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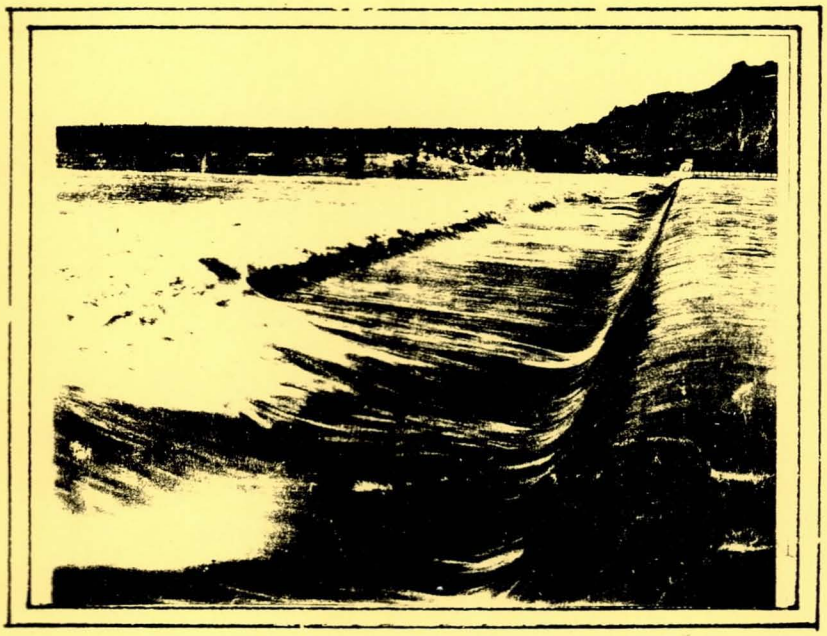

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FLOOD CONTROL DISTRICT of MARICOPA COUNTY, ARIZONA

1962

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FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

COMPREHENSIVE FLOOD CONTROL

PROGRAM REPORT

Board of Supervisors
of Maricopa County
and Board of Directors of the District

Mrs. James T. O'Neil, Chairman
B. W. (Barney) Burns
James E. Lindsay

County Engineer
Samuel F. Lanford

Chief Engineer and General Manager
John C. Lowry

Advisory Board

George Cavin, Chairman
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John Fisher
Sam Tucker, Ex-Officio
City of Phoenix

Louis Jurwitz, Vice-Chairman
H. S. Raymond
Hugh Nichols
Henry Shipley, Ex-Officio
Salt River Project

Cover Picture:
Verde Flood Water at
Granite Reef Dam,
February 21, 1920

-1962-

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. Neiswander	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
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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

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3.	TRANSMITTAL LETTER
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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.

b. Channel clearance along Gila and Salt River from Gillespie Dam 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 246 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 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 the wash.

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 CAVE DAMS

a. Construction of an earth-fill dam on each of these two small washes. Height of these dams are 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 unlived 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 the dam just West of Guadalupe and one near 43rd Avenue.

c. Related inlet and outlet controls works 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 School Road. This joins the lower Indian Bend Channel at the canal.

b. Install concrete box culverts to accomodate 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 $101,908,550. The District will contribute $27,670,900 and receive other participation of $74,237,650 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.

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	1,401,226

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 GROUP 1	F.C.D. COSTS	OTHER COSTS	TOTAL COSTS
Salt River Channel	1,020,000	2,550,000	3,570,000
Lower Indian Bend Channel	1,954,000	6,856,000	8,810,000
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 and Sunny Cove Dams	79,000	-00 -	79,000
Buckhorn-Mesa Structures	3,574,200	3,855,000	7,429,200
Bender and Sand Tank Structures	152,100	113,750	265,850
Sub-total	17,147,500	41,659,750	58,807,250
GROUP 11*			
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	21,511,300	57,785,450	79,296,750
GROUP 111**			
Sols Wash Channel	40,000	- 0 -	40,000
Powder House 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
San Tan 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
TOTAL	27,670,900	74,237,650	101,908,550

* Includes Group 1 plus projects below

** Includes Group 1 and 11 plus projects below

SUMMARY 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
1	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	328,000	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	132,500	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	1.80 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	

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	400,000	2,600,000	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			

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.

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 table of contents. 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 have reported on projects scattered throughout the County including Box Canyon Dam, Maxwell Dam and the Salt River Channel.

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 particularily 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 incooperated in 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 good 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 problem can be oriented. Needed flood plain zoning, checking of subdivision plats, a master plan of major works, construction of needed works as warranted, operation and maintenance of works, and correlation of other agency's plans are part of the overall job of the District.

The locations of the Flood Control Projects recommended in this report are based on surveys and are located where the greatest possible protection is afforded with the least expenditure of funds.

SECTION 9

INDIVIDUAL DRAINAGE AREAS

9.0-A SALT RIVER CHANNEL

9.0-A-1 General

For the overall plan for flood control in Maricopa County to be successful there must be some solution presented for controlling the Salt River. Hazardous occupancy within the channel increases daily and flood plain zoning or regulation to the historical banks of the river becomes more essential.

At the present time, without construction of Maxwell Dam, the peak flow possible in the Salt River is 290,000 cfs -- the Standard Project Flood. Some protection from lesser flows could be provided by building levees in key places but channelization and levee work to protect against the standard project flood is impractical. The natural banks will contain a flow of approximately 82,000 cfs and plans recommended are based on this size flow or less.

The plan finally adopted and installed depends largely on the amount of water released by Maxwell Dam, and this quantity is not definitely known at this time. The following are alternate plans based on variable flows in the River.

9.0.A-2 Plans

a. This is the present plan as recommended by the U.S. Army Corps of Engineers and is based on a regulated discharge

from Maxwell Dam of approximately 82,000 cfs. The Army plans to start construction on this project about July 1963. The County has agreed to acquire the lands, easements, and rights of way necessary for the construction of this project.

The plan consists of short levees between 40th Street, Phoenix, and Tempe Butte, Tempe, and channel improvements (primarily clearing) between Gillespie and Granite Reef Dams. Other levees that will give added protection to Tempe, Mesa, and other areas are presently under study and may be included in the final plan.

For more details on this plan, see the December 1957 Interim Report on Gila and Salt Rivers by Corps of Engineers, Los Angeles District. Maps 9.0-A through 9.0-G show planned extent and location. Table 9.0-1 shows a summary of costs.

b. This alternate plan is based on an outflow of approximately 82,000 cfs from Maxwell Dam and consists of the following: Short levees between 40th Street, Phoenix, and Tempe, Butte, Tempe, and channel clearing from Gillespie to Granite Reef Dam, as shown above exclusive of the reach from 107th Avenue to Country Club Drive in Mesa.

For this length of approximately 27 miles the river will be channelized; channel will be unlined and have the

following dimensions: bottom width 1686 feet; average depth 6.0 feet; side slope 2¼:1. Slopes will be lined with rubble masonry with bottom left unlined. Total right of way width is estimated at 1900 feet and a cost of $13,000,000. Total estimated cost of this channel is $60,000,000.

c. This alternate plan is based on an outflow from Maxwell Dam of 40,000 cfs. Project consists of the following: channel clearing from Gillespie Dam to 107th Avenue and an unlined channel from that point up the river to Country Club Drive in Mesa. Channel will have the following dimensions: bottom width 826 feet; average depth 6.0 feet; side slopes 2¼:1. Slopes will be lined with rubble masonry from three feet above the water line to five feet below the bottom of the channel. Total right of way width will be 1,000 feet, at an estimated cost of $8,100,000. Total project cost is estimated at $54,100,000.

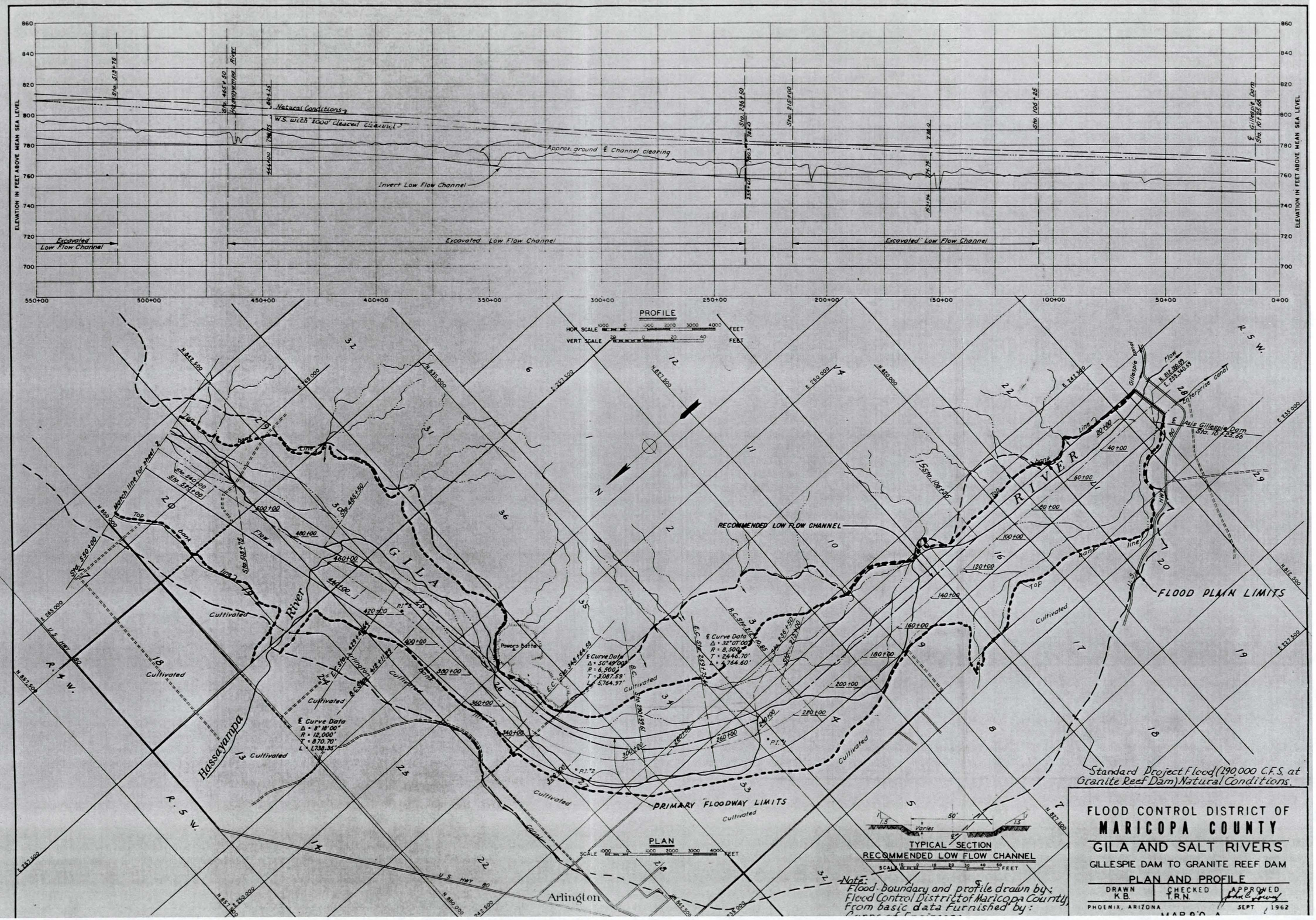
d. This alternate is based on an outflow from Maxwell Dam of 40,000 cfs. Project consists of the following: channel clearing from Gillespie Dam to 107th Avenue and a lined channel from this point up the river to Country Club Drive in Mesa. Dimensions: bottom width, 35 ft.; average depth, 20.0 ft.; side slopes 2¼:1. Entire cross-section

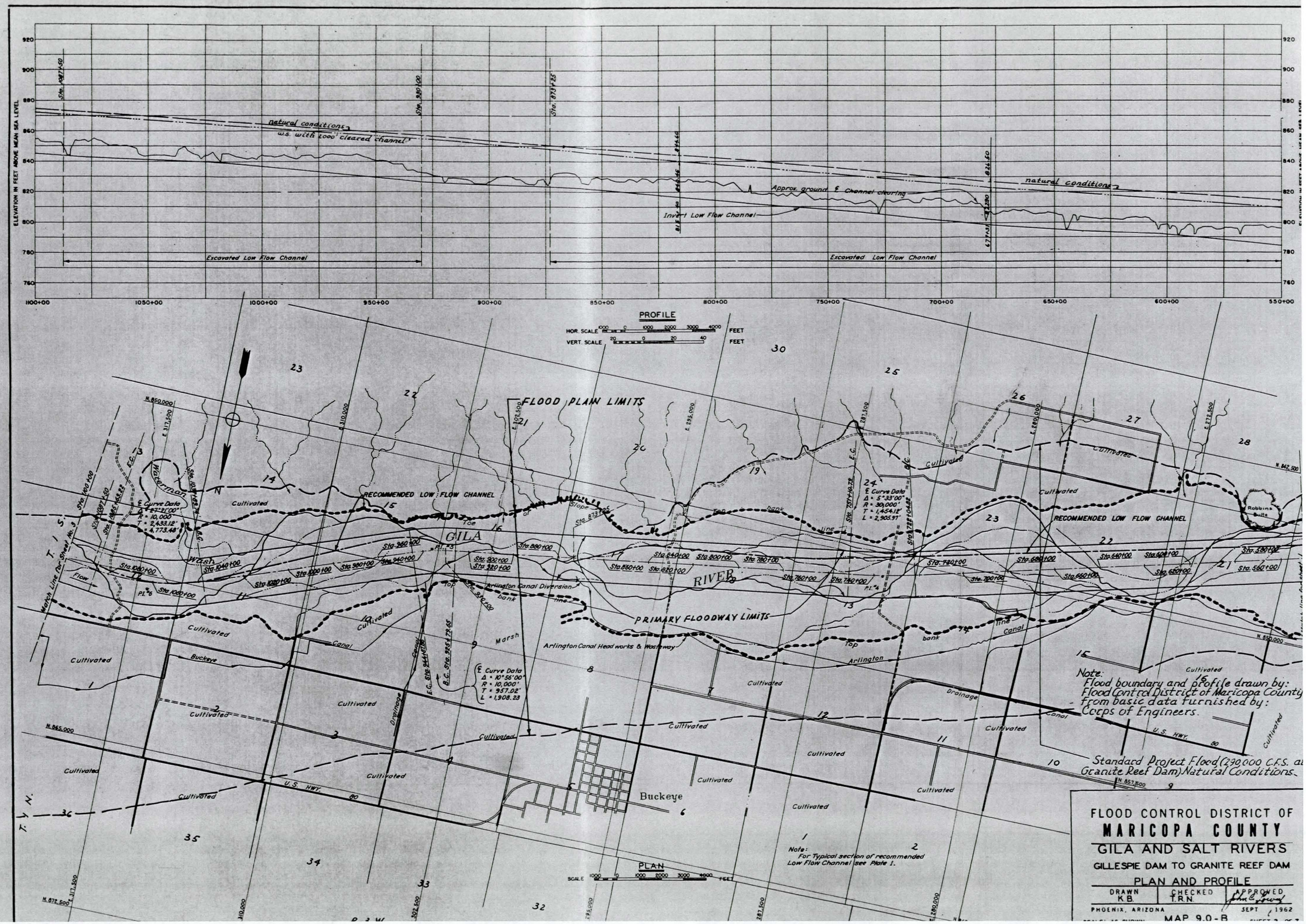
will be lined. Total right of way width will be 330 feet at an estimated cost of $2,700,000. Total project cost is estimated at $32,940,000.

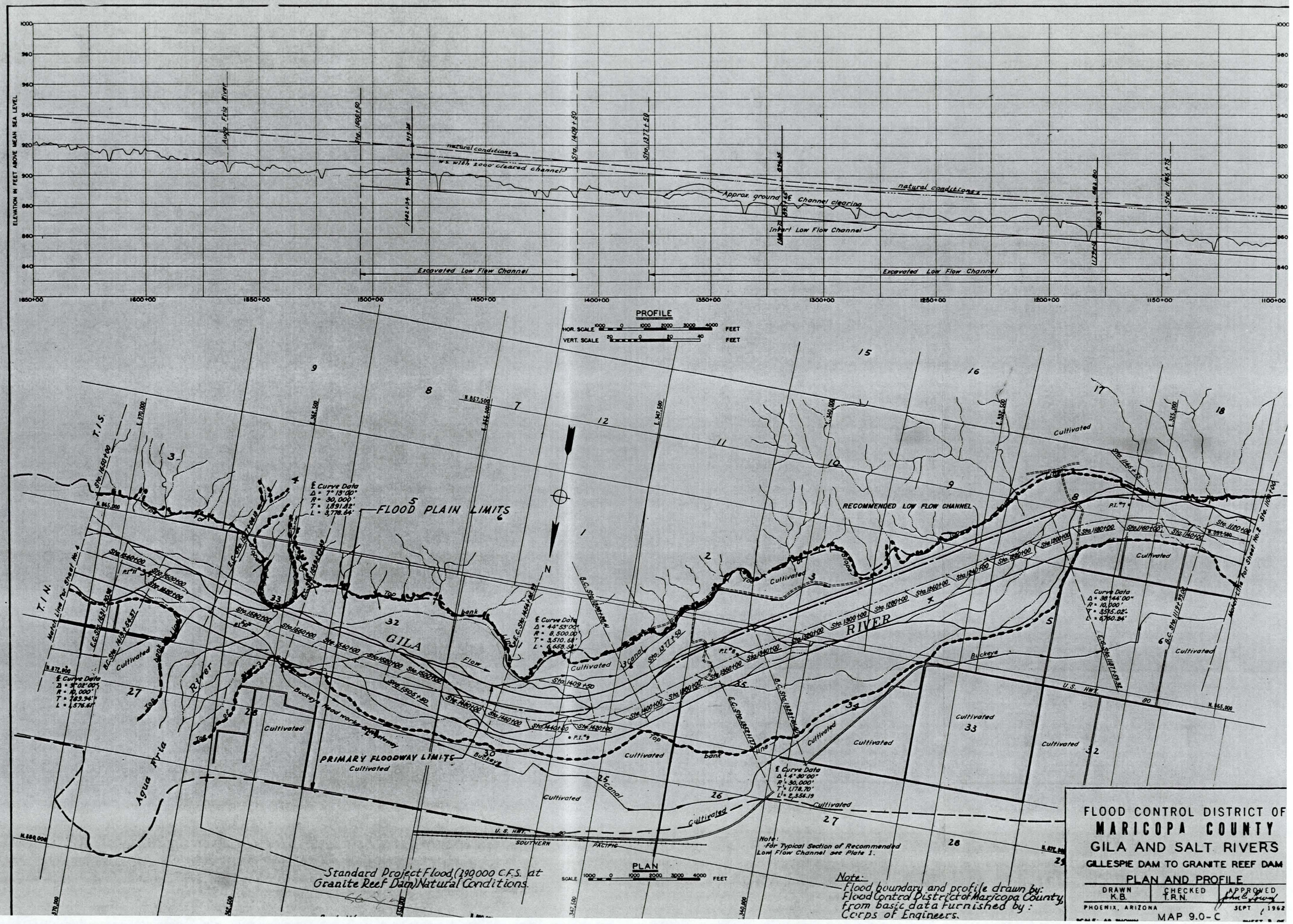
Based on the construction of Maxwell Dam, with an outflow of approximately 40,000 cfs, alternate (d) is the recommended plan.

TABLE 9.0-1 SALT RIVER CHANNEL SUMMARY

Job Description	Estimated Cost: Flood Control Dist.	Estimated Cost: Corps of Engineers
Short levees between 40th Street Phoenix and Tempe Bytte, Tempe and Channel improvement between Gillespie and Granite Reef Dam		
TOTAL	1,020,000	1,550,000
TOTAL PROJECT COST	3,570,000	
Flood Damage without Project		386,000
Flood Damage with Project		32,000
Benefits from Reduction of Flood Damage		354,000
Irrigation Benefits		-0-
Other Benefits		-0-
Total Annual Benefits		354,000
Total Project Cost Amortized @ 2-5/8%		149,650
Annual Operation and Maintenance		53,000
Total Annual Costs		202,000
Benefit-Cost Ratio	1.75 to 1.00	

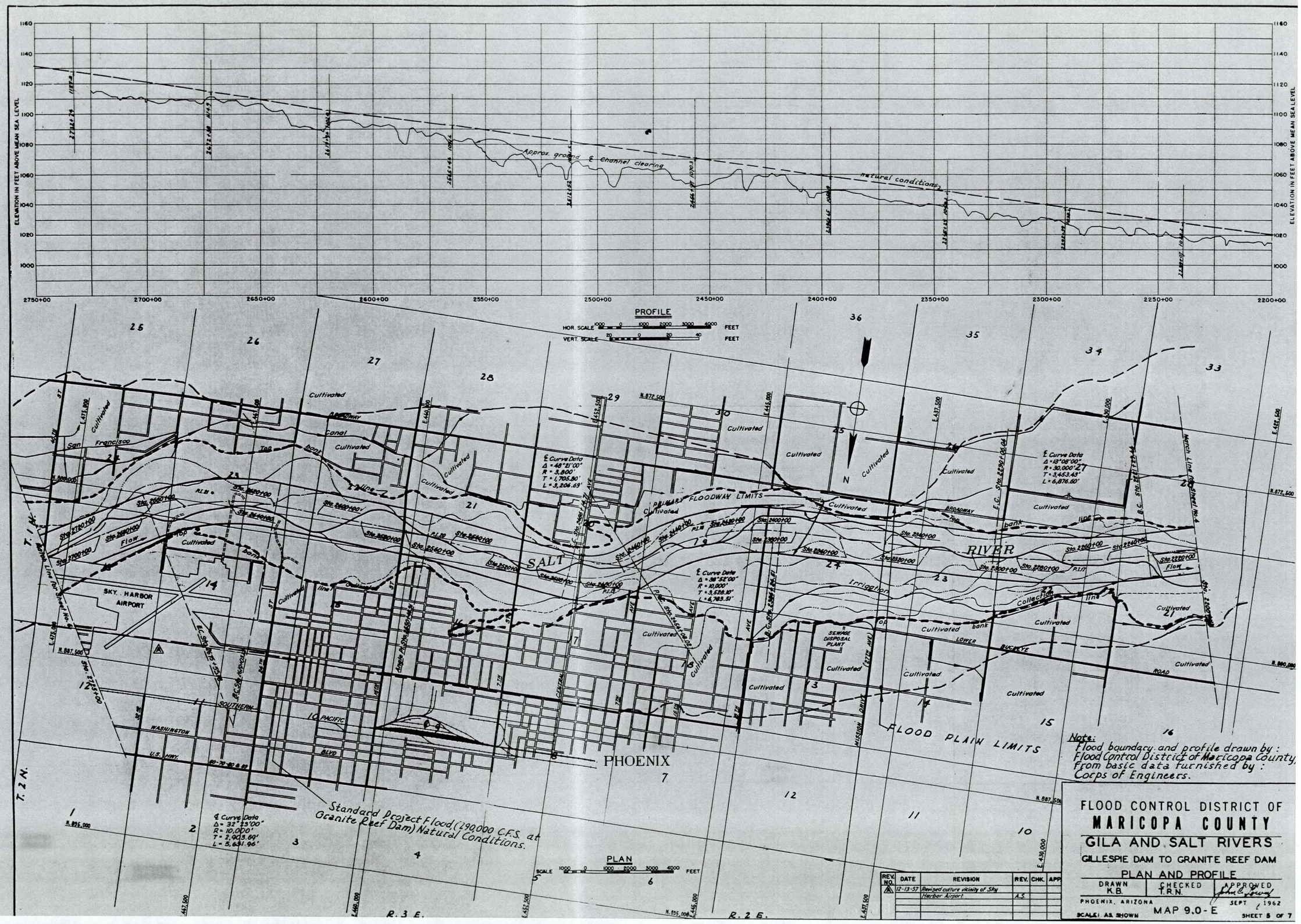

PROFILE
HOR. SCALE
VERT. SCALE
FEET
ELEVATION IN FEET ABOVE MEAN SEA LEVEL
Natural Conditions
W.S. with 1000' cleared channel
Approx. ground & Channel clearing
Invert Low Flow Channel
Excavated Low Flow Channel
Excavated Low Flow Channel
Excavated Low Flow Channel
PLAN
RECOMMENDED LOW FLOW CHANNEL
PRIMARY FLOODWAY LIMITS
FLOOD PLAIN LIMITS
GILA RIVER
Hassayampa River
Gillespie canal
Enterprise canal
Powers Butte
Arlington
Cultivated
U.S. HWY 80
R. 4 W.
R. 5 W.
TYPICAL SECTION
RECOMMENDED LOW FLOW CHANNEL
Standard Project Flood (190,000 C.F.S. at Granite Reef Dam) Natural Conditions.
Note: Flood boundary and profile drawn by: Flood Control District of Maricopa County, from basic data furnished by:
FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
GILA AND SALT RIVERS
GILLESPIE DAM TO GRANITE REEF DAM
PLAN AND PROFILE
DRAWN K.B.
CHECKED T.R.N.
APPROVED
PHOENIX, ARIZONA
SEPT. 1962


PROFILE
HOR. SCALE 1000 0 1000 2000 3000 4000 FEET
VERT. SCALE 20 0 20 40 FEET
ELEVATION IN FEET ABOVE MEAN SEA LEVEL
natural conditions
w.s. with 2000' cleared channel
Approx. ground & Channel clearing
Invert Low Flow Channel
Excavated Low Flow Channel
Excavated Low Flow Channel
natural conditions
Sta. 1087+50
Sta. 989+00
Sta. 873+25
Sta. 671+50
1100+00
1050+00
1000+00
950+00
900+00
850+00
800+00
750+00
700+00
650+00
600+00
550+00
FLOOD PLAIN LIMITS
RECOMMENDED LOW FLOW CHANNEL
GILA
RIVER
PRIMARY FLOODWAY LIMITS
Arlington Canal Diversion
Arlington Canal Head works & Wasteway
Buckeye
U.S. HWY. 80
Robbins Butte
Cultivated
Note:
For Typical section of recommended Low Flow Channel see Plate I.
PLAN
SCALE 1000 0 1000 2000 3000 4000 FEET
Note:
Flood boundary and profile drawn by:
Flood Control District of Maricopa County
from basic data furnished by:
Corps of Engineers.
Standard Project Flood (290,000 C.F.S. at Granite Reef Dam) Natural Conditions.
FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
GILA AND SALT RIVERS
GILLESPIE DAM TO GRANITE REEF DAM
PLAN AND PROFILE
DRAWN K.B.
CHECKED T.R.N.
APPROVED
PHOENIX, ARIZONA
SEPT. 1962
MAP 9.0-B


ELEVATION IN FEET ABOVE MEAN SEA LEVEL
Agua Fria River
natural conditions
W.S. with 2000' cleared channel
Approx ground
℄ Channel clearing
Invert Low Flow Channel
Excavated Low Flow Channel
Excavated Low Flow Channel
PROFILE
HOR. SCALE
VERT. SCALE
FEET
FLOOD PLAIN LIMITS
RECOMMENDED LOW FLOW CHANNEL
GILA
RIVER
Agua Fria River
PRIMARY FLOODWAY LIMITS
Cultivated
Buckeye
U.S. HWY. 80
SOUTHERN PACIFIC
Canal
Top of bank
Flow line
Buckeye Flood Works Diversion Channel
T. 1 N.
T. 1 S.
Match Line for Sheet No. 4
Match Line for Sheet No. 2
PLAN
SCALE
FEET
Note:
For Typical Section of Recommended Low Flow Channel see Plate 1.
Standard Project Flood (190,000 C.F.S. at Granite Reef Dam) Natural Conditions.
Note:-
Flood boundary and profile drawn by: Flood Control District of Maricopa County, from basic data furnished by: Corps of Engineers.
FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
GILA AND SALT RIVERS
GILLESPIE DAM TO GRANITE REEF DAM
PLAN AND PROFILE
DRAWN K.B.
CHECKED T.R.N.
APPROVED
PHOENIX, ARIZONA
SEPT. 1962
MAP 9.0-C

PROFILE
HOR. SCALE 1000 0 1000 2000 3000 4000 FEET
VERT. SCALE 20 0 20 40 FEET
ELEVATION IN FEET ABOVE MEAN SEA LEVEL
natural conditions
Approx. ground
Channel clearing
w/ with 2000' cleared channel
Gila River
2200+00
2150+00
2100+00
2050+00
2000+00
1950+00
1900+00
1850+00
1800+00
1750+00
1700+00
1650+00
PLAN
SCALE 1000 0 1000 2000 3000 4000 FEET
GILA & SALT RIVER BASE LINE
SOUTHERN AVE.
T. 1 N.
SALT
RIVER
GILA
PRIMARY FLOODWAY LIMITS
FLOOD PLAIN LIMITS
Cultivated
Flow
Top of bank
Toe of slope
Sta. 2190+00
Sta. 2160+00
Sta. 2140+00
Sta. 2120+00
Sta. 2100+00
Sta. 2080+00
Sta. 2060+00
Sta. 2040+00
Sta. 2020+00
Sta. 2000+00
Sta. 1980+00
Sta. 1960+00
Sta. 1940+00
Sta. 1920+00
Sta. 1900+00
Sta. 1880+00
Sta. 1860+00
Sta. 1840+00
Sta. 1820+00
Sta. 1800+00
Sta. 1780+00
Sta. 1760+00
Sta. 1740+00
Sta. 1720+00
Sta. 1700+00
Sta. 1680+00
Sta. 1660+00
E. Curve Data
Δ = 6°18'00"
R = 30,000'
T = 1,651.04'
L = 3,298.67'
E. Curve Data
Δ = 31°37'00"
R = 5,886.12'
T = 1,666.53'
L = 3,248.05'
E. Curve Data
Δ = 21°30'00"
R = 7,500'
T = 1,423.92'
L = 2,814.34'
E. Curve Data
Δ = 35°44'00"
R = 4,700'
T = 1,515.04'
L = 2,931.22'
Match Line for Sheet No. 5
Match Line for Sheet No. 3
N. 865,000
N. 872,500
N. 880,000
E. 422,500
E. 415,000
E. 407,500
E. 400,000
E. 392,500
E. 385,000
E. 377,500
Standard Project Flood (290000 C.F.S. at Granite Reef Dam) Natural Conditions.
Note:
Flood boundary and profile drawn by:
Flood Control District of Maricopa County,
From basic data furnished by:
Corps of Engineers.
FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
GILA AND SALT RIVERS
GILLESPIE DAM TO GRANITE REEF DAM
PLAN AND PROFILE
DRAWN K.B.
CHECKED T.R.N.
APPROVED
PHOENIX, ARIZONA
SEPT 1962
SCALE: AS SHOWN
MAP 9.0 - D

450-5



Note:
Flood boundary and profile drawn by:
Flood Control District of Maricopa County,
from basic data furnished by:
Corps of Engineers.

REV. NO.	DATE	REVISION	REV.	CHK.	APP.
1	12-13-57	Revised culture vicinity of Sky Harbor Airport.	A.S.		

FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

GILA AND SALT RIVERS

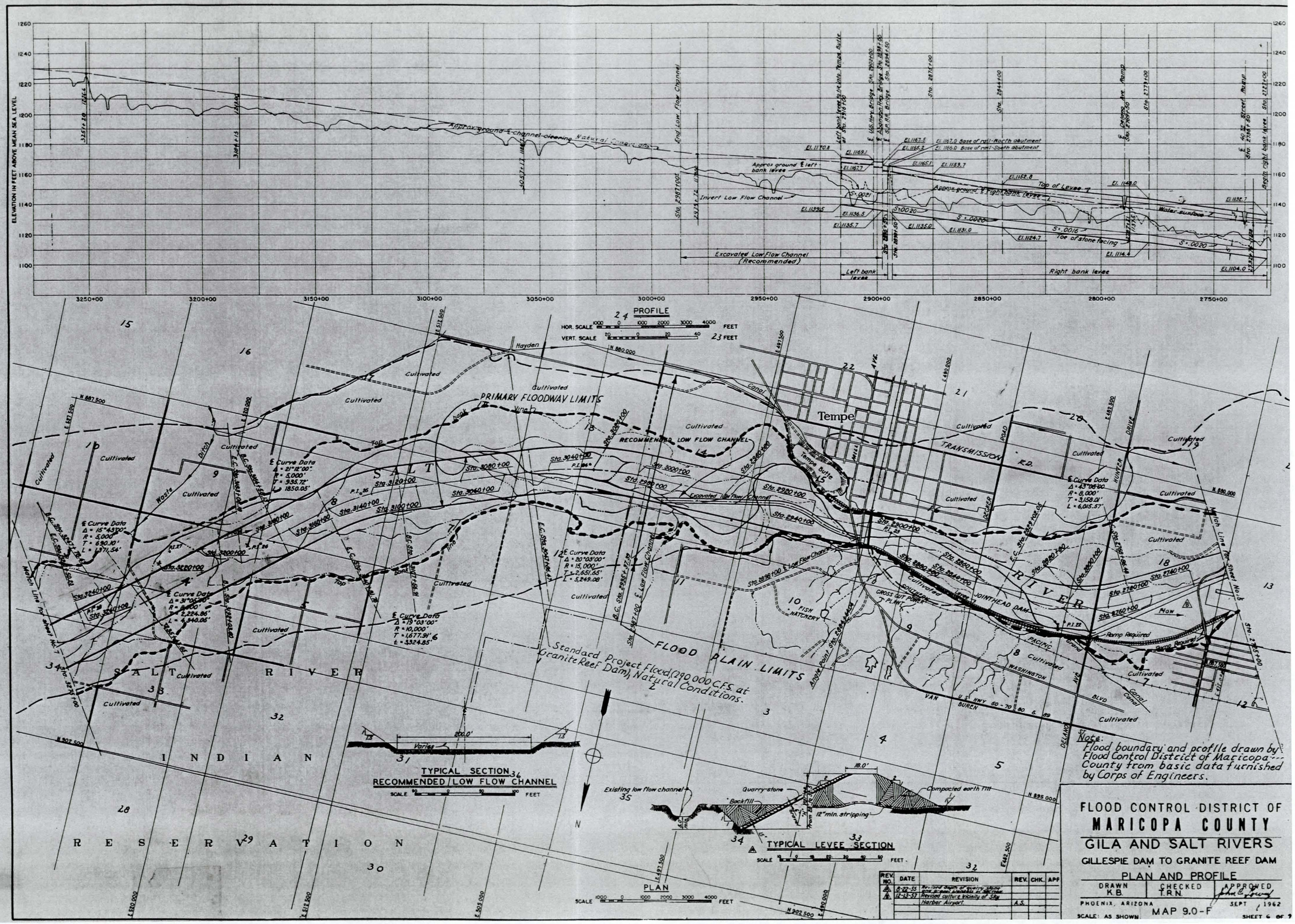
GILLESPIE DAM TO GRANITE REEF DAM

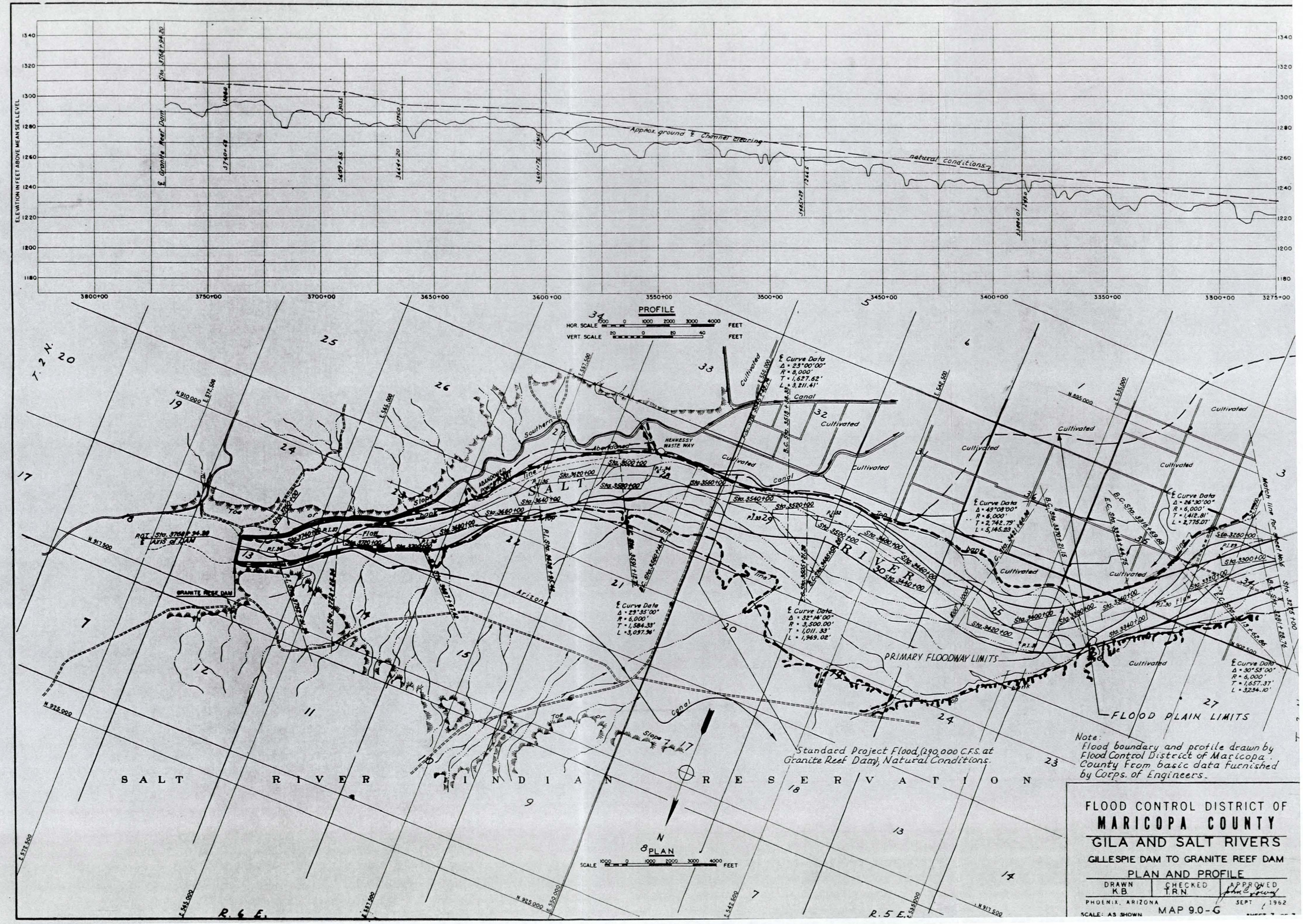
PLAN AND PROFILE

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

PHOENIX, ARIZONA — SEPT. 1962

SCALE: AS SHOWN — MAP 9.0-E — SHEET 5 OF 7


PROFILE
HOR. SCALE 1000 0 1000 2000 3000 4000 FEET
VERT. SCALE 20 0 20 40 FEET
ELEVATION IN FEET ABOVE MEAN SEA LEVEL
Approx. ground ℄ channel-cleaning
Natural Conditions
End Low Flow Channel
Invert Low Flow Channel
Approx. ground ℄ left bank levee
Approx. ground ℄ right bank levee
Top of Levee
Water surface
Toe of stone facing
Excavated Low Flow Channel (Recommended)
Left bank levee
Right bank levee
PRIMARY FLOODWAY LIMITS
RECOMMENDED LOW FLOW CHANNEL
Tempe
Tempe Butte
SALT RIVER
INDIAN RESERVATION
FISH HATCHERY
CROSS CUT POWER PLANT
JOINTHEAD DAM
FLOOD PLAIN LIMITS
Standard Project Flood (290,000 C.F.S. at Granite Reef Dam), Natural Conditions.
TRANSMISSION
R.R.
Canal
Hayden
Cultivated
Ramp Required
Flow
TYPICAL SECTION
RECOMMENDED LOW FLOW CHANNEL
SCALE 50 0 50 100 FEET
TYPICAL LEVEE SECTION
SCALE 10 0 10 20 30 40 50 FEET
Quarry-stone
Backfill
Compacted earth fill
12" min. stripping
PLAN
SCALE 1000 0 1000 2000 3000 4000 FEET
Note:
Flood boundary and profile drawn by Flood Control District of Maricopa County from basic data furnished by Corps of Engineers.
FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
GILA AND SALT RIVERS
GILLESPIE DAM TO GRANITE REEF DAM
PLAN AND PROFILE
DRAWN K.B.
CHECKED T.R.N.
APPROVED
PHOENIX, ARIZONA
SEPT 1962
SCALE: AS SHOWN
MAP 9.0-F
SHEET 6 OF 7
REV. NO. DATE REVISION REV. CHK. APP
6-22-55 Revised depth of quarry stone and added typical section
12-13-57 Revised culture vicinity of Sky Harbor Airport A.S.


