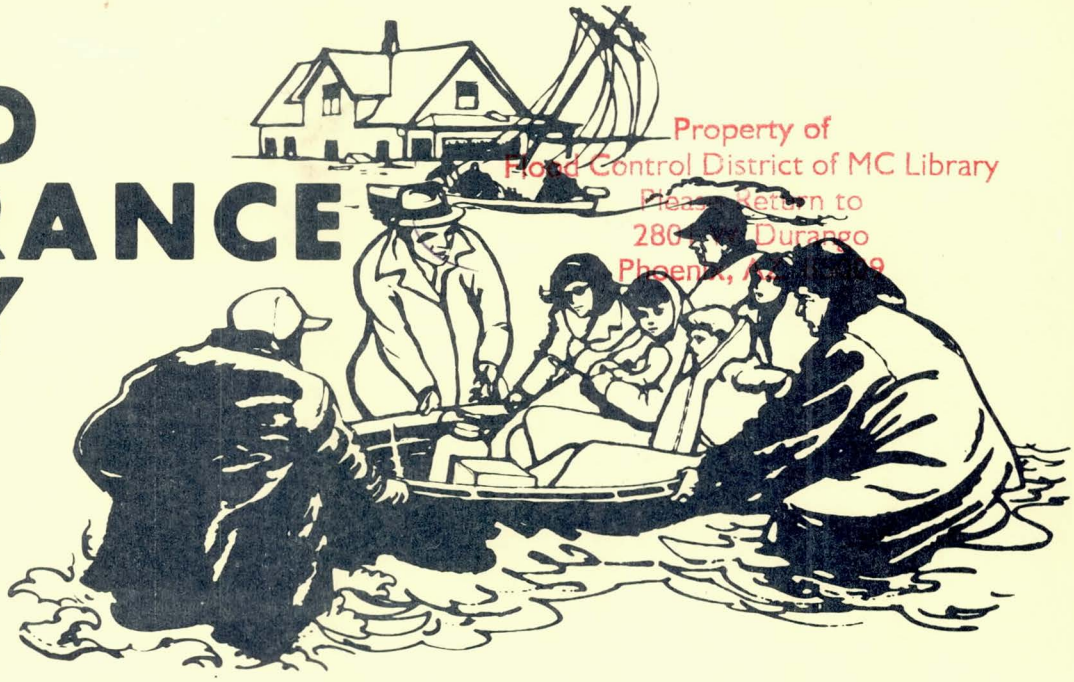
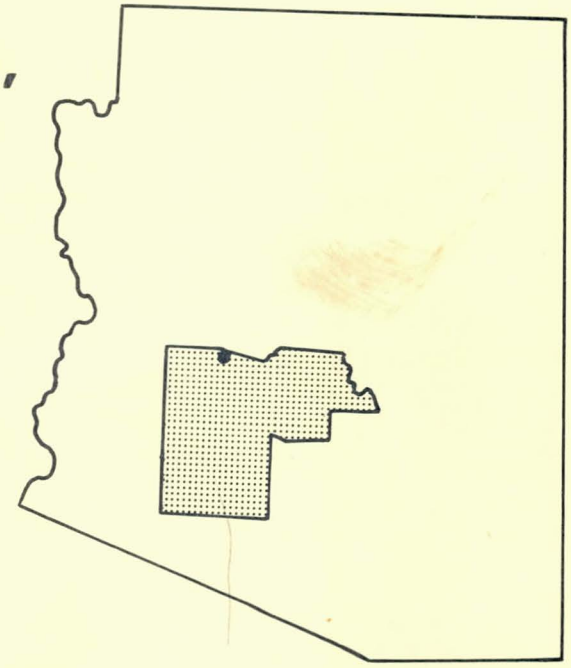
FLOOD INSURANCE STUDY



Property of
Flood Control District of MC Library
Please Return to
280 W. Durango
Phoenix, Arizona

TOWN OF WICKENBURG, ARIZONA

MARICOPA COUNTY



HYDRO LIBRARY

JULY 1977

REVISED: 3/29/83

Federal Emergency Management Agency

COMMUNITY NUMBER - **040056**

FEMA 07/77

TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	1
	1.1 Purpose of Study	1
	1.2 Coordination	1
	1.3 Authority and Acknowledgements	1
2.0	AREA STUDIED	2
	2.1 Scope of Study	2
	2.2 Community Description	2
	2.3 Principal Flood Problems	5
	2.4 Flood Protection Measures	6
3.0	ENGINEERING METHODS	6
	3.1 Hydrologic Analyses	6
	3.2 Hydraulic Analyses	7
4.0	FLOOD PLAIN MANAGEMENT APPLICATIONS	8
	4.1 Flood Boundaries	9
	4.2 Floodways	9
5.0	INSURANCE APPLICATION	13
	5.1 Reach Determinations	13
	5.2 Flood Hazard Factors	13
	5.3 Flood Insurance Zones	14
	5.4 Flood Insurance Rate Map Description	14

REVISED: 3/29/83

TABLE OF CONTENTS (Continued)

	Page
6.0 OTHER STUDIES	17
7.0 LOCATION OF DATA	17
8.0 BIBLIOGRAPHY AND REFERENCES	17

FIGURES

Figure 1 - Vicinity Map	3
Figure 2 - Floodway Schematic	10

TABLES

Table 1 - Summary of Discharges	7
Table 2 - Floodway Data	11-12
Table 3 - Flood Insurance Zone Data	15-16

EXHIBITS

Exhibit 1 - Flood Profiles	
Hassayampa River	Panel 01P
Sols Wash	Panels 02P-04P
Casandro Wash	Panels 05P-09P
Flying "E" Wash	Panel 10P
South Branch Casandro Wash	Panels 11P-12P
Hospital Wash	Panel 13P
Powder House Wash	Panels 14P-15P
Exhibit 2 - Flood Boundary and Floodway Map Index	
Exhibit 3 - Flood Boundary and Floodway Map	Panels 040056 0001C-0002C

PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index	
Flood Insurance Rate Map	Panels 040056 0001C-0002C

REVISED: 3/29/83

FLOOD INSURANCE STUDY
TOWN OF WICKENBURG, ARIZONA

1.0 INTRODUCTION

1.1 Purpose of Study

The purpose of this Flood Insurance Study is to investigate the existence and severity of flood hazards in the Town of Wickenburg, Maricopa County, Arizona, and to aid in the administration of the Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. Initial use of this information will be to convert Wickenburg to the regular program of flood insurance by the Federal Insurance Administration (FIA). Further use of the information will be made by local and regional planners in their efforts to promote sound land use and flood plain development.

1.2 Coordination

Contact was maintained during the course of this study with the Town of Wickenburg, the Arizona State Department of Highways, and the Atchison, Topeka, and Santa Fe Railroad.

Hydrologic data developed for this study by the U.S. Army Corps of Engineers (COE) was coordinated with that developed by the Soil Conservation Services (SCS) for this area.

At the final consultation and coordination meeting held on July 16, 1976, the results of this Flood Insurance Study were reviewed by representatives of the FIA, the COE Los Angeles District, and the Town of Wickenburg.

1.3 Authorization and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968, as amended.

The hydrologic and hydraulic analyses for this study were performed by the Los Angeles District COE for the FIA under Inter Agency Agreement Nos. IAA-H-16-75, Project Order No. 17, and IAA-H-7-76, Project Order No. 1. This work, which was completed in October, 1976, covered all flooding sources in the Town of Wickenburg. An additional detailed study on Powder House Wash was completed in 1979 by Harris-Toups Associates under Contract H-4008 with the Department of Housing and Urban Development.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Town of Wickenburg. The area of study is shown on the Vicinity Map (Figure 1).

The limits of the detailed and approximate studies in the Town of Wickenburg were determined by the FIA after consultation with the community and the study contractor. Areas studied in detail were the Hassayampa River, Sols Wash, Hospital Wash, Casandro Wash, South Branch Casandro Wash, Powder House Wash, and portions of Flying "E" Wash. Portions of Flying "E" Wash, Sunset Wash, Sunny Cove Wash, Cemetery Wash, and Hartman Wash were studied by approximate methods because of lack of development and insignificant flooding.

The areas studied in detail were chosen with consideration given to all forecasted development for the next five years (through June, 1981).

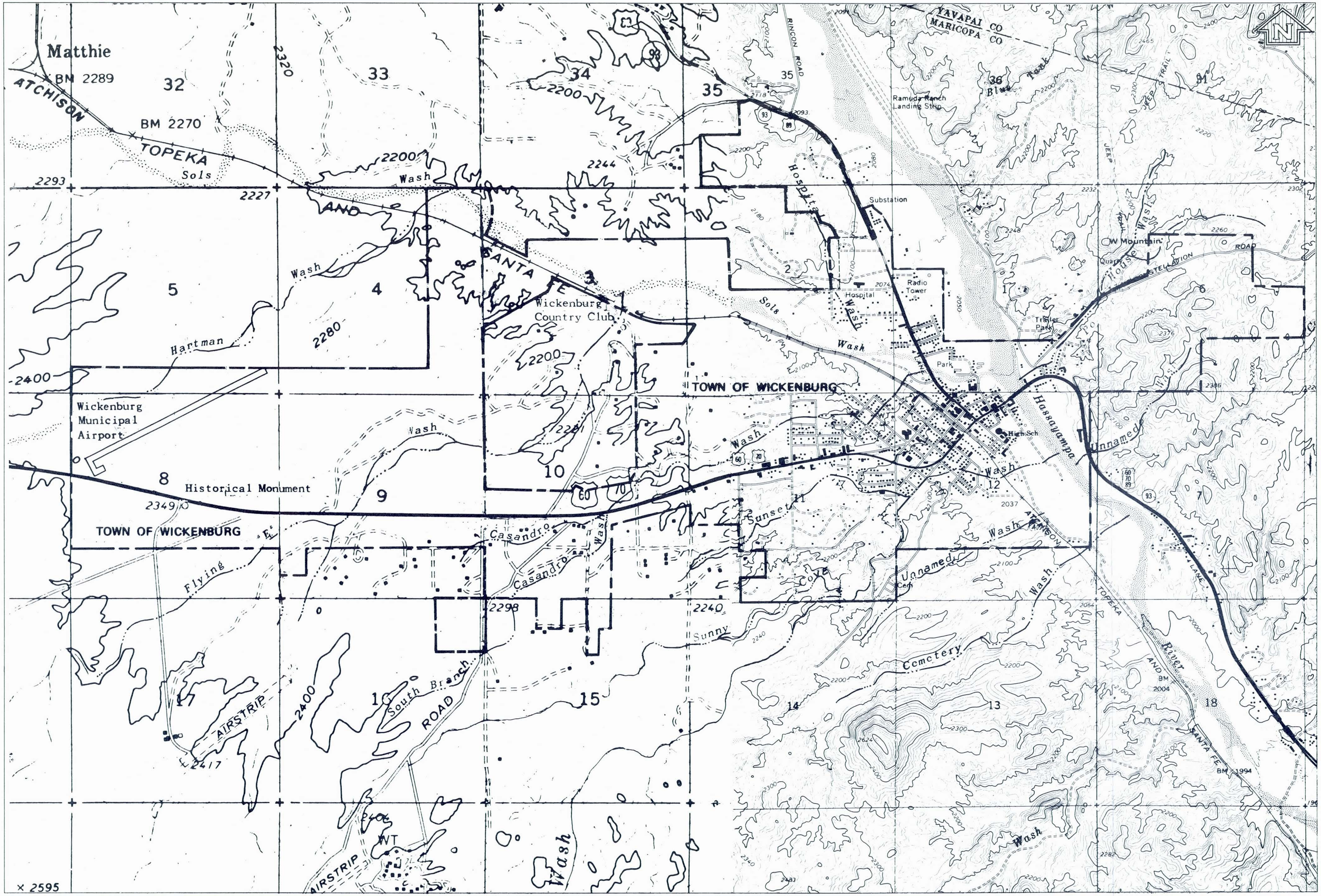
2.2 Community Description

The Town of Wickenburg, located in the north central part of Maricopa County, lies about 50 miles northwest of the City of Phoenix in south central Arizona.

