Mojave River Bridge at Yucca Loma Road
Town of Apple Valley and City of Victorville
San Bernardino County, California

Location Hydraulic Study Report

Prepared for:

Town of Apple Valley

and

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WRECO

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Submitted to:
Town of Apple Valley

This report has been prepared by or under the supervision of the following Registered Engineer. The Registered Civil Engineer attests to the technical information contained herein and has judged the qualifications of any technical specialists providing engineering data upon which recommendations, conclusions, and decisions are based.

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Registered Civil Engineer

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Date

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Table of Contents

Figures

Tables

Photos

Appendices

Executive Summary

The proposed Mojave River Road Bridge at Yucca Loma Road Project (Project) would provide a new route between the Town of Apple Valley and the City of Victorville in San Bernardino County, California. The eastern limit of the Project is located at the intersection of Yucca Loma Road and Apple Valley Road. The western limit of the Project is located at the intersection of Green Tree Boulevard and Hesperia Road. In addition, Yates Road and Ridgecrest Road, in the City of Victorville, are also within the Project limits.

The Project would construct a four-lane bridge over the Mojave River and connect Yucca Loma Road, in the Town of Apple Valley, to Yates Road, in the City of Victorville. Both Yucca Loma Road and Yates Road would be widened from two lanes to four lanes in order to support the projected traffic at the proposed bridge.

The Mojave River is the only major creek, river or stream within the Project vicinity. The characteristics of the Mojave River are:

- A high percolation rate of the riverbed material.
- A channel that is dry most of the year.
- The flow is controlled by the Mojave River Dam, a flood-control facility owned and controlled by United States Army Corps of Engineers (USACE), Los Angeles District.

The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) for the San Bernardino County Incorporated Areas shows that the 100-year floodplain is contained in the Mojave River main channel at the Project location. FEMA has conducted a detailed floodplain analysis downstream of the Project location (Zone AE floodplain). Upstream from the proposed bridge location, the floodplain analysis of the Mojave River was based on the Approximate Method (Zone A floodplain).

The hydraulic models for the existing and proposed conditions indicated that the 100-year design would be contained in the main channel of the Mojave River, within the Project limits. Although the proposed bridge structure would obstruct the flow, and slightly elevate the upstream 100-year water surface elevation, it should not significantly modify the characteristics of the existing 100-year floodplain (see Table 1).

Table 1. Comparisons of the 100-year Flow Characteristics for Existing and Proposed Conditions

		Immediate upstream of the proposed bridge		500 ft upstream of the proposed bridge	
		Existing	Proposed	Existing	Proposed
Average Flow Velocity	(ft/s)	6.0	5.9	5.9	5.6
Flow Depth	(ft)	7.2	7.7	6.9	7.1
Floodplain Width	(ft)	1,078	1,095	1,137	1,143
Channel Freeboard	(ft)	3.3	2.8	2.9	2.7

The natural and beneficial floodplain values for the Project Location are limited to the main channel of the Mojave River. Bridge construction may cause temporary or permanent impacts to the existing vegetation. Construction activity in the riverbed would be performed as to minimize disturbance to the surrounding vegetation. Transplanting or revegetation should be performed in order to maintain the existing vegetation at the Project site. Construction Best Management Practices (BMP) will be applied to minimize any potential impacts to the Mojave River. With these measures, the Project's impact to the natural and beneficial floodplain values would be less than significant.

Acronyms

ADT	Average Daily Traffic
APS	Advanced Planning Study
BMP	Best Management Practices
BNSF	Burlington Northern Santa Fe
Caltrans	California Department of Transportation
CEQA	California Environmental Quality Act
EB	Eastbound
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIS	Flood Insurance Study
MWA	Mojave Water Agency
NAVD	North American Vertical Datum
NEPA	National Environmental Policy Act
NB	Northbound
Project	Mojave River Bridge at Yucca Loma Road Project
RWQCB	Regional Water Quality Control Board
SB	Southbound
SR 18	State Route 18
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
WB	Westbound
WSE	Water Surface Elevation

1 GENERAL DESCRIPTION

1.1 Project Description

The proposed Mojave River Road Bridge at Yucca Loma Road Project (Project) would provide a new route between the Town of Apple Valley and the City of Victorville in San Bernardino County, California. The eastern limit of the Project is located at the intersection of Yucca Loma Road and Apple Valley Road. The western limit of the Project is located at the intersection of Green Tree Boulevard and Hesperia Road. In addition, Yates Road and Ridgecrest Road, in the City of Victorville, are also within the Project limits.

The existing Yucca Loma Road, from the road terminus at the Mojave River bank to the intersection at Apple Valley Road, is a two-lane roadway surrounded by a single-unit residential development. Yates Road is also a two-lane roadway, and is located at the northern end of the residential developments near Spring Valley Lake. Ridgecrest Road is a two- to four-lane roadway located at the western end of the residential developments, also near Spring Valley Lake. Green Tree Boulevard is a four-lane roadway that terminates at the intersection of Hesperia Road, which is approximately 0.9 mi west of Ridgecrest Road.

1.1.1 No-Build Alternative

Under the No-Build Alternative, the Mojave River Bridge would not be constructed and Yucca Loma Road and Yates Road would remain unchanged.

1.1.2 Build Alternative

The Project would widen Yucca Loma Road from two to four lanes, from Apple Valley Road to its current terminus. A new bridge crossing the Mojave River would be constructed. This bridge would connect to Yates Road, which would also be widened from two lanes to four lanes, approximately from Fortuna Lane to Park Road. Yates Road, from Park Road to Ridgecrest Road, is currently striped for two lanes but is wide enough for four lanes. This section would have added curb, gutter and sidewalk, and would be re-striped for four lanes.