PROFILE
HOR. SCALE 1000 0 1000 2000 3000 4000 FEET
VERT. SCALE 20 0 20 40 FEET
ELEVATION IN FEET ABOVE MEAN SEA LEVEL
1340
1320
1300
1280
1260
1240
1220
1200
1180
3800+00
3750+00
3700+00
3650+00
3600+00
3550+00
3500+00
3450+00
3400+00
3350+00
3300+00
3275+00
℄ Granite Reef Dam
Approx. ground & Channel clearing
natural conditions
PLAN
SCALE 1000 0 1000 2000 3000 4000 FEET
T. 2 N.
R. 4 E.
R. 5 E.
SALT RIVER INDIAN RESERVATION
GRANITE REEF DAM
HENNESSY WASTE WAY
Southern Pacific
Arizona Canal
Cultivated
PRIMARY FLOODWAY LIMITS
FLOOD PLAIN LIMITS
Match line for next sheet
℄ Curve Data
Δ = 23°00'00"
R = 8,000'
T = 1,627.62'
L = 3,211.41'
℄ Curve Data
Δ = 49°08'00"
R = 6,000'
T = 2,742.79'
L = 5,145.83'
℄ Curve Data
Δ = 26°30'00"
R = 6,000'
T = 1,412.81'
L = 2,775.07'
℄ Curve Data
Δ = 23°35'00"
R = 6,000'
T = 1,584.33'
L = 3,097.36'
℄ Curve Data
Δ = 32°14'00"
R = 3,500.00'
T = 1,011.33'
L = 1,969.02'
℄ Curve Data
Δ = 30°53'00"
R = 6,000'
T = 1,657.37'
L = 3234.10'
Standard Project Flood, (290,000 C.F.S. at Granite Reef Dam), Natural Conditions.
Note:
Flood boundary and profile drawn by Flood Control District of Maricopa County from basic data furnished by Corps. of Engineers.
FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
GILA AND SALT RIVERS
GILLESPIE DAM TO GRANITE REEF DAM
PLAN AND PROFILE
DRAWN K.B.
CHECKED T.R.N.
APPROVED
PHOENIX, ARIZONA
SEPT. 1962
SCALE: AS SHOWN
MAP 9.0-G

9.1 AJO AREA

9.1-A General

Ajo area is located in the extreme Southwest corner of Maricopa County and has an area of 380 square miles.

The area is bordered on the North by the Tea Kettle and Crater Mountains. General drainage is toward the West. Main drainage ways are Growler, Rio Cortez and Ten Mile Washes. They eventually drain into the Gila River.

All of this area is in the Bombing and Gunnery Range and no land development exists now and none is planned for the near future.

Due to lack of development, no flood damage has been reported and there is little chance that flood damage will become a problem.

9.2 SENTINEL AREA

9.2-A General

Sentinel area is located in the Southwestern part of Maricopa County and has an area of 750 square miles. Bordered on the East by the Sauceda Mountains and on the South by the Crater Mountains, this area generally drains Northwest toward the Gila River. No well defined drainage system exists now.

Most of this area is covered with lava rock. Geographically it lies within the Williams Bombing and Gunnery range. There are four auxillary airfields located here but only minor damages have been reported.

Arizona Highway 85 runs South through this area. The Southern Pacific Railroad and U.S. Highway 80 run East-West through the Northern part. Practically all damage possible in this area will be to these public tranportation systems. At the present time, damages do not warrant flood control measures.

9.3 PAINTED ROCK AREA

9.3-A General

Painted Rock Area is located in the West Central part of Maricopa County and has an area of 550 square miles. The area is bordered on the South by the Gila River and on the North by the Gila River Mountains. Principal drainage pattern is to the South, eventually draining into the Gila River.

There is very little chance for flood damage in this area at the present time Some damage occurs to the highway system and to the Southern Pacific railroad but present development does not warrant any structural protective measures.

9.4 LOWER CENTENNIAL AREA

9.4-A General

Lower Centennial area is located in the Western part of Maricopa County and has an area of 1,300 square miles. Drainage is generally to the Southeast and to the Gila River. Centennial Wash runs the full length of this area but does not show a well defined channel.

There is some land developed along Centennial Wash from the Yuma County line to the Gila River. The largest areas are near the intersection of Gin Road and Courthouse Road and near the mouth of the Wash. Approximately 70,000 acres are now under irrigation and more land is being developed.

Numerous small washes originating in the higher mountains flow into Centennial Wash. These washes cross the developed areas causing considerable damage to crops, to the land by erosion, and to established irrigation systems during heavy rains and runoff.

The potential flood damage from a major flood is great. Damage to pump installations, irrigation ditches and land under cultivation as well as to building improvements would be heavy.

Presently there are only a few diversion dikes and levees in this area. They were built by individual property owners. These leves are inadequate to handle the heavy run-offs to which the area is subjected.

To protect these agricultural areas, three projects have been proposed. They consist of diversion dikes and floodways, that will intercept the water from the mountainous regions and direct the excess back into Centennial Wash at a place where flood damages can be held to a minimum.

9.4-B HARQUAHALA VALLEY WATERSHED

9.4-B-1 General

The flood producing area consists primarily of steep mountains between contours 5,700 and 1,300. The topography is characterized by the presence of many washes which emerge from the Southern end of the Harquahala and Bighorn Mountains onto a broad and level plain. Rainfall concentrates quickly in the washes and then flows across the plain generally in a Southerly direction toward Centennial Wash.

9.4-B-2 Damages

It is expected this area will be highly developed as proposed highways are completed. When this occurs, damage from flood waters will proportionately increase.

9.4-B-3 Plan

Plan for this watershed consists of a retarding structure and a floodway. The retarding basin will begin approximately on the line between Range 10 West and Range 11 West and in the center of Township 3 North and runs in an Easterly direction along the 1,400 foot contour. The dike continues East until it intersects Gin Road. Ranchers in this area have constructed a channel along the West side of the road going South toward Centennial Wash.

Flow in this channel will be controlled and necessary work will be done to make its capacity adequate to carry the extra water.

Total estimated length of the retarding dike is 10 miles and the floodway will be 7.7 miles long.

Original locations, sizes, and lengths as recommended by Johannsen and Girand can be studied by referring to APPENDIX II-E-7-(a) of their report.

After careful study, the County Flood Control Engineer has recommended some changes. The ammended plan is shown in this report. A summary of costs as recommended is shown in table 9.4-1 and Map 9.4-A shows planned extent and location. Table 9.4-A shows structural data.

9.4-C TONOPAH WATERSHED

9.4-C-1 General

The flood producing area consists primarily of steep mountains between contours 1,300 and 3,000 The topography is characterized by many washes which emerge from the Southern and Eastern slopes of the Bighorn Mountains onto the flood plain below. Rainfall in this area gathers rapidly into the washes and then flows across the plain generally in a Southerly direction toward Centennial Wash.

9.4-C-2 Developments

Presently the area has no extensive urban development. However, small concentrations of population are located at Tonopah. Preliminary planning for a large urban development which may extend into this watershed is in progress.

9.4-C-3 Damages

Little or no information as to former flood damage is available, mainly because development of the area has occurred in recent years.

The potential damage from a major flood is great. Damage to pump installations, irrigation ditches, cultivated land, and building improvements would be heavy.

9.4-C-4 Plan

Over all plan for flood control in this watershed consists of a retarding basin for temporary water storage and a floodway to carry the controlled flow away to an area where damage will not result.

The retarding basin begins on the Northeast side of Centinnial Wash in Section 17, Township 2 North, Range 7

West. The dike follows the 1,200 contour in a arch to the North and ends in Section 16, Township 2 North, Range 5 West. The total length is approximately 12 miles.

The main wash in this area is known as Winters Wash. Present plan is to empty the water into this wash in a controlled amount and to convey it to the Hassayampa River. Necessary work will be done in the wash to make its capacity adequate to carry the design flow.

Changes from the location as shown by Johannessen and Girand are recommended by the Flood Control Engineer. Benefits derived from the longer dike does not warrant it being considered at this time. For Johannesson and Girands recommendations see APPENDIX II-E-7(b) of their report.

The revised plans are shown in this report A summary of cost of the structures are shown in table 9.4-2 and Map 9.4-B shows planned extend and location. Table 9.4-B shows structural data.

9.4-D EAGLE TAIL MOUNTAIN WATERSHED

9.4-D-1 General

The drainage area above the planned works is composed primarily of steep mountains and foothill slopes between contours 2,900 and 1,300. The topography is rough and is characterized by the presence of many washes that emerge from the Northeastern slopes of the Eagle Tail Mountains and cut through an extensive flood plain. Rainfall gathers quickly into these washes and flows across the plain in a Northeasterly direction towards Centennial Wash.

9.4-D-2 Developments

There are presently no major urban popu;ation centers in this watershed. However, smaller concentrations of population are located at various labor camps scattered throughout the agriculturally developed areas. There are now approximately 22,000 acres now under irrigation and more is being developed.

9.4-D-3 Damages

Very little information as to previous flood damage is available mainly because area development has occurred just recently. Potential flood damage from a major flood is great. Damage to roads, pump installations, irrigation ditches, cultivated land and building improvements would be heavy.

9.4-D-4 Plan

The basic plan for flood control in this watershed includes a retarding basin to temporarily store the water and

a floodway to carry it to Centennial Wash.

The dike will begin in Section 26, Township 2 North, Range 11 West and run along the 1,400 foot contour. Structure as proposed by the flood control engineer will end in Section 1, Township 1 South, Range 10 West. Total length is estimated at 14 miles.

Floodway to carry the controlled flow to Centennial Wash will begin in the Southwest corner of Section 1, Township 1 South, Range 10 West and run East along the section line until it empties into the main wash. At the present time there is a channel at this location with an average depth of six feet and a bottom width of 50 feet. Necessary work will be done in this channel to make its capacity adequate to carry the design outflow from the retarding basin.

For the recommendations of Johannessen and Girand see APPENDIX II-E-7-C of their report. Revised plans as proposed by the flood control engineer are included in this report. A summary of costs are shown in table 9.4.3 and Map No. 9.4-C shows extent and location. Table 9.4-C shows structural data.

TABLE 9.4-1 HARQUAHALA VALLEY WATERSHED SUMMARY

No.	Job Description	Estimated Cost: Flood Control Dist.	Estimated Cost: SCS
1.	Harquahala Retarding Basin	$300,000	$2,730,000
2.	Harquahala Floodway	100,000	1,040,000
	TOTAL	$400,000	$3,770,000
	TOTAL PROJECT COST	$4,170,000	

Flood Damage Without Project	75,000
Flood Damage With Project	5,000
Benefits From Reduction of Flood Damage	70,000
Irrigation Benefits	-0-
Total Annual Benefits	70,000
Total Project Cost Amortized @ 2-5/8%	151,000
Annual Operation and Maintenance	20,000
Total Annual Costs	171,000
Benefit-Cost Ratio	0.41 to 1.00

TABLE 9.4-2 TONOPAH WATERSHED SUMMARY

No.	Job Description	Estimated Cost: Flood Control Dist.	Estimated Cost: SCS
1	Tonopah Retarding Basin	$ 90,000	$1,560,000
2	Tonopah Floodway	30,000	390,000
	TOTAL	$120,000	$1,950,000
	TOTAL PROJECT COST	$2,070,000	

Flood Damage Without Project	57,500
Flood Damage With Project	7,500
Benefits from Reduction of Flood Damages	50,000
Irrigation Benefits	-0-
Total Annual Benefits	50,000
Total Project Cost Amortized @ 2 5/8%	75,000
Annual Operation and Maintenance	10,000
Total Annual Costs	85,000
Benefit-Cost Ratio	0.60 to 1.00

TABLE 9.4-3 EAGLE TAIL MOUNTAIN WATERSHED SUMMARY

No.	Job Description	Estimated Cost: Flood Control Dist.	Estimated Cost: SCS
1.	Eagle Tail Mountain Retarding Basin	$490,000	$969,000
2.	Eagle Tail Mountain Floodway	210,000	880,000
	TOTAL	$700,000	$1,849,000
	TOTAL PROJECT COST	$2,549,000	

Flood Damage Without Project	75,000
Flood Damage With Project	5,000
Benefits from Reduction of Flood Damage	70,000
Irrigation Benefits	-0-
Total Annual Benefits	70,000
Total Project Cost Amortized @ 2 5/8%	92,000
Annual Operation and Maintenance	20,000
Total Annual Costs	112,000
Benefit-Cost Ratio	0.63 to 1.00

TABLE 3.4-A STRUCTURAL DATA

HARCHALA WATERSHED

RETARDING STRUCTURE

No.	Item	Units	Structure
1	Drainage Area	sq.mi.	200
2	Sediment Capacity	ac.ft.	3,000
3	Flood Water Capacity	ac.ft.	17,000
4	Total Storage Capacity	ac.ft.	20,000
5	Total Surface Area	acres	2,400
6	Length	miles	100
7	Maximum Height	feet	25
8	Total Volume of fill	cu.yd.	2,200,000
9	Principal Spillway size	inches	120 x 120
10	Maximum Release Rate	cfs	1,000

COST DISTRIBUTION

11	Total Construction Cost	Dollars	2,730,000
12	Contract Administration	"	20,000
13	Right of Way	"	280,000
14	Relocations & other costs	"	-0-
15	Flood Control Dist. Cost	"	300,000
16	Total Project Cost	"	3,030,000

FLOODWAY

No.	Item	Units	Structures
1.	Discharge Capacity	cfs	1,000
2	Length	feet	73,920
3	Average Bottom Width	feet	300
4	Average Depth	feet	5.0
5	Average Side Slope		1:1
6	Excavation	cu. yds.	490,000
7	Concrete	cu.yds.	15,000

Cost Distribution

8	Total Construction Costs	1,040,000
9	Contract Administration	20,000
10	Right of Way	80,000
11	Relocations & other	-0-
12	Flood Control Dist. cost	100,000
13	Total Project Cost	1,140,000

TABLE 9.4-B STRUCTURAL DATA

TONOPAH WATERSHED

RETARDING STRUCTURE

No.	Item	Units	Structures
1	Drainage Area	sq. mi.	145
2	Sediment Capacity	ac. ft.	600
3	Flood Water Capacity	ac. ft.	12,000
4	Total Storage Capacity	ac. ft.	12,600
5	Total Surface Area	acres	2,000
6	Length	miles	12.0
7	Maximum Height	feet	19
8	Total Volume of fill	cu. yd.	2,000,000
9	Principal Spillway size	inches	72 x 72
10	Maximum Release Rate	cfs	600

COST DISTRIBUTION

11	Total Construction Cost	Dollars	1,560,000
12	Contract Administration	"	10,000
13	Right of Way	"	80,000
14	Relocations & other costs	"	- 0 -
15	Flood Control Dist. Cost	"	90,000
16	Total Project Cost	"	1,650,000

FLOODWAY

No.	Item	Units	Structures
1	Discharge Capacity	cfs	600
2	Length	feet	26,400
3	Av. Bottom Width	feet	10.0
4	Av. Depth	feet	4.2
5	Av. Side Slope		1:1
6	Excavation	cu. yds.	30,000
7	Concrete	cu. yds.	6,000

Cost Distribution

8	Total Construction Cost	Dollars	390,000
9	Contract Administration	"	10,000
10	Right of Way	"	20,000
11	Relocations & other	"	- 0 -
12	Flood Control Dist. Cost	"	30,000
13	Total Project Cost	"	420,000

TABLE 9.4-C STRUCTURAL DATA

EAGLE TAIL MOUNTAIN WATERSHED

RETARDING STRUCTURE

No.	Item	Units	Structures
1	Drainage Area	sq. mi.	40
2	Sediment Capacity	ac. ft.	200
3	Flood WaterCapacity	ac. ft.	4,000
4	Total StorageCapacity	ac. ft.	4,200
5	Total Surface Area	acres	2,100
6	Length	miles	14.0
7	Maximum Height	feet	20.0
8	Total Volume of Fill	cu. yd.	2,500,000
9	Principal Spillway size	inches	54
10	Maximum Release Rate	cfs	300

Cost Distribution

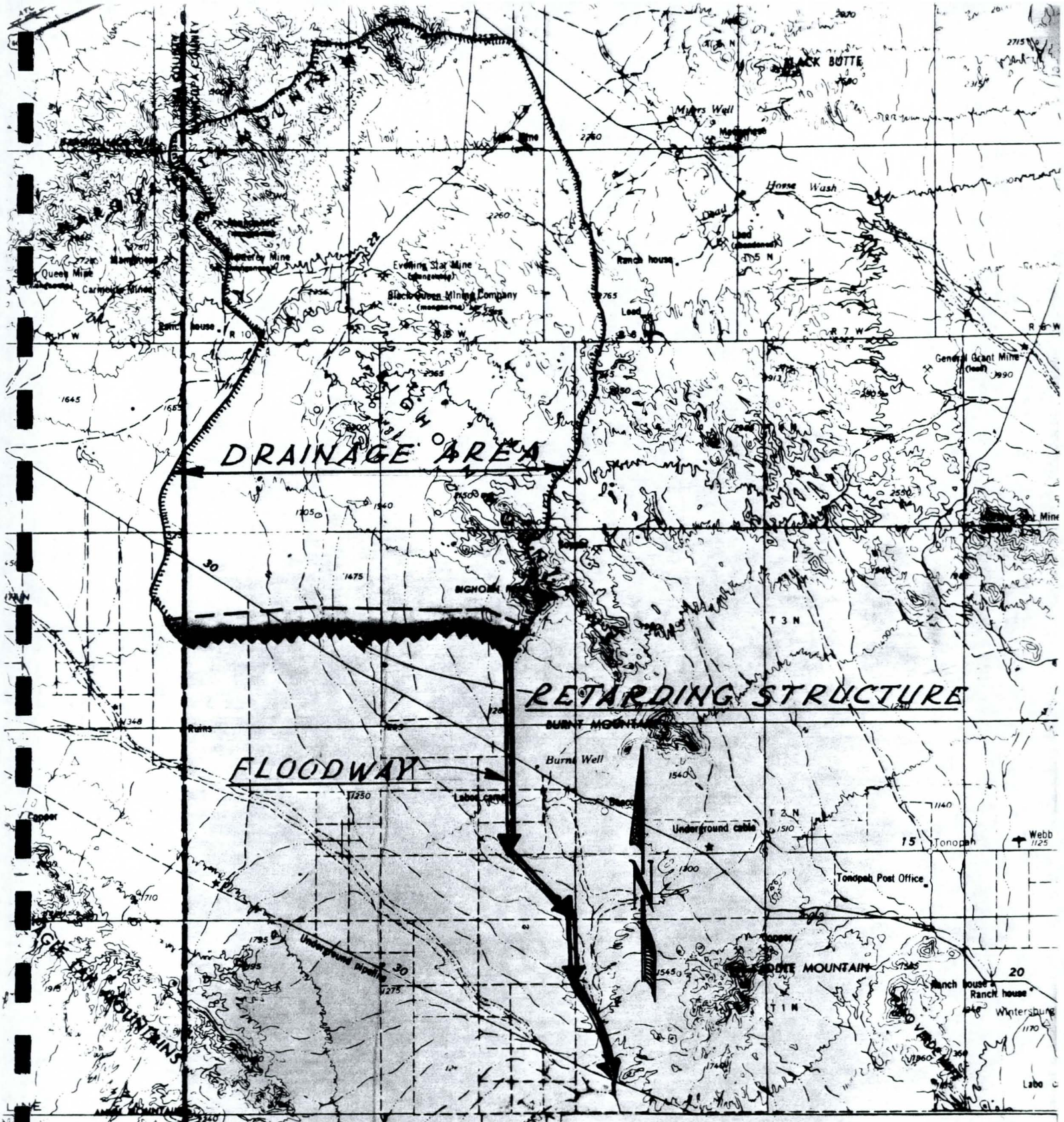
11	Total Construction Cost	Dollars	969,000
12	Contract Administration	"	10,000
13	Right of Way	"	480,000
14	Relocations & other costs	"	- 0 -
15	Flood Control Dist. Cost	"	490,000
16	Total Project Cost	"	1,459,000

FLOODWAY

No.	Item	Units	Structures
1	Discharge Capacity	cfs	350
2	Length	feet	63,360
3	Av. Bottom Width	feet	10.0
4	Av. Depth	feet	2.8
5	Av. Side Slope		1:1
6	Excavation	cu. yds.	90,000
7	Concrete	cu. yds.	

Cost Distribution

8	Total Construction Cost	Dollars	880,000
9	Contract Administration	"	10,000
10	Right of Way	"	200,000
11	Relocations & other	"	- 0 -
12	Flood Control Dist. Cost	"	210,000
13	Total Project Cost	"	1,090,000



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

HARQUAHALA VALLEY

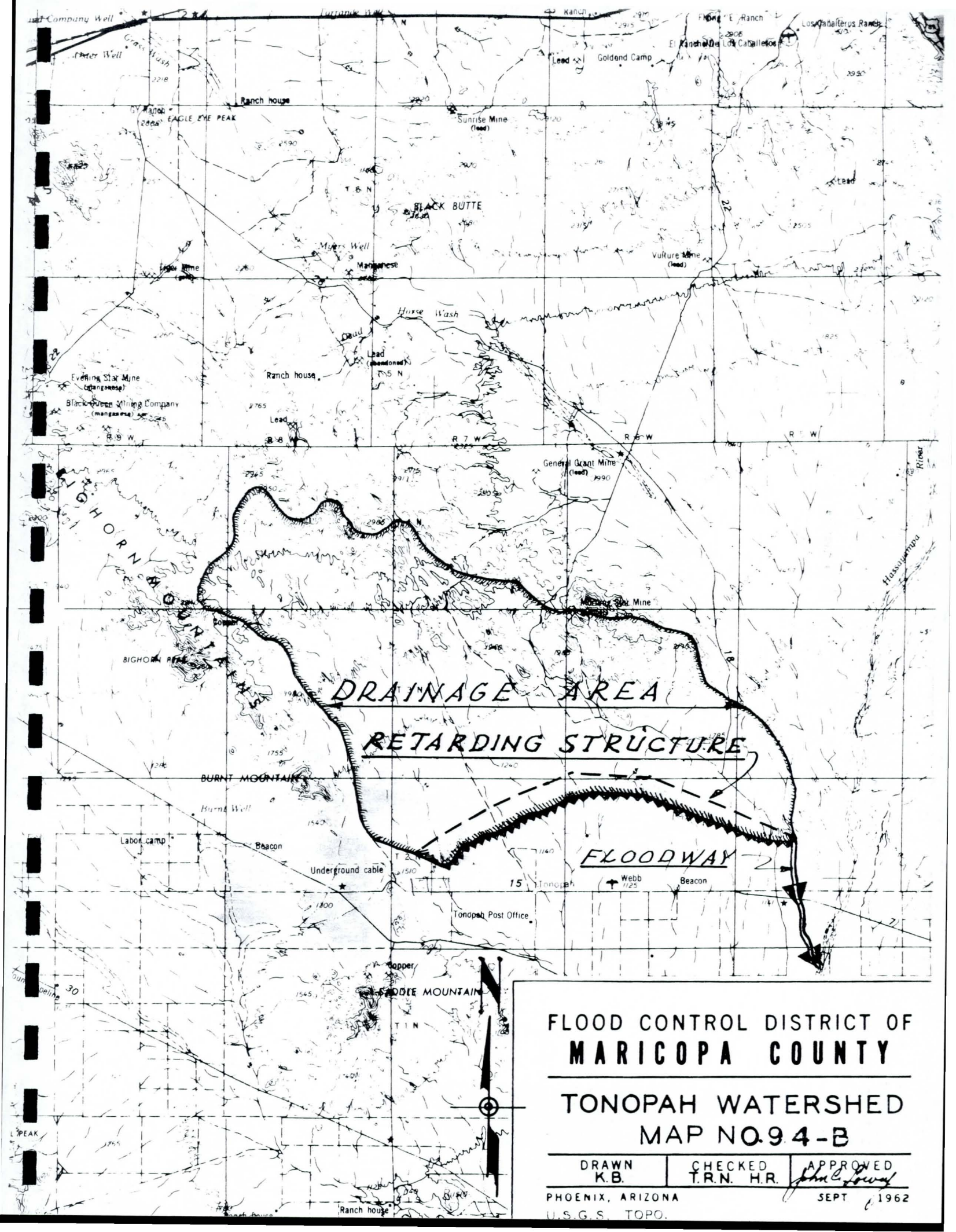
WATERSHED-MAP NO. 9.4-A

DRAWN	CHECKED	APPROVED
K.B.	T.R.N. H.R.	John C. Lowry

PHOENIX, ARIZONA

U.S.G.S. TOPO.

SEPT. 20, 1962



FLOOD CONTROL DISTRICT OF

MARICOPA COUNTY

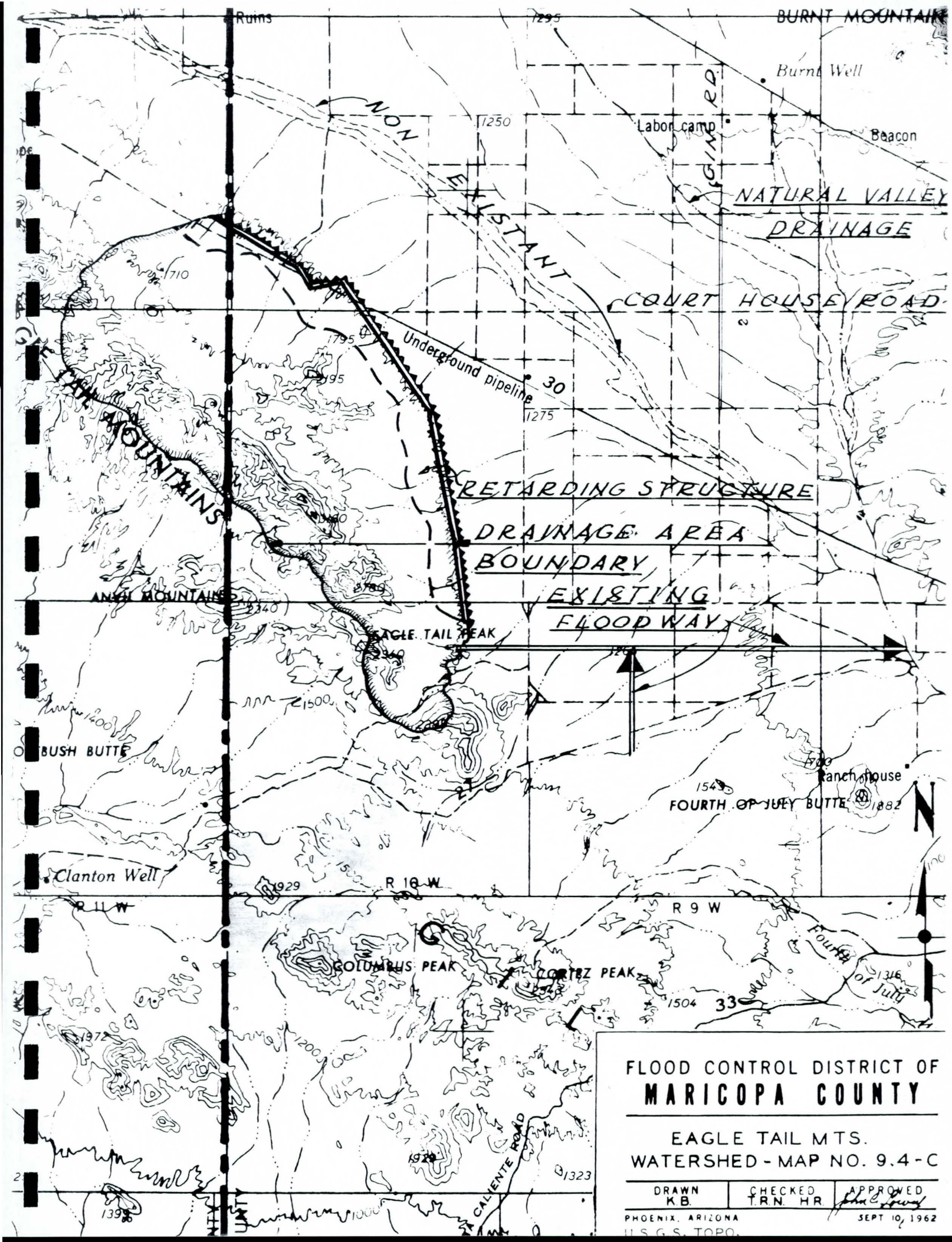
TONOPAH WATERSHED

MAP NO. 94-B

DRAWN	CHECKED	APPROVED
K.B.	T.R.N. H.R.	John C. Lowry

PHOENIX, ARIZONA SEPT 1962

U.S.G.S. TOPO.



FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

EAGLE TAIL MTS.
WATERSHED - MAP NO. 9.4-C

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

PHOENIX, ARIZONA — SEPT 10, 1962

U.S.G.S. TOPO.

9.5. UPPER CENTENNIAL AREA

9.5-A General

Upper Centennial area is located in the Northwestern part of Maricopa County and includes an area of 675 square miles. Most of this area is outside of the County but drainage pattern is such that flood water comes down Centennial Wash and into Maricopa County.

Centennial Wash runs the full length of the watershed and is the main drainage channel. In the vicinity of Salome, this wash crosses the Parker branch of the Santa Fe Railroad and U.S. Highway 60 and 70. For the major portion of its length Centennial Wash runs through a wide flat valley with gentle slopes rising from the floor of the Valley to the higher, rocky mountain areas along the sides. Flood waters coming down from the mountains flowing across the developed areas of the Valley cause considerable damage to crops and irrigation systems.

Flood damage in upper Centennial Wash is not excessive at the present time. Some protection levees have been built by farmers and ranchers and these provide some local protection.

As development continues in this area, flood protection may become a necessity but at the present time no flood control measures are planned.

9.6 UPPER HASSAYAMPA AREA

9.6-A General

This area begins above Box Canyon Dam site and North of the Maricopa County line but contributes flood water that affects land and property in this County. Total area is 417 sq. mi. Drainage area consists of steep mountains and sloping foothills ranging up to over 7,000 ft. elevation. Topography is rough and undulating. Slopes are mostly brush-covered. Rainfall is of a high intensity but usually covers small areas.

Due to the steep slopes, water concentrates quickly and runs off at high velocities. The general drainage is to the south and the Hassayampa River is the main drainage channel.

9.6.-B BOX CANYON DAM

9.6-B-1 General

In the Hassayampa River basin approximately six miles North of Wickenburg the hills come in close to the channel to form what is known as "The Box."

A dam has been proposed here by the U.S. Bureau of Reclamation for the Whitman Project. This has been abandoned due to insufficient water for irrigation. This project is recommended on the basis of flood control and domestic water supply for the town of Wickenburg.

9.6-B-2 Developments and damages

The town of Wickenburg, with a population of about 2,000 would be affected by a major flood.

The A.T.S.F. Railroad is subject to damage by flood water. The toe of the fill in many places between Morristown bridge and Wickenburg is in or near the stream channel. Extreme floods would also damage the bridge approach and overflow approximately three miles of track.

U.S. Highway No. 60 extends along the East side of the river above Morristown, crossing at Wickenburg. Severe floods would endanger portions of the highway and the bridge.

9.6-B-3 Plan

The present plan for flood control in this area is to construct the dam at Box Canyon.

This will be a multi-purpose structure in that it will be for recreation, municipal water, as well as for flood control.

Flash floods resulting from mountain cloudburts occur frequently on this drainage basin. These flood peaks will be partially controlled by providing for 10,000 acre feet of storage capacity below the spillway crest, in addition to the super-storage above the permanent spillway.

The dam is an earth-fill structure with related diversion and outlet works. The maximum height of the dam will be 246 feet and total storage of 200,000 acre-feet is planned.

A summary of costs can be found in table No.9.6-1 and Map No. 9.6-A shows location and extent. Table 9.6-A shows related structural data.