The Town of Wickenburg was named for Henry Wickenburg, an Austrian immigrant born in 1820. He arrived in Arizona in 1862 and in 1863 he discovered the Vulture Gold Mine about 10 miles south of the present City. This mine became one of the richest in Arizona's territorial history. With profits from the Vulture Mines, Henry Wickenburg established a ranch near the present site of the Town of Wickenburg. The name of Wickenburg was first used by James Moore while writing Governor John N. Goodwin; Moore headed his letters "Wickenburg Ranch," and the name was used thereafter. As the Vulture Mines developed, so did Wickenburg which reached a population of 500 persons in 1870. The population of the Wickenburg area was about 1,000 in 1940, about 3,000 in 1970 (Reference 1), and is now estimated to be 2,908 (Reference 2).

Today, Wickenburg is famous as a retirement and dude ranch center. The Town is served by the Wickenburg Municipal Airport, U.S. Highways 70 and 89, the Atchison, Topeka, and Santa Fe Railroad (AT&SF), and by bus service.

REVISED:3/29/83



APPROXIMATE SCALE

0.5 0 0.5 1.0 1.5 MILES

VICINITY MAP

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WICKENBURG, AZ
(MARICOPA CO.)

FIGURE 1

REVISED: 3/29/83

The majority of the town is built above the flood plain elevation, but some trailer courts are located within the floodway fringe of Sols Wash, Casandro Wash and Flying "E" Wash. Some residential and commercial buildings are located in the Hassayampa River flood plain. The general terrain of the open space in Wickenburg is rolling hills. Flat developable land is scarce, and the undeveloped flood plain land will come under increasing demand.

The principal water course through Wickenburg, the Hassayampa River, drains an area in northwestern Maricopa County and empties into the Gila River about 40 miles west of Phoenix. The total drainage area of the Hassayampa River, upstream of Wickenburg, is about 742 square miles. The basin ranges in elevation from about 1,830 feet to about 7,700 feet National Geodetic Vertical Datum of 1929 (NGVD) formerly referred to as mean sea level Datum with the 1929 general adjustment. Another major water course is Sols Wash. It originates in the Date Creek Mountains north of Wickenburg. The drainage area for Sols Wash is 145 square miles at its confluence with the Hassayampa River. The basin is bounded by low, poorly defined ridges and hills extending to Twin Peaks. On the south and on the east, pronounced foothills and mountains distinguish the drainage divide. The Sols Wash basin is predominantly a mildly sloping desert plain, bordered by a fringe of rugged foothills and mountains. Sols Wash basin elevation ranges from 2,000 feet at Wickenburg to 4,400 feet NGVD in the Date Creek Mountains. The Sols Wash drainage basin within Wickenburg consists of Sols Wash, Flying "E" Wash, Hospital Wash, Casandro Wash and South Branch Casandro Wash.

Several small tributaries are Hartman Wash which flows through the extreme northwestern corner of the community and Sunset Wash, Sunny Cove Wash, unnamed wash and Cemetery Wash which flow eastward into the Hassayampa River in the southeastern corner of the community.

The climate in these drainage basins varies with latitude and elevation. Wickenburg is in an arid, sub-tropical climatic zone characterized by hot summers, mild winters, and infrequent rain fall. Extremes in temperatures recorded in Wickenburg are 10 and 117 degrees F. Summer highs frequently exceed 100 degrees F; winter lows occasionally dip below freezing. The mean annual precipitation in the area ranges from 11 inches in the lower desert to about 30 inches in the higher mountains, and averages about 18 inches over the total area.

In general, vegetation in the basin is sparse. Cacti, along with other desert shrubs, grow throughout the region on the fairly level areas.

A few stunted trees, including juniper, paloverde, mesquite, ironwood, and scrub oak, exist among the shrubs. The vegetation tends to be thicker along, and adjacent to, the stream courses. Perennial grasses form a small portion of the vegetation; however, a good cover of annual grasses develops after winter rains.

There are some residential, commercial, and light industrial structures in the flood plain of the Hassayampa River. The trailer courts at Country Club Park on both sides of Circle Boulevard are subject to flooding from Casandro Wash. In spite of the effect of SCS dams on Sunset and Sunny Cove Washes, the residential homes upstream of the railroad tracks in the vicinity of Sylvan Road are subject to flooding due to the large drainage area remaining downstream of these dams. The bridges on U.S. Highways 60, 70, and 89 are in the flood plain, as are the A. T. & S. F. railroad crossings over Casandro Wash, the unnamed wash and Sunset Wash.

2.3 Principal Flood Problems

Damaging floods on the Hassayampa River are known to have occurred in Wickenburg as early as 1890. Large floods have occurred in 1916, 1919, 1921, 1923, 1925, 1927, 1935, 1937, 1938, 1951, 1958, 1963 and 1970. The flood of September 1970 had the largest recorded peak discharge since records were instituted in 1916. The peak discharge of this flood is estimated to have been 58,000 cubic feet per second (cfs). However, the flood of 1890 was a worse disaster in terms of loss of life. In addition, the local newspaper reports that severe local storms and floods have occurred in the town in 1945, 1953, 1955, 1957, and 1959.

The embankment of the AT&SF railroad tracks at Mohave Street causes the floodwater of Casandro Wash to pond behind the small culvert, flooding the nearby houses. The highway 89 bridge over Sols Wash and the highway 60 bridges over the Hassayampa River and Flying "E" Wash are the major man-made obstructions to the floodwater from these water-courses. During floods, brush growing in floodways can impede floodflows, thus causing backwater and increased flood heights. Brush may be washed out and carried downstream to collect on bridges and culverts, creating a damming effect and raised water-surface elevations. In general, obstructions restrict flood flows and cause overbank flows, unpredictable areas of flooding, destruction of or damage to bridges and culverts and increased velocity of flow immediately downstream of these constrictions.

2.4 Flood Protection Measures

The SCS has completed flood-control dams on Sunset and Sunny Cove Washes; both dams are designed to control the 100-year flood. These dams will reduce flooding in the southern part of town. The local property owners have financed the construction of small levees on Constellation Road on Powder House Wash to protect individual property from low flood flows. Also, the developer of West Park has built a levee which protects his development from the 100-year flood on Flying "E" Wash.

The Town of Wickenburg presently has an ordinance that prohibits any new construction in the 50-year flood plain of any of the flooding sources within the community.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Floods having recurrence intervals of 10, 50, 100, and 500 years have been selected as having special significance for flood plain management and for flood insurance premium rates. The analyses reported here reflect current conditions in the watersheds of the flooding sources.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail in the community.

The discharge-frequency relationship for the Hassayampa River was developed using stream flow data for 30 years of record at the stream gage on the Hassayampa River at Bos Damsite near Wickenburg (Reference 3), and rainfall-runoff relationships derived from reconstitutions of observed storms and floods in Arizona (Reference 4). The discharge-frequency relationships for the tributaries to the Hassayampa River in Wickenburg were derived by two methods: rainfall-runoff analysis and correlation with other watersheds. Both methods produced compatible results. The stream gage on Hassayampa River at Box Canyon, was used to determine the rainfall-runoff relationship on this river. Because of its hydrologic and meteorologic similarity, the rainfall-runoff relationship for Sols Wash was computed using an S-graph derived from reconstitutions of observed flood events on Indian Bend Wash (Reference 5). For the smaller streams studied, the rainfall-runoff

relationship was computed using the Phoenix Mountain S-graph (Reference 6). The peak discharge on Hassayampa River slightly decreased as the drainage area increased from 564 square miles to 671 square miles. This decrease was due to the storage in the river's wide channel in addition to infiltration losses.

Peak discharges of the 10-, 50-, 100-, and 500-year floods for streams studied in detail are listed in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
HASSAYAMPA RIVER					
.32 Miles (approximately) upstream from corporate limits	564	14,500	47,000	71,000	185,000
.14 miles (approximately) downstream from corporate limits	671	14,000	46,000	70,000	184,000
SOLS WASH					
River Street	145	4,000	16,500	24,000	59,000
FLYING "E" WASH					
U.S. Highway 60 and 70	8.4	1,000	4,500	6,500	15,000
CASANDRO WASH					
U.S. Highway 60 and 70	0.5	50	500	800	1,900
AT&SF Railroad	1.5	250	1,050	1,500	3,500
SOUTH BRANCH CASANDRO WASH					
Upstream corporate limit	0.2	50	250	400	1,000
HOSPITAL WASH					
Honeysuckle Ave	0.5	150	600	900	2,000
POWDER HOUSE WASH					
Jack Burden Road	1.9	300	1,300	1,900	4,400

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of streams studied in detail in the community were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of these streams.

For the streams studied in detail cross-sections were drawn on the topographic work map (References 7, 8, and 9).

At the bridges and culverts extra cross-sections were taken immediately upstream and downstream to determine the regime of flow through the openings. Locations of selected cross-sections used in the hydraulic analyses are shown on the Flood Boundary and Floodway Map (Exhibit 3).

Channel and overbank roughness factors (Manning's "n" values) for these computations were assigned on the basis of field inspection of the flood plain area (Reference 10). The roughness factors for the streams studied in detail were between 0.03 to 0.06 for the channels and 0.04 to 0.06 for the overbanks.

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals (Exhibit 1). Water surface elevations of floods of the selected recurrence intervals were computed through use of the COE HEC-2 step-backwater computer program (Reference 11). The starting water-surface elevations were computed through the normal depth method. The water-surface slope shown in the backwater for Casandro Wash is caused by the hydraulic gradient of Sols Wash. All elevations are measured from NGVD. Elevation reference marks used in this study are shown on the maps.

During a 100-year flood, the confluence of Hospital Wash with Sols Wash will be located at the south end of Pappy Street. The Hospital Wash flow line which joins the Sols Wash near Cavaness Avenue carries only the lower flows.

The 100-year boundaries for the streams studied by approximate methods were based on normal depth calculations, or verification of the flood plain information overflow maps (Reference 8).

The hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations as shown on the profiles are thus considered valid only if hydraulic structures in general remain unobstructed and do not fail.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

A prime purpose of the National Flood Insurance Program is to encourage state and local governments to adopt sound flood plain management programs. Each Flood Insurance Study, therefore, includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FIA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100- and 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps (References 7, 8, and 9) at a scale of 1"=500', with contour intervals of 5 and 4 feet. In cases where the 100- and 500-year flood boundaries are close together, only the 100-year boundary has been shown.

For most of the streams studied by approximate methods, the boundary of the 100-year flood was developed from normal depth calculations. Exceptions to this method of delineating the 100-year boundary are Sunset Wash and Flying "E" Wash. The approximate 100-year boundaries for Sunset Wash were determined by extrapolating depth-discharge relationships presented in Reference 8. The 100-year flood plain boundaries determined by the COE (Reference 8) for Flying "E" Wash were used for this study. The flood boundaries for the streams studied by approximate methods were delineated on the topographic maps referenced above.

