L. 209

FLOOD PLAIN INFORMATION

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AGUA FRIA RIVER

MARICOPA COUNTY
ARIZONA

PREPARED FOR
THE COUNTY OF MARICOPA
BY
CORPS OF ENGINEERS, U. S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA
MARCH 1968

PLATES

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INTRODUCTION

This report relates to the flood situation along the reach of the Agua Fria River extending about 23 miles from the diversion dam, just below Waddell Dam, to Camelback Road, near Litchfield Park, Maricopa County, Ariz. It was prepared at the request of the Flood Control District of Maricopa County to aid in the solution of local flood problems and in the best utilization of land subject to overflow. The report is based upon information on rainfall, runoff, historical and estimated flood heights, and technical data bearing upon the occurrence and size of floods in the report area.

The report covers two significant phases of the Agua Fria River flood problem. It first brings together a record of the largest known floods of the past. Secondly, it treats of probable future floods: namely, Intermediate Regional Floods and Standard Project Floods. Intermediate Regional Floods are floods that have an average frequency of occurrence in the order of once in 100 years and are determined from an analysis of known floods on other streams that have similar physical characteristics and are in the same general geographical region. Standard Project Floods are floods of rare occurrence and, on most streams, are considerably larger than any floods that have occurred in the past. However, such floods should be considered in planning for use of the flood plain.

In problems concerned with the control of development in the flood plain of Agua Fria River and in reaching decisions on the size of floods to consider for this purpose, appropriate consideration should be given to the possible future occurrence of floods of the size of those that have occurred in the past, the Intermediate Regional Flood, and the Standard Project Flood.

The report contains maps, profiles, and cross sections, which indicate the extent of flooding that might occur in the future along the Agua Fria River. This report should prove helpful in planning the best use of the flood plain. From the maps, profiles, and cross sections, the depth of probable flooding upon occurrence of the Intermediate Regional or Standard Project Floods at any location may be learned. With this information, building plans could provide for floor levels high enough to avoid flood damage or, if not, such planning should recognize the chance and hazards of flooding that are being taken.

This report does not include plans for the solution of flood problems. Rather, it is intended to provide the basis for further study and planning on the part of the Flood Control District of Maricopa County in arriving at solutions to minimize vulnerability to flood damages and to protect the public health and safety. This study and planning might involve local programs to guide development by controlling the type of use made of the flood plain through zoning and subdivision regulations, the construction of flood-protection works, or a combination of the two approaches.

The Los Angeles District of the Corps of Engineers will, upon request, provide technical assistance to Federal, State, and local agencies in the interpretation and use of the information contained herein and will provide other available flood data related thereto.

SUMMARY OF FLOOD SITUATION

The 23-mile reach of Agua Fria River, in Maricopa County, that is the basis of this report is located northwestward and westward of Phoenix, extending from a point about 800 feet downstream from the diversion dam, just below Waddell Dam, to Camelback Road. (See pl. 1.)

The principal development on the Agua Fria River flood plain results from agricultural activities. Parts of the agricultural land have been inundated by floods of the past, and a substantially greater area is within reach of potentially greater floods in the future.

Two staff gages at Waddell Dam are the only gages in the vicinity of the study area. Newspaper reports and historical documents have been searched for information concerning past floods. From these investigations and from studies of possible future floods on Agua Fria River, the limits of the flood plain have been developed. The following paragraphs summarize the significant findings, which are discussed in more detail in succeeding sections of the report.

* * *

THE GREATEST FLOODS known to have occurred on the Agua Fria River during the past 100 years or more occurred in January 1916 and in November 1919. Each is estimated to have had a discharge of 105,000 cubic feet per second. Records of discharges prior to the completion of construction of Waddell Dam in 1927 cannot be used as a basis for indicating conditions that have prevailed since that date.

* * *

OTHER FLOODS have occurred on Agua Fria River since 1889. The records indicate five floods with discharges ranging from 50,000

to 80,000 cubic feet per second, four floods with discharges ranging from 30,000 to 50,000 cubic feet per second, and three floods with discharges ranging from 10,000 to 30,000 cubic feet per second. During the period since 1889, 11 additional floods, without substantial evidence of size, were reported.

* * *

INTERMEDIATE REGIONAL FLOOD determinations on Agua Fria River indicate that the Intermediate Regional Flood for Agua Fria River would create depths of flow of as much as 8 feet on the flood plain.

* * *

STANDARD PROJECT FLOOD determinations indicate that floods having depths about 2 feet greater than the Intermediate Regional Flood could occur on Agua Fria River.

* * *

FLOOD DAMAGES that would result from recurrences of major known floods would be substantial. Extensive damages would be caused by the Intermediate Regional Floods and Standard Project Floods because of their wider extent, greater depth, and higher velocities.

* * *

MAIN FLOOD SEASONS for the Agua Fria River basin are in winter and in summer. Winter storms usually occur during December through March. They originate over the Pacific Ocean as a result of the interaction between cool polar Pacific and warm tropical Pacific air masses and move eastward over the area. These storms often last for several days and are accompanied by widespread rainfall.

Summer storms, which usually occur during July through September, are associated with the influx of moist tropical air originating over the Gulf of Mexico or the South Pacific Ocean. These storms are often accompanied by relatively heavy precipitation over large areas for periods up to 24 hours, with light showers continuing for as long as 3 days.

Local thunderstorms may occur at any time of the year, during general storms or as isolated phenomena. These thunderstorms are most common from July through September, cover relatively small areas, and result in high-intensity precipitation for durations of 3 hours or less.

* * *

VELOCITY OF WATER in the channel during future Standard Project Floods would range from about 4.5 feet per second to about 15 feet per second. The corresponding figures on the flood plain would be about 1.5 feet per second and 8.9 feet per second. Channel velocity during future Intermediate Regional Floods would range from about 3.5 feet per second to about 13.5 feet per second. The corresponding figures on the flood plain would be about 1.5 feet per second and 8 feet per second. Velocities greater than 5 feet per second combined with depths of 3 feet or greater are generally considered hazardous.

* * *

DURATION OF FLOODS depends upon the type of storms that occurs. Stages can rise from streambed to extreme flood peaks in less than 8 hours following an intense local thunderstorm. Flood stages may take as long as 36 hours to reach their peak when winter or summer storms occur.

* * *

HAZARDOUS CONDITIONS would occur during large floods as a result of the rapidly rising stream, high velocity, and deep flows.

* * *

NO AUTHORIZED, PROPOSED, OR CONSTRUCTED FEDERAL FLOOD CONTROL OR RELATED STRUCTURES are in the study reach, except for an authorized project in the area where the New River joins the Agua Fria River (H. Doc. 216, 89th Cong., 1st sess.).

* * *

FUTURE FLOOD HEIGHTS that would be reached if the Intermediate Regional and Standard Project Floods occurred on the Agua Fria River flood plain are shown in table 1. The table gives the depth of flow at concentration points in the study reach.

* * *

TABLE 1

FLOOD DEPTHS AND DISCHARGES

Flood	Location	Mile above mouth	Estimated peak discharge* cfs	Depth of flow feet
	Upper Limits of Study	33.15		
Intermediate Regional			59,000	9.5
Standard Project			65,000	10.5
	.34 mile southwest of ¼ corner of section 28-29, Township 6 N	32.73		
Intermediate Regional			59,000	10.1
Standard Project			75,000	11.7
	West of section corner 4-5-8-9, Township 5 N	30.45		
Intermediate Regional			59,000	13.8
Standard Project			90,000	16.6
	.75 mile north of ¼ corner of section 7-8, Township 4 N	24.02		
Intermediate Regional			59,000	6.8
Standard Project			110,000	7.8
	Section corner 1-6-7-12 Township 3 N	17.95		
Intermediate Regional			73,000	8.2
Standard Project			140,000	11.0
	.32 mile north of section corner 19-24-25-30, Township 3 N	15.30		
Intermediate Regional			77,000	8.5
Standard Project			150,000	10.3
	Camelback Road	10.00		
Intermediate Regional			95,000	7.0
Standard Project			190,000	8.4

* These figures reflect a reduction in flood peak discharges by regulation at Waddell Dam.

GENERAL CONDITIONS AND PAST FLOODS

This section of the report is a history of floods along a 23-mile reach of the Agua Fria River in Maricopa County, Ariz. extending from a point about 800 feet downstream from the diversion dam, just below Waddell Dam, to Camelback Road, near Litchfield Park, Ariz. The Agua Fria River drains an area of 2,340 square miles, most of which is in Yavapai County, Ariz.

Natural vegetation in the study area is sparce. Cactus, creosote bush, sagebrush, and palo verde are the dominant desert plants. Irrigation canals and wells that serve much of the drainage area deliver sufficient water to permit productive farmland and landscaped residential tracts.

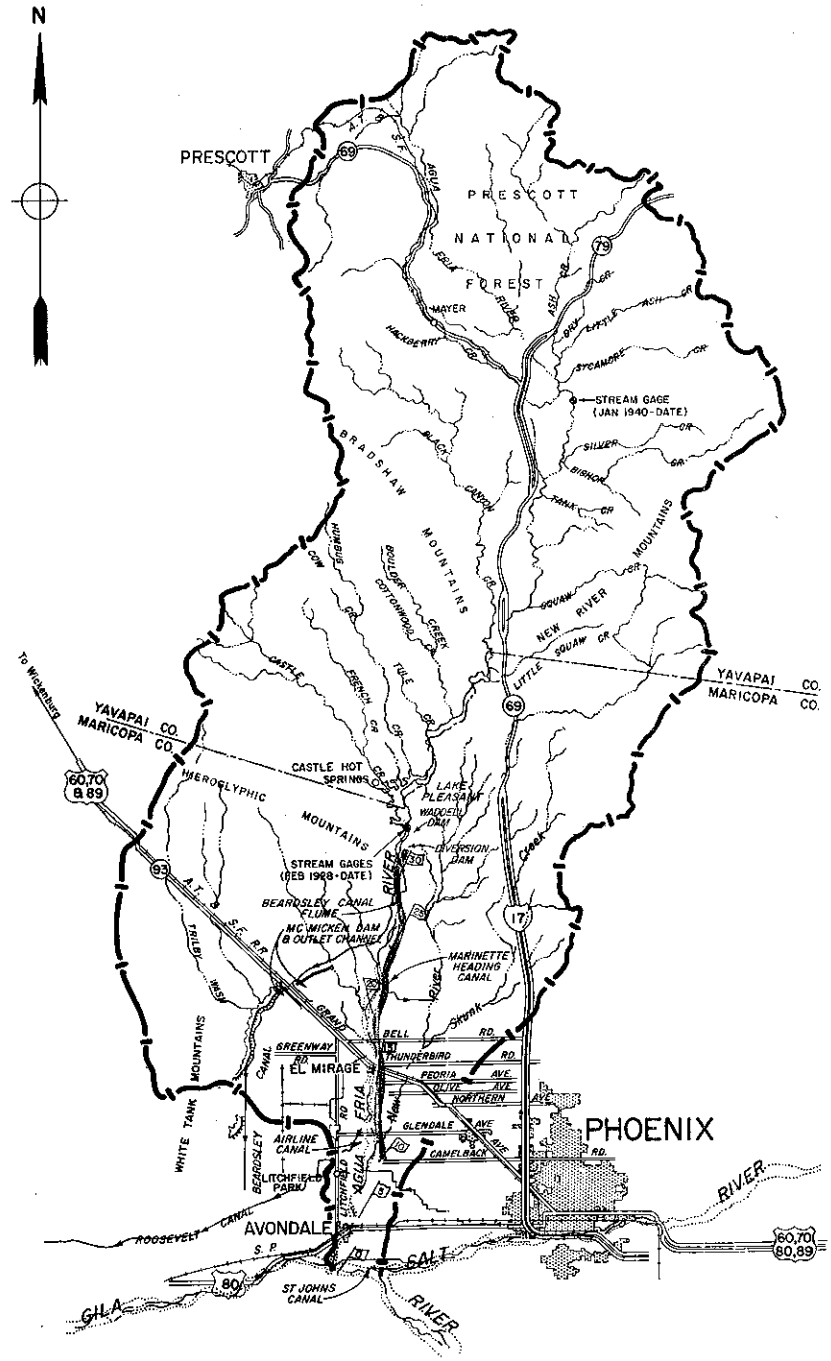
Most of the existing residential, commercial, and industrial properties are on high ground adjacent to the flood plain. However, some structures are in the flood plain downstream from the Beardsley Canal flume.

Intermittent records of river stage and discharge were collected from 1910 to 1928 at the Frog Tanks gage (now Waddell Dam). Records have been collected and maintained by the U.S. Geological Survey since 1928 in cooperation with Maricopa County Municipal Water Conservation District No. 1.

Newspaper files, historical documents, and gage records were researched and field investigations were made to develop a history of floods that are known to have occurred on the Agua Fria River. The history of the area can only be traced for the past 78 years.

Settlement

Arizona, the nation's third youngest state, was organized as a territory in 1863 and joined the Union in 1912. Maricopa County was formed on February 12, 1871. The county's early history



REACH COVERED BY THIS REPORT

5 MILES ABOVE MOUTH OF RIVER

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

AGUA FRIA RIVER WATERSHED

SCALE 5 0 5 10 15 20 MILES

MARCH 1968

PLATE I

was typical of the beginnings of other western areas. The hardships involved in settling a new state were not enough to discourage a people in a consuming struggle for self-preservation.

On June 4, 1909, 25,000 acres of land in the Agua Fria River basin were filed through the Phoenix land office by citizens who desired to make the territory of Arizona their home. Today this land still is for the most part agricultural.

Arizona was among the leaders in population growth from 1950 to 1960 and was the leader during the period from 1946 to 1950. About one-half of the people in Arizona reside in Maricopa County, whose 1960 population figure of 663,500 is expected to almost double by 1970. The 1989 population figure is estimated at 2,000,000.

Even though the Agua Fria River area, with the exception of the town of Avondale, which is just below the lower limits of the study, has not developed to the same extent as other areas to the south and east, rapid population growth and the resultant residential and urban development now taking place in the adjacent Phoenix metropolitan area are expected to result in future development in the study area.

Flood damage prevention measures

No authorized, proposed, or constructed federal flood-control or related structures are in the study reach of the Agua Fria River, except for an authorized project in the area where New River joins the Agua Fria River.

Flood warning and forecasting services

Avondale is the only community along the Agua Fria River that receives specific flood warnings or forecasting services from the U.S. Weather Bureau at the present time. However, general weather forecasts of intense rainfall, with accompanying flash flood warnings, are issued by the Weather Bureau office in Phoenix, Ariz.

The stream and its valley

The Agua Fria River rises in the Prescott National Forest in central Arizona (elevation about 7,000 feet) and flows southward for about 130 miles to its confluence with the Gila River, about 10 miles west of Phoenix, Ariz. The course of the stream is about equidistant from two parallel mountain ranges that form the eastern and western boundaries of the drainage area. One major tributary, New River, flows generally southward for about 40 miles from its source to its confluence with the Agua Fria River at mile 10.4. Plate 1 shows the watershed and stream-drainage system for the Agua Fria River.

Total fall in the Agua Fria River from its headwaters to the upper limits of the study reach is about 4,200 feet, an average of 59 feet per mile. In the 23-mile study reach, the average fall is 16.5 feet per mile.

Except for the headwater reaches, the Agua Fria River flows through a flood plain ranging from several hundred feet to about 1.7 miles in width. The width of the flood plain, in the study reach, is the greatest at mile 11.5.

Pertinent drainage areas of Agua Fria River are given in table 2.

TABLE 2

DRAINAGE AREAS OF THE WATERSHED OF AGUA FRIA RIVER

Location	Mile above mouth	Drainage area sq. mi.
Upper limits of study	33.15	1,459
Above McMicken Dam outlet channel	20.38	1,554
Above New River confluence	10.90	1,923
Camelback Road	10.00	2,273
Mouth	0.00	2,340

Developments in the flood plain

Generally, there are no concentrated developments on the flood plain; most of the flood plain is devoted to agriculture or related purposes. Plate 2 is an index map indicating the 24 plates that show details of flooded areas of Agua Fria River. Plates 3 through 26 show the flood plain of the reach of the Agua Fria River covered in this report.

Bridges across the channel

A main line of the Atchison, Topeka and Santa Fe Railway Co. crosses two bridges over the Agua Fria River at mile 16.93. The tracks on the principal bridge, which is over the main channel, are above both the Intermediate Regional Flood and the Standard Project Flood. The tracks on the overflow bridge, which is approximately 1,000 feet west of the principal bridge, are subject to inundation by both the Intermediate Regional Flood and the Standard Project Flood.

U.S. Highway 60, 70, and 89 and Arizona Highway 93 (Grand Ave.) also crosses two bridges over the Agua Fria River just downstream and parallel to the Atchison, Topeka and Santa Fe railroad line. The principal 4-lane highway bridge and, approximately 1,000 feet to the west, the overflow bridge are at mile 16.90. Sections of the floor of the main bridge would be covered by both the Intermediate Regional Flood and the Standard Project Flood. The floor of the overflow bridge would be susceptive to flooding by the Intermediate Regional and Standard Project Floods.

The Bell Road bridge crossing Agua Fria River is at mile 19.00. This bridge was not constructed at the time of submission of the aerials and topography for the Agua Fria River report. The Intermediate Regional Flood and Standard Project Flood were plotted as if the Bell Road bridge were shown. (See pl. 17.)

The Bell Road bridge is above the Intermediate Regional Flood but is subject to inundation by the Standard Project Flood.

Table 3 lists pertinent data for all bridge structures and shows their relation to the crest of the Intermediate Regional Flood. Figures 1 through 6, pages 12 and 13, are photographs of these bridges.

TABLE 3

BRIDGES ACROSS AGUA FRIA RIVER

Mile above mouth	Identification	Streambed elevation feet	Floor elev. feet	Under-clearance elevation feet	Intermediate Regional Flood crest elevation feet
29.19	Beardsley Canal flume	1330.0	*1350.5	1344.0	1338.8
19.00	Bell Road	1155.0	1165.5	1166.0	1164.0
16.93	Atchison, Topeka and Santa Fe railroad	1115.5	**1141.0	1130.0	1133.0
16.93	Atchison, Topeka and Santa Fe railroad overflow bridge	1115.6	**1131.7	1128.0	1132.7
16.90	U.S. Highway 60, 70, and 89 and Arizona Highway 93 (Grand Avenue)	1115.0	1134.0	1128.5	1127.0
16.90	U.S. Highway 60, 70, and 89 and Arizona Highway 93 overflow bridge (Grand Avenue)	1115.5	1126.0	1123.5	1126.7

* Top of semicircular conduit
** Top of rail

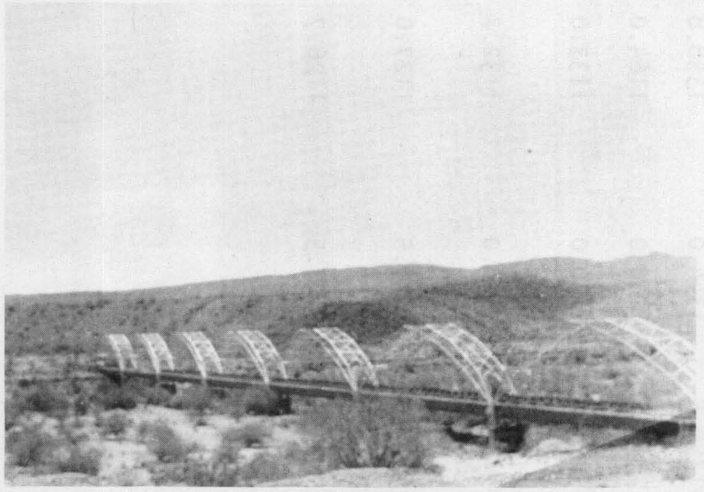


Figure 1.

Downstream side of Beardsley Canal flume at mile 29.19.

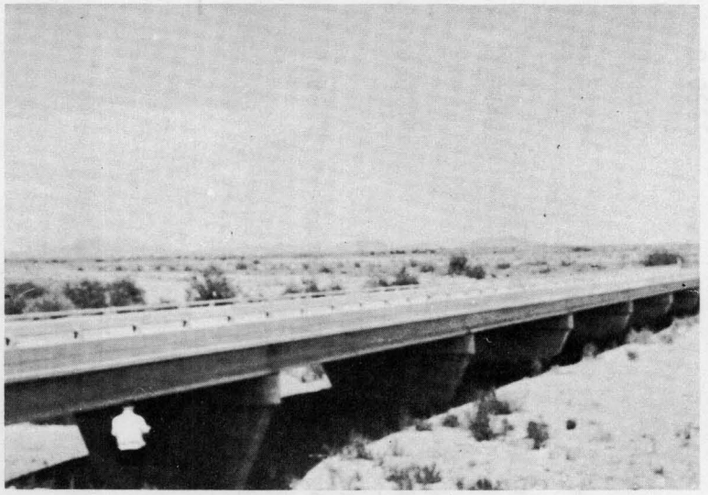


Figure. 2.

Downstream side of Bell Road bridge at mile 19.00.

Figure 3.

Downstream side of Atchison, Topeka and Santa Fe railroad bridge at mile 16.93.

Figure 4.

Downstream side of Atchison, Topeka and Santa Fe railroad overflow bridge at mile 16.93.

