III. AFFECTED ENVIRONMENT

III. AFFECTED ENVIRONMENT

A. Determination of Significant Resources

Scoping occurred throughout the Central Arizona Water Control Study (CAWCS), so that the range of alternatives and issues was progressively narrowed. The scope of the study was finally limited to the candidate plans, and the issues were sharpened so that only the most significant ones were treated in depth. Significant issues were those recognized as being institutionally, publicly, or technically important to people.

In August 1981, a special edition of the CAWCS newsletter was published describing the candidate plans and the proposed significant issues to be discussed in detail in the EIS. The public was asked to comment on the range of alternatives and issues using a response form provided. The resulting areas of concern and factors within each issue are as follows:

Biological Resources - including impacts to endangered species, riparian wetland communities, desert communities, reservoir communities, perennial stream/riverine communities, and special use and management areas.

Water Quality - including changes in concentrations of constituents in local surface water mixed with CAP water, and eutrophication potential in the New Waddell and Confluence Reservoirs.

Cultural Resources - including impacts to prehistoric sites and artifacts and historic sites and properties which are on or are eligible for inclusion on the National Register of Historic Places.

Recreation - including changes in stream-oriented and lake-oriented recreation resources, facilities, and activities.

Social Impacts - including impacts of relocation on people living in project areas, and impacts of flooding on transportation, health, and safety.

Economics - including costs, benefits, and economic justification of the candidate plans.

The affected resources related to these issues are described in detail in this chapter. Other resources judged not to be significant as a result of the scoping process are also described, but not in as much detail. These other resources are: air quality, noise, aesthetics, land resources, and geology/soils.

Chapter III. B describes the affected resources in the general CAWCS area (see Figure I-1). Section C describes the affected site areas (Cliff, Roosevelt, Stewart Mountain, Confluence, New Waddell, downstream). The affected site areas shown in Figure III-1 are areas around the proposed dam and reservoirs in the candidate plans. These areas were used as the geographic basis for assessing impacts of plans. The downstream segment of the Salt and Gila Rivers from Granite Reef Dam to Gillespie Dam is also shown as a site area for impact analysis.

Descriptions of affected resources are excerpted from the EIS supporting document, Second Level Environmental Inventory (Dames & Moore, 1982a) which contains detailed descriptions of all affected resources in the CAWCS area and in affected site areas. All information in this chapter is based on the Second Level Environmental Inventory unless otherwise indicated.

B. General Description of Area Resources

1. Significant Resources

a. Biological Resources

Within the study area there is an extreme elevation gradient of approximately 7,600 feet, a diverse microclimatic regime, an extensive drainage pattern, and a variety of landforms and soils. These factors contribute to diverse ecosystems, of which many biotic communities can be identified based on vegetation and associated vertebrate wildlife. The description of the biological resources focuses on the major biotic communities of the study area including their dominant flowering plants and wildlife.

Six resource factors have been identified as having the greatest importance with respect to action-related impacts:

1. Riparian/Wetland Biotic Communities
2. Other Terrestrial Biotic Communities
3. Perennial Stream/Riverine Aquatic Communities
4. Reservoir Aquatic Communities (Lakes and Lacustrine Communities)
5. Threatened and Endangered Plants and Wildlife
6. Management and Special Use Areas

Of these, riparian/wetland communities, perennial stream/riverine communities, and threatened and endangered plants and wildlife have been identified through the scoping process as most important.

Acreage and percent range of the major biotic communities (factors 1-4 above) occurring within the CAWCS study area vary considerably, as shown in the Table III-1.

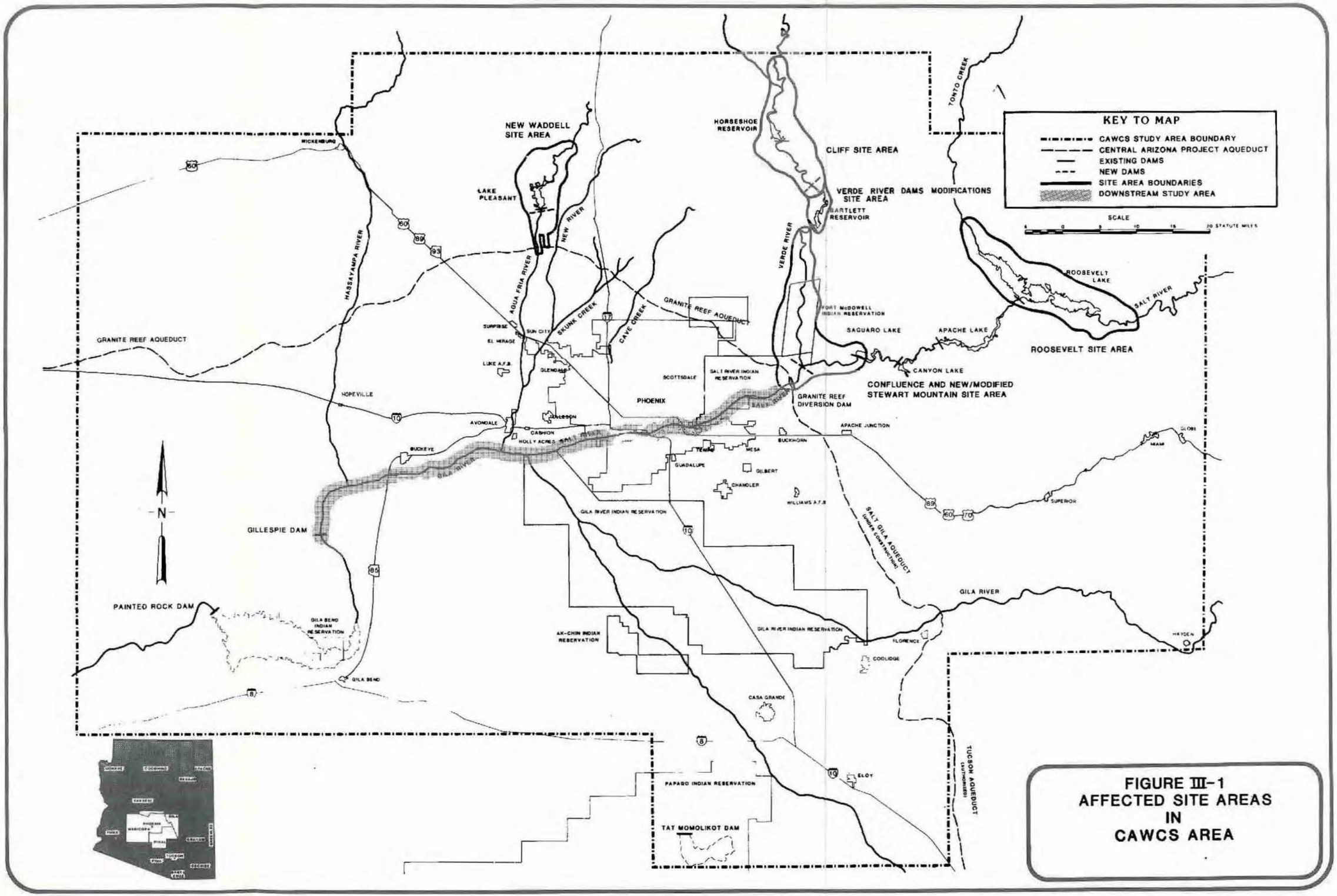


FIGURE III-1
AFFECTED SITE AREAS
IN
CAWCS AREA

Table III-1

ACREAGE AND PERCENT RANGE OF BIOMES AND BIOTIC SERIES IN THE STUDY AREA

Biotic Community	Acres	Percent
Temperate Uplands:		
Montane conifer forest	82,200	1.0
Pinyon-juniper series	189,000	2.2
Oak-pine series	24,700	0.3
Interior chaparral	756,100	8.8
Sonoran savanna grassland	115,000	1.3
Riparian and Wetland Communities:[a]		
Warm temperate and tropical-subtropical and riparian forests	59,000	0.7
Desert Uplands:		
Creosotebush-bursage series	2,037,000	23.7
Paloverde-mixed cacti series	3,509,000	40.9
Saltbush series	411,000	4.8
Aquatic Communities:		
Lakes, rivers, reservoirs	75,000	0.9
Human-Dominated Communities:		
Agricultural lands	1,055,000	12.3
Developed urban lands[b]	263,000	3.1
Total	8,576,000	100.0

[a]The series within riparian and wetland communities were not segregated due to scalar resolution. However, the inclusive series are elaborated in the text.

[b]Developed urban lands refer to lands modified for human occupation and may not necessarily conform to jurisdictional boundaries.

Source: Second Level Environmental Inventory, Dames & Moore, 1982.

