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FINAL ENVIRONMENTAL IMPACT STATEMENT

NEW RIVER & PHOENIX CITY STREAMS

MARICOPA COUNTY, ARIZONA

U.S. ARMY ENGINEERS
LOS ANGELES DISTRICT
CORPS OF ENGINEERS

MARCH 1976

SUMMARY

NEW RIVER AND PHOENIX CITY STREAMS

( ) DRAFT (X) FINAL ENVIRONMENTAL STATEMENT

RESPONSIBLE OFFICE: US ARMY ENGINEER DISTRICT, LOS ANGELES, CALIFORNIA

FOR FURTHER INFORMATION REGARDING THIS STATEMENT CONTACT:

COL. JOHN V. FOLEY
US ARMY ENGINEER DISTRICT, L.A.
300 N. LOS ANGELES STREET
LOS ANGELES, CALIFORNIA 90053
(213) 688-5470

1. NAME OF ACTION: (X) ADMINISTRATIVE ( ) LEGISLATIVE

2. DESCRIPTION: The project is the second phase of a 5-phase plan designed to serve as a framework for flood control work in the Phoenix area. Indian Bend Wash from the Arizona Canal to the Salt River, the first of the 5 independent phases, is in preconstruction planning.

The purpose of the project is to control floods along Cave Creek, Skunk Creek, Dreamy Draw Wash, and the New and Agua Fria Rivers, thereby affording flood protection to a highly urbanized part of Maricopa County including parts of the Cities of Phoenix, Glendale, Peoria, Sun City, and Avondale.

Flood protection will be provided by a combination of structural and nonstructural controls. Three flood control dams, to be located on Cave Creek, Skunk Creek, and New River, will be constructed. A fourth dam on Dreamy Draw Wash was completed in 1973. Informal recreational facilities for activities such as picnicking, camping, hiking and riding will be provided at two of the damsites. The third site will remain as open space.

A 17-mile long diversion channel will be constructed immediately north of and parallel to the Arizona Canal. The diversion channel will contain both concrete and earth sections. The earth section (4.4 miles) will be developed into a recreational greenbelt.

Flood plain management will be initiated along 14 miles of Skunk Creek and New River as well as along Cave Creek and Dreamy Draw Wash. Flowage easements will be purchased along 21 miles of Skunk Creek and the New and Agua Fria Rivers below the proposed diversion channel. Along the streambeds, riding and hiking trails will be planned to complement existing and proposed trail systems. Along Cave Creek, a regional park will be developed in conjunction with local sponsors.

This project is independent of the proposed Central Arizona Project.

3. ENVIRONMENTAL IMPACTS:

a. Beneficial impacts include: (1) a high degree of flood protection for existing urban areas; (2) a substantial increase in recreational facilities; (3) continued environmental and esthetic quality along Cave Creek, Skunk Creek, Dreamy Draw Wash and the New and Agua Fria Rivers; the preservation of 4,630 acres of open space behind the dams.

b. Adverse impacts include: (1) the loss or alteration of 410 acres of riparian habitat; (2) the alteration or destruction of sites within three National Register archeological districts; (3) the relocation of 288 homes and 38 businesses, primarily along the proposed Arizona Canal Diversion Channel.

4. ALTERNATIVES: Five combinations of structural and nonstructural measures were considered. The five alternatives were:

Alternative 1: Under this alternative, no further Federal action would be taken. Management of the flood plains would be accomplished by local governments through implementation of flood plain regulatory laws. Existing and future development within the flood plain would continue to be subject to flooding.

Alternative 2, Dams and Channels: This alternative would provide a high degree of flood protection in a manner that would differ from the proposed project by replacing the floodways and flowage easements with channels.

Alternative 3, Dams Only: As a part of this alternative, only one dam, on Cave Creek, would be constructed. A reinforced concrete pipe drain would be constructed from the Arizona Canal to the Salt River. Management of the flood plains would be accomplished by local governments through implementation of flood plain regulatory laws. This alternative would not provide as high degree of flood protection as the recommended plan.

Alternative 4, Channels Only: This alternative calls for the construction of the same channels as alternative 2, but large enough to convey floodflows without the construction of additional dams. The degree of flood protection provided would be similar to alternative 2 and the recommended plan.

Alternative 5, Structural and Nonstructural Measures: This alternative is essentially the same as the recommended plan with the addition of a channel to divert the discharge from Cave Buttes Dam to Skunk Creek. An additional flowage easement would be required on Skunk Creek.

Three other alternatives were given preliminary consideration and were rejected as infeasible. One alternative called for the combination of certain features of the Central Arizona Project (CAP) and the proposed flood control project. The second alternative involved conveying floodwaters from Cave Creek by means of a channel, from the Arizona Canal through downtown Phoenix to the Salt River. The third alternative called for combining the Arizona Canal and the Arizona Canal Diversion Channel in some manner to reduce right-of-way requirements.

5. COMMENTS RECEIVED:

Federal

Department of Agriculture
Department of Health, Education and Welfare
Environmental Protection Agency
Department of Interior
Department of Transportation
Department of Commerce

State of Arizona

State Clearinghouse
Office of Economic Planning and Development
Game and Fish Department
Arizona State Museum
Arizona Water Commission
Department of Transportation

Maricopa County

Planning Department
Flood Control District
Maricopa Association of Governments (MAG)
Department of Health Services

Cities

City of Phoenix:
City Engineer
City Manager of Glendale
Town Manager of Paradise Valley

Citizens Groups and Private Interests

Arizona State University
Salt River Project
Saddleback Meadows Property Owners Association
Jade Park North Homeowners Association
Deer Valley Planning Committee
Malapai Homeowners Group
Atchison, Topeka and Santa Fe Railway Company

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SECTION I

NEW RIVER AND PHOENIX CITY STREAMS FLOOD CONTROL PROJECT

I-1. PROJECT DESCRIPTION

I-1.01 INTRODUCTION AND PURPOSE. This environmental statement, which is submitted in compliance with the National Environmental Policy Act of 1969 (Public Law 91-190), concerns the New River and Phoenix City Streams Flood Control Project. The environmental statement describes (a) the recommended plan for the project, (b) the environmental setting without the project, (c) the relationship of the project to existing land use plans, (d) the probable impact of the project on the environment, (e) the probable adverse environmental effects which cannot be avoided, (f) the alternatives to the recommended plan for the project, (g) the relationship between the short-term use of the environment and the maintenance and enhancement of long-term productivity, (h) the irreversible and irretrievable commitments of resources which would be involved in the project should it be implemented, and (i) the coordination effort which has taken place.

I-1.02 ORGANIZATION OF THE ENVIRONMENTAL STATEMENT. The environmental statement has six sections. The first section, Section 1, describes the overall project, the regional environmental setting, and the alternatives considered in developing the recommended plan. This section also addresses the regional effects of the recommended and alternative plans, the unavoidable adverse effects of the recommended plan, regional relationships between short-term uses of the environment and long-term productivity, regional irreversible commitments of resources, and the overall regional coordination effort. Sections II through VI concern individual project features. These sections describe in detail the individual project features, the local environmental setting, the impacts of the project features, and the detailed alternatives for the project features, such as specific alternative sites or alinements.

I-1.03 During detailed design studies, the environmental statement will be revised as required. Prior to construction of the recommended project features, pertinent sections of the environmental statement will be re-examined and updated or supplemented if required.

I-1.04 Plates, tables, photos, references, a glossary of technical terms, and Appendix A (Letters of Comment) follow the last feature section of the report.

I-1.05 PROJECT LOCATION. The New River and Phoenix City Streams project is located in Maricopa County in the southcentral portion of the State of Arizona. The project area extends from the Salt and Gila Rivers north about 30 miles to the base of the Hieroglyphic, McDowell, and Usery Mountains and east from the White Tank Mountains to the base of the McDowell Mountains (pl. 1). This area contains both desert and irrigated lands, as well as the Phoenix metropolitan area.

I-1.06 PROJECT AUTHORIZATION. The New River and Phoenix City Streams project was authorized by the Flood Control Act of 1965, Public Law 89-298, approved October 27, 1965. The project is an integral part of a five-phase flood control plan for the

Greater Phoenix area (pl. 2). This five-phase plan was designed to serve as a framework for flood control work in the Phoenix area. The phases, their areas of study, and their status are tabulated below.

Phase	Area of Study	Status
A	Indian Bend Wash from the Arizona Canal to the Salt River	Authorized Project–final environmental statement has been completed.
B	New River and Phoenix City Streams	Authorized Project–presently under study.
C	Glendale-Maryvale area and south Phoenix area	This study, which is underway, has been incorporated into the Phoenix Urban Study.
D	Salt River from Orme Dam Site downstream to the confluence with the Gila River.	This study, which is underway, has been incorporated into the Phoenix Urban Study.
E	Indian Bend Wash upstream from the Arizona Canal	This study, which is not yet underway, has been incorporated into the Phoenix Urban Study.

Phases A and B have been authorized by Congress as flood-control projects. Phases C, D, and E, which are still in the study stage, are being incorporated into the Phoenix urban studies program. This program, which has just started, will study water resource problems, including wastewater management, in the Phoenix metropolitan area.

I-1.07 PROJECT PURPOSE. The purpose of the New River and Phoenix City Streams project is to control floods along Cave Creek, Skunk Creek, Dreamy Draw Wash, and the New and Agua Fria Rivers and to protect areas within and adjacent to Phoenix, Glendale, Peoria, Sun City, and Avondale. The area to be protected contains residential, commercial, industrial, agricultural and public property. Recreation has been added as a project purpose.

I-1.08 AUTHORIZED PROJECT PLAN. The project document plan, which is described in House Document 216, 89th Congress, 1st session, provides for the construction of four compacted-earthfill dams (pl. 3). Dreamy Draw Dam, which was completed in 1973, is located on Dreamy Draw Wash, just south of Northern Avenue and about 1 mile east of 16th Street. Dreamy Draw Dam is the only feature of the authorized project that has been constructed (ref. 1, 9). The authorized Cave Buttes Dam would be located about 2 miles downstream of the existing Cave Creek Dam. The authorized Adobe Dam would be constructed on a tributary of Skunk Creek, about 7 miles north of Bell Road and 1 mile east of Black Canyon Highway. The authorized New River Dam would be constructed on New River about 8 miles upstream of its confluence with Skunk Creek. The project would also require the construction of 53 miles of channels, of which half would be concrete lined.

Dreamy Draw channel would extend from Dreamy Draw Dam to the authorized Arizona Canal diversion channel. Cave Creek channel would extend from the authorized Cave Buttes Dam to the authorized Union Hills diversion channel. The Union Hills diversion channel would extend from 40th Street to Skunk Creek. Skunk Creek channel would extend from a point on Skunk Creek just upstream from its confluence with the Union Hills diversion channel to its confluence with New River. New River channel would extend from the mouth of Skunk Creek to the confluence of the New and Agua Fria Rivers. The Agua Fria channel would extend from the mouth of New River to a point about 2 miles downstream of the U.S. Highway No. 80 crossing. The authorized Arizona Canal diversion channel would generally parallel the north side of the Arizona Canal from approximately 12th Street to Skunk Creek. A more detailed description of the uncompleted features of the authorized project is given in Sections II through VI of this statement.

I-1.09 RECOMMENDED PROJECT PLAN. The recommended plan (pl. 4a) for the uncompleted features of the project, which differs from the authorized plan, is described in the following subparagraphs.

a. Cave Buttes Dam. The recommended Cave Buttes Dam will be constructed at a location 1.2 miles north of the authorized site, approximately 0.7 miles downstream from the existing Cave Creek Dam. The main embankment will be a 2,280-foot long compacted-earthfill structure rising a maximum of 110 feet above the streambed. Three additional earthfill dikes will be required, with lengths of up to 9,010 feet and maximum heights of up to 56 feet. An unlined spillway, west of the right dam abutment, in conjunction with the outlet works will pass a peak discharge of 101,500 cfs. The outlet works will be capable of releasing 494 cfs. The detention basin will have a capacity of 46,600 acre-feet at spillway crest of which 5,730 acre-feet will be for the accumulation of sediment.

b. Adobe Dam. Adobe Dam will be constructed on Skunk Creek, across Deer Valley Drive, 1 mile west of the Black Canyon Highway. This site is approximately 4 miles south of the authorized site. The main embankment will be a compacted-earthfill structure, a maximum of 63 feet high and 2.1 miles long. A concrete-lined spillway, west of the main embankment, in conjunction with the outlet works will pass a peak discharge of 14,800 cfs. The outlet works will be capable of releasing up to 1,890 cfs. The detention basin will have a capacity of 18,350 acre-feet of which 2,700 acre-feet will be used for the accumulation of sediment over a 100-year period. Channelization of Skunk Creek will be required in the vicinity of Black Canyon Highway to assure conveyance of the standard project flood to the Adobe detention basin. The two existing highway bridges and two frontage road bridges must be lengthened 134 feet to accommodate the wider channel.

c. New River Dam. New River Dam will be constructed on New River at the authorized site, 8 miles upstream from the confluence with Skunk Creek. The main embankment will be a compacted-earthfill structure 2,800 feet long having a maximum height of 91 feet. An earthfill dike will be required along the west edge of the detention basin. A concrete-lined spillway, east of the left abutment, in conjunction with the outlet works, will pass a peak discharge of 63,300 cfs. The outlet structure will be capable of releasing up to 2,590 cfs. The detention basin will have a capacity of 34,500 acre-feet, of which 4,920 acre-feet will be used for the accumulation of sediments over a 100-year period.

d. Arizona Canal Diversion Channel. The Arizona Canal diversion channel will be built immediately north of and generally parallel to the Arizona Canal from 40th Street, at the upstream end, to Skunk Creek. The channel will continue to be concrete lined to approximately Cactus Road. From Cactus Road to Skunk Creek the channel will become a wide earth-lined channel suitable for development into a recreational greenbelt. At the time of construction of the project, local interests will construct 26 bridges, at all streets and highways that presently cross the Arizona Canal.

e. Floodways. In order to assure the long-term capacity to operate the four dams as designed, local interests will be required to manage and maintain floodways and floodway fringe areas along Dreamy Draw Wash from 14th Street to the Arizona Canal diversion channel, along Cave Creek from Cave Buttes Dam to Peoria Ave., along Skunk Creek from Adobe Dam to the Arizona Canal diversion channel and along New River, from New River Dam to the confluence with Skunk Creek. Limits of the floodways and floodway fringe areas will be delineated by the Corps of Engineers. Along Cave Creek between Peoria Avenue and the Arizona Canal 0.7 mile of concrete channel will be required along with a confluence structure at the Arizona Canal diversion channel. These structures are described in detail in Section VI of this report. As part of the project, local interests will construct 8 bridges at existing dip crossings, as required by urban development.

f. Flowage Easements. Downstream of the confluence of the Arizona Canal diversion channel with Skunk Creek flowage easements will be required along Skunk Creek and the New and Agua Fria Rivers to assure positive control of the flood plain under the condition of diverted flows discharging from the diversion canal. Within these reaches evacuation of portions of the flood plain and some structural measures such as flood proofing, bank stabilization, and levee construction will be required along with some channelization and channel clearing. These structural measures are discussed in more detail in Section V of this report and are shown on plates 13 through 19 in Appendix 5 of the General Design Memorandum. As part of the project, local interests will construct 11 bridges at existing dip crossings, as required by urban development. In addition, one railroad bridge will require modification.

I-1.10 Recreational opportunities will be provided at Cave Buttes Dam and Adobe Dam and along the Arizona Canal diversion channel, Cave Creek, Skunk Creek and the New and Agua Fria Rivers. Facilities proposed for the damsites include picnicking and camping areas, riding and hiking trails, equestrian areas, and nature areas. No recreational facilities are planned for Dreamy Draw Dam, however future development is not precluded. Recreational facilities will not be provided at New River Dam; instead, in accordance with the suggestions of the Recreation Task Force, the acreage behind the dam will remain in its natural state. Facilities along the channels generally include trails and conveniently located rest stops with comfort stations and picnic tables. A regional park with an outdoor education center and recreation facilities is planned along Cave Creek. A low intensity recreational greenbelt is planned along the Arizona Canal diversion channel west of Cactus Road. Other facilities are planned by local interests.

I-1.11 The recommended plan differs from the authorized plan in the following ways:

a. Union Hills Diversion Channel is deleted.
b. The Arizona Canal Diversion Channel is extended to 40th Street.
c. The site for Adobe Dam is relocated to a location 4 miles south of the authorized site.
d. The site for Cave Buttes Dam is relocated to a location 1.5 miles north of the authorized site.
e. Skunk Creek Channel is deleted.
f. Dreamy Draw Channel is deleted.
g. Cave Creek Channel is deleted.
h. Flowage easements are substituted for structural channels on Skunk Creek, and the New and Agua Fria Rivers.
i. The provision of maintained floodways on reaches of New River, Skunk Creek, Cave Creek and Dreamy Draw Wash.

A detailed description of the features of the recommended plan is given in sections II through VI of this environmental statement.

I-1.12 The total first cost of the recommended plan is $233,400,000*, based on October 1975 price levels. The current estimate of monetary benefits accruing from the recommended plan at an interest rate of 3.25 percent (the Congressionally-authorized rate) and a project life of 100 years is $15,126,000. The ratio of benefits to costs for the recommended plan (proposed action) is 2.1 to 1. A summary of economic data for all of the project alternatives, and for Alternative 5b (the recommended plan), is presented in the table on the following page.

* Includes $1,000,000 for archeological mitigation, and $23,400,000 for recreation development.

TABLE 1

"ECONOMIC DATA, EXTRACTED FROM U.S. ARMY CORPS OF ENGINEERS GENERAL DESIGN MEMORANDUM, GILA RIVER BASIN, NEW RIVER AND PHOENIX CITY STREAMS, MARCH 1976. COMPLETE DOCUMENT IS AVAILABLE AT U.S. ARMY ENGINEER DISTRICT, LOS ANGELES."

Summary of Economic Data for Alternative Plans
(3-1/4 percent – 100 years)

	Alternatives					
	1	2	3	4	5a	5b
First Cost*						
Flood Control	$ 671	$257,000	$52,700	$289,000	$218,000	$210,000
Recreation	0	10,030	16,000	5,900	10,300	23,400
Total	$ 671	$267,030	$68,700	$294,900	$228,300	$233,400
Average Annual Charges*						
Flood Control	28	7,653	1,883	8,395	6.474	6,216
Recreation	0	410	726	202	331	1,086
Total	$ 28	$ 8,063	$ 2,609	$ 8,597	$ 6,805	$ 7,302
Equivalent Annual Benefits*						
Flood Control**	135	13,442	4,953	12,968	13,380	13,380
Recreation	0	1,022	1,180	531	927	1,746
Total	$ 135	$ 14,464	$ 6,133	$ 13,499	$ 14,307	$ 15,126
Equivalent Annual Net Benefits*						
Flood Control	107	5,789	3,070	4,573	6,906	7,164
Recreation	0	612	454	329	596	660
Total	$ 107	$ 6,401	$ 3,524	$ 4,902	$ 7,502	$ 7,824
Equivalent Annual Nonprevented damages (Flood Control)	$17,853	$ 4,948	$13,108	$ 5,344	$ 4,948	$ 4,948
Benefit to Cost Ratio						
Flood Control	4.8	1.8	2.6	1.5	2.1	2.2
Recreation	--	2.5	1.6	2.6	2.8	1.6
Flood control and recreation	4.8	1.8	2.4	1.6	2.1	2.1

*In thousands of dollars.

**Includes flood damages prevented and savings in cost of fill.

I-2. ENVIRONMENTAL SETTING WITHOUT THE PROJECT

I-2.01 TOPOGRAPHY AND DRAINAGE. The project area is within the Gila River Basin, which is the largest drainage area tributary to the lower Colorado River and comprises 58,200 square miles. About 70 percent of the drainage area is mountainous while the remainder is alluvial valley. The mountains are characterized by rugged terrain and steep gradients, while the valleys are fairly flat with regular slopes.

I-2.02 The area pertinent to flood problems in Phoenix and vicinity is in Maricopa and Yavapai Counties in the central part of Arizona (see pl. 2), and comprises approximately 2,730 square miles. The area is roughly oval, with a maximum length and width of approximately 90 and 45 miles respectively. Elevations range from 910 feet at the confluence of the Agua Fria and Gila Rivers to 7,000 feet in the mountains near the headwaters of the Agua Fria River. The topographic characteristics of the major watercourses draining the project area are described in the following subparagraphs.

a. Agua Fria River. The Agua Fria River originates about 7,000 feet above sea level in the mountains of central Arizona and flows southward for about 130 miles before emptying into the Gila River, 15 miles west of downtown Phoenix, at elevation 910 feet. The course of the stream is nearly equidistant between two parallel mountain ranges, the Black Hills-New River Mountains and the Bradshaw Mountains, that form the eastern and western boundaries of the drainage area. The gradient of the Agua Fria River ranges from about 300 feet per mile in the headwaters to about 10 feet per mile at the Gila River.

b. New River. New River, the major tributary of the Agua Fria River, has its headwaters in the New River Mountains, roughly 40 miles north of Phoenix. New River flows generally southward for about 40 miles to its confluence with the Agua Fria River, about 15 miles west of Phoenix. The drainage area of New River at its mouth is 340 square miles, of which approximately one-third is mountainous. Elevations in the basin range from a little over 5,000 feet in the New River Mountains to about 1,040 feet at the confluence with the Agua Fria River. The stream gradient ranges from 370 feet per mile in the mountains to 10 feet per mile in the valley.

c. Skunk Creek. Skunk Creek, the major tributary of New River, rises in the New River Mountains about 35 miles north of Phoenix and flows generally southwestward for about 30 miles to its confluence with New River about 15 miles northwest of Phoenix. The drainage area of Skunk Creek is 110 square miles, of which about 20 percent is mountainous. Stream gradients on Skunk Creek decrease from 650 feet per mile in the mountains to 20 feet per mile near its confluence with the New River.

d. Cave Creek. Cave Creek has its source in the New River Mountains to the north of Phoenix, where elevations rise to as high as 5,000 feet. The stream then descends to the alluvial fan near the community of Cave Creek and flows south for 13 miles to Cave Creek Dam, which controls the 175 square mile drainage area upstream from the dam. Cave Creek then flows across an alluvial fan which is undergoing urbanization between Cave Creek Dam and the Arizona Canal. Floodflows on Cave Creek exceeding the freeboard capacity of the Arizona Canal flow directly through metropolitan Phoenix to the Salt River. The total drainage area of Cave Creek at the Salt River is 311 square miles. The stream gradient ranges from 500 feet per mile in the mountains to 25 feet per mile near the Arizona Canal.

e. Dreamy Draw. Dreamy Draw, a tributary of Cave Creek, rises in the Phoenix Mountains and flows generally southwestward for about 5 miles to its confluence with Cave Creek in Phoenix. Dreamy Draw Dam controls 1.3 square miles of the 2.0-square-mile drainage area above the Arizona Canal.

f. Cudia City Wash. Cudia City Wash, with a drainage area of 4.9 miles above the Arizona Canal, rises in the Phoenix Mountains northeast of Phoenix and upstream from the Arizona Canal.

I-2.03 GEOLOGY AND SOILS. The project area is located in the Sonoran Desert Section of the Basin and Range physiographic province. This province is characterized by steep mountains and broad alluvium-filled valleys. The mountain ranges, which are generally parallel and trend northwest to southeast, are composed of metamorphic and volcanic rock. The basins are filled with alluvial and colluvial materials, primarily gravel, sands and clays (ref. 5) to depths of over 1,000 feet. The valley floor was formed by extensive alluvium deposits, which have filled the basin and covered the foreslopes of the hills and mountains. Alluvium in the valley may extend to depths of over 1,000 feet and consists of coarse, unconsolidated, unsorted sands, gravels and cobbles. The deep dissection of the mountains and the extent of the alluvial fans suggest that the project area has had a long history of erosion and deposition.

I-2.04 The soil types in the study area are derived from parent materials characteristic of the Basin and Range physiographic province. The soils in the gently sloping valleys are deep, heterogeneous in texture, low in organic material and have not been leached of soil nutrients. The relatively level surface, combined with soils of favorable workability, provide areas of good cropland where irrigation is available. General soil types in theproject area are sandy loams, limy clay loans, and limy loamy soils (ref. 3). Stony and rocky soils are locally present on slopes greater than 30 percent. The soils in the study area are commonly affected by the precipitation of salts produced by weathering of rock-forming minerals and brought in by surface runoff. Because seepage from rainfall is usually not sufficient to carry salts down to the water table, they accumulate in the soil as the water evaporates. The effects are most noticable near mountains formed of calcium-bearing rocks, where alluvial deposits are commonly cemented by calcium carbonate to a concrete-like material called caliche. Farther down the basin slopes, calcium carbonate content decreases, but soluble alkali salts detrimental to agriculture are still present. Erosion from the drainage above the proposed dams was calculated by the Corps of Engineers for the purpose of determining sediment storage requirements in the reservoirs. The sediment yield of 0.3 acre-foot of sediment from each square mile was estimated for the drainage area upstream of the dams.

I-2.05 EARTHQUAKE HAZARD. The earthquake potential in the project area is considered low (ref. 4). Severe earthquakes in California and Mexico have been widely felt throughout southern Arizona, but only a few weak earthquakes have had epicenters in southern Arizona during the 122 years of recorded earthquake history. During that period, earthquake damage in southern Arizona has been minor (ref. 4). Based on available data, the largest earthquake expected in the project area would have an intensity of approximately V on the Modified Mercalli Scale, which ranges from I (weak) to XII (very strong) (ref. 4). The proposed project site is in a low seismic risk area, assigned to Zone 2, Seismic Risk Map of the United States (1969) (pl. 5).

I-2.06 NATURAL RESOURCES. The natural resources considered in this statement are those resources that have a large enough volume or value so that their exploitation would have a significant impact on the water use, land use, or economy of Maricopa County. The resources are discussed in three general groups: mineral and fossil fuels, metallic minerals, and nonmetallic minerals. All data is derived from the "Lower Colorado Region Comprehensive Framework Study", U.S. Dept. of Interior.

I-2.08 Mineral and Fossil Fuels. There are no known resources of coal or crude oil in Maricopa County. The nearest source of coal to the project area is the Deer Creek Field, a relatively minor field in eastern Pinal County, located about 100 miles southwest of downtown Phoenix.

I-2.08 Although appreciable uranium-vanadium deposits have been located in Coconino, Navajo, and Gila Counties, none have been located in Maricopa County. The closest uranium resource to the study area lies in the Sierra Ancha Mountains in the Tonto National Forest, 75 miles east of Phoenix.

I-2.09 Metallic Minerals. South of the study area, in a wide belt running south eastward through Pinal, Pima, and Santa Cruz Counties, lies a district in which disseminated copper and copper-molybdenum ores are being developed for future large-scale mining.

I-2.10 A large volume of potential iron resource occurs in the Hieroglyphic Mountains (Pikes Peak District) 35 miles northwest of Phoenix. Known resources in the area total about 90 million short tons.

I-2.11 Nonmetallic Minerals. Halite (common salt) has been discovered 20 miles west of Phoenix in wells drilled about 1 mile apart. In one well, below 880 feet, more than 3,000 feet of solid halite was penetrated. This resource could be used for underground storage as well as exploited as a raw material for the chemical industry.

I-2.12 Sand and gravel, a resource that is becoming more limited in the study area because of the vast quantities of aggregate materials used by the construction industry, occurs in recoverable concentrations in exposed and buried stream channels, on terraces near mountain fronts, and on alluvial fans. The materials near the mountain fronts contain a higher ratio of gravel to sand, whereas the basin fills are mostly sand and silt. In 1970, Maricopa County produced 6,363,000 tons of sand and gravel, which represented more than a third (35.7 percent) of the production for the state. Other significant mining activities include the production of scrap mica near Buckeye in Maricopa County, and miscellaneous clay and shale for manufacturing building brick, mined at the Tolleson pit in Maricopa County.

I-2.13 CLIMATE. The project area is located in the Sonoran Desert Climatic Zone (ref. 6), a zone characterized by long hot summers, short mild winters, low annual rainfall, low relative humidity, and a high percentage of possible hours of sunshine. July is the hottest summer month, with temperatures ranging from an average daily maximum of 105 degrees Fahrenheit to an average daily minimum of 75 degrees Fahrenheit. January is the coldest month, with average daily temperature ranging from a maximum of 66 degrees Fahrenheit to a minimum of 34 degrees Fahrenheit.

I-2.14 Precipitation is biseasonal, generally occurring as short heavy thundershowers in the summer and long, light showers in the winter. Most summer precipitation falls in the afternoon or evening. In late summer or early fall, tropical storms may bring heavy and widespread precipitation. Most winter precipitation results from cyclonic storms. Slightly more than 50 percent of the precipitation falls from November to April. Average annual precipitation is 7.2 inches in Phoenix and about 24 inches in the upper watersheds. The maximum monthly precipitation of record at Phoenix is 5.6 inches, and the maximum precipitation for a 24-hour period is 5.0 inches, which occurred in July 1911.

I-2.15 The project area has an average relative humidity ranging from 24 percent in the summer to 54 percent in the cooler, moister winter. Relative humidity has increased in the Phoenix area as the result of large irrigated areas, open canal systems, and introduced urban plantings.

I-2.16 The project area averages 86 percent of possible hours of sunshine annually with monthly averages ranging from 77 percent in December to 94 percent in June. Winds in the project area are generally from the east, having an average velocity of about 6 miles per hour. Peak gusts occasionally reach as much as 50 miles per hour. The strongest gust of record at Phoenix was 75 miles per hour.

I-2.17 The combination of high temperatures, low relative humidities, maximum amount of sunshine, and wind causes a high evaporation rate. The evaporation rate in the project area has been estimated to be 6.5 feet per year (ref. 7).

I-2.18 SURFACE HYDROLOGY. The watercourses of the Agua Fria River, New River, Gila River, and Skunk Creek are generally characterized by well-defined floodways and channels. The channels of Cave Creek and Dreamy Draw are well defined above the Arizona Canal; downstream from the Canal the natural floodways have been obliterated by urban development. Flows in the channels are ephemeral because climate and drainage characteristics are not conducive to continuous runoff. Flows occur only during and immediately after periods of heavy rainfall.

I-2.19 The United States Geological Survey has recorded discharge for surface waters at several recording gages within the project area. Precipitation and stream gages are located both above and below the sites for the proposed New River, Adobe, and Cave Creek Dams. Data presented in the subsequent subparagraphs are derived from these precipitation and stream gages.

a. The average annual total discharge for surface waters of Cave Creek at Phoenix, Arizona, is 1,900 acre-feet (ref. 8). The period of record was from October 1957 to 1972. The drainage area of Cave Creek above the gaging station at Phoenix is 252 square miles.

b. The average annual discharge for the New River at the Bell Road Gaging Station at Bell Road is 4,180 acre-feet, based on records of annual discharge for Water Years 1963, 1965, 1967, and annual maximums for 1968 through 1972. The drainage area is 187 square miles.

c. The total average annual discharge at the Skunk Creek Gaging Station is 1,220 acre-feet, based on records of annual discharge for Water Years 1960-1967, and annual maximums from October 1967 to 1972. The drainage area is 64.6 square miles.

I-2.20 Surface flows percolate through the ground and may enter the ground water supply. Current urbanization is causing an appreciable increase in the amount of impervious area, especially in the lower reaches of the drainage area. Thus a lesser amount of flow is percolated, and the amount of runoff flow is increased. In addition, increased urbanization, through the increase in the impervious area and paving of streets, has resulted in increased velocities of flows with a resultant increase in peak discharges. The increase in runoff flow and peak discharge are causes of increased flooding.

I-2.21 FLOOD HAZARD. The most common floods in the drainage area are "flash floods" resulting from localized thunderstorms that occur unexpectedly. The Phoenix office of the National Weather Service has a flash flood warning program, but little time is available to warn affected communities. Flooding also results from general summer or winter storms.

I-2.22 Flows are interrupted and concentrated by manmade structures, such as irrigation canals and systems. The Black Canyon Highway (Interstate 17) intercepts Cave Creek runoff diverted by the Arizona Canal. Floodflows intercepted by the highway, which is below ground level at several underpasses, are handled by a system of pumps. The two major irrigation canals that intercept flows are the Arizona and Grand Canals, which are under the jurisdiction of the Salt River project; their canal capacities in the vicinity of Cave Creek are about 800 and 600 cubic feet per second, respectively. These canals, which are north of and generally parallel to the Salt River, provide a minor amount of flood protection by intercepting low flows, using available freeboard capacity to convey the additional water. Larger floodflows cause pondings that occasionally overtop and breach the canal banks. Although the system of irrigation canals have been operated as emergency flood-control channels in the past, they are not designed to carry floodflows. The canals are designed with their maximum capacity upstream rather than downstream, exactly the reverse required for flood control purposes. Consequently, they are limited in their ability to carry large quantities of water that emanate from such major water courses as Cave Creek and Cudia City Wash. In Phoenix, both the Arizona and Grand Canals flow through the city. Where the Arizona Canal crosses Cave Creek, the peak discharge of the creek varies from 50,000 cfs in a standard project flood to 7,000 cfs in a 25-year flood. Where the Grand Canal crosses Cave Creek, similar peak discharges, ranging from 45,000 cfs in a standard project flood to 7,500 cfs in a 25-year flood, would be experienced.

I-2.23 The standard project flood, as developed by the Corps of Engineers, represents the flood that would result from the most severe combination of meteorologic and hydrologic conditions considered reasonably characteristic of the region. Normally larger than any past recorded flood in the area, it can be expected to be exceeded in magnitude only on rare occasions. It constitutes a standard for design that will provide a high degree of flood protection. Historically, the most severe summer thunderstorm to occur within the State of Arizona was the Queen Creek thunderstorm of August 19, 1954. This thunderstorm, which centered over the Queen Creek drainage area southeast of Phoenix, was determined to be the local storm with the most severe flood-peak-producing relationship between rainfall depth, area, duration and isohyetal pattern that may reasonably be expected to occur over the central portion of Arizona, and was used as the standard project storm for design and economic considerations for all areas except Cave Buttes and New River damsites. The general summer storm of August 1951 that centered near the Trilby Wash drainage area northwest of Phoenix was determined to be the most critical storm for Cave Buttes and New River Dams that may reasonably be expected to occur over the central portion of Arizona. As with the August 1954 storm, the August 1951 storm was transposed to the Phoenix area for standard project flood determinations.

I-2.24 FLOOD DAMAGES. Severe local storms and floods have occurred in the Phoenix area and extensive damages have resulted from these floodflows. Damages resulting from representative floods of record are discussed in detail in the following subparagraphs.

a. Floods of 1921 and 1943. Before the construction of Cave Creek Dam (in 1922-23), a storm caused "over a million dollars" in flood damages, according to the "Arizona Republic". The basement of the State Capitol was inundated by this flood. Another destructive flood took place on Cave Creek in 1943; the area affected by this flood was largely agricultural. The 1943 flood was caused by severe thunderstorms over the desert areas just north of Phoenix. Newspaper accounts and reports by local agencies indicate that rapid runoff upstream from the Arizona Canal quickly overtaxed the capacity of the canal system. In the Cave Creek area, north of Phoenix, a break occurred in the south bank of the canal, releasing water that ultimated caused 9 breaks in the Grand Canal. At that time, much of the area downstream from the Arizona Canal was used for citrus groves or other agricultural pursuits that were not seriously damaged by the floodwaters. Available reports indicate that floodwaters, ranging in depth from a few inches to 2 feet, flooded a hundred or more homes and businesses and made travel impossible for several hours.

b. Flood of June 1972. The heavy thunderstorm that hit northeast Phoenix on the morning of June 22, 1972, was part of a series of moderate to heavy early summer thunderstorms that affected the entire Southwest during June 20-23. The maximum unofficial intensity reported was 5.25 inches of rainfall in the vicinity of 24th Street and Camelback Road in Phoenix during an estimated 2-hour period. Heavy runoff from the south slopes of the Phoenix Mountains occurred as a result of the intense rainfall of June 22. In Paradise Valley and on the southwest slopes of the McDowell Mountains, large areas were inundated by sheetflow. A peak discharge of 20,000 cfs was measured at Indian Bend Road on Indian Bend Wash. Flooding occurred upstream from the Arizona Canal as floodwaters ponded behind the canal levees. Much of the damage downstream from the Arizona Canal resulted from breaks in the canal as overtopping occurred.

I-2.25 FLOOD-PRONE AREAS. The overflow areas for the standard project flood, under projected future conditions, are shown on plate 6. These overflow areas can be described in three parts: (a) the overflow area along Cave Creek from about 0.7 miles south of the existing Cave Creek Dam to the Salt River, including a breakout from Cave Creek near Cactus Road extending to Grand Avenue; (b) ponding areas along the north bank of the Arizona Canal, and the most probable overflow areas from overtopping of the canal levees by flows from the drainage areas north of the Arizona Canal, excluding Cave Creek; and (c) the overflow area along Skunk Creek and the New and Agua Fria Rivers, from the proposed damsites to the Gila River. These overflow areas are described in the following subparagraphs.

a. Cave Creek Overflow Area. The Cave Creek overflow area is on a broad alluvial fan. Upstream from the Arizona Canal, the stream flows in a defined channel. Several reaches of Cave Creek have been improved by the City of Phoenix between Greenway Road and the Arizona Canal in conjunction with a planned linear park along the channel. Downstream from the Arizona Canal, the urban development that has taken place has obliterated almost all traces of the old channel. Floodflows follow a broad swale through an intensively developed section of Phoenix. The overflow area has a wide areal extent over which floodflow depths are relatively shallow (average of 2 feet in depth). The area included in the Cave Creek overflow area amounts to 19,310 acres.

b. Most Probable Overflow Areas from Canal Breaks. Local thunderstorms centering over the Phoenix Mountains, which rise east of Cave Creek and north of the Arizona Canal, can produce extreme downstream flooding. Floodwaters flow down well-defined washes of small capacity to an alluvial fan that consists of braided streams of very small capacity. They are intercepted by the Arizona Canal, which is an irrigation canal of limited capacity, until they overtop and breach the canal levee. Downstream from the Arizona Canal, urban development has obliterated almost all traces of the old channels, and floodflows follow broad swales through an intensively developed section of Phoenix. The drainage area tributary to the breaks in the Arizona Canal levees consists of 21 square miles above the canal and extends from Cave Creek to Cudia City Wash near 40th Street. The most probable overflow areas from canal breaks, based on historical events as well as theoretical analysis, amounts to 8,890 acres. It results from 6 major breakouts east of Cave Creek and two breakouts west of Cave Creek (Peoria Avenue and 59th Avenue). The delineated overflow areas are the areas where water depths would exceed 6 inches. The potential of canal breaks and overtopping was demonstrated during the 22 June 1972 flood when over 3,000 acres were flooded. Flood damages amounting to an estimated $4.3 million occurred below the Arizona Canal to residential, commercial, and public properties, as well as to irrigation works. The greatest damage ($3.8 million) resulted from the breaks in the Arizona Canal at 32d and 40th Streets.

c. Skunk Creek and the New and Agua Fria Rivers Overflow Areas. The channels for each of these streams are fairly well-defined through this overflow area and are capable of conveying nondamaging flows of 10- to 20-year frequencies. The standard project flood overflow area extends along the Agua Fria River from the Gila River upstream to the New River confluence; along the New River to Paradise Valley Road (extended); and along Skunk Creek to the proposed Granite Reef Aqueduct. It consists of 22,295 acres.

I-2.26 URBAN DEVELOPMENT SUBJECT TO FLOODING. The developed areas subject to overflow along Cave Creek, Dreamy Draw Wash, Cudia City Wash, and other unnamed washes in the Sunnyslopes area are predominantly urban, whereas the overflow areas along Skunk Creek, the New River, and the Agua Fria River are predominantly agricultural. Of the 18,370 acres of land subject to inundation by the New and Agua Fria Rivers, about 96 percent is presently open space or under cultivation. Future residential, commercial, and public uses are projected to develop on the flood-plain fringe over the next 50 years. The present and projected urban development subject to flooding in each of the three overflow areas is discussed in the following subparagraphs.

a. Cave Creek Overflow Area. Between the proposed Cave Buttes Dam and the Arizona Canal approximately 3,265 acres are within the Cave Creek overflow area, 1,150 of which are developed into urban uses. In the next 20 years, residential and public uses are expected to be developed on the floodway fringe adjacent to the planned linear park. South of the Arizona Canal, the Cave Creek and adjoining overflow areas include the business and government center of downtown Phoenix, as well as large residential areas, local strip commercial and shopping centers, the State capitol, city and county government offices, the Phoenix financial center, the central shopping district, and two other major shopping centers. Because of the lack of large parcels of vacant land south of the canal, most of the future development will concentrate north of the canal. The overflow area south of the Arizona Canal comprises about 16,045 acres. Of this land, all but about 1,135 acres are in urban use.

b. Most Probable Overflow Areas From Canal Breaks. Flooding from overtopping of the Arizona Canal east of Cave Creek primarily floods the residential area in north and northeast Phoenix. In addition, the Biltmore Shopping Center and various strip commercial facilities are subject to flooding. Also, floodflows that breach the Arizona Canal can be expected to flood some residential and commercial development west of Cave Creek. The majority of land flooded west of Cave Creek, however, is vacant and not expected to be fully developed to residential and commercial uses until about 1997.

c. Skunk Creek and the New and Agua Fria River Overflow Areas. Agricultural and vacant land (3,780 acres) comprise about 96 percent of the acreage subject to flooding by Skunk Creek. Fringe development of the Phoenix urbanized area is rapidly approaching the flood plain. Future development on the floodway fringe is expected to consist of residential subdivisions with commercial and public land uses.

I-2.27 EXISTING WATER RESOURCE FACILITIES AFFECTING FLOOD CONTROL. Existing flood-control facilities affecting flood control are described in the following subparagraphs.

a. Salt River Project. The Salt River Project, which was the first multipurpose project authorized under the Federal Reclamation Act of 1902, includes an irrigation project managed by the Salt River Valley Water Users' Association and a power project managed by the Salt River Project Agricultural Improvement and Power District. The Association manages the 13,000 square-mile watershed of the Salt and Verde Rivers and operates and maintains the transmission and distribution system that provides water for municipal, industrial, and agricultural uses within the project's 250,000-acre area. The Salt River Project's storage-and-distribution system consists of six storage dams; one diversion dam; and 1,300 miles of transmission canals, distribution laterals, and ditches. Completed in 1911, Roosevelt Dam on the Salt River is the oldest and largest dam in the system, with a reservoir capacity of 1,381,580 acre-feet. The remaining dams increase the total storage capacity to 2,072,000 acre-feet. The Arizona and Grand Canals, which were constructed in the late 1800's and the early 1900's, are a part of the distribution system in the Phoenix area. The Arizona Canal traverses the flood-control project area south of the Phoenix Mountains, crosses Cave Creek near Dunlap Avenue, and flows northwestward north of Peoria to Skunk Creek. Although the canal's purpose is water distribution, it also intercepts nominal floodflows.

b. Cave Creek Dam. Following a heavy rainstorm over the Cave Creek watershed in August 1921, plans were made to construct a concrete multiple-arch dam across Cave Creek. The State of Arizona, Maricopa County, the City of Phoenix, the Salt River Valley Water Users' Association (part of the Salt River Project), and the Paradise-Verde Irrigation District (now defunct) participated in the construction of the dam, which was completed in 1923. At the present time, the dam is operated and maintained by the Salt River Project. The 1,692-foot-long dam consists of 38 reinforced-concrete arches and buttresses spaced at about 44-foot centers. At its deepest section, the crest of the dam (elevation 1,642) is 52 feet above the existing downstream ground surface. The outlet works consist of three 4-foot-square openings, one ungated and two gated. With the invert elevation at 1,580.6, the discharge rate through each of these openings is estimated at 500 cubic feet per second with the water surface at elevation 1,642.0. The dam, as constructed, had a reservoir capacity of 14,000 acre-feet at elevation 1,642.0. From an April 1970 aerial survey, the reservoir area was determined to be 830 acres with a corresponding capacity of 12,400 acre-feet. Based on Corps of Engineers hydrology, a flood having a frequency between 25 to 50 years would spill over the top of the dam. Overtopping of the dam for an extended period of time could undermine the foundation of the dam and cause it to collapse.

c. Other Projects. Waddell Dam (also known as Carl Pleasant Dam) backs up the waters of the Agua Fria River to form Lake Pleasant. Waddell Dam, which is 30 miles northwest of downtown Phoenix, provides water conservation, flood control, and recreation. The dam, completed in 1927, is under the jurisdiction of the Maricopa County Municipal Water Conservation District Number 1, and operates effectively. McMicken Dam (also known as the Trilby Wash Detention Basin) is located about 25 miles northwest of downtown Phoenix. This dam was constructed by the Corps of Engineers in 1956 to control 238 square miles of drainage area tributary to the Agua Fria River. This dam is also under the jurisdiction of the Maricopa County Municipal Water Conservation District Number 1, and operates effectively.

I-2.28 PROPOSED WATER RESOURCES FACILITIES AFFECTING FLOOD CONTROL. Water resources facilities, proposed by other agencies, that would affect flood control are discussed in the following subparagraphs.

a. Central Arizona Project. The Central Arizona Project (CAP) is an authorized project of the U.S. Bureau of Reclamation. Major project features involve the construction of four dams; four aqueducts, including tunnels and pumping plants; and power-transmission facilities to the plants. Water would be transported from Lake Havasu on the Colorado River via the aqueduct system for multipurpose uses in the CAP area. It would provide municipal and industrial water for the Tucson and Phoenix metropolitan areas and water for lands in Maricopa, Pinal and Pima Counties in Arizona and in Grant County in New Mexico. A feature of the CAP is the Granite Reef Aqueduct, which extends from a point near the Colorado River to the proposed Orme Reservoir, at the confluence of the Salt and Verde Rivers. Aqueduct turnouts would be provided at required locations to furnish water to agricultural and urban areas, primarily in the Phoenix area, and to planned recreation areas. In general, to protect the aqueduct from floodflows, low earth dikes would be constructed uphill from the aqueduct to collect and convey floodflows (up to 50-year frequency) to drainage structures, such as culverts and overchutes. In the Paradise Valley area north of Phoenix, however, about 12 miles of detention dikes have been constructed in a general east-west direction along the aqueduct from Cave Creek Road to the McDowell Mountains. The basins behind these dikes have the capacity to store the maximum probable flood and sediments accruing over a 100-year period. The basins also have the capacity to store a 100-year flood occurring within a 24-hour period after the maximum probable flood. The Granite Reef Aqueduct would traverse the New River and Phoenix City Streams project area, as shown on plate 7. The aqueduct reach between the Agua Fria River and Cave Creek Road would be protected from 50-year floods by overchutes. The effect of these overchutes was deemed insignificant in the Corps of Engineers hydrologic analysis because the volume of retention behind the overchutes is minimal compared to the volume of runoff of the more infrequent floods. The aqueduct east of Cave Creek would be protected by the detention dikes, which would also provide flood protection to an area south of the aqueduct. The hydrologic analysis reflects the existence of these dikes, completed in late 1975.

b. Storm Drains. In 1970, Yost and Gardner Engineers prepared a report, titled "Storm Drainage Report for Maricopa Association of Governments." Based on population projections to 1995, the report recommends a storm-drain construction program that would be accomplished in 25 years for an area of 480 square miles in Maricopa County, Arizona. The study area includes, in part, the area lying immediately east of the Agua Fria-New River-Skunk Creek channel and north of the Gila and Salt Rivers. In general, protection for the 1-year flood is recommended; however, in certain critical and high-value areas, a greater degree of protection is recommended.

c. Detention Basins. In 1972 and 1973, John Carollo Engineers prepared two reports and a supplement, titled "Investigation of North Phoenix Mountains and Flood Detention Basin, City of Phoenix, Arizona," for the purpose of determining sites suitable for flood-detention basins that would regulate the surface runoff from a 100-year design storm originating in the higher elevations in the Phoenix Mountains. These reports recommended that a total of eight detention basins be located upstream from developing residential and commercial properties in the City of Phoenix. Of the eight detention basins recommended, seven are in the project area. The dams would control drainage areas ranging from 0.2 to 1.0 square mile. Although these dams would provide significant protection to the areas immediately below them, only Dam No. 4 (pl. 8) would affect the design of the Corps of Engineers project; this dam would reduce Dreamy Draw flows at the Arizona Canal. Flow values reported for this portion of the recommended project take this reduction into account.

I-2.29 SUBSURFACE HYDROLOGY. The ground water basin is generally bounded on the north and east by the McDowell Mountains, South Mountains, Sierra Estrella Mountains and Buckeye Hills; and on the west by the White Tank Mountains. Aquifer depth to bedrock exceeds 1,000 feet over much of the ground water basin. (ref. 2.) Ground water occurs in discontinuous layers and lenses in the sands and gravels of the basin alluvium. Within the project area, the depth to ground water can vary tremendously; depth to ground water along the Salt River is only a few feet, while along Cave Creek it is several hundred feet (table 2).

I-2.30 Historically, ground water has been a major source of water in the region. About two-thirds of Arizona's water supply comes from ground water reservoirs. From 1953 to 1964 more than 2 million acre-feet of water has been withdrawn annually from ground water sources in the project area. The quantity of ground water pumped from aquifers in the Salt River Valley has decreased slightly since 1964, with 1.8 million acre-feet of ground water being withdrawn in 1972. (ref. 28)

I-2.31 With the extensive pumping of ground water and resultant lowering of water levels, the State has declared the Salt River Valley and the project area a critical ground-water basin. A critical ground-water basin is defined as one in which no new wells may be developed for agricultural purposes on agricultural land not already under cultivation when the ban was placed in effect. The overdraft of ground water is one of the primary reasons for the development of the Central Arizona Project. Future legal and legislative decisions can be expected to control more closely the use of water within the ground-water basin. The legality of ground-water use for esthetic or promotional displays is currently being explored by the Arizona Water Commission and State Land Department.

I-2.32 Records collected at gaging stations on the Agua Fria River and its tributaries show that much surface flow disappears as surface water moves downstream from the mountains. Most of the surface flows recorded at the Bell Road gaging station on New River never reached the mouth of the Agua Fria River. Of 25 peak flows at the New River gage, only six were recorded downstream on the Agua Fria River at Avondale, and these were greatly dissipated. This reduction in surface flow is due in part to the combined effects of infiltration and evaporation. Rates of infiltration vary throughout the reaches in the drainage area.

I-2.33 Recharge of ground water results from the percolation of rainfall and the associated runoff. Calculations of the estimated average annual runoff available for ground water recharge at the New River, Adobe, and Cave Buttes damsites were based on extrapolation of U.S. Geological Survey Stream Gage Data (ref. 8). These stream-gaging stations are located on New River at Bell Road near Peoria; on Skunk Creek near Phoenix; and on Cave Creek. The average annual runoff available for recharge at the New River damsite is 4,200 acre-feet, based on a 164 square mile drainage area. The 90-square-mile drainage area of Skunk Creek at the Adobe damsite could produce 1,700 acre-feet for recharge. The 191-square-mile Cave Creek drainage area above the proposed Cave Buttes Dam could produce 4,700 acre-feet of runoff. These figures represent maximum potential recharge that could be intercepted by the dams.

I-2.34 Calculations of streambed percolation are discussed in detail in the "Hydrologic Engineering Report of The Gila River Basin" (ref. 9). Rates of percolation were determined using flood data observed during the September 3-7, 1970 storm. The recorded water stage behind Cave Creek Dam, as well as the observed flood hydrograph for Cave Creek at Phoenix, allowed computation of channel percolation. The steady outflow from the existing Cave Creek Dam was the source of the constant flow. The outflow was computed to be 400 cfs for the same period that 290 cfs was recorded downstream, a loss of 110 cfs to channel percolation in the 11.7 mile channel reach. Assuming an average wetted channel width of 75 feet, a loss rate of 1.05 cfs per wetted acre was computed. Using this observed percolation rate for Cave Creek, percolation rates were estimated for the project area under design discharge conditions. Rates of 1.25 cfs per wetted acre of main channel and 0.50 cfs per wetted acre of overbank were estimated. The main channel percolation rate is higher than the computed 1.05 cfs per wetted acre rate because higher discharges produce higher hydrostatic heads and thus a higher percolation rate. The overbank material is less pervious than the streambed deposits, hence the percolation rate for the overbank area was estimated at 0.50 cfs per wetted acre.

I-2.35 WATER QUALITY. The water quality index used in this statement is based on the quantity of total dissolved solids (TDS) per unit volume. The U.S. Public Health Service's drinking water standards, established in 1962, indicate that domestic water supply should not exceed a TDS of 500 milligrams per liter (mg/1). The quality of water in the project area varies with its source. The primary sources are perennial and ephemeral surface streams, ground water, and effluent discharges.

I-2.36 The municipal and industrial water used in the Phoenix metropolitan area comes from a combination of two sources: (a) surface water in the Salt and Verde Rivers originating outside the study area and (b) ground water from deep wells within the Phoenix ground-water basin. Water destined for consumption in the metropolitan area is processed in four water treatment plants operated by the City of Phoenix. The Deer Valley and Squaw Peak plants are located along the Arizona Canal, the Verde plant is at the confluence of the Salt and Verde Rivers, and the Val Vista Point plant is located on the South Canal. An additional source of surface water is derived from an infiltration gallery and 13 shallow wells along the Verde River. The City of Phoenix Water and Sewer Department water analysis for March 1973 indicated a surface water average TDS of 440 mg/1 and a ground-water average of 714 mg/1.

I-2.37 The Central Arizona Project (CAP) is a potential source of additional water supply for the project area. The Colorado River at its entrance into the CAP system at Parker Dam had an average TDS of 740 mg/1 for the period 1963-1967 (ref. 7).

I-2.38 Limited data are available on the quality of storm runoff. Data from the Agua Fria watershed were used as a measure of the quality of storm runoff from the upstream nonurbanized watersheds that discharge waters into the project area. Although the Agua Fria watershed is considerably larger than the watersheds in the project area, it is adjacent to the project area and has similar characteristics to the project area watersheds. The average annual TDS for water from the Agua Fria entering Lake Pleasant was 259 mg/1 in 1971 and 270 mg/1 in 1972. See table 3 for additional data. The quality of urban storm runoff had not been determined.

I-2.39 The Maricopa County Health Department has local responsibility for sewage treatment facilities. The County requires that all private sewer facilities must dispose on-site, with only the municipalities allowed to discharge into drainages. The majority of waste water treatment within the project area is handled at two facilities, both operated by the City of Phoenix. The treatment plants are both located immediately north of the Salt River, one at 23d Avenue with a capacity of 40 million gallons per day and the other at 91st Avenue with a capacity of 65 million gallons per day (January-February 1967). These plants provide secondary treatment by utilizing the activated sludge method. Discharge of the effluent is to the Salt River at 35th Avenue for the 23d Avenue plant and at 91st Avenue for the 91st Avenue multicity waste-water plant. The 91st Avenue plant provides treatment for the communities of Phoenix, Tempe, Mesa, Scottsdale, Glendale, Sun City, Peoria, and Youngstown, while the 23d Avenue plant handles only Phoenix waste water. The TDS of the effluent waste from the Phoenix treatment facilities is 1,400 mg/1 (ref. 7).

I-2.40 AIR QUALITY. The project area is located in the Phoenix-Tucson air quality control region (AQCR), which is one of four AQCR's into which the State of Arizona has been divided. The Phoenix-Tucson AQCR has been designated as an example region because it has 81 percent (ref. 10) of the State's population, measures the highest concentration of pollutants, and contains most types of emission sources found in the State (table 4).

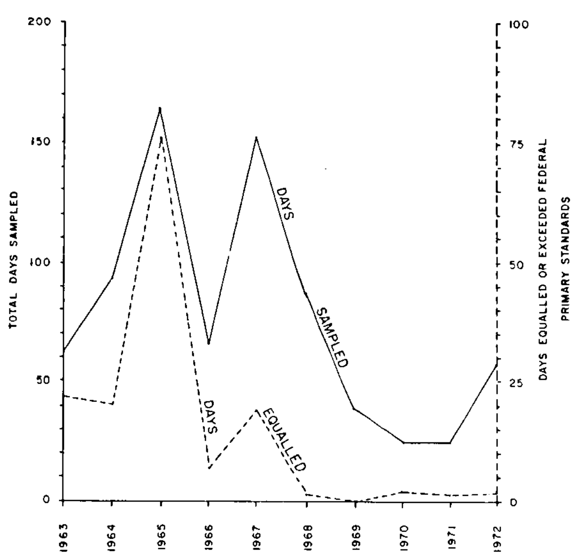
I-2.41 The population density in the Phoenix-Tucson AQCR and, in particular, within Maricopa County (which has 67 percent of the population in the AQCR), leads to high concentrations of motor vehicles and motor-vehicle associated pollutants, i.e., carbon monoxide, nitrogen dioxide, hydrocarbons, and photochemical oxidants. The atmospheric conditions—clear skies and dry air at night—that are generally present in the study area favor the development of temperature inversions. These inversions may exist for as much as two-thirds of the 24-hour day; when combined with periods of weak winds or stagnant air, they permit pollutants to accumulate.

I-2.42 Complex atmospheric conditions involving oxides of nitrogen, hydrocarbons, and other organic gases utilizing ultraviolet energy from the sun, cause photochemical air pollution, which is a source of concern in the AQCR. The meteorological conditions trap the necessary reactants, and the ultraviolet energy, which is available in the basin in copious amounts, forms photochemical smog. A detailed review of hourly values for 1971 reveals that concentrations of carbon monoxide and hydrocarbons are consistently high in the late night and early morning and drop to a minimum during daylight, regardless of the time of year (ref. 11).

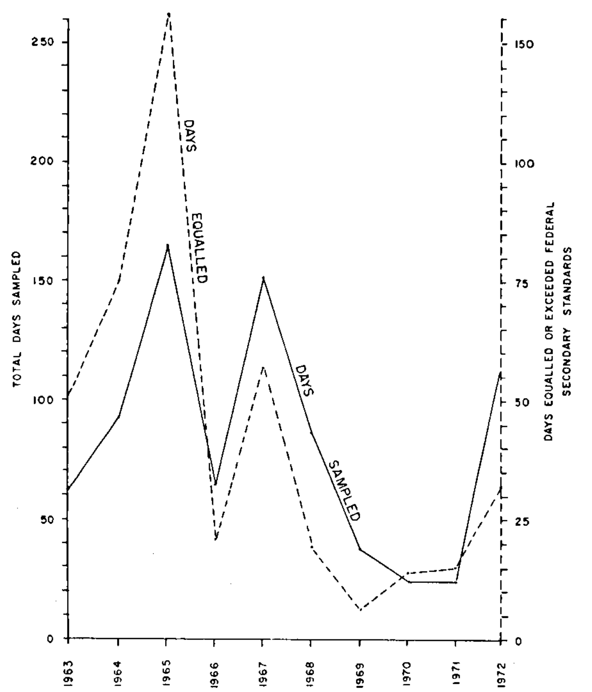
I-2.43 In the Phoenix metropolitan area, carbon monoxide comprises 73.4 percent of the total pollution; and the automobile is responsible for 94.6 percent (ref. 11) of the total carbon monoxide production. Similarly, hydrocarbon from all sources comprises 16.2 percent of the total pollution; and the automobile is responsible for half the total amount of hydrocarbon production. The automobile also causes 62.3 percent of the sulfur dioxide, 57.9 percent of the nitrogen oxides, and 44.5 percent of the aldehydes. Emissions from the automobile constitute 82.6 percent of the total atmospheric loading (ref. 11).

I-2.44 Air quality data for the Central Phoenix Station, provided by Maricopa County Health Department, are compared with Federal standards in the diagrams on the following page. The annual average concentration of sulfur dioxide and nitrogen dioxide has not exceeded Federal standards since continuous monitoring was initiated and, therefore, has not been shown. Efforts are being made to control air pollution in the area before it reaches a critical stage. The State of Arizona and Maricopa County share the responsibility for air pollution control in the study area. The Arizona State Air Pollution Control Division of the Department of Health has jurisdiction over all major sources that emit 75 tons of particulates a day, as well as over all intercounty mobile units of pollution. The Maricopa County Department of Health Services, Bureau of Air Pollution Control has jurisdiction over any other source of air pollution. The county air implementation program requires permits for equipment that discharges pollutants into the atmosphere and also monitors air quality.

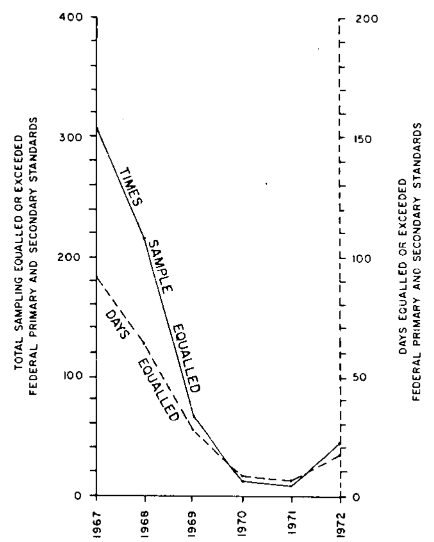
CENTRAL PHOENIX STATION
AIR QUALITY PARAMETERS



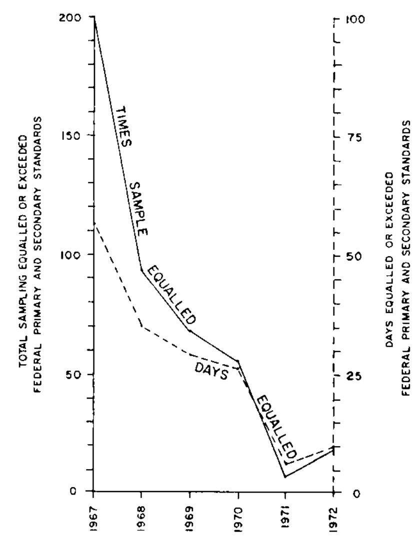
SUSPENDED PARTICULATE CONCENTRATIONS
COMPARED TO FEDERAL PRIMARY STANDARDS
(maximum 260 ug/m³, 24 hour average)



SUSPENDED PARTICULATE CONCENTRATIONS
COMPARED TO FEDERAL SECONDARY STANDARDS
(maximum 150 ug/m³, 24 hour average)



PHOTOCHEMICAL OXIDANTS CONCENTRATION COMPARED
TO FEDERAL PRIMARY AND SECONDARY STANDARDS
(maximum 160 ug/m³, 1 hour average)



CARBON MONOXIDE CONCENTRATIONS COMPARED
TO FEDERAL PRIMARY AND SECONDARY STANDARDS
(maximum 40 mg/m³, 1 hour average)

COMPARISON OF AMBIENT AIR QUALITY STANDARDS

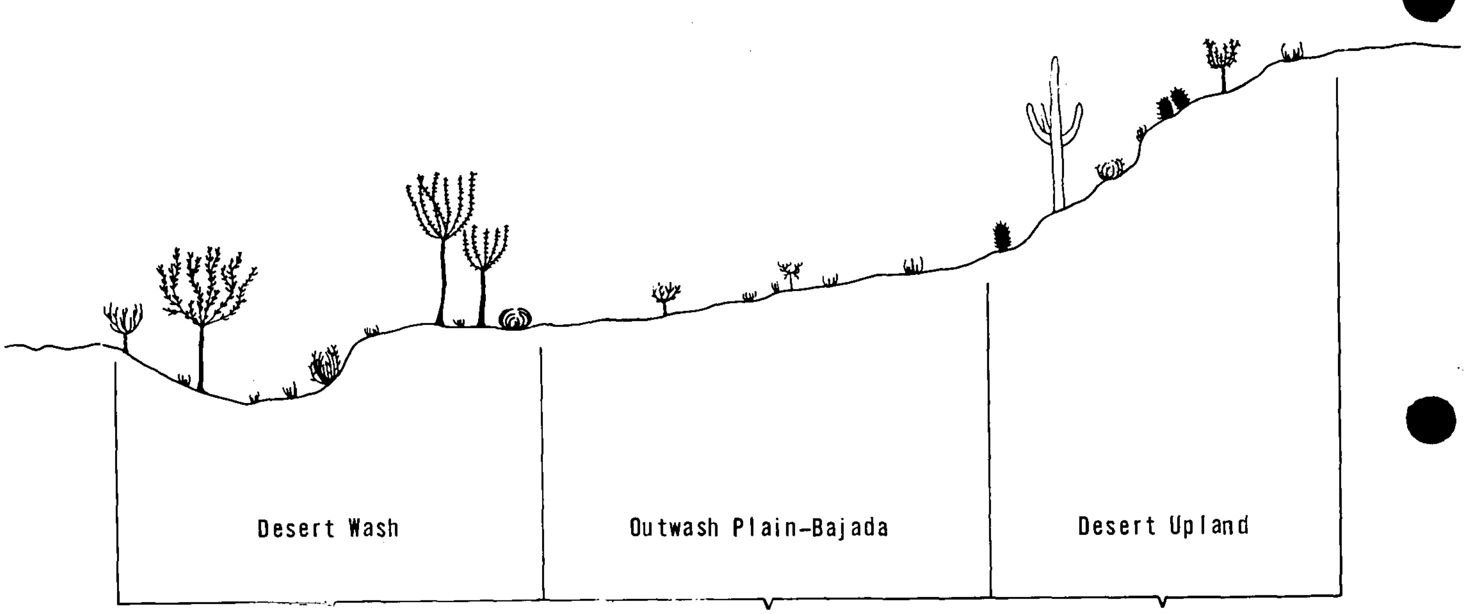
Pollutant	Condition	Arizona standard	Federal primary standard	Federal secondary standard
Sulfur oxides (sulfur dioxide) (ug/m3)	3 hr. avg.	1300	––	1300
	24 hr. avg.	260	365	260
	Annual avg.	50	80	60
Suspended particulates (ug/m3)	24 hr. avg. (Max.)	100	260	150
	Annual geometric mean	60	75	60
Photochemical oxidants (ug/m3)	1 hr. avg.	80	160	160
	Peak value	150	––	––
Hydrocarbons (ug/m3)	3 hr. avg. (Annual Max.) (6 to 9 a.m.)	––	160	160
Nonmethane	Peak value	80	––	––
Nitrogen dioxide (ug/m3)	Annual avg.	100	100	100

I-2.45 A plan devised by the State provides for the attainment of State air quality standards instead of national air quality standards. These State standards are equal to or more stringent than the national secondary standards (table 5). Indications from the State Air Implementation Plan are that a 2-year extension will be needed before carbon monoxide is controlled, but no extension will be needed for particulates, hydrocarbons, and photochemical oxidants. By 1975, the State will meet all other air-quality standards, using closed-loop operational strategy controls to achieve ambient air standards for sulfur dioxide and utilizing the Federal auto-emission standards for control of nitrogen dioxide (ref. 10).

I-2.46 The State of Arizona has identified those areas where either current air quality or projected growth rates indicate a potential for exceeding national standards within a 10-year period (ref. 12). The Phoenix standard metropolitan statistical area (SMSA), which includes all of Maricopa County, was identified as such an area (ref. 12). The State has completed its analysis and presented its findings in a report, "Designation of Air Quality Maintenance Areas for the State of Arizona" (ref. 12). Pertinent information concerning the Air Quality Maintenance Areas (AQMA) is contained in table 6. Total suspended particulates, sulfur dioxide, and nitrogen dioxide were not considered critical in the AQMA. Photochemical oxidants and carbon monoxide were designated on the basis of actual projections (ref. 12). Tables 7 and 8 present the data used for the State's determination.

I-2.47 VEGETATION AND WILDLIFE. The biological study area for this statement is delimited as the area where project effects could occur. This area extends north from the Salt and Gila Rivers about 30 miles, and east from the Agua Fria River and floodplain to 40th Street in Phoenix (see pl. 9). The area includes natural plant communities (mostly north of Phoenix; disturbed vegetation; irrigated agricultural crops (mostly west of Phoenix); and urban landscaping (the greater Phoenix metropolis). The estimated acreage of native vegetation at proposed damsites and channels within the study area is shown in table 9. The biological study area lies within the Lower Sonoran Life-Zone, which is equivalent to desert. This life-zone is based on the observable ecologic distribution of plants and animals and has been mapped on the basis of vegetation. The vegetation found within this life-zone is termed Southwestern Desert scrub. The Sonoran Desert, one of three subdivisions of the North American Desert, covers most of southwestern Arizona and is usually characterized by a creosote-bush community and paloverde community. An important feature of the desert vegetation is the large number of short-lived herbaceous plants (ephemerals), which appear in the early spring and late summer following the two seasonal periods of rainfall (winter and summer) that occur during most years. Based on research of the appropriate botanical literature and limited field observation, the study area includes at least 90 perennial, 109 winter annual, and 51 summer annual plant species. Table 10 lists the principal floral species for Phoenix and vicinity.

I-2.48 For the purpose of this report, the native plant communities within the study area have been classified into three types: desert wash or riparian, outwash plain or bajada, and desert upland. The variability of substrates, moisture, and topography, as well as other features, has produced a multitude of microenvironments. This often makes it difficult to identify discrete vegetative associations for the study area. However, the generalized classification used provides a fairly meaningful characterization of the floral environment. A plant community and physiographic profile is shown on the following page.



Desert Wash	Outwash Plain-Bajada	Desert Upland
Ironwood	Creosotebush	Little Leaf Paloverde
Blue Paloverde	Triangle Bursage	Brittle Bush
Mesquite	White Bursage	Barrel Cactus
Catclaw Acacia	Brittle Bush	Hedgehog Cactus
Burro Brush	Cholla	Saguaro Cactus
Desert Broom	Saguaro Cactus	Triangle Bursage
Wash Bursage	Various Grasses	Creosotebush
Desert Thorn		Ocotillo
Desert Willow		Indian Wheat
Desert Hackberry		Bladderpod
Creosotebush		Various Grasses
Various Grasses		

Diagrammatic profile showing desert plant communities and representative species

I-2.49 In areas of transition from one type of plant community to another, an intergradation of species characteristic of each type occurs. Desert wash, desert outwash plain, and desert upland plant communities are discussed in the following subparagraphs:

a. Desert Wash Community. Desert wash vegetation occurs along small arroyos, washes, major drainageways, and slight depressions resulting from concentrated runoff. The desert riparian vegetation usually consists of trees such as ironwood, blue paloverde, mesquite, and desert willow; shrubs such as catclaw acacia, desert broom, and burrobrush; and various annual and perennial herbaceous vegetation and grasses (see photo 1). Along major drainageways, such as the Agua Fria River, some cottonwood also occurs. Where a reticulate or braided drainage system occurs, desert wash species spread more uniformly over the alluvial plain. As water penetration is enhanced and evaporation is retarded, riparian vegetation develops over a large area rather than being confined to the drainage channel itself. As the area of the drainageway increases, a corresponding increase in the size and density of the riparian species usually develops.

b. Desert Outwash Plain Community. Over four-fifths of the total area of the Lower Colorado Valley Desert, a vegetational subregion of the Sonoran Desert, is low elevation and composed of sand and gravel outwash alluvium (ref. 13). The outwash plain plant community (see photo 2), which covers much of the arid intermountain plains and lower bajada areas of this desert, usually consists of a sparse assemblage of shrubs and dwarf shrubs, few trees, and annual and perennial herbs and grasses. The outwash plain community grades from a nearly pure stand of creosote bush to the inclusion of bursages, cactus, and even desert riparian trees in the drainageways. Saltbush is often an important representative of this community. Urban development and irrigated agriculture have eliminated or altered much of the extensive desert outwash plain plant community that historically occurred in the Phoenix area.

c. Desert Upland Community. The desert upland plant community (see photo 3) occurs outside areas subject to significant flooding. The vegetation is often a more dense continuation of the outwash plain or bajada community. Species characteristic of this community include creosote bush, bursages, barrel cactus, saguaro, ocotillo and various grasses. Various cholla cacti also occur, with teddybear cholla being a most frequent representative. This plant community has experienced the least disturbance of the natural habitats within the study area. Where disturbance has occurred, off-road vehicular use has caused most of the disruption and destruction of this plant community.

I-2.50 The natural plant communities have been disturbed or greatly altered by man in many places. Extensive acreages of riparian vegetation, especially along the larger channels, have been disturbed by gravel mining. Desert outwash vegetation has also been disturbed over wide areas by such land-use activities as farming, urbanization, and off-road vehicular uses. Almost all areas have been modified to an undetermined extent by domestic grazing. Man-made topographic and drainage changes have also produced disturbed plant communities, where the natural association is not allowed to develop its climax. Annual herbaceous vegetation such as pigweeds, Russian thistle, mustards, sunflower, and cocklebur and such shrubs as tree tobacco and desert broom often occur in disturbed communities, in addition to natural community representatives. Open areas adjacent to agricultural lands, roads, and urban residences have semi-natural plant communities. Where man has increased soil moisture, such as along canals, and road ditches, species usually characteristic of riparian areas (i.e., mesquite, ironwood, blue paloverde and cottonwood) occur in moderate densities. A substantial amount of agricultural land has not been cultivated for many years in the Phoenix area. Native species have revegetated the old fields as have many introduced weedy annual and perennial plants, forming disturbed plant associations.

I-2.51 Extensive acreages of agricultural crops are planted in the Phoenix area. The agricultural production, which consists of field and seed crops (cotton, milo, barley, sorghum, and alfalfa), vegetable, fruit (citrus and grape), and nut crops, accounts for a significant amount of vegetation in the western part of the study area. Development that is occurring on agricultural lands and the disturbed outwash plain habitats is rapidly replacing open space areas. Some native vegetation has been retained in the urbanized part of the study area, which has many introduced plant species.

I-2.52 Wildlife are present in all the various habitats (natural desert communities, agricultural, and urban) within the study area. The largest number and greatest diversity of desert fauna within the Phoenix study area appear to occupy the desert wash and upland habitats north of Phoenix. This is related to the abundance of wildlife plant foods in these habitats. Areas of intensive urban development and agricultural activity usually have a limited wildlife diversity and abundance, although some bird species flourish around agricultural areas. Wildlife found in various habitats throughout the Phoenix study area include: amphibians and reptiles, such as toads, frogs, lizards, and snakes; many bird species (346 species are listed in the annotated field lists of Birds of Maricopa County) (ref. 31); and mammals such as bats, rodents, skunks, rabbits, coyotes, and deer. An inventory of the fauna, based on appropriate literature and field observations, appears in table 11.

I-2.53 Although desert wildlife species are adapted to very dry conditions, most species depend on some free water. Consequently, animals are most abundant where water or succulent foods are available. The streambeds and riverbeds attract and concentrate animal populations at various times, depending on the availability of food, water, and cover. Summer and winter periods of rainfall usually occur in the Phoenix area, providing at least temporary sources of water. Some gravel pits along the drainages in the study area contain ponded water throughout most of the year. Effluent from sewage treatment plants and sedimentation ponds, such as along New and Agua Fria Rivers, also provides water sources for wildlife in the Phoenix area.

I-2.54 Wildlife, particularly birds, are concentrated by the vegetation in desert washes and along major creeks and rivers. This vegetation, especially mesquite, provides important nesting, feeding, resting, and roosting sites. As agricultural, mining and urban uses have eliminated much of the natural habitat along the major drainageways in the area, the remaining riparian habitat is particularly important as a refuse area for wildlife where adequate food and cover sources are available.

I-2.55 Irrigated agriculture has replaced a large amount of natural desert habitat and eliminated some animal species in local areas; however, it has also provided food, water, and cover (new niches) that support certain adaptable wildlife species, especially birds, at higher densities. Agricultural crops (safflower, sorgham, barley, and citrus groves) in the area provide food and nesting areas for many species of song birds and game birds such as mourning doves, white-winged doves, and gambel's quail. Common bird species associated with irrigated agriculture include red-winged and brewer's blackbirds, brown-headed cowbirds, white-crowned sparrows, and western meadowlarks. Birds, such as the starling, house sparrow, mockingbird, house finch, and inca dove are common in the urban areas. In addition to these species, other regionally common birds include species of hawk, owl, woodpecker, wren, hummingbird, and the roadrunner.

I-2.56 Although some reaches of the Agua Fria and New Rivers and Cave and Skunk Creeks remain relatively natural, the biological communities along most of the channels have been considerably altered as a result of sand and gravel mining, motorcycle riding, and unauthorized trash disposal. The desert upland areas, part of the proposed Adobe and Cave Creek damsites, and most of the New River area, contain relatively undisturbed natural vegetation, although these areas have experienced some habitat degradation and loss caused by sand and gravel mining, off-road vehicular use, camping, vandalism, and trash disposal. The plant communities and associated wildlife in the area affected by the proposed project are discussed in sections II through VI of this statement.

I-2.57 ENDANGERED WILDLIFE. The peregrine falcon (presently on the endangered species list established by the Endangered Species Act of 1973) may be an occasional migratory visitor to the project area. Two peregrine falcons were observed during the 1971 Christmas bird-count. It is unlikely that the peregrine falcon nests in the study area because suitable nesting habitat is lacking. No other endangered wildlife species are known to utilize the study area.

I-2.58 RARE AND ENDANGERED VEGETATION. The State of Arizona has statutes protecting various native plants growing wild on State, public, or privately owned lands. The statutes are administered by the Arizona Commission of Agriculture and Horticulture. Among the protected plants are all species of the lily, amaryllis, orchid, orpine and cactus family. It is unlawful to take or transport protected plants from their original growing site without a valid permit from the Commission of Agriculture and Horticulture. The Endangered Species Act of 1973 provided for the establishment of a Federal endangered plants list. A report on Endangered and Threatened Plant Species of the United States (ref. 35) was published in December 1974.

I-2.59 ARCHEOLOGICAL AND HISTORICAL RESOURCES. Research into the archeological and historical resources in the project area was carried out by Arizona State University, Department of Anthropology, under contracts with the National Park Service and the Corps of Engineers. Material presented in this section was obtained from two reports prepared under these contracts: "An Archeological Survey in the Gila River Basin, New River and Phoenix City Streams, Arizona Project Area" (ref. 6) and "An Archeological Survey of the Cave Buttes Dam Alternative Site and Reservoir, Arizona" (ref. 14). An overview of the archeology of the project area, abstracted from these reports, is given in this section.

I-2.60 Lands in west central Arizona situated between the Verde River on the east and the Hassayampa River on the west, and extending northward from the Salt-Gila River to Prescott have received relatively little attention from archeologists until the last few years. This entire study area is designated as the Agua Fria district in this environmental statement, although the statement is concerned primarily with the part of the district lying south of Lake Pleasant.

I-2.61 The archeology of the project area best documents the Hohokam native American culture. The cultural development of the Hohokam people has been traced from Cochise manifestations of the Desert Culture and has been divided into four general periods: the Pioneer (300 B.C. - 500 A.D.), Colonial (A.D. 500 - 900), Sedentary (A.D. 900 - 1100), and Classic (A.D. 1100 - 1450).

I-2.62 The archeological surveys resulted in the discovery of 85 sites, all but three of which are within or on the margins of the rights-of-way for one or more of the project alternatives considered during formulation of the recommended plan. The archeological remains vary in size from a sherd and/or lithic tool scatter that is about 7 to 10 feet in diameter to a continuous distribution of cultural remains over an area of about 0.45 square mile. Temporally, the earliest sites appear to pre-date ceramics in the study area and may represent an Archaic Period which is as yet undefined. The earliest ceramics, Sweetwater Red-on-gray and Snaketown Red-on-buff, dating about A.D. 100 to 500, are represented only at one site in the Salt-Gila Valley near the end of the Agua Fria River. The earliest ceramic identified in the vicinity of the proposed dams are Gila Butte Red-on-buff, about A.D. 500-700, and the associated Wingfield Plain. Only four sherds of Gila Butte Red-on-buff have been found in the New River damsites, which suggests that the archeological sites are late in the above time interval. The number of remains increases rapidly through the period equivalent to the Santa Cruz Phase with the maximum number occurring in the time of Sacaton Red-on-buff, or A.D. 900 to 1100. There is then a sharp decline in the number of sites, and the district was abandoned in the interval equivalent to the Soho Phase, about A.D. 1100 to 1250. The single site with an example of Pinto Polychrome, which could date as late as A.D. 1350, is at the southern end of the New River channel.

I-2.63 Evidences of recent historic activities (1800-1900) in the district are abundant as large tracts of land show the effects of past cultivation. Occasional remains of structures have been encountered and are recorded in the field journals but without site designations. A good example is the Keefer Ranch which is within the area of site AZ T:8:1 (ASU).

I-2.64 NATIONAL REGISTER SITES. Currently, there are no sites or districts on the National Register of Historical Places within the project area. However, several concentrations of sites have a potential for nomination to the National Register as districts. The State Historic Preservation Officer and the Keeper of the National Register have determined that within the project area there are three districts and one site that merit nomination to the National Register. The nomination procedure is in progress at this time. The sites with National Register potential are shown on plate 10. Pursuant to Section 106 of the National Historic Preservation Act of 1966 and to Title 36 C.F.R. Part 800.4 the Corps of Engineers has provided the Advisory Council on Historic Preservation a preliminary case report and has requested their comments. The case report contained relevant project information, its impact on National Register sites and proposed mitigation measures. Completion of this action will determine what mitigative measures should be taken. A memorandum of agreement will detail the action to be taken to avoid or mitigate any adverse effect on National Register sites or National Register properties. The mitigation measures proposed by the archeological contractors and agreed upon by the Corps of Engineers primarily consist of archeological excavation to recover archeological data that would be disrupted by construction of the project. Additionally it is recommended that the petroglyph site immediately south (downstream) of the west abutment of Adobe Dam be acquired and that measures be developed to assure its preservation.

I-2.65 ESTHETICS. Phoenix lies on a flat, gently-sloping piedmont, broken only by distinct, rugged mountains. The subtle, muted desert colors are enhanced in the sharp light of early morning and late afternoon. In the spring, following the winter rains, annual flowering plants carpet the desert, and the perennial vegetation greens and blooms. Until recently, the clear visibility for 50 miles or more enhanced the sense of space; now degradation of air quality in the area often reduces the usual visibility to 8 to 12 miles or less. Despite smoke, dust, and other air pollutants, Arizona's sky is still spectacular especially in the summer when cumulus clouds build up in the afternoon.

I-2.66 Man's activities have greatly altered the natural esthetics of the desert. The climate encourages outdoor recreation, and private swimming pools are commonplace; 12 percent of the households in Maricopa County have swimming pools. Public open space is important to the social and recreational lifestyles of the people. Although a strong concern exists for retention of open space and natural vegetation in Maricopa County, some of the population who have migrated from the more humid climates prefer the appearance of green lawns, landscaped areas, and lakes to the appearance of the native desert (photo 4). Some developers have used this preference for water as a sales device.

I-2.67 As the land close to the urban core has become more densely developed with multifamily and commercial construction, the single-family developments have moved out into the desert and agricultural lands in leapfrog fashion. More and more of the desert is subject to urban sprawl; many large-scale developments, complete with recreational lakes and green irrigated vegetation, dot the valley floor.

I-2.68 LAND USE. As the urbanized area around Phoenix has expanded during the past 20 years, it has absorbed peripheral development and become a continuous urban complex. In Maricopa County, the population increased by more than 305,000 people from 1960 to 1970, which led to rising property values near the urban core (an area generally within a 2-mile radius of downtown Phoenix) and accelerated the conversion of low-density residential land to multifamily and commercial uses. Increased property values in the urbanized areas forced the lower density single-family development into the citrus groves, agricultural lands, and undeveloped desert on the urban periphery where land cost was lower. The general pattern of urban growth from 1958 to 1975 is shown on plate 11.

I-2.69 During this period of rapid urban growth, more than 162,000 persons settled in the Scottsdale-Tempe-Mesa area. The completion of the Black Canyon Highway helped to direct development north into Deer Valley, a section of Phoenix that was reported growing at the rate of 1,000 persons per month in 1972 (ref. 15). Growth to the northwest was made easier by U.S. Route 60-70, which provides access to the cities of Glendale and Peoria, and the communities of Sun City and Youngtown. The spread of urbanization southward has been slowed by the wide flood plain of the Salt River.

I-2.70 Of the 50,495 acres in the future standard project flood overflow areas of the project, 24,650 acres contain urban land uses (49 percent), 12,530 acres contain agricultural land uses (25 percent), and 13,315 acres are devoted to open space or are vacant (26 percent).

I-2.71 The pattern of future urban development in the next 50 years is shown on plate 12. An important factor in future urban development is the expectation of many large-scale developments that will be physically detached, like satellite cities, but economically and socially tied to the larger urbanized area, like suburbs. As of March 1975, there were 3 existing or proposed large-scale developments, each with a design population of 50,000 or more. An additional eight existing or proposed large-scale developments not so grand in scope, ranging from 10,000 to 50,000 in design population, as well as numerous developments of less than 10,000, will also have an effect on the emerging land-use pattern of Maricopa County.

I-2.72 By the year 2027, the land use in the project area that could be subject to a future standard project flood without any additional flood control, is projected to be 35,845 acres urban (71 percent), 8,740 acres agricultural (17 percent), and 5,910 acres open space and vacant (12 percent). With additional flood control facilities, the land use is expected to be 36,710 acres urban (73 percent), 8,525 acres agricultural (17 percent), and 5,100 acres open space and vacant (10 percent). A more detailed listing of the land use projections for the standard project flood overflow areas is given in table 12. More detailed land use descriptions are also given in the sections concerning individual project features.

I-2.73 DEMOGRAPHIC CHARACTERISTICS. The concept of race used by the Census Bureau does not denote clear-cut scientific definitions of biological stock; rather, it reflects self-identification by respondents. Since the 1970 census obtained information on race principally through self-enumeration, the data represent essentially the race with which people identified themselves.

I-2.74 The category "white" includes persons who indicated their race as white, as well as persons who did not classify themselves in one of the specific racial categories but entered Mexican, Puerto Rican, or a response suggesting Indo-European stock.

I-2.75 The category "Negro" includes persons who indicated their race as Negro or Black, as well as persons who did not classify themselves in one of the specific racial categories but entered Jamaican, Trinidadian, West Indian, Haitian, Ethiopian, or a response suggesting Negroid stock.

I-2.76 The Spanish-American population is defined in the five southwestern States, including Arizona, as persons of Spanish language or persons who report Spanish as their mother tongue, as well as persons in families in which the head or wife reports Spanish as his or her mother tongue. Persons not of Spanish language but of Spanish surname were identified by matching with a list of about 8,000 such names.

I-2.77 The 1970 census reported that the racial composition of Maricopa County was 94.8 percent White, 3.4 percent Black, and 1.8 percent other races. The Spanish-American ethnic group, which is totaled mostly as part of the White racial group but includes some Blacks and other races, was reported as 14.5 percent of the total population. There has been no discernable change in the racial composition of Maricopa County since 1970.

I-2.78 Approximately 93.4 percent of Maricopa County's 1970 population was classified as urban, with an average density of 105.8 persons per square mile, although the density varies considerably throughout the county. The following tabulation compares the population density of Phoenix with other major population centers in the country.

City	Population Density (per square mile)
Phoenix, Arizona	2,350
Glendale, Arizona	2,308
Mesa, Arizona	3,087
Scottsdale, Arizona	1,071
Tempe, Arizona	2,542
Chicago, Illinois	15,126
Los Angeles, California	6,073
Atlanta, Georgia	3,779

I-2.79 The 1970 census reported that the median age in Maricopa County was 27.0 years and that 58.8 percent of the population was in the prime working age group of 16 to 64 years old, while persons over 65 accounted for 9.4 percent of the total population. Within the future standard project flood overflow area the median age was 30.3 years, with 60.1 percent of the population in the prime working age and 11.5 percent over 65 years of age.

I-2.80 Residents of Maricopa County display a high degree of mobility. A survey by the Republic-Gazette (ref. 16) showed that 63 percent of the households within the county have moved within the past 5 years. Of these moves, only 48 percent were moves from outside of Arizona, while 3 percent were moves from other Arizona counties. The remaining 49 percent of the moves were from different housing units within the county.

I-2.81 HOUSING. As reported by the 1970 census, the housing in Maricopa County (Phoenix SMSA) consisted of single-family dwellings, 72 percent; multiple-family dwellings, 21 percent; and mobile homes, 7 percent. The median housing value in Maricopa County that year for single-family dwellings was $18,541 and the median rent was $105 per month. By mid-1973 the housing makeup had shifted to the following: single-family dwellings, 62.9 percent; multiple-family dwellings, 26.3 percent; and mobile-homes, 10.8 percent (ref. 17). The median housing value of owner-occupied single-family dwellings rose from $18,500 in 1970 to $26,500 in 1973.

I-2.82 According to the 1970 census, 4.2 percent of the housing units in Maricopa County were substandard; that is, 4.2 percent of the year-round housing units lacked some or all plumbing facilities. The ethnic communities near the Salt River in the Phoenix metropolitan area contain almost one-half of this substandard housing, with the remainder being migratory labor housing located on the periphery of the urban development.

I-2.83 Assuming that conditions continue to be favorable to the construction of multiple-family dwellings, both the total number of multiple-family dwellings and their percentage of the total housing will continue to increase. Large parcels of land on the periphery of the urbanized area will continue to attract housing development. To date, several planned developments (ranging from a few thousand to nearly 160,000 persons) have already been proposed for future construction. According to the Maricopa County Planning Department, more than 30 developers have indicated an interest in developing over 36 large-scale planned developments that would cover 186,000 acres and have a total design population of over 837,000.

I-2.84 EMPLOYMENT. The following tabulation from the Arizona Department of Employment Security shows employment trends in Maricopa County for the period 1964-1974, along with a 2020 projection.

Employment trends in Maricopa County*

Type of employment	Actual number 1964*	Preliminary number 1974*	Projected number 2020**	Percentage increase 1964-1974	Percentage increase 1974-2020
Agricultural	19,300	11,800	8,000	-38	-32
Nonagricultural	255,100	472,300	904,300	+85	+91
Wage and salary	221,300	443,700	839,300	+100	+89
Manufacturing	44,500	77,200	245,000	+73	+217
Mining and quarrying	100	400	300	+300	-25
Contract construction	16,700	30,900	70,000	+85	+127
Transportation, communications, and public utilities	13,500	24,200	33,000	+79	+36
Wholesale and retail trade	56,900	115,300	188,000	+102	+63
Finance, insurance, and real estate	14,900	31,900	55,000	+114	+72
Services and miscellaneous	35,800	82,500	127,000	+130	+54
Government	38,900	81,300	121,000	+109	+49
Other***	33,800	38,900	65,000	+15	+67

* Source: Arizona Department of Employment Security.
** Source: Arizona Tradeoff Model, adjusted by Los Angeles District, Corps of Engineers, to agree with OBERS series "E" population projections.
*** Includes self-employed and unpaid workers.

The increase in nonagricultural employment and decline in agricultural employment results in part from the rapidly growing electronics industry. Tourism, retirement, and trade, as well as Phoenix's place as the State capital, have also contributed to the rapid urban growth of the county. As the county's economy matures, future urban growth is expected to be moderate.

I-2.85 INCOME. Over 49 percent of Maricopa County's households earned in excess of $10,000 in 1969. Median family income rose from $5,896 in 1959 to $9,855 in 1969. Inflationary pressures (consumer prices rose over 31 percent) contributed to a good deal of this increase, but real income still rose over 27 percent. The number of wives working and the multiple-job households were largely responsible for the growth in personal income. Variation in income was considerable: median income for downtown Phoenix was only $4,421, whereas Paradise Valley had a median income of more than $17,000. The family income for 11.9 percent of the population in 1969 was below the poverty level, a figure which compares with 10.7 percent nationally.

I-2.86 ECONOMY. The principal factors influencing growth in Maricopa County prior to 1940 were agriculture, tourism, government, and some food and fibre processing. Since 1940, the principal stimuli for urban expansion have been the natural increases in population and corresponding migration to the Southwest, in addition to the growth of the defense and aerospace industries. Today, the economy of Maricopa County is based on agriculture, manufacturing, tourism, and retirement.

I-2.87 In 1972, Maricopa County was the largest producer of agricultural products in the State and the fifth largest agricultural producer in the nation, with a market value of $269 million (ref. 17). Land under cultivation in the Salt River Project area reached a peak of 227,000 acres in 1940 and began a decline after World War II as land use shifted toward urbanization. By 1975, the cultivated acreage in the area had decreased to 117,000 acres. The principal crops produced include cotton, alfalfa, cereal grains, lettuce, citrus fruits, and sugar beets.

I-2.88 In 1972, two-thirds of Arizona's manufacturing firms and three-fourths of the manufacturing employment were located in Maricopa County (ref. 17). The largest manufacturing class was electrical and electronic equipment and supplies. The group was aided by defense contracts for the research and development of electronic products. The growth in these industries is also attributable to the following conditions:

Low humidity levels in Arizona are conducive to the manufacture of electronic equipment.

Specific locational requirements do not exist for such industries.

Local planners look favorably upon the desirability of attracting and retaining "clean industry."

Technical manpower is available.

Favorable tax structure exists at the State and local level.

I-2.89 In 1974, tourism decreased to $340 million, or 1 percent under 1973 (ref. 4). This decrease has been attributed to the energy crisis and the recession, and is seen as a short term trend. With its natural and cultural attractions, Maricopa County is becoming a prime year-round vacation and convention center for the nation, as well as the southwest. For example, 171,153 delegates in 1974 spent more than $33 million as a result of 886 conventions. With over 1,200 hotel rooms to be added by 1975, the increasing economic effects of the conventions will be substantial (ref. 16).

I-2.90 To a large extent, the future economic growth of the County will reflect the national economy. The Bureau of Business and Economics Research at Arizona State University has predicted the County's economy will reflect increasing growth in government, manufacturing, tourism, recreational activities, and the service sector (ref. 18). Constraints to future growth would include a slowdown of the national economy, enforcement of pollution standards, and the lack of development of public facilities.

I-2.91 TRANSPORTATION. Maricopa County is a major transportation center in the southwest, with major highways, railroad lines, and airports. Interstate highways 17 and 10 connect the Phoenix area with Flagstaff and Tucson, and Interstate highway 8 connects it with San Diego. A future alinement of Interstate 10 is currently being studied. When complete, I-10 will join I-17 to provide a more direct route to Los Angeles.

