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FLOOD PLAIN INFORMATION

TRUCKEE RIVER

RENO - SPARKS - TRUCKEE MEADOWS, NEVADA

Prepared for

THE REGIONAL PLANNING COMMISSION

OF

RENO, SPARKS, AND WASHOE COUNTY

By the

DEPARTMENT OF THE ARMY

SACRAMENTO DISTRICT, CORPS OF ENGINEERS

SACRAMENTO, CALIFORNIA

OCTOBER 1970

FLOOD PLAIN INFORMATION - TRUCKEE RIVER - RENO-SPARKS-TRUCKEE MEADOWS, NEVADA

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INTRODUCTION

This report presents the flood situation along the Truckee River and several of its tributaries in the Reno-Sparks-Truckee Meadows area, Washoe County, Nevada. It was prepared at the request of the Regional Planning Commission of Reno, Sparks, and Washoe County to aid in solving local flood problems and in planning the best use of land subject to overflow. Information contained in this report is based on records of rainfall, runoff, and historical flood heights, and on other technical data bearing on the size of floods in the Reno-Sparks-Truckee Meadows area.

Available data on the largest known floods on the Truckee River and its principal tributaries in the study area are compiled in this report, and the nature and extent of probable future floods are discussed. This report is intended to provide information to developers, organizations, and local agencies for their use in developing and using flood plain areas in such a way that flood hazards and future flood damages may be minimized. In problems associated with developments in the flood plains in the Reno-Sparks-Truckee Meadows area, the Regional Planning Commission and other local interests should give consideration to the possible recurrence of floods of the same magnitude as past floods, and to the occurrence of future floods of greater magnitude.

This report contains information on past floods, and maps, profiles, and cross sections that indicate the depth and extent of flooding that can reasonably be expected to occur in the future.

Recommendations or plans for the solution of flood problems in the study area are not included in this report. Rather it provides the Regional Planning Commission and others concerned with a basis for further study and planning for optimum development of flood plain areas commensurate with the flood hazard. This might involve local planning programs to guide development of flood plains by controlling the types of use through zoning and subdivision regulations, by construction of flood control projects, or by a combination of these and other approaches.

Washoe County, through the Regional Planning Commission, will make the information in this report available to all interested agencies and individuals. Copies of this report and information on its use may be obtained from that office. Upon request, the Corps of Engineers will provide technical assistance to Federal, State, and local agencies in the interpretation and use of data presented herein, and will provide other available flood data related thereto. However, this report is not intended to extend any Federal authority over zoning or other regulation of flood plain use.

SUMMARY OF FLOOD SITUATION

The area covered in this report comprises the flood plains of the Truckee River and tributaries in the Reno-Sparks-Truckee Meadows urban-suburban complex. Specifically, it covers the flood plain of the Truckee River; Steamboat Creek and its tributaries; Alum, Hunter, and Peavine Creeks; and the North Truckee Drain. (See Plate I.)

Commercial, residential, and industrial areas of Reno and Sparks are located in the flood plain of the Truckee River and its tributaries in the study area. In the Meadows, commercial, residential, and agricultural developments, and the municipal airport, are subject to overflow from the Truckee River and its tributaries. Portions of Reno, Sparks, and the Meadows have been flooded repeatedly in the past. Substantially larger areas are within the limits of potentially greater floods in the future. The tributary streams have little influence on the total area flooded in the Reno-Sparks-Truckee Meadows area during major rainfloods on the Truckee River, but these streams can inundate flood plain areas along their courses during cloudbursts.

Information relative to past floods was developed from available streamflow records, from searches of newspaper files and historical documents, from interviews with local residents and officials, and from photographs of past floods. The extent of flooding to be expected in the future was developed from detailed study of past floods and statistical analyses of the hydrological and meteorological characteristics of the region. Consideration was given to existing development in flood plain areas and conditions of river control that assume completion of the Martis Creek Project. The following paragraphs summarize significant findings that are discussed in more detail later in the report.

THE LARGEST FLOOD of record on the Truckee River in the study area occurred on 23 December 1955 when a peak flow of 20,800 cubic feet per second was measured at Reno. That flood caused extensive damage in downtown Reno and in Truckee Meadows.

* *

ANOTHER LARGE FLOOD occurred on 21 November 1950. During that flood, a maximum flow of 19,900 cubic feet per second was recorded at Reno. Damage was particularly heavy in downtown Reno where businesses were flooded and the Rock Street bridge was washed away, and flooding in Truckee Meadows was extensive.

* *

OTHER LARGE FLOODS on the Truckee River occurred in 1907, 1937, and 1963. Cloudburst floods have occurred on the small tributaries in the study area, notably on Peavine Creek on 20 July 1956, when homes, streets, and business establishments located in northwest Reno were damaged by debris and high water. Cloudbursts have caused less extensive flooding on Steamboat Creek and the other tributaries.

* *

FLOOD DAMAGE PREVENTION MEASURES. Existing flood control facilities affecting the study area consist of improved channel in the Reno area and a number of upstream reservoirs that include flood control as a function. Lake Tahoe also provides incidental flood protection to downstream areas. A U. S. Soil Conservation Service watershed protection project that includes flood detention dams provides some flood control along Peavine Creek. Another watershed protection project that will provide some flood protection to the northern section of Reno is scheduled for construction on Evans Creek. A flood control reservoir under construction by the Corps of Engineers on Martis Creek and channel improvements to be provided by local interests in connection with that reservoir will substantially increase the degree of flood protection afforded Reno and Sparks. Additional flood control improvements to protect rapidly developing sections of Reno and Sparks are under study by the Corps of Engineers. With the exception of ordinances that require construction setbacks along waterways in Reno and Sparks, measures to regulate flood plain use and development in relationship to flood hazards have not been adopted for the study area.

* * *

AN INTERMEDIATE REGIONAL FLOOD on the Truckee River is one that would have a frequency of occurrence of once in 100 years on the average. Its magnitude was determined from an analysis of streamflow records and computed hydrographs of synthetic floods. These studies show that the peak flow of the Intermediate Regional Flood would be about 18,000 cubic feet per second in Reno. Comparative flow and water surface elevation data for the Intermediate Regional Flood and historical floods are contained in Table 1.

* * *

STANDARD PROJECT FLOODS would be larger than any flood known to have occurred on the Truckee River or its tributaries. Such a flood could reasonably be expected to occur in the future, but would be a rare event. Studies show that a Standard Project Flood on the Truckee River would have a peak flow almost twice as large as the Intermediate Regional Flood at Reno. A Standard Project Flood on any of the tributaries in the study area would have peak flows about 20 percent to 50 percent larger than the Intermediate Regional Flood. Comparative flow and water surface elevation data for the Standard Project Flood and historical floods are contained in Table 1.

* * *

FLOOD DAMAGE that would result from recurrences of the major known floods would be significant. An occurrence of the Intermediate Regional or Standard Project Flood would cause substantially greater damage because of their wider extent, greater depths, longer duration, and higher velocity flows.

* * *

MAIN FLOOD SEASON for the Reno-Sparks-Truckee Meadows area is during the winter. All major past floods have resulted from heavy general rains, sometimes augmented by melting snow, during the period of October through March, and it is probable that future major floods would occur during that time period. Localized flooding resulting from cloudburst-type storms can occur along the tributary streams anytime from late spring to early fall, but usually occurs in July and August.

* * *

VELOCITIES OF FLOODFLOWS in the Truckee River channel through Reno range from 6 to 12 feet per second. Overbank flow velocities in the downtown streets of Reno range from 2 to 6 feet per second. Overbank flows in the Truckee Meadows area are reduced to virtually standing water. In the upper reaches of the tributary streams, computations indicate possible velocities of 10 to 12 feet per second in the channels and 6 to 8 feet per second in overbank areas. In the Meadows, tributary floodflows spread out and largely dissipate.

* * *

DURATION OF RAINFLOODS is relatively short in the Reno-Sparks-Truckee Meadows area. During a general storm lasting 4 to 5 days, rainfall usually reaches its highest intensity during the first 24-48 hours and streamflows reach their peaks about 12 hours after maximum intensity rainfall. During an Intermediate Regional Flood, Truckee River would remain at flood stage for about 25 hours. Critical levels during a Standard Project Flood could last as long as 53 hours. On the various tributary streams, duration of critical stage would range from 1 to 7 hours during an Intermediate Regional Flood and from 2-8 hours during a Standard Project Flood. Floods caused by rapid melting of the mountain snowpack can last for several weeks. Such floods have modest peak flows, moderate rates of rise, and marked diurnal fluctuation, but cause only modest flooding along the river. Cloudburst floods on the tributary streams would last for only a few hours.

* * *

HAZARDOUS CONDITIONS would occur during medium to large floods as a result of rising water and high velocity flows. Rapidly rising streams could trap people and prevent effective flood fighting. Floodwaters 3 or more feet deep and flowing at a velocity of 3 or more feet per second could easily sweep individuals off their feet, thus creating a definite danger of drowning. Shallower but higher velocity flows are also extremely dangerous.

* * *

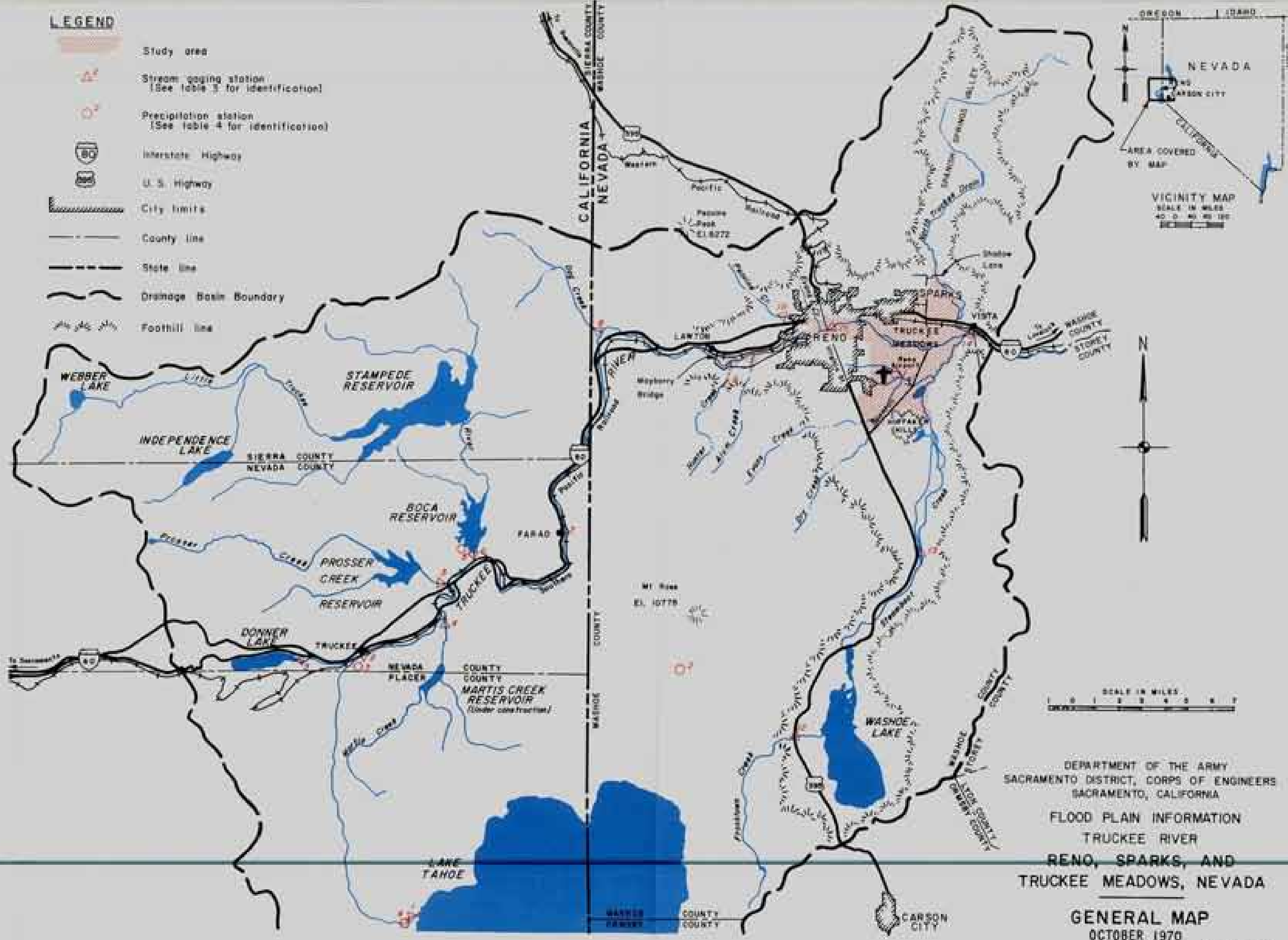
HEIGHTS OF FUTURE FLOODS. In Reno, flood heights resulting from a Standard Project Flood could be as much as 6 feet higher than those resulting from an Intermediate Regional Flood. In the Meadows, the Standard Project Flood height could be as much as 7 feet greater than that of the Intermediate Regional Flood. Table I on the following page compares the Intermediate Regional Flood, the Standard Project Flood, and large floods of record in Reno and Truckee Meadows.

TABLE I

RELATIVE FLOOD HEIGHTS

Flood	Estimated Peak Flow cfs	Water Surface Elevation (a)
	At Virginia Street Bridge in Reno	
November 1950	19,900	4,496.5
December 1955	20,800	4,495.5
February 1963	18,400	*(b)*
Intermediate Regional	18,100	4,496
Standard Project	34,700	4,501
	At Jones' Barn in Truckee Meadows *(c)*	
November 1950	*(d)*	4,394.4
December 1955	*(d)*	4,394.4
February 1963	*(d)*	4,391.0
Intermediate Regional	19,200	4,392
Standard Project	36,600	4,399

(a) *Feet above mean sea level.*
(b) *Not available.*
(c) *Along the Truckee River about 1-1/2 miles downstream from Boynton Lane.*
(d) *Unknown.*



DEPARTMENT OF THE ARMY
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FLOOD PLAIN INFORMATION
TRUCKEE RIVER
RENO, SPARKS, AND
TRUCKEE MEADOWS, NEVADA

GENERAL MAP
OCTOBER 1970

PLATE I

GENERAL CONDITIONS AND PAST FLOODS

INTRODUCTION

The metropolitan area of Reno extends along both banks of the Truckee River from about Mayberry Bridge to the eastern city boundary, a distance of about 7 miles. Sparks adjoins Reno and is located about 1 mile north of the river. Truckee Meadows, which is actually the remnant of a much larger meadow area, lies easterly and southeasterly of the Reno-Sparks metropolitan complex. The Meadows is a low-lying area traversed for about 5 miles by the river and is drained primarily by the North Truckee Drain and Steamboat Creek.

The study area comprises the flood plains along the Truckee River from Lawton to Vista; Steamboat Creek downstream from the Huffaker Hills, including the Boynton Slough area and Dry and Evans[a] Creeks east of South Virginia Street; the lower 1/2 mile of Alum Creek; the lower 1/4 mile of Hunter Creek; Peavine Creek downstream from the storm drain entrance; and the North Truckee Drain downstream from Shadow Lane.

Available records of streamflow date back to 1895 when the U. S. Geological Survey (USGS) established a gaging station at the outlet of Lake Tahoe. Additional stations were installed at Farad and Vista in 1899 and at Reno in 1906. Streamflow measurements on the major upstream tributaries have been made intermittently since the early 1900's and continuously since the late 1950's and early 1960's. Except for Steamboat, Hunter, and Peavine Creeks, records for which date from the early 1960's, no streamflow records have been made on the tributary streams joining the Truckee River in the study area.

(a) Should not be confused with the Evans Creek that enters the Truckee River from the north.

Reasearch of newspaper files and various published and unpublished reports revealed information on floods affecting the study area from about the middle of the 19th century. Local residents have been interviewed relative to past floods. From these and other sources, a history of known floods on the Truckee River has been developed. The river has been studied by the Corps of Engineers in connection with channel improvement work completed in 1960, in connection with the authorization and preconstruction planning of the Martis Creek Project, and in connection with preparing flood control operation regulations for Boca, Stampede, and Prosser Creek Reservoirs. Flood damage surveys of the Reno-Sparks-Truckee Meadows area were conducted by the Corps of Engineers after the 1950, 1955, and 1963 floods.

Settlement

The Reno-Sparks area has an interesting and colorful history. Trappers and traders were the first white men to visit the area, and the ill-fated Donner Party, one of the first emigrant trains to pass through, traveled up the Truckee River in late 1846. The fate of the Donner Party so frightened later emigrants that for over a decade groups wintered near the lush Truckee Meadows rather than attempt a late crossing of the Sierra Nevada.

After discovery of the Comstock lode in 1859, the Nevada Territorial Legislature chartered toll roads and bridges to encourage road building. Such a charter was granted to C. W. Fuller of Susanville in 1859. He settled in what was to become downtown Reno, and built a crude hotel and a bridge at about the same location as the present-day Virginia Street Bridge. Within a short time, the area became known as "Fuller's Crossing." In 1863, Fuller sold his bridge to C. M. Lake who claimed about 1/3 of a section extending across the river at the bridge site. By 1864, the Central Pacific Railroad had completed the western section of the transcontinental line to Dutch Flat, California, and a road from Dutch Flat to Virginia City by way of Donner Pass and [now] "Lake's Crossing." This road took most of the traffic from the Placerville-Carson City route, and Lake's Crossing became the nucleus of a tiny settlement. The railroad was completed to Lake's Crossing on 9 May 1868 and the Central Pacific acquired 80 acres from Lake on the condition that a station be located thereon. A townsite was laid out, lots were sold, and the present city of Reno was established. It was named in honor of General Jesse Lee Reno, a Union officer in the Civil War. In 1871 the county seat was moved to Reno from Washoe City, 15 miles to the south. Reno's prosperity as a trading center gained new impetus when the Virginia and Truckee Railroad was completed in 1872, connecting Virginia City with Reno and the transcontinental rail service provided by the Central Pacific Railroad.

Reno's early growth was largely dependent upon the railroad. The origin of Sparks was entirely due to the railroad. Until about 1900, the railroad's division point shops were located at Wadsworth, about 35 miles to the east of Reno. At that time, it was decided to move the shops to Reno. Since a suitable site could not be found in the city, a site on the Thomas Martin ranch 4 miles to the east was selected. New shops were built during 1902-1903 and, on 4 July 1904, the railroad moved homes, shrubbery, fruit trees, pets, household goods, and the workers and their families to new homesites selected by lottery at the new location. The new community was first called Harriman in honor of the President of the Union Pacific Railroad, but its name was changed to Sparks in honor of John Sparks, the Governor of Nevada at the time. Sparks was incorporated in 1905.

The Streams and Their Valleys

The Truckee River Basin is situated in eastern California and western Nevada. Above Vista, the river drains about 1,430 square miles of mountainous terrain, including about 500 square miles above the Lake Tahoe outlet. Most of the runoff from the basin originates on the eastern slopes of the Sierra Nevada, which rise to over 10,000 feet in this region. Truckee River begins at the outlet of Lake Tahoe and flows northerly about 12 miles, thence northeasterly about 60 miles, and north northwesterly about 16 miles to Pyramid Lake, a remnant of prehistoric Lake Lahontan. The stream basin has no outlet to the sea. The main tributaries below Lake Tahoe are the Little Truckee River, and Prosser, Donner, Martis, and Steamboat Creeks. Numerous intermittent tributaries along the stream contribute to floodflows during periods of general rain and snowmelt. Near Reno the river enters a vast meadow, the western and northern sections of which are occupied by Reno and Sparks. The eastern part of the meadow, which is known as Truckee Meadows, is low in elevation and poorly drained. Though urban development is encroaching on the Meadows periphery, it is still largely used for agriculture. At Vista, the Truckee River enters a steep canyon reach.

The largest tributary to the Truckee River in the study area is Steamboat Creek. Rising in Washoe Lake, about 15 miles south of Reno, this stream drains the southern and eastern part of Truckee Meadows and enters the Truckee River near Vista. Evans and Dry Creeks, tributaries to Steamboat Creek by way of Boynton Slough, originate on the northeastern slopes of Mt. Rose. These streams flow northeasterly to a point east of South Virginia Street where Evans Creek joins Dry Creek. Dry Creek enters Boynton Slough north of East Peckham Lane, and Boynton Slough joins Steamboat Creek at about mile 2.7. Hunter and Alum Creeks originate on the northern slopes of Mt. Rose and flow northerly in steep narrow canyons to enter the Truckee River west of Reno. Peavine Creek flows southeasterly from Peavine Mountain to the outskirts of Reno where it enters the storm drain conduit system. North Truckee Drain consists of a natural channel now largely improved and realigned to provide better drainage of Spanish Springs Valley and the northeasterly sector of Truckee Meadows. It joins the Truckee River near Vista. With the exception of Steamboat Creek, all of the tributary streams in the vicinity of Reno are intermittent.

The climate in the Reno-Sparks area is characterized by hot, dry summers and moderately cold winters. Temperatures range from a high of 105 degrees in July to a low of 15 degrees in January. Mean annual precipitation is 7.6 inches, most of which occurs as rain or snow during the months of December, January, and February. Although numerous thunderstorms occur during the summer months, they do not contribute significantly to the annual precipitation.

Vegetation in the basin varies from heavy growth of conifers in the western portion to sparse desert-type growth consisting mostly of sagebrush and hardy native grasses in the eastern portion. In the western portion, meadows are found on the less arid mountain slopes and alpine vegetation occurs above the timberline.

Drainage areas at various points in the study area are given in the following table:

TABLE 2

DRAINAGE AREAS

Location	Drainage area sq. mi.
Truckee River at Reno	1,067
Steamboat Creek above mouth	187
Dry Creek at East Peckham Lane	14
Evans Creek at East Peckham Lane	10
Alum Creek at Truckee River	7
Hunter Creek at Truckee River	12
Peavine Creek at storm drain entrance	4
North Truckee Drain at Interstate 80	92
Truckee River above Vista	1,429

Developments in the Flood Plain

In Reno, the flood plain of the Truckee River is highly developed with homes; schools; parks; churches; and numerous commercial, entertainment, and governmental establishments.

In Sparks, warehouses, industrial facilities, commercial establishments, some homes, and the eastern portion of the Southern

Pacific Railroad yards are situated in the flood plain. South of the river, a monastery and a modern jet airport occupy a large part of the area subject to flooding. Near the south end of the airport, suburban development is taking place in the flood plains of Dry and Evans Creeks. Virtually the entire eastern third of Truckee Meadows is overflow area and is now used mainly for agriculture and pasture.

Rising tourism, the increased demand for recreation, a moderate climate, favorable business environment, and good transportation insure continuing development in the area. The present population of the metropolitan area, 100,000, is expected to increase to about 265,000 by the year 2000.

