Loop 303 Corridor/White Tanks Area Drainage Master Plan Update Contract FCD 99-40

DRAFT Data Collection Report

Prepared for:

Flood Control District of Maricopa County

May 2003

Prepared by:

URS

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EXECUTIVE SUMMARY

The Flood Control District of Maricopa County (FCDMC) contracted with the URS Corporation (URS) team to develop an update to the Area Drainage Master Plan (ADMP) for the Loop 303 Corridor/White Tanks Area, Contract FCD 99-40. This study updates the prior ADMP completed by The WLB Group, Inc. in March 1995. The update includes flood control projects constructed on recommendation of the previous study as well as infrastructure and land use changes. The need for the update reflects dramatic changes in population density and land use in the West Valley, converting land from agriculture to residential use. The land use changes are requiring infrastructure improvements that keep pace with development. Included in these infrastructure improvements must be flood control. Now is the opportunity to improve the drainage infrastructure of the area, since crucial drainageways could be blocked as a result of development. Planning and implementing drainage improvement concurrently with development can provide favorable alliances with stakeholders that ensure land, financing, and public support. Early planning simplifies decisions including multi-use activities as part of the project. It also allows for facilitating and coordinating landscape character and visual themes into the project.

There are two primary objectives to this ADMP update. The first is to develop a plan to control runoff and prevent flood damage in the watershed. The second is to develop and implement a plan to manage the interim condition due to discontinuous development in order to preserve the ability to provide protection to lands downstream from 100-year flood events.

The area being studied is bounded by the White Tank Mountains to the west, McMicken Dam/ Deer Valley Road to the north, the Agua Fria River to the east, and Gila River to the south. The area includes the portions of the incorporated areas of Avondale, Buckeye, El Mirage, Glendale, Goodyear, Litchfield Park, Peoria, Sun City, and Surprise, as well as unincorporated areas of Maricopa County.

The project is separated into four components:

1 Data Collection and Existing Conditions

2 Level I Alternatives Analysis (Alternatives Formulation/Preliminary Analysis)

3 Level II Alternatives Analysis (Alternative Analysis)

4 Level III Alternatives Analysis (Preferred Alternative Analysis)

This section of the final report describes the data collection efforts and present conditions in the study area. The data will be used as the basis for developing alternatives through selecting a preferred alternative. The information collected includes existing flood data, existing and future developments, existing and proposed drainage facilities, ecological assessment, archaeological assessment, hazardous waste inventory, aesthetic treatments and multi-use data, land use and zoning data, initial hydrology, and major utilities.

LIST OF ACRONYMS

ADA	Arizona Department of Agriculture
ADMP	Area Drainage Master Plan
ADOT	Arizona Department of Transportation
ADWR	Arizona Department of Water Resources
AGFD	Arizona Game and Fish Department
ASM	Arizona State Museum
AT&SF	Atchison Topeka and Santa Fe Railroad
BID	Buckeye Irrigation District
cfs	cubic feet per second
CI	contour interval
CLOMR	Conditional Letters of Map Revision
COE	US Army Corps of Engineers
EPA	US Environmental Protection Agency
FCDMC	Flood Control District of Maricopa County
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Maps
FIS	Flood Insurance Studies
FRS	flood retarding structure
GIS	Geographic Information Systems
GLO	General Land Office
GRS	Geodetic Reference System
LOMR	Letters of Map Revision
Loop 303 ADMP	Loop 303 Corridor/White Tanks Area Drainage Master Plan Update
Luke AFB	Luke Air Force Base
LUST	leaking underground storage tank
MAG	Maricopa Association of Governments
MCDOT	Maricopa County Department of Transportation
NAD	North American Datum
NPL	National Priority List
RID	Roosevelt Irrigation District
SHPO	State Historic Preservation Office

USFWS	US Fish and Wildlife Service
USGS	United States Geologic Survey
UST	underground storage tank
VOC	volatile organic compounds
WQARF	Water Quality Assurance Revolving Fund
WTAF ADMP	White Tanks/Agua Fria Area Drainage Master Plan
WTGAAP	White Tank Grand Avenue Area Plan

1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

This report documents all data collection efforts associated with the Loop 303 Corridor/White Tanks Area Drainage Master Plan Update (Loop 303 ADMP). The Loop 303 ADMP covers an approximate 220-square-mile watershed west of metropolitan Phoenix. Although there has been a significant amount of development in the study area in the last 10 years, the dominant land use remains agricultural with a growing number of commercial and residential areas. This rapid growth, together with the Maricopa County Department of Transportation's (MCDOT) plan to design and build the Loop 303 highway project, has prompted the FCDMC to commission a restudy of the White Tanks/Agua Fria watershed. This study will serve as an update to the existing White Tanks/Agua Fria Area Drainage Master Plan, prepared by The WLB Group, Inc., March 1995.

1.1.1 Location

The study area boundary is defined by the ridgeline in the White Tank Mountains on the west, the Gila River on the south, the Agua Fria River on the east, and the McMicken Dam/Deer Valley Road on the north. The study area spans across the majority of Townships 1N-4N and Ranges 1W-3W which includes the cities of Goodyear, Glendale, Buckeye, Litchfield Park, El Mirage, Avondale, Sun City, Peoria, and Surprise, as well as unincorporated Maricopa County. See Figure 1.1 on the following page.

Topography

The topography found within the Loop 303 ADMP study area varies between three distinctive features. The first is the mountainous terrain found in the White Tank Mountains on the west. This region is characterized by very steep and rugged slopes where the mountain ranges rise abruptly from the gently sloping valley floor. Slopes in the area range from 1% in the foothills to over 100% in the upper mountain peaks. The second type of terrain found in the Loop 303 ADMP project area is the floodplain adjacent to the Agua Fria and Salt/Gila rivers. This area is fairly flat with the exception of the main river channels where the channel banks have been incised approximately 25 feet. The valley floor characterizes the third type of terrain in the Loop 303 ADMP project area. In this area, the valley floor is a smooth alluvial surface that is primarily used for agriculture but has concentrated areas of development. Extensive irrigation is used in this region to grow crops throughout the year. Agriculture is the dominant land use present in the Loop 303 ADMP study area. Slopes in this portion of the Loop 303 ADMP project

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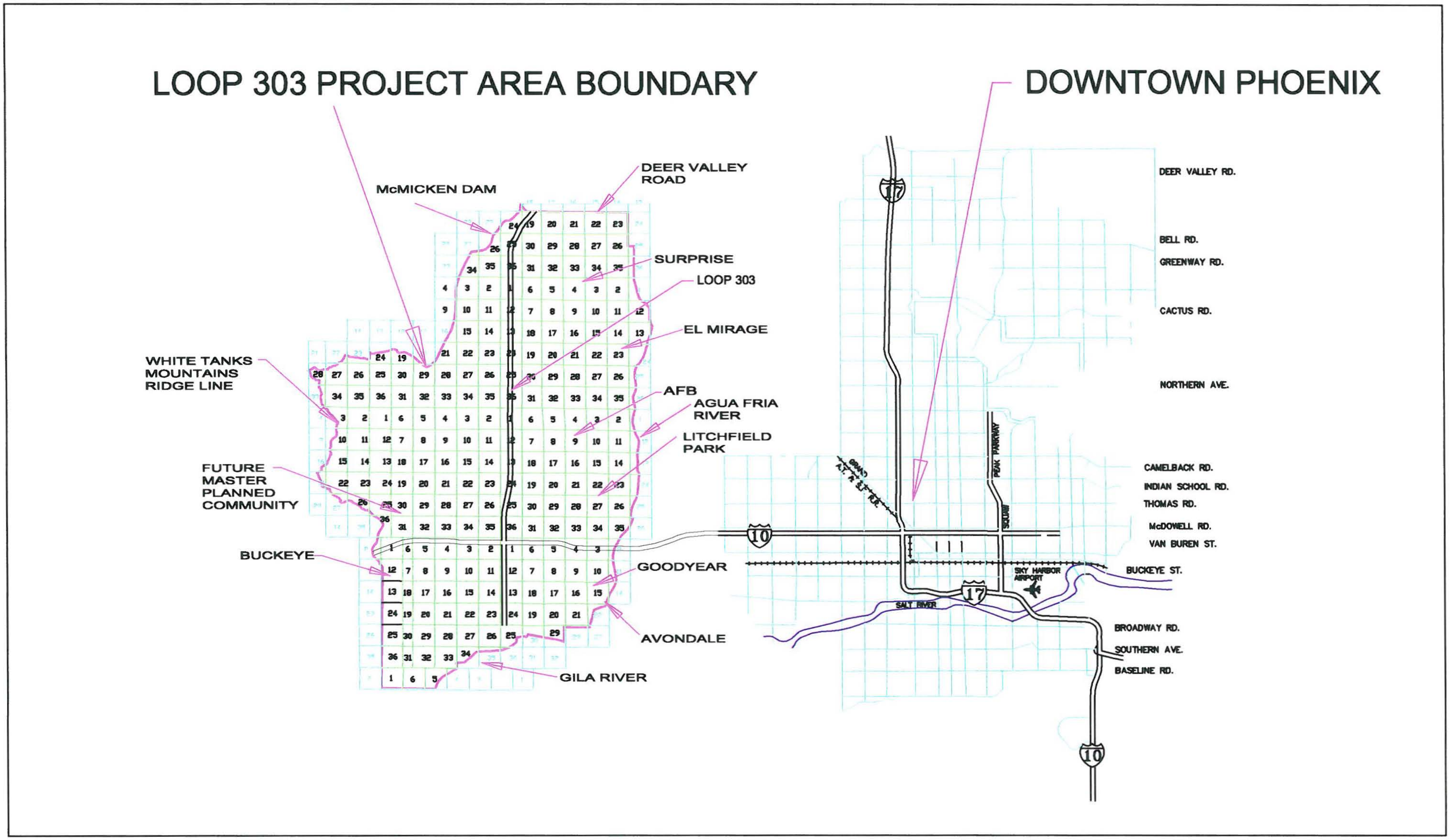


VICINITY MAP

URS

Flood Control District of Maricopa County

MAY, 2003
Figure 1.1

area range from 0.4% to 0.8% and tend toward the Agua Fria and Salt/Gila rivers in a southeasterly direction from the White Tank Mountains.

Soils

As a result of the varied topography described above, the soils present in the Loop 303 ADMP project area also vary widely. In the mountainous regions, two distinctive soil groups are found. In the lower foothill elevations of the mountains, the soils are largely characterized by gravelly loams, very cobbly loams, and gravelly clay loams on alluvial fans. At the higher altitudes, the soils are characterized by Cherioni-Rock outcrops; gently sloping to very steep, very gravelly loams and rock outcrop. Soils in the lower valley regions also vary. In the southern valley, the soils are of Laveen-Coolidge association. They are nearly level sandy loams, loams and clay loams on old alluvial fans and valley plains. Soils in the northern valley are a combination of Mohall-Laveen and Rillito-Gunsight-Perryville associations. The Mohall type soils are comprised of nearly level loams and clay loams on old alluvial fans and valley plains. The Rillito type soils are nearly level to moderately steep gravelly loams and loams on old alluvial fans and valley plains. The prominent soils found in the river areas as well as the Central Valley are mostly Gilman-Estrella-Avondale association. These soils are comprised of nearly level loams and clay loams on valley plains and low stream terraces.

Demographics

The information regarding demographics in the Loop 303 ADMP project area was summarized and paraphrased from the "White Tank Grand Avenue Area Plan" (WTGAAP) draft. This information is presented below.

The Loop 303 ADMP project area has recently experienced an increasingly rapid growth in population. According to 1985 census data, the total population in the Grand Avenue Planning Area was approximately 11,890 people. By the time the 1990 census was conducted, the population had increased by 47% to approximately 17,567 people. This information is confirmed by looking at the historical housing unit analysis. Between the 1985 and 1990 census, there was a significant increase in residential homes. In 1985, there were 7,768 residential housing units. In 1990, this figure had increased to 11,186 or 44%. According to the Maricopa Association of Governments (MAG) projections, the population is expected to increase by 120% over the next 20 years. By comparison, the population of Maricopa County as a whole is only expected to increase 55%. In addition, total housing units are expected to increase 119% over the next 20 years.

Census data from 1995 show that the median age in the Loop 303 ADMP project area is 71 and the median household income is approximately $28,000. The County average income is significantly higher at $35,000.

Future populations are expected to concentrate in three sub-areas within the region. These include the Luke Air Force Base (Luke AFB) sub-area, the I-10 corridor, and the Agua Fria sub-area. These sub-areas are described in the WTGAAP as "sub-areas of the overall study area." No exact boundaries were described or drawn on the map provided in the WTGAAP text. This map has been reproduced here as Figure 1.2 on the following page. For more detailed demographic information, refer to the WTGAAP.

1.1.2 Purpose

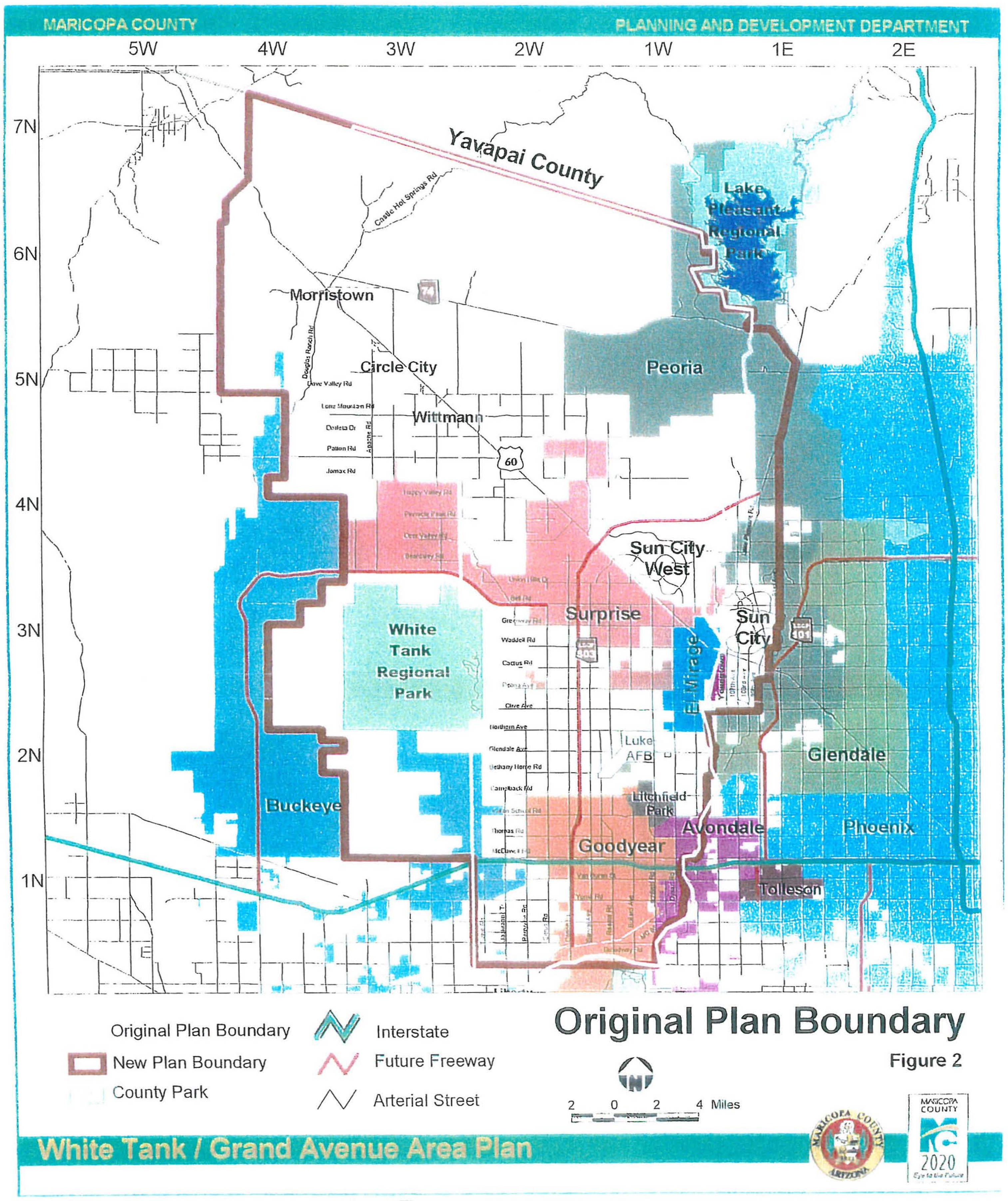
The purpose of this report is to document all data collected in regard to the development of multiple flood control alternatives presented in the study area.

The first of two major objectives of this update study is to develop a plan to control runoff to prevent flood damage in the watershed both existing and in the future. The second objective is to develop an implementation plan to manage the interim condition due to discontinuous short-term development. The plan shall develop and identify preliminary costs, alignments, typical sections, right-of-way requirements, aesthetic/landscape themes, utility conflicts, and potential project participants for implementation of the preferred alternatives.

The first phase of the update study identifies several alternatives for an overall flood control system within the Loop 303 ADMP study area. The second phase of the update study further evaluates alternatives and selects and describes in more detail a single preferred alternative from the list prepared during Phase 1.

At a minimum, each alternative considered must identify alignments, typical sections, right-of-way requirements, landscape themes, and utility conflicts. Each alternative will be evaluated for multiple uses and integration with other local and regional recreational facilities. Environmental issues will be monitored related to hazardous waste locations, archaeological and historical sites, and ecological impacts.

Valid alternative flood control systems for the area may propose new regional outfalls necessary for the discharge of concentrated stormwater resulting from rainfall events and recent, ongoing, and future development. The alternatives will tie existing facilities and outfalls together with proposed components into one contiguous hydraulic flood control system. Any proposed components such as channels, retention/detention basins, regional outfalls, etc., will be designed



Demographic Data From the Draft
White Tank Grand Avenue Area Plan

May, 2003

Loop 303 Corridor/White Tanks ADMP Update

FIGURE 1.2

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to mitigate existing known flood hazards as well as alleviate documented flooding in specific areas or locations. In addition, the alternative will emphasize the importance of multiple-use facilities and landscape aesthetics. At a minimum, each alternative must show consistency with desired future landscape character, make use of any opportunity to improve landscape aesthetics, protect existing valued aesthetic features, and incorporate any chance available for multiple uses.

The data documented in this report include the following items:

- All recent/ongoing drainage studies
- Recent Letters of Map Revision (LOMR)
- Conditional Letters of Map Revision (CLOMR)
- As-built plans
- Design reports for recent/planned master planned communities
- Subdivisions reports
- Design reports for recent/planned flood control projects in the area
- All current Flood Insurance Studies (FIS)
- Historic photographs documenting original flow paths and/or actual floods
- Digital contour information
- Digital photography
- Utility information
- Archaeological surveys
- Endangered species lists
- Land use data
- Vegetation data
- Updated hydrologic information
- Hazardous Waste Inventory

1.1.3 History of the Loop 303 Project Area

The history of the White Tanks and Gila River Valley area indicates a long tradition of farming and agriculture. It is believed that the Hohokam Indians, who occupied the area from approximately 500 BC to 1450 AD, lived in small farming villages scattered throughout the region. One of the most impressive accomplishments of these early inhabitants was to build an extensive irrigation canal system. This system delivered water necessary to grow food to dry desert areas miles away from the river. European settlers later used these canals in the late 19th Century.

Around World War II, the land use patterns in the area began to change. Recognizing the large amount of low-cost land available, the aluminum, cotton, electronics and aerospace industries began to move into the area. Also, Luke AFB was opened in 1941. As a result of these new industries and the establishment of an Air Force Base, a large number of people began to move into the area. Gradually, agriculture has begun to be replaced by residential, commercial, and industrial development, a trend that has continued to this day.

Currently, the project area is one of the fastest growing regions in the country.

1.2 SCOPE OF WORK

The following describes the Loop 303 ADMP Scope of Work for the Data Collection Report.

Data Collection & Existing Conditions Analysis

1. The Consultant shall collect and review the pertinent data received from the FCDMC as specified. The Consultant shall collect data from the agencies, developers and other outside sources. The data to be collected shall include materials relevant to the project such as: previous hydrology developed for developments within the study area; existing topographic mapping; as-built plans for existing structures; Federal Emergency Management Agency (FEMA) Flood Hazard Boundary Maps and any Letters of Map Amendment and/or Revisions, drainage reports, site plans and future drainage improvement plans and other pertinent information. Interviews should be arranged with appropriate agencies for information on drainage problems in the area. The Consultant shall prepare a list summarizing the collected data.
2. The Consultant shall develop a comprehensive list and historic photographs if available of known flooding problems within the study area. Development of this list will require coordination with the officials from each of the municipalities, transportation agencies, irrigation districts, and other sources. The Consultant shall document historical, known flood damage costs.
3. The Consultant will obtain, review and document the data necessary for aesthetics/visual resources assessment and multiple-use opportunities assessment as required in the section on

Landscape Aesthetics Assessment and Multi-Use Opportunities Assessment. The Consultant shall include the documentation as a section in or appendix to the Data Collection Report entitled Landscape Aesthetics Assessment and Multi-Use Opportunities Assessment.

4. The Consultant shall prepare an inventory of drainage facilities that are being planned by other public jurisdictions, irrigation districts, or private development. These will be illustrated on the Existing Facilities Exhibit. These facilities are to be incorporated into the alternatives as appropriate.

5. The Consultant shall develop a comprehensive list and a map of current, ongoing and proposed developments within the study area. This information shall include the engineering consulting firm, principal contact, telephone number as well as the developer. The map shall be submitted in an electronic Geographic Information Systems (GIS) format per the requirements of the Consultant Guideline section on GIS/HIS DTM Standards or in accordance with the Deliverables section.

6. The Consultant shall contact utilities, known or suspected to have facilities within the project area, to request the alignment and size of the utility facilities. Utilities within the study limits shall be identified and shown in the Data Collection Report.

7. The Consultant shall prepare an Existing Facilities Exhibit illustrating the location of major natural washes and man-made drainage facilities in the watershed. The condition, capacity and ownership of man-made facilities will be noted. These facilities will become part of the base map for alternatives. The Consultant shall make maximum use of these facilities, where feasible, as part of the stormwater management plan alternatives. The base map for the exhibit will be developed from base mapping provided by the FCDMC.

8. The Consultant shall prepare a Data Collection Report with the Existing Facilities Exhibit summarizing the data collection effort. The report shall include documentation of existing flooding problems, current drainage and topographic features, existing flood plains, and current plans for facilities by others. The Consultant shall submit a draft of this report and include the final report with the Area Drainage Master Plan Update Report.

Data Collection Report

The Data Collection Report will contain a description of the known flooding problems within the study area, the data collected, and the existing drainage structures in the area and discuss any surveying that has been performed. Existing major natural washes and existing and planned man-made drainage facilities in the watershed will be shown on the Existing Facilities Exhibit to be submitted with the Data Collection Report.

The Data Collection Report shall include but not be limited to the following:

- Executive Summary
- Project Description
- Scope of Project
- Data Collection Reports
  - Current Conditions
  - Areas of Flooding
  - Existing and Future Developments
  - Areas and Location of Potential Flooding
  - Existing and Future Drainage Facilities
- Environmental Overview
  - Ecological Assessment
  - Archaeological Assessment
  - Environmental Permits and Approvals
  - Hazardous Waste Inventory
  - Aesthetic Treatments and Multi-Use Analysis
- Land
  - Rights-of-Entry Requirements
  - Land Use/Zoning Map
- Initial Hydrological Report
- Major Utilities
- Existing Facilities Exhibit
- References/Figures

1.3 REPORT ORGANIZATION

Sections 1.0 and 2.1-2.2 provide general information regarding the watershed area. In an effort to simplify the discussions regarding known flooding, existing/future drainage facilities, existing/ future developments, and major utilities, the project area is subdivided into five regions. These regions are consistent with those discussed in the original White Tanks/Agua Fria Area Drainage

Master Plan (WTAF ADMP) (WLB Group, Inc., March 1995). Sections 2.3-2.6 provide discussions specific to each region identified within the project area.

Section 3.0 presents the initial hydrological report. Section 4.0 presents the environmental overview as well as aesthetic treatments and multiple-use applications. Finally, Section 5.0 discusses land use/zoning and rights of entry.

2.0 DATA COLLECTION AND RESULTS

Many sources of information were contacted and data reviewed in the preparation of the Loop 303 ADMP. The following is a summary of the primary sources used to create the database for this project:

- Field reconnaissance
- Blue Stake – utilities search
- FIS
- CLOMR/LOMR
- GIS database
- Documented public works projects since 1990
- Documented master plans since 1990
- Documented private and commercial development since 1990
- As-built drawings
- Hazardous waste impacts record search
- Subsidence data for project area
- Documented historic flooding
- Aerial photography
- Traffic regulations and access requirements
- Historic character
- Landscape character, land use and multi-use data
- Environmental permits and approvals
- Cultural resources
- Ecological assessments

One of the most important aspects of this project involves the determination of the extent to which the watershed has developed since the original WTAF ADMP, March 12, 1994. This is extremely important so that a comprehensive and effective drainage plan for the entire project area can be prepared. As part of this initial effort, an intensive study of existing conditions must be conducted in order to assess the direction development has taken in recent years. Several questions regarding these issues need to be answered prior to developing alternatives. Some of these questions include:

- Have developments made an effort to utilize hydrologic information in the original WTAF ADMP?
- If a development did not follow the original WTAF ADMP, why not? Was there a lack of coordination between the cities and towns and the FCDMC on hydrologic/hydraulic issues? Was there a change to zoning which made the recommendations in the original WTAF ADMP unfeasible? Were there other reasons why the original WTAF ADMP was not followed that need to be considered for the success of this study?
- Have new developments created new flood hazards?
- Have new drainage facilities eliminated existing flood hazards?
- Have there been recent flooding problems in the project area which were not identified in the original WTAF ADMP?
- Has development incorporated multi-use and specific aesthetic themes that should be continued?
- How many of the recommendations from the original WTAF ADMP have been designed and/or constructed?
- Have there been threatened, endangered, or sensitive species identified in the project area that precluded the use of recommendations made in the original WTAF ADMP?
- Have cultural resources, archaeological artifacts, or sensitive vegetation been located in areas that have precluded the use of the original WTAF ADMP?
- What are the social/economic consequences of recent development?
- Is current development following any historical and/or pre-historical themes found within the project area?
- Have there been any conflicts with wetlands or riparian areas?

See the Map of Existing Development in Appendix D for locations of the known developments within the project area as of May 15, 2000.

Field Reconnaissance — The first source of information is field reconnaissance. Thorough field reconnaissance occurred to familiarize the project team with the project area and its basic features. For an area of this size, it is not possible to view all points of interest in just one day. The purpose of the first field trip was to observe and photograph known key facilities and features within the project area. It intended to give a broad overview of the project area as a whole. Subsequent field trips focused on particular areas of interest that are identified through the data collection effort itself. Although field reconnaissance is necessary to provide the team with a sense of the spatial relationships between known features and existing facilities, it is also important in identifying undocumented changes in the area and features and/or facilities not previously identified.

The initial field reconnaissance occurred on December 8, 1999. Representatives were present from both FCDMC and the URS team. The specific locations observed in the watershed included:

- I-10 borrow pit ponds adjacent to Loop 303
- Bullard Wash south of I-10 including the new construction
- Salt-Gila Outfall Area
- MC 85 Estrella Parkway to Cotton Lane
- MC 85/Cotton Lane/Railroad Crossing Area
- Cotton Lane and Roosevelt Irrigation District (RID) Canal
- I-10 and RID Canal
- Loop 303/I-10 Interchange
- White Tank Flood Retarding Structure (FRS) #4
- Tuthill/Jackrabbit Road Area
- Palm Valley Development
- Loop 303
- Sun City Grand
- Dysart Drain
- El Mirage Projects
- Areas Adjacent to Luke AFB
- Colter Channel
- North Bullard Wash

Utilities Search (Blue Stake) — To assist in the development of an economically feasible alternative for the Loop 303 ADMP, a comprehensive list of existing utilities in the project area must be developed. A design that minimizes utility conflicts will in turn minimize the number of utility relocations required.

In addition, a complete knowledge of utility locations helps avoid injuries, prevents costly damages and interruptions of facility services, avoids hazards, and eliminates construction delays. It is clear that this information will save a significant amount of time, money, and effort upon implementation of the final Loop 303 ADMP developed for the project area.

In developing a comprehensive utility list, the local Blue Stake Center was contacted on January 12, 2000. The Center provided a list of 47 utilities and contact names and telephone numbers located within the project area. See Table 2.1 on the following page.

The Blue Stake Center assists excavators with the statutory requirements to notify underground facility owners prior to excavation. This service is provided free of charge. For studies and projects not involving immediate excavation, the Blue Stake Center will provide a list of all utilities found within a given study area for informational purposes.

URS contacted all 47 of the utilities listed in order to obtain map locations for each. The locations given by those utilities that responded can be seen on Figure 2.1 following Table 2.1. The majority of the utilities contacted did not respond. Those that did respond provided only schematic information that is informational in nature. No vertical data was provided for any of the utilities contacted.

Flood Insurance Studies and Floodplain Mapping — Given that the primary focus of the Loop 303 ADMP is flood control, the relative importance of up-to-date/currently published FIS information cannot be overstated.

This information is critical in the identification of areas where existing floodplains require prudent management. In some cases, this may limit development so that it does not encroach into conveyance and storage areas or eliminate critical regional outfalls required for stormwater conveyance and disposal.

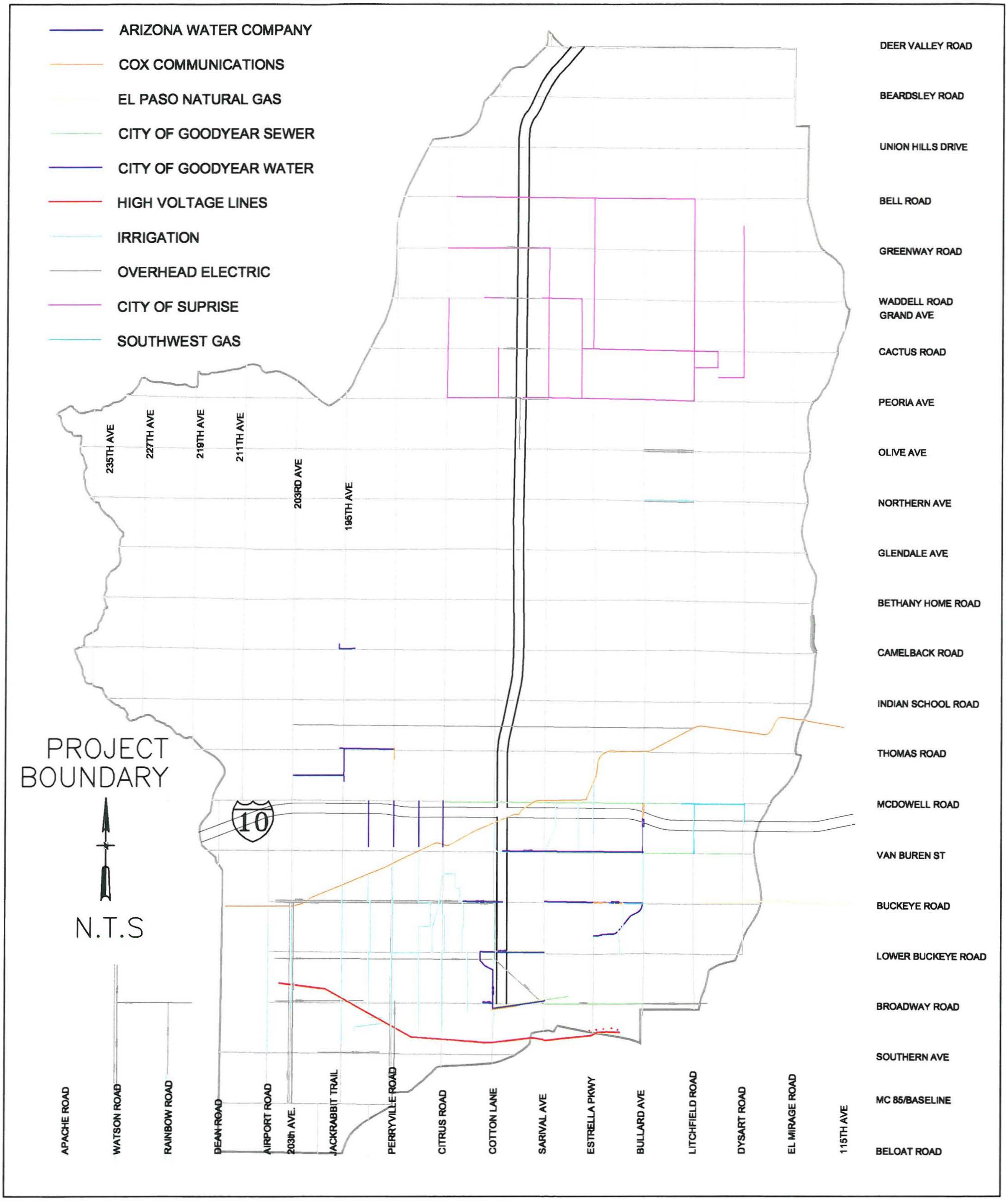
In other cases, it may require the elimination of local flooding caused by ponding behind existing natural or man-made land features. Ponding areas may also be present in areas where existing conveyance systems are simply inadequate and must be improved. Elimination of this type of ponding is usually essential for improved flood protection of existing or proposed development.

Table 2.1
Utilities Identified Within the Loop 303 Project Area

Utility Name	Utility Type	Contact	Telephone No.
Utilities Notified by Blue Stake			
AT&T	Telephone	Anyone who answers	1-800-252-1133
AmeriGas Terminal	Gas	David Harbushaka	623-935-2661
Arizona Department of Transportation	Electric, Culverts, Storm Drain, Propane	Scott Vollrath	602-255-6665
Arizona Department of Transportation	Culverts, Storm Drain	Richard Zeller	520-684-2131
Arizona Public Service (APS)	Electric	Tiffany at UTI	602-462-9844
Citizens Utility Company		Tiffany at UTI	602-462-9844
City of Phoenix	Sewer, Water	Tiffany at UTI	602-462-9844
Cox Communications	Cable	Tiffany at UTI	602-462-9844
Insight Cable	Cable	Tiffany at UTI	602-462-9844
Southwest Gas	Gas	Tiffany at UTI	602-462-9844
US West	Telephone	Tiffany at UTI	602-462-9844
Southwest Gas	Gas	Lee Magee	602-484-5345
APS Water	Water	Julie Hunter	602-371-6104
Arizona Water Company	Water	Tom Seuberling	623-853-9302
Central Arizona Conservation District	Electric, Coaxial Cable, Fiber Optics	Abe Sahli	623-869-2126
Citizens Water Resources	Water	Robert Bermea	602-309-7639, Ext. 116
City of Avondale	Water, Sewer, Traffic Signals	Richard Sullins	623-932-1909
City of El Mirage	Water, Sewer	Mary Nabarro	623-972-8116
City of Glendale	Traffic Signals	Jerry Whelpley	623-930-2762
City of Peoria	Water, Sewer, Electric	Dave Ortiz	623-412-7433
City of Phoenix	Water, Sewer	Shannon Clark	602-534-6640
City of Surprise	Sewer, Electric	Rhet Huskey	623-583-6025
El Paso Natural Gas	Gas	Bill Ward	602-438-4224
First National Management	Water	Fred	480-833-2027
Flood Control District of Maricopa County	Electric, Water, Storm Drain	Mike Meng	602-506-4722

Utility Name	Utility Type	Contact	Telephone No.
IXC Communications	Fiber Optics	Geneva Titus	1-800-548-4167
Insight Cable	Cable	James Phelts	623-780-2222
Kinder Morgan Energy	Petroleum	Dan Tarango	602-278-2320
Level Three Communications	Fiber Optics	Kim Bolas	1-303-635-4020
Litchfield Park Service Company	Water, Sewer	Dave Printhorne	623-935-9367
Maricopa County Department of Transportation	Traffic Signals	Pete Allen	602-506-8666
MCI Worldcom	Fiber Optics	Anyone who answers	1-800-624-9675
Quest Communications	Fiber Optics	Sara Wade	1-800-283-4237
Rigby Water Company	Water	Dale Mewes	480-833-2027
Salt River Project (SRP)	Electric, Irrigation	Greg James	602-236-8143
Sprint Communications	Fiber Optic	Joney Duffie	1-800-521-0579
Valley Utilities Water Company	Water	Bob Prince	623-935-1100
Utilities Notified by Engineer			
Adaman Water District	Water Line	David Schlofield	623-935-2837
American Public Service, Casitas Bonitas	Sewer	Lester Schmidt	623-268-4111
City of Goodyear	Water, Sewer, Traffic Signals	Barbara Alice	623-932-1627
Clear Water Farms	Irrigation	Verna Kohler	623-853-0622
Recreation Centers of Sun City	Miscellaneous	Dan Smith Tom Lintgen	623-876-3043 623-876-3047
Roosevelt Irrigation District	Irrigation	Ken Craig	623-386-2046
Satellite Management Services Inc.	Miscellaneous	Mel Tates	480-921-2090 Ext. 307
Sun Health Corporation	Coaxial Cable, Fiber Optic	Randy Jackson	623-876-5435
Tierra Buena Water Company	Water	Bob Prince	623-935-1100

Utility Name	Utility Type	Contact	Telephone No.
Water Utilities of Greater Buckeye	Water	Jack Meister	623-386-4252



NOTE: UTILITY LOCATIONS SHOWN ARE SCHEMATIC IN NATURE AND ARE FOR PLANNING PURPOSES ONLY. THE INFORMATION IS NOT NECESSARILY COMPLETE AND REPRESENTS A COMBINATION OF DATA OBTAINED FROM FIELD OBSERVATION AS WELL AS INFORMATION SENT TO URS BY AREA UTILITIES CONTACTED. THE MAJORITY OF UTILITIES CONTACTED FAILED TO PROVIDE ANY DATA.

UTILITY LOCATIONS

URS

MAY, 2003
Figure 2.2

URS has obtained copies of all current Flood Insurance Rate Maps (FIRMs), Floodway Maps and FIS in the project area. These documents are prepared by FEMA for both incorporated areas and unincorporated Maricopa County. The FCDMC library is a primary source of these data.

CLOMR/LOMR — In addition to the current FIS for the project area, any CLOMR/LOMR activity is being identified for a complete view of existing floodplains and their possible modification in the near future.

URS has obtained all available CLOMR/LOMR's on file with FEMA, FCDMC and the incorporated areas.

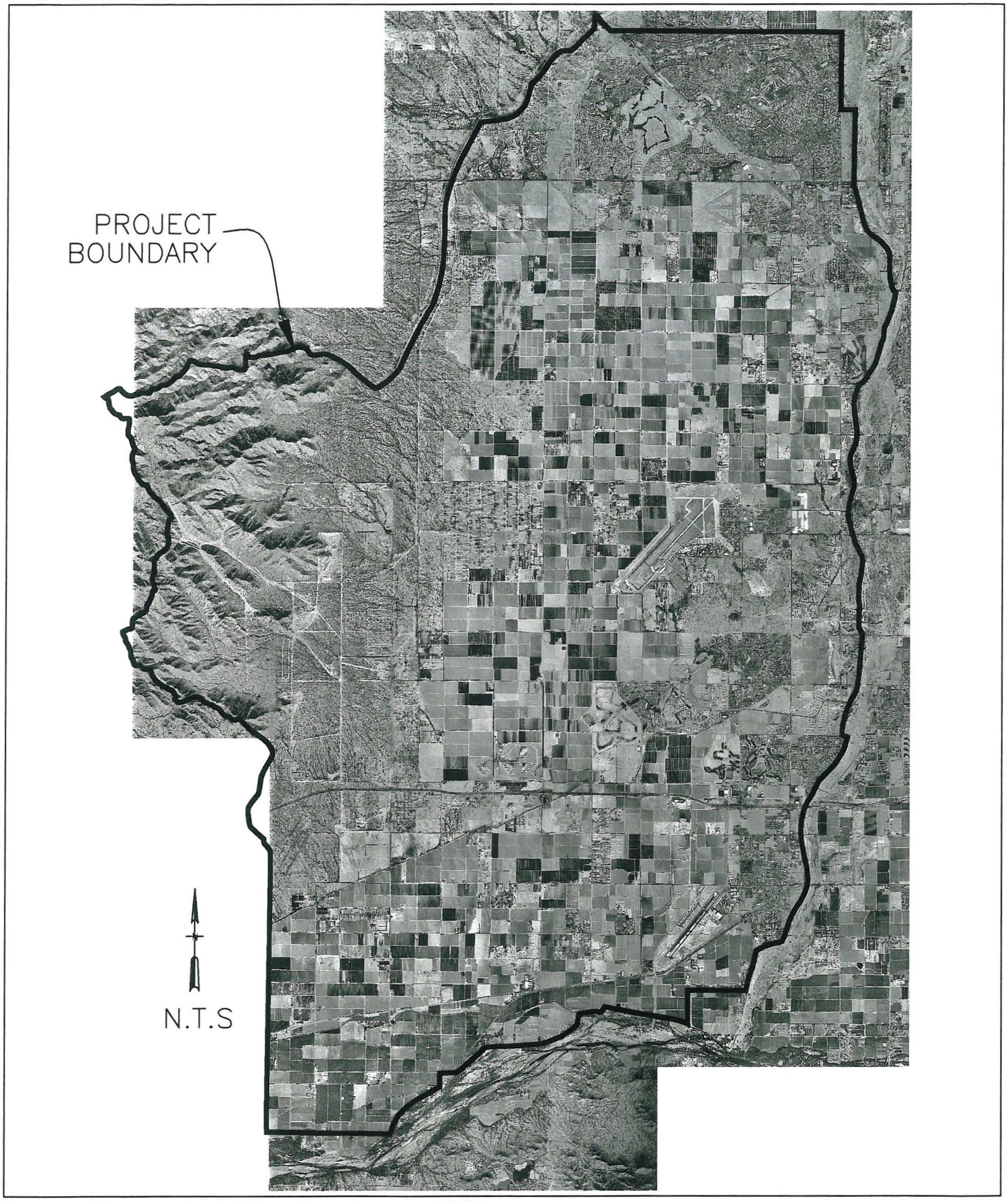
GIS Database — To develop a base map which can efficiently and effectively display the general infrastructure, topography, land use, existing floodplains, utilities, significant existing hydraulic structures and other relevant characteristics of the project area, the GIS database available at the FCDMC was used as an initial reference. URS is updating the FCDMC database as new data are obtained and verified.

The topographic information provided by the FCDMC consists of 2-foot contour interval (CI) topography and a small portion of United States Geological Survey (USGS) 20-foot CI topography. The USGS information was provided to fill in a 1-2 square mile gap on the western border of the project area in the White Tank Mountains where the higher resolution 2-foot CI topography was not available.

In addition to this information, the FCDMC provided high-resolution black-and-white orthorectified aerial photography of the entire project area. The photography was flown in the early part of 1999 and provides an excellent resource for comparison of development in the project area today with that of the early 1990's.

Another source of geographic information was obtained from Kenney Aerial Mapping Company. Kenney Aerial Mapping was retained by URS to provide high-resolution color orthorectified aerial photography of the entire project area. The data obtained include contact prints, color photographs of the project area and digital imagery. This information is valuable in identifying landscape character throughout the project area as well as evaluation of the most recent development that has taken place since the 1999 photography was flown. See Figure 2.2 on the following page.

All of the above information has been tied to the North American Datum of 1983 (NAD 83) that uses the Geodetic Reference System of 1980 (GRS) as the model on which NAD 83 was



Source: Kenney Aerial Mapping, January 2001

AERIAL MAP

URS

MAY, 2003
Figure 2.2

developed. Use of this datum and state plane coordinate projection is required to ensure compatibility with the FCDMC GIS database.

Public Works Projects — All information available for public works projects related to hydrology and hydraulics was collected and analyzed to make full use of existing and proposed facilities with the final Loop 303 ADMP. This information includes any projects completed since the original WTAF ADMP and those currently under construction or proposed.

The vast majority of this type of information has been collected using the FCDMC's library, archives and other resources. We have contacted the municipalities, towns and other stakeholders in the study area to supplement data received from the FCDMC. Information from the cities of Avondale, Goodyear and, Glendale was needed because they do not specifically submit projects to the FCDMC.

Master Plans — To create an overall flood control system for the project area, large developments that create significant increases in stormwater runoff and modifications to drainage patterns must prepare master plans that include local, state and federal drainage/floodplain criteria.

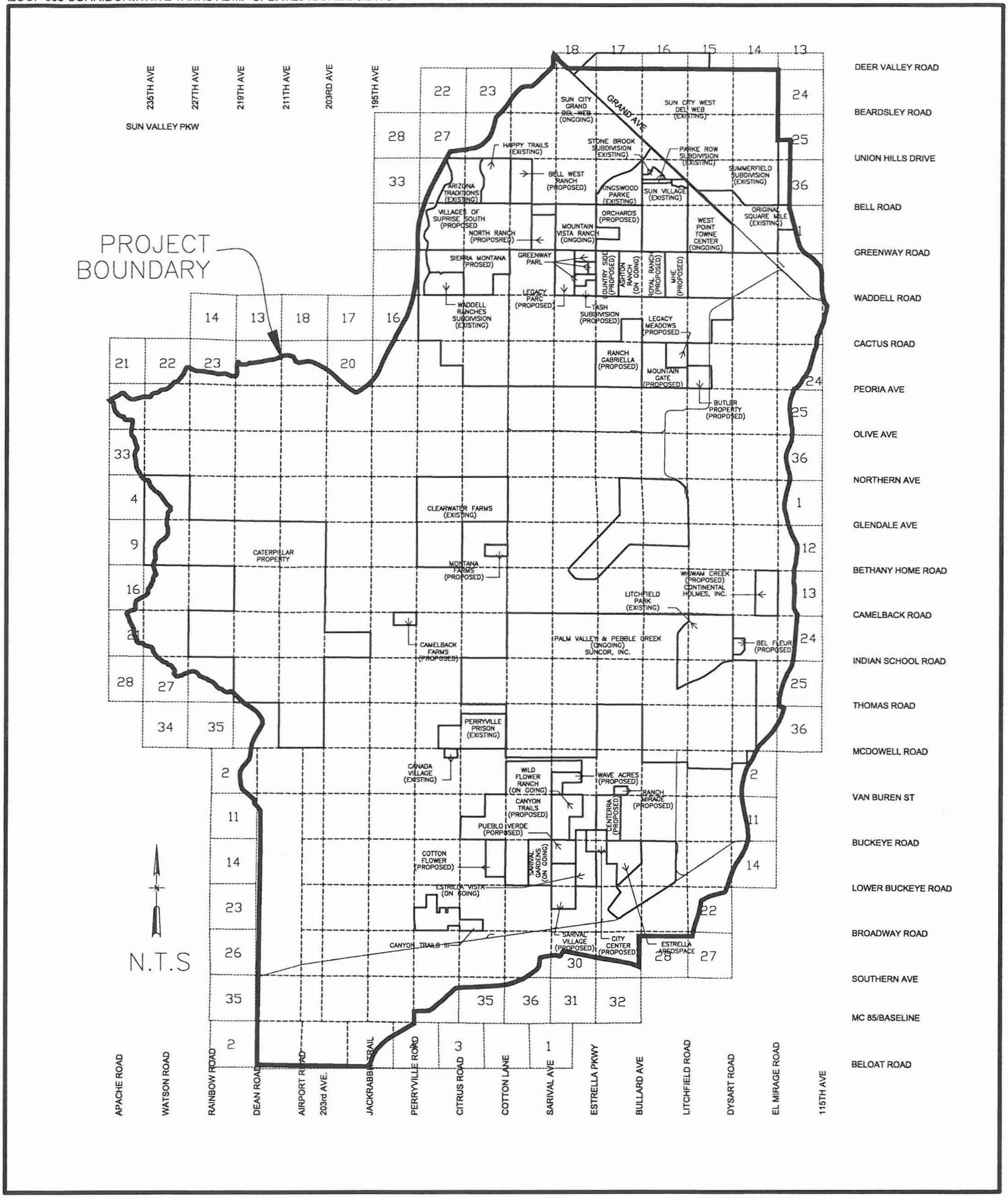
An evaluation of all existing and ongoing master-planned communities was made as to whether they have implemented recommended drainage from the original WTAF ADMP. If they have not followed the recommendations described in the WTAF ADMP, then a clear understanding of how they are affecting area-wide drainage patterns' concentrations and excess runoff volumes must be determined. This information is then incorporated into the existing and future condition hydrologic analysis and the final Loop 303 ADMP.

The results of the evaluation of the master-planned communties were complete as of March 2001. See Figure 2.3 on the following page.

Some local cities in the project area do not submit projects to the FCDMC for approval (Goodyear, Avondale and Glendale). These cities have been contacted separately in order to collect this type of information.

Private/Commercial Development — In the project area, there are many small private multi-family and subdivision developments as well as commercial development, which could modify runoff volume and affect existing drainage patterns. Although these developments taken individually may not cause significant problems to the overall hydraulic function of the project area, taken as a whole, they can have a significant adverse effect.

\LOOP 303 CORRIDOR\WHITE TANKS ADMP UPDATE\FIGURE 2-3.DWG



NOTE: ALL EXISTING DEVELOPMENT AS OF MARCH 15, 2000

EXISTING DEVELOPMENT MAP

URS

MAY, 2003

Figure 2.3

A comprehensive development scheme for the project area is crucial to minimizing the discontinuities currently present in the existing drainage infrastructure that characterizes the project area. If all of the small developments follow a clear and logically planned flood control strategy, they will work together to achieve a positive stormwater collection and disposal system. Likewise, if they do not follow an area-wide plan, the project area will continue to experience discontinuities in the stormwater collection and conveyance system, which may only serve to increase flooding to other developments and land.

We are presently working with FCDMC staff to obtain these documents. However, much of it is off-site being scanned and archived. We have contacted the other stakeholders as an alternative source of these data.

As-Built/Record Drawings — As-built information is important in verifying that the original design intent has been successfully constructed in the field. These data are used to ensure that the structure in question can operate according to its intended function and is providing the amount of capacity and potential protection in the original design.

To date, we have collected as-built information from FCDMC, MCDOT and Arizona Department of Transportation (ADOT). Below is a list of the facilities we have received as-builts and/or record drawings for:

- White Tanks FRS #4
- Dysart Drain Improvements Project
- Colter Channel
- RID Overchute Project
- ADOT Detention Basins
- Agua Fria River Channel Improvements
- Bullard Wash Outfall Channel

Record Search for Hazardous Waste Inventory — The proper storage and disposal of hazardous waste in the project area is important to the overall safety and well being of both the environment and the people living there.

Potential pollutant leaks, existing landfills and reported spills are identified so that stormwater conveyance systems do not inadvertently concentrate and convey pollutants to outfall areas where they may be directly or indirectly introduced into the groundwater table. This could result in a serious health hazard throughout the entire project area.

URS has completed an environmental review of the project locality using an area search strategy for the alternatives analysis. A project area outline was transmitted to a commercial site assessment firm, Vista Information Solutions. Vista searched for site listings from the US Environmental Protection Agency (EPA), National Priority List (NPL), and CERCLIS/NFRAP lists (Superfund), CORRACTS and RCRA Treatment Storage and Disposal facility database, the Arizona State NPL-equivalent (Water Quality Assurance Revolving Fund [WQARF]), registered hazardous materials spills and underground storage tank (UST) program. In addition, all solid waste landfills, incinerators and transfer stations and hazardous waste generators were located. In all, 385 sites were found in the subject area.

Reports were inspected on all located sites and the status of all regulated sites was noted. The two NPL sites and all WQARF sites are well characterized, actively used, and are undergoing active remedial investigations or clean-up actions. For this reason, it is extremely unlikely that any of the drainage structures or other features envisioned by the project will impact these sites.

Due to the large number of leaking underground storage tank (LUST) sites identified by the record search, the FCDMC agreed that these would not need to be shown on the exhibits submitted with this report. However, these sites should be considered when selecting the final alternative alignments.

For more detail, see Section 3.0.

Land Subsidence — All of the following information was paraphrased from a Technical Paper by the US Department of the Interior and the USGS, entitled "Investigation of Hydrogeology, Land Subsidence, and Earth Fissures, Luke Air Force Base, Arizona," by Herbert H. Schumann and Christie M. O'Day, dated 1995.

Land subsidence is the permanent lowering or sinking of the land surface that is common in areas where there is large-scale withdrawal of groundwater. Large, rapid depletion of water volumes present in an aquifer produce an increased effective stress on the deeper parts of the alluvial aquifer causing those strata composed of silt and clay particles to compress. This aquifer compression results in a measurable lowering of the land surface. In effect, land subsidence is a natural process that is accelerated by human activity. Land subsidence usually occurs at different rates that reflect the variance in adjacent underlying soil strata. This is referred to as differential settlement and can produce large earth cracks or fissures. Earth fissures may pose serious hazards to people, livestock, wildlife and engineering structures such as roads, streets, railroads, runways, canals, buried pipelines, storm drains, and sewers. Over the past 40 years, a significant amount of land subsidence has taken place in the Loop 303 ADMP project area.

Fissures act as drains or vertical pathways through which large volumes of stormwater runoff can be conveyed directly to the groundwater table. Large volumes of stormwater runoff flowing into fissures can cause them to erode and form gullies that are enlarged by slumping from erosion. Gullies formed in this way can be as much as 50 feet wide and 10-15 feet deep.

During floods causing stormwater runoff from the south side of Luke AFB, significant volumes of stormwater were discharged into an unlined oil/water separator drainage canal that is intersected by a large earth fissure. This fissure is located south of Luke AFB north of Camelback Road between Reems Road and Bullard Avenue. The fissure conveyed the stormwater containing volatile organic compounds (VOC's) into the groundwater. As a result, VOC's have been directly introduced to the groundwater table. So far, monitoring wells have showed concentrations of VOC's to be below clean-up action levels. Generally, deep water-supply wells present throughout the project area provide water quality suitable for most uses.

Around 1940, large-scale pumping in the Loop 303 ADMP project area began to have significant impacts on groundwater recharge. The increases in pumping resulted in water extraction rates that exceeded water recharge rates. From 1941 to 1961, water levels in the wells near Luke AFB dropped by 150 feet. By 1977, water levels had dropped more than 300 feet. The rate of decline was estimated to be approximately 13 feet/year. Groundwater in the project area is present in large quantities due to the properties of the sediments in this area. The highly permeable mixtures of clay, silt, sand and gravel-size materials that are more than 1,000 feet thick under much of the area can store large volumes of groundwater. Also, the unconsolidated sand and gravel deposits under the channel and floodplain of the Agua Fria River are highly permeable. These sediments are capable of transmitting large volumes of recharge through infiltration of streamflow and/or sewage effluent along the Agua Fria River.

Groundwater conditions prior to large-scale pumping in the area were in a state of dynamic equilibrium. That is, the long-term volumes of recharge were considered to be equal to the long-term volumes of discharge. Recharge was largely due to seepage in unlined irrigation channels, seepage due to excess irrigation water runoff, infiltration of streamflow, and groundwater underflow into the area. The flow directions of the groundwater from underflow into the area were from the northwest, north, northeast, and southeast. Groundwater underflow out of the project area was to the west between the White Tank Mountains and the Sierra Estrella. Groundwater was also being discharged through evaporation and transpiration.

Groundwater conditions subsequent to large-scale pumping indicated the movement of underflow into the area was similar to the patterns observed prior to large-scale pumping. By 1964, the underflow of groundwater out of the area had changed toward two major cones of depression that formed as a result of the large-scale pumping. One cone of depression is located southwest of Luke AFB and the other in the northern part of Glendale. Any recharge by the processes mentioned above moves toward these depression cones.

In 1991, a level survey of the western part of the Salt River Valley, including the Loop 303 ADMP project area, indicated as much as 18 feet of land subsidence had occurred at the intersection of Reems Road and Olive Road. This was the largest amount of subsidence ever measured in Arizona resulting from groundwater withdrawal. Differential land subsidence caused extensive damage to large underground storm drains located on Luke AFB and had to be replaced. Several culverts under roads around the base perimeter were filled with sediment seriously inhibiting conveyance capacity.

The Dysart Drain experienced some of the worst damage due to land subsidence. Portions of the drain invert sank as much as 12 feet over 33 years since its construction. The subsidence caused an adverse downstream slope along the axis of the drain. As a result, there was a decrease in the design capacity from 1,100 cubic feet per second (cfs) to 300 cfs. On September 20, 1992, a high-intensity storm caused major flooding at Luke AFB. Floodwater overtopped the Dysart Drain and spilled southward onto the Base and into housing facilities. Approximately 100 homes were inundated. The Base closed and ceased operations for three days, and flood damage cleanup was estimated in excess of $3 million. The Dysart Drain was reconstructed in 1995 to restore its original 100-year conveyance capacity. The total cost of reconstructing the facility was estimated to be approximately $16 million.

Another component that is believed to be impacting the rates of land subsidence and groundwater in the project area is the Luke salt body. The Luke salt body is large incompressible mass of halite that occurs in a crescent-shaped arc south and east of Luke AFB. Halite is sodium chloride or rock salt. The salt body has been confirmed to depths of 4,500 feet by drilling. The salt body has been mined commercially for years using solution-mining techniques. Due to the generally incompressible nature of the rock salt and the large amounts mined over the years, there has been speculation that the removal of this material has also contributed to local land subsidence.

The Luke salt body also impacts the way groundwater flows and its overall chemical make-up. The reduced thickness of alluvial sediments above the salt body and their compression due to the intrusion of the mass has greatly reduced their hydraulic conductivity. Based on this fact and the impermeable salt mass, very low water yield has been observed from existing wells in these areas. The salt body also causes unusually high salinity in water from wells east and south of Luke AFB. For example, water samples from these areas show dissolved solids concentrations of as much as 9,000 mg/L compared with 500 mg/L in wells located north and west of Luke AFB.

The need for detailed information regarding land subsidence is clear. It must be considered while designing facilities in the area to have a long-term useful life.

URS will continue to collect data on land subsidence by contacting other agencies such as the Natural Resource Conservation Service, formerly the Soil Conservation Service, Arizona Department of Water Resources (ADWR) and USGS and by comparing new surveys with past survey information.

Historic Flooding — Knowledge of historic flooding in the project area can help accomplish two equally practical goals.

First, it can provide a clear idea of the areas most susceptible to flooding in the project area. This is important and is used to assist us in identifying locations that are most in need of flood protection. Since financial resources are usually limited, the information will be to prioritize the areas in need of flood protection. In this way, funds can be allocated in a manner that will ensure flood protection takes place first in areas that most urgently require it.

Second, historic flood documentation can provide a powerful motivation to those in government to take action and spend the amount of money necessary to protect people and property throughout the project area.

The main source for historic flood information at this time is historic photographs found in the FCDMC archives. Some of these photos are from the flood in the early 1950's that motivated the design and construction of the White Tanks FRS #3 and #4, the McMicken Dam and the Dysart Drain. More recent photos from the flood in the early 1990's were also obtained. These photos document flooding on Luke AFB and other areas within the project area. See Figure 2.4 on the following page for the historic photos.

URS will continue to look for documentation regarding historical flooding during the course of this project. To date, there has been no search of public library archives or the local cities within the project area.

Traffic Regulations and Access Requirements — This information is necessary to determine public and private access requirements within and across the project for the ultimate build-out

Figure 2.4

Historic Flooding in the Loop 303 ADMP Project Area, 1951

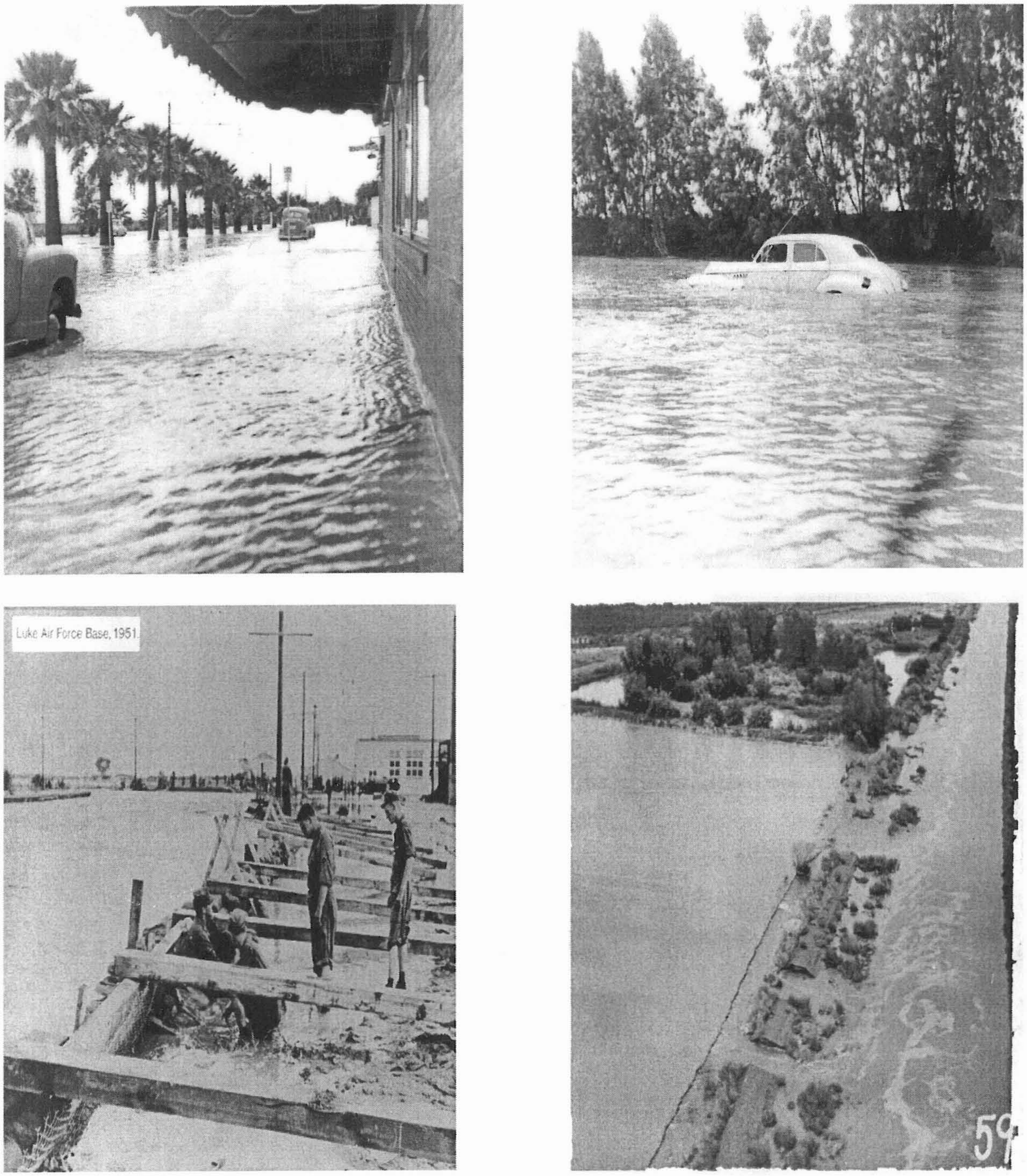
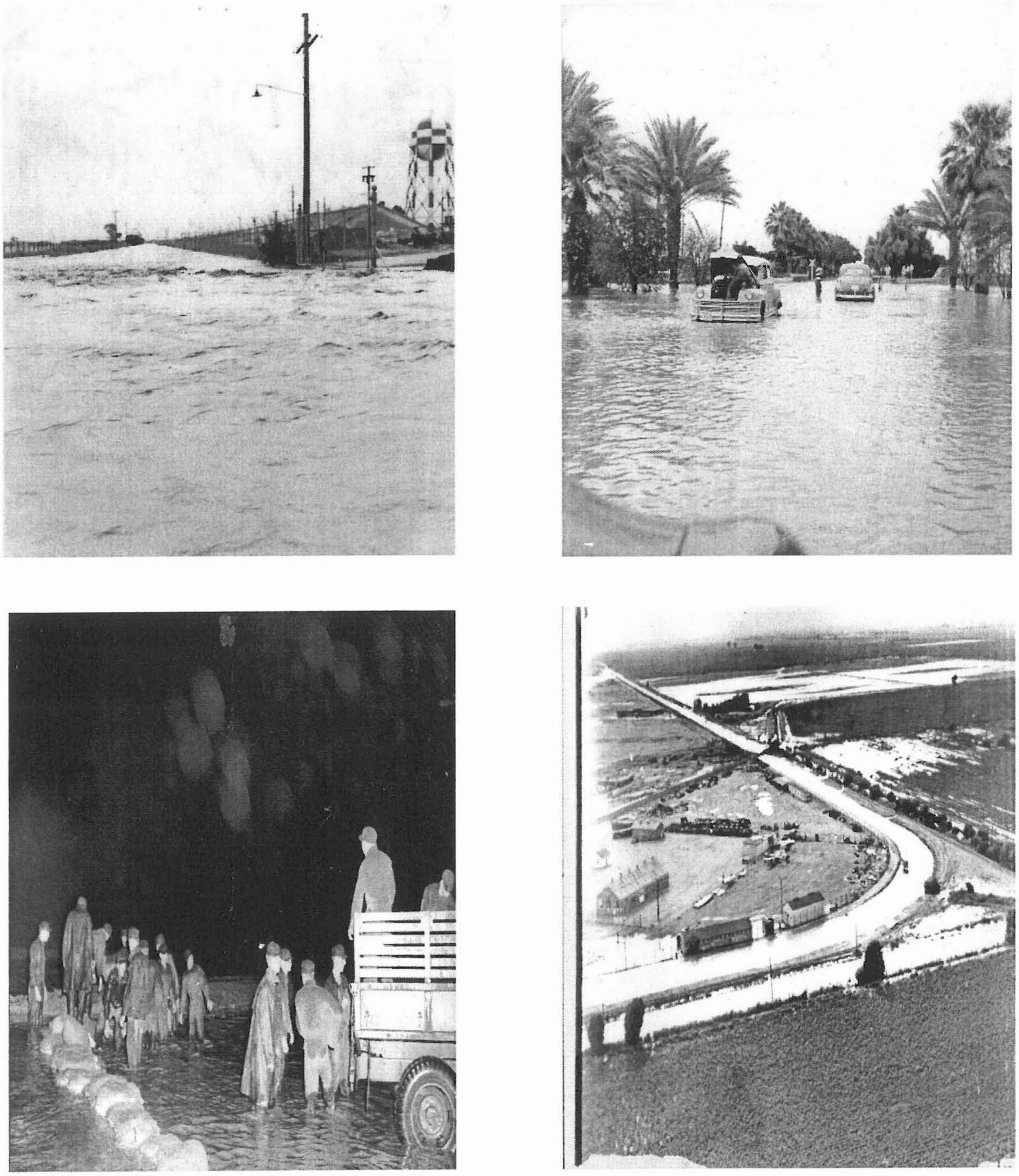


Figure 2.4

Historic Flooding in the Loop 303 ADMP Project Area, 1951



section for all proposed roadways. This portion of the data collection requires coordination and documentation of all aspects of the traffic requirements specific to any jurisdictional authority within the project limits. The data encompasses automobiles, rail, bicycles, horses and pedestrian travel modes.

The source of this information will be local county and city government. Below is a list of the city or agency and the regulations used by each:

City of Surprise –	Recommends the use of FCDMC technical specifications. Per phone conversation with Bret Huskey, 06/08/00.
City of Litchfield Park –	No regulations in place regarding this issue. Per phone conversation with Mike Cartsonis, 05/25/00, we can meet with him to discuss this issue during the project design phase if necessary.
City of Goodyear –	City of Goodyear Engineering Design Standards and Policies, July 22, 1997 – Chapter 4.
City of Avondale –	City of Avondale, Public Works Department Engineering Division, Engineering Design Standards.
City of Buckeye –	Per phone record 05/25/00 and 06/08/00, unable to obtain information.
City of El Mirage –	City of El Mirage uses the City of Phoenix *Barricade Manual* and the City of Glendale Specifications. They do not have any specifics regarding traffic/access. Per phone conversation with Larry Tisiac, 05/25/00.

Historical and Prehistorical Themes — The data to be used in evaluating historic and prehistoric themes in the study area are described in detail in Section 4.0 of the report.

Landscape Character, Land-Use/Multiple-Use Data — The scope of services requires that the Loop 303 ADMP incorporate current and historical landscape character/themes as possible. In addition, any opportunity for a multiple-use facility will be explored and included in the plan. Section 4.4 of this report contains the additional information on this topic.

The primary source of this information has been aerial photography, the GIS land use database, field reconnaissance, and land use information obtained from local cities within the project area.

If land uses obtained from local cities conflicted with those shown on the FCDMC GIS database, the land use from the city was used as the most current information. This information will be updated upon receiving the color aerial photography.

Environmental Permits and Approvals — Permits and approvals may be required from local, state and federal agencies. These agencies may include the Arizona Department of Environmental Quality, EPA, and US Army Corps of Engineers (COE). Once alternatives are developed, the type of permits required will be determined. This information will be included in the Level I Report.

Cultural Resources — An archaeological assessment was performed to determine the effects of each identified alternative on existing cultural resources. Section 4.2 provides detailed information on the findings of this assessment.

Ecological Assessments — Minimizing adverse impacts to existing sensitive ecological resources is a goal of this project. These resources include the vegetation present, wildlife, sensitive species and critical habitat, water resources and wetlands. Section 4.1 describes the finding of the Ecological Assessment.

2.1 OVERVIEW OF CURRENT CONDITIONS IN LOOP 303 PROJECT AREA

In recent years, there has been a significant increase in development activity in the project area. The data gathered by the project team will allow for a comprehensive comparison between the project area as it existed at the time of the original WTAF ADMP in 1995 and today.

2.1.1 Land Use

Currently the project area is dominated by agricultural land use with concentrations of single/multiple family residential and commercial development. Although this was also true at the time of the original WTAF ADMP in 1995, today there are more developments in the agricultural areas. There have also been several new projects that provide regional flood control and positive conveyance of both existing and future stormwater runoff.

To date, a significant amount of the existing agricultural land found within the Loop 303 ADMP project area is planned for future development. Therefore, it is reasonable to assume that the rate at which the area has been developing will only increase with time.

Section 5.0 includes additional detailed information on land use and zoning in the project area.

2.1.2 Existing Drainage Facilities

Drainage improvements are ongoing in the project area. The first flood control projects were constructed by the Soil Conservation Service (now known as the NRCS). These structures included McMicken Dam and White Tanks FRS #3 and FRS #4. Other drainage projects in place prior to the WTAF ADMP projects include the Dysart Drain, the ADOT (I-10) detention basins, various detention/retention basins on the Caterpillar property, and the original Camelback Road Channel.

Since the time of the original WTAF ADMP, there have been some significant improvements made to existing facilities as well as new designs that have been built or are currently under construction.

The more significant of the flood control/drainage facilities that have been recently constructed or are currently under construction include the following:

- Channelization of the Bullard Wash Outfall
- Litchfield Park Drainage Systems
- The RID Canal Overchute and Siphon
- The Colter Channel
- The Camelback Road Channel
- Portions of the Reems Road Channel
- Channelization of the El Mirage Wash and El Mirage Wash Tributary located within the City of El Mirage

Among these, the Colter Channel and RID Overchute have been confirmed to be complete on the first project field trip of December 1999. The remaining facilities listed are either under construction or nearly complete.

Below is a list of facilities which were existing at the time of the original WTAF ADMP but were identified as inadequate and have been recently improved to provide the level of flood protection and function that was originally intended.

- Dysart Drain
- White Tanks FRS #4 Inlet

These facilities are complete and were observed in the field during the first project field reconnaissance of December 1999.

All of the facilities listed above will be discussed in more detail on a region-by-region basis in Section 2.4. For a complete listing of existing/designed facilities, see the Existing Facilities Inventory, Table 2.2. For locations of the existing facilities in the project area, see the Existing Facility Map in Appendix D.

2.1.3 Recent Changes to Existing Flow Patterns Within the Project Area

The new projects listed in Section 2.1.2 had significant impacts on the flow patterns that existed at the time of the original WTAF ADMP in 1995. Although some of the design specific elements may have been changed from that recommended in the 1995 study, the general capacity and recommended alignments for each facility remain the same.

A brief description of the general impacts of each structure follows with more detail provided in Section 2.4. According to the best available data collected to date and documented by individual design reports, the structures listed have been designed for the 100-year storm event unless otherwise noted. See Table 2.2 on the following page.

- The channelization of the Bullard Wash Outfall is providing a regional 100-year outfall for the Bullard Wash that has been virtually eliminated by encroaching agriculture as well as the Goodyear/Phoenix Airport.
- The RID Overchute consists of a detention basin and channels that eliminate several breakouts of flow that occurred south over the RID canal inundating the property adjacent and to the south.
- The Colter Channel cuts off flow from the south side of Dysart Drain and conveys it east to the Agua Fria River. Previously, runoff continued overland to the southeast.
- The Camelback Road Channel conveys off-site flow from the south side of Colter Channel east to the Agua Fria River. Previously, runoff continued overland to the southeast.
- The portion of Reems Road being channelized reduced the width of the previously delineated floodplain. This reduction in floodplain limits happens as development occurs adjacent to Reems Road. Two areas have been channelized or proposed for channelization. The first is from Greenway Road to Hearn Road on the west side of Reems Road. This channelization protects the Greenway Parc at Surprise development by Legacy Land Development and Kaufman & Broad. The second channelization is

Table 2.2B
Existing Facilities Inventory
in the Loop 303 ADMP Project Area

Facility Name/Description	Channel/ Basin Width (ft)	Ponding/ Flow Depth (ft)	FB[8] Freeboard (ft)	Overtopping Bank Elevation (ft)	[3]Basin Volume (ac-ft)	[3]Basin Outflow (cfs)	[3]Outfall Structure (size)	[3]Footprint Area (ac)
Dysart Drain	Varies[6]		1 Subcritical 2 Supercritical 3 If Bermed above adjacent ground					
Falcon Dunes Golf Course					550 Ac*Ft	446 555 (Peak)	2 Barrell 6' x 6' Box	160
Reems Road Channel (Bell to Greenway)	28							
Reems Road Channel (Greenway to 330' N. of Acorn)	54		1					
Colter Channel	150 - 340[4]		1					
[1]Bullard Wash Outfall Channel	51.29 - 839.61[5]		1 Subcritical 2 Supercritical 3 If Bermed above adjacent ground					
ADOT Detention Basins	617	982.6	3.4					
Litchfield Detention Basin	1600	1064.9			88.7 Ac*Ft	92	42 " Pipe	
[1]Camelback Road Channel	71 - 106[7]	1.3 - 6.4	0					
RID Overchute	60	6.25 - 6.5						
McMicken Dam	9.33 Miles Long	34' max			30500 Ac*Ft		11' x 20" Ungated 2, 24" Pipes Gated	
White Tanks FRS #3		1199.1	10	Emerg. Spillway: 1209 Dam Crest Elev: 1212.1	850 Ac*Ft			
White Tanks FRS #4		1041.6	7	Emerg. Spillway: 1048.5 Dam Crest Elev: 1054.9	674 Ac*Ft			
Bell Road Channel	60 - 145							
[1]Indian Road Channel	72 - 107	6	0					
Caterpillar Property Retention Basin(s)	Varies	Varies	Varies	Varies	Varies	Varies	Varies	Varies

1. Facility is recently constructed
2. Facility is not yet on Existing Facilities Exhibit
3. Only for detention/retention basins
4. Value Scaled From Drainage Map
5. See Table E5.1 in Bullard Wash Channel Improvements, Technical Data Workbook Vol. 1
6. See Fig. 4 Dysart Drain Improvement Project 90% Plan Submittal
7. Right of Way Width
8. Based on limitations with HEC-1 modeling, this WSEL/Ponding depth may be underestimated. HEC-1 distributes the entire volume within the basin instantaneously and does not account for equalization time between the adjacent basins. Therefore, there may be a time before equalization when the WSEL within a portion of the basins is higher than this.

Table 2.2A
Existing Facilities Inventory
Loop 303 ADMP Update

Type of Facility:
CH = Channel
RB = Retention Basin
DB = Detention Basin
DAM = Dam

Facility Name/Description	Owner/Jurisdiction	Location City/Development Township, Range and Sections	Type	Design Event	Facility Capacity	Source	Approximate Date of Construction
Dysart Drain	MCFCD	Maricopa County / Luke AFB T3N, R1W 32 T2N, R1W 1-5	CH	100-year	448 - 3984 cfs	Dysart Drain Improvement Project 90% Plan Submittal By: Wood Patel Associates Inc. For: FCDMC September 94	
Falcon Dunes Golf Course	Luke AFB/MC	Maricopa County T3N, R1W 32	DB	100-year	407 Ac*Ft	Dysart Drain Improvement Project 90% Plan Submittal By: Wood Patel Associates Inc. For: FCDMC September 94	
Reems Road Channel (Bell to Greenway)	Private	City of Surprise T3N, R1W 5	CH	100-year	414 cfs	(RBF-2) Conditional Letter of Map Revision, Reems Road Mountain Vista Ranch Development, 12/99	
Reems Road Channel (Greenway to 130' N. of Hearn)	Private	City of Surprise T3N, R1W 6-7	CH	100-year	743 cfs	(CE-1) Drainage Report for Channelization of Reems Road Floodplain Greenway Road to Hearn Road and Conditional Letter of Map Revision Application, 6/8/99	
Colter Channel	MCFCD	Maricopa County T2N, R1W 13-15	CH	100-year	1,060 - 1,900 cfs	(As-Builts) Plans for the Construction of: Colter Channel, FCDMC, 8-23-93	
[1]Bullard Wash Outfall Channel	MCFCD	City of Goodyear T1N, R1W 17, 20, 29	CH	100-year	3,200 cfs	(WPA-1) Bullard Wash Channel Improvements, City of Goodyear, Maricopa County Arizona, Technical Data Notebook, Vol 2 of 2.	
ADOT Detention Basins	ADOT	City of Goodyear T1N, R1W 4,3	DB	50-yr, 24-hr	1,020 Ac*Ft	Offsite Drainage Design Report, Dibble and Associates Consulting Engineers, dated January 1976	
Litchfield Detention Basin	Litchfield Park	Litchfield Park	DB	100-year	88.7 Ac*Ft	Drainage Report for Litchfield Park Detention Facility By: Coe & VanLoo For: FCDMC March 90	
[1]Camelback Road Channel	MCDOT	Litchfield Park / County T2N, R1W 14 - 16 & 21 - 23	CH	100-year	135 - 725 cfs	Camelback Road Litchfield Road to El Mirage Road Final Drainage Report, 7/98, CBA	
RID Overchute	MCFCD	T2N, R1W 28	CH	100-year	1,456 cfs	RID Overchute Project Design Report, SFC Engineering, July 97	
McMicken Dam	MCFCD	T3N, R2W 1,12,13,24,25,36 T4N, R2W 23,24,26,27,34	DAM	100-year	30,500 Ac*Ft	McMicken Dam Flood Control By: Army Corp of Engineers For: Maricopa County Water Conservation District 55 - 56	Jul-56
White Tanks FRS #3	MCFCD	T2N, R2W 9	DAM	100-year	850 Ac*Ft	White Tanks / Agua Fria ADMS By: WLB Group For: FCDMC Oct 92	
White Tanks FRS #4	MCFCD	T1N, R2W 5	DAM	100-year	674 Ac*Ft	White Tanks / Agua Fria ADMS By: WLB Group For: FCDMC Oct 92	1954
[1]Indian Road Channel	SunCor	T2N, R2W 23,24 T2N, R1W 19,20	CH	100--year	[3]1,250/510 - 3,390/3,860	Addendum to Drainage Design Report for Palm Valley Phase II A Indian School Road Interim Condition Channel, WLB, 8/99	
Caterpillar Property Retention Basin(s)	Caterpillar		RB	Varies	Varies		

1. Facility is recently constructed
2. Facility is not yet on Existing Facilities Exhibit
3. Unclear as to which range of discharges actually used in construction. Field inspection would indicate the lower values.

adjacent to the Mountain Vista Ranch development from Bell Road to Greenway Road. The channelization protects the Mountain Vista Ranch development located on the West Side of Reems Road.

- The channelization of the El Mirage Wash and the El Mirage Wash Tributary was constructed to minimize the floodplain and allow development to proceed with a regional outfall in place. The ultimate outfall for these improved channels will be the Agua Fria River to the east.
- The Jackrabbit Trail Wash improvement was constructed to convey the 100-year stormwater runoff to the White Tanks FRS #4 inlet without breakouts. Prior to this improvement, the existing inlet channel could not convey the 100-year flow.
- The Dysart Drain improvement eliminated several areas along the alignment where stormwater was breaking out and flowing south. Luke AFB experienced some flood damage because of these breakouts in 1993 after a large storm event. The drain had lost over 70% of its original capacity due to land subsidence over its 33-year life.

In addition to the above flood control facilities, several large private developments such as Pebble Creek, Palm Canyon and Sun City Grand have been constructed or are under design that may be impacting existing flow patterns within the project area. The detailed information on these projects has not yet been obtained. The data will be included in the final report.

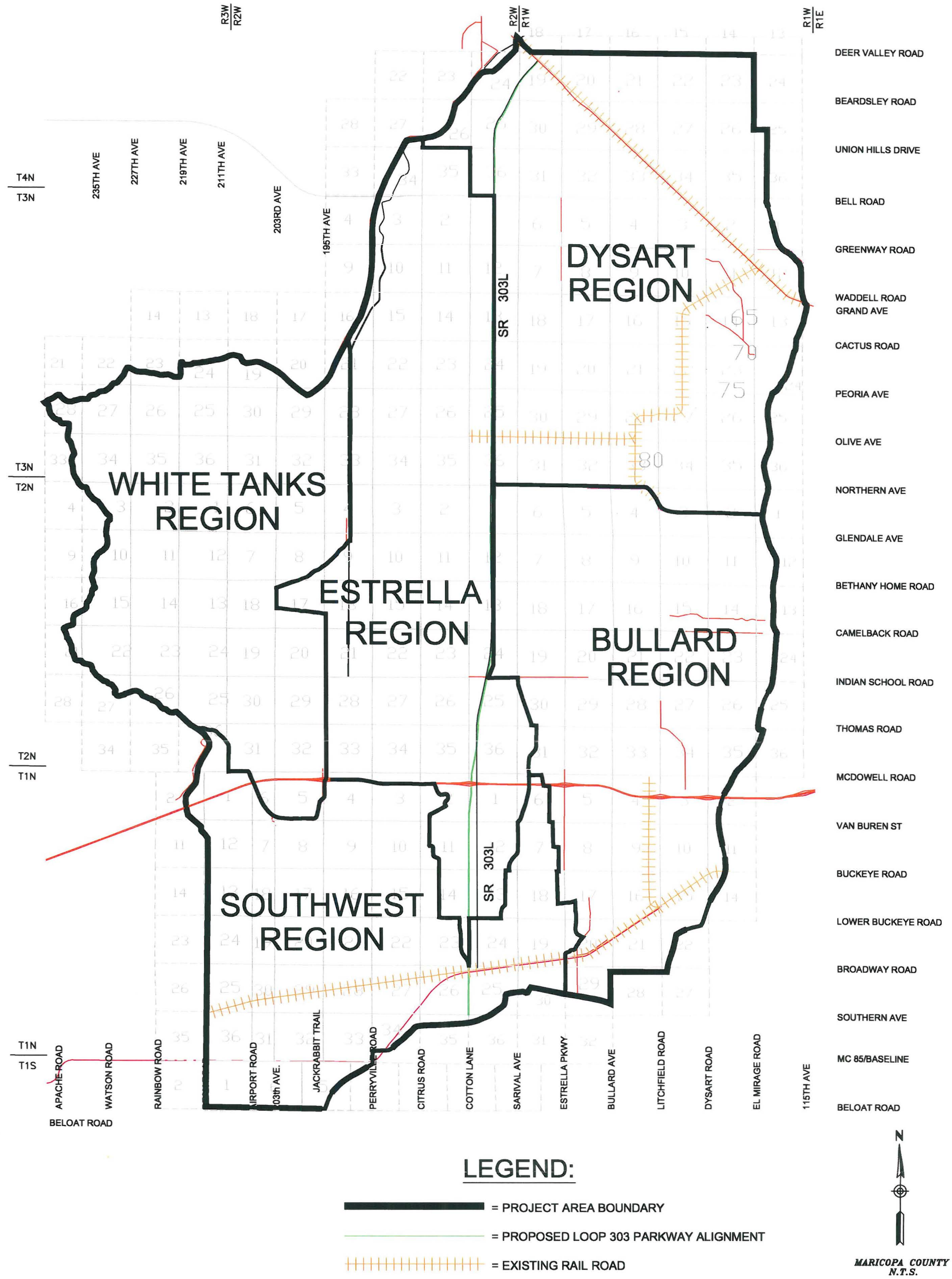
2.2 AREAS OF FLOODING AND POTENTIAL FLOODING

The study area is divided into five regions in discussing areas of potential flooding. These five regions are as follows:

1. White Tanks Region
2. Estrella Region
3. Dysart Region
4. Bullard Region
5. Southwest Region

2.2.1 White Tanks Region

The White Tanks Region (shown on Figure 2.5 on the following page) is bounded on the west by the White Tank Mountains ridge line; on the south by the existing White Tanks FRS #4; on the



LEGEND:

= PROJECT AREA BOUNDARY

= PROPOSED LOOP 303 PARKWAY ALIGNMENT

= EXISTING RAIL ROAD

= EXISTING STRUCTURE OR FACILITY

= FLOODPLAIN IDENTIFIED BY THE ORIGINAL WHITE TANKS ADMP, 1992

Project Regions

May, 2003

Loop 303 Corridor/White Tanks ADMP Update

FIGURE 2.5

Flood Control District of Maricopa County

URS

east by the Jackrabbit Trail Road alignment, White Tanks FRS #3, and the Beardsley Canal Wash; and on the north by the White Tank Mountains and the McMicken Dam.

The majority of identified flood hazards present in the White Tanks Region have been identified by the WTAF ADMS, October 1992, using a combination of the COE Hydrologic Modeling Software HEC-1, COE Hydraulic Modeling Software HEC-2, and 2-foot CI topographic mapping. These tools were used to identify areas of potential flooding. A small amount of actual flooding was documented by field observed erosion as part of the original WTAF ADMP, 1992. There is also a report by the COE that documents actual flooding during the summer of 1951. This flood inundated several areas in the White Tank Mountains and downstream, "McMicken Dam Flood Control," by the COE, 1956. The FEMA floodplain is delineated on the Existing Floodplain Map in Appendix D.

Areas of Flooding — The observed erosion occurred in two locations along the Tuthill Dike Wash. The first area of erosion occurred along the Tuthill Dike in the vicinity of McDowell Road. The second was located southeast of a Caterpillar Tractor Company retention basin north of McDowell Road along the west side of Tuthill Dike. Outlet flows from the retention basin have caused erosion along the toe of the dike and could eventually lead to failure of the dike.

While the documentation on the 1951 flood does not name actual flooded washes within the White Tanks Region, from its description of downstream damages to existing property and infrastructure, it is a reasonable assumption that many washes will overtop their banks during large storm events. There is also evidence of some alluvial fan activity along Osborn Road Wash within the Caterpillar property. The information documenting this activity is part of a geomorphological study performed by JE Fuller/Hydrology & Geomorphology, Inc. This information was included in the "Master Drainage Plan for the Caterpillar Property," by Wood, Patel & Associates, Inc., revised August 16, 1999.

To date, the data collection effort has not produced any other type of documented evidence of actual flooding in the White Tanks Region such as photographs or eyewitness accounts.

Areas of Potential Flooding — Using a combination of HEC-1, HEC-2, and 2-foot CI topographic mapping, approximate floodplains and flood hazards were identified for the White Tanks Region by the WTAF ADMS, 1992. Although most of the flood hazards identified by the original WTAF ADMS, 1992, should generally remain unchanged, results of a recent FCDMC study of the soil groups found within the White Tanks FRS #3 and #4 contributing watershed area indicated that runoff from these sub basins may be higher than the original ADMS predicted.

The major flood hazards identified by the WTAF ADMS, 1992, include the following:

- Beardsley Canal Wash
- Tuthill Dike Wash, Jackrabbit Trail Wash and all other channels that divert runoff to the White Tanks FRS #3 and FRS #4

Only one known physical change in the area has impacted the original flood hazards identified in the White Tanks Region by the original WTAF ADMS, 1992. This physical change involves the improvement made to the White Tanks FRS #4 inlet. Documented in a report by Dibble & Associates, July 1993, the improvement involved the channelization of Jackrabbit Trail Wash, which was discussed under Section 2.1.3 above. The channel was designed to intercept and convey runoff from the 100-year storm to the FRS #4. The existing Jackrabbit Trail Wash did not have sufficient capacity to convey the 100-year runoff.

It should be noted that the FRS #4 inlet improvement only extends one-quarter mile north of McDowell Road. The WTAF ADMS, 1992, documents flow breakouts at a location north of Camelback Road. In addition, the original WTAF ADMS, 1992, recommends that the existing Jackrabbit Trail Wash improvement be extended approximately 4,000 feet north of Camelback Road. This extension would intercept additional runoff that flows across Jackrabbit Trail and continues to the east. The extension would also allow the White Tanks FRS #3 to discharge via a pipe directly into Jackrabbit Trail Wash. This would provide a well-defined conveyance for stormwater that would otherwise go overland.

To date, there is no reason to believe that there have been changes to the floodplain delineation north of Thomas Road along Jackrabbit Trail Wash.

As previously noted above, a recent study conducted by the FCDMC, "Hydrologic Analysis for White Tanks Flood Retarding Structure No. 3 Watershed," dated May 11, 2000, indicated that the soil groups present within the contributing watersheds of White Tanks FRS #3 and #4 may have less infiltration capacity than originally modeled. If this is in fact the case, increased surface runoff and therefore increased inflow volume to the White Tanks FRS #3 and #4 may result. The data from the FCDMC study have been incorporated into the "White Tanks FRS #3 Modifications Design Project," by Dames & Moore, FCD Contract #98-11.

The existing floodplain delineations are shown on the Existing Floodplain Map in Appendix D.

2.2.2 Estrella Region

The Estrella Region (shown on Figure 2.5) is bounded on the west by the White Tanks Region; on the north by the McMicken Dam and the Dysart Region; on the east by the Dysart, Bullard and Southwest Region(s); and on the south by the Southwest Region. This 37-mile corridor has been chosen as the location for the proposed Loop 303 parkway alignment. The corridor presents a unique opportunity to cut off stormwater runoff from the west and convey it downstream to the Salt/Gila River. Currently, MCDOT is coordinating with ADOT in developing the typical sections for the proposed roadway. An interim two-lane roadway was constructed along the proposed Loop 303 corridor from Thomas Road north to Grand Avenue in the early 1990's.

Aside from some minor development that has occurred in the most northern portion of the Estrella Region, there has been very little change in this area since the original WTAF ADMS, 1992. The Arizona Traditions subdivision/golf course and Great Eagle (formerly Happy Trails) golf course at the northern tip of this region may have affected existing condition flow paths slightly, but no significant impacts to the floodplains established downstream by the WTAF ADMS, 1992, are anticipated (Existing Floodplain Map in Appendix D).

Areas of Flooding — Flooding that occurred during the summer of 1951 has been documented in the COE report discussed in Section 2.2.1. This flood inundated several areas in the White Tank Mountains and downstream, "McMicken Dam Flood Control," by the COE, dated 1956. Some photographs of this event show widespread shallow to moderately deep flooding in the area. These photographs are being scanned for URS by the FCDMC and have not yet been received. Although the photographs do not specifically refer to the Estrella Region, they show areas downstream. It is very reasonable to assume similar flooding occurred in this area as well.

To date, the data collection effort has not produced any other evidence of actual flooding in the Estrella Region such as photographs, newspaper articles and/or eyewitness accounts.

Areas of Potential Flooding — Using a combination of the COE Hydrologic Modeling Software HEC-1, COE Hydraulic Modeling Software HEC-2, and 2-foot CI topographic mapping, approximate floodplains and flood hazards were identified for the White Tanks Region by the WTAF ADMS, 1992. Although the flood hazards identified by the original WTAF ADMS, 1992, should generally remain unchanged, results of a recent FCDMC study of the soil groups found within the White Tanks FRS #3 and #4 contributing watershed area show that runoff from these sub basins may be higher than the original ADMS predicted. See the "Hydrologic Analysis for White Tanks Flood Retarding Structure No. 3 Watershed," dated May 11, 2000 for more information. This could result in higher discharges at places where flow from the White Tank

Mountains watershed break into the Estrella Region. These locations are generally along the Beardsley Canal where most of the discharge from the White Tanks is directed south with some overtopping at a few locations. These overtopping flows are modeled by diversions in the HEC-1 software and continue to the east.

The areas of potential flooding identified by the WTAF ADMS, 1992, include the following:

- Ponding areas along Cotton Lane Wash
- Perryville Road Wash
- 191st Avenue Wash
- The RID and I-10

The approximate limits of the ponding along the west side of Cotton Lane extend from a point just south of Greenway Road downstream to Indian School Road. Large amounts of flow break out at major intersections along the alignment. These breakouts tend to either flow east on the intersection roadway and/or over land to the southeast.

The detailed ponding limits along Perryville Road Wash began at an agricultural reservoir located one-half mile west of Citrus Road along the north side of Camelback Road. The floodplain extends north along the west side of Perryville Road Wash to Northern Avenue where flow breaks out from the Beardsley Canal Wash which is located in the White Tanks Region of the project area. Large amounts of flow break out at major intersections along the alignment. These breakouts tend to either flow east on the intersection roadway and/or over land to the southeast.

The ponding limits for the 191st Avenue Wash begin downstream at I-10 and continue up to approximately Bethany Home Road. As with the previous two floodplains, large amounts of flow break out at major intersections along the alignment. These breakouts tend to either flow east on the intersection roadway and/or overland to the southeast.

2.2.3 Dysart Region

The Dysart Region (shown on Figure 2.5) is located within the northern portion of the project area. It is bounded on the north by Grand Avenue, on the west by the Estrella Region, on the south by the Bullard Region, and on the east by the Agua Fria River. Prior to the construction of the McMicken Dam, this region experienced infrequent flooding from stormwater runoff generated within the White Tank Mountains. Floodwaters generated in these areas would flow downstream and discharge to the long, flat farmland which characterized the majority of this area. As development continued, the need for flood control became a greater priority.

Areas of Flooding — Flooding that occurred during the summer of 1951 has been documented by the COE report discussed in previous sections. This flood inundated several areas in the White Tank Mountains and downstream, "McMicken Dam Flood Control," by COE, dated 1956. Some photographs of this area show widespread shallow to moderately deep flooding in the area. Although the photographs do not specifically refer to the Dysart Region, they show areas just downstream. Therefore, it is reasonable to assume similar flooding occurred in this area as well.

To date, the data collection effort has not produced any other type of documented evidence of actual flooding in the Dysart Region such as photographs, newspaper articles and/or eyewitness accounts.

Areas of Potential Flooding — Using a combination of the COE Hydrologic Modeling Software HEC-1, COE Hydraulic Modeling Software HEC-2, and 2-foot CI topographic mapping, approximate floodplains and flood hazards were identified for the White Tanks Region by the WTAF ADMS, 1992. Based on all data available to date, the flood hazards identified by the original WTAF ADMS, 1992, have changed slightly.

The areas of potential flooding identified by the WTAF ADMS, 1992, include the following:

- The ponding area on the north side of the Atchison Topeka and Santa Fe Railroad (AT&SF)
- The existing floodplain along the Agua Fria River
- The floodplain along the Lower El Mirage Wash Tributary
- The floodplain along Reems Road
- The floodplain along the west side of the AT&SF south of Waddell Road
- The ponding on the north side of the Dysart Drain

Since the WTAF ADMS, 1992, some improvements in the Dysart Region have or may have changed the floodplain delineations from those shown on the current FIRM panels which were based on the WTAF ADMS, 1992. Conceptually, these improvements generally followed the recommendations set forth by the WTAF ADMS, 1992, and therefore any changes to the floodplain should be consistent with what was intended in the WTAF ADMP, 1995 (Existing Floodplain Map in Appendix D).

Improvements Affecting Existing Floodplains — Recent improvements to the Dysart Drain resulted from lost capacity over time due to a significant amount of land subsidence in the area. The improvements have resulted in the containment of the 100-year floodplain within the Dysart Drain channel section. In addition to this, the channel has been built with excess capacity in anticipation of potential future subsidence.

Another area experiencing floodplain changes is along Reems Road. Two developments have submitted proposed designs for reducing the Reems Road floodplain by channelization on the west side of the road. The first proposed channel is from Greenway Road to Hearn Road. This channel will protect the Greenway Parc at Surprise development by Legacy Land Development and Kaufman & Broad. The second channel is adjacent to the Mountain Vista Ranch development from Bell Road to Greenway Road. These improvements were recommended as part of the WTAF ADMP, 1995. Both projects have submitted CLOMR's that shows the reduction of the floodplain due to the proposed channelization adjacent to each.

Another channel constructed along the Lower El Mirage Tributary Wash from Dysart Road to West Point Parkway prompted a LOMR and subsequent update to FEMA Flood Insurance Rate Map(s), 4013C1165 G and 4013C1605 G in October 1997. This channel was part of the development of the West Point Towne Center, a master plan community in the City of Surprise.

The channelization of the El Mirage Wash and the El Mirage Tributary was recently completed. This project provides positive conveyance and reduced floodplains along these existing wash alignments. There will also be a proposed multi-use park/detention basin facility. The off-line detention basin will attenuate peaks downstream in the existing natural wash ultimately discharges into the Agua Fria River. An application for a CLOMR was submitted on January 18, 2000.

As a continuation of the channelization of the floodplain along Reems Road from Greenway to Cactus, the "Reems Road Project," which is a joint project between the FCDMC and the City of Surprise, is currently recommended for inclusion in the FCDMC's CIP.

Reems Road has always been intended to convey stormwater runoff. This is evident by its construction as an inverted crown. Inverted crowns are typically used in areas where the road is relied upon to positively convey large storm flows to a regional drain or outfall. Recently, the floodplain delineation shown along Reems Road north of Bell Road was eliminated through a Letter of Map Revision obtained in 1998 for Sun City Grand. Additionally, the portion of Reems Road between Bell Road and Greenway Road no longer has the capacity to contain the current 100-year floodplain (FEMA Application and Technical Analysis Volume II – Hydraulic

Analysis; Conditional Letter of Map Revision, Reems Road, Mountain Vista Ranch Development, by Robert Bein, William Frost and Associates, 12/99). This is due in part to the disappearance of the berm that was present along the east side of the road at the time of the original White Tanks ADMS/ADMP. This berm contained a large amount of flow. The other reason for the lack of conveyance of the Reems Road channel in this location is due to the regrading of Reems Road from due north north of Bell Road to the northeast. This results in increase to the contributing drainage area by approximately 30%.

2.2.4 Bullard Region

The Bullard Region (shown on Figure 2.5) is bounded on the west by the Estrella and Southwest regions; on the north by the Dysart Region; on the south by the Gila/Salt River and on the east by the Agua Fria River.

While some flood hazards within the Bullard Region have been documented by historic photographs of actual flood events and eyewitness accounts, the majority of flood hazards have been determined by a combination of detailed and approximate floodplain studies prepared for the major watercourses within the area (Existing Floodplain Map in Appendix D).

Areas of Flooding — Some areas that have been documented to be historically susceptible to flooding in this region are Litchfield Park, Goodyear, Avondale and Luke AFB. Photographs from the 1951 flood, which prompted the design and construction of the White Tanks FRS #3 and #4 and the McMicken Dam, show widespread flooding that occurred in the Bullard Region. Another set of photographs shows the less severe flooding that occurred after a storm event in September 1992. Several breakouts took place along the Dysart Drain and flooded areas downstream including Luke AFB. In addition to the photographs from September 1992, the aftermath of the flooding is documented by the FCDMC on a VHS tape entitled, "Sep 19-20, 1992 Floods/Dysart Drain, Camelback Drain."

Although the above flooding represents the results of severe storm events, smaller, more frequent events have also caused flooding in the area. One such area prone to this type of flooding is the Tierra Buena Subdivision. In a documented telephone conversation on January 21, 2000, with the spokesman for the subdivision, Bill Lawrence, URS learned that this subdivision has recently experienced flooding.

Mr. Lawrence explained that his subdivision, located at Camelback and 129th Avenue, was originally designed to drain into a small earthen V-ditch at the southeast corner of the property. The V-ditch was designed to convey stormwater runoff from the Tierra Buena Subdivision south across an open piece of property currently owned by SunCor developers. Apparently, the ditch has been neglected and, due to lack of maintenance, its capacity to effectively convey stormwater runoff away from the Tierra Buena Subdivision has virtually been eliminated. According to Mr. Lawrence, two to three homes in the subdivision have experienced approximately 3 inches of flooding as a result of at least two or three different storm events. Subsequently, there was some property damage associated with these floods. During the conversation, Mr. Lawrence expressed open frustration and bitterness about the fact that no one was doing anything to fix the problem.

Areas of Potential Flooding — Using a combination of the COE Hydrologic Modeling Software HEC-1, COE Hydraulic Modeling Software HEC-2 and 2-foot CI topographic mapping, approximate and detailed floodplain maps were prepared for the Bullard Region by the WTAF ADMS, 1992.

Since the time of the WTAF ADMS, 1992, there has been a significant amount of activity in the Bullard Region that has resulted in changes to the conditions as they existed in 1992. To date, it appears that development has followed the WTAF ADMS, 1992, and therefore the changes to floodplains and associated hazards are what the study recommended. Since data are still being collected, this conclusion is tentative and may change if information contradicting it becomes available in the future.

The major floodplains and hazards identified by the WTAF ADMS, 1992, and recent information include the following:

- Ponding behind the Airline Canal
- Flooding along Dale Creek Wash (also called Litchfield Wash)
- Shallow flooding along the Bullard Wash Floodplain
- Breakout flows from Dysart Drain
- Inadequate conveyance capacity at the Bullard Wash outfall
- Ponding behind the Southern Pacific Railroad
- Ponding behind the RID Canal
- Inadequate capacity of existing channel along Camelback Road
- The Agua Fria River Floodplain
- The Litchfield Detention Basin

Several improvements have taken place since 1992 that have significantly altered some of the above-mentioned floodplain/hazards.

Currently, the FCDMC is constructing improvements along the Bullard Wash outfall from Lower Buckeye Road south the Gila/Salt River. These improvements consist of a well-defined lined channel along the existing Bullard Wash alignment that will significantly reduce the floodplain in this area. There is also a small lateral channel that will alleviate ponding behind the Southern Pacific Railroad. A CLOMR has been prepared and submitted.

Improvements to the Dysart Drain have significantly reduced the flood hazards which were present downstream at the time of the original WTAF ADMS, 1992. These improvements involved a complete reconstruction of the existing channel profile which had experienced as much as 12 feet of subsidence over 33 years. As a result of this subsidence, the channel capacity was diminished from 1,100 cfs to approximately 300 cfs. This resulted in flow breaking out of the channel at several locations and flooding areas downstream (south). The photographs discussed above from 1993 document this type of flooding.

The RID Overchute facility was constructed to alleviate flooding behind the RID canal between Litchfield Road and Dysart Road just south of Litchfield Road. This facility also serves as a positive outfall for the area draining to it. Ultimately, flow is conveyed south to the existing four ADOT retention/detention basins located adjacent to I-10 on the north.

The design and construction of the Colter Channel has also significantly altered flowpaths and floodplains since 1992. The Colter Channel, located approximately one-quarter mile north of Camelback Road, was designed to reduce stormwater runoff concentrations at Camelback Road. The channel is designed to collect and convey the 100-year runoff from the drainage area north. The current published FIRM panel does not reflect the effect of the Colter Channel on the floodplain; however, FEMA has accepted a LOMR for the Colter Channel, May 3, 1996. The next printing of the map will reflect this change in the floodplain.

Camelback Road is currently being improved from approximately Litchfield Road east to the Agua Fria River. As part of the roadway improvements, MCDOT is including a drainage channel on the north side of the roadway. The channel is designed to intercept and convey runoff from the area north between the existing Colter Channel and Camelback Road. The effect of this improvement is to route floodwaters east to the Agua Fria River and protect Litchfield Park from off-site flooding.

There are other improvements to the Bullard Wash outfall that are under construction will significantly reduce the floodplain limits currently shown on the FEMA FIRM panel in this area.

The improvements are being done from approximately Lower Buckeye Road to the Gila River outfall. These improvements are consistent with those recommended under the original WTAF ADMP, 1995. A CLOMR reflecting the floodplain changes was prepared for the Bullard Wash outfall by JE Fuller/Hydrology & Geomorphology, November 1998.

All of the above changes/improvements have altered the current published FEMA FIRM panels for this area. However, the changes seem to be consistent with those recommended by the WTAF ADMS, 1992.

2.2.5 Southwest Region

The Southwest Region (shown on Figure 2.5) is bounded on the west by Dean Road and the White Tank Mountains; on the north by the White Tanks Region, the Estrella Region and the Bullard Region; and on the south by the Gila/Salt River.

While some flood hazards within the Southwest Region have been indirectly documented by historic photographs, the majority of flood hazards have been determined by a combination of detailed and approximate floodplain studies prepared for the major watercourses within the area (Existing Floodplain Map in Appendix D).

Since the time of the WTAF ADMS, 1992, there has been very little activity in the Southwest Region that has resulted in changes to the conditions as they existed in 1992. To date, URS has found no data to suggest that any of the floodplains delineated as part of the WTAF ADMS, 1992, have been altered. Since data are still being collected, this conclusion is tentative and may change if information contradicting it becomes available in the future.

Areas of Flooding — Currently, URS has not uncovered any direct documentation of flooding in this region.

Areas of Potential Flooding — The major floodplains and hazards identified by the WTAF ADMS, 1992, and recent information include the following:

- Ponding behind the RID Canal
- Ponding behind the Buckeye Irrigation District (BID) Canal
- Ponding behind the Southern Pacific Railroad
- Accumulation of runoff in low-lying area south of the BID

- Concentrated flows from culverts under I-10
- Shallow flooding in agricultural areas where there are no well-defined channels

To date, there have been no known changes to these floodplains.

2.3 EXISTING/FUTURE DRAINAGE FACILITIES

A significant effort was spent on obtaining documentation on all existing and proposed facilities in the ADMP Update project area. This information is essential to accurately represent what is happening in the project area. As above, the existing/future facilities will be discussed on a region-by-region basis. See the Existing Facilities Exhibit.

2.3.1 White Tanks Region

Figure 2.5 shows the location of the Dysart Region relative to the overall project area.

Existing Facilities — The following facilities currently exist in the White Tanks Region:

- Several retention/detention basins on the Caterpillar Property
- The White Tanks FRS #3
- North Fork Bedrock Wash
- White Tanks FRS #4
- Caterpillar Dike Wash (renamed Diversion Dike Wash)
- Caterpillar Wash (renamed Osborn Road Wash)
- Jackrabbit Trail Wash – White Tanks FRS #4 Inlet
- Bulldozer Wash
- Tractor Wash
- White Granite Wash
- North Fork White Granite Wash
- White Tanks No. 3 Wash
- North Fork Cholla Wash
- Waterfall Wash

- Cholla Wash
- Beardsley Canal Wash

The White Tanks FRS #3 and #4 are the most significant of the existing facilities in the White Tanks Region. These FRS's were constructed to provide flood protection to properties downstream after several severe storms in August of 1951 caused an estimated $3,000,000 in property damage. Both facilities are currently owned by the FCDMC. Each facility has capacity in excess of the 100-year storm event. White Tanks FRS #3 is located at the southwest corner of the intersection of the Glendale Avenue Alignment with the 191st Avenue Alignment. White Tanks FRS #4 is located at the northwest corner of Van Buren Street and Jackrabbit Trail.

The White Tanks FRS #4 inlet along Jackrabbit Trail was designed and constructed to intercept and convey the 100-year stormwater runoff south the White Tanks FRS #4. This channel was part of the WTAF ADMP, 1995. Although the ADMP recommended the channel extend as far north as 1,000 feet north of Camelback Road, this improvement ends at approximately Thomas Road.

Several dikes, berms, diversion channels, retention basins, etc., exist in this region. These structures were constructed by the Caterpillar Tractor Company as a means to test its equipment (WTAF ADMS, 1992).

All the other existing drainage corridors are natural washes.

Future/Proposed Facilities — At this time there are no known proposed drainage facilities or structures in this area.

2.3.2 Estrella Region

Figure 2.5 shows the location of the Dysart Region relative to the overall project area.

Existing Facilities — The following facilities currently exist in the Estrella Region:

- Beardsley Canal Wash
- Cotton Lane Wash
- Perryville Road Wash
- 191st Avenue Wash
- RID Canal

The Perryville Wash, Beardsley Canal Wash and 191st Avenue Wash are all existing diversion channels that collect and convey stormwater. None of these existing facilities has the capacity to convey the 100-year stormwater runoff. Ownership of these facilities is unknown.