I-2.92 Over 100 transcontinental, interstate, and intrastate truck lines service the county. Overnight service by truck is available to southern California and parts of New Mexico and Utah. Next-day service to 10 additional states is provided. Two railroad lines and transcontinental buslines serve the area.

I-2.93 With excellent flying conditions, the county is an important aviation center. Currently the 24th busiest in the nation, Sky Harbor International Airport is served by ten major airlines, with 3,948,569 passenger arrivals and departures in 1974. Phoenix recently purchased and plans to modernize Deer Valley Airport, located north of the city.

I-2.94 In 1974, the county had 628,000 registered passenger vehicles, over a 100 percent increase since 1962. The total number of vehicles in 1974 was 851,000 or one vehicle for every 1.4 persons (ref. 17).

I-2.95 With a low-density population and widely dispersed urban growth, an adequate public transportation system has not developed. In 1974, Maricopa County had 309 buses and 251 taxis (ref. 17). Although riders have increased as additional buses have been added, only one-half of 1 percent of the total number of trips made in the urban area are made by mass-transit vehicles (ref. 19).

I-2.96 Existing and proposed large-scale developments are not likely to become autonomous satellite cities. It is unlikely that mass-transit links to the high-employment areas of Phoenix will be provided, and, even if mass transit is provided, it is unlikely to effectively replace the automobile. Consequently, the amount of traffic moving into Phoenix will increase. In the Phoenix area, transportation planning has been conducted over the past several decades. A major street and highway plan was adopted for the area in 1961 and the Valley Area Traffic and Transportation Study (VATTS) was established as an ongoing transportation planning program for the metropolitan Phoenix area in 1965. In 1972, the Maricopa Association of Governments Transportation Planning Office (MAGTPO) began preparing the Phoenix Urban Area Transportation Plan, as directed by the U.S. Department of Transportation.

I-2.97 RECREATIONAL RESOURCES. The Phoenix metropolitan area is encircled with a system of regional and semi-regional parks (pl. 13), all of which are within an hour's drive from central Phoenix. A total of 113,000 acres of land are contained within these parks, but rugged terrain renders over half of the land unusable for recreational development. About 5,000 acres have presently been developed within the regional parks in Maricopa County of approximately 50,000 acres capable of being developed. (A more detailed description of the development capabilities of each park is contained in table 13.) Activities to be provided for in the expansion of existing and development of new parks include picnicking, camping, hiking, bicycling, equestrian activities, and amphitheater and nature centers.

I-2.98 The Arizona Outdoor Recreation Coordination Commission found that the greatest recreational demand in Arizona is for passive outdoor activities such as picnicking, followed by active outdoor recreation and water sports. As population and available leisure time increase, the demand for both passive and active recreational facilities will increase. Although the county parks will continue to be expanded and additional mini-parks and neighborhood parks will be provided, the Arizona State-wide recreation plan shows that a shortage of facilities presently exists, and programmed facilities will not be able to meet the increasing demand for recreation. The increased use of bicycles for transportation by all age groups will bring about the completion of many proposed bikeways now being planned by several cities in the metropolitan area. Today Maricopa County has 122 miles of bicycle trails, and over 100 additional miles are proposed. Completion of all the proposed trails will meet only present need, however, and the demand for trails for bicycling, hiking and horseback riding will continue to increase.

I-2.99 PERTINENT LEGISLATION. Federal, State, and local laws and regulations pertaining to flood control are described in the following paragraphs.

I-2.100 The National Flood Insurance Act of 1968 (Public Law 90-448) and its amendments encourage State and local government to regulate the development of land that is exposed to flood damage and to guide the development of future construction away from locations threatened by flood hazards. The Flood Disaster Protection Act of 1973 (Public Law 93-234) requires, in part, that State and local communities, as a condition of Federal financial assistance, participate in the flood insurance program and adopt adequate floodplain ordinances with effective enforcement provisions consistent with Federal standards to reduce or avoid future flood losses. The act imposes serious sanctions on communities having flood hazards for nonparticipation in the flood insurance program. The sanctions for nonparticipation are basically that no lending institution regulated by an instrumentality of the Federal Government (such as Federal Deposit Insurance Corporation member banks and all savings and loan associations) may make loans for any structure in the areas identified as having flood hazards by the Federal Insurance Agency. In addition, communities participating in the flood insurance program are required to adopt and enforce certain land-use regulations applicable to residential, commercial, and industrial construction in flood hazard areas.

I-2.101 In compliance with these two acts, the Governor of the State of Arizona approved an act on 3 May 1973 (House Bill 2010) providing for floodplain management within the State. The purpose of the act is to impower, encourage, and assist cities, towns and counties of the State to establish appropriate regulations for a floodplain management program along watercourses, streams, and lakes. In part, the regulations are designed to minimize flood damages, reduce the height and violence of floods that are caused by obstructions restricting the capacity of the floodways, and prevent unwise encroachment and development within floodplain areas.

I-2.102 The most current regulations for the unincorporated areas of Maricopa County were adopted by the Board of Supervisors of Maricopa County on 14 July 1975. These regulations require that floodplains be delineated; construction that may divert, retard, or obstruct floodwater be regulated; and minimum flood protection elevations and flood damage prevention requirements for uses that are vulnerable to flood damage be established. The regulation defines the allowable and permitted uses for 2 districts within the regulatory floodplain, the floodway district and the floodway fringe district. The regulatory floodplain is defined as that portion of the natural floodplain that would be inundated by the 100 year flood, as determined by Arizona Water Commission criteria. The delineation of a regulatory floodplain is subject to the approval of the Board of Supervisors and is shown on the County official Zoning Map. By letter dated 10 June 1974, the Flood Control District of Maricopa County requested the Los Angeles District, Corps of Engineers to delineate floodplains along some water courses.

I-2.103 In February 1974, the Council of the City of Phoenix passed an ordinance (Ord. No. G-1343) that established floodplain regulations controlling use of land and construction within the channel and floodplain areas along water courses, streams and lakes within the City of Phoenix. The regulations will minimize flood damages and reduce the height and violence of floods that are caused by restricting the capacity of the floodways and will also prevent unwise encroachment and building development within the floodplain areas. The City Engineer of Phoenix will establish "Floodway Encroachment Lines" and "Selected Floodway". The "Floodway Encroachment Lines" are the outer limits of the 100-year flood; the "Selected Floodway" is the limit of permitted encroachment into the floodplain that will allow the passage of the 100-year flood without unduly increasing the flood heights by a significant amount (generally considered 1 foot or less).

I-2.104 The city of Peoria has also adopted floodplain regulations commensurate with state law.

I-2.105 These laws and regulations apply to most of the overflow areas in the project area and should prevent further development within the floodways of Skunk Creek, New River, Agua Fria River, and Cave Creek as well as smaller stream courses.

I-3. RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE PLANS

I-3.01 With the exception of Adobe Dam and portions of the Arizona Canal Diversion Channel, the recommended plan (proposed action) conforms to the objectives and specific terms of existing and proposed Federal, State, and local land use plans, policies, and controls. The recommended floodways and flood easements on Skunk Creek, New River, and Agua Fria River conform to the objectives of the Flood Disaster Protection Act of 1973 (PL 93-234) as well as to the objectives of the State of Arizona Preventive Flood Control Law (Ariz. Rev. Stat. Ann. 45-2341–2346, May 3, 1973). The Flood Disaster Protection Act requires that flood prone areas be identified and that floodplain ordinances be adopted, to allow for the sale of flood insurance. The State of Arizona Preventive Flood Control Law restricts construction within areas prone to flooding until the appropriate governing body adopts flood plain regulations. Because both Federal and State laws require floodplain management on land that would be affected by the project features, the recommendation to continue floodplain management conforms to the objectives and intent of the laws.

I-3.02 The recommended Cave Buttes Dam conforms to the Maricopa Association of Governments (MAG) Composite Land Use Plan (pl. 14), which designates conservation land uses for the affected area. The MAG Composite Land Use Plan was compiled from public agency plans prepared by Maricopa County, and the municipalities and Indian communities within Maricopa County. On the Maricopa County Land Use Plan, this area is designated as a mountainous area. The plan shows the Cave Buttes Dam project feature at its recommended site.

I-3.03 The recommended New River Dam conforms to the MAG Composite Land Use Plan which designates conservation land uses for the affected area. The Maricopa County Land Use Plan designates the affected area as a desert and mountainous area, and shows the New River Dam project feature at its recommended site.

I-3.04 The recommended Adobe Dam conflicts with the specific terms of Phoenix Land Use Plan 1990 and the Deer Valley Area Plan (ref. 15). These plans both designate rural and low density residential land uses for the affected area. The Maricopa County Future Land Use Plan shows Adobe Dam at the recommended damsite.

I-3.05 The recommended Arizona Canal Diversion Channel from 40th Street to 51st Avenue conflicts with the MAG Composite Land Use Plan, Maricopa County Land Use Plan, Phoenix Land Use Plan – 1990 (ref. 21), and Deer Valley Area Plan. These plans all designate low and medium density residential land uses with interspersed commercial, public, and industrial land uses for the affected area. The reach of the Diversion Channel from 51st Avenue to Skunk Creek is consistent with the City of Glendale 1985 Development Plan (ref. 22), which designates the affected area for riding trails and open space with adjacent rural and medium density land uses. Some of the undeveloped land that will be required for the construction of the Diversion Channel is presently being used for temporary storm drainage detention basins, as this area is currently subject to flooding.

I-3.06 Although portions of the recommended Adobe Dam and Arizona Canal Diversion Channel conflict with specific terms of several county and local land use plans, these project features conform to the objectives of the land use plans. These project features provide flood protection to land designated for urban land uses that are presently confronted with the threat of damages due to flooding.

I-4. THE PROBABLE IMPACT OF THE PROPOSED ACTION ON THE ENVIRONMENT

I-4.01 INTRODUCTION. The probable impact of the proposed action on the environment is discussed in terms of direct and indirect impact and in terms of temporary and permanent impact. Direct impact is defined as the impact of the recommended project features on the construction area itself; indirect impact is defined as the impact on areas outside of the construction area. Temporary impact is defined as the impact resulting from construction activities; permanent impact is defined as the impact of the recommended project features after their completion. The impact of the proposed action is described in the following paragraphs in terms of its permanent direct and indirect impact on physical, biological and socio-economic environmental elements. The temporary impacts of the proposed action are discussed separately in paragraph I-4.63. The discussion generally parallels the "Environmental Setting" section of this statement.

I-4.02 TOPOGRAPHY AND DRAINAGE. The proposed project will cause significant changes in the existing topography of the study area. Permanent alterations will occur as a result of construction of three dams, channels, and associated recreational facilities. In the vicinity of the dams, approximately 5,100 acres of desert landforms will be disturbed. About 660 acres will be affected by the construction of channels. An additional 1,200 acres will be affected by the development of recreational facilities. In total, the project will alter about 7,000 acres to some degree.

I-4.03 Skunk Creek will remain as a natural floodway from the recommended Adobe Dam to the confluence with the Arizona Canal Diversion Channel. The New River streambed will remain as a natural floodway from the recommended New River Dam to the confluence with Skunk Creek. The recommended Arizona Canal Diversion Channel will divert water from Cave Creek west to Skunk Creek. This will require the purchase of flowage easements along Skunk Creek from the diversion channel to the confluence with the New River, on the New River from the Skunk Creek confluence to the Agua Fria River, and on the Agua Fria River from the New River confluence to the Gila River. The reaches requiring flowage easements will remain essentially natural except for the construction of earth dikes, flood walls, and bridge protection structures as required (ref. 33). The total acreage required for flowage easements under the proposed plan is 8,510 acres.

I-4.04 Temporary disturbances will result from excavation and grading operations, especially in borrow areas and along haul roads. Areas outside the immediate limits of construction that are disturbed will be returned to a pre-construction condition in accordance with the standards presented in Supplement A to this statement.

I-4.05 GEOLOGY AND SOILS. The downstream transport of sediments (sand, silts, gravels, etc.) from upstream sources will be significantly reduced by the three recommended dams. An estimated 13,350 acre-feet of sediment will be trapped by the three dams during their 100-year project life.

I-4.06 The dams will provide for the controlled release of floodflows into the downstream watercourses. These controlled flows will have velocities lower than those occurring under natural conditions. This decrease in velocity will not be sufficent to affect existing erosion patterns.

I-4.07 The flood control reservoirs behind the dams will act as stilling basins, reducing the level of suspended solids in impounded flood flows. During floods, increased scour will occur downstream of the dams until the sediment load of the released flows has been restored. The length of downstream channel affected will vary with the duration of impoundment behind the dams. Increased scouring will occur for a few miles below the dams. No change in the scouring pattern along the Gila River is anticipated.

I-4.08 NATURAL RESOURCES. Sand and gravel occur in recoverable quantities along the streambeds in the project area. Aggregate materials have been excavated from numerous locations along Cave Creek, Skunk Creek and the Agua Fria, Salt, and Gila Rivers. The major sources of supply close to the City of Phoenix, along the Salt and Gila Rivers, will not be affected by the proposed project. The only potential resource that will be permanently removed is the land under the proposed embankments. The stream channels will still be available for mining. The proposed floodways and flowage easements will restrict urban development along the stream channels, helping to preserve sources of material adjacent to urban areas. The areas behind the dams will be available for mining before the development of recreational facilities or in areas where no facilities are planned.

I-4.09 The proposed dams will trap some of the sediments that would normally replenish the streambeds. This will not significantly affect the quantity of sand and gravel available downstream. Sediments not removed by mining will be periodically excavated during maintenance operations to maintain the storage capacity of the reservoir.

I-4.10 No existing active mining operations will be disturbed by construction of the project.

I-4.11 The dam embankments, dikes and levees will require approximately 7.5 million cubic yards of material, primarily sands, silts and gravels. Based on design refinements and further soil exploration, the estimates that were presented in the draft environmental statement of the acres of borrow area required for the project have been revised and substantially lowered. An estimated 640 acres will be excavated as borrow to supply construction materials. Over 95 percent of these designated borrow areas will be located within the proposed reservoir areas.

I-4.12 With many miles of stream channel available for mining in the study area, the construction of the proposed project will not significantly affect the quantity or location of aggregate material in the Phoenix area.

I-4.13 HYDROLOGY. The surface hydrology in the study area will be modified by the project. The recommended project will affect the volume, velocity, duration, and course of surface flows downstream from the three dams. By controlling the release of storm runoff from the dams, peak floodflows and velocities will be reduced, while the duration of the flows will increase.

I-4.14 The proposed Arizona Canal Diversion Channel will divert water from Cave Creek to Skunk Creek. This additional water will increase the total volume (acre-feet) of flows along Skunk Creek and the New and Agua Fria Rivers. Floodflows originating upstream from Adobe and New River Dams will be detained for release at a much reduced rate. Although the total volume of water flowing down Skunk Creek and the New and Agua Fria Rivers will increase substantially, the combined effect of the dams and the diversion channel will be a reduction in the peak rate of flow (cubic feet per second) along the New and Agua Fria Rivers below Skunk Creek. Along the 1.8 mile reach of Skunk Creek from the diversion channel to New River, the peak flow rate will increase slightly. The maximum increase occurs for a 100-year storm, where the flow rate will increase approximately 5 percent, from 37,000 cfs to 39,000 cfs.

I-4.15 As a result of the dams and the channelization necessary to introduce flows from the diversion channel to Skunk Creek, the floodplain along Skunk Creek from the diversion channel to New River will decrease from 550 acres to 510 acres. The flood plain of New River from Skunk Creek to the Agua Fria River (7.6 miles) will decrease from 2,910 acres to 2,060 acres. The floodplain of the Agua Fria River (10.1 miles) will decrease from 6,160 acres to 5,940 acres. The floodplain of Skunk Creek from Adobe Dam to the diversion channel (5.6 miles) and New River from New River Dam to Skunk Creek will be reduced substantially as a result of construction of the dams.

I-4.16 The recommended dams are designed to control runoff, up to the standard project flood, originating upstream of the dams. The Arizona Canal Diversion Channel is designed to provide 100-year protection from storms originating above the channel. The floodways along Cave Creek, Skunk Creek, Dreamy Draw Wash, New River and the Agua Fria River are designed to convey the 100-year flood.

I-4.17 The recommended project is independent of and compatible with the Granite Reef Aqueduct, a unit of the Central Arizona Project. The operation of existing irrigation canals, such as the Arizona Canal, will not be affected except during flooding, when the recommended project will intercept potentially damaging floodflows that would otherwise enter these canals and breach their levees.

I-4.18 The recommended project will have no significant impact on the total groundwater regimen in the project area. Within the project area there are four major sources of ground water recharge; seepage from canals and irrigated lands, percolation of surface stream flows, underflow along streams, and percolation of rainfall. Based on average annual runoff data for the drainages involved, the maximum percolation that can be expected from the storage and regulation of floodwaters is an insignificant part of the total recharge available to the regional ground water basin from all sources. The actual quantity of floodwater percolating to ground water aquifers will be affected by the infiltration rates, the duration of inundation, and the quality of storm runoff, which in turn will be affected by storm frequency and magnitude.

I-4.19 Along the 13 miles of the Arizona Canal Diversion Channel that will be concrete lined no recharge will occur. However, the route of the proposed diversion channel does not follow a natural water course and will contain water only during periods of storm runoff. Much of the area bordering the Arizona Canal is already impervious as a result of urbanization.

I-4.20 As a result of the construction of the dams, floodflows will be temporarily detained for later release at a controlled rate. While this will tend to increase ground water recharge potential by increasing the time that flows remain within the channels, there will be no significant effect on the total ground water regimen, as percolation of floodwater accounts for a very small part of the total recharge available. Riparian vegetation along the downstream channels may benefit from the increase in available moisture, however no substantial change in the vegetation along the downstream channels is expected. Temporary detention of floodflows will also increase water losses due to evaporation. The magnitude of these potential losses has not been determined.

I-4.21 The diversion of floodflows from Cave Creek to Skunk Creek will have no significant effect on the total volume of floodflows in the Gila River below the Agua Fria River.

I-4.22 The decrease in the peak flow rate along the Agua Fria (see paragraph I-4.14) in conjunction with an increase in percolation (see paragraph I-4.20) may affect the size of the floodplain along the Gila River. Until recently there was no accurate way of estimating the flow reaching the Gila River from the Agua Fria. Since water year 1968, a stream gage installed at Avondale has been measuring the contribution of the Agua Fria River to the Gila River. Although the record is too short to be statistically meaningful, the contribution of the Agua Fria River below Waddell Dam is estimated to be approximately 7 percent (ref. 36). Considering the relatively small contribution of the Agua Fria River, it is unlikely that the floodplain of the Gila River will be significantly reduced.

I-4.23 WATER QUALITY. The temporary impoundment and subsequent controlled release of flood waters by the proposed dams will have no significant effect on the water quality of the study area. Impounded flows will be discharged before salinity levels can be significantly increased by evaporation.

I-4.24 Construction of the Arizona Canal Diversion Channel will result in the introduction of urban runoff into streams that presently drain sparsely developed areas. No information is available on the quality of the urban runoff that will be collected, but it is expected that the quality of surface flows along Skunk Creek and the New and Agua Fria Rivers will be degraded to some degree. The quantity of runoff that will be percolated to ground water will not be sufficient to affect the quality of the regional ground water basin.

I-4.25 Possible localized effects on water quality due to recreational development are discussed in subsequent sections of this report.

I-4.26 AIR QUALITY. The recreation facilities that will be provided by the recommended plan are indirect sources of air pollution. The facilities themselves will not pollute, but will attract vehicles that emit pollutants. The projected number of parking spaces, average number of vehicles attracted to the facilities each day, and the size and projected volume of traffic added to existing and proposed access roads are below the threshold size set by the Environmental Protection Agency for required air quality studies as outlined in the following regulations:

a. Clarification of Management of Parking Supply, August 22, 1974.

b. Indirect Source Review Regulation, February 26, 1974 (delayed to July 1, 1975).

c. Transportation Control Plan for Phoenix and Tucson, December 3, 1973.

I-4.27 The project will have a negligible effect on population growth of the region and therefore will not conflict with the State Air Implementation Plan.

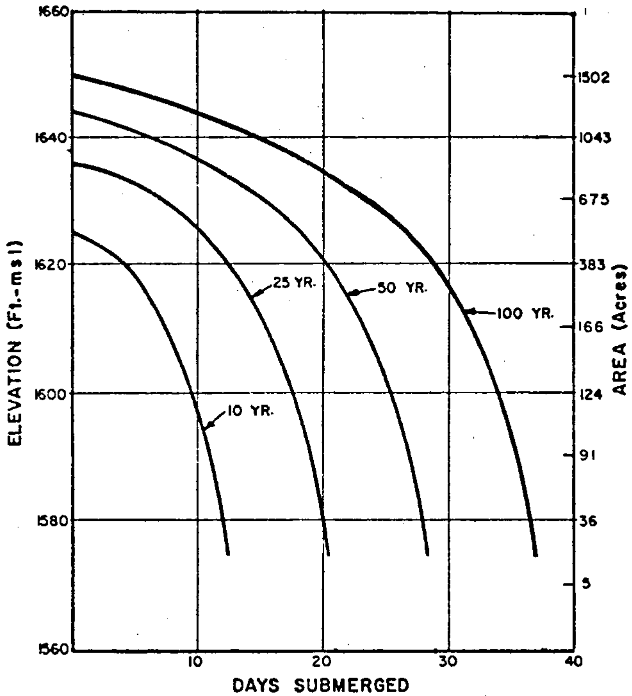
I-4.28 VEGETATION AND WILDLIFE. The quantifications and quality appraisals of biotic communities within the Phoenix project area are based upon field observations made in August and November 1973 and January, March, and September 1974 by Corps of Engineers biologists; data given in a report prepared for the Corps of Engineers by the University of Arizona (ref. 34) in October 1972; and studies of aerial photographs covering the proposed project area. It should be pointed out that the estimated acreage values and quality of natural vegetative communities for the proposed project area are continually changing (lowering) because of man-made habitat modifications and developmental encroachments. This section provides sum total estimates of acreages of vegetation and wildlife habitat impacted by the proposed project. Project feature sections should be consulted for specific acreage estimates of habitat losses and project effects.

I-4.29 The proposed project will permanently remove an estimated 1,100 acres of existing biotic communities, including about 410 acres of riparian habitat. An estimated 640 acres of this total are borrow areas that will recover some wildlife habitat value through landscaping and reestablishment of vegetation, although the new plant community structure may not approximate the existing natural communities.

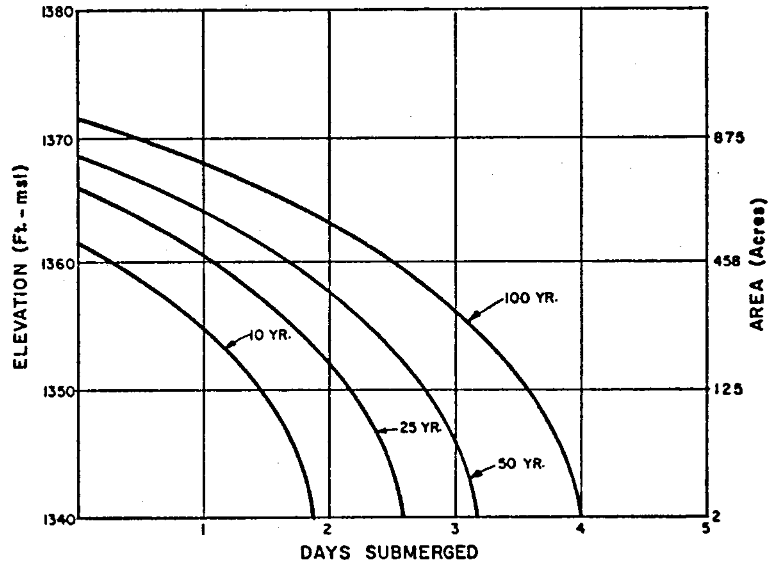
I-4.30 About 460 acres will be affected by dam construction and other structural features. Project construction will result in the removal of important wildlife habitat species such as ironwood, mesquite, catclaw acacia, palo verde, desert willow, cactus, and forbs and grasses. The principal wildlife species that will be impacted by the project include snakes, lizards, small desert rodents (kangaroo rats and gophers), cottontail rabbits, jackrabbits, gray fox, coyotes, doves, quail, raptors and various song birds.

I-4.31 An estimated 4,630 acres of vegetation and wildlife habitat within the proposed reservoir areas may be impacted during a standard project flood. Prolonged inundation (over 14 days) of the habitats within the flood overflow areas probably would kill or severely damage many riparian and outwash trees and shrubs such as ironwood, mesquite, palo verde, desert willow and creosotebush. The duration of inundation of the acreage behind the dams is presented on the following page. Many small rodents and reptiles would be killed by the flooding and larger animals would be displaced to habitats already supporting wildlife populations. The displaced animals might be lost to predators or through a debilitative cause such as stress.

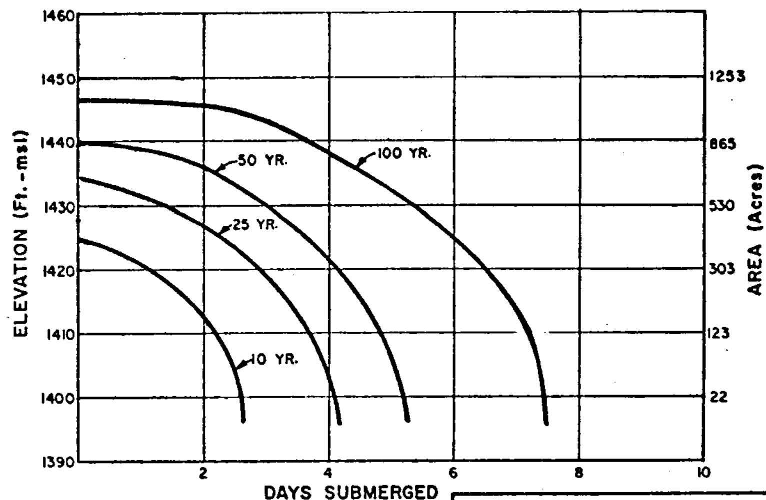
I-4.32 Construction of Adobe and New River Dams will significantly decrease floodflows along Skunk Creek and New River above the Arizona Canal Diversion Channel. This will cause a decrease in total vegetative cover and vigor along the affected reaches.



CAVE BUTTES DAM



ADOBE DAM



NEW RIVER

CAVE BUTTES DAM
AREA AND DURATION OF INUNDATION
FOR FOUR FREQUENCY FLOODS

ADOBE DAM – NEW RIVER DAM
AREA AND DURATION OF INUNDATION
FOR FOUR FREQUENCY FLOODS

I-4.33 The diversion of floodwaters from Cave Creek to Skunk Creek will prevent floodwaters from reaching portions of the Salt River and the Gila River between the Salt and Agua Fria Rivers. Vegetation along the Salt River is already impoverished as a result of extensive sand and gravel mining, in conjunction with a lack of constant water supply. No significant change in vegetation is expected along the Salt River. The University of Arizona, under contract to the Corps of Engineers, compiled environmental information on the Gila River from the Salt River to Gillespie Dam (ref. 36). As part of this report, potential impacts due to increased or decrease flow were postulated. The most significant effects would occur when flows were substantially decreased. A lowering of the water table would be expected, resulting in a loss of vegetation in and along the river channel. The associated increase in salinity would adversely impact both native vegetation and agriculture. The distribution of existing riparian plant species will further shift toward salt-tolerant species, such as salt cedar and salt bush. Flows along the Gila River are not expected to decrease substantially as a result of the project.

I-4.34 WILDLIFE HABITAT MITIGATION. The U.S. Fish and Wildlife Service and the Arizona Game and Fish Department evaluated the effects of the construction of the proposed project on fish and wildlife habitat values. In a letter dated 20 January 1976, the U.S. Fish and Wildlife Service stated that the project construction will result in the direct loss of 1,600 acres of wildlife habitat, of which about 400 acres is good quality desert wash (riparian) habitat. The two agencies indicated the acquisition of additional lands as the only feasible means of providing partial conpensation for the habitat that will be destroyed by the project. The Arizona Game and Fish Department will operate and maintain the mitigation lands.

I-4.35 Three alternative mitigation proposals were considered. The original proposal consisted of the acquisition of a 400 acre parcel at the confluence of the Agua Fria and Gila Rivers. Preservation of the New River Dam detention basin as a wildlife area was also considered. As a result of problems encountered with these proposals, a third alternative was formulated. This proposal involves the acquisition of about 413 acres of land on the Gila River southwest of Buckeye, Arizona, to provide mitigation for both the proposed project and for wildlife losses associated with the Indian Bend Wash project. A letter from the Flood Control District of Maricopa County dated January 14, 1976 confirmed that the acquisition procedures have been initiated.

I-4.36 ARCHEOLOGICAL AND HISTORICAL RESOURCES. Construction of the three dams in the recommended plan will result in alteration or destruction of all or part of three archeological districts that have been nominated for inclusion in the National Register of Historical Places (Cave Creek, Skunk Creek and New River Archeological Districts). See plate 10.

I-4.37 The Corps of Engineers requested a consultation with the Advisory Council on Historic Preservation and prepared a preliminary case report as required under Section 106 of the National Historic Preservation Act of 1966. A meeting was held on October 2 and 3, 1975 at which all concerned agencies were present. An onsite inspection was conducted, and appropriate mitigation measures were discussed, preliminary to executing a Memorandum of Agreement. This agreement will be between the District Engineer, the Advisory Council on Historic Preservation and the State Historic Preservation Officer. Pending execution of the Memorandum of Agreement, the Corps of Engineers will take no action that will affect archeological or historical resources.

I-4.38 POPULATION. The construction of the recommended project will have a negligible effect on population growth in the region. None of the land provided flood protection by the project is expected to immediately change to urban land uses. The recreational facilities to be constructed as part of the project are not of the type that will cause escalation of private development plans.

I-4.39 LAND USE. With the exception of Adobe Dam and portions of the Arizona Canal, the recommended plan conforms to the objectives and specific terms of existing and proposed Federal, State and local land use plans. Portions of the recommended Adobe Dam and Arizona Canal Diversion Channel conflict with the specific terms of several county and local land use plans, but these project features conform to the objectives of the plans by providing flood protection to land designated for urban land uses.

I-4.40 Construction of the recommended plan will permanently commit approximately 6,512 acres of land to flood control. An estimated 340 acres required for the dam embankments, dikes and levees will be lost to all other uses. The 229 acres required for the concrete-lined channel rights-of-way will become open space, unavailable for any other uses. The remaining 436 acres of earth-bottom channel rights-of-way and 4,630 acres of land behind the three recommended dams will remain as open space and will be available for development of wildlife and recreational facilities. The 8,510 acres designated as floodway or purchased as flowage easements will be subject to the provisions of the Federal Flood Disaster Act of 1973 and the Arizona State Preventive Flood Control Law and will thereby be protected from unrestricted urban development.

I-4.41 The construction of the recommended Adobe Dam will protect 865 acres of Skunk Creek floodway from flood damage; however demand for urban development of this acreage is not projected until 2006. This land will continue to be used for agricultural purposes. The construction of the recommended New River Dam will also release floodway acreage for other uses; because of the remote location of the acreage, no impact on land use is expected to occur.

I-4.42 TRANSPORTATION. The project will have an impact on the transportation network in the study area. The construction of Adobe Dam will result in the termination of Deer Valley Drive west of 35th Avenue. North of Deer Valley Drive, 35th Avenue will be ramped over the dam embankment. This will be an inconvenience to people living above the damsite during construction, adding approximately 4 miles per round trip to work, school and shopping facilities. At Cave Buttes Dam, an estimated 2,000 to 3,000 drivers per day will suffer temporary increased traffic congestion and inconvenience while Cave Creek Road is being constructed over Dike No. 2. This increased congestion will last until alteration of the road is complete. The dam embankments, dikes and levees will also present a barrier to informal human movement.

I-4.43 As part of the recommended plan, a total of 45 bridges will be constructed; of these, 26 bridges will be constructed in conjunction with the Arizona Canal Diversion Channel, and local interests will replace 19 existing dip crossings with all-weather bridges. The completion of the bridges replacing dip crossings will have a significant beneficial effect on transportation, allowing continued use of these thoroughfares during periods of flooding. However, in the interim between completion of the dams and completion of the bridges, there will be a significant disruptive impact on the flow of traffic. As a result of sustained controlled release from the dams, dip crossings that were impassible for a day or two during flooding will become impassable for many days or weeks. For example, releases from Cave Buttes for a 100-year frequency flood will continue for 37 days. Releases for a 10-year frequency flood will last 12 days. At Adobe Dam and New River Dam releases for a 10-year frequency flood will continue for approximately 2 and 3 days, respectively. Along Cave Creek, bridges downstream from Bell Road are planned for construction before construction of the proposed project. It is probable, but not certain, that other bridge construction will keep pace with the construction of the dams and that bridges for the most widely-used crossings will be built first, minimizing the adverse impact. Along the Arizona Canal Diversion Channel, bridge construction will cause traffic congestion problems, but alternate route are available.

I-4.44 Black Canyon Highway (Interstate 17) will require a bridge modification as part of the construction of Adobe Dam. Two alternate bridges, currently in existence and being used as frontage roads, will probably be used for rerouting traffic during this period. Current traffic along this highway is estimated at 10,400 vehicles on an average weekday. Bridge modifications along the Black Canyon Highway will also be required when the Arizona Canal Diversion Channel is constructed. Traffic will be rerouted along the frontage roads. This is expected to cause major traffic congestion, especially during rush hours.

I-4.45 The trails and bikepaths that will be developed in connection with the project, particularly along the diversion channel project feature, will supplement the existing transportation system by providing local alternatives for walking or cycling to schools, jobs, stores, etc.

I-4.46 ECONOMICS. The proposed project will have a significant beneficial impact on the economy of the study region by reducing flood damages. Resources required to repair and replace property damage that is expected to occur without the project will be released to be invested in productive economic pursuits. The project will provide additional recreational facilities to supplement existing facilities. Adverse effects on the regional economy will result from the cost of local interests' participation in land acquisition, relocations construction, maintenance, and development of recreational facilities.

I-4.47 In the 10- to 15-year period that will be necessary to complete construction of the project, an estimated 200 to 300 workers per year will be employed. In 1974, employment levels for contract construction were significantly below those of the previous year. If this situation continues, construction of the project will be immediately beneficial to the employment and income situation in Maricopa County. Additional employment will be generated from the need to operate and maintain the facilities that will be constructed.

I-4.48 SOCIAL. The construction of the recommended project will have significant impacts on the social environment of the region. An adverse effect will result from the need to relocate both homes and businesses. A total of 288 family dwellings will be affected; 263 of these dwellings are located along the proposed Arizona Canal Diversion Channel. Construction of the diversion channel will also require the relocation of 38 businesses, 33 apartment buildings, 1 church, the parking area for a public swimming pool, and portions of the grounds of two schools. Relocation of some utilities will also be required. Relocations resulting from construction of each project feature are discussed in detail in the project feature sections of this report.

I-4.49 Individuals involved in relocations will be compensated according to the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970. Nonetheless, the life styles of individual families will be altered by the effects typical of any relocation of residence. Relocated businesses will be disrupted and will suffer temporary and possibly permanent loss of clientele. Pending actual acquisition of the properties, property values may be adversely affected by the threat of acquisition. It may become difficult for property owners to sell their property prior to its actual acquisition for flood control purposes. It is important to recognize that nearly all of the disrupted homes and businesses are flood-prone under existing conditions. The project will enable property owners to relocate in areas that are not flood-prone.

I-4.50 The replacement of 19 dip crossings with all-weather bridges will improve the transportation network; during flooding this will increase community cohesion. However, if construction of a dam precedes construction of the associated bridges, cohesion will suffer as a result of proposed dam release schedules that will keep existing dip crossings impassable for varying periods of time, depending on the size of the storm and volume of release. Vehicular access to medical and educational facilities will not be affected. Bridges already planned for construction along Cave Creek will minimize the adverse impacts on those residents along Cave Creek who do not have access to vehicular transportation.

I-4.51 The construction of the Arizona Canal Diversion Channel will have a disruptive effect on the community. It will intensify the existing physical and social separation between communities bordering the north and south sides of the Arizona Canal.

I-4.52 The construction of Adobe Dam will have a disruptive effect on the surrounding area by physically separating the residents and restricting formal and informal movement. Initially, some residents and businessmen may be hesitant to live or work immediately below a dam; however, the proximity to the recreational facilities that will be provided behind the dam, coupled with the fact that no water will be permanently impounded, may reduce public concern.

I-4.53 Further temporary disruptions to community life will occur as a result of construction activities. Traffic congestion will increase due to heavy construction vehicles using the roads. Necessary utility relocations may cause inconvenience, but no services will be stopped. Sunnyslope High School will be affected by the project; part of the playing field will be closed 3 to 4 months during construction of the Arizona Canal Diversion Channel. Herberger Park No. 1, which will be removed by construction of the diversion channel, will be replaced when the channel is in place. In spite of localized adverse effects, the health, safety and morale of the community at large will be improved by the construction because the threat of flooding, flood damages, and the resulting disruptions of community life will be reduced.

I-4.54 RECREATION. The construction of the recommended plan will have a significant impact on the available recreational facilities in the project area. According to the Arizona Outdoor Recreation Coordinating Commission, there is a deficiency in recreational facilities in the project area, especially picnicking and camping facilities and equestrian, hiking and bicycle trails. Considering the past rapid population growth in the Phoenix metropolitan area, and projections for continued growth, the region will be increasingly deficient in outdoor recreational facilities. Project recreational facilities, together with associated facilities planned by the City of Phoenix and Maricopa County, will help meet the growing demand for recreation. A detailed description of the recreational facilities proposed for each feature of the recommended plan is given in Sections II thru VI of this report.

I-4.55 The proposed recreation facilities will replace some of the informal activities, including riding, hiking and hunting, presently taking place at the damsites. Some of these activities involve trespass. The recreational facilities were designed to include as many of these informal activities as possible. Hunting – a popular activity within the project area – will not be permitted in developed recreation areas. New River damsite is used more extensively for hunting than the other damsites because of the remote location. No recreational facilities are planned for the New River site; present informal activities will not be affected. Construction of the proposed recreational facilities will have no adverse impact on the use of existing public or private facilities. The use of some facilities and trail systems may increase.

I-4.56 Construction of the Arizona Canal Diversion Channel will disrupt approximately 7 miles of trail scheduled for construction in 1976. A new trail will be provided as part of the construction of the proposed diversion channel.

I-4.57 As urban expansion continues, the damsites, floodways, and flowage easements will become increasingly important as areas of permanent open space.

I-4.58 ESTHETICS. The recommended project will have an impact on the esthetic quality in the project area. The sites for Cave Buttes Dam and New River Dam are remote, and construction of these dams will cause less readily-visible esthetic impairment than will the construction of Adobe Dam, which will be located in an urban area.

I-4.59 The recommended Adobe Dam will be unavoidably visible to people living and working in the area. The dam may initially be visible to persons traveling north on Black Canyon Highway. However, continued commercial development along the highway, coupled with landscaping of the highway median, will eventually eliminate any view of the dam.

I-4.60 In an attempt to reduce the visual prominence of Adobe Dam, the main embankment will be mounded and contoured to better blend with existing landforms, and will be faced with native materials. The proposed embankments, dikes, and levees will be planted with native grasses and shrubs. After the project features are completed, the borrow areas will be reshaped and reseeded to restore them as nearly as possible to a natural-looking condition. Some borrow areas will remain readily visible for a long period after construction even with revegetation programs. These areas will have reduced habitat and esthetic values and will be more susceptible to erosion than surrounding desert areas. These adverse impacts will only be partially mitigated by the initial reshaping and replanting procedures.

I-4.61 Because the topography is relatively flat, the recommended channels will not be visible unless the viewer is crossing the channels or observing them from heights. Landscaping in the channel rights-of-way will screen the channels in most areas. Along the 13 miles of concrete-lined channel, a 5- to 10-foot-wide strip of rights-of-way will be landscaped with trees, shrubs, and ground covers. The majority of the plants will be native or arid-region varieties for compatibility with the natural environment and wildlife habitat. The use of native plants will also reduce maintenance costs. The 4.4 miles of earth-bottom channel included in the recommended plan will be designed as a greenbelt area and will be extensively landscaped for recreation.

I-4.62 CONSTRUCTION-RELATED TEMPORARY IMPACTS. Some temporary impacts will result from construction activities. These are discussed in the following subparagraphs.

a. Air Pollution. Temporary air pollution, in the form of increased particulates such as dust, will occur as a result of construction activities. This impact will be minimized by requiring the contractor to maintain all excavation areas, stockpiles, haul roads, waste areas, and borrow areas free from dust that would be a hazard or nuisance to others. Methods of stabilization include sprinkling, chemical treatment, light bituminous treatment, or similar methods.

b. Erosion. During the construction period disturbed areas, especially borrow areas, will be subject to increased wind and water erosion. After construction, disturbed areas will be replanted with native vegetation to lessen these effects.

c. Noise. Temporary noise pollution will occur during construction. Large earthmoving equipment produces a high level of noise. The noise associated with heavy construction operation is highly objectionable in confined areas or near developed areas. Blasting may also be required at the damsites. Utilization of equipment on a round-the-clock basis is not uncommon in the construction industry. The greatest increase in noise over ambient noise levels will occur during the nighttime. Wildlife may be stressed and displaced by the noise.

d. Lighting. Supplemental lighting will be required to support any nighttime construction activities. The extent of lighting requirements are dependent on length of the workday, economic utilization of equipment, and the number of shifts necessary to meet the required contract deadlines. In addition, extreme desert heat may force the contractor to adjust working hours to provide for tolerable working conditions. Adequate security lighting will also be required in areas of materials storage, equipment service, office, and camps. Due to the remote nature of some of the construction areas, lighting will not affect populated areas at the damsites but could cause adverse effects in the urban areas along the recommended Arizona Canal Diversion Channel. The length of the workday can be restricted when the construction site is near a residential area. Wildlife displaced by the lighting and activity will return after the construction has been completed.

e. Storage of Materials. Delivery schedules for necessary materials, lead time, and remoteness of the construction area dictate the use of temporary storage for materials. Storage areas in close proximity to the construction area are desirable for economic handling and onsite distribution or utilization of the materials. Security and vandalism protection are needed for these areas. The storage areas will be located on the construction site.

f. Equipment Storage and Service Areas. Construction equipment will require a certain amount of periodic maintenance and repair. The contractor will generally establish equipment service areas near the construction site. The location will be controlled by access from existing roads and field conditions. The activities at these areas will be of such nature that oil, diesel fuel, grease, and solvents may be spilled on the ground. These and other waste products of the servicing operation will be disposed of in a manner to avoid water pollution in case of flash flood or runoff. Waste products will generally be collected and disposed of in an approved manner in accordance with current regulations. Waste products are usually retained in drums and sold to oil reclamation companies.

g. Increase in Surface Street Traffic. There will be an increase in traffic congestion near the construction site owing to the use of the streets by construction equipment and by construction workers traveling to the site. Detours around road relocations and bridge construction will cause increased traffic congestion along the detour route.

I-5. ANY PROBABLY ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

I-5.01 All or part of three archeological districts will be altered or destroyed. These districts have been nominated for inclusion in the National Register of Historic Places. Several archeological sites of lesser importance will also be altered or destroyed. Proposed mitigation studies will lessen the direct and indirect impact but will not completely eliminate the losses.

I-5.02 A total of 1,100 acres of existing biotic communities will be removed. Of this total, 410 acres are classified as riparian habitat.

I-5.03 Approximately 7.5 million cubic yards of material will be required for construction of the dams.

I-5.04 Much of the sediment transported by Cave Creek, Skunk Creek, and New River will be impounded by the dams; 13,350 acre-feet of sediments will be impounded during a 100-year period.

I-5.05 The project will require relocations including 288 homes, 38 businesses, 33 apartment buildings, and some existing utilities.

I-5.06 Visual impairment will occur with construction of the project. The three dams and structural channels will be obviously artificial structures that many persons will consider unattractive.

I-5.07 A permanent increase in surface traffic will occur on Cave Creek Road, Pinnacle Peak Road and other major streets offering access to the proposed recreational facilities.

I-6. ALTERNATIVES TO THE PROPOSED ACTION

I-6.01 Alternative 1 would involve no further Federal action. This alternative would maintain the status quo and is the baseline to which all other alternatives were compared in assessing impacts. Four alternatives which would accomplish the purpose of the project were considered as economically justified:

a. Alternative 2, a modification of the authorized plan would provide dams and channels.

b. Alternative 3 would provide one dam.

c. Alternative 4 would provide channels.

d. Alternative 5a is a modification of the recommended plan and would provide dams and channels.

I-6.02 In addition to the economically justified alternatives, two others were considered. One would provide a dam at Cave Buttes and a channel on Cave Creek from the Arizona Canal to the Salt River in lieu of the recommended Arizona Canal diversion channel. Under this plan, New River and Adobe Dams would not be built. The other alternative was proposed by the Arizona Water Commission. These two alternatives are not presently considered to be viable. All seven alternatives are discussed under subsequent subheadings.

Alternative 1 (No Further Federal Action)

I-6.03 DESCRIPTION OF ALTERNATIVE 1. In this alternative, no further flood control facilities would be constructed with Federal funds under the authority of the Flood Control Act of 1965 (Dreamy Draw Dam, a project feature, was completed in 1973). The existing Cave Creek Dam, which is considered unsafe, would not be removed under this alternative; no decision has been made as to what action would be taken. Management of the flood plains would be accomplished by local interests through implementation of the 1973 State of Arizona flood plain management law (House Bill 2010). This law is intended to preclude further development within a 100-year-floodway.

I-6.04 ENVIRONMENTAL EFFECTS OF ALTERNATIVE 1. Under this alternative, existing development within the 100-year-floodways would continue to be subject to flooding. Floods larger than the 100-year-flood would cause damage to both existing development and existing and future development outside of the floodway. Property losses from flood damage could be reimbursed to some extent by flood insurance, for which property owners would be eligible under the Flood Disaster Protection Act of 1973 (PL 93-234); however, the losses to property would still occur. Other problems associated with flooding would continue, such as disruption of communications, transportation, and utilities; loss of income; and threat to life and safety.

I-6.05 Archeological resources would remain potentially subject to loss from flood damage, vandalism, urban development and other subjective land uses.

I-6.06 Some of the rights-of-way required for the Adobe Dam and Cave Buttes Dam project features are not within the 100-year-floodway and are therefore subject to potential urban development (the rights-of-way required for New River Dam are not subject to potential urban development). The Corps of Engineers estimates that all of this acreage will become urbanized by the year 2026, and thus will not be available as open space and wildlife habitat.

I-6.07 REASON ALTERNATIVE 1 WAS REJECTED. Alternative 1 was rejected because it would not provide an adequate degree of flood protection. The Corps of Engineers estimates that the equivalent annual nonpreventable flood damages would amount to $17.9 million a year.

Alternative 2 (Dams and Channels)

I-6.08 DESCRIPTION OF ALTERNATIVE 2. Alternative 2 is a structural alternative designed to provide flood control along Cave Creek as well as along Skunk Creek and the New and Agua Fria Rivers. Features similar to those included in the recommended plan include Cave Buttes Dam, Adobe Dam, New River Dam, the Arizona Canal diversion channel and a floodway on the New River from New River Dam to the confluence of Skunk Creek. Alternative 2 differs from the recommended plan in the addition of Cave Creek diversion channel to divert the discharge from Cave Buttes Dam into Skunk Creek, a concrete trapezoidal channel on Skunk Creek from the end of the Cave Creek diversion channel to the New River, an earth bottom trapezoidal channel on the New River from the Skunk Creek confluence to the Agua Fria River, and an earth bottom trapezoidal channel on the Agua Fria River from the New River confluence to the Gila River (See pl. 15).

I-6.09 ENVIRONMENTAL EFFECTS OF ALTERNATIVE 2. The alternative would provide flood protection to existing and future development within the standard project flood overflow area (See pl. 6). The effects of the alternative on geology and soils, surface hydrology, water quality, air quality, archeological and historical resources and economics, and the magnitude of construction-related temporary impacts would be similar to those discussed in the recommended plan. Other environmental impacts include:

a. Topography and Drainage. Alternative 2 would cause significant changes in the existing topography of the study area. Permanent alterations would occur as a result of the construction of the three dams, two diversion channels, recreational facilities, earth and concrete-lined channels and related service and access roads. The alternative would modify 340 acres under the embankments and dikes, 440 acres under the 29 miles of concrete channels, and 1,496 acres under the 23 miles of earth channels. In total the alternative would alter, to some degree, 7,460 acres of desert landforms.

b. Natural Resources. The alternative would have an impact on the quantity of aggregate material available in the study area. Sand and gravel occur in recoverable quantities in the stream channels. As future urban construction continues in the study area, the availability of this resource will become increasingly important. The construction of the alternative would eliminate the availability of 340 acres of land under and behind the dam embankments. About 8.8 miles of stream channel would become unavailable to either existing or future mining operations. Construction of the dam embankments, dikes, and levees would require large amounts of earth, primarily sands, silts and gravels. The quantity of fill required is estimated at 7.5 million cubic yards. This material would be excavated from designated borrow sites located upstream and downstream from the proposed embankments, dikes and levees.

c. Subsurface Hydrology. Alternative 2 would have an impact on the existing ground water regimen by affecting both the surface area and quantity of rainfall runoff available for percolation. No ground water recharge would occur along the concrete-lined channel; 125 acres of natural stream bed would be unavailable for infiltration. However, as a result of the construction of the dams, floodflows would be temporarily detained for later release at a controlled rate; this would increase ground water recharge potential by increasing the time that flows remain within the earth bottom channels. The potential increase in recharge would not be sufficient to have a significant effect on the regional ground water table. Based on average annual runoff data for the drainages involved, the maximum percolation that could be expected from the storage and regulation of floodwaters would be an insignificant part of the total recharge available to the regional ground water basin from all sources. The actual quantity of water percolating to ground water aquifers would be affected by the infiltration rates, the duration of inundation, and the availability of storm runoff dictated by storm frequency and magnitude.

d. Water Quality. Alternative 2 will have no significant effect on water quality in the project area.

e. Vegetation and Wildlife. Alternative 2 would have a greater impact upon vegetation and wildlife than the recommended plan since Skunk Creek, New River and Agua Fria River would be channelized in addition to construction of the Arizona Canal Diversion Channel, Cave Creek diversion channel, and Adobe, Cave Buttes and New River Dams. An estimated 3,150 acres of existing biotic communities, including about 490 acres of disturbed and undisturbed riparian habitat, would be removed by this alternative. An estimated 1,500 acres of this total (borrow area and soft-bottomed channels) would recover some wildlife habitat value through revegetation. Some native vegetation would reestablish on the New River and Agua Fria River soft-bottom channels, although flooding and maintenance operations would limit regrowth. Along the concrete-lined channels, riparian growth not removed by project construction probably would be lost because of the significant reduction in ground water recharge along the channel. The extensive area of riparian habitat that would be destroyed by channelization would significantly affect wildlife populations, including many species of birds. Riparian vegetation along the Agua Fria River that lies within the Audubon Society's Christmas bird count area would be removed. Landscaping along the channels would provide some wildlife habitat benefits. An estimated 4,630 acres of vegetation and wildlife habitat within the proposed standard project flood overflow area, not directly affected by the alternative, may be impacted during a standard project flood. Also, an estimated 1,950 acres of this total would have habitat values affected by proposed recreational use of the terrestrial areas behind the dams. Construction of the three dams and channelization of the streams and rivers would cause a significant adverse impact on biological communities. Loss of riparian habitat is considered significantly adverse because this plant community has been dramatically eliminated or highly disturbed throughout the Phoenix project area. Losses of riparian vegetation at the proposed dam site and along the channels could be mitigated by the acquisition of good quality riparian habitat elsewhere in the project area.

f. Esthetics. Alternative 2 would have a significant impact on the esthetic quality of the project area. The esthetic impact of the three dams would be the same as discussed in the recommended plan, but Alternative 2 would provide for construction of 29 miles of concrete-lined trapezoidal and rectangular diversion channels and 23 miles of earth bottom trapezoidal channels. Because the topography is relatively flat, the channels would not be visible unless the viewer is crossing the channels or observing them from heights. Landscaping in the channel rights-of-way would screen the channels in most areas.

g. Land Use. Construction of Alternative 2 would commit 7,460 acres of land to flood control. The 340 acres required for the dam embankments, dikes and levees would be lost to all other uses. The 440 acres required for the concrete-lined channel would become open space, unavailable for any other uses. The 1,496 acres of earth bottom channel and acres of land behind the three recommended dams would remain as open space and would be available for development of land based recreational facilities. The construction of Alternative 2 would protect 865 acres of Skunk Creek floodway from flood damage. This land will develop to urban uses during the period 1987-2007. Floodway acreage would also be released along the New and Agua Fria Rivers for other uses. However, because most of this land is designated in the MAG Land Use Plan for open space and agricultural purposes, no impact on the land use would occur.

h. Population. Alternative 2 would have the same impact on population growth and distribution as the recommended plan. The alternative would, however, displace about 304 family dwellings, 38 businesses, and 33 apartment buildings consisting of 263 family dwellings, 38 businesses, and 33 apartment buildings along the Arizona Canal diversion channel, 3 family dwellings along Skunk Creek, 20 family dwellings along the New River, 5 family dwellings along the Agua Fria River, and 1 family dwelling along the Cave Creek diversion channel. The Adobe Dam would displace 9 family dwellings and a feed lot. The Cave Buttes Dam would displace 3 family dwellings. New River Dam would not displace any dwellings or businesses.

i. Transportation. Alternative 2 would affect the transportation network of the study area. The impact of the construction of the 3 dams would be the same as described in the recommended plan, with the exception that Deer Valley Drive west of 35th Ave. would not be closed. The alternative would require the construction by local interests of 51 all-weather bridges over the channels. The completion of the bridges would have a significant beneficial effect on transportation, allowing continued use of these thoroughfares during periods of flooding.

j. Social. Alternative 2 would add two unnatural diversion channels to the project area. The effect of the Arizona Canal diversion channel would be the same as discussed in the recommended plan. The Cave Creek diversion channel would have a minor disruptive effect on the neighboring communities because of its remote location and the relatively low density urban development now present in the study area.

k. Recreation. Alternative 2 would have a significant impact on the available recreational facilities in the project area. The recreational facilities provided with the dams would be the same as discussed in the recommended plan. The alternative would also provide an opportunity for recreational use at the facilities along all the channels.

I-6.10 REASONS ALTERNATIVE 2 WAS REJECTED. Although Alternative 2 would provide a similar degree of flood protection to that provided by the recommended plan, the cost of alternative 2 exceeds the cost of the recommended plan by $33.6 million. The economic benefit-cost ratio of Alternative 2 is 1.8 to 1, compared to an economic benefit-cost ratio of 2.1 to 1 for the recommended plan. Additional considerations were that 60 acres of riparian habitat along Skunk Creek, and the New and Agua Fria Rivers would be significantly altered by channelization. This area is within the Audubon Society's Christmas Bird Count Area (pl. 9) and the local chapter of the Society has expressed opposition to any type of channelization.

Alternative 3 (Cave Buttes Dam only)

I-6.11 DESCRIPTION OF ALTERNATIVE 3. Under this alternative only Cave Buttes Dam (in addition to Dreamy Draw Dam) and a storm drain extending from the Arizona Canal to the Salt River would be constructed (see pl. 16). Elements of the alternative are discussed in the following subparagraphs.

a. Cave Buttes Dam, with three dikes, would be located about 0.7 mile downstream of the existing Cave Creek Dam. The main embankment would be a compacted earthfill structure with a maximum height of about 110 feet above streambed and a crest length of about 2,280 feet. The outlet works would consist of an approach channel, an intake structure, a concrete conduit and a stilling basin. The outlet conduit would be 3.75 feet in diameter, capable of releasing up to 500 cfs with the pool at the spillway crest.

b. That part of Cave Creek extending from Cave Buttes Dam to the Arizona Canal has an existing capacity greater than the 500 cfs discharge from Cave Buttes Dam. To assure long term capability to operate Cave Buttes Dam as designed, local interests would be required to regulate development within the flood plain.

c. The Arizona Canal has the capacity to intercept the 500 cfs discharge when empty and fully operational. However, such a situation is not assured, and during a major flood the canal would probably be inoperable for one to several days during which time flooding from the dam discharge could not be accommodated, resulting in damages downstream of the canal. To eliminate flooding south of the canal as a result of project operations, a 7.5- to 8.5-foot diameter reinforced-concrete pipe storm drain with a 500 cfs capacity would be constructed from the Arizona Canal to the Salt River along 19th Avenue. Inverted siphons would be required at the Arizona and Grand Canals.

I-6.12 ENVIRONMENTAL EFFECTS OF ALTERNATIVE 3. Alternative 3 would provide flood protection to existing and future development within the standard project flood overflow area along Cave Creek only (see pl. 6). The other direct effects of the alternative are described in the following subparagraphs.

a. Topography. Alternative 3 would cause significant changes in the existing topography of the study area. Permanent alterations would occur as a result of the construction of 76 acres of embankments and dikes. The concrete-pipe storm drain that would carry Cave Creek flows underground downstream of Arizona Canal would have no permanent effect on topography.

b. Geology and Soils. The downstream transport of sediments (sand, silts, gravels, etc.) from upstream sources would be stopped by Cave Buttes Dam. An estimated 5,700 acre-feet of sediment would be trapped by the dam during its 100-year project life. Because the existing Cave Creek Dam presently stops this sediment, the alternative would have no impact downstream of the dam.

c. Natural Resources. Alternative 3 would eliminate the availability of 76 acres of potential sand and gravel resources under the Cave Buttes Dam. Construction of the dam embankment and dikes would require large amounts of earth, primarily sands, silts, and gravels. The quantity of fill required is estimated at 3.5 million cubic yards. This material will be excavated from designated borrow sites located upstream and downstream from the damsite.

d. Surface Hydrology. The surface hydrology in the study area would be modified by the alternative. The dam would affect the volume, velocity, duration and course of surface flows in a manner similar to the existing Cave Creek Dam. As with Cave Creek Dam, the peak floodflows and velocities would be reduced, while the duration of the flows would increase. The concrete-pipe storm drain from the Arizona Canal to the Salt River would safely convey Cave Creek flows underground to the Salt River.

e. Subsurface Hydrology. The alternative would have an insignificant impact on the groundwater regime of the study area. As with the Cave Creek Dam, the floodflows would be temporarily detained and released at a controlled rate of less than 500 cfs.

f. Water Quality. Alternative 3 will have no significant effect on the water quality in the area.

g. Air.Quality. The impacts on air quality would be similar to those discussed for the recommended plan, but lesser in magnitude because of the reduced recreational facilities that would be provided.

h. Vegetation and Wildlife. Alternative 3 would remove an estimated 770 acres of desert biotic communities, including about 110 acres of riparian habitat. An estimated 340 acres of desert wash and outwash habitats removed in borrow areas would be landscaped and would revegetate following construction activities, recovering some wildlife habitat value. The dikes would revegetate providing some wildlife potential especially for small rodents, reptiles and birds. However, these areas would be subject to periodic maintenance activities which would limit plant development to small herbaceous forbs and grasses. Compensation for the removal of riparian habitat would be provided because of the importance of this habitat for wildlife locally. To mitigate the loss of riparian habitat, similar habitat of comparable acreage and quality would be acquired at another site. Alternative 3 would have the indirect impact of exposing an additional 1,860 acres of biotic communities within the standard project flood overflow area to the effects of inundation and sedimentation. Prolonged inundation (14-30 days) and/or heavy sedimentation behind the dam would probably kill riparian and outwash trees and shrubs. The areas subject to flood overflow would be expected to develop disturbed desert wash or outwash communities. The dam would partially impede local wildlife movements. Some landscaping would be provided to enhance the esthetics and suitability of the area for recreational users. Some wildlife habitat benefits may accrue from the landscaping. No endangered wildlife species or vegetation would be jeopardized by construction of Cave Buttes Dam.

i. Archeological and Historical Resources. Alternative 3 would alter or destroy all or part of the Cave Creek Archeological District that has been nominated for inclusion in the National Register of Historic Places.

j. Esthetics. Alternative 3 would have an impact on the esthetic quality of the project area. The remoteness of the damsite and the sculpturing and landscaping of the embankment, related structures, and borrow areas would minimize the visual impact of the alternative. The construction of the concrete-pipe storm drain would create a temporary visual impact on the surrounding communities along 19th Avenue.

k. Land Use. Construction of Alternative 3 would commit 3,060 acres of land to flood control. The 76 acres required for the dam embankment and dikes would be lost to all other uses. The 1,860 acres in the reservoir would be available for open space and recreation uses. About 1,200 acres would be developed for recreation along Cave Creek.

l. Population. Alternative 3 would have a negligible effect on the population growth of the region. The alternative would displace three families at the Cave Buttes damsite.

m. Transportation. Construction of Cave Buttes Dam would cause an estimated 2,000 to 3,000 drivers per day to suffer increased traffic congestion and inconvenience while Cave Creek Road is being constructed over Dike No. 2. This increased congestion would last until alteration of the road was complete. The dam embankment and dikes would represent a barrier to informal human movement. The recreation facilities would increase the vehicle use on the surface streets in the vicinity of the dam. The placement of the concrete-pipe storm drain to the Salt River would disrupt traffic on 19th Avenue during construction.

n. Economics. The alternative would have an impact on economics similar to that discussed for the recommended plan.

o. Social. Alternative 3 would displace 3 families at the Cave Buttes damsite. The placement of the concrete-pipe storm drain under 19th Avenue would cause severe but temporary impacts on the communities bordering 19th Avenue. Numerous utility relocations would cause temporary interruptions in service. Transportation and community cohesion would be temporarily disrupted.

p. Recreation. Alternative 3 would have a significant impact on available recreation facilities in the project area. Recreational facilities would include camping and picnicking facilities, riding, hiking and bicycle trails, and nature study areas. A regional park would be developed along Cave Creek.

q. Construction-related Temporary Impacts. The temporary impacts would be similar to those discussed for the recommended plan.

I-6.13 REASON FOR REJECTION. Alternative 3 was rejected because it would not provide adequate flood protection. Residual damages would amount to $13.1 million annually. When comparing the additional cost of the recommended plan with this alternative, the additional benefits that would accrue to the recommended plan are more than justified. The economic benefit-cost ratio of Alternative 3 is 2.4 to 1, compared to an economic benefit-cost ratio of 2.1 to 1 for the recommended plan.

Alternative 4 (Channels only)

I-6.14 DESCRIPTION OF ALTERNATIVE 4. Under this alternative no dams would be constructed. The major features of this alternative are (a) Cave Creek Diversion Channel, a concrete-lined channel extending from an inlet, about 2 miles downstream of the existing Cave Creek Dam, along Beardsley Road to Skunk Creek; (b) Skunk Creek channel, a concrete-lined channel extending from an inlet north of Beardsley Road to New River; (d) New River channel, an earth bottom channel extending from the Skunk Creek confluence to the Agua Fria River; (e) Agua Fria River channel extending from the New River confluence to the Gila River; (f) Arizona Canal Diversion Channel, a rectangular concrete channel extending from 40th Street to Cave Creek, a trapezoidal concrete-lined channel extending from Cave Creek to Cactus Road, and an unlined trapezoidal channel from Cactus Road to Skunk Creek.

I-6.15 Although this alternative would consist of the same channels as Alternative 2, the channels would be much larger to convey the greater peak discharges because of the lack of dams. Nearly the same degree of flood protection as Alternative 2 and the recommended plan would be provided.

I-6.16 ENVIRONMENTAL EFFECTS OF ALTERNATIVE 4. The alternative would provide flood protection to existing and future development within the standard project flood overflow area (See pl. 6). The effects of the alternative on the environment are discussed in the following subparagraphs.

a. Topography and Drainage. Alternative 4 would cause significant changes in the existing topography of the study area. Permanent alterations would occur as a result of the construction of 28 miles of concrete channel, 22 miles of earth bottom channel, and recreational facilities. In total, the project would alter to some degree 1,800 acres of desert landforms.

b. Geology and Soils. The downstream transport of sediments (sand, silts, gravels, etc.) from upstream sources would be carried downstream of the project by the channels. Little sediment deposition would occur in the channels.

c. Natural Resources. Alternative 4 would have an impact on the quantity of aggregate material available in the study area. Sand and gravel occur in recoverable quantities in the stream channels. As future urban construction continues in the study area, the availability of this resource will become increasingly important. The construction of the channels would make unavailable to either existing or future mining operations 7 miles of streambed.

d. Surface Hydrology. The surface hydrology in the study area would be modified. The channels would affect the volume, velocity, duration and course of surface flows through the project area.

e. Subsurface Hydrology. Alternative 4 would have an impact on the existing groundwater regime by affecting the surface area available for percolation. No groundwater recharge would occur in the reaches where concrete-lined channels would be constructed. In the 7 miles of concrete-lined channel, 165 acres of natural stream bed would be unavailable for infiltration.

f. Water Quality. Alternative 4 would have no significant impact on water quality.

g. Air Quality. Alternative 4 would have no significant impact on air quality.

h. Vegetation and Wildlife. Alternative 4 would have a greater impact upon vegetation and wildlife than the recommended plan since Skunk Creek, New River, and Agua Fria River would be channelized in addition to construction of the Arizona Canal Diversion Channel and Cave Creek Diversion Channel. The channels would require about 3,000 acres of rights-of-way. An estimated 1,800 acres of existing biotic communities, including about

50 acres of natural desert wash and riparian habitat, would be removed by the alternative. Most of the vegetation to be removed would be highly disturbed desert wash and outwash growth. Some native vegetation would reestablish on about 2,000 acres of New River and Agua Fria River soft-bottom channels, recovering some wildlife habitat values lost through channelization, although flooding and maintenance operations would limit regrowth. Along the concrete-lined channels, riparian growth not removed by project construction probably would be lost because of the significant reduction in groundwater recharge along the channel. The extensive area of riparian habitat that would be destroyed by channelization would significantly affect wildlife populations, including many species of birds. Riparian vegetation along the Agua Fria River that falls within the Audubon Society's Christmas Bird Count Area would be removed. Landscaping along the channels would provide some wildlife habitat benefits. Losses of riparian vegetation along the channels would be mitigated by the acquisition of good quality riparian habitat at the confluence of the Agua Fria River and Gila River. The concrete channels would be complete barriers to terrestrial wildlife movements and the soft-bottom channels would partially impede terrestrial wildlife movements.

i. Archeological and Historical Resources. Alternative 4 would have no impact on archeological or historical resources.

j. Esthetics. Alternative 4 would have an impact on the esthetic quality of the project area. The alternative would provide for the construction of 28 miles of concrete-lined channels and 22 miles of earth bottom channels. Because the topography is relatively flat the channels would not be obviously visible unless the viewer were crossing the channels or observing them from heights. The channels would be considerably larger than those described in the recommended plan. As in the recommended plan, landscaping in the channel rights-of-way would screen the channels in most areas.

k. Land Use. The construction of the channels would commit about 3,000 acres of land to flood control and open space land uses. Acreage would be released from the floodways for development; however, the MAG Land-Use Plan designates open space and agricultural uses for most of this land; therefore, the alternative would have only a minor impact on land use.

l. Population. Alternative 4 would have a negligible effect on the population growth of the region; however, it may have a significant impact on the distribution of population within the study area. Land protected from flooding would be released for future urban development. The alternative would displace about 371 family dwellings, 38 businesses, and 33 apartment buildings. These relocations would include one family dwelling along the Cave Creek Diversion Channel, three family dwellings along Skunk Creek, 94 family dwellings (plus seven trailers) along the New River, about 263 family dwellings, 38 businesses and 33 apartment buildings along the Arizona Canal Diversion Channel, and 10 dwellings along the Agua Fria River.

m. Transportation. Alternative 4 would have an impact on the transportation network of the project area. As part of the alternative plan, local interests would construct 50 all-weather bridges over the channels. The completion of the bridges would have a significant beneficial effect on transportation, allowing continued use of these thoroughfares during periods of flooding.

n. Economics. The impact of Alternative 4 on the economy of the study region would be similar to that discussed for the recommended plan.

o. Social. Alternative 4 would add several unnatural channels to the project area. The effect of the Arizona Canal Diversion Channel would be the same as discussed in the recommended plan. The Cave Creek Diversion Channel would have a minor disruptive effect on the neighboring communities because of its remote location and the relatively low density urban development now present in the study area. The replacement of dip crossings with all-weather bridges would improve the transportation network during flooding; this would increase community cohesion. The alternative would displace 371 homes, 33 apartment buildings and 38 businesses. Individuals involved in these relocations would be compensated, according to the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

p. Recreation. Alternative 4 would provide 49 miles of landscaped trails along the channel service roads. Trail systems along the Arizona Canal Diversion Channel would be particularly convenient to residents of Phoenix and Glendale and would provide free, close-by recreation. An existing bicycle trail would be destroyed, but would be replaced by the trails along the Arizona Canal Diversion Channel. The 4.4 miles of earth bottom channel west of Cactus Road along the Arizona Canal Diversion Channel would be designed as a greenbelt area and would be extensively landscaped for recreation.

q. Construction-related Temporary Impacts. Some temporary impacts would result from construction activities. These impacts would be similar to those discussed for the recommended plan.

I-6.17 REASON FOR REJECTION. Alternative 4 provides a similar degree of protection to that provided by the recommended plan, but the additional costs incurred in construction are not justified by additional benefits. The economic benefit-cost ratio of Alternative 4 is 1.3 to 1, compared to an economic benefit to cost ratio of 2.1 to 1 for the recommended plan. Additional considerations were that the Cave Creek, Skunk Creek, and New River and Agua Fria River channels would be considerably larger than the recommended plan. When comparing Alternative 4 with the recommended plan, this increase in width would require the relocation of an additional 67 homes and also alter an additional 60 acres of riparian habitat.

Alternative 5a (Dams and Channels)

I-6.18 DESCRIPTION OF ALTERNATIVE 5a. Alternative 5a would combine structural and nonstructural measures to provide flood protection to the urbanized areas of Phoenix along Cave Creek and south of the Arizona Canal while maintaining the natural floodway along Skunk Creek and the New and Agua Fria Rivers (pl. 18). The alternative is similar to the recommended plan (5b). Included in the plan would be Cave Buttes Dam, Adobe Dam, New River Dam, the Arizona Canal Diversion Channel, and flowage easements and floodways on Skunk Creek, New River and Agua Fria River. The major difference between the alternative and the recommended plan is the addition of the Cave Creek Diversion Channel to divert the discharge from Cave Buttes Dam directly to Skunk Creek. The addition of this diversion channel would require an additional 700 acres of flowage easement on Skunk Creek from the end of the diversion channel to the Arizona Canal Diversion Channel. The Arizona Canal Diversion Channel would be retained to control damaging floodflows from the Phoenix Mountains.

I-6.19 ENVIRONMENTAL EFFECTS OF ALTERNATIVE 5a. The alternative would provide flood protection to existing and future development within the standard project flood overflow area (see pl. 6). The effects of the alternative on geology and soils, natural resources, surface hydrology, water quality, air quality, vegetation and wildlife, wildlife mitigation, archeological and historical resources, economics and the magnitude of the construction-related temporary impacts would be the same as those described for the recommended plan. The alternative would also have the following impacts.

a. Topography and Drainage. Alternative 5a would cause significant changes in the existing topography of the study area. Permanent alterations would occur as a result of the construction of three dams, two diversion channels, and associated recreational facilities. The alternative would include 340 acres of embankments, dikes, and levees; 21.7 miles of concrete channel, 12.0 miles of earth bottom channel; and an undetermined amount of permanent maintenance and access roads. The acreage purchased as flowage easements would total 9,300 acres.

b. Subsurface Hydrology. Alternative 5a would have an insignificant impact on the existing ground water regimen. As a result of the construction of the dams, floodflows would be temporarily detained for later release at a controlled rate. This would increase ground water recharge potential by increasing the time that flows remain within the channels. However, the potential increase in recharge would not be sufficient to have a significant effect on regional ground water table. Based on average annual runoff data for the drainages involved, the maximum percolation that could be expected from the storage and regulation of floodwaters would be an insignificant part of the total recharge available to the regional ground water basin from all sources. The actual quantity of water percolating to ground water aquifers would be affected by the infiltration rates, the duration of inundation, and the availability of storm runoff dictated by storm frequency and magnitude.

c. Esthetics. Alternative 5a would have a significant impact on the esthetic quality of the project area. The esthetic impact of the three dams would be the same as discussed in the recommended plan. Alternative 5a would provide for construction of 21.7 miles of concrete-lined trapezoidal and rectangular diversion channels. Because the topography is relatively flat, the channels would not be visible unless the viewer is crossing the channels or observing them from heights. As in the recommended plan, landscaping in the channels rights-of-way would screen the channels in most areas. The 4.4 miles of earth bottom channel along the Arizona Canal Diversion Channel included in the alternative plan would be designed as a greenbelt area and would be extensively landscaped for recreation.

d. Land Use. Construction of Alternative 5a would commit 4,640 acres of land to flood control. The 340 acres required for the dam embankments, dikes and levees would be lost to all other uses. The 29 acres required for the concrete-lined channel would become open space, unavailable for any other uses. The 375.5 acres of earth bottom channel and 4,630 acres of land behind the three recommended dams would remain as open space and would be available for development of recreational facilities. The acres purchased as flowage easement and the acres designated as floodway would be subject to the provisions of the Federal Flood Disaster Act of 1973 and the Arizona State Preventive Flood Control Law and would thereby be protected from unrestricted urban development. The alternative would protect 865 acres of Skunk Creek floodway from flood damage, releasing it for development to urban uses. This land would continue to be used for agricultural purposes. The alternative would also release floodway acreage for other uses; however, because of the remote location of the acreage, no impact on the land use would be expected to occur.

e. Population. Alternative 5a would have the same impact on population growth and distribution as the recommended plan. The alternative would, however, displace about 290 family dwellings, 38 businesses, and 33 apartment buildings consisting of 263 family dwellings, 38 businesses, and 33 apartment buildings along the Arizona Canal Diversion Channel, 6 family dwellings along Skunk Creek, 8 family dwellings along the New and Agua Fria Rivers, and 1 family dwelling along the Cave Creek Diversion Channel. Adobe Dam would displace 9 family dwellings and a feed lot; 3 families would be displaced by Cave Buttes Dam. The New River Dam would not displace any family dwellings or businesses.

f. Transportation. Alternative 5a would affect the transportation network of the study area. The impact of the construction of the three dams would be the same as described in the recommended plan. The alternative would require the construction by local interests of 49 all-weather bridges over existing dip crossings and over the two diversion channels. The completion of the bridges would have a significant beneficial effect on transportation, allowing continued use of these thoroughfares during periods of flooding.

g. Social. Alternative 5a would add two unnatural diversion channels to the project area. The effect of the Arizona Canal diversion channel would be the same as discussed in the recommended plan. The Cave Creek Diversion Channel would have a minor disruptive effect on the neighboring communities because of its remote location and the relatively low density urban development now present in the study area.

h. Recreation. Alternative 5a would have a significant impact on the available recreational facilities in the project area. The recreational facilities provided with the dams would be the same as discussed in the recommended plan.

I-6.20 REASON FOR REJECTION. Although the alternative would provide an equivalent degree of flood protection to that which would be provided by the recommended plan, this protection would require an additional expenditure of $5.1 million. This increase in cost is due to the construction of the Cave Creek Diversion Channel. The economic benefit-cost ratio of Alternative 5a and the recommended plan is 2.1 to 1.

Other Alternatives

I-6.21 The two plans which were studied but not considered as reasonable alternatives are presented in the following paragraphs.

I-6.22 CAVE CREEK CHANNEL – ARIZONA CANAL TO SALT RIVER. This plan was considered as an alternative to the Arizona Canal Diversion Channel between Cave Creek and Skunk Creek. Floodwaters intercepted by the diversion channel east of Cave Creek and floodwaters from Cave Creek were combined for the design flow rate for the considered Cave Creek channel. From the Arizona Canal, it would extend south through downtown Phoenix and discharge into the Salt River.

I-6.23 Two types of channelization were considered – an open rectangular channel and a covered channel. The open channel would be alined adjacent to 19th Avenue. Approximately 180 acres of costly right-of-way would be required. The cost of this channel would be in excess of $210 million.

I-6.24 The covered channel was considered to reduce right-of-way costs by alining it under existing streets. The required section was too wide for a single street so it was analyzed as two conduits, one along 7th Avenue and one along 19th Avenue. Although the rights-of-way costs were reduced, the construction costs increased substantially, and the cost of this plan would be in excess of $330 million.

I-6.25 Although the features of these plans would intercept runoff generated north of the canal and convey it to the Salt River, they were not sized to intercept and convey residual flows generated south of the Arizona Canal. A third plan was considered which would provide capacity for local runoff south of the canal (50-year storm) in addition to providing capacity for Cave Creek and runoff north of the canal (100-year storm). In this plan the Arizona Canal Diversion Channel was eliminated and floodwaters were conveyed across the canal at four locations where canal siphons would be required. The total peak discharge increased from about 40,000 cfs at the Arizona Canal to about 63,000 cfs at the Salt River. The plan analyzed consisted of four covered sections which extended south along 19th Avenue, 7th Avenue, 16th Street, and 40th Street from the Arizona Canal to the Salt River.

I-6.26 In addition to the high cost (in excess of $650 million) several major problems were encountered. They are: (a) the requirement for some channelization north of and parallel to the Arizona Canal; (b) the need for the construction of a total of eight siphons where the four conduits crossed the Arizona and Grand Canals; (c) the extensive street sheet drainage system that would be required to convey flows to the conduits; (d) the depths at which the conduits must be constructed to maintain existing street grades; (e) the 10 miles of channelization that would be required along the Salt River to allow the conduits to drain; (f) utility relocations through downtown Phoenix, which would be extensive and very difficult to design because of the widths (20 to 30 feet) and depths (15 to 16 feet) of the conduits and the widths of the streets; and (g) the extensive social disruption that construction would cause in downtown and residential areas of Phoenix. Because of the problems encountered and the higher costs of these alternatives as compared to the diversion channel in combination with the New River and Adobe Dams, they were not considered further.

I-6.27 ARIZONA WATER COMMISSION PLAN. In April 1972, the Arizona Water Commission (AWC) proposed a plan that would combine proposed features of the Central Arizona Project (CAP) and the authorized flood control projects to (a) provide flood protection to the proposed Granite Reef Aqueduct while maintaining or increasing downstream flood control benefits, and (b) provide a means of conserving floodflows by introducing them into the Granite Reef Aqueduct for conveyance to the proposed Orme Reservoir. The primary features of the proposed CAP that are important in this proposal are the Granite Reef Aqueduct and the Paradise Valley detention dike, which extends from 32nd Street east along the aqueduct to the McDowell Mountains, while those important in the Corps of Engineer's flood control project are the four dams (Dreamy Draw, Cave Buttes, Adobe and New River) and the Arizona Canal Diversion Channel. Channelization of Cave Creek, Skunk Creek, New River and the Agua Fria River was eliminated as was the diversion of floodwaters along the Union Hills Drive (Union Hills Diversion Channel).

I-6.28 Because the aqueduct comes in very close proximity to the authorized Corps detention basins, the AWC suggested that its construction should present the opportunity for some revisions in the planned operations of Cave Buttes and Adobe detention basins. By careful control of the aqueduct, some of the flood releases from the detention basins could be allowed into the aqueduct. The proposed joint project would consist of the following major features:

a. A flood channel, upstream of the aqueduct, to divert flows from Cave Buttes Dam along the aqueduct, through the Paradise Valley detention dikes and into the Salt River about 5 miles downstream of the Granite Reef Dam. This 23-mile-long diversion would utilize the proposed detention dikes, with some modification, but would require construction of a 10-mile-long channel down to the Salt River. It would, however, eliminate the need for the Cave Creek Channel and the Union Hills Diversion Channel.

b. The detention basins authorized as a part of the flood control project.

c. A low-velocity diversion channel about 1 mile north of Union Hills Drive, extending from Skunk Creek across the New River and discharging into the Agua Fria River. The channel would intercept residual flows downstream of Adobe and New River Dams and divert them to the Agua Fria River. Outlets with the capacity of 500 cfs would be provided at Skunk Creek and New River.

d. The Arizona Canal Diversion Channel and western extension of the channel that would cross Skunk Creek and New River and discharge into the Agua Fria River. The western extension would convey the flows intercepted by the diversion channel east of Skunk Creek and the residual flows of Skunk Creek and New River into the Agua Fria River. Outlets with a capacity of 500 cfs would again be provided at Skunk Creek and New River.

e. Additional outlets capable of discharging floodflows from Adobe and Cave Buttes detention basins into the Granite Reef Aqueduct. Cave Buttes and Adobe Dams (authorized sites) would each be modified to have two outlets – a small capacity low level outlet (500 cfs) that would discharge into their respective streams and a larger capacity high level outlet (5,000 cfs at Cave Buttes Dam and 2,000 cfs at Adobe Dam) that would discharge into the Paradise Valley detention basin (Cave Buttes Dam) or the Granite Reef Aqueduct. If the Granite Reef Aqueduct did not have capacity available for the discharge from Adobe Dam, it would be diverted to the New River Dam by a wasteway.

I-6.29 The plan was analyzed and several modifications were made. The major one was a flowage easement requirement along the Agua Fria River downstream from the diversion channels. Initially, only a cost analysis was made. A cursory review of the benefits revealed that no significant increase in flood control benefits occurred with this plan over the authorized plan. Benefits attributable to water conservation were not calculated because the available capacity of the Granite Reef Aqueduct following a storm of such magnitude as to reach the high level outlets of the two dams was unknown.

I-6.30 After considerable engineering and economic studies were completed and cost estimates were prepared, the results were presented to representatives of the Arizona Water Commission, the U.S. Bureau of Reclamation and the Flood Control District of Maricopa County at a meeting on 30 March 1973. It was recommended at the meeting that the proposed plan be dropped and all participants agreed. Upon written confirmation from the Flood Control District and the U.S. Bureau of Reclamation, Mr. Wesley E. Steiner, Executive Director of the Arizona Water Commission requested by letter dated July 9, 1973 that this plan should not receive further consideration for the following reasons:

a. The estimated first cost of the proposed alternative is over $50 million greater than the authorized plan (July 1972 price levels).

b. The Paradise Valley detention basins would have to be modified to include gated outlets between each detention basin. The operation of the gates during a large flood would be difficult and undesirable.

c. The construction of Cave Buttes Dam and the Paradise Valley dikes would be delayed while new designs are prepared.

d. The "local cost" of the proposed plan is nearly $35 million greater than the authorized plan (July 1972 price levels).

I-6.31 Because this alternative plan was not considered to be a viable solution, no environmental analysis was made.

I-7. THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY.

I-7.01 The recommended flood control plan will reduce flood damage to existing urban developments. This protection will be afforded not only to existing populations but also to future populations. The recommended project will also provide recreation facilities that will be available to both existing and future populations. The recommended project will provide for the study and recovery of archeological resources.

I-7.02 The project will permanently alter 1,100 acres of wildlife habitat. In addition to flood protection afforded to existing urban areas, 865 acres of presently undeveloped flood plain will be protected and will have potential for future development.

I-8. ANY IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED.

I-8.01 The recommended plan would commit the land at Cave Buttes, Adobe, and New River reservoir areas (4,630 acres), the land along the Arizona Canal Diversion Channel (490 acres), and the land along the Skunk Creek, New and Agua Fria River flowage easements (8,510 acres) to flood control and associated purposes.

I-8.02 The project will result in the alteration or destruction of archeological resources within three archeological districts (Cave Creek, Skunk Creek, and New River Dams) which have been nominated to the National Register of Historic Places.

I-8.03 Construction of the dams and appurtenances will require approximately 7.3 million cubic yards of earth (silt, sand, gravel, and cobbles).

I-9. COORDINATION

I-9.01 PUBLIC PARTICIPATION. The first formal public involvement in the proposed New River and Phoenix City Streams project occurred on 30 October 1963 in Phoenix, Arizona, when Phase B of the plan that was subsequently authorized was presented at a public hearing. The Maricopa County Board of Supervisors later approved this phase of the plan. With passage of the Flood Control Act of 1965, Congress authorized detailed planning and construction of the project.

I-9.02 Concurrent with design studies and reexamination of project formulation, two formal meetings were held, one in April 1972 and one in April 1974. These meetings were held to provide information on the reevaluation and progress of the authorized plan, and to solicit ideas and alternative plans that should be considered in analyzing solutions to the flood control and associated problems. Both meetings were held in Phoenix. At the first post-authorization formal meeting in 1972 five basic alternatives were presented for public discussion:

a. no further action;

b. a combination of dams and channels, corresponding to the authorized plan;

c. dams only;

d. channels only; and

e. a combination of structural (dams and channels) and nonstructural (flood plain management) techniques.

The project was generally supported by the public, although there were controversial elements, including adverse impacts upon natural riparian habitat resulting from channelization of Skunk Creek, New River and Agua Fria River, and possible detrimental effects on wildlife habitat along the Gila River downstream from the proposed project area.

I-9.03 In the 2 years following the 1972 meeting, the Corps reevaluated the authorized plan and developed detailed design analyses. The Corps, in consultation with the local community, developed alternative proposals addressed to environmental issues. Numerous meetings and workshops were held, articles appeared in local newspapers, and local television programs featured the project. Concerned citizens, anxious for flood control in the area, contributed ideas and comments to aid in the formulation of alternative plans. Those agencies and interests with whom meetings were held, and their primary concerns, are discussed in the following paragraphs.

I-9.04 Replanting of natural vegetation in the areas to be affected by the project was urged by the U.S. Fish and Wildlife Service, the Arizona Commission of Agriculture and Horticulture, and the Arizona Conservation Council.

I-9.05 The archeological resources at the proposed damsites came under close scrutiny of the State Historic Preservation Officer, the Arizona Archeological Center of the National Park Service, and the Advisory Council on Historic Preservation. Coordination is continuing as mitigation discussions are being carried out.

I-9.06 Considerable discussion focused on the recreational aspects of the project. In September 1973 a Task Force committee, composed of representatives of Federal, State, and local agencies, was established to determine the best recreational plan. The members of the Recreation Task Force advocated development of water-based recreation at Adobe and Cave Buttes damsites. Initially, several agencies favored preservation of the New River site for wildlife habitat, but in June 1974 the Task Force decided to also recommend a recreation pool behind New River Dam, based on assurance from the Arizona Water Commission that water would be available for the three pools. However, in March 1975, the Maricopa County Board of Supervisors advised the Corps of Engineers that no local agency could provide the assurances necessary for the development of recreation lakes at the dams and requested that water-based recreation be deleted from the recommended plan. Based on this request, the Corps of Engineers revised the recommended plan to exclude water-based recreation and began coordination efforts with local planning agencies and the recreation task force to develop the dry land recreation concept presented in the recommended plan.

I-9.07 Concern in the areas studied for channelization was expressed by several groups. The Arizona Cotton Growers Association advocated channelization of the Gila, Salt, Agua Fria, and New Rivers and Skunk Creek and diversion of water from Cave Creek, Dreamy Draw, and north Phoenix. Most government agencies and citizen groups favored natural river channels. The U.S. Fish and Wildlife Service, the Arizona Conservation Council, the Sierra Club, and several environmental organizations, including the Arizona Mountaineering Club, the Riparian Areas Protection Commission, the National Wildlife Coalition, the Arizona Wildlife Federation, the Maricopa Audubon Society, and the Arizona Friends of the Earth recommended that nonstructural flood control measures (e.g., flowage easements and flood plain management) be used in the natural channels. The Sierra Club and the Audubon Society were anxious to keep the lower New and Agua Fria Rivers natural for the annual Christmas bird count.

I-9.08 Concern over construction of the Arizona Canal diversion channel was also expressed by the City of Glendale, town of Paradise Valley and the Arizona Biltmore Estates. The objections raised by these entities were that the Arizona Canal diversion channel would have an adverse social as well as economic effect on their interest in the area of the channel. Discussions are currently taking place to develop alternatives that would minimize the adverse effect. The City of Glendale's objections have been reconciled; the Corps of Engineers has modified the recommended plan to include a soft bottom channel where it passes through Glendale. This design will allow multipurpose use of the channel rights-of-way.

I-9.09 At the second formal meeting in 1974, the Corps officially stated that alternative 5B appeared to be the most acceptable alternative. This alternative was generally supported by the public at the meeting as the best choice. However, it was strongly criticized on a few points, including the diversion of water to the west and the change from channelization to flowage easements along Skunk Creek, New River and Agua Fria River. The recommended plan has been endorsed as the plan most compatible with the needs of the community by the City of Phoenix Engineering Department, the Maricopa County Board of Supervisors, the Arizona Conservation Council, and the Phoenix City Council.

I-9.10 The August 1975 draft environmental statement was distributed for formal coordination, and on 12 September 1975 it was filed with the Council on Environmental Quality. A formal public meeting was held in Phoenix on 21 October 1975 to solicit questions and comments on the draft environmental statement. The rationale for selecting the recommended plan was reviewed. The remainder of the meeting was devoted to answering questions and comments about the recommended plan.

I-9.11 GOVERNMENT AGENCIES. The August 1975 draft environmental statement was sent to the following government agencies requesting their review and comment. The comments of the agencies are summarized in the following subparagraphs. The letters of comment are reproduced in full in Appendix A.

a. Department of Agriculture, SCS

Comment: If there is a chance that flows would increase along Skunk Creek and the New and Agua Fria Rivers as a result of the Arizona Canal Diversion Channel, this should be specifically determined and affected areas should be defined.

Response: Paragraphs I-4.14 to I-4.15 and VI-4.03 to VI-4.04 have been added to define the extent of the changes in flow and the areas that will be affected.

Comment: Are there downstream channels that will be blocked by the dams or diversions that will not receive releases from the structures? What will happen to riparian vegetation along these washes?

Response: The effect of changes in the rate of flow along the downstream channels are discussed in paragraphs I-4.13 to I-4.22 and I-4.28 to I-4.33.

Comment. Erosion should be added to section on construction-related temporary impacts.

Response: Paragraph I-4.62 has been modified to include erosion effects.

Comment: In the EIS, the statement is made that the project will have no significant effect on water quality. We believe that there should be a beneficial effect on water quality by removal of a portion of the sediment.

Response: The release of clear water from the proposed dams will result in an increase in scouring downstream. Within a few miles of the dams the original sediment load of the floodflows will be restored. No significant benefit to water quality will occur.

b. Department of Commerce

Comment: The availability of the National Weather Service Flood Warning Service should be considered in the draft environmental impact statement.

Response: Paragraph I-2.21 has been modified to include a reference to the flood warning system.

Comment: If Geodetic Control Survey Monuments are located within the project area, the National Ocean Survey requires 90 days advance notification to plan for relocation. The cost of such relocations should be included as a project cost.

Response: The National Ocean Survey will be notified if Geodetic Control Survey Monuments are disturbed by project construction. Relocations will be made as a part of the project construction.

c. Department of Health, Education, and Welfare

COMMENT: Adobe Dam will effectively and permanently divide one community, with a resultant four mile round trip required to gain access to schools, shopping facilities and places of employment due to the closure to two main access routes, 35th Avenue and Deer Valley Drive. The long term effects upon the transportation system should be examined closely relative to access to health, medical and educational services and facilities. It appears that the closure of 35th Avenue and Deer Valley Drive plus the possible impassability of many "dip crossings" during water release periods may preclude ready access to needed services. The statement does not address this problem nor offer alternatives.

Response: Construction of Adobe Dam will not result in increased travel distance to schools, shopping facilities, or jobs for residents remaining upstream of the dam. In response to the requests of local interests, 35th Avenue will be ramped over the dam embankment and will remain open. Closure of Deer Valley Drive will not affect the remaining residents.

Comment: Release of flood waters from Cave Buttes Dam will render 20 existing "dip" crossings unusable for periods up to 73 days (100-year flood) or 23 days (10-year flood) unless local interests construct bridges. If bridges and overcrossings are not constructed concurrently with the dam construction, what provisions will be made to assure passage by elementary school children, senior citizens, and others who may not have access to vehicular transportation?

Response: Paragraphs I-4.43, I-4.49 and I-4.50 have been expanded to address these concerns. With the bridges now existing, vehicular access to medical and educational facilities will not be affected. Telephone conversations with the school districts within the project area revealed that school boundaries are arranged so that few if any elementary school children have to cross a river to reach school. There are no assurances that local interests will be able to finance the necessary bridges over existing dip crossings and there are no provisions being made for those people that do not have access to vehicular transportation. However, the City of Phoenix has stated that, along Cave Creek, the necessary bridges are planned or under construction; these bridges would significantly reduce the impact of the project since Cave Buttes Dam has the longest release schedule - 12 days for a 10 year flood, and 37 days for a 100-year flood, as revised. Releases for Adobe and New River Dams are 2 days and 3 days, respectively, for a 10 year flood.

d. Department of Interior

Comment: Discussion about overall effects of the project on sand and gravel resources should be expanded to show in more detail the magnitude of the impact and to discuss measures for mitigation.

Response: Paragraphs I-4.08 through I-4.12 have been expanded to discuss more fully the impacts of the project on existing mining operations and the sources and quantities of material that will remain available to the Phoenix area if the project is constructed.

Comment: Some major construction requirements which would apparently entail major impacts in urban areas have been mentioned in a peripheral manner in widely scattered parts of the draft environmental statement. It would be helpful to provide a reference to the map on which these proposed facilities have been delineated, and to evaluate any resulting impacts.

Response: Paragraphs I-1.09d, e, f, have been expanded to identify all structural features of the project, the bridges that will be constructed as part of the project, and the channelization required along Skunk Creek and the New and Agua Fria Rivers. These features and the impacts resulting from them are described in detail in the appropriate sections of this report. Proposed channelization within the flowage easements is shown in detail on plates 13 through 19 of the General Design Memorandum, Appendix 5, and is described in detail in Paragraph V-1.04 of this report.