Figure 1. Project Location Map

Source: USGS topography map

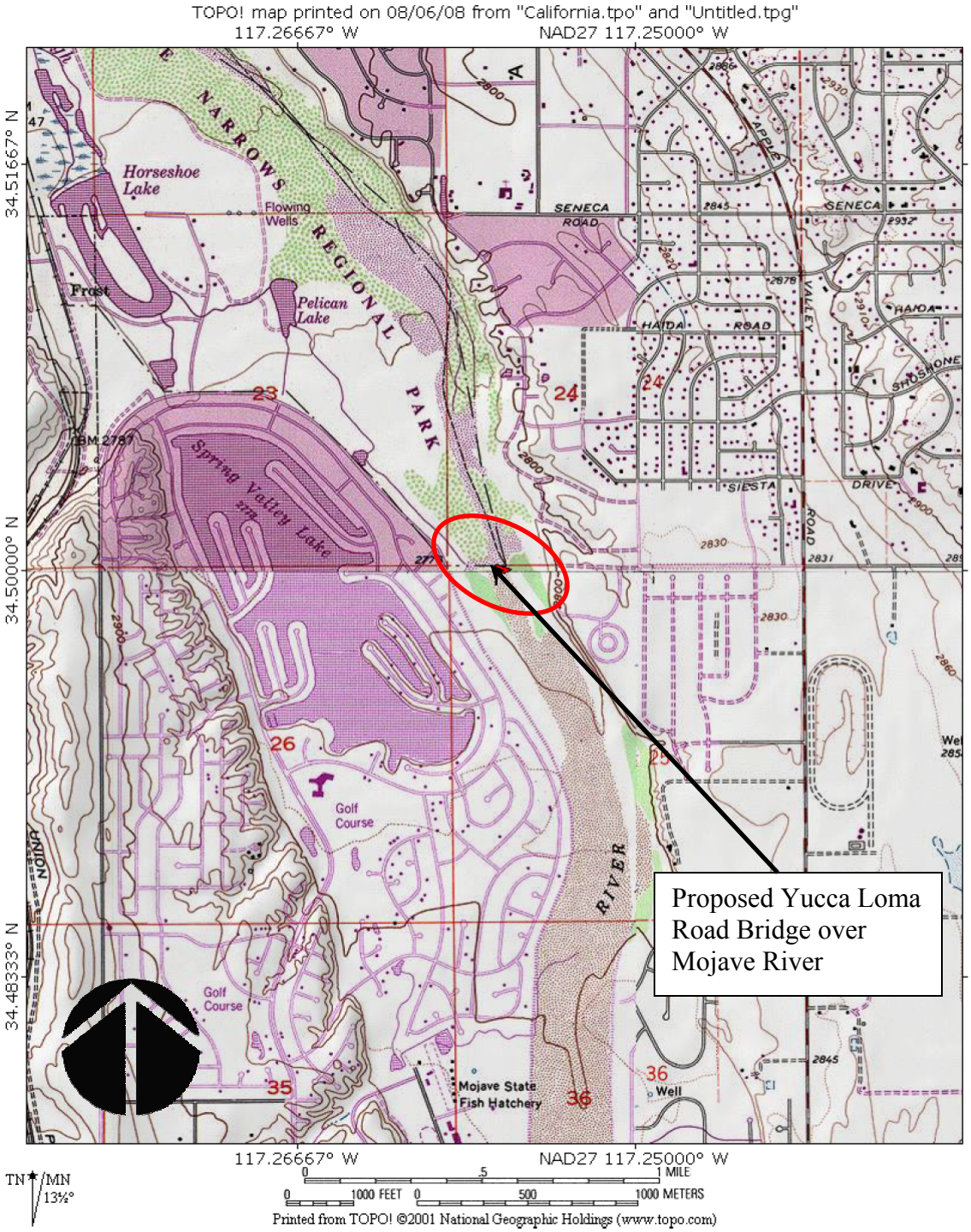


Figure 2. Project Vicinity Map

Source: USGS topography map

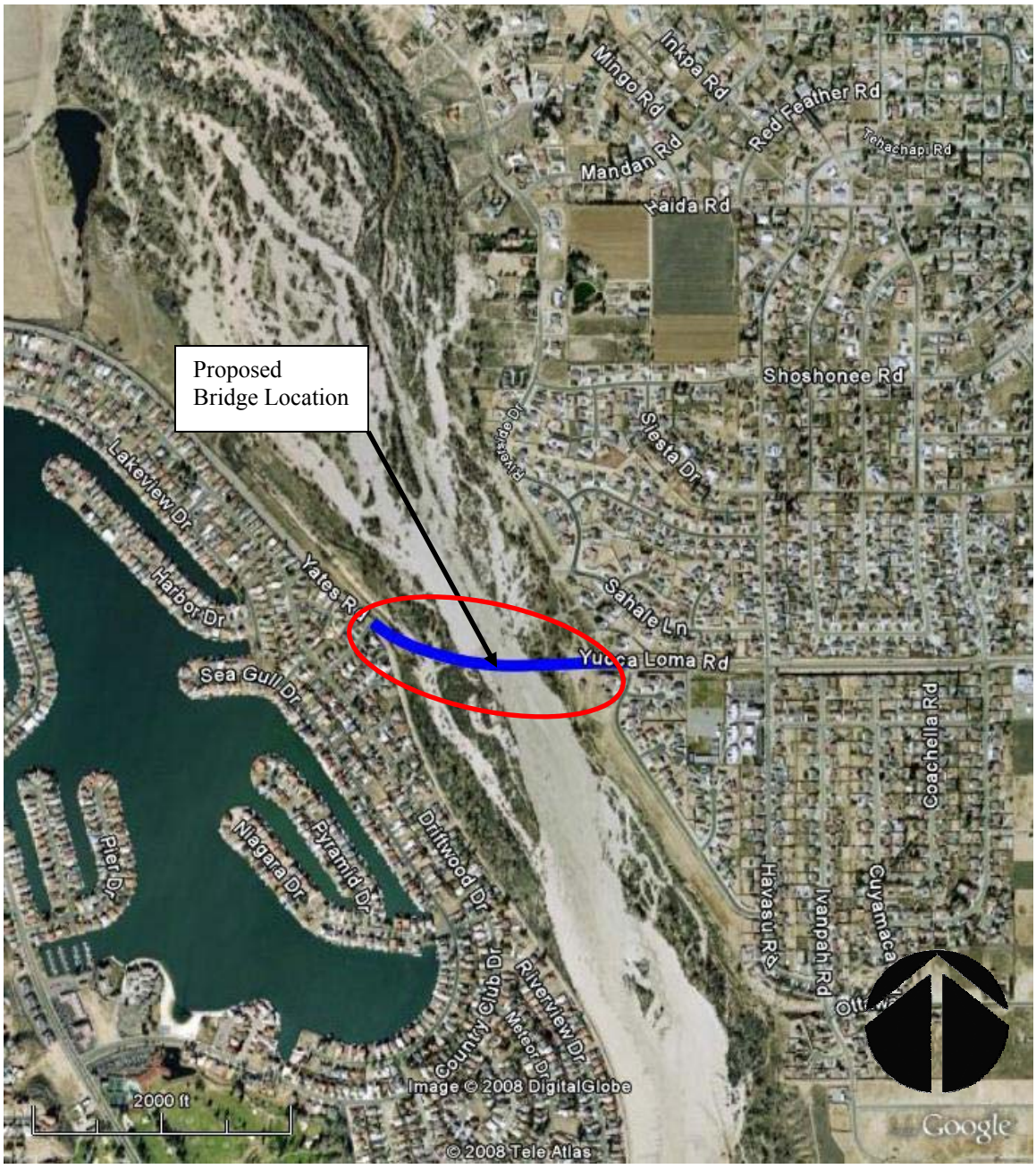


Figure 3. Project Vicinity Map, Aerial View

Source: Google Earth

1.2 Need for Project

The primary purpose of the proposed Project is to provide an alternative route for crossing the Mojave River between the Town of Apple Valley and City of Victorville. The new bridge would also reduce traffic congestion at the existing bridges.

1.3 Project History

The Project was initiated in July 2007 with the Town of Apple Valley as the lead agency for the Project, under the California Environmental Quality Act (CEQA). Other participating agencies include the City of Victorville and San Bernardino County. The California Department of Transportation (Caltrans) is the National Environmental Policy Act (NEPA) lead and review agency.

1.4 Creek, Stream, and River Crossings

The Mojave River is the major river crossing within the Project limits.

