Appendix C
Aerial Photographic Analysis

United States
Environmental Protection
Agency

Environmental Sciences
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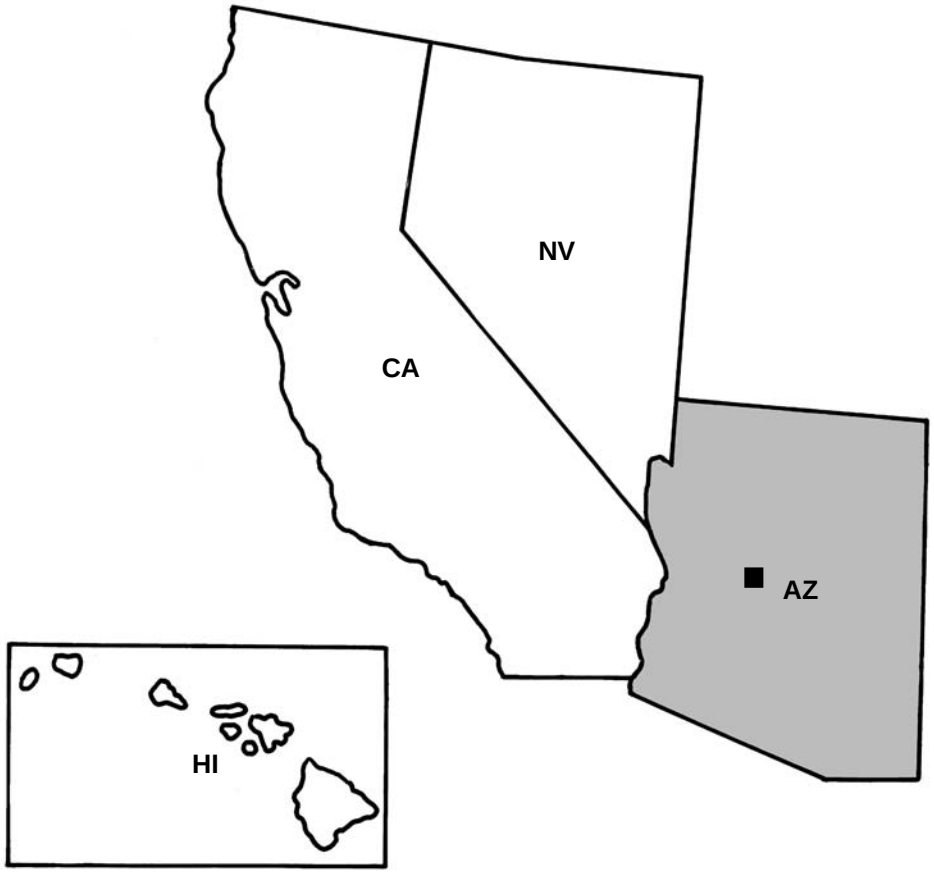
Research and Development

AERIAL PHOTOGRAPHIC ANALYSIS OF IRON KING MINE/HUMBOLDT SMELTER SITE

Dewey-Humboldt, Arizona

Volumes 1 & 2 Combined

EPA Region 9



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Dewey-Humboldt, Arizona

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U.S. ENVIRONMENTAL PROTECTION AGENCY
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NOTICE

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ABSTRACT

This report presents the findings from a historical aerial photographic analysis of the Iron King Mine/Humboldt Smelter site located near Dewey-Humboldt, Arizona. The site comprises the Iron King Mine and the Humboldt Smelter. The analysis was performed using fourteen (14) dates of historical black-and-white, color, and color infrared aerial photographs that cover the period from 1940 through 2003. For the historical aerial photographic analysis, all fourteen (14) dates of photography were analyzed, and eight (8) dates were selected for reproduction and inclusion in this report. The purpose of the historical aerial photographic analysis is to document the nature, extent, and location of contaminants and other observable conditions of environmental significance at the Iron King Mine and the Humboldt Smelter. This report provides operational remote sensing information in support of remedial actions conducted by the Region 9 Office of the U.S. Environmental Protection Agency (EPA) under the Comprehensive, Environmental Response, Compensation, and Liability Act (CERCLA). This report is presented in two volumes: the first volume includes the text descriptions and photographic analyses, while the second volume contains the aerial photographs and interpretive overlays.

According to collateral information supplied by the EPA, the Iron King Mine, located west of Highway 69 and west of Humboldt, Arizona, operated from the late 1800s through approximately the 1970s. A portion of the mine was also used by a fertilizer manufacturing facility. The Humboldt Smelter, located east of Highway 69 and south of Humboldt, was used as a smelter from the early 1900s through approximately 1960 and may have been used intermittently after that date for smelting and other purposes. Tailings have been periodically released from the Iron King Mine down through the Chaparral Gulch extending to the Humboldt Smelter.

Findings from the historical aerial photographic analysis of the Iron King Mine/Humboldt Smelter site indicate that an ore processing facility

and two processing facilities operated on the Iron King Mine section of the site during the time frame of the analysis. The ore processing facility was composed of processing buildings, tanks, overhead pipes, and tailings ponds, and was active in 1940 through at least 1964. Processing facility PF-1 was active in 1940 through at least 1980. Processing facility PF-2 was active in 1992 through at least 2003. Waste materials generated from the facilities appear to have entered the tributaries of the Chaparral Gulch and the Galena Gulch.

Evidence that ore processing had occurred on the Humboldt Smelter section of the King Mine/Humboldt Smelter site prior to 1940 was found. Ore Processing Facility-1 was operational in 1964 through at least 1970. Tailings ponds and dumping of materials were observed near the facility. Ore Processing Facility-2 did not appear to be active during the time frame of the analysis. However, the extent of light-toned material, located along a hillside that slopes to the Chaparral Gulch, did increase between 1940 and 1953. Waste materials generated from Ore Processing Facility-1 appear to have entered the Agua Fria River and waste materials generated from Ore Processing Facility-2 appear to have entered the Chaparral Gulch.

The EPA Environmental Sciences Division, Landscape Ecology Branch in Las Vegas, Nevada, prepared this report for the EPA Region 9 Superfund Division in San Francisco, California, and the EPA Office of Superfund Remediation Technology Innovation in Washington, D.C.

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INTRODUCTION

This report presents the findings from a historical aerial photographic analysis of the Iron King Mine/Humboldt Smelter site (EPA ID# AZ0000309013) located near Dewey-Humboldt, in Yavapai County, Arizona. To produce this report, fourteen (14) dates of historical black-and-white, color, and color infrared aerial photographs, that cover the period from 1940 through 2003, were obtained and analyzed. Eight (8) dates of photography (1940, 1953, 1964, 1970, 1973, 1980, 1992, and 2003) have been reproduced for inclusion in this report. The purpose of the historical aerial photographic analysis is to document the nature, extent, and location of contaminants, and other observable conditions of environmental significance at the Iron King Mine/Humboldt Smelter site. The Iron King Mine/Humboldt Smelter site is composed of two locations the Iron King Mine and the Humboldt Smelter (Figure 2). This report provides operational remote sensing information in support of remedial actions conducted by the Region 9 Office of the U.S. Environmental Protection Agency (EPA) under the Comprehensive, Environmental Response, Compensation, and Liability Act (CERCLA).

According to collateral information (EPA, 2008), the Iron King Mine operated from the late 1800s through approximately the 1970s. A portion of the mine was also used as dump in the 1990s and a portion was used by a fertilizer manufacturing facility. The Humboldt Smelter was used as a smelter from the early 1900s through approximately 1960 and may have been used intermittently after that date for smelting and other purposes. Tailings have been periodically released from the Iron King Mine down through the Chaparral Gulch extending to the Humboldt Smelter.

The Iron King Mine section of the site analyzed in this report covers approximately 129.5 hectares (320 acres) and is located west of Humboldt, Arizona and Highway 69. The Iron King Mine section is bounded on the east

by Highway 69, on the north by the Chaparral Gulch, on the south by an unnamed tributary, and by open desert on the west. Surface elevations of the Iron Mine section of the site range from approximately 1,470 meters (4,822 feet) above sea level in the western part of the section of the mine to approximately 1,378 meters (4,520 feet) above sea level along Chaparral Gulch in the northeast (USGS, 1973, 1974, and 1975). Surface drainage from the section of the mine north of the Iron King Road flows into the Chaparral Gulch via unnamed tributaries of the gulch. Surface drainage from areas of the mine south of the Iron King Road flows through unnamed tributaries of the Galena Gulch and then into the Agua Fria River, approximately two kilometers (1.2 miles) southeast of the mine.

The Humboldt Smelter section of the site analyzed in this report covers approximately 65 hectares (160 acres), and is located east of Highway 69 and south of Humboldt, Arizona. The Chaparral Gulch, which forms the west side of the Humboldt Smelter, flows into the Agua Fria River at the southern tip of the smelter. The Agua Fria River forms the eastern side of the Humboldt Smelter and Humboldt, Arizona is located along its northern boundary. The surface elevations of the Humboldt Smelter section of the site range from approximately 1,402 meters (4,600 feet) above sea level in the center part of the smelter to approximately 1,341 meters (4,400 feet) above sea level in the southern part of the smelter, where the Chaparral Gulch joins the Agua Fria River (USGS, 1973, 1974, and 1975). Surface drainage from the southwest areas of the Humboldt Smelter flows into the Chaparral Gulch. Surface drainage from the northeast areas of the Humboldt Smelter flows into the Agua Fria River.

The aerial photographic analysis of the Iron King Mine/Humboldt Smelter site is detailed in the “Historical Aerial Photographic Analysis” section of this report. The findings are presented in two separate subsections, one each for the Iron King Mine and the Humboldt Smelter. In the report, if there are no changes in environmentally significant features or activities from one date of analysis to the next, these features and activities will continue to be annotated on the overlays, but not discussed in the text. Should these features and activities change in future dates, they will again be discussed in the text.

Findings from the historical aerial photographic analysis of the Iron King Mine/Humboldt Smelter site indicate that an ore processing facility and two processing facilities operated on the Iron King Mine section of the site during the time frame of the analysis. The ore processing facility was composed of processing buildings, tanks, overhead pipes, and tailings ponds, and was active in 1940 through at least 1964. Processing facility PF-1 was active in 1940 through at least 1980. Processing facility PF-2 was active in 1992 through at least 2003. Tailings ponds and dams were constructed in the drainage channels around the Iron King Mine section of the site. Most of these ponds and dams were breeched at some time in the past. Waste materials generated at the facilities at the mine likely settled behind the dams and in the ponds. The breeches provide a route for the waste materials to enter the tributaries of the Chaparral Gulch and the Galena Gulch.

Evidence that ore processing had occurred on the Humboldt Smelter section of the King Mine/Humboldt Smelter site prior to 1940 was found. Ore Processing Facility-1 did not appear to be active in 1940 and 1953, although evidence of past ore processing activities was noted at the facility. Ore Processing Facility-1 was, however, operational in 1964 through at least 1970. Tailings ponds and dumping of materials were observed at the facility. Ore Processing Facility-2 did not appear to be active during the time frame of the analysis. However, the extent of light-toned material, located along a hillside that slopes to the Chaparral Gulch, did increase between 1940 and 1953. Waste materials generated from Ore Processing Facility-1 appear to have entered the Agua Fria River and waste materials generated from Ore Processing Facility-2 appear to have entered the Chaparral Gulch.

This report is presented in two volumes. Volume 1 contains the text of the report, including the Introduction, Methodology, and Photographic Analysis sections. Volume 2 contains the various maps and the photographs, with respective annotated overlays.

A Glossary, defining features or conditions identified in this report, follows the Photographic Analysis section. Sources for all maps, aerial photographs, and collateral data used in the production of this report are listed in the References section. A list of all aerial photographs that were identified and evaluated for potential application to this study can be obtained by contacting the EPA Work Assignment Manager.

Historical aerial photographs used in the analysis of this site have been digitally scanned and printed for use in this report. A transparent overlay with interpretative data is affixed to each of the digital prints. See the Methodology section for a discussion of the scanning and printing procedures.

Boundaries used in this report are based on those provided by EPA and been further developed during the course of the analysis. These boundaries do not necessarily denote legal property lines or ownership.

The EPA Environmental Sciences Division, Landscape Ecology Branch in Las Vegas, Nevada, prepared this report for the EPA Region 9 Superfund Division in San Francisco, California, and the EPA Office of Superfund Remediation Technology Innovation in Washington, D.C.