Comment: A reference has been made to disposal of spoil from the diversion channel at specific sites that have been delineated on maps (Design Memorandum, P. SA-24). However, no discussion of sites for spoil disposal, or of volumes to be disposed of, has been found in the draft environmental statement.

Response: Approximately 11.5 million cubic yards of waste material will have to be disposed of during the construction of the Arizona Canal Diversion Channel. It is the responsibility of the flood control district to find and acquire adequate disposal areas. The flood control district has supplied the Corps with a map showing the potential spoil disposal sites that should be available at the time of construction. Adequate disposal areas were found within 5 miles of the proposed channel. A general map indicating potential disposal sites can be found on page 124 of the General Design Memorandum.

Comment: The project would evidently have a significant impact in terms of displacement of existing structures and improvements, as evidenced by the fact that there would be 237 homes and 25 businesses displaced. However, displacements have been mentioned only briefly (for example, page 2, paragraph 3; page VI-30, paragraph 1), and no information has been found on the magnitude of these impacts.

Response: Paragraphs I-4.48 and VI-4.14 to VI-4.20 have been expanded to more fully address the impacts of relocations required by the project.

Comment: The environmental statement should more fully address the effects on ground water of both the concrete-lined and earth sections of the diversion channel and should treat more fully evapotranspiration effects resulting both from the impoundments and from the prolonged periods of controlled floodflow.

Response: Paragraph I-4.18 through I-4.22 have been expanded relating to the impacts of the proposed project on ground water.

Comment: A number of statements are made regarding archeological sites which do not qualify for inclusion in the National Register. It is not clear if this was determined by the archeological contractor, the State Historic Preservation Officer, or the Keeper of the National Register. Only the Secretary of the Interior or his designee can make such a determination. In order to fully evaluate the adequacy of the statement in terms of mitigation measures for the protection of National Register properties, the Advisory Council's recommendations and the final mitigation procedures should be included in the statement.

Response: All the archeological sites affected by the project are included in the 3 archeological districts that have been nominated to the National Register. Statements regarding the eligibility of sites not affected by the recommended project were based on the opinion of the contractor and have been deleted from the report. Paragraphs II-4.13, III-4.12, and IV-4.12 discuss the proposed mitigation measures for each damsite. A final mitigation proposal is being formulated for approval by the Advisory Council.

Comment: Some discrepancies in acres of habitat to be lost appear between the Environmental Statement and the Design Memorandum.

Response: Habitat figures have been revised and discrepancies between the environmental statement and the design memorandum have been eliminated.

Comment: The draft environmental statement briefly discusses the beneficial impact of the recreation developments associated with the project, but there is no indication in the statement as to whether the project will have any adverse impact on any existing recreation resources. We recommend that such information be included.

Response: Paragraphs I-4.55 and I-4.56 have been expanded to contain this information.

e. Environmental Protection Agency.

Comment: Section VI-4.03 points to the fact that surface flows may be increased in the areas downstream of the Arizona Canal Diversion Channel and that these increased flows will have an impact. EPA would like more information concerning the probable impacts of this increased flow. Specifically, more information is needed on: (1) the anticipated sediment loads and deposition and scouring rates and patterns in the affected areas, particularly the Gila River, (2) any anticipated changes in the magnitude, frequency and duration of flooding in the affected areas (i.e. downstream areas), and (3) any anticipated changes in the riparian habitat in the downstream areas as a result of (1) and (2) above.

Response: Paragraphs I-4.07 and I-4.14 through I-4.33 have been expanded to more fully address these impacts.

Comment: Several features of the project provide for the development of new recreational facilities. Many of these facilities (i.e., lagoons, green belts) will require water to maintain them. Section I-2.31 states that the Arizona Water Commission and State Land Department are currently studing the legality of using ground water for esthetic or promotional displays. Section VI-4.06 states that an additional well may have to be drilled to provide water for recreational facilities. EPA would like to see a more thorough discussion of the water demand for project-related recreational areas within the context of the overall water supply situation in the area, particularly in relation to existing ground water overdraft problems.

Response: Since the 1920's ground water extraction has exceeded recharge within the project area. Along Cave Creek Park and the Glendale Parkway, recreational facilities will be maintained for the most part with water from the Central Arizona Project. The additional well that may be required will not affect the ground water supply in the area. Landscaping for the recreational facilities will make use of native and desert adapting vegetation in order to reduce water demand to a minimum compatible with providing multipurpose uses.

Comment: The DEIS discusses the project impact on the quantity of ground water in the area. However, very little discussion is offered on the project impact on ground water quality. EPA would like to see a more detailed assessment of the project impact on ground water quality.

Response: Paragraphs I-4.23 through I-4.25 and corresponding paragraphs in Sections II through VI have been expanded to more fully address impacts on ground water quality.

Comment: The Granite Reef Aqueduct of the Central Arizona Project tranerres the project area. Although the DEIS states that the two projects are independent and compatible, EPA would like to see a more detailed discussion of the relationship between the two projects. Specifically, EPA would like a more complete discussion on the inter-relationship of the flood protection offered by the Granite Reef Aqueduct and the proposed project.

Response: This concern is addressed in Paragraph I-2.28a of the statement.

Comment: Three hundred and ten acres of land will become available for urbanization as a result of the flood protection offered by the project. This is listed as both an adverse and beneficial impact in the project summary (page 2 of the DEIS). It is further discussed in Sections I-4.27, VI-2.17 and VI-4.12. EPA would like to see a more explicit discussion of the anticipated impacts of urbanization which may occur as a result of the flood protection offered by the project.

Response: Since the release of the draft, the 310 acres of land in question have begun to be developed without benefit of flood protection. References to the development of the area as a result of the flood protection offered by the project have been removed.

Comment: Since the Arizona Canal Diversion Channel will pass through residential areas it is suggested that a discussion of safety measures be provided.

Response: Paragraph VI-4.24 has been added to address safety measures.

Comment: The impact on vegetation and topography behind the dams will be spatially varied depending on the duration and frequency of inundation. EPA would like to see a more detailed discussion of the spatial distribution of impacts behind the damsites, i.e., what are the expected inundation levels and associated impacts for different frequency events?

Response: Paragraphs I-4.28 through I-4.33, and parallel paragraphs in Sections II through VI have been expanded to cover these effects. A tabulation showing frequency of inundation is shown on page .

Comment: A more thorough discussion of the maintenance requirements for the Arizona Canal Diversion Channel should be presented. EPA would be most interested in a discussion of the removal requirements for deposited material in the channel. If periodic removal of deposited material is required, the DEIS should discuss the methods and amounts of material which will be removed and the location of disposal sites.

Response: Material deposited in the channel will be removed when necessary to maintain hydraulic efficiency of the channel. Little deposition is anticipated along the concrete-lined portion of the channel. Along the Glendale Parkway, removal of debris and maintenance and repair of recreational facilities will be required. The flood control district of Maricopa County will be responsible for maintenance of the channel. The frequency of debris removal will depend on the frequency and magnitude of storms and cannot be determined at this time. It is also difficult to pinpoint disposal sites ahead of time due to rapidly increasing urbanization.

Comment: A discussion of the maintenance requirements for the damsites should be presented. Additionally, if removal of deposited material behind the damsites will be allowed (i.e., sand and gravel operations) then a discussion of the impacts and reclamation requirements should be given.

Response: Paragraph I-4.09 discusses this. It will be the responsibility of the flood control district to maintain the sediment capacity of the reservoirs. Clearing operations will be infrequent.

Comment: Since the project relies heavily on local management of floodways and flowage easements, EPA would like to see a more thorough discussion of how these areas will be managed and maintained after the project is completed, particularly in relation to existing structures, and commercial operations (i.e., sand and gravel).

Response: Floodways will be maintained by the county in accordance with State and local laws and regulations prescribed by the Secretary of the Army. Maintenance operations typically consist of clearing excessive plant growth or sediments that would obstruct flows. Existing sand and gravel operations will continue, provided that the carrying capacity of the floodway is maintained. Removal of existing structures is discussed in paragraph V-4.13.

f. State of Arizona Game and Fish Department

Comment: Neither the Design Memorandum nor the DES discuss hunting, which occurs throughout the project in significant numbers.

Response: The effects of the proposed project on hunting have been identified in Paragraph I-4.55.

Comment: The Department feels that the DES should include the recommendations of the recreation task force to "... provide the New River site as a wildlife area ..."

Response: Paragraph I-1.10 has been modified to include the recommendation.

Comment: On Page IV-11, hunting is indicated as a trespass use in the New River area. This is true only on posted land. Some public and private land is available for hunting.

Response: Paragraph IV-2.17 has been modified to reflect that hunting is a legitimate us in non-posted areas.

Comment: The Department generally agrees with the habitat loss figures presented in the design memorandum and the EIS. However, there are some discrepancies on the number of acres lost.

Response: The number of total acres of habitat lost have been altered somewhat by a substantial reduction in borrow area required. The new figures appear in the appropriate paragraphs in Sections I through VI. These revised estimates have been incorporated into the General Design Memorandum. About 410 acres of riparian habitat will be lost due to construction of the project. The reports reflect this habitat loss estimate. The 315 acres of riparian habitat discussed in paragraph I-4.20 of the draft EIS was an estimate supplied by the U.S. Fish and Wildlife Service in a letter dated 30 September 1974, and applied to the area behind the dams only. The Corps estimated the riparian habitat loss for the total project at 410 acres. For the purposes of mitigation, it was generally agreed that the acquisition of 350 to 400 acres of good quality riparian habitat would be reasonable mitigation.

g. Arizona Water Commission

Comment· Paragraph I-2.103, which discusses the flood plain regulations for the unincorporated areas of Maricopa County, should be revised to reflect recent changes.

Response: Paragraph I-2.103 (now I-2.102) has been revised to include the new flood plain regulations adopted on 14 July 1975.

Comment: The City of Peoria has adopted flood plain regulations commensurate with state law. It would be appropriate to mention this since New River passes through this city.

Response: Paragraph I-2.104 has been modified to include acknowledgement of the City of Peoria flood plain regulations.

Comment: Paragraph I-3.01 states that the flood disaster protection act requires that flood prone areas be identified and that flood plain ordinances be adopted. It should be mentioned that identification is only required to allow the sale of flood insurance.

Response: Paragraph I-3.01 has been revised as recommended.

Comment: The statement that the state law prohibits construction in flood prone areas prior to adopting flood plain regulations is incorrect. A provision of the law allows special permits authorizing construction or development prior to the adoption of flood plain regulations.

Response: Paragraph I-3.01 has been revised as recommended.

Comment: In paragraph I-4.12, the statement that 10,600 acre-feet is less than one-percent of the total ground water recharge available could be misinterpreted. It is suggested that the reference to percentage of total recharge be deleted or modified to a percentage of total runoff in the basin.

Response: Paragraph I-4.12 (now I-4.18) has been modified.

Comment: Paragraph I-4.12 refers to "operation of the dams." This implies that control gates will be installed, while the GDM indicates that all the dams are ungated. This point should be mentioned or the terminology modified.

Response: The reference to "operation of the dams" has been deleted from paragraph I-4.12 (now I-4.18).

Comment: Paragraph I-4.20 describes the proposal to purchase 400 acres at the confluence of the Agua Fria and Gila Rivers as a wildlife mitigation measure. Will there be a flood potential created by setting aside an area within the Agua Fria or Gila Rivers?

Response: Other mitigation sites have been considered along the Gila River, and another site is now favored. Acquisition of a mitigation site along either river would have no effect on flooding. Future flood control would not be precluded. Management of the area by the Arizona Game and Fish Department would not increase vegetation in the river bottom to the point of increasing the flood hazard.

Comment: Paragraph I-4.21 indicates an agreement regarding the acquisition of 400 acres for wildlife habitat mitigation. We have been advised that at least one other option is being considered.

Response: Paragraph I-4.21 (now I-4.34) and paragraph I-4.35 have been modified to discuss the ongoing negotiations concerning wildlife mitigation.

Comment: Paragraph I-5.04 should be modified to mention that the mining of sand and gravel within a reservoir is common practice.

Response: Paragraph I-5.04 and related paragraphs have been modified to state that sediments accumulated behind the dam would be available for mining.

Comment: There are discrepancies within the report on the number of homes to be relocated.

Response: More accurate data on required relocation is now available. All sections of the report and the GDM have been corrected to reflect updated information.

Comment: It should be pointed out that many of the homes and businesses to be relocated would be damaged to such a degree that they could not be rebuilt under the Phoenix Flood Plan Regulation Ordinance.

Response: Section I-4.49 and VI-4.18 point out that under existing conditions of localized ponding, many of the homes and businesses requiring relocation are flood prone.

Comment: A tabulation depicting land use and ownership of parcels which must be purchased for the project would add to the description of the overall impact.

Response: Land use and land ownership at the recommended damsite are shown on plates 21, 22, 24, 25, 26, and 27.

h. Maricopa County Planning Department

Comment: On several occasions in the report the statement is made that the recommended Adobe Dam site conflicts with the site illustrated on the proposed Future General Land Use Plan for Maricopa County. It appears that your staff has an early draft of the Future General Land Use for Maricopa County, Arizona report. The Plan illustrates the Adobe Dam at the recommended site.

Response: All references to the Future General Land Use Plan for Maricopa County have been corrected.

i. Flood Control District of Maricopa County

Comment: In paragraph I-2.23 the first complete sentence, "The Black Canyon Highway (I-17) intercepts Cave Creek runoff near the Arizona Canal." should be clarified to reflect that runoff from Cave Creek intercepted by the Black Canyon Highway would be only runoff diverted by the Arizona Canal.

Response: Paragraph I-2.23 (now I-2.22) has been corrected.

Comment: Since this report, the City of Phoenix has put in service a fourth water treatment plan (Val Vista) on the South Canal near Val Vista Drive and McDowell Road.

Response: Reference to this water treatment plant has been included in paragraph I-2.36.

Comment: In paragraph VI-1.03a, bridge requirements should include 32nd Street, 24th Street, 16th Street, 12th Street, Maryland Avenue, Glendale Avenue, Dunlap Avenue, Metro Parkway, 35th Avenue, Peoria Avenue, Cactus Road, and Thunderbird Road.

Response: Paragraph VI-1.03 describes the authorized plan, which is not presently recommended. These bridges are not required under the authorized plan.

Comment: In several places within the report it is stated that one relocation would be required as a result of the construction of Cave Buttes Dam. The Cave Buttes area contains 3 residential dwelling units.

Response: All references to relocations at Cave Buttes Dam have been corrected.

j. City of Phoenix

Comment: Paragraph I-3.05: the recommended Arizona Canal Diversion Channel is not in conflict with actual land usage. Some of the land needed for the channel has already been excavated and is being used for temporary storm drainage detention basins.

Response: Paragraph I-3.05 has been revised to reflect the fact that in some places the recommended plan conforms with the actual land use. The environmental statement is correct, however, in noting that the recommended Arizona Canal Diversion Channel conflicts with existing land use plans.

Comment: Paragraph I-4.30 should state that in the City of Phoenix along Cave Creek, many of the bridges already exist or are planned for construction ahead of the proposed dam.

Response: Paragraph I-4.30 (now I-4.43) has been modified to reflect this.

Comment: It is very important to recognize nearly all of the disrupted homes and businesses are now flood prone and acquisition for flood control purposes will enable the property owners to relocate in areas that are not flood prone.

Response: Paragraphs I-4.49 and VI-4.18 reflect this.

Comment: The Arizona Canal is a physical barrier that existed long before neighboring communities were developed. The modification of this barrier should have a minimum social impact. In fact, the use of the associated trail by people on both sides of the canal may even serve to unify the communities to some extent.

Response: Although the Arizona Canal already exists as a physical barrier our assessment indicates that construction of a wider channel requiring the removal of homes and disruption of the neighborhoods along the Arizona Canal will intensify the physical separation.

Comment: Spillway Alternate No. 1 for Adobe Dam Site No. 4 is in conflict with the location of a proposed 42 inch water supply line and access road for the Hedgepeth Hills Reservoir planned by the City of Phoenix. A memo describing this conflict and illustrative maps prepared by the City Water and Sewers Department are attached.

Response: This conflict will be resolved during detailed design studies by relocation of one of the features in a manner acceptable to both the Corps and the City of Phoenix.

Comment: The proposed plan has been endorsed by the City Council of the City of Phoenix.

Response: Paragraph I-9.08 has been modified to reflect this.

Comment: The City of Phoenix has 80 acres under active mineral lease that would be affected by the recommended dam.

Response: Paragraph II-2.22 has been modified to reflect this.

Comment: Paragraphs IV-4.03, III-4.09, and IV-17 seem to contradict each other about the effect on downstream riparian vegetation.

Response: The recommended plan will impact on vegetation in several, sometimes contradictory, ways. These effects are more fully explained in Section I, paragraphs I-4.13 through I-4.22.

Comment: Paragraph VI-1.02 should reflect that the channel begins at 40th Street in Phoenix, goes through Paradise Valley and back into Phoenix, etc.

Response: Paragraph VI-1.02 has been modified.

Comment: The terminus of the channel is at 75th Avenue.

Response: Paragraph VI-2.07 has been corrected.

Comment: Paragraph VI-8.02: Will the disposal of excavated material for this feature pose a large problem?

Response: The Flood Control District of Maricopa County is responsible for determining suitable disposal areas. The district has forwarded to the Corps maps outlining enough potential disposal sites to satisfy project requirements.

Comment: Paragraph VI-1.04a: If the channel is entirely below ground level why must the inlets be gated? Does this apply to future storm drains built by the City?

Response: In local ponding areas, pipe inlets will be provided. Automatic drainage gates will be included only when necessary to prevent backflow.

Comment: Paragraph VI-1.04c: If the flows from Cave Creek are too large to be taken into the Arizona Canal Diversion Channel by side channel spillway, it is hoped that the necessary concrete channel in Cave Creek Park can be much shorter than extending to Peoria Avenue.

Response: An inlet structure is required at Cave Creek. To satisfy hydraulic criteria, the inlet must extend to the Peoria Avenue Bridge.

I-9.12 Favorable responses were received from the following government agencies:

Arizona Department of Transportation
Maricopa County Association of Governments
Maricopa County Department of Health Services
City of Glendale

I-9.13 The August 1975 draft environmental statement was also sent to the following government agencies requesting their review and comment, and no replies were received:

Advisory Council on Historic Preservation
Arizona State Parks Board
City of Avondale
City of Peoria
Federal Energy Administration
Federal Highway Administration
Maricopa County Board of Supervisors
Maricopa County Engineer
Maricopa County Parks and Recreation Department
U.S. Department of Agriculture, Forest Service
U.S. Department of Commerce, Economic Development Administration

I-9.14 NON-GOVERNMENT INTERESTS. The August 1975 draft environmental statement was sent to the following non-government interests requesting their review and comment. The comments of the non-government interests are summarized in the following subparagraphs and copies of their letters are reproduced in full in Appendix A.

a. Salt River Project

Comment: In paragraph I-2.27 the title "Salt River Project Agricultural Improvement Power District" should be "Salt River Project Agricultural Improvement and Power District."

Response: Paragraph I-2.27 has been corrected.

Comment: Paragraph VI-2.21 states that the "Arizona Canal has many pumping stations. . ." This is not an accurate statement. The Arizona Canal is a gravity flow canal. It has no pumping stations. However, the Salt River Project does have 13 deep wells adjacent to the Arizona Canal which provide water for the canal and/or adjacent lands.

Response: Paragraph VI-2.21 has been modified.

Comment: Paragraph VI-4.04: Reduction of ponding against the Arizona Canal north bank by the diversion channel would reduce recharge in this area somewhat.

Response: This reduction and the associated effects are discussed in paragraph VI-4.05.

I-9.15 Opposition to some of the project features was expressed by several non-government interests. These interests are:

James Schoenwetter, Center for Environmental Studies, Arizona State University
Saddleback Meadows Property Owners Association
Jade Park North Homeowners Association
Deer Valley Planning Committee
Malapai Homeowners Association

Their opposition is centered around two features of the proposed project, Adobe Dam and the Arizona Canal Diversion Channel. The specific conflicts over these features are discussed in detail in the coordination portion of Sections III and VI of this report.

I-9.16 Favorable responses were received from the following non-government agencies:

Arizona Conservation Council
Arizona State Museum
Atchison, Topeka and Santa Fe Railway Company

I-9.17 The August 1975 draft environmental statement was also sent to the following non-government interests requesting their review and comment, and no replies were received:

Advisory Council on Arizona Environment
Arizona Biltmore Estates, Inc.
Arizona Cotton Growers Association
Arizona Federation of Women's Clubs
Arizona Friends of the Earth
Arizona Historical Foundation, ASU
Arizona State Horsemen's Association
Arizona Wildlife Federation
Central Arizona Water Conservation District
Hohokam Resources Conservation and Development Office
League of Women Voters
Maricopa County Audubon Society
National Water Resources Association
National Wildlife Federation
Salt River Pima Maricopa Community, Tribal Chairman
Sierra Club
Valley Forward Association

II

FEATURE OF
THE NEW RIVER &
PHOENIX CITY STREAMS
FLOOD CONTROL PROJECT

CAVE BUTTES DAM

SECTION II

CAVE BUTTES DAM
Feature of the
New River and Phoenix City Streams
Flood Control Project

II-1. DESCRIPTION OF PROJECT FEATURE

II-1.01 INTRODUCTION AND PURPOSE. This section describes the Cave Buttes Dam feature of the New River and Phoenix City Streams Flood Control Project. This section includes: (a) a detailed description of the recommended Cave Buttes Dam project feature, (b) a description of the environmental setting in the immediate area of the recommended damsite and alternative damsite, (c) the relationship of Cave Buttes Dam to land use plans for the area, (d) the probable impact of Cave Buttes Dam on the environment, (e) the probable adverse impacts which cannot be avoided should Cave Buttes Dam be constructed, (f) an analysis of the alternative sites and facilities studied, (g) the relationship between the short-term use of the environment at the recommended damsite and the maintenance and enhancement of long-term productivity, (h) the irreversible and irretrievable commitments of resources which would be involved should the feature be constructed, and (i) the coordination effort which has taken place.

II-1.02 PROJECT FEATURE LOCATION. The site of the recommended Cave Buttes Dam feature is on Cave Creek 0.7 mile south of the existing Cave Creek Dam. This site, which is an alternative to the authorized site, is located 18 miles north of the Phoenix civic center and 8.5 miles southwest of the town of Cave Creek. The location of the recommended dam embankment, dikes, and reservoir is shown on plate 19.

II-1.03 AUTHORIZED PROJECT FEATURE. The authorized Cave Buttes Dam, which is not presently recommended, was to be situated 2 miles south of the existing Cave Creek Dam (see pl. 19). The main elements of a flood control structure at this site would include an embankment, two dikes, a concrete-lined spillway, an outlet conduit, and access roads. These elements are described in the following subparagraphs.

a. Embankment. The dam embankment would have a length of 2,120 feet and a crest elevation of 1,641 feet, approximately 120 feet above the elevation of the existing streambed. The embankment would be a compacted earthfill structure.

b. Dikes. The east dike would be 9,300 feet in length, extending from a point approximately 2,500 feet northeast of the east dam abutment to a point west of the existing Cave Creek Road. The west dike would be located approximately 2,000 feet northwest of the right abutment of the dam. The west dike would have a crest length of 3,560 feet and a maximum height of 102 feet above the lowest elevation along its centerline.

c. Spillway. The spillway would be located 800 feet northwest of the dam embankment. Subsurface investigation revealed that a rectangular concrete-lined spillway would be required.

d. Outlet Conduit. The outlet conduit works would be located near the west abutment of the dam and would cross under the proposed Granite Reef Aqueduct, a feature of the Central Arizona Project. The maximum release would be 530 cubic feet per second (cfs).

e. Access Roads. Vehicular access would be provided from Cave Creek Road. Vehicular access roads would connect all of the structural elements.

II-1.04 RECOMMENDED PROJECT FEATURE. The recommended Cave Buttes damsite is approximately 1.2 miles upstream of the authorized damsite, or approximately 0.7 mile south of the existing Cave Creek Dam. A dam at this location will control a drainage area of 191 square miles, or 4 square miles less than a dam at the authorized damsite. Main elements of a flood control structure at the recommended site include an embankment, three dikes, an outlet works, an unlined spillway, an unlined drainage channel, access roads, modification of Cave Creek Road, and recreational facilities. These elements are described in the following subparagraphs.

a. Embankment. The dam embankment will have a length of 2,280 feet and a height of 110 feet above the existing streambed. The embankment will be a compacted earthfill structure.

b. Dikes. Dike No. 1, the smallest dike, will be located approximately 300 feet east of the main embankment. This dike will have a length of 940 feet and a maximum height of 40 feet. Dike No. 2 will be located approximately 6,000 feet northeast of the main embankment. It will have a length of 9,010 feet and a maximum height of 56 feet. The eastern 3,580 feet of dike No. 2 is designed to divert flood water into the detention basin from the drainage area northeast of Cave Creek Road. This portion of the dike will have a variable height, ranging from 6 to 10 feet above the existing ground. Dike No. 3 is designed to prevent overflow into the adjacent Skunk Creek drainage. The dike will be located approximately 2.5 miles northwest of the main embankment. It will have a length of 3,600 feet and a maximum height of 11 feet.

c. Outlet Works. The outlet works will consist of an approach channel, an ungated intake structure, a conduit 500 feet long, and a stilling basin. The outlet conduit will be 3.75 feet in diameter and will be capable of releasing up to 494 cfs.

d. Spillway. The spillway will be located approximately 1,600 feet west of the dam embankment. Because of the natural terrain, there are no feasible alternative spillway sites. The spillway will be excavated in rock, and will be unlined except at the spillway crest, where a concrete sill will be provided. The spillway will have a crest width of 500 feet and a length of 670 feet.

e. Drainage Channel. The drainage channel will be located north of dike No. 2 near its west abutment, and will be designed to drain ponding behind the dike. The drainage channel will be 2,800 feet in length, unlined, and trapezoidal in cross section. The base width of the channel will be 12 feet.

f. Access Roads. Paved access to the dikes, dam embankment, and unlined spillway will be provided from the existing public Cave Creek Road at the junction of dike No. 2. The tops of the embankment and dikes will be utilized as service roads. An access road 3,688 feet long will connect dike No. 1 and dike No. 2; its minimum elevation will be above the maximum water surface behind the dam. An access road 100 feet long will connect dike No. 1 and the dam embankment; the roadway will be excavated through the hill between the dike and the dam. The main embankment will incorporate access ramps from the service road on the top of the dam down the embankment slopes to the intake area of the outlet works. An access road 3,300 feet long around the south side of the hill between the embankment and the spillway will connect the west end of the dam embankment and the spillway. Dike No. 3 will be in an isolated area where there is no public road within a 2-mile radius. A paved access road to this dike will not be provided. The dike will be inspected during dry periods when the existing dirt road can be used.

g. Modification of Cave Creek Road. Construction of dike No. 2 will necessitate raising the existing Cave Creek Road from its existing elevation of 1,660 feet to an elevation of 1,682.6 feet. The existing road is a paved two-lane road; expansion to a four-lane road is planned in the future. The modification will affect approximately 1,850 feet of the existing road and will require culverts under the road embankment to drain ponding between the road and dike No. 2. During modification work on the road, a detour will be provided.

h. Recreational Facilities. The area surrounding the proposed Cave Buttes Dam is currently used for informal equestrian activities. The recreation plan for the area (pl. 20) will officially designate the northern portion of the detention basin as an open area for riding and training horses. Trails constructed in the basin will connect to existing and proposed riding trails to the north and south of the site. In response to requests from field dog training organizations in the Phoenix area, the land immediately upstream from the proposed dam will be designated as public open space for dog training activities. The natural topography and the recommended dam will confine the area and facilitate the management of training activities. Other recreational facilities planned for the site include primitive campsites, an improved group camping area, 25 individual improved campsites, picnicking areas, and riding and hiking trails. An overlook structure, which will be constructed in the early phases of the project, will provide views of the dam during construction and of the entire recreational area when it is fully developed.

II-2. ENVIRONMENTAL SETTING WITHOUT THE PROJECT FEATURE

II-2.01 TOPOGRAPHY. The topography adjacent to the recommended and authorized Cave Buttes damsites (the land that would be directly affected by either the recommended or authorized Cave Buttes dams) is characterized by rugged mountains, a gently sloping terrace, and a flat reservoir area subject to periodic inundation.

II-2.02 The mountains are a southern extension of the Union Hills which are dissected by intermittent drainages. The highest nearby peak has an elevation of 2,144 feet, about 525 feet above the adjacent valley floor. The Cave Creek drainage flows in this valley. The terrace that forms the valley has an average slope of 30 feet per mile in the study area. The existing Cave Creek Dam, erected in 1923, has altered the topography by impounding sediments and creating a basin. The basin surface has a slope of about 20 feet per mile.

II-2.03 The terrace area between Cave Creek Dam and the authorized damsite has been extensively altered by sand and gravel operations. The valley floor has been pot-marked by excavations 20 to 25 feet deep.

II-2.04 GEOLOGY AND SOILS. The geology at the recommended Cave Buttes damsite consists of greenstone/schist (metaigneous rock) at the dam abutments, spillway, and underlying the alluvium of the valley floor. The east abutment of the dam embankment is metaigneous rock veneered with older alluvium (mostly talus debris) to depths ranging to 10 feet. The recommended spillway site is primarily schistose metaigneous rock with very little talus veneer. The alinement of the dam embankment is on unconsolidated alluvium with a depth of at least 35 feet. The alluvium consists of sand, gravel, cobbles, and boulders. The site of dike No. 1 is on greenstone bedrock. The west abutment of dike No. 2 is metaigneous rock veneered to depths of 10 feet with older alluvium (talus debris). The alinement of the dike itself is underlain by silty to clayey sand and gravel (mostly unconsolidated) in excess of 60 feet thick. Depth to and character of bedrock is unknown. There is no east abutment, as the dike will feather out just east of Cave Creek Road. Dike No. 3 will rest on Recent and older alluvium – mostly consolidated clay, silt, sand, and gravel. The depth to and character of the bedrock is unknown.

II-2.05 The embankment of the authorized (not presently recommended) Cave Buttes Dam would be situated between two volcanic hills. The west abutment is basalt overlying, and possibly intruding, metaigneous greenstone. There is no talus where the axis abuts the hill, an 80 foot high cliff. The east abutment is greenstone, tuff, and tuffaceous agglomerate capped and intruded by basalt and thinly veneered (0 to 2 feet) with talus debris. The valley floor is Recent and older alluvium to 29 feet thick overlying tuffaceous bedrock. The alluvium consists of clay, silt, sand, gravel, cobbles, and boulders and ranges from unconsolidated to poorly consolidated. The north abutment of the west dike is schist with a thin talus veneer. The south abutment of the west dike consists of vesicular basalt with talus cover 0 to 10 feet thick on the lower slopes. The valley floor under the west dike alinement is Recent and older alluvium to 40 feet deep underlain with tuffaceous agglomerate and schist (metaigneous). The alluvium is mostly consolidated clay, silt, sand, gravel, cobbles, and boulders. The west abutment of the east dike consists of tuffaceous agglomerate with a thin veneer of talus debris. A low schist (metaigneous) knob outcrops near the center of the dike alinement. The valley floor under the rest of the dike's alinement is consolidated Recent and older alluvium to approximately 50 feet deep west of the schist knob and somewhat deeper east of it. The alluvium is clay, silt, sand, and gravel with occasional cobbles and boulders. There is no east abutment, as the east dike would feather out near Cave Creek Road. The spillway would be in older alluvium, tuffaceous agglomerate, and greenstone.

II-2.06 The alluvial soil in the recommended site has been characterized as a limy clay loam subsoil (B4M) by the Soil Conservation Service. They classify the alluvial soil at the authorized site as a deep sandy loam soil (ALa). Both of these soils are moderately fertile (ref. 3).

II-2.07 SURFACE HYDROLOGY. The western portion of the Paradise Valley is drained by an intricate system of ephemeral drainages. Flowing only seasonally, these drainages carry runoff from the valley into Apache Wash and Cave Creek, the principal watercourses in the study area. The drainage area upstream from the recommended damsite contains 191 square miles; the drainage area upstream from the authorized damsite contains 195 square miles. Based on stream gage records the average annual runoff for the Cave Buttes study area is estimated to be 4,700 acre-feet.

II-2.08 The existing Cave Creek Dam, located at the confluence of Apache Wash and Cave Creek, is about 0.7 mile upstream of the recommended site and 2 miles upstream from the authorized site. Cave Creek Dam was built in 1922-23, following a damaging flood on Cave Creek that occurred in 1921. The dam was jointly financed by the State of Arizona, Maricopa County, the city of Phoenix, and other local interests and is on Bureau of Land Management land.

II-2.09 Cave Creek Dam is a reinforced concrete structure with 38 arches and supporting buttresses spaced about 44 feet apart. The dam is 1,692 feet long and rises 52 feet above the downstream ground surface. A detached unlined spillway is located in a natural saddle about 4,800 feet east of the left abutment of the dam. No floodwater detained by Cave Creek Dam is believed to have ever reached spillway elevation and discharged through the spillway. The outlet works consist of three 4- by 4-foot openings, one ungated and two gated. The maximum discharge rate through each of these openings is estimated at about 500 cfs (with water surface at the crest of the dam).

II-2.10 The dam, as constructed, had a reservoir capacity of 14,000 acre-feet. Capacity has been lost as a result of siltation; the estimated capacity in 1970 was 12,400 acre-feet. According to the latest hydrologic analysis, the reservoir capacity behind the existing Cave Creek Dam could control floods having an occurrence frequency between 25 and 50 years.

II-2.11 After Congress authorized the New River and Phoenix City Streams project, Cave Creek Dam was studied to determine its safety (ref. 24). These studies concluded that the existing structure would be inadequate for major floods. The Arizona Water Commission also conducted an evaluation of the safety aspects of the existing dam, and affirmed that the existing Cave Creek Dam cannot continue to be operated without extensive alterations.

II-2.12 SUBSURFACE HYDROLOGY. Ground water depths in the Cave Buttes study area vary tremendously with the local geology. The U.S.G.S. data (ref. 23) indicate that the depth to water ranges from a measured depth of 33 feet immediately downstream of the existing Cave Creek Dam (perched on bedrock) to a measured depth of 271 feet downstream of the authorized Cave Buttes damsite. The ground water contours upstream of the alternative Cave Buttes Dam study area range in depth from 300 feet to 800 feet.

II-2.13 VEGETATION AND WILDLIFE. The recommended Cave Buttes damsite (see pl. 21 and photo 5) contains about 250 acres of desert wash vegetation and 1,650 acres of desert outwash and upland vegetation within the standard project flood overflow area. About 250 acres of these communities, including 80 acres in the inundation area behind Cave Buttes Dam, are highly disturbed or altered. Environmental disturbance has occurred primarily in the desert wash habitat and, to a lesser degree, in the desert outwash and upland habitats. There is some excellent desert wash habitat, which includes large ironwood, mesquite and catclaw acacia, within the proposed detention basin.

II-2.14 The detention basin behind the existing Cave Creek Dam has a dense growth of mostly annual herbaceous vegetation and grasses, including such species as cocklebur, sunflower, dock, mustard, thistle and brome grasses (see photo 6). Because of the heavy sedimentation and inundation effects near Cave Creek Dam, only a few small shrubs occur. Many small mesquite, catclaw acacia and some ironwood occur about 300 yards north of the dam. At least five cottonwoods 30-50 feet tall are growing within the detention basin area. Cave Creek, which meanders through the detention basin, is lined with such species as blue paloverde, mesquite and, near the dam, by a dense growth of cocklebur 4-6 feet tall. A large amount of vegetation within the detention basin, especially near the dam, is mowed annually. The area upstream from the dam is also used to graze cattle. About 50 acres of dense riparian growth (mesquite, blue paloverde, catclaw acacia and some ironwood) are located about 2,000 feet northwest of the east abutment of Cave Creek Dam (see photo 6). This appears to be the best quality desert wash habitat in the area. Cave Creek habitats support such upland game species as mourning doves, white-winged doves, Gambel's quail and jackrabbits. The large number of spent shotgun shells present suggests the area is important to hunters.

II-2.15 The authorized Cave Buttes damsite contains about 170 acres of desert wash vegetation and 620 acres of desert outwash and upland vegetation within the standard project flood overflow area. About 300 acres of the desert wash and outwash habitats have been highly disturbed by man's activities. Gravel mining, roads and trails account for most of the loss or heavy disturbance of desert wash and outwash vegetation at this alternative site. Stripping of surface vegetation prior to gravel mining is continuing in the area with resultant heavy loss of desert wash vegetation (see photo 7). Man's land-use activities are rapidly decreasing this site's wildlife habitat value, although it is still of fairly good quality.

II-2.16 ARCHEOLOGICAL AND HISTORICAL RESOURCES. Research into the archeological and historical resources of the recommended Cave Buttes damsite was carried out in June 1974 by Mr. James B. Rogers and Mr. Donald E. Weaver, Jr., Department of Anthropology, Arizona State University, under a contract with the National Park Service (ref. 14). An earlier survey of the authorized Cave Buttes damsite was carried out in September 1973 by Dr. Alfred E. Dittert, Jr., Department of Anthropology, Arizona State University, under a contract with the Corps of Engineers (ref. 6).

II-2.17 The two archeological surveys revealed 14 archeological sites at the recommended damsite and 10 archeological sites at the authorized damsite. No historical sites were identified at either damsite.

II-2.18 Ten archeological sites at the recommended damsite and one archeological site at the authorized damsite were recommended for nomination for inclusion in the National Register of Historic Places by the contract archeologist. Because of the concentration of these sites the State Historic Preservation Officer and the Director of the Office of Archeology and Historic Preservation nominated the area comprised of Sections 27, 28, 33, 34, and 35 of T5N, R3E, and the west half of Section 1 and Sections 2, 3, 4, 9, 10, 15 and 16 of T4N, R3E for inclusion in the National Register as the Cave Creek Archeological District (see pl. 10). The Cave Creek Archeological District was officially nominated to the National Register in July 1975 (ref. 29).

II-2.19 The archeological suverys revealed a cultural ecological zone which had previously been considered economically unproductive for prehistoric exploitation. Although the artifactual remains that were recovered are relatively unspectacular, they provide valuable data concerning prehistoric subsistence patterns.

II-2.20 The majority of the archeological sites in both surveys are related to the cultivation and collection of foodstuffs. No permanent occupational units were revealed by the surveys; however, some may be beneath the thick silt deposits common to the area. Because of a lack of diagnostic ceramics, the temporal placement of the archeological resources at the recommended and authorized damsites precludes dating to other than a general period within the Wingfield Plain, A.D. 700 to A.D. 1250. An Archaic horizon prior to this appears to be also represented.

II-2.21 POPULATION. The Cave Buttes study area, encompassing both the authorized and recommended sites, presently contains three residential dwelling units. The pattern of development depicted in the following tabulation is based on population projections for Maricopa County made by the Bureau of Economic Analysis of the U.S. Department of Commerce and the Economic Research Service of the U.S. Department of Agriculture (OBERS). The projections were allocated by the Corps of Engineers within the county on the basis of data provided by the Maricopa Association of Governments, historical trends, local and regional land use plans, current zoning and the National Flood Disaster Protection Act of 1973. The population projections were calculated for an area with a radius of 5 miles from a point midway between the authorized and the recommended damsites.

Population Projections

Year	Population	Density (per sq mi)
1974	74,880	960
1990	262,080	3,360

II-2.22 LAND USE. The majority of the land within the Cave Buttes Dam study area is devoted to grazing and mining. There are 20 acres of land under active mineral mining leases from the State Department of Lands within the area that would be affected by the recommended Cave Buttes Dam; the authorized dam would affect 120 acres of land under mineral lease. The City of Phoenix presently has 80 acres of land under mineral lease at the recommended site that will be affected by the project. Present land ownership at the damsite is shown on plate 22.

II-2.23 All of the land in the study area upstream from the existing Cave Creek Dam is used for grazing, either under grazing leases from the State or on land in private ownership. Commercial leases with the State often run concurrently with many of these grazing leases. The majority of the land near the study area is presently undeveloped; however, plans are being made by private developers for future large-scale residential developments.

II-2.24 TRANSPORTATION. The Cave Buttes Dam study area is accessible by three unpaved, limited-duty roads, joining all-weather, paved, two-lane roads. Cave Creek Road passes in a north-south direction about 1.8 miles from Cave Creek Dam. Neither railroad nor mass transit lines service the study area.

II-2.25 SOCIAL SAFETY. The existing Cave Creek Dam has been determined to be unsafe by the Corps of Engineers. Based on Corps hydrology, a flood having a frequency between 25 to 50 years would spill over the top of the dam. Overtopping of the dam for an extended period of time might undermine the foundation of the dam and cause it to collapse. Should the dam fail in a major storm, it would increase both the flood damages and probability of loss of life. The flood potential of Cave Creek and the history behind the construction of Cave Creek Dam is discussed in detail in General Design Memorandum No. 3, Gila River Basin, New River and Phoenix City Streams, General Design Memorandum - Phase I, Plan Formulation.

II-2.26 RECREATION. There are no formal recreational facilities within the Cave Buttes Dam study area, although Cave Creek Dam shows evidence of use for sightseeing and equestrian activities. The study area is also used by hunters and off-road vehicles, although this use often involves trespass.

II-2.27 NOISE LEVELS. The study area is uniquely quiet when the nearby sand and gravel equipment and off-road vehicles are not operating. The surrounding hills block the view of the city and tend to accentuate the silence.

II-2.28 ESTHETICS. The vistas to the north and east of the existing Cave Creek Dam offer a high degree of visual quality; the distant mountain ranges provide a scenic background to the vast Paradise Valley with its wide expanse of unobstructed sky. These views are complemented by the presence of the confining Union Hills, which rise steeply on either side of the site forming a small valley. While the valley floor below the dam has been extensively disturbed by sand and gravel mining operations and road cuts, the steep hillsides have remained relatively undisturbed and provide a natural resource of scenic value. In the inundation area, braided streams support a dense growth of non-native vegetation and grasses. Viewed from atop Cave Creek Dam, this lush area contrasts sharply with the surrounding desert wash vegetation.

II-3. RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE PLANS

II-3.01 The Cave Buttes feature of the recommended plan (proposed action) conforms to the objectives and specific terms of existing and proposed Federal, State, and local land use plans, policies, and controls.

II-3.02 The recommended Cave Buttes Dam conforms to the Maricopa Association of Governments (MAG) Composite Land Use Plan (pl. 14), which designates conservation land uses for the affected area. The MAG Composite Land Use Plan was compiled from public agency plans prepared by Maricopa County, and the municipalities and Indian communities within Maricopa County. On the Maricopa County Land Use Plan, this area is designated as a mountainous area. The plan shows the proposed Cave Buttes Dam at or near its recommended site.

II-4. THE PROBABLE IMPACT OF THE PROPOSED PROJECT FEATURE ON THE ENVIRONMENT

II-4.01 TOPOGRAPHY. The topography at the recommended damsite will be altered by the construction of the main embankment, three dikes, an unlined spillway, an unlined drainage channel, access roads and recreation facilities. The embankments, which will total 15,830 feet in length, will rise as high as 110 feet above the ground. An additional 1,860 acres will be affected by periodic inundation of flood waters.

II-4.02 The existing Cave Creek Dam has altered the topography of the area by impounding sediments. At the recommended Cave Buttes damsite 5,730 acre-feet of storage capacity has been allocated for the accumulation of sediment over the 100 year period following construction of the dam.

II-4.03 NATURAL RESOURCES. Construction of the project feature will have a minimal effect on the quantity of sand and gravel available for mining. The land under the dam embankment will be permanently removed as a potential resource. The land behind the dam will remain available for mining before the development of recreational facilities, or in areas where no facilities are planned.

II-4.04 Construction of the project feature will have no effect on the replenishment of sediments in the streambeds below the dam because the existing Cave Creek Dam presently traps most sediments.

II-4.05 Construction of the embankment and other structural features will require large quantities of material. An estimated 240 acres will be excavated as borrow to provide the required material. Approximately 220 acres of designated borrow is within the reservoir area.

II-4.06 SURFACE HYDROLOGY. Construction of the recommended dam will have no impact on the quantity of water flowing in Cave Creek downstream from the recommended damsite. Both the recommended dam and the existing Cave Creek Dam have outlet structures designed for an ungated maximum discharge of approximately 500 cfs.

II-4.07 SUBSURFACE HYDROLOGY. As a result of the construction of the dam, flood flows will be temporarily detained for later release at a controlled rate. This will increase ground water recharge potential by increasing the duration of flow in the downstream channel. While this will not have a significant effect of the total ground water of the study area, riparian vegetation along the channels may benefit from the increased duration of available moisture.

II-4.08 WATER QUALITY. The recommended project feature and associated recreational facilities will have no significant effect on the water quality in the area. Recreational use figures project that the damsite will be lightly used with respect to the size of the basin. Waste discharges associated with the equestrian and dog training activities will not be of sufficient quantity to effect the quality of water in the area. Recreational facilities will be maintained in accordance with applicable health standards.

II-4.09 AIR QUALITY. The recommended project feature will have a minor and localized effect on air quality. Development of the proposed recreational facilities will encourage some increased travel to and from the facilities.

II-4.10 VEGETATION AND WILDLIFE. Construction of the recommended project feature will result in the loss and/or alteration of natural vegetal communities and wildlife habitat over an extensive area. The direct losses and habitat modifications will not jeopardize biological communities regionally, because much of the biota found at the damsite is sparse and not unique to the general area. However, the impact is significant enough to warrant mitigation for loss of riparian habitat. In total, about 330 acres of desert biotic communities will be removed by the recommended project feature. Construction of the dam, three dikes, spillway, and access roads will permanently remove about 90 acres of native vegetation and wildlife habitat. Borrow areas upstream (140 acres) and downstream (20 acres) from the recommended dam will remove about 160 acres of wildlife habitat. In addition, borrow areas for materials to construct the dikes will remove about 80 acres of desert wash and outwash habitat within the confines of the standard project flood overflow area. When possible, borrow areas will be located where desert vegetation is not well developed to facilitate the removal of materials. In these cases, the damage to the natural biotic communities will be reduced. In total, an estimated 240 acres of desert wash and outwash habitats will be removed in the borrow areas. The disturbed areas will revegetate following construction activities, restoring some wildlife habitat; however, natural desert areas often revegetate very slowly following scraping or removing of surface soils. Most of the borrow areas will be located near the dam, where more frequent inundation will occur. Vegetative regrowth will be limited mostly to forbs and grasses. Those borrow areas not subject to frequent inundation will be contoured and landscaped to enhance the redevelopment of biotic communities. Still, without replacement of surface soils, natural desert tree and shrub growth may remain limited for many years in these borrow areas and annual forbs and grasses may predominate. The downstream slope of the dikes and dam will be landscaped and will revegetate, thus providing about 22 acres of habitat with some wildlife potential – mostly for small rodents, reptiles, and birds. The upstream slope of the dikes and dam will not be landscaped since it will be subject to periodic maintenance activities which will limit plant development to small herbaceous forbs and grasses.

II-4.11 An estimated 120 acres of fair to good quality desert wash habitat will be removed by project-related activities. The loss of desert wash habitat is significant since exploitation of rivers and streams in the Phoenix area, especially for sand and gravel, has removed much of this habitat. Sand and gravel mining from the existing Cave Creek Dam, downstream to the lower Cave Buttes damsite, has eliminated or highly disturbed all riparian habitat except for an estimated 50 acres. An estimated 110 acres of outwash plain and upland habitats will be removed by the proposed action. The remaining 100 acres of land to be altered by the project have a disturbed assemblage of vegetation (annual herbs, grasses, some shrubs and trees) or are devoid of most vegetation because of sand and gravel mining.

II-4.12 The proposed action will have the indirect impact of exposing a maximum area of 1,860 acres of biotic communities within the standard project flood overflow area to the effects of inundation and sedimentation during a large flood. It is more probable that flood damage to biotic communities would occur over a much smaller area. During a 100-year flood, a maximum of 1,410 acres of biotic communities will be inundated for about 4-1/2 days while an 80-acre area will be covered for about 36 days. A 10-year flood will inundate up to 500 acres of wildlife habitat for about 2 days and cover an 80-acre area for about 11 days. Prolonged inundation (14-30 days) and/or heavy sedimentation behind the dam will probably kill many trees and shrubs such as ironwood, mesquite, blue paloverde and catclaw acacia in the areas subject to such adverse conditions. The areas subject to frequent flood overflow is expected to develop disturbed desert wash or outwash communities. Weedy annual and perennial herbaceous plants and grasses, such as found behind the existing Cave Creek Dam, are expected to predominate in flooded areas. This vegetation provides habitat, including food and cover, for various wildlife such as dove, quail, song birds, raptors, rodents and reptiles. Increased water supply in the area behind the dam should enhance the growth of desert wash vegetation in the overflow area subject to infrequent flooding. The 9,000-foot-long dike located east of the recommended dam will cut off the natural drainage downstream from the dike, causing total vegetative cover and vigor to decrease (ref. 30). An estimated 90 acres of riparian growth will experience reduced vigor and cover; outwash vegetation downslope from the dike also will become impoverished. Upstream from the dike, riparian vegetation will show increased cover and vigor from the additional water. The effect of the dike upon the vegetative communities will be essentially a readjustment of plant biomass. No empirical data are present to indicate whether or not this effect is beneficial for desert wildlife.

II-4.13 ARCHEOLOGICAL AND HISTORICAL RESOURCES. The construction and operation of the recommended project feature will alter or destroy 16 archeological sites, 14 within the recommended site and two in a downstream borrow area. These sites are located within the Cave Buttes Archeological District, a property that has been nominated to the National Register of Historic Places (pl. 10). The type of land modification and inundation proposed for the recommended damsite precludes preservation of the cultural resources. Mitigation measures proposed by the Corps of Engineers to the Advisory Council on Historic Preservation include the mapping of the location of artifacts for sites outside the reservoir area. For sites located within the reservoir or downstream borrow areas, proposed mitigation measures include excavation, pollen analysis, carbon 14 and archaeomagnetism dating, identification of flora and fauna from archeological deposits, petroglyphic analyses of ceramics and the formulation of an adequate research design and testing program to identify and interpret the cultural resources removed from the sites.

II-4.14 POPULATION AND LAND USE. Construction of the recommended Cave Buttes Dam will not have a significant impact on the direction of future urbanization in the project area. The recreational facilities presently planned for the damsite are not of the type that would cause private development plans for the area to be escalated, resulting in increased urbanization in the direction of the dam. The construction of the project feature itself at the recommended site will commit approximately 2,000 acres of land to flood control and related purposes. This commitment has been incorporated into local land use plans.

II-4.15 SOCIAL. The Corps of Engineers has determined that the existing Cave Creek Dam is inadequate to control major floods. The Arizona Water Comission also conducted a safety evaluation of the existing structure and affirmed that Cave Creek Dam cannot continue to be operated without extensive alterations. Construction of the recommended project feature will have an affirmative effect on public safety and morale in the community by providing flood control while eliminating the danger of a possible failure of the existing dam.

II-4.16 Construction of the recommended dam and associated recreational facilities will require the relocation of 3 homes. Individuals involved in these relocations will be compensated according to the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

II-4.17 TRANSPORTATION. Construction of the dam will cause temporary adverse impacts on vehicular traffic in the area. An estimated 2,000 to 3,000 drivers per day will suffer increased traffic congestion and inconvenience while Cave Creek Road is being constructed over dike No. 2. The dam embankments and levees will constitute a permanent barrier to informal movement in the area.

II-4.18 RECREATION. The area in the vicinity of the recommended dam is presently used by hunters, hikers, and off-road vehicle operators. Most of this activity involves trespass. Construction of the dam and associated recreational facilities will eliminate some of the informal recreational activities presently taking place at the damsite. The proposed facilities will provide for a wide range of recreational opportunities.

II-4.19 ESTHETICS. Construction of the dam at the recommended site will obstruct essentially the same view as the existing Cave Creek Dam. Some areas near the damsite, including some existing sand and gravel mining operations, will be used as borrow areas to obtain construction materials for the dam embankments. After construction, these areas will be graded, shaped and replanted with native vegetation to reduce their visual impact. Removal of Cave Creek Dam will significantly affect the visually pleasing vegetation that has developed in the inundation area behind the dam. This disturbed area will be returned to a more natural, if less esthetically pleasing, desert vegetation by the removal of the dam. As sediments accumulate behind the proposed Cave Buttes Dam, a similar disturbed community will probably develop.

II-4.20 OTHER. The temporary effects on air quality, noise, traffic congestion, etc., resulting from construction activities will be the same as those discussed in Section I, paragraph 4.62.

II-5. ANY PROBABLY ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

II-5.01 The construction and operation of the recommended project feature will alter or destroy 16 archeological sites within the Cave Creek Archeological District.

II-5.02 Construction of the project feature will subject 1,860 acres of habitat to the effects of periodic inundation and sedimentation. A total of 330 acres of existing biotic communities will be permanently removed. Of this total, 20 acres are outside the reservoir area, and 120 acres are classified as riparian habitat.

II-5.03 Sediments transported by Cave Creek will be impounded by the recommended dam; an estimated 5,730 acre-feet of sediments will be impounded during a 100-year period.

II-5.04 Visual impairment will occur with construction of the project. The dam and appurtenances will be obviously artificial structures that many persons will consider unattractive.

II-5.05 The project feature will require relocation of 3 homes.

II-6. ALTERNATIVES FOR THE PROPOSED PROJECT FEATURE

II-6.01 INTRODUCTION. Only one alternative site to the recommended site for the Cave Buttes Dam project feature was considered. This alternative site, which is the authorized site, is discussed in the following paragraphs.

II-6.02 DESCRIPTION OF ALTERNATIVE. The alternative site is located 2 miles south of the existing Cave Creek Dam (about 1.3 miles south of the recommended site). The elements of a dam at this site would include an embankment, two dikes, a concrete-lined spillway, an outlet conduit, and access roads. These elements are described in paragraph II-1.03. Recreation facilities similar to those described for the recommended site would be included at the alternative site.

II-6.03 ENVIRONMENTAL EFFECTS OF THE ALTERNATIVE. The degree of flood protection provided by a dam at the alternative site would be almost identical to the protection provided by a dam at the recommended site. The effects of a dam at the alternative site on surface hydrology, subsurface hydrology, water quality, air quality, natural resources, social, recreation, noise, esthetics, population and land use, vegetation and wildlife, as well as construction related temporary impacts will be similar to those discussed for a dam at the recommended site. Construction of a dam at the authorized site will require an additional dike and the relocation of a major power transmission line that passes through the reservoir area. This additional construction will alter the topography of the area; increase the quantity of sand and gravel lost as a resource; and increase the disruption of vegetation and wildlife in the area.

II-6.04 REASON FOR REJECTION. Although the alternative would provide an equivalent degree of flood protection to that which would be provided by the recommended project feature, this protection would require an additional expenditure of $7.3 million. This increase in cost is due to the construction of an additional dike, a more costly spillway, and the relocation of a powerline.

II-7. THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

II-7.01 The recommended project feature will reduce flood damage to existing urban developments. This protection will be afforded not only to existing populations but also to future populations. The recommended project feature will also provide recreation facilities that will be available to both existing and future populations. The recommended project feature will provide for the study and recovery of archeological resources.

II-7.02 The project feature will permanently alter 330 acres of wildlife habitat.

II-8. ANY IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED

II-8.01 The recommended project feature plan will commit the land at Cave Buttes reservoir area (1,860 acres) for flood control and recreational purposes.

II-8.02 The project feature will result in the destruction of archeological resources at the Cave Creek Archeological District.

II-8.03 Construction of the dams and appurtenances will require 3.5 million cubic yards of earth (silt, sand, gravel and cobbles).

II-9. COORDINATION

II-9.01 Coordination for the Cave Buttes feature of this project is discussed in paragraph I-9.01. No special coordination was made concerning the Cave Buttes feature.

III

FEATURE OF
THE NEW RIVER &
PHOENIX CITY STREAMS
FLOOD CONTROL PROJECT

ADOBE DAM

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SECTION III

ADOBE DAM
Feature of the
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III-1. DESCRIPTION OF PROJECT FEATURE

III-1.01 PURPOSE. This section describes the Adobe Dam feature of the New River and Phoenix City Streams Flood Control Project. The section includes: (a) a detailed description of the recommended Adobe Dam project feature, (b) a description of the environmental setting in the immediate area of the recommended Adobe Dam, (c) the relationship of Adobe Dam to land use plans for the area, (d) the probable impact of Adobe Dam on the environment, (e) the probable adverse impacts which cannot be avoided should Adobe Dam be constructed, (f) an analysis of the alternative sites and facilities studied, (g) the relationship between the short-term use of the environment at the recommended damsite and the maintenance and enhancement of long-term productivity, (h) the irreversible and irretrievable commitment of resources which would be involved should the feature be constructed, and (i) the coordination effort which has taken place.

III-1.02 PROJECT FEATURE LOCATION. The site of the recommended Adobe Dam feature is on Skunk Creek northeast of the Hedgpeth Hills, and west of the Black Canyon Highway. The dam embankment, which will run northeast to northwest, will be approximately at Deer Valley Drive.

III-1.03 AUTHORIZED PROJECT FEATURE. The authorized Adobe Dam project feature is located immediately north of the Deem Hills and west of the Black Canyon Highway (shown as alternative site No. 2 on pl. 19). Elements of the authorized project feature comprise a dam embankment, outlet conduit, and a diversion channel and auxiliary levee. The authorized site shown on plate 14 has been modified slightly by skewing the axis of the dam embankment to avoid interference with the proposed Central Arizona Project (CAP) canal. No other modifications have been made. The embankment, as modified, would be about 5,340 feet long and would have a maximum height of 63 feet. The dam would have an ungated outlet conduit 8 feet in diameter, and an unlined spillway with a crest width of 300 feet. A diversion channel and an auxiliary levee would also be required to collect floodwaters flowing in Skunk Creek. This diversion system would convey standard project floodwater under Black Canyon Highway (Interstate Highway 17) and into the reservoir area. Modification of the existing highway would require two new 600-foot-long multiple-span bridges over the diversion channel.

III-1.04 RECOMMENDED PROJECT FEATURE. The location of the recommended Adobe Dam feature is shown as alternative site No. 4 on plate 19. The dam will control a 90-square-mile drainage area of Skunk Creek. Elements of the recommended project feature comprise a dam embankment, outlet works, and spillway; an access road; a channel and levee; modification of the Black Canyon Highway; and recreational facilities. These elements are described in the following subparagraphs.

a. Dam Embankment. The dam embankment will be 11,200 feet (2.1 miles) long with a crest elevation of 1,403 feet. The top of the dam will be a maximum of 63 feet above the existing streambed.

b. Outlet Works. The outlet works will comprise an ungated intake structure, an 8-foot circular conduit 302 feet long, and an energy dissipator capable of reducing the outflow velocity from 50 to 14 feet per second.

c. Spillway. The spillway will be located west of the dam embankment and will have a crest width of 50 feet and a total length of 743 feet, (including a 150-foot-long approach channel, a 571-foot-long converging chute section, and a 22-foot-long flip bucket).

d. Access Road. Entrance to the dam embankment and spillway by motor vehicles will be afforded by an access ramp between the existing paved Deer Valley Drive and the embankment. The ramp will be approximately 900 feet long. The western end of the embankment and the spillway area will be connected by a road approximately 1,700 feet in length.

e. Diversion Channel. The diversion channel will be approximately 2 miles northeast of the left abutment of the dam at the natural Skunk Creek crossing under the Black Canyon Highway. The existing channel will be enlarged by excavation to a greater depth and by widening the streambed from its existing 265 feet to 365 feet. The channel will be 6,900 feet in length, unlined, and trapezoidal in cross section. A levee will be constructed immediately south of the channel with excavated material. The levee will be approximately 7,600 feet long and will have a 16-foot crest width. Its height will vary from 6 to 10 feet above the channel invert. The streambed face of the levee will be revetted with a 2-foot layer of stone.

f. Modification of the Black Canyon Highway. Channelizing Skunk Creek will require the extension of two highway and two frontage road bridges. Each existing structure of 8 spans will be lengthened to 12 spans, extending the overall bridge length from 269 to 403 feet.

g. Recreational Facilities. The proposed Adobe Dam site is bounded on three sides by an existing regional park (Thunderbird) and 2 proposed regional parks (Deem Hills and Skunk Creek). Phased development of recreational facilities compatible with existing and proposed facilities in these 3 parks is planned at the damsite (see pl. 23) The first phase facilities to be developed will be regional in appeal and will comprise group and individual picnicking and camping facilities around the periphery of the site and riding and hiking trails designed to be continuous with existing and proposed trails in the adjacent regional parks. An equestrian center is planned for the eastern portion of the site, comprising a lighted gymkhana with facilities for spectators, a training ring, and an open riding area. A riding stable and associated facilities will be developed by a local sponsor in a nearby area. Community park facilities will be added as a later phase, as population increases in the immediate vicinity of the dam. Among the facilities proposed are a children's play area, active sports area and additional picnicking areas. An expansive area in the center of the damsite will be developed as an 18-hole professional golf course by Maricopa County Parks and Recreation Department in conjunction with facilities to be developed at Thunderbird Park.

III-2. ENVIRONMENTAL SETTING WITHOUT THE PROJECT FEATURE

III-2.01 INTRODUCTION. The four alternative sites (including the authorized site) considered in selecting the recommended site for the Adobe Dam feature are along Skunk Creek within an area about 11 miles long in a north-south direction and about 5 miles wide in an east-west direction (pl. 19). The environmental setting at each site varies, as do the appurtenant structures required. For this reason, and for ease in reference to a specific site, the description of the environmental setting has been separated into four subheadings, each dealing with one of the damsites. These sites, progressing from south to north along Skunk Creek, are:

a. The recommended site (also referred to as alternative site No. 4);

b. Alternative site No. 2 (which is a modification of the authorized site);

c. Alternative site No. 3; and

d. Alternative site No. 1.

The environmental setting at each of these sites is discussed in following subheadings.

The Recommended Site

III-2.02 TOPOGRAPHY. The recommended site (alternative site No. 4) is in Little Deer Valley (see photo 8). This valley is oriented in a northwest-southeast direction and has a general slope of 30 feet per mile. The site is bordered on its southwest margin by the steep Hedgpeth Hills, which reach an elevation of 1,905 feet. The elevation of the valley floor is about 1,352 feet. Pilcher Hill, Ludden Mountain, and the Deem Hills form the northwest border of the valley. Adobe Mountain, with an elevation of over 1,700 feet is on the east margin of the site. The land south of the site is without major landforms and slopes gently toward the Salt River.

III-2.03 GEOLOGY AND SOILS. The southwest abutment of the recommended dam is formed of tuff, tuffaceous agglomerate, and basalt, overlain with about 5 feet of consolidated older alluvium (mostly talus debris). There is no northeast abutment, as the embankment will feather out into the valley near the toe of Adobe Mountain. The spillway will be in a saddle about 1/2 mile west of the west abutment. It will be excavated in basalt and flow breccia. Evidence of faulting was found on each side of the spillway site. The valley floor is unconsolidated Recent and consolidated older alluvium of unknown thickness.

III-2.04 SURFACE HYDROLOGY. Skunk Creek is the dominant drainage that will be controlled by the dam. Skunk Creek enters the Little Deer Valley from the northeast through a low area between the Deem Hills and Adobe Mountain. The slope of the valley floor is such that water from all of the intermittent drainages and from Skunk Creek is concentrated at the southeast end of the Hedgpeth Hills. The recommended dam will not control flows on Scatter Wash, an ephemeral stream located east of Adobe Mountain. Based on stream gage records the average annual runoff for the Adobe study area is estimated to be 1,700 acre-feet annually. No surface water quality data is available for the site.

III-2.05 SUBSURFACE HYDROLOGY. Research of the U.S.G.S. well data for the recommended site indicates that the groundwater table varies from a measured depth of 250 to 420 feet.

III-2.06 VEGETATION AND WILDLIFE. The recommended site contains about 80 acres of natural desert wash vegetation and about 300 acres of natural desert outwash and upland vegetation. (pl. 24) Large scale man-made disruptions (cultivation, leveling, gravel pits) have disturbed the natural communities throughout most of the valley floor at this site. Little native vegetation remains except along the intermittent drainageways and where it has reestablished itself in fallow fields (see photo 8, 9). About 1,600 acres of land within the proposed project-feature area have highly disturbed plant communities. Of the four alternative sites considered, this site has experienced the most disruption to the natural communities from past and present agricultural activities and urban development. Along the drainageways, blue paloverde, ironwood and mesquite predominate; creosote bush, bursage, introduced grasses and weedy annuals and perennials from the old fields are now common plants in the areas between the drainageways. Many of the old (fallow) agricultural fields are covered with a seminatural assemblage of outwash plain vegetation. A sparse riparian community occurs along Skunk Creek through most of the study area where habitat modification and disturbance have been heavy. However, upstream from the Black Canyon Highway bridge (about 2 miles northeast of the east abutment of the dam), where channelization of Skunk Creek will be required, the riparian community is quite dense and well developed with such species as blue paloverde, mesquite, desert willow, burrobrush and wash bursage predominating.

III-2.07 On Adobe Mountain and in the Hedgpeth Hills (the proposed eastern and western dam abutments), the upland growth of creosote bush, bursage, brittlebush, little leaf paloverde, saguaro, and many small cacti has experienced little disturbance. Where water has collected along the north face of the Hedgpeth Hills, there is a dense growth of blue paloverde, mesquite and ironwood trees. This riparian area of about 30 acres provides excellent wildlife habitat utilized by game animals such as doves, quail, rabbits, jackrabbits, coyotes, fox, as well as many small rodents and various bird species. A stock-watering pond, located near this riparian habitat, retains water for several months following substantial rainfall.

III-2.08 ARCHEOLOGICAL AND HISTORICAL RESOURCES. A survey of archeological and historical resources within the recommended Adobe Dam site was conducted by Arizona State University, Department of Anthropology, under a contract with the Corps of Engineers. The survey identified five archeological sites at the recommended site. On the recommendation of the State Historic Preservation Officer the area bounding these sites, which comprises Section 21 and the southwest 1/4 of Section 22, in Township 4 North, Range 2 East, was nominated to the National Register of Historic Places as the Skunk Creek Archeological District (pl. 10). The Skunk Creek Archeological District was determined to be eligible for inclusion in the National Register in July 1975 (ref. 29).

III-2.09 Except for two occurrences of isolated stone tools, one on the top of Adobe Mountain and one on a colluvial ridge, all of the identified archeological resources are situated near the zone in which drainages from the valley are concentrated. Small temporary sites used while gathering foodstuffs may have existed in other sections of the valley, for example along Skunk Creek, but evidence has been destroyed by land subjugation. The limited spatial distribution of sites suggests that only in the southernmost part of the project area were there sufficient resources - available moisture, concentration of wild foodstuffs, and/or arable lands - to meet the requirements of even a small prehistoric population.

III-2.10 At least four major activity patterns are postulated, based on the attributes of the five recorded sites. The first major activity pattern is represented at two sites, which are classed as campsites. Concentrations of fire-cracked rock occur near scattered circles of stone which are interpreted as the margins of hearths and the locations of subsurface ovens. A complete lack of ceramics and the reestablishment of desert pavement on the fill over the features suggests some antiquity, possibly a date contemporaneous with the later stages of the Cochise. Stone tools, principally choppers, occur on the surface but are sparse. One metate fragment was noted. Food preparation is suggested as the dominant apparent activity.

III-2.11 The second major activity represented by an agricultural site occupies the southern end of a low colluvial bench adjacent to the flood plain of Skunk Creek. Ceramics from the site indicate an occupation within the period A.D. 900 to 1100. Surface remains suggest the presence of two subsurface structures, a refuse mound, and a wall 0.3 feet high along the east side of the site. No intact water control structures could be identified near the habitation. Repeated inundation of the Skunk Creek flood plain is evident; if structures were present, destruction or burial in the alluvium may have occurred.

III-2.12 The third major activity, gathering, has been identified on the west-facing upper slopes of the southeasternmost Hedgpeth Hills. The single site is characterized by stone tools scattered over the surface. The tools include choppers, hammerstones (pounders), and a knife, all made from materials imported from the riverbed below.

III-2.13 The fourth activity is represented by a rock art site (see photos 10, 11, and 12). Basalt boulders on the lower, east-facing slope of Hedgpeth Hills are covered with petroglyphs. Most of the representations occur within a 328-foot span and extend 82 feet up the slope. There is a decrease in the number of figures to the north and south along the slope from the above area. Some time depth is represented since there is superimposition of figures and there is a redevelopment of patina where the rocks have been pecked. A gradation from examples that appear relatively "fresh" to those which are almost the color of the unpecked surface is present. Figures include human and animal forms, combinations of biomorphic forms, and geometric designs.

III-2.14 There are no known historical sites in the study area.

III-2.15 POPULATION. As of July, 1975, the recommended site contained 9 residential dwelling units. The pattern of development depicted in the following tabulation is based on population projections for Maricopa County made by the Bureau of Economic Analysis of the U.S. Department of Commerce and the Economic Research Service of the U.S. Department of Agriculture (OBERS). The projections were allocated by the Corps of Engineers within the county on the basis of data provided by the Maricopa Association of Governments, historical trends, local and regional land use plans, current zoning and the National Flood Disaster Protection Act of 1973. The population projections were calculated for an area with a radius of 5 miles from the recommended Adobe Dam.

Year	Population	Density (Persons per sq. mi.)
1974	6,400	82
1990	21,760	278
2020	332,800	4,266

III-2.16 LAND USE. The majority of the land surrounding the recommended damsite is devoted to grazing. Most of the area shows evidence of cultivation at some time although crops are not now present. Housing construction has begun to encroach on the grazing lands. Some houses (primarily mobile homes) are located above and below the damsite and construction is underway on additional units. Some sand and gravel mining is evident in the surrounding area. Large piles of trash and other debris are conspicuous in the area. The area is also used for informal recreational activities. Land ownership at the damsite is shown on plate 25.

II-2.17 TRANSPORTATION. The site is served by three improved roads—Deer Valley Drive, Pinnacle Peak Road, and 35th Avenue—as well as numerous unimproved roads which crisscross the site. Two interchanges, at Pinnacle Peak Road and Deer Valley Drive, provide access to the Black Canyon Highway. The Deer Valley Airport is located 1 mile east of the site, offering access to private aircraft and connecting commuter aircraft to Sky Harbor Airport. No railroads are located near the site.

III-2.18 RECREATION. The site is bordered by regional parks on the north, east, and west (Deem Hills Park, Skunk Creek Recreational Area, and Thunderbird Park) and lies in the pathway of projected urban growth (pl. 12). There are no formal recreational facilities within the site. The site shows evidence of use by hunters and off-road vehicles, although this use involves trespass.

III-2.19 NOISE LEVELS. Near-by construction activities are the only sources of noise near the site.

III-2.20 ESTHETICS. Relative to the other Adobe Dam alternative sites, the recommended site has the least esthetic value. Adobe Mountain, which rises sharply out of the Little Deer Valley, is bounded closely on the east by the Black Canyon Highway. A mobile home park is sited close to the southern toe of the mountain. The Hedgpeth Hills have the greatest visual resource value in the site. The saddles where the two alternative spillway sites are located offer a less forbidding slope, thereby supporting more vegetation.

Off-road vehicle trails are visible on both of these saddles. As viewed to the northwest from the Black Canyon highway, two mobile home parks located in the valley lessen the visual quality of the mountains. The valley floor within the site has been cultivated, removing all the desert vegetation and leaving the valley floor furrowed. The land is presently lying fallow. Piles of rock and cobbles, as well as trash and rubbish, are present along Deer Valley Drive, Pinnacle Peak Road, and Skunk Creek. A sand and gravel mining operation has scarred the south side of the Hedgpeth Hills immediately north of the spillway alternative site No. 1.

Alternative Site No. 2 (Modified Authorized Site)

III-2.21 TOPOGRAPHY. Alternative Site No. 2 is in a valley that is confined by prominent topographic features. Middle Mountain, an isolated, triangular-shaped hill that rises some 170 feet above the valley, forms the east side of the damsite. The west side of the damsite consists of a north-south alinement of small hills that are outliers of the rugged terrain that divides the Skunk Creek drainage from the New River drainage. The valley is relatively flat between these hills, with a southward slope of 35 feet per mile. The elevation of the valley floor is 1,510 feet above sea level at this damsite.

III-2.22 GEOLOGY AND SOILS. The east abutment at this damsite consists of rhyolite overlain by a thin veneer of talus debris. The west abutment is basalt and rhyolite overlain by talus. The valley floor is Recent and older alluvium with a thickness of at least 20 feet, overlying tuffaceous agglomerate. There are two potential spillway sites. Spillway site No. 1 is located in a saddle, which is basalt, northeast of the east abutment. Spillway site No. 2 is located in a saddle about 1/4 mile to the west of the west abutment. The east side of the saddle is basalt, and the west side is deeply weathered granite.

III-2.23 SURFACE HYDROLOGY. The study area is characterized by numerous small intermittent drainages, of which only three are prominent. Two small washes converge a short distance south of the proposed damsite before joining Skunk Creek. A dam at this site without a diversion channel and levee would control flows generated from a watershed of 9 square miles.

III-2.24 SUBSURFACE HYDROLOGY. The depth to groundwater at Alternative Site No. 2 is 200 to 300 feet (ref. 23).

III-2.25 VEGETATION AND WILDLIFE. Riparian vegetation at Alternative Site No. 2 totals about 40 acres. The area is characterized by numerous small intermittent drainageways and three prominent tributaries that converge south of the proposed damsite. Riparian growth is best developed along the major drainages. Most of the vegetation at this site (about 1,200 acres) is representative of outwash plain and upland communities. The growth in these communities is quite sparse. A fire that occurred in 1973 burned over an estimated 200 acres of this alternative site. Recent modifications of the area have been minimal; about 25 acres of land have highly disturbed vegetation (this total excludes the burned acreage). The results of grazing are evident and several cattle watering tanks have been constructed in the area. One cattle watering tank, observed in September 1974, had a good level of water and had many large mesquite growing around it. Mallard and Cinnamon Teal ducks were flushed from this pond. A gravel pit of recent origin has disturbed some natural vegetation. Trailer homes have been established in the vicinity of the alinement of the dam embankment. Roads and trails through this area are minimal, helping to limit environmental disturbance of natural habitats.

III-2.26 ARCHEOLOGICAL AND HISTORICAL RESOURCES. Evidences of prehistoric activities at the Alternative Site No. 2 are scarce; no historic sites have been recorded. The two prehistoric sites found at Alternative Site No. 2 were characterized as nonceramic workshop and food preparation campsites. Both may be contemporaneous with the later stages of Cochise. The two sites are described in detail in the following subparagraphs.

a. AZ T:4:6 (ASU) occupies a colluvial ridge at the margin of a major tributary drainage and covers an irregular area 1,000 feet in diameter. The center of the site was characterized by a concentration of basalt cobbles, with the suggestion that the larger ones have been cleared from areas of the surface. The artifacts noted were primarily from the perimeter zone, about 300 feet wide, around the cobble concentration. The metates were all adjacent to the drainage; workshop debris consisting of flakes and debitage occurs to the east of the drainage. Along the drainage, one-half mile to the north and south of AZ T:4:6 (ASU), isolated flakes, cores, and metate fragments were recorded. On the recommendation of the State Historic Preservation Officer, site AS T:4:6 (ASU) was nominated to the National Register of Historic Places (pl. 10). In July 1975 the site was determined to be eligible for inclusion in the National Register (ref. 29).

b. The second site, which has not been nominated to the National Register, occupies higher ground between two drainages. Cultural materials were scattered sparsely over a trapezoidal-shaped area. The central part of the site lacked material culture objects. Flakes, debitage, and choppers were concentrated on the north side of the site; and metates were on the east and west closest to the drainages.

III-2.27 POPULATION. As of July, 1975, several residential units were located in the vicinity of alternative site No. 2. The pattern of development depicted in the following tabulation is based on population projections for Maricopa County made by the Bureau of Economic Analysis of the U.S. Department of Commerce and the Economic Research Service of the U.S. Department of Agriculture (OBERS). The projections were allocated by the Corps of Engineers within the county on the basis of data provided by the Maricopa Association of Governments, historical trends, local and regional land use plans, current zoning and the National Flood Disaster Act of 1973. The population projections were calculated for an area with a radius of 5 miles from Alternative Site No. 2.

Population Projections

Year	Population	Density (Persons per sq. mi.)
1974	Negligible	
1990	Negligible	
2020	108,800	1,394

III-2.28 LAND USE. Most of the study area is used for grazing under a lease with the Arizona State Land Department. A large cattle tank is located at the confluence of the two major drainages, about 1,500 feet north from the alinement of the dam embankment. A mineral mining lease occupies portions of the southwest margin of the study area. Recent gravel mining operations are evident. Roads and trails are scarce throughout the area. Low density residential land uses are beginning to appear southwest of Middle Mountain.

III-2.29 TRANSPORTATION. Alternative Site No. 2 can be reached from the west Black Canyon Highway frontage road. The site is located 2 miles north of the Happy Valley Road interchange. No improved roads or railroads service the area. The Deer Valley Airport is located about 4 miles southeast of the site. The Black Canyon Highway is located immediately east of the site.

III-2.30 RECREATION. No formal recreation resources are located within the site. The study area shows evidence of hunting and off-road vehicle use, although these uses involve trespass.

III-2.31 NOISE. There are no major point sources of noise within the study area.

III-2.32 ESTHETICS. The Deem Hills, Pyramid Peak, and Middle Mountain enclose Alternative Site No. 2. Scenic vistas from Middle Mountain include the Hieroglyphic Mountains to the far northeast across vast open expanses of Biscuit Flat, a flat alluvial plain. Residential development and mining operations have reduced the visual quality of the site.

Alternative Site No. 3

III-2.33 TOPOGRAPHY. Alternative Site No. 3 is on the broad valley northwest of the Union Hills. A dam at this site would lie between two small hills, one an outlier of the Union Hills and the other a small knoll. Elevations at the site range from 1,550 feet in the reservoir to 1,800 feet at the southeast abutment and 1,676 feet at the northwest abutment. The valley at the site has a slope of 50 feet per mile.

III-2.34 GEOLOGY AND SOILS. The northwest abutment is rhyolite capped by vesicular basalt. The southeast abutment consists of highly weathered granitic rock. Two faults were found near the southeast abutment. One fault strikes N50°-55°W and the other strikes N40°E. Dips of both faults are undetermined. The intensity of floodflows has removed much of the soil cover, leaving colluvial ridges divided by numerous channels ranging from a few inches to several feet deep in the older alluvium.

III-2.35 SURFACE HYDROLOGY. The dam embankment at Alternative Site No. 3 would not control Skunk Creek. Instead, the dam would control a large dendritic tributary drainage system that flows into Skunk Creek southwest of the damsite. This drainage system, which converges at the damsite, drains the southwest slopes of a range of hills and a valley to the north and northeast of the Union Hills. The site controls the drainage from an 11 square mile area.

III-2.36 SUBSURFACE HYDROLOGY. The depth to groundwater at Alternative Site No. 3 is estimated by the U.S.G.S. to be 200 to 300 feet (ref. 23).

III-2.37 VEGETATION AND WILDLIFE. Alternative Site No. 3 contains about 10 acres of desert wash vegetation and 175 acres of desert outwash plain and upland vegetation. The limited riparian growth is along intermittent dendritic drainageways which flow into Skunk Creek southwest of the damsite. In the outwash or bajada area, riparian species are missing and creosote bush, buckhorn cholla, grasses and occasional barrel cactus predominate. The hillslopes have the typical desert upland species. About 170 acres of the natural plant communities have been highly disturbed, altered, or eliminated by quarrying or other activities of man.

III-2.38 ARCHEOLOGICAL AND HISTORICAL RESOURCES. Investigations at Alternative Site No. 3 revealed the existence of three artifact concentrations which were recorded as sites.

III-2.39 In all three archeological sites the concentrations of artifacts are considered to represent campsites utilized while gathering foodstuffs. There is little to distinguish the sites from their surroundings except for the ceramic remains scattered over the surface.

III-2.40 POPULATION. As of July 1975, Alternative Site No. 3 contained no residential dwelling units. The patterns of development depicted in the following tabulation is based on population projections for Maricopa County made by the Bureau of Economic Analysis of the U.S. Department of Commerce and the Economic Reserarch Service of the U.S. Department of Agriculture (OBERS). The projections were allocated by the Corps of Engineers within the county on the basis of data provided by the Maricopa Association of Governments, historical trends, local and regional land use plans, current zoning and the National Flood Disaster Act of 1973. The population projections were calculated for an area with a radius of 5 miles from Alternative Site No. 3.

Population Projections

Year	Population	Density (Persons per sq. mi.)
1974	Negligible	
1990	Negligible	
2020	4,880	960

III-2.41 LAND USE. The majority of the land in Alternative Site No. 3 is vacant. The site contains no residential land use. One large quarry is present at the southeast end of the site. A cattle watering tank is located immediately west of the northwest abutment. Much of the acreage north of the site is used for grazing.

III-2.42 TRANSPORTATION. Alternative Site No. 3 can be reached from an unimproved road which connects the quarry operation with the Black Canyon Highway east frontage road about 3 miles southwest of the site. No railroads service the area.

III-2.43 RECREATION. No formal recreation resources are located within the site. The study area shows evidence of hunting and off-road vehicle use, although these uses involve trespass.

III-2.44 NOISE. The quarry is the only point source of noise in the site.

III-2.45 ESTHETICS. The nearby unnamed hills to the northeast provide a scenic background for the open grazing land of the site. The intensity of the floodwaters running across the site has removed much of the soil cover, cutting numerous channels several feet deep in the soft colluvial plain. Most of the site is sparsely vegetated except in the major drainageways where riparian growth predominates. The quarry operations have scarred the northeast end of the Union Hills, reducing their scenic quality.

Alternative Site No. 1

III-2.46 TOPOGRAPHY. Alternative Site No. 1 is 1.5 miles east of the Black Canyon Highway and 1.5 miles north of Carefree Road in the northeast part of Paradise Valley. A dam at this site would lie in a northwest-southeast trending range of mountains that lie southwest of the upper end of Paradise Valley. The dam embankment would be situated in a gap in this low range of mountains through which Skunk Creek flows in a southwest direction as it leaves Paradise Valley. Elevations at the site range from 1,750 feet at the reservoir site to 2,280 feet on the northwest abutment of the proposed dam. The valley floor has a slope of 80 to 90 feet per mile.

III-2.47 GEOLOGY AND SOILS. The northwest abutment consists of a thin layer of older alluvium (mostly talus debris) overlying well-cemented tuff and tuffaceous agglomerate. The southeast abutment consists of older alluvium overlying tuff and vesicular basalt. There are two potential spillway sites. Spillway site No. 1 would be excavated in basalt in a saddle located about 1/2 mile southeast of the dam embankment. A high-angle fault is located in this saddle and runs parallel to the centerline of proposed spillway site No. 1; Spillway site No. 2 would be in a saddle about 1-1/2 miles southeast of the dam embankment. The material in this saddle consists of older alluvium to about 15 feet in depth underlain by tuff, flow-breccia, basalt, and granite. Dike No. 1 (the west dike) would be located 1/2 mile north of the northwest abutment. Dike No. 2 (the east dike) would be centered about 2 miles east of the southeast abutment.

III-2.48 SURFACE HYDROLOGY. Skunk Creek, the dominant drainage to be controlled by a dam at Alternative Site No. 1, originates a short distance to the north in the New River Mountains. Skunk Creek flows through the western portion of the site, in a distinctly defined channel which passes through a gap between the prominent hills. An intermittent dendritic system drains the eastern three-fourths of the site and joins Skunk Creek at the gap. A dam at Alternative Site No. 1 would control drainage from a 47 square mile drainage area. No water quality data are available for this site.

III-2.49 SUBSURFACE HYDROLOGY. The depth to groundwater at Alternative Site No. 1 is 500 to 600 feet (ref. 23).

III-2.50 VEGETATION AND WILDLIFE. Alternative Site No. 1 contains about 1,385 acres of desert outwash and upland vegetation. A fairly dense riparian community, totalling about 70 acres, occurs along Skunk Creek and an adjacent drainageway where it flows through the western section of this site. Blue paloverde, mesquite and ironwood are the dominant tree forms; creosote bush, prickly pear, acacia and chollas also occur. Creosote bush attains a large size (8-10 feet tall) in the riparian zone. The vegetative communities on about 80 acres of land have been highly disturbed. Low intensity development (ranch homes) has occurred on some of the upstream lands within this alternative site. The result has been greater disturbances to natural wildlife habitats in the area and a decline in habitat quality; however, the presence of huntable populations of game species is suggested by the presence of a realty-owned hunting area at this site.

III-2.51 ARCHEOLOGICAL AND HISTORICAL RESOURCES. One concentration of cultural material classed as an archeological site was discovered at Alternative Site No. 1. The site is considered to be a temporary campsite used upon several occasions, or a seasonally-occupied farming unit. The site is situated on a low colluvial rise at the junction of two intermittent drainages, one of which is a side channel of Skunk Creek.

III-2.52 Scattered sherds or stone tools were also discovered in six areas along the "Skunk Creek Corridor" in the western portion of the damsite. It appears that floodwaters have destroyed other attributes of the use areas and have moved the objects so that the original spatial arrangement no longer exists.

III-2.53 POPULATION. As of July 1975, Alternative Site No. 1 contained 15 dwelling units within the proposed taking line. An additional 13 dwelling units would be isolated by a major flood. The pattern of development contained in the following tabulation is based on population projections for Maricopa County made by the Bureau of Economic Analysis of the U.S. Department of Commerce and the Economic Research Service of the U.S. Department of Agriculture (OBERS). The projections were allocated by the Corps of Engineers within the county on the basis of data provided by the Maricopa Association of Governments, historical trends, local and regional land use plans, current zoning and the National Flood Disaster Act of 1973. The population projections were calculated from an area with a radius of 5 miles from Alternative Site No. 1.

Year	Population	Density (per sq. mi.)
1974	Negligible	
1990	Negligible	
2020	4,990	64

III-2.54 LAND USE. A large part of the lands within the site have been taken over for homesteads, often with large fenced land parcels. Grazing leases with the State Land Department have been issued on much of the area.

III-2.55 TRANSPORTATION. The Carefree Road interchange of the Black Canyon Highway is located about 2 miles southwest of Alternative Site No. 1. The site can be reached by driving north on the unimproved road that merges with Carefree Road east of the freeway interchange. No railroads service the site.

III-2.56 RECREATION. A private, realty-owned hunting area is located within the site in the proposed reservoir area. The Black Canyon Shooting Range and Biscuit Tank Camp are located 1-1/2 miles southwest of the site. Scenic vistas from these hills include the Hieroglyphic Mountains on the western horizon and a northwestern extension of the McDowell Mountains, including Apache Peak and Black Mountain, on the northern and eastern horizons. The scenic value of the valley near the site has been reduced by the presence of many large homesites and unimproved roads which divide the study area into a grid pattern. A high tension powerline crosses the valley near the base of the McDowell Mountains, further reducing the scenic value of the valley.

III-3. RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE PLANS

III-3.01 The recommended Adobe Dam conflicts with the MAG Composite Land Use Plan and the Deer Valley Area Plan. These plans all designate rural and low density residential land uses for the affected area. The Maricopa County Future Land Use Plan shows Adobe Dam at the recommended damsite.

III-3.02 Although the recommended plan for the project feature conflicts with specific terms of several county and local land use plans, it conforms to the objectives of the land use plans by providing flood protection to land designated for urban land uses that is presently confronted with the threat of damages due to flooding.

III-4. THE PROBABLE IMPACT OF THE PROPOSED PROJECT FEATURE ON THE ENVIRONMENT

III-4.01 TOPOGRAPHY. The natural land forms at the recommended damsite will be altered by the construction of a dam embankment, outlet works, access roads, an unlined diversion channel, a levee, bridges on the Black Canyon Highway and recreational facilities. The project feature will require construction of 18,800 linear feet of embankments, rising as high as 63 feet above the ground. About 1,310 acres in the reservoir area will be affected by periodic inundation with flood waters. Further alterations will occur as a result of sediment accumulation behind the dam. A storage capacity of 2,700 acre-feet has been allocated for sediment accumulation over a 100-year period.

III-4.02 NATURAL RESOURCES. The project feature will have a minimal effect on the quantity of sand and gravel available to be mined. The land under the embankment will be permanently removed as a potential resource. The sediments that are entrapped behind the dam will not be conveyed to potential mining areas in the downstream river bed. These sediments along with other material behind the dams will be available for mining before the construction of recreational facilities, or where no facilities are planned. Construction of the embankment and levee will require large quantities of aggregate. About 205 acres, all within the reservoir, will be excavated to supply the necessary material.

III-4.03 SUBSURFACE HYDROLOGY. As a result of the construction of the dam, floodflows will be temporarily detained for later release at a controlled rate. This will decrease the volume of surface flows in the downstream channels during periods of flooding and will increase the duration of flow in the downstream channels. This, in turn, will increase the groundwater recharge potential. Potential recharge from floodflows is small and will not have a significant effect on groundwater recharge in the study area. Riparian vegetation along the stream channel may benefit from the increased duration of available moisture.

III-4.04 WATER QUALITY. The recommended project feature and associated recreational facilities will not affect water quality in the area. Water for the irrigation of activity areas and filling and maintenance of lagoons in the proposed golf course will come from existing wells. These wells presently meet water quality requirements for agricultural, recreation and esthetic uses as established by the Arizona State Department of Health. The lagoons will be maintained in keeping with these standards.

III-4.05 VEGETATION AND WILDLIFE. Construction of the recommended project feature will result in the loss and/or alteration of natural vegetation and wildlife habitat over about 400 acres, although the natural habitats previously have been highly disturbed or completely altered by man's past land use activities throughout all but about 300 acres of the Adobe area. The elimination of biological communities by the proposed project is an adverse impact significant enough to warrant mitigation for loss of riparian habitat. Construction of the dam, spillway access roads and Skunk Creek diversion channel and levee, will permanently remove about 200 acres of vegetation and wildlife habitat. One large borrow area immediately upstream from the dam will remove about 200 acres of biotic communities. The areas disturbed by project construction will revegetate following construction activity restoring some wildlife habitat. Portions of the borrow area not subject to frequent flooding will be contoured and landscaped to enhance redevelopment of biotic communities.

III-4.06 The downstream surface of the proposed dam will have extra fill provided and the surface will be landscaped with trees, shrubs, herbaceous vegetation and grasses. About 26 acres of the dam face will have some wildlife habitat potential. Such wildlife as lizards, rodents, and birds would be expected to utilize the available habitat. The upstream dam surface will not be landscaped since maintenance activities will limit plant growth and wildlife habitat value will be very limited.

III-4.07 An estimated 50 acres of desert wash vegetation within the detention basin area, including many large mesquite, will be removed. This desert wash habitat has high value locally for wildlife species, especially doves, quail, rabbits and song birds and the loss will be mitigated by acquisition of similar riparian habitat. About 100 acres of outwash and upland habitat and an estimated 250 acres of highly disturbed vegetation in old agricultural fields will be removed by the project. Most of the vegetation and wildlife habitat that will be removed is neither unique nor of especially good quality. The impact of the proposed action will be greatest upon small mammals, reptiles and various bird species.

III-4.08 In addition to the desert wash habitat lost in the immediate Adobe Dam detention area, an estimated 15 acres of desert wash habitat will be removed by the channelization of about 6,900 feet of Skunk Creek in the vicinity of the Black Canyon Highway. In total, about 100 acres of Skunk Creek channel and adjacent flood plain (includes center of channel with no vegetative growth, good to excellent desert wash vegetation and outwash plain habitat) will be affected by the channelization and levee construction both upstream and downstream from the Black Canyon Highway. The loss of this habitat will affect mostly song birds, doves, rabbits, small rodents and reptiles. Some native vegetation will reestablish along the channel and on the proposed levee along the channel within several years, thus recovering some wildlife habitat value for the area.

III-4.09 The proposed action will expose about 1,310 acres of biotic communities to the effects of inundation and sedimentation during a standard project flood. It is more probable that flood damage to biotic communities would occur over a much smaller area. A 100-year flood will inundate a maximum of 775 acres for about 1 day and about 70 acres for 3-1/2 days. A 10-year flood will cover about 300 acres for 1 day and 70 acres for 1-1/2 days. Most of the area that potentially could be affected has a limited growth of native trees and shrubs that might be adversely impacted by prolonged inundation and heavy sedimentation. The community composition is predominantly herbaceous plants, grasses and some shrubs such as creosote bush and bursages. The influence of additional water in the area behind the dam should enhance the growth of riparian plant species. Riparian and outwash growth along Skunk Creek downstream from the dam will have a significantly reduced water supply; total plant vigor and cover will be significantly reduced along the creek channel.

III-4.10 Locally, the total project impact on small wildlife species such as rodents, lizards and birds will be substantial because of the extent of the area influenced. The loss of the old field vegetation and disturbed outwash habitat will reduce feeding areas for many local and migratory birds, including song birds, hawks and doves. No endangered plant or wildlife species will be jeopardized by the proposed action.

III-4.11 ARCHEOLOGICAL AND HISTORICAL RESOURCES. The construction of the recommended project feature will directly alter or destroy three archeological sites, and indirectly affect two additional archeological sites. All of these sites are within the Skunk Creek Archeological District, a property that has been officially nominated to the National Register of Historic Places (pl. 10). The three sites that will be directly affected include desert culture campsites and a habitation site which dated after A.D. 900. The two sites that will be indirectly affected are a petroglyphic site and food gathering area.

III-4.12 In a preliminary case report to the Advisory Council on Historic Preservation, the Corps of Engineers has presented a proposal to mitigate for any adverse effects on these five sites located within the Skunk Creek Archeological District. The mitigation action proposed by the Corps includes the systematic mapping and excavation of the directly and indirectly affected sites, pollen analysis and the formulation of an adequate research design and testing program to identify and interpret the cultural resources removed from the sites. The Corps further proposes to acquire the indirectly affected petroglyphic site to assure positive control over its preservation. A plan is being prepared to incorporate this site into an educational display which will be part of the project feature recreation development.