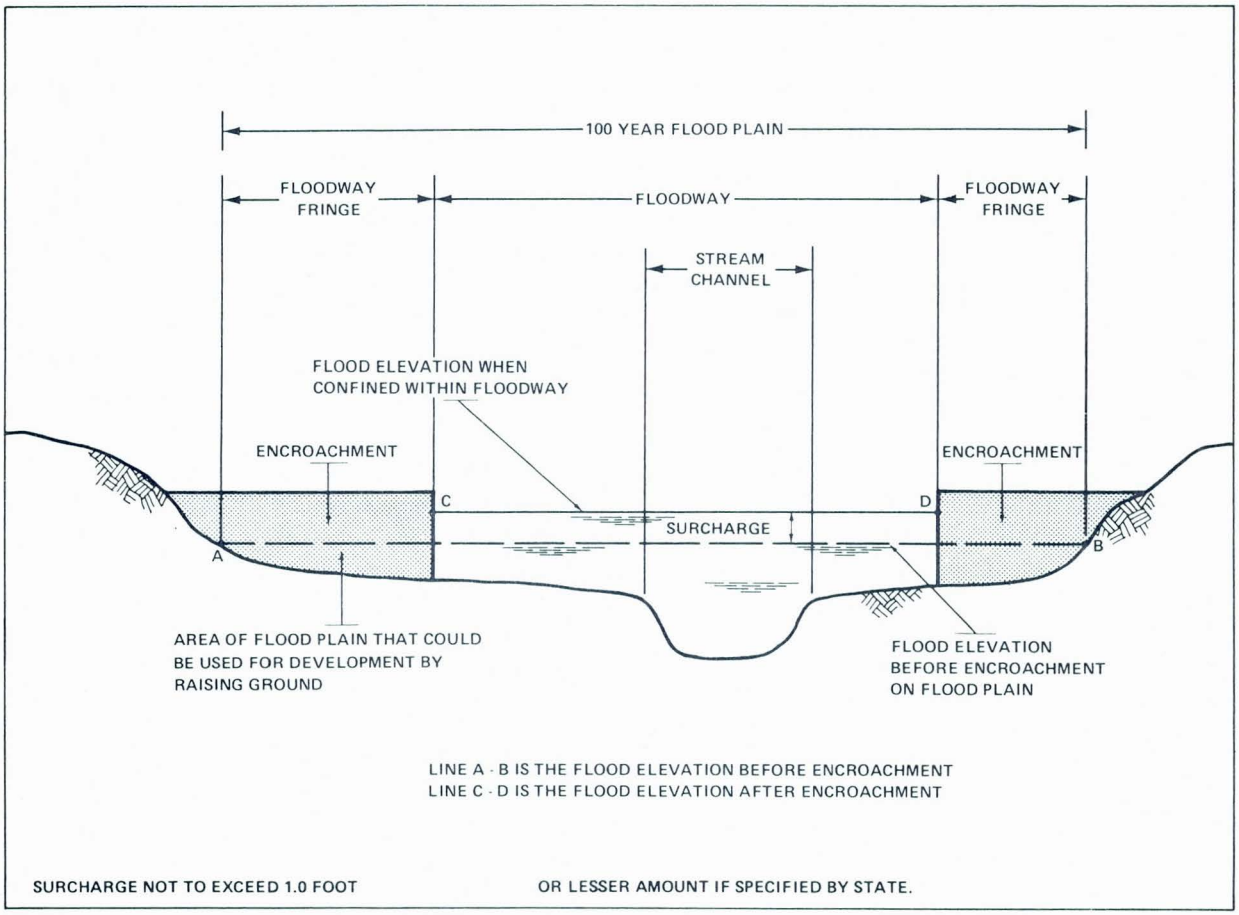
The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 3). Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding. Owing to limitations of the map scale and lack of detailed topographic data, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases flood heights, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment in order that the 100-year flood may be carried without substantial increases in flood heights. Minimum standards of the FIA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this report are presented to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations are tabulated at selected cross sections for each stream studied in detail (Table 2). As shown on the Flood Boundary and Floodway Map, the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated and drawn. In cases where the boundaries of the floodway and the 100-year flood are close together, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than one foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.



FLOODWAY SCHEMATIC

Figure 2.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY	INCREASE (FEET)
CASANDRO WASH								
A	0.355	190	236	6.35	2076.3	2076.3	2076.5	0.2
B	0.555	271	259	5.78	2092.0	2092.0	2092.0	0.0
C	0.755	273	267	5.63	2110.0	2110.0	2110.0	0.0
D	0.955	105	194	7.72	2127.5	2127.5	2127.5	0.0
E	1.455	126	206	7.28	2181.9	2181.9	2181.9	0.0
F	1.900	196	254	3.50	2215.5	2215.5	2215.5	0.0
G	2.460	164	271	2.95	2253.0	2253.0	2253.0	0.0
H	2.560	169	378	2.21	2258.8	2258.8	2258.8	0.0
SOUTH BRANCH CASANDRO WASH								
A	0.375	157	122	4.50	2245.5	2245.5	2245.5	0.0
B	0.565	105	128	3.91	2257.4	2257.4	2257.4	0.0
C	0.730	98	104	4.81	2272.1	2272.1	2272.1	0.0
HOSPITAL WASH								
A	0.290	208	201	4.47	2095.0	2095.0	2095.0	0.0
POWDER HOUSE WASH								
A	1230 [2]	43	123	15.51	2057.9	2057.9	2057.9	0.0
B	1540 [2]	80	278	6.80	2066.4	2066.4	2066.4	0.0
C	1690 [2]	70	199	9.60	2070.1	2070.1	2070.1	0.0
D	2020 [2]	88	214	8.90	2075.7	2075.7	2075.7	0.0
E	2184 [2]	98	221	8.60	2079.2	2079.2	2079.7	0.5
F	2494 [2]	50	177	10.70	2087.3	2087.3	2087.5	0.2
G	2814 [2]	85	210	9.00	2095.2	2095.2	2095.7	0.5
H	3034 [2]	70 [3]	199	9.60	2098.6	2098.6	2098.7	0.1

1. MILES ABOVE MOUTH
2. FEET ABOVE MOUTH
3. THIS WIDTH EXTENDS BEYOND THE CORPORATE LIMITS

REVISED: 3/29/83

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WICKENBURG, AZ
(MARICOPA CO.)

FLOODWAY DATA

CASANDRO WASH, SOUTH BRANCH CASANDRO WASH, HOSPITAL WASH AND POWDER HOUSE WASH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY	INCREASE (FEET)
HASSAYAMPA RIVER								
A	47.350	1367	7753	9.15	2034.1	2034.1	2034.6	0.5
B	47.790	1452	14343	4.95	2050.5	2050.5	2051.5	1.0
C	48.170	1170 [2]	8721	8.14	2057.4	2057.4	2058.4	1.0
SOLS WASH								
A	0.620	600	2910	8.25	2067.5	2067.5	2068.2	0.7
B	0.820	920	3558	6.74	2077.9	2077.9	2078.6	0.7
C	1.020	1082	3384	7.09	2086.9	2086.9	2087.9	1.0
D	1.120	808	3326	7.22	2091.1	2091.1	2092.1	1.0
E	1.219	374	1913	12.55	2096.8	2096.8	2097.1	0.3
F	1.317	650	3808	6.30	2100.7	2100.7	2101.7	1.0
G	1.412	729	2342	10.25	2104.4	2104.4	2104.4	0.0
H	1.508	1060	3307	7.26	2110.7	2110.7	2110.9	0.2
I	1.609	1043	3699	6.49	2114.8	2114.8	2114.8	0.0
FLYING "E" WASH								
A	1.800	237	676	9.62	2278.2	2278.2	2278.2	0.0
B	1.881	484	1148	5.66	2286.4	2286.4	2286.4	0.0
C	1.955	476	1243	5.23	2290.4	2290.4	2290.4	0.0
D	2.080	474	1356	4.79	2297.2	2297.2	2297.2	0.0
E	2.234	142	561	11.59	2309.6	2309.6	2309.6	0.0
F	2.434	499	943	6.89	2322.0	2322.0	2322.0	0.0

1. MILES ABOVE MOUTH

2. THIS WIDTH IS ENTIRELY OUTSIDE OF THE CORPORATE LIMITS

REVISED: 3/29/83

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WICKENBURG, AZ
(MARICOPA CO.)

FLOODWAY DATA

HASSAYAMPA RIVER, SOL'S WASH AND FLYING "E" WASH

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FIA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHFs), and flood insurance zone designations for each flooding source affecting the Town of Wickenburg.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet

Sixteen reaches meeting the above criteria were required for the flooding sources at Wickenburg. These include three on the Hassayampa River and four on Sols Wash. Casandro Wash has two reaches, and Flying "E" Wash has three. Powder House Wash and Hospital Wash each have one reach. The South Branch Casandro Wash has two reaches. The location of the reaches are shown on the Flood Profiles (Exhibit 1).

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is the FIA device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10-year and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10-year and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire incorporated area of Wickenburg was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.
Zone A2, A3, A4, A5, A6, A7, A8, A9, A11, A14, A15:	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones assigned according to FHFs.
Zone B:	Areas between A2, A3, A4, A5, A6, A7, A8, A9, A11, A14, A15, and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other flood-control structure; and areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot. Zone B is not subdivided.
Zone C:	Areas not subject to flooding by the 500-year flood, including areas that are protected from 500-year floods by dike, levee, or other water-control structure. Zone C is not subdivided.

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Town of Wickenburg is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the FIA.

FLOODING SOURCE	PANEL [1]	ELEVATION DIFFERENCE [2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD) [3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
HASSAYAMPA RIVER							
Reach 1	0002C	-3.98	-1.45	+3.98	040	A8	Varies - See Map
Reach 2	0002C	-6.98	-3.04	+9.06	070	A14	Varies - See Map
Reach 3	0002C	-3.59	-1.35	+6.24	035	A7	Varies - See Map
SOLS WASH							
Reach 1	0002C	-3.87	-0.77	+3.87	040	A8	Varies - See Map
Reach 2	0002C	-7.43	-2.78	+5.20	075	A15	Varies - See Map
Reach 3	0002C	-4.16	-0.92	+4.12	040	A8	Varies - See Map
Reach 4	0001C & 0002C	-3.20	-0.70	+2.40	030	A6	Varies - See Map
CASANDRO WASH							
Reach 1	0001C & 0002C	-1.41	-0.42	+1.26	015	A3	Varies - See Map
Reach 2	0001C	-2.90	-0.80	+1.48	030	A6	Varies - See Map
FLYING "E" WASH							
Reach 1	0001C	-4.30	-1.40	+2.20	045	A9	Varies - See Map
Reach 2	0001C	-5.30	-1.70	+6.50	055	A11	Varies - See Map
Reach 3	0001C	-2.40	-0.70	+2.50	025	A5	Varies - See Map

[1] FLOOD INSURANCE RATE MAP PANEL

[2] WEIGHTED AVERAGE

[3] ROUNDED TO NEAREST FOOT

REVISED: 3/29/83

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WICKENBURG, AZ
(MARICOPA CO.)

FLOOD INSURANCE ZONE DATA

HASSAYAMPA RIVER, SOL'S WASH, CASANDRO WASH AND FLYING "E" WASH

FLOODING SOURCE	PANEL [1]	ELEVATION DIFFERENCE [2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD) [3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
SOUTH BRANCH CASANDRO WASH							
Reach 1	0001C	-1.98	-1.02	+1.60	020	A4	Varies - See Map
Reach 2	0001C	-1.52	-0.55	+1.00	015	A3	Varies - See Map
HOSPITAL WASH							
Reach 1	0002C	-0.82	-0.35	+0.80	010	A2	Varies - See Map
POWDER HOUSE WASH							
Reach 1	0002C	-1.90	-0.60	+1.60	020	A4	Varies - See Map

[1] FLOOD INSURANCE RATE MAP PANEL [2] WEIGHTED AVERAGE [3] ROUNDED TO NEAREST FOOT

REVISED: 3/29/83

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WICKENBURG, AZ
(MARICOPA CO.)

FLOOD INSURANCE ZONE DATA

SOUTH BRANCH CASANDRO WASH, HOSPITAL WASH AND POWDER HOUSE WASH

6.0 OTHER STUDIES

The 100-year flood data presented in this report agrees with the results and the profiles of two Flood Plain Information Reports (References 7 and 8) prepared by the COE. Also, the "Watershed Work Plan of Wickenburg," prepared by the SCS, was used to locate the sites of new dams on Sunset Wash and Sunny Cove Wash (Reference 12).

The SCS used the TR-20 computer program with small sub-areas for computing the 100-year discharge of 14,400 cfs on Sols Wash. However, the COE used the Indian Bend Wash rainfall-runoff relationships to compute the 100-year discharge of 24,000 cfs. Both agencies agreed that the 24,000 cfs should be utilized.

This study is authoritative for purposes of the Flood Insurance Program, and the data presented herein either supersede or are compatible with previous determinations.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study are on file for five (5) years (through June, 1981) at the Office of the U.S. Army Corps of Engineers, Los Angeles District, Los Angeles, California.

8.0 BIBLIOGRAPHY AND REFERENCES

1. U.S. Department of Commerce, Bureau of the Census, 1970 Census of Inhabitants of Arizona, Washington: Government Printing Office, Washington, D.C., 1971.

2. State of Arizona, Department of Economic Planning and Development, "Special Census Estimate," 1975.

3. Patterson, James L., and Somers, William P., "Magnitude and Frequencies of Floods in the United States, Part 9, Colorado River Basin, U.S. Geological Survey Water-Supply Paper 1683."

