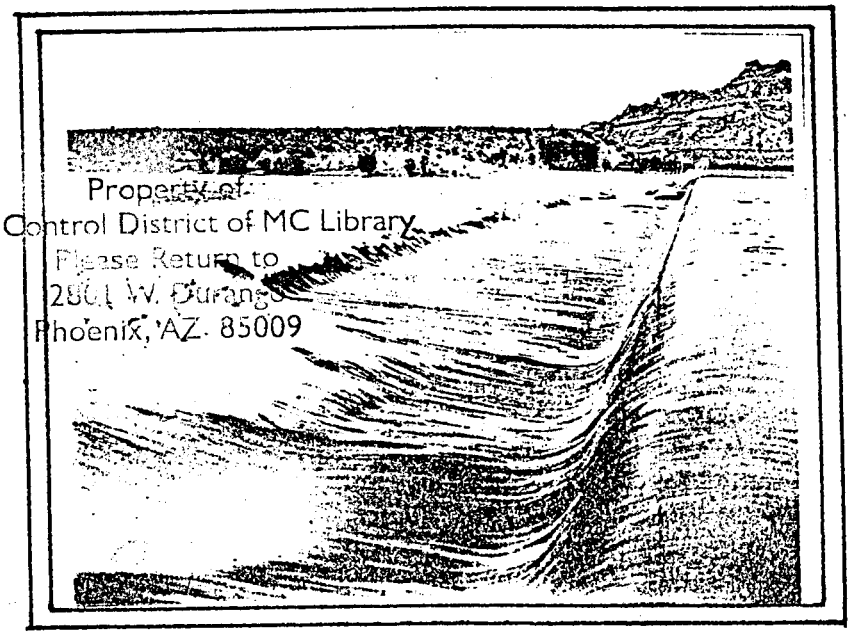
Summary of FLOOD CONTROL PROGRAM report:



Property of
Flood Control District of MC Library
Please Return to
2801 W. Durango
Phoenix, AZ. 85009

PREPARED BY THE

FLOOD CONTROL DISTRICT

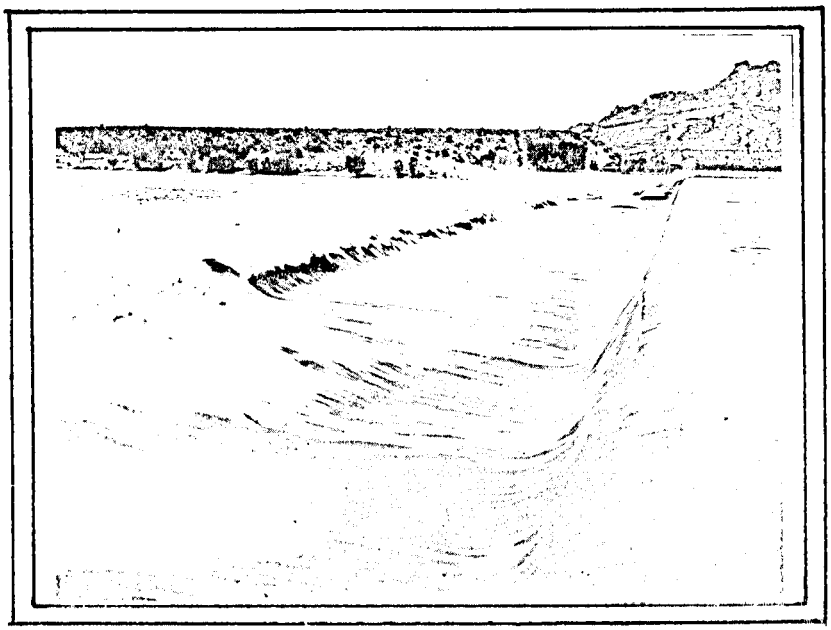
of

MARICOPA COUNTY, ARIZONA

FP
899.089

1963

Summary of FLOOD CONTROL PROGRAM report:



PREPARED BY THE

FLOOD CONTROL DISTRICT

of

MARICOPA COUNTY, ARIZONA

1963

SR-12

ACKNOWLEDGMENTS

The Flood Control District makes a special acknowledgment to the members of the Flood Protection Improvement Committee. This committee, formed under the guidance of Jack Williams, then Mayor of Phoenix, and Fred Glendening, then County Engineer, was instrumental in the securing of passage of the Arizona State Statutes which authorized the formation of the Flood Control District. The citizens of Maricopa County are deeply indebted to this committee, whose members are here listed:

Maricopa County	City of Phoenix	Salt River Project
T.R. Weiswander	Leigh Gardner, Chairman	H.J. Roth, Secretary
H.C. Tognoni	Sam Tucker	E.L. Wilson
H.H. Williams	L.R. Jurwitz	Henry Shipley

Further acknowledgment is made to all former members of the Citizens' Advisory Board to the Flood Control District: namely, Jess Watt, first chairman; Charles Patten, former chairman; Del Fisher, Jack Williams, and Othel Narramore.

Thanks are due to the members of the Advisory group representing the various communities in the District, and to the newspapers of the County who made their past records available.

The Flood Control District is grateful to the Maricopa County Highway Department whose facilities have been made available, and to the County Engineer, under whose direction the Flood Control District operates.

Further acknowledgments for technical assistance and cooperation:

Salt River Project
Engineering Department, City of Phoenix
Bureau of Reclamation
Soil Conservation Service
Bureau of Land Management
U.S. Army Corps of Engineers
U.S. Geological Survey
Soil Conservation Districts of the County
Roosevelt Irrigation District
Maricopa County Municipal Water Conservation Dist.#1
Roosevelt Water Conservation District
Buckeye Irrigation & Drainage District
Maricopa County Parks Commission
Arizona State Highway Department
Arizona State Land Department
Bureau of Indian Affairs

FLOOD CONTROL DISTRICT
of
MARICOPA COUNTY
4701 East Washington Street
Phoenix 34, Arizona

Board of Directors
Flood Control District
Phoenix, Arizona

Honorable Board:

Submitted herewith for your consideration is the Comprehensive Flood Control Program Report for Maricopa County, Arizona.

The Report consists of:

1. The basic narrative with descriptions of all drainage areas within or adjacent to the County.

2. A tabulation of drainage areas showing the major flood control problems, recommended solutions, and cost estimates.

3. A summary showing the recommended projects that, based on information now available, are feasible and practical.

The conclusions and recommendations herein are based on reports by consulting engineers, various federal, state and local agencies and on experience and studies made by the staff of the Flood Control District.