1.4.1 Geographic Location

The Project site is located in the southwestern portion of the Mojave River Basin. The Mojave River is formed at the confluence of the West Fork Mojave River and Deep Creek, which is at an altitude of approximately 3,000 ft above sea level. The confluence is known as "The Forks." Both bodies of water originate in the San Bernardino Mountains with peak elevations of approximately 8,500 ft above sea level. Generally, the West Fork Mojave River and Deep Creek travel east-north-east and west-north-west to the Forks, respectively. At the immediate downstream of the Forks, the flow passes through the ungated outlet structure of the Mojave River Dam. From the dam outlet, the Mojave River travels north through the Mojave Desert. At the Project location, the ground elevation of the Mojave River is approximately 2,770 ft above sea level.

1.4.2 Watershed Size

The Mojave River covers a watershed area of approximately 3,800 mi^2 in the Mojave Basin [Mojave Water Agency (MWA), 2004]. A majority of the watershed area is within the alluvial plain of the Mojave Desert.

The watershed area for the Mojave River at the Project location was delineated by WRECO using the contour lines in the United States Geological Survey (USGS) topography map. The watershed area of the proposed bridge location is approximately 306.6 mi^2 (See Figure 4). Approximately one-third of the watershed area is within the Mojave Desert. The remaining two-thirds of the watershed area is located in the San

Bernardino Mountains (see

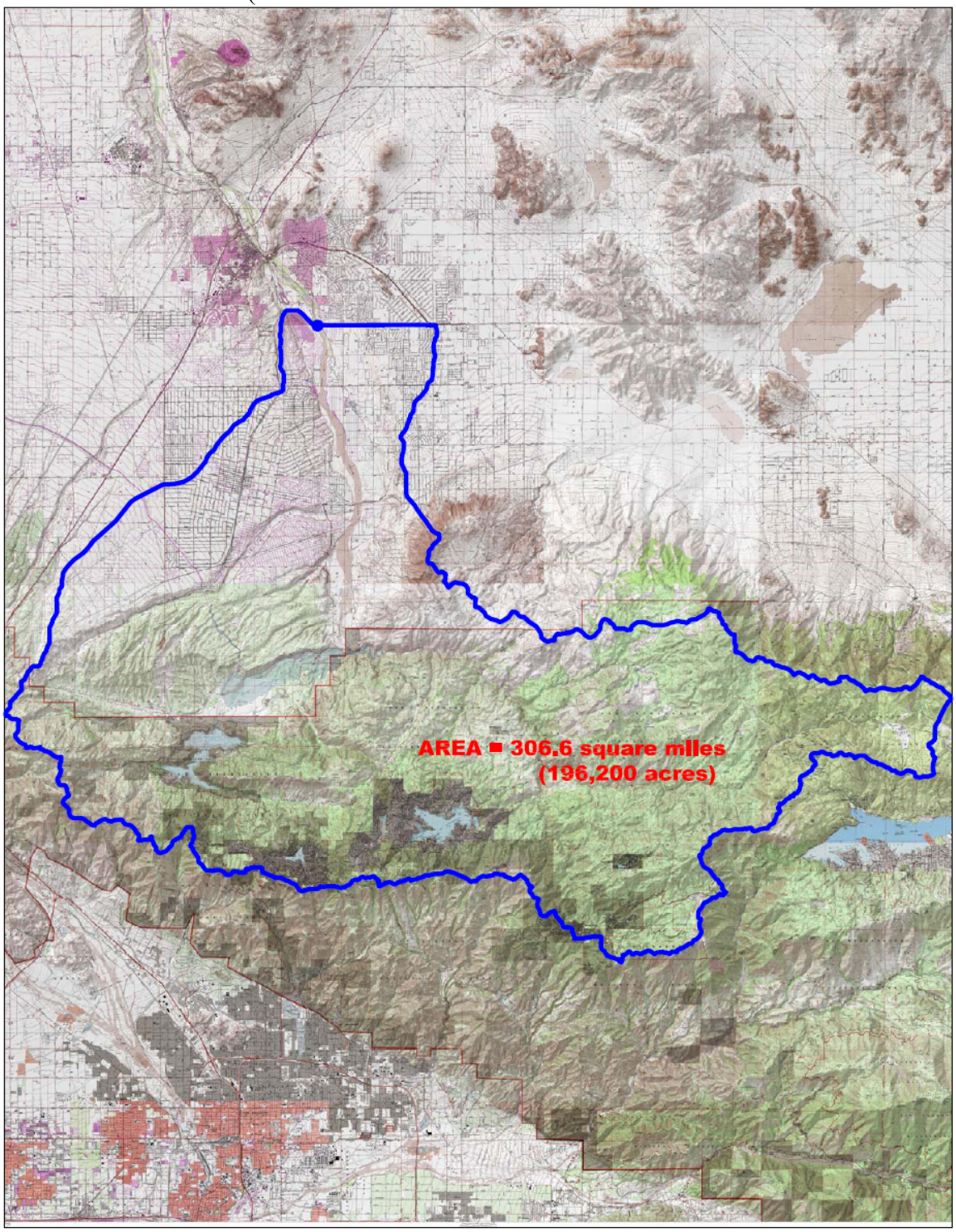


Figure 4. Mojave River Watershed Area at the Proposed Bridge Location

Source: USGS

Table 2). Runoff from the San Bernardino Mountains, which feeds the majority of the flow to the Mojave River, is controlled by the Mojave River Dam and the Cedar Springs Dam, which are located approximately 11 and 13 mi upstream from the proposed bridge location, respectively.