TABLE 9.6-1 BOX CANYON DAM SUMMARY

No.	Job Description	Estimated Cost FCD	Recreation & Wild Life	Bureau of Reclamation
1	Box Canyon Dam	$652,000	$1,188,000	$5,760,000
	TOTAL PROJECT COST		$7,600,000	

Benefits from Reduction of Flood Damage	20,000
Domestic Water Supplied	300,000
Recreation Benefits	8,600
Total Annual Benefits	328,600
Total Project Cost Amortized @ 2-5/8%	275,000
Annual Operation and Maintenance	50,000
Total Annual Costs	325,000
Benefit-Cost Ratio 1.01 to 1.00	

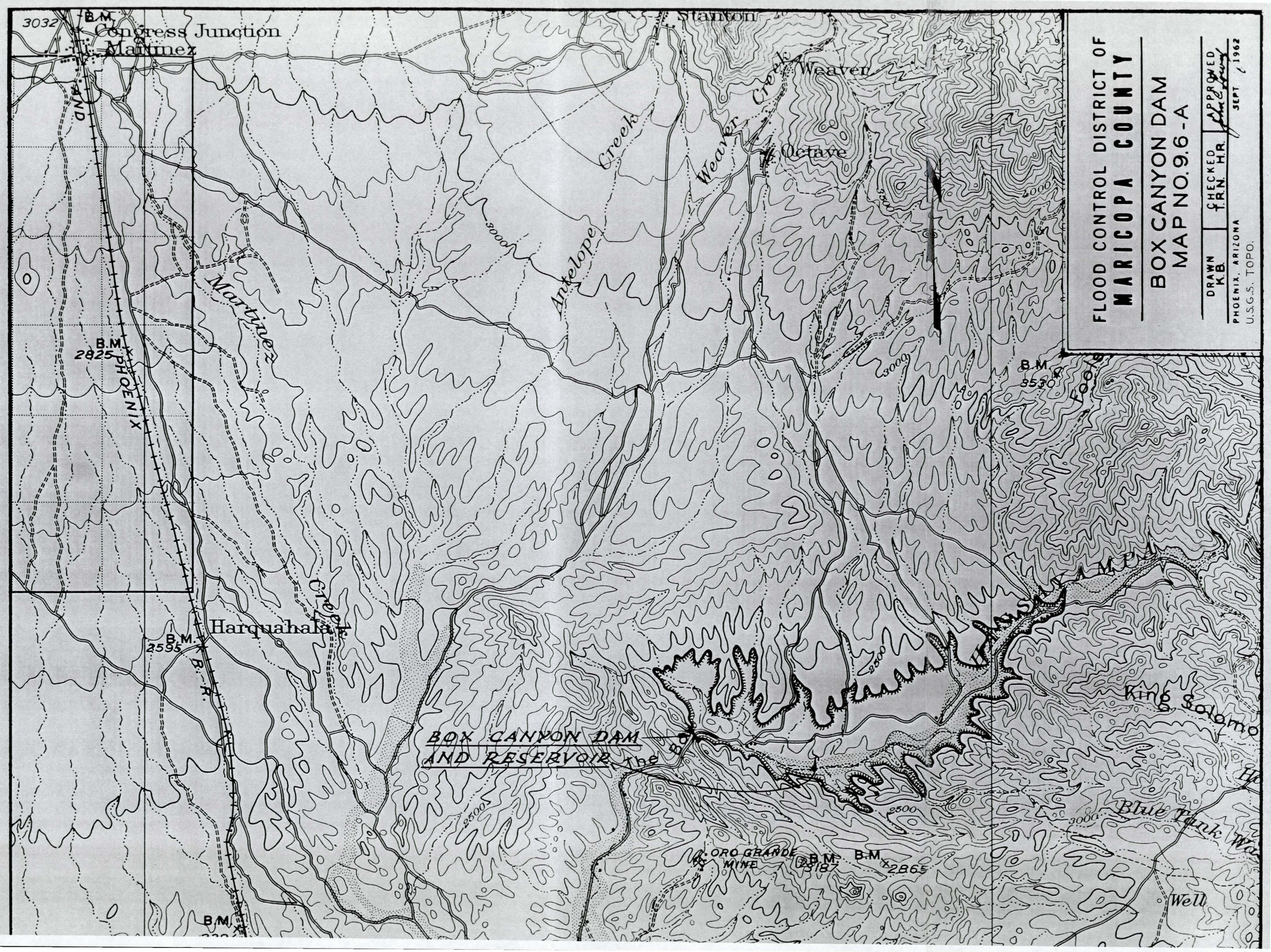
TABLE 9.6-A STRUCTURAL DATA

UPPER HASSAYAMPA AREA - BOX CANYON DAM

No.	Item	Units	Quanity
1	Drainage Area	sq. mi.	422
2	Dead Storage	ac. ft.	10,000
3	Irrigation & Domestic Storage	ac. ft.	180,000
4	Flood Control Storage	ac. ft.	10,000
5	Total Storage Capacity	ac. ft.	200,000
6	Total Surface Area	acres	230
7	Length of Dam	feet	1,050
8	Maximum Height	feet	246
9	Volume of Fill	cu. yds.	3,029,000
10	Principal Spillway Size	inches	2 - 24
11	Maximum Release Rate	cfs	500
12	Diversion Capacity	cfs	1,500
13	Spillway Capacity	cfs	57,800

COST DISTRIBUTION

14	Total Construction Costs	Dollars	5,760,000
15	Contract Administration	"	40,000
16	Rigth of Way	"	612,000
17	Relocations & other costs	"	1,188,000
18	Flood Control District Cost	"	652,000
19	Total Project Cost	"	7,600,000


FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
BOX CANYON DAM
MAP NO. 9.6-A
DRAWN K.B.
CHECKED T.R.N. H.R.
APPROVED
SEPT 1962
PHOENIX, ARIZONA
U.S.G.S. TOPO.
Congress Junction
Martinez
Stanton
Weaver
Weaver Creek
Octave
Antelope Creek
Martinez
PHOENIX
Harquahala
Creek
BOX CANYON DAM
AND RESERVOIR
The Box
King Solomo
Blue Tank
Well
B.M. 3032
B.M. 2825
B.M. 2595
B.M. 3530
B.M. 2865
B.M. 2318
3000
2500
4000

9.7 LOWER HASSAYAMPA AREA

9.7-A General

The Hassayampa Area lies below the Box Canyon Dam site and is located in the North Central part of Maricopa County. It is one of the larger drainage areas in the county and contains 1,060 square miles.

The area is characterized generally by steep mountains at the edges blending into foothills and eventually in a broad Valley. From Box Canyon at around Morristown to its junction with the Gila River, the river flows through a relatively flat sandy plain. From the point where the river leaves U.S. Highway 60 until it nears the Buckeye Valley practically no development has occurred.

As the river enters the Valley and the topography flattens there are scattered farms irrigated by wells. From the Roosevelt Irrigation District Canal South to the Gila River there are considerable developments.

Present plans for flood protection are all in the Wickenburg area.

9.7-B MATTHIE DAM

9.7-B-1 General

This proposed structure is located on Sols Wash approximately eight miles West of Wickenburg on the county line between Maricopa and Yavapai County. The total area of Sols Wash above this proposed dam is 125 square miles. Except for very small areas, this wash drains through a broad valley with relatively flat slopes. General drainage pattern is to the east emptying into the Hassayampa River in Wickenburg.

9.7-B-2 Developments and Damages

In the past, heavy rains have caused extensive damage to the Santa Fe railroad where it crosses Sols Wash. Damage has occurred to U.S. Highway 89 bridge in the Northern section of Wickenburg. At the present time, there is no population concentrations outside the City of Wickenburg.

Property development along Sols Wash inside the City has been hindered due to constant threat of floods.

9.7-B-3 Plan

The dam proposed by Johannessen and Girand would create a lake of approximately 500 acres in area with a maximum depth of 70 feet. The major benefit of this structure would be for recreation. There is doubt, however, that this watershed will produce the water needed to keep the reservoir full.

Due to an unfavorable benefit cost ratio and other factors this structure is not recommended for construction by the County Flood Control Engineer at this time. Future developments may warrant a re-survey of this proposal.

For a resume of the Johannessen and Girand's recommendations regarding this structure see Page II-6, II-7, II-8 and APPENDIX II-E-1, II-F-1 and II-G-1 of their report. See Table 9.7-1, Table 9.7-B and Map 9.7-B.

9.7-C SOLS WASH CHANNEL

9.7-C-1 General and Plans

Protection from flood water is needed, especially along Flying "E" Wash and within the city limits of Wickenburg.

To solve this problem, the County Flood Control Engineer recommends channel clearing in Sols Wash from the Hassayampa River to a point just above where Flying "E" Wash comes in. This will involve about ten acres of clearing.

A pilot channel will then be excavated, beginning just below the highway bridge on Sols Wash and extended up to the junction of Flying "E" Wash; thence up this Wash for a distance of approximately 1,800 feet.

A summary of the proposed channel works is shown in Table 9.7-2 and Map 9.7-A shows its location. Table 9.7-A shows structural data.

9.7-D FLYING "E" WASH DAM

9.7-D-1 General

Flood producing area consists primarily of rugged, steep mountains ranging up to approximately 3,500 feet elevation. The topography is characterized by many washes that drain through the steep foothills. Drainage is generally North and eventually into Sols Wash about two miles above the Hassayampa River.

9.7-D-2 Development & Damages

Presently there are no centers of population within this project area. The principal damage from this wash occurs to the golf course of the Wickenburg Country Club. Damage has also been reported north of the U.S. Highway 60-70 bridge.

9.7-D-3 Plan

Johannessen and Girand have reported on this project and complete information can be found in their report. At the present time, as indicated by the benefit-cost ratio, this project is not justified on the basis of flood damage alone.

Future developments in this area or a sizable contribution from local interests may make this project feasible.

A summary of costs is found in table 9.7-3 and Map No 9.7-A shows planned location. Structural data Table 9.7-B.

9.7-E POWDER HOUSE WASH DAM

9.7-E-1 General

This wash comes into the Hassayampa River on the East side within the town of Wickenburg. The wash comes through an area known locally as "East Wickenburg".

The flood producing area consists of steep, brush covered hills at an elevation of approximately 3,200'. Topography is characterized by many washes cutting through the lower foothills into the Hassayampa River. Grade in these washes is steep and water comes down at high velocities.

9.7-E-2 Development and damages

Along the lower reaches of this wash is a highly developed area, including motels, service stations, private homes and other properties. Overflow during periods of heavy runoff causes considerable damage to this developed area.

There are two roads affected by floods in this area. Both become impassible and several homes are isolated for

long periods.

Future developments in this area will increase possible damage.

9.7-E-3 Plan

Powder House Wash offers two dam sites above the flooded area. The one recommended by the Flood Control Engineer is called the "lower alternate" site and is located approximately 1,000 feet above the point where Constellation Road starts to climb from the floor of the wash.

The cost of the dam at the lower site is greater than that of the upper site. However, because of the greater drainage area controlled by the lower site the additional cost appears to be justified.

A summary of costs is shown in table 9.7-4 and Map No. 9.7-A shows planned location. Table 9.7-B shows structural data.

9.7-F CASANDRO WASH (REEDS ADDITION)

9.7-F-1 General

The watershed of this wash contains approximately 1.5 square miles of area and begins in the vicinity of the Vulture Mine Road north of Los Caballeros guest ranch, about a mile South of U.S. Highway 60 and 70. Topography is characterized by rocky terrain and steep grades in the wash. Runoff from this area is considerably greater than the normal ratio of runoff to rainfall.

9.7-F-2 Damages

From a point near Avispa Street at the West edge of Reeds Addition to the railroad, the wash meanders through Reeds addition in man-made channels and in the streets. Channel has been restricted by walls and other developments.

Capacity of present channel is limited and any overflow spreads into adjacent property and into homes causing extensive damage.

The constant flood threat has prevented development of potentially valuable property along the wash within the Casandro tract. A major flood could cause considerable damage to homes, streets, the city pumping plant and other developments within the flood area.

9.7-F-3 Plan

The over all plan for flood control in this area will include an earth-fill dam withoutlet and will be located approximately 1,500 feet downstream from where Country Club Road crosses Casandro Wash. The dam will have an uncontrolled outlet to discharge approximately 40 C.F.S. Channel below will handle this flow and will not damage developments below.

A summary of cost can be found in table 9.7-5 and Map No. 9.7-A shows proposed location. Table 9.7-C shows structural data.

9.7-G SUNSET AND SUNNY COVE WASHES

9.7-G-1 General

These two washes are small but the characteristics of

the watershed area makes runoff ratio extremely high and high peak flows are possible even though the area is small.

Both washes originate in the vicinity of the Vulture Mine Road and run Northeast and eventually come together and continue on to the Hassayampa River.

Watershed is characterized by steep hills and rocky terrain. The wash profile is steep and when water flows then high velocities are the result.

9.7-G-2 Development and damages

In the path of these washes are the Sunny Cove subdivision, part of Wickenburg, Fishers Addition and Maguire's addition. Below the junction of these two washes, extensive damage has been reported during past floods and the potential damage due to the maximum probable flood would be very extensive. Further area development will increase the potential damage.

9.7-G-3 Plan

Plan for control of these washes consists of an earthfill dam in each wash. Each dam will have an uncontrolled outlet. Channel below is adequate to carry the outflow. Dams will be designed to handle a 100 year frequency flood.

A summary of costs is found in table 9.7-6 and Map 9.7-A shows proposed location. Table 9.7-C shows structural data.

TABLE 9.7-1 MATTHIE DAM SUMMARY

No.	Job Description	Estimated Cost: Flood Control District	Estimated Cost: Other
1	Earth-fill Dam and Related Works	$500,000	$ 556,000
	TOTAL PROJECT COST	$1,056,000	

Benefits from Reduction of Flood Damage	4,000
Benefits from Recreation	7,000
Total Annual Benefits	11,000
Total Project Cost Amortized @ 2-5/8%	38,000
Annual Operation & Maintenance	5,000
Total Annual Costs	43,000
Benefit-Cost Ratio	0.26 to 1.00

TABLE 9.7-2 SOLS WASH CHANNEL SUMMARY

Job Description	Estimated Cost: Flood Control Dist.	Estimated Cost: Other
Channel Clearing and Excavation in Sols and Flying "E" Wash	$ 40,000	None
TOTAL		
TOTAL PROJECT COST	$40,000	

Flood damage Without Project	3,000
Flood Damage with Project	500
Benefits from Reduction of Flood Damage	2,500
Irrigation Benefits	
Total Annual Benefits	2,500
Total Project Cost Amortized @ 2 5/8%	1,500
Annual Operation and Maintenance	500
Total Annual Costs	2,000
Benefit-Cost Ratio	1.25 TO 1.00

TABLE 9.7-3 FLYING "E" WASH DAM SUMMARY

Job Description	Estimated Cost: Flood Control Dist.	Estimated Cost: Other
1 Earth-fill Dam and Related Works	- 0 -	$183,000
TOTAL PROJECT COST	$183,000	

Benefits from Reduction of Flood Damage	4,500
Total Annual Benefits	4,500
Total Project Cost Amortized @ 2 5/8%	6,600
Annual Operation and Maintenance	600
Total Annual Cost	7,200

Benefit-Cost Ratio - - - - - - - 0.63 to 1.00

TABLE 9.7-4 POWDER HOUSE WASH DAM SUMMARY

No.	Job Description	Estimated Cost Flood Control Dist.	Estimated Cost C. of E.
1	Earth-fill Dam and Related Works (Lower Site)	$ 50,000	$ 82,500
	TOTAL PROJECT COST	$132,500	

Benefits from Reduction of Flood Damage	10,000
Total Annual Benefits	10,000
Total Project Cost Amortized @ 2 5/8%	4,800
Annual Operation and Maintenance	800
Total Annual Costs	5,600
Benefit-Cost Ratio	1.79 to 1.00

TABLE 9.7.5 CASANDRO WASH (REED'S ADDITION) DAM SUMMARY

No.	Job Description	Estimated Cost: Flood Control Dist.	Estimated Cost: Other
1	Earth-fill Dam and Related Works	$ 60,200	- 0 -
	TOTAL PROJECT COST	$60,200	

Benefits from Reduction of Flood Damage	$ 4,500
Total Annual Benefits	4,500
Total Project Cost Amortized @ 2 5/8%	2,200
Annual Operation and Maintenance	300
Total Annual Costs	2,500
Benefit-Cost Ratio	1.80 to 1.00

TABLE 9.7-6 SUNSET AND SUNNY COVE WASHES DAM SUMMARY

No.	Job Description	Estimated Cost: Flood Control Dist.	Estimated Cost: Other
1	Earth-fill Dam and Related Works, 1 each on Sunset and Sunny Cove Washes	$ 79,000	$ - 0 -
	TOTAL PROJECT COST	$79,000	

Flood Damage Without Project	$ 7,200
Flood Damage With Project	1,000
Benefit from Reduction of Flood Damage	6,200
Total Annual Benefits	6,200
Total Project Cost Amortized @ 2 5/8%	2,900
Annual Operation and Maintenance	600
Total Annual Costs	3,500
Benefit-Cost Ratio	1.77 to 1.00

TABLE 9.7-A STRUCTURAL DATA

SOLS WASH

CHANNEL IMPROVEMENTS

No.	Item	Units	Structure	
			Sols Wash	Flying "E" Wash
1	Discharge Capacity	cfs	7,300	960
2	Length	ft.	8,760	1,800
3	Av. Bottom Width	ft.	60	30
4	Av. Depth	ft.	3.0	2.0
5	Av. Side Slope		3:1	3:1
6	Excavation	cu.yds.	70,000	5,400
7	Concrete	cu.yds.	- -	- -

COST DISTRIBUTION

8	Total Construction Cost	35,000	3,900
9	Contract Administration	1,000	100
10	Right of Way	-0-	-0-
11	Relocations & other costs	-0-	-0-
12	Flood Control District Cost	36,000	4,000
13	Total Project Cost	36,000	4,000

TABLE 9.7-B STRUCTURAL DATA

LOWER HASSAYAMPA AREA

WICKENBURG FLOOD RETARDING DAMS

No.	Item	Units	Structures		
			Matthie	Flying "B"	Powder House
1	Drainage Area	sq.mi.	125.0	9.3	1.8
2	Sediment Capacity	ac.ft.	-0-	-0-	-0-
3	Flood Water Capacity	ac.ft.	5,200	335	150
4	Total Storage Capacity	ac.ft.	11,500	715	200
5	Total Surface Area	acres	570	80	30
6	Length	ft.	600	1,800	450
7	Maximum Height	ft.	70.0	33.0	35.0
8	Total Volume of fill	cu.yds.	247,000	102,000	58,000
9	Principal Spillway Size	in.	60	48	24
10	Maximum Release Rate	cfs	260	200	40

COST DISTRIBUTION

11	Total Construction Cost	Dollars	1,036,000	183,000	82,500
12	Contract Administration	"	20,000	-0-	2,000
13	Right of Way	"	-0-	-0-	48,000
14	Relocations & Other Costs	"	-0-	-0-	-0-
15	Flood Control Dist. Cost	"	500,000	-0-	50,000
16	Total Project Cost		1,056,000	183,000	132,500

TABLE 9.7-C STRUCTURAL DATA

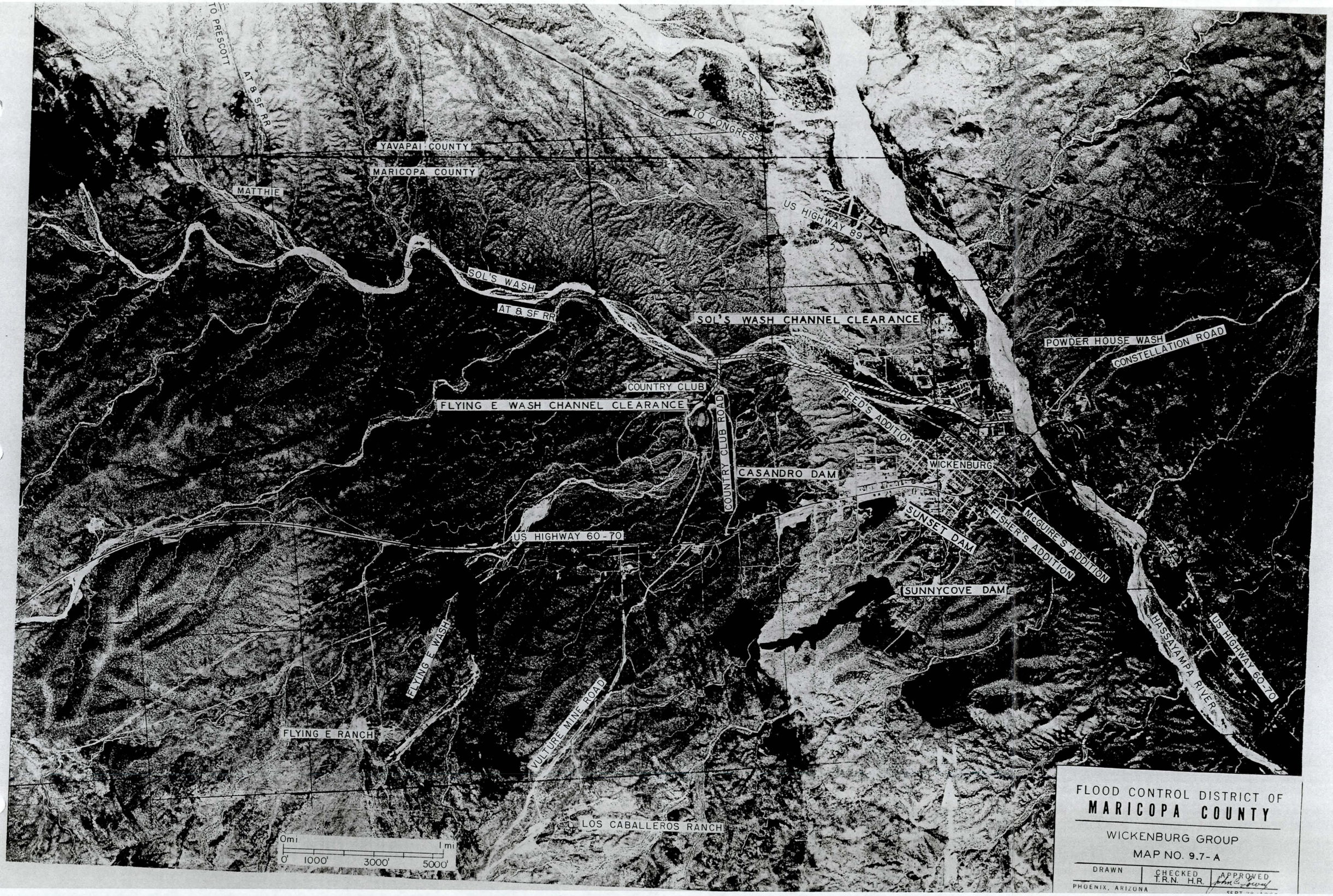
LOWER HASSAYAMPA AREA

FLOOD RETARDING DAMS

No.	Item	Units	Structures		
			Casandro	Sunset	Sunny Cove
1	Drainage Area	sq.mi.	1.5	0.6	1.4
2	Sediment Capacity	ac.ft.	-0-	27	33
3	Flood Water Capacity	ac.ft.	90	55	82
4	Total Storage Capacity	ac.ft.	90	82	115
5	Total Surface Area	acres	20	7	18
6	Length	feet	460	470	610
7	Maximum Height	feet	24.0	20.0	19.0
8	Total Volume of fill	cu.yd.	15,000	9,200	16,000
9	Principal Spillway Size	inches	24	24	30
10	Maximum Release Rate	cfs	40	30	50

COST DISTRIBUTION

11	Total Construction Cost	Dollars	29,200	32,880	45,320
12	Contract Administration	"	1,000	300	500
13	Right of Way	"	30,000	-0-	-0-
14	Relocations & Other Costs	"	-0-	-0-	-0-
15	Flood Control Dist. Cost	"	60,200	33,180	45,820
16	Total Project Cost	"	60,200	33,180	45,820

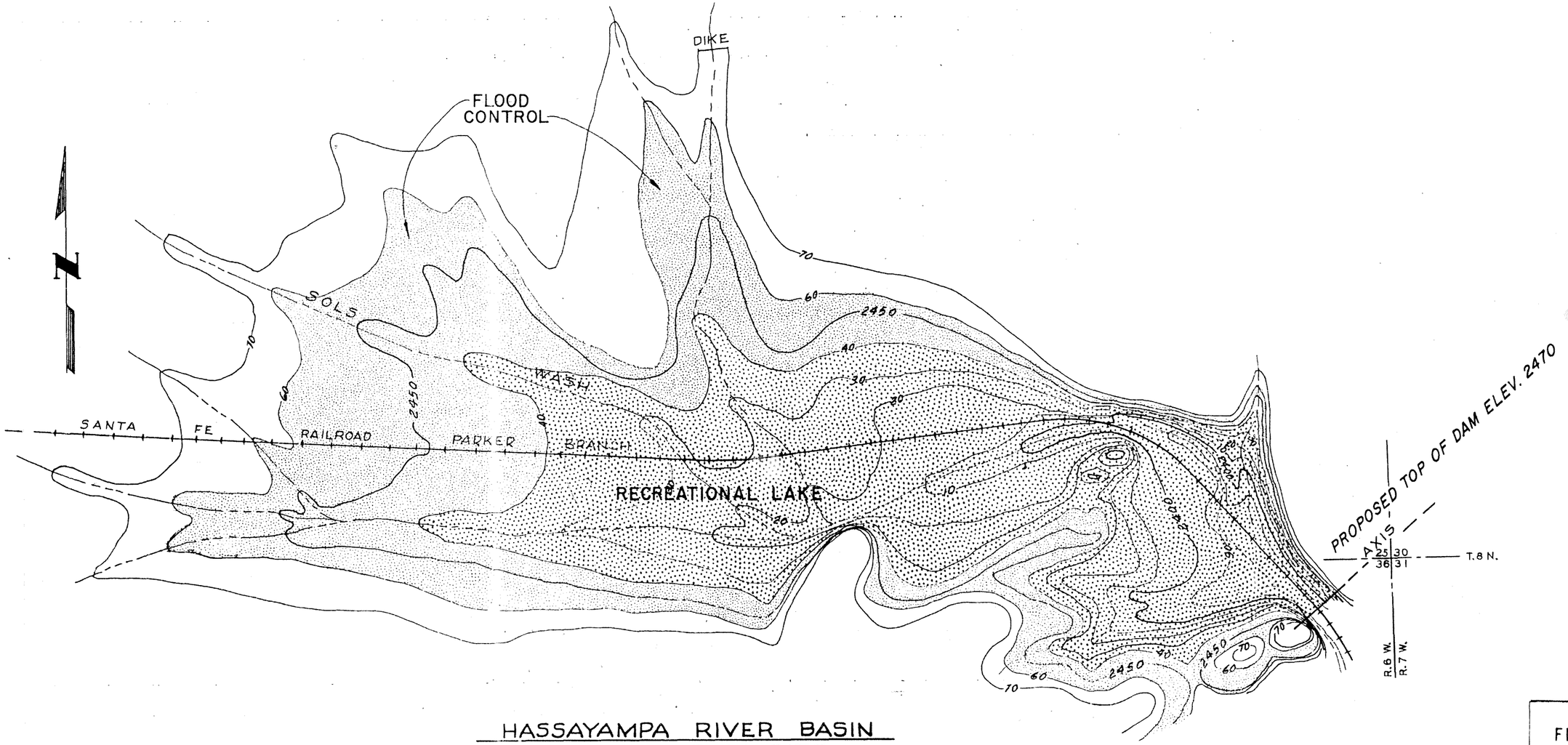


FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

WICKENBURG GROUP
MAP NO. 9.7-A

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

PHOENIX, ARIZONA



HASSAYAMPA RIVER BASIN
MATTHIE DAM SITE

SCALE: 1" = 1000'
CONTOUR INTERVAL: 10'

FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

MATTHIE DAM SITE
MAP NO. 9.7-B

DRAWN	CHECKED	APPROVED
J.&G.	T.R.N.	

PHOENIX, ARIZONA SEPT. 1962

9.8 ARLINGTON AREA

9.8-A-1 General

Arlington Area is located West of the Hassayampa River between the river and Centennial Wash. The area is a long narrow valley extending from its juncture with the Gila River North to flat iron mountain. Total area of the watershed is 60 square miles.

Flood producing area is the fairly steep country at the North end in the higher elevations. Topography is characterized by rolling hills traversed by distinct washes. The valley floor close to the mouth is narrow and relatively flat.

Approximately 80 acres of farm land and the Arlington Canal would be affected if flooding should occur in Arlington Wash. No definite channel exists below the canal and damage may be extensive if a record flood should occur.

Under present conditions of development and due to the small drainage area no flood control work is planned in this area. Future conditions, however, may warrant further study.

9.9 BUCKEYE VALLEY AREA

9.9-A GENERAL

Buckeye Valley Area is located in the central part of Maricopa County and includes the town of Buckeye. Total area is 120 square miles. Practically this whole drainage area is included in the Buckeye watershed. Overall drainage is to the south and water eventually drains into the Gila River. Possibility for development of this area in the future is considered very good.

9.9-B BUCKEYE WATERSHED

9.9-B-1 General

This watershed is located north of Buckeye and has an area of 104 square miles above the proposed dike. The topography is characterized by many washes which emerge from the southern end of the White Tank Mountains and cut through on to the broad, gently sloping flood plain.

Rainfall concentrates quickly in these washes and then runs across the plain toward the Gila River.

9.9-B-2 Developments

The flood plain area is practically all under irrigation and water is delivered by canals of the Roosevelt Irrigation District, Buckeye Irrigation Company and Arlington Canal Company. U.S. Highway 80 and the main line of the Southern Pacific Railway run the length of the flood plain.

Developments along the highway are extensive. Center of the

urban area is the town of Buckeye with smaller concentrations at Liberty and Palo Verde.

9.9-B-3 Damages

Damage from flood water occurs almost every year. Water flows across the Roosevelt Irrigation District Canal in many places. Damage to canals and laterals as well as irrigated land is heavy.

Flood damage from a major flood would be extensive and would encompass many additional areas of farm land and into the urban areas where private homes and businesses are located. The railroad and all highways also suffer flood damage. The damage potential is increasing rapidly as new developments are made.

9.9-B-4 Plan

The basic flood control plan for this watershed consists of a system of diversions, dikes and channels to intercept and carry the flood water to the Hassayampa River.

Beginning in Sec. 36, T2N, R2W with a diversion, the retarding structure continues generally westward and empties into the river in Sec.3, T1N, R5W. Total structure length is estimated to be 14 miles.

The diversion is 3.0 miles long extending into Sec. 9 R3W. The diversion picks up water that would otherwise affect Luke AFB and carries it west emptying it into

"Buckeye East" retarding structure. This structure runs west into Sec. 7 where it empties into "Buckeye West" structure through the East floodway; thence west to Sec. 1, T1N, R5W, where it empties into the West floodway. Water is carried from there into the Hassayampa River.

The Canal to carry the flood water to the Roosevelt Irrigation District Canal will run along the west side of Rooks Road and enter the main canal in controlled amounts. This ditch will be concrete-lined and have capacity equal to the release rate of the principal spillway of "Buckeye West" retarding structure. Total channel length is 1.4 miles.

A summary of costs are shown in table 9.9-1 and Map 9.9-A shows planned location and extent. Table 9.9-A shows structural data.

TABLE 9.9.1 BUCKEYE WATERSHED SUMMARY

No.	Job Description	Estimated Cost: Flood Control Dist.	Estimated Cost: S.C.S.
	Consists of 2 Retarding Structures, 1 Diversion Dike, 2 floodways and 1 slip-form canal for water distribution	$ 687,300	$2,930,300
	TOTAL PROJECT COST	$3,617,600	

Flood Damage Without Project	210,000
Flood Damage with Project	60,000
Benefits from Reduction of Flood Damage	150,000
Irrigation Benefits	- 0 -
Other Benefits	- 0 -
Total Annual Benefits	150,000
Total Project Cost Amortized @ 2 7/8%	110,500
Annual Operation and Maintenance	13,500
Total Annual Costs	124,000
Benefit-Cost Ratio	1.21 to 1.00

TABLE 9.9-A

STRUCTURAL DATA

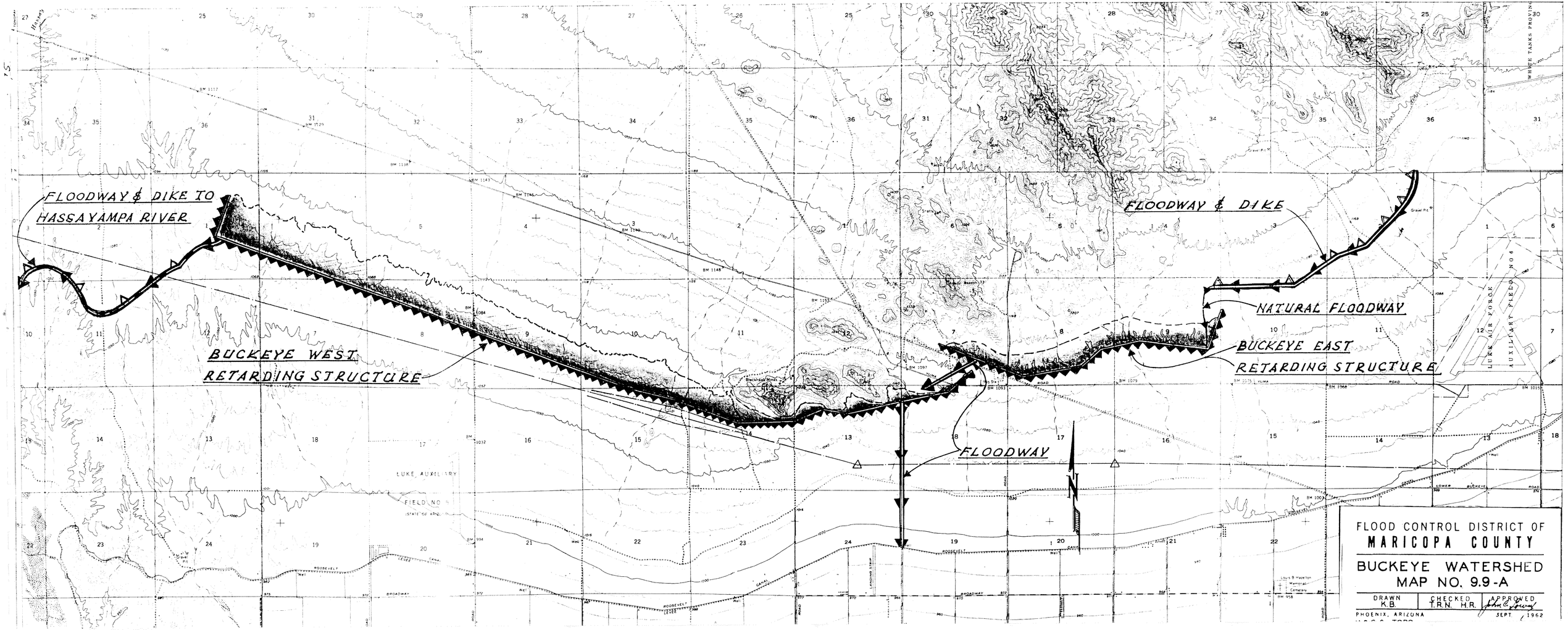
BUCKEYE WATERSHED

RETARDING STRUCTURES

No.	Item	Unit	Structures East	Structures West
1	Drainage Area	sq.mi.	14.6	42.7
2	Sediment Capacity	ac.ft.	220	600
3	Flood Water Capacity	ac.ft.	1,240	3,500
4	Total Storage Capacity	ac.ft.	1,460	4,100
5	Total Surface Area	acres	320	990
6	Length	miles	2.8	9.0
7	Maximum Height	ft.	23.5	25.0
8	Total Volume of fill	cu.yd.	535,000	1,082,000
9	Parincipal Spillway Size	inches	36"	60"
10	Maximum Release Rate	cfs	147	440
	Cost Distribution			
11	Total Construction Cost	Dollars	691,000	1,565,000
12	Contract Administration	"	5,000	12,000
13	Right of Way	"	154,000	481,000
14	Relocations & Other costs	"	-0-	-0-
15	Flood Control Dist. Cost	"	159,000	493,000
16	Total Project Cost	"	850,000	2,058,000

FLOODWAYS

No.	Item	Units	East	West	Diversion
1	Discharge Capacity	cfs	147	685	1,910
2	Length	ft.	3,200	15,600	16,400
3	Av. Bottom Width	ft.	12	30	90
4	Av. Depth	ft.	3.0	5.0	3.1
5	Av. Side Slope		2:1	Variable	Variable
6	Excavation & Fill	cu.yds.	17,560	172,100	140,000
7	Concrete & Rock Rip-Rap	cu.yds.	-	2,110	10,000
	Cost Distribution				
8	Total Construction Cost	Dollars	9,600	437,000	183,000
9	Contract Administration	"	100	3,000	1,400
10	Right of Way	"	4,500	18,000	53,000
11	Relocations & Other	"	-0-	-0-	-0-
12	Flood Control Dist. Cost	"	4,600	21,000	54,400
13	Total Project Cost	"	14,200	458,000	237,400


FLOODWAY & DIKE TO HASSAYAMPA RIVER
BUCKEYE WEST RETARDING STRUCTURE
FLOODWAY
FLOODWAY & DIKE
NATURAL FLOODWAY
BUCKEYE EAST RETARDING STRUCTURE
LUKE AUXILIARY FIELD NO 5
LUKE AIR FORCE AUXILIARY FIELD NO 4
WHITE TANKS PROVING
ROOSEVELT
BROADWAY
LOWER BUCKEYE ROAD
FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
BUCKEYE WATERSHED
MAP NO. 9.9-A
DRAWN K.B.
CHECKED T.R.N. H.R.
APPROVED
PHOENIX, ARIZONA
SEPT. 1962

9.10 GILLESPIE AREA

9.10-A General

The Gillespie area is located in the South Central portion of Maricopa County and has a area of 350 square miles.

