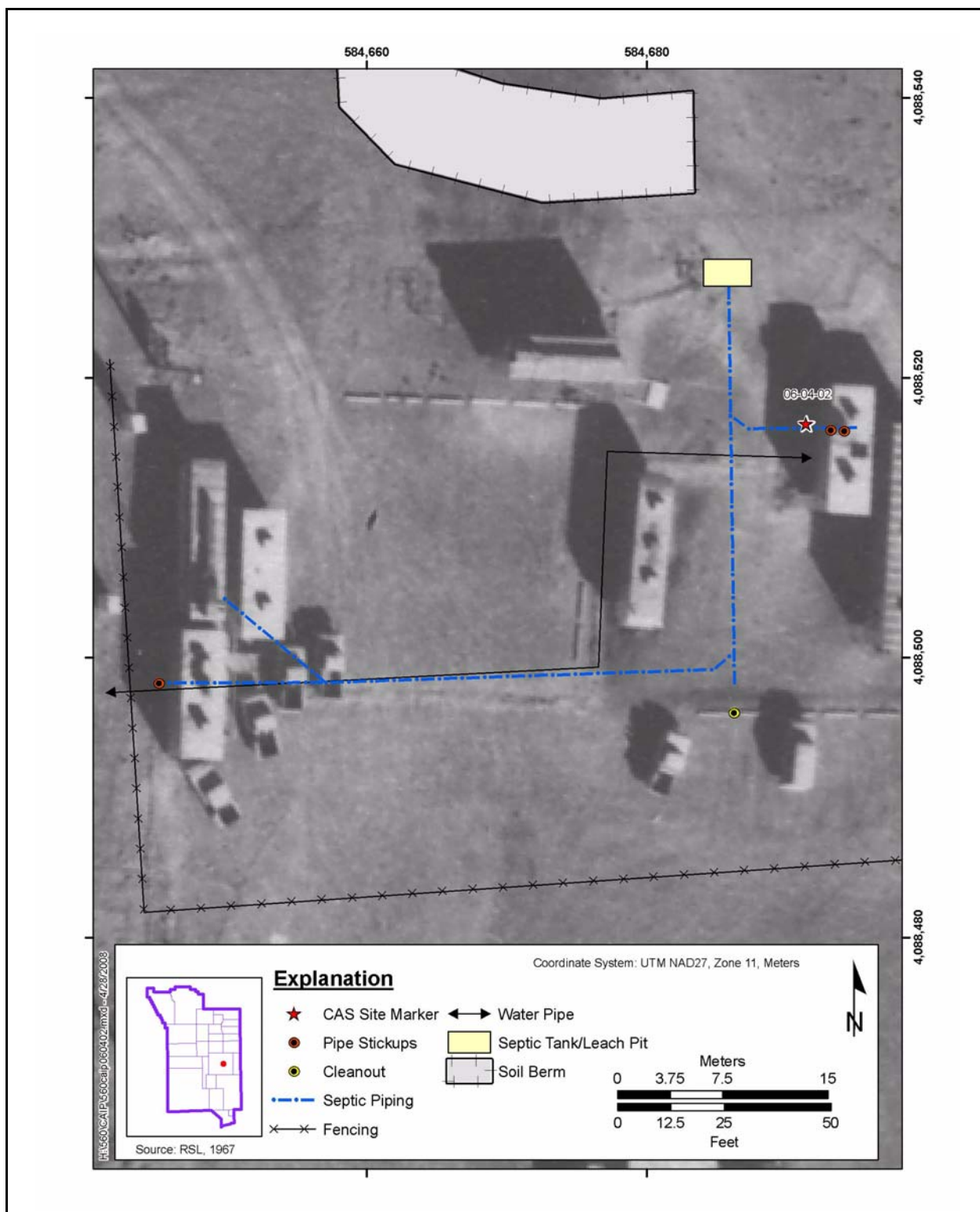


Figure A.2-3
Site Sketch of CAS 06-04-02, Septic Tank

biasing factors at any surface locations, although the excavations may reveal subsurface contamination was released through the leach pit or where the system may have leaked.

Previous Investigation Results – A 2004 geophysical survey detected the septic tank/leach pit (Fahringer, 2004). No sampling or radiological walkover surveys have been conducted at this CAS. No previous sampling results or radiological walkover surveys have been identified for CAS 06-04-02.

A.2.3 Corrective Action Site 06-05-03, Leach Pit

Corrective Action Site 06-05-03 consists of a leach pit, a septic tank, inactive subsurface piping connected to the leach pit and septic tank, as well as the soil surrounding these features. This CAS was originally identified as a leach pit associated with Building CP-160, Site Maintenance Facility. The structures at the CAS include Building CP-160, which is currently active. [Figure A.2-4](#) shows a site sketch of the CAS.

Physical Setting and Operational History – Corrective Action Site 06-05-03 is located on Yucca Flat in Area 6. Building CP-160, Site Maintenance Facility, was constructed in 1967 and is currently active. Historically, CP-160 has been used as an electricians shop, a reefer/fitters shop, and an arc welding area. This septic system received wastes from commodes, urinals, sinks and floor drains. This septic system was bypassed in the mid-1990s and a portion of the original piping was re-used; only the inactive/abandoned piping is included in the scope of this CAS. Surface features include clean-outs and vent lines (EBH, 1968; H&N, 1977a).

Release Information – The septic system was designed to release effluent from a drain through a septic tank and then to subsurface soil through the leach pit disposal feature. There is no indication that the septic tank or subsurface piping are source(s) of potential contamination. There are no visible soil stains or other biasing factors at any surface locations, although the excavations may reveal subsurface contamination was released through the leach pit or where the system may have leaked.

Previous Investigation Results – A 2007 geophysical survey of CAS 06-05-03 detected the leach pit, but did not conclusively determine the location of a septic tank or the VCP (Weston, 2007).

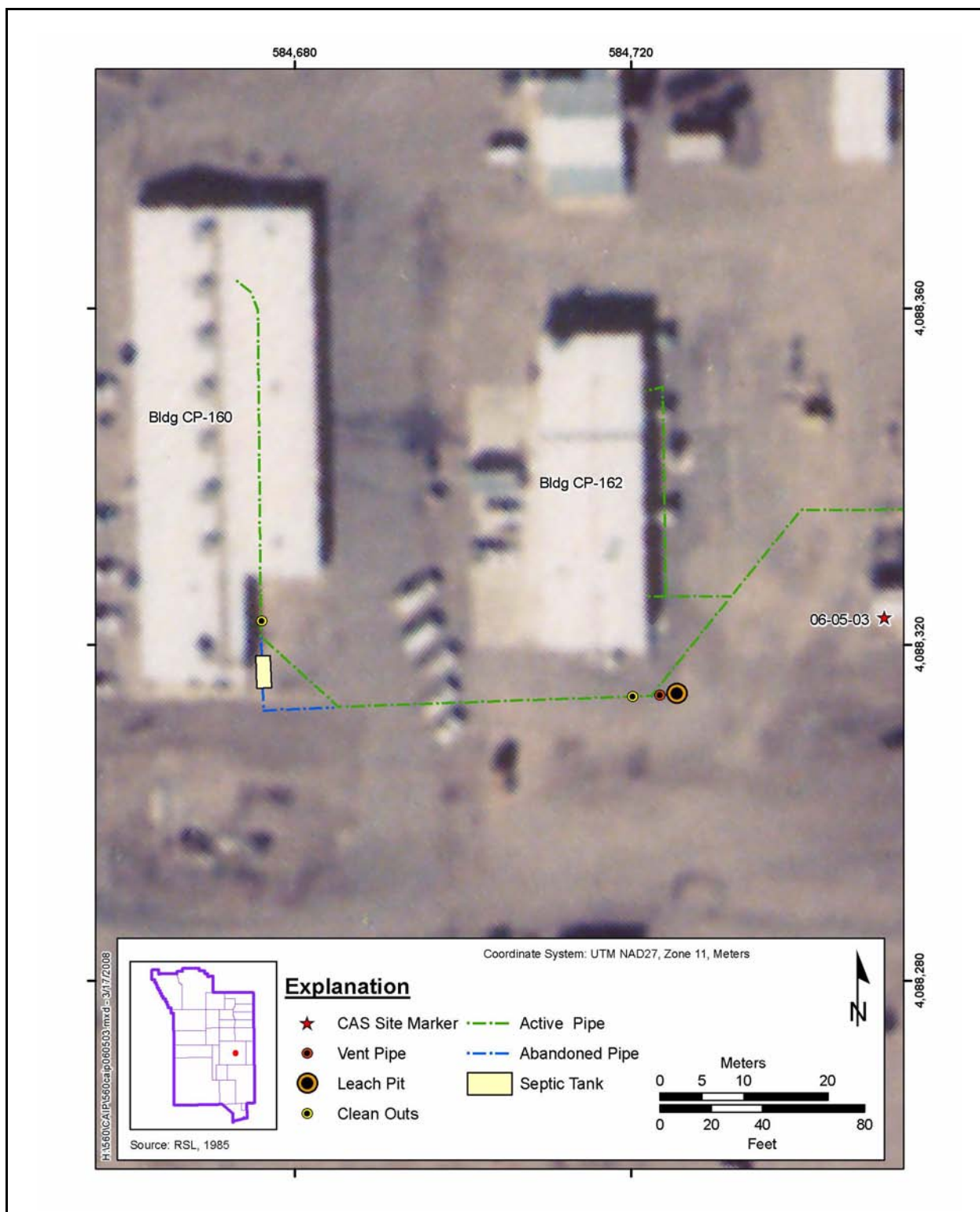


Figure A.2-4
Site Sketch of CAS 06-05-03, Leach Pit

Previous sampling results for the septic tank of CAS 06-05-03 have been identified. Both liquid and solid samples were taken at the septic tank. The liquid samples were analyzed for oil/grease, SVOC/BNA, total metals, and VOC; of which the results are all below current PALs. The samples of solid material were analyzed for TCLP-metals, TCLP-VOC, TCLP-SVOC/BNA, TPH, and oil/grease. A review of the sample results identified one sample of solid material from the septic tank with a concentration of TPH of 3,290 mg/kg, which is above the current NDEP regulatory PALs (Kendall, 1995).

No radiological walkover surveys have been conducted at this CAS.

A.2.4 Corrective Action Site 06-05-04, Leach Bed

Corrective Action Site 06-05-04 consists of a leach bed, septic tank, distribution box, subsurface piping connected to the leach bed, as well as the soil surrounding these features. This CAS was originally identified as a leach bed associated with Building 162, Site Maintenance Facility. Structures at the CAS include Building CP-162, which is currently active, as well as two large trailers adjacent to the north and south of the leach bed. Surface features include a manhole and a fence surrounding bermed soil at the location of the leach bed. [Figure A.2-5](#) shows a site sketch of the CAS.

Physical Setting and Operational History – Corrective Action Site 06-05-04 is located on Yucca Flat in Area 6. Building CP-162, Site Maintenance Facility, was constructed in 1979 and is currently active. Historically, CP-162 has been used as a woodworking shop, paint shop, and electric motor repair shop. This septic system received wastes from a water curtain, floor drains, sinks, commodes, and showers. This septic system was bypassed in the mid-1990s and a portion of the original piping was re-used; only the inactive/abandoned piping is included in the scope of this CAS (EBH, 1968; H&N, 1977b).

Release Information – The septic system was designed to release effluent from a drain through a septic tank and distribution feature and then to subsurface soil through the leach bed disposal feature. There is no indication that the septic tank, distribution box or subsurface piping are source(s) of potential contamination. There are no visible soil stains or other biasing factors at any surface

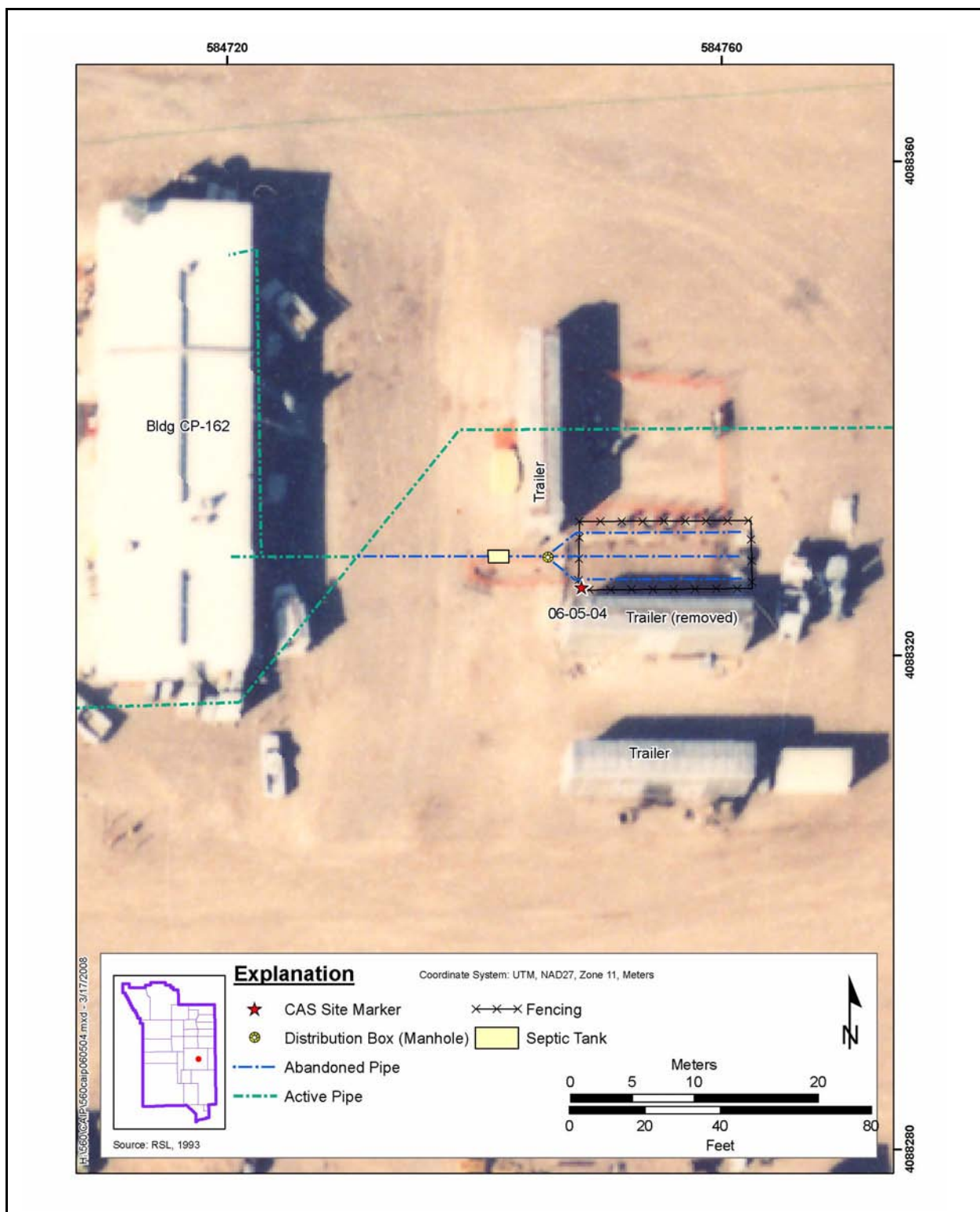


Figure A.2-5
Site Sketch of CAS 06-05-04, Leach Bed

locations, although the excavations may reveal subsurface contamination was released through the leach pit or where the system may have leaked.