The Cotton Lane Wash is merely an existing corridor of ponded water that generally flows south once it achieves a certain level of head against the AT&SF which runs parallel to the roadway. The corridor runs from approximately Waddell Road south to Indian School Road.

The RID Canal is used for the conveyance of irrigation water and is not designed to convey stormwater runoff. The canal is elevated above adjacent ground and stormwater ponds on the upstream (north) side.

Future/Proposed Facilities — To date, the only facility proposed for design in the Estrella Region is the Loop 303 parkway. This roadway will be built by MCDOT and with ADOT retaining control of the right-of-way. These two agencies are currently working together to determine the typical section that will be used to build the roadway.

The WTAF ADMP, 1995, proposed a large drainage channel/corridor be constructed adjacent to the future Loop 303 parkway. This alternative will be explored further in the alternatives analysis portion of this report.

2.3.3 Dysart Region

Figure 2.5 shows the location of the Dysart Region relative to the overall project area.

Existing Facilities — The following facilities currently exist in the Estrella Region:

- Reems Road Channelization (multiple reaches)
- Lower El Mirage Wash and Tributary Channelization
- Dysart Drain Tributary
- Channel along the Lower El Mirage Tributary Wash from Dysart Road to West Point Parkway

The Reems Road channelization recommendation in the original WTAF ADMP, 1995, was to be an earthen channel from approximately Bell Road to a proposed detention basin at the northeast corner of Northern Avenue and Reems Road. To date, two sections of the channel are being designed. As stated above in Section 2.1.3, the sections of Reems Road from Greenway Road to

Hearn Road and from Bell Road to Greenway Road are part of commercial development taking place on the west side of Reems Road.

The Dysart Drain Tributary is a natural wash that discharges to the Dysart Drain about one-half mile upstream of the drain's outlet to the Agua Fria River.

The channel along the Lower El Mirage Tributary Wash from Litchfield Road to West Point Parkway on the north side of Greenway Road was proposed in conjunction with the development of the West Point Towne Center.

Future/Proposed Facilities — The following facilities have been proposed and will be either under design or construction in the near future.

- Waddell/Lower El Mirage Wash Project
- The Reems Road Channel Project
- Channelization of the Lower El Mirage Wash and Tributary
- North-south channel to connect the Lower El Mirage Wash Tributary with the Lower El Mirage Wash

The Waddell/Lower El Mirage Wash Project involves several channels that work together as a single system to collect and convey stormwater runoff to the Lower El Mirage Tributary inlet. Although this project has been recommended for inclusion in the FCDMC's capital improvement plan for the fiscal year 2000-2001, it is not yet clear if the FCDMC will be involved with this project or not.

Some of the proposed channels are portions of the recommended channels from the WTAF ADMS, 1992. These include the channel along Dysart Road from the Lower El Mirage Tributary inlet north to Waddell Road, the channel along Waddell Road from Dysart Road west to Litchfield Road, and the channel along Litchfield Road from Waddell Road north to Greenway Road. The last proposed channel was an addition to what was recommended by the WTAF ADMS, 1992. This is a channel that comes into the channel proposed from Dysart Road west to Litchfield Road at 90 degrees from the north along the one-half section line of Section 10.

The Reems Road Project is currently recommended for inclusion in the FCDMC's capital improvement plan for the fiscal year 2000-2001. This project includes the channelization of the existing Reems Road Floodplain from Greenway Road south to Cactus Road.

The channelization of the Lower El Mirage Wash and Tributary are part of a multi-use plan which will seek to combine the channelization of the Lower El Mirage Wash and Tributary with some sort of park or recreational corridor

2.3.4 Bullard Region

Figure 2.5 shows the location of the Bullard Region relative to the overall project area.

Existing Facilities — The following facilities currently exist in the Estrella Region:

- Litchfield Park Detention Facility
- RID Overchute and Siphon
- Bullard Wash and Bullard Wash Outfall
- ADOT Detention Basins
- Dysart Drain Improvement
- Dysart Road Channel

The Litchfield Park Detention facility was constructed in 1991 and took the place of the old Litchfield Park Dam. The detention basin was part of the "City of Litchfield Park Master Drainage Study Report," by Wildan Associates, March 1989. This facility intercepts stormwater runoff from Dale Creek Wash.

The RID Overchute facility was proposed as an option in the "City of Litchfield Park Master Drainage Study Report," by Wildan Associates, March 1989. However, the facility was finally designed by SFC Engineering Corporation for the FCDMC in July 1997. The purpose of this existing facility is to allow concentrated stormwater runoff to outfall over the existing RID canal. South of the overchute, flow is conveyed by an existing earthen ditch and overland for approximately one-half mile. At Thomas Road, the flow is intercepted by the existing channel through the Palm Valley development golf course. South of Palm Valley, the flow is conveyed by an earthen channel for approximately one-quarter mile and outfalls into the existing ADOT basins.

The Bullard Wash and Bullard Wash Outfall is a natural watercourse whose downstream conveyance has been "choked" as a result of gradual encroachment by adjacent agricultural farms, development, and the Goodyear Airport. The upper reach of the Bullard Wash is a well-defined, manageable floodplain (however wide and shallow). The outfall mentioned above is currently being channelized as part of a FCDMC project and is designed to convey stormwater runoff from the 100-year storm event.

The ADOT Detention Basins were constructed as part of the I-10 roadway to provide flood protection for the highway. The four detention basins were excavated on the north side of I-10 between Bullard Avenue and Dysart Road and have capacity for the 100-year stormwater runoff. They are drained by a 48-inch storm sewer pipe that discharges to the Agua Fria River at Van Buren Street (WTAF ADMP, 1995).

The Dysart Drain improvement, completed in the mid 1990's, was a restoration of an existing flood control facility. Land subsidence in the area had diminished the capacity of the facility from 1,100 cfs to 300 cfs. The recent improvement, which included a large detention basin and collector channel at the upstream end, has restored the drain capacity to the 100-year storm event.

The Dysart Road Channel improvement was constructed by MCDOT as part of their improvements to Dysart Road. The channel discharges to a series of detention basins along the north side of the RID Canal.

2.4 EXISTING AND FUTURE DEVELOPMENTS

One of the most important aspects of the data collection for the Loop 303 ADMP is a comprehensive analysis of recent and currently planned development. Before any regional flood control system can be designed and constructed, an up-to-date hydrologic model must be created. The model must incorporate recently constructed and currently planned facilities as well as reflect both recent and proposed development. Section 3.0 of this report describes the hydrologic model.

Another reason for the incorporation of the drainage characteristics associated with existing and proposed developments is to minimize the discontinuity in the drainage system as a new flood control plan is implemented. The intent is to develop a comprehensive regional drainage design that provides a network of channels, retention/detention facilities and large regional outfalls that may be used by all future development.

Since the original WTAF ADMP, 1995, was completed, a large amount of development has taken place within the project area. To discuss every subdivision existing or currently planned would be beyond the scope of this report; therefore, only the very large developments will be summarized below. For all other developments, refer to Table 2.3 on the following page. This

Table 2.3
Inventory of Existing and Ongoing Development in the Loop 303 ADMP Update Project Area

Development Name	Region	Acres	Engineer	Owner/Developer	Location City/Development Township, Range and Sections	Contact	Phone # (Engineer / Developer)	Existing/Proposed/ Ongoing
Sage Creek[5]	Bullard	101	Infinity Engineering Services, LTD.	/Presley Homes	Avondale			
Arizona Traditions	Estrella	530	Clouse Engineering, July 22, 1999		[1]Surprise			Ongoing
Ashton Ranch	Dysart	156	American Engineering Company, November 24, 1998		[1]Surprise			Ongoing
Bel West Ranch	Estrella		David Evans and Associates, Inc.		[1]Surprise			Proposed
Butler Property[3]	Dysart	80			[1]Surprise			Ongoing
Country Side[3]	Dysart				[1]Surprise			Proposed
Centex Surprise Farms	Dysart	152	American Engineering Company	Centex Homes	[1]Surprise		602-582-0260 / 602-264-9284	Proposed
Greenway Parc I,II,III	Dysart	160	La Marca Engineering Group, Rev. July 1, 1999;Clouse Engineering, July 22, 1999	/Legacy Land Development	[1]Surprise			Ongoing
Happy Trails[3]	Estrella	400			[1]Surprise			Existing
Kingswood Parke	Dysart	360	Coe & Van Loo Consultants, Inc.	/Del Webb's Sun City West, March 20, 1995	[1]Surprise			Existing
Legacy Meadows[3]	Dysart				[1]Surprise			Proposed
Legacy Parc/Kenly Farms	Dysart		Paulsell & Associates, LLC	NKA Legacy Parc, October 1997	[1]Surprise			Proposed
MHE Proposal[3]	Dysart				[1]Surprise			Proposed
Mountain Gate[3]	Dysart				[1]Surprise			Proposed
Mountain Vista Ranch	Dysart	572	American Engineering Company	Harvard Investments	[1]Surprise		602-582-0260 / 602-956-0446	Ongoing
Northwest Ranch	Dysart	234	Coe & Van Loo Consultants, Inc. Revised July 24, 1998	Verde Investmemts	[1]Surprise		602-264-6831 / 602-852-6624	Proposed
Orchards[3]	Dysart				[1]Surprise			Proposed
Original Square Mile[3]	Dysart	220			[1]Surprise			Existing
Parke Row Subdivision	Dysart	19.2	American Engineering Company,November 6, 1997	/Brighton Development,	[1]Surprise			Existing
Roseview	Dysart	230	Coe & Van Loo Consultants, Inc. August 10, 1999	Woodside Homes	[1]Surprise		602-264-6831 / 602-755-0801	Proposed
Ranch Gabriella[3]	Dysart				[1]Surprise			Proposed
Sierra Montana[3]	Estrella				[1]Surprise			Proposed
Stonebrook Subdivision[3]	Dysart				[1]Surprise			Existing
Sumerfield Subdivision[3]	Dysart				[1]Surprise			Existing
Sun City Grand	Dysart	4000	Stanley Consultants	Del Webb Development Co. LP.	[1]Surprise		602-912-6500	Ongoing
Sun City West	Dysart		Stanley Consultants	Del Webb Development Co. LP.	[1]Surprise		602-912-6501	Existing
Sun Village[3]	Dysart	440			[1]Surprise			Existing
Surprise Farms	Dysart	158	American Engineering Company, August 4, 1998	Continental Homes Incorporated	[1]Surprise		602-264-6831 / 602-433-5280	Proposed
Tash Subdivision[3]	Dysart				[1]Surprise			Proposed
Villages of Surprise South[3]	Estrella				[1]Surprise			Proposed
Waddell Ranches Subdivision[3]	Estrella	240			[1]Surprise			Existing
West Point Towne Center	Dysart	595	David Evans and Associates, Inc.	/Group Six Properties, July 1996	[1]Surprise			Ongoing
Canada Village[3]	Estrella	35			Goodyear			Existing
Canyon Trails	Estrella/Southwest	2000	Coe & Van Loo Consultants, Inc., Rev. 2-29-2000		Goodyear			Proposed
Centerra	Bullard	296	Fleet Fisher Engineering, Inc.	John C. Hughes/Centerra LLC	Goodyear	Kimo Seymour	602-264-3335/480-777-7757	Proposed
Cottonflower	Estrella	97.5	American Engineering	/The Roston Company	Goodyear			Ongoing
Palm Valley I	Estrella/Bullard	850	The WLB Group	SunCor Development Company	Litchfield Park/Goodyear/Avondale	Tim Kelley	602-279-1016	Ongoing
Pebble Creek I&II	Estrella/Bullard	500	The WLB Group	SunCor Development Company	Litchfield Park/Goodyear/Avondale		602-279-1016	Ongoing
Pueblo Verde	Southwest		CMX Group, Inc.,August 1999	Recorp Inc.	Goodyear			Proposed
Rancho Mirage	Bullard	56.52	Hook Engineering	Richmond American Homes	Goodyear		602-956-4100	Ongoing
Sarival Gardens	Estrella/Southwest		Clouse Engineering, Inc., November 1, 1999		Goodyear			Ongoing
Sarival Village[3]	Southwest				Goodyear			Ongoing
Wade Acres[3]	Estrella/Southwest				Goodyear			Proposed

Table 2.3
Inventory of Existing and Ongoing Development in the Loop 303 ADMP Update Project Area

Development Name	Region	Acres	Engineer	Owner/Developer	Location City/Development Township, Range and Sections	Contact	Phone # (Engineer / Developer)	Existing/Proposed/ Ongoing
Wigwam Creek	Bullard	320	Coe & Van Loo Consultants	Continental Homes, Inc.	Maricopa County		602-264-6831 / 602-483-0006	Proposed
Wildflower Ranch	Southwest	340	Keogh Engineering, Inc.,Rev. April 1996		Goodyear			Ongoing
Estrella Vista	Southwest	180	Neil/McGill Consultants, Inc.,August 31, 1998		Goodyear			Ongoing
Estrella Aerospace Center	Bullard	556	Coe & Van Loo Consultants, Inc.,February 23, 2000	Sun Chase Estrella Limited Partnership	Goodyear		602-264-6831/602-468-1090	Proposed
Parke Row	Dysart Region	19	American Engineering	Brighton Development	Surprise		602-582-0260/602-957-0604	
Caterpillar Property	White Tanks	8800	Wood, Patel & Associates,Revised Aug. 16, 1999	DMB White Tank LLC	Town of Buckeye		602-234-1344 /	Existing
Perryville Prison[3]	Estrella	640		Perryville	Perryville			Existing
Corte Sierra Unit I & II	Estrella/Bullard	630	American Engineering	Stardust Development, Inc	Avondale		602-582-0260/602-607-5800	
Clearwater Farms[3]	Estrella	2056		Clearwater Farms	?			Existing
Montana Farms	Estrella	30	Stadler Consulting Engineers, Inc.,Feb. 5, 1998	Clearwater Farms	?		602-274-2911	Existing
Camelback Garden Farms	Estrella	80	Raymond W. Stadler,Revised June 9, 1999	Camelback-Perryville Limited Partnership	Litchfield Park		520-753-8927 / 602-853-1196	Proposed
Palmilla Apartments[5]	Bullard	89	Geodimensions, Inc., 12/98	FF Development, L.P.				Existing
Bel Fleur	Estrella		Sage Engineering Corporation,April 12, 1999	Hancock Communities	Unicorporated Maricopa County			Ongoing
Snyders of Hanover	Bullard	35	Primatech , LLC, January 1998	Deutsch Associates	Goodyear		602-685-9009/602-840-2929	Existing
Luke Air Force Base[3]	Bullard	2640		Federal Government				Existing
Southwest Specialty Foods	Bullard	9.3	Primatech, LLC, April 14, 2000	Deutsch Associates	Goodyear		602-685-9009/602-840-2929	Proposed
Litchfield Park	Bullard	1050	Willdan Associates, March 1989		Litchfield Park			Existing
Goodyear Planned Regional Center	Bullard	604	Coe & Van Loo Consultants, Inc.	The Globe Corporation	Goodyear		602-381-4848/	Proposed
Goodyear Gateway[3]								
Goodyear 1000[3]								
The Spencer Development[3]								
Airport Commerce Center[3]								
Estrella Distribution Center[3]								
Litchfield Commerce Center[3]								
Phoenix-Litchfield Airport[3]		870						
Sun Village Resort[3]	Dysart Region							Existing
The Villages at West Point[4]	Dysart Region	106	David Evans and Associates, Inc.,8/96	The Estes Company	Surprise		602-956-9850/	Existing
Dreaming Summit	Bullard Region	630	David Evans and Associates, Inc.,Revised May 2000	Stardust Development, Inc	Unicorporated Maricopa County		602-678-5757/602-607-5800	Proposed
White Tanks Mountain Ranch	Estrella Region	1297	Hunn & Associates, December 10, 1999	White Springs, L.L.C.	Unicorporated Maricopa County		602-279-0004/602-945-6300	Proposed
White Tank Foothills	Estrella Region	640	Hunn & Associates, March, 2000	/Hinton Financial Services, Inc.	Unicorporated Maricopa County		602-279-0004/780-482-6451	
Sonoran Ridge Estates	White Tanks	320	Fleet Fisher Engineering		Unicorporated Maricopa County			Proposed
Rancho Santa Fe	Bullard	340	Coe & Van Loo Consultants, Inc., 2/24/94	/Continental Homes, Inc.	Avondale		602-264-6831/602-433-5280	
Blue Horizon[3]	White Tanks							Proposed
Pasqualetti Mountain Ranch	White Tanks							Proposed
Litchfield Heights	White Tanks							Proposed
Roseview		297						
Primrose Estates		160						
Falcon Dunes		640						

1. Jurisdictional government has adopted MCFCD standards for drainage design.
3. Report not in house and/or unavailable.
4. Part of West Point Town Center.
5. Part of Palm Valley.

table will be updated throughout the course of the project as more data are collected. In addition, refer to the "Map of Existing and Proposed Development."

Development in the project area has largely taken place in the Estrella and Dysart Regions. Of the 55 developments accounted for to date, 75% fall within these regions with the majority located within the City of Surprise. The next largest concentration of new developments is within the Southwest Region where 16% of the total known developments are located. The majority of these developments lie within the City of Goodyear. Although only 8% of the total known developments lie within the Bullard Region of the project area, two of them are among the largest. Similarly, only 2% of the known developments lie within the White Tanks Region; however, the second-largest of all known developments is in this area.

In addition to Sun City West and Sun City Grand by Del Webb Development Co. LP, there are four large developments which could have a significant impact on the Loop 303 ADMP. These developments are large Master Planned Communities and/or residential subdivisions. A brief summary of each follows below.

The Caterpillar Property — The Caterpillar property is a large Master Planned Community proposed within the White Tanks Region of the project area (Figure 2.5). This property, owned by the Caterpillar Foundation in conjunction with Caterpillar, Inc., consists of approximately 8,700 acres. The proposed Master Plan for this area is based on mixed uses. The major land uses planned include residential, commercial, resort areas, parks and schools.

Historically, this land has been used as a proving ground operation for the Caterpillar Tractor Company. As part of the operation, Caterpillar built roads, excavated large basins, and built dikes. Many of these facilities have significantly altered the natural drainage patterns on the property, and some provided a considerable amount of flood control.

One of the primary goals of the Master Drainage Plan for the Caterpillar Property is to design a drainage collection and disposal system that will keep all post-development 100-year peak discharges leaving the property the same or lower than the pre-development values. The Master Plan references the original WTAF ADMP, 1995, as a basis for hydrologic model.

The Palm Valley — The Palm Valley Master Planned Community is an ongoing development located within the Estrella and Bullard Regions of the project area. It lies within the boundaries of three different governmental jurisdictions: the City of Avondale, the City of Goodyear, and the City of Litchfield Park. The majority of the development lies within Avondale. The project area covers 9,000 acres and is being developed by the SunCor Development Company. The master plan will incorporate multiple uses including, residential, commercial, industrial, golf courses, schools and others.

The Palm Valley Master Planned Community is being designed in accordance with the original WTAF ADMP, 1995. In addition, the Master Drainage Study for Palm Valley is intended to replace the existing drainage report titled "Master Drainage Report for Litchfield Master Planned Communities."

Canyon Trails — Canyon Trails is an approximately 2,000 acre master planned community located within the Estrella and Southwest Regions of the study area. It is both existing and proposed and is located within the City of Goodyear. This master plan is being developed by Continental Homes, Inc. URS has been coordinating with this development in regard to the ADMP Update study.

The development is providing a conveyance corridor for offsite storm water runoff through the central portion of the site. The corridor extends from just south of I-10 to the south and slightly west. Ultimately, Canyon Trails will be responsible for tieing this conveyance channel into the ADMP Update proposed channel along the SR 303L. Canyon Trails will be responsible for showing calculations that will verify no adverse impacts to any adjacent land owners due to the connection of this channel with the proposed ADMP Update facility. It would be preferable to coordinate the linking of these two facilities between Canyon Trails and FCDMC while the 15% level plans for the ADMP Update are being perpared, however, to date, the representatives for the Canyon Trails development have not been consistent in their communications with the FCDMC. Therefore, the ADMP Update will move forward.

Wigwam Creek — Wigwam Creek is proposed within the Bullard Region of the project area and is a 320-acre residential subdivision located within Maricopa County. The subdivision is being developed by Continental Homes, Inc. The drainage design is being designed in accordance with the WTAF ADMP, 1995.

2.5 MAJOR UTILITIES

The Maricopa County Blue Stake Center identified 47 utility owners (Table 2.1) within the project area. URS has worked hard to obtain data on the identified utilities within the project area. However, most utilities were un responsive and did not respond. URS made several attempts to contact these utilities that have been documented in phone logs. To date, URS has only received a fraction of the requested information. Another source of data obtained for the study is a map of Maricopa County Utility Corridors. This map will be used in reviewing Level I alternatives since it shows some areas where there could be potential conflicts. A final means of assessing alternatives will be done in a site review of the proposed projects. A list of the utilities which responded to the data request and provided information is listed below:

- The City of Surprise Utilities Department – provided detailied plan view maps of master sewer service areas
- Southwest Gas Corporation – provided plan view quarter section mapping
- Roosevelt Irrigation District – provided plan view schematic map of irrigation system in the area
- AT&T – provided dtailed information regarding fiber optics lines in the project area.
- Cox Communications – provided plan view maps of the existing cable lines
- Times Mirror Cable Television – provided plan view maps of existing cable lines
- Arizona Water Company – provided plan view maps of water distribution systems in the area
- El Paso Natural Gas – provided information regarding 10' gass line within the area. This gas line was crossed by the existing Bullard Wash Outfall Channel near Broadway Road. The gas line continues west toward the SR 303L facility but turns south at approximately 1 mile east of the alignment. From the mapping it does not appear to conflict with the SR 303L.
- The City of Goodyear – water system map
- The City of Goodyear – sewer system map
- MCI World Com – very little usable schematic mapping information

All of the data received from the above agencies was added to the base mapping and will be visible on the Level III conceptual level plans. Any conflicts that do ocurr will be assumed to require utlitity relocation as a 'worst case' assumption in lieu of detailed vertcal and horizontal data. Additional schematic information on existing overhead electric lines and high voltage corridors was collected during field visits. This information is not comprehensive and should be used for informational purposes only. Upon the final design of any proposed component of the final alteratnive selected as a result of this ADMP Update a very thorough and detailed investigation of any existing utilities present within the immediate vicinity of the improvement will be required.

APPENDIX A

EXISTING CONDITION HYDROLOGY
URS, NOVEMBER, 2002

EXISTING CONDITION
HYDROLOGY
Loop 303 Corridor/White Tanks
Area Drainage Master Plan Update
Contract FCD 99-40

Prepared for
Flood Control District of Maricopa
County

URS Job No. E1-00001526
November 2002

3.0 HAZARDOUS MATERIALS INVENTORY

An environmental contamination search was completed on the entire study area to identify potentially hazardous sites that may conflict with the proposed channel alignments. Vista was contacted to perform a database search including the local, state, and Federal environmental databases for the area of study. Table 3.1 on the following page identifies the potential environmental hazards that are included in the database search along with a description of the agency responsible for site evaluation and remediation oversight.

The Vista search produces area maps showing the location of each identified site based on the addresses given to the applicable agency. In addition, the search produces a summary of each site with the current (as of the date of the database search) site conditions. Although the information is typically accurate, the agency databases are not always updated regularly. In addition, addresses are sometimes not available or are incorrect. In cases where no address is available, the site is listed as "unmappable." Verification of the site address can be done by field reconnaissance or by a more detailed file review.

3.1 PROCESS

Results from the Vista Site Assessment – Special Project database search (Vista, December 13, 1999, Appendix A) were reviewed and summarized. Table 3.2 following Table 3.1 presents a list of the Vista sites identified and the recognized environmental condition at each location. A relative environmental risk factor was assigned to each Vista identified site. The relative risk was based on the estimated amount of remediation required to attain closure of the site and on the potential for current conditions to cause environmental conditions to occur in the future. Table 3.1 provides a list of each type of recognized environmental condition identified by Vista and assigns a relative environmental risk factor to each site based on the status of the site identified in the Vista report. Table 3.2 presents the assigned relative environmental risk factors for each Vista identified site. For Vista identified sites with more than one recognized environmental condition, the condition with the highest relative environmental risk factor was applied to the site.

Each Vista identified site was roughly mapped on the site map (Figure 3.1) to identify sites that may be near proposed channel alignments. The relative environmental risk factors were incorporated into Figure 3.1 to show areas of greater risk. Sites with a risk factor of "none" were not reviewed further. Sites with a risk factor of "low" within approximately one-eighth mile and sites with a risk factor of "medium" within approximate one-half mile of a proposed alignment were reviewed further. Sites with a risk factor of "high" within approximately one mile of a

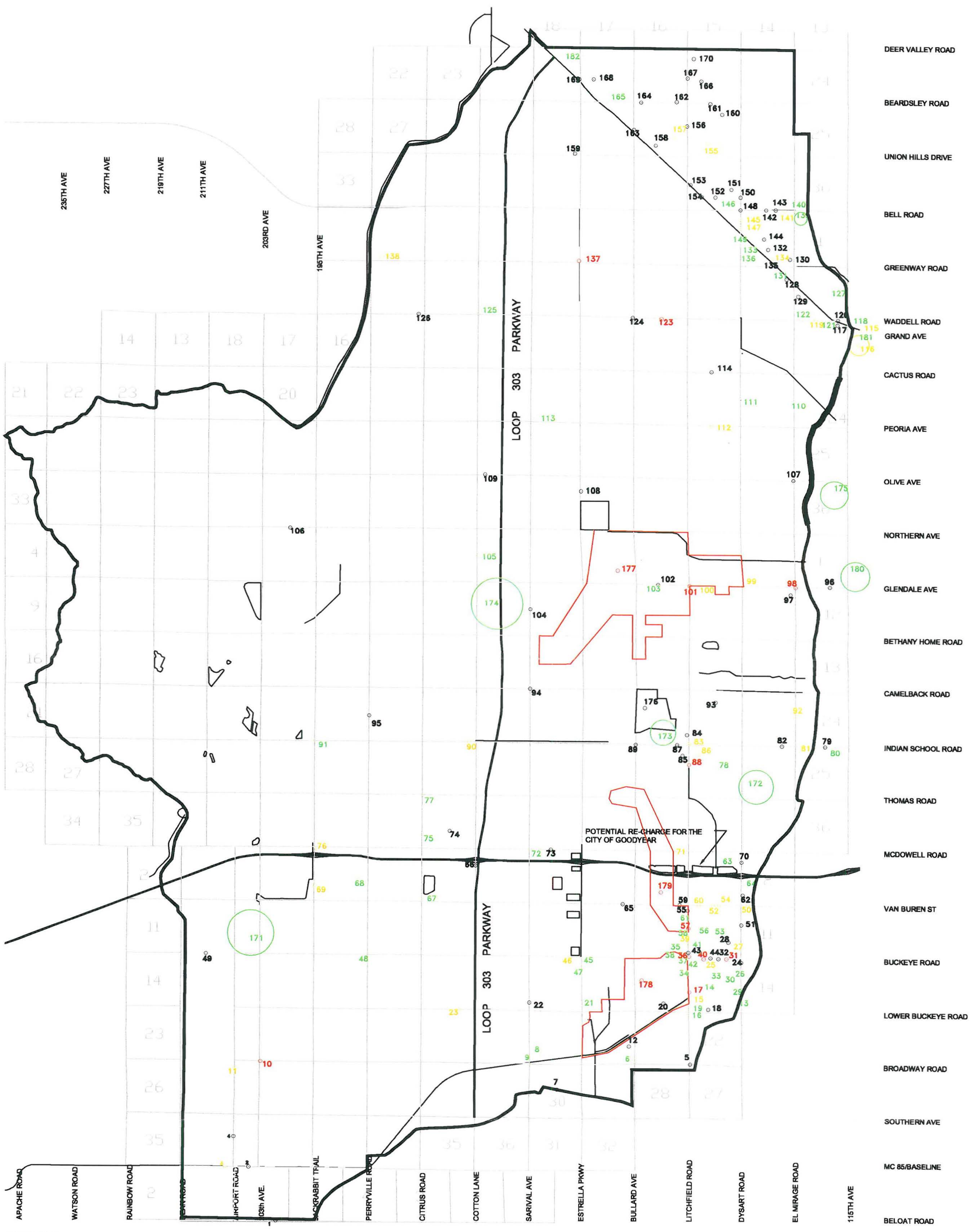
LEGEND:

100 RELATIVE ENVIRONMENTAL RISK FACTOR OF 'NONE'

75 RELATIVE ENVIRONMENTAL RISK FACTOR OF 'LOW' WITH 1/8 MILE OF A PROPOSED ALTERNATIVE CHANNEL ALIGNMENT

50 RELATIVE ENVIRONMENTAL RISK FACTOR OF 'MEDIUM' WITHIN 1/2 MILE OF A PROPOSED ALTERNATIVE CHANNEL ALIGNMENT

25 RELATIVE ENVIRONMENTAL RISK FACTOR OF 'HIGH' WITH 1 MILE OF A PROPOSED ALTERNATIVE CHANNEL ALIGNMENT



HAZARDOUS MATERIAL SEARCH

URS

Figure 3.1

TABLE 3.1
Environmental Hazard Priority Table

Hazard Type	Hazard Description	Condition of Hazard	Hazard Priority*
Underground Storage Tank (UST)	state registered underground or above ground storage tanks	Removed or out of service	none
		5 or less years old with monitoring and secondary containment	none
		greater than 5 years old with some containment/monitoring	low
		any age with steel or concrete tanks	medium
Leaking Underground Storage Tank (LUST)	state registered underground tanks that have reported a leak or other contamination released from a UST	Closed case	none
		Case pending closure	none
		Undefined soil contamination extent, or soil contamination requiring some remediation	low
		Groundwater contamination	medium
Toxic Release Inventory System (TRIS)	US EPA database of toxic releases	all	medium
Resource Conservation and Recovery Act Small Generator (RCRA SmGen)	US EPA regulated industries that exceed set generation limits for regulated chemicals	no previous spills or releases noted	none
		at least one previous spill or release noted	low
Resource Conservation and Recovery Act Large Generator (RCRA LgGen)	US EPA regulated industries that exceed set generation limits for regulated chemicals	no previous spills or releases noted	none
		at least one previous spill or release noted	low
SCL - State Equivalent CERCLIS list	state regulated soil remediation sites	Closed case	none
		State lead or preliminary assessment	medium
		Ongoing remediation status, unknown status	high
NFRAP	sites currently or formerly under review by US EPA	all	medium
Emergency Response Notification System (ERNS)	US EPA database of chemical spills	Spill > 10 years old	low
		Spill < 10 years old	medium
State Spills	state database of chemical spills	Spill > 10 years old	low
		Spill < 10 years old	medium
CERCLIS	sites currently or formerly under review by US EPA	all	high
State Solid Waste Landfill (SWLF)	permitted as a solid waste landfill, incinerator or transfer station	construction/green debris	low
		municipal, liquid, or mixed waste	medium
CORRACTS and RCRA-TSD CORRACTS	US EPA RCRA corrective actions	all	high
National Priorities List (NPL)	US EPA superfund sites	all	high

TABLE 3.2
Vista Sites and Relative Risk Factors

Vista Map ID #	Facility Name	State or Federal List	Recognized Environmental Condition	Relative Environmental Risk Factor
1	Bales Bales	UST	2 - removed	none
2	Wayne Van Landingham	UST	1- removed	none
3	Dean Farms	UST	1 - removed	none
		LUST	1 - undefined soil	**low**
4	Abrams Roadsiding Inc.	UST	1 - removed	none
5	Calmat Co. of Arizona	UST	1 - removed	none
		LUST	1 - case closed	none
6	Kysor/Kalt Manufacturing Company, Inc.	TRIS		**medium**
		RCRA-SmGen	1 previous spill	**low**
7	Goodyear Wastewater Treatment Plant	UST	1 - removed	none
8	Quakermaid Cabinetry	SCL	preliminary assessment	**medium**
		NFRAP		**medium**
		RCRA-LgGen	no previous spills	none
	Patterson Labs. Inc.	TRIS		**medium**
	Bulk Transportation	ERNS	May, 1998 - HCl to soil	**medium**
		State Spills	same as ERNS (duplicate report)	**medium**
9	Solar Fertilizer	SCL	preliminary assessment	**medium**
		NFRAP		**medium**
10	Liberty Substation	CERCLIS		**high**
11	Amcor Investments Corporation	UST	4 - 2 removed, 2 12-year old plastic w/ monitoring	**low**
12	Goodyear Well 12	UST	1 - removed	none
13	City of Avondale - Public Works	ERNS	May, 1993 - waste oil and paint material	**medium**
	City of Avondale	UST	4 - removed	none
		LUST	4 - case closed	none
14	Circle K #822	UST	5 - 2 removed, 3 13-year old plastic w/ monitoring	**low**
		LUST	1 - groundwater	**medium**
15	Avondale Quik Stop	UST	2 - 17-year old plastic w/ monitoring	**low**
		LUST	1 - case closed	none
	Savco #1	UST	3 - removed	none
		LUST	2 - case closed	none
16	Sabretech/Goodyear	RCRA-SmGen	no previous spills	none
	FedEx	RCRA-LgGen	no previous spills	none
	Litchfield Aviation	SCL	preliminary assessment	**medium**
		NFRAP		**medium**
	Sabretech/Goodyear	RCRA-SmGen	no previous spills	none
17	Goodyear Laundry and Dry Cleaning	CERCLIS		**high**
	Goodyear Laundry and Dry Cleaning	SCL	preliminary assessment	**medium**
	Unidynamics Phoenix Inc.	UST	2 - removed	none
		SCL	preliminary assessment	**medium**
	Circle K	State Spills	September, 1994 - unknown substance in building	**medium**
	Unidynamics Phoenix Inc.	NFRAP		**medium**
18	City of Avondale	UST	1 - removed	none
		LUST	1 - case closed	none
19	Loral System Grond	ERNS	March, 1993 - hardener and resin	**medium**
		ERNS	duplicate of March, 1993 ERNS report	-
		ERNS	January, 1996 - solvents to storm drain	**medium**
		State Spills	same as ERNS (duplicate report)	-
20	Phoenix Goodyear Municipal Airport	UST	1 - removed	none
		LUST	1 - case closed	none
21	Saguaro Metals	SCL	preliminary assessment	**medium**
		NFRAP		**medium**
22	W.R. Meadows of Arizona, Inc.	RCRA-SmGen	no previous spills	none
23	Goodyear Well 11	UST	1 - removed	none
		LUST	1 - soils > SSCLS	**low**

TABLE 3.2
Vista Sites and Relative Risk Factors

Vista Map ID #	Facility Name	State or Federal List	Recognized Environmental Condition	Relative Environmental Risk Factor
24	West Valley Collision Center	RCRA-SmGen	no previous spills	none
	Country Pontiac Body Shop	RCRA-SmGen	no previous spills	none
25	Avondale Elementary School District Trans	UST	1 - 9-year old plastic w/ monitoring	**low**
		LUST	1 - case closed	none
26	Avondale Texaco	UST	7 - 5 out of service, 2 27-year old steel w/out monitoring	**medium**
	Saveall Savco Travel Stop #11	UST	6 - removed	none
		LUST	8 - case closed	none
27	CKC Inc.	State Spills	June, 1989	**low**
28	Agua Fria Union High SD#216	UST	4 - removed	none
		LUST	1 - case closed	none
29	Unknown - 300 S 7th St	State Spills	July, 1997 - used oil	**medium**
30	Mini-Max Food Store	UST	2 - 15-year old plastic w/ monitoring	**low**
	Pasco Petroleum Corp./M. Shepherd	UST	6 - 3 removed, 1 7-year old doubled walled w/ monitoring, 2 4-year old steel and granite w/out monitoring	**medium**
		LUST	3 - case closed	none
31	Western Dry Cleaners	UST	4 - steel and granite unknown age w/out monitoring	**medium**
		SCL	preliminary assessment	**medium**
		NFRAP		**medium**
	Aladdin Cleaners	SCL	PA completed	**high**
		CERCLIS		**high**
32	Joseph A. Hill	UST	3 - removed	none
33	Unknown - 200 S 4th St	State Spills	February, 1998 - drug lab chemicals	**medium**
34	Helena Chem Co.	UST	1 - removed	none
		SCL	preliminary assessment	**medium**
		NFRAP		**medium**
	Farmers Agricultural Chemical	SCL	preliminary assessment	**medium**
	Syntex	SCL	preliminary assessment	**medium**
		NFRAP		**medium**
	Cenex	LUST	1 - case closed	none
	Farmers Agricultural Chemical	NFRAP		**medium**
	Navy Goodyear Airport	UST	1 - steel and granite unknown age w/out monitoring	**medium**
35	Arizona Metal Processing Services	SCL	preliminary assessment	**medium**
		NFRAP		**medium**
		RCRA-SmGen	no previous spills	none
36	Unknown - 119 N Litchfield Rd	State Spills	January, 1997 - drug lab chemicals	**medium**
	Police Department	UST	3 - removed	none
		LUST	1 - case closed	none
	WQ - City of Goodyear	SCL	state lead	**medium**
	Valley Radiologists LTD West Valley	RCRA-SmGen	no previous spills	none
	Goodyear Dry Cleaners	SCL	preliminary assessment	**medium**
		CERCLIS		**high**
37	Goodyear Auto Service Center	UST	1 - removed	none
		RCRA-SmGen	no previous spills	none
	K.W. Enterprises	State Spills	June, 1988 - sulfuric acid	**low**
	Pacific Scientific Co. Goodyear	RCRA-LgGen	no previous spills	none
	Unidynamics - Phoenix	ERNS	September, 1992 - VC, carbon tet to the air	**medium**
		ERNS	duplicate of September, 1992 ERNS report	-
		State Spills	same as ERNS (duplicate report)	-

TABLE 3.2
Vista Sites and Relative Risk Factors

Vista Map ID #	Facility Name	State or Federal List	Recognized Environmental Condition	Relative Environmental Risk Factor
38	Sahara Industries	SCL	preliminary assessment	**medium**
		NFRAP		**medium**
	Coldwater Co #143130	UST	1 - removed	none
39	West Valley Emergency Center	RCRA-SmGen	no previous spills	none
	Mobil 18-AQX	UST	4 - 10-year old plastic w/ monitoring	**low**
		LUST	1 - case closed	none
40	Western Avenue PCE Plume	SCL	state lead	**medium**
	Western Avenue PCE	SPL	remediation	**high**
41	Litchfield Chevron (GMT #302)	UST	4 - 1-year old plastic double-walled w/ monitoring	none
	Chevron #9-8179	UST	4 - removed	none
		LUST	3 - 2 undefined soil, 1 groundwater	**medium**
42	Public Works Yard	UST	2 - removed	none
		LUST	1 - groundwater	**medium**
	City of Goodyear Public Works	SCL	preliminary assessment	**medium**
		NFRAP		**medium**
43	Public Works Department	UST	3 - removed	none
44	Avondale Elementary School #44 Bus Bar	UST	2 - removed	none
		LUST	1 - case closed	none
45	Amcor Investments, Inc.	UST	4 - 1 removed, 3 unknown age and make w/out monitoring	**medium**
46	City of Goodyear	UST	1 - removed	none
		LUST	1 - case closed	none
	Estrella Business Park	UST	1 - removed	none
		LUST	1 - undefined soil	**low**
47	Reclaimed Metals	NFRAP		**medium**
	Imsalco	SCL	preliminary assessment	**medium**
	International Mill Service	UST	2 - removed	none
		LUST	1 - case closed	none
48	Perryville Feed Store	UST	5 - removed	none
		LUST	1 - groundwater	**medium**
	Somerfield Corporation	UST	1 - removed	none
		LUST	1 - undefined soil	**low**
49	Buckeye Earth Station	UST	1 - removed	none
50	Avondale Maintenance Yard	UST	6 - 4 removed, 2 13-year old plastic w/out monitoring	**low**
51	Agua Fria Paint and Body Shop	RCRA-SmGen	no previous spills	none
52	Maricopa County Avondale SS	RCRA-SmGen	no previous spills	none
	Unknown - 520 E Van Buren	State Spills	March, 1990 - drug lab chemicals	**low**
	Avondale Dodge	RCRA-SmGen	no previous spills	none
53	Arizona Department of Economic Security	ERNS	March, 1995 - cleaning compounds	**medium**
		State Spills	same as ERNS (duplicate report)	-
	Ryder/Pie Corporation	State Spills	August, 1984 - hexalint fungicide	**low**
54	Circle K #2893	UST	2 - 15-year old plastic w/ monitoring	**low**
55	Chevron Station 98179	RCRA-SmGen	no previous spills	none
	Mobil on the Run #204	UST	4 - 3-year old plastic double-walled w/ monitoring	none
56	Unknown - 117 E Loma Linda	State Spills	March, 1997 - drug lab chemicals	**medium**
	Unknown - 177 Loma Linda	State Spills	April, 1997 - drug lab chemicals	**medium**
57	Unidynamics	RCRA-LgGen	no previous spills	none
		CORRACTS		**high**
		RCRA-TSD CORRACTS		**high**
58	Parker-Hannifin Aerospace Group	SCL	preliminary assessment	**medium**
		NFRAP		**medium**
59	Arizona Public Service	UST	3 - removed	none
		LUST	2 - case closed	none

TABLE 3.2
Vista Sites and Relative Risk Factors

Vista Map ID #	Facility Name	State or Federal List	Recognized Environmental Condition	Relative Environmental Risk Factor
60	Gateway Chevrolet Inc.	UST	3 - 2 removed, 1 10-year old plastic w/ monitoring	**low**
		LUST	1 - case closed	none
		State Spills	October, 1988 - gasoline	**low**
		RCRA-SmGen	1 previous spill	**low**
61	Unknown - 1178 N Litchfield Rd	State Spills	June, 1997 - floor wax	**medium**
62	Maricopa County	RCRA-SmGen	no previous spills	none
	Savco #10	UST	5 - removed	none
		LUST	1 - case closed	none
63	Boers Dairy DDT	NFRAP		**medium**
64	Ray Tech Express	State Spills	June, 1991 - methylene chloride waste	**medium**
65	Northside Hay Mill Trading Co.	UST	3 - removed	none
		LUST	1 - case closed	none
66	Desert Sky Metal Recovery	RCRA-SmGen	no previous spills	none
67	Phoenix West KOA	UST	3 - 12-year old steel w/ monitoring	**medium**
68	Unknown - 18927 W Latham	State Spills	August, 1996 - drug lab chemicals	**medium**
69	Tosco Circle K #1198	UST	3 - 22 year old plastic w/ monitoring	**low**
		LUST	1 - soils > SSCLS	**low**
70	Avondale SOC #143131	UST	1 - removed	none
	Westside Mini Storage	UST	1 - removed	none
		LUST	1 - case closed	none
71	McLane Sunwest	UST	4 - 13-year old plastic w/ monitoring	**low**
72	W.R. Meadows Inc.	UST	4 - removed	none
		SCL	preliminary assessment	**medium**
		NFRAP		**medium**
	Hay Barns	UST	1 - removed	none
73	Estrella Flying Services	RCRA-SmGen	no previous spills	none
74	Arizona State Prison Complex - Perryville	UST	9 - removed	none
75	Arizona State Prison Complex - Perryville	LUST	10 - 8 case closed, 1 undefined soil, 1 groundwater	**medium**
76	Multi-Materials Handling	State Spills	March, 1987 - trichlorofluoromethane	**low**
	Multi-Materials Handling, Inc.	RCRA-SmGen	1 previous spill	**low**
77	Litchfield Elementary Trans Fac	UST	3 - 11-year old steel w/ monitoring	**medium**
78	Adapto Inc	SCL	preliminary assessment	**medium**
		NFRAP		**medium**
79	Blue Circle West Leasing	RCRA-SmGen	no previous spills	none
80	Sunward/JSJ Mining Co. West	UST	7 - removed	none
		LUST	4 - 2 case closed, 1 soils > SSCLS, 1 groundwater	**medium**
81	Calmat-Litchfield/Avondale RLF	SWLF	2 active construction/green landfills	**low**
	Calmat Litchfield Plant	UST	6 - removed	none
		LUST	3 - case closed	none
82	Fuel Dept	UST	2 - removed	none
83	Litchfield Pool Supply	State Spills	August, 1988 - chlorine	**low**
84	Litchfield Park Laundry and Dry Clean	RCRA-SmGen	no previous spills	none
		RCRA-SmGen	duplicate of above	-
85	Litchfield Main Co #143060	UST	1 - removed	none
		LUST	1 - case closed	none
86	Litchfield SD Trans Facility	UST	2 - removed	none
		LUST	1 - soils > SSCLS	**low**
87	Wilhelm Garage/Goodyear tire	UST	5 - removed	none
		LUST	2 - case closed	none
88	Lockheed Martin Aeronutronic	RCRA-LgGen	no previous spills	none
		RCRA-SmGen	no previous spills	none
		CORRACTS		**high**
		RCRA-TSD CORRACTS		**high**

TABLE 3.2
Vista Sites and Relative Risk Factors

Vista Map ID #	Facility Name	State or Federal List	Recognized Environmental Condition	Relative Environmental Risk Factor
89	Old Marsh Aviation	RCRA-LgGen	no previous spills	none
90	Cottonlane Indian School	UST	2 - removed	none
		LUST	1 - undefined soil	**low**
91	Caterpillar Inc. Proving Ground	SCL	preliminary assessment	**medium**
		NFRAP		**medium**
		RCRA-SmGen	no previous spills	none
	Arizona Proving Grounds	UST	8 - removed	none
		LUST	7 - case closed	none
92	BCW/Blue Circle West Inc.	UST	2 - removed	none
		LUST	1 - soils > SSCLS	**low**
93	Wigwam Golf course - East/Suncor	UST	2 - removed	none
		LUST	2 - pending closure	none
94	Espil Brother	UST	2 - removed	none
95	Moseley Aviation Inc	UST	2 - removed	none
		LUST	1 - case closed	none
96	United Metro Plant #2	RCRA-SmGen	no previous spills	none
	Glendale Plant 12	UST	7 - removed	none
		LUST	3 - case closed	none
97	Farm Shop	UST	1 - removed	none
98	USAF Luke Waste Annex	RCRA-LgGen	no previous spills	none
		CORRACTS		**high**
		RCRA-TSD CORRACTS		**high**
99	Circle K #7963	UST	2 - 14-year old plastic w/ monitoring	**low**
		LUST	1 - case closed	none
100	Circle K #42	UST	3 - removed	none
	Malco M M Self Service	UST	3 - removed	none
		LUST	1 - case closed	none
	Circle K #1908	UST	3 - 13-year old plastic w/ monitoring	**low**
101	Abandoned Car Wash	SCL	voluntary cleanup	**high**
102	Luke Air Force Base Goldwater Ra	UST	3 - removed	none
		LUST	1 - case closed	none
103	Luke Air Force Base	SCL	preliminary assessment	**medium**
104	Ashby Farms LTD	UST	2 - removed	none
105	Unknown - 15500 W Orangewood	State Spills	April, 1997 - drug lab chemicals	**medium**
106	J I Case Company	UST	4 - removed	none
		LUST	3 - case closed	none
107	El Mirage Plant	UST	5 - removed	none
108	Leyton Woolf	UST	1 - removed	none
109	Mr. & Mrs. H L Anderson	UST	3 - removed	none
110	Pueblo El Mirage Country Club	UST	2 - 13 year old steel, no monitoring	**medium**
111	Dysart Middle School	State Spills	August, 1984 - ether, bromine	**low**
		State Spills	August, 1995 - mercury	**medium**
	Dysart Unified Trans Yard	UST	7 - 4 removed, 1 out of service, 2 5-year old plastic double-walled w/ monitoring	none
		LUST	1 - case closed	none
112	Sage Development Corp.	UST	2 - 11 year old plastic w/ monitoring	**low**
113	Greer Farms	UST	3 - 18 year old steel w/out monitoring	**medium**
114	M and J Spray Inc.	UST	1 - removed	none
		RCRA-SmGen	no previous spills	none
115	Jim Newtons Automotive	UST	4 - removed	none
		LUST	1 - case closed	none
	Parks Sons of Sun City, Inc.	UST	4 - removed	none
		LUST	1 - undefined soil	**low**
	Arizona Sand and Rock CSWL	SWLF	2 closed construction/green landfills	**low**
116	El Mirage CRLF	SWLF	2 closed construction/green landfills	**low**
117	Circle K #876	UST	3 - removed	none
		LUST	2 - case closed	none
118	Manuel Domiquez	UST	3 - unknown age steel and granite w/out monitoring	**medium**
119	Maggies Market	UST	2 - 14-year old plastic w/ monitoring	**low**

TABLE 3.2
Vista Sites and Relative Risk Factors

Vista Map ID #	Facility Name	State or Federal List	Recognized Environmental Condition	Relative Environmental Risk Factor
120	Firebird Automotive	UST	3 - removed	none
121	Gus Gradillas	UST	1 - unknown age steel and granite w/out monitoring	**medium**
122	James Ngoinguyen	UST	2 - unknown age steel and granite w/out monitoring	**medium**
	Ray Reynolds	UST	2 - removed	none
123	Western Farm Services	SCL	voluntary cleanup	**high**
124	Kemper Marley Farms	UST	5 - removed	none
125	Western Farm Produce	State Spills	January, 1996 - toxaphene	**medium**
126	Cotton Lane Holdings Inc	UST	1 - removed	none
127	Calmat Industrial Asphalt	UST	6 - 2 27-year old steel w/ monitoring, 4 22-year old steel w/out monitoring	**medium**
		LUST	3 - case closed	none
128	APS Company El Mirage Construction	UST	1 - removed	none
		RCRA-SmGen	no previous spills	none
129	El Mirage Service Yard	UST	2 - out of service	none
		LUST	2 - case closed	none
	Terry Lopers Garage	UST	2 - out of service	none
130	Roberts Exxon Country Store	UST	2 - removed	none
		LUST	1 - case closed	none
131	Sonora Nursery	UST	3 - unknown age steel and granite w/out monitoring (< 20 gallons each)	**medium**
		LUST	1 - case closed	none
132	4 Sons Food Store	UST	4 - 1-year old plastic double-walled w/ monitoring	none
133	Wozniak Wayne	State Spills	June, 1991 - plating waste	**medium**
134	City Shop	UST	1 - removed	none
		LUST	1 - undefined soil	**low**
135	Circle K #1184	UST	5 - 2 removed, 3 4-year old plastic double walled w/ monitoring	none
		LUST	1 - case closed	none
136	Delarojas Pedro (residence)	State Spills	June, 1991 - waste oil	**medium**
137	Reems Road DBCP Area	SCL	preliminary assessment	**medium**
		NFRAP		**medium**
	West Salt River Valley	SCL	unknown	**high**
138	Maricopa Water District	UST	3 - removed	none
		LUST	1 - undefined soil	**low**
139	UFI CSWLF	SWLF	2 closed liquid waste	**medium**
140	Valley Sprayer Duster Service Inc.	SCL	preliminary assessment	**medium**
	UFI Surprise (Valley Sprayer Duster)	NFRAP		**medium**
141	Chevron Station 99954	UST	3 - 10-year old plastic double-walled w/ monitoring	**low**
		RCRA-SmGen	no previous spills	none
142	United Properties/Goodyear Tire	UST	3 - removed	none
		LUST	1 - case closed	none
	District III Sheriff's Office	UST	1 - removed	none
		LUST	1 - case closed	none
143	Sun West Cleaners	RCRA-SmGen	no previous spills	none
144	Roy W Pete Jones	UST	2 - removed	none
145	Maricopa County North Valley SVC Stn	RCRA-SmGen	no previous spills	none
	Surprise Maintenance Yard	UST	3 - 1 removed, 2 11-year old plastic w/ monitoring	**low**
		LUST	1 - undefined soil	**low**
146	The Motorworks Co.	UST	1 - 13-year old steel w/out monitoring	**medium**
	Sun West Citys	RCRA-SmGen	no previous spills	none
147	Leon's Trailer Park West	UST	2 - removed	none
		LUST	1 - case closed	none
	Bestway Food Gas	UST	3 - 11-year old plastic w/ monitoring	**low**
148	Western Technologies Inc.	RCRA-SmGen	no previous spills	none

TABLE 3.2
Vista Sites and Relative Risk Factors

Vista Map ID #	Facility Name	State or Federal List	Recognized Environmental Condition	Relative Environmental Risk Factor
149	Mexico Deli Inc.	UST	3 - 17-year old unknown material w/ monitoring	**medium**
150	Old Construction Yard	UST	1 - removed	none
		LUST	1 - case closed	none
151	Pete King Corporation	UST	1 - removed	none
152	Del Webb Construction Yard	RCRA-SmGen	no previous spills	none
153	Beardsley Co Aqua Fria #143025	UST	1 - removed	none
	Farm Property	UST	1 - removed	none
154	Maricopa County Water District	UST	4 - removed	none
		LUST	1 - case closed	none
	Tyler DBA Beardsley Nursery	UST	1 - removed	none
		LUST	1 - case closed	none
155	Fast 1 Hour Foto	RCRA-SmGen	no previous spills	none
	Mobil Oil Corporation SS 771	UST	4 - 1 removed, 3 18-year old plastic w/ monitoring	**low**
		LUST	6 - case closed	none
		RCRA-SmGen	no previous spills	none
156	Pebblebrook Golf Course Maintenance	UST	2 - removed	none
157	Mobil 18-Ayn	UST	4 - 13-year old plastic w/ monitoring	**low**
		LUST	1 - pending closure	none
	Arizona Medical Clinic LTD	RCRA-SmGen	no previous spills	none
158	Sun Health Del Webb Memorial Hospital	RCRA-SmGen	no previous spills	none
	Sun Health Del Webb Mammography	RCRA-SmGen	no previous spills	none
159	Former Farm Operations	UST	2 - removed	none
160	Sun City West Fire Station	UST	4 - removed	none
		LUST	1 - case closed	none
161	Hillcrest Golf Course Maintenance Yard	UST	2 - removed	none
		LUST	1 - case closed	none
162	Echo Mesa Golf Course	UST	2 - removed	none
		LUST	1 - pending closure	none
163	Welch Garage	UST	4 - removed	none
164	Grandview Golf Course Maintenance	UST	2 - removed	none
165	Sonora-Beardsley Nurseries	UST	1 - 17-year old steel w/out monitoring	**medium**
166	Stardust Golf Course Maintenance	UST	2 - removed	none
167	Briarwood Maintenance Shop	UST	2 - removed	none
		LUST	3 - pending closure	none
168	Trail Ridge Golf Course	UST	2 - removed	none
		LUST	1 - case closed	none
169	Henry M Guzman	UST	6 - removed	none
170	Bodine Company	UST	3 - removed	none
		LUST	1 - case closed	none
171	Maricopa County-Perryville CSWLF	SWLF	2 closed municipal facilities	**medium**
172	Old Town Dump CSWLF	SWLF	2 closed mixed waste	**medium**
173	Old Marsh Aviation	SCL	case closed	none
		SCL	preliminary assessment	**medium**
		NFRAP		**medium**
174	Tanita Farms Inc.	SCL	preliminary assessment	**medium**
		NFRAP		**medium**
175	Design Master Homes CSWLF	SWLF	2 closed mixed waste	**medium**
176	Wigwam Golf Course West	UST	1 - removed	none
		LUST	1 - case closed	none

TABLE 3.2
Vista Sites and Relative Risk Factors

Vista Map ID #	Facility Name	State or Federal List	Recognized Environmental Condition	Relative Environmental Risk Factor
177	USAF Luke Air Force Base	State Spills	July, 1997 - fuel	**medium**
	USAF Luke Environmental Prg Flights	RCRA-LgGen	no previous spills	none
		CORRACTS		**high**
	Luke Air Force Auxiliary Field #3	SCL	unknown	**high**
	USAF Luke Air Force Base	SCL	unknown	**high**
		SCL	preliminary assessment	**medium**
		CERCLIS		**high**
		NPL		**high**
	Luke Air Force Base	UST	94 - 77 removed, 5 or 6 potential problems	**medium**
		LUST	42 - 26 case closed, 5 pending closure, 1 soil > SSCLS, 10 undefined soil	**low**
178	Sperry Flight Systems - Goodyear	SCL	preliminary assessment	**medium**
		NFRAP		**medium**
	Phoenix Goodyear Municipal Airport	UST	9 - removed	none
		LUST	15 - 12 case closed, 1 pending closure, 2 groundwater	**medium**
	Litchfield Airport Area	SCL	preliminary assessment	**medium**
		CERCLIS		**high**
		NPL		**high**
	Pacific Southwest Airlines Training Center	UST	3 - removed	none
		SCL	preliminary assessment	**medium**
		NFRAP		**medium**
179	PGA - Goodyear Aerospace Corp.	SCL	preliminary assessment	**medium**
	PGA Phoenix-Goodyear Airport	SCL	NPL site	**high**
	Goodyear Aerospace Corp.	NFRAP		**medium**
180	City of Glendale MSWLF	SWLF	2 active mixed waste	**medium**
181	El Mirage Industrial Landfill	SCL	preliminary assessment	**medium**
		NFRAP		**medium**
182	Tosco #257455	UST	7 - 4 removed, 3 4-year old plastic double-walled w/ monitoring	none
		LUST	8 - case closed	none
	Wells Quick Stop/Robert Halsey	UST	4 - 25-year old steel w/ monitoring	**medium**
		LUST	1 - case closed	none

proposed alignment were also reviewed further. A field reconnaissance of these identified sites was then conducted.

Sites identified by Vista that were considered "unmappable" were reviewed to determine their approximate location. No unmappable sites identified by Vista are expected to be in the study area, or were identified as sites that were already mapped.

3.2 FINDINGS

Based on a review of Figure 3.1, the following Vista identified sites were determined to require further review based on their proximity to proposed channel alignments:

- Site 10
- Site 21
- Site 47
- Site 48
- Site 63
- Site 64
- Site 67
- Site 72
- Site 75
- Site 91
- Site 101
- Site 103
- Site 105
- Site 110
- Site 111
- Site 112
- Site 113
- Site 123
- Site 125
- Site 133
- Site 136
- Site 137
- Site 171
- Site 174
- Site 177
- Site 178
- Site 179

The following sections describe the findings of the site reconnaissance effort.

Site 10 – Liberty Substation

Site 10 was observed on November 7, 2000. The site is located north of Broadway Road and in between Airport Road and 203rd Avenue. Due to the private nature of the facility, it was observed from outside the site boundaries. No obvious signs of surface soil contamination were observed, and the land surrounding the facility was observed to be barren and cleared of all vegetation (Picture 1). The nature of the recognized environmental condition (CERCLIS site) warrants caution when conducting excavation activities. Also, the site was observed to potentially intersect the proposed channel alignment on the east side of the property.

Site 21 – Saguaro Metals

Site 21 was observed on November 7, 2000. No current buildings were present at the location provided by Vista. The land was noted to be farmland and did not show evidence of previous industry. The records should be reviewed to better assess the location of this site. The Phoenix-Goodyear Airport was located to the east of the location observed.

Site 47 – Reclaimed Metals and Imsalco

Site 47 was observed on November 7, 2000. No current buildings were present at the location provided by Vista. The land was noted to be farmland and did not show evidence of previous industry. The records should be reviewed to better assess the location of this site.

Site 48 – Perryville Feed Store and Somerfield Corporation

Site 48 was observed on November 7, 2000. Although the recognized environmental condition could not be observed directly (LUST), the site was reviewed further to assess site conditions (Picture 2). The site was noted to be developed as commercial retail and appeared to be a repair shop and/or storage facility for vehicles. Cars, vans, trucks, and tractor-trailer cabs were noted on the property. No spill protection or prevention measures (such as drip pans under cars waiting for service) were noted.

Picture 2 – Site 48

Site 63 – Boers Dairy DDT

Site 63 was observed on November 7, 2000. The exact location of the site could not be determined in the field. At the approximate location of the site, an undeveloped field was observed. The land immediately north of the undeveloped field was commercial retail, and ADOT retention basins were observed west of the site. The field was bounded on the east by Dysart Road and on the south by I-10. No obvious signs of surface soil contamination or stressed vegetation were observed. However, the nature of the recognized environmental condition (NFRAP site) warrants further investigation into the status of the site.

Site 64 – Ray Tech Express

Site 64 was observed on December 5, 2000. The site is located south of I-10 on Dysart Road. The exact location of the site could not be determined in the field. The area is currently developed as commercial retail; however, a business under the name "Ray Tech Express" was not observed at the site. No vegetation was present at the site due to ongoing construction activities.

Site 67 – Phoenix West KOA

Site 67 was observed on November 7, 2000. Although the recognized environmental condition could not be observed directly (UST), the site was reviewed further to assess site conditions. The site was observed to be a refueling station for private vehicles and appeared to be in good condition. Although no containment measures were observed at the fueling station (such as berms for spill containment), there was little or no staining on the concrete surface adjacent to the pumps.

Site 72 – W.R. Meadows Inc.

Site 72 was observed on November 2, 2000. Due to the private nature of the facility, it was only observed from outside the site boundaries. The site was noted to be developed as industrial and appeared orderly and free of debris. Cars, trucks, and miscellaneous farm equipment were noted on the property. No obvious signs of surface soil contamination were observed, and the land immediately surrounding the facility was observed to be barren and cleared of all vegetation (Picture 3). The nature of the recognized environmental condition (CERCLIS site) warrants caution when conducting excavation activities.

Picture 3 – Site 72

Site 75 – Arizona State Prison Complex – Perryville

Site 75 was observed on November 7, 2000. Due to the nature of the facility and the type of recognized environmental condition (LUST), the site was not reviewed further. It should be noted that there could be potentially contaminated groundwater in the aquifer beneath this site.

Site 91 – Caterpillar Inc. Proving Ground

Site 91 was observed on November 7, 2000. The site is located on the northwest corner of Indian School Road and Jackrabbit Trail. Due to the private nature of the facility, it was observed from outside the site boundaries. No obvious signs of surface soil contamination were observed on the east side of the property that was accessible. However, the nature of the recognized environmental condition (SCL site) warrants caution when conducting excavation activities. Also, the site was observed to potentially intersect the proposed channel alignment on the east side of the property.

Sites 101, 103, and 177 – Luke Air Force Base

Sites 101, 103 and 177 were observed on November 7, 2000. Due to the private nature of the facility, it was only observed from outside the site boundaries. The nature of the recognized environmental conditions (NPL site) warrants caution when conducting excavation activities on and around the property. A proposed north channel alignment was observed to end into an existing channel alignment and did not intersect the Luke AFB property boundaries directly. The northern portion of a proposed southern channel alignment intersects the property boundary significantly. This portion of the channel could not be reviewed further. There was no evidence of stressed vegetation along the northeast and southeast boundaries of the property. Some development – mostly commercial retail – was noted along the east side of the base, and the remainder of the property boundary was undeveloped land.

Site 105 – Unknown

Site 105 was observed on November 2, 2000. The exact location of the site could not be determined in the field. The land was noted to be residential and did not show evidence of previous industrial activities. No evidence of stressed vegetation was noted in the approximate vicinity of the site.

Site 110 – Pueblo El Mirage Country Club

Site 110 was observed on December 5, 2000. Although the recognized environmental condition could not be observed directly (UST), the site was reviewed further to assess site conditions. Due to the private nature of the facility, it was observed from outside the site boundaries. The facility was orderly with no obvious signs of stressed vegetation.

Site 111 – Dysart Middle School

Site 111 was observed on December 5, 2000. No buildings were entered during the site reconnaissance. No outdoor chemical storage was noted at the facility. The facility was orderly with no obvious signs of stressed vegetation.

Site 112 – Sage Development Corporation

Site 112 was observed on November 7, 2000. Although the recognized environmental condition could not be observed directly (UST), the site was reviewed further to assess site conditions. Due to the private nature of the facility, it was observed from outside the site boundaries. The facility was orderly with no obvious signs of stained soil or stressed vegetation.

Site 113 – Greer Farms

Site 113 was observed on December 5, 2000. Although the recognized environmental condition could not be observed directly (UST), the site was reviewed further to assess site conditions. The land was noted to be developed as farmland. There was no evidence of stressed vegetation at the approximate location of the site.

Site 123 – Western Farm Services

Site 123 was observed on November 7, 2000. Due to the private nature of the facility, it was observed from outside the site boundaries. The nature of the recognized environmental condition (NPL site) warrants caution when conducting excavation activities on and around the property. The site was observed to store tanks, tanker trucks, and tires (Picture 4). The tankers were noted to be stored over bare soil, and no spill protection or prevention measures were noted.

Picture 4 – Site 123

Site 125 – Western Farm Produce

Site 125 was observed on November 2, 2000. The exact location of the site could not be determined in the field. At the approximate location of the site, an undeveloped field was observed (Picture 5). The land surrounding the property was undeveloped or was developed as farmland. The field is bounded on the east by Cotton Lane and on the south by Waddell Road. No obvious signs of surface soil contamination were observed; however, the field was noted to be barren of vegetation.

Site 133 – Wozniak Wayne

Site 133 was observed on December 5, 2000. Due to the private nature of the site (private residence), it was only observed from the neighborhood boundaries. Residences in the area were noted to have some storage of scrap materials in side and back yards.

Picture 5 – Site 125

Site 136 – Delarojas Pedro (Residence)

Site 136 was observed on December 5, 2000. Due to the private nature of the site (private residence), it was only observed from the neighborhood boundaries. Residences in the area were noted to have some storage of scrap materials in side and back yards.

Site 137 – Reems Road DBCP Area and West Salt River Valley

Site 137 was observed on November 2, 2000. The exact location of the site could not be determined in the field. At the approximate location of the site, an undeveloped field was observed (Picture 6). The land north and west of the undeveloped field was residential. The field was bounded on the east by Reems Road and on the south by Greenway Road. No obvious signs of surface soil contamination or stressed vegetation were observed. A pile of excavated material including steel piping and concrete were noted on the southeast corner of the undeveloped field (Picture 7). The nature of the recognized environmental condition (SCL site) warrants further investigation into the status of the site.

Picture 6 – Site 137

Picture 7 – Site 137

Site 171 – Maricopa County – Perryville CSWLF

Site 171 was observed on November 7, 2000. The exact location of the site could not be determined in the field. No current buildings, mounding or monitoring equipment was noted at the approximate location provided by Vista. No evidence of stressed vegetation was noted in the approximate vicinity of the site.

Site 174 – Tanita Farms, Inc.

Site 174 was observed on November 2, 2000. The exact location of the site could not be determined in the field. At the approximate location of the site, an undeveloped field was observed (Picture 8). The land surrounding the undeveloped field appeared to be farmland. The field was bounded on the east by Loop 303 and located between Glendale Avenue and Bethany Home Road. No obvious signs of surface soil contamination were observed. The field was barren of vegetation and appeared to have been graded. The nature of the recognized environmental condition (SCL site) warrants further investigation into the status of the site.

Picture 8 – Site 174

Sites 178 and 179 – Phoenix-Goodyear Municipal Airport and Associated Facilities

Sites 178 and 179 were observed on November 2, 2000. Due to the private nature of the facility, it was only observed from outside the site boundaries. The nature of the recognized environmental condition (NPL site) warrants caution when conducting excavation activities on and around the property. The southern portion of a proposed southeastern channel alignment intersects the property boundary near Lower Buckeye Road. This portion of the channel could not be reviewed further. The land surrounding the Airport property was noted to be developed as farmland or industrial property.

3.3 CONCLUSIONS

This environmental search was preliminary and is subject to change based on updated information about each site. Three areas of interest were identified during this review: Site 91 – the Caterpillar Inc. Proving Ground; Sites 101, 103 and 177 – Luke Air Force Base; and Sites 178 and 179 – Phoenix-Goodyear Municipal Airport and associated facilities. These areas are directly adjacent to or cross potential channel alignments and show a medium or high risk for environmental hazards. Sites with addresses that did not match with current site conditions are of risk since the location of the facility is questionable. In addition, some sites were identified but had little information regarding the current site conditions, therefore making them a potential future risk as investigations into the extent of contamination are completed.

Based on the findings of this study, URS recommends an updated Vista search be conducted periodically to identify new or previously unreported areas of concern similar to those listed above that should be investigated further. A more detailed investigation should include agency file review to verify facility location and current remediation status (if applicable).

4.0 ENVIRONMENTAL OVERVIEW

Environmental factors are to be considered in developing a solution for stormwater collection and disposal within the study area. Two major categories of environmental resources are addressed — natural and cultural. Section 4.1 documents data collection studies to support an ecological assessment, focusing on natural vegetation and wildlife, as well as threatened, endangered, and sensitive plant and animal species. Section 4.2 documents data collection for an archaeological and historical assessment and a study of historic and prehistoric themes.

4.1 ECOLOGICAL ASSESSMENT

4.1.1 Methods

A reconnaissance ecological survey of the project area was undertaken on December 28 and 29, 1999. Biologists Adam Duerr and Thomas Strong conducted this survey primarily by vehicle, making stops for pedestrian inspections as necessary to examine some habitats in more detail. Survey observations and 1996 and 1999 aerial photographs were used to map vegetation communities and locations of agricultural and urban development (see Figure 4.1 following Section 4.0). The vegetation resources of the project area were assessed, and plant and wildlife species observed in the field were recorded (Table 4-1). Lists of potentially occurring mammals, birds, and herpetofauna were generated from the existing literature on the distribution and habitat requirements of Arizona flora and fauna (Tables 4-2, 4-3, and 4-4).

4.1.2 Vegetation

Two vegetation communities, the Lower Colorado River and the Arizona Upland subdivisions of the Sonoran Desert Biome, dominate native vegetation within the study area (Turner and Brown 1994). Within these vegetation communities, xeroriparian areas along washes are distinct from the surrounding vegetation. Small fragments of riparian vegetation exist near the boundaries of the study area adjacent to the Gila and Agua Fria rivers. Native vegetation within much of the study area has been drastically altered or completely removed by human activities. These altered landscapes include agriculture fields, urban/suburban environments, and canals, ponds, and lakes created in urban and agricultural environments.

Lower Colorado River Subdivision

Vegetation characteristic of the Lower Colorado River Valley subdivision of Sonoran desertscrub (Turner and Brown 1994) is present in a large part of the study area. This habitat is typically flat, with a 1 to 2% slope draining to the southeast. This cover type is characteristic of most of the area between the base of the White Tank Mountains and the urban and agricultural areas to the east. A number of xeroriparian washes dissect the area in a west to east or northwest to southeast direction.

Interfluvial flats in this habitat are dominated by creosote bush (*Larrea tridentata*), and triangle-leaf bursage (*Ambrosia deltoidea*), saltbush (*Atriplex* spp.), and jimmyweed (*Happlopappus heterophyllus*) also are common. Blue paloverde (*Cercidium floridum*) is the dominant tree species along the xeroriparian washes, and western honey mesquite (*Prosopis glandulosa*), ironwood (*Olneya tesota*), and catclaw acacia (*Acacia greggii*) also are present. Barrel cactus (*Ferocactus wislizenii*), ocotillo (*Fouquieria splendens*), and saguaro (*Carnegiea gigantea*) are widely scattered throughout this habitat, primarily at higher elevations.

This subdivision has the lowest diversity of wildlife species in the Sonoran Desert because of the relatively sparse vegetation and limited plant species diversity. Species that may be present in this habitat are listed in Tables 4-2, 4-3, and 4-4. The round-tailed ground squirrel (*Spermophilus tereticaudus*) is characteristic of this habitat, and the only common large mammal is the coyote (*Canis latrans*). Other common mammals include kit fox (*Vulpes macrotis*) and desert kangaroo rat (*Dipodomys deserti*). Common bird species include turkey vulture (*Cathartes aura*) and mourning dove (*Zenaida macroura*).

Several species of desert-adapted toads, including the Sonoran Desert toad (*Bufo alvarius*), red-spotted toad (*Bufo punctatus*), and Great Plains toad (*Bufo cognatus*) can survive in the Lower Colorado River subdivision. Spadefoot toads (*Scaphiopus* spp.) are likely to be present in the vicinity of seasonal pools. Sandy conditions in this desert provide habitat for several sand-adapted reptiles, including the fringe-toed lizard (*Uma notata*), banded sand snake (*Chilomeniscus cinctus*), and sidewinder (*Crotalus cerastes*).

Arizona Upland Subdivision

Characteristic plants of the Arizona Upland subdivision of Sonoran Desertscrub are present on steeper slopes and higher elevations in the White Tank Mountains on the western edge of the study area. A relatively high density of tree species and cacti characterize this subdivision. Dominant plant species include saguaro and foothill paloverde (*Cercidium microphyllym*), with smaller numbers of blue paloverde, ironwood, mesquite, cat-claw acacia, and triangle-leaf bursage. Several species of cholla and prickly pear cactus (*Opuntia* spp.) also are present.

Xeroriparian habitats also are present in the Arizona Upland subdivision. These habitats are long, narrow corridors adjacent to ephemeral washes. Plant species in the xeroriparian habitats are similar to those in the Arizona Upland, but with higher densities of ironwood, honey mesquite, and blue paloverde.

The boundary between the Lower Colorado River subdivision and the Arizona Upland subdivision is not a sharp line. Within this study area, the boundary is a transition zone that may be up to 1/2 mile wide. In this transition zone, the relative densities of creosote and saltbush decrease with increasing elevation, while the densities of saguaro and foothill paloverde increase with elevation. The boundary line shown on the habitat map indicates the approximate center of the transition zone.

The Arizona Upland subdivision generally supports a greater variety of wildlife species than the Lower Colorado River subdivision, as listed on Tables 4-2, 4-3, and 4-4 because of the greater topographic relief, higher vegetation densities, and greater plant species diversity. Common mammals in this habitat include the black-tailed jackrabbit (*Lepus californicus*), white-throated wood rat (*Neotoma albigula*), Harris' antelope squirrel (*Ammospermophilus harrisii*), and several species of bats. Some characteristic bird species include Harris' hawk (*Parabuteo unicinctus*), Gambel's quail (*Callipepla gambelii*), gilded flicker (*Colaptes chrysoides*), cactus wren (*Campylorhynchus brunneicapillus*), and curve-billed thrasher (*Toxostoma curvirostre*).

Amphibians are scarce in this habitat, although the red-spotted toad may be present near intermittent water sources. Reptiles are abundant in the Arizona Upland, with a high diversity of lizard and snake species. Some of the characteristic species include desert tortoise (*Gopherus agassizi*), regal horned lizard (*Phrynosoma solare*), western whiptail (*Cnemidophorus tigris*), Gila monster (*Heloderma suspectum*), long-nosed snake (*Rhinocheilus lecontei*), and tiger rattlesnake (*Crotalus tigris*).

Riparian Deciduous Forest

Patches of riparian deciduous forest are present adjacent to the Gila River and the lower end of the Agua Fria River, on the southern and eastern boundaries of the study area. This habitat is characterized by the presence of tall, deciduous trees such as Fremont cottonwood (*Populus fremontii*) and Goodding willow (*Salix gooddingii*). Understory shrubs include desert willow (*Chilopsis linearis*), willows (*Salix* spp.), desert broom (*Baccharis sarothroides*), and non-indigenous salt cedar (*Tamarix* spp.). Salt cedar forms dense thickets in some areas near the edge of the floodplain of the Gila River.

The relative abundance of water and the structural diversity of the vegetation in the habitat allow for high densities and diversities of wildlife species, as listed in Tables 4-2, 4-3, and 4-4. Common mammals in this habitat include the big brown bat (*Eptesicus fuscus*), deer mouse

(*Peromyscus maniculatus*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), and mule deer (*Odocoileus hemionus*). Typical bird species include the great blue heron (*Ardea herodias*), Cooper's hawk (*Accipiter cooperii*), vermilion flycatcher (*Pyrocephalus rubinus*), northern cardinal (*Cardinalis cardinalis*), and Abert's towhee (*Pipilo aberti*).

The perennial availability of water makes the riparian deciduous forest suitable for more amphibian species than the other habitats in this area. Potential species include the Woodhouse toad (*Bufo woodhousei*), lowland leopard frog (*Rana yavapaiensis*), and the introduced bullfrog (*Rana catesbiana*). Some of the characteristic reptiles of this habitat include Clark's spiny lizard (*Sceloporus clarki*), tree lizard (*Urosaurus ornatus*), and checkered garter snake (*Thamnophis marcianus*).

Agricultural Lands

Agricultural lands cover much of the study area, particularly in the south and east. Conversion of desertscrub to agriculture requires the complete removal of native vegetation. Land in this use classification includes fallow fields, recently plowed fields, vegetable crops, cotton, roses, citrus groves, and a palm nursery. The quality and potential for wildlife use of this habitat will vary with the type of crop, stage in the growing cycle, and intensity of irrigation. Agriculture is impossible in this area without irrigation, and the presence of flooded fields, canals, and return collection basins will increase the diversity of animal species that could be present in this habitat.

Any wildlife species present in this habitat must be able to tolerate a high level of human activity. Some typical mammals in the agricultural areas include black-tailed jackrabbit, Botta's pocket gopher (Thomomys bottae), cactus mouse (Peromyscus eremicus), and coyote. Many bird species are able to forage in agricultural areas, although they might need other areas for cover. Some common birds include killdeer (Charadrius vociferus), greater roadrunner (Geococcyx californianus), horned lark (Eremophiila alpestris), vesper sparrow (Pooecetes gramineus), and brown-headed cowbird (Molothrus ater). Raptors are relatively common in agricultural areas where they forage on insects and rodents. The most common raptors are red-tailed hawk (Buteo jamaicensis) and American kestrel (Falco sparverius), with northern harrier (Circus cyaneus) present in winter.

The widespread use of irrigation canals makes agricultural areas accessible and suitable for many of the amphibian species present in the riparian habitats. However, the cyclic disturbances of agricultural uses limit the suitability of this habitat for reptiles. Some species that could be present include the tree lizard, gopher snake (*Pituophis melanoleucus*), and western diamondback rattlesnake (*Crotalus atrox*).

Urban Development

The remaining land within the study area is occupied by urban development, primarily within the eastern part of the study area. The urban development classification covers a wide range of conditions, including low-density residential areas, high-density residential subdivisions, commercial and industrial sites, Luke AFB, and Goodyear Municipal Airport. This cover type is frequently interspersed with agricultural lands. The area of urban development is increasing, generally at the expense of agricultural lands or the Lower Colorado River subdivision of the Sonoran Desert Biome.

The number of wildlife species present in an urban environment is dependent on the extent of removal of native vegetation and the intensity of human activities. Low-density residential areas with significant amounts of native vegetation will support many of the species present in the Arizona Upland or Lower Colorado River subdivisions of the Sonoran Desert. High-density residential areas and commercial and industrial properties will support very few species.

Mammals that are able to adapt to high levels of human activity include the desert cottontail (*Sylvilagus audubonii*), house mouse (*Mus musculus*), and coyote. Several species of bats could forage for insects in urban areas. Bird species common in urban environments include rock dove (*Columba livia*), European starling (*Sturnus vulgaris*), great-tailed grackle (*Quiscalus mexicanus*), house finch (*Carpodacus mexicanus*), and house sparrow (*Passer domesticus*). Reptiles and amphibians, other than the introduced Mediterranean gecko (*Hemidactylus turcicus*), are generally poorly represented in urban environments.

Canals, Streams, Ponds, and Lakes

These aquatic habitats are closely linked to the riparian habitats along the Gila and Agua Fria rivers and to the agricultural areas throughout the study area. Although these features occupy an extremely small proportion of the total area of the site, they are very important ecologically. These features provide an open water habitat that can be used by a wide variety of species that are incapable of utilizing other habitats in the study area.

The perennial water in this reach of the Gila River and in the larger canals provides some habitat for fish. However, most of the species likely to be present in these conditions are introduced sport or bait fishes. Some of the exotic species that could be present include carp (*Cyprinus carpio*), golden shiner (*Notemiqonus crysoleucus*), channel catfish (*Ictalurus punctatus*), mosquitofish (*Gambusia affinis*), largemouth bass (*Micropterus salmoides*), and bluegill (*Lepornis macrochirus*). Because of human impacts on the natural river systems and the competition with introduced species, very few native fish are likely to survive in this vicinity.

Longfin dace (*Agosia chrysogaster*) and desert sucker (*Catostomus clarkii*) are the only native species that potentially could be found in this vicinity.

Seasonal or perennial surface water habitats are essential in the life cycles of the toads and frogs that are present in this vicinity. They must lay their eggs in water, and the tadpole stages are strictly aquatic. The adult stages of the lowland leopard frog and the bullfrog are generally found in or very close to open water. Surface water is much less important for reptiles. The checkered garter snake is the only reptile likely to be found in aquatic habitats.

Many bird species are dependent on open water for foraging or resting habitat, and they would not be present in this vicinity without open water. These groups of birds include grebes, herons, ducks, rails, plovers, and sandpipers. Swallows commonly forage over open water, and cliff swallows (*Petrochelidon pyrrhonota*) build nests under bridges over streams and canals.

Although most mammals require some drinking water, large bodies of open water usually are not an essential part of their habitat requirements. Of all the mammals in the study area, only the raccoon is confined primarily to habitats with perennial surface water.

4.1.3 Wildlife

Amphibians and Reptiles

No reptiles or amphibians were observed during the reconnaissance survey. However, these species generally are not active during the winter, and no detailed search was made for suitable habitats. A list of species that could occur in this vicinity, with the habitats in which they might be present, is included in Table 4-4.

Much of the study area provides only limited habitat for amphibians because of the arid conditions. However, two species of spadefoots (*Scaphiopus* spp.) and four species of toads (*Bufo* spp.) do not require permanent water. Some potential breeding habitat is available along the Gila and Agua Fria rivers, and the network of canals through the agricultural areas has created some additional habitat. Potential habitat is available for the lowland leopard frog, but the introduced bullfrog is the only frog likely to be encountered in areas of perennial surface water.

The Sonoran Desert supports a high diversity of reptile species, many of which could be present in the study area. The desert tortoise is likely to occur in undisturbed desert areas near the foothills of the White Tank Mountains. Fifteen species of lizards and 19 species of snakes could be present in the habitats of the study area. Some of the lizards expected to be common on this site include the desert iguana (*Dipsosaurus dorsalis*), desert spiny lizard (*Sceloporus magister*), tree lizard, and western whiptail. Common snake species should include the glossy snake (*Arizona elegans*), gopher snake, and common kingsnake (*Lampropeltis getulus*). Poisonous reptiles likely to be present on the site include Gila monster, Arizona coral snake (*Micruroides euryxanthus*), and four species of rattlesnake (*Crotalus* spp.).

Birds

Most bird species are active and visible during daylight hours, and they are the most likely group of vertebrates to be encountered during a brief survey. During the reconnaissance, 41 species of birds were observed. Many other species probably would be seen with more time in the study area and with visits during other seasons. Other species that could be present on the site and their potential habitats are listed in Table 4-3.

Some of the common bird species observed during the survey include mourning dove, Gila woodpecker (*Melanerpes uropygialis*), northern mockingbird (*Mimus polyglottos*), great-tailed grackle, and house finch. Bird species associated with aquatic habitats include the pied-billed grebe (*Podilymbus podiceps*), great blue heron, great egret (*Ardea alba*), snowy egret (*Egretta thula*), American coot (*Fulica americana*), and killdeer.

Raptors are common in the agricultural areas. The most commonly observed species were red-tailed hawk, American kestrel, and northern harrier. Others include the turkey vulture, Harris' hawk, and prairie falcon (*Falco mexicanus*).

Mammals

Most mammals generally are secretive and nocturnal, and very few of the possible species are ever encountered during a brief survey. The only mammals seen during the reconnaissance were the coyote, black-tailed jackrabbit, and desert cottontail.

Some of the other mammals likely to be present include the round-tailed ground squirrel, cactus mouse, desert wood rat (*Neotoma lepida*), bobcat (*Felis rufus*), and collared peccary (*Tayassu tajacu*). Raccoons and striped skunks could be present in riparian areas. Other mammals that are likely to be present on the site are listed in Table 4-2.

4.1.4 Threatened, Endangered, and Sensitive Species

A list of threatened, endangered, or otherwise sensitive plants and animals known from Maricopa County was compiled from information obtained through publications and web sites from the US Fish and Wildlife Service (USFWS 1999a), Arizona Game and Fish Department (AGFD 1996), and Arizona Department of Agriculture (ADA 1999) (Table 4-5). USFWS lists species as candidate, threatened or endangered. AGFD lists species whose occurrence in Arizona is or may become in jeopardy. ADA lists species as highly safeguarded if their prospect for survival in Arizona is in jeopardy or if the species is in danger of extinction. ADA also places plant species into four other categories (salvage restricted, export restricted, salvage assessed, and harvest restricted) requiring various permits prior to destruction of the plants. These other categories are not addressed in this report. Direct communication with the USFWS and AGFD also provided information on sensitive species that have the potential to occur in the study area (see appended letters). Of the 52 species listed in Table 4-5, only 14 species can be reasonably expected to occur within the study area.

California Leaf-nosed Bat

The California leaf-nosed bat (*Macrotis californicus*) is listed as a species of special concern in Arizona. Foraging habitat for these bats is available in Sonoran desertscrub in the western part of the study area. The primary threats to this species are vandalism and disturbance at roost sites and by a limit to the number of roost sites warm enough for this bat to use during the winter (AGFD 1996). Lack of foraging habitat does not appear to be a limiting factor. California leaf-nosed bats roost in mine shafts or caves, which are not present in most of this study area. It is possible that some mine shafts could be located in the White Tank Mountains on the western edge of the area.

The primary design consideration for flood control structures to avoid impacts on the California leaf-nosed bat is to avoid potential roost sites in mines or caves. It is unlikely that there are any mines or caves in locations that might be considered for flood control, and this project is unlikely to have any adverse impact on these bats.

Lesser Long-nosed Bat

The lesser long-nosed bat (*Leptonycteris curasoae*) is listed by the USFWS as endangered, and it is a species of special concern in Arizona. These bats are present in southern Arizona only in the summer. Lesser long-nosed bats require mine tunnels or limestone caves for daytime roosts and maternity colonies. They feed heavily on the nectar and pollen of agaves and columnar cacti, and eat saguaro fruit. Primary threats to this species are loss of foraging habitat through land use conversions and disturbances at roost sites and migration stopover points.

Saguaro cacti and agaves are abundant in the Arizona Upland subdivision of the study area, and a few saguaros are present in the Lower Colorado River subdivision. No limestone caves are present within the study area or the surrounding vicinity. If mine tunnels or shafts are present in the White Tank Mountains, they could provide the habitat requirements for this species.

The primary design considerations for flood control structures to avoid impacts on the lesser long-nosed bat is to avoid potential roost sites in mines or caves and to minimize destruction of saguaro and agave foraging sites. It is unlikely that there are any mines or caves in locations that might be considered for flood control, and there are very few saguaros and virtually no agaves in the Lower Colorado River subdivision where control structures are likely to be situated. Consequently, this project is unlikely to have any adverse impact on these bats.

Southern Yellow Bat

The southern yellow bat (*Lasiurus ega*) is listed as a species of special concern in Arizona. The preferred roosting habitat for this species is the California fan palm (*Washingtonia filifera*). These bats may be present in the study area because of a palm nursery on the north side of Bethany Home Road that could provide suitable roosting habitat. Potential foraging habitat is available over the agricultural fields, irrigation canals, and return collection basins.

The primary design consideration for flood control structures to avoid impacts on the southern yellow bat is to avoid the potential roost site in the palm nursery on Bethany Home Road. If this roost site is not affected, this project is unlikely to have any adverse impact on these bats.

Great Egret

The great egret is listed as a species of special concern in Arizona. This large heron is present in Maricopa County as a common transient during migration and as an uncommon winter visitor and an irregular summer resident. They have nested at Painted Rock Dam, on the Gila River approximately 50 miles downstream from the study area. Great egrets typically forage along the edges of rivers, streams, and marshes for fish, frogs, salamanders, crayfish, mice, aquatic insects, grasshoppers, and other insects. In the vicinity of the study area, suitable foraging habitat is available along the Gila River and along the larger irrigation canals. Great egrets were observed in these habitats during the reconnaissance survey.

The primary design consideration for flood control structures to avoid impacts on the great egret is to minimize alterations to flow patterns that could reduce foraging habitat in areas of perennial surface water. This project is not expected to affect the existing canal system or the Gila River foraging areas, and it is unlikely to have any adverse impact on the great egret.

Snowy Egret

The snowy egret is also listed as a species of special concern in Arizona. This species is present in Maricopa County as a relatively common transient during migration and as an uncommon winter visitor and an irregular summer resident. They have nested at Painted Rock Dam, on the Gila River approximately 50 miles downstream from the study area. Snowy egrets typically forage along the edges of rivers, streams, and marshes for small fish, frogs, lizards, crayfish, aquatic insects, and grasshoppers. In the vicinity of the study area, suitable foraging habitat is available along the Gila River and along the larger irrigation canals. Snowy egrets were observed near the Gila River during the reconnaissance survey.

The primary design consideration for flood control structures to avoid impacts on the snowy egret is to minimize alterations to flow patterns that could reduce foraging habitat in areas of perennial surface water. This project is not expected to affect the existing canal system or the Gila River foraging areas, and it is unlikely to have any adverse impact on the snowy egret.

Gray Hawk

The gray hawk (*Asturina nitida*) is listed as a species of special concern in Arizona, and one gray hawk was seen in an agricultural area in the study area during the reconnaissance survey. However, this observation was an extremely rare event, and these hawks are not normally expected in this vicinity. Gray hawks are usually found in deciduous riparian forests in southern Arizona. These hawks are also migratory, moving south into Mexico during the winter months. The bird seen during the survey was outside its normal range and habitat, and it was also outside its normal season in Arizona.

Because the gray hawk is not normally expected in this vicinity, no special measures are necessary for its protection.

Ferruginous Hawk

Ferruginous hawks (*Buteo regalis*) occur in Maricopa County as fairly common transients and winter visitors. These hawks feed on jackrabbits, cottontails, and a variety of rodents, but they will also eat snakes, lizards, birds, and large insects. They typically forage from fence posts or telephone poles adjacent to open fields. The creosote and bursage flats in the Lower Colorado River subdivision and cultivated fields throughout the study area are potential foraging areas for ferruginous hawks.

Protection of suitable foraging habitat is the primary concern for this species. Construction of flood control structures in this vicinity will have no significant impact on potential foraging areas, and this project is unlikely to have any adverse impact on the ferruginous hawk.

Peregrine Falcon

The peregrine falcon (*Falco peregrinus*) was formerly listed as endangered by USFWS, but it has recently been delisted because of its recovery throughout the United States. It is still listed as a species of special concern in Arizona. Peregrines are uncommon local residents in the eastern part of Maricopa County, and they are uncommon transients and winter visitors elsewhere in the county. Peregrines feed primarily on birds captured in flight. They seem to prefer rock doves, but they will take almost any species. They could potentially utilize any part of the study area as a foraging area, but the presence of this falcon would be an uncommon event.

Protection of suitable foraging habitat is the primary concern for the peregrine falcon. Construction of flood control structures in this vicinity will have no significant impact on potential foraging areas, and this project is unlikely to have any adverse impact on the peregrine falcon.

Western Yellow-billed Cuckoo

The western yellow-billed cuckoo (*Coccyzus americanus*) is listed as a species of special concern in Arizona. In Maricopa County, it is an uncommon summer resident in riparian areas in the Lower Sonoran zone. Yellow-billed cuckoos feed primarily on tent caterpillars, but they will also eat a variety of other insects and some fruit. In the vicinity of the study area, potential habitat is available in the large deciduous trees in the riparian zone along the Gila River.

The primary design consideration for flood control structures to avoid impacts on the western yellow-billed cuckoo is to avoid the potential habitat sites in the large deciduous trees in the riparian areas of the Gila River and the lower Agua Fria River. Flood control structures are not likely to be situated in these riparian areas, and this project is unlikely to have any adverse impact on the western yellow-billed cuckoo.

Cactus Ferruginous Pygmy-owl

The cactus ferruginous pygmy-owl (*Glaudidium brasilianum cactorum*) is listed by USFWS as an endangered subspecies, and it is a species of special concern in Arizona. These small owls inhabit Arizona Upland, mature cottonwood/willow areas, and mesquite bosques. They require a cavity, usually in a columnar cactus, for nesting. Although there are no records of pygmy-owls from this area, the study area does contain potential pygmy-owl habitat in the Arizona Upland subdivision and in xeroriparian habitat along dry washes through the Lower Colorado River subdivision.

It is expected that most construction for the flood control structures in this project will be in the Lower Colorado River subdivision or in existing agricultural areas. These conditions provide little habitat for the cactus ferruginous pygmy-owl, except for the xeroriparian habitats along dry washes. Flood control structures could have adverse impacts on these xeroriparian habitats. When alternative sites are selected, they should be surveyed in detail for the possible presence of pygmy-owls.

Belted Kingfisher

The belted kingfisher (*Ceryle alcyon*) is listed as a species of special concern in Arizona. In Maricopa County it is a fairly common winter visitor near ponds, streams, and canals. Belted kingfishers feed mainly on small fish and other aquatic organisms captured by diving into open water. In the vicinity of the study area, potential foraging habitat is available where there is open water along the Gila and Agua Fria rivers and along the network of canals throughout the agricultural areas.

The primary design consideration for flood control structures to avoid impacts on the belted kingfisher is to minimize alterations to flow patterns that could reduce foraging habitat in areas of perennial surface water. This project is not expected to affect the existing canal system or the Gila River foraging areas, and it is unlikely to have any adverse impact on the belted kingfisher.

Southwestern Willow Flycatcher

The southwestern willow flycatcher (*Empidonax trailli extimus*) is listed by USFWS as an endangered subspecies and as a species of special concern in Arizona. In Maricopa County, the willow flycatcher is considered to be an uncommon transient, but there have been some summer records. These birds forage in the typical flycatcher manner, flying out from a perch to capture aerial insects. Their preferred habitat in Arizona is in cottonwood, willow, and tamarisk thickets along rivers and streams. Potential habitat for this species is available in the riparian areas along the Gila River and the lower part of the Agua Fria River.

The primary design consideration for flood control structures to avoid impacts on the southwestern willow flycatcher is to avoid the potential habitat sites in the cottonwood, willow, and tamarisk thickets in the riparian areas of the Gila River and the lower Agua Fria River. Flood control structures are not likely to be situated in these riparian areas, and this project is unlikely to have any adverse impact on the southwestern willow flycatcher.

Lowland Leopard Frog

The lowland leopard frog is listed as a species of special concern in Arizona. Populations of the species are apparently decreasing, and it has been extirpated from large areas of its original range. These frogs are generally found along permanent streams and side branches of rivers south and west of the Mogollon Rim below an elevation of about 4,800 feet. They are known to be present in the upper parts of the Gila River and the Agua Fria River, but they have been extirpated from the lower Gila River. Their status in the vicinity of the study area is unknown, but potential habitat is present in the riparian areas along the Gila River.

The primary design consideration for flood control structures to avoid impacts on the lowland leopard frog is to minimize alterations to flow patterns that could affect potential habitat in areas of perennial surface water. This project is not expected to affect the existing canal system or the surface water in the Gila River, and it is unlikely to have any adverse impact on the lowland leopard frog.

Desert Tortoise

The desert tortoise is listed as a species of special concern in Arizona. Desert tortoises are found in the deserts of the southwestern part of Arizona around oases, riverbanks, washes, dunes, and rocky slopes. They generally feed on herbs, grasses, and cacti. In the vicinity of the study area, they are likely to be found in rocky foothills and washes of the Arizona Upland and the Lower Colorado River subdivisions.

It is expected that most construction for the flood control structures in this project will be in the Lower Colorado River subdivision or in existing agricultural areas. These conditions provide little habitat for the desert tortoise. However, when specific sites are selected, they should be surveyed in detail for the possible presence of tortoises.

Crested Saguaro

Crested or fan-top saguaros are a rare growth form caused by freezing or mechanical injury to the saguaro's apical meristem (Steenbergh and Lowe 1983). The crested saguaro is listed as highly safeguarded in Arizona. This growth form could be present wherever saguaros are found. In the study area, saguaros are abundant in the Arizona Upland subdivision, rare in the Lower Colorado River subdivision, and relatively common in the transition zone between the subdivisions. No crested saguaros were observed during the reconnaissance survey, but a complete inventory was not attempted.

It is expected that most construction for the flood control structures in this project will be in the Lower Colorado River subdivision or in existing agricultural areas where there are few, if any, saguaros. However, when specific sites are selected, they should be surveyed in detail for the possible presence of crested saguaros.

Table 4-1. Plants observed within the study area and the types of habitat where they occur.

Common Name	Scientific Name	Lower Colorado River	Arizona Upland	Xero-riparian Washes	Riparian Washes	Agriculture Areas	Urban Areas	Canals, Ponds and Lakes
Narrowleaf cattail	*Typha angustifolia*				✔			
Three-awn grass	*Aristida spp.*	✔	✔	✔	✔	✔	✔	
Buffelgrass	*Cenchrus cilliarus*	✔	✔	✔		✔	✔	
Bermuda grass	*Cynodon dactylon*			✔	✔	✔	✔	
Fluffgrass	*Erioneuron pulchellum*	✔	✔	✔		✔	✔	
Reed	*Phragmites communis*				✔			
Johnson grass	*Sorghum halapense*			✔	✔	✔		✔
California fan palm	*Washingtonia filifera*					✔	✔	
Horsetail casuarina	*Casuarina equisetifolia*				✔	✔		
Fremont cottonwood	*Populus fremontii*				✔			
Willow	*Salix sp.*				✔			
Mistletoe	*Phoradendron sp.*	✔	✔	✔			✔	
Curly-leaf dock	*Rumex crispus*							
Four-wing saltbush	*Atriplex canescens*	✔		✔	✔			
All scale	*Atriplex polycarpa*	✔		✔	✔			
Russian thistle	*Salsola iberica*	✔	✔	✔	✔	✔	✔	✔
Palmers amaranth	*Amaranthus palmeri*	✔	✔	✔	✔	✔	✔	
Wooly tidestromia	*Tidestromia lanuginosa*	✔	✔	✔		✔	✔	
Mustard	*Brassica tournefortii*	✔	✔	✔		✔	✔	
White-thorn acacia	*Acacia constricta*	✔	✔	✔				
Catclaw acacia	*Acacia greggii*	✔	✔	✔				
Blue paloverde	*Cercidium floridum*	✔	✔	✔				
Foothill paloverde	*Cercidium microphyllum*	✔	✔	✔				
Mexican paloverde	*Parkinsonia aculeata*	✔	✔	✔		✔	✔	

Table 4-1. Plants observed within the study area and the types of habitat where they occur.

Common Name	Scientific Name	Lower Colorado River	Arizona Upland	Xero-riparian Washes	Riparian Washes	Agriculture Areas	Urban Areas	Canals, Ponds and Lakes
Western honey mesquite	*Prosopis glandulosa* var. *torreyana*	✔	✔	✔			✔	
Ironwood	*Olneya tesota*	✔	✔	✔				
Eucalyptus	*Eucalyptus* sp.					✔	✔	
Creosote bush	*Larrea tridentata*	✔	✔	✔		✔	✔	
Spurge	*Euphorbia* spp.	✔	✔	✔	✔	✔	✔	✔
Jojoba	*Simmondsia chinensis*		✔					
Greythorn	*Zizyphus obtusifolia*	✔	✔	✔				
Globemallow	*Sphaeralcea ambigua*	✔	✔	✔		✔	✔	
Tamarisk, Salt Cedar	*Tamarix* spp.			✔	✔	✔		
Saguaro	*Carnegiea gigantea*	✔	✔	✔			✔	
Fishhook barrel cactus	*Ferocactus wislizenii*		✔					
Teddy-bear cholla	*Opuntia bigelovii*		✔					
Buckhorn cholla	*Opuntia acanthocarpa*		✔					
Ocotillo	*Fouquieria splendens*		✔					
Rambling milkweed	*Sarcostemma hirtellum*			✔				
Yellow tree tobacco	*Nicotiana glauca*				✔			
Desert willow	*Chilopsis linearis*				✔			
Wolfberry	*Lycium* sp.	✔	✔	✔				
Canyon ragweed	*Ambrosia ambrosoides*	✔	✔	✔				
Triangle-leaf bursage	*Ambrosia deltoidea*	✔	✔	✔				
Desert broom	*Baccharis sarothroides*	✔	✔	✔	✔			
Brittlebush	*Encelia farinosa*		✔	✔				
Jimmyweed	*Haplopappus heterophyllus*	✔	✔	✔		✔	✔	

Table 4-1. Plants observed within the study area and the types of habitat where they occur.								
Common Name	**Scientific Name**	**Lower Colorado River**	**Arizona Upland**	**Xero-riparian Washes**	**Riparian Washes**	**Agriculture Areas**	**Urban Areas**	**Canals, Ponds and Lakes**
Burro brush	*Hymenoclea* sp.	✔	✔	✔		✔		
Arrow weed	*Pluchea sericea*				✔			✔

SOURCES: Kearney and Peebles 1960; Lehr 1978

Table 4-2. Mammal species that could occur in vegetation communities present in the study area.

Common Name	Scientific Name	Lower Colorado River	Arizona Upland	Xero-riparian Washes	Riparian Washes	Agriculture Areas	Urban Areas	Canals, Ponds and Lakes
Desert shrew	*Notiosorex crawfordi*	✔	✔	✔	✔			
California-leaf nosed bat	*Macrotus californicus*	✔	✔	✔	✔	✔		
Lesser long-nosed bat	*Leptonycteris curasoae*	✔	✔	✔				
Yuma myotis	*Myotis yumanensis*				✔			✔
Cave myotis	*Myotis velifer*	✔	✔	✔	✔	✔	✔	✔
California myotis	*Myotis californicus*	✔	✔	✔	✔	✔	✔	✔
Western pipistrelle	*Pipistrellus hesperus*	✔	✔	✔	✔	✔	✔	✔
Big brown bat	*Eptesicus fuscus*	✔	✔	✔	✔	✔	✔	✔
Southern yellow bat	*Lasiurus ega*	✔	✔	✔	✔	✔	✔	✔
Townsend's big-eared bat	*Corynorhinus townsendii*	✔	✔	✔	✔	✔	✔	✔
Pallid bat	*Antrozous pallidus*	✔	✔	✔	✔	✔	✔	✔
Brazilian free-tailed bat	*Tadarida brasiliensis*	✔	✔	✔	✔	✔	✔	✔
Pocketed free-tailed bat	*Nyctinomops femorosaccus*	✔	✔	✔	✔	✔	✔	✔
Big free-tailed bat	*Nyctinomops macrotis*	✔	✔	✔	✔	✔	✔	✔
Western mastiff bat	*Eumops perotis*	✔	✔	✔	✔	✔	✔	✔
Desert cottontail *	*Sylvilagus audubonii*	✔	✔	✔	✔	✔	✔	
Black-tailed jackrabbit *	*Lepus californicus*	✔	✔	✔	✔	✔	✔	
Harris' antelope squirrel	*Ammospermophilus harrisii*	✔	✔	✔		✔	✔	
Rock squirrel	*Spermophilus variegatus*	✔	✔	✔	✔	✔		
Round-tailed ground squirrel	*Spermophilus tereticaudus*	✔	✔	✔		✔	✔	
Botta's pocket gopher	*Thomomys bottae*	✔	✔	✔	✔	✔	✔	

Table 4-2. Mammal species that could occur in vegetation communities present in the study area.

Common Name	Scientific Name	Lower Colorado River	Arizona Upland	Xero-riparian Washes	Riparian Washes	Agriculture Areas	Urban Areas	Canals, Ponds and Lakes
Little pocket mouse	*Perognathus longimembris*	✔						
Arizona pocket mouse	*Perognathus amplus*	✔	✔					
Desert pocket mouse	*Chaetodipus penicillatus*	✔	✔	✔	✔	✔		
Bailey's pocket mouse	*Chaetodipus baileyi*	✔	✔	✔		✔		
Rock pocket mouse	*Chaetodipus intermedius*		✔					
Merriam's kangaroo rat	*Dipodomys merriami*	✔	✔					
Desert kangaroo rat	*Dipodomys deserti*	✔		✔				
Western harvest mouse	*Reithrodontomys megalotis*	✔	✔	✔	✔	✔		
Cactus mouse	*Peromyscus eremicus*	✔	✔	✔	✔	✔		
Deer mouse	*Peromyscus maniculatus*				✔			
Southern grasshopper mouse	*Onychomys torridus*	✔	✔	✔				
Arizona cotton rat	*Sigmodon arizonae*	✔	✔	✔	✔	✔		✔
White-throated wood rat	*Neotoma albigula*	✔	✔	✔	✔			
Desert wood rat *	*Neotoma lepida*	✔	✔	✔	✔			
House mouse	*Mus musculus*							✔
Coyote *	*Canis latrans*	✔	✔	✔	✔	✔	✔	✔
Kit fox	*Vulpes macrotis*	✔		✔	✔			
Gray fox	*Urocyon cinereoargenteus*	✔	✔	✔	✔			
Ringtail	*Bassariscus astutus*	✔	✔	✔	✔			
Raccoon	*Procyon lotor*				✔		✔	✔
Badger	*Taxidea taxus*	✔	✔	✔	✔	✔		
Spotted skunk	*Spilogale gracilis*	✔	✔	✔	✔			
Striped skunk	*Mephitis mephitis*				✔	✔		
Mountain lion	*Felis concolor*		✔					

Table 4-2. Mammal species that could occur in vegetation communities present in the study area.								
Common Name	**Scientific Name**	**Lower Colorado River**	**Arizona Upland**	**Xero-riparian Washes**	**Riparian Washes**	**Agriculture Areas**	**Urban Areas**	**Canals, Ponds and Lakes**
Bobcat	*Felis rufus*	✔	✔	✔	✔	✔		
Collared peccary	*Tayassu tajacu*		✔	✔	✔			
Mule deer	*Odocoileus hemionus*	✔	✔	✔	✔			
Bighorn sheep	*Ovis canadensis*		✔					

SOURCES: Hoffmeister 1986, Jones et al. 1992

Table 4-3. Bird species that could occur in vegetation communities within the study area. An asterisk (*) indicates species observed during the reconnaissance survey.								
Common Name	**Scientific Name**	**Lower Colorado River**	**Arizona Upland**	**Xero-riparian washes**	**Riparian Washes**	**Agriculture Areas**	**Urban Areas**	**Canals Ponds and Lakes**
Pied-billed grebe*	*Podilymbus podiceps*							✔
Eared grebe	*Podiceps nigricollis*							✔
Great blue heron*	*Ardea herodias*				✔			✔
Great egret*	*A. alba*					✔		✔
Snowy egret*	*Egretta thula*							✔
Cattle egret	*Bubulcus ibis*					✔		✔
Green heron	*Butorides virescens*				✔			✔
Black-crowned night-heron	*Nycticorax nycticorax*				✔			✔
Canada goose	*Branta canadensis*					✔		✔
Green-winged teal	*Anas crecca*							✔
Mallard	*A. platyrhynchos*				✔	✔	✔	✔
Northern pintail	*A. acuta*							✔
Blue-winged teal	*A. discors*							✔
Cinnamon teal	*A. cyanoptera*							✔
Northern Shoveler	*A. clypeata*							✔
Gadwall	*A. strepera*					✔		✔
American wigeon	*A. americana*					✔		✔
Canvasback	*Aythya valisineria*							✔
Redhead	*A. americana*							✔
Ring-necked duck	*A. collaris*							✔
Lesser scaup	*A. affinis*							✔
Bufflehead	*Bucephala albeola*							✔
Common merganser	*Mergus merganser*							✔
Ruddy duck	*Oxyura jamaicensis*							✔

Table 4-3. Bird species that could occur in vegetation communities within the study area. An asterisk (*) indicates species observed during the reconnaissance survey.

Common Name	Scientific Name	Lower Colorado River	Arizona Upland	Xero-riparian washes	Riparian Washes	Agriculture Areas	Urban Areas	Canals Ponds and Lakes
Turkey vulture*	*Cathartes aura*	✔	✔	✔	✔	✔	✔	
Northern harrier*	*Circus cyaneus*	✔	✔			✔		✔
Sharp-shinned hawk	*Accipiter striatus*	✔	✔	✔	✔	✔	✔	
Cooper's hawk	*A. cooperii*	✔	✔	✔	✔	✔	✔	
Gray hawk*	*Asturina nitida*					✔		
Harris' hawk*	*Parabuteo unicinctus*	✔	✔	✔	✔	✔	✔	
Swainson's hawk	*Buteo swainsoni*	✔	✔			✔		
Red-tailed hawk*	*B. jamaicensis*	✔	✔	✔	✔	✔	✔	
Ferruginous hawk	*B. regalis*	✔				✔		
American kestrel*	*Falco sparverius*	✔	✔	✔	✔	✔	✔	
Prairie falcon*	*F. mexicanus*	✔	✔	✔	✔	✔	✔	
Peregrine falcon	*F. peregrinus*	✔	✔	✔	✔	✔	✔	✔
Gambel's quail*	*Callipepla gambelii*	✔	✔	✔	✔	✔	✔	
Virginia rail	*Rallus limicola*							✔
Sora	*Porzana carolina*							✔
Common moorhen	*Gallinula chloropus*							✔
American coot*	*Fulica americana*							✔
Semipalmated plover	*Charadrius semipalmatus*							✔
Killdeer*	*C. vociferus*				✔	✔	✔	✔
Black-necked stilt	*Himantopus mexicanus*							✔
American avocet	*Recurvirostra americana*							✔
Greater yellowlegs	*Tringa melanoleuca*					✔		✔
Lesser yellowlegs	*T. flavipes*					✔		✔
Spotted sandpiper	*Actitis macularia*							✔

Table 4-3. Bird species that could occur in vegetation communities within the study area. An asterisk (*) indicates species observed during the reconnaissance survey.