III-4.13 POPULATION AND LAND USE. Construction of the recommended dam will have an impact on land use in the area. The dam will provide 1,310 acres of permanent open space in an area presently designated by most local land use plans for rural and low density residential uses. The construction of Adobe Dam will reduce the Skunk Creek floodway, allowing for the potential urbanization of 865 acres. Demand for urban development of this acreage is not projected until 1986. This area is presently designated on local land use plans for low density residential uses. The recreational facilities presently planned for the damsite are not of the type that will cause private development plans to be escalated.

III-4.14 SOCIAL. The recommended Adobe Dam will have positive and negative effects on community morale. The dam will act as a permanent barrier – separating residents in the area and restricting movement. Some of the people living immediately downstream of the site may be disturbed by the prospect of living below a dam. However, the dam will provide protection against flooding and will increase public safety. Construction of the dam will result in the relocation of 9 homes. Individuals involved in the relocations will be compensated in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

III-4.15 TRANSPORTATION. Construction of the dam embankment will result in the termination of Deer Valley Drive east of 35th Avenue; 35th Avenue north of Deer Valley Drive will be rerouted over the dam embankment. This will inconvenience people living in the area during the construction period. Construction of the project feature will require the extension of 2 bridges on the Black Canyon Highway and 2 bridges on frontage roads. A detour system will be required and will result in increased traffic congestion and inconvenience to travelers during the construction period.

III-4.16 RECREATION. Recreational facilities proposed for the damsite will provide for a wide range of recreational opportunities. Construction of the facilities will eliminate some of the informal, and often illegal, uses of the site.

III-4.17 ESTHETICS. The recommended Adobe Dam will have an impact on the esthetic quality of the area. As a large and unavoidable obstacle, to be built in close proximity to existing homes, the dam will severely restrict the sense of open space and the natural vistas in the area.

III-4.18 In an attempt to reduce the visual prominence of the dam, the main embankment will be contoured and all the structural features will be replanted with native vegetation. The borrow areas will be restored as nearly as possible to natural-looking conditions. The reservoir area behind the dam will be preserved as recreational open space, unavailable for urban development. The landscaping associated with the completed recreational facilities will provide an attractive visual resource. Under present conditions, the dam would be visible to travelers driving north on the Black Canyon Highway. However, commercial development along frontage roads and landscaping of the highway median will eventually eliminate any view of the dam from the highway.

III-5. ANY PROBABLY ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

III-5.01 Construction of the recommended project feature will subject 1,310 acres of biotic communities to the effects of periodic inundation and sedimentation. Within the reservoir area, 400 acres of natural vegetation will be altered or destroyed. An additional 15 acres outside the reservoir will also be affected. Of the 415 acres affected, 65 acres contain good quality riparian habitat.

III-5.02 Construction of the recommended project feature will directly alter or destroy 3 archeological sites and indirectly affect 2 additional sites. All of these sites are within a district that has been nominated to the National Register of Historic Places.

III-5.03 Sediments transported along Skunk Creek will be impounded by the recommended dam; an estimated 2,700 acre-feet of sediments will be impounded during a 100-year period.

III-5.04 Visual impairment will occur with construction of the project. The dam and appurtenances will be obviously artificial structures that many persons will consider unattractive.

III-5.05 The project feature will require the relocation of 9 homes.

III-6. ALTERNATIVES TO THE PROPOSED PROJECT FEATURE

Introduction

III-6.01 During plan formulation for the Adobe Dam project feature, 4 feasible damsites were identified in the upper reaches of the Skunk Creek overflow area (see pl. 19). These damsites were considered separately and in combination, and 5 alternatives (in addition to the recommended project feature) were developed to maximize flood protection. Comparative cost-benefit relationships and environmental effect were also considered. The 5 alternatives to the recommended project feature comprise (a) a single dam at site 2, (b) a single dam at site 1, (c) dams at sites 1 and 2, (d) dams at sites 1 and 4, and (e) dams at sites 1, 2, and 3. These alternatives are discussed under the following subheadings.

Single Dam at Site No. 2

III-6.02 DESCRIPTION OF ALTERNATIVE. The main elements of a single dam at site 2 would include a main embankment, ungated outlet works, access roads, and a concrete-lined spillway. In addition, the site would require the construction of a diversion channel and auxiliary levee to collect flood flows on Skunk Creek. This diversion system would carry floodwaters under the Black Canyon Highway, necessitating modification of the highway. Two locations for the diversion channel and levee were investigated. The configuration referred to as 2C would control a drainage area of 76 square miles. Configuration 2B would control a drainage area of 58 square miles. The environmental effects of the 2 configurations are essentially the same.

III-6.03 ENVIRONMENTAL EFFECTS OF ALTERNATIVE. The environmental effects of a single dam at site 2 are discussed in the following subparagraphs.

a. Topography. The topography of the area would be altered by construction of 12,530 linear feet of embankments, levees, an lined spillway, a stone revetted diversion channel, access roads, modifications to Black Canyon Highway, and associated recreational facilities. In the reservoir, 1,010 acres would be subject to alteration by periodic inundation during flooding. Further changes would occur as sediments accumulate behind the dam; 2,269 acre-feet of storage would be allocated for accumulation of sediments over a 100-year period.

b. Natural Resources. Construction of a single dam at site 2 would have an impact on the available sand and gravel resources in the area. An existing mining operation in the area would be affected. In addition, the land under the embankments would be permanently removed as a potential resource. Sediments trapped behind the dams would not be conveyed to the downstream channels, but would become available periodically when the reservoir storage areas were cleaned. Construction of the embankment and dikes would require large quantities of material that would be excavated from suitable locations near the damsite.

c. Subsurface Hydrology. As a result of construction of a dam at site 2, flood flows would be temporarily detained for later release at a controlled rate. This would result in a decrease in the volume of surface flows in the downstream channel during periods of flooding, and would increase the duration of flow in the downstream watercourse. This in turn would increase the groundwater recharge potential. While the increase in potential recharge would not be sufficient to affect the total groundwater regime in the area, riparian vegetation along the stream channels could benefit from the increased duration of available moisture.

d. Water Quality. A single dam at site 2 and the associated recreational features would have no effect on water quality in the area.

e. Vegetation and Wildlife. Construction of this alternative would result in the loss and/or alteration of natural vegetation and wildlife habitat over an estimated 410 acres. Construction of the dam, spillway, Skunk Creek diversion channel and access roads would permanently remove an estimated 310 acres of biotic communities. Borrow areas, although undesignated, would probably result in the removal of an estimated 100 acres of wildlife habitat. The borrow area habitat losses are not permanent since these areas, would vegetate following construction activities, although habitat revegetation may be very slow. Borrow and other disturbed areas would be contoured and landscaped to enhance redevelopment of biotic communities. These area would recover some wildlife habitat value for reptiles, small rodents and birds. An estimated 20 acres of desert wash vegetation, 370 acres of outwash habitat and 20 acres of upland habitat that would be removed or altered are neither unique nor of especially good quality. The impact would be greatest upon small mammals, reptiles and various bird species. The alternative would expose about 1,170 acres of biotic communities within the standard project flood overflow area to the effects of inundation and sedimentation during such a large flood. It is more probable that flood damage to biotic communities would occur over a much smaller area (acreage undetermined) during either 50 or 100-year floods. Most of the area has a very limited growth of natural trees and shrubs that might be adversely impacted by prolonged inundation and heavy sedimentation. The influence of additional water in the area behind the dam should enhance the growth of riparian vegetation. Riparian and outwash growth downstream from the dam probably would decrease except along Skunk Creek because of reduced water supply. The total impact upon vegetation and wildlife for this site would be small because of the sparse cover, high amount of disturbance, and limited riparian growth. However, riparian habitat losses would be mitigated because of the high importance of this habitat for wildlife. No threatened or endangered plant or wildlife species would be jeopardized by this alternative.

f. Archeological and Historical Resources. The construction of a single dam at site 2 would directly alter or destroy two archeological sites classified as non-ceramic workshops and food preparation campsites. One of these sites has been nominated to the National Register. This site, designated as AZ T:4:6 (ASU), would only be inundated by major floods. The second site would be destroyed by the diversion channel and levee. Mitigative measures would be identical to those discussed in the recommended plan.

g. Population and Land Use. Construction of this alternative would have no effect on the future population or land use in the area. Local and county land use plans presently show Adobe Dam at site 2. The recreational facilities that would be provided would not cause private development plans to be escalated, nor would the projected pattern of urbanization in the area be affected.

h. Social. At the present time no residences are located within the taking line of the dam. However, several residences may be affected by the immediately adjacent construction activities. If relocation of any homes becomes necessary, individuals involved in the relocations would be compensated in accordance with the Uniform Relocation Assistance of Real Property Acquisition Policies Act of 1970. The alternative would reduce the fear of flooding and would increase community morale and public health and safety.

i. Transportation. Construction of a single dam at site 2 would require the construction of 2 new bridges on Black Canyon Highway. Detours required during the construction of each bridge would cause increased traffic congestion during the construction period. The embankment and levee would be permanent barriers to informal human movement.

j. Recreation. The recreational facilities that would be built as a part of this alternative would be identical to those provided in the recommended project feature. These facilities would provide recreational opportunities, while eliminating some of the informal activities for which the damsite is currently being used. Most of the informal activities involve trespass.

k. Esthetics. Construction of a dam at site 2 would have a significant impact on the visual quality of the area. Both the embankment and diversion levee would be easily visible from the Black Canyon Highway and would obstruct the natural view. Levees and borrow areas would be sculptured and replanted with native vegetation to reduce the visual effect of the structures. Increased urban development would eventually eliminate any view of the dam from the highway.

l. Other. Two configurations for a single dam at site 2 were studied. The only major difference between the 2 configurations is the location of the diversion channel and levee. The environmental effects of the two configurations would be essentially the same.

III-6.04 REASONS FOR REJECTING ALTERNATIVE. Due to complications caused by the location of the Black Canyon Highway and the Granite Reef Aqueduct, as well as the hydraulicly inefficient alinement of the diversion channel intercepting the flow in Skunk Creek, a more economical and hydraulically efficient damsite along Skunk Creek was selected.

Single Dam at Site No. 1

III-6.05 DESCRIPTION OF ALTERNATIVE. The main elements of a single dam at site 1 would include an embankment, 2 saddle dikes, ungated outlet works, access roads, and a concrete-lined spillway. A dam at this site would provide flood control for a drainage area of 47 square miles.

III-6.06 ENVIRONMENTAL EFFECTS OF ALTERNATIVE. The environmental effects of a single dam at site 1 are discussed in the following subparagraphs.

a. Topography. The effects of this alternative in topography would be similar to the effects of a single dam at site 2 except that a total of 11,800 linear feet of artificial embankments would be created, and 1,270 acres in the reservoir area would be affected by periodic inundation by floodwaters. Further alterations would result from the accumulation of sediment behind the dam; 1,406 acre-feet of storage would be allocated for sediment accumulation over a 100-year period.

b. Natural Resources. The effects of this alternative on natural resources would be similar to the effects of a single dam at site 2, except that no mining operations are presently located near the damsite.

c. Subsurface Hydrology. The effects of this alternative on subsurface hydrology would be similar to the effects of a single dam at site 2.

d. Water Quality. This alternative would have no effect on water quality in the area.

e. Vegetation and Wildlife. Construction of this alternative would result in the loss and/or alteration of natural vegetation and wildlife habitat over an estimated 500 acres. Construction of the dam, spillway, two dikes and access roads would permanently remove about 155 acres of biotic communities. Borrow areas, although undesignated, would probably result in the removal of an estimated 250 acres of wildlife habitat. Habitat losses within the borrow areas would not be permanent since these areas would revegetate following construction activities, although natural revegetation might be very slow. Borrow and other project disturbed areas would be contoured and landscaped to enhance redevelopment of biotic communities. These areas would recover some wildlife habitat value for reptiles, small rodents and birds. An estimated 40 acres of desert wash vegetation and 460 acres of outwash and upland habitat would be removed within the proposed project area. Riparian vegetation losses would be mitigated because of the high ecologic value of this habitat. The habitat losses would affect mostly reptiles, small rodents, rabbits, and birds. The alternative would expose about 1,380 acres of biotic communities to the effects of inundation and sedimentation during such a large flood. It is more probable that flood damage to biotic communities would be confined to a much smaller area (acreage undetermined) during 50 to 100-year floods. The influence of additional water in the area behind the dam should enhance the growth of riparian vegetation. The total impact upon vegetation and wildlife for this site would be small. Replanting of natural vegetation would help recover many wildlife habitat values. No threatened or endangered plant or wildlife species would be jeopardized by this alternative.

f. Archeological and Historical Resources. The construction of a single dam at site 1 would directly alter or destroy only one archeological site, classified as a temporary campsite or a seasonally occupied farming unit.

g. Population and Land Use. Construction of this alternative would have an impact on land use in the area. As of 1975, 28 families live behind the dam, 15 of which would have to be relocated. Local land use plans designate the area (behind the dam) to remain natural desert. The 1,270 acres of land subject to inundation by a standard project flood would become permanent open space, unavailable for urban uses. The recreation facilities that would be provided would not cause large-scale private development plans to be escalated.

h. Transportation. Construction of the embankment would terminate the major access road (Carefree Road) into the area behind the dam. Although other access is available, 13 families would be isolated by a major flood. To mitigate this adverse effect, an alternative access to Carefree Road would be constructed.

i. Social. Construction of a dam at this site would require the relocation of 15 families. Individuals involved in the relocations would be compensated in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

j. Recreation. The effects of this alternative on recreation would be identical to those resulting from the recommended plan.

k. Esthetics. A dam at site 1 will be visible to people traveling north on the Black Canyon Highway or Carefree Road. It would also be visible to people living behind the dam. However, due to its location, the dam would do little to restrict the natural vistas available behind the dam.

III-6.07 REASONS FOR REJECTING ALTERNATIVE. A dam at site 1 would provide less flood protection to the urbanizing Phoenix area than a dam at the recommended site. Site 1 is the farthest upstream site on Skunk Creek. The dam is a great distance from the urbanized area and no protection would be provided from floods originating from rain storms falling below the damsite.

Dams at Sites 1 and 2

III-6.08 DESCRIPTION OF ALTERNATIVE. This alternative calls for the construction of 2 dams. The upstream dam, at site 1, would control a drainage area of 47 square miles and would be identical to the single dam considered at site 1. The second dam, at site 2, will include an embankment, ungated outlet works, access roads and a concrete-lined spillway. No diversion channel or levee will be required, thereby eliminating the need to modify the Black Canyon Highway. As part of a combination, the dam at site 2 would be smaller than a single dam at the same site, and would control only 9 additional square miles of drainage area.

III-6.09 ENVIRONMENTAL EFFECTS OF ALTERNATIVE. As part of a combination, the dam proposed for site 1 would be identical to the single dam considered at the site, and the impacts will be identical to those discussed in paragraph III-6.06. The additional effects of a small dam at site 2 are discussed in the following subparagraphs.

a. Topography. The natural topography of the damsite would be altered by the construction an 5,120 lineal feet of embankment, reaching a height of 35 feet, and by construction of a lined spillway, access roads, and recreational facilities. About 250 acres in the inundation area would be subject to periodic inundation by floodwaters. Further alterations would result from sediment accumulation behind the dam; 270 acre-feet of storage would be allocated for sediment accumulation over a 100-year period.

b. Natural Resources. The effects of a small dam at site 2 on natural resources would be substantially the same as those discussed in paragraph III-6.03, though of lesser magnitude. The existing mining operation at the site would be affected.

c. Subsurface Hydrology. The small dam at site 2 would contribute to the effects on subsurface hydrology previously discussed for single dam alternatives.

d. Water Quality. The dam and associated recreational facilities would have no effect on water quality in the area.

e. Vegetation and Wildlife. This alternative would have essentially the same effects on vegetation and wildlife as previously discussed for single dams at sites 1 and 2.

f. Archeological and Historical Resources. The impacts of this two dam combination would be identical to the impacts of single dams proposed for sites 1 and 2.

g. Population and Land Use. Construction of a small dam at site 2 would have no effect on the future population and land use in the area.

h. Social. Construction of the dam at site 2 would require the relocation of no homes or businesses.

i Transportation. The dam embankment would become a permanent barrier to informal human movement.

j. Recreation. The recreational facilities that would be provided at the damsite would provide for a wide range of recreational opportunities. This would eliminate some of the informal activities for which the site is currently used, often illegally.

k. Esthetics. Construction of a dam at site 2 would have an impact on the visual quality of the area. As part of a combination, a dam at site 2 would be reduced in size from a single dam at the same site, and would have a correspondingly reduced visual effect. The embankment might be visible from Black Canyon Highway for a period of time, but increasing development and landscaping along the highway would eventually block any view of the structure.

III-6.10 REASONS FOR REJECTING ALTERNATIVE. The additional flood control benefits obtained by constructing dams at sites 1 and 2 would not be sufficient to offset the increases in construction costs and the increase in environmental impacts associated with construction at both sites.

Dams at Sites 1 and 4

III-6.11 DESCRIPTION OF ALTERNATIVE. This alternative calls for the construction of 2 dams. The upstream dam at site 1 would control a drainage area of 47 square miles and would be identical to the single dam proposed for site 1. The second dam, at site 4, will be smaller than the single dam proposed for the site as part of the recommended plan. The dam, consisting of an embankment, ungated outlet works, access roads, and concrete lined spillway, would control an additional 43 square miles of drainage area.

III-6.12 ENVIRONMENTAL EFFECTS OF ALTERNATIVE. As part of a combination, the dam proposed for site 1 would be identical to the single dam proposed for site 1, and the impacts would be the same as those described in paragraph III-6.06. The additional effects of a small dam at site 4 are discussed in the following subparagraphs.

a. Topography. The area of the damsite would be altered by the construction of 9,380 lineal feet of embankment, a maximum of 49 feet high, along with outlet works, access roads, a lined spillway and associated recreational facilities. About 800 acres in the reservoir area would be periodically affected due to inundation by floodwater. Further alteration will occur as a result of sediment accumulation behind the dam. A storage capacity of 1,300 acre-feet has been allocated for sediment accumulation over a 100-year period.

b. Natural Resources. The effects of a small dam at site 4 on natural resources would be similar to those discussed in previous alternatives. No mining operations are presently being conducted at the site.

c. Subsurface Hydrology. The dam at this site would contribute to the effects on subsurface hydrology previously discussed for other alternatives.

d. Water Quality. The dam and associated recreational facilities would have no effect on the water quality in the area.

e. Vegetation and Wildlife. This alternative would have essentially the same effect as those described for a single dam proposed for site 1 and the recommended dam proposed for site 4.

f. Archeological and Historical Resources. The effects of this 2 dam combination on archeological and historical resources would be identical to those described for the single dam at site 1 and the recommended dam proposed for site 4.

g. Population and Land Use. Construction of a dam at site 4 would have an impact on land use in the area. The dam would provide 800 acres of permanent open space in an area presently designated by local land use plans for rural and low density residential uses. The recreational facilities that would be provided at the damsite are not of the type that would cause private development plans to be escalated.

h. Social. Construction of the dam would result in the relocation of 9 homes. Individuals involved in the relocations would be compensated according to the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

i. Transportation. Construction of the dam embankment would result in the termination of Deer Valley Drive west of 35th Avenue. Deer Valley Drive would be relocated over the embankment. This will cause inconvenience to people living in the area.

j. Recreation. The recreational facilities that would be provided would provide for a wide range of recreational opportunities. Construction of the facilities would eliminate some of the informal and often illegal uses of the site.

k. Esthetics. A dam at site 4 would have an effect on the visual quality in the area. As a large and unavoidable obstacle, to be built in close proximity to existing homes, the dam would severely restrict the sense of open space in the area. The dam might be visible to north-bound travelers on the Black Canyon Highway for a period of time, but increasing commercial development and landscaping along the highway would eventually eliminate any view of the dam.

III-6.13 REASONS FOR REJECTING ALTERNATIVE. The increased costs of constructing dams at both site 1 and site 4 would be offset by the increase in flood control benefits obtained. However, construction of the 2 dams would increase the adverse effects on the environment without providing for significantly greater flood control benefits than a dam at the recommended site.

Dams at Sites 1, 2, and 3

III-6.14 DESCRIPTION OF ALTERNATIVE. Three dam combination (Sites 1, 2, and 3). This alternative calls for the construction of 3 dams. The dams at sites 1 and 2 would be identical to the dams described in paragraph III-6.08. The third dam, to be constructed at site 3, would include an embankment, ungated outlet works, access roads, and concrete lined spillway. An additional 11 square miles of drainage area would be controlled by the third dam.

III-6.15 ENVIRONMENTAL EFFECTS OF ALTERNATIVE. As part of a 3-dam combination, the effects of the dams at sites 1 and 2 would be identical to those discussed in paragraph III-6.09. The additional effects of a dam at site 3 are discussed in the following subparagraphs.

a. Topography. Topographic alterations would result from the construction of an embankment, levee, unlined spillway access roads, and recreational facilities. A total of 5,900 feet of artificial embankment would be created, and 260 acres in the reservoir area would be affected by periodic inundation by floodwaters. Further alterations will occur as a result of sediment accumulation behind the dam; 320 acre-feet of storage has been allocated for sediment accumulation over a 100-year period.

b. Natural Resources. An existing sand and gravel mining operation at the area would not be required to relocate and would not be affected. The other effects of a dam at site 3 on natural resources would be similar to those discussed in previous alternatives.

c. Subsurface Hydrology. The dam at site 3 would contribute to the effects on subsurface hydrology previously discussed for other alternatives.

d. Water Quality. A dam and associated recreational facility at site 3 would have no effect on water quality in the area.

e. Vegetation and Wildlife. Construction of this alternative would result in the loss and/or alteration of natural vegetation and wildlife habitat over an estimated 170 acres. The dam, spillway, dike and access roads would permanently remove about 45 acres of biotic communities. Borrow areas, although undesignated, would probably result in the removal of an estimated 125 acres of wildlife habitat. Habitat losses within the borrow area would not be permanent since these areas would revegetate following construction activities, although natural habitat vegetation might be very slow. The borrow and other areas disturbed by construction would be contoured and landscaped to enhance redevelopment of biotic communities. These areas would recover some wildlife habitat value for reptile, small rodents and birds. An estimated 5 acres of desert wash vegetation, 50 acres of natural outwash, and 115 acres of highly disturbed vegetation and upland habitat would be removed within the proposed project area. Riparian vegetation losses would require mitigation because this habitat has high ecology value for wildlife. The habitat losses would affect mostly reptiles, small rodents, rabbits and birds. The alternative would expose about 315 acres of biotic communities within the standard project flood overflow area to the effects of inundation and sedimentation during such a large flood. It is more probable that flood damage to biotic communities would be confined to a smaller area (acreage undetermined) during either 50 or 100-year floods. Riparian vegetative growth upstream from dam should be enhanced because of the additional water supply. Likewise, riparian and outwash vegetation downstream from the dam may experience somewhat reduced vigor and cover because of less water supply. The total impact upon vegetation and wildlife at this site would be very small since modification of the area would be very limited and about half of the area has been highly disturbed or stripped of vegetation. No threatened or endangered plant or wildlife species would be jeopardized by this alternative.

f. Archeological and Historical Resources. The construction of a dam at site 3 would directly alter or destroy only one site classified as a seasonal gathering area. Two additional sites, also seasonal gathering areas, would be located near enough to the flood pool to be indirectly affected by a dam at this location. Mitigative measures would only be applied to the directly affected site, and would be identical to the measures described for the recommended plan.

g. Population and Land Use. Construction of a dam at site 3 would have no effect on population or future land use in the area. Local and county land use maps designate the area in the vicinity of the damsite to remain natural desert. If urbanization eventually encroaches on the area, the dam would permanently preserve open space. The recreational facilities would not be of the type that would encourage escalation of any private development plans that might exist.

h. Social. No relocations of homes would be necessary.

i. Transportation. The dam embankment and levee would be a barrier to movement and would require relocation of a road that is presently used by vehicles servicing the sand and gravel mining operation.

j. Recreation. The recreational facilities that would be constructed as a part of the project feature would provide for a wide range of recreational opportunities.

k. Esthetics. The construction of a dam at site 3 would affect the visual quality of the area. The dam would be visible to persons traveling north on Black Canyon Highway.

III-6.16 REASONS FOR REJECTING ALTERNATIVE. The additional flood control benefits obtained by constructing dams at sites 1, 2, and 3 would not be sufficient to offset the increase in construction costs and the increase in environmental impacts associated with construction at 3 sites.

III-7. THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

III-7.01 The recommended flood control plan will reduce flood damage to existing urban developments. This protection will be afforded not only to existing populations but also to future populations. The recommended Adobe Dam project feature will also provide recreation facilities that will be available to both existing and future populations. The recommended project feature will provide for the study and recovery of archeological resources.

III-7.02 The project feature will permanently alter 400 acres of wildlife habitat. In addition to flood protection afforded to existing urban areas, 865 acres of presently undeveloped flood plain will be protected and will have a potential for future development.

III-8. ANY IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED

III-8.01 The recommended project feature will permanently commit 1,310 acres of land to flood control and associated recreational purposes.

III-8.02 Construction of this project feature will result in the destruction of archeological resources at the Skunk Creek Archeological District.

III-8.03 Construction of Adobe Dam and appurtenances will require 2.3 million cubic yards of earth (silt, sand, gravel and cobbles).

III-9. COORDINATION

III-9.01 Coordination for the Adobe Dam project feature has been carried out through numerous telephone conversations and meetings with interested home and land owners in the project study area. Particular concern about construction of the dam at the recommended site has been expressed by Saddleback Meadows Homeowners' Association, the Jade Park Mobile Home Community, and the Deer Valley Planning Committee.

III-9.02 The concern centers around the location of the recommended dam. The Jade Park Mobile Home Community considers the recommended site unacceptable, and has presented the Corps with a report outlining an alternative site for consideration. Saddleback Meadows Homeowners' Association and the Deer Valley Planning Committee recommend the construction of the 2-dam combination at sites 1 and 4 to reduce the height of the dam at site 4.

III-9.03 In addition to concerns about the location of the recommended dam, Saddleback Meadows Homeowners' Association and the Deer Valley Planning Committee object to the location of some of the proposed recreation facilities and have requested that they be included in future recreation planning for the damsite.

III-9.04 Continuing efforts are being made to resolve the conflicts associated with this project feature. The alternative damsite suggested by the Jade Park Homeowners' Association is being explored, and the construction of a 2-dam combination at sites 1 and 4 will be investigated in detail during Phase II design studies. Following a request by Deer Valley Planning Committee, flood control measures will be considered along Scatter Wash. In addition, a member of the Deer Valley Planning Committee and the Saddleback Meadows Homeowners' Association will be invited to join the recreational task force, which is planning the recreational facilities for Adobe Dam.

IV

FEATURE OF
THE NEW RIVER &
PHOENIX CITY STREAMS
FLOOD CONTROL PROJECT

NEW RIVER DAM

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SECTION IV

NEW RIVER DAM
Feature of the
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IV-1. PROJECT DESCRIPTION

IV-1.01 INTRODUCTION AND PURPOSE. This section describes the New River Dam feature of the New River and Phoenix City Streams Flood Control Project. This section includes: (a) a detailed description of the recommended New River Dam project feature, (b) a description of the environmental setting in the immediate area of the recommended damsite and alternative damsites, (c) the relationship of New River Dam to land use plans for the area, (d) the probable impact of New River Dam on the environment, (e) the probable adverse impacts which cannot be avoided should New River Dam be constructed, (f) an analysis of the alternative sites and facilities studied, (g) the relationship between the short-term use of the environment at the recommended damsite and the maintenance and enhancement of long-term productivity, (h) the irreversible and irretrievable commitments of resources which would be involved should the feature be constructed, and (i) the coordination effort which has taken place.

IV-1.02 PROJECT FEATURE LOCATION. The site of the recommended New River Dam feature is on the New River about 9 miles north of the New River-Skunk Creek confluence. This site, which is the authorized site, is located about 14 miles north of Glendale and 6-1/2 miles west of the Black Canyon Highway. The location of the recommended dam embankment, dike, and reservoir is shown on plate 19.

IV-1.03 AUTHORIZED AND RECOMMENDED PROJECT FEATURE. The authorized and recommended New River Dam is sited between the easterly tip of West Wing Mountain and an unnamed knoll northwesterly from Keefer Hill. The main elements of a dam at this site will include an embankment, a dike, a concrete-lined spillway, an ungated outlet works, and access roads. (See pl. 19.) These elements are described in the following subparagraphs.

a. Embankment. The dam embankment will have a length of 2,800 feet and a crest elevation of 1,482 feet, which will be a maximum of 91 feet above the elevation of the existing streambed. The embankment will be a compacted-earthfill structure.

b. Dike. The dike, which will extend northerly from West Wing Mountain paralleling Lake Pleasant Road, will have a length of 5,800 feet and a maximum height of about 30 feet above the lowest elevation along its centerline.

c. Spillway. The spillway will be concrete lined. Its width will vary from 220 feet at the crest to 173 feet at the downstream end of the chute. This rectangular section, which will be 589 feet long, will include 94 feet of approach channel, 470 feet of chute structure, and a 25-foot-long flip bucket.

d. Outlet Works. The outlet works will consist of an ungated intake structure, conduit, and an energy dissipator. Discharge through the outlet conduit, which will be 450 feet in length and 8.5 feet in diameter, will be 2,590 cfs with the water surface at spillway crest. At the downstream end of the conduit, an energy dissipator will reduce the velocity of flow from 60 to 14 feet per second before the water is discharged into the streambed.

e. Access Roads. Vehicular access to the dike, dam, and spillway will be provided by one road having its single entrance at the northernmost end of the dike, which ties into Lake Pleasant Road. The total length of the access and service roads will be approximately 18,500 feet, with a constant elevation of 1,484 feet.

f. No recreational facilities are presently planned at the recommended New River Dam. This will not preclude recreational or wildlife development at a later date.

IV-2. ENVIRONMENTAL SETTING WITHOUT THE PROJECT FEATURE.

IV-2.01 INTRODUCTION. The sites considered in selecting the recommended site for the New River Dam feature are in three locations on the New River. Both the recommended (authorized) site and Alternative Site 1 (which is located approximately 2,000 feet downstream from the recommended site) are located in a narrow valley between West Wing Mountain and outliers of East Wing Mountain. Alternative Site 2 is about 2.2 miles downstream from the recommended site. The environmental setting at the recommended and alternative sites is described in the following paragraphs.

IV-2.02 TOPOGRAPHY. The hills to the east of the recommended site and Alternative Site 1 are a northern extension of the Hedgpeth Hills, while the west side is composed of uplifts that separate New River from the Agua Fria River system. The hills adjacent to the damsites are over 2,020 feet in elevation, while the lowest part of the river valley is 1,325 feet. The valley at the recommended damsite is constricted by the West Wing Mountains and Keefer Hill, an outlier of East Wing Mountain. From this point southward to Alternative Site 1, New River is confined to a narrower bed. The valley area has a slope of 20 to 40 feet per mile.

IV-2.03 Alternative Site 2 is on a wide plain between Pitcher Hill on the east, which has a maximum elevation of 2,585 feet, and unnamed hills south of West Wing Mountain, which have a maximum elevation of over 1,850 feet. The wide flood plain has a slope of about 30 feet per mile.

IV-2.04 GEOLOGY AND SOILS. The embankments at both the recommended site and Alternative Site 1 would be on poorly consolidated alluvium (primarily silt, sand, and gravel, with occasional cobbles and boulders) that is about 90 feet deep. The alluvium is underlain by tuffaceous agglomerate and granite. The embankment at Alternative Site 2 would be on alluvium of unknown depth. At the recommended damsite, the west abutment is well-cemented tuffaceous agglomerate of undetermined thickness capped with felsite and andesite and the east abutment is granite and granodiorite overlain by felsite. Both abutments are thinly veneered with talus. At Alternative Site 1, the west abutment is felsite with occasional intervals of welded tuff and the east abutment is weathered granite. Talus is negligible at both abutments. At Alternative Site 2, the west abutment is granite and gneiss and the east abutment is felsite with an andesite cap. The spillway at the recommended damsite will be excavated in granite; the spillway at Alternative Site 1 would be excavated in granite and crystalline quartzite; and the spillway at Alternative Site 2 would be excavated in felsite. The dike that is common to both the recommended site and Alternative Site 1 is on older alluvium (consolidated silt, sand, and gravel) of unknown thickness.

IV-2.05 The mountain soils in the study area are thin and poorly developed, while the valley soils are alluvial soils (sand, gravels and cobbles) in the drainages and sandy loam or loam on the gently sloping fans and valley slopes (ref. 3).

IV-2.06 SURFACE HYDROLOGY. New River and its tributaries drain the western slopes of the New River Mountains and then flow southward across the dissected plateau at the northwest end of Biscuit Flat. In the Biscuit Flat area, the drainages form a dense dendritic pattern that merges at the study area. Here, the water course is confined by hills before it flows onto the lower bajada of Deer Valley. A dam at the recommended site will control the runoff from 164 square miles. A dam at Alternative Site 1 would control the runoff from 176 square miles, and a dam at the Alternative Site 2 would control runoff from 164 square miles of drainage area. Based on stream gage records the average annual runoff for the New River study area is estimated to be 4,200 acre feet annually.

IV-2.07 SUBSURFACE HYDROLOGY. The U.S.G.S. reports that depths to groundwater in the study area generally range from 200 to 300 feet. Data for a well within the study area of the recommended damsite indicated depth-to-water of 126 feet in August of 1970. Groundwater depths in the area have been decreasing, with a drop of 49 feet during the decade from 1962 to 1972 (ref. 27). Wells in the area are capable of producing 1,000 or more gallons per minute. Infiltration rates in the area are high, often measured in the feet-per-day range. No water quality data are available for wells in the New River Dam area.

IV-2.08 VEGETATION AND WILDLIFE. The study area at the recommended site and at Alternative Site 1 is a natural desert landscape with little disturbance to the vegetative communities. (See photo 13 and pl. 26). About 350 acres of desert wash vegetation and 1,665 acres of desert outwash and upland vegetation are within the study area. An additional 25 acres are classified as having highly disturbed vegetation. The site is relatively isolated, which accounts for the lack of significant disruption to the natural communities. The vegetation is more varied and denser than at the sites for Cave Buttes or Adobe dams. Some of the largest specimens of ironwood (25-30 feet tall) seen near Phoenix grow near this site (see photo 14). Large ironwoods are unique in the Phoenix area, because many have been cut for firewood or have been removed for citrus planting.

IV-2.09 None of the land in the study area at the recommended site and Alternative Site 1 is currently under cultivation, and there is little evidence that farming occurred here historically. The area is used for grazing many types of domestic animals, including cattle, sheep, goats and horses. The disturbances to the vegetative communities are primarily from grazing and off-road vehicular uses. The area contains an extensive area of high quality riparian wildlife habitat, composed of dense growth of large mesquite, ironwood, blue paloverde and desert willow (photo 15). Riparian habitat of this quality in close proximity to metropolitan Phoenix is limited. This habitat, as well as bajada and upland habitats, provides food and cover for such game species as doves, quail and cottontail rabbits. A few desert mule deer can also be found at the site. Many nongame wildlife species also inhabit the area, including many birds, large and small mammals, amphibians and reptiles.

IV-2.10 Comparing the three dams recommended as project features, based on habitat quality and least amount of disturbance, animal population densities should be greatest at the recommended New River Dam feature, followed in descending order by Cave Buttes and Adobe Dams.

IV-2.11 Alternative Site 2 has about 110 acres of desert wash vegetation and 1,500 acres of desert outwash and upland vegetation within the standard project flood overflow area. This site has experienced greater habitat disturbance than the recommended site or Alternative Site 1. The disturbance to the desert landscape has occurred from a mining operation, land clearing (about 10 acres), and a trailer site. An estimated 100 acres have highly disturbed plant communities. Extensive damage to the vegetation and land has occurred from use of the area by off-road vehicles. Open-land grazing occurs throughout the alternative site. As at the upper sites, game species are common, providing many hunting opportunities.

IV-2.12 ARCHEOLOGICAL AND HISTORICAL RESOURCES. An intensive survey of archeological and historical resources in the New River study area was conducted by Arizona State University, Department of Anthropology, under a contract with the Corps of Engineers. A total of 43 archeological sites were recorded in the study area, of which 20 were at the recommended site and Alternative Site 1, and 23 were at Alternative Site 2. No single attribute, except for the presence of material culture remains on the surface, is characteristic of all the manifestations. In terms of size, the archeological sites range from a sherd and/or lithic tool scatter within a circle only a few yards in diameter to a continuous distribution of remains over an area of about 0.45 square miles. The State Historic Preservation Officer has recommended that an area comprising all of Sections 1, 2, and 3, and the north 1/2 of Sections 11 and 12 of Township 4 North, Range 1 East, and the south 1/2 of Sections 13, 14, and 15, and all of Sections 22, 23, 24, 25, 26, 27, 34, 35, 36, of Township 5 North, Range 1 East be nominated to the National Register of Historical Places as an archeological district. (pl. 10) The New River Dams Archeological District was nominated to the National Register in July 1975 (ref. 29).

IV-2.13 A classification of site types within the archeological district includes sherd and/or lithic scatter areas, campsites, gathering sites, agricultural areas, habitation sites, multicomponent sites and 4 sites which do not fit in any of these categories. These 4 sites include three parallel channels 1,300 feet long; a ring of fire cracked rock, probably belonging to a food-processing unit of an early date; a ceremonial quartz rectangle; and a horseshoe-shaped basalt boulder structure suggestive of a lookout or shrine. One historical site has been identified at the recommended dam site.

IV-2.14 POPULATION. The New River study area contains no residential dwelling units. The pattern of development depicted in the following tabulation is based on population projections for Maricopa County made by the Bureau of Economic Analysis of the U.S. Department of Commerce and the Economic Research Service of the U.S. Department of Agriculture (OBERS). The projections were allocated by the Corps of Engineers within the county on the basis of data provided by the Maricopa Association of Governments, historical trends, local and regional land use plans, current zoning and the

National Flood Disaster Act of 1973. The population projections were calculated for an area with a radius of 5 miles from the recommended New River Dam.

Year	Population	Density (persons sq. mi.)
1979	Negligible	
1990	Negligible	
2020	25,000	320

IV-2.15 LAND USE. The majority of the land in the three New River damsites considered is used for grazing, although some land at Alternative Site 2 has been platted in preparation for future subdivision and development. There are several mineral mining leases on lands along the New River at Alternative Site 2. The present land ownership at the recommended site is shown on plate 27.

IV-2.16 TRANSPORTATION. Improved roads are scarce in the area; however, the sites can be reached by driving to the northernmost end of 83rd Avenue. The sites are also easily approached from Lake Pleasant Road. No railroads are present in the study area. A private landing strip is located 1.5 miles west of the recommended site.

IV-2.17 RECREATION. There are no formal recreational facilities at any of the sites. The sites show evidence of use by hunters and off-road vehicles, although some of this use involves trespass. Hunting is permissible on some public lands and on non-posted private lands.

IV-2.18 NOISE. There are no point sources of noise at any of the sites.

IV-2.19 ESTHETICS. Relative to all of the project damsites, these sites have the greatest esthetic value. The East Wing and West Wing Mountains provide a background of high visual quality to the extensive riparian vegetation in the New River floodway, which forms esthetically pleasing dark ribbon patterns on the lighter colored valley floor. Scenic vistas from the West Wing Mountains include the Hieroglyphic Mountains on the northwestern horizon across the dark desert wash vegetation of the Agua Fria flood plain. An unnamed hill bounds the northeast margin of the study area, providing an additional visual resource. Vistas to the south of the study area include the green agricultural development of the Deer Valley and a view of the encroaching urban development.

IV-3. RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE PLANS

IV-3.01 The recommended project feature (proposed action) conforms to the objectives and specific terms of existing and proposed Federal, State, and local land use plans, policies, and controls. The recommended floodway on the New River conforms to the objectives of the Flood Disaster Protection Act of 1973 (PL 93-234) as well as to the objectives of the State of Arizona Preventive Flood Control Law (Ariz. Rev. Stat. Ann. 45-2341-2346, May 3, 1973). The Flood Disaster Protection Act requires that flood prone areas be identified and that flood plain ordinances be adopted. The State of Arizona Preventive Flood Control Law restricts construction within areas prone to flooding until the appropriate governing body adopts flood plain regulations. Because both Federal and State laws require flood plain management on land that would be affected by the project feature, the recommendation to continue flood plain management conforms to the objectives and intents of the laws.

IV-3.02 The recommended New River Dam conforms to the MAG Composite Land Use Plan which designates conservation land uses for the affected area. (pl. 14) The Maricopa County Land Use Plan designates the affected area as a desert and mountainous area, and shows New River Dam at its recommended site.

IV-4. THE PROBABLE IMPACT OF THE PROPOSED PROJECT FEATURE ON THE ENVIRONMENT

IV-4.01 TOPOGRAPHY. The topography at the recommended damsite will be altered by the construction of a main embankment, one dike, a concrete-lined spillway, and access roads. A total of 8,600 feet of embankment will rise as high as 91 feet above the streambed, and 1,460 acres will be affected periodically by inundation with flood waters. Sediment accumulation will alter the area upstream of the dam; 4,920 acre feet of storage has been allocated for sediment accumulation over a 100-year period.

IV-4.02 NATURAL RESOURCES. The recommended project feature will have a minimal effect on the quantity of sand and gravel available to be mined. The land under the embankments will be permanently inaccessible as a potential resource. The sediments that accumulate behind the dam will not be conveyed to the downstream channels. These sediments will be available to mining operations. The sediments not removed by mining will be periodically cleared to maintain the storage capacity of the reservoir. Construction of the embankments will require large quantities of material. An estimated 195 acres will be excavated as borrow to supply the necessary material. Approximately 143 acres of the designated borrow areas will be within the reservoir.

IV-4.03 SUBSURFACE HYDROLOGY. As a result of the construction of the dam, flood flows will be temporarily detained for release at a controlled rate. This will decrease the volume of surface flows in the downstream channels during periods of flooding, and will increase the duration of flows in the downstream channels. This, in turn, will increase the groundwater recharge potential. The potential recharge is not sufficient to affect the total groundwater regimen in the area. Riparian habitat along the downstream channels may benefit from the increased duration of available moisture.

IV-4.04 WATER QUALITY. The recommended project feature will have no effect on water quality in the area.

IV-4.05 VEGETATION AND WILDLIFE. The proposed project will cause a significant loss of native vegetation and wildlife habitat at the relatively unspoiled New River site. The habitat losses will not jeopardize the perpetuation of plant and animal communities locally or regionally since the species occur extensively throughout the Sonoran Desert; however, the impact of the loss is viewed as severe because of the excellent quality of the habitat, especially the native desert wash community, and its close proximity to Phoenix. Habitat of the quality found at New River will be in danger of elimination as Phoenix continues to grow and expand. The impact of the proposed action is significant enough to warrant mitigation for the loss of riparian vegetation. In total, about 300 acres of desert biotic communities will be removed by the recommended project feature. Construction of the proposed dam, dike, spillway and access roads will permanently remove about 100 acres of wildlife habitat. Borrow areas will eliminate natural vegetation from an estimated 200 acres of land. For construction of the dam and dike an estimated 225 acres of high quality (natural growth with little man-made alterations) desert wash or riparian vegetation, utilized by a diverse variety of wildlife species, will be removed by project related activities. The remaining vegetation to be affected by the project (about 75 acres) is desert outwash and upland vegetation with a fairly sparse assemblage of plants.

IV-4.06 In addition to the 300 acres of habitat physically removed by the proposed action, an estimated 1,460 acres of vegetation will be vulnerable to inundation from a standard project flood. However, probability of this occurrence is only once in a 200- to 300-year period. Inundation of vegetation over a much smaller area (acreage undetermined) is more likely to occur during smaller 50 or 100-year floods. A 100-year flood will inundate about 1,000 acres for 3 days and 80 acres for 7-1/2 days. A 10-year flood will cover about 300 acres for 1 day and 80 acres for 2-1/2 days. Prolonged inundation and heavy sedimentation probably would kill or severely damage large trees and shrubs in part of the overflow area. Vegetation characteristic of highly disturbed areas (i.e. many weedy annuals) would flourish while many desert wash and outwash plain species would be lost. An area behind the dam of perhaps 100 to 200 acres, where water will frequently impound and maintenance operations will be required, will be characterized by highly disturbed vegetation of mostly weedy forbs and grasses. The community structure probably would approximate that found in the area subject to inundation behind Cave Creek Dam. The weedy herbaceous growth and grasses behind Cave Creek Dam that thrive under such highly disturbed conditions provide excellent food and cover for wildlife, especially such game species as Gambel's quail, mourning and white-winged doves, and rabbits.

IV-4.07 When possible, borrow areas will be located where damage to natural vegetation, especially high quality riparian growth, will be reduced. Borrow areas will be contoured to facilitate reestablishment of natural vegetation. Exposed project areas will be landscaped with native vegetation to provide visual and habitat benefits. Suitable species of native vegetation in the borrow and excavation areas will be salvaged and used for landscaping when possible (i.e., saguaro cactus, barrel cactus). In those disturbed areas where surface soils are removed and not replaced, natural redevelopment of desert trees and shrubs may be very slow and forbs and grasses probably will predominate for many years. The downstream slope of the dam and dike will be landscaped, helping to recover some wildlife habitat losses. Wildlife expected to dominate the disturbed terrestrial habitats include lizards, snakes, pocket gophers, desert mice and rats, rabbits, doves and various song birds.

IV-4.08 The impoundment of water behind New River Dam during floods will influence the quality of the riparian vegetation behind the dam and downstream. The floodway below the dam will significantly decrease, resulting in a decrease in total plant cover and vigor along New River from the dam to Skunk Creek. A similar condition appears to predominate along Cave Creek below Cave Creek Dam although no empirical data are available to support this assumption. Riparian vegetation behind New River Dam probably will show increased vigor and cover in response to an additional water supply. However, any enhancement of riparian growth behind the dam probably will be at the expense of riparian and outwash vegetation downstream from the dam (i.e., a redistribution of total plant biomass). Salt cedar presently does not occur at the proposed New River Dam site. It is not known if the development of this dam will produce conditions favorable for salt cedar growth. For example, salt cedar growth behind the existing Cave Creek Dam is very rare. Although salt cedar provides wildlife habitat benefits for such species as white-winged doves, it is often at the expense of native vegetation which provides valuable food and cover sources.

IV-4.09 Large ironwood, mesquite, blue paloverde, and desert willow will be removed by the proposed action. The loss of these trees as well as other less prominent members of the desert wash community structure represents a significant adverse impact on wildlife species since such growth provides food, cover, nesting and resting habitat. The loss of saguaro cactus is also viewed as adverse. The saguaro cactus has been declining in numbers in Arizona because of limited recruitment of new plants. Several factors (i.e., temperature, moisture, land uses) are apparently responsible for the limited recruitment of new plants. This large prominent plant provides esthetic benefits as well as food and cover for various wildlife species (i.e., flicker, Gila woodpecker, white-winged dove, elf owl, woodrat). Every effort will be made to retain or salvage saguaro cactus during project construction.

IV-4.10 The proposed action will remove habitats that support a variety of wildlife species including lizards, snakes, rabbits, small rodents, song birds, doves, quail, hawks, badger, coyote, fox, javelina, and mule deer. Many small animals, especially rodents and reptiles, will be destroyed by construction activities and/or inundation of the overflow area during floods. Those animals not actually killed by construction activities will be displaced to surrounding habitats probably already supporting maximum wildlife populations and probably most would not survive.

IV-4.11 No threatened or endangered plant or animal species will be jeopardized by the proposed action.

IV-4.12 ARCHEOLOGICAL AND HISTORICAL RESOURCES. Construction of the recommended project feature will alter or destroy 20 archeological sites that are located within the New River Dams Archeological District, a property that has been nominated to the National Register of Historic Places (pl. 10). The type of land modification and inundation associated with the recommended damsite precludes preservation of the cultural resources. Mitigation measures proposed by the Corps of Engineers to the Advisory Council on Historic Preservation include the mapping of the location of artifacts, excavation, pollen analysis, carbon 14 and archaeomagnetism dating, identification of flora and fauna from archeological deposits, petrographic analysis of ceramics, and the formulation of an adequate research design and testing program to identify and interpret the cultural resources removed from the sites. The recovery ratio will vary, depending on the degree of impact and the importance of the site. Between 75 and 100 percent recovery is contemplated for sites that will be directly affected by construction or borrow operations, while the recovery of moderately and minimally affected sites will vary from 1 to 40 percent depending on the estimated value of the site.

IV-4.13 POPULATION AND LAND USE. Construction of a dam on New River at the recommended site will have no effect on future land use or population in the area. County and local land use plans presently indicate this site as the future location of New River Dam. The inundation basin behind the dam will become permanent open space. As a result of the construction of the dam, the floodway immediately below New River Dam will be reduced, and acreage will be released for other uses. Because of the remote location of this acreage, no impact on land use is expected to occur.

IV-4.14 SOCIAL. Although there is access to the damsite via Lake Pleasant Road, there are no dwellings within the area that will be affected by the project feature. Construction of the dam will benefit public health, safety and morale by reducing the threat of flooding and flood damages.

IV-4.15 TRANSPORTATION. Construction of the recommended project feature will have no effect on the transportation network in the surrounding area.

IV-4.16 RECREATION. No recreational facilities are planned for construction at the proposed New River Dam; however this will not preclude recreation or wildlife development at a later date. Informal activities, such as hunting and hiking, will not be affected.

IV-4.17 ESTHETICS. Construction of the recommended dam will adversely affect the visual qualities in the area. The main embankment will be visible from a large area downstream of the site. The dike will be immediately adjacent to Lake Pleasant Road and will be unavoidably prominent to travelers using the road. The reservoir area behind the dam will remain undisturbed except during periodic flooding and will represent a permanent open space resource.

IV-5. ANY PROBABLY ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

IV-5.01 Visual impairment will occur with construction of the recommended project feature. The dam and its appurtenances will be obviously artificial structures that many persons will consider unattractive.

IV-5.02 Sediments transported by New River will be impounded by the recommended dam; an estimated 4,920 acre-feet of sediments will be impounded over a 100-year period.

IV-5.03 Large quantities of material will be required for construction of the dam.

IV-5.04 Construction of the project feature will subject 1,460 acres to the effects of periodic inundation and sedimentation. Approximately 300 acres of desert biotic communities within the reservoir area will be removed by the construction. Of this total, approximately 225 acres are high quality desert wash or riparian vegetation.

IV-5.05 Twenty archeological sites within the New River Dams Archeological District will be altered or destroyed.

IV-6. ALTERNATIVES FOR THE PROPOSED PROJECT FEATURE

IV-6.01 INTRODUCTION. Two alternative sites to the recommended site for the New River Dam project feature were considered. These alternative sites are discussed in the following paragraphs.

IV-6.02 DESCRIPTION OF ALTERNATIVE SITE 1. Alternative Site 1 is located approximately 2,000 feet downstream of the recommended site. The main embankment would be located across the same narrow valley spanned at the recommended site. The reservoir areas at both sites would be almost identical. The recommended site and Alternative Site 1 are considered one and the same in the project planning (ref. 32).

IV-6.03 ENVIRONMENTAL EFFECTS OF ALTERNATIVE SITE 1. The environmental effects of Alternative Site 1 would be identical to those described for the recommended site.

IV-6.04 REASONS FOR REJECTING ALTERNATIVE SITE 1. Alternative Site 1 was not selected over the recommended (authorized) site because it had no significant advantages.

IV-6.05 DESCRIPTION OF ALTERNATIVE SITE 2. Alternative Site 2 would be located on New River approximately 2.2 miles downstream from the recommended site. The primary structural features of a dam at this site would include a main embankment, 2 dikes, a concrete-lined spillway, ungated outlet works and access roads.

IV-6.06 ENVIRONMENTAL EFFECTS OF ALTERNATIVE SITE 2. The degree of flood protection provided by a dam at Alternative Site 2 would not be significantly greater than that provided at the recommended site. The effects of a dam at this alternative site on surface and subsurface hydrology, water quality, vegetation and wildlife, population and land use, and social and transportation elements–as well as construction related temporary impacts–would be similar to those described for the recommended site.

IV-6.07 Topographic conditions at Alternative Site 2 differ from the recommended site. The recommended site spans a narrow valley, while the alternative site traverses a wide plain. Although the embankment heights would be identical, the embankment at Alternative Site 2 would be approximately 4 times longer than the embankment at the recommended site. It would use a proportionately large quantity of natural resources and would create more obvious visual impairment.

IV-6.08 Construction of a dam at Alternative Site 2 would also have a significant adverse impact on archeological resources, disturbing or destroying 23 sites.

IV-6.09 REASON FOR REJECTING ALTERNATIVE SITE 2. Although a dam at Alternative Site 2 would provide an equivalent degree of flood protection to that which will be provided by the recommended project feature, this protection would require an additional expenditure of about $5 million for the construction of a longer main embankment.

IV-7. THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY.

IV-7.01 The recommended project feature is an integral element of a flood control plan that will reduce flood damage to existing urban and agricultural developments. This protection will be afforded not only to existing populations but also to future populations. The recommended New River feature will also preserve open space that will be available to both existing and future populations. The recommended feature will provide for the study and recovery of archeological resources.

IV-7.02 The project feature will permanently alter 300 acres of wildlife habitat.

IV-8. ANY IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED.

IV-8.01 The recommended feature would commit 1,460 acres of land to flood control purposes.

IV-8.02 Construction of this project feature will result in the destruction of archeological resources in the New River Dams Archeological District.

IV-8.03 Construction of New River dam and its appurtenances will require 1.8 million cubic yards (silt, sand, gravel and cobbles) of material.

IV-9. COORDINATION

IV-9.01 Detailed coordination for the New River Dam feature of this project has been carried out with the Recreation Task Force, the Arizona Conservation Council, the U.S. Fish and Wildlife Service, the Arizona Game and Fish Department, the National Park Service, and the Advisory Council on Historic Preservation.

V

FEATURE OF
THE NEW RIVER &
PHOENIX CITY STREAMS
FLOOD CONTROL PROJECT

SKUNK CREEK, NEW RIVER & THE AGUA FRIA RIVER

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SECTION V

SKUNK CREEK, NEW RIVER AND AGUA FRIA RIVER
Feature of the
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V-1. DESCRIPTION OF PROJECT FEATURE

V-1.01 INTRODUCTION AND PURPOSE. This section describes the Skunk Creek, New River, and Agua Fria River feature of the New River and Phoenix City Streams Flood Control Project. This feature will collectively be called the flowage easement feature. This section includes: (a) a detailed description of the flowage easement feature for these drainages, (b) a description of the environmental setting in the immediate area of the drainages, (c) the relationship of the flowage easement feature to land use plans for the area, (d) the probable impact of the flowage easement feature on the environment, (e) the probable adverse impacts which cannot be avoided should the flowage easement feature be implemented, (f) an analysis of the alternatives studied, (g) the relationship between the short-term use of the environment in the study area and the maintenance and enhancement of long-term productivity, (h) the irreversible and irretrievable commitments of resources which would be involved should the flowage easement feature be implemented, and (i) the coordination effort which has taken place.

V-1.02 PROJECT FEATURE LOCATION. The interconnected drainages of Skunk Creek, New River, and the Agua Fria River flow southwesterly and southerly to the Gila River. The portion of the drainage system affected by this feature is (a) Skunk Creek from the site of Adobe Dam to the confluence with the New River, (b) New River from the site of New River Dam to the confluence with the Agua Fria River, and (c) the Agua Fria River from the New River to the Gila River. This part of the drainage system is about 15 miles west and northwest from central Phoenix. (See pl. 4.)

V-1.03 AUTHORIZED PROJECT FEATURE. The authorized project feature, which is not presently recommended, comprises structural channelization of Skunk Creek, New River, and the Agua Fria River from the Adobe Dam site to the Gila River. These elements are described in the following subparagraphs:

a. Skunk Creek Channel. The authorized project feature provides for about 6.5 miles of concrete-lined trapezoidal channel on Skunk Creek from a point just upstream from the outlet of the authorized Union Hills diversion channel downstream to the New River. The design capacity of the channel would range from 24,400 to 41,400 cfs. The channel would have bottom widths ranging from 15 to 40 feet and depths ranging from 10 to 23 feet. Bridges would be required at 59th Avenue, Bell Road, and 83d Avenue; and about 2,000 feet of Union Hills Drive would require relocation.

b. New River Channel. The authorized project feature provides for about 8 miles of trapezoidal earth-bottom channel with revetted side slopes on New River from the Skunk Creek confluence to the Agua Fria River. The design capacity of the channel would range from 53,400 to 58,000 cfs. The channel would have bottom widths ranging from 400 to 800 feet and depths ranging from 8.5 to 11 feet. The Santa Fe railroad, Highway No. 60, and the Glendale Avenue bridges would require modification. Dip crossings at Thunderbird Road and Peoria, Northern, and Olive Avenues would be required.

c. Agua Fria River Channel. The authorized project feature provides for about 7.5 miles of trapezoidal earth-bottom channel with revetted side slopes on the Agua Fria River from the New River confluence to a point about 2 miles downstream (south) of the U. S. Highway 80 bridge. The design capacity of the channel would range from 70,000 to 74,000 cfs. The channel would have bottom widths ranging from 800 to 1,500 feet and depths ranging from 8.5 to 10 feet. The channel invert under existing bridges and the channel terminus would be protected against scour with dumped stone. About one-half mile of El Mirage Road would be relocated and dip crossings would be required at Van Buren Street and at Indian School, Thomas, and McDowell Roads.

V-1.04 RECOMMENDED PROJECT FEATURE. The recommended project feature provides for (a) designated floodways or flowage easements along Skunk Creek from the recommended Adobe Dam to New River, along New River from the recommended New River Dam to the Agua Fria River, and along the Agua Fria from the New River confluence to the Gila River; (b) localized structural and nonstructural flood control measures; and (c) 13 new highway bridges and 1 railroad bridge extension. Elements of the recommended project feature are described in the following subparagraphs:

a. Skunk Creek. As a part of the recommended project feature, local interests will be required to manage and maintain a designated floodway (100-year flood) on Skunk Creek from the recommended Adobe Dam to the point of confluence of the recommended Arizona Canal Diversion Channel, a distance of about 5.6 miles. The designated floodway will assure that the presently adequate capacity of this reach to safely convey a 1,890 cfs release from Adobe Dam is permanently retained. The limits of the floodway and the floodway fringe areas will be delineated by the Corps of Engineers. From the Arizona Canal Diversion Channel confluence to New River, a distance of about 1.8 miles, the recommended project feature will provide for a flowage easement. The flowage easement will assure positive control of the flood plain, which will range from 2,500 to 3,000 feet in width and encompasses about 510 acres. Within the flowage easement, localized floodproofing will comprise (1) constructing concrete floodwalls up to 4 feet in height around two residences, (2) removing five residences, and (3) raising the elevation of three mobile home pads about 3 feet. As part of the recommended plan, new bridges will be constructed at Beardsley Road and 67th Avenue.

b. New River. As a part of the recommended project feature, local interests will be required to manage and maintain a designated floodway (100-year flood) on New River from the recommended New River Dam to the confluence of New River with Skunk Creek, a distance of about 8.5 miles. This designated floodway will assure that the presently adequate capacity of this reach to safely convey a 2,590 cfs release from New River Dam is permanently retained. The limits of the floodway and the floodway fringe areas will be delineated by the Corps of Engineers. From Skunk Creek for a distance of about 9 miles, the recommended plan will provide a flowage easement to assure positive control of the flood plain resulting from diverted flows discharging from the Arizona Canal Diversion Channel. The flowage easement will range in width from 300 to 4,000 feet and will encompass about 2,110 acres. Localized flood control measures, including flood proofing of existing structures, removal of structures, bank stabilization, levee construction and some channelization and channel clearing will be required. These measures include constructing floodwalls around seven residences, raising the elevation of two mobile home pads by 3 feet, and removing two residences. A 5,700-foot-long revetted earthen levee, up to 4 feet in height, will extend downstream of Thunderbird Road on the east bank of the New River; this levee will reduce the flowage easement requirements by about 200 acres. The end of this levee will tie into the upstream end of a 3,000-foot-long unlined trapezoidal channel. This 12- to 15-foot-deep, 300-foot-wide channel will allow 100-year floodflows to pass through the two existing six-span bridges which carry U. S. Highway 60-89-93 over the river. As part of the recommended plan, an existing timber trestle (part of a trestle and four-span railroad bridge) will be replaced with an additional two-span bridge. Downstream of the channelization, about 7,000 linear feet of revetment will be placed along the west bank of the New River to preclude bank erosion. As part of the recommended plan, new bridges will also be constructed at Beardsley Road, Union Hills Drive, 83d Avenue, Thunderbird Road, 99th Avenue, Northern Avenue, and Camelback Road. One rest stop area with picnicking and landscaping will be developed as part of the recommended plan within the New River flowage easement.

c. Agua Fria River. From the New River-Agua Fria River confluence to the Gila River, a distance of 10.1 miles, the recommended project feature will provide a flowage easement to assure positive control of the flood plain resulting from diverted flows discharging from the Arizona Canal Diversion Channel. The flowage easement will range in width from 900 to 6,000 feet and will encompass about 5,950 acres. Localized flood control measures, including floodproofing of existing structures, removal of structures, and diking of a residential subdivision will be required. These measures include floodwalls up to 4 feet in height around five residences, the raising of two mobile home pads, the removal of five residences, and construction of nearly 10,000 feet of dikes, ranging from 3 to 8 feet in height around five residential subdivisions. As part of the recommended plan, new bridges across the Agua Fria River will be constructed at Thomas Road, McDowell Road, Van Buren Street, and Lower Buckeye Road. One rest stop area with picnicking and landscaping will be developed as part of the recommended plan within the Agua Fria River flowage easement.

V-2. ENVIRONMENTAL SETTING WITHOUT THE PROJECT FEATURE

V-2.01 The study area for this project feature extends about 25 miles in a north-south direction and 13 miles in an east-west direction. Because of the extent of the study area, the environmental setting is described separately for Skunk Creek, New River, and Agua Fria River in the following subheadings.

Skunk Creek

V-2.02 TOPOGRAPHY. The Skunk Creek drainage flows across the bajadas forming Little Deer Valley (northeast of the Hedgpeth Hills) and Deer Valley (southwest of the Hedgpeth Hills). Skunk Creek downstream from the recommended Adobe Dam site flows generally southerly around the east end of the Hedgpeth Hills, where it is joined by Scatter Wash. A braided drainage system then trends southwesterly to 59th Avenue, at which point the channel becomes quite well defined and continues southwest to join New River. The slope of the bajada is about 30 feet per mile.

V-2.03 GEOLOGY AND SOILS. The bed of Skunk Creek is shallow, having a maximum depth of about 7 feet, and consists of unconsolidated porous sands, gravel and cobbles that have an infiltration rate of 2 inches per hour. This alluvium has no agricultural value. Deep sandy and silty loam soils occupy long narrow strips paralleling Skunk Creek. These soils are of Recent origin as compared with other soils of the area, and are deep, friable, slightly hard, moderately alkaline, and pale brown in color. The soils can withstand velocities up to 6 feet per second before erosion becomes apparent. These soils are well suited to crops requiring a rather light textured yet fertile soil. Similar soils produce alfalfa, cotton, small grains, and other truck crops (ref. 25).

V-2.04 SURFACE HYDROLOGY. Skunk Creek is an ephemeral stream having surface flows only during and after periods of heavy rainfall. The creek has a drainage area of 110 square miles and a stream gradient ranging from 19 to 33 feet per mile; its headwaters are located 35 miles north of Phoenix in the New River Mountains. A U.S.G.S stream gage located near the recommended Adobe Dam site recorded a maximum discharge of 11,500 cfs on August 1, 1964 during the creek's largest storm of record. Estimates of the magnitude of several frequency flood discharges at two concentration points, under present conditions, are shown in the following tabulation.

Concentration Point	Flood Frequency 50 yr (cfs)	100 yr (cfs)	SPF (cfs)
Skunk Creek at Hedgpeth Hills	26,000	37,000	60,000
Skunk Creek above New River confluence	26,000	37,000	60,000

V-2.05 SUBSURFACE HYDROLOGY. The depth of ground water is estimated by the U.S.G.S. (ref. 23) to vary from 300 to 500 feet along Skunk Creek in the study area.

V-2.06 VEGETATION AND WILDLIFE. There are about 20 acres of natural undisturbed desert vegetation and about 90 acres of highly disturbed vegetation along the Skunk Creek channel. Most of the undisturbed riparian vegetation occurs in the upstream reach of Skunk Creek. Just downstream from the recommended Adobe Dam, there is a fairly dense growth of paloverde, ironwood, some mesquite and grasses. Some common shrubs in or along the creek downstream from this area are burrobrush, blue paloverde and mesquite. In the downstream reach of Skunk Creek near the New River confluence, the riparian strip becomes narrower and agricultural fields extend up to the creek banks. Large cottonwoods, both native and introduced, are present at the confluence of Skunk Creek and New River. Reaches of Skunk Creek near Bell Road and 75th Avenue and Greenway Road and 83d Avenue have been channelized. Strips of riparian vegetation, transitioning into desert outwash vegetation, border areas where channelization has occured. A large gravel mining operation at the confluence of Skunk Creek and New River has destroyed or altered the natural habitats. The predominant agricultural crops grown in areas near the channel are citrus fruits, cotton, and milo.

V-2.07 Wildlife populations are discussed for the entire project feature study area in paragraphs V-2.37 through V-2.39 under a subsequent subheading, "Agua Fria River."

V-2.08 ARCHEOLOGICAL AND HISTORICAL RESOURCES. Research into historical and archeological resources was carried out by the Arizona State University, Department of Anthropology, under contract with the Corps of Engineers. An intensive examination of the lands along Skunk Creek, an inspection of adjacent lands, and a review of the literature failed to reveal the existence of archeological or historic resources. Not a single piece of ceramic material (not including modern refuse) or a stone tool was recovered.

V-2.09 POPULATION. There are about 770 people living within the future standard project flood overflow area of Skunk Creek (pl. 6). Projections of future population for this area, with and without flood control, are given in the following tabulation.

	1974	1976	1986	1996	2026
Population with flood control	770	770	6,200	18,100	27,000
Population without flood control	770	770	6,200	13,400	18,700

V-2.10 The pattern of development depicted in the above tabulation is based on population projections for Maricopa County made by the Bureau of Economic Analysis of the U. S. Department of Commerce and the Economic Research Service of the U. S. Department of Agriculture (OBERS). The projections were allocated by the Corps of Engineers within the county on the basis of data provided by the Maricopa Association of Governments, historical trends, local and regional land use plans, current zoning and the National Flood Disaster Act of 1973.

V-2.11 LAND USE. The land immediately adjacent to Skunk Creek is primarily in agricultural uses, with many fields extending up to the banks of the creek. Houses are adjacent to the creek in the vicinity of Greenway Road. A large gravel mining operation is located at the confluence of Skunk Creek and the New River. The present and future use of the land within the standard project flood overflow area of Skunk Creek (pl. 6), about 3,925 acres, is shown for the without flood control condition in the following tabulation.

Land Use	1974	1976	1986	1996	2006	2016	2026
Residential	55	55	585	1,285	1,805	1,805	1,805
Trailer Parks	20	20	20	20	20	20	20
Commercial	0	0	70	100	120	120	120
Industrial	0	0	0	0	0	0	0
Public, Semi-Public	0	0	60	60	60	60	60
Transportation	70	70	70	70	70	70	70
Urban Parks	0	0	50	50	50	50	50
Total, Urban	145	145	855	1,585	2,125	2,125	2,125
Agriculture	610	610	610	580	265	265	265
Open Space-Vacant	3,170	3,170	2,460	1,760	1,535	1,535	1,535
Channels-Irrigation	0	0	0	0	0	0	0
Total, Non-urban	3,780	3,780	3,070	2,340	1,800	1,800	1,800
TOTAL	3,925	3,925	3,925	3,925	3,925	3,925	3,925

V-2.12 TRANSPORTATION. Two east-west highways and four north-south highways cross Skunk Creek. Three of these crossings are on all-weather bridges, the remaining three are dip crossings that become impassable when flows in the creek exceed 6 inches in depth. One private landing strip is located near the creek, one-half mile north of Bell Road.

V-2.13 RECREATION. There are no formal recreation facilities along the reaches of Skunk Creek within the study area; however, parts of the creek are used informally, and often illegally, for riding, hiking, off-road vehicles, hunting, and nature observation.

V-2.14 NOISE. Point sources of noise in the study area include the six highway crossings and gravel operations at the confluence with New River.

V-2.15 ESTHETICS. Some areas of Skunk Creek have experienced disturbance and degradation of the wildlife habitat through off-road vehicle use, channelization, gravel mining, and indiscriminate dumping of trash. The degradation is especially evident at highway crossings, in the vicinity of the proposed Adobe Dam site, and near the confluence of Skunk Creek with the New River, where a sand and gravel operation is located. However, the natural vegetation along Skunk Creek still provides a unique visual resource in an area of rapidly encroaching agricultural and urban land uses. This juxtaposition of different patterns of land use creates a composite landscape which provides opportunities for people to experience a variety of environmental settings. The sky and distant mountain ranges provide a background for the expansive vistas of natural vegetation along Skunk Creek when viewed across the open agricultural fields.

New River

V-2.16 TOPOGRAPHY. The New River drainage flows south through the valley between West Wing and East Wing Mountains and out onto the broad bajada of Deer Valley. On the northerly part of the bajada, the drainage is extensively braided, and has many small tributaries. The New River drainage is more defined in the southerly part of the bajada, and is confined to an incised channel. A large gravel mining operation at the confluence of Skunk Creek is altering the riverbed topography. The general slope of the bajada ranges from 30 to 17 feet per mile.

V-2.17 GEOLOGY AND SOILS. The bed of the New River consists of unconsolidated sands, gravel, and cobbles having an infiltration rate of about 2 inches per hour. The alluvium has no agricultural value. Fine loamy soils are located on both sides of the New River upstream of the confluence of Skunk Creek, and on the east bank downstream of the confluence. These soils, reddish yellow in color, are very friable, slightly hard, with lime filaments and soft lime masses in the subsoil. Limy loamy soils are located west of the New River downstream of the Skunk Creek confluence. These soils, pale brown in color, are friable, slightly hard, moderately alkaline, with mica flakes and lime concretions in the subsoil. All of these soils have infiltration rates of 0.15 to 0.30 inches per hour and can withstand velocities of 6 feet per second before erosion becomes apparent. These soils are well suited to crops requiring a rather light textured, yet fertile soil. Similar soils produce alfalfa, cotton, small grains and other truck crops. (Ref. 25.)

V-2.18 SURFACE HYDROLOGY. The New River is an ephemeral stream having surface flows only during and after periods of heavy rainfall. The river has a drainage area of 340 square miles and a stream gradient ranging from 370 to 10 feet per mile; its headwaters are located 40 miles north of Phoenix in the New River Mountains. U.S.G.S. stream gages on the river recorded maximum discharges of 14,600 cfs at Bell Road and 19,800 cfs at Glendale Avenue on December 19, 1967, during the river's largest storm of record. Estimates of the magnitude of flood discharges at various concentration points on the New River, under present conditions, are shown in the following tabulation.

Concentration Point	Flood Frequency 50 yr. (cfs)	100 yr. (cfs)	SPF (cfs)
New River near West Wing Mountain	39,000	53,000	76,000
New River at Bell Road	39,000	53,000	75,000
New River below confluence with Skunk Creek	44,000	58,000	86,000

V-2.19 SUBSURFACE HYDROLOGY. The depth to ground water is estimated by the U.S.G.S. (ref. 23) to vary from 100 to 500 feet along the New River in the study area. No water quality data are available for surface or subsurface water along the New River.

V-2.20 VEGETATION AND WILDLIFE. There are 600 acres of highly disturbed desert wash habitat along the New River channel; only 10 acres remain in a fairly natural condition. The riparian vegetation is best developed and least disturbed at the confluences with Skunk Creek and the Agua Fria River. However, sand and gravel mining operations at the Skunk Creek confluence have removed some vegetation from the center of the channel. Many large, native or introduced, cottonwoods with a 30-inch diameter at breast height occur at the confluence with Skunk Creek.

V-2.21 From Grand Avenue south to Olive Avenue (about 2 miles), residential development and agricultural land uses occur adjacent to the channel and natural vegetation is mostly limited to a sparse growth of riparian trees, shrubs and grasses. Agricultural land uses predominate along the New River channel from Olive Avenue to the confluence with the Agua Fria River about 4 miles downstream (near Camelback Road). The predominant agricultural crops grown in areas near the channel are citrus fruits, cotton and milo. The riparian growth through this section is sparse to medium. Introduced tamarisk and eucalyptus plantings border the New River flood plain in several areas. Weedy annuals and perennials are more common here than in the less disturbed upstream reaches. At most road crossings that lack bridges, extensive channelization has occurred, limiting larger vegetation to areas along the channel banks.

V-2.22 Wildlife populations are discussed for the entire project feature study area in paragraphs V-2.37 through V-2.39 under a subsequent subheading, "Agua Fria River."

V-2.23 ARCHEOLOGICAL AND HISTORICAL RESOURCES. Archeological and historical resources were investigated by the Arizona State University, Department of Anthropology, under contract with the Corps of Engineers. Two archeological remains were found in the course of the investigations along the New River channel; the first site was located 0.9 mile west of the channel, the second was on the terrace overlooking the Agua Fria River. The project has no effect on these sites because both are outside of the project overflow area. No evidences of prehistoric remains or historic sites were found along the New River within the project overflow area.

V-2.24 POPULATION. There are about 2,770 people living within the combined New River and Agua Fria River future standard project flood overflow areas (pl. 7). Projections of future population for this area, with and without flood control, are given in the following tabulation.

	1974	1976	1986	1996	2026
Population with flood control	2,770	4,110	7,800	12,900	34,200
Population without flood control	2,770	4,110	7,800	12,900	34,200

V-2.25 The pattern of development depicted in the above tabulation is based on population projections for Maricopa County made by the Bureau of Economic Analysis of the U. S. Department of Commerce and the Economic Research Service of the U. S. Department of Agriculture (OBERS). The projections were allocated by the Corps of Engineers within the county on the basis of data provided by the Maricopa Association of Governments, historical trends, local and regional land use plans, current zoning and the National Flood Disaster Act of 1973.

V-2.26 LAND USE. The land immediately adjacent to the New River in the upper reach, from the recommended New River Dam to the Skunk Creek confluence, is primarily in agricultural uses, although large areas are vacant. Downstream from the Skunk Creek confluence, the lands are occupied by agricultural and occasional residential and industrial uses. Gravel mining operations occupy two locations in the riverbed, one at the Skunk Creek confluence and one just north of Olive Street. One unregulated trash fill area is located immediately south of Glendale Avenue. A sewage treatment facility is immediately north of Glendale Avenue outside the project area. The present and projected future uses of the land within the future standard project flood overflow area of the New River are shown on the following tabulation. In the tabulation, the area, which totals about 13,300 acres, has been divided into two reaches: (a) from the recommended New River Dam to the Skunk Creek confluence, and (b) from the Skunk Creek confluence to the Agua Fria River.

From the Recommended New River Dam to Skunk Creek Confluence

Land Use	1974	1976	1986	1996	2006	2016	2026
Residential	185	190	260	450	650	1,100	1,755
Trailer Parks	0	0	0	0	0	0	0
Commercial	0	0	0	25	40	80	115
Industrial	0	0	0	0	0	0	0
Public, Semi-Public	0	0	0	0	30	40	50
Transportation	210	210	210	210	210	210	210
Urban Parks	0	0	0	0	0	0	0
Total, urban	395	400	470	685	930	1,430	2,130
Agriculture	3,895	4,895	4,840	4,675	4,430	3,950	3,265
Open Space-Vacant	2,790	2,785	2,770	2,720	2,720	2,700	2,685
Channels-Irrigation	0	0	0	0	0	0	0
Total, non-urban	7,685	7,680	7,610	7,395	7,150	6,650	5,950
TOTAL	8,080	8,080	8,080	8,080	8,080	8,080	8,080

From the Skunk Creek Confluence to Agua Fria River

Land Use	1974	1976	1986	1996	2006	2016	2026
Residential	50	175	475	750	1,020	1,325	1,325
Trailer Parks	0	0	0	0	0	0	0
Commercial	0	20	70	120	160	210	210
Industrial	65	70	85	160	250	340	340
Public, Semi-Public	0	0	0	0	0	0	0
Transportation	104	104	104	104	104	104	104
Urban Parks	0	0	0	0	0	0	0
Total, urban	219	369	734	1,134	1,534	1,979	1,979
Agriculture	2,875	2,765	2,415	2,035	1,655	1,240	1,240
Open Space-Vacant	955	915	900	880	860	830	830
Channels-Irrigation	0	0	0	0	0	0	0
Total non-urban	3,830	3,680	3,315	2,915	2,515	2,070	2,070
TOTAL	4,049	4,049	4,049	4,049	4,049	4,049	4,049

V-2.27 TRANSPORTATION. Nine east-west highways and two north-south highways cross the New River. Four of these crossings are on all-weather bridges, the remainder are dip crossings that become impassable when flows in the river exceed 6 inches in depth. No public airports nor private landing strips are located near the river. The Atchison, Topeka and Santa Fe railroad crosses the river on a multispan bridge immediately north of Grand Avenue near the town of Peoria.

V-2.28 RECREATION. There are no formal recreation facilities along the reach of the New River within the study area; however parts of the river are used informally, and often illegally, for riding, hiking, off-road vehicles, hunting, and nature observation.

V-2.29 NOISE. Point sources of noise in the study area include the 111 highway crossings, the railroad crossing and the 2 sand and gravel operations located on the river.

V-2.30 ESTHETICS. The upper reach of the New River from the proposed New River Dam site to the Skunk Creek confluence offers a visual contrast to the open desertland, crisscrossed with unsurfaced roads, and the uniformly planted orchards. Although there has been indiscriminate dumping of trash at dip crossings, and major topographic disruptions at the sand and gravel operations, the riparian vegetation that remains provides a valuable visual resource. Residential development has encroached on the river at Sun City. The juxtaposition of the river, the well ordered orchards, the flat agricultural fields, and the residential areas create a diversified landscape. The open space of the New River provides visual relief from the intensity of urban and agricultural development in the study area.

Agua Fria River

V-2.31 TOPOGRAPHY. The portion of the Agua Fria River within the study area extends about 10 miles downstream from the confluence of the Agua Fria and New Rivers to the Gila River. The Agua Fria River occupies a wide flood plain with distinctive alluvial units between higher terrace slopes. In the 10 miles between the New River confluence and the Gila River, the Agua Fria River drops about 11 feet per mile.

V-2.32 GEOLOGY AND SOILS. The bed of the Agua Fria River is shallow, having a maximum depth of 7 feet, and consists of unconsolidated sands, gravels and cobbles that have an infiltration rate of about 2 inches per hour. This alluvium has no agricultural value. Deep fine sandy and silty loam soils parallel the Agua Fria River from McDowell Road upstream to the confluence with the New River. These alluvial soils are pale brown in color, friable, slightly hard, moderately alkaline, well drained, calcareous, and coarse, and will withstand velocities of up to 6 feet per second before becoming seriously eroded. These soils have infiltration rates of from 0.15 to 0.30 inches per hour and are well suited to crops requiring a light textured yet fertile soil. Similar soils produce alfalfa, cotton, small grains and other truck crops.

V-2.33 Limy fine sand soil parallels the Agua Fria River on the west bank from McDowell Road downstream to the confluence with the Gila River. The soil is pale brown in color, highly mixed, moderately alkaline, containing lime concentrations, quartz, and mica flakes. This type of soil can withstand velocities of 1.5 feet per second before erosion becomes apparent. Soils to the east of the river are similar to those upstream of McDowell Road (ref. 26).

V-2.34 SURFACE HYDROLOGY. The portion of the Agua Fria River within the study area has the characteristics of an ephemeral stream, only flowing during and after heavy rainfall. The river has a drainage area of 941 square miles below the Lake Pleasant Dam. Within the study area the river has a gradient of 10 feet per mile. Since 1960, the maximum discharge recorded on the Agua Fria River was 20,600 cfs. This was recorded at the U.S.G.S. stream gage at Avondale on September 6, 1970. Historically, a maximum discharge of 105,000 cfs was estimated to have occurred at Lake Pleasant Dam as a result of two general winter storms occurring in January 1916. Estimates of the magnitude of flood discharges using present conditions without the project are shown in the following tabulation.

	Flood Frequency		
Concentration Point	50 yr. (cfs)	100 yr. (cfs)	SPF (cfs)
Agua Fria River at Bell Road	40,000	54,000	78,000
Agua Fria River below New River confluence	44,000	58,000	95,000
Agua Fria River at McDowell Road	43,000	57,000	94,000
Agua Fria River at Buckeye Road near Avondale	42,000	56,000	93,000

V-2.35 SUBSURFACE HYDROLOGY. The depth to ground water is estimated by the U.S.G.S. (ref. 23) to vary from 100 to 200 feet along the Agua Fria River in the study area. No water quality data are available for surface or subsurface water along the reach of the Agua Fria River within the study area.

V-2.36 VEGETATION AND WILDLIFE. Almost all of the 1,000 acres of desert wash and outwash vegetation along the Agua Fria River have been highly disturbed by man's activities, including agriculture and off-road vehicular uses. The densest and most abundant riparian and outwash growth along the river channel and flood plain extends downstream about 1-1/4 miles from the New River confluence at Camelback Road to India School Road. In this reach, desert wash and desert outwash growth is about 0.8 mile wide. Large desert willow predominate in some areas. The growth of mesquite and blue paloverde is sparse to medium. The vegetation away from the immediate channel where moisture conditions do not favor riparian species is mostly desert broom, creosote bush, saltbush, Mormon tea (8 feet tall), cheeseweed, burrobrush and various annual and perennial herbs and grasses. The presence of this xeric vegetation instead of the expected riparian growth is due to reductions of normal flows resulting from upstream impoundment at Waddell Dam (Lake Pleasant).

V-2.37 Downstream from Indian School Road near Thomas Road, a sand and gravel mining operation in the channel has highly disturbed the natural wash community. Large tamarisks, growing on both sides of the channel, are numerous from Thomas Road south to Van Buren Street. Salt cedar shrub growth in the channel is sparse to heavy along the lower reaches of the Agua Fria River, depending on the availability of water. Agricultural land use predominates adjacent to the channel. The major agricultural crops grown in areas near the channel are citrus fruits, cotton and milo. Cottonwood, eucalyptus, mesquite, California fan palm and Canary Island date palm are common species that have been planted along field boundary roads and around residences in the area. The ponding of effluent from a sewage treatment plant between McDowell Road and Van Buren Street provides habitat for some water-associated birds. The wide and highly disturbed channel from Van Buren Street south to about a mile below Buckeye Road has sparse riparian growth and mostly weedy annuals. Riparian growth, mostly salt cedar and willow, becomes very heavy at the confluence of the Agua Fria and Gila Rivers, about 3 miles downstream from Buckeye Road.

V-2.38 The wildlife populations along the river and creek channels in the entire project feature study area are variable. Along certain reaches of Skunk Creek, Cave Creek, the New River and the Agua Fria River, sand and gravel mining operations have eliminated the habitat, and wildlife populations are practically nonexistent. Alternatively, other reaches of Cave Creek, Skunk Creek, New River and the Agua Fria River have less disturbed habitat and support fairly diverse wildlife populations. During four field surveys of the area made in 1973 and 1974, doves, quail, rabbits, ground squirrels, lizards, hawks, weasels and many song birds were observed. Wildlife is surprisingly common along the Agua Fria River even where recent urban development has encroached upon the flood plain habitats.

V-2.39 During the winter, many raptors migrate to the study area and prey upon small rodents and other animal species around the agricultural land and natural habitats. Other migrant bird species also find the Phoenix area suitable as a winter habitat. The Maricopa

Audubon Society annually conducts a Christmas bird-count in the southwest Phoenix area. The bird-count area, which has a 15-mile diameter, is about 10 miles west of downtown Phoenix (pl. 9). Included within the count area are parts of the Grand Canal and the riverbeds of the Salt, New, Gila and Agua Fria Rivers. About 32 percent of the area is in agricultural land use; 47 percent is urbanized; 19 percent is dry riverbed and creosote bush desert; and 2 percent is open water and marshes. A total of 94,000 birds representing 156 species were observed during the 1973 Christmas bird-count. Preliminary data for the 1974 bird-count show about 90,000 birds representing about 162 species. The New and Agua Fria Rivers are important riparian habitats where many bird species are observed during the Christmas count.

V-2.40 During bird migrations, waterfowl use ponded areas along the Agua Fria River near the Avondale sewage treatment plant. The large number of shotgun shells along the Agua Fria and New Rivers and Skunk Creeks indicates these areas are used for hunting. The game species hunted include white-wing doves, mourning doves, Gambel's quail, rabbits and occasionally waterfowl.

V-2.41 ARCHEOLOGICAL AND HISTORICAL RESOURCES. Archeological and historical resources were investigated by the Arizona State University, Department of Anthropology, under a contract with the Corps of Engineers. The survey revealed one archeological site which has not been considered for nomination to the National Register. The site is a habitation area that extends for 720 feet in a northeast-southwest direction and 360 feet in a northwest-southeast direction, occupying an older river alluvial terrace remnant.

V-2.42 From the preliminary investigation it appears that the ancient fields of the site were irrigated by waters brought from the Gila River rather than from the Agua Fria River. What remains of the agricultural component consists of a canal system that parallels the terrace base for a distance of about 690 feet and extends in a northeast direction. Two lateral feeders or small ancillary ditches are associated with the canal and would have irrigated fields situated just north of the site proper. The artifactual collection from the site indicates a Hohokam settlement occupied between the late pioneer period and the late colonial period, or about 100 to 900 A.D.

V-2.43 POPULATION. Data concerning population of the combined New River and Agua Fria future standard project flood overflow areas are presented in paragraph 2.23, under a preceding subheading "New River."

V-2.44 LAND USE. The land adjacent to the Agua Fria River downstream of the New River confluence is primarily in agricultural uses. The riverbed contains about seven sand and gravel mining sites located near Glendale Avenue, Camelback Road, Thomas Road, Van Buren Street, and Lower Buckeye Road. Urban land uses occur on the east bank of the river near McDowell Road, on the west bank from Van Buren Street to Lower Buckeye Road, and on the east bank from Lower Buckeye Road about one-half mile downstream. A sewage disposal facility is located south of the City of Avondale and is within the 100-year flood plain.

V-2.45 The present and projected future land use of the land within the future standard project flood overflow area of the Agua Fria River is shown in the following tabulation. The area contains about 6,239 acres. The projections for land uses with and without flood control are identical.

Land Use	1974	1976	1986	1996	2006	2016	2026
Residential	65	80	105	200	750	1,280	1,280
Trailer Parks	0	0	0	0	0	0	0
Commercial	0	0	0	10	50	125	125
Industrial	0	0	0	0	10	25	25
Public, Semi-Public	0	0	0	25	65	105	105
Transportation	49	49	49	49	49	49	49
Urban Parks	0	0	0	0	0	0	0
Total, urban	114	129	154	284	924	1,584	1,584
Agriculture	2,595	2,580	2,565	2,445	2,280	2,105	2,105
Open Space-Vacant	3,530	3,530	3,520	3,510	3,035	2,550	2,550
Channels–Irrigation	0	0	0	0	0	0	0
Total, non-urban	6,125	6,110	6,085	5,955	5,315	4,655	4,655
TOTAL	6,239	6,239	6,239	6,239	6,239	6,239	6,239

V-2.46 TRANSPORTATION. The study area of the Agua Fria River is not crossed by any major north-south highways, but is crossed by seven major east-west highways. The highway crossings at Buckeye Road and Indian School Road are over bridges, while the remainder are dip crossings that become impassable when flows in the river exceed 6 inches in depth. A mainline of the Southern Pacific Railroad crosses the river immediately north of Buckeye Road on a multispan bridge. A private landing strip is located 1.5 miles east of the river just below McDowell Road. The Phoenix-Litchfield Municipal Airport is located about 2 miles west of the river immediately north of Lower Buckeye Road. This airport accommodates aircraft of all sizes including occasional chartered jets. Although the airport reported 168,000 operations in 1974 there are no continuing commercial flights into the airport and none are anticipated in the future. Luke Air Force Base is located about 4 miles west of the river at the end of Glendale Avenue. Both airports have landing patterns which cause aircraft to occasionally fly over the New and Agua Fria Rivers; however, the aircraft are at a sufficient height to minimize any adverse effects they may have on the study area.

V-2.47 RECREATION. There are no formal recreation facilities along this section of the Agua Fria River; however, parts of the river are used informally, and sometimes illegally, for riding, hiking, off-road vehicle use, and hunting. Parts of the river are used for nature observation, especially bird watching. This reach of the Agua Fria contains part of the National Audubon Society's Christmas Bird Count Area which is shown on plate 9.

V-2.48 NOISE. Point sources for noise in the study area include the seven highway crossings, the railroad crossing, and the numerous sand and gravel mining operations on the river.

V-2.49 ESTHETICS. Within the study area the Agua Fria River passes through vacant, agricultural, and urbanized areas. The river is fairly expansive, and supports several areas of extensive riparian vegetative growth, which in turn supports numerous wildlife species. Sand and gravel mining operations, off-road vehicle trails, and indiscriminate dumping of trash have reduced the esthetic quality of the river; however the areas of wildlife habitat, although contained by adjacent agricultural land uses, provide a valuable educational, recreational, and visual resource. The juxtaposition of the various land uses creates landscape diversity.

V-3. RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE PLANS

V-3.01 The recommended project feature (proposed action) conforms to the objectives and specific terms of existing and proposed Federal, State, and local land use plans, policies, and controls. The recommended floodways and flowage easements on Skunk Creek, New River, and Agua Fria River conform to the objectives of the Flood Disaster Protection Act of 1973 (Public Law 23-234) as well as to the objectives of the State of Arizona Preventive Flood Control Law (Ariz. Rev. Stat. Ann. 45-2341--2346, May 3, 1973). The Flood Disaster Protection Act requires that flood prone areas be identified and that flood plain ordinances be adopted. The State of Arizona Preventive Flood Control Law prohibits construction within areas prone to flooding until the appropriate governing body adopts flood plain regulations. Because both Federal and State laws require flood plain management on land that would be affected by the project feature, the recommendation to continue flood plain management conforms to the objectives and intent of the laws.

V-4. THE PROBABLE IMPACT OF THE PROPOSED PROJECT FEATURE ON THE ENVIRONMENT

V-4.01 TOPOGRAPHY. Construction of the recommended improvements along Skunk Creek, New River and the Agua Fria River will have a minor impact on the natural topography of the area. As part of the recommended plan local interests will be required to manage and maintain floodways and flowage easements along these waterways as an alternative to channelization. These floodways will remain essentially natural. Minimal structural measures will be required. Flood proofing, bank stabilization, and bridge protection structures, along with some channelization and clearing, will be necessary.

V-4.02 NATURAL RESOURCES. The recommended improvements along Skunk Creek and the New and Agua Fria Rivers will not have a significant effect on the quantity of sand and gravel available in the area. Some material will be required to construct the structural improvements. No stream channel will be made unavailable to existing or future mining operations. The proposed floodways and flowage easements will restrict urban encroachment and assist in preserving supplies of construction aggregate adjacent to the urban areas.

V-4.03 SURFACE HYDROLOGY. The construction recommended as part of the project feature will not significantly affect the velocity, duration, volume, or course of surface flows.

V-4.04 SUBSURFACE HYDROLOGY. Floodways and flowage easements along Skunk Creek, New River and the Agua Fria River will allow the continued percolation of ground water through the streambeds.

V-4.05 WATER QUALITY. The recommended project feature will not adversely affect water quality in the area. A sewage treatment facility which is presently in the flood plain will be protected by dikes as part of the recommended feature.

V-4.06 VEGETATION AND WILDLIFE. The recommended flowage easements will not alter or adversely affect existing native plant communities and associated wildlife along the channels. No productive gains in wildlife habitats will result from the proposed action, nor will this action prevent landowners from modifying the habitat for such allowable land uses as agriculture, golf courses, or certain structural developments.

V-4.07 The recommended localized flood proofing measures will disturb and remove some wildlife habitat. Construction of an earthen levee, unlined trapezoidal channel and bank stabilization along New River between Thunderbird Road and Peoria Avenue will alter or eliminate an estimated 10 acres of riparian and non-riparian wildlife habitat. The impact on wildlife will be relatively insignificant. A 40 to 50 acre area of disturbed riparian habitat upstream from Thunderbird Road will not be altered by nearby project-related activities. Construction of a 3,300-foot-long earthen dike along the west bank of the Agua Fria River downstream from Buckeye Road will eliminate highly disturbed biological communities on about 10 acres. This impact is considered insignificant.

V-4.08 The construction of bridges at two crossings along Skunk Creek, seven crossings along New River and four crossings along the Agua Fria River will disturb some existing riparian habitat without causing a significant impact.

V-4.09 If riparian growth is strongly enhanced by changes in the water regime induced by the project, and if this growth restricts the conveyance of floodflows, excess vegetation will be removed along New River and Agua Fria River to restore the floodway to the delineated (original project) 100-year floodway.

V-4.10 ARCHEOLOGICAL AND HISTORICAL RESOURCES. No archeological or historical resources were discovered within the project overflow area along Skunk Creek or New River. The archeological site discovered near the Agua Fria River is located on a terrace out of the flood plain and will not be disturbed by this project feature.