Previous Investigation Results – A 2007 geophysical survey of CAS 06-05-04 did not detect the septic tank, which may have been removed as well as the VCP (Weston, 2007).

Previous sampling results for the septic tank of CAS 06-05-04 have been identified. Both liquid and solid samples were taken at the septic tank. The liquid samples were collected for oil/grease, SVOC/BNA, total metals, and VOC. The samples of solid material were analyzed for TCLP-metals, TCLP-SVOC/BNA, TPH, and oil/grease. A review of the sample results identified a sample of solid material from the septic tank with a concentration of TPH of 1,950 mg/kg; which is above the current NDEP regulatory PALs (Kendall, 1995).

No radiological walkover surveys have been conducted at this CAS.

A.2.5 Corrective Action Site 06-59-03, Building CP-400 Septic System

Corrective Action Site 06-59-03 consists of a septic tank, a potential dry well, a potential filter box, surface and subsurface piping connected to the collection feature, as well as the soil surrounding these features. This CAS was originally identified as a septic system associated with Building CP-400. No structures remain at this CAS. Surface features include the concrete pad of CP-400, several cut pipes, and an extent of aboveground piping that emerges from the side of the cliff and enters the ground downhill. The location of the septic tank is directly below an excavated/undermined area; the locations of the dry well and filter box have not been determined. [Figure A.2-6](#) shows a site sketch of the CAS.

Physical Setting and Operational History – Corrective Action Site 06-59-03 is located on Yucca Flat in Area 6. Building CP-400 was constructed in 1953 and demolished June 2003. This CAS is located on a graded area with eroding hillsides to the west and steeply sloping cliffs to the south and east. An excavated area is located above the septic tank, where the soil is undermining into the septic tank.

Historically, CP-400 was active beginning in 1953 and was used as a photo-processing lab. It is unknown when CP-400 was abandoned; however, the building was demolished June 24, 2003. Drawings from 1951 show a septic system consisting of a filter box and piping. Drawings from 1953

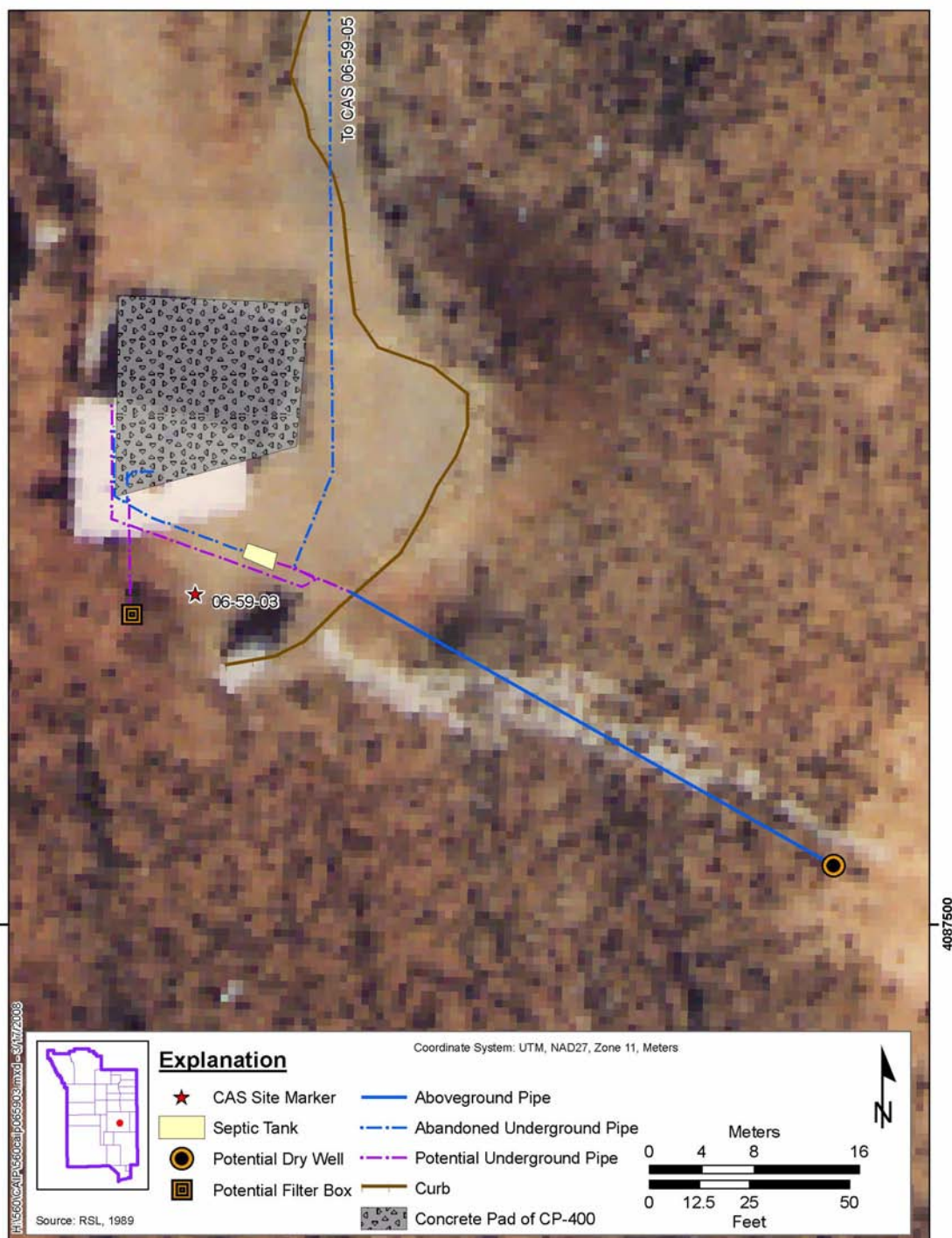


Figure A.2-6
Site Sketch of CAS 06-59-03, Building CP-400 Septic System

show a septic system comprised of a 500-gal septic tank that discharged to the CP Hill septic system (CAS 06-59-05). This septic tank received wastes from a lavatory, water closet, sink, drinking fountain, floor drains, and a darkroom sink. In 1963, the outlet line to the CP Hill septic system was cut and rerouted to a new dry well, and additional piping was installed in parallel with the septic tank (SM, 1952, SM, 1953; REEC_o, 1962).

Release Information – The septic system may have been designed to release effluent to subsurface soil through a disposal feature (i.e., the potential filter box and the potential dry well). There is no indication that the septic tank or subsurface piping are source(s) of potential contamination. There are no visible soil stains or other biasing factors at any surface locations, although the excavations may reveal subsurface contamination at designed release points (i.e., the septic tank, potential filter box, and potential dry well).

Previous Investigation Results – A geophysical survey was conducted at the site in 2006; however, the surveyed area did not include the location of much of the septic system. The location of the filter box and dry well are undetermined (Weston, 2006).

No radiological walkover surveys or sampling investigations have been identified for CAS 06-59-03.

A.2.6 Corrective Action Site 06-59-04, Office Trailer Complex Sewage Pond

Corrective Action Site 06-59-04 consists of a covered sewage pond and subsurface piping connected to the sewage pond up to the point where it was disconnected from a former manhole then abandoned, as well as the soil surrounding these features. This CAS was originally identified as a sewage pond associated with the Area 6 Office Trailer Complex. The structures at the CAS include Building 06-998652 (aka the Ice House). Surface features include a clean-out and bermed soil at the location of the sewage pond: approximately 1 ft above the mean ground surface. [Figure A.2-7](#) shows a site sketch of the CAS.

Physical Setting and Operational History – Corrective Action Site 06-59-04 is located on Yucca Flat in Area 6. The sewage pond and Office Trailer Complex were constructed before 1972. Historically, the Office Trailer Complex was used for administrative purposes; specific activities that occurred within the buildings are undetermined. The trailer complex utilized the sewage pond until 1976, at

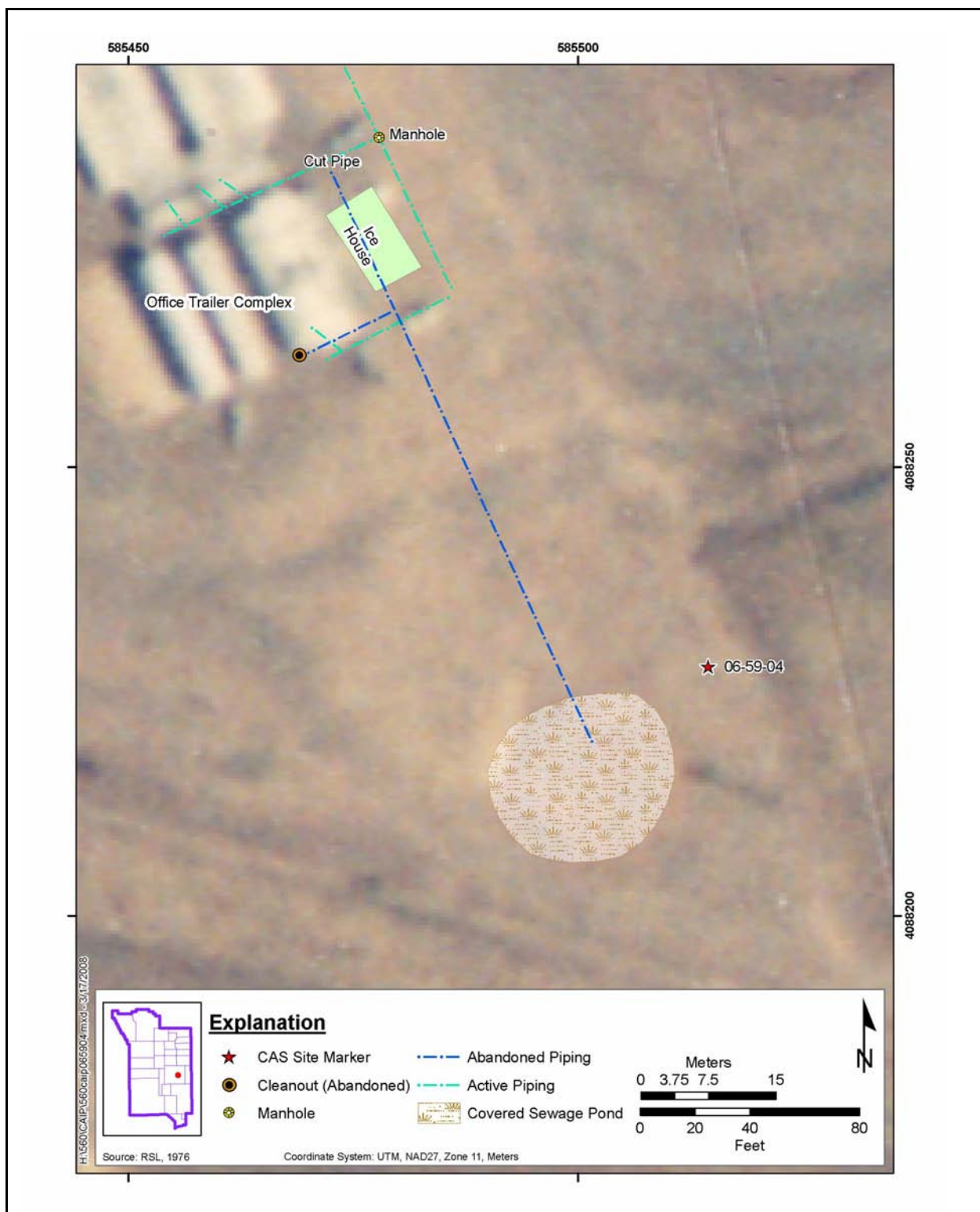


Figure A.2-7
Site Sketch of CAS 06-59-04, Office Trailer Complex Sewage Pond

which time the sewage pond was backfilled. A portion of the existing septic piping was used to connect the trailer complex to the Yucca Lake septic system. Some of the re-used piping was addressed as CAS 06-03-01; only the inactive/abandoned piping is included in the scope CAS 06-59-04 (REEC_o, 1972).

Release Information – The septic system was designed to route effluent to the sewage pond. There is no indication that the subsurface piping is a source of potential contamination. There are no visible soil stains or other biasing factors at any surface locations, although the excavations may reveal subsurface contamination at designed release points into the sewage pond.

Previous Investigation Results – A 2004 geophysical survey at CAS 06-59-04 detected elevated conductivity at the location of the backfilled sewage pond (Fahringer, 2004). No previous radiological walkover surveys or sampling investigations have been identified for CAS 06-59-04.