The Citizens' Advisory Board on _____ reviewed and made suggestions regarding the contents of this report. This Board, finding the report to be satisfactory, and with the concurrence of the Chief Engineer and General Manager of the Flood Control District, and of the County Engineer, hereby recommends its adoption.

Respectfully submitted,

CITIZENS' ADVISORY BOARD

Chairman

SECTION 5

SECTION	TABLE OF CONTENTS	PAGE
1	COVER SHEET	1
2	ACKNOWLEDGMENTS	2
3	TRANSMITTAL LETTER	3
4	REPORT OUTLINE	4
5	TABLE OF CONTENTS	5 through 16
6	APPENDICES	
6.1	SUMMARY SHEETS	17 & 18
6.2	STRUCTURAL DATA SHEETS	19 & 20
6.3	LOCATION MAPS	21 & 22
7	RECOMMENDATIONS & SUMMARY	
7.1-A	GENERAL	23
7.1-B	RECOMMENDED PROJECTS & PLANS	24
7.1-B-1	Salt River Channel	24
7.1-B-2	Box Canyon Dam	24
7.1-B-3	Sols Wash Channel	24
7.1-B-4	Powder House Wash	24
7.1-B-5	Casandro Wash Dam	25
7.1-B-6	Sunset & Sunny Cove Dams	25
7.1-B-7	Buckeye Retarding Structures	25
7.1-B-8	Bender & Sand Tanks Improvements	25
7.1-B-9	Deer Valley Group	26

		Page
7.1-B-10	West Phoenix Floodways	27
7.1-B-11	Old Cave Creek Dam	27
7.1-B-12	Cave Creek Town Dike	28
7.1-B-13	Guadalupe Retarding Structure	28
7.1-B-14	Lower Indian Bend Channel	28
7.1-B-15	Maxwell Dam	28
7.1-B-16	Apache Junction-Gilbert Structures	29
7.1-B-17	Buckhorn-Mesa Structures	29
7.1-B-18	Mesa-Chandler-Gilbert Structures	29
7.1-B-19	Williams-Chandler Structures	30
7.1-B-20	Santan Structures	30
7.1-C	PROJECTS NOT RECOMMENDED	
7.1-C-1	Harquahala Valley Structures	31
7.1-C-2	Tonopah Structures	31
7.1-C-3	Eagle Tail Mountain Structures	31
7.1-C-4	Matthie Dam	32
7.1-C-5	Flying "E" Wash Dam	32
7.1-C-6	South Mountain Structures	32
7.1-C-7	Upper Indian Bend Channel	32
7.1-C-8	Queen Creek Floodway	32a
7.1-D	PROGRAM SUMMARY	33, 34
7.1-E	PROJECT LOCATION MAP	34 a
8	INTRODUCTION	34 a
8.1-A	OBJECT OF REPORT	35

		Page
8.1-B	SCOPE	36, 37
8.1-C	DIVISION OF AREAS	38
8.1-D	BASIC DATA	39, 40
8.1-E	ECONOMIC DEVELOPMENT	41, 42, 43
8.1-F	CLIMATOLOGY	44, 45
8.1-G	RUNOFF & STREAM FLOW DATA	46
8.1-H	OTHER PROJECTS & STUDIES	47, 48

SECTION 7

RECOMMENDATIONS & SUMMARY

7.1-A GENERAL

As a result of the various studies of flood control problems in Maricopa County, the Chief Engineer and staff of the Flood Control District have arrived at some definite recommendations and conclusions.

Based on this information, it is possible to classify proposed projects into two categories: Recommended and Not Recommended.

Projects recommended are considered justified and practical at the present time. Those not recommended are not considered justified and practical at this time, but could be at some future date. Ratio of benefits to cost is the main factor that has determined into which category a project is placed. In cases where this ratio will not permit recommendation, then participation by local individuals or groups may make it possible for the Flood Control District to re-classify such projects.

As directed by the Flood Control Law, the District is charged with the responsibility of operating and maintaining the projects recommended in this report. In addition to this, the District is also obligated to operate and maintain certain structures already installed, such as McMicken Dam and others. Also, the District may in the future enter into agreement with any group or agency to

operate and maintain flood control structures.

Cost of this phase of the program will, of course, vary according to the type of structure. For example: a channel will ordinarily require more maintenance than a retarding dam.

This responsibility and expenditure of time and money will increase with the number and age of the structures.

7.1-B RECOMMENDED PROJECTS AND PLANS

7.1-B-1 SALT RIVER CHANNEL

a. Construct short levees along Salt River between 40th Street, Phoenix, and Tempe Butte, Tempe. Includes channel clearance along Gila and Salt River from Gillespie to Granite Reef Dam.

b. As an alternate to the plan above, the Flood Control District recommends the following: channel clearing from Gillespie Dam to 107th Avenue and a lined channel from this point up the river to Country Club Drive in Mesa, then clearing on to Granite Reef Dam.

7.1-B-2 BOX CANYON DAM

a. Construction of an earth-fill dam across the Hassayampa River. Dam will be approximately 245 feet high and store 200,000 acre-feet of water.

b. Construct related outlet works to provide for flood control and domestic water.

7.1-B-3 SOL'S WASH CHANNEL

a. Plan calls for channel clearing and excavation beginning at U.S. Highway 89 and extending West to Flying "E" Wash; thence up Flying "E" Wash to a point above the Country Club.

b. Channel clearing will consist of removal of all brush, trees and debris.

c. Excavation will consist of digging a pilot channel for

the planned total length of clearing.

d. Total planned channel work will cover approximately 2.0 miles.

7.1-B-4 POWDER HOUSE WASH

a. Construction of an earth-fill dam on the Wash northeast of Wickenburg. Dam will be approximately 35 feet high and store 150 acre-feet of flood water.

b. Related outlet works and emergency spillway.

7.1-B-5 CASANDRO WASH DAM

a. Construction of an earth-fill dam across the Wash just North of U.S. Highway 60-70 and just West of City of Wickenburg. Maximum height of the dam will be 24 feet and planned flood water storage is 90 acre-feet.

b. Related outlet works and emergency spillway.

7.1-B-6 SUNSET AND SUNNY COVE DAMS

a. Construction of an earth-fill dam on each of these two small washes. Height of these dams is approximately 20 feet and total storage of both reservoirs is 137 acre-feet.

b. Related outlet works and emergency spillways.