FIGURE 1. SITE LOCATION MAP, ARIZONA (USGS, 1972).
APPROXIMATE SCALE 1:2,500,000

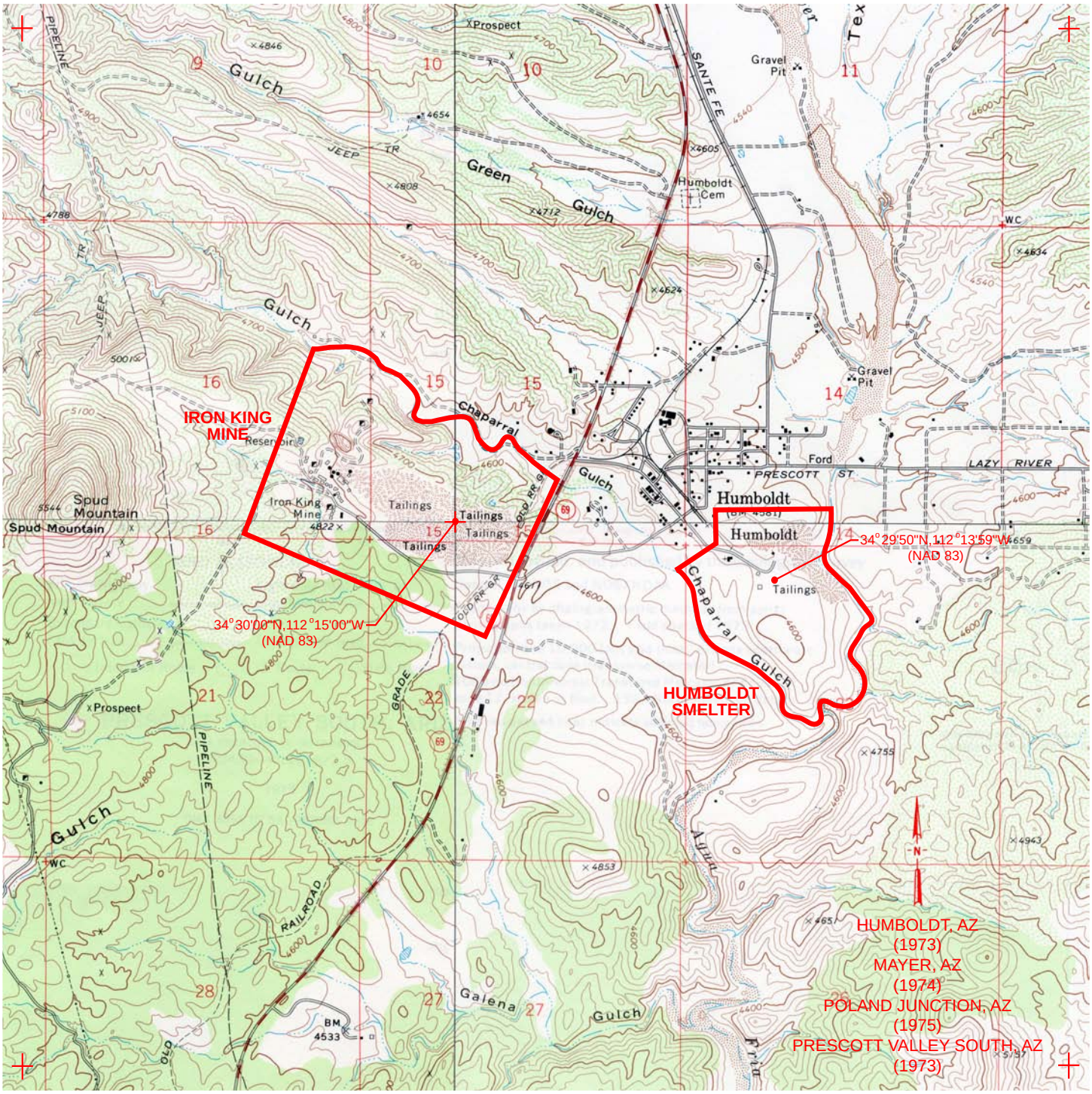

FIGURE 2. LOCAL SITE LOCATION MAP, HUMBOLDT, AZ (USGS, 1973), MAYER, AZ (USGS, 1974), POLAND JUNCTION, AZ (USGS, 1975), AND PRESCOTT VALLEY SOUTH, AZ (USGS, 1973). APPROXIMATE SCALE 1:14,370

METHODOLOGY

This report was prepared using a standard methodology that includes the following steps:

- data identification and acquisition,
- photographic analysis and interpretation, and
- graphics and text preparation.

These steps are described below. Subsections also address details related to specific kinds of analyses that may be required to identify environmental features such as surface drainage and wetlands. All operational steps and processes used to perform this work (including data identification and acquisition, photographic analysis and interpretation, and graphics and text preparation) adhere to strict QA/QC guidelines and standard operating procedures (SOPs). These guidelines and procedures are documented in the Master Quality Assurance Project Plan (QAPP) prepared for Remote Sensing Support Services Contract No. EP-D-05-088 (LMS, 2006).

Data identification and acquisition included a search of government and commercial sources of historical aerial film for the study area. Photographs with optimal spatial and temporal resolution and image quality were identified for acquisition. In addition, U.S. Geological Survey (USGS) topographic maps were obtained to show the study area location and to provide geographic and topographic context.

To conduct this analysis, the analyst examined diapositives (transparencies) of historical aerial photographs showing the study area. Diapositives are most often used for analysis instead of prints because the diapositives have superior photographic resolution. They show minute details of significant environmental features that may not be discernible on a paper print.

A photographic analyst uses a stereoscope to view adjacent, overlapping pairs of diapositives on a backlit light table. In most cases, the stereoscope is capable of various magnifications up to 60 power.

Stereoscopic viewing involves using the principle of parallax (observing a feature from slightly different positions) to observe a three-dimensional representation of the area of interest. The stereoscope enhances the photo interpretation process by allowing the analyst to observe vertical as well as horizontal spatial relationships of natural and cultural features.

The process of photographic analysis involves the visual examination and comparison of many components of the photographic image. These components include shadow, tone, color, texture, shape, size, pattern, and landscape context of individual elements of a photograph. The photo analyst identifies objects, features, and "signatures" associated with specific environmental conditions or events. The term "signature" refers to a combination of components or characteristics that indicate a specific object, condition, or pattern of environmental significance. The academic and professional training, photo interpretation experience gained through repetitive observations of similar features or activities, and deductive logic of the analyst as well as background information from collateral sources (e.g., site maps, geologic reports, soil surveys) are critical factors employed in the photographic analysis.

The analyst records the results of the analysis by using a standard set of annotations and terminology to identify objects and features observed on the diapositives. Significant findings are annotated on overlays attached to the photographic or computer-reproduced prints in the report and discussed in the accompanying text. Annotations that are self-explanatory may not be discussed in the text. The annotations are defined in the legend that accompanies each print and in the text when first used.

Objects and features are identified in the graphics and text according to the analyst's degree of confidence in the evidence. A distinction is made between certain, probable, and possible identifications. When the analyst believes the identification is unmistakable (certain), no qualifier is used. Probable is used when a limited number of discernible characteristics allow the analyst to be reasonably sure of a particular identification. Possible is used when only a few characteristics are discernible, and the analyst can only infer an identification.

The prints in this report have been reproduced, either by photographic or computer methods, from the original film. Reproductions are made from the original film and may be either contact (the same size) prints or enlargements, depending on the scale of the original film. Any computer-produced prints used in this report are generated from scans of the film at approximately 1,300 dots per inch (dpi) and printed at 720 dpi. Although the reproductions allow effective display of the interpretive annotations, they may have less photographic resolution than the original film. Therefore, some of the objects and features identified in the original image and described in the text may not be as clearly discernible on the prints in this report.

Study area boundaries shown in this report were determined from aerial photographs and from information supplied by EPA Region. Boundaries used in this report do not necessarily denote legal property lines or ownership.

Digital Diapositives

Some film vendors no longer supply analog film products (e.g., diapositive transparencies) to their customers. Digital files, created by scanning the original analog film products, are provided. The digital file, a representation of an original analog film product, can be analyzed either by computer viewing techniques or by creating a secondary diapositive from the digital file and viewing the secondary diapositve on a light table. The result of this process of converting an analog diapositive image to a digital file may be a reduction in the photographic resolution. A potential consequence of this in the realm of aerial photographic analysis is a lower confidence in the identification of features or conditions of environmental significance. For example, what may have been identified with certainty as Aa drum@ on the analog version of the diapositive may, on the digital diapositive, only be determined to be "a probable drum".

Color Infrared Photographs

Some photographs used for this analysis were made from color infrared film. Normal color film records reflected energy in the blue, green, and

red portions of the electromagnetic spectrum. Color infrared film differs in that it is sensitive not only to reflected blue, green, and red energy, but also to reflected energy in the infrared portions of the electromagnetic spectrum; however, the blue energy is filtered out and only the green, red, and infrared energy is recorded. When color infrared film is processed, it displays "false" colors that do not correspond with the true colors of the features photographed. For example, features that are highly reflective in the infrared portion of the spectrum, such as healthy vegetation, appear red to magenta on color infrared film. The false color displayed by a feature is produced in accordance with the proportions of green, red, and infrared energy it reflects. These portions are referred to as the "spectral reflectance characteristics" of the feature. To interpret the true color of a particular feature accurately from color infrared film, a knowledge of the spectral reflectance characteristics of that feature is required. This information is not readily available for the majority of features identified in this report. Therefore, unless otherwise indicated, no attempt has been made to interpret the true colors of the features identified on the color infrared film analyzed for this report.

Surface Drainage

The surface drainage analysis produced for this report identifies the direction and potential path that a liquid spill or surface runoff would follow based on the topography of the terrain and the presence of discernible obstacles to surface flow. The analyst determines the direction of surface drainage by stereoscopic analysis of the aerial photographs and by examining USGS topographic maps. Site-specific surface drainage patterns are annotated on the map or photo overlay. Where the direction of subtle drainage cannot be determined, an indeterminate drainage line symbol is used. Regional surface flow is ascertained from the USGS topographic maps.

HISTORICAL AERIAL PHOTOGRAPHIC ANALYSIS

The Iron King Mine/Humboldt Smelter site is located near Dewey-Humboldt, in Yavapai County, Arizona (Figure 1). The Iron King Mine/Humboldt Smelter site is composed of two locations the Iron King Mine and the Humboldt Smelter (Figure 2). The aerial photographic analysis results are presented in two separate subsections, one each for the Iron King Mine and the Humboldt Smelter.

Iron King Mine

Surface runoff from the section of the Iron Mine located south of Iron King Road trends to the east via Chaparral Gulch, a tributary of the Agua Fria River. Surface drainage from the part of the mine located south of Iron Mine Road flows to the southeast through an unnamed tributary into the Galena Gulch.

OCTOBER 13, 1940 (FIGURE 3)

Full aerial photographic coverage of the western boundary the Iron Mine section of the Iron King Mine/Humboldt Smelter site was not available for this date.

The Iron King Mine section of the Iron King Mine/Humboldt Smelter site is located west of a railroad line that skirts the western edge of Humboldt, Arizona. Access to the Iron King Mine is via the Iron King Road which links the mine to Humboldt. Features and conditions on the Iron King Mine indicate that ore processing activities have occurred at the location prior to 1940. In 1940 an Ore Processing Facility, which is located north of Iron Mine Road, is operating at the head of a narrow unnamed tributary of the Chaparral Gulch. Drainage from the Ore Processing Facility flows eastward, via the unnamed tributary, into to the Chaparral Gulch, east of

3rd Street, on the outskirts of Humboldt. The Ore Processing Facility is composed of one building, overhead pipes, and two vertical tanks. Light-toned mounded material (LTMM) has been deposited adjacent to the building. Three tailings ponds (TP) have been constructed in the drainage channel, down gradient from the Ore Processing Facility. The ponds have been designed to process materials from the Ore Processing Facility. Dark-toned liquid (not annotated) that emanates from the facility flows through the three ponds that have been constructed down gradient from one another. The liquid exits from the base of the easternmost impoundment into the drainage channel via outfalls (OF).

A dirt access road (AR) leads north from the area of the Ore Processing Facility past two possible mine shafts, each of which has light-toned material (LTM) (likely spoil) adjacent to it.

Processing facility PF-1 appears to be operational and is located south of Iron Mine Road. Processing facility PF-1 is composed of four buildings and other associated nearby features: two impoundments (IM), light-toned material, and a nearby possible mine shaft. Drainage from processing facility PF-1 flows to the southeast through an unnamed tributary of the Galena Gulch. Light-toned material is noted at two locations south of processing facility PF-1. A dirt access road (not annotated) leads from the processing facility to a large possible ground scar (GS). The possible ground scarred area slopes to the south away from the access road to the edge of a drainage channel.

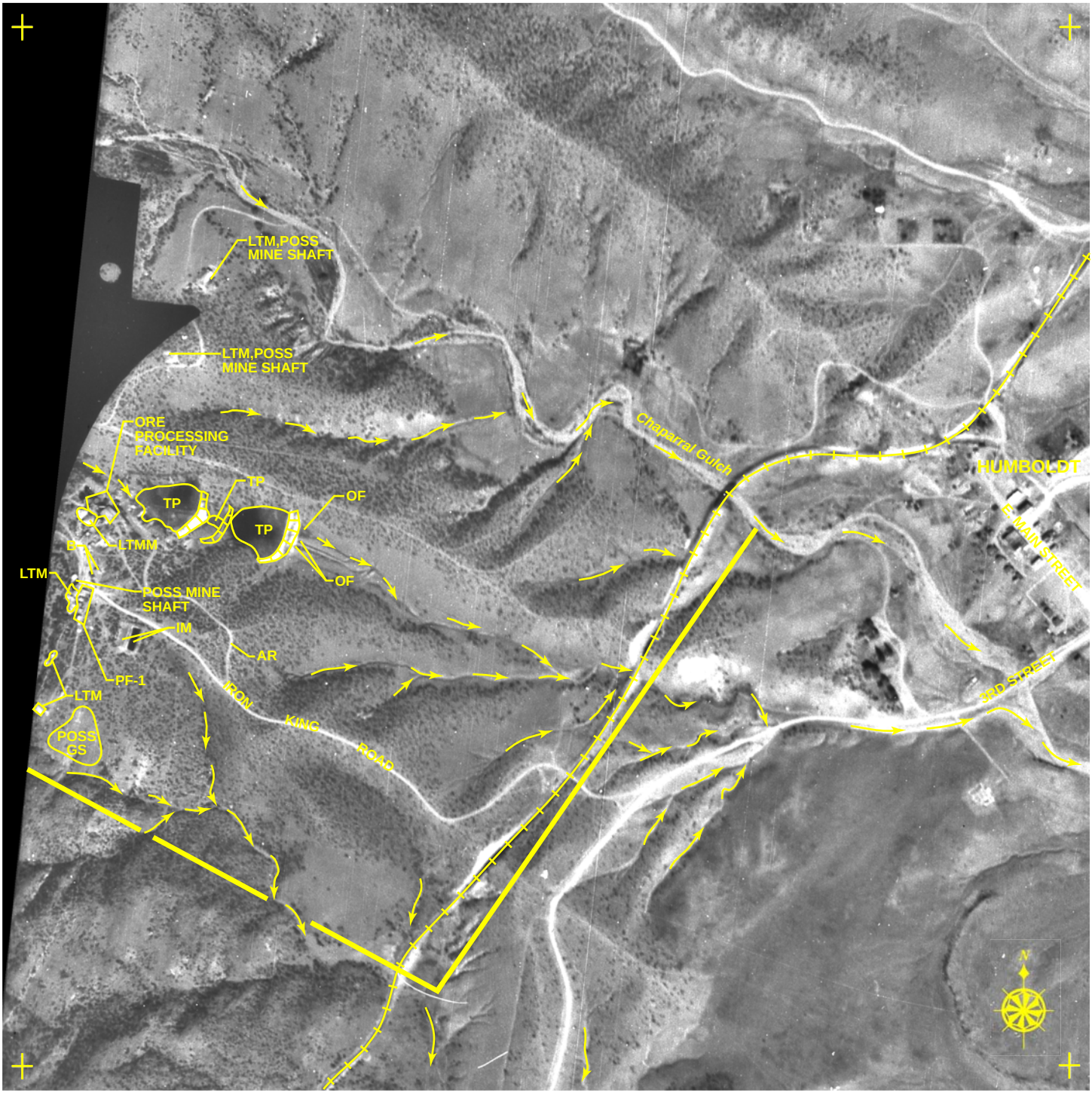

FIGURE 3. IROM KING MINE, OCTOBER 13, 1940. APPROX. SCALE 1:5,000.