V-4.11 POPULATION AND LAND USE. The acreage along Skunk Creek, New River and the Agua Fria River designated as floodway or purchased as flowage easements will be subject to the provisions of the Federal Flood Disaster Act of 1973 and the Arizona State Preventive Flood Control Law, which place restrictions on urban development within the flood plain. Within designated floodways and flowage easements no structures for human habitation will be allowed. Eight existing structures will be removed, 15 others will be floodproofed. Other structures may be approved for construction within the limits of the floodways or flowage easements in accordance with existing laws if the required capacity of the waterways is not significantly reduced. Certain land uses, including agriculture, recreation and sand and gravel mining, will not be restricted.

V-4.12 TRANSPORTATION. Flowage easements along Skunk Creek and the New and Agua Fria Rivers will have no effect on transportation in the area.

V-4.13 SOCIAL. The establishment of designated floodways and the purchase of flowage easements will require some evacuations within the flood plains. Five residences will be removed from Skunk Creek; along the New and Agua Fria rivers eight residences will be removed. Individuals involved in these relocations will be compensated in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

V-4.14 Within designated floodways, Federal and State statutes limit the permissible land uses. Owners of land within flowage easements and floodways along Skunk Creek and the New and Agua Fria rivers will not be reimbursed for the possible effects of these restrictions.

V-4.15 In areas where flowage easements are purchased, land owners will receive no further compensation for flood damages incurred.

V-4.16 RECREATION. As part of the recommended plan, riding and hiking trails and associated rest and staging areas will be constructed along Skunk Creek and the New and Agua Fria rivers in cooperation with local sponsors. This development will benefit the many recreationists who presently use the area for nature walks and bird watching.

V-4.17 ESTHETICS. The recommended project feature will have a minor impact on the visual quality of the area. The structural floodproofing measures that will be constructed will be obviously artificial, and may be considered visually displeasing by some persons. By minimizing the structural elements required, the impact of the project feature on the visual quality of the area will be minimized. The acquisition of flowage easements and floodways along Skunk Creek, New River and the Agua Fria River will help limit urban encroachment and preserve existing natural vistas and open space.

V-5. ANY PROBABLY ADVERSE ENVIRONMENTAL EFFECTS THAT CANNOT BE AVOIDED

V-5.01 The required structural floodproofing measures will be visually intrusive.

V-5.02 A total of 13 residences along Skunk Creek and the New and Agua Fria rivers will require relocation.

V-5.03 Land uses within the proposed flowage easements and floodways will be limited. Individuals owning land within the flowage easements and floodways along Skunk Creek and the New and Agua Fria rivers will not be reimbursed for the possible effects of these restrictions.

V-6. ALTERNATIVES TO THE PROPOSED PROJECT FEATURE

V-6.01 INTRODUCTION. The only feasible alternative to the proposed project feature is a system of channels similar to the authorized project feature. This alternative is described and its impacts are evaluated in the following paragraphs.

V-6.02 DESCRIPTION OF THE CHANNELIZATION ALTERNATIVE. A concrete-lined trapezoidal channel would be constructed along Skunk Creek from Adobe Dam to the confluence of Skunk Creek with New River 7.4 miles to the south. A trapezoidal earth-bottom channel, with revetted side slopes, would be constructed along New River from the Skunk Creek confluence downstream to the confluence with the Agua Fria River, a distance of about 7.6 miles. The channel would be excavated below the existing ground surface. A trapezoidal earth-bottom channel would be constructed along the Agua Fria River from the confluence of New River to a point about 2 miles downstream of the U. S. Highway 80 bridge, a distance of 10.1 miles.

V-6.03 ENVIRONMENTAL EFFECTS OF THE CHANNELIZATION ALTERNATIVE. The channelization alternative would have the following environmental effects.

a. Topography. Construction of 25 miles of earth and concrete channels along Skunk Creek and the New and Agua Fria Rivers would result in major alterations to the topography of the streambeds.

b. Natural Resources. Construction of the channels would have a significant adverse impact on the quantity of sand and gravel available in the area. Seven miles of streambed covered by concrete channel would be permanently unavailable for mining. No mining activities would be permitted in any portion of the channels.

c. Surface Hydrology. Channelization would affect the volume and course of surface flows released from the proposed dams. Channelization would severely restrict the course of surface flows. There would be no percolation along concrete-lined reaches, resulting in a somewhat greater volume of water arriving at the confluence of the Agua Fria and Gila Rivers than would be expected under present conditions.

d. Water Quality. The channelization alternative would not affect water quality.

e. Vegetation and Wildlife. Within the channel right-of-way, construction of the channel would destroy all vegetation including the riparian habitat along the Agua Fria River that lies within the Audubon Society's Christmas Bird Count area. In earth-bottom sections, periodic maintenance would remove any regrowth. The channels would be barriers to wildlife movement.

f. Archeological and Historical Resources. Channelization of Skunk Creek and the New River would not affect any archeological or historical resources. Channelization of the Agua Fria River would indirectly affect one archeological site by encouraging urbanization of the 100-year flood plain.

g. Population and Land Use. Construction of channels would allow the urbanization of agricultural land and open space along Skunk Creek and the New and Agua Fria Rivers by providing flood protection and removing the need for existing flood plain regulations.

h. Transportation. Construction of channels along Skunk Creek and the New and Agua Fria Rivers would have the same impact on transportation as the recommended project feature.

i. Social. The construction of channels along Skunk Creek and the New and Agua Fria Rivers would require some relocations of families. Because less land would be required for construction of channels, fewer relocations would be required for this alternative than for the recommended project feature. Individuals involved in relocations would be compensated according to the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

j. Recreation. Riding and hiking trails and associated rest and staging areas would be developed along the channel rights-of-way. However, habitat supporting the wildlife that presently attracts hikers would be destroyed by the construction and continued maintenance of the channels and, indirectly, by land use changes resulting from channelization.

k. Esthetics. Channels along Skunk Creek and New and Agua Fria Rivers would have a significant adverse impact on the visual quality along the streambeds. The structures would be obviously artificial elements replacing the vegetation and contours of the natural stream channel.

V-6.04 REASONS FOR REJECTING THE ALTERNATIVE. While the channelization alternative would provide a degree of flood protection similar to that of the recommended plan, the higher cost and adverse environmental impacts associated with channelization of Skunk Creek and the New and Agua Fria Rivers make this alternative less desirable.

V-7. THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

V-7.01 The recommended project feature will reduce flood damage to existing urban developments. This protection will be afforded only to existing populations. The recommended Skunk Creek, New River and Agua Fria River feature will provide recreation facilities that will be available to both existing and future populations.

V-7.02 The feature will permanently alter 20 acres of disturbed wildlife habitat. In addition to flood protection afforded to existing urban areas, 8,510 acres of presently undeveloped flood plain will be committed to flowage easements and will have no potential for future urban development.

V-8. ANY IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED

V-8.01 The recommended project feature would not require any significant irreversible and irretrievable commitment of resources should it be implemented. The estimated 150,000 cubic yards of earth and rock used for levees can be removed and reused as fill materials should the flood threat ever be eliminated.

V-9. COORDINATION

V-9.01 Detailed coordination for the flowage easement feature of this project has been carried out with the Recreation Task Force, and the Arizona Conservation Council, the U. S. Fish and Wildlife Service, the Arizona Game and Fish Department, the National Park Service, and the Advisory Council on Historic Preservation.

VI

FEATURE OF
THE NEW RIVER &
PHOENIX CITY STREAMS
FLOOD CONTROL PROJECT

ARIZONA CANAL DIVERSION CHANNEL, CAVE CREEK & DREAMY DRAW WASH

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SECTION VI

ARIZONA CANAL DIVERSION CHANNEL, CAVE CREEK AND DREAMY DRAW WASH
Feature of the
New River and Phoenix City Streams
Flood Control Project

VI-1. DESCRIPTION OF PROJECT FEATURE

VI-1.01 INTRODUCTION AND PURPOSE. This section describes the Arizona Canal Diversion Channel, Cave Creek, and Dreamy Draw Wash feature of the New River and Phoenix City Streams Flood Control Project. This project feature is subsequently referred to as the "Diversion Channel" feature for brevity. This section includes: (a) a detailed description of the recommended Diversion Channel project feature, (b) a description of the environmental setting in the immediate area of the recommended Diversion Channel, (c) the relationship of the Diversion Channel to land use plans for the area, (d) the probable adverse impacts which cannot be avoided should the Diversion Channel be constructed, (f) an analysis of the alternative designs studied, (g) the relationship between the short-term use of the environment along the recommended Diversion Channel and the maintenance and enhancement of long-term productivity, (h) the irreversible and irretrievable commitments of resources which would be involved should the feature be constructed, and (i) the coordination effort which has taken place.

VI-1.02 PROJECT FEATURE LOCATION. The recommended Diversion Channel feature extends (a) along the northerly side of the Arizona Canal from 40th Street to Skunk Creek, a distance of about 17 miles; (b) along Cave Creek from the Arizona Canal northerly to the recommended Cave Buttes damsite; and (c) along Dreamy Draw Wash from the Arizona Canal northeasterly to the existing Dreamy Draw Dam (pl. 4).

VI-1.03 AUTHORIZED PROJECT FEATURE. The authorized Diversion Channel feature, which is not presently recommended, is described in the following subparagraphs.

a. Arizona Canal Diversion Channel. The authorized Arizona Canal Diversion Channel would extend along the northerly side of the Arizona Canal from 12th Street, in the City of Phoenix, to Skunk Creek, a distance of about 12 miles. From 12th Street to Central Avenue, a distance of about 2 miles, the channel would be a rectangular concrete channel ranging in width from 10 to 50 feet and in depth from 8 to 18 feet. From Central Avenue to Skunk Creek, a distance of about 10 miles, the channel would be a trapezoidal earth-bottom channel with revetted side slopes; channel widths would range from 20 to 220 feet and depths would range from 8 to 20 feet. The design capacity of the channel would range from 1,500 to 18,500 cfs. A reinforced-concrete transition channel and a side-channel spillway structure would be provided at Skunk Creek to assure proper confluence of the two flows. Bridges would be provided at 7th Street, Central Avenue, 7th Avenue, 19th Avenue, Black Canyon Highway, 43d Avenue, 51st Avenue, 59th Avenue, and Northern Avenue.

b. Dreamy Draw Channel. The authorized Dreamy Draw Channel would extend from Dreamy Draw Dam to the Arizona Canal Diversion Channel, a distance of about 3-1/2 miles. The channel would be a rectangular concrete channel 10 feet wide with a depth ranging from 7 to 9 feet. The design capacity of the channel would range from 100 to 1,500 cfs. Bridges would be provided at Northern Avenue, 16th Street, Winter Drive, 14th Street, Belmont Avenue, and 12th Street.

c. Cave Creek Channel. The authorized Cave Creek Channel would be tributary to the authorized Union Hills Diversion Channel, rather than to the Arizona Canal Diversion Channel. The authorized Cave Creek Channel is discussed in Section I of this statement.

VI-1.04 RECOMMENDED PROJECT FEATURE. The recommended project feature will provide (a) about 17 miles of structural diversion channel parallel to the north of the Arizona Canal from 40th Street to Skunk Creek, (b) a designated floodway along Dreamy Draw Wash from the existing Dreamy Draw Dam to the recommended Arizona Canal Diversion Channel, and (c) a designated floodway along Cave Creek from the recommended Cave Buttes Dam to Peoria Avenue and a structural channel from Peoria Avenue to the Arizona Canal Diversion Channel. These elements are described in the following subparagraphs. The route of the diversion channel is shown on plates 28a through d.

a. Arizona Canal Diversion Channel. The recommended channel will comprise 8.1 miles of rectangular concrete channel from about 700 feet west of 40th Street to Cave Creek, near the Black Canyon Highway, 4.8 miles of trapezoidal concrete channel from Cave Creek to about Cactus Road, and 4.4 miles of trapezoidal earth-bottom channel from Cactus Road to Skunk Creek. The rectangular channel will range from 36 to 60 feet in width and from 21.5 to 25.0 feet in depth; the trapezoidal concrete channel will range from 60 to 245 feet in bottom width and from 21 to 23 feet in depth; and the trapezoidal earth-bottom channel will have a bottom width of 245 feet and will range from 19 to 22.5 feet in depth. The design capacity of the channel will range from 6,800 to 36,000 cfs. The channel will be entrenched below ground level for its entire length to allow side inflow to enter over the channel walls or through gated inlets. A side channel spillway will be provided at Cudia City Wash and Dreamy Draw Wash and a confluence structure will be provided at Cave Creek. Confluence structures will also be provided for 10th Street Wash, Myrtle Avenue Wash and Little Dreamy Draw Wash. The channel will be nearly parallel and immediately adjacent to the Arizona Canal where possible. The Arizona Canal will be realined to the south at several locations to avoid major developments, such as the Arizona Biltmore Hotel east of 24th Street and the Squaw Peak Filtration Plant west of 24th Street. The canal and channel will also be realined near 59th Avenue to eliminate undesirable curves and to miss an existing subdivision. West of Central Avenue the channel alinement passes through the Sunnyslope High School athletic field. In this reach the channel will be a covered section, and the athletic field will be restored after the channel is constructed. Bridges will be provided at all streets and highways that presently cross the Arizona Canal - 26 bridges in all will be required. Recreational facilities will be developed as part of the recommended plan along the Diversion Channel and on the Cave Creek floodway. (plates 29a through 29f). No recreational facilities will be developed from 40th Street to Dreamy Draw. From Dreamy

Draw to Cactus Road the recreational development will consist of a trail system on the service road and two 1/2-acre rest stop areas with picnicking facilities. The earth-bottom channel from Cactus Road to Skunk Creek will be developed as a recreational greenbelt with court and field games, picnicking, trails, an amphitheater, an equestrian training area, and a nature area. A golf course is planned for development by local interests.

b. Dreamy Draw Wash Channel. As a part of the recommended plan, local interests will be required to manage and maintain a designated floodway on Dreamy Draw Wash from the existing Dreamy Draw Dam to the confluence with the recommended Arizona Canal Diversion Channel. The limits of the floodway and the floodway fringe areas will be delineated by the Corps of Engineers for a 100-year frequency flood. This designated floodway will assure that the presently adequate capacity of this reach to safely convey a 200 cfs release from Dreamy Draw Dam is permanently retained. Flows in Dreamy Draw will enter the Diversion Channel via a side channel spillway. No recreational development will be included within the Dreamy Draw Wash floodway.

c. Cave Creek Channel. As a part of the recommended plan, local interests will be required to manage and maintain a designated floodway on Cave Creek from the recommended Cave Buttes Dam to Peoria Avenue. The limits of the floodway and the floodway fringe will be delineated by the Corps of Engineers for a 100-year frequency flood. This designed floodway will assure that the presently adequate capacity of this reach to safely convey a 500 cfs release from Cave Buttes Dam is permanently retained. A concrete trapezoidal channel will be constructed from Peoria Avenue to the Arizona Canal Diversion Channel. To satisfy the Salt River Valley Water Users Association's claim for water rights to Cave Creek runoff, a water conservation diversion channel will be provided to divert up to 500 cfs from Cave Creek near Peoria Avenue, convey it across the Arizona Canal Diversion Channel, and discharge it into the Arizona Canal. Cave Creek Park will be constructed in the Cave Creek floodway from Beardsley Road to the Diversion Channel as part of the recommended plan. Recreational development at this 1,850-acre park will include picnicking, trails, court and field games, a nature center and natural history museum, and a scenic drive. The park construction will be cost-shared with the local sponsors.

VI-2. ENVIRONMENTAL SETTING WITHOUT THE PROJECT FEATURE

VI-2.01 TOPOGRAPHY. The Diversion Channel project feature is on the alluvial plain south of the Phoenix Mountains and extends to Skunk Creek along the southwesterly margin of Deer Valley. North Mountain and South Mountain, immediately north of the east part of the project feature, have maximum elevations of 2,104 and 2,608 feet, respectively. There are numerous small deeply incised drainages emanating from the mountains. The topography from 32nd Avenue to Skunk Creek, the west part of the project feature, is a relatively flat alluvial plain with slopes of 30 feet per mile toward the southwest.

VI-2.02 The most important topographic feature in the area is the Arizona Canal, a man-made irrigation canal. The Arizona Canal varies in width from 30 feet to 72 feet and in depth from 4.5 feet to 9 feet. Its confining levees rise no more than 10 feet above natural ground on either side of the channel.

VI-2.03 GEOLOGY AND SOILS. The project feature channels and floodways pass through distinct geological zones characterized as talus, upper bajada and lower bajada. The talus deposits are limited to the area fronting North and South Mountain, which are predominantly composed of igneous and metamorphic outcroppings. The upper bajada consists primarily of colluvial deposits of gravel and cobbles, while the material in the lower bajada is composed of well sorted and deep alluvial deposits. Talus and upper bajada deposits predominate between 40th Street and 23d Avenue, while the lower bajada is characteristic from 23d Avenue to Skunk Creek.

VI-2.04 SURFACE HYDROLOGY. There are two distinctive types of surface flow in the project feature area - channel and sheet flow. In the reach from 40th Street to the Black Canyon Highway, channel flow is characteristic; sheet flow is characteristic in the area to the west of the Black Canyon Highway.

VI-2.05 Major drainages in the 40th Street to Black Canyon Highway reach are Cudia City Wash, Dreamy Draw and Cave Creek, with watersheds upstream from the Arizona Canal of about 5, 2, and 252 square miles, respectively. These drainages and all other flows are intersected by the Arizona Canal. Before construction of the Arizona Canal, these drainages continued to the Salt River. Their streambeds have been obliterated downstream from the Arizona Canal by agricultural and urban development.

VI-2.06 The surface hydrology in the reach from the Black Canyon Highway west to Skunk Creek has no major drainages, and is characterized by sheet flow across the gently sloping valley. As the area is increasingly modified for farming and, subsequently, for urban development, there will be some concentration and channelization of flows.

VI-2.07 The Arizona Canal was designed to convey irrigation waters at a nonscouring velocity. Its vertical drop between 50th Street and Skunk Creek is 40 feet, a slope of only 2 to 3 feet per mile. The irrigation flow capacity of the Arizona Canal ranges from about 700 cfs at 40th Street to about 625 at 75th Street near its terminus. The freeboard capacity can contain only minor flood runoff. Breaks in the canal levees or overtopping resulting from floodflow surcharge have occurred frequently; the areas most likely to be inundated are shown on plate 6.

VI-2.08 SUBSURFACE HYDROLOGY. The Arizona Canal has a pronounced effect on ground water in the study area for two reasons: (a) continual seepage from the canal is a source of artificial recharge, and (b) during storm runoff water ponded north (upstream) of the canal percolates into the ground water table. Ground water depths along the project feature alinement range from less than 100 feet to nearly 400 feet.

VI-2.09 WATER QUALITY. No water quality data exist for surface or subsurface water in the study area.

VI-2.10 VEGETATION AND WILDLIFE. Vegetation and wildlife along the alinements of Arizona Canal Diversion Channel, Cave Creek, and Dreamy Draw Wash are described in the following subparagraphs.

a. Arizona Canal Diversion Channel. Most of the existing natural biotic communities (about 40 acres) along the 17.3-mile-long alinement of the Arizona Canal Diversion Channel have been highly disturbed. East of the Black Canyon Highway, the area is heavily urbanized, and native vegetation is restricted to very narrow strips along the Arizona Canal (photo 19) or rare plots of open land. New residential developments are rapidly replacing the remaining agricultural lands along the canal. The existing vegetation is mostly weedy annuals, such as Russian thistle and pigweeds; shrubs such as tree tobacco, desert broom, creosote bush and gray thorn; and trees such as blue paloverde, mesquite and catclaw acacia. Many nonindigenous plants have been introduced for landscaping purposes in residential areas bordering the canal. West of the Black Canyon Highway, agricultural land uses prevail and natural vegetation is somewhat more common. Recently, however, many acres of agricultural land have been converted to housing developments or businesses in this reach, removing part or all of the vegetation. Some large mesquite, cottonwood and tamarisk (large tree) grow along or near the Arizona Canal through this reach. The cottonwood and tamarisk growth is a reflection of the artificial water supply brought in by the canal.

b. Cave Creek. Habitats along Cave Creek from the vicinity of the proposed Cave Buttes Dam site to the Arizona Canal near the Black Canyon Highway have been highly altered. Sand and gravel mining, landfills, off-road vehicular uses and trash disposals have eliminated or severely altered the desert wash plant community. There is little natural riparian growth remaining along Cave Creek, except for some fair quality growth along about 1 mile downstream from the recommended damsite, and downstream from the authorized Cave Buttes damsite. Residential and commercial developments have encroached on Cave Creek throughout almost all the reach from the authorized damsite to the Arizona Canal. The City of Phoenix is developing a greenbelt park on a sanitary landfill along Cave Creek near 19th Avenue and Greenway Road. The creek through this reach has been highly modified. The vegetation through the highly disturbed areas include burrobrush, bursages, desert broom, some blue paloverde, mesquite, tree tobacco, giant reed, and annual herbaceous plants and various grasses. Wildlife populations along the disturbed downstream reaches of Cave Creek include mostly small rodents, doves, song birds and rabbits.

c. Dreamy Draw Wash. Most of Dreamy Draw Wash has been subjected to considerable environmental disturbance in the past. Consequently, the vegetation in the area is generally sparse, although moderate densities of desert riparian trees and shrubs (i.e., mesquite and blue paloverde) occur within and along portions of Dreamy Draw Wash. The past destruction of native plants and surface disturbance due to off-road vehicle use and mining, especially in the Dreamy Draw Dam detention basin area, have apparently contributed to a somewhat unnatural assemblage of weedy plants. The weedy plants include five-stamen saltcedar, Jerusalem-thorn, bermuda grass, horse purslane, pigweed and a variety of annuals. Residential encroachment occurs along some portions of Dreamy Draw Wash and motorcycle trails have caused noticeable disturbance to the natural habitats.

VI-2.11 ARCHEOLOGICAL AND HISTORICAL RESOURCES. A survey of archeological and historical resources in the Diversion Channel study area was conducted by Arizona State University, Department of Anthropology, under a contract with the Corps of Engineers. The archeological and historical resources along the alinements of the Arizona Canal Diversion Channel, Cave Creek from Cave Creek Dam to the Arizona Canal and Dreamy Draw Wash from Dreamy Draw Dam to the Arizona Canal, are described in the following subparagraphs.

a. Arizona Canal Diversion Channel. Neither the search of site records and early sources at Arizona State University (ASU) nor the archeological field survey yielded information on archeological or historic resources that would be affected by construction of the Arizona Canal Diversion Channel. Data from nearby districts similarly situated with respect to topography suggested that scattered tools and an occasional temporary campsite dating before A.D. 1300 could have been expected in the reach from 40th Street to Cave Creek; remains from regions similar to the reach from Cave Creek to Skunk Creek are extremely rare. It appears that what few remains might have been present have been destroyed by recent construction and agricultural activities.

b. Dreamy Draw Wash. Neither the search of site records and early sources at ASU nor the archeological survey conducted by ASU on 26 December 1969 yielded any information on archeological or historic resources within the Dreamy Draw Wash study area. Data from nearby districts similarly situated with respect to topography suggest that scattered tools and an occasional temporary campsite dating before A.D. 1300 could have been expected in the study area. It appears, however, that what few remains might have been present have been destroyed by agricultural and construction activities.

c. Cave Creek. The portion of Cave Creek from the Cave Creek Dam to the Arizona Canal intersects three habitation and agricultural sites, and a petroglyph site. A description of these sites follows:

(1) An extensive archeological site is located within the study area about 3 to 4 miles downstream from Cave Creek Dam. Although erosion resulting from flooding of Cave Creek has disarranged many of the features, evidences of habitations occur in six areas of the site; hearths and fire-cracked rock are along the west margin of the remains, and suggestions of water control structures extend over an area 2,625 feet long and 1,300 feet wide at its maximum width. No mounds are evident but it is probable that cultural deposits reach a depth of 3 feet in parts of the site.

(2) A second site occupying an alluvial deposit on the flood plain of Cave Creek and the substratum outcrop to the west is a complex of agricultural terraces, garden plots, water control structures, canals, subsurface ovens, and field houses that extend for 3,120 feet. The agricultural system is situated so as to take advantage of both sheet wash from the slope to the west and water from Cave Creek that can be conducted to the fields by a canal. At a distance of 450 feet west of the agricultural system is one cluster of habitations and a large refuse mound. Vandalism has resulted in four areas of the refuse mound being opened. However, enough of the deposit remains intact to provide stratigraphic information. Digging also has been accomplished at a large rectangular room. A stone masonry foundation wall bounds a partly subterranean structure. At least two structures, possibly the earlier ones at the site, are still intact. Time placement of the site is estimated at A.D. 900 to 1200. The site area has been subjected to heavy motorcycle traffic in recent years and gravel mining operations are now encroaching upon the margin. In spite of the damage suffered already, a sufficient number of features remain intact to provide a valuable study of prehistoric water control and agricultural systems. The site is within the Cave Creek Archeological District.

(3) A third site is an area of basalt boulders exhibiting petroglyphs. A preliminary study has defined 15 locations within the site at which there are a total of 39 individual geometric and life form pictures. The site is within the Cave Creek Archeological District.

(4) A fourth site consists of a series of structures, refuse areas, and evidences of water control structures on the lower margin of a talus slope. A portion of the site has been destroyed already by earlier construction and roadways. While it is possible that the Cave Creek flood plain has been cultivated by the people who occupied the site, shifts in the stream have removed all traces. The remaining part of the habitations occupies the crest of a low colluvial ridge for a distance of 180 feet. Ceramics and lithic tools are represented on both slopes of the ridge. Northeastward, alinements of basalt cobbles mark the terraced talus slope. Heavy sheetwash has modified some of the lines and possibly destroyed others. Exact extent of the system has not been determined. Unlike other examples of terraced slopes in the vicinity, ceramics, fire-cracked rock and field houses are not present in the terraced area. Ceramics from the habitation area suggest a limited time period of occupation, largely in the late A.D. 1100's. The site is within the Cave Creek Archeological District.

VI-2.12 POPULATION. The study area for the Diversion Channel project feature has a total population of 165,280 – 56,820 in the area subject to overflow from breaks in the Arizona Canal, and 108,460 in the area subject to overflow from Cave Creek (pl. 6). The pattern of development depicted in the following tabulations is based on population projections for Maricopa County made by the Bureau of Economic Analysis of the U.S. Department of Commerce and the Economic Research Service of the U.S. Department of Agriculture (OBERS). The projections were allocated by the Corps of Engineers within the county on the basis of data provided by the Maricopa Association of Governments, historical trends, local and regional land use plans, current zoning and the National Flood Disaster Act of 1973.

Overflow Area Population	1974	1976	1986	1996	2026
Arizona Canal:					
With flood control	56,820	59,400	62,500	67,500	67,500
Without flood control	56,820	59,400	62,500	67,500	67,500
Cave Creek:					
With flood control	108,460	115,720	125,000	128,000	128,000
Without flood control	108,460	115,720	122,000	125,000	125,000

VI-2.13 LAND USE. Land use immediately adjacent to the recommended Diversion Channel east of Cave Creek is mostly residential. Much of the area west of Cave Creek has recently undergone a transition from agricultural land uses to residential, commercial, and light industrial uses.

VI-2.14 Two types of overflow areas are affected by the recommended Diversion Channel, the overflow area of Cave Creek and the overflow areas caused by the overtopping of the Arizona Canal (pl. 6). Between the proposed Cave Buttes Dam and the Arizona Canal approximately 3,265 acres are within the creek overflow; 1,150 acres in the overflow area are presently in urban uses, primarily low density residential. Industrial uses are characterized by newly developing industrial parks. Lack of vacant land below the canal will cause most future development to concentrate above the canal.

VI-2.15 South of the Arizona Canal the Cave Creek overflow area, as well as the area flooded by the breakout of Cave Creek at Cactus Road ("Q" Avenue), includes the business and government center of downtown Phoenix as well as large residential areas and commercial and shopping centers. A total of 16,045 acres are subject to flooding, all but 1,135 acres of which are in urban use. Six hundred fifty-five acres in the area are subject to damages by the Cactus Road breakout.

VI-2.16 Eight thousand eighty acres are subject to flooding from overtopping of the Arizona Canal east of Cave Creek. All but 1,285 acres are in urban uses, primarily residential with related commercial and shopping facilities.

VI-2.17 Three hundred ten acres presently in non-urban land uses in the Cave Creek overflow area, south of the recommended diversion channel, are expected to be developed into residential and public land uses if flood protection is provided.

VI-2.18 Present and projected future uses of acreage within these overflow areas are shown in the following tabulations.

Overflow Areas from Overtopping the Arizona Canal
(in acres)

Land Use	1974	1976	1986	1996	2006	2016	2026
Residential	5,985	6,260	6,590	7,120	7,120	7,120	7,120
Trailer Parks	70	70	70	70	70	70	70
Commercial	810	810	820	845	845	845	845
Industrial	10	10	10	10	10	10	10
Public, Semi-Public	480	480	480	485	485	485	485
Transportation	250	250	250	250	250	250	250
Urban Parks	0	0	0	0	0	0	0
Urban Subtotal	7,605	7,880	8,220	8,780	8,780	8,780	8,780
Agriculture	1,175	900	560	0	0	0	0
Open Space-Vacant	0	0	0	0	0	0	0
Channels-Irrigation	110	110	110	110	110	110	110
Non-Urban Subtotal	1,285	1,010	670	110	110	110	110
TOTAL	8,890	8,890	8,890	8,890	8,890	8,890	8,890

Cave Creek Overflow Area Without Flood Control
(in acres)

Land Use	1974	1976	1986	1996	2006	2016	2026
Residential	10,450	11,190	11,870	12,230	12,230	12,230	12,230
Trailer Parks	310	290	230	170	170	170	170
Commercial	1,940	1,980	2,070	2,240	2,240	2,240	2,240
Industrial	1,220	1,340	1,470	1,560	1,560	1,560	1,560
Public, Semi-Public	940	970	1,020	1,060	1,060	1,060	1,060
Transportation	540	540	540	540	540	540	540
Urban Parks	260	260	260	260	260	260	260
Urban Subtotal	15,660	16,570	17,460	18,060	18,060	18,060	18,060
Agriculture	430	420	340	140	140	140	140
Open Space-Vacant	3,185	2,285	1,475	1,075	1,074	1,075	1,075
Channels-Irrigation	35	35	35	35	35	35	35
Non-Urban Subtotal	3,650	2,740	1,850	1,250	1,250	1,250	1,250
TOTAL	19,310	19,310	19,310	19,310	19,310	19,310	19,310

Cave Creek Overflow Area With Flood Control
(in acres)

Land Use	1974	1976	1986	1996	2006	2016	2026
Residential	10,450	11,190	12,170	12,530	12,530	12,530	12,530
Trailer Parks	310	290	230	170	170	170	170
Commercial	1,940	1,980	2,070	2,240	2,240	2,240	2,240
Industrial	1,220	1,340	1,470	1,560	1,560	1,560	1,560
Public, Semi-Public	940	970	1,030	1,070	1,070	1,070	1,070
Transportation	540	540	540	540	540	540	540
Urban Parks	260	260	260	260	260	260	260
Urban Subtotal	15,660	16,570	17,770	18,370	18,370	18,370	18,370
Agriculture	430	420	200	0	0	0	0
Open Space-Vacant	3,185	2,285	1,290	890	890	890	890
Channels-Irrigation	35	35	50	50	50	50	50
Non-Urban Subtotal	3,650	2,740	1,540	940	940	940	940
TOTAL	19,310	19,310	19,310	19,310	19,310	19,310	19,310

VI-2.19 TRANSPORTATION. The Arizona Canal Diversion Channel study area is crossed by the 26 streets and highways that presently cross the Arizona Canal. No railroads cross the study area, nor are any airfields located nearby.

VI-2.20 RECREATION. There is one park located along the Arizona Canal; however, the Sun Circle trail parallels the study area utilizing in part the rights-of-way of the Arizona Canal. This trail, a Maricopa County Parks Recreational Department facility, is used for hiking, horseback riding and bicycle riding. An additional paved bicycle trail within the study area has been proposed by the county and has been tentatively funded by the Bureau of Outdoor Recreation; this trail could be constructed as soon as 1976.

VI-2.21 NOISE. The study area contains numerous point sources of noise, including highway crossings and urbanized lands located adjacent to the study area. The Arizona Canal has many gates and related facilities which also produce noise.

VI-2.22 ESTHETICS. In many portions of the Arizona Canal, the gently flowing water reflecting the natural vegetation which grows on the excess rights-of-way provides an esthetic resource as well as a visual relief from the adjacent urbanized areas. However, much of recommended Diversion Channel's alinement is bounded by visually unattractive junkyards, construction storage areas, and vehicle maintenance facilities. The fences along many of the property lines are unattractive and often lined with weeds and trash.

VI-3. RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE PLANS

VI-3.01 The recommended project features (proposed action) basically conforms to the objectives and specific terms of existing and proposed Federal, State, and local land use plans, policies, and controls.

VI-3.02 The recommended Arizona Canal Diversion Channel from 40th Street to 51st Avenue conflicts with the MAG Composite Land Use Plan (pl. 14), Maricopa County Land Use Plan, Phoenix Land Use Plan – 1990, and Deer Valley Area Plan. These plans all designate low and medium density residential land uses with interspersed commercial, public, and industrial land uses for the affected area. The reach of the Diversion Channel from 51st Avenue to Skunk Creek conforms to the City of Glendale 1985 Development Plan, which designates the affected area for riding trails and open space with adjacent rural and medium density land uses.

VI-3.03 Although portions of the Arizona Canal Diversion Channel conflict with specific terms of several county and local land use plans, the project feature conforms to the objectives of the land use plans by providing flood protection to lands designated and developed for urban land uses that are presently confronted with the threat of damages due to flooding.

VI-4. THE PROBABLE IMPACT OF THE PROPOSED PROJECT FEATURE ON THE ENVIRONMENT

VI-4.01 TOPOGRAPHY. The probable impact of elements of the recommended Diversion Channel project feature on topography are discussed in the following subparagraphs.

a. Arizona Canal Diversion Channel. Construction of the Arizona Canal Diversion Channel will result in alterations to a 17.3 mile strip of land upstream of and nearly parallel to the Arizona Canal. Along the proposed route of the Diversion Channel, extensive alteration has occurred as a result of the construction of commercial businesses and private residences.

b. Dreamy Draw Wash. As part of the recommended project feature no construction is required along Dreamy Draw Wash. The wash will remain unaltered and a floodway will be designated to assure that adequate capacity is retained.

c. Cave Creek. From Cave Buttes Dam to Peoria Avenue, Cave Creek will not be altered. A floodway will be designated to assure that adequate capacity is retained. From Peoria Avenue to the Arizona Canal Diversion Channel, channel construction will alter the natural channel.

VI-4.02 NATURAL RESOURCES. Construction of the recommended project feature will have no significant impact on natural resources. The Arizona Canal Diversion Channel is not being constructed along a natural watercourse where the occurrence of sand and gravel would be expected. There are presently no mining operations located along the north side of the Arizona Canal. Mining will be permitted within the floodways along Dreamy Draw Wash and Cave Creek.

VI-4.03 SURFACE HYDROLOGY. The construction of the Arizona Canal Diversion Channel will have a significant impact on the volume and course of surface flows in the study area. The channel will intercept floodflows originating on Cave Creek, and will ultimately discharge these flows into Skunk Creek. As a result of this diversion, the peak rate of flow in the 1.8 mile reach of Skunk Creek from the diversion canal to New River will increase up to a maximum of 5 percent. However, the flood plain will not increase along New River and the Agua Fria River. The peak flow rate will decrease over natural conditions, decreasing the size of the flood plains. Flowage easements (the right to flood) will be purchased along the watercourses that will convey the diverted flows.

VI-4.04 The recommended diversion channel will not interfere with the normal operation of the Arizona Canal. To satisfy the claim of the Salt River Valley Water User's Association for water rights to Cave Creek runoff, a water conservation diversion channel will be provided to divert up to 500 cfs from Cave Creek, across the Arizona Canal Diversion Channel, and into the Arizona Canal.

VI-4.05 SUBSURFACE HYDROLOGY. Construction of the recommended project feature will have no significant effect on the total ground water regimen in the area. Along the 13 miles of the channel that will be concrete-lined no recharge will occur. However, the route of the diversion channel does not follow a natural watercourse. Much of the area is already impervious as a result of urbanization. The area contains water only during periods of flooding, when ponds form above the Arizona Canal. As a result of the reduction in ponding, localized ground water recharge north of the Arizona Canal will decrease, while recharge along Skunk Creek will increase. Habitat along the downstream channels may benefit by the increase in available moisture but the potential recharge from floodflows is not sufficient to significantly affect the overall ground water level.

VI-4.06 WATER QUALITY. Construction of the recommended project feature will have no effect on the overall water quality within the region. Water to irrigate activity areas and to fill and maintain lagoons in Cave Creek Park and the golf course in the Glendale Parkway will come, for the main part, from existing wells and the Arizona Canal. The drilling of an additional well may be required. These sources presently meet water quality standards for agricultural, recreation and esthetic uses, as established by Arizona State Department of Health. Water quality in the lagoons will be maintained in keeping with these standards.

VI-4.07 The Central Arizona Project is a proposed source of irrigation water for some of activity areas in Cave Creek Regional Park. While Colorado River water presently meets state water quality standards, records indicate an increase in salinity in water released toward Arizona. Until a salinity control program is implemented, plants selected for use in the northern part of Cave Creek Regional Park must be tolerant to the existing salt content of water diverted from the Colorado River. Infiltration of this water will not be in sufficient quantity to affect the quality of ground water in the area.

VI-4.08 VEGETATION AND WILDLIFE. The Arizona Canal Diversion Channel will permanently remove about 40 acres of vegetation and wildlife habitat along the north side of the existing Arizona Canal and about 10 acres of vegetation along Cave Creek. Vegetation along the Arizona Canal is mostly limited to a narrow strip of native species or exotic vegetation landscaped around residences or businesses. Large cottonwoods, mesquite, blue paloverde, and eucalyptus will be removed for project construction. Some local wildlife, such as lizards, song birds, doves, ground squirrels and rabbits will experience habitat losses that will jeopardize their survival because they are entirely dependent upon the narrow corridor of available habitat along the canal. These losses are not significantly adverse because of the relatively small amount of habitat that will be removed along the 17.3 mile project route. Recent urbanization (1974-1975) along the Arizona Canal has eliminated much native vegetation and significantly restricted wildlife habitats.

VI-4.09 The rectangular concrete Arizona Canal Diversion Channel will be a barrier for non-flying animals (i.e., ground squirrels and rabbits); however, the existing Arizona Canal is a barrier to those animals not willing or able to swim the channel. Overall, the channel will not be a significant barrier to animal movement because urban development along both sides of the Arizona Canal for most of its length has severely restricted natural populations and already is a barrier to wildlife movements. Most local wildlife have limited movements or fly, and so are not influenced by roads, canals, or channels.

VI-4.10 Landscaping along the channel will provide some habitat benefits for wildlife species tolerant to living in close proximity to a heavily developed area. Such species as Inca doves, mockingbirds, house sparrows and house finches should benefit.

VI-4.11 ARCHEOLOGICAL AND HISTORICAL RESOURCES. There are no archeological or historical resources that will be affected by the construction of the recommended Arizona Canal Diversion Channel or the recommended floodway on Dreamy Draw Wash. The archeological sites located in the Cave Creek Archeological District will not be directly affected by the recommended floodway from Cave Buttes Dam to Peoria Avenue; however, the Cave Creek Park recreational development will have an indirect effect on many of these sites. The park will attract recreationists who may alter or destroy the sites. A proposal for the preservation or mitigation of these National Register sites has been presented to the Advisory Council on Historic Preservation. An additional site not within the Cave Creek Archeological District will also be indirectly affected by the park development. If later investigations indicate that the site warrants inclusion in the National Register, the Advisory Council will be given an opportunity to comment on the need for its preservation. No archeological sites will be affected by the recommended concrete trapezoidal channel from Peoria Avenue to the Arizona Canal Diversion Channel.

VI-4.12 POPULATION AND LAND USE. Construction of the recommended project feature will have no impact on future population levels and land use along the Arizona Canal. Present trends of urbanization and land use along the Arizona Canal will not be altered.

VI-4.13 TRANSPORTATION. Construction of the Arizona Canal Diversion Channel will have temporary adverse impacts on traffic flow. During the construction of bridges for each of 26 streets and highways that cross the Arizona Canal, traffic congestion will increase and motorists will be inconvenienced. The modification of bridges along the Black Canyon Highway will require the rerouting of traffic along frontage roads. This is expected to cause major traffic congestion, especially during rush hours. The impact will cease when the construction is completed.

VI-4.14 SOCIAL. Construction of the recommended project feature will have a significant adverse impact on the communities bordering the Arizona Canal, intensifying the existing physical and social community separation. Further disruption to communities and individuals will result from the relocation of homes and businesses.

VI-4.15 Project rights-of-way requirements require the relocation of 263 homes and portions of 33 apartment buildings along the Arizona Canal. The lives of the families involved will be disrupted, neighborhood bonds will be broken, and some children will probably be forced to change schools. According to the Phoenix City Planning Department, housing is available for these families within 6 miles of their present location.

VI-4.16 The number of homes requiring relocation reflects several shifts in channel alinement that were incorporated in an attempt to reduce the number of relocations to a minimum. Adjustments in the final alinement of the channel will be made during Phase II design studies.

VI-4.17 Both industrial and commercial enterprises will be relocated as a result of the project. The 38 businesses to be displaced are predominantly small, privately-owned shops. Included are 2 print shops, 2 pet centers, a realty office, a tax service, a blacksmith, a roofing service, an air conditioning company, a refrigeration company, a cabinet manufacturer, a boat motor service, and several junk/storage yards. In many cases, offices must be relocated because all or part of storage or maintenance yards will be taken. According to the City of Phoenix Planning Department, several areas zoned for commercial establishments exist in close proximity to those that will be displaced. However, potential relocation sites for the industries are limited. Many of the businesses to be relocated rely heavily on local clientele and relocation will disturb business for a time. Permanent loss of business may occur.

VI-4.18 If desired, families and businesses will be relocated as close as possible to their former site, although they may choose to be relocated anywhere up to a maximum distance of 50 miles. Individuals involved in the relocations will be compensated in accordance with the Uniform Relocation Assistance and Real Properties Acquisition Policies Act of 1970. It should be noted that, under existing conditions of localized ponding, most of the homes and businesses to be relocated are presently flood prone.

VI-4.19 Other relocations required by the project include the parking lot of a public swimming pool and portions of the playgrounds of two schools. Part of the playing field at Sunnyslope High School will be closed during the construction of a portion of the Arizona Canal Diversion Channel. The playing field will be fully restored after construction. A portion of the playground at Arroyo Elementry School will be required for project rights-of-way. The playground will be restored or comparable facilities will be provided adjacent to the school.

VI-4.20 Project construction will not affect public services significantly, although the relocation of 13,000 feet of water pipeline, 23,500 feet of sewer line, 8,100 feet of gas line and undetermined amounts of telephone and electrical line will be required. Interruptions in services due to relocations are not expected to exceed a few hours at a maximum.

VI-4.21 RECREATION. Construction of recreational facilities associated with the recommended project feature will provide for a wide range of recreational opportunities along portions of the Arizona Canal Diversion Channel and along Cave Creek below Cave Buttes Dam.

VI-4.22 Approximately 7 miles of trail along the Arizona Canal from 20th Street to 35th Avenue will be constructed by local interests in 1976. This trail will be disrupted by the construction of the proposed Arizona Canal Diversion Channel. A new trail will be provided as part of the proposed construction.

VI-4.23 ESTHETICS. Construction of the Arizona Canal Diversion Channel will have a minor impact on the visual quality of the area. The channel will be entrenched along its entire length and will be visible only from the bridge crossing. Landscaping associated with the proposed trails and recreational facilities will provide vegetation diversity, especially between Cactus Road and Skunk Creek, where the earth channel will be developed into a greenbelt parkway.

VI-4.24 SAFETY. As part of the proposed construction, safety fences will be provided along the 13 miles of concrete-lined channel. Access will not be restricted along the 4.4 mile greenbelt, which will remain as an earth channel, developed for recreation, nor within the rights-of-way adjacent to the concrete-lined channel.

VI-5. ANY PROBABLY ADVERSE ENVIRONMENTAL EFFECTS THAT CANNOT BE AVOIDED

VI-5.01 Construction of the recommended project feature will require the relocation of 263 homes and 38 businesses and portions of 33 apartment buildings.

VI-5.02 A total of 50 acres of natural vegetation and wildlife habitat will be altered or destroyed by the construction of the recommended project feature.

VI-6. ALTERNATIVES TO THE PROPOSED ACTION

VI-6.01 No feasible alternatives to the recommended diversion channel were identified. Two alternative plans were studied but neither was determined to be feasible. These alternative plans are discussed in the following paragraphs.

VI-6.02 One plan was to intercept and collect flood waters by a diversion channel from east of Cave Creek to 40th Street. These floodwaters, as well as floodwaters from Cave Creek, would be connected by means of a channel from the Arizona Canal south through downtown Phoenix to discharge into the Salt River. Two types of channelization were considered – an open rectangular channel and a covered section. This plan would intercept runoff from north of the canal and convey it to the Salt River, but the features were not sized to intercept and convey residual flows generated south of the Arizona Canal. In order to provide capacity for local runoff south of the canal, in addition to providing capacity for Cave Creek and runoff north of the canal, a total of 8 siphons would be required where the channels crossed the Arizona and Grand Canals. In addition, some channelization would be required north of and parallel to the Arizona Canal.

VI-6.03 Because of the high cost of the plan, it was not considered to be feasible and no further engineering or economic studies were conducted.

VI-6.04 The second alternative plan involved combining the Arizona Canal and the diversion channel in some way to reduce right-of-way requirements. Six possible plans for such a combination were developed. Four of these plans were given limited consideration, the 2 additional plans were analyzed in greater detail. Those given limited consideration were (a) a dual purpose channel with collapsible check dams; (b) a pipe conduit under the flood control channel berm; (c) a pressure pipe system; and (d) open combined canal and channel using pumps for delivery to laterals. None of these plans were considered to be viable solutions for several reasons ranging from conflicts in operation requirements between water supply and flood control to costly canal and pump maintenance involving the removal of sediment and moss. Preliminary cost estimates were prepared for the remaining two plans – (a) a concrete-lined rectangular or trapezoidal flood control channel constructed north of the Arizona Canal right-of-way but using a common 50-foot wide berm for maintenance (the Arizona Canal would remain as is) and (b) two rectangular channels side by side, one for the Arizona Canal and one for the flood control channel.

VI-6.05 Because of high construction costs without significant savings in rights-of-way, these 2 plans were not considered feasible.

VI-7. THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

VI-7.01 The recommended Arizona Canal Diversion Channel project feature will reduce flood damage to existing urban development. This protection will be afforded not only to existing populations but also to future populations. The recommended feature will also provide recreation facilities that will be available to both existing and future populations, and will provide for the study and recovery or preservation of archeological features.

VI-7.02 The feature will permanently alter 50 acres of wildlife habitat. Flood protection will be afforded to existing urban areas.

VI-8. ANY IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED

VI-8.01 The recommended project feature would commit the land along the Arizona Canal Diversion Channel (490 acres) for flood control and recreation purposes.

VI-8.02 Construction of this feature will require moving approximately 11 million cubic yards of earth (silt, sand, gravel and cobbles).

VI-9. COORDINATION

VI-9.01 The potential adverse social impact of the Arizona Canal Diversion Channel has brought about an intense effort to coordinate with those individuals, communities, and businesses which would be affected. Numerous meetings have been held with the cities of Phoenix and Glendale and the town of Paradise Valley.

VI-9.02 An informal workshop was held in September 1974 in an effort to reach those individual families and businesses displaced by construction. About 325 persons attended the workshop which generated numerous followup meetings and telephone conversations. Considerable opposition to the project feature was expressed by individuals attending the meeting. The general feeling seemed to be one of uniform opposition to the plan. The opposition stems from the fact that, at the time of construction, approximately 263 homes will be acquired for project rights-of-way. At present, no funds are available to the flood control district to acquire homes in the area. This will cause severe hardship for people who must sell their homes before project construction begins (approximately 5 to 7 years for the downstream portion). Unless funds can be made available from some source for advanced acquisition of rights-of-way, no resolution of this conflict is in sight.

VI-9.03 The Arizona Biltmore Estates, a major land owner in the area affected by the project, has expressed concern over construction of the recommended Arizona Canal Diversion Channel. Several meetings have taken place and alternative actions have been discussed. The conflict has not been resolved.

APPENDIX A

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
6029 Federal Building, Phoenix, AZ 85025

October 15, 1975

Col. John V. Foley
US Army Engineer District, L. A.
300 N. Los Angeles Street
Los Angeles, California 90054

Dear Colonel Foley:

We have reviewed the Draft Environmental Impact Statement for New River and Phoenix City Streams, Maricopa County, Arizona. The statement contains a wealth of information about the many features of the planned flood control projects for Cave Creek, Skunk Creek, Dreamy Draw Wash, and the New and Agua Fria rivers. The projects will be a benefit in solving the flood problems for parts of the cities of Phoenix, Glendale, Peoria, Sun City, and Avondale.

The draft statement would be strengthened if it provided more detailed information in the following areas.

1. On page I-80 a statement is made: "I-4.09 Because the proposed Arizona Canal Diversion channel will divert water from Cave Creek to Skunk Creek, the volume of storm runoff carried in the flood plains of Skunk Creek and the New and Agua Fria rivers below the Arizona Canal Diversion Channel may increase as a result of the Project."

If, in fact, there is a chance that flows would increase along Skunk Creek and the New and Agua Fria rivers, this should be specifically determined. The affected areas should also be defined.

2. On page I-81 in paragraph I-4.13, a statement is made: "The riparian vegetation will benefit from the increase in availability of groundwater."

Are there downstream channels that will be blocked by the dams or diversions that will not receive releases from the structures? What would happen to the riparian vegetation along these washes?

3. Erosion should be added to section I-4.46: Construction-Related Temporary Impacts. During the construction period the disturbed areas will be exposed to increased wind and water erosion.

Are these developed areas in the vicinity or downstream that would be affected?

4. On page II-20, paragraph II-4.08, a statement is made that the project features will have no significant effect on water quality.

We believe there should be a beneficial effect on water quality by removal of a portion of the sediment.

We appreciate the opportunity to review and submit our comments on the draft statement.

Sincerely,

R S Swenson For:

George C. Marks
State Conservationist

UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Science and Technology
Washington, D.C. 20230

October 10, 1975

Mr. Garth A. Fuquay
Chief, Engineering Division
Corps of Engineers - Phoenix District
U. S. Department of the Army
2721 No. Central Avenue
Suite 800
Phoenix, Arizona 85004

Dear Mr. Fuquay:

The draft environmental impact statement "New River and Phoenix City Streams, Maricopa County, Arizona", which accompanied your letter of August 20, 1975, has been received by the Department of Commerce for review and comment.

The statement has been reviewed and the following comments are offered for your consideration.

Geodetic control survey monuments may be located in the proposed project areas. If there is any planned activity which will disturb or destroy these monuments, the National Ocean Survey (NOS) requires not less than 90 days notification in advance of such activity in order to plan for their relocation. NOS recommends that funding for this project include the cost of any relocation required for NOS monuments.

It is stated in the Syllabus of Design Memorandum No. 3 that flood protection will be provided by a combination of structural and nonstructural controls, and in paragraphs I-2.24 through I-2.26 of the draft environmental impact statement flooding is discussed. However, the availability of the National Weather Service (NWS) flood warning service isn't mentioned in either of these two documents. The NWS Field Office at Phoenix has an excellent flash flood warning program, and these services as described in the attachment should be considered in the draft environmental impact statement.

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Thank you for giving us an opportunity to provide these comments, which we hope will be of assistance to you. We would appreciate receiving five (5) copies of the final statement.

Sincerely,

Sidney R. Galler

Sidney R. Galler
Deputy Assistant Secretary
for Environmental Affairs

Attachment

Weather Service Statement on Flood Warning Program

The National Oceanic and Atmospheric Administration (NOAA) National Weather Service provides flood forecasting service for major river basins. This system involves predictions of anticipated stages at a particular gage or gages in the basin. These forecasts are based on observed precipitation and stages at upstream points and anticipated weather conditions. The flood forecast is transmitted to City officials, newspapers, and radio and television stations in the basin. These media disseminate the information to residents of the flood plain in the form of a flood warning. This timely forewarning permits protective measures to be undertaken by industrial plants, public utilities, municipal officials, and individuals with property in the lowlands. Services available are of the following types:

1. Flash Flood: The responsible Weather Service Forecast Office supplies weather forecasts twice daily for the State. In addition to the routine forecasts, special forecasts of severe storms and general flash flood watches for small streams are issued as required. WSR-57 Weather Radar installations have capability for immediate detection and evaluation of rainfall intensity, location, and storm movement. Information is promptly relayed by teletype circuits and telephone to news media and community officials and law enforcement agencies. The Weather Service Office issues Flash Flood Warnings as required for small streams in its area of responsibility.

2. Major Floods: River stage forecasts are based on radar coverage, reports from river and rainfall reporting stations and telemetry in or near the basin. The River Forecast Centers are staffed with professional hydrologists responsible for the preparation of river forecasts based on water equivalent of snow cover, rainfall-runoff relations, streamflow routing, and a working knowledge of anticipated weather conditions. The lead time between distribution of the forecasts and the flood crest may be short; however, lead time normally ranges from 12 hours for rainfall and up to several weeks for snowmelt. Specific crest forecasts are issued as required. River District Offices are responsible for the interpretation and distribution of flood forecasts and the operation of the hydrologic reporting substation network in its area of responsibility.

3. Hydroclimatic Data: Most of the data from the network is published. These records provide the basis for forecasts as well as for the planning and design of protective works and their operation during floods. River and flood forecasting is fundamental in the design and essential in the operation of a levee or reservoir system.

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
REGIONAL OFFICE
50 FULTON STREET
SAN FRANCISCO, CALIFORNIA 94102
Office of Environmental Affairs

OFFICE OF
THE REGIONAL DIRECTOR

October 20, 1975

Garth A. Fuquay
Chief, Engineering Division
US Army Engineer District, L.A.
300 N. Los Angeles Street
Los Angeles, California 90054

Attn: Col. John V. Foley

Dear Sir:

The draft Environmental Impact Statement and Design Memorandum No. 3 for the New River and Phoenix City Streams in Maricopa County, Arizona, have been reviewed in accordance with the interim procedures of the Department of Health, Education and Welfare for compliance with the National Environmental Policy Act.

The draft Environmental Impact Statement describes the impacts resulting from a proposed Flood Control Project in which three earth dams and 53 miles of channels would be constructed. The project is estimated to cost $225,000,000.00 and extended over an 11 year period.

The proposed project will be highly disruptive to the communities in close proximity to the construction. Adobe Dam will effectively and permanently divide one community, with a resultant four mile round trip required to gain access to schools, shopping facilities and places of employment due to the closure to two main access routes, 35th Ave. and Deer Valley Drive. It is unclear whether this means that elementary school students will be faced with an additional four mile daily route to school. Will this require increased school bus service and/or new school facilities?

Release of flood waters from Cave Buttes Dam will render 20 existing "dip" crossings unusable for periods up to 73 days (100 year flood) or 23 days (10 year flood) unless local interests construct bridges. It is presumed that pedestrians also use these streets and will experience severe hardship in attempting to cross during a period of water release. What assurance is given that the "local interests" will be able to finance the construction of the necessary crossings? If such bridges and overcrossings are not constructed concurrently with the dam construction, what provisions will be made to assure passage by elementary school children, senior citizens, and others who may not have access to vehicular transportation? Currently, these dips are passable after only two days of flooding.

The long term effects upon the transportation system should be examined closely relative to access to health, medical and educational services and facilities. It appears that the closure of 35th Ave. and Deer Valley Drive plus the possible impassibility of many "dip crossings" during water release periods may preclude ready access to needed services. The statement does not address this problem nor offer alternatives.

The opportunity to review this statement was appreciated.

Sincerely,

James D Knochenhauer

James D. Knochenhauer
Regional Environmental Officer

cc: CEQ
OEA

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF OUTDOOR RECREATION
PACIFIC SOUTHWEST REGIONAL OFFICE
BOX 36052
450 GOLDEN GATE AVENUE
SAN FRANCISCO, CALIFORNIA 94102

IN REPLY REFER TO:
D6427

December 18, 1975

Mr. Garth A. Fuquay
Chief, Engineering Division
U.S. Army Engineer District
Los Angeles
300 N. Los Angeles Street
Los Angeles, California 90054

Dear Mr. Fuquay:

This letter is in response to your request of this office to review your August 1975 Design Memorandum No. 3, General Design Memorandum - Phase I, Plan Formulation for New River and Phoenix City Streams, Arizona. Time and manpower constraints have necessitated an abbreviated review of this document. Accordingly we have concentrated our review on those aspects relating to the recreation demands, use, and benefit presentation in Appendix 7, Recreation and Esthetic Treatment.

The assessment of recreation demands appears to be in accord with the Arizona Statewide Outdoor Recreation Plan and generally reflects the urgency of needs for urban recreation facilities.

The procedure given on page A7-26 and 27 suggests that the attendance estimates are based on the assumption that facilities installed will be operating at capacity from year one on. Where sufficient unmet needs exist, as we feel they do in this case, we have advocated such an assumption as reasonable for estimating project recreation benefits. If these assumptions are the basis for your estimates, we suggest that you revise this section to clarify this important point. Assuming that such assumptions were used, we feel that the use estimates are reasonable.

We note that, in your calculation of annual recreation benefits, you have applied unit values to individual activity-days instead of recreation days as advocated by the Water Resource Council's "Principles and Standards for Planning Water and Related Land Resources". Without considerably

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more study than we presently have time for of the relative values of the many activities cited in tables 7 and 8, we cannot fully endorse the incremental unit values used. However, the overall average of about one dollar per recreation day appears to be reasonable and valid.

We note an inconsistency between the use estimates cited for Cave Buttes Dam on page A7-27 and in table 7 on page A7-76. Also, the total average annual cost for Cave Creek Park in table 6 is also in error.

We appreciate the opportunity for this review and trust that our comments will be useful in completing your report.

Respectfully,

for Frank E. Sylvester
Regional Director

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
PACIFIC SOUTHWEST REGION
BOX 36098 • 450 GOLDEN GATE AVENUE
SAN FRANCISCO, CALIFORNIA 94102
(415) 556-8200

ER-75/837

October 30, 1975

Col. John V. Foley
U.S. Army Engineer District, L.A.
Corps of Engineers
300 N. Los Angeles Street
Los Angeles, CA 90054

Dear Col. Foley:

The Department of the Interior has reviewed the draft environmental statement and General Design Memorandum for flood control project, Gila River Basin, New River and Phoenix City Streams, Maricopa and Yavapai Counties, Arizona.

We are pleased that impacts on sand and gravel resources are acknowledged in both documents. Because of rapid growth and continuing development in the Phoenix area, these aggregate resources are of considerable value and significance. In fact, data more recent than the 1970 figure cited in the environmental statement (page 1-19) show an upsurge in the production of sand and gravel in Maricopa County. According to the Bureau of Mines' Minerals Yearbook, quantities produced rose from 6,363,000 tons ($6,866,000) in 1970 to 12,912,000 tons ($14,022,000) in 1971 and to 15,675,000 tons ($18,198,000) in 1972. We suggest that the discussion about overall effects of the project on this prosaic but vital mineral resource be expanded to show in more detail the magnitude of the impact and to discuss measures for mitigation.

Aggregate resources, of unspecified quality and quantity, would be lost at Cave Buttes Dam (DES, page II-19), at Adobe Dam (DES, page III-29), and at New River Dam (DES, page IV-13), and at the first two sites, ongoing mining operations apparently would be displaced (DES, pages II-19 and III-13). For the whole project, aggregate resources under some 6,100 acres required for channels, dams or dikes and impoundments would be committed (DES, pages I-79 and I-87); urban development that is expected to result from flood protection afforded by the project might cover another 1,200 acres of potential aggregate-bearing land (DES, page I-88); and the 8,300 acres of designated floodway/flowage easement would remain open for recovery of aggregate resources (DES, page V-31) subject to a lack of replenishment from upstream sources (DES, pages I-79 and -80).

The documents do not provide any analysis about the significance of project impacts in relation to the total supply of aggregate in the Phoenix area.

Basic to such analysis is proximity of available aggregate resources to markets. Since, generally, the price of aggregate at the quarry or pit is doubled after 25 miles of truck transportation, the importance of close-in recoverable resources of aggregate is obvious. If such resources are available only at some distance from the city because of encroachment and commitment of close-in deposits, the documents should recognize that costs of construction would be increased significantly. We suggest that the reports show not only the commitment of aggregate but also the overall impact of the project on the availability of sand and gravel in the Phoenix area. To mitigate or reduce the loss of this valuable resource, we urge that multiple sequential use of project lands be considered and practices wherever possible so that aggregate resources lying in the path of the project can be extracted before they are lost.

Some major construction requirements which would apparently entail major impacts in urban areas have been mentioned in a peripheral manner in widely scattered parts of the draft environmental statement. For example, the first mention of bridges that has been noted is that the channelization of Skunk Creek would require the lengthening by 134 feet of two existing highway bridges and two frontage road bridges (p. I-7, par. 3). Later it is noted that 20 dip crossings would be replaced by all-weather bridges (p. I-91, par. 2). Still later, a briefing reference is made to the requirement for 14 new highway bridges and one railroad bridge extension in providing the recommended floodways below the dams (p. V-3, par. 3). It is first mentioned in the supplementary section on the Arizona Canal Diversion Channel that 26 bridges would be required for streets and highways that presently cross the Arizona Canal (p. VI-4, line 19).

Similarly, the first mention of the proposed construction of fairly extensive levees in several places was found in the supplementary section on Skunk Creek, New River and the Agua Fria River. There it is noted that nearly 10,000 feet of levees from three- to eight-feet high are proposed around five residential subdivisions along the Agua Fria River (p. V-6) and that 5,700 feet of levee up to four-feet high would be constructed along New River (p. V-5). These proposed facilities do not appear to be included among the proposed levees and dikes delineated on Plate 4 (Recommended Plan, Flood Control). It would be helpful to provide a reference to the map on which these proposed facilities have been delineated, and to evaluate any impact of these levees.

A reference has been made to disposal of spoil from the Diversion Channel at specific sites that have been delineated on maps (Design Memorandum, P. SA-24). However, no discussion of sites for spoil disposal, or of volumes to be disposed of, has been found in the draft environmental statement, nor have the proposed disposal sites been found on any map in the statement or in the general design memorandum for Phase 3.

The project would evidently have a significant impact in terms of displacement of existing structures and improvements, as evidenced by the fact that there would be 237 homes and 25 businesses displaced. However, displacements have been mentioned only briefly (for example, p. 2, par. 3; p. VI-30, par. 1), and no information has been found on the magnitude of these impacts. For example, neither the sizes nor types of the businesses to be displaced appears to have been mentioned, nor have we found any mention of requirements for, or impacts from, displacement of utilities such as pipelines, power lines, etc. By contrast, the benefits to landowners that would result from the project have been estimated in a fair amount of detail, including acreages held and values of the benefits (Design Memorandum, p. SA-24).

Most evaluations of impacts on ground water resulting from the principal project proposal and from the alternatives are adequate. However, a summary presentation of the various impacts would be especially useful because of the nature of the area involved. It appears that more beneficial than adverse impacts on ground water should be expected, principally from net increases in recharge with little change in quality of water that should result from the more lengthy time distribution of floodwater flows. However, we believe the final environmental statement should more fully address the effects on ground water of both the concrete-lined and earth sections of the diversion channel and should treat more fully evapotranspiration effects resulting both from the impoundments and from the prolonged periods of controlled floodflow.

The proposed action will not affect any existing or proposed units of the National Park System. However, the project will have an adverse impact upon archeological resources in the area. As the results of the archeological survey point out, the project area is rich in archeological resources. The State Historic Preservation Officer has determined three affected archeological districts and one affected site eligible for nomination to the National Register. Nomination procedures are being implemented. Also, a number of statements are made regarding archeological sites which do not qualify for inclusion in the National Register. It is not clear if this was determined by the archeological contractor, the State Historic Preservation Officer, or the Keeper of the National Register. Only the Secretary of the Interior or his designee can make such a determination. In order to fully evaluate the adequacy of the statement in terms of mitigation measures for the protection of National Register properties, the Advisory Council's recommendations and the final mitigation procedures should be included in the statement.

Project impacts on fish and wildlife resources are fully explained, as are impacts of the various alternatives. The Design Memorandum and appendices present a good discussion of the problems and solutions. Excellent coverage was given wildlife habitat losses and the recommended wildlife mitigation plan.

Some discrepancies in acres of habitat to be lost appear between the environmental statement and the Design Memorandum. The environmental statement on page I-84 indicates a total loss of 1,585 acres, including 410 acres of riparian habitat, but on page I-98 the statement lists a total of 1,685 acres to be lost, including 410 acres of riparian habitat. The Design Memorandum on page 191 indicates the project would remove a total of 2,200 acres of habitat, including 390 acres of riparian habitat.

The draft environmental statement briefly discusses the beneficial impact of the recreation developments associated with the project, but there is no indication in the statement as to whether the project will have any adverse impact on any existing recreation resources. We recommend that such information be included.

Cordially,

Webster Otis

Webster Otis
Special Assistant to the Secretary

cc: OEPR, w/c incoming
Regional Director, BuRec, Boulder City
Regional Director, BOR, San Francisco
Regional Director, NPS, San Francisco
Regional Director, FWS, Portland
Director, USGS, Reston
Director, BOM, D.C.
State Director, BLM, Phoenix
Area Director, BIA, Phoenix

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
100 CALIFORNIA STREET
SAN FRANCISCO, CALIFORNIA 94111

Col. John V. Foley
U.S. Army Engineer District L.A.
300 N. Los Angeles Street
Los Angeles CA 90054

NOV 5 1975

Dear Col. Foley:

The Environmental Protection Agency has received and reviewed the draft environmental impact statement for the New River and Phoenix City Streams Project in Maricopa County, Arizona.

EPA's comments on the draft environmental statement have been classified as Category LO-2. Definitions of the categories are provided on the enclosure. The classification and the date of EPA's comments will be published in the *Federal Register* in accordance with our responsibility to inform the public of our views on proposed Federal actions under Section 309 of the Clean Air Act. Our procedure is to categorize our comments on both the environmental consequences of the proposed action and the adequacy of the environmental statement.

EPA appreciates the opportunity to comment on this draft environmental statement and requests one copy of the final environmental statement when available.

Sincerely,

L. Russell Freeman / Deputy

Acting Paul De Falco, Jr.
Regional Administrator

Enclosure

cc: Council on Environmental Quality

Comments on the Draft Environmental Impact Statement (DEIS) For the New River and Phoenix Streams Project Maricopa County Arizona

EPA is pleased to note that the Phoenix Streams project has changed emphasis from a structural to a more nonstructural approach to providing flood protection. It is apparent from the DEIS and other available information that the Phoenix area is in need of flood protection. EPA believes that flood protection should be provided in a manner that provides the greatest benefits while minimizing the impact on the natural environment. The proposed project appears to have taken this general philosophy into consideration. Our comments are offered in two levels; the first concerns the project as a whole and the second concerns some individual aspects of the project.

Comments concerning the project as a whole:

1. Section VI-4.03 points to the fact that surface flows may be increased in the areas downstream of the Arizona Canal Diversion Channel and that these increased flows will have an impact. EPA would like more information concerning the probable impacts of this increased flow. Specifically, more information is needed on:

    a. The anticipated sediment loads and deposition and scouring rates and patterns in the affected areas, particularly the Gila River. Section I-4.05 points out that the scouring potential of the waters released from the dams may be increased because of deposition in the floodpools. A more definitive discussion of this phenomenon and the associated impacts should be presented.

    b. Any anticipated changes in the magnitude, frequency and duration of flooding in the affected areas (i.e. downstream areas).

    c. Any anticipated changes in the riparian habitat in the downstream areas as a result of a. and b. above.

2. Several features of the project provide for the development of new recreational facilities. Many of these facilities (i.e., lagoons, green belts) will require water to maintain them. Section I-2.31 states that the Arizona Water Commission and State Land Department are currently studying the legality of using ground water for esthetic or promotional displays. Section VI-4.06 states that an additional well may have to be drilled to provide water for recreational facilities. EPA would like to see a more thorough discussion of the water demand for project-related recreational areas within the context of the overall water supply situation in the area, particularly in relation to existing ground water overdraft problems.

3. Since the project relies heavily on local management of floodways and flowage easements, EPA would like to see a more thorough discussion of how these areas will be managed and maintained after the project is completed, particularly in relation to existing structures and commercial operations (i.e., sand & gravel).

4. The Granite Reef Aqueduct of the Central Arizona Project traverses the project area. Although the DEIS states that the two projects are independent and compatible, EPA would like to see a more detailed discussion of the relationship between the two projects. Specifically, EPA would like a more complete discussion on the interrelationship of the flood protection offered by the Granite Reef Aqueduct and the proposed project.

5. The DEIS discusses the project impact on the quantity of ground water in the area. However, very little discussion is offered on the project impact on ground water quality. EPA would like to see a more detailed assessment of the project impact on ground water quality.

6. Three hundred and ten acres of land will become available for urbanization as a result of the flood protection offered by the project. This is listed as both an adverse and beneficial impact in the project summary (page 2 of the DEIS). It is further discussed in Sections I-4.27, VI-2.17 and VI-4.12. EPA would like to see a more explicit discussion of the anticipated impacts of urbanization which may occur as a result of the flood protection offered by the project.

Comments concerning certain project features:

Arizona Canal Diversion Channel

1. Since the channel will pass through residential areas it is suggested that a discussion of safety measures be provided. EPA is pleased to note that the esthetic impacts of the channel on bordering residential areas will be mitigated by landscaping.

2. A more thorough discussion of the maintenance requirements for the channel should be presented. EPA would be most interested in a discussion of the removal requirements for deposited material in the channel. If periodic removal of deposited material is required, the DEIS should discuss the methods and amounts of material which will be removed; and the location and deposition of disposal sites.

New River, Adobe and Cave Buttes Dams

1. The impact on vegetation and topography behind the dams will be spatially varied depending on the duration and frequency of inundation. EPA would like to see a more detailed discussion of the spatial distribution of impacts behind the damsites, i.e., what are the expected inundation levels and associated impacts for different frequency events?

2. A discussion of the maintenance requirements for the damsites should be presented. Additionally, if removal of deposited material behind the damsites will be allowed (i.e., sand and gravel operations) then a discussion of the impacts and reclamation requirements should be given.

EIS CATEGORY CODES

Environmental Impact of the Action

LO--Lack of Objections

EPA has no objection to the proposed action as described in the draft impact statement; or suggests only minor changes in the proposed action.

ER--Environmental Reservations

EPA has reservations concerning the environmental effects of certain aspects of the proposed action. EPA believes that further study of suggested alternatives or modifications is required and has asked the originating Federal agency to reassess these aspects.

EU--Environmentally Unsatisfactory

EPA believes that the proposed action is unsatisfactory because of its potentially harmful effect on the environment. Furthermore, the Agency believes that the potential safeguards which might be utilized may not adequately protect the environment from hazards arising from this action. The Agency recommends that alternatives to the action be analyzed further (including the possibility of no action at all).

Adequacy of the Impact Statement

Category 1--Adequate

The draft impact statement adequately sets forth the environmental impact of the proposed project or action as well as alternatives reasonably available to the project or action.

Category 2--Insufficient Information

EPA believes that the draft impact statement does not contain sufficient information to assess fully the environmental impact of the proposed project or action. However, from the information submitted, the Agency is able to make a preliminary determination of the impact on the environment. EPA has requested that the originator provide the information that was not included in the draft statement.

Category 3--Inadequate

EPA believes that the draft impact statement does not adequately assess the environmental impact of the proposed project or action, or that the statement inadequately analyzes reasonably available alternatives. The Agency has requested more information and analysis concerning the potential environmental hazards and has asked that substantial revision be made to the impact statement.

If a draft impact statement is assigned a Category 3, no rating will be made of the project or action, since a basis does not generally exist on which to make such a determination.

Arizona Water Commission

222 NORTH CENTRAL AVENUE, SUITE 800
Phoenix, Arizona 85004
TELEPHONE (602) 258-7561

September 16, 1975

Col. John V. Foley
Department of the Army
Corps of Engineers
P.O. Box 2711
Los Angeles, California 90053

Dear Col. Foley:

Thank you for the opportunity to review the Draft Environmental Impact Statement and General Design Memorandum for the proposed New River and Phoenix City Streams Project. You and your staff are to be complimented for the efforts expended in formulating the recommended plan. It effectively strikes a balance between social, economic and environmental needs in the area.

The following remarks are offered for your consideration:

1. Section I-2.102, which discusses the floodplain regulations for the unincorporated areas of Maricopa County, should be revised to reflect recent changes. New floodplain regulations were adopted by the county supervisors on July 14, 1975. These regulations take into account the changes in State law which were made during the 1975 session. They also substantially change allowed development in the floodplain by establishing the standard "two district" type of ordinance.

2. Sections I-2.102 and 2.103 discuss the floodplain regulations of Maricopa County and the City of Phoenix. Although these regulations cover the majority of the area, the City of Peoria has also adopted floodplain regulations commensurate with State law. It would be appropriate to mention this since New River passes through this city.

3. In Section I-3.01 it is stated that the Flood Disaster Protection Act requires that flood prone areas be identified and that floodplain ordinances be adopted. It should be mentioned that identification is only required to allow the

sale of flood insurance. Also the statement that State law prohibits construction in flood prone areas prior to adopting floodplain regulations is incorrect. A provision of the law allows special permits authorizing construction or development prior to the adoption of floodplain regulations.

4. Section I-4.12 discusses the impact on the groundwater regimen in the area. The reference that 10,600 acre-feet is less than one percent of the total recharge available could be misinterpreted. It is suggested that the reference to percentage of total recharge available be deleted or modified to a percentage of total runoff in the basin. Certainly 10,600 acre-feet would represent a substantial part of recharge actually taking place annually. The same section also refers to the "operation of the dams." This implies that control gates will be installed. Design Memorandum No. 3, Phase I, indicates that all dams will have ungated outlets thereby precluding any operation. This point should be mentioned or the terminology in the section modified.

5. Section I-4.20 describes the proposal to purchase 400 acres at the confluence of the Agua Fria and Gila Rivers as a mitigation measure for wildlife habitat lost to the project. Will there be a flood potential created by setting aside an area within the Agua Fria or Gila Rivers?

6. Section I-4.21 indicates an agreement regarding the acquisition of 400 acres for wildlife habitat mitigation. We have been advised that at least one other option is being considered to provide for mitigation.

7. Section I-5.04 should be modified to mention that the mining of sand and gravel within a reservoir is common practice in many areas. The operation in Devil's Gate Reservoir in the Los Angeles area is one example where recreation, flood control, water conservation, and mining activities have been practiced for a number of years.

8. Section I-5.07 indicates the necessity of relocating 237 homes. Section I-4.34 indicates 225 homes. It should be pointed out in the report that many of these homes and businesses would be damaged to such a degree that they could not be rebuilt under the Phoenix floodplain regulation ordinance.

9. We were unable to find a tabulation of land use and ownership (i.e., State, federal, private) of parcels which must be purchased for the project. Such a tabulation depicting

what type of land will be set aside for the project features would add to the description of the overall impact.

We will be happy to discuss any of these comments with you or your staff.

Sincerely,

Wesley E. Steiner

Wesley E. Steiner
Executive Director

ARIZONA GAME & FISH DEPARTMENT

2222 West Greenway Road Phoenix Arizona 85023 942-3000

September 23, 1975

Colonel John V. Foley
U.S. Army Engineer District, L.A.
300 North Los Angeles Street
Los Angeles, California 90054

Dear Colonel Foley:

The Arizona Game and Fish Department has reviewed the draft environmental impact statement, "New River and Phoenix City Streams, Maricopa County, Arizona" and the Design Memorandum No. 3, New River and Phoenix City Streams. We offer the following comments.

First, we wish to thank the Corps for the fine job of coordination that has continued through the initial planning stages. That type of coordination has greatly helped in preventing conflicts and is primarily the reason the Department can support the Phase 5B Phoenix Flood Control Project.

Neither the Design Memorandum or the DES discusses hunting or fishing under the recreation sections. Fishing, of course, is unavailable except in the Arizona Canal and that is not permitted by the Salt River Project. Hunting, however, does occur throughout the project area and in significant numbers.

The Department agrees with the statement found on page I-9 of the DES, that recreational facilities should not be provided at the New River site and that it should be left in its natural state as a wildlife area. We feel, however, it should include the recommendations of the Task Force to "...provide the New River site as a wildlife area..." (page 125 Design Memo #3).

On page IV-11 (DES), hunting is indicated as a trespass use in the New River area. That may be true on posted private land in the area, but not all private land is posted. There is also some public land in the area where hunting is a legitimate use.

The Department generally agrees with the habitat loss figures presented in the two documents. There is, however, some discrepancies on the number of acres of habitat lost. The Design Memorandum #3 list 2,200 acres including 390 acres of riparian habitat (page 191). The DES on page I-98, list 1,685 acres of which 410 acres are riparian and on page I-85, list 1,350 acres of which 315 are riparian.

These figures have been used to base the acquisition of lands for mitigation to offset wildlife losses. The Department is, of course, in full support of the mitigation proposals as outlined in the reports. The Department was pleased to read (page 255, Design Memorandum #3) that the Corps agrees that the mitigation proposal to acquire 360 acres of riparian habitat is justified and recommends its acquisition.

Finally, the Department agrees that there is a need for flood control in the project area and agrees with the statement (page 153, Design Memorandum No. 3) that "...this plan (5B) has the least impact on the environment as compared to other plans...".

We look forward to continued coordination and cooperation in planning and implementing this project.

Sincerely,

Robert A. Jantzen, Director

By: John N. Carr, Supervisor
Planning & Evaluation Branch

JNC:ab

ARIZONA DEPARTMENT OF TRANSPORTATION

HIGHWAYS DIVISION

206 South Seventeenth Avenue Phoenix, Arizona 85007

RAUL H. CASTRO
Governor

WILLIAM A. ORDWAY
Director

WILLIAM N. PRICE
State Engineer

October 1, 1975

Colonel John V. Foley
U.S. Army Engineering
District, L.A.
300 North Los Angeles Street
Los Angeles, CA 90054

Re: Draft Environmental Statement
for Flood Control Project
Gila River Basin
New River and Phoenix City Streams, Arizona
State Identifier: 75-80-0041

Dear Colonel Foley

The Environmental Planning Services and the Structures Section of the Highways Division, Arizona Department of Transportation, has reviewed the Draft Environmental Statement for the Flood Control Project, Gila River Basin, New River and Phoenix City Streams, Arizona.

We are in agreement there is a need to better control the movement of flood waters along the waterways in the vicinity of Phoenix, Glendale, Peoria, Sun City, Avondale, and the surrounding area.

In the selection of alternative solutions, this office recommends the adoption of the Two Dam Combination for the Adobe Dam, Alternate Dam Number 1, and Alternate Dam Number 4A, as shown on page A3-46 of the study appendixes. This alternate shows the best benefit-cost ratio. It will not require modification of the bridges and the highway and will not disrupt traffic on busy Highway I-17.

We appreciate the opportunity to review and comment on this study.

Yours very truly

WM. N. PRICE
State Engineer

MASON J. TOLES, Manager
Environmental Planning Services

MJT:ADG:add
cc Constance LaMonica, OEPAD
Structures Section, ADOT

TL

ARIZONA STATE MUSEUM

THE UNIVERSITY OF ARIZONA

TUCSON, ARIZONA 85721

September 29, 1975

Ms. Constance LaMonica
State Clearinghouse Contact
1645 West Jefferson
Phoenix, AZ 85007

Project: Draft Environmental Impact Statement for New River and Phoenix City Streams

State Application Identifier: 75-80-0041

Dear Ms. LaMonica:

The Draft EIS for the New River and Phoenix City Streams represents an excellent consideration of the archaeological resources that will be affected by this project. The thoroughness exhibited in this aspect of the document is appreciated.

Sincerely,

Robert J. Hard
Robert J. Hard
State Clearinghouse Contact
Arizona State Museum

R. Gwinn Vivian
R. Gwinn Vivian
Archaeologist
Arizona State Museum

RJH/RGV:sr

cc: Garth A. Fuguay

ARIZONA
OFFICE OF THE GOVERNOR

OFFICE OF
ECONOMIC PLANNING AND DEVELOPMENT

MAILING ADDRESS: 1645 West Jefferson • Room 428 • Phoenix, Arizona 85007

MEMORANDUM

TO: Clearinghouse

FROM: Dave Hamernick DH

THROUGH: Dennis Thompson

DATE: August 29, 1975

SUBJECT: Two Clearinghouse proposals: 1) FHA subdivision feasibility analysis and 2) Army Corps of Engineers Flood Control proposal - New River and Phoenix City Streams.

I am not familiar with the hydrologic-topographic characteristics of the specific FHA subdivision in question (Clearinghouse #75-85-0091). However, the site is in the general vicinity of Cave Creek which is a key element in the Corps of Engineers flood control proposal. Should this site be developed prior to completion of the Corps' project? Not if it is presently subject to flooding.

Looking at the Corps' proposal (again without specific knowledge of many detailed facts) it seems to me that it should positively be integrated with the Phoenix area urban forms studies that have been coordinated through the Maricopa Association of Governments.

If the life style of Phoenix residents is to be altered significantly (negatively) by new growth; if transportation costs are increasing rapidly due to petroleum price rises and if the current Phoenix residents will have to pay for a major portion of the front-end costs for new developments; then isn't it reasonable to place the Corps' proposal (of a couple of hundred million dollars) into the context of an urban growth study? What is the current value of the buildings and improvements that will be protected? Will new development increase per capita governmental costs? Obviously, I nor anyone else knows most of the answers to these and related questions so let's start looking for them. I believe the best way to do it is to push the urban forms studies beyond the talk stages and into the applied planning stages.

Dr. Suzanne Dandoy, Acting Dir.
Department of Health Services
1740 West Adams Street
Phoenix, Arizona 85007

State Application Identifier (SAI)
August 27, 1975
State AZ Number 75-80-0041

Economic Sec.	Highway
Civil Rights	Ag. & Hort.
Indian Affairs	Power
Game and Fish	Health
Mineral Res.	Land
Bureau of Mines	Water
Arid Lands Studies	Parks
AZ Mining Ass'n	AORCC
Environmental Studies	OEPAD
S.W. Minerals Expl.	
Archaeological Research	Region I
Library and Archives	

From: Constance LaMonica

This project is referred to you for review and comment. Please evaluate as to:

(1) the program's effect upon the plans and programs of your agency
(2) the importance of its contribution to State and/or areawide goals and objectives
(3) its accord with any applicable law, order or regulation with which you are familiar
(4) additional considerations

Please return this form to the clearinghouse no later than 15 working days from the date noted above. Please contact the clearinghouse if you need further information or additional time for review.

☐ No comment on this project
☐ Proposal is supported as written
☒ Comments as indicated below

Comments: (Use additional sheets if necessary)

75-80-0041

The Department supports the project and recommends that this be coordinated with Section 208 planning under Public Law 92-500 which is being conducted by MAG. The Department also recommends that proper mosquito control measures be considered to minimize public health problems when there is water behind the dams.

Reviewer's Signature James D. Goff PE
JAMES D. GOFF, P.E., ASSISTANT DIRECTOR

Title

Date 9-22-75

Telephone

TO:

Mrs. Barbara Smith
Center for Environmental Studies
125 Wilson Hall, ASU
Tempe, AZ 85281

State Application Identifier (SAI)

August 27, 1975

State AZ Number 75-80-0041

From: Constance LaMonica

Economic Sec.	Highway
Civil Rights	Ag. & Hort.
Indian Affairs	Power
Game and Fish	Health
Mineral Res.	Land
Bureau of Mines	Water
Arid Lands Studies	Parks
AZ Mining Ass'n	AORCC
Environmental Studies	OEPAD
S.W. Minerals Expl.	
Archaeological Research	Region I
Library and Archives	

This project is referred to you for review and comment. Please evaluate as to:

(1) the program's effect upon the plans and programs of your agency
(2) the importance of its contribution to State and/or areawide goals and objectives
(3) its accord with any applicable law, order or regulation with which you are familiar
(4) additional considerations

Please return this form to the clearinghouse no later than 15 working days from the date noted above. Please contact the clearinghouse if you need further information or additional time for review.

☐ No comment on this project
☐ Proposal is supported as written
☑ Comments as indicated below

Comments: (Use additional sheets if necessary)

See Attached

Reviewer's Signature James Schoenwetter

Date 15 Sep 75

Title Center for Env. Studies

Telephone

NEW RIVER AND PHOENIX CITY STREAMS DRAFT E. I. S.

1. The draft EIS presents inadequate data for evaluation of alternatives as regards cost-to-benefit ratios. Specifically, the statement does not provide a breakdown of dollar values assigned to particular costs and particular benefits. Thus it is not possible to determine if specific costs or benefits have been under- or over-evaluated, and the claim that the recommended plan has a lower cost to benefit ratio than an alternative is specious.

2. The apparent estimate of the cost of irreperable and irretrievable loss of archaeological resources eligible for nomination to the National Register is $900,000. This figure is an estimate of the cost of archaeological mitigation under the recommended plan. This estimate is inadequate for calculation of cost to benefit ratio, however, because it has no necessary or evidenced relationship to the value of the archaeological resources involved.

Cultural resources have a number of intangible values. No dollar estimate can be placed, for example, upon the worth of the informational, recreational or aesthetic values of cultural resources. But such intangible values are not realized without dollar investment. We cannot produce information without paying for the effort and equipment of investigation and the dissemination of knowledge obtained. Estimates of the costs of investments required to recover the intangible values of archaeological resources may be made. Such estimates may or may not have a direct relationship to the costs of mitigation of impact on the resources, for the estimated cost of recovery is not necessarily the price we are willing or able to pay for the loss of the resources involved.

The recovery costs of the archaeological resources impacted by the proposed plan may be calculated from the data available in Appendix A of Reference 6. Roughly, the professional opinion of the archaeologist employed by the Corps works out to estimate total recovery costs in excess of $ 2.3 million. This figure should be adopted in calculation of the cost to benefit ratio of the recommended plan, rather than the $900,000.00 used in the EIS.

3. The mitigation measures proposed to lessen the effect of impact on archaeological resources are not equivalent in quality to those proposed to lessen the effect of impact on wildlife resources. The exact character of archaeological mitigation measures will only become known subsequent to "106 action". However, we are informed that $ 900,000 is estimated as the cost of such mitigation. Evidently, since estimates of the dollar value of recovery of the impacted archaeology exceed $ 2.3 million, no serious effort has been made by the Corps to realistically compensate the loss of these resources. On the other hand, proposed wildlife habitat mitigation measures specifically attempt to compensate the loss of acreage of good quality habitat with equivalent amounts of habitat of similar quality. Clearly, the serious attempt proposed by the Corps is to compensate the adverse impact to wildlife as closely as possible. Considering the fact that wildlife is a renewable resource and that archaeological sites of National Register quality are nonrenewable, it would appear that the Corps proposal to treat the mitigation measures unequally is very inappropriate.

4. Alternative 3 provides less flood control than the recommended plan. But it provides a higher cost to benefit ratio regardless. Thus the dollar value of the probable destruction generated by reduced flood control under Alternative 3 is not compensated by the increased cost of protection. Further, this benefit to cost ratio has been calculated without regard for the value of archaeological resources which would be irreperably and irretrievably lost if the recommended plan were adopted. This loss would add further to the descrepancy in benefit to cost ratio between the recommended plan and Alternative 3. The properties left threatened by Alternative 3 are presently so threatened and they would not be devalued by the Alternative course of action. Thus Alternative 3 far exceeds the recommended plan as regards return of dollar benefit for dollars expended.

Alternative 3 also has substantially lesser impact than the proposed plan as regards non-dollar values and resources. Alternative 3 has less affect upon acreage of topography and drainage (436 acres vs. 6,600 acres), upon the stoppage of downstream transport of sediments (5,700 acre-feet vs. 13,300 acre-feet), upon the archaeological and historical resources (1 archaeological district vs. 3 districts and a site), upon wildlife habitat (770 acres vs. 1,585 acres), upon the commitment of land to flood control use (2,276 acres vs. 6,600 acres), upon the requirement of local interests to provide all-weather bridges at dip crossings (0 bridges vs. 20 bridges), and upon the need to relocate homes and businesses (0 vs. 250).

In view of the disparity in costs and impacts, Alternative 3 should be adopted rather than the recommended plan.

James Schoenwetter
1246 E. Riviera Dr.
Tempe A Z 85282

ARIZONA STATE
UNIVERSITY — TEMPE, ARIZONA 85281

Comments on draft environmental impact
statement for

New River and Phoenix City Streams.

R. J. Becker R. J. Becker
Center for Public Affairs
SS220
Arizona State University
Tempe, AZ 85281

sent to Army Corps of Engineers
Los Angeles District
300 N. Los Angeles Street
Los Angeles, CA 90054

9-17-75

re: draft environmental impact statement, New River and Phoenix City Streams.

The justification of the project is questionable. While some flood hazard does exist for those who have built on the flood plain, there are structures being added in those same flood plains and this project seems inadequate in methods to restrain this expanding hazard. The values to be lost by floods beyond the volumes of water that can be controlled, are added to by extension of the area settled and by intensification of values in the present settled areas. The cost to the public via tax supported insurances are certainly increased when high-rise structures are added on a flood plain, BY PERMISSION, because the site has an approved flood control system. The restraint on development is not adequate.

Most of the initial investments on the plain have been amortized. All of the initial structures were placed in knowledge of the flood hazard. Why should all other parties be made subject to that risk assumed deliberately by any specific person who builds on the flood plain? Any justification for adding to the public cost must be placed in perspective, then, to judge the extent to which the taxpayer will be further forced into risk position and into certainty of payment for the irresponsible act of the person building on the flood plain. In this regard, the benefit-cost ratios become more significant. While expenses for control measures can be assumed, and structures put in place, under any "favorable" benefit-cost ratio, it seems imperative to take the most favorable ratio under present conditions. The project chosen cannot be justified if it is not that most favorable ratio; which ratio is obtained under present conditions. A ratio made more favorable IF property values are added by lateral extension of the protected area and by intensification of values in the protected area, is not an acceptable ratio. The extent of the floodplain to be protected should be minimized: protection from flood damage by newcomers should be gained by staying off the flood plain. Possibly the cheapest cost for extending legislatively-mandated flood protection to scattered structures would be by condemnation of those structures at flood-damaged prices, with some relocation assistance. Not

R. J. Becker

ASU 9-17-75

re: draft environmental impact statement, New River and Phoenix City Streams.

Timing for "present conditions" should be set at whatever time it was that the insertion of publicly-funded flood control programs became a mater of some certainty. Those adding to the risk in the flood plain to be borne by the people after that time should be subject to review.

Data provided in these two documents do not permit examination of the detail, nor of method, by which the calculated results were obtained.

The language of the texts is not always readily communicative: for example, the use of the term "authorized" (past tense) gives an impression that any consideration of a draft EIS is impertinent. Might it be possible to find and use other terms, or sentences, to project the true status of stages of the project, and the project in total?

The "Authorized plan" map of page 9, Design Memo # 3, Gen. Design Memo Phase 1 Plan Formulation, shows considerable channelization. Can there be any justification for this? Why is not that stream zoned. Channelization is not needed and is environmentally destructive. It is very objectionable. Residents in the river bed have undertaken the position in knowledge of the risk. If they prefer public subsidization, the least objectionable action would be to help them out of there: not try to protect them in there.

The project needs evaluation in terms of "present value" as of the date of public committment to become involved in the risk; and the alternates for public funding include moving out the parties; but do not include adding to area extent post date, nor adding to value post-date. Regardless of "control" structures, floods do damage "protected" properties; and the extent of loses via insurance settlements cannot be added to by allowing values beyond the date of public risk-taking.

R. J. Becker

ASU 9-17-75

MARICOPA COUNTY PLANNING DEPARTMENT

300 County Administration Bldg. 111 S. 3rd Avenue, Phoenix, Arizona 85003

October 1, 1975

Colonel John V. Foley
U. S. Army Engineer District L.A.
300 N. Los Angeles Street
Los Angeles, CA 90054

Dear Colonel Foley:

The Maricopa County Planning Department staff has reviewed the Draft Environmental Impact Statement--New River and Phoenix City Streams, and the Design Memorandum No. 3--Gila River Basin, New River, and Phoenix City Streams. In general, we agree with the results of the study; and we concur that the Recommended Plan causes the least negative impact and the greatest benefit in resolving flood control problems in the Phoenix Metropolitan Area.

After our review, we have two comments on the reports that we wish to forward to you. First, on several occasions in both reports the statement is made that the recommended Adobe Dam site conflicts with the site illustrated on the proposed Future General Land Use Plan for Maricopa County (e.g. page III-28, Draft E.I.S.). It appears that your staff has an early draft of the Future General Land Use for Maricopa County, Arizona report. The Plan, forwarded to the County Planning and Zoning Commission and upon which a public hearing was held on April 10, 1975, illustrated the Adobe Dam at the recommended site. Enclosed is a copy of that preliminary Future General Land Use Plan for your review.

Secondly, in the Design Memorandum No. 3 on Page 28, Table 1, there is a vast difference between the population projections utilized by your staff and those utilized by this Department, MAG, and the various cities and towns of Maricopa County. Your 1980 population estimate of approximately 1.3 million persons is the same as our 1975, or present, population estimate. In addition, your year 2000 population estimate is 1.2 million persons lower than that utilized by this Department and MAG. If you have not already done so, we would suggest that you contact the Maricopa Association of Governments Transportation and Planning Office for the most recent population estimates.

Colonel John V. Foley
Page 2
October 1, 1975

Other than these two comments, we agree and support your studies on the New River and Phoenix City Streams. If we may be of any assistance in your continuing work, please do not hesitate to contact this Department.