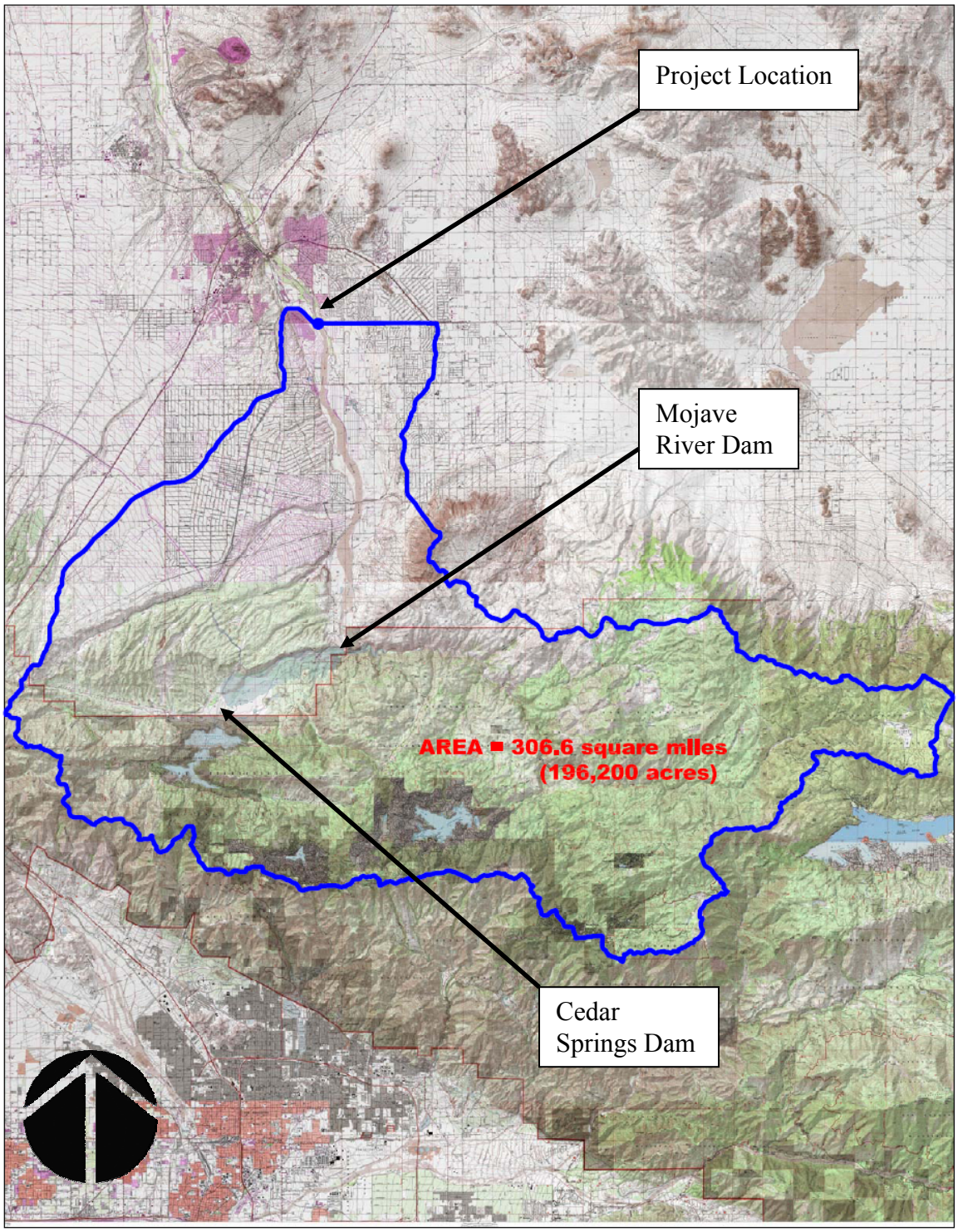


Figure 4. Mojave River Watershed Area at the Proposed Bridge Location

Source: USGS

Table 2. Watershed Size of the Tributaries at the Project Location

Name of the Tributary	Watershed Area (mi^2)
San Bernardino Mountains*	215
West Fork Mojave River*	75
Deep Creek*	140
Mojave Desert	91.6
Total Watershed Area:	**306.6**

*Source: United States Army Corps of Engineers (USACE), 1985

1.5 Geographical References

The following were the geographical references used:

- United States Geological Survey (USGS) Topographic CD-ROM
- Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS), *San Bernardino County, California and Incorporated Areas*
- Topographic Surveys of the Project locations, provided by Dokken Engineering

1.6 Traffic

The purpose of constructing the new four-lane bridge over the Mojave River is to reduce the traffic load of the existing State Route 18 (SR 18) and Bear Valley Road Bridges over the Mojave River (see Table 3 for the current and future traffic projections for the proposed Mojave River Bridge). In addition, see Table 4 and Table 5 for the current traffic counts of the local streets in the Project vicinity.

Table 3. Current and Future Traffic at the Proposed Mojave River Bridge

Year	ADT*
Current	0**
2015	19,800
2035	29,800

*Average Daily Traffic
**No bridge, no road, no legal crossing of the river
Source: Brian Stephenson, personal communication, September 11, 2008

Table 4. Traffic Counts in the Local Streets, City of Victorville, CA

#	Location	Direction	Traffic Count	Year
	Ridgecrest Road			
1	At Bear Valley Road	NB	6,225	2005
		SB	5,210	2005
2	At Pebble Beach Drive	NB	5,259	2004
		SB	3,825	2004
3	At Chinquapin Drive	NB	1,749	2004
		SB	663	2004
4	At Park Road	NB	674	2004
		SB	585	2004
	Green Tree Blvd			
5	At Hesperia Road	EB	8,471	2004
		WB	8,132	2004
	Bear Valley Road			
6	At Jacaranda Avenue	EB	23,819	2004
		WB	24,420	2004
7	At Hesperia Road	EB	20,938	2004
		WB	24,216	2004

Source: City of Victorville 24-Hour Traffic Counts

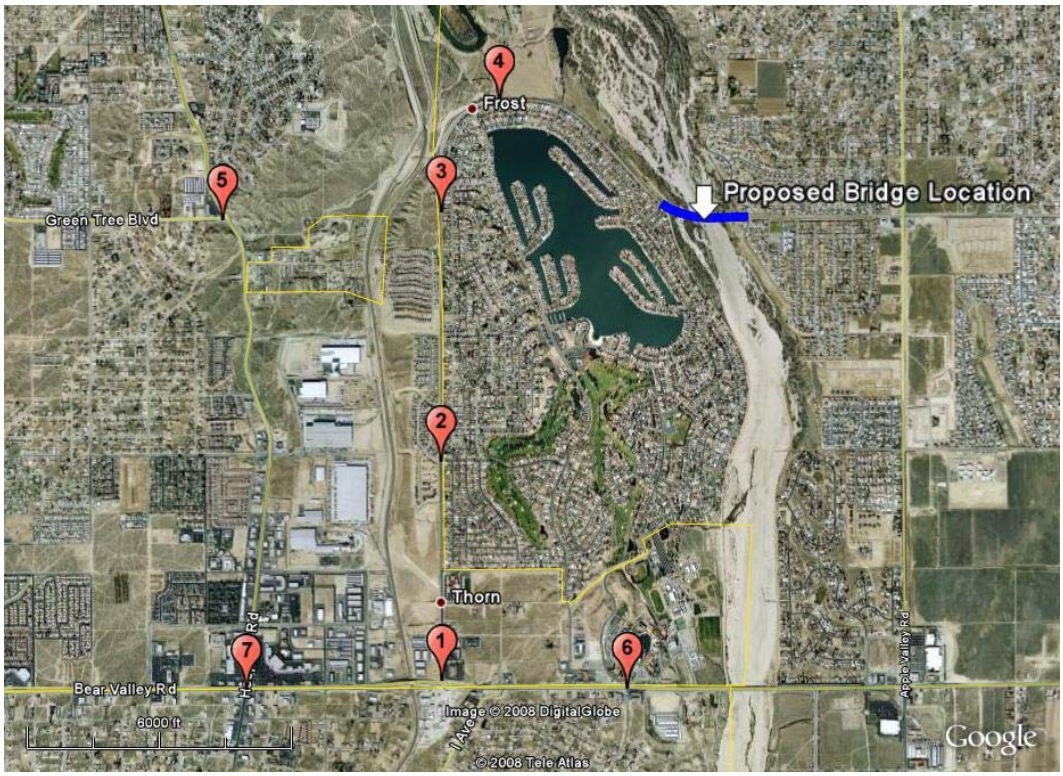


Figure 5. Traffic Count Locations, City of Victorville, CA

Source: Google Earth

Table 5. Traffic Counts in the Local Streets, Town of Apple Valley, CA

	Location	Direction	Traffic Count	Year
	Yucca Loma Road			
1	At Havasu Road	EB	303	2003
		WB	998	2003
2	At Apple Valley Road	EB	1,692	2007
		WB	5,120	2007
3	At Kiowa Road	EB	2,148	2007
		WB	1,944	2007
	Apple Valley Road			
4	At Bear Valley Road	NB	6,064	2007
		SB	12,673	2007
5	At Seneca Road	NB	9,502	2007
		SB	9,071	2007
	Bear Valley Road			
6	At Jess Ranch Parkway	EB	29,124	2005
		WB	28,172	2005
7	At Kiowa Road	EB	15,505	2007
		WB	12,625	2007