A.2.7 Corrective Action Site 06-59-05, Control Point Septic System

Corrective Action Site 06-59-05 consists of a septic tank, a tile field, subsurface piping between the septic tank and the former connection to a distribution manway, subsurface piping between the septic tank and the tile field, as well as soil surrounding these features. This CAS was originally identified as a septic tank servicing several buildings within the CP Complex. The structures at the CAS include the exposed top of the concrete septic tank. Surface features include manhole covers and vent lines on the concrete pad. [Figure A.2-8](#) shows a site sketch of the CAS.

Physical Setting and Operational History – Corrective Action Site 06-59-05 is located on Yucca Flat in Area 6. Documentation indicates that the septic system was active in 1951. By 1973, the septic system of CAS 06-59-05 was bypassed, and waste was diverted to the CP-72 sewage lagoons (CAS 06-03-03). Currently, the CP Complex is serviced by the Yucca Lake septic system. A portion of the original piping has been/is used in the active septic system; only the inactive/abandoned piping is included in the scope of this CAS (H&N, 1951a; H&N, 1951b).

Release Information – The septic system was designed to release effluent to subsurface soil through a disposal feature (i.e., the tile field). There is no indication that the septic tank, distribution box or subsurface piping are source(s) of potential contamination. There are no visible soil stains or other

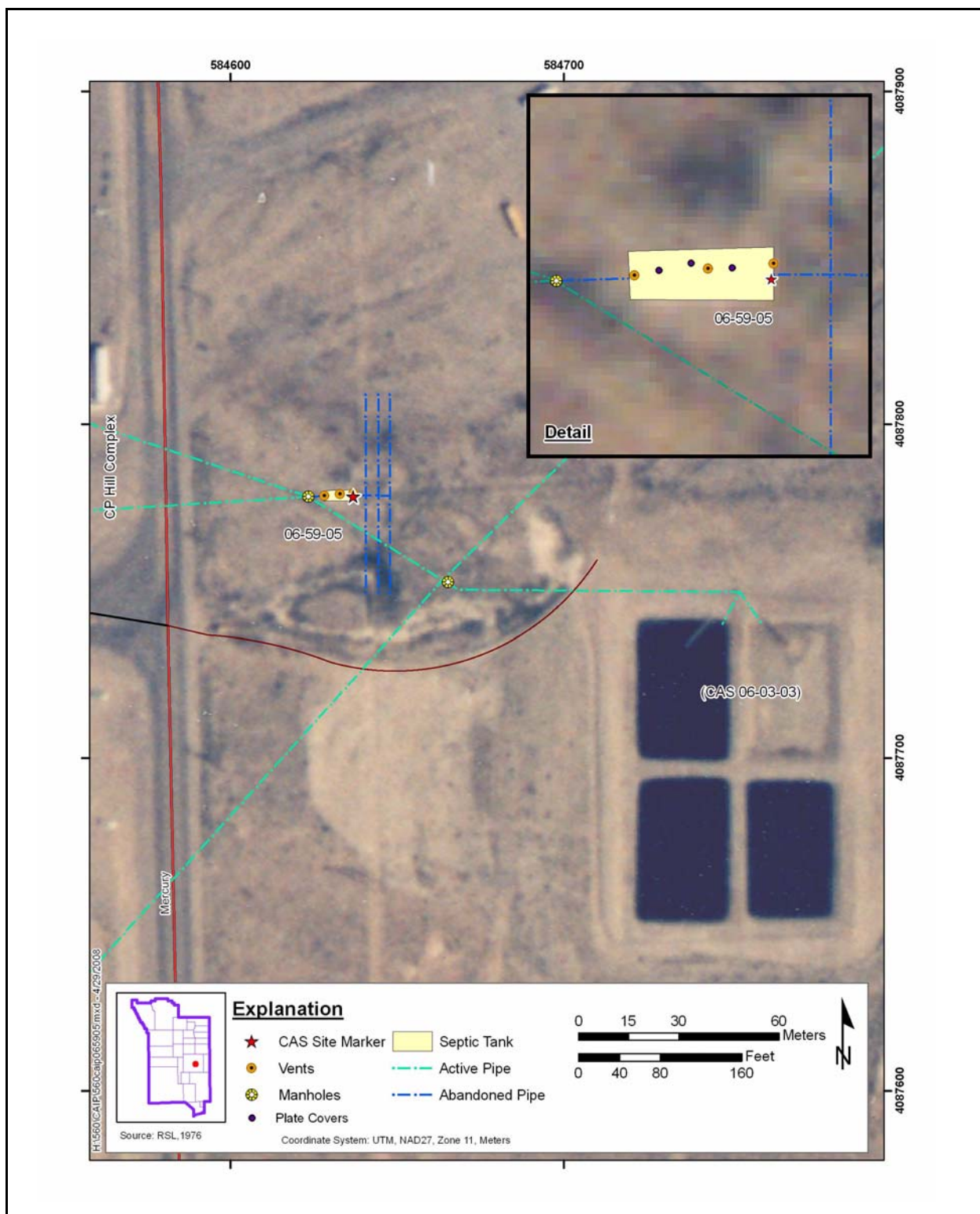


Figure A.2-8
Site Sketch of CAS 06-59-05, Control Point Septic System

biasing factors at any surface locations, although the excavations may reveal subsurface contamination at designed release points (i.e., the septic tank, distribution box, and tile field).

Previous Investigation Results – No geophysical surveys, radiological walkover surveys, or sampling investigations have been identified for CAS 06-59-05.

A.3.0 Step 1 - State the Problem

Step 1 of the DQO process defines the problem that requires study; identifies the planning team, and develops a conceptual model of the environmental hazard to be investigated.

The problem statement for CAU 560 is: “Existing information on the nature and extent of potential contamination is insufficient to evaluate and recommend corrective action alternatives for the seven CASs in CAU 560.”

A.3.1 Planning Team Members

The DQO planning team consists of representatives from NDEP, NNSA/NSO, SNJV, and NSTec. The DQO planning team met on January 22, 2008, for the DQO meeting. The primary decision makers are the NDEP and NNSA/NSO representatives.

A.3.2 Conceptual Site Model

The CSM is used to organize and communicate information about site characteristics. It reflects the best interpretation of available information at any point in time. The CSM is a primary vehicle for communicating assumptions about release mechanisms, potential migration pathways, or specific constraints. It provides a good summary of how and where contaminants are expected to move and what impacts such movement may have. It is the basis for assessing how contaminants could reach receptors both in the present and future. The CSM describes the most probable scenario for current conditions at each site and define the assumptions that are the basis for identifying appropriate sampling strategy and data collection methods. Accurate CSMs are important as they serve as the basis for all subsequent inputs and decisions throughout the DQO process.

The CSM was developed for CAU 560 using information from the physical setting, potential contaminant sources, release information, historical background information, knowledge from similar sites, and physical and chemical properties of the potentially affected media and COPCs.

The CSM consists of:

- Potential contaminant releases including media subsequently affected.
- Release mechanisms (the conditions associated with the release).
- Potential contaminant source characteristics including contaminants suspected to be present and contaminant-specific properties.
- Site characteristics including physical, topographical, and meteorological information.
- Migration pathways and transport mechanisms that describe the potential for migration and where the contamination may be transported.
- The locations of points of exposure where individuals or populations may come in contact with a COC associated with a CAS.
- Routes of exposure where contaminants may enter the receptor.

If additional elements are identified during the investigation that are outside the scope of the CSM, the situation will be reviewed and a recommendation will be made as to how to proceed. In such cases, NDEP and NNSA/NSO will be notified and given the opportunity to comment on and/or concur with the recommendation.

The applicability of the CSM to each CAS is summarized in [Table A.3-1](#) and discussed below.

[Table A.3-1](#) provides information on CSM elements that will be used throughout the remaining steps of the DQO process. [Figure A.3-1](#) represents site conditions applicable to this/the CSM.

A.3.2.1 Contaminant Release

The most likely locations of the contamination and releases to the environment are the soils directly below or adjacent to the surface and subsurface components of the CSM (i.e., septic tanks, leach bed/tile field, filter box outfall, dry wells, and any associated underground piping). The CSM accounts for potential releases resulting from overflow of system components that are present at, or just below the ground surface (e.g., fill pipes for septic tanks, leach pits, dry wells, filter boxes, distribution boxes, and connections to the leach bed/tile field). Any contaminants migrating from CASs, regardless of physical or chemical characteristics, are expected to exist at interfaces and in the soil in lateral and vertical directions adjacent to disposal features.

Table A.3-1
Conceptual Site Model
Description of Elements for Each CAS in CAU 560
(Page 1 of 2)

CAS Identifier	03-51-01	06-04-02	06-05-03	06-05-04	06-59-03	06-59-04	06-59-05
CAS Description	Leach Pit	Septic Tank	Leach Pit	Leach Bed	Building CP-400 Septic System	Office Trailer Complex Sewage Pond	Control Point Septic System
Site Status	Inactive and abandoned		Located near currently active areas or buildings; however, CAS components include only the inactive and/or abandoned features.		Inactive and abandoned	Located near currently active areas or buildings; however, CAS components include only the inactive and/or abandoned features.	Inactive and abandoned
Exposure Scenario	Occasional Use Area	Industrial Area					
Sources of Potential Soil Contamination	Leaking containers, broken pipe lines, and subsurface disposal of waste water and/or sewage						
Location of Contamination/Release Point	Surface soil at or near location(s) of disposed waste/materials. Subsurface soil below pipe breaks, septic tanks, dry wells, leach beds/tile fields, leach pits, distribution boxes, and filter boxes						
Amount Released	Unknown						
Affected Media	Surface, shallow subsurface, and subsurface soil						
Potential Contaminants	Undetermined		TPH, RCRA Metals, VOCs		Silver	Undetermined	
Transport Mechanisms	Percolation of precipitation through subsurface media serves as a driving force for migration of contaminants. Surface water runoff may provide for the transportation of some contaminants within or outside of the footprints of the CASs. In addition, liquids released as a waste component may also have provided a hydraulic driver for percolation and migration of contaminants.						

Table A.3-1
Conceptual Site Model
Description of Elements for Each CAS in CAU 560
(Page 2 of 2)

CAS Identifier	03-51-01	06-04-02	06-05-03	06-05-04	06-59-03	06-59-04	06-59-05
CAS Description	Leach Pit	Septic Tank	Leach Pit	Leach Bed	Building CP-400 Septic System	Office Trailer Complex Sewage Pond	Control Point Septic System
Migration Pathways	Vertical transport expected to dominate over lateral transport due to small surface gradients.						
Lateral and Vertical Extent of Contamination	Contamination, if present, is expected to be contiguous to the release points. Concentrations are expected to decrease with distance and depth from the source. Groundwater contamination is not expected. Lateral and vertical extent of COC contamination is assumed to be within the spatial boundaries.						
Exposure Pathways	The potential for contamination exposure is limited to industrial and construction workers, and military personnel conducting training. These human receptors may be exposed to COPCs through oral ingestion, inhalation, dermal contact (absorption) of soil and/or debris due to inadvertent disturbance of these materials or irradiation by radioactive materials.						

COC = Contaminant of concern
COPC = Contaminant of potential concern
RCRA = *Resource Conservation and Recovery Act*
TPH = Total petroleum hydrocarbons
VOC = Volatile organic compound

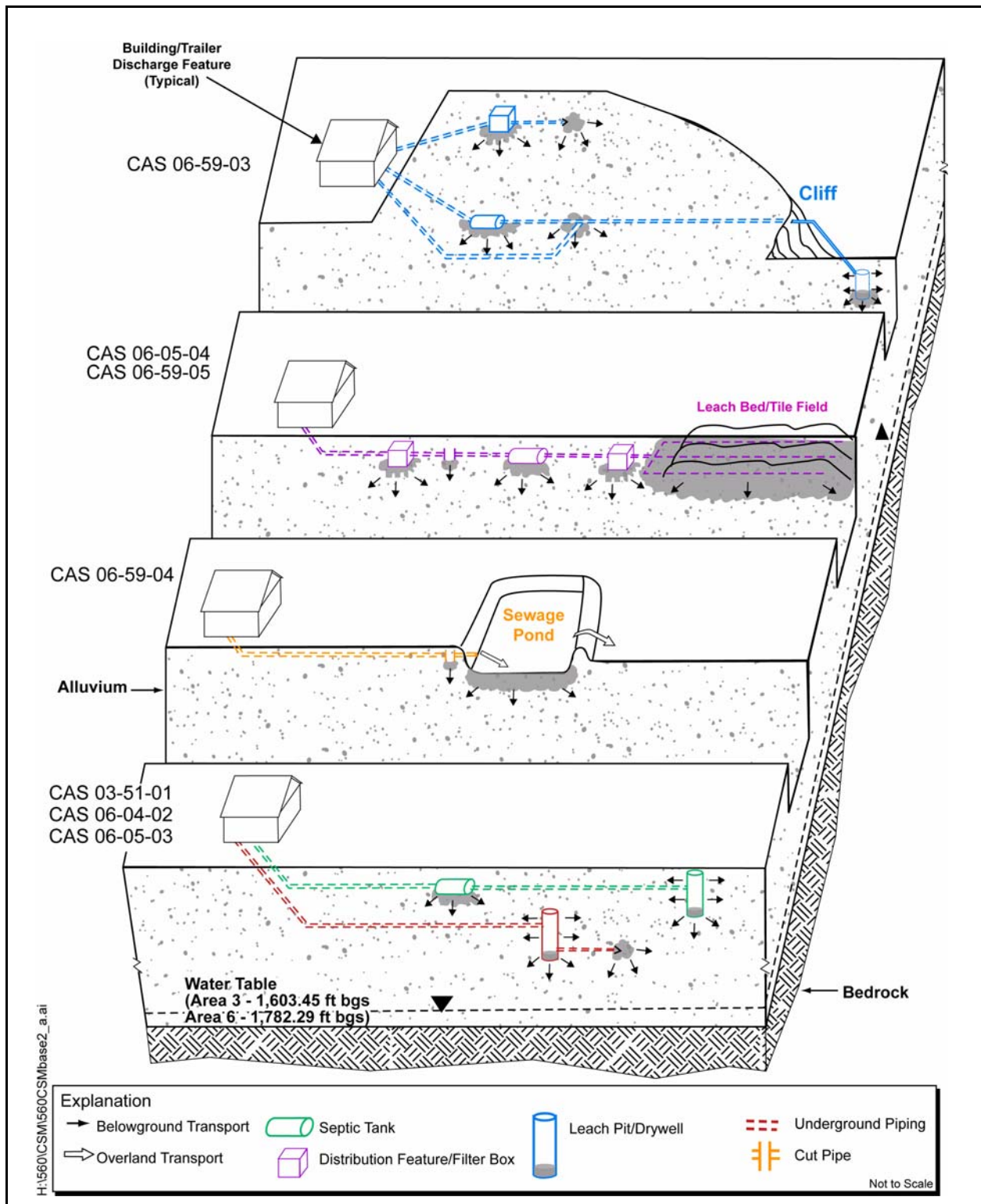


Figure A.3-1
Conceptual Site Model for CAU 560

A.3.2.2 Potential Contaminants

The COPCs were identified during the planning process through the review of site history, process knowledge, personal interviews, past investigation efforts (where available), and inferred activities associated with the CASs. Because complete information regarding activities performed at the CAU 560 sites is not available, contaminants detected at similar NTS sites were included in the contaminant lists to reduce uncertainty. The list of COPCs is intended to encompass all of the contaminants that could potentially be present at each CAS. The COPCs applicable to Decision I environmental samples from each of the CAU 560 CASs are defined as the constituents reported from the analytical methods stipulated in [Table A.3-2](#).