The topography is typical of the desert country in central Arizona. The flood producing areas are the Maricopa and Eagle Mountains. The Maricopa Mountainas run North-South on the Eastern boundry of this watershed. Many washes originate in the higher elevations and flow west and North to the Gila River. There are no major drainage channels but all are well defined.

Water collects rapidly in the washes and flows across the relatively steep flood plain at high velocities.

There are no extensive developments in this area. Most of it is in range land with poor vegetative cover. U.S. Highway 80 runs the entire length of the water shed and although the highway does not wash out often flood waters do cover it during a storm and cause traffic delays and some damage.

The Gila Bend canal is subject to washout from flood water and considerable time and money is spent during rainy years on maintenance.

At the present time value of improvements in this area do not warrant a flood control project. Future developments may change the economic picture to the point where protection works will be justified.

9.11 THEBA AREA

9.11-A General

Theba Area is located in the Southerwestern part of Maricopa County and has an area of 500 square miles. This area is characterized by steep, rocky terrain along the edges blending into a broad Valley toward the center.

General drainage pattern is toward the Northwest emptying eventually into the Gila River. A large part of the area is included in the Williams Bombing and Gunnery Range.

Quilotosa Wash is the principal drain. It originates in the Sauceda and Sand Tank Mountains about 30 miles South and 15 miles West of Gila Bend.

Flood damage is slight in this area. At times some damage occurs on the Gila Bend Ranch. Other areas experiencing damage are Gila Bend Air Force Base; Tucson, Cornelia and Gila Bend Railroad, Arizona Highway 85; Gillespie Canal, Southern Pacific Railroad; U.S. Highway 80; and developed areas West of Gila Bend.

At the present time, however, total damage does not warrant any protective measures.

Future area improvements may change the economic picture. At that time means of protecting the area from floods will be studied.

9.12 GILA BEND AREA

9.12-A GENERAL

The Gila Bend area is located in the southwestern part of Maricopa County and has an area of 345 square miles. The flood producing area is the Sand Tank Mountains which are located in the southern section. Highest point is Maricopa Peak. Many washes originate in these mountains and flow out from the southwest and northeastern slopes eventually flowing into the Gila River in the Gila Bend Area.

Approximately 160 square miles of the total drainage area is in steep, rocky terrain with shallow soils. The remaining 185 square miles is a broad, flat flood plain with deep soils of high infiltration. Major drainages are the Bender and Sand Tank Washes.

9.12-B BENDER AND SAND TANK WASHES

9.12-B-1 General

Bender wash heads up in the same general area on the southwestern slopes of the Maricopa Mountains about 25 miles southeast of Gila Bend, Arizona. It flows northwesterly through barren, rocky country crossing under State Highway 84 and finally emerging into the flatter alluvial plains. It continues on northwest and passes through Gila Bend approximately 300 yards east of the

main channel of the Sand Tank Wash. Before reaching the Gila Bend area, the flows of Bender and Sand Tank washes have been joined together by means of many small cross-channels.

9.12-B-2 Development & Damages

Flood damages reported in the Gila Bend area center mostly in the extreme east end of town and in an area in the south section of town, south of Gillespie Canal and east of State Highway 85, leading to Ajo, Arizona. This area is known locally as Mexican Town and has experienced considerable flood damage in the past five years. Areas experiencing flood damages in the eastern section of Gila Bend are motels, service stations and other business establishments. Also affected are the Gillespie Canal, Southern Pacific Rialroad and U.S. Highway 80. No records are available from the Gillespie Canal owners which would indicate the average annual cost due to floods. However, visual observations reveal that some damages have occurred to the canal bank and to the structures.

9.12-B-3 Plan

A study of this area by Johannessen & Girand reveals several solutions to the flood control problem in this

area. After careful consideration and mostly due to benefit-cost determinations, the County Flood Control Engineer has selected the following structural measures:

a. Provide adequate diking and channelization above the Gillespie Canal to guide the flood water into the channels to be constructed; channelization and dikes to be built between the canal and the railroad; between the railroad and the highway and north of the highway a sufficient distance to protect the developed property below.

b. In conjunction with this channel and dike work the present siphon located in Bender Wash under Gillespie Canal will be replaced with one of sufficient capacity to carry the canal flow under Bender Wash. This siphon would be similar to the one already existing in Sand Tank Wash.

A summary of costs can be found in Table 9.12-1 and Map No. 9.12-A shows planned extent and location. Table 9.12-A shows structural data.

TABLE 9.12.1 BENDER AND SAND TANK WASHES SUMMARY

No.	Job Description	Estimated Cost: Flood Control Dist.	Estimated Cost: Other
1	Channel Clearing and Dike Construction. Includes siphon under Bender Wash	$ 152,100	$ 113,750
	TOTAL PROJECT COST	$265,850	

Flood Damage Without Project	13,450
Flood Damage with Project	1,000
Benefits from Reduction of Flood Damage	12,450
Total Annual Benefits	12,450
Total Project Cost Amortized @ 2 5/8%	9,600
Annual Operation and Maintenance	1,100
Total Annual Costs	10,700
Benefit-Cost Ratio	1.16 to 1.00

TABLE 9.12-A STRUCTURAL DATA

BENDER AND SAND TANK WATERSHED

CHANNEL CLEARING

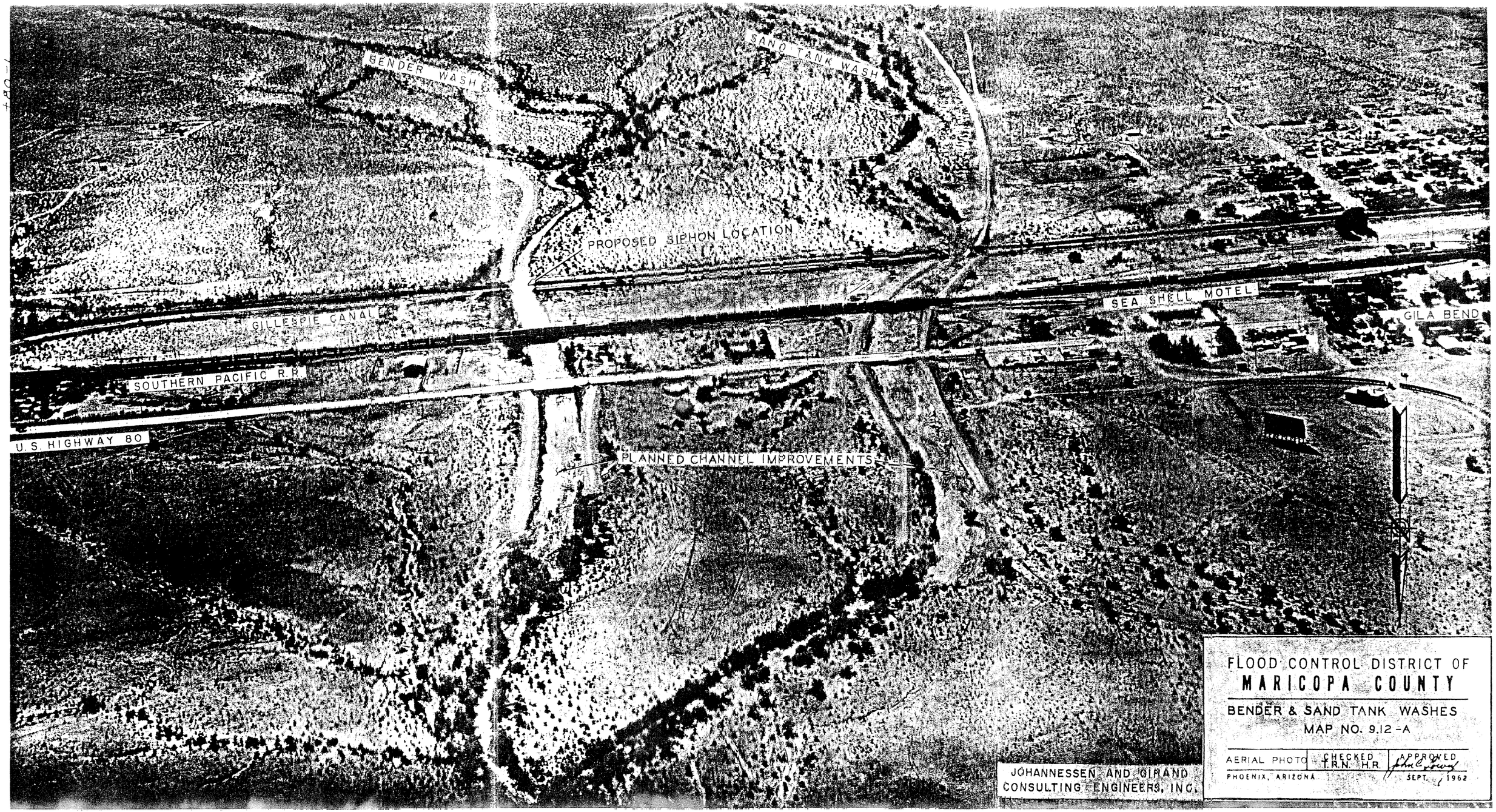
No.	Item	Units	Quantity
1	Maximum Discharge	cfs	6,000
2	Total Length	ft	7,000
3	Avg. Bottom Width	ft	100
4	Avg. Depth	ft	4.1
5	Avg. Side Slope		2:1
6	Total Excavation	cu.yd.	50,000

DIKE CONSTRUCTION

No.	Item	Units	Quantity
1	Total Length	ft	12,000
2	Maximum Height	ft	12.0
3	Avg. Side Slope		2.5:1
4	Total Volume of Fill	cu.yds.	100,000

COST DISTRIBUTION

1	Total Construction Cost	Dollars	140,000
2	Contract Administration	"	8,850
3	Right of Way	"	12,000
4	Relocations & other costs	"	105,000
5	Flood Control District Cost	"	152,100
6	Total Project Cost	"	265,850


BENDER WASH
SAND TANK WASH
PROPOSED SIPHON LOCATION
SEA SHELL MOTEL
GILA BEND
GILLESPIE CANAL
SOUTHERN PACIFIC R.R.
U.S. HIGHWAY 80
PLANNED CHANNEL IMPROVEMENTS
JOHANNESSEN AND GIRAND
CONSULTING ENGINEERS, INC.
FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
BENDER & SAND TANK WASHES
MAP NO. 9.12-A
AERIAL PHOTO
CHECKED T.R.N. H.R.
APPROVED
PHOENIX, ARIZONA
SEPT. 1962

9.13 SANTA ROSA AREA

9.13-A General

The Santa Rosa Area is located in the outheast corner of the lower section of Maricopa County and has a total area of 60 square miles.

Drainage is to the Southeast and the flood waters continue in a Southerly direction into Pima County. Most of the area is included in the Papago Indian Reservation.

Flood damage occurring in Maricopa County is slight-mostly because this area has not been developed. Channels in this area are well defined and there exists very little chance for serious flood damage.

9.14- VEKOL AREA

9.14-A General

The Vekol Area is located in the South Central part of Maricopa County and contains an area of 285 square miles.

The flood producing area of this watershed within Maricopa County are the Eastern slopes of the San Tank Mountains.

The topography is typical of the desert country of central Arizona. There are many washes that form in the higher elevations and cut through the moderately steep foothills. Due to the steep slope and sparse cover, these flood waters run off at high velocities.

The main drainage way is Vekol Wash and the general drainage is to the North.

At the present time there is very little development in this area of Maricopa County. There are no extensive centers of population and rural development is also scanty. Arizona Highway 84 crosses the upper end of the area and there is some settlement along it.

Reports of flood damage in this wqtershed area are very few. There is some minor damage to state and county roads and some erosion occurs along the banks of Vekol Wash.

These damages are not considered serious enough to warrant a flood control project at this time. Future developments may change the economic picture and make flood control a major problem.

9.15 WATERMAN AREA

9.15-A The Waterman Area is located in outh Central Maricopa and has an area of 520 square miles.

The main drainage channel in this area is Watermans Wash which has its origin in the Eastern slopes of the Maricopa Mountains approximately 20 miles East of Gila Bend, Arizona. The wash then drains North through the steep foothills and then Northwest opening out into a relatively flat Valley that leads into the Gila River just Southeast of Buckeye.

The topography of this area is typical of the desert topography of Central Arizona. The foothills and Valley are traversed by many washes that bring water from the higher elevations on the watershed perimeter down to the main drainage. Cover is sparse and slopes are steep so water concentrates quickly and runs off at high velocities.

Flood damage reports from this area have been meager. Presently there are very few developments of any importance in this area. There is a small concentration of population at Mobile on the southern Pacific Railroad but mostly there is only range land with no settlement. Range condition is poor and when rain comes it runs off quickly at high velocities.

Due to lack of development and a corresponding lack of flood damage, no flood protection projects are planned at the present time. If in the future economic jutification can be found, then flood control problems will be re-evaluated

9.16 WHITE TANKS AREA

9.16-A General

The White Tanks Area is located in the central section of Maricopa County and has an area of 200 square miles. The major flood producing areas are the White Tank Mountains on the western border of the watershed. The White Tanks detention structures constructed several years ago have eliminated a lot of flooding problems in this area. Local flooding, however, is still a problem in some areas.

The general topography is uniform except near the mountains and slope is mostly to the southeast.

9.16-B WHITE TANKS WATERSHED

9.16-B-1 Developments

Concentration of development is mostly in the valley area just north of the Gila River. The area is almost completely in cultivation with scattered population centers. Included are the towns of Liberty, Perryville, Goodyear and Avondale. Also within this area is Luke Air Force Base, Litchfield Park and the Litchfield Naval Air Station. The outlying farming areas are well populated and land values are high.

9.16-B-2 Damages

Damaging floods in this area occur frequently. Total

areas affected have been greatly reduced by construction of White Tanks projects but there are still many farming areas subject to damage. There are some residential areas that could be flooded and all roads and utilities are in danger from major runoff.

9.16-B-3 Plan

There are at present two detention structures located in this area and the McMicken Dam has its beginning here. The lower detention basin is in danger of spilling because the drainage area above it is too large compared to the available storage. By constructing two small channels and dikes, about eight square miles of drainage above the upper structure can be diverted to the Trilby Wash detention basin; then, by another channel and dike, about five square miles above the lower basin can be taken to the upper basin. This would relieve the pressure on the lower basin and extend its useful life.

The U.S. Corps of Engineers, to protect Luke Field, has constructed a concrete lined channel along Northern Ave. from the northwest corner of Luke Field to the Agua Fria River. The Maricopa County Flood Control District will be required to convey excess water to this channel. The above projects are not included in the Summary Sheets of this report but will be done as a part of the regular program.

9.17 TRILBY AREA

9.17-A General

The Trilby Wash area is located in central part of Maricopa County northwest of Phoenix and covers an area of 320 square miles.

The area extends from the McMicken dam and Beardsley Canal North to approximately the Yavapai County line and from the ridge east of the Hassayampa River to the Agua Fria river. Most of the floods occurring here are produced within the watershed mostly above U.S. Highway 60-70.

There are many washes that are essentially parallel and run generally South and East. One of the main drainage ways is Tribly Wash. The Trilby Wash detention basin created by McMicken dam was completed in July 1956 by the U.S. Corps of Engineers at a cost of approximately two million dollars. Luke A.F.B. and the towns of Litchfield, Good year, Avondale and about 50,000 acres of rich farm land receive protection from this structure.

Population density is low and there is very little development especially above U.S. Highway 60-70. The area above is typical desert range land in fair condition. Below are irrigated farms of considerable value, mostly irrigated by wells.

Areas subject to damage are highway bridges and the Santa Fe Railroad. Also affected are numberous county roads and public utilities.

Below the highway where land use is intensified, there would, of course, be greater damage from a major storm.

At the present time no major flood control works are planned in this area. Local problems may come up in the future but these will be handled in the regular operation of the Flood Control District.

Future land developments may warrant a re-evaluation of this area.

9.18 UPPER AGUA FRIA AREA

9.18-A General

The Upper Agua Fria area begins above Carl Pleasant dam in the Northern part of Maricopa County and extends into Yavapai County. Total area is 1,459 square miles.

This is one of the larger drainage areas that affect Maricopa County. However, most of it lies outside the bounds of this county.

The building of the Carl Pleasant dam has reduced the frequency of a flood below the dam but has not reduced the probable maximum flood. The construction of New River and Adobe dams will reduce the flood below in the Agua Fria.

There are no plans for additional flood control projects within this area.

9.19 LOWER AGUA FRIA AREA

9.19-A General

The lower Agria Fria area begins at the Lake Pleasant dam and extends South to the Salt River. Total area is 110 square miles.

Topography can be divided into two distinct classes; the rough, steep, hills at the upper end and the smoother, flatter land at the lower end near the Salt River. The area is long and narrow and consists mostly of the flood channel of the Agua Fria River and its tributaries. Cover is typically desert with very little vegetative growth. Velocities in the existing channels are high due to lack of cover and steep slopes.

Some farming is done in the bottom land adjacent to the river and there are approximately 3,000 acresoutside the river channel. Damage would occur to these and other developments during a major flood.

Work done in the Deer Valley group will affect this area since the Agua Fria will be the outlet channel for these works. The West Phoenix floodways will also extend into this area.

9.20 UPPER NEW RIVER AREA

9.20-A General

The Uper New River Area begins at the proposed New River Dam in the North Central portion of Maricopa County Northwest of the town of Adobe and contains an area of 170 square miles.

The main drainage way in this watershed is New River, an intermittent stream that heads up in Yavapai County about 10 miles East of Rock prings. River channel is well defined for most of its length.

The flood producing areas are the higher mountains at the upper end of the watershed at elevations up to 5,000 feet. The topography is rough and characterized by many washes that originate on the perimeter and flow down to main channel. Due to the impervious nature of the ground and steep slopes, percentage of runoff and velocities are high.

At a point near where the river crosses Black Canyon, the slope of the whole watershed flattens out and the topography changes to broken, brush covered foothills.

Approximately 8 miles Northwest of the town of Adobe the hills converge to form a narrow box. At this point the proposed New River dam will be located.

At the present time, development in the flood plain is limited but future population expansion may include this area. The main urban concentration is the tow of Peoria.

There is some possibility that the river may leave its present channel during a major flood and flood the town causing extensive damages.

Some farming is done in the bottom land adjacent to the river and there are approximately 3,000 acres outside the river banks. These could be damaged by flood waters.

Extent of damage on the Agua Fria river below New River junction can be reduced by construction of New River dam.

9.21 LOWER NEW RIVER AREA

9.21-A. General

The Lower New River area begins at the proposed New River dam site and continues South to the Agua Fria River. Total area is 45 square miles.

From the dam site South to Deer Valley Road the area is typical desert foothills, mostly brush covered and trending toward the main channel. Topography is rough and the low hills are traversed by many small washes that flow individually to New River.

Farming areas begin at Deer Valley Road and continue to the junction with the Agua Fria River. Skunk Creek enters in Section 10, Township 3 North, Range 1 East and would be a heavy contributor of flood water during a major storm.

At the present time no protective works are planned below the New River dam. This lower area will receive the protection afforded by the New River flood control project. Therefore, damages and benfits are discussed under Section 9.25-B-5.

In the future some channel work may have to be done below Skunk Creek. If Cave Creek, Skunk Creek and North Phoenix Mountain water is diverted into the river and Adobe and New River dams are not built then this channel work will become necessary.

9.22 DEER VALLEY AREA

9.22-A General

The Deer Valley area is located just West of the City of Phoenix and contains an area of 140 square miles.

The upper end of the watershed begins at the Union Hills, approximately one mile South of Cave Creek dam. As the Watershed extends southward it widens out to take in parts of Deer Valley and then on to include the thickly populated areas West of Phoenix. The Southern boundry of the watershed is the Salt River.

The major flood producing part of this area is the upper end east of the Skunk Creek watershed, however, local flooding conditions are produced South in the watershed. This condition is mainly a result of flat slopes and poor outlets where water that falls has no chance to get away.

The Arizona Canal effectively divides this area into two parts and under ordinary conditions flood waters do not cross it. However, a major flood has in the past and will again cause breaks to occur in the canal and allow flood waters to flow through the highly developed areas below. This, of course, will cause major damage.

Most of the area North of the canal is in farming but beginning at the canal and going South toward the Salt River population density increases and a greater portion is all urban. Included are the towns of Glendale and Maryvale plus many surburban residential developments.

Planned projects that affect this area are North Phoenix Mountains, Arizona Canal diversion, Union Hills diversion, New River and Adobe dams and the West Phoenix floodways. They are described under Sections as follows:

9.25-B-2	North Phoenix Mountains
9.25-B-3	Arizona Canal Channel
9.25-B-4	Union Hills Diversion
9.25-B-5	New River Dam
9.25-B-6	Adobe Dam
9.22-B	West Phoenix Floodways

9.22-B WEST PHOENIX FLOODWAYS

9.22-B-1 General

This area has been one of the most rapidly developing sections of Maricopa County. Settlement has been so recent that it is difficult to estimate possible damage but it would be very severe.

There are hundreds of residences located here that would be flooded by a major storm. The only possible drainage at the present time comes from S.R.V.W.U. laterals and it is likely that they would be ineffective during a flood. In the past no provisions have been made to carry flood water to the Agua Fria and the Salt River.

9.22-B-2 Plan

(a) Glendale-Peoria drain

A lined channel, trapezoidal in section, 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.

Much of this project is in a developing area where land acquisition costs are rising; thus total project costs will be proportionally higher. Total estimated cost at present is $2,181,000.

(b) Maryvale-Glendale drain

A lined channel trapezoidal in section, with 2:1 side slopes, running from the Grand Canal ½ mile West of 67th Avenue Westerly approximately 5½ miles to the Agua Fria River.

Much of this project is in a rapidly developing area. Land acquisitions will continue to rise thus increasing total project costs. Total estimated cost at present is $1,978,000.

(c) West Phoenix-Maryvale drain

Will run from a covered box culvert section at 47th Avenue from the Grand Canal Southerly to Thomas Road; becoming an open-topped lined channel, trapezoidal in section, with 2:1 slopes at 47th and Thomas then run Southerly about 5.3 miles to the Salt River.

Present estimated cost is $2,542,000.

The three projects listed above are proposed by the Flood Control District to satisfy the need for major flood channels in the West Phoenix Area. Other channels and storm drains within the City Limits of Phoenix are needed, of course, but plans are not now available. Study of problems in the Metropolitan area will be continued in cooperation with the City of Phoenix and othermunicipalities.

For a summary of costs see Table 9.22-1 and Map No. 9.22-A shows planned extent, location, and structural data. Table 9.22-A shows related structural data.

TABLE 9.22.1 WEST PHOENIX FLOODWAYS SUMMARY

No.	Job Description	Estimated Cost: Flood Control Dist.	Estimated Cost: Corps. of Engineers
	Lined Channels North of Glendale and West to New River near Campbell Avenue. From the Grand Canal West to the Agua Fria, and near 47th Avenue from Grand Canal Southerly to the Salt River	$ 996,000	$5,705,000
	TOTAL PROJECT COST	$ 6,701,000	

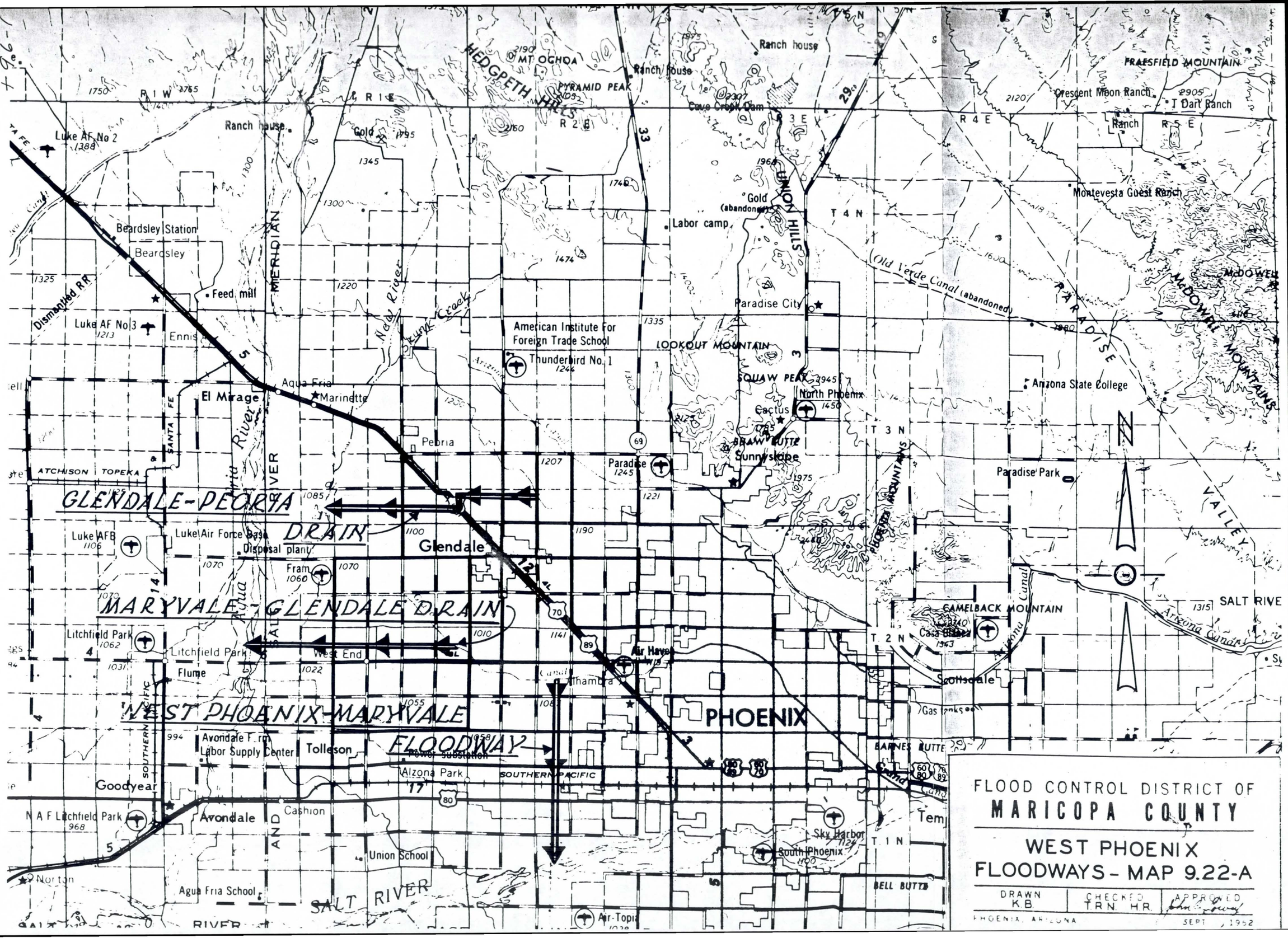
Flood Damage Without Project	231,500
Flood Damage with Project	33,500
Benefits from Reduction of Flood Damage	198,000
Irrigation Benefits	- 0 -
Other Benefits	- 0 -
Total Annual Benefits	198,000
Total Project Cost Amortized @ 2 5/8%	240,000
Annual Operation and Maintenance	18,000
Total Annual Costs	258,000
Benefit-Cost Ratio	0.77 to 1.00

TABLE 9.22-A STRUCTURAL DATA

DEER VALLEY AREA

WEST PHOENIX FLOODWAYS

No.	Item	Units	Glendale-Peoria	Maryvale-Glendale	W.Phoenix-Maryvale
1	Discharge Capacity	cfs	4,100	4,300	3,600
2	Length	ft.	33,264	30,624	29,568
3	Avg. Bottom Width	ft.	13.0	11.0	9.0
4	Avg. Depth	ft.	9.0	8.0	8.0
5	Avg. Side Slope		2:1	2:1	2:1
6	Excavation	cu.yd.	346,000	315,000	266,000
7	Concrete	cu.yd.	43,772	39,000	32,000
	COST DISTRIBUTION				
8	Total Construction Cost		$1,839,000	$1,661,000	$2,205,000
9	Contract Administration		30,000	20,000	30,000
10	Right of Way		158,000	137,000	116,000
11	Relocations & Other Costs		154,000	160,000	191,000
12	Flood Control Dist. Cost		342,000	317,000	337,000
13	Total Project Cost		$2,181,000	1,978,000	2,542,000


FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
WEST PHOENIX
FLOODWAYS - MAP 9.22-A
DRAWN K.B.
CHECKED T.R.N. H.R.
APPROVED
PHOENIX, ARIZONA
SEPT. 1962
GLENDALE-PEORIA DRAIN
MARYVALE-GLENDALE DRAIN
WEST PHOENIX-MARYVALE FLOODWAY
PHOENIX
Glendale
Peoria
Tolleson
Avondale
Goodyear
Litchfield Park
Luke AFB
Luke Air Force Base
Luke AF No 2
Luke AF No 3
Beardsley Station
Beardsley
Ennis
El Mirage
Aqua Fria
Marinette
Pebria
Paradise
Sunnyslope
North Phoenix
Cactus
Paradise City
Paradise Park
Scottsdale
Tempe
South Phoenix
Sky Harbor
Air Haven
Thunderbird No. 1
American Institute For Foreign Trade School
Arizona State College
Montevesta Guest Ranch
Crescent Moon Ranch
T Dart Ranch
Ranch house
Cave Creek Dam
Gold (abandoned)
Labor camp
Feed mill
Disposal plant
Fram
Flume
West End
Avondale Farm Labor Supply Center
Power Substation
Alzona Park
Union School
Agua Fria School
Cashion
Norton
Air-Topia
Gas tanks
MT OCHOA
PYRAMID PEAK
HEDGPETH HILLS
UNION HILLS
LOOKOUT MOUNTAIN
SQUAW PEAK
BRAW BUTTE
CAMELBACK MOUNTAIN
BARNES BUTTE
BELL BUTTE
McDOWELL MOUNTAINS
PRAESFIELD MOUNTAIN
Old Verde Canal (abandoned)
Arizona Canal
Grand Canal
Dismantled RR
SALT RIVER
Agua Fria River
New River
Cave Creek
SOUTHERN PACIFIC
ATCHISON TOPEKA
SANTA FE
GILA AND SALT RIVER MERIDIAN
PARADISE VALLEY
R 1 W
R 1 E
R 2 E
R 3 E
R 4 E
R 5 E
T 4 N
T 3 N
T 2 N
T 1 N

9.23 SKUNK CREEK AREA

9.23-A General

The Skunk Creek area is located in the North Central part of Maricopa County North of the City of Phoenix and contains an area of 135 square miles.

The headwaters of Skunk Creek rise on the South Western slopes of New River Mesa and flows generally in a Southwestern direction toward New River, entering in Section 10, Township 3 North, Range 1 East.

This area can be divided into three distinct topographical group - upper, middle and lower. The upper is characterized by steep, rugged mountains with brush cover; the middle is gently rolling with low, well rounded hills; the lower is relatively flat with gentle slopes. The washes are well defined at the upper reaches but tend to loose their identity as they flow into the flat alluvial Valley.

The runoff producing area is the steep mountains and foothills East of New River.

There is very little development until the Creek enters the plain in upper Deer Valley. There is, however, limited settlement along the Cave Creek Road from New River to Cave Creek.

The area east of Black Canyon highway is well developed and is intensively farmed. Water is supplied by wells. Population concentrations exist at Adobe and rural areas are well settled West to New River.

At the present time very little damage occurs in this area. Potential damage, whoever, is high in the future because this is a rapidly developing area. The cultivated areas along the wash would be the hardest hit by a major flood and considerable damage to land and crops would result.

There are planned projects within the Deer Valley Group that are located in or else affect this area. See the write-ups on North Phoenix Mountains, Arizona Canal Diversion, Union Hills Diversion, the Adobe, and New River Dams, and the West Phoenix Floodways.

9.24 CAVE CREEK AREA

9.24-A General

The Cave Creek area is located in the North Central part of Maricopa County and contains an area of 240 square miles.

The Cave Creek area extends from the Salt River to the New River Mesa in Eastern Yavapai County. The area is long but not very wide.

The topography varies from high brush covered mountains to the low desert floor. Direction of drainage is generally South and Cave Creek is the principal natural drain.

Other than the town of Cave Creek, there is very little development in the upper Cave Creek area. Beginning at Cave Creek dam, the density of population increases and beginning near Union Hills drive the whole area becomes urbanized. There are a number of subdivisions in the lower Cave Creek area and below the Arizona Canal development is highly concentrated.

Within this area the potential damage is greater than any other within Maricopa County.

County roads are succeptible to washouts around Cave Creek and also the creek at times jumps its banks and runs through the town causing considerable damage.

A Cave Creek approaches the Arizona Canal development increases with a parallel increase in potential damage. In August 1943 a storm centered over the Valley caused Cave Creek to overflow its banks, break the Arizona Canal, and cause considerable damage to the urban areas. A similar storm now could cause damages running into millions of dollars.

Plans for flood control in Cave Creek area are tied in with other projects. The recommended plan is construction of the North Phoenix Mountains Diversion, Arizona Canal Diversion, Union Hills Diversion, and Adobe and New River Dams. See applicable section for a description of these projects.

9.24-B OLD CAVE CREEK DAM

9.24-B-1 General

A major storm would fill the reservoir behind the dam and cause the present earth spillway to operate. When this happens there is a strong possibility that the spillway will wash out and cause extensive damage below.

There have been some studies made regarding what could be done to remedy this condition but no plan has been fully accepted. Further study and evaluation will be necessary before a final decision can be reached.

9.24-B-2 Plan

Alternate number one consists of an earth dike 2,900 fee long across the natural spillway and construction of a new spillway on the West side of the old dam. There is some

doubt that a new spillway located here will stand up. Rock here is highly fractured and may fail.

Alternate number two consists of an earth-fill dam across the spillway the same as number one. However, instead of making a new spillway on the West side, an apron will be poured below the old concrete dam and water will pass over the dam during a flood.

Total estimated cost of either plan will be approximately the same. Further study will determine the final decision.

Table 9.24-1 shows a summary of costs and Map 9.24-A shows planned location and extent.

TABLE 9.24.1 OLD CAVE CREEK DAM SUMMARY

No.	Job Description	Estimated Cost: Flood Control Dist.	Estimated Cost: Corps. of Engineers
	An earthfill Dam across the Original Spillway approximately 4,000 feet long.		
	Also Location and Construction of of a new Spillway on the West Side of the Dam		
	TOTAL	$ 65,000	$ 91,000
	TOTAL PROJECT COST	$ 156,000	

Flood Damage Without Project	11,200
Flood Damage with Project	1,000
Benefits from Reduction of Flood Damage	10,200
Irrigation Benefits	- 0 -
Other Benefits	- 0 -
Total Annual Benefits	10,200
Total Project Cost Amortized @ 2 5/8%	5,600
Annual Operation and Maintenance	2,600
Total Annual Costs	8,200
Benefit-Cost Ratio	1.24 to 1.00

9.24-C CAVE CREEK TOWN DIKE

9.24-C-1 General

There are approximately 115 square miles of drainage above the town of Cave Creek. The runoff producing area is steep and rough and water concentrates quickly in the washes.

The channel of Cave Creek here is well defined and steep. Flood waters come down at high velocities.

The wash has in the past over flowed the South bank of Cave Creek and traveled in another wash through the developed portion of town.

9.24-C-2 Plan

About 800 feet of dike, with revetment for the wash about one-half mile East of the center of the town of Cave Creek.

See table 9.24-2 for a summary of costs.

TABLE 9.24-2 CAVE CREEK TOWN DIKE SUMMARY

No.	Job Description	Estimated Cost: Flood Control Dist.	Estimated Cost: Corps. of Engineers
	Approximately 800 Feet of Dike, with Revetment for the Wash about 0.5 miles East of the Center of Town	$ 3,300	$ 11,700
	TOTAL PROJECT COST	$ 15,000	

Flood Damage Without Project	1,000
Flood Damage with Project	- 0 -
Benefits from Reduction of Flood Damage	1,000
Irrigation Benefits	- 0 -
Other Benefits	- 0 -
Total Annual Benefits	1,000
Total Project Cost Amortized @ 2 5/8%	542
Annual Operation and Maintenance	300
Total Annual Costs	842
Benefit-Cost Ratio	1.19 to 1.00

9.24-D LOWER CAVE CREEK DAM

9.24-D-1 General

To help control flood waters from the Cave Creek Watershed, an additional structure is being studied on Cave Creek, in Section 9, Township 4 North, Range 3 East.