The community types which occur in the CAWCS affected site areas include lake and river aquatic communities, riparian and wetland communities, and desert upland communities. The temperate upland communities occur at higher elevations within the study area, but do not occur within the site areas. Human-dominated community types are essentially urban and farmlands and are nearly absent from the site areas.

The biotic communities identified within the site areas are representative of the Southwestern Sonoran Desert and are either upland desert-communities that directly rely on precipitation or are riparian and quasi-riparian communities that depend on soil moisture which is more readily available along drainages. The floral composition varies accordingly between these two community groups and lends to the conspicuous contrast of open cacti-desert shrubland and the more verdant riparian woodland and wetland life forms occurring as green vegetation corridors along washes and perennial streams.

(1) Riparian and Wetland Communities

Riparian/wetland biotic communities, although they occupy less than 1 percent of the CAWCS area, have been given high priority both in the EIS scoping process and by wildlife management agencies, mainly because they are used by numerous wildlife species including the bald eagle, black hawk, osprey, snowy egret, great egret, javelina, and raccoon.

The riparian-wetland biotic communities within the CAWCS study area are primarily confined to the main Gila drainage. Of the 59,000 acres of riparian/wetland community types in the CAWCS area, the following six community types have been identified.

Mixed-broadleaf forest consists of stands of large sycamore, ash, and walnut trees intermixed with cottonwood and willow. Only about 100 acres of mixed-broadleaf forest occur in all the affected site areas. Specifically all of this community occurs upstream of Horseshoe Dam along cobble and gravel alluvial benches adjacent to the Verde River and perennial-flowing tributaries.

Cottonwood-willow series consisting of pure stands and intermixed stands of cottonwood and willow also occur along perennial streams. The larger stands of cottonwood-willow forest within the CAWCS study area occur at the Salt-Verde confluence, near Horseshoe Reservoir on the Verde River, near the Blue Point Ranger Station and Coon Bluff on the Salt River, and upstream of Ashurst-Hayden Dam on the Gila River.

Mesquite bosques - ("river forests") are somewhat different than the mixed-broadleaf and cottonwood-willow communities. Mesquite forests generally are less than 50 feet tall and are more "acacia-like", forming rather large stands of pure mesquite to mesquite intermixed with other riparian and quasi-riparian communities including cottonwood-willow and salt cedar. The largest mesquite bosque occurs near the Salt-Verde confluence, where some 6,000 acres are found, varying from dense woodland adjacent to the rivers to more open savanna adjacent to the desert.

Cattail marsh - represents a community type almost exclusively confined to backwater pools of the Salt-Verde-Gila Rivers and downstream of Waddell Dam. Usually this vegetation consists of pure to mixed stands of cattail and rushes in shallow waters.

Mixed scrub - consists of degenerated or newly established vegetation associated with disturbed sites adjacent to lakes and rivers. The vegetation composition consists of a conglomerate of seep willow, salt-cedar, arrowweed, and seedling and sapling species of the aforementioned communities.

Salt-cedar communities - are dominated by the Asiatic exotic species, salt-cedar. The salt-cedar communities are the predominant woodland-shrubland habitat downstream of the Salt-Verde confluence and along the Gila River in the CAWCS area.

(2) Other Terrestrial Communities

Desert communities are the predominant communities of the study area, and represent about 69 percent of the area (Table III-1). Three upland desert communities occur within the study area: creosotebush-bursage, saltbush, and paloverde-mixed cacti series. The first two are open scrubland desert vegetation and occur at lower elevations than the affected site areas.

The paloverde-mixed cacti series occurs within affected site areas. This series, also referred to as the Arizona upland subdivision of the Sonoran Desert, occurs on bajadas, foothills, and steep slopes of desert mountains at 800 to 3,500 foot elevations. It supports a diverse plant species complex including such trees as foothills paloverde, blue paloverde, ironwood; cacti such as saguaro, cholla, pricklypear; and shrubs such as triangle bursage, ratany, and Mormon tea.

The fauna of the paloverde-mixed cacti series is abundant and diverse and includes Gila woodpecker, cactus wren, elf owl, phainopepla, black-tailed jackrabbit, javelina, coyote, and kangaroo rat.

(3) Perennial Stream/Riverine Communities

There are 137 miles of perennial stream community in the CAWCS area. This represents about 30 percent of the original perennial rivers in the study area, due to the construction of water storage dams along the Verde, Salt, Agua Fria, and Gila Rivers. Approximately 70 miles of perennial streams occur within specific site areas.

Riverine fishes include such native species as longfin dace, desert sucker, and round-tailed chub, as well as introduced species such as bass, catfish, carp, and rainbow trout.

(4) Reservoir Aquatic Communities

Other aquatic communities are primarily represented by the approximately 35,000 surface acres in reservoirs on the Agua Fria, Verde, and Salt Rivers. Introduced game species dominate the fish fauna within these impoundments. Largemouth and smallmouth bass, black crappie, threadfin shad, channel catfish, and sunfish are all common in reservoirs. Lake Pleasant is a popular white bass fishery. At Horseshoe Reservoir the success of sportfish production is somewhat compromised by fluctuating water levels.

(5) Threatened and Endangered Plants and Wildlife

Descriptions of threatened and endangered species occurring in the CAWCS study area are excerpted from the EIS supporting document, A Biological Assessment of Endangered Species (Dames & Moore, 1982c), and from Threatened Native Wildlife in Arizona (Arizona Game and Fish Department, 1982).

The U.S. Fish and Wildlife Service, through Section 7 of the Endangered Species Act, has issued a list of proposed and designated threatened and endangered species that are known to occur in or whose ranges overlap the CAWCS study area. Two endangered plant species and four endangered vertebrates which are known or suspected to occur in the study area come under this designation. The Arizona hedgehog cactus (*Echinocereus triglochidiatus* var. *arizonicus*) and the Turk's head cactus (*Echinocactus horizonthalonius* var. *nicholii*), through occurring in or near the study area, are not known to occur in any affected site area.

The peregrine falcon (*Falco peregrinus anatum*) is a wide-ranging endangered transient species which may use major segments of the Salt-Verde drainage, but which has not been reported in the affected site areas during the CAWCS. The Gila topminnow (*Poeciliopsis o. occidentalis*) is listed as endangered and is a species of interest to the State of Arizona because it may be in jeopardy in Arizona in the foreseeable future. This species was reintroduced into Tule Creek upstream of Lake Pleasant; the population was recently found to be in good condition. Other topminnow are known to occur at Seven Springs and Hidden Water; both areas are in the CAWCS study area but outside of the affected site areas.

The bald eagle (*Haliaeetus l. leucocephalus*) and the Yuma clapper rail (*Rallus longirostris yumanensis*) occur at affected site areas. There are six bald eagle breeding areas in the CAWCS study area, of which five are within affected site areas. Bald eagle preferred habitat includes cliffs and large trees near flowing segments of the Salt-Verde drainage where the species feeds primarily on fish. Preferred foraging perches are in mesquite, cottonwood, and willow trees along the rivers, and cliffs above the rivers. The Yuma clapper rail has been observed in the confluence site area. Immature birds and as many as four adults have been reported in cattail marsh habitat at the Salt-Verde confluence. Several sightings have also been reported for the Gila drainage downstream of Phoenix and at Picacho Reservoir.

In addition to the species receiving Federal protection, the Arizona Game & Fish Department directs special management protection to species which are threatened or unique in Arizona. These species have been designated by the Arizona Game & Fish Commission (10 December, 1982) as threatened native wildlife in Arizona. The species have been categorized into four groups, the following are known or are likely to occur, or could be reintroduced, within the CAWCS area.

Group I wildlife are considered extinct in Arizona but are known to occur elsewhere in the United States. The desert pupfish (Cyprinodon m. macularius) is the only such species.

Group II wildlife includes species whose occurrence in Arizona approaches extinction. They include woundfin (Plagopterus argentissimum), bald eagle, gray hawk (Buteo nitidus), and river otter (Lutra canadensis sonora). The kin subspecies of river otter (L.c.lataxina) has been reintroduced on the Verde River by the Arizona Game & Fish Department.

Group III wildlife species whose continued presence in Arizona could be in jeopardy in the foreseeable future include: Colorado River roundtail chub (Gila robusta robusta), Gila chub (Gila intermedia), razorback sucker (Xyrauchen texanus), Gila topminnow, sonoran mud turtle (Kinosternon sonoriense), desert tortoise (Gopherus agassizii), Mexican garter snake (Thamnophis rufinpunctatus), desert bighorn (Ovis canadensis nelsoni). Bird species include osprey (Pandion haliaetus carolinensis), Mississippi kite (Ictinia mississippiensis), common black-hawk (Buteogallus a. anthracinus), peregrine falcon, and Yuma clapper rail. The razorback sucker, Gila topminnow, and desert bighorn have been reintroduced to the CAWCS area.