Flood Damage Prevention Measures

Existing flood damage prevention measures include Federal improvement of the Truckee River channel by widening, straightening, and steepening the gradient from the Second Street Bridge downstream to Vista, and removal of obstructive rock reefs at Vista; Boca and Stampede Reservoirs on the Little Truckee River; and Prosser Creek Reservoir on Prosser Creek. Lake Tahoe, which is operated under a Federal Court decree issued on 8 September 1944, provides some flood protection to downstream areas by storing water up to a maximum elevation of 6,229.1 feet (U.S.B.R. datum). Local interests have also accomplished channel improvement work and bridge improvements to permit passage of floodflows. Martis Creek Reservoir (which is under construction by the Corps of Engineers and scheduled to be operational in late 1971) and facilities to be provided by local interests to increase channel capacity in Reno, will substantially increase the degree of flood protection in Reno and Sparks. A watershed protection project that includes flood detention dams provides some flood control along Peavine Creek. A similar project in the Evans Creek watershed (which is adjacent to the Peavine Creek watershed) is nearing construction status. This project will provide some flood protection to the University of Nevada campus and surrounding urban areas. A comprehensive plan of improvement to provide flood protection to the Reno-Sparks-Truckee Meadows area is under study by the Corps of Engineers. Private interests have installed some flood proofing measures to protect their properties. Reno and Sparks recognize the problems of the use and development of flood prone areas, and have adopted ordinances that require construction setbacks along the Truckee River and other waterways. However, zoning or other regulatory measures to permit optimum development and use of flood plain areas commensurate with flood hazards have not been adopted for the study area.

Flood Warning and Forecasting Services

The National Oceanic and Atmospheric Administration (NOAA) maintains year-round surveillance of weather conditions. Daily forecasts for Reno and vicinity are issued by the Reno office of the National Weather Service, NOAA. The National Weather Service River Forecast Center in Sacramento, California, prepares flood forecasts for the Truckee River through the metropolitan area. These forecasts, along with flood warnings for the Truckee Meadows, are released to local news media and law enforcement agencies by the National Weather Service office in Reno. Residents and business establishments in low-lying areas may receive warnings of impending flash floods through law enforcement agencies.

Flood Fighting and Emergency Evacuation Plans

A coordinated plan for flood fighting and other flood emergencies has been developed by Washoe County in cooperation with the cities of Reno and Sparks. In general, the plan provides that the Directors of Public Works supervise flood emergency operations in their respective jurisdictions, and that the Civil Defense Agency for Washoe County coordinates activities in the three political jurisdictions involved, establishes communications, disseminates weather and flood information, and requests State and Federal assistance when the flood situation so warrants.

Formal emergency evacuation plans have not been developed. People in flood-prone areas are asked to evacuate through flood warnings. In the event of flash floods, city and county equipment is used to assist in the evacuation of damaged areas.

FLOOD SITUATION

Flood Records and Basic Data

Basic hydrologic data for the Truckee River and the major tributaries studied in this report were derived from the runoff records of the USGS gaging stations shown in Table 3. The locations of these stations are shown on Plate I.

TABLE 3

STREAM GAGING STATIONS

No.	Station Name	Period of Record
1	Truckee River at Tahoe City, California	1900 to date
2	Truckee River near Truckee, California	1944 to 1960
3	Donner Creek at Donner Lake, California	1909-1910 & 1929 to date
4	Martis Creek near Truckee, California	1958 to date
5	Prosser Creek near Boca, California	1942 to date
6	Little Truckee River at Boca, California	1911-1915 & 1937 to date
7	Truckee River at Farad, California	1899 to date
8	Dog Creek near Verdi, Nevada	1956 to date
9	Hunter Creek near Reno, Nevada	1961 to date
10	Peavine Creek near Reno, Nevada	1963 to date
11	Truckee River at Reno, Nevada	1906-1935 & 1946 to date
12	Franktown Creek at Franktown, Nevada	1948 to 1955
13	Steamboat Creek at Steamboat, Nevada	1961 to date
14	Truckee River at Vista, Nevada	1899-1907 & 1932 to date

The U. S. Soil Conservation Service (in cooperation with other Federal and State agencies) conducts annual snow surveys to assist in assessing the flood potential in the mountain snowpack.

Precipitation data used in the basic hydrology studies for this report were obtained from precipitation data published by the National Weather Service. The stations considered are shown in Table 4; their locations are shown on Plate 1.

TABLE 4

RELATIVE PRECIPITATION VALUES

Station Number and Name		Precipitation (inches) Normal annual	22-24 Dec 1955 storm	30 Jan-1 Feb 1963 storm
1	Reno WB Airport	7.15	3.76	1.18
2	Mt. Rose Highway Station	*(a)*	*(a)*	6.45
3	Truckee Ranger Station	31.14	11.49	9.36
4	Tahoe City	30.90	11.82	8.53
5	Boca	20.40	6.00	4.22

(a) No data available.

In addition to streamflow and precipitation records, local residents were interviewed, newspaper files and various published and unpublished reports were researched, and available photographs of past floods were examined. From these sources, a general knowledge of floods of the Truckee River and its tributaries in the study area was developed.

The mapping used in the preparation of this report was developed by the Corps of Engineers and was supplemented by the 7-1/2-minute Vista quadrangle sheet dated 1963 and the 15-minute Reno and Mt. Rose quadrangle sheets dated 1950. Additional detailed data on small local areas were obtained from topography furnished by the Engineering Departments of Reno, Sparks, and Washoe County.

FLOOD DESCRIPTIONS

The Reno-Sparks-Truckee Meadows area has a long history of floods. Early accounts indicate that flooding or periods of high water occurred during December 1861, January and February 1862, December 1867, January 1886, and May 1890. Since about 1900, when records of streamflow were begun, serious rainfloods occurred in March 1907, January 1909, March 1928, December 1937, November 1950, December 1955, and February 1963. Snowmelt floods occurred in 1906, 1907, 1938, and 1952. Cloudburst flooding occurs in the study area, but is of shorter duration and less in areal extent than rain or snowmelt floods. The most severe cloudburst flood known to have occurred was that from the Peavine Creek watershed on 20 July 1956.

MARCH 1907

According to newspaper accounts, the 1907 flood was the largest that had occurred since the late 1860's. In Reno, Wingfield Park (then an unnamed island) was completely submerged, and floodwater almost covered Riverside Drive. "The basements of the Elks Home and the Masonic Temple were flooded and the Glendale section became an immense lake. Many square miles in the Meadows were covered with water backed up from Vista and the ranchers were compelled to seek refuge in Reno or with neighbors whose homes were on higher ground. Water was from one to two feet deep in many homes in that area."[a] A 16-year old boy attempting to rescue a squatter from a tree on the island was drowned when his boat overturned.

(a) Extract from an account of the 1907 flood contained in the 13 December 1937 edition of the Reno Evening Gazette.

Figure 1

Figure 2

Figure 3

December 1907 flood in Reno. *(Photographs by Professor S. G. Palmer, University of Nevada)*

DECEMBER 1937

Although not as large as the 1907 flood, the December 1937 flood created moderately heavy damage in Reno. During the flood, main highways and county roads were impassable, a portion of the central section of Reno was flooded, and the Chestnut Street (now Arlington Avenue) bridge was damaged to such an extent that it had to be replaced. Log jams and debris deposits on the upstream side of bridges had to be broken up by blasting. Trees were uprooted and shrubbery and lawns were damaged in Wingfield and other city parks. In general, ranching areas in the Glendale District were hardest hit by the floodwaters, which inundated many ranch homes; caused the loss of cattle, hogs, and sheep; ruined winter pasture; and submerged many haystacks. The feeding corrals were flooded and damaged.

Figure 4. Flooding in Truckee Meadows near Vista, December 1937. (Reno Evening Gazette photo)

Excerpt from Reno Evening Gazette, Saturday, 11 December 1937 [a]

Rivers Overflow Banks and Wreck Bridges, Halt Travel and Damage Property As Rainfall Continues

TRUCKEE SWOLLEN TO HIGH POINT AND MAY GO HIGHER

Main highways to west, south are blocked: S. P. trains are moving

A downpour of December rain, which observers say, is without precedent here, continued today, swelling rivers far out of their banks in scattered parts of western Nevada, tearing out bridges, paralyzing highway travel on three main trunks leading from Reno to the coast, and disrupting telephone service in many places. Trains were late because of the disturbance, and there was virtually no airplane travel.

According to W. P. A. officials, about 500 people in Reno and vicinity were rendered homeless by the flood which swept away river cabins between Reno and Sparks. An appeal for clothing and bedding was made by the W. P. A.

Rising water in the Truckee River had reached to the top points of the bridge arches here early this afternoon, and a further rise was anticipated by Watermaster Harry C. Dukes.

There were 9,500 second feet of water flowing in the Truckee River through Reno at noon today, Dukes estimated. The gauge at Iceland showed 10.25 feet vertical depth at eight o'clock this morning and the estimated flow was 9,500 second feet there at that time. Rate of vertical rise was from one to one and one half inches per hour during the morning, Dukes said.

An increasing amount of water was pouring into the river from the Little Truckee, it was reported, while many irrigation ditches were spilling over in some places.

PARK BRIDGE COLLAPSES EARLY TODAY

Shantytown swept away: River overflows banks on riverside drive

Unable to withstand the pounding water and tons of driftwood, the south bridge at Wingfield Park collapsed this morning. One corner of the bridge settled below the flood level. Traffic had been barred from the two island bridges earlier in the day, after the roadway had been covered with water.

Careful watch was kept today on the Lake Street Bridge, which was built last spring and summer. This bridge has a lower grade than the other bridges over the Truckee. By noon, the water level was within six inches of the arch. An hour later, the river had risen higher than the arches and occasional high surges sent muddy water splashing across the sidewalk. Much driftwood, some of it big trees and stumps, piled against the piers and tops of arches.

Six feet of water filled the underpass at the west end of Second Street. The bottom of the underpass is below the normal river level, and was protected by a ridge of ground to the south. The Wells Avenue underpass was not affected by the high water up to this afternoon.

The Glendale District, in the lower Truckee Meadows, was under water this afternoon.

(a) Simulated from original.

Figure 5

Figure 6

Figure 7

A portion of Wingfield Park, the Chestnut Street (now Arlington Avenue) Bridge, and evacuation of an aged resident in the vicinity of North Street Bridge during the December 1937 Flood.
(Reno Evening Gazette photos)

NOVEMBER 1950

The November 1950 flood, the greatest recorded since streamflow records were begun in 1900, resulted from a succession of warm rainstorms that produced more than 5 inches of precipitation in one day at some stations in the Truckee River basin. In Reno, floodwaters extended from West Second Street on the north to Mill Street on the south. All bridges across the river were closed; the Rock Street Bridge was destroyed; and damage to residential, commercial, and other properties totalled about $2,000,000. Floodwater in the central business district was more than 4 feet deep. In Truckee Meadows, about 3,800 acres of agricultural lands were flooded. Livestock was drowned, crops destroyed or damaged, land washed away, farm and ranch homes and their furnishings damaged, and irrigation facilities washed out. Power and other utility lines were extensively damaged.

Figure 8. Floodwater on First Street, November 1950. (Mulcahy photo*)

Furnished courtesy of the Reno Junior Chamber of Commerce and the Silver State Press.

Excerpt from Reno Evening Gazette, Tuesday, 22 November 1950[a]

Course of Flood in Reno Is Followed by Reporter

By FRANK McCULLOCH

I followed the course of the flood through Reno early Tuesday morning.

It was one of the most disheartening experiences of my life.

Throughout the night before, I had worked along the edge of the same district, awed at the power of the surging water.

But it wasn't until daylight, until the savage, churning torrents had receded, that the full impact of what had taken place struck me.

BEARS BRUNT

From the Gazette, I made my way west up First Street, which, with Island Avenue, bore the brunt of the battering.

When I started, the water was roaring hip deep down First Street. By the time I had completed the tour, it was down below my knees. It was then the full damage became apparent.

Among the lovely old homes along Riverside Drive and up the streets running into it, men and women stood and surveyed the havoc, most of them in stunned silence.

In front of one house, a tangled mass of logs, uprooted trees and other debris blocked the steps. At another, the twisted wreckage of a child's tricycle lay against the front door.

LAWNS GONE

Lawns, among the best-manicured in Reno, had disappeared under as much as a foot of silt. Shrubbery was gone from most yards.

And the basements -- the basements were pools of muddy, stinking water and floating family possessions.

Just beyond the Century Club, logs and other debris had battered down the new fence around St. Thomas Aquinas School. There, too, the basement was almost ceiling full.

Across the river, 15-foot log jams loomed like gray ghosts up out of the water swirling through Wingfield Park.

It was at the southern end of Roff Way, where it intersects, with First Street, that the warning of a Reno police lieutenant came home hard.

"Don't go wandering down these streets alone," he had told me. "Get someone to go with you."

FALLS IN HOLE

I was edging carefully across the hip-deep current pouring down Roff Way, when suddenly there was nothing there.

My feet were yanked out from beneath me, and water suddenly roared up to my armpits. It was an instant before I realized I had stepped into a manhole from which the cover had been ripped.

Fortunately, I have long arms. They kept me from going the rest of the way down. I managed to get out alone, while a crowd gathered near St. Thomas Aquinas Cathedral shouted advice.

Across the street, the shops and offices in the Hughes-Porter building were deserted, cold and dank. A "buzzer" at the main entrance rang steadily, foolishly, insistently.

The First Methodist church was out of the flood water by the time I reached it, but I was told its basement was half-full. So, said my informant, was the basement of the Trinity Episcopal church, across the river.

The crowd at the corner of First and West Street wanted to know "what it was like up the street."

"Pretty wet," I told them. I couldn't think of anything else.

The water and the debris it carried had neatly torn out the big plate glass windows in the Slingerland Insurance Company building. The ultra-modern office was a sodden mess of records, of floating desks, of tipped-over filing cabinets.

It was the same story at the Federal store on the corner.

I forded First street again and checked in at the Home Furniture store.

Somewhere around $150,000 worth of furnishings in the basement were a total loss, they told me. Included was $75,000 worth of hard-to-get carpeting, just received.

But if you wanted to get the full story of what the flood had done, you could do it in one visit at Gray Reid's, on the opposite corner of First and Sierra.

There, 28 employees had been stranded when the rapidly rising waters caught them in the building at about 10 o'clock Monday night. They didn't get out until national guard trucks rescued them at 7:30 this morning.

There, Fred Cashman, a buyer for the store, had dropped dead of a heart attack as he worked frantically with other employees to save stock in the basement.

There, employees had watched, at first in disbelief and then in startled terror, as the roaring current carried a

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(a) *Simulated from original.*

Dodge sedan around the corner at about midnight, smashed it against the building across the street, and then tossed it back almost in their laps.

"I thought the whole front of the store was going down then," said one of the weary stock clerks.

It did smash out an entire display window. Then it was snatched again by the current and rolled on down First Street like a cork.

BASEMENT FILLED

Inside Gray Reid's, the water had filled the basement, risen to a depth of four feet on the main floor. Stock was piled high on the tables. Items which would have been on Christmas lists two weeks hence were buried beneath tons of mud.

A rubber doll with golden blond hair lay beneath a litter of debris in one of the aisles. I picked it up.

"Mama," it said weakly.

The Granada theater, next door, was a miniature lake inside. At the First and Virginia street branch of the First National Bank, Carl Friesen, vice-president, took me into the basement, where two feet of water stood. It was down from four feet.

"We lost some of our older records and much of our supplies," Mr. Friesen said. Employees were mopping up ankle deep water in the lobby. He glanced at them. "But we still got out of it pretty lucky," he added.

The Nevada Bank of Commerce, in the Masonic building across the street, was hit even harder. On the alley adjacent to the river, it was hit quickly by the flood waters.

It was deserted, its lobby awash and its basement full to the top.

Between it and the Mapes hotel, squarely in the middle of Virginia Street was an uprooted tree.

The Mapes' main floor escaped almost unscathed. Foresight by the management, which began installing sandbags two days ago, protected the downstairs bar, the casino and the main lobby. Only seepage had entered, and it was being mopped up.

It was a different story in the basement, where thousands of dollars worth of stock, for the hotel and for its stores, was destroyed.

It was a vastly different story, too, at the Riverside Hotel, on the south bank of the river.

There the waters had risen to a depth of four feet or more during the night in the plush gambling casino, the swanky theater restaurant, the main lobby. It still stood there, stagnant and smelly, this morning.

I found Pete Peterson, Reno postmaster, checking on the mails when I got to the postoffice.

In true postal tradition, both motor and foot carriers were already out with todays' first class mail -- in those areas they could reach.

In the basement, he said, the rushing waters had poured in from Hill street, filling up one big room to the bursting point -- and then tore out the partition.

As they roared across the basement, they ripped out all other partitions.

DAMAGE $150,000

The structural damage would run to at least $150,000, Mr. Peterson said.

I conjectured that probably thousands of dollars worth of stamps had been lost.

"Two million dollars worth, to be exact," the postmaster replied. "That's a paper loss, of course, because they can be replaced. But in the meantime, we're short."

I caught a ride across the "closed" Second Street bridge and had a brief look at the so-called "jungles" beneath the Wells Avenue underpass.

Along the edges of the district, whole families wandered disconsolately in the wreckage.

They poked in the litter of their former homes and among the log jams which littered the banks.

One family was trying to reach a trunk jammed up in the fork of a cottonwood tree still surrounded by water.

"We think it's our trunk," said the mother. "If it is, the stuff in it is all we have left in the world."

Their riverbank cabin home, about 500 yards upstream, had been hit by the flood almost 12 hours before.

When I got back downtown, mopping up was underway.

Everywhere, the river was dropping. The proprietor of a sweet shop rolled up his shirt sleeves.

"Well," he said to another man, "let's get to work."

Reno was digging out.

Figure 9. Surging floodwaters at First and Sierra Streets, November 1950. (Mulcahy Photo*)

Figure 10. Mill Street and Post Office Building, November 1950. (Hughes Photo*)

* *Furnished courtesy of the Reno Junior Chamber of Commerce and the Silver State Press.*

Figure 11. The shambles made of the Home Furniture Company's basement storage room, November 1950 Flood.
(Frank Steuer Photo*)

* *Furnished courtesy of the Reno Junior Chamber of Commerce and the Silver State Press.*

Figure 12. Partially submerged automobile and debris deposited on South Virginia Street, November 1950.
(Gene Christensen photo*)

DECEMBER 1955

Fed by 15 inches of melted snow and more than 13 inches of rain in a 3-day period, the December 1955 flood was the largest experienced in the Reno-Sparks-Truckee Meadows area. In Reno, floodwaters 3 to 5 feet deep covered a strip one to two blocks wide on each side of the river from Idlewild Park to the eastern city limits. However, advance preparations and a well-coordinated flood fighting program limited flood damage. Water entered some basements and some unprotected buildings in the central commercial district were flooded, and streets, lawns, and shrubbery were

* *Furnished courtesy of the Reno Junior Chamber of Commerce and the Silver State Press.*

buried with sand and debris, but damage totalled only $900,000, less than 1/2 the damage that occurred in 1950. About $200,000 flood damage occurred in Sparks.

In Truckee Meadows, more than 6,000 acres of agricultural lands were inundated for 6 to 10 days by floodwaters up to 6 feet deep. Extensive flooding occurred in the Steamboat Creek area where destruction of irrigation headgates let floodwaters into the canals and onto the adjoining lands. Reno Municipal Airport was inundated and air traffic completely curtailed for several days, and the University of Nevada Experimental Farm was damaged. Throughout the flooded areas, streambanks were eroded, fences destroyed, baled hay and haystacks ruined, and deep deposits of sand, silt, and debris were left on the land.

Figure 13. Flooding in the vicinity of the Lake Street Bridge, December 1955. (Photo courtesy of the Silver State-Press)

Figure 14. Flooding in Truckee Meadows, December 1955.
(Photo courtesy of Albert Katona)

Excerpt from Reno Evening Gazette, Friday, 23 December 1955*(a)*

Truckee Rampages Through Streets

The usually peaceful Truckee River, swollen by heavy rains which have melted the mountain snow pack, came snarling out of its banks this morning, threatening to dwarf its rampage of five years ago.

By this afternoon, the normally placid stream was a yellow monster, 300 yards wide, and it was trespassing boldly down nearby streets, converting them into torrents, ranging up to four feet deep.

Businessmen along the riverfront, however, wise in the ways of the river since the November 1950 flood, will not suffer the hugh losses sustained five years ago.

Stocks have been moved to higher levels. The Thanksgiving week flood of 1950 destroyed Christmas stocks stored in basements, but that debacle will not be repeated this year.

Various unofficial estimates placed the river flow through Reno this afternoon at around 17,000 cubic feet per second, with a high water mark expected to near or surpass the 1950 maximum of 19,300 second feet early this evening.

But heavy rains are continuing over the entire Sierra watershed and the weather bureau reports that the "real storm front hasn't hit the Sierra yet, so the crest of this flood hasn't formed."

That in effect means that the Truckee will surpass the 1950 high water mark before subsiding.

Reno was cut in two by the muddy debris-laden river, with none of the eight bridges open. The Second Street Bridge, which crosses near the police headquarters was closed at 1:30 o'clock this afternoon.

The Wells underpass was closed this morning by high water, and the Second Street underpass was reported threatened early this afternoon.

More than 100 airmen from Stead Air Base, and 200 Nevada National Guardsmen joined additional hundreds of civilians in building sandbag barricades along First Street and at the intersections of First and the main north south streets of the city.

The barricades were holding back the great volume of the flood but the high water mark had crept to midway between First and Second Streets this afternoon.

Business houses at the intersection of First and Second came under heavy battering shortly before noon as the flood waters rose.

TRUCKEE MEADOWS

Low-lying areas in the Truckee Meadows have been flooding for two days, and additional families were evacuated from the Home Gardens area this morning. Glendale district ranches are isolated.

Miraculously, there have been no casualties reported to official agencies as yet.

Red Cross personnel, more than 300 of them, are on duty at various points in the city, supplying food and coffee for those engaged in fighting the flood, and making living arrangements of evacuated families.

No doubt the big losers in the early stage of the flood were some of the marooned business houses on the south side of First Street, and the lesser number across the river, but their very unavailability made many difficult to check.

READY FOR WATER

But in some, the battle was even if far from over, and almost without exception, businessmen said that forethought had put them in a vastly better position on merchandise and equipment loss than was the case five years ago. Also, a surprising number in flooded areas were keeping the river at bay.

COVERED BY INSURANCE

Controller Joe Towley noted that Gray Reid's has flood insurance this time which should cover much of the loss that is so evident.

Thirty-five people were at work in the store and at the barricades, along with six pumps.

Nearby, on the upper side of First Street, another heavy 1950 loser, the Home Furniture Co. was managing to keep all but some minor seepage out of the basement at mid-morning even though a finger of the river raced by outside.

In addition to these two examples, hundreds of store operators up and down First Street and on the northbound adjacent streets fought, moved material, and fought again in an especial disaster area ranging from Chestnut Street to the Second Street Bridge. Water in basements was common, rare on first floors.

HOTELS MAROONED

The city's two largest hotels were in the marooned category, although one, the Mapes, was open for business via truck to its rear loading platform.

Manager Walter Ramage reported near midday that no water at all had come into the beleaguered establishment, with heavy sandbagging and bulkheading doing the work.

At the Riverside, where the stripped lobby, bars, gaming room, theater restaurant and coffee shop gave an odd appearance, Manager Arthur Allen reported the major inconvenience was from lack of heat, since boilers were put out as a safety measure. The same was true of the regular lighting system, with an emergency generator supplying lights after a brief cessation.

(a) Simulated from photo copy of original.