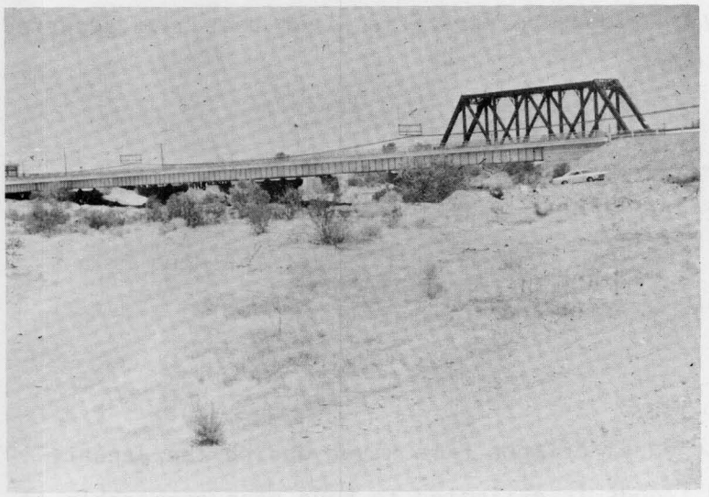


Figure 5.

Downstream side of U.S. Highway 60, 70, and 89 and Arizona Highway 93 bridge (Grand Ave.) at mile 16.90.

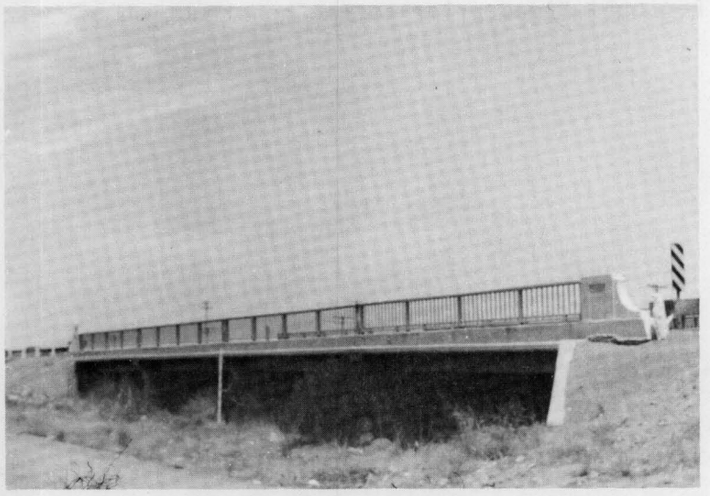


Figure 6.

Downstream side of U.S. Highway 60, 70, and 89 and Arizona Highway 93 overflow bridge (Grand Ave.) at mile 16.90.

FLOOD SITUATION

Flood records

Records of river stages and discharges on Agua Fria River have been maintained intermittently since 1910. Two gages are at Waddell Dam and one is near Mayer.

To supplement the information obtained from these gaging stations, newspaper files and historical documents and records were searched. These records and subsequent field investigations cover the history of floods on Agua Fria River that have occurred over the past 78 years.

Flood stages and discharges

Table 4 lists flood dates and estimated discharges in cubic feet per second. Complete records of flows of the Agua Fria River do not exist.

Velocity

Flow in the channel of Agua Fria River during the January 1916 and November 1919 floods is estimated to have been comparable to the Intermediate Regional Flood prior to the construction of Waddell Dam.

TABLE 4

FLOOD DATES AND ESTIMATED DISCHARGES

Date	Estimated discharge cfs
March 1889	Flood*
February 20-23, 1890	Flood*
February 19, 1891	80,000
February 24, 1891	Flood*
January 1895	Flood*
March 1905	Flood*
November 1905	Flood*
March 1906	Flood*
March 6, 1907	Flood*
February 1911	Flood*
January 29, 1915	60,000
January 19, 1916	45,000
January 27, 1916	105,000
April 18, 1917	26,000
July 27, 1917	80,000
August 6, 1918	39,600
September 8, 1919	53,500
November 27, 1919	105,000
February 22, 1920	30,000
January 3, 1922	25,000
September 2, 1922	60,000
December 27, 1923	39,000
September 19, 1925	Flood*
February 1927	Flood*
February 13, 1931	Flood*
March 15, 1941	11,000
August 3, 1943	Flood*
August 27, 1951	Flood*
July 30, 1964	1,200

* Amount of discharge unknown.
Note: Waddell Dam was constructed in 1927.

Obstructions to floodflow

Bridges and their approach fills have been described in the preceding paragraphs. With the exception of these bridges, there are no serious obstructions to flows in the Agua Fria River reach included in this study.

Flooded areas, high-water profiles, and cross sections

Plates 3 through 26 show the approximate areas along the Agua Fria River that would be inundated by the Intermediate Regional and Standard Project Floods. The actual limits of these overflow areas on the ground may vary from those shown on the map because the 5-foot contour interval and scale of the map make precise plotting of the flooded areas difficult.

Plates 27, 28, 29, and 30 show the high-water profiles for the Intermediate Regional Flood and the Standard Project Flood discussed in the chapter titled "Future Floods."

Plates 31 and 32 show cross sections that are typical of the total of 64 sections used in the reach investigated. The elevation and extent of overflow of the Intermediate Regional Flood and the Standard Project Flood are indicated on these sections.

FLOOD DESCRIPTIONS

Following are excerpts from newspaper accounts that contained descriptions of known large floods that have occurred on Agua Fria River.

Arizona Republican
February 22, 1891

"ALONG THE AGUA FRIA.

"The Rainfall Heavier and the River Higher than a Year Ago

"J. Gasser came in from Castle Creek Hot Springs last night, having left there about 8 o'clock Friday morning.

"I came down the old road bed about three miles, when I found it was washed out so it was impassible, said Mr. Gasser. I succeeded in crossing the mountains and struck the new road, which I found in good condition. All the old road west of the Agua Fria seemed to be washed out, and near the crossing at Frog Tanks there was a sand drift twelve feet high. I crossed the river at Frog Tanks Friday afternoon on horseback, but it was a risky trip. From the marks of the flood I judged the river had been twenty-five feet high the day before. From Frog Tanks to New River the road is in good condition, but the banks of New river are washed out so they will have to be graded down before teams can cross. The river was still high when I crossed Friday night, and the sloping banks had washed away, leaving them high and steep.'

" 'It began raining at the Hot Springs Tuesday night, ...finally breaking up about Thursday morning with a sharp thunderstorm. The rain was much heavier than a year ago, and the Agua Fria was considerably higher than it was then.' "

* * * * * * *

"The Agua Fria, draining the tremendous watershed of the Bradshaw mountains, is reported to be so high and so wide that to attempt to ford would be suicide...."

* * * * * * *

Arizona Republican
February 24, 1891

* * * * * * *

"The Agua Fria is said to have been almost an ocean of water, spreading out its channel to the width of several miles near its mouth. Several houses on the alkali flat on this side of the Agua Fria, are believed to have been taken down stream."

* * * * * * *

Arizona Republican
February 27, 1891

* * * * * * *

"Several men started out yesterday morning for Peck Brothers' sheep ranch on the Agua Fria, twenty miles northwest of Phoenix. They found the Agua Fria still high, but managed, by swimming their team, to safely make the northern bank."

* * * * * * *

"On Friday night the Agua Fria rose suddenly and flooded the premises....

"The main loss...was in a corral near the house, where there were penned over 1300 sheep....

"To reach the corral the waters must have risen nearly twenty feet, and the Agua Fria, ordinarily a dry bed, must have been fully a mile in width."

* * * * * * *

Arizona Republican
November 28, 1919

* * * * * * *

"Flood waters in the Agua Fria, 12 miles west, washed out the Arizona Eastern bridge and the approaches to the state highway bridge yesterday afternoon...."

"The last big flood in the Agua Fria, previous to the present one, was in 1916, at that time a great volume of water coming down the Agua Fria river changed the channel of that stream, moving it more than one-half mile west. This flood occurred while the railroad bridge over the Agua Fria was being built. Since 1916 the state highway department has been gradually moving the river back under the bridge at an estimated cost of $60,000.

"Shortly after noon yesterday the water in the Agua Fria had reached the rail level of the bridge and ran over both approaches and below the highway bridge. Seven hundred feet of piling went out, a couple of bents going out first. When about the third had gone the deck dropped until the water caught it and the force of the current tore the deck and piling and swept it around and down the stream. The ties remaining on the rails and floating like a log boom.

"The piling, relieved of the weight of the superstructure and pulled up by the bouyancy, jumped clear out of the water, and started down the river toward Yuma. Estimated damage to railroad now is between $25,000 and $30,000 and probably nearly as much on the big highway bridge approaches.

"The protection work put in by the state in 1917 and recently repaired is apparently holding the water in the main channel under the bridge, although this cannot be definitely told until after the flood subsides. If the river returns to the west channel it will make a difference of from $15,000 to $20,000 to get it under

the bridge again. Between 5 o'clock and 6 o'clock the water went down four inches, but this was a small quantity to the 20 feet of water under the bridge."

* * * * * * *

"Trees and other debris coming down the Agua Fria indicated that the channel was changing.

"A combination freight and passenger train enroute from Buckeye to Phoenix was held on the west side of the Agua Fria when it discovered that the bridge was about to go out. The bridge at the time had swung out several feet and was in such a feeble condition that had the train attempted to cross it would have been swept away with the bridge, Sheriff Montgomery said after talking with railroad men. The train was taken back to Buckeye to await the re-opening of the road.

With their home washed away, Robert Percy, a rancher living three miles south of Coldwater, /Avondale/ found himself at 11 o'clock yesterday morning with his wife and two children on a small island in the center of the Agua Fria river, there a raging torrent a mile wide. The four took refuge on the roof of their granary.

Deputies, Troutman, Blanco and Smith left Phoenix and organized a rescue party on the banks. A thousand feet of rope was used in a vain effort to reach them. Boats were capsized by waves from five to ten feet high....

"...The families of William Edwards and E. Psass on South Twenty-second Avenue, were also forced to leave their homes by the rising water in the river near at hand."

* * * * * * *

Arizona Republican
February 17, 1927

* * * * * * *

"Five spans of an automobile bridge across the Agua Fria river at Coldwater were washed out...."

* * * * * * *

"The five spans of the bridge over the Agua Fria river went out early yesterday morning after the flood waters in the river had undermined the piling supporting the trestle work of the sections according to W. W. Lane, chief engineer of the state highway department."

* * * * * * *

"The sections of both bridges washed out were temporary piling trestles or wooden trestle work, Mr. Lane said, and were put in several years ago to replace sections washed out by 1919 floods.

"The Coldwater bridge was built in 1915 and was originally a concrete structure. In the fall of 1919, during a heavy flood in the Agua Fria river, a portion of the concrete bridge washed out. The sections washed out in that flood were replaced by Thomas Maddock, then state engineer, with a temporary piling trestle of wood. Since that time no funds have been available for the replacement of the bridge with a concrete structure.

"The high waters of the Agua Fria river from time to time have been undermining the piling, Mr. Lane said, until the piling supporting the bridge gave way early yesterday morning, after continual pounding from the flood waters, and let the sections of the bridge wash out."

* * * * * * *

"It is expected that more sections of the Coldwater bridge will wash out before the flood waters recede."

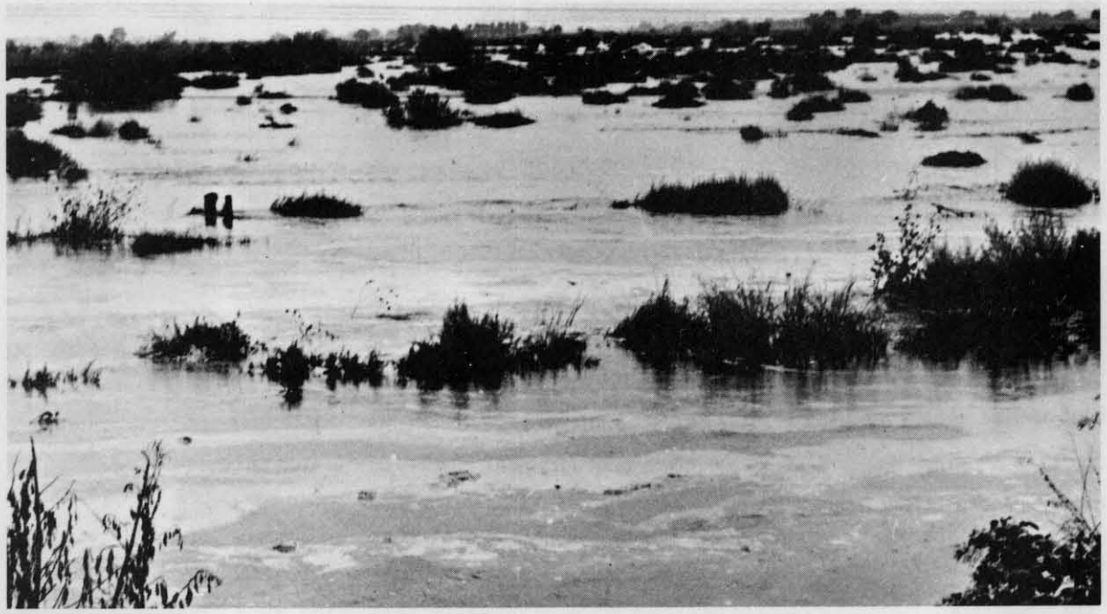


Figure 7.-- Flooded area along Agua Fria River.

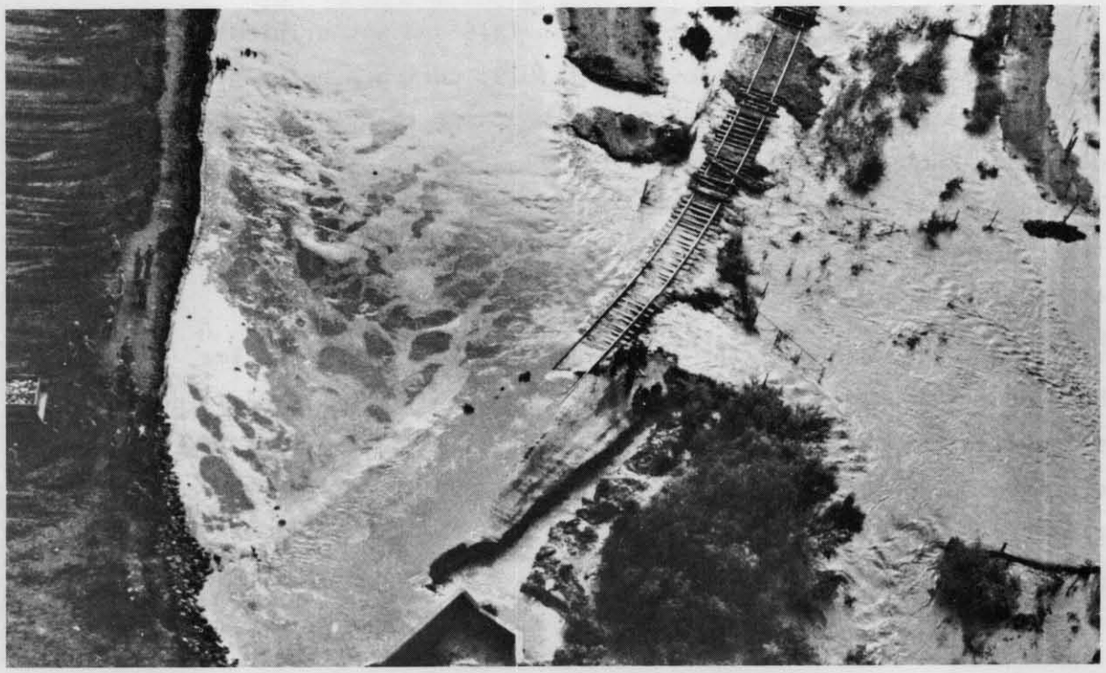


Figure 8.--View of flooded area along Agua Fria River showing washed-out part of railroad track.

Figure 9.--Flood scene along Agua Fria River showing overflow of river.

Figure 10.--Flood scene along Agua Fria River. Overflow made road impassable.

FUTURE FLOODS

This section of the report discusses the Standard Project Flood and the Intermediate Regional Flood on Agua Fria River. The Standard Project Flood represents the reasonable upper limits of expected flooding. The Intermediate Regional Flood represents a flood that may reasonably be expected to occur more frequently, although the depth will not be as great as the infrequent Standard Project Flood.

Large floods have been experienced in the past on streams in the general geographical region of the Agua Fria River watershed. Storms similar to those causing these floods could occur over the watershed of Agua Fria River. In this event, floods comparable in size with those experienced on neighboring streams would occur on the Agua Fria River. It is therefore desirable, in connection with any determination of future floods that may occur on the Agua Fria River, to consider storms and floods that have occurred in the general region on watersheds whose topography, watershed cover, and physical characteristics are similar to those of this stream.

Determination of Intermediate Regional Floods

The Intermediate Regional Flood is defined as a flood having an average frequency of occurrence of once in 100 years, at a designated location, although the flood may occur in any year. Some probability estimates are based on statistical analyses of available streamflow records of the watershed under study, but limitations in such records usually require analyses of rainfall and runoff characteristics in the "general region" of the area under study. The Intermediate Regional Flood represents a major flood, although it is much less severe than the Standard Project Flood.

To determine the Intermediate Regional Flood for Agua Fria River, statistical studies were made using maximum known floods that have occurred on watersheds comparable with the Agua Fria River watershed and within the same geographical region.

Estimated peak discharges for the Intermediate Regional Flood for the Agua Fria River are shown in table 1.

Determination of Standard Project Floods

Only in rare instances has a specific stream experienced the largest flood that is likely to occur. Severe as the maximum known flood may have been on any given stream, it is a commonly accepted fact that, in practically all cases, sooner or later a larger flood can and probably will occur. The Corps of Engineers has made broad and comprehensive studies and investigations based on the records of experienced storms and floods and has evolved generalized procedures for estimating the flood potential of streams. These procedures have been used in determining the Standard Project Flood. The most severe storm of record occurred on August 19, 1954, over the Queen Creek drainage area southeast of Phoenix. Heavy rainfall occurred during the first 3 hours of this thunderstorm; light rainfall occurred during the next 3 hours. An estimated 100-square-mile area had over 5 inches of rainfall, and about 1,000 square miles had over 1 inch of rainfall. The peak discharge at Whitlow Ranch damsite (in the Queen Creek drainage area near Florence Junction on U.S. Highway Nos. 60 and 70 in Pinal County) was estimated at 42,000 cubic feet per second. If a comparable storm were centered over the Agua Fria River drainage area upstream from the downstream limits of study at a time when ground conditions were reasonably conducive to runoff, the peak discharge for the Standard Project Flood at Camelback Road would be 190,000 cubic feet per second. A Standard Project Flood is defined as the largest flood that can be expected from the most

severe combination of meteorological and hydrological conditions that is considered reasonably characteristic of the geographical region involved.

Estimated peak discharges for the Standard Project Flood for the Agua Fria River are shown in table 1.

Frequency. It is not practical to assign a frequency to the Standard Project Flood. The occurrence of such a flood would be a rare event; however, it could occur in any year.

Possible larger floods. Floods larger than the Standard Project Flood are possible; however, the combination of factors that would be necessary to produce such floods would seldom occur. The consideration of floods of this magnitude is of greater importance in some problems than in others but should not be overlooked in the study of any problem.

Hazards of great floods

The amount and extent of damage caused by any flood depend in general upon how much area is flooded, the height of flooding, the velocity of flow, the rate of rise, and the duration of flooding.

Areas flooded and heights of flooding. The areas along Agua Fria River that would be flooded by the Standard Project Flood and the Intermediate Regional Flood are shown on plates 3 through 26. Depths of flows can be estimated from the high-water profiles, which are shown on plates 27 through 30.

The high-water profiles of the Standard Project Flood and the Intermediate Regional Flood depend in part upon the degree of destruction or clogging of various bridges during the flood.

Because it is impossible to forecast such destruction or clogging, it was assumed that all bridge structures would stand and that no clogging would occur.

Figures 11 and 12 on page 28 show the heights that would be reached by the Standard Project Flood and the Intermediate Regional Flood on and near facilities presently existing within the flood plain in the study reach.

Velocity. Water velocity during floods depends largely upon the size and shape of the cross section, the condition of the stream, and the bed slope, all of which vary on different streams and at different locations on the same stream.

The maximum velocity that would occur in the study reach during the Intermediate Regional Flood is at mile 32.35 where the channel flow would be about 13.5 feet per second.

The maximum velocity that would occur in the study reach during the Standard Project Flood is at mile 32.35 where the channel flow would be approximately 15.1 feet per second.

The rapid rate of rise and high-stream velocity in combination with deep, fairly long-duration flooding would create a hazardous situation in the flood plain. Velocity greater than 3 feet per second combined with depths of 3 feet or greater is generally considered hazardous.

Figure 11.--Arrows indicate depths that would be reached by the Standard Project Flood and the Intermediate Regional Flood on a trailer-court building near Glendale Avenue, within the flood plain of the Agua Fria River.

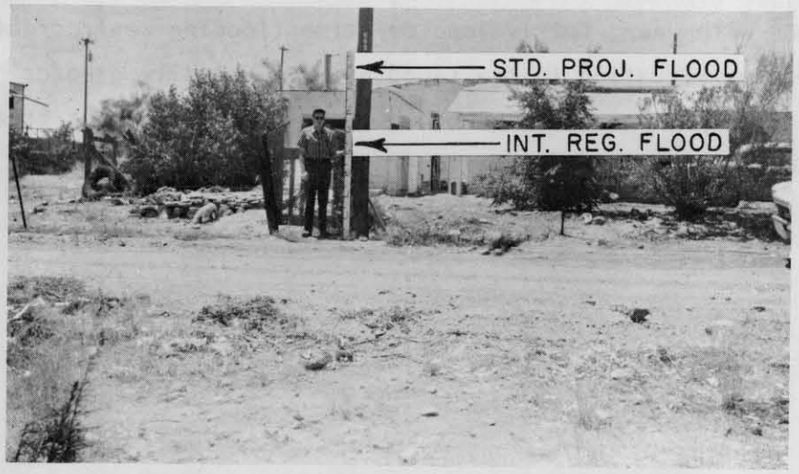


Figure 12.--The depths that would be reached by the Intermediate Regional Flood and the Standard Project Flood are shown in this view taken near Grand Avenue in the town of Agua Fria.