Common Name	Scientific Name	Lower Colorado River	Arizona Upland	Xero-riparian washes	Riparian Washes	Agriculture Areas	Urban Areas	Canals Ponds and Lakes
Long-billed curlew	*Numenius americanus*					✔		✔
Western sandpiper	*Calidris mauri*							✔
Least sandpiper	*C. minutilla*							✔
Baird's sandpiper	*C. bairdii*							✔
Pectoral sandpiper	*C. melanotus*							✔
Long-billed dowitcher	*Limnodromus scolopaceus*							✔
Common snipe	*Gallinago gallinago*					✔		✔
Wilson's phalarope	*Phalaropus tricolor*							✔
Red-necked phalarope	*P. lobatus*							✔
Ring-billed gull	*Larus delawarensis*					✔		✔
Forster's tern	*Sterna forsteri*							✔
Rock dove*	*Columba livia*					✔	✔	
White-winged dove	*Zenaida asiatica*	✔	✔	✔	✔	✔	✔	
Mourning dove*	*Zenaida macroura*	✔	✔	✔	✔	✔	✔	
Inca dove	*Columbina inca*	✔	✔	✔	✔	✔	✔	
Common ground-dove*	*C. passerina*	✔		✔	✔	✔		
Greater roadrunner*	*Geococcyx californianus*	✔	✔	✔	✔	✔	✔	
Western screech-owl	*Asio kennicottii*		✔	✔	✔		✔	
Great horned owl	*Bubo virginianus*		✔	✔	✔	✔	✔	
Elf owl	*Micrathene whitneyi*	✔	✔	✔	✔			
Burrowing owl	*Athene cunicularia*	✔	✔			✔		
Short-eared owl	*Asio flammeus*					✔		

Table 4-3. Bird species that could occur in vegetation communities within the study area. An asterisk (*) indicates species observed during the reconnaissance survey.

Common Name	Scientific Name	Lower Colorado River	Arizona Upland	Xero-riparian washes	Riparian Washes	Agriculture Areas	Urban Areas	Canals Ponds and Lakes
Lesser nighthawk	*Chordeiles acutipennis*	✔	✔			✔		
Common poorwill	*Phalaenoptilus nuttallii*	✔	✔					
White-throated swift	*Aeronautes saxatalis*				✔		✔	✔
Black-chinned hummingbird	*Archilochus alexandri*			✔	✔		✔	
Anna's hummingbird*	*Calypte anna*			✔	✔	✔	✔	
Costa's hummingbird	*C. costae*	✔	✔	✔	✔			
Rufous hummingbird	*Selasphorus rufus*			✔	✔		✔	
Belted kingfisher	*Ceryle alcyon*				✔			✔
Gila woodpecker*	*Melanerpes uropygialis*	✔	✔	✔	✔	✔	✔	
Red-naped sapsucker	*Sphyrapicus nuchalis*			✔	✔		✔	
Ladder-backed woodpecker	*Picoides scalaris*	✔	✔	✔	✔			
Northern flicker	*Colaptes auratus*		✔	✔	✔		✔	
Gilded flicker*	*C. chrysoides*	✔	✔	✔	✔			
Western wood-pewee	*Contopus sordidulus*			✔	✔		✔	
Hammond's flycatcher	*Empidonax hammondii*			✔	✔			
Dusky flycatcher	*E. oberholseri*	✔	✔	✔	✔			
Gray flycatcher	*E. wrightii*			✔	✔	✔		
Pacific-slope flycatcher	*E. difficilis*	✔	✔	✔	✔			
Black phoebe	*Sayornis nigricans*			✔	✔			✔
Say's phoebe*	*Sayornis saya*	✔	✔	✔	✔	✔	✔	
Vermilion flycatcher*	*Pyrocephalus rubinus*			✔	✔	✔		✔
Ash-throated flycatcher	*Myiarchus cinerascens*		✔	✔	✔			

Table 4-3. Bird species that could occur in vegetation communities within the study area. An asterisk (*) indicates species observed during the reconnaissance survey.

Common Name	Scientific Name	Lower Colorado River	Arizona Upland	Xero-riparian washes	Riparian Washes	Agriculture Areas	Urban Areas	Canals Ponds and Lakes
Brown-crested flycatcher	*M. tyrannulus*			✔	✔			
Western kingbird	*Tyrannus verticalis*	✔	✔	✔	✔	✔	✔	
Horned lark	*Eremophila alpestris*	✔				✔		
Tree swallow	*Tachycineta bicolor*				✔			✔
Violet-green swallow	*T. thalassina*				✔			✔
Northern rough-winged swallow	*Stelgidopteryx serripennis*				✔			✔
Bank swallow	*Riparia riparia*				✔			✔
Cliff swallow	*Petrochelidon pyrrhonota*				✔		✔	✔
Barn swallow	*Hirundo rustica*				✔	✔	✔	✔
Common raven	*Corvus corax*	✔	✔	✔	✔	✔		
Verdin*	*Auriparus flaviceps*	✔	✔	✔	✔		✔	
Cactus wren*	*Campylorhynchus brunneicapillus*	✔	✔	✔	✔		✔	
Rock wren	*Salpinctes obsoletus*	✔	✔	✔				
Canyon wren	*Catherpes mexicanus*		✔					
Bewick's wren	*Thryomanes bewickii*			✔	✔		✔	
House wren	*Troglodytes aedon*			✔	✔			
Marsh wren	*Cistothorus palustris*				✔			✔
Ruby-crowned kinglet	*Regulus calendula*	✔	✔	✔	✔		✔	
Black-tailed gnatcatcher	*Polioptila melanura*	✔	✔	✔	✔			
Western bluebird	*Sialia mexicana*			✔	✔	✔		
American robin	*Turdus migratorius*					✔	✔	

Table 4-3. Bird species that could occur in vegetation communities within the study area. An asterisk (*) indicates species observed during the reconnaissance survey.

Common Name	Scientific Name	Lower Colorado River	Arizona Upland	Xero-riparian washes	Riparian Washes	Agriculture Areas	Urban Areas	Canals Ponds and Lakes
Northern mockingbird*	*Mimus polyglottos*	✔	✔	✔	✔	✔	✔	
Sage thrasher	*Oreoscoptes montanus*	✔	✔					
Bendire's thrasher	*Toxostoma bendirei*	✔	✔	✔	✔	✔		
Curve-billed thrasher*	*T. curvirostre*		✔	✔	✔		✔	
Crissal thrasher	*T. crissale*			✔	✔			
LeConte's thrasher	*T. lecontei*	✔						
American pipit	*Anthus rubescens*				✔	✔	✔	✔
Cedar waxwing	*Bombycilla cedrorum*				✔		✔	
Phainopepla*	*Phainopepla nitens*	✔	✔	✔	✔			
Loggerhead shrike*	*Lanius ludovicianus*	✔	✔	✔	✔	✔		
European starling*	*Sturnus vulgaris*	✔	✔	✔	✔	✔	✔	
Bell's vireo	*Vireo bellii*			✔	✔			
Plumbeous vireo	*V. plumbeus*		✔	✔	✔			
Cassin's vireo	*V. cassinii*		✔	✔	✔			
Warbling vireo	*V. gilvus*	✔	✔	✔	✔			
Orange-crowned warbler	*Vermivora celata*				✔		✔	
Nashville warbler	*V. ruficapilla*				✔		✔	
Lucy's warber	*V. luciae*	✔	✔	✔	✔			
Yellow warbler	*Dendroica petechia*				✔		✔	
Yellow-rumped warbler*	*Dendroica coronata*			✔	✔		✔	
Black-throated gray warbler	*D. nigriscens*				✔		✔	
Townsend's warbler	*D. townsendi*				✔		✔	

Table 4-3. Bird species that could occur in vegetation communities within the study area. An asterisk (*) indicates species observed during the reconnaissance survey.

Common Name	Scientific Name	Lower Colorado River	Arizona Upland	Xero-riparian washes	Riparian Washes	Agriculture Areas	Urban Areas	Canals Ponds and Lakes
MacGillivray's warber	*Oporornis tolmiei*				✔		✔	
Common yellowthroat	*Geothlypis trichas*				✔		✔	✔
Wilson's warbler	*Wilsonia pusilla*			✔	✔		✔	
Yellow-breasted chat	*Icteria virens*				✔			
Summer tanager	*Pirangra rubra*				✔			
Western tanager	*P. ludoviciana*			✔	✔			
Northern cardinal	*Cardinalis cardinalis*		✔	✔	✔			
Pyrrhuloxia	*C. sinuatus*			✔	✔			
Black-headed grosbeak	*Pheucticus melanocephalus*			✔	✔			
Blue grosbeak	*Guiraca caerulea*			✔	✔	✔		
Lazuli bunting	*Passerina amoena*			✔	✔	✔	✔	
Green-tailed towhee	*Pipilo chlorurus*			✔	✔		✔	
Canyon towhee*	*P. fuscus*		✔	✔				
Abert's towhee*	*P. aberti*			✔	✔	✔	✔	
Chipping sparrow	*Spizella passerina*		✔	✔	✔	✔	✔	
Brewer's sparrow	*S. breweri*		✔			✔	✔	
Vesper sparrow	*Pooecetes gramineus*	✔				✔		
Lark sparrow	*Chondestes grammacus*		✔	✔	✔	✔		
Black-throated sparrow*	*Amphospiza bilineata*		✔	✔				
Sage sparrow	*A. belli*	✔						
Lark bunting	*Calamospiza melanocorys*		✔			✔		
Savannah sparrow	*Passerculus sandwichensis*	✔	✔			✔		
Song sparrow*	*Melospiza meloda*				✔	✔		✔

Table 4-3. Bird species that could occur in vegetation communities within the study area. An asterisk (*) indicates species observed during the reconnaissance survey.								
Common Name	**Scientific Name**	**Lower Colorado River**	**Arizona Upland**	**Xero-riparian washes**	**Riparian Washes**	**Agriculture Areas**	**Urban Areas**	**Canals Ponds and Lakes**
Lincoln's sparrow					✔	✔		✔
White-crowned sparrow*	*Zonotrichia leucophrys*	✔	✔	✔	✔	✔	✔	
Dark-eyed junco	*Junco hyemalis*	✔	✔	✔	✔	✔	✔	
Red-winged blackbird	*Agelaius phoeniceus*				✔	✔	✔	✔
Western meadowlark*	*Sturnella neglecta*	✔	✔			✔		
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*					✔		✔
Brewer's blackbird	*Euphagus cyanocephalus*				✔	✔		✔
Great-tailed grackle*	*Quiscalus mexicanus*				✔	✔	✔	✔
Brown-headed cowbird*	*Molothrus ater*	✔	✔	✔	✔	✔		
Hooded oriole	*Icterus cucullatus*			✔		✔		
House finch*	*Carpodacus mexicanus*	✔	✔	✔	✔	✔	✔	
Lesser goldfinch	*Carduelis psaltria*		✔	✔	✔		✔	
House sparrow*	*Passer domesticus*					✔	✔	

SOURCES: American Ornithologists' Union 1998; National Geographic Society 1999; Peterson 1990; Witzeman et al. 1997

Table 4-4. Reptile and amphibian species that could occur in vegetation communities present in the study area.

Common Name	Scientific Name	Lower Colorado River	Arizona Upland	Xero-riparian washes	Riparian Washes	Agriculture Areas	Urban Areas	Canals Ponds and Lakes
Couch spadefoot	*Scaphiopus couchi*	✔		✔	✔			✔
Western spadefoot	*S. hammondi*	✔		✔	✔			✔
Woodhouse toad	*Bufo woodhousei*			✔	✔	✔	✔	✔
Red-spotted toad	*B. punctatus*		✔		✔			✔
Great Plains toad	*B. cognatus*	✔		✔	✔			✔
Sonoran Desert toad	*B. alvarius*				✔	✔	✔	✔
Lowland leopard frog	*Rana yavapaiensis*				✔	✔		✔
Bullfrog	*R. catesbiana*				✔	✔		✔
Desert tortoise	*Gopherus agassizi*	✔	✔	✔				
Banded gecko	*Coleonyx variegatus*	✔	✔	✔				
Desert iguana	*Dipsosaurus dorsalis*	✔	✔					
Chuckwalla	*Sauromalus obesus*	✔	✔					
Zebratail lizard	*Callisaurus draconoides*	✔	✔					
Fringe-toed lizard	*Uma notata*	✔						
Collared lizard	*Crotophytus collaris*	✔	✔	✔	✔			
Long-nosed leopard lizard	*C. wislizenii*	✔	✔					
Desert spiny lizard	*Sceloperus magister*	✔	✔	✔	✔			
Clark's spiny lizard	*S. clarki*				✔			
Brush lizard	*Urosaurus graciosus*	✔						
Tree Lizard	*U. ornatus*		✔	✔	✔	✔	✔	
Side-blotched lizard	*Uta stansburiana*	✔	✔	✔				

Table 4-4. Reptile and amphibian species that could occur in vegetation communities present in the study area.

Common Name	Scientific Name	Lower Colorado River	Arizona Upland	Xero-riparian washes	Riparian Washes	Agriculture Areas	Urban Areas	Canals Ponds and Lakes
Desert horned lizard	*Phrynosoma platyrhinos*	✔	✔	✔				
Regal horned lizard	*P. solare*	✔	✔					
Western whiptail	*Cnemidophorus tigris*	✔	✔	✔	✔			
Gila monster	*Heloderma suspectum*	✔	✔	✔	✔			
Rosy boa	*Lichanura trivirgata*	✔	✔	✔	✔			
Western blind snake	*Leptotyphlops humilis*	✔	✔	✔	✔			
Spotted leaf-nosed snake	*Phyllorhynchus decurtatus*	✔		✔				
Saddled leaf-nosed snake	*P. browni*		✔	✔				
Coachwhip	*Masticophis flagellum*		✔	✔				
Sonoran whipsnake	*M. bilineatus*	✔	✔	✔				
Western patch-nosed snake	*Salvadora hexalepsis*	✔	✔	✔				
Glossy snake	*Arizona elegans*	✔	✔	✔				
Gopher snake	*Pituophis melanoleucus*		✔	✔	✔	✔		
Common kingsnake	*Lampropeltis getulus*		✔	✔	✔			
Long-nosed snake	*Rhinocheilus lecontei*	✔	✔	✔				
Checkered garter snake	*Thamnophis marcianus*				✔	✔	✔	✔
Western ground snake	*Sonora semiannulata*	✔	✔	✔	✔	✔		
Western shovel-nosed snake	*Chionactus occipitalis*	✔	✔	✔				
Banded sand snake	*Chilomeniscus cinctus*	✔	✔	✔				
Night snake	*Hypsiglena toquata*							

Table 4-4. Reptile and amphibian species that could occur in vegetation communities present in the study area.								
Common Name	**Scientific Name**	**Lower Colorado River**	**Arizona Upland**	**Xero-riparian washes**	**Riparian Washes**	**Agricultur e Areas**	**Urban Areas**	**Canals Ponds and Lakes**
Arizona coral snake	*Micruroides euryxanthus*		✔	✔	✔			
Western diamondback rattlesnake	*Crotalus atrox*	✔	✔	✔	✔	✔		
Sidewinder	*C. cerastes*	✔		✔				
Tiger rattlesnake	*C. tigris*	✔	✔	✔				
Mohave rattlesnake	*C. scutulatus*	✔	✔	✔		✔		

SOURCES: Sredl et al. 1997; Stebbins 1985

Table 4-5. Special status wildlife and plant species known from Maricopa County.					
Common Name	**Scientific Name**	**Habitat**	**Federal Status**	**State Status**	**Habitat Present in Project Area**
MAMMALS					
California leaf-nosed bat	*Macrotus californicus*	Primarily cave and mine dwellers, mostly in Sonoran desertscrub		SC	Yes
Lesser long-nosed bat	*Leptonycteris curasoae yerbabuenae*	Desertscrub with agave and columnar cacti present as food plants	E	SC	Yes
Red bat	*Lasiurus borealis*	Over ponds, along waterways, among oaks, sycamores, walnuts, cottonwoods, and pine-fir forest		SC	No
Southern yellow bat	*Lasiurus ega*	Associated with Washington fan palms		SC	Yes
Spotted bat	*Euderma maculatum*	Uneven cliffs within a mile of a riparian situation		SC	No
Jaguar	*Panthera onca*	Low mountains, chaparral, open forest		SC	No
Chihuahuan pronghorn	*Antilocapra americana mexicana*	Plains and meadows of shortgrass from the deserts of the south to the high plateaus of the north		SC	No
Sonoran pronghorn	*Antilocapra americana sonoriensis*	Broad, intermountain alluvial valleys with creosote-bursage and paloverde-mixed cacti	E	SC	No, outside of normal range
BIRDS					
American bittern	*Botaurus lentiginosus*	Marshy areas		SC	No
Least bittern	*Ixobrychus exilis*	Cattail marshes		SC	No
Great egret	*Ardea alba*	Ponds, streams, and marshes		SC	Yes
Snowy egret	*Egretta thula*	Ponds, streams, and marshes		SC	Yes
Black-bellied whistling duck	*Dendrocygna autumnalis*	Ponds		SC	No
Osprey	*Pandion haliaetus*	Near lakes and streams		SC	No
Mississippi kite	*Ictinia mississippiensis*	Riparian areas of upper Gila and San Pedro Rivers		SC	No, outside of normal range
Bald eagle	*Haliaeetus leucocephalus*	Large trees or cliffs near water (reservoirs, rivers and streams) with abundant prey	T	SC	No, outside of normal range
Northern goshawk	*Accipiter gentilis*	Pinyon-juniper to mixed conifer zones		SC	No
Gray hawk	*Asturina nitida*	Riparian areas in Sonoran zones		SC	No, outside of normal range
Common black-hawk	*Buteogallus anthracinus*	Riparian areas in Sonoran zones		SC	No, outside of normal range

Table 4-5. Special status wildlife and plant species known from Maricopa County.					
Common Name	**Scientific Name**	**Habitat**	**Federal Status**	**State Status**	**Habitat Present in Project Area**
Ferruginous hawk	*Buteo regalis*	Dry open country, fields		SC	Yes
Peregrine falcon	*Falco peregrinus*	Cliffs near Salt River reservoir, generally distributed, tops of tall urban buildings		SC	Yes
Yuma clapper rail	*Rallus longirostris yumanensis*	Fresh water and brackish marshes	E	SC	No
Snowy plover	*Charadrius alexandrinus*	Ponds		SC	No
Western yellow-billed cuckoo	*Coccyzus americanus*	Riparian areas of lower Sonoran zone		SC	Yes
Cactus ferruginous pygmy-owl	*Glaucidium brasilianum cactorum*	Mature cottonwood/willow, mesquite bosques, and Sonoran desertscrub	E	SC	Yes
Mexican spotted owl	*Strix occidentalis lucida*	Nests in canyons and dense forests with multi-layered foliage structure	T	SC	No
Belted kingfisher	*Ceryle alcyon*	Ponds, streams, and canals		SC	Yes
Southwestern willow flycatcher	*Empidonax trailli extimus*	Cottonwood/willow and tamarisk vegetation communities along rivers and streams	E	SC	Yes
Tropical kingbird	*Tyrannus melancholicus*	Lowlands near water, often nests in cottonwood		SC	No, outside of normal range
REPTILES AND AMPHIBIANS					
Chiricahua leopard frog	*Rana chiricahuensis*	Rocky streams and other wetlands between 3,500-7,900 ft. elevation	C	SC	No
Lowland leopard frog	*Rana yavapaiensis*	Restricted to permanent waters: pools of foothill streams, overflow ponds below 4,800 ft. elevation		SC	Yes
Great plains narrow-mouthed toad	*Gastrophryne olivacea*	Ranges from mesquite grassland to oak woodland in southern Arizona		SC	No, outside of normal range
Desert tortoise	*Gopherus agassizii*	Riverbanks, washes, dunes, and rocky slopes		SC	Yes
Arizona skink	*Eumeces gilberti arizonensis*	Pinyon-juniper woodland and yellow pine forest		SC	No
Mexican garter snake	*Thamnophis eques*	Canyons of pine-oak and pinyon-juniper woodlands down to mesquite grasslands in southern Arizona, near water		SC	No, outside of normal range
Narrow-headed garter snake	*Thamnophis rufipunctatus*	Pinyon-juniper and oak-pine belts to ponderosa pine forests along clear, permanent, or semi-permanent rocky streams		SC	No

Table 4-5. Special status wildlife and plant species known from Maricopa County.					
Common Name	**Scientific Name**	**Habitat**	**Federal Status**	**State Status**	**Habitat Present in Project Area**
FISH					
Colorado squawfish	*Ptychocheilus lucius*	Water deeper than a meter and with strong to moderate currents	E	SC	No
Bonytail chub	*Gila elegans*	Eddies and pools, not in swift currents	E	SC	No
Gila chub	*Gila intermedia*	Deep water or near cover in smaller creeks, cienegas, and other impoundments	C	SC	No
Roundtail chub	*Gila robusta*	Eddies and pools, often in swift currents below rapids		SC	No
Spikedace	*Meda fulgida*	Shallow water, often near the downstream ends of riffles or in eddies	T	SC	No, outside of normal range
Razorback sucker	*Xyrauchen texanus*	Riverine and lacustrine areas, generally not in fast-moving water and may use backwaters	E	SC	No, outside of normal range
Desert pupfish	*Cyprinodon macularius macularius*	Shallow springs, small streams, and marshes. Tolerates saline and warm water.	E	SC	No
Gila topminnow	*Poeciliopsis occidentalis occidentalis*	Concentrates in shallow water, especially where aquatic vegetation or debris is present	E	SC	No, outside of normal range
PLANTS					
Arizona agave	*Agave arizonica*	Transition zone between oak-juniper woodland and mountain mahogany oak scrub	E	HS	No
Tonto Basin agave	*Agave delamateri*	Found in foothills of Sierra Ancha and Mazatzal Mountains, Tonto Basin, Globe, and vicinity		HS	No
Hohokam agave	*Agave murpheyi*	In Maricopa County, found in Paradise Valley		HS	No
Arizona cliffrose	*Purshia subintegra*	Characteristic white soils or tertiary limestone lakebed deposits	E	HS	No
Crested or Fan-top saguaro	*Carnegiea gigantea*	Rocky hillsides and outwash slopes		HS	Yes
Arizona hedgehog cactus	*Echinocereus triglochidiatus arizonicus*	Ecotone between interior chaparral and madrean evergreen woodland	E	HS	No

Table 4-5. Special status wildlife and plant species known from Maricopa County.

Common Name	Scientific Name	Habitat	Federal Status	State Status	Habitat Present in Project Area
Acuna cactus	*Echinomastus erectocentrus acunensis*	Limestone hills and flatlands in western lower Sonoran desert	C	HS	No
Lemmon fleabane	*Erigeron lemmoni*	Cliff areas within Fish Creek Canyon in Maricopa County	C	HS	No

Key to Table:
Federal Status: E = Endangered T = Threatened C = Candidate
State Status: SC = Special Concern HS = Highly Safeguarded

SOURCES: Arizona Department of Agriculture 1994, 1999; Arizona Game and Fish Department 1996; Hoffmeister 1986; Minckley 1971; Monson and Phillips 1981; Stebbins 1985; US Fish and Wildlife Service 1999a, 1999b, 1999c; Witzeman et al. 1997

4.2 CULTURAL RESOURCE ASSESSMENT AND HISTORIC/PREHISTORIC THEMES

4.2.1 Goals and Methods

These investigations reflect FCDMC's proactive approach for complying with the Arizona Antiquities Act (Arizona Revised Statutes Title 41, Chapter 4.1, Section 41-841 through 41-846, 3-906.01, 13-3702, and 13-3702.01). Section 41-844 of the Act stipulates that:

> A person in charge of any survey, excavation or construction on any lands owned or controlled by ... any county ... shall report promptly to the director of the Arizona State Museum the existence of any archaeological, paleontological or historical site or object that is at least fifty years old and that is discovered in the course of such survey, excavation or construction or other like activity and, in consultation with the director, shall immediately take all reasonable steps to secure its preservation.

Resources protected by the Arizona Antiquities Act are more specifically defined as historic or prehistoric ruins, burial grounds, archaeological and vertebrate paleontological sites, fossilized footprints, inscriptions made by human agency, and other archaeological, paleontological, and historical features on lands owned or controlled by the state of Arizona or local governments. Protected archaeological specimens are more specifically defined as items resulting from past human life or activities that are at least 100 years old, including petroglyphs, pictographs, paintings, pottery, tools, ornaments, jewelry, textiles, ceremonial objects, weapons, armaments, vessels, ships, vehicles, and human skeletal remains.

Amendments of the Antiquities Act enacted in 1990 further address human remains, funerary objects, sacred objects, and objects of patrimony, providing protection for such items on state land. In addition, human remains and associated funerary objects on private lands were provided protection by requiring those who discover such items to notify the Director of the Arizona State Museum (ASM), who must consult with affiliated groups to determine the disposition of such remains. The Act is implemented by administrative rules 8-101 to 8-207.

Maricopa County has determined that its activities are not governed by the State Historic Preservation Act, but, as warranted, county agencies often provide the Arizona State Historic Preservation Office (SHPO) an opportunity to review county undertakings and comment on potential impacts on resources protected by that act. The criteria for evaluating the significance of resources protected by the State Historic Preservation Act are those used for determining eligibility for the Arizona Register of Historic Places (which are identical to criteria for listing on the National Register of Historic Places). To be determined eligible for inclusion on the Arizona Register, properties must be important in history, architecture, archaeology, engineering, or culture. They also must possess integrity of location, design, setting, materials, workmanship, feeling, and association, and meet at least one of the following four criteria:

- Criterion A: Are associated with events that have made a significant contribution to the broad patterns of our history
- Criterion B: Are associated with the lives of persons significant in our past
- Criterion C: Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant distinguishable entity whose components may lack individual distinction
- Criterion D: Have yielded, or may be likely to yield, information important in prehistory or history

At this time, the project involves no federal funding, federal rights-of-way, or federal permits, and therefore is not considered to be a "federal undertaking." Thus, there is no requirement to comply with federal regulations for Protection of Historic Properties (36 CFR Part 800), which implement Section 106 of the National Historic Preservation Act. However, the information compiled in this report would be directly relevant to any Section 106 compliance requirements that might be identified in future phases of planning and implementing stormwater collection and disposal projects within the White Tanks Drainage Area.

As FCDMC plans projects, consideration of archaeological and historical resources typically involves the following three steps:

1. Evaluation of a project area to determine if cultural resources are present
2. Assessment of the potential effects the proposed project may have on such properties
3. Consultation to determine measures to avoid or mitigate any adverse impacts on those properties

This report represents the initial step in evaluating the project area to determine whether archeological and historical resources are present. The study was based on existing information identified primarily in the files of the following agencies and research institutions:

- State Historic Preservation Office
- Arizona State Museum
- Museum of Northern Arizona
- Pueblo Grande Museum
- Arizona State University (Department of Anthropology, Arizona Collection of the Hayden Library, and Architecture and Design Library)
- Arizona State Historical Society
- Arizona Department of Library, Archives, and Public Records
- State Office and Phoenix Field Office of the Bureau of Land Management
- Bureau of Reclamation

The goal of this review was to identify any prior cultural resource surveys and recorded archaeological and historical sites within the project area for use in evaluating project alternatives. Data collection also was undertaken to provide information for a summary of relevant historic and prehistoric themes that will be elaborated on in a subsequent report. Many of the agencies and research institutions that were visited typically have information mapped on USGS 7.5-minute quadrangles, and relevant information was copied at that scale when available, and incorporated into the project files. Locations of archaeological and historical sites subsequently were annotated onto an aerial photograph of the project area to accompany this report. Information about prior studies and previously recorded resources was tabulated as is presented in accompanying tables.

The information in the agency and research institution files has been collected over the past several decades by numerous researchers for many different reasons. The completeness and quality of information vary substantially. Accordingly, the plotted locations of prior surveys and previously recorded sites are subject to some degree of error. In general, more recently compiled information is likely to be more accurate, but the older records sometimes are the only information about major archaeological resources that have subsequently been masked by later agricultural and urban development.

The significance of most of the previously recorded archaeological and historical resources has not been formally evaluated, but where available, information about the significance of previously recorded resources was tabulated. No agency consultations regarding the significance of cultural resources were conducted at this phase of study. Field visits were made to familiarize project personnel with the project area, but no cultural resource field surveys were conducted for this phase of planning.

Dr. A.E. (Gene) Rogge directed the collection of information and preparation of this report. Douglas Avann, Carmen Costner, and Cara Lonardo assisted with the collection and tabulation of information about prior studies and recorded archaeological and historical resources. Erika Finbraaten also contributed to the study, focusing on research at historical archive repositories.

4.2.2 Cultural History Background

This section of the report summarizes the cultural history of the region surrounding the project area. More detailed considerations of these cultural traditions may be found in other studies conducted in the general vicinity of the project area (for example, Ciolek-Torrello 1981; Doyel and Elson 1985; Green 1989; Rodgers 1985).

Pre-Contact Occupation

Paleoindian and Archaic Eras

People entered the New World at least some 12,000 years ago. From about 10,000 to 7500 BC, highly mobile Paleoindian groups ranged across much of the Americas, hunting game and gathering natural plant foods. The subsistence economy of these Paleoindians focused on hunting large Pleistocene animals such as mammoth, bison, camels, horses, sloths, four-horned antelope, and dire wolves. These species became extinct as the last Ice Age waned, and archaeologists continue to debate whether these extinctions were due to changing climate, excessive hunting, or a combination of these factors.

Some of the oldest Paleoindian archaeological sites in North America, with bones of large Pleistocene animals and large, distinctive, and well-made spear or dart points, have been found in Arizona. However, none of these sites are close to the project area and local evidence of the Paleoindian era is limited to rare isolated spear or dart points (for example, Crownover 1994:10-11; Rodgers 1985:10).

The subsequent Archaic era represents a seemingly stable lifeway based on gathering a wide variety of native plant foods and hunting smaller game animals that survived the termination of the Pleistocene. Archaeological evidence of the Archaic era is more common than for the Paleoindian horizon, but is far from abundant. Archaic peoples are thought to have lived in small groups of about 25 individuals who moved with seasonal changes across territories of hundreds of square miles, meeting occasionally with other groups to conduct ceremonies, exchange information, and find marriage partners (Huckell 1994).

The long Archaic era of southern Arizona lasted for several millennia, and typically is divided into three periods, primarily on the basis of changing styles of spear or dart points. The Early Archaic period dates from about 7500 to 5000 BC, the Middle Archaic era from about 5000 to 1500 BC, and Late Archaic from about 1500 BC to AD 200 (Huckell 1984, 1988). Because of the increasingly abundant evidence of maize agriculture during the Late Archaic period, the label "Early Agricultural" period is more appropriate than "Late Archaic" for many areas (Huckell 1995).

Scatters of flaked or ground stone tools without ceramics, sometimes with clusters of fire-cracked rock representing roasting pits, are the most common type of Archaic era site found in the region, and some of these have been reported in the project area. However, such sites are often impossible to date, and some may very well represent localities where later Formative peoples pursued activities that did not require ceramic vessels.

Hohokam Era

About two to three thousand years ago subsistence strategies shifted to farming crops of corn, beans, squash, and cotton. Regional populations grew larger, settlements became more permanent, and ceramics were produced. The aboriginal farmers of this era in central Arizona are known as the Hohokam, and they became the most sophisticated irrigation agriculturists in North America. The dynamic Hohokam society grew and flourished for approximately a millennium. Abundant broken pottery, some of which is elaborately decorated, and other artifacts such as pieces of shell jewelry commonly mark Hohokam sites. Remains of the Hohokam overwhelmingly dominate the archaeological record of the region, and several Hohokam village sites and evidence of temporary camps and resource collecting and processing locales have been recorded in the project area.

The Hohokam have been the subject of relatively intensive study in the Gila-Salt Basin (for example, Crown 1987, 1991; Doyel 1981; Gladwin and others 1937; Haury 1976; Wilcox and Sternberg 1983). There are four (some researchers argue for five) major periods in the Hohokam chronology, which in turn are divided into a number of phases based on differences in decorated ceramics, other artifact styles, types of residential and public architecture, and mortuary practices. The Hohokam cultural sequence is reasonably well dated, except for the initial appearance of the tradition (Dean 1991; Eighmy and McGuire 1988; Haury 1976; Plog 1980;

Schiffer 1982). The chronological sequence developed by Dean (1991) is followed in this brief summary.

Archaeologists have argued for many years about Hohokam origins. Some think the cultural tradition is an indigenous outgrowth of the preceding Archaic sequence while others see it as the result of immigration from Mesoamerica. Currently, many investigators favor the hypothesis of indigenous development (for example, Cable and Doyel 1987; Doelle 1985; Fish and others 1985, 1986). Recent research in the Tucson and Phoenix basins documents the presence of Late Archaic, ceramic producing, pithouse villagers who farmed along river floodplains. These sites lack many traits characteristic of the later Hohokam, but these findings have not resolved the issue of Hohokam origins (Mabry 1998; Mabry and Clark 1994; Mabry and others 1998).

About 15 years ago, researchers initiated attempts to reconstruct the far-flung Hohokam "regional system" (Crown and Judge 1991; Wilcox 1979, 1980). The Gila–Salt Basin was characterized as the Hohokam "core area" that was surrounded by a number of peripheral subareas. To the north and east, peripheral areas centered on the Agua Fria River, Verde River, and Tonto Basin. Peripheries south and east of the Gila-Salt Basin include the Safford, San Pedro River, Tucson Basin, and upper Santa Cruz River areas. To the west and south, peripheral areas include the Gila Bend area and the eastern and western subdivisions of the Papagueria. Interactions between the core and peripheral areas shifted during the Hohokam occupation and are the focus of ongoing investigations, but some have argued that the core-periphery model has outlived its usefulness (Whittlesey 1997).

In the Gila-Salt Basin, the Pioneer period (AD 300-775) is divided into four phases, but an earlier manifestation, the Red Mountain phase, which predates AD 300, also has been recognized (Cable and Doyel 1987). This phase originally was recognized three decades ago (Morris 1969), but more widespread, corroborating evidence has been discovered only recently. From the few sites that have been investigated, the Red Mountain phase appears similar to the terminal Late Archaic sites recently documented in the Tucson Basin, and its relation to subsequent Hohokam phases remains unclear.

The four succeeding Pioneer period Hohokam phases include Vahki (AD 300-500), Estrella (AD 500-600), Sweetwater (AD 600-700), and Snaketown (AD 700-775). Changes primarily in ceramics and architecture are the basis for distinguishing the Pioneer period phases.

Phases defined for the Colonial period (AD 775-975) include Gila Butte (AD 775-850) and Santa Cruz (AD 850-975). It is during the Colonial period that inhabitants first arranged their villages into clusters of houses or courtyard groups, apparently reflecting increasing social complexity

(Howard 1985; Wilcox and others 1981). Public architecture in the form of features called ball courts also developed at some of the more substantial Colonial period villages in the Gila-Salt Basin.

Usually a single phase is associated with the Sedentary period (AD 975-1150). In the Gila-Salt Basin this is the Sacaton phase, although a Santan phase, transitional to the Classic period, is sometimes defined. The Sedentary period witnessed further expansion of settlements and canal irrigation systems as well as the development of various alternate agricultural strategies. The construction of ball courts continued and another form of monumental architecture, the platform mound, was developed. Hierarchical relationships among Sedentary period sites are recognized in the Gila-Salt Basin as well as the Tucson Basin (Doelle and others 1987; Gregory 1991; Howard 1987; Wilcox and Sternberg 1983).

The two Classic period phases defined in the Gila-Salt Basin are the Soho (AD 1150-1300) and Civano (AD 1300-1400). The Classic period contrasts sharply with the pre-Classic period, exhibiting radical shifts in material culture, architecture, mortuary practices, and settlement patterning. It has been argued that the Tucson Basin increased in importance as a regional center at this time (Doelle and Wallace 1991).

A late Classic or post-Classic occupation, labeled the Polveron phase, has been identified at a few sites in the Gila-Salt Basin (Crown and Sires 1984; Rapp 1996; Sires 1983). Researchers still are interpreting this phase (for example, Chenault 1995; Craig 1995; Hackbarth 1995), which is characterized by pithouses constructed on top of apparently abandoned platform mounds, small clusters of pithouses in other settings, and high quantities of obsidian flaking debris. Red-on-brown decorated wares are common in Polveron sites, as are Salado polychromes. Although not common, some Hopi yellow wares also are often present.

The presence of the Hohokam is well documented to AD 1450 or 1500, but archaeological evidence of subsequent periods is rare. Although modern O'odham groups regard the Hohokam as their ancestors, as do other groups such as the Hopi, the relationship between these ethnohistoric groups and the preceding Hohokam is difficult to demonstrate archaeologically. In fact, the gap between the end of the archaeologically documented Hohokam era and the historically documented aboriginal groups residing in southern Arizona has been referred to as the "Dark Ages" (Ezell 1983). Re-examination of O'odham and Hopi oral traditions, which describe social class conflict, have provided some insight about the late prehistoric and protohistoric periods (Bahr and others 1994; Teague 1993).

Other aboriginal farming societies along the lower Colorado River Valley are known as the Patayan culture, but also have been referred to as Yumans or Hakatayans (McGuire and Schiffer 1982). The Patayan culture has been studied much less than the Hohokam, but they appear to have practiced only floodwater farming and never built canal irrigation systems like the Hohokam. Rogers (1945) believed the Patayan culture arrived in southwestern Arizona as a result of immigration from southern California. The Patayan occupation has been divided into three phases, beginning about AD 850 and continuing to about 1850 (Roberts and others 1993). Over much of southwestern Arizona, Patayan sites appear to be ephemeral, indicating the remains of camps or limited activity loci; however, larger sites, particularly along the Gila River, represent more permanent villages (McGuire and Schiffer 1982).

Investigations prior to the construction of Painted Rocks Dam northwest of Gila Bend documented a mixture of Hohokam and Patayan sites (Wasley and Johnson 1965). The distribution of Patayan pottery appears to have expanded to the east toward the Hohokam heartland during later periods of the Hohokam sequence. Archeological sites with Patayan ceramics have been recorded in the project area.

Ethnohistoric Occupation

When Europeans first arrived in the area, they encountered numerous aboriginal groups. Yavapais inhabited west-central Arizona north of the Gila and Salt rivers. The Western Apache lived in the higher country to the north and east. Various O'odham (Piman) groups, including the Akimel (Pima), Tohono (Papago), and Hia-Ced (Sand Papago), ranged primarily south of the Gila River. Groups that came to be known as the Maricopa lived along the lower Gila and Colorado river valleys and migrated upriver to join the Akimel O'odham during the nineteenth century.

The Phoenix Basin was largely uninhabited by native peoples at this time because it was a contested boundary zone between the territories of the Akimel O'odham villagers residing on the Gila River to the south, and the Yavapais to the north and Apaches to the northeast. Evidence of ethnohistoric occupation in the project area is limited to a few ceramic sherds of ambiguous affiliation.

Yavapais

During the ethnohistoric era, the Yavapais occupied a large, approximately triangular territory stretching from near Flagstaff in the north, southeast to the Globe vicinity, and west to near Yuma. The lower Gila River was the approximate southern boundary of traditional Yavapai territory. The Yavapais speak a Yuman language of the Hokan language family, which is related to the languages of numerous other groups living along the lower Colorado River Valley, as well as the upland dwelling Hualapai who lived north of the Yavapai.

The Yavapai population in the 1860s was estimated to be about 1,500 to 2,000, but tribal oral history indicates these numbers were greatly reduced from pre-contact levels by warfare and disease. Nevertheless, even earlier population densities were probably low, as is typical of hunting and gathering societies. However, the Yavapais also farmed at favorable locations, particularly in more upland areas where streams or springs provided sufficient water. Tribal oral history indicates the Yavapais pursued horticultural activity more intensively than is generally attributed to them by ethnohistoric accounts. After planting their gardens, the Yavapais would leave to gather and hunt, returning to harvest the crops that had matured.

The Yavapais followed a seasonal round, moving from lowland deserts to upland chaparral and woodlands to hunt and collect native plant resources and tend their fields. They were organized into local groups or "camps" of up to 10 related households that were organized into bands. The bands were organized into three or four subtribes. The southwestern subtribe, the Tolkapaya, was the closest Yavapai group to the project area. The Tolkapaya periodically traveled to the Colorado River to plant crops, and during the 1850s and 1860s, some families joined the Cocopah along the lower Colorado River after Euro-Americans started to invade their territory (Khera and Mariella 1983:41).

During the 1800s, Yavapais were hostile to O'odham groups living south of the Gila River, as well as to the Hualapais living north of the Bill Williams River. The Yavapais also were, on occasion, hostile towards the Tonto Apaches to the east and incidents of "wife-stealing" were reported. However, relations with Apaches were generally cooperative, as they were with the lower Colorado River Valley Mohaves and Quechans, with whom the Yavapais traded frequently.

Hostilities between Yavapais and Euro-Americans originated with the discovery of gold in the Prescott highlands in the 1860s. Some Yavapais were persuaded to move to the Colorado River Indian Reservation, but conflict intensified in the late 1860s. By 1871, the US Army confined about 1,000 Yavapais to the military reservation at Camp Date Creek (Boles 1994). By 1873 the Yavapais were militarily defeated, with perhaps a loss of 15 to 30% of the tribal population. The surviving Yavapais were concentrated at Camp Verde, and in 1874 they were marched to the San Carlos Reservation, where they lived with Apaches for about 25 years. A few hundred Yavapais apparently escaped this incarceration and worked as laborers in the mines in the Castle Dome Mountains (Bean and Vane 1978:5-70).

By 1900, many Yavapais had moved back to their old homeland along the Verde River, and only about 200 Yavapais remained at San Carlos. The Fort McDowell Reservation, encompassing about 38.6 square miles, was established on the lower Verde River in 1903. In that same year, a band of "Palomas Apaches" was reported living west of Gila Bend (James 1903), but these probably were Yavapais (who were often referred to as Mojave Apaches, reflecting their linguistic affinity with Mojaves and Apachean lifesay). A small, 40-acre parcel also was set aside as a reservation for the Yavapais near Camp Verde in 1910, and through small expansions in 1914, 1916, and in the 1950s, the parcel now totals 635 acres. Another small, 75-acre reservation was established near Prescott in 1935, and enlarged by 1,320 acres in 1956.

Today, there are approximately 800 enrolled members on the Fort McDowell Reservation. About 1,180 enrolled members live on the Camp Verde Reservation parcels, and about 130 enrolled members reside on the Yavapai-Prescott Reservation (Schell 1993).

Maricopas

When Europeans first arrived in the area, the Maricopas resided in the Gila River Valley east of Gila Bend and used adjacent uplands (Stein 1981). They spoke a Yuman language related to the Yavapai language. Spier (1933) conducted the basic ethnographic research of the Maricopas, and subsequent research was undertaken for the Indian Claims Commission (Fontana 1958; Hackenberg and Fontana 1974). Other researchers have investigated the confusing origin of the Maricopas (Bean and Vane 1978; Dobyns and others 1963; Ezell 1963; Harwell 1979; Harwell and Kelly 1983; Kelly 1972).

Spanish accounts are limited and not entirely consistent, but the Spanish named about 10 separate Yuman speaking groups living along the lower Colorado River and lower Gila River. Two groups formed a powerful north-south alliance—the Quechans (also called Yumas) residing near the confluence of the Gila and Colorado rivers and the Mojaves who lived farther upstream along the Colorado River.

Numerous other, and apparently smaller, groups were part of a more general east-west alliance. Starting at the Colorado River delta, these groups included the Cocopahs, Halyikwamis, and the Kohuanas, all living south of the Quechans, and the Halchidomas situated between the Quechans and Mojaves. Allies along the lower Gila River included the Kaveltcadoms, and farther upriver the Cocomaricopas and the Opas. Some researchers have concluded that Halchidoma, Kaveltcadom, Cocomaricopa, and Opa were simply geographical units of a single cultural group, which they refer to as the Panya (Bean and Vane 1978).

The population of the Panya probably was on the order of about 5,000 in the 1700s. The Panya lived in dispersed settlements (rancherias), similar to other Yuman speaking groups along the lower Colorado River. They hunted and exploited wild plant foods, but also fished and farmed with floodwater techniques.

The name "Cocomaricopa" may be the Spanish transliteration of the Akimel O'odham name for a group that lived near modern day Gila Bend—Kokomalik Aapap. Aapap means "friendly enemies," a seeming oxymoron that made sense to the Akimel O'odham who lived to the east along the Gila River above the Salt River confluence and were enemies of the two strongest Yuman groups—the Quechans and Mojaves. Kokomalik refers to the Gila Bend Mountains. So, "Maricopa" may be derived from Spanish observers shortening the Akimel O'odham name for the "friendly enemies of the Gila Bend Mountain area." Alternatively, some researchers have suggested that Maricopa evolved from the Spanish word "mariposa," or butterfly, which might have been used to describe the brightly painted Indians. Today, the Maricopa refer to themselves as the Pee Posh.

Whatever its origin, Maricopa came to be first applied in about 1839 to an amalgam of the various remnants of the Panya who had absorbed the Kohuana and Halyikwamai by that time. The various groups of Panya had been driven from the lower Colorado and lower Gila river valleys by increased pressure from the Mojaves and Quechans, perhaps stimulated by the arrival of mountain men in search of furs or new markets for slaves in Mexico. The fleeing Panya took up residence in south-central Arizona adjacent to the Akimel O'odham on the Gila River above its confluence with the Salt River and became known collectively as the Maricopa. Some Halchidoma first fled to Sonora and resided there for several years before returning to the Gila Valley to join their relatives. The Maricopas adopted aspects of Hispanic culture, including cattle, horses, mules, wheat, and possibly barley. Some Maricopas spoke Spanish well, serving as interpreters for the Akimel O'odham (Harwell and Kelly 1983:75).

In the 1840s, military battalions traveling to California passed through the Akimel O'odham and Maricopa villages, purchasing food from them. After the discovery of gold in California, about 60,000 "Forty-niners" crossed Arizona along this trail, creating a huge market for the Gila River farmers, who raised and sold three crops of wheat during the summer of 1849. In the 1850s, travelers on stage lines, including the Butterfield Stage, also took advantage of the "roadside groceries" offered by the Akimel O'odham and Maricopa Indians.

The Akimel O'odham and Maricopas never fought the Americans, and in 1859 the federal government rewarded them by setting aside the first reservation in Arizona for their use. The Akimel O'odham and Maricopas, in fact, joined the US Army troops in fighting their common enemies, the Apaches and Yavapais. Despite putting their lives on the line, the Akimel O'odham and Maricopas were ill-rewarded. American farmers settled on the Gila River in the Florence and Safford areas upstream of the Akimel O'odham and Maricopas, and began building their own irrigation canals. By 1871, the Americans diverted so much of the river flows that the Akimel O'odham and Maricopa fields were left dry. The natives refer to the subsequent half century as the "years of famine." Some Akimel O'odham and Maricopas moved north to the Salt River, in the eastern part of the Phoenix Basin where a reservation was established in 1879, and others moved to the confluence of the Salt and Gila rivers (DeJong 1992).

Today, the Maricopas continue to reside primarily in two communities. There are approximately 5,400 enrolled tribal members at the 87-square-mile Salt River Reservation, of which approximately 100 are Maricopas (who identify themselves as Halchidhomas) concentrated in the Lehi area. There are approximately 11,600 enrolled tribal members on the 583-square-mile Gila River Reservation, of which about 600 are Maricopas, concentrated in the Laveen area in the northwestern corner of the reservation (Schell 1993).

O'odham (Pimans)

The O'odham speak a Piman language of the Uto-Aztecan language family, which is quite distinct from the Yuman languages of the Hokan language family. The Hokan family includes Shoshonean languages such as Hopi and Paiute, as well as numerous languages extending far south into Mexico. Fontana (1983a:125) concludes that no one knows exactly how long the O'odham have lived throughout what we know today as northern Sonora, Mexico and the western two-thirds of southern Arizona. However, there is general agreement that the extent of O'odham territory "from prehistoric times to the nineteenth century encompassed a vast tract extending from the Gulf of California across to the Salt River in central Arizona" (Hackenberg 1983:161).

O'odham ("we, the people") is the term used by all Upper Pimans to refer to themselves, but one the Spanish never used. The Spanish explorers referred to them as the Pima Altos (Upper Pimans), and recognized distinct groups based on geographical location and cultural differences, labeling them Papago, Pima, Sobaipuri, Soba, Gileños, and Piatos. Use of these labels was not entirely consistent, but desert-dwelling farmers south of the Gila River and west of the Santa Cruz River were generally called Papagos. The people dwelling along the middle Gila River were known as Pimas or Gileños. Groups living at Bac near Tucson on the Santa Cruz River and along the San Pedro River were called Sobaipuris. People who lived in the extremely arid western and southwestern portions of the northern Sonoran Desert were known as the Sobas, and apostate Pimans who lived in the Altar Valley were called Paitos (Fontana 1983a:125).

The Pimeria Alta extends throughout portions of the Sonoran Desert where three modes of adaptation are recognized. Fontana (1983a:126-134) refers to these as No Villagers (Hia-Ced O'odham), Two Villagers (Tohono O'odham), and One Villagers (Akimel O'odham). Nabhan and others (1989) question the characterization of the Hia-Ced O'odham as "no villagers," pointing out that the Hia-Ced had substantial, repeatedly used camps at better-watered locations. These camps were on the margins of Hia-Ced territory along the head of the Gulf of California, at the spring at Quitobaquito, and along the lower Gila River.

Historically, the Akimel O'odham lived in permanent villages on the northern riverine perimeter of the Pimeria Alta. Although the Spaniards established settlements as far north as Tucson, they never settled among the Akimel O'odham. Numerous visits by missionaries were made to the Gila River O'odham, most notably by Father Eusebio Francisco Kino (Russell 1975:27-28).

After Mexico gained independence from Spain in 1821, more Mexican farmers, ranchers, and miners began moving north, and mission efforts decreased. These Mexicans moved into O'odham country and usurped their land and water holes. As the situation became more intolerable, the O'odham engaged the Mexicans in armed conflict. Fighting started in May 1840, and eventually escalated into a state of war that lasted until June 1843 when the O'odham capitulated (Fontana 1983b:139).

The raids of the Quechan from the west, Yavapai from the north, and Apache from the east probably were of more concern to the Gila River O'odham than the invasion of the Spaniards from the south. However, domesticated plants and animals brought by the Spaniards, especially winter wheat, markedly affected the Akimel O'odham economy (Ezell 1961, 1983:153; Russell 1975:90). The Gila River O'odham greatly expanded their farm production to meet market demands created by the Spaniards, and the resulting prosperity of the O'odham towns attracted Apache raiders. At the end of the Hispanic era of hegemony in the mid 1800s, the Akimel O'odham were characterized as a "nation" that had become an economic force and virtually the only effective military force restraining the Apaches in Sonora (Ezell 1983: 155).

Today, the Akimel O'odham live on the Gila River (583 square miles), Salt River (87 square miles), and Ak-Chin (34 square miles) reservations in southern Arizona, and off-reservation in the adjacent towns of Casa Grande, Chandler, Coolidge, and the greater Phoenix metropolitan area. There are about 11,500 enrolled members at Gila River, 5,400 at Salt River, and 500 at Ak-Chin (Schell 1993).

The Tohono O'odham speak several dialects closely related to other Upper Piman languages. An early historical account of the Tohono O'odham was prepared by Lumholtz (1912), and more recent ethnohistories were prepared by Dobyns (1972) and Fontana (1981, 1983b). The Tohono O'odham have been the subject of considerable ethnographic research (for example, Underhill 1939, 1940, 1946).

Father Eusebio Kino was the first to document the Tohono O'odham as he pursued missionary work in Pimeria Alta from 1687 until his death in 1711. Although missions and associated visiting stations were established in southern Arizona, they were confined to the upper Santa Cruz and San Pedro river valleys. Although the Tohono O'odham were not directly affected by Spanish presence in their territory, some were enticed to move to the new mission communities.

The Gadsden Purchase of 1853-1854 split the Tohono O'odham territory, with the northern portion coming under control of the United States. The international boundary proved to be quite permeable for the Tohono O'odham for many decades, but eventually most of the Tohono O'odham migrated to the United States.

The United States Senate had barely ratified the provisions of the Gadsden Purchase when Euro-American miners and mining promoters moved into the Papagueria, settling near Arivaca and Ajo. Mining activities quickly intensified contacts between Euro-Americans and the Tohono O'odham, first as the Euro-Americans rushed to the California goldfields and then as many came back to prospect in Arizona.

Historically, the Tohono O’odham lived in the eastern portion of the Papagueria where a biseasonal rainfall pattern enabled them to depend on a subsistence strategy that mixed farming with hunting game and gathering a diversity of desert plant foods. These native foods included saguaro fruit, mesquite seeds, and fruits of cholla and prickly pear cactus (Castetter and Underhill 1935). The Tohono O’odham followed a seasonal migration pattern, living in winter dwellings in the mountain foothills next to permanent springs and summer dwellings in the intermontane plains where they farmed at the mouths of washes after the summer rains had watered their fields (Fontana 1983a:131). The material culture, social organization, and subsistence practices of the Tohono O’odham are relatively well documented (Bahr 1983; Castetter and Bell 1942; Fontana 1974, 1983a, 1983b; Fontana and others 1962; Russell 1975; Underhill 1939).

As Euro-American settlement increased, reservations were established for the Tohono O'odham. The San Xavier Reservation was set aside first in 1874. The construction of the transcontinental Southern Pacific Railroad through southwestern Arizona in the 1880s depended in large part on Tohono O’odham labor, and led to the establishment of both Tohono O’odham and Euro-American settlements at Gila Bend (Hackenberg 1946). A second small reservation encompassing about 16 square miles was established for the Tohono O'odham at Gila Bend in 1882, and about 300 people were living there in three villages after the turn of the century (Fontana 1983b; Lumholtz 1912). Congress appropriated funds in 1914 to build a day school on the reservation at Gila Bend. The main Tohono O'odham reservation was not established until 1916.

Today, there are approximately 17,400 enrolled tribal members on the approximately 4,450 square miles of the Tohono O'odham reservations (Schell 1993). These include the main reservation along with San Xavier just southwest of Tucson and San Lucy at Gila Bend, both of which are governed as districts of the Tohono O'odham Nation. Some Tohono O'odham live on the Ak-Chin Reservation, and others live in nearby non-reservation communities of south-central Arizona and northern Sonora.

Rankin (1995:65-66) summarizes the scant available information concerning the Hia-Ced O'odham. She indicates that the group consisted of one or two bands that ranged widely in an area extending west from the Growler Mountains to the Colorado River, north to the Gila, and south to the Gulf of California. When Juan Mateo Manje accompanied the Jesuit priest Eusebio Francisco Kino through northwestern Sonora he gave the first written description of the Indians living there (Manje 1954). He estimated there were about 500 of these Indians. They wrested a living in the arid western Papagueria by hunting wild game, collecting plants and insects, and gathering shellfish and other seafoods from the Gulf of California. They also traded salt gathered from salt deposits at the head of the Gulf of California and performed ceremonies in exchange for earthenware pottery from the Yuman-speaking Cocopahs who lived adjacent to them in the lower Colorado River delta (Fontana 1974:513, 1983a:127-128). According to Fontana (1974:516), the Hia-Ced O'odham obtained virtually all of their pottery in trade from the Yuman Indians and because they were nomadic, they cached much of their material culture where it was needed, leaving it to be used again during future visits. Their "houses" were made of crude stone corrals or stone sleeping circles. These consisted of rings of medium-sized rocks with cobbles stacked one to two courses high.

Hackenberg (1983:161) provides a brief overview of the occupation of this territory by one group of Hia-Ced O'odham.

The Sand Papago or Areneños intermittently occupied the forbidding Sierra Pinacate region of Sonora, west of the Ajo Mountains and south to the present international boundary (Childs 1954). This band, which probably never exceeded 150 members, had a deviant subsistence pattern consisting of fish, shellfish, and a few highly specialized plants of the region of which the most important was sandroot (Ammobroma sonorae). They ranged from the Gulf of California to the Tinaja Altas in Arizona and inhabited the driest part of the Sonoran Desert. Like all Pima peoples, their subsistence pattern was diversified, including mountain sheep and other game. They also planted at least one field at Suvuk in the Sierra Pinacate (Castetter and Bell 1942:63; Lumholtz 1912:239-331, 394-397).

Given the extreme desert environment in which the Hia-Ced O'odham lived, it is not surprising that water was of great concern. The rivers marking the boundaries of their territory—the Sonoyta, Gila, and Colorado—were the most substantial sources of water. Other sources included fracture and fault springs, especially the ones at Quitobaquito and Quitovac and the head of the Gulf of California. Other ephemeral sources included streams, ponds, and charcos that briefly held water after rains, and tinajas or rock tanks that periodically fill with rain and flood water. There are about two dozen tinajas scattered throughout the western Papagueria. Scatters of flaked stone and sherds of broken ceramic vessels, as well as other archaeological materials near all of them indicate "man's former campsites, all giving testimony to the man's dependence on these sources of water" (Fontana 1983a:129). Trails that run from water source to water source also are evidence of their importance to human existence in this part of the Sonoran Desert that was home to the Hia-Ced O'odham.

Until quite recently, it was thought the Hia-Ced O'odham of the western Papagueria no longer existed as a cultural group (Bell and others 1980; Fontana 1974, 1983a; Hayden 1967). Indeed, during the last half of the nineteenth century many Hia-Ced died at the hands of Mexicans and Euro-Americans as well as succumbing to epidemic diseases. Survivors moved into mining camps and non-Indian settlements in southern Arizona, and others moved onto the Papago Indian Reservation and intermarried or enrolled with the Tohono O'odham. Today, approximately 1,300 descendants of these survivors are reclaiming their identity. Two efforts—one by the Hia-Ced Program supported by the Tohono O'odham Nation and one by the Hia-Ced Alliance promoted by off-reservation Hia-Ced—are seeking federal recognition and establishment of a reservation (Annerino 1994; Nabhan and others 1989:509).

Euro-Americans

Early Exploration

The project area was on the northern fringes of Spain's New World empire for almost three centuries beginning in the sixteenth century. Despite the claims of sovereignty, Spanish settlements in Arizona never extended north beyond Tucson, except for missions among the Hopi from 1629 to 1680 (Spicer 1962:190-194). Although the indirect impacts of the arrival of Europeans in the New World were substantial, Spanish activities in what is now Arizona were largely limited to exploration, and none of this appears to have reached the project area (Walker and Bufkin 1986).

About 44 years after the arrival of Columbus, Alvar Nuñez Cabeza de Vaca and three companions may have been the first to travel through the region after being shipwrecked on the Texas Gulf. They may have crossed the extreme southeastern corner of Arizona as they made their way to Euro-American settlements in Mexico. Cabeza de Vaca's stories of seven cities of gold stimulated the 1539 expedition led by Fray Marcos de Niza and the much more substantial effort by Francisco Vásquez de Coronado who traveled across southeastern Arizona, New Mexico, and onto the Great Plains in 1540-1542. Components of Coronada's expedition explored the Gulf of California and lower Colorado River, and also visited the Grand Canyon, but did not come within 100 miles of the project area. Spanish interests waned after Coronado failed to find riches, and colonization was not attempted until some four decades later, and then was targeted on the upper Rio Grande River Valley of New Mexico rather than Arizona. Expeditions sent out from the New Mexican colonies again visited northern Arizona, and in 1604-1605 Don Juan de Oñate followed the Colorado River to the Gulf of California.

Approximately a century later, Jesuit missionary efforts expanded into southern Arizona. Father Eusebio Francisco Kino traveled north from Sonora and Tucson to the Gila River ministering to the O'odham. Although he followed the Gila River to the Gulf of California in 1699, he avoided the big bend in the river traveling through a pass in the Maricopa Mountains about 30 miles south of the project area. However, Kino climbed a pass in the Sierra Estrella Mountains and apparently viewed the Salt River Valley to the confluence with the Verde River. The cutoff taken by Kino became the usual route of travel for later explorers such as Capitan Juan Bautista de Anza and Fray Francisco Garcés in 1775.

In 1744, Father Jacobo Sedelmayr traveled north from the Pima villages on the Gila River to the Salt River below its confluence with the Verde River, and then followed the river to the west (Bostwick and others 1996:426; Dunne 1955). He probably was the first non-Indian to travel along the southern boundary of the project area. He reported encountering no native villages until about 30 miles downstream of the confluence of the Salt and Gila rivers.

Throughout the Spanish era native groups effectively maintained control over virtually all of Arizona. The Apaches, in particular, were effective in constraining Euro-American settlement to the upper Santa Cruz River Valley from Tucson south, where no more than about 1,000 non-Indians were located at the beginning of the nineteenth century (Sheridan 1995:38). In 1795 Father Diego Miguel Bringas recommended that a presidio be built at the confluence of the Gila and Salt rivers to stem the threat of Apaches, but it never was pursued. The Spanish were occupied with civil unrest and fighting for independence broke out early in the nineteenth century. After a decade of conflict, the Mexicans won their independence from Spain in 1821. Although more Mexican ranchers and miners moved north into southern Arizona after independence, Mexican control was less effective than Spain's, and brief, lasting only slightly more than a quarter century.

During the Mexican era, the first Anglos from the United States made their way into the fringes of Mexican territory. They were mountain men in search of beaver furs. For example, Sylvester Pattie and his son James Ohio Pattie and their party entered Arizona along the Gila River and trapped along the river in 1825-1827 (Thwaites 1905). The party traveled all the way to the Colorado River, passing by the southern boundary of the project area. The party was attacked while visiting a native village (probably Maricopa) about a mile above the confluence with the Salt and Gila rivers, and later returned to exact vengeance (Sheridan 1995:43).

The project area became part of the territory of the United States as a result of the Treaty of Guadalupe Hidalgo at the conclusion of the 1846-1848 Mexican War. The southern edge of the project area was the boundary with Mexico until land south of the Gila River was acquired through the Gadsden Purchase of 1853. During the war, General Stephen Watts Kearny led troops down the Gila River but took the cutoff through the Maricopa Mountains passing about 30 miles south of the project area. Captain Philip St. George Cooke led the Mormon Battalion building a wagon road along the same cutoff (Walker and Bufkin 1986).

With acquisition of the region by the United States, the pace of Euro-American settlement quickened dramatically, and completely transformed the region within half a century. During the 1850s, the United States sent military units to explore and survey the new territory. Although several of these expeditions followed the Gila Trail, they did not enter the project area. However, in 1852 John Bartlett, of the commission established to define the boundary with Mexico, would have passed along the southern boundary of the project area as he traveled up the Gila River from Gila Bend into the Salt River Valley. There he encountered about a dozen O'odham fishing and hunting along the river (Bartlett 1854; Bostwick and others 1996:431).

Some 60,000 gold seekers traveled the Gila Trail in the late 1840s, again bypassing the project area about 30 miles to the south. Although few of these emigrants lingered in Arizona, some prospectors returned as the gold fields in California played out. The Civil War slowed settlement in the 1860s, but gold was discovered in central Arizona in 1863 and Arizona simultaneously was designated as a territory independent of New Mexico. The territorial capital and a fort were established at Prescott, and as miners spread across the territory, other forts were established to protect them from natives who resisted the invaders. The closest military installations to the project area were Camp Date Creek southwest of Prescott and Fort McDowell (originally known as Camp Verde, and then Camp McDowell) at the confluence of the Salt and Verde rivers.

The project area was along some of the routes of travel between Prescott, Fort McDowell, and the Tucson area. However, as during the preceding three centuries of early exploration, the project area was largely bypassed and witnessed little more than an occasional traveler.

Homesteading and Agriculture

The establishment of Fort McDowell stimulated agricultural activities in the Salt River Valley and irrigation ditches, following the alignments of the ancient and long-abandoned Hohokam canals, were opened up in the 1860s. The Phoenix townsite was laid out in 1870 and settlement and agricultural development spread to other parts of the valley.

In 1865, the General Land Office (GLO) selected a small hill at the confluence of the Salt and Gila rivers, some 3 miles southeast of the project area, as the initial point of survey in Arizona. The GLO surveys were conducted to promote homesteading under the terms of the Homestead Act of 1862. The project area includes all or parts of 13 townships (6-by 6-mile squares). The first two of these townships were surveyed in 1868, along the lower Agua Fria River where homesteading interests were anticipated. Five other townships to the west were surveyed 15 years later in 1883, and 11 years later four others were surveyed to the north in 1894. The rugged White Tank Mountains were not surveyed before 1922 and survey of some limited areas was not completed until 1955.

Few cultural features are depicted on these GLO plats. Three irrigation ditches, a diversion dam, fields, a house, and a corral are shown on an 1883 plat along the Gila River at the south margins of the project area. Several informal roads cross the project area from northwest to southeast and are labeled variously as wagon roads between Prescott and Phoenix or between Wickenburg (founded in response to discovery of gold at the Vulture Mine) and Fort McDowell. A few houses and a place identified as Elder's Well are plotted on an 1894 plat near these roads on the west margins of the Agua Fria River. The 1883 plat of the Township 1 North, Range 2 West depicts a right-of-way for a never-built Agua Fria and Hassayampa Railway.

The history of homesteading in the project area has not been written. A scan of Master Title Plats on file at the Bureau of Land Management indicates that numerous entries of various types were made from the 1860s through the 1890s, but most seem to have been unsuccessful and voluntarily relinquished or cancelled for lack of efforts to "prove up."

Early agricultural settlement and development seems to have been largely confined to the areas irrigated centuries before by the Hohokam. The Buckeye Canal was in operation by 1886, and was the stimulus for the founding of the town of Buckeye (originally called Sydney) in 1889 just to the southwest of the project area, and the community of Liberty within the project area in 1895 (Granger 1983). This canal was replaced with a new Buckeye Canal in 1903, and it remains in use today. The completion of Roosevelt Dam in 1912 on the Salt River (and subsequently Coolidge Dam on the Gila River in 1929) provided additional protection from flood damage that plagued the canal heading.

Agricultural development to the north of the Buckeye Canal was limited by water supplies. Attempts to develop an irrigation project along the lower Agua Fria River valley date from the 1880s (Fenicle and others 1994). William Beardsley and the Agua Fria Water and Land Company began building a diversion dam near Frog Tanks (beneath the modern New Waddell Dam) in the 1890s, but the dam was left unfinished until 1926-1927 when it was completed in conjunction with the construction of Waddell Dam and the Beardsley Canal.

Railroads were constructed on the margins of the project area. This was not in response to the level of development within the project area, however, but instead to larger regional influences. The Santa Fe, Prescott, and Phoenix Railroad was completed along the Grand Avenue corridor in 1893, providing Phoenix with a link to the Santa Fe Pacific Railroad. The Phoenix and Buckeye Railroad, a short radial line, was completed in 1910.

World Wars I and II and Goodyear

World War I gave a boost to agricultural development in the project area when the supply of long-staple cotton from Egypt and Sudan was cut off. Demand for this variety of cotton increased because it was essential for tires and airplane fabric. The Goodyear Tire & Rubber Company of Akron, Ohio purchased 24,000 acres (more than an entire township) of undeveloped land in the project area, and embarked on raising its own cotton (Sheridan 1995:213). Paul Litchfield was in charge of Southwest Cotton, a wholly owned subsidiary of Goodyear. Litchfield Park developed from his farm headquarters and labor camps during World War I. Thousands of American Indians and Mexican nationals were recruited to work in the fields.

The end of the war led to a drastic decline in cotton prices, and production shrank in response. Goodyear suffered financially, almost to the point of insolvency. During the Great Depression Goodyear developed a program for educating yeoman farmers with the intent of making it possible for them to buy small irrigated farms, and Southwest Cotton transformed into Goodyear Farms by 1943. The water right dispute between the upstream Waddell Dam project and

Southwest Cotton was resolved in the mid-1930s in favor of the upstream project, and farmland under the Beardsley Canal continued to be developed.

The Phoenix Cutoff of the Southern Pacific Railroad mainline was constructed through the area in 1926 to provide Phoenix with a direct connection to the southern transcontinental railroad. Numerous railroad spurs were built throughout much of the project area to provide access for agricultural products. Several unincorporated communities, such as Burnstead, Citrus Park, Fennemore, Norton, Perryville, Waddell, and Wayne appear to have developed as small population centers along these lines.

The onset of World War II again stimulated development in the project area. Paul Litchfield was instrumental in getting the Federal Defense Plant Corporation to lease land from Goodyear and build an aircraft plant that was operated by the Goodyear Aircraft Corporation. Goodyear employed 7,500 employees (the majority of whom were women) as wartime production peaked.

The Litchfield Naval Air Facility was established to test and deliver aircraft produced by Goodyear. During World War II, Luke Air Field also was established to the north of Litchfield Park, stimulating additional growth. The base trained more than 13,500 advanced pilots, making it the largest such training school in the world.

Post-World War II

The post-World War II period has been one of continued agricultural production. The Goodyear Aircraft Corporation has been transformed into Goodyear Aerospace, and Luke AFB continues to train fight pilots. The original "Organization House" developed at Litchfield to house visiting Goodyear executives was transformed into a public resort in 1929, and continues to operate as a resort. However, Sunbelt resort and tourism development has focused more on Phoenix and Scottsdale. The "West Side" commonly has been viewed as an agricultural backwater, blue collar, and often minority dominated community.

The development of Sunbelt retirement communities has been a West Side phenomenon. Youngtown, established in 1954, led the way. Del Webb soon followed with Sun City on the north edge of the project area, and its success led to Sun City West, and most recently Sun City Grand. Other post-World War II towns, such as El Mirage and Surprise, also continue to grow. The completion of Interstate 10 and other freeways is turning much of the project area into driving distances for "bedroom communities," and agricultural land rapidly is being converted to residential and commercial uses. The sale of Goodyear Farms to the SunCor Development Company in 1987 is representative of this trend. Upscale developers are turning their focus from the East Valley to the West Side, and the sprawl of the Phoenix metropolitan area shows signs of leaping the White Tank Mountains.

In sum, the cultural history of the region is long and complex, but the project area itself was not center stage for much of this history. Archaeological evidence of prehistoric use of the area is present, mostly relating to the Hohokam culture. Evidence of the earlier Paleoindian culture has not been recognized and evidence of the Archaic era is reflected in only a few sites that have not been investigated in any detail. Similarly, evidence of ethnohistoric use is limited to a few ambiguous ceramic sherds that might be of Yavapai origin. Historic sites relate primarily to the early agricultural history of the area. Historic preservation seems to have been a subject of little public concern, and a single 1910 school seems to be the only extant historic building that has been restored and publicly interpreted. However, local historical societies have been organized, and interest in the past is likely to increase with the ongoing rapid redevelopment of the area.

4.2.3 Prior Cultural Resource Studies

The review of agency, museum, and university files documented 92 cultural resource studies that have been previously conducted in the vicinity of the project area (Table 4-6). [Note that different institutions and agencies have used their own designations in assigning project numbers and some projects are unnumbered.] These studies have been conducted since the 1920s, but only four projects were undertaken prior to the 1970s. Since then, the pace of investigations has increased markedly in response to increasing regulatory protection of cultural resources. Fourteen projects were conducted in the 1970s, 21 in the 1980s, and 51 in the 1990s.

The studies have been conducted for a variety of reasons. The earliest studies were driven only by research interests, focused on documenting and understanding the pre-contact Hohokam culture (Gladwin and Gladwin 1929, 1930; Midvale nd, 1970). These first studies may seem out of date by modern study methods, but they are virtually the only sources of information about some of the largest Hohokam sites and canal systems, which have since been masked by modern agricultural and urban developments.

Virtually all of the other projects have been conducted to support land use planning or assess impacts of building various types of infrastructure. Housing and other types of types of development, such as a prison, fire station, senior citizens center, and landfill, have stimulated about 25 studies, and road projects another 24 studies. Flood control structures (9 projects), sand and gravel pits (8 projects), communication facilities (6 projects), pipelines (2 projects), and irrigation canal upgrades (2 projects) stimulated other surveys. Other studies were conducted in support of land use planning or land sales and exchanges by county agencies, (2 projects), the

Arizona State Land Department (2 projects), and federal agencies, including the Bureau of Land Management and Luke AFB (4 projects).

The scopes of these cultural resource projects have varied tremendously. The earliest were broad regional studies, and the areas searched for cultural resources are not well documented. These surveys did not result in complete intensive coverage by current standards. More recent surveys are much more intensive, usually being conducted by walking observational transects spaced at 15 to 20 meters apart, but they often are of very limited scope. Most of the modern surveys in the project area involve inspection of only 1 to 40 acres, and about two of every three surveys have resulted in the discovery of no archaeological or historical sites. No one survey has recorded more than eight sites in the project area. Only seven of the modern intensive surveys in the project area have encompassed a square mile or more, and the two largest have covered only a little more than 2 square miles of the project area. The projects are quite broadly distributed across the project area, and in the aggregate, they constitute somewhere on the order of a 10% sample of the 220-square-mile project area.

4.2.4 Inventory of Previously Recorded Cultural Resources

The review of records identified information about 62 archaeological and historical sites previously recorded within the project area (Table 4-7). [Site numbers have been defined by many institutions using different systems. The alphanumeric numbers assigned by the ASM are the most common, and many other institutions use a similar format. The initial alpha characters of a site number identify the state (AZ), and 1-degree by 1-degree in which the site is located unit (grid unit T encompasses the project area). Each of these grid units is divided into 16 15-minute units, and the first numeric code of a site number indicates in which of these 15-minute units the site is located. The second number is assigned serially as sites are registered. The final alpha characters indicate the recording institution, such as ASM for Arizona State Museum, ASU for Arizona State University, ACS for Archaeological Consulting Services, and ARS for Archaeological Research Services. Each institution has assigned numbers independently, and some sites have several designations. Mercifully, a move is under way to consolidate site numbers systems in conjunction with building a geographic information system database for much of the state.]

Almost two-thirds of the sites recorded in the project area are aboriginal sites dating from the pre-contact era. These sites are mostly identified as related to the Hohokam cultural tradition. However, three sites are identified as possibly dating to the earlier Archaic era. A couple of sites have sherds of Patayan ceramics as well as Hohokam sherds, and one site may have Yavapai sherds—the only indication of ethnohistoric use of the area.

More than 40% of these pre-contact sites are identified as Hohokam village sites, and some of these, particularly near the Gila River, are quite large. Most of the other sites are characterized as limited seasonal habitations or locations used during collection and processing of various types of resources such as game or native food plants. Petroglyphs (images pecked onto rocks) are reported at two sites in the White Tank Mountains. Two Hohokam irrigation canal systems also have been mapped. Midvale (nd) mapped on eof these, which we label "Canal Coldwater," as a 3- to 4-mile-long system heading from the west bank of the lower Agua Fria River and running to the southwest to serve a large village site known as Coldwater Ruin. The second system, Canal Liberty, headed from the north bank of the Gila River, and ran to the west some 7 to 8 miles dividing into three main branches and serving about a half dozen Hohokam villages, including those known as Alkali Ruin, Morocco Ruin, and the Van Liere Site.

The historic era sites represent a diversity of site types, but most are related to agricultural settlement of the area. Four are remnants of farmsteads, dating from the first half of the twentieth century. Another four are irrigation canals. One is an abandoned segment of the Old Buckeye Canal, and the other three remain in use, including the new Buckeye Canal (originally the White Tank Canal), the Beardsley Canal, and the Airline Canal. Another site is an abandoned irrigation well. One site is a hunting cabin built in 1934 by P.W. Litchfield in the White Tank Mountains, and another site is a prospect pit reflecting mining activities in the mountains. One site consists of the foundations of buildings related to the Atchison Topeka & the Santa Fe Railroad along Grand Avenue. Five of the sites appear to be simply trash dumps.

Two historical bridges across the Agua Fria River also have been recorded. The one along Grand Avenue recently has been replaced with a more modern structure, and the other is an abandoned structure along the "Avondale Highway" and has been evaluated as lacking historical significance.

One historical house, built in Spanish Colonial Revival style along Litchfield Road south of Goodyear, is inventoried in the SHPO files indicating some potential significance. However, register listing has never been pursued and the current condition of the building is unknown. Apparently, the only building within the project area that has been rehabilitated for historic interpretation is the 1910 Liberty Elementary School. [The Wigwam Resort often is locally recognized as an important historic resource, but register listing of the property has never been pursued and impacts of recent remodeling on the historical integrity of the property have not been formally evaluated.]

Two of the recorded sites have both pre-contact and historic era remains. These include the remains of an adobe stage station at the Hohokam village site known as the Morocco Ruin. The other site is the remains of a historic farmstead and a scatter of pre-contact flaked and ground stone artifacts and ceramic sherds.

4.2.5 Potential for Significant Cultural Resources

The compiled information indicates that archaeological and historical sites are common in the project area, and if the compiled inventory is representative, it suggests there might be somewhere on the order of 600 archaeological and historical sites within the project area. The vast majority of these remain to be discovered, recorded, and evaluated. In fact, the current condition and significance of many of the recorded sites are not well documented, but clearly they all do not have significant historic values and warrant in-place preservation.

The recorded sites are mostly distributed around the margins of the project area. Clearly, the most sensitive area is along the Gila River margins at the southern end of the project area. The Hohokam and early historic settlers were able to irrigate this zone and several large Hohokam villages and historic farmsteads have been recorded in this area. Although subsequent development may have obliterated the surface manifestations of the Hohokam sites, extensive buried archaeological deposits and features, such as house remnants and various types of cooking and storage pits, may remain intact. Human burials often are associated with such sites and can greatly complicate any project that affects such sites.

Other sites have been recorded along the margins of the Agua Fria River along the eastern boundary of the project area. The most substantial of these is Quass Pueblo. Remnants of what may have been other Hohokam habitations along the river have been discovered by surveys within agricultural fields prior to redevelopment for residential use. However, few sites have been recorded within the agricultural lands in the core of the project area. Surveys of undeveloped lands around Luke AFB have discovered several sites, mostly representing temporary camps and seasonal use locales. This suggests that the agricultural development probably has destroyed other similar sites that commonly are limited to surface or only shallowly buried artifact scatters and simple features such as hearths. The only Hohokam village site recorded away from the margins of the project area was noted decades ago along Yuma Road, at least a couple of miles north of the Hohokam canals.

Surveys in the creosote bush flats to the east of the White Tank Mountains are limited but suggest few sites are present in this zone. However, several smaller pre-contact and historic sites have been recorded in the mountains themselves, and surprisingly large Hohokam village sites have been noted along the eastern base of the mountains.

In sum, the compiled information indicates significant archaeological and historical sites could be found within specific drainage and flood control projects that might be designed within the project area. Most of these cultural resources are unlikely to be "project stoppers," but procedures to inventory, evaluate, and assess effects should continue to be pursued as more detailed plans are developed. See Figure 4.2, following Section 4.0 for the Cultural Resources Exhibit.

4.3 AESTHETIC TREATMENTS AND MULTI-USE

See Appendix B for the "Landscape Aesthetics Assessment and Multi-Use Opportunities Assessment," Logan Simpson Design Inc., April 17, 2000.

Table 4-6. Prior Cultural Resource Studies in the Project Area

	Project Name and Number	Scope	Sites	Reference	USGS QUAD
1	survey of "Red-on-Buff Culture" in Gila Basin and Western Arizona	regional reconnaissance survey, inspected areas not well documented	numerous sites recorded but locations of most ambiguous, 3 identified in project area, AZ A:11:2 (GP) [AZ T:11:18 (MNA), Coldwater Ruin] AZ A:11:3 (GP) [AZ T:11:22 (ASM)] AZ A:11:4 (GP) [Brewster Ruin]	Gladwin and Gladwin 1929, 1930	Avondale SW, Buckeye, Perryville
2	survey of central Arizona	regional reconnaissance survey conducted by avocational archaeologist from 1920s-1960s, inspected areas not well documented	numerous Hohokam villages and canals recorded prior to modern development, 9 sites and 2 canal systems in project area, Alkali, Brewerster, Coldwater, Morroco, Van Liere, M-1, M-3, M-4, M-5, "Canal Coldwater," and Canal Liberty	Midvale nd, 1970 (see Antieau 1981)	Buckeye, Perryville, Tolleson
3	Southern Pacific Pipeline survey ASM 1955-3	~4600 acres (80ft x 475mi) ~11 miles in project area	15 sites, none in project area	Komerska and Breternitz 1955; Holzkamper and McConville nd.	Perryville, Tolleson, Valencia
4	Maricopa County regional parks survey ASM 1963-13	reconnaissance of 28,500 acres in White Tank Mountain Regional Parks	11 sites, 3 in project area, AZ T:6:1, 2 and 7 (ASM)	Johnson 1963	Waddell, White Tanks SE
5	summary of sites in Maricopa County ASM 1964-4 SHPO 2955-I, 17-R	extensive vehicular and pedestrian survey of known site locations	352 sites, 2 previously recorded in project area, AZ T:6:7 (ASM) AZ T:11:22 (ASM)	Ayres 1965	Waddell, White Tanks SE, Perryville
6	materials pit survey ASM 1970-5	~40 acres	none	no report or registration form available	Perryville
7	flood retarding structures 2 and 3 and Buckeye Valley survey	~8 sq miles, very little in project area	17 sites, 1 in project area, AZ T:10:9 (ASU)	Bruder and others 1972	Valencia
8	ADOT Materials Pit #8321 survey ASM 1973-4	40 acres	1 previously recorded site, AZ T:11:22 (ASM)	Urban and Duering 1973	Avondale, Perryville
9	Liberty-Parker 230 kV transmission line survey ASU 73-016, 4-74	4,775 acres, (200-250ft x 175mi), ~1 mile in project area	2 sites, none in project area	Bair 1974	Valencia

Table 4-6. Prior Cultural Resource Studies in the Project Area					
	Project Name and Number	**Scope**	**Sites**	**Reference**	**USGS QUAD**
10	Tucson Gas & Electric El Sol-Vail transmission line survey ASM 1974-1	182.5 miles, 3.5 miles in project area	33 sites, 1 in project area, AZ T:11:24 (ASM), Alkali Ruin	McDonald and others 1974; Vivian 1974	Perryville, Tolleson
11	Sarival Gardens housing development survey ASU 76-096, 55-76	99 acres	none	Connors 1976	Perryville
12	White Tank Mountain communications sites survey BLM 10-179/18-10	~250 acres (in 6 parcels), ~75 acres in project area	1 site, small lithic scatter, not recorded and no number assigned	Kincaid 1976	White Tanks SE
13	Palo Verde to Kyrene 500 kV transmission system survey and data recovery BLM 18-95	~1,800 acres (100-1000ft x 73.3mi), 3.5 miles in project area	10 sites, 1 in project area, AZ T:11:24 (ASM) [AZ T:11:3 (MNA), NA 12,542, Alkali Ruin]	Powers 1978; Yablon 1982	Perryville, Tolleson
14	Caterpillar Tractor lease survey ASM 1977-48	~1,350 acres as sample of 8,625 acres	8 sites, AZ T:6:1-3 (ARS) AZ T:10:1-5 (ARS	Stone 1978; Yablon 1978	White Tanks SE, Valencia
15	survey in El Mirage ASU 5-77-037	~5 acres	none	no report or registration form available	El Mirage
16	survey in El Mirage ASU 5-77-038	~5 acres	none	no report or registration form available	El Mirage
17	canal rehabilitation survey ASU 78-056, 15-78	150 acres (100ft x 12.5 mi) 5 miles in project area	5 sites, none in project area	Roy 1978	Perryville, Valencia
18	ADOT Materials Pit #5065 survey ASM 1979-012	40 acres	none	Hammack 1979	El Mirage
19	Perryville prison survey ASM 1979-093	800 acres	none	Stone 1979	Perryville
20	Liberty sanitary landfill survey ASM 1980-83	300 acres	none	Madsen and Lange 1980	Perryville, Valencia
21	Kelton Contracting materials pit survey ASM 1981-34	44 acres, ~10 acres in project area	none	Raring-Hart 1981	Calderwood Butte
22	BLM Class II survey, sample unit #128 (Vulture Planning Unit)	40 acres	none	Bennett and Simonis 1981	Valencia

Table 4-6. Prior Cultural Resource Studies in the Project Area					
	Project Name and Number	**Scope**	**Sites**	**Reference**	**USGS QUAD**
23	BLM Class II survey, sample unit #137 (Vulture Planning Unit)	40 acres	none	Rogler 1981	White Tanks SE
24	White Tank Mountain microwave survey ASM 1982-46	1 acre	none	Murphy 1981	White Tanks SE
25	ADOT Materials Pit #8660 survey ASM 1982-54	~50 acres	none	Rosenberg 1982	Waddell, White Tanks SE
26	Marcell's communicationstower survey ASM 1983-061	8 acres	none	Madsen 1983	Waddell
27	El Mirage redevelopment project survey BLM 18-122/123	320 acres	1 site AZ T:7:3 (ACS)	Effland 1984	El Mirage
28	Sun City Interfaith senior citizens center survey (state land) ASM 1986-92	10 acres	1site (outside of survey parcel) AZ T:7:22 (ASM)	Rozen 1986	Calderwood Butte
29	Properties Corporation of American survey (state land) ASM 1986-158	281 acres	1 site AZ T:11:37 (ASM)	Zyniecki 1986	Perryville
30	Interfaith Services 12kV extension survey ASM 1987-162	<1 acre	none	Macnider 1987	Calderwood Butte
31	Grand Avenue (US 60) survey and supplement ASM 1987-175	150 acres (150ft x 8mi)	1 site, AZ T:7:137 (ASM), 1 historic structure, Grand Avenue Agua Fria River Bridge	Bontrager and Stone 1987	Calderwood Butte, El Mirage, McMicken Dam
32	Grand Avenue (US 60) supplemental survey ASM 1987-179 SHPO 2890-I,1829-R	~60 acres (70ft x 7mi)	none	Stone 1987	Calderwood Butte, El Mirage, McMicken Dam
33	McMurry Bros. Gravel Pit survey ASM 1987-179	650 acres, ~80 in project area (pit #94290)	1 site, none in project area	Madsen 1988	Perryville
34	U.S. Telecom Fiber Optic Cable Project survey ASM 1987-222 BLM 18-152	785 acres (25ft x 259mi) ~20 acres in project area (25ft x 6.5mi)	43 sites, none in project area	O'Brien and others 1987	Tolleson, Valencia

	Project Name and Number	Scope	Sites	Reference	USGS QUAD
35	Mountain States White Tank survey ASM 1988-115	<2 acres (1.5mi x 10ft)	none	Fish 1988	Waddell
36	survey for state land sale in Goodyear ASM 1988-148	85 acres	none	Bontrager 1988	Tolleson
37	ADOT Estrella Freeway-initial survey ASM 1988-239	723 acres (300-600ft x 15mi)	1 site, AZ T:7:46 (ASM) (Cotton Lane Site)	Rodgers 1989	McMicken Dam, Perryville, Waddell
38	survey along Agua Fria River between Camelback and Indian School roads ASU 88-002	~180 acres	none	no information	El Mirage
39	Huitt-Zollars property survey ASU 88-003	150 acres	none	Fowler 1988	El Mirage
40	ADOT Grand Avenue survey ASM 1989-148	422 acres (150ft x 24mi), ~9 linear miles in project area	3 sites (1 previously recorded), 1 in project area, AZ T:7:49 (ASM)	Curtis 1989	Calderwood Butte, El Mirage, McMicken Dam
41	Luke AFB golf course survey ASM 1990-15 SHPO 2985-I, 3702-R	435 acres	2 sites, AZ T:7:47 (ASM) AZ T:7:48 (ASM)	Slawson and Maldonado 1990	El Mirage
42	ADOT Estrella Freeway-Parcel 1 survey ASM 1990-185	32 acres	none	Rodgers 1990	McMicken Dam, Perryville, Waddell
43	ADOT Estrella Freeway-Parcels 4S and 8 survey ASM 1991-199	21 acres and 17 acres	none	Rodgers 1991a, 1991b	Waddell
44	Luke AFB survey SHPO 3059-I, 4020-R	440 acres	1 previously recorded site, AZ T:7:47 (ASM), 1 newly recorded site, AZ T:7:68 (ASM)	Adams 1991	El Mirage, Waddell
45	White Tank Materials Pit survey ASM 1991-53 SHPO 3020-I, 3793-R	40 acres	none	Rodgers 1991c	Waddell

Table 4-6. Prior Cultural Resource Studies in the Project Area					
	Project Name and Number	**Scope**	**Sites**	**Reference**	**USGS QUAD**
46	El Paso Natural Gas water line Salt and Gila rivers crossings survey ASM 1992-5	<10 acres, ~1 acre in project area	none	Macnider 1992	Perryville
47	Colter Flood Control Channel survey ASM 1992-36 BLM 18-213 SHPO 3182-I, 4784-R	~2.65 linear miles	1 site, AZ T:7:76 (ASM)	Rodgers 1992a, 1992b	El Mirage
48	Avondale mining reclamation survey ASM 1992-172	213 acres	none	Hohmann 1992	Tolleson
49	Survey of RTC property at Capistrano Estates, El Mirage SHPO 3104-I, 4277-R	247 acres	2 sites, AZ T:7:79 (ASM) AZ T:7:80 (ASM)	Northland Research 1992	El Mirage
50	Litchfield Vista Views survey SHPO 3112-I	~78 acres	none	Rodgers 1992c	El Mirage
51	Electric Southwest Fibernet Project survey BLM 10-252 SHPO 3169-I, 4748-R	1,440 acres (40ft x 296mi), ~27 acres in project area (5.6 miles)	37 sites (21 previously recorded), none in project area	Foster and others 1993	McMicken Dam
52	Dysart Drain improvement survey ASM 1993-228 SHPO 3200-I, 3211-I	248 acres	none	Rodgers 1993, 1994a	El Mirage, Waddell
53	Dysart Drain addendum II survey ASM 1994-35	4 acres	none	Rodgers 1994b	El Mirage
54	Litchfield and Bethany Home Road Development survey ASM 1994-67	243 acres	2 sites, AZ T:7:125 (ASM) AZ T:7:127 (ASM)	DeMaagd 1994	El Mirage
55	White Tanks FRS No. 4 inlet survey ASM 1994-188 SHPO 3242-I, 5158-R	86 acres	none	Rodgers 1994c	Perryville

Table 4-6. Prior Cultural Resource Studies in the Project Area

	Project Name and Number	Scope	Sites	Reference	USGS QUAD
56	UCI Homes Quailridge survey ASM 1994-250 SHPO 3363-I, 5385-R	407 acres	2 sites, AZ T:7:126 (ASM) AZ T:7:134 (ASM)	Rodgers 1994d	El Mirage
57	Tuthill Road Gila River bridge survey ASM 1994-291 SHPO 3240-I, 5150-R	67 acres, ~20 acres in project area	1 site, none in project area	Mitchell and Stubing 1994	Avondale SW
58	MC 85 Crossing of Buckeye Canal South Branch survey ASM 1994-305 SHPO 3346-I	~8 acres	none	Davies and Foster 1994b	Perryville
59	Arlington and Jackrabbit roads survey ASM 1994-350	7 acres, about 4 in project area	none	Wenker 1994	Perryville
60	Estrella Interim Freeway survey ASM 1994-357 SHPO 3338-I, 5362-R	22 acres	none	Howell 1994	McMicken Dam
61	Glendale Avenue survey ASM 1994-307	88 acres	none	Davies and Foster 1994a	El Mirage
62	Bullard Wash Outfall survey ASM 1995-38 SHPO 3009-I, 5301-R	300 acres	1 previously recorded site AZ T:11:24 (ASM) 2 newly recorded sites AZ T:11:49 (ASM) AZ T:11:50 (ASM)	Rodgers 1995	Perryville
63	White Tanks FRS #3 survey ASM 1995-95	256 acres	none	Adams 1995	Waddell
64	Del Webb housing development survey ASM 1995-159	95 acres	1 site, AZ T:7:136 (ASM)	Larkin 1995	McMicken Dam
65	Roosevelt Canal crossings survey ASM 1995-192 SHPO 3301-I	9 acres, ~3 acres in project area	none	Stubing and Mitchell 1995a	Valencia
66	McDowell Road canal crossing survey ASM 1995-307 SHPO 3406-I	10 acres	none	Stubing and Mitchell 1995b	Perryville

Table 4-6. Prior Cultural Resource Studies in the Project Area

	Project Name and Number	Scope	Sites	Reference	USGS QUAD
67	Greenway Road survey ASM 1996-18	35 acres	1 site, AZ T:7:138 (ASM)	Stubing and Mitchell 1996	Calderwood Butte, El Mirage
68	Maricopa Highway 85 and Estrella Parkway intersection survey ASM 1996-19 SHPO 3407-I	22 acres	none	Stubing 1996a	Perryville
69	SunCor survey ASM 1996-119	15 acres	none	Hackbarth 1996	Tolleson
70	Roosevelt Irrigation District adjunct survey ASM 1996-166	7 acres	none	Rodgers 1996	Tolleson
71	Avondale Wash survey ASM 1996-175	10 acres	none	Stubing 1996b	Perryville
72	Camelback Road Survey- Agua Fria River to Bullard Avenue ASM 1996-177	106.3 acres	none	Stubing 1996c	El Mirage
73	Inventory of undeveloped portions of Luke AFB 1996	~1,400 acres	none	Masse 1996	El Mirage, Waddell
74	El Mirage fire station survey ASM 1997-96	8 acres	none	Huett 1997	El Mirage
75	Dysart and Indian School Roads survey ASM 1997-243	109 acres	1site AZ T:11:90 (ASM)	Craig 1997	Tolleson
76	Estrella Interim Parkway survey ASM 1997-271	2,679 acres, ~550 in project area	22 sites; 1 previously recorded, 1 site in project area, AZ T:7:142 (ASM)	Adams 1997	Waddell
77	Trend Homes and Stardust development survey ASM 1997-405	800 acres	none	Marshall 1997	Waddell
78	Stardust Development survey ASM 1997-406	100 acres	none	Walsh-Anduze 1997	Tolleson
79	Regal Homes Mountain Ranch survey ASM 1997-447	424 acres	none	Mitchell 1998a	Perryville
80	Roosevelt Irrigation District Canal crossing ASM 1998-23	17 acres	1 site, AZ T:10:90 (ASM)	DeMaagd 1998	Valencia

Table 4-6. Prior Cultural Resource Studies in the Project Area

	Project Name and Number	Scope	Sites	Reference	USGS QUAD
81	El Mirage Road survey ASM 1998-42	536 acres, ~100 acres in project area	none	Lackey and Lewenstein 1999	Calderwood Butte
82	Bennett & Associates development survey ASM 1998-52	56 acres	none	Walsh-Anduze 1998	Perryville
83	Bullard Wash Outfall Expansion survey ASM 1998-53	18 acres	none	Rodgers 1998	Perryville
84	Indian School Road survey ASM 1998-123	3 acres	none	Wilson and Rogge 1998	Tolleson
85	Stardust Development Northwest Ranch project survey ASM 1998-182	250 acres	none	Henderson 1998a	McMicken Dam
86	summary of existing Information along MC 85	records search for 26-mile corridor	16 archaeological sites, 122 historic buildings and structures	Bauer and Rogge 1998	Avondale SW, Buckeye, Perryville, Tolleson, Valencia
87	Luke AFB integrated cultural resource management plan	inventory summary and management plan	>,1000 buildings and structures evaluated, 1 building (blockhouse) determined to be register eligible	Bruder and Keane 1998	El Mirage, Waddell
88	Estrella Parkway and MC 85 survey ASM 1998-408	137 acres	none	Garcia and Lewenstein 1998	Perryville
89	Fleet-Fisher Engineering White Tanks survey ASM 1998-429	320 acres	none	Mitchell 1998b	Waddell
90	Stardust Development at Van Buren & Reams Road survey ASM 1998-463	57 acres	none	Henderson 1998b	Perryville
91	no information available ASM 1999-272	160 acres	none	no information available	Waddell
92	White Tanks FRS #3 survey	~1,425 acres	1 site, AZ T:7:175 (ASM)	Bauer and others 2000	Waddell

	Table 4-7. Cultural Resources Previously Recorded in the Project Area							
	Site Name	**USGS QUAD**	**Legal Description**	**Type**	**Features**	**Size**	**Status/ Register Eligibility**	**Reference**
1	AZ T:3:55 (ASM) [AZ T:3:4 (ARS)] Beardsley Canal	McMicken Dam, Waddell, Perryville	T6N, R1E T5N, R1E T5N, R1W T4N, R1W T4N, R2W T3N, R2W T2N, R2W	irrigation canal, started in 1890s but abandoned unfinished until finished in 1927-1928	concrete lined canal	about 27 miles long	determined register eligible, documented to mitigate impacts to northern parts of canal, remains in use	Fennicle and others 1994, Introcaso 1988, Stone and Ayres 1984
2	AZ T:6:1 (ASM)	White Tank Mountains SE	T3N, R3W Section 19	Hohokam village site	scattered artifacts, cleared areas (houses), petroglyphs	75 acres	within county park	Johnson 1963
3	AZ T:6:1 (ARS)	White Tank Mountains SE	T2N, R3W Section 11	historic hunting cabin built by P.W. Litchfield ca. 1934	stone cabin	20 sq m	roof restored 1974, recorded in detail to mitigate land transfer	Stone 1978, Yablon 1978
4	AZ T:6:2 (ASM)	White Tank Mountains SE	T3N, R3W Section 24	Hohokam habitation	rockshelter, up to 1 m of deposits, disturbed		within county park	Johnson 1963
5	AZ T:6:2 (ARS)	White Tank Mountains SE	T2N, R2W Section 7	prehistoric resource procurement and processing site	rock overhang, 4 bedrock mortars, <10 artifacts (flaked stone and 1 sherd)		recorded only	Stone 1978, Yablon 1978
6	AZ T:6:3 (ARS)	White Tank Mountains SE	T2N, R3W Section 23	Hohokam petroglyphs	6 panels (21 glyphs)		recorded only	Stone 1978, Yablon 1978
7	AZ T:6:7 (ASM)	White Tank Mountains SE	T3N, R2W Section 30	Hohokam village, Colonial period	scattered artifacts, petroglyphs, up to 0.25 m of deposits	25 acres	within county park	Johnson 1963
8	AZ T:7:3 (ACS)	El Mirage	T3N, R1W Section 24	Hohokam limited habitation site	scatter of ceramics (Wingfield Plain and Gila Plain) and flaked stone, <50 artifacts		all artifacts collected, tested, recommended register ineligible, highly disturbed by farming activities	Effland 1984
9	AZ T:7:22 (ASM)	Calderwood Butte	T4N, R1W Section 36	unknown cultural affiliation and function	difuse, subrectangular cluster of cobbles about 5 meters in diameter, <20 lithic flakes and a core	175 sq m	recorded only	Rozen 1986
10	AZ T:7:25 (ASM) Quass Pueblo	El Mirage	T2N, R1W Section 1	Hohokam village site, Coloniand Sedentary periods	abundant artifacts and more than a meter of deposits	40,000 sq m (~9.9 acres)	ongoing excavation by Glendale Community College	Lawson 1987 (see Rodgers 1993)

Table 4-7. Cultural Resources Previously Recorded in the Project Area

	Site Name	USGS QUAD	Legal Description	Type	Features	Size	Status/ Register Eligibility	Reference
11	AZ T:7:46 (ASM) [AZ T:7:2 (ARS)]	McMicken Dam	T4N, R2W Section 24	possibly Archaic resource procurement and processing site	scatter of flaked and ground stone, <10 artifacts	78 sq m	completely collected	Rodgers 1988
12	AZ T:7:47 (ASM)	El Mirage	T2N, R1W Section 9	possibly Archaic resource procurement and processing site	scatter of flaked and ground stone (including a projectile point) and 5 plain ware ceramics, ~200 artifacts	23,400 sq m (~6 acres)	potentially register eligible (Criterion D), some erosion	Adams 1991, Slawson and Maldonado 1990
13	AZ T:7:48 (ASM)	El Mirage	T2N, R1W Section 9	prehistoric and Euroamerican habitation site	aboriginal ceramics (type unknown), flaked and ground stone, 3 concrete and brick structure foundations, 2 wells, 1 stock tank, and 1 concrete fish pond, several trash dumps (historic metal and glass items)	120,000 sq m (~30 acres)	potentially register eligible (Criterion D)	Slawson and Maldonado 1990
14	AZ T:7:49 (ASM) [AZ T:7:2 (ARS)]	McMicken Dam	T4N, R1W Section 20	Euroamerican trash disposal, circa 1910-1920	dispersed artifact scatter, <100? Artifacts	2,675 sq m	recommended register ineligible	Stone 1989
15	AZ T:7:68 (ASM)	Waddell	T2N, R1W Section 17	possibly Archaic resource procurement and processing site	scatter of flaked and ground stone, 10 plain ware ceramics, three artifact concentrations, several clusters of burned and unburned rock	245,000 sq m (~60 acres)	potentially register eligible (Criterion D), some erosion	Adams 1991
16	AZ T:7:76 (ASM) Airline Canal	El Mirage	T2N, R1W Sections 11, 12, 14, 21, 22, 23	irrigation canal built circa 1916	concrete-lined canal, 12 ft wide, 3 ft deep	4.7 miles	concrete lining deteriorating, still in use	Rodgers 1992
17	AZ T:7:79 (ASM)	El Mirage	T3N, R1W Section 13	possible Hohokam habitation site, Sacaton phase	scatter of flaked and ground stone, and ceramics (Sacaton Red-on-buff, and Gila Plain)	3,375 sq m	potentially eligible (Criterion D), in tilled field	Northland Research 1992
18	AZ T:7:80 (ASM)	El Mirage	T3N, R1W Section 13	possible Hohokam habitation site, Sacaton phase	scatter of flaked and ground stone, and ceramics (Sacaton Red-on-buff, and Gila Plain)	6,000 sq m (~1.5 acres)	potentially eligible (Criterion D), in tilled field	Northland Research 1992
19	AZ T:7:125 (ASM)	El Mirage	T2N, R1W Section 15	Euroamerican trash deposits, circa 1900-1940	two discrete concentrations, ~400 artifacts (glass, ceramics, metal, wood)	140 sq m	recommended register ineligible	DeMaagd 1994
20	AZ T:7:126 (ASM)	El Mirage	T2N, R1W Section 15	prehistoric resource procurement and processing site	rock ring (~1 m diameter), scatter of flaked stone (~20 artifacts)	120 sq m	recommended register ineligible	DeMaagd 1994, Rodgers 1994c

	Site Name	USGS QUAD	Legal Description	Type	Features	Size	Status/ Register Eligibility	Reference
21	AZ T:7:127 (ASM)	El Mirage	T2N, R1W Section 10	prehistoric resource procurement and processing site	scatter of flaked stone (<30 pieces), and 4 pices of burned stone	550 sq m	unknown	DeMaagd 1994
22	AZ T:7:134 (ASM)	El Mirage	T2N, R1W Section 15	Euroamerican homestead, circa 1921-1939	concrete water tank foundation, water trough foundation, concrete piers (house foundation), concrete trough, well, 2 roads, trash scatter, trash dump	6,650 sq m (~1.6 acres)	register ineligible, site subsequently destroyed	Rodgers 1994c
23	AZ T:7:136 (ASM)	McMicken Dam	T4N, R2W Section 26	Hohokam resource procurement and processing site	two artifact concentrations (Wingfield Plain ceramics, flaked and ground stone), rectangular depression	20,000 sq m (~5 acres)	register eligible, tested	Larkin 1995, Lerner and Larkin 1995
24	AZ T:7:137 (ASM) [AZ T:7:1 (ARS)]	El Mirage	T3N, R1W Section 12	structure and building foundations, probably railroad related	concrete floor slab, concrete foundation, steel clad water tower, 20 masonary pilasters, 21 concrete pilasters	1,000 sq m	recommended register ineligible	Bontrager and Stone 1987
25	AZ T:7:138 (ASM)	El Mirage	T3N, R1W Section 12	Hohokam resource procurement and processing site	scatter of ceramics (Gila Plain and red-on-buff), flaked and ground stone (<30 artifacts)	850 sq m	recommended register eligible, in tilled field	Stubing and Mitchell 1996
26	AZ T:7:142 (ASM)	McMicken Dam	T4N, R2W Section 24	prehistoric resource procurement and processing site	scatter of flaked and ground stone, 2 clusters of fire-cracked rock	1,700 sq m	potentially register eligible	Adams 1997
27	AZ T:7:175 (ASM)	Waddell	T2N, R2W Section 4	Euroamerican trash deposits, circa 1900-1940	4 concrete, cobble, and pipe features, small rock ring, 4 artifact concentrations	20,000sq m (~5 acres)	recommended register ineligible	Bauer and others 2000
28	AZ T:10:1 (ARS)	Valencia	T2N, R3W Section 23	Hohokam petroglyphs	7 panels (108 glyphs)		recorded in detail to mitigate land transfer	Stone 1978, Yablon 1978
29	AZ T:10:2 (ARS)	Valencia	T2N, R3W Section 23	Hohokam and Patayan seasonal base camp, Santa Cruz phase	scatter of flaked stone and ceramics (Santa Cruz Red-on-buff, Gila Plain,Gila Bend Variety, and Lower Colorado Buff Ware)	2,000 sq m	surface collected and tested to mitigate land transfer	Stone 1978, Yablon 1978
30	AZ T:10:3 (ARS)	Valencia	T2N, R3W Section 24	historic mining related site	prospect shaft		recorded only	Stone 1978, Yablon 1978
31	AZ T:10:4 (ARS)	Valencia	T2N, R3W Section 24	Hohokam resource procurement site, Sacaton phase	scatter of ceramics (~400) (Sacaton Red-on-buff), only 1 or 2 vessels	3,700 sq m	completely collected and tested to mitigate land transfer	Stone 1978, Yablon 1978

Table 4-7. Cultural Resources Previously Recorded in the Project Area

	Site Name	USGS QUAD	Legal Description	Type	Features	Size	Status/ Register Eligibility	Reference
32	AZ T:10:5 (ARS)	Valencia	T2N, R3W Section 23	Hohokam, Patayan, and possibly Yavapai resource procurement site	3 sherd concentrations, ~100 sherds (Santa Cruz/Sacaton Red-on-buff, Gila Plain, Wingfield Plain, Lower Colorado Buff Ware, Yavapai?)	465 sq m	completely collected to mitigate land transfer	Stone 1978, Yablon 1978
33	AZ T:10:9 (ASU)	Buckeye	T1S, R3W Sections 11, 12	Hohokam habitation site, Classic period	artifact concentration	3,000 sq m	badly disturbed by historic house foundations, and agricultural development	Bruder and others 1972
34	AZ T:10:90 (ASM)	Valencia	T1N, R2W Sections 13, 18	Euroamerican trash dump, 1940s-1960s historic artifact scatter containing	dirt road (possible historic), earthen ditch, trash scatter (glass, ceramic, metal, wood, concrete items)	149,000 sq m (~37 acres)	recommended register ineligible	DeMaagd 1998
35	AZ T:11:2 (PG) [Site 81]	Perryville	T1N, R2W Sections 11, 14	Hohokam village, Classic period	trash mounds, ceramic scatters		mounds partially leveled by cultivation	Schroeder 1940, (see Bostwick 1993)
36	AZ T:11:4 (ASU)	Perryville	T1N, R1W Section 32	prehistoric resource procurement site	scatter of flaked stone and ceramics			site form not found, (see Stone 1983)
37	AZ A:11:4 (GP) Brewster Ruin	Avondale, Buckeye	T1S, R2W Section 7	Hohokam village site, Colonial and Sedentary phases				site form not found, (see Stone 1983)
38	AZ T:11:5 (ASM) [AZ A:11:3 (PG)]	Perryville	T1N, R2W Sections 29, 30	Hohokam resource procurement area, Sedentary and Classic periods	sherd scatter (Sacaton Red-on-buff, red wares), possible chert quarry	10 acres		Ayres 1965, Johnson 1963
39	AZ T:11:7 (MNA) [NA 14693]	Perryville	T1N, R2W Section 28	site of Liberty Gin Company, circa 1917-1925	2 concrete foundations, brick-lined well, sparse artifacts	10,000 sq m (~2.5 acres)	data recovery conducted to mitigate imapcts of PVNGS water line	Antieau 1981, Stein 1977
40	AZ T:11:8 (MNA) [NA 14694]	Perryville	T1N, R2W Section 27	Euroamerican farmstead, circa 1917-1940s	4 concrete foundations, cemented cobble wall in bank of adjacent Buckeye Canal	9,375 sq m (~2.3 acres)	data recovery conducted to mitigate imapcts of PVNGS water line	Antieau 1981, Stein 1977

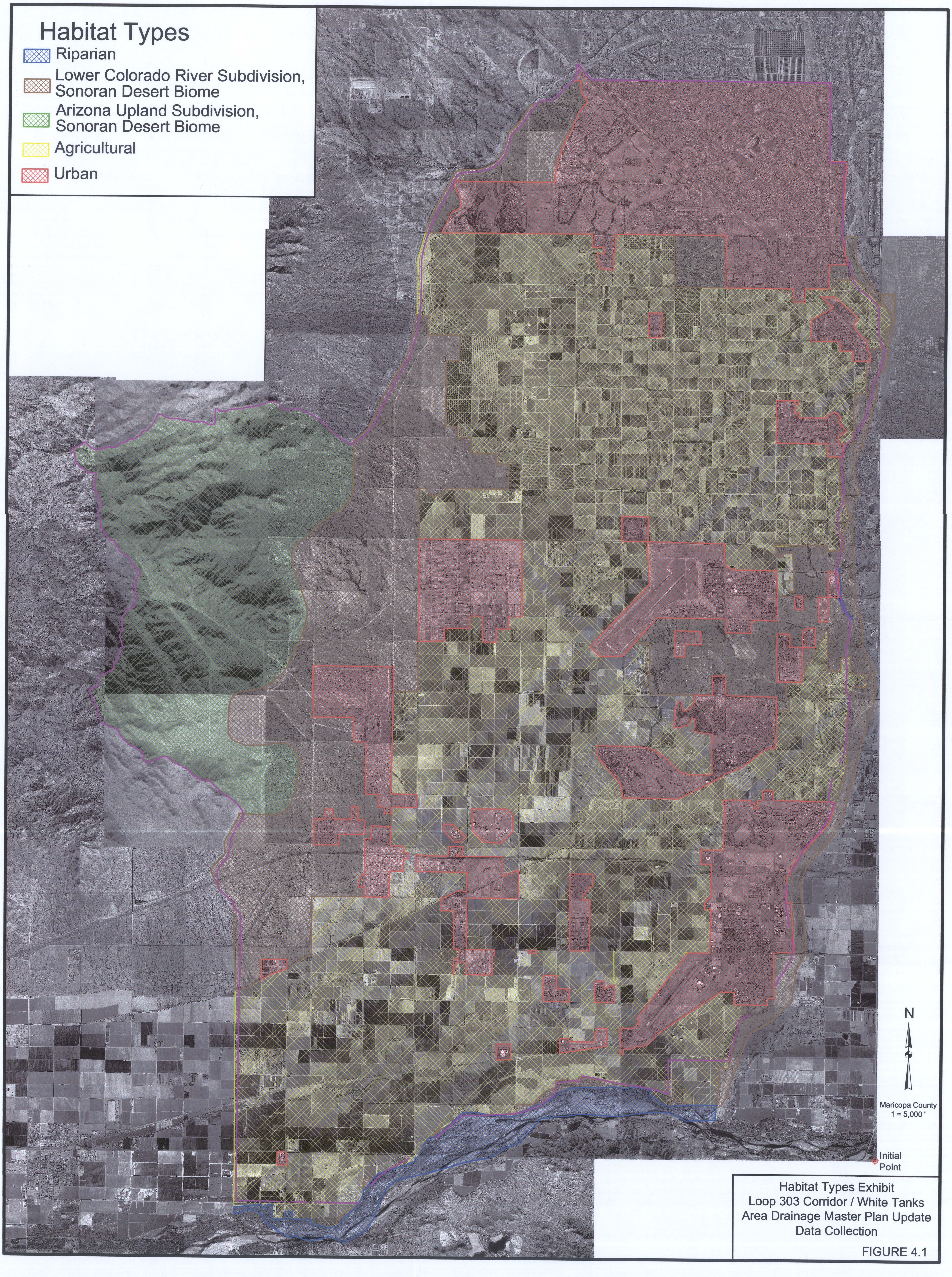
Table 4-7. Cultural Resources Previously Recorded in the Project Area								
	Site Name	USGS QUAD	Legal Description	Type	Features	Size	Status/ Register Eligibility	Reference
41	AZ T:11:9 (MNA) [NA14695] Morocco Ruin	Perryville	T1N, R2W Sections 25, 26	Hohokam Classic period village; historic era stage station	compound, several trash mounds, burials, adobe ruins of stage station	~50 to 55 acres	badly damaged by agricultural and residential development, data recovery conducted to mitigate imapcts of PVNGS water line	Antieau 1981, Midvale nd, Stein 1977
42	AZ T:11:12 (MNA) [NA14725]	Perryville	T1N, R2W Section 27	historic farmstead, circa 1926	house, barn, animal pens, all of wood frame construction	~7 acres		Stein 1977
43	AZ T:11:18 (MNA) [AZ A:11:2 (GP)] [NA12540] [NA15798] [State Inventory #312] Coldwater Ruin	Tolleson, Perryville	T1N, R1W Sections 21, 22, 27, 28	Hohokam vllage site	ball court 24 mounds	>300 acres	data recovery conducted to mitigate imapcts of PVNGS water line	Antieau 1981, Midvale nd, Stein 1977
44	AZ T:11:22 (ASM) [AZ A:11:3 (GP)]	Perryville	T1N ,R2W Section 34	possible Hohokam habitation site, Sacaton phase	aritfact scatter	10,000 sq m (~2.5 acres)	disturbed by agricultural development and erosion, site location ambiguous	Ayres 1965, Urban and Duering 1973 Vivian 1963
45	AZ T:11:24 (ASM) [AZ T:11:2 (MNA)] [AZ T:11:3 (MNA)] [NA 12541, 12542] Alkali Ruin	Perryville	T1N, R2W Section 25 T1N R1W Sections 29, 30	Hohokam village site	~ 15 trash mounds	~200 acres	disturbed by agricultural development and Buckeye Canal, data recovery conducted to mitigate imapcts of PVNGS water line	Antieau 1981, Midvale nd, Stein 1977
46	AZ T:11:37 (ASM)	Perryville	T1N, R2W Section 5	Euroamerican trash dump, early 20th century	2 trash scatters	100 sq m	recommended register ineligible	Zyniecki 1986

Table 4-7. Cultural Resources Previously Recorded in the Project Area								
	Site Name	**USGS QUAD**	**Legal Description**	**Type**	**Features**	**Size**	**Status/ Register Eligibility**	**Reference**
47	AZ T:11:38 (ASM) [AZ T:11:1 (MNA)] [NA 125529] Van Liere Site	Perryville	T1N, R2W Sections 28, 29	Hohokam village site, Santa Cruz and Sacaton phases	>15 trash mounds, ballcourt, "huge cremation burial ground	~75 acres	disturbed by agricultural development, limited excavations in 1930s and 40s, data recovery conducted to mitigate imapcts of PVNGS water line	Antieau 1981, Midvale nd, Stein 1977
48	AZ T:11:44 (ASM)	Tolleson	T1N ,R1W Section 9	historic well, post-1927	steel well shaft, concrete pad, concrete pipe, concrete basins, 5 concrete foundation pilasters	1,075 sq m	recommended potentially register eligible	Stone 1992
49	AZ T:11:49 (ASM) Old Buckeye Canal	Perryville	T1N, R1W Section 29	historic canal, circa 1886-1902	canal depression	0.3 mile long	lakcs integrity, recommended register ineligible	Rodgers 1995
50	AZ T:11:50 (ASM) Buckeye Canal	Perryville	T1N, R1W Section 29	historic canal, built 1903	modern canal, on alignment of older White Tanks Canal	0.3 mile long segment rcorded	recommended register eligible	Rodgers 1995
51	AZ T:11:90 (ASM)	Tolleson	T2N, R1W Section 26	possible Euroamerican habitation site, post-World War I	grave (dog) canal segment several cement foundations reservoir 2 wells or cisterns scattered trash (mostly modern)	96,000 sq m (~24 Acres)	recommended register ineligible	Craig 1997
52	M-1	Perryville, Buckeye	T1N, R2W Section 33 T2N, R2W Sections 4, 5	Hohokam habitation site	trash mounds		unknown, recorded decades ago	Midvale nd, 1970; (see Stone 1983)
53	M-3	Perryville		Hohokam habitation site	trash mounds		unknown, recorded decades ago	Midvale nd, 1970; (see Stone 1983)
54	M-4	Perryville	T1N, R2W Section 32	Hohokam habitation site	trash mounds		unknown, recorded decades ago	Midvale nd, 1970; (see Stone 1983)

	Site Name	USGS QUAD	Legal Description	Type	Features	Size	Status/ Register Eligibility	Reference
Table 4-7. Cultural Resources Previously Recorded in the Project Area								
55	M-5	Perryville, Tolleson	T1N, R1W Section 29	Hohokam habitation site	trash mounds		unknown, recorded decades ago	Midvale nd, 1970; (see Stone 1983)
56	lithic scatter no number assigned	White Tank Mountains SE	T3N, R3W Section 27 and 34	prehistoric resource procurement	scatter of flaked stone	"small"	avoided, not recorded, evaluated as not warranting mitigation	Kincaid 1976
57	Canal "Coldwater"	Tolleson	T1,N, R1W Sections 14, 15, 21, 22, 28	Hohokam canal	main canal and 4 unnamed branches on southwestern end	3 to 4 miles long,	disturbed by development	Midvale nd, 1970; (see Antieau 1981)
58	Canal Liberty	Perryville, Avondale SW	T1N, R1W Sections 29, 30, 32 T1N, R2W Sections 25, 26, 27, 28, 29, 31, 32, 33, 34 and 35 T1S, R2W Sections 4 and 5	Hohokam canal	main canal splits into Lower Branch, Liberty Branch, and Van Liere Branch	7 to 8 miles long	disturbed by development	Midvale nd, 1970; (see Antieau 1981)
59	historic house, State Inventory #123	Tolleson		historic house	Spanish Colonial Revival style residence		unknown	SHPO files
60	Agua Fria Bridge State Inventory #228	Tolleson	T1N, R1W Sections 11, 14	bridge, built 1915-1916, replaced with new bridge 1930	original bridge a concrete deck girder with 38 spans, 12 washed away by 1920, replacement bridge has 5 through truss spans and 16 concrete girder approach spans	~1/4 mile long	register ineligible	Abbe 1981, Fraser 1987a, 1987b
61	Liberty Elementary School State Inventory #2736	Perryville	T1N, R2W Section 32	historic school house, built 1910	4-room, brick building with bell tower	<1 acre	register eligible, restored 1980s	Martin 1986

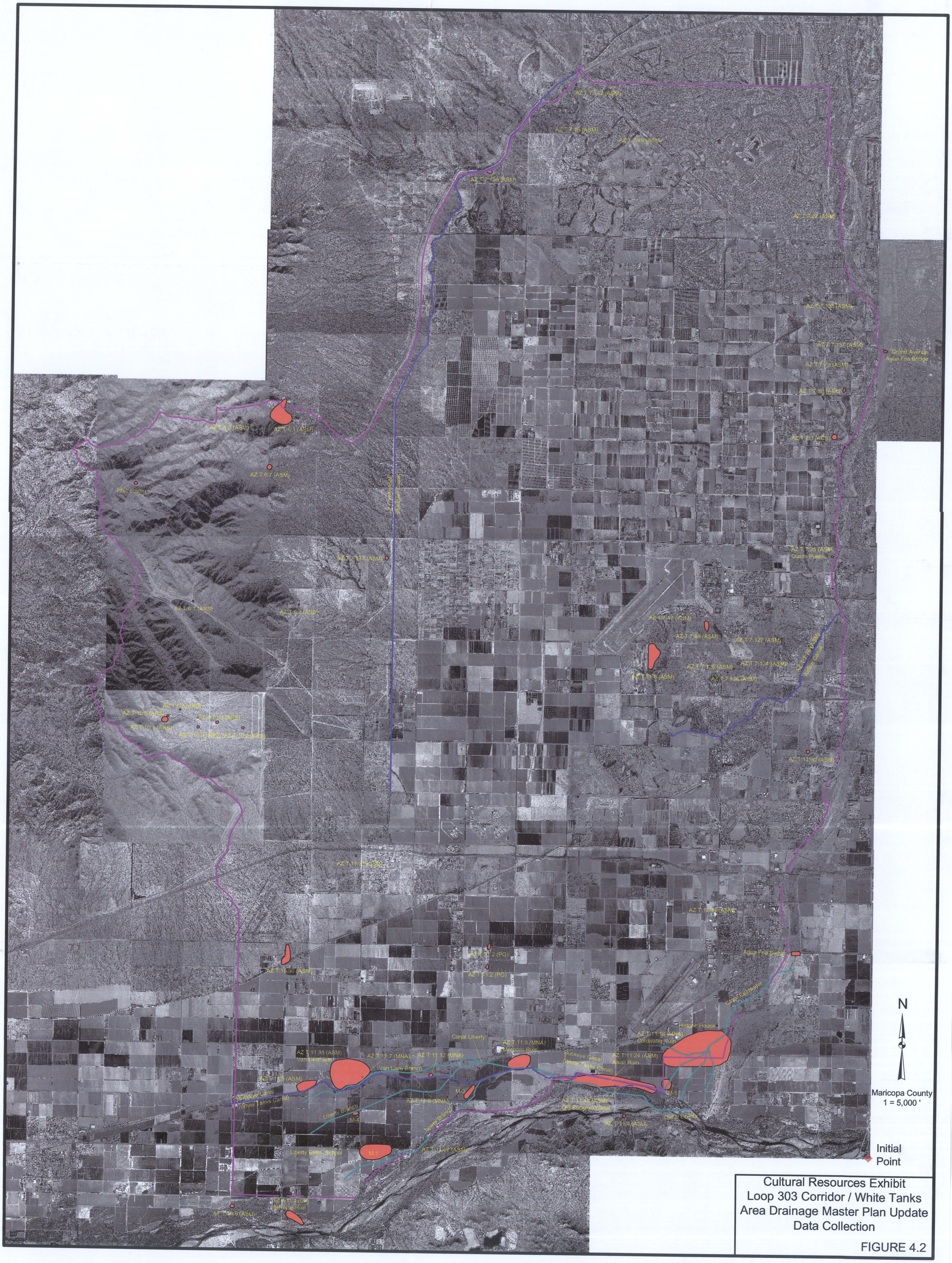
Table 4-7. Cultural Resources Previously Recorded in the Project Area

	Site Name	USGS QUAD	Legal Description	Type	Features	Size	Status/ Register Eligibility	Reference
62	Grand Avenue Agua Fria Bridge	El Mirage	T3N, R1E Section 18	bridge, circa 1920			register ineligible	Bontrager and Stone 1987, Fraser 1987a, 1987b



Habitat Types Exhibit
Loop 303 Corridor / White Tanks
Area Drainage Master Plan Update
Data Collection

FIGURE 4.1



Cultural Resources Exhibit
Loop 303 Corridor / White Tanks
Area Drainage Master Plan Update
Data Collection

FIGURE 4.2

5.0 LAND

The following sections contain brief discussions on Rights of Entry and Land Use/Zoning. Rights of entry describe how a piece of land can be accessed for survey, construction or any other purpose. Land use and zoning describes the type of land use expected within the Loop 303 ADMP project area based on current zoning, area plans and field investigation.