This dam will materially affect the peak flow and the expected runoff from this area and will change the size and carrying capacity of the structure in Deer Valley Group (see Sec. 9.25-B, page 104 of Report.) The expected flow in the Union Hills diversions can be reduced from 28,000 cfs to approximately 4,000 cfs. The size and cost of this structure can therefore be greatly reduced.

This planned structure will eliminate the need for channelization and concrete lining of outflow channels in Skunk Creek, New River and the Agua Fria River. Protection will also be given the Central Arizona Project Canal (proposed) as it runs through this area.

Cost estimates indicate this structure will cost approximately $7,000,000 with $1,000,000 to be charged to the Flood Control District.

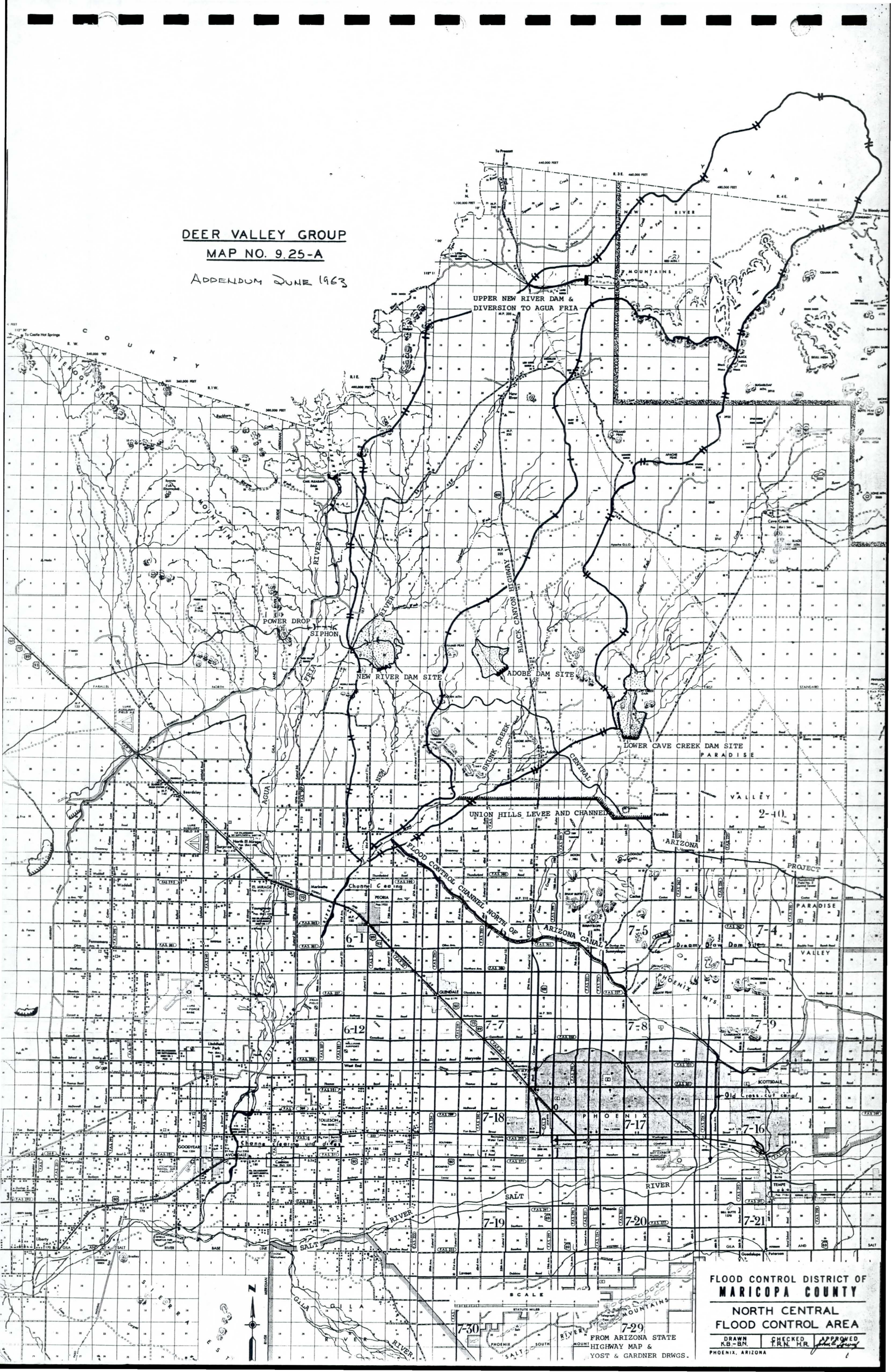
It is expected that this total cost will be offset by savings in the Union Hills diversion and channel clearing of Skunk Creek, New River and Agua Fria River; therefore a decrease in the total program cost can be expected.

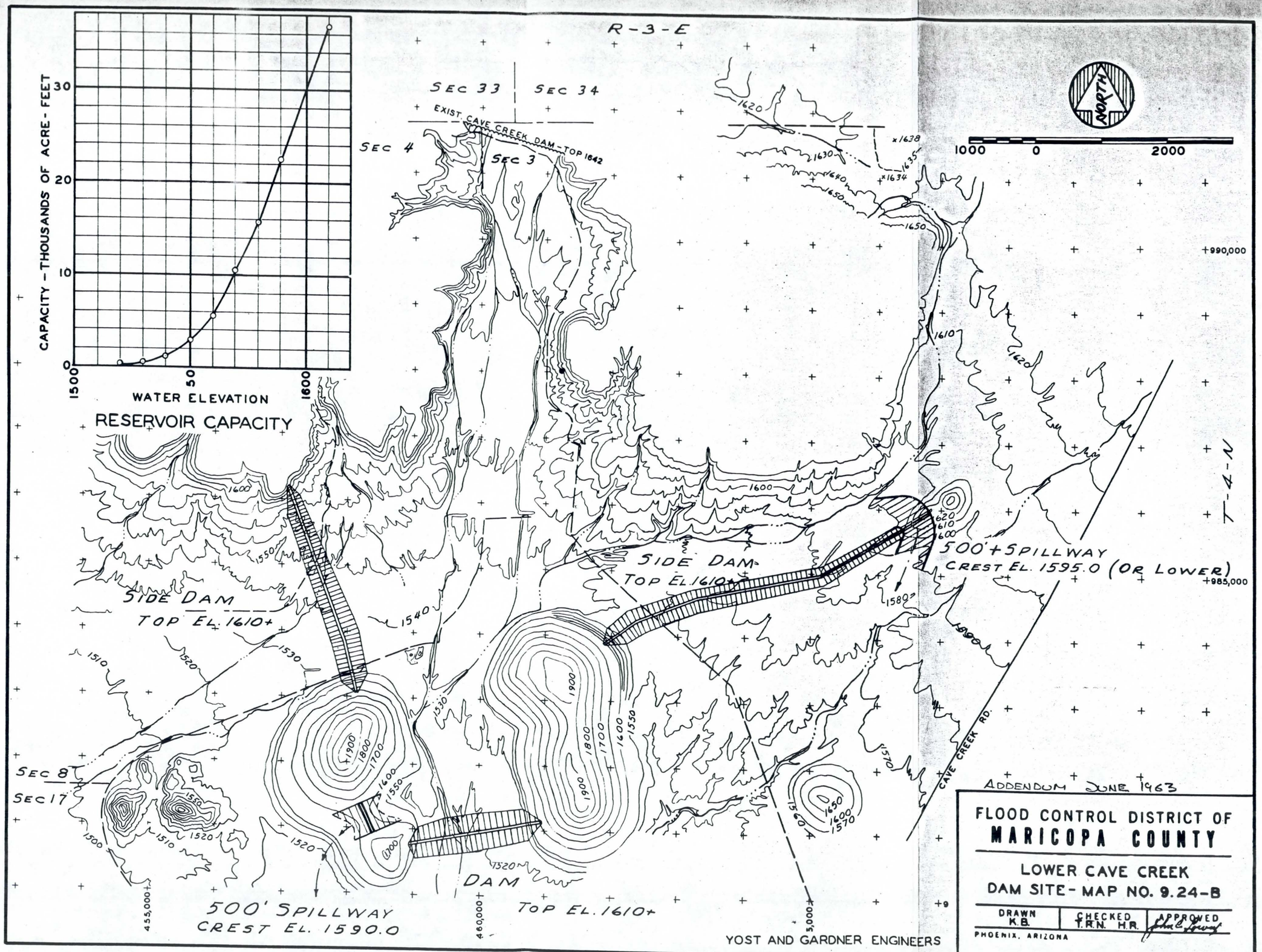
This proposed Lower Cave Creek Dam is being currently studied by the U.S. Army Corps of Engineers as to its feasibility. Topographic maps of the area are available for this purpose.

The advantages of the Dam will be as follows:

1. Permit reduced and controlled flow of flood waters from the Reservoir, eliminating flood damage.
2. Permit reduction in the size of the proposed Union Hills Drive diversion structures.
3. Eliminate necessity of concrete lining of Skunk Creek, New River and Agua Fria.
4. Provide protection for the proposed Central Arizona Project Canal, the location of which, as presently planned, will be a short distance downstream from the Dam.

From preliminary studies it appears that the savings in reducing the size of Union Hills Drive structures and the elimination of concrete-lining of the stream channels will be greater than the cost of the Dam. (See Map 9.24-B.)


DEER VALLEY GROUP
MAP NO. 9.25-A
ADDENDUM JUNE 1963
UPPER NEW RIVER DAM &
DIVERSION TO AGUA FRIA
POWER DROP
SIPHON
NEW RIVER DAM SITE
ADOBE DAM SITE
LOWER CAVE CREEK DAM SITE
UNION HILLS LEVEE AND CHANNEL
FLOOD CONTROL CHANNEL NORTH OF
ARIZONA CANAL
Channel Clearing
Channel Clearing and dike
Dreamy Draw Dam Site
Old cross-cut canal
PARADISE
VALLEY
ARIZONA
PROJECT
PHOENIX
SCOTTSDALE
TEMPE
GLENDALE
PEORIA
TOLLESON
GOODYEAR
AVONDALE
EL MIRAGE
SURPRISE
Waddell
Beardsley
Cave Creek
SALT
RIVER
GILA
AGUA
FRIA
NEW
BLACK CANYON HIGHWAY
SKUNK CREEK
CENTRAL
MOUNTAINS
PHOENIX MTS.
SIERRA
SCALE
STATUTE MILES
FROM ARIZONA STATE
HIGHWAY MAP &
YOST & GARDNER DRWGS.
FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
NORTH CENTRAL
FLOOD CONTROL AREA
DRAWN K.B.-B.N.
CHECKED T.R.N. H.R.
APPROVED
PHOENIX, ARIZONA


R-3-E
T-4-N
SEC 33
SEC 34
SEC 4
SEC 3
SEC 8
SEC 17
EXIST. CAVE CREEK DAM - TOP 1642
CAPACITY - THOUSANDS OF ACRE-FEET
WATER ELEVATION
RESERVOIR CAPACITY
NORTH
1000 0 2000
SIDE DAM
TOP EL. 1610+
SIDE DAM
TOP EL. 1610+
500'+ SPILLWAY
CREST EL. 1595.0 (OR LOWER)
500' SPILLWAY
CREST EL. 1590.0
DAM
TOP EL. 1610+
CAVE CREEK RD.
+990,000
+985,000
455,000+
460,000+
5,000
ADDENDUM JUNE 1963
FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
LOWER CAVE CREEK
DAM SITE - MAP NO. 9.24-B
DRAWN K.B.
CHECKED T.R.N. H.R.
APPROVED
PHOENIX, ARIZONA
YOST AND GARDNER ENGINEERS

9.25 SUNNYSLOPE AREA

9.25-A General

The Sunnyslope area is located in the central part of Maricopa County and has within its boundries a large section of Northeast Phoenix. Total area is 80 square miles.

The area is bounded on the South by the Salt River and on the North by the Phoenix Mountains. The topography is characterized by steep, rugged mountains and well defined channels to the Arizona Canal. Runoff rate and velocities are high. These factors combined with lack of cover and urbanization of lower slopes create high peak flows.

The flood producing areas are in the Phoenix Mountains.

There are a lot of small washes in this area. All of them empty into the Arizona Canal causing breaks during high flows. This releases the water into the highly developed urban sections below.

There has been serious enroachment on the natural channels in this area. Many subdivisions have been built without regard to floodways and channels. All these would be seriously damaged by a major storm. Runoff comparable to that produced by the storm of August 1943 would cause damage estimated to run into millions of dollars.

Present plans for flood control is to install the North Phoenix Mountains project described in section 9.25-B-2.

The plan is to enlarge the old cross-cut canal and divert all water possible back to this channel, then construct a channel to take the remaining water West to Skunk Creek.

9.25-B DEER VALLEY GROUP

9.25-B-1 GROUP DEFINITION AND EXTENT

For the purpose of showing the complete picture and because control measures are so closely related the following drainage areas have been combined to form a group called "Deer Valley Group". The main outlet for all works in this group is the Agua Fria River.

Section 9.25-B through Section 9.25-B-6 shows planned projects within this group.

Areas included in this group are:

No. 19 - Lower Agua Fria	-	110 Sq. Mi.
No. 20 - Upper New River	-	170 Sq. Mi.
No. 21 - Lower New River	-	45 Sq. Mi.
No. 22 - Deer Valley	-	140 Sq. Mi.
No. 23 - Skunk Creek	-	135 Sq. Mi.
No. 24 - Cave Creek	-	240 Sq. Mi.
No. 25 - Sunnyslope	-	80 Sq. Mi.

A general description of these areas can be found in Section 9.19 through 9.25.

Principal streams included in this area are the Agua Fria, New River, Skunk Creek, Cave Creek and , the Agua Fria being the main drainage into theSalt River. Elevations in this group of individual areas vary from 800 to 5,300 feet above sea level and the topography changes from relatively flat irrigated land to steep mountains.

The "Deer Valley Group" is about 30 miles wide and 55 miles long North to South. The major flood producing areas are the Northern Mountains.

There is a definite relation between the flood problems within this over all group. Ordinarily water from an area should be taken in its natural channel to the major outlet. Due to the high cost, etc. of going through the urban areas of Phoenix and surrounding towns, this cannot be done for the Deer Valley, Cave Creek and Sunnyslope watersheds. Of necessity, this water must be taken to the West and into the Agua Fria drainage. Therefore, projects planned in this area will extend from one major drainage to another.

For the purpose of this report, the projects will be reported in the following order: North Phoenix Mountains, Arizona Canal Diversion, Union Hills Diversion, New River Dam and Adobe Dam.

Map No. 9.25-A shows the whole group and the interrelation between the planned projects.

9.25-B-2 NORTH PHOENIX MOUNTAINS DIVERSION

a. General

Solution to the North Phoenix Mountain drainage problem is difficult. A combination of a channel along the Arizona Canal plus full utilization of the Canal itself seems to be the only generally workable solution.

The difficulties of new construction through portions of the North Mountains and the consequent need to utilize Salt River Project facilities leads to the selection of the minimum design occurrence of this report. General ability of the Arizona Canal to handle water from the Arcadia District, possibility of reverse flow from 39th Street back to the Old Crosscut, and the Canals capabilities again between 39th Street and 20th Street, pointed toward an approximate 20 year flood flow design.

There are still a few (rapidly disappearing) storage sites that could be developed. If the present plan is not approved then improvements to the Arizona Canal, utilization of the Old Crosscut and construction of all storages feasible becomes essential.

Without the cooperation of the Salt River Project parts of this project become prohibitive - for example, to carry about 2,000 cfs from 40th Street and the Arizona Canal (Cudia City to the Salt River would cost approximately $5,000,000.

b. Plan

A lined channel from 20th Street to the point where Cave Creek meets the Arizona Canal, and lying immediately North of and parallel to the Arizona Canal. Deepening to produce a reverse flow of the Arizona Canal from the Echo Canyon inlet east to the old Cross-Cut Canal at 48th St. Installation of control gates at the Echo Canyon Inlet and at the old Cross-Cut Canal and 48th Street. Enlarging and lining of the old Cross-Cut Canal with adequate crossing structures at major arterials and installation of gates at the Old Cross-Cut crossing of the Grand Canal. The Salt River Project plans to use the Arizona Canal from east of the Cross-Cut Canal and between 38th Street and 20th Street to handle the 20-year floods or about its present capacity. Item added for overtime and special work in Canal from Echo Canyon Inlet to old Cross-Cut Canal and setting gates.

For structural data see map, where typical sections are given showing bottom width, side slope, capacity and other pertinent data.

Table 9.25-1 shows a summary of costs and Map 9.25-B shows planned extent and location.

9.25-B-3 ARIZONA CANAL DIVERSION

a. General

This project is recommended to be installed in conjunction with the Union Hills Diversion and the North Phoenix Mountains channel to carry flood water to Skunk Creek.

Construction in this area is becoming increasingly difficult due to urbanization; therefore, a minimum recurrence interval has been selected for design of this project. The degree of protection will vary depending on whether the Union Hills Diversion and the North Phoenix Mountains projects are concurrently installed.

b. Plan

A lined channel from Cave Creek to Skunk Creek lying north of and parallel to the Arizona Canal with an inlet control structure at the Cave Creek entrance about 0.5 miles west of 19th Avenue.

Design calls for the channel to be able to carry 10,000 cfs at Cave Creek and 12,000 cfs at Skunk Creek.

Table 9.25-1 shows a summary of costs and Map 9.25-A shows planned extent and location. Structural data is shown in Table 9.25-A.

9.25-B-4 UNION HILLS DIVERSION

a. General

This project is to be installed as a part of the overall

plan for flood control in the Cave Creek watershed. Other projects that are directly related to this one are North Phoenix Mountains, the Arizona Canal Diversion, Adobe Dam and New River Dam.

One of the best jobs for controlling Cave Creek flood water has already been done in the form of the existing Cave Creek Dam. Limited capacity of the Dam and residual flows originating below the Dam makes further works necessary.

Estimated flow below the dam to be diverted by this structure is 47,000 and will be the total flow generated above the structure and none will be by-passed.

b. Plan

A lined channel beginning approximately at 36th Street between Bell Road and Union Hills drive running west to 12th Street; then angles Northwest to 7th Avenue and ¼ mile above Union Hills Road; then West to Skunk Creek.

The Channel will have a 20 foot bottom at the upper end with 2:1 slopes and will be 6.5 feet deep. At its outlet it will have same general shape but will be 26 feet deep. Inlet structures will be located where needed.

Table 9.25-1 shows a summary of costs and Map 9.25-A shows planned extent and location. Pertinent structural data is shown in table 9.25-B

9.25-B-5 NEW RIVER DAM

a. General

New River dam is planned to be built in conjunction with the Cave Creek structures and Adobe Dam.

Storage in the upper reaches of New River and Skunk Creek becomes more needed depending on the amount of water diverted from Cave Creek. If only approximately 12,000 C.F.S. is diverted by the Arizona Canal diversion, the storage above is not so critical.

If more water is diverted, then the channel capabity of Lower Skunk Creek and New River becomes critical and it becomes essential that the New River dam and the Adobe Dams be built.

b. Plan

b. Plan

The dam is located in Section 26, Township 5 North,

The dam is located in Section 26, Township 5 North,

Range 1 East, approximately 8 Miles Northwest of Adobe. The structure will be an earthfill and contain approximately 1,300,000 cu. yds. of fill. The upstream face will be rip-rapped and a 72" outlet will be placed through the fill.

Range 1 East, approximately 8 Miles Northwest of Adobe. The structure will be an earthfill and contain approximately 1,300,000 cu. yds. of fill. The upstream face will be rip-rapped and a 72" outlet will be placed through the fill.

Reservoir storage at the spillway crest is 33,500 acre-feet and total surface area is 1,550 acres. Table 9.25-1 shows a summary of costs, table 9.25-C shows structural data and Map 9.25-C shows planned extent and location.

Reservoir storage at the spillway crest is 33,500 acre-feet and total surface area is 1,550 acres. Table 9.25-1 shows a summary of costs, table 9.25-C shows structural data and Map 9.25-C shows planned extent and location.

9.25-B-6 ADOBE DAM

a. General

This structure is planned to be constructed along with the Cave Creek and New River projects.

Storage above the junction of Union Hills diversion and the Arizona Canal diversion becomes important if large amounts of water are diverted into Skunk Creek.

This is an off-channel dam and storage area. A diversion and channel will be required to take the water to the reservoir. Land for dam and storage area is government owned.

b. Plan

The dam is located in Township 5 North, Range 2 East and angles across the line between sections 27 and 34. It will be of earth fill construction and contain approximately 1,6000,000 cu. yds. The upstream face will be rock rip-rapped and a 72" free flow outlet will be place in the fill.

Reservoir storage at the spillway crest is 13,000 acre-feet and total surface area is 800 acres.

Table 9.25-1 shows a summary of costs, table 9.25-D gives structural data and Map 9.25-D shows planned extent and location.

///

TABLE 9.25.1 DEER VALLEY GROUP SUMMARY

No.	Job Description	Estimated Cost: Flood Control Dist.	Estimated Cost: Corps. of Engineers
1.	North Phoenix Mountains Channel	$2,366,000	$ 4,277,000
2.	Arizona Canal Diversion	944,000	7,060,000
3.	Union Hills Dam	2,396,000	12,645,000
4.	New River Dam	3,770,000	2,002,000
5.	Adobe Dam	832,000	2,301,000
	TOTAL	10,308,000	28,285,000
	TOTAL PROJECT COST	38,593,000	

Flood Damage Without Project	2,648,000
Flood Damage with Project	416,000
Benefits from Reduction of Flood Damage	2,232,000
Irrigation Benefits	- 0 -
Other Benefits	- 0 -
Total Annual Benefits	2,232,000
Total Project Cost Amortized @ 2 5/8%	1,394,750
Annual Operation and Maintenance	86,000
Total Annual Costs	1,480,750
Benefit-Cost Ratio	1.51 to 1.00

TABLE 9.25-A STRUCTURAL DATA

DEER VALLEY GROUP

Arizona Canal Diversion

No.	Item	Units	Quantity
1	Discharge Capacity	cfs	12,000
2	Length	ft.	53,850
3	Avg. Bottom Width	ft.	20
4	Avg. Depth	ft.	17.8
5	Avg. Side Slope		2:1
6	Excavation	cu.yds.	1,875,000
7	Concrete	cu.yds.	115,000
	COST DISTRIBUTION		
8	Total Construction Cost		7,060,000
9	Contract Administration		30,000
10	Right of Way		472,000
11	Relocations & other Costs		442,000
12	Flood Control District Cost		944,000
13	Total Project Cost		8,004,000

TABLE 9.25-B STRUCTURAL DATA

DEER VALLEY GROUP

Union Hills Diversion

No.	Item	Units	Quantity
1	Discharge Capacity	cfs	50,000
2	Length	ft.	57,000
3	Avg. Bottom Width	ft.	20
4	Avg. Depth	ft.	15.0
5	Avg. Side Slope		2:1
6	Excavation	cu.yds.	4,941,000
7	Concrete	cu.yds.	160,000

COST DISTRIBUTION

8	Total Construction Cost	$12,645,000
9	Contract Administration	50,000
10	Right of Way	1,103,000
11	Relocations & other costs	1,243,000
12	Flood Control District Cost	2,396,000
13	Total Project Cost	$15,041,000

STRUCTURAL DATA

DEER VALLEY GROUP

New River Dam

No.	Item	Units	Quantity
1	Drainage Area	sq.mi.	175
2	Total Storage	acre feet	33,500
3	Total Surface Area	acres	1,550
4	Spillway Crest Elevation	ft.	1,454
5	Top Dam Elevation	ft.	1,471
6	Length of Dam	ft.	3,000
7	Maximum height	ft.	71
8	Total Volume of fill	cu.yds.	1,333,000
9	Principal Spillway Size	in.	72
10	Maximum Release Rate	cfs	1,000

COST DISTRIBUTION

11	Total Construction Cost	$2,002,000
12	Contract Administration	20,000
13	Right of Way	288,000
14	Other Costs	87,000
15	Flood Control District Cost	3,770,000
16	Total Project Cost	$5,772,000

TABLE 9.25-D STRUCTURAL DATA

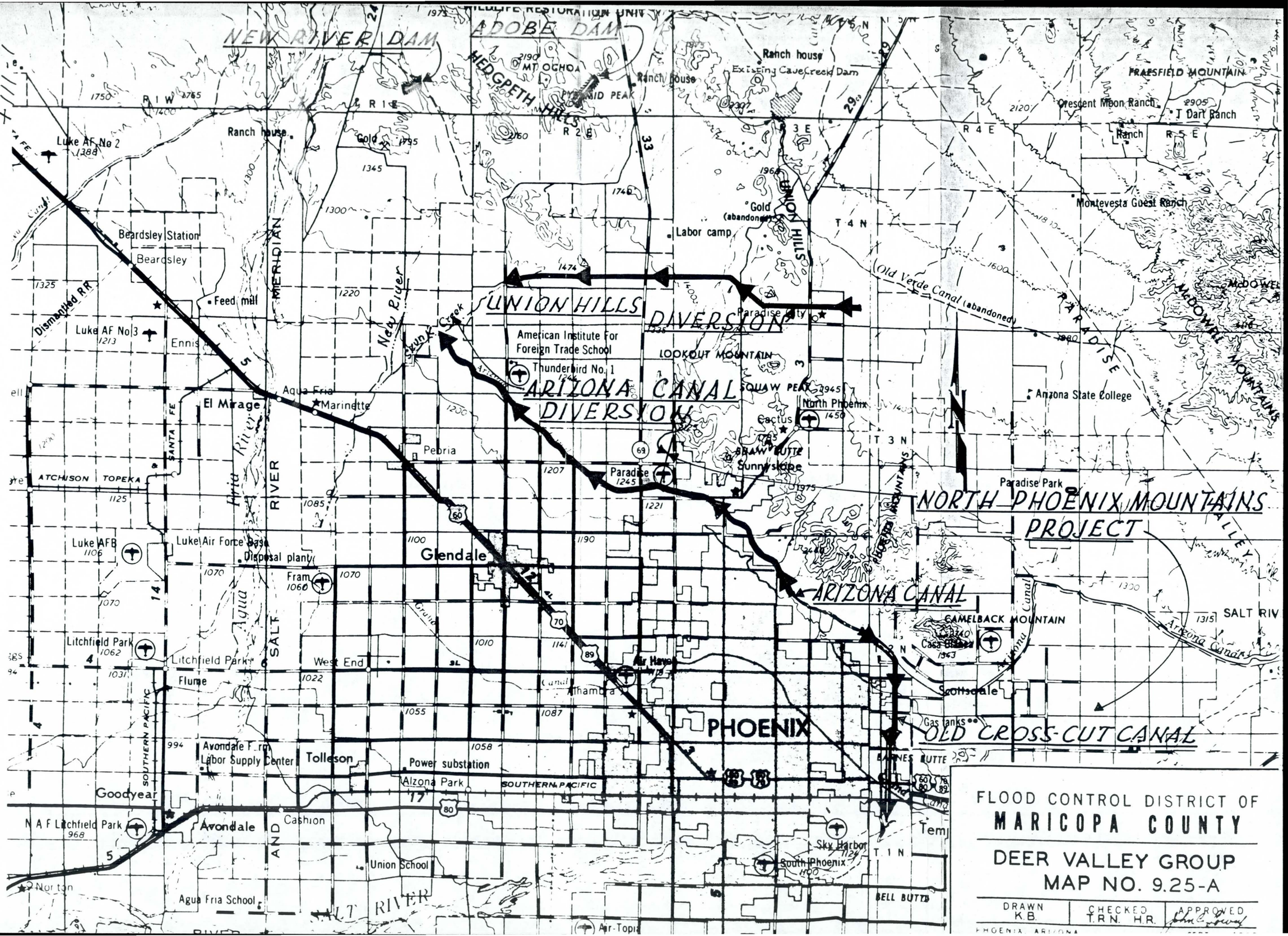
DEER VALLEY GROUP

Adobe Dam

No.	Item	Units	Quantity
1	Drainage Area	sq.mi.	59.3
2	Total Storage	ac.ft.	13,000
3	Total Surface Area	acres	800
4	Spillway Crest Elevation	ft.	1,538
5	Top Dam Elevation	ft.	1,560
6	Length of Dam	ft.	3,800
7	Maximum Height	ft.	60
8	Total Volume of Fill	cu.yds.	1,640,000
9	Principal Spillway size	in.	72
10	Maximum Release Rate	cfs	1,000

COST DISTRIBUTION

11	Total Construction Cost	$2,301,000
12	Contract Administration	30,000
13	Right of Way	66,000
14	Other Costs	736,000
15	Flood Control District Cost	832,000
16	Total Project Cost	$3,133,000

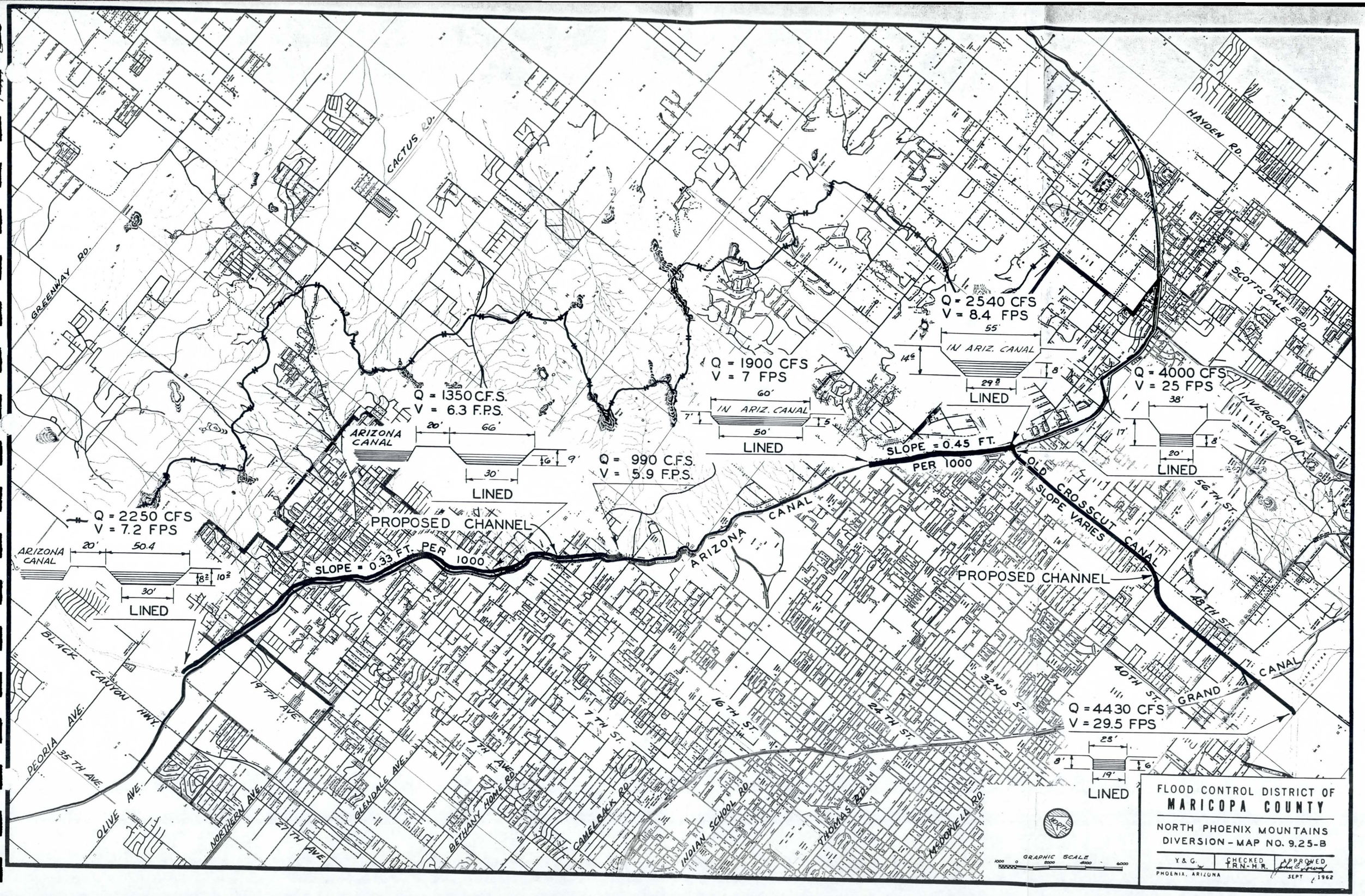


FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

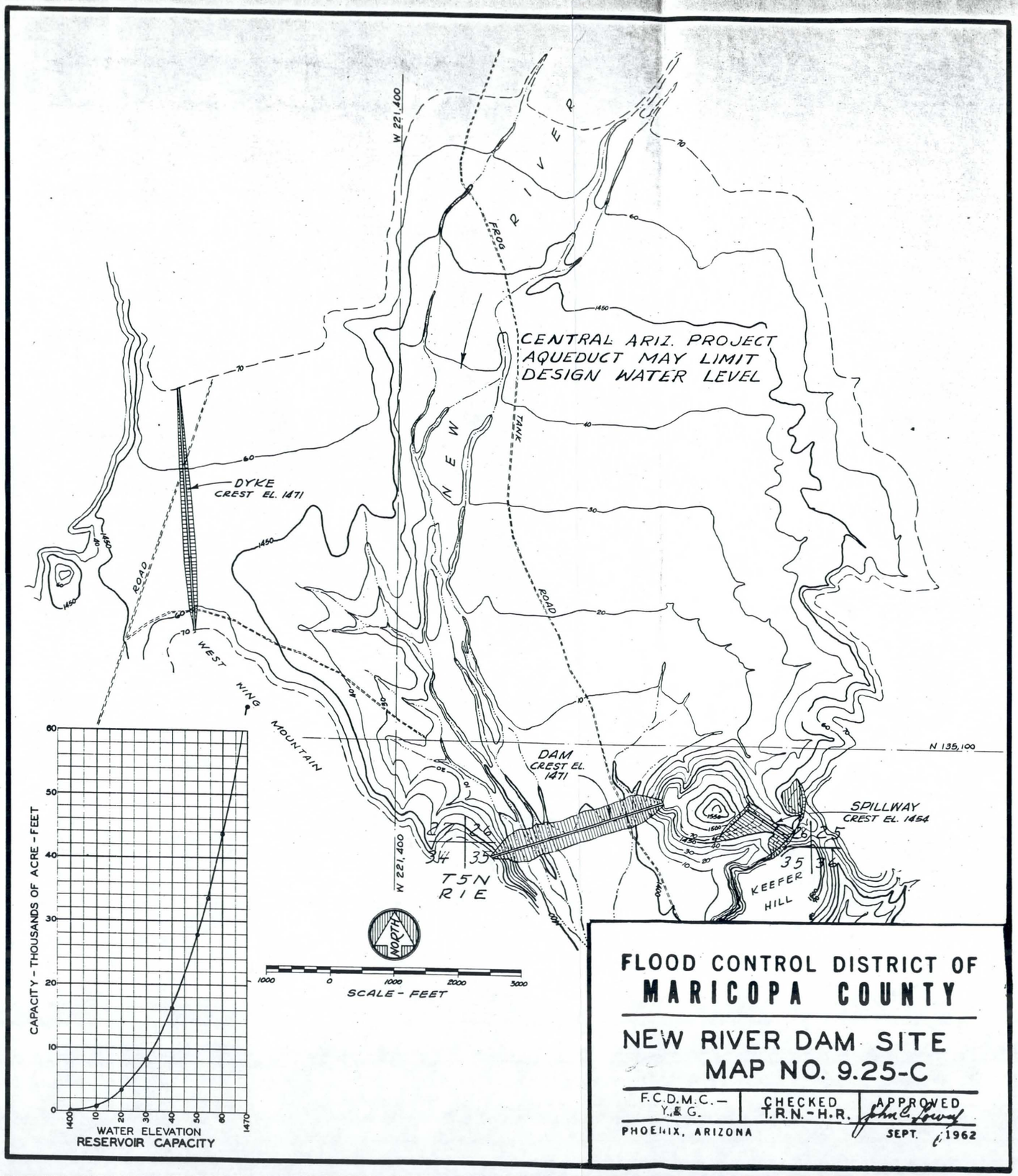
DEER VALLEY GROUP
MAP NO. 9.25-A

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

PHOENIX, ARIZONA


FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
NORTH PHOENIX MOUNTAINS
DIVERSION - MAP NO. 9.25-B
Y & G.
CHECKED T.R.N.-H.R.
APPROVED
PHOENIX, ARIZONA
SEPT 1962
GRAPHIC SCALE
1000 0 2000 4000 6000
Q = 2250 CFS
V = 7.2 FPS
ARIZONA CANAL
20'
50.4
8.2
10.2
30'
LINED
Q = 1350 C.F.S.
V = 6.3 F.P.S.
ARIZONA CANAL
20'
66'
6'
9'
30'
LINED
Q = 990 C.F.S.
V = 5.9 F.P.S.
PROPOSED CHANNEL
SLOPE = 0.33 FT. PER 1000
Q = 1900 CFS
V = 7 FPS
60'
IN ARIZ. CANAL
7'
5'
50'
LINED
SLOPE = 0.45 FT. PER 1000
Q = 2540 CFS
V = 8.4 FPS
55'
IN ARIZ. CANAL
14.6
8'
29.8
LINED
Q = 4000 CFS
V = 25 FPS
38'
17'
8'
20'
LINED
OLD CROSSCUT CANAL
SLOPE VARIES
PROPOSED CHANNEL
Q = 4430 CFS
V = 29.5 FPS
25'
8'
6'
19'
LINED
ARIZONA CANAL
GRAND CANAL
GREENWAY RD.
CACTUS RD.
HAYDEN RD.
SCOTTSDALE RD.
INVERGORDON RD.
56TH ST.
48TH ST.
40TH ST.
32ND ST.
24TH ST.
16TH ST.
7TH ST.
7TH AVE.
19TH AVE.
27TH AVE.
35TH AVE.
BLACK CANYON HWY.
PEORIA AVE.
OLIVE AVE.
NORTHERN AVE.
GLENDALE AVE.
BETHANY HOME RD.
CAMELBACK RD.
INDIAN SCHOOL RD.
THOMAS RD.
McDOWELL RD.