7.1-B-7 BUCKEYE RETARDING STRUCTURE AND FLOODWAY

a. Plan calls for construction of a system of channels, retarding structures and a diversion to carry flood water to the Hassayampa River.

b. There will be 2 retarding structures approximately 12 miles long. Maximum height of the dams will be 25.0 feet and total storage will be 5560 acre feet.

c. In conjunction with the retarding structure, two floodways and one diversion will be constructed.

7.1-B-8 BENDER AND SAN TANKS IMPROVEMENTS

a. Construction of approximately 2.5 miles of dikes along each side of each wash to guide flood water into the proposed channels.

b. Channelization of Bender and Sand Tank Washes to make their capacity adequate to carry designed flows. Total length of channel will be approximately 1.5 miles. Design capacity - 6,000 cfs.

c. Relocation of the present siphon in Bender Wash. Redesign will allow canal water to go under the wash.

7.1-B-9 DEER VALLEY GROUP

a. North Phoenix Mountains Diversion - Construction of a channel from 20th Street to Cave Creek, parallel to the Arizona Canal, emptying into the Arizona Canal Diversion and eventually into Skunk Creek.

Construction of a channel from 38th Street to 48th Street, parallel to Arizona Canal for disposal of flood water to the Salt River through the old Cross-Cut Canal. Channel will be lined and have the necessary inlet and outlet structures.

Cost sharing as given for this project is based on the U.S. Corps of Engineers contributing a share of the total cost.

If they do not, then the Flood Control District will either have to support the complete project or else build it as a joint venture with the City of Phoenix.

b. Arizona Canal Diversion - construction of a channel parallel to the Arizona Canal running from the Cave Creek west to Skunk Creek. Channel will be lined with an inlet structure at the Cave Creek entrance about 0.5 miles west of 19th Avenue.

c. Union Hills Diversion - Construction of a lined channel beginning approximately at 36th Street between Bell Road and Union Hills Drive running generally west to empty into Skunk Creek. Channel will be concrete lined with necessary inlet structures.

d. New River Dam - an earth-fill dam located on New River in Section 26, Township 5 North, Range 1 East, approximately 8 miles northwest of Adobe. Dam will contain approximately 1,300,000 cu. yds. of fill and store 33,500 acre feet of water. Related outlet and emergency spillway included.

e. Adobe Dam - an earth-fill dam located in Township 5 North, Range 2 East, in Section 27 and 34. Reservoir will store approximately 13,000 acre-feet of flood water and dam will contain 1,600,000 cu.yds. of fill. Outlet works and emergency spillway will be included in the construction.

7.1-B-10 WEST PHOENIX FLOODWAYS

a. Glendale-Peoria Drain. Plan consists of a lined channel trapezoidal in shape, with 2:1 side slopes, from 51st Avenue and ¼ mile south of Olive Avenue running westerly for 2½ miles, then southerly ¼ mile, then westerly about 3½ miles to New River.

b. Maryvale-Glendale Drain

A lined channel running from the Grand Canal ½ mile west of 67th Avenue westerly approximately 5½ miles to the Agua Fria River.

c. West Phoenix-Maryvale Drain

Planned to run from 47th Avenue at the Grand Canal south to Thomas Road, thence southerly about 5.3 miles to the Salt River.

Cost sharing as given for the above projects are based on the U.S. Corps of Engineers contributing a share of the total cost.

If they do not, then the Flood Control District will either have to support these projects or else build them as a joint venture with the City of Phoenix.

7.1-B-11 CAVE CREEK DAM MODIFICATION

a. Alternate number one consists of building an earth dike 2,900 feet long across the natural spillway and construction of a new spillway on the west side of the old dam.

b. Alternate number two involves construction of an earth-fill dam across the natural spillway as above. An apron will be poured below the old concrete dam and flood water will flow over the dam during the floods.

7.1-B-12 CAVE CREEK TOWN DIKE

a. Work plan consists of constructing approximately 800 feet of earth dike with rock revetment on the wash about one-half mile East of the center of the town of Cave Creek.

7.1-B-13 GUADALUPE RETARDING STRUCTURES AND FLOODWAYS

a. Construction of three retarding levees of varying lengths. Average height is approximately 15 feet and total storage is 1170 acre-feet.

b. Construction of four floodways in conjunction with the retarding structures to convey floodwater eventually to the Gila River.

Channels will be concrete lined and have adequate capacity to carry maximum flow from the retarding basins.

7.1-B-14 LOWER INDIAN BEND CHANNEL

a. Plan is to construct a lined channel, trapezoidal in section, from the Arizona Canal at Indian Bend running Southerly to and entering Salt River at about 0.5 miles East of Scottsdale Road.

b. Bottom width is 14 feet and depth varies from 23 to 26 feet with a crossing structure over the Arizona Canal and an energy dissipating structure at the Salt River.

7.1-B-15 MAXWELL DAM

a. Construction of an earth-fill dam rising 169 feet above the streambed with a crest length of 5,200 feet.

Reservoir will store approximately 860,000 acre-feet with 672,000 acre-feet assigned to flood water storage.

b. Spillway will be built in the channel section of the dam. Related inlet and outlet works also included.

7.1-B-16 APACHE JUNCTION-GILBERT STRUCTURES

a. Construction of one retarding basin and 14.8 miles of floodways.

b. Retarding structure will be built south of U.S. Highway 60-70-80-89 and west of Vineyard Road. Total storage capacity will be 4,135 acre-feet with 3,960 reserved for flood storage. Dam will be 3.9 miles long with a maximum height of 25 feet.

c. Floodways will be constructed to operate in conjunction with the retarding structures to safely carry the floodwater to Queen Creek. Maximum capacity will be 2,550 cfs.

7.1-B-17 BUCKHORN-MESA STRUCTURES

a. The overall plan for flood control will include four floodwater retarding structures and 8.1 miles of floodways. Total length of retarding structures is 11.2 miles and the maximum height varies from 15.5 to 41.0 feet. Floodways will work in conjunction with the retarding structures to convey the floodwater to a safe outlet.

b. A debris basin and division box will be included so as to properly utilize the floodwater for irrigation purposes.

The above plan as recommended includes Weekes Wash retarding dam and floodway. While these structures are considered to be necessary in the watershed plan, the Flood Control Engineer does not recommend that the local share of funds be contributed by the Maricopa County Flood Control District.