Source: Town of Apple Valley, Traffic Counts

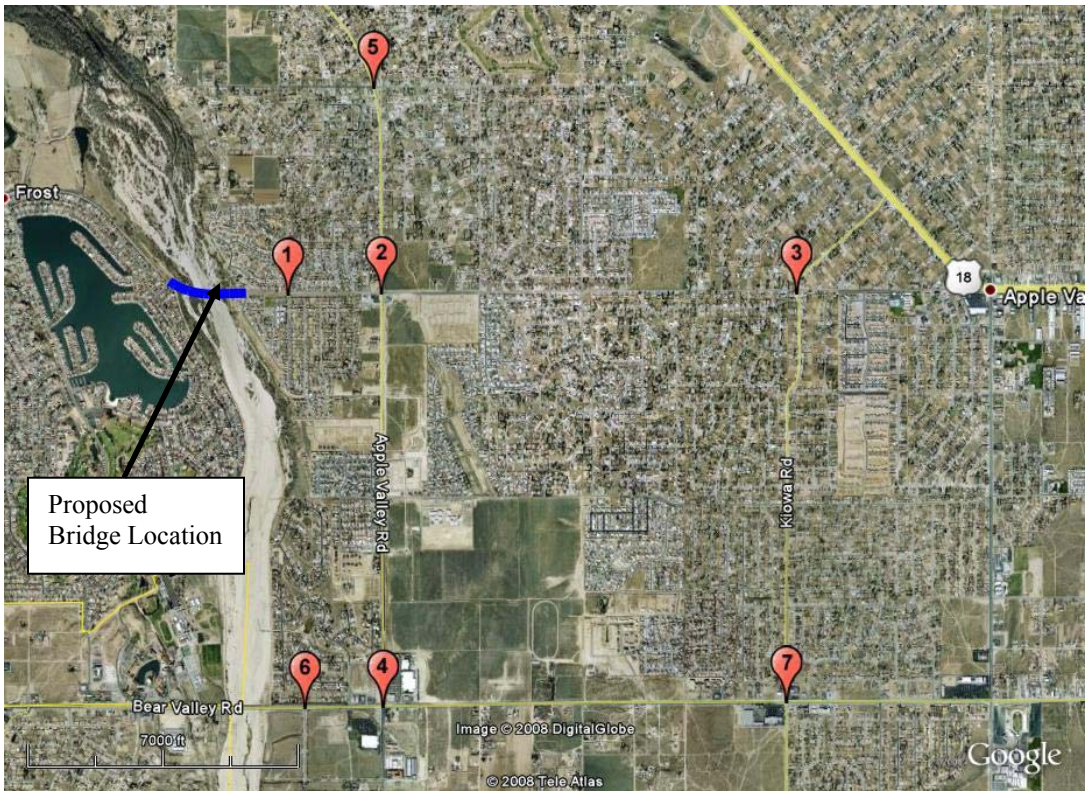


Figure 6. Traffic Count Locations, Town of Apple Valley, CA

Source: Google Earth

At the Project location, both Yucca Loma Road and Yates Road are two-lane roadways in residential areas. Currently, both roads end at the bank of the Mojave River. According to the 24-hour traffic count, both Yates Road (Ridgecrest Road turns to Yates Road at Park Road intersection) and Yucca Loma Road have a very small traffic count. Both roads may also be used for evacuation, emergency vehicle access, school buses and mail delivery. However, practical detour routes are available and could be made available during the new bridge construction. The following is the summary of the traffic assessment:

- Emergency Supply or Evacuation Route Yes
- Emergency Vehicle Access Yes
- Practical Detour Route Yes
- School Bus or Mail Route Yes

1.7 Traffic Interruptions for Base Flood (Q_{100})

As previously stated, there is no existing bridge over the Mojave River. Also, there should not be any traffic interruptions caused by the base flood event.

1.7.1 Land Use

The Town of Apple Valley, City of Hesperia and City of Victorville cover the majority of the watershed area in the Mojave Desert. Land use within the cities, which are also within the watershed area, comprises mostly low-density, single-unit residential housing units (see Figure 7 and Figure 8).

The watershed area of the Mojave River, upstream of the Mojave River Dam, is predominantly unused open space. There are not any incorporated communities within the mountainous portion of the watershed area.

1.7.2 Soil and Bed Material

The soil classification analysis at the Project location was conducted by Geotechnics, Incorporated. According to their analysis, bed material within the Project location is predominantly fine to coarse sand (see Table 6).

Table 6. Channel Bed Particle Size Distribution

Location	Sediment			D_{50}	D_{95}
	Type	Percent	Diameter (mm)	(mm)	(mm)
Mojave River	Fine Sand	8-35	0.07-0.5		
	Medium Sand	45-61	0.5-2	0.8	
	Coarse Sand	17-25	2-5		4.0
	Fine Gravel	4-5	5-20		
	Coarse Gravel	1	20-100		