NOVEMBER 25, 1953 (FIGURE 4)

The Ore Processing Facility remains in operation and has been significantly expanded since 1940. There are now four buildings, overhead pipes, and two vertical tanks on the facility. The three tailings ponds, located in the unnamed drainage channel down gradient from the facility, have been reconfigured and enlarged. A fourth tailings pond has been added down gradient from the three ponds that were in place in 1940. Multi-toned liquid (not annotated) from the Ore Processing Facility flows through the four ponds. Outfalls, located at the base of the new pond, release flow into the unnamed tributary of Chaparral Gulch.

Since 1940 an open pit and a probable mine shaft have been excavated due north of the Ore Processing Facility. North of the Ore Processing Facility, near Chaparral Gulch, a new possible mine shaft and associated light-toned material are noted. Mining operations at the possible mine shaft located nearby to the south, in place in 1940, have been ongoing since 1940 at this location. More light-toned material (likely mine spoil) has been deposited around the entrance to the possible mine shaft.

Processing facility PF-1 remains operational and now is composed of three buildings, and a possible vertical tank, and a possible horizontal tank. Two possible mine shafts, not visible on the 1940 photographs, and associated light-toned material are located on the southwest side of processing facility PF-1. The two impoundments located to the east each contain standing liquid (not annotated). Two new small buildings (B) have been built south of the processing plant, at the end of the access road on the northern edge of the ground scarred area.

Fill material has been placed in fill areas (FA) around the Ore Processing Facility and processing facility PF-1 creating flat fill areas used to conduct facility operations. Numerous buildings have been constructed around the two facilities since 1940. These buildings likely serve support ancillary functions for operations at the two facilities.

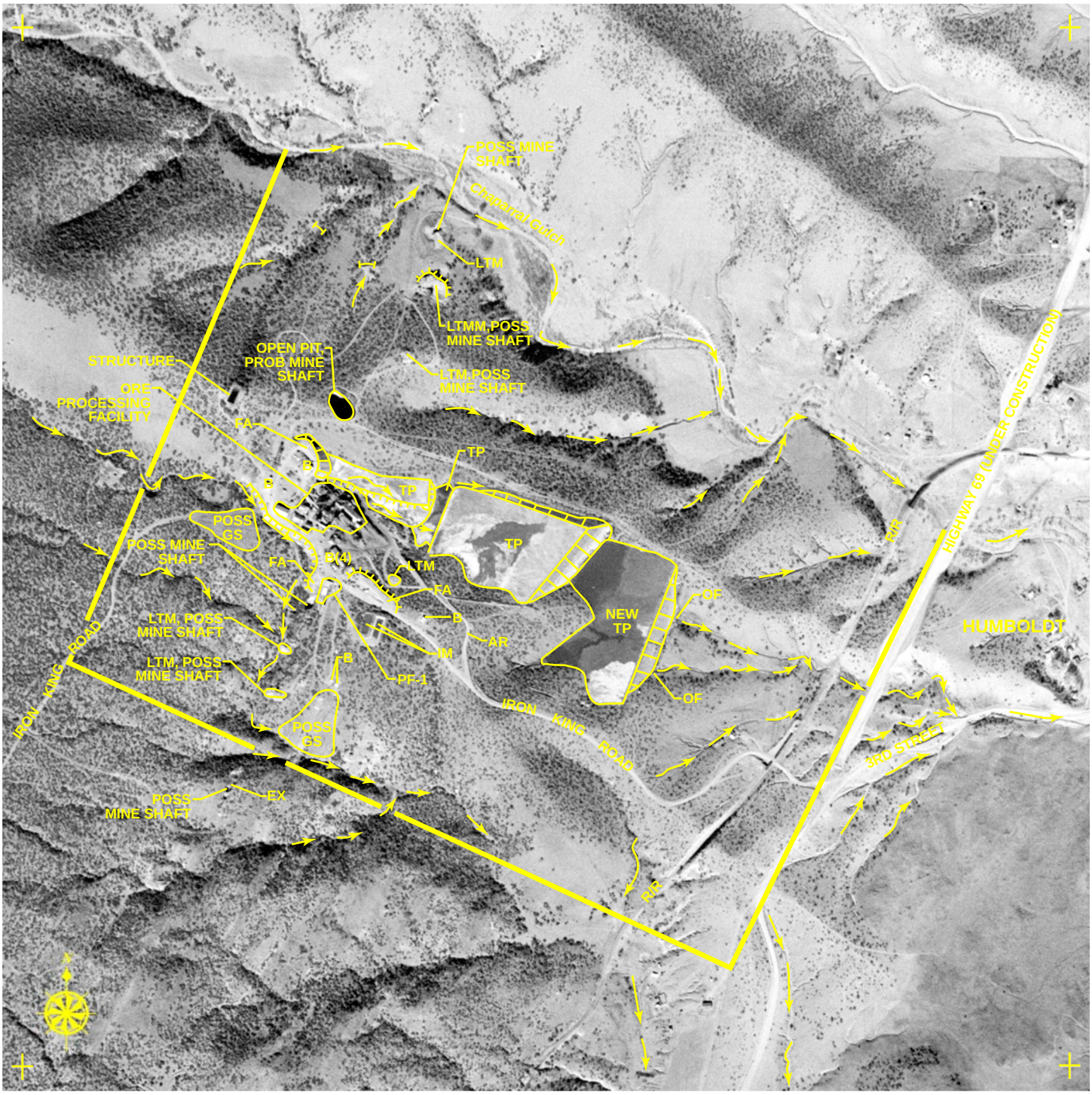

FIGURE 4. IRON KING MINE, NOVEMBER 25, 1953. APPROX. SCALE 1:5,300.

JANUARY 15, 1964 (FIGURE 5)

The Ore Processing Facility continues to be operational and has been significantly expanded since 1953. There are now ten buildings, eight vertical tanks, overhead pipes, and staining on the surface of the facility. The tailings ponds, operating at the Ore Processing Plant in 1953, have been reconfigured and expanded. A drainage channel and two impoundments that may function as overflow catchments have been constructed along the northern bottom edge of the tailings dam. The channel directs some of the discharge from the facility into two, relatively smaller tailings ponds that have been constructed to the east, downstream from the other tailings ponds. Breaches in the berms of the two new ponds appear to allow liquid to circumvent the ponds. An outfall into the drainage channel is also noted at the base of the easternmost tailings pond.

The fill areas around the Ore Processing Facility have been expanded, likely to accommodate expansion of activities at the facility. Four vertical tanks (VT), buildings (not all are annotated), and vehicles/equipment (not annotated) are on the fill area north of the Ore Processing Facility. The open pit, located north of the Ore Processing Facility, has been expanded and ground scars from the extraction (EXT) of materials from around the rim of the pit are noted. The amount of light-toned material deposited adjacent to the possible mine shaft northeast of the open pit has increased, indicating continued ore extraction at this location. An impoundment has been constructed along a tributary of the Chaparral Gulch that drains the area east of the open pit. The impoundment contains liquid (not annotated) at this time.

Southwest of the Ore Processing Facility are two ground scarred areas. The ground scarred area that is situated astride Iron King Road has been expanded and mounded material has been deposited at this location. Solid waste (SW) has been deposited along the southern edge of the southernmost ground scarred area. An access road (not annotated) leads from Iron King Road to this location.

Processing facility PF-1 remains in operation. The facility is now composed of four buildings. The two impoundments, located to the east, are dry and no longer appear to be in use. The fill area (not annotated) around processing facility PF-1 has been expanded, likely to accommodate expansion of activities at the facility. A dirt access road leads south from the vicinity of processing facility PF-1 to a fill area located adjacent to the possible ground scarred area first noted in 1940.

The railroad bridge that crossed the Chaparral Gulch has been removed.

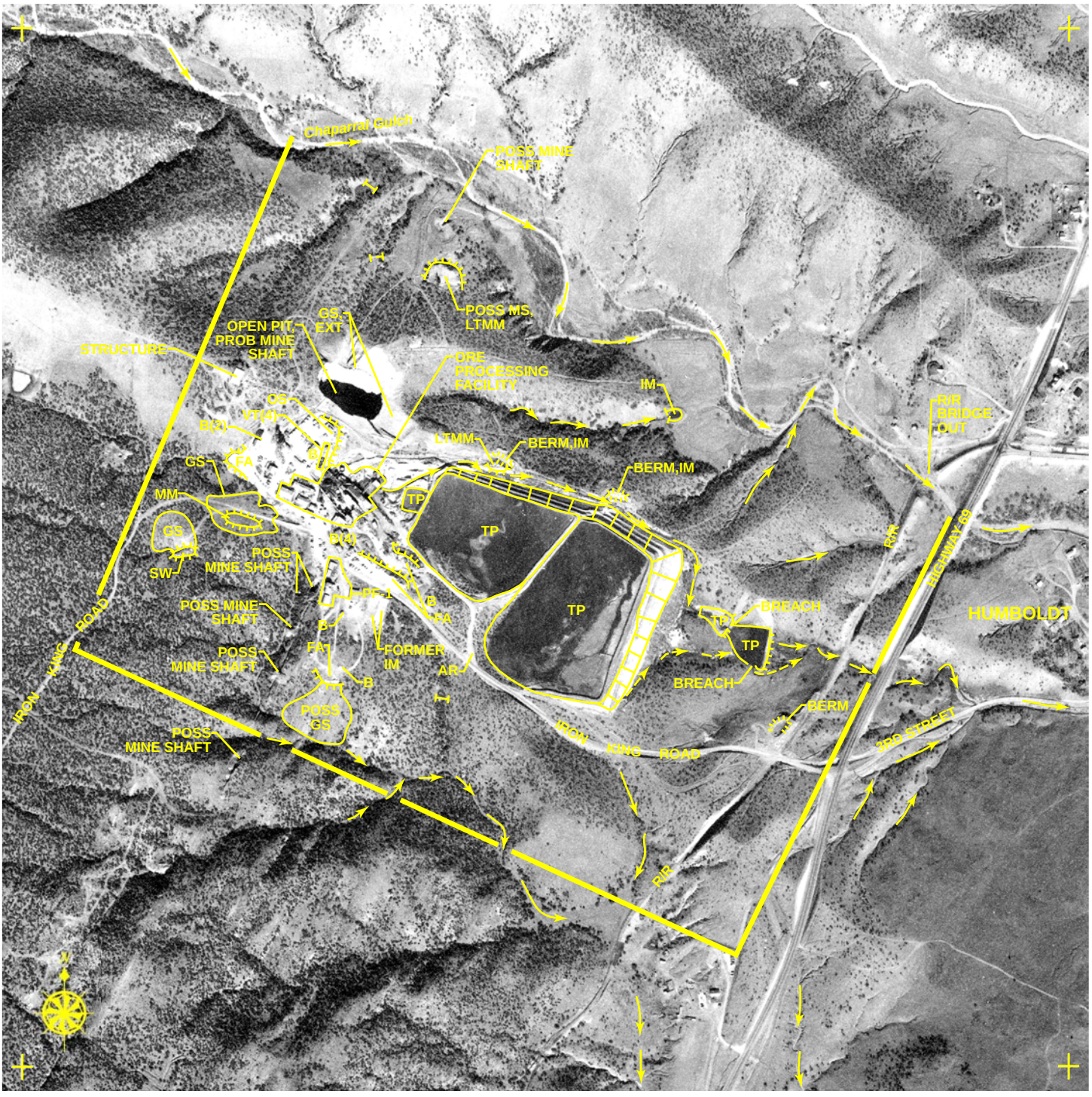

FIGURE 5. IRON KING MINE, JANUARY 15, 1964. APPROX. SCALE 1:5,300.

FEBRUARY 6, 1970 (FIGURE 6)

The inventory of buildings and tanks on the Ore Processing Facility does not appear to have changed since 1964. It is likely that the Ore Processing Facility is no longer in operation. A large section of one of the tailings ponds has collapsed. East of the collapsed wall a new pond, which extends east to a railroad line, has been built. All but the easternmost tailings pond is empty. A second impoundment has been constructed adjacent to the impoundment located along a tributary of the Chaparral Gulch that drains the area east of the open pit. The impoundments contain liquid at this time.

The open storage area (OS) located north of the Ore Processing Facility in 1964 is empty and dark-toned mounded material (DTMM) has been placed at this location. Nearby to the west a new fill area containing dark-toned material has been established. More solid waste has been scattered on the ground scarred area south of Iron King Road.

Processing facility PF-1 remains in operation. The fill area to the west and south of processing facility PF-1 has been enlarged, likely to accommodate operations at the facility. No other environmentally significant change is noted in association with the facility.

Two open trenches (TR) have been dug on the side of a hill south of Iron King Road near the railroad line (R/R). No established access road leads to this area.