Table A.3-2
Analytical Program^a
(Page 1 of 2)

Analyses	03-51-01	06-04-02	06-05-03	06-05-04	06-59-03	06-59-04	06-59-05
Organic Contaminants of Potential Concern (COPCs)							
Total Petroleum Hydrocarbons-Diesel-Range Organics	X	X	X	X	X	X	X
Polychlorinated Biphenyls	X	X	X	X	X	X	X
Semivolatile Organic Compounds	X	X	X	X	X	X	X
Volatile Organic Compounds	X	X	X	X	X	X	X
Pesticides	X	X	X	X	X	X	X
Inorganic COPCs							
<i>Resource Conservation and Recovery Act Metals</i>	X	X	X	X	X	X	X
Total Beryllium	X	X	X	X	X	X	X
Radionuclide COPCs							
Gamma Spectroscopy ^b	X	X	X	X	X	X	X
Isotopic Uranium ^b	Contingent depending on review of gamma spectroscopy results, or may be submitted if field-screening levels are exceeded during aliquot field screening.						
Isotopic Plutonium ^b							
Strontium-90 ^b							

Table A.3-2
Analytical Program^a
(Page 2 of 2)

Analyses	03-51-01	06-04-02	06-05-03	06-05-04	06-59-03	06-59-04	06-59-05
Potential Remediation Waste Requirements							
Toxicity Characteristic Leaching Procedure (TCLP) Metals ^c	X	X	X	X	X	X	X
TCLP Volatile Organic Compounds ^c	X	X	X	X	X	X	X
TCLP Semivolatile Organic Compounds ^c	X	X	X	X	X	X	X
TCLP Pesticides ^c	X	X	X	X	X	X	X

^aThe contaminants of potential concern are the constituents reported from the analytical methods listed.

^bResults of gamma analysis will be used to determine whether further radioanalytical analysis is warranted.

^cTotal analysis may be used to determine if TCLP analysis is needed.

X = Required analytical method

Some COPCs were identified as targeted contaminants at specific CASs. Targeted contaminants are those COPCs for which evidence in the available site and process information suggests that they may be reasonably suspected to be present at a given CAS. The targeted contaminants are required to meet a more stringent completeness criteria than other COPCs, thus providing greater protection against a decision error (see [Section 6.2.6](#)). Targeted contaminants for each CAU 560 CAS are identified in [Table A.3-3](#).

Table A.3-3
Targeted Contaminants for CAU 560

Corrective Action Site	Chemical Targeted Contaminant(s)	Radiological Targeted Contaminant(s)
06-05-03, 06-59-04	Total petroleum hydrocarbons	None
06-59-03	Silver	None
03-51-01, 06-04-02, 06-59-04, 06-59-05	None	None

A.3.2.3 Contaminant Characteristics

Contaminant characteristics include, but are not limited to: solubility, density, and adsorption potential. In general, contaminants with low solubility, high affinity for media, and high density can

be expected to be found relatively close to release points. Contaminants with small particle size, high solubility, low density, and/or low affinity for media are found further from release points or in low areas where evaporation of ponding will concentrate dissolved contaminants.

A.3.2.4 Site Characteristics

Site characteristics are defined by the interaction of physical, topographical, and meteorological attributes and properties. Physical properties include permeability, porosity, hydraulic conductivity, degree of saturation, sorting, chemical composition, and organic content. Topographical and meteorological properties and attributes include slope stability, precipitation frequency and amounts, precipitation runoff pathways, drainage channels and ephemeral streams, and evapotranspiration potential.

A.3.2.5 Migration Pathways and Transport Mechanisms

Migration pathways include the lateral migration of potential contaminants across surface soils/sediments and vertical migration of potential contaminants through subsurface soils. Yucca Flat Dry Lake is generally dry but is subject to seasonal ponding. Stormwater flow events provide an intermittent mechanism for both vertical and horizontal transport of contaminants. Contaminated sediments entrained by these stormwater events would be carried by the streamflow to locations where the flowing water loses energy and the sediments drop out. These locations are readily identifiable by hydrologists as sedimentation areas.

Infiltration and percolation of precipitation serves as a driving force for downward migration of contaminants. However, due to high PET (annual PET at the Area 3 Radiological Waste Management Site has been estimated at 62.6 in. [Shott et al., 1997]) and limited precipitation for this region (6.67 in. per year [ARL/SORD, 2007]), percolation of infiltrated precipitation at the NTS does not provide a significant mechanism for vertical migration of contaminants to groundwater (DOE/NV, 1992).

A.3.2.6 Exposure Scenarios

Human receptors may be exposed to COPCs through oral ingestion, inhalation, dermal contact (absorption) of soil or debris due to inadvertent disturbance of these materials or irradiation by

radioactive materials. The land-use and exposure scenarios for the CAU 560 CASs are listed in [Table A.3-4](#). These are based on NTS current and future land use.

**Table A.3-4
Land-Use and Exposure Scenarios**

CAS	Record of Decision Land-Use Zone	Exposure Scenario
03-51-01	Nuclear and High Explosives Test Zone This area is designated within the Nuclear Test Zone for additional underground nuclear weapons tests and outdoor high-explosive tests. This zone includes compatible defense and nondefense research, development, and testing activities.	Occasional Use Area Worker will be exposed to the site occasionally (up to 80 hours per year for 5 years). Site structures are not present for shelter and comfort of the worker.
06-04-02, 06-05-03, 06-05-04, 06-59-03, 06-59-04, 06-59-05	Defense Industrial Zone	Industrial Area Worker will be exposed to the site full time (225 days per year, 10 hours per day for 25 years). Active powered buildings with toilets are present at the site.

Exposure scenarios for the CAU 560 CASs have been categorized based on current and projected future land uses: All area 6 CASs are within the Industrial Complex and, therefore, are categorized as Industrial Areas. This exposure scenario assumes industrial use of a site. This scenario addresses exposure to industrial workers continuously exposed to contaminants in soil during each workday for an entire career (225 days per year, 8 hours per day for a duration of 25 years).

Occasional Use Area for CAS 03-51-01. This exposure scenario assumes exposure to industrial workers who are not assigned to the area as a regular worksite but may occasionally use the site for intermittent or short-term activities. A site worker under this scenario is assumed to be on the site for an equivalent of 8 hours per day, 10 days per year, for 5 years.

A.4.0 Step 2 - Identify the Goal of the Study

Step 2 of the DQO process states how environmental data will be used in meeting objectives and solving the problem, identifies study questions or decision statement(s), and considers alternative outcomes or actions that can occur upon answering the question(s).

A.4.1 Decision Statements

The Decision I statement is: “Is any COC present in environmental media within the CAS?” For judgmental sampling design, any analytical result for a COPC above the FAL will result in that COPC being designated as a COC. A COC may also be defined as a contaminant that, in combination with other like contaminants, is determined to jointly pose an unacceptable risk based on a multiple constituent analysis (NNSA/NSO, 2006). If a COC is detected, then Decision II must be resolved.

The Decision II statement is: “If a COC is present, is sufficient information available to evaluate potential corrective action alternatives?” Sufficient information is defined to include:

- Identifying the volume of media containing any COC bounded by analytical sample results in lateral and vertical directions.
- The information needed to determine potential remediation waste types.
- The information needed to evaluate the feasibility of remediation alternatives.

A corrective action will be determined for any site containing a COC. The evaluation of the need for corrective action will include the potential for wastes that are present at a site to cause the future contamination of site environmental media if the wastes were to be released. To evaluate the potential for wastes to result in the introduction of a COC to the surrounding environmental media, the following conservative assumptions were made:

- That any containment would fail at some point and the wastes would be released to the surrounding media.
- That the resulting concentration of contaminants in the surrounding media would be equal to the concentration of contaminants in nonliquid waste.

- That any contaminant in the septic tank exceeding the RCRA toxicity characteristic concentration can result in introduction of a COC to the surrounding media.

Nonliquid waste containing a contaminant exceeding an equivalent FAL concentration would be considered to be PSM and would require a corrective action. Liquid waste with contaminant concentrations exceeding an equivalent toxicity characteristic action level would be considered to be PSM and require a corrective action.

If sufficient information is not available to evaluate potential corrective action alternatives then site conditions will be re-evaluated and additional samples will be collected (as long as the scope of the investigation is not exceeded and any CSM assumption has not been shown to be incorrect).

A.4.2 Alternative Actions to the Decisions

In this section, the actions that may be taken to solve the problem are identified depending on the possible outcomes of the investigation.

A.4.2.1 Alternative Actions to Decision I

If no COC associated with a release from the CAS is detected, then further assessment of the CAS is not required. If a COC associated with a release from the CAS is detected, then the extent of COC contamination will be determined and additional information required to evaluate potential corrective action alternatives will be collected.

A.4.2.2 Alternative Actions to Decision II

If sufficient information is available to evaluate potential corrective action alternatives, then further assessment of the CAS is not required. If sufficient information is not available to evaluate potential corrective action alternatives, then additional samples will be collected.

A.5.0 Step 3 - Identify Information Inputs

Step 3 of the DQO process identifies the information needed, determines sources for information, and identifies sampling and analysis methods that will allow reliable comparisons with FALs.

A.5.1 Information Needs

To resolve Decision I (determine whether a COC is present at a given CAS), samples need to be collected and analyzed following these two criteria:

- Samples must be collected in areas most likely to contain a COC, if present.
- The analytical suite selected must be sufficient to identify any COCs present in the samples.

To resolve Decision II (determine whether sufficient information is available to evaluate potential corrective action alternatives at each CAS), samples need to be collected and analyzed to meet the following criteria:

- Samples must be collected in areas contiguous to the contamination but where contaminant concentrations are below FALs.
- Samples of the waste or environmental media must provide sufficient information to determine potential remediation waste types.
- Samples of wastes must provide sufficient information to determine whether they contain PSM.
- Appropriate samples must be submitted to evaluate the feasibility of remediation alternatives.
- The analytical suites selected must be sufficient to detect contaminants at concentrations equal to or less than their corresponding FALs.

A.5.2 Sources of Information

Information to satisfy Decision I and Decision II will be generated by collecting environmental samples using grab sampling, backhoe excavation, drilling, or other appropriate sampling methods. These samples will be submitted to analytical laboratories meeting the quality criteria stipulated in the QAPP (NNSA/NV, 2002). Only validated data from analytical laboratories will be used to make DQO decisions. Sample collection and handling activities will follow standard procedures.

A.5.2.1 Sample Locations

Design of the sampling approaches for the CAU 560 CASs must ensure that the data collected are sufficient for selection of the corrective action alternatives (EPA, 2002). To meet this objective, the samples collected from each site should be from locations that most likely contain a COC, if present. These sample locations can, therefore, be selected by means of biasing factors used in judgmental sampling (e.g., stains, discolored soil, field-screening results). A judgmental sampling design has been developed for all CAU 560 CASs, due to the presence and significance of biasing factors.

Decision I sample locations at all CAU 560 CASs will be selected based on field-screening techniques, biasing factors, the CSM, and existing information. Analytical suites for Decision I samples will include all COPCs identified in [Table A.3-2](#).

Field-survey techniques may be used to select appropriate sampling locations and field-screening techniques may be used to provide semiquantitative data that can be used to comparatively select samples to be submitted for laboratory analyses. Field screening may also be used for health and safety monitoring and to assist in making certain health and safety decisions. The following techniques may be used to select analytical samples at CAU 560:

- Alpha and beta/gamma radiation – A radiological survey instrument will be used to screen soil at the CASs where soil samples are collected.

Biasing factors may also be used to select samples to be submitted for laboratory analyses based on existing site information and site conditions discovered during the investigation. The following factors will also be considered in selecting locations for analytical samples at CAU 560:

- Documented process knowledge on source and location of release (e.g., volume of release).
- Stains: Any spot or area on the soil surface that may indicate the presence of a potentially hazardous liquid. Typically, stains indicate an organic liquid such as an oil has reached the soil, and may have spread out vertically and horizontally.
- Elevated radiation: Any location identified by field screening of soil that had alpha or beta/gamma levels significantly higher than surrounding background soil.

- Geophysical anomalies: Any location identified during geophysical surveys that had results indicating surface or subsurface materials existed, and were not consistent with the natural surroundings (e.g., the sewage pond).
- Drums, containers, equipment or debris: Materials of interest that may have been used at, or added to, a location, and that may have contained or come in contact with hazardous or radioactive substances at some point during use.
- Lithology: Locations where variations in lithology (soil or rock) indicate that different conditions or materials exist.
- Preselected areas based on process knowledge of the site: Locations where evidence such as historical photographs, experience from previous investigations, or interviewee's input, exists that a release of hazardous or radioactive substances may have occurred.
- Preselected areas based on process knowledge of the contaminant(s): Locations that may reasonably have received contamination, selected on the basis of the chemical and/or physical properties of the contaminant(s) in that environmental setting.
- Previous sample results: Locations that have been shown to have been contaminated based on the results of previous field investigations.
- Experience and data from investigations of similar sites.
- Visual indicators such as discoloration, textural discontinuities, disturbance of native soils, or any other indication of potential contamination.
- Presence of debris, waste, or equipment.
- Odor.
- Physical and chemical characteristics of contaminants.
- Other biasing factors: Factors not previously defined for the CAI, but become evident once the investigation of the site is under way.