FEBRUARY 1963

The flood of February 1963 inundated essentially the same areas flooded during the 1950 and 1955 floods; that is, a strip one to two blocks wide along each side of the river from Idlewild Park on the west to Coney Island Drive on the east. As in 1955, potential flood damage was greatly reduced by advance preparation and effective flood fighting. In 1963, Sparks escaped flooding, but about 4,000 acres of agricultural lands in Truckee Meadows, and Reno Municipal Airport, were flooded. Damage in Reno and Truckee Meadows was about $600,000.

Figure 15. Sandbag barrier emplaced to protect the Riverside Hotel during the February 1963 flood. (Reno Evening Gazette photo)

Excerpt from Nevada State Journal, Friday, 1 February 1963[a]

WATER OVER BRIDGES

River Spills Into Streets

Shortage of Sandbags;

Many Homes Damaged

An angry Truckee River swept over the railings of bridges in the downtown Reno area this morning and began spilling into adjoining streets.

At 1 a.m. only two of the 12 bridges connecting the north and south portions of Truckee Meadows remained open. The Sierra Street bridge appeared in imminent danger of collapse from battering of flood-swept logs and debris.

The police radio network was filled with frantic calls as the usually mild-mannered river began breaking out of its banks. Dickerson Road in the west part of the city was flooded at 1:30 a.m.

City officials had sent out a frantic call for more sandbags, and a truckload was en route from Smith Valley.

And the crest of flooding caused by three days of Sierra rains appeared to still be several hours away. At 12:30 a.m. the California Highway Patrol in Truckee reported the pouring rain had "definitely increased" in intensity. A similar report was given by Daryl DeWalt, weather observer at Tahoe City.

That water will sweep into Reno sometime this morning. Serious flooding is expected by 6 a.m.

The flood threat built up rapidly yesterday. The flow of water through the Farad gauging station doubled between 1 p.m. and 6 p.m., held steady until 11 p.m. then began climbing again. It takes about six hours for Farad water to reach Reno. The water which began overflowing into the downtown area at 1 a.m. today passed through Farad a 7 o'clock last night.

City officials had a demolition crane ready to knock the railings off bridges in an effort to save them if the flow increased.

Unofficially at midnight the flow through Reno was about 12,000 second feet. The calamitous Reno floods of 1950 and 1955 peaked at about 19,000 to 20,000 second feet at the Vista checkpoint.

Serious flooding already had taken place in many areas of the City. South Virginia Street was flooded to a depth of two feet at Plumb Lane; Lakeside Drive and numerous other low areas in the city were flooded from runoff water. Hundreds of houses throughout the city were inundated.

(a) Simulated from photo copy of original.

DITCHES OVERFLOW

Ditches which surround the city were full to overflowing before noon yesterday, and several washouts which sent water streaming past homes below were reported. The Lake Ditch was breached in at least three places in the southwest portion of the city. Torrents of water rolled down across Mayberry Drive, inundating it to the depth of three feet at one point.

Below California Avenue water threatened homes on Robin Street and Vulgamore Place. Another stream flowed from the ditch near Charles Drive down Arbutus Street into Westfield Village.

In the southeast an overflowing drain ditch virtually cut off residents of the Smithridge subdivision from the rest of the city. In the northwest runoff from the slopes of Peavine Mountain, only partially-controlled by a series of new dams, raced down the streets below the Highland Ditch. Mill Street between Kietzke Lane and Washoe Medical Center was blocked most of the afternoon and police estimated depth of the water at more than three feet.

AIRPORT CLOSES

Joe Hicks, manager of the Reno Municipal Airport, reported airlines were still operating "on a reasonably normal basis" early in the evening, but at 11 p.m. Hicks ordered the field closed because of water on the runways. All inbound flights were directed elsewhere or cancelled.

Dukes said all the water flowing through the Truckee is coming directly from surface runoff, since no water had been flowing out of Lake Tahoe or Boca and Prosser reservoirs for 18 hours as of 6 p.m. yesterday.

RESERVOIR STORAGE UP

At 5 p.m. Boca contained 13,900 acre feet, a gain of 2,500 from 8 a.m. yesterday morning. The reservoir has a capacity of 30,000 acre feet. Prosser Reservoir, which has the same capacity, contained 2,000 acre feet.

W. W. White, Nevada state sanitary engineer, said last night there was "no danger" of the Reno-Sparks area water supply becoming contaminated because of flood conditions.

New underground wells practically guarantee sanitary water for human consumption despite any flood condition, he pointed out. The new wells supplement surface reservoirs.

SEWAGE "NO DANGER"

Sewage in the Reno-Sparks area yesterday was "bubbling" out of street mains. However, White said that problem was "no danger" to the area either.

"We will be safe as long as we can pump the sewage out of buildings connected to the lines," he stated.

SCHOOLS CLOSED

Washoe County School District officials were taking no chances with the anticipated flood. They announced last night that schools would be closed in Reno and at Lake Tahoe today. The only county schools scheduled to be open are Wadsworth, Natchez, Gerlach-Empire and Bonham. All Reno parochial schools will close also.

Reno area floods are usually either one or both of two types.

The most common in past years has been caused by blockage of the Truckee River channel near Vista. Water then backs up over the Glendale area, sometimes as far upstream as Reno.

In the other type the flow through downtown Reno exceeds the capacity of the channel through the city, and the water breaks over the banks inundating the heart of the city.

First signs of flooding yesterday were in the Wingfield Park area where the roily, brown-colored, pounding stream rose almost even with its banks about 2 p.m. Flashboards were removed from the channel and the level subsided slightly, climbing later in the evening.

By 5 p.m. there were signs the channel was becoming overloaded in the Vista area. At the Boynton Lane bridge the river was bank full, and some water was flowing out of the channel, forming ponds in adjoining fields.

Figure 16

Figure 17

Figures 16 - 18. Typical flood scenes in Reno during the February 1963 flood. (Reno Evening Gazette photos)

Figure 18

Peak flows of the foregoing major floods are shown in Table 5.

TABLE 5

PEAK FLOWS FOR LARGE FLOODS OF RECORD
(At Reno)

Flood period	Flow at Reno cfs
17-19 March 1907	18,500
10-12 December 1937	17,000[a]
19-21 November 1950	19,900
22-24 December 1955	20,800
31 January - 2 February 1963	18,400

(a) Estimated from records at other stations.

Flood Season

Floods in the Reno-Sparks-Truckee Meadows area are caused by melting snow, cloudbursts, and heavy general rains. Rainfloods, which normally occur during the period October through March and are characterized by high peak flows and short duration, have caused the major flood problems in the area. Severe but localized flooding from cloudbursts resulting from intense, convective-type thunderstorms centered over the tributary basins may occur from late spring to early fall, but generally occurs during the summer months of July and August. Because of small volume of runoff, cloudburst floods do not cause significant changes in Truckee River flows. Flooding from rapid melting of the mountain snowpack occurs during the period May through July. Snowmelt floods are characterized by moderate peak flows and long durations, but rarely cause significant damage in the study area.

TRUCKEE RIVER

Obstructions to Floodflow

There are 15 street bridges and 2 railroad bridges across the Truckee River between Vista and Lawton. Ten would obstruct flows from an Intermediate Regional Flood and 13 would obstruct flows from a Standard Project Flood. The city of Reno has improved the flow characteristics through the bridges in downtown Reno through rigid channel maintenance and clearance of debris. Removable handrails have been installed on the Lake Street Bridge. During floods, the handrails are removed to prevent collection of debris and damage to the bridge. The obstructive effect of the Arlington Avenue and Sierra, Virginia, Center, and Lake Street bridges is to divert water into the downtown area, particularly along First Street. The obstructive effect of eight irrigation diversion structures located in the study area aggravates the flood situation. Representative bridges across the Truckee River in Reno and collections of flood-carried debris behind bridges are shown in the following photographs. Pertinent data on railroad and street bridges are contained in Table 6.

Figure 19. Arlington Avenue Bridge.

Figure 20. Sierra Street Bridge.

Figure 21. Virginia Street Bridge.

Figure 22. Center Street Bridge.

Figure 23. Lake Street Bridge showing removable handrails.

Figure 24. Debris jam at the Sierra Street Bridge, November 1950 flood. (Gene Christensen Photo*)

* *Furnished courtesy of the Reno Junior Chamber of Commerce and the Silver State Press.*

Figure 25. Debris on Mayberry Drive Bridge after the December 1955 flood. (Photo courtesy of the Washoe County Engineer's Office)

Figure 26. Flood-carried debris seriously damaged the main sewerage pipeline bridge east of Wells Avenue, November 1950 (Gene Christensen Photo*)

* *Furnished courtesy of the Reno Junior Chamber of Commerce and the Silver State Press.*

TABLE 6

BRIDGES ACROSS THE TRUCKEE RIVER

		Elevations(b)				
Bridge Identification	Location(a)	Streambed	Low Chord(c)	Top of Road	Intermediate Regional Flood(d)	Standard Project Flood(e)
Southern Pacific R.R.	42.84	4,365	4,386	4,392	4,380	4,385
Southern Pacific R.R.	44.00	4,368	4,393	4,397	4,388	4,395
Boynton Lane	47.62	4,386	4,399	4,402	4,396	4,402
Glendale Avenue (Asylum Bridge)	50.07	4,423	4,437	4,440	4,436	4,438
Kietzke Lane	50.71	4,435	4,457	4,461	4,448	4,451
Wells Avenue	51.54	4,463	4,474	4,478	4,475	4,483
North Street	51.77	4,469	4,490	4,495	4,481	4,485
East Second Street	51.81	4,470	4,482	4,490	4,484	4,490
Lake Street	52.01	4,472	4,483	4,488	4,489	4,494
Center Street	52.09	4,475	4,488	4,491	4,491	4,496
Virginia Street	52.17	4,475	4,490	4,494	4,496	4,501
Sierra Street	52.23	4,478	4,489	4,492	4,498	4,502
Arlington Avenue	52.39	4,483	4,494	4,497	4,500	4,505
Keystone Avenue	52.94	4,493	4,514	4,518	4,504	4,508
Booth Street	53.05	4,494	4,508	4,511	4,510	4,511
Mayberry Drive	57.31	4,611	4,622	4,624	4,623	4,630
Warren Ranch	58.16	4,632	4,644	4,646	4,644	4,648

(a) River mile upstream from Pyramid Lake.
(b) Feet above mean sea level at upstream side of structure.
(c) Bottom of lowest member between supports.
(d) A flood having a frequency of occurrence of once in 100 years, on the average.
(e) The flood expected from the most severe combination of hydrological and meteorological conditions considered reasonably characteristic of the geographical region in which the Truckee River basin is located.

Velocities

Velocities of flow in the Truckee River vary widely in the study area. During major floods, such as those that occurred in 1950 and 1955, the velocity of flow is estimated to range from 8 to 12 feet per second in the channel and 2 to 5 feet per second in overbank areas from Lawton to Idlewild Park. Below Keystone Avenue Bridge, the velocity of flow in the channel would decrease to 6 to 10 feet per second. In Truckee Meadows, the stream gradient is such that velocity of in-channel flow is reduced to less than 3 feet per second and flows in overbank areas are reduced to virtually standing water.

Flooded Areas and Flood Profiles

Little data on the areal extent and water surface elevation during the 1907 and 1937 floods are available. In general, however, the large floods of the past inundated a 3-4 block wide strip through downtown Reno and affected 6,000-7,000 acres in the Meadows. In 1963, channel work that had been completed reduced the extent of flooding in Reno and limited flooding in the Meadows to about 4,000 acres even though near-record flows occurred. The areas flooded during large floods such as those of 1950 and 1955 were about the same as those shown for the Intermediate Regional Flood on Plates 3-11. Observed highwater elevations at selected locations during those floods are shown on Plates 12-14. Depth of flooding during the 1950 and 1955 floods was about the same as that shown for the Intermediate Regional Flood on Plates 12-15. The depth of flooding and the area flooded during major past floods and during an Intermediate Regional Flood are about equal because the Intermediate Regional Flood reflects the effect of recently completed and under-construction flood control improvements. However, the frequency of occurrence of the Intermediate Regional Flood would be less than that of equivalent past floods.

TRIBUTARY STREAMS

Obstructions to Floodflow

Numerous culverts and small bridges exist on the tributaries to the Truckee River in the Reno-Sparks-Truckee Meadows area. With a few exceptions, all are inadequate to pass flows of the Intermediate Regional and Standard Project Floods. During moderate flows, the culverts and bridges often become blocked with debris, which causes localized flooding in the vicinity of the obstruction. A series of pictures showing bridges and culverts and other obstructions on the tributary streams follow. Pertinent data on bridges and culverts are contained in Table 7.

Figure 27. Pembroke Drive Bridge over Steamboat Creek.

Figure 28. Obstructive irrigation structure on Dry Creek. Bridge at East Peckham Lane in background.

Figure 29. Culvert on Evans Creek at South Virginia Street.

Figure 30. Natural obstructions in and along the channel of Hunter Creek.

Figure 31. Culvert on North Truckee Drain at Prater Way.

Figure 32. Southern Pacific railroad bridge crossing of North Truckee Drain. Box culvert at Interstate 80 in background.

TABLE 7

CULVERTS AND BRIDGES ON TRIBUTARY STREAMS

Structure Identification	Location[a]	Size and Type[b] of Structure	Elevations[c] Streambed	Low Chord[d]	Top of Road	Intermediate Regional Flood	Standard Project Flood
			STEAMBOAT CREEK				
Kimlick Lane	0.77	Bridge	4,376	4,390	4,392	4,393	4,399
Pembroke Drive	2.32	Bridge	4,379	4,387	4,387	4,393	4,399
			BOYNTON SLOUGH				
Boynton Lane	(e)	8'x15' Box Culvert	4,391	4,399	4,400	4,401	4,402
			DRY CREEK				
East Peckham Lane	(e)	Bridge (Two 7'6"x10' openings)	4,410	4,417	4,418	4,419	4,420
South Virginia Street	(e)	Bridge	4,455	4,461	4,463	4,464	4,465
			EVANS CREEK				
South Virginia Street	(e)	4'6"x6'	4,452	4,456	4,457	4,458	4,459
			ALUM CREEK				
Mayberry Drive	(e)	2 - 4'x8' Box Culverts	4,588	4,592	4,594	4,596	4,597
			PEAVINE CREEK				
Wyoming Avenue	(e)	3' Diameter RCP Conduit	4,706	4,709	4,716	4,709	4,717
			NORTH TRUCKEE DRAIN				
Kleppe Lane	0.27	Bridge	4,376	4,388	4,390	4,392	4,399
Southern Pacific R.R.	0.38	Bridge	4,379	4,390	4,394	4,393	4,399
Interstate Highway 80	0.61	2 - 7'6"x8' Box Culverts	4,380	4,388	4,395	4,393	4,399
Prater Way	1.87	3 - 3' Diameter CMP	4,387	4,390	4,392	4,394	4,399
Parlanti Lane	2.86	7'6"x9'6" Box Culvert	4,394	4,402	4,403	4,402	4,403
Shadow Lane	3.70	4' Diameter CMP	4,401	4,405	4,406	4,407	4,408

(a) *River mile upstream from Truckee River.*
(b) *RCP = Reinforced Concrete Pipe; CMP = Corrugated Metal Pipe.*
(c) *Feet above mean sea level at upstream side of structure.*
(d) *Bottom of lowest member between supports on bridges, top of waterway opening on culverts.*
(e) *Stream not stationed.*

Velocities

Velocity of flow in the tributary streams has not been measured during cloudburst floods. However, during such floods, velocity of flow in the upper reaches of these streams would be quite high, but would drop sharply as stream gradients flatten near the Truckee River and in the Meadows. For the upper reaches, computations indicate velocities of 10 to 12 feet per second in the channel and 6 to 8 feet per second in overbank areas. In Truckee Meadows, flows spread out and largely dissipate.

Flooded Areas and Flood Profiles

Hunter and Alum Creeks flow down steep slopes in narrow channels with no well-defined flood plains. Consequently, these streams flood only small areas near the Truckee River. Evans and Dry Creeks flow across broad outwash fans off the slopes of Mt. Rose into Truckee Meadows. Wide areas are flooded by these streams south of Reno Airport before their flood plains merge with that of the Truckee River near East Peckham Lane. However, little data on areas flooded by these streams in the past are available. The flood plains of Steamboat Creek and the North Truckee Drain in the study area are inundated essentially by backwater from the Truckee River. In the past, Peavine Creek has caused damage to about 40 blocks of residential and commercial property in western and northwestern Reno. Flooding from Peavine Creek up to about the magnitude of an Intermediate Regional Flood is now controlled by a system of reservoirs and watershed protection measures provided by the U. S. Soil Conservation Service. With existing flood protection facilities, the flooded area shown for the Standard Project Flood on Plate 5 is much less than that flooded in the past.

FUTURE FLOODS

Discussion of future floods in this report is limited to those designated as the Intermediate Regional and Standard Project Floods. The Standard Project Flood would be larger in magnitude and would occur less frequently than the Intermediate Regional Flood. Selection of these floods was based on hydrologic computations, which include analysis of available records of past floods, and consideration of pertinent meteorologic and physiographic conditions.

Floods on the Truckee River occur principally from general rains during the winter months. Since floods from melting snow have smaller peak flows for a given frequency of occurrence than those from general rain, they are not covered in detail in this report.

The Intermediate Regional and Standard Project Floods to be expected on the tributaries would result from intense thunderstorm or cloudburst-type events. Because of the small areal extent of these storms, the quantity of runoff produced would result in localized flooding and would have very little effect on the stage in the Truckee River.

In determining the runoff at Reno and delineation of flooded areas, existing and under-construction projects having an effect on flooding in the study area were taken into account.

DETERMINATION OF INTERMEDIATE REGIONAL FLOODS

The Intermediate Regional Flood is one that could occur about once in 100 years on the average. Peak flows for the Intermediate Regional Flood on the Truckee River were derived from statistical analyses of streamflow frequency curves. Due to lack of long-term streamflow records, Intermediate Regional Flood peak flows for the tributary streams were based on 100-year precipitation values obtained from rainfall frequency curves, taking into account infiltration and surface pondage losses. Peak flows that would occur during an Intermediate Regional Flood are shown on Table 8.

TABLE 8

INTERMEDIATE REGIONAL FLOOD - PEAK FLOWS

Stream	Location	Flow cfs
Truckee River	At Lawton	17,450
Truckee River	At Reno Gage	18,100
Truckee River	At Vista Gage	21,500
Steamboat Creek	At Truckee River	8,200
Dry Creek	At Last Chance Ditch	6,100
Evans Creek	At Last Chance Ditch	3,050
Alum Creek	At Last Chance Ditch	3,000
Hunter Creek	At Last Chance Ditch	3,950
Peavine Creek	Below reservoirs	80
North Truckee Drain	At Truckee River	580

DETERMINATION OF STANDARD PROJECT FLOODS

The Standard Project Flood on the Truckee River is that which can be expected from a standard project rainstorm[(a)] centered over the drainage basin, taking into account reduction of runoff through infiltration, surface ponding, and other factors. Standard Project Floods on the tributary streams were based on a standard project thunderstorm centered over the drainage basin of the tributary. Peak flows for Standard Project Floods on the Truckee River and tributaries in the Reno-Sparks-Truckee Meadows area are shown in Table 9 on the following page.

(a) The storm that would result from the most severe combination of meteorological conditions considered reasonably characteristic of the geographical region.

TABLE 9

STANDARD PROJECT FLOOD - PEAK FLOWS

Stream	Location	Flow cfs
Truckee River	At Lawton	33,550
Truckee River	At Reno Gage	34,700
Truckee River	At Vista Gage	39,400
Steamboat Creek	At Truckee River	12,800
Dry Creek	At Last Chance Ditch	7,800
Evans Creek	At Last Chance Ditch	3,950
Alum Creek	At Last Chance Ditch	3,800
Hunter Creek	At Last Chance Ditch	5,100
Peavine Creek	Below Reservoirs	240
North Truckee Drain	At Truckee River	1,060

FREQUENCY

Frequency studies show that a flow of 21,300 cubic feet per second on the Truckee River at Vista (the approximate magnitude of the 1 February 1963 flood) could be expected about once in 80 years on the average, under conditions that existed at that time. Currently, a flood of that magnitude could be expected less frequently than once in 100 years. The July 1956 flood on Peavine Creek had a flow of about 2,500 cubic feet per second and a frequency of flooding of about once in 70 years on the average.[a] Data on floods smaller than the Intermediate Regional Flood were developed and are available on request. Floods larger than the Standard Project Flood would be possible, but the combination of events necessary to produce these large flows would be extremely rare.

HAZARDS OF GREAT FLOODS

The amount and extent of damage caused by any flood depends upon the topography of the area flooded, depth and duration of flooding, velocity

(a) Existing watershed protection project provides protection to Intermediate Regional Flood frequency.

of flow, rate of rise, and developments in flood plain areas. Rapidly rising floodwaters create especial hazards to people, and endanger those involved in flood fighting. High velocity floodflows can sweep individuals off their feet, thus creating danger of drowning or injury. Vehicles may be submerged or swept off streets and roadways, and dwellings and business concerns may be submerged or totally destroyed. Floating and submerged debris, which may move at high velocities, also creates hazards to people and property. Health hazards may result from flooded domestic water supply and waste disposal systems.

An occurrence of the Intermediate Regional Flood on the Truckee River would result in extensive damage to commercial and entertainment facilities in downtown Reno, extensive damage to public utilities, and moderate damage to streets and roads. Surface and air transportation and communications would be interrupted. On the tributary streams, irrigation facilities would be damaged, basements of homes and commercial establishments along the streams would be flooded, and vehicular traffic would be interrupted. An occurrence of the Standard Project Flood on the Truckee River would result in severe damage to roads and streets, probable destruction of two bridges, closure of the municipal airport and disruption of rail transportation, deposition of a large amount of debris, and inundation of practically all homes and commercial establishments in the flood plain. On the tributary streams, a Standard Project Flood would result in severe damage to agricultural developments, severe erosion damage, deposition of large amounts of silt and debris, destruction of communication facilities and other public utilities, and inundation of the lower levels of homes and business establishments in the flood plains.

Flooded Areas, Velocities, Rates of Rise, and Duration of Flooding

The areas that would be flooded by the Intermediate Regional and Standard Project Floods in the Reno-Sparks-Truckee Meadows area are shown on Plates 3-11. As indicated above, these areas include commercial and entertainment facilities in downtown Reno, residential and civic developments, streets and roads, power and communication facilities and other public utilities, railroad and industrial facilities, the municipal airport, educational and religious institutions, and irrigation facilities and other agricultural developments.

Depth of flow in flooded areas can be estimated from the flood profiles shown on Plates 12-18. No profile for Peavine Creek has been prepared because it flows in a conduit from just below the lower flood detention basin to the Truckee River. However, it is estimated that flooding from Peavine Creek would not exceed 1 foot in depth in the overflow area. Typical stream channel cross sections indicating the water surface elevations of the Intermediate Regional and Standard Project Floods are shown on Plates 19-22.

The peak flows of the Intermediate Regional and Standard Project Floods are shown in Tables 8 and 9. During a Standard Project Flood, velocities of flow in the channel of the Truckee River would range from less than 2 feet per second in Truckee Meadows to over 12 feet per second in the upper reaches of the study area. Velocities of flow in the channels of the tributary streams would range from about 6 to 14 feet per second. Average velocity of flow in overbank areas along the Truckee River would range from 6 feet per second in the upper portion of the study area to virtually standing water in the Meadows. In overbank areas along the tributary streams, velocity of flow would average 2 feet per second in the lower reaches of the streams and 6 feet per second in the upper reaches.