5.1 RIGHTS OF ENTRY

Before engineers, planners, architects, survey crews or any other personnel associated with the Loop 303 ADMP may enter a private piece of land for any reason, they must have proper rights of entry. This will be very important during Level II of this project once the specific alternatives under consideration have been narrowed to three. At this point, rights of entry can be obtained for the pieces of private land where access is required for the project to continue forward.

Prior to actual construction of a structure or facility, rights of entry might be required for detailed field reconnaissance, land surveys or a variety of other reasons.

At this point in the project, it is not anticipated that private land will need to be accessed. Since there have not been any specific alternatives identified as part of the data collection portion of the project, exact locations for proposed facilities are not yet known. Therefore, no private property where entry would be required has been identified.

We have contacts with municipalities, Luke AFB, ADOT, MCDOT and the private subdivisions that we can contact prior to entering their limited-access, gated sites. When entry is required on FDCMC property, we will be coordinating with our project manager.

5.2 LAND USE/ZONING

Several types of land use occur throughout the project area. These uses range from agricultural to residential to governmental.

Agricultural – The predominant land use in the project area is agricultural. Several types of agricultural uses occur such as vegetable crops, rose fields, citrus orchards, hay fields, and dairy farms. Most of this existing agricultural land will change to residential developments in the near future.

Residential – Existing residential development occurs throughout the project area. Higher concentrations of residential development occur to the north (Sun City) and along the east edge of the project area.

Park/Open Space – Designated park and open space occurs predominantly within the residential areas. The White Tanks Regional Park is located on the northwest corner of the project area.

Industrial – Small pockets of industrial development occur within the project area. This mainly occurs in the southeast corner of the project site adjacent to the Goodyear Airport.

Commercial – Commercial developments typically occur at the major intersections. Commercial development ranges from the local Circle K to anchor shopping centers and strip shopping centers.

Governmental – Luke AFB is located within the project area. As is typical, this area is not open to public use. This installation includes base housing, commercial areas, park/open space and what could be considered industrial areas.

White Tank Mountains – The White Tank Mountains are a mountain range bounding the project area on the west. This mountain range is mostly natural with some privately owned land, military land, state trust land and county land.

Agua Fria and Gila Rivers – The Agua Fria River defines the east boundary of the project area. The river and its floodplain are mostly natural with a mixture of private/commercial development and agriculture adjacent on the west. The immediate river area is characterized as a riparian habitat and is heavily vegetated. The Gila River defines the southern boundary of the project area. This river and its floodplain are mostly natural. The land use in the project area adjacent to the river on the north is predominantly agriculture mixed with a very small number of private residences. The immediate river area is characterized as a riparian habitat and is heavily vegetated. There is usually water present in the low channel of the river during the winter months.

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Loop 303 Corridor/White Tanks Area Drainage Master Plan Update Contract FCD 99-40

Existing Condition Hydrology

Prepared for:

Flood Control District of Maricopa County

November 2002

Prepared by:

URS

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1.0 INTRODUCTION

The purpose of this report is to document the results of the updated existing condition HEC-1 hydrology model submitted to the Flood Control District of Maricopa County (FCDMC) for the Loop 303 Corridor/White Tanks Area Drainage Master Plan Update (ADMP Update). The results of the updated HEC-1 model will supercede those prepared by WLB and submitted with the "Flood Study Technical Data Notebook," dated May 28, 1992, produced for the "White Tanks/Agua Fria Area Drainage Master Study." From this point forward, that study will be referred to as the WLB Study.

The project area is located west of the Agua Fria River and is bounded on the north by the McMicken Dam and US 60, on the west by the White Tanks Mountains, on the east by the Agua Fria River and on the south by the Salt/Gila rivers. For a more detailed description of the project and location, see the "Draft Data Collection Report," February 2000. See Figure 1.1.

For simplicity, multiple groupings of sub basins were created and labeled as Super Basins. These groupings were based upon major drainage divides or boundaries found throughout the project area. In other words, all of the sub basins within a particular Super Basin will ultimately discharge to a common point downstream. The super basin concept allows the reader to quickly identify the general geographic location of a sub basin relative to the overall project area. Major super basin divides include existing canals, ridge lines, existing or improved channels, etc.

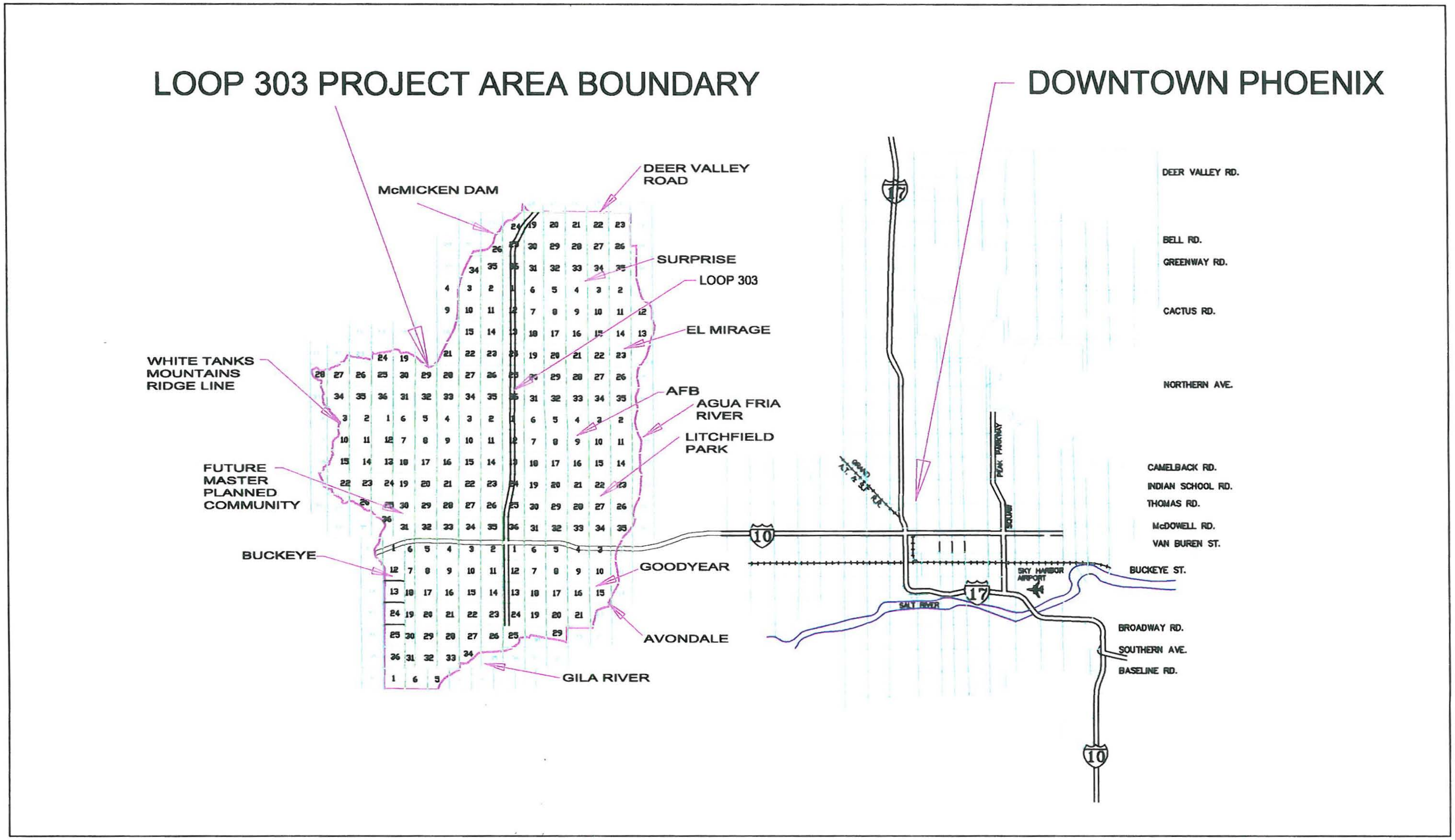
This report will briefly describe any changes in modeling assumptions, methodology or the project area that have occurred since the WLB Study. Such changes include the recent construction of flood control structures, land use within sub basins, updated approach to modeling technique, revised input for all HEC-1 variables with new assigned values, and more detailed soil information.

In addition to changes that have occurred since the WLB Study was completed, other changes to the effect of retention due to existing methodology, assumptions regarding the extent of development, land use and proposed development will be summarized.

1.1 ADMP UPDATE HYDROLOGIC MODEL

As with the WLB Study, the hydrologic modeling used with the ADMP Update was prepared using the HEC-1 Flood Hydrograph Package computer program created by the U.S. Army Corps of Engineer's Hydrologic Engineering Center. The following input data methods were used with the ADMP Update study. These are the same methods used with the WLB Study.

P:\FCDMC\E152600\SUBMITTALS\RE-SUBMIT\DATA COLLECTION&VA - EXIST. HYDROLOGY\4-15-03\FIGURES\FIGURE 1.1.DWG



VICINITY MAP

URS

Flood Control District of Maricopa County

MAY, 2003
Figure 1.1

Rainfall – The SCS Type II rainfall distribution was used to model the rainfall pattern expected during the 100-year, 24-hour storm event.

Precipitation – The total 100-year, 24-hour precipitation was estimated using the isopluvial map on Figure 2.13 from the FCDMC Hydrology Manual Volume II, 1995. This value was estimated by the WLB Study as 4.03 inches and was verified by this study.

Aerial Reduction Factor(s) – Using the JD card in the HEC-1 model, the aerial reduction factors from table 2.1a in the FCDMC Hydrology Manual were used to simulate the effect of increased distance from the storm center on rainfall intensity.

Hydrograph Generation – The hydrograph generation was done using UI cards to simulate the S-Valley Hydrograph for each individual sub basin. The UI records were generated using the FCDMC MCUHP2 program.

Rainfall Runoff Estimation – The Green and Ampt method for determining the amount of rainfall runoff on a given sub basin was used in this study.

1.2 ASSUMPTIONS

There were several assumptions associated with the development of the ADMP Update existing condition HEC-1 model for the project area. Below is a brief summary of the assumptions used.

Existing Development – All development visible on the aerial photo (flown in January 2000) was assumed to be developed. A few other areas were included based on field reconnaissance conducted several weeks after the flight date. Large drainage systems that were proposed by various approved master planned communities and observed to be under construction during field visits were also considered to be existing. It should be noted that the original intent was to include all development with final approved drainage reports as of May 15, 2000. This approach was abandoned when it became clear that many of these developments, while approved, might never actually be built.

Transmission Losses – Transmission losses were removed from the HEC-1 model. This was due to a lack of adequate calibration data.

Onsite Retention in Developed Areas – It was recommended by FCDMC that only 80% of the reported value for retention provided by a given development within the project area would be reflected by the HEC-1 model. This should account for any decrease in efficiency of constructed basins due to siltation, variations from the design during construction, addition of aesthetic berms and mounds decreasing calculated (designed) capacity and/or site grading field changes that may have eliminated some areas from those contributing to the runoff at a particular retention basin.

Sub Basin Boundary Areas – The digitized version of the sub basin boundary map provided by the FCDMC does not exactly match the hand-drawn version submitted with the WLB Study. Consequently, measurement of the digitized areas does not exactly match those used in the model. Since the areas used in the model correspond to the sub basins drawn by WLB, the areas used in the model are assumed to be correct. If a sub basin boundary was changed as a result of the ADMP Update, then the revised boundary was drawn and the area recalculated.

Existing Borrow Pits on Caterpillar/DMB Property – The borrow pits that currently exist in the White Tanks Watershed on the Caterpillar property where the developer (DMB) is proposing a master planned community have been modeled as existing. According to the DMB report for this master plan, the borrow pits will be replaced in kind with similar basins to provide an equivalent amount of retention volume.

Routes and Diverts – In sub basins where there were no significant changes since the WLB Study, routes and diverts were assumed to be the same. See the "Loop 303 Corridor Existing Condition Routes, Diverts, Stage-Storage," by URS, March 23, 2001. If the route in the WLB Study was through a wash or channel that was incorporated into a development, or mass grading changed the direction of flow between sub basins, new routes were developed and input to the ADMP Update HEC-1 model.

1.3 OTHER RELEVANT STUDIES

Other drainage studies that have been conducted in the project area by others since the WLB Study have been reviewed and incorporated into the ADMP Update where appropriate.

Recently, a study of the watershed area contributing to the peak discharges at the White Tanks Flood Retarding Structure (FRS) #3 was conducted by the Engineering Application/ Development Branch Manager of the FCDMC. The report, "Hydrologic Analysis for White Tanks Flood Retarding Structure No. 3 Watershed," dated May 11, 2000, was prepared after comparison of runoff volumes computed by the WLB Study were made with those computed by the Natural Resources Conservation Service (NRCS) TR-20 model. This comparison showed that the volume of runoff computed at the White Tanks FRS #3 under the WLB Study was approximately 60% less than that computed under the NRCS study.

It was discovered that the values for the saturated hydraulic conductivity described with the XKSAT variable in WLB Study, were overestimated for all of the soil types present in the watershed. In fact, the WLB Study used XKSAT values that were much higher than those currently documented in the FCDMC Drainage Design Hydrology Manual (DDHM), 1995. However, even the values documented in the FCDMC DDHM are too high when compared with the NRCS' soil hydrologic group classification. The reason for this is based on the theory that as the volume of rock material within the soil-rock matrix increases, the hydraulic conductivity of the soil decreases. This effect is not considered in the XKSAT values given in the FCDMC's DDHM.

A verification field trip was conducted by FCDMC and NRCS staff to determine the correct estimates for the volumetric rock percentage within the White Tanks FRS #3 structure watershed soil groups. Based on the results of this field trip, a final hydrologic model was developed by modifying the XKSAT values within the HEC-1 model prepared during the WLB Study. Additionally the revised model does not account for transmission losses since these have been determined too complex to accurately estimate.

The output from the modified model showed higher volume estimates in the individual sub basins within the White Tanks FRS #3 watershed from approximately 11% to 89%. The average increase in volume produced throughout the watershed was approximately 54%. Similarly, the peak discharges generated within the watershed increased from 8% to 54% with an average increase of approximately 29%.

It was decided that the revised XKSAT values developed by the detailed study of soils conducted by the FCDMC staff described above would be used to design the White Tanks FRS #3 improvements only.

For consistency with the current FCDMC DDHM, the values documented in the DDHM for the XKSAT variable were applied to all of the sub basins in ADMP Update project area including the White Tanks FRS #3. These values are lower than those used with the WLB Study and therefore produce higher volumes and peak discharges however they are higher than those associated with the above analysis for White Tanks FRS #3.

2.0 SUB BASIN PARAMETER REVISIONS

Some of the parameters used to describe the physical characteristics of individual sub basins were changed as a part of the ADMP Data Existing Condition HEC-1 model. While some of the changed parameters were a result of recent development in the project area, others were due to new assigned values for certain variables or more detailed source data that have recently become available.

2.1 SOILS

Since the WLB Study, the soils mapping available in the ADMP Update project area has become more detailed. Given these new data, some of the parameters for sub basins have changed and were updated in the current study.

2.1.1 WLB Study

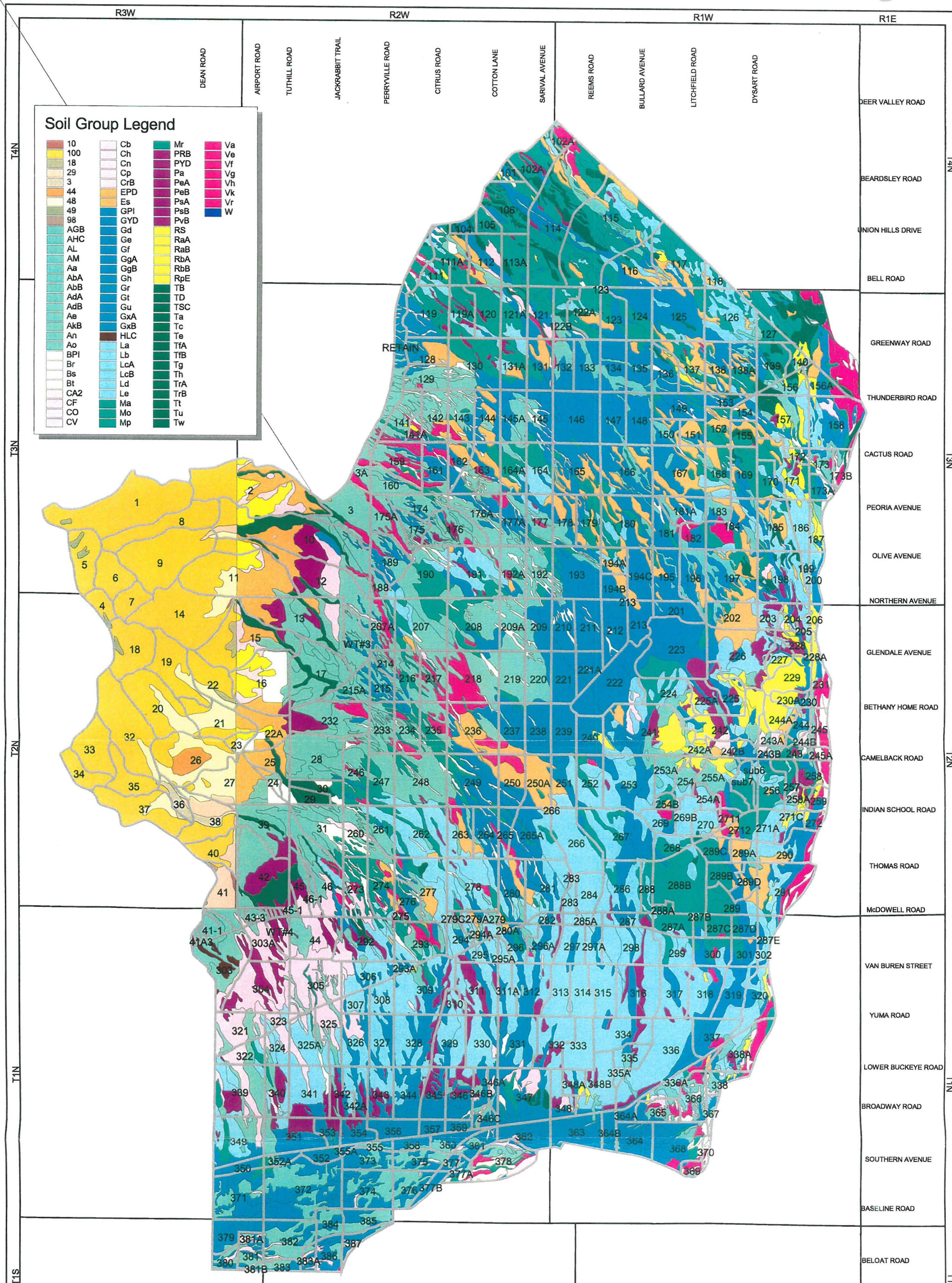
The soils map used in the WLB Study was a simple Soil Conservation Service (SCS) (now the NRCS) map showing four basic soil groups: A, B, C and D. The WLB Study used this map with their sub basin map to determine the percentage of each soil group present within a given sub basin. Soil groups A through D vary in infiltration, hydraulic conductivity and other properties. In general, Soil group A soils are characterized by high infiltration and relatively low run-off while Soil group D soils are characterized by low infiltration and relatively high run-off.

Using the SCS map, HEC-1 input variables dependent on soil type such as initial abstraction (IA), hydraulic conductivity (XKSAT), etc., were determined for each sub basin and input.

2.1.2 Updated Soil Information

Since the time of the WLB Study, a more comprehensive and detailed soil coverage map published by the NRCS was available for use in the project area.

The NRCS map provides several sub-categories within and across the four SCS categories (A-D) described above. Since the variables initial abstraction, volumetric moisture deficit, wetting front suction and hydraulic conductivity (IA, DTHETA, PSIF, XKSAT) are all soil dependent variables and will vary according to soil type, they were estimated based on the more detailed (NRCS) map and input to the model. See Figure 2.1.



Legend

Drainage Area Boundary

380 Sub-basin Identification No.

N W E S

1 0 1 2

Scale in Miles

Map Produced 06/08/01

SOIL GROUP MAP
Loop 303 Corridor/White Tanks Area Drainage Master Plan Update Existing Condition

Figure 2.1

FLOOD CONTROL DISTRICT of MARICOPA COUNTY

URS

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2.1.3 Change in Assigned Values for XKSAT Variable

The assigned XKSAT values used with the ADMP Update model are from Table 4.2 in the Drainage Design Manual for Maricopa County, Volume 1 Hydrology, dated 1995. The assigned values used in the WLB model tend to produce higher runoff rates for like soil groups. For consistency with currently accepted FCDMC procedures, all of the (XKSAT) values were selected based on the NRCS map and using the County Hydrology Manual mentioned above and adjusted to reflect the estimated vegetative cover using the aerial photograph. This resulted in new soil parameter input variables (XKSAT, IA, PSIF) and unit hydrographs for every sub basin in the project area. Interestingly, while all of the XKSAT values were recalculated, some recalculated XKSAT values were the same as those used in the original study.

In several cases, the XKSAT values changed significantly producing as much as a 20% increase in discharge while in others the values remained relatively unchanged and produced a runoff estimate within 5% or less of the original.

2.2 PERCENT IMPERVIOUS

One of the most sensitive variables to development in HEC-1 is the RTIMP value. This variable estimates that portion of a sub basin that is impervious to infiltration of rainfall given a specific land use. When it was determined that a change in land use had occurred since the WLB Study, the extent of the development within the sub basin was estimated. By overlaying the sub basin map with the aerial photo, the portion of the total sub basin area that had experienced development was determined.

Using Table 4.2a in the FCDMC *Drainage Design Manual*, Volume I, the value for RTIMP was determined based on the land use for the development that occurred in each sub area. Sub basins in which the percent impervious was changed are listed in Table 2.1.

Table 2.1

RTIMP Comparison URS vs. WLB

WLB Basin ID	WLB %IMP	URS Basin ID	URS %IMP
21	4.7	21	7
22	7.4	22	8
23	10.6	23	26
27	0.3	27	21
30	0.2	30	32
37	8.4	37	9
40	7	40	11
111	0	111	25
		111A	18
112	0	112	21
114	0	114	26
115	0	115	27
116	0	116	28
117	8	117	26
118	0	118	80
122	0	122A	35
		122B	35
126	0	126	25
133	0	133	8
135	0	135	15
		138A	30
139	0	139	26
157	0	157	12
158	6	158	25
198	0	198	12
245	0	245	18
254	0	254	8
		SUB6	20
		SUB7	3
256	0	256	3
266	0	266	14
267	0	267	14
268	0	268	30
269	0	269	30
		269B	15
		2711	20
271	0	2712	2
281	0	281	1
286	0	286	7
289	0	289	27
		289A	27
		289B	15
		289C	1
290	0	290	11
291	0	291	20
295	0	295	5

Table 2.1.xls

Table 2.1

RTIMP Comparison URS vs. WLB

WLB Basin ID	%IMP	URS Basin ID	%IMP
296	0	296	8
		296A	6
298	0	298	16
299	0	299	14
313	0	313	20
314	0	314	7
330	6	330	9
333	0	333	12
113A	0	113A	30
192A	0	192A	5
22A	1	22A	6
243A	5	243A	30
243B	0	243B	18
244A	0	244A	9
265A	0	265A	2
271A	0	271A	13
279A	0	279A	90
279B	0	279B	90
279C	0	279C	90
287A	0	287A	16
287B	0	287B	54
287C	0	287C	48
287E	0	287E	59
288B	0	288B	14
289A	0	289D	26
336A	2	336A	3

3.0 CHANGE IN LAND USE OF SUPER BASINS

Since the time of the WLB Study, there has been some change in land use within the super basins defined by the ADMP Update. The land uses present within the majority of these super basins at the time of the WLB Study were primarily agriculture with some open desert. In addition, there were some residential areas located within or near the small local city centers throughout the project area. Finally, there was some very low density residential/ranch areas in various locations throughout the ADMP Update project area. Since the time of the original study, an increasing amount of agriculture, open space and natural desert land uses has changed to residential, commercial, industrial and recreational. See Figure 3.1 for the super basin locations within the ADMP Update project area.

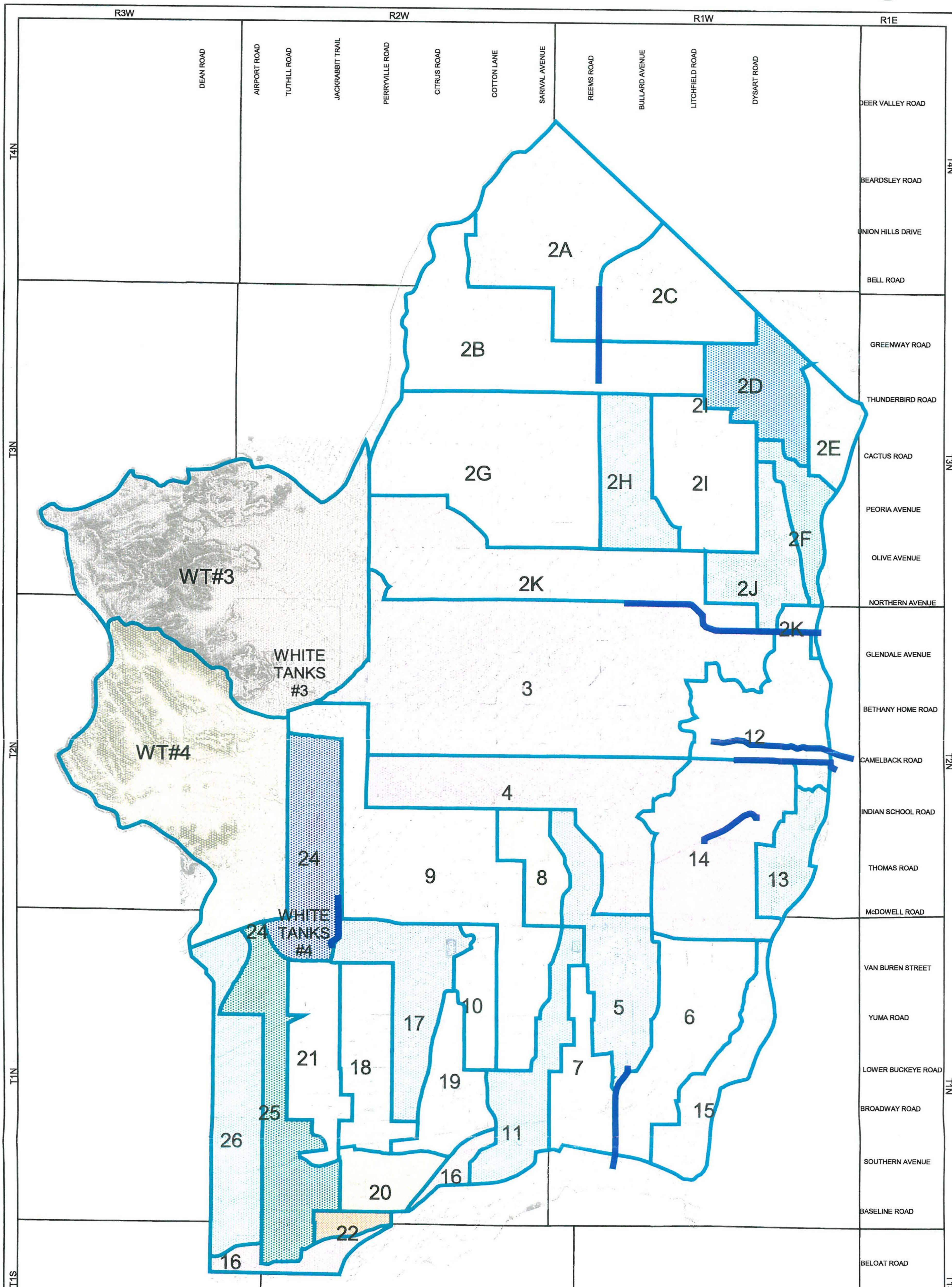
3.1 EXTENT OF DEVELOPMENT DURING WLB STUDY

At the time of the WLB Study, the project area was mainly agricultural with a few areas of concentrated development. These areas were mainly within the Cities of Goodyear, Avondale, Surprise, El Mirage and Litchfield Park as well as portions of unincorporated Maricopa County. Development outside of these localized concentrations was very sparse and generally separated by large expanses of open fields, agriculture and desert.

Using a combination of a 1996 aerial photograph and the HEC-1 input file for the existing condition model produced by the WLB Study, URS was able to estimate the extent of development existing at the time of the WLB Study and included in the WLB Study HEC-1 model.

The following information resulted from the above analysis and has been provided for general background. It is not meant to be a comprehensive list, rather the intent is to list the general location of the major development present in the ADMP Update project area at the time of the WLB Study. This will give a reference for comparison with currently existing development. The following development will be described in terms of the super basins used with the ADMP Update. Super basins not specifically addressed below were either mostly undeveloped, primarily agriculture or a combination of each.

Super Basin #2A – Super Basin #2A is located within the City of Surprise. At the time of the original study, this area was being developed in portions of Sun City Grand and Sun City West. From inspection of the 1996 aerial photograph, the amount of development present was approximately 7% of the total super basin area.



Legend

Drainage Area Boundary

2C Super Basins

Existing Flood Control Facility

1 0 1 2

Scale in Miles

Map Produced 06/08/01

SUPER BASIN KEY MAP
Loop 303 Corridor/White Tanks Area Drainage Master Plan Update
Existing Condition

Figure 3.1

FLOOD CONTROL DISTRICT of MARICOPA COUNTY

URS

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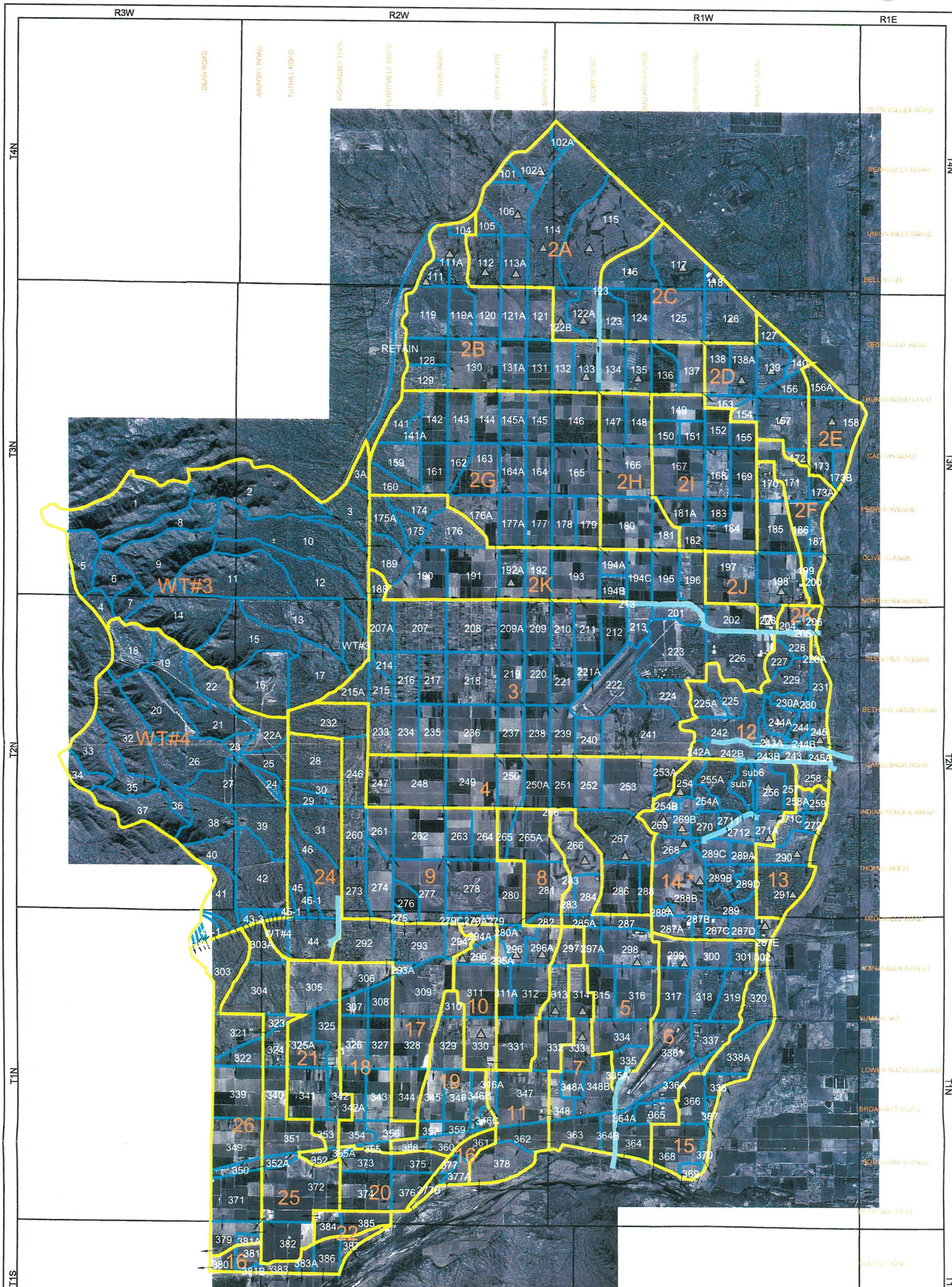

Legend

- Super Basin Boundary
- Drainage Area Boundary
- 2C Super Basins
- Flow Path
- Retention
- Sub-basin Identification No.
- Off-line Detention Basin
- Existing Flood Control Facility

N
W E
S

1 0 1 2

Scale in Miles

Map Produced 06/08/01

SUB BASIN/AERIAL MAP
Loop 303 Corridor/White Tanks Area
Drainage Master Plan Update
Existing Condition

Figure 5.1

FLOOD CONTROL DISTRICT of MARICOPA COUNTY

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Table 4.1

Summary of
Sub Basin Boundary Changes

WLB Sub Basin	Revised Sub Basin	Development	Reason for Change to Boundary	[2]Outside Boundary Changed (Y/N)	Comments
100	114	Sun City Grand	[1]Mass Grading	Y	WLB area removed
103	114	Sun City Grand	[1]Mass Grading	Y	
107	114	Sun City Grand	[1]Mass Grading	Y	
108	114	Sun City Grand	[1]Mass Grading	Y	
	115	Sun City Grand	[1]Mass Grading	n/a	
109	115	Sun City Grand	[1]Mass Grading	Y	
110	117	Park Row	[1]Mass Grading	Y	WLB area removed
111	111A	Arizona Tradtions	[1]Mass Grading	N	
	111	Arizona Tradtions	[1]Mass Grading	n/a	
112	111A	Arizona Tradtions	[1]Mass Grading	Y	
	112	Happy Trails	[1]Mass Grading	n/a	
113	114	Sun City Grand	[1]Mass Grading	Y	
114	114	Sun City Grand	[1]Mass Grading	Y	
	115	Sun City Grand	[1]Mass Grading	n/a	
115	115	Sun City Grand	[1]Mass Grading	Y	
116	115	Sun City Grand	[1]Mass Grading	Y	
	116	Kingswood Park	[1]Mass Grading	n/a	
117	117	Parke Row/Sun Village	[1]Mass Grading	Y	
138	138A	Open Field	Field Visit	N	
	138	Roseview	[1]Mass Grading	n/a	
194	194A	Open Field	Field Visit	N	
	194B	Falcon Dunes	[1]Mass Grading	n/a	
	194C	Open Field	Field Visit	n/a	
242	242	Colter Channel	Field Visit	N	
	242B	Colter Channel	Field Visit	n/a	
254	254	Palm Valley	[1]Mass Grading	Y	
	254B	Palm Valley	[1]Mass Grading	n/a	
	269B	Palm Valley	[1]Mass Grading	n/a	

1. Boundary change verified by either a field visit, drainage report or combination.
2. Refers to sub basin identification used in WLB Study.

Table 4.1

Summary of
Sub Basin Boundary Changes

WLB Sub Basin	Revised Sub Basin	Development	Reason for Change to Boundary	[2]Outside Boundary Changed (Y/N)	Comments
255	255A	Litchfield Park/RID Overchute	Field Visit	Y	
	SUB6	Litchfield Park/RID Overchute	Field Visit	n/a	
	SUB7	Litchfield Park/RID Overchute	Field Visit	n/a	
266	266	Pebble Creek Phase II	Field Visit/Report	Y	
267	266	Pebble Creek Phase II	Field Visit/Report	Y	
	267	Pebble Creek Phase I	Field Visit/Report	n/a	
268	253	Pebble Creek Phase I	Field Visit/Report	Y	
	267	Pebble Creek Phase I	Field Visit/Report	n/a	
	269	Pebble Creek Phase I	Field Visit/Report	n/a	
269	268	Palm Valley	[1]Mass Grading	Y	
	269	Palm Valley	[1]Mass Grading	n/a	
	269B	Palm Valley	[1]Mass Grading	n/a	
270	270	Litchfield Park/RID Overchute	[1]Mass Grading	Y	
	2711	RID Overchute	[1]Mass Grading	n/a	
	2712	Palm Valley	[1]Mass Grading	n/a	
271	2711	RID Overchute	[1]Mass Grading	Y	
	2712	Palm Valley	[1]Mass Grading	n/a	
281	281	Pebble Creek Phase II	[1]Mass Grading	Y	
283	283	Pebble Creek Phase II	[1]Mass Grading	Y	
284	284	Pebble Creek Phase II	[1]Mass Grading	Y	
289	289	Palm Valley	[1]Mass Grading	Y	
	289B	Palm Valley	[1]Mass Grading	n/a	
	289C	Palm Valley	[1]Mass Grading	n/a	
296	296	Wild Flower Ranch	[1]Mass Grading	Y	
	296A	Wild Flower Ranch	[1]Mass Grading	n/a	
304	304	White Tanks FRS #4	Field Visit	Y	
335	335A	Bullard Outfall Channel	Plans, Report, Field Visit	Y	
	335	Bullard Outfall Channel	Plans, Report, Field Visit	n/a	
336	336	Goodyear Airport/Bullard Outfall Channel	Plans, Report, Field Visit	Y	

1. Boundary change verified by either a field visit, drainage report or combination.
2. Refers to sub basin identification used in WLB Study.

Table 4.1

Summary of Sub Basin Boundary Changes

WLB Sub Basin	Revised Sub Basin	Development	Reason for Change to Boundary	[2]Outside Boundary Changed (Y/N)	Comments
364	364A	Bullard Outfall Channel	Plans, Report, Field Visit	Y	
	364B	Bullard Outfall Channel	Plans, Report, Field Visit	n/a	
254A	254A	Litchfield Park/RID Overchute	Field Visit	Y	
117A	117	Park Row	[1]Mass Grading	Y	WLB area removed
265A	265A	Pebble Creek Phase II	[1]Mass Grading	Y	
271B	271A	RID Overchute	[1]Mass Grading	Y	
271C	271C	Sage Creek	[1]Mass Grading	Y	
288A	288A	Palm Valley	[1]Mass Grading	Y	
	288B	Palm Valley	[1]Mass Grading	n/a	
288B	288B	Palm Valley	[1]Mass Grading	Y	
289A	289	Palm Valley	[1]Mass Grading	Y	
	289B	Palm Valley	[1]Mass Grading	n/a	
	289D	Palm Valley	[1]Mass Grading	n/a	
303A	303A	White Tanks FRS #4	Field Visit	Y	
336B	348B	Bullard Outfall Channel	Plans, Report, Field Visit	Y	
364A	364A	Bullard Outfall Channel	Plans, Report, Field Visit	Y	
	364B	Bullard Outfall Channel	Plans, Report, Field Visit	n/a	

1. Boundary change verified by either a field visit, drainage report or combination.
2. Refers to sub basin identification used in WLB Study.

4.2 LAND USE

Land use changes in the project area were determined through a combination of field reconnaissance, analysis of the aerial photo and review of current drainage reports and construction documents. By comparing the 1996 aerial photo against the 2000 aerial photo, land use changes in specific sub basins were easily and quickly identified. Once these sub basins were identified, reports describing the development were used to gain specific information as to density of the development, retention provided and proposed improvements. In some cases, there were no reports available and the relevant parameters had to be estimated by using the regulations of the appropriate city or regulating municipality.

These changes were accounted for by adjusting the RTIMP variable on the HEC-1 LG input card. Generally, land use changed from agriculture to some form of development. In most cases, development was in the form of residential with some open space as part of a master planned community. Table 2.1 summarizes the sub basins where land use changes are reflected by revised percent impervious.

4.3 ROUTES

Routes were prepared according to the normal depth channel routing procedures using the RS, RC, RX and RY cards. This method was used in the WLB Study too. In several cases, physical changes to sub basin boundaries and general flow patterns within developed sub basins were significant and warranted updating the route data. This was the case in areas where mass grading for a development changed flow patterns and diversions.

In areas where no significant changes occurred to routing paths, the WLB Study routing data were retained. In the case where there was a flow route defined by a natural low point or wash and development maintained the feature but regraded it, the original route data were maintained. In other words, if the feature was relatively straight before the development was complete and meanders were added to it for aesthetic purposes, the original routing data were retained. It was decided that changing all of the routes to reflect minor grading changes would have little impact on the final discharge values and would be difficult to evaluate.

The NSTPS variable found on the RS card in the HEC-1 input data set describes the number of steps used by the HEC-1 storage routing procedures. This variable is a function of velocity and requires an initial estimate for calculation. In some cases, NSTPS variables calculated by WLB and shown on the WLB calculation sheets were different than those in the HEC-1 model. These values were revised based upon actual velocities calculated and output by the ADMP Update

HEC-1 file. For cases of no land use changes (no development), the NSTPS variable in HEC-1 was retained even if it was slightly different from those shown on the calculation data sheets.

4.4 DIVERTS

Since the WLB Study was completed, there were several new developments resulting in mass grading of various sub basins. This effectively changed sub basin boundaries and, in some cases, the diverts associated with them.

When it was determined that there might be a change to an existing divert, field reconnaissance was conducted and the 2-foot contour interval (CI) topographic map was used to recalculate or eliminate the existing divert. In some cases, recent development and sub basin boundary changes created new diverts.

All new or revised diverts were calculated using a cross section to generate inflow and outflow estimates for several stages. This information was input to the DI and DQ cards and the backup data sheets provided under separate cover.

In the case of subdivision walls that may divert and store runoff, it was decided that these walls would influence the diversion of storm water but not provide new storage or additional storage volume.

4.5 RETENTION

Retention has been provided by several new developments throughout the ADMP Update project area. In the case where a drainage report was available for a given development, the reported value for the amount of retention provided onsite was first reduced by 20% and then input into the ADMP Update HEC-1 model by using the DSTRMX (Field 2) on the DT card. This effectively models the retention provided by a given development.

In many cases, there was neither a drainage report or construction documents available for estimating the amount of retention volume provided within a given development. In this situation, the onsite retention requirement of the regulating municipality under which the development was bound was used to calculate the appropriate retention volume. This was done using the developed sub basin area to calculate the amount of retention it would be required to provide by the regulating municipality. As stated previously, the required amount of volume calculated was reduced by 20% and reflected in the ADMP Update HEC-1 model on the DT card. The retention volume diversion calculations are available under separate cover. See

Table 3.4 for a list of the municipalities present in the ADMP Update area and the associated onsite retention requirement.

5.0 RESULTS

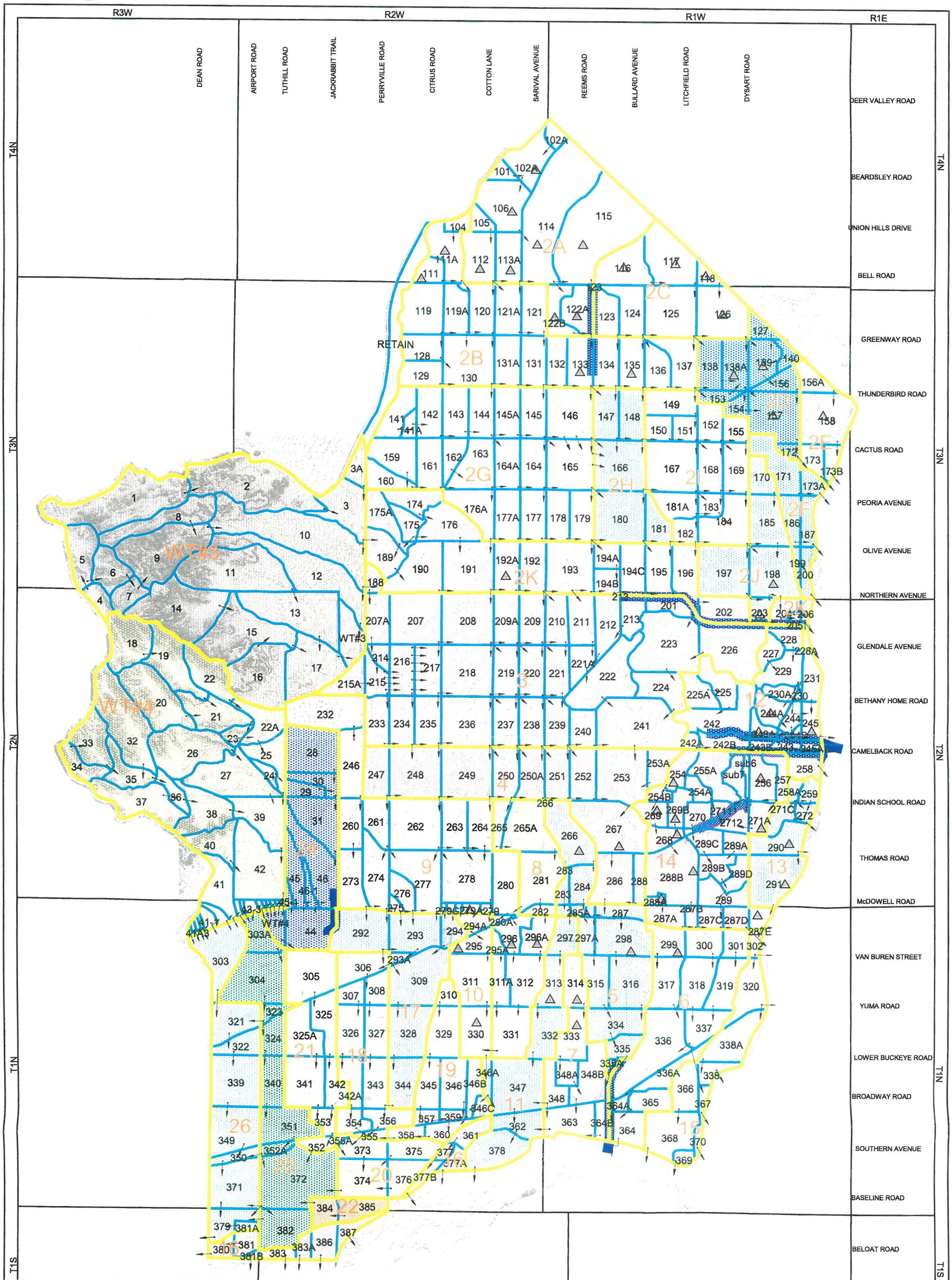
Although most of the sub basins present in the ADMP Update project area are going to be developed or are planned to be developed in the near future, the majority have not yet experienced any significant change since the WLB Study. For this reason, there is no point in discussing these areas in detail. The following discussion will focus only on those areas in which there has been a significant amount of activity since the WLB Study. In these areas the discharges estimated by the WLB model have been compared with those estimated by the existing condition URS ADMP Update model.

As with any update model when making comparisons between the ADMP Update model and the WLB Study model, it is important to note that this is not entirely a direct comparison. While the WLB Study model uses the same basic modeling approach, some changes to the assigned values of the XKSAT variable and more detailed soils information significantly impact runoff estimates produced by HEC-1 (Section 2.1). Figure 5.1 represents the sub basins and the color aerial photograph (January 2000).

5.1 RECENT DEVELOPMENT

As discussed in Section 3.0, there have been several new developments constructed since the WLB Study was completed. Since a detailed discussion of each of these developments is time consuming and of little value, only a few of the most hydrologically significant developments are discussed in detail. The developments chosen for this discussion occur in areas where are significant change since the WLB Study and where the effects of this recent development are the most significant. For a comprehensive list of known recent development, refer to Table 3.3. Table 3.3 shows both the super basin and sub basin in which the new/recent development occurs and indicates whether there is a drainage report associated with the development. Refer to Table 3.1 for a list of all known existing developments including those present at the time of the WLB Study. Table 3.1 also indicates the size of each development in acres.

Table 5.1 has been prepared to show discharge comparisons at points of interest for the sub basins discussed below. The table provides a means of comparison between the discharges calculated by the WLB Study model versus those calculated in the ADMP Update model. Refer to Table 5.1 for the following discussion.



Legend

- Drainage Area Boundary
- Super Basins Boundary
- 2C Super Basins Label
- Flow Path
- Retention
- 111 Sub-basin Identification No.
- Off-line Detention Basin
- Existing Flood Control Facility

1 0 1 2

Scale in Miles

Map Produced 11/04/02

SUB BASIN MAP
Loop 303 Corridor/White Tanks Area Drainage Master Plan Update Existing Condition

Figure 4.1

FLOOD CONTROL DISTRICT of MARICOPA COUNTY

URS

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Moderately Developed to Date – This is defined as a region in which the total footprint or area of new development relative to the total super basin area in which it occurs is between 20 and 30%.

Highly Developed to Date – This is defined as a region in which the total footprint or area of new development relative to the total super basin area in which it occurs is greater than 30%.

The percentages indicated above were estimated by overlaying the ADMP Update sub basin map with the January 2000 color aerial photo. By comparing the 1996 aerial photo with the January 2000 aerial photo areas of new development were identified and outlined on the ADMP Update sub basin map. The footprint area of these new developed areas was estimated by inspection and divided by the total super basin area in which they occurred to obtain a percentage. The super basins were then classified using the above criteria. See Table 3.2.

Some portions of the project area have developed more rapidly then others. The following section briefly summarizes the Super Basins in which development has occurred since the WLB Study was completed. See Table 3.3 for a list of super basins where new development has occurred since the completion of the WLB Study.

Mostly Undeveloped to Date – Although there are several proposed developments associated with Super Basins #1, #2F-#2J, #3-#4, #6, #9, #12 and #15 through #26 these areas have experienced little or no development since the WLB Study and remain largely undeveloped at this time. These areas are primarily located within the White Tanks mountains, south of I-10 and west of Cotton Lane and north of the Dysart Drain west of El Mirage. The known developments both existing and ongoing associated with the super basins mentioned above are listed on Table 3.1.

Slightly Developed – Super Basins #2B, #2K, #5, #7, #8, #10 through #11 and #14 have all experienced a slight amount of development since the time of the WLB Study. Again, the majority of the developments proposed in these Super Basins have not yet been built. These areas are primarily located within portions of the City of Surprise (north of Thunderbird Road and west of Reems Road), the City of Goodyear (north of I-10, east of Cotton Lane and south of 1-10 west of Bullard Wash). The known developments both existing and ongoing associated with these super basins are listed on Table 3.1.

Moderately Developed – Super Basin #2E has experienced a moderate amount of development since the time of the WLB Study. While a significant portion of the development proposed in this area has been constructed, a large portion is only partially developed and is occurring in phases. This area is located within the City of El Mirage (north of Peoria Avenue, east of El Mirage Road and south of Grand Avenue). The name of the developments both existing and

Criteria for Relative Development Comparison of Super Basins

Table 3.2

Super Basin	[1]Approximate Percentage of Existing Development During WLB Study in Super Basin	[2]Approximate Percentage of New Development in Super Basin	Approximate Percentage of Current Development in Super Basin	Total Development, Existing (WLB) Plus New			
				Mostly Undeveloped to Date	Slightly Developed to Date	Moderately Developed to Date	Highly Developed to Date
1	-----	0%	0%	0%			
2A	7%	65%	72%				72
2B	8%	10%	18%		18%		
2C	26%	35%	61%				61
2D	15%	35%	50%				50
2E	30%	30%	60%				60
2F	20%	0%	20%		20%		
2G	-----	0%	0%	0%			
2H	-----	0%	0%	0%			
2I	-----	0%	0%	0%			
2J	10%	0%	10%		10%		
2K	-----	10%	10%		10%		
3	35%	0%	35%				35
4	15%	7%	22%			22	
5	-----	20%	20%		20%		
6	40%	0%	40%				40
7	5%	16%	21%			21	
8	-----	13%	13%		13%		
9	10%	8%	18%		18%		
10	-----	20%	20%		20%		
11	12%	15%	27%			27	
12	-----	0%	0%	0%			
13	20%	40%	60%				60
14	50%	12%	62%				62
15	-----	0%	0%	0%			
16	-----	0%	0%	0%			

1. This is the approximate ratio of existing development area at the time of the WLB Study to total super basin area.
2. This is the ratio of new development area to total super basin area.
3. This is the sum of existing and new development area in the super basin.

Criteria for Relative Developm[illegible]nt Comparison of Super Basins

Table 3.2

Super Basin	[1]Approximate Percentage of Existing Development During WLB Study in Super Basin	[2]Approximate Percentage of New Development in Super Basin	Approximate Percentage of Current Development in Super Basin	Total Development, Existing (WLB) Plus New: Mostly Undeveloped to Date	Slightly Developed to Date	Moderately Developed to Date	Highly Developed to Date
17	-----	0%		0%			
18	-----	0%		0%			
19	-----	0%		0%			
20	-----	0%		0%			
21	-----	7%		7%			
22	-----	0%		0%			
23	-----	0%		0%			
24	-----	0%		0%			
25	-----	0%		0%			
26	-----	0%		0%			

1. This is the approximate ratio of existing development area at the time of the WLB Study to total super basin area.
2. This is the ratio of new development area to total super basin area.
3. This is the sum of existing and new development area in the super basin.

New Development in Super Basins

Table 3.3

Super Basin	[1]Sub Basin In Which New Development Has Occurred	[2]Approximate Percentage of New Development in Super Basin	Development Name	Report (Y/N)
1(WT#3)	-----	0	-----	-----
2A	112	65%	[3]Happy Trails	N
	113A		Bell West Ranch	Y
	114		Sun City Grand	Y
	115			
	122A		Mountain Vista Ranch	Y
2B	111	10%	Arizona Traditions	Y
	111A			
	133		Greenway Parc	Y
	135		Ashton Ranch	Y
2C	116	35%	Kingswood Park	Y
	118		[3]WalMart/Home Depot	Y
	117		[3]Park Row/Sun Village	Y
	126		West Point Towne Center	Y
2D	138A	35%	Roseview	Y
	139			
	157		Unknown	N
	172		Unknown	N
2E	158	30	Unknown	N
2F	-----	0	-----	-----
2G	-----	0	-----	-----
2H	-----	0	-----	-----
2I	-----	0	-----	-----
2J	-----	0	-----	-----
2K	194B	10	Falcon Dunes	N
3	-----	0	-----	
4	267	7	Pebble Creek Phase I	Y
5	266	20%	Pebble Creek Phase II	Y
	298		Rancho Mirage	Y
			Snyder's of Hanover	Y
6	-----	0	-----	-----
7	314	16%	Wildflower Ranch	Y
	333		[3]Estrella Vista	Y
	348A		Sarival Village	Y
8	265A	13%	Pebble Creek Phase II	Y
	281			
9	296	8%	Canyon Trails	Y
	296A			
10	330	20	Cotton Flower	Y
11	313	15	Wildflower Ranch	Y
12	-----	0	-----	-----

1. New development refers to any development that has taken place since the WLB Study.
2. This is the ratio of new development area to total super basin area.
3. Development shows on the 1996 aerial however, it did not exist at the time the WLB ADMS was complete, 10/92.

New Development in Super Basins

Table 3.3

Super Basin	[1]Super Basin In Which New Development Has Occurred	[2]Approximate Percentage of New Development in Super Basin	Development Name	Report (Y/N)
13	271C 290 291	40%	Sage Creek [3]Corte Sierra	Y Y
14	[3]268 [3]289 [3]289A 289B 289D 288B	12%	Palm Valley Phase I&II	Y
15	-----	0	-----	-----
16	-----	0	-----	-----
17	-----	0	-----	-----
18	-----	0	-----	-----
19	-----	0	-----	-----
20	-----	0	-----	-----
21	325 325A	7%	Primrose Estates	Y
22	-----	0	-----	-----
23(WT#4)	-----	0	-----	-----
24	-----	0	-----	-----
25	-----	0	-----	-----
26	-----	0	-----	-----

1. New development refers to any development that has taken place since the WLB Study.
2. This is the ratio of new development area to total super basin area.
3. Development shows on the 1996 aerial however, it did not exist at the time the WLB ADMS was complete, 10/92.

ongoing associated with super basin 2E are not known and therefore have not been included on Table 3.1.

Highly Developed – Super Basins #2A, #2C, #2D and #13 have all experienced a significant amount of development to date. These areas are primarily located within the City of Surprise (north of Greenway Road), the City of El Mirage (east of Dysart Road) and the City of Avondale (east of Dysart Road just north of I-10). The known developments both existing and ongoing associated with these super basins are listed on Table 3.1.

3.3 EFFECT OF EXISTING DEVELOPMENT ON EXISTING HYDROLOGY

The general effect of development on a previously undeveloped watershed is to increase the impervious area, concentrate flow and change the way in which hydrographs combine within the overall watershed.

In most cases, a proposed development is required to convey offsite flow through or around its property. In the Loop 303 watershed, there are many cases where offsite flow is in the form of sheet flow due to the flat terrain east of the White Tanks Mountains where most of the development is taking place.

Once a development constructs channels or other hydraulic structures to capture this offsite flow, it has essentially concentrated previously unconcentrated runoff, thereby increasing the velocity of the discharge and decreasing time of concentration. In this way, development can significantly change the way in which the hydrograph associated with the offsite flow will now combine with other hydrographs further downstream.

Similarly, the shape of the hydrograph generated on the developed site could be significantly different in shape, magnitude of peak flow and volume. The result of a development concentrating discharges in gutters or storm drains and the overall impervious nature of development relative to undeveloped land usually results in much higher discharges and volumes of runoff. For this reason, the majority of development within the ADMP Update area have provided onsite retention for the 100-year storm event. Depending upon the location of a development within the project area the regulating municipality may require the retention of the 100-year, 1-hour, 2-hour or 6-hour storm event. Onsite retention usually reduces the overall peak discharge and volume leaving a developed area. Table 3.1 provides a list of existing and ongoing developments and the storm event used to design retention provided onsite.

When modeling existing conditions and comparing with developed conditions, the existing condition model is modified to reflect the development. Values for soils and tables defining input variables based on soils should be constant. This allows the modeler to make direct comparisons between the existing and developed condition with confidence that development is the only difference in the two hydrologic models.

With the comparison of the ADMP Update existing hydrology model to the existing condition model produced by WLB, care must be taken when making comparisons between the two. One reason is that the actual assigned value of the XKSAT variables has changed since the WLB Study. Therefore, the number used to represent the XKSAT parameter for a given soil is different depending on which assigned value was applied. If the currently accepted assigned value for the XKSAT variables had been used to create an alternate model at the time the WLB Study with no other changes, there would be significant differences in the discharges calculated by HEC-1.

Another reason for using caution when making comparisons between the WLB and URS models is that the WLB model used only four soil groups (SCS) and the URS ADMP Update model uses the more detailed map produced by NRCS. See Section 2.1 for more detail regarding changes to the soil parameters in the ADMP Update model.

In addition, transmission losses which occur in channels due to infiltration during the routing of discharge were included in portions of the WLB model but were not considered with the ADMP Update model.

The use of a more detailed soil map alone may result in different discharges for the two models using the same assigned value of the XKSAT variable. Since both soil information and XKSAT variable assigned values were updated since the WLB Study, the discharge and volume results for all sub basins may be expected to change.

Taking the above points in mind, it is important to use a combination of common sense and general knowledge of the watershed to make broad/general comparisons between the WLB HEC-1 and the URS HEC-1 models.

As described above, the general effect of existing development in the ADMP Update watershed has been to increase the percentage of impervious area within the sub basin where the development is taking place. Additionally, the requirement that development must pass offsite flow through and/or around its property has resulted in concentrating runoff that was previously in the form of sheet flow, increasing velocities and reducing the time to concentration for the sub basin as a whole.

Generally, due to the enforcement of retention requirements by local cities and/or Maricopa County, the development within the project area provides onsite retention basins that collect and store the onsite runoff generated by the 100-year storm event for various storm durations. Since these onsite basins are generally retention basins and do not release the floodwater once it has been impounded, there is a decrease in the overall peak discharges and runoff volume leaving developed sub basin areas.

Exceptions to this may occur when the amount of previously undeveloped area within the sub basin becomes impervious and the proportion of the developed area to the total sub basin area is very high or close to a ratio of 1.0. This generally occurs in smaller sub basins with commercial/industrial land uses. In these areas, when the volume of run-off exceeds onsite retention, peak discharges may exceed those associated with the undeveloped condition.

With the exception of the City of Goodyear, all of the municipalities present in the ADMP Update project area currently require that the runoff generated by the 100-year, 2-hour storm event be retained onsite for any proposed development. The City of Goodyear requires that the stormwater runoff generated by the 100-year, 6-hour storm event be retained. The City of Surprise has recently changed their requirement from the 100-year, 1-hour storm event to the 100-year, 2-hour storm event. See Table 3.4.

3.4 PROPOSED DEVELOPMENT

There are currently 38 known proposed developments within the project area. The majority of these are large master planned communities. Most are located within the City of Goodyear and the City of Surprise. Although these developments were not modeled for the existing condition, they will be accounted for in the future condition model.

Several areas that are currently undeveloped or are being used for agriculture have been platted for new subdivisions and/or master planned communities. One example is the DMB/Caterpillar property in the White Tanks Mountains. This area is approximately 9,000 acres of undeveloped desert which has historically been used as a testing ground for the Caterpillar Tractor Company. This master plan community incorporates several different land uses including residential, and recreational.

Other large master plans that are approved but not yet fully built-out include Canyon Trails south of I-10 in the City of Goodyear and portions of Pebble Creek Phase II north of I-10 and west Bullard Avenue. In short, the majority of the approximately 220-square-mile area which is currently either undeveloped or an agriculture land use is proposed for development in the future.

Table 3.4

Onsite Retention Requirement for Proposed Development

City	Storm Event (year/hour)
[1]Surprise	100/2
Avondale	100/2
Litchfield Park	100/2
Goodyear	100/6
El Mirage	100/2
Buckeye	100/2
County	100/2

1. Previously, the requirement was the 100-year, 1-hour storm event, City of Surprise, . Surprise Municipal Code title 16 - Subdivision, Surprise Comprehensive Development Guide, January 1997.
2. New 100-year, 2-hour requirement per phone conversation with City of Surprise, 4/9/01 & 5/9/01.

4.0 MODEL MODIFICATIONS

Although the ADMP Update HEC-1 model was based on the WLB Study, several modifications were required to maintain consistency with both currently accepted modeling procedures as well as more up-to-date data regarding area soils, new sub basin boundaries, routes, diverts, land use and revised assigned values for the XKSAT variable. Changes to assigned values for XKSAT and soil coverage were discussed in preceding sections of this report.

Two parameters that were changed in the ADMP Update HEC-1 input were the NQ (number of hydrograph ordinates to be computed), STRM and TRDA variables. The STRM and TRDA variables are related to the average precipitation in inches and the area in square miles, respectively. These variables are used to model the effects of aerial reduction factors on the storm event. The values used for the STRM variable were derived from Table 2.1a in the "Drainage Design Manual for Maricopa County, Arizona, Volume I Hydrology." Changes to sub basin boundaries, diverts, routes and land use are briefly described and summarized in following sections. Figure 4.1 shows the sub basin locations.

4.1 SUB BASIN BOUNDARIES

In order to incorporate HEC-1 models associated with existing development into the revised ADMP existing condition HEC-1 model, it was necessary to consolidate sub-areas delineated by specific development into areas more appropriate to a regional study. Sub basin preparation sheets were then created for the consolidated area and entered into the HEC-1 model.

In some cases, sub basins that were undeveloped at the time of the WLB study that are currently developed did not have drainage reports and/or models available for use with the restudy. In such cases, the aerial photo was studied and field reconnaissance was conducted to determine any changes to the original sub basin boundary lines established during the WLB Study. In certain instances, mass grading on these developed sites resulted in changes to sub basin boundary lines and flow patterns between sub basins.

Based on this information, new boundary lines for sub basins were constructed where appropriate and the sub basin preparation sheets were regenerated for the updated boundary condition. Factors reflecting RTIMP and vegetative cover were determined by inspection in the field and of the aerial photo. Table 4.1 lists all of the original sub basins from the WLB study that were changed under the restudy. The table summarizes the reason for the change and indicates the new sub basin name(s).

Super Basin 2B – At the time of the WLB study, super basin 2B contained mostly agriculture with some low density residential. This development was located in the north-west corner of the super basin. The development present in 1996 in Super Basin 2B was approximately 8% of the total super basin area.

Super Basin 2C – At the time of the WLB study, super basin 2C contained mostly agriculture with some residential development located within the north-central portion of the super basin. The development present in 1996 in Super Basin 2C was approximately 26% of the total super basin area.

Super Basin(s) #2D, #2E – These super basins are located within the City of El Mirage. Since the WLB Study, Super Basins #2D and #2E have undergone significant development. The amount of development present in 1996 in Super Basins #2D and #2E was approximately 15% and 30% of the total super basin area, respectively.

Super Basin 2F – At the time of the WLB study, super basin 2F contained mostly agriculture with some low density residential. The development was located in the north-central portion of the super basin. The development present in 1996 in Super Basin 2F was approximately 20% of the total super basin area.

Super Basin 2J – At the time of the WLB study, super basin 2J contained mostly agriculture with some low density residential. This development was located in the northern portion of the super basin. The development present in 1996 in Super Basin 2J was approximately 10% of the total super basin area.

Super Basin #3 – Super Basin #3, located in a portion of unincorporated Maricopa County, contained a large developed area known as Clearwater Farms as well as Luke Air Force Base (LAFB). Clearwater Farms is roughly bound by Estrella/Reems Road on the west, Northern Avenue on the north, Bethany Home Road on the south and Cotton Lane on the east. LAFB, located east of Clearwater Farms, is roughly bounded by Sarival Avenue on the west, Glendale Avenue on the north, Bethany Home Road on the south and Bullard Avenue on the east. The development present in 1996 in Super Basin 3 was approximately 35% of the total super basin area.

Super Basin #4 – Super Basin #4, located in the City of Goodyear contained mostly agriculture with some residential development. The residential development was located within the eastern portion of the super basin. The development present in 1996 in Super Basin 4 was approximately 15% of the total super basin area.

Super Basin #6 – Super Basin #6, located within the City of Goodyear, mostly agriculture with some residential development. The residential development is located within the center of the super basin. The development present in 1996 in Super Basin 7 was approximately 40% of the total super basin area.

Super Basin #7 – Super Basin #7, located within the City of Goodyear, contained the Goodyear Airport or the Goodyear Phoenix Airport. The airport is roughly bounded by Estrella/Reems Road on the west, Buckeye Road on the north, Broadway Road on the south and Litchfield Road on the east. In addition, there was highly concentrated residential and commercial development present in the northeast and east portions of the super basin. The development present in 1996 in Super Basin 7 was approximately 5% of the total super basin area.

Super Basin #9 – Super Basin #9, located in unincorporated Maricopa County, contained the Perryville Prison facility. The prison is roughly bounded by Citrus Road on the west, Thomas Road on the north, I-10 on the south and Cotton Lane on the east. In addition, there is a small residential development present just south and west of the main prison complex on the north side of I-10. The development present in 1996 in Super Basin 9 was approximately 10% of the total super basin area.

Super Basin #11 – Super Basin #1, located in portions of unincorporated Maricopa County and the City of Goodyear, was mostly agriculture at the time of the WLB Study. The super basin also contained some residential development. This development was located within the southern half of the super basin just north of MC 85. The development present in 1996 in Super Basin 11 was approximately 12% of the total super basin area.

Super Basin #13 – Super Basin #13, located within the northwest corner of the City of Avondale, contained fairly high-density residential development at the time of the WLB Study. This area is roughly bounded by Dysart Road on the west, Thomas Road on the north, I-10 on the south and the Agua Fria River on the east. The development present in 1996 in Super Basin 13 was approximately 20% of the total super basin area.

Super Basin #14 – Super Basin #14 spans across a portion of the City of Goodyear and the City of Litchfield Park. From inspection of the 1996 aerial photograph Litchfield Park was fully developed. Litchfield Park is roughly bounded by Litchfield Road on the west, Camelback Road on the north, Indian School Road on the south and El Mirage Road on the east. In addition, a portion of the Palm Valley Phase I development was constructed. This portion of Palm Valley is located in the southeast corner of Super Basin 14. The development present in 1996 in Super Basin 14 was approximately 50% of the total super basin area.

The predominant land use outside of the super basins described above was primarily farmland with some ranches and very low density residential areas. Some commercial/industrial land uses also existed in various locations throughout the ADMP Update project area.

In addition to the development that existed at the time of the original study, there were also a few flood control structures in place. These included the McMicken Dam and the White Tanks FRS Structures #3 and #4. These facilities were constructed by the SCS in response to severe flooding which occurred throughout the project area in the summer of 1951. The Dysart Drain was also constructed to protect LAFB and downstream areas from flooding. The drain was originally constructed in the early 1960's and was recently improved to restore conveyance capacity lost due to more than 30 years of subsidence. The ADOT detention basins along I-10 were designed in the 1970's and constructed as part of the I-10 highway project.

For more detail regarding these facilities, refer to Section 2.0 of the "Draft Data Collection Report" for the Loop 303 Corridor/White Tanks Area Drainage Master Plan Update, dated February 2000.

3.2 CURRENT EXTENT OF EXISTING DEVELOPMENT

Significant development has occurred throughout the project area, since the time of the WLB Study. Large master planned communities such as Sun City Grand, Palm Valley, Pebble Creek and many others have been developing in phases. Most of these developments are not yet fully built out but have significantly altered the existing hydrologic conditions in the project area. Table 3.1 provides a list of known existing and ongoing developments in the ADMP Update project area.

For the purpose of determining the general change in overall development in areas where land use changes have occurred since the WLB Study was completed, criteria defining relative development in the super basins throughout the ADMP Update project area have been defined. Classifications representing the increase in development or the 'new' development (i.e., development that has occurred since the WLB Study) in any given area have been defined as follows:

Mostly Undeveloped to Date – This is defined as a region in which the total footprint or area of new development relative to the total super basin area in which it occurs is between 0 and 10%.

Slightly Developed to Date – This is defined as a region in which the total footprint or area of new development relative to the total super basin area in which it occurs is between 10 and 20%.

Super Basin vs. Known Development

Table 3.1

Super Basin	Existing Development	Area (ac)	Proposed Development	Retention Provided	Ongoing Development	Area (ac)	Retention Provided	[1]Date
1	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	Caterpillar Master Plan		-----	-----		-----
2A	Happy Trails	[3]400	-----	[5]100-yr,1-hr	-----	-----	-----	-----
	Bell West Ranch	258	-----	[6]100-yr,2-hr	-----	-----	-----	Mar-99
	-----	-----	-----	-----	Mountain Vista Ranch	572	[9]Unknown	1-Jun-98
	-----	-----	-----	-----	[8]Sun City Grand	3700	[6]100-yr,2-hr	Dec-94
2B	Arizona Traditions	530	-----	[6]100-yr,2-hr	-----	-----	-----	1-Jan-96
	-----	-----	Villages of Surprise South		-----	-----	-----	-----
	-----	-----	Surprise Farms		-----	-----	-----	-----
	-----	-----	Sierra Montanna		-----	-----	-----	-----
	Waddell Ranches	[3]240	-----	none	-----	-----	-----	-----
	-----	-----	Legacy Parc		-----	-----		-----
	-----	-----	Country Side	-----	Greenway Parc	160	[5]100-yr,2-hr	18-Mar-99
	-----	-----	Tash Subdivision	-----	-----	-----		-----
	-----	-----	-----	-----	-----	-----		-----
	-----	-----	-----	-----	Ashton Ranch	156	[6]100-yr,2-hr	14-Nov-97
	-----	-----	Royal Ranch		-----	-----		-----
	-----	-----	MHE Proposed		-----	-----		-----
2C	West Point Town Center	595		[5]100-yr,2-hr	-----	-----	-----	1-Jul-96
	Parke Row/Sun Village	19/360	-----	[6]100-yr,2-hr	-----	-----	-----	6-Nov-97
	[7]Kingswood Parke	360	-----	[5]100-yr,2-hr	-----	-----	-----	20-Mar-95
	-----	-----	-----	-----	-----	-----	-----	-----
2D	Roseview	297	-----	[5]100-yr,2-hr	-----	-----	-----	1-Aug-98
	[2]Original Square Mile	[3]220	-----	none	-----	-----	-----	-----
2H	-----	-----	Rancho Gabriella	-----	-----	-----	-----	-----
2I	-----	-----	Mountain Gate	-----	-----	-----	-----	-----
	-----	-----	Legacy Meadows	-----	-----	-----	-----	-----
	-----	-----	-----	-----	Butler Property	[3]80	none	-----
2K	-----	-----	-----	-----	-----	-----	-----	-----
	Falcon Dunes	[3]640	White Tanks Foothills	[5]450	-----	-----	-----	-----
3	Clearwater Farms	[3]2056	-----	none	-----	-----	-----	-----
	Montana Farms	30	-----	none	-----	-----	-----	-----
	Luke Air Force Base	[3]2640	-----	none	-----	-----	-----	-----
4	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----	-----

1. Date of drainage report for existing and ongoing developments only. "-----" indicates no drainage report.
2. 420 acres outside of ADMP Update project boundary.
3. No report, area estimated from aerial.
4. Report gives total master planned area only.
5. Report not found or provided retention volumes not clearly specified, therefore volume estimated.
6. From drainage report.
7. Excess retention reallocated to provide 100-year, 2-hour volume. Original design for 100-year, 1-hour - see "Master Drainage Report Update for Kingswood Parke Phase One", 5/1/95.
8. From "Master Drainage Report for Del Webb's Grand Avenue Property", 12/94
9. The rainfall depth used to compute this retention requirement was P = 2.6", $P_{100yr,1hr}$ = 2.4" and $P_{100yr,2hr}$ = 2.6"

1. Date of drainage report for existing and ongoing developments only.

Super Basin vs. Known Development

Table 3.1

Super Basin	Existing Development	Area (ac)	Proposed Development	Retention Provided	Ongoing Development	Area (ac)	Retention Provided	[1]Date
	[4]Pebble Creek Phase I&II	[3]500	-----	[6]100-yr,6hr	-----	-----	-----	1-Sep-92
	-----	-----	-----	-----	-----	-----	-----	-----
5	Snyders of Hanover	35	City Center	[5]100-yr,6hr	Rancho Mirage	57	[6]100-yr,6hr	Jan-98; Jun-99
	-----		Southwest Specialty Foods					
	-----	-----	Centerra		-----	-----		-----
	[4]Pebble Creek Phase I&II	[3]500	Estrella Aerospace	[6]100-yr,6hr	-----	-----	-----	Aug-98
6	Goodyear Airport	[3]870	-----	none	-----	-----	-----	-----
7	Estrella Vista	180	Sarival Village	[6]100-yr,6hr	-----	-----	-----	Aug-98
	-----	-----	-----	-----	-----	-----	-----	-----
8	-----	-----	-----	-----	-----	-----	-----	-----
9	Perryville Prison	[3]640	-----	none	-----	-----	-----	-----
	-----	-----	Camelback Farms	-----	Canyon Trails	2000	[6]100-yr,6hr	12-Nov-99
	Canada Village	[3]35	-----	none	-----	-----	-----	-----
10	-----	-----	-----	-----	Canyon Trails	2000	[6]100-yr,6hr	12-Nov-99
	-----	-----	-----	-----	Cotton Flower	97.5	[6]100-yr,6hr	Aug-99
11	Sarival Gardens	107	Wade Acres	[6]100-yr,6hr	Wild Flower Ranch	[3]340	[5]100-yr,2-hr	Nov-99; Apr-96
	-----	-----	Pueblo Verde		-----	-----		-----
	-----	-----	Estrella Industrial Park		-----	-----		-----
	-----	-----	-----		-----	-----		-----
12	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	Wigwam Creek		-----	-----		-----
13	-----	-----	-----	-----	Sage Creek	101	[6]100-yr,6hr	1-Feb-00
	Corte Sierra Units I&II	630	-----	[5]100-yr,2-hr	-----	-----	-----	Jul-99
14	Litchfield Park	[3]1050	-----	[6]100-yr,24hr	-----	-----	-----	Mar-89
	-----	-----	-----	-----	[4]Palm Valley	[3]1800	[6]100-yr,6hr	Jul-99
17	-----	-----	-----	-----	-----	-----	-----	-----
19	-----	-----	-----	-----	-----	-----	-----	-----
	-----	-----	Canyon Trails III		-----			-----
21	-----	-----	Blue Horizon		-----	-----	-----	-----
	Primrose Estates	[3]160	-----	none	-----	-----	-----	-----
23	-----	-----	-----	-----	-----	-----	-----	-----
24	-----	-----	Litchfield Heights	-----	-----	-----	-----	-----
	-----	-----	Pasqualetti Mountain Ranch	-----	-----	-----	-----	-----
25	-----	-----	-----	-----	-----	-----	-----	-----
26	-----	-----	-----	-----	-----	-----	-----	-----

1. Date of drainage report for existing and ongoing developments only. "-----" indicates no drainage report.
2. 420 acres outside of ADMP Update project boundary.
3. No report, area estimated from aerial.
4. Report gives total master planned area only.
5. Report not found, therefore volume estimated.
6. From drainage report.
7. Excess retention reallocated to provide 100-year, 2-hour volume. Original design for 100-year, 1-hour - see "Master Drainage Report Update for Kingswood Parke Phase One", 5/1/95.
8. From "Master Drainage Report for Del Webb's Grand Avenue Property", 12/94
9. The rainfall depth used to compute this retention requirement was P = 2.6", $P_{100yr,1hr}$ = 2.4" and $P_{100yr,2hr}$ = 2.6"

1. Date of drainage report for existing and ongoing developments only.

Table 5.1

Impact of Development on Peak Discharge

Development	Approximate Area of Development (acres)	Sub Basin (WLB)	Sub Basin (URS)	[1]Undeveloped Peak Discharge (cfs)	Time of Peak (h:m)	[2]Developed Peak Discharge (cfs)	Time of Peak (h:m)	[3]Exiting Peak Discharge (cfs)	Time of Peak (h:m)
Happy Trails	[5]400	112	112	534	12:20	846	12:15	393	12:40
Arizona Traditions	[4]530	112	111A	534	12:20	870	12:15	271	12:25
Sun Village	[5]440	117	117	359	13:20	920	12:35	364	13:05
Kingswood Parke	[4]360	116	116	575	13:18	872	12:20	233	12:40
Wal*Mart, Home Depot, Etc...	[5]102	118	118	126	12:50	326	12:05	253	12:10
Roseview	[4]297	138	138A	587	13:20	717	12:10	257	12:30
Pebble Creek Phase I&II	[5]500	266	266	181	12:20	923	12:25	0	n/a
	"	267	266&267	[6]n/a	[6]n/a	[6]n/a	[6]n/a	[6]n/a	[6]n/a
	"	269	268	[6]n/a	[6]n/a	[6]n/a	[6]n/a	[6]n/a	[6]n/a
Estrella Vista	[4]180	333	333	388	13:05	558	12:30	558	12:30
Palm Valley Phase I	[5]850	289	289	519	13:50	492	12:10	[7]n/a	[7]n/a
		289A	289A	326	13:10	326	12:10	[7]n/a	[7]n/a
			289B			569	12:05	[7]n/a	[7]n/a
			289C			383	12:10	[7]n/a	[7]n/a
			289D			388	12:10	[7]n/a	[7]n/a
		Total:							
Corte Sierra Units I&II	[5]630	291	291	454	13:15	1555	12:10	118	12:40

1. Based on the WLB model.
2. Based on the URS model.
3. This is the flow exiting the sub basin attenuated by onsite retention.
4. Per drainage report.
5. Per aerial photo.
6. Areas too different to compare directly.
7. Areas drain directly to the ADOT basins.

Super Basin 2A:

Sub basin 112 – Happy Trails (approximately 400 acres) is one of two golf resort communities that was built in a portion of the original sub basin 112 from the WLB Study model. The second is Arizona Traditions (approximately 530 acres). These developments are located within the City of Surprise. The property line separating these two developments is also the new boundary line that cuts the original sub basin 112 into two new sub basins (112 and 111A).

Both Happy Trails and Arizona Traditions have performed mass grading which has changed the internal flow patterns of the sub basin. Although mass grading of the two areas has resulted in different hydrograph combinations downstream, it is obvious that the development within this area has increased the overall runoff produced onsite.

The combined peak flow rates leaving these developed sub basins after retention are somewhat less than in the undeveloped case. The reduction in peak flow rates leaving the sub basins can be attributed to the effects of the onsite retention provided by each of the developments.

Super Basin 2C:

Sub basin 116 – Kingswood Parke is a large master planned community (360 acres) located within sub basin 116 in the City of Surprise. This development has implemented a network of recreational parks and lakes that serve as retention basins which are connected by earthen drainage channels. Due to the development of Kingswood Parke, the discharges produced onsite have increased significantly from the time of the WLB Study.

Through the provision of onsite retention in Kingswood Parke the peak discharge leaving the retention basin provided in sub basin 116 is much lower than the discharge leaving the sub basin modeled in the WLB Study.

Sub basin 117 – Sub basin 117 has experienced development since the original study. The Parke Row/Sun Village development(s) has significantly increased the amount of runoff produced within sub basin 117. Parke Row and Sun Village are residential developments located within the City of Surprise (approximately 19 and 440 acres, respectively).

The undeveloped discharge produced onsite estimated by the WLB Study model is significantly lower than that produced in the ADMP Update (developed condition) model. Due to the onsite retention, the post development peak discharge leaving the retention basin is approximately the same as the pre-development discharge.

Sub basin 118 – Sub basin 118 has undergone significant land use changes since the WLB Study. With the development of several commercial businesses including a WalMart and Home Depot, the area of this once undeveloped sub basin has been almost completely covered with impervious area.

Since the volume of runoff provided by the development within the area was not available by the report, it was manually calculated for the 100-year, 2-hour storm even per the City of Surprise standards. With the reduction of this calculated volume by the agreed upon 80%, the total effective volume modeled for this sub basin was approximately 14.7 ac-ft.

The ADMP Update model raised the WLB Study RTIMP variable from 0 to 80 to represent the large proportion of concrete, asphalt and roofing associated with this development. Additionally, the revised values for the IA, XKSAT, PSIF and DTHETA parameters all suggest higher runoff than before. These changes are attributed to the use of the NRCS soil map and the changes to the assigned value of the XKSAT parameter.

The results of the comparison of the WLB Study (undeveloped) runoff and volume with the ADMP Update (developed) runoff showed that the undeveloped condition produced a much lower discharge relative to the developed discharge. After modeling the onsite retention, the flow exiting the sub basin was still higher than the WLB Study discharge. The reason for this is due to the fact that the 100-year, 2-hour volume provided by the onsite retention basin is approximately one half of the total volume generated onsite by the 100-year, 24-hour storm.

Super Basin 2D:

Sub basin 138 – Sub basin 138 experienced mass grading associated with the recent development of Roseview (approximately 297 acres). Roseview is a residential development located in the City of Surprise.

The grading associated with this development resulted in a new sub basin within 138 labeled 138A. Runoff from sub basin 138 and 138A under the developed (ADMP Update) condition was much higher than the peak flow generated by the existing condition modeled by the WLB Study. Onsite retention provided as part of the new development effectively reduced the peak flow rate leaving the retention basin to less than the pre-developed condition.

Super Basin 4, 5 and 14:

Sub basin(s) 266, 267 and 268 – Pebble Creek Phases I and II is a very large master planned community located within the City of Goodyear (approximately 500 acres). This is a residential community with several golf courses and lake features. The lakes and golf courses serve to convey storm water runoff throughout the development and provide the retention necessary to retain the volume generated onsite by the 100-year, 6-hr storm event.

The pre-developed peak discharge from area 266 represents a small portion of Pebble Creek Phase II. This was the only sub basin that retained the same general shape as its original boundary. The actual area within the boundary is higher since, although the general shape is similar, the boundary was expanded proportionally to reflect the effects of mass grading. With this in mind, an indirect comparison of peaks can be made using a ratio and proportion. The original area of sub basin 266 was approximately 40% of the revised. Therefore, if the values for peak flow are reduced by this amount, a general comparison can be seen.

Since the total volume generated in sub basin 266 is less than that provided by the retention, the actual post developed discharge leaving sub basin 266 is zero.

Other sub basin boundaries containing portions of the Pebble Creek development have changed significantly enough to preclude a simple/direct comparison of pre-developed peak discharges with developed peak discharges on a sub basin by sub basin basis. Additionally, the shapes are so different that even a ratio and proportion comparison is not possible.

Super Basin 7:

Sub basin 333 – Sub basin 333 has experienced some moderate development with the construction of the Estrella Vista Master Plan (approximately 180 acres) located in the City of Goodyear, Arizona. The pre-developed peak discharge from sub basin was increased significantly with development.

The effect of the retention volume provided onsite within Estrella Vista is not enough to lower the developed peak generated within the entire sub basin 333. This is obvious since the total volume of flow produced within the partially developed sub basin 333 (45 ac-ft) is approximately five times the volume provided (8.7 ac-ft) within Estrella Vista development.

Although the master drainage plan for Estrella Vista documents a total volume provided by proposed retention basins of 20.2 ac-ft, three of the nine parcels providing retention have not yet been constructed. Cumulatively, these three parcels provide 9.3 ac-ft of volume. Therefore, only 8.7 ac-ft of volume was used in the ADMP Update model ((20.2 – 9.3) * 0.8).

Since Estrella Vista only accounts for a portion of the entire sub basin 333, it cannot be expected to retain the entire 45 ac-ft, rather only a portion of such based upon the volume generated within its own project boundary. Upon full build-out of the rest of sub basin 333, the exiting peak discharge would be expected to drop below the undeveloped (WLB Study) value.

Super Basin 13:

Sub basin 291 – Sub basin 291 contains the large master plan community Corte Sierra Units I and II (approximately 630 acres).

The undeveloped peak discharge from sub basin 291 is approximately 30% of the developed peak. In addition to the usual reasons for increases in developed peaks, the magnitude of this increase can be attributed to the fact the Corte Sierra development encompasses almost all of sub basin 291. The development has significantly increased the percent impervious over the entire sub basin area. The large amount of onsite retention volume provided onsite effectively attenuates the post developed discharge to approximately 25% of the predeveloped value.

Super Basin 14:

Sub basin(s) 289 and 289A – These sub basins add up to roughly the same area as sub basins 289 and 289A-D from the ADMP Update model. The areas have been further divided to simulate new boundaries created by the mass grading associated with the Palm Valley Phase I development. Palm Valley Phase I (approximately 850 acres) is part of an approximately 9,000-acre master planned community that incorporates recreational parks and golf courses into drainage basins and conveyance ways.

The total (directly added) peak discharge from this general area in the WLB Study model was 40% of the total (directly added) peak discharge from this area under the ADMP Update (URS) model or post developed condition.

This increased discharge is representative of an increase to the percent impervious as well as differences in IA, XKSAT, DTHETA and PSIF. The undeveloped values for IA and DTHETA are significantly higher than those for developed conditions. The higher values for these variables will lead to less runoff and therefore lower peak discharges. Additionally, the large increase in RTIMP in the developed condition will produce much higher peak discharges over a given area.

There is no onsite retention provided in Palm Valley Phase I, therefore, the developed condition peak flow rates do not experience any attenuation. The reason for the lack of onsite retention in Phase I is due to the idea that the existing ADOT basins downstream were designed to accept the post-developed runoff from this watershed. The post-developed design storm event used to analyze the ADOT Basins was the 50-year storm event. Documentation in the "Palm Valley Phase I Golf Course LOMR," by the WLB Group, dated February 2, 1998, indicates that the basins have an excess capacity. The report further states that the basins provide adequate volume to safely retain the post developed volume generated within the Palm Valley Phase I development during the 100-year, 24-hour storm event. The ADOT basins will be discussed in more detail in Section 5.2 of this report.

5.2 IMPACT OF DEVELOPMENT AND MODELING REVISIONS TO EXISTING FLOOD CONTROL FACILITIES

There have been several flood control facilities designed and constructed within the ADMP Update project area since the completion of the WLB Study. Although most of these facilities were built by FCDMC, some were either constructed by private development or completed under inter-governmental agreements (IGA) between the FCDMC and local city governments.

With the development of the ADMP Update HEC-1 model, it is important to determine the impacts of the revised model and resultant peak discharges upon the recently constructed flood control facilities. In addition to the recent flood control structures, key existing flood control corridors and/or basins were also included in the above summary of results to determine the extent to which the revised hydrology model may have affected them.

The following section briefly describes each facility/corridor and summarize the effect of the revised hydrologic model on each. The following information has been tabulated and presented in more detail in Table 5.2.

Bullard Wash Outfall Channel – The Bullard Wash Outfall Channel was built and designed as a first step in the channelization of the historic Bullard Wash corridor from Thomas Road to the Salt/Gila Rivers. This particular reach of the channelized corridor recommended by the WLB Study begins at the Salt/Gila Rivers and extends north to approximately Lower Buckeye Road.

The design discharge used for this reach of the Bullard Channel was 3,200 cfs. The discharge calculated with the revised HEC-1 in the ADMP Update was 2,485 cfs. The apparent drop in discharge is largely due to a significant volume of retention provided by several upstream developments constructed since the WLB Study.

The peak discharge associated with the ADMP Update occurs earlier than the discharge used in the design. This is reflected by the fact that upstream development has not only provided onsite retention volume but is concentrating flow through and around the developed areas. This

Table 5.2

Existing Discharge vs. Design Discharge for Existing Flood Control Facilities

Existing Flood Control Facility	Design/WLB Concentration Point CP	Design Discharge (cfs)	Time of Peak (hr:min)	ADMP Update Concentration Point CP	ADMP Update Discharge (cfs)	Time of Peak (hr:min)	Design Discharge Source Documents
Bullard Wash through Goodyear Planned Regional Center - McDowell north to Thomas	CP286	3400	-----	CP286	2553	14:20	[1]Conditional Letter of Map Revision (CLOMR) Technical Data Notebook, for Bullard Wash, Maricopa County Arizona, by JE Fuller/Hydrology & Geomorphology, June 1999
	CP287	3538	-----	CP287	2521	14:30	"" "" ""
Bullard Wash from Lower Buckeye Road North to I-10	[2]CP334	[3]3191	-----	CP334	2398	15:35	"" "" ""
	[2]CP316	[3]2742	-----	CP316	2252	15:20	"" "" ""
	[2]CP298	[3]2764	-----	CP298	2260	14:55	"" "" ""
Bullard Wash Outfall Channel from Salt/Gila to Lower Buckeye Road	[4]CP364A	3200	20:00	[5]BLRD3	2485	16:00	Bullard Wash Channel Improvements - Technical Data Notebook,Volume 1 of 2, By: Flood Control District of Maricopa County (FCDMC) - 2-99; & Volume II by Sverdrup Civil & Wood Patel - 11-98
Bullard Wash through Pebble Creek Phase II - McDowell north to Camelback	[7]CPS6A	3703	15:40	CP253	2640	13:20	Palm Valley Master Drainage Study, by WLB,dated 2-2-98
	[7]CPS6	3872	16:10	CP267	2557	13:45	"" "" ""
	[7]CPS29	3812	16:35	CP286	2553	14:20	"" "" ""
RID outfall channel through Palm Valley Phase II - McDowell north to Camelback	RS55	1260	-----	CP287C	1414	13:55	Palm Valley Master Drainage Study, by WLB,dated 2-2-98
	RCS57A	1347	-----	CP289	1239	13:30	"" "" ""
	RSCS53	1486	-----	CP289D	1376	13:00	"" "" ""
	CS336A	1579	-----	CP289B	1762	12:35	"" "" ""
	CPS36	1492	-----	CP289C	1636	12:20	"" "" ""
[8]Bullard Wash north of Camelback & adjacent to LAFB	CP221A	380	-----	CP221A	451	14:40	White Tanks / Agua Fria Area Drainage Master Plan, The WLB Group, 3/95
	CP221	590	-----	CP221	573	15:25	"" "" ""
Indian School Road Interim Channel (Sarival Road to Bullard Wash)	CP250A	1250; [6]510	-----	CP250A	554	14:55	Addendum to Drainage Design Report for Palm Valley Phase II A Indian School Road Interim Condition Channel, WLB, 8/99
	CP251	1420; [6]560	-----	CP251	1503	16:30	"" "" ""
	CP252	2670; [6]560	-----	CP252	1536	16:50	"" "" ""
	CP253	3390; [6]3860	-----	CP253	2640	13:20	"" "" ""
Dysart Drain from Falcon Dunes Golf Course to the Agua Fria River	CP194	[9]510;**448**	-----	SR194B & CP194C	[10]284 & 748	18:50 & 13:25	White Tanks / Agua Fria Area Drainage Master Plan, The WLB Group, 3/95 & Figure 3 from "Dysart Drain Improvements Project", 90% Plans, Wood Patel & NBS/Lowry, 9-94
	CP195	[9]960;**1772**	-----	CP195	1360	18:00	"" "" ""
	CP196	[9]1200;**2300**	-----	CP196	1483	18:05	"" "" ""
	CP202	[9]1400;**2287**	-----	CP202	1480	18:15	"" "" ""
	CP205	[9]2400;**3984**	-----	CP205	2294	17:35	"" "" ""
Colter Channel from east of Litchfield Road to the Agua Fria River	D242F	1060	-----	CP242	1054	12:10	Hydrology of Colter Channel, Contributing Drainage Area, FCDMC, 7/8/92
	CPNV1	1161	-----	CP243A	1160	10:15	
	CPNV2	1088	-----	CP243A			
	CPNV3	1080	-----	CP243A			"" "" ""
	D243	1210	-----	CP244B	1160	12:20	"" "" ""
	245	1900	-----	CP245	1132	12:20	"" "" ""
White Tanks Flood Retarding Structure #4 Inlet Channel	I10WT4	2206	----	I10WT4	2216	13:00	Flood Control District of Maricopa County, White Tanks Flood Retention Structure No. 4 Inlet improvements, Dibble and Associates Consulting Engineers, 7-29-93
ADOT Detention Basins	CP287A	[11]618	13:50	CP287A	245	12:35	White Tanks / Agua Fria Area Drainage Master Plan, The WLB Group, 3/95 & Palm Valley Phase I Golf Course LOMR, the WLB Group, 2-2-98
	CP287B	[1]212; [12]1064	14:15; 12:05	CP287B	687	12:20	"" "" ""
	CP287C	[11]649	16:50	CP287C	1414	13:55	"" "" ""
	CP287D	[1]382; [12]142	19:35; 12:05	CP287D	460	15:00	"" "" ""

1. Study extends from approximately McDowell Road and Bullard Wash to approximately 1900' downstream of Thomas Road.
2. Report did not include a HEC-1 model or sub basin map. CP's are inferred by the location of 'significant change in discharge shown on CLOMR Floodplain Map.
3. Note: Current thinking is to allow 3200cfs in Bullard South of I-10 - this requires an update to the JE Fuller CLOMR in this reach.
4. See HEC-1 file in report labeled "BULLAB3.dat".
5. Nomenclature change per FCD comments, 3-13-01.
6. Low flow assumes Camelback Road Channel is in place directly north. Note: Camelback Road Channel is NOT in place and therefore, not reflected by the URS model.
7. See Palm Valley Master Drainage Study Developed Conditions Drainage Area Map, 1-8-98 & HEC-1 'PVFUT52.dat'.
8. See WLB Area Drainage Master Plan 11"x17" plan sheets, "Bullard Watershed", 3/95.
9. Discharges from WLB ADMP and 90% Plans by Wood Patel/NBS Lowry. Bold value denotes the design discharge shown on Figure 3.0 from 90% Plans Submittal.
10. Sub basin 194 was divided into A, B and C in the URS model based on basin as-built plans. CP194B not included with WLB or 90% Plan reports.
11. Dishcarge from WLB ADMS.
12. Discharge from "Palm Valley Phase I LOMR" and represents total inflow to ADOT these two basins.
13. Discharge reported in the Sun City Grand LOMR.