Sincerely,

Donald W. Hutton

Donald W. Hutton
Director

DWH/PVB/el

Enclosure

cc: Major W. T. Kirkpatrick

FLOOD CONTROL DISTRICT of Maricopa County

3325 West Durango Street • Phoenix, Arizona 85009 • Telephone (602) 262-3630/262-3639

September 16, 1975

United States Department of the Army
Los Angeles District, Corps of Engineers
P. O. Box 2711
Los Angeles, California 90053

ATTN: Mr. Garth Fuquay

RE: New River and Phoenix City Streams, Environmental Impact Statement and Design Memorandum No. 3

Dear Mr. Fuquay:

Thank you for the opportunity to review and comment on the above documents. We wish to offer the following comments for your consideration:

<u>Environmental Impact Statement</u>:

Page I-23, The first complete sentence, "The Black Canyon Highway (I-17) intercepts Cave Creek runoff near the Arizona Canal.", should be clarified to reflect that runoff from Cave Creek intercepted by the Black Canyon Highway would be only runoff diverted by the Arizona Canal.

Page I-39, paragraph 2.36: Since this report, the City of Phoenix has put in service a fourth water treatment plant (Val Vista) on the South Canal near Val Vista Drive and McDowell Road.

Page I-45, paragraph 2.47: "---statement is delimited---." correct to read "----statement is delineated----."

Page I-78, line 3: correct to read "---will require 300-400 acres of land----."

Pages I-114 and I-115, paragraph 6.13, l and o: The construction of Cave Buttes Dam as part of alternative 3 would require relocation of 3 homes as stated in paragraph 4.16 on Page II-25.

Page I-126, paragraph 6.19, e : Cave Buttes Dam would displace three family dwellings.

Page II-2, paragraph 1.02: Cave Buttes Dam location is about 18 miles north of the Phoenix Civic Center.

Page II-14, paragraph 2.20: The Cave Buttes area contains three residential dwelling units, not one as stated. (See also Page II-27, paragraph 5.05 and compare with paragraph 4.16 on page II-25).

Page III-8, paragraph 2.06: Correct reference to photo 12. Should this be photo 9?

Page III-11, paragraph 2.13: Correct reference to photos 9, 10, and 11. Should this be photos 10, 11 and 12?

Page III-13, paragraph 2.17: Reference to 34th Avenue should be 35th Avenue.

Page IV-5, paragraph 2.04: Correct wording of first sentence which reads "---poorly consolidated alluvium (---) that is about granite."

Page VI-2, paragraph 1.03, a: Bridge requirements should include 32nd Street, 24th Street, 16th Street, 12th Street, Maryland Avenue, Glendale Avenue, Dunlap Avenue, Metro Parkway, 35th Avenue, Peoria Avenue, Cactus Road, and Thunderbird Road.

Page VI-9, paragraph 2.10, a: Correct reference to photo 7. Should this be photo 19?

Page VI-28, paragraph 4.14: Compare relocations of 225 homes and 25 businesses with GDM page 146 which calls for relocation of about 275 homes and businesses.

<u>Design Memorandum Mo. 3</u>:

Page 74: Lower photo caption should refer to June 22, 1972 storm.

Pages 145 and 216: Reference to Arizona Canal diversion channel relocations of about 275 homes and businesses should be reconciled with E.I.S. Page VI-28, paragraph 4.14.

Page 221: Consideration should be given to ramping 35th Avenue over the Adobe Dam structure.

Page 236: The first two paragraphs on this page should be clarified to indicate $2,761,000 in first paragraph as average annual flood losses and $350,000 in second paragraph as average annual reduction in costs.

Page 249: Clarify the 2.3 percent contribution of total construction cost to be paid by local sponsors.

Page 276: Reference in item "c" to displacement of 250 residences and businesses should be reconciled with the statement on page 145 and with page VI-28 paragraph 4.14 of the E.I.S.

Page A3-54: Last line - "A small gate provided" should be deleted or the sentence completed.

Page A4-31 paragraph 62: Should read "The outlet works would consist of an intake structure, an ungated 8.5 foot-diameter outlet conduit, and an energy dissipator." The balance of that paragraph should be deleted since there will be no recreation lake.

Page A4-44, paragraph 101: Should read "The outlet works would consist of an approach channel, an intake structure, an ungated 3.75 foot-diameter outlet conduit and a stilling basin." The balance of that paragraph should be deleted since there will be no recreation lake.

We also wish to direct your attention to the City of Phoenix plan to construct a new water line in the area of the emergency spillway of Adobe Dam as presently proposed. One solution would be to design the emergency spillway into the dam structure somewhere near Skunk Creek. We would recommend that serious consideration be given to this alternate location for the spillway. Also consideration should be given to design the emergency spillways for Cave Buttes and New River dams into the dam structure.

We have noted that the existing I-17 bridges at Skunk Creek are not adequate to pass a 100-year flood and must therefore be enlarged to implement the plan for Adobe Dam and Skunk Creek as presented. Since these bridges are entirely out of the Adobe Dam reservoir we do not consider the cost of providing the increased capacity to be a Flood Control District responsibility.

Should you have any questions regarding these comments please contact Bob Gehle of my staff.

Sincerely,

Herbert P. Donald, P. E.
Chief Engineer and General Manager

HPD:RVG:det

MARICOPA ASSOCIATION OF GOVERNMENTS

WEST WASHINGTON PHOENIX, ARIZONA

October 24, 1975

TO: Col. John Foley

SUBJECT: COMMENTS ON PROJECT PROPOSED ACTION

Applicant: Army Corps of Engineers, L.A. District

Project Title: New River and Phoenix City Streams Maricopa County

MAG/State Application Identifier: 75-80-0041

Dear Col. Foley:

The Maricopa Association of Governments' Clearinghouse has received and reviewed your notification of proposed action concerning the above project. In accordance with current requirements as set forth in the Office of Management and Budget Circular A-95, Revised, this letter will serve as the area-wide clearinghouse comment on the proposal.

- ◯ No comment on the above project.
- ⊗ Proposal is supported as written.
- ◯ The proposal is not supported as written.
- ◯ Comments are attached.

Please include the MAG State application identifier if applicable in any future correspondence regarding this proposal. Thank you for providing MAG with the opportunity to comment on this proposal.

JOHN J. DEBOLSKE, Secretary

By Ken Driggs

G. Kenneth Driggs

CITY
OF
PHOENIX
ENGINEERING DEPARTMENT

October 24, 1975

U.S. Army Engineer District, L.A.
300 North Los Angeles Street
Los Angeles, California 90054

Attention Mr. Garth A. Fuquay, Chief,
Engineering Division

Gentlemen:

Draft Environmental Impact Statement
New River and Phoenix City Streams.

In response to your invitation of August 20, 1975 we offer the following comments:

Page I-76, paragraph I-3.05: The recommended Arizona Canal Diversion Channel is not in conflict with actual land usage. Some of the land needed for the channel has already been excavated and is being used for temporary storm drainage detention basins.

Page I-87, paragraph I-4.25: Spillway Alternate No. 1 for Adobe Dam Site No. 4 is in conflict with the location of a proposed 42" water supply line and access road for the Hedgepeth Hills Reservoir planned by the City of Phoenix. A memo describing this conflict and illustrative maps prepared by the City Water and Sewers Department are attached.

Page I-89, paragraph I-4.30: In the City of Phoenix along Cave Creek, many of the bridges already exist or are planned for construction ahead of the proposed dam.

Page I-90, paragraph I-4.34: It is very important to recognize nearly all of the disrupted homes and businesses are now flood prone and acquisition for flood control purposes will enable the property owners to relocate in areas that are not flood prone.

Page I-91, paragraph I-4.36: The Arizona Canal is a physical barrier that existed long before these communities were developed. The modification of this barrier should have a minimum social impact. In fact, the use of the associated trail by people on both sides of the canal may even serve to unify the communities to some extent.

251 WEST WASHINGTON • PHOENIX, ARIZONA 85003 • TELEPHONE (602) 262-6561

U.S. Army Engineer District, L.A.
Draft Environmental Impact Statement
October 24, 1975 - Page 2

Page I-140, paragraph I-9.11: The proposed plan has been endorsed by the City Council of the City of Phoenix.

Page II-15, paragraph II-2.22: The City of Phoenix has 80 acres under active mineral lease that would be affected by the recommended dam.

Page III-30, paragraph IV-4.03, Page III-33, paragraph III-4.09, and page IV-17, paragraph 1: These three paragraphs seem to contradict each other about the effect on downstream riparian vegetation.

Page VI-2, paragraph VI-1.02: The channel begins at 40th Street in Phoenix, goes through Paradise Valley and back into Phoenix, etc.

Page VI-4, paragraph a: If the channel is entirely below ground level why must the inlets be gated? Does this apply to future storm drains built by the City?

The impact of constructing structures to introduce water from other major washes, such as the 10th Street Wash, the Myrtle Avenue Wash, and Little Dreamy Draw Wash, may not be minimal and could be discussed.

Page VI-5, paragraph c: If the flows from Cave Creek are too large to be taken into the Arizona Canal Diversion Channel by side channel spillway, it is hoped that the necessary concrete channel in Cave Creek Park can be much shorter than extending to Peoria Avenue.

Page VI-8, paragraph VI-2.07: The terminus of the channel is at 75th Avenue.

Page VI-34, paragraph VI-8.02: Will the disposal of excavated material for this feature pose a large problem?

Very truly yours,

J. E. Attebery

J. E. ATTEBERY, P.E.
City Engineer

RS:vlm

Attachment

TOWN OF
PARADISE VALLEY

6325 NORTH INVERGORDON ROAD
OFFICE OF TOWN OF PARADISE VALLEY, ARIZONA 85253 PHONE: 948-7412

October 20, 1975

Major W. T. Kirkpatrick
2721 N. Central Ave.
Suite 800
Phoenix, Arizona

Dear Major Kirkpatrick,

Due to a prior commitment, I am unable to attend your meeting on Flood Control this evening, but felt it important enough to express my opinion and remind you of the Town of Paradise Valley Council action on October 10, 1974.

As you are aware, my opinion, as an interested party but not one directly involved by possible loss of property, is one of disfavor for the project. I felt that yourfailure to contact the people involved, in the Town of Paradise Valley of the Town Council until after your recomminda-tions were formulated was far from justified by your comments that you did not realize the town existed.

Your failure to recognize the town and the people directly involved is mirrored by the failure to understand the problems in this area.

We need not spell out again the facts of the problems or the alternative that we have provided you for the area between 40th Street and 32nd Street.

TOWN OF

PARADISE VALLEY

6325 NORTH INVERGORDON ROAD

OFFICE OF TOWN OF PARADISE VALLEY, ARIZONA 85253 PHONE: 948-7412

On October 10, 1974, the Town of Paradise Valley Council unanimously opposed both the installation of the detension basins and diversion channels within the Town of Paradise Valley. This decision has not changed.

We all are aware that the balance of the project would not be affected by the delition of the eastern end of the channel east of 32nd Street and are requesting that your acknowledgement of that fact be made and you exclude any work within the Town of Paradise Valley.

Very truly yours,

J. Duncan Brock

J. Duncan Brock

J. Duncan Brock Builder, Inc.

JDB/sj

The Atchison, Topeka and Santa Fe Railway Company
A Santa Fe Industries Company
121 East Sixth Street, Los Angeles, California 90014, Telephone 213/628-0111 Ext. 22457

September 9, 1975

File: 454 - Br. 178.0 AQ=4
(New River)

Garth A. Fuquay
Chief, Engineering Division
Corps of Engineers
Los Angeles District
P. O. Box 2711
Los Angeles, CA 90053

Dear Sir:

The Draft Environmental Statement for Flood Control Project Gila River Basin, New River and Phoenix City Streams, Arizona, has been received and reviewed.

Your report is very complete and Santa Fe is in accord with the need of the project.

Very truly yours,

J. G. Fry

J. G. Fry,
Assistant General Manager
Engineering

SALT RIVER PROJECT
P.O. BOX 1980
PHOENIX, ARIZONA 85001

October 2, 1975

TELEPHONE 273-5900

Col. John V. Foley
U. S. Army Engineer District, L.A.
300 N. Los Angeles Street
Los Angeles, California 90054

Dear Col. Foley:

The Salt River Project has reviewed the Draft Environmental Impact Statement for the New River & Phoenix City Streams, Maricopa County, Arizona (U.S. Army Engineers, Los Angeles District Corps of Engineers, August 1975) and would like to offer the following comments:

1. Section I-2.27 a., page I-30: The title "Salt River Project Agricultural Improvement Power District" should be "Salt River Project Agricultural Improvement and Power District".

2. Section VI-2.21, page VI-21: This section states that the "Arizona Canal has many pumping stations. . ." This is not an accurate statement. The Arizona Canal is a gravity flow canal. It has no pumping stations. However, the Salt River Project does have 13 deep wells adjacent to the Arizona Canal which provide water for the canal and/or adjacent lands.

3. Sections VI-4.03 to 4.06, pages VI-24 and 25: These sections are mislabled IV instead of VI.

4. Section VI-4.04, page VI-24: Reduction of ponding against the Arizona Canal north bank by the diversion channel would reduce recharge in this area somewhat.

Thank you for the opportunity to comment on this statement.

Sincerely,

Frank T. Darmiento

Frank T. Darmiento
Environmental Planning

ccn

cc: Garth A. Fuquay

GATEWAY TO PHOENIX, ARIZONA

DEER VALLEY PLANNING COMMITTEE

c/o 4702 West Soft Wind Drive
R.F.D. #3
Glendale, Arizona 85310
22 October 1975

Colonel John V. Foley
US Army Engineer District, L. A.
300 N. Los Angeles Street
Los Angeles, California 90054

Subject: Draft Environmental Statement for Flood Control Project, Gila River Basin, New River and Phoenix City Streams, Arizona

Sir:

The Deer Valley Planning Committee appreciates this opportunity to review the subject document, and the Corps of Engineers' General Design Memorandum No. 3 which accompanied it.

Our comments on the two documents are contained in the attached report of our Flood Control Subcommittee. As indicated in the report, the DVPC has serious reservations about the Arizona Canal Diversion Channel. We emphasize, however, that our comments are offered with a view toward cooperative solution of a thorny problem. We hope that we can continue fruitful discussion of solutions to the problem with members of the Corps, the Flood Control District, and the city's Engineering Department.

A copy of the enclosed report was submitted at the public hearing for the project on 21 October. You are requested to furnish us with copies of submittals of the contents of our report to other agencies, and of their responses to those contents.

Thank you.

Sincerely yours,

Arthur J Hallinan Jr

Arthur J. Hallinan, Jr.
Chairman, Flood Control
Subcommittee

Enclosure

DEER VALLEY PLANNING COMMITTEE

REPORT OF THE
FLOOD CONTROL SUBCOMMITTEE

The Flood Control Subcommittee of the Deer Valley Planning Committee has reviewed the main body of the draft General Design Memorandum and the draft Environmental Statement prepared by the U. S. Army Corps of Engineers for its Flood Control Project: Gila River Basin, New River and Phoenix City Streams. The documents present more detailed proposals in accordance with "Alternative 5b" which was presented as one of six alternatives at a public hearing on 25 April 1974. The "Alternative 5b" approach to flood control for Phoenix has been endorsed by, among others, Phoenix City Council resolution 14324 of 7 May 1974, and the Flood Control District of Maricopa County Board of Directors resolution of 3 June 1974.

The project, as described in the two draft documents, substantially affects the Deer Valley area, as well as the Deer Valley Area Plan previously approved (December 1973) by Phoenix City Council. Features of the project lying within the Deer Valley plan area include:

Adobe Dam in the northwest plan area
Cave Creek Park along the east of the plan
Arizona Canal along the south of the plan

The context in which this review of the Corps' draft documents is understood to be occurring is that of a general design, whose approval cycle must be completed prior to commencing construction of the first project feature, Cave Buttes Dam. We understand the critical urgency of Cave Buttes Dam. We note that priority construction of that feature is common to four of the six alternative plans presented by the Corps of Engineers some 18 months ago. Even if Cave Buttes Dam were the only project feature ever constructed, it would be an improvement of Phoenix' present position vis-a-vis flood hazards in the City. It therefore seems reasonable to us that Cave Buttes should be able to proceed unhindered by uncertainties about the Arizona Canal Diversion Channel raised in this report.

ARIZONA CANAL DIVERSION CHANNEL

At the present time, the Deer Valley Planning Committee must accept and support efforts of citizens who expressed their views at our meeting of October 2nd. That view is to oppose construction of the Arizona Canal Diversion Channel.

The Deer Valley Area Plan, approved by Phoenix City Council as <u>the</u> plan for Deer Valley after expenditure of in excess of 10,000 citizen manhours in its development, does not consider the flood control channel to be the best use of the land.

We have read the economic analyses of costs and benefits prepared by the Corps of Engineers. These conclude that the channel is justifiable. We have heard statements by the City's Engineering Department that Deer Valley cannot have storm sewers unless the channel is installed as an outlet for collected waters.

<u>But</u>, we have also heard the cries of frustrated citizens to be affected by the project. Based upon such information as the committee has been able to gather, the Deer Valley Planning Committee does not believe that Effects on Social Well-Being have been considered to the extent required by Sub-section V.B of "Standards for Planning Water and Related Land Resources," <u>Federal Register</u>, XXXVIII, No. 174, Part III, pages 24778-862, Sept. 10, 1973. The sociological effects with which the committee is concerned include not only those of the channel itself, but also of those antecedant to construction of the channel. These latter effects, antecedant to construction, have been totally ignored in the environmental impact statement.

We agree that governmental planning should not be conducted in secret. We also believe, however, that the principle of "Put up or shut up" should also apply to governmental planning. That is, governmental planning should not proceed when (a) the process of planning has an <u>adverse</u> affect on large numbers of the citizens, and (b) funds for mitigating that adverse affect are at best figments of the planner's imagination. In the case of the Arizona Canal Diversion Channel, both (a) and (b) obtain:

People along the north bank of the Arizona Canal have had the marketing of their homes affected by the planning of the channel. They have received advice from those planning the project that they don't have to advise buyers of the plans because the plans are "public knowledge." Offering such advice, we believe, is an implied admission by the planners themselves that the planning process itself would narrow the number of buyers for a home to be affected by the plan. Further, we regard it as dangerous advice in an era increasingly becoming one of "Let the <u>seller</u> beware."

Yet when the affected homeowners apply to the Flood Control District for relief, they are effectively told that they must remain in limbo at least until 1981. Indeed, the history of Flood Control District funds for acquiring lands appears to run in inverse order to need. We consider this unprecedented cruelty to the citizenry of Deer Valley.

Our conclusion is therefore that plans for the Arizona Canal Diversion Channel be dropped because (a) substantial adverse effects on social well-being are being experienced by the planning process itself, (b) these adverse affects have been ignored in the environmental impact statement, (c) funds are unavailable with which to mitigate those effects, and (d) the history of Flood Control District funding does not indicate that funds will be available for required land acquisition until long after the scheduled 1981.

We do not, however, take a one-sided view against flood protection for the Cities of Phoenix and Glendale. Rather, we believe that alternatives exist. The members of the Deer Valley Planning Committee are drawn from the business community, and we find defective a management/planning process in which the following common-place techniques do not obtain:

1. Optimization of the mix of resources in a plan, using programming techniques available in operations research, a branch of management science developed by the military during World War II. Two items in the Corps' development of Alternative 5b lead us to recommend the use of O.R. programming techniques. First, most of the probabilistic damage curves for floods at various points in the system have already been worked out. Second, the manner in which a $30,000,000 pipe was added for Alternative 3 (p. 135 of the GDM No. 3) is disquieting. Third, planning of the channel for 100-year flood protection appears to be unwarranted when the city plans to furnish sewers for only one- or two-year flood protection.

2. Cost data should be used which ignores sunk costs. We do not understand how intelligent management decisions can be made by the various government agencies involved which do not differentiate between sunk costs and costs yet to be incurred. We recognize that it is government responsibility to measure the total cost of a project to society, which includes sunk costs for land removed from other uses. But we also recognize that it is government responsibility to effectively manage public funds, and that requires the differentiation we believe necessary.

3. Discount rates should approximate those expected to be observed. Otherwise, the discount process becomes specious and wasteful of public funds spent in its development.

Additional comments on the Arizona Danal Diversion Channel include the following:

4. We consider it unfortunate that the Flood Control District, the City of Phoenix, and the Corps of Engineers apparently accept the intransigent attitude expressed by Salt River Project toward flood control. The Arizona Canal will be

the primary beneficiary of the proposed channel, yet SRP has seen fit to give next to nothing in return. Rather, SRP insists that its present neighbors to the north have their land condemned so that SRP may reap the benefits at no cost to itself. We consider this an unconscionable misfeasance of the public trust presently placed with SRP.

5. We further recommend that alternate diversion of storm waters into the city storm drain system south of the Arizona Canal be considered. Other alternatives include planning of detention reservoirs along Cave Creek and at other locations within Deer Valley. While we are forced to accept that Alternative 5b is a way to furnish 100-year flood protection to Phoenix, we are not convinced that it is the only way. We are, however, convinced that there must be a better way. We do not accept that "a way" is necessarily the "best way," and are further unconvinced that "a way" should be followed merely because a substantial sum has been spent on its development.

6. An alternative should be developed to preserve all of the Arroyo Elementary School land, without sacrificing other homes. Further straightening of the bend in the existing canal at that point, with more extensive use of the less intensely developed private and public land adjacent to the south bank of the canal should make it unnecessary to take school land or abutting developed private residential land on the north side. It would be preferable to use and re-cover school land, as is planned in Sunnyslope, rather than destroying more homes and neighborhoods to provide new land for the school.

CAVE CREEK PARK

Cave Creek Park will be a City of Phoenix project with minimal Corps of Engineers participation. The DVPC's comments on the park plans as presented by the Corps are as follows:

1. The park boundaries as shown in the General Design Memorandum generally conform to those of the Deer Valley Area Plan. An exception which concerns us is the area of 24th Avenue south of Thunderbird Road. Park plans presented by Corps show a park boundary requiring the acquisition of several existing homes along the east side of 24th Avenue. A map entitled "Cave Creek Park Acquisition Plan," prepared by the City of Phoenix Parks and Recreation Department and dated January 8, 1975, shows the area as a "deleted acquisition," i.e., no longer planned for acquisition. Clarification is required as to the park boundaries actually to be used.

2. To ensure that the DVPC is apprised of park plans, we request DVPC participation in the recreation task force described on pages 87-88 of the General Design Memorandum. We understand that such participation is currently in the process of being requested by Corps.

ADOBE DAM

Adobe Dam will be constructed in the northwest corner of the Deer Valley Area Plan. The dam will reduce a Skunk Creek standard project flood to less than 2000 cfs, thus permitting water from the Arizona Canal Diversion Channel to be introduced below it without increasing the flood hazard southwest of Greenway and 83rd Avenue. Adobe Dam and the Arizona Canal Diversion Channel are therefore much inter-related projects. The DVPC's comments on Adobe Dam and plans for the park in the floodplain behind it are as follows:

1. We understand that the alternative of using two dams to control the Skunk Creek watershed is being actively

considered by Corps. We believe that the reduction in dam height at Site No. 4 permitted by the alternative would decrease sociological effects of the dam in both Saddleback Meadows and in Jade Park, and therefore recommend its adoption.

2. We recommend that the Corps consider channeling Scatter Wash from I-17 westward along the south of Adobe Mountain in behind the dam. Scatter Wash has flooded the south end of Jade Park on at least two occassions since 1970.

3. Existence of Adobe Dam park in conjunction with Thunderbird Park will substantially increase traffic on Pinnacle Peak Road. We therefore recommend that the interchange at I-17 and Pinnacle Peak Road be modified from its present half-diamond serving only the Flagstaff direction, to a full diamond serving also the Phoenix direction.

4. The General Design Memorandum and the Environmental Statement show a gymkhana in a triangular-shaped site at Pinnacle Peak Road and 47th Avenue. We recommend relocation of the gymkhana to the south of Pinnacle Peak Road, perhaps using existing structures on the Medigovich ranch. This recommendation is made for two reasons: (1) All trails for horse use require crossing of either 47th Avenue or Pinnacle Peak Road, with the dangerous result of mixing high-speed automobiles and low-speed horses; (2) lights and activity associated with a gymkhana would violate the life style of homeowners in the existing subdivision.

5. In the aerial photograph of the area (Plate 23 of the GDM), the rectangular green-cross-hatch area in the northwest is a platted subdivision with two occuppied residences and two homes under construction. The area should therefore be color-coded as urban use rather than agricultural use.

6. To ensure that the DVPC is apprised of park plans, changes to which will obviously required if two dams are used on Skunk Creek, we request DVPC participation in the recreation task force described on pages 87-88 of the General Design Memorandum. We understand that such participation is currently in the process of being requested by Corps.

JADE PARK NORTH HOMEOWNERS ASSOCIATION
3301 W. Monona Dr.
Glendale, Arizona
85308

October 18, 1975

Major Kirkpatrick
Army Corps of Engineers
2721 N. Central Ave.
Phoenix, Arizona 85004

Dear Major Kirkpatrick,

The residents of Jade Park North are deeply concerned about the proposed construction of a flood control dam in their backyard. We feel strongly that Site 4, the recommended Adobe Dam Site, is not in the best interest of the community and should not be considered as proposed.

The accompanying report has been prepared by a special committee in behalf of the Jade Park North Homeowners Association and the Flood Control Project Committee of the Deer Valley Council.

The intent of this report is to point out alternatives that are more acceptable to the affected homeowners. The revised Site 3 shown in the report was presented as a possible alternative by the Jade Park North Homeowners at the pre-public meeting held in the Jade Park North Recreation Center, October 8th.

We feel the site should be thoroughly investigated. It appears to have the potential of providing the needed flood protection at less cost than any other site.. Also there are no residents in the immediate vicinity of the site.

Copies of this report are being presented to all state legislators in this legislative district and to our concerned congressional representatives.

As Chairman of the Jade Park North Homeowners Association, and as Chairman of Flood Control Projects for the Deer Valley Council, I cannot express too strongly our opposition to the recommended Adobe Dam at Site 4, as proposed.

Sincerely,

Thomas O. Barnes, Chairman
Jade Park North Homeowners Assoc.
Chairman, Deer Valley Council,
Flood Control Committee
938-1670

Copy:
Colonel Donald

P.S. A written reply of your analysis of the committee report is requested.

October 7, 1975

To: U.S. Army Corps of Engineers

cc. Parks and Recreation
Herb Donald

From: Saddleback Meadows Property Owners Association

Subject: Comments on Draft Environmental Impact Statement

We are most appreciative of this opportunity to provide comments on the Draft Environmental Impact Statement. We hope that our comments will be taken in the positive manner in which we intended them to be. As we have indicated in the past, the S.M.P.O.A. in no way opposes flood control. We only ask that proper consideration be given to the property rights and the human rights of those of us who find ourselves effected by flood control projects.

First of all, the S.M.P.O.A. wishes to reiterate our position concering dikes in or adjacent to Saddleback Meadows. We remain unalterably opposed to dikes in any length, height or shape. We realize that there was no reference to dikes in the Environmental Impact Statement (EIS), but because we feel so strongly about this item we felt it necessary to restate our position.

We feel that regardless of the size of the dam at Site 4, a southbound entrance to BlackCanyon should be built at Pinnacle Peak Road prior to the start of construction at Site 4. There should also be an exit from the freeway northbound at Pinnacle Peak Road. This should occur whether or not there is a closure of 35th Ave. between Pinnacle Peak and Deer Valley Road. It is for certain that during the construction period of the dam at Site 4, 35th Ave. will be closed for long periods of time causing a great deal of inconvenience to persons using it to get to and from work and shopping as well as taking children to and from school. The increased traffic along Pinnacle Peak Road as the result of the added recreational features in the flood plain behind the dam should provide adequate continuing justification for the freeway entrance.

After carefully reviewing the recreational plans presented in the E.I.S., we found that we were in general agreement with the type of facilities planned. There was, however, one specific item that caused a great deal of concern. That was the location of a lighted gymkhana and horse area north of Pinnacle Peak Road and west of 47th Ave. This is grossly inconsistant with the lifestyle that most of the people living in Saddleback moved here to enjoy. The lights, crowds, noise, and air pollution generated by that facility in such close proximity to our homes is totally unacceptable. We are not opposed to the concept, only to its location.

The S.M.P.O.A. feels that a great deal of misunderstanding and anxiety could be avoided if we were permitted to be involved in planning of the recreational facilities. It seems to us that there is a great deal of flexibility possible in the location of the various facilities planned and since we are the only residential subdivision effected by these facilities, it would be entirely appropriate for us to be involved in the planning. If this is agreed to by Maricopa County Parks and Recreation and the Corps of Engineers, we will choose a member of the S.M.P.O.A. to be our representative to the various planning agencies.

We thank you again for the opportunity to comment on the draft (EIS).

George Bosler
Vice Chairman, S.M.P.O.A.

cjv/gb

October 15, 1975

Col. John V. Foley
U. S. Army Engineer District, L. A.
300 N. Los Angeles Street
Los Angeles, California 90054

RE: Flood Control Project, New River and Phoenix City Streams

Dear Col. Foley:

Thank you for the opportunity to study Design Memorandum No. 3 and the Environmental Impact Statement for the above referenced project. We further appreciate the opportunity to offer our comments concerning this project.

Design Memorandum #3 states on page 91 "the greatest potential for flood damage exists along Cave Creek, especially through the heart of Phoenix, between the Arizona Canal and the Salt River." Alternative #3 describes building a dam on Cave Creek only, along with a 500 CFS concrete pipe drain along 19th Ave. to the Salt River. The estimated cost for this alternative is shown in table #11 as $58,900,000, the estimated equivalent annual net benefit is $2,445,000. This alternative seems a sounder investment, when compared to the other alternatives.

In short I agree with Mr. C. A. Pugh, Projects Manager, for the Bureau of Reclamation. In his letter to Mr. Weesner of the S.R.P. dated June, 1974, "the Corps of Engineers proposal for the Arizona Canal Diversion Channel appears to be a rather elaborate plan involving acquisition of considerable right of way through highly valued developed areas. We question the practicality of such a proposal. . .". These are the words of a professional engineer fully qualified and knowledgeable in the field of Flood Control.

We the Malapai Homewowners group and others who feel as strongly as we do; hereby state our strong opposition to the proposed Arizona Canal Diversion Channel for the following reasons:

Our homes are three to four years old. We were not informed of this approved project prior to our homes being built by anyone, neither the County, City, State, Builder, or Corp. of Engineers. Even the public meeting in April of 1974 was conducted without our knowledge. Our first knowledge of this project was when we read a notice in the paper of a flood control meeting to be held Sept 1974. We then learned our homes were in the proposed right of way to be taken for flood control.

You realize the social impact is already being felt in our area. County - funds are not available to purchase homes of those who are transferred or who have valid reasons for selling now. The latest word we have is that it may be 8 to 10 or even as much as 20 years before this money is appropriated and made available for this purpose. In the meantime you surely realize the hopelessness of selling these homes to anyone else. We feel living with these uncertainties is most unfair.

The social impact upon our neighborhood if and when this project is constructed will be greater than typically would be expected. The people required to move, are those who have invested in a new home within the last 3 to 4 years. To many of these people it would have been the only home they would ever have bought regardless of what the statistics say about mobility. Further we wish to point out the reason why 3 of 5 household owners have moved in the past 5 years as pointed out in Design Memorandum #3 on page 216, is that the houses were all new in the last 5 years. Such items as location, shopping facilities, schoold, flood plains, and churches were very carefully selected by most of us.

Many people living in the general area, yet a considerable distance from the A.C.D.C. are concerned over the potential devaluation of their property, and the infringement of such a monstrosity in their neighborhood.

As stated earlier we could offer our support to alternative #3 with some form of modification such as landscaped detension basins along Cave Creek or other solutions which eliminate the need for acquiring highly developed land.

Thank You

Charley L Shelton

Charley L. Shelton
3815 W. Malapai Dr.
Phoenix, Arizona 85021

cc: Environmental Protection Agency
County Board of Supervisors
City of Phoenix
Department of Housing & Urban Development
MAG of Maricopa County
Maricopa County Flood Control District

October 27, 1975

Col. John Foley
U. S. Army Engineer District, L. A.
300 N Los Angeles Street
Los Angeles, California 90054

RE: Flood Control Project, New River and Phoenix City Streams

Attention: Environmental Protection Agency

Dear Col Foley:

Enclosed please find (206) signatures voicing opposition to the Arizona Canal Diversion Channell of the referenced Flood Control Project.

Since we were unaware we would be afforded the opportunity to respond to this program prior to receiving the Design memorandum and due to untimely illnesses, we feel this is only a small fraction of those who oppose the A.C.D.C.

Reta Shelton

Mrs Reta J Shelton
3815 W Malapai Dr.
Phoenix, Arizona 85021

cc

A R I Z O N A   C O N S E R V A T I O N   C O U N C I L
4701 East Washington Street
Phoenix, Arizona 85034

February 9, 1976

Major Terry Kirkpatrick
United States Army
Corps of Engineers
2721 North Central Avenue
Phoenix, Arizona 85004

Dear Major Kirkpatrick:

At its meeting of October 9, 1975, the Arizona Conservation Council unanimously supported Alternative B., of the New River and Phoenix City Streams Flood Control Program. The principal concern of the Council was that the Skunk Creek, New River, and Agua Fria channels would be left essentially in their present natural condition.

The Arizona Conservation Council, composed of 18 member organizations representing some 48,000 people throughout Arizona, would like to thank the Corps of Engineers for the opportunity to comment on this project, and at the same time, congratulate them on their visibility and willingness to listen to the public voice.

Sincerely,

Howard E. Gillmore

Howard E. Gillmore
Chairman

G:s

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GLOSSARY OF TERMS

DEBITAGE – The waste chips of stone left over after a stone tool has been fashioned.

DEBRIS BASIN – A basin formed behind a low dam or excavated in a stream channel to trap debris carried by flood water.

DENDRITIC DRAINAGE – A tree-like pattern of converging tributaries upon a main river or stream.

DETENTION BASIN – (Also called a retarding basin) a reservoir wherein excess water is stored for a relatively brief period of time, until it can be safely released.

DIKE – An embankment constructed to prevent overflow from a body of water, to retain water in a reservoir, or to prevent water from inundating an area of lower elevation.

DIVERSION DAM – A fixed dam built to divert all or part of the water in a stream away from its natural course.

DROP STRUCTURE – Structure, vertical or inclined, installed for the purpose of dropping water to a lower level and dissipating its energy.

ECOSYSTEM – A basic unit of ecology referring to a balanced system of organisms with their environment. It is usually self-maintaining and self-stabilizing unless its organisms or environment are altered by natural or human influences.

ECOTONE – The boundary between two ecosystems. It is important to consider such areas in an environmental/ecological analysis. Because two different ecosystems are acting in such areas, there tends to be greater species diversity and activity (referred to as the "edge effect").

ENERGY DISSIPATOR – A structure designed to decrease the velocity or turbulence of flowing water.

ENTRENCHED – See intrenched.

EPHEMERAL STREAM – A stream which flows only during and following a period of rainfall.

FAUNA – The animals of a given region taken collectively.

FELSITE – A light-colored igneous rock having few or no conspicuous crystals.

FERRIGENOUS – Of or pertaining to iron.

FLAKE – Any bit of stone derived when a core is struck with another stone. It may be waste or may be fashioned into a tool.

FLIP BUCKET – An energy dissipating structure found on the spillway or outlet works of a dam.

FLOOD INSURANCE – Any insurance program designed to provide financial relief for damages incurred due to flooding.

FLOOD PLAIN – A belt of low, flat ground bordering a river or stream on one or both sides which is inundated when surface flows exceed the capacity of natural channel.

FLOOD PROOFING – Those adjustments, temporary or permanent, to a building or its contents, which are designed to keep water out or reduce effects due to inundation.

FLOOD WARNING – Any system of broadcasting an advance warning of possible flooding, to allow time to activate flood proofing devices or to evacuate a flood-prone area.

FLOODWAY – Is the portion of a flood plain required to carry and discharge the flood waters of a selected probability of occurence storm with an insignificant (less than 1 foot) increase in floodstage above that of normal conditions.

FLOODWAY FRINGE – The portion of the flood plain between the floodway and the normal outline of the selected flood.

FLOWAGE EASEMENT – The acquired legal right to flood land owned by others.

FLOW BRECCIA – Rock consisting of consolidated angular rock fragments larger than sand grains, formed in connection with a lava flow.

FORB – A pasture herb.

FRIABLE – Easily crumbled or pulverized.

GABIONS – Wire containers filled with stones and used to construct stabilizing structures.

GNEISS – A thickly banded (foliated) metamorphic rock of no specific composition.

GRADIENT – The steepness of a slope expressed either as a proportion between its vertical interval and its horizontal equivalent, e.g. 1V to 2H, or as an angular measurement from the horizontal.

HABITAT – The place where an organism lives or the place occupied by an entire community.

HERBACEOUS – Any plant that lacks woody tissue on which the leaves and stem fall to ground during periods of freezing or dry weather.

IGNEOUS ROCKS – Rocks formed by the solidification of hot flowing rock material (magma).

INCISED – Intrenched.

INTAKE STRUCTURE – The works or building at the head of a pipe, culvert or conduit into which water passes when the reservoir is drained.

INTERMITTENT STREAM – Stream that is dry for considerable time each year.

INTERMONTANE – Between the mountains; in Arizona this area is desert.

INTRENCHED – To have steep symmetrical sides owing to dominant vertical erosion.

INVERT – The floor, bottom, or lowest portion of the internal cross-section of a conduit or channel.

KNAPPABLE – Referring to a kind of stone that can be worked into a tool by percussion (striking) methods.

LAGTIME – The time that elapses between an event and the appearance of effects of that event.

LENTICULAR – Applied to a mass of rock or earth that thins out in all directions from the center like a double convex lens.

LEVEE – An embankment along a river or arm of the sea built to prevent overflow.

LEGUMINOUS – Referring to a plant belonging to the pea family.

LITHIC – Of or pertaining to stone especially as a material for building or implements.

MANO – The upper stone of a pair used together to grind grain (see metate).

MAXIMUM PROBABLE FLOOD – Represents a flood discharge that may be expected from the most severe combinations of critical meteorologic and hydrologic conditions that are reasonably possible in the area.

METAIGNEOUS – Refers to igneous rocks that have been subjected to metamorphic processes.

METAMORPHIC ROCK – Formed from igneous or sedimentary rock through alterations produced by pressure, heat or infiltration of other materials at depths below the surface zones.

METASEDIMENTS – Sedimentary rocks that have been subjected to metamorphic processes.

METATE – The lower bowl-like stone of a pair used together to grind grain. (See mano.)

MITIGATION – A moderation of the severity of the effects of a proposed action.

NICHE – Place in the environment suitable for supporting animals.

100 YEAR FLOOD – That flood discharge which has a one percent chance of being equalled or exceeded in a given year.

OUTLET WORKS – Downstream opening or discharge end of a pipe, culvert or channel; or opening near the bottom of a dam to drain the reservoir.

PATINA – A film formed on a material due to weather or long exposure.

PETROGLYPH – A drawing or carving on a rock by prehistoric or primitive people.

PEIDMONT – Lying or formed at the foot of a mountain.

PHYSIOGRAPHIC PROVINCE – A large area or region, the parts of which are characterized by similar features or history differing significantly from those of adjacent areas.

POT SHERD – Fragment of earthen ware from a prehistoric or past culture.

PROJECT AREA – Area in which a project is to be constructed.

RAPTOR – A bird of prey (hawk, owl)

RESERVOIR – A pond, lake, tank, basin or other space, natural or created, which is used for storage, regulation and control of water.

RETICULATE – See braided drainage system.

REVETMENT – A facing of masonry or the like placed on an embankment as protection against erosion.

RHYOLITE – A type of volcanic rock.

RIGHT-OF-WAY – A right of passage over another's land.

RIPARIAN – Living or located along a natural water course (stream or river) or lake.

SCHIST – A crystalline metamorphic rock having closely spaced bands (layers) and a tendency to split readily into thin flakes or slabs.

SHERD – Any fragment or broken piece of pottery. (See pot sherd.)

SPILLWAY – A passageway over which excess water escapes from a reservoir.

SPILLWAY CREST – Highest point of a spillway, or the maximum elevation of water to be stored in the reservoir.

SOFT BOTTOM CHANNEL – A channel in which the bottom remains unlined; such a channel allows ground water recharge.

SPF – Standard project flood. The flood that may be expected from the most severe combination of meteorologic and hydrologic conditions that are considered reasonably characteristic of the region.

STILLING BASIN – A structure or excavation that reduces velocity or turbulence of flowing or falling water.

STORAGE DAM – A fixed dam used to impound water, usually for long periods of time.

STUDY AREA – The area impacted by a project feature.

SUBSTRATE – The layer upon which organisms grow, often used synonymously with surface of ground.

TACONITE – Bonded rock with high iron content.

TALUS – An accumulated heap of rock fragments derived from and lying at the base of a cliff or very steep slope.

TUFFACEOUS – Pertaining to or resembling tuff, a hardened mass of rock, predominantly consisting of fine grained volcanic ash and dust.

VESICULAR – A textural term indicating the presence of many small cavities in a rock.

WEIR – A structure with a crest and some side containment of known geometric shape, used to measure the flow of water.

XERIC – Characteristic of a scanty water supply.

GLOSSARY OF ABBREVIATIONS

PHOTOGRAPHS

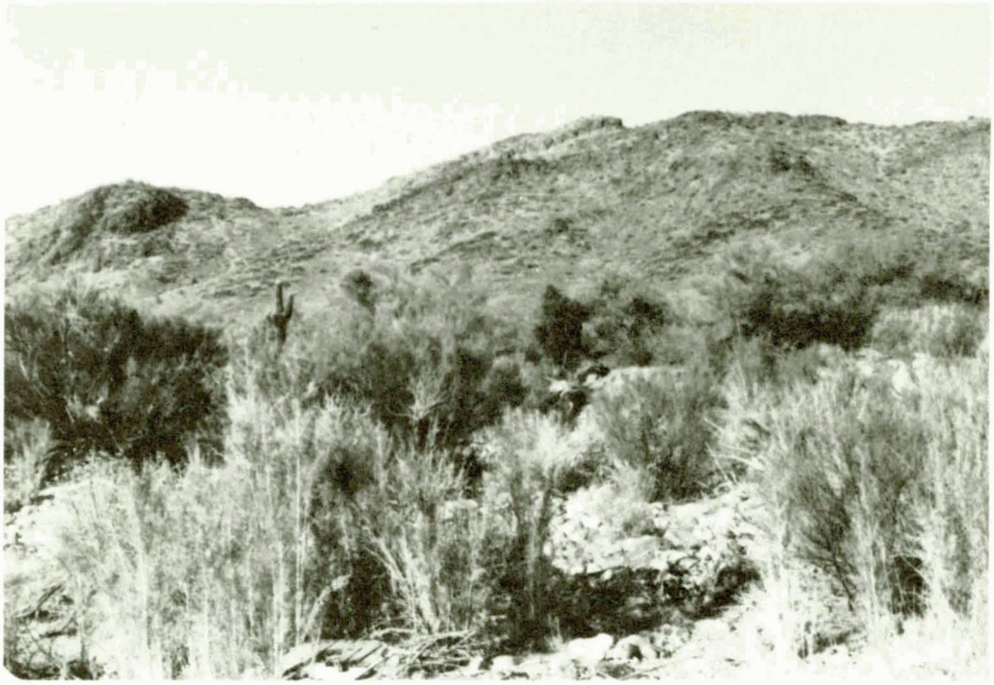


PHOTO 1. In the New River area, a desert wash or riparian plant community of ironwood, mesquite, blue paloverde, desert willow, catclaw acacia, desert broom, burrobrush, and saguaro cactus.

PHOTO 2. In the New River area, an outwash plain or <u>bajada</u> plant community of creosotebush and grasses with a scattering of bursages, cholla cactus and saguaro cactus.

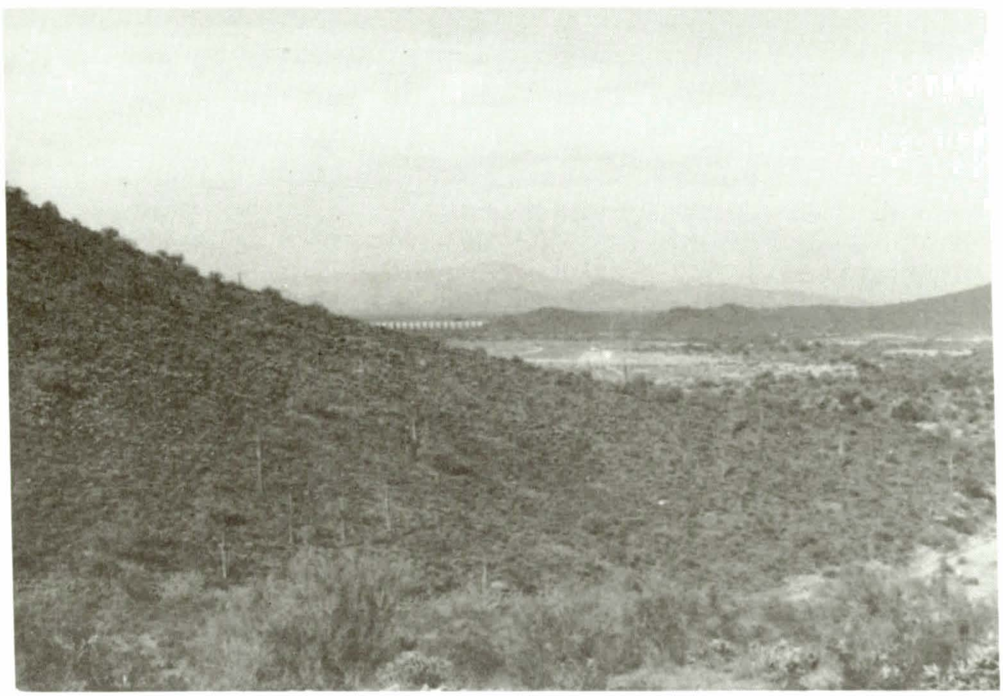


PHOTO 3. A Desert Upland vegetation community of yellow paloverde, brittlebush, creosotebush, cholla, barrel and saguaro cactus and various grasses covers the steep hills in the vicinity of the existing Cave Creek Dam and proposed Cave Buttes Dam site.

PHOTO 4. A "greening" of the natural desert landscape provides many urban dwellers with a facsimile of former Eastern and Midwestern environments.

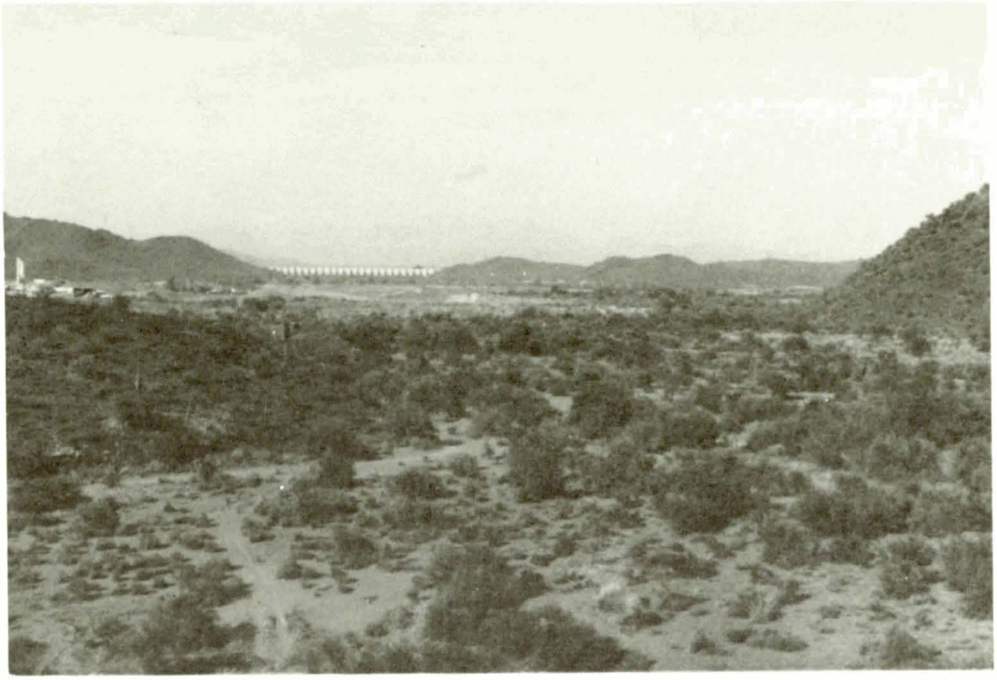


PHOTO 5. Riparian growth along Cave Creek downstream from the dam. Most natural growth along the creek between the existing dam and the proposed lower dam site has been removed by the sand and gravel mining operations on the left.

PHOTO 6. Looking northeast of Cave Creek Dam. Dense riparian growth of mesquite, ironwood, blue paloverde and catclaw acacia. Houses on the left will be in the reservoir area.

PHOTO 7. Large gravel mining operation downstream from the proposed Cave Buttes Dam. An extensive area of riparian vegetation and some outwash plain growth was removed prior to excavation.

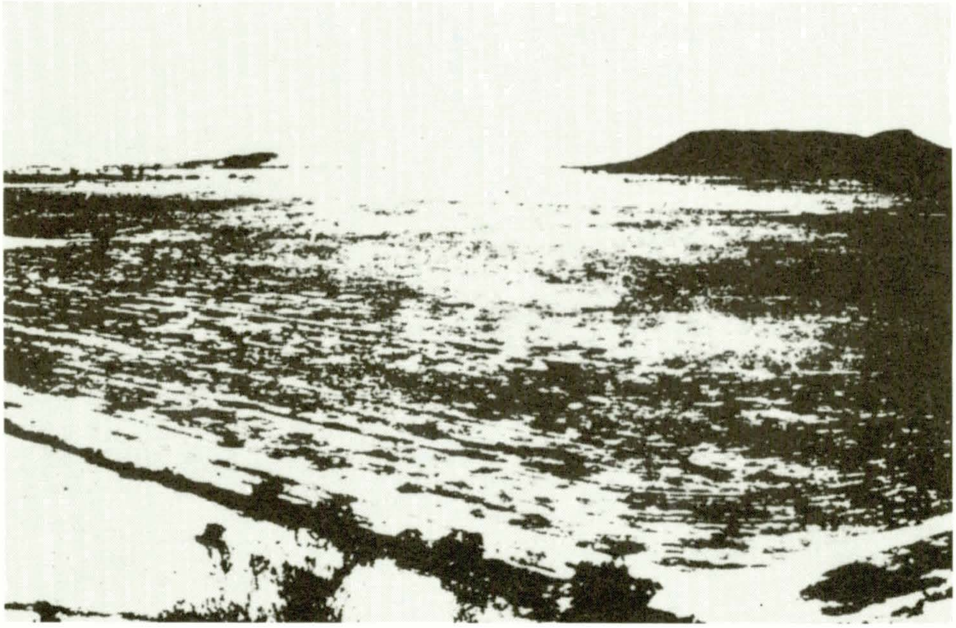


PHOTO 8. The recommended Adobe Dam site, from the east abutment looking southwest along the proposed embankment. Stream flow is from right to left.

PHOTO 9. Looking west from the east abutment into the reservoir area at the recommended Adobe Dam site. Stream flow is from right to left. The houses in the background are outside the standard project flood pool.

PHOTO 10. Petroglyphs found within the study area.

PHOTO 11. Petroglyphs found within the study area.

PHOTO 12. Petroglyphs found within the study area. Note bullet holes.

PHOTO 13. The recommended New River Dam site, looking southeast from the west abutment. Stream flow is from left to right.

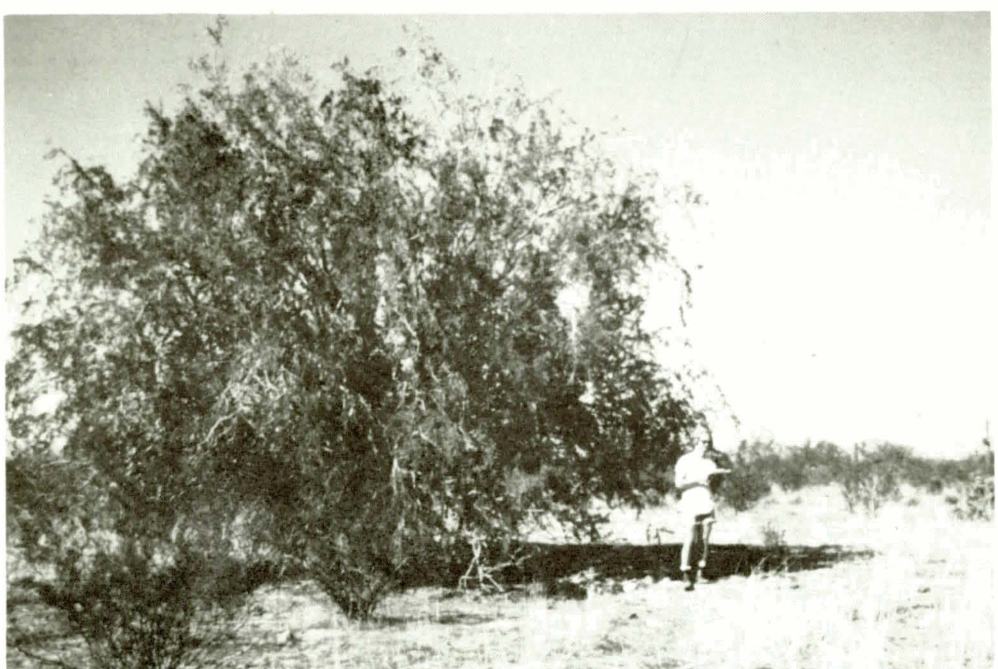


PHOTO 14. A large ironwood (Olneva tesota) about twenty-five feet tall in the vicinity of the proposed New River Dam site.

TO 15. Riparian vegetation behind New River Dam.

PHOTO 16. The Arizona Canal looking east from Nineteenth to Twenty-fourth Street.

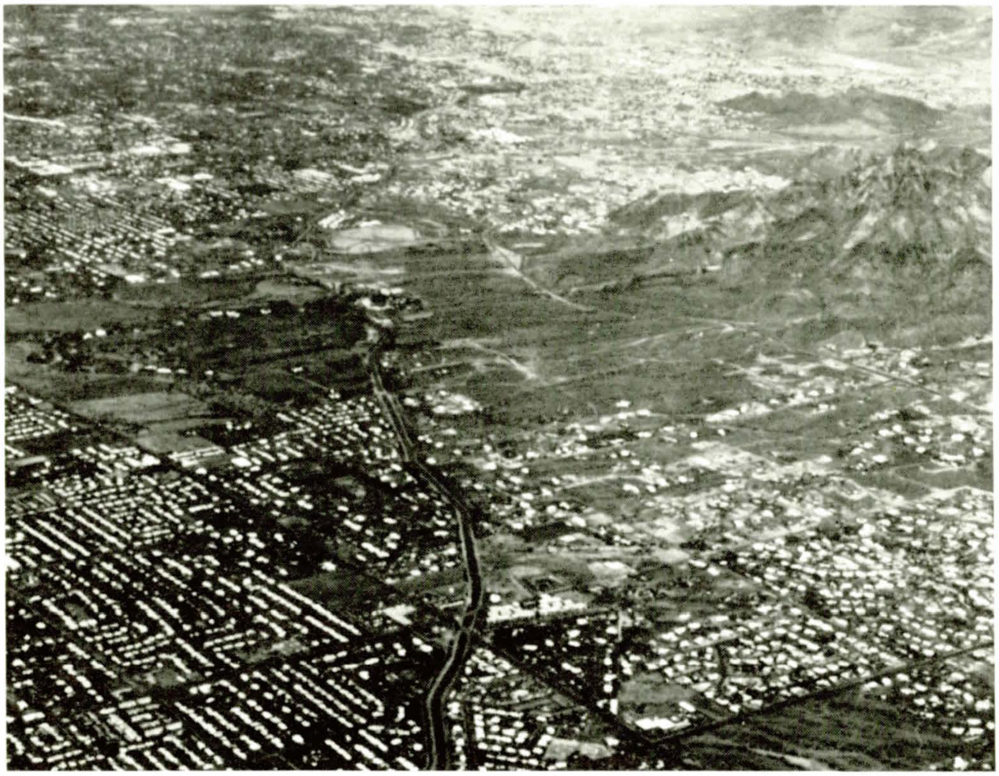


PHOTO 17. The Arizona Canal looking west from Fortieth Street. The Arizona Biltmore Hotel and the water treatment plant are in the center of the photo with the Phoenix Mountains on the right.

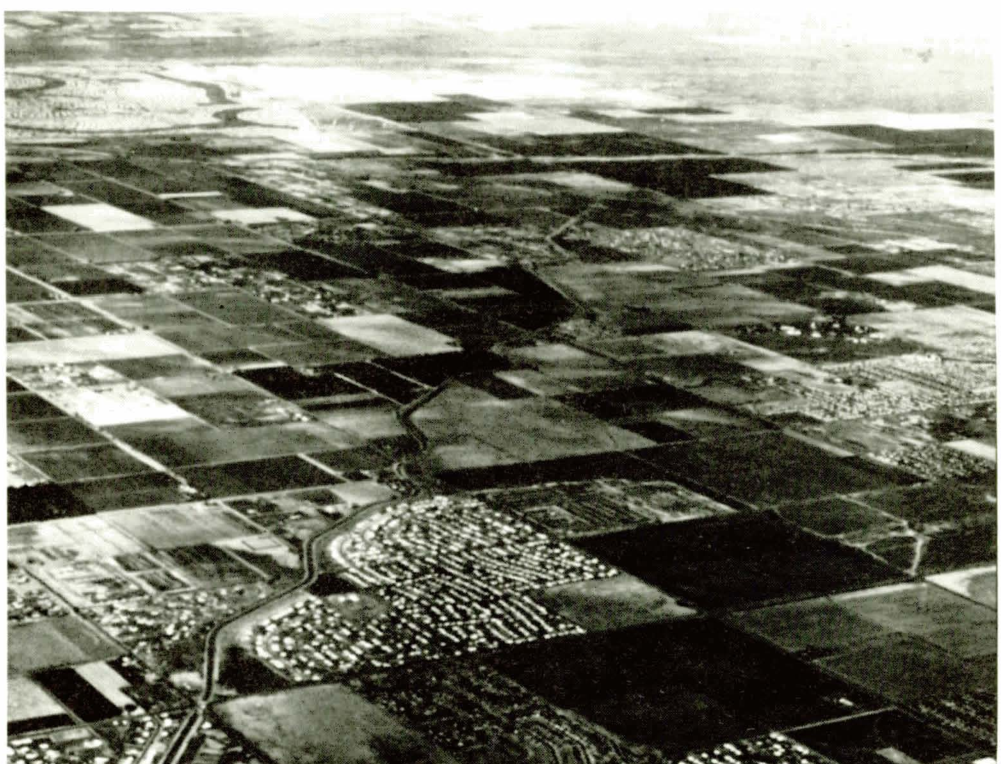


PHOTO 18. The Arizona Canal looking west from Forty-third Avenue to Skunk Creek.

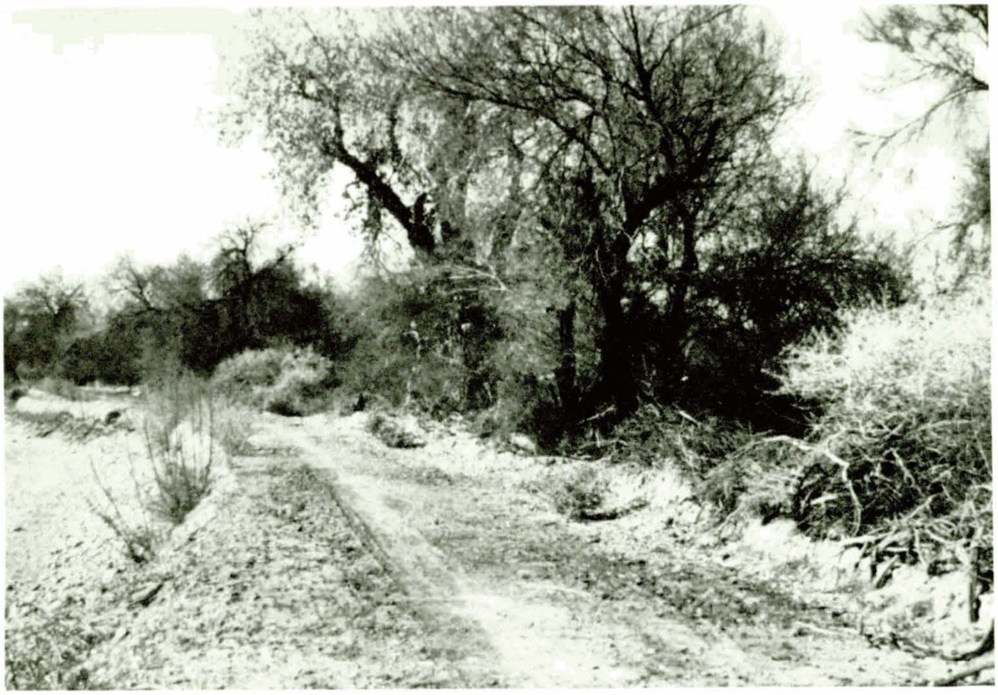


PHOTO 19. A narrow strip of cottonwood, blue paloverde and mesquite riparian vegetation along the Arizona Canal near Thirty-second Street.

PHOTO 20. A section of Herberger Park No. 1 along the Arizona Canal that will be removed.

TABLES

TABLES

TABLE 1

"ECONOMIC DATA, EXTRACTED FROM U.S. ARMY CORPS OF ENGINEERS GENERAL DESIGN MEMORANDUM, GILA RIVER BASIN, NEW RIVER AND PHOENIX CITY STREAMS, MARCH 1976. COMPLETE DOCUMENT IS AVAILABLE AT U.S. ARMY ENGINEER DISTRICT, LOS ANGELES."

Summary of Economic Data for Alternative Plans
(3-1/4 percent – 100 years)

	Alternatives 1	2	3	4	5a	5b
First Cost*						
Flood Control	$ 671	$257,000	$52,700	$289,000	$218,000	$210,000
Recreation	0	10,030	16,000	5,900	10,300	23,400
Total	$ 671	$267,030	$68,700	$294,900	$228,300	$233,400
Average Annual Charges*						
Flood Control	28	7,653	1,883	8,395	6.474	6,216
Recreation	0	410	726	202	331	1,086
Total	$ 28	$ 8,063	$ 2,609	$ 8,597	$ 6,805	$ 7,302
Equivalent Annual Benefits*						
Flood Control**	135	13,442	4,953	12,968	13,380	13,380
Recreation	0	1,022	1,180	531	927	1,746
Total	$ 135	$ 14,464	$ 6,133	$ 13,499	$ 14,307	$ 15,126
Equivalent Annual Net Benefits*						
Flood Control	107	5,789	3,070	4,573	6,906	7,164
Recreation	0	612	454	329	596	660
Total	$ 107	$ 6,401	$ 3,524	$ 4,902	$ 7,502	$ 7,824
Equivalent Annual Nonprevented damages (Flood Control)	$17,853	$ 4,948	$13,108	$ 5,344	$ 4,948	$ 4,948
Benefit to Cost Ratio						
Flood Control	4.8	1.8	2.6	1.5	2.1	2.2
Recreation	--	2.5	1.6	2.6	2.8	1.6
Flood control and recreation	4.8	1.8	2.4	1.6	2.1	2.1

*In thousands of dollars.

**Includes flood damages prevented and savings in cost of fill.

TABLE 2

DEPTH TO WATER IN WELLS PRINCIPALLY IN
ALLUVIAL DEPOSITS, IN FEET BELOW LAND SURFACE

New River Study Area	200' to 300'
Adobe Dam Study Area	200' to 500'
Cave Buttes Dam Study Area	300' to 400'
Along Cave Creek	33' to 239'
Along New River Channel Study Area	100' to 200'
Along Agua Fria Channel Study Area	100' to 200'
Along Salt River Channel Study Area	0' to 100'
Along Arizona Canal Channel Study Area	300' to 400'

Map showing Depth to Water in Wells in the Phoenix Area, Arizona, 1972, by W. R. Osterkamp, 1973.
Base from U.S. Geological Survey, Phoenix and Mesa 1954-69, Ajo 1953-69, Tucson 1956-62.

TABLE 3

WATER QUALITY INVENTORY
LAKE PLEASANT

Chemical	Average Concentration* January 1, 1972 to December 31, 1972	January 1, 1971 to December 31, 1971
Alkalinity – P.	0	0
– M.O.	120	160
Carbon Dioxide	8	100
Chloride	30	25
Chromate	0.02	0
Copper	0.40	.08
Dissolved Oxygen	8	7
Hardness – Total	150	NT
– Calcium	90	150
– Magnesium	60	125
Iron	0.1	25
Manganese	NT	0
Nitrogen – Total	0.53	0
– Ammonia	0	NT
– Nitrate	0.529	NT
– Nitrite	0.011	.06
pH		0
Phosphate – Total	0.25	8.50
– Ortho	0.22	.25
– Meta	0.03	.25
Silica	12	0
Sulfate	49	9.0
Zinc	0.05	47
Physical Data		
Color (P.C.C.U.)	40	20
Discharge (cfs)	NT	NT
Temperature (ºF)	58	72
Total Dissolved Solids (p.p.m.)	270	259
Turbidity (J.T.U.)	NT	5

* – Recorded in parts per million (mg/1)

NT – No Test Conducted

Source: Water Quality Report, Proposed Recreational and Fisheries, Lakes, John Corollo Engineers, Sept 1974

TABLE 4

TYPES OF EMISSION SOURCES FOUND IN THE AIR QUALITY CONTROL REGIONS OF ARIZONA

Air-quality-control region	Regional Classification*					Basis for Classification**				
	Particulate	Sulfur oxides	Carbon monoxide	Nitrogen dioxide	Oxidants and hydrocarbons	Particulate	Sulfur oxides	Carbon monoxide	Nitrogen dioxide	Oxidants and hydrocarbons
Phoenix-Tucson ..... (example region)	I	I	I	I	I	A	A	A	A	A
Southern Borders ... (New Mexico)	IA	IA	III	III	III	A	A	C	C	C
Four Corners .... (Utah, Colorado, New Mexico)	IA	IA	III	IA	III	A	B	C	B	C
Clark-Mohave-Yuma .. (Nevada)	I	IA	I	I	I	A,C	A,C	C	A,C	C

*Code I designates priority I regions; code IA, priority IA regions; code II, priority II regions; and code III, priority III regions.
**Code A designates measured air-quality data; code B, point source model; and code C, urban population.

TABLE 5

COMPARISON OF AMBIENT AIR QUALITY STANDARDS OF THE STATE OF ARIZONA WITH NATIONAL STANDARDS

Pollutant	Condition	Arizona standard	Federal primary standard	Federal secondary standard
Sulfur oxides (sulfur dioxide)	3-Hr. avg	1300	--	1300
	24-Hr. avg	260	365	260
	Annual avg	50	80	60
Suspended particulates	24-Hr. avg (max.)	100	260	150
	Annual geometric mean	60	75	60
Photochemical oxidants	1-Hr. avg	80	160	160
	Peak value	150	--	--
Hydrocarbons	3-Hr. avg (annual max. 6 to 9 a.m.)	--	160	160
Nonmethane	Peak value	80	--	--
Nitrogen dioxide	Annual avg	100	100	100

TABLE 6

SUMMARY OF THE PHOENIX AIR QUALITY MAINTENANCE AREA

CONCENTRATIONS OF CARBON MONOXIDE*

Standard Metropolitan Statistical Area	Year	1-Hour Average		8-Hour Average		Annual Average
		Maximum	Second Highest	Maximum	Second Highest	
Phoenix	1970	63.0	56.1	40.8	40.1	---
	1971	45.8	43.5	31.1	29.4	---
	1972	51.5	48.1	42.5	40.4	---
	1973	40.1	38.9	27.8	25.6	---

CONCENTRATIONS OF PHOTOCHEMICAL OXIDANTS

Phoenix	1970	216	216	---	---	---
	1971	255	236	---	---	---
	1972	236	236	---	---	---
	1973	373	314	---	---	---

CONCENTRATIONS OF NITROGEN DIOXIDE

Phoenix	1972	---	---	---	---	80.5
	1973	---	---	---	---	70.1

*Federal standards for carbon monoxide concentrations are as follows: 1-hour average, 40 mg/m3, 8-hour average, 10 mg/m3.

TABLE 7

PROJECTED SULFUR DIOXIDE CONCENTRATIONS

INITIAL CRITERIA

STANDARD: ANNUAL (80 ug/m3)

Standard metropolitan statistical area	Year	Maximum concentration ug/m3	Second highest concentration ug/m3	Growth factor	Projected 1985 concentration
Phoenix	1970	13.5	---	2.218	30.0
	1971	11.8	---	2.081	24.7
	1972	9.0	---	1.961	17.6
	1973	8.9	---	1.853	16.4

STANDARD: 24-HOUR AVERAGE (365 ug/m3)

Phoenix	1970	31.8	31.8	2.218	69.0
	1971	28.4	28.4	2.081	59.0
	1972	172.0	172.0	1.961	337.0
	1973	78.4	77.7	1.853	144.0

STANDARD: 3-HOUR AVERAGE (1300 ug/m3)

Phoenix	1970	53.3	53.3	2.218	118.0
	1971	157.0	140.0	2.081	291.0
	1972	577.0	564.0	1.961	1,106.0
	1973	136.0	136.0	1.853	252.0

Source: Designation of Air Quality Maintenance Areas for the State of Arizona, April 1974.

TABLE 8

PERTINENT DATA ON CARBON MONOXIDE AND HYDROCARBON EMISSION PROJECTIONS

PHOENIX SMSA

Source Class	(A) 1975 Emissions* tons/day	(B) Growth rate (1985/1975)*	(C) Emission factor adjustment**	A(1 + BC) 1985 Emissions tons/day
Fuel combustion				
Power plants	0.1	----	----	----
Other point sources	0	----	----	----
Area sources	0	----	----	----
Subtotal	0.1	***0.670	1.00	0.2
Industrial process				
Point sources	----	----	----	----
Subtotal	5.6	†0.727	0.40	7.2
Solid-waste disposal				
Point sources	0	----	----	----
Area sources	0	----	----	----
Subtotal	0	----	----	0
Transportation				
LDV	299.3	----	----	78.2
HDV	49.4	----	----	92.7
Subtotal	348.7	----	----	††170.9
Miscellaneous				
Point sources	0	----	----	----
Area sources (motorcycles and aircraft)	31.0	----	----	----
Subtotal	31.0	----	----	----

See footnotes on second page following.

TABLE 8 Continued

HYDROCARBON

Source class	(A) 1975 Emissions* tons/day	(B) Growth rate (1985/1975)*	(C) Emission factor Adjustment**	A(1 + BC) 1985 Emissions tons/day
Fuel combustion				
Power plants	8.3	----	----	----
Other point sources	0	----	----	----
Area sources	0	----	----	----
Subtotal	8.3	***0.670	1.00	13.9
Industrial process†††				
Point sources	----	----	----	----
Subtotal	34.8	†0.727	0.40	44.9
Solid-waste disposal				
Point sources	0	----	----	----
Area sources	0	----	----	----
Subtotal	0	----	----	0
Transportation				
LDV	38.6	----	----	10.5
HDV	6.2	----	----	10.3
Subtotal	44.8	----	----	††20.8
Miscellaneous				
Point sources	0	----	----	----
Area sources (motorcycles and aircraft)	13.5	----	----	----
Subtotal	13.5	*0.670	1.00	22.5
Total	101.4	----	----	102.1

See footnotes on following page.

TABLE 8 Continued

* <u>State of Arizona Transportation Control Strategies</u>, September 1973 (Rev. 1), p. 31.

** In accordance with page IV-10 AQMA document.

*** Based on percent increase in total earnings, page IV-9 AQMA document.

† Based on percent increase in manufacturing earnings, page IV-9 AQMA document.

†† In accordance with Equation (1), Q1985 = Q1975 GE, page IV-9 of the AQMA document. Growth was 6.8 percent per annum, i.e., G = (1 + .068)10 = 1.935 for 1975 - 1985. Emission factor ratios, E, were in accordance with Table V-1 and were normalized for 1975, i.e., 0.135 for LDV and 0.97 for HDV.

††† Tank farms, filling stations, and other processes.

Source: <u>Designation of Air Quality Maintenance Areas for the State of Arizona</u>, April 1974.

TABLE 9

ESTIMATED ACREAGE OF NATIVE VEGETATION

IN THE PROPOSED PROJECT AREAS

	Natural Desert Wash Community	Natural Desert Outwash and Upland Community	Highly Disturbed Vegetation	Total
Recommended Dam Sites				
Cave Buttes (Upper site)	250	1,650	250	2,150
Adobe Dam (Site 4)	80	300	1,600	1,980
New River Dam (Upper site)	350	1,665	25	2,040
Alternative Dam Sites				
Cave Buttes Dam Alt. (Lower site)	170	620	300	1,090
Adobe Dam Alt. Site 1	70	1,385	80	1,535
Site 2	40	1,200	225	1,465
Site 3	10	175	170	355
New River Dam Alt.	110	1,500	100	1,710
Channel Alternatives				
Cave Creek Channel	5	0	8	13
Skunk Creek Channel	20	0	90	110
Arizona Canal Diversion Channel	0	0	40	40
New River Channel	10	0	600	610
Agua Fria Channel	10	0	1,000	1,010

* Totals include vegetation within proposed project right-of-way

** This category includes disturbed desert wash, outwash and upland communities as well as a community consisting mostly of primary successional species (i.e. old field).

TABLE 10

PRINCIPAL FLORA FOR PHOENIX AND VICINITY

Species	Abundance*	Wildlife Habitat	Cultural, Esthetic and/or Scientific Value
TREES			
Desert hackberry Celtis pallida	Uncommon	Food source	Yes
Blue paloverde Cercidium floridum	Common	Nesting site food value for rodents	Yes
Little leaf paloverde Cercidium microphyllum	Common	Nesting sites, food for rodents	Yes
Desert willow Chilopsis linearis	Locally common	Cover	Yes
Ironwood Olneya tesota	Common	Excellent food and cover	Yes
Cottonwood Populus fremontii	Uncommon	Shade tree; raptor resting and nesting tree	Yes

TABLE 10 Continued

Species	Abundance*	Wildlife Habitat	Cultural, Esthetic and/or Scientific Value
Honey mesquite <u>Prosopis juliflora</u>	Abundant	Excellent wildlife food source; important honey yielding plant; nesting sites	Yes
Athel tamarisk <u>Tamarix aphylla</u>	Fairly common (planted)	Nesting for birds; raptor perching value	Yes
HERBACEOUS PLANTS AND GRASSES			
Mustards <u>Brassica sp.</u>	Common	Food	Yes
Coyote melon <u>Cucurbita foetidissima</u>	Fairly common	Food	Yes
Sunflower <u>Helianthus sp.</u>	Fairly common (disturbed areas)	Food	Yes

TABLE 10 Continued

Species	Abundance*	Wildlife Habitat	Cultural Esthetic and/or Scientific Value
Bladderpod *Lesquerella gordoni*	Locally common	Some food value	Yes
Indianwheat *Plantago insularis*	Locally common	Forage	Yes
Dock *Rumex hymenosepalus*	Locally common	Food	Yes
Cocklebur *Xanthium spinosum*	Common (disturbed areas)	Limited food and cover value	No (kills livestock; nuisance weed)
Grasses	Abundant	Good food and cover	Yes
CACTUS			
Sahuaro *Carnegiea gigantea*	Locally common	Excellent food source and nesting site	Yes
Hedgehog cactus *Echinocereus engelmannii*	Fairly common	Fruit excellent wildlife food	Yes
Barrel cactus *Ferocactus sp.*	Fairly commmon	Fruit good food source for deer and rodents	Yes
Fishhook cactus *Mammillaria microsperma*	Fairly common	Food source	Yes

TABLE 10 Continued

Species	Abundance*	Wildlife Habitat	Cultural Esthetic and/or Scientific Value
Cholla _Opuntia spp._	Common	Limited cover and food	Yes
SHRUBS			
Catclaw acacia _Acacia greggii_	Common	Excellent food, cover and nesting site	Yes
Four-winged saltbush _Atriplex canescens_	Common	Excellent food and cover	Yes
Desert broom _Baccharis sarothroides_	Locally common (desert washes)	Cover	Yes
Gray thorn _Condalia lycioides_	Rare	Food	Yes
Sacred datura _Datura meteloides_	Fairly common	Limited food value for some rodents	Yes
Creosotebush _Larrea divaricata_	Abundant	Minor cover use	Yes
Desert thorn _Lycium spp._	Fairly common	Seasonal source of food and roosting	Yes
Tree tobacco _Nicotiana trigonophylla_	Locally common	Very limited value	Yes (culture value: smoked by Indians)

TABLE 10 Continued

Species	Abundance*	Wildlife Habitat	Cultural, Esthetic and/or Scientific Value
Brittlebush *Encelia farinosa*	Fairly common	Browse value	Yes
Mormon tea *Ephedra trifurca*	Uncommon to locally common	Cover	Yes
Wash bursage *Franseria ambrosioides*	Common	Forage	Yes
Triangle bursage *Franseria deltoidea*	Fairly common	Good forage	Yes
White bursage *Franseria dumosa*	Common	Good forage	Yes
Ocotillo *Fouquieria splendens*	Uncommon	Limited resting site	Yes
Burrobrush *Hymenoclea pentalepis*	Locally common	Good ground cover; limited forage value	Yes
Cheeseweed *Hymenoclea monogyra*	Locally common	Good ground cover; limited forage value	Yes
Desert lavender *Hyptis emoryi*	Fairly common	Food	Yes

TABLE 10 Continued

Species	Abundance*	Wildlife Habitat	Cultural, Esthetic and/or Scientific Value
Russian thistle Salsola kali	Locally common	Limited temporary ground cover and food value	Negative esthetic value; nuisance weed
Goatnut (Jojoba) Simmondsia chinensis	Common	Excellent browse	Yes
Salt cedar Tamarix pentandra	Locally common (drainageways)	Cover; good dove nesting shrub	Yes

TABLE 10 Continued

* Abundance Criteria Similar to That Used in the Birds of Arizona (ref.)

Abundant - seen in numbers
Common - always seen but not in large numbers
Locally common - present in numbers in isolated areas
Fairly common - seen in small numbers or not always seen
Uncommon - infrequently seen, but not surprising
Rare - always a surprise when seen but within normal range

TABLE 11

FAUNA FOR PHOENIX AND VICINITY

MAMMALS

Species	Habitat and/or Seasonal Status	Range in Region or State	Abundance in Region	Range in U.S.	Project Impact
California myotis <u>Myotis californicus</u>	Crevice dweller	Throughout region and state	Fairly common	Western North America	None
Western pipistrel <u>Pipistrellus hesperus</u>	Arid conditions near water	Throughout region and state	Common	Western North America	None
Blacktail jackrabbit <u>Lepus californicus</u>	Open prairies and sparsely vegetated deserts	Throughout region and state	Abundant-fairly common	Western and Central U.S.	Minimal
Desert cottontail <u>Sylvilagus audoboni</u>	Plains, grass-lands, and sagebrush communities	Throughout region and state	Common	S.W. and North Central U.S.	Moderate
Rock squirrel <u>Citellus variegatus</u>	Rocky canyons and slopes	Throughout region and state	Common	S.W. U.S.	Minimal

TABLE 11 Continued

Species	Habitat and/or Seasonal Status	Range in Region or State	Abundance in Region	Range in U.S.	Project Impact
Roundtail ground squirrel *Citellus tereticaudus*	Low deserts	Throughout region	Fairly common	S.W. U.S.	Minimal
Yuma antelope squirrel *Citellus harrisi*	Low arid desert	Throughout region	Fairly common	Arizona	Minimal
Valley pocket gopher *Thomomys bottae*	Valleys and mountain meadows	Throughout region and state	Fairly common	S.W. U.S.	Minimal
Arizona pocket mouse *Perognathus amplus*	Arid desert and scattered vegetation	Throughout region	Fairly common	Arizona	Minimal
Rock pocket mouse *Perognathus intermedius*	Rocky slopes	Throughout region	Common	S.W. U.S.	Minimal
Merriam kangaroo rat *Dipodomys merriami*	Low deserts with scattered vegetation	Throughout region	Common	S.W. U.S.	Minimal
Southern grasshopper mouse *Onychomys torridus*	Open grasslands and sagebrush	Throughout region	Common	S.W. U.S.	Minimal

TABLE 11 Continued

Species	Habitat and/or Seasonal Status	Range in Region or State	Abundance in Region	Range in U.S.	Project Impact
Western harvest mouse *Reithrodontomys megalotis*	Grasslands and open desert	Usually near water	Fairly common	Western and Central U.S.	Minimal
Cactus mouse *Peromyscus eremicus*	Low deserts	Throughout region	Common	S.W. U.S.	Minimal
Deer mouse *Peromyscus maniculatus*	Almost all dry-land habitat	Throughout region and state	Common	All U.S. except S.E. states	Minimal
Whitethroat woodrat *Neotoma albigula*	Brushland and rocky cliffs	Throughout region	Common	S.W. U.S.	Minimal
Mule deer *Odocoileus hemionus*	Chaparral, grassland and desert	Throughout region and state	Uncommon	Western North America	Minimal
Coyote *Canis latrans*	Prairies, deserts, and open woodlands	Throughout region and state	Uncommon	U.S.	Minimal
Gray fox *Urocyon cinereoargenteus*	Chaparral and open forests	Throughout region and state	Uncommon	S.W. and Eastern America	Minimal

TABLE 11 Continued

Species	Habitat and/or Seasonal Status	Range in Region or State	Abundance in Region	Range in U.S.	Project Impact
Bobcat *Lynx rufus*	Chaparral	Throughout region and state	Uncommon	Western, Southern, and North eastern U.S.	Minimal
Striped skunk *Mephitis mephitis*	Open country and brush-land	Usually near water	Common	U.S.	Minimal
Spotted skunk *Spilogale putorius*	Brushy areas and prairies	Throughout region and state	Fairly common	Western, Central and Southern U.S.	Minimal
Badger *Taxidea taxus*	Open grass-lands and desert	Throughout region and state	Uncommon	Western, and Central North America	Minimal
Ringtail *Bassariscus astutus*	Chaparral and rocky ridges and cliffs	Near water	Uncommon	S.W. North America	Minimal
Longtail weasel *Mustela frenata*	Almost all terrestrial habitats	Near water	Rare	U.S.	Moderate

TABLE 11 Continued

Species	Habitat and/or Seasonal Status	Range in Region or State	Abundance in Region	Range in U.S.	Project Impact
Javelina Pecari tajacu	Dry desert washes	Southeastern and Central part of state	Common	S.W. U.S.	Moderate
		BIRDS			
Gadwall Anas strepera	Migrant	Ponds	Fairly common	U.S.	Minimal
Cinnamon teal Anas cyanoptera	Migrant	Ponds and marshes	Fairly common	Western North America	Minimal
White-faced ibis Plegadis chihi	Casual visitor	Ponds and marshes	Uncommon	Central and S.W. North America	Minimal
Turkey vulture Cathartes aura	Permanent resident	Statewide	Common	U.S.	Minimal
Cooper's hawk Accipiter cooperii	Permanent resident	Statewide	Fairly common	U.S.	Minimal
Red-tailed hawk Buteo jamaicensis	Permanent resident	Statewide	Common	U.S.	Minimal

TABLE 11 Continued

Species	Habitat and/or Seasonal Status	Range in Region or State	Abundance in Region	Range in U.S.	Project Impact
Swainson's hawk *Buteo swainsoni*	Rare visitor	Fields and deserts	Rare	Western North America	Minimal
Prairie falcon *Falco mexicanus*	Migrant	Fields and deserts	Rare	Western North America	Minimal
Sparrow hawk *Falco sparverius*	Permanent resident	Statewide	Common	U.S.	Minimal
Gambel's quail *Lophortyx gambelii*	Permanent resident	Statewide	Abundant	S.W. U.S.	Moderate
White-winged dove *Zenaida asiatica*	Permanent resident	Generally distributed	Seasonally abundant	S.W. North America	Moderate
Mourning dove *Zenaidura macroura*	Permanent resident	Generally distributed	Abundant	U.S.	Moderate
Ground dove *Columbigallina passerina*	Permanent resident	Fields and hedgerows	Fairly common	Southern U.S.	Moderate
Inca dove *Scardefella inca*	Permanent resident	Urban, farm-yards, and fields	Abundant	S.W. North America	Moderate

TABLE 11 Continued

Species	Habitat and/or Seasonal Status	Range in Region or State	Abundance in Region	Range in U.S.	Project Impact
Roadrunner <u>Geococcyx californianus</u>	Permanent resident	Generally distributed	Common	S.W. North America	Moderate
Screech owl <u>Otus asio</u>	Permanent resident	Generally distributed	Common	U.S.	Moderate
Great horned owl <u>Bubo virginianus</u>	Permanent resident	Streamside and Sonoran Desert	Fairly common	U.S.	Moderate
Elf owl <u>Micrathene whitneyi</u>	Spring and summer resident	Sonoran and Transition Zone	Fairly common	S.W. North America	Moderate
Poor-will <u>Phalaenoptilus nuttallii</u>	Permanent resident	Sonoran Zones	Fairly common	Western North America	Moderate
Lesser nighthawk <u>Chordeiles acutipennis</u>	Summer resident	Generally distributed	Common	S.W. North America	Moderate
Black-chinned hummingbird <u>Archilochus alexandri</u>	Summer resident	Urban and streamside	Common	Western North America	Moderate

TABLE 11 Continued

Species	Habitat and/or Seasonal Status	Range in Region or State	Abundance in Region	Range in U.S.	Project Impact
Costa's hummingbird *Calypte costae*	Fall, winter and spring resident	Sonoran Zones	Common	S.W. U.S.	Moderate
Gilded flicker *Colaptes chrysoides*	Permanent resident	Streamside and lower Sonoran Desert	Fairly common	S.W. North America	Moderate
Gila wood-pecker *Centurus uropygialis*	Permanent resident	Generally distributed in southern part of state	Common	S.W. North America	Moderate
Ladder-backed woodpecker *Dendrocopos scalaris*	Permanent resident	Streamside and Sonoran Deserts	Fairly common	S.W. North America	Moderate
Western kingbird *Tyrannus verticalis*	Summer resident; spring and fall migrant	Generally distributed	Common	Western North America	Moderate
Ash-throated flycatcher *Myiarchus cinerascens*	Summer resident; winter visitor	Streamsides and Lower Sonoran Desert	Common in summer; uncommon in winter	Western North America	Moderate

TABLE 11 Continued

Species	Habitat and/or Seasonal Status	Range in Region or State	Abundance in Region	Range in U.S.	Project Impact
Wied's crested flycatcher *Myiarchus tyrannulus*	Summer resident	Streamsides and Lower Sonoran Desert	Common	S.W. North America	Moderate
Say's phoebe *Sayornis sayos*	Summer resident; winter visitor	Urban, streamside and Lower Sonoran Desert. Generally distributed in winter	Fairly common in summer: Otherwise common.	Western North America	Moderate
Common raven *Corvus corax*	Permanent resident	Upper Sonoran Zone	Fairly common in summer; common in winter	Western and Northern North America	Minimal
Verdin *Auriparus flaviceps*	Permanent resident	Generally distributed	Common	S.W. North America	Moderate
Bewick's wren *Thryomanes bewickii*	Permanent resident	Streamside and hedgerows	Fairly common in summer; Otherwise common	Southern and Central latitude states	Moderate

TABLE 11 Continued

Species	Habitat and/or Seasonal Status	Range in Region or State	Abundance in Region	Range in U.S.	Project Impact
Cactus wren *Campylorhynchus brunneicapillus*	Permanent resident	Generally distributed	Common	S.W. North America	Moderate
Mockingbird *Mimus polyglottos*	Permanent resident	Generally distributed	Abundant	Southern and Central North America	Minimal
Curve-billed thrasher *Toxostoma curvirostre*	Permanent resident	Generally distributed	Common	S.W. North America	Moderate
Black-tailed gnatcatcher *Polioptila melanura*	Permanent resident	Lower Sonoran Desert, streamside and salt-bush desert	Fairly common	S.W. North America	Moderate
Phainopepla *Phainopepla nitens*	Permanent resident	Streamside and Lower Sonoran Desert	Fairly common	S.W. North America	Moderate

TABLE 11 Continued

Species	Habitat and/or Seasonal Status	Range in Region or State	Abundance in Region	Range in U.S.	Project Impact
Loggerhead shrike *Lanius ludovicianus*	Permanent resident	Generally distributed	Common in winter; Fairly common in summer	U.S.	Moderate
Starling *Sturnus vulgaris*	Permanent resident	Generally distributed	Abundant	U.S.	None
Lucy's warbler *Vermivora luciae*	Migrant resident in summer	Streamside	Common in summer	S.W. North America	Moderate
Western meadowlark *Sturnella neglecta*	Summer resident; winter visitor	Fields	Common in summer fairly common in winter	Western North America	Minimal
Yellow-headed blackbird *Xanthocephalus xanthocephalus*	Migrant	Marshes, fields and streamsides	Abundant in winter; uncommon in summer	Western North America	Minimal
Red-winged blackbird *Agelaius phoeniceus*	Summer resident; winter visitor	Urban, marshes, streams and fields	Common in summer; abundant in winter	U.S.	Minimal

TABLE 11 Continued

Species	Habitat and/or Seasonal Status	Range in Region or State	Abundance in Region	Range in U.S.	Project Impact
Brewer's blackbird *Euphagus cyanocephalus*	Migrant	Farms, fields, streamsides, and urban	Abundant	Western and Central U.S.	Minimal
Bullock's oriole *Icterus bullockii*	Summer resident; winter visitor	Streamside	Fairly common	Western North America	Moderate
Cardinal *Richmondena cardinalis*	Permanent resident	Generally distributed	Common	Eastern and S.W. U.S.	Moderate
Pyrrhuloxia *Pyrrhuloxia sinuata*	Permanent resident	Hedgerows	Fairly common	S.W. North America	Moderate
House finch *Carpodacus mexicanus*	Permanent resident	Generally distributed	Abundant	Western North America and New York	Minimal
Brown towhee *Pipilo fuscus*	Permanent resident	Upper and Lower Sonoran Deserts	Common	S.W. North America	Moderate

TABLE 11 Continued

Species	Habitat and/or Seasonal Status	Range in Region or State	Abundance in Region	Range in U.S.	Project Impact
Black-throated sparrow <u>Amphispiza bilineata</u>	Summer resident; winter visitor	Sonoran Zones	Fairly common in summer; otherwise common	S.W. North America	Minimal
White-crowned sparrow <u>Zonotrichia leucophrys</u>	Migrant	Generally distributed	Abundant in winter	All North America	Moderate
AMPHIBIANS AND REPTILES					
Couch's spadefoot toad <u>Scaphiopus couchi</u>	Creosote bush scrub, short grass, plains and mesquite savannah	Dry, sandy regions	Abundant	S.W. U.S.	Minimal
Western spadefoot toad <u>Scaphiopus hammondi</u>	Open lowlands and foothills in floodplains and washes	Sandy, gravelly soil with open vegetation	Common	S.W. U.S.	Minimal
Great Plains toad <u>Bufo cognatus</u>	Grasslands and creosote bush desert	Near pools or slow moving water	Fairly common	Central North America	Moderate

TABLE 11 Continued

Species	Habitat and/or Seasonal Status	Range in Region or State	Abundance in Region	Range in U.S.	Project Impact
Red-spotted toad *Bufo punctatus*	Desert rocklands and canyons	Near pools or slow moving water	Uncommon	S.W. North America	Minimal
Leopard frog *Rana pipiens*	Moist areas from mountains to lowlands	Near water	Common	U.S.	Moderate
Desert tortoise *Gopherus agassizi*	Creosote bush scrub	Throughout unpopulated region	Rare	S.W. U.S.	Moderate
Gila monster *Heloderma suspectum*	Rocky lowlands semi-arid regions	Throughout region	Rare	S.W. U.S.	Moderate
Banded gecko *Colconyx variegatus*	Pinon-juniper belt and creosote bush flats	Where rocks are present	Rare	S.W. U.S.	Moderate
Chuckwalla *Sauromalus obesus*	Creosote bush scrub	Near rocks	Fairly common	S.W. U.S.	Minimal
Collard lizard *Crotaphytus collaris*	Semi-arid canyons, mountain slopes, and rock gullies	Near rocks	Fairly common	S.W. U.S.	Minimal

TABLE 11 Continued

Species	Habitat and/or Seasonal Status	Range in Region or State	Abundance in Region	Range in U.S.	Project Impact
Leopard lizard <u>Crotaphytus wislizeni</u>	Arid and semi-arid plains	Where dense vegetation is lacking	Fairly common	S.W. U.S.	Minimal
Side-blotched lizard <u>Uta stansburiana</u>	Arid and semi-arid regions	Throughout region	Fairly common	Western and S.W. U.S.	Minimal
Tree lizard <u>Urosaurus ornatus</u>	Semi-arid regions	Throughout range where trees are found	Fairly common	S.W. U.S.	Minimal
Western whiptail <u>Cnenidophorus tigris</u>	From deserts to pine forests in mountains	Where sparse vegetation exists	Fairly common	S.W. U.S.	Minimal
Coachwhip <u>Masticophis flagellum</u>	Variety of semi-arid and arid habitats	Throughout region	Fairly common	S.W. U.S.	Minimal
Gopher snake or Bullsnake <u>Pituophis melanoleucus</u>	Variety of habitats	Throughout region	Common	S.W. and Central North America	Minimal