4. U.S. National Weather Service, "Precipitation-Frequency Atlas of the Western United States, Volume VIII - Arizona," 1973.

5. U.S. Army Corps of Engineers, "Design Memorandum No. 1, General Design Memorandum - Phase 1, Plan Formulation for Indian Bend Wash," October, 1973.

6. U.S. Army Corps of Engineers, "New River and Phoenix City Streams, Arizona, Design Memorandum No. 2, Hydrology, Part 1," October, 1974.

7. U.S. Army Corps of Engineers, "Flood Plain Information Report, Hassayampa River Vicinity of Wickenburg, Maricopa County, Arizona," April, 1972.

8. U.S. Army Corps of Engineers, "Flood Information Study for Maricopa County, Arizona, Volume IV Wickenburg Report," December, 1965.

9. U.S. Army Corps of Engineers, "Topographic Map for Area South of the U.S. Highway 60 and West of Country Club Drive," scale 1"=500', contour interval 4 feet, 1976.

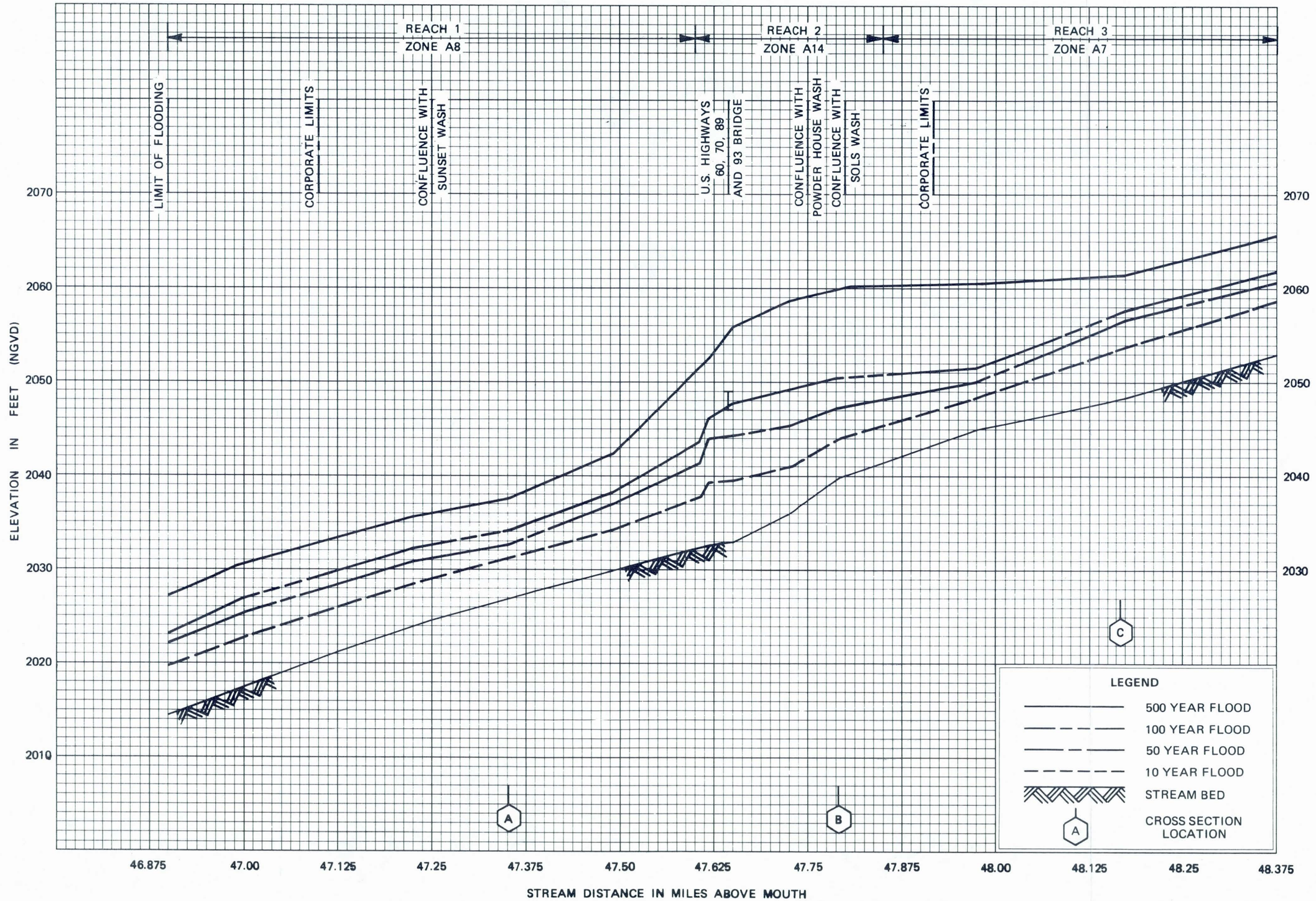
10. Chow, V. T., Open-Channel Hydraulics, New York: McGraw-Hill Book Company, 1959.

11. U.S. Army Corps of Engineers, HEC-2 Water-Surface Profiles - Computer Program 723-X6-L202A, Davis, California: Hydrologic Engineering Center, October, 1973.

12. U.S. Soil Conservation Service, "Watershed Work Plan, Wickenburg, Maricopa and Yavapai Counties, Arizona," December, 1974.

U.S. Army Corps of Engineers, "Hydrology for Flood Plain Information Studies, Hassayampa River, Maricopa-Yavapai Counties, Arizona," December 14, 1971.

REVISED: 3/29/83



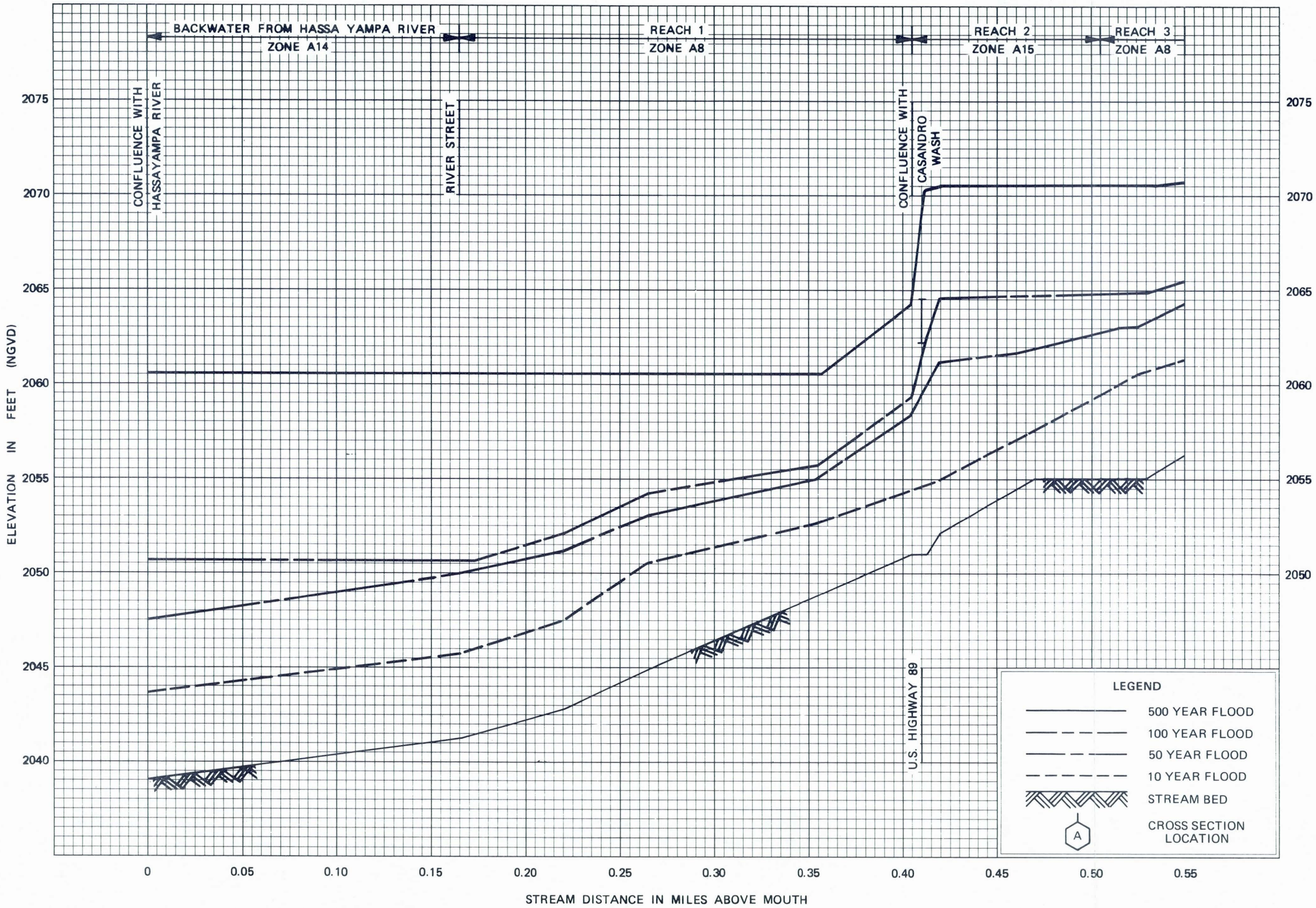
FLOOD PROFILES

HASSAYAMPA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WICKENBURG, AZ
(MARICOPA CO.)

01P



FLOOD PROFILES

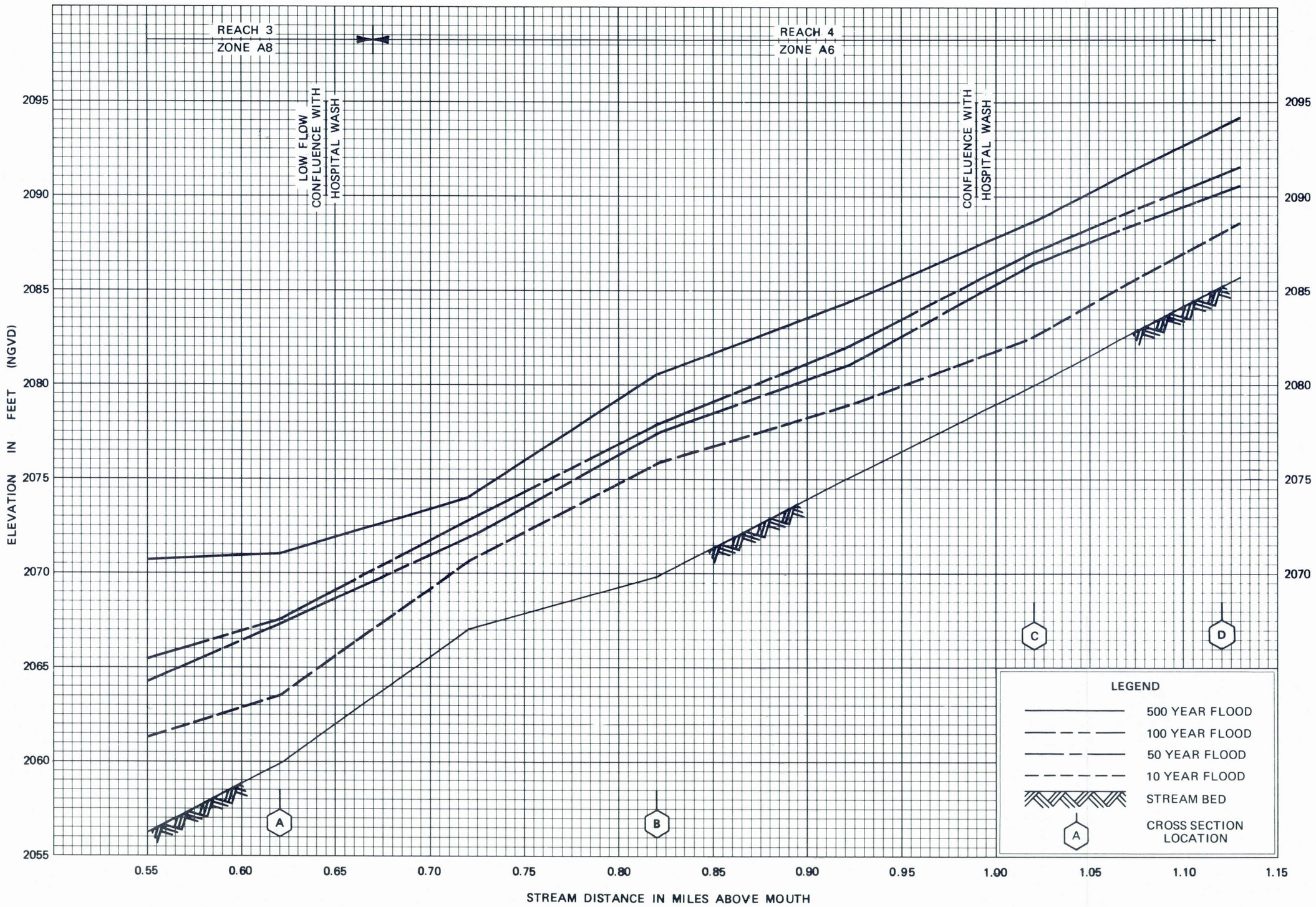
SOLS WASH

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WICKENBURG, AZ

(MARICOPA CO.)