Table 5.2

Existing Discharge
vs.
Design Discharge for
Existing Flood Control Facilities

Existing Flood Control Facility	Design/WLB Concentration Point CP	Design Discharge (cfs)	Time of Peak (hr:min)	ADMP Update Concentration Point CP	ADMP Update Discharge (cfs)	Time of Peak (hr:min)	Design Discharge Source Documents
Reems Road Channel - Bell Road to Greenway	CP122	414	14:45	CP122A	911	14:00	Conditional Letter of Map Revision, Reems Road, Mountain Vista Ranch Development, Robert Bein, William Frost and Associates, 7-99
Reems Road Channel - Greenway Road to Hearn Road (1/2 mile north of Waddell)	CP122	[13]743	-----	CP133	1005	14:25	Drainage Report for Greenway Parc at Surprise (One - Three), 3/99-7/99 and Channelization of Reems Road Floodplain Greenway Road to Hearn Road and Conditional Letter of Map Revisioin Application, 6/99
Lower El Mirage Wash	CP154	789	16:25	LLE1	366	16:00	The Lower El Mirage Wash Channelization and Tributary a Portion of the El Mirage Master Drainage Plan, 1-14-00
	R154	784	16:40	RLLE1	363	16:20	"" "" ""
	2I157	1216	16:45	2I157	725	12:55	"" "" ""
	D126	856	13:20	D126	776	12:50	"" "" ""
	R126	838	13:30	RLE	692	13:00	"" "" ""
	CP139	1372	13:25	LE1	870	13:00	"" "" ""
	R139	1347	13:30	RLE1	806	13:05	"" "" ""
	CP156	1431	13:25	LE2	965	13:00	"" "" ""
	R156S	1389	13:35	RLE2	891	13:15	"" "" ""
	CP157	1638	14:05	LE3	1487	12:55	"" "" ""
	R157	1634	14:10	RLE3	1512	12:55	"" "" ""
	CP172	1635	14:10	LE4	1573	12:55	"" "" ""
Camelback Rod Channel	CP242A	135	12:05	242A	204	12:00	Camelback Road Litchfield Road to El Mirage Road Final Drainage Report, 7/98, CBA
	CP503	505	12:10	CP242B	678	12:10	"" "" ""
	CP506	603	12:10	CP243	650	12:25	"" "" ""
	CP509	725	12:15	CP245A	617	12:35	"" "" ""
White Tanks FRS #3	CPWT3	[14]6,649	12:55	CPWT3	7,760	12:55	White Tanks / Agua Fria Area Drainage Master Plan, The WLB Group, 3/95
White Tanks FRS #4	CPWT4	[15]6,026	13:00	CPWT4	6,896	12:55	White Tanks / Agua Fria Area Drainage Master Plan, The WLB Group, 3/96
McMicken Dam	[16]N/A	[16]N/A	[16]N/A	[16]N/A	[16]N/A	[16]N/A	USACOE, 1956

1. Study extends from approximately McDowell Road and Bullard Wash to approximately 1900' downstream of Thomas Road.
2. Report did not include a HEC-1 model or sub basin map. CP's are inferred by the location of 'significant change in discharge shown on CLOMR Floodplain Map.
3. Note: Current thinking is to allow 3200cfs in Bullard South of I-10 - this requires an update to the JE Fuller CLOMR in this reach.
4. See HEC-1 file in report labeled "BULLAB3.dat".
5. Nomenclature change per FCD comments, 3-13-01.
6. Low flow assumes Camelback Road Channel is in place directly north. Note: Camelback Road Channel is NOT in place and therefore, not reflected by the URS model.
7. See Palm Valley Master Drainage Study Developed Conditions Drainage Area Map, 1-8-98 & HEC-1 'PVFUT52.dat'.
8. See WLB Area Drainage Master Plan 11"x17" plan sheets, "Bullard Watershed", 3/95.
9. Discharges from WLB ADMP and 90% Plans by Wood Patel/NBS Lowry. Bold value denotes the design discharge shown on Figure 3.0 from 90% Plans Submittal.
10. Sub basin 194 was divided into A, B and C in the URS model based on basin as-built plans. CP194B not included with WLB or 90% Plan reports.
11. Dishcarge from WLB ADMS.
12. Discharge from "Palm Valley Phase I LOMR" and represents total inflow to ADOT these two basins.
13. Discharge reported in the Sun City Grand LOMR.
14. The design discharge is not given in the original design report by the U.S. Army Corps of Engineers, 1956. This report only gives the facility capacity in ac-ft of approximately 2,655.
15. The design discharge is not given in the original design report by the U.S. Army Corps of Engineers, 1956. This report only gives the facility capacity in ac-ft of approximately 1,036.
16. The design discharge is not given in the original design report by the U.S. Army Corps of Engineers, 1956. This report only gives the facility capacity in ac-ft of approximately 30,500. This facility is not directly studied in the WLB Study or the ADMP Update.

concentration and increased conveyance efficiency effectively reduces the overall time to peak at downstream concentration points (CP).

Bullard Corridor – Lower Buckeye to I-10 – This segment of the Bullard Wash corridor is the next segment of the overall channelization project by the City of Goodyear. Proposed development along the corridor has agreed to set aside an approximately 300-foot wide corridor to allow the construction of a conveyance cross section proposed by the City of Goodyear. For more information on this corridor, see Section 2.0 of the "Draft Level II Phase I Technical Memorandum for the Bullard Wash – Thomas Road to Lower Buckeye," September 2000.

The cross section will be used as both a flood control channel and a multi-use aesthetic corridor featuring parks, paths and trails.

A Conditional Letter of Map Revision (CLOMR) for this segment of the Bullard Wash was prepared by JE Fuller/Hydrology & Geomorphology in June of 1999. It is important to note that the CLOMR shows several discharge values through this reach that are lower than the 3,200 cfs used to design the downstream portion of the existing Bullard Outfall Channel. This is important since 3,200 cfs may be the design discharge used when constructing this portion of the wash improvements. Use of this higher discharge could require a new CLOMR with revised water surface elevations. These water surface elevations are used by proposed adjacent development when designing finish floor elevations for proposed structures.

Since the JE Fuller CLOMR is based on the existing channel section through this area, the CLOMR would already require updating since the improved hydraulic section proposed would also produce different water surface elevations. The main reason for the JE Fuller CLOMR was to reflect the effect of the recently completed Dysart Drain improvements on these key downstream corridors.

Bullard Wash Corridor – Goodyear Planned Regional Center – The segment of the Bullard Wash through the Goodyear Planned Regional Center has also been studied as part of the JE Fuller CLOMR. As stated earlier, this segment of the wash will be constructed using the 300-foot cross section proposed by the City of Goodyear. The CLOMR was mainly prepared to reflect the recent completion of the Dysart Drain improvements and the effect of cutting off previously overtopping discharges from downstream portions of the ADMP Update area including the Bullard Wash.

The discharges through this portion of the Bullard Wash are actually lower in the ADMP Update HEC-1 model than those used with the CLOMR. This presents an opportunity to route more storm water runoff from other parts of the watershed through this reach without adversely impacting the water surface elevations used in the CLOMR.

Again, a new CLOMR would be required based on the improved hydraulic section proposed by the City of Goodyear as well as final discharge values determined from the routing of storm water runoff upstream from this location.

Bullard Wash – Pebble Creek Phase II – This portion of the Bullard Wash traverses the Pebble Creek Phase II golf course. The wash is graded to convey storm water through the golf course and is routed through constructed retention areas.

Discharge values reported by the "Palm Valley Master Drainage Study" through this reach are lower than those estimated using the ADMP Update model. Again, the decrease is due to the effects of retained storm water upstream in several new developments.

The lower discharge rates in the ADMP Update indicate that more storm water may be routed through this corridor from other parts of the watershed. A CLOMR would be required through this reach to reflect the change in water surface elevation due to the changed discharge values.

RID Outlet Channel – Palm Valley Phase II – This portion of the Palm Valley development conveys storm water from the Roosevelt Irrigation District Overchute (RID) as well as adjacent drainage basins through the Palm Valley golf course to the existing ADOT detention basins. In general, the discharges through this corridor have decreased; however, there was an approximate 10% increase in runoff in the upstream reach. This is primarily due to significant increases in percent impervious within sub basins 2711, sub6 and sub7 (Litchfield Park) and 289B and 289C (Palm Valley Phase II). No additional retention was provided for the reason that these ongoing master planned communities have already met the imposed retention requirements.

The decreased discharges were due to the effects of onsite storage routing through golf course features located in sub basins 289, 289B and 289D.

Bullard Wash – North of Camelback Adjacent to LAFB – This portion of the Bullard Wash remains undeveloped and is not currently part of the proposed future channelization. This area is of interest since it is directly adjacent to LAFB. The discharges in this area have decreased since the WLB Study. The lower peak flow rates reflect the result of the recently completed Dysart Drain improvements.

The discharges shown in Table 5.2 under the "Design Discharge" column are from the WLB Area Drainage Master Plan and reflect the estimated impacts to the peak flow in this area after proposed improvement of the Dysart Drain.

Indian School Road Interim Drainage Channel – This facility was constructed as part of the Palm Valley Phase II development to provide protection from offsite flow north of Indian School Road. Ultimately, there will be a parallel channel constructed along Camelback Road as well as onsite retention facilities with the ultimate build-out of the entire Palm Valley Master Planned development north of Indian School.

Dysart Drain – Falcon Dunes to the Agua Fria River – The Dysart Drain facility was originally constructed in the 1960's to provide protection against flooding. Over the course of 30 years since its construction, portions of the drain experienced severe subsidence. In fact, subsidence was so severe that the longitudinal channel slope became adverse toward the downstream end.

Due to this subsidence, the Dysart Drain could no longer convey the 100-year peak discharge. As a result, in the early 1990's storm water runoff produced by heavy rainfall within the project area caused extensive flooding on LAFB directly downstream of the Dysart Drain. This deficiency in the Dysart Drain's conveyance capacity prompted an improvement project to restore the facility. The new design was based on future subsidence estimates in an effort to prevent a similar loss of capacity with the newly restored facility.

For more detail on the Dysart Drain and land subsidence in the area, refer to the Draft Data Collection Report, February 2000.

The ADMP Update HEC-1 model shows reduced discharges along the entire Dysart Drain. This is primarily due to the effects of retained storm water by several developments upstream.

Colter Channel – The Colter Channel was constructed to provide an outfall for the storm water runoff generated within the developed area which is part of Super Basin #12. Portions of development adjacent to the Colter Channel on the north donated right-of-way for the channel in exchange for relaxed onsite retention requirements. Therefore, the channel has been designed to convey the storm water runoff during the post-developed condition for portions of the contributing watershed.

The design discharges used with the Colter Channel are generally higher than those computed with the ADMP Update HEC-1 model. It is interesting to note that dividing the ADMP Update sub basin 243 results in a slightly lower peak discharge at the Colter Channel in the "Hydrology of Colter Channel Contributing Area" report 7/92. This is primarily due to the sub division of sub basin 243 in the Colter Channel report. Two of the three sub areas resulting from this division of sub basin 243 are modeled as developed (NV2 & NV3) while the third area (NV1) is modeled as undeveloped.

In the ADMP Update model, sub basin 243 is modeled as one area with a weighted RTIMP value assigned based upon the developed and undeveloped portions of the area. This difference combined with the effects of routing discharge from one area to the next (Colter Channel HEC-1) results in a peak discharge that is approximately 7% lower than the peak computed with the ADMP Update model.

White Tanks Flood Retarding Structure #4 Inlet Channel – This inlet channel was constructed as part of a recommendation from the WLB ADMP. The channel design discharge is essentially identical to the ADMP Update discharge.

ADOT Detention Basins – The ADOT detention basins were constructed as part of the original I-10 highway project. These basins provide retention volume for the entire Palm Valley Phase I development directly upstream. The combined discharge into the two basins farthest west is very similar (slightly less) to the post-developed condition discharge reported in the "Palm Valley Phase I Golf Course LOMR." The combined discharge into the two basins farthest east is more difficult to directly compare due to the larger difference in time to peak. However, direct addition of these peaks indicates an increase in inflow of approximately 11%.

The total estimated volume available within the existing ADOT basins is approximately 1,000 ac-ft. This includes any freeboard that may be available within the basins. The total volume draining to the facilities as estimated by the ADMP Update HEC-1 model is 641 ac-ft. This value was obtained by adding the volumes associated with the following operations: 287D, CP287C, R288B, 287B and CP287A. This implies that the ADOT basins have excess storage volume available for peak attenuation of future runoff.

Reems Road Channel – Construction of a channel along Reems Road was recommended in the WLB Study. Two developments recently constructed along Reems Road have each performed hydrologic analysis based on 'current' conditions and have designed and built portions of this channel.

The first of these developments is the Mountain Vista Ranch development. Mountain Vista Ranch parallels Reems Road on the west from Bell Road south to Greenway Road. According to the hydrologic analysis, the flow rate used for the channel design is approximately half of the discharge calculated by the ADMP Update.

Upon inspection of the hydrologic models and sub basin maps used for the two models, the difference seems to be a result of two important parameters. The first reason for this difference is that the Mountain Vista Ranch (MVR) CLOMR hydrology does not appear to reduce the onsite retention in contributing offsite sub basins by the 20% described in Section 4.0 of this report.

The second reason for the large difference in discharge is that the MVR CLOMR uses Reems Road as a hard boundary on the east. According to the maps included with the MVR CLOMR, Reems Road has a straight north-south alignment and precludes runoff from the sub basin areas to the northeast of the Reems Road/Bell Road intersection from entrance to the Reems Road Channel. Based on field reconnaissance MVR CLOMR sub basins 100, 100A, 102, 103, 107, 108, 113, 114 and 115 were consolidated into the ADMP Update sub basins 114 and 115.

Due to substantial regrading in Sun City Grand the Reems Road alignment north of Bell Road was shifted significantly to the east. Since the roadway directs runoff on the west south along its alignment, this results in a 30% increase in the area that contributes to the peak discharge in the Reems Road Channel.

The second development constructing a portion of the Reems Road Channel is the Greenway Parc at Surprise (GPS) One through Three. This development uses a flow rate that was reported by the MVR CLOMR as "Flow in cfs from 1388 LMR." The MVR CLOMR showed that this peak flow was revised to 414 cfs due to the incorporation of retention basins proposed with the MVR development, use of the FCDMC depth area reduction ratios and the exclusion of Arizona Traditions from the contributing drainage area.

Again, GPS does not account for the change in the Reems Road alignment and the resulting increase in contributing area nor does it assume an 80% efficiency of proposed onsite retention in upstream developments.

Lower El Mirage Wash – The Lower El Mirage Wash and Tributary are in the process of being channelized to reduce the effective floodplain and increase the amount of area available to development. This corridor is in the CLOMR process.

According to WLB study, discharges in this area were on the order of approximately 800 cfs to approximately 1,640 cfs. By comparison, the ADMP Update HEC-1 model predicts discharges from approximately 360 cfs to 870 cfs. The time to peak at the locations within this corridor varied depending on the existing condition of the contributing sub basin area at any given point.

At concentration points (CP) 154 (LLE1), 157 (LE3) and 172 (LE4) the time to peak decreased while at CP's 139 (LE1) and 156 (LE2), the time to peak was about the same. By inspection of the aerial photo, and development reports in the adjacent area, approximately 1/3 of the total contributing area (direct and indirect) at CP's 154 (LLE1), 157 (LE3) and 172 (LE4) have onsite retention however, the modeling of the recently constructed channelization of Lower El Mirage Wash had the effect of peak discharges and decreasing the time to peak. At CP's 139 (LE1) and 156 (LE2), the effect of development and concentrated storm water runoff has resulted in a decrease in the time to peak, however, overall peak discharge is still reduced due to upstream retention.

Camelback Road Channel – The Camelback Road Channel was recently constructed by the Maricopa County Department of Transportation (MCDOT) from Litchfield Road to El Mirage Road. The channel was designed to eliminate flow breakouts at Dysart road and El Mirage road for the 100-year, 24-hour storm event. The channel discharge values shown in the design report are somewhat lower (6% on average) than the values calculated by the ADMP Update HEC-1 model.

The difference in discharge is most likely due to the differences in the modeling methods and parameters used by the Cella Barr Model (Camelback Road Channel Design Report).

The Cella Barr model uses Muskingum-Cunge routing vs. the normal depth method in the ADMP Update and the soil parameters used on the LG card are different. Probably the most important difference between the models is the point rainfall depths shown on the JD cards. The Cella Barr model shows a maximum rainfall depth of 3.8 inches vs. 4.03 inches used in the ADMP Update.

White Tanks FRS #3 & #4 – The existing White Tanks FRS #3, White Tanks FRS #4 and McMicken Dam were built in the 1950's after severe flooding in the summer of 1951 caused an approximate 3 million dollars in direct damages. The original design volume for these structures was approximately 2,655 ac-ft (WT FRS #3) and 1,036 ac-ft (WT FRS #4), respectively. The WLB Study showed an approximate 3,000 ac-ft and 1,690 ac-ft capacity at each structure, respectively. The volumes used with the WLB Study were obtained by assuming 3 feet of freeboard from the last elevation shown on the HEC-1 rating curve. Subtracting the freeboard from this elevation and using the corresponding storage value provided the above estimate for capacity. The elevation-storage rating curves have not been changed in the ADMP Update for these facilities.

The White Tanks FRS #3 is currently being studied by the FCDMC and may be replaced in kind with one or more flood control basins. While providing the same level of flood control, these basins would also provide multi-use and recreational opportunities.

The reason for the replacement of White Tanks FRS #3 stems from the fact that in the 47 years since its construction the facility has experienced significant crest settlement due to land subsidence. The facility has also experienced cracking due to subsidence. Other issues relating to safety and inspection requirements by federal and state agencies have played a role in the FCDMC's decision to pursue possible dam replacement options.

Design discharges used for the improvement study were taken from the hydrologic model developed by FCDMC staff discussed in Section 1.1. These discharges are higher than those estimated by either the WLB Study or the ADMP Update. Therefore these discharges are more conservative than those estimated with either the WLB Study or the ADMP Update HEC-1 models. According the FCDMC study, approximately 1,968 ac-ft drain to the existing White Tanks FRS #3. By comparison, 719 ac-ft and 912 ac-ft were estimated to drain to the facility by the WLB Study and ADMP Update, respectively.

The volume of storm water draining to the existing White Tanks FRS #4 has increased from approximately 626 ac-ft in the WLB Study to approximately 767 ac-ft in the ADMP Update. Although this structure is not currently being studied by the FCDMC, it may eventually be considered for replacement due issues similar to those discussed with White Tanks FRS #3.

The increased discharge and volume estimates at both the White Tanks FRS #3 and #4 are a result of changes to the soil parameters used to describe the infiltration and runoff characteristics in the contributing watersheds. These values changed due to revisions in the assigned values for the XKSAT variable and updated NRCS soils coverage maps. No significant development has occurred in these watersheds since the WLB Study.

The McMicken Dam – Like the White Tanks FRS #3 and #4, the McMicken Dam was constructed to protect downstream areas from severe flooding following the floods in the early 1950's. Although the dam is not being specifically studied as a part of the ADMP Update study, it is crucial to the hydrologic model developed for the ADMP Update project area. This dam cuts off a significant amount of stormwater from an approximately 247 square mile drainage area. The flow from this area is retained behind the dam and discharged to the Agua Fria River via principal and emergency spillways that route excessive discharge around the ADMP Update project boundary on the north.

6.0 CONCLUSIONS

Since the completion of the WLB Study in the early 1990's, several factors have contributed to changes in the existing condition HEC-1 hydrologic model used to predict 100-year, 24-hour peak discharges at key points within the watershed. Among these factors are changes to both the physical characteristics present in the ADMP project watershed area as well as changes to hydraulic conductivity (XKSAT) assigned values and accepted modeling techniques in general. Additionally, more detailed information regarding area topography and soils has become available that required some modification of various HEC-1 input parameters.

When considering all of the changes to the HEC-1 model since the WLB Study, two distinct categories begin to emerge. The first category involves land use or physical change that has occurred in the watershed since the completion of the original study was complete. These changes include the following examples:

- Construction of new flood control facilities
- Construction of planned area developments
- Construction of onsite retention within developed areas
- Mass grading resulting in new drainage boundaries between sub basins

These are changes that would impact the existing peak discharges when all other modeling inputs are held constant.

The second category of changes include parameters that impact the existing peak discharges calculated by the model if no physical change had occurred in the project area since the completion of the WLB Study. These changes include the following examples:

- Changes in assigned value for the XKSAT parameter regardless of physical changes in the watershed
- Changes in modeling technique such as excluding transmission losses
- Updated soil group information

The second category changes make direct comparisons between the WLB Study HEC-1 model and the ADMP Update HEC-1 very difficult and general at best.

Development throughout the ADMP Update project area has been fairly constant since the completion of the WLB Study and is increasing in intensity. Several master planned communities are either being constructed or are proposed for future development. Currently, there are several sub divisions under construction with many more approved and platted that will begin construction soon. Most of the recent development has occurred in the City of Surprise, the City of El Mirage and the City of Goodyear.

Development in the City of Surprise due to the Sun City West development as well as many other smaller projects has been concentrated north of Bell Road. Development that has occurred in the City of Goodyear has been mainly concentrated in the northwest and western portions of the city limits. Finally, significant development has taken place in the City of El Mirage east of the intersection of Litchfield Road and Thunderbird Road both north and south of Thunderbird Road.

While the general effect of the above development has been to increase and concentrate onsite discharge due to increased impervious surfaces such as roads, sidewalks and building roofs, the enforcement of onsite retention requirements by local government agencies tends to attenuate the peak discharge exiting developed sub basins. Additionally, many of these developments are required to either pass offsite discharge through or around their property limits. Constructed channels and inlets collect and concentrate offsite storm water. This usually increases flow velocities and decreases the time of peak at the exit point from the development. Since the onsite peaks are significantly attenuated, the result is usually a lower time of peak and peak discharge.

With the large amount of undeveloped land present in the project area that is already platted or planned for future development, it will be very important that a flood control backbone system of channels and basins be implemented to provide both an outfall and relief to surrounding areas. It is also very important that onsite retention requirements continue to be strictly enforced so that overall peak discharges throughout the watershed area do not increase. With the magnitude of the proposed master planned communities within the project area as large as 9,000 acres (DMB/Caterpillar Master Plan), this will be very important to downstream land owners where lack of retention on developed property upstream could result in significant flooding and drainage to property.

As mentioned above, most of the development that has taken place since the WLB Study has actually reduced the peak discharges. However, some exceptions have been noted throughout the watershed. One such exception occurred in sub basin 118. In this case, the percent of impervious area relative to the overall sub basin area was so large that the amount of volume generated during the developed condition was larger than the design storm required for retention by the City of Surprise.

The retention requirements throughout the ADMP Update project area although based on the 100-year storm event range in duration from 1, 2 or 6 hours. In the case of sub basin 118 the parking area, building footprint and other developed impervious features associated with the Home Depot, Wal-Mart and other commercial businesses was extremely large. Therefore, the 100-year, 24-hour storm event modeled by the ADMP Update produced a larger volume of runoff than the provided onsite retention could attenuate.

Another example of an area where peak discharges significantly increased was in sub basins 289 and 289A. These sub basins make up the Palm Valley Phase I Master Planned Community. This area significantly increased the exiting peak discharge. Since the plan for the development prior to final approval was to drain the post development peak discharge to the existing ADOT basins, the increase in peak was accounted for and does not adversely impact downstream land owners.

In addition to the recent development within the ADMP Update area, recent construction and rehabilitation of proposed and existing flood control facilities has to mitigate flood hazards throughout the watershed.

Since the modeled discharge changed based on not only land use but on modeling procedures and changes in assigned value for the XKSAT parameter, the peak discharges computed at concentration points along the flood control facilities present within the project area are extremely important. In almost every case, the peak discharge associated with a particular flood control channel or facility was lower in the ADMP Update HEC-1 model than the design value used to construct the facility.

While some minor increases in discharge were noted along flood control channels built along various master planned communities, these were generally not significant. One exception was the golf course channel through Palm Valley Phase II north of McDowell Road downstream from the RID overchute. Three out of five concentration points along the channel experienced increases in peak flow from 6 to 10%. The design of this channel should be examined to ensure that the hydraulic section can still safely convey the peak discharge resulting from the 100-year, 24-hour storm event.

Other facilities where design discharges increased were the Reems Road Channel reaches recently constructed adjacent to the Greenway Parc and Mountain Vista Sub divisions, the ADOT detention facilities and the Camelback Road Channel.

Increased discharges at the ADOT basins are expected since the Palm Valley Phase I development received approval to drain the onsite post developed discharge directly to the basins.

The large increase to the discharges along the Reems Road channel are a result of mass grading upstream where the contributing watershed area increased by 30%. These channel segments will probably require further improvement in the future to safely convey the 100-year, 24-hour peak discharge.

Finally, the increase in the peak discharges along the Camelback Road Channel are on the order of 10 to 30% and are most likely due to the changes in modeling assumptions, techniques and assigned value for the XKSAT parameter discussed above. Again, this channel may require improvement to safely convey the 100-year, 24-hour peak discharge.

Peak inflow rates to the White Tanks FRS #3 and #4 have increased due to changes in assigned values for soil parameters in contributing watershed areas alone. No development has taken place in the contributing watersheds since the WLB Study. Since both structures have excess capacity, this increase in discharge and volume is not critical; however, concerns over the age of these facilities and dam safety requirements may result in their improvement and/or replacement.

While the ADMP Update existing condition HEC-1 model provides a reasonable estimate for peak discharges produced throughout the project area, it should be noted that this area is extremely dynamic. Due to the ever-changing nature of both actual land use as well as future proposed land use further updates to the "existing condition" hydrologic model will be required in the next few years.

In certain locations throughout the ADMP Update area, there are existing features that are either diverting or ponding storm water runoff. Discharges along these features have not been analyzed with a hydraulic model to determine the potential for overtopping of the structure or possible flow break-out locations. Such an analysis may be warranted in a variety of locations and may be conducted at a later date under the optional services provision within this contract.

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APPENDIX

Peak Discharge Comparison

WLB vs. ADMP Update

Concentration Point Comparison
Original ADMS vs. URS Model Output
FCDMC ADMP

Original ADMS			URS - 9/30/2002		
Station	Peak Flow (cfs)	Time to Peak (hours)	Station	Peak Flow (cfs)	Time to Peak (hours)
1	1342	12.5	1	1719	12.42
2	1174	12.75	2	1339	12.75
3	828	12.33	3	863	12.33
4	339	12.25	4	396	12.25
5	716	12.25	5	927	12.25
6	591	12.08	6	746	12.08
7	390	12.08	7	494	12.08
8	704	12.33	8	890	12.33
9	1096	12.42	9	1402	12.33
10	1173	12.75	10	1357	12.75
11	1313	12.5	11	1559	12.42
12	1149	12.58	12	1214	12.5
13	1170	12.42	13	1223	12.42
14	1163	12.33	14	1548	12.33
15	1039	12.42	15	1272	12.42
16	1255	12.42	16	1206	12.42
17	929	12.25	17	1036	12.33
18	923	12.17	18	1179	12.17
19	622	12.42	19	819	12.42
20	861	12.33	20	1218	12.33
21	688	12.42	21	913	12.42
22	525	12.25	22	730	12.25
23	289	12.08	23	310	12.08
24	207	12.25	24	193	12.25
25	500	12.33	25	560	12.33
26	943	12.5	26	1333	12.5
27	999	12.42	27	1153	12.33
28	747	12.5	28	734	12.5
29	228	12.25	29	262	12.25
30	244	12.33	30	338	12.25
31	525	12.5	31	580	12.5
32	956	12.42	32	1154	12.33
33	643	12.25	33	811	12.25
34	361	12.25	34	457	12.25
35	400	12.25	35	510	12.17
36	193	12.25	36	301	12.25
37	672	12.42	37	909	12.42
38	715	12.25	38	911	12.25
39	588	12.5	39	628	12.5
40	525	12.25	40	586	12.25
41	567	12.42	41	536	12.42
42	1029	12.5	42	1055	12.5
43	23	12	43	23	12
44	300	12.25	44	287	12.25
45	401	12.42	45	845	12
46	651	12.58	46	525	12.58
100	283	12.58			
101	233	12.25	101	215	12.25
102	135	12.42			

Concentration Point Comparison
Original ADMS vs. URS Model Output
FCDMC ADMP

Original ADMS			URS - 9/30/2002		
Station	Peak Flow (cfs)	Time to Peak (hours)	Station	Peak Flow (cfs)	Time to Peak (hours)
103	286	12.92			
104	236	12.17	104	218	12.25
105	354	12.25	105	306	12.25
106	871	12.5	106	712	12.5
107	398	13.08			
108	478	13.25			
109	536	13.25			
110	270	12.83			
111	443	12.67	111	482	12.08
112	534	13.33	112	846	12.25
113	431	13.08			
114	326	13	114	2117	12.75
115	379	13.08	115	2122	12.67
116	575	13.5	116	872	12.33
117	335	12.83	117	920	12.58
118	126	12.83	118	326	12.08
119	600	13.17	119	544	13.17
120	397	13.25	120	388	13.25
121	325	12.92	121	360	12.92
122	552	13.33			
123	338	13	123	320	13
124	355	13.33	124	331	13.33
125	1044	12.5	125	934	12.5
126	562	13.33	126	1038	12.5
127	469	12.08	127	456	12.08
128	312	12.92	128	299	12.92
129	378	12.67	129	339	12.67
130	647	13.25	130	571	13.25
131	355	13.08	131	317	13.08
132	271	13	132	253	13
133	328	13.08	133	304	12.83
134	334	13.08	134	313	13.08
135	315	13.17	135	373	12.67
136	315	13.08	136	291	13.08
137	307	13.42	137	280	13.42
138	587	13.33	138	278	13
139	338	13.08	139	719	12.25
140	194	12.67	140	180	12.67
141	460	12.33	141	484	12.33
142	351	13	142	305	13
143	354	13	143	300	13
144	351	13	144	328	13
145	328	13.08	145	297	13.08
146	548	13.17	146	523	13.17
147	342	13	147	325	13
148	328	13	148	307	13
149	312	13.08	149	293	13.08
150	193	12.75	150	188	12.75
151	208	12.75	151	200	12.75

Concentration Point Comparison
Original ADMS vs. URS Model Output
FCDMC ADMP

Original ADMS			URS - 9/30/2002		
Station	Peak Flow (cfs)	Time to Peak (hours)	Station	Peak Flow (cfs)	Time to Peak (hours)
152	284	12.92	152	252	12.92
153	112	13.33	153	117	13.33
154	171	12.58	154	174	12.58
155	250	12.75	155	255	12.75
156	252	12.75	156	233	12.75
157	946	12.58	157	610	12.83
158	494	13.08	158	1195	12.33
159	531	12.33	159	608	12.33
160	432	12.42	160	409	12.42
161	294	13	161	310	13
162	268	12.5	162	268	12.5
163	551	12.92	163	492	12.92
164	363	13.08	164	314	13.08
165	548	13.25	165	507	13.25
166	533	13.33	166	496	13.33
167	528	13.33	167	501	13.33
168	340	13.17	168	312	13.17
169	368	13.17	169	384	13.17
170	301	12.67	170	296	12.67
171	409	13.42	171	386	13.42
172	122	12.58	172	111	12.58
173	198	13	173	193	13
174	612	12.25	174	572	12.25
175	375	12.25	175	354	12.25
176	701	12.42	176	635	12.42
177	336	13.08	177	291	13.08
178	298	13.08	178	274	13.08
179	333	13.08	179	293	13.08
180	574	13.33	180	515	13.33
181	283	12.92	181	258	12.92
182	212	12.75	182	191	12.75
183	258	12.42	183	226	12.42
184	531	13.17	184	465	13.17
185	465	13.08	185	443	13.08
186	187	13.25	186	180	13.25
187	81	12	187	75	12
188	240	12.25	188	256	12.25
189	521	12.42	189	514	12.42
190	657	12.92	190	534	12.92
191	610	13.25	191	545	13.25
192	346	13.08	192	282	13.08
193	545	13.25	193	502	13.25
194	535	13.42			
195	256	13.5	195	239	13.5
196	313	13	196	284	13
197	524	13.5	197	468	13.5
198	494	13.42	198	547	13.08
199	74	13.08	199	71	13.08
200	231	12.67	200	216	12.67

Concentration Point Comparison
Original ADMS vs. URS Model Output
FCDMC ADMP

Original ADMS			URS - 9/30/2002		
Station	Peak Flow (cfs)	Time to Peak (hours)	Station	Peak Flow (cfs)	Time to Peak (hours)
201	420	12.33	201	379	12.33
202	258	13.42	202	235	13.42
203	162	12.25	203	145	12.25
204	381	12.25	204	366	12.25
205	125	12.08	205	112	12.08
206	188	12.17	206	182	12.17
207	619	13.25	207	508	13.25
208	632	13.17	208	530	13.17
209	336	13.08	209	308	13.08
210	296	13.08	210	283	13.08
211	309	13.08	211	300	13.08
212	279	13.42	212	268	13.42
213	373	12.5	213	335	12.5
214	208	12.25	214	196	12.25
215	419	12.33	215	383	12.33
216	366	12.92	216	301	12.92
217	350	13	217	309	13
218	624	13.25	218	498	13.25
219	343	13.08	219	278	13.08
220	335	13.08	220	281	13.08
221	303	13.08	221	292	13.08
222	541	13.58	222	493	13.58
223	1763	12.42	223	1689	12.42
224	1054	12.33	224	1022	12.33
225	460	12.42	225	430	12.5
226	1573	12.33	226	1426	12.33
227	331	12.25	227	311	12.25
228	361	12.33	228	326	12.33
229	724	12.17	229	702	12.17
230	56	12.33	230	59	12.33
231	265	12.42	231	303	12.42
232	1006	12.42	232	953	12.42
233	496	12.42	233	464	12.42
234	347	13.17	234	280	13.17
235	303	13.17	235	243	13.17
236	582	13.25	236	516	13.25
237	300	13.25	237	280	13.25
238	314	13.17	238	301	13.17
239	313	13.08	239	300	13.08
240	282	13	240	266	13
241	1436	12.5	241	1380	12.5
242	965	12.67	242	1063	12.17
243	298	12.33	243	293	12.08
244	200	12.58	244	95	13
245	181	13.17	245	168	12.83
246	670	12.5	246	619	12.5
247	330	13.08	247	303	13.08
248	592	13.25	248	471	13.25
249	571	13.25	249	514	13.25

Concentration Point Comparison
Original ADMS vs. URS Model Output
FCDMC ADMP

Original ADMS			URS - 9/30/2002		
Station	Peak Flow (cfs)	Time to Peak (hours)	Station	Peak Flow (cfs)	Time to Peak (hours)
250	316	13.08	250	294	13.08
251	313	13.17	251	302	13.17
252	326	13.17	252	294	13.17
253	641	13.17	253	493	13
254	556	12.58	254	434	12.17
255	1512	12.25			
256	326	13	256	297	12.83
257	217	13.42	257	207	13.42
258	334	12.42	258	355	12.42
259	242	12.25	259	263	12.17
260	536	12.33	260	523	12.33
261	264	13.17	261	212	13.17
262	616	13.25	262	509	13.25
263	328	13.08	263	291	13.08
264	337	13	264	318	13
265	118	13.33	265	98	13.08
266	181	13.33	266	923	12.42
267	335	13.17	267	1412	12.42
268	589	13.25	268	513	12.08
269	491	13	269	405	12.17
270	446	12.25	270	548	12.08
271	377	13.25			
272	231	12.25	272	267	12.25
273	671	12.42	273	624	12.42
274	329	13.5	274	282	13.5
275	136	12.42	275	117	12.42
276	187	13	276	167	13
277	570	13.08	277	495	13.08
278	537	13.33	278	452	13.33
279	79	12.25	279	71	12.25
280	340	13.33	280	313	13.33
281	487	13.25	281	393	13
282	161	12.33	282	160	12.33
283	102	13.08	283	84	12.75
284	326	13.17	284	201	12.75
285	56	12.33	285	55	12.33
286	473	13.08	286	420	12.92
287	223	12.67	287	211	12.67
288	160	13.25	288	125	13.25
289	519	13.83	289	492	12.17
290	413	12.67	290	453	12.67
291	454	13.25	291	1555	12.17
292	1004	12.5	292	903	12.5
293	679	12.67	293	586	12.67
294	274	12.17	294	237	12.25
295	419	12.25	295	428	12.25
296	565	13	296	339	12.58
297	240	13.17	297	231	13.17
298	591	13	298	654	12.75

Concentration Point Comparison
Original ADMS vs. URS Model Output
FCDMC ADMP

Original ADMS			URS - 9/30/2002		
Station	Peak Flow (cfs)	Time to Peak (hours)	Station	Peak Flow (cfs)	Time to Peak (hours)
299	289	13	299	324	12.75
300	353	12.83	300	348	12.83
301	535	12.17	301	504	12.17
302	242	12.17	302	225	12.17
303	910	12.67	303	626	12.67
304	1221	12.33	304	1104	12.33
305	666	13	305	525	13
306	367	12.92	306	343	12.92
307	219	12.58	307	208	12.58
308	270	12.75	308	260	12.75
309	666	13.17	309	606	13.17
310	183	12.58	310	165	12.58
311	420	13.33	311	402	13.33
312	423	13.17	312	415	13.17
313	258	13.17	313	651	12.17
314	293	13	314	337	12.67
315	278	13.25	315	266	13.25
316	512	13.17	316	502	13.17
317	341	13.25	317	323	13.25
318	581	12.67	318	547	12.67
319	577	12.5	319	531	12.5
320	677	12.42	320	685	12.42
321	942	12.17	321	866	12.17
322	261	12.92	322	212	12.92
323	181	12.33	323	162	12.33
324	279	12.83	324	237	12.83
325	294	13.25	325	242	13.25
326	373	13	326	344	13
327	373	13	327	358	13
328	521	12.92	328	473	12.92
329	496	12.83	329	455	12.83
330	467	12.83	330	484	12.67
331	489	13.08	331	468	13.08
332	353	13.17	332	315	13.17
333	388	13.08	333	558	12.5
334	452	13	334	269	12.5
335	277	12.92	335	400	12.67
336	552	13.92	336	540	13.92
337	744	12.25	337	694	12.25
338	260	12.58	338	255	12.58
339	625	13.17	339	511	13.17
340	348	13	340	283	13
341	506	13.08	341	427	13.08
342	327	12.83	342	278	12.83
343	323	13.17	343	297	13.17
344	343	13.33	344	325	13.33
345	296	13	345	273	13
346	403	12.75	346	358	12.75
347	671	13.08	347	595	13.08

Concentration Point Comparison
Original ADMS vs. URS Model Output
FCDMC ADMP

Original ADMS				URS - 9/30/2002		
Station	Peak Flow (cfs)	Time to Peak (hours)		Station	Peak Flow (cfs)	Time to Peak (hours)
348	283	12.75		348	261	12.75
349	654	13		349	580	13
350	106	13.33		350	101	13.33
351	607	12.83		351	540	12.83
352	150	12.75		352	144	12.75
353	183	12.75		353	167	12.75
354	315	12.58		354	297	12.58
355	85	12.92		355	90	12.92
356	346	12.58		356	333	12.58
357	132	12.67		357	128	12.67
358	119	13.17		358	122	13.17
359	104	12.58		359	101	12.58
360	168	13		360	176	13
361	138	13.17		361	147	13.17
362	339	12.83		362	325	12.83
363	360	13.25		363	343	13.25
364	559	13		364	305	13.08
365	272	12.83		365	267	12.83
366	289	13		366	249	13
367	240	12.08		367	245	12.08
368	367	13.58		368	367	13.58
369	133	12.25		369	171	12.25
370	61	12.33		370	60	12.33
371	487	13.67		371	533	13.67
372	796	13.75		372	884	13.75
373	386	12.75		373	398	12.75
374	459	13.5		374	493	13.5
375	262	13.42		375	274	13.42
376	344	13		376	357	13
377	120	12.42		377	120	12.42
378	349	13.42		378	415	13.42
379	220	13.58		379	214	13.58
380	188	12.83		380	199	12.83
381	184	12.92		381	191	12.92
382	539	13.17		382	552	13.17
383	154	12.92		383	161	12.92
384	262	12.83		384	271	12.83
385	298	13.17		385	314	13.17
386	222	13.25		386	241	13.25
387	205	13		387	221	13
				2711	226	12
				2712	705	12.17
100A	212	12.5		100A	173	12.5
102A	525	12.58		102A	462	12.5
				111A	870	12.25
113A	409	13.08		113A	772	12.25
117A	195	12.83				
119A	356	13.17		119A	296	13.17
121A	324	12.92		121A	366	12.92

Concentration Point Comparison
Original ADMS vs. URS Model Output
FCDMC ADMP

Original ADMS			URS - 9/30/2002		
Station	Peak Flow (cfs)	Time to Peak (hours)	Station	Peak Flow (cfs)	Time to Peak (hours)
			122A	587	12.25
			122B	734	12.25
131A	354	13.08	131A	316	13.08
			138A	717	12.17
141A	202	12.17	141A	214	12.17
145A	327	13.08	145A	287	13.08
156A	508	12.17	156A	501	12.17
158A	114	13.25			
158B	483	13			
158C	105	12.58			
158D	560	12.25			
158E	767	12.17			
164A	365	13.08	164A	309	13.08
173A	191	12.75	173A	161	12.75
173B	88	12.83	173B	110	12.83
175A	362	12.5	175A	417	12.5
176A	378	13.25	176A	327	13.25
177A	334	13.08	177A	293	13.08
181A	249	13.17	181A	227	13.17
192A	345	13.08	192A	327	12.83
			194A	210	12.75
			194B	206	12.75
			194C	707	13.42
207A	469	12.42	207A	497	12.42
209A	335	13.08	209A	276	13.08
215A	497	12.42	215A	453	12.42
221A	175	13.25	221A	172	13.25
225A	441	12.42	225A	409	12.42
228A	125	12.17	228A	129	12.08
22A	764	12.25	22A	733	12.25
230A	292	12.17	230A	287	12.17
242A	161	12.08	242A	204	12
			242B	607	12.17
243A	253	12.42	243A	353	12.08
243B	64	12.67	243B	120	12.25
244A	486	12.17	244A	220	12.08
			244B	46	12.58
			245A	132	12.17
250A	308	13.17	250A	296	13.17
253A	291	12.33	253A	253	12.33
254A	443	12.08	254A	340	12.08
			254B	246	12.08
			255A	916	12.25
258A	150	12.25	258A	140	12.25
265A	627	13.08	265A	506	12.83
			269B	410	12.17
271A	95	13.33	271A	260	12.58
271B	109	12.83			
271C	263	12.17	271C	278	12.17

Concentration Point Comparison
Original ADMS vs. URS Model Output
FCDMC ADMP

Original ADMS		
Station	Peak Flow (cfs)	Time to Peak (hours)
279A	89	12.33
279B	46	12.25
279C	78	12.25
279D	33	12.17
280A	53	12.75
285A	82	12.33
285B	83	12.33
287A	331	12.83
287B	127	12.5
287C	270	12.67
287D	239	12.67
287E	194	12.58
288A	607	13.33
288B	179	13.42
289A	326	13.17
293A	76	12.5
294A	368	12.25
295A	114	12.08
297A	206	12.92
303A	531	12.25
311A	241	12.92
325A	404	13.08
336A	149	14
336B	168	12
338A	736	12.42
342A	240	13.17
346A	110	13
346B	159	13.25
346C	135	12.5
348A	229	12.58
348B	355	13.33
352A	89	13.08
355A	46	12.5
364A	99	12.25
377A	188	13
377B	58	13.58
381A	115	12.58
381B	67	12.75
383A	122	13
3A	296	12.33
41-1	208	12.17
41-2	143	12.17
41A	91	12.08

URS - 9/30/2002		
Station	Peak Flow (cfs)	Time to Peak (hours)
279A	185	12
279B	81	12
279C	136	12
279D	30	12.17
280A	50	12.75
285A	80	12.33
285B	81	12.33
287A	246	12.58
287B	155	12.17
287C	315	12.25
287D	234	12.67
287E	365	12.17
288A	63	12.5
288B	864	12.58
289A	326	12.17
289B	569	12.08
289C	383	12.17
289D	388	12.17
293A	73	12.5
294A	338	12.25
295A	106	12.08
296A	394	12.42
297A	198	12.92
303A	486	12.25
311A	248	12.92
325A	337	13.08
335A	107	12.25
336A	78	13.5
338A	766	12.42
342A	224	13.17
346A	102	13
346B	146	13.25
346C	131	12.5
348A	215	12.58
348B	391	13.33
352A	84	13.08
355A	47	12.5
364A	92	12.67
364B	146	13.08
377A	184	13
377B	55	13.58
381A	123	12.58
381B	69	12.75
383A	134	13
3A	313	12.33
41-1	223	12.17
41-2	150	12.17
41A	92	12

Concentration Point Comparison
Original ADMS vs. URS Model Output
FCDMC ADMP

Original ADMS			URS - 9/30/2002		
Station	Peak Flow (cfs)	Time to Peak (hours)	Station	Peak Flow (cfs)	Time to Peak (hours)
41A1	48	12	41A1	47	12
41A2	60	12	41A2	64	12
41A3	69	12	41A3	61	12
43-1	76	12.08	43-1	73	12.08
43-2	19	12	43-2	19	12
43-3	107	12	43-3	106	12
43-4	64	12	43-4	64	12
43-5	43	12	43-5	44	12
43-6	45	12	43-6	44	12
43-7	45	12	43-7	46	12
43-8	23	12	43-8	23	12
45-1	143	12.08	45-1	137	12.08
46-1	184	12.25	46-1	151	12.25
CP10	5141	12.75	CP10	6970	12.83
CP10	3655	12.75			
CP10	1486	12.75			
CP100	283	12.58			
CP101	635	12.5			
CP102	753	12.5			
			CP102A	597	12.42
			CP106	409	12.83
CP107	1044	12.75			
CP108	1158	12.75			
CP109	535	13.25			
			CP111A	271	12.42
CP112	790	13.33	CP112	393	12.67
CP113	556	13.08			
CP113A	560	13.08	CP113A	766	12.25
CP114	376	13.08	CP114	860	13.5
CP115	2705	13.17	CP115	513	13.58
CP116	892	13.75			
CP117	1172	13.75	CP117	454	13.08
CP119	706	13.17			
CP119A	533	13.25	CP119A	439	13.25
CP12	4125	12.83	CP12	4724	12.83
CP120	1056	13.33	CP120	857	13.33
CP121	708	13	CP121	692	12.92
CP121A	465	12.92	CP121A	402	12.92
CP122	2976	13.58			
			CP122A	911	14
			CP122B	719	12.25
CP124	665	13.33	CP124	618	13.33
CP125	1318	14.08	CP125	924	12.5
CP126	856	13.33	CP126	776	12.83
CP128	537	13.25	CP128	481	12.92
CP13	1743	12.58	CP13	2062	12.58
CP130	1703	13.42	CP130	1457	13.42
CP131	1909	13.5	CP131	1727	13.5
CP131A	1102	13.58	CP131A	979	13.58

Concentration Point Comparison
Original ADMS vs. URS Model Output
FCDMC ADMP

Original ADMS			URS - 9/30/2002		
Station	Peak Flow (cfs)	Time to Peak (hours)	Station	Peak Flow (cfs)	Time to Peak (hours)
CP132	460	13.58	CP132	415	13.58
CP133	725	14.33	CP133	1005	14.42
CP134	2847	14	CP134	558	13.25
CP135	970	14.08	CP135	389	12.83
CP136	931	14.92	CP136	527	13.17
CP137	1306	14.5	CP137	867	13.5
CP138	1326	15	CP138	314	14.08
CP138	1651	15.42			
			CP138A	453	16.08
CP139	569	13.33	CP139	870	13
CP141A	540	12.33	CP141A	571	12.33
CP142	692	12.5	CP142	690	12.5
CP143	992	13	CP143	921	12.92
CP144	1398	13.67	CP144	1199	13.08
CP145	2946	14	CP145	2498	14
CP145A	1467	13.25	CP145A	1318	13.25
CP146	1441	14.08	CP146	727	13.5
CP147	2010	14.42	CP147	372	15.33
CP148	323	13	CP148	291	13
CP149	533	13.58	CP149	400	13.67
CP15	1920	12.5	CP15	2485	12.5
CP150	196	12.75	CP150	183	12.75
CP151	638	13.75	CP151	531	13.42
CP152	320	13.25	CP152	266	13
CP153	423	16.17	CP153	234	15.83
CP154	1017	16	CP154	366	16
CP155	243	12.75	CP155	237	12.75
CP156	598	13	CP156	965	13
CP157	1733	15	CP157	1487	12.92
CP158	557	14.17	CP158	534	12.58
CP158A	577	13.17			
CP158B	483	13			
CP160	955	12.42	CP160	996	12.42
CP161	1032	12.58	CP161	1087	12.58
CP163	1575	13	CP163	1565	13
CP164	2141	13.25	CP164	1944	13.25
CP164A	1865	13.17	CP164A	1765	13.17
CP165	3187	15.08	CP165	1945	15.17
CP166	1975	15.58	CP166	506	13.42
CP167	1870	15.92	CP167	924	13.75
CP168	515	13.5	CP168	424	13.58
CP169	491	13.83	CP169	463	13.83
CP17	3428	12.75	CP17	4474	12.67
CP172	1729	15.08	CP172	1573	12.92
CP173	1706	15.42	CP173	1519	13.33
CP173A	421	13.58	CP173A	387	13.67
CP173B	496	14.58	CP173B	257	13.17
CP175A	687	12.42	CP175A	721	12.42
CP176	792	12.5	CP176	708	12.5

Concentration Point Comparison
Original ADMS vs. URS Model Output
FCDMC ADMP

Original ADMS			URS - 9/30/2002		
Station	Peak Flow (cfs)	Time to Peak (hours)	Station	Peak Flow (cfs)	Time to Peak (hours)
CP176A	378	13.25	CP176A	322	13.25
CP177	902	13.75	CP177	738	13.75
CP177A	581	13.17	CP177A	493	13.17
CP178	993	13.42	CP178	810	13.42
CP179	3923	14.17	CP179	1834	14
CP180	1797	14.33	CP180	1185	16.5
CP181	292	14.75	CP181	240	12.92
CP181A	1200	16.25	CP181A	736	13.83
CP182	903	16.58	CP182	582	14.17
CP183	1078	16.42	CP183	638	14.17
CP184	1574	17.5	CP184	1085	15.25
CP185	552	13.67	CP185	486	13.67
CP187	173	13.67	CP187	166	13.67
CP188	1457	12.83	CP188	2696	12.83
CP189	940	12.58	CP189	954	12.58
CP19	1353	12.33	CP19	1799	12.33
CP190	1336	13.08	CP190	1221	13.08
CP191	2358	13.25	CP191	2048	13.25
CP191	1019	13.25			
CP192	1241	13.75	CP192	742	13.83
CP192A	1140	13.5	CP192A	699	13.58
CP193	2347	14.5	CP193	926	14.42
CP194	875	13.5			
			CP194A	192	12.75
			CP194B	921	14.75
			CP194C	748	13.42
CP195	2559	15.5	CP195	1360	18
CP196	945	17.42	CP196	1483	18.08
CP197	611	18.42	CP197	435	16.17
CP198	1418	19.17	CP198	1111	16.75
CP2	2284	12.75	CP2	2821	12.75
CP200	231	12.67	CP200	216	12.67
CP201	2025	15.67			
CP202	565	13.42	CP202	1480	18.25
CP203	598	18.92	CP203	431	16.58
CP204	1721	19.25	CP204	2295	17.5
CP205	1721	19.33	CP205	2294	17.58
CP206	1722	19.33	CP206	153	12.17
CP207A	1450	13	CP207A	2660	13
CP208	2175	13.33	CP208	1969	13.58
CP209	1285	14.08	CP209	796	14.17
CP209A	1706	13.58	CP209A	1479	13.67
CP21	1933	12.42	CP21	2606	12.42
CP210	304	13.08	CP210	277	13.08
			CP211	287	13.08
CP212	1350	15.58	CP212	289	13.75
CP214	1392	13.08	CP214	2603	13.08
CP215	1484	12.42	CP215	375	12.5
CP217	372	13.08	CP217	1538	13.5

Concentration Point Comparison
Original ADMS vs. URS Model Output
FCDMC ADMP

Original ADMS			URS - 9/30/2002		
Station	Peak Flow (cfs)	Time to Peak (hours)	Station	Peak Flow (cfs)	Time to Peak (hours)
CP218	669	13.25	CP218	491	13.92
CP219	1270	14.58	CP219	1060	14.75
CP220	1241	14.58	CP220	895	14.67
CP221	1018	15.17	CP221	573	15.42
CP221A	1377	16.17	CP221A	451	14.67
CP222	1380	16.5	CP222	499	15.08
CP223	2480	16.33	CP223	1534	12.42
CP224	2410	16.58	CP224	1856	12.5
CP225	959	12.42	CP225	832	12.42
CP226	1483	12.33			
CP229	863	12.33	CP229	771	12.33
CP22A	1108	12.33	CP22A	1285	12.33
CP23	288	12.08	CP23	909	12.92
CP230	672	12.42	CP230	637	12.33
CP230A	530	12.25	CP230A	508	12.25
CP231	279	12.5	CP231	305	12.5
CP233	1685	12.58	CP233	722	12.5
CP234	2084	12.83	CP234	1594	13.17
CP235	1467	13.42	CP235	2048	13.75
CP236	1222	13.58	CP236	1213	14.08
CP237	993	13.83	CP237	867	14.08
CP238	1226	15.25	CP238	1044	15.33
CP239	2367	16.17	CP239	1852	15.92
CP240	634	16.5	CP240	544	13
CP241	4216	17.08	CP241	2376	12.92
CP242	1051	12.58	CP242	1054	12.17
			CP242B	678	12.17
CP243	1462	12.67	CP243	650	12.42
CP243A	1263	12.67	CP243A	1160	12.25
CP243B	1112	12.67	CP243B	768	12.25
CP244	1195	12.5	CP244	746	12.58
CP244A	485	12.17	CP244A	215	12.08
			CP244B	1160	12.33
CP245	1861	13.17	CP245	1132	12.33
			CP245A	617	12.58
CP246	1239	12.58	CP246	1150	12.58
CP248	2174	13.67	CP248	1900	14
CP249	694	14	CP249	567	14.25
CP25	1414	12.42	CP25	1670	12.42
CP250	909	14.42	CP250	710	14.75
CP250A	1254	14.58	CP250A	554	14.92
CP251	2394	16.5	CP251	1503	16.5
CP252	439	16.83	CP252	1536	16.83
CP253	4103	17.67	CP253	2640	13.33
			CP254B	244	12.08
CP255	1512	12.25			
			CP255A	1107	12.17
CP256	325	13	CP256	296	12.83
CP259	243	12.25	CP259	262	12.17

Concentration Point Comparison
Original ADMS vs. URS Model Output
FCDMC ADMP

Original ADMS			URS - 9/30/2002		
Station	Peak Flow (cfs)	Time to Peak (hours)	Station	Peak Flow (cfs)	Time to Peak (hours)
CP260	1336	12.75	CP260	1237	12.75
CP261	264	13.17	CP261	212	13.17
CP262	2219	13.83	CP262	1820	14.17
CP263	1071	14.08	CP263	854	14.42
CP264	412	14.33	CP264	332	13.08
			CP265	507	13.75
CP265A	604	13.08	CP265A	587	14
CP266	1964	16.75			
CP267	2106	16.92	CP267	2557	13.75
CP268	4676	17.92	CP268	914	12.17
CP269	491	13	CP269	592	12.17
CP27	3011	12.5	CP27	3741	12.5
			CP2711	338	12.08
			CP2712	1359	12.25
CP270	520	12.33			
CP271	1104	13.5			
CP271A	284	13.42	CP271A	260	12.58
CP271B	109	12.83			
CP271C	263	12.17	CP271C	274	12.17
CP272	304	12.25	CP272	318	12.25
CP273	1407	12.83	CP273	1275	12.92
CP274	687	13.17	CP274	541	13.17
CP275	135	12.42	CP275	113	12.42
CP276	186	13	CP276	162	13
CP277	606	13.17	CP277	471	13.08
CP278	1660	15.42	CP278	1372	15.75
CP279	1632	15.58	CP279	1337	16
CP279A	88	12.42	CP279A	34	12.58
CP279B	45	12.25	CP279B	74	12
CP279C	76	12.25	CP279C	126	12
CP279D	32	12.17	CP279D	27	12.17
CP280	826	16.17	CP280	660	16.5
CP280A	585	17.58	CP280A	466	17.92
CP281	742	13.92	CP281	631	13.75
CP282	669	14.17	CP282	571	14
CP283	231	17.33			
CP284	1266	17.58	CP284	199	12.75
CP285	1007	18	CP285	49	12.33
CP285A	1259	17.83	CP285A	71	12.33
CP285B	229	17.58	CP285B	79	12.33
CP286	4638	18.5	CP286	2553	14.33
CP287	5293	18.58	CP287	2521	14.5
CP287A	618	13.83	CP287A	245	12.58
CP287B	212	14.25	CP287B	687	12.33
CP287C	649	16.83	CP287C	1414	13.92
CP287D	382	19.58	CP287D	460	15
CP287E	199	12.58			
CP288A	606	13.33			
			CP288B	1207	12.58

Concentration Point Comparison
Original ADMS vs. URS Model Output
FCDMC ADMP

Original ADMS			URS - 9/30/2002		
Station	Peak Flow (cfs)	Time to Peak (hours)	Station	Peak Flow (cfs)	Time to Peak (hours)
CP289	660	16.17	CP289	1239	13.58
			CP289B	1762	12.58
			CP289C	1636	12.33
			CP289D	1376	13
CP291	453	13.25	CP291	116	12.67
CP292	1704	13.25	CP292	1508	13.33
CP293	1408	13.5	CP293	1130	13.58
CP293A	1367	14.08	CP293A	1101	14.17
CP294	264	12.17	CP294	223	12.25
CP294A	730	15.92	CP294A	638	16.25
CP295	722	16.08	CP295	632	16.42
CP296	674	18.83	CP296	463	18.33
			CP296A	533	16
CP297	230	13.17	CP297	208	13.17
CP297A	519	18.33	CP297A	214	12.92
CP298	4491	19.83	CP298	2260	14.92
CP3	2245	12.92	CP3	2823	12.83
CP3	1755	12.92	CP3	0	0
CP3	490	12.92			
CP30	879	12.5	CP30	923	12.5
CP302	241	12.17	CP302	221	12.17
CP303	911	12.67	CP303	621	12.67
CP303A	516	12.25	CP303A	479	12.25
CP304	1646	12.42	CP304	1474	12.42
CP306	974	13	CP306	807	13
CP308	1063	13.25	CP308	888	13.25
CP309	1190	15.25	CP309	932	15.5
CP31	1258	12.58	CP31	1368	12.58
CP311	721	13	CP311	618	16.83
CP311A	270	12.92	CP311A	267	12.92
CP312	645	20	CP312	830	19.83
CP313	247	13.17	CP313	5	12.92
CP315	510	19.92	CP315	249	13.25
CP316	4483	20.08	CP316	2252	15.33
CP317	341	13.25	CP317	322	13.25
CP318	580	12.67	CP318	547	12.67
CP319	578	12.5	CP319	531	12.5
CP320	675	12.42	CP320	676	12.42
CP321	1309	12.25	CP321	1084	12.25
CP322	1104	13	CP322	660	13.17
CP323	1600	12.58	CP323	1417	12.58
CP324	1180	13.25	CP324	921	13.33
CP325	880	13.33	CP325	689	13.33
CP326	533	13.08	CP326	489	13.08
CP327	1232	13.5	CP327	1024	13.5
CP328	1086	16.5	CP328	815	16.83
CP329	663	12.83	CP329	600	12.83
CP33	1003	12.25	CP33	1259	12.25
CP330	1446	13.08	CP330	1108	13.17

Concentration Point Comparison
Original ADMS vs. URS Model Output
FCDMC ADMP

Original ADMS		
Station	Peak Flow (cfs)	Time to Peak (hours)
CP331	632	21.25
CP332	388	13.75
CP333	388	13.08
CP334	4960	20.33
CP335	4949	20.58
CP336	4943	20.75
CP336A	4942	20.75
CP337	1120	12.83
CP337B	58	13.58
CP338	852	12.67
CP338A	734	12.42
CP339	1396	13.33
CP340	1090	13.67
CP341	518	13.92
CP342	858	13.75
CP342A	625	13.58
CP343	1821	13.83
CP344	974	17.33
CP345	756	13.17
CP346A	1404	13.5
CP346B	1268	14.25
CP346C	1244	14.08
CP347	635	13.08
CP348A	379	13.42
CP348B	667	13.42
CP349	1430	13.83
CP35	2155	12.33
CP350	1417	14.25
CP351	1053	14
CP352	1238	14.33
CP352A	925	14.75
CP353	1291	13.92
CP354	604	13.92
CP355	2031	14.75
CP356	1792	14.08
CP357	750	13.42
CP358	896	18
CP359	1281	14.42
CP36	2886	12.42
CP360	1026	15.83
CP362	4429	22.33
CP363	4435	21.92
CP364	3139	21.08
CP364A	4940	20.83
CP368	367	13.58
CP371	1698	20.67
CP372	2124	19.42

URS - 9/30/2002		
Station	Peak Flow (cfs)	Time to Peak (hours)
CP331	822	21
CP332	281	13.17
CP333	555	12.5
CP334	2398	15.58
CP335	2340	15.92
CP335A	2334	16
CP336	704	13.92
CP337	1020	12.83
CP337B	55	13.58
CP338	869	12.67
CP338A	755	12.42
CP339	846	13.5
CP340	826	13.75
CP341	425	13.08
CP342	648	13.75
CP342A	565	13.58
CP343	1502	13.83
CP344	730	17.83
CP345	671	13.17
CP346A	1075	13.67
CP346B	961	21.83
CP346C	980	14.33
CP347	521	13.08
CP348A	594	12.92
CP348B	877	13.25
CP349	873	14
CP35	2717	12.25
CP350	872	14.5
CP351	763	14.08
CP352	925	14.42
CP352A	674	15
CP353	982	14
CP354	546	13.92
CP355	1735	14.75
CP356	1481	14.08
CP357	663	13.42
CP358	922	24.83
CP359	895	14.75
CP36	3736	12.33
CP360	941	22.92
CP362	1321	14.67
CP363	1155	13.92
CP364	302	13.08
CP364A	120	12.75
CP367	392	13.92
CP368	366	13.58
CP371	1251	21.5
CP372	1487	20.17

Concentration Point Comparison
Original ADMS vs. URS Model Output
FCDMC ADMP

Original ADMS			URS - 9/30/2002		
Station	Peak Flow (cfs)	Time to Peak (hours)	Station	Peak Flow (cfs)	Time to Peak (hours)
CP373	1770	15.92	CP373	1343	16.08
CP374	1870	16.83	CP374	1377	17.25
CP377	120	12.42	CP377	119	12.42
CP378	4403	23.17	CP378	1193	16.5
CP379	1797	21.67	CP379	1466	16.67
CP38	3253	12.42	CP38	4305	12.42
CP380	188	12.83	CP380	198	12.83
CP382	556	13.17	CP382	544	13.17
CP384	269	14.33	CP384	309	14.25
CP39	6110	12.67	CP39	7708	12.58
CP41	567	12.42	CP41	535	12.42
CP41	484	12.5			
CP41-1	208	12.17	CP41-1	222	12.17
CP41-1	103	12.33			
CP41-2	143	12.17	CP41-2	149	12.17
CP41-2	0	0.08			
CP41A	91	12.08	CP41A	91	12
CP41A	0	0.08			
CP41A1	0	0.08	CP41A1	0	0
CP41A2	60	12	CP41A2	63	12
CP41A2	36	12			
CP41A3	86	12.08	CP41A3	83	12.08
CP41A3	0	0.08			
CP42	7140	12.67	CP42	8776	12.67
CP43	6786	12.83	CP43	8794	12.75
CP43	4061	12.92			
CP43	1441	12.92			
CP43-1	465	12.58	CP43-1	423	12.58
CP43-1	0	0.08			
CP43-1	282	12.83			
CP43-2	19	12	CP43-2	18	12
CP43-2	0	0.08			
CP43-2	10	12.17			
CP43-3	107	12	CP43-3	103	12
CP43-3	0	0.08			
CP43-3	23	12.17			
CP43-4	64	12	CP43-4	61	12
CP43-4	0	0.08			
CP43-4	21	12.17			
CP43-5	43	12	CP43-5	42	12
CP43-5	0	0.08			
CP43-5	19	12.17			
CP43-6	45	12	CP43-6	43	12
CP43-6	0	0.08			
CP43-6	6	12.17			
CP43-7	45	12	CP43-7	44	12
CP43-7	0	0.08			
CP43-7	20	12.08			
CP43-8	23	12	CP43-8	22	12

Concentration Point Comparison
Original ADMS vs. URS Model Output
FCDMC ADMP

Original ADMS			URS - 9/30/2002		
Station	Peak Flow (cfs)	Time to Peak (hours)	Station	Peak Flow (cfs)	Time to Peak (hours)
CP43-8	0	0.08			
CP43-8	12	12.08			
			CP44	4880	12.92
CP45	1030	13.08	CP45	2581	12.92
CP45	485	13.17			
CP45	330	13.17			
CP45-1	1440	12.92	CP45-1	3296	12.83
CP45-1	1104	13			
CP45-1	325	13			
CP46	1737	12.67	CP46	1672	12.75
CP46-1	316	13.25	CP46-1	1567	13.08
CP46-1	0	0.08			
CP46-1	118	13.42			
CP5	1053	12.25	CP5	1315	12.25
			CP6	1854	12.17
CP7	1668	12.17	CP7	2245	12.17
CP9	3227	12.33	CP9	4190	12.33
CPWT3	6649	12.92	CPWT3	7760	12.92
CPWT4	6026	13	CPWT4	6896	12.92
CPWTAF	9459	24.83			
			SUB6	183	12.17
			SUB7	413	12.17
WT3	413	12.5	WT3	383	12.5
WT4	997	12.25	WT4	919	12.25

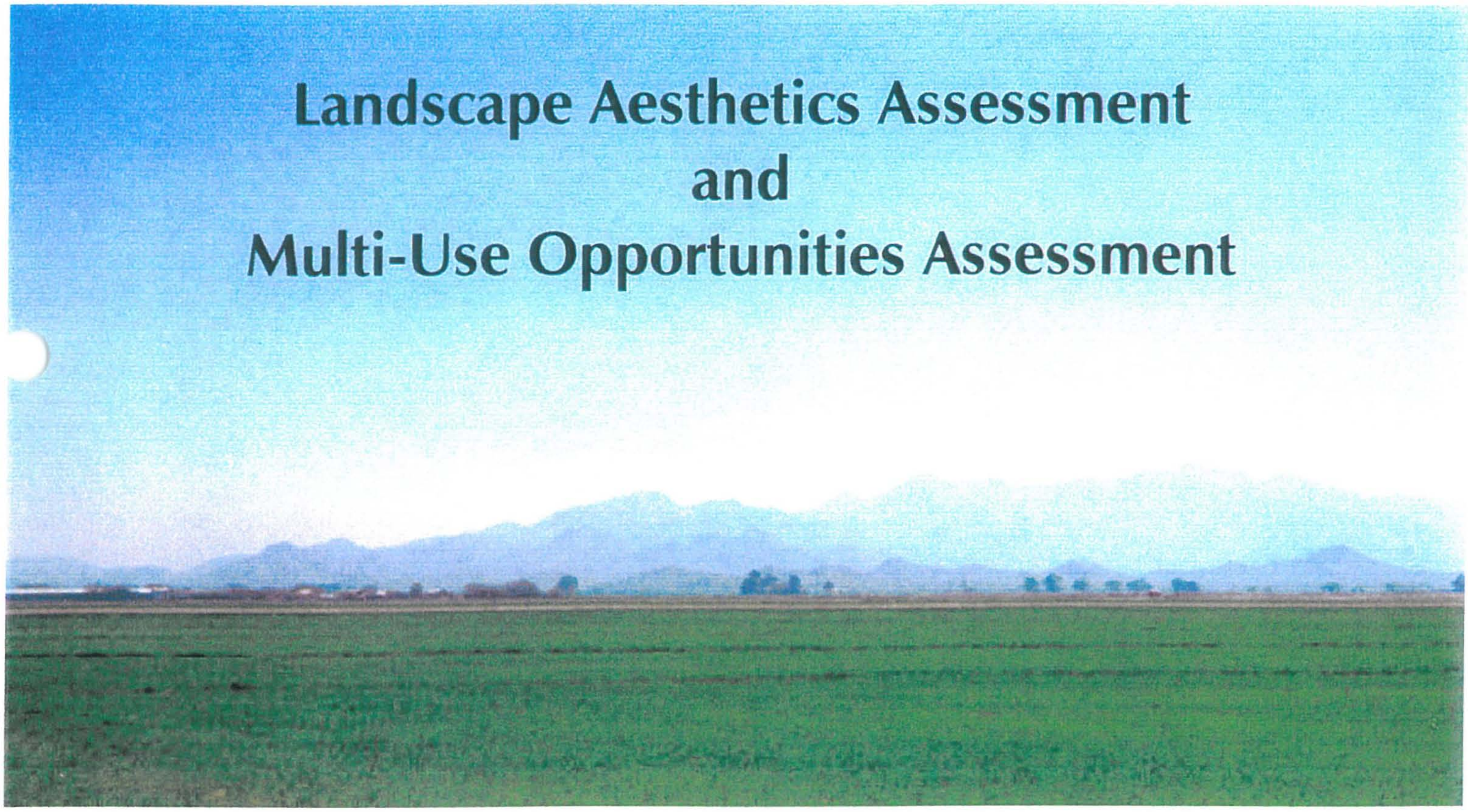
APPENDIX B

LANDSCAPE AESTHETICS ASSESSMENT AND MULTI-USE OPPORTUNITIES ASSESSMENT LOGAN SIMPSON DESIGN, INC., APRIL 17, 2000

Flood Control District of Maricopa County

www.fcd.maricopa.gov

Landscape Aesthetics Assessment
and
Multi-Use Opportunities Assessment



Prepared by:

LOGAN SIMPSON DESIGN INC.

REGISTERED LANDSCAPE ARCHITECT
CERTIFICATE NO.
27437
STEVEN E.
LOHIDE
Date Signed
ARIZONA, U.S.A.

October 28, 2002

INDEX

INTRODUCTION

Purpose: The purpose of this report is to document data collected in regards to landscape aesthetics and multi-use opportunities in the project area.

Objective: The objectives of this report is to identify ways in which landscape aesthetics and multi-use opportunities can be incorporated into existing and future flood control facilities as well as be a tool in identifying sites for future flood control facilities; provide insights into the existing character of the watershed so that flood control projects can blend with the existing landscape character and provide consistent landscape aesthetics and themes; and to evaluate existing flood control facilities and to what extent they do or do not conform to the DISTRICT's policy for aesthetic treatment and landscaping of flood control projects.

Approach/Methodology: The approach/methodology used for this report is based upon the United States Department of Agriculture - Agriculture Handbook Number 701 *"Landscape Aesthetics – A Handbook for Scenery Management"*.

Project Area: The Loop 303 Corridor / White Tanks Area Drainage Master Plan Update study area is located in the northwestern portion of the Phoenix Metropolitan Area. The project area is defined by the ridgeline in the White Tanks Mountains on the west, McMicken Dam/Deer Valley Road on the north, the Agua Fria River on the east, and the Gila River on the south. The study area spans across the majority of Townships 1N-4N and Ranges 1W-3W which includes the Cities of Avondale, Buckeye, El Mirage, Glendale, Goodyear, Litchfield Park, Peoria, Sun City, and Surprise, and as well as unincorporated areas of Maricopa County. The project area is approximately 220 square miles. The entire study area lies within the jurisdiction of Maricopa County. Lands within the study area are generally privately owned with large pockets of State Land located throughout. Refer to *Figure 1.1 – Vicinity Map* located within the *Loop 303 Corridor / White Tanks ADMP Update Draft Data Collection Report* for a map identifying the location of the project.

Report Layout: This report is broken into three (3) main categories: Data Collection and Existing Conditions Analysis; Visual Resources Assessment; and Multi-Use Opportunities Assessment.

1. The Data Collection and Existing Conditions Analysis identifies information that was collected and reviewed and identifies what activities took place during site visits/field reconnaissance.

2. The Visual Resource Assessment identifies aesthetic features and areas of the project area that may be preserved, enhanced or improved. This section is broken out into eight (8) categories to help identify the aesthetic features and areas.

    A. *Existing Landscape Character* – This category offers a brief narrative description of the characteristics of landform, rock formations, vegetation, and water features and cultural features which give each unit an identifiable character and sense of place.
    B. *Scenic Quality* – This category assesses the Scenic Quality of structural, natural and cultural features in the study area taking into consideration the degree of variety or uniqueness of the features.
    C. *Existing Visual Conditions/Visual Integrity* – This category identifies the relative visual intactness of natural and cultural features within the study area.
    D. *Assessment of Existing DISTRICT Facilities* – This category assesses the extent to which existing flood control facilities and their related features incorporate the aesthetic treatment guidelines contained in the DISTRICT's *"Policy for Aesthetic Treatment and Landscaping of Flood Control Projects"*.

E. *Viewing Analysis* – This category offers a brief narrative describing the major views and focal points to be preserved, enhanced, and taken advantage of within and adjacent/outside the study area.
F. *Historic Character* – This category assesses the historic character of historic and prehistoric landscapes of the study area.
G. *Future Desired Landscape Character* – This category assesses the future desired landscape character by compiling developer, agency and municipal plans as well as through public sensing.
H. *Landscape Character Themes* – This category develops landscape character themes and aesthetic design guidelines that protect and enhance local community character and create aesthetic value.

3. The Multi-Use Opportunities Assessment identifies opportunities and limitations of integrating multiple-use functions into the study area. This section is broken out into five (5) categories to help identify the potential opportunities and limitations.

A. *Inventory of Existing and Future Planned Land Uses* – This category inventories existing and future planned land uses, including recreation sites, open spaces, natural areas, transportation systems and nodes, and residential, commercial, educational, and employment centers, within the project area as a part of the Data Collection Phase.
B. *Identification of Multi-Use Opportunities* – This category briefly describes and identifies the types of multi-uses that might be appropriately incorporated into the project.
C. *Assessment of Existing DISTRICT Facilities for Multi-Use Potential* – This category assesses the suitability of existing DISTRICT facilities for multi-uses.
D. *Identification of Possible Partners and Funding Sources* – This category briefly describes possible partners and funding sources for implementation of multi-use opportunities.
E. *Implementation Guidelines* – This category briefly describes design standards / implementation guidelines for integration of multi-use opportunities with flood control facilities.

LANDSCAPE AESTHETICS ASSESSMENT AND MULTI-USE OPPORTUNITIES ASSESSMENT

1.01 DATA COLLECTION AND EXISTING CONDITIONS ANALYSIS

1.01.1 Data Collection and Review

Various information was collected and reviewed during the preparation of the Landscape / Aesthetics Assessment and Multi-use Opportunities Assessment. Information collected and reviewed included an aerial photo of the study area, general plans from the various cities and towns in the study area identifying proposed land use, site visits to collect existing land uses, proposed development plans from the various developers in the study area, a report describing the El Rio project currently being proposed adjacent to the Gila River, mapping identifying existing District facilities, District standards for flood control facilities, and cultural and biological surveys for the study area.

1.01.2 Site Visits / Field Reconnaissance

Several site visits / field reconnaissance trips were made to the study area to collect data and verify information received as well as document existing site conditions. During these visits photos of the site were taken to document the study area. In addition, during these site visits the existing landscape character and existing land uses were developed. Existing District facilities were observed to determine their adherence to District policies and to determine their multi-use opportunities. Scenic quality of the study area was observed as well as the visual integrity of the study area. Opportunities to enhance or improve public viewing were also a component considered during these site visits.

1.02 VISUAL RESOURCES ASSESSMENT

1.02.1 Existing Landscape Character

Landscape Character as defined by Agriculture Handbook Number 701 *'Landscape Aesthetics – A Handbook for Scenery Management'* is defined as an overall visual and cultural impression of landscape attributes – the physical appearance and cultural context of a landscape that gives it an identity and 'sense of place'. Landscape character gives a geographic area its visual and cultural image, and consists of the combination of physical, biological and cultural attributes that make each landscape identifiable or unique. Landscape character embodies distinct landscape attributes, such as line, form, color, and texture, which exist throughout an area.

The Phoenix Metropolitan Area, which includes the Loop 303 Corridor / White Tanks ADMP Update study area, lies within Arizona's Basin and Range geologic province. The Basin and Range province is characterized by rocky mountain ranges that alternate with desert basins as the primary landform organization. The White Tank Mountains and the Estrella Mountains, visible to the west and south respectively, are large formations characteristic of the Basin and Range province and are major landforms within and adjacent to the project area.

The study area is typically flat, sloping to the south/southeast, except for the steep slopes of the White Tank Mountains located in the western/northwestern portions of the study area. Elevations within the study area range from approximately 2,288 feet above mean sea level within the White Tanks Mountains to approximately 1375 feet above mean sea level at the intersection of Grand Avenue and Loop 303 to approximately 950 feet above mean sea level at the Agua Fria River confluence with the Gila River. Minor elevation differences within the study area provide panoramic views of distant vistas, adjacent landforms, undeveloped desert areas and urban development.

Sonoran Desertscrub

Two vegetation communities, the Lower Colorado River and the Arizona Upland subdivisions of the Sonoran Desert Biome, are present within the study area. In addition, xeroriparian vegetation is present along washes and riparian vegetation can be found adjacent to the Gila and Agua Fria Rivers. Due to the development of agricultural fields and urban areas much of the native desert vegetation has been removed or altered. Refer to *Section 4.1.2 – Vegetation* of the Loop 303 Corridor / White Tanks Area Drainage Master Plan Update for in-depth descriptions, maps, and tables regarding the vegetation communities found in the project study area.

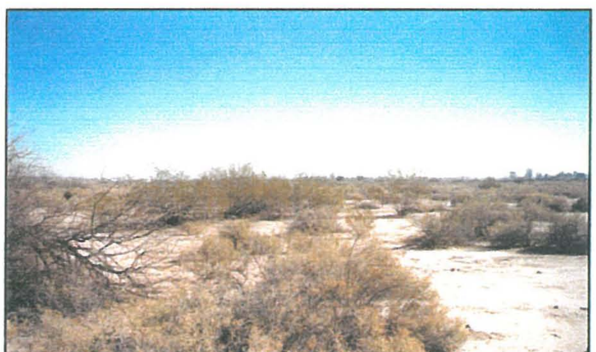
The Lower Colorado River subdivision of Sonoran Deserscrub is typically flat, with a one (1) to two (2) percent slope. Plant material found in this subdivision include Creosotebush (*Larrea tridentata*), Triangle-Leaf Bursage (*Ambrosia deltoidia*), Saltbush (*Atriplex spp.*), Jimmyweed (*Happlopappus heterophyllus*), Blue Paloverde (*Cercidium floridum*), Western Honey Mesquite (*Prosopis glandulosa*), Ironwood (*Olneya* *tesota*), Catclaw Acacia (*Acacia greggii*), Barrel cactus (*Ferocactus wislizenii*), Ocotillo (*Fouquieria splendens*), and Saguaro (*Carnegiea gigantea*). The dominant shrubs in this subdivision are the Creosotebush and Triangle-Leaf Bursage and the dominant tree is the Blue Paloverde. Trees in this area are typically found along the xeroriparian washes.

Higher densities of tree species and cacti characterize the Arizona Upland subdivision of Sonoran Desertscrub. This plant subdivision is typically found on steeper slopes and higher elevations of the White Tank Mountains. Plant material found within this subdivision include Saguaro (*Carnegiea gigantea*), Foothill Paloverde (Cercidium microphyllum), Blue Paloverde (*Cercidium floridum*), Ironwood (*Olneya tesota*), Western Honey Mesquite (*Prosopis glandulosa*), Catclaw Acacia (*Acacia greggii*), Triangle-Leaf Bursage (*Ambrosia deltoidia*), and several species of cholla and prickly pear cactus (Opuntia spp.). The dominant plant species for this subdivision are the Saguaro and Blue Paloverde.

Also present in the Arizona Upland subdivision of Sonoran Desertscrub are Xeroriparian habitats. These typically occur along ephemeral washes. They are long narrow corridors with plant material that is similar to those found in the Arizona Upland, but have higher densities of Ironwood (*Olneya tesota*), Western Honey Mesquite (*Prosopis glandulosa*), and Blue Paloverde (*Cercidium floridum*).

Segments of Riparian Deciduous Forest can be found adjacent to the Gila River and the lower end of the Agua Fria River. Tall, deciduous trees and understory shrubs characterize this habitat. Typical trees found in this habitat include Fremont Cottonwood (*Populus fremontii*) and Goodding Willow (*Salix gooddingii*). Understory shrubs found in this habitat include Desert Willow (*Chilopsis linearis*), Willows (*Salix spp.*), Desert Broom (*Baccharis sarothroides*), and non-indigenous Salt Cedar (*Tamarix spp.*).

To further describe the visual resources of the Loop 303 Corridor / White Tanks ADMP, the study area has been broken into broad-based landscape character units. Landscape character is the physical appearance of the landscape including the natural, physical, and architectural/cultural features that give it an identity and "sense of place." Landscape character units are based on the presence of vegetation, changes in land use, degree of spatial enclosure, and the presence of notable landform or architectural/cultural patterns in the landscape. The resulting units are areas of similar visual character. Each unit has been named and described in terms of its vegetative cover, landform, land use, and special features in the foreground, middle ground, or background. Figure 1 identifies the location of eleven units delineated within the study area.


Desertscrub

Desertscrub. The predominant characteristic of lands within this unit is one of relatively undisturbed native desert. This unit predominantly occurs in the western portion of the study unit adjacent to the White Tanks Mountains. Smaller areas of desertscrub occurs south and southeast of Luke Air Force Base and in a few locations in the northern reaches of the study area. The terrain is moderately rolling. The irregularity, texture, and color of native vegetation make it readily distinguishable from that of surrounding agricultural fields and urban development. Mature light green palo verde trees and dark green mesquite and creosote are prevalent and dominate the setting. Built elements are isolated visual features, including: transmission lines and canals and a few residences. However, these individual features do not affect the overall visual character created by the native desert. Distant views of the White Tank Mountains to the west form a distinct background for the project area.

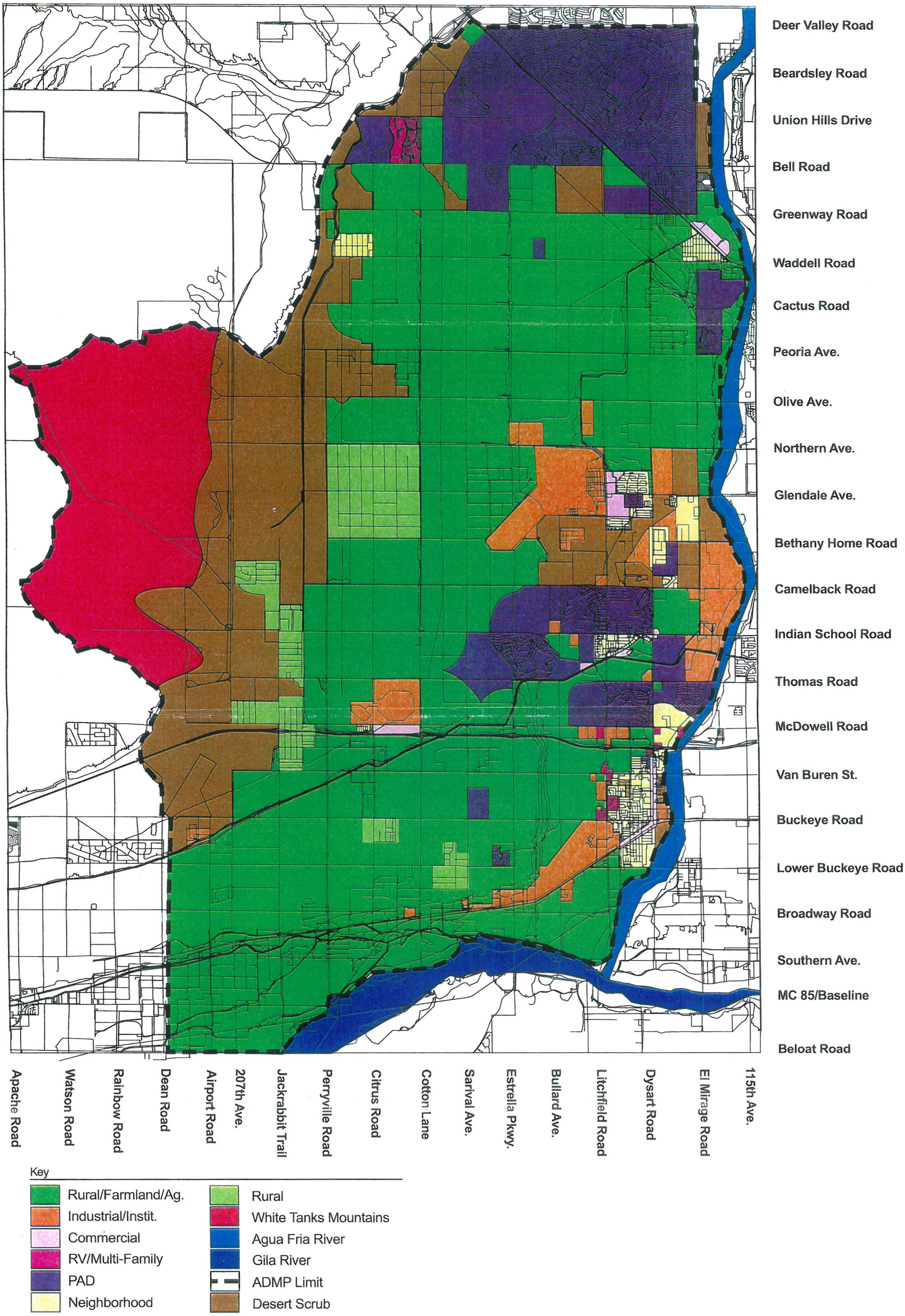


Figure 1. Existing Landscape Character

April 2000

Loop 303 ADMP Corridor/White Tanks ADMP Update

Logan Simpson Design Inc.

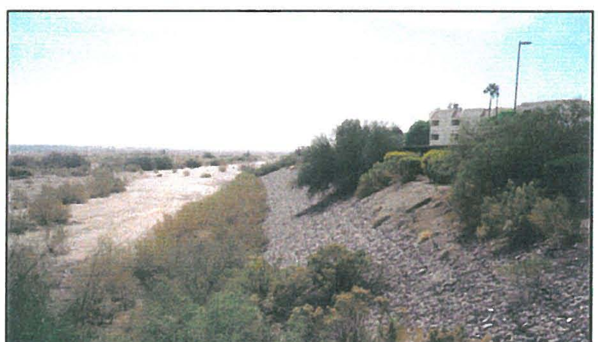
White Tanks Mountain

White Tanks. This unit is located in the western portion of the study area and is characterized by the bold, massive peaks and ridgelines of the White Tanks Mountains. This unit is visible from throughout the study area and creates a distinctive backdrop for views to the west and northwest. This unit contains the highest elevation (2,288 feet above mean sea level) in the study area. Vegetation found in the unit is typical of the Sonoran Desert. The predominant color of the unit is tan from the mountains with the vegetation ranging from gray to green. Structures and roadways are typically not found in the unit. However, some structures and roads can be found within the White Tanks Regional Park. These structures and roadways are not visible from the distance. Ground disturbance is visible in a portion of the unit. This area of disturbance is identified by the distinctive change in color from the surrounding area. This ground disturbance is the result of Caterpillar proving grounds.

Gila River

Gila River. This unit is located along the southern edge of the study area. The main characteristic of this unit is water. Both pools and streams of water can be found in this unit. Lush green vegetation of varying heights is evident along the banks of the river creating strong vertical and horizontal lines. The tall Cottonwoods and Willows can be seen from a distance.

Agua Fria River. This unit is located along the eastern edge of the study area. A typical characteristic of this unit is the uniform edge and bottom of the channelized river. The sides of the river have a consistent, hardened slope and create strong linear lines up and down the channel. Various portions of the river, primarily in the southern reaches, have been disturbed by sand and gravel operations. Vegetation within this unit contains primarily shrubs and grasses. Gray from the river rock is the predominant color of this unit. Pockets of lush green wetland habitat are visible within the unit, but are not a dominant feature.



Agua Fria River

Two views of a P.A.D. One from within (top) and one from outside (bottom)

P.A.D. The P.A.D. (planned area development) unit typically has a uniform residential character. Concrete block walls enclose the residential developments. These block walls create a strong linear form within the suburban surroundings. The P.A.D. unit has similar architectural elements, narrow lots, mixed ornamental and desert landscaping, masonry block walls, lakes or water bodies, and street lights typical of a modern suburban neighborhood setting. These modern, residential developments have similar materials and colors, typical of the stucco and tiled-roof, suburban architectural genre. Residences within the unit include one and two-story homes. The second floor of these homes provides views to the surroundings. The building and wall structures dominate the setting. Vegetation is predominately ornamental and turf is used frequently to create open space and connect the various built facilities within the subdivision. The vegetation is also consistently manicured to create a sense of organization and formality.

Neighborhood. Moderate to large open lots, scattered single-story, ranch style residences having a variety of materials and colors and a mixture of mature ornamental and desert vegetation are typical in this unit. There are a few overhead utilities on single wood poles, but in general, the appearance and character of this unit is one of mature, well-established neighborhoods. Seldom are vertical block walls used to delineate property boundaries, instead vegetation, wood, or chain-link fencing are used. Ornamental tree species within the yards include eucalyptus, evergreen elm, and pine. Orchard trees are also evident at some locations. The vegetation and building structures are prominent in the setting.

Typical Neighborhood Setting

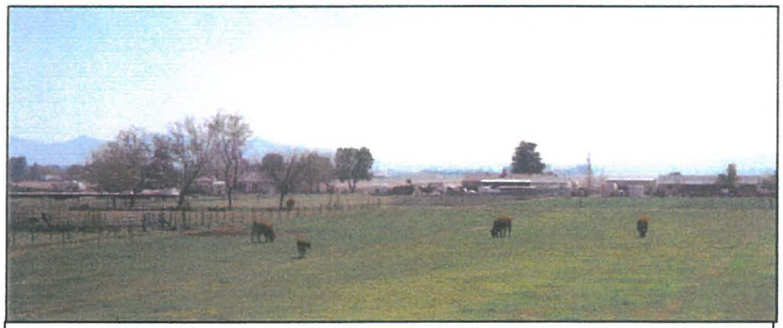
Typical View of RV Development

RV/Multi-Family. The character of this unit is a mixture of high-density, pre-manufactured dwelling units common in suburban areas of the Phoenix Metropolitan Area. Overhead utilities, street signage and lighting are built features that dominate and are readily visible in the landscape. The closeness of the existing structures creates a sense of high visual enclosure. Vegetation is very limited and subordinate to the built features. The architectural styles of the multi-family residences vary substantially, and there is a general lack of cohesive of shape or textures. In the RV units, the building scale, form, color and style are relatively uniform.

Typical View of Agricultural Area

Agricultural. Agriculture characterizes this unit. This unit is depicted by flat terrain with expansive views in all directions with agricultural patterns and colors dominating the landscape. Agricultural features found within this unit include: planted and unplanted fields, dairies, fencing, linear windrow tree plantings, and irrigation ditches. The various canals and tailwater/irrigation ditches are built features adding to the unit's rural character.

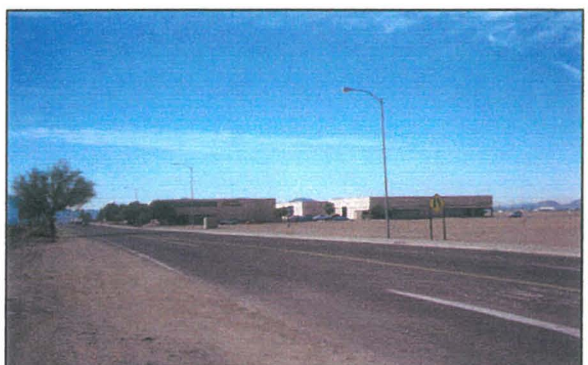
Rural. Low-density single-family residences create a rural setting which characterizes the unit. This unit is depicted by flat terrain with expansive views in all directions. Residences are scattered throughout the unit though some areas are developed more densely than others. The residences are predominantly located on the west side of the unit. Open perimeter fencing typically surrounds lots. Seldom are vertical block walls used to delineate property boundaries, instead vegetation, wood, or chain-link are used. Pastures and corrals are also typical. The residential structures are conventionally constructed, single-story type residences of varying materials and colors such as wood, brick, and block.



Typical Rural Setting

Windbreak

Industrial/Institutional. Industrial and institutional uses and activities characterize this unit. Large buildings, tall block walls, security fences, and towers are the prominent visual elements within the unit. These structures create strong vertical and horizontal elements and contrast in color and material with their surroundings. The terrain is relatively flat and vegetation is scarce. The vertical scale and color of some of the facilities, such as water towers, airport control towers, aircraft hangers, and transmission lines combine to create distinct features in the landscape.



Typical Industrial Development


Typical Commercial Development

Commercial. The character of this unit is a mixture of development including office, retail, service-oriented, and restaurant uses common to suburban development along major arterial roadways. Billboards, building signs, overhead utilities, and street signage and lighting are built features that dominate and are readily visible in the landscape. Commercial areas most frequently occur along the major transportation corridors and at major intersections and are predominantly located along the east side of the project area. The existing structures create high visual enclosure because of the presence of two-story buildings, signs, and other built features. Vegetation is limited and subordinate to the built features. Architectural styles vary and there is a general lack of cohesive materials, textures, or colors. The terrain is relatively flat.

1.02.2 Scenic Quality

Areas of high scenic quality that occur in, or immediately adjacent to, the study area include the White Tanks and Estrella Mountains, riparian habitat located along the Gila River and isolated locations along the Agua Fria River, the various citrus orchards and vineyards in the north portion of the study area, portions of the native desert, and the agricultural fields and windrow tree plantings. All are significant pieces to the landscape in providing high scenic quality to the study area. There are several structures throughout the study area related to agriculture, airports, and utilities but are not considered elements that contribute in providing high scenic quality.

Areas of low scenic quality that occur in, or immediately adjacent to, the study area include the various canals that cross the study area, the Arizona Department of Transportation detention basins located on the north side of I-10, the sand and gravel operations located in the Agua Fria River, the White Tanks #3 and #4 structures, Morton Salt mining facility, an aluminum manufacturing facility, towers and structures at Luke Air Force Base, and the major utility corridors that cross the south portion of the study area. All are significant elements in the landscape that degrade the scenic quality of the study area. However, these areas provide opportunities, through the implementation of various treatments, to improve their scenic quality.

1.02.3 Existing Visual Conditions / Visual Integrity

The existing visual resources of the study area are described below based on readily accessible viewpoints along existing roadways and accessible locations within the study area. The visual conditions analysis included an identification of distinct features, a demarcation high/low visual diversity, a delineation of the relative visual intactness of natural or cultural resources within the study area, and an identification of major viewpoints. Distinct features are those features comprised of contrasting landscape natural or built elements that, when combined, make a memorable visual impression or striking visual pattern. Diversity is considered to be a qualitative measure of the scenic value of a landscape; landscapes with the greatest variety (or diversity) have the greatest correlation with high scenic value. For the Loop 303 Corridor / White Tanks ADMP Update visual study it is assumed that landscapes of low diversity represent opportunities for enhancement when implementing the proposed action. Conversely, highly diverse landscapes should be preserved where possible to retain their valuable qualities. Visual intactness relates to the cohesion of visual order in the natural and human built landscape and the extent to which the landscape is free from visual encroachment by conflicting uses or activities.


Positive Distinct Feature (Cotton Gin)

Figure 2 graphically represents the existing visual conditions within the Loop 303 Corridor / White Tanks ADMP. There are numerous natural and built distinct features that contribute to the visual conditions of the study area. Distinct features are features that stand out in the landscape. These distinct built features have been categorized as features within the landscape that might be enhanced, based upon their visual appearance.

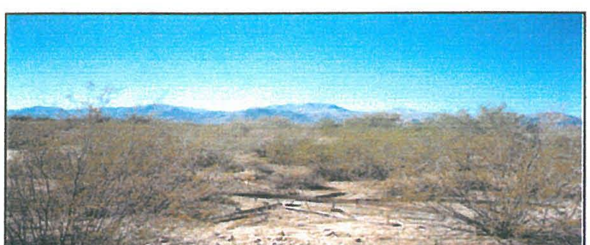
Distinct built features include the orchards and vineyards, dairy/farm lands, eucalyptus windbreaks, palm nurseries, and cotton gins. Estrella Mountain Community College, Sundome, World Wildlife Zoo, and Duncan Family Farm are cultural/educational centers within the study area and are seen as positive distinct built features. These facilities are unique due to several factors. Examples of these factors include architecture, landscape, location, type of service offered, and product provided.


Negative Distinct Feature (Aluminum Recycling Plant)

Distinct built features that could be enhanced include the Perryville Prison, Morton Salt mining operation, aluminum manufacturing facility, Rubbermaid plant, Luke Air Force Base, Goodyear Airport, trotting track, McMicken Dam, White Tanks #3 and #4 structures, various irrigation canals, and miscellaneous drainage conveyance structures. Other distinct built features that could be enhanced include major overhead transmission lines and towers, sand and gravel extraction sites, the urban arterial street network, existing and proposed transportation corridors/facilities such as the Loop 303, Grand Avenue (US 60), AT & SF Railroad.

Areas of low visual diversity are landscapes highly uniform in character. Within the study area, the expansive agricultural areas constitute low diversity landscapes because of their uniform character.

High diversity landscapes are those that contain a diverse array of natural species and landforms or a combination of built features that indicate a high level of biological or cultural value. Examples of high diversity landscapes in, or adjacent to, the study area include the riparian vegetation of the Gila River, the small, isolated wetlands along the Agua Fria River, the natural washes coming out of the White Tanks Mountains, and the mountain landforms of the White Tanks Mountains and Estrella Mountains.


Desertscrub

There are three major intact landscape areas within the study limits, desertscrub, P.A.D., and agriculture. The desertscrub environment located in the White Tanks Mountains and small pockets around Luke Air Force Base and in the northern portions of the study area represent a unique resource within the study area; they could be lost in the future to the advancing suburban development. The agriculture environment, located

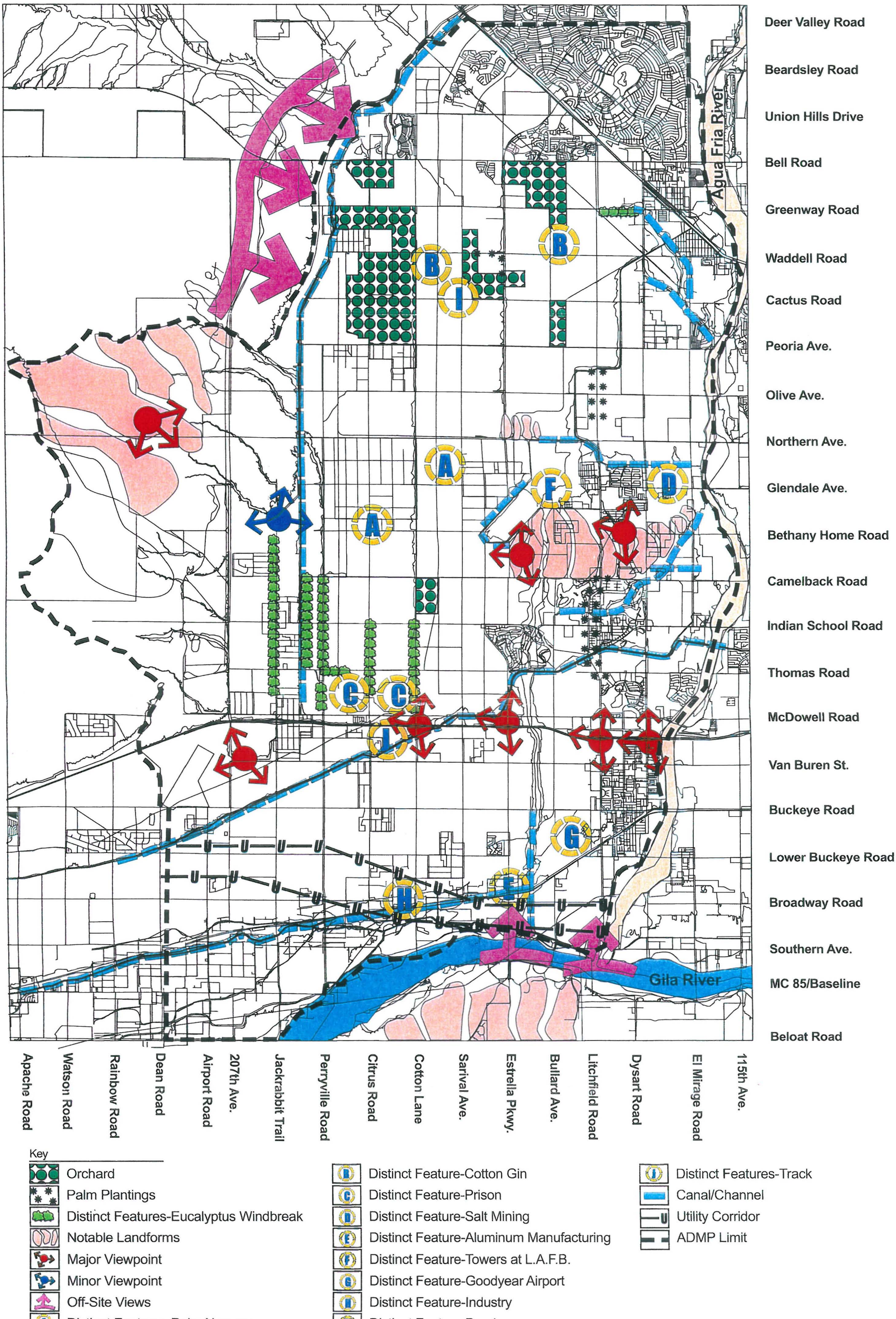


Figure 2. Visual Analysis

April 2000

throughout a majority of the study area, represent an era that settled the area. This rich environment will also be lost in the future to the advancing suburban development. The P.A.D. with its uniform architectural character, which is located primarily in the middle portion of the study area, will become the major landscape over time. A majority of the study area is currently planned to be developed as P.A.D's.

1.02.4 Assessment of Existing DISTRICT Facilities

The District's *Policy for the Aesthetic Treatment and Landscaping of Flood Control Projects* provides general guidance for incorporating aesthetic features as an integral part of the planning, design and construction of flood control projects. This document also promotes consideration of aesthetics in the design of new structures, alterations to existing structures and other projects developed by the District. According to the Policy, aesthetic features of flood control projects shall be designed in consideration of the following: the structural integrity and function of the facility are not compromised; the safety of the site and the public is not diminished, maintenance requirements for the facility are not hindered or significantly increased; there is no significant cost increase for real estate; costs to the District are within acceptable budgetary constraints; the aesthetic treatment is compatible with the prevailing features in the surrounding area; and the aesthetic features will not increase the District's liability regarding personal safety and/or property. Multi-purpose uses are also encouraged to the extent that they do not interfere with the operations of the facility. The Policy also requires that an Aesthetics Advisory Committee be formed for each project.

The existing drainage facilities in the study area include dams, channels/washes, and an overchute and siphon. These facilities are located throughout the project area. DISTRICT facilities located in the area include Dysart Drain, Colter Channel, Bullard Wash Outfall Channel, Roosevelt Irrigation District Overchute, White Thanks #3 and #4 structures, and White Tanks #4 Inlet Channel Improvement.

The existing facilities appear to not have included provisions for landscape aesthetics or multi-use opportunities. In general, the facilities need to incorporate some type of landscape plantings consistent with the District's policy. In addition, all facilities should incorporate some type of multi-use activity if appropriate for the facility.

<u>Dysart Drain</u> is a large concrete lined channel void of vegetation and provides no access to the public. Approximately thirty percent of this channel is located within Luke Air Force Base and thus restricts opportunities for public usages. The remaining portions of Dysart Drain are fenced and gated off to the public. The entire channel is located within a narrow right-of-way. Significant changes would need to occur to retrofit this channel to comply with District policies and to provide opportunities to the public. First would be the incorporation of appropriate plant material. Currently the channel is void of vegetation due to its proximity to the existing runways and lack of space. Additional right-of-way needs to be acquired along the length of the channel so that vegetation can be incorporated. Second would be the location of the channel. Major portions of the channel would need to be relocated outside of Luke Air Force Base property. This would provide for the possibility of pedestrian access and multi-use opportunities. Currently there is no public access to the channel adjacent to Luke Air Force Base due to security and safety issues. Third would be provisions to allow access to the top of the channel for the general public by means of entry points and a multi-use path.

It could be argued that since portions of this facility are within industrial areas, it complies with the DISTRICT's requirement that it be "Compatible with the prevailing features in the surrounding area." Further improvements to this facility to accommodate vegetation, pedestrian access and multi-use opportunities would be significantly expensive, require right-of-way for relocation and increase maintenance costs.

<u>Colter Channel</u> is located approximately ¼ mile north of Camelback Road. It extends from just east of Litchfield Road eastward to the Agua Fria River. This facility is an earthen lined channel with a concrete low flow channel. Various shrubs are scattered throughout the channel that have naturally grown in the area. The facility is fenced off and allows no public access. Minor changes to the channel would need to be incorporated to comply with District policies and to provide opportunities to the public. First would be the incorporation of appropriate plant material throughout the channel. This would soften the channel and make it more aesthetically pleasing to the passing public. Second would be access points for the public and the incorporation of a multi-use trail that meanders through the channel. A multi-use trail would provide a west-east link in the study area.

Bullard Wash

<u>Bullard Wash Channel</u> extends form the Gila River north to a point between Lower Buckeye Road and Buckeye Road. This facility was recently completed but appears to provide no provisions for landscape aesthetics. Provisions for a future trail/path were built into the drop structures. The channel is comprised of an earthen lined bottom with a concrete lined low flow channel and river rock filled gabions along the sides. The channel is fenced and gated to limit public access. Minor changes to the channel would need to be incorporated to comply with District policies and to provide opportunities to the public. First would be the incorporation of landscape material. It appears that sufficient area is available to incorporate trees and shrubs within the existing right-of-way without affecting maintenance activities. This landscape material would help soften the strong edges created by the rock filled gabions. Second would be provisions for public access and the incorporation of a meandering multi-use trail along the top of the channel, channel banks, and channel bottom. Again, it appears that there is sufficient right-of-way for incorporation of a multi-trail. This would provide and opportunity for access to the Gila River.