Decision II sample step-out locations will be selected based on the CSM, biasing factors, and existing data. Analytical suites will include those parameters that exceeded FALs (i.e., COCs) in prior samples. Biasing factors to support Decision II sample locations include Decision I biasing factors plus available analytical results.

A.5.2.2 Analytical Methods

Analytical methods are available to provide the data needed to resolve the decision statements. The analytical methods and laboratory requirements (e.g., detection limits, precision and accuracy) are provided in [Tables 3-4](#) and [3-5](#).

A.6.0 Step 4 - Define the Boundaries of the Study

Step 4 of the DQO process defines the target population of interest and its relevant spatial boundaries, specifies temporal and other practical constraints associated with sample/data collection, and defines the sampling units on which decisions or estimates will be made.

A.6.1 Target Populations of Interest

The population of interest to resolve Decision I (“Is any COC present in environmental media within the CAS?”) is any location within the site that is contaminated with any contaminant above a FAL. The populations of interest to resolve Decision II (“If a COC is present, is sufficient information available to evaluate potential corrective action alternatives?”) are:

- Each one in a set of locations with bounding contamination in lateral and vertical directions.
- Potential remediation waste.

A.6.2 Spatial Boundaries

Spatial boundaries are the maximum lateral and vertical extent of expected contamination at each CAS, as shown in [Table A.6-1](#). Contamination found beyond these boundaries could indicate a flaw in the CSM and possibly require re-evaluation of the CSM before the investigation continues. Each CAS is considered geographically independent and intrusive activities are not intended to extend into the boundaries of neighboring CASs.

A.6.3 Practical Constraints

Practical constraints such as military activities at the NTS, weather (i.e., high winds, rain, lightning, extreme heat), utilities, threatened or endangered animal and plants, unstable or steep terrain, and/or access restrictions may affect the ability to investigate this site. The practical constraints associated with the investigation of the CAU 560 CASs are summarized in [Table A.6-2](#).

Table A.6-1
Spatial Boundaries of CAU 560 CASS

Corrective Action Site	Spatial Boundaries
03-51-01	15-foot (ft) lateral buffer from the leach pit; 15 ft below ground surface (bgs) vertically.
06-04-02	15-ft lateral buffer from the septic tank; 15 ft bgs vertically.
06-05-03	15-ft lateral buffer from the septic tank, 15-ft lateral buffer from the leach pit; 15 ft bgs vertically.
06-05-04	15-ft lateral buffer from the septic tank, 15-ft lateral buffer from the distribution box, 15-ft lateral buffer from leach bed margins; 15 ft bgs vertically.
06-59-03	15-ft lateral buffer from the septic tank or any other designed subsurface release feature, 50-ft downgradient from surface release features, if existing; 15 ft bgs vertically.
06-59-04	15-ft lateral buffer outward from the sewage pond margins; 15 ft bgs vertically.
06-59-05	15-ft lateral buffer from the septic tank, 15-ft lateral buffer from the tile field margins; 15 ft bgs vertically.

Table A.6-2
Practical Constraints for the CAU 560 Field Investigation

Corrective Action Site	Practical Constraints ^a
03-51-01	Depth of approximately 15 feet (ft) (reach of backhoe).
06-04-02	Depth of approximately 15 ft (reach of backhoe).
06-05-03	Depth of approximately 15 ft (reach of backhoe). Restricted backhoe access due to Building CP-160 and aboveground utilities. Potentially active sewer lines.
06-05-04	Depth of approximately 15 ft (reach of backhoe). Restricted backhoe access due to the presence of trailers to the north and south of the leach pit and aboveground utilities. Potentially active sewer lines.
06-59-03	Depth of approximately 15 ft (reach of backhoe). Restricted backhoe access due to steepness of hillsides and of site access road, loose and unconsolidated terrain, and aboveground utilities.
06-59-04	Depth of approximately 15 ft (reach of backhoe). Restricted backhoe access due to active Icehouse building and aboveground utilities. Potentially active sewer lines.
06-59-05	Depth of approximately 15 ft (reach of backhoe). Restricted backhoe access due to aboveground utilities. Potentially active sewer lines.

^aMojave Desert population of the desert tortoise is listed as a threatened species by the U.S. Fish and Wildlife Service (DOE/NV, 1996).

A.6.4 Define the Sampling Units

The scale of decision-making in Decision I is defined as the CAS. Any COC detected at any location within the CAS will cause the determination that the CAS is contaminated and needs further evaluation. The scale of decision making for Decision II is defined as a contiguous area contaminated with any COC originating from the CAS. Resolution of Decision II requires this contiguous area to be bounded laterally and vertically.

A.7.0 Step 5 - Develop the Analytic Approach

Step 5 of the DQO process specifies appropriate population parameters for making decisions, defines action levels, and generates an “If ... then ... else” decision rule that involves it.

A.7.1 Population Parameters

For judgmental sampling results, the population parameter is the observed concentration of each contaminant from each individual analytical sample. Each sample result will be compared to the FALs to determine the appropriate resolution to Decision I and Decision II. For Decision I, a single sample result for any contaminant exceeding a FAL would cause a determination that a COC is present within the CAS.

The Decision II population parameter is an individual analytical result from a bounding sample. For Decision II, a single bounding sample result for any contaminant exceeding a FAL would cause a determination that the contamination is not bounded.

A.7.2 Action Levels

The PALs presented in this section are to be used for site screening purposes. They are not necessarily intended to be used as clean-up action levels or FALs. However, they are useful in screening out contaminants that are not present in sufficient concentrations to warrant further evaluation and, therefore, streamline the consideration of remedial alternatives. The RBCA process used to establish FALs is described in the *Industrial Sites Project Establishment of Final Action Levels* (NNSA/NSO, 2006). This process conforms with NAC Section 445A.227, which lists the requirements for sites with soil contamination (NAC, 2006a). For the evaluation of corrective actions, NAC Section 445A.22705 (NAC, 2006b) requires the use of ASTM Method E 1739-95 (ASTM, 1995) to “conduct an evaluation of the site, based on the risk it poses to public health and the environment, to determine the necessary remediation standards (i.e., FALs) or to establish that corrective action is not necessary.”

This RBCA process defines three tiers (or levels) of evaluation involving increasingly sophisticated analyses:

- Tier 1 Evaluation - Sample results from source areas (highest concentrations) are compared to action levels based on generic (non-site-specific) conditions (i.e., the PALs established in the CAIP). The FALs may then be established as the Tier 1 action levels or the FALs may be calculated using a Tier 2 evaluation.
- Tier 2 Evaluation - Conducted by calculating Tier 2 SSTLs using site-specific information as inputs to the same or similar methodology used to calculate Tier 1 action levels. The Tier 2 SSTLs are then compared to individual sample results from reasonable points of exposure (as opposed to the source areas as is done in Tier 1) on a point-by-point basis. Under Tier 2 or Tier 3, TPH concentrations will not be used for risk-based decisions. Rather, the individual chemicals of concern will be compared to the SSTLs.
- Tier 3 Evaluation - Conducted by calculating Tier 3 SSTLs on the basis of more sophisticated risk analyses using methodologies described in Method E 1739-95 that consider site-, pathway-, and receptor-specific parameters.

The comparison of laboratory results to FALs and the evaluation of potential corrective actions will be included in the investigation report. The FALs will be defined (along with the basis for their definition) in the investigation report.

A.7.2.1 Chemical PALs

Except as noted herein, the chemical PALs are defined as the EPA *Region 9 Risk-Based Preliminary Remediation Goals (PRGs)* for chemical contaminants in industrial soils (EPA, 2004). Background concentrations for RCRA metals and zinc will be used instead of PRGs when natural background concentrations exceed the PRG, as is often the case with arsenic on the NTS. Background is considered the mean concentration plus two standard deviations for sediment samples collected by the Nevada Bureau of Mines and Geology throughout the Nevada Test and Training Range (formerly the Nellis Air Force Range) (NBMG, 1998; Moore, 1999). For detected chemical COPCs without established PRGs, the protocol used by the EPA Region 9 in establishing PRGs (or similar) will be used to establish PALs. If used, this process will be documented in the investigation report.

A.7.2.2 Total Petroleum Hydrocarbon PALs

The PAL for TPH is 100 ppm as listed in NAC 445A.2272 (NAC, 2006c).

A.7.2.3 Radionuclide PALs

The PALs for radiological COPCs are based on the NCRP Report No. 129 recommended screening limits for construction, commercial, industrial land-use scenarios (NCRP, 1999) scaled to 25 mrem/yr dose constraint (Murphy, 2004) and the generic guidelines for residual concentration of radionuclides in DOE Order 5400.5 (DOE, 1993). The NCRP PALs are based on the construction, commercial, and industrial land-use scenario provided in the guidance that all PALs are appropriate for the NTS, based on future land-use scenarios, as presented in [Section A.3.2](#).

A.7.3 Decision Rules

The decision rules applicable to both Decision I and Decision II are:

- If COC contamination is inconsistent with the CSM or extends beyond the spatial boundaries identified in [Section A.6.2](#), then work will be suspended and the investigation strategy will be reconsidered, else the decision will be to continue sampling to define the extent.

The decision rules for Decision I are:

- If the population parameter of any COPC in the Decision I population of interest (defined in Step 4) exceeds the corresponding FAL, then that contaminant is identified as a COC, and Decision II samples will be collected, else no further investigation is needed for that COPC in that population.
- If a COC exists at any CAS, then a corrective action will be determined, else no further action will be necessary.
- If a waste is present that, if released, has the potential to cause the future contamination of site environmental media, then a corrective action will be determined, else no further action will be necessary.

The decision rules for Decision II are:

- If the population parameter (the observed concentration of any COC) in the Decision II population of interest (defined in Step 4) exceeds the corresponding FAL in any bounding direction, then additional samples will be collected to complete the Decision II evaluation, else the extent of the COC contamination has been defined.
- If valid analytical results are available for the waste characterization samples defined in [Section A.9.0](#), then the decision will be that sufficient information exists to determine potential remediation waste types and evaluate the feasibility of remediation alternatives, else collect additional waste characterization samples.

A.8.0 Step 6 - Specify Performance or Acceptance Criteria

Step 6 of the DQO process defines the decision hypotheses, specifies controls against false rejection and false acceptance decision errors, examines consequences of making incorrect decisions from the test, and places acceptable limits on the likelihood of making decision errors.

A.8.1 Decision Hypotheses

The baseline condition (i.e., null hypothesis) and alternative condition for Decision I are:

- Baseline condition – A COC is present.
- Alternative condition – A COC is not present.

The baseline condition (i.e., null hypothesis) and alternative condition for Decision II are as follows:

- Baseline condition – The extent of a COC has not been defined.
- Alternative condition – The extent of a COC has been defined.

Decisions and/or criteria have false negative or false positive errors associated with their determination. The impact of these decision errors and the methods that will be used to control these errors are discussed in the following subsections. In general terms, confidence in DQO decisions based on judgmental sampling results will be established qualitatively by:

- The development and concurrence of CSMs (based on process knowledge) by stakeholder participants during the DQO process.
- Validity testing of CSMs based on investigation results.
- Evaluation of the data quality based on DQI parameters.

A.8.2 False Negative Decision Error

The false negative decision error would mean deciding that a COC is not present when it actually is (Decision I), or deciding that the extent of a COC has been defined when it has not (Decision II). In both cases, the potential consequence is an increased risk to human health and environment.

In judgmental sampling, the selection of the number and location of samples is based on knowledge of the feature or condition under investigation and on professional judgment (EPA, 2002).

Judgmental sampling conclusions about the target population depend upon the validity and accuracy of professional judgment.

The false negative decision error (where consequences are more severe) for judgmental sampling designs is controlled by meeting these criteria:

- For Decision I, having a high degree of confidence that the sample locations selected will identify COCs if present anywhere within the CAS. For Decision II, having a high degree of confidence that the sample locations selected will identify the extent of COCs.
- Having a high degree of confidence that analyses conducted will be sufficient to detect any COCs present in the samples.
- Having a high degree of confidence that the dataset is of sufficient quality and completeness.

To satisfy the first criterion, Decision I samples must be collected in areas most likely to be contaminated by COCs. Decision II samples must be collected in areas that represent the lateral and vertical extent of contamination (above FALs). The following characteristics must be considered to control decision errors for the first criterion:

- Source and location of release
- Chemical nature and fate properties
- Physical transport pathways and properties
- Hydrologic drivers

These characteristics were considered during the development of the CSMs and selection of sampling locations. The field-screening methods and biasing factors listed in [Section A.5.2.1](#) will be used to further ensure that appropriate sampling locations are selected to meet these criteria. Radiological survey instruments and field-screening equipment will be calibrated and checked in accordance with the manufacturer's instructions and approved procedures. The investigation report will present an assessment on the DQI of representativeness that samples were collected from those locations that best represent the populations of interest as defined in [Section A.6.1](#).

To satisfy the second criterion, Decision I samples will be analyzed for the chemical and radiological parameters listed in [Section 3.2](#) of this document. Decision II samples will be analyzed for those

chemical and radiological parameters that identified unbounded COCs. The DQI of sensitivity will be assessed for all analytical results to ensure that all sample analyses had measurement sensitivities (detection limits) that were less than or equal to the corresponding FALs. If this criterion is not achieved, the affected data will be assessed (for usability and potential impacts on meeting site characterization objectives) in the investigation report.