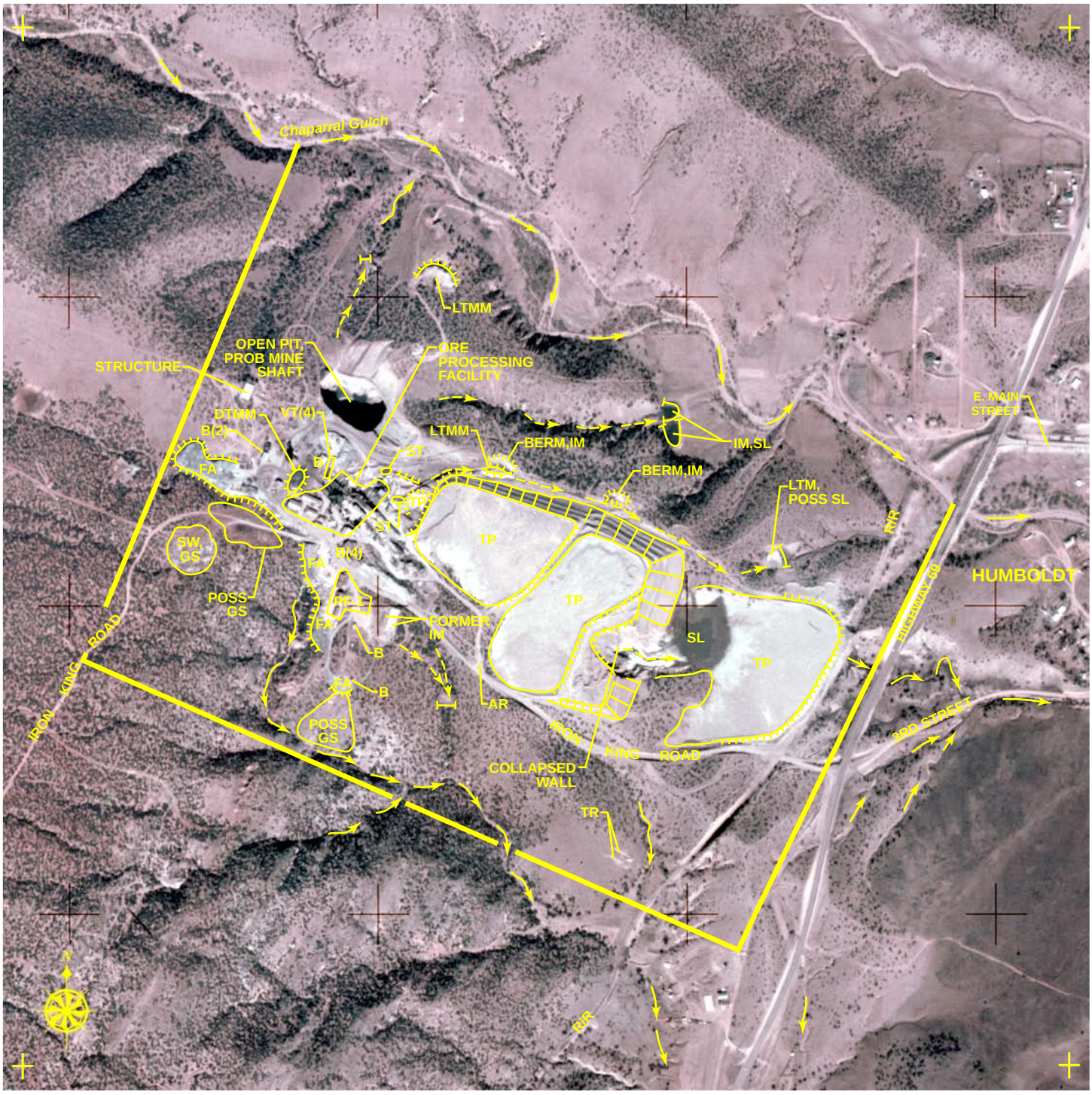

FIGURE 6. IRON KING MINE, FEBRUARY 6, 1970. APPROX. SCALE 1:5,300.

JUNE 27, 1973 (FIGURE 7)

The Ore Processing Facility no longer appears to be in operation. There are now ten buildings and ten empty vertical tanks on the facility that do not appear to be in use. The tailings ponds are empty and much of their upper surfaces have been graded. Few vehicles are parked in the area. The photography was taken on a Wednesday, a work day. The dark-toned mounded material noted west of the facility in 1970 has been removed. The ground scarred area, located west of the Ore Processing Facility, has been enlarged and the scattered waste noted on the surface of the area in 1970 is no longer visible. Probable solid waste continues to be visible along the southern edge of the area. The amount of probable solid waste material at this ground scarred area does not appear to have significantly changed since 1970. Material has been extracted (not annotated) from a section of the fill area noted north of the ground scarred area. Two depressions or pits containing standing liquid (SL) are visible in the dry bottom of the small, westernmost former tailings pond. The impoundments located along a tributary of the Chaparral Gulch that drains the area east of the open pit are empty. The southern impoundment has been breached.

Processing plant PF-1 appears be in operation. Three vertical tanks, vehicles and equipment (not annotated), and five buildings are visible on the facility. East of the facility are two possible derelict (DER) horizontal tanks (HT) that have been placed in and adjacent to the easternmost former impoundment. The western former impoundment (not annotated) has been filled in.

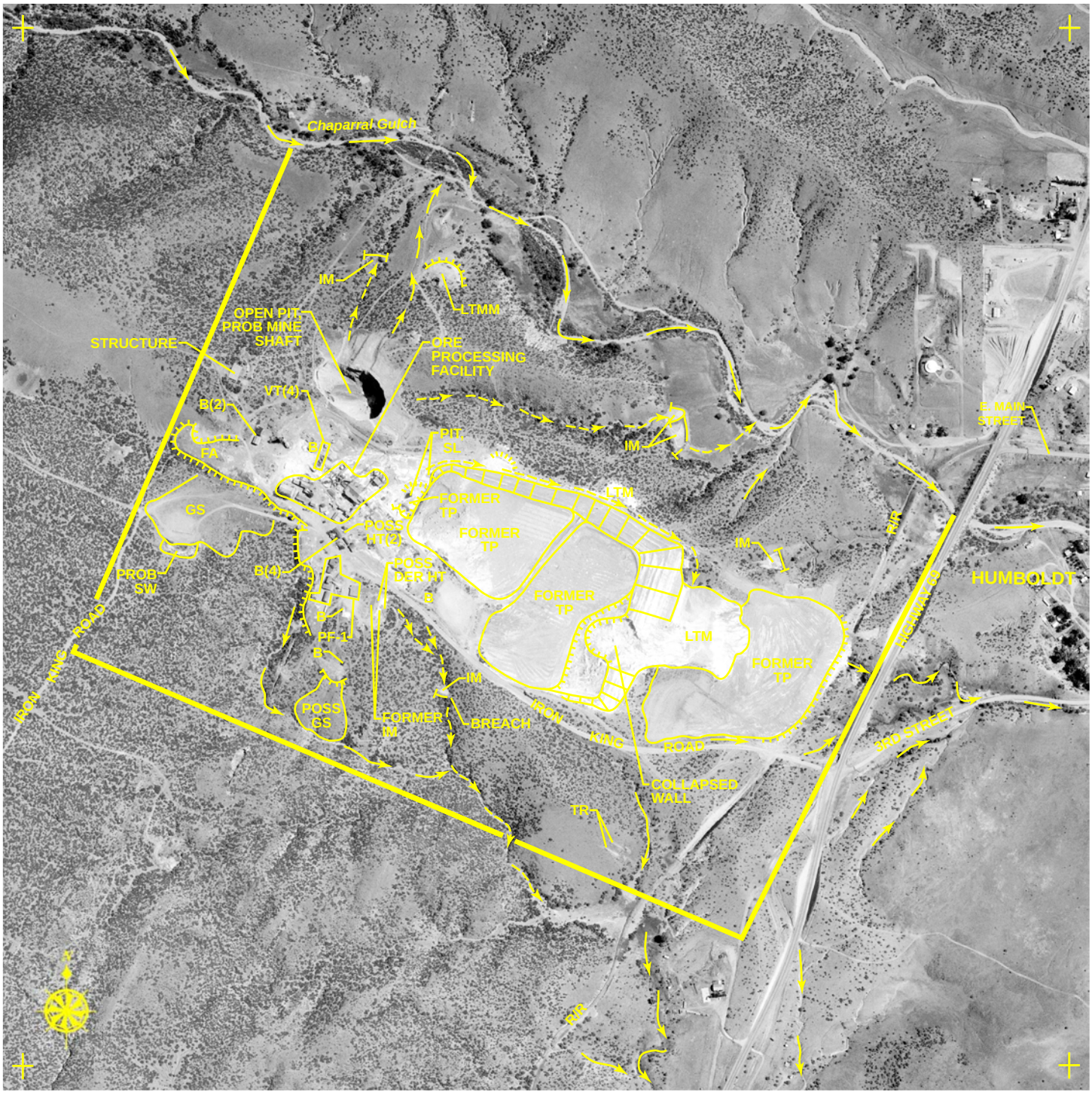

FIGURE 7. IRON KING MINE, JUNE 27, 1973. APPROX. SCALE 1:5,300.

SEPTEMBER 25, 1980 (FIGURE 8)

Most of the buildings and all the tanks have been removed from the location of the Former Ore Processing Facility. Two tank pads are visible at the location of the former facility. A probable fill area is located on the southern portion of the ground scarred area located west of the former facility. The probable fill area is located at the former location of probable solid waste, which is no longer visible. Material has been extracted from the fill area located north of Iron King Road.

Processing facility PF-1 appears to be in operation and eight buildings are on the facility. The two possible derelict horizontal tanks located near the former impoundment in 1970 have been removed. A ground scar remains at the locations of the easternmost former impoundment.

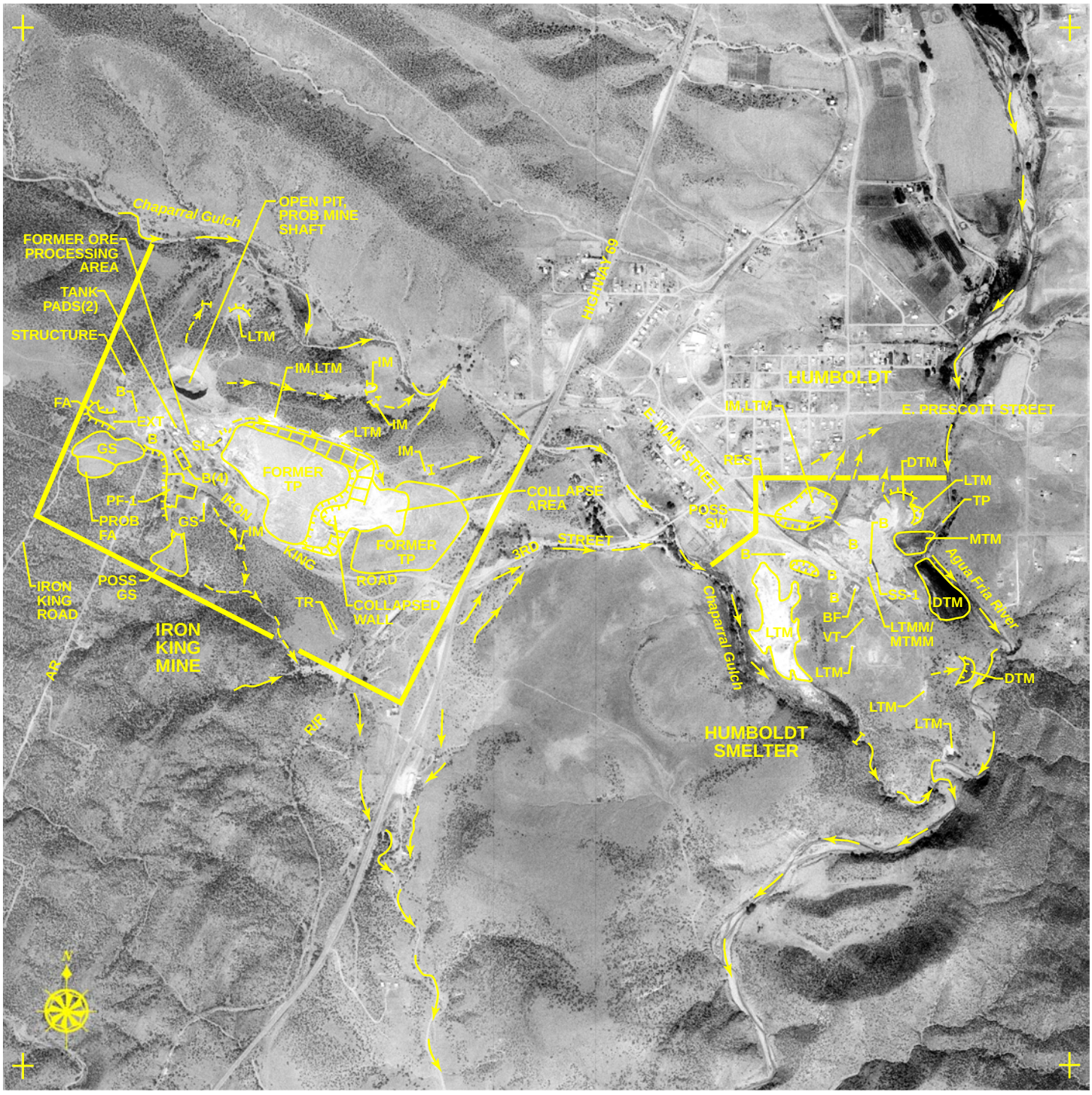

FIGURE 8. IRON KING MINE/HUMBOLDT SMELTER SITE, SEPTEMBER 25, 1980. APPROX. SCALE 1:9,800.

JUNE 5, 1992 (FIGURE 9)

Little observable environmentally significant change has occurred on the Former Ore Processing Facility since 1980. The two tank pads, visible in the area in 1973, have been removed. Small mounds of light-toned material (not annotated) are scattered around the Former Ore Processing Facility. The berms that formed two impoundments, located along a tributary of the Chaparral Gulch that drains the area east of the open pit, are no longer visible. Light-toned material now covers this location.

Processing facility PF-1 no longer appears to be in operation. Three buildings have been removed and there are now five buildings on the processing facility. A building has been constructed east of this area since 1980. The impoundment that has been visible near this location since 1940 appears to have been filled in.

Processing facility PF-2 has been built north of the easternmost former tailings pond. The facility is composed of three buildings, five tanks, and overhead pipes and appears to be in operation. Two liquid-filled impoundments are located adjacent to the west side of the facility. A drainage channel (not annotated) links the impoundments to an unnamed tributary of the Chaparral Gulch.

South of processing facility PF-2 is a building and an impoundment, each of which is likely associated with the facility. The impoundment, which has been built in a tributary of the Chaparral Gulch, contains standing liquid (not annotated). Another impoundment is located in the collapse area of a former tailings pond. A probable pipeline or hose appears to drain liquid from the impoundment into an unnamed tributary of the Galena Gulch.