GLOSSARY OF TERMS

Flood. An overflow of lands not normally covered by water and that are used or usable by man. Floods have two essential characteristics: The inundation of land is temporary; and the land is adjacent to and inundated by overflow from a river or stream or an ocean, lake, or other body of standing water.

Normally, a "flood" is considered as any temporary rise in streamflow or stage, but not the ponding of surface water, that results in significant adverse effects in the vicinity. Adverse effects may include damages from overflow of land areas, temporary backwater effects in sewers and local drainage channels, creation of unsanitary conditions or other unfavorable situations by deposition of materials in stream channels during flood recessions, rise of ground water coincident with increased streamflow, and other problems.

Flood Crest. The maximum stage or elevation reached by the waters of a flood at a given location.

Flood Peak. The maximum instantaneous discharge of a flood at a given location. It usually occurs at or near the time of the flood crest.

Flood Plain. The relatively flat area or low land adjoining the channel of a river, stream or watercourse or ocean, lake, or other body of standing water, which has been or may be covered by floodwater.

Flood Profile. A graph showing the relationship of water-surface elevation to location, the latter generally expressed as distance above mouth for a stream of water flowing in an open channel. It is generally drawn to show surface elevation for the crest of a specific flood, but may be prepared for conditions at a given time or stage.

Flood Stage. The stage or elevation at which overflow of the natural banks of a stream or body of water begins in the reach or area in which the elevation is measured.

Head Loss. The effect of obstructions, such as narrow bridge openings or buildings that limit the area through which water must flow, raising the surface of the water upstream from the obstruction.

Intermediate Regional Flood. A flood having an average frequency of occurrence in the order of once in 100 years although the flood may occur in any year. It is based on statistical analyses of streamflow records available for the watershed and analyses of rainfall and runoff characteristics in the "general region of the watershed."

Left Bank. The bank on the left side of a river, stream, or watercourse, looking downstream.

Low Steel (or Underclearance). See "underclearance."

Probable Maximum Flood. The probable maximum flood represents a flood discharge that may be expected from the most severe combination of critical meteorological and hydrological conditions that are reasonably possible in the region. Such floods, as used by the Corps of Engineers, are applicable to projects, such as dams, where consideration is to be given to virtually complete security against potential floods.

Right Bank. The bank on the right side of a river, stream, or watercourse, looking downstream.

Standard Project Flood. The flood that may be expected from the most severe combination of meteorological and hydrological conditions that is considered reasonably characteristic of the geographical area in which the drainage basin is located, excluding extremely rare combinations. Such floods, as used by the Corps of Engineers, are intended as practicable expressions of the degree of protection that should be sought in the design of flood control works, the failure of which might be disastrous.

Underclearance. The lowest point of a bridge or other structure over or across a river, stream, or watercourse that limits the opening through which water flows. This is referred to as "low steel" in some regions.

AUTHORITY, ACKNOWLEDGMENTS, AND INTERPRETATION OF DATA

This report has been prepared in accordance with the authority granted by section 206 of the Flood Control Act of 1960 (Public Law 86-645), as amended.

* * *

Assistance and cooperation of the FLOOD CONTROL DISTRICT OF MARICOPA COUNTY and of individuals who directly or indirectly aided in the preparation of this report are gratefully acknowledged. Topographic and aerial mosaic maps prepared by Dibble & Associates, Engineers; Johannessen & Girand Consulting Engineers, and Aerial Mapping Company were the basic maps used for the study. The topographic maps, furnished by Maricopa County, are dated January 1964 and July 1965. These maps, supplied by the Flood Control District of Maricopa County, Arizona, were used for the delineation of flood areas (see pls 3 through 26).

* * *

This report presents the local flood situation for the Agua Fria River in Maricopa County, Ariz. The Los Angeles District Corps of Engineers will, upon request, provide technical assistance to Federal, State, and local agencies in the interpretation and use of the information contained herein and will provide other available flood data related thereto.

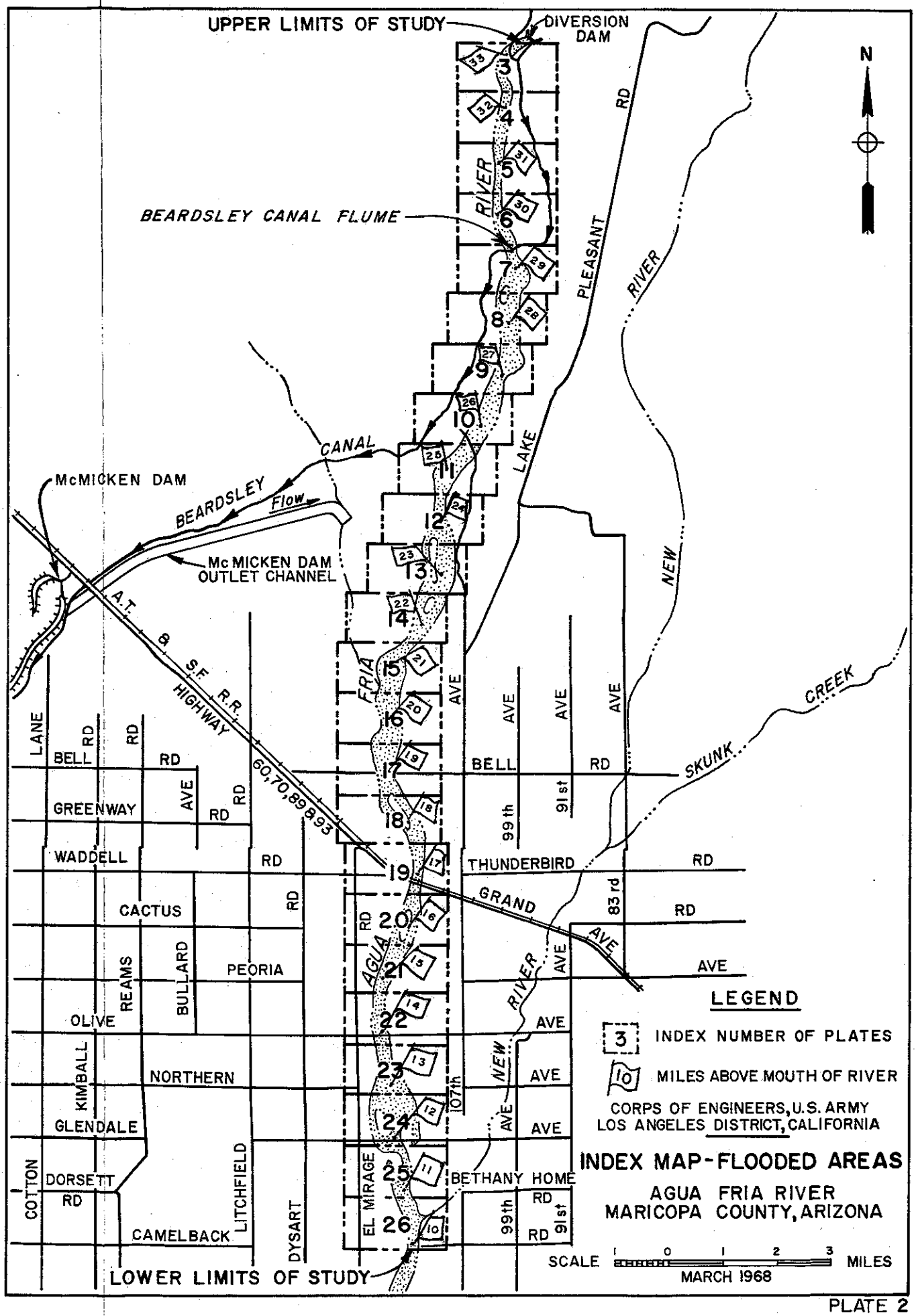

UPPER LIMITS OF STUDY
DIVERSION DAM
N
BEARDSLEY CANAL FLUME
RIVER
PLEASANT
RIVER
RD
LAKE
NEW
CANAL
McMICKEN DAM
BEARDSLEY
Flow
McMICKEN DAM
OUTLET CHANNEL
A.T. & S.F. R.R.
HIGHWAY
60,70,89&93
FRIA
AGUA
EL MIRAGE
DYSART
LITCHFIELD
BULLARD
REAMS
COTTON
KIMBALL
LANE
BELL RD
GREENWAY RD
WADDELL RD
CACTUS RD
PEORIA AVE
OLIVE AVE
NORTHERN AVE
GLENDALE
DORSETT RD
CAMELBACK
99th AVE
91st AVE
107th AVE
83rd AVE
THUNDERBIRD RD
GRAND AVE
BETHANY HOME RD
SKUNK CREEK
LOWER LIMITS OF STUDY
LEGEND
INDEX NUMBER OF PLATES
MILES ABOVE MOUTH OF RIVER
CORPS OF ENGINEERS, U.S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA
INDEX MAP-FLOODED AREAS
AGUA FRIA RIVER
MARICOPA COUNTY, ARIZONA
SCALE 0 1 2 3 MILES
MARCH 1968

PLATE 2

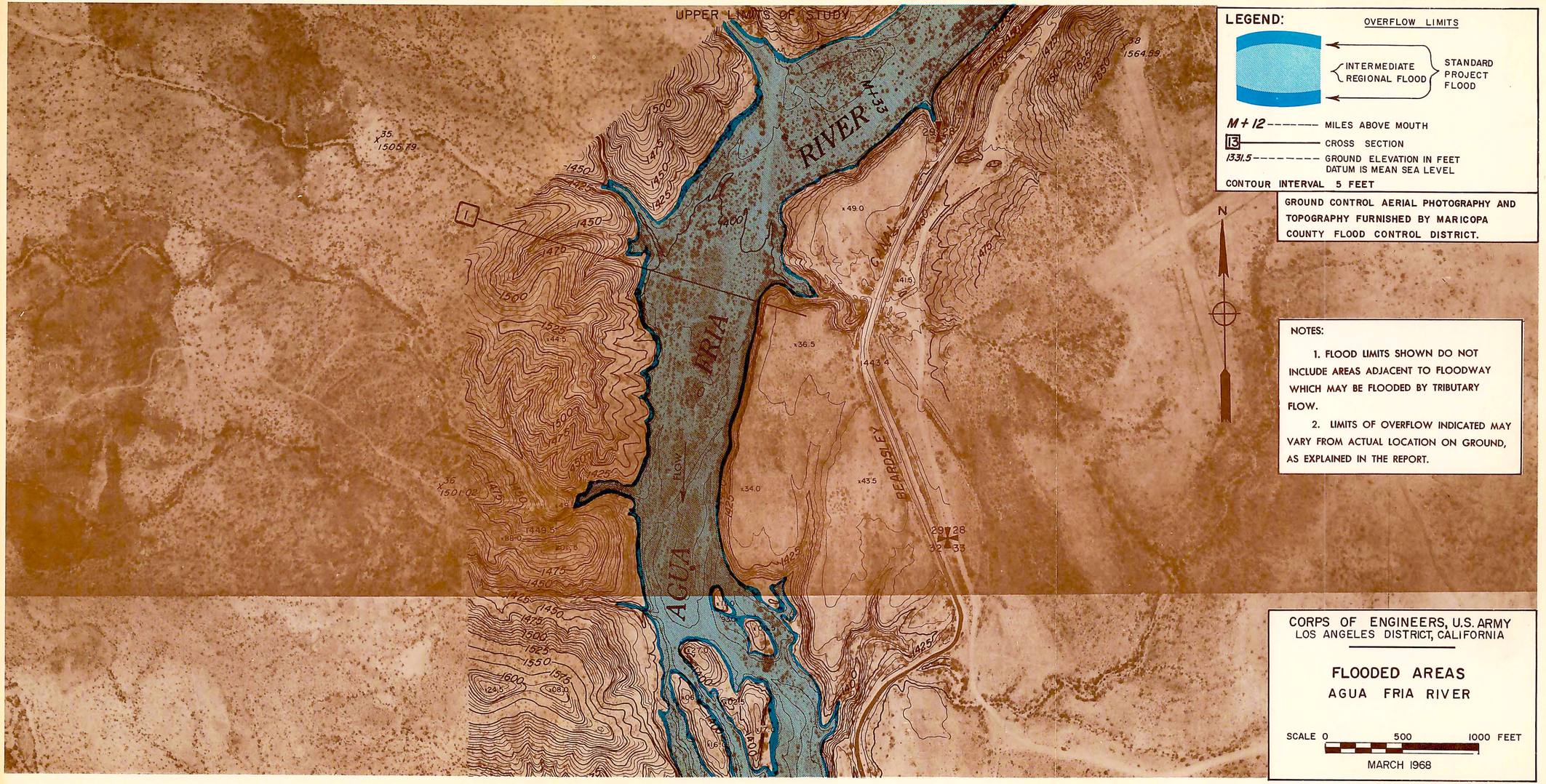

UPPER LIMITS OF STUDY
AGUA FRIA RIVER
M+33
BEARDSLEY
BLOW
LEGEND:
OVERFLOW LIMITS
INTERMEDIATE REGIONAL FLOOD
STANDARD PROJECT FLOOD
M+12 MILES ABOVE MOUTH
13 CROSS SECTION
1331.5 GROUND ELEVATION IN FEET DATUM IS MEAN SEA LEVEL
CONTOUR INTERVAL 5 FEET
GROUND CONTROL AERIAL PHOTOGRAPHY AND TOPOGRAPHY FURNISHED BY MARICOPA COUNTY FLOOD CONTROL DISTRICT.
N
NOTES:
1. FLOOD LIMITS SHOWN DO NOT INCLUDE AREAS ADJACENT TO FLOODWAY WHICH MAY BE FLOODED BY TRIBUTARY FLOW.
2. LIMITS OF OVERFLOW INDICATED MAY VARY FROM ACTUAL LOCATION ON GROUND, AS EXPLAINED IN THE REPORT.
CORPS OF ENGINEERS, U.S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA
FLOODED AREAS
AGUA FRIA RIVER
SCALE 0 500 1000 FEET
MARCH 1968

PLATE 3

LEGEND:

OVERFLOW LIMITS

INTERMEDIATE REGIONAL FLOOD — STANDARD PROJECT FLOOD

M+12 ------- MILES ABOVE MOUNTH

13 ——— CROSS SECTION

1331.5 - - - - - - - - GROUND ELEVATION IN FEET DATUM IS MEAN SEA LEVEL

CONTOUR INTERVAL 5 FEET

GROUND CONTROL AERIAL PHOTOGRAPHY AND TOPOGRAPHY FURNISHED BY MARICOPA COUNTY FLOOD CONTROL DISTRICT.

N

NOTES:

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2. LIMITS OF OVERFLOW INDICATED MAY VARY FROM ACTUAL LOCATION ON GROUND, AS EXPLAINED IN THE REPORT.

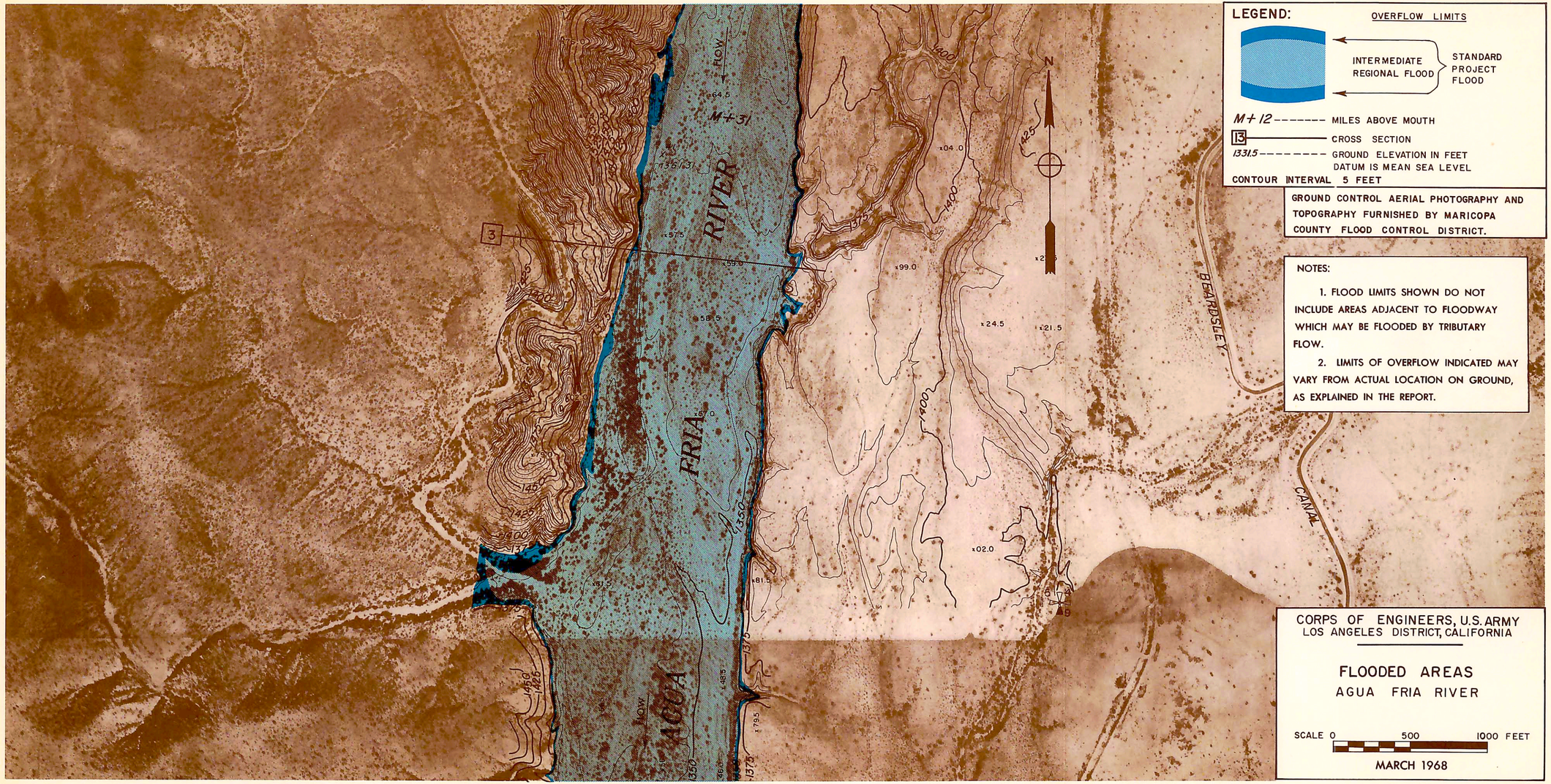
CORPS OF ENGINEERS, U S ARMY
LOS ANGELES DISTRICT, CALIFORNIA

FLOODED AREAS
AGUA FRIA RIVER

SCALE 0 500 1000 FEET

MARCH 1968

PLATE 4



LEGEND:

OVERFLOW LIMITS

INTERMEDIATE REGIONAL FLOOD

STANDARD PROJECT FLOOD

M+12 ------- MILES ABOVE MOUTH

13 ——— CROSS SECTION

1331.5 ------- GROUND ELEVATION IN FEET DATUM IS MEAN SEA LEVEL

CONTOUR INTERVAL 5 FEET

GROUND CONTROL AERIAL PHOTOGRAPHY AND TOPOGRAPHY FURNISHED BY MARICOPA COUNTY FLOOD CONTROL DISTRICT.