TABLE 11 Continued

Species	Habitat and/or Seasonal Status	Range in Region or State	Abundance in Region	Range in U.S.	Project Impact
Common kingsnake *Lampropeltis getulus*	Variety of habitats	Throughout region	Fairly common	Temperate and sub-tropical North America	Minimal

TABLE 12

ESTIMATED LAND USE IN FUTURE STANDARD PROJECT FLOOD

OVERFLOW AREAS

Land use	Acres						
	1974	1976	1986	1996	2006	2016	2026
URBAN							
Residential							
With flood control	16,790	17,950	20,185	22,790	24,690	25,975	26,630
Without flood control	16,790	17,950	18,885	22,035	23,575	24,860	25,515
Trailer parks - no impact from flood control	400	380	320	260	260	260	260
Commercial							
With flood control	2,750	2,810	3,030	3,390	3,505	3,670	3,705
Without flood control	2,750	2,810	3,030	3,340	3,455	3,620	3,655

TABLE 12 Continued

Land Use	Acres						
	1974	1976	1986	1996	2006	2016	2026
Industrial - no impact from flood control	1,295	1,420	1,565	1,730	1,830	1,935	1,935
Public, semipublic							
With flood control	1,420	1,450	1,570	1,640	1,710	1,760	1,770
Without flood control	1,420	1,450	1,560	1,630	1,700	1,750	1,760
Transportation - no impact from flood control	1,223	1,223	1,223	1,223	1,223	1,223	1,223
Parks - no impact from flood control	260	260	310	310	310	310	310
Subtotal with flood control	24,138	25,493	28,203	31,343	33,528	35,133	35,833
Subtotal without flood control	24,138	24,493	27,893	30,528	32,353	33,958	34,658

TABLE 12 Continued

Land Use	Acres						
	1974	1976	1986	1996	2006	2016	2026
NON-URBAN							
Agriculture							
With flood control	12,580	11,190	12,170	9,735	8,630	7,560	6,875
Without flood control	12,580	11,330	12,170	9,875	8,770	7,700	7,015
Open space - vacant							
With flood control	13,630	10,940	12,685	9,255	8,175	7,640	7,625
Without flood control	13,630	11,125	12,685	9,945	9,225	8,690	8,675
Channel - irrigation							
With flood control	145	160	145	160	160	160	160
Without flood control	145	145	145	145	145	145	145
Subtotal with flood control	26,355	22,290	25,000	19,150	16,965	15,360	14,660
Subtotal without flood control	26,355	22,600	25,000	19,965	18,140	16,535	15,835
TOTAL	50,493	50,493	50,493	50,493	50,493	50,493	50,493

TABLE 13

INVENTORY OF LARGE RECREATIONAL FACILITIES WITHIN 50 MILES OF THE PHOENIX METROPOLITAN AREA

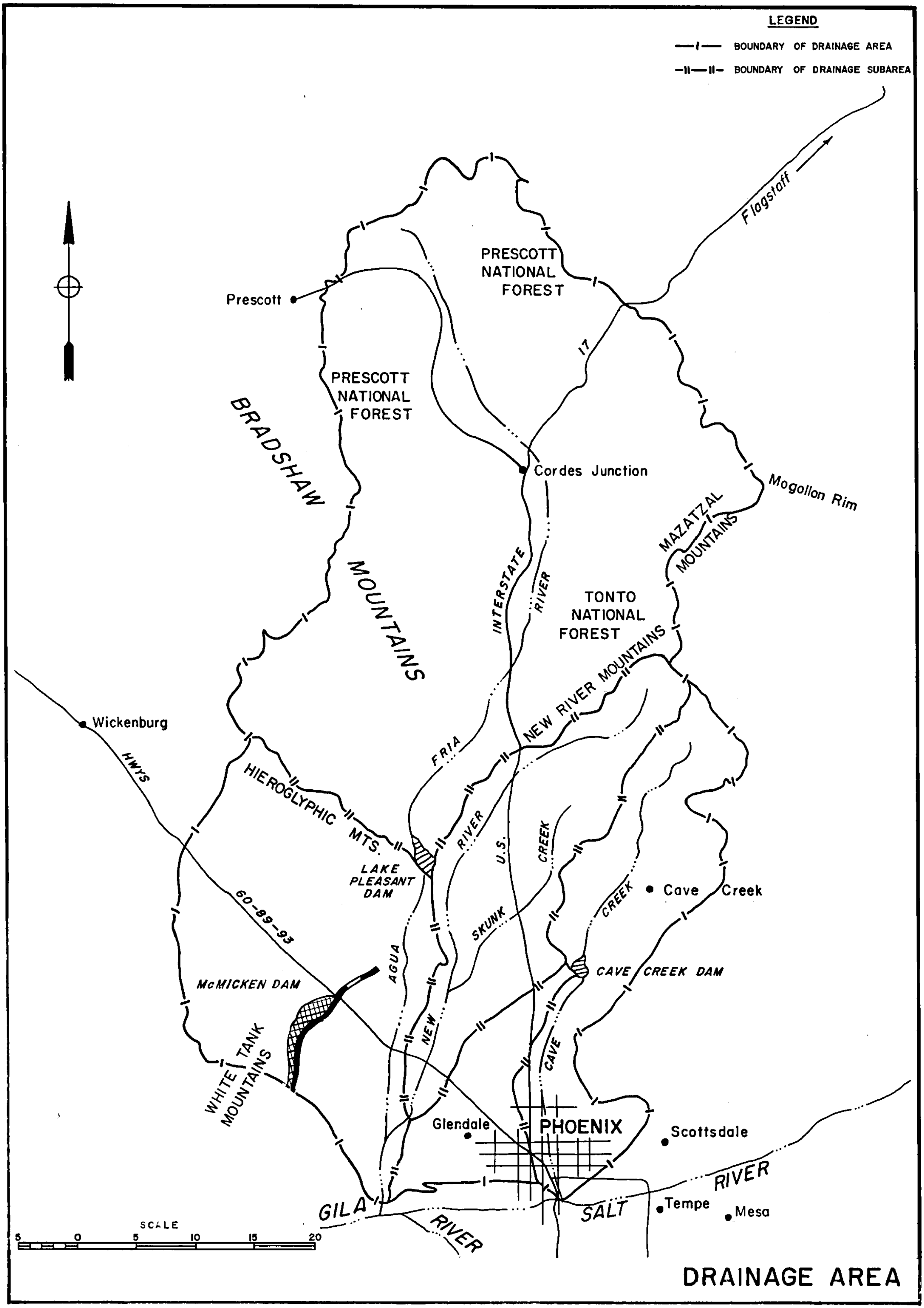
Jurisdiction/Name	Total Acres	Acres Developed	Acres Potentially Developable
Phoenix			
Phoenix Mountain Reserve	2,120.00	0.00	-
North Mountain Park	275.00	80.00	0.00
Papago Park	888.64	820.61	60.00
South Mountain Park	14,817.00	800.00	0.00
Squaw Peak Park	546.40	100.00	0.00
Stony Mountain Park	161.00	0.00	0.00
Cave Creek Park and Scenic Drive	595.00	0.00	595.00
Deer Valley Park	147.88	0.00	147.88
Encanto Park	61.01	61.01	0.00
Esteban Park	64.08	64.08	0.00
Scottsdale			
McCormick Park	100.00	0.00	100.00
Tempe			
Papago Park	275.00	40.00	235.00
Wickenburg			
Unnamed open area	288.00	10.00	278.00
Maricopa County			
Black Canyon Shooting Range	1,433.70	1,000.00	200.00
Buckeye Hills	4,474.00	20.00	2,000.00

TABLE 13 Continued

Jurisdiction/Name	Total Acres	Acres Developed	Acres Potentially Developable
Casey Abbott Park	2,124.06	600.00	1,500.00
Cave Creek	3,002.00	0.00	1,500.00
Thunderbird	726.68	10.00	300.00
Usery Mountain	3,324.24	25.00	3,000.00
Estrella Mountain	16,467.91	0.00	8,000.00
Lake Pleasant	14,357.17	300.00	4,000.00
McDowell Mountain	20,941.73	0.00	16,000.00
White Tank Mountain	26,337.75	3.00	12,000.00
Bush Highway Recreation area	267.40	5.00	262.40
Paradise Valley Park	340.00	40.00	300.00
Total	110,758.66	3,978.70	50,478.28

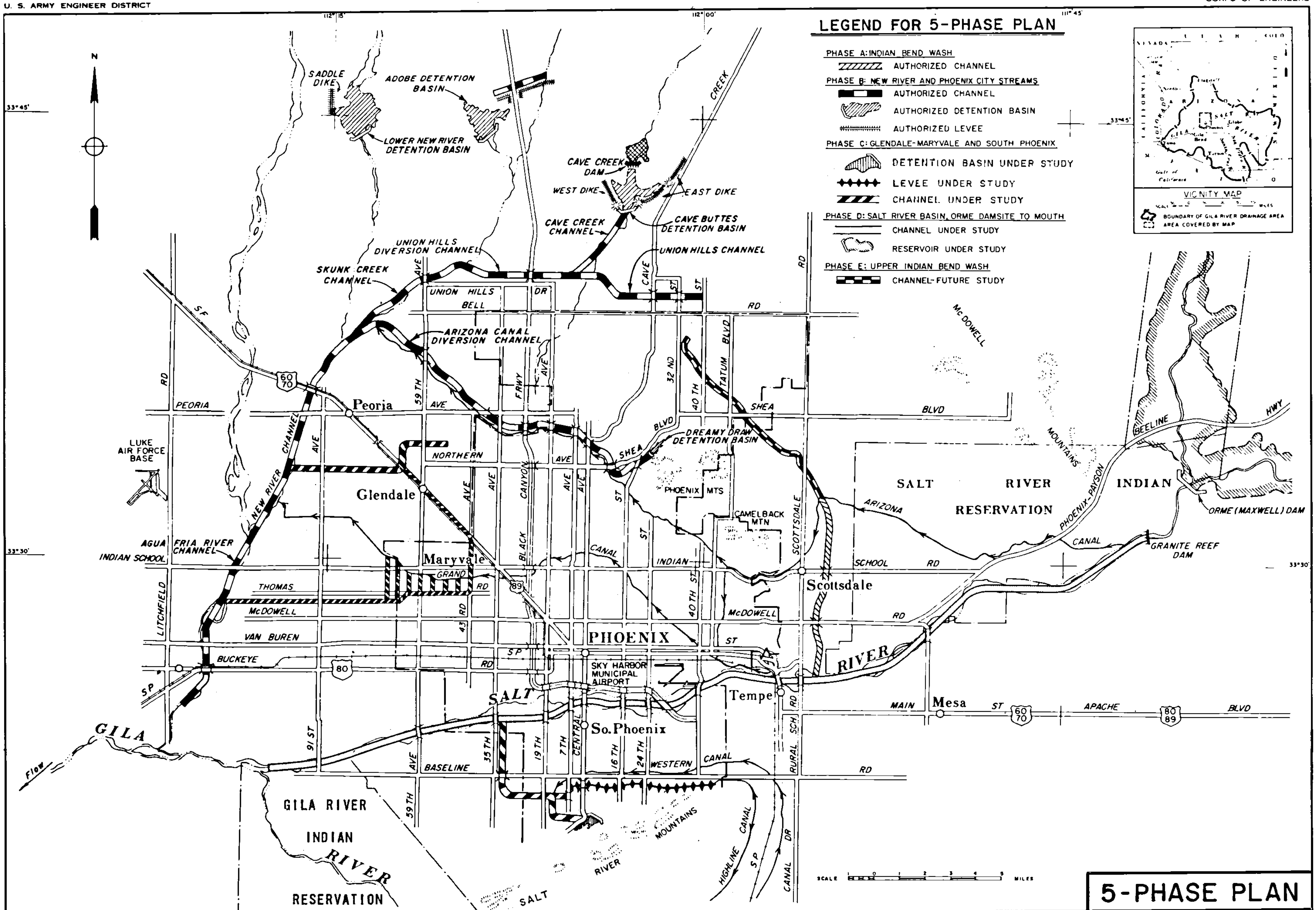
PLATES

PLATES


LEGEND
BOUNDARY OF DRAINAGE AREA
BOUNDARY OF DRAINAGE SUBAREA
Flagstaff
PRESCOTT NATIONAL FOREST
Prescott
PRESCOTT NATIONAL FOREST
17
BRADSHAW
Cordes Junction
Mogollon Rim
MAZATZAL MOUNTAINS
MOUNTAINS
INTERSTATE
RIVER
TONTO NATIONAL FOREST
NEW RIVER MOUNTAINS
Wickenburg
HWYS
FRIA
HIEROGLYPHIC MTS.
RIVER
U.S.
CREEK
LAKE PLEASANT DAM
CREEK
Cave Creek
60-89-93
SKUNK
CAVE CREEK DAM
McMICKEN DAM
AGUA
NEW
CAVE
WHITE TANK MOUNTAINS
Glendale
PHOENIX
Scottsdale
RIVER
GILA
SALT
Tempe
Mesa
RIVER
SCALE
5 0 5 10 15 20
DRAINAGE AREA

U. S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS



5-PHASE PLAN

PLATE 2

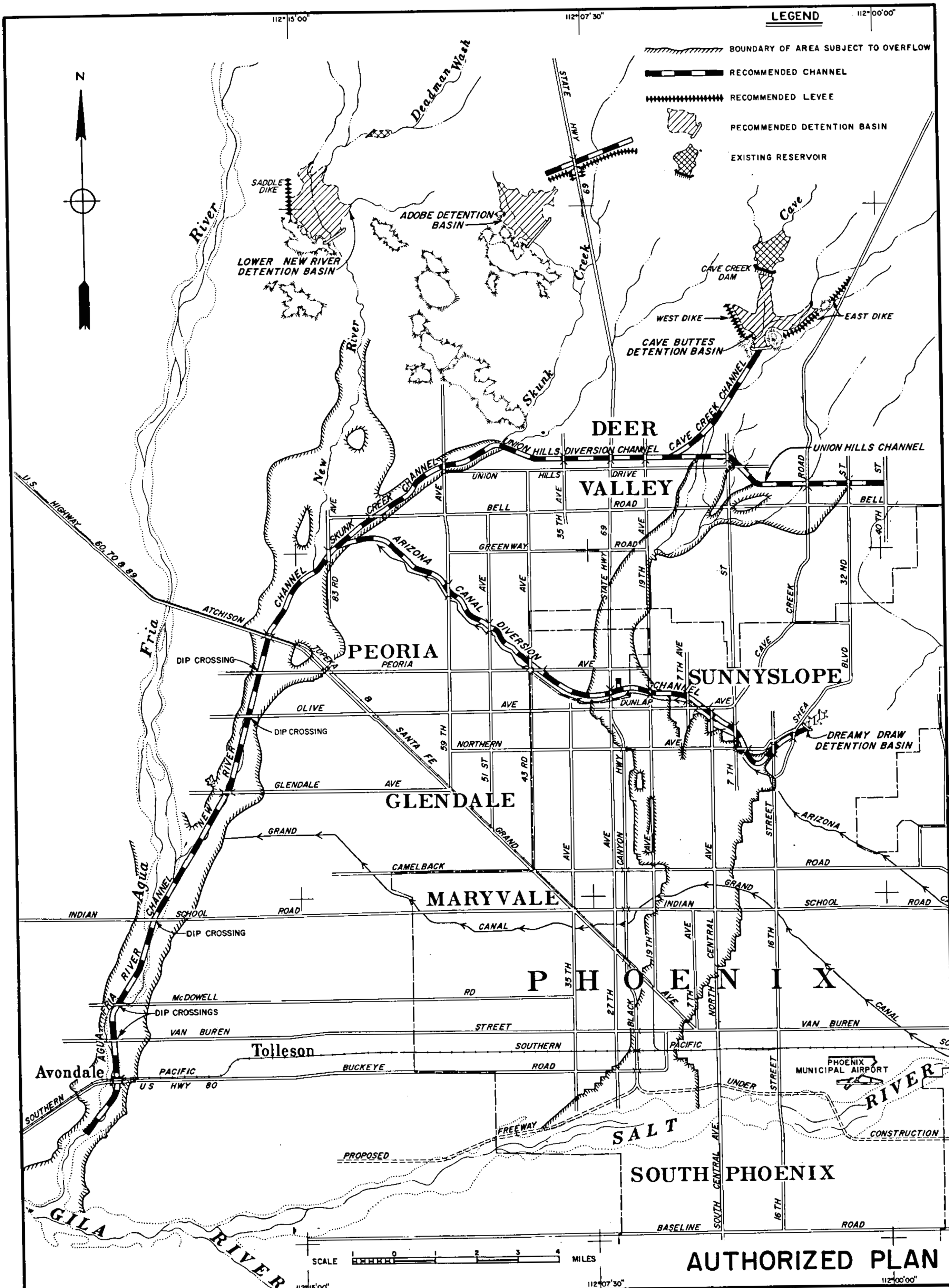
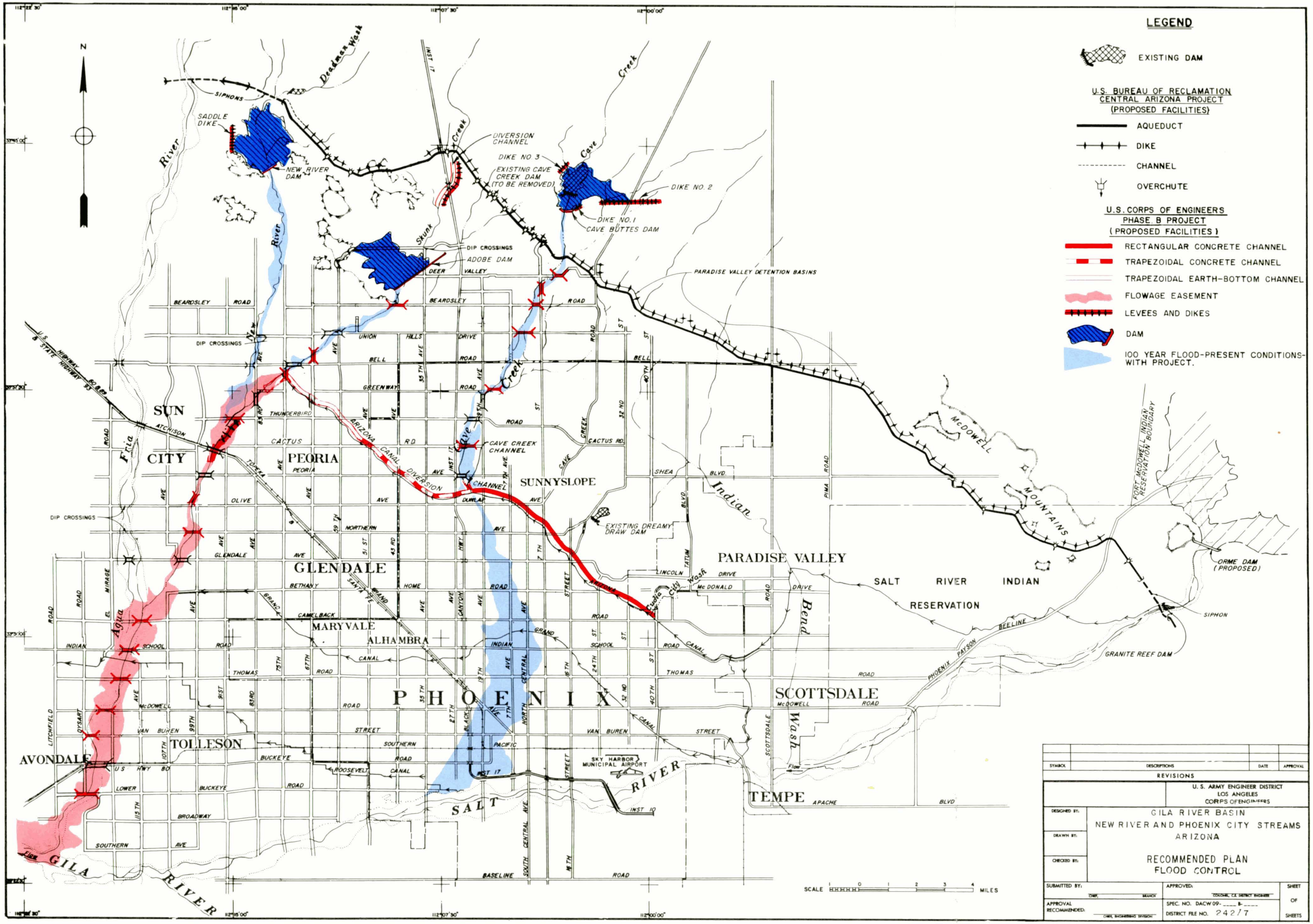
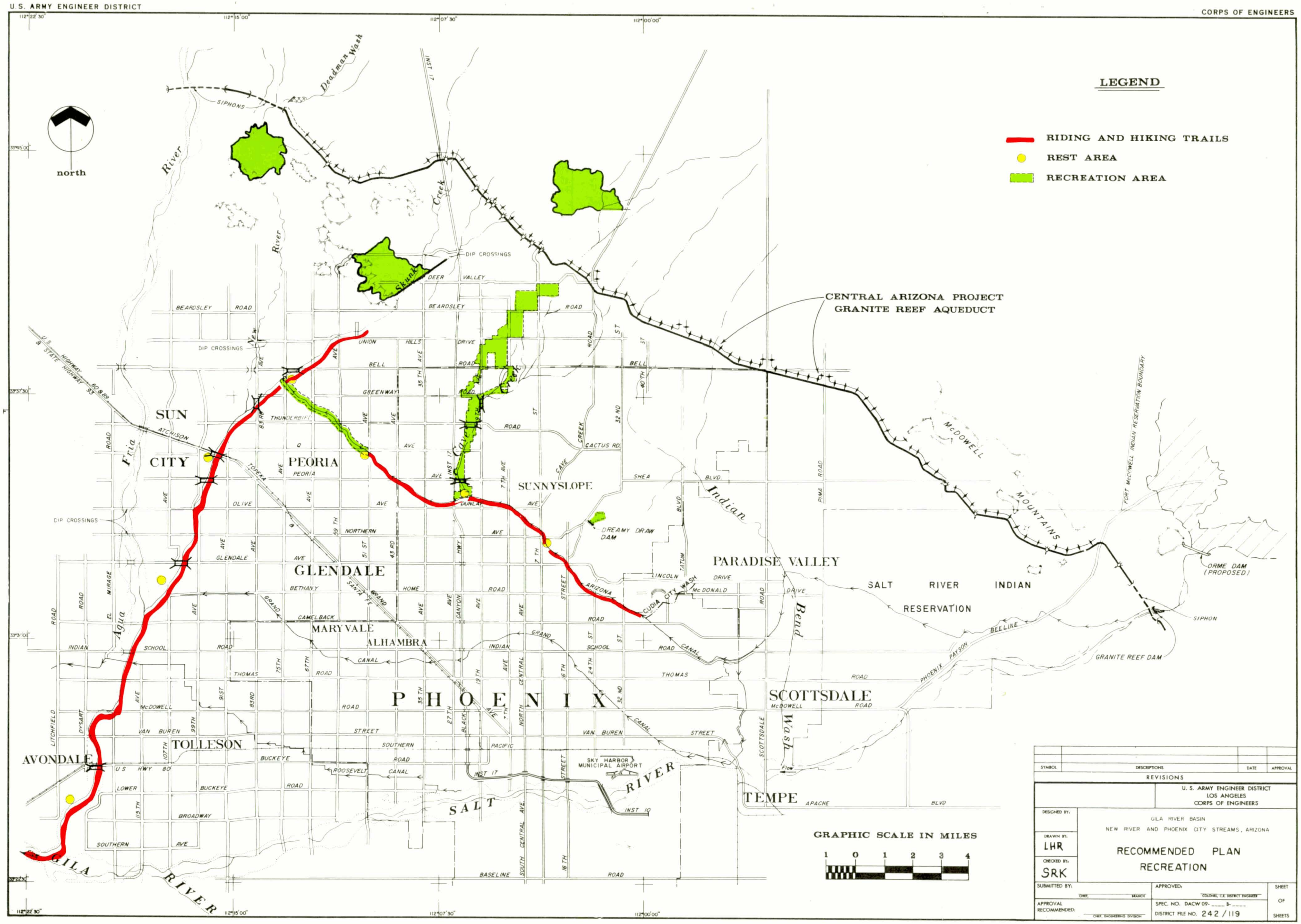

LEGEND
BOUNDARY OF AREA SUBJECT TO OVERFLOW
RECOMMENDED CHANNEL
RECOMMENDED LEVEE
RECOMMENDED DETENTION BASIN
EXISTING RESERVOIR
112° 15' 00"
112° 07' 30"
112° 00' 00"
N
Deadman Wash
SADDLE DIKE
LOWER NEW RIVER DETENTION BASIN
ADOBE DETENTION BASIN
STATE HWY 69
Skunk Creek
Cave
CAVE CREEK DAM
WEST DIKE
EAST DIKE
CAVE BUTTES DETENTION BASIN
CAVE CREEK CHANNEL
UNION HILLS DIVERSION CHANNEL
UNION HILLS CHANNEL
DEER VALLEY
New River
Agua Fria River
U.S. HIGHWAY 60, 70 & 89
ATCHISON TOPEKA & SANTA FE
SKUNK CREEK CHANNEL
ARIZONA CANAL DIVERSION CHANNEL
PEORIA
SUNNYSLOPE
DIP CROSSING
DREAMY DRAW DETENTION BASIN
GLENDALE
MARYVALE
PHOENIX
DIP CROSSINGS
Tolleson
Avondale
SOUTHERN PACIFIC
US HWY 80
PHOENIX MUNICIPAL AIRPORT
SALT RIVER
PROPOSED FREEWAY UNDER CONSTRUCTION
SOUTH PHOENIX
GILA RIVER
UNION HILLS DRIVE
BELL ROAD
GREENWAY ROAD
PEORIA AVE
OLIVE AVE
DUNLAP AVE
NORTHERN AVE
GLENDALE AVE
GRAND CANAL
CAMELBACK ROAD
INDIAN SCHOOL ROAD
McDOWELL RD
VAN BUREN STREET
BUCKEYE ROAD
BASELINE ROAD
83 RD AVE
59 TH AVE
51 ST AVE
43 RD AVE
35 TH AVE
27 TH AVE
19 TH AVE
7 TH AVE
CENTRAL AVE
7 TH ST
16 TH STREET
32 ND ST
40 TH ST
BLACK CANYON HWY
CAVE CREEK ROAD
SHEA BLVD
SCALE
MILES
AUTHORIZED PLAN

PLATE 3



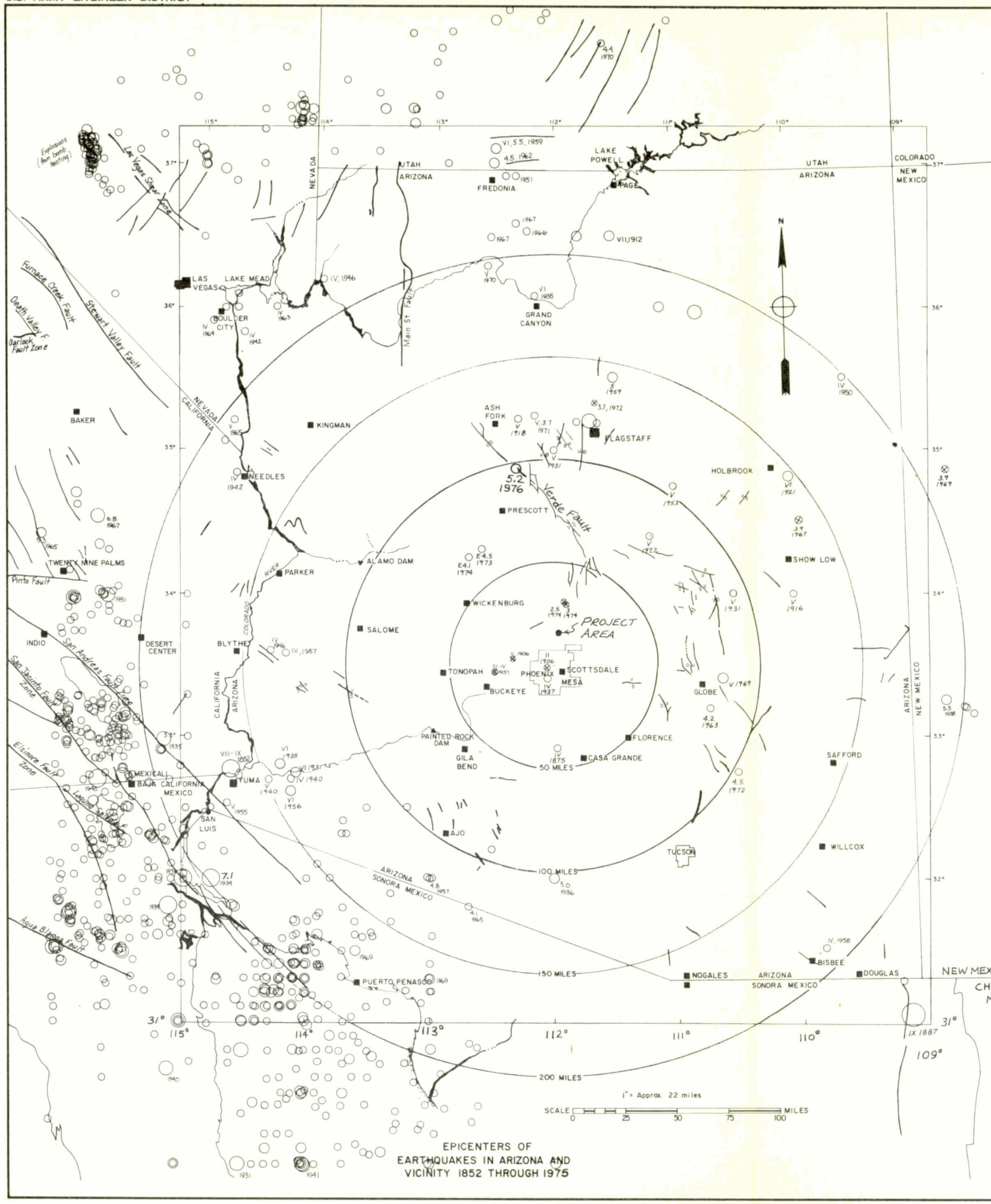
LEGEND
EXISTING DAM
U.S. BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
(PROPOSED FACILITIES)
AQUEDUCT
DIKE
CHANNEL
OVERCHUTE
U.S. CORPS OF ENGINEERS
PHASE B PROJECT
(PROPOSED FACILITIES)
RECTANGULAR CONCRETE CHANNEL
TRAPEZOIDAL CONCRETE CHANNEL
TRAPEZOIDAL EARTH-BOTTOM CHANNEL
FLOWAGE EASEMENT
LEVEES AND DIKES
DAM
100 YEAR FLOOD-PRESENT CONDITIONS-WITH PROJECT.
SUN CITY
PEORIA
GLENDALE
MARYVALE
ALHAMBRA
PHOENIX
SUNNYSLOPE
PARADISE VALLEY
SCOTTSDALE
TEMPE
TOLLESON
AVONDALE
SALT RIVER INDIAN RESERVATION
SKY HARBOR MUNICIPAL AIRPORT
SADDLE DIKE
NEW RIVER DAM
ADOBE DAM
DIKE NO 3
EXISTING CAVE CREEK DAM (TO BE REMOVED)
DIKE NO. 2
DIKE NO. 1
CAVE BUTTES DAM
DIVERSION CHANNEL
PARADISE VALLEY DETENTION BASINS
CAVE CREEK CHANNEL
ARIZONA CANAL DIVERSION CHANNEL
EXISTING DREAMY DRAW DAM
ORME DAM (PROPOSED)
GRANITE REEF DAM
FORT McDOWELL INDIAN RESERVATION BOUNDARY
McDOWELL MOUNTAINS
GILA RIVER
SALT RIVER
SCALE 0 1 2 3 4 MILES
SYMBOL
DESCRIPTIONS
DATE
APPROVAL
REVISIONS
U. S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS
DESIGNED BY:
DRAWN BY:
CHECKED BY:
GILA RIVER BASIN
NEW RIVER AND PHOENIX CITY STREAMS
ARIZONA
RECOMMENDED PLAN
FLOOD CONTROL
SUBMITTED BY:
APPROVAL RECOMMENDED:
APPROVED:
SPEC. NO. DACW 09- ____ B- ____
DISTRICT FILE NO. 24217
SHEET OF SHEETS

PLATE 4a



U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
LEGEND
RIDING AND HIKING TRAILS
REST AREA
RECREATION AREA
CENTRAL ARIZONA PROJECT
GRANITE REEF AQUEDUCT
north
PHOENIX
GLENDALE
PEORIA
SUN CITY
AVONDALE
TOLLESON
MARYVALE
ALHAMBRA
SUNNYSLOPE
PARADISE VALLEY
SCOTTSDALE
TEMPE
SALT RIVER INDIAN RESERVATION
SALT RIVER
GILA RIVER
Agua Fria River
New River
Skunk Creek
Cave Creek
Deadman Wash
Indian Bend Wash
McDOWELL MOUNTAINS
SKY HARBOR MUNICIPAL AIRPORT
DREAMY DRAW DAM
GRANITE REEF DAM
ORME DAM (PROPOSED)
FORT McDOWELL INDIAN RESERVATION BOUNDARY
GRAPHIC SCALE IN MILES
1 0 1 2 3 4
REVISIONS
U. S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS
GILA RIVER BASIN
NEW RIVER AND PHOENIX CITY STREAMS, ARIZONA
RECOMMENDED PLAN
RECREATION
DRAWN BY: LHR
CHECKED BY: SRK
DISTRICT FILE NO. 242/119

PLATE 4b



MAGNITUDE/INTENSITY CHART

Magnitude--Approx. Richter Equivalent (after RICHTER)	Modified Mercalli Intensity (damage) Scale of 1931 (abridged)
2	I. Not felt except by a very few under especially favorable circumstances. (I Rossi-Forel Scale)
	II. Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing. (I to II Rossi-Forel Scale)
3	III. Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing motorcars may rock slightly. Vibration like passing of truck. Duration estimated. (III Rossi-Forel Scale)
4	IV. During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, doors disturbed; walls make creaking sound. Sensation like heavy truck striking building. Standing motorcars rocked noticeably. (IV-V Rossi-Forel Scale)
	V. Felt by nearly everyone, many awakened. Some dishes, windows, etc., broken; a few instances of cracked plaster; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop. (V to VI Rossi-Forel Scale)
5	VI. Felt by all, many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys. Damage slight. (VI to VII Rossi-Forel Scale)
6	VII. Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving motorcars. (VIII Rossi-Forel Scale)
	VIII. Damage slight in specially designed structures; considerable in ordinary substantial buildings with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving motorcars disturbed. (VIII+ to IX Rossi-Forel Scale)
7	IX. Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken. (IX+ Rossi-Forel Scale)
	X. Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks. (X Rossi-Forel Scale)
8+	XI. Few, if any, (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.
	XII. Damage total. Waves seen on ground surface. Lines of sight and level distorted. Objects thrown upward into the air.

LEGEND

Symbol	Description
⊙ V 1918	Earthquake epicenter, giving intensity (from Modified Mercalli Scale of 1931) in Roman numerals, and year of quake. Where no intensity is given, it is not known.
⊙ 4.1 1963	Earthquake of known magnitude, according to the Richter Scale.
✱	Location and intensities (both estimated), from Pala Verde Report, Ariz. 1975.
⊙IV 4.5 1959	Earthquake of known magnitude and intensity.
⊙E4.5 1973	Artificial shock caused by mining activities.
⊗	$M<4.0$
○	$4.0 \le M < 5.0$
○	$5.0 \le M < 6.0$
○	$6.0 \le M < 7.0$
○	$7.0 \le M < 8.0$
○	$8.0 \le M$
■	Town or city.
	Larger city.
U D	Quaternary fault traces, dashed where approximately located, dotted where concealed. U— Upthrown side D— Downthrown side

Magnitude of shock determined by size of circle.

GENERAL NOTES

1. Richter Scale magnitudes are a measure of the energy release at the focus (center of the earthquake), as determined by the amplitudes produced on a seismogram. Epicenter is the point on the Earth's surface directly above the focus.
2. Intensity--expressed on the Modified Mercalli Intensity Scale of 1931--is a measure of the effects of an earthquake on people and objects, as determined by experienced observers (See chart, this sheet. Approximate equivalents of intensity and magnitude are shown.). Intensities on this sheet are recorded at the epicenters.
3. Earthquake information gathered from U.S. Dept. of Commerce publication, United States Earthquakes (1938 through 1971), and from U.S. Dept. of Commerce Environmental Data Service, Boulder, Colorado.
4. Earthquakes not centered in this area (whether felt here or not) are not included.
5. Map of Arizona drawn using Richfield Oil Company map of 1962 and Arizona Highway Dept. map of 1970.
6. Rossi-Forel Scale shown in chart is still used by some countries to evaluate earthquake effects.
7. Center of Phoenix is used as focal center of mileage rings.
8. Longest Quaternary fault within 100 miles of Phoenix is 33 miles long.
9. Only earthquakes greater than 4 magnitude are shown outside of the 150-mile radius circle.
10. Earthquake of Dec. 30, 1934 in Mexico--intensity felt in the vicinity of Phoenix was reported as III.
    Earthquake of May 18, 1940 near Imperial, Calif.--intensity felt in the vicinity of Phoenix was reported at about IV.
    Earthquake of Apr. 10, 1947 near Barstow (VII)--intensity felt in vicinity of Phoenix was IV.
    The 1887(8) Sonora earthquake apparently was only felt by a few persons (i.e. <III).
    Prior to 1974, 5 earthquakes were reportedly felt at Phoenix, (i.e. 1903, 1906 (2), 1934 and 1937). These have no instrumentally located epicenters within Arizona. Of six events felt in Phoenix, two have epicenters in Baja and one near Flagstaff. (Sturger and Irwin, 1971).

SYMBOL	DESCRIPTIONS	DATE	APPROVAL

REVISIONS

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: R.M.H.

DRAWN BY: R.N.P.

CHECKED BY:

GILA RIVER BASIN
NEW RIVER AND PHOENIX CITY STREAMS, ARIZONA

STRUCTURAL AND EARTHQUAKE MAP OF CENTRAL ARIZONA

SUBMITTED BY: CHIEF, BRANCH

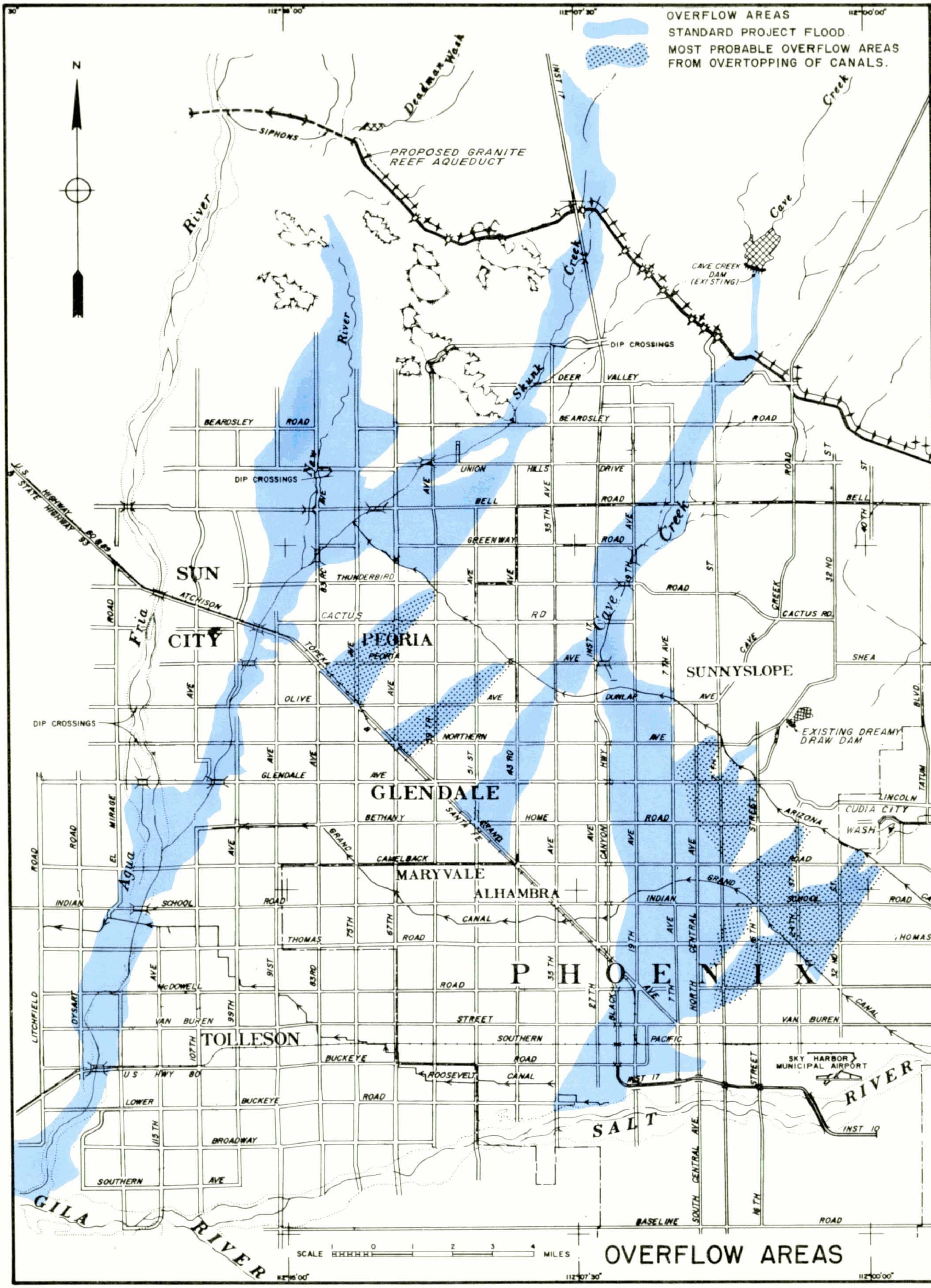
APPROVED: COLONEL, C.E. DISTRICT ENGINEER

APPROVAL RECOMMENDED: CHIEF, ENGINEERING DIVISION

SPEC. NO. DACW 09-____ B-____

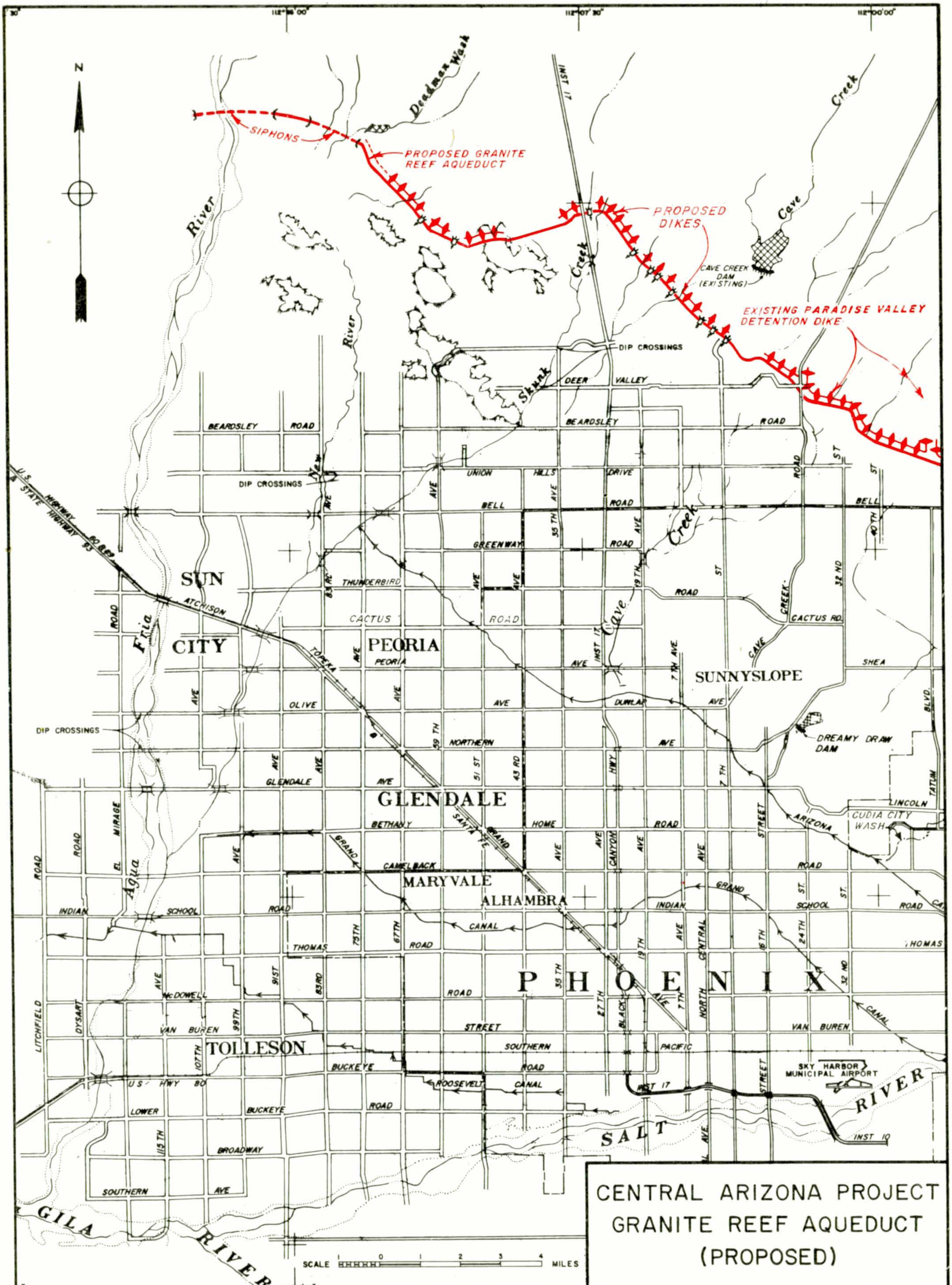
DISTRICT FILE NO. 242/41

SHEET OF SHEETS



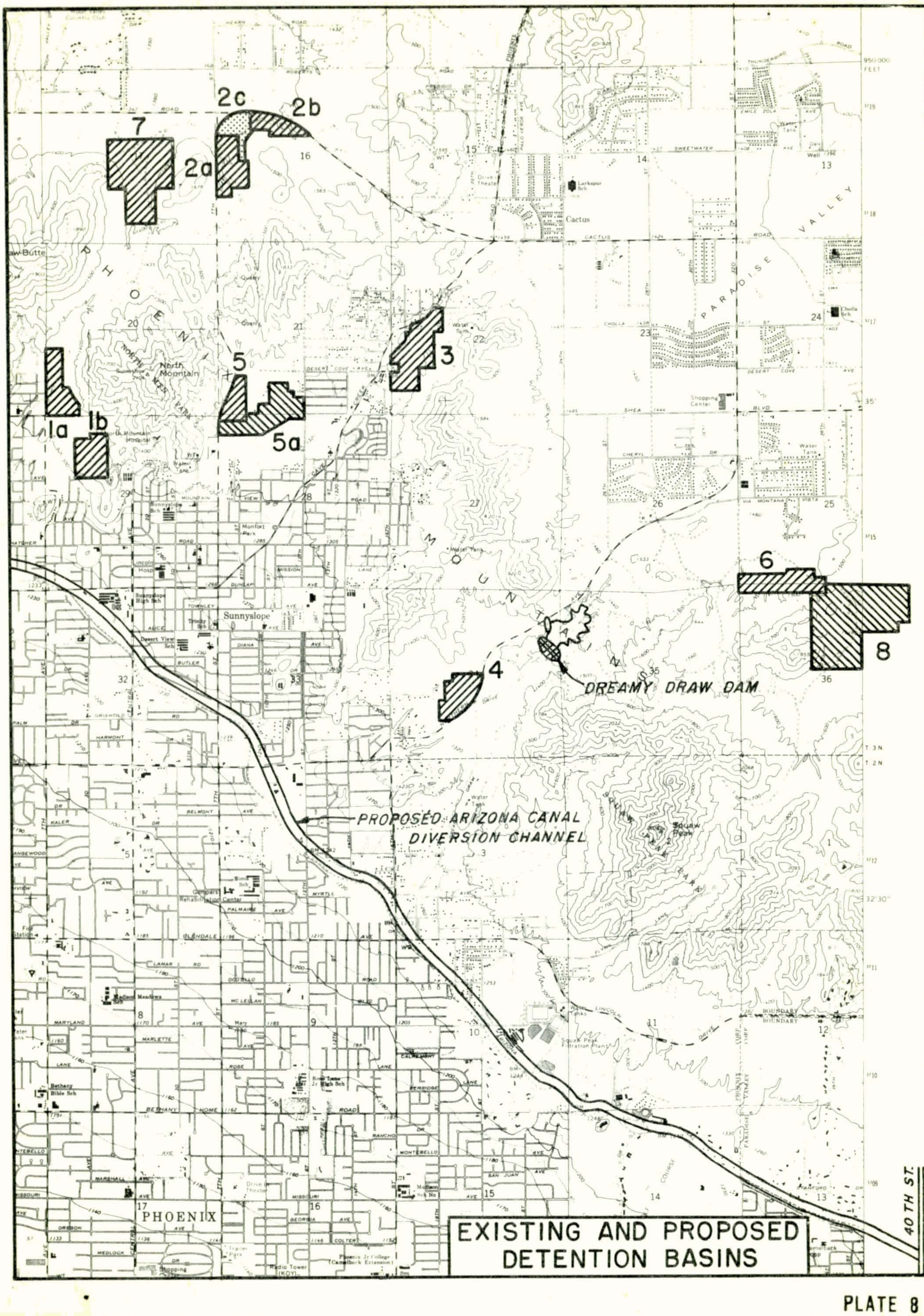
OVERFLOW AREAS

PLATE 6



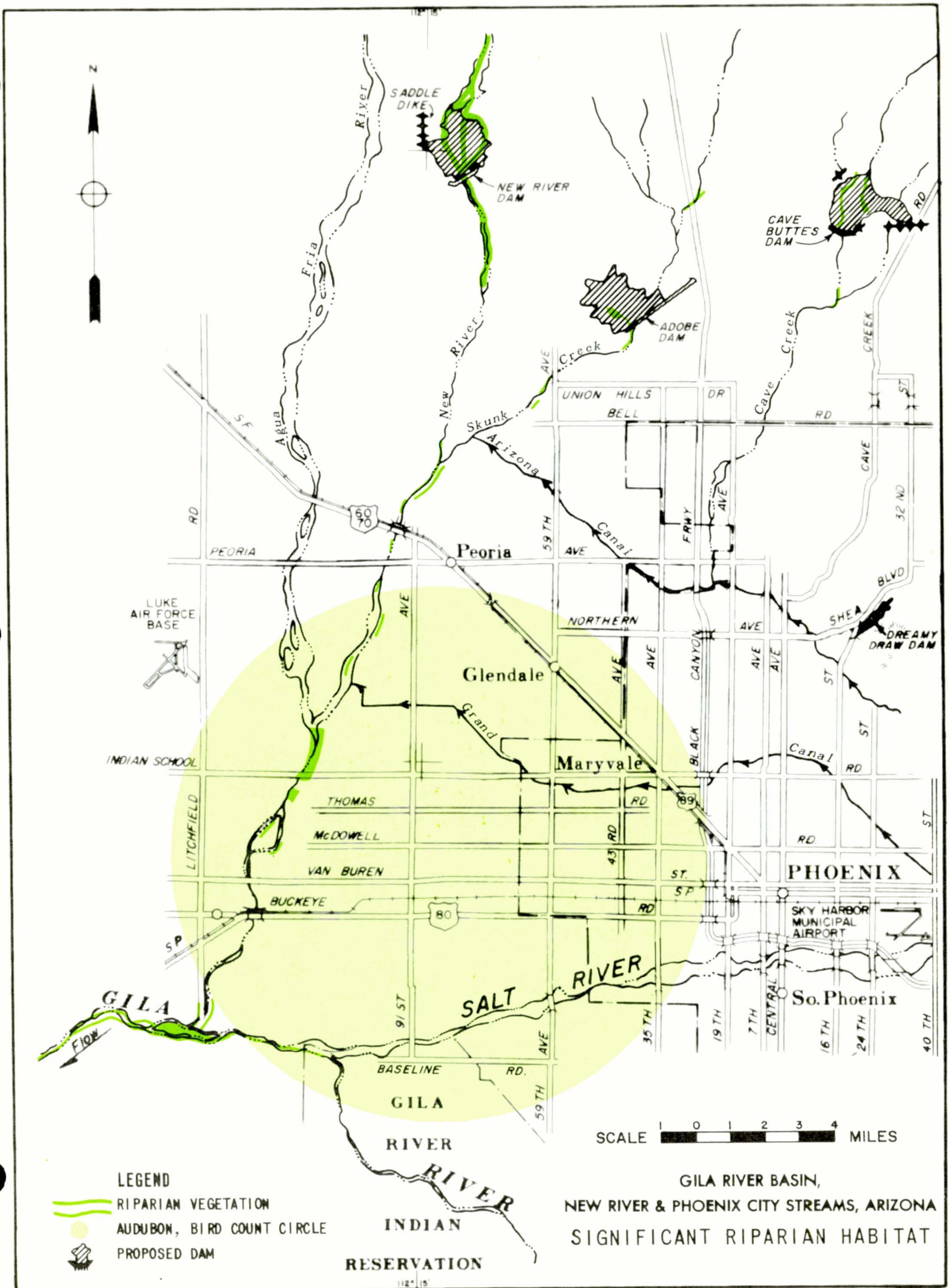
CENTRAL ARIZONA PROJECT
GRANITE REEF AQUEDUCT
(PROPOSED)

PLATE 7



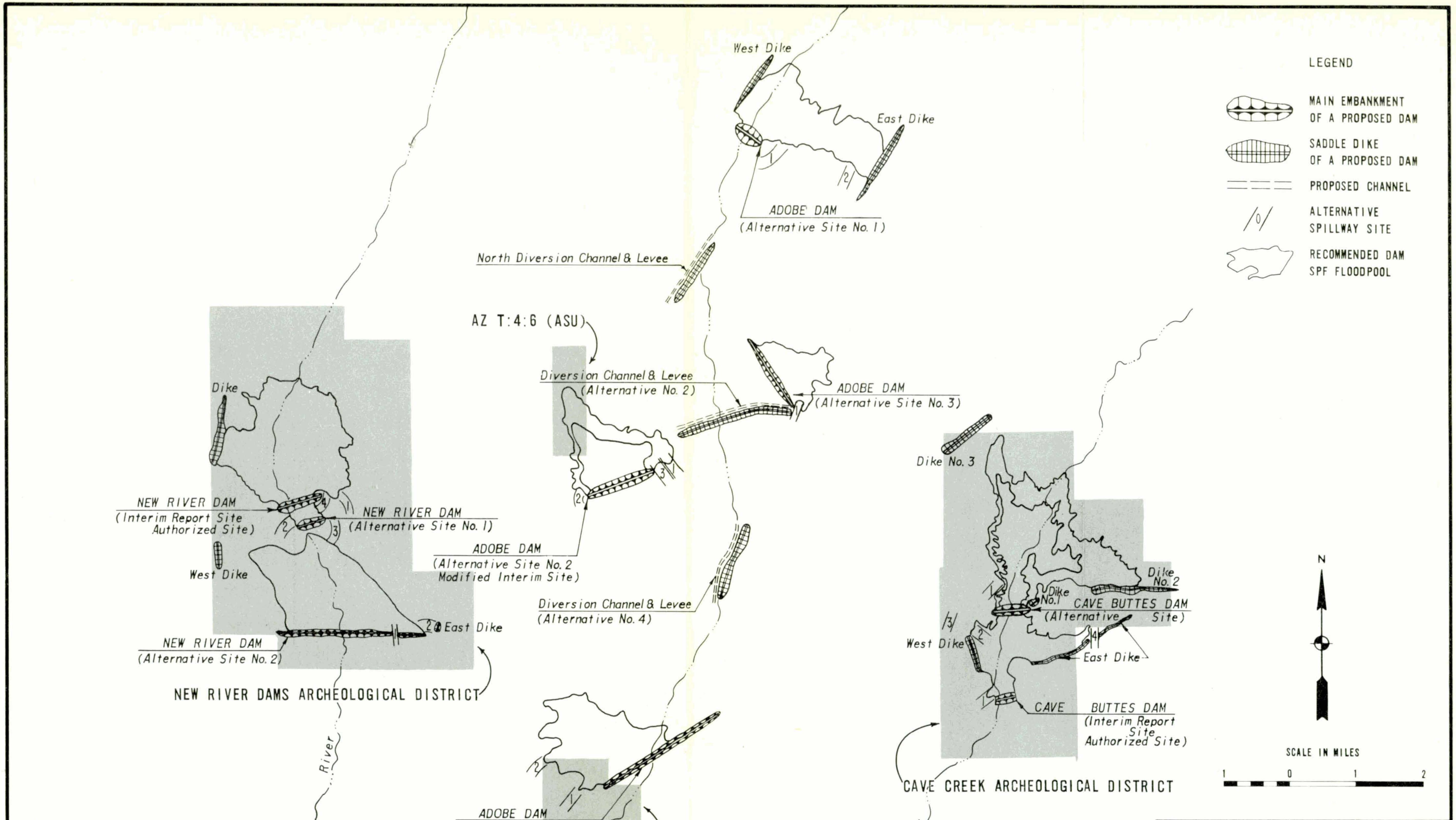
2c
2b
7
2a
5
3
1a
1b
5a
6
8
4
DREAMY DRAW DAM
PROPOSED ARIZONA CANAL
DIVERSION CHANNEL
North Mountain
Sunnyslope
Squaw Peak
PHOENIX
PARADISE VALLEY
40TH ST.
EXISTING AND PROPOSED
DETENTION BASINS

PLATE 8



GILA RIVER BASIN,
NEW RIVER & PHOENIX CITY STREAMS, ARIZONA
SIGNIFICANT RIPARIAN HABITAT

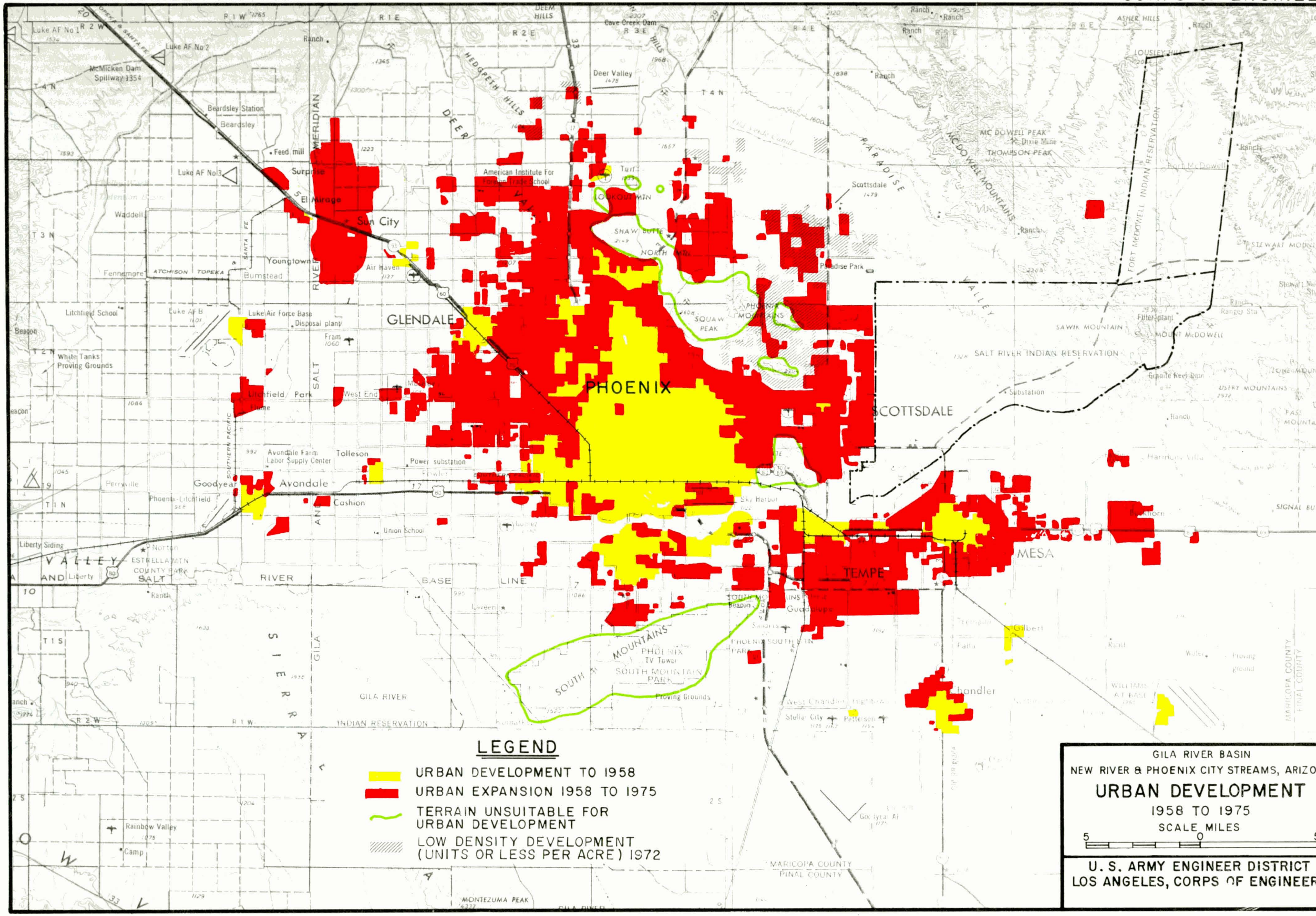
PLATE 9

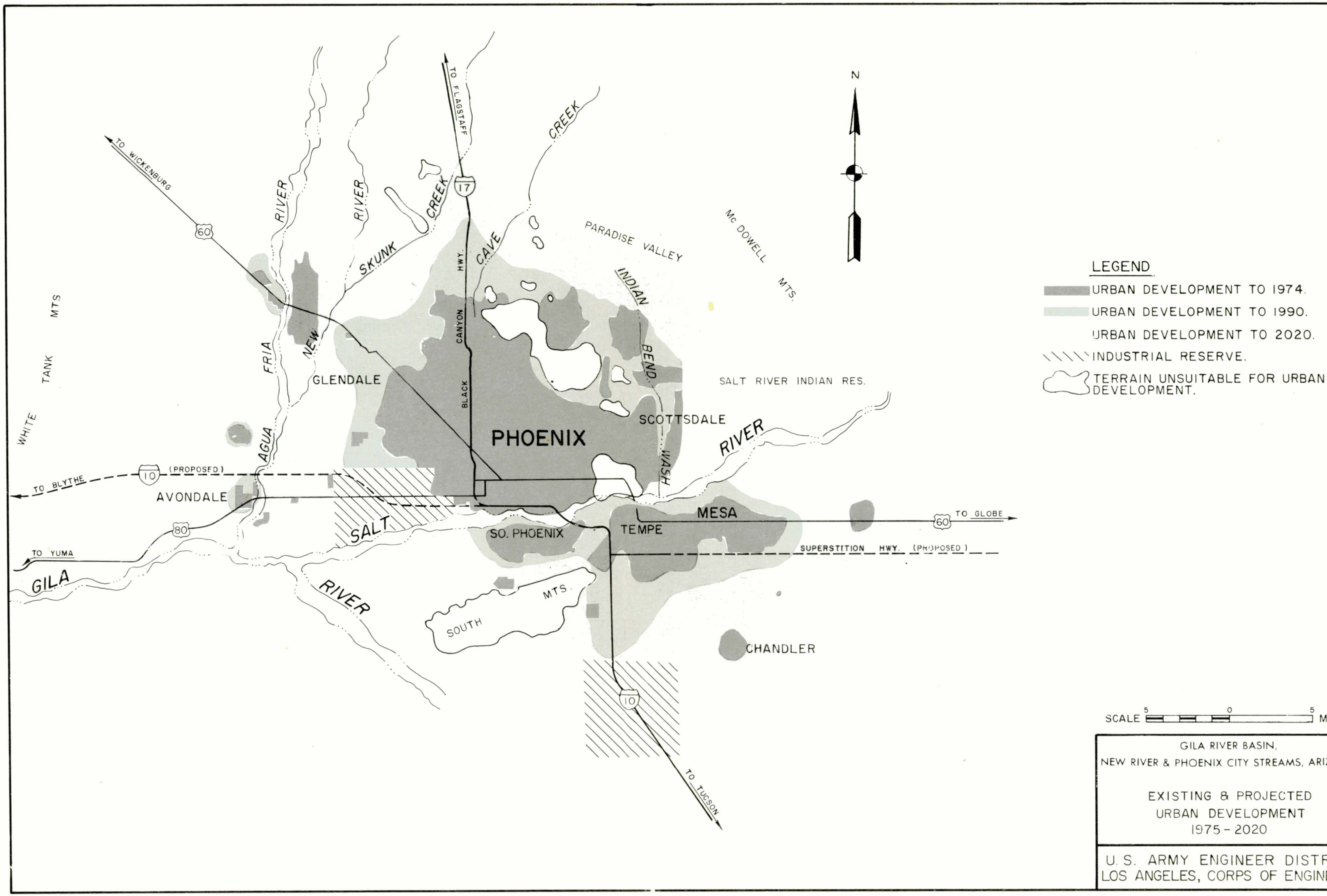


GILA RIVER BASIN
NEW RIVER AND PHOENIX CITY STREAMS, ARIZONA

NATIONAL REGISTER
ARCHEOLOGICAL DISTRICTS

U S ARMY ENGINEER DISTRICT
LOS ANGELES CORPS OF ENGINEERS


LEGEND
URBAN DEVELOPMENT TO 1958
URBAN EXPANSION 1958 TO 1975
TERRAIN UNSUITABLE FOR URBAN DEVELOPMENT
LOW DENSITY DEVELOPMENT (UNITS OR LESS PER ACRE) 1972
GILA RIVER BASIN
NEW RIVER & PHOENIX CITY STREAMS, ARIZO
URBAN DEVELOPMENT
1958 TO 1975
SCALE MILES
U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEER
PHOENIX
GLENDALE
SCOTTSDALE
TEMPE
MESA
Sun City
Avondale
Goodyear
Litchfield Park
Chandler
Gilbert
SALT RIVER INDIAN RESERVATION
GILA RIVER INDIAN RESERVATION
SOUTH MOUNTAINS
SIERRA

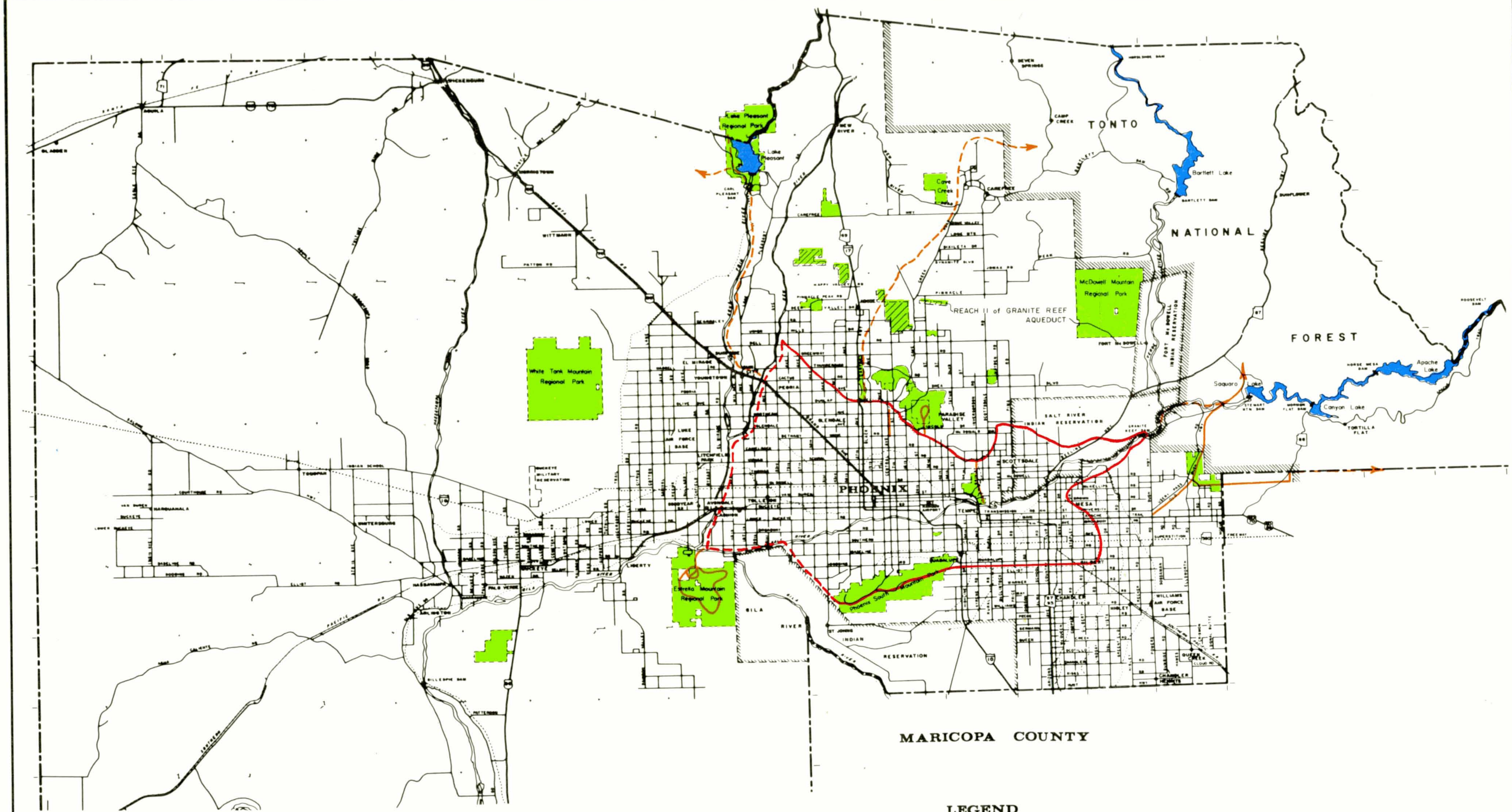


GILA RIVER BASIN,
NEW RIVER & PHOENIX CITY STREAMS, ARIZ

EXISTING & PROJECTED
URBAN DEVELOPMENT
1975 - 2020

U. S. ARMY ENGINEER DISTR
LOS ANGELES, CORPS OF ENGINE

PLA



LEGEND

north

GRAPHIC SCALE IN MILES

0 2 4 6 8 10 12

HIKING AND RIDING TRAILS

- PRIMARY TRAILS-PROPOSED*
- PRIMARY TRAILS-EXISTING*
- SECONDARY TRAILS-PROPOSED
- SECONDARY TRAILS-EXISTING
- REGIONAL PARKS
- RECREATIONAL LAKES (OVER 100 SURFACE ACRES)
- PROPOSED REGIONAL PARKS

*NOTE: SUN CIRCLE TRAIL

SYMBOL	DESCRIPTIONS	DATE	APPROVAL
REVISIONS			

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY:

DRAWN BY: LHR

CHECKED BY: SRK

GILA RIVER BASIN
NEW RIVER AND PHOENIX CITY STREAMS, ARIZONA

RECREATION RESOURCES IN MARICOPA COUNTY

SUBMITTED BY:

APPROVED:

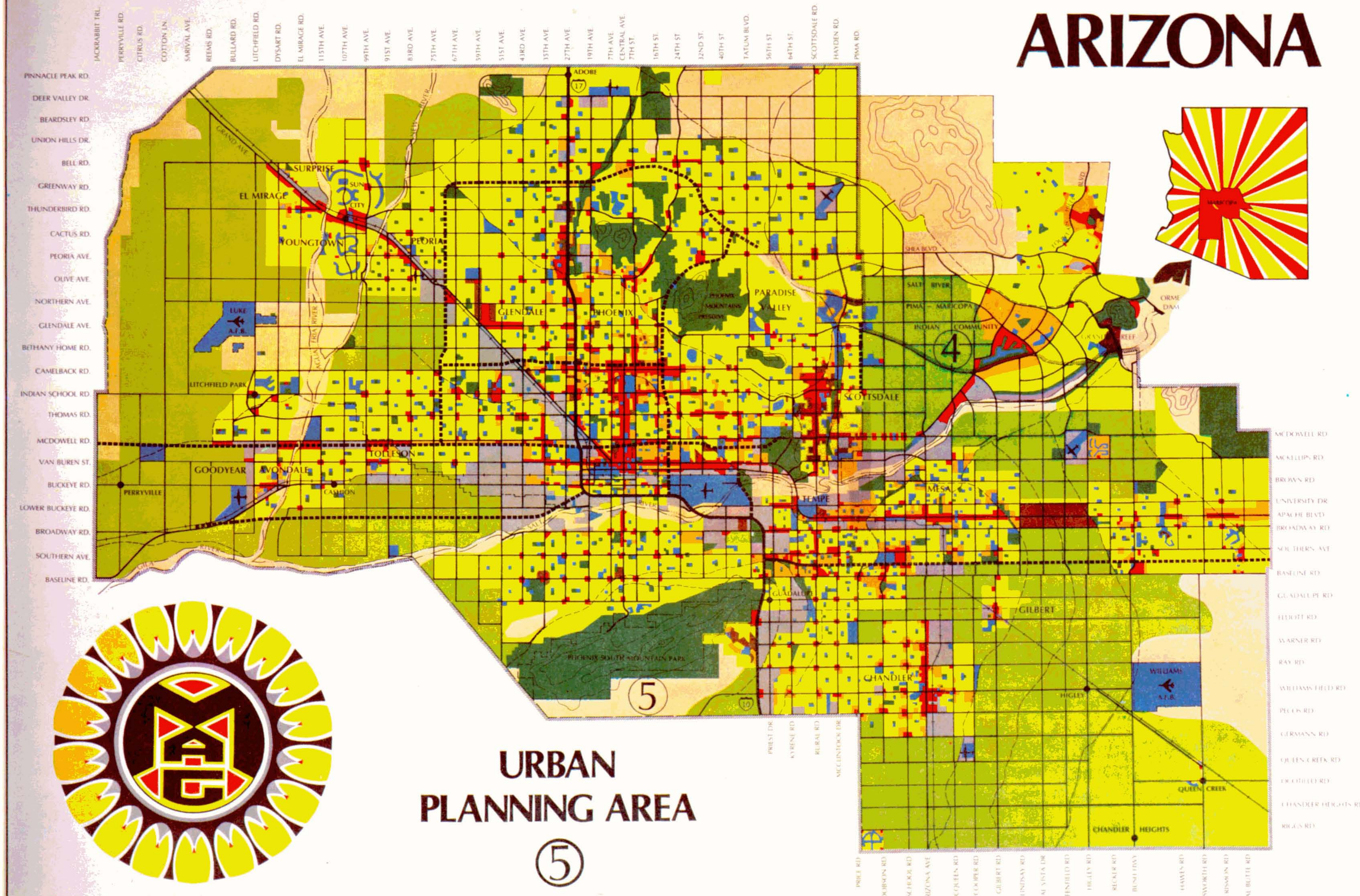
APPROVAL RECOMMENDED:

SPEC. NO. DACW09-

DISTRICT FILE NO. 242 / 117

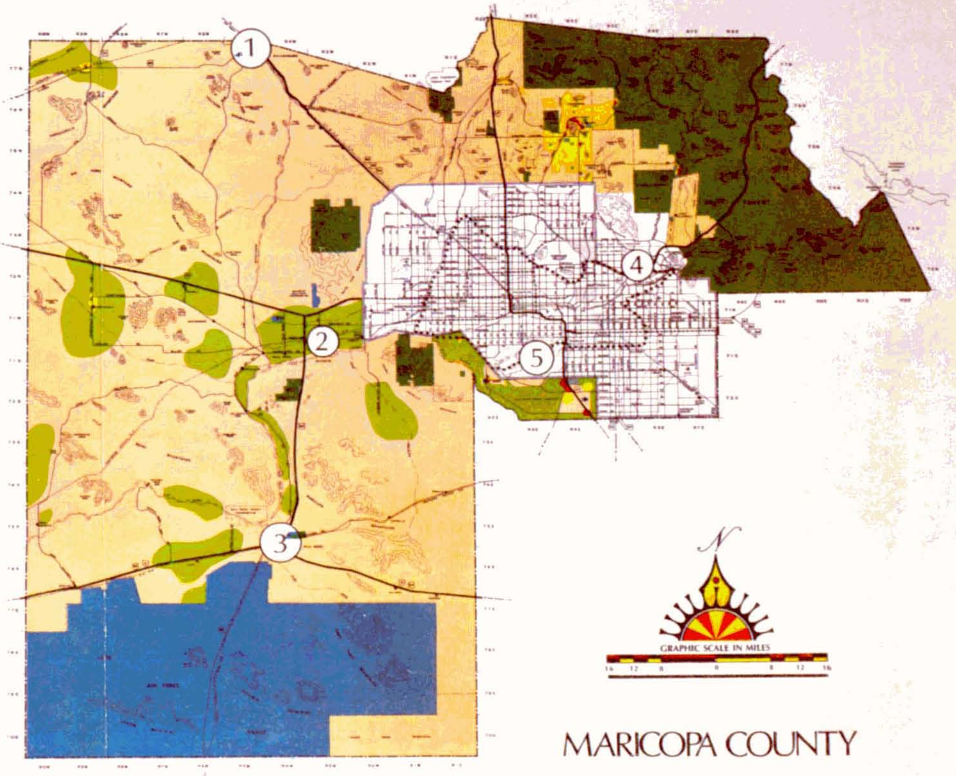
SHEET OF SHEETS

COMPOSITE LAND USE PLAN FOR MARICOPA COUNTY, ARIZONA

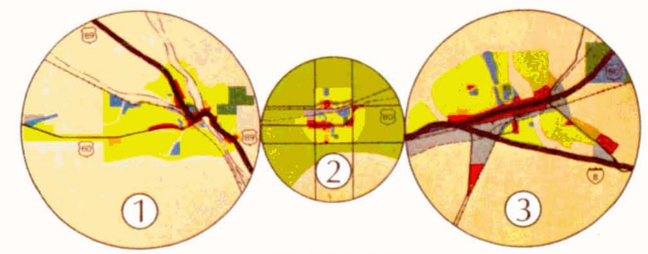


URBAN PLANNING AREA

5



MARICOPA COUNTY



WICKENBURG
BUCKEYE
GILA BEND

PREPARED AND PUBLISHED BY
MARICOPA ASSOCIATION OF GOVERNMENTS
MARICOPA COUNTY, ARIZONA

PREPARED FROM PLANS OF MAG MEMBER AGENCIES

The preparation of this map was financed in part through funds from the Federal Highway Administration, the Department of Housing and Urban Development, and the Urban Mass Transportation Administration, and was prepared on the 15th day of May, 1975.

GRAPHIC SCALE IN MILES

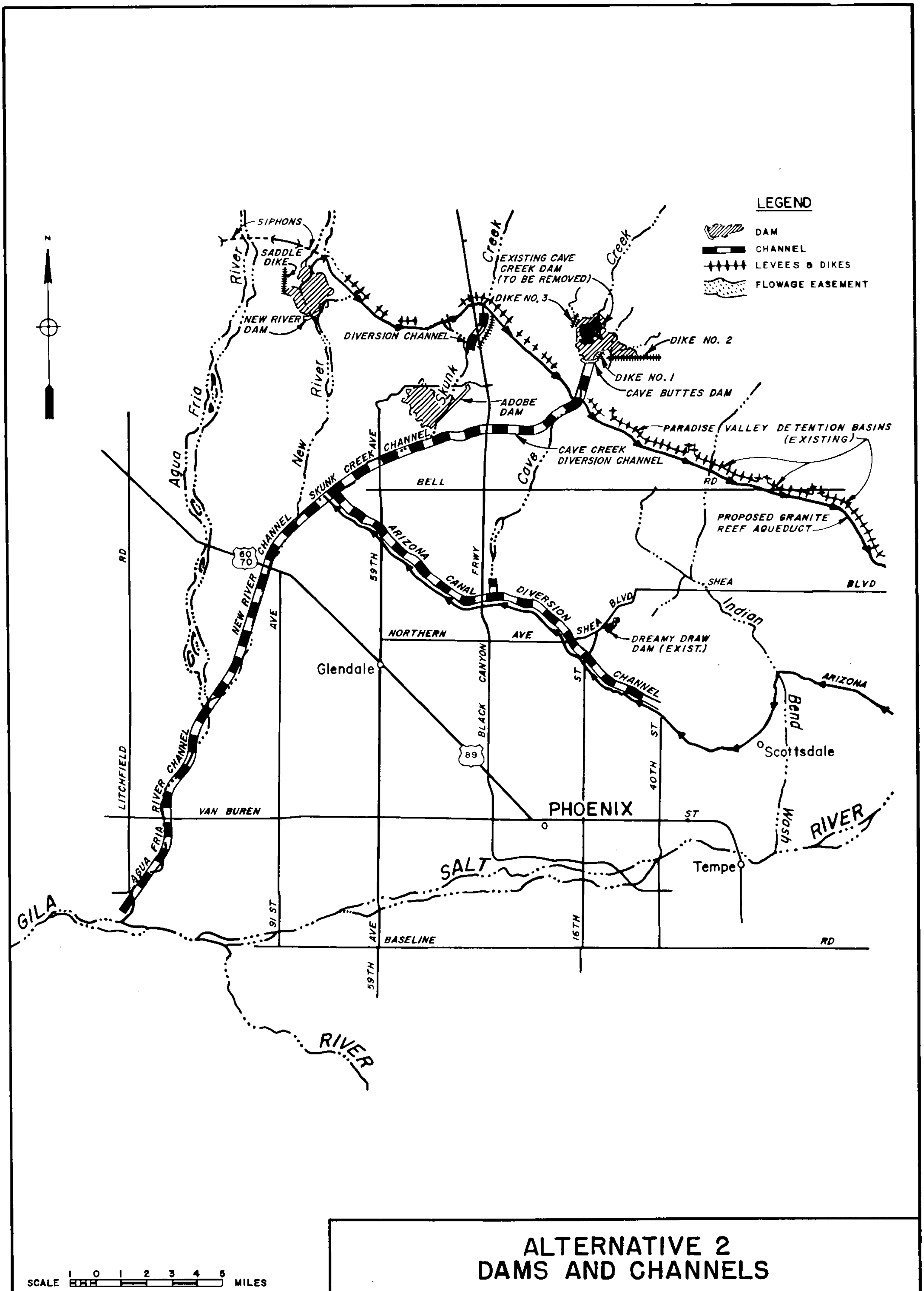
TRANSPORTATION CORRIDORS	
URBAN PLANNING AREA	OTHER MARICOPA COUNTY
EXISTING FREEWAY	MAJOR HIGHWAY
PLANNED FREEWAY, EXPRESSWAY ROUTE	OTHER ROADS
MAJOR STREET	SUN CIRCLE HIKING AND RIDING TRAIL

LOW DENSITY RESIDENTIAL	MEDIUM DENSITY RESIDENTIAL	HIGH DENSITY RESIDENTIAL 15 & OVER HOUSING UNITS PER GROSS ACRE	COMMERCIAL	PUBLIC AND SEMI-PUBLIC	INDUSTRIAL	PARKS	AGRICULTURAL	CONSERVATION

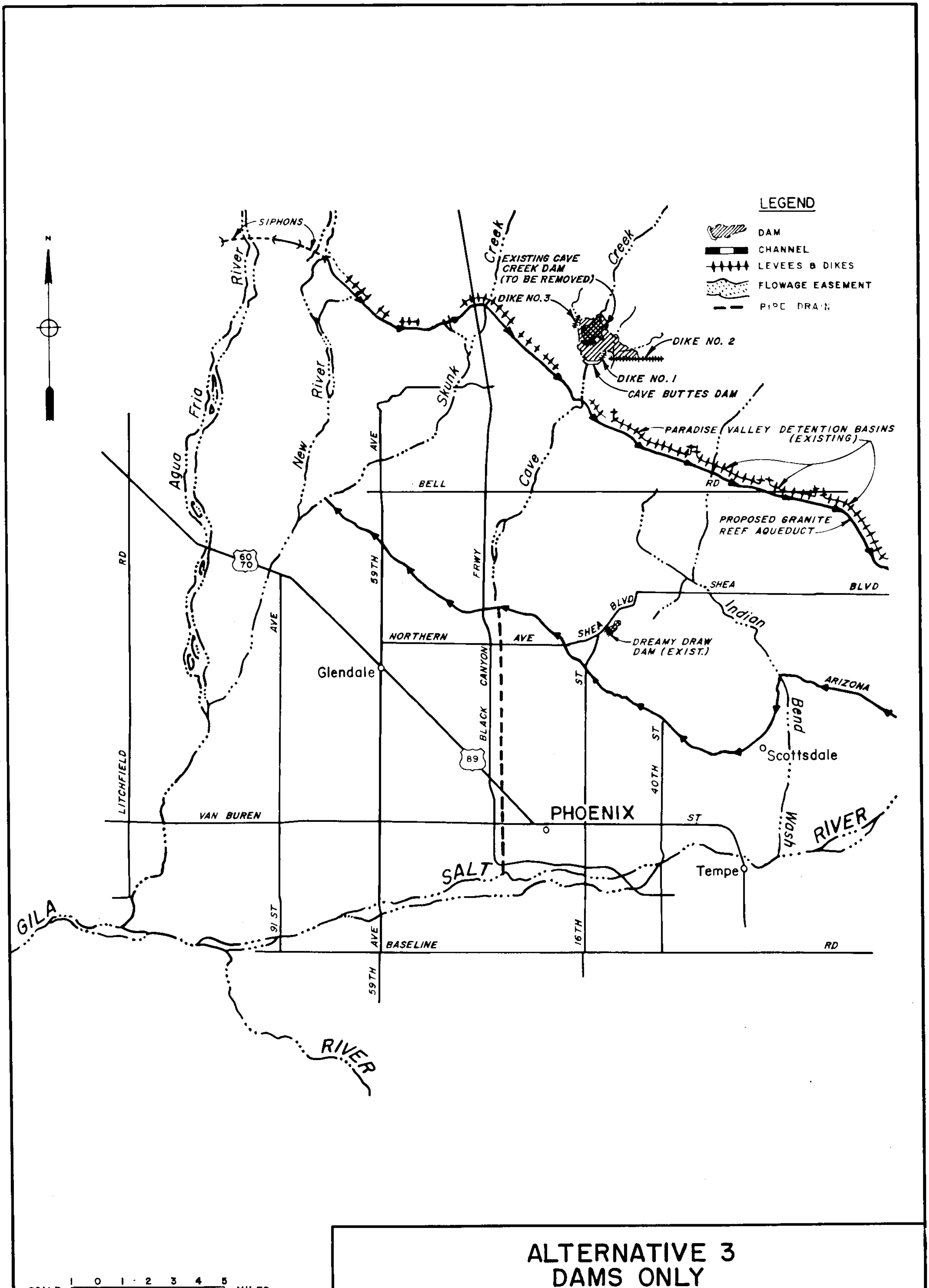
GILA RIVER BASIN
NEW RIVER & PHOENIX CITY STREAMS, ARIZONA

MARICOPA ASSOCIATION OF GOVERNMENT COMPOSITE LAND USE PLAN

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS

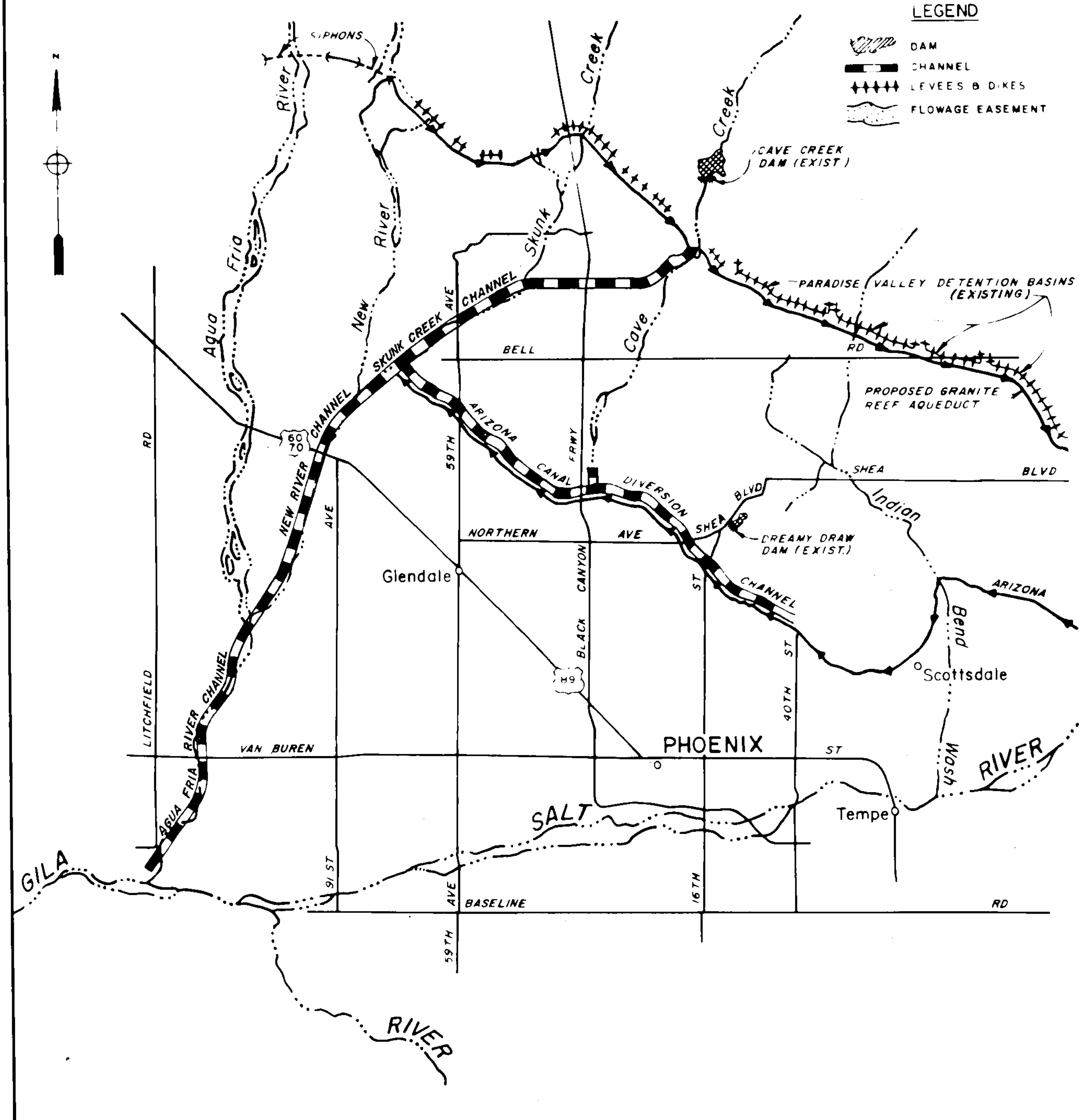


ALTERNATIVE 2
DAMS AND CHANNELS

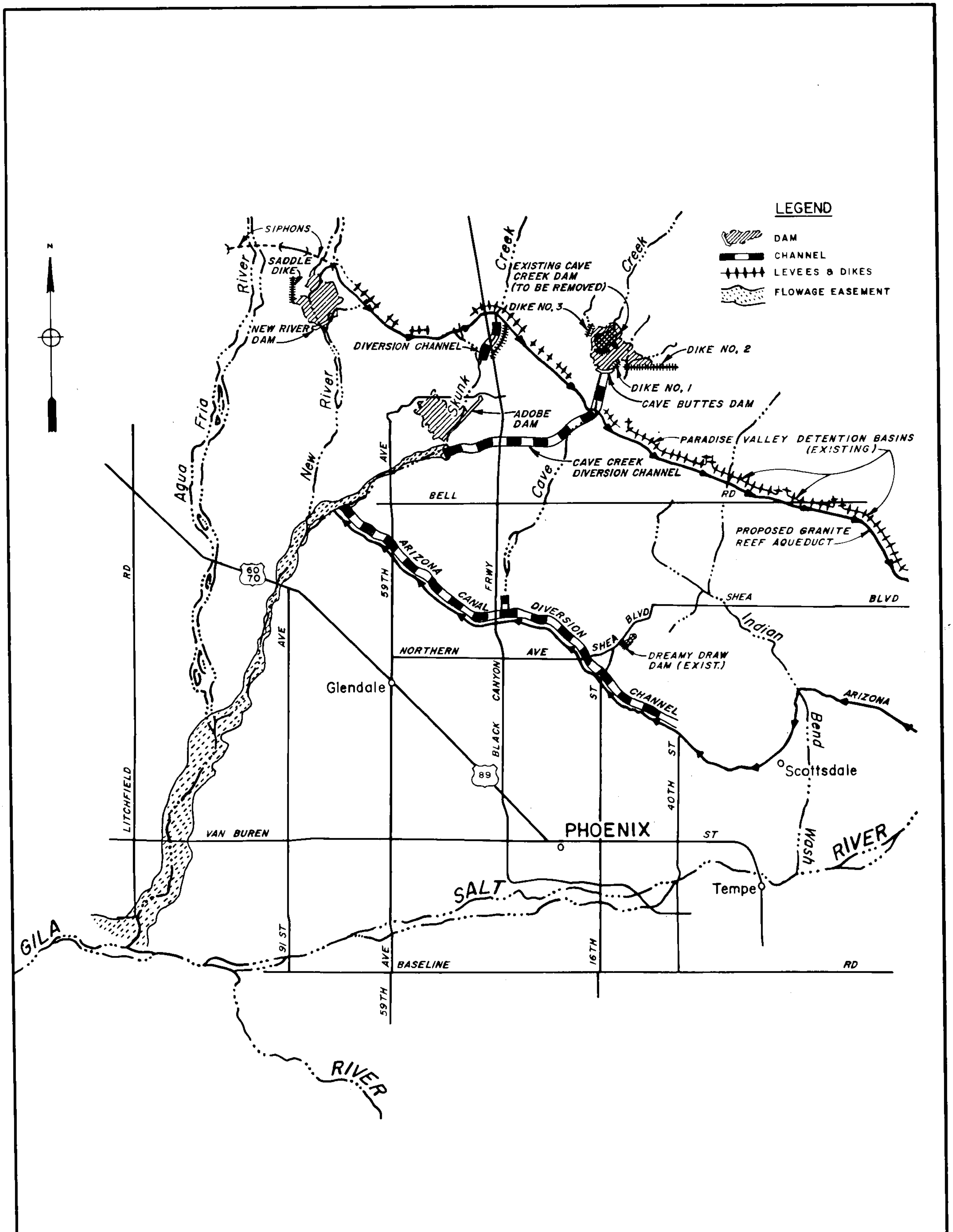


ALTERNATIVE 3
DAMS ONLY

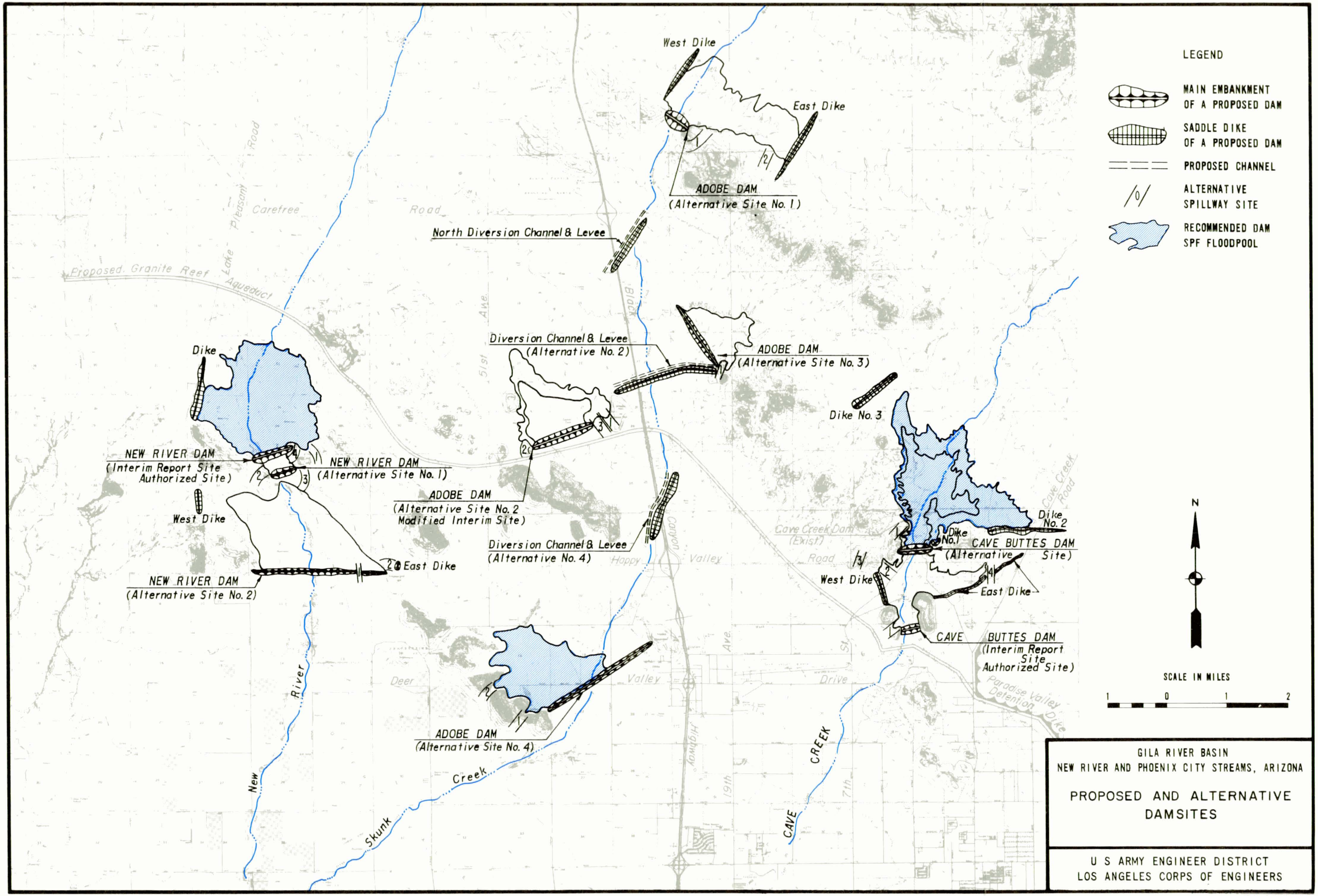
PLATE 16



ALTERNATIVE 4
CHANNELS ONLY



ALTERNATIVE 5a
STRUCTURAL & NONSTRUCTURAL MEASURES (WITH CAVE CREEK DIVERSION CHANNEL)