<u>White Tanks #3</u> structure is a large earthen structure that provides retention on the northwest side. There is no formal landscape associated with the structure but over time the native vegetation has established itself throughout. The current facility provides no multi-use opportunities to the public. Because the area is so large there are many opportunities available for landscape aesthetics and multi-use. Access to the site needs to be provided for the public. With access to the area this facility could offer many different types of multi-use. Multi-use opportunities range from creation and enhancement of wildlife habitat and multi-use trails to BMX courses and ballfields.

White Tanks #4 Structure

<u>White Tanks #4</u> structure is a large structure with a retention area located on the north side. There is no formal landscape associated with the structure and the surrounding area has somewhat reestablished itself over time. The entire area is gated off to the public thus providing no muti-use opportunities. Minor changes to the facility would need to be incorporated to comply with District policies and to provide opportunities to the

public. First would be the incorporation of additional landscape material. This would help to visually soften the facility. Second would be to provide access points to the public. With access to the area this facility could offer many different types of multi-use. Multi-use possibilities include wildlife habitat, ballfields, open space, BMX course, etc. Because the area is so large there are many opportunities available for landscape aesthetics and multi-use.

1.02.5 Viewing Analysis

There are various ways to enhance viewing opportunities. Viewing opportunities can be enhanced through the design, orientation, and location of a facility. If a channel was to be constructed as a needed facility and a major focal point is located to the northeast, it may be possible through the orientation and location of the channel to capitalize on this view. It may be possible to locate and orientate the channel at an angle that would optimize views to the major focal point. The landscape features of the channel could then be used to direct and frame views of the major focal point. If the channel could not be located and orientated at an angle to maximize views to the major focal point, it may be possible to create view corridors to the major focal point utilizing earth mounding and landscape material. Because of the relatively flat nature of the study area, the use of earth mounding could also be utilized to elevate viewing points along a facility. This would enable users to potentially rise above the surrounding area and structures to see the distant features/focal points.

Major Focal Point - Palm Farm

Major focal points within the study area that should be preserved include the Estrella and White Tanks Mountains, orchards and vineyards, dairy/farm lands, eucalyptus windbreaks, palm nurseries, cotton gins, golf courses, various schools, libraries, Estrella Mountain Community College, Sundome, World Wildlife Zoo, and Duncan Family Farm. New facilities that are constructed and existing facilities that are rehabbed should take advantage of these focal points. Views should be captured or linkages should be established to these major focal points.

Due to the relatively flat nature of the study area there are few major viewing points within the study area. Major viewing points in the study area occur from the overpasses along I-10, the White Tanks Mountains, White Tanks #3 and #4 structure, and locations just south of and east of Luke Air Force Base.

Views from the overpasses along I-10 include the White Tanks and Estrella Mountains, the various agricultural fields, and the urban development. Views from the White Tanks Mountains include the native desert, agricultural fields, various landforms to the east, White Tanks Mountains to the north, and the Estrella Mountains to the south. The White Tanks #4 structure offers views to the White Tanks and Estrella Mountains, I-10, desertscrub areas, and agricultural fields. Locations south and east of Luke Air Force Base offer views of the aircraft arriving and departing from the air base, agricultural fields, and urban development.

The views from I-10, because of the type of facility, looking out to the Estrella Mountains and White Tanks Mountains will be preserved. The only view that may disappear from I-10 will be that of the agricultural fields. Views of the agricultural fields will be replaced with new urban development.

Views from the White Tanks Mountain Regional Park should be preserved. Views from the park are that of the study area as well as distant views of the Phoenix metropolitan area. Views from the planned developed areas of the White Tanks Mountains, south of the park, should also be preserved. This could be accomplished through the location of houses and creation of viewing corridors. However, views of the White Tanks Mountains from within the study area will be altered by this proposed development. Housing developments are proposed to be built around the base and up the slopes of the White Tanks Mountains. This will degrade the views of the White Tanks Mountains from the study area.

View off of White Tanks #4 Structure

Views from White Tanks #4 structure include the native desert, agricultural fields, I-10, and the Estrella and White Tanks Mountains. The views to the Estrella and White Tanks Mountains should be preserved. However, these views will be altered depending upon the development that will occur in the area. As in other cases throughout the study area, the surrounding land around White Tanks #4 is identified as future urban development. The elevation of White Tanks #4 will allow for views over traditional housing developments with only the foreground view being altered.

1.02.6 Historic Character

Two vegetation communities, the Lower Colorado River and the Arizona Upland subdivisions of the Sonoran Desert Biome, dominate native vegetation within the study area. Within these two areas, small pockets of riparian and xeoriparian areas occur. These two basic communities as well as the riparian and xeoriparian areas are typical of what the area would have been like prior to being altered by human activities.

The visual character of the area for the early Hohokam settlements would have been that of an undisturbed desert. The Hohokam would have cleared small areas of the desert for construction of their villages, canals, and crop fields. The scale of these disturbances would have been minimal based upon the overall population of the area.

Over time the visual character of the area would have remained very similar to that which the Hohokam settlements would have experienced. However, in the early 1900's the visual character of the area began to change dramatically. Large tracts of land were cleared for agriculture, specifically the production of cotton. Soon, with the development of the railroad facilities, other large tracts of land were cleared for agriculture, towns (Goodyear, Surprise, etc.), and airfields (Luke and Goodyear). Today, most of the native desert has been removed with only small pockets remaining. Agriculture and urban development have replaced the native desert.

Refer to *Section 4.2 Cultural Resource Assessment and Historic/Prehistoric Themes* in the Loop 303 Corridor / White Tanks Area Drainage Master Plan Update Draft Data Collection Report for further information regarding the cultural resources and history of the project area.

1.02.7 Future Desired Landscape Character

Figure 3 graphically represents the future desired landscape character within the Loop 303 Corridor / White Tanks ADMP. Information collected from developers and the Town and City general plans

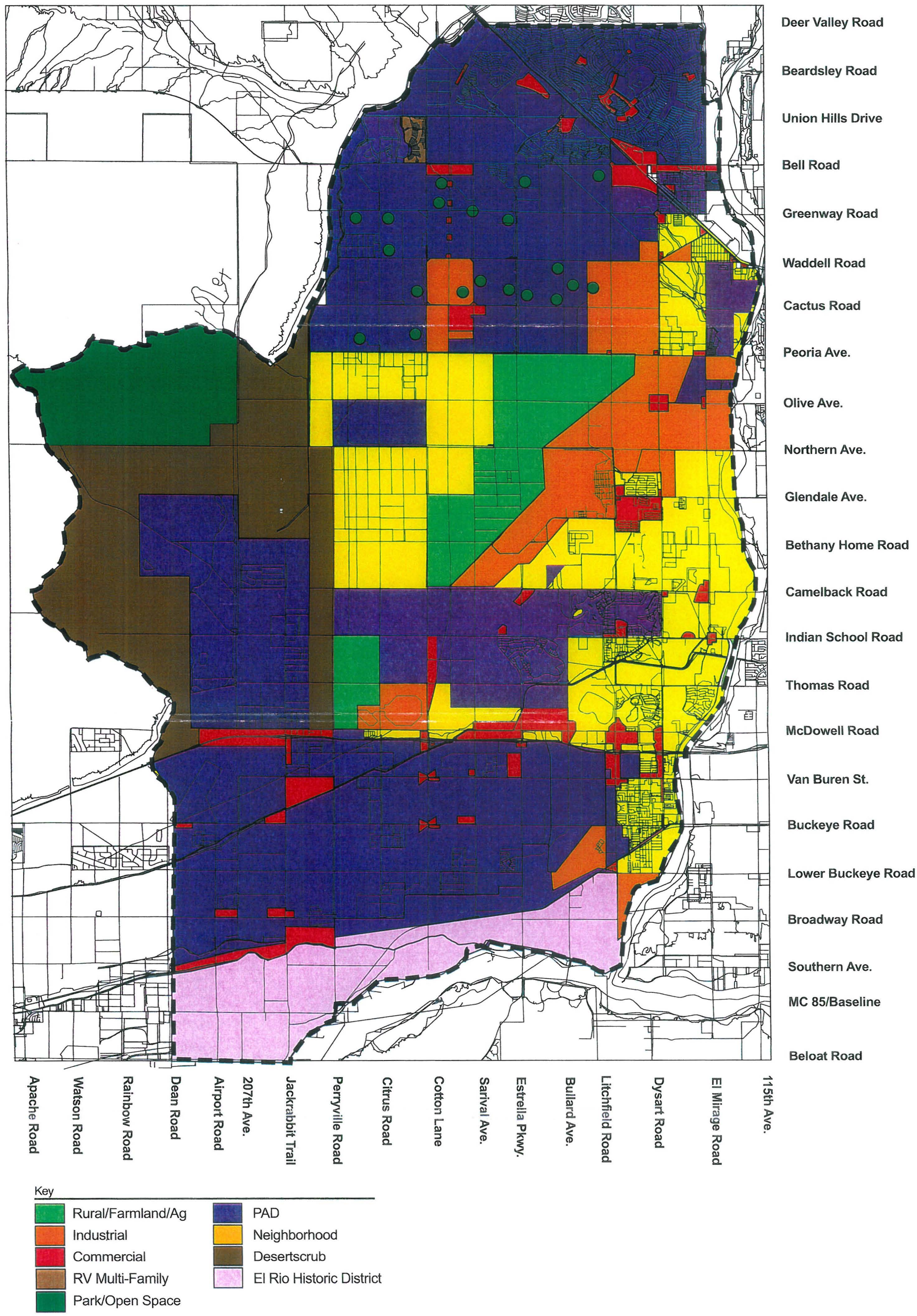


Figure 3. Future Desired Landscape Character

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indicate a future desired landscape character that leans toward a more urban character as opposed to the current agricultural / suburban character.

The FCDMC has begun an initial study to restore the land adjacent to the Gila River. Current General Plans indicate that this area will be developed as urban residential. However, a future plan has been developed for this area by multiple agencies and is known as the El Rio Vision. The objectives outlined by the agencies for the development of the Gila River and associated area lean towards a more natural character. The objectives include to restore and maintain the natural functions within the river corridor as a riparian habitat; focus on multi-use facilities and functions; maintain or enhance flood control elements or mitigãte; focus on public/private partnerships; and link functional compatibility outside the riparian habitat limits.

Two public meetings were held to present flood control alternatives and proposed aesthetic treatments. Few comments were received from the public due to the low turnout at the meetings. However, of the comments received a majority were for softer more natural looking facilities/structures.

1.02.8 Landscape Character Themes

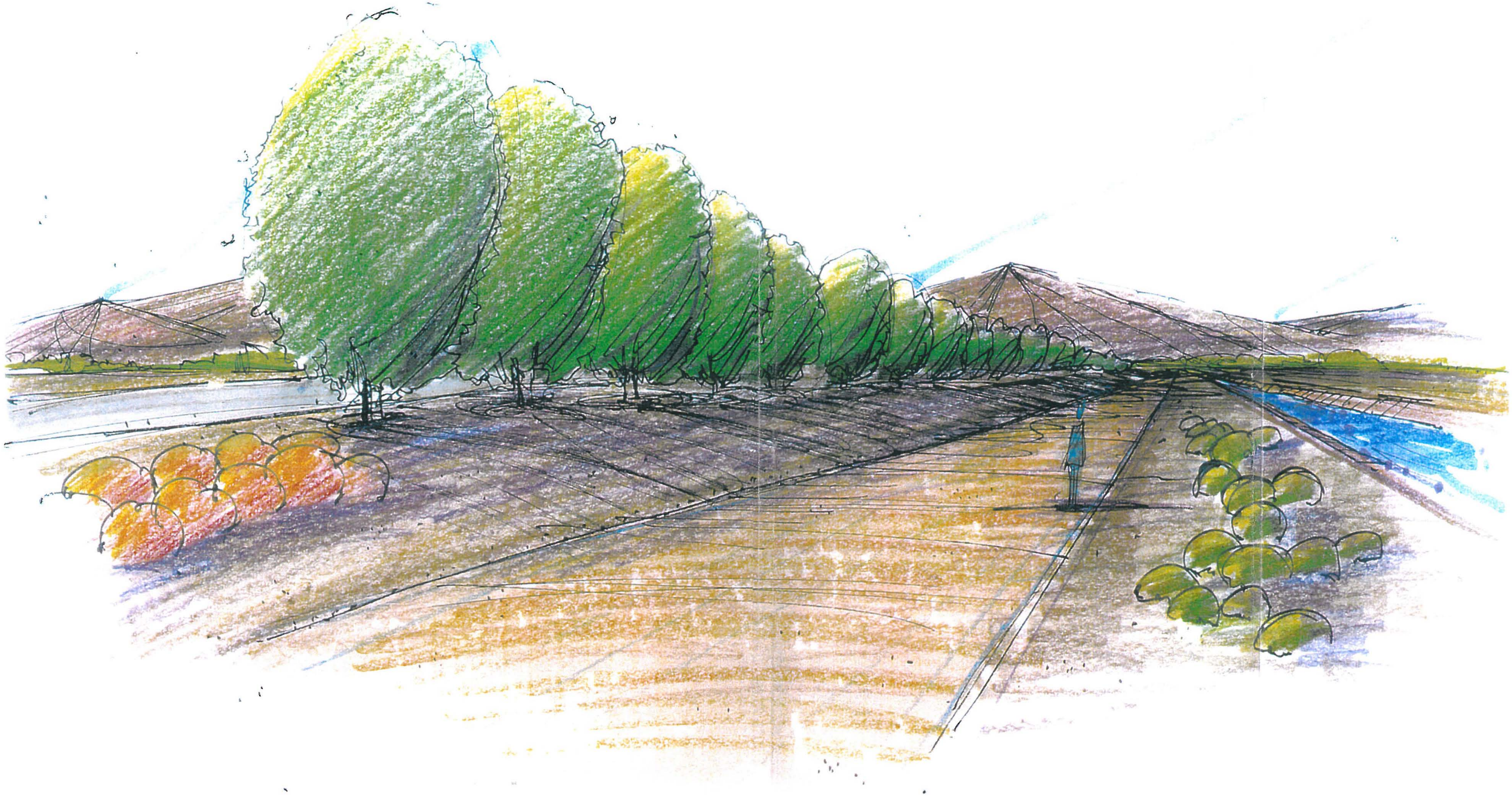
Various landscape character themes were developed based upon the existing and proposed landscape character of the study area. Following are descriptions of the various landscape character themes.

Agricultural Theme: The landscape character theme associated with agriculture reinforces the pastoral landscape through: (1) planting of large shade tree species with few shrubs and no turf; (2) creating linear windbreaks with tall trees (3) creating small groves of trees representing the surrounding orchards; (4) maintaining open views to the surrounding area; (5) utilizing native material for pathways and trails such as stabilized decomposed granite; (6) incorporating where appropriate, enhanced wildlife habitats and small ponds of water; and (7) creating a regular pattern of elements interwoven with occasional sinuous features such as pathways.

Industrial Theme: The landscape character theme associated with the industrial area would visually mitigate the horizontal and vertical scale of the adjacent industrial or institutional land uses through: (1) planting of specimen and exotic/native trees, and shrubs, but no turf; (2) utilizing large, bold masses of plant material; (3) mimicking distinct features on a smaller scale and incorporating them into structures and hardscape elements; (4) interpreting industrial/institutional land uses in materials and colors; and (5) creating simple, yet bold pattern of elements.

Urban Theme: The landscape character theme associated with the Urban area would integrate the proposed facilities as an extension of the subdivision's streetscape character through: (1) planting specimen exotic and native tress, installation of shrubs, and the introduction of turf at various locations; (2) repeating the adjacent hardscape elements utilizing small walls and concrete pathways; (3) incorporating stucco and tile materials and colors associated with adjacent development; (4) integrating the existing concrete block walls as art elements to add interest and identity to individual subdivisions, and (5) creating a well organized, repetitive pattern of elements.

Neighborhood Theme: The landscape character theme associated with the neighborhood area would be for the proposed facilities to be a continuation of the residential "yard" through: (1) planting of large shade tree species with shrubs used as accent plantings; (2) selective use of turf in special use areas; (3) utilizing a variety of materials such as brick, wood, and masonry in hardscape elements; (4) incorporating



Graphic 1. Agricultural Theme

May 2000

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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

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Graphic 2. Industrial Theme

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Graphic 3. Urban Theme

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Graphic 4. Neighborhood Theme

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Flood Control District of Maricopa County

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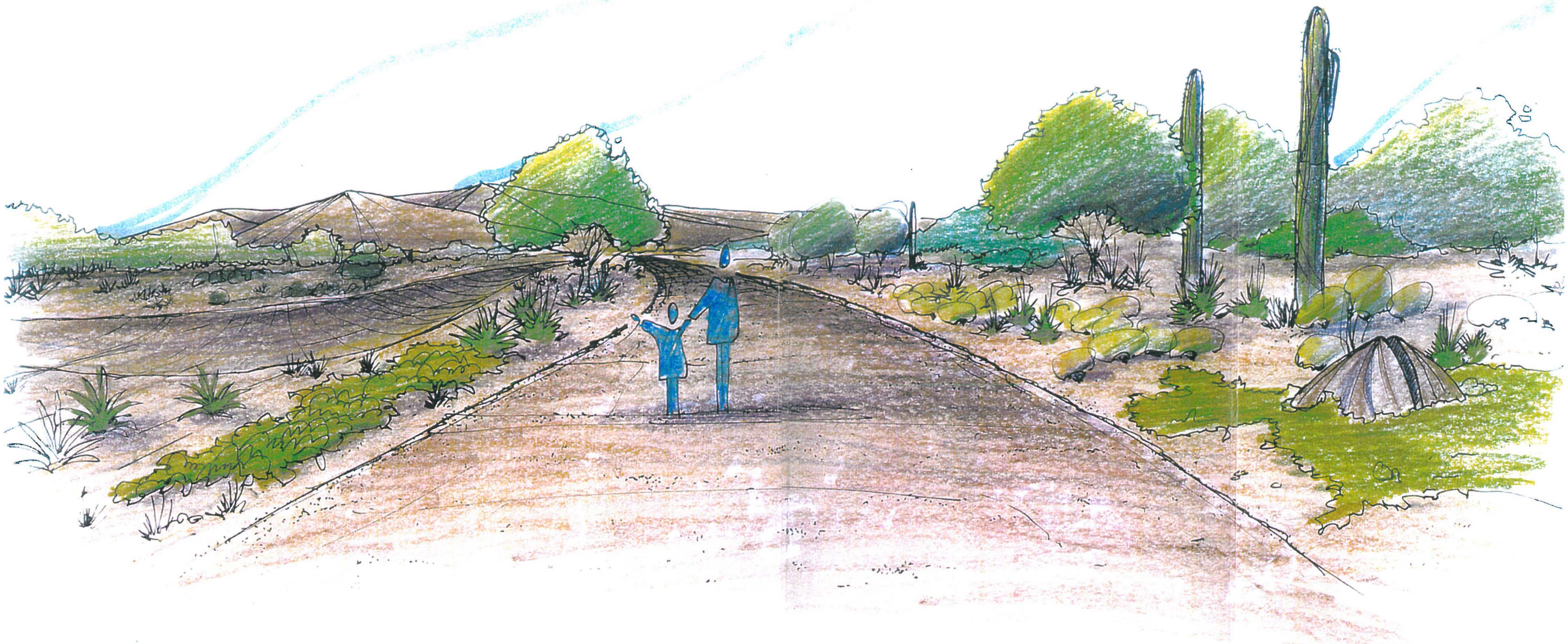

Graphic 5. Sonoran Desert Theme

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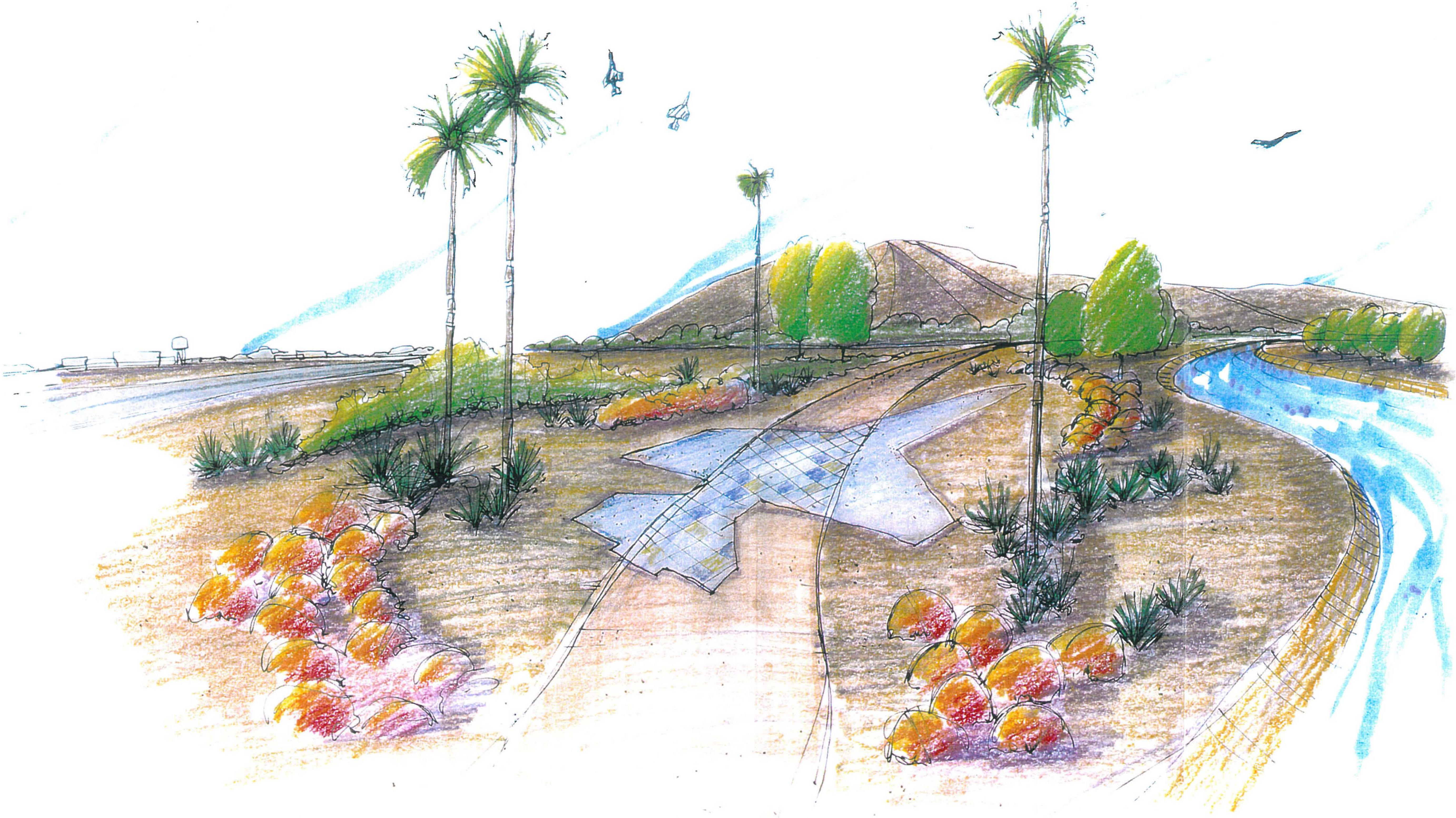

Graphic 6. Aircraft Theme

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Graphic 7. Railway Theme

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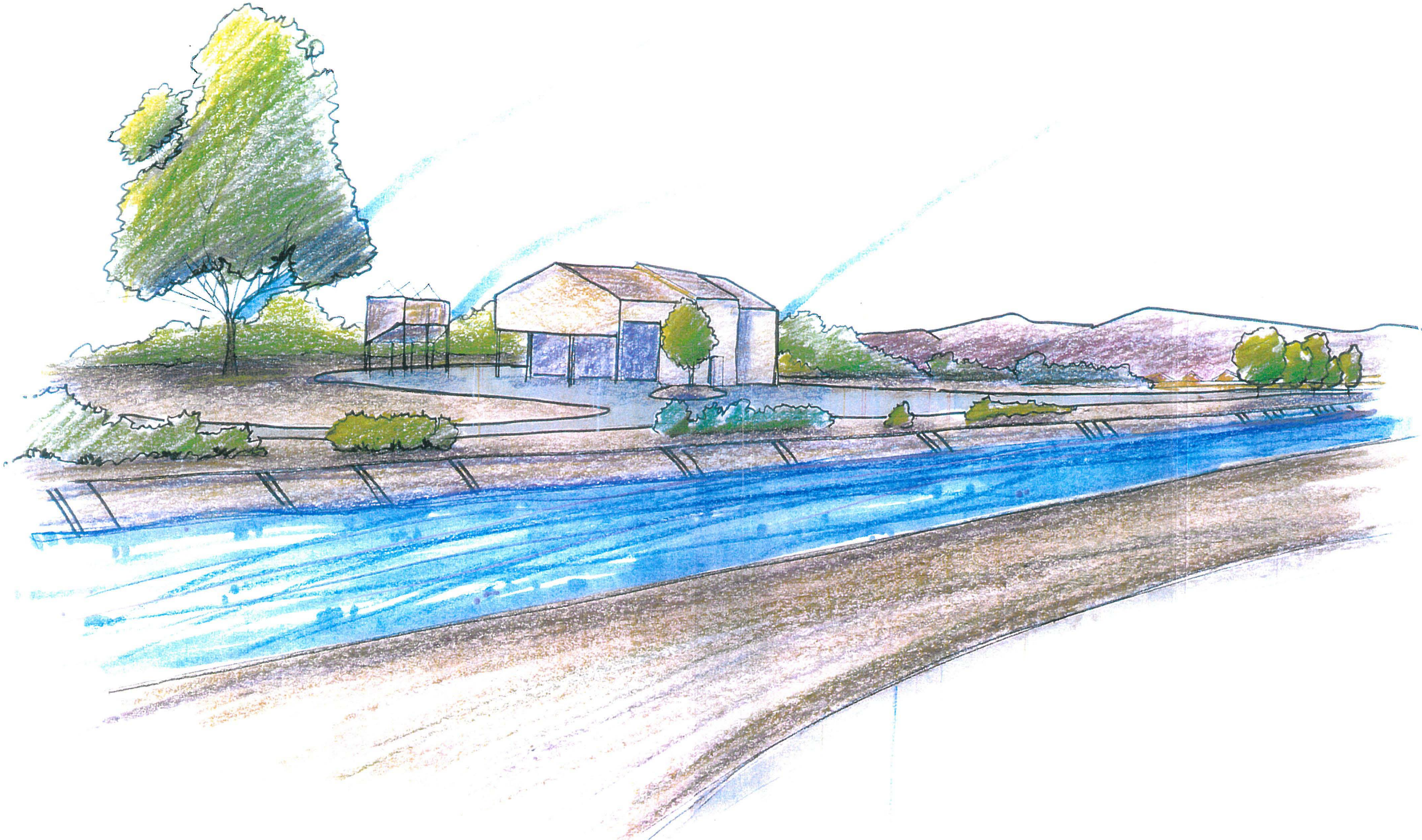

Graphic 8. Historic Theme

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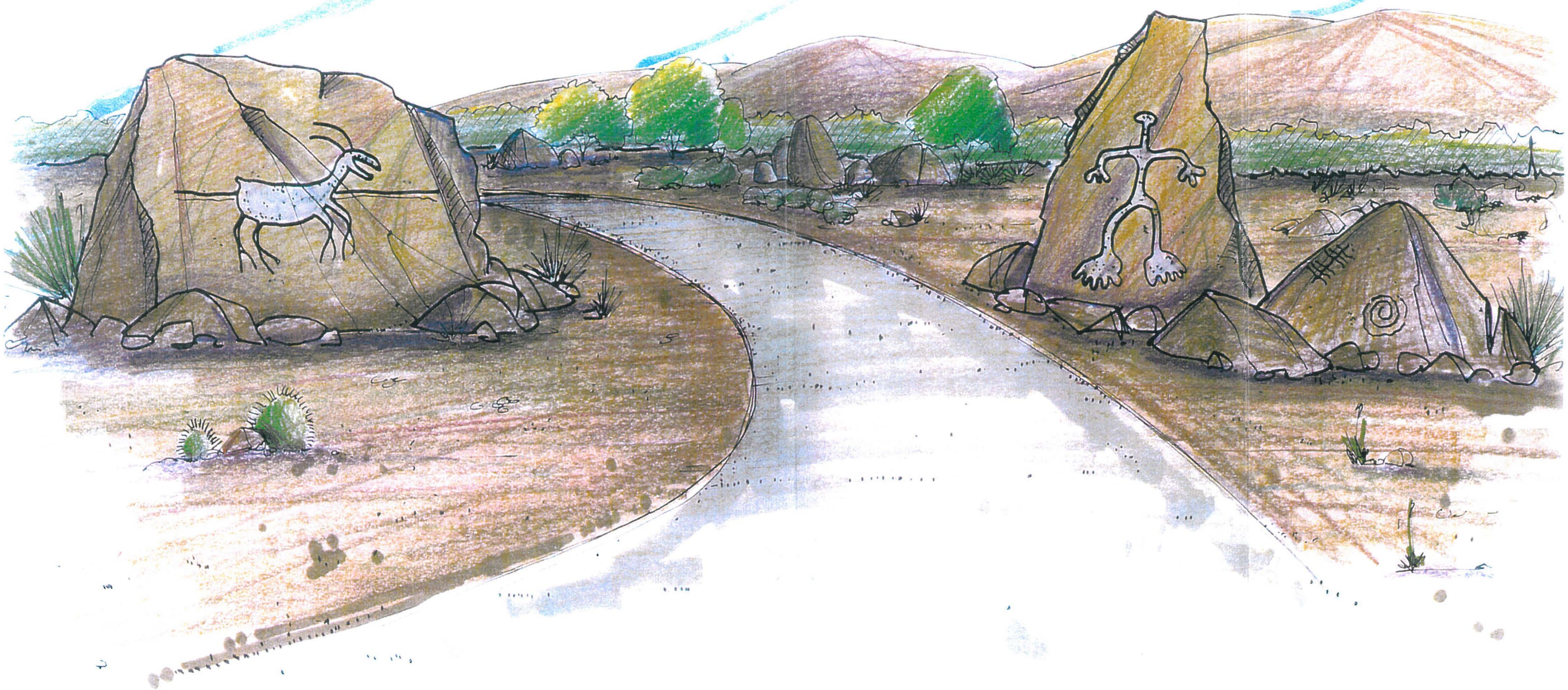

Graphic 9. Cultural Theme

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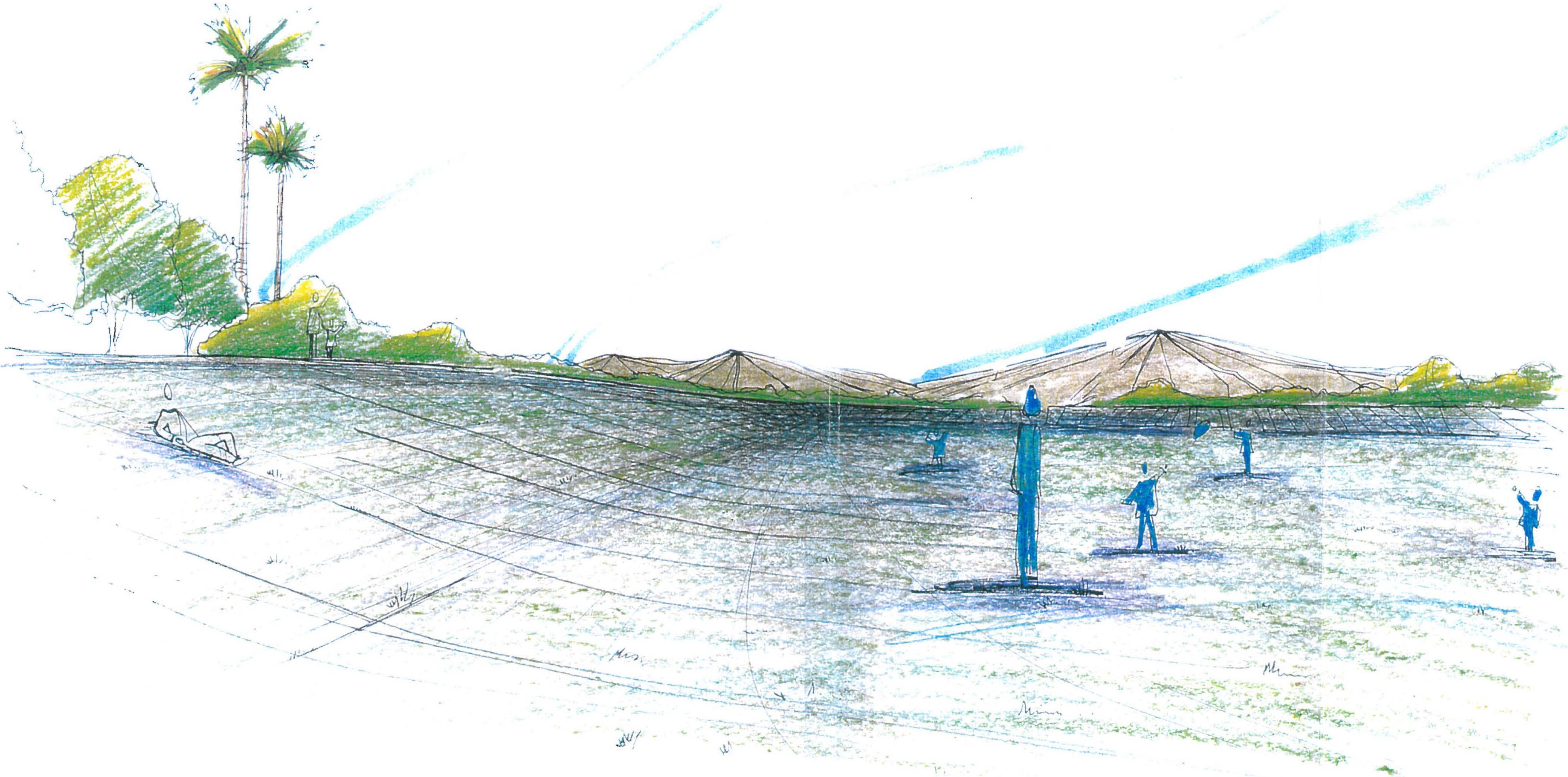

Graphic 10. Recreational Theme

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native materials for pathways and trails such as stabilized decomposed granite, and (5) creating an informal pattern of elements.

Sonoran Desert Theme: The landscape character theme associated with the Sonoran Desert area would reinforce the native Sonoran Desertscrub Biotic Community through: (1) planting of native trees, shrubs, and grasses, but no turf; (2) maintaining open views to the surrounding area; (3) utilizing native material for pathways and trails such as stabilized decomposed granite; and (4) creating an irregular more organic pattern of elements.

Aircraft Theme: This theme would reinforce the various aircraft facilities in the area through: (1) incorporating flood control facilities with existing airports and flight paths; and (2) incorporating elements of the various airports and airfields (old propellers, hanger facilities, jet engines, metal and fabric, etc.) throughout the study area.

Railway Theme: This theme would reinforce the various railway corridors in the area through: (1) incorporating flood control facilities with existing railway corridors; and (2) incorporating elements (railroad ties, steel rails, etc.) of the potentially abandoned railway corridors.

Historic/Heritage Theme: This theme would reinforce the various historic/heritage elements/sites found in the study area through: (1) incorporation of historic elements (structures, cotton, etc.) discovered through research of the site; and (2) incorporation of interpretive sites regarding the history of water, cotton, aircraft, and Goodyear Tire and Rubber Company etc.

Cultural Theme: This theme would reinforce the various cultural sites in the study area through: (1) incorporation of elements (Hohokam symbols, structures, etc.) found at the cultural sites; and (2) incorporation of interpretive sites regarding the early canals from the Hohokam to the present.

Recreational Theme: This theme would reinforce the various canals, flood control facilities, basins, and washes that could be: (1) modified to include new flood control measures as well as multi-use opportunities; (2) loop systems utilizing existing and proposed canals, basins, and washes could be used for local and regional races as well as linkages to other areas within the study area; and (3) to interpret the importance of water to the valley and this area.

1.02.9 Assessment of Visual Impacts

This task assesses the visual impacts of each alternative based upon evaluation criteria designed to measure the alternative's landscape aesthetic characteristics and benefits. This task will be completed in detail during the development and evaluation of alternatives.

1.03 MULTI-USE OPPORTUNITIES ASSESSMENT

1.03.1 Inventory of Existing and Future Planned Uses

Existing Land Use:

Review of current aerial photographic maps for the greater Phoenix area, several field reviews of the study area and a "windshield survey" along major streets and transportation routes were the methods used to identify the existing land uses. This research identified the existing land uses in the general categories of residential, commercial, agriculture, park/open space, industrial, public/quasi-public, and vacant (Figure 4). The predominant land use throughout the study area is agricultural. Agriculture extends from the northern limits of the study area to the southern limits adjacent to the Gila River. Most development, as well as park/open space, occurs along the eastern and northern edges of the study area. Vacant/Undeveloped land typically occurs in the western portion of the study area adjacent to the White Tanks Mountains. Industrial areas occur south of I-10 along Litchfield Road and Buckeye Road.

General Plan Land Use:

Adopted general plans from the respective municipalities of Buckeye, Goodyear, Avondale, Litchfield Park, Glendale, Sũrprise, El Mirage, and Maricopa County identify the general planned land uses within the Loop 303 Corridor / White Tanks ADMP Update study area. These land uses are divided into the categories of residential, commercial, mixed use, park/open space, general industrial, public/quasi-public, agricultural land, and vacant/undeveloped (Figure 5). As planned, almost all of the vacant/open space and agricultural areas are anticipated to convert to residential uses in the future. Only the lands surrounding Luke Air Force Base will not be converted to residential uses. These lands will either stay as agricultural or be converted to general industrial. Large pockets of general industry are also planned in the northern areas of the study area north of Peoria Avenue. Commercial strips are planned along the I-10, Grand Avenue, and Buckeye Road corridors. Pockets of commercial development are also anticipated to develop throughout the residential areas at major intersections and along major arterials.

1.03.2 Identification of Multi-Use Opportunities

The information identifying multi-use opportunities was generated using the General Plans for each of the affected cities and site visits to the area. Existing and planned multi-modal transportation links were identified and include existing and planned multi-use pathways, existing canals, existing and planned bike lanes/trails, existing transit routes, and existing/proposed Loop 303. Major utility corridors were also identified.

In general, identified multi-use trails available to the public are few, mostly associated with the Litchfield Park area. A segment of multi-use trail exists along the Agua Fria River between Indian School Road and McDowell Road. Another small segment of multi-use trail exists adjacent to El Mirage Road between Greenway Road and Waddell Road. Several proposed multi-use trails are planned to occur throughout the area. Multi-use trails are planned to be constructed along the Gila River and Agua Fria River as well as down Trilby Wash. The multi-use trail proposed along the Agua Fria River is planned to connect into the Lake Pleasant Regional Park. The Sun Circle trail is proposed to occur along Olive Avenue from Airport Road to Jackrabbit Trail north to Peoria Avenue, east along Peoria Avenue to El Mirage Road then south back to Olive Avenue where it will continue east. New flood control facilities could be located to help link these proposed and existing multi-use trails. New facilities should have sufficient right-of-way to allow for a meandering trail and earth contouring within the facility.

Existing parks/open spaces, and existing golf courses, flood control basins, utility corridors, schools, and retail/cultural/social centers have been identified in the study area. Significant parks in or adjacent to the study area include the White Tanks Mountains Regional Park, Estrella Mountain Regional Park, and the Bill Casey Recreation Area. In addition to these major regional facilities, both proposed and existing parks are located throughout the study area. These predominantly occur along the eastern side of the study area. New flood control facilities could be located to connect these major parks/open spaces. In addition, new flood control basins should be located at the proposed park locations identified in the study area. These flood control basins should be designed to accommodate future park uses such as soccer, softball, and court sports. These basins could also be designed to allow for some use during a

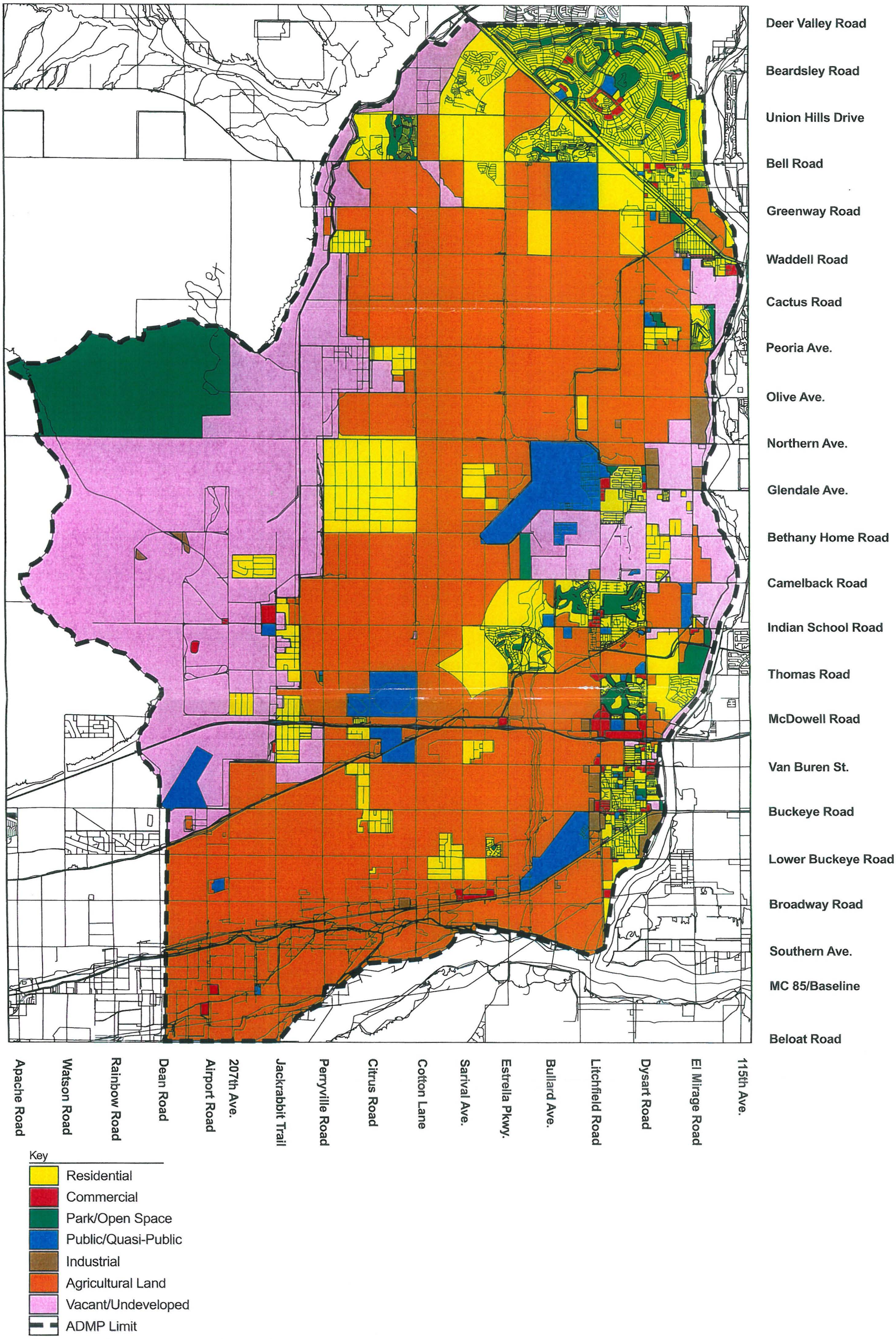

Figure 4. Existing Land Use

April 2000

Loop 303 Corridor/White Tanks ADMP Update

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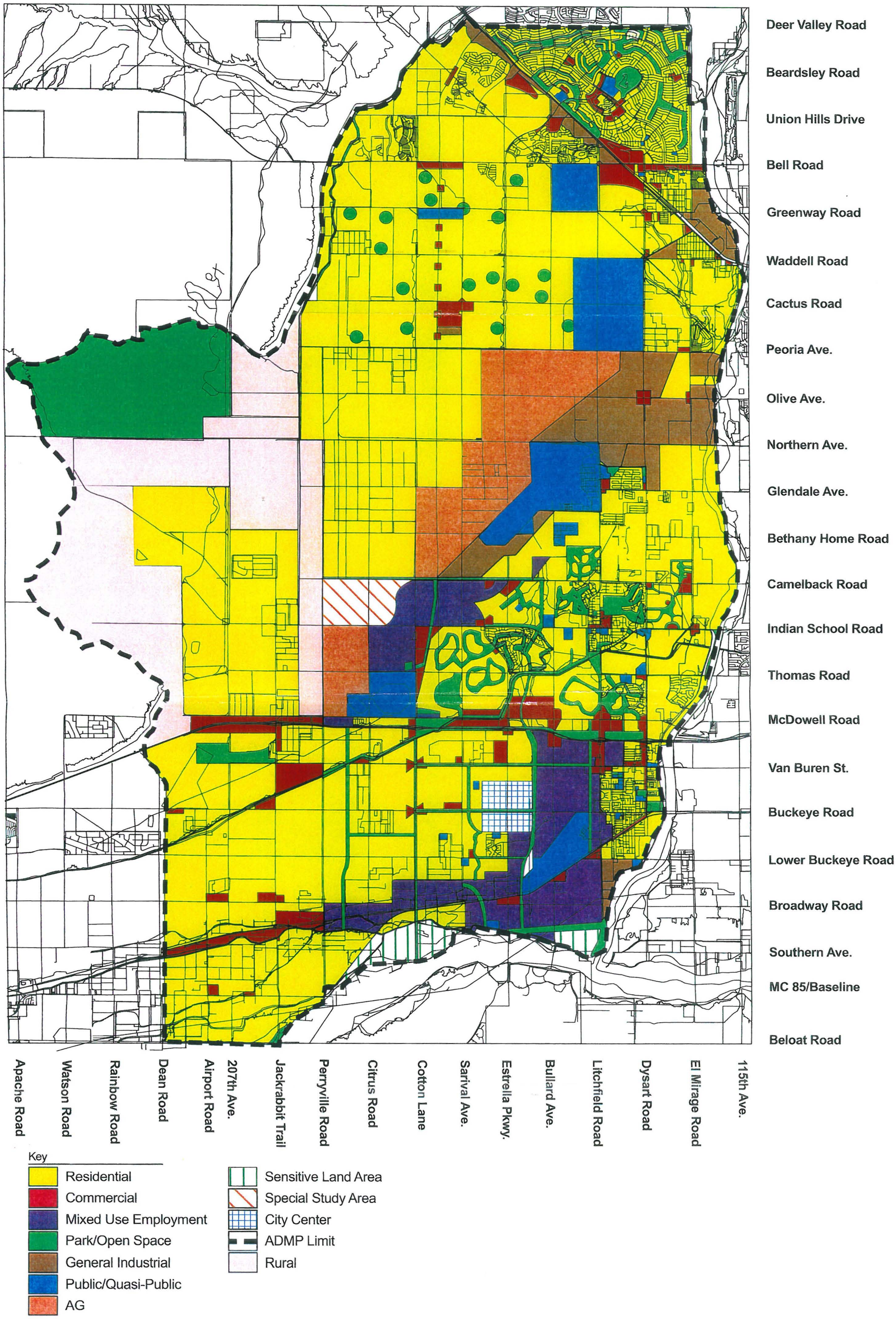


Figure 5. General Plan Land Use

April 2000

Loop 303 Corridor/White Tanks ADMP Update

LOGAN SIMPSON DESIGN INC.

ten year, two hour storm event. This could be accommodated through the design of varying levels within the basin. Sufficient land should be acquired to allow for basins with varying levels, varying side slopes, as well as for ground contouring along the top of the basin.

White Tanks #4 structure is a large earthen structure with a basin located on the north side. This facility could be reconfigured to possibly accommodate an amphitheater for performances. White Tanks #3 structure could be reconfigured to be a regional recreation facility. Multiple ballfields could be developed to accommodate regional tournaments.

The inventory and evaluation of the environmental considerations associated with the Loop 303 Corridor / White Tanks ADMP Update study area was synthesized to identify the opportunities and constraints (planning influences) on the development of flood control measures and multi-use facilities (Figure 6). Opportunities for multi-use recreation include adding trail and pathway segments along the Agua Fria and Gila Rivers. There are few east-west connections between the White Tanks Mountains and the Agua Fria River. Therefore, it is recommended that a pedestrian linkage be constructed along Olive and Peoria avenues (Sun Circle Trail alignment) and an Intergovernmental Agreement (IGA) be established with the Roosevelt Irrigation District (RID) to allow for a pedestrian linkage to occur along the RID canal. A new drainage channel could be located along the proposed route of the Sun Circle trail. Sufficient right-of-way should be acquired so that a meandering multi-use trail can be incorporated into the design. This would provide a west-east connection from the White Tanks Mountains to the Aqua Fria River. It is also recommended that north-south pedestrian linkage connections be established, particularly between the Gila River and the White Tanks Mountains. Bullard Wash, Loop 303, and Jackrabbit Trail could be connected by a multi-use trail. These facilities could be designed or retrofitted to accommodate multi-use trails.


Railroad Corridor

Portions of existing railroad corridors are abandoned. It is recommended that these corridors be utilized for flood control facilities, be developed with multi-use trails, and used to help establish linkages between use areas if practical.

Existing and planned transportation routes have a substantial affect on the development of multi-use and recreation opportunities within the study area (Figure 7). Transportation corridors are both a physical constraint and visual barrier that create opportunities specific to their physical characteristics. The Loop 303 corridor presents numerous challenges for the development of multi-use facilities, particularly for east-west oriented pedestrian trails due to the high roadway traffic volumes. However the Loop 303 corridor provides an opportunity for north-south pedestrian trails. Interstate 10 presents challenges in development of north-south corridors. The interstate is elevated and is fenced off and only allows for crossings under the


ADOT Basin

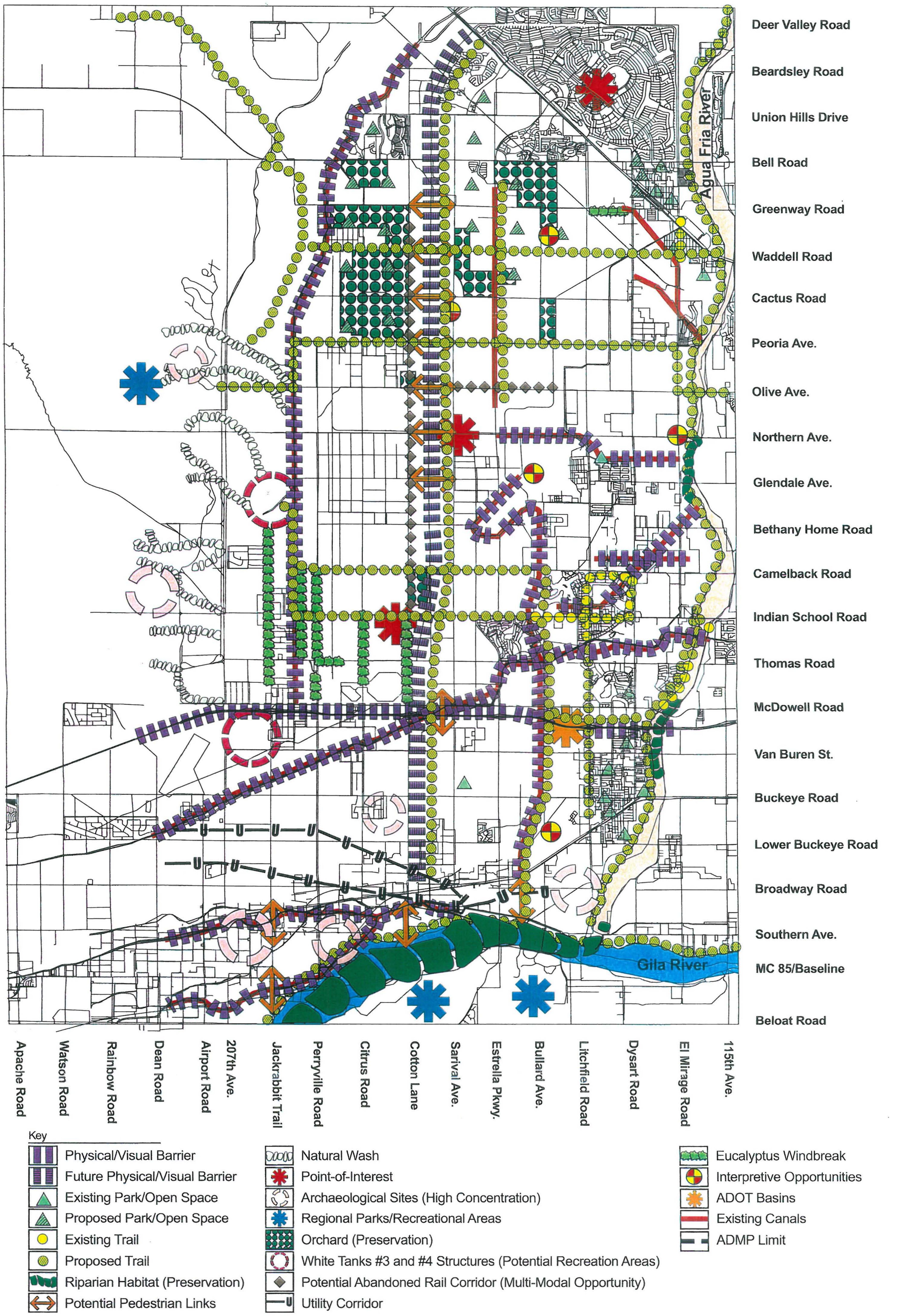


Figure 6. Planning Influences

Revised October 2002 April 2000

Loop 303 Corridor/White Tanks ADMP Update

LOGAN SIMPSON DESIGN INC.

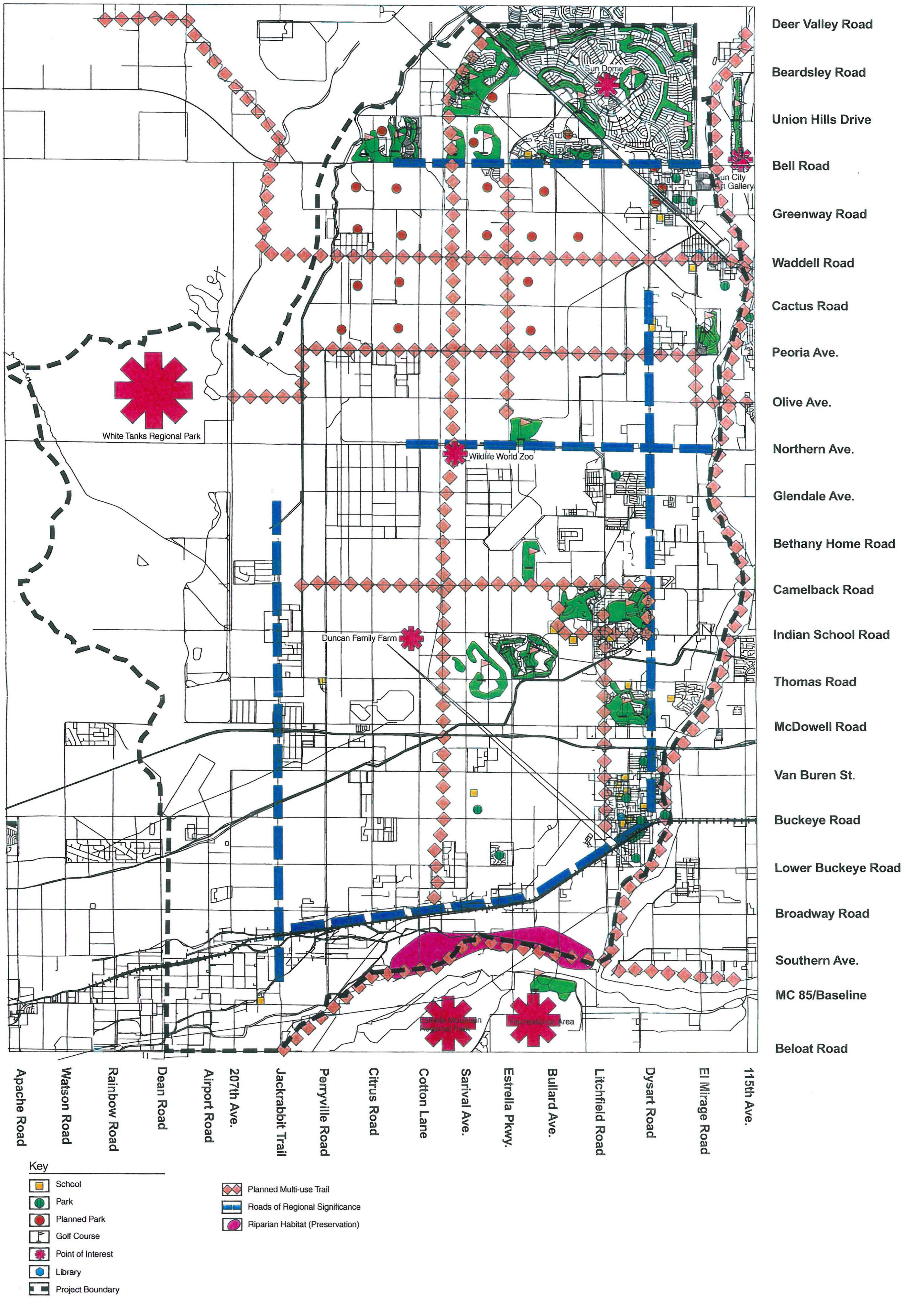


Figure 7. Transportation, Land Use, Links & Nodes

Revised October 2002 April 2000

Loop 303 ADMP Corridor/White Tanks ADMP Update

Logan Simpson Design Inc.

freeway at major mile locations. However, because of the interstate, several large potential detention basins were created as borrow sites with the additional benefit to accommodate drainage. An IGA or purchase could be negotiated with ADOT and others to convert these basins into public use. Potential uses could include a golf course, soccer fields, softball/baseball fields, wildlife habitat, BMX courses, or large open space.

Existing canals and channels offer potential multi-use links both north-south and east-west. As mentioned previously, the RID could be retrofitted to include a multi-use trail connecting the west side of the study area to the Agua Fria River. Other canals and channels such as the Beardsly canal, Jackrabbit Wash Channel, Bullard Wash, Colter Channel, and the Buckeye Canal could also be utilized to offer multi-use trails connecting the various areas of the study area.

Roosevelt Irrigation District (RID) Canal

The study area contains substantial natural and cultural resources, which can enhance the recreation experience of users of any new trails, or path systems created as a result of this study. The known resources include xeoriparian areas along the Agua Fria River, riparian areas along the Gila River, and numerous cultural sites. In particular, the Gila River is an important natural resource that contains high quality wildlife habitat and offers recreation opportunities. This resource is unique to the study area, and other similar riparian habitats are rapidly being lost in the Phoenix Metropolitan area due to urban encroachment. Even though other interests may alter the resources during the expansion of suburban development, they should be avoided where possible (or minimally affected) by actions proposed by the District. The District's actions could establish the prototype for how to address drainage issues along the Gila River. The District is currently involved in a study known as the El Rio Vision that identifies this area and proposes the restoration of the river as well as providing multi-use activities.

Luke Air Force Base F-16

There are numerous areas throughout the study area that could be developed as interpretive areas. Examples would be around Luke Air Force Base and Goodyear Airport. Interpretive areas could be developed along the Dysart Drain and Bullard Wash to interpret the types of aircraft and the Air Force Base. This type of interpretive area could be created farther down Bullard Wash adjacent to Goodyear Airport. Interpretive areas could be developed revolving around the agricultural history of the area. There are existing cotton gins, orchards, vineyards, and rose fields that could be interpreted for the public. Potential location for these interpretive areas could occur along Reems Road Channel, Beardsley Canal, and Buckeye Canal. Another area of interest that could be interpreted throughout the study area is the railroad facilities. Major railroad facilities occur adjacent to Grand Avenue and MC 85 along with spurs occurring adjacent to Cotton Lane, Olive Avenue, from Grand Avenue to Luke Air Force Base, and from MC 85 to I-10.

Other potential multi-use opportunities for new and existing flood control facilities include the restoration/preservation of wildlife habitat, creation of wildlife corridors, creation of agricultural heritage zones, mitigation banking, water quality remediation/improvements, and groundwater recharge.

Goodyear Airport

1.03.3 Assessment of Existing DISTRICT Facilities for Multi-Use Potential

Refer to Section 4.12.2.4 Assessment of Existing DISTRICT Facilities.

1.03.4 Identification of Possible Partners and Funding Sources

Potential partners and funding sources for multi-use facilities in the study area include the various Towns and Cities, various Developers located in the study area, Caterpillar, TEA-21 funds available from the Arizona Department Of Transportation (ADOT), County Parks and Recreation Department, Corp of Engineers, and Heritage funding from the Arizona Game and Fish Department. Several funding sources have been located through the Internet. These and other partners and funding sources will be explored during the development of alternatives for the study area. Partners and funding sources will be determined based upon the type of facility or activity that is being desired.

1.03.5 Implementation Guidelines

Design standards and implementation guidelines for the integration of multi-use opportunities will be developed based upon the final alternative selected for the study area. These design standards and implementation guidelines will be utilized in project planning and design in subsequent phases of the project.

In general, flood control channels should be designed to incorporate some type of multi-use facility as well as provide visual interest through the use of plant material and ground contouring. Sufficient land should be acquired to accommodate a channel with meandering side slopes and channel bottom, a meandering multi-use trail, potential interpretive sites, and ground contouring.

Flood control basins should be designed to facilitate multi-use options as well as provide visual interest through the use of plant material and ground contouring. Sufficient land should be acquired to accommodate a basin that has varying levels and side slopes, provides sufficient open space for activities, and provides a buffer space at the top of the basin for ground contouring.

The design standards and implementation guidelines developed for the study area will tie the various proposed themes identified in this document with the desired landscape character for each area.

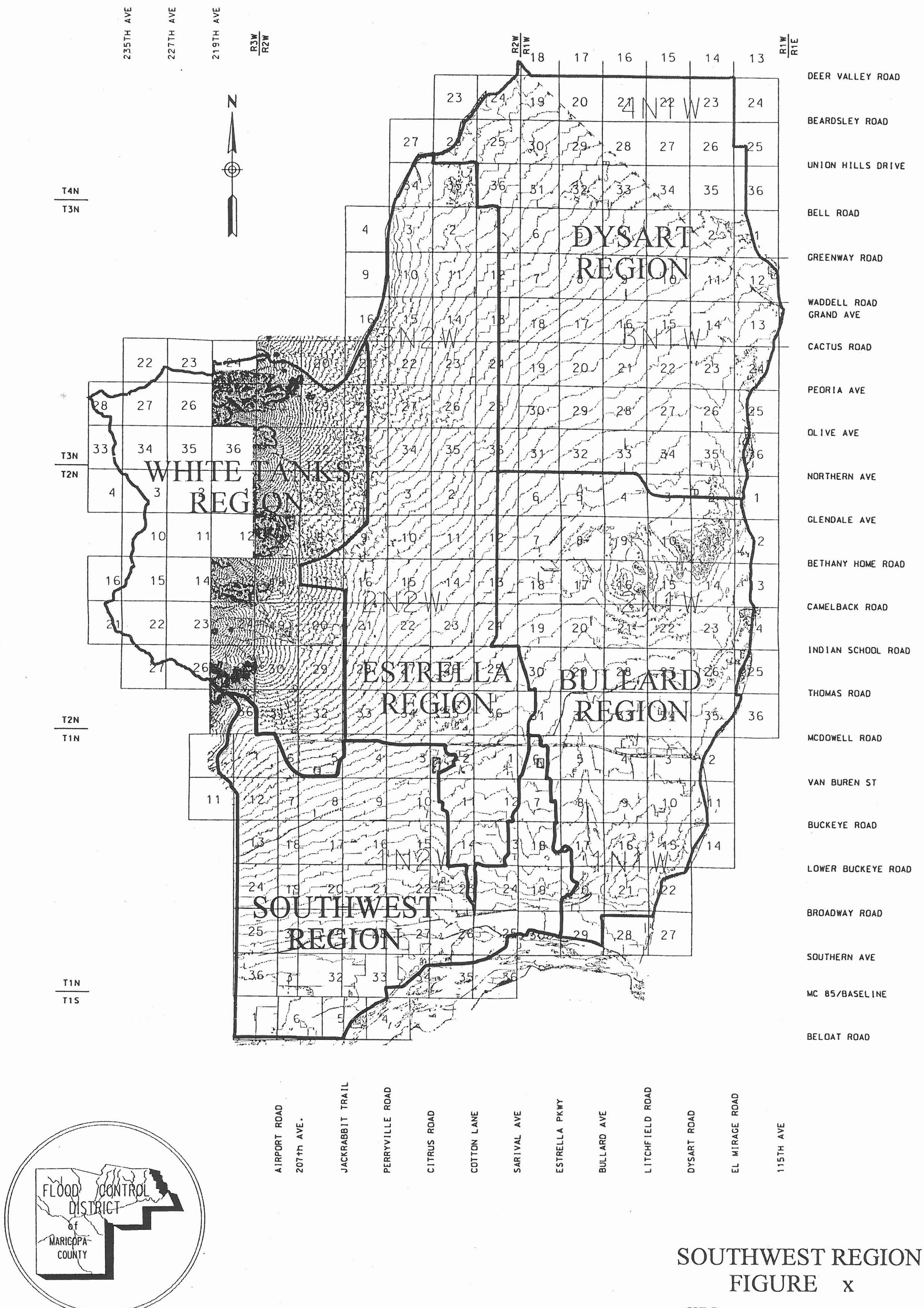
APPENDIX C

PROJECT AREA REGIONS
CORRESPONDENCE
DATA COLLECTION BIBLIOGRAPHY

APPENDIX C

PROJECT AREA REGIONS
CORRESPONDENCE
DATA COLLECTION BIBLIOGRAPHY

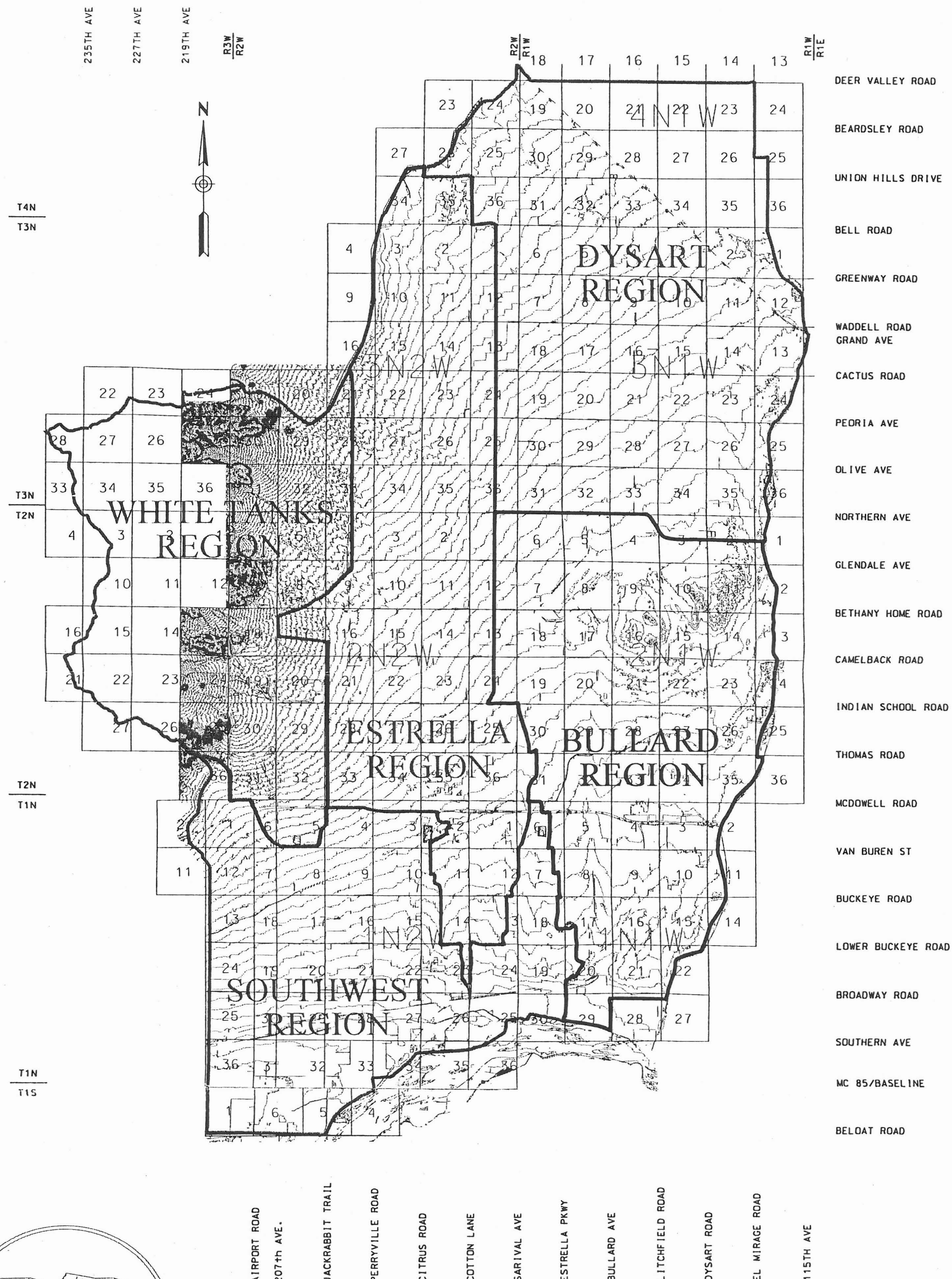
LOOP 303 PROJECT AREA



SOUTHWEST REGION
FIGURE x

URS

LOOP 303 PROJECT AREA

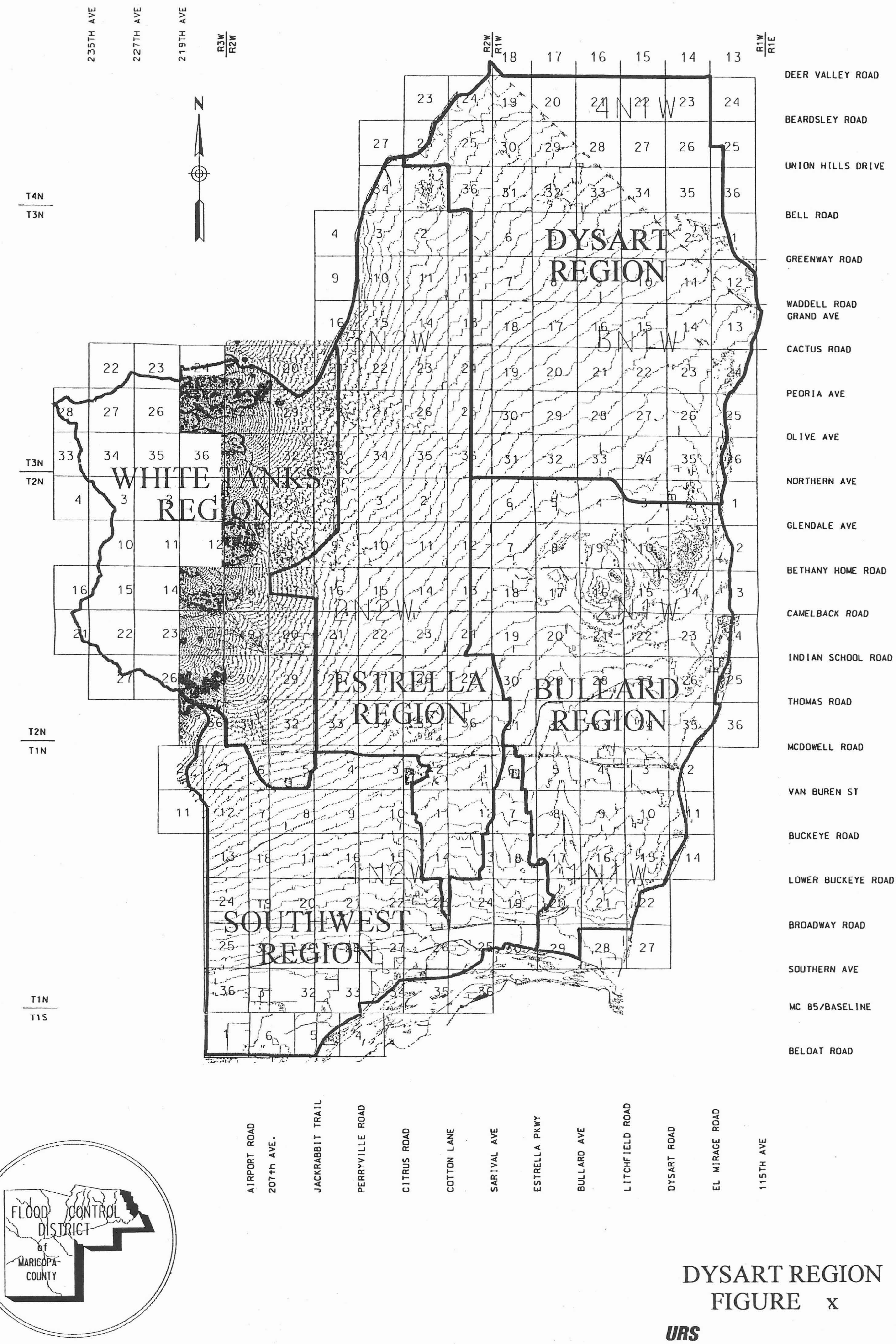


FLOOD CONTROL DISTRICT of MARICOPA COUNTY

BULLARD REGION
FIGURE x

URS

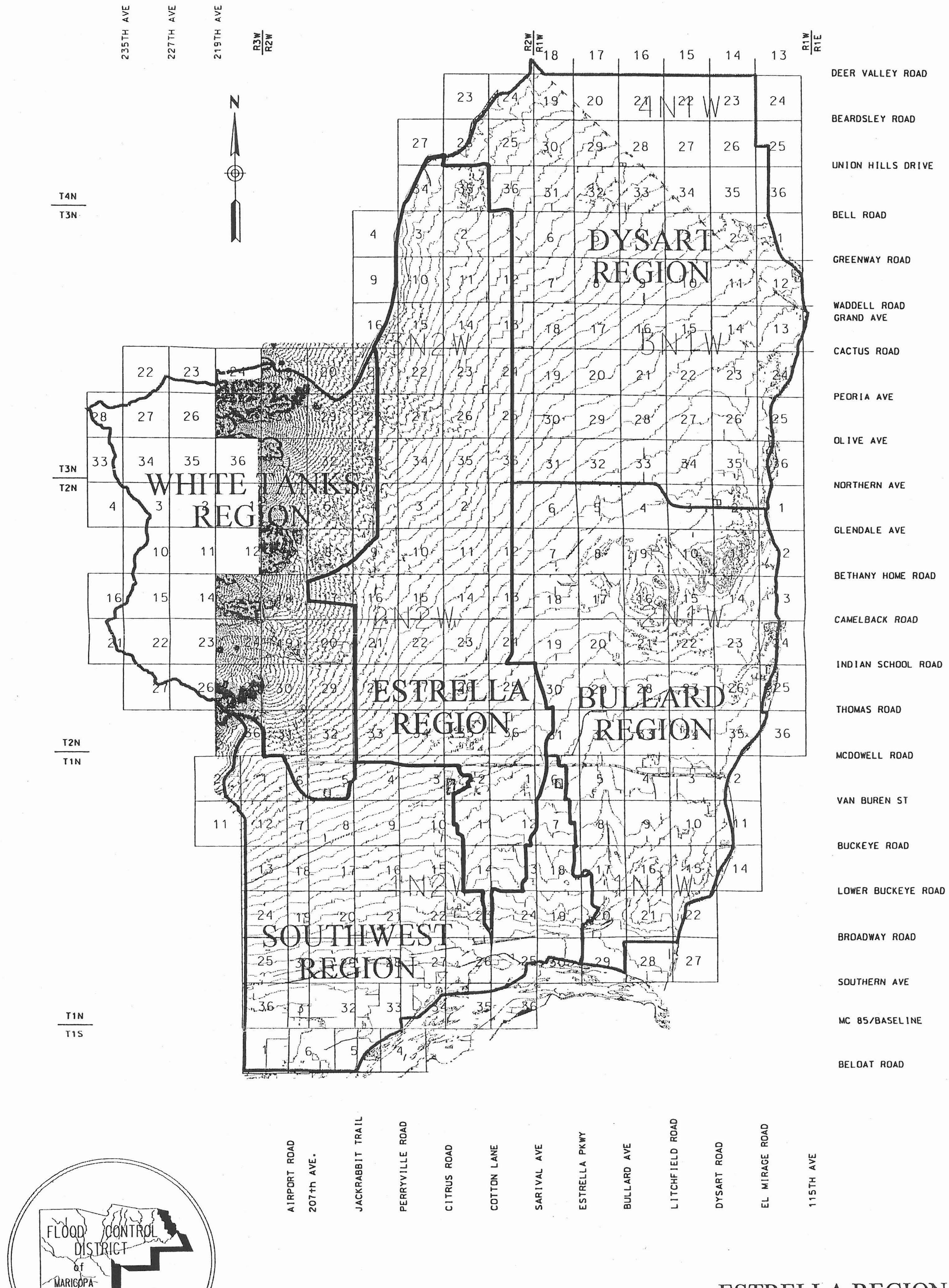
LOOP 303 PROJECT AREA



DYSART REGION
FIGURE x

URS

LOOP 303 PROJECT AREA



ESTRELLA REGION
FIGURE x

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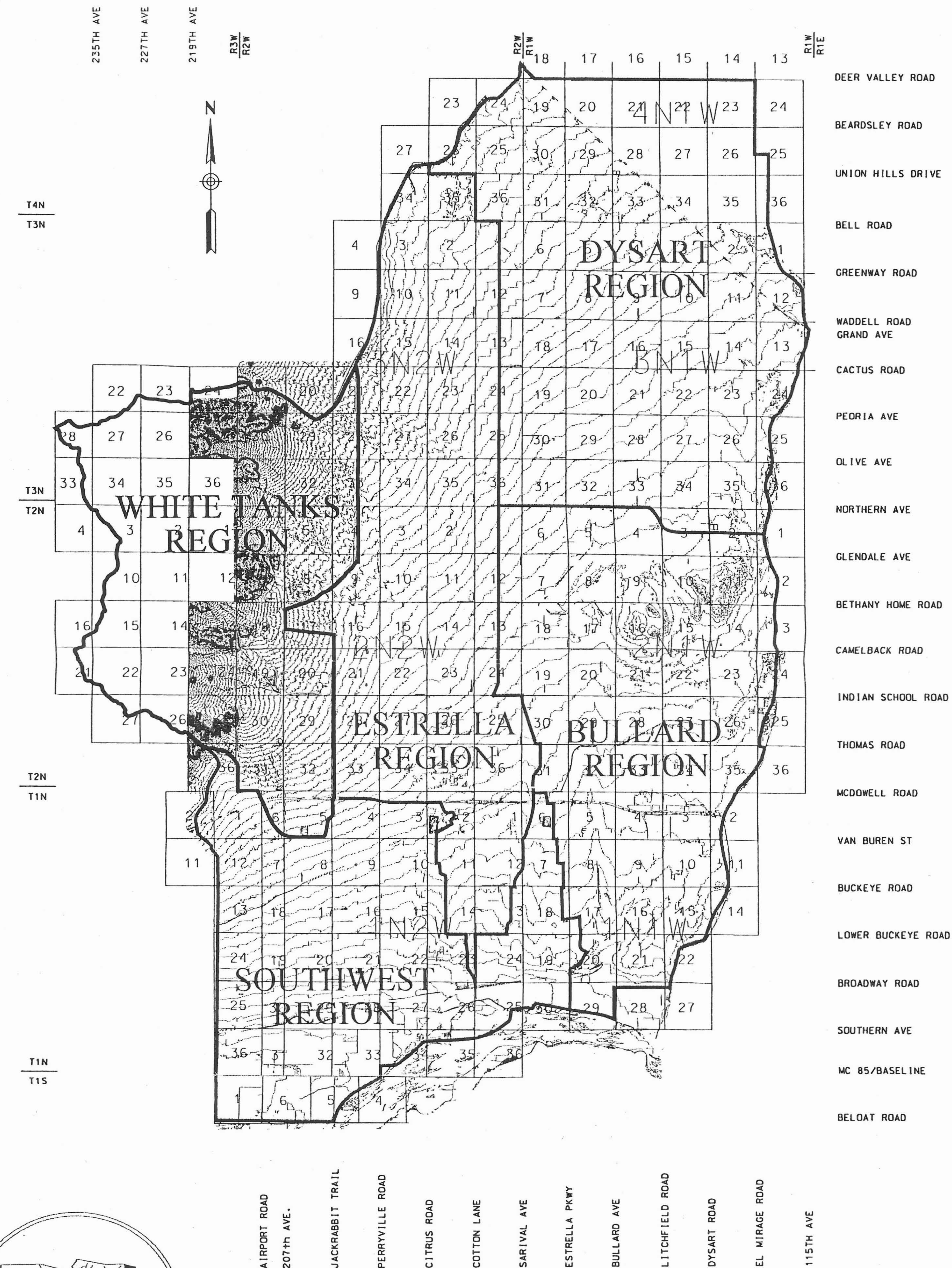
LOOP 303 PROJECT AREA



FLOOD CONTROL DISTRICT of MARICOPA COUNTY

WHITE TANKS REGION
FIGURE x

URS

United States Department of the Interior
U.S. Fish and Wildlife Service
2321 W. Royal Palm Road, Suite 103
Phoenix, Arizona 85021-4951
(602)640-2720 FAX (602)640-2730

In Reply Refer To:
AESO/SE
2-21-00-I-084

December 23, 1999

Mr. Adam Duerr
Dames & Moore
Cambric Corporate Center
1790 East River Road, Suite E-300
Tucson, Arizona 85718-5876

RE: Loop 303/White Tanks Area Drainage Master Plan

Dear Mr. Duerr:

This letter responds to your December 20, 1999, request for an inventory of threatened or endangered species, or those that are proposed to be listed as such under the Endangered Species Act of 1973, as amended (Act), which may potentially occur in your project areas (Maricopa County). The enclosed list may include candidate species as well. We hope the enclosed county list of species will be helpful. In future communications regarding this project, please refer to consultation number 2-21-00-I-084.

The enclosed list of the endangered, threatened, proposed, and candidate species includes all those potentially occurring anywhere in the county, or counties, where your project occurs. Please note that your project area may not necessarily include all or any of these species. The information provided includes general descriptions, habitat requirements, and other information for each species on the list. Also on the enclosed list is the Code of Federal Regulations (CFR) citation for each list and is available at most public libraries. This information should assist you in determining which species may or may not occur within your project area. Site-specific surveys could also be helpful and may be needed to verify the presence or absence of a species or its habitat as required for the evaluation of proposed project-related impacts.

Endangered and threatened species are protected by Federal law and must be considered prior to project development. If the action agency determines that listed species or critical habitat may be adversely affected by a federally funded, permitted, or authorized activity, the action agency must request formal consultation with the Service. If the action agency determines that the planned action may jeopardize a proposed species or destroy or adversely modify proposed critical habitat, the action agency must enter into a section 7 conference with the Service. Candidate species are those which are being considered for addition to the list of threatened or endangered species. Candidate species are those for which there is sufficient information to support a proposal for listing. Although candidate species have no legal protection under the Act, we recommend that they be considered in the planning process in the event that they become listed or proposed for listing prior to project completion.

If any proposed action occurs in or near areas with trees and shrubs growing along watercourses, known as riparian habitat, the Service recommends the protection of these areas. Riparian areas are critical to biological community diversity and provide linear corridors important to migratory species. In addition, if the project will result in the deposition of dredged or fill materials into waterways or excavation in waterways, we recommend you contact the Army Corps of Engineers which regulates these activities under Section 404 of the Clean Water Act.

The State of Arizona protects some plant and animal species not protected by Federal law. We recommend you contact the Arizona Game and Fish Department and the Arizona Department of Agriculture for State-listed or sensitive species in your project area.

The Service appreciates your efforts to identify and avoid impacts to listed and sensitive species in your project area. If we may be of further assistance, please feel free to contact Tom Gatz.

Sincerely,

Jacqueline Hanson

for David L. Harlow
Field Supervisor

Enclosure

cc: John Kennedy, Habitat Branch, Arizona Game and Fish Department, Phoenix, AZ

LISTED, PROPOSED, AND CANDIDATE SPECIES FOR THE FOLLOWING COUNTY: **MARICOPA**

08/26/1999

1) LISTED TOTAL= 13

NAME: ARIZONA AGAVE *AGAVE ARIZONICA*

STATUS: ENDANGERED CRITICAL HAB No RECOVERY PLAN: No CFR: 49 FR 21055, 05-18-1984

DESCRIPTION: HAS ATTRACTIVE ROSETTES OF BRIGHT GREEN LEAVES WITH DARK MAHOGANY MARGINS. FLOWER: BORNE ON SUB-UMBELLATE INFLORESCENCES.

ELEVATION RANGE: 3000-6000 FT.

COUNTIES: GILA, YAVAPAI, MARICOPA

HABITAT: TRANSITION ZONE BETWEEN OAK-JUNIPER WOODLAND & MOUNTAIN MAHOGANY-OAK SCRUB

SCATTERED CLONES IN NEW RIVER MOUNTAINS AND SIERRA ANCHA. USUALLY FOUND ON STEEP, ROCKY SLOPES. POSSIBLY MAZATAL MOUNTAINS. SHOULD BE LOOKED FOR WHEREVER THE RANGES OF Agave toumeyana var. bella AND Agave chrystantha OVERLAP.

NAME: ARIZONA CLIFFROSE *PURSHIA SUBINTEGRA*

STATUS: ENDANGERED CRITICAL HAB No RECOVERY PLAN: Yes CFR: 49 FR 22326 5-29-84

DESCRIPTION: EVERGREEN SHRUB OF THE ROSE FAMILY (ROSEACEAE). BARK PALE SHREDDY. YOUNG TWIGS WITH DENSE HAIRS. LEAVES 1-5 LOBES AND EDGES CURL DOWNWARD (REVOLUTE). FLOWERS: 5 WHITE OR YELLOW PETALS <0.5 INCH LONG.

ELEVATION RANGE: <4000 FT.

COUNTIES: GRAHAM YAVAPAI MARICOPA MOHAVE

HABITAT: CHARACTERISTIC WHITE SOILS OF TERTIARY LIMESTONE LAKEBED DEPOSITS.

WHITE SOILS OF TERITIARY LIMESTONE LAKEBED DEPOSITS CAN BE SEEN FROM A DISTANCE.

NAME: ARIZONA HEDGEHOG CACTUS *ECHINOCEREUS TRIGLOCHIDIATUS ARIZONICUS*

STATUS: ENDANGERED CRITICAL HAB No RECOVERY PLAN: No CFR: 44 FR 61556,10-15-1979

DESCRIPTION: DARK GREEN CYLINDROID 2.5-12 INCHES TALL, 2-10 INCHES IN DIAMETER, SINGLE OR IN CLUSTERS. 1-3 GRAY OR PINKISH CENTRAL SPINES LARGEST DEFLEXED AND 5-11 SHORTER RADIAL SPINES. FLOWER: BRILLIANT RED, SIDE OF STEM IN APRIL- MAY

ELEVATION RANGE: 3700-5200 FT.

COUNTIES: MARICOPA, GILA, PINAL

HABITAT: ECOTONE BETWEEN INTERIOR CHAPPARAL AND MADREAN EVERGREEN WOODLAND

OPEN SLOPES, IN NARROW CRACKS BETWEEN BOULDERS, AND IN UNDERSTORY OF SHRUBS. THIS VARIETY IS BELIEVED TO INTERGRADE AT THE EDGES OF ITS DISTRIBUTION WITH VARIETIES MELANCANTHUS AND NEOMEXICANUS CAUSING SOME CONFUSION IN IDENTIFICATION.

LISTED, PROPOSED, AND CANDIDATE SPECIES FOR THE FOLLOWING COUNTY: **MARICOPA**

08/26/1999

NAME: LESSER LONG-NOSED BAT *LEPTONYCTERIS CURASOAE YERBABUENAE*

STATUS: ENDANGERED CRITICAL HAB No RECOVERY PLAN: Yes CFR: 53 FR 38456, 09-30-88

DESCRIPTION: ELONGATED MUZZLE, SMALL LEAF NOSE, AND LONG TONGUE. YELLOWISH BROWN OR GRAY ABOVE AND CINNAMON BROWN BELOW. TAIL MINUTE AND APPEARS TO BE LACKING. EASILY DISTURBED.

ELEVATION RANGE: <6000 FT.

COUNTIES: COCHISE, PIMA, SANTA CRUZ, GRAHAM, PINAL, MARICOPA

HABITAT: DESERT SCRUB HABITAT WITH AGAVE AND COLUNMNAR CACTI PRESENT AS FOOD PLANTS

DAY ROOSTS IN CAVES AND ABANDONED TUNNELS. FORAGES AT NIGHT ON NECTAR, POLLEN, AND FRUIT OF PANICULATE AGAVES AND COLUMNAR CACTI. THIS SPECIES IS MIGRATORY AND IS PRESENT IN ARIZONA, USUALLY FROM APRIL TO SEPTMBER AND SOUTH OF THE BORDER THE REMAINDER OF THE YEAR.

NAME: SONORAN PRONGHORN *ANTILOCAPRA AMERICANA SONORIENSIS*

STATUS: ENDANGERED CRITICAL HAB No RECOVERY PLAN: Yes CFR: 32 FR 4001, 03-11-67

DESCRIPTION: BUFF ON BACK AND WHITE BELOW, HOOFED WITH SLIGHTLY CURVED BLACK HORNS HAVING A SINGLE PRONG. SMALLEST AND PALEST OF THE PRONGHORN SUBSPECIES.

ELEVATION RANGE: 2000-4000 FT.

COUNTIES: PIMA, YUMA, MARICOPA

HABITAT: BROAD, INTERMOUNTAIN ALLUVIAL VALLEYS WITH CREOSOTE-BURSAGE & PALO VERDE-MIXED CACTI ASSOCIATIONS

TYPICALLY, BAJADAS ARE USED AS FAWNING AREAS AND SANDY DUNE AREAS PROVIDE FOOD SEASONALLY. HISTORIC RANGE WAS PROBABLY LARGER THAN EXISTS TODAY. THIS SUBSPECIES ALSO OCCURS IN MEXICO.

NAME: DESERT PUPFISH *CYPRINODON MACULARIUS*

STATUS: ENDANGERED CRITICAL HAB Yes RECOVERY PLAN: Yes CFR: 51 FR 10842, 03-31-1986

DESCRIPTION: SMALL (2 INCHES) SMOOTHLY ROUNDED BODY SHAPE WITH NARROW VERTICAL BARS ON THE SIDES. BREEDING MALES BLUE ON HEAD AND SIDES WITH YELLOW ON TAIL. FEMALES & JUVENILES TAN TO OLIVE COLORED BACK AND SILVERY SIDES.

ELEVATION RANGE: <5000 FT.

COUNTIES: LA PAZ, PIMA, GRAHAM, MARICOPA, PINAL, YAVAPAI, SANTA CRUZ

HABITAT: SHALLOW SPRINGS, SMALL STREAMS, AND MARSHES. TOLERATES SALINE & WARM WATER

CRITICAL HABITAT INCLUDES QUITOBAQUITO SPRING, PIMA COUNTY, PORTIONS OF SAN FELIPE CREEK, CARRIZO WASH, AND FISH CREEK WASH, IMPERIAL COUNTY, CALIFORNIA. TWO SUBSPECIES ARE RECOGNIZED: DESERT PUPFISH (C. m. macularis) AND QUITOBAQUITO PUPFISH (C. m. eremus).

LISTED, PROPOSED, AND CANDIDATE SPECIES FOR THE FOLLOWING COUNTY: **MARICOPA**

08/26/1999

NAME: GILA TOPMINNOW *POECILIOPSIS OCCIDENTALIS OCCIDENTALIS*

STATUS: ENDANGERED CRITICAL HAB No RECOVERY PLAN: Yes CFR: 32 FR 4001, 03-11-1967

DESCRIPTION: SMALL (2 INCHES), GUPPY-LIKE, LIVE BEARING, LACKS DARK SPOTS ON ITS FINS. BREEDING MALES ARE JET BLACK WITH YELLOW FINS.

ELEVATION RANGE: <4500 FT.

COUNTIES: GILA, PINAL, GRAHAM, YAVAPAI, SANTA CRUZ, PIMA, MARICOPA, LA PAZ

HABITAT: SMALL STREAMS, SPRINGS, AND CIENEGAS VEGETATED SHALLOWS

SPECIES HISTORICALLY OCCURRED IN BACKWATERS OF LARGE RIVERS BUT IS CURRENTLY ISOLATED TO SMALL STREAMS AND SPRINGS

NAME: RAZORBACK SUCKER *XYRAUCHEN TEXANUS*

STATUS: ENDANGERED CRITICAL HAB Yes RECOVERY PLAN: Yes CFR: 55 FR 21154, 05-22-1990; 59 FR 13374, 03-21-1994

DESCRIPTION: LARGE (UP TO 3 FEET AND UP TO 16 POUNDS) LONG, HIGH SHARP-EDGED KEEL-LIKE HUMP BEHIND THE HEAD. HEAD FLATTENED ON TOP. OLIVE-BROWN ABOVE TO YELLOWISH BELOW.

ELEVATION RANGE: <6000 FT.

COUNTIES: GREENLEE, MOHAVE, PINAL, YAVAPAI, YUMA, LA PAZ, MARICOPA (REFUGIA), GILA, COCONINO, GRAHAM

HABITAT: RIVERINE & LACUSTRINE AREAS, GENERALLY NOT IN FAST MOVING WATER AND MAY USE BACKWATERS

SPECIES IS ALSO FOUND IN HORSESHOE RESERVOIR (MARICOPA COUNTY).CRITICAL HABITAT INCLUDES THE 100-YEAR FLOODPLAIN OF THE RIVER THROUGH GRAND CANYON FROM CONFLUENCE WITH PARIA RIVER TO HOOVER DAM; HOOVER DAM TO DAVIS DAM; PARKER DAM TO IMPERIAL DAM. ALSO GILA RIVER FROM AZ/NM BORDER TO COOLIDGE DAM; AND SALT RIVER FROM HWY 60/SR 77 BRIDGE TO ROOSEVELT DAM; VERDE RIVER FROM FS BOUNDARY TO HORSESHOE LAKE.

NAME: BALD EAGLE *HALIAEETUS LEUCOCEPHALUS*

STATUS: THREATENED CRITICAL HAB No RECOVERY PLAN: Yes CFR: 60 FR 35999, 07-12-95

DESCRIPTION: LARGE, ADULTS HAVE WHITE HEAD AND TAIL, HEIGHT 28 - 38"; WINGSPAN 66 - 96". 1-4 YRS DARK WITH VARYING DEGREES OF MOTTLED BROWN PLUMAGE. FEET BARE OF FEATHERS.

ELEVATION RANGE: VARIES FT.

COUNTIES: YUMA, LA PAZ, MOHAVE, YAVAPAI, MARICOPA, PINAL, COCONINO, NAVAJO, APACHE, SANTA CRUZ, PIMA, GILA, GRAHAM, COCHISE

HABITAT: LARGE TREES OR CLIFFS NEAR WATER (RESERVOIRS, RIVERS AND STREAMS) WITH ABUNDANT PREY

SOME BIRDS ARE NESTING RESIDENTS WHILE A LARGER NUMBER WINTERS ALONG RIVERS AND RESERVOIRS. AN ESTIMATED 200 TO 300 BIRDS WINTER IN ARIZONA. ONCE ENDANGERED (32 FR 4001, 03-11-1967; 43 FR 6233, 02-14-78) BECAUSE OF REPRODUCTIVE FAILURES FROM PESTICIDE POISONING AND LOSS OF HABITAT, THIS SPECIES WAS DOWN LISTED TO THREATENED ON AUGUST 11, 1995. ILLEGAL SHOOTING, DISTURBANCE, LOSS OF HABITAT CONTINUES TO BE A PROBLEM. SPECIES HAS BEEN PROPOSED FOR DELISTING (64 FR 36454) BUT STILL RECEIVES FULL PROTECTION UNDER ESA.

LISTED, PROPOSED, AND CANDIDATE SPECIES FOR THE FOLLOWING COUNTY: MARICOPA

08/26/1999

NAME: CACTUS FERRUGINOUS PYGMY-OWL *GLAUCIDIUM BRASILIANUM CACTORUM*

STATUS: ENDANGERED CRITICAL HAB Yes RECOVERY PLAN: No CFR: 62 FR 10730, 3-10-97

DESCRIPTION: SMALL (APPROX. 7"), DIURNAL OWL REDDISH BROWN OVERALL WITH CREAM-COLORED BELLY STREAKED WITH REDDISH BROWN. SOME INDIVIDUALS ARE GRAYISH BROWN

ELEVATION RANGE: <4000 FT.

COUNTIES: MARICOPA, YUMA, SANTA CRUZ, GRAHAM, GREENLEE, PIMA, PINAL, GILA, COCHISE

HABITAT: MATURE COTTONWOOD/WILLOW, MESQUITE BOSQUES, AND SONORAN DESERTSCRUB

RANGE LIMIT IN ARIZONA IS FROM NEW RIVER (NORTH) TO GILA BOX (EAST) TO CABEZA PRIETA MOUNTAINS (WEST). ONLY A FEW DOCUMENTED SITES WHERE THIS SPECIES PERSISTS ARE KNOWN, ADDITIONAL SURVEYS ARE NEEDED. CRITICAL HABITAT IN PIMA, COCHISE, PINAL, AND MARICOPA COUNTIES (64 FR 37419).

NAME: MEXICAN SPOTTED OWL *STRIX OCCIDENTALIS LUCIDA*

STATUS: THREATENED CRITICAL HAB No RECOVERY PLAN: Yes CFR: 56 FR 14678, 04-11-91

DESCRIPTION: MEDIUM SIZED WITH DARK EYES AND NO EAR TUFTS. BROWNISH AND HEAVILY SPOTTED WITH WHITE OR BEIGE.

ELEVATION RANGE: 4100-9000 FT.

COUNTIES: MOHAVE, COCONINO, NAVAJO, APACHE, YAVAPAI, GRAHAM, GREENLEE, COCHISE, SANTA CRUZ, PIMA, PINAL, GILA, MARICOPA

HABITAT: NESTS IN CANYONS AND DENSE FORESTS WITH MULTI-LAYERED FOLIAGE STRUCTURE

GENERALLY NESTS IN OLDER FORESTS OF MIXED CONIFER OR PONDERSA PINE/GAMBEL OAK TYPE, IN CANYONS, AND USE VARIETY OF HABITATS FOR FORAGING. SITES WITH COOL MICROCLIMATES APPEAR TO BE OF IMPORTANCE OR ARE PREFERED.

NAME: SOUTHWESTERN WILLOW FLYCATCHER *EMPIDONAX TRAILLII EXTIMUS*

STATUS: ENDANGERED CRITICAL HAB Yes RECOVERY PLAN: No CFR: 60 FR 10694, 02-27-95

DESCRIPTION: SMALL PASSERINE (ABOUT 6") GRAYISH-GREEN BACK AND WINGS, WHITISH THROAT, LIGHT OLIVE-GRAY BREAST AND PALE YELLOWISH BELLY. TWO WINGBARS VISIBLE. EYE-RING FAINT OR ABSENT.

ELEVATION RANGE: <8500 FT.

COUNTIES: YAVAPAI, GILA, MARICOPA, MOHAVE, COCONINO, NAVAJO, APACHE, PINAL, LA PAZ, GREENLEE, GRAHAM, YUMA, PIMA, COCHISE, SANTA CRUZ

HABITAT: COTTONWOOD/WILLOW & TAMARISK VEGETATION COMMUNITIES ALONG RIVERS & STREAMS

MIGRATORY RIPARIAN OBLIGATE SPECIES THAT OCCUPIES BREEDING HABITAT FROM LATE APRIL TO SEPTEMBER. DISTRIBUTION WITHIN ITS RANGE IS RESTRICTED TO RIPARIAN CORRIDORS. DIFFICULT TO DISTINGUISH FROM OTHER MEMBERS OF THE EMPIDONAX COMPLEX BY SIGHT ALONE. TRAINING SEMINAR REQUIRED FOR THOSE CONDUCTING FLYCATCHER SURVEYS. CRITICAL HABITAT ON PORTIONS OF THE 100-YEAR FLOODPLAIN ON SAN PEDRO AND VERDE RIVERS; WET BEAVER AND WEST CLEAR CREEKS, INCLUDING TAVASCI MARSH AND ISTER FLAT; THE COLORADO RIVER, THE LITTLE COLORADO RIVER, AND THE WEST, EAST, AND SOUTH FORKS OF THE LITTLE COLORADO RIVER, REFERENCE 60 CFR:62 FR 39129, 7/22/97.

LISTED, PROPOSED, AND CANDIDATE SPECIES FOR THE FOLLOWING COUNTY: **MARICOPA**

08/26/1999

NAME: YUMA CLAPPER RAIL *RALLUS LONGIROSTRIS YUMANENSIS*

STATUS: ENDANGERED CRITICAL HAB No RECOVERY PLAN: Yes CFR: 32 FR 4001, 03-11-67; 48 FR 34182, 07-27-83

DESCRIPTION: WATER BIRD WITH LONG LEGS AND SHORT TAIL. LONG SLENDER DECURVED BILL. MOTTLED BROWN ON GRAY ON ITS RUMP. FLANKS AND UNDERSIDES ARE DARK GRAY WITH NARROW VERTICAL STRIPES PRODUCING A BARRING EFFECT.

ELEVATION RANGE: <4500 FT.

COUNTIES: YUMA, LA PAZ, MARICOPA, PINAL, MOHAVE

HABITAT: FRESH WATER AND BRACKISH MARSHES

SPECIES IS ASSOCIATED WITH DENSE EMERGENT RIPARIAN VEGETATION. REQUIRES WET SUBSTRATE (MUDFLAT, SANDBAR) WITH DENSE HERBACEOUS OR WOODY VEGETATION FOR NESTING AND FORAGING. CHANNELIZATION AND MARSH DEVELOPMENT ARE PRIMARY SOURCES OF HABITAT LOSS.

THE STATE OF ARIZONA

GAME & FISH DEPARTMENT

2221 West Greenway Road, Phoenix, Arizona 85023-4399 (602) 942-3000
www.gf.state.az.us

Governor
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Director
Duane L. Shroufe

Deputy Director
Steve K. Ferrell

January 11, 2000

Mr. Adam Duerr
Dames & Moore
1790 East River Road, Suite E-300
Tucson, Arizona 85718-5876

Re: Special Status Species; Loop 303/ White Tanks Area Drainage Master Plan

Dear Mr. Duerr:

The Arizona Game and Fish Department (Department) has received your letter, dated December 20, 1999, regarding special status species in the above-referenced area, and the following information is provided.

The Department's Heritage Data Management System has been accessed and current records show that the special status species listed below have been documented as occurring within 3 miles of the Loop 303 corridor study area.

COMMON NAME	SCIENTIFIC NAME	STATUS
lowland leopard frog	*Rana yavapaiensis*	**WC,S**
Sonoran desert tortoise	*Gopherus agassizii*	**WC**
Western least bittern	*Ixobrychus exilis hesperis*	**WC**
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	**WC,S**
Yuma clapper rail	*Rallus longirostris yumanensis*	**LE,WC**

STATUS DEFINITIONS

LE - **Listed Endangered.** Species identified by the U.S. Fish and Wildlife Service under the Endangered Species Act as being in imminent jeopardy of extinction.

WC - **Wildlife of Special Concern in Arizona.** Species whose occurrence in Arizona is or may be in jeopardy, or with known or perceived threats or population declines, as described by the Department's listing of **Wildlife of Special Concern in Arizona** (WSCA, in prep.). Species included in WSCA are currently the same as those in **Threatened Native Wildlife in Arizona** (1988).

S - **Sensitive.** Species classified as "**sensitive**" by the Regional Forester when occurring on lands managed by the U.S.D.A. Forest Service.

At this time, the Department's comments are limited to the special status species information provided above. This correspondence does not represent the Department's evaluation of impacts to wildlife or wildlife habitat associated with activities occurring in the subject area. If the Department has specific comments or concerns regarding this project, they will be provided to you by January 18, 2000. Please contact me at (602) 789-3606, if you have any questions regarding this letter.

Sincerely,

Nancy Olson

Nancy Olson
Project Evaluation Specialist
Habitat Branch

NLO:no

cc: Russ Haughey, Habitat Program Manager, Region VI, Mesa

AGFD# 12-23-99(07)

United States Department of the Interior
U.S. Fish and Wildlife Service
2321 W. Royal Palm Road, Suite 103
Phoenix, Arizona 85021-4951
(602)640-2720 FAX (602)640-2730

In Reply Refer To:
AESO/SE
2-21-00-I-084

December 23, 1999

Mr. Adam Duerr
Dames & Moore
Cambric Corporate Center
1790 East River Road, Suite E-300
Tucson, Arizona 85718-5876

RE: Loop 303/White Tanks Area Drainage Master Plan

Dear Mr. Duerr:

This letter responds to your December 20, 1999, request for an inventory of threatened or endangered species, or those that are proposed to be listed as such under the Endangered Species Act of 1973, as amended (Act), which may potentially occur in your project areas (Maricopa County). The enclosed list may include candidate species as well. We hope the enclosed county list of species will be helpful. In future communications regarding this project, please refer to consultation number 2-21-00-I-084.

The enclosed list of the endangered, threatened, proposed, and candidate species includes all those potentially occurring anywhere in the county, or counties, where your project occurs. Please note that your project area may not necessarily include all or any of these species. The information provided includes general descriptions, habitat requirements, and other information for each species on the list. Also on the enclosed list is the Code of Federal Regulations (CFR) citation for each list and is available at most public libraries. This information should assist you in determining which species may or may not occur within your project area. Site-specific surveys could also be helpful and may be needed to verify the presence or absence of a species or its habitat as required for the evaluation of proposed project-related impacts.

Endangered and threatened species are protected by Federal law and must be considered prior to project development. If the action agency determines that listed species or critical habitat may be adversely affected by a federally funded, permitted, or authorized activity, the action agency must request formal consultation with the Service. If the action agency determines that the planned action may jeopardize a proposed species or destroy or adversely modify proposed critical habitat, the action agency must enter into a section 7 conference with the Service. Candidate species are those which are being considered for addition to the list of threatened or endangered species. Candidate species are those for which there is sufficient information to support a proposal for listing. Although candidate species have no legal protection under the Act, we recommend that they be considered in the planning process in the event that they become listed or proposed for listing prior to project completion.

If any proposed action occurs in or near areas with trees and shrubs growing along watercourses, known as riparian habitat, the Service recommends the protection of these areas. Riparian areas are critical to biological community diversity and provide linear corridors important to migratory species. In addition, if the project will result in the deposition of dredged or fill materials into waterways or excavation in waterways, we recommend you contact the Army Corps of Engineers which regulates these activities under Section 404 of the Clean Water Act.

The State of Arizona protects some plant and animal species not protected by Federal law. We recommend you contact the Arizona Game and Fish Department and the Arizona Department of Agriculture for State-listed or sensitive species in your project area.

The Service appreciates your efforts to identify and avoid impacts to listed and sensitive species in your project area. If we may be of further assistance, please feel free to contact Tom Gatz.

Sincerely,

Jacqueline Hanson

for David L. Harlow
Field Supervisor

Enclosure

cc: John Kennedy, Habitat Branch, Arizona Game and Fish Department, Phoenix, AZ

LISTED, PROPOSED, AND CANDIDATE SPECIES FOR THE FOLLOWING COUNTY: MARICOPA

08/26/1999

1) LISTED

TOTAL= 13

NAME: **ARIZONA AGAVE** *AGAVE ARIZONICA*

STATUS: ENDANGERED CRITICAL HAB No RECOVERY PLAN: No CFR: 49 FR 21055, 05-18-1984

DESCRIPTION: HAS ATTRACTIVE ROSETTES OF BRIGHT GREEN LEAVES WITH DARK MAHOGĀNY MARGINS. FLOWER: BORNE ON SUB-UMBELLATE INFLORESCENCES.

ELEVATION RANGE: 3000-6000 FT.

COUNTIES: GILA, YAVAPAI, MARICOPA

HABITAT: TRANSITION ZONE BETWEEN OAK-JUNIPER WOODLAND & MOUNTAIN MAHOGANY-OAK SCRUB

SCATTERED CLONES IN NEW RIVER MOUNTAINS AND SIERRA ANCHA. USUALLY FOUND ON STEEP, ROCKY SLOPES. POSSIBLY MAZATAL MOUNTAINS. SHOULD BE LOOKED FOR WHEREVER THE RANGES OF Agave toumeyana var. bella AND Agave chrystantha OVERLAP.