NOTES:

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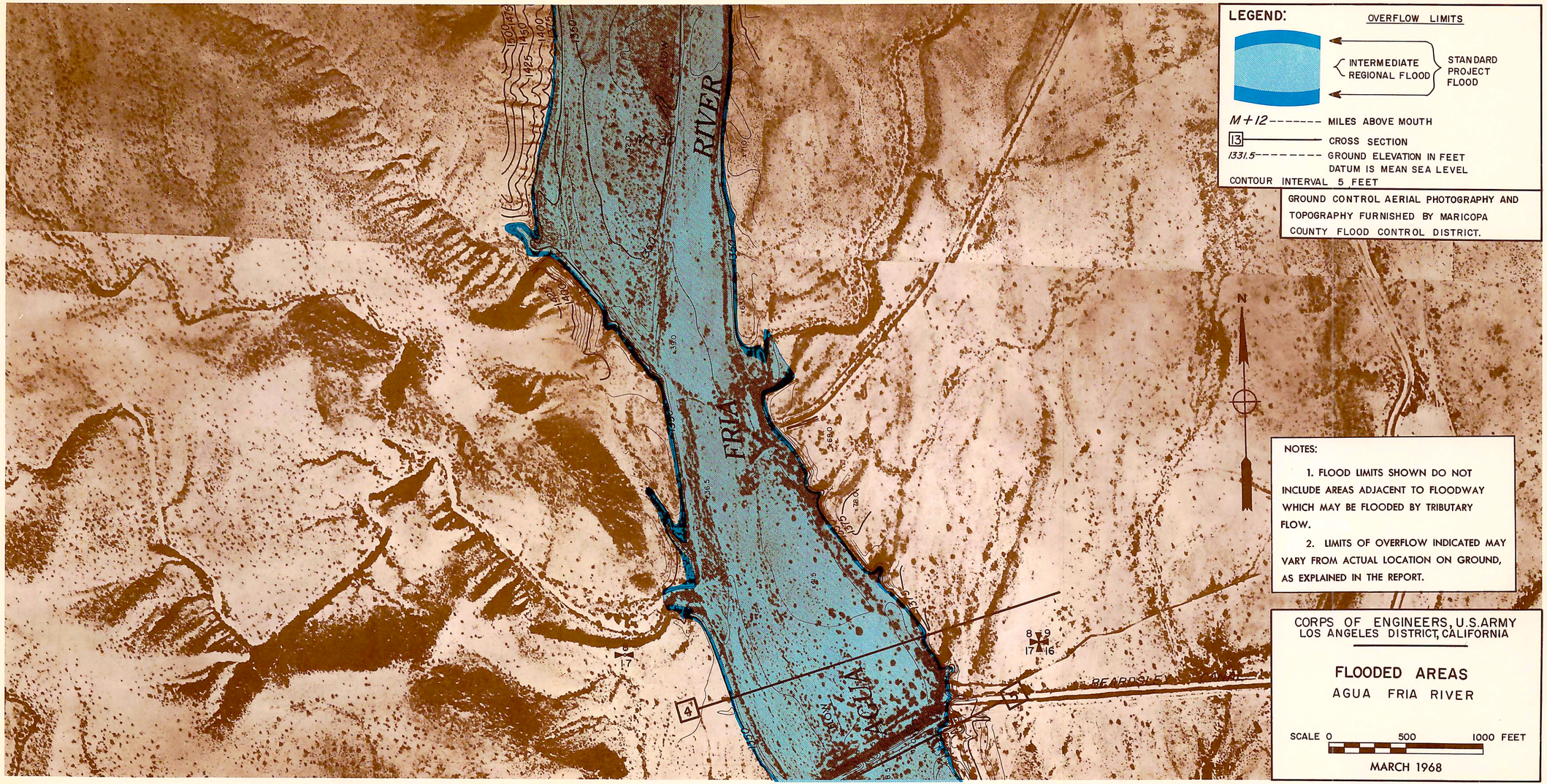
CORPS OF ENGINEERS, U.S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA

FLOODED AREAS
AGUA FRIA RIVER

SCALE 0 500 1000 FEET

MARCH 1968

PLATE 5


RIVER
FRIA
AGUA
WITTMANN
BEARDSLEY
LEGEND:
OVERFLOW LIMITS
INTERMEDIATE REGIONAL FLOOD
STANDARD PROJECT FLOOD
M+12 ------- MILES ABOVE MOUNTH
13 ——— CROSS SECTION
1331.5 ------- GROUND ELEVATION IN FEET DATUM IS MEAN SEA LEVEL
CONTOUR INTERVAL 5 FEET
GROUND CONTROL AERIAL PHOTOGRAPHY AND TOPOGRAPHY FURNISHED BY MARICOPA COUNTY FLOOD CONTROL DISTRICT.
N
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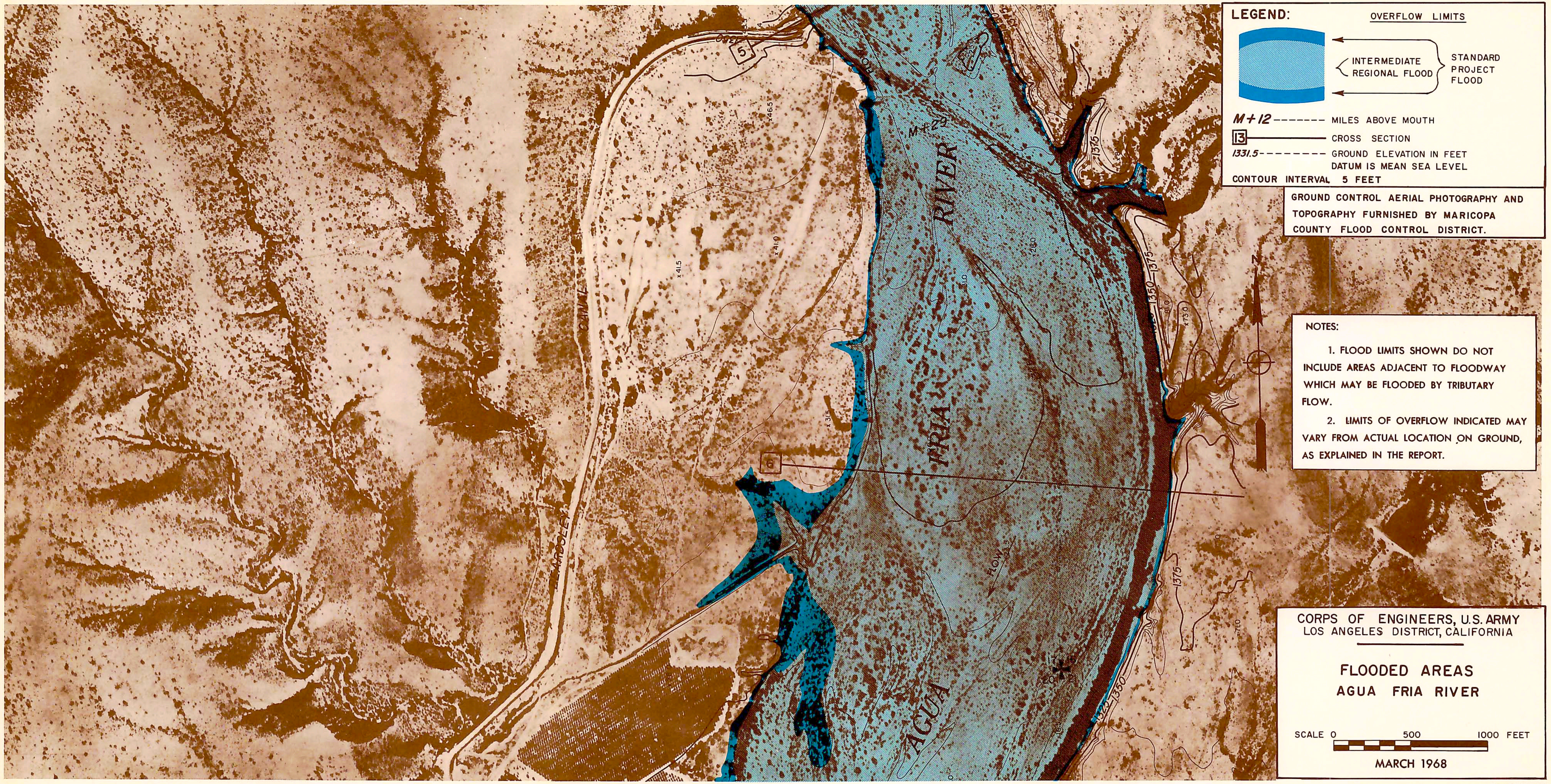
CORPS OF ENGINEERS, U.S.ARMY
LOS ANGELES DISTRICT, CALIFORNIA
FLOODED AREAS
AGUA FRIA RIVER
SCALE 0 500 1000 FEET
MARCH 1968

PLATE 6


LEGEND:
OVERFLOW LIMITS
INTERMEDIATE REGIONAL FLOOD
STANDARD PROJECT FLOOD
M+12 MILES ABOVE MOUTH
13 CROSS SECTION
1331.5 GROUND ELEVATION IN FEET DATUM IS MEAN SEA LEVEL
CONTOUR INTERVAL 5 FEET
GROUND CONTROL AERIAL PHOTOGRAPHY AND TOPOGRAPHY FURNISHED BY MARICOPA COUNTY FLOOD CONTROL DISTRICT.
NOTES:
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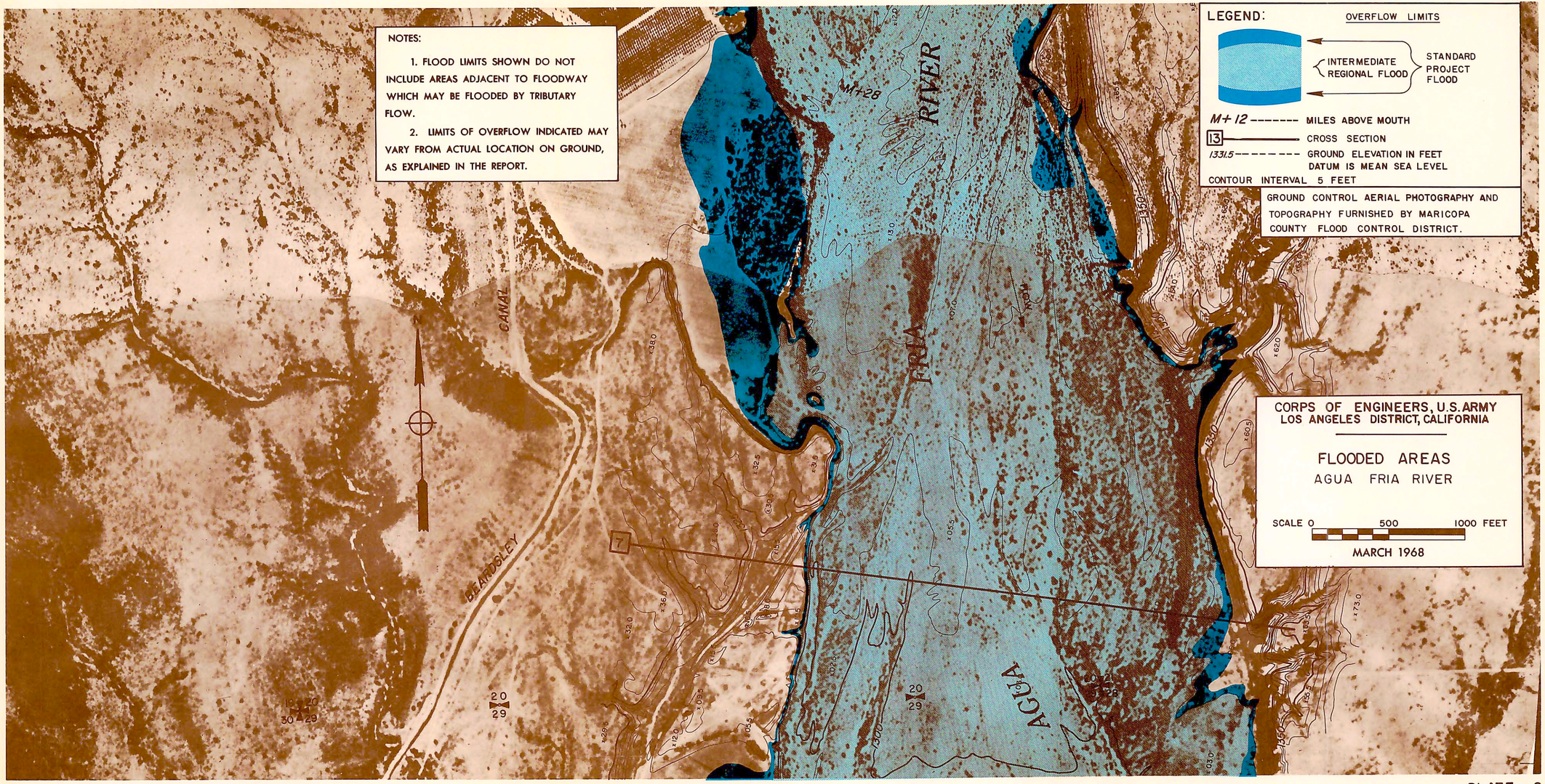
2. LIMITS OF OVERFLOW INDICATED MAY VARY FROM ACTUAL LOCATION ON GROUND, AS EXPLAINED IN THE REPORT.
AGUA FRIA RIVER
M+2.9
5
6
1375
1350
CORPS OF ENGINEERS, U.S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA
FLOODED AREAS
AGUA FRIA RIVER
SCALE 0 500 1000 FEET
MARCH 1968


NOTES:
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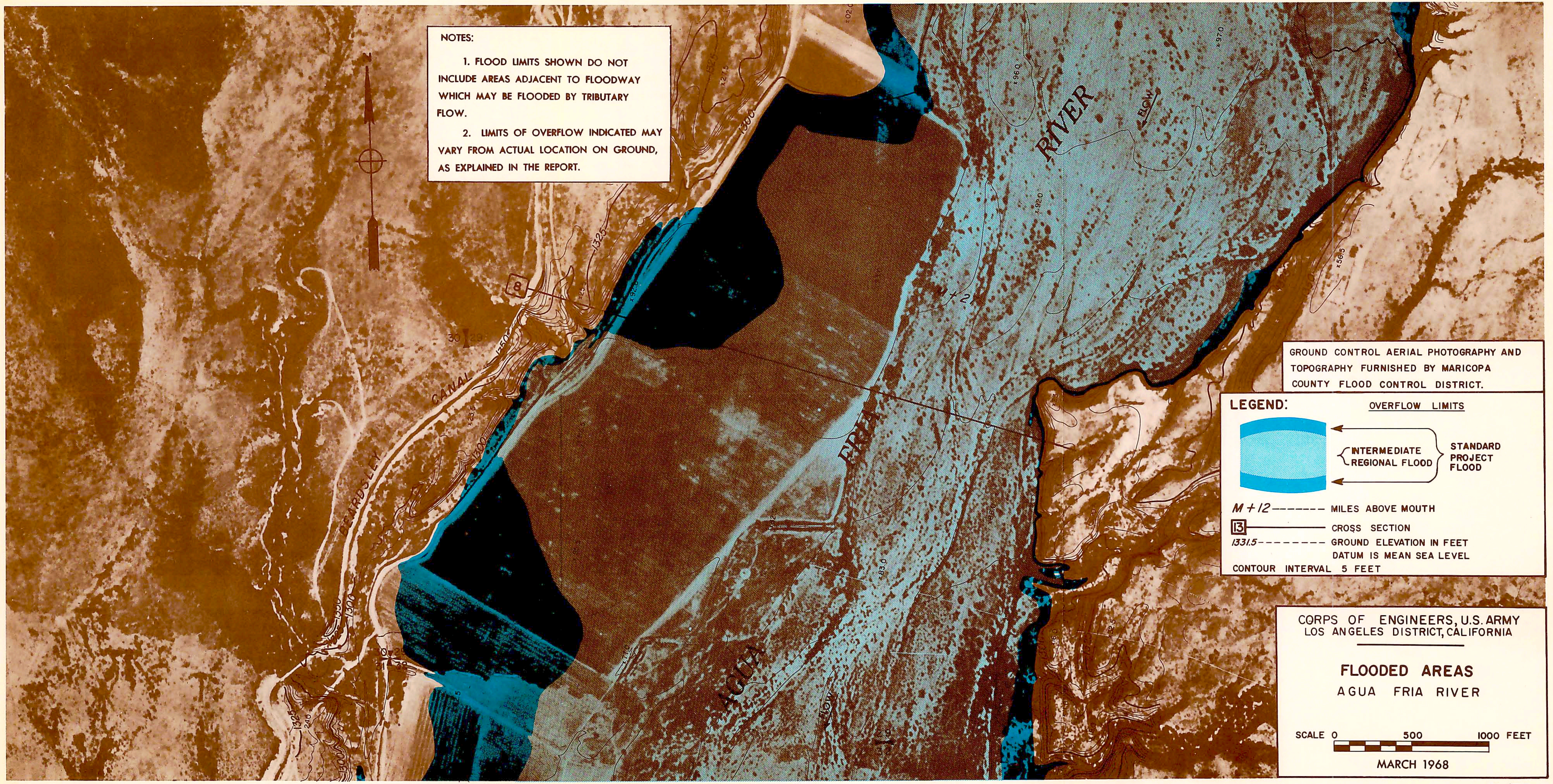
2. LIMITS OF OVERFLOW INDICATED MAY VARY FROM ACTUAL LOCATION ON GROUND, AS EXPLAINED IN THE REPORT.
LEGEND:
OVERFLOW LIMITS
INTERMEDIATE REGIONAL FLOOD
STANDARD PROJECT FLOOD
M+12 ------- MILES ABOVE MOUTH
13 ——— CROSS SECTION
1331.5 ------- GROUND ELEVATION IN FEET DATUM IS MEAN SEA LEVEL
CONTOUR INTERVAL 5 FEET
GROUND CONTROL AERIAL PHOTOGRAPHY AND TOPOGRAPHY FURNISHED BY MARICOPA COUNTY FLOOD CONTROL DISTRICT.
CORPS OF ENGINEERS, U.S.ARMY
LOS ANGELES DISTRICT, CALIFORNIA
FLOODED AREAS
AGUA FRIA RIVER
SCALE 0 500 1000 FEET
MARCH 1968
AGUA FRIA RIVER
BEARDSLEY CANAL
M+28
M+20
M+12
20
29
30
29

PLATE 8


NOTES:
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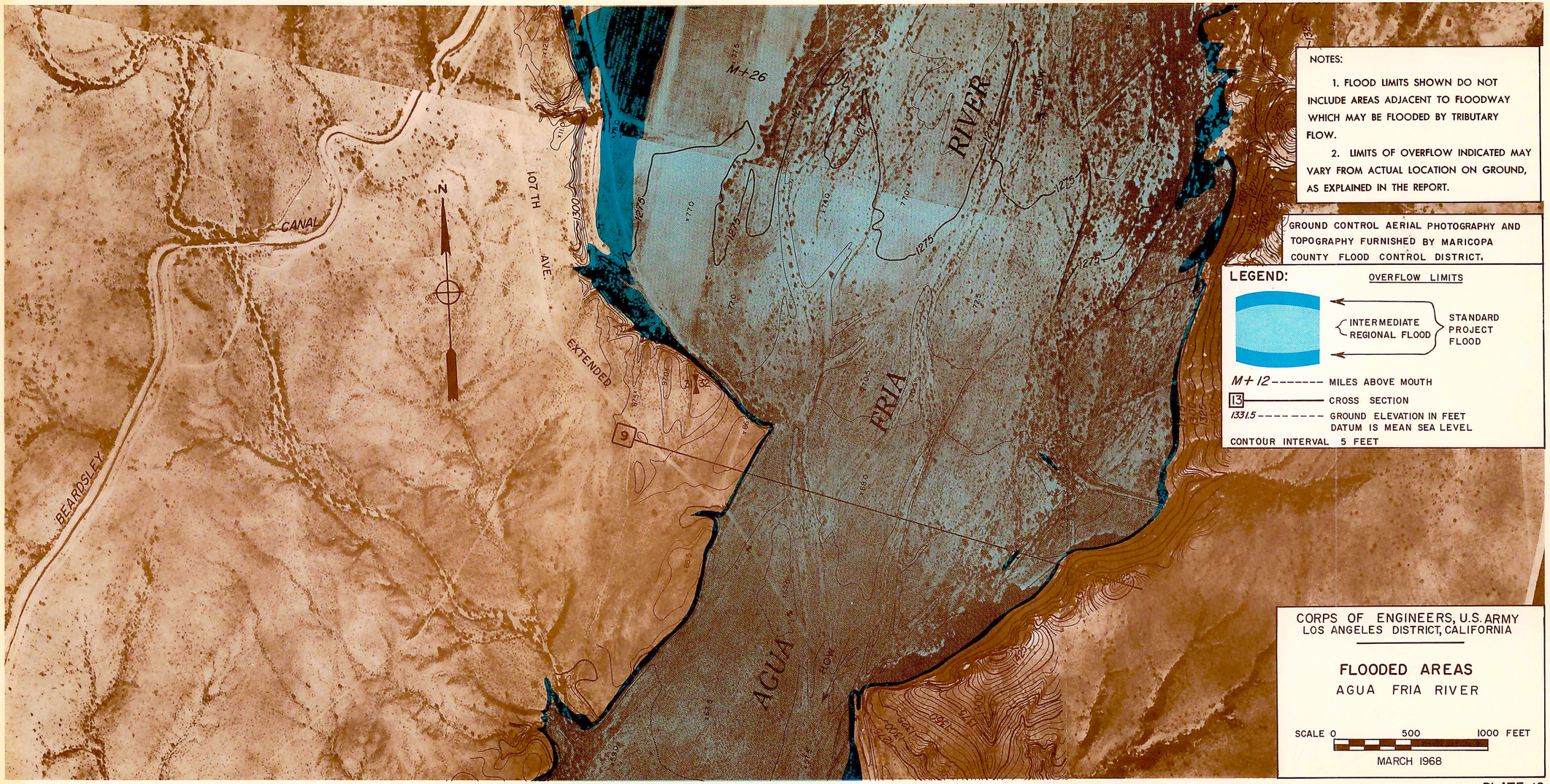
2. LIMITS OF OVERFLOW INDICATED MAY VARY FROM ACTUAL LOCATION ON GROUND, AS EXPLAINED IN THE REPORT.
RIVER
FLOW
FRIA
AGUA
CANAL
GROUND CONTROL AERIAL PHOTOGRAPHY AND TOPOGRAPHY FURNISHED BY MARICOPA COUNTY FLOOD CONTROL DISTRICT.
LEGEND:
OVERFLOW LIMITS
INTERMEDIATE REGIONAL FLOOD
STANDARD PROJECT FLOOD
M+12 MILES ABOVE MOUTH
13 CROSS SECTION
1331.5 GROUND ELEVATION IN FEET
DATUM IS MEAN SEA LEVEL
CONTOUR INTERVAL 5 FEET
CORPS OF ENGINEERS, U.S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA
FLOODED AREAS
AGUA FRIA RIVER
SCALE 0 500 1000 FEET
MARCH 1968

PLATE 9



NOTES:

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2. LIMITS OF OVERFLOW INDICATED MAY VARY FROM ACTUAL LOCATION ON GROUND, AS EXPLAINED IN THE REPORT.

GROUND CONTROL AERIAL PHOTOGRAPHY AND TOPOGRAPHY FURNISHED BY MARICOPA COUNTY FLOOD CONTROL DISTRICT.