Group IV wildlife includes species which occupy habitats that have been susceptible to modification, or are threatened to the extent that their welfare may worsen in the future. Such species include great egret (Casmerodium albus egretta), snowy egret (Egretta thula brewsteri), black-crowned night heron (Nycticorax n. hoactle), and black-bellied whistling-duck (Dendrocygna autumnalis fulgens). All of these species are dependent on aquatic/riparian habitat and are known to occur in the CAWCS area.

(6) Management and Special Use Areas

Major special use and protected areas in the study area are managed by the U.S. Forest Service (USFS), U.S. Fish and Wildlife Service (FWS), U.S. Bureau of Land Management (BLM), and Arizona Game and Fish Department (AGFD). These include USFS habitat rehabilitation sites along the Salt and Verde Rivers; designated wintering areas for bald eagles and peregrine falcons; restricted access priority areas located in vicinities of bald eagle territories, marsh habitat which may harbor the Yuma clapper rail, 14 game management units, the Roosevelt Lake Wildlife area for waterfowl, the Three Bar Research area, and fisheries of the major reservoirs and perennial streams maintained by the AGFD; and the Lower Salt River Recreation Area managed by the USFS in the Salt-Verde confluence area.

b. Water Quality

There is a wide range in the quality of the various sources of water in the study area. For example, a 1979 Maricopa Association of Governments publication (Groundwater Quality in the Major Basins of Maricopa County) reports a total dissolved solids (TDS) level of 243 mg/l in an Aguila area well and a TDS level of 22,300 mg/l in an Agua Calinete-Hayden area well. Pumped average groundwater quality in the service area is documented in the Reclamation's EIS Water Allocations & Water Service Contracting, Central Arizona Project INT FES 82-7. Surface water quality records show TDS ranging from 220 mg/l in the Verde River below Bartlett Dam to over 4,300 mg/l in the Gila River near Kelvin, Arizona. Generally, however, the quality of CAP Colorado River water delivered to users in central Arizona will be of poorer quality than most local surface supplies that are presently being used and will be of better quality than currently used ground water.

Since the CAP intake is located on the Bill Williams Arm of Lake Havasu, CAP water is assumed to be similar in quality to water quality of the Colorado River at Parker Dam until influenced by regulatory storage mixing with local surface waters. Water quality data for the Colorado River at Parker Dam is presented on Table III-2.

Studies to determine the effects of aqueduct evaporation on total dissolved solids indicate an average increase of 1 to 3 percent which is considered insignificant.

The acceptability of water quality is ultimately determined by the designated use. The majority of water currently used in the study area is for either agricultural or municipal and industrial (M&I) use. State and Federal regulated water constituent standards are presented in Water Quality Impacts, Section IV.B.2.

Much of the CAP water will be used to reduce ground water pumping for irrigation purposes. Recently ground water levels have been dropping 3 to 8 feet per year in the service area. By importing about 65 million acre-feet of additional water into central Arizona over the 50-year repayment period of the project, CAP deliveries will slow this rate of decline. In many cases the ground water used for crop irrigation is higher in TDS than the imported CAP water. The infiltration of irrigation water may carry dissolved minerals that could reach the water table and raise the TDS level of the ground water. The general effects associated with salt accumulation in ground water is documented in Reclamation's EIS, Water Allocations & Water Service Contracting, INT FES 82-7. Due to limited research, and the complexity of ground water recharge and movement of dissolved minerals, site-specific technical analysis is not practical over an area as large and diverse as the CAP service area; however, no adverse impact on soil productivity from application of Colorado River CAP water is expected (INT FES 82-7).

Table III-2

SURFACE WATER QUALITY, COLORADO RIVER BELOW PARKER DAM[a]
(mg/l, unless otherwise noted)

	Constituent	No. of Samples	Minimum	Average	Maximum
	Alkalinity as $CaCO_3$	156	98.0	128.	150.
D	Arsenic	1	0.00400	0.00400	0.00400
T	Arsenic	56	BDL	0.00284	0.00500
D	Barium	1	BDL	BDL	BDL
T	Barium	57	BDL	0.135	0.500
	Bicarbonate	145	120.	156.	177.
T	Boron	65	0.0500	0.196	0.360
D	Cadmium	7	BDL	0.000286	0.00100
T	Cadmium	65	BDL	0.00462	0.0130
	Calcium	146	73.0	85.6	100.
T	Carbon (organic)	59	1.90	4.55	14.0
	Carbonate	139	BDL	0.0288	4.00
	Chloride	166	75.0	94.5	140.
	Chromium (Hexa)	1	0.00100	0.00100	0.00100
T	Chromium	58	BDL	0.00357	0.0200
D	Copper	1	BDL	BDL	BDL
T	Copper	57	BDL	0.00793	0.0290
T	Cyanide	58	BDL	0.000862	0.0200
	Oxygen (dissolved)	109	5.10	8.53	11.7
	Fecal Coliforms (cols/100 ml)	49	0.990	4.78	41.9
D	Fluoride (84.7°)	127	0.200	0.378	0.500
	Hardness (total, as $CaCO_3$)	166	290.	339.	380.
	Hardness (noncarbonate)	165	170.	211.	243.
T	Iron	57	0.0300	0.159	0.550
D	Lead	9	BDL	0.00144	0.00400
T	Lead	57	BDL	0.0408	0.100
	Magnesium	146	26.0	30.9	40.0
T	Manganese	58	BDL	0.0208	0.0400
T	Mercury	58	BDL	0.0000431	0.000600
T	Nitrate (as N)	1	0.170	0.170	0.170
	pH (pH units)	202	7.10	7.95	8.80
T	Phosphorus (as P)	66	BDL	0.0258	0.100
	Potassium	139	4.50	5.21	6.80
D	Selenium	1	0.00300	0.00300	0.00300
T	Selenium	58	BDL	0.00279	0.00500
	Specific Conductance (µ℧/cm)	700	950.	1120.	1720.
D	Silver	1	BDL	BDL	BDL
T	Silver	58	BDL	0.00350	0.0100
	Sodium	119	90.0	107.	120.
	Sodium Adsorption Ratio (no units)	119	2.20	2.54	2.88
	Sulfate	167	240.	309.	380.
	Dissolved solids (180°C)	636	602.	722.	848.
	Turbidity (JTU)	43	1.00	2.58	10.0
D	Zinc	9	BDL	0.00889	0.0200
T	Zinc	57	BDL	0.0239	0.310
	Phenolics	62	BDL	0.00127	0.00700

Note: D = Dissolved Fraction; T = Total Recoverable; BDL = Below Detection Level

[a]Environmental Protection Agency STORET Data Retrieval System, March 1981 invent version. Run made on August 24, 1981 using data for the period of record October 1968 - June 1981. All constituent levels shown rounded to three significant figures.

The major water quality impacts of the proposed regulatory storage alternatives will result from the reservoir mixing or exchanges of CAP and local sources of water. These impacts involve the introduction of Colorado River water into local surface waters, changing the concentrations of constituents in the CAP and local source waters, and increasing the potential for eutrophication downstream from or in the storage reservoir. Risk of eutrophication as computed for the Confluence and New Waddell Reservoirs is documented in Hydrology Supporting Document (USBR, 1982h).

Tables III-3, III-4, III-5, and III-6 present the water quality data referenced during CAWCS for local surface water sources which might be affected by regulatory storage mixing. The Agua Fria River water quality data have fewer sample analyses and, therefore, are not as representative as the information on the other water sources.

These data were obtained by the Arizona Department of Health Services from the Environmental Protection Agency (EPA) STORET (storage and retreival) water quality data system. Most of the STORET data were collected by the U.S. Geological Survey (USGS), which conducts regular sampling and laboratory testing at the sites shown on the tables. Some early data were collected from other sources. The data collection is a continuing process which has recently been expanded to include two new stations near Lake Pleasant to establish baseline data for the proposed regulatory storage reservoir.