02P



REVISED: 3/29/83

FLOOD PROFILES

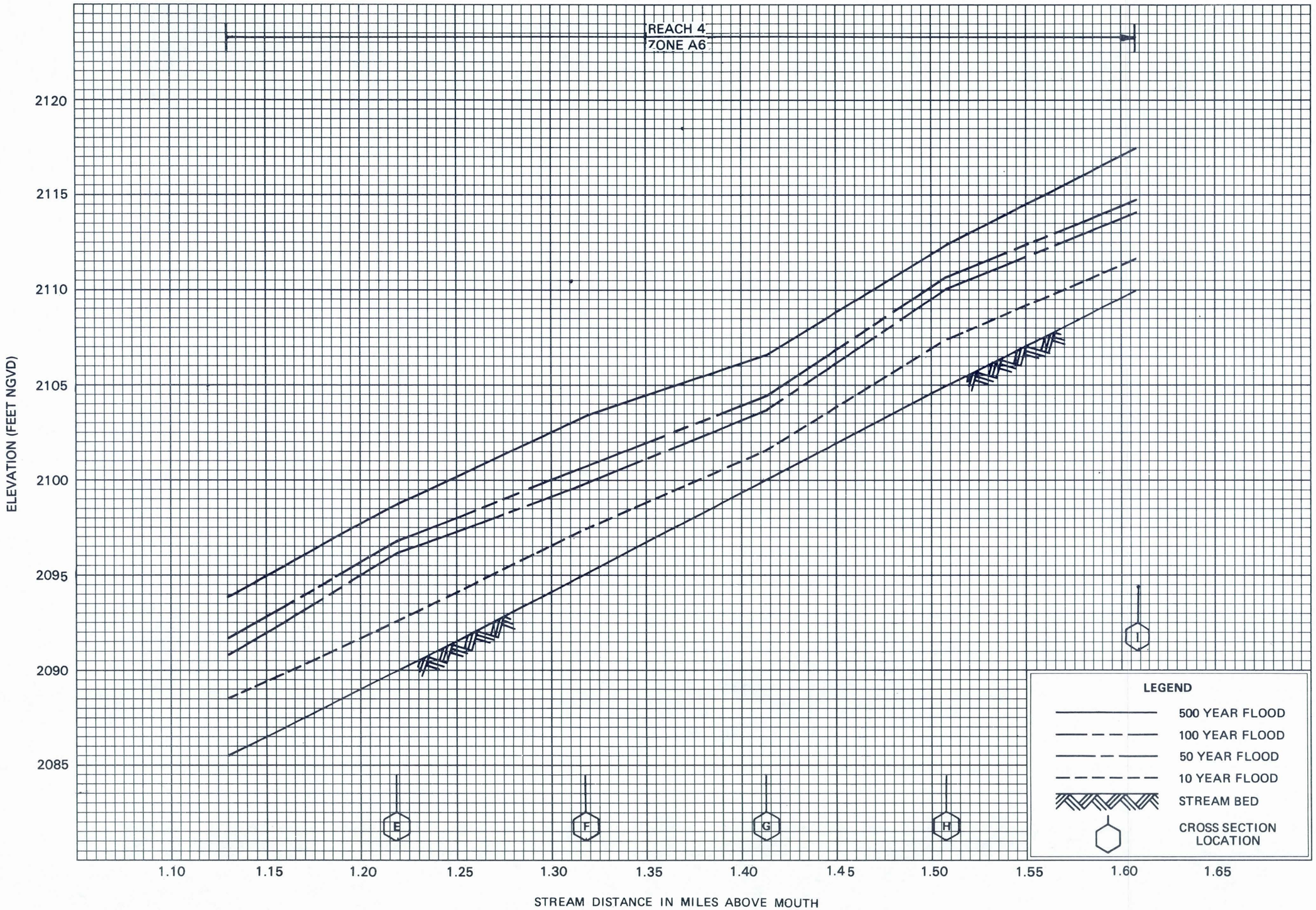
SOLS WASH

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WICKENBURG, AZ

(MARICOPA CO.)

03P



REVISED: 3/29/83

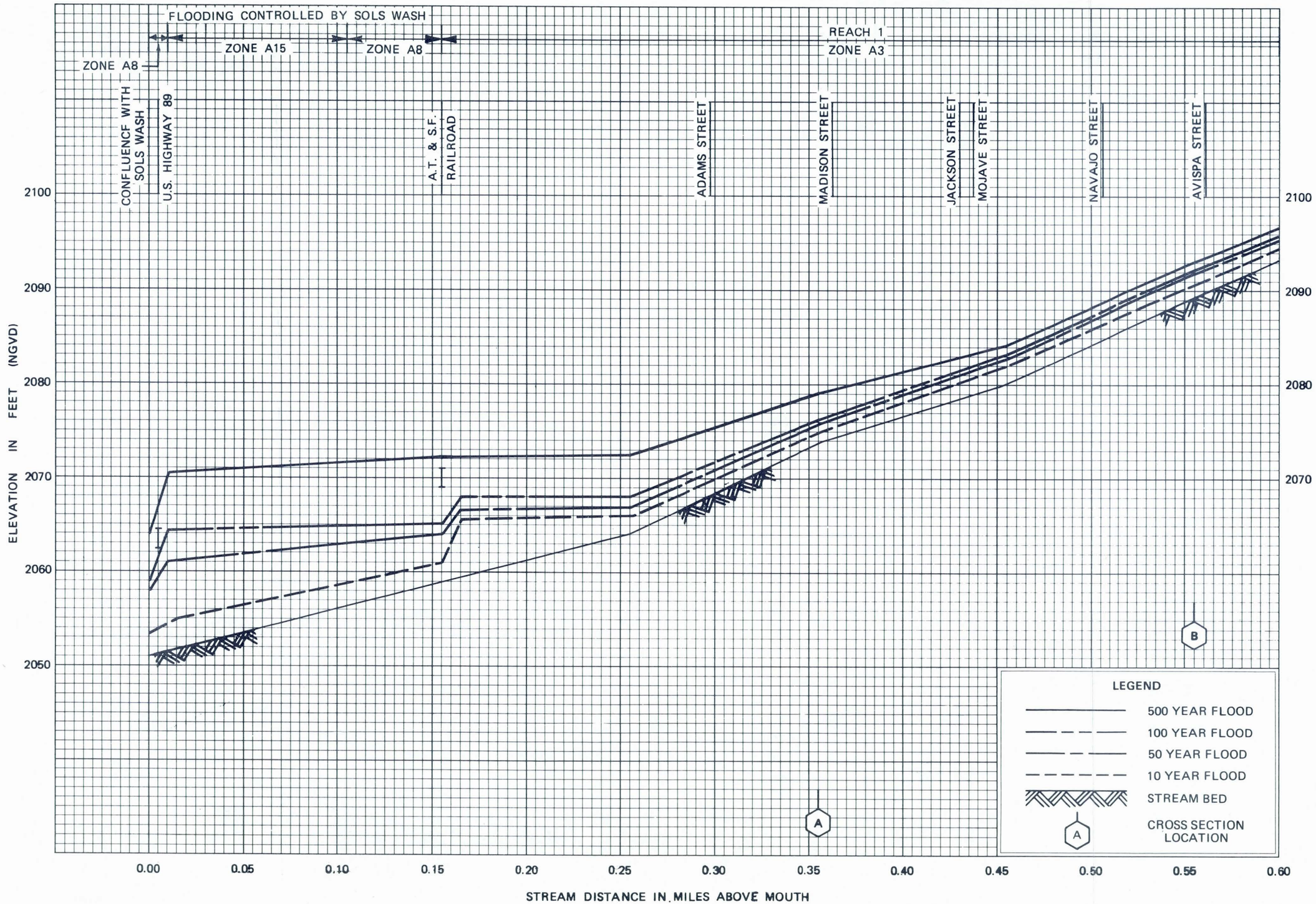
FLOOD PROFILES

SOL'S WASH

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WICKENBURG, AZ
(MARICOPA CO.)

04P



FLOOD PROFILES

CASANDRO WASH

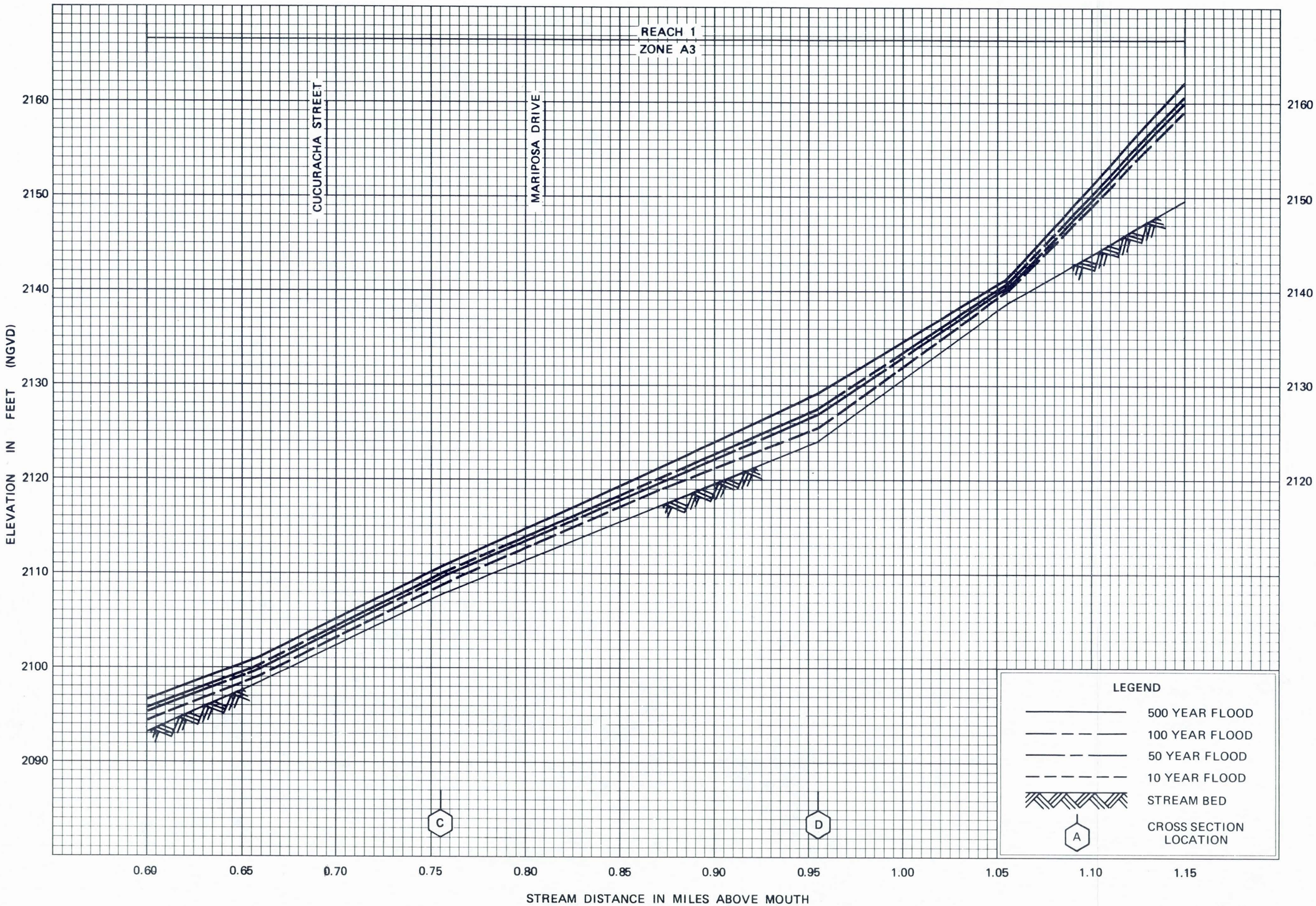
FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WICKENBURG, AZ

(MARICOPA CO.)