7111-3



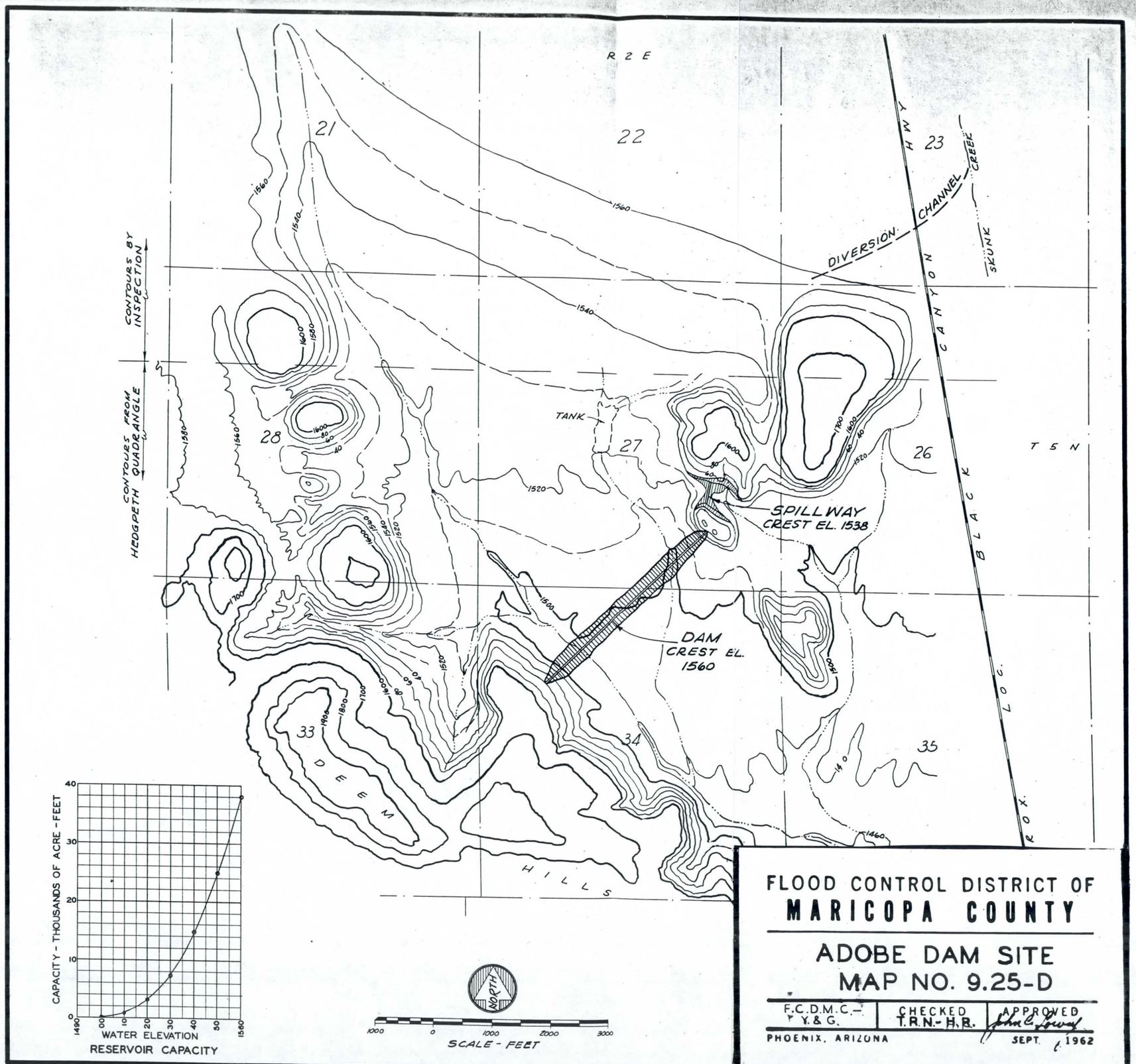
FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

NEW RIVER DAM SITE
MAP NO. 9.25-C

F.C.D.M.C. — Y. & G.	CHECKED T.R.N. - H.R.	APPROVED John C. Lowry

PHOENIX, ARIZONA SEPT. 1962

+ 1111-4



FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

ADOBE DAM SITE
MAP NO. 9.25-D

F.C.D.M.C. — Y.&G.	CHECKED T.R.N.-H.R.	APPROVED John C. Lowry

PHOENIX, ARIZONA SEPT. 1962

9.26 SOUTH MOUNTAIN AREA

9.26-A General

South Mountain Area is located just south of the Salt River across from Phoenix and contains an area of 240 square miles. Area is bordered on the north by the Salt River and on the southwest by the Gila River. General drainage is in a semi-circular direction due to the fact that the center is occupied by the Salt River Mountains and water drains away in all directions.

9.26-B GUADALUPE WATERSHED

9.26-B-1 General

This watershed comprises the south and eastern slopes of the South Mountains. The flood producing area consists mainly of steep mountains between contours 1150 and 2310. The topography is characterized by many washes that emerge from the eastern end of the South Mountains into a broad and level plain. Rainfall here concentrates quickly into the washes and flows across the plain in a general southeasterly direction to the Gila River.

9.26-B-2 Developments

The affected flood area is semi-circular. Approximately half is under irrigation with water supplied by generally southward flowing canals of the Salt River

Valley Water Users. Industrial development is extensive along the east line of the drainage area.

9.26-B-3 Damages

There are some flood damages reported every year. Flood water runs across the developed land in many places. Damage to canals as well as the land is heavy. Flood water extends also into urban areas where homes, business houses, and industrial buildings are located. The Southern Pacific railroad and the highway running along the eastern side of this watershed are affected.

9.26-B-4 Plan

Overall plan for flood control in this area includes a system of detention levees and floodways. There will be three levees and four floodways to convey the water from the base of the mountains down to the River. Each detention reservoir will have a controlled outlet that will allow the channels to drain the basin in a reasonable time. A summary of the costs for all structures can be found in table 9.26-1 and Map No. 9.26-A shows planned extent and location. Table 9.26-A shows related structural data.

9.26-C SOUTH MOUNTAINS WATERSHED

9.26-C-1 General

The South Mountain area has few storage sites other than the one west of Guadalupe in the City of Phoenix Park and the one near 43rd Avenue. Storage near South Central Avenue and 7th Street would do the next most effective job.

If a reasonable degree of protection at the South Mountain flood plain is to be achieved, a channel paralleling the foothills is required. Flood storage reservoirs require fairly rapid draining and the Highline Canal capacity is limited. If channels are built directly north from the mountains to the Salt River there still should be transverse collection facilities covering principal washes between these south-north channels.

The North Phoenix Mountains afford an illustration. If work had been started on a channel paralleling the Arizona Canal, when development was limited, a channel could have been provided many times less costly in right of way or construction. We believe the time to start the South Mountain channel is right now.

9.26-C-2 Alternates

Alternate alignments and location possibilities are almost unlimited. There will be varying degrees of protection for different locations. The plan included in this report is

the one proposed by the consultant. Lack of time and other factors do not allow a complete evaluation of this proposal but there are some changes that will be considered before this project is installed. Relocation of the channel beginning at approximately 24th Street to run closer to the Mountains as it goes west is one of the changes that will be studied. This will involve reversing the flow of water and bringing it back east and into the river at approximately 32nd Street. However, for the present time, the plan is presented as is.

9.26-C-3 Plan

Essentially an unlined channel, trapezoidal in section, which parallels the Highline Canal on the south side; from 48th St. to 7th Avenue, thence westerly to the east side of the Western Canal at Dobbins Road, thence along the south side of lateral 13 to 59th Avenue, thence northwesterly along the east boundary of the Gila River Indian Reservation to the Salt River, plus dams and detention basins in the Guadalupe Area and the vicinity of 43rd Ave. and 1.4 miles south of Dobbins Road. There is also a collector channel from about 8th St. 0.5 mile south of Dobbins Rd. westerly and northwesterly converging with the aforementioned channel at about 19th Ave. and Dobbins Rd. A summary of costs is found in table 9.26-2 and Map 9.26-B shows location and structural data.

TABLE 9.26-1 GADALUPE WATERSHED SUMMARY

No.	Job Description	Estimated Cost: Flood Control Dist.	Estimated Cost: SCS
1.	Park Retarding Basin	$ 324,00	$ 156,000
2.	Ray Road Retarding Basin	61,000	70,000
3.	Proving Grounds Retarding Basin	61,000	100,000
4.	Park Floodway	5,000	29,200
5.	Ray Road Floodway	5,000	78,000
6.	Proving Ground Floodway	3,000	21,000
7.	Reservation Floodway	60,000	206,000
	TOTAL	$ 519,000	$ 660,200
	TOTAL PROJECT COST	$1,179,200	

Flood Damage Without Project	113,000
Flood Damage with Project	- 0 -
Benefits from Reduction of Flood Damage	113,000
Irrigation Benefits	- 0 -
Total Project Cost Amortized @ 2 5/8%	42,600
Annual Operation and Maintenance	18,000
Total Annual Cost	60,600
Benefit-Cost Ratio	1.86 to 1.00

TABLE 9.26.2 SOUTH MOUNTAIN WATERSHED SUMMARY

No.	Job Description	Estimated Cost: Flood Control Dist.	Estimated Cost: Corps. of Engineers
	Earth Channel Beginning at 48th Street Running West to 59th Avenue, then Northwest Along Indian Reservation Boundary to Salt River.		
	Plus Detention Dams and Retarding Basins As Shown		
	TOTAL	$2,652,000	$6,251,000
	TOTAL PROJECT COST	$8,903,000	

Flood Damage Without Project	283,500
Flood Damage with Project	30,000
Benefits from Reduction of Flood Damage	253,500
Irrigation Benefits	- 0 -
Other Benefits	- 0 -
Total Annual Benefits	253,500
Total Project Cost Amortized @ 2 5/8%	321,754
Annual Operation and Maintenance	29,000
Total Annual Costs	350,754
Benefit-Cost Ratio	0.72 to 1.00

TABLE 9.26-A STRUCTURAL DATA

GUADALUPE WATERSHED

Detention Structures

No.	Item	Units	Park	Ray Road	Proving Gr.
1	Drainage Area	sq.mi.	2.5	4.0	3.1
2	Sediment Capacity	ac.ft.	50	50	30
3	Flood Water Capacity	ac.ft.	250	450	340
4	Total Storage Capacity	ac.ft.	300	500	370'
5	Total Surface Area	acres	200	25	60
6	Length	mi.	2.0	0.2	0.5
7	Maximum Height	ft.	13.0	15.0	15.0
8	Total Volume of fill	cu.yd.	140,000	20,000	50,000
9	Principal Spillway Size	in.	36	48	36
10	Maximum Release Rate	cfs	100	200	100
	COST DISTRIBUTION				
11	Total Construction Cost		$156,000	$70,000	$100,000
12	Contract Administration		4,000	1,000	1,000
13	Right of Way		320,000	60,000	60,000
14	Relocations & Other Costs		0	0	0
15	Flood Control District Cost		324,000	61,000	61,000
16	Total Project Cost		$480,000	131,000	161,000

TABLE 9.26-B STRUCTURAL DATA

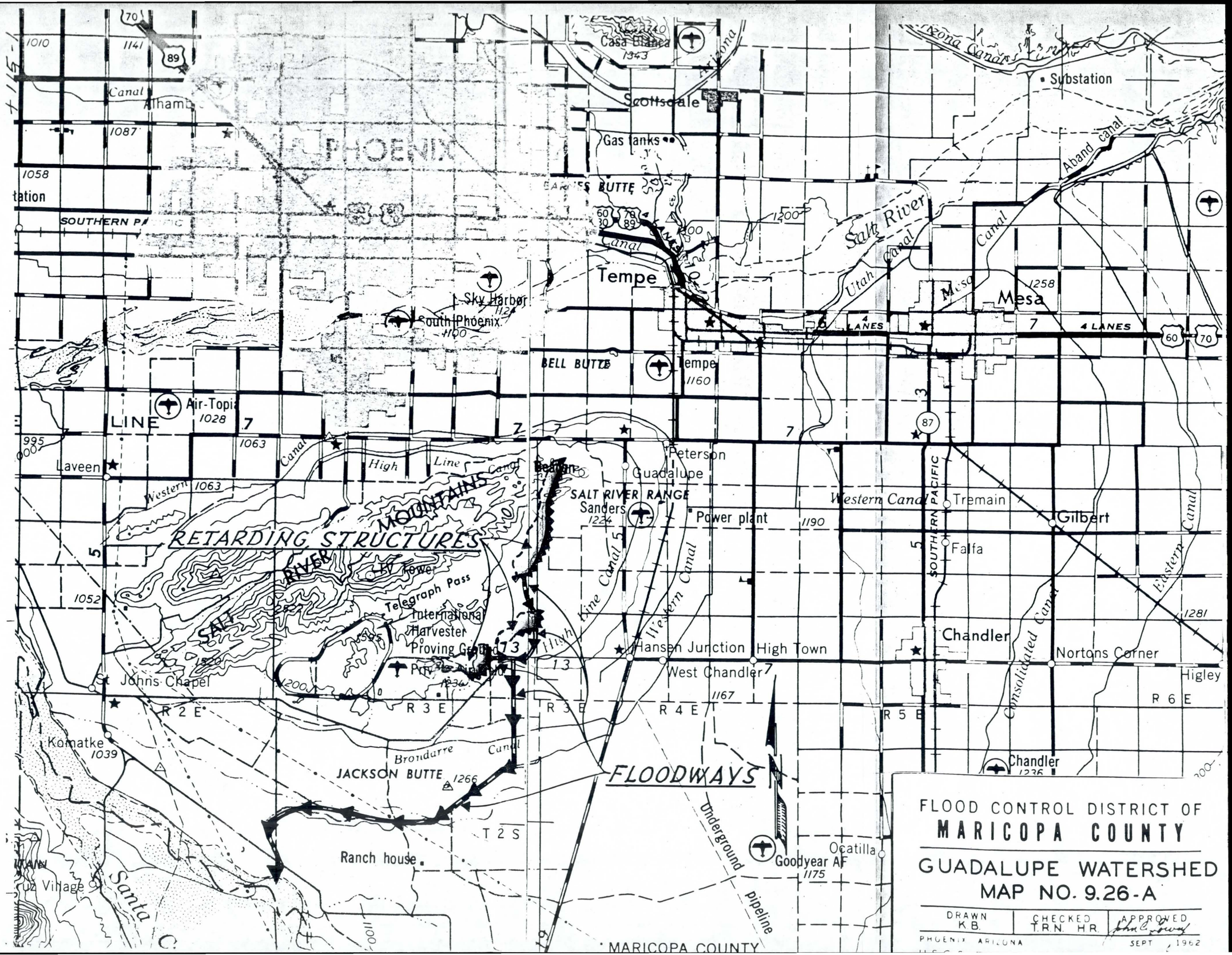
GUADALUPE WATERSHED

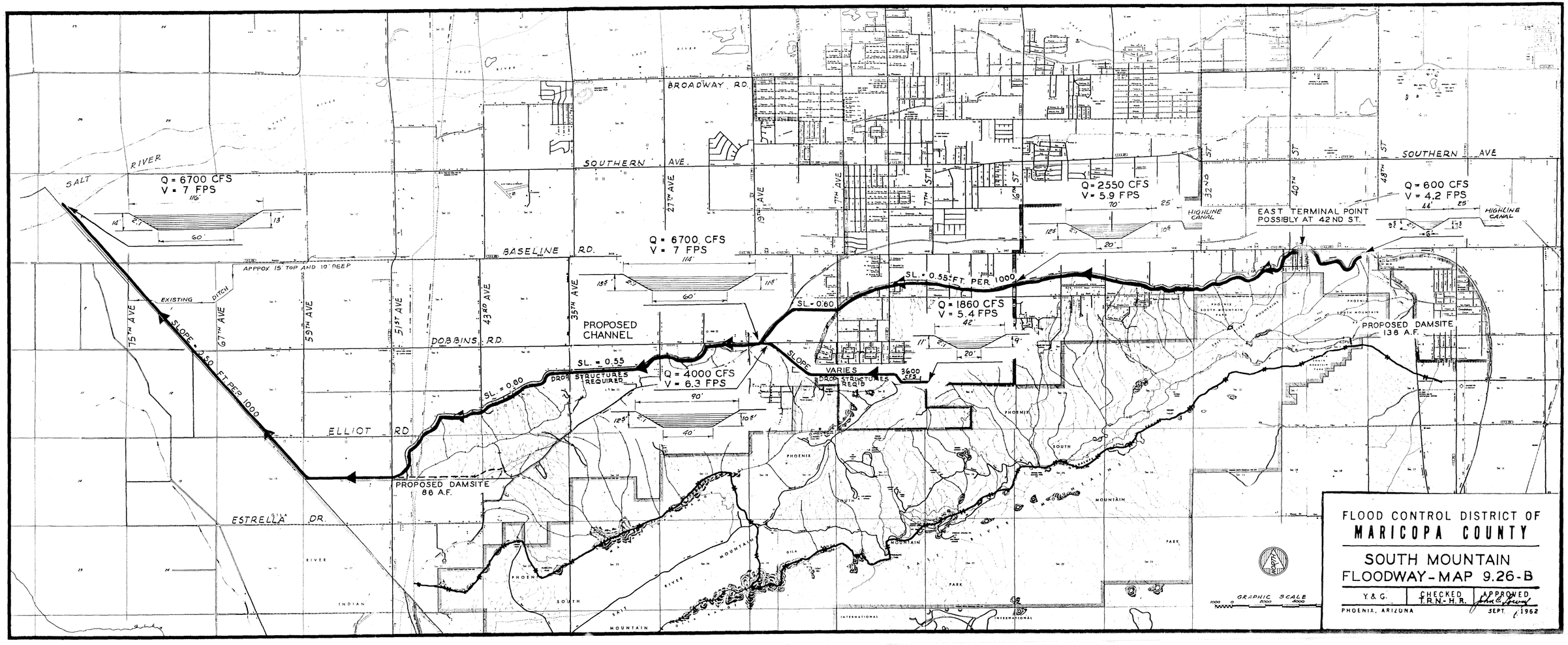
Floodways

No.	Item	Units	Park	Ray Rd.	Proving Gr.	Reservation
1	Discharge Capacity	cfs	100	200	100	300
2	Length	ft.	5,280	5,280	2,640	13,200
3	Avg. Bottom Width	ft.	3.0	3.0	3.0	6.0
4	Avg. Depth	ft.	2.0	3.4	2.0	3.4
5	Avg. Side Slope		1:1	1:1	1:1	1:1
6	Excavation	cu.yd.	2,000	2,640	1,300	16,000
7	Concrete	cu.yd.	330	880	160	2,500

COST DISTRIBUTION

8	Total Construction Cost	$29,200	$78,000	$21,000	$206,000
9	Contract Administration	1,000	1,000	1,000	20,000
10	Right of Way	4,000	4,000	2,000	40,000
11	Relocation & other costs	0	0	0	0
12	Flood Control District	5,000	5,000	3,000	60,000
13	Total Project Cost	34,200	83,000	24,000	266,000

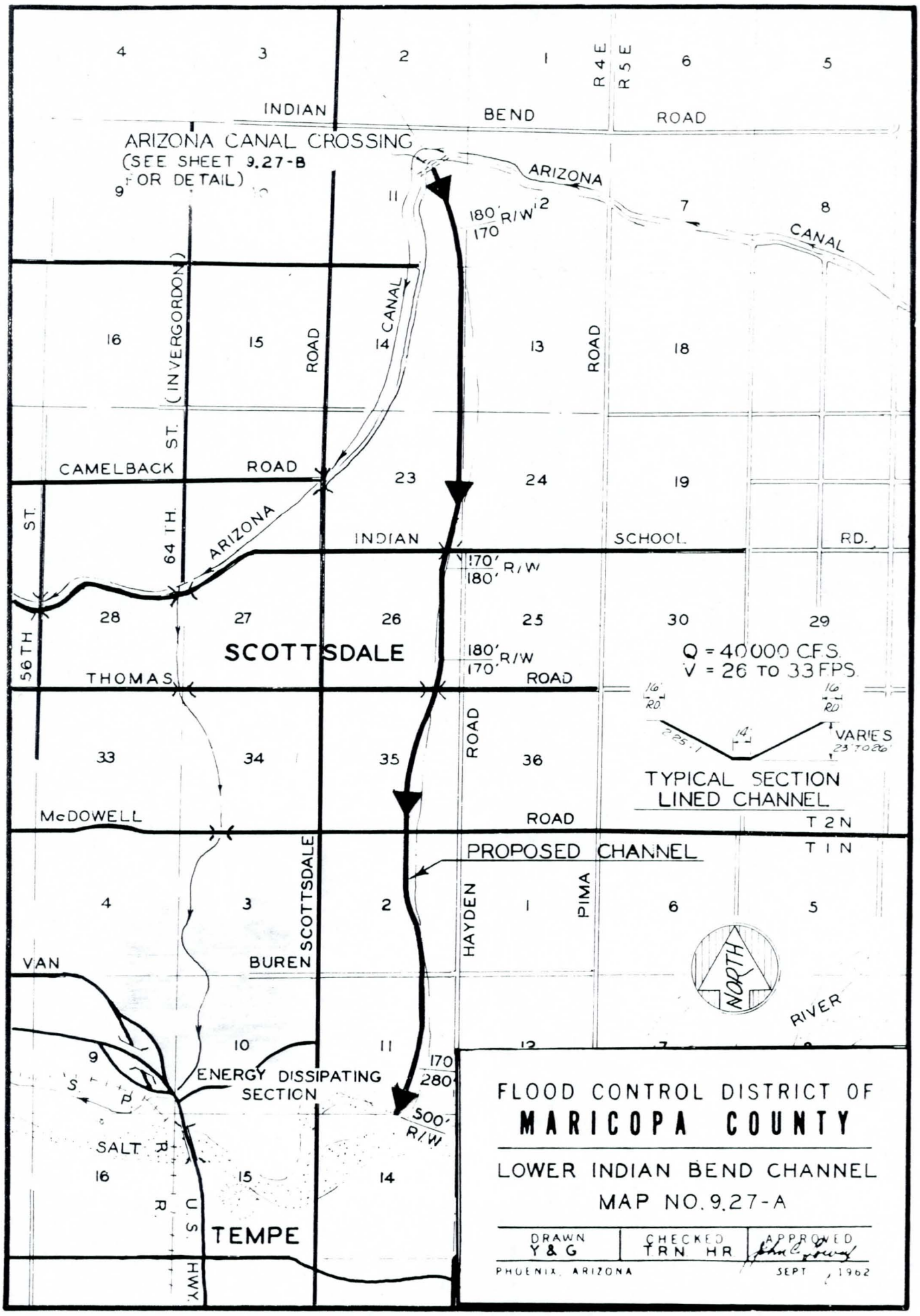

FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
GUADALUPE WATERSHED
MAP NO. 9.26-A
DRAWN K.B.
CHECKED T.R.N. H.R.
APPROVED
PHOENIX ARIZONA
SEPT 1962
RETARDING STRUCTURES
FLOODWAYS
SALT RIVER MOUNTAINS
SALT RIVER RANGE
BELL BUTTE
JACKSON BUTTE
Scottsdale
Tempe
Mesa
Chandler
Gilbert
Guadalupe
Peterson
Laveen
Sky Harbor
South Phoenix
Air-Topia
Casa Blanca
Substation
Gas tanks
Power plant
Sanders
Hansen Junction
High Town
West Chandler
Tremain
Falfa
Norton's Corner
Higley
Ocatilla
Goodyear AF
Ranch house
Komatke
St Johns Chapel
Telegraph Pass
International Harvester Proving Ground
Salt River
Arizona Canal
Aband canal
Utah canal
Western Canal
Eastern Canal
Consolidated Canal
High Line Canal
Brondarre Canal
Underground pipeline
SOUTHERN PACIFIC
4 LANES
MARICOPA COUNTY
R 2 E
R 3 E
R 4 E
R 5 E
R 6 E
T 2 S

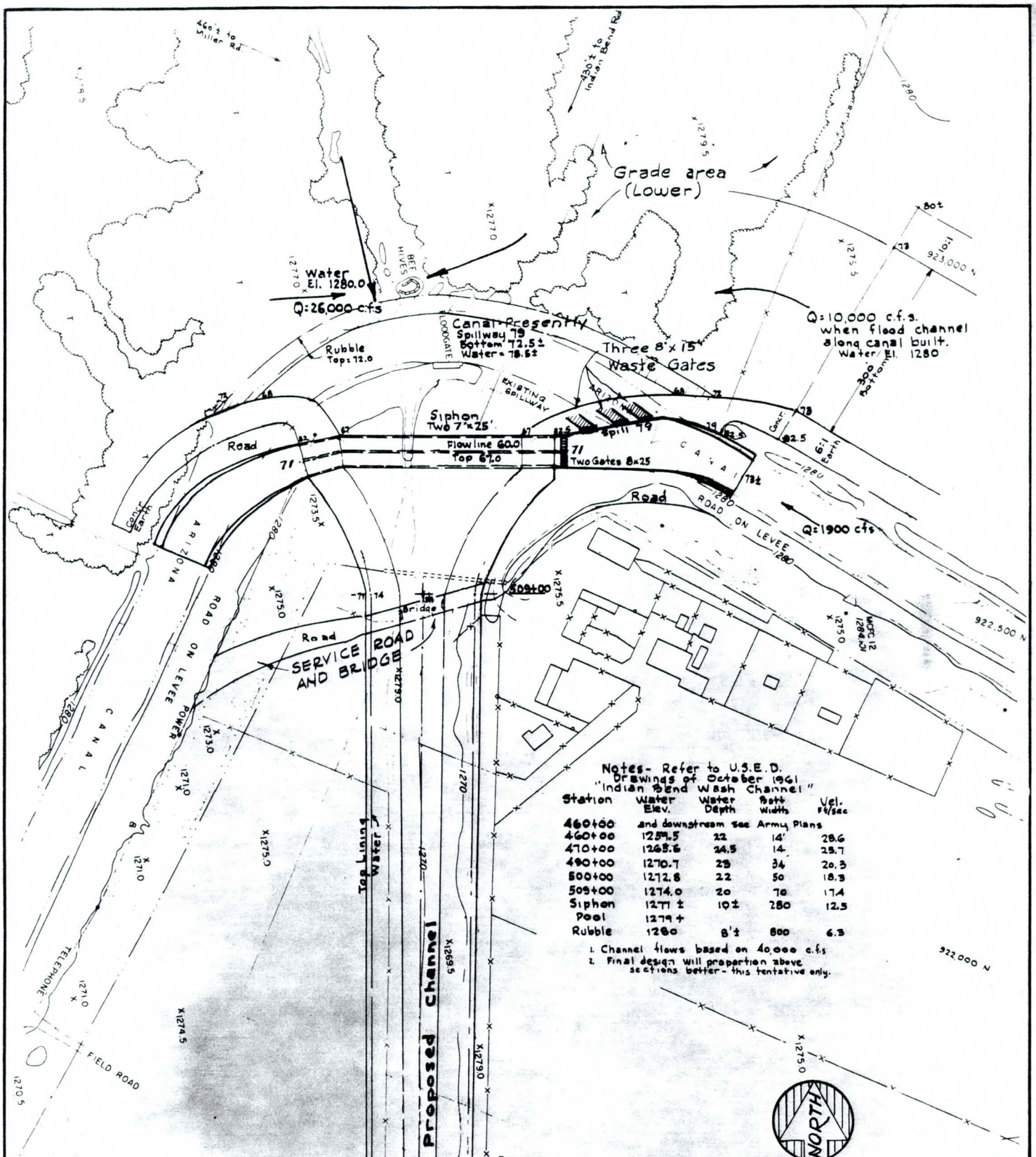

FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
SOUTH MOUNTAIN
FLOODWAY-MAP 9.26-B
Y & G.
CHECKED T.R.N.-H.R.
APPROVED
PHOENIX, ARIZONA
SEPT. 1962
SALT RIVER
Q = 6700 CFS
V = 7 FPS
116'
14'
13'
60'
BROADWAY RD.
SOUTHERN AVE.
SOUTHERN AVE
BASELINE RD.
DOBBINS RD.
ELLIOT RD.
ESTRELLA DR.
75TH AVE
67TH AVE
59TH AVE
51ST AVE
43RD AVE
35TH AVE
27TH AVE
19TH AVE
7TH AVE
7TH ST
12TH ST
32ND ST
40TH ST
48TH ST
APPROX. 15' TOP AND 10' DEEP
EXISTING DITCH
SLOPE = 2.50 FT PER 1000
Q = 6700 CFS
V = 7 FPS
114'
135'
115'
60'
PROPOSED CHANNEL
SL. = 0.60
SL. = 0.55
SL. = 0.80
DROP STRUCTURES REQUIRED
Q = 4000 CFS
V = 6.3 FPS
90'
125'
105'
40'
PROPOSED DAMSITE
86 A.F.
SLOPE VARIES
DROP STRUCTURES REQ'D
3600 CFS
Q = 1860 CFS
V = 5.4 FPS
42'
11'
9'
20'
SL. = 0.55 FT. PER 1000
Q = 2550 CFS
V = 5.9 FPS
70'
25'
125'
105'
20'
HIGHLINE CANAL
EAST TERMINAL POINT POSSIBLY AT 42ND ST.
Q = 600 CFS
V = 4.2 FPS
44'
25'
HIGHLINE CANAL
PROPOSED DAMSITE
138 A.F.
PHOENIX
SOUTH MOUNTAIN
GILA RIVER
INDIAN
INTERNATIONAL
PARK
GRAPHIC SCALE
1000 0 2000 4000

7115-2

TABLE 9.27-1 LOWER INDIAN BEND SUMMARY

No.	Job Description	Estimated Cost Flood Control Dist.	Estimated Cost Corps of Engineers
	A concrete-lined channel running southerly from the Ariz. Canal to and meeting the Salt River at approx. 0.5 miles east of Scottsdale Rd.		
	TOTAL	1,770,000	7,250,000
	TOTAL PROJECT COST	9,020,000	
	Flood Damage Without Project		555,500
	Flood Damage With Project		25,500
	Benefits from Reduction of Flood Damage		530,000
	Irrigation Benefits		0
	Other Benefits		0
	Total Annual Benefits		530,000
	Total Project Cost Amortized at 2-5/8%		325,982
	Annual Operation & Maintenance		22,000
	Total Annual Costs		347,982
	Benefit-Cost Ratio	1.52 to 1.00	


INDIAN BEND ROAD
R 4 E
R 5 E
ARIZONA CANAL CROSSING
(SEE SHEET 9.27-B FOR DETAIL)
ARIZONA CANAL
180' R/W
170
CAMELBACK ROAD
64TH ST. (INVERGORDON)
56TH ST.
14 CANAL
ROAD
INDIAN SCHOOL RD.
170' R/W
180'
180' R/W
170'
THOMAS ROAD
SCOTTSDALE
Q = 40,000 CFS.
V = 26 TO 33 FPS.
16' RD.
VARIES 23' TO 26'
TYPICAL SECTION
LINED CHANNEL
McDOWELL ROAD
T 2 N
T 1 N
PROPOSED CHANNEL
VAN BUREN
SCOTTSDALE
HAYDEN
PIMA
NORTH
RIVER
ENERGY DISSIPATING SECTION
170
280
500' R/W
SALT
U.S. HWY
TEMPE
FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
LOWER INDIAN BEND CHANNEL
MAP NO. 9.27-A
DRAWN Y & G
CHECKED TRN HR
APPROVED
PHOENIX, ARIZONA
SEPT, 1962



Notes- Refer to U.S.E.D. Drawings of October 1961 "Indian Bend Wash Channel"

Station	Water Elev.	Water Depth	Bott Width	Vel. Ft/sec
460+00	and downstream see Army Plans			
460+00	1259.5	22	14'	28.6
470+00	1265.6	24.5	14	25.7
490+00	1270.7	23	34	20.3
500+00	1272.8	22	50	18.3
509+00	1274.0	20	70	17.4
Siphon	1277 ±	10±	280	12.5
Pool	1279 +			
Rubble	1280	8'±	800	6.3

1. Channel flows based on 40,000 c.f.s
2. Final design will proportion above sections better - this tentative only.

Base topographic map MARICOPA COUNTY FLOOD CONTROL DISTRICT "INDIAN BEND PARKWAY" Sheet 22

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

INDIAN BEND CHANNEL

INLET DETAILS - MAP NO. 9.27-B

DRAWN	CHECKED	APPROVED
Y & G.	T.R.N. H.R.	John C. Lowry

PHOENIX ARIZONA SEPT 1962

9.28 UPPER INDIAN BEND AREA

9.28-A General

The upper Indian Bend area lies above Arizona Canal and is located Northest of the City of Phoenix and has an area of 187 square miles.

The runoff producing sections are the Phoenix Mountains, Paradise Valley and Pinnacle Peak area located on the perimeter of the watershed. General drainage pattern is to the Southwest turning Southward at the Old Verde Canal.

Ground cover is sparse, especially in the lower reaches and ratio of runoff to rainfall is high. Soils in the hills are shallow and relatively impervious. Water concentrates quickly in the many washes and runs at high velocities on to the relatively flat flood plain below.

9.28-B UPPER INDIan BEND CHANNEL

9.28-B-1 General and Damages

Damages in the past here have not been too severe mainly because most of the improvements have been recent. A major flood now would cause varying degrees of damage to approximately 200 homes and businesses.

There is also some farm land here that would suffer damage.

9.28-B-2 Plan

The upper Indian Bend may eventually warrant expensive channel works but at the present time it can by proper zoning be held as a very wide flood plain with some clearing and excavation as a shallow earth channel.

The Plan that follows is for construction of a earth channel.