Trihalomethane (THM) is produced when water which is high in dissolved organic materials undergoes normal disinfection with chlorine at domestic water treatment plants. THM production is dependent on the amount of organic compounds in the water, the amount of chlorine used in disinfection, and the length of time the chlorine is in contact with the water prior to final use. THM is carcinogenic in nature and the EPA has established a maximum contaminant limit (MCL) of 0.1 mg/l for treated domestic water. The Southern Nevada Water System (SNWS) applies chlorine disinfection to Colorado River water from Lake Mead and delivers the treated water to several cities including Las Vegas. The SNWS has reported THM levels at the 0.1 mg/l MCL and are considering alternative water disinfection methods for the Colorado River water. M&I users of SRP water have also observed THM levels approaching the MCL. This is believed to be a result of the high levels of dissolved organic materials in both of these water sources. The potential therefore exists for producing THM at M&I water treatment facilities which receive Colorado River water. This potential exists for any CAP M&I users of Colorado River water regardless of which plan is implemented.

c. Recreation

Within the CAWCS study area, water-related recreation opportunities are extremely popular among residents, as is evident by the intense use of existing reservoirs and streams. The Arizona Statewide Comprehensive Outdoor Recreation Plan (1978) and other sources were used to inventory stream- and reservoir-oriented recreation resources and facilities in a five-county region of central Arizona so that future conditions and project-related impacts could be determined. The five-county region of

Table III-3

SURFACE WATER QUALITY, AGUA FRIA RIVER AT ROCK SPRINGS[a]
(mg/l, unless otherwise noted)

	Constituent	No. of Samples	Minimum	Average	Maximum
	Alkalinity as $CaCO_3$	4	140.	175.	190.
D	Arsenic[b]	2	0.00900	0.0100	0.0110
T	Arsenic	4	0.00900	0.0133	0.0160
D	Barium[b]	2	0.0650	0.0730	0.0810
T	Barium	4	<0.100	<0.100	0.100
	Bicarbonate	0	--	--	--
T	Boron	4	0.0900	0.165	0.230
D	Cadmium[b]	2	<0.00300	<0.00300	<0.00300
T	Cadmium	4	<0.00100	<0.00150	0.00200
	Calcium	4	39.0	50.8	58.0
T	Carbon (organic)	4	2.50	4.10	5.20
	Carbonate	0	--	--	--
	Chloride	2	32.0	36.0	40.0
	Chromium (Hexa)	0	--	--	--
T	Chromium	4	0.00300	0.00725	0.0190
D	Copper[b]	2	0.00700	0.00750	0.00800
T	Copper	4	0.00700	0.0138	0.0290
T	Cyanide	4	<0.0100	<0.0100	<0.0100
	Oxygen (dissolved)	4	8.60	8.88	9.10
	Fecal Coliforms (cols/100 ml)	4	4.00	36.3	120.
D	Fluoride (84.7°)	4	0.300	0.325	0.400
	Hardness (total, as $CaCO_3$)	4	160.	215.	240.
	Hardness (noncarbonate)	4	23.0	41.3	54.0
T	Iron	4	0.0600	2.04	6.40
D	Lead[b]	2	0.00200	0.00200	0.00200
T	Lead	4	0.00100	0.00425	0.00800
	Magnesium	4	16.0	21.8	25.0
T	Manganese	4	0.0100	0.0850	0.270
T	Mercury	4	<0.000100	<0.000100	<0.000100
T	Nitrate (as N)	2	3.20	3.85	4.50
	pH (pH units)	4	8.30	8.43	8.60
T	Phosphorus (as P)	4	0.0900	0.150	0.180
	Potassium	4	1.60	1.98	2.30
D	Selenium[b]	2	<0.00100	<0.00100	<0.00100
T	Selenium	4	<0.00100	<0.00100	0.00100
	Specific Conductance (µ℧/cm)	4	420.	582.	676.
D	Silver[b]	2	<0.00100	<0.00100	<0.00100
T	Silver	4	<0.00100	<0.00100	<0.00100
	Sodium	4	25.0	37.8	45.0
	Sodium Adsorption Ratio (no units)	4	0.900	1.20	1.40
	Sulfate	4	53.0	85.0	100.
	Dissolved solids (180°C)	4	257.	358.	401.
	Turbidity (NTU)	4	0.600	31.6	110.
D	Zinc[b]	2	<0.0120	<0.0120	<0.0120
T	Zinc	4	0.0200	0.0325	0.0600
	Phenolics	0	--	--	--

Note: D = Dissolved Fraction; T = Total Recoverable; -- Data Not Available

[a] U.S. Geological Survey from U.S. Bureau of Reclamation unpublished data, 1982; period of record January-April 1982. All constituent levels shown rounded to three significant figures.

[b] Samples taken below Lake Pleasant.

Table III-4

SURFACE WATER QUALITY, VERDE RIVER BELOW BARTLETT DAM[a]
(mg/l, unless otherwise noted)

	Constituent	No. of Samples	Minimum	Average	Maximum
	Alkalinity as $CaCO_3$	328	28.0	185.	350.
D	Arsenic	16	0.00500	0.0121	0.0180
T	Arsenic	15	0.00700	0.0133	0.0210
D	Barium	6	BDL	0.0550	0.100
T	Barium	6	BDL	0.100	0.200
	Bicarbonate	520	34.0	236.	427.
T	Boron	1	0.190	0.190	0.190
D	Cadmium	16	BDL	0.00156	0.0140
T	Cadmium	16	BDL	0.00619	0.0100
	Calcium	541	19.0	42.5	75.0
T	Carbon (organic)	23	1.80	4.20	9.60
	Carbonate	399	BDL	1.57	15.0
	Chloride	352	2.00	18.8	130.
	Chromium (Hexa)	0	--	--	--
T	Chromium	16	BDL	0.00375	0.0100
D	Copper	16	BDL	0.00275	0.00700
T	Copper	16	0.00300	0.00888	0.0200
T	Cyanide	0	--	--	--
	Oxygen (dissolved)	21	8.60	11.6	17.8
	Fecal Coliforms (cols/100 ml)	31	1.00	8.35	99.0
D	Fluoride (84.7°)	210	BDL	0.340	0.800
	Hardness (total, as $CaCO_3$)	540	79.0	212.	413.
	Hardness (noncarbonate)	519	BDL	18.9	182.
T	Iron	71	BDL	0.192	3.50
D	Lead	16	BDL	0.00300	0.0120
T	Lead	16	0.00400	0.0714	0.100
	Magnesium	541	6.40	25.7	55.0
T	Manganese	16	BDL	0.0900	0.380
T	Mercury	16	BDL	0.000263	0.00260
T	Nitrate (as N)	3	0.0200	0.0967	0.140
	pH (pH units)	512	6.80	8.01	8.80
T	Phosphorus (as P)	53	BDL	0.206	0.400
	Potassium	219	1.30	3.39	7.40
D	Selenium	16	BDL	0.000750	0.00300
T	Selenium	15	BDL	0.000600	0.00100
	Specific Conductance (µU/cm)	522	150.	510.	929.
D	Silver	6	BDL	BDL	BDL
T	Silver	6	BDL	BDL	BDL
	Sodium	502	4.20	30.4	290.
	Sodium Adsorption Ratio (no units)	502	0.210	0.880	8.21
	Sulfate	350	11.0	52.9	107.
	Dissolved solids (180°C)	482	109.	314.	550.
	Turbidity (JTU)	39	1.00	83.3	2800.
D	Zinc	16	BDL	0.00700	0.0300
T	Zinc	16	0.0100	0.0356	0.200
	Phenolics	0	--	--	--

Note: D = Dissolved Fraction; T = Total Recoverable; -- Data Not Available; BDL = Below Detection Level

[a]Environmental Protection Agency STORET Data Retrieval System. Run made on February 16, 1980 using data for the period of record December 1950 - September 1979. All constituent levels shown rounded to three significant figures.

Table III-5

SURFACE WATER QUALITY, SALT RIVER BELOW STEWART MOUNTAIN DAM[a]
(mg/l, unless otherwise noted)

	Constituent	No. of Samples	Minimum	Average	Maximum
	Alkalinity as $CaCO_3$	323	15.0	130.	189.
D	Arsenic	16	0.00200	0.00338	0.00600
T	Arsenic	15	0.00100	0.00387	0.00700
D	Barium	7	BDL	0.0771	0.200
T	Barium	7	BDL	0.100	0.200
	Bicarbonate	385	18.0	160.	230.
T	Boron	2	0.140	0.185	0.230
D	Cadmium	16	BDL	0.000813	0.00400
T	Cadmium	16	BDL	0.00669	0.0100
	Calcium	406	36.0	50.4	420.
T	Carbon (organic)	20	2.20	4.79	18.0
	Carbonate	162	BDL	0.358	35.0
	Chloride	303	70.0	234.	610.
	Chromium (Hexa)	0	--	--	--
T	Chromium	16	BDL	0.00188	0.0100
D	Copper	16	BDL	0.00250	0.00600
T	Copper	16	BDL	0.00868	0.0200
T	Cyanide	0	--	--	--
	Oxygen (dissolved)	20	1.60	6.61	13.7
	Fecal Coliforms (cols/100 ml)	28	1.00	22.0	470.
D	Fluoride (84.7°)	182	0.200	0.380	1.10
	Hardness (total, as $CaCO_3$)	404	121.	180.	270.
	Hardness (noncarbonate)	400	BDL	49.4	113.
T	Iron	27	BDL	0.187	2.10
D	Lead	16	BDL	0.00663	0.0600
T	Lead	16	BDL	0.0743	0.100
	Magnesium	406	5.50	13.7	28.0
T	Manganese	16	BDL	0.0625	0.170
T	Mercury	16	BDL	0.0000438	0.000400
T	Nitrate (as N)	3	BDL	0.0533	0.160
	pH (pH units)	396	4.50	7.74	9.10
T	Phosphorus (as P)	46	0.0100	0.223	8.30
	Potassium	185	2.40	5.83	42.0
D	Selenium	16	BDL	0.000188	0.00100
T	Selenium	15	BDL	0.000267	0.00200
	Specific Conductance (µ℧/cm)	405	505.	1140.	2340.
D	Silver	7	BDL	BDL	BDL
T	Silver	7	BDL	0.00171	0.0100
	Sodium	377	47.0	161.	382.
	Sodium Adsorption Ratio (no units)	377	1.29	5.13	10.4
	Sulfate	299	32.0	51.4	360.
	Dissolved solids (180°C)	362	316.	635.	1300.
	Turbidity (JTU)	33	1.00	2.91	10.0
D	Zinc	16	BDL	0.0160	0.120
T	Zinc	16	0.0100	0.0331	0.100
	Phenolics	0	--	--	--