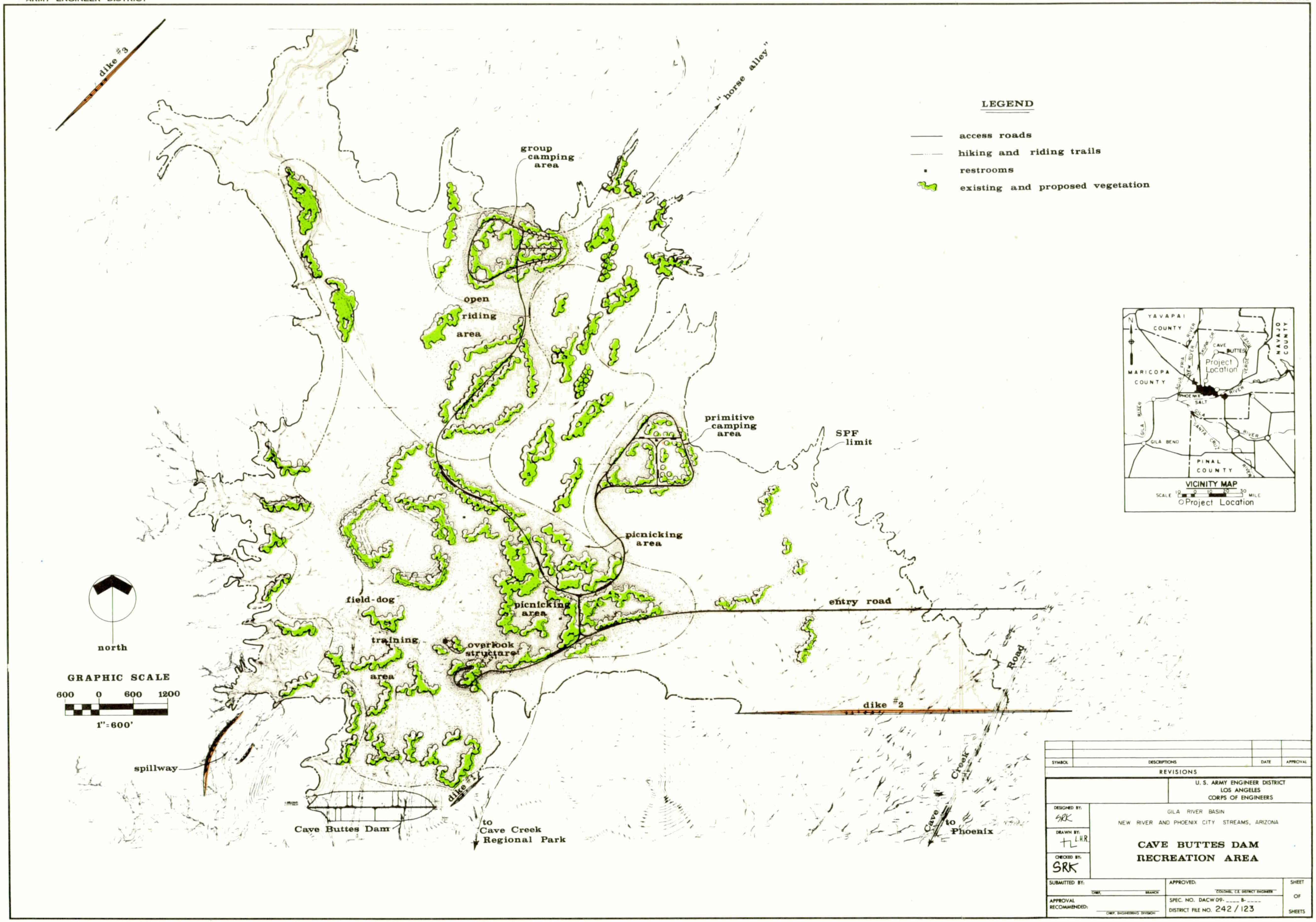


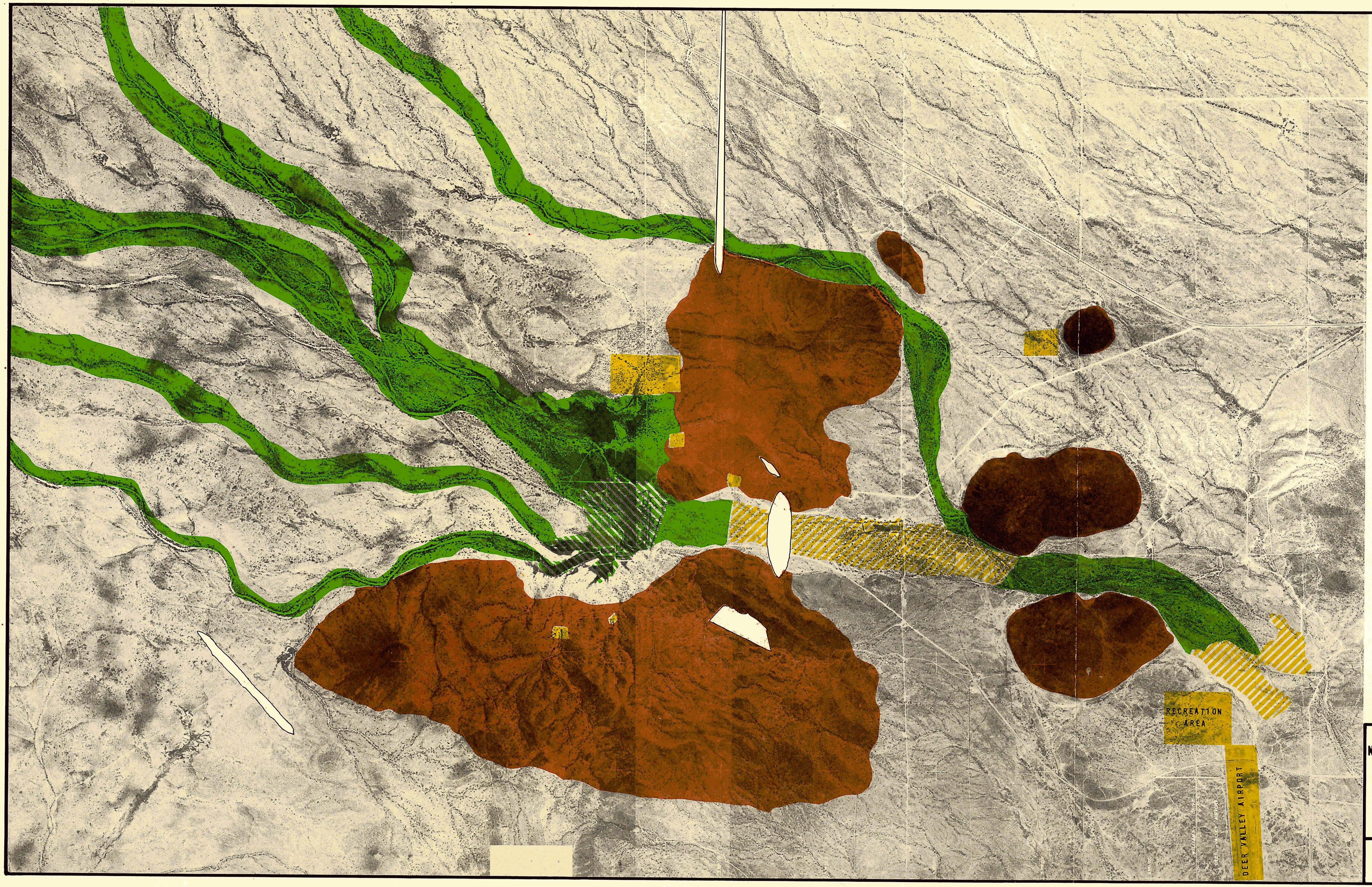
GILA RIVER BASIN
NEW RIVER AND PHOENIX CITY STREAMS, ARIZONA

PROPOSED AND ALTERNATIVE DAMSITES

U S ARMY ENGINEER DISTRICT
LOS ANGELES CORPS OF ENGINEERS

PLATE 19


LEGEND
access roads
hiking and riding trails
restrooms
existing and proposed vegetation
dike #3
"horse alley"
group camping area
open riding area
primitive camping area
SPF limit
picnicking area
picnicking area
entry road
field-dog training area
overlook structure
north
GRAPHIC SCALE
600 0 600 1200
1"=600'
spillway
Cave Buttes Dam
dike #1
to Cave Creek Regional Park
dike #2
Cave Creek Road
to Phoenix
YAVAPAI COUNTY
NAVAJO COUNTY
MARICOPA COUNTY
PINAL COUNTY
CAVE BUTTES
Project Location
PHOENIX
GILA BEND
SALT
VICINITY MAP
SCALE 10 0 10 20 30 MILE
○Project Location
SYMBOL
DESCRIPTIONS
DATE
APPROVAL
REVISIONS
U. S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS
DESIGNED BY: SRK
DRAWN BY: LHR
CHECKED BY: SRK
GILA RIVER BASIN
NEW RIVER AND PHOENIX CITY STREAMS, ARIZONA
CAVE BUTTES DAM
RECREATION AREA
SUBMITTED BY:
APPROVED:
APPROVAL RECOMMENDED:
SPEC. NO. DACW 09-____ B-____
DISTRICT FILE NO. 242 / 123
SHEET OF SHEETS

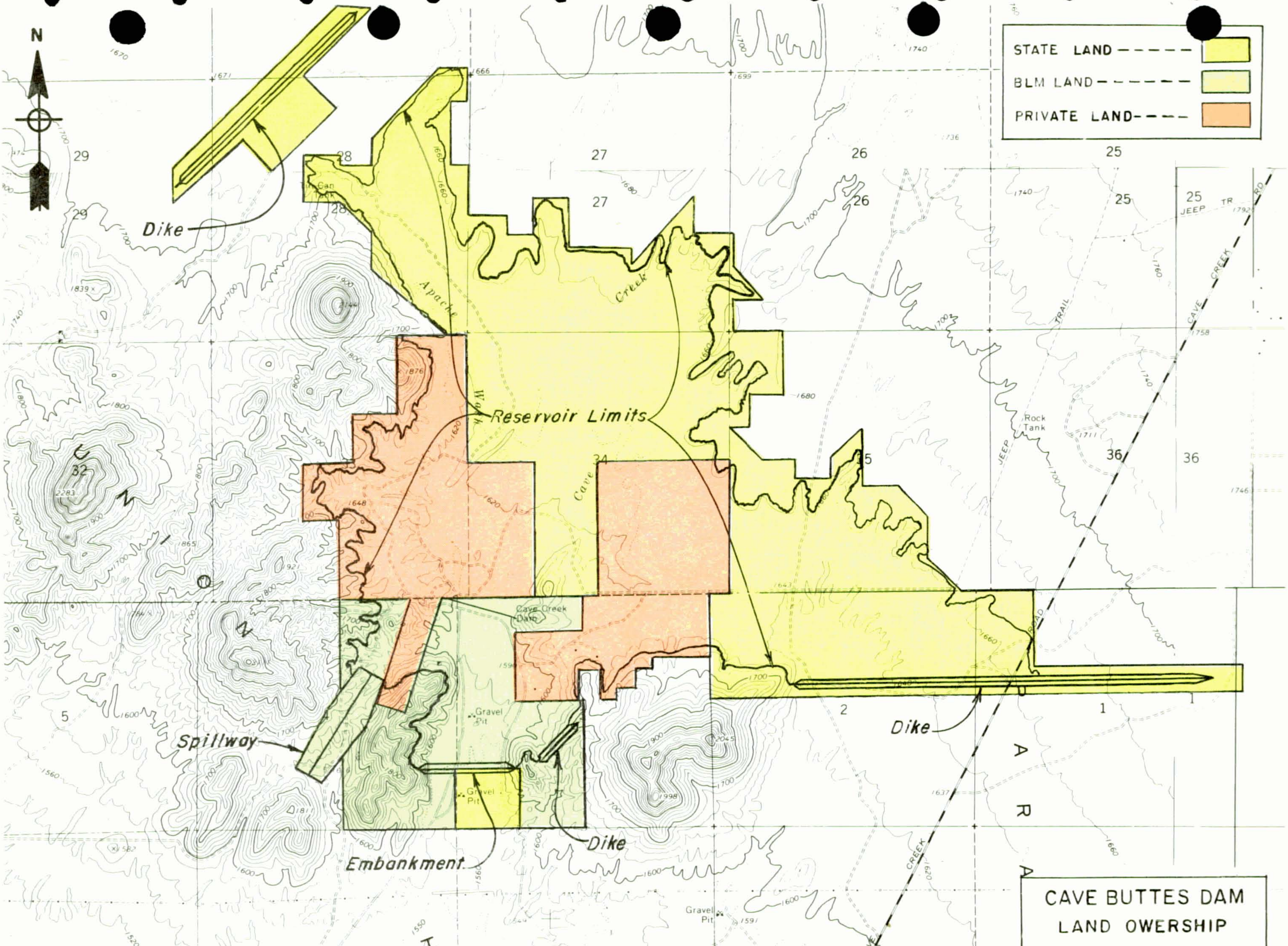


GILA RIVER BASIN
NEW RIVER AND PHOENIX CITY STREAMS, ARIZONA

LAND USE AND PLANT COMMUNITIES
CAVE BUTTES DAMSITE

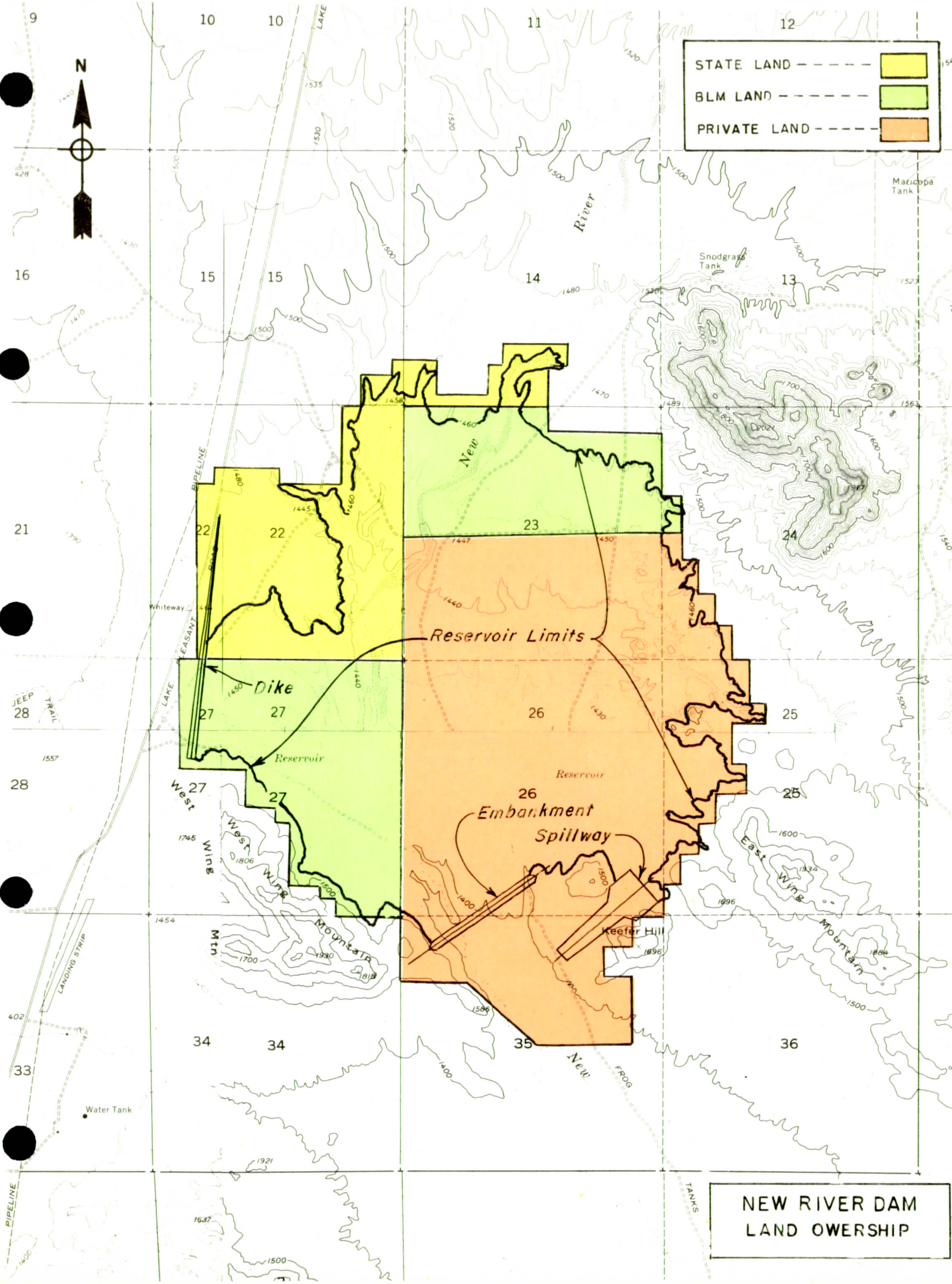
U S ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS

PLATE 21



CAVE BUTTES DAM
LAND OWERSHIP

PLATE 22



NEW RIVER DAM
LAND OWERSHIP


LEGEND
hiking and riding trails (Adobe Dam Recreation Area)
hiking and riding trails (Thunderbird Park)
restrooms
existing and proposed vegetation
standard project flood elevation
Thunderbird Park boundary line (county park)
no Corps participation
Corps participation (irrigated / non-irrigated)
VICINITY MAP
YAVAPAI COUNTY
MARICOPA COUNTY
PINAL COUNTY
PHOENIX
Project Location
equestrian center
park maintance yard
clubhouse
PINNACLE PEAK ROAD
to Skunk Creek recreation area
hiking trails
9 hole golf course and driving range
18 hole golf course
sports area
picnicking area
group picnic
picnic
hiking trails
amphitheater
park headquarters
interperative complex
hiking and riding trails
group picnicking area
recreation complex
group camping area
DEER VALLEY DRIVE
SKUNK CREEK
Embankment
Outlet Conduit
Spillway
Access Road
Access Ramp
to 51st avenue trail
north
GRAPHIC SCALE
500 0 500 1000
1" = 500'
N 971,888
E 425,640
SYMBOL | DESCRIPTIONS | DATE | APPROVAL
REVISIONS
U. S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS
DESIGNED BY: T.L.
DRAWN BY: L.H.R. T.L.
CHECKED BY:
GILA RIVER BASIN
NEW RIVER AND PHOENIX CITY STREAMS, ARIZONA
ADOBE DAM
RECREATION AREA
SUBMITTED BY:
CHIEF, BRANCH
APPROVED:
COLONEL, C.E. DISTRICT ENGINEER
APPROVAL RECOMMENDED:
CHIEF, ENGINEERING DIVISION
SPEC. NO. DACW 09-____ B-____
DISTRICT FILE NO. 242 / 125
SHEET OF SHEETS

LEGEND

- UPLAND
- OLDFIELD & OUTWASH
- RIPARIAN
- AGRICULTURAL
- URBAN

N

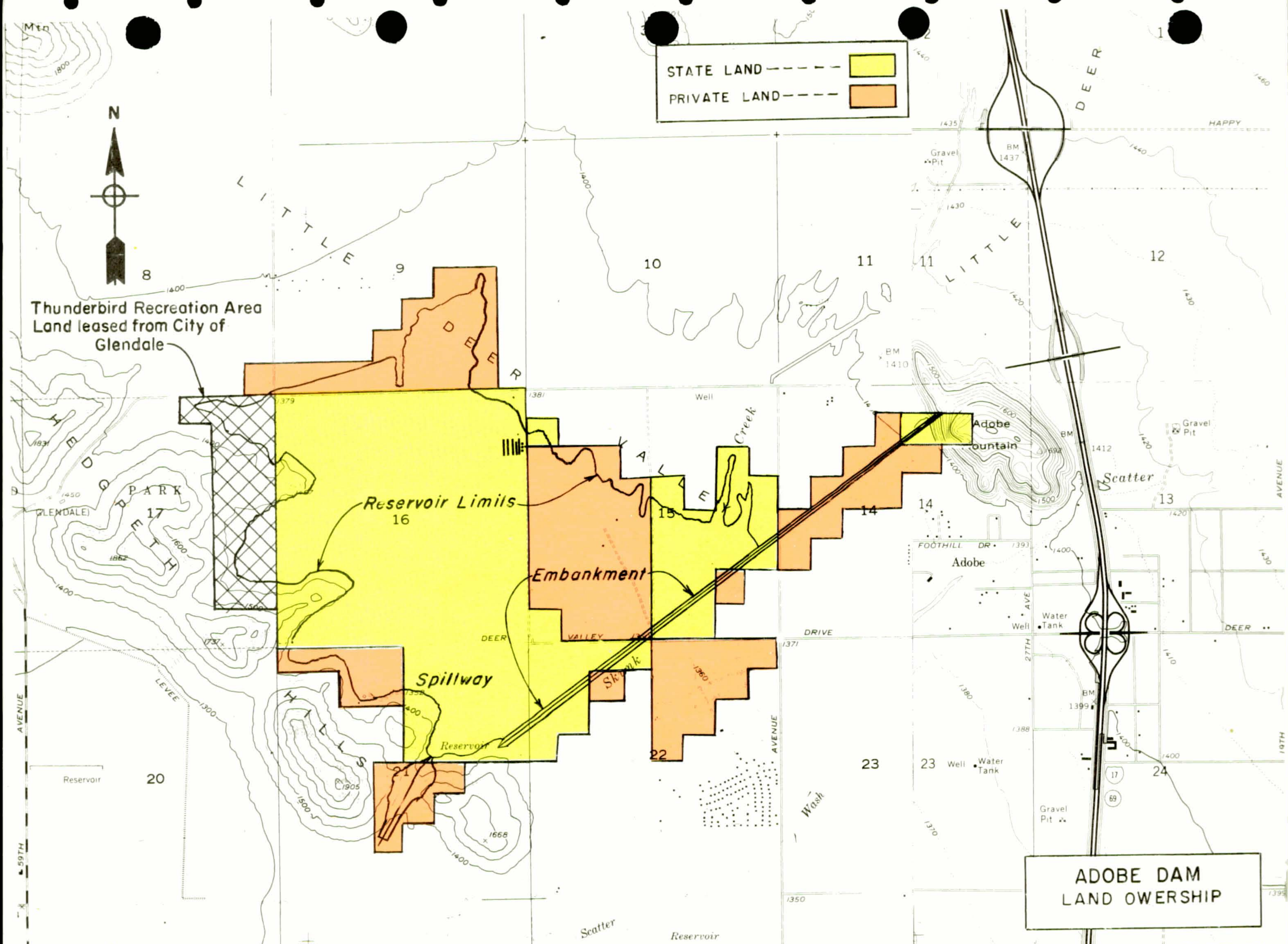
SCALE IN FEET
1500 0 1500

GILA RIVER BASIN
NEW RIVER AND PHOENIX CITY STREAMS, ARIZONA

LAND USE AND PLANT COMMUNITIES
ADOBE DAMSITE NUMBER 4

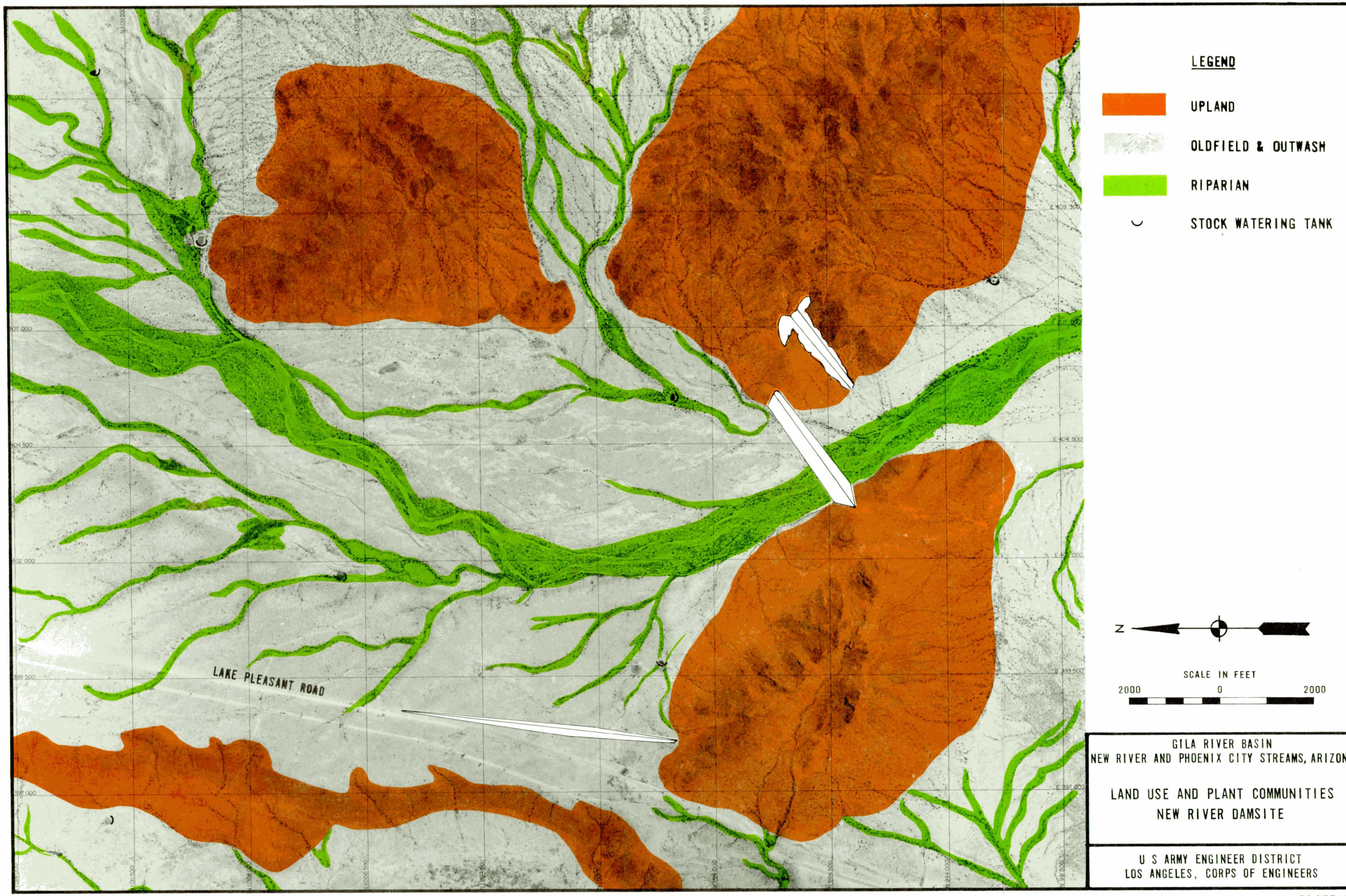
U S ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS

PLATE 24



STATE LAND
PRIVATE LAND
N
Thunderbird Recreation Area Land leased from City of Glendale
Reservoir Limits
Embankment
Spillway
LITTLE DEER VALLEY Creek
HEDGPETH PARK
HEDGPETH HILLS
DEER VALLEY DRIVE
FOOTHILL DR
Adobe
Adobe Mountain
Scatter
Reservoir
Well
Water Tank
Gravel Pit
HAPPY
27TH AVE
19TH AVENUE
59TH AVENUE
LEVEE
Wash
ADOBE DAM
LAND OWERSHIP

PLATE 25

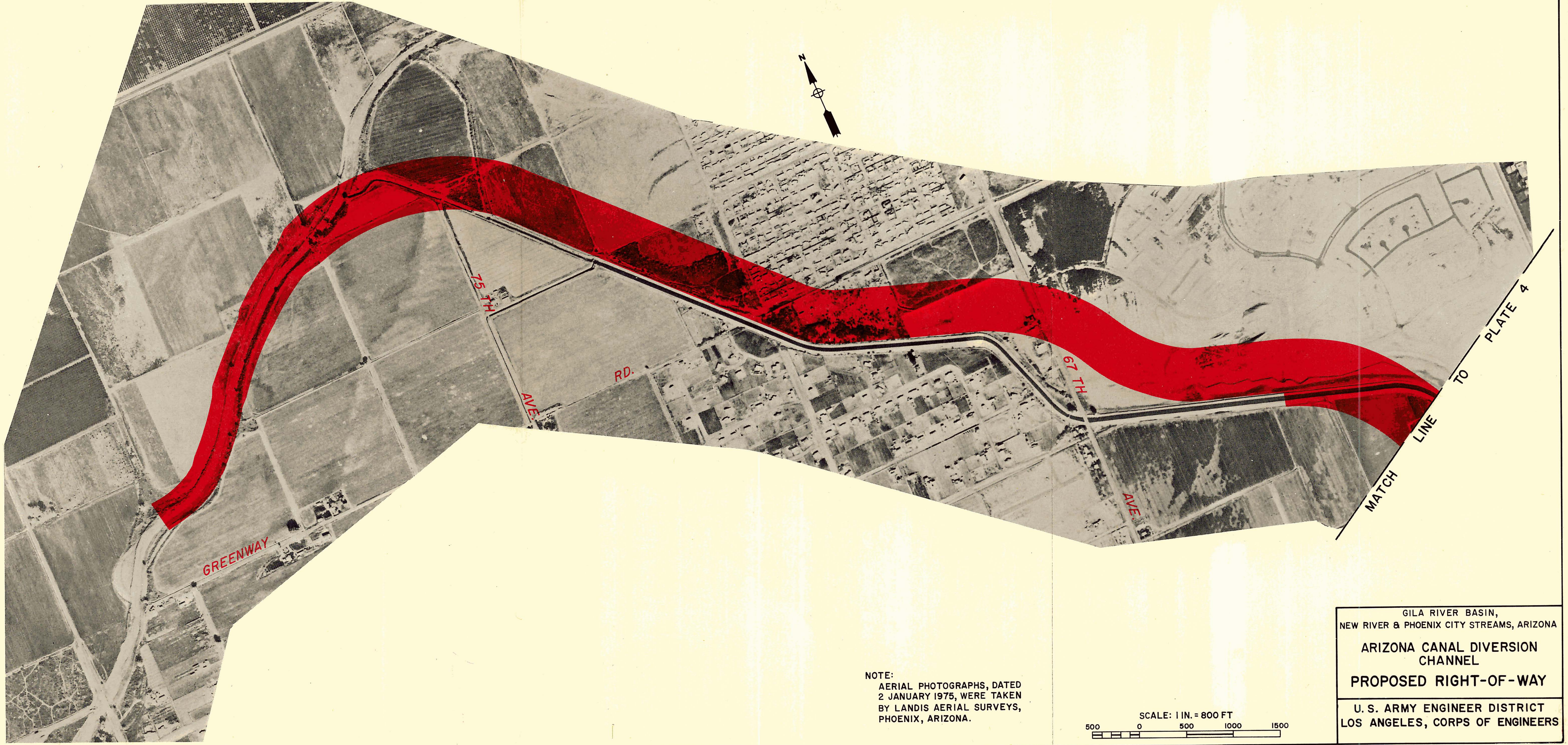


GILA RIVER BASIN
NEW RIVER AND PHOENIX CITY STREAMS, ARIZONA

LAND USE AND PLANT COMMUNITIES
NEW RIVER DAMSITE

U S ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS

PLATE 26



NOTE:
AERIAL PHOTOGRAPHS, DATED 2 JANUARY 1975, WERE TAKEN BY LANDIS AERIAL SURVEYS, PHOENIX, ARIZONA.

SCALE: 1 IN. = 800 FT

500 0 500 1000 1500

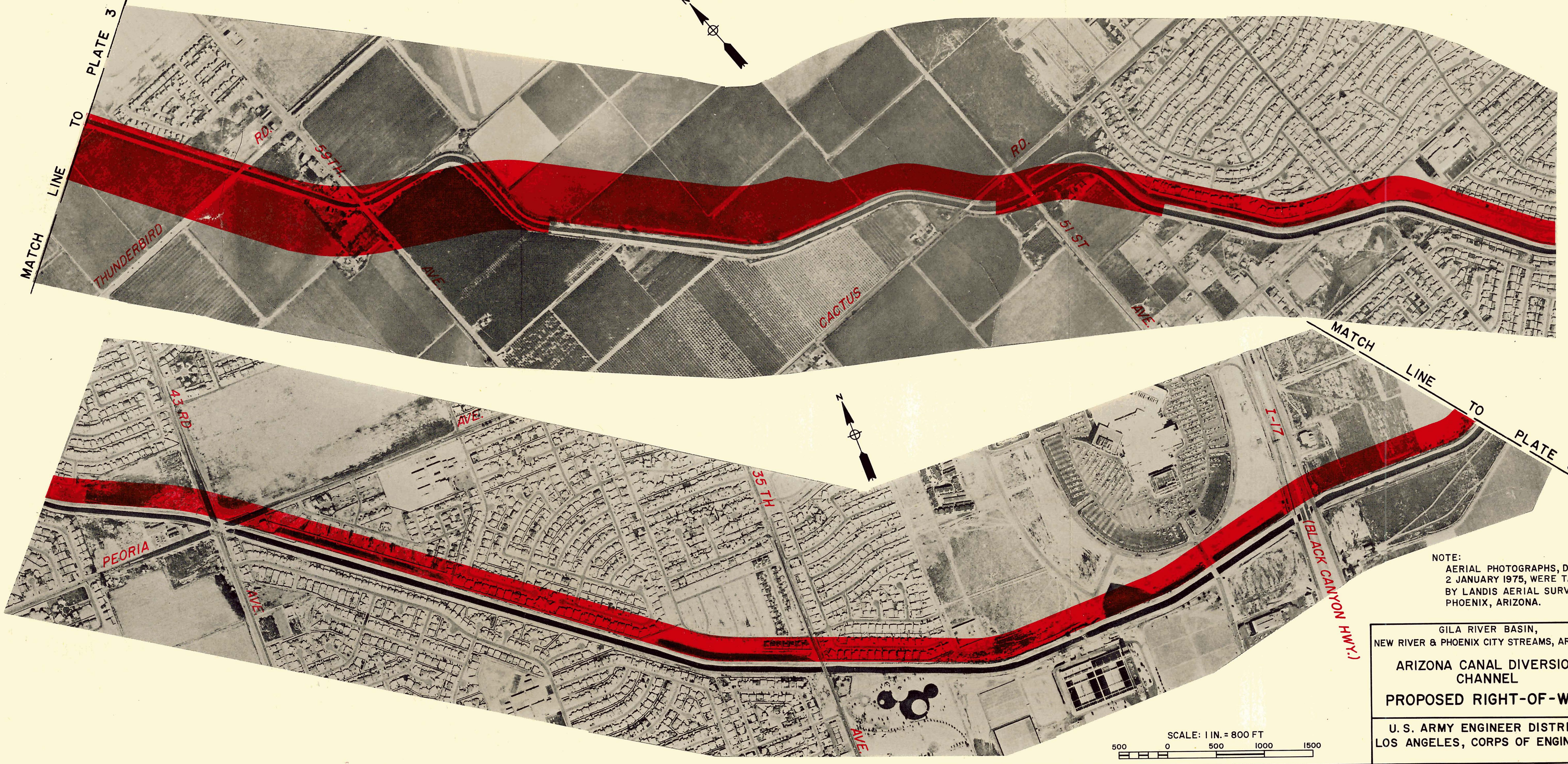
GILA RIVER BASIN,
NEW RIVER & PHOENIX CITY STREAMS, ARIZONA

ARIZONA CANAL DIVERSION CHANNEL

PROPOSED RIGHT-OF-WAY

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS

PLATE 28a



NOTE:
AERIAL PHOTOGRAPHS, DATED 2 JANUARY 1975, WERE TAKEN BY LANDIS AERIAL SURVEYS, PHOENIX, ARIZONA.

GILA RIVER BASIN,
NEW RIVER & PHOENIX CITY STREAMS, ARIZONA

ARIZONA CANAL DIVERSION CHANNEL

PROPOSED RIGHT-OF-WAY

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS

PLATE 28b

NOTE:
AERIAL PHOTOGRAPHS, DATED 2 JANUARY 1975, WERE TAKEN BY LANDIS AERIAL SURVEYS, PHOENIX, ARIZONA.

SCALE: 1 IN. = 800 FT
500 0 500 1000 1500

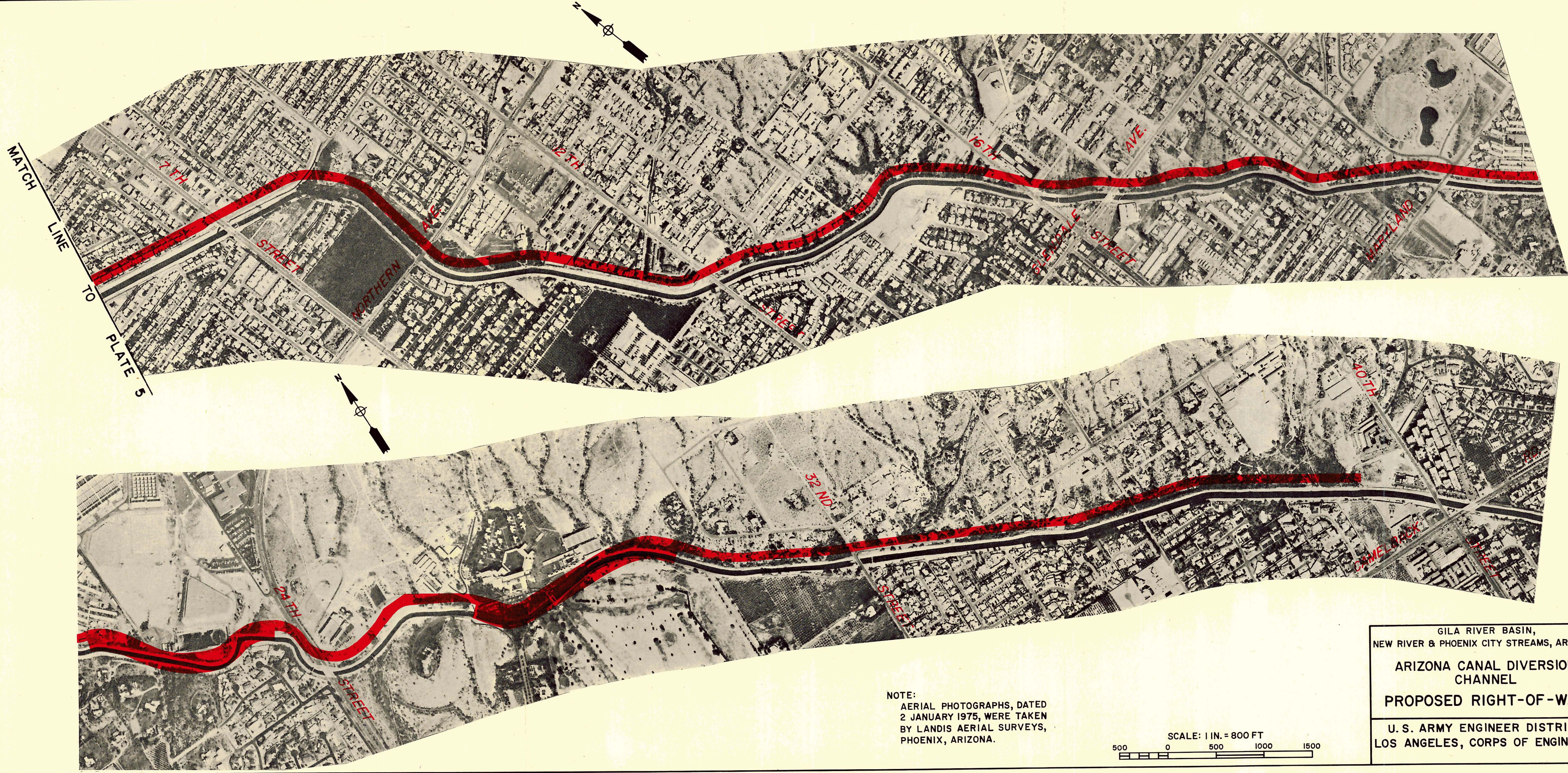
GILA RIVER BASIN,
NEW RIVER & PHOENIX CITY STREAMS, ARIZONA

ARIZONA CANAL DIVERSION CHANNEL

PROPOSED RIGHT-OF-WAY

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS

PLATE 28c



NOTE:
AERIAL PHOTOGRAPHS, DATED 2 JANUARY 1975, WERE TAKEN BY LANDIS AERIAL SURVEYS, PHOENIX, ARIZONA.

GILA RIVER BASIN,
NEW RIVER & PHOENIX CITY STREAMS, ARIZONA

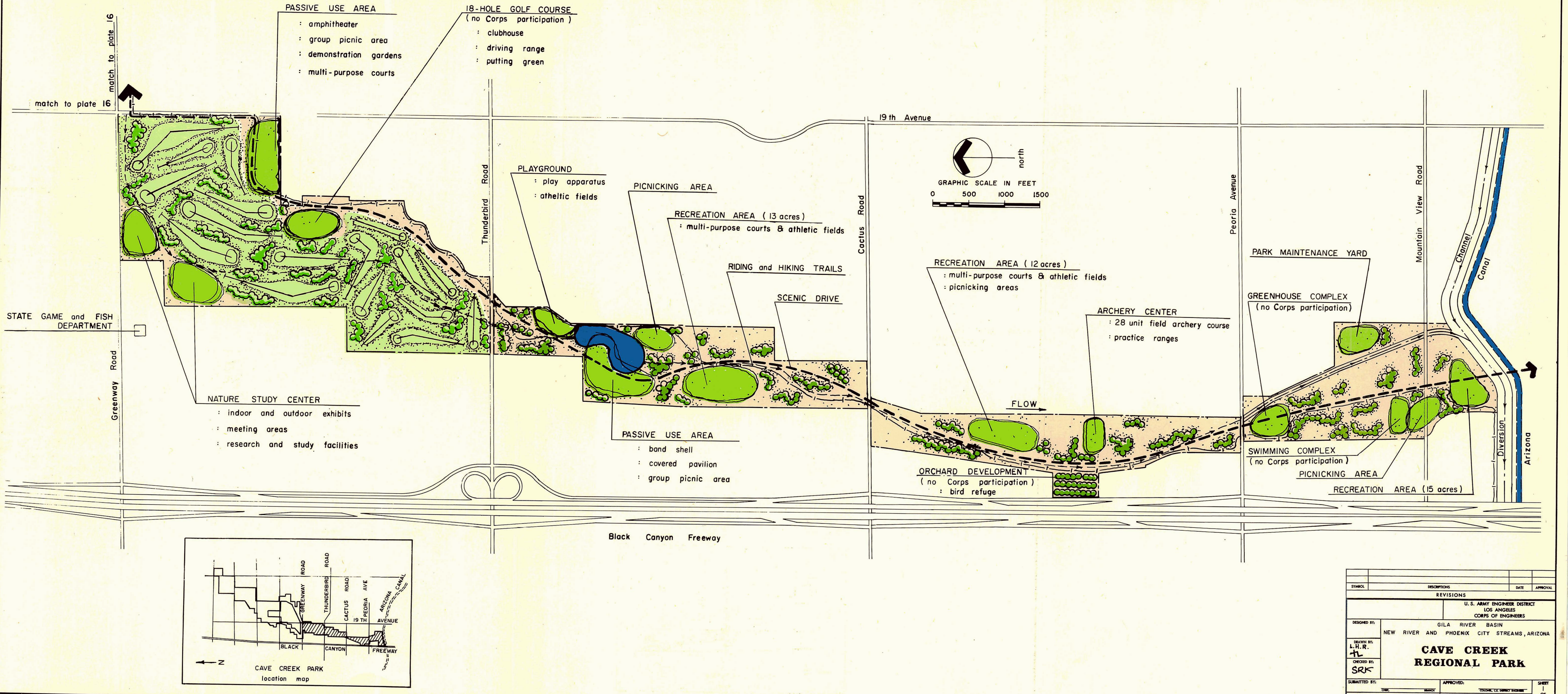
ARIZONA CANAL DIVERSION CHANNEL

PROPOSED RIGHT-OF-WAY

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS

U.S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS



SYMBOL	DESCRIPTIONS	DATE	APPROVAL

REVISIONS

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY:

DRAWN BY: L.H.R.

CHECKED BY: SRK

GILA RIVER BASIN
NEW RIVER AND PHOENIX CITY STREAMS, ARIZONA

CAVE CREEK REGIONAL PARK

SUBMITTED BY: CHIEF, BRANCH

APPROVED: COLONEL, C.E. DISTRICT ENGINEER

APPROVAL RECOMMENDED: CHIEF, ENGINEERING DIVISION

SPEC. NO. DACW 09-____ B-____

DISTRICT FILE NO. 242 / 130

SHEET 1 OF 3 SHEETS

U.S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS

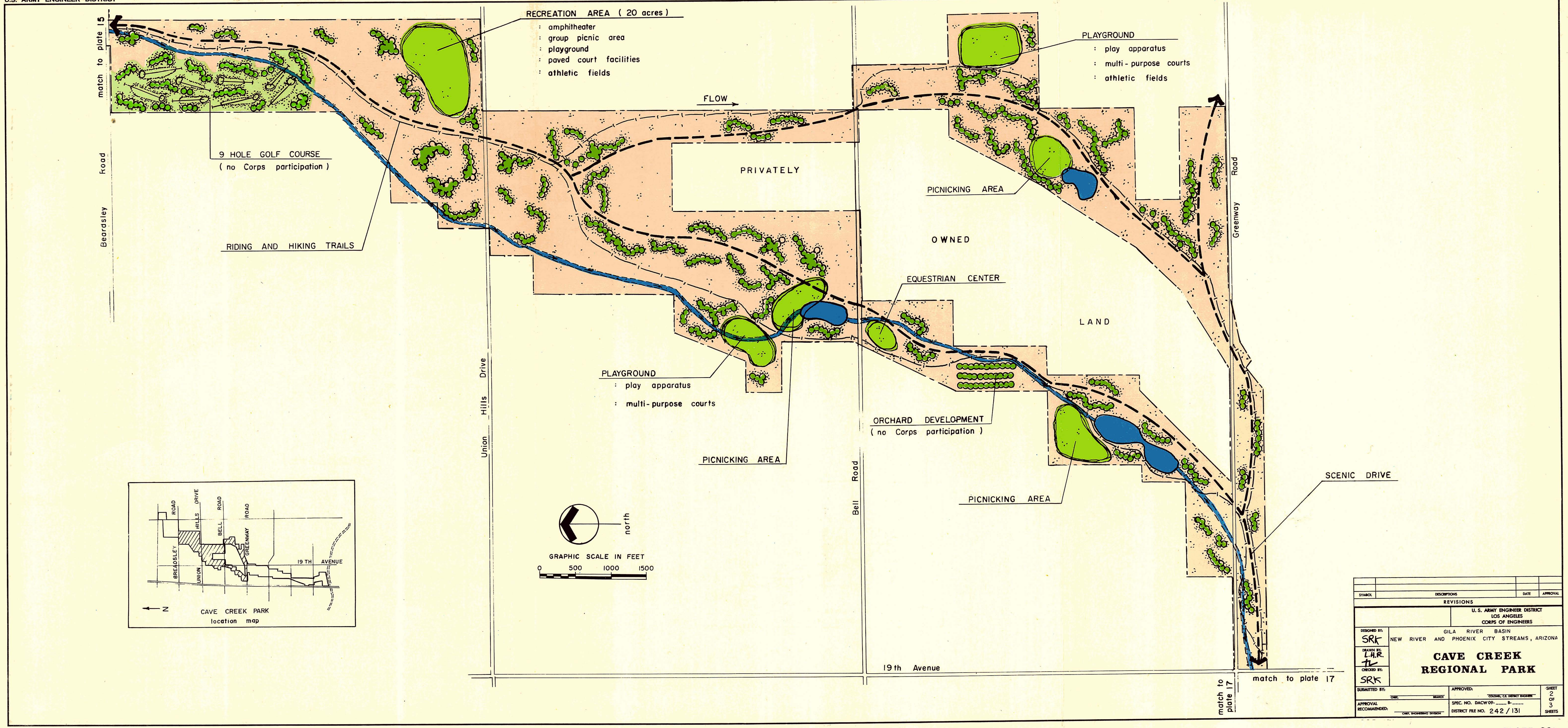


PLATE 29b

SYMBOL	DESCRIPTIONS	DATE	APPROVAL

REVISIONS

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: SRK
DRAWN BY: LHR
CHECKED BY: SRK

GILA RIVER BASIN
NEW RIVER AND PHOENIX CITY STREAMS, ARIZONA

CAVE CREEK REGIONAL PARK

SUBMITTED BY: ______ CHIEF, ______ BRANCH

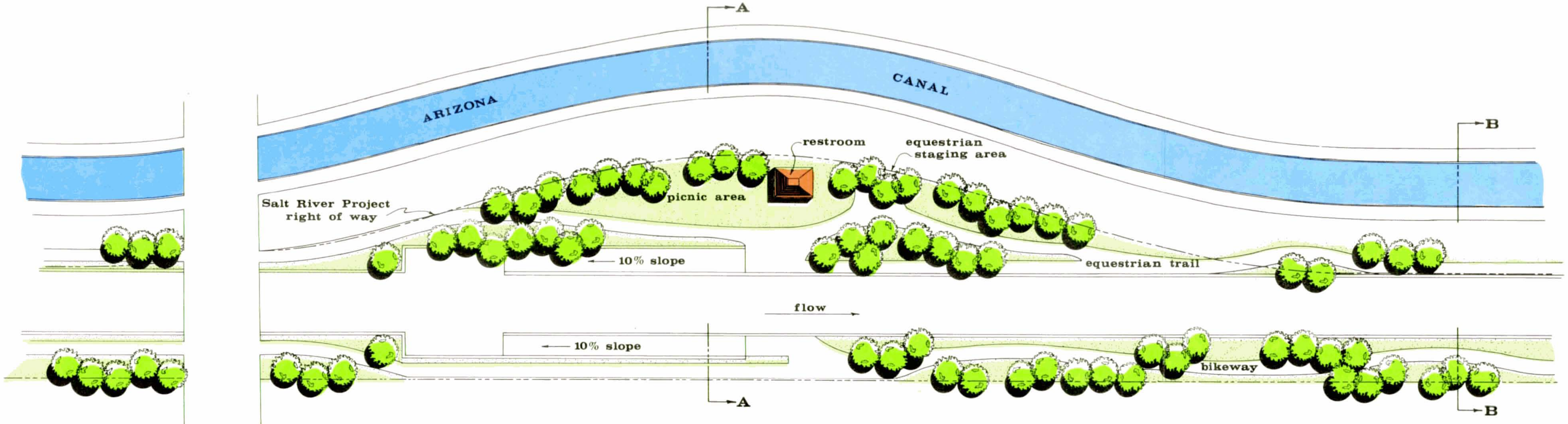
APPROVED: ______ COLONEL, C.E. DISTRICT ENGINEER

APPROVAL RECOMMENDED: ______ CHIEF, ENGINEERING DIVISION

SPEC. NO. DACW 09- ____ B- ____

DISTRICT FILE NO. 242/132

SHEET 3 OF 3 SHEETS



REST AREA and RECTANGULAR CHANNEL STREET CROSSING (TYPICAL)

north

GRAPHIC SCALE

30 0 30 60

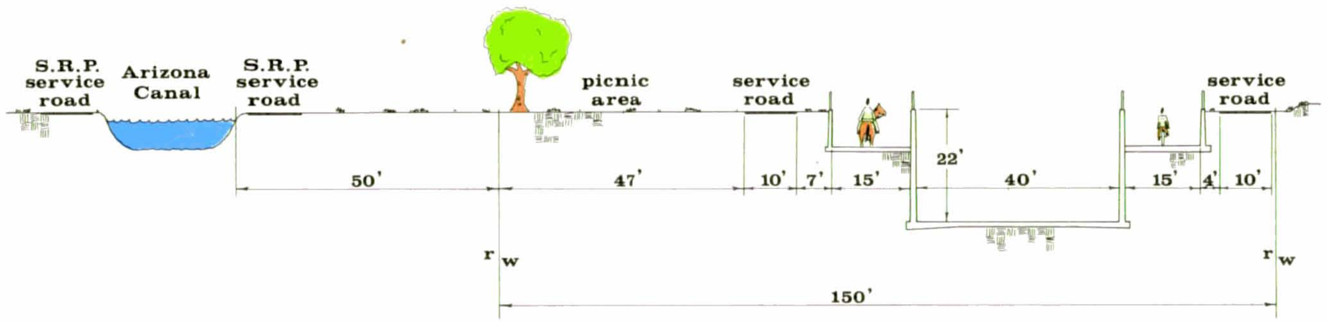
1" = 30'

SECTION A:A

GRAPHIC SCALE

10 0 10 20 30

3/4" = 10'

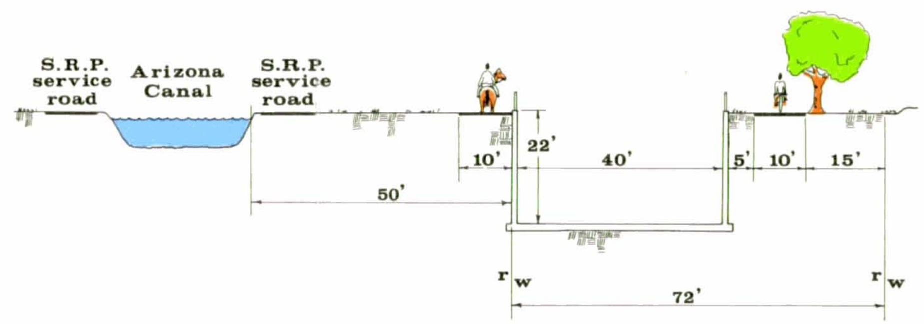


SECTION B:B

GRAPHIC SCALE

10 0 10 20 30

3/4" = 10'



SYMBOL	DESCRIPTIONS	DATE	APPROVAL

REVISIONS

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: SRK
DRAWN BY: LHR
CHECKED BY: SRK

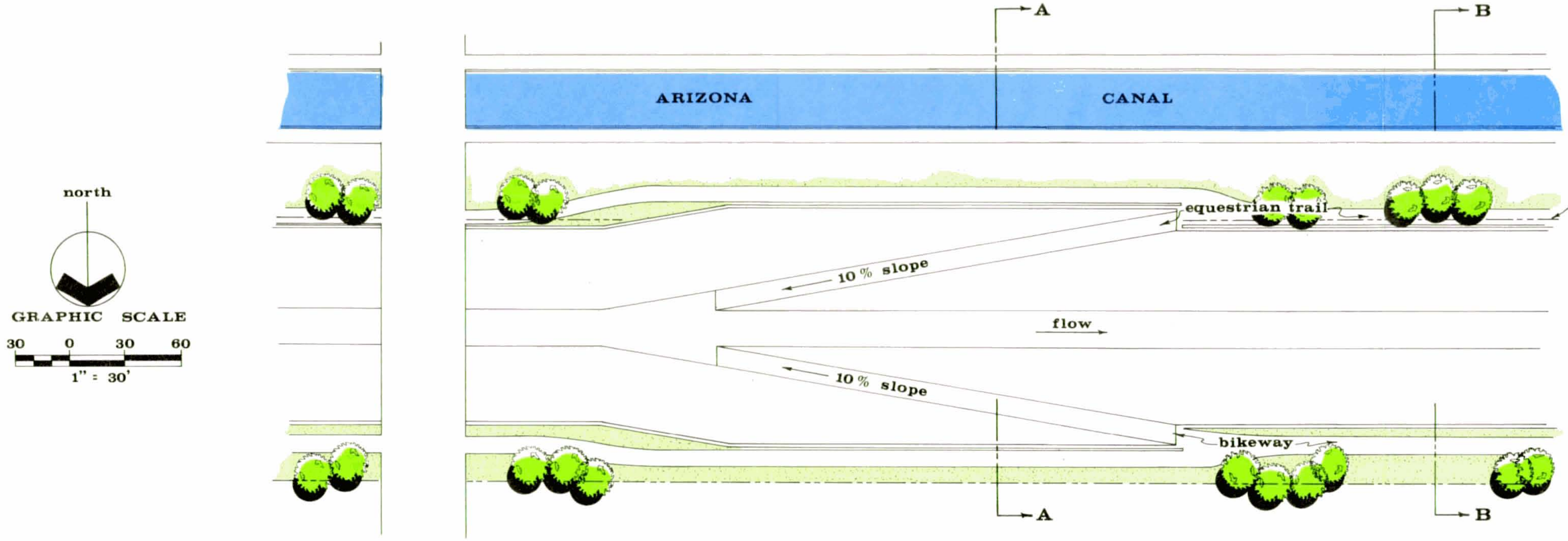
GILA RIVER BASIN
NEW RIVER AND PHOENIX CITY STREAMS, ARIZONA

ARIZONA CANAL DIVERSION CHANNEL - RECREATION AND ESTHETIC TREATMENT

SUBMITTED BY: CHIEF, BRANCH
APPROVED: COLONEL, C.E. DISTRICT ENGINEER
APPROVAL RECOMMENDED: CHIEF, ENGINEERING DIVISION

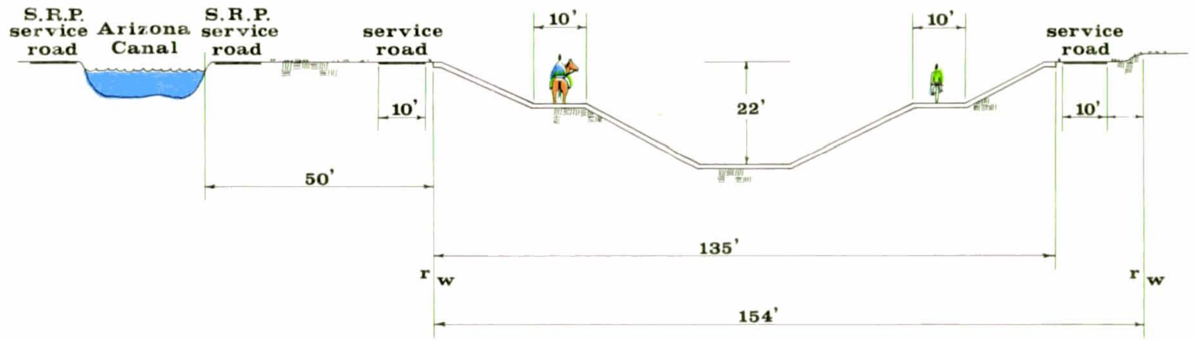
SPEC. NO. DACW 09-____ B-____
DISTRICT FILE NO. 242/126

SHEET 1 OF 2 SHEETS

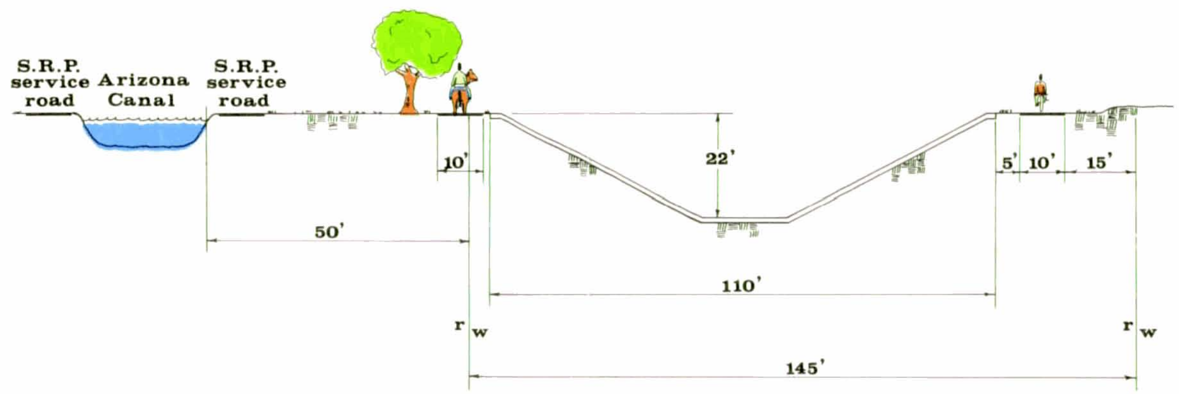


TRAPEZOIDAL CHANNEL STREET CROSSING (TYPICAL)

SECTION A:A



SECTION B:B



GRAPHIC SCALE

15 0 15 30

1" = 15'

SYMBOL	DESCRIPTIONS	DATE	APPROVAL

REVISIONS

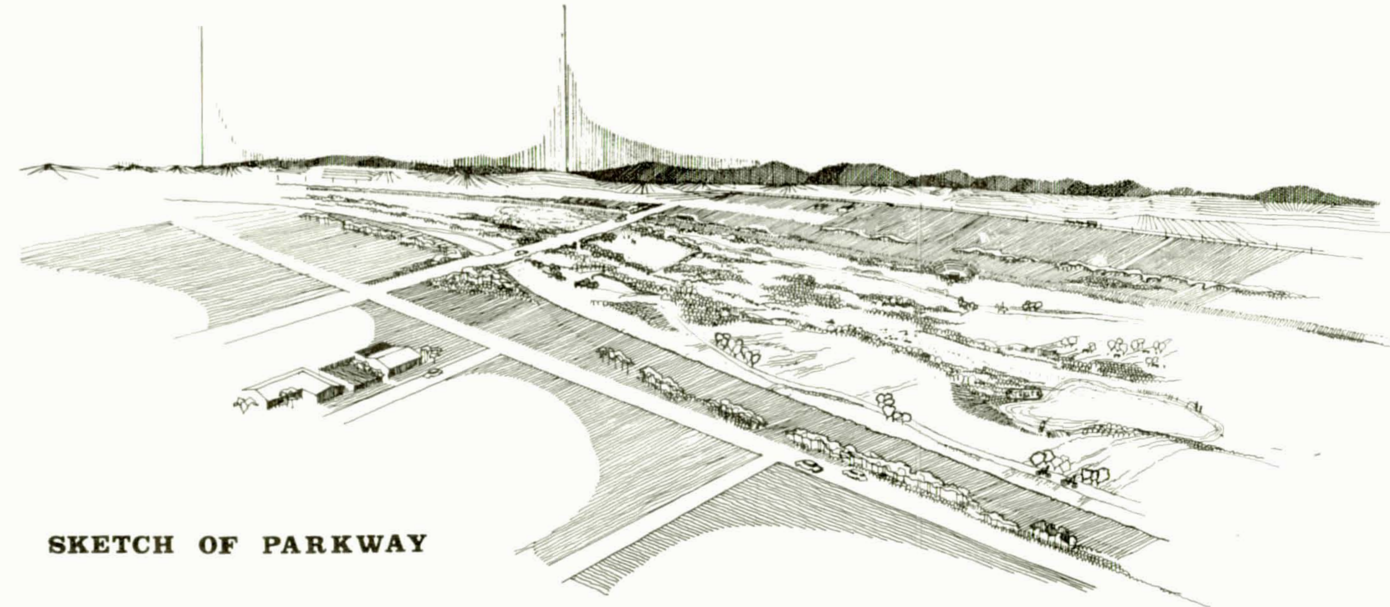
U. S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: SRK
DRAWN BY: LHR
CHECKED BY: SRK

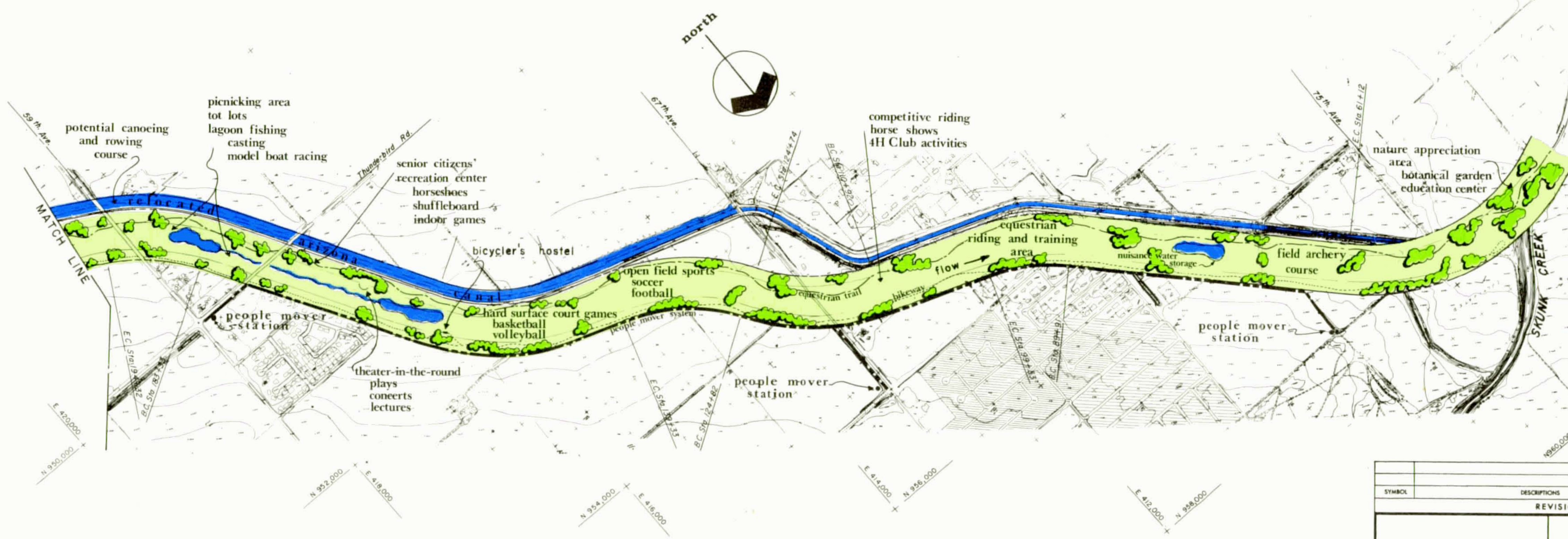
GILA RIVER BASIN
NEW RIVER AND PHOENIX CITY STREAMS, ARIZONA

ARIZONA CANAL DIVERSION CHANNEL RECREATION AND ESTHETIC TREATMENT

SUBMITTED BY: CHIEF, BRANCH
APPROVAL RECOMMENDED: CHIEF, ENGINEERING DIVISION
APPROVED: COLONEL, C.E. DISTRICT ENGINEER
SPEC. NO. DACW 09-___ B-___
DISTRICT FILE NO. 242 / 127
SHEET 2 OF 2 SHEETS



SKETCH OF PARKWAY



GRAPHIC SCALE

500 0 500 1000 1500

1" = 500'

SYMBOL	DESCRIPTIONS	DATE	APPROVAL

REVISIONS

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: SRK
DRAWN BY: LHR
CHECKED BY: SRK

GILA RIVER BASIN
NEW RIVER AND PHOENIX CITY STREAMS, ARIZONA

ARIZONA CANAL DIVERSION CHANNEL – CONCEPT FOR

GLENDALE PARKWAY

SUBMITTED BY: CHIEF, BRANCH
APPROVED: COLONEL, C.E. DISTRICT ENGINEER
APPROVAL RECOMMENDED: CHIEF, ENGINEERING DIVISION
SPEC. NO. DACW09-___ B-___
DISTRICT FILE NO. 242/129
SHEET OF SHEETS

Appendix 1

Finding of No Significant Impact

and

Supplemental Environmental Assessment

DEPARTMENT OF THE ARMY
LOS ANGELES DISTRICT, CORPS OF ENGINEERS
P.O. BOX 2711
LOS ANGELES, CALIFORNIA 90053-2325

REPLY TO
ATTENTION OF:

FINDING OF NO SIGNIFICANT IMPACT

Phoenix, Arizona, and Vicinity

Arizona Canal Diversion Channel
Maricopa County, Arizona

I have reviewed the supplemental environmental assessment prepared for the purchase of additional lands for the Arizona Canal Diversion Channel, Maricopa County, Arizona (Enclosure 1). The significant resources potentially affected by this project modification include land use and cultural resources. I have considered possible impacts on these significant resources as discussed in the supplemental environmental assessment and find that there are no significant impacts resulting from the purchase of additional lands for the project. An environmental impact statement need not be prepared for this project modification.

31 Jan 86
DATE

Norman ... , LTC
D. FRED BUTLER
for
Colonel, Corps of Engineers
District Engineer

FINAL
SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT

Phoenix, Arizona, and Vicinity

Arizona Canal Diversion Channel

Maricopa County, Arizona

U. S. ARMY CORPS OF ENGINEERS

LOS ANGELES DISTRICT

LOS ANGELES, CALIFORNIA

January 1986

CONTENTS

FINAL
SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT

ARIZONA CANAL DIVERSION CHANNEL

MARICOPA COUNTY, ARIZONA

1. PROJECT LOCATION

1.1 The project covered by the feature design memorandum (main report) is the Arizona Canal Diversion Channel - 40th Street to Cactus Road, including Cave Creek Sediment Basin, Cave Creek Channel, and Cudia City Wash Sediment Basin(ACDC). These project features will be located in Maricopa County within the town of Paradise Valley and the City of Phoenix, Arizona. The diversion channel will extend from Cudia City Wash near 40th Street at the upstream end to just northwest of Cactus Road, a distance of about 12.5 miles (plate 1). It will be located nearly parallel and adjacent to the existing Arizona Canal.

2. PROJECT BACKGROUND

2.1 The ACDC is an authorized project feature of the Phoenix, Arizona and Vicinity (Including New River) Flood Control Project. The overall project consists of four earthfill flood control dams (Dreamy Draw, Cave Buttes, Adobe, and New River), the ACDC, Skunk Creek, and the New and Agua Fria Rivers from the ACDC to the Gila River. The environmental impacts associated with all features of the project were presented in the Final Environmental Impact Statement (FEIS), Phoenix, Arizona and Vicinity (including New River) Flood Control Project, Maricopa County, Arizona, prepared by the U. S. Army Corps of Engineers, Los Angeles District, March 1976. The ACDC is specifically addressed in Section VI of the FEIS. The impacts associated with changes made subsequent to the FEIS were presented in the environmental assessment (EA) and Finding of No Significant Impact (FONSI) for the final Design Memorandum No. 3, General Design Memorandum - Phase II for the Arizona Canal Diversion Channel (Including Cave Creek Channel and Sediment Basins on Cave Creek and Cudia City Wash), dated March 1985 (GDM-3). The impacts associated with the disposal sites for the project were presented in the EA/FONSI, Disposal Sites, ACDC, dated June 1985. The impacts associated with modifications to the Skunk Creek and the New and Agua Fria Rivers portion of the project were presented in the (draft) environmental assessment and FONSI dated July 1985, currently under review. The

7. AFFECTED ENVIRONMENT

7.1 General. Details of the existing environment may be found in the FEIS and the EA/FONSI (which is part of the GDM-3). The following resources were reexamined for this EA and found to have no significant changes since the March 1985 EA/FONSI for the GDM-3: soils; air quality; surface water resources; ground water resources; water quality; noise; esthetics; transportation; safety; and social resources. Vegetation and wildlife resources were examined and it was determined that the project modifications would not significantly impact biotic resources of the additional lands. The significant resources which may be impacted by the change in the project covered by this EA were determined to be land use and cultural resources, which are covered in the following paragraphs.

7.2 Land Use. Land use within the ACDC project area is predominantly residential and commercial development, with some light commercial development. Land use has not changed appreciably since the completion of the EA/FONSI.

7.3 Cultural Resources. A record search and archeological survey of the original ACDC alignment were performed by Arizona State University under contract to the Corps in 1973. Subsequent changes in the alignment were surveyed by New World Research, Inc., under contract to the Corps in 1983. A No Effect determination for that alignment was coordinated with the Arizona State Historic Preservation Office (SHPO) in 1984.

The areas affected by the most recent changes in the ACDC alignment were surveyed by two Corps archeologists in September 1985. No cultural resources of any kind were found.

8. ENVIRONMENTAL EFFECTS

8.1 General. A FEIS was prepared by the Corps in March 1976 to address the environmental impacts associated with construction of the ACDC. In addition, the Corps completed an EA/FONSI as part of the GDM-3 in March 1985 to address changes made subsequent to completion of the FEIS. Additional EA's prepared for this project are listed in Section 2, Project Background. This EA will address only those changes made subsequent to the EA/FONSI (Section 5).

8.2 Land Use. The existing land use on the areas affected by the most recent changes in the ACDC alignment would be changed from urban/ruderal to open space, with landscaping being added for esthetic treatment.

8.3 Cultural Resources. The areas affected by the most recent changes in the ACDC alignment were surveyed by two Corps archeologists in September 1985. No cultural resources of any kind were found. Therefore, the proposed realignment will not affect any significant cultural resources.

j. Executive Order 11990, Protection of Wetlands. The project is in full compliance. The project will not affect any wetlands.

9.2 Environmental Protection Statutes and Other Environmental Requirements Found to be Not Applicable. The following Laws and Executive Orders were found to be not applicable to this project:

Coastal Zone Management Act
Estuary Protection Act
Marine Protection, Research, and Sanctuaries Act
Rivers and Harbors Act
Watershed Protection and Flood Prevention Act
Wild and Scenic Rivers Act

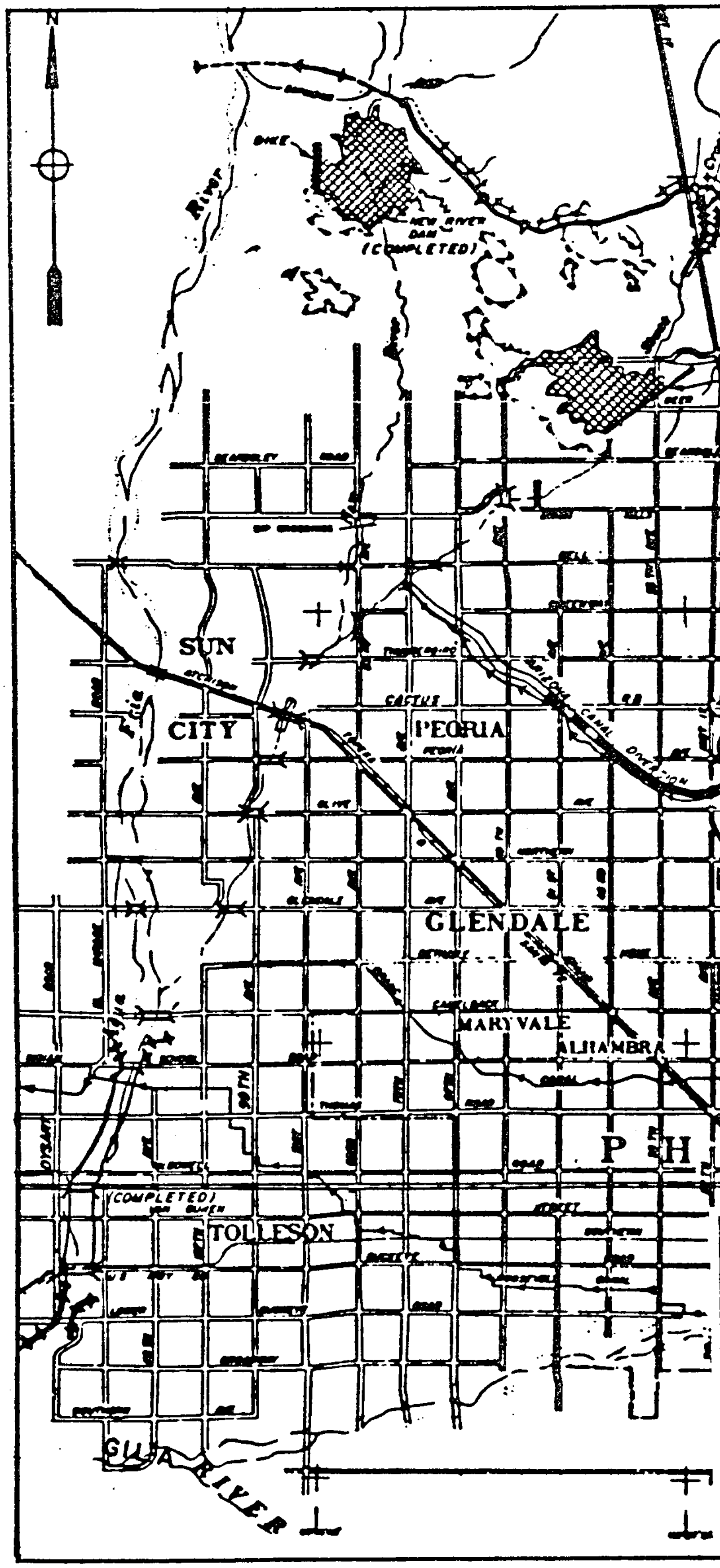
10. COORDINATION

10.1. Formal coordination with the Arizona SHPO has been initiated and a response received (Attachment 1).

10.2 This environmental assessment has been coordinated with the following agencies:

Environmental Protection Agency
U. S. Fish and Wildlife Service
Soil Conservation Service
Arizona State Historic Preservation Office
Arizona Game and Fish Department
Flood Control District of Maricopa County
City of Phoenix
Town of Paradise Valley

10.3 Responses were received from the U. S. Fish and Wildlife Service (FWS) and the Soil Conservation Service (SCS). The FWS concurred that the changes to the project will not significantly affect fish and wildlife resources. The SCS had no comments.



GILA RIVER BASIN

PHOENIX, ARIZ. AND VICINITY (INCLUDING NEW RIV.)

ARIZONA CANAL DIVERSION CHANNEL

PROJECT AREA

U.S. ARMY CORPS OF ENGINEERS

LOS ANGELES DISTRICT

ATTACHMENT 1

PERTINENT CORRESPONDENCE

Corps Letter to Arizona SHPO	September 30, 1985
Arizona SHPO Letter to Corps	October 18, 1985
Letters of Comment on the Draft SEA:	
FWS Comment Letter	January 13, 1986
SCS Comment Letter	January 13, 1986

DEPARTMENT OF THE ARMY
LOS ANGELES DISTRICT, CORPS OF ENGINEERS
P O BOX 2711
LOS ANGELES, CALIFORNIA 90053-2325

September 30, 1985

REPLY TO
ATTENTION OF

Office of the Chief
Environmental Resources Branch

Ms. Donna Schober
Arizona State Historic Preservation Officer
Arizona State Parks Board
1688 West Adams Street
Phoenix, Arizona 85007

Dear Ms. Schober:

The Los Angeles District Corps of Engineers has realigned portions of the Arizona Canal Diversion Channel (ACDC). The purpose of this letter is to request your concurrence with the determination that this realignment will not affect significant cultural resources.

A record search and cultural resources survey of the original alignment were performed by Arizona State University in 1973. Subsequent changes in the alignment were surveyed by New World Research in 1983. A No Effect determination for that alignment was coordinated with your office in 1984.

The recent changes in the alignment are shown on the enclosed map (encl 1). These changes involve 40 separate locations throughout the length of the Arizona Canal. Minor realignments occur between these forty locations, but these average 10-20 feet in width and cannot be shown on a map of this scale.

The forty locations were surveyed for cultural resources by two Corps archeologists, Dr. Helen Wells and Dr. Nedenia Kennedy, on September 18, 19, and 20, 1985. It was assumed that any significant cultural resources within the area of the minor realignments should have been observed during the earlier surveys. However, many of these areas were reexamined either on foot or from an automobile while traveling between the 40 locations. Many of the realignment locations have already been severely disturbed by previous construction. No cultural resources were encountered.

Based on the results of the investigation described above, the Los Angeles District Corps of Engineers has determined that the proposed realignment will not affect significant cultural resources. Your concurrence with this determination is requested.

ARIZONA
STATE
PARKS

1688 WEST ADAMS STREET
PHOENIX, ARIZONA 85007
TELEPHONE 602-255-4174

October 18, 1985

Mr. Norman Arno, Chief
Engineering Division
Department of the Army
Los Angeles District
Corps of Engineers
P.O. Box 2711
Los Angeles, CA 90053-2325

Re: Arizona Canal Diversion Channel
- Realignments
DOD-CORPS

Dear Mr. Arno:

I have reviewed the project information submitted for this proposed undertaking and have the following comments:

1. Based on the negative results of the archaeological survey done by Dr. Helen Wells and Dr. Nedenia Kennedy, CORPS archaeologists, it appears that there is little likelihood that significant archaeological resources are located in the realignment areas.

2. Therefore, pursuant to 36 CFR 800.4 of the Advisory Council's regulations ("Protection of Historic and Cultural Properties"), in my opinion this project should have no effect on any National Register or eligible properties.

3. One conditional comment, however, is that should subsurface archaeological remains be encountered during project construction, work should cease in the area of the discovery and this office be notified immediately.

Your continued cooperation with this office in consulting regarding the historic preservation requirements for federal undertakings is appreciated. If you have any questions about any of this, please contact me.

Sincerely,

Shereen Lerner

Shereen Lerner, Ph.D.
Deputy SHPO, Archaeology and Compliance

for Donna J. Schober
State Historic Preservation Officer

SL:ms

Attachment 1 to Appendix 1

United States Department of Agriculture

Soil Conservation Service

Suite 200, 201 East Indianola
Phoenix, Arizona 85012

January 13, 1986

District Engineer
U.S. Army Corps of Engineers,
Los Angeles District
P.O. Box 2711
Los Angeles, California 90053-2325

Attention: Mr. Ronald MacDonald

Dear Mr. MacDonald:

Thank you for the opportunity to review the draft supplemental environmental assessment for the Arizona Canal Diversion Channel. We have no comments that we feel would improve the document.

Sincerely,

Verne M. Bathurst

Verne M. Bathurst
State Conservationist

The Soil Conservation Service is an agency of the United States Department of Agriculture

ARIZONA STATE PARKS

800 W. WASHINGTON
SUITE 415
PHOENIX, ARIZONA 85007
TELEPHONE 602-542-4174

July 12, 1989

Bruce D. Ellis
Chief, Environmental Division
DOI Bureau of Reclamation
Arizona Projects Office
P.O. Box 9980
Phoenix, AZ 85068

FLOOD CONTROL DISTRICT
RECEIVED
JUL 20'89

	CH ENG		P & PM
	DEP		HYDRO
	ADMIN		LMGT
	FINANCE		FILE
	C & O		FAK
	ENGR		

REMARKS

RE: Phoenix, Arizona Canal Diversion Channel, SRP, DOD-Corps and DOI-BR

Dear Mr. Ellis:

I am responding to your letter requesting our opinion about the eligibility of the Arizona Canal. I have discussed this matter with Roger Brevoort, an architectural historian in our office, and have the following comments pursuant to 36 CFR Part 800:

1. It is our opinion that the Arizona Canal may be eligible for listing on the National Register of Historic Places because of its role in the development of Phoenix and its later association with other historic elements of the entire Salt River Project (SRP) canal system.

2. Since the Arizona Canal Diversion Channel (ACDC) project, which is a Corps of Engineers project (DOD-Corps), will involve sections of the Arizona Biltmore property, it is also important to consider that this office views the Arizona Biltmore and two bridges attributed to Frank Lloyd Wright that cross the Arizona Canal on the Biltmore property, as properties that are eligible for listing on the National Register. The involved agencies should also consider that any impacts to the Arizona Canal on the Biltmore property should address the potential for adverse impacts to the setting of this National Register-eligible property.

3. We agree with your recommendation that it would be appropriate to enter into a Memorandum of Agreement (MOA) with the Corps of Engineers, the Bureau of Reclamation and the Advisory Council on Historic Preservation for the appropriate treatment of the Arizona Canal and other register-eligible properties. The Corps of Engineers should be the lead federal agency. It is our opinion that SRP should probably be a signator to this proposed Agreement as well.

I apologize for the delay in responding to your letter but hope that the above comments will be helpful. If you have any questions, please do not hesitate to contact me.

Enclosure w/
EIS - March,
1976

Sincerely,

Robert E. Gasser
Archaeologist & Compliance Coordinator

for Shereen Lerner, Ph.D.
State Historic Preservation Officer

cc: Colonel Tadahiko Ono, DOD-Corps
Judy Brunson, SRP

United States Department of the Interior

BUREAU OF RECLAMATION
ARIZONA PROJECTS OFFICE
23636 N. 7TH STREET
P.O. BOX 9980
PHOENIX, ARIZONA 85068

IN REPLY REFER TO:

APO-150

JUN 09 1989

RECEIVED

JUN 13 1989

Environ. Serv. Dept.

Dr. Shereen Lerner
State Historic Preservation Office
Arizona State Parks
800 West Washington, Suite 415
Phoenix AZ 85007

Subject: Section 106 Consultation - Arizona Canal (Cultural Resources)

Dear Dr. Lerner:

It has recently come to our attention that the U.S. Army Corps of Engineer's (COE), Arizona Canal Diversion Channel (ACDC) will have an impact upon the historic Arizona Canal. We are aware that the ACDC project has been described in detail through the normal environmental process; however, we are not sure that adequate consideration was given to the Arizona Canal as prescribed by the National Historic Preservation Act, Section 106 process.

The Arizona Canal is owned by the Bureau of Reclamation (Reclamation) in public trust and is operated by the Salt River Project under terms of agreements it has with Reclamation. We believe the Arizona Canal is significant to the historical development of Central Arizona, and therefore, is eligible for listing on the National Register of Historic Places. We are seeking your concurrence for a determination of eligibility.

If you concur, our recommendation will be that your office, COE, and Reclamation enter into a Memorandum of Agreement (MOA) with the Advisory Council on Historic Preservation for the appropriate treatment of the Arizona Canal. This would likely consist of a Historic American Engineering Record of the canal.

The COE is sending us copies of environmental documents detailing their cultural resource activities with regard to the Arizona Canal. They are also sending copies of correspondence they have had with your office regarding the ACDC. Once we have had the opportunity to review these documents, we will contact the various parties to secure an agreement and then process the MOA for signatures.

If you have any questions or comments, please refer them to Mr. Thomas Lincoln at (602) 870-6761.

Sincerely,

Thomas R. Lincoln

Bruce D. Ellis
ACTING Chief, Environmental Division

cc: Colonel Tadahiko Ono
District Engineer
U.S. Army Corps of Engineers
Los Angeles District Office
Attention: Mr. Edward Andrews
P.O. Box 2711
Los Angeles CA 90053

Ms. Judith Brunson
Environmental Management Services
Salt River Project
P.O. Box 52025
Phoenix AZ 85072-2025

United States Department of the Interior

BUREAU OF RECLAMATION
ARIZONA PROJECTS OFFICE
23636 N. 7TH STREET
P.O. BOX 9980
PHOENIX, ARIZONA 85068

IN REPLY
REFER TO:

APO-150

RECEIVED

JUN 13 1989

Environ. Serv. Dept.

JUN 8 1989

Colonel Tadahiko Ono
District Engineer
U.S. Army Corps of Engineers
Los Angeles District Office
Attention: Mr. Edward Andrews
P.O. Box 2711
Los Angeles CA 90053

Subject: National Historic Preservation Act Consultation on the Impacts of the Arizona Canal Division Channel (ACDC) (Cultural Resource)

Dear Colonel Ono:

It has recently come to our attention that the ACDC will have an effect on the historic Arizona Canal. While this impact was identified in the environmental process, we are uncertain about the consideration given to the Arizona Canal during the consultation process outlined by Section 106 of the National Historic Preservation Act. The Arizona Canal is owned by the Bureau of Reclamation (Reclamation) in public trust and is operated by the Salt River Project (SRP) under terms of agreements it has with Reclamation. Reclamation has determined the Arizona Canal to be a property significant to the historical development of central Arizona; therefore, it is eligible for listing on the National Register of Historic Places. We cannot find a review record in our files of the environmental assessment for the ACDC, nor can we establish the level of documentation and significance evaluation of the Arizona Canal. It appears that there may have been an oversight in notifying Reclamation of the impacts to the Arizona Canal and in considering its historical significance.

We request that you provide copies of the environmental documentation for the ACDC, and any correspondence you have had with the Arizona State Historic Preservation Officer (SHPO) and SRP regarding Section 106 consultation for the Arizona Canal. It is our intention to enter into a Memorandum of Agreement with the Advisory Council on Historic Preservation, the SHPO, and the Corps of Engineers to ensure that the Arizona Canal is properly considered and mitigated if ACDC impacts are determined to have an effect on the property. We anticipate that completion of a Historic American Engineering Record for the Arizona Canal would be sufficient mitigation.

Let me assure you that we will do everything possible to keep the ACDC project moving forward. However, we do feel it necessary to complete our legal mandates before impacts can occur to the Arizona Canal. SRP is planning some construction activities in support of the ACDC for September of 1989. As you can see, it is imperative that we resolve the Section 106 consultation as quickly as possible. Please send your response to Mr. Thomas Lincoln, Chief, Cultural Resource Branch, or call him at (602) 870-6761, if you have any questions.

Sincerely,

THOMAS G. BURBEY

ACTING FOR John D. Newman
Operations Manager

cc: Ms. Judith Brunson (602) 236-2618
Environmental Management Services
Salt River Project
P.O. Box 52025
Phoenix AZ 85072-2025

Mr. Timothy Phillips
Water Construction and Maintenance
Salt River Project
P.O. Box 52025
Phoenix AZ 85072-2025

Dr. Shereen Lerner
State Historic Preservation Officer
Arizona State Parks
800 West Washington, Suite 415
Phoenix AZ 85007