REVISED: 3/29/83

05P



REVISED: 3/29/83

FLOOD PROFILES

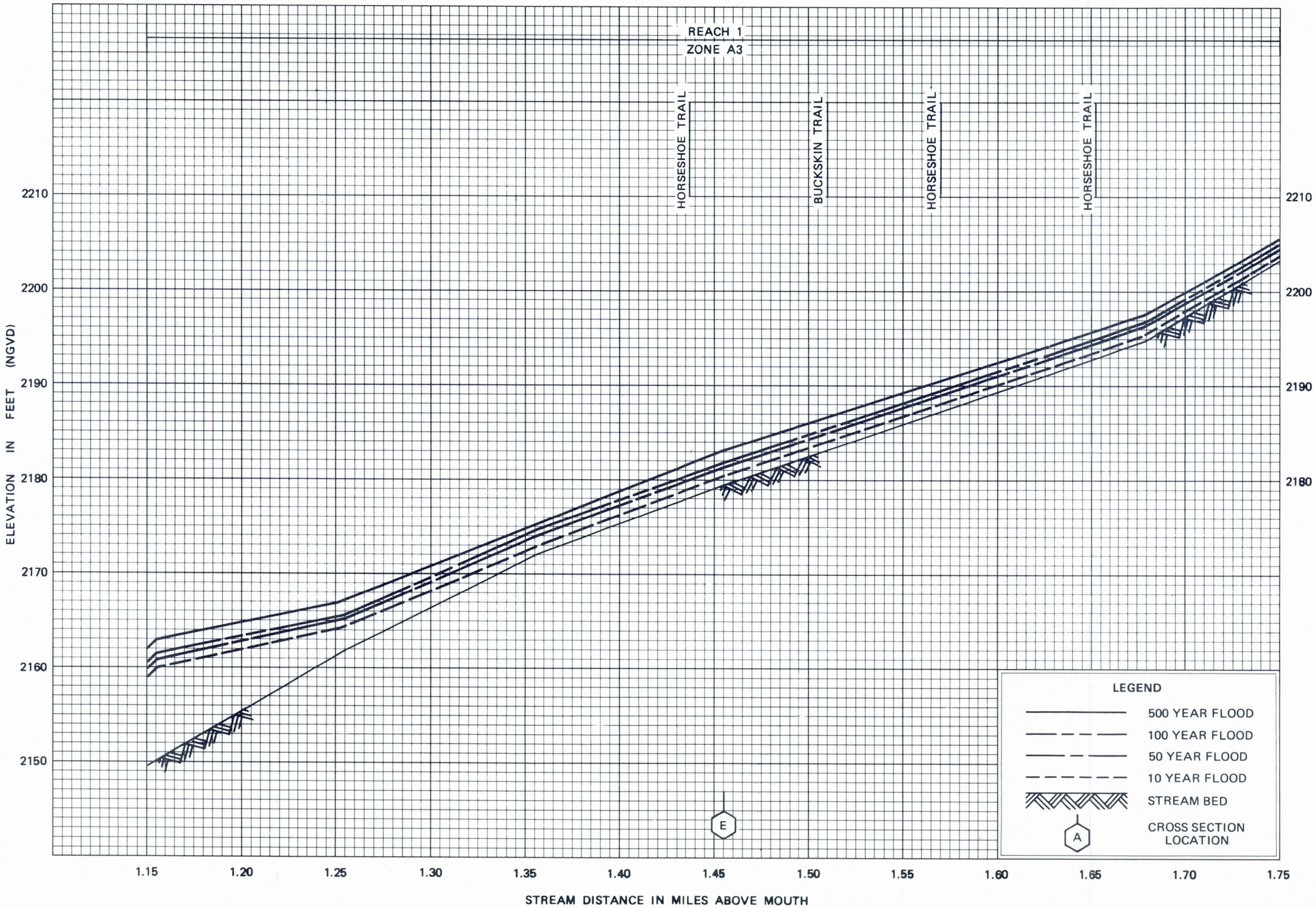
CASANDRO WASH

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WICKENBURG, AZ

(MARICOPA CO.)

06P



REVISED: 3/29/83

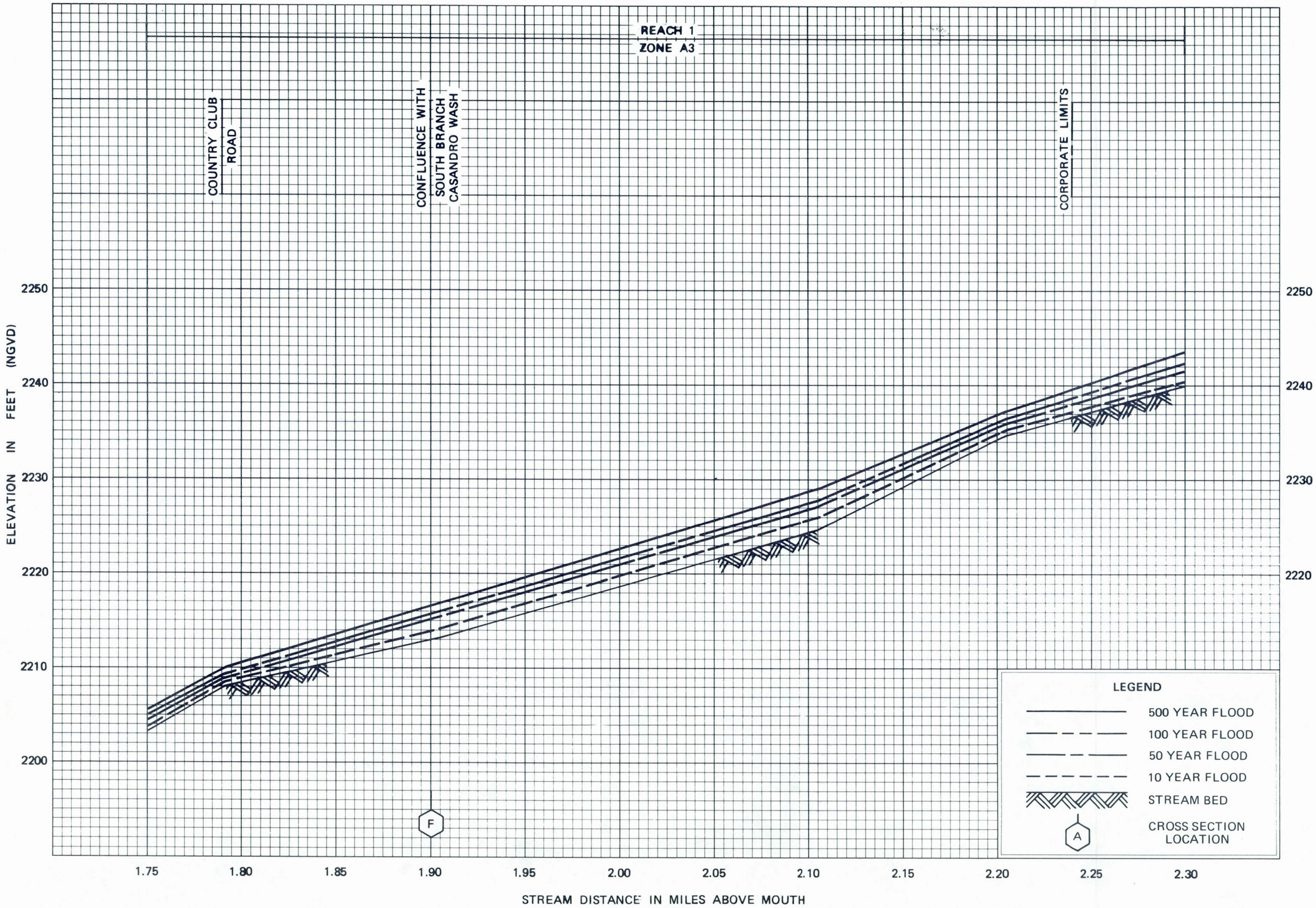
FLOOD PROFILES

CASANDRO WASH

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WICKENBURG, AZ
(MARICOPA CO.)

07P



REVISED: 3/29/83

FLOOD PROFILES

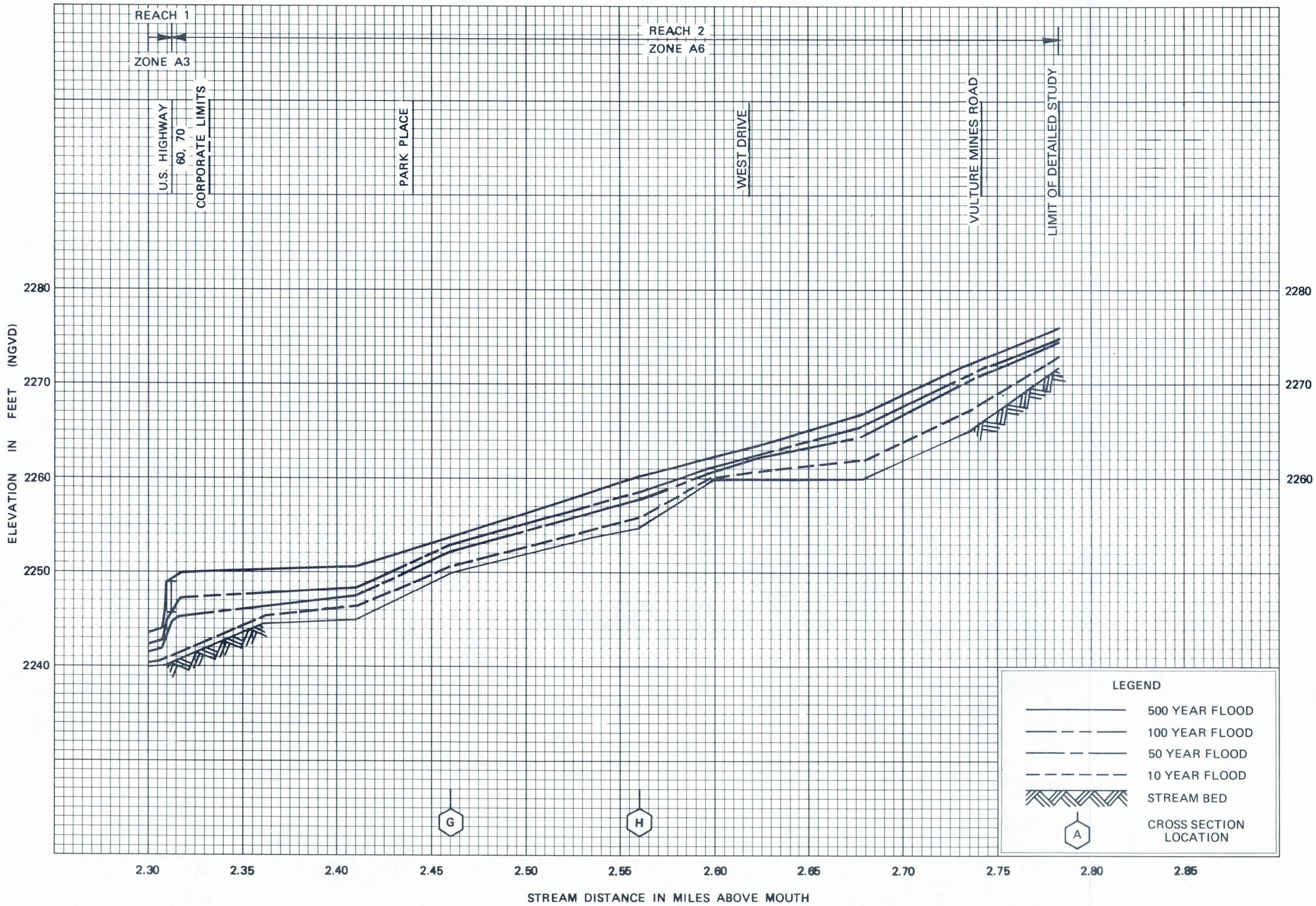
CASANDRO WASH

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WICKENBURG, AZ

(MARICOPA CO.)