Note: D = Dissolved Fraction; T = Total Recoverable; -- Data Not Available; BDL = Below Detection Level

[a]Environmental Protection Agency STORET Data Retrieval System. Run made on February 16, 1980 using data for the period of record December 1950 - September 1979. All constituent levels shown rounded to three significant figures.

Table III-6

SURFACE WATER QUALITY, SALT RIVER PROJECT WATER[a]
(mg/l, unless otherwise noted)

	Constituent	No. of Samples[b]	Minimum[c]	Average[d]	Maximum[c]
	Alkalinity as $CaCO_3$	323	15.0	154.	350.
D	Arsenic	16	0.00200	0.00761	0.0180
T	Arsenic	15	0.00100	0.00792	0.0210
D	Barium	6	BDL	0.0676	0.200
T	Barium	6	BDL	0.100	0.200
	Bicarbonate	385	18.0	193.	427.
T	Boron	1	0.140	0.187	0.230
D	Cadmium	16	BDL	0.00113	0.0140
T	Cadmium	16	BDL	0.00648	0.0100
	Calcium	406	19.0	47.0	420.
T	Carbon (organic)	20	1.80	4.54	18.0
	Carbonate	162	BDL	0.879	35.0
	Chloride	303	2.00	141.	610.
	Chromium (Hexa)	0	--	--	--
T	Chromium	16	BDL	0.00268	0.0100
D	Copper	16	BDL	0.00261	0.00700
T	Copper	16	BDL	0.00877	0.0200
T	Cyanide	0	--	--	--
	Oxygen (dissolved)	20	1.60	8.76	17.8
	Fecal Coliforms (cols/100 ml)	28	1.00	16.1	470.
D	Fluoride (84.7°)	182	BDL	0.363	1.10
	Hardness (total, as $CaCO_3$)	404	79.0	194.	413.
	Hardness (noncarbonate)	400	BDL	36.3	182.
T	Iron	27	BDL	0.189	3.50
D	Lead	16	BDL	0.00507	0.0600
T	Lead	16	BDL	0.0731	0.100
	Magnesium	406	5.50	18.9	55.0
T	Manganese	16	BDL	0.0743	0.380
T	Mercury	16	BDL	0.000138	0.00260
T	Nitrate (as N)	3	BDL	0.0720	0.160
	pH (pH units)	396	4.50	7.86	9.10
T	Phosphorus (as P)	46	BDL	0.216	8.30
	Potassium	185	1.30	4.78	42.0
D	Selenium	16	BDL	0.000430	0.00300
T	Selenium	15	BDL	0.000410	0.00200
	Specific Conductance (µU/cm)	405	150.	869.	2340.
D	Silver	6	BDL	BDL	BDL
T	Silver	6	BDL	0.000975	0.0100
	Sodium	377	4.20	105.	382.
	Sodium Adsorption Ratio (no units)	377	0.210	3.30	10.4
	Sulfate	299	11.0	52.0	360.
	Dissolved solids (180°C)	362	109.	497.	1300.
	Turbidity (JTU)	33	1.00	37.5	2800.
D	Zinc	16	BDL	0.0121	0.120
T	Zinc	16	0.0100	0.0342	0.200
	Phenolics	0	--	--	--

Note: D = Dissolved Fraction; T = Total Recoverable; -- Data Not Available; BDL = Below Detection Level

[a] Environmental Protection Agency STORET Data Retrieval System. Run made on February 16, 1980 using data for the period of record December 1950 - September 1979. All constituent levels shown rounded to three significant figures.

[b] Minimum number of samples from Salt or Verde data.

[c] Minimum and maximum are for the Salt or Verde Rivers and could be experienced if the other river was not flowing.

[d] Weighted average based on USGS flow records resulting in a 43 percent Verde and 57 percent Salt mix at the confluence of the two rivers.

Maricopa, Pima, Pinal, Gila, and Yavapai Counties was defined as the affected area to assess comparative water-related activities accessible to portions of the regional population.

Within the region, popular stream-oriented activities include stream fishing, swimming, tubing (river floating), camping, and picnicking. Reservoir-oriented activities include boat fishing, swimming, powerboating, waterskiing, non-powerboating, camping, and picnicking.

Over 9,000 campsites are found in the region, ranging from developed campsites with picnic tables, fire rings, running water, community showers, and electrical hookups to undeveloped campsites with only a cleared area to pitch a tent. Many campground facilities are located near or adjacent to study area lakes and reservoirs. Statewide, between 14 and 16 percent of all households participate in camping. Approximately 2,716,000 maximum annual recreation days (see glossary under "recreation day") are associated with existing developed campsites.

A total of 11,600 picnic sites are found within the region. Statewide, over 30 percent of all households participate in picnicking activities. The total number of maximum annual recreation days associated with the picnic areas in the region is approximately 5.5 million.

Swimming in lakes and rivers in the region is, for the most part, a non-structured recreation activity and does not necessarily depend on a beach or other facilities. Statewide participation rates for lake and river swimming indicate that 17 percent of all households participate in this activity. According to the Arizona Outdoor Recreation Coordinating Commission (AORCC), a total of 51 improved or developed swimming sites are found in the five-county region. An estimated 2 million maximum annual recreation days are associated with lake and river swimming.

Over 985 miles of fishable stream exist within the region. Specific shoreline facilities are not usually associated with stream fishing activities. Approximately 1 million maximum annual recreation days are associated with stream fishing in the region.

In recent years, tubing has become very popular among valley residents of all ages, but especially those in the 16 to 30 age bracket. A survey conducted along the Salt River during the summer of 1981 by the Corps of Engineers estimated that visitation along the Salt River for tubing was greater than 1 million. Because of lower stream flows, tubing on the Verde River is not as intensive. A total of 34.3 miles are estimated to be available for tubing within the five-county region. Maximum annual recreation days associated with tubing miles total over 2,200,000.

A relatively small proportion of the population (about 7 percent) in the region participates in boating activities. Boating resources within the five-county region consist of eight major lakes: Apache, Bartlett, Horseshoe, Canyon, Lake Pleasant, Roosevelt, Saguaro, and San Carlos. The total number of usable surface acres for recreation associated with these lakes is approximately 35,000. Maximum annual recreation days for all boating activities including fishing, powerboating, non-powerboating, and waterskiing currently total approximately 2 million.

d. Cultural Resources

(1) Prehistoric Resources

The CAWCS study area has been occupied for the last 13,000 years, of which only the last 300 years have been recorded in written form. The earliest evidence for human populations in the study area dates to about 11000 B.C. The Paleo-Indians who lived at the time appear to have been mainly hunters who concentrated on large, and now mostly extinct, fauna such as mammoth, bison, and horse. Sites reflecting this occupation are rare, and a high priority is placed by the archaeological community on finding and excavating such remains. No Paleo-Indian sites have been recorded in the CAWCS site areas.

At about 8000 B.C., and into the Christian Era, the hunting emphasis was gradually replaced by an Archaic culture that emphasized the harvesting and collection of wild plant foods. While hunting continued in importance, there was a shift to the capture of small, rather than large, fauna. No definite Archaic sites have been recorded in affected site areas although some nondiagnostic lithic artifact scatters may date from this period.

At about 300 B.C, the Hohokam cultural tradition began, marked by the addition of ceramic vessels to the artifact inventory and by the adoption of a greater emphasis on agriculture. The central Hohokam area is roughly equivalent to the combined limits of the Gila River Indian Reservation and the Phoenix metropolitan area. This area saw the development of extensive irrigation networks, higher population density, and a more complex level of political organization. The Hohokam occupation extends to varying degrees into the mountains and deserts surrounding the central area. It includes Lake Roosevelt to the east, the Tucson Basin to the south, Horseshoe Dam and Waddell Dam to the north, and Gila Bend to the west.