LEGEND:

OVERFLOW LIMITS

INTERMEDIATE REGIONAL FLOOD — STANDARD PROJECT FLOOD

M+12 ------- MILES ABOVE MOUTH

13 ——— CROSS SECTION

1331.5 ---------- GROUND ELEVATION IN FEET DATUM IS MEAN SEA LEVEL

CONTOUR INTERVAL 5 FEET

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

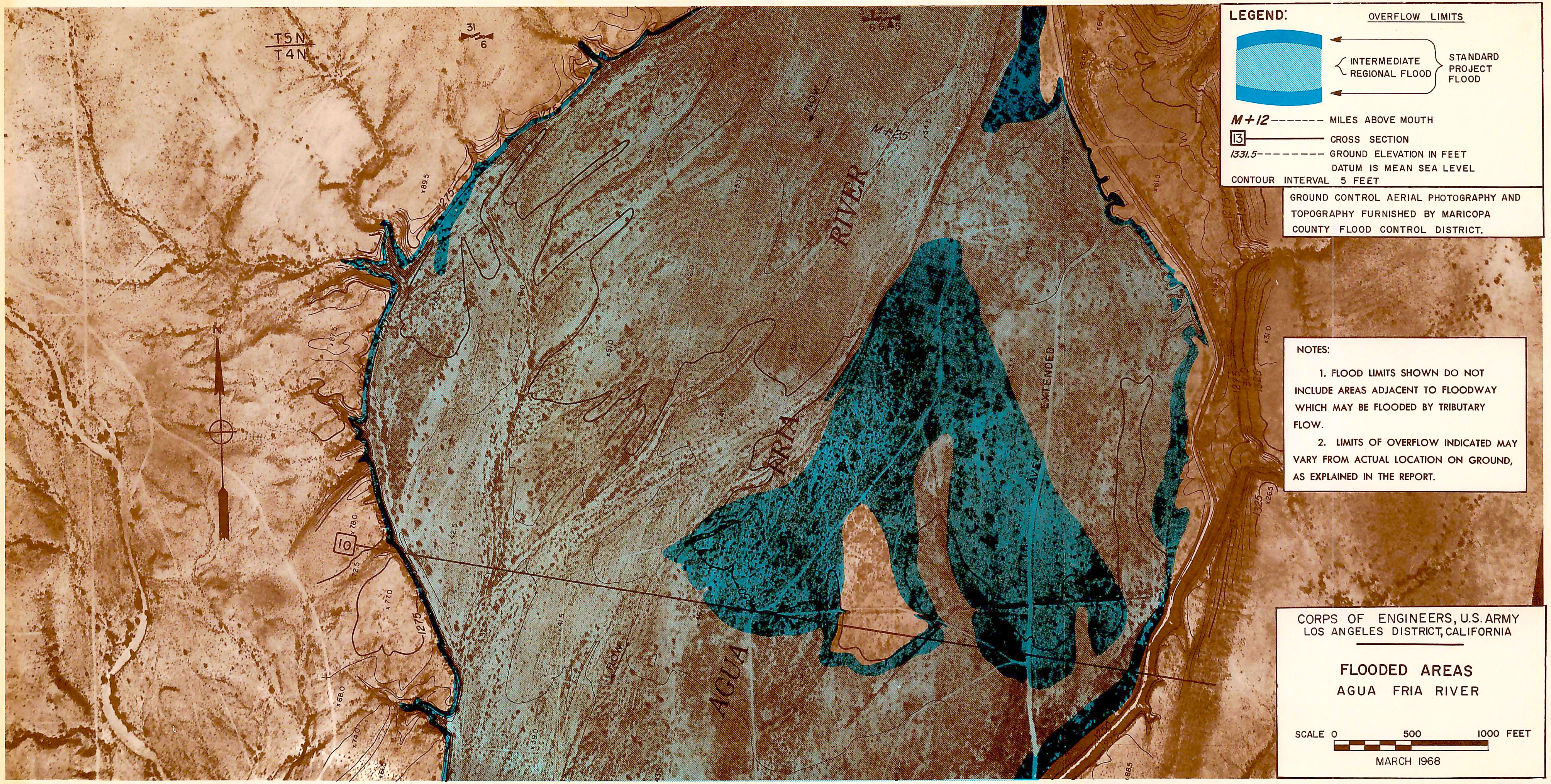
FLOODED AREAS

AGUA FRIA RIVER

SCALE 0 500 1000 FEET

MARCH 1968

PLATE 10



LEGEND:
OVERFLOW LIMITS
INTERMEDIATE REGIONAL FLOOD
STANDARD PROJECT FLOOD
M+12 MILES ABOVE MOUTH
13 CROSS SECTION
1331.5 GROUND ELEVATION IN FEET
DATUM IS MEAN SEA LEVEL
CONTOUR INTERVAL 5 FEET
GROUND CONTROL AERIAL PHOTOGRAPHY AND TOPOGRAPHY FURNISHED BY MARICOPA COUNTY FLOOD CONTROL DISTRICT.
NOTES:
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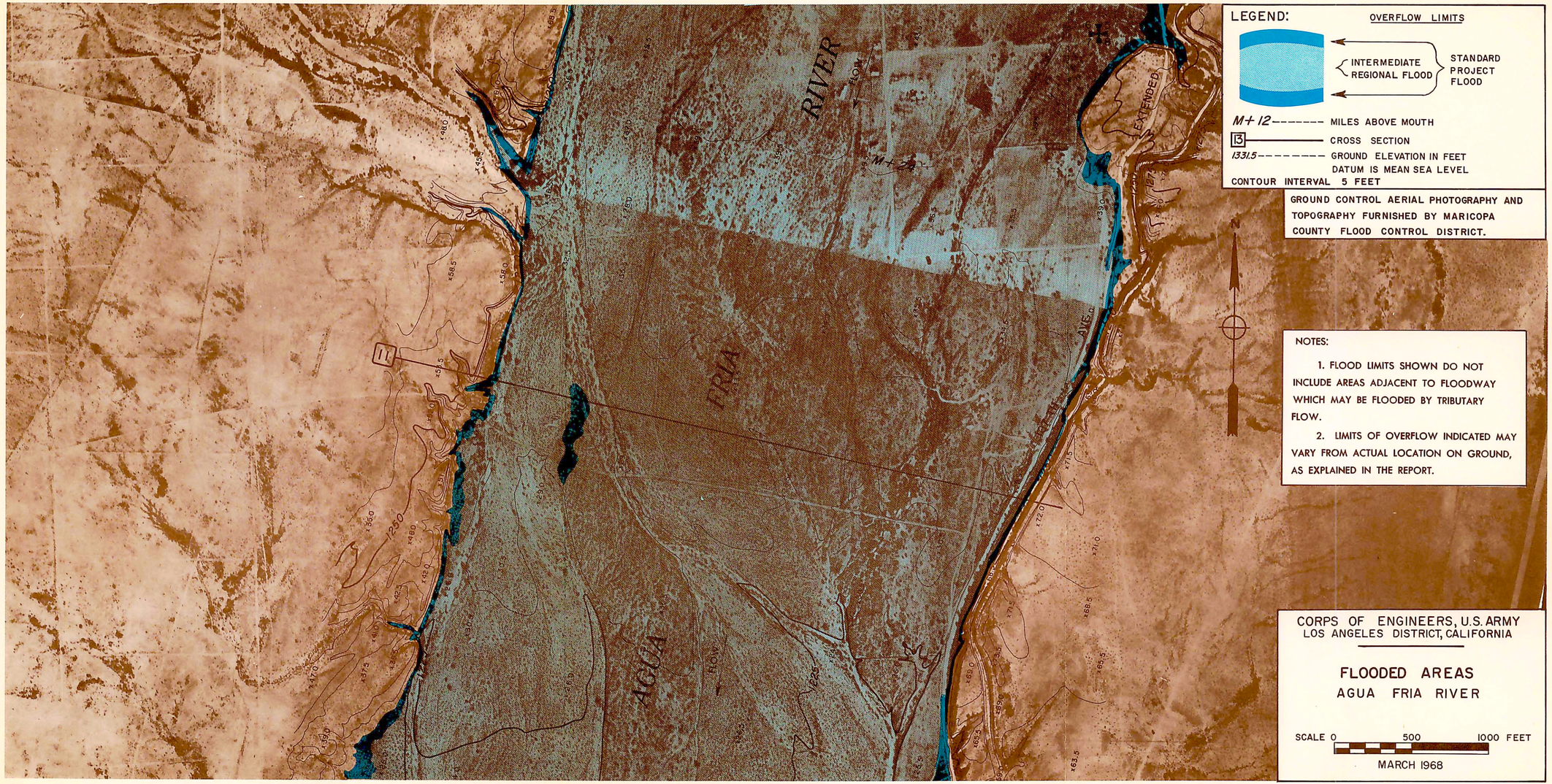
2. LIMITS OF OVERFLOW INDICATED MAY VARY FROM ACTUAL LOCATION ON GROUND, AS EXPLAINED IN THE REPORT.
CORPS OF ENGINEERS, U.S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA
FLOODED AREAS
AGUA FRIA RIVER
SCALE 0 500 1000 FEET
MARCH 1968
T5N
T4N
N
AGUA
FRIA
RIVER
M+25
FLOW
EXTENDED
AVE
10

PLATE 11



LEGEND:

OVERFLOW LIMITS

INTERMEDIATE REGIONAL FLOOD — STANDARD PROJECT FLOOD

M+12 ------- MILES ABOVE MOUTH

13 ——— CROSS SECTION

1331.5 ------- GROUND ELEVATION IN FEET

DATUM IS MEAN SEA LEVEL

CONTOUR INTERVAL 5 FEET

GROUND CONTROL AERIAL PHOTOGRAPHY AND TOPOGRAPHY FURNISHED BY MARICOPA COUNTY FLOOD CONTROL DISTRICT.

N

NOTES:

1. FLOOD LIMITS SHOWN DO NOT INCLUDE AREAS ADJACENT TO FLOODWAY WHICH MAY BE FLOODED BY TRIBUTARY FLOW.

2. LIMITS OF OVERFLOW INDICATED MAY VARY FROM ACTUAL LOCATION ON GROUND, AS EXPLAINED IN THE REPORT.

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

FLOODED AREAS
AGUA FRIA RIVER

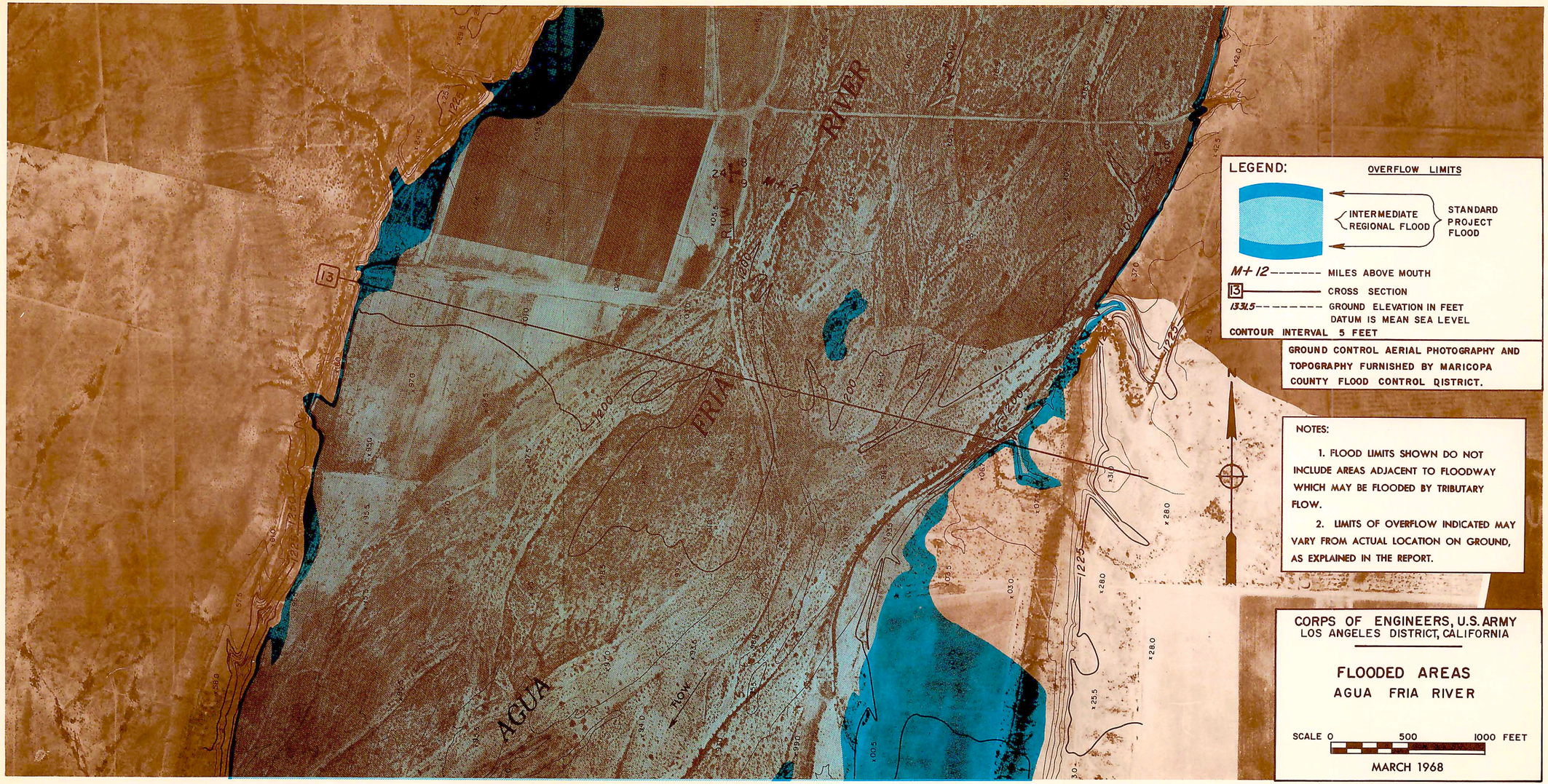
SCALE 0 500 1000 FEET

MARCH 1968

PLATE 12

LEGEND:
OVERFLOW LIMITS
INTERMEDIATE REGIONAL FLOOD
STANDARD PROJECT FLOOD
M+ 12 MILES ABOVE MOUTH
13 CROSS SECTION
1331.5 GROUND ELEVATION IN FEET DATUM IS MEAN SEA LEVEL
CONTOUR INTERVAL 5 FEET
GROUND CONTROL AERIAL PHOTOGRAPHY AND TOPOGRAPHY FURNISHED BY MARICOPA COUNTY FLOOD CONTROL DISTRICT.
NOTES:
1. FLOOD LIMITS SHOWN DO NOT INCLUDE AREAS ADJACENT TO FLOODWAY WHICH MAY BE FLOODED BY TRIBUTARY FLOW.
2. LIMITS OF OVERFLOW INDICATED MAY VARY FROM ACTUAL LOCATION ON GROUND, AS EXPLAINED IN THE REPORT.
CORPS OF ENGINEERS, U.S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA
FLOODED AREAS
AGUA FRIA RIVER
SCALE 0 500 1000 FEET
MARCH 1968
N
AGUA
FRIA
RIVER
R.1W R.1E
12
1250

PLATE 13


RIVER
AGUA
FRIA
FLOW
13
1225
1200
1400
LEGEND:
OVERFLOW LIMITS
INTERMEDIATE REGIONAL FLOOD
STANDARD PROJECT FLOOD
M+12 ------- MILES ABOVE MOUTH
13 ——— CROSS SECTION
1334.5 ------- GROUND ELEVATION IN FEET DATUM IS MEAN SEA LEVEL
CONTOUR INTERVAL 5 FEET
GROUND CONTROL AERIAL PHOTOGRAPHY AND TOPOGRAPHY FURNISHED BY MARICOPA COUNTY FLOOD CONTROL DISTRICT.
NOTES:
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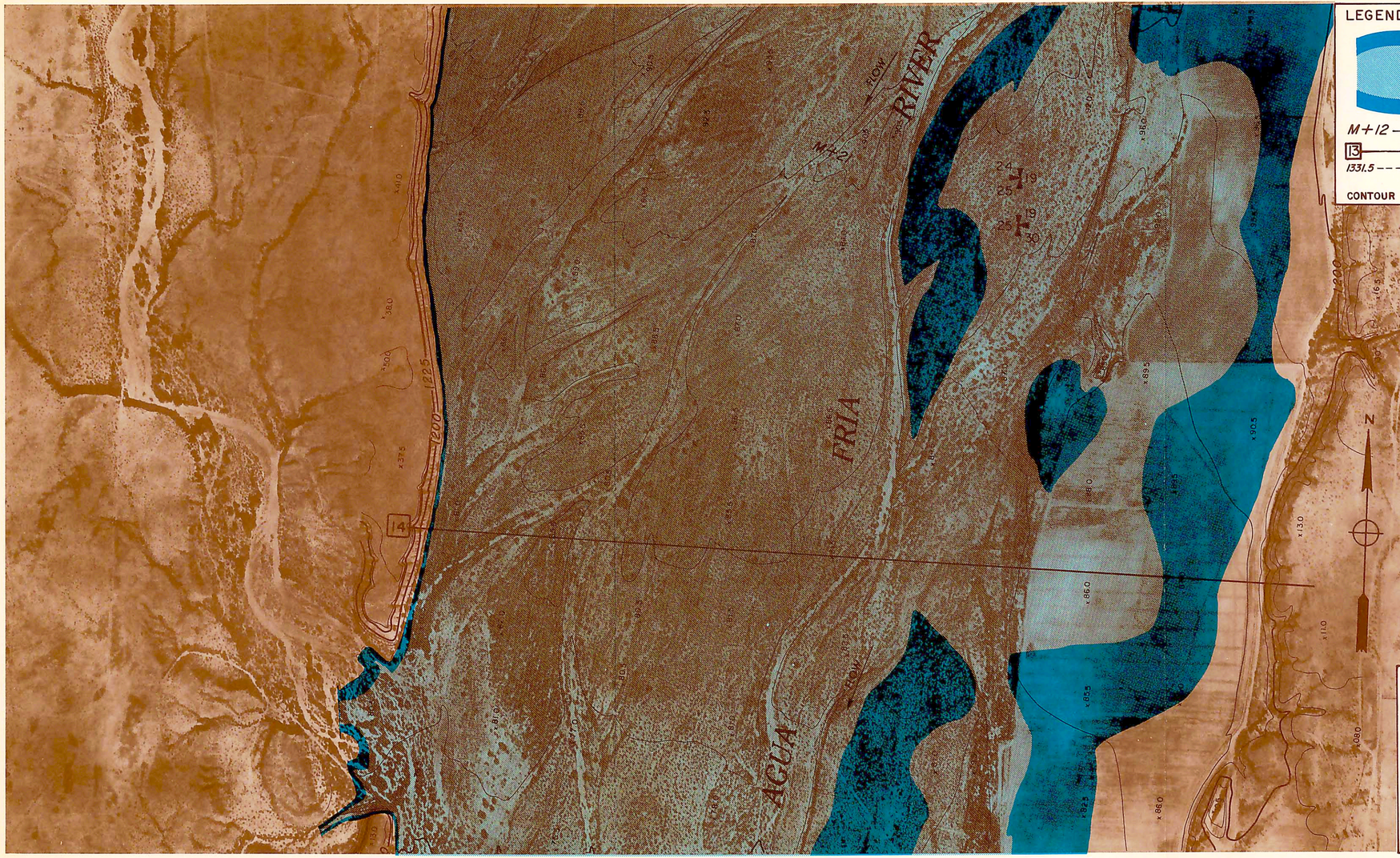
2. LIMITS OF OVERFLOW INDICATED MAY VARY FROM ACTUAL LOCATION ON GROUND, AS EXPLAINED IN THE REPORT.
CORPS OF ENGINEERS, U.S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA
FLOODED AREAS
AGUA FRIA RIVER
SCALE 0 500 1000 FEET
MARCH 1968

PLATE 14



LEGEND:

OVERFLOW LIMITS

INTERMEDIATE REGIONAL FLOOD

STANDARD PROJECT FLOOD

M+12 ------- MILES ABOVE MOUTH

13 ——— CROSS SECTION

1331.5 ——— GROUND ELEVATION IN FEET DATUM IS MEAN SEA LEVEL

CONTOUR INTERVAL 5 FEET

GROUND CONTROL AERIAL PHOTOGRAPHY AND TOPOGRAPHY FURNISHED BY MARICOPA COUNTY FLOOD CONTROL DISTRICT.

NOTES:

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2. LIMITS OF OVERFLOW INDICATED MAY VARY FROM ACTUAL LOCATION ON GROUND, AS EXPLAINED IN THE REPORT.