08P



REVISED: 3/29/83

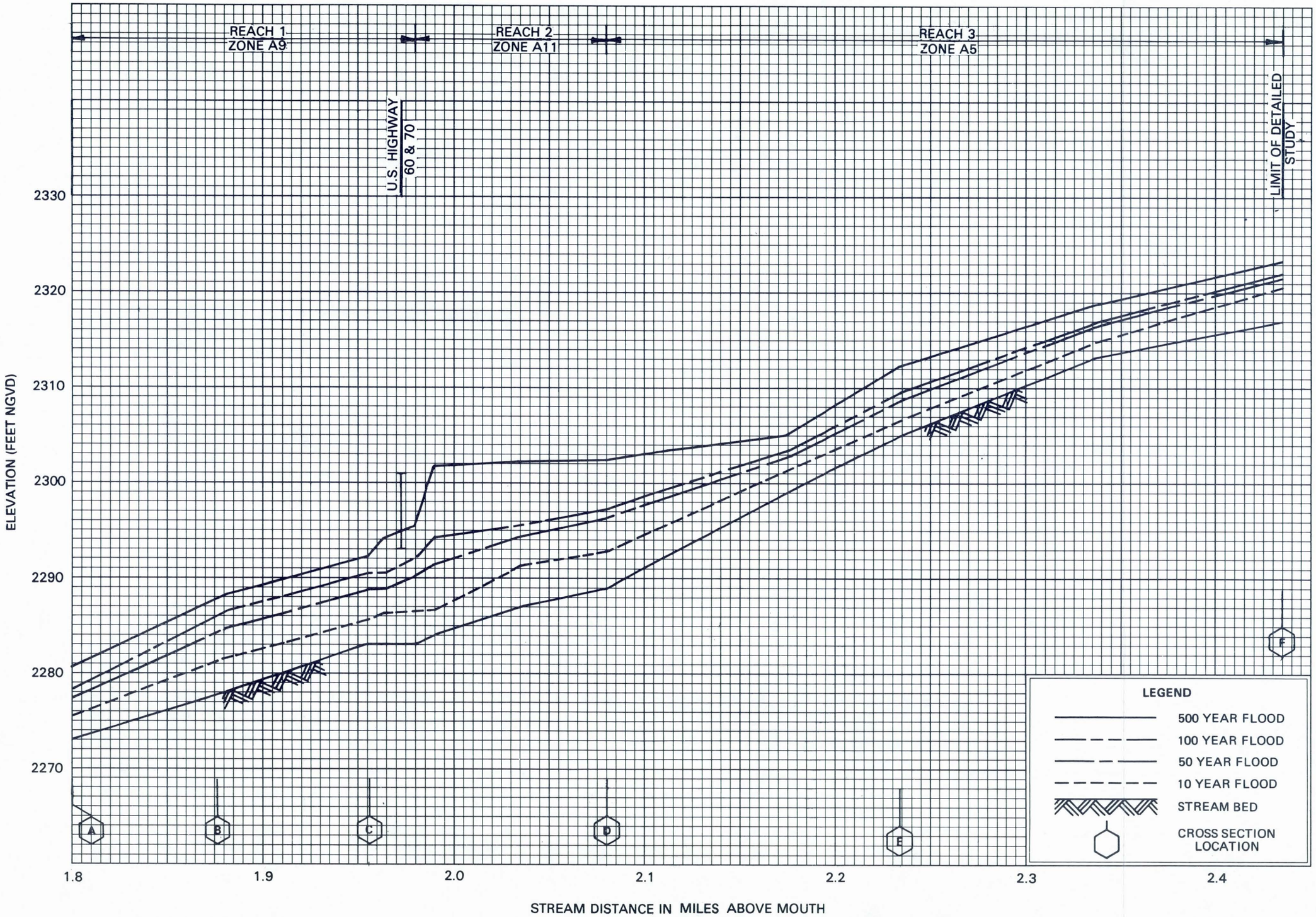
FLOOD PROFILES

CASANDRO WASH

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WICKENBURG, AZ
(MARICOPA CO.)

09P



REVISED: 3/29/83

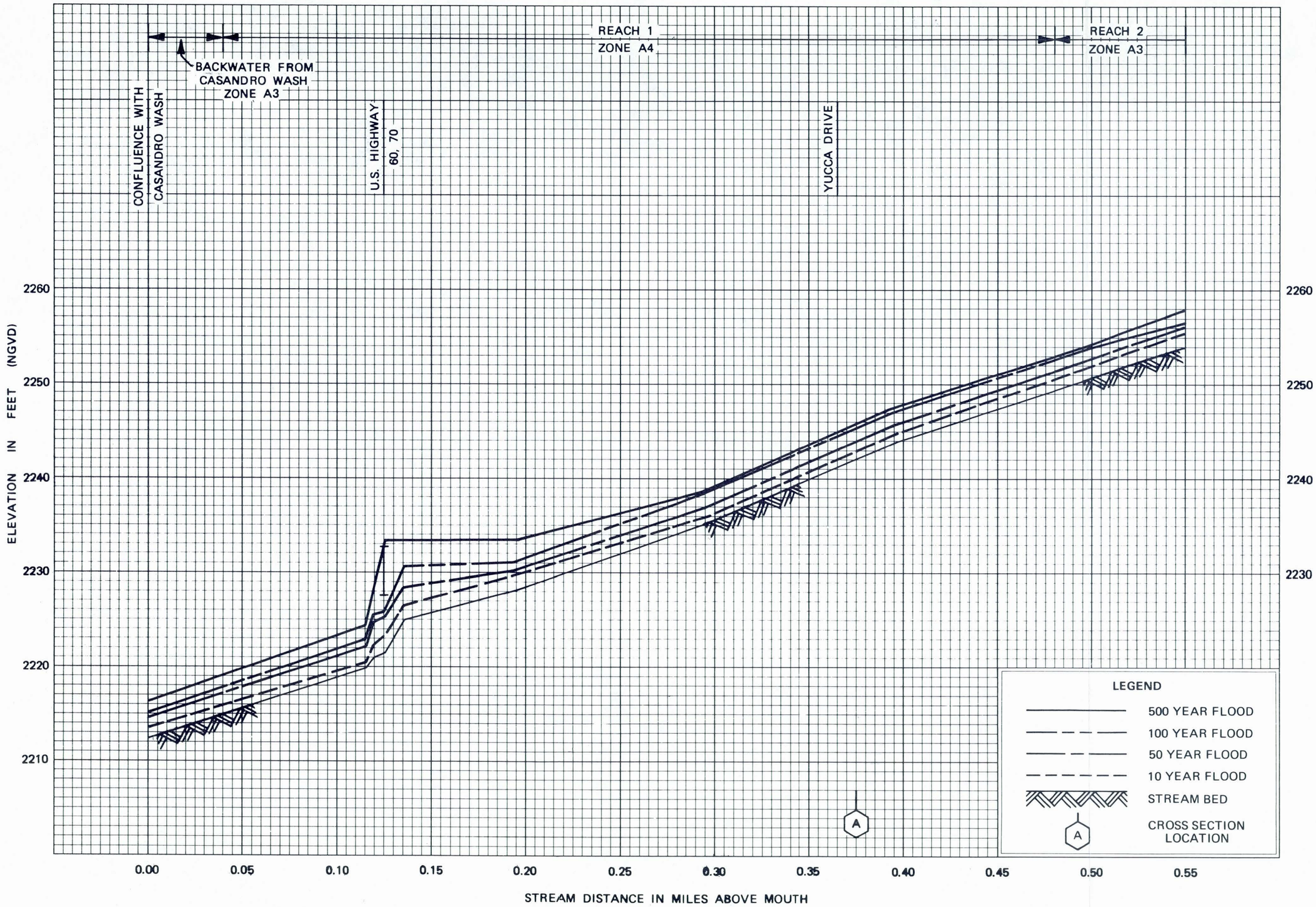
FLOOD PROFILES

FLYING "E" WASH

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WICKENBURG, AZ
(MARICOPA CO.)

10P



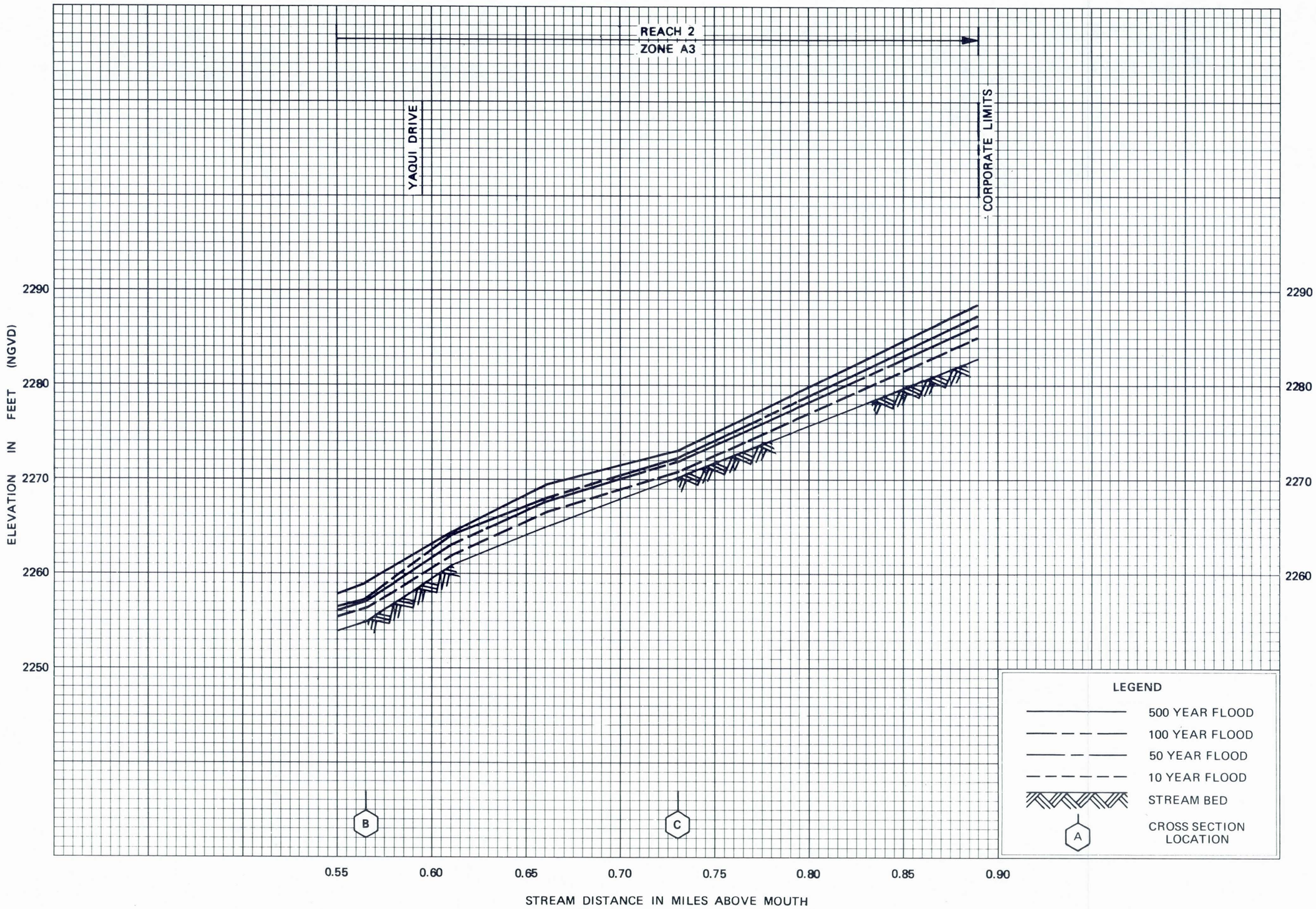
FLOOD PROFILES

SOUTH BRANCH CASANDRO WASH

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WICKENBURG, AZ

(MARICOPA CO.)