Other related cultural groups recognized in the CAWCS study area include the Patayan, Sinagua, and Salado. These groups are less well defined than the Hohokam.

By about A.D. 1400, the Hohokam tradition disappears from the archaeological record. When Spanish explorers arrived in the American Southwest, they reported villages of Piman Indians living along the Gila River. These people were possibly the descendants of the Hohokam although their population size, area of occupation, and social complexity was much less than that of the preceding Hohokam.

The Hohokam tradition, which dominated the CAWCS study area, provides an opportunity to examine different models for the development of complex social and political systems. These prehistoric resources provide a rare opportunity to examine the interrelated effects of trade and irrigation agriculture on the growth of political elites. The Hohokam irrigation network is unusual in the New World due to its large size and complexity.

Although thousands of sites dating from the Hohokam era are present in the affected site areas, archaeologists emphasize the study and/or preservation of large Hohokam sites, because they occur in relatively small numbers and there is considerable internal variability. Large archaeological sites in the CAWCS area, such as Tonto National Monument, Casa Grande, and Pueblo Grande, make impressive tourist attractions and contain a wealth of information on the rise and fall of the Hohokam social system.

(2) Historic Resources

Historic cultural resources or sites within the CAWCS study area reflect the general patterns and historic trends of land use which characterized the region. In order to describe regional history, it is useful to recognize three historical periods to which the study area historic sites may be attributed.

Many of the historic sites which have been recorded within the study area are of major importance as evidence of a dynamic state and local cultural heritage. The significance of several of the sites has been recognized through their entry in the National Register of Historic Places, an inventory of sites considered important at a local, regional, or national level. Numerous other sites have been identified which are eligible for nomination to the National Register.

(a) Pre-Territorial (1650 to 1863) Period

Non-Indian intrusions into the study area before 1863 were both sporadic and temporary in nature. Fur trappers worked along the Verde and Gila Rivers during the period before about 1850; explorers and other travelers traversed the area using the river courses as travel routes through central Arizona. While sites representing this period exist in the CAWCS area, no sites from this period have been identified in affected site areas.

(b) Territorial-Settlement Period (1863-1912)

Permanent settlement within the study area began with the establishment of Camp McDowell, later Fort McDowell, on the Verde River in 1865. Fort McDowell was abandoned by the military in 1890. The military reservation was then turned over to the Interior Department in 1891 for disposal. A portion of the lands which comprised the original Camp McDowell Military Reservation was sold to non-Indian settlers. On September 15, 1903, President Roosevelt, by executive order, set aside the lands of the former Camp McDowell Military Reservation that had not been legally settled upon and to which no valid claims could be attached. The Federal government then bought out the rights of 14 squatters and 21 valid settlers who had claims to lands within the military reserve. The entire area that originally comprised the old Camp McDowell Military Reservation was then set aside for the Yavapai Indians. By the 1870s, Salt River Valley communities such as Phoenix, Mesa, Tempe, and Lehi were established as the area in general was explored, settled, and developed. By 1880, homesteads, farms, and ranches had been located along most of the major drainages. With

the construction of major canals during the 1880s and 1890s, and of Roosevelt Dam and the associated Granite Reef Diversion Dam between 1905 and 1911, the groundwork was established for extensive irrigation agriculture. The development of a railroad transportation system during the period from about 1880 until 1910 contributed a final stimulus to the area's development. Historic sites characteristic of these events and activities are present at each of the affected site areas.

(c) Statehood-Early Modern Development (1912-1930)

Activities within the area during the first two decades after Arizona statehood (1912) were, by and large, a continuation and elaboration of existing and developing trends. Agricultural activities increased throughout this period due to a series

of dam construction projects, including the Ashurst-Hayden Diversion Dam (1922), Mormon Flat Dam (1925), Horse Mesa Dam (1927), Carl Pleasant Dam (now Waddell Dam) (1927), and Stewart Mountain Dam (1930). New towns, such as Litchfield Park (1916), Chandler (1912), Gilbert (1910), and Tolleson (1910), which were primarily agriculture-oriented, were created during the transition from territory to state. A number of historic sites attributable to this period, including construction camps for the dams, have been recognized at each of the affected site areas.

e. Social Resources

CAWCS plans would affect the communities, individuals, and families, who are subject to flooding along the Salt and Gila Rivers from Granite Reef Dam to Gillespie Dam and the people who would be relocated because of construction and reservoir inundation in the site areas. The social implications of changes in recreation resources and facilities are analyzed in the EIS supporting document Social Impacts and Effects of CAWCS Plans (Dames & Moore, 1982b), but social impacts of recreation were scoped out of the EIS because they were not considered significant factors.

The affected flooding area includes communities within the study area. These are the cities of Phoenix, Tempe, Mesa, the communities of Buckeye and Holly Acres, and the Salt River Pima-Maricopa Indian Community and the Gila River Indian Community. Phoenix, Mesa, and Tempe are urban centers and residential areas, while Buckeye, Holly Acres, Salt River Pima-Maricopa Indian Community and Gila River Indian Community are rural agricultural communities.

Action plans described in this EIS would require relocations in three locations: the Fort McDowell Indian Community, Roosevelt Lake, and KA Ranch.

The Fort McDowell Indian Community is approximately 25 miles northeast of Phoenix. Established in 1903, the current population of the reservation is 374 (Fort McDowell Office of Economic Development Planning, 1980), the majority of whom are Yavapai. Residents would be required to relocate if a dam were constructed at the confluence of the Salt and Verde Rivers.

Roosevelt Lake is approximately 75 miles from the Phoenix metropolitan area. Some residents from each of the following communities would be required to relocate if a new or enlarged dam were built at Roosevelt Lake. Population of these communities is:

- North Bay Estates (approximately 60 residents)-Roosevelt Lake Estates (approximately 360 residents)
- Rockhouse Farm (approximately 50 residents)
- Roosevelt Gardens East (approximately 130 residents)

Of the total population of these communities, approximately 50 percent are part-time residents, living at the lake only on weekends or during part of the year.

2. Other Resources

a. Air Quality

The EPA and the Arizona Department of Health Services (ADHS) have set primary and secondary standards for various air quality constituents. Primary standards define the maximum pollutant levels allowable to protect the public health with an adequate margin of safety; secondary standards define the maximum pollutant levels allowable to protect the public welfare from any known or anticipated adverse effects. The state standards, which are generally comparable to the federal standards, are maximum pollutant levels that the ADHS considers to be in the best interest of the health of the general public. Both the National Ambient Air Quality Standards (NAAQS) and the Arizona state standards deal primarily with six pollutants. An area in which any NAAQS is exceeded, as shown by monitored data, is classified as a "non-attainment" area with regard to the offending pollutant. The state is required to reduce the ambient level of this pollutant within a specified period of time. A large portion of the study area is included in the Phoenix metropolitan area which has been designated a non-attainment area for carbon monoxide (CO), ozone (O_3), and total suspended particulates (TSP).

Ambient air quality data have been collected within the study area by government agencies and private industries. Most of the data, however, are from the Phoenix metropolitan area with only limited data from outlying areas. The following section describes the air quality of the study area in 1980 relative to each of the six designated pollutants.

Carbon Monoxide (CO): Virtually all of the CO data are from the Phoenix Metropolitan Area. The one-hour Federal and state standard was not violated at any location. However, the 8-hour standard was violated at a number of locations. The Phoenix Metropolitan Area has been designated as non-attainment for CO.

Non-methane Hydrocarbons (NMH): The Federal and state standard was grossly violated in 1980 at the one Phoenix monitoring site where data were collected. Because hydrocarbons play a key role in the chemical formation of ozone, the standard is used as a guide in devising plans to

achieve the ozone standard. Therefore, although the NAAQS has been violated, the Phoenix metropolitan area has been designated non-attainment for oxidants (ozone) rather than NMH.

Nitrogen Dioxide (NO_2): NO_2 data were collected at two Phoenix locations in 1980. The Federal and state standard was not violated at either of the sites.

Ozone (O_3): The Federal and state standard was violated at approximately half of the locations monitored. The majority of the locations are within the Phoenix metropolitan area, which has been designated non-attainment for O_3.

Total Suspended Particulates (TSP): Numerous violations of the Federal and state standards occurred in 1980. The EPA has classified the Phoenix metropolitan area as non-attainment for TSP.

Sulfur Dioxide (SO_2): None of the Federal or state standards were violated in the Phoenix area in 1980.

b. Aesthetics

The visual landscape of the CAWCS area includes the city and suburbs of Phoenix, lush green irrigated farmland, and the Arizona desert.