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

FLOODED AREAS
AGUA FRIA RIVER

SCALE 0 500 1000 FEET

MARCH 1968

PLATE 15


RIVER
AGUA FRIA
M+20
M+12
15
30
36
31
R.1W
R.1E
1200
1175
LEGEND:
OVERFLOW LIMITS
INTERMEDIATE REGIONAL FLOOD
STANDARD PROJECT FLOOD
M+12 ------- MILES ABOVE MOUTH
13 CROSS SECTION
1331.5 GROUND ELEVATION IN FEET DATUM IS MEAN SEA LEVEL
CONTOUR INTERVAL 5 FEET
GROUND CONTROL AERIAL PHOTOGRAPHY AND TOPOGRAPHY FURNISHED BY MARICOPA COUNTY FLOOD CONTROL DISTRICT.
NOTES:
1. FLOOD LIMITS SHOWN DO NOT INCLUDE AREAS ADJACENT TO FLOODWAY WHICH MAY BE FLOODED BY TRIBUTARY FLOW.
2. LIMITS OF OVERFLOW INDICATED MAY VARY FROM ACTUAL LOCATION ON GROUND, AS EXPLAINED IN THE REPORT.
CORPS OF ENGINEERS, U.S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA
FLOODED AREAS
AGUA FRIA RIVER
SCALE 0 500 1000 FEET
MARCH 1968

PLATE 16

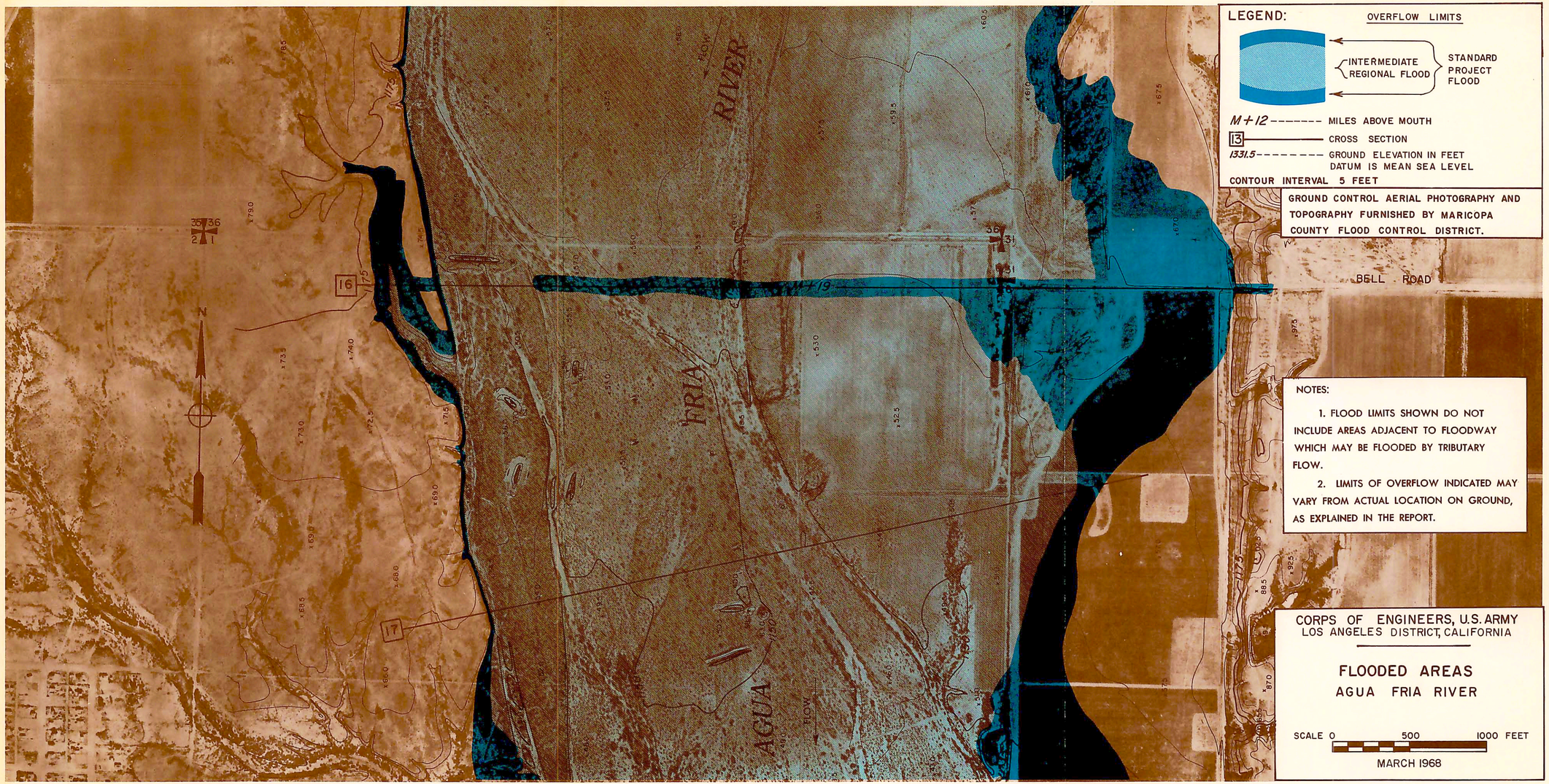
LEGEND:
OVERFLOW LIMITS
INTERMEDIATE REGIONAL FLOOD
STANDARD PROJECT FLOOD
M+12 ------- MILES ABOVE MOUTH
13 ——— CROSS SECTION
1331.5 ------- GROUND ELEVATION IN FEET DATUM IS MEAN SEA LEVEL
CONTOUR INTERVAL 5 FEET
GROUND CONTROL AERIAL PHOTOGRAPHY AND TOPOGRAPHY FURNISHED BY MARICOPA COUNTY FLOOD CONTROL DISTRICT.
BELL ROAD
AGUA FRIA RIVER
M+19
NOTES:
1. FLOOD LIMITS SHOWN DO NOT INCLUDE AREAS ADJACENT TO FLOODWAY WHICH MAY BE FLOODED BY TRIBUTARY FLOW.
2. LIMITS OF OVERFLOW INDICATED MAY VARY FROM ACTUAL LOCATION ON GROUND, AS EXPLAINED IN THE REPORT.
CORPS OF ENGINEERS, U.S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA
FLOODED AREAS
AGUA FRIA RIVER
SCALE 0 500 1000 FEET
MARCH 1968

PLATE 17


LEGEND:
OVERFLOW LIMITS
INTERMEDIATE REGIONAL FLOOD
STANDARD PROJECT FLOOD
M+12 MILES ABOVE MOUTH
13 CROSS SECTION
1331.5 GROUND ELEVATION IN FEET DATUM IS MEAN SEA LEVEL
CONTOUR INTERVAL 5 FEET
GROUND CONTROL AERIAL PHOTOGRAPHY AND TOPOGRAPHY FURNISHED BY MARICOPA COUNTY FLOOD CONTROL DISTRICT.
NOTES:
1. FLOOD LIMITS SHOWN DO NOT INCLUDE AREAS ADJACENT TO FLOODWAY WHICH MAY BE FLOODED BY TRIBUTARY FLOW.
2. LIMITS OF OVERFLOW INDICATED MAY VARY FROM ACTUAL LOCATION ON GROUND, AS EXPLAINED IN THE REPORT.
CORPS OF ENGINEERS, U.S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA
FLOODED AREAS
AGUA FRIA RIVER
SCALE 0 500 1000 FEET
MARCH 1968
AGUA FRIA RIVER
M+18
GREENWAY RD.
JERRY ST.
A.T. & S.F. R.R.
HIGHWAY 60, 70, 89 & 93
GRAND AVE.
SANTA FE LANE
EL MIRAGE RD.
PALM ST.
FLOW
R.1W.
R.1E.
N

PLATE 18

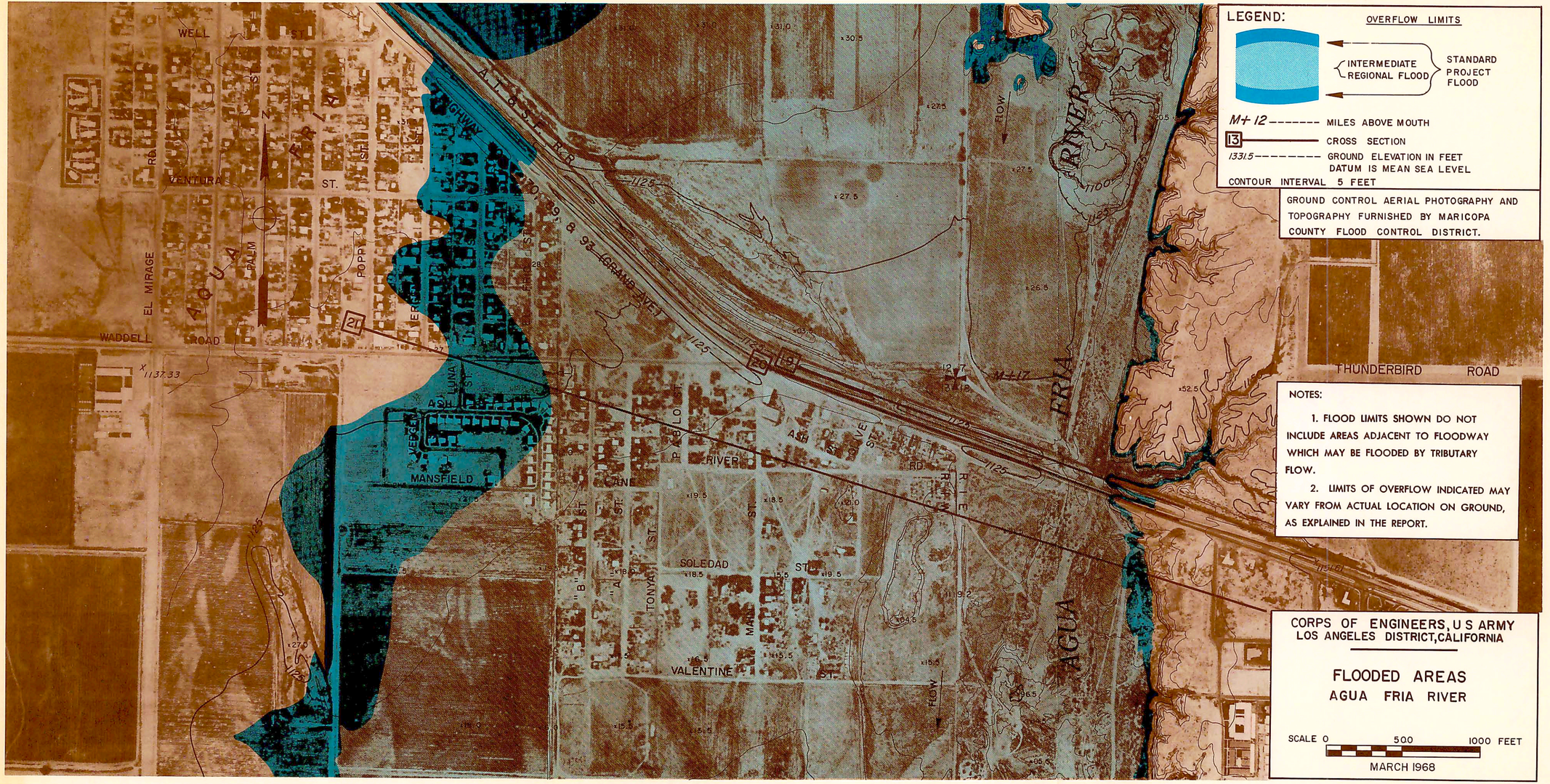
LEGEND:
OVERFLOW LIMITS
INTERMEDIATE REGIONAL FLOOD
STANDARD PROJECT FLOOD
M+12 ------- MILES ABOVE MOUTH
13 CROSS SECTION
1331.5 ------- GROUND ELEVATION IN FEET DATUM IS MEAN SEA LEVEL
CONTOUR INTERVAL 5 FEET
GROUND CONTROL AERIAL PHOTOGRAPHY AND TOPOGRAPHY FURNISHED BY MARICOPA COUNTY FLOOD CONTROL DISTRICT.
NOTES:
1. FLOOD LIMITS SHOWN DO NOT INCLUDE AREAS ADJACENT TO FLOODWAY WHICH MAY BE FLOODED BY TRIBUTARY FLOW.
2. LIMITS OF OVERFLOW INDICATED MAY VARY FROM ACTUAL LOCATION ON GROUND, AS EXPLAINED IN THE REPORT.
CORPS OF ENGINEERS, U S ARMY
LOS ANGELES DISTRICT, CALIFORNIA
FLOODED AREAS
AGUA FRIA RIVER
SCALE 0 500 1000 FEET
MARCH 1968
WELL ST
VENTURA ST.
EL MIRAGE
AGUA FRIA
PALM
POPPY
WADDELL ROAD
X 1137.33
HIGHWAY 60, 70 & 93 (GRAND AVE.)
A.T. & S.F. R.R.
LUNA ST.
VERDEN
MANSFIELD
ASH
PALO VERDE
RIVER
CANAL
SOLEDAD ST.
VALENTINE ST.
"A" ST.
"B" ST.
TONYA ST.
MAIN ST.
ROW
AGUA FRIA RIVER
THUNDERBIRD ROAD
M+17
1125
1100
1075

PLATE 19


LEGEND:
OVERFLOW LIMITS
INTERMEDIATE REGIONAL FLOOD
STANDARD PROJECT FLOOD
M+12 MILES ABOVE MOUTH
13 CROSS SECTION
1331.5 GROUND ELEVATION IN FEET
DATUM IS MEAN SEA LEVEL
CONTOUR INTERVAL 5 FEET
GROUND CONTROL AERIAL PHOTOGRAPHY AND TOPOGRAPHY FURNISHED BY MARICOPA COUNTY FLOOD CONTROL DISTRICT.
NOTES:
1. FLOOD LIMITS SHOWN DO NOT INCLUDE AREAS ADJACENT TO FLOODWAY WHICH MAY BE FLOODED BY TRIBUTARY FLOW.
2. LIMITS OF OVERFLOW INDICATED MAY VARY FROM ACTUAL LOCATION ON GROUND, AS EXPLAINED IN THE REPORT.
CORPS OF ENGINEERS, U.S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA
FLOODED AREAS
AGUA FRIA RIVER
SCALE 0 500 1000 FEET
MARCH 1968
EL MIRAGE ROAD
CACTUS ROAD
AGUA FRIA RIVER
FLOW
M+16
22
RHODE ISLAND AVE.
NEVADA AVE.
ALABAMA AVE.
113 TH AVE.
111TH AVE.
YOUNGTOWN
SUN CITY
CHERRY HILLS DRIVE
LAKE SHORE DR.
CONNECTICUT AVE.
DULUTH AVE.
ELK AVE.
FLORIDA AVE.
114 TH AVE.
N

PLATE 20

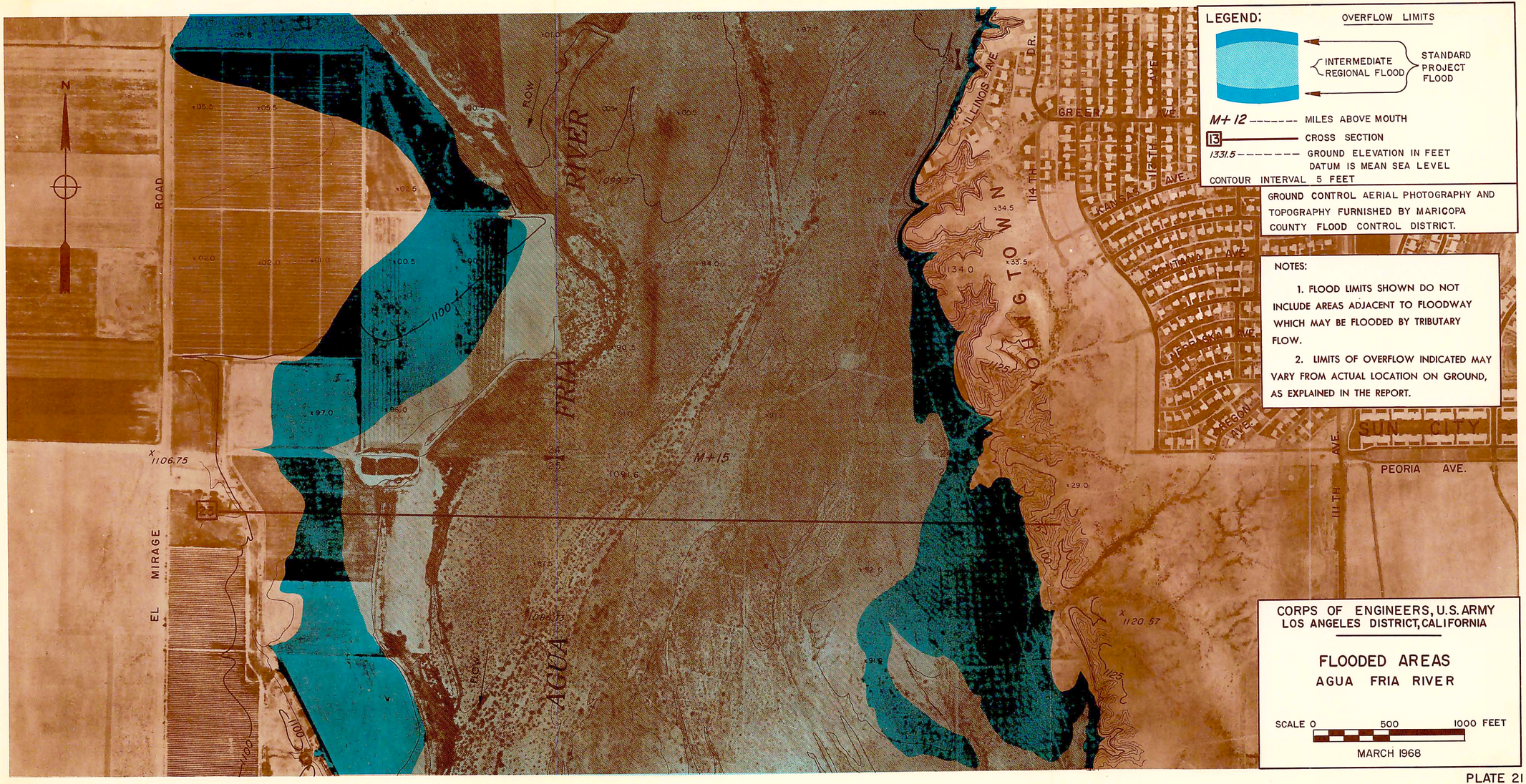
LEGEND:
OVERFLOW LIMITS
INTERMEDIATE REGIONAL FLOOD
STANDARD PROJECT FLOOD
M+12 ------- MILES ABOVE MOUTH
13 CROSS SECTION
1331.5 ------- GROUND ELEVATION IN FEET DATUM IS MEAN SEA LEVEL
CONTOUR INTERVAL 5 FEET
GROUND CONTROL AERIAL PHOTOGRAPHY AND TOPOGRAPHY FURNISHED BY MARICOPA COUNTY FLOOD CONTROL DISTRICT.
NOTES:
1. FLOOD LIMITS SHOWN DO NOT INCLUDE AREAS ADJACENT TO FLOODWAY WHICH MAY BE FLOODED BY TRIBUTARY FLOW.
2. LIMITS OF OVERFLOW INDICATED MAY VARY FROM ACTUAL LOCATION ON GROUND, AS EXPLAINED IN THE REPORT.
CORPS OF ENGINEERS, U.S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA
FLOODED AREAS
AGUA FRIA RIVER
SCALE 0 500 1000 FEET
MARCH 1968
N
AGUA FRIA RIVER
EL MIRAGE ROAD
GREER AVE.
ILLINOIS AVE
DR.
114 TH AVE
JOHNSTON AVE
OREGON AVE
SUN CITY
PEORIA AVE.
111 TH AVE
M+15
1106.75
1120.57
1134.0
1099.37
1091.6
1100
1125
FLOW

PLATE 21


LEGEND:
OVERFLOW LIMITS
INTERMEDIATE REGIONAL FLOOD
STANDARD PROJECT FLOOD
M+12 ------- MILES ABOVE MOUNTH
13 ——— CROSS SECTION
1331.5 ------- GROUND ELEVATION IN FEET DATUM IS MEAN SEA LEVEL
CONTOUR INTERVAL 5 FEET
GROUND CONTROL AERIAL PHOTOGRAPHY AND TOPOGRAPHY FURNISHED BY MARICOPA COUNTY FLOOD CONTROL DISTRICT.
NOTES:
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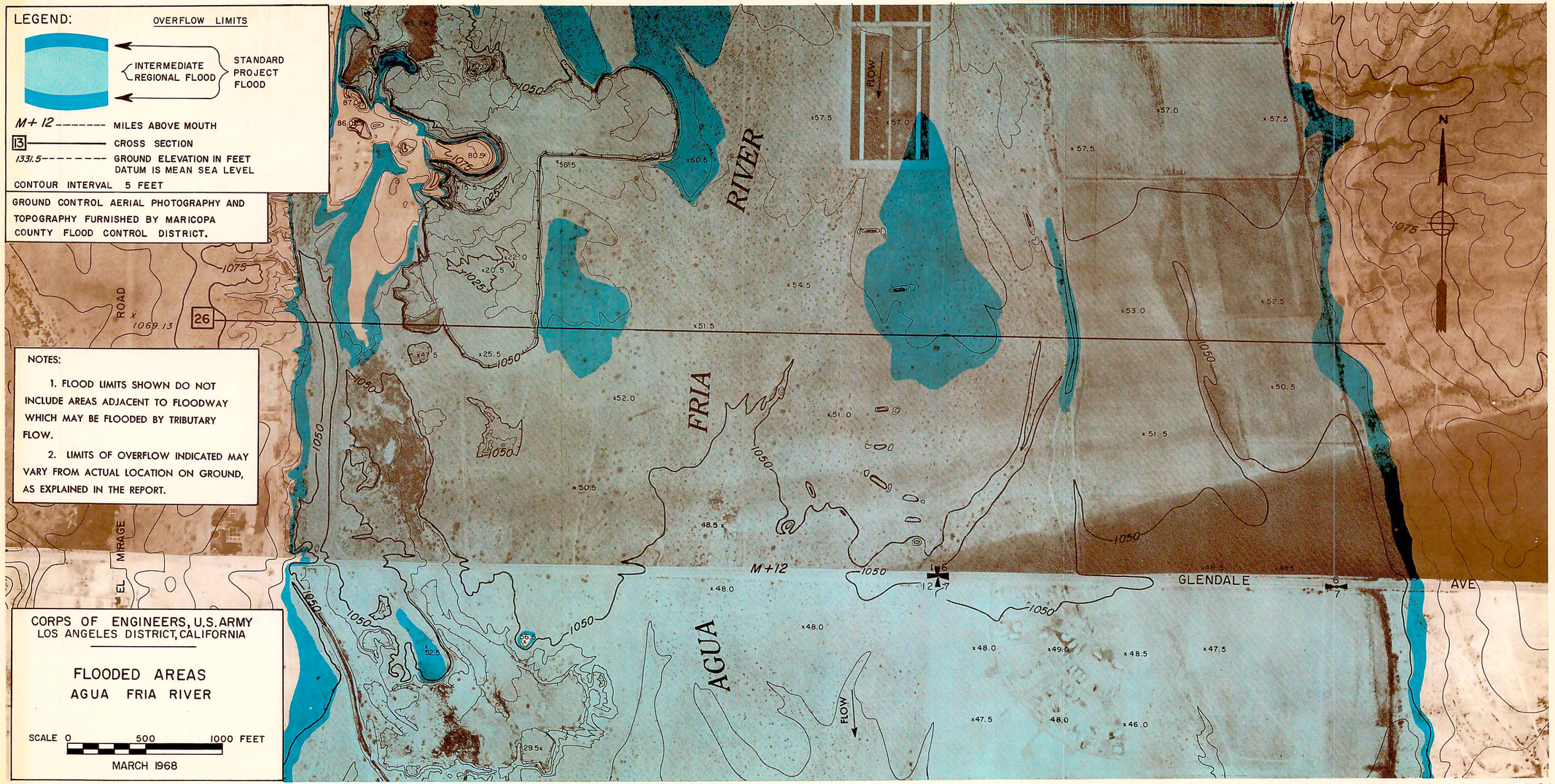
2. LIMITS OF OVERFLOW INDICATED MAY VARY FROM ACTUAL LOCATION ON GROUND, AS EXPLAINED IN THE REPORT.
CORPS OF ENGINEERS, U.S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA
FLOODED AREAS
AGUA FRIA RIVER
SCALE 0 500 1000 FEET
MARCH 1968
AGUA FRIA RIVER
FLOW
EL MIRAGE ROAD
OLIVE AVE
M+14
24
25
30
36
31
N