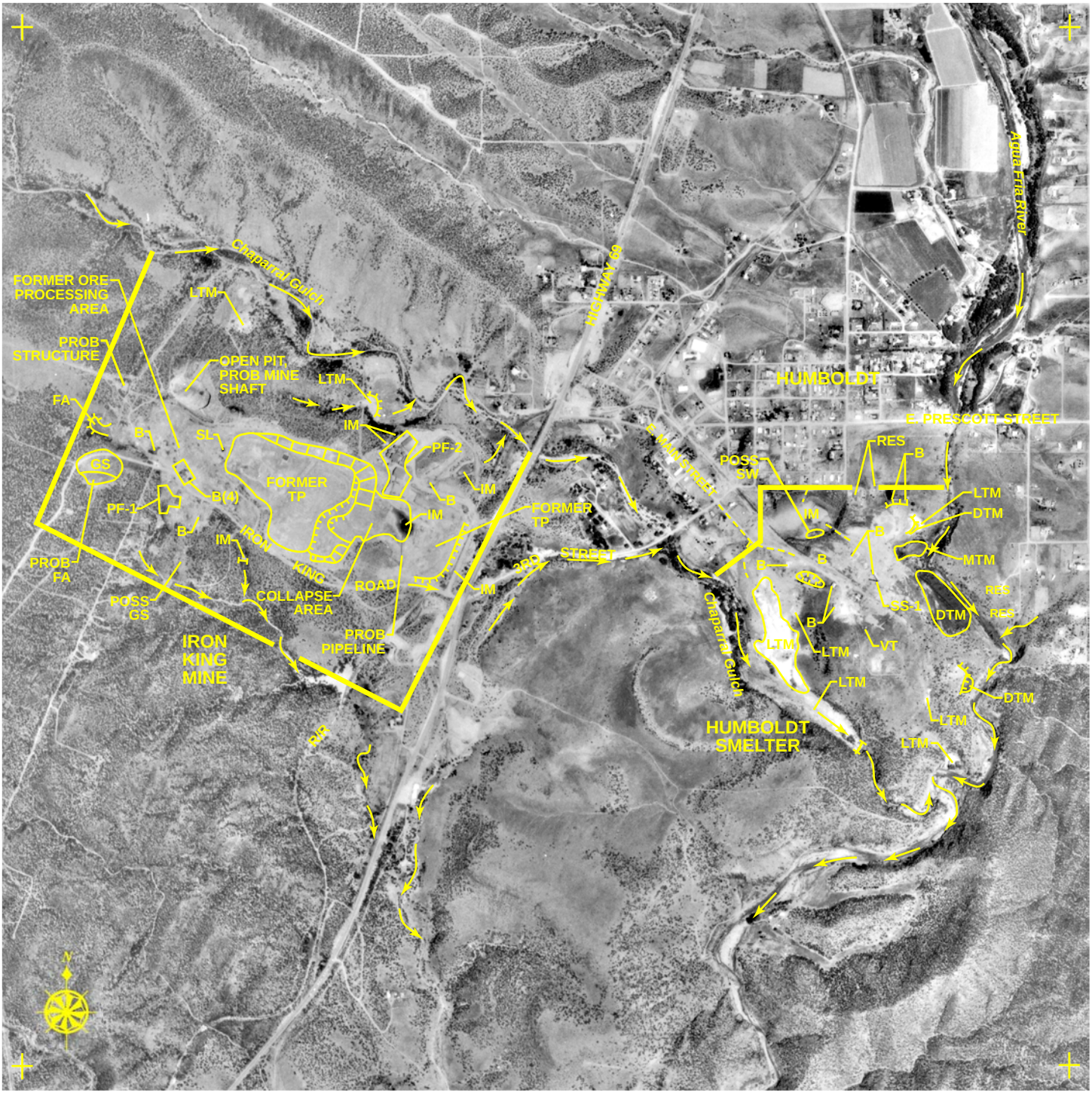

FIGURE 9. IRON KING MINE/HUMBOLDT SMELTER SITE, JUNE 5, 1992. APPROX. SCALE 1:9,800.

SEPTEMBER 20, 2003 (FIGURE 10)

The surface area of the Former Ore Processing Facility and the area between it and the former tailings ponds has been graded and covered with material. Since 1992, five new buildings have been constructed west of the Former Ore Processing Facility. Large open containers (CONT) are stored near the new buildings (NB). Mounds of probable solid waste have been deposited in the area to the south of the containers. Material continues to be extracted from the fill area located along the boundary of the site, west of the probable solid waste. Numerous mounds of material have been deposited in the bottom of the open pit. A fill area is located north of the open pit. The fill area is located where light-toned mounded material and a possible mine shaft were noted in the past.

Only two buildings remain at the location of processing facility PF-1. Two vertical tanks are located east of the area.

Processing facility PF-2 appears to be in operation and is composed of three buildings, seven vertical tanks, and overhead pipes. A new building has been constructed east of the facility and an impoundment has been constructed along Highway 69 at the eastern boundary of the mine. Part of a former tailings pond is being used as an open storage area for the processing facility. Three horizontal tanks stand north of the open storage area. The impoundment, which contains standing liquid, is located in the collapse area of a former tailings pond. A drainage channel located along the northern bottom edge of the tailings dam directs surface flow into the impoundment.

An automobile salvage facility is operating in the southeast corner of this section of the Iron King Mine/Humboldt Smelter site.

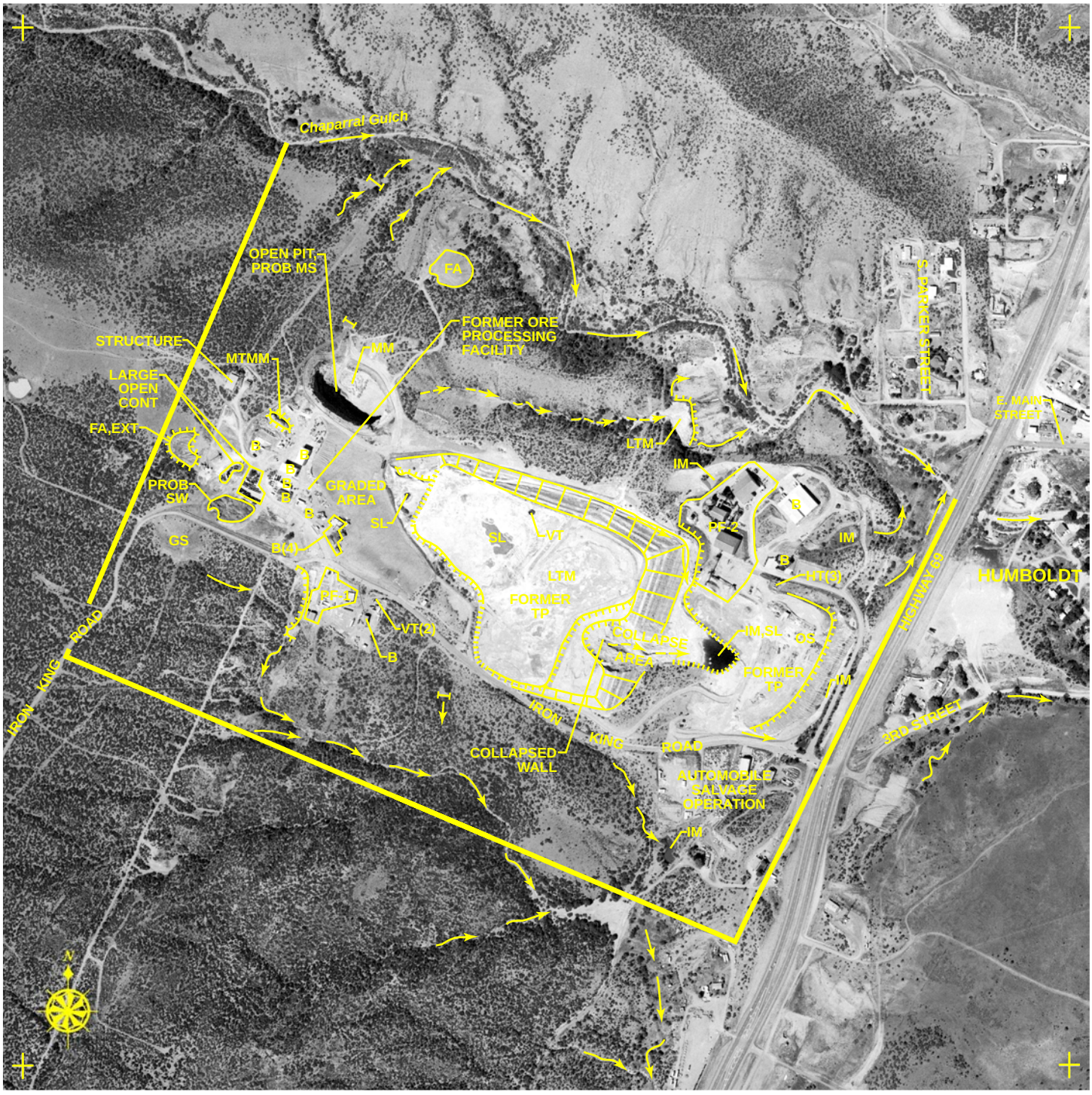

FIGURE 10. IRON KING MINE, SEPTEMBER 20, 2003. APPROX. SCALE 1:5,300.

Humboldt Smelter

Surface runoff on the southwestern portion of the Humboldt Smelter enters the Chaparral Gulch, a tributary of the Agua Fria River. Surface drainage from the northeastern part of the smelter flows directly into the Agua Fria River.

OCTOBER 13, 1940 (FIGURE 11)

The Humboldt Smelter section of the Iron King Mine/Humboldt Smelter site is situated on a hill that overlooks the Agua Fria River, the Chaparral Gulch, and the confluence of these two drainageways. The Humboldt Smelter is located east of Highway 69 on the outskirts of the southern section of Humboldt, Arizona. A probable residence (RES) is located along the northwestern border of the smelter near 3rd Street. Access to the Humboldt Smelter is via both East Main Street and a network of rail lines that enter the Humboldt Smelter from the northwest. Features and conditions on the Humboldt Smelter indicate that ore processing activities have occurred in this section of the Iron King Mine/Humboldt Smelter site prior to 1940. Remnants of ore processing activities are located in two areas of the site (Ore Processing Area-1 and Ore Processing Area-2).

Ore Processing Area-1 is located in the eastern section of the Humboldt Smelter and is situated on top of a hill, overlooking the Agua Fria River. A network of rail lines and access roads, which provides access to the area, enters the area from Humboldt. Five railroad spurs end in this area. Remnants of former ore processing operations including building foundations, probable rubble, and areas covered with light-toned material (all are not annotated) are visible at Ore Processing Area-1. Two areas containing multiple building foundations (BF*-1, BF*-2) and associated rubble (not annotated) are visible. Two smokestacks (SS) and two buildings are visible near building foundation BF*-1. One stack is connected to one of the two buildings in the area. Dark-toned ground stains cover the surface along the rail line north of the buildings. A lone smokestack stands in the northeast section of the site.

Along the edge of a hill slope overlooking the Agua Fria River are mounds of dark- and medium-toned material (MTM). The material is likely waste product derived from ore processing activities. In places the material extends down the slope to the edge of the Agua Fria River. Adjacent to the west side of the medium-toned material are three contiguous impoundments each of which contains standing liquid.

West of the large dark-toned mounded material, a mound of medium-toned material has been deposited in the form of a ramp at the end of a rail spur; an empty possible impoundment is located nearby. A possible former impoundment is located near building foundation BF*-2.

Along the rivers edge, adjacent to the northeast corner of the large mound of dark-toned material is a building foundation, likely a former pump house.

Ore Processing Area-2 includes the area atop and along a hillside overlooking the Chaparral Gulch in the western portion of the Humboldt Smelter section of the site. Multiple building foundations (BF*-3), likely remnants of an ore processing facility, are located between the main rail line and the access road that leads into the area from East Main Street. A possible vertical tank still remains at this location. To the east an impoundment that contains standing liquid is located in a depression formed by the bed the access road and the headwaters of a drainage channel that flows into the Chaparral Gulch. Down slope to the south, toward the Chaparral Gulch, dams have been built astride drainage channels so as to form a series of tailings ponds (not annotated). All the dams are breached. Light-toned materials (tailings) have been deposited in and along the drainage channel behind the southernmost dam. Some light-toned material also appears to have been washed down the slope to the banks of the Chaparral Gulch.

South of the large mound of dark-toned material, located along the hillside over looking the Agua Fria River, dark- and light-toned mound of material has been deposited at three locations. This material is likely waste products derived from ore processing activities. An incised drainage

channel leads down slope from the area of a rail spur to the dark-toned material. On the slope above the light-toned material is probable rubble. The arrangement of the rubble suggests that this is the location of a former processing facility.

In the center of the smelter, south of Ore Processing Area-1, is an array of buildings and building foundations that are connected to one another by a network of sidewalks (not annotated). The function of the apparently associated buildings that were located at this location cannot be ascertained from the aerial photographs. The building foundations in this area of the smelter will no longer be annotated or discussed unless significant environmental change is noted in association with them.