The greatest share of benefits does not accrue to developments within this County. If the rights of way and other local costs were borne by local interests, then these structures could be built.

7.1-B-18 MESA, CHANDLER, GILBERT FLOODWAYS

a. The over all plan for control of floodwater in this area consists of a system of channels, eventually emptying into the Gila River. Channels are planned leading from the above cities that are designed to carry a five year recurrence flood.

b. Total length of the channels is 29 miles and they have an average bottom width of 10 feet with depths up to 10 feet.

7.1-B-19 WILLIAMS-CHANDLER STRUCTURES

a. Plan consists of two floodwater retarding structures, 9.2 miles of floodway construction, and one irrigation water turnout with gates.

b. Total length of retarding structures is 9.0 miles and the average height of the dams is 22 feet.

c. Total floodway length is 9.2 miles and capacity will be adequate to handle the floodwater released from the retarding structures.

7.1-B-20 SANTAN STRUCTURES

a. Overall plan for flood control here consists of a system of retarding structures and floodways to intercept and carry the

floodwater eventually to Queen Creek.

b. There will be four retarding structures and four floodways.

c. Total length of retarding levees is 7.3 miles with average height of 18.0 feet.

d. Total length of floodways is 6.1 miles maximum capacity is 400 cfs.

7.1-C PROJECTS NOT RECOMMENDED

7.1-C-1 HARQUAHALA VALLEY STRUCTURES

a. Construction of a levee approximately 10 miles long extending parallel to the 1400 foot contour from the west side of Range 10 West, approximately in the center of Township 3 North, then easterly to an intersection with Gin Road.

b. Improvement of the channel along Gin Road along with necessary new channel to carry the released flood water to Centennial Wash.

7.1-C-2 TONOPAH STRUCTURES

a. Construct a levee approximately 12 miles long along the 1200 foot contour beginning in Section 17, Township 2 North, Range 7 West and extending to Section 16, Township 2 North, Range 5 West.

b. Channel improvements in Winters Wash to make it adequate to carry the designed release flow.

7.1-C-3 EAGLE TAIL MOUNTAIN STRUCTURES

a. Construction of a dike beginning in Section 26, Township 2 North, Range 11 West and running along the 1400 foot contour ending in Section 1, Township 1 South, Range 10 West. Total length will be approximately 14 miles.

b. A floodway will be built beginning in Sec. 1, Township 1, South, Range 10 West, and run easterly along section line, intersecting Centennial Wash. Old channel there will be enlarged to carry the required capacity.

7.1-C-4 MATTHIE DAM

a. An earth-fill dam located on Sols Wash approximately 8 miles west of Wickenburg. Maximum dam height will be 70 feet and total surface area will be 500 acres.

7.1-C-5 FLYING "E" WASH DAM

a. Construction of an earth-fill dam just south of U.S. Highway 60-70 and west of Wickenburg. Dam will be approximately 33 feet high and have a flood water storage capacity of 335 acre-feet.

b. Related outlet works and emergency spillway included.

7.1-C-6 SOUTH MOUNTAIN STRUCTURES

a. Present work plan consists of an unlined channel, trapezoidal in section, running parallel to the Highline Canal on the South side from near 48th Street westerly to the Indian reservation boundary and thence to the Salt River.

b. Construct a dam just west of Guadalupe and one near 43rd Avenue.

c. Related inlet and outlet controls works as needed.

7.1-C-7 UPPER INDIAN BEND CHANNEL

a. Plan consists of an unlined channel from Cholla Road and 36th Street to the Arizona Canal below Indian Bend Road. This joins the lower Indian Bend Channel at the canal.

b. Install concrete box culverts to accommodate low flows and wide sections at half-mile roads.

7.1-C-8 QUEEN CREEK FLOODWAY

a. Plan consists of an unlined channel beginning at the Maricopa-Pima County line in Section 4, Township 3 South, Range 6 East and continuing to the Gila River.

7.1-D PROGRAM SUMMARY

7.1-D-1 General

The entire program as recommended by the Flood Control District will cost $135,058,550. The District will contribute $30,165,700 and receive other participation of $104,892,850 mostly from federal agencies.

For the purpose of study and consideration the complete program has been broken down into three groups or "phases."

Group I includes the very minimum that could be done at the present time, and should be considered Phase I of the overall plan. Group II is an intermediate step working still toward Group III and the total cost as given in Paragraph 1, above.

The Flood Control program as recommended requires, on most projects, federal government approval and assistance. This approval and assistance may not always be forthcoming, according to the order of projects as listed on page 34 or to priorities that may be established. For example: Soil Conservation Service funds may become available to share in the cost of the projects in eastern Maricopa County before the U.S. Corps of Engineers funds are allocated to build the structures in the Deer Valley Group. This, of course, will determine when the projects can be installed and priorities may have to be revised.

Annual cost for the total program to the Flood Control District will depend upon the interest rate paid for bonds sold and the period of amortization. Annual funds required also include maintenance and operation and is estimated as follows:

Group I	$	798,000
Group II		1,005,918
Group III		1,526,838

Following are the three major groups with group three being the ultimate present recommended plan. County-wide coverage and degree of protection increases in each successive group.

RECOMMENDED PROJECTS SUMMARY

Job Description	FCD COST	OTHER COSTS	TOTAL COSTS
Group I			
Gila Salt River Channel Clearance	1,020,000	2,550,000	3,570,000
Lower Indian Bend Channel	1,770,000	7,250,000	9,020,000
Arizona Canal Diversion	944,000	7,060,000	8,004,000
North Phoenix Mountain Channel	2,366,000	4,277,000	6,643,000
Union Hills Diversion	2,396,000	12,645,000	15,041,000
New River Dam	3,770,000	2,002,000	5,772,000
Adobe Dam	832,000	2,301,000	3,133,000
Casandro Wash Dam	60,200	0	60,200
Sunset & Sunny Cove Dams	79,000	0	79,000
Buckhorn-Mesa Structures	3,574,200	3,855,000	7,429,200
Bender & Sand Tank Structures	152,100	113,750	265,850
Sub-Total	16,963,500	42,053,750	59,017,250
Group II*			
Apache Jct.-Gilbert Structures	1,208,900	3,803,700	5,012,600
Mesa-Chandler-Gilbert Floodways	3,000,000	0	3,000,000
Williams-Chandler Structures	836,900	3,738,000	4,574,900
Buckeye Structures	687,300	2,930,300	3,617,600
West Phoenix Floodways	996,000	5,705,000	6,701,000
Sub-Total	23,692,600	58,230,750	81,923,350
Group III**			
Sols Wash Channel	40,000	0	40,000
Powder House Wash Dam	50,000	82,000	132,000
Guadalupe Structures	519,000	660,200	1,179,200
Cave Creek Town Dike	3,300	11,700	15,000
Maxwell Dam	650,000	5,050,000	5,700,000
Salt River Channelization***	2,678,800	30,261,200	32,940,000
Santan Structures	895,000	2,678,000	3,573,000
Box Canyon Dam	652,000	6,948,000	7,600,000
Cave Creek Dam	65,000	91,000	156,000
Queen Creek Floodway	920,000	880,000	1,800,000
GRAND TOTAL	30,165,700	104,892,850	135,058,550