PLATE 22


LEGEND:
OVERFLOW LIMITS
INTERMEDIATE REGIONAL FLOOD
STANDARD PROJECT FLOOD
M+12 MILES ABOVE MOUTH
13 CROSS SECTION
1331.5 GROUND ELEVATION IN FEET DATUM IS MEAN SEA LEVEL
CONTOUR INTERVAL 5 FEET
GROUND CONTROL AERIAL PHOTOGRAPHY AND TOPOGRAPHY FURNISHED BY MARICOPA COUNTY FLOOD CONTROL DISTRICT.
NOTES:
1. FLOOD LIMITS SHOWN DO NOT INCLUDE AREAS ADJACENT TO FLOODWAY WHICH MAY BE FLOODED BY TRIBUTARY FLOW.
2. LIMITS OF OVERFLOW INDICATED MAY VARY FROM ACTUAL LOCATION ON GROUND, AS EXPLAINED IN THE REPORT.
AGUA FRIA RIVER
EL MIRAGE ROAD
NORTHERN AVE
M+13
25
1075
FLOW
N
CORPS OF ENGINEERS, U.S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA
FLOODED AREAS
AGUA FRIA RIVER
SCALE 0 500 1000 FEET
MARCH 1968

PLATE 23


LEGEND:
OVERFLOW LIMITS
INTERMEDIATE REGIONAL FLOOD
STANDARD PROJECT FLOOD
M+12 ------- MILES ABOVE MOUTH
13 ——— CROSS SECTION
1331.5 ------- GROUND ELEVATION IN FEET DATUM IS MEAN SEA LEVEL
CONTOUR INTERVAL 5 FEET
GROUND CONTROL AERIAL PHOTOGRAPHY AND TOPOGRAPHY FURNISHED BY MARICOPA COUNTY FLOOD CONTROL DISTRICT.
NOTES:
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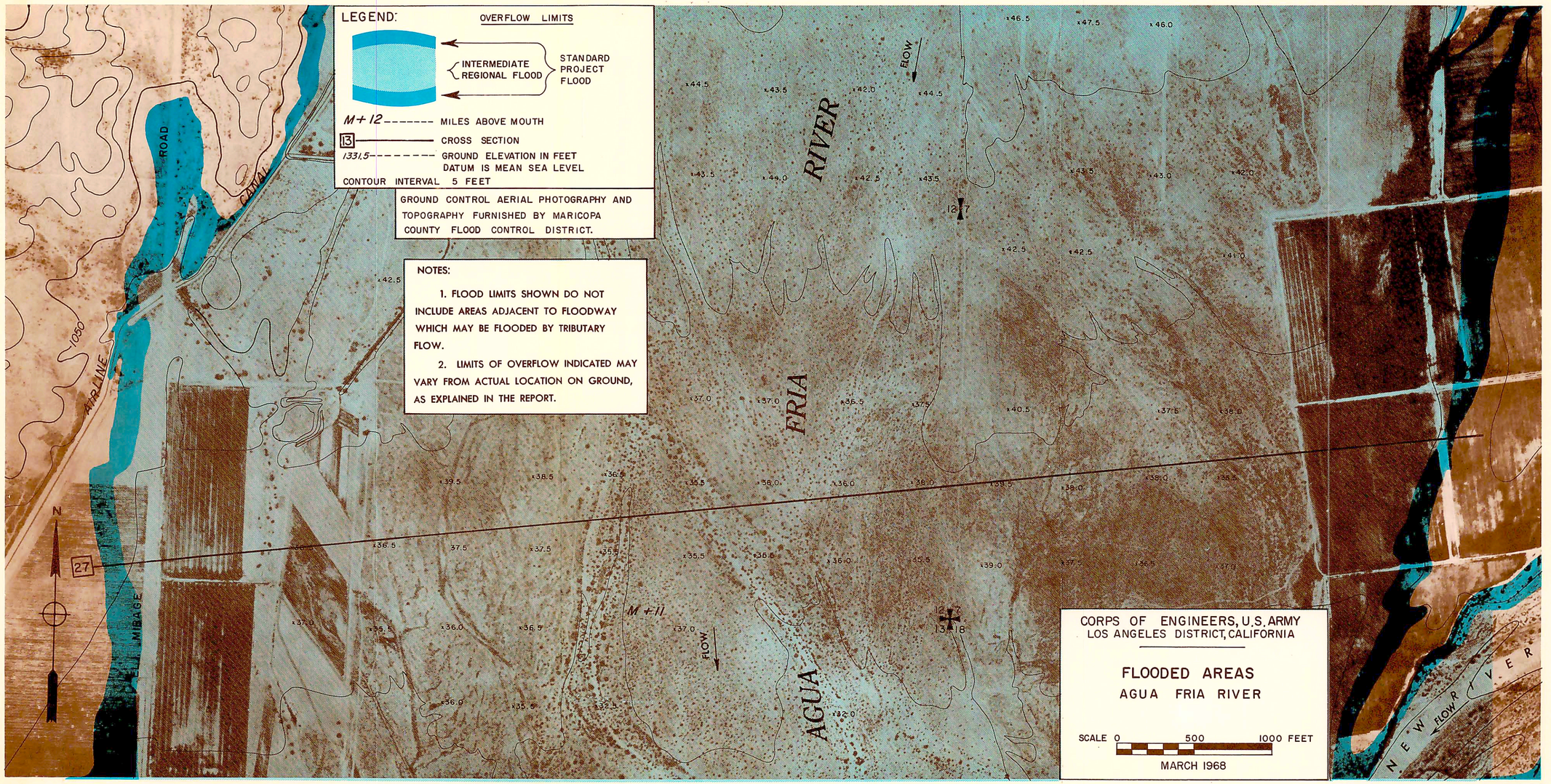
2. LIMITS OF OVERFLOW INDICATED MAY VARY FROM ACTUAL LOCATION ON GROUND, AS EXPLAINED IN THE REPORT.
CORPS OF ENGINEERS, U.S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA
FLOODED AREAS
AGUA FRIA RIVER
SCALE 0 500 1000 FEET
MARCH 1968
AGUA FRIA RIVER
FLOW
ROAD
EL MIRAGE
GLENDALE
AVE
M+12
26
1069.13
N

PLATE 24


LEGEND:
OVERFLOW LIMITS
INTERMEDIATE REGIONAL FLOOD
STANDARD PROJECT FLOOD
M+12 MILES ABOVE MOUTH
13 CROSS SECTION
1331.5 GROUND ELEVATION IN FEET DATUM IS MEAN SEA LEVEL
CONTOUR INTERVAL 5 FEET
GROUND CONTROL AERIAL PHOTOGRAPHY AND TOPOGRAPHY FURNISHED BY MARICOPA COUNTY FLOOD CONTROL DISTRICT.
NOTES:
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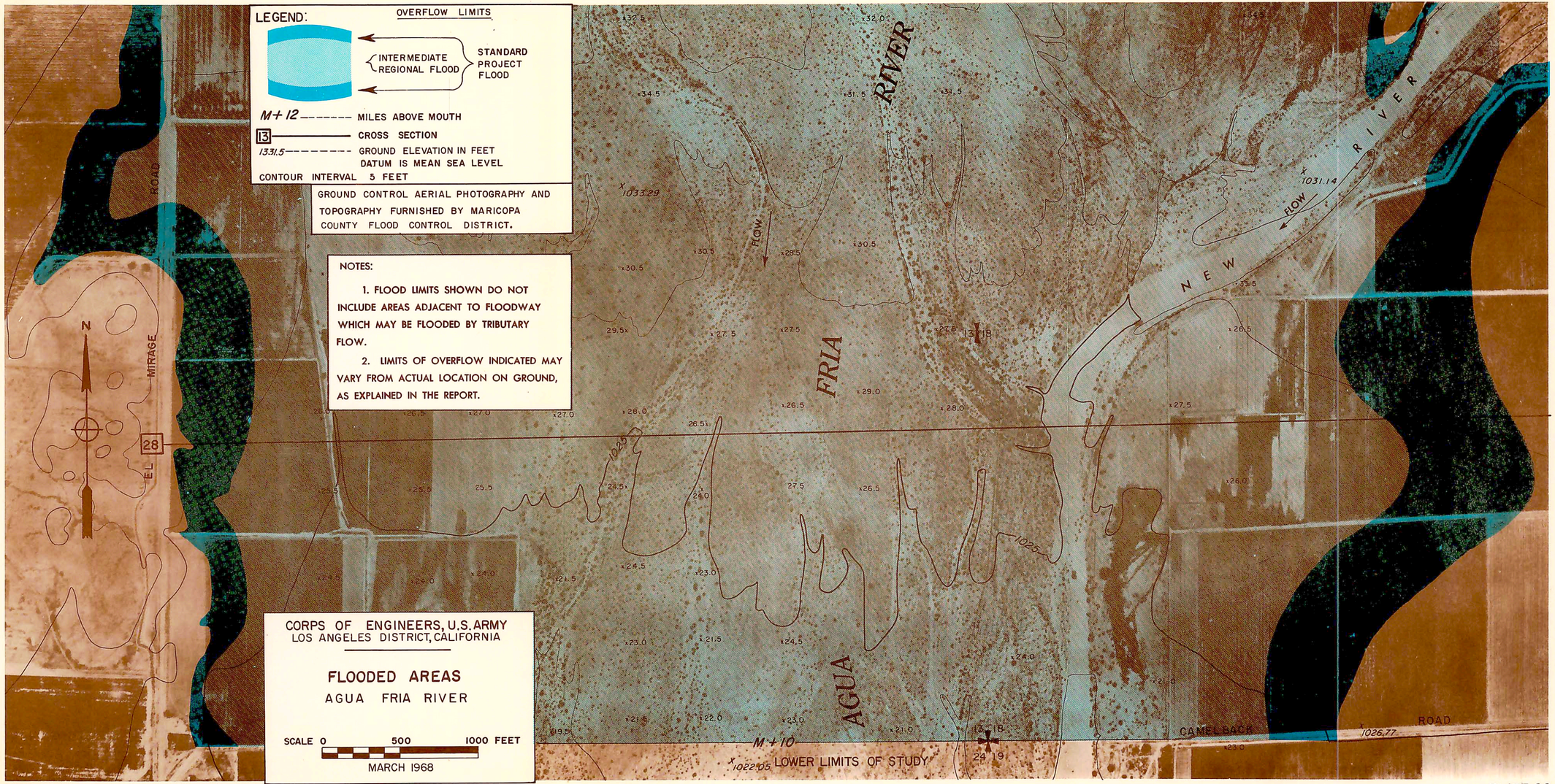
2. LIMITS OF OVERFLOW INDICATED MAY VARY FROM ACTUAL LOCATION ON GROUND, AS EXPLAINED IN THE REPORT.
AGUA FRIA RIVER
FLOW
M+11
ROAD
CANAL
AIRLINE
1050
MIRAGE
N
27
NEW RIVER
CORPS OF ENGINEERS, U.S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA
FLOODED AREAS
AGUA FRIA RIVER
SCALE 0 500 1000 FEET
MARCH 1968

PLATE 25


LEGEND:
OVERFLOW LIMITS
INTERMEDIATE REGIONAL FLOOD
STANDARD PROJECT FLOOD
M+12 MILES ABOVE MOUTH
13 CROSS SECTION
1331.5 GROUND ELEVATION IN FEET DATUM IS MEAN SEA LEVEL
CONTOUR INTERVAL 5 FEET
GROUND CONTROL AERIAL PHOTOGRAPHY AND TOPOGRAPHY FURNISHED BY MARICOPA COUNTY FLOOD CONTROL DISTRICT.
NOTES:
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2. LIMITS OF OVERFLOW INDICATED MAY VARY FROM ACTUAL LOCATION ON GROUND, AS EXPLAINED IN THE REPORT.
N
MIRAGE ROAD
EL 28
AGUA FRIA RIVER
NEW RIVER
FLOW
FLOW
1033.29
1031.14
1025
1026.77
M+10
1022.05 LOWER LIMITS OF STUDY
CAMELBACK ROAD
13 18
24 19
CORPS OF ENGINEERS, U.S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA
FLOODED AREAS
AGUA FRIA RIVER
SCALE 0 500 1000 FEET
MARCH 1968

PLATE 26

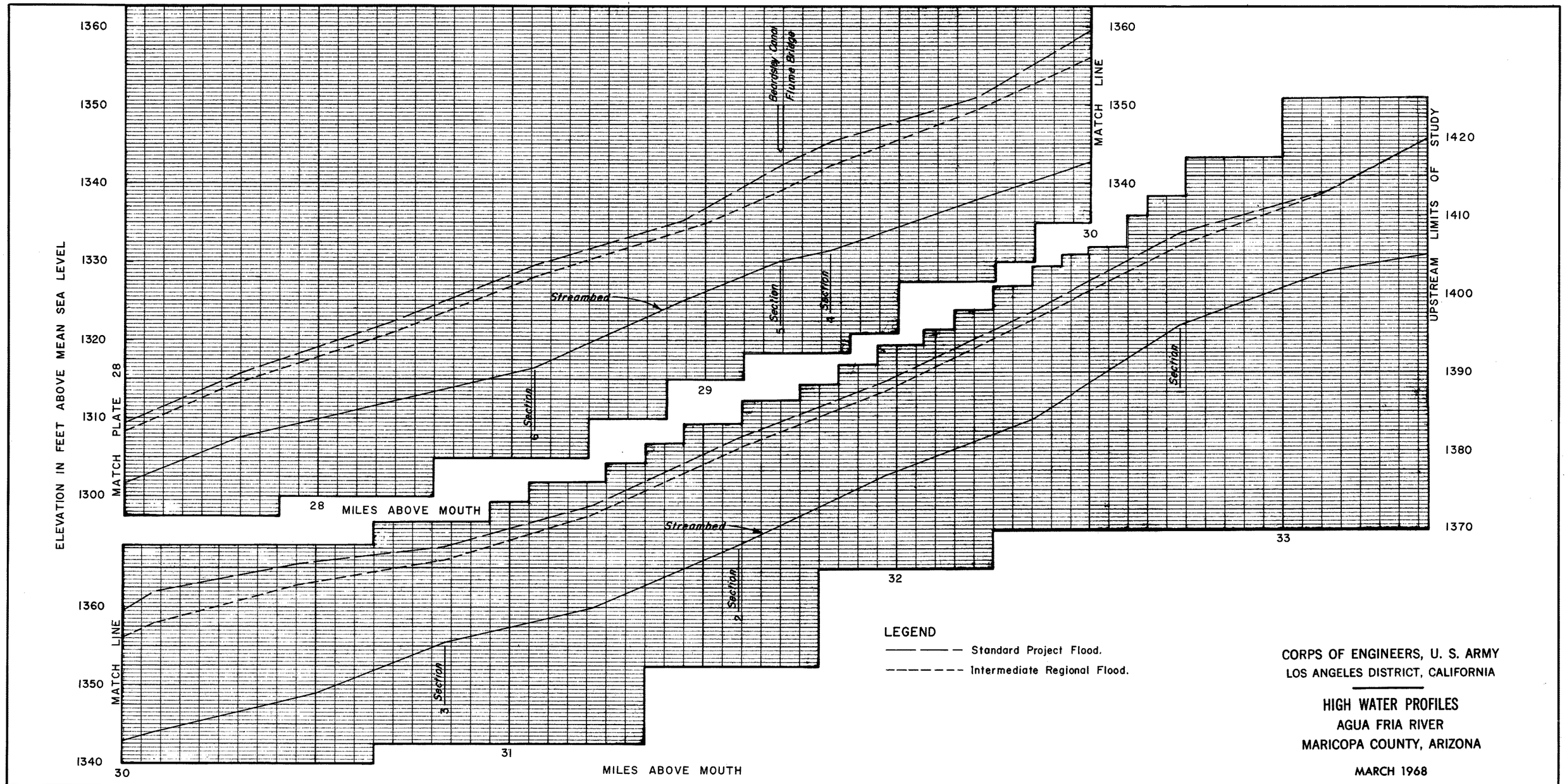

ELEVATION IN FEET ABOVE MEAN SEA LEVEL
1360
1350
1340
1330
1320
1310
1300
MATCH PLATE 28
MATCH LINE
UPSTREAM LIMITS OF STUDY
1420
1410
1400
1390
1380
1370
Streambed
Section 6
Section 5
Section 4
Section 3
Section 2
Section 1
Gearoday Canal Flume Bridge
28
29
30
31
32
33
MILES ABOVE MOUTH
LEGEND
Standard Project Flood.
Intermediate Regional Flood.
CORPS OF ENGINEERS, U. S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA
HIGH WATER PROFILES
AGUA FRIA RIVER
MARICOPA COUNTY, ARIZONA
MARCH 1968

PLATE 27

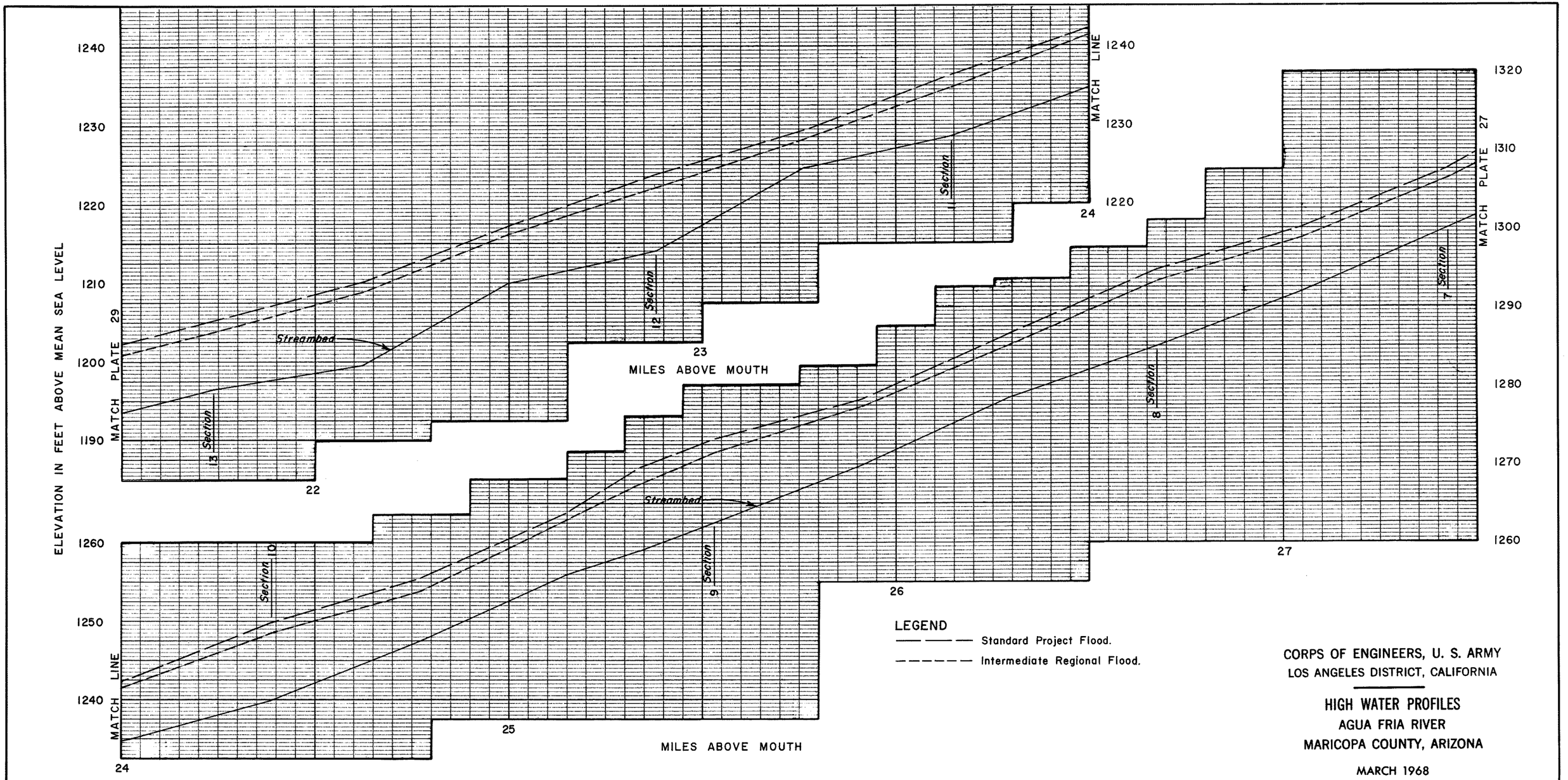

ELEVATION IN FEET ABOVE MEAN SEA LEVEL
1240
1230
1220
1210
1200
1190
MATCH PLATE 29
1260
1250
1240
MATCH LINE
Streambed
13 Section
12 Section
11 Section
10 Section
9 Section
8 Section
7 Section
22
23
24
25
26
27
MILES ABOVE MOUTH
MILES ABOVE MOUTH
MATCH LINE
1240
1230
1220
MATCH PLATE 27
1320
1310
1300
1290
1280
1270
1260
LEGEND
Standard Project Flood.
Intermediate Regional Flood.
CORPS OF ENGINEERS, U. S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA
HIGH WATER PROFILES
AGUA FRIA RIVER
MARICOPA COUNTY, ARIZONA
MARCH 1968