The terrain of the study area can be characterized by mountain ranges and steep barren slopes. Frequently, these slopes become massive, exotically shaped cliffs formed from rocks of various colors. The rugged terrain is often separated by broad, gently sloping, alluvium-filled valleys. Flowing rivers and intermittent streams meander through the desert landscape. Along the rivers, riparian vegetation adds a contrast with the earth colors and sparse vegetation of the desert. Visually these rivers and the shade of riparian vegetation are strong elements of the central Arizona landscape. Several large man-made lakes also provide a pleasing visual experience.

c. Noise

Typical background ambient sound levels (in decibels) for various study area land uses are displayed in Table III-7. The EPA has suggested an annual day-night sound level (L_{dn}) of less than 55 dB as being requisite to protect public health and welfare.

d. Geology/Soils

Most of the study area is included in the Basin and Range Physiographic Province. The northeastern part of the area is in the Transition Zone which separates the Basin and Range Province from the Colorado Plateau. The Basin and Range is characterized by mountain ranges that are distinctly longer than they are wide, generally parallel to other ranges, with steep slopes and rugged topography. The mountain ranges are usually separated by near-flat to gently sloping valleys or basins which have been filled with alluvium. The Transition Zone is characterized by a topography which is more rugged than that of the Plateau; however, altitudes are generally lower in the Transition Zone.

Table III-7

AMBIENT SOUND LEVELS BY LAND USE TYPE

Land Use	Day-Night Ambient Sound Level (L_{dn}) in dB
Urban Residential Near to Highway	75-85
Urban Residential Hi-Rise	65-85
Urban Shopping Center	55-70
High Density Single Family Urban Residential	50-65
Suburban Residential	35-60
Suburban Residential at City Outskirts	45-60
Small Town Residential	40-55
Farm	30-45
Open Land (except agricultural)	15-45

Various igneous, sedimentary, and metamorphic rocks ranging in age from Precambrian to Quaternary are exposed within the study area. The area has been subjected to a number of geologic processes including folding, faulting, intrusions, deposition, and erosion. Modern landforms are, in part, a result of the Basin and Range orogeny which extended from early or middle Miocene time into the Pliocene.

Historic seismic activity in Arizona has ranged from moderate in some areas to virtually nonexistent in others. Of the recorded epicenters in Arizona, very few have had a magnitude of 5.0 or greater on the Richter scale.

The study area is characterized by broad valleys underlain by permeable alluvial deposits hundreds to even thousands of feet thick and by abruptly rising mountains which typically consist of crystalline rocks of low permeability. Within these areas, particularly in portions of Pinal and Maricopa Counties, where the state's population and agriculture are centered, water levels have been declining since 1923. The decline is due to water withdrawal in excess of the volume of recharge. With water level declines on the order of 200 to 300 feet over the years, the dewatered zone has become compacted, the land surface has subsided, alluvial deposits have been subjected to stress, and earth fissures have formed, usually near the margins of basins adjacent to mountains. Often there is some vertical displacement across these cracks. The cracks quickly widen due to erosion by surface water and usually form gully-like features.

Although there are no earth fissures known to occur at the CAWCS site areas, they do occur within the general study area and the potential for their formation is high in areas where ground water levels continue to decline.

There are many known localities of metallic and nonmetallic minerals, nonferrous base, and precious metals throughout the study area. A majority of the ore bodies are located within the mountainous region, but the alluvial basins contain abundant sources of sand and gravel and other minerals.

Because of their quality, growing season, and moisture supply, some of the soils in the study area are able to produce sustained high agricultural yields by modern farming methods. The Soil Conservation Service has mapped these areas of prime farmland for a portion of the study area. In 1980 there were an estimated 620,000 acres of prime farmland within the CAWCS area.

e. Land Resources

Existing generalized land use and landownership patterns within the CAWCS study area are described below.

(1) Existing Land Use Patterns

Land use patterns within the 13,400-square-mile CAWCS study area are shown in Figure III-2. The CAWCS study area is predominantly rangeland, with approximately 76 percent of land classified in this category. Agricultural lands comprise approximately 12 percent of the total CAWCS area. They lie primarily west and southeast of the Phoenix metropolitan area.

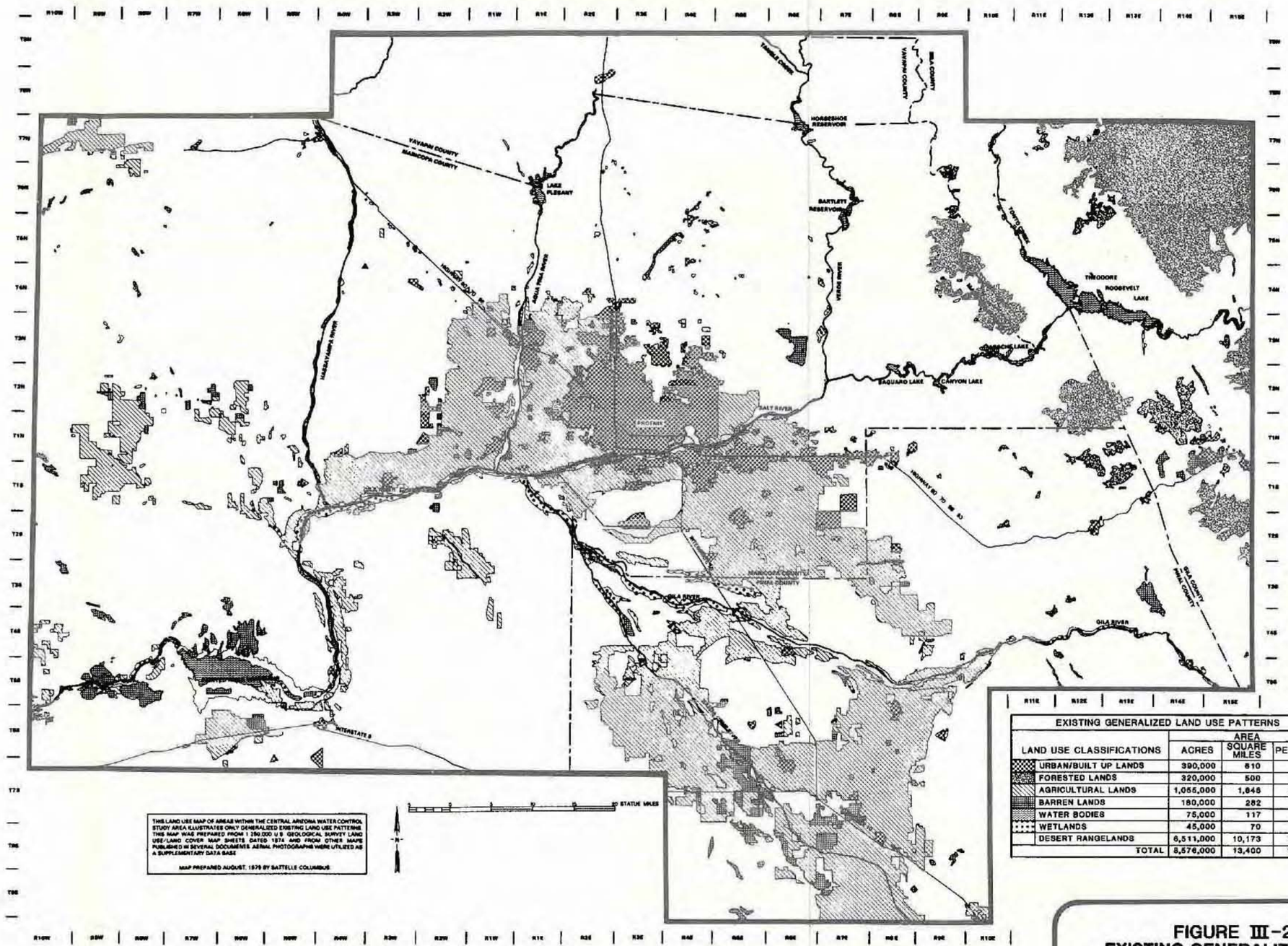
Urban/built-up lands comprise approximately 5 percent of the total CAWCS area. The major urban and built-up lands are located within the City of Phoenix and the adjacent Cities of Tempe, Mesa, Scottsdale, Paradise Valley, Fountain Hills, Glendale, Peoria, Sun City, Surprise, El Mirage, and Youngtown.

Four other minor land use/land cover classifications found within the study area include forest lands, barren lands, surface water bodies, and narrow riparian wetland areas as indicated on Figure III-2.

(2) Landownership Patterns

General surface landownership patterns for the CAWCS area are shown in Figure III-3. Approximately 70 percent of lands remain in public ownership or are Indian reservations. These lands are predominantly desert rangeland. The privately-owned lands, mostly located in the central part of the study area, are predominantly urbanized or agricultural.