* Includes Group I plus projects below

**Includes Group I and II plus projects below

*** Based on construction of Maxwell Dam with Outflow of Approx.40,000 cfs

SUMMMARY SHEET OF STRUCTURES FOR FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

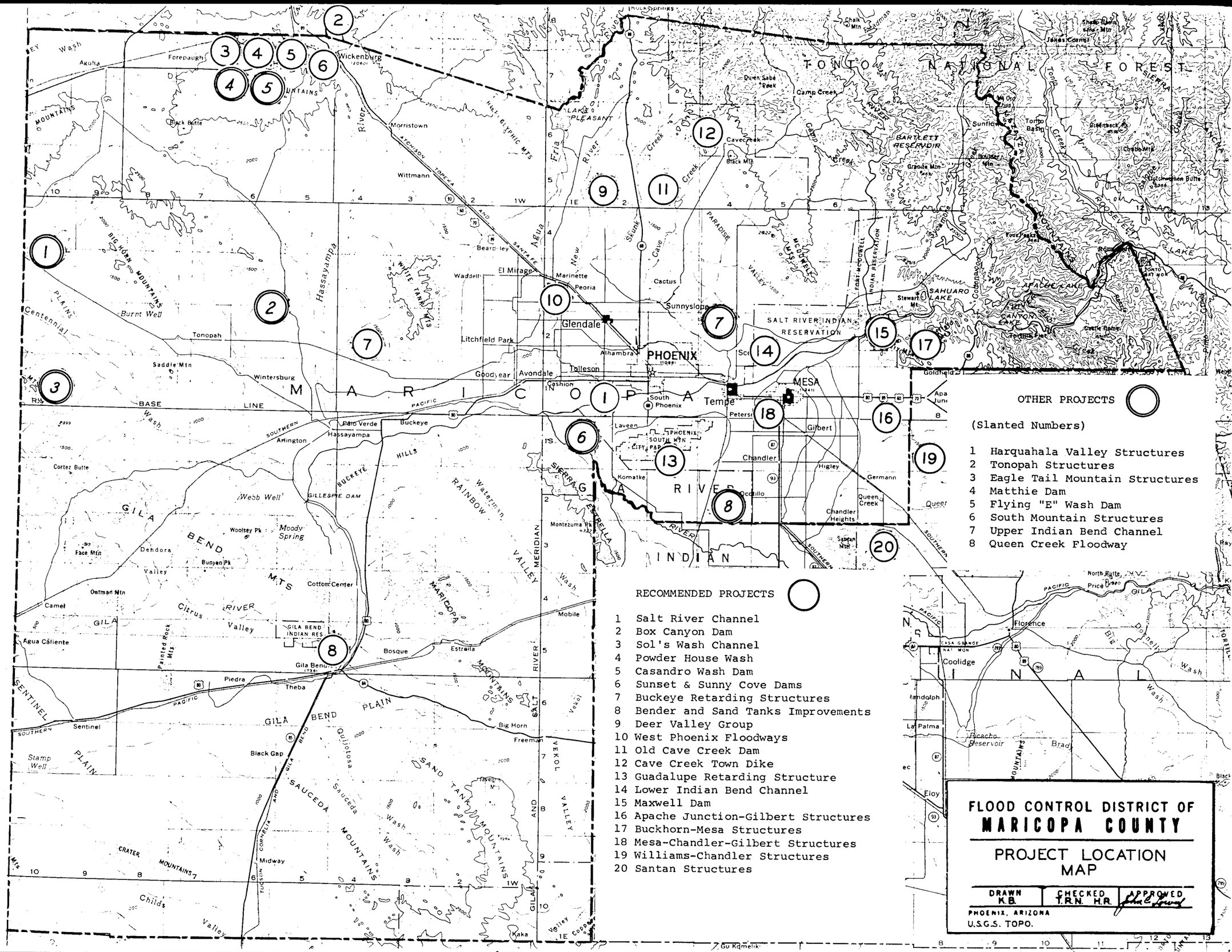
DRGE. AREA	LOCATION	JOB DESCRIPTION	FCD COST $	OTHER FUNDS	TOTAL COSTS $	ANNUAL BENEFITS	ANNUAL COSTS $	BENEFIT-COST RATIO	REMARKS
	Gillespie Dam to Granite Reef Dam	Channel clearing & Levee Construction	1,020,000	2,550,000	3,570,000	354,000	202,000	1.75 to 1.00	Approved by U.S.A. Corps of Eng.
4	Harquahala Valley Drainage	Retarding Structures & Floodways	400,000	3,770,000	4,170,000	70,000	171,000	0.41 to 1.00	Under study by SCS
4	On Winters Wash near Tonopah	Retarding Structures & Floodways	120,000	1,950,000	2,070,000	50,000	85,000	0.60 to 1.00	Under study by SCS
4	Eagle Tail Mtn. Drainage	Retarding Structures & Floodways	700,000	1,849,000	2,549,000	70,000	112,000	0.63 to 1.00	Under study by SCS
6	Box Canyon nr. Wickenburg	Earth Dam	652,000	6,948,000	7,600,000	328,600	325,000	1.01 to 1.00	Benefits based on domestic water at $50 ac. ft.
7	Sol's Wash at Wickenburg	Matthie Dam (Earth dam)	500,000	556,000	1,056,000	11,000	43,000	0 26 to 1.00	Major benefit will be recreation