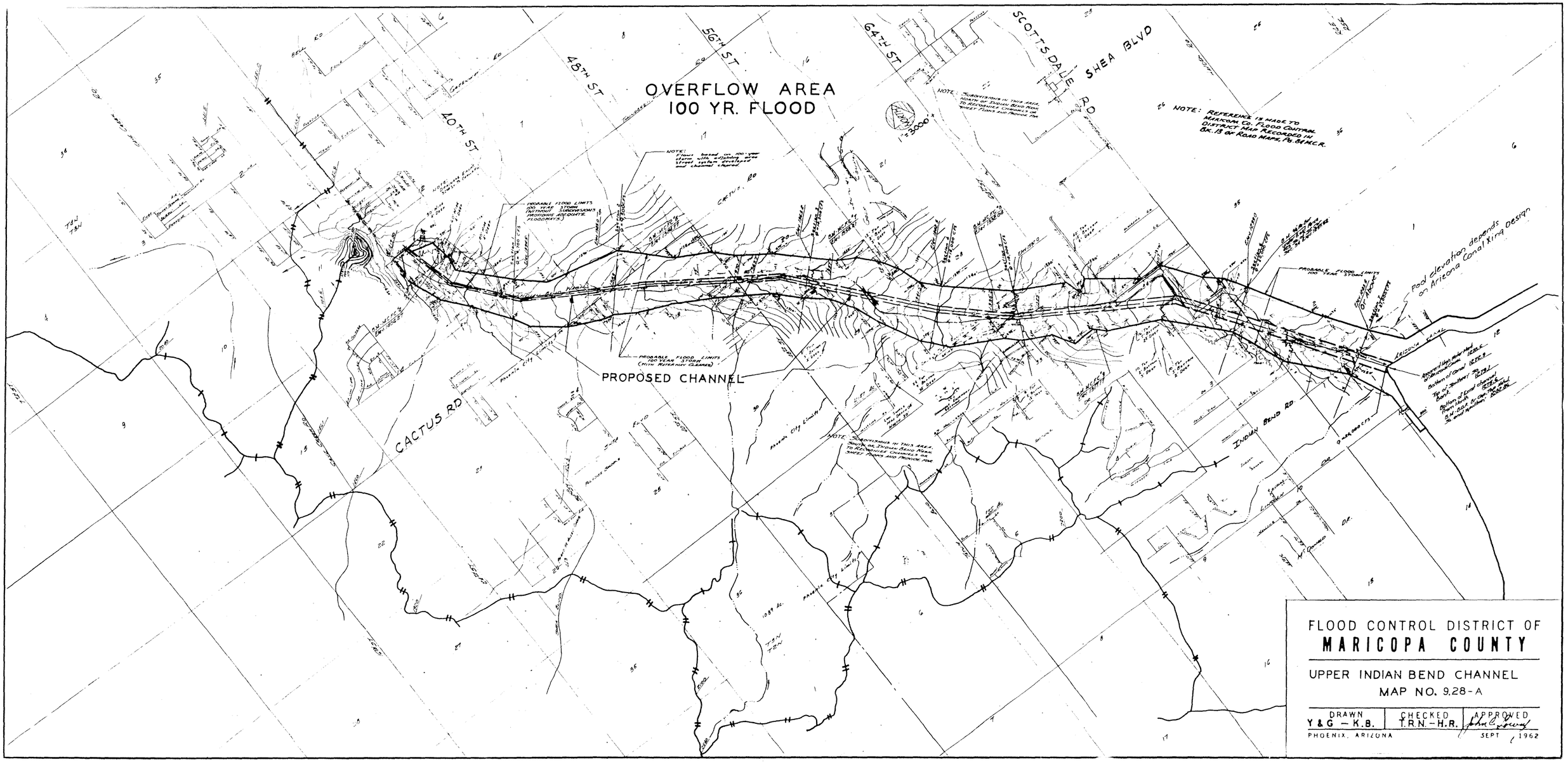
An unlined channel from Cholla Road and 36th Street to the Arizona Canal below Indian Bend Road with concrete box culverts to accommodate low flows and wide sections at half mile roads. Excavation costs reduced 50% from unit prices used elsewhere assuming excess dirt from channel can be easily disposed of. Channel to have 5:1 sideslopes and approximate water depth of five feet except at 1/2 mile road crossings, sideslopes will be 15:1 with water depth of four feet. Water level width varies from 141 feet at about Cholla Road and 36th Street to 441 feet at about Indian Bend Road 1/2 mile east of Scottsdale Road.

A summary of costs can be found in table 9.28-1 and Map 9.28-A shows location and pertinent structural data.

TABLE 9.28.1 UPPER INDIAN BEND SUMMARY

No.	Job Description	Estimated Cost: Flood Control Dist.	Estimated Cost: Corps. of Engineers
	An Unlined Channel From Cholla Road and 36th Street To The Arizona Canal Below Indian Bend Road. Includes Box Culverts For Low Flows		
	TOTAL	$1,217,000	$1,701,000
	TOTAL PROJECT COST	$2,918,000	

Flood Damage Without Project	85,000
Flood Damage with Project	9,000
Benefits from Reduction of Flood Damage	76,000
Irrigation Benefits	- 0 -
Other Benefits	- 0 -
Total Annual Benefits	76,000
Total Project Cost Amortized @ 2 5/8%	105,450
Annual Operation and Maintenance	19,000
Total Annual Costs	124,450
Benefit-Cost Ratio	0.61 to 1.00


OVERFLOW AREA
100 YR. FLOOD
40TH ST
48TH ST
56TH ST
64TH ST
SCOTTSDALE RD
SHEA BLVD
CACTUS RD
INDIAN BEND RD
PROPOSED CHANNEL
NOTE: REFERENCE IS MADE TO MARICOPA CO. FLOOD CONTROL DISTRICT MAP RECORDED IN BK. 19 OF ROAD MAPS, PG. 64 M.C.R.
Pool elevation depends on Arizona Canal King Design
FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
UPPER INDIAN BEND CHANNEL
MAP NO. 9.28-A
DRAWN Y&G – K.B.
CHECKED T.R.N. – H.R.
APPROVED
PHOENIX, ARIZONA
SEPT 1962

9.29 EVERGREEN AREA

9.29-A General

The Evergreen Area is located in the east central part of Maricopa County and contains an area of 35 square miles. The runoff producing areas here are the McDowell Mountains that form the Watershed boundaries on the north. Practically all the runoff is collected by the Arizona Canal and is released in the Evergreen Wasteway.

At the present time no appreciable damages are likely here. The Salt River Indian Reservation comprises the larger part of the watershed and improvements are at a minimum. In the past, the ARizona Canal has been breached but damage was minor.

The Flood Control District has recommended the Indians run a diversion from the northwest corner of their Reservation to the southeast near Evergreen. The water can then be taken over the Canal or into Salt River in controlled quantities.

9.30 UPPER VERDE AREA

9.30+A General

The upper Verde Area begins above Bartlett Dam; is located in the northeast section of Maricopa County and contains an area of 6188 square miles.

The runoff producing areas are the higher elevations of the Mogollon Rim country. The mountains are brush and tree covered, well rounded but relatively steep. Runoff here is mostly controlled by the systems of dams on the Verde River being mainly regulated by Bartlett Dam.

Flood damages in this area are difficult to assess. This area would in flood contribute damaging flood water but the damage caused is difficult to assign. There are presently no plans for flood control in this area. Future developments may change the picture. If conditions warrant, a re-survey of the flood control problems here will be made and necessary action taken.

9.31 LOWER VERDE AREA

9.31-A General

The Lower Verde River area lies between Bartlett and Granite Reef Dam and is located in the Northeast section of Maricopa County. Total area is approximately 500 square miles.

The runoff producing areas are the Mazatzal Mountains on the East and the McDowell Mountains on the West. Flood water from this area could cause considerable damage in the Salt River Valley since there is no appreciable storage below Granite Reef Dam.

9.31-B MAXWELL DAM

9.31-B-1 General

The over all plan for this dam is to build into the planned terminal storage reservoir 672,000 acre-feet of flood control storage. Nearly all damages caused by a standard flood along Salt River will be prevented by the construction of this dam along with the channel improvements recommended under Section 9.0-A Relatively minor damages along Salt River would still occur to property located in and immediately adjacent to the river channel. Downstream from the mouth of the Salt, partial flood protection would result. Control of floods would be effected by reducing discharges to approximately 30,000 to 50,000 cfs.

Floods smaller than 30,000 C.F.S. would not be affected by the operation of this reservoir.

9.31-B-2 Plan

An earthfill dam rising 169 feet above the stream bed with a crest length of 5,200 feet. Spillway will be in the channel section of the dam. The reservoir will extend about 10 miles Northward in the broad Verde River Valley and about 8 miles eastward along Salt River. Total storage is planned to be 860,000 acre-feet with about 672,000 acre-feet assigned to flood storage.

Table 9.31-1 shows a summary of costs and Map 9.31-A shows planned extent and location.

TABLE 9.31.1 MAXWELL DAM SUMMARY

No.	Job Description	Estimated Cost: Flood Control Dist.	Estimated Cost: Corps. of Engineers
1	Dam and Related Works ($5,700,000 Allocated To Flood Control)	$ 650,000	$30,350,000
	TOTAL PROJECT COST	$31,000,000	

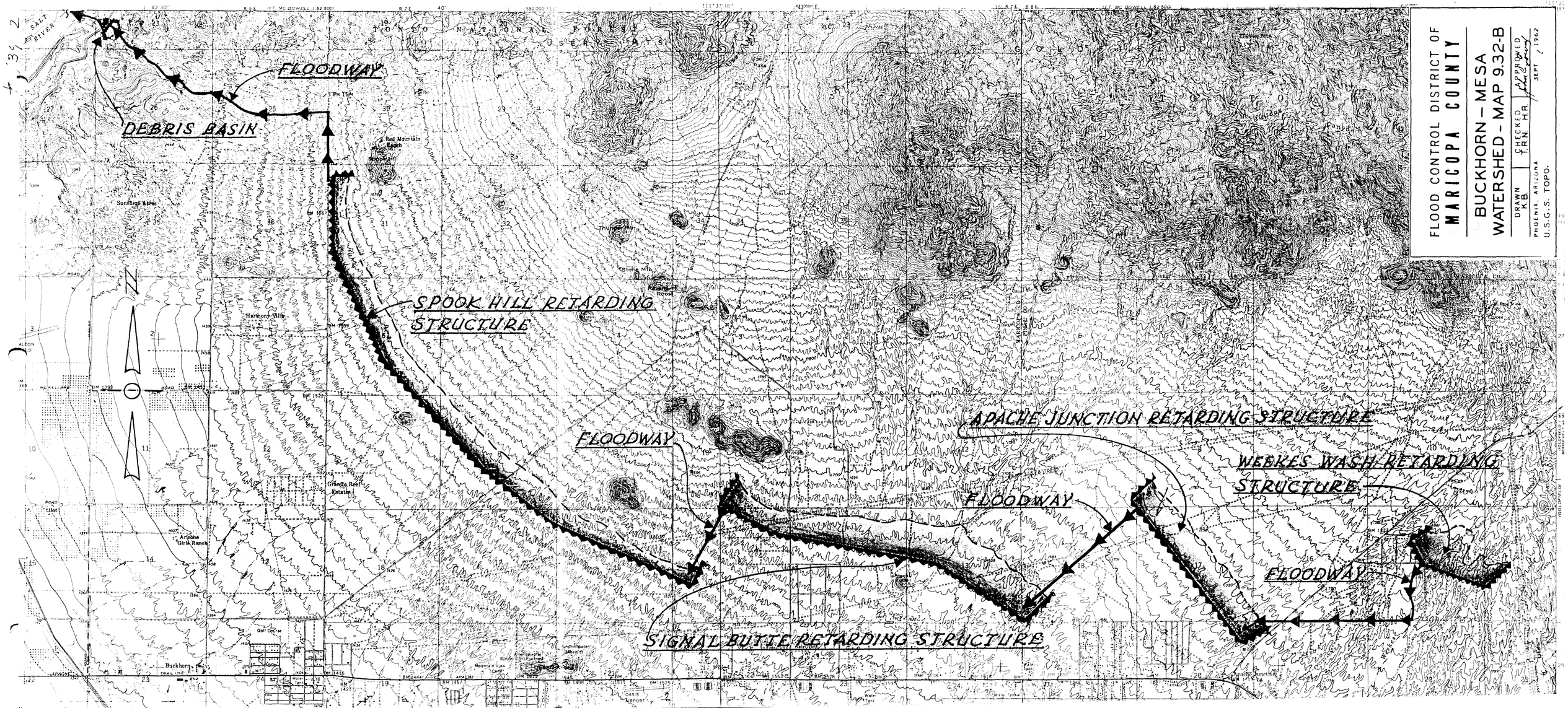
Flood Damage Without Project	280,232
Flood Damage with Project	39,232
Benefits from Reduction of Flood Damage	241,000
Irrigation and Recreation Benefits	128,000
Total Annual Benefits	369,000
Total Project Cost Amortized @ 2 5/8%	235,000
Annual Operation and Maintenance	41,000
Total Annual Costs	276,000
Benefit-Cost Ratio	1.34 - 1.00

FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

MAWELL DAM
MAP NO. 931-A

DRAWN	CHECKED	APPROVED
K.B.	T.R.N. H.R.	John C. Lowry

PHOENIX, ARIZONA
U.S.G.S. TOPO
SEPT. 10, 1962


FLOODWAY
DEBRIS BASIN
SPOOK HILL RETARDING STRUCTURE
FLOODWAY
APACHE JUNCTION RETARDING STRUCTURE
WEBKES WASH RETARDING STRUCTURE
FLOODWAY
FLOODWAY
SIGNAL BUTTE RETARDING STRUCTURE
N
FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
BUCKHORN – MESA
WATERSHED - MAP 9.32-B
DRAWN K.B.
CHECKED TRN HR
APPROVED
PHOENIX, ARIZONA
SEPT 1962
U.S.G.S. TOPO.

9.32 GOLDFIELD AREA

9.32-A General

The Goldfield area is located in the east central part of Maricopa County with the eastern part extending over into Pinal County. The eastern section contains the Superstition Mountains and is characterized by steep rugged terrain that slopes west toward the Apache Junction area.

The general drainage pattern is to the southwest with numerous washes heading toward the Gila River. Due to the extensive development in the south and western part of this area, a major flood could cause severe damage.

Three projects are proposed for this area--Apache Junction Gilbert Watershed, Buckhorn- Mesa Watershed, and Mesa-Chandler Gilbert Floodway;

9.32-B APACHE JUNCTION-GILBERT WATERSHED

9.32-B-1 General

This watershed is located in eastern section of the Goldfield Area and will offer protection for the Gilbert-Chandler Area. The flood producing watershed is made up principally of steep mountains up to 5000 feet elevation and foothills lying between 1400 and 1700 ft. elevation. Peak flows are of short duration but high intensity. Due to steep slopes and high velocities, serious damage can result from a major storm.

9.32-B-2 Development

On both sides of U.S. Highway 60-70-80 and 89 are located many trailer parks, private homes, motels and business establishments. The center of this urban area is the town of Apache Junction. In the Apache Junction - Gilbert area, urban and commercial development has literally "exploded" during the last few years. Also included in this watershed are some of the most highly productive irrigated farm land in the State of Arizona.

9.32-B-3 Damages

The heavy rains in 1954 produced floods that caused considerable damage. The highway was covered from six miles West to two miles East of Apache Junction. Practically every business establishment along the road was damaged. In addition, many homes located in the surrounding area were seriously affected by flood water.

Damage in urban areas is just a part of the total damage that may occur from a major storm. The highly productive farm land as well as irrigation systems could be severely damaged due to erosion and silt deposition.

9.32-B-4 Plan

The over all plan for flood control in this watershed includes one retarding basin and 14.8 miles of floodways. This one retarding structure will control

approximately 38% of the watershed area.

The Powerline retarding structure will be built South of U.S. Highway 60-70-80-89 and West of Vineyard Road. Structure will provide protection from the 1% storm. It will have a total storage capacity of 4,135 acre-feet, with 3,960 acre-feet reserved for flood water storage and 175 acre-feet for the 50 year accumulated sediment storage.

The dam will be 3.9 miles long and have a maximum height of 25 feet. An earth emergency spillway 600 feet wide with a capacity of 1,980 C.F.S. will be located at the South end of the embankment. The maximum release from the 54" principal spillway will be 328 cubic feet per second.

The Powerline Floodway will convey floodwater from the Powerline dam to the Roosevelt Water Conservation Floodway. This will be a combination earth and reinforced concrete channel. Water from the Vineyear Road and Rittenhouse Retarding structures in the Williams-Chandler Watershed will enter this floodway at a junction structure located at station 117+30. A stilling basin will be constructed at the lower end of the floodway.

The Roosevelt Water Conservation District Floodway consists of the existing floodway above the canal. It will be enlarged to carry floodwaters originating below the floodwater retarding structures.

The design capacity is variable but will be sufficient to handle water flowing in from the Buckhorn-Mesa Watershed.

Water will be carried to Queen Creek or through inlet structures to the RWCD Canal for irrigation use.

A summary of costs can be found in table 9.32-1. Table 9.32-A shows structural data and Map 9.32-A shows planned extent and location.

9.32-C BUCKHORN-MESA WATERSHED

9.32-C-1 General

This watershed is located in eastern Maricopa and Northwestern Pinal County. Flood producing areas are the rugged Usury and Goldfield Mountains. Flood waters drain down onto the wide alluvial fan where slopes are flatter and channels become less defined. Drainage pattern is to the southwest.

9.32-C-2 Development

The flood plain is representative of the Country East of Phoenix and Mesa in which the population and development rates have "sky rocketed" during the past few years. It covers the rapidly expanding urban and commercial developments along U.S. Highway 60-70-80-89 (Apache Trail) from Mesa East to the Pinal County line. The highway traverses the entire length of the watershed. Surrounding this rapidly expanding area are some of the most highly productive irrigated farm land in the state.

Damage from a major storm in this watershed would be very extensive.

9.32-C-3 Damages

Heavy rains result in destructive floods that cover the residential and commercial developments along the Apache Trail and the rich irrigated farm lands.

From 1910 to 1960, 33 floods of varying magnitude have occurred damaging land, residences, commercial establishments, roads, highways and other physical features. Runoff during 1954 storm inundated nearly 6000 acres of highly productive irrigated land.

Total estimated damage from a flood comparable to the one in 1954 happening now would be $1,270,000.

9.32-C-4 Plan

The over all plan for flood control in this watershed will include four floodwater retarding structures and 8.1 miles of floodways. It has been determined by extensive study that these four structures with interconnecting floodways with one common outlet will be the most economical without sacrificing any benefits. A debris basin and diversion box are also proposed so as to properly utilize the floodwater for irrigation purposes.

Weekes Wash Dam

The weekes Wash floodwater retarding structure will be constructed northeast of Apache Junction on Weekes Wash. This structure will provide floodwater protection from storms up to and including the 1% event. It will have a total storage capacity of 1360 acre-feet, with 1140 acre-feet floodwater storage and 220 acre-feet for a 50-year accumulated sediment storage. The dam will be 1.2 miles long and have a maximum

height of 41 feet. An emergency spillway 250 feet wide with a capacity of 6490 cfs will discharge at the east end of the embankment. The maximum release rate from the 30-inch reinforced concrete pipe principal spillway will be 105 cubic feet per second.

Apache Junction Dam

The Apache Junction floodwater retarding structure will be constructed north of the Town of Apache Junction. This structure will provide floodwater protection from the 1% event. It will have a total storage capacity of 1035 acre feet with 930 acre feet for floodwater storage and 105 acre feet for a 50-yr. accumulated sediment storage. The dam will be 2.0 miles long and have a maximum height of 19 feet. An emergency spillway with a width of150 feet and a capacity of 3100 cfs will be located on the southeast end of the embankment. The maximum release from the 42-in. reinforced concrete pipe principal spillway will be 173 cfs. An earth diversion 0.2 miles long will be constructed above the Apache Junction Dam to divert floodwaters from a small wash into the reservoir area.

Signal Butte Dam

The Signal Butte floodwater retarding structure will be constructed above the Apache Trail near the Maricopa-Pinal County line. This structure will provide protection from the 1% event. It will have a total storage capacity of 1485 acre ft. with 1340 ac. ft. for floodwater storage and 145 acre feet for a 50 year accumulated sediment storage. The dam will be 3.1 miles long and have a maximum height of 18,0 ft. An emergency spillway with a width of 200 feet and a capacity of 4930 cfs will be located on the east end of the embankment. The maximum release rate from the 54-in. diameter reinforced concrete pipe principal spillway will be 294 cfs.

Spook Hill Dam

The Spook Hill floodwater retarding structure will be constructed above the Apache Trail and the New Bush Highway. This structure will provide floodwater protection from the 1% event. It will have a total storage capacity of 1230 ac. ft., with 1110 ac. ft. for floodwater storage and 120 ac. ft. for a 50-yr. accumulated sediment storage. The dam will be 4.9 miles long and have a maximum height of 15.5. An

emergency spillway with a width of 100 ft. and capacity of 2680 cfs will be located on the north end of the embankment. The maximum release rate from the 5' x 5' reinforced concrete box principal spillway will be 435 cfs.

Weekes Wash Floodway

A floodway 2.0 miles long will convey floodwater from the 30-in. reinforced concrete pipe principal spillway in the Weekes Wash Dam to the Apache Junction Dam. This floodway will be lined with reinforced concrete with a stilling basin at the lower end and will have a capacity of 105 cfs.

Apache Junction Floodway

A floodway 1.4 miles long will convey floodwaters from the 42-in. reinforced concrete pipe principal spillway in the Apache Junction Dam east to the Signal Butte Dam. This floodway will be lined with reinforced concrete with a stilling basin at the lower end and will have a capacity of 173 cfs.

Signal Butte Floodway

A floodway 0.8 miles long will convey floodwater from the 54-in. reinforced concrete pipe principal spillway in the Signal Butte Dam to the Spook Hill

This floodway will be lined with reinforced concrete stilling basin at the lower end and will have a capacity of 294 cfs.

Spook Hill Floodway

A floodway 3.9 miles long will convey floodwater from the Spook Hill Dam to the Southern Canal and the Salt River. The earth section will be 2.1 mi. long and 1.8 mi. will be lined with reinforced concrete and will have a capacity of 435 cfs. The lined section will empty into a wash. Floodwaters from the floodway and the wash will be conveyed into a debris basin immediately above the Southern Canal. Floodwaters may be released into the Canal through a division box with gates or through the proposed Spook Hill floodway to the Salt River.

Debris Basin

The debris basin will have a total capacity of 48 ac. ft. of which 40-ac. ft. are for floodwater and 8 ac. ft. are for sediment. The dam will be 19 ft. high and 0.2 mi. long. It will release 590 cfs. Its purpose is to remove sediment from water used for irrigation. There will be a division box in conjunction with the debris basin so as to accomplish the diversion of floodwater released from the structures into the Southern Canal.

See tables 9.32-2 and 9.32-B, and Map 9.32-B.

9.32-D WILLIAMS - CHANDLER WATERSHED

9.32-D-1 General

The watershed is composed primarily of steep mountains between contours 1,700 and 5,000 and foothills lying between contours 1,400 and 1,700. Flow is generally in a southwesterly direction into the broad and level plain. Velocities in the washes are usually high due to steep slopes and well defined channels.

9.32-D-2 Development and Damages

Many homes, businesses, highways and roads are located in the flood plain. U.S. Highway 60-70-80-89 crosses the flood area and is subject to flood damage with consequent interruption of traffic. Williams Air Force Base is considered vulnerable to heavy floods even though protective dikes and channels have been constructed there.

The town of Chandler would probably suffer damage from a heavy flood. The heavy rains in 1954 caused extensive damage in the watershed. Damage of urban areas is only a part of the total damage. Surrounding them are many acres of farm land, also subject to damage from flood water.

9.32-D-3 Plan

Structural measures to be installed are those needed to reducedamages caused by flooding and those needed for agricultural water management. Two floodwater retarding structures controlling 66% of the watershed

area, 9.2 miles of floodway construction, and one irrigation water turnout structure with gates are included in this plan.

a. Vineyard Road Dam

The Vineyard Road floodwater retarding structure will be constructed immediately east of Vineyard Road in Pinal County. The structure will provide floodwater protection from the 1% event. It will have a total storage capacity of 4,310 acre-feet, with 4,110 acre-feet allocated to floodwater storage and 200 acre-feet allocated to a 50 year accumulated sediment storage. The dam will be 5 miles long and have a maximum height of 21 feet. The maximum release rate from the 6' x 6' reinforced concrete culvert principal spillway will be 705 cubic feet per second and will drain the runoff from the 1% event in about 10 days. The emergency spillway will be of earth construction and will be located around the south end of the embankment.

b. Rittenhouse Dam

The Rittenhouse floodwater retarding structure will be constructed east of the Rittenhouse Auxiliary Air Field in Pinal County. This structure will provide floodwater protection from the 1% event. It will have a total storage capacity of 3,770 acre-feet with 3,590 acre-feet allocated to floodwater storage and 180

acre-feet allocated to a 50 year accumulated sediment storage. The dam will be 4 miles long and have a maximum height of 22 feet. The maximum release rate from the 54 inch diameter reinforced concrete pipe principal spillway will be 313 cubic feet per second and will drain the runoff from the 1% event in about 10 days. The emergency spillway will be of earth construction and will be located around the south end of the embankment.

c. Rittenhouse Floodway

A floodway 1.2 miles long will convey floodwater from the principal spillway in the Rittenhouse dam to the Vineyard Road dam. The capacity of this floodway is 313 c.f.s. The floodway will be lined with reinforced concrete with a stilling basin at the lower end.

d. Vineyard Road Floodway

A floodway 0.8 miles long will convey floodwaters from the 6'x6' reinforced concrete culvert principal spillway in the Vineyard Road dam to a reinforced concrete junction structure in the Powerline floodway in the Apache Junction-Gilbet Watershed. The capacity of this floodway is 705 c.f.s.

e. Roosevelt Water Conservation District Floodway

The existing 7.2 miles of floodway within this watershed above the Roosevelt Water Conservation District Canal will be enlarged to collect and discharge flood

waters from the Vineyard Road floodway plus the floodwaters from the uncontrolled area below the dams. This 7.2 miles of improvement of the floodway represents a portion of the total 14.6 miles of floodway improvement proposed in the two watersheds. The remaining 7.4 miles of floodway improvement is proposed within the Apache Junction-Gilbert Watershed. The floodway capacity varies from 4,133 c.f.s. to 4,633 c.f.s. These floodway improvements are designed to convey the 1% event.

f. Measures for Irrigation

A reinforced concrete structure with gates is planned in the levee between the Roosevelt Water Conservation District floodway and canal below the junction with the Powerline floodway. This structure will permit floodwaters to enter the canal, when desired, and be utilized for irrigation purposes. This structure will have a capacity of about 500 c.f.s.

A summary of costs are shown in table 9.32-3. Locations are shown on Map 9.32-C and extent of structural works is shown in Table 9.32-D.

9.32-E. MESA, CHANDLER, GILBERT FLOODWAY

9.32-E-1 General

Affected by this floodway is one of the most highly developed areas in Maricopa County including the population centers of Mesa, Chandler and Gilbert.

Topograph of this area is characterized by relatively flat terrain with developed irrigation systems.

The general drainage pattern is to the Southwest and eventually to the Gila River. Presently the urban areas have no outlet for storm runoff and this floodway will provide one.

9.32-E-2 Development and Damages

This valley area is highly developed and has expanded at a tremendous rate in the past few years. It includes Mesa, Gilbert, and Chandler as the major urban areas. There are also smaller concentrations of population at West Chandler and Hightown. Numerous roads, irrigation works, and other improvements would be severely damaged by a major flood.

9.32-E-3 Plan

The over all plan for handling floodwater in this area consists of a system of channels to serve the population centers of Mesa, Chandler, Gilbert and adjacent developments. The Mesa Channel will begin at Baseline Road ½ mile West of Country Club Drive and run South to a point at approximately the center of Section 9, Township 1 South, Range 5 East where it joins a channel coming from Gilbert to form the main channel serving the whole area.

A similar channel is planned for chandler to run along Pecos Road West to join the main canal where it enters the Salt River Indian Reservation. The main channel continues on to eventually drain into the Gila River.

The main channel is designed to carry a 5 year flood. Total length of main channel is 22 miles and will be 10 feet deep with a 10 foot bottom width. The Chandler floodway will be seven miles long.

The U.S. Corps of Engineers will be requested to make a study of this problem.

A summary of costs are shown in table 9.32-4 and Map No. 9.32-D shows planned extent and location.

TABLE 9.32-1 APACHE-JUNCTION-GILBERT WATERSHED SUMMARY

No.	Job Description	Estimated Cost Flood Control Dist.	Estimated Cost S.C.S.
1	Powerline Retarding Structure	$ 842,000	$1,170,000
2	Powerline Floodway	138,100	2,257,600
3	R.W.C.D. Floodway	228,800	376,100
	TOTAL	$1,208,900	$3,803,700
	TOTAL PROJECT COST	$5,012,600	

Flood Damage Without Project	347,810
Flood Damage with Project	73,860
Benefits from Reduction of Flood Damage	273,950
Irrigation Benefits	- 0 -
Other Benefits	2,800
Total Annual Benefits	276,750
Total Project Cost Amortized @ 2 5/8%	181,200
Annual Operation and Maintenance	16,300
Total Annual Costs	197,500
Benefit-Cost Ratio	1.40 to 1.00

TABLE 9.32-2 BUCKHORN-MESA WATERSHED SUMMARY

No.	Job Description	Estimated Cost: Flood Control Dist.	Estimated Cost: S.C.S.
1	Apache-Junction Retarding Structure	$ 679,400	$ 443,600
2	Signal Butte Retarding Structure	1,095,600	559,500
3	Spook Hill Retarding Structure	1,173,300	812,000
4	Weekes Wash Retarding Structure	405,500	391,000
5	Apache-Junction Floodway	25,600	339,100
6	Signal Butte Floodway	14,300	229,000
7	Spook Hill Floodway	144,700	630,400
8	Weekes Wash Floodway	35,800	450,400
	TOTAL	$3,574,200	$3,855,000
	TOTAL PROJECT COST	$7,429,200	

Flood Damage Without Project	602,720
Flood Damage with Project	120,920
Benefits from Reduction of Flood Damage	481,800
Irrigation Benefits	16,360
Other Benefits	1,280
Total Annual Benefits	499,440
Total Project Cost Amortized @ 2 5/8%	268,500
Annual Operation and Maintenance	12,500
Total Annual Costs	281,000
Benefit-Cost Ratio	1.78 to 1.00

TABLE 9.32-3 WILLIAMS-CHANDLER WATERSHED SUMMARY

No.	Job Description	Estimated Cost: Flood Control Dist.	Estimated Cost: S.C.S.
1	Rittenhouse Retarding Structure	$ 256,200	$1,109,200
2	Vineyard Road Retarding Structure	337,600	1,336,000
3	Rittenhouse Floodway	4,900	403,500
4	Vineyard Road Floodway	10,200	291,200
5	R.W.C.D. Floodway	228,000	598,100
	TOTAL	$ 836,900	$3,738,000
	TOTAL PROJECT COST	$4,574,900	

Flood Damage Without Project	383,150
Flood Damage with Project	103,300
Benefits from Reduction of Flood Damage	279,850
Irrigation Benefits	41,000
Other Benefits	5,200
Total Annual Benefits	326,050
Total Project Cost Amortized @ 2 5/8%	165,300
Annual Operation and Maintenance	23,700
Total Annual Costs	189,000
Benefit-Cost Ratio	1.73 to 1.00

TABLE 9.32-4 MESA, CHANDLER, GILBERT FLOODWAY SUMMARY

No.	Job Description	Estimated Cost: Flood Control District	Estimated Cost: Other
1	Mesa-Gilbert Floodway	$ 360,000	$1,870,000
2	Chandler Floodway	40,000	100,000
3	Bridges and Other Structures	- 0 -	630,000
	TOTAL	$ 400,000	$2,600,000
	TOTAL PROJECT COST	$3,000,000	

Flood Damage without Project		260,530
Flood Damage with Project		1,000
Benefits from Reduction of Flood Damage		259,530
Total Annual Benefits		259,530
Total Project Cost Amortized @ 2 5/8%		108,420
Annual Operation and Maintenance		14,000
Total Annual Cost		122,420
Benefit-Cost Ratio	2.11 to 1.00	

TABLE 9.32-A STRUCTURAL DATA

APACHE JUNCTION-GILBERT WATERSHED

Retarding Structures

No.	Item	Units	Structures Powerline
1	Drainage Area	sq.mi.	49.9
2	Sediment Capacity	ac.ft.	175
3	Flood Water Capacity	ac.ft.	3,960
4	Total Storage Capacity	ac.ft.	4,135
5	Total Surface Area	acres	690
6	Length	mi.	3.9
7	Maximum height	ft.	25.0
8	Total Volume of fill	cu.yd.	936,000
9	Principal Spillway size	in.	54
10	Maximum Release Rate	cfs	328

COST DISTRIBUTION

11	Total Construction Cost	1,170,000
12	Contract Administration	9,000
13	Right of Way	833,000
14	Relocations & other costs	0
15	Flood Control Dist. Cost	842,000
16	Total Project Cost	2,012,000

FLOODWAYS

No.	Item	Units	Structures Powerline	RWCD
1	Discharge Capacity	cfs	1,033	2,550
2	Length	ft.	38,890	39,100
3	Avg. Bottom Width	ft.	6.0	80.0
4	Avg. Depth	ft.	7.0	6.0
5	Avg. Side Slope		1½ : 1	3:1
6	Excavation	cu.yd.	150,000	508,500
7	Concrete	cu.yd.	20,890	0

COST DISTRIBUTION

8	Total Construction Cost	$2,257,600	$376,100
9	Contract Administration	17,400	2,900
10	Right of Way	120,700	225,900
11	Relocations & other costs	0	0
12	Flood Control Dist. Cost	138,100	228,800
13	Total Project Cost	$2,395,700	$604,900

TABLE 9.32-B

STRUCTURAL DATA

BUCKHORN-MESA WATERSHED

Detention Structures

No.	Item	Units	Apache Jct.	Signal Butte	Structures Spook Hill	Weekes Wash	Debris Basin
1	Drainage Area	sq.mi.	8.2	14.3	11.8	10.9	1.0
2	Sediment Capacity	ac.ft.	105	145	120	220	8
3	Flood Water Capacity	ac.ft.	930	1,340	1,110	1,140	40
4	Total Storage Capacity	ac.ft.	1,035	1,485	1,230	1,360	48
5	Total Surface Area	acres	220	340	340	150	10
6	Length	mi.	2.0	3.1	4.9	1.2	0.2
7	Maximum Height	ft.	19.0	18.0	15.5	41.0	19.0
8	Total Volume	cu.yd.	420,000	525,000	790,000	391,000	33,000
9	Principal Spillway size	in.	42	54	60 x 60	30	
10	Maximum Release Rate	cfs	173	294	435	105	590

Cost Distribution

11	Total Construction Cost	$443,600	$559,500	$812,000	$391,000
12	Contract Administration	3,400	4,300	6,200	3,000
13	Right of Way	676,000	1,091,000	1,167,100	402,500
14	Relocations & other Costs	0	0	0	0
15	Flood Control Dist. Cost	679,400	1,095,600	1,173,300	405,500
16	Total Project Cost	1,123,000	1,655,100	1,985,300	796,500

TABLE 9.32-C

STRUCTURAL DATA

BUCKHORN-MESA WATER SHED FLOODWAYS

No.	Item	Units	Structure			
			Apache Junction	Signal Butte	Spook Hill	Weekes Wash
1	Discharge Capacity	cfs	173	294	435	105
2	Length	ft	7,215	4,420	20,330	10,815
3	Av. Bottom Width	ft	5.5	6.0	7.0	4.8
4	Av. Depth	ft	3.3	3.0	3.5	3.0
5	Av. Side Slope		Vertical	Vertical	Variable	Vertical
6	Excavation	cu.yds.	14,500	10,000	113,600	19,500
7	Concrete	cu.yds.	2,430	1,500	3,596	3,035
	COST DISTRIBUTION					
8	Total Construction Cost	Dollars	339,100	229,000	630,400	450,400
9	Contract Administration	"	2,600	1,800	5,100	3,500
10	Right of Way	"	23,000	12,500	108,000	32,300
11	Relocations and other costs	"	-0-	-0-	31,600	-0-
12	Flood Control District Cost	"	35,600	14,300	144,700	35,800
13	Total Project Cost	"	364,700	243,300	775,100	486,200