PLATE 28

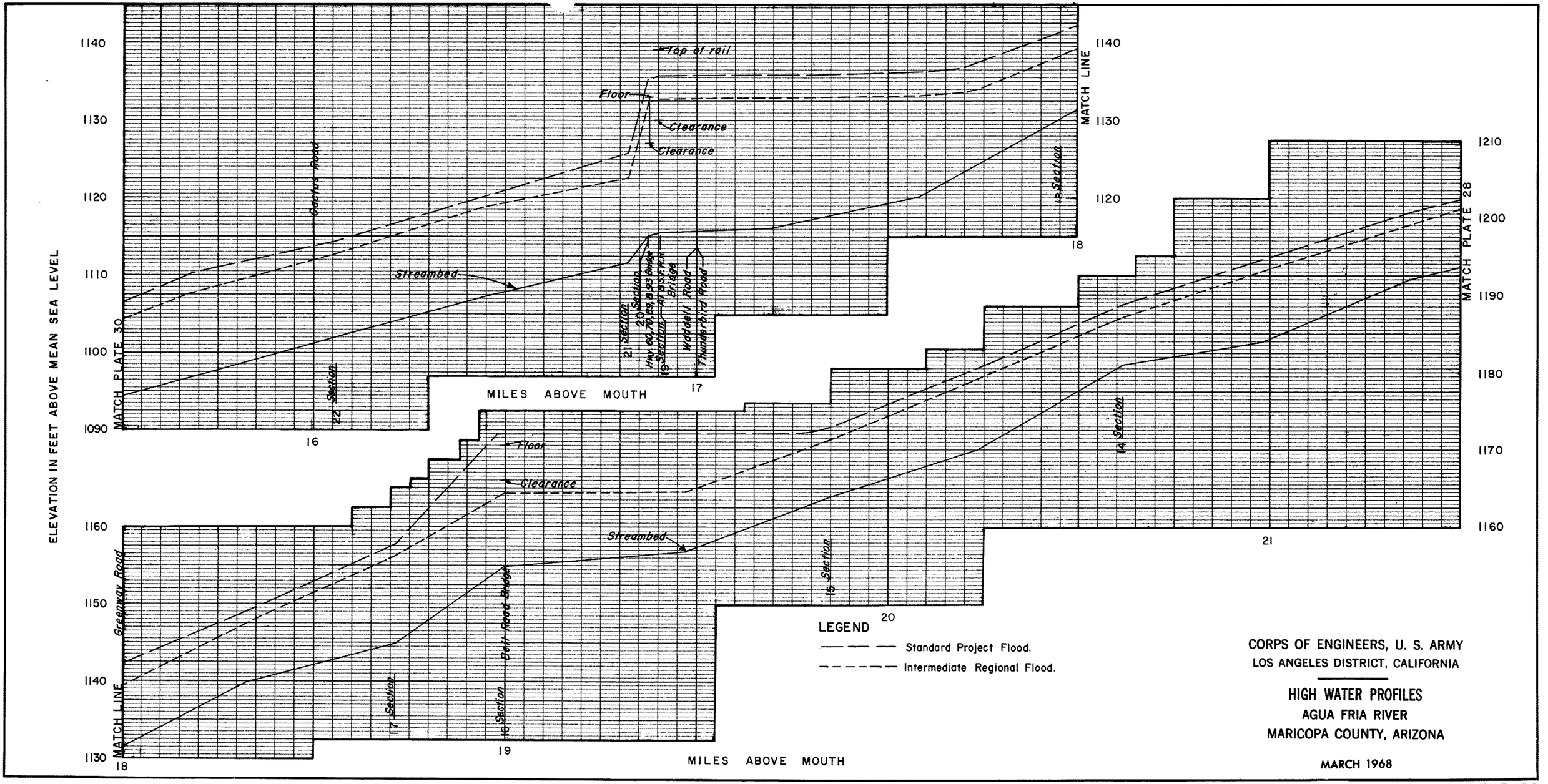
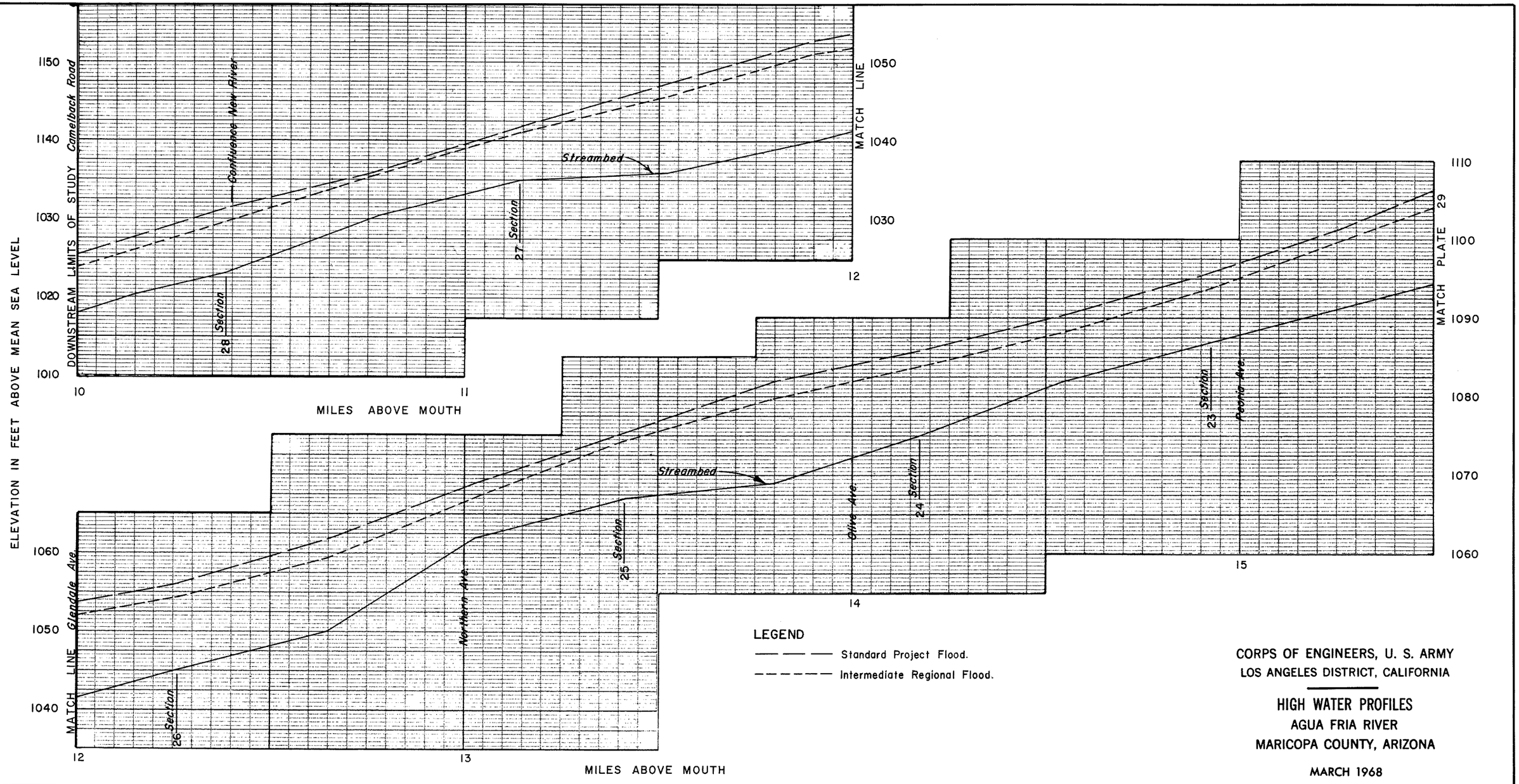

ELEVATION IN FEET ABOVE MEAN SEA LEVEL
1140
1130
1120
1110
1100
1090
1160
1150
1140
1130
1210
1200
1190
1180
1170
1160
MATCH PLATE 30
MATCH PLATE 28
MATCH LINE
MATCH LINE
Cactus Road
Greenway Road
Beth Road Bridge
Thunderbird Road
Waddell Road
Hwy 60, 70, 89, 93 Bridge
Top of rail
Floor
Clearance
Clearance
Streambed
Floor
Clearance
Streambed
22 Section
21 Section
20 Section
19 Section
18 Section
17 Section
16 Section
15 Section
14 Section
16
17
18
19
20
21
MILES ABOVE MOUTH
MILES ABOVE MOUTH
LEGEND
Standard Project Flood.
Intermediate Regional Flood.
CORPS OF ENGINEERS, U. S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA
HIGH WATER PROFILES
AGUA FRIA RIVER
MARICOPA COUNTY, ARIZONA
MARCH 1968

PLATE 29



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

HIGH WATER PROFILES
AGUA FRIA RIVER
MARICOPA COUNTY, ARIZONA

MARCH 1968

PLATE 30

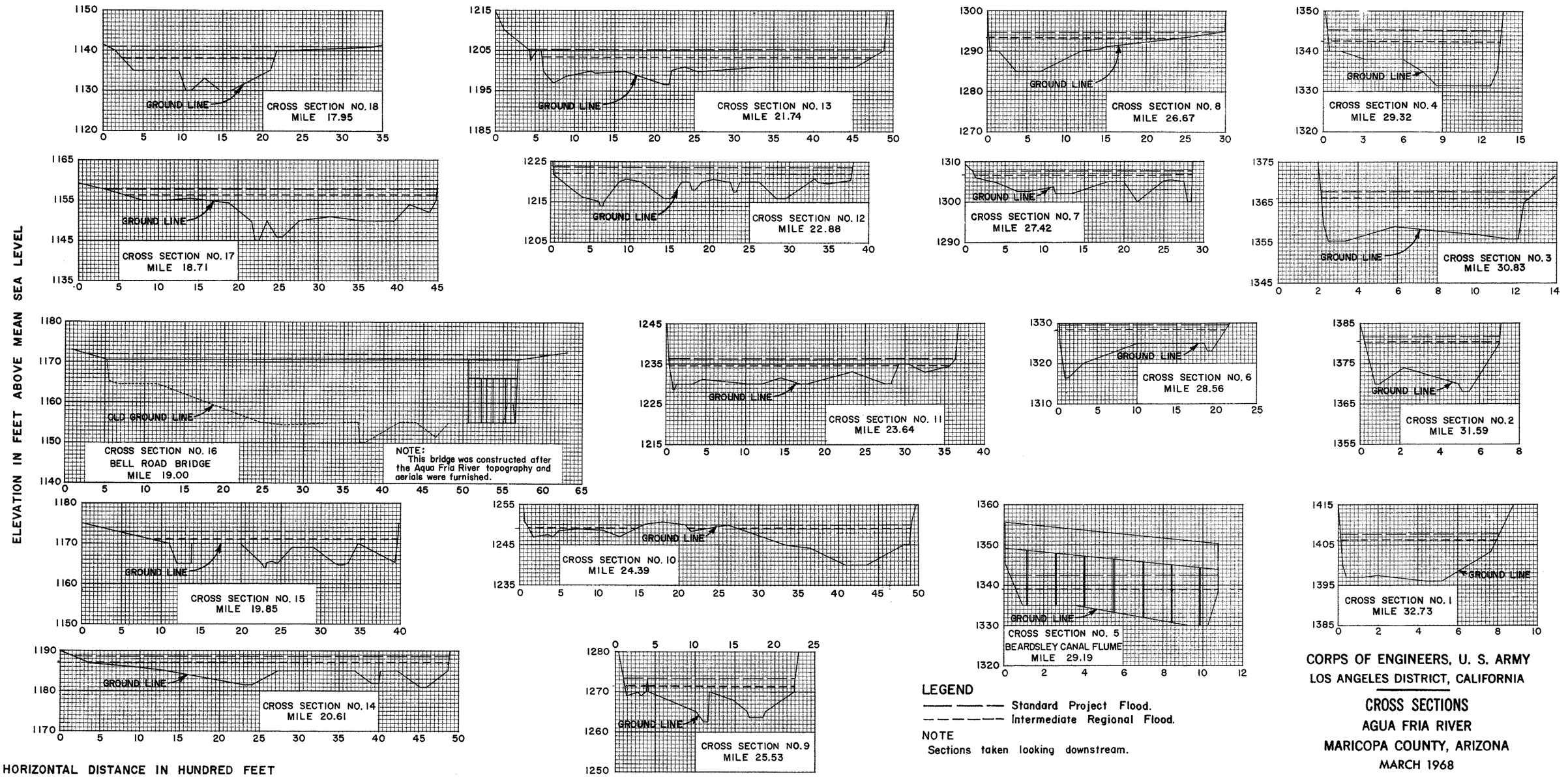
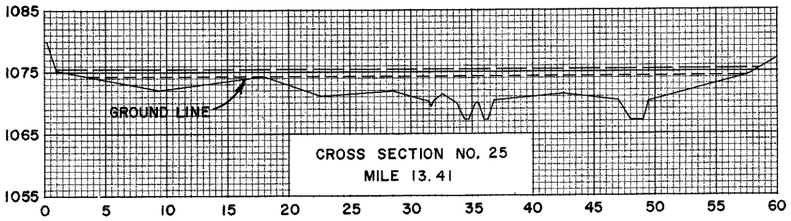
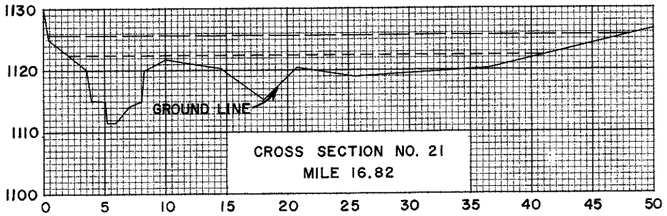
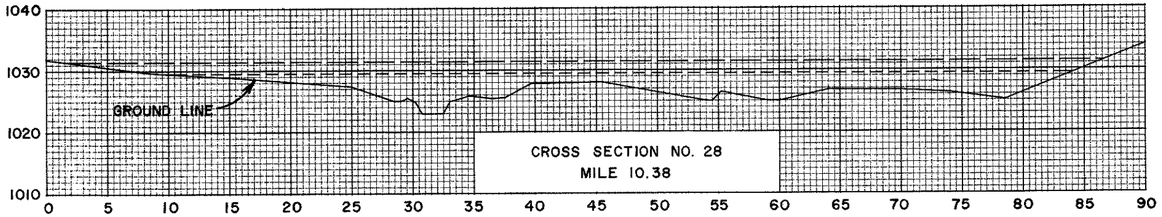
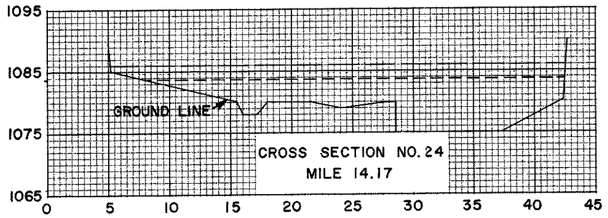

ELEVATION IN FEET ABOVE MEAN SEA LEVEL
GROUND LINE
CROSS SECTION NO. 18
MILE 17.95
CROSS SECTION NO. 13
MILE 21.74
CROSS SECTION NO. 8
MILE 26.67
CROSS SECTION NO. 4
MILE 29.32
CROSS SECTION NO. 17
MILE 18.71
CROSS SECTION NO. 12
MILE 22.88
CROSS SECTION NO. 7
MILE 27.42
CROSS SECTION NO. 3
MILE 30.83
OLD GROUND LINE
CROSS SECTION NO. 16
BELL ROAD BRIDGE
MILE 19.00
NOTE:
This bridge was constructed after the Aqua Fria River topography and aerials were furnished.
CROSS SECTION NO. 11
MILE 23.64
CROSS SECTION NO. 6
MILE 28.56
CROSS SECTION NO. 2
MILE 31.59
CROSS SECTION NO. 15
MILE 19.85
CROSS SECTION NO. 10
MILE 24.39
CROSS SECTION NO. 5
BEARDSLEY CANAL FLUME
MILE 29.19
CROSS SECTION NO. 1
MILE 32.73
CROSS SECTION NO. 14
MILE 20.61
CROSS SECTION NO. 9
MILE 25.53
HORIZONTAL DISTANCE IN HUNDRED FEET
LEGEND
Standard Project Flood.
Intermediate Regional Flood.
NOTE
Sections taken looking downstream.
CORPS OF ENGINEERS, U. S. ARMY
LOS ANGELES DISTRICT, CALIFORNIA
CROSS SECTIONS
AGUA FRIA RIVER
MARICOPA COUNTY, ARIZONA
MARCH 1968

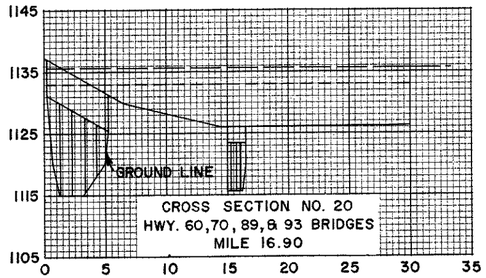
PLATE 31



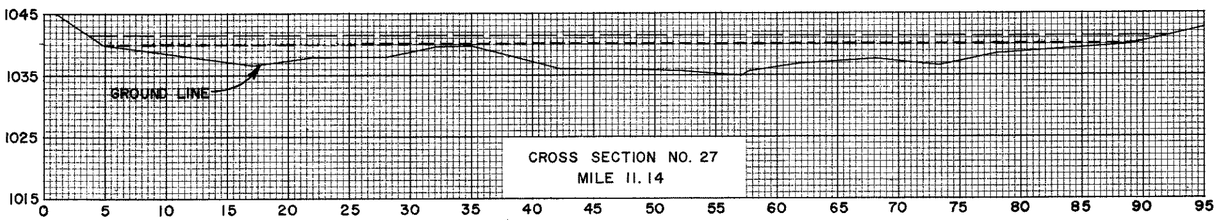


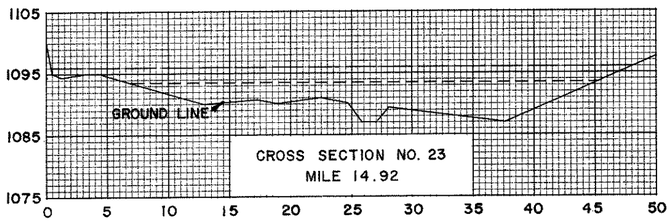


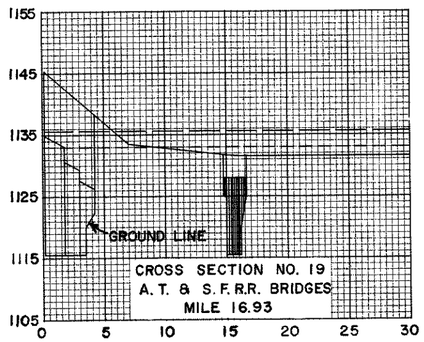


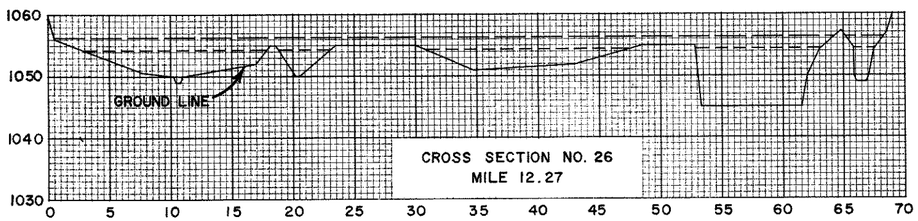


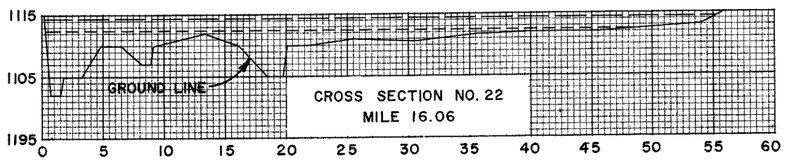
ELEVATION IN FEET ABOVE MEAN SEA LEVEL











LEGEND

——— ——— Standard Project Flood.

– – – – – – Intermediate Regional Flood.

NOTE

Sections taken looking downstream.

CORPS OF ENGINEERS, U. S. ARMY

LOS ANGELES DISTRICT, CALIFORNIA

CROSS SECTIONS

AGUA FRIA RIVER

MARICOPA COUNTY, ARIZONA

MARCH 1968

HORIZONTAL DISTANCE IN HUNDRED FEET

PLATE 32