DRGE. AREA	LOCATION	JOB DESCRIPTION	FCD COST	OTHER FUNDS $	TOTAL COSTS $	ANNUAL BENEFITS	ANNUAL COSTS	BENEFIT-COST RATIO	REMARKS
7	Sol's Wash at Wickenburg	Channel alignment & protection	40,000	0	40,000	$2,500	$2,000	1.25 to 1.00	Work to be done by FCD
7	Flying "E" Wash at Wickenburg	Earth Dam	0	183,000	183,000	4,500	7,200	0.62 to 1.00	Local people will finance
7	Powder House Wash at Wickenburg	Earth Dam	50,000	82,000	132,000	10,000	5,600	1,80 to 1.00	To be studied by Corps of Engineers
7	Casandro Wash at Wickenburg	Earth Dam	60,200	0	60,200	4,500	2,500	1,80 to 1.00	Work to be done by FCD
7	Sunset & Sunny Cove Washes in Wickenburg	Earth Dam	79,000	0	79,000	6,200	3,500	1.77 to 1.00	Work to be done by FCD
9	Buckeye-Palo Verde Area	Retarding structures & floodways	687,300	2,930,300	3,617,600	150,000	124,000	1.21 to 1.00	Under study by SCS
12	Bender & Sand Tank Washes at Gila Bend	Channel protection & Canal siphon	152,100	113,750	265,850	12,450	10,700	1.16 to 1.00	Possible participation by SCS
22	West Phoenix-Glendale-Peoria	Floodways (Deer Valley below canal)	996,000	5,705,000	6,701,000	198,000	258,000	0.77 to 1.00	Based on participation by C.of Eng.

DRGE. AREA	LOCATION	JOB DESCRIPTION	FCD COST	OTHER FUNDS	TOTAL COSTS	ANNUAL BENEFITS	ANNUAL COSTS	BENEFIT-COST RATIO	REMARKS
24	Existing Cave Creek Dam	Levees & spillway	65,000	91,000	156,000	10,200	8,200	1.24 to 1.00	Part of the original plan
24	Town of Cave Creek	Levee	3,300	11,700	15,000	1,000	842	1.19 to 1.00	Will be included in U.S. C of E
22	20th St. to Cave Creek & Old Cross Cut	No. Phnx. Mtn. channel along Ariz. Canal	2,366,000	4,277,000	6,643,000		All of these projects are part of the Deer Valley Group. This is for the protection of Metropolitan Phoenix (Deer Valley, No. Mountain Area)		
22	Cave Creek to Skunk Creek	Arizona Canal Diversion to Skunk Creek	944,000	7,060,000	8,004,000				
22	Cave Creek to Skunk Creek in Deer Valley	Union Hills Diversion	2,396,000	12,645,000	15,041,000				
22	New River nw. of Glendale	Earth Dam	3,770,000	2,002,000	5,772,000				
22	Adobe Dam site nr. Adobe	Earth Dam	832,000	2,301,000	3,133,000				
22	64th St. to New River	Total Metropolitan Phoenix Area (Deer Valley Group)	10,308,000	28,285,000	38,593,000	2,232,000	1,480,750	1.51 to 1.00	TOTAL

DRGE. AREA	LOCATION	JOB DESCRIPTION	FCD COST	OTHER FUNDS	TOTAL COSTS	ANNUAL BENEFITS	ANNUAL COSTS	BENEFIT-COST RATIO	REMARKS
26	Guadalupe Watershed, East End. So. Mtn.	Retarding structure & Floodways	519,000	660,200	1,179,200	113,000	60,600	1.86 to 1.00	Under consideration by SCS
26	So. Mtn. 40th St. to 75th Ave.	Retarding structure & floodways	2,652,000	6,251,000	8,903,000	253,500	350,754	0.72 to 1.00	Under study by U.S. C. of E.
27	Indian Bend Wash below Ariz. Canal	Floodway	1,770,000	7,250,000	9,020,000	530,000	347,982	1.52 to 1.00	Approved by U.S. Corps of Engr.
28	Indian Bend Wash above Arizona Canal	Floodway	1,217,000	1,701,000	2,918,000	76,000	124,450	0.61 to 1.00	Study by U.S. Corps of Engr. requested
31	Salt River Above Granite Reef Dam	Maxwell Dam	650,000	5,050,000	5,700,000	369,000	276,000	1.34 to 1.00	Flood Control Cost
31	Salt River Above Granite Reef Dam	Maxwell Dam	650,000	30,350,000	31,000,000			Total Cost of Dam	
	Salt River Chan Channel	Channel clearing & lined channel thru Metropolitan area	2,678,800	30,261,200	32,940,000				

DRGE. AREA	LOCATION	JOB DESCRIPTION	FCD COST	OTHER FUNDS	TOTAL COSTS	ANNUAL BENEFITS	ANNUAL COSTS	BENEFIT-COST RATIO	REMARKS
32	Apache Junction Gilbert Watershed nr. Gilbert & Proving Grnds.	Retarding structures & floodways	1,208,900	3,803,700	5,012,600	276,750	197,500	1.40 to 1.00	Under study by SCS
32	Buckhorn-Mesa Watershed nr. Apache Junction	Retarding structures & floodways	3,574,200	3,855,000	7,429,200	499,440	281,000	1.78 to 1.00	Under study by SCS
32	Williams-Chandler Watershed nr. Higley & Williams AFB	Retarding structures & floodways	836,900	3,738,000	4,574,900	326,050	189,000	1.73 to 1.00	Under study by SCS
32	Mesa to Gila River	Outlet floodways for storm drainage	3,000,000	0	3,000,000	259,530	122,420	2.11 to 1.00	Storm drainage outlet for urban areas
33	Santan Watershed nr. Chandler Hts.	Retarding structures & floodways	895,000	2,678,000	3,573,000	250,000	145,000	1.72 to 1.00	SCS Study will be requested
33	Queen Creek at Gila River Indian Reservation	Flood Channel to carry water to Gila River	920,000	880,000	1,800,000	This project is considered a part of the eastern Maricopa County projects listed therein and no separate benefit-cost ratio determinations are made			



OTHER PROJECTS

(Slanted Numbers)

1 Harquahala Valley Structures
2 Tonopah Structures
3 Eagle Tail Mountain Structures
4 Matthie Dam
5 Flying "E" Wash Dam
6 South Mountain Structures
7 Upper Indian Bend Channel
8 Queen Creek Floodway

RECOMMENDED PROJECTS

1 Salt River Channel
2 Box Canyon Dam
3 Sol's Wash Channel
4 Powder House Wash
5 Casandro Wash Dam
6 Sunset & Sunny Cove Dams
7 Buckeye Retarding Structures
8 Bender and Sand Tanks Improvements
9 Deer Valley Group
10 West Phoenix Floodways
11 Old Cave Creek Dam
12 Cave Creek Town Dike
13 Guadalupe Retarding Structure
14 Lower Indian Bend Channel
15 Maxwell Dam
16 Apache Junction-Gilbert Structures
17 Buckhorn-Mesa Structures
18 Mesa-Chandler-Gilbert Structures
19 Williams-Chandler Structures
20 Santan Structures

FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

PROJECT LOCATION MAP

DRAWN	CHECKED	APPROVED
K.B.	T.R.N. H.R.	