NAME: **ARIZONA CLIFFROSE** *PURSHIA SUBINTEGRA*

STATUS: ENDANGERED CRITICAL HAB No RECOVERY PLAN: Yes CFR: 49 FR 22326 5-29-84

DESCRIPTION: EVERGREEN SHRUB OF THE ROSE FAMILY (ROSEACEAE). BARK PALE SHREDDY. YOUNG TWIGS WITH DENSE HAIRS. LEAVES 1-5 LOBES AND EDGES CURL DOWNWARD (REVOLUTE). FLOWERS: 5 WHITE OR YELLOW PETALS <0.5 INCH LONG.

ELEVATION RANGE: <4000 FT.

COUNTIES: GRAHAM YAVAPAI MARICOPA MOHAVE

HABITAT: CHARACTERISTIC WHITE SOILS OF TERTIARY LIMESTONE LAKEBED DEPOSITS.

WHITE SOILS OF TERITIARY LIMESTONE LAKEBED DEPOSITS CAN BE SEEN FROM A DISTANCE.

NAME: **ARIZONA HEDGEHOG CACTUS** *ECHINOCEREUS TRIGLOCHIDIATUS ARIZONICUS*

STATUS: ENDANGERED CRITICAL HAB No RECOVERY PLAN: No CFR: 44 FR 61556,10-15-1979

DESCRIPTION: DARK GREEN CYLINDROID 2.5-12 INCHES TALL, 2-10 INCHES IN DIAMETER, SINGLE OR IN CLUSTERS. 1-3 GRAY OR PINKISH CENTRAL SPINES LARGEST DEFLEXED AND 5-11 SHORTER RADIAL SPINES. FLOWER: BRILLIANT RED, SIDE OF STEM IN APRIL- MAY

ELEVATION RANGE: 3700-5200 FT.

COUNTIES: MARICOPA, GILA, PINAL

HABITAT: ECOTONE BETWEEN INTERIOR CHAPPARAL AND MADREAN EVERGREEN WOODLAND

OPEN SLOPES, IN NARROW CRACKS BETWEEN BOULDERS, AND IN UNDERSTORY OF SHRUBS. THIS VARIETY IS BELIEVED TO INTERGRADE AT THE EDGES OF ITS DISTRIBUTION WITH VARIETIES MELANCANTHUS AND NEOMEXICANUS CAUSING SOME CONFUSION IN IDENTIFICATION.

NAME: **LESSER LONG-NOSED BAT** *LEPTONYCTERIS CURASOAE YERBABUENAE*

STATUS: ENDANGERED CRITICAL HAB No RECOVERY PLAN: Yes CFR: 53 FR 38456, 09-30-88

DESCRIPTION: ELONGATED MUZZLE, SMALL LEAF NOSE, AND LONG TONGUE. YELLOWISH BROWN OR GRAY ABOVE AND CINNAMON BROWN BELOW. TAIL MINUTE AND APPEARS TO BE LACKING. EASILY DISTURBED.

ELEVATION RANGE: <6000 FT.

COUNTIES: COCHISE, PIMA, SANTA CRUZ, GRAHAM, PINAL, MARICOPA

HABITAT: DESERT SCRUB HABITAT WITH AGAVE AND COLUNMNAR CACTI PRESENT AS FOOD PLANTS

DAY ROOSTS IN CAVES AND ABANDONED TUNNELS. FORAGES AT NIGHT ON NECTAR, POLLEN, AND FRUIT OF PANICULATE AGAVES AND COLUMNAR CACTI. THIS SPECIES IS MIGRATORY AND IS PRESENT IN ARIZONA , USUALLY FROM APRIL TO SEPTMBER AND SOUTH OF THE BORDER THE REMAINDER OF THE YEAR.

NAME: **SONORAN PRONGHORN** *ANTILOCAPRA AMERICANA SONORIENSIS*

STATUS: ENDANGERED CRITICAL HAB No RECOVERY PLAN: Yes CFR: 32 FR 4001, 03-11-67

DESCRIPTION: BUFF ON BACK AND WHITE BELOW, HOOFED WITH SLIGHTLY CURVED BLACK HORNS HAVING A SINGLE PRONG. SMALLEST AND PALEST OF THE PRONGHORN SUBSPECIES.

ELEVATION RANGE: 2000-4000 FT.

COUNTIES: PIMA, YUMA, MARICOPA

HABITAT: BROAD, INTERMOUNTAIN ALLUVIAL VALLEYS WITH CREOSOTE-BURSAGE & PALO VERDE-MIXED CACTI ASSOCIATIONS

TYPICALLY, BAJADAS ARE USED AS FAWNING AREAS AND SANDY DUNE AREAS PROVIDE FOOD SEASONALLY. HISTORIC RANGE WAS PROBABLY LARGER THAN EXISTS TODAY. THIS SUBSPECIES ALSO OCCURS IN MEXICO.

NAME: **DESERT PUPFISH** *CYPRINODON MACULARIUS*

STATUS: ENDANGERED CRITICAL HAB Yes RECOVERY PLAN: Yes CFR: 51 FR 10842, 03-31-1986

DESCRIPTION: SMALL (2 INCHES) SMOOTHLY ROUNDED BODY SHAPE WITH NARROW VERTICAL BARS ON THE SIDES. BREEDING MALES BLUE ON HEAD AND SIDES WITH YELLOW ON TAIL. FEMALES & JUVENILES TAN TO OLIVE COLORED BACK AND SILVERY SIDES.

ELEVATION RANGE: <5000 FT.

COUNTIES: LA PAZ, PIMA, GRAHAM, MARICOPA, PINAL, YAVAPAI, SANTA CRUZ

HABITAT: SHALLOW SPRINGS, SMALL STREAMS, AND MARSHES. TOLERATES SALINE & WARM WATER

CRITICAL HABITAT INCLUDES QUITOBAQUITO SPRING, PIMA COUNTY, PORTIONS OF SAN FELIPE CREEK, CARRIZO WASH, AND FISH CREEK WASH, IMPERIAL COUNTY, CALIFORNIA. TWO SUBSPECIES ARE RECOGNIZED: DESERT PUPFISH (C. m. macularis) AND QUITOBAQUITO PUPFISH (C. m. eremus).

LISTED, PROPOSED, AND CANDIDATE SPECIES FOR THE FOLLOWING COUNTY: MARICOPA

08/26/1999

NAME: GILA TOPMINNOW *POECILIOPSIS OCCIDENTALIS OCCIDENTALIS*

STATUS: ENDANGERED CRITICAL HAB No RECOVERY PLAN: Yes CFR: 32 FR 4001, 03-11-1967

DESCRIPTION: SMALL (2 INCHES), GUPPY-LIKE, LIVE BEARING, LACKS DARK SPOTS ON ITS FINS. BREEDING MALES ARE JET BLACK WITH YELLOW FINS.

ELEVATION RANGE: <4500 FT.

COUNTIES: GILA, PINAL, GRAHAM, YAVAPAI, SANTA CRUZ, PIMA, MARICOPA, LA PAZ

HABITAT: SMALL STREAMS, SPRINGS, AND CIENEGAS VEGETATED SHALLOWS

SPECIES HISTORICALLY OCCURRED IN BACKWATERS OF LARGE RIVERS BUT IS CURRENTLY ISOLATED TO SMALL STREAMS AND SPRINGS

NAME: RAZORBACK SUCKER *XYRAUCHEN TEXANUS*

STATUS: ENDANGERED CRITICAL HAB Yes RECOVERY PLAN: Yes CFR: 55 FR 21154, 05-22-1990; 59 FR 13374, 03-21-1994

DESCRIPTION: LARGE (UP TO 3 FEET AND UP TO 16 POUNDS) LONG, HIGH SHARP-EDGED KEEL-LIKE HUMP BEHIND THE HEAD. HEAD FLATTENED ON TOP. OLIVE-BROWN ABOVE TO YELLOWISH BELOW.

ELEVATION RANGE: <6000 FT.

COUNTIES: GREENLEE, MOHAVE, PINAL, YAVAPAI, YUMA, LA PAZ, MARICOPA (REFUGIA), GILA, COCONINO, GRAHAM

HABITAT: RIVERINE & LACUSTRINE AREAS, GENERALLY NOT IN FAST MOVING WATER AND MAY USE BACKWATERS

SPECIES IS ALSO FOUND IN HORSESHOE RESERVOIR (MARICOPA COUNTY).CRITICAL HABITAT INCLUDES THE 100-YEAR FLOODPLAIN OF THE RIVER THROUGH GRAND CANYON FROM CONFLUENCE WITH PARIA RIVER TO HOOVER DAM; HOOVER DAM TO DAVIS DAM; PARKER DAM TO IMPERIAL DAM. ALSO GILA RIVER FROM AZ/NM BORDER TO COOLIDGE DAM; AND SALT RIVER FROM HWY 60/SR 77 BRIDGE TO ROOSEVELT DAM; VERDE RIVER FROM FS BOUNDARY TO HORSESHOE LAKE.

NAME: BALD EAGLE *HALIAEETUS LEUCOCEPHALUS*

STATUS: THREATENED CRITICAL HAB No RECOVERY PLAN: Yes CFR: 60 FR 35999, 07-12-95

DESCRIPTION: LARGE, ADULTS HAVE WHITE HEAD AND TAIL. HEIGHT 28 - 38"; WINGSPAN 66 - 96". 1-4 YRS DARK WITH VARYING DEGREES OF MOTTLED BROWN PLUMAGE. FEET BARE OF FEATHERS.

ELEVATION RANGE: VARIES FT.

COUNTIES: YUMA, LA PAZ, MOHAVE, YAVAPAI, MARICOPA, PINAL, COCONINO, NAVAJO, APACHE, SANTA CRUZ, PIMA, GILA, GRAHAM, COCHISE

HABITAT: LARGE TREES OR CLIFFS NEAR WATER (RESERVOIRS, RIVERS AND STREAMS) WITH ABUNDANT PREY

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NAME: **MEXICAN SPOTTED OWL** *STRIX OCCIDENTALIS LUCIDA*

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THE STATE OF ARIZONA

GAME & FISH DEPARTMENT

2221 West Greenway Road, Phoenix, Arizona 85023-4399 (602) 942-3000
www.gf.state.az.us

January 11, 2000

Mr. Adam Duerr
Dames & Moore
1790 East River Road, Suite E-300
Tucson, Arizona 85718-5876

Re: Special Status Species; Loop 303/ White Tanks Area Drainage Master Plan

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Sonoran desert tortoise	*Gopherus agassizii*	WC
Western least bittern	*Ixobrychus exilis hesperis*	WC
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WC - **Wildlife of Special Concern in Arizona.** Species whose occurrence in Arizona is or may be in jeopardy, or with known or perceived threats or population declines, as described by the Department's listing of **Wildlife of Special Concern in Arizona** (WSCA, in prep.). Species included in WSCA are currently the same as those in **Threatened Native Wildlife in Arizona** (1988).

S - **Sensitive.** Species classified as "**sensitive**" by the Regional Forester when occurring on lands managed by the U.S.D.A. Forest Service.

At this time, the Department's comments are limited to the special status species information provided above. This correspondence does not represent the Department's evaluation of impacts to wildlife or wildlife habitat associated with activities occurring in the subject area. If the Department has specific comments or concerns regarding this project, they will be provided to you by January 18, 2000. Please contact me at (602) 789-3606, if you have any questions regarding this letter.

Sincerely,

Nancy Olson

Nancy Olson
Project Evaluation Specialist
Habitat Branch

NLO:no

cc: Russ Haughey, Habitat Program Manager, Region VI, Mesa

AGFD# 12-23-99(07)

URS Greiner Woodward Clyde
December 3, 1999
Project Manager: Elliot Silverston

Bibliography

Catalog #	Reviewed By				Received From	URSGWC	D&M	LSD	EEC
	ES	RS	JB						
AEC-1			X	Mountain Vista Ranch Drainage Proposed Drainage Channel Prepared By: American Engineering Company, June 25, 1998	FCDMC	X			
AEC-2			X	Preliminary Drainage Report for Centrex Surprise Farms American Engineering Company, August 4, 1998	FCDMC	X			
AEC-3				Final Drainge Report for Ashton Ranch, Unit 1 Prepared for: Beazer Homes Prepared by: American Engineering Company, November 14, 1997		X			
AEC-4				Final Drainage Report for Ashton Ranch, Unit 2 Prepared for: Beazer Homes Prepared by: American Engineering Company, November 24, 1998		X			
AEC-5-AI				Master Grading and Drainage Plan for Corte Sierra Units I & II Prepared for: Stardust Development, Revised July 1999 Prepared by: American Engineering Company		X			
AEC-6				Final Drainage Report for Parke Row Prepared for: Brighton Development, Revised November 6, 1997 Prepared by: American Engineering Company		X			
AEC-7				Final Drainage Report for Units I, II & III, Cottonflower Community Prepared for The Boston Company, August 1999 Prepared by: American Engineering Company	Goodyear	X			X
AEC-8				Mountain Vista Ranch, Drainage Proposal for Reems Road November 11, 1996 Prepared by: American Engineering Company	EEC				
AEC-9				Drainage Report for Mountain Vista Ranch January 26, 1995 Prepared by: American Engineering Company	EEC				
ANW-1		X	X	Flood Control District Project Proposal From El Mirage Prepared For: City Of El Mirage Prepared By:A-N West, Sept 1998	ANW	X			
ANW-2				Response to Initial FCDMC Review Comments for Application for CLOMR for The Lower El Mirage Wash Channelization and Tributary, A Portion of the El Mirage Master Drainage Plan Prepared by: A-N West, Inc. January 14, 2000		X			X
ANW-3				Reems Road Project Flood Control District Project Proposal from City of Surprise Prepared by: A-N West, July 1999	City of Surprise	X			
ANW-4				Flood Control District Project Proposal from City of El Mirage September 1998 Prepared by: A-N West Inc.	A-N West	X			
ASL-1				Drainage Design Report for the Estrella Roadway and Grade Separation Project, Phase I Prepared for the MCDOT, Revised February 25, 2000 Prepared by: ASL Consulting Engineers, Arizona Inc.	FCDMC	X			
ASL-2		X		Drainage Improvements Outfalling to the RID Overchute - Litchfield Road and Neolin Avenue Prepared for the City of Litchfield Park, Prepared by: ASL Consulting Engineers, Arizona Inc.	FCDMC	X			X
ATL-1				Report of Geotechnical Investigation for SGC Engineering Company September 26, 1994 Prepared by: ATL, Inc.	EEC				
B&R-1		X		Pebblecreek Phase II, Master Drainage Report Revised August 1998 Prepared by: B&R Engineering, Inc.	Goodyear	X			X
B&R-2				Pebblecreek Phase 1 P.A.D. Book Prepared by: B&R Engineering, Inc.	COG				
B&R-3				Conceptual Master Drainage Report, Pebblecreek Golf Resort Revised September 1992 Prepared by: B&R Engineering, Inc.	COG				
BEN-1		X		Final Report, Evaluation of Oil/Water Separator (912) and Storm Water Systems Analysis Prepared by: The Benham Group/Phoenix, 30 March 1990					
BHA-1				Estrella Parkway, Yuma Road to 1/4 Mile North of McDowell Road Final Drainage Report, June 1999 Prepared by: Brooks, Hersey & Associates, Inc.		X			X
CBA-1		X		Estrella Freeway State Route 303L S.R. 85 to Interstate 17, Maricopa County, Arizona Final Environmental Assessment Prepared for: ADOT Prepared BY: CBA/Kimley-Horn, September 11, 1991 Project RAM-600-9-301	FCDMC	X			
CBA-2				Final Drainage Report, Camelback Road, Litchfield Road to El Mirage Prepared for MCDOC		X			X

Bibliography

Catalog #	Reviewed By ES	RS	JB		Received From	URSGWC	D&M	LSD	EEC
				Prepared by: Cella Barr Associates, July 1998					
CE-1		X		Drainage Report Channelization Of Reems Road Floodplain Greenway Road To Hearn Road and CLOMR Prepared For: Legacy Land Development and Kaufman & Broad Prepared By: Clouse Engineering, June 1999	CE	X			
CE-2				Master Drainage Study for Arizona Traditions Prepared by: Clouse Engineering, January 12, 1996		X			
CE-3				Drainage Report for Greenway Parc at Surprise Two Prepared by: Clouse Engineering, July 22, 1999	City of Surprise	X			
CE-4				Drainage Report for Greenway Parc at Surprise One Prepared by: Clouse Engineering, March 18, 1999		X			
CEN-1				Rezoning Request for Final Planned Area Development Area, Goodyear, AZ Prepared for: City of Goodyear Prepared for: Centerra LLC	COG				
CLOMR-1				Application Information: CLOMR for Lower El Mirage Wash Trib Consultant: David Evans & Assoc., No. FA96-096		X			X
CLOMR-2				Application Information: CLOMR for Dysart Drain of White Tanks / Agua Fria ADMS VOLUME 1 (FEMA Forms Computer Model Hardcopy, Output and Diskette)		X			
CLOMR-3				Application Information: CLOMR for Dysart Drain of White Tanks / Agua Fria ADMS VOLUME 2 (Project Construction Plan Drawings and floodplain revision workmaps)		X			
CLOUSE-1		X		Drainage Report for Sarival Gardens Prepared by: Clouse Engineering, Inc., November 1, 1999	Goodyear	X			X
CMX-1		X		Pueblo Verde Preliminary Drainage Plan Prepared for: Recorp Inc., August 1999 Prepared by: CMX Group, Inc.	Goodyear	X			X
COA-1				City of Avondale, Public Works Department, Engineering Division Engineering Design Standards June 1997	Avondale?	X			
COE-1			X	McMicken Dam Flood Control Prepared by: US Army Corps of Engineers		X			
COG-1				City of Glendale Policies for Lands West of the Agua Fria River Prepared by the City of Glendale, December 1989	FCDMC	X			
COG-2				Design Guidelines For Site Development and Infrastructure Construction Prepared by the City of Glendale, 1997		X			
COGY-1				Zoning Ordinance of the City of Goodyear, Arizona Adopted May 24, 1999	Goodyear	X			
COGY-2				Engineering Design Standards and Policies Manual City of Goodyear , July 22, 1997	Goodyear	X			
COL-1				Request for Letter of Map Revision, Flood Insurance Rate Map, Federal Emergency Management Agency Technical Data Notebook Cotton Lane: Glendale Avenue to Northern Avenue Prepared by: Collins/Pina Consulting Engineers, November 1997		X			
CRS-1			X	Recommendation Report: Colter Channel Project, November 1992 Prepared by: CRSS Civil Engineers / Wood, Patel & Associates		X			
CVL-1			X	Preliminary Drainage Report for Roseview, Surprise, Arizona Prepared By: Coe & Van Loo Consultants, Inc. August 10, 1998	FCDMC	X			
CVL-2			X	Master Drainage Report for Northwest Ranch, Surprise, Arizona Prepared By: Coe & Van Loo Consultants, Inc. July 17, 1997	FCDMC	X			
CVL-3			X	Drainage Report for Northwest Ranch Phase I, Surprise, Arizona Prepared By: Coe & Van Loo Consultants, Inc. Revied July 24, 1997	FCDMC	X			
CVL-4			X	Preliminary Drainage Report for Surprise Farms, Surprise, Arizona Prepared By: Coe & Van Loo Consultants, Inc. July 31, 1998	FCDMC	X			
CVL-5			X	Drainage Report for Northwest Ranch Phase I, Surprise, Arizona Prepared By: Coe & Van Loo Consultants, Inc. Revised July 24, 1998	FCDMC	X			
CVL-6				Preliminary Drainage Report for Wigwam Creek, Maricopa Co, AZ Prepared for: Continental Homes, March 4, 1999, Rev. Aug. 17, 1999 Prepared by: Coe & Van Loo Consultants		X			
CVL-7				Drainage Report for Litchfield Park Detention Facility June 1989, Revised March 1990 Prepared by: Coe & Van Loo		X			
CVL-8		X		Conceptual Drainage Report for Goodyear Planned Regional Center, Goodyear, Arizona August 30, 1999, Revised October 12, 1999	City of Goodyear	X			X

Bibliography

Catalog #	Reviewed By ES	RS	JB		Received From	URSGWC	D&M	LSD	EEC
				Prepared by: Coe & Van Loo Consultants, Inc.					
CVL-9-AI				Master Drainage Report for Rancho Santa Fe Prepared for: Continental Homes, February 24, 1994 Prepared by: Coe & Van Loo Consultants, Inc.		X			
CVL-10				Master Drainage Report, Kingswood Parke Prepared for: Del Webb's Sun City West, March 20, 1995 Prepared by: Coe & Van Loo Consultants, Inc.		X			
CVL-11		X		Master Drainage Report for Canyon Trails, Goodyear, Arizona Prepared for: Continental Homes, 2nd Rev. 11-12-99 Prepared by: Coe & Van Loo Consultants, Inc.	Goodyear	X			X
CVL-12				Rezoning Request for a Planned Area Development Plan Canyon Trails III, Goodyear, Arizona, Rev. 2-29-2000 Prepared by: Coe & Van Loo Consultants, Inc.					
CVL-13				Master Drainage Report for Estrella Aerospace Center, Goodyear, AZ February 23, 2000 Prepared by: Coe & Van Loo Consultants, Inc.	EEC				
CLV-14				Master Drainage Report for Estrella-Industrial Park, Goodyear, AZ January 4, 2000 Prepared by: Coe & Van Loo Consultants, Inc.	EEC				
CVL-15				Conceptual Drainage Report for Goodyear Planned Regional Center, Goodyear, AZ August 30, 1999 Prepared by: Coe & Van Loo Consultants, Inc.	COG				
CVL-16				Master Drainage Report for Estrella Aerospace Center, Goodyear, AZ February 23, 2000 Prepared by: Coe & Van Loo Consultants, Inc.	COG				
CVL-17				Master Drainage Report for Roseview, Surprise, Arizona August 10, 1998 Prepared by: Coe & Van Loo Consultants, Inc.	EEC				
CVL-18				Drainage Report for Roseview - Parcels 3 & 4, Surprise, Arizona January 12, 1999 Prepared by: Coe & Van Loo Consultants, Inc.	EEC				
CVL-19				Drainage Report for Roseview - Parcel 5 February 5, 1999 Prepared by: Coe & Van Loo Consultants, Inc.	EEC				
CVL-20				Drainage Report for Roseview - Parcel 2 December 11, 1998 Prepared by: Coe & Van Loo Consultants, Inc.	EEC				
CVL-21				Drainage Report for Roseview - Parcel 1 Rev. March 3, 1999 Prepared by: Coe & Van Loo Consultants, Inc.	EEC				
CVL-22				Drainage Report for Roseview - Parcel 6 February 24, 1999 Prepared by: Coe & Van Loo Consultants, Inc.	EEC				
CVL-23		X		Master Drainage Report for Litchfield Phase I Prepared for SunCor Development Company, October 1989 Prepared by: Coe & Van Loo Consulting Engineers, Inc.					
DAME-1				Design Issues Memorandum, White Tanks FRS #3 Modification Design Project Prepared for FCDMC, February 10, 2000 Prepared by: Dames & Moore	Dames & Moore	X			X
DAW-1				Drainage Report, Wal-Mart Prepared for: Wal-Mart Stores, Revised January 13, 2000 Prepared by: Dunaway Associates West, Inc.		X			
DCC-1		X		Estrella Corridor Study, MC 85 to Interstate 17 Drainage Technical Memorandum Prepared For: Maricopa County DOT Prepared By: DeLeuw Cather & Company, August 17, 1998 Contract No. CY1997-14, Work Order No. 80505	FCDMC	X			
DEA-1				Final Drainage Report, Dreaming Summit, Unit 1 December 1999 Prepared by: David Evans and Associates, Inc.		X			
DEA-1B				Final Drainage Report, Dreaming Summit, Unit 1 Revised May 2000 Prepared by: David Evans and Associates, Inc.	FCDMC				
DEA-2				Final Drainage Report, Dreaming Summit, Unit 2B January 2000 Prepared by: David Evans and Associates, Inc.		X			
DEA-2B				Final Drainage Report, Dreaming Summit, Unit 2B Revised June 2000 Prepared by: David Evans and Associates, Inc.	FCDMC				

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DEA-3				Infrastructure Drainage Report, Dreaming Summit January 2000 Prepared by: David Evans and Associates, Inc.		X			
DEA-3B				Infrastructure Drainage Report, Dreaming Summit Revised May 2000 Prepared by: David Evans and Associates, Inc.					
DEA-4				Final Drainage Report, Dreaming Summit, Unit 2A January 2000 Prepared by: David Evans and Associates, Inc.		X			
DEA-4B				Final Drainage Report, Dreaming Summit, Unit 2A Revised April 2000 Prepared by: David Evans and Associates, Inc.	FCDMC				
DEA-5				Master Drainage Report, Dreaming Summit November 1999 Prepared by: David Evans and Associates, Inc.		X			
DEA-6				Master Drainage Report, Bell West Ranch March 1999 Prepared by: David Evans and Associates, Inc.		X			
DEA-7				Final Drainage Report, Bell West Ranch, Parcel 4 July 1998 Prepared by: David Evans and Associates, Inc.		X			
DEA-8				Final Master/Infrastructure Drainage Report for West Point Towne Ctr Prepared for: Group Six Properties, July 1996 Prepared by: David Evans and Associates, Inc.		X			
DEA-9-AI				Final Drainage Report for the Villages at West Point Prepared for: The Estes Company, August 1996 Prepared by: David Evans and Associates, Inc.		X			
DIB-1			X	White Tanks Flood Retention Structure No. 4 Inlet Improvements Conceptual Design Report Prepared For: Maricopa County Flood Control District Prepared By: Dibble & Associates, July 1993 Contract No. FCD 92-38CY1997-14, Work Order No. 80505	DIB	X			
DIB-2				Offsite Drainage Design Report January 1976 Prepared by: Dibble and Associates	ADOT				
DIB-3				Final Design and Quantity Calculations White Tanks No. 4 FRS Inlet Improvements, October 28, 1994 Prepared by: Dibble and Associates	EEC				
EEC-1				White Tanks / Agua Fria Area Drainage Master Study - Update Hydrology Draft Prepared for: Flood Control District of Maricopa County Prepared by: eec May 17, 2000		X			
EEC-2				White Tanks / Agua Fria Area Drainage Master Study - Update Hydrology Draft Prepared for: Flood Control District of Maricopa County Prepared by: eec August 9, 2000		X			
EEC-3				Vol. I Existing Conditions Hydrology, HEC-1, 1/5/01 Prepared for FCDMC Prepared by: EEC Consultants					
EEC-4				Vol. II, Existing Conditions Hydrology Retention/Routing, 1/5/01 Prepared for FCDMC Prepared by: EEC Consultants					
EEC-5				Vol. III, Existing Conditions Hydrology Input Parameters, 1/5/01 Prepared for FCDMC Prepared by: EEC Consultants					
EEC-6				Palm Valley Master Drainage Report for Areas Contributing to Bullard Wash Proposed Conditions, September 3, 1997 Received from EEC Consultants	EEC				
ENT-1		X		Final Report: Drainage Channel Right-of-Way Requirement Study for West Half of Estrella Freeway Loop 303 from I-10 to Bell Road Work Order No. 80505 Prepared for Maricopa County DOT Prepared By: Entellus, March 1997	FCDMC	X			
ETR-1				Final Design Concept Report Dysart Road, Cactus Road to Greenway Road, WO #68968 Submitted by: Entranco, March 10, 1999					
FCD-1				Data Delivery Specifications: The Hydrologic Information System (H.I.S.) Revision 3.1, June 1, 1998 Flood Control District of Maricopa County	FCDMC	X	X	X	X

Bibliography

Catalog #	Reviewed By ES	RS	JB		Received From	URSGWC	D&M	LSD	EEC
FCD-2				Loop 303 Corridor/White Tanks Area Drainage Master Plan Update Contract FCD 99-40 / C69.00.090.5 Flood Control District of Maricopa County	FCDMC	X			
FCD-3				Consultant Guideline Flood Control District of Maricopa County, October 1, 1998	FCDMC	X	X	X	X
FCD-4				El Mirage Drainage Improvement Project; Resolution FCD 1999RO15 Flood Control District of Maricopa County, Nov 1999	FCDMC	X			
FCD-5		X		Bullard Wash Channel Improvements - Technical Data Notebook Volume 1 of 2 FCD #95-39 Prepared For: Federal Emergency Management Agency (FEMA) Prepared By: Flood Control District of Maricopa County (FCDMC)	FCDMC	X			X
				FCD Library Listings For:	FCDMC	X			
FCD-6				Sun City West					
FCD-6				Dysart					
FCD-6				Luke					
FCD-6				Agua Fria					
FCD-6				El Mirage					
FCD-6				South Mountain					
FCD-6				43rd Avenue and Southern					
FCD-6				Salt-Gila					
FCD-6				Upper Gila					
FCD-6				Colter					
FCD-6				Durango					
FCD-6				Reed					
FCD-6				South Phoenix					
FCD-6				Cotton					
FCD-6				Numerical Listings in Title					
FCD-6				Holly Acres					
FCD-6				Allenville					
FCD-6				Surprise					
FCD-6				Buckeye					
FCD-6				Avondale					
FCD-6				Laveen					
FCD-6				Litchfield Park					
FCD-6				RID Overchute					
FCD-6				Bullard					
FCD-7		X	X	A Chronology of Significant Floodplain Management Events Prepared for: The Flood Control District Prepared by: The Flood Control District		X			
FCD-8				Waddell/Lower El Mirage Wash Project Project Proposal, City of Surprise Jul-99	FCDMC	X			
FCD-9				Hydrologic Analysis for White Tanks Flood Retarding Structure No. 3 Watershed Prepared for: The Flood Control District Prepared by: The Flood Control District, May 11, 2000	FCDMC				
FIS-1				Flood Insurance Study, Maricopa County, Arizona Volume 1 of 12 FEMA, Sept. 30, 1995		X			
FIS-2				Flood Insurance Study, Maricopa County, Arizona Volume 2 of 12 FEMA, Sept. 30, 1995		X			
FIS-3				Flood Insurance Study, Maricopa County, Arizona Volume 3 of 12 FEMA, Sept. 30, 1995		X			
FIS-4				Flood Insurance Study, Maricopa County, Arizona, Unincorporated Areas FEMA, May 1979		X			
FIS-5				Flood Insurance Study, City of Avondale, Arizona FEMA, August 1982		X			
FIS-6				Flood Insurance Study, Town of Buckeye, Arizona FEMA, August 1979		X			
FIS-7				Flood Insurance Study, City of Glendale, Arizona FEMA, September 1981		X			
FIS-8				Flood Insurance Study, Town of Goodyear, Arizona FEMA, January, 1979		X			
FIS-9				Flood Insurance Study, Town of El Mirage, Arizona FEMA, June, 1978		X			
FIS-10				Flood Insurance Study, Town of Surprise, Arizona FEMA, March, 1983		X			
GI-1-AI				Final Drainage Report, Palmilla Apartments Prepared for: FF Development, Revised December 17, 1998 Prepared by: Geodimensions, Inc.		X			
GIL-1-AI				Quintero Lane (Off-Site) December 27, 1999		X			

Bibliography

Catalog #	Reviewed By				Received From	URSGWC	D&M	LSD	EEC
	ES	RS	JB						
				Prepared by: Gilbertson Associates, Inc.					
GIL-2-AI				BLM Offroads Quintero December 29,1 999 Prepared by: Gilbertson Associates, Inc.		X			
HE-1		X		Final Drainage Report for Rancho Mirage Prepared for: Marwest Group, June 1999 Prepared by: Hook Engineering, Inc.		X			
HUN-1		X		White Tanks Mountain Ranch Development Master Plan Prepared for: White Springs, LLC Prepared by: Hunn & Associates, December 10, 1999	Hunn	X			
HUN-2		X		White Tanks Foothills Development Master Plan Preliminary Master Drainage Report Prepared for: Hinton Financial Services, March 2000 Prepared by: Hunn & Associates, Inc.		X			
HUN-3-AI				Northern Channel and Basin Diversion Project - Five-Year CIP Application Prepared for: FCDMC Prepared by: Hunn & Associates, Inc., July 21, 2000	FCDMC				
HUN-4				White Tank Mountain Ranch Development Master Plan Final Master Drainage Report, Rev. April 27, 2000 Prepared by: Hunn & Associates, Inc.	EEC				
IES-1-AI				Final Drainage Report for Las Palmeras West Prepared for: Pulte Homes, Revised July 8, 1999 Prepared by: Infinity Engineering Services, Ltd.		X			
IES-2-AI				Final Drainage Report for Sage Creek Prepared for: Presley Homes, Revised February 1, 2000 Prepared by: Infinity Engineering Services, Ltd.		X			
JEF-1			X	CLOMR, Technical Data Notebook For Bullard Wash Maricopa County Sections 2.371 - 6.320 Prepared for: Pinnacle Engineering, INC Prepared by: JE Fuller/Hydrology & Geomorphology, Nov 1998	JEF	X			
JEF-2				Conditional Letter of Map Revision (CLOMR) Technical Data Notebook for Bullard Wash; Maricopa County, Arizona Prepared for: Pinnacle Engineering, Inc. Prepared by: JE Fuller/Hydrology & Geomorphology, June 1999	COG				
KE-1		X		Master Drainage Plan, Wildflower Community, Goodyear, Arizona Rev. April 1996 Prepared by: Keogh Engineering, Inc.	City of Goodyear	X			X
KE-2-AI				Drainage Report, Litchfield Subdivision, Surprise, Arizona July 1997 Prepared by: Keogh Engineering, Inc.		X			
LE-1				Preliminary Drainage Report, Countryside A Planned Area Development on 200 Acres Located on the East Side of Reems Road, South of Greenway Road, Surprise Prepared for: Ryland Homes Prepared by: Landmark Engineering, Inc., September 17, 1999	City of Surprise	X			
LME-1				Final Drainage Report for Greenway Parc at Surprise Three Prepared for: Legacy Land Development Prepared by: La Marca Engineering Group, Rev. July 1, 1999	City of Surprise	X			
LOMR-1				Floodplain Administration Application Information LOMR Application to FEMA, FA98-034 Submitted by: Stanley Consultants for Del Webb, April 22, 1998		X			
LOOP 303-RD				General Information, Loop 303 by Maricopa County		X			
LOOP 303-RD-1				Greenway Road Improvements in the City of Surprise By the CMX Group Inc. For:Maricopa County Dpartment of Transportation	MCFCD	X			
LOOP 303-RD-2				West Valley Recreation Corridor Del Rio - www.wilburforce.org/htguide1.htm By: Carter-Burgess For: Not clear	MCFCD	X			
LOOP 303-RD-3				Bullard Wash Corridor Aesthetic/Multi-Use Improvements - Goodyear The City of Goodyear's plan for parks and trails along Bullard Wash By: The City of Goodyear For: The City of Goodyear (Kevin Kugler)	MCFCD	X			
LOOP 303-RD-4				White Tank and Grand Avenue Area Plan Updates Project Advisory (PAC) Committee Meeting #1 Agenda and Information By: Matt Holm (MCPDD) For: Russ Miracle (MCFCD)	MCFCD	X			
LOOP 303-RD-5				Figure showing downstream floodplain of central pipe - WT#3 FRS By: Bing @ FCD For: N/A					

Bibliography

Catalog #	Reviewed By ES	RS	JB		Received From	URSGWC	D&M	LSD	EEC
LOOP 303-RD-6				Arizona Geology "Ground Water Pumping Causes Arizona to Sink" By: Larry D. Fellows For: N/A					
LOOP 303-RD-7				US Department of the Interior "Investigation of Hydrogeology, Land Subsidence........Luke AFB, AZ" By: USGS and US Dept. of the Interior For: Administrative Report, 1995					
LOOP 303-RD-8				Neighborhood Meeting No. 1, 3/7/00, 3/9/00 Sign in Sheet and Questionnaire By: LSD For: Loop 303 ADMP Update					
LOOP 303-RD-9				Goodyear Planned Regional Center / City Council Action Form Typical Section, and Area Map By: CornoyerHedrick, February 14, 2000					
LOOP 303-RD-10				Final Plat for "Centerra" By: Fleet Fisher Engineering Inc. May 2000					
LOOP 303-RD-11				I-10/Litchfield Road Basins, Portion of Final Hydrology Study By: Parsons Brinkerhoff 1999					
LOOP 303-RD-12				Final Plat for "Rancho Mirage" By: Hook Engineering Inc. May 1999					
LSD-1				Landscape Aesthetics Assessment and Multi-Use Opportunities Assessment By: Logan Simpson Design Inc. For: Flood Control District of Maricopa County, July 6, 2000					
MAS-1		X		Conceptual Drainage Report for Commercial Center Northwest Corner of Thomas Road at Jackrabbit Trail December 1999 Prepared by: Mastec North American, Inc.	FCDMC				
MCP-1			X	White Tank / Grand Avenue Area Plan Draft 2.0 Prepared for: Maricopa County Prepared by: Maricopa County Planing & Development Dept, Oct 1999	MCP	X			
MIC-1				Salt-Gila River Floodplain Delineation Restudy Volume 1 of 5, May 1999 Submitted by: Michael Baker, Jr., Inc.		X			
MIC-2				Salt-Gila River Floodplain Delineation Restudy Volume 2 of 5, May 1999 Submitted by: Michael Baker, Jr., Inc.		X			
MIC-3				Salt-Gila River Floodplain Delineation Restudy Volume 3 of 5, May 1999 Submitted by: Michael Baker, Jr., Inc.		X			
MIC-4				Salt-Gila River Floodplain Delineation Restudy Volume 4 of 5, May 1999 Submitted by: Michael Baker, Jr., Inc.		X			
MIC-5				Salt-Gila River Floodplain Delineation Restudy Volume 5 of 5, May 1999 Submitted by: Michael Baker, Jr., Inc.		X			
NBS-1				Dysart Drain Improvement Project, 90% Plans Submittal Draft Special Provisions, Bridges and Carrier Pipes Detention Basin and Collector Channels Prepared by: NBS/Lowry Engineers, August 1994		X			
NBS-2				Dysart Drain Improvement Project, 90% Plans Submittal Design Report Submitted by: NBS/Lowry Engineers, September 1994		X			
NEIL-1		X		Master Drainage Study, Estrella Vista, Parcels A-H and Parcel 8 August 31, 1998 Prepared by Neil/McGill Consultants, Inc.	Goodyear	X			X
PA-1-AI				Master Drainage Report for Kenly Farms Subdivision Prepared for: NKA Legacy Parc, October 1997 Prepared by: Paulsell & Associates, LLC		X			
PB-1				Final Hydrology Study, I-10/Litchfield Road Basins Prepared for: ADOT Prepared by: Parsons Brinckerhoff, July 23, 1999	ADOT				
PB-2				Final Land Development Study, I-10/Litchfield Road Basin Prepared for: ADOT Prepared by: Parsons Brinckerhoff, July 13, 1999	ADOT				
PEC-1		X		Drainage Report for Preliminary PAD, Centerra Prepared for: Centerra LLC, December 3, 1999 Prepared by: Premier Engineering Corporation		X			X
PEC-2		X		Drainage Report for Preliminary PAD	PEC	X			

Bibliography

Catalog #	Reviewed By ES	RS	JB		Received From	URSGWC	D&M	LSD	EEC
				Prepared for Centerra L.L.C., Revised February 11, 2000 Prepared by: Premier Engineering Corporation					
PERMITS				Various Permits		X			
PRIM-1				Final Drainage Report, Snyder's of Hanover, I-10 and Bullard Avenue Goodyear, Arizona Prepared for: Deutsch Associates Prepared by: Primatech , LLC, January 1998	COG				
PRIM-2				Final Drainage Report for Southwest Specialty Foods, Bullard Avenue, Goodyear, Arizona Prepared for: Deutsch Associates Prepared by: Primatech, LLC, April 14, 2000	COG				
PRM-1				Application to Floodplain Administration, FA No. 94-11 Submitted by Citizens Utilities March 4, 1994		X			
PRM-2				Application to Floodplain Administration, FA No. 27-39 Submitted by Norm Hatcher, Central Development Enterprises March 4, 1987		X			
RAY-1				Camelback Garden Farms, Drainage Report March 25, 1999, Revised June 9, 1999 Prepared by: Raymond W. Stadler, PE		X			
RBF-1		X		Conditional Letter Of Map Revision Reems Road: Mountain Vista Ranch Development FEMA Application and Technical Analysis Volume I: Main Report Prepared for: Mountain Vista Ranch LLC Prepared by: Robert Bein, William Frost & Associates, Dec 1999	RBF	X			X
RBF-2		X		Conditional Letter Of Map Revision Reems Road: Mountain Vista Ranch Development FEMA Application and Technical Analysis Volume II: Hydraulic Analysis Prepared for: Mountain Vista Ranch LLC Prepared by: Robert Bein, William Frost & Associates, Dec 1999	RBF	X			X
RH-1		X		Value Engineering Conference, February 25, 2002 Prepared by: Rider Hunt Levette & Bailey Prepared for: FCDMC					
SFC-1		X		Rid Canal Overchute/Siphon, Litchfield Road and Indian School Report of Geotechnical Investigation, Sept. 26, 1994 Prepared by: SFC Engineering Company		X			X
SFC-2		X		RID Overchute Project, Design Report, July 1997 Prepared for FCDMC, FCD #94-07 Prepared by: SFC Engineering Corporation		X			X
SFC-3		X		Dysart Drain Detention Basin, Proposed Basin Modifications, March 1995 Prepared for: Luke Air Force Base Prepared by: SFC Engineering Corporation		X			
SGE-1				"Bel Fleur" Final Drainage Report Prepared for: Hancock Communities, April 12, 1999 Prepared by: Sage Engineering Corporation		X			
STD-1				Montana Farms Preliminary Drainage Study Prepared by: Stadler Consulting Engineers, Feb. 5, 1998		X			
STN-1		X		Sun City Grand Project, Reems Road Floodplain Preliminary Hydrology for Letter of Map Revision Prepared by: Stanley Consultants, Jan. 1998, Rev. Feb. 1998	EEC	X			
STN-2		X		Sun City Grand Project, Reems Road Floodplain Request for Letter of Map Revision Prepared by: Stanley Consultants, March 1998	EEC	X			
STN-3		X		Delineation of Spillway Flows for Buckeye Structures 1, 2 and 3 Final Report and Tech Data Notebook, October 1996 Prepared by: Stanley Consultants for FCDMC		X			
STN-4				Master Drainage Report for Del Webb's Grand Avenue Property December 1994 Prepared by: Stanley Consultants	EEC				
SUR-1				Surprise General Plan 2020: Imagine the Possibilities 60-Day Review Draft, March 2000 Prepared by: The City of Surprise	FCDMC	X			X
TEC-1		X		A Comprehensive Analysis of a Major Storm and Associated Flooding in Arizona, Tech. Bulletin 202 Submitted by: University of Arizona, Tucson, May 1973		X			
303-OVRLY		X		Loop 303 Drainage Master Study Map with Overlays	FCDMC	X			
URS-1		X		Draft Data Collection Report Prepared for FCDMC Prepared by URS Greiner Woodward Clyde, February 2000		X			
URS-2				HEC-1, Existing Condition Hydrology Submittal to FCDMC					

URS Greiner Woodward Clyde
December 3, 1999
Project Manager: Elliot Silverston

Bibliography

Catalog #	Reviewed By ES	RS	JB		Received From	URSGWC	D&M	LSD	EEC
				Input and Output Files, March 29, 2001 Prepared by URS (three volumes)					
URS-3		X		Draft NAOS, First Flush & Retention Waiver Analysis, June 2002 Prepared by: URS Prepared for: FCDMC					
URS-4		X		Project Work Plan, May 14, 2001 Prepared by: URS Prepared for: URS/FCDMC					
URS-5		X		SR 303L, Indian School Road to Clearview Boulevard, DCR, April 24, 2002 Prepared by: URS Prepared for: MCDOT					
URS-6		X		White Tanks FRS #3, Design Issues/Basin Alternatives Report, August, 2001 Prepared by:URS Prepared for: FCDMC					
URS-7		X		Phase I Environmental Site Assessment, April 17, 2001 Prepared by:URS Prepared for:FCDMC					
URS-8		X		Draft Level I Alternatives Report, February 2002 Prepared by:URS Prepared for:FCDMC					
URS-9		X		Draft Level II Phase I Draft Alternatives Technical Memo, February 2002 Prepared by:URS Prepared for:FCDMC					
URS-10		X		Level II Draft Phase II Alternatives Analysis Report, September 2001 Prepared by:URS Prepared for:FCDMC					
URS-11		X		SR 303L Indian School Road to Clearview Blvd, Initial Drainage Report, April 16, 2002 Prepared by:URS Prepared for:FCDMC					
URS-12		X		Draft Existing Condition Hydrology, June 2001 Pepared by:URS Prepared for:FCDMC					
URS-13		X		Draft Level I Alternatives Analysis Report, May 2000 Pepared by:URS Prepared for:FCDMC					
URS-14		X		Draft Level II Phase I Technical Memo for the Bullard Wash - Thomas to Lower Buckeye, September 2000 Pepared by:URS Prepared for:FCDMC					
URS-15		X		Landscape Aesthetics Assessment and Multi-Use Opportunities Assessment, April 17, 2000 Prepared by:Logan Simpson Design Prepared for:FCDMC					
URS-16				Draft Composite Channel Analysis, September, 2002 Pepared by:URS Prepared for:FCDMC					
URS-17		X		Bullard Wash LOMR through Pebble Creek/Palm Valley Pepared by:WLB Group and B&R Engineering Prepared for: City of Goodyear/FEMA	FCDMC				
URS-18		X		Bullard Wash FIS through Pebble Creek/Palm Valley Pepared by:Current FEMA FIS Data Prepared for: N/A	FEMA				
URS-19		X		Additional Survey Cross Sections - Plotted and described in Excel Pepared by:URS Prepared for: L303 ADMP Update - FCDMC	URS Survey				
USGS-1		X		Investigation of Hydrogeology, Land Subsidence, and Earth Fissures, Luke Air Force Base, Arizona Administrative Report, Tucson, Arizona, 1995 Prepared by US Department of the Interior		X			
WA-1		X		City Of Litchfield Park Master Drainage Study Report Prepared for: City Of Litchfield Park Prepared by: Willdan Associates, March 1989		X			
WLB-1		X		White Tanks/Agua Fria Area Drainage Master Study Part A: Flood Study Technical Data Notebook Prepared For: FCDMC Prepared By: The WLB Group, Inc., October 1992	FCDMC	X			
WLB-2		X		White Tanks/Agua Fria Area Drainage Master Study Part B: Area Drainage Master Plan Prepared For: FCDMC Prepared By: The WLB Group, Inc., December 1994	FCDMC	X			
WLB-3 (OFF)		X		White Tanks/Agua Fria Area Drainage Master Study Floodplain Maps Prepared For: Flood Control District of Maricopa County Prepared By: The WLB Group, Inc., December 22, 1989	FCDMC	X			
WLB-4			X	White Tanks/Agua Fria Area Drainage Master Study Appendix A: ADMP Hydologic Analysis (HEC-1 Output) Prepared For: FCDMC Prepared By: The WLB Group, Inc., May 28, 1992	FCDMC	X			
WLB-5			X	White Tanks/Agua Fria Area Drainage Master Study Appendix B: Vol 1 of 15; Field Survey Data Prepared For: FCDMC Prepared By: The WLB Group, Inc., May 28, 1992	FCDMC	X			
WLB-6			X	White Tanks/Agua Fria Area Drainage Master Study Appendix B: Vol 2 of 15; Field Survey Data Prepared For: FCDMC Prepared By: The WLB Group, Inc., May 28, 1992	FCDMC	X			
WLB-7			X	White Tanks/Agua Fria Area Drainage Master Study Appendix B: Vol 3 of 15; Field Survey Data	FCDMC	X			

Bibliography

Catalog #	Reviewed By ES	RS	JB		Received From	URSGWC	D&M	LSD	EEC
				Prepared For: FCDMC Prepared By: The WLB Group, Inc., May 28, 1992					
WLB-8			X	White Tanks/Agua Fria Area Drainage Master Study Appendix C: Vol 4 of 15; HEC-1 Output Results, Numerical Runoff Summary, HEC-1 Runoff Summary Table Prepared For: FCDMC Prepared By: The WLB Group, Inc., May 28, 1992	FCDMC	X			
WLB-9			X	White Tanks/Agua Fria Area Drainage Master Study Appendix D: Vol 5 of 15; Manning's N-Value Picture Documentation Prepared For: FCDMC Prepared By: The WLB Group, Inc., May 28, 1992	FCDMC	X			
WLB-10			X	White Tanks/Agua Fria Area Drainage Master Study Appendix E: Vol 6 of 15; S-Graph Input Parameters, Soils Tables Prepared For: FCDMC Prepared By: The WLB Group, Inc., May 28, 1992	FCDMC	X			
WLB-11			X	White Tanks/Agua Fria Area Drainage Master Study Appendix F: Volume 7 of 15: MCUHP2 Input Data Prepared For: FCDMC Prepared By: The WLB Group, Inc., May 1992	FCDMC	X			
WLB-12			X	White Tanks/Agua Fria Area Drainage Master Study Appendix G: Vol 8 of 15; Channel Routing Parameters Prepared For: FCDMC Prepared By: The WLB Group, Inc., May 28, 1992	FCDMC	X			
WLB-13			X	White Tanks/Agua Fria Area Drainage Master Study Appendix H: Vol 9 of 15; Velocity Calculations Prepared For: FCDMC Prepared By: The WLB Group, Inc., May 28, 1992	FCDMC	X			
WLB-14			X	White Tanks/Agua Fria Area Drainage Master Study Appendix I: Volume 10 of 15: Discharge & Diversion Tables, Exst Struct Prepared For: FCDMC Prepared By: The WLB Group, Inc., May 1992	FCDMC	X			
WLB-15			X	White Tanks/Agua Fria Area Drainage Master Study Appendix J: Volume 11 of 15: HEC-2 Output Results; Wash 1-5A Prepared For: FCDMC Prepared By: The WLB Group, Inc., May 1992	FCDMC	X			
WLB-16			X	White Tanks/Agua Fria Area Drainage Master Study Appendix J: Volume 12 of 15: HEC-2 Output Results; Wash 5B-9 Prepared For: FCDMC Prepared By: The WLB Group, Inc., May 1992	FCDMC	X			
WLB-17			X	White Tanks/Agua Fria Area Drainage Master Study Appendix J: Volume 13 of 15: HEC-2 Output Results; Wash 10-21 Prepared For: FCDMC Prepared By: The WLB Group, Inc., May 1992	FCDMC	X			
WLB-18			X	White Tanks/Agua Fria Area Drainage Master Study Appendix K: Volume 14 of 15: Stream Profiles Prepared For: FCDMC Prepared By: The WLB Group, Inc., May 1992	FCDMC	X			
WLB-19			X	White Tanks/Agua Fria Area Drainage Master Study Appendix L: Volume 15 of 15: Study Abstracts Prepared For: FCDMC Prepared By: The WLB Group, Inc., May 1992	FCDMC	X			
WLB-20			X	White Tanks/Agua Fria Area Drainage Master Study Appendix B: Beardsley Canal Wash Improvement Project Prepared For: FCDMC Prepared By: The WLB Group, Inc., Aug 1993	FCDMC	X			
WLB-20			X	White Tanks/Agua Fria Area Drainage Master Study Appendix C: Improvements To Tuthill Dike Wash (Alternative No. 1) Prepared For: FCDMC Prepared By: The WLB Group, Inc., Dec 1994	FCDMC	X			
WLB-20			X	White Tanks/Agua Fria Area Drainage Master Study Appendix D: Improvements To Tuthill Dike Wash (Alternative No. 2) Prepared For: FCDMC Prepared By: The WLB Group, Inc., Dec 1994	FCDMC	X			
WLB-20			X	White Tanks/Agua Fria Area Drainage Master Study Appendix E: Improvements To Jackrabbit Trail Wash Prepared For: FCDMC Prepared By: The WLB Group, Inc., Dec 1994	FCDMC	X			
WLB-20			X	White Tanks/Agua Fria Area Drainage Master Study Appendix F: Estella Freeway Channel Prepared For: FCDMC Prepared By: The WLB Group, Inc., Dec 1994	FCDMC	X			
WLB-20			X	White Tanks/Agua Fria Area Drainage Master Study Appendix G: I-10 Channel Prepared For: FCDMC Prepared By: The WLB Group, Inc., Dec 1994	FCDMC	X			

Bibliography

Catalog #	Reviewed By ES	RS	JB		Received From	URSGWC	D&M	LSD	EEC
WLB-20			X	White Tanks/Agua Fria Area Drainage Master Study Appendix H: Reems Road Channel Prepared For: FCDMC Prepared By: The WLB Group, Inc., Dec 1994	FCDMC	X			
WLB-20			X	White Tanks/Agua Fria Area Drainage Master Study Appendix I: Waddell Road Channel Prepared For: FCDMC Prepared By: The WLB Group, Inc., Dec 1994	FCDMC	X			
WLB-20			X	White Tanks/Agua Fria Area Drainage Master Study Appendix J: Bullard Wash Channel Prepared For: FCDMC Prepared By: The WLB Group, Inc., Dec 1994	FCDMC	X			
WLB-21		X		Dysart Drain Improvement Project Concept Design Study Selected Alternative Prepared For: FCDMC Prepared By: The WLB Group, Inc., Aug 1993	FCDMC	X			
WLB-22		X		Addendum To Dysart Drain Improvement Project Concept Design Study Selected Alternative Prepared For: FCDMC Prepared By: The WLB Group, Inc., Nov 1993	FCDMC	X			
WLB-23			X	Master Drainage Study For Palm Valley Prepared For: FCDMC Prepared By: The WLB Group, Inc., August 1998; Rv: July 1999	FCDMC	X			
WLB-24				Camelback Road Channel, Concept Design Report Litchfield Road to Agua Fria River, October 21, 1993 Prepared for MCDOT Prepared by: The WLB Group, Inc.					
WLB-25				Master Drainage Study for Palm Valley March 8, 1998 Prepared by: The WLB Group, Inc.	COG				
WLB-26				Palm Valley Phase I Golf Course LOMR RID Canal Overchute to ADOT Detention Basins Prepared by: The WLB Group, Inc.	EEC				
WLB-27				Addendum to Drainage Design Report for Palm Valley Phase IIIA Indian School Road Interim Condition Channel, Rev. October 1999 Prepared by: The WLB Group, Inc.	EEC				
WLB-28				Palm Valley Concept Drainage Plan for the Roosevelt Canal Watershed Rev. December 17, 1996 Prepared by: The WLB Group, Inc.	EEC				
WLB-29				Drainage Report for Palm Valley Phase 2 Mass Grading Rev. November 23, 1998 Prepared by: The WLB Group, Inc.	EEC				
WLB-30				Revision for: The Roosevelt Irrigation District (RID) Canal Over-Chute Hydrologic Model, Rev. June 24, 1999 Prepared by: The WLB Group, Inc.	EEC				
WPA-1		X		Bullard Wash Channel Improvements - Technical Data Notebook Volume 2 of 2 FCD #95-39 Prepared For: Sverdrup Civil, Inc. & MCFCD Prepared By: Wood, Patel & Associates, Inc.	FCDMC	X			
WPA-2			X	Bullard Wash Channel Improvements - Final Design Volume 1 of 2 FCD #98-15 Prepared For: MCDOT & MCFCD Prepared By: Sverdrup Civil, Inc.	FCDMC	X			
WPA-3			X	Bullard Wash Channel Improvements - Final Design Volume 2 of 2 FCD #98-15 Prepared For: MCDOT & MCFCD Prepared By: Sverdrup Civil, Inc. & Wood, Patel & Associates, Inc.	FCDMC	X			
WPA-4		X		Recommendation Report: Colter Channel Project, November 1992 Prepared by: CRSS Civil Engineers / Wood, Patel & Associates		X			
WPA-5				Master Drainage Plan for the Caterpillar Property Prepared for: DMB White Tank LLC, Revised Aug. 16, 1999 Prepared by: Wood, Patel & Associates		X			
WPA-6				Maryvale Area Drainage Master Study Floodplain Mitigation Study Prepared for: The Flood Control District Prepared by: Wood, Patel and Associates, Inc. , Nov 12, 1997		X			
WPA-7				Maryvale Area Drainage Master Study Floodplain Mitigation Study Appendix A & B Prepared for: The Flood Control District Prepared by: Wood, Patel and Associates, Inc. , Nov 12, 1997		X			

Bibliography

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Loop 303 Corridor/White Tanks Area Drainage Master Plan Update

URS Greiner Woodward Clyde
December 3, 1999
Project Manager: Elliot Silverston

Office Location Codes

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JF: **Job File Cabinets**
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Bibliography

Category	Description	Received From	URSGWC	D&M	LSD	EEC	Date	Section	Township & Range	Area of Development	Major Crossroads	Location in Office
70% CD's	MCDOT - Plans for the Construction of:	MCDOT	X				Apr-00	Sec's 36,25,19	T4N, R2W/R1W	N/A	Union Hills bet. Cotton & Sarival	FF2
	Estrella Roadway (Loop 303) and Grade Separation Phase I											
CD's	Plans for the Construction of the site improvements for the WalMart Store Expansion	City of Avondale	X				Apr-00	NW 1/4 sec2	T1N, R1W	N/A	I-10 and Dysart Road	FF2
As-Builts	ADOT detention basins adjacent to I-10; 1/2 size plans; select sheets [I-IG-102(37)]	ADOT	X				May-00		T1N R1W	N/A	Bullard to Dysart	FF2
Plat Map	Cottonflower Preliminary Plat	The Roston Company	X			X		14	T1N R2W	235.46 ac	SW corner Yuma Rd. and Cotton Ln.	OFF
	Subdivision											
	Prepared For: The Roston Company											
	Prepared By: American Engineering											
Quad	Tolleson, AZ	USGS	X						T1N-2N; R1W-1E	N/A		FF2
Quad	Perryville, AZ	USGS	X						T1S-2N; R1W-2w	N/A		FF2
Quad	Valencia, AZ	USGS	X						T1S-2N; R2W-4W	N/A		FF2
Quad	White Tanks Mountains, SE, AZ	USGS	X						T2N-3N; R2W-4W	N/A		FF2
Quad	White Tanks Mountains, NE, AZ	USGS	X						T3N-5N; R2W-4W	N/A		FF2
Quad	Waddell	USGS	X						T2N-T3N; R1W-R2W	N/A		FF2
Quad	McMicken Dam	USGS	X						T3N-T5N; R1W-R2W	N/A		FF2
Quad	Calderwood Butte	USGS	X						T3N-T5N; R1E-R1W	N/A		FF2
Quad	El Mirage	USGS	X						T2N-T3N; R1E-R1W	N/A		FF2
CD's	Bullard Wash Channel Improvements Project	EEC	X						T1N, R1W	N/A	Lower Buckeye just E. of Estrella	FF1
Blue Prints	White Tanks Area developments	AZ Water Company	X						T1N-T2N, R2W	N/A	Van Buren And Jackrabbit Trail	
Flood Maps	Flood plain maps by WLB Group as part of original ADMS, 1994	FCD	X					Entire Area	Entire Area	N/A	N/A	OFF
CD's	Bank Stabilization, Perryville Area	FCD	X					3-4	T1S, R2W	N/A	Perryville Rd and Aqua Fria	FF2
	Prepared By: Camp Dresser & McKee Inc.											
	Prepared For: FCD											
	Date:2/23/83											
CD's/AB	Agua Fria River Channel Improvements	FCD	X					2-3,25-26,36-35	T1N,R1W; T2N,R1W	N/A	N/A	FF2
	Prepared By:Simons, Li Associates&Dibble Associates											
	Prepared For:FCD											
	Date:7/8/85											
CD's	Bank Stabilization, Holly Acres Area	FCD	X					25-26,35-36	T1N, R1w	N/A	Outside project area	FF2
	Prepared By:Camp Dresser&McKee Inc.											
	Prepared For:FCD											
	Date:5/21/84											
CD's/AB	Dysart Drain Improvements Project Reems Rd to Agua Fria River and Bridges and Utility Crossings	FCD	X					1-5,8-12	T2N,R1W	N/A	Between Northern&Glendale from Reems Rd to Agua Fria River	FF2
	Prepared By:NBS/Lowry											
	Prepared For:FCD											
	Date:12/1/99											
CD's/AB	Dysart Drain Improvements Project Reems Rd to Agua Fria River Channel Improvements	FCD	X					1-5,8-12	T2N,R1W	N/A	Between Northern&Glendale from Reems Rd to Agua Fria River	FF2
	Prepared By:NBS/Lowry											
	Prepared For:FCD											
	Date:9/95											

1. *-M = Utility is mapped
2. *-NM = Utility is not mapped

Loop 303 Corridor/White Tanks Area Drainage Master Plan Update

Office Location Codes

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P ct Manager: Elliot Silverston

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CD's/AB	Dysart Drain Improvements Project Reems Rd to Agua Fria River Detention Basin and Collector Channel	FCD	X					1-5,8-12	T2N,R1W	N/A	Between Northern&Glendale from Reems Rd to Agua Fria River	FF2
	Prepared By:NBS/Lowry											
	Prepared For:FCD											
	Date:10/94											
CD's/AB	Roosevelt Irrigation District Overchute Project - Phase I	FCD	X					27-28	T2N, R1W	N/A	Litchfield and Indian School	FF2
	Prepared By:SFC											
	Prepared For:FCD											
	Date:11/96											
CD's/AB	Roosevelt Irrigation District Overchute Project - Phase II	FCD	X					27-28	T2N, R1W	N/A	Litchfield and Indian School	FF2
	Prepared By:SFC											
	Prepared For:FCD											
	Date:----											
CD's/AB	Colter Channel	FCD	X					13-15	T2N, R1W	N/A	Between Bethany Home and Camelback from Litchfield to 115th Ave.	FF2
	Prepared By:Dibble and Associates											
	Prepared For:FCD											
	Date:9/93											
CD's/AB	White Tanks #4 FRS Inlet Improvements Roosevelt Street to McDowell Rd.	FCD	X					5,32	T1N-2N, R2W	N/A	Adjacent to Jackrabbit Trail North of McDowell to North of Van Buren	FF2
	Prepared By:Dibble and Associates											
	Prepared For:FCD											
	Date:10/94											
CD's/AB	White Tanks #4 FRS Inlet Channel Cross Sections	FCD	X					5,32	T1N-2N, R2W	N/A	Adjacent to Jackrabbit Trail North of McDowell to North of Van Buren	FF2
	Prepared By:---											
	Prepared For:FCD											
	Date:---											
CD's	Camelback road - Litchfield road to El-Mirage road	MCDOT	X					14-16,21-23	T2N, R1W	N/A	Bullard Ave. and Camelback Road	FF2
	Prepared By:CBA											
	Prepared For:MCDOT											
	Date:'99											
CD's/AB	LOMR Exhibit for the Lower El Mirage Wash Tributary Channelization	Surprise	X				Oct-01	11, 14	T3N, R1W	N/A	Dysart and Greenway	FF2
	Prepared By: A-N West Inc.											
	Prepared For: City of El Mirage											
	Date: 11/16/99											
CD's/AB	LOMR Exhibit for the Lower El Mirage Wash Channelization	Surprise	X				Oct-01	14, 23	T3N, R1W	N/A	Dysart and Thunderbird	FF2
	Prepared By: A-N West Inc.											
	Prepared For: City of El Mirage											
	5/25/2000											
l Maps	Flood plain maps by WLB Group as part of original ADMS, 1994 ***(2ND Set-Contain Detail the Set Above Didn't)***	FCD	X					Entire Area	Entire Area	N/A	N/A	OFF
FIRM Panels												
687	Flood Insurance Rate Maps (FIRM)	FCD	X				Dec-93	-----	T5-6N,R3W	N/A	Black Mt Road and Hwy 60	FF1

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Loop 303 Corridor/White Tanks Area Drainage Master Plan Update

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689	Flood Insurance Rate Maps (FIRM)	FCD	X				Dec-93	-----	T6N,R3W	N/A	Undeveloped	FF1
694	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-91	-----	TX,R2-3W	N/A	Dixeletta&211 Ave	FF1
695	Flood Insurance Rate Maps (FIRM)	FCD	X				Dec-93	-----	T5-6N,R2-3W	N/A	Grand Ave & Crozier St	FF1
715	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-91	-----	T5-6N,R2W	N/A	North of Grand Ave & 203rd Ave	FF1
720	Flood Insurance Rate Maps (FIRM)	FCD	X				Dec-93	-----	T5-6N,RX	N/A	Cotton Lane	FF1
740	Flood Insurance Rate Maps (FIRM)	FCD	X				Dec-93	-----	T5-6N,R1W	N/A	CAP Canal & Litchfield Road	FF1
745	Flood Insurance Rate Maps (FIRM)	FCD	X				Dec-93	-----	T5-6N,RX	N/A	Carefree Highway	FF1
1080	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-95	-----	T4-5N,R4-5W	N/A	Daggs Wash and Patton Rd.	FF1
1085	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-95	-----	T4-5N,R4W	N/A	West White Tank Mountains	FF1
1090	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-95	-----	T3-4N,R4-5W	N/A	CAP Canal & Hassayampa River	FF1
1095	Flood Insurance Rate Maps (FIRM)	FCD	X				Dec-93	-----	T3-4N,R4W	N/A	Carefree Highway	FF1
1105	Flood Insurance Rate Maps (FIRM)	FCD	X				Dec-93	-----	T4-5N,R3-4W	N/A	243rd Ave & Patton Rd	FF1
1110	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-91	-----	T4-5N,R2-3W	N/A	Pinnacle Peak Road and 219th ave	FF1
1115	Flood Insurance Rate Maps (FIRM)	FCD	X				Dec-93	-----	T3-4N,R3-4W	N/A	Sun Valley Pkwy & White Tanks Park	FF1
1120	Flood Insurance Rate Maps (FIRM)	FCD	X				Dec-93	-----	T3-4N,R2-3W	N/A	Sun Valley Pkwy & Crozier Rd	FF1
1130	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-91	-----	-----	N/A	Pinnacle Peak Road and 195th ave	FF1
1135	Flood Insurance Rate Maps (FIRM)	FCD	X				8/5/97-LOMR	-----	T4-5N,R1-2W	N/A	Sarival and Grand Ave	FF1
1140	Flood Insurance Rate Maps (FIRM)	FCD	X				Dec-93	-----	T3-4N,R2W	N/A	Jackrabbit Road & Union Hills Rd	FF1
1145	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-95	-----	T3-4N,R1-2W	N/A	Sarival and Union Hills Drive	FF1
1155	Flood Insurance Rate Maps (FIRM)	FCD	X				Dec-93	-----	T4-5N,R1W	N/A	El Mirage Rd & Jomax Rd	FF1
1160	Flood Insurance Rate Maps (FIRM)	FCD	X				8/5/97-LOMR	-----	T4-5N,RX	N/A	Pinnacle & Lake Pleasant	FF1
1165	Flood Insurance Rate Maps (FIRM)	FCD	X				8/5/97-LOMR	-----	T3-4N,RX	N/A	Dysart Rd. & Grand Ave.	FF1
1170	Flood Insurance Rate Maps (FIRM)	FCD	X				8/5/97-LOMR	-----	T3-4N,R1E-R1W	N/A	Bell E. of Agua Fria	FF1
1530	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-95	-----	T3N,R4-5W	N/A	East White Tank Mountains	FF1
1550	Flood Insurance Rate Maps (FIRM)	FCD	X				Dec-93	-----	T2-3N,R4-5W	N/A	East White Tank Mountains	FF1
1560	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-95	-----	T3N,R2-3W	N/A	West White Tank Mountains	FF1
1570	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-95	-----	T2-3N,R2-3W	N/A	Caterpillar Proving Grounds	FF1
1580	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-95	-----	T3N,R2W	N/A	Cactus Rd & Citrus Rd	FF1
1585	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-95	-----	T3N,R1-2W	N/A	Cactus Rd & Reems Rd.	FF1
1590	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-95	-----	T2-3N,R2W	N/A	Glendale Ave & Perryville Rd	FF1
1595	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-95	-----	T2-3N,R1-2W	N/A	Sarival and Glendale Avenue	FF1
1605	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-95	-----	T3N,R1W	N/A	Cactus Rd & Dysart Rd.	FF1
1610	Flood Insurance Rate Maps (FIRM)	FCD	X				8/5/97-LOMR	-----	-----	N/A	E. of Agua Fria	FF1
1615	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-95	-----	T2-3N,R1W	N/A	Glendale Ave & Dysart Rd	FF1
1620	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-91	-----	-----	N/A	E. of Agua Fria	FF1
1620	Flood Insurance Rate Maps (FIRM)	FCD	X				8/5/97-LOMR	-----	-----	N/A	E. of Agua Fria	FF1
2015	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-95	-----	T1N,R4-5W;T1S,R4-5W	N/A	Broadway Rd & Johnson Rd	FF1
2020	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-95	-----	T1N,R4W;T1S,R4W	N/A	Broadway Rd & Wilson Ave	FF1
2025	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-95	-----	T1-2N,R4-5W	N/A	McDowell Rd & 249th Avenue	FF1
2035	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-95	-----	T1-2N,R2-3W	N/A	White Tanks Proving Grounds	FF1
2040	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-95	-----	T1N,R3-4W	N/A	Miller Rd & Broadway Rd	FF1
2045	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-95	-----	T1N,R3W	N/A	Rainbow Rd & Broadway Rd	FF1
2050	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-95	-----	T1-2N,R3-4W	N/A	McDowell Rd & Buckeye Military Reservation	FF1
2055	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-95	-----	T1-2N,R2W	N/A	Perryville Rd & McDowell Rd	FF1
2060	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-95	-----	T1-2N,R1-2W	N/A	Pebblecreek Pkwy & McDowell Rd	FF1
2065	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-95	-----	T1N,R2W;T1S,R2W	N/A	Perryville Rd and Buckeye Rd	FF1
2070	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-95	-----	T1N,R1-2W;T1S,R1-2W	N/A	Sarival and Buckeye Rd	FF1
2080	Flood Insurance Rate Maps (FIRM)	FCD	X				8/5/97-LOMR	-----	T1-2N,RX	N/A	Litchfield Rd & McDowell Rd-ADOT Bsns.	FF1
2085	Flood Insurance Rate Maps (FIRM)	FCD	X				Apr-88	-----	-----	N/A	E. of Agua Fria	FF1
2090	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-95	-----	T1N,R1W: T1S,R1W	N/A	Aqua Fria River & Gila River	FF1
2230	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-91	-----	T1-2N,R7-8E	N/A	Out of Area	FF1
2480	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-95	-----	T1S,R4-5W	N/A	Gila River & Hassayampa River	FF1

1. *-M = Utility is mapped
2. *-NM = Utility is not mapped

Loop 303 Corridor/White Tanks Area Drainage Master Plan Update

URS Greiner Woodward Clyde
December 3, 1999
Project Manager: Elliot Silverston

Office Location Codes

OFF: **Over size Flat File**
FF1: **Flat File Drawer #1 (top)**
FF2: **Flat File Drawer #2 (bottom)**
JF: **Job File Cabinets**
LIB: **Project Library**

Bibliography

Category	Description	Received From	URSGWC	D&M	LSD	EEC	Date	Section	Township & Range	Area of Development	Major Crossroads	Location in Office
2485	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-95	-----	T1S,R4W	N/A	Gila River & Wilson Avenue	FF1
2505	Flood Insurance Rate Maps (FIRM)	FCD	X				Sep-95	-----	T1S,R3-4W	N/A	Gila River & Rooks Road	FF1
2510	Flood Insurance Rate Maps (FIRM)	FCD	X					-----	-----	N/A	Out of Area	FF1
Flood Photos	Historic Flooding of Agua Fria River Photographed from Air-some explaination and history given	FCD	X				Jun-80	-----	-----	N/A	Agua Fria River	FF1
Utility-NM	Overall Water Distribution-AZ WATER Company, White Tank	AZ Water Company	X				Feb-00	-----	T1N-2N, R2W	N/A	N/A	FF3
Utility-NM	Southwest Gas Corporation, Gas Distribution	Southwest Gas Corporation	X				Aug-00		T1N-2N, R1W	N/A	N/A	FF3
Utility-M	Roosevelt Irrigation District Collection Area Map	Roosevelt Irrigation District	X				Aug-00		T1N-3N, R1W-3E	N/A	N/A	FF3
Utility-NM	Map of Roosevelt Irrigaton District	Roosevelt Irrigation District	X				Aug-00		T1S-2N, R5W-1W	N/A	N/A	FF3
Utility-M	Area Map and Two Plan Sheets from MCI WorldCom	MCI WorldCom	X				Aug-00		T1N-2N, R2W-1W	N/A	Thomas Rd., Cotton Ln.	FF3
Utility-NM	Preliminary Water and Sewer System Service Area Maps	City of Goodyear	X				Aug-00		T1S-2N, R2W-1W	N/A	N/A	FF3
Utility-M	Quarter Section Maps with Hand Labeling of Existing AT&T Utilities	AT&T	X				Aug-00		T1N-2N, R1W-R1E	N/A	N/A	FF3
Utility-NM	Southwest Gas Corporation, Gas Distribution	Southwest Gas Corporation	X				Sep-00		T1N, 1W	N/A		FF3
Utility-NM	Cox Communications Service Area Maps	COX Communications	X				Sep-00			N/A		FF3
Utility-M	3 Maps Showing Location of El Paso Natural Gas Line	El Paso Natural Gas	X							N/A		FF3
Land Value Assesment	Estimated Cost per Acre for land included in White Tanks / Agua Fria Area Drainage Master Study, prepared by Mr. John P. Palmieri of the Flood Control District of Maricopa County	FCD	X				Aug-00			N/A	N/A	FF2
CD's	Bullard Wash Channel	SunCor	X				Jun-00				From Indian School to Camelback	FF1
	Indian School Road to Camelback											
	By the WLB Group, Inc., for Palm Valley											
CD's	Indian School Road Channel	SunCor	X				Jun-00				Citrus to Bullard Wash	FF1
	Citrus Road to Bullard Wash											
	By the WLB Group, Inc., for Palm Valley											
Map	FIS Workmaps for Agua FriaFIS		X									FF2
	By: Jerry R. Jones and Associates Inc. April 1990											
Map	White Tanks FRS #3 & #4		X									FF2
	1. Hydrologic Subbasin & Soil Groups											
	2. Hydrologic Subbasins & Contour Lines											
	By: EEC											
Map	City of Surprise Land Use Map		X									FF2
CD	Sanitary Sewer Extension Plans for Wigwam Creek		X									FF2
	By: Knudson-Smith Engineering Inc.											
	For: Suncor Development 3/00											
CD	Agua Fria River Floodplain Delineation Between the Gila River Confluence and the New Waddel Dam		X									FF2
	By: Coe and Van Loo Consultants Inc.											
	For: Flood Contron District of Maricopa County											
CD	Tribly Wash Floodplain Delineation Study		X									FF2
	By: P&D Technologies											
	For: Flood Contron District of Maricopa County											
Map	City of Goodyear Land Use Map		X									FF1

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2. *-NM = Utility is not mapped

Loop 303 Corridor/White Tanks Area Drainage Master Plan Update

URS Greiner Woodward Clyde
December 3, 1999
Project Manager: Elliot Silverston

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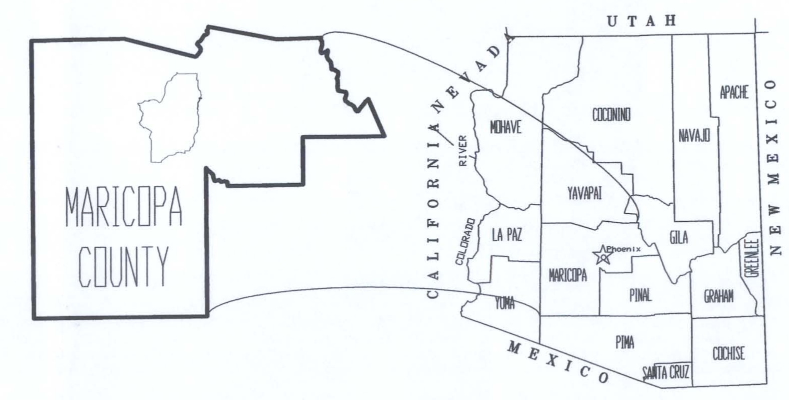
Bibliography

Category	Description	Received From	URSGWC	D&M	LSD	EEC	Date	Section	Township & Range	Area of Development	Major Crossroads	Location in Office
	Nov. 12, 1999											
CD / Report	East Mesa Drainage Master Plan / Recommended Design Report		X									FF2
	By: Dibble and Associates											
	For: Flood Control District of Maricopa County July 1998											
CD	Improvement Plans for Bullard Wash Channel, Goodyear, AZ		X									FF2
	By: Pinnacle Engineering Inc.											
	For: City of Goodyear 7/99											
CD	Estrella Parkway Yuma Rd. to North of mcDowel Rd.		X									FF2
	Drainage Plan and Profile and Detention Basin											
	By: Brooks Hensey and Assoc. 10/11/99											
CD	Rancho Mirage		X									FF2
	Landscape and Irrigation Plans											
	By: Gilmore / Graves Inc. 12/15/99											
Notes	Various Report Reviews By Rob Scrivo		X									FF1

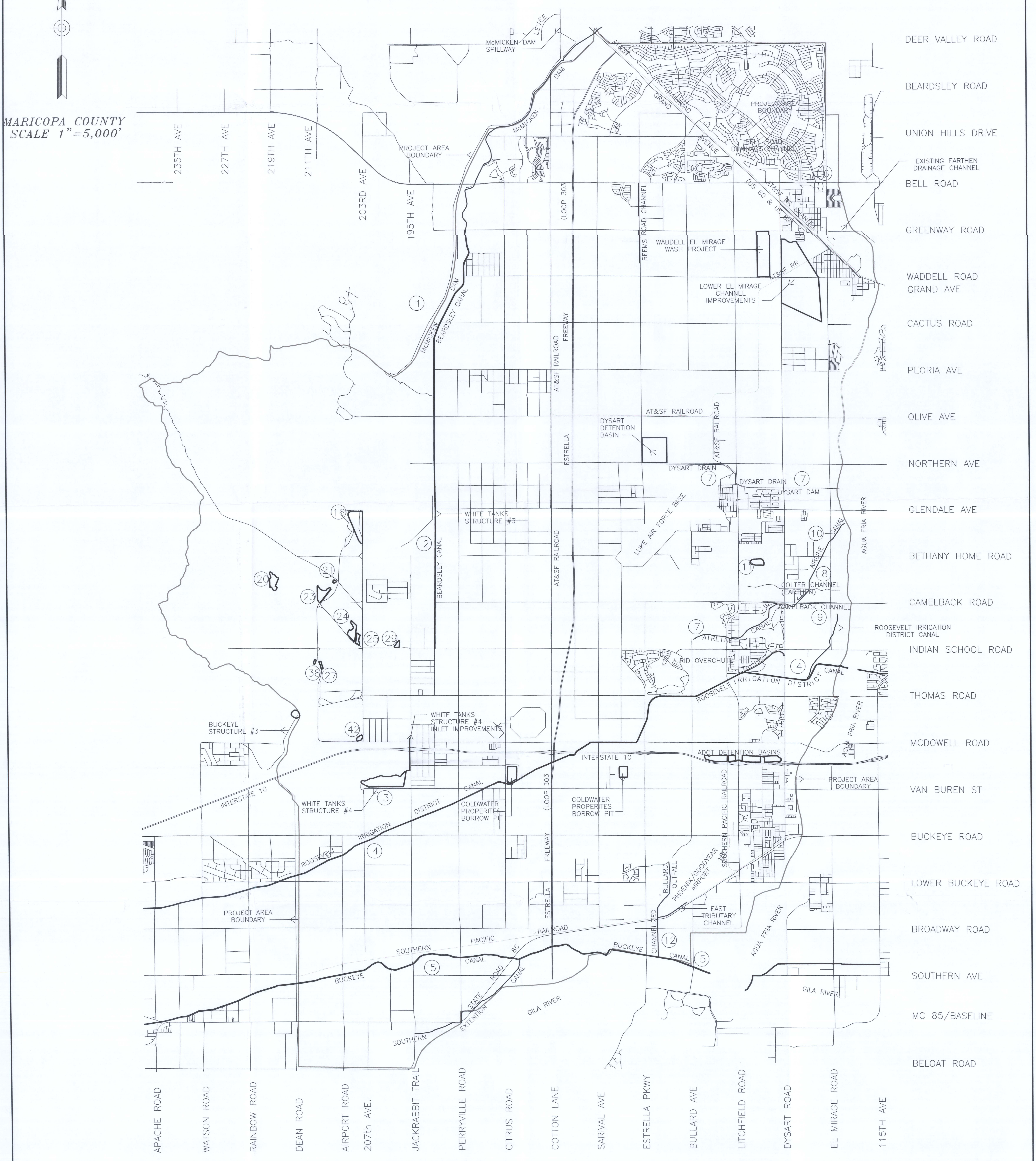
1. *-M = Utility is mapped
2. *-NM = Utility is not mapped

TABLE OF EXISTING RETENTION BASINS (94 ADMP)

Retention Basin	Ownership	Capacity at Spillway elev (AF)	Peak Storage	Condition	Discription
1	Flood Control District of Maricopa County	30,500 (US Army Corps of Engineers)	X	Good—Restored in 1980 Dam & Channel Have Capacity in Excess of the 100-year flood (94 ADMP)	McMicken Dam
2	Flood Control District of Maricopa County	2,655 (US Army Corps of Engineers)	X		Levee White Tank Structure #3
3	Flood Control District of Maricopa County	1,036 (US Army Corps of Engineers)	X		Levee White Tank Structure #4
4	Roosevelt Irrigation District	Not Designed For Storm Warter Runoff	X		Canal
5	Buckeye Irrigation District	Not Designed For Storm Warter Runoff	X		Canal
6	Verify	Verify	X		Canal Constructed as Part of the Sun City West Development
7	Flood Control District of Maricopa County	100 Year Flood	X	Good—Improved Concrete Lined Channel	Canal
8	Flood Control District of Maricopa County	100 Year Flood	X	Good—Built in 1994	Earthen Canal
9	Maricopa County Department of Transportation	5 Yr (Interum) 100 Yr (Fully Developed)	X	Under Construction	Earthen Canal
10	Verify	Not Designed For Storm Water Runoff	X		Canal
11	Litchfield Park	100 Year Flood Attenuation 900cfs—85cfs	X	Good—Constructed in 1991	Detention Facility
12	Flood Control District of Maricopa County	3,200 cfs 100 Year Flood	X	Under Construction (MCFCD 5/10/99)	Bullard Wash Channel Improvement
13	Arizona Department of Transportation	Unknown	X	Good—Some Trees & Brush in Basins	Detention Basins
16	Caterpillar Proving Grounds	1300	X		Retention Basins
21	Caterpillar Tractor Company	96	101		Retention Basins
23	Caterpillar Tractor Company	645	34		Retention Basins
24	Caterpillar Tractor Company	283	9		Retention Basins
25	Caterpillar Tractor Company	13	22		Retention Basins
27	Caterpillar Tractor Company	11	15		Retention Basins
29	Caterpillar Tractor Company	55	9		Retention Basins
38	Caterpillar Tractor Company	39	51		Retention Basins
42	Caterpillar Tractor Company	70	142		Retention Basins



VICINITY MAP



Date MAY 2003 Job No. E1152600 Sheet X of X	EXISTING FACILITY MAP LOOP 303 CORRIDOR/WHITE TANKS AREA DRAINAGE MASTER PLAN UPDATE DATA COLLECTION	Design Drawn XXX Check XXX Scale 1"=5,000'	URS

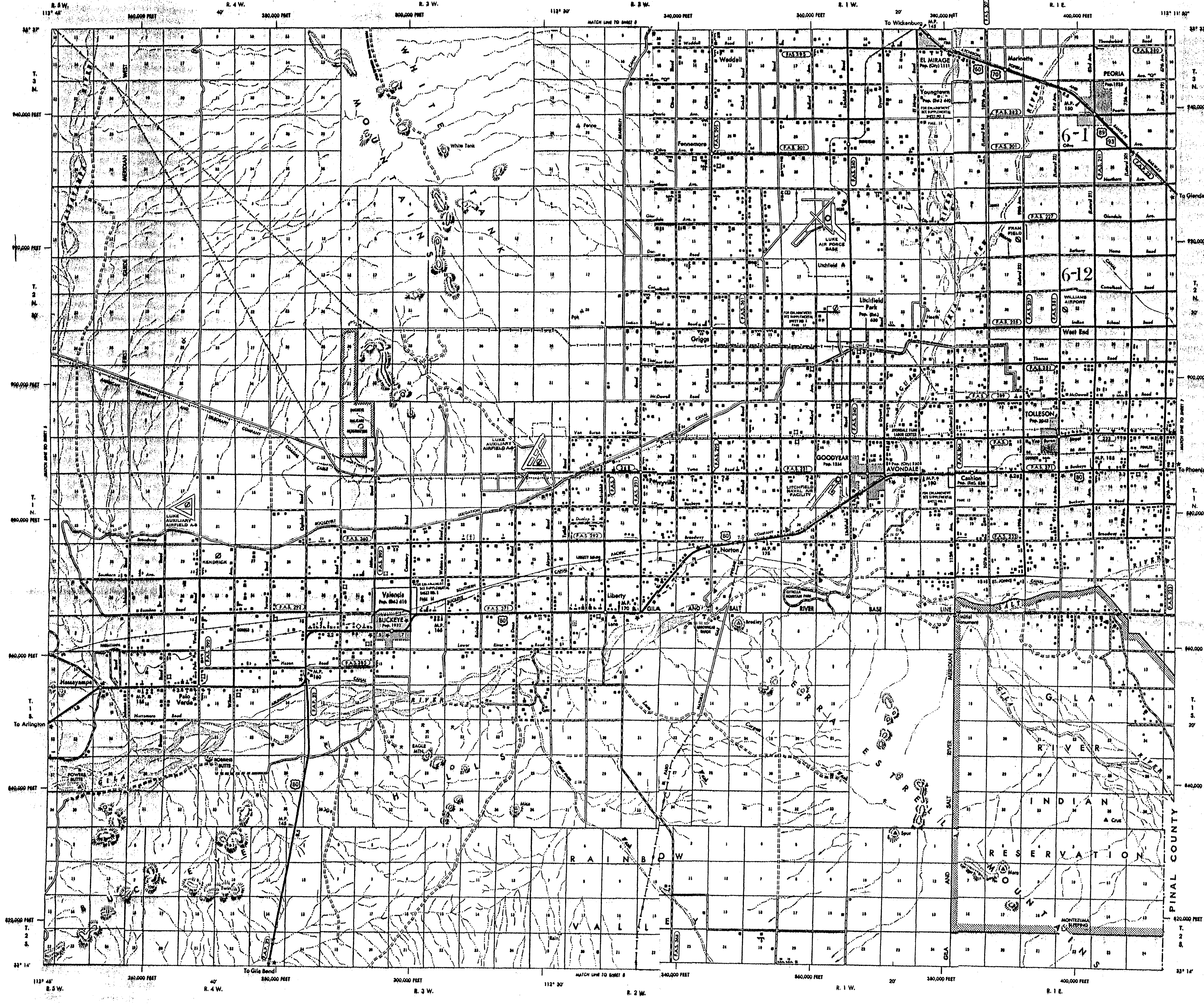
Flood Control District of Maricopa County

APPENDIX D

EXISTING FACILITY MAP
MAP OF EXISTING DEVELOPMENT
EXISTING FLOODPLAIN MAP

APPENDIX E

GENERAL LAND OFFICE MAPS/PLATS

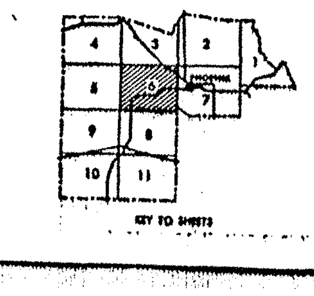


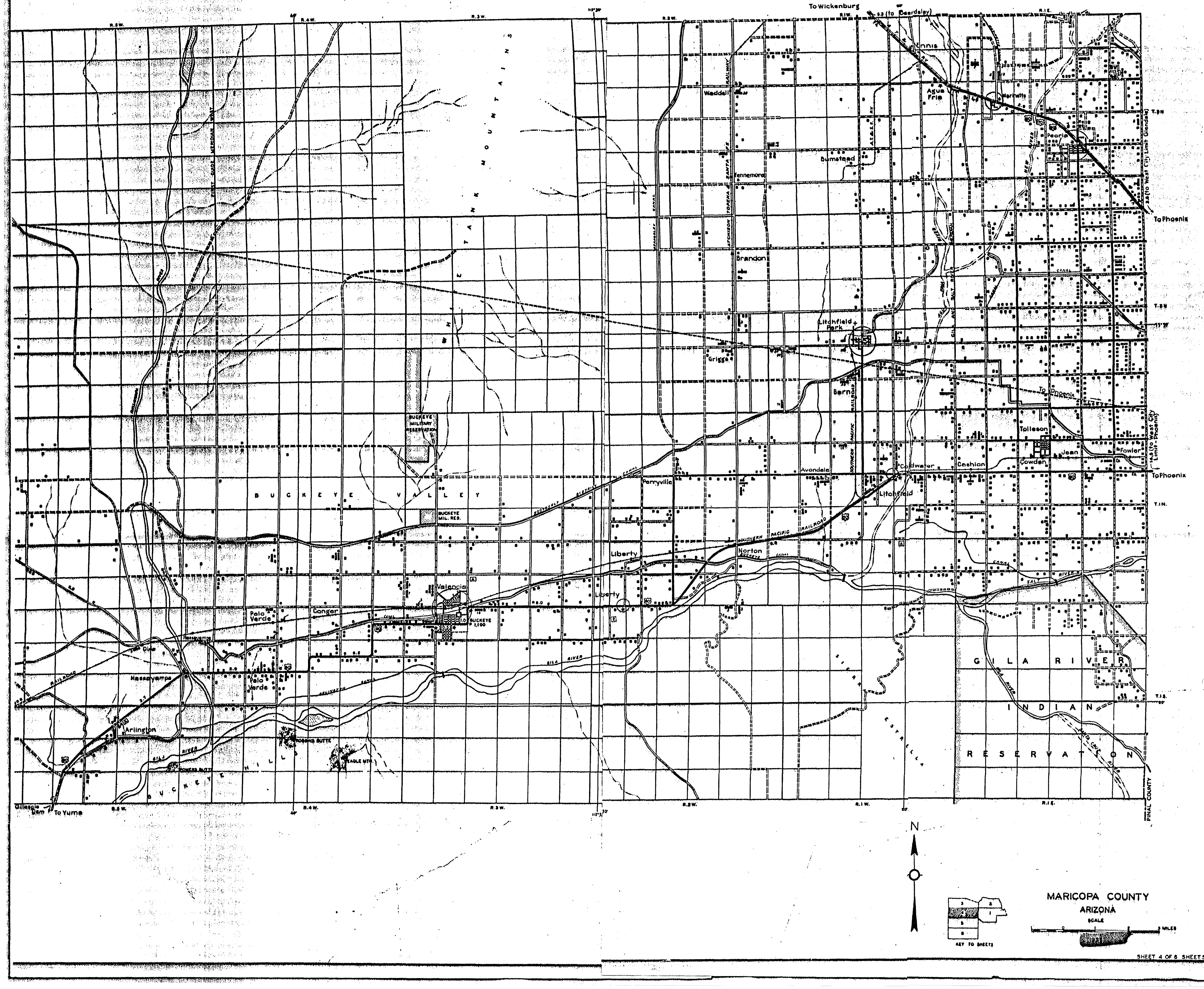
SCALE

STATUTE MILES

TRANSVERSE MERCATOR PROJECTION, ARIZONA CENTRAL ZONE
COMPILED BY PHOTOGRAMMETRIC METHODS
1927 NORTH AMERICAN DATUM
CONTROL BY U. S. COAST AND GEODETIC SURVEY, U. S. GEOLOGICAL SURVEY
U. S. FOREST SERVICE AND U. S. GENERAL LAND OFFICE
INVENTORY 1964

GENERAL HIGHWAY MAP ZONA
MARICOPA COUNTY, ARI
ARIZONA STATE HIGHWAY DEPARTMENT SION
PHOTOGRAMMETRY AND MAPPING DIVI
IN COOPERATION WITH THE IENCE
UNITED STATES DEPARTMENT OF COMM
BUREAU OF PUBLIC ROADS



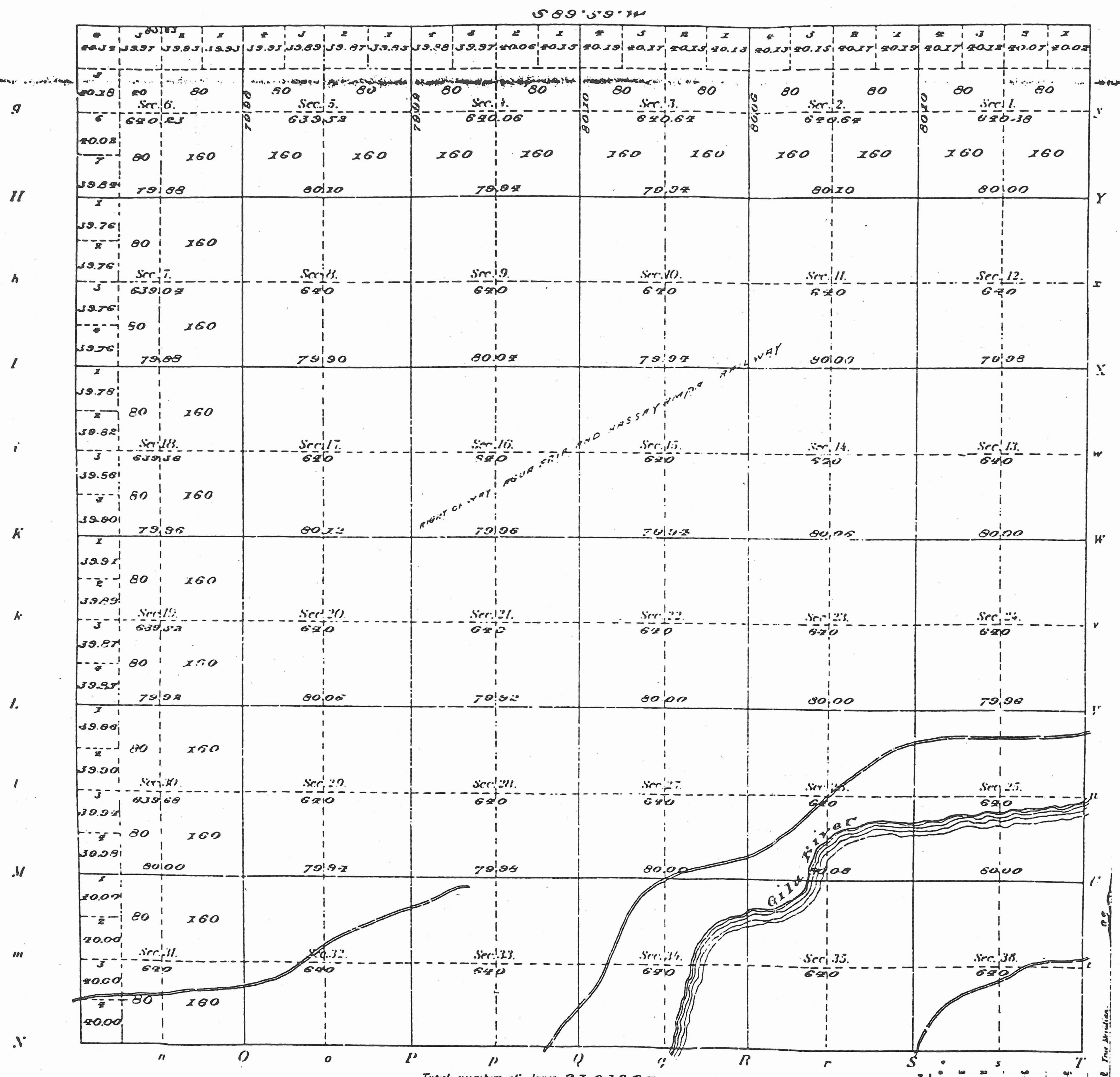


To Wickenburg
Ennis
Agua Fria
Marinette
Peoria
Waddell
Bumstead
Tennemoree
Brandon
Litchfield Park
Griggs
Barn
Tolleson
Cashion
Cowden
Jean
Fowler
Avondale
Coldwater
Litchfield
Perryville
Liberty
Norton
Valencia
Buckeye 1,100
Palo Verde
Canger
Hassayampa
Arlington
Gillespie Dam
To Yuma
To Phoenix
WHITE TANK MOUNTAINS
BUCKEYE VALLEY
BUCKEYE MILITARY RESERVATION
BUCKEYE MIL. RES.
GILA RIVER
SALT RIVER
BUCKEYE CANAL
ARLINGTON CANAL
ROOSEVELT IRRIGATION CANAL
SOUTHERN PACIFIC RAILROAD
ATCHISON TOPEKA & SANTA FE RAILWAY
SIERRA ESTRELLA
BUCKEYE HILLS
GILA RIVER INDIAN RESERVATION
PINAL COUNTY
R.5W.
R.4W.
R.3W.
R.2W.
R.1W.
R.1E.
T.3N.
T.2N.
T.1N.
T.1S.
N
MARICOPA COUNTY
ARIZONA
SCALE
KEY TO SHEETS
SHEET 4 OF 6 SHEETS

Township No. 1 North Range No. 2 West, Gila and Salt River Meridian Ariz.

2627

OFFICIALLY FILED 4-23-1883



Total number of Acres 23,039.07

Surveys Designated	By Whom Surveyed	Date of Contract	Amount of Surveys M.	Ch.	Lk.	When Surveyed	Mean Var.
Township lines	B.C. Powers	Oct. 24, 1882	18	00	23	Jan. 16-18, 83	13°54' E.
Subdivisions	" "	" " "	59	79	60	" 30 Feb. 3 "	"
BASE LINE	" "	" " "	6	00	00	Dec. 5,-6. 188?	"

The above Map of Township No. 1 North of Range No. 2 West Gila & S.R. Meridian Arizona is strictly conformable to the field notes of the survey thereof on file in this Office, which have been examined and approved.

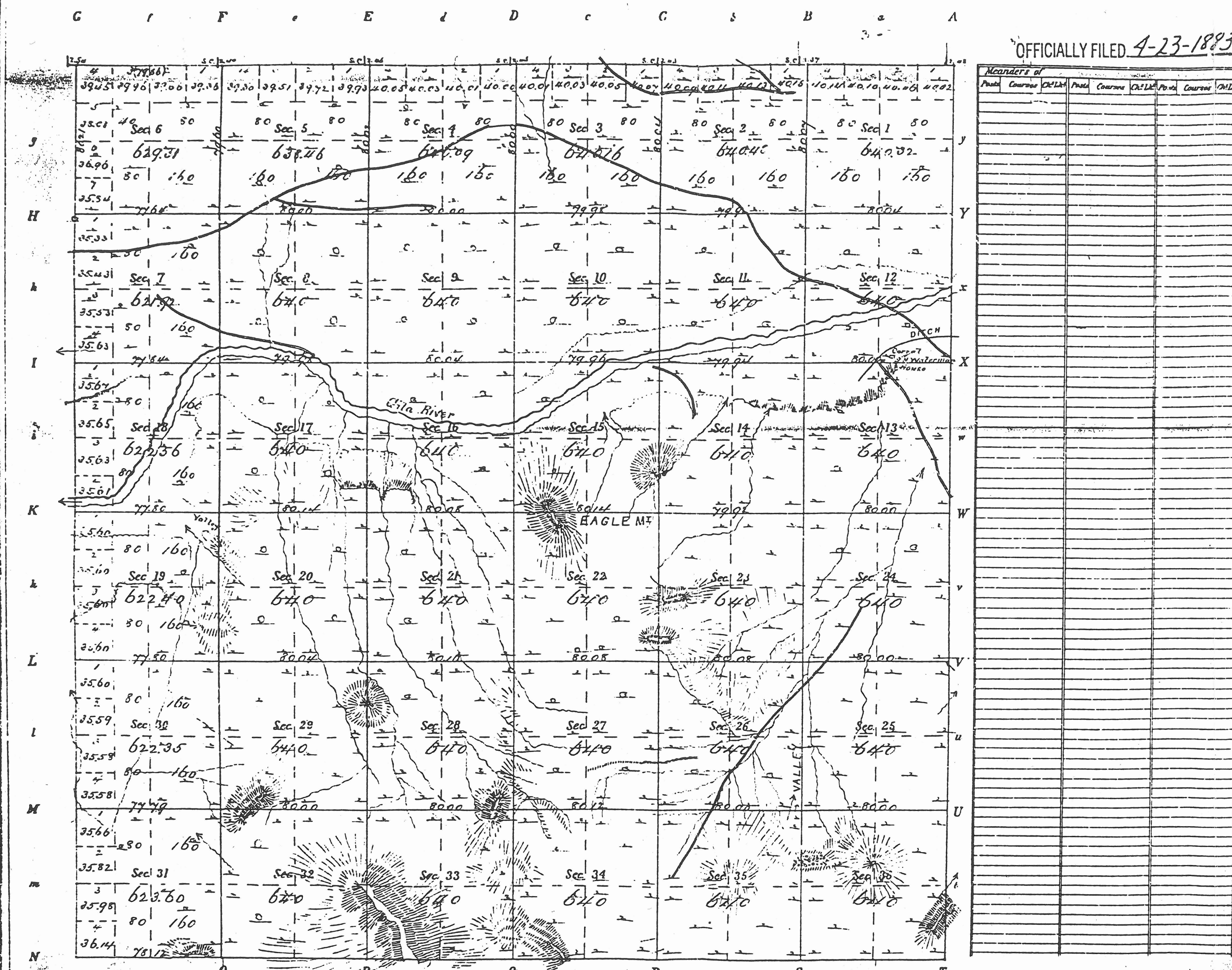
Surveyor Generals Office.
Tucson Feb. 21, 1883.

J.W. Robbins
Surv. Gen.

Copied From L.O. Plat May 29, 1908 F.D.H.

TOWNSHIP No 1 South RANGE No 3 West Gila and Salt River MERIDIAN

OFFICIALLY FILED 4-23-1883



Total number of Acres 22941.65 Scale 40 Chains to an Inch

Surveys Designated	By Whom Surveyed	Date of Contract	Amount of Surveys (M. Chs Lks)	When Surveyed	Mean Declination
Township Lines	R. C. Powers	Oct 24 1882	17 78 33	Dec. 13th to 16th 1882	13° 51' E
Subdivisions	" " "	" " "	69 69 32	Jan. 6th to 10th 1883	" "
Base	" " "	" " "	5. 79 94	Dec. 5th to 8th 1882	" "

The above Map of Township No 1 South of Range No 3 West Gila & Salt River Meridian Arizona is strictly conformable to the field notes of the survey thereof on file in this Office which have been examined and approved.

Surveyor General's Office,
Tucson, February 21st 1883

J. W. Robbins
Surv. Genl.

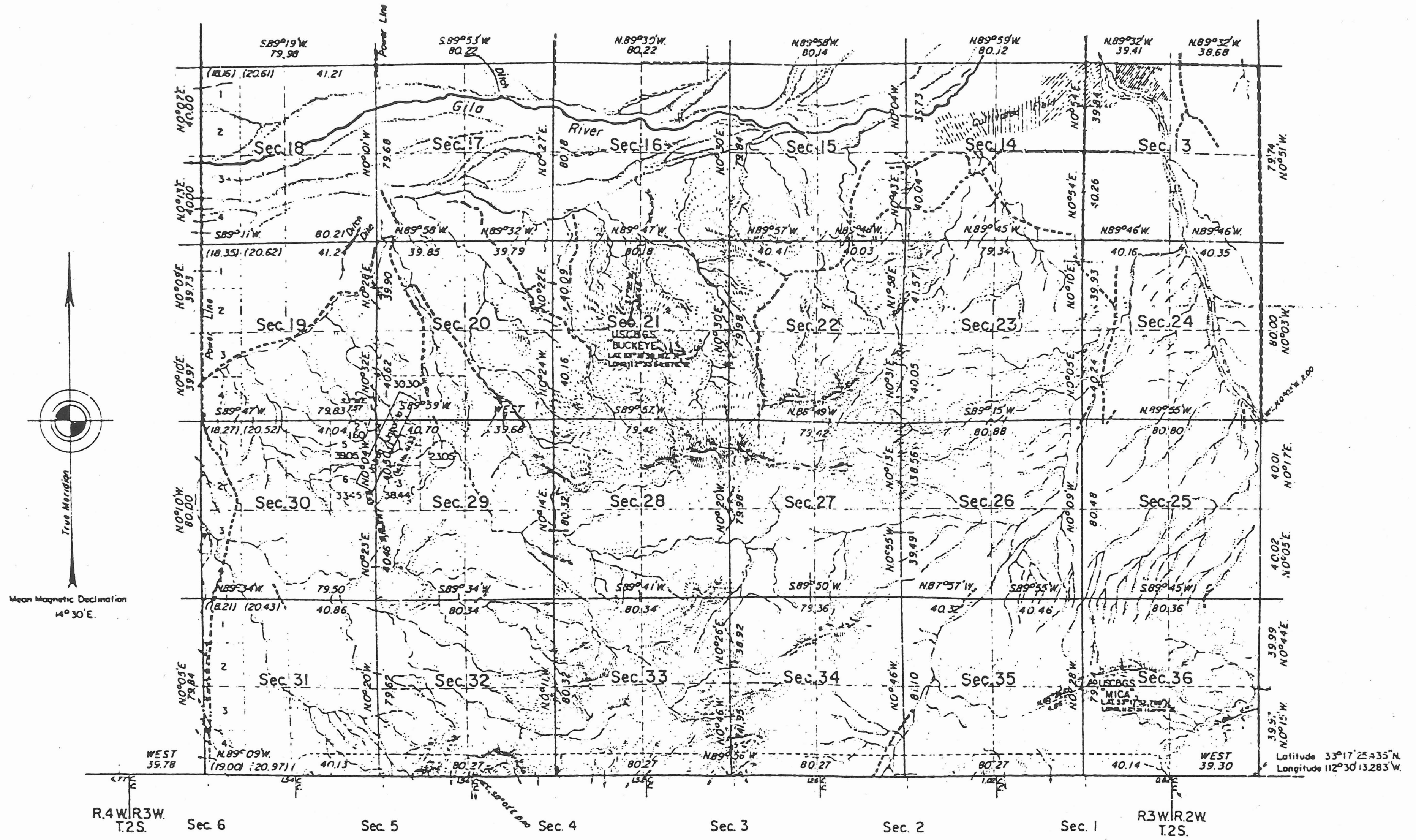
ORIGINAL

3707-A

TOWNSHIP 1 SOUTH, RANGE 3 WEST, OF THE GILA AND SALT RIVER MERIDIAN, ARIZONA

DEPENDENT RESURVEY

OFFICIALLY FILED 5-27-1960



Scale in Chains

Total area of segregations,	41.32 Acres.	
Total area exclusive of segregations,	15,256.80	"
Total area resurveyed,	15,298.12	"

History of earlier surveys is contained in the field notes.

This plat represents the dependent resurvey of portions of the east and west boundaries and a portion of the subdivisional lines of T. 1 S., R. 3 W., Gila and Salt River Meridian, Arizona, designed to restore the corners in their original locations according to the best available evidence and the segregation of patented Mineral Survey No. 4133. Except as shown hereon, lottings and areas are as shown on plat approved February 21, 1883.

Survey executed by Donald E. Harding, February 10 to March 10, 1958, under special instructions dated December 26, 1957, for Group 322, Arizona.