TABLE 9.32-D STRUCTURAL DATA

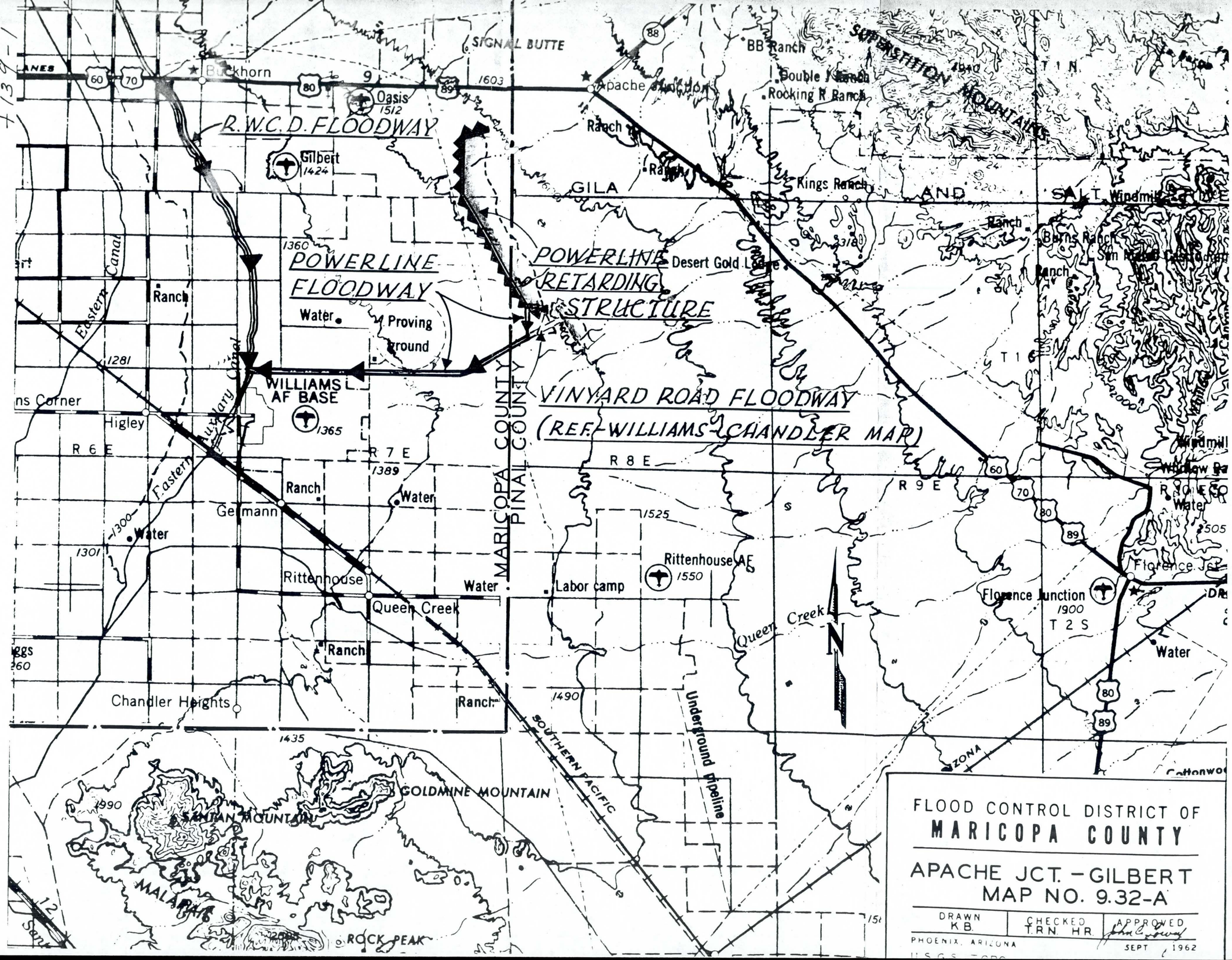
WILLIAMS-CHANDLER WATERSHED

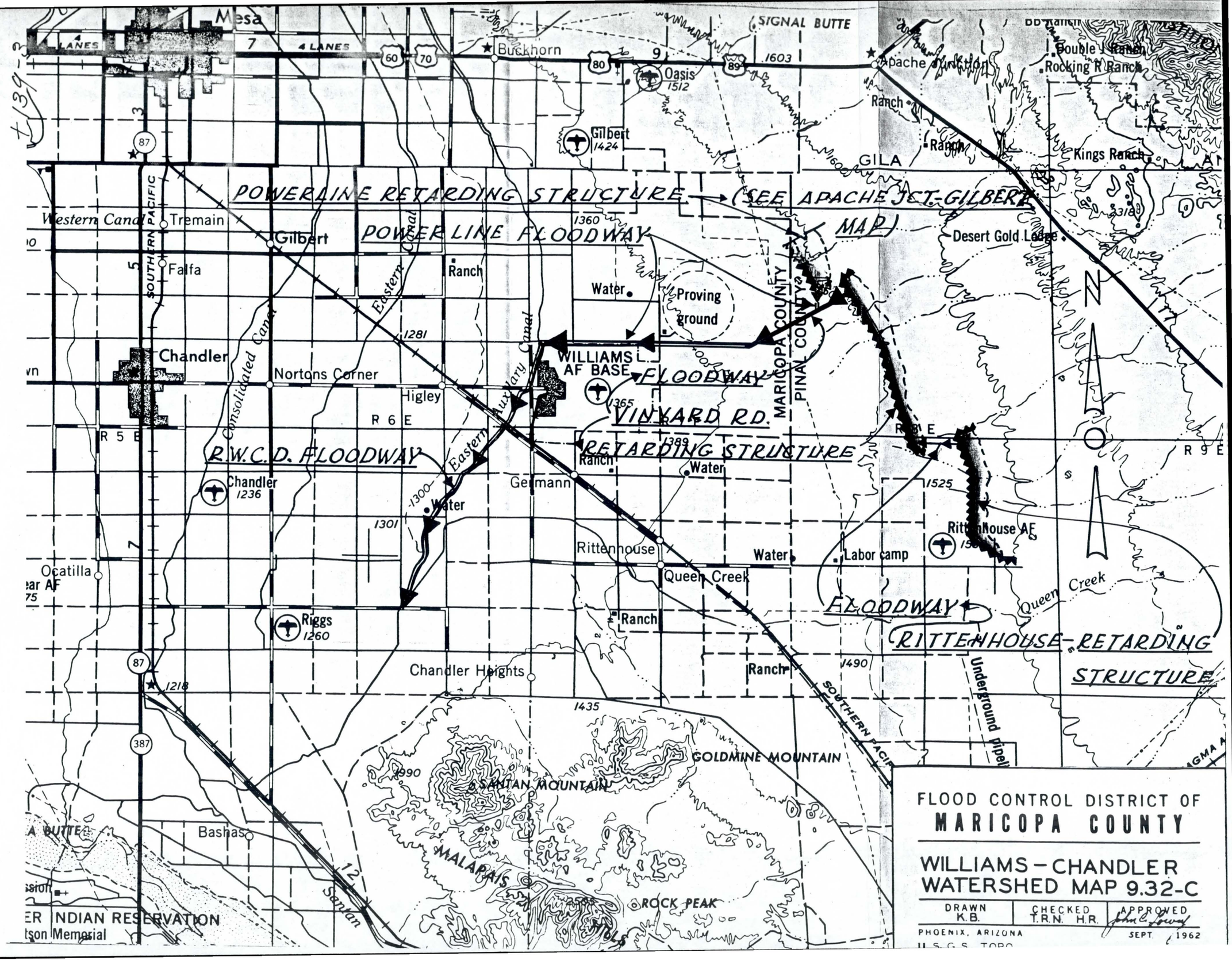
Retarding Structures

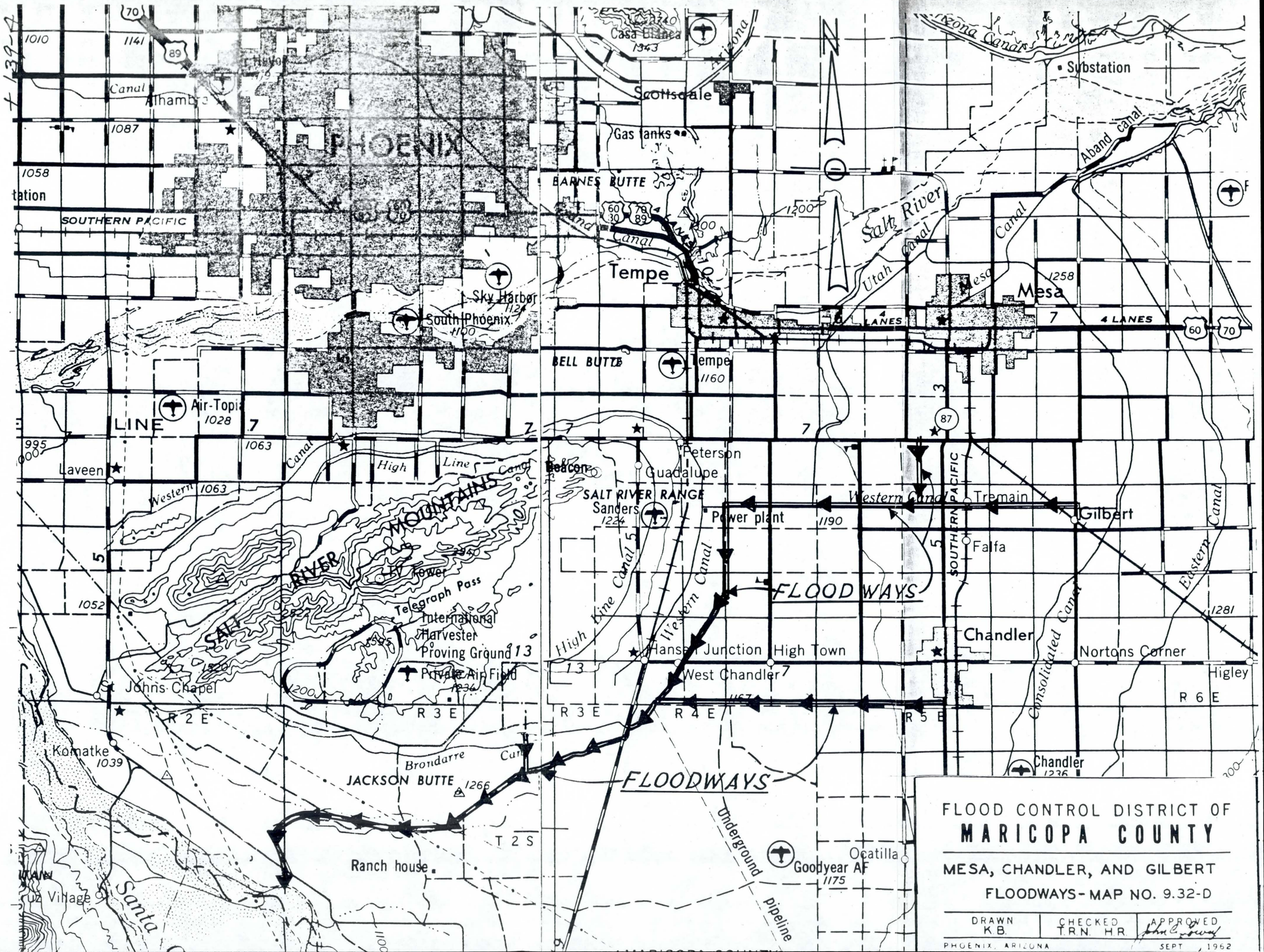
No.	Item	Units	Rittenhouse	Structures Vineyard Rd.
1	Drainage Area	sq.mi.	51.3	57.8
2	Sediment Capacity	ac.ft.	180	200
3	Flood Water Capa'y	ac.ft.	3,590	4,110
4	Total Storage Cap'y	ac.ft.	3,770	4,310
5	Total Surface Area	acres	680	840
6	Length	mi.	4.0	5.0
7	Maximum Height	ft.	22.0	21.0
8	Total Volume of fill	cu.yd.	883,000	1,035,000
9	Principal Spillway	in.	54	72 x 72
10	Maximum Release Rate	cfs	313	705
	COST DISTRIBUTION			
11	Total Construction		$1,109,200	$1,336,000
12	Contract Administration		8,500	10,300
13	Right of Way		247,700	327,300
14	Relocations & other costs		0	0
15	Flood Control Dist. Cost		256,200	337,600
16	Total Project Cost		1,365,400	1,673,600

FLOODWAYS

No.	Item	Units	Rittenhouse	Structures Vineyard Rd.	RWCD
1	Discharge Capacity	cfs	313	705	4,633
2	Length	ft.	6,390	4,430	38,000
3	Avg. Bottom Width	ft.	7.5	6.0	100.0
4	Avg. Depth	ft.	5.3	5.3	7.0
5	Avg. Side Slope		Vertical	1.5:1	3:1
6	Excavation	cu.yd.	20,000	13,000	832,000
7	Concrete	cu.yd.	2,690	2,100	0
	COST DISTRIBUTION				
8	Total Construction Cost		$403,500	$291,200	$598,100
9	Contract Administration		3,100	2,200	4,700
10	Right of Way		1,800	8,000	217,900
11	Relocations & other		0	0	5,400
12	Flood Control Dist. Cost		4,900	10,200	228,000
13	Total Project Cost		408,400	301,400	826,100


FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
APACHE JCT. - GILBERT
MAP NO. 9.32-A
DRAWN K.B.
CHECKED T.R.N. H.R.
APPROVED
PHOENIX, ARIZONA
SEPT. 1962
R.W.C.D. FLOODWAY
POWERLINE FLOODWAY
POWERLINE RETARDING STRUCTURE
VINYARD ROAD FLOODWAY
(REF. WILLIAMS-CHANDLER MAP)
WILLIAMS AF BASE
Proving Ground
Buckhorn
Oasis
Gilbert
Apache Junction
Rittenhouse
Rittenhouse AF
Florence Junction
Chandler Heights
Higley
Germann
Queen Creek
Labor camp
Desert Gold Lodge
Kings Ranch
BB Ranch
Double J Ranch
Rocking R Ranch
Barns Ranch
SIGNAL BUTTE
SUPERSTITION MOUNTAINS
GILA AND SALT
MARICOPA COUNTY
PINAL COUNTY
Eastern Canal
Eastern Auxiliary Canal
SOUTHERN PACIFIC
Underground pipeline
GOLDMINE MOUNTAIN
SANTAN MOUNTAIN
MALAPAIS
ROCK PEAK
R 6 E
R 7 E
R 8 E
R 9 E
T 1 N
T 1 S
T 2 S


Mesa
4 LANES
SIGNAL BUTTE
Buckhorn
Oasis
1512
Apache Junction
Double J Ranch
Rocking R Ranch
Kings Ranch
Gilbert
1424
GILA
POWERLINE RETARDING STRUCTURE
(SEE APACHE JCT-GILBERT MAP)
POWER LINE FLOODWAY
Western Canal
Tremain
Gilbert
Falfa
Ranch
Eastern Canal
Water
Proving ground
Desert Gold Lodge
MARICOPA COUNTY
PINAL COUNTY
Chandler
Consolidated Canal
Nortons Corner
Higley
WILLIAMS AF BASE
FLOODWAY
VINYARD RD.
RETARDING STRUCTURE
Eastern Auxiliary Canal
R 6 E
R 5 E
R 9 E
R.W.C.D. FLOODWAY
Chandler
1236
Germann
Water
Rittenhouse
Rittenhouse AF
Labor camp
Queen Creek
Ocatilla
Riggs
1260
FLOODWAY
RITTENHOUSE RETARDING STRUCTURE
Underground pipeline
Chandler Heights
SOUTHERN PACIFIC
GOLDMINE MOUNTAIN
SANTAN MOUNTAIN
MALAPAIS
ROCK PEAK
Bashas
Santan
INDIAN RESERVATION
Tatson Memorial
FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
WILLIAMS – CHANDLER
WATERSHED MAP 9.32-C
DRAWN K.B.
CHECKED T.R.N. H.R.
APPROVED
PHOENIX, ARIZONA
SEPT. 1962
U.S.G.S. TOPO


FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
MESA, CHANDLER, AND GILBERT
FLOODWAYS - MAP NO. 9.32-D
DRAWN K.B.
CHECKED T.R.N. H.R.
APPROVED
PHOENIX, ARIZONA
SEPT. 1962
FLOODWAYS
FLOODWAYS
PHOENIX
Scottsdale
Tempe
Mesa
Chandler
Gilbert
Casa Blanca
Substation
Gas tanks
BARNES BUTTE
BELL BUTTE
JACKSON BUTTE
SALT RIVER MOUNTAINS
SALT RIVER RANGE
Salt River
Sky Harbor
South Phoenix
Air-Topia
Laveen
Alhambra
Peterson
Guadalupe
Beacon
Sanders
Power plant
Tremain
Falfa
Hansen Junction
High Town
West Chandler
Nortons Corner
Higley
Telegraph Pass
International Harvester Proving Ground
Private Air Field
TV Tower
St. Johns Chapel
Komatke
Ranch house
Goodyear AF
Ocatilla
Underground pipeline
Western Canal
High Line Canal
Eastern Canal
Consolidated Canal
Utah Canal
Aband. canal
Brondarre Canal
SOUTHERN PACIFIC
4 LANES
R 2 E
R 3 E
R 4 E
R 5 E
R 6 E
T 2 S

9.33 LOWER QUEEN CREEK AREA

9.33-A General

The Lower Queen Creek area begins below Whitlow Dam and is located in the extreme Southeast corner of Maricopa County and contains an area of 530 square miles. This area is long east-west and Maricopa County-Pima County line runs down the center of the watershed.

The area above the outhern Pacific Railroad to the East is rolling, moderately steep and characterized by many small Washes that cut through to Queen Creek. Below the railroad ther terrain is much flatter and channels become less defined.

There are extensive developments along ueen Creek mostly within Maricopa County. A greater part of flood damage that occurs is within this county.

Two watershed projects are planned for this area. One project extends into this area from area 32.

9.33-B SAN TAN WATERSHED

9.33-B-1 General

Although located in Pinal County the San Tan Mountains contribute runoff that affects developed areas in Maricopa County.

The flood producing area contains primarily steep mountains between contours 1,300 and 3,100. The topograph is characterized by many washes which come down from the North slopes of the San Tan Mountains into a broad and level plain. Rainfall concentrates quickly in these washes and then runs

across the plain in a Northerly direction.

9.33-B-2 Developement and Damage

The flood plain area is roughly trapezoidal and elongated, in the East-West direction. Approximately one-fourth of the watershed is under irrigation with water supplied from wells. Principal urban development is Chandler Heights.

Water flows across the developed areas every year causing damage in many locations. Damage to roads, irrigation structures as well as the land is heavy.

9.33-B-3 Plan

Over all plan for flood control in this watershed consists of a system of detention levees and floodways to intercept and convey the flood water from the mountain areas down to Queen Creek. There will be four retarding structures and four floodways. Each levee will have uncontrolled outlets of a size suitable to discharge a predetermined amount of water into the floodways below.

A summary of costs for the complete watershed can be found in table 9.33-1 and Map 9.33-A shows extent and location. Related structural data can be found in table 9.33-B.

9.33-C QUEEN CREEK FLOODWAY

9.33-C-1 General

Floodwaters released by the proposed projects in the Southeastern part of Maricopa County are directed into the Roosevelt Water Conservation District Floodway. Also emptying into this floodway is water from lower Queen Creek.

All of this water is then carried on to the Gila River

Indian Reservation in the Northwest ¼, Section 4, Township 3 South, Range 6 East. Actual flood volumes, however, will be much less than in the past because water will be released in controlled amounts. This control will be effected by the Retarding Structures plus the Whitlow Ranch Dam.

The purpose of this planned floodway is to carry this controlled flow of approximately 7,000 C.F.S. to the Gila River.

9.33-C-2 Developments and Damages

Located below the point of release of this water are many dwellings along with schools and churches. There is also approximately 3,000 acres of cultivated land along with numerous irrigation facilities. All of these developments would be subject to damage from floodwater.

9.33-C-3 Plan

The plan for disposal of this floodwater consists of an earth channel beginning in the Northwest ¼, Section 4, Township 3 South, Range 6 East. The channel runs generally Southwest to a point just above the Gila Butte; thence South into the Gila River. xisting bridge at Highway 87 will have to be widened and a new bridge will be required on Highway 387.

The channel will be approximately 7.6 miles long and vary from 150 to 400 feet in width. Discharge capacity will be 7200 C.F.S. Excavation will be used to build a dike on each side of the channel.

For any structural data see table 9.33-C. Map 9.33-B shows planned location and extent.

TABLE 9.33-1 SANTAN WATERSHED SUMMARY

No.	Job Description	Estimated Cost: Flood Control District	Estimated Cost: SCS
1	Hunt Highway Retarding Basin	$ 205,000	$ 520,000
2	Gold Mine " "	124,000	195,000
3	Earth Crack " "	124,000	195,000
4	Chandler Heights "	204,000	650,000
5	Hunt Highway Floodway	12,000	260,000
6	Gold Mine "	11,000	104,000
7	Earth Crack "	11,000	104,000
8	Chandler Heights Floodway	204,000	650,000
	TOTAL	$895,000	$ 2,678,000

TOTAL PROJECT COST $3,573,000

Flood Damage Without Project	350,000
Flood Damage With Project	100,000
Benefits from Reduction of Flood Damage	250,000
Total Annual Benefits	250,000
Total Project Cost Amortized @ 2-5/8%	129,000
Annual Operation & maintenance	16,000
Total Annual Cost	145,000

Benefit-Cost Ratio -- 1.72 to 1.00

TABLE 9.33-A

STRUCTURAL DATA

SAN TAN WATERSHED

RETARDING BASINS

No.	Item	Units	Structures			
		sq.mi.	Hunt Highway	Goldmine	Earth Crack	Chandler Heights
1	Drainage Area	sq.mi.	8.8	1.3	1.2	7.0
2	Sediment Capacity	ac.ft.	150	10	10	50
3	Flood Water Capacity	ac.ft.	1,050	190	190	800
4	Total storage Capacity	ac.ft.	1,200	200	200	850
5	Total Surface Area	acres	300	132	145	273
6	Length	mi.	3.0	1.0	1.0	2.3
7	Maximum Height	ft.	18.0	15.0	16.0	24.0
8	Total Volume of fill	cu.yds.	490,000	138,000	150,000	480,000
9	Principal Spillway Size	in.	54	54	54	54
10	Maximum Release Rate	cfs	300	350	300	350
		COST DISTRIBUTION				
11	Total Construction Cost	Dollars	520,000	195,000	195,000	650,000
12	Contract Administration	"	5,000	4,000	4,000	4,000
13	Right of Way	"	200,000	120,000	120,000	200,000
14	Relocations and Other Costs	"	-0-	-0-	-0-	-0-
15	Flood Control District Cost	"	205,000	124,000	124,000	204,000
16	Total Project Cost	"	725,000	319,000	319,000	854,000

TABLE 9.33-B

STRUCTURAL DATA

SAN TAN WATERSHED FLOODWAYS

No.	Item	Units	Structures			
			Hunt Highway	Goldmine	Earth Crack	Chandler Heights
1	Maximum Discharge	cfs	250	300	350	400
2	Length	ft.	5,200	2,000	2,000	21,120
3	Av. Bottom Width	ft.	10.0	10.0	10.0	10.0
4	Av. Depth	ft.	4.2	4.2	4.2	4.0
5	Av. Side Slope		1:1	1:1	1:1	1:1
6	Excavation	cu.yds.	15,000	6,000	6,000	45,000
7	Concrete	cu.yds.	2,000	800	800	5,000
			COST DISTRIBUTION			
8	Total Construction Cost	Dollars "	260,000	104,000	104,000	650,000
9	Contract Administration	"	2,000	1,000	1,000	4,000
10	Right of Way	"	10,000	10,000	10,000	200,000
11	Relocations and Other Costs	"	-0-	-0-	-0-	-0-
12	Flood Control District Cost	"	12,000	11,000	11,000	204,000
13	Total Project Cost	"	272,000	115,000	115,000	854,000

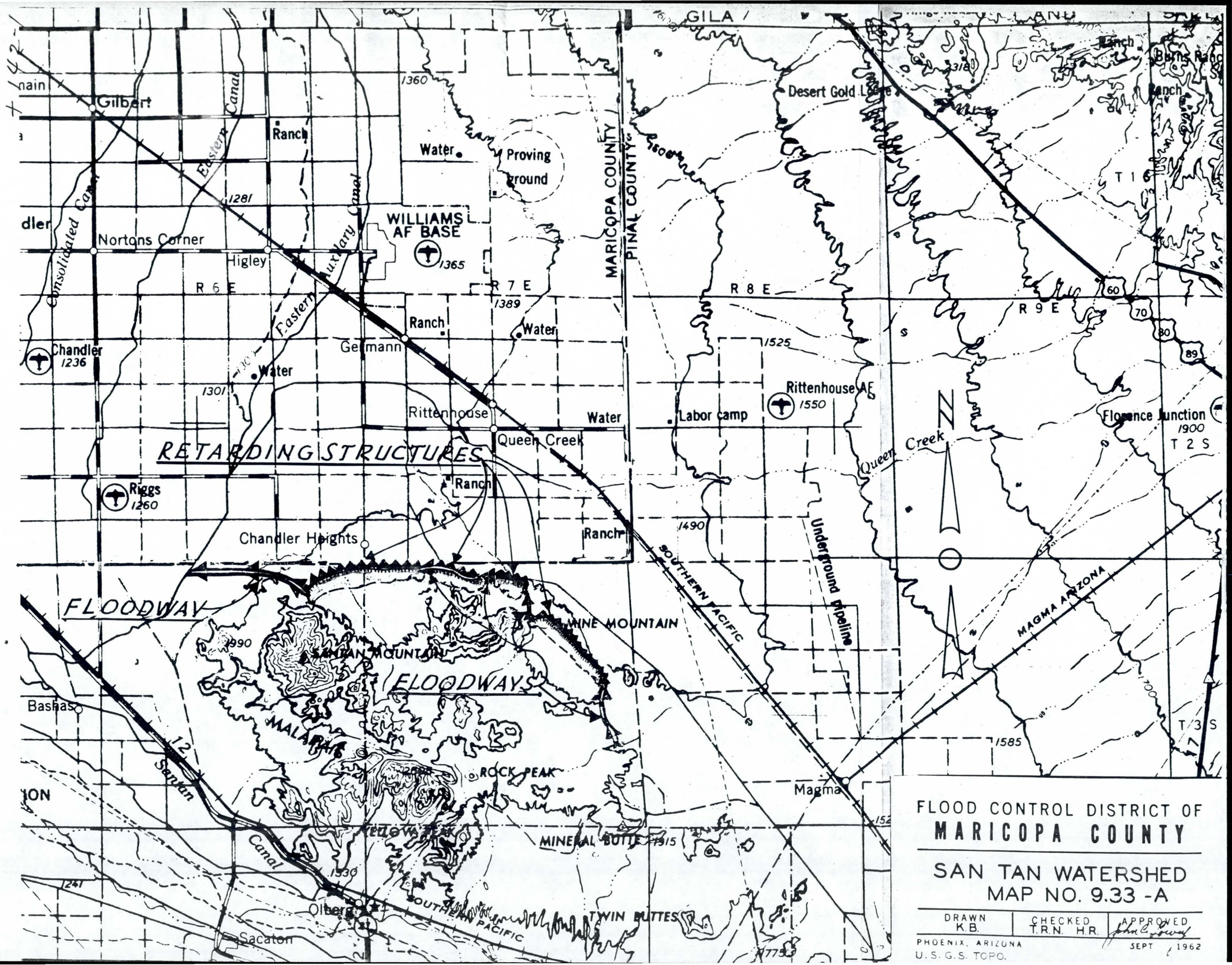
TABLE 9.33-C STRUCTURAL DATA

QUEEN CREEK FLOODWAY

No.	Item	Units	Quantity
1	Discharge Capacity	cfs	7,200
2	Length	ft.	40,000
3	Avg. Bottom Width	ft.	2,750
4	Avg. Depth	ft.	5.2
5	Avg. Side Slope		2:1
6	Excavation	cu.yd.	1,760,000
7	Concrete	cu.yd.	

COST DISTRIBUTION

8	Total Construction Cost	$ 880,000
9	Contract Administration	20,000
10	Right of Way	50,000
11	Relocations & other Costs	850,000
12	Flood Control Dist. Cost	920,000
13	Total Project Cost	$1,800,000

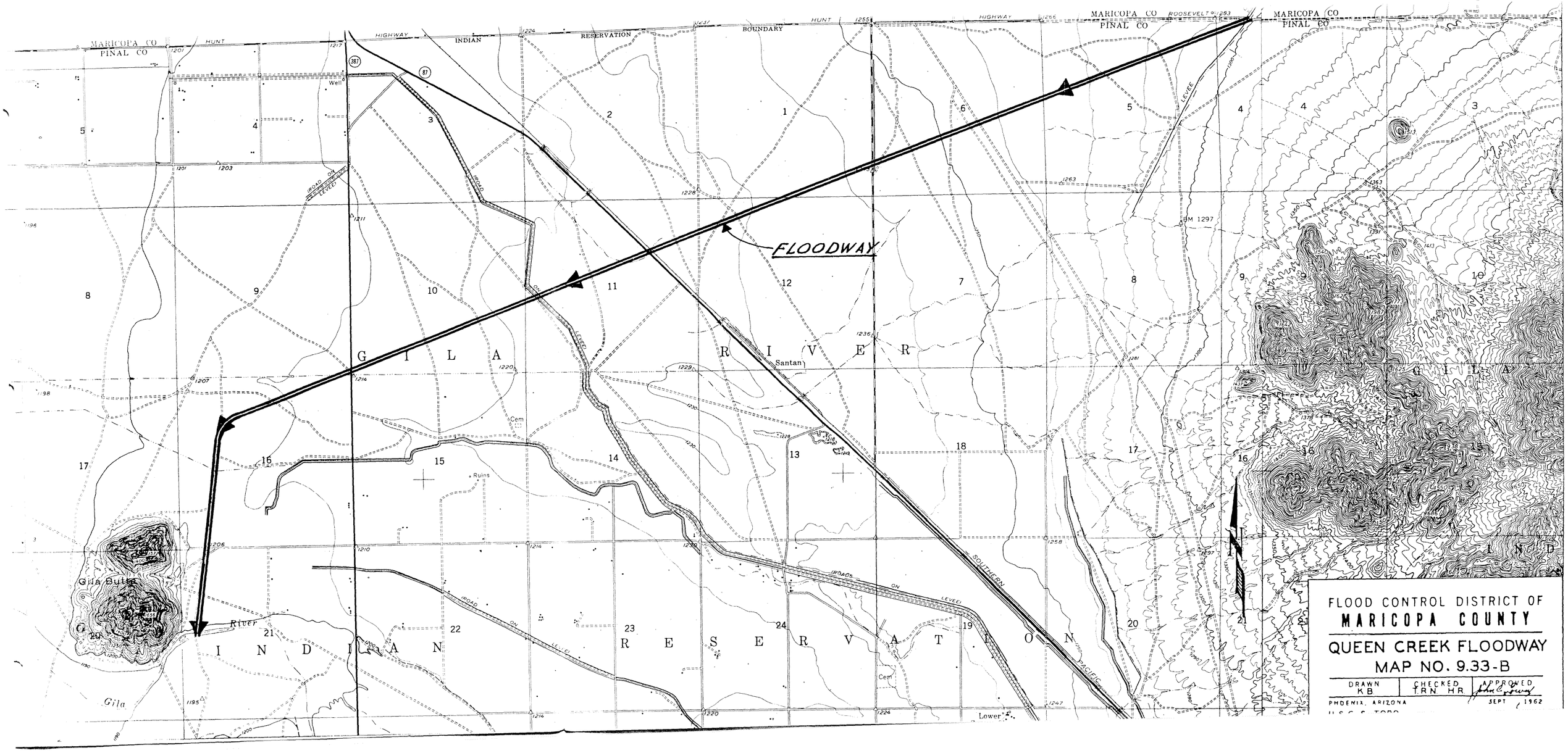


FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

SAN TAN WATERSHED
MAP NO. 9.33 -A

DRAWN	CHECKED	APPROVED
K.B.	T.R.N. H.R.	John C. Lowry

PHOENIX, ARIZONA
U.S.G.S. TOPO.
SEPT 1962



FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

QUEEN CREEK FLOODWAY
MAP NO. 9.33-B

DRAWN	CHECKED	APPROVED
KB	TRN HR	

PHOENIX, ARIZONA SEPT 1962

U.S.G.S. TOPO

9.34 UPPER QUEEN CREEK AREA

9.34-A General

The Upper Queen Creek Area lies above Whitlow Dam and is located in Pinal County southeast of Apache Junction.

This area contains the runoff producing terrain that at one time caused much flooding on lower Queen Creek. This conditio n has now been alleviated by the construction of the Whitlow Ranch Dam by the Corps of Engineers.

The topography is characterized by steep, rocky, barren mountains that produce a high rate of runoff. There are many well defined channels that carry the flood water at high velocities. At the present time there is little development and minor damage has occurred in this area. No flood control measures are planned. Future economic developments may, however, warrant further consideration of this area.

9.35 UPPER SALT RIVER AREA

9.35-A General

The Upper Salt River Area is located in the eastern part of Maricopa County and lies mostly outside of the County. Total area is 6232 sq. miles and this is the largest single area covered in this report. The Flood problem is virtually under control in this section of the County, mostly due to the reservoirs located on Salt River.

General topography is rough and steep varying from low brush covered hills to high timber covered mountains. Runoff is much less per unit than in the desert country at lower elevation. Snow melt contributes to the runoff here and the proper conditions could cause a major flood.

This is virtually undeveloped area except for recreation facilities. Because of this, there has been little damage reported and at the present time no major flood control structures are planned. Future economic growth may change this picture and make it necessary to re-evaluate the flood control picture here.

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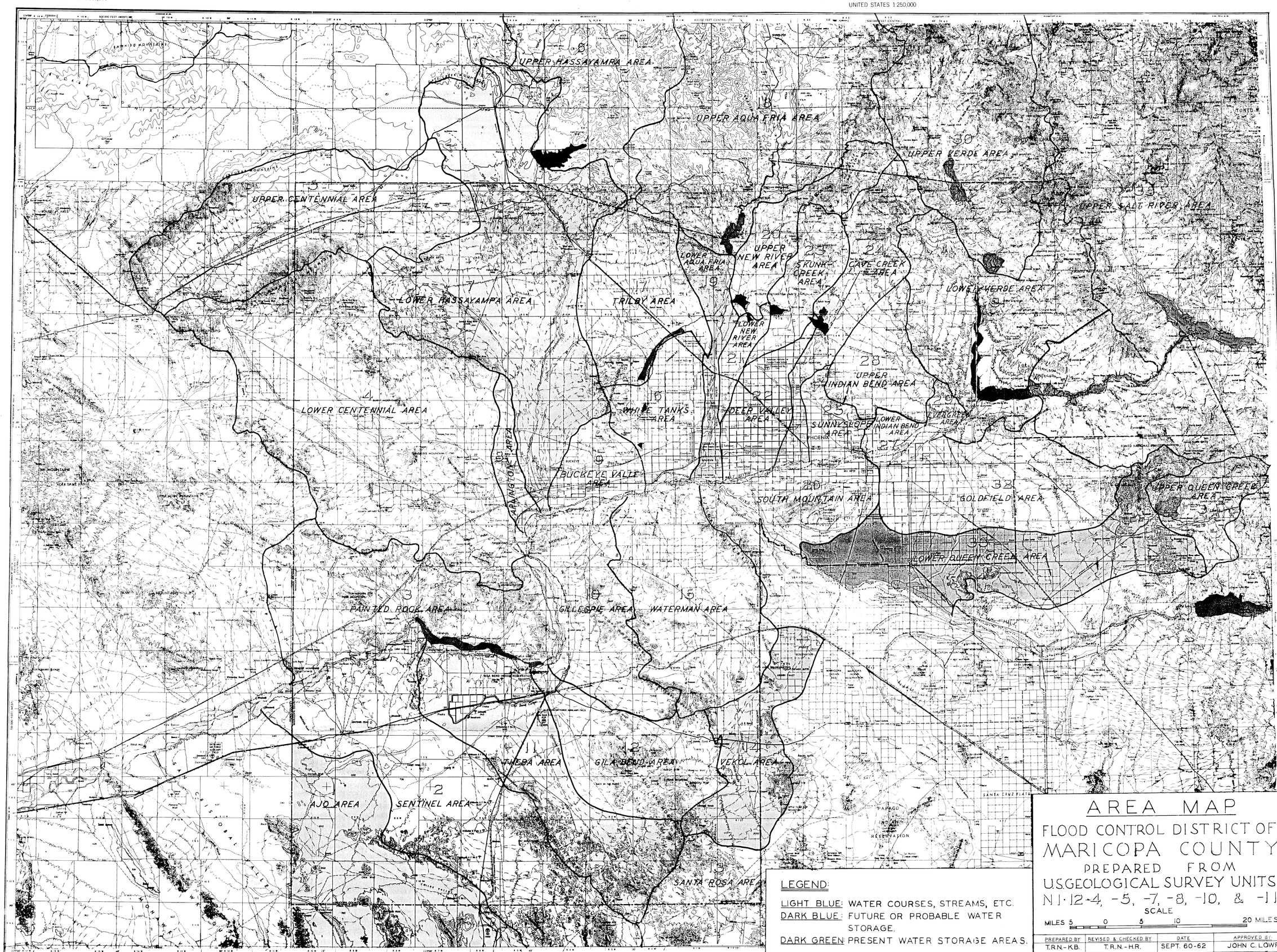
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