PHOENIX, ARIZONA
U.S.G.S. TOPO.

8.1-A OBJECT OF REPORT

The basic purpose of this report is to summarize and place in a usable form all pertinent information on Maricopa County flood control problems and to make recommendations for their solution.

Authority for this report is set forth in the Flood Control Law, Article 5, Sections 45-2351 through 45-2371, inclusive, Chapter 10, Title 45, Arizona Revised Statutes. Based on this law, the Board of Supervisors of Maricopa County, on August 3, 1959, authorized the establishment of the Flood Control District to include all of Maricopa County.

Within this report are listed the major flood control problems, recommended solution to prevent or minimize damage, and cost estimates on structural measures required. If, in the future, a flood control problem should arise that has not been considered in this report, it will be studied and become a part of the comprehensive program.

Although flood control is the prime objective, consideration herein is given to erosion control, recreation, irrigation water storage, and ground water recharge.

In the past, heavy floods have occurred in certain areas but because of lack of economic development, protective measures cannot be justified at this time. Future expansion in these areas may be such that flood control works can be recommended and installed.

8.1-B -- SCOPE

The area covered by this report includes all of Maricopa County, Arizona, a total of 9,226 square miles.

Topography is extremely variable, going from high mountains to flat deserts. A major portion of the county is dry, rough desert with sparse vegetative cover. Flash floods occur in all sections due to steep slopes, high intensity rainfall, and lack of cover.

General trend of the drainage is to the southwest. The Gila and Salt River Basin is the main natural drain from the east side of the County until it leaves the County just south of Agua Caliente. Virtually all of the County drains into this system, with main tributaries being Indian Bend Wash, Cave Creek, Skunk Creek, New River, Agua Fria and Hassayampa.

The major problem areas are located near the urban population concentrations. This, of course, is due to the high damage possibilities from development, including businesses, industries and residences. Phoenix, Mesa, Apache Junction, Wickenburg, Gila Bend and the smaller towns scattered throughout the County are all greatly concerned with the problem of flood control. Extensive damage has also occurred in the developed agricultural areas throughout the County.

It should be kept in mind that according to law, the Flood

Control District has responsibility for operating and maintaining all structures included in this report. When these projects have been authorized, a program will be set up whereby the District can begin to carry out this important phase of the Flood Control Program.

8.1-C -- DIVISION OF AREAS

For the purpose of this report, Maricopa County has been divided into 35 different areas or watersheds.

Generally, the area boundaries conform to major drainage areas but this is not true in all cases. Descriptive titles have been given to make it easier to locate any particular structure within the County. Numbering of areas begins in the southwest corner and proceeds generally up and down, eventually reaching number 35 in the northeast part of the County.

These area numbers form the basis for the overall divisions of the report. The complete report is included in nine (9) chapters as shown in the report outline. Individual projects are given numbers corresponding to the drainage area in which they are located.

As an example, the Harquahala detention reservoir is located in the Lower Centennial Area so its project number is 9.4-_B The number 9 is the chapter number; the number 4 is the drainage area number; and the letter $_B$ indicates the order within the listing of projects.

8.1-D -- BASIC DATA

There have been many contributions to the study of flood control in Maricopa County. Many individuals and groups have for years been concerned with the problem .

On October 31, 1957, a committee was appointed by the City of Phoenix; the Board of Supervisors of Maricopa County, and the Board of Directors of the Salt River Project. It was directed to prepare a general plan of flood control for the greater Phoenix area and to recommend methods of financing, construction and operation of major flood protection works for the benefit of all the people. This constituted one of the first organized efforts to solve the flood control problem and provided the main impetus for formation of the present Flood Control District.

As directed by the Flood Control District Engineer, in order to expedite the work, the County was divided into three parts called "study areas". Reports from consultants who studied these areas are complete and available in the office of the Chief Engineer.

Area 1 consists of the southeastern part of Maricopa County and was studied by Benham Engineering Company.

Area 2 includes the whole western half of Maricopa County and was reported on by Johannessen and Girand Engineers

Area 3 includes the northeastern section of Maricopa County particularly the area north of the City of Phoenix, and was

reported on by Yost and Gardner Engineers.

The Soil Conservation Service has prepared reports on different watersheds in the east and southeastern part of the County.

The U.S. Corps of Engineers has reported on projects scattered throughout the County including Box Canyon Dam, Maxwell Dam and the Salt River Channel clearance.

All of these reports are available and form the background for the preparation of this comprehensive report.

Valuable basic data has also been contributed by the Salt River Project, U.S. Bureau of Reclamation, and the City of Phoenix.

8.1-E -- ECONOMIC DEVELOPMENT

Arizona was among the leaders in population growth from 1950 to 1960 and was the actual leader during the period from 1946 to 1950.

In reviewing Arizona's population trends over the past half century, figures indicate that growth has been concentrated in just a few counties, particularly Maricopa and Pima. Approximately half of Arizona's people live in Greater Phoenix and in Maricopa County.

Population within the County is expected to increase 85% from the 1959 figure and by 1969 will be 1,135,000 persons. Over 185,000 new workers must come from increased vocational training as well as from newcomers to the area. Like the State of Arizona, largest numerical growth will be in manufacturing and trade. Loss in agricultural land will be primarily to withdrawal of farm lands for residential and industrial use.

The following table shows County population, labor force and employment as of May 1959 and projected for May 1969. This will emphasize the tremendous growth expected for Maricopa County in the coming years.