Source: Geotechnics Incorporated

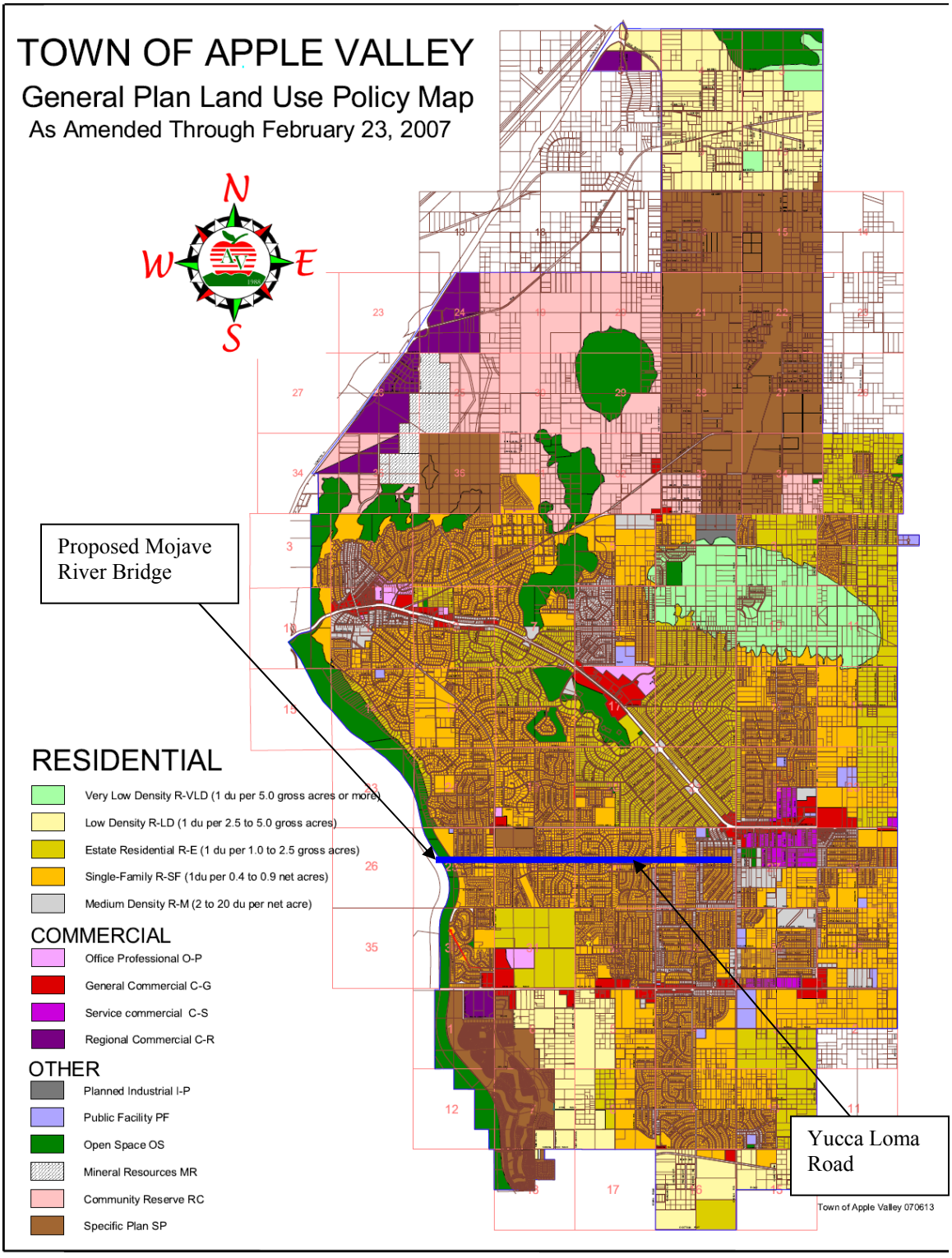


Figure 7. Land Use Map, Town of Apple Valley

Source: Town of Apple Valley, Land Use Element

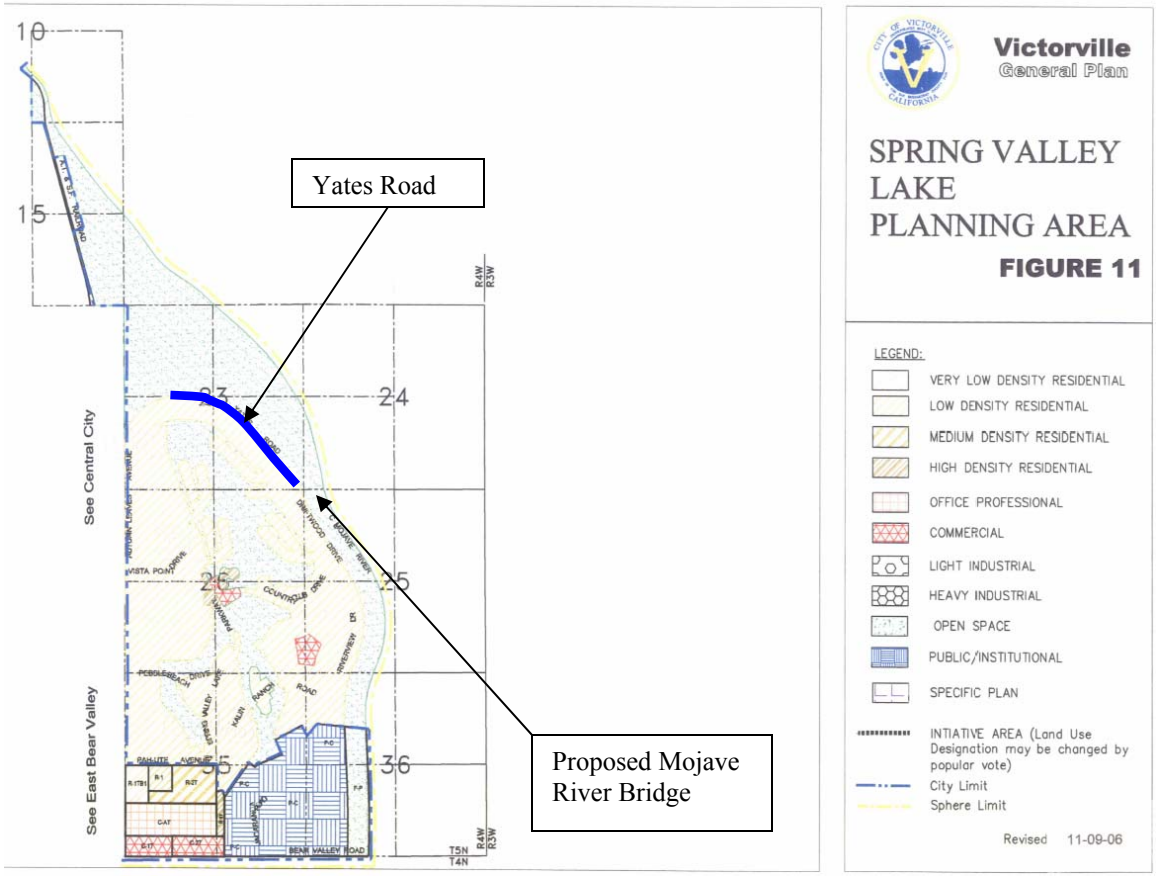


Figure 8. Land Use Map, City of Victorville

Source: City of Victorville General Plan

1.8 Historic Flood Events

The USGS Gaging Station 10261500 has recorded peak flows for the Mojave River, from 1931 to 2008, from a location downstream of the Project location (see Figure 9). The record flood in this gaging station was 70,600 cfs on March 2, 1938 (USGS, 2008a). After the completion of the Mojave River Dam in 1971, the intensity of the peak flood dropped significantly (see Table 7). At the USGS Gaging Station 10261100, located immediately downstream of the Mojave River Dam outlet structure, the record flood was 21,300 cfs on February 8, 1993 (USGS, 2008b). The record flood recorded at the USGS Gaging Station 10261500, after the completion of the Mojave River Dam, was 24,000 cfs, on February 24, 1998.