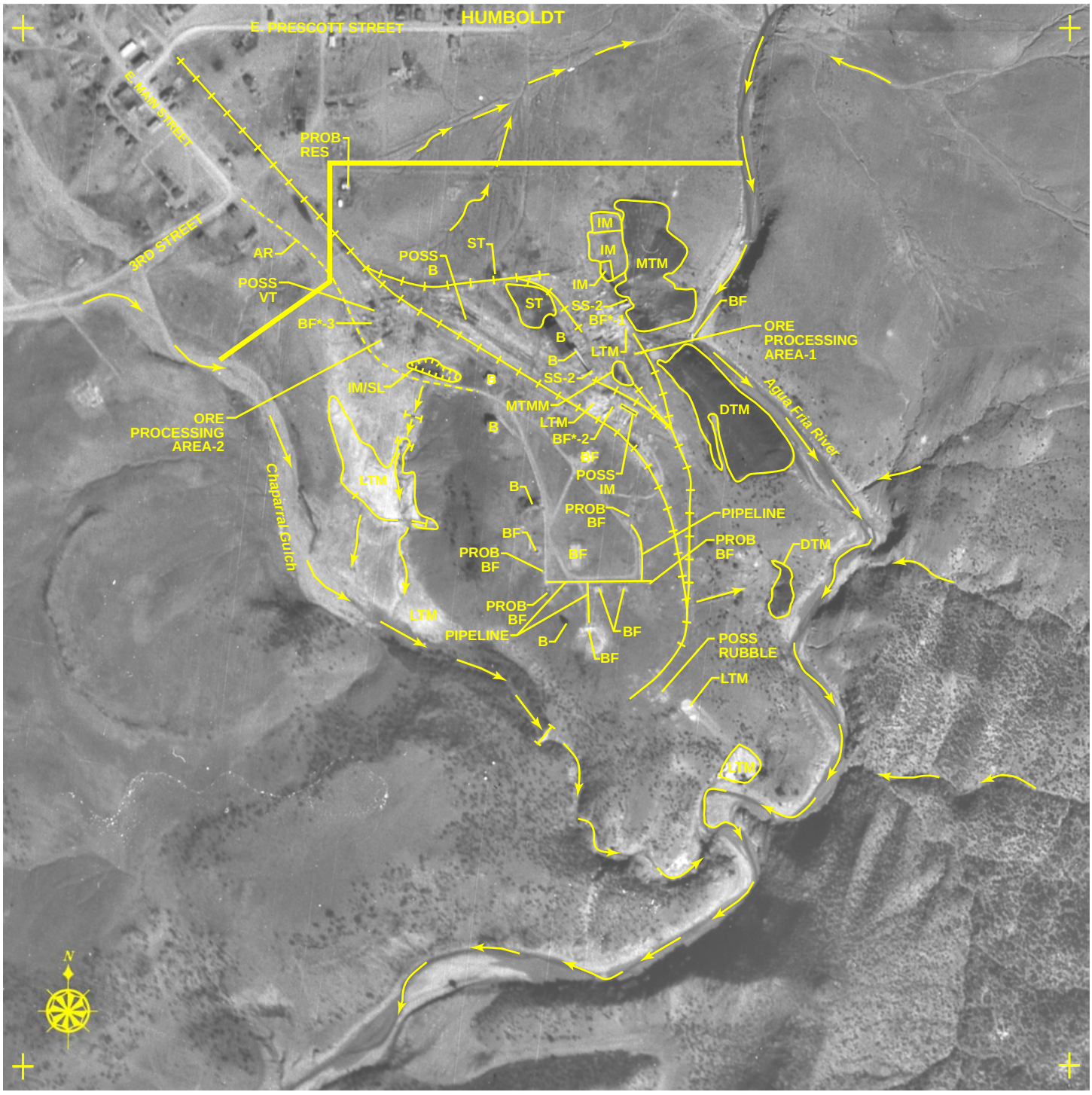

FIGURE 11. HUMBOLDT SMELTER, OCTOBER 13, 1940. APPROX. SCALE 1:4,500.

NOVEMBER 25, 1953 (FIGURE 12)

Much of the Humboldt Smelter section of the Iron King Mine/Humboldt Smelter site is relatively unchanged since 1940. Most of the buildings and features noted in 1940 remain in place.

Much of the area on and around Ore Processing Area-1 is relatively unchanged since 1940. Each of the two smokestacks remains in place and the mounds of dark- and medium-toned material, located along the Agua Fria River, are relatively unchanged. A building, located north of one of the smokestacks in 1940, has been partially removed and a building foundation is all that remains at the location. Of the three impoundments noted in 1940 west of the medium-toned mound material only the northernmost impoundment appears to be in use. The berms surrounding this impoundment have been improved. Some building foundations and rubble have been removed from the areas around building foundations BF*-1 and BF*-2.

Much of the area on and around Ore Processing Area-2 is relatively unchanged since 1940. The possible vertical tank noted in 1940, however, is no longer in place. The areal extent of the light-toned material that covers the hill side above the Chaparral Gulch has increased. One continuous area of light-toned material now extends down to the Chaparral Gulch. More dams have been placed in the drainage channel leading down to the gulch. All the dams appear to have been breached. Since 1940 three possible contiguous impoundments, which are no longer in use, have been built on the up slope western edge of the light-toned material. A dirt access road (not annotated), which does not appear to have been heavily used recently, leads to the area from the north.

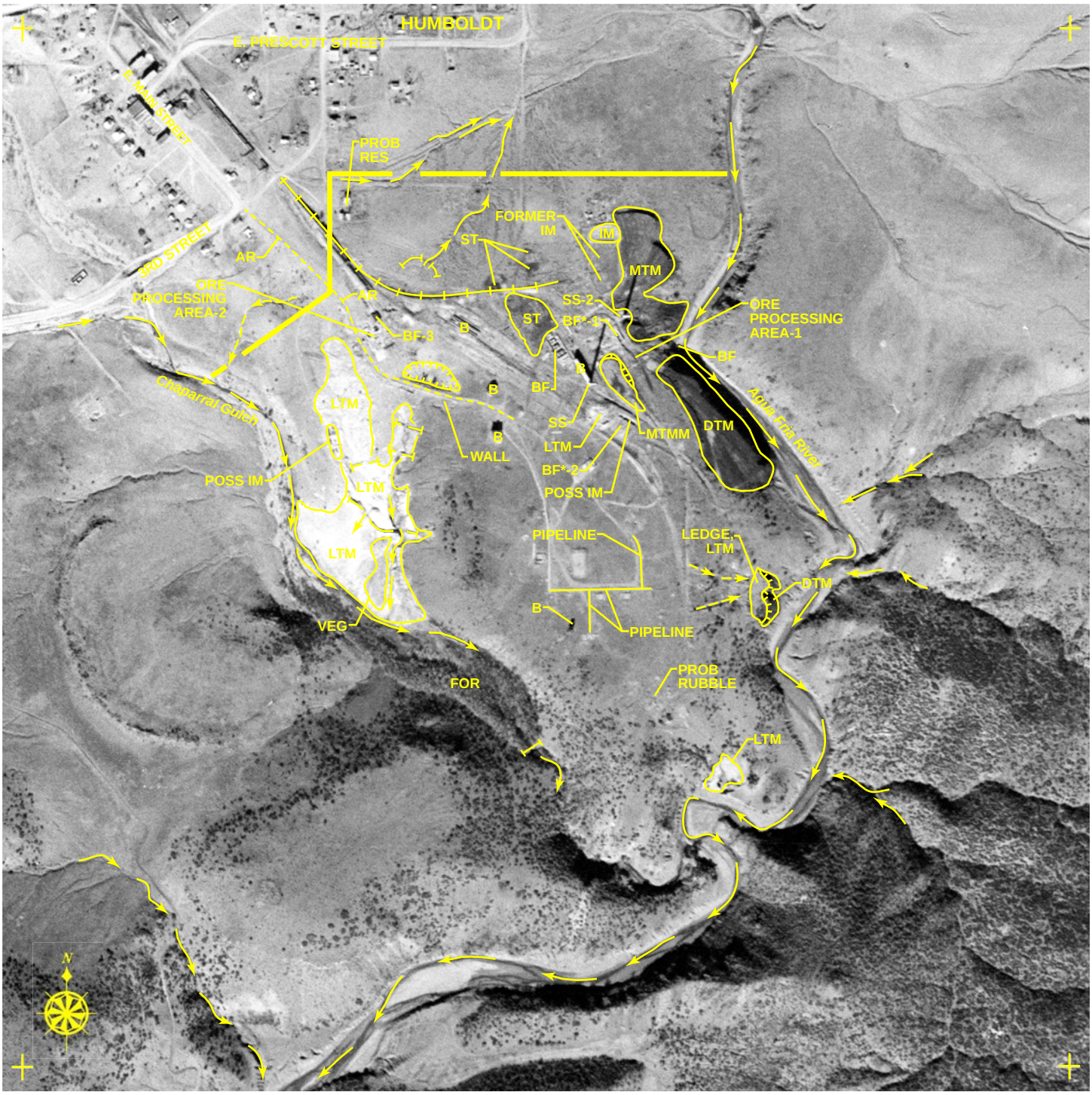

FIGURE 12. HUMBOLDT SMELTER, NOVEMBER 25, 1953. APPROX. SCALE 1:4,500.

JANUARY 15, 1964 (FIGURE 13)

Ore processing is ongoing at Ore Processing Area-1 in the northern section of the smelter. Ore processing activity in the area appears to be centered on smokestack SS-1. Light-toned material has been spread over the surface of the area around the stack. Three new buildings, a probable horizontal tank, two probable impoundments, and an open storage area containing probable equipment and probable crates are now in this area. Open hopper railcars (not annotated) are on the rail lines in the area. A large impoundment has been excavated and formed in a drainage channel in the northwest corner of the smelter. The impoundment is empty and a probable outfall is located on the north side of the impoundment. Light-toned material has been deposited on top of the mound of medium-toned material located east of the Agua Fria River. An access road, likely used for hauling waste material to the location, leads from the ore processing area west to the top of the mound. The impoundment, noted in 1953 west of the medium-toned mounded material, has been partially covered over with fill material. Smokestack SS-2, noted in place in this area since 1940, has been removed.

Little observable environmentally significant change has occurred on or around Ore Processing Area-2 since 1953. The dams located in the wash leading down to the Chaparral Gulch in this area of the smelter will no longer be annotated or discussed unless significant environmental changes is noted in association with them.

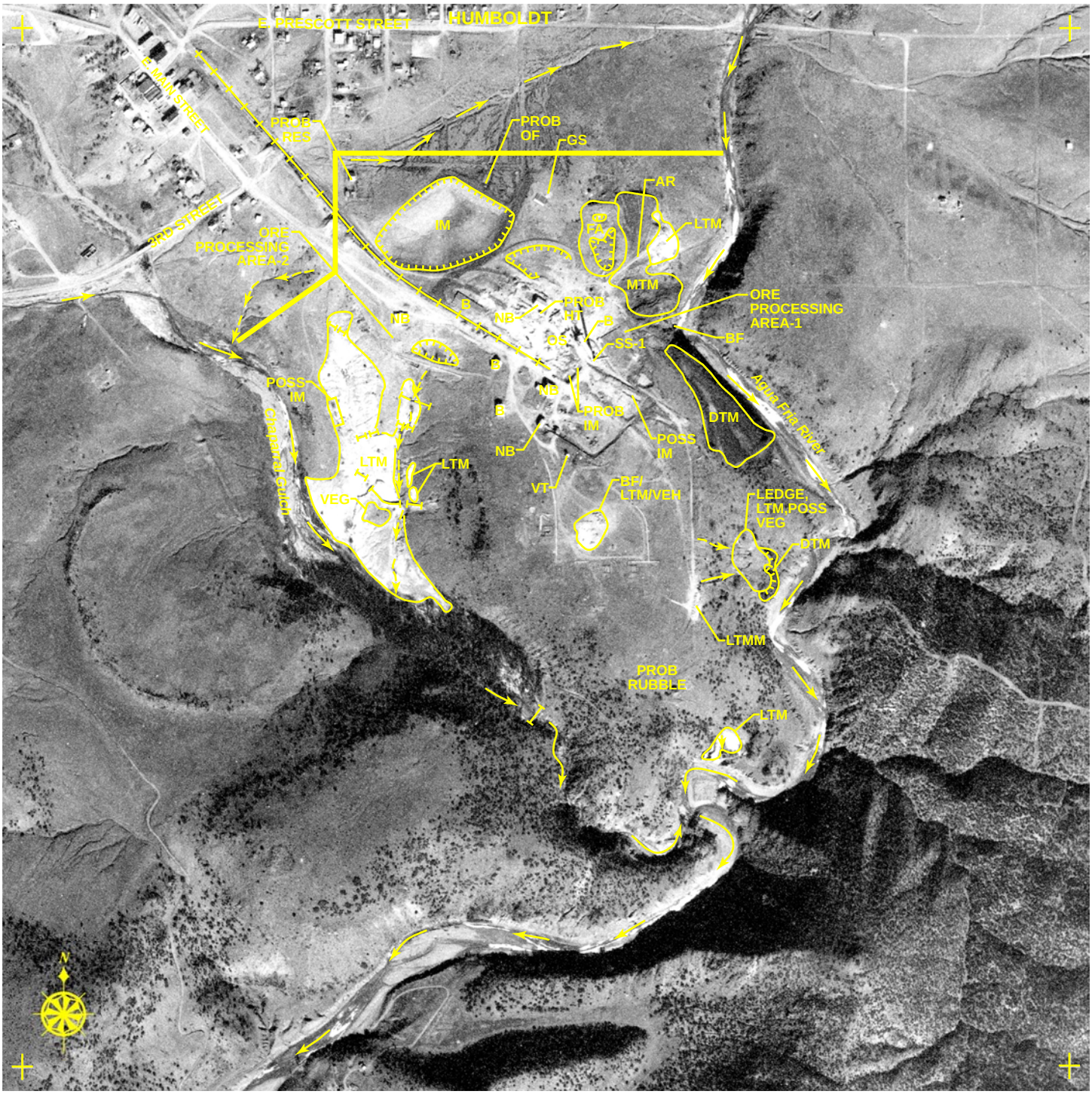

FIGURE 13. HUMBOLDT SMELTER, JANUARY 15, 1964. APPROX. SCALE 1:4,500.

FEBRUARY 6, 1970 (FIGURE 14)

Since 1964 ore processing in northern section of the smelter has continued. A linear-shaped tailings pond has been constructed and is in use northwest of smokestack SS-1. The pond appears to be designed to direct the flow of liquid into another tailings pond located in the large impoundment first noted in 1964 in the northwest section of the smelter. The drainage channel connecting the two tailings ponds appears to be blocked at this time. Dark- and light-toned liquid/sludge (not annotated) is in each of the tailings ponds. Light-toned material and dark-toned material has been deposited across the surface of the area east of the two ponds and also on the large mounded of medium-toned material located nearby. The area near the northeast corner of the smelter slopes to the northeast and it appears that material has flowed northward toward the Agua Fria River. A dirt road extends down the hill from the area around smokestack SS-1 to the Agua Fria River. The road ends near a tailings pond that has been constructed along the banks of the river. Light-toned material is visible in the pond (not annotated) and on the hillside above the pond. Since 1964 scattered mounds of light-toned and dark-toned material have been deposited in the area south of smokestack SS-1. The probable horizontal tank and two probable impoundments located near smokestack SS-1 are no longer visible.