Flow in Truckee Meadows would have little velocity at high stages. Through downtown Reno, high velocity flow would erode streets and roads, carry away bridges, and send heavy debris crashing against buildings and structures with destructive force.

Table 10 gives the approximate height of rise (overbank level to maximum floodflow level), time of rise (time period corresponding to height of rise), maximum rate of rise, and duration of critical stage (period of overbank flow) for the Truckee River and tributaries.

TABLE 10

RATES OF RISE AND DURATION OF FLOODING[a]

Streams and Location	Height of Rise ft.	Time of Rise hrs.	Maximum Rate of Rise ft./hr.	Duration of Critical State hrs.
Intermediate Regional Flood				
Truckee River at Reno Gage	3	9	0.5	25
Steamboat Creek at Huffaker Hills	6	2	6	7
Dry Creek at Virginia Street	1	0.5	2	2
Evans Creek at Virginia Street	1	0.5	2	2
Alum Creek at Mayberry Drive	2	1	6	4
Hunter Creek at Last Chance Ditch	1.5	2.5	10	4.5
Peavine Creek below reservoir (b)	--	--	--	--
North Truckee Drain at Prater Way	1	0.5	2	1
Standard Project Flood				
Truckee River at Reno Gage	7	14	1	53
Steamboat Creek at Huffaker Hills	8	1.5	8	8
Dry Creek at Virginia Street	1	1	1	3
Evans Creek at Virginia Street	1	0.5	2	3
Alum Creek at Mayberry Drive	3	1.5	7	5
Hunter Creek at Last Chance Ditch	2	2.5	10	5
Peavine Creek below reservoir	1	1	20	3[c]
North Truckee Drain at Prater Way	1	0.5	9	2

(a) Above critical stage (bankfull).
(b) No flooding if culvert at Wyoming Avenue remains open.
(c) If channel or culvert at Wyoming Avenue become restricted, duration of flooding will be prolonged, although areas flooded will be similar.

The water surface elevation of the Standard Project Flood along the Truckee River in downtown Reno would be, in general, about 5-6 feet higher than the Intermediate Regional Flood. Following is a series of photographs illustrating the elevations that the Intermediate Regional and Standard Project Floods are expected to reach at various key locations in the study area.

Figure 33 - Future flood heights at the northwest corner of Sierra Street and Truckee Lane in downtown Reno.

Figure 34 - Future flood heights south of Reno Municipal Airport near Pockham Lane.

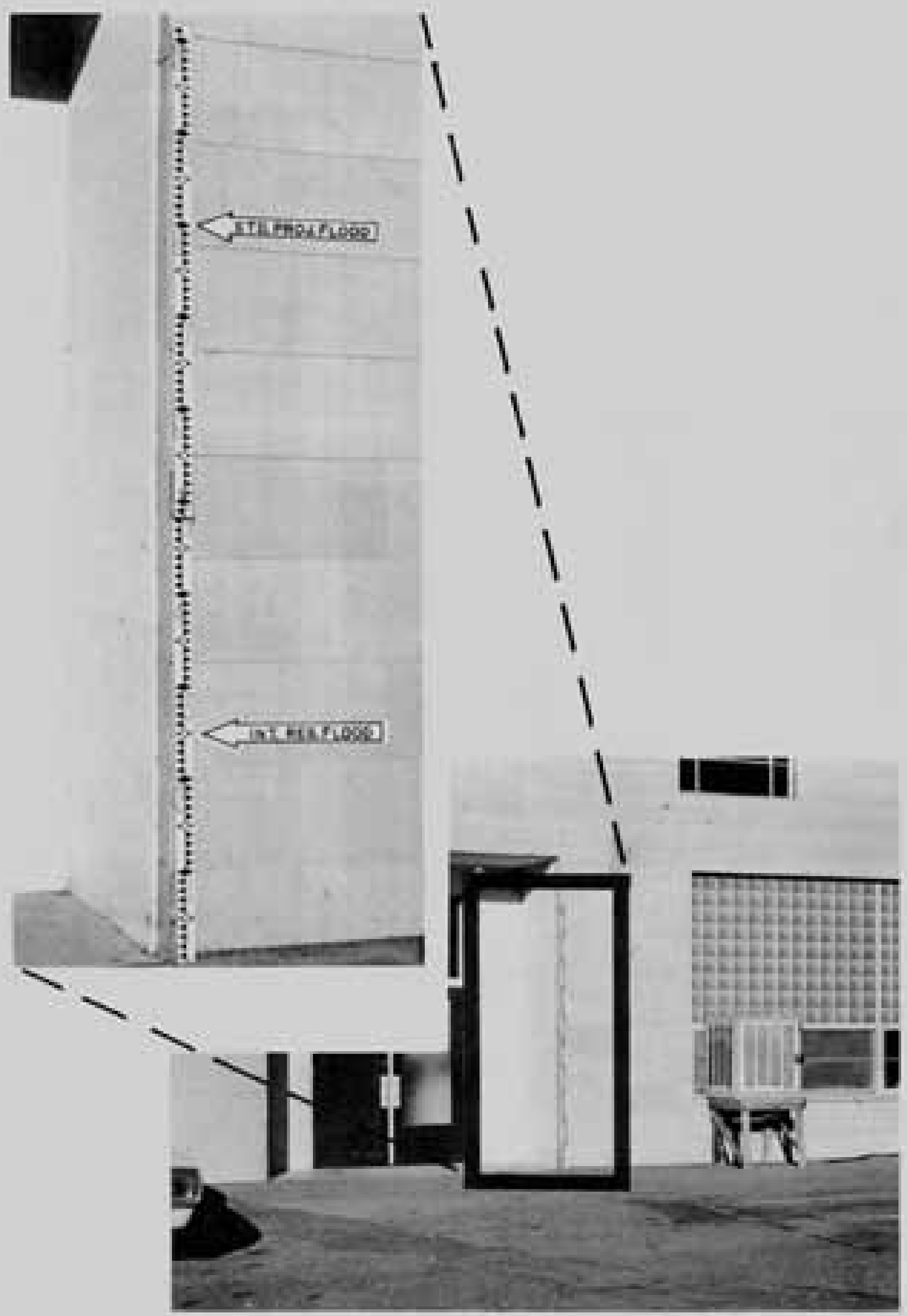


Figure 35 - Future flood heights at Brothers of Holy Rosary Mission (near Boynton Lane in Truckee Meadows).

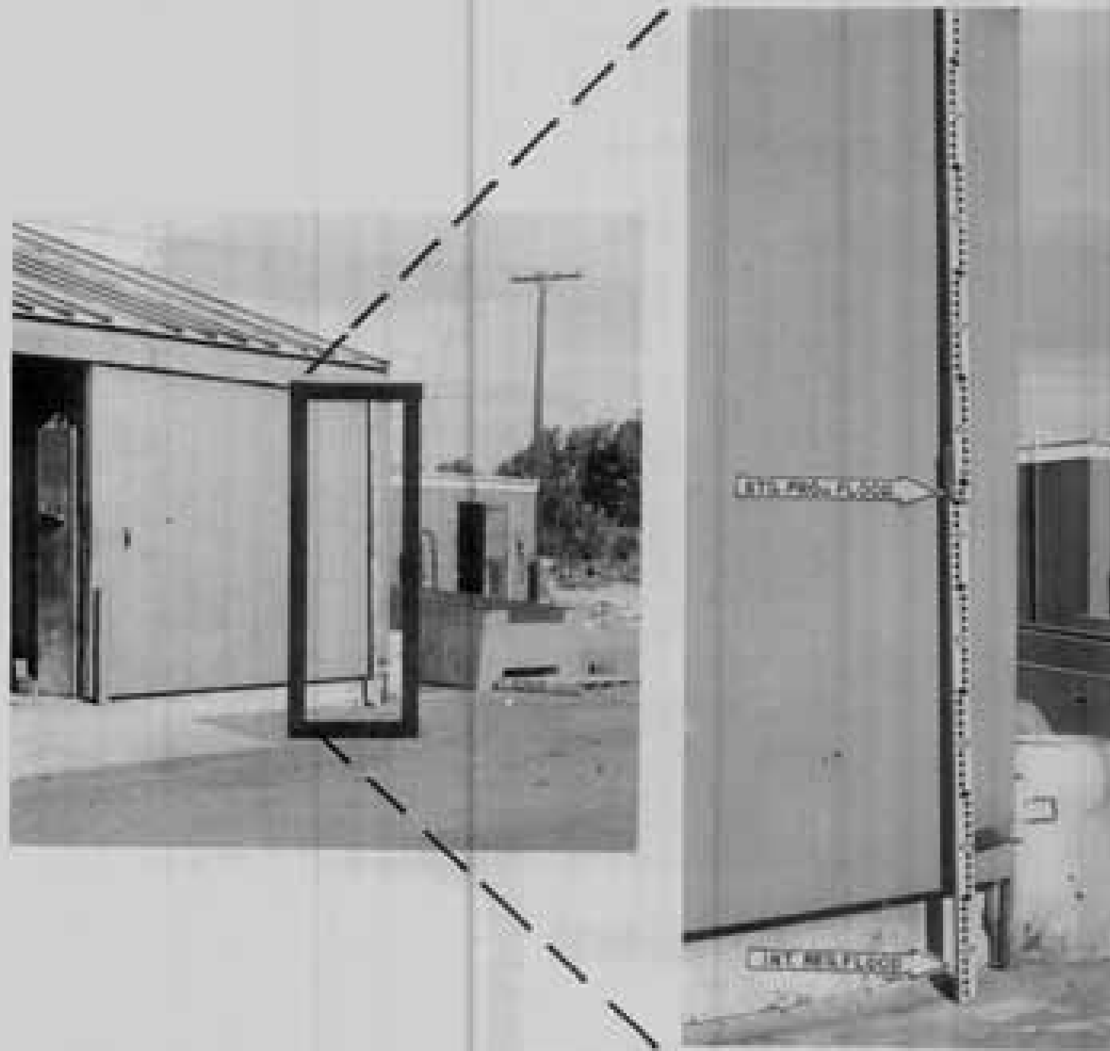


Figure 36 - Future flood heights at Nevada Fish and Game Department facilities on Glendale Avenue.

GLOSSARY

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, stream, 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 lowlands adjoining a river, stream, watercourse, ocean, lake, or other body of standing water that have 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 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.

Floodway. The channel of the stream and that portion of the flood plain that would be used to carry floodflows.

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.

Standard Project Flood. The flood that may be expected from the most severe combination of meteorological and hydrological conditions that are considered reasonably characteristic of the geographical area in which the drainage basin is located, excluding extremely rare combinations. Peak discharges for these floods are generally about 40-60 percent of the Probable Maximum Floods for the same basins. As used by the Corps of Engineers, Standard Project Floods 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.

Probable Maximum Flood. A hypothetical flood representing the most severe flood with respect to volume, concentration of runoff, and peak discharge that may be expected from a combination of the most severe meteorological and hydrological conditions in the region.

Thunderstorm. A high intensity, convective type rainstorm of short duration that is characterized by extremely heavy rainfall. As used in this report, "cloudburst" and "thunderstorm" are essentially synonymous.

AUTHORITY, ACKNOWLEDGEMENTS, AND INTERPRETATION OF DATA

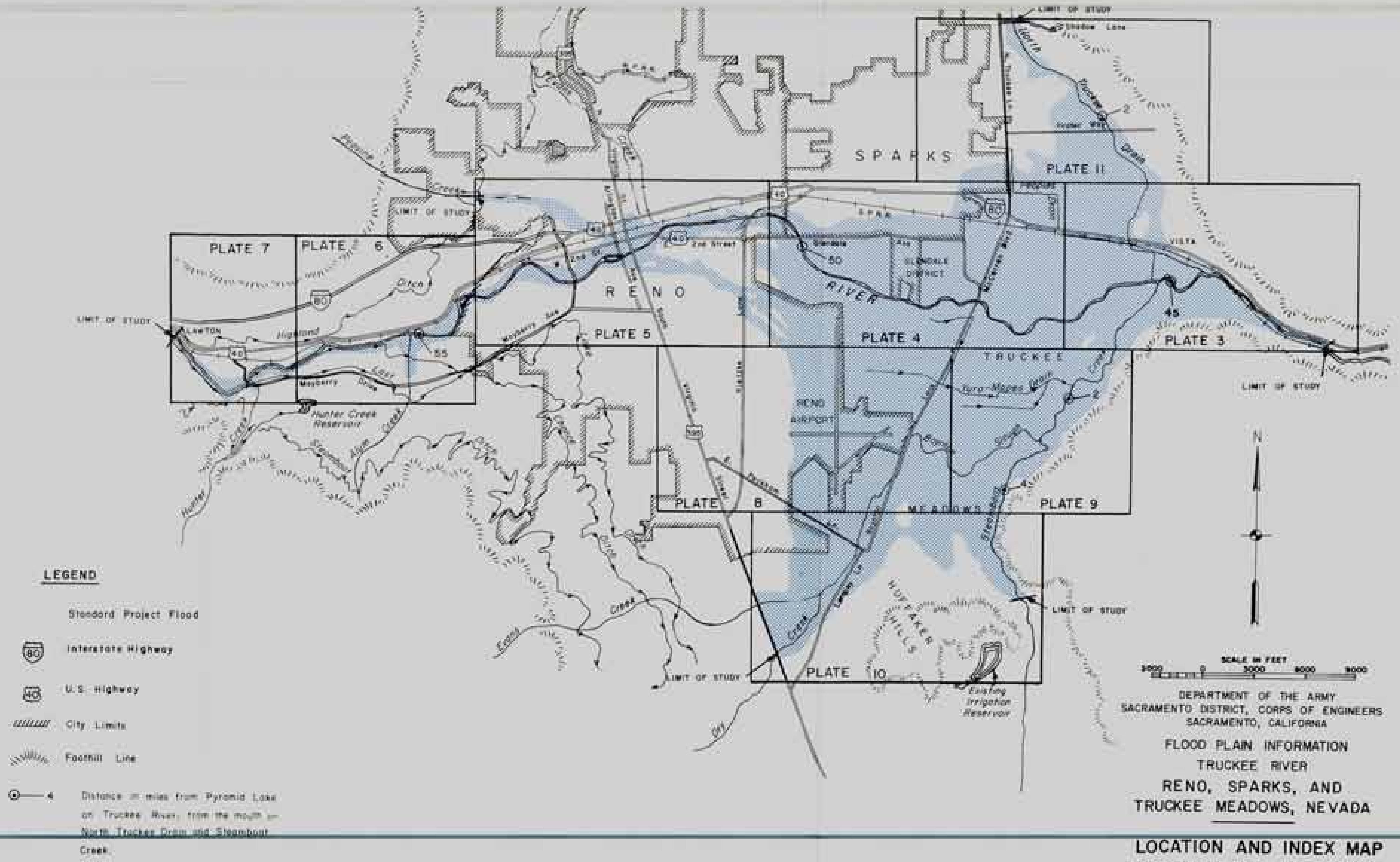
This report has been prepared under the authority of Section 206 of the 1960 Flood Control Act (Public Law 86-645), as amended by Section 206 of the 1966 Flood Control Act (Public Law 89-789).

* * *

The cooperation and assistance of the U. S. Soil Conservation Service; the National Weather Service; the U. S. Geological Survey; the State Division of Water Resources; the State Fish Hatchery in Reno; the Washoe County Public Works Department; the Regional Planning Commission of Reno, Sparks, and Washoe County; the City Engineers of Reno and Sparks; the Reno Newspapers, Inc. Library; John Webster Brown, Consulting Engineers; Millard-Spink, Inc.; the Silver State Press; and others who directly or indirectly aided in the preparation of this report are gratefully acknowledged.

* * *

The report presents the local flood situation of the Truckee River and tributaries in the Reno-Sparks-Truckee Meadows area. The Sacramento District of the Corps of Engineers will, upon request, provide interpretation and limited technical assistance in the application of the data presented herein.



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SACRAMENTO, CALIFORNIA

FLOOD PLAIN INFORMATION
TRUCKEE RIVER
RENO, SPARKS, AND
TRUCKEE MEADOWS, NEVADA

LOCATION AND INDEX MAP
OCTOBER 1970

PLATE 2

LEGEND

Overflow Limits

Intermediate Regional Flood

Standard Project Flood

44.00 Distance in miles from Pyramid Lake on Truckee River; from the mouth on North Truckee Drain and Steamboat Creek.

80 Interstate Highway

NOTES

Map developed from U.S. Army Corps of Engineers photo contour map, File No. TR-13-200 based on aerial photographs taken July 1968.

The horizontal grid is based on the "Reno Area Modified Grid System".

Elevations shown are based on mean sea level datum.

Limits of overflow indicated may vary from actual location on the ground because of accuracy of available topography.

SCALE IN FEET

1000 0 1000 2000

CONTOUR INTERVAL 5'

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FLOOD PLAIN INFORMATION
TRUCKEE RIVER
RENO, SPARKS, AND
TRUCKEE MEADOWS, NEVADA

FLOODED AREAS
TRUCKEE RIVER, STEAMBOAT CREEK
NORTH TRUCKEE DRAIN
OCTOBER 1970 PLATE 3

LEGEND

Overflow Limits

Intermediate Regional Flood

Standard Project Flood

48.00 Distance in miles from Pyramid Lake on Truckee River.

47.03 Cross Section

80 Interstate Highway

40 U. S. Highway

32 State Highway

NOTES

Map developed from U.S. Army Corps of Engineers photo contour map, File No. TR-13-200, based on aerial photographs taken July 1968.

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Elevations shown are based on mean sea level datum.

Limits of overflow indicated may vary from actual location on the ground because of accuracy of available topography.

SCALE IN FEET

1000 0 1000 2000

CONTOUR INTERVAL 5'

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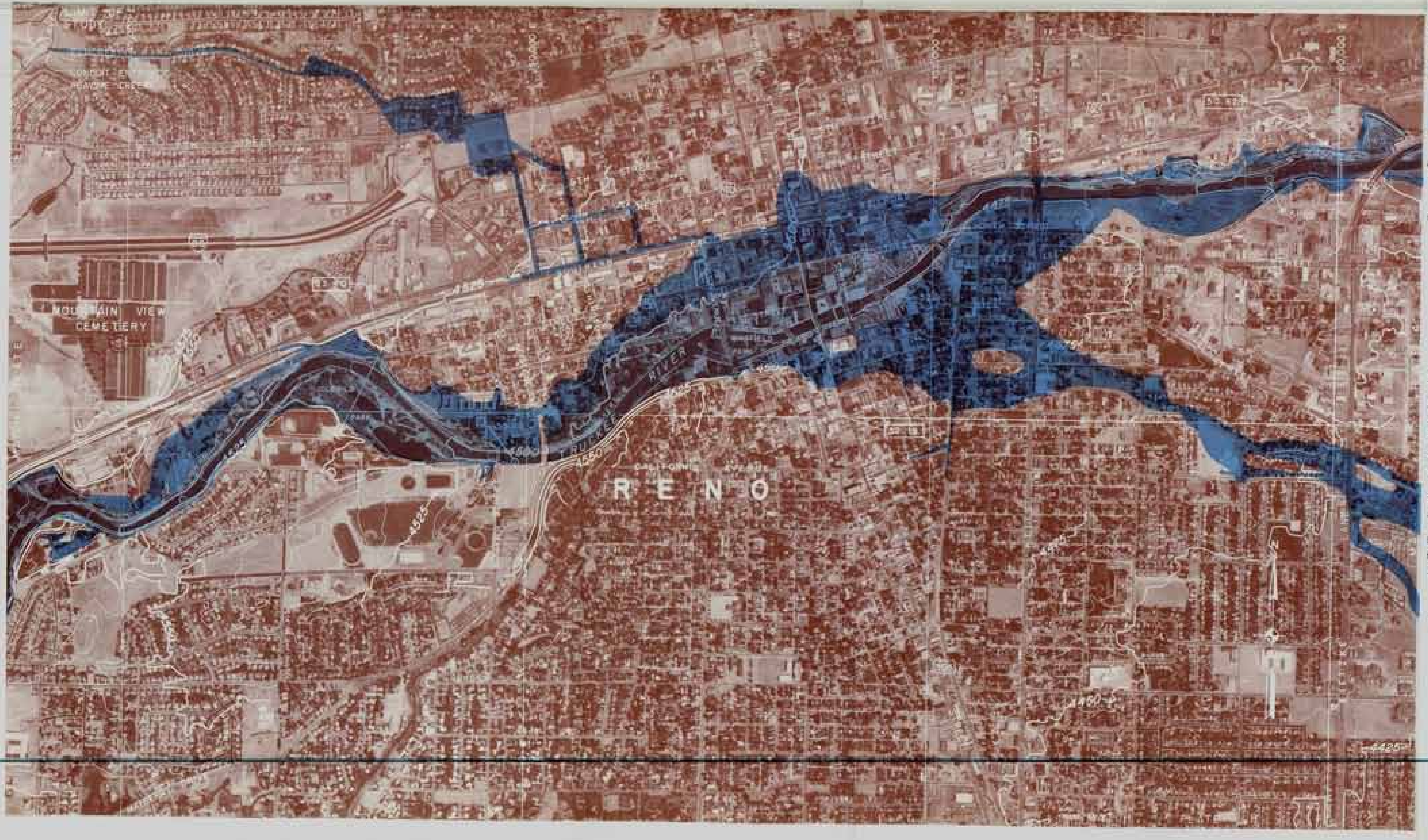
FLOOD PLAIN INFORMATION
TRUCKEE RIVER
RENO, SPARKS, AND
TRUCKEE MEADOWS, NEVADA

FLOODED AREAS

TRUCKEE RIVER
OCTOBER 1970

PLATE 4



LEGEND

Overflow Limits

Intermediate Regional Flood

Standard Project Flood

54.00 Distance in miles from Pyramid Lake on Truckee River.

52.18 Cross Section

80 Interstate Highway

395 U.S. Highway

33 State Highway

NOTES

Map developed from U.S. Army Corps of Engineers photo contour map, File No. TR-13-200, based on aerial photographs taken July 1968.

The horizontal grid is based on the "Reno Area Modified Grid System".

Elevations shown are based on mean sea level datum.

Limits of overflow indicated may vary from actual location on the ground because of accuracy of available topography.