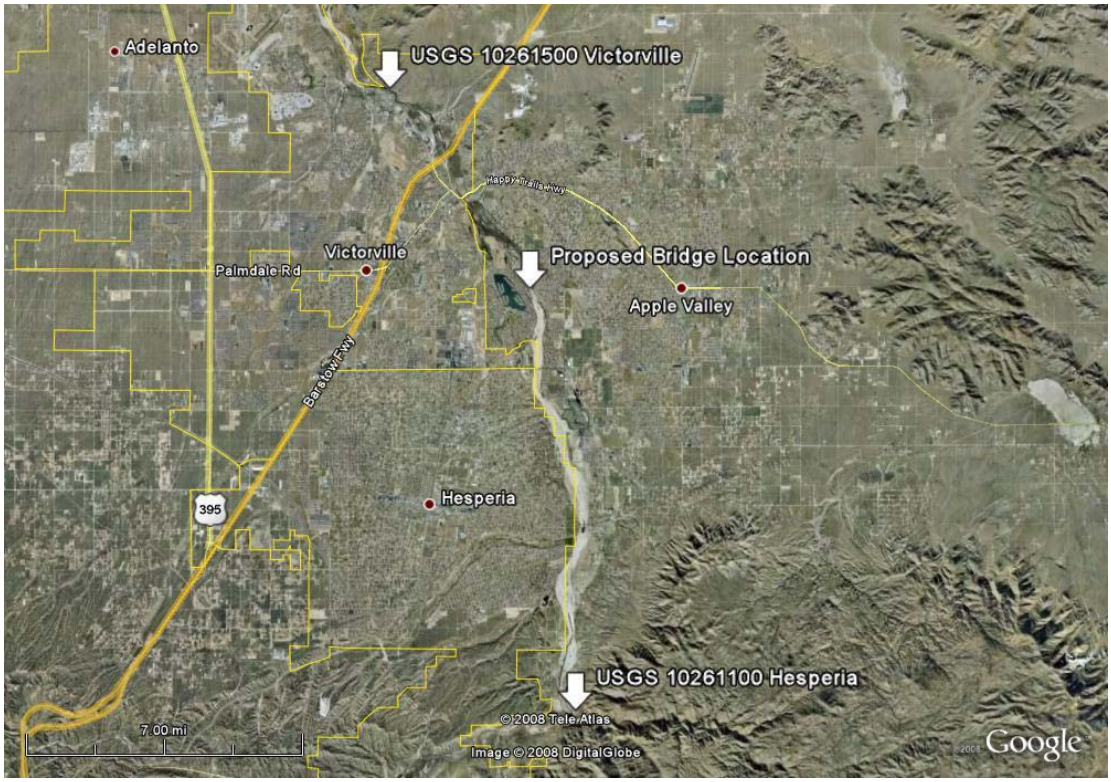


Figure 9. USGS Gaging Stations in the Project Vicinity

Source: Google Earth and USGS, 2008b

Table 7. Annual Peak Flows, Before and After Completion of the Mojave River Dam

Before Dam Completion		After Dam Completion	
Peak Flow (cfs)	Recorded Date	Peak Flow (cfs)	Recorded Date
70,600	Mar 2, 1938	24,000	Feb 24 1998
34,500	Feb 25, 1969	21,400	Feb 8, 1993
32,800	Dec 29, 1965	20,800	Jan 11, 2005

Source: USGS, 2008a

2 HYDROLOGIC AND HYDRAULIC DATA

2.1 Hydrologic Stability

As stated earlier in the report, the Mojave River Dam controls approximately two-thirds of the watershed area and a majority of the flow to the Mojave River in the Project location. Modifications within the watershed area upstream of the Mojave River Dam would be controlled by the outlet structure and would not significantly modify the 100- and 50-year peak flows in the Project location. In addition, county zoning ordinances prohibit any kind of development that would encroach onto the floodway (Town of Apple Valley, 2008). Channel characteristics are unlikely to change in the near future. Overall, the characteristics of the flood flow in the Project location would also be unlikely to change in the near future.

2.2 Federal Emergency Management Agency Data

The FEMA Flood Insurance Study (FIS) for San Bernardino County and Incorporated Areas provided the peak flow data for the Mojave River. The FEMA's designated locations for various design flows are identified in Figure 10. See Table 8 for the 500-, 100-, 50- and 10-year flows of the Mojave River at the designated locations.

Figure 10. FEMA Design Flow Locations along the Mojave River

Source: Google Earth and FEMA (2008a)

Table 8. FEMA Flood Insurance Study Hydrologic Data

Flooding Source and Location	Drainage Area	Peak Discharge (cfs)			
	(mi^2)	10-year	50-year	100-year	500-year
Mojave River					
At Barstow, Irwin Road	1,290	*	*	18,820	*
Upper Narrows	510	8,000	20,000	26,500	38,500
Below City of Victorville	53	8,000	20,000	26,500	39,000

Source: FEMA 2008a

2.3 Map of Floodplain

The FEMA FIRM for San Bernardino County and Incorporated Areas show the 100-year floodplain at the Project location (see Appendix C). The FIRM indicates a majority of the 100-year floodplain is contained in the Mojave River main channel.

The Zone AE is the 100-year floodplain determined in the FIS by detailed hydraulic analyses (FEMA, 2006). The Zone AE floodplain starts at approximately 2,500 ft downstream of the proposed bridge location (FEMA, 2008b). The 500-, 100-, 50- and 10-year water surface elevations (WSE) of the Zone AE floodplain were also described in the San Bernardino County FIS. At the upstream limit of the Zone AE floodplain, the 100-year WSE of the Mojave River was set at 2,765 ft NAVD. In the Project vicinity, Zone AE floodplain is contained in the Mojave River main channel. According to the aerial image shown in the FIRM, there are no residential units within the Zone AE floodplain.

The Zone A is the 100-year floodplain determined in the FIS by the Approximate Method of analysis (FEMA, 2006). The Mojave River, at the upstream of FEMA's detailed study area, is recognized as a Zone A floodplain (FEMA, 2008b). The proposed Mojave River Bridge would cross the Zone A floodplain. The majority of the Zone A floodplain in the Project vicinity is contained in the Mojave River main channel, including the proposed bridge location. However, according to the background aerial image in the FIRM, some of the residential units adjacent to the right bank of the Mojave River are within the Zone A floodplain; the FIRM indicates this area is protected by FEMA accredited hydraulic structures.

2.4 Estimating Design Discharge

2.4.1 Rivertech Hydrologic Data

Reconnaissance Level Analysis of the Mojave River, conducted by Rivertech, Incorporated in 1994, included the design flows of the Mojave River at the proposed bridge location; see Table 9 for their estimate of the design discharge of the Mojave River in the Project location.

Table 9. Estimated Design Discharges at the Project Location

Recurrence Interval (yr)	Design Discharge Rate (cfs)
2	3,500
5	9,800
10	14,400
50	21,100
100	32,400
200	95,000

Source: Rivertech, 1994

2.4.2 USACE Data

The USACE 100-year flow rate of the Mojave River was provided by the San Bernardino County Flood Control District, Water Resources Division (Personal Communication, April 8, 2008). According to the USACE study, the 100-year flow in the Mojave River is 30,830 cfs. The study was performed between Bear Valley Road (2 mi upstream of the Project location) and the Mojave River Narrows (3 mi downstream of the Project location).

2.4.3 Peak Flows from USGS Gaging Station

In addition to the peak flows obtained from various sources, the Project Team conducted hydrologic analyses of the 50- and 100-year flows from the peak flows recorded at the USGS gaging stations (see Figure 9). USGS Gaging Station 10261500 has recorded peak flows for the Mojave River, from 1931 to 2008, approximately 6.5 mi downstream from the Project location. To reflect the current condition of the Mojave River, the recorded peak flows prior to the completion of the Mojave River Dam were not included in the analysis; peak flow data from 1973 to 2007 were used in the analysis. USGS Gaging Station 10261100 recorded peak flows from 1971 to 1997.

The Generalized Extreme Value (GEV) Probability Distribution Method was selected to determine the 50- and 100- year flow rates from the USGS peak flow data. The design flows in the Project location were determined using the linear interpolation between two gaging stations based on their watershed areas (see Table 10).

Table 10. Estimated Design Discharge, GEV Method

	USGS 10261100, Hesperia Gaging Station	USGS 10261500, Victorville Gaging Station	Project Location
Watershed Area (mi^2)	513	209	306.6
Q100 (cfs)	40,699	28,058	32,200
Q50 (cfs)	27,194	22,620	24,100

2.4.4 Design Discharge

The hydraulic analyses performed were based on the most conservative design flows presented in the available studies. The 100-year flow is 32,400 cfs, based on the Rivertech, Incorporated's analysis conducted in 1994. The 50-year flow is 24,100 cfs, based on the annual peak flows recorded at the USGS gaging stations using the Generalized Extreme Value (GEV) Probability Distribution Method. Please see Table 11 for the design 50- and 100-year discharge rates used in the hydraulic and scour analyses.