POPULATION & EMPLOYMENT CHARACTERISTICS	1959	1969	INCREASE	% INCREASE
Total Population	614,000	1,135,000	521,000	84.9
Total Population, 14 & Over	420,600	756,000	335,400	79.7
Civilian dLabor Force	215,500	396,000	180,500	83.8
TOTAL Employment	208,800	378,000	169,200	81.0
Total Non-Agricultural Wage & Salaried	156,600	305,000	148,400	94.8
Manufacturing	29,600	72,000	42,400	143.2
Mining	500	600	100	20.0
Trade	41,200	80,500	39,300	95.4
Construction	16,100	30,200	14,100	87.6
Service	19,900	39,500	19,600	98.5
Transportation, Communications & Public Utilities	11,900	17,300	5,400	45.4
Finance, Insurance & Real Estate	9,000	16,800	7,800	86.7
Government	28,400	48,100	19,700	69.4
"All Other" Non-Agricultural*	28,600	50,000	21,400	74.8
Agricultural	24,000	23,000	- 1,000	-4.2

*Includes self-employed, unpaid family workers and domestic household workers.

Note: Data reported to nearest 100

Source: Arizona State Employment Service

The County's assessed valuation has grown as follows:

FISCAL YEAR	AMOUNT
1954 - 55	$359,352,720
1956 - 57	440,801,195
1958 - 59	538,674,654
1960 - 61	689,429,369
As of May 1, 1962	840,429,369

True value is approximately five times the above figures.

The Entire County is growing rapidly, especially in the urban areas. Land values are increasing very rapidly and acquisition for flood control purposes will become increasingly expensive.

8.1-F -- CLIMATOLOGY

By the standards of other regions Arizona has very little rainfall, yet it does have two relatively rainy periods in the year. These two periods are characterized by two distinctly different rainfall patterns.

Winter storms, yielding about one-half the total rainfall, occur from November through March. This precipitation usually results from general winter storms associated with extra tropical cyclones of North Pacific origin and often last for several days. These storms move south over the ocean and then inland to southern California, Arizona and New Mexico. They may cover thousands of square miles.

Summer storms, occuring during July, August and September, bring the other half of the total rainfall. During this period air currents bring warm moist air from the Gulf of Mexico. Mountain ranges and cold fronts act to produce thunderstorm conditions characterized by the cumulus clouds seen during this season. These summer storms often produce rainfall of high intensity, short duration, and limited areal extent. They may occur separately or in conjunction with general storms.

Such things as the distance from the sea by possible paths of moisture bearing currents, depth of such currents as affected by atmospheric depth and structure, ground elevations, temperature differentials, and other factors, influence the rain producing capacity of the atmosphere. The net effect of all these factors is to produce a variation of rainfall intensity

with geographic location. Maps have been prepared by the U. S. Department of Commerce - Weather Bureau and are available for study.

Structural designs in this report are based on "Technical Paper No. 40, "Rainfall Frequency Atlas of the United States" issued May 1961. For further study of rainfall patterns and intensities this report should be consulted.

The highest intensity of rainfall recorded at the Phoenix Post Office Weather Bureau station occurred on July 26, 1936 when 0.43 inches of rain fell in five minutes. This is a rate of 5.16 inches per hour. The record for 10 minutes was set July 26, 1952 when 0.70 inches fell, giving a rate of 4.2 inches per hour.

The number of weather bureau precipitation stations (or cooperating stations) is increasing and valuable data is being gathered.

8.1-G -- RUNOFF AND STEAMFLOW DATA

Steamflow data is meager except in the case of the Salt River flows. The Flood Control District is cooperating with the U. S. Department of Commerce - Geological Survey in establishing, maintaining and operating gaging stations within the county.

Gaging stations are located on Sycamore Creek, New River, Indian Bend, Lower Hassayampa River, Centennial Wash, Rainbow Wash and at Youngtown, South Mountain and Apache Junction. These stations are now operating and will provide much needed information toward future designs. They are at critical points such as small mountainous watersheds, desert watersheds, and urban areas so they will provide valuable data.

There will eventually be over 100 gaging stations in Maricopa County including approximately 34 of the recording type.

8.1-H -- OTHER FLOOD CONTROL PROJECTS AND STUDIES

Scattered throughout the county are various flood control projects. The White Tanks detention reservoirs, the Trilby Wash-McMicken dam project, Whitlow Ranch Dam, Queen Creek Channel, Painted Rock Dam and Cave Creek dam are examples.

The City of Phoenix has many miles of storm drains for 1 to 2 year frequency storms and are valuable as local drainage for the street system. The County, State and other municipalities have smaller ditches and drains in this same category. Some channelization and clearing has been done in spots on the Salt and New Rivers. In some areas local owners have built dams and dikes for flood control. These have been valuable for local protection but have not solved the overall problem.

The Salt River Project operates the Cave Creek Dam and also uses irrigation canals as best they can to alleviate flood damage. The canals intercept runoff and where possible the project diverts water to the Salt River and to waste ditches to keep flood damages to a minimum.

The City of Phoenix plans to construct a dam on Dreamy Draw in the North Phoenix Mountains and they continue to do a good job on their local drainage problem.

Projects are going forward for the Salt River and Lower Indian Bend through cooperation of Maricopa County and the U.S. Corps of Engineers.

The United States Army Corps of Engineers through their Los Angeles District is also studying Flood Control Projects

throughout the county and the results of their findings will be of major interest and importance to the community. The U.S.E.D. has also embarked on flood plain zoning studies along the Upper Indian Bend, Upper Cave Creek, Skunk Creek, New River, and the Agua Fria River. This work will be of great value as results become available.

The Salt River Indian Reservation through the Bureau of Indian Affairs is studying flood control problems, particularly above the Arizona Canal and east of Indian Bend Wash.

The U.S. Bureau of Reclamation continues its studies of the Central Arizona Project. Project and flood control measures will be incorporated into the final plans.

Tentative alignment of the Central Arizona Aqueduct indicates that much good protective work can be done in connection with that job. The proposed Maxwell Dam, provided with flood storage, will be of tremendous value to the Salt River in particular and the entire area in general.

Some works have been accomplished, a substantial amount is going on, and a tremendous amount needs doing.

The Flood Control District is providing that center around which the entire program can be oriented. Needed flood plain zoning checking of subdivision plats, a master plan of major works, construction of warranted projects, operation and maintenance of structures, and correlation of other agencies' plans, are part of the overall job of the District.

The projects recommended are based on surveys, and are located where the greatest possible protection is afforded at least cost.