SCALE IN FEET

1000 0 1000 2000

CONTOUR INTERVAL 5'

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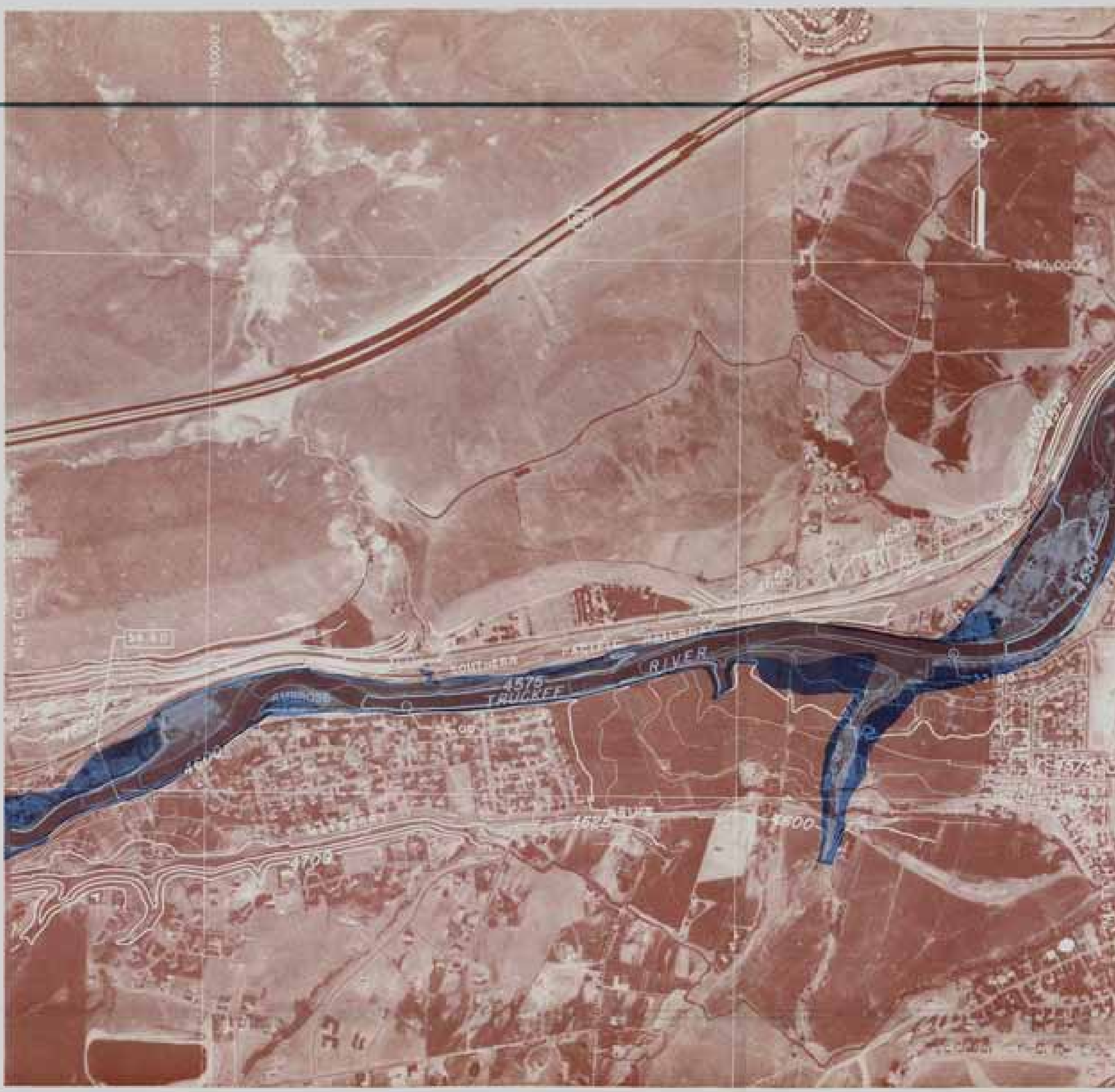
FLOOD PLAIN INFORMATION
TRUCKEE RIVER
RENO, SPARKS, AND
TRUCKEE MEADOWS, NEVADA

FLOODED AREAS

TRUCKEE RIVER
OCTOBER 1970

PLATE 5



LEGEND

Overflow Limits

Intermediate Regional Flood

Standard Project Flood

⊙——55.00 Distance in miles from Pyramid Lake on Truckee River.

56.60 Cross Section

80 Interstate Highway

40 U. S. Highway

NOTES

Map developed from U.S. Army Corps of Engineers photo contour map, File No. TR-13-200 based on aerial photographs taken July 1968.

The horizontal grid is based on the "Reno Area Modified Grid System".

Elevations shown are based on mean sea level datum.

Limits of overflow indicated may vary from actual location on the ground because of accuracy of available topography.

SCALE IN FEET

1000 0 1000 2000

CONTOUR INTERVAL 5'

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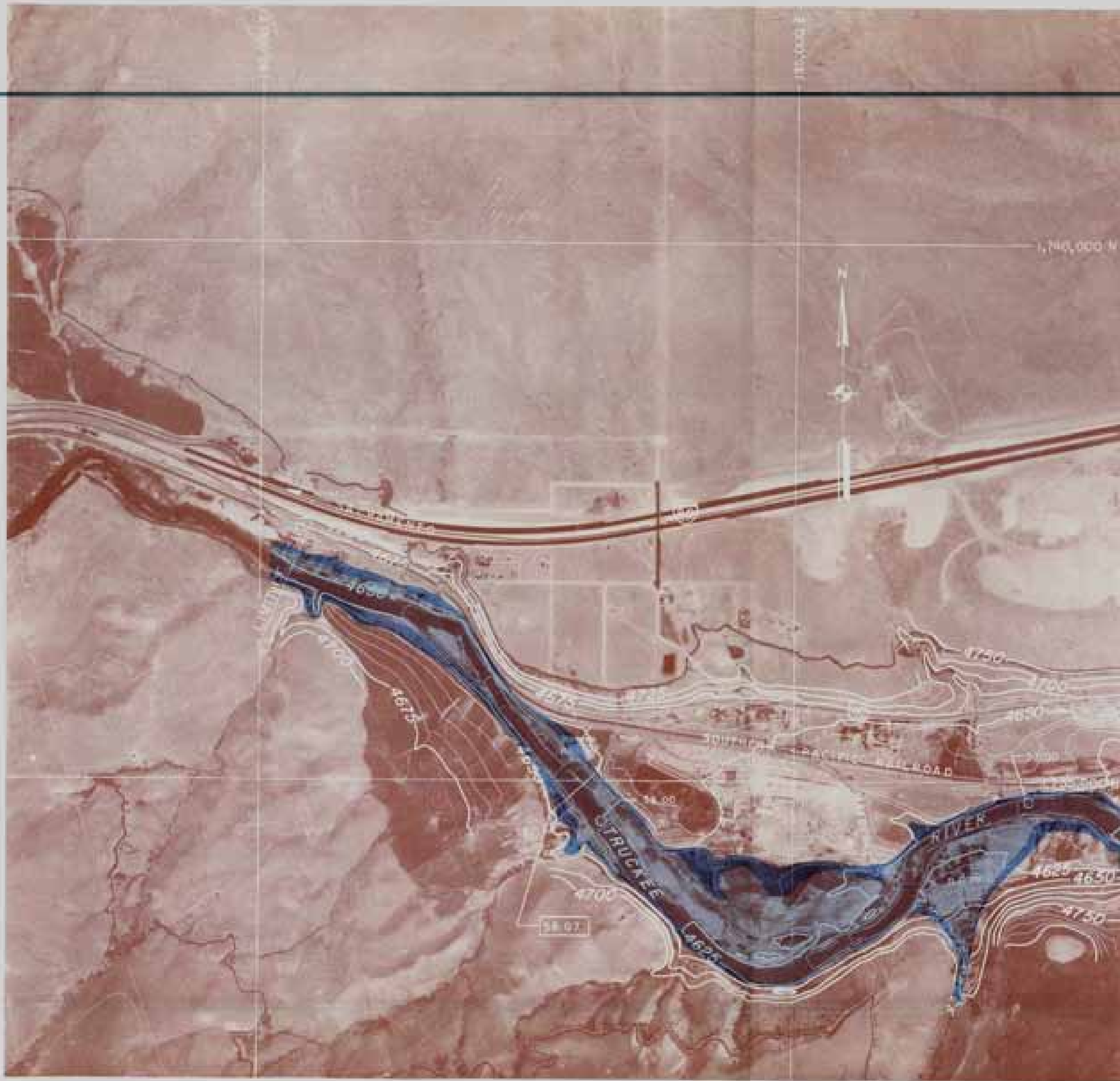
FLOOD PLAIN INFORMATION
TRUCKEE RIVER
RENO, SPARKS, AND
TRUCKEE MEADOWS, NEVADA

FLOODED AREAS
TRUCKEE RIVER
OCTOBER 1970

PLATE 6



LEGEND

Overflow Limits

- Intermediate Regional Flood
- Standard Project Flood

57.00 Distance in miles from Pyramid Lake on Truckee River.

58.07 Cross Section

80 Interstate Highway

40 U. S. Highway

NOTES

Map developed from U. S. Army Corps of Engineers photo contour map, File No. TR-13-200, based on aerial photographs taken July 1968.

The horizontal grid is based on the "Reno Area Modified Grid System".

Elevations shown are based on mean sea level datum.

Limits of overflow indicated may vary from actual location on the ground because of accuracy of available topography.

SCALE IN FEET

1000 0 1000 2000

CONTOUR INTERVAL 5'

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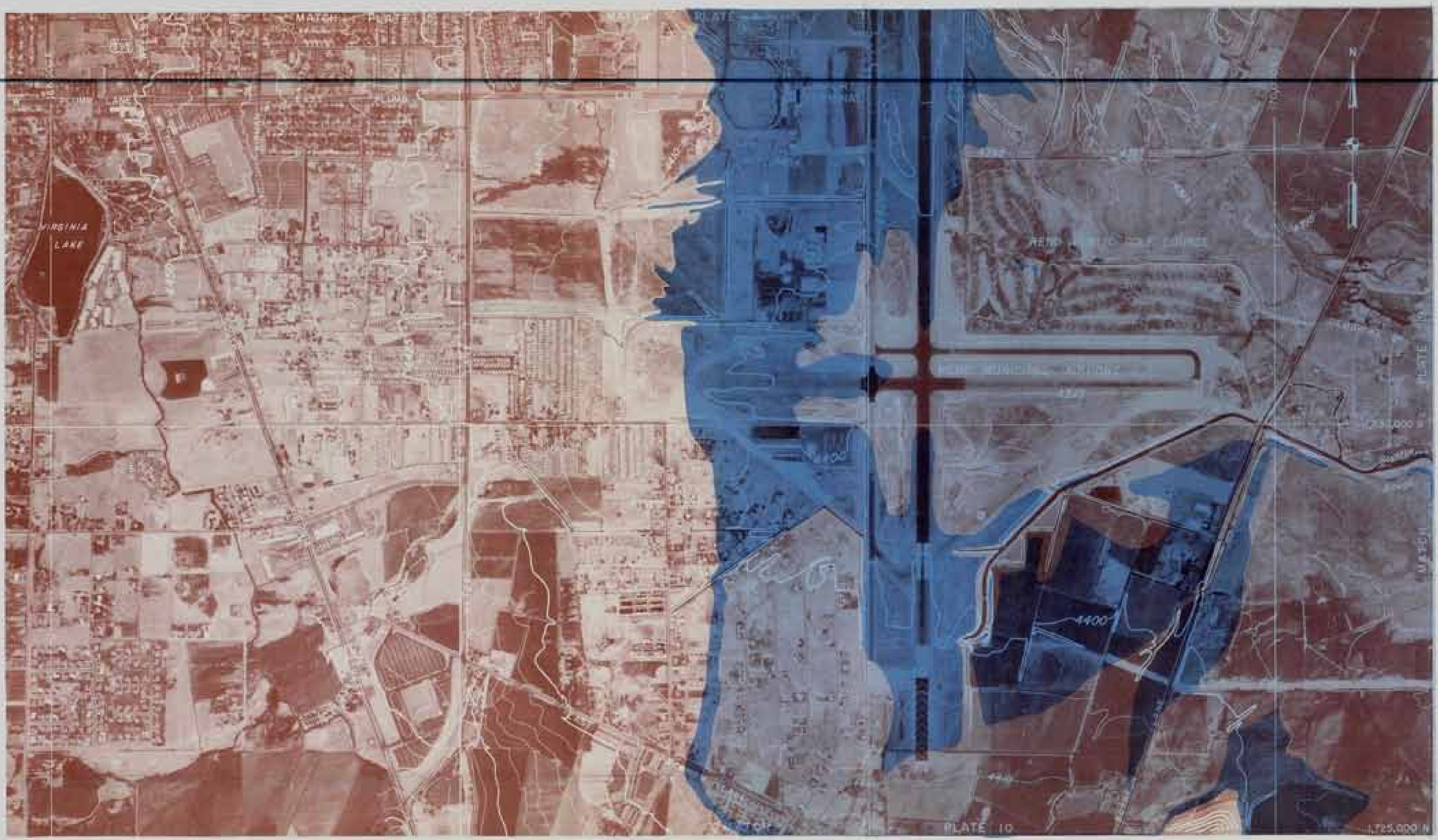
FLOOD PLAIN INFORMATION
TRUCKEE RIVER

RENO, SPARKS, AND
TRUCKEE MEADOWS, NEVADA

FLOODED AREAS
TRUCKEE RIVER
OCTOBER 1970

PLATE 7



LEGEND

Overflow Limits

Intermediate Regional Flood

Standard Project Flood

(395) U. S. Highway

NOTES

Map developed from U.S. Army Corps of Engineers photo contour map, File No. TR-13-200, based on aerial photographs taken July 1968.

The horizontal grid is based on the "Reno Area Modified Grid System".

Elevations shown are based on mean sea level datum.

Limits of overflow indicated may vary from actual location on the ground because of accuracy of available topography.

SCALE IN FEET

1000 0 1000 2000

CONTOUR INTERVAL 5'

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FLOOD PLAIN INFORMATION
TRUCKEE RIVER
RENO, SPARKS, AND
TRUCKEE MEADOWS, NEVADA

FLOODED AREAS

TRUCKEE RIVER
OCTOBER 1970

PLATE 8

LEGEND

Overflow Limits

Intermediate Regional Flood

Standard Project Flood

2.00 Distance in miles from mouth of Steamboat Creek.

47.03 Cross Section

NOTES

Map developed from U.S. Army Corps of Engineers photo contour map, File No. TR-13-200, based on aerial photographs taken July 1968.

The horizontal grid is based on the "Reno Area Modified Grid System".

Elevations shown are based on mean sea level datum.

Limits of overflow indicated may vary from actual location on the ground because of accuracy of available topography.

SCALE IN FEET

1000 0 1000 2000

CONTOUR INTERVAL 5'

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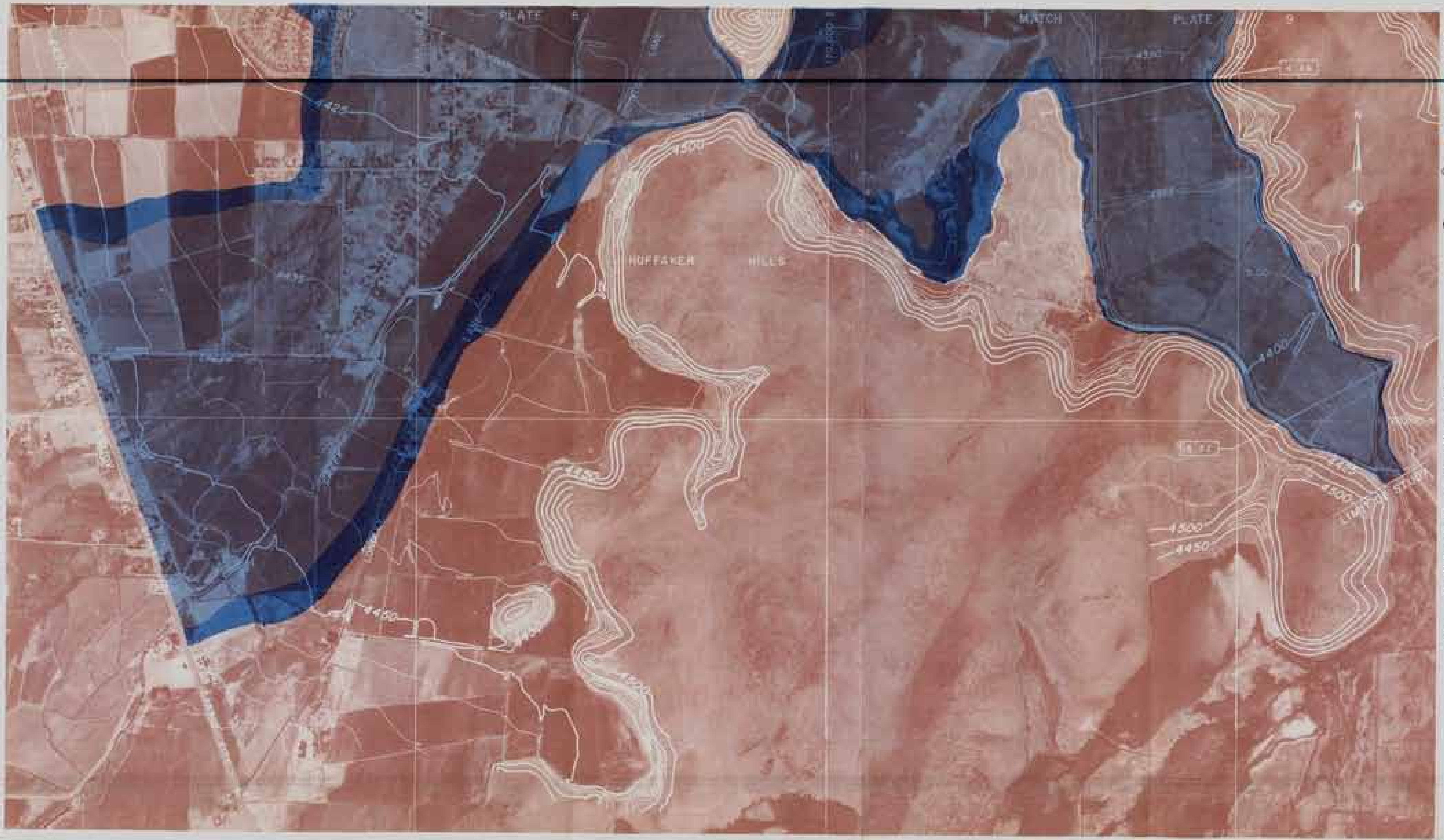
FLOOD PLAIN INFORMATION
TRUCKEE RIVER
RENO, SPARKS, AND
TRUCKEE MEADOWS, NEVADA

FLOODED AREAS
STEAMBOAT CREEK
OCTOBER 1970

PLATE 9



LEGEND

Overflow Limits

Intermediate Regional Flood

Standard Project Flood

5.00 Distance in miles from mouth of Steamboat Creek

5.32 Cross Section

395 U.S. Highway

NOTES

Map developed from U.S. Army Corps of Engineers photo contour map, File No. T.R-13-200, based on aerial photographs taken July 1968.

The horizontal grid is based on the "Reno Area Modified Grid System".

Elevations shown are based on mean sea level datum.

Limits of overflow indicated may vary from actual location on the ground because of accuracy of available topography.

SCALE IN FEET

1000 0 1000 2000

CONTOUR INTERVAL 5'

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FLOOD PLAIN INFORMATION
TRUCKEE RIVER
RENO, SPARKS, AND
TRUCKEE MEADOWS, NEVADA

FLOODED AREAS
STEAMBOAT CREEK
OCTOBER 1970

PLATE 10

LEGEND

Overflow Limits

Intermediate Regional Flood

Standard Project Flood

3.00 Distance in miles from mouth of North Truckee Drain.

2.20 Cross Section

32 State Highway

NOTES

Map developed from U.S. Army Corps of Engineers photo contour map, File No. TR-13-200, based on aerial photographs taken July 1968.

The horizontal grid is based on the "Reno Area Modified Grid System".

Elevations shown are based on mean sea level datum.

Limits of overflow indicated may vary from actual location on the ground because of accuracy of available topography.

SCALE IN FEET

1000 0 1000 2000

CONTOUR INTERVAL 5'

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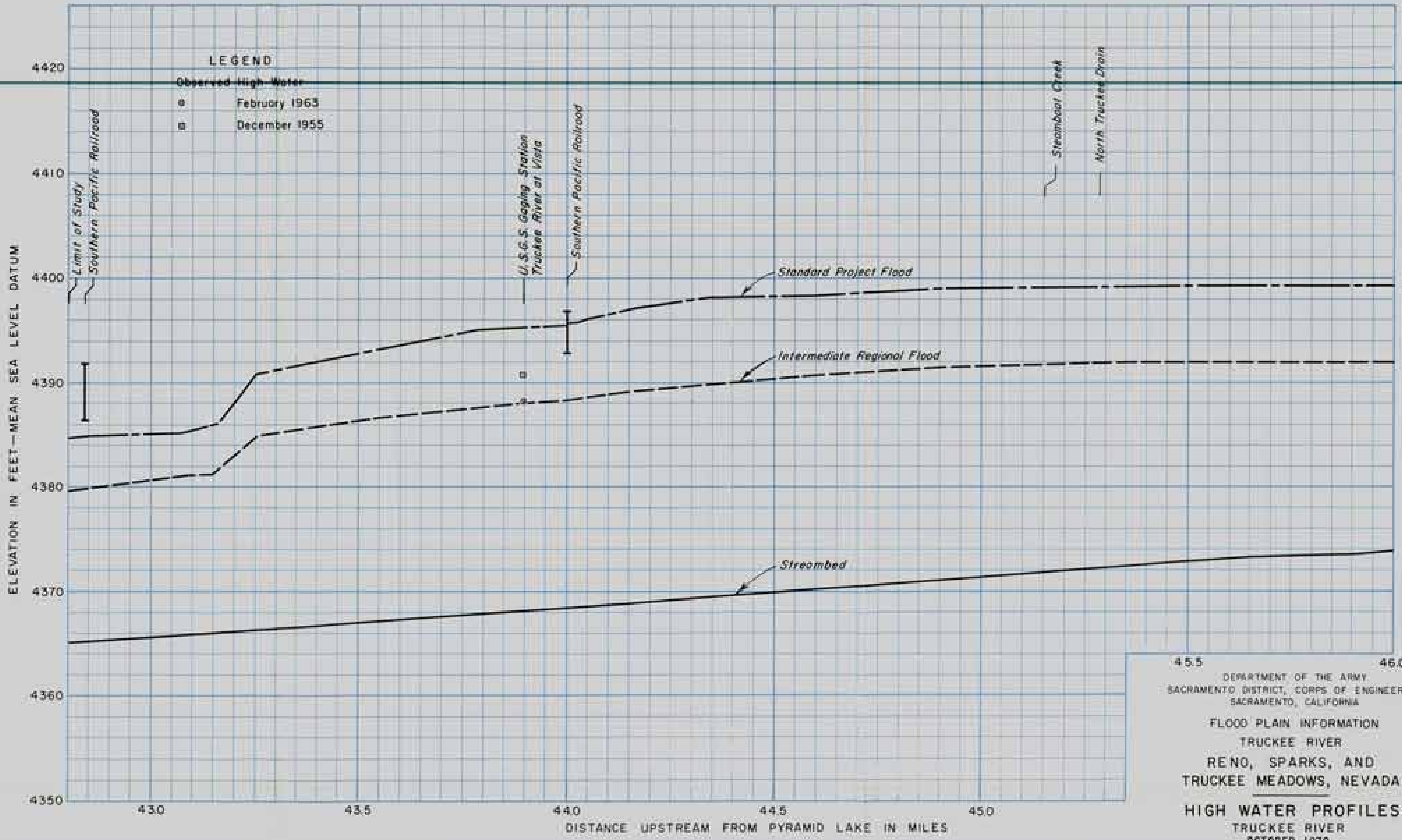
FLOOD PLAIN INFORMATION
TRUCKEE RIVER
RENO, SPARKS, AND
TRUCKEE MEADOWS, NEVADA