FLOOD PROFILES

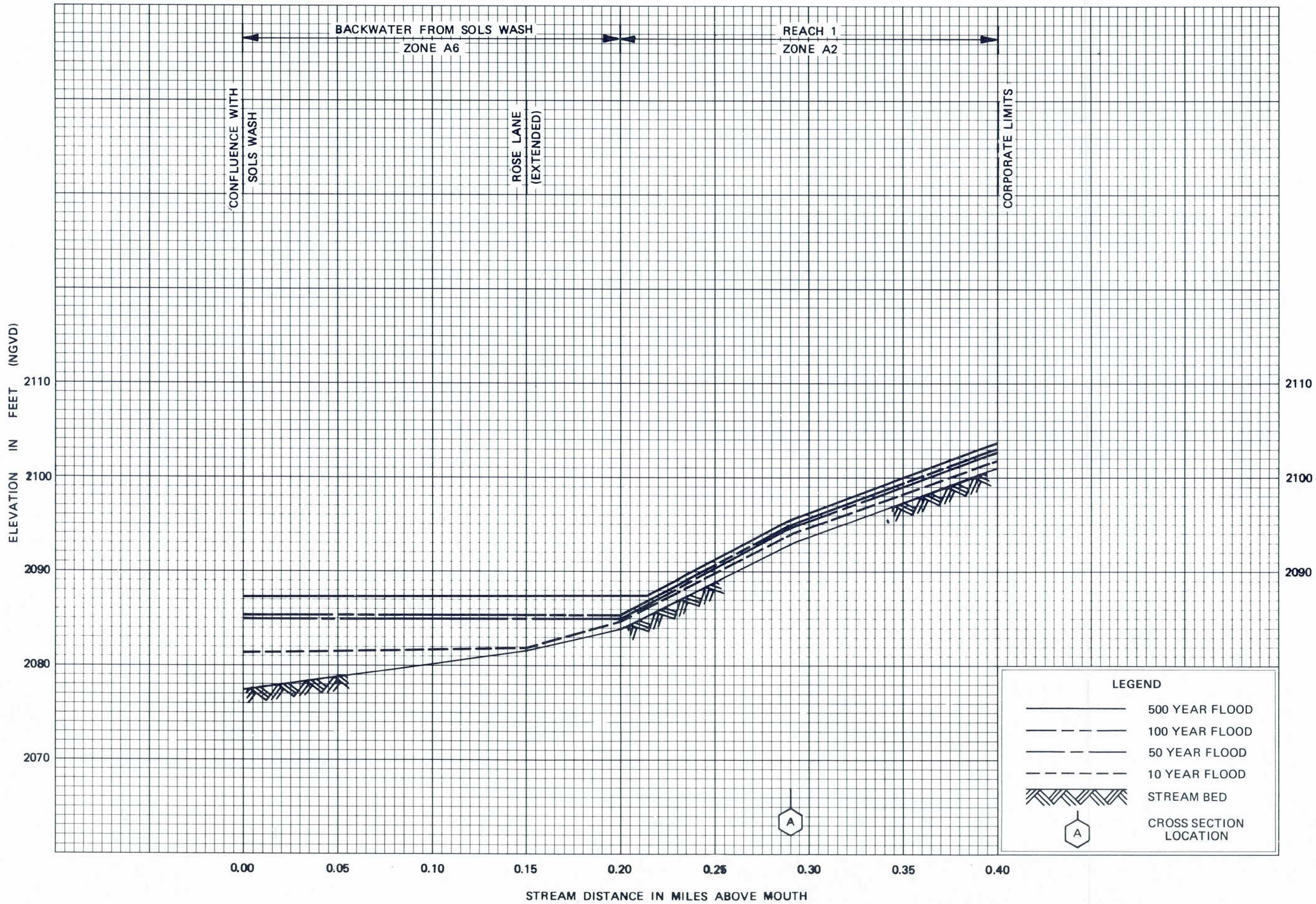
SOUTH BRANCH CASANDRO WASH

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WICKENBURG, AZ

(MARICOPA CO.)

12P



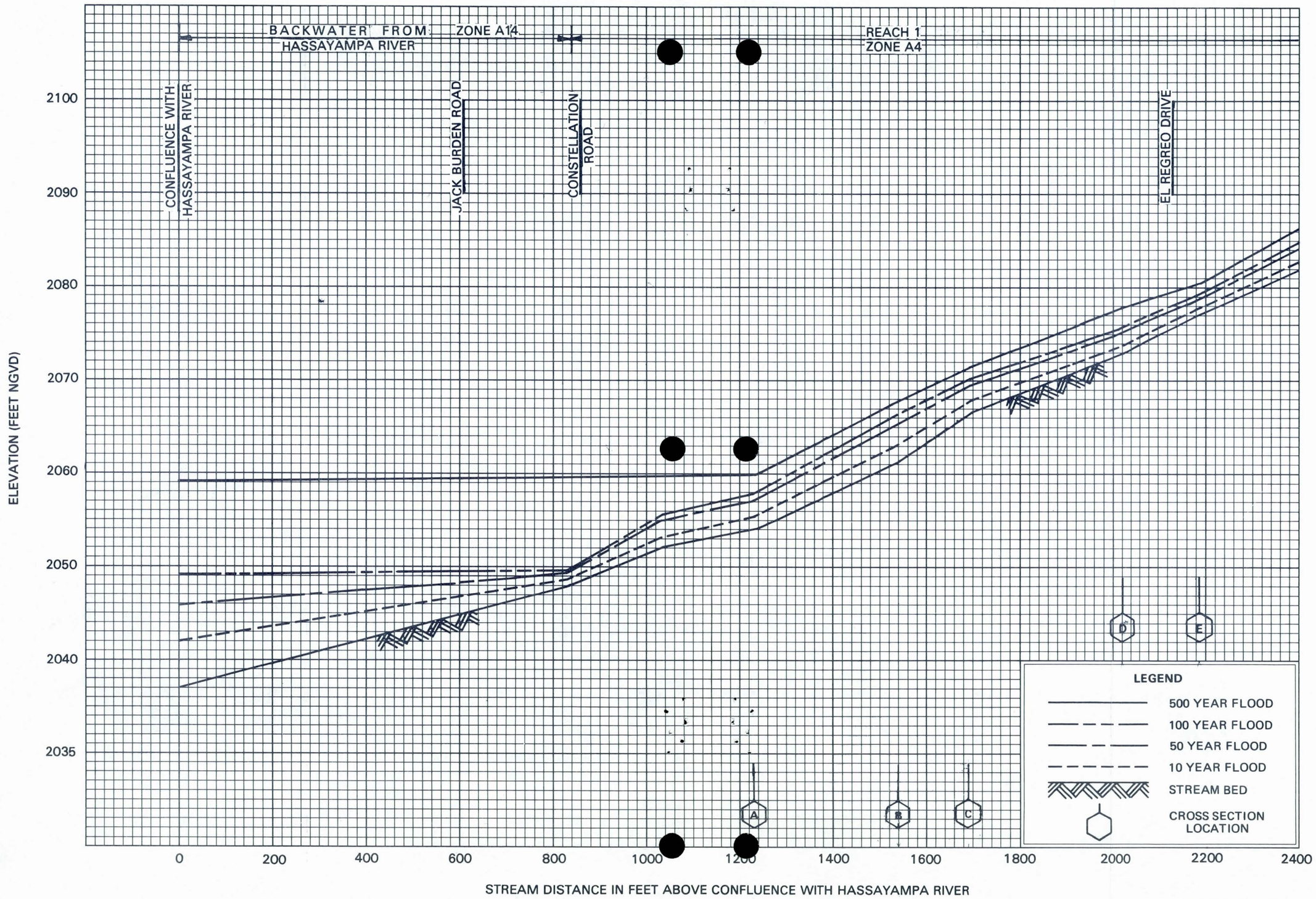
FLOOD PROFILES

HOSPITAL WASH

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WICKENBURG, AZ

(MARICOPA CO.)



REVISED: 3/29/83

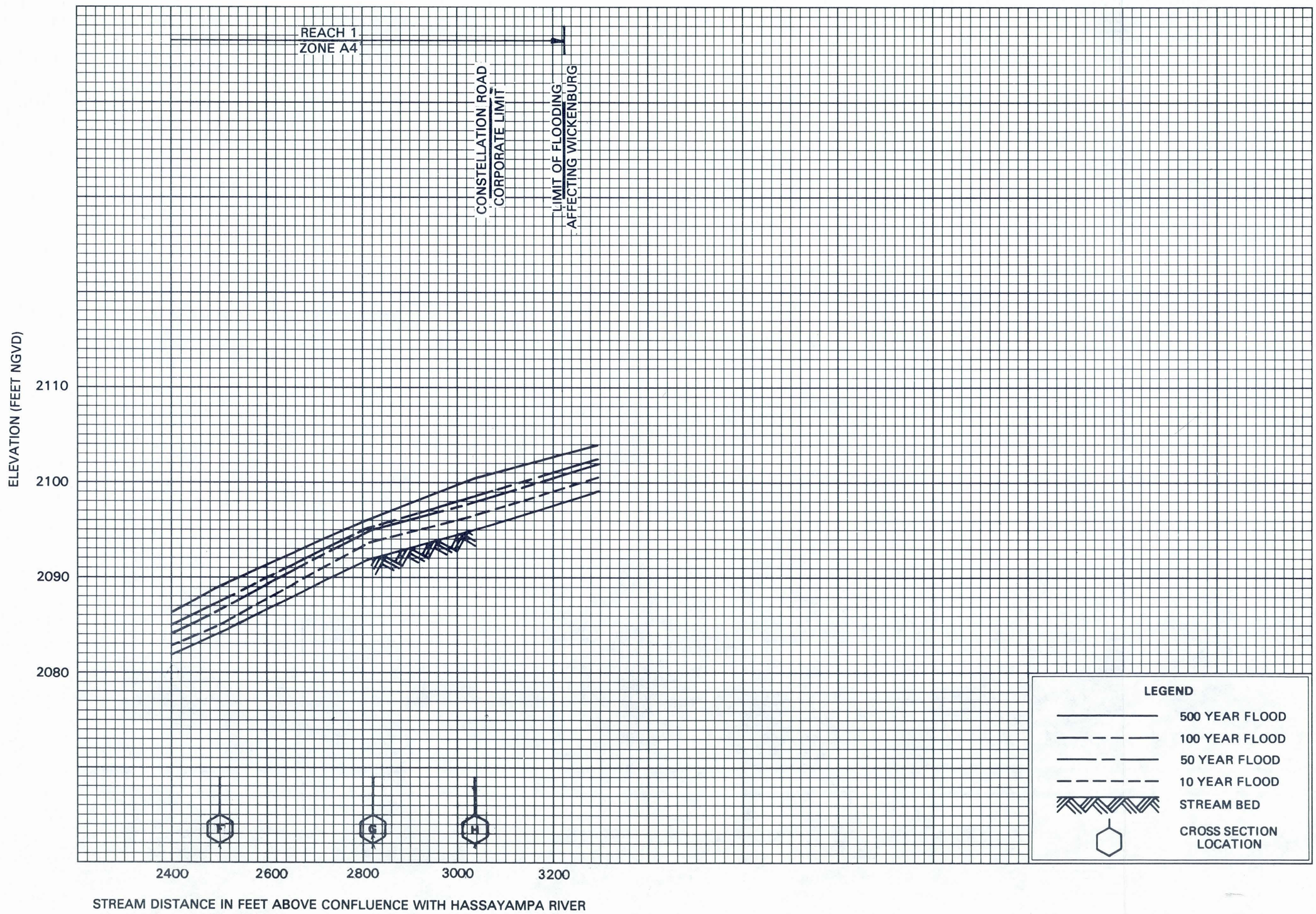
FLOOD PROFILES

POWER HOUSE WASH

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WICKENBURG, AZ
(MARICOPA CO.)

14P



REVISED: 3/29/83

FLOOD PROFILES

POWDER HOUSE WASH

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WICKENBURG, AZ
(MARICOPA CO.)