To satisfy the third criterion, the entire dataset, as well as individual sample results, will be assessed against the DQIs of precision, accuracy, comparability, and completeness as defined in the QAPP (NNSA/NV, 2002) and in [Section 6.2.2](#) of this document. The DQIs of precision and accuracy will be used to assess overall analytical method performance as well as to assess the need to potentially “flag” (qualify) individual contaminant results when corresponding QC sample results are not within the established control limits for precision and accuracy. Data qualified as estimated for reasons of precision or accuracy may be considered to meet the constituent performance criteria based on an assessment of the data. The DQI for completeness will be assessed to ensure that all data needs identified in the DQO have been met. The DQI of comparability will be assessed to ensure that all analytical methods used are equivalent to standard EPA methods so that results will be comparable to regulatory action levels that have been established using those procedures. Strict adherence to established procedures and QA/QC protocol protects against false negatives. Site-specific DQIs are discussed in more detail in [Section 6.2.2](#) of this document.

To provide information for the assessment of the DQIs of precision and accuracy, the following quality control samples will be collected as required by the QAPP (NNSA/NV, 2002):

- Field duplicates (minimum of 1 per matrix per 20 environmental samples, or one per CAS matrix, if less than 20 collected).
- Laboratory QC samples (minimum of 1 per matrix per 20 environmental samples or 1 per CAS per matrix, if less than 20 collected).

A.8.3 False Positive Decision Error

The false positive decision error would mean deciding that a COC is present when it is not, or a COC is unbounded when it is not, resulting in increased costs for unnecessary sampling and analysis.

False positive results are typically attributed to laboratory and/or sampling/handling errors that could cause cross contamination. To control against cross contamination, decontamination of sampling equipment will be conducted according to established and approved procedures and only clean sample containers will be used. To determine whether a false positive analytical result may have occurred, the following quality control samples will be collected as required by the QAPP (NNSA/NV, 2002):

- Trip blanks (1 per sample cooler containing VOC environmental samples)
- Equipment blanks (1 per sampling event for each type of decontamination procedure)
- Source blanks (1 per uncharacterized source lot)
- Field blanks (minimum of 1 per CAS, additional if field conditions change)

A.9.0 Step 7 - Develop the Plan for Obtaining Data

Step 7 of the DQO process selects and documents a design that will yield data that will best achieve performance or acceptance criteria. Judgmental sampling schemes will be implemented to select sample locations and evaluate analytical results for CAU 560. [Sections A.9.1](#) through [A.9.2](#) contain general information about collecting Decision I and Decision II samples, while the subsequent sections provide CAS-specific sampling activities, including proposed sample locations.

A.9.1 Sampling

A judgmental sampling design will be implemented for all CASs of CAU 560. Because individual sample results, rather than an average concentration, will be used to compare to FALs at the CASs undergoing judgmental sampling, statistical methods to generate site characteristics will not be used. Adequate representativeness of the entire target population may not be a requirement to developing a sampling design. If good prior information is available on the target site of interest, then the sampling may be designed to collect samples only from areas known to have the highest concentration levels on the target site. If the observed concentrations from these samples are below the action level, then a decision can be made that the site contains safe levels of the contaminant without the samples being truly representative of the entire area (EPA, 2006).

All sample locations will be selected to satisfy the DQI of representativeness in that samples collected from selected locations will best represent the populations of interest as defined in [Section A.6.1](#). To meet this criterion for judgmentally sampled sites, a biased sampling strategy will be used for Decision I samples to target areas with the highest potential for contamination, if it is present anywhere in the CAS. Sample locations will be determined based on process knowledge, previously acquired data, or the field-screening and biasing factors listed in [Section A.5.2.1](#). If biasing factors are present in soils below locations where Decision I samples were removed, additional Decision I soil samples will be collected at depth intervals selected by the Site Supervisor, based on biasing factors to a depth where the biasing factors are no longer present, or the vertical spatial boundary is reached. The Site Supervisor has the discretion to modify the judgmental sample locations, but only if the modified locations meet the decision needs and criteria stipulated in this DQO.

A.9.2 Decision II Sampling

To meet the DQI of representativeness for Decision II samples (that Decision II sample locations represent the population of interest as defined in [Section A.6.1](#)), sampling locations at each CAS will be selected based on the outer boundary sample locations where COCs were detected, the CSM, and other field-screening and biasing factors listed in [Section A.5.2](#). In general, sample locations will be arranged in a triangular pattern around the Decision I location or area at distances based on site conditions, process knowledge, and biasing factors. If COCs extend beyond the initial step-outs, Decision II samples will be collected from incremental step-outs. Initial step-outs will be at least as deep as the vertical extent of contamination defined at the Decision I location and the depth of the incremental step-outs will be based on the deepest contamination observed at all locations. A clean sample (i.e., COCs less than FALs) collected from each step-out direction (lateral or vertical) will define extent of contamination in that direction. The number, location, and spacing of step-outs may be modified by the Site Supervisor, as warranted by site conditions.

A.9.3 Corrective Action Site 03-51-01, Leach Pit

Corrective Action Site 03-51-01 contains a leach pit and subsurface piping. The results of a 2007 geophysical survey indicate that a large subsurface anomaly may be connected to the leach pit by piping. As practical, a video-mole survey will be conducted on piping to identify potential breaches or unknown tie-ins.

During Decision I sampling, the following features will be sampled:

- One sample will be collected at the base of the inflow pipe to the leach pit.
- One sample will be collected of the contents of the leach pit, if contents are present.
- One sample will be collected at the native soil interface below the leach pit.
- If the leach pit has been removed, then sampling will be conducted below the non-native (fill) material, at the apparent native soil interface.
- If an outlet pipe is found during investigations, then one sample will be collected at the base of the outlet pipe and site inspections will continue to include the subsurface anomaly. If the geophysical anomaly is related to the septic system and has a potential to release

contaminants, then the geophysical anomaly will be sampled, as appropriate (e.g., as a tank or leach pit).

- One sample will be collected at any breach encountered during surveying of collection system piping within the spatial boundary.

Proposed Decision I sample locations are shown in [Figure A.9-1](#). Site conditions may dictate adjustment or additional sampling if biasing factors are encountered during site investigations.

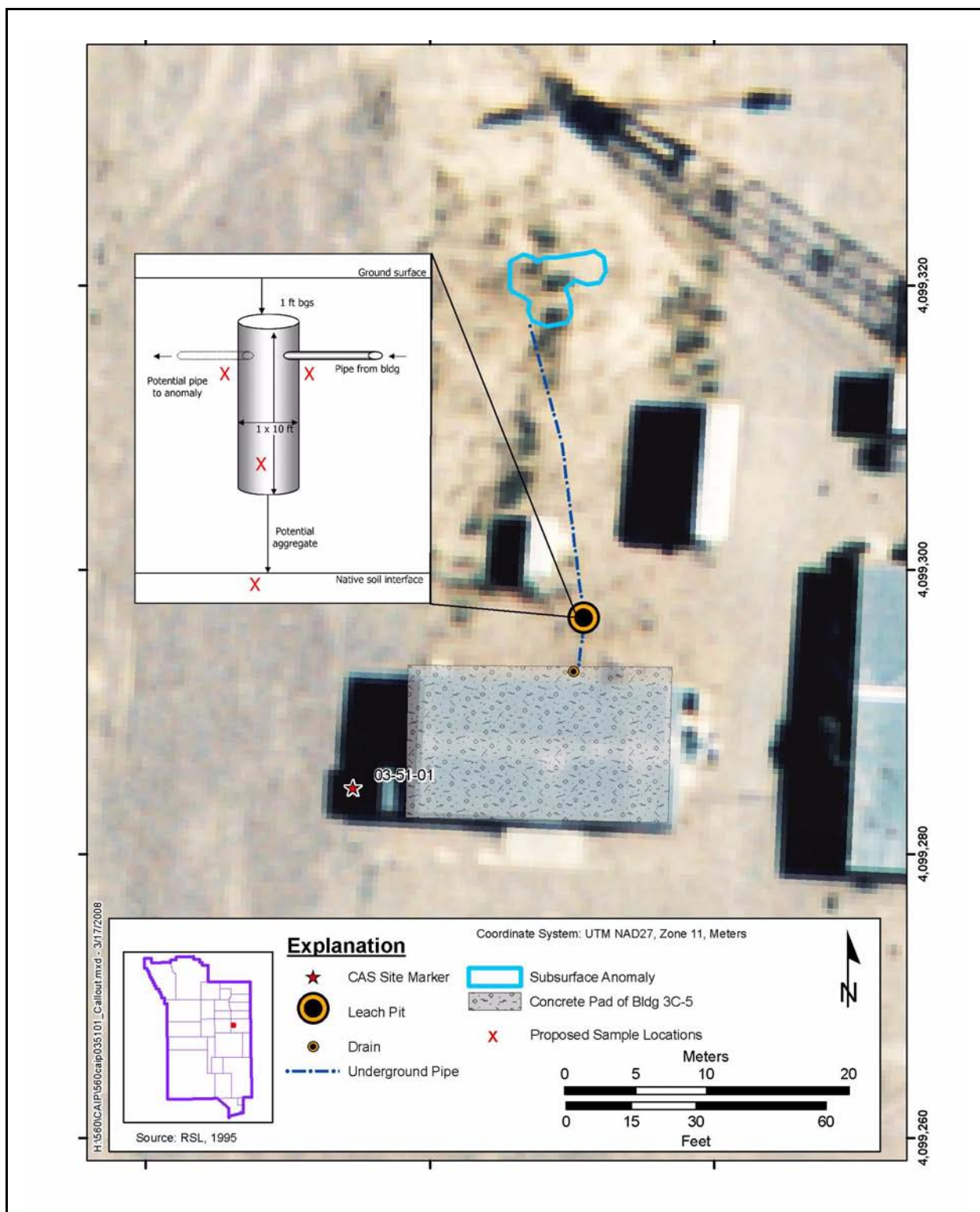
A.9.4 Corrective Action Site 06-04-02, Septic Tank

Corrective Action Site 06-04-02 contains a septic tank and subsurface piping. Documentation indicates that the septic tank may actually be a leach pit. As practical, a video-mole survey will be conducted on piping to identify potential breaches or unknown tie-ins.

During Decision I sampling, the following features will be sampled:

- If a septic tank is present, and the tank contains material that can be sampled, then samples will be collected of the contents of the tank; a sample for each phase of material in each chamber. In addition, two samples will be collected at the base of the tank; one below the inflow pipe and one below the outlet pipe, if present.
- If a leach pit is present, and if the leach pit contains material that can be sampled (e.g., not leach rock), then one sample will be collected of the contents of the leach pit. In addition, one sample will be collected at the native soil interface below the leach pit.
- If the CAS systems components (e.g., the septic tank/leach pit) have been removed, then sampling will be conducted below the non-native (fill) material, at the apparent native soil interface.
- If an outlet pipe is found during investigations, then one sample will be collected at the base of the outlet pipe.
- One sample will be collected at any breach encountered during surveying of collection system piping.

Proposed Decision I sample locations are shown in [Figure A.9-2](#). Site conditions may dictate adjustment or additional sampling if biasing factors are encountered during site investigations.



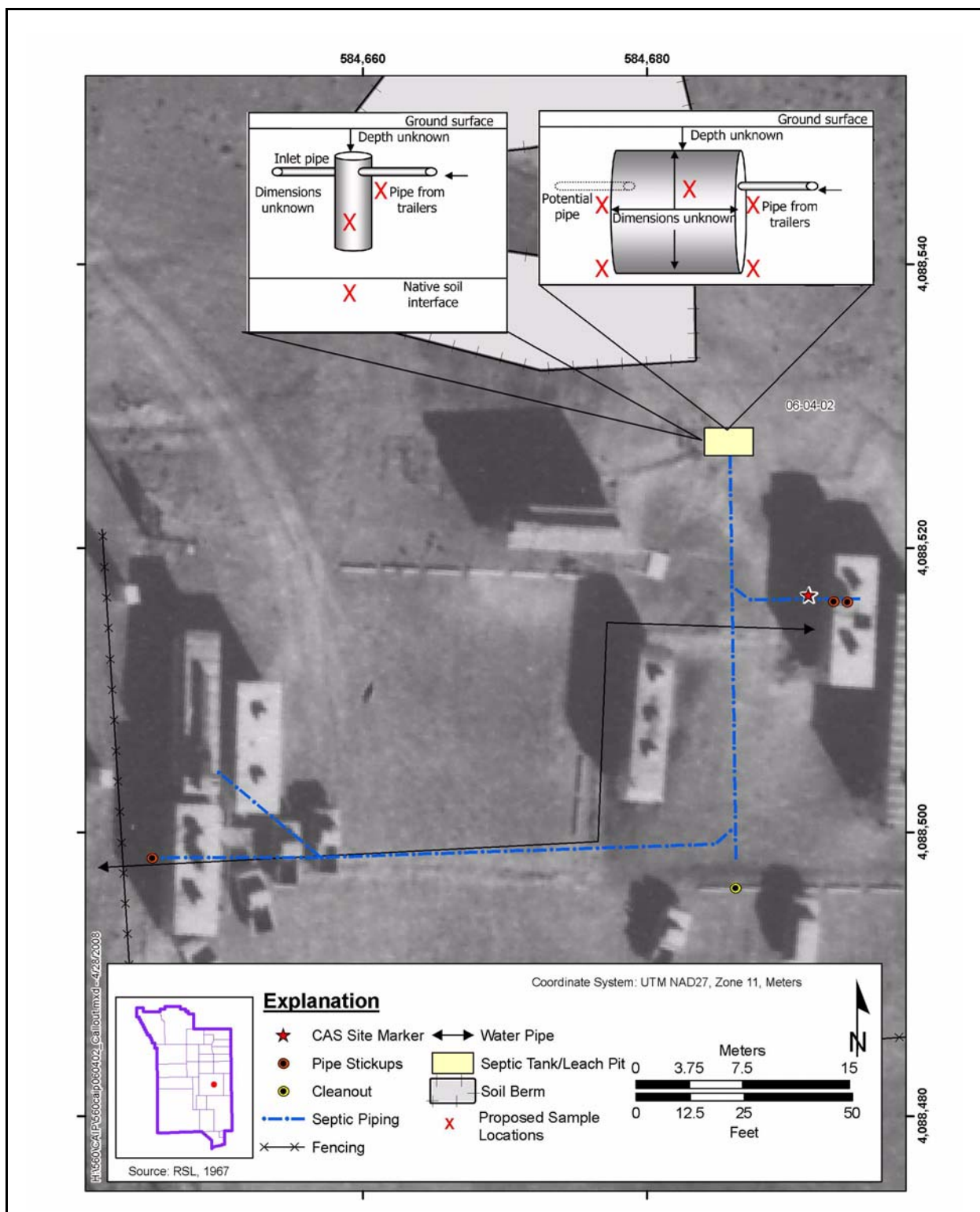


Figure A.9-2
Proposed Sample Locations at CAS 06-04-02

A.9.5 Corrective Action Site 06-05-03, Leach Pit

Corrective Action Site 06-05-03 contains a septic tank, a leach pit, and subsurface piping. Results of a 2007 geophysical survey did not conclusively detect the presence of the septic tank. The septic tank may have been removed. As practical, a video-mole survey will be conducted on piping to identify potential breaches or unknown tie-ins. Only inactive piping will be included in site investigations.