The U.S. Forest Service manages about 23 percent of the land within the CAWCS area, including portions of two Tonto National Forest Wilderness areas, the Mazatzal and Superstition. National Resource



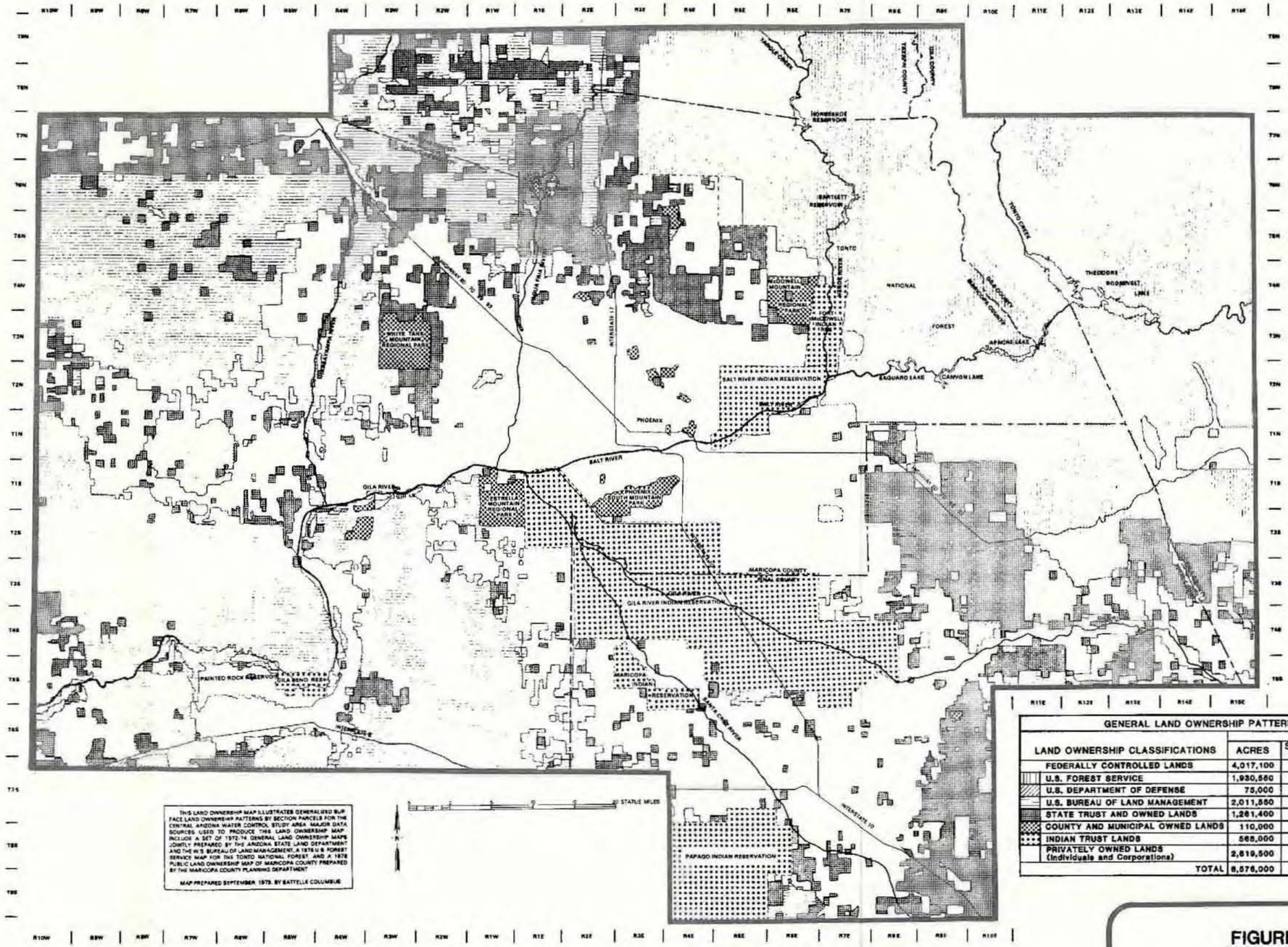
THIS LAND USE MAP OF AREAS WITHIN THE CENTRAL ARIZONA WATER CONTROL STUDY AREA ILLUSTRATES ONLY GENERALIZED EXISTING LAND USE PATTERNS. THIS MAP WAS PREPARED FROM 1:250,000 U.S. GEOLOGICAL SURVEY LAND USE/LAND COVER MAP SHEETS DATED 1974 AND FROM OTHER MAPS PUBLISHED IN SEVERAL DOCUMENTS. AERIAL PHOTOGRAPHS WERE UTILIZED AS A SUPPLEMENTARY DATA BASE.

MAP PREPARED AUGUST, 1979 BY BATTELLE COLUMBUS

EXISTING GENERALIZED LAND USE PATTERNS

LAND USE CLASSIFICATIONS	AREA ACRES	AREA SQUARE MILES	AREA PERCENT
URBAN/BUILT UP LANDS	390,000	610	4.6
FORESTED LANDS	320,000	500	3.7
AGRICULTURAL LANDS	1,055,000	1,648	12.3
BARREN LANDS	180,000	282	2.1
WATER BODIES	75,000	117	0.9
WETLANDS	45,000	70	0.5
DESERT RANGELANDS	6,511,000	10,173	75.9
TOTAL	8,576,000	13,400	100%

FIGURE III-2
EXISTING GENERALIZED LAND USE PATTERNS



GENERAL LAND OWNERSHIP PATTERNS

LAND OWNERSHIP CLASSIFICATIONS	ACRES	AREA SQUARE MILES	PERCENT
FEDERALLY CONTROLLED LANDS	4,017,100	6,276	46.8
U.S. FOREST SERVICE	1,930,560	3,016	22.5
U.S. DEPARTMENT OF DEFENSE	75,000	117	0.9
U.S. BUREAU OF LAND MANAGEMENT	2,011,550	3,143	23.4
STATE TRUST AND OWNED LANDS	1,261,400	1,971	14.7
COUNTY AND MUNICIPAL OWNED LANDS	110,000	172	1.3
INDIAN TRUST LANDS	568,000	886	6.6
PRIVATELY OWNED LANDS (Individuals and Corporations)	2,619,500	4,093	30.5
TOTAL	8,576,000	13,400	100%

FIGURE III-3
GENERAL LAND OWNERSHIP PATTERNS

Lands controlled by the Bureau of Land Management also comprise approximately 23 percent of the total study area. The majority of these lands are consolidated blocks of mountains and foothills located in the western part of Maricopa County. Williams and Luke Air Force Bases and the Florence Military Reservation controlled by the U.S. Department of Defense account for approximately 1 percent of the total CAWCS area.

The Arizona State Land Department and several other state agencies have administrative responsibilities for managing approximately 15 percent of land within the CAWCS area. The majority of the State Trust Lands within the study area are located north and southeast of the Phoenix urban area. The State Land Department generates revenues from these lands by leasing the lands for grazing, mineral, homesite, agricultural and other purposes. Under provisions of the recently enacted Urban Lands Management legislation, the Land Department now engages in the long-term lease of State Trust Lands near urban areas for private development (Arizona Revised Statutes, Title 37; Arizona State Land Department).

County and municipally owned lands constitute slightly over 1 percent of the total CAWCS area. Almost all of these lands are unspoiled nature preserve parklands within the Maricopa County and City of Phoenix park systems.

Five Indian reservations comprise approximately 7 percent of the study area. These are the entire Fort McDowell, Salt River, Gila River, and Ak-Chin Indian Reservations, and a portion of the Papago Indian Reservation. Most Indian reservation lands are primarily open rangelands generally used for farming or grazing purposes, but increasingly, the Indian communities are leasing unused community lands to the general public for commercial, housing, agricultural, recreational and industrial development.

Privately owned lands, totalling approximately 31 percent of the CAWCS area, are mostly located within the Phoenix urbanized area and to the southeast and west of the City of Phoenix. The smaller parcels of privately owned land located within or near urban areas are primarily used for residential, commercial, industrial, recreational, and public utility purposes. The larger parcels of privately owned lands located outside of the urban areas are predominantly used for agriculture.

C. Description of Affected Site Areas

1. New/Modified Stewart Mountain Site Area

The existing Stewart Mountain Dam, located on the Salt River approximately 10 miles upstream from the confluence of the Salt and Verde Rivers, was constructed in 1930 as part of the SRP system for water storage and hydroelectric purposes.

The entire area which would be affected by construction of New Stewart Mountain Dam is located within the boundaries of the Confluence site area (see Figure III-1). The description of the New Stewart Mountain affected site area is, therefore, included in the description of the Confluence site area.