FLOODED AREAS
NORTH TRUCKEE DRAIN
OCTOBER 1970

PLATE 11



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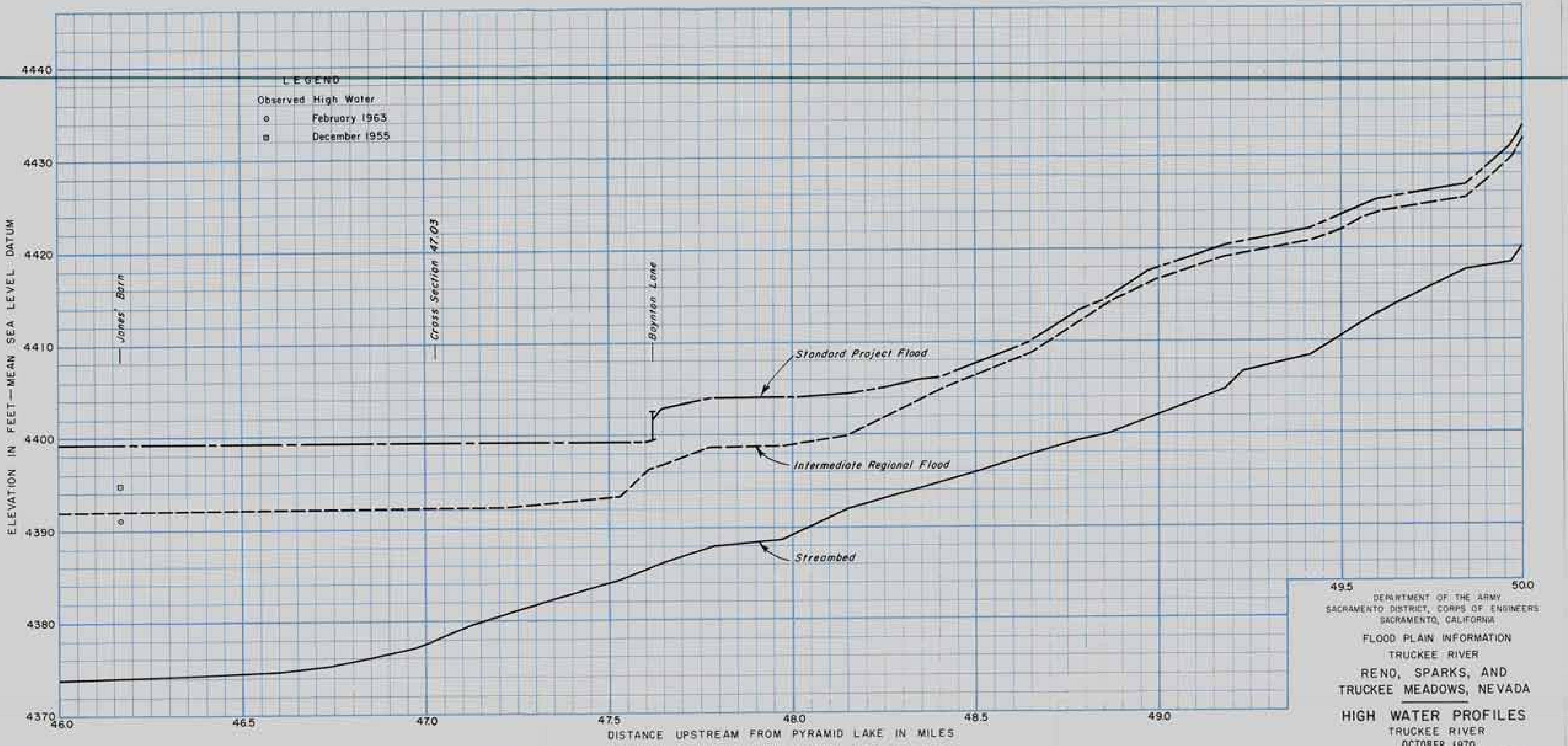
FLOOD PLAIN INFORMATION
TRUCKEE RIVER
RENO, SPARKS, AND
TRUCKEE MEADOWS, NEVADA

HIGH WATER PROFILES
TRUCKEE RIVER
OCTOBER 1970

PLATE 12



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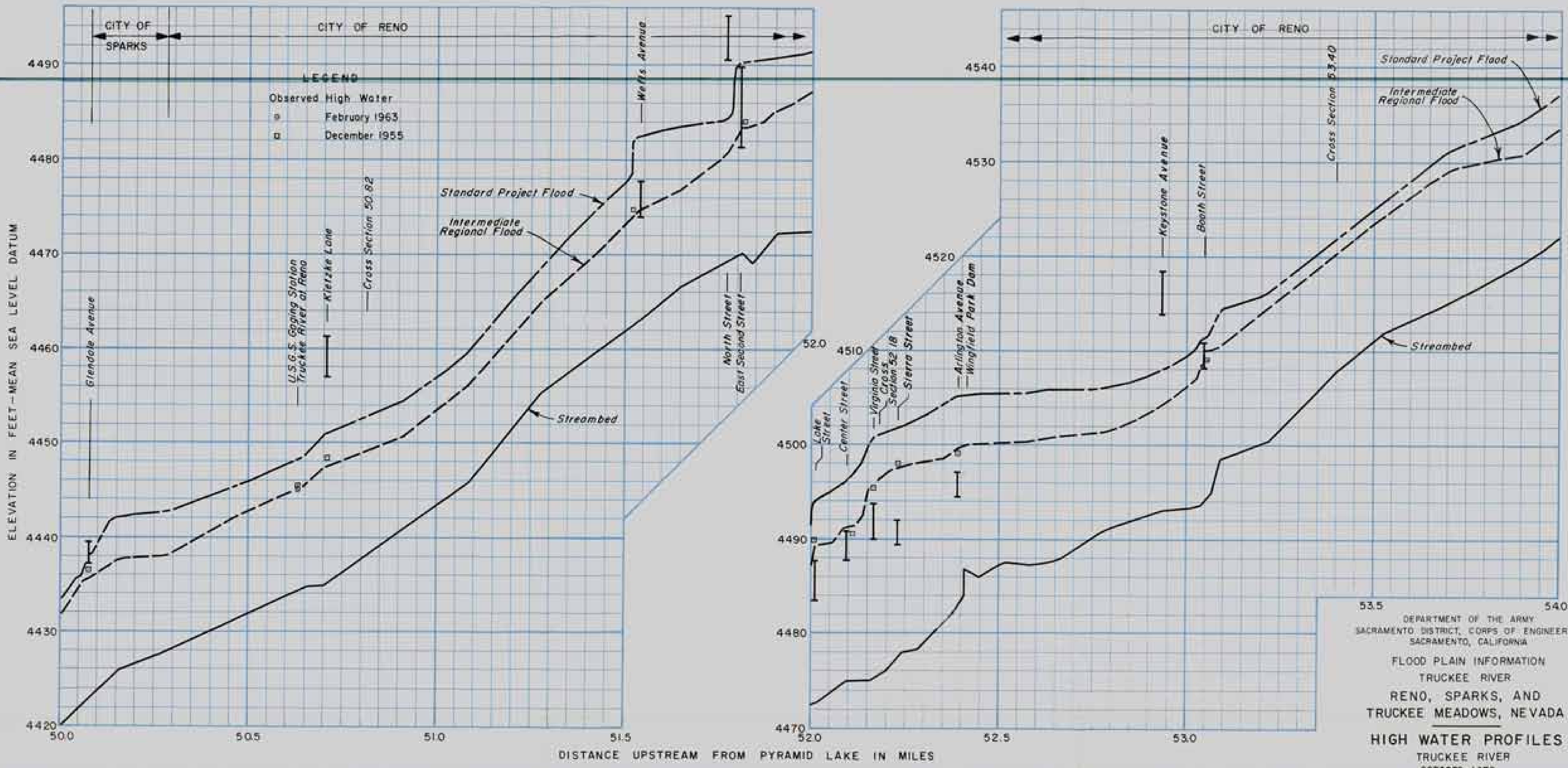
FLOOD PLAIN INFORMATION
TRUCKEE RIVER
RENO, SPARKS, AND
TRUCKEE MEADOWS, NEVADA

HIGH WATER PROFILES
TRUCKEE RIVER
OCTOBER 1970

PLATE 13



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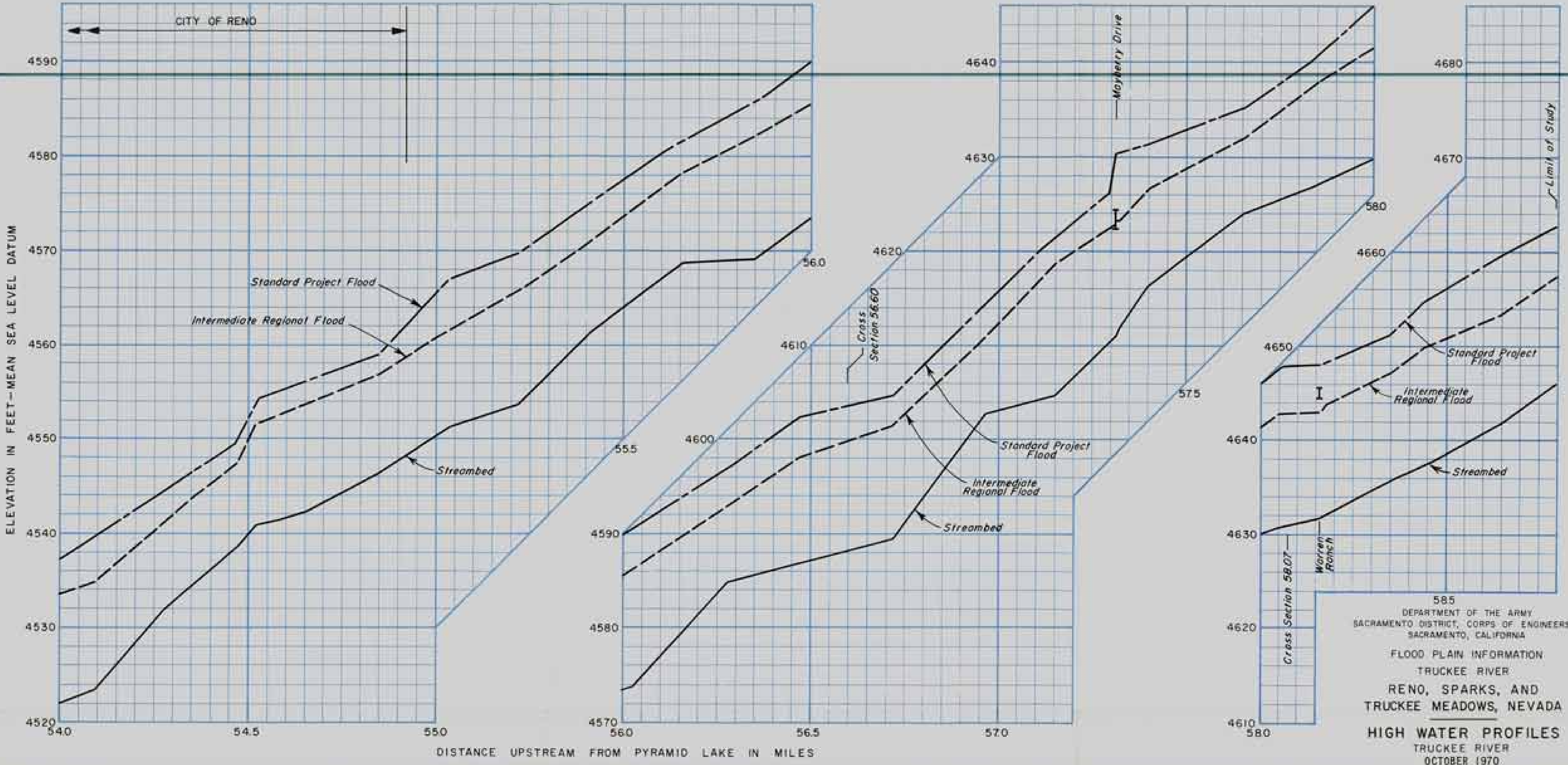
FLOOD PLAIN INFORMATION
TRUCKEE RIVER
RENO, SPARKS, AND
TRUCKEE MEADOWS, NEVADA

HIGH WATER PROFILES
TRUCKEE RIVER
OCTOBER 1970

PLATE 14



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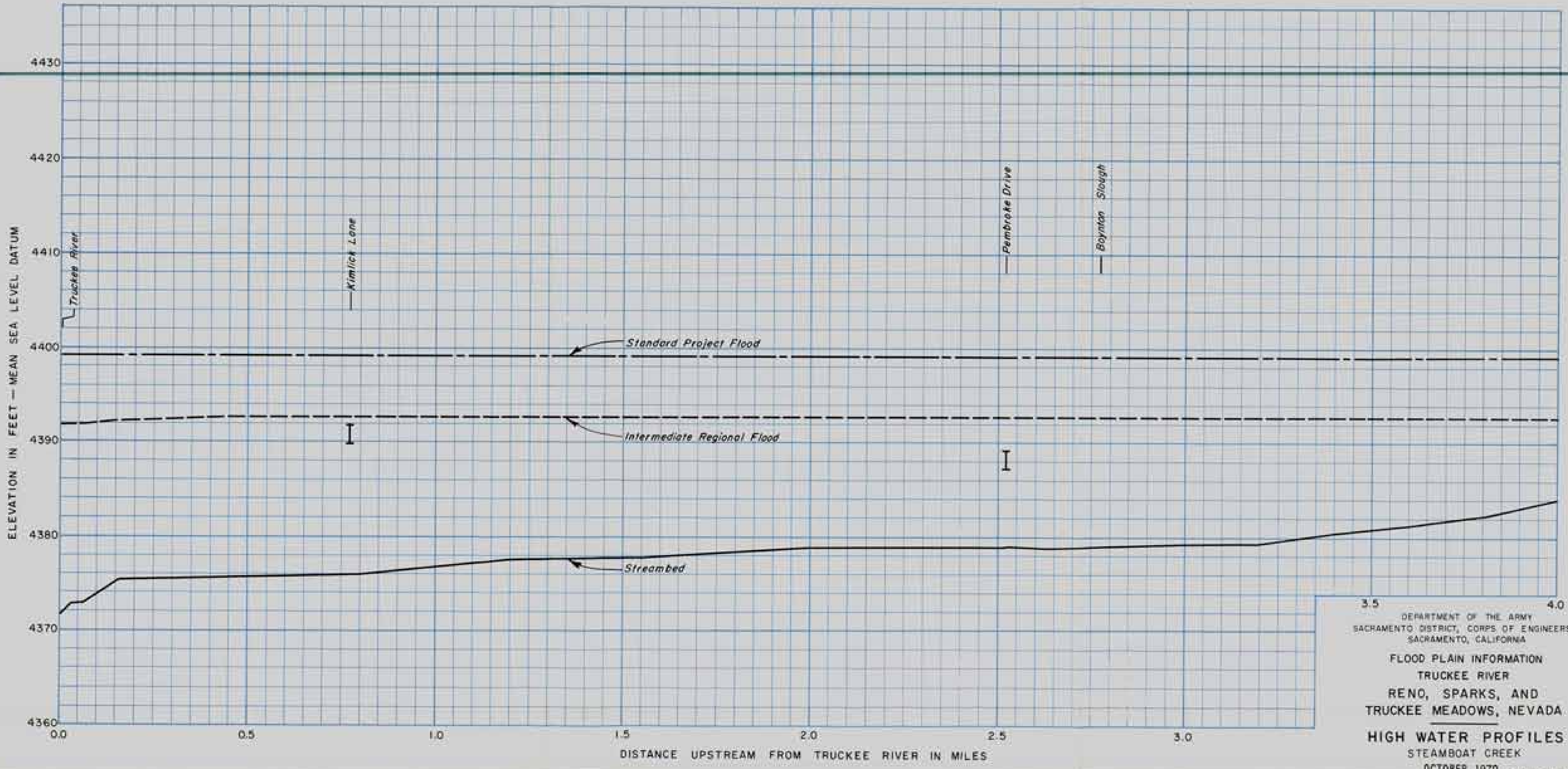
FLOOD PLAIN INFORMATION
TRUCKEE RIVER