During Decision I sampling, the following features will be sampled:

- If the septic tank is present, and the tank contains material that can be sampled, then samples will be collected of the contents of the tank; a sample for each phase of material in each chamber. In addition, one sample will be collected at the base of the inflow pipe, one sample will be collected at the base of the outlet pipe, and samples will be collected near both ends at the base of the tank, or adjusted if biasing factors are encountered.
- If the CAS systems components (e.g., the septic tank and leach pit) have been removed, then sampling will be conducted below the non-native (fill) material, at the apparent native soil interface.
- One sample will be collected at the base of the inflow pipe to the leach pit.
- One sample will be collected of the contents of the leach pit, if contents are present.
- One sample will be collected at the native soil interface below the leach pit.
- One sample will be collected at any breach encountered during surveying of collection system piping.

Proposed Decision I sample locations are shown in [Figure A.9-3](#). Site conditions may dictate adjustment or additional sampling if biasing factors are encountered during site investigations.

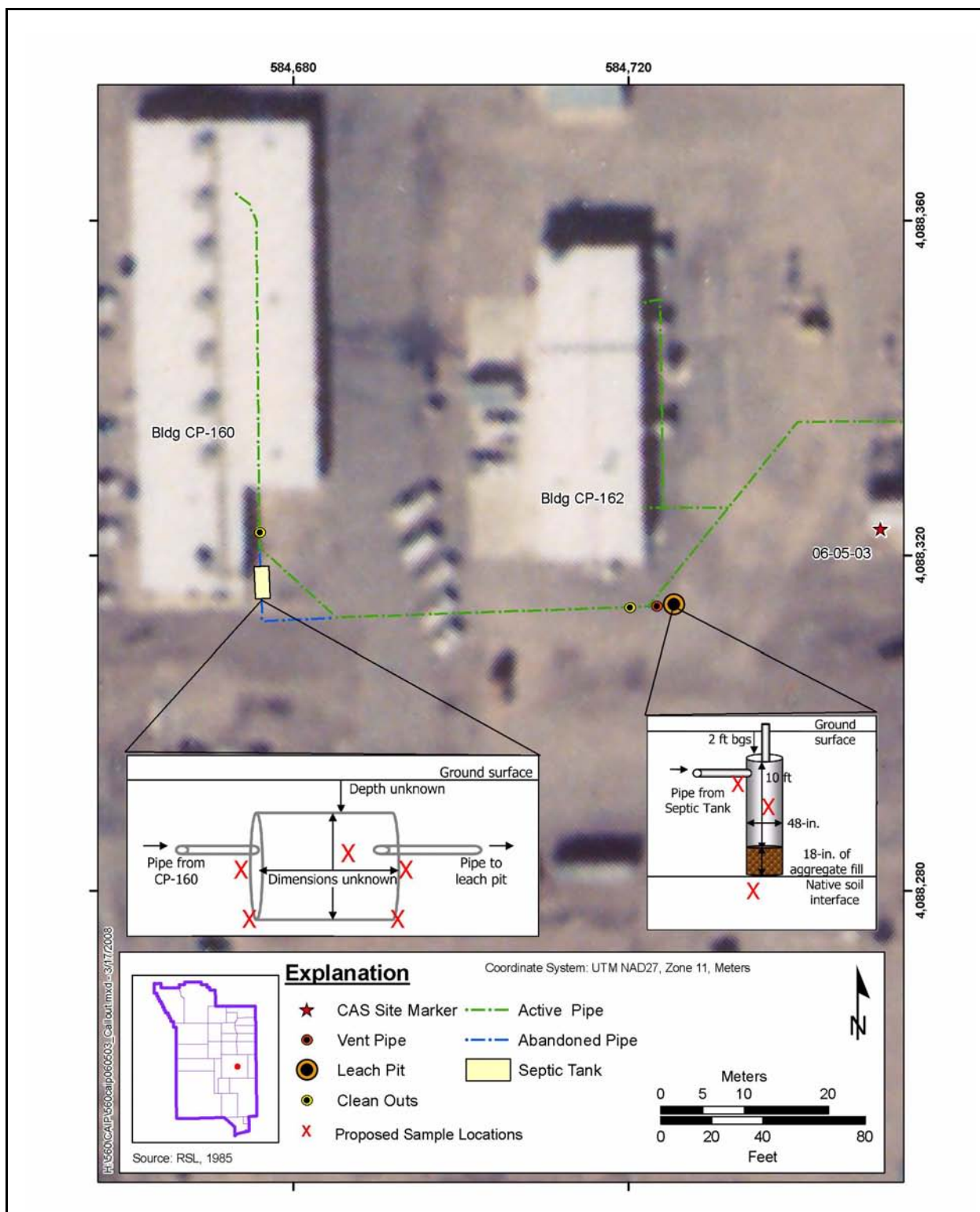


Figure A.9-3
Proposed Sample Locations at CAS 06-05-03

A.9.6 Corrective Action Site 06-05-04, Leach Bed

Corrective Action Site 06-05-04 contains a septic tank, a distribution box or manhole, a leach bed, and subsurface piping. Results of a 2007 geophysical survey did not conclusively detect the presence of the septic tank. The septic tank may have been removed. As practical, a video-mole survey will be conducted on piping to identify potential breaches or unknown tie-ins. Only inactive piping will be included in site investigations.

During Decision I sampling, the following features will be sampled:

- If the septic tank is present, and the tank contains material that can be sampled, then samples will be collected from the contents of the tank; a sample for each phase of material in each chamber. In addition, one sample will be collected at the base of the inflow pipe to the septic tank, one sample will be collected at the base of the outlet pipe from the septic tank, and samples will be collected near both ends at the base of the tank.
- If the CAS systems components (e.g., the septic tank, distribution box, and leach bed) have been removed, then sampling will be conducted below the non-native (fill) material, at the apparent native soil interface.
- One sample will be collected at the base of the inflow pipe to the distribution box/manhole.
- The interior of the distribution box/manhole will be inspected. If it appears to have breached, then a sample will be collected below the distribution box.
- If contents are found within the distribution box/manhole, and the material can be sampled, then one sample will be collected of the material.
- One sample will be collected at the base of the outflow pipe from the distribution box/manhole.
- One sample will be collected at the native soil interface at proximal and distal ends of each of three pipes of the leach bed.
- If PSM is encountered within transects at each proximal and distal location, then samples will be collected of the PSM.
- One sample will be collected at any breach encountered during surveying of collection system piping.

Proposed Decision I sample locations are shown in [Figure A.9-4](#). Site conditions may dictate adjustment or additional sampling if biasing factors are encountered during site investigations.

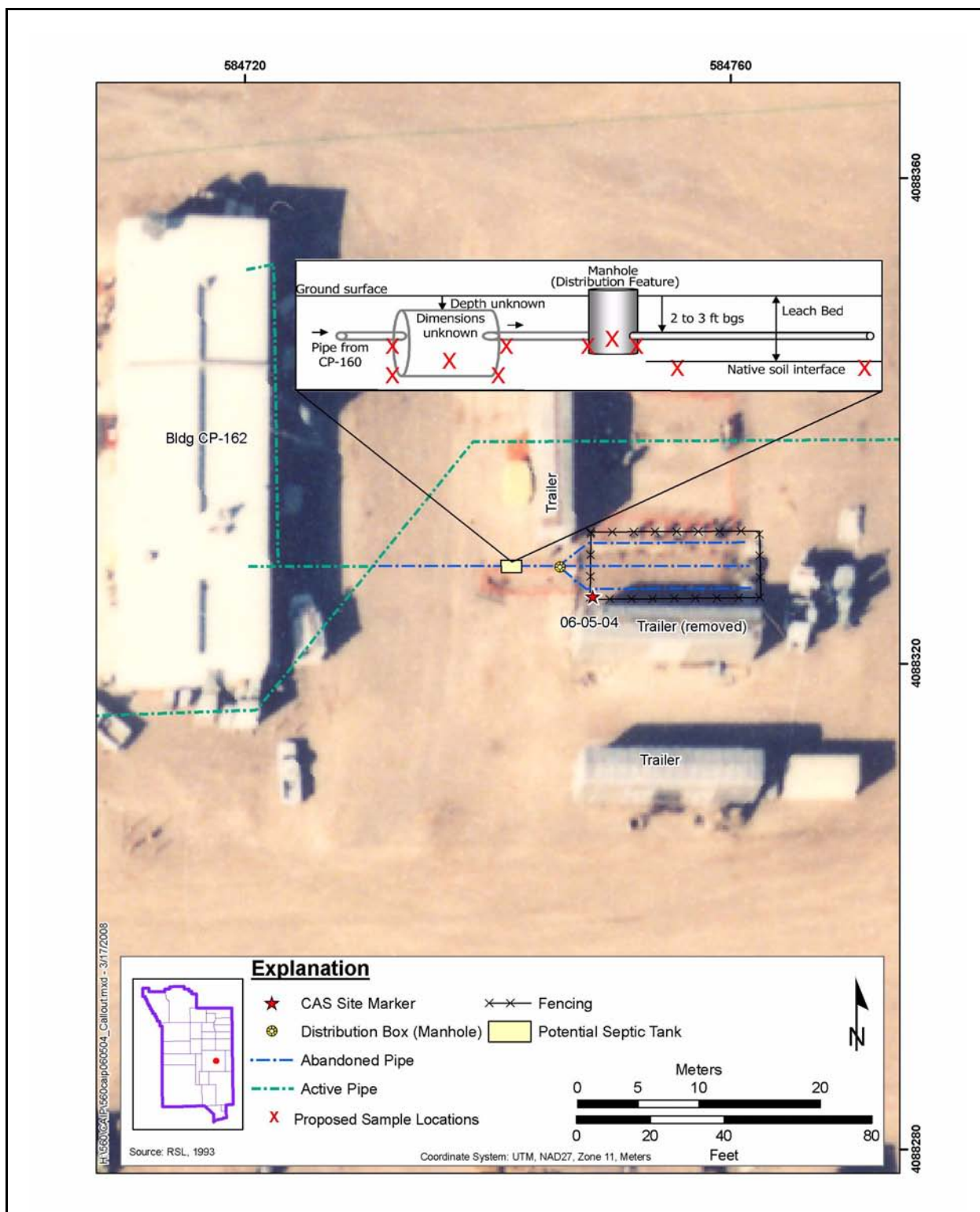


Figure A.9-4
Proposed Sample Locations at CAS 06-05-04

A.9.7 Corrective Action Site 06-59-03, Building CP-400 Septic System

Corrective Action Site 06-59-03 contains a filter box, a dry well, a septic tank, as well as surface and subsurface piping. It is uncertain if the filter box or dry well are present at the site. As practical, a video-mole survey will be conducted on piping to identify potential breaches or unknown tie-ins; however, site investigations will not include underground steel (small-diameter) pipe outside the CAS boundary.

During Decision I sampling, the following features will be sampled:

- If the filter box is present, then one sample will be collected below the inflow pipe, one sample will be collected below the outlet pipe, one composite sample will be collected of the contents (if the filter box contains material that can be sampled), and two samples will be collected below the base of the filter box; one below the inflow pipe and one below the outlet pipe.
- If the dry well is present, then one sample will be collected below the inflow pipe, one sample will be collected of the contents of the casing (if the dry well contains material that can be sampled [e.g., not leach rock]), and one sample will be collected at the native soil interface below the casing.
- If the septic tank contains material that can be sampled, then samples will be collected of the contents of the tank; a sample for each phase of material in each chamber.
- One sample will be collected at the base of the inflow pipe to the septic tank
- One sample will be collected at the base of the outlet pipe from the septic tank
- Samples will be collected near both ends at the base of the tank, or adjusted if biased soil is encountered.
- One sample will be collected at any breach encountered during surveying of collection system piping.
- If the CAS systems components (e.g., the septic tank, filter box, and dry well) have been removed, then sampling will be conducted below the non-native (fill) material, at the apparent native soil interface.

Proposed Decision I sample locations are shown in [Figure A.9-5](#). Site conditions may dictate adjustment or additional sampling if biasing factors are encountered during site investigations.