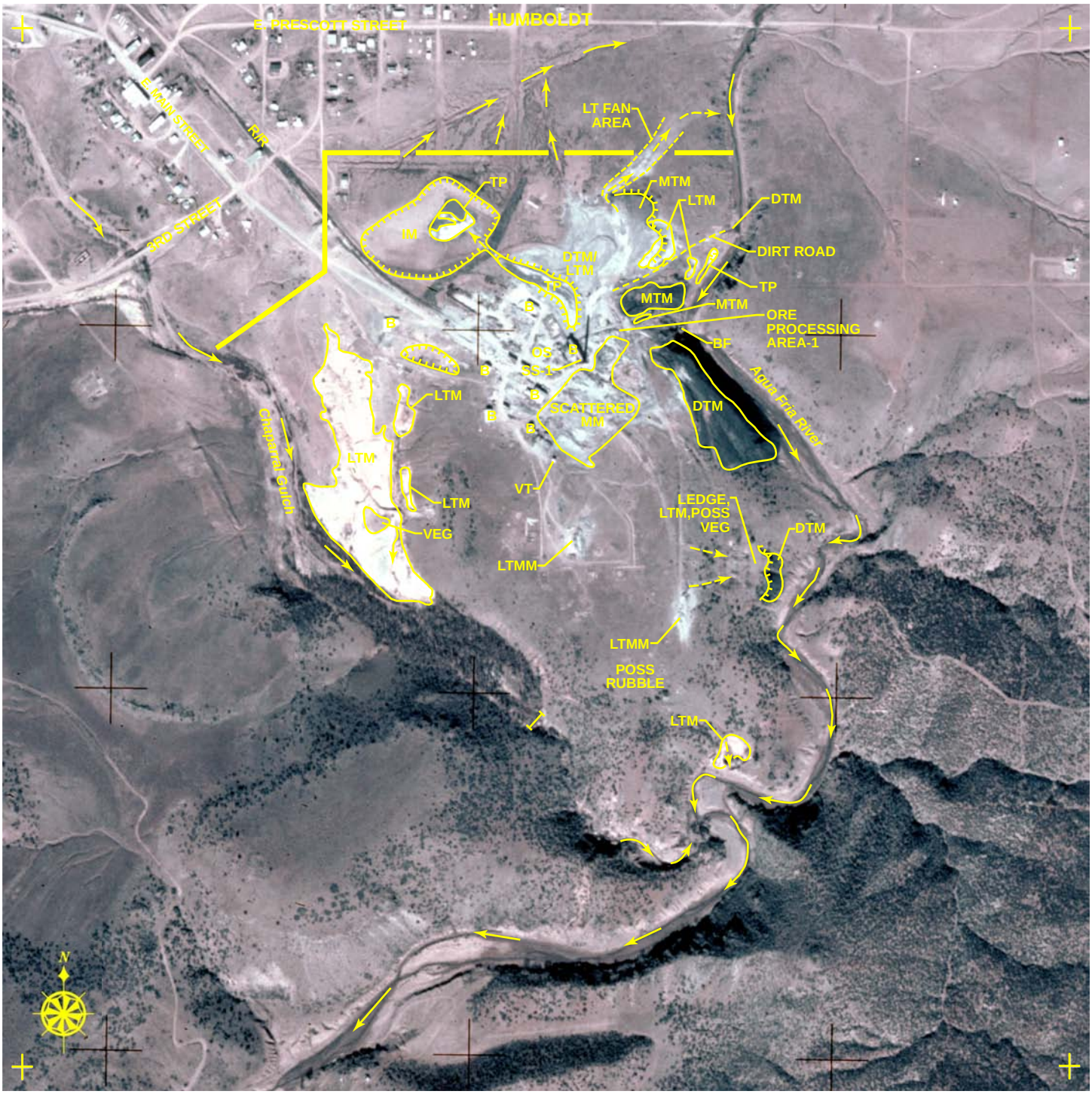

FIGURE 14. HUMBOLDT SMELTER, FEBRUARY 6, 1970. APPROX. SCALE 1:4,500.

JUNE 27, 1973 (FIGURE 15)

Ore Processing Area-1 no longer appears to be in operation. The two tailings ponds located in the north section of the smelter in 1970 are no longer in use. The large impoundment, that contained a tailings pond in 1970, is dry and light-toned material covers part of the bottom of the impoundment. Probable solid waste has been deposited along the southern edge of the large impoundment. The linear tailings pond, situated north of smokestack SS-1 in 1970, has been demolished. The ground surface at the location of the former tailings pond and around the area north of smokestack SS-1 has been graded and light-toned fine-grained material appears to have been spread across the surface. Scattered mounds of light-toned and dark-toned material remain in place in the area south of smokestack SS-1 and mounds of light-toned material have been deposited just north of the smokestack. The tailings pond, located along the banks of the Agua Fria River, does not appear to contain liquid and light-toned material lines the bottom of the pond.

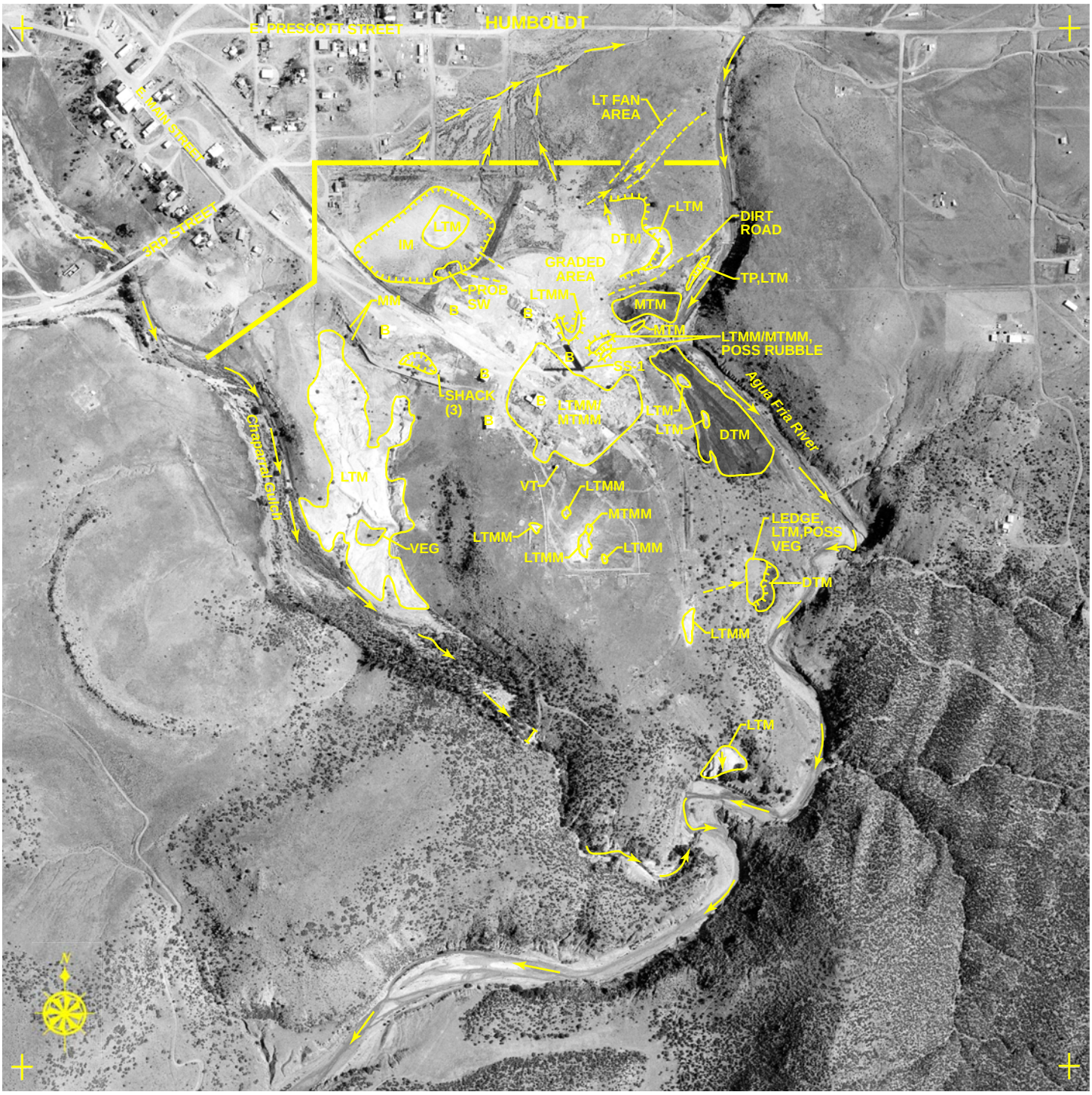

FIGURE 15. HUMBOLDT SMELTER, JUNE 27, 1973. APPROX. SCALE 1:4,500.

SEPTEMBER 25, 1980 (FIGURE 16)

Little observable environmentally significant change has occurred on the smelter since 1973. A building in the center of the smelter, southwest of smokestack SS-1, has been removed and a building foundation is visible at the location. The tailings pond, located along the banks of the Agua Fria River, is no longer in use. The large impoundment in the north section of the smelter is empty. A dirt road crosses the southern berm and provides access to the bottom of the impoundment. The probable solid waste, located on the southern berm of the impoundment, does not appear to have changed.

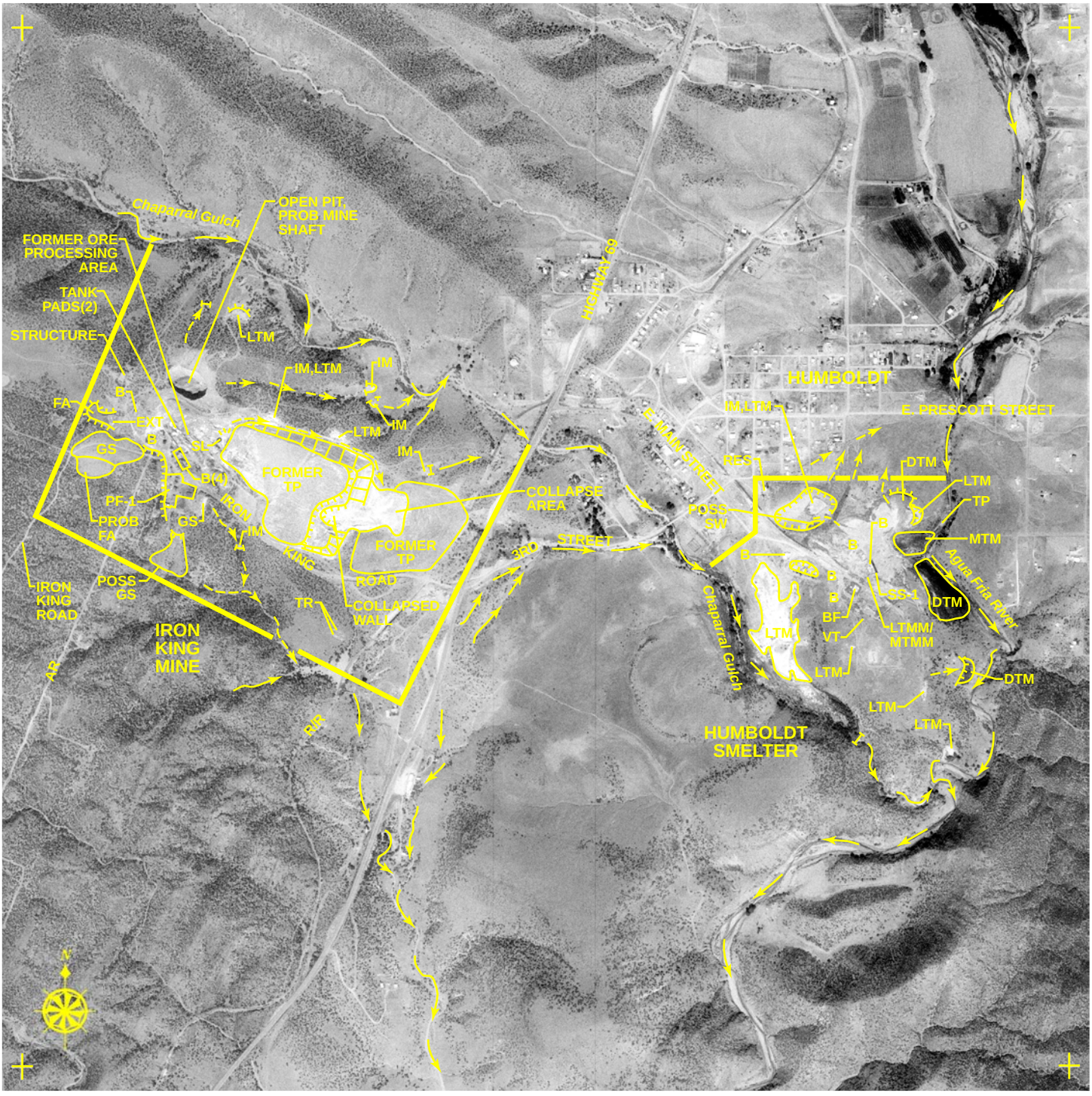

FIGURE 16. IRON KING MINE/HUMBOLDT SMELTER SITE, SEPTEMBER 25, 1980. APPROX. SCALE 1:9,800.

JUNE 5, 1992 (FIGURE 17)

Little observable environmentally significant change has occurred on the smelter since 1980. Most of the scattered mounds of light-toned and dark-toned material, in place south of smokestack SS-1 in 1973 and 1980, are no longer visible. Three mounds of medium-toned material (not annotated) have been deposited on the probable solid waste located on the southern berm of the large impoundment. A new dirt road crosses the northern berm of the large impoundment.

Third Street now extends across the northern boundary of the smelter and provides access to the large impoundment. New residences and two out buildings have been built off the site, east of East 3rd Street, along the northern edge of the smelter.