RENO, SPARKS, AND
TRUCKEE MEADOWS, NEVADA

HIGH WATER PROFILES
TRUCKEE RIVER
OCTOBER 1970

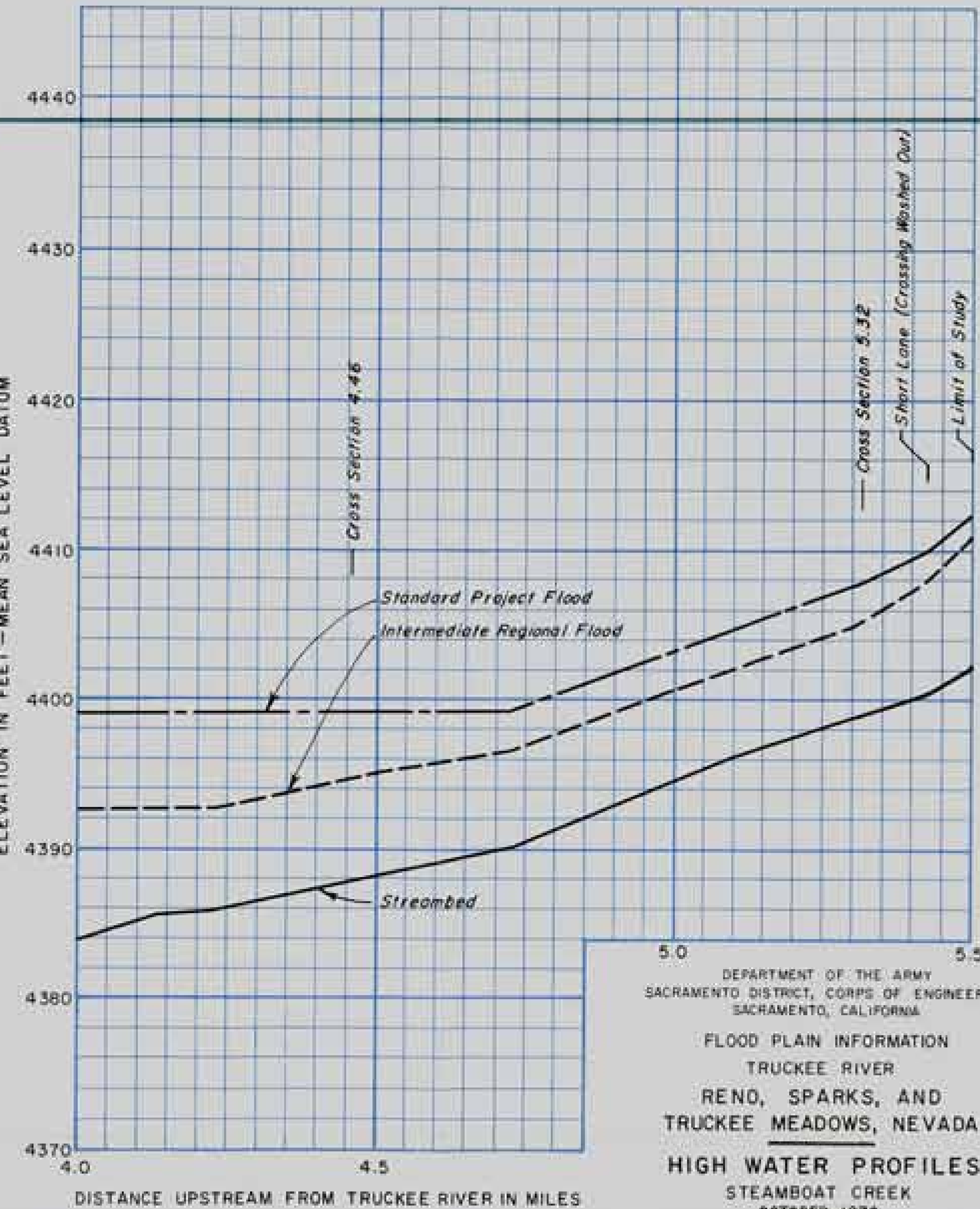
PLATE 15



DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

FLOOD PLAIN INFORMATION
TRUCKEE RIVER
RENO, SPARKS, AND
TRUCKEE MEADOWS, NEVADA

HIGH WATER PROFILES
STEAMBOAT CREEK
OCTOBER 1970 PLATE 16

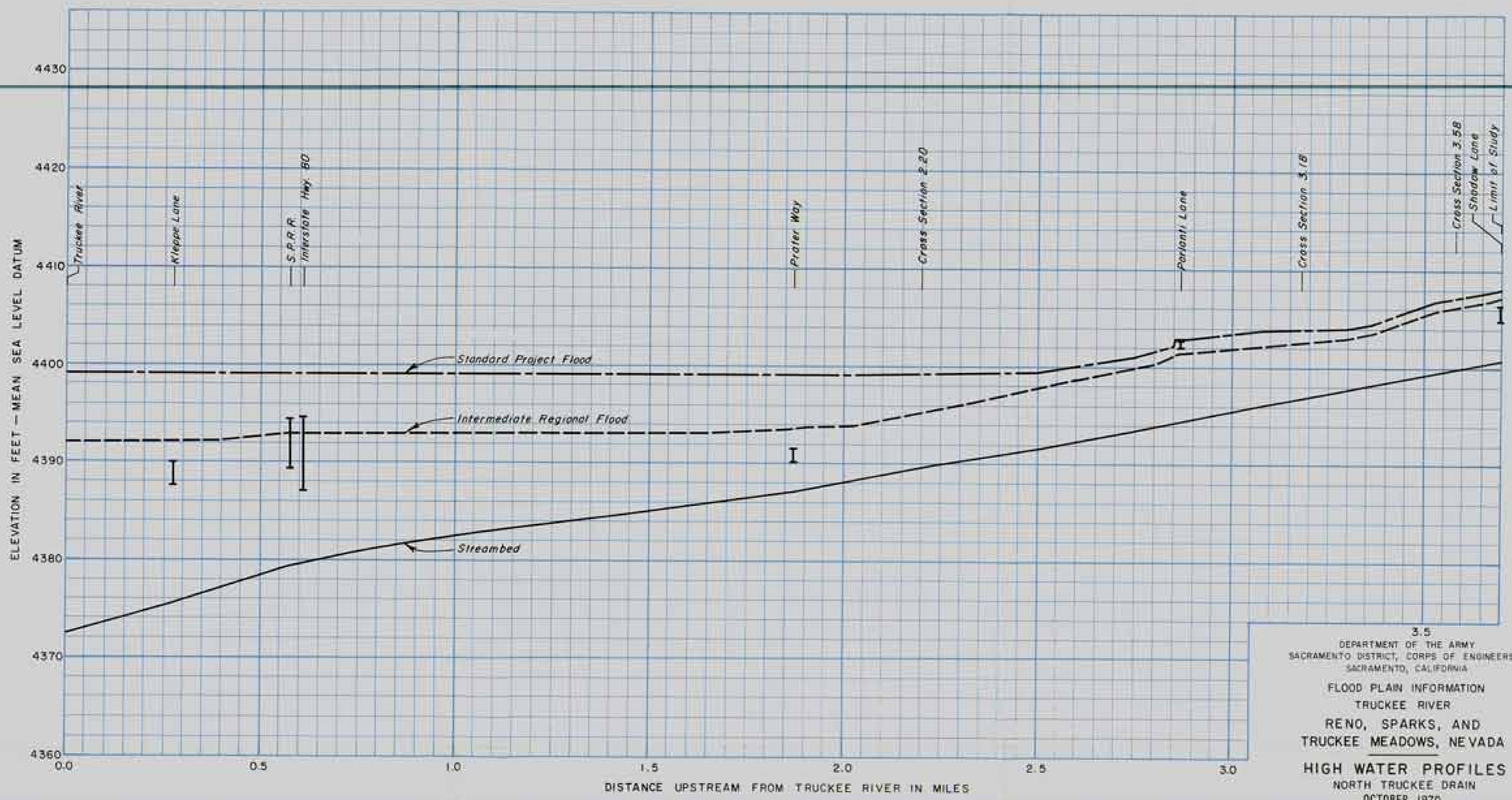


DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

FLOOD PLAIN INFORMATION
TRUCKEE RIVER
RENO, SPARKS, AND
TRUCKEE MEADOWS, NEVADA

HIGH WATER PROFILES
STEAMBOAT CREEK
OCTOBER 1970

PLATE 17

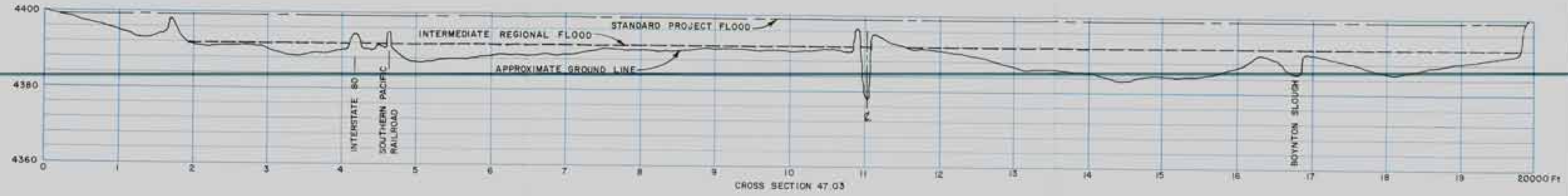


DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

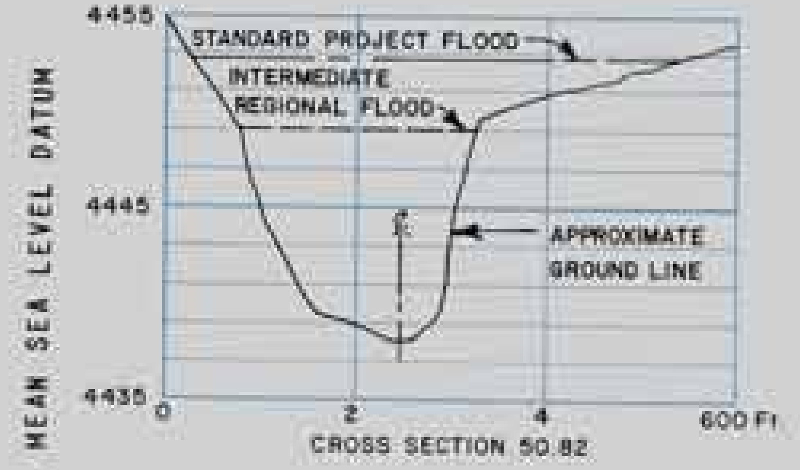
FLOOD PLAIN INFORMATION
TRUCKEE RIVER
RENO, SPARKS, AND
TRUCKEE MEADOWS, NEVADA

HIGH WATER PROFILES
NORTH TRUCKEE DRAIN
OCTOBER 1970

PLATE 18

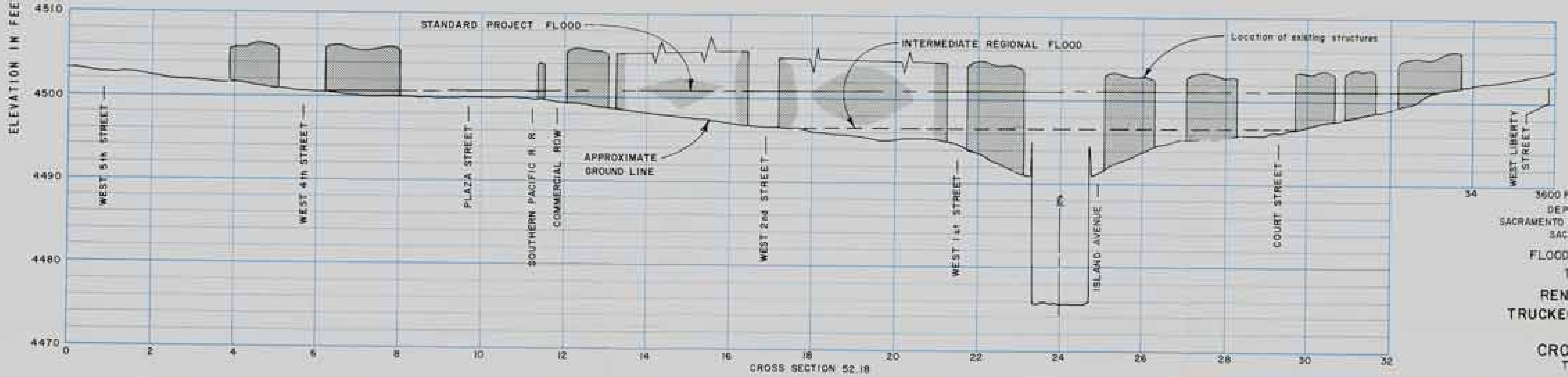


CROSS SECTION 47.03



CROSS SECTION 50.82

Note:
All cross sections are viewed in direction of flow.



CROSS SECTION 52.18

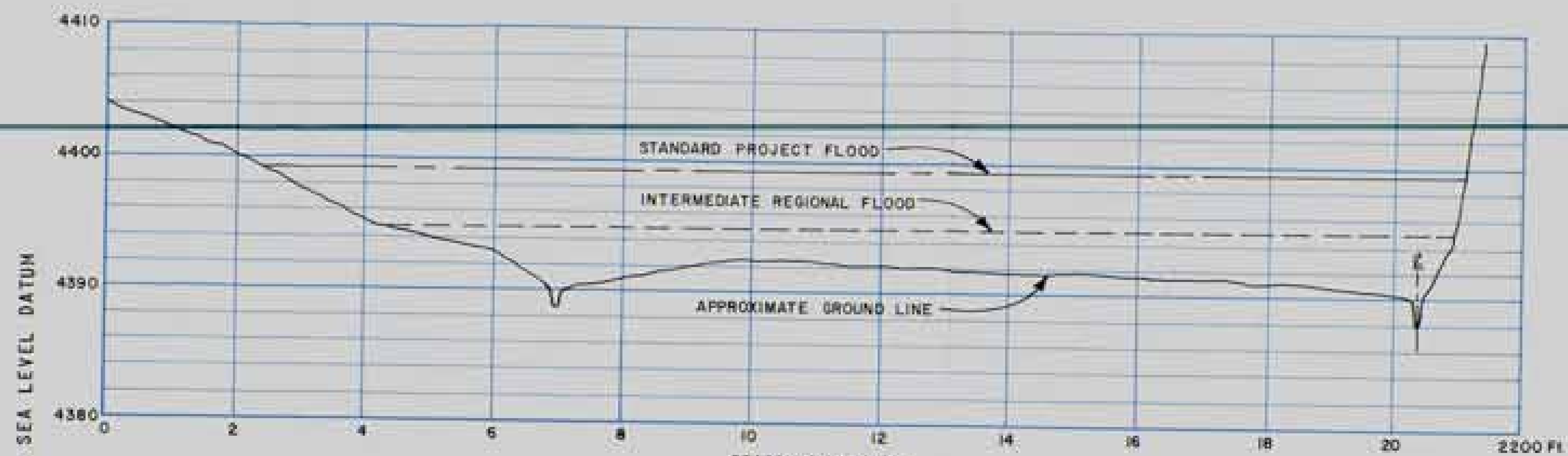
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

FLOOD PLAIN INFORMATION
TRUCKEE RIVER

RENO, SPARKS, AND
TRUCKEE MEADOWS, NEVADA

CROSS SECTIONS
TRUCKEE RIVER
OCTOBER 1970

PLATE 19



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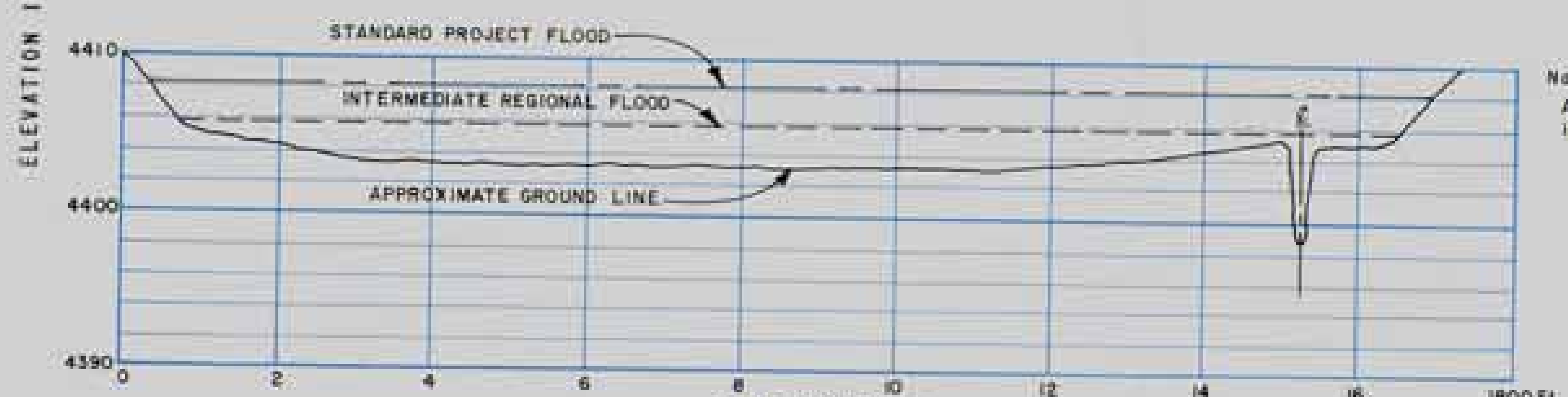


CROSS SECTION 5.32

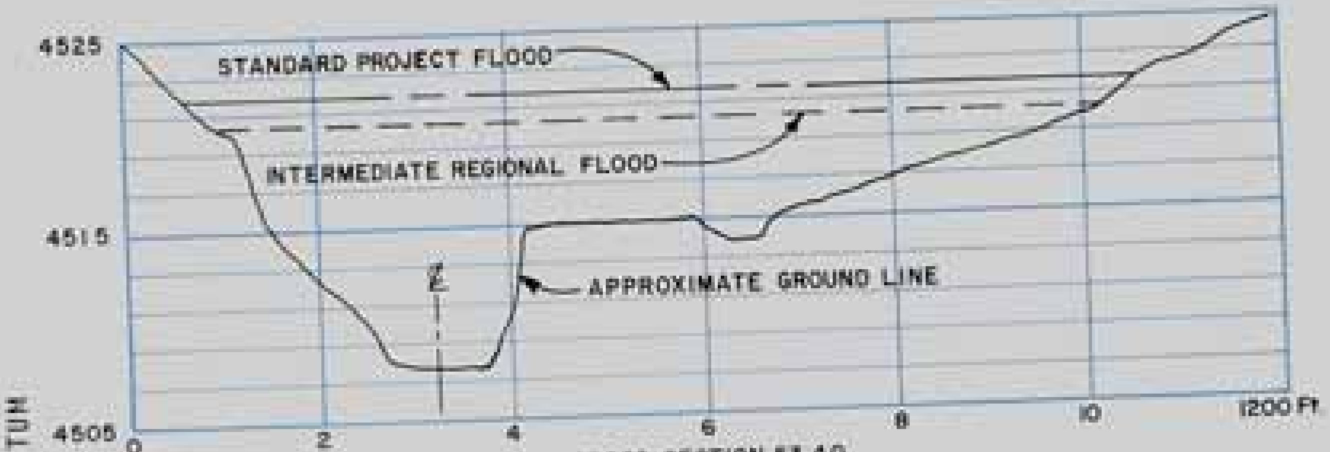
Note:
All cross sections are viewed in direction of flow.

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

FLOOD PLAIN INFORMATION
TRUCKEE RIVER
RENO, SPARKS, AND
TRUCKEE MEADOWS, NEVADA

CROSS SECTIONS
STEAMBOAT CREEK
OCTOBER 1970

PLATE 21



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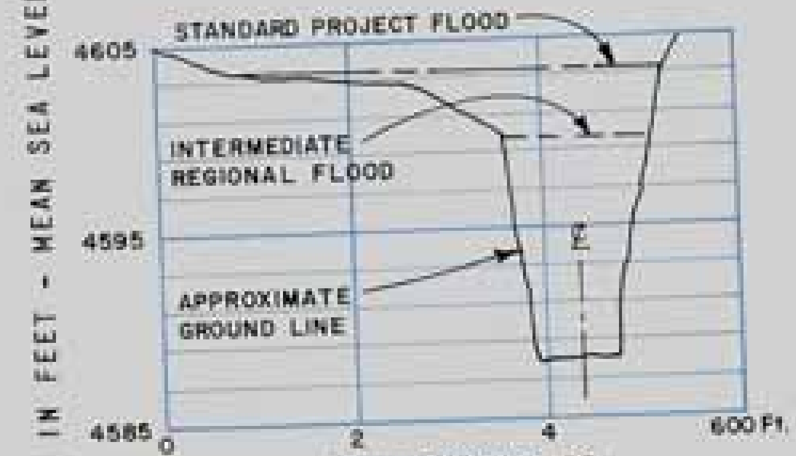
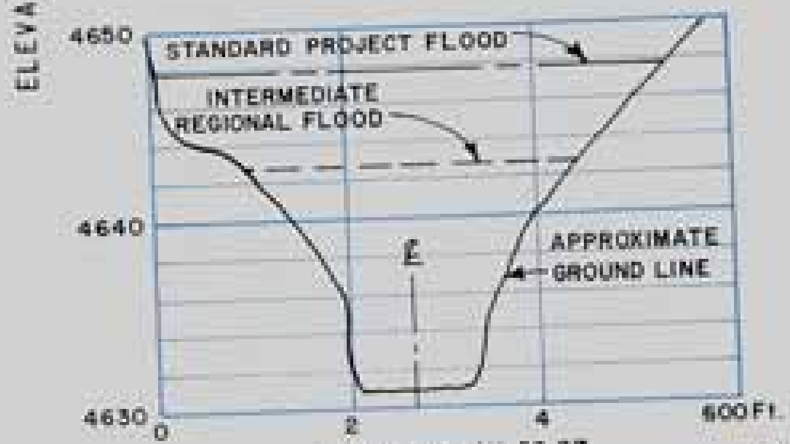


CROSS SECTION 56.60



CROSS SECTION 58.07

Note:
All cross sections are viewed in direction of flow.

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

FLOOD PLAIN INFORMATION
TRUCKEE RIVER

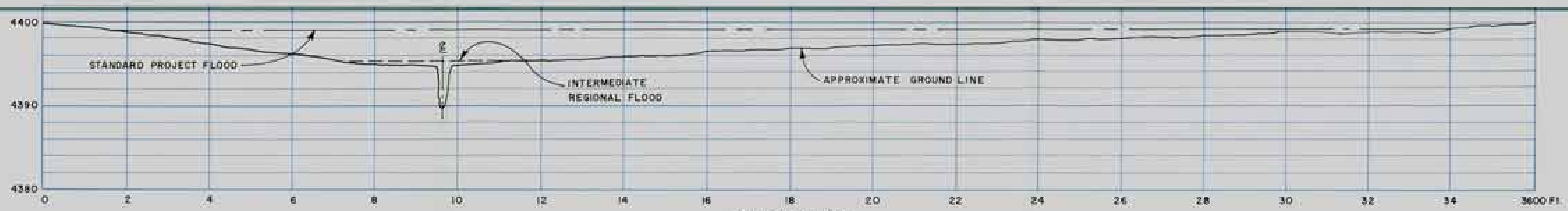
RENO, SPARKS, AND TRUCKEE MEADOWS, NEVADA

CROSS SECTIONS
TRUCKEE RIVER

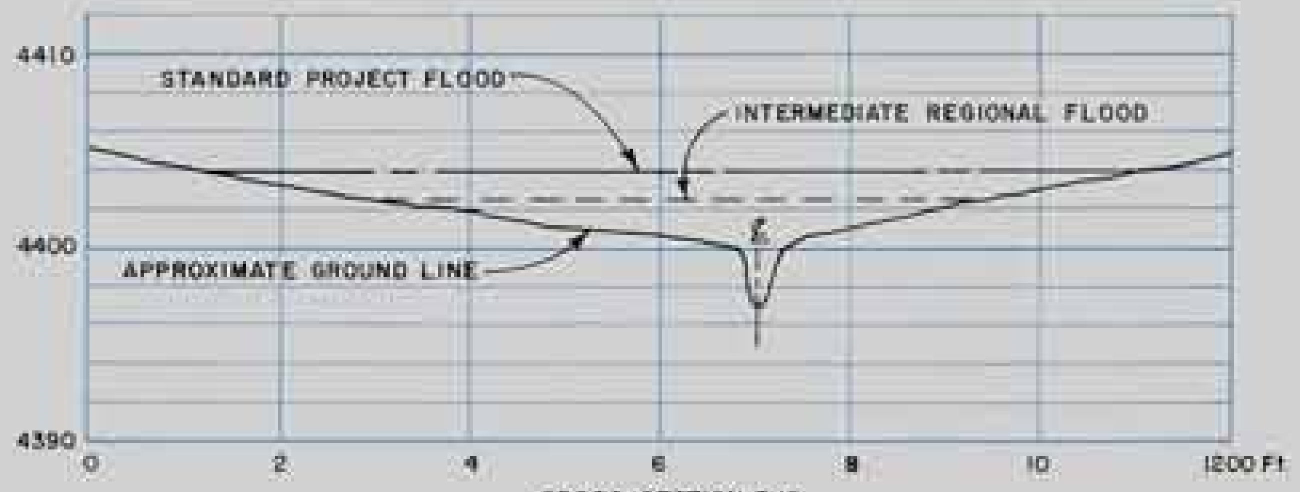
OCTOBER 1970

PLATE 20

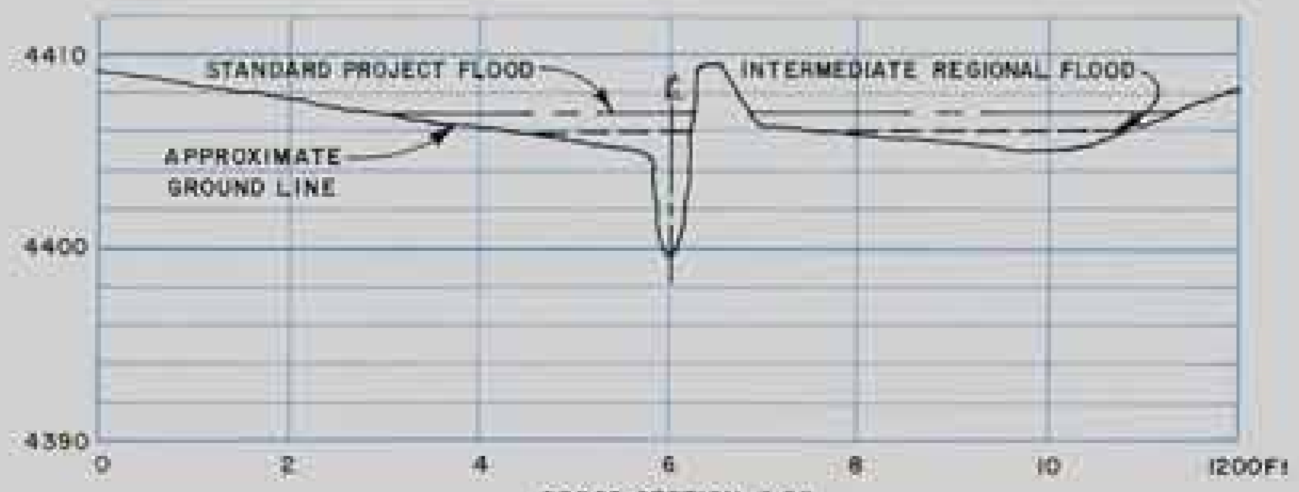
ELEVATION IN FEET - MEAN SEA LEVEL DATUM



CROSS SECTION 2.20



CROSS SECTION 3.18



CROSS SECTION 3.58

Note:
All cross sections are viewed in direction of flow.