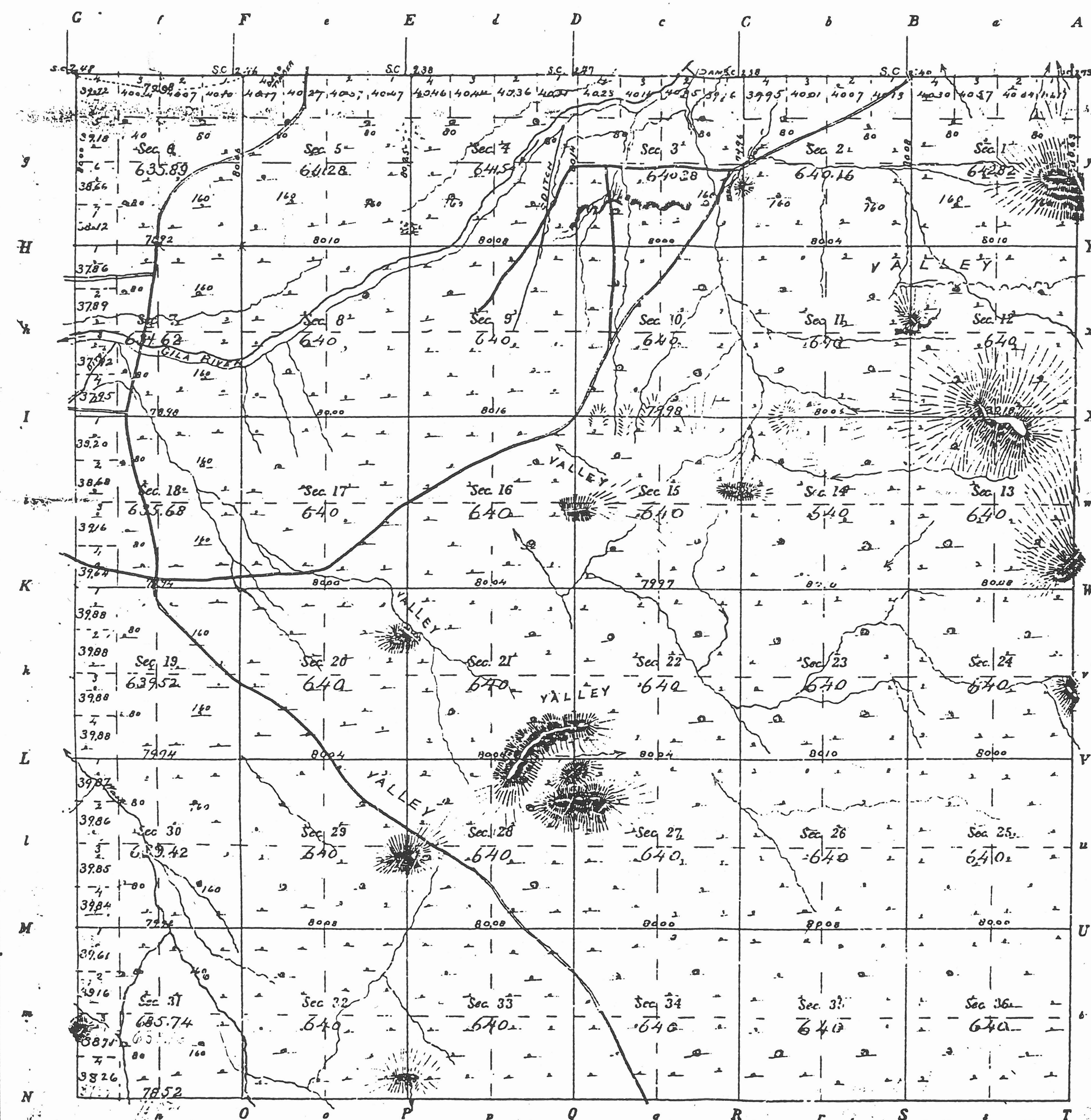
UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Washington, D.C. January 25, 1960

This plat is strictly conformable to the approved field notes, and the survey, having been correctly executed in accordance with the requirements of law and the regulations of this Bureau, is hereby accepted.

For the Director

Cadastral Engineering Staff Officer

TOWNSHIP No. 1 SOUTH RANGE No. 2 WEST GILA and SALT RIVER MERIDIAN



OFFICIALLY FILED 4-23-1883

Meanders of								
Posts	Courses	Chs. Lks.	Posts	Courses	Chs. Lks.	Posts	Courses	Chs. Lks.

Total number of Acres 23024.05

Scale 40 Chains to an Inch

Surveys Designated	By Whom Surveyed	Date of Contract	Amount of Surveys	When Surveyed	Var. Declination
Township Lines	R.C. Powers	Oct. 24th 1882	17 79 65	Dec 1st to 14th 1882	13°54' E
Subdivisions	"	"	50 79 54	Jan 4th to 15th 1883	
Base	"	"	6 00 25	Dec 5th to 6th 1882	

The above Map of Township No 1 South of Range No 2 West Gila & Salt River Meridian is strictly conformable to the field notes of the survey thereof on file in this office which have been examined and approved.

Surveyor General's Office
Tucson February 1883

[illegible]
Sur. Genl.

ORIGINAL

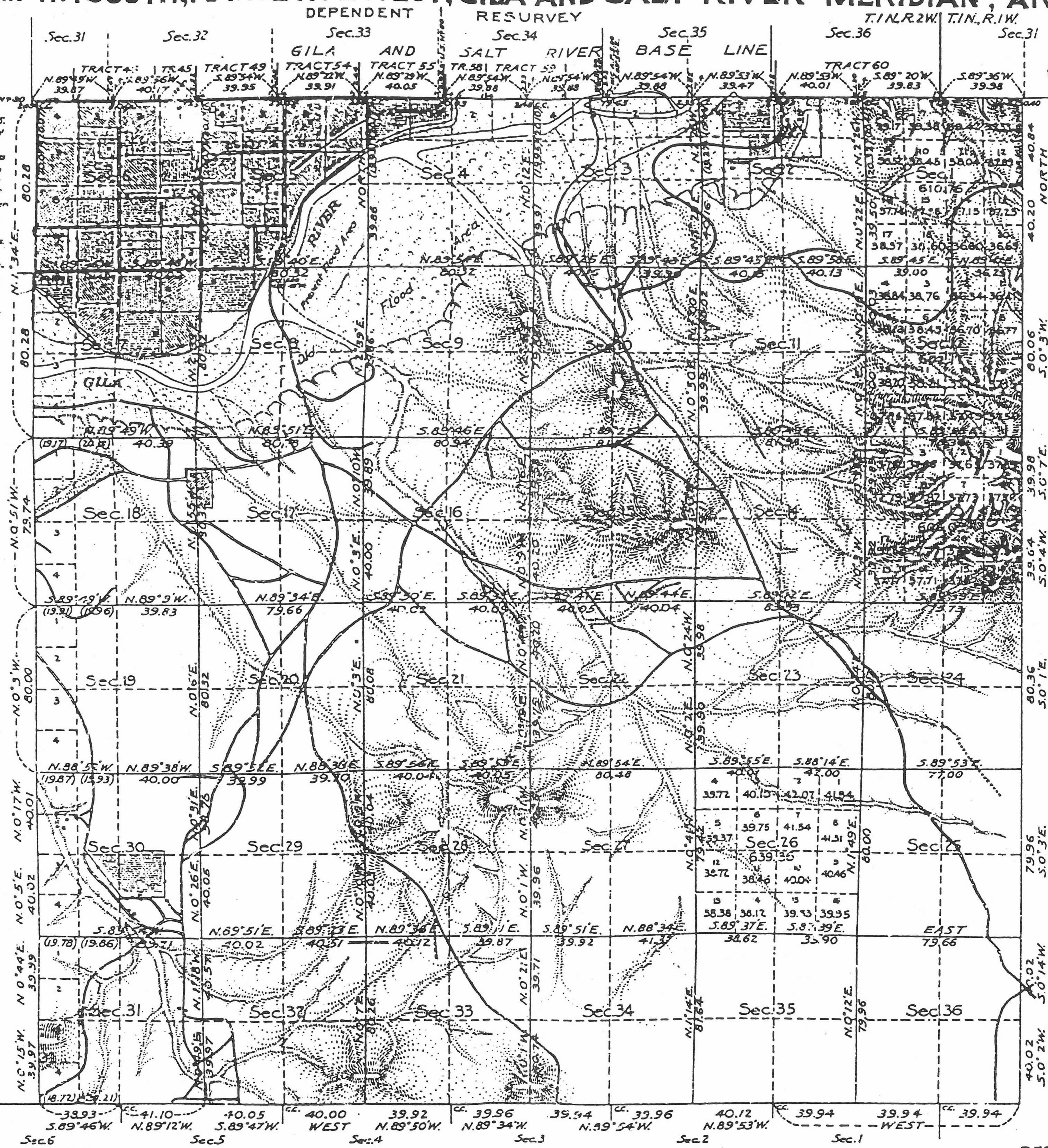
TOWNSHIP No. 1 SOUTH, RANGE No. 2 WEST, GILA AND SALT RIVER MERIDIAN, ARIZONA.

DEPENDENT RESURVEY

3705

OFFICIALLY FILED 9-5-1933

Note:
A.T. cors. on the G & S.R. Base Line on S. bdrs. of secs. 31, 32 & 33 are marked by crosses chiseled in highway pavement, and each cor. has two witness cors. consisting of brass-capped iron posts set in close proximity outside the pavement. The bearings and ties to the said witness cors. cannot be given on this plat owing to lack of space, therefore reference to the field notes must be made for such data. Other cors. of this township which have witness cors. in addition to being monumented at their true points, by reason of being in traveled roads, and data regarding the ties to such witness cors. also omitted from this plat, are as follows:
Cor. of Secs. 1, 6, 7 & 12 W. Bdy. (4 W.C.s)
1/4 Sec. Cor. Secs. 1 & 6, W. Bdy. (4 W.C.s)
Cor. of Secs. 5, 6, 7 & 8 (4 W.C.s)
1/4 Sec. Cor. of Secs. 6 & 7 (4 W.C.s)



FOOTHILLS OF ESTRELLA MOUNTAINS

This plat of the resurvey of T. 1 S., R. 2 W., G. & S. R. Base & Meridian, Arizona, delineates a retracement and reestablishment of the lines of the original survey as shown upon the plat approved February 21, 1883, in their true original position according to the best available evidence of the position of the original corners; all differences between the measurements shown on the original plat and those derived in the retracement have been distributed proportionally between accepted corners in accordance with surveying rules; reference will be made to the original plat for the showing of all the areas except the vacant land in those sections where the area of one or more of the subdivisions, computed on the basis of the measurement of the resurvey is beyond the limits of excess or deficiency of the original area as defined by Chapter 8, Par. 661 of the 1930 Manual of Surveying Instructions, in which cases the section is considered as the unit and all of the vacant land therein subdivided, with amended designations and areas as shown hereon, and such amended designations and areas will hereafter govern the disposal of said vacant land.

Latitude 33°17'40"N.
Longitude 112°24'05"W.

Mean Magnetic Declination 14°37'E. Scale: 40 Chains to an Inch. Area resurveyed: 22920.55 Acres

LINES DESIGNATED	BY WHOM SURVEYED	GROUP No.	GROUP DATE	MILEAGE MLS.	MILEAGE CHS.	WHEN SURVEYED BEGUN	WHEN SURVEYED COMPLETED
Exterior	Karl L. Siebecker	164	Feb. 16, 1931.	11	39.19	Mar. 13, 1931.	Mar. 28, 1931.
Subdivisional				59	75.26	" " "	" 27, "

J.B.

Office of U.S. Supervisor of Surveys
Denver, Colorado, June 14, 1932.
The above plat of Township No. 1 South, Range No. 2 West, of the Gila and Salt River Meridian, Arizona, is strictly conformable to the field notes of the survey thereof which have been examined and approved.

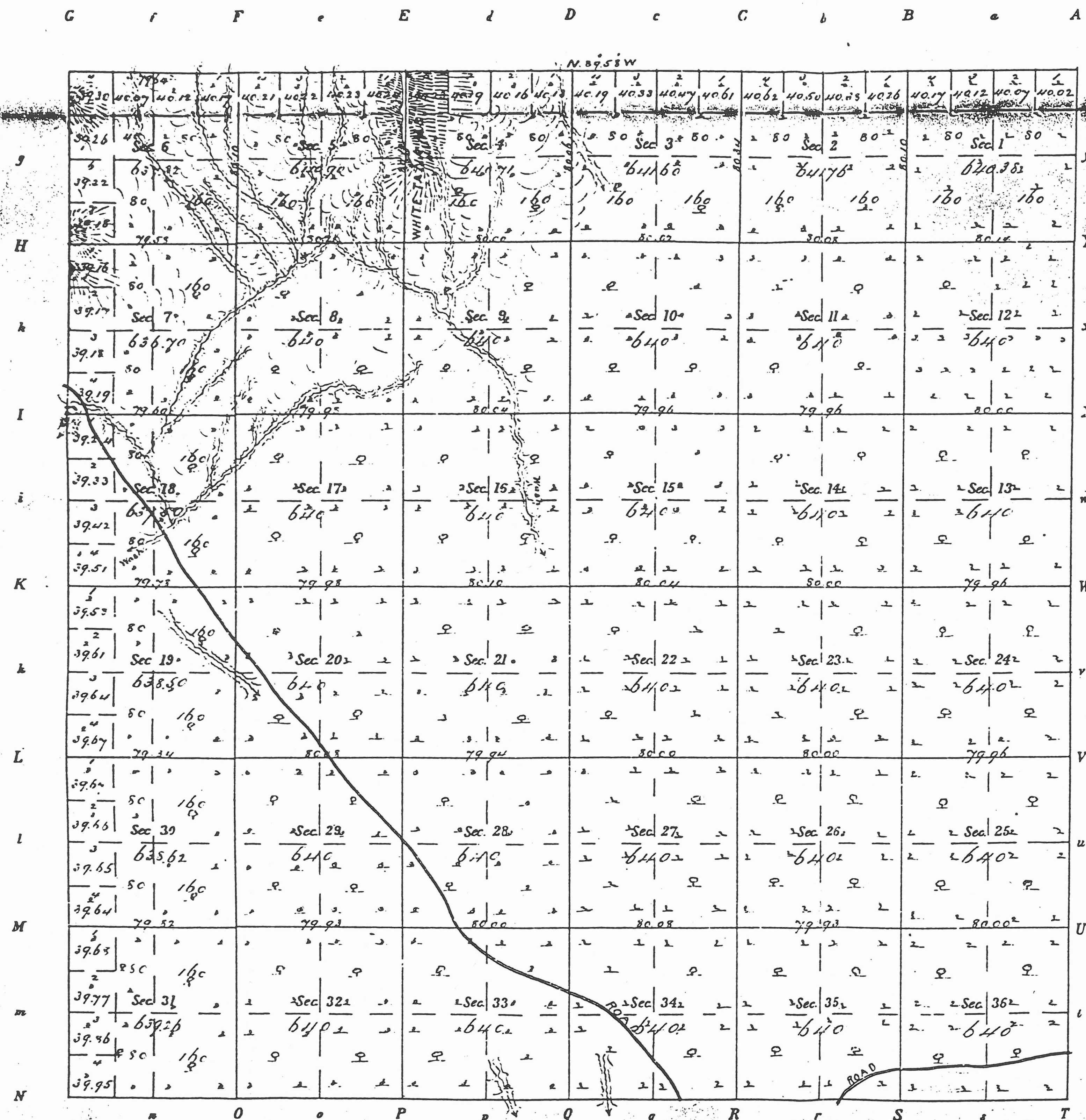
U.S. Supervisor of Surveys

DEPARTMENT OF THE INTERIOR
GENERAL LAND OFFICE
Washington, D.C., October 22, 1932.
The survey represented by this plat having been correctly executed in accordance with the requirements of law and the regulations of this office, is hereby accepted.

Acting Assistant Commissioner

TOWNSHIP No. 1 North RANGE No. 3 West Gila and Salt River MERIDIAN

2628



Meanders of								
Posts	Courses	Chs. Lks.	Posts	Courses	Chs. Lks.	Posts	Courses	Chs. Lks.

OFFICIALLY FILED 4-23-1883

Total number of Acres 23033.25

Scale 40 Chains to an Inch

Surveys Designated	By Whom Surveyed	Date of Contract	Amount of Surveys (M. Chs. Lks.)	When Surveyed	Mean Declination
Township Lines	R. C. Powers	Oct 24th 1882	17 79 64	Jan. 16th to 19th 1883	13°54' E
Subdivisions	" " "	" " "	59 79 73	" 25th " 29th "	
Base	" " "	" " "	6 00 00	Dec. 5th to 8th 1882	

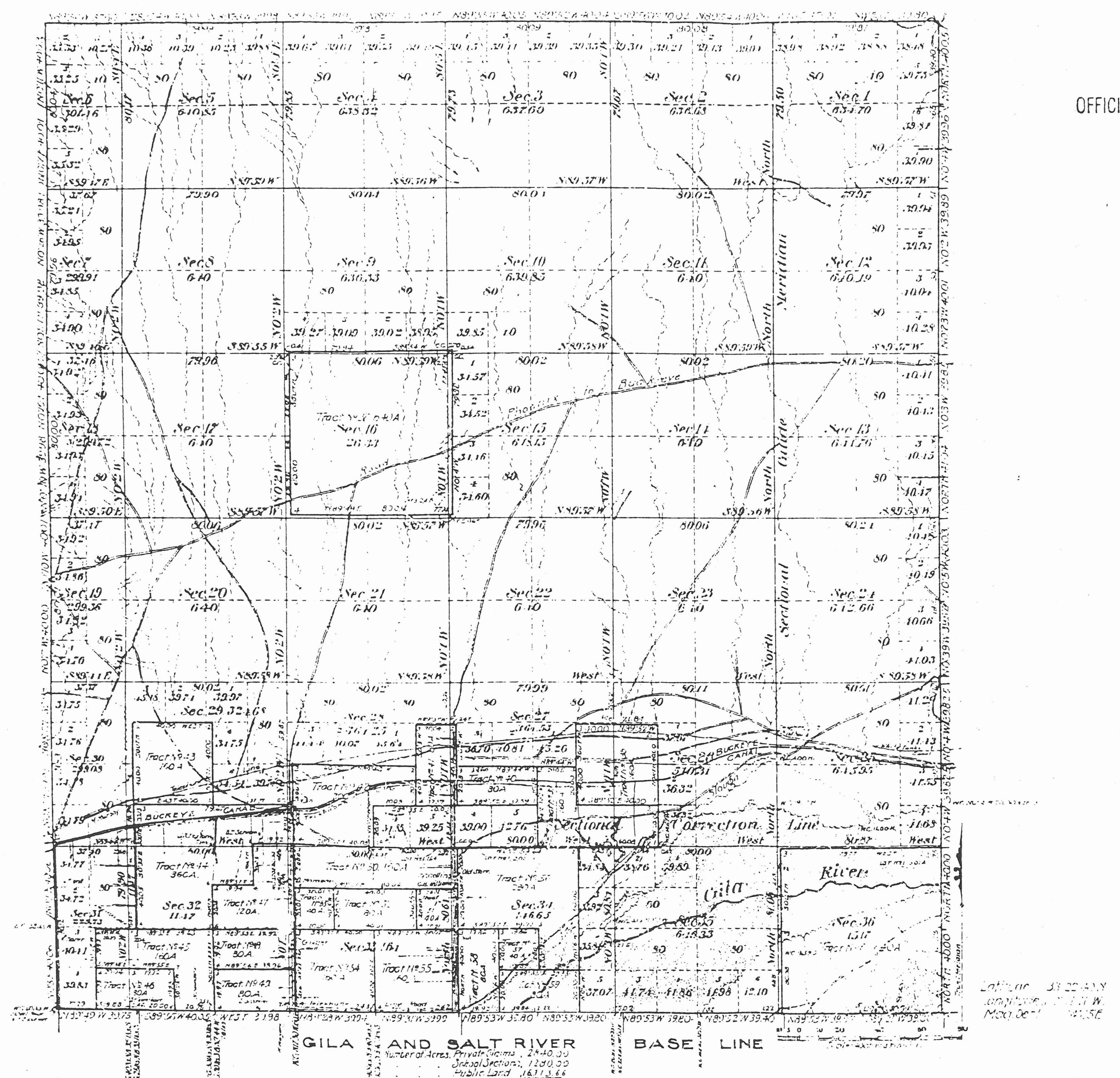
The above Map of Township No. 1 North of Range No. 3 West Gila & Salt River Meridian Arizona is strictly conformable to the field notes of the survey thereof on file in this Office which have been examined and approved.

Surveyor General's Office
Tucson February 21st 1883

J. W. Robbins
Surv. Genl.

Plat of the Resurvey of Township Nº 1 North, Range Nº 2 West, Gila and Salt River Meridian, Arizona. 2625

OFFICIALLY FILED__________



Surveys Designated	By whom surveyed	Date of Contract Nº 132	Amount of Surveys M.	Chs.	Lks.	When Surveyed
Base Line	John F Hesse	November 10. 1906.	5	38	28	May 16-23 1907
Township Lines	"	"	17	37	64	" 18-28 "
Subdivisions	"	"	57	30	86	" 29-June 16 "
(Land Entries)	"	"	30	78	88	June 16-26 "
Connections	"	"	1	17	26	

The above Map of Township Nº 1, North, Range Nº 2 West, G.& S.R. Meridian, Arizona, is strictly conformable to the field notes of the survey thereof on file in this Office, which have been examined and approved.
U.S. Surveyor Generals Office
Phoenix, Ariz. Dec 16 1907

Sur. Gen.

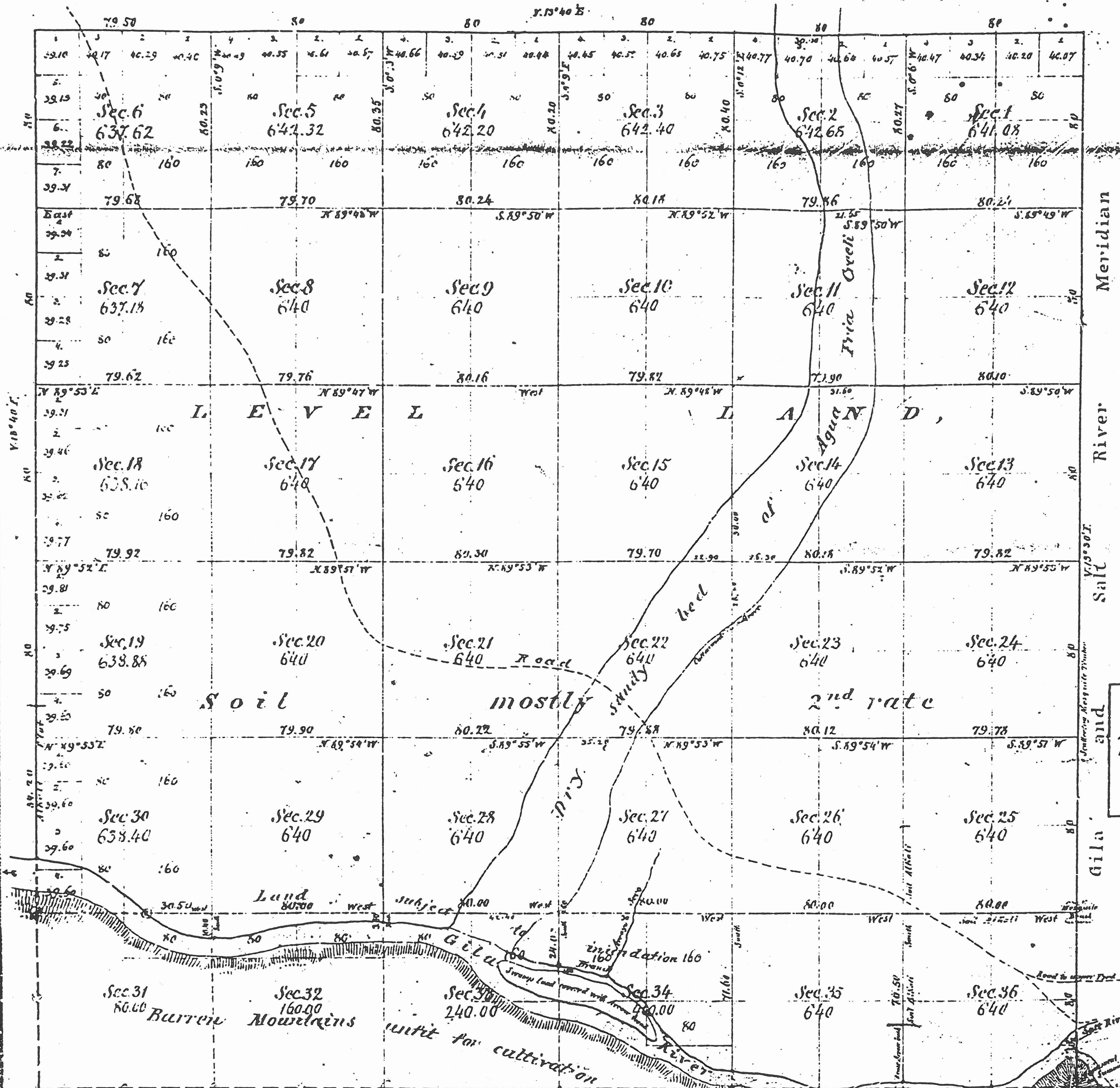
Township No. 1 North, Range No. 1 West, Gila and Salt River Meridian.

2624

Received and filed in U.S. Land Office Prescott Arizona December 2d 1870.

Wm. C. Berry Register

OFFICIALLY FILED 12-2-1870



Section lines run at a Variation of 13°40' East.

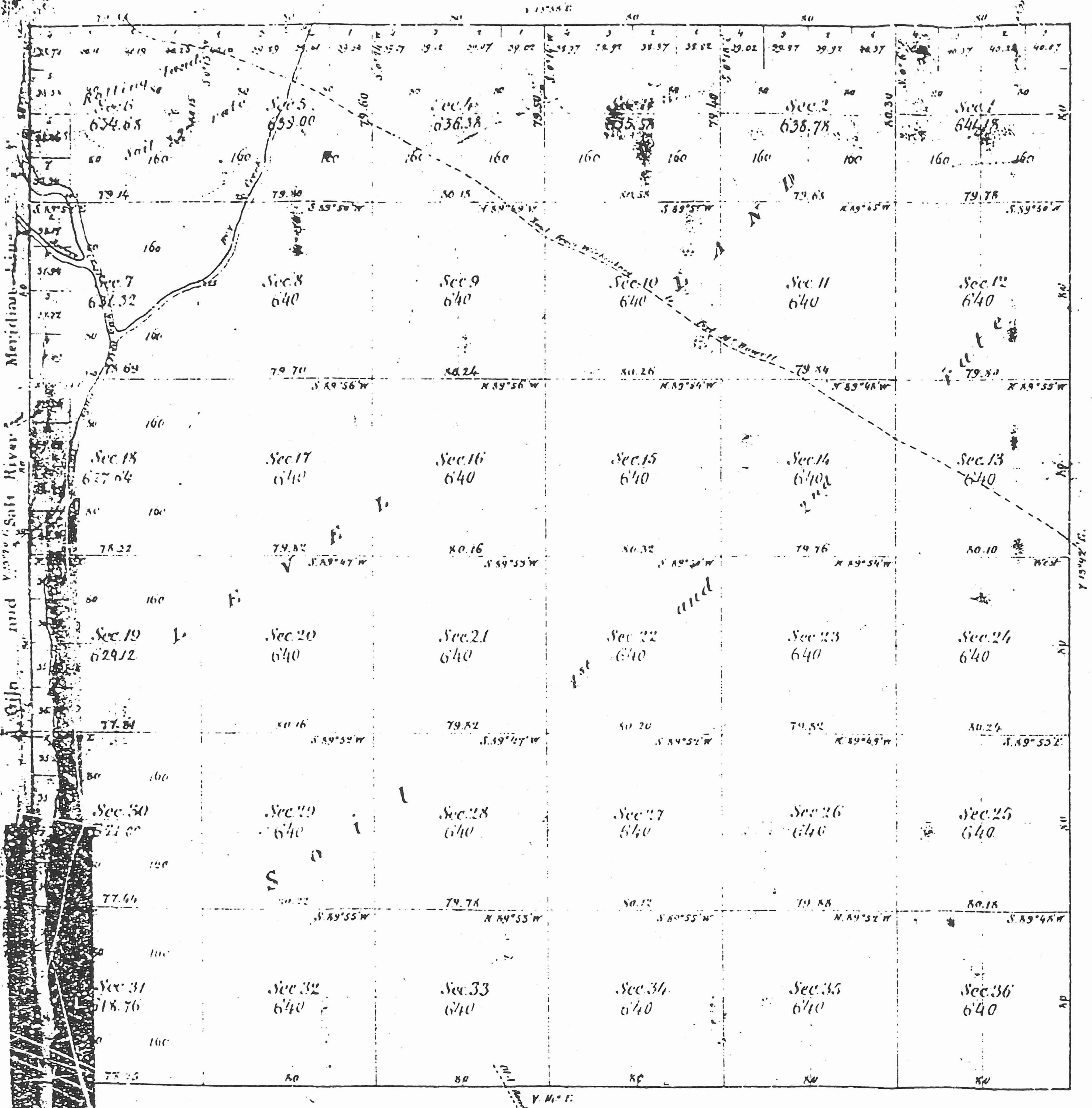
Aggregate Area of Public land surveyed	21,350.92 A
Estimated Area of unsurveyed Mountain land	1,680.00
Aggregate	23,040.92

Surveys Designated	By Whom Surveyed	Date of Contract	Amount of Surveys	When Surveyed
East boundary of Township	Wm. H. Pierce	December 15th 1866	——	1867
Rest of Township Lines	G. P. Ingalls	February 29th 1868	10 Ms. 53 Chs. 70 Lks.	1868
Section lines	"	"	54 . 56 . 65.	June 22nd 1868

The above Map of Township No. 1 North, Range No. 1 West of Gila and Salt River Meridian is strictly conformable to the field notes of the Surveys thereof on file in this Office which have been examined and approved.
Surveyor General's Office,
San Francisco, California,
December 31st 1868.

Sherman Day
Surv. Gen. Cal.

Township No. 2 North. Range No. 1 East. Gila and Salt River Meridian



Recorded and filed in U.S. Land Office Prescott Arizona December 2nd 1870

Register

OFFICIALLY FILED 12-2-1870

Aggregate Area of Public Land 22,958.44 Acres

Section lines run at a Variation of 13° 42' East

Designated	By Whom Surveyed	Date of Contract	Amount of Surveys	When Surveyed
... of Township	Wm. H. Pierce	December 15th 1866	————	1867.
	W. F. Ingalls	February 13th 1868	————	1868.
Township lines	G. P. Ingalls	February 29th 1868	11 Ms. 79 Ch. 38 Lk.	1868
lines			59 . 70 . 59 .	March 21st 1868.

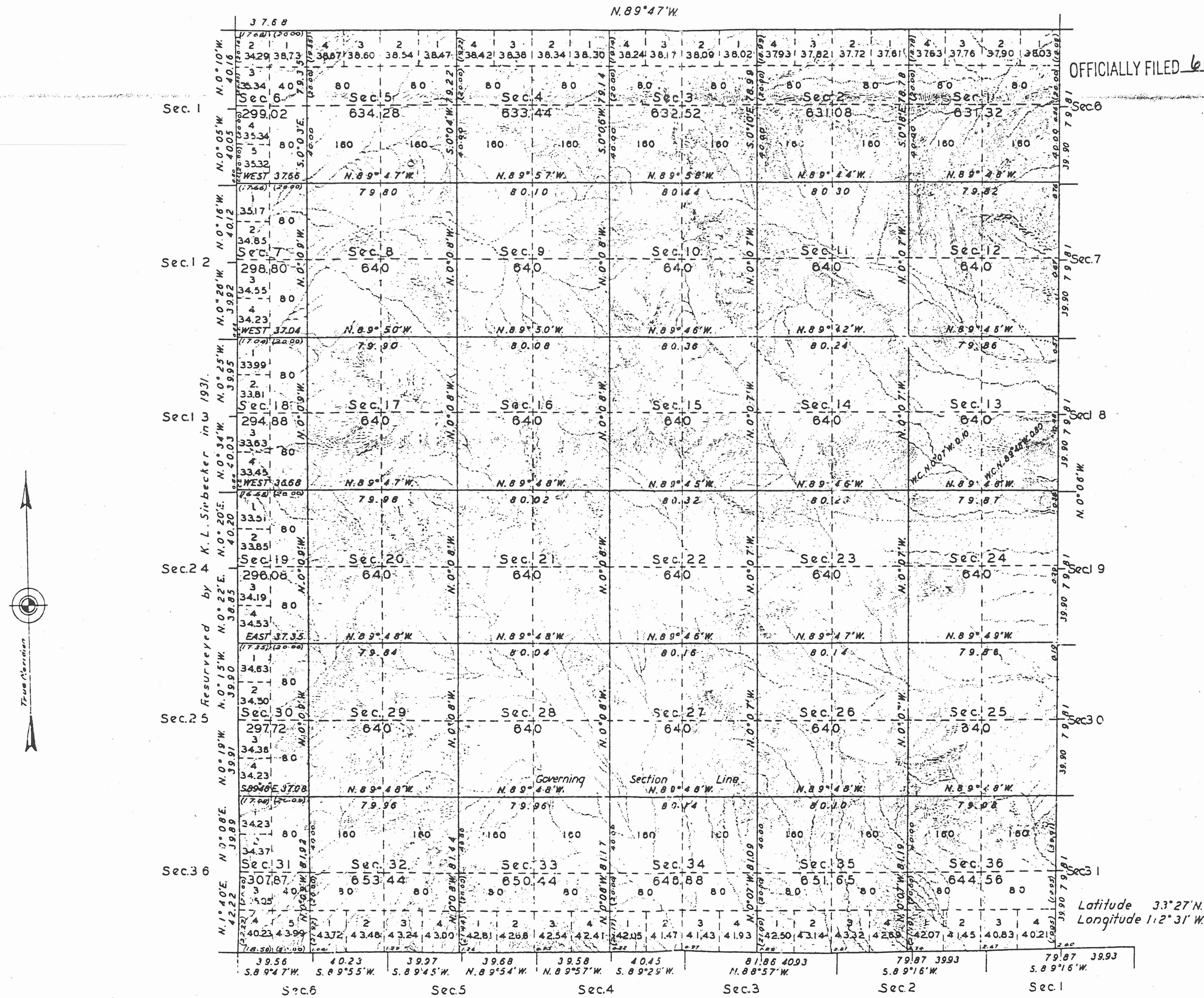
The above Map of Township No. 2 North, Range No. 1 East of Gila and Salt River Meridian is strictly conformable to the field notes of the Surveys thereof on file in this Office which have been examined and approved.

Surveyor General's Office,
San Francisco, California,
December 3rd 1868.

TOWNSHIP Nº 2 NORTH, RANGE Nº 3 WEST, GILA AND SALT RIVER MERIDIAN, ARIZONA.

2650

OFFICIALLY FILED 6-25-1936



Scale: 40 Chains to an inch

Area Surveyed 21,003.98 Acres.

LINES DESIGNATED	BY WHOM SURVEYED	GROUP Nº	GROUP DATE	MILEAGE MLS	MILEAGE CHS	WHEN SURVEYED BEGUN	WHEN SURVEYED COMPLETED
Exterior	Francis E. Joy	187	Oct. 4, 1933	17	37.81	Nov. 11, 1933	April 23, 1934
Subdivisional	Theodore Vander Meer	"	"	57	29.65	April 4, 1934	April 23, 1934
Miscellaneous	Benjamin J. Mollette	"	"		2 46	"	"

Office of U.S. Supervisor of Surveys
Denver, Colorado, February 23, 1935.

The above plat of Township Nº 2 North, Range Nº 3 West, of the Gila and Salt River Meridian, Arizona, is strictly conformable to the field notes of the survey thereof which have been examined and approved.

[signature]
U.S. Supervisor of Surveys.

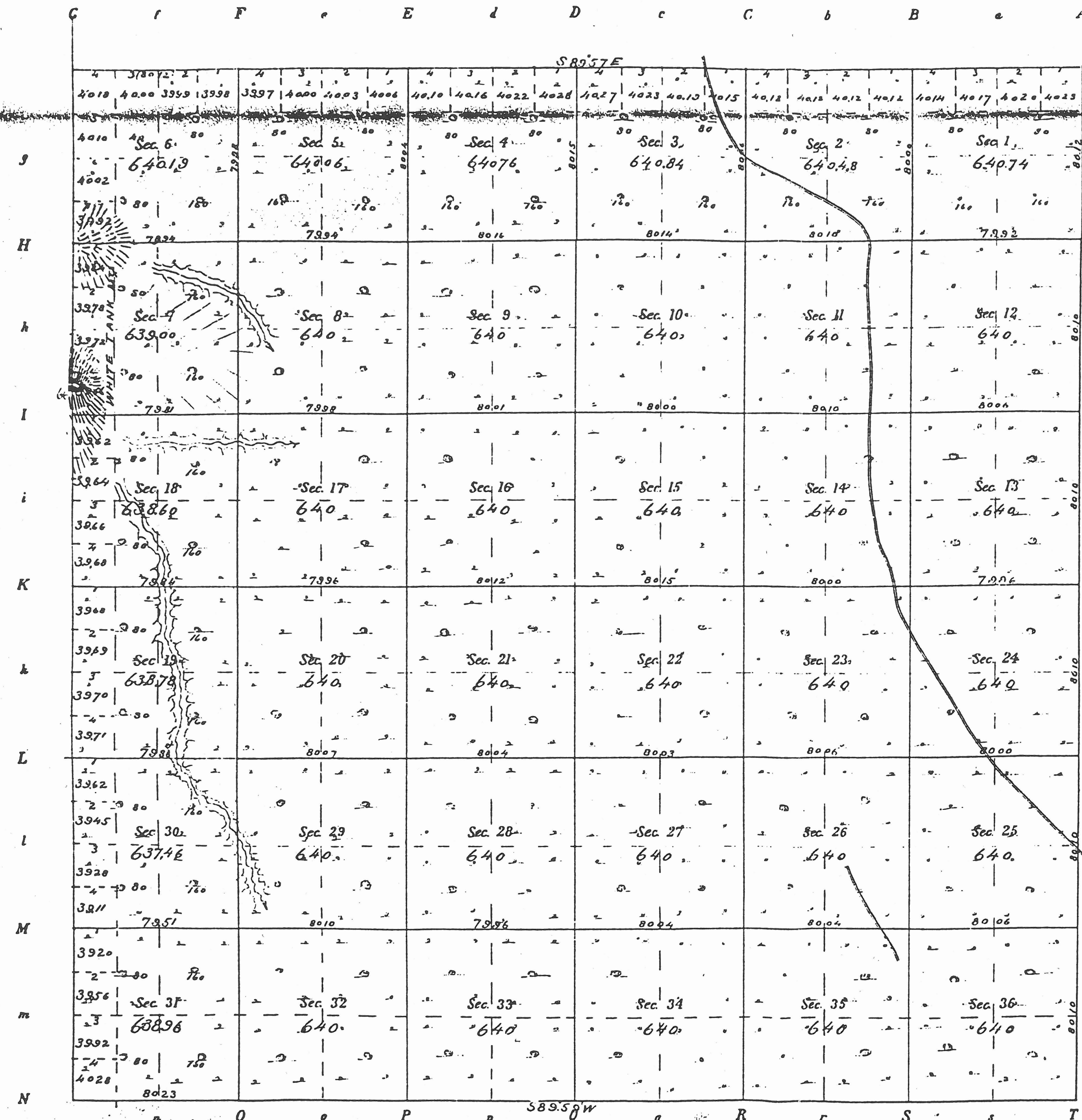
DEPARTMENT OF THE INTERIOR
GENERAL LAND OFFICE

Washington, D.C., April 2, 193[illegible]

The survey represented by this plat having been correctly executed in accordance with the requirements of law and the regulations of this office, is hereby accepted.

[signature]
Assistant Commissioner

TOWNSHIP No 2 NORTH RANGE No 2 WEST GILA and SALT RIVER MERIDIAN



Total number of Acres 23035.87

Scale 40 Chains to an Inch

Meanders of								
Posts	Courses	Chs Lks	Posts	Courses	Chs Lks	Posts	Courses	Chs Lks

OFFICIALLY FILED 4-7-1883

Surveys Designated	By Whom Surveyed	Date of Contract	Amount of Surveys (M. Chs Lks)	When Surveyed	Mean Declination
Township Lines	R.C. Powers	Jan 2nd 1883	18 00 74	Feb. 5th to 7th 1883	13°56' E
Subdivisions	"	"	60 00 25	" 8th to 12th "	" "

The above Map of Township No 2 North of Range No 2 West Gila & Salt River Meridian Arizona is strictly conformable to the field notes of the survey thereof on file in this Office which have been examined and approved.

Surveyor General's Office
Tucson Feb 27 1883 [signature] Sur. Genl

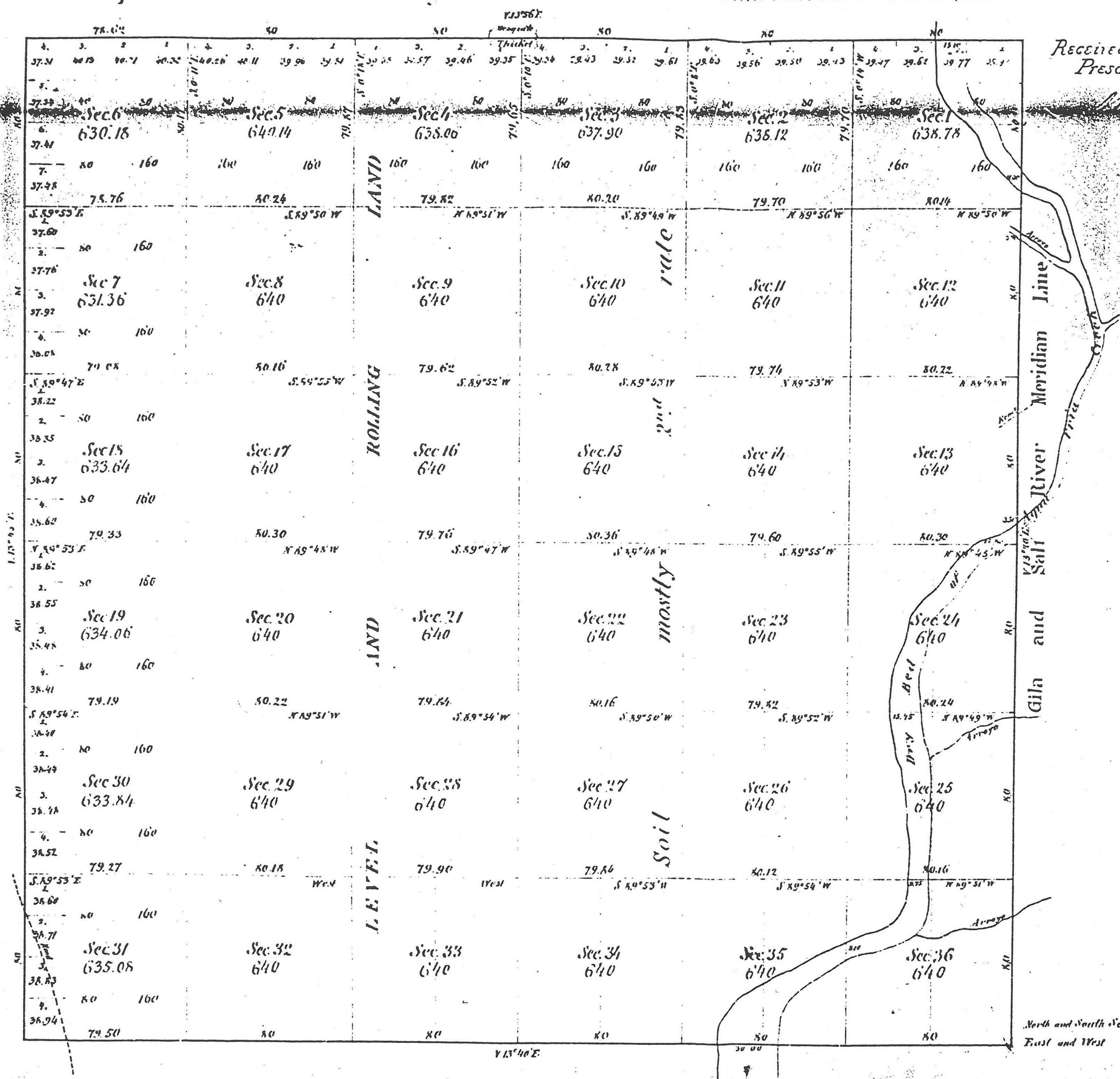
Township No. 2 North. Range No. 1 West. Gila and Salt River Meridian

2648

Received and filed in U S Land Office Prescott Arizona December 2nd 1870

Register

OFFICIALLY FILED 12-2-1870



Aggregate Area of Public land

North and South Section lines run at a Variation of 13° 45' East.
East and West . . . . 13° 40' East.

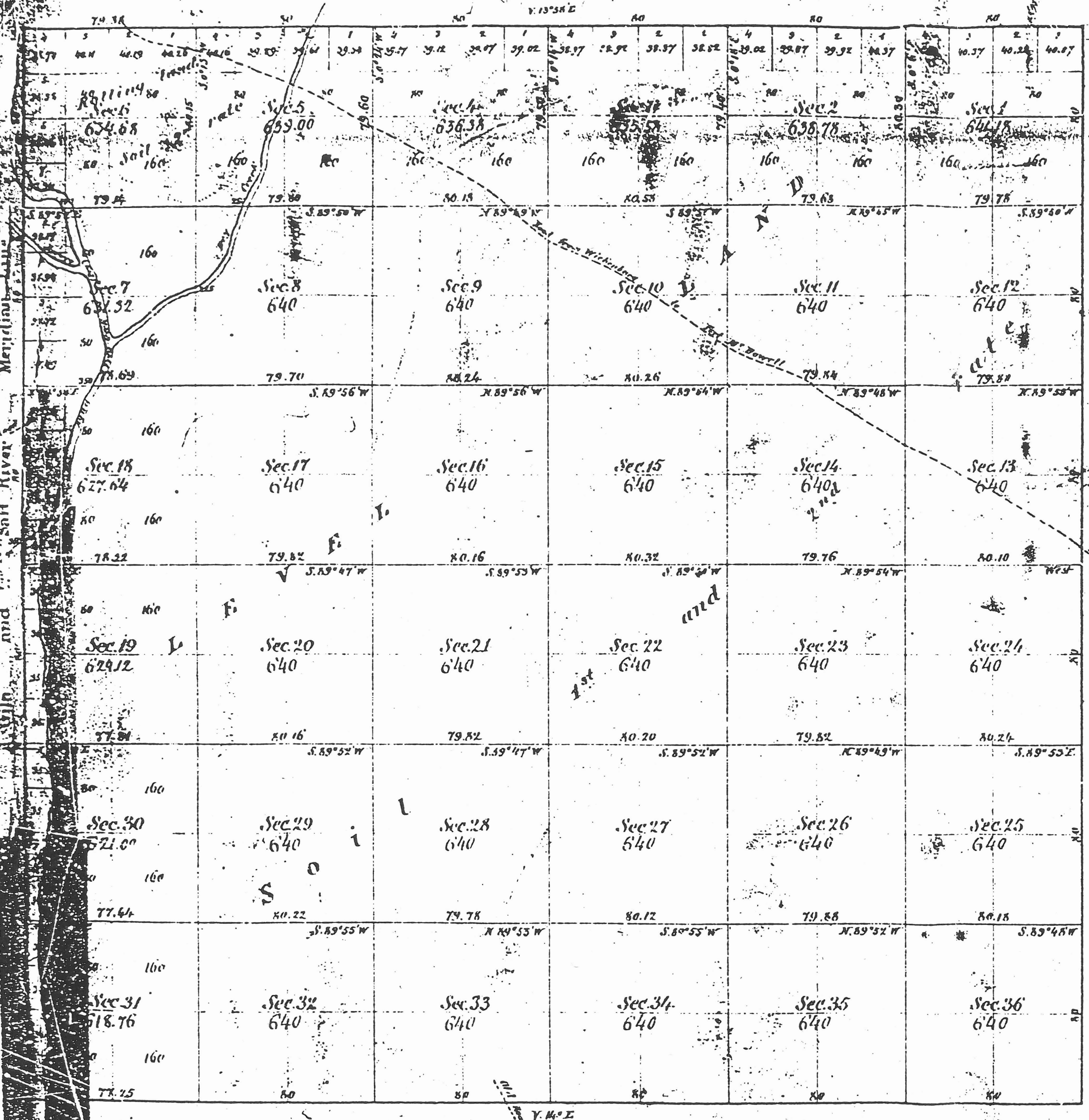
Surveys Designated	By Whom Surveyed	Date of Contract	Amount of Surveys	When Surveyed
East boundary of Township	Wm. H. Pierce	December 15th 1866		1867
Rest of Township lines	G. P. Ingalls	February 29th 1868	17 M. 75 Ch. 12 Lk.	1868
Section Lines	" " "	" " "	59 " 75 " 77 "	July 1st 1868

The above Map of Township No. 2 North, Range No. 1 West of Gila and Salt River Meridian is strictly conformable to the field notes of the Surveys thereof on file in this Office, which have been examined and approved.

Surveyor General's Office
San Francisco, Cal.
December 31, 1868.

Sherman Day
Surv. Genl. of Cal. and Arizona

Township No. 2 North, Range No. 1 East, Gila and Salt River Meridian



Received and filed in U.S. Land Office
Prescott Arizona December 2nd 1870.
John J. Berry
Register

OFFICIALLY FILED 12-2-1870

Aggregate Area of Public Land 22,958.56 Acres

Section lines run at a Variation of 13° 42' East.

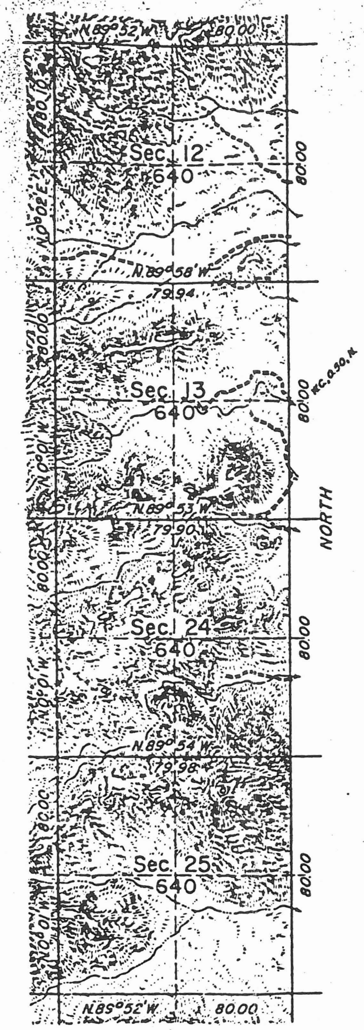
Designated	By Whom Surveyed	Date of Contract	Amount of Surveys	When Surveyed
of Township	Wm. H. Pierce	December 15th 1866	———	1867.
- -	W. F. Ingalls	February 13th 1868.	———	1868.
Township lines	G. P. Ingalls	February 29th 1868	11 Ms. 79 Ch. 38 Ls.	1868.
lines			59 . 70 . 69 .	March 21st 1868.

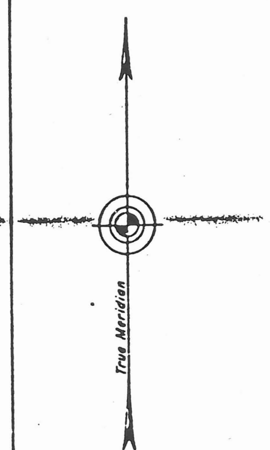
The above Map of Township No. 2 North, Range No. 1 East of Gila and Salt River Meridian is strictly conformable to the field notes of the Surveys thereof on file in this office which have been examined and approved.
Surveyor General's Office,
San Francisco, California,
December 2nd 1868.

ORIGINAL
2673-A

TOWNSHIP 3 NORTH, RANGE 3 WEST, OF THE GILA AND SALT RIVER MERIDIAN, ARIZONA.

OFFICIALLY FILED 6-25-1959





Mean magnetic declination
14° 30' E.

10 5 0 10 20 40 80
Scale in Chains

Area surveyed, 2,560.00 acres.

History of earlier surveys is contained in the field notes.

Survey of a portion of the subdivisional lines of T. 3 N., R. 3 W., Gila and Salt River Meridian, Arizona, executed by Donald E. Harding, March 19 to 26, 1958 under special instructions dated February 24, 1958 for Group 325, Arizona.

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Washington, D. C. March 25, 1959

This plat is strictly conformable to the approved field notes, and the survey, having been correctly executed in accordance with the requirements of law and the regulations of this Bureau, is hereby accepted.

For the Director

Earl G. Harrington
Cadastral Engineering Staff Officer

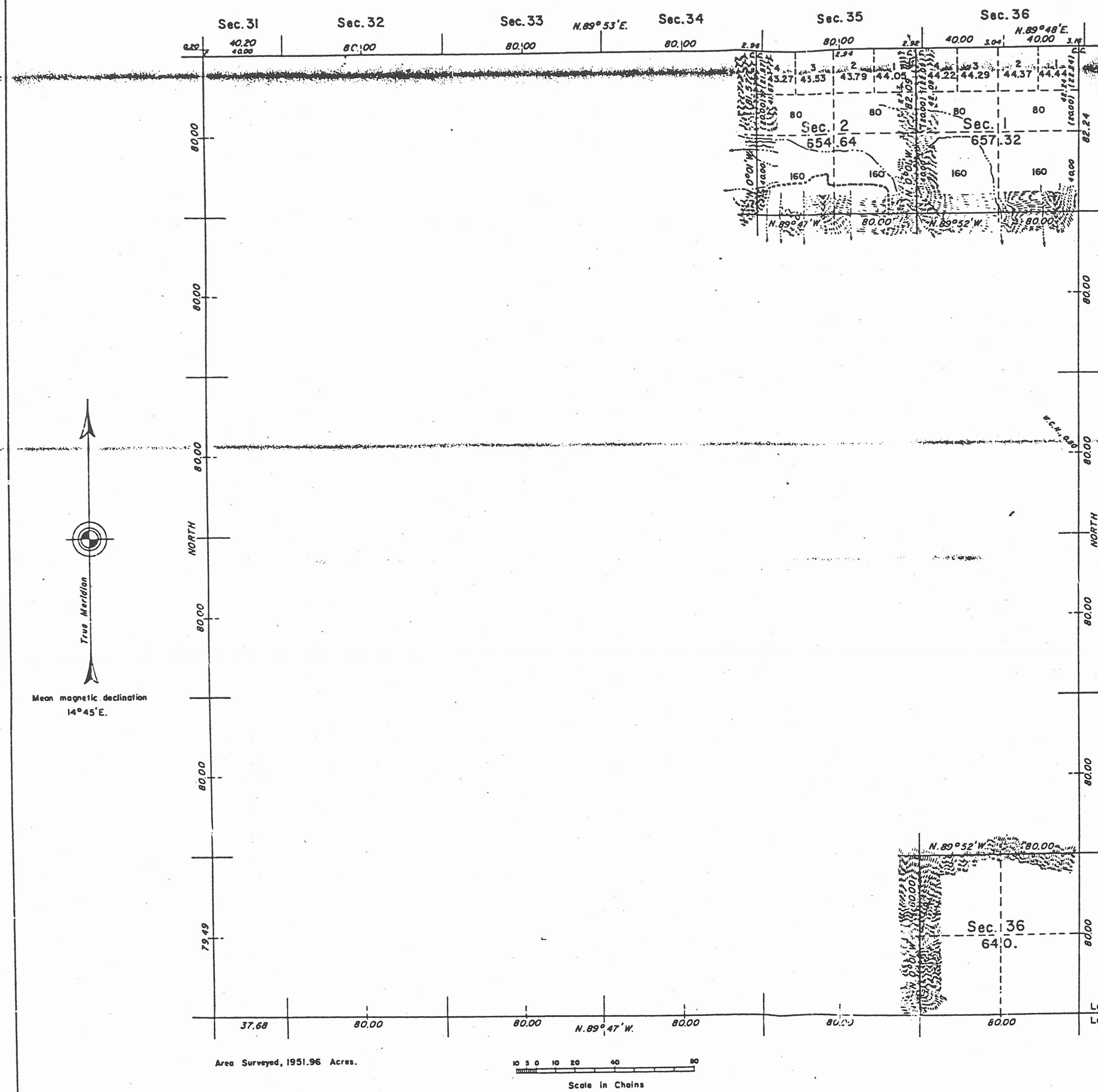
ABG

M.S.
I.W.H.

ORIGINAL

TOWNSHIP 3 NORTH, RANGE 3 WEST, OF THE GILA AND SALT RIVER MERIDIAN, ARIZONA.

2674



OFFICIALLY FILED 5-31-1956

The history of earlier surveys is contained in the field notes.

The survey of a portion of the subdivisional lines of Township 3 North, Range 3 West, executed by Paul K. Russell January 26 to February 7, 1955 under special instructions dated December 13, 1954 for Group 300, Arizona.

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Washington, D.C. November 15, 1955

This plat is strictly conformable to the approved field notes, and the survey, having been correctly executed in accordance with the requirements of law and the regulations of this Bureau, is hereby accepted.

For the Director

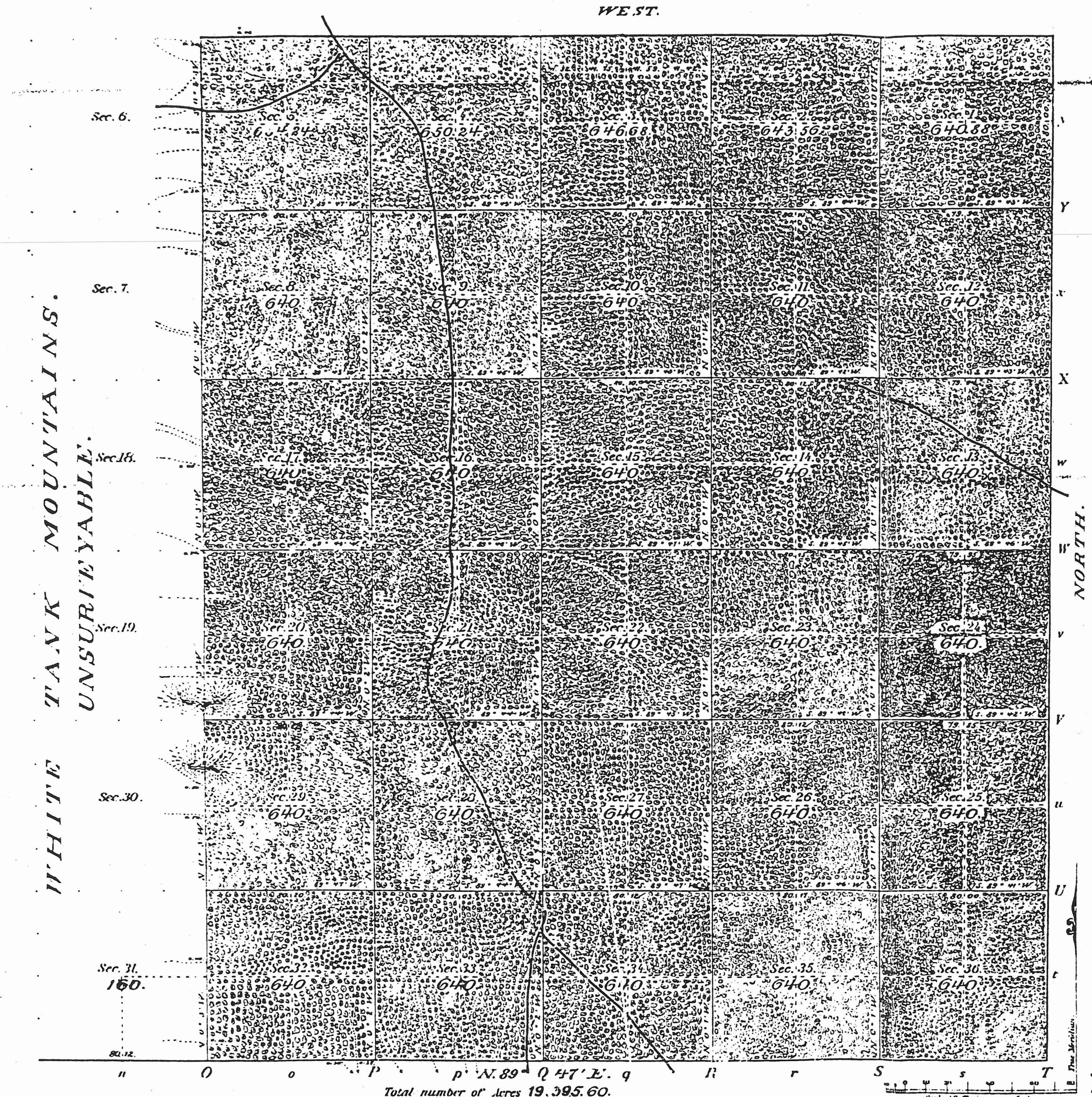
Earl G. Harrington

Cadastral Engineering Staff Officer

Latitude 33°33'00" N.
Longitude 112°30'49" W.

Township No. 3 North Range No. 2 West Gila and Salt River Meridian Ariz.

2673



Meanders of

Posts	Courses	Ch. Lks.	Posts	Courses	Ch. Lks.	Posts	Courses

OFFICIALLY FILED 11-12-1896

Latitude: 33° 33' N.
Longitude: 112° 25' 25" W.

Total number of Acres 19,395.60.

Surveys Designated	By Whom Surveyed	Date of Contract	Amount of Surveys M. Ch. Lks.	When Surveyed	Mean Declinatn
N. E. & S. Township lines	Albert J. Colton	35. March 14. 1894.	17. 00. 12.	Sept: 18 - 19. 1894.	
Subdivisions	" " "	" " " "	55. 00. 97.	Oct: 15 - 25. 1894.	13° 45' East.

The above Map of Township No. 3 North of Range No. 2 West Gila and Salt River Meridian Arizona is strictly conformable to the field notes of the survey thereof on file in this Office, which have been examined and approved.

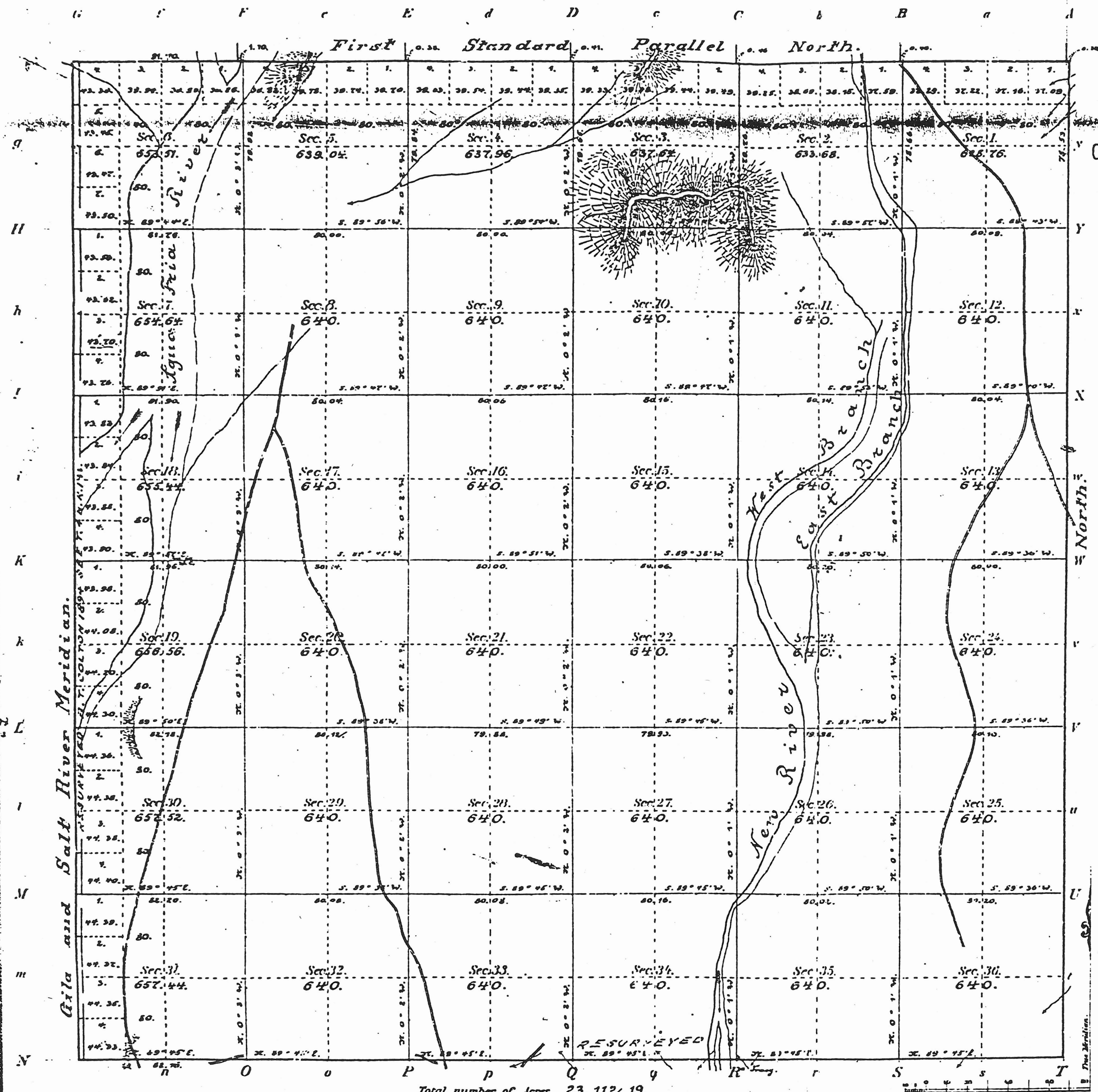
Surveyor General's Office.
Tucson, Arizona, August 6th 1896.

George J. Roskruge
Sur. Genl.

X00158

Township No. 4 North Range No. 1 East Gila and Salt River Meridian

OFFICIALLY FILED 5-20-1895



Total number of Acres 23.112.19.

Surveys Designated	By Whom Surveyed	Date of Contract	Amount of Surveys M.	Chs.	Lks.	When Surveyed	Mean Declin:
Township lines	James H. Martineau	June 21st 1893.	5.	78.	53.	Decbr: 16-27. 1893	
Subdivisions	Ridgley C. Powers	Jan: 1st 1892	60.	09.	38.	Sep: 1-7th 1894	13° 19' East
Connections Subdivn	do	do		3.	35.	do	
do Town: lines	James H. Martineau	June 21st 1893.			32.	Decbr 16-27th 1893	
Standard	Wm. H. Pierce	Decbr 15th 1866	6.	00.	00.	Febry 8th 1867	
Meridian	do	do	6.	00.	00.	Jany 31st 1867.	
South Bound.	G. P. Ingalls.	Febr. 29th 1868	6.	02.	16.	March 24th 1868	
do resurv:	James H. Martineau	June 21st 1893	6.	02.	16.	Decbr 16-27 1893	

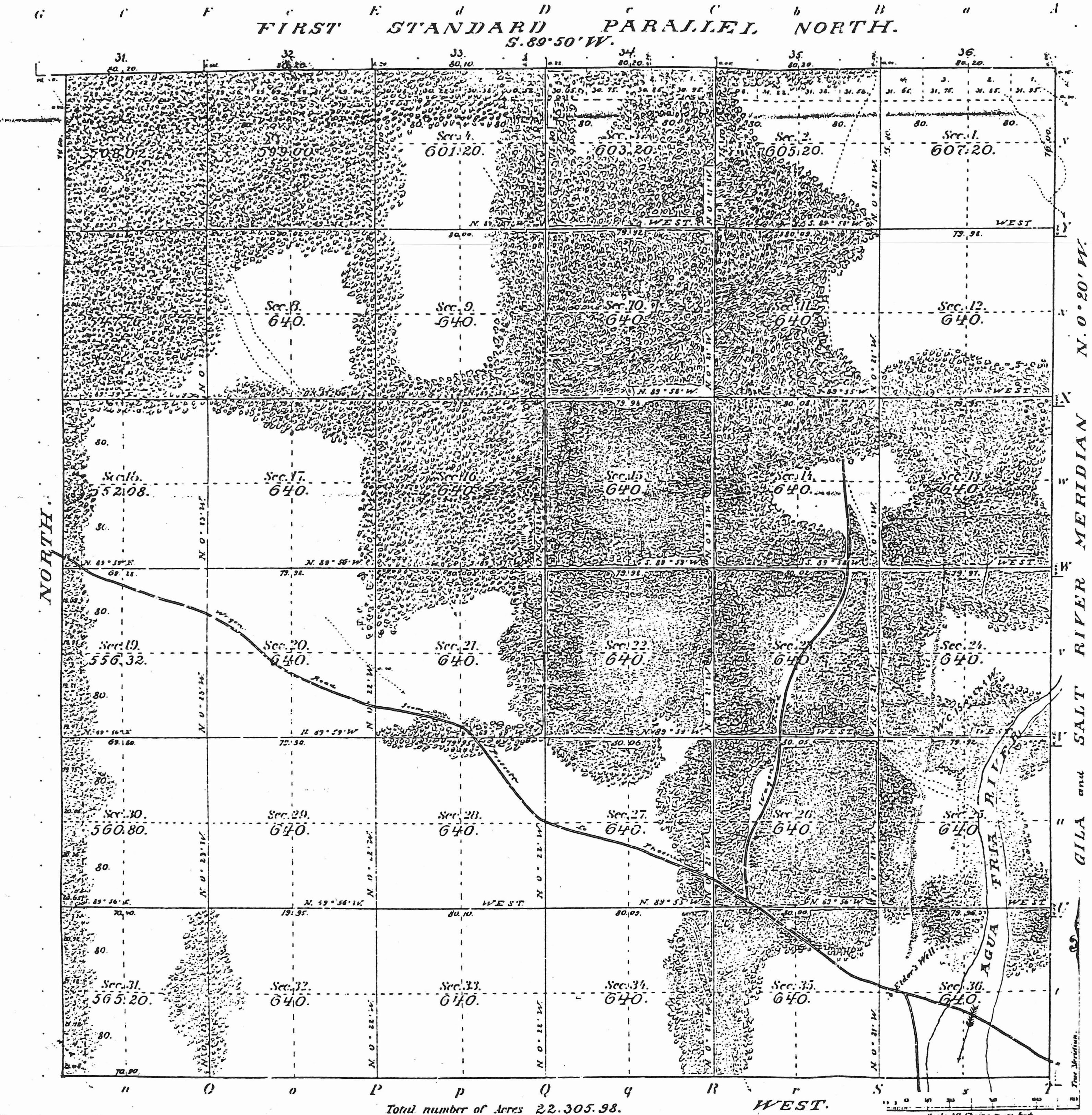
The above Map of Township No. 4 North of Range No. 1 East Gila and Salt River Meridian, Arizona is strictly conformable to the field notes of the survey thereof on file in this Office, which have been examined and approved.

Surveyor Generals Office,
Tucson, Arizona, January 28th 1895.

Levi H. Manning
Surv. Genl.

Township No. 4 North Range No. 1 West Gila and Salt River Meridian, Ariz.

2696



Total number of Acres 22.305.98.

Latitude: 33° 38' N.
Longitude: 112° 18' 25" W.

Surveys Designated	By Whom Surveyed	Date of Contract	Amount of Surveys M.	Ch.	Lk.	When Surveyed	Mean Declination
Township lines	Albert J. Colton	35. March 14. 1894	11.	65.	50.	Sept: 7. 11. 1894.	
Subdivisions	" " "	" " " "	59.	02.	63.	Octob: 3 - 13. 1894.	13° 45' East.
Meridian Resurvey	" " "	" " " "	5.	79.	90.	September 17. 1894	
Standard "	" " "	" " " "	6.	1.	10.	" 13. "	
Connections	" " "	" " " "		37.	27.	Octob: 3 - 13th 1894	

Meanders of

Posts	Courses	Ch. Lks	Posts	Courses	Ch. Lks	Posts	Courses

OFFICIALLY FILED 11-12-1896

The above Map of Township No. 4 North of Range No. 1 West Gila and Salt River Meridian Arizona is strictly conformable to the field notes of the survey thereof on file in this Office, which have been examined and approved.

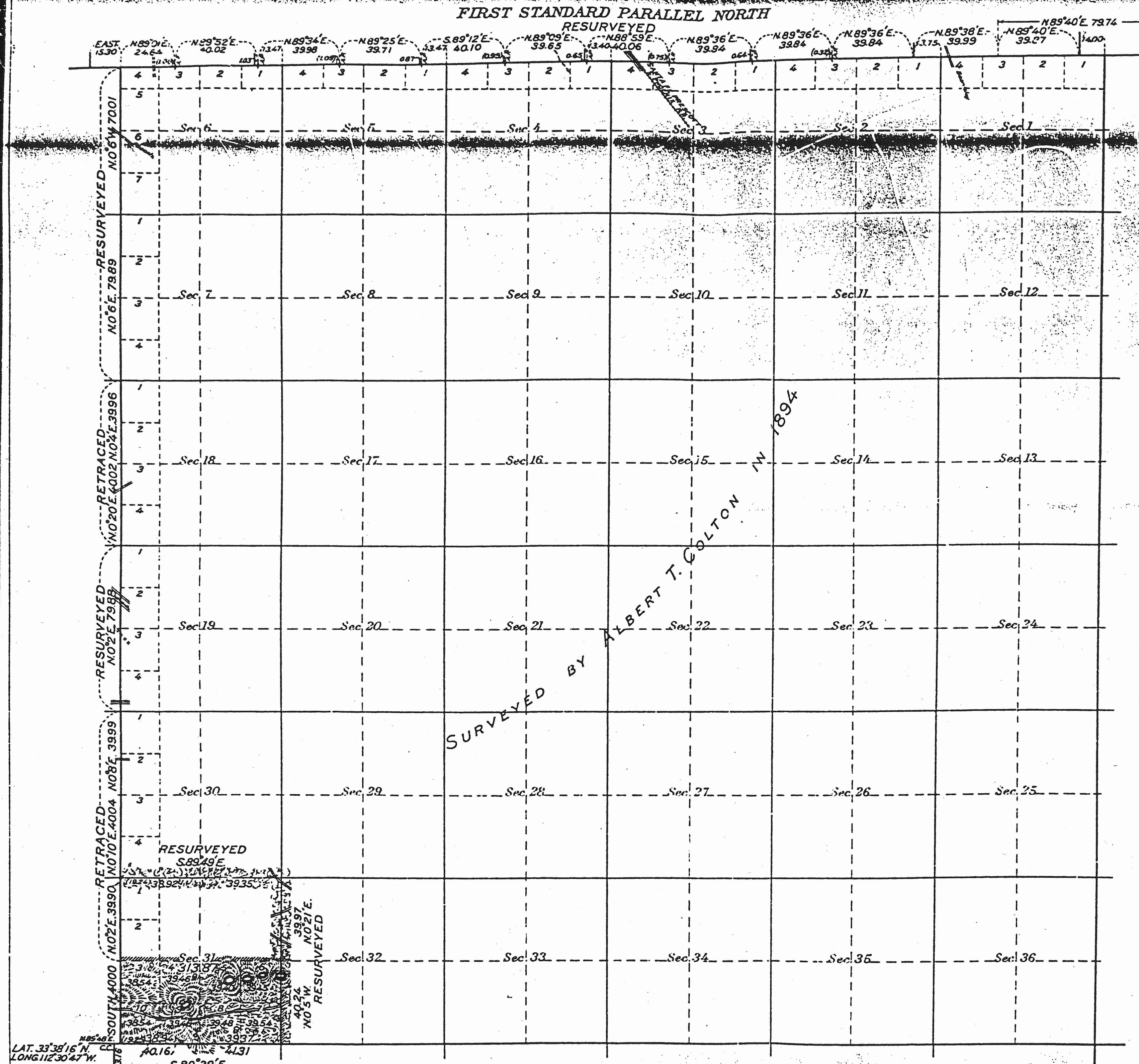
Surveyor General's Office.
Tucson, Arizona, August 6th 1896.

George J. Roskruge
Sur. Genl.

Township No. 4 North Range No. 2 West, Gila and Salt River Meridian, Arizona.

2697

OFFICIALLY FILED 9-9-1924



Areas in Acres	
Public Land	313.87
Indian Reservation	
Indian Allotments	
Mineral Claims	
Water Surface	
Total Area	

Scale 40 Chains to an inch

Mean Magnetic Declination 14°45' E.

Surveys Designated	By Whom Surveyed	Group No.	Group Date	Amount of Surveys (Mls. chs. lks.)	When Surveyed Begun	When Surveyed Completed
South Bdy. Surv.	Ty White, U.S.T.	115	May 20, 1921.	S. of sec. 31.	Dec. 1,	1922.
Sub. lines Resurv.				30/31 and 31/32	Dec 1,	1922.
1st Std. Par. N. Resurv.	H. D. Voigt, U.S.T.	59	Sept. 24, 1915.	Completed	19	16
West Bdy. Retraced	H. D. Voigt, U.S.T.	39	Dec. 4, 1914.	W. of 18, 30 & N ½ 31	19	15
West Bdy. Resurv.				W. of 6, 7 & 19	19	15
West Bdy. Surveyed				W. of S ½ 31	19	15
South Bdy. Surveyed	A. T. Colton, U.S.D.S.	Contract 35	March 14, 1894	E. 5 Miles	18	94
East Bdy. Surveyed				Complete	18	94
Sub. lines Surveyed				Complete	18	94

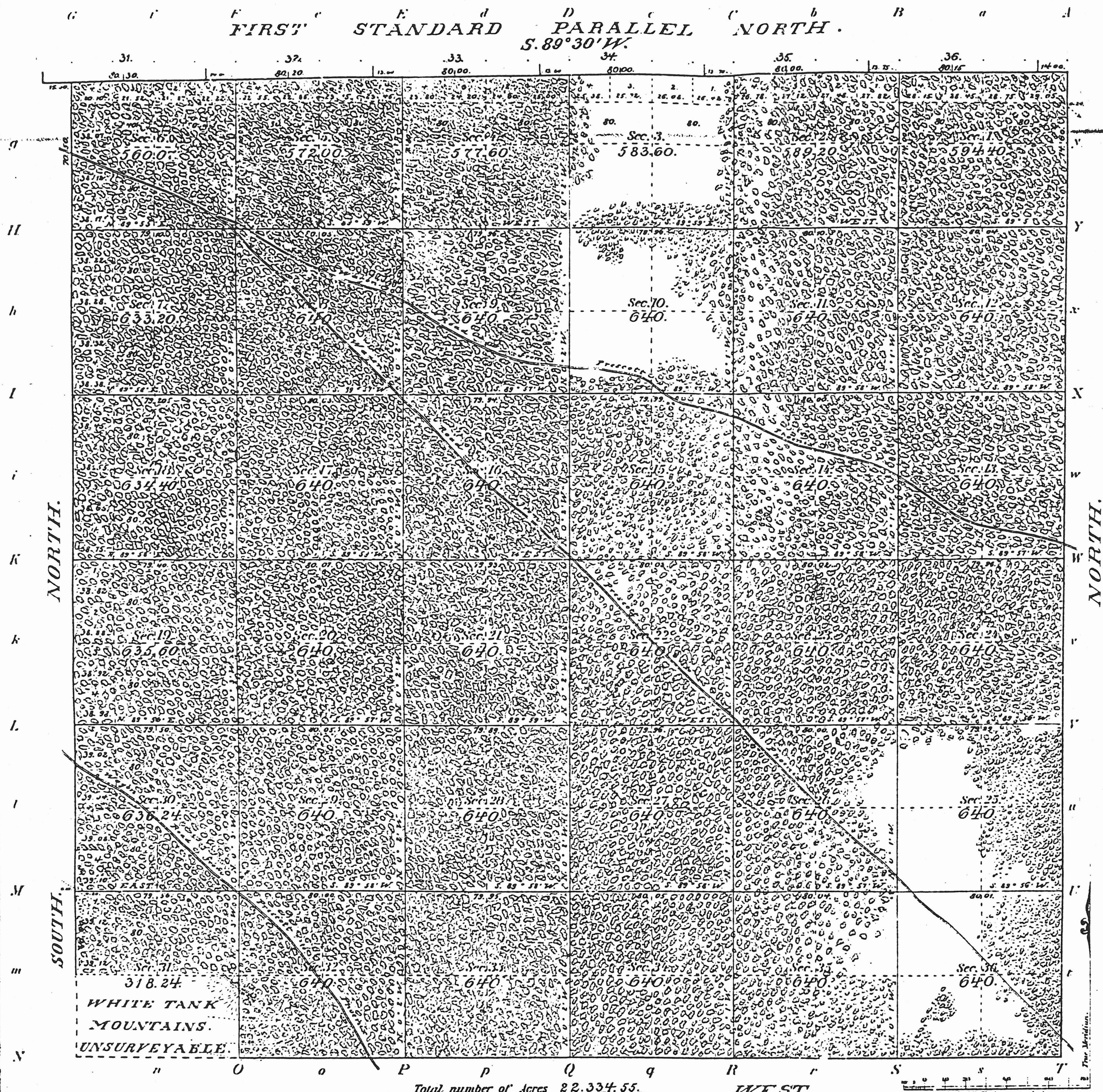
The above map of Township No. 4 North Range No. 2 West of the Gila and Salt River Meridian, Arizona is strictly conformable to the field notes of the survey thereof on file in this office, which have been examined and approved.

U. S. Surveyor General's Office.
Phoenix, Arizona, April 22, 1924.

Charles M. Donohoe
Surveyor General.

Township No. 4 North Range No. 2 West Gila and Salt River Meridian, Ariz.

2698



Total number of Acres 22.334.55.

WEST.

Scale 40 Chains to an Inch.

Meanders of

Posts	Courses	Ch's Lks	Posts	Courses	Ch's Lks	Posts	Courses

OFFICIALLY FILED 11-12-1896

Latitude: 33° 38' N.
Longitude: 112° 24' 45" W.

Surveys Designated	By Whom Surveyed	Date of Contract	Amount of Surveys M.	Ch's	Lks	When Surveyed	Mean Declination
E. S. & W. Township lines	Albert J. Colton	35. March 14. 1894.	16.	34.	60.	Sep: 1. 19. 20, 1894.	
Subdivisions	" " "	" " " "	59.	39.	65.	Oct: 26 - Nov: 6. 1894.	13° 45' East.
Standard Resurvey	" " "	" " "	6.	00.	65.	Sept: 14. 1894.	
Connections	" " "	" " " "	1.	03.	35.	Oct: 26 - Nov: 6. 1894.	

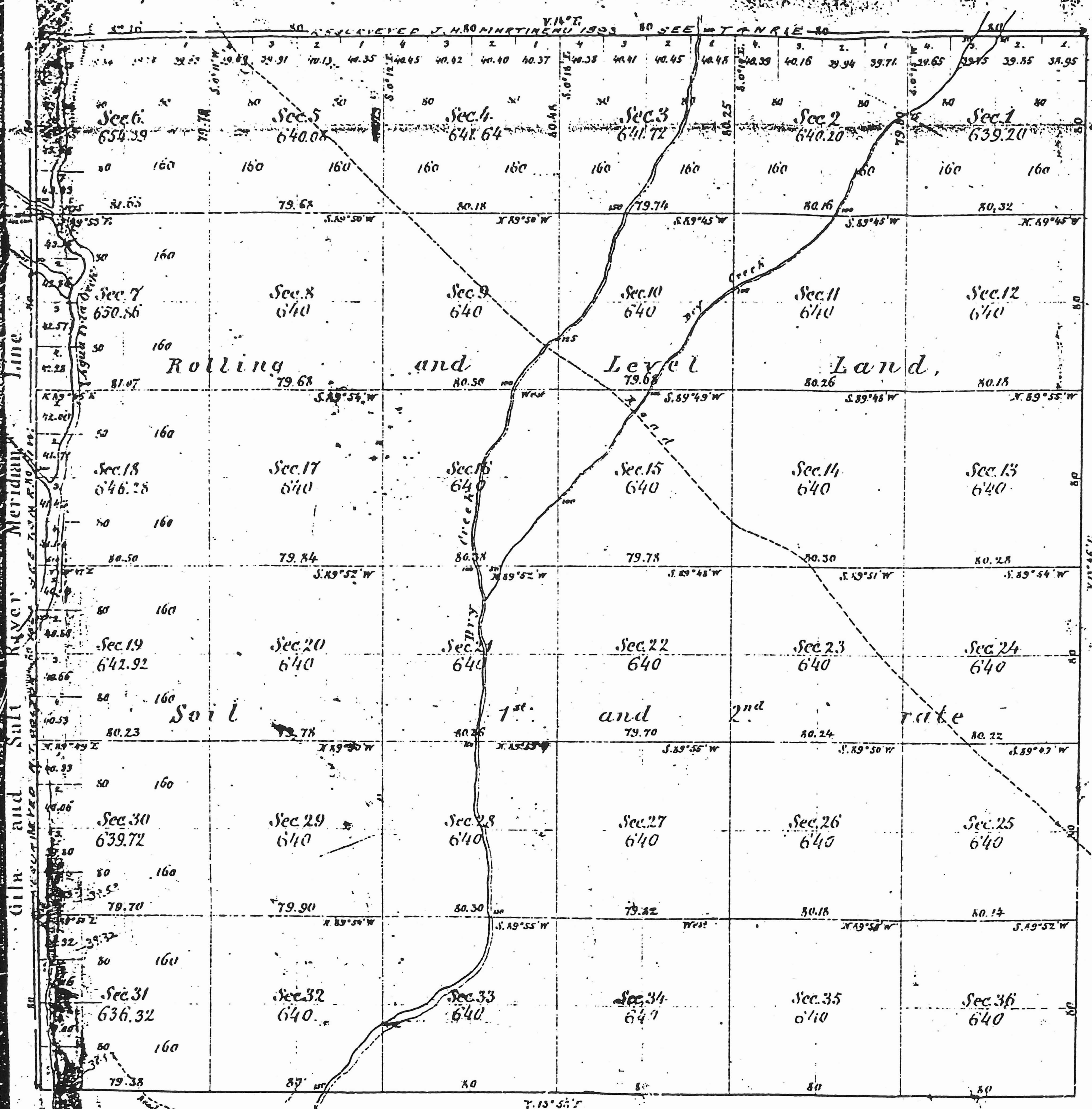
The above Map of Township No. 4 North of Range No. 2 West Gila and Salt River Meridian Arizona is strictly conformable to the field notes of the survey thereof on file in this Office, which have been examined and approved.

Surveyor General's Office.
Tucson, Arizona, August 6th 1896

George J. Roskruge
Sur. Gen.

Township No. 3 North. Range No. 1 East. Gila and Salt River Meridian

X00108



Received and filed in U S Land Office Prescott Arizona December 2d 1870.

Register.

OFFICIALLY FILED 12-2-1870

Aggregate Area of Public Land . . . . 23,073.33 Acres.

North and South Section lines run at a Variation of 13°46' East
East and West " " " " " 13°58' East.

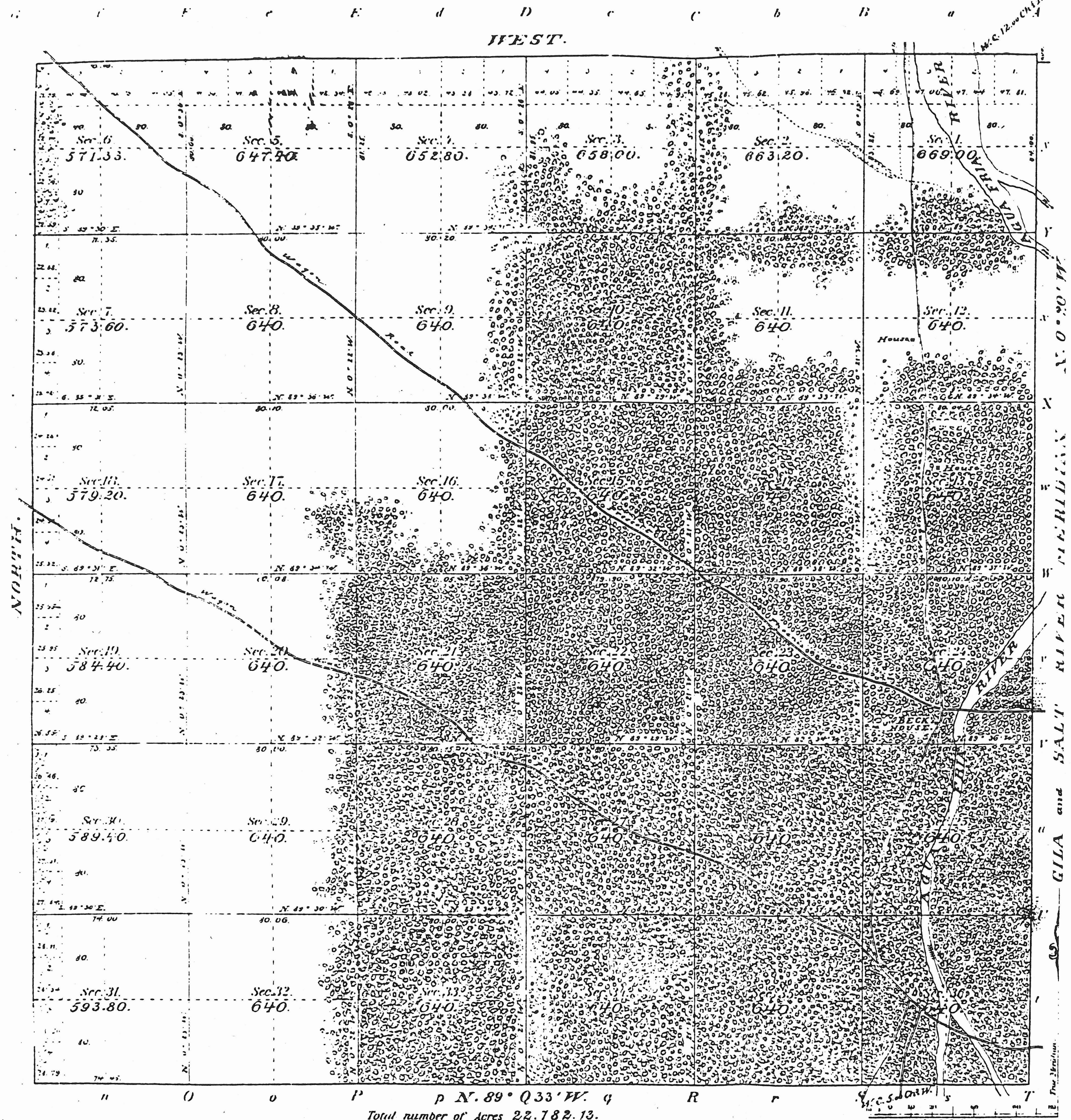
Surveys Designated	By Whom Surveyed	Date of Contract	Amount of Surveys	When Surveyed
Boundary of Township	Wm. K. Pierce	December 15th 1866	———	1867
of Township lines	G. P. Ingalls	February 29th 1868	18 Ms. 01 Ch. 50	1868
Section lines	" " "	" " "	60 " 05 " 60	April 2nd 1868

The above Map of Township No. 3 North, Range No. 1 East of Gila and Salt River Meridian is strictly conformable to the field notes of the Surveys thereof on file in this Office which have been examined and approved.
Surveyor General's Office,
San Francisco, California,
December 31st 1868.

Sur. Gen. Cal.

2671

Township No. 3 North Range No. 1 West Gila and Salt River Meridian, Ariz.



Total number of Acres 22.782.13.

Latitude: 33° 6' N.
Longitude: 112° 18' 30' W.

OFFICIALLY FILED 11-12-1896

Surveys Designated	By Whom Surveyed	Date of Contract	Amount of Surveys M.	Ch.	Lk.	When Surveyed	Mean Declinatn
N. W. & S. Township lines	Albert J. Colton 35.	March 14. 1894	17.	65.	35.	Sept. 3. 6. 10. 1894	
Subdivisions	" " "	" " "	59.	53.	40.	Sept. 21 - Oct. 2. 1894	13° 45' East.
Meridian Resurvey	" " "	" " "	6.	4.	00.	September 6. 1894	

The above Map of Township No. 3 North of Range No. 1 West Gila and Salt River Meridian Arizona is strictly conformable to the field notes of the survey thereof on file in this Office, which have been examined and approved.

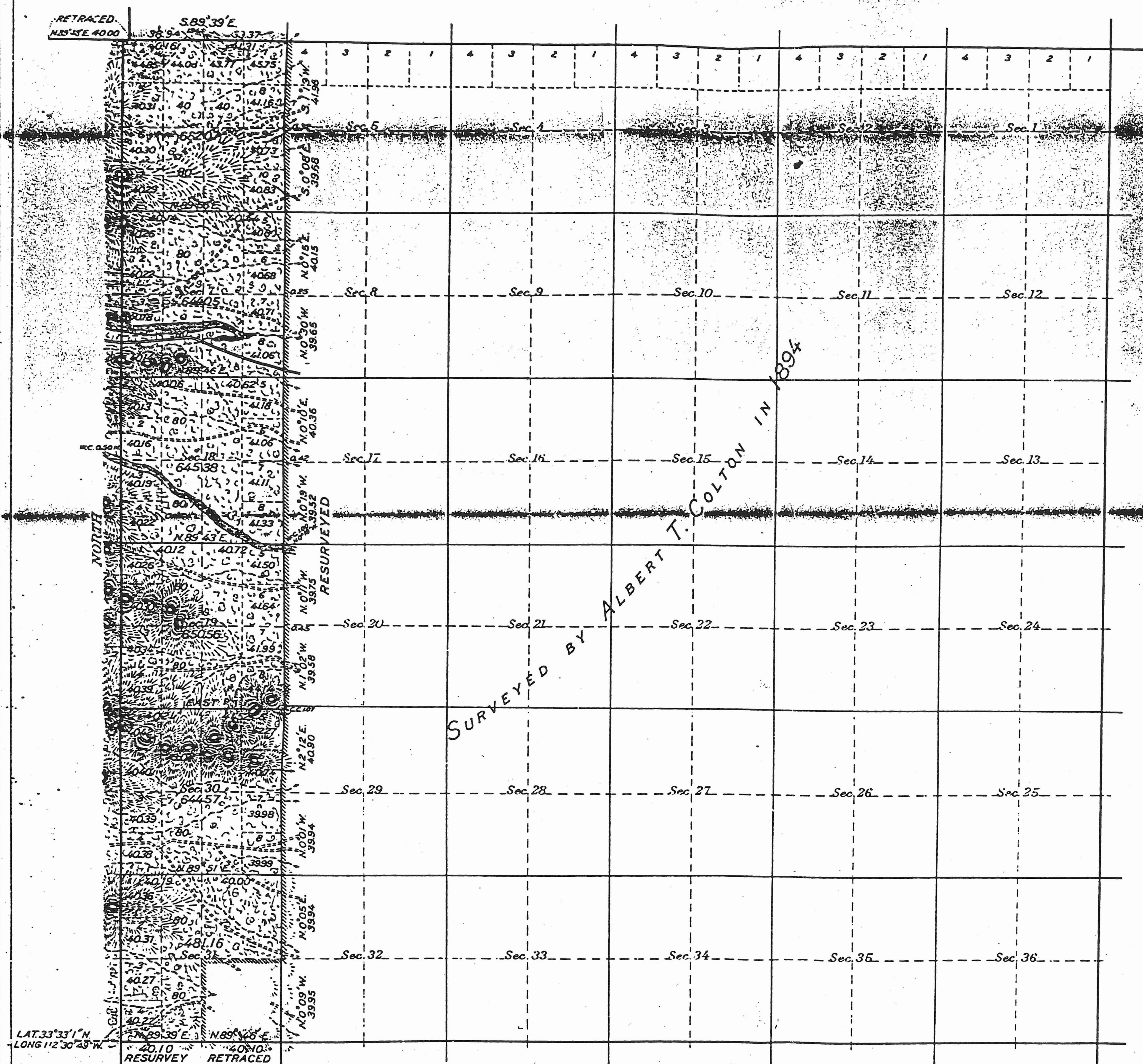
Surveyor General's Office.
Tucson, Arizona, August 6th 1896.

George J. Roskruge
Surv. Genl.

Township No 3 North Range No 2 West Gila and Salt River Meridian Arizona

2672

OFFICIALLY FILED 9-9-1924



Areas in Acres	
Public Land	3,727.79
Indian Reservation	
Indian Allotments	
Mineral Claims	
Water Surface	
Total Area	

Scale 40 Chains to an inch

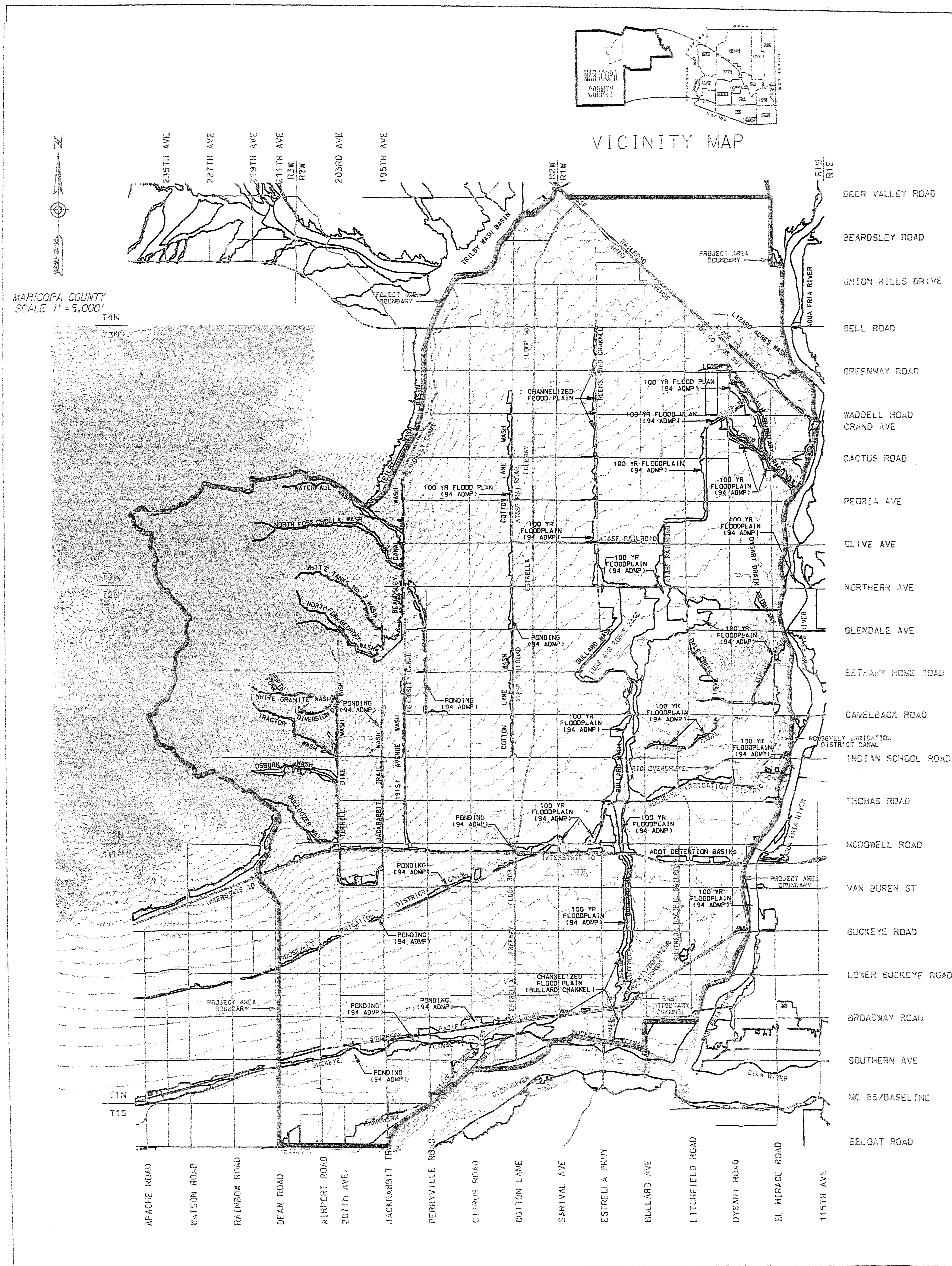
Mean Magnetic Declination 14°43' E.

Surveys Designated	By Whom Surveyed	Group No.	Group Date	Amount of Surveys (Mls. chs. lks.)	When Surveyed: Begun	When Surveyed: Completed
South Bdy. Retraced.	Wm. H. Thorn U.S.C.E. and Ty White, U.S.T.	115	May 20, 1921.	S. of E½ Sec. 31.	Dec. 4, 1922.	
South Bdy. Resurveyed.				S. of W½ Sec. 31.	Dec. 4, 1922.	
West Bdy. Surveyed.				Complete	Dec. 4, 1922.	Dec. 9, 1922.
North Bdy. Surveyed.				S. of sec. 31 T. 4 N.-R. 2 W.	Dec. 1, 1922.	
Subdivisions Resurv.				W. of 5, 8, 17, 20, 29 & 32.	Dec. 2, 1922.	Dec. 4, 1922.
Subdivisions Surv.				6/7, 7/18, 18/19, 19/30 & 30/31	Dec. 7, 1922.	Dec. 11, 1922.
S. Bdy. Resurv. & N. Bdy. Surv.	A. T. Colton, U.S.D.S.	Cont. 35	March 14, 1894.	E. 5 miles	1894	
E. Bdy. Surveyed.				Complete	1894	
Subdivisions Surv.				E. 5 ranges of secs.	1894	

The above map of Township No. 3 North Range No. 2 West of the Gila and Salt River Meridian, Arizona is strictly conformable to the field notes of the survey thereof on file in this office, which have been examined and approved.

U. S. Surveyor General's Office.
Phoenix, Arizona, April 22, 1924.

Charles M. Donohoe.
Surveyor General.



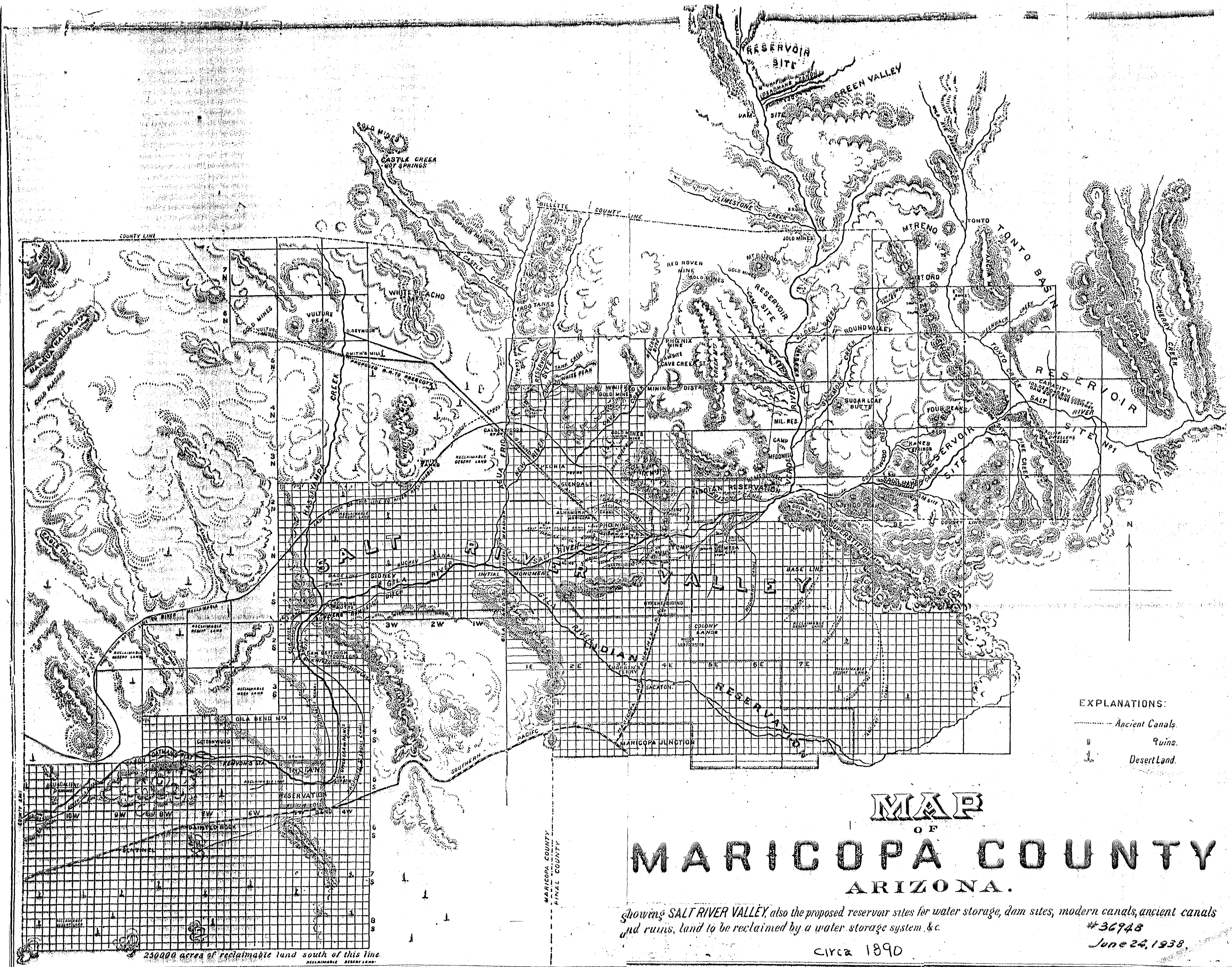
Date MAY 2003		
Job No. E1152600		
Sheet X of X		

EXISTING FLOOD PLAIN MAP
AND NATURAL WASHES
LOOP 303 CORRIDOR/WHITE TANKS
AREA DRAINAGE MASTER PLAN UPDATE
DATA COLLECTION

Design
Drawn XXX
Check XXX
Scale 1"=5,000'

URS

Flood Control District of Maricopa County



MAP OF MARICOPA COUNTY ARIZONA.

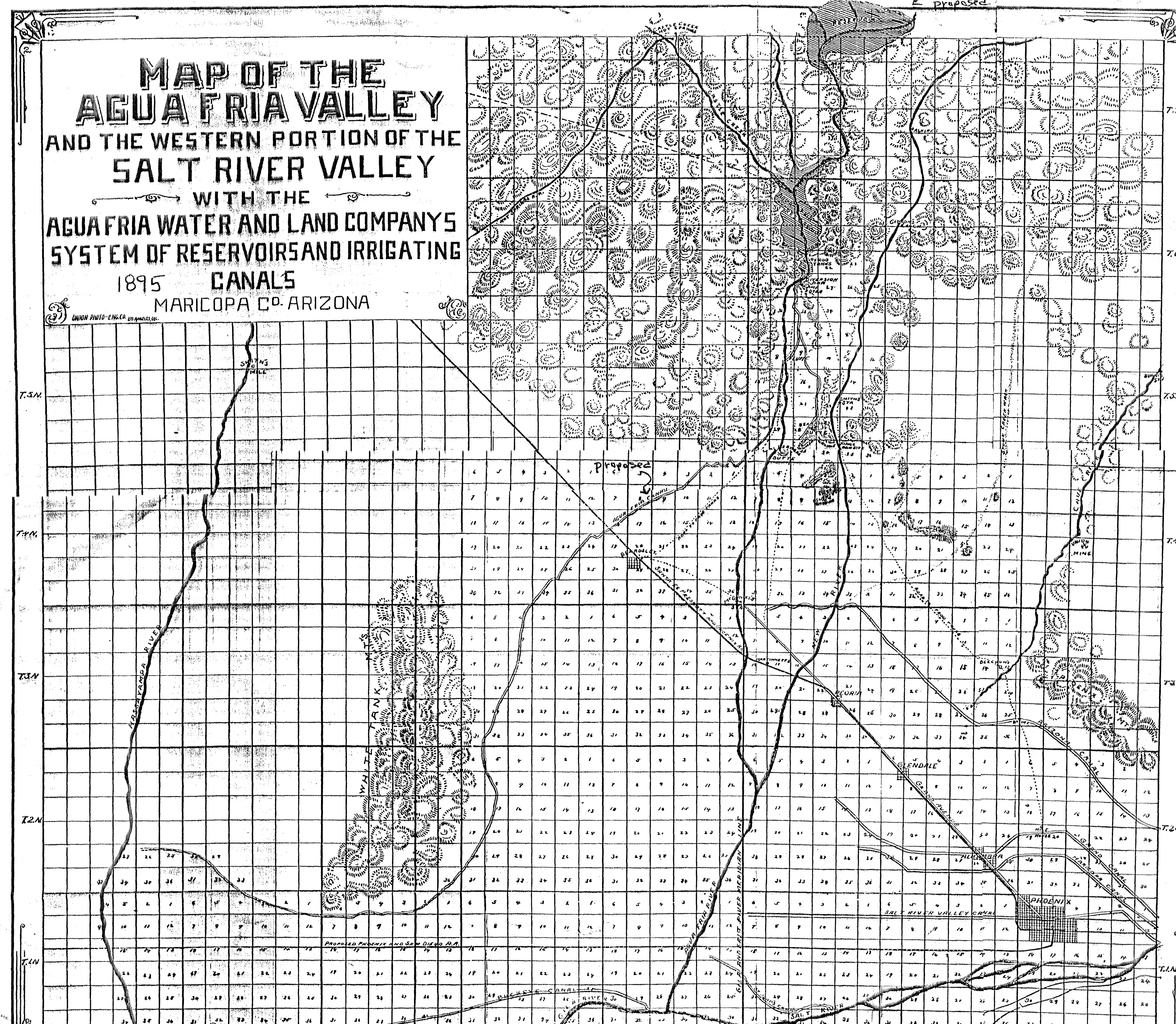
Showing SALT RIVER VALLEY, also the proposed reservoir sites for water storage, dam sites, modern canals, ancient canals and ruins, land to be reclaimed by a water storage system &c.

EXPLANATIONS:
Ancient Canals.
Ruins.
Desert Land.

#36948
June 24, 1938.

Circa 1890

Counties
Maricopa C...



The Portion of Map Printed in Blue Shows the Lands Under the Canal and Irrigation System.