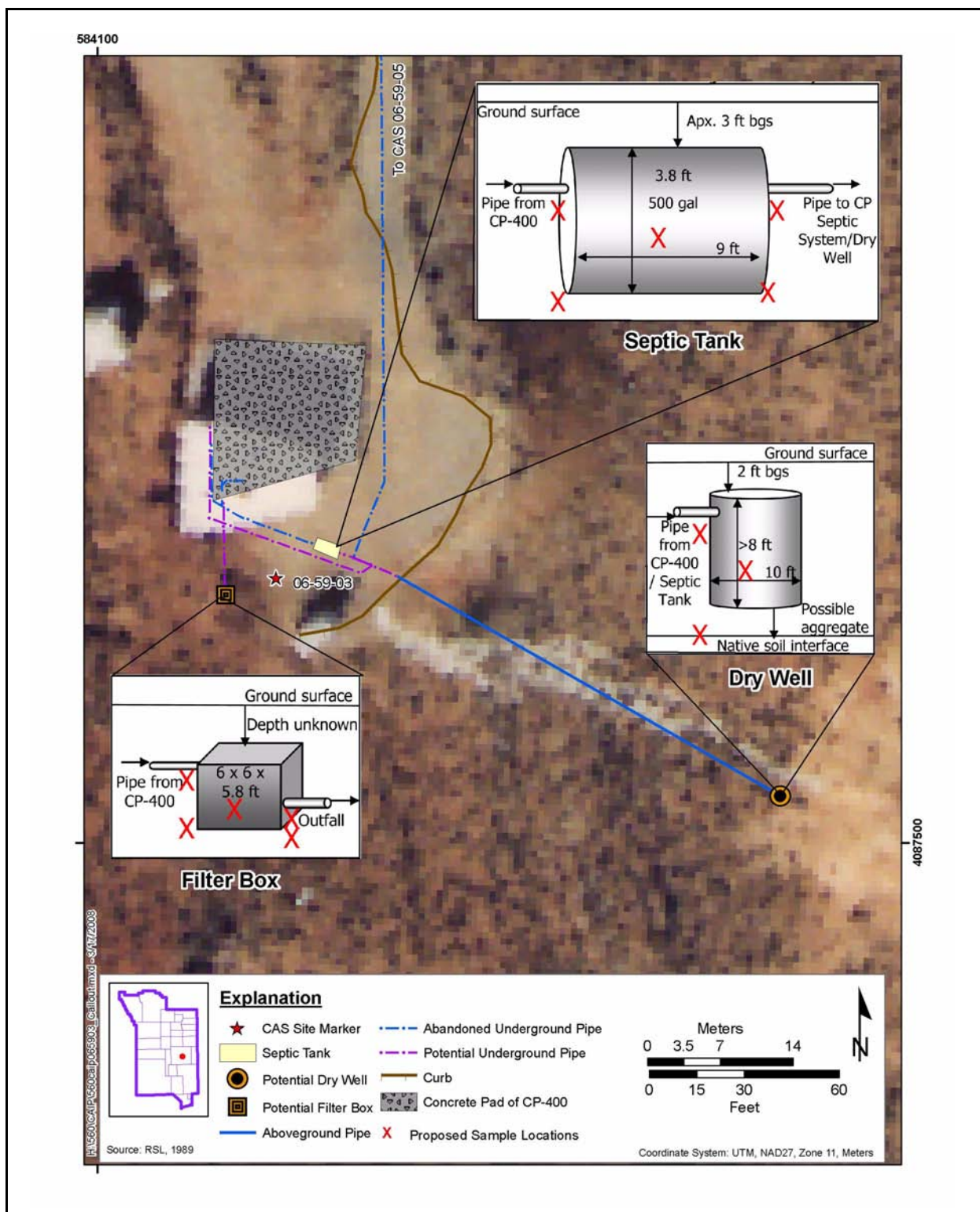


Figure A.9-5
Proposed Sample Locations at CAS 06-59-03

A.9.8 Corrective Action Site 06-59-04, Office Trailer Complex Sewage Pond

Corrective Action Site 06-59-04 contains a covered sewage pond and subsurface piping. As practical, a video-mole survey will be conducted on piping to identify potential breaches or unknown tie-ins. During the investigation, it will be determined if the pond has a liner, and if so, the sampling approach will be modified so that there is minimal damage to the liner.

During Decision I sampling, the following features will be sampled:

- Before sampling, investigations will include exploratory trenching at the location of the former manhole/cut pipe to look for biasing factors, and if found, a subsurface sample will be collected.
- One sample will be collected below the outlet pipe within the sewage pond, or similar location if pipe is not identified.
- One sample will be collected of the material covering the sewage pond at the lowest surface point, or the center if the low point is not apparent.
- One sample will be collected of the contents of the sewage pond, if PSM exists.
- One sample will be collected at the original disposal surface (i.e., fill/native interface) of the sewage pond, below the surface sample location.
- One sample will be collected at any breach encountered during surveying of collection system piping.

Proposed Decision I sample locations are shown in [Figure A.9-6](#). Site conditions may dictate adjustment or additional sampling if biasing factors are encountered during site investigations.

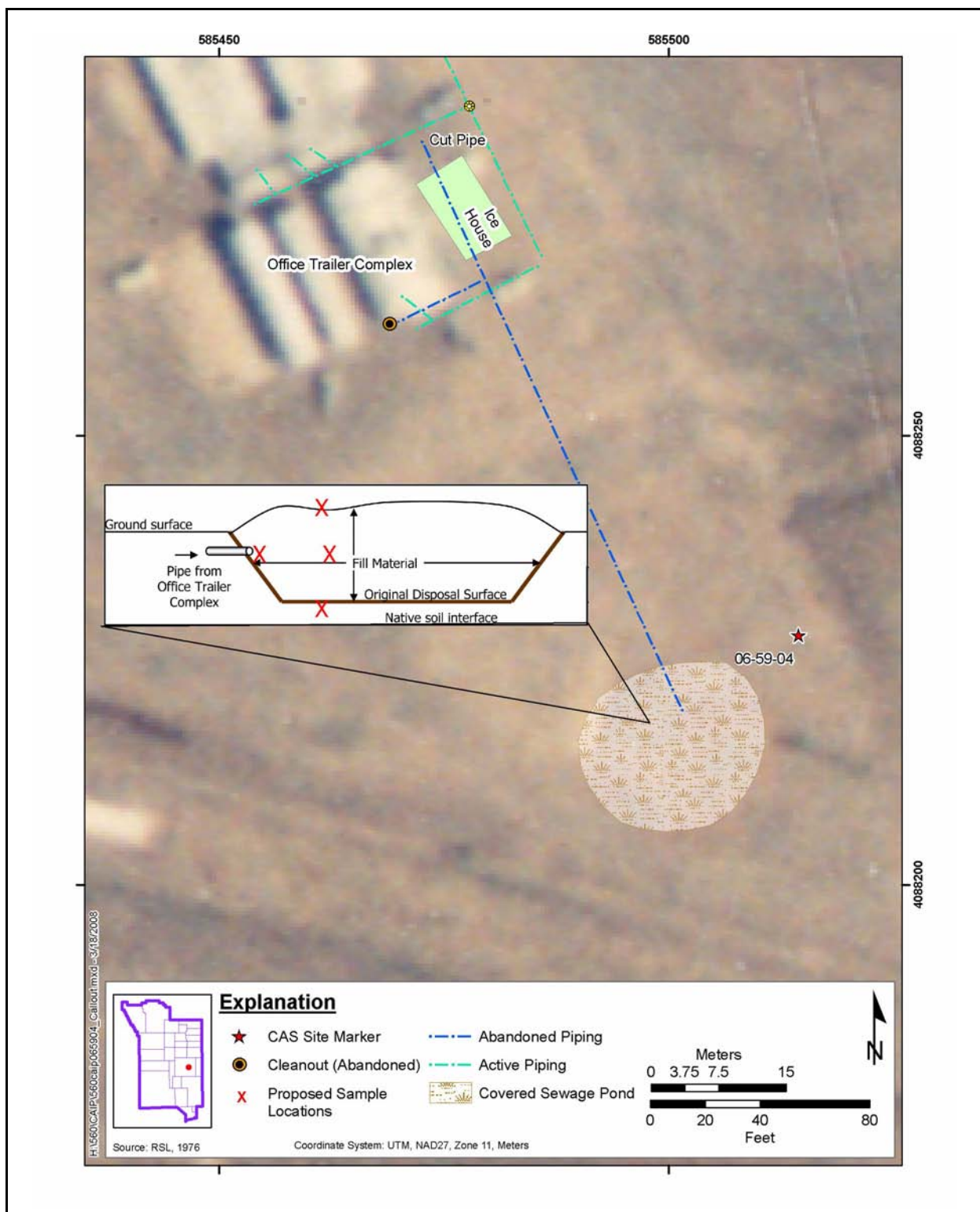


Figure A.9-6
Proposed Sample Locations at CAS 06-59-04

A.9.9 Corrective Action Site 06-59-05, Control Point Septic System

Corrective Action Site 06-59-05 contains a distribution box, a septic tank, and a tile field. As practical, a video-mole survey will be conducted on piping to identify potential breaches or unknown tie-ins. Only inactive piping will be included in site investigations.

During Decision I sampling, the following features will be sampled:

- Before sampling, investigations will include exploratory trenching at the location of the former manhole/cut pipe to look for biasing factors.
- One sample will be collected at the base of the inflow pipe to the distribution box/manhole.
- The interior of the distribution box will be inspected. If it appears to have breached, then a sample will be collected below the distribution box.
- If contents are found within the distribution box, and the material can be sampled, then one sample will be collected of the material.
- One sample will be collected at the base of the outflow pipe from the distribution box.
- One sample will be collected at the base of the inflow pipe to the septic tank.
- If the septic tank contains material that can be sampled, then samples will be collected of the contents of the tank; a sample for each phase of material in each chamber.
- One sample will be collected at the base of the outlet pipe from the septic tank.
- Samples will be collected near both ends at the base of the tank, or adjusted if biased soil is encountered.
- One sample will be collected at the native soil interface at proximal and distal ends of both left and right branches of each of three pipes of the tile field. If the tile field has been removed, then sampling will be conducted below the non-native (fill) material, at the apparent native soil interface.
- If PSM is encountered within transects at each proximal and distal location, then samples will be collected of the PSM.
- One sample will be collected at any breach encountered during surveying of collection system piping.

Proposed Decision I sample locations are shown in [Figure A.9-7](#). Site conditions may dictate adjustment or additional sampling if biasing factors are encountered during site investigations.

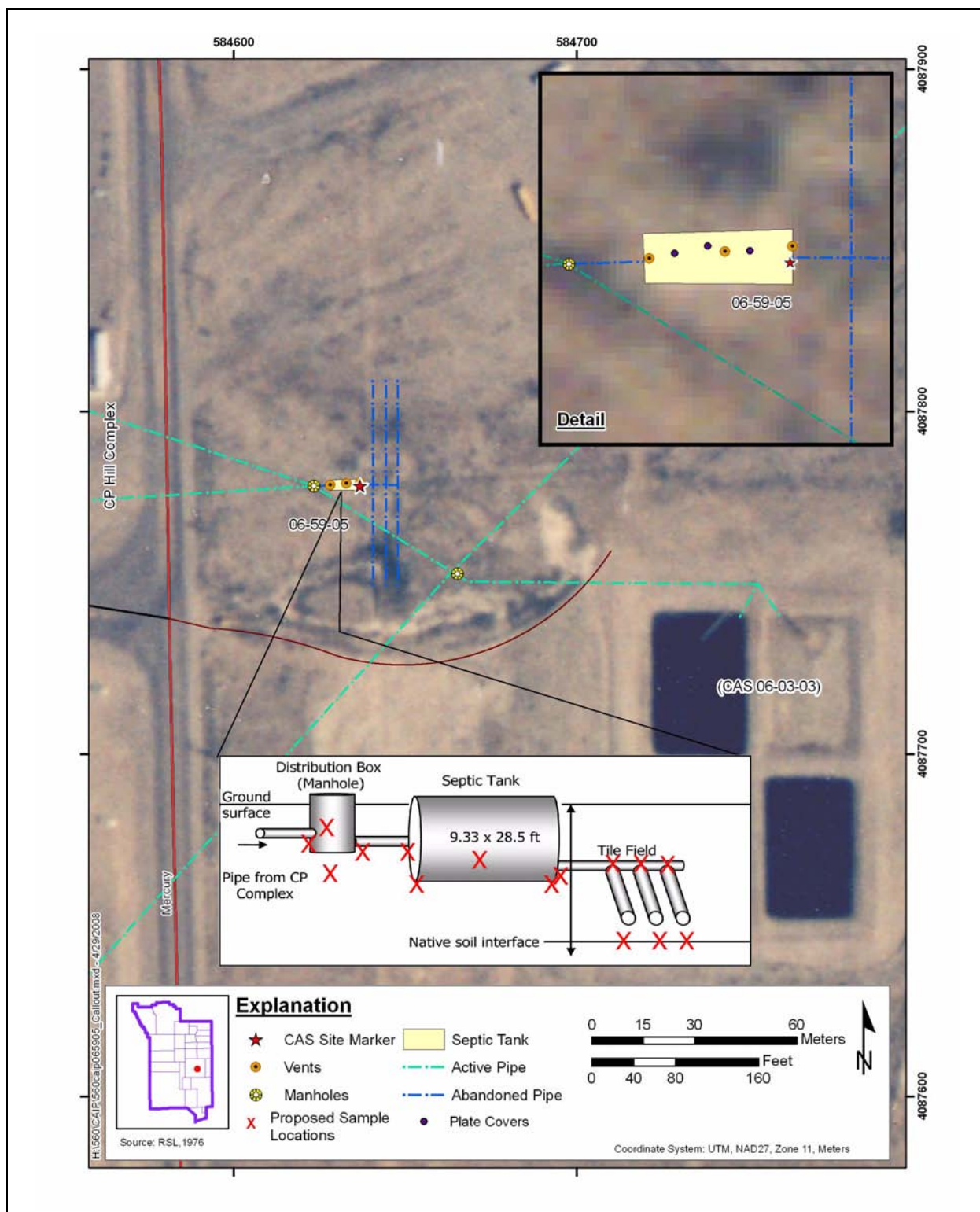


Figure A.9-7
Proposed Sample Locations at CAS 06-59-05

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Appendix B

Project Organization

B.1.0 Project Organization

The NNSA/NSO Acting Federal Sub-Project Manager is Kevin Cabble. He can be contacted at (702) 295-5000. The NNSA/NSO Task Manager is Janis Romo. She can be contacted at (702) 295-0838.

The identification of the project Health and Safety Officer and the Quality Assurance Officer can be found in the appropriate plan. However, personnel are subject to change and it is suggested that the DOE Federal Sub-Project Manager be contacted for further information. The Task Manager will be identified in the FFACO Monthly Activity Report before the start of field activities.

Appendix C

Nevada Division of Environmental Protection Comment Responses

(1 Page)

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