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

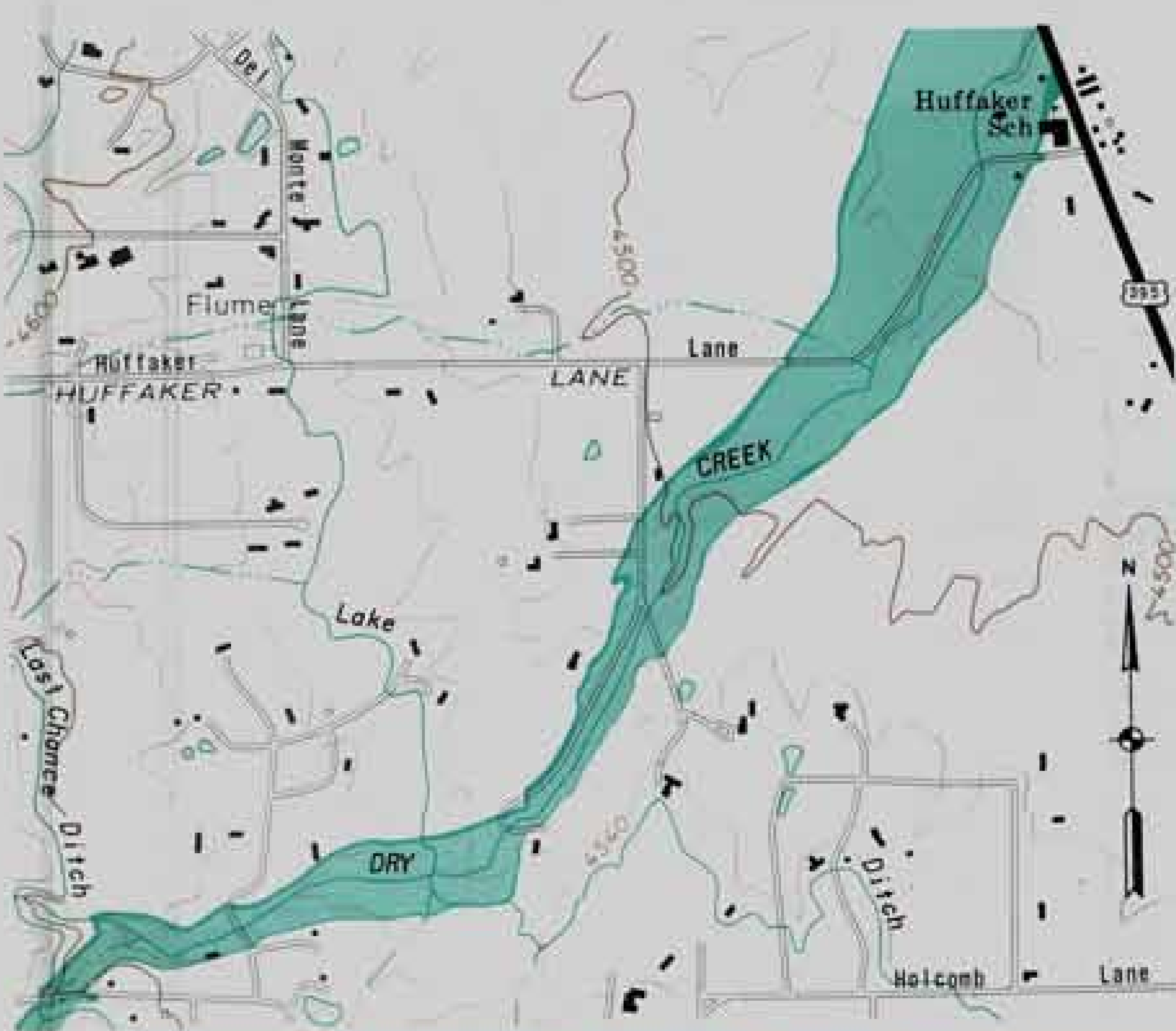
FLOOD PLAIN INFORMATION
TRUCKEE RIVER

RENO, SPARKS, AND
TRUCKEE MEADOWS, NEVADA

CROSS SECTIONS
NORTH TRUCKEE DRAIN
OCTOBER 1970

SPKED SPKPA NOV 70, 800

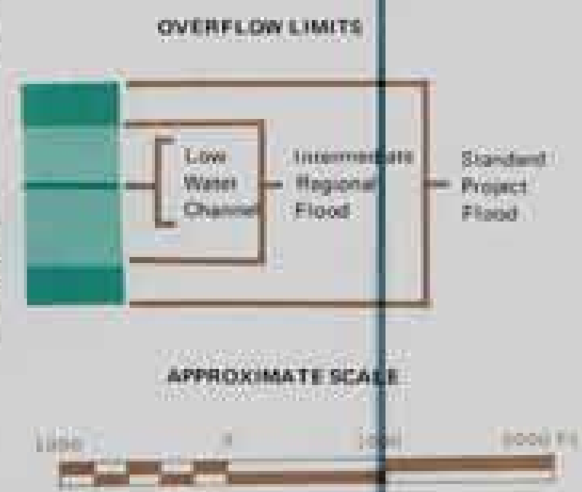
PLATE 22



FLOOD PATTERNS

SOUTHWEST FOOTHILL STREAMS

RENO, NEVADA

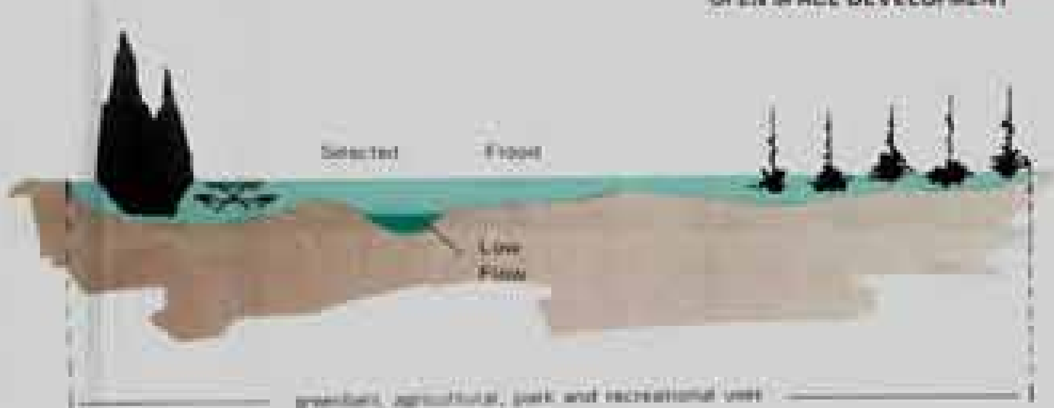


Maps and other illustrations for the remainder of the study area (the flood plains and immediately adjacent areas along the lower reaches of Evans, Dry, Thomas, and Whites Creeks and Skyline Wash) are contained in the FPI Report.

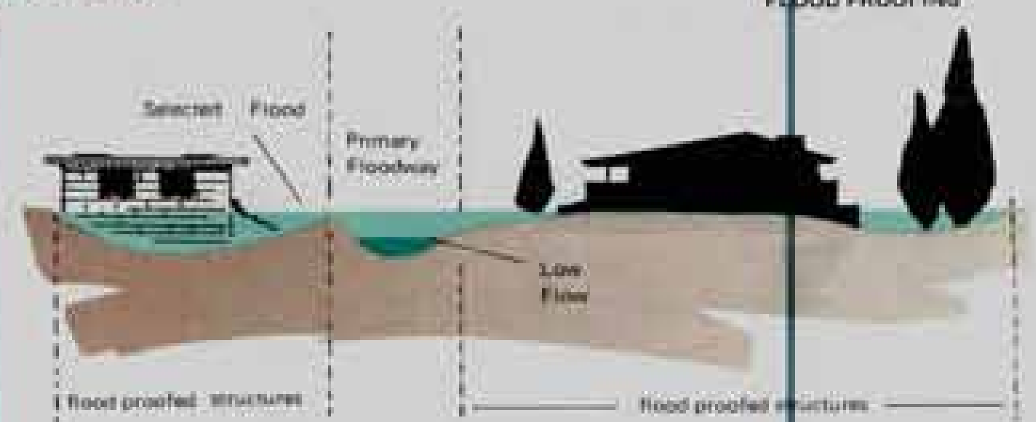
FLOOD PLAIN MANAGEMENT MEASURES USABLE FOR THE REDUCTION OF FLOOD DAMAGE

PREVENTIVE MEASURES

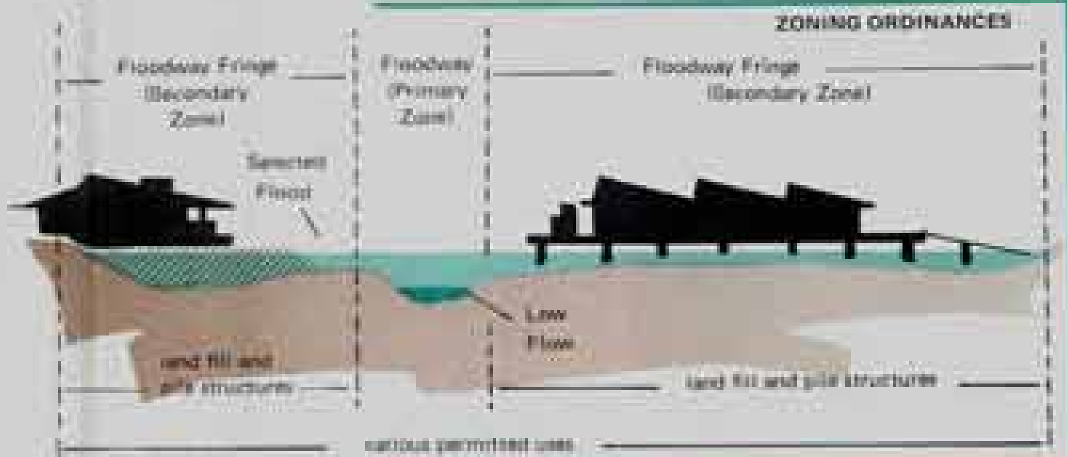
OPEN SPACE DEVELOPMENT



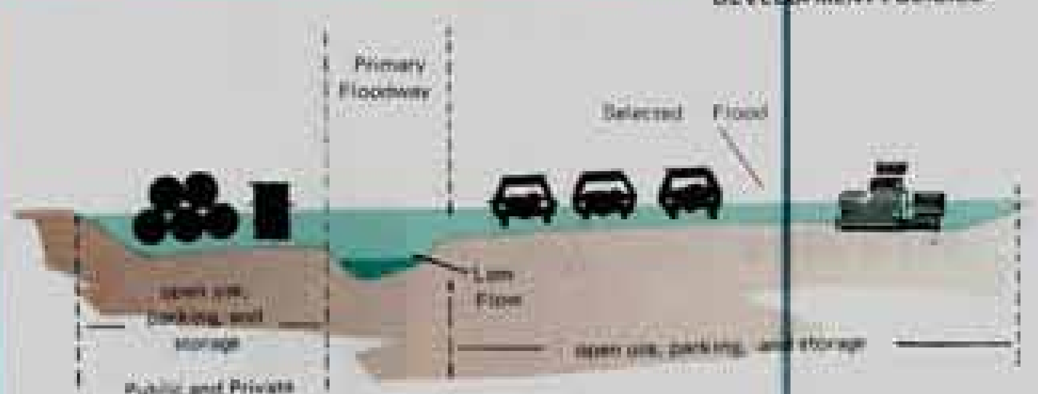
FLOOD PROOFING



ZONING ORDINANCES

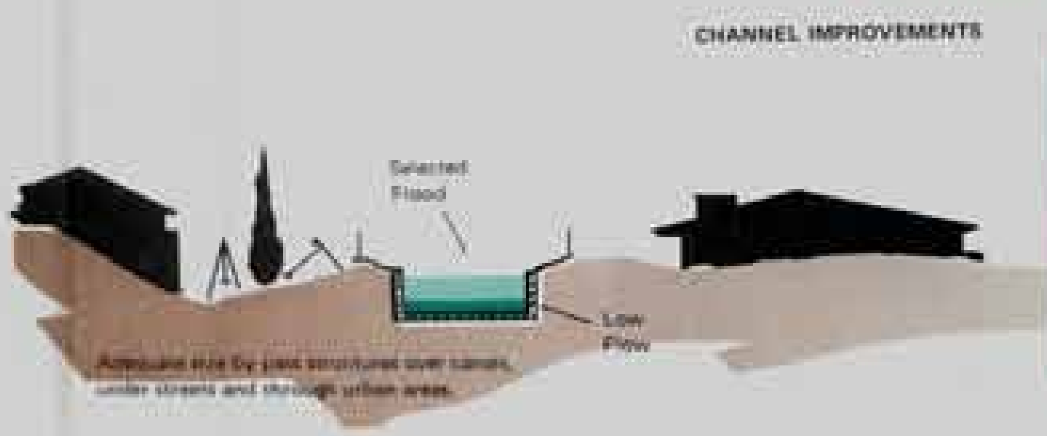


DEVELOPMENT POLICIES



CORRECTIVE MEASURES

CHANNEL IMPROVEMENTS



WATERSHED MANAGEMENT

Preventive measures reduce vulnerability to flood damage and provide for greater flexibility in land use management, often at minor cost and with little adverse effect on the environment. Preventive measures other than those illustrated above include subdivision regulations, building codes, health regulations, tax adjustments, warning signs, and flood insurance. Corrective measures are often required to alleviate existing flood problems and forestall future problems.

Two types of corrective measures are illustrated above. Others include dams and reservoirs, flood plain evacuation, flood forecasting, and urban redevelopment. Preventive and corrective measures may be used by themselves or in varying combinations to meet the specific needs of a particular flood prone area. Public support is necessary to obtain needed flood damage reduction through flood plain management measures.

FLOODS

ON THE
Southwest Foothill Streams

Flood plain areas of the Southwest Foothill Streams have suffered damage from large floods in the past. Studies made for a flood plain information (FPI) report show that floods of similar or larger magnitude can occur in the future.

The FPI Report presents facts on the flood potential and flood hazard along Evans, Dry, Thomas, and Whites Creeks, and Skyline Wash in the area generally south of Plumb Lane and west of Highway 395 in and in the vicinity of Reno. It includes maps, drawings, and photographs that illustrate the extent and severity of future floods that have been designated as the Intermediate Regional Flood (IRF) and Standard Project Flood (SPF). An IRF is a large flood expected to occur about once in 100 years on the average, although it could occur, and has a 1 percent probability of occurring, in any given year. An SPF would be greater than an IRF, but one that can reasonably be expected to occur in the future. It would occur less frequently than an IRF, but still could occur in any particular year.

Future flood heights along Evans Creek at U.S. 395.

The purpose of FPI reports is to provide a basis for managing the use of flood prone lands in such a way that flood hazards and damage during future floods are minimized or eliminated.

This folder has been prepared for Washoe County by the Sacramento District, U.S. Army Corps of Engineers. It is partially based on data in the report entitled "Flood Plain Information, Southwest Foothill Streams, Reno, Nevada." Copies of the report and this folder are available upon request from the Regional Planning Commission of Reno, Sparks and Washoe County.

COVER PHOTOGRAPH:

Remains of Steamboat Ditch Flume crossing of Thomas Creek following the January-February 1963 floods. Rock debris from earlier cloudburst floods appear in the background (Soil Conservation Service photo).

FLOODS

SOUTHWEST FOOTHILL STREAMS

(EVANS, DRY, THOMAS, AND WHITES CREEKS AND SKYLINE WASH)

RENO, NEVADA

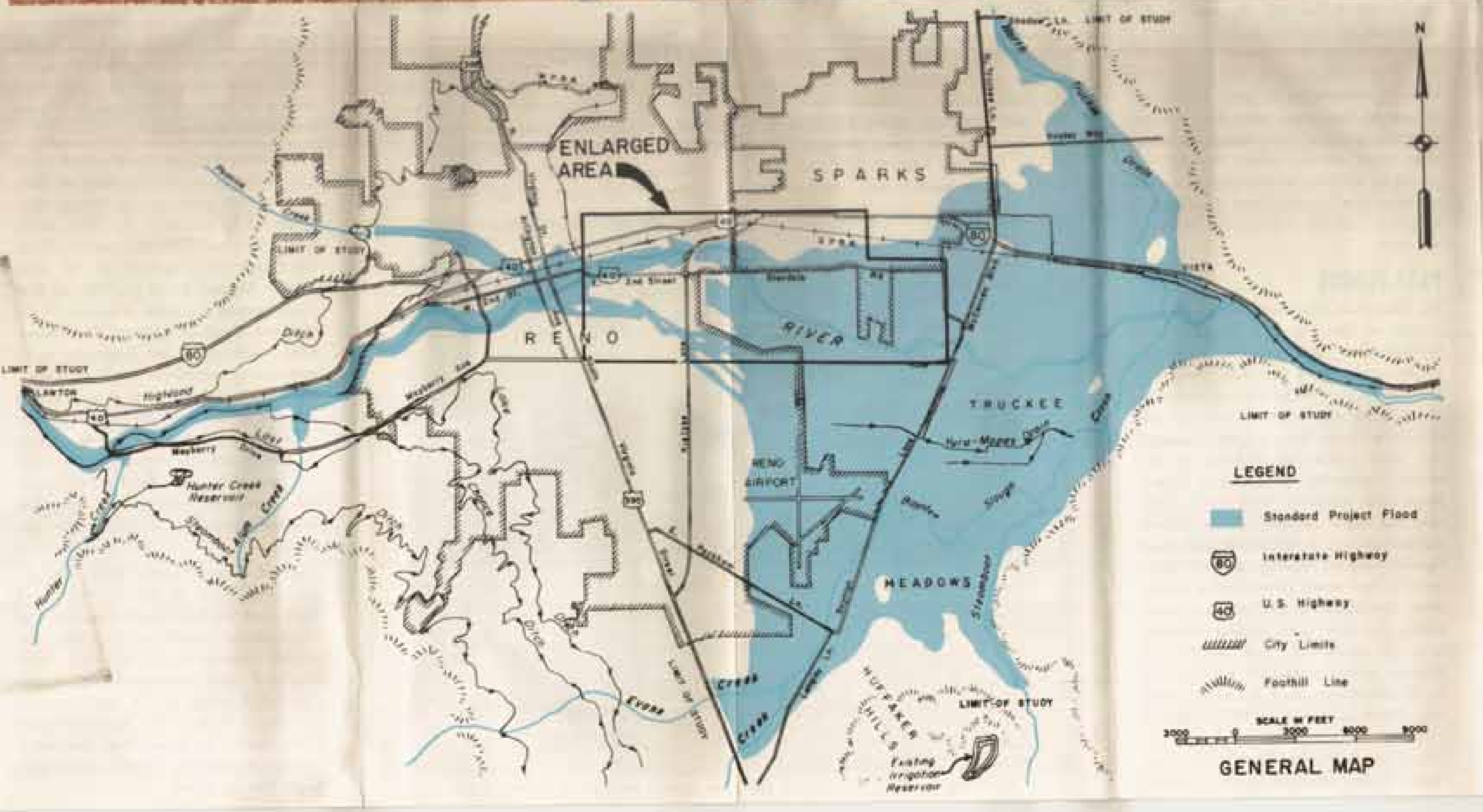
JUNE 1974

Flood plains along the Southwest Foothill Streams south of Reno are being converted from their rural nature to residential, commercial, and recreational uses.

With continued community growth, greater pressure to utilize these flood prone areas will occur. Flood hazards and flood damage will increase unless some preventive or corrective action is taken.

Effective regulatory measures such as flood plain zoning, subdivision regulations, and building codes can be adopted to prevent or minimize the increase in flood damage. Flood insurance can help to compensate for flood losses. Flood proofing that prevents future damage to existing structures subject to flooding, and flood control works to modify flood patterns can also be a part of a long-range solution. Flood plain regulations, which are becoming more and more acceptable as a practical approach to flood damage reduction, encourage the highest and best use of flood prone areas.

Future flood heights along Thomas Creek at Sierra Manor Drive.



Future flood heights at the northwest corner of Sierra Street and Truckee Lane in downtown Reno.

FLOODS

Truckee River
RENO-SPARKS-TRUCKEE MEADOWS, NEVADA

Study area

OCTOBER 1970

FLOODS IN THE RENO-SPARKS - TRUCKEE MEADOWS AREA

The Reno-Sparks-Truckee Meadows area has a long history of floods. On the basis of available records, it was found that floods have occurred 18 times in this area during the last 120 years, or about once in every 7 years on the average. In earlier years, flood damage was only nominal because of limited development in the flood plain, even though some of the floods were very large. The more recent floods have caused substantial damage to commercial and residential areas in downtown Reno; to streets, roads and bridges; public utilities; and to agricultural properties in Truckee Meadows.

Three existing reservoirs with flood control as a function and improvement of the Truckee River channel by widening, straightening, and steepening the gradient now provide a substantial degree of protection to the cities and adjacent urban, suburban, industrial, and agricultural areas. Nevertheless, areas along the river and in the Meadows are still subject to flood hazards.

A large flood could cause moderate to severe damage in commercial and residential areas in downtown Reno; to city parks; to roads, streets, and bridges; to the municipal airport; to public utilities; and to commercial, agricultural, and developing suburban residential areas in Truckee Meadows. Although the flooded areas would bear the brunt of such a misfortune, the general welfare and economy of the area would also be affected.

Large floods can be expected to recur in the Reno-Sparks-Truckee Meadows area. However, information to guide safe development of flood-prone areas, and methods to reduce potential flood damage are available. Local officials believe that citizens should be informed that future large floods are inevitable, but that flood damages can be greatly reduced if appropriate measures are taken.

PAST FLOODS

The December 1955 flood was the largest known to have occurred in the Reno-Sparks-Truckee Meadows area. In Reno, floodwaters 3 to 5 feet deep covered a strip one to two blocks wide on each side of the river from Idlewild Park to the eastern city limits. Water entered basements and some unprotected buildings in the central commercial district, and streets, lawns, and shrubbery were buried with sand and debris. However, due to advance preparations and a well-coordinated flood fighting program, damage totalled about one-half that which resulted from a large flood that occurred in November 1950. During the 1955 flood, more than 6,000 acres of agricultural lands in Truckee Meadows were inundated for 6 to 10 days by floodwaters up to 6 feet deep. Other large floods occurred in 1907, 1937 and 1963.

Floods on the Truckee River in the Reno-Sparks-Truckee Meadows area result mainly from prolonged heavy rainfall, and most frequently occur during the winter months. Cloudbursts resulting from intense convective-type thunderstorms centered over the drainage basins of tributary streams in this area may cause severe but localized flooding from late spring to early fall. Melting snow may intensify rainfloods, but flooding from snowmelt alone would rarely occur.

(Photo courtesy of the Silver State Press)

Flooding in the vicinity of the Lake Street Bridge. December 1955.

FUTURE FLOODS

Floods larger than those of record can occur in the Reno-Sparks-Truckee Meadows area. Future floods studied for this report have been designated as the Intermediate Regional and Standard Project Floods. Meteorologic and hydrologic studies indicate future floods of these magnitudes can reasonably be expected to occur in the study area, and that they would be significantly more severe than any past flood because of increased development of areas now subject to flooding.

Intermediate Regional Floods, which would have a frequency of occurrence of about once in 100 years on the average, were developed for the study area from meteorologic data and hydrologic studies. In the Reno area, the magnitude of the Intermediate Regional Flood would be less than the magnitude of some historical floods. However, floods of historical flood magnitude would occur less frequently under now-existing conditions of river control. For example, a flood of the magnitude that occurred in February 1963 had a frequency of occurrence of about once in 80 years on the average under conditions that existed at that time. Currently, a flood of that magnitude would be expected to occur less frequently than once in 100 years on the average.

Standard Project Floods, which represent the upper limits of flooding that would result from the most severe combination of meteorological conditions considered reasonably characteristic of the region, were developed from studies of storms and historical floods in the Truckee River and adjoining watersheds. The Standard Project Flood would be larger than the Intermediate Regional Flood and considerably larger than any previous known flood.

POSSIBLE SOLUTIONS

To start a realistic program for flood damage reduction, it is necessary to know the elevation that future floods can be expected to reach and the areas that may be flooded. A map showing the limits of the Intermediate Regional and Standard Project Floods in a portion of the study area appears in this folder. Similar maps for the remainder of the study area are contained in a Corps of Engineers report entitled "Flood Plain Information, Truckee River, Reno-Sparks-Truckee Meadows, Nevada."

Although past floods have caused substantial damage in the study area, future floods can cause even greater damage due to increasing developments in flood plain areas. As economic development continues, there will be an even greater demand for use of the flood plain areas. Unless properly regulated, improvements in flood-prone locations would be vulnerable to serious flood damages and could restrict flood flows, thus increasing flood heights and possibly threaten areas not previously subject to flooding.

Flood hazard information can be used to guide and control the use of flood-prone areas. Regulations and control measures have been adopted in many localities and have become accepted as a practical approach to safe development of flood plains and reduction of potential flood damage. The adoption of flood plain regulations would not prevent the use of these areas for park and other open-type facilities. Existing and proposed structures could be flood proofed to make them less vulnerable. This involves permanently closing ground-level openings, waterproofing walls and floors, installing removable bulkheads over entrances, using flap valves on sewer and storm drain outfalls, and other structural changes.

This folder was prepared by the Corps of Engineers from data contained in the flood plain information report referred to in a preceding paragraph. Preparation of that report was requested by the State of Nevada and the Regional Planning Commission of Reno, Sparks, and Washoe County under the authority contained in Section 206 of the 1960 Flood Control Act, as amended by Section 206 of the 1966 Flood Control Act. Copies of the report and this folder are available from Washoe County, the cities of Reno and Sparks, and the Regional Planning Commission.

(Gene Christensen photo)

Partially submerged automobile and debris deposited on South Virginia Street. November 1950.

(Photo courtesy of Albert Katona)

Flooding in Truckee Meadows. December 1955.