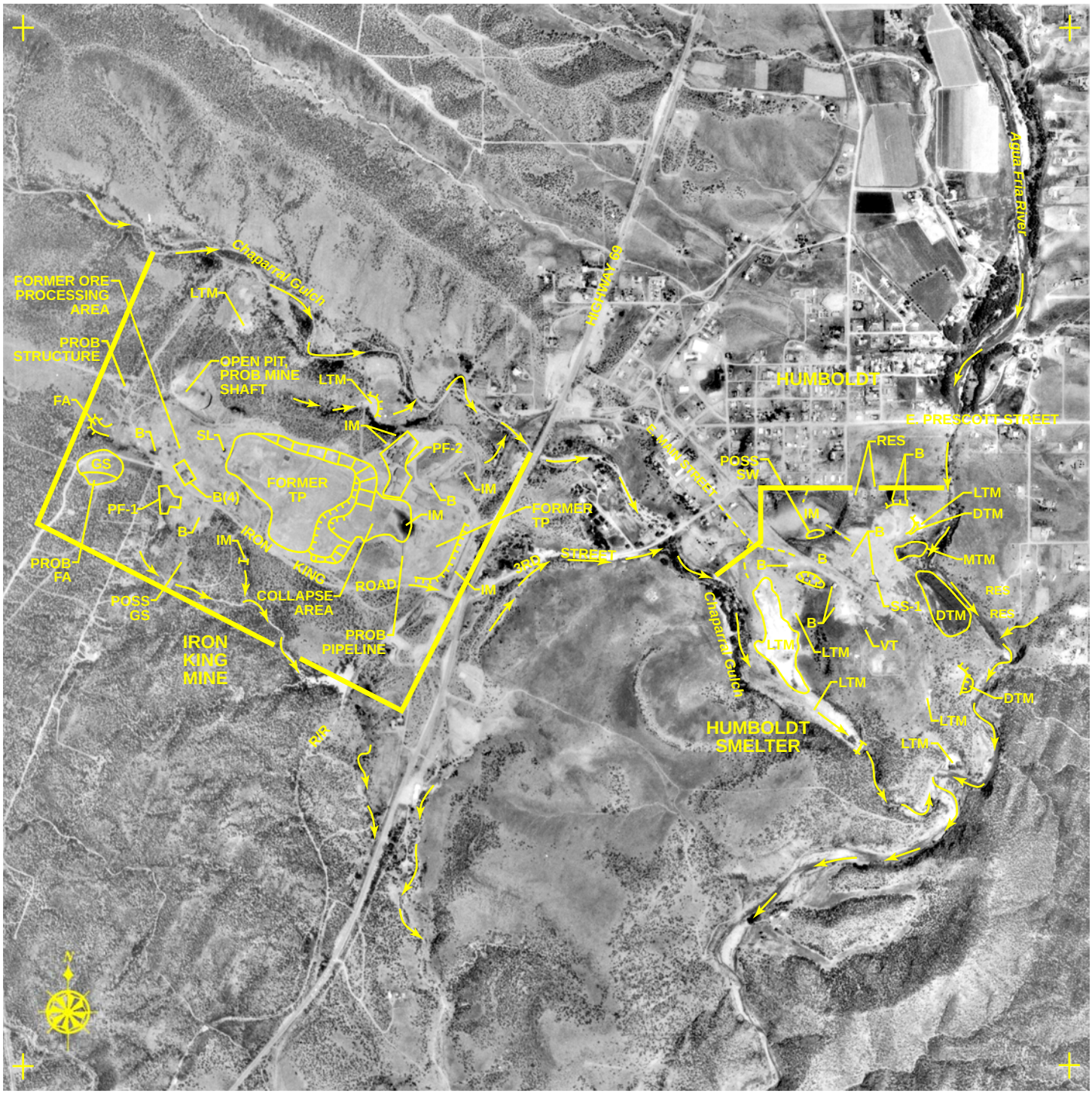

FIGURE 17. IRON KING MINE/HUMBOLDT SMELTER SITE, JUNE 5, 1992. APPROX. SCALE 1:9,800.

SEPTEMBER 20, 2003 (FIGURE 18)

Little observable environmentally significant change has occurred on the smelter since 1992. The tailings pond, located along the banks of the Agua Fria River, is no longer visible. Vegetation obscures the area. An open storage area housing crates and containers is located in the center of the smelter. Light-toned material has been spread across both the southern berm of the large impoundment and across the area where probable solid was visible in the past on the southern berm of the large impoundment. A wall has been built across the bottom of the impoundment and a dirt access road crosses the northern berm of the impoundment.

There are now three residences along the northeast border of the smelter. A fence separates the residences from the smelter. Nearby an open storage area (crates and containers) has been placed on the dark-toned mounded material that had been in place at the location since at least 1940.

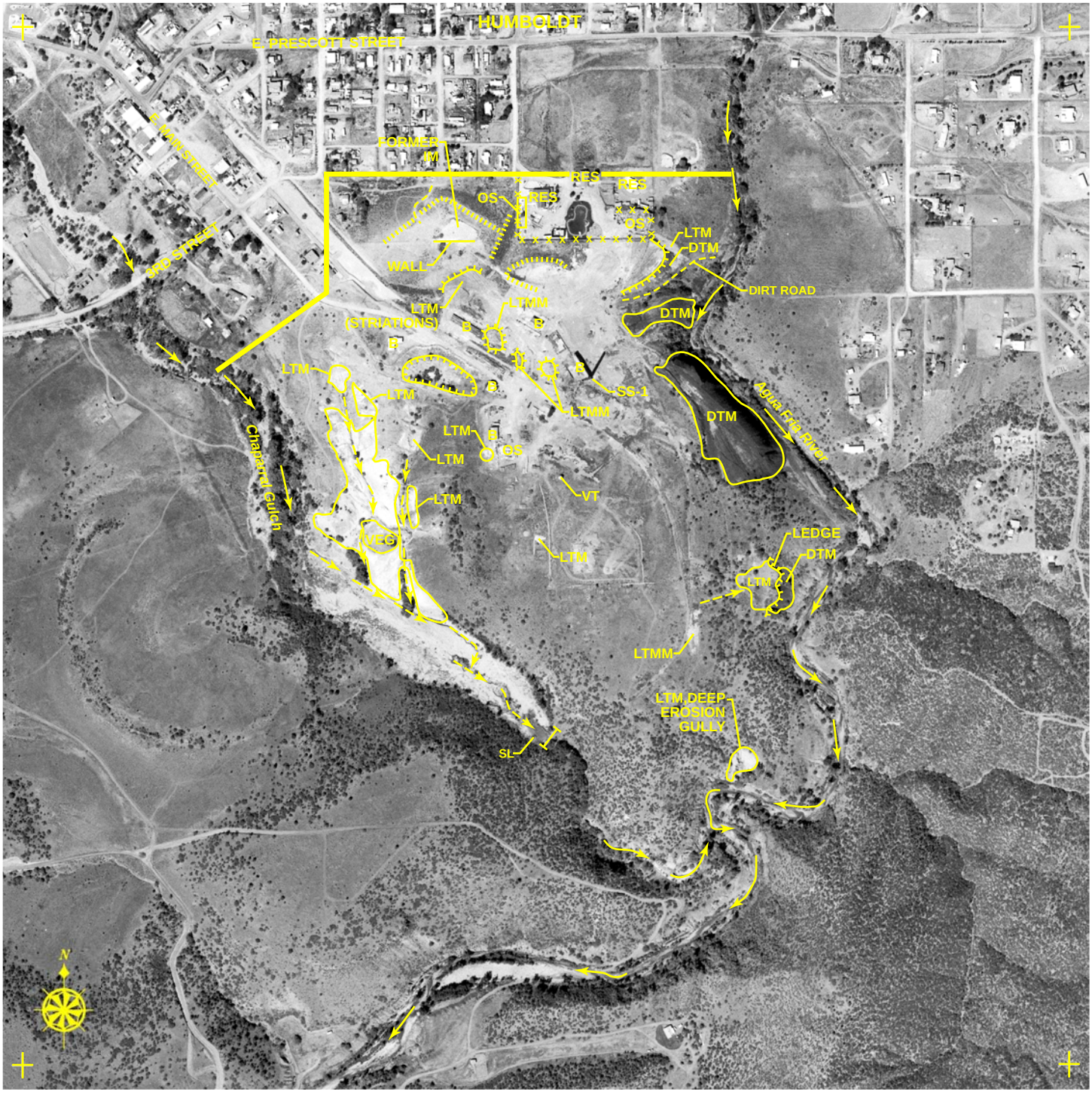

FIGURE 18. HUMBOLDT SMELTER, SEPTEMBER 20, 2003. APPROX. SCALE 1:4,500.

GLOSSARY

Access Road (AR) - A paved or unpaved route of vehicular access.

Automobile Salvage Operation - A yard for the collection, storage, and resale of junked vehicles and the salvage of junked vehicles for scrap metal.

Berm/Dike - An embankment of either natural or man-made materials that impounds liquids, solids or other materials, or controls flood waters.

Building (B) - A relatively permanent, essentially boxlike construction having a roof.

Container (CONT) - Any portable device in which material is stored, transported, handled, or disposed.

Dark- (DT), Medium- (MT), or Light-Toned (LT) - Tones of features in question are compared with the darkest and lightest tones of gray (if using B&W photography) on the print.

Extraction Area (EXT) - An area where earth or other material is being removed for specific use elsewhere (e.g., quarry, sand and gravel pits, etc.).

Fill Area (FA) - An area where material is being deposited to fill a depression; or area where materials have been added, altering the elevation of the ground surface.

Ground Scar (GS) - An area of bare soil, apparently the result of human activity.

Impoundment (IM) - A liquid containment area that appears to be related to activity on a site and may be used for waste storage, disposal and/or treatment.

Material (M) - Raw or waste materials on or in the vicinity of the site.

Mounded Material (MM) - Piles of raw or waste materials on or in the vicinity of the site.

Open Storage Area (OS) - An area of open-air (outdoor) storage of containerized, raw or waste materials, within industrial or manufacturing sites.

Outfall (OF) - The place where an effluent is discharged into the environment.

Pit - A steep-sided hole in the ground surface.

Rubble - Broken bits and pieces of anything that has been demolished (usually associated with brick or stone).

Solid Waste (SW) - Any garbage, refuse, or sludge from a waste treatment, water supply treatment plant, or air pollution control facility, and other discarded material, including solid or semi-solid material resulting from industrial, commercial, mining, and agricultural operations, and from community activities; does not include solid or dissolved material in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges.

Stain (ST) - A residue or discoloration resulting from a spill, discharge, or removed/dispersed materials.

Standing Liquid (SL) - A small, shallow, temporary collection of liquid, not necessarily waste. Not to include liquid contained in impoundments, trenches, pits, etc.

Tailings - Residue of ground rock and process effluents that are generated in a mine processing plant.

Tailings Dam - A structure constructed to create a tailings pond for storing mining tailings and process water.

Tanks - Vertical tanks (VT), horizontal tanks (HT), pressure tanks (PT), tank farms, and solid waste management units. A large receptacle, container, or structure for holding liquid or gas.

Trench (TR) - A long, narrow excavation unrelated to drainage.

REFERENCES

MAPS

Source[a]	Figure	Name	Scale	Date
USGS	1	United States	1:2,500,000	1972
USGS	2	Humboldt, AZ	1:24,000	1973
USGS	2	Mayer, AZ	1:24,000	1974
USGS	2	Poland Junction, AZ	1:24,000	1975
USGS	2	Prescott Valley South, AZ	1:24,000	1973

COLLATERAL INFORMATION

EPA. 2008. Collateral data and site map supplied by EPA Region 9 as an attachment to Remote Sensing Services Request Form.

LMS (Lockheed Martin Services). 2006. Master Quality Assurance Project Plan. Prepared for EPA Environmental Sciences Division. Contract EP-D-05-088. Las Vegas, Nevada.

AERIAL PHOTOGRAPHS

Photo source[a]	Figure[b]	Date of acquisition	Original scale	Film type[c]	Mission I.D.	Source frame #	EPIC ID #
NAS/VIP	3,11	10-13-40	1:31,680	B&W	COUG	23,24	146044,146045
USGS[d]	4,12	11-25-53	1:54,000	B&W	AMS	264-268	DI0000150
ASU	5,13	01-15-64	1:24,000	B&W	AZ-4	1-4	DI00001
USGS[d]	6,14	02-06-70	1:58,692	CC	NASA	167,168	DI0000151
USGS[d]	-	01-18-71	1:62,474	CIR	UNK	117-119	DI0000150
USGS[d]	7,15	06-27-73	1:24,000	B&W	GS-VDGD	117-119	DI0000152
USGS[d]	-	08-31-73	1:36,000	B&W	GS-VDLD	72-74	DI0000152
USGS[d]	-	06-11-79	1:59,500	CIR	2769	802	DI0000151
USGS[d]	8,16	09-25-80	1:60,000	B&W	HAP-80	42-44	DI0000152
USGS	9,17	06-05-92	1:40,600	B&W	NAPP-1006	5231-1,-2	142177,142178
USGS	-	09-28-92	1:40,600	B&W	NAPP-1005	5243-29,-30	142179,142180
USGS[d]	-	08-21-94	1:42,857	CIR	UNK	95,96	DI0000151
USGS	-	05-23-98	1:40,000	B&W	NAPPW	91-93	142181,142182
USGS[d]	10,18	09-20-03	1:40,000	B&W	NAPPW	58,59	DI0000152

[a]ASU Arizona State University, Tempe, Arizona
NAS/VIP National Aerial Survey Center Corp./Visual Image Presentations Silver Spring, Maryland
USGS U.S. Department of Interior, U.S. Geological Survey, Washington, D.C.
[b]Photographs listed with no figure number were analyzed but not placed in this report.
[c]B&W Black-and-white
CIR Color infrared
[d]Digital diapositive (see Methodology section)

LEGEND

SITE BOUNDARY


FENCE


DRAINAGE


FLOW


RAILROAD

VEHICLE ACCESS


DAM


DAM WITH BREACH


TAILINGS DAM


BERM


ESCARPMENT


DEPRESSION, PIT


MOUNDED MATERIAL

AR	ACCESS ROAD
B	BUILDING
BF	BUILDING FOUNDATION
BF*	BUILDING FOUNDATIONS
CONT	CONTAINER(S)
DER	DERELICT
DT	DARK-TONED
EXT	EXTRACTION
FA	FILL AREA
GS	GROUND SCAR
HT	HORIZONTAL TANK
IM	IMPOUNDMENT
ILT	LIGHT-TONED
M	MATERIAL
MM	MOUNDED MATERIAL
MT	MEDIUM-TONED
NB	NEW BUILDING
OF	OUTFALL
OS	OPEN STORAGE AREA
PF	PROCESSING FACILITY
RES	RESIDENCE(S)
R/R	RAILROAD
SL	STANDING LIQUID
SS	SMOKESTACK
ST	STAIN
SW	SOLID WASTE
TP	TAILINGS POND
TR	TRENCH
VEG	VEGETATION
VEH	VEHICLE(S)
VT	VERTICAL TANK