Table 11. Estimated Design Discharge

Recurrence Interval (yr)	Design Discharge Rate (cfs)
50	24,100
100	32,400

2.5 Hydraulic Assessment

2.5.1 Design Tools

The hydraulic analyses for the Mojave River involved a standard step backwater calculation using the USACE's HEC-RAS, Version 4.0, to provide flow characteristics. The analyses were performed for the existing condition and proposed condition using the same hydrologic data.

2.5.2 Cross Section Data

A total of nine cross sections along a 9,594 ft reach of the Mojave River, in the Project vicinity, were provided by Dokken Engineering. The upstream and downstream limits are 2,396 ft and 7,198 ft from the proposed bridge end locations, respectively. The four cross sections, immediately upstream and downstream of the proposed bridge location, were cut parallel to the longitude grid. The alignment of the cross sections had an approximate 35 degree skew from the direction of the flow of the Mojave River. The remaining five cross sections were cut perpendicular to the flow of the Mojave River. A skew option in the HEC-RAS was used to modify the cross sections that were not cut perpendicular to the flow. Cross section elevation data was based on the North American Vertical Datum (NAVD) 1988.

The proposed bridge structure for the proposed condition was based on the Project's Advance Planning Study (APS). The pier width was tripled from 5.5 ft to 16.5 ft by assigning a floating debris function in the hydraulic model to accommodate debris accumulation at the piers.

2.5.3 Manning's n

Manning's n values were used in the hydraulic model to estimate frictional energy losses in the flow. The San Bernardino County FIS selected the following Manning's n value for the Mojave River at Barstow (FEMA, 2008a):

Main Channel: 0.040-0.045
Left and Right Overbank: 0.040-0.050

According to the aerial image from Google Earth and the bird's eye view from Microsoft Virtual Earth, the main channel of the Mojave River at Barstow is sandy with almost no vegetation. The main channel condition of the Mojave River at the Barstow is similar to the main channel condition of the Mojave River at the Project location. The following selected Manning's n values best describe the channel characteristics.

Table 12. Manning's n value selected for the Hydraulic Analysis

Cross Section Characteristics	Manning's n
Main Channel	0.045
Left and Right Overbank	0.050

2.5.4 Expansion and Contraction Coefficient

Expansion and contraction coefficients were used to describe transition between cross sections. The expansion and contraction coefficients used in these channels were 0.3 and 0.1, respectively. They represent a river with a gradual transition between cross sections. Within the vicinity of the bridge, expansion and contraction coefficients of 0.5 and 0.3, respectively, were used to represent flow interference caused by the proposed bridge structures.

2.5.5 Existing Condition

Table 13 summarizes the estimated 100- and 50-year WSEs and channel average velocities. Figure 11 shows that both design 100- and 50-year WSEs would be contained within the main channel. The hydraulic model did not indicate the escape flow from the main channel with the existing condition.

Table 13. Existing Condition, Mojave River

	Channel Bank Elevation	Q100		Q50	
		WSE	Velocity	WSE	Velocity
	(ft, NAVD)	(ft, NAVD)	(ft/s)	(ft, NAVD)	(ft/s)
Upstream End of the Study Limit (Station 2548*)	2788.57	2784.62	5.3	2783.75	4.7
Proposed Bridge Immediate Upstream (Station 200*)	2780.00	2776.50	6.0	2775.69	5.3
Proposed Bridge Immediate Downstream (Station 100*)	2778.95	2776.06	6.2	2775.26	5.5

*Refer to Figure 11

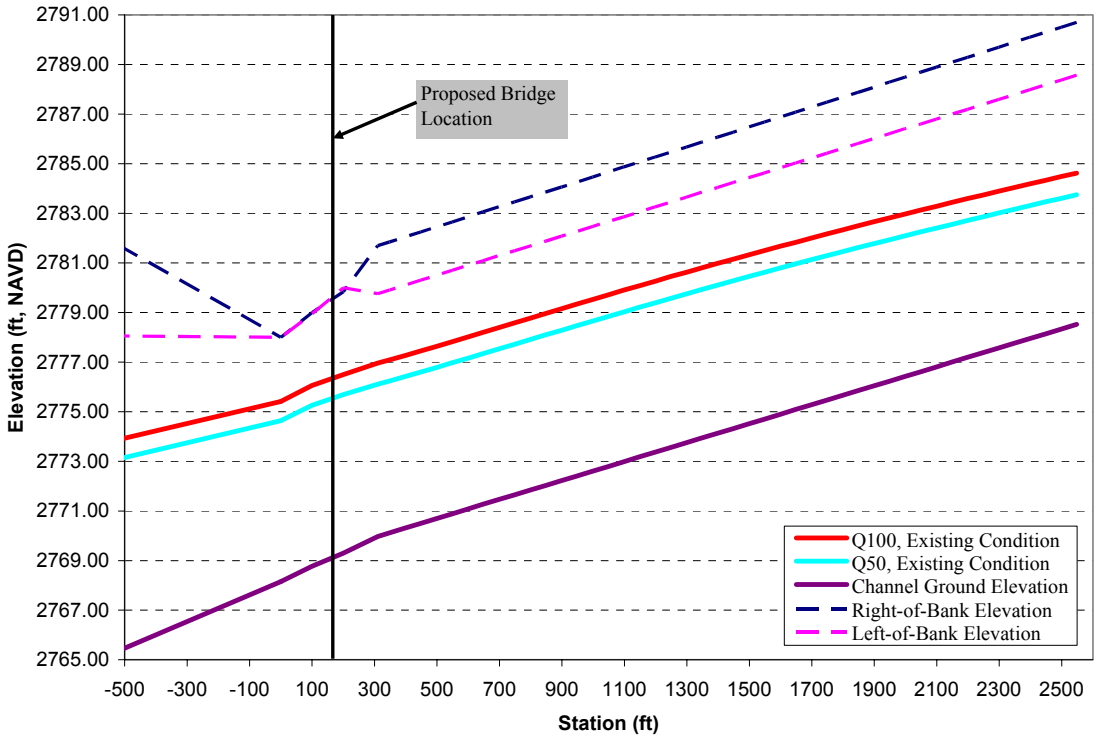


Figure 11. Water Surface Profiles, Existing Condition

2.5.6 Proposed Condition

The proposed action would be to construct a four-lane bridge over the Mojave River, which would connect Yucca Loma Road, in the Town of Apple Valley, to Yates Road in the City of Victorville. Additionally, both Yucca Loma Road and Yates Road would also be widened from two lanes to four lanes. See Table 14 for the proposed bridge design specifications.

Table 14: Design Specification of the Proposed Mojave River Bridge

Bridge Span (ft)	1515.5
Bridge Width (ft)	98.3
Deck Elevation at Profile Grade (ft, NAVD)	2784.00--2798.81
Soffit Elevation at Profile Grade (ft, NAVD)	2778.75--2793.56
Number of Piers	11
Pier Type	Three 5.5 ft Circular Columns aligned parallel to the 100-year flow direction.

Source: Project Advanced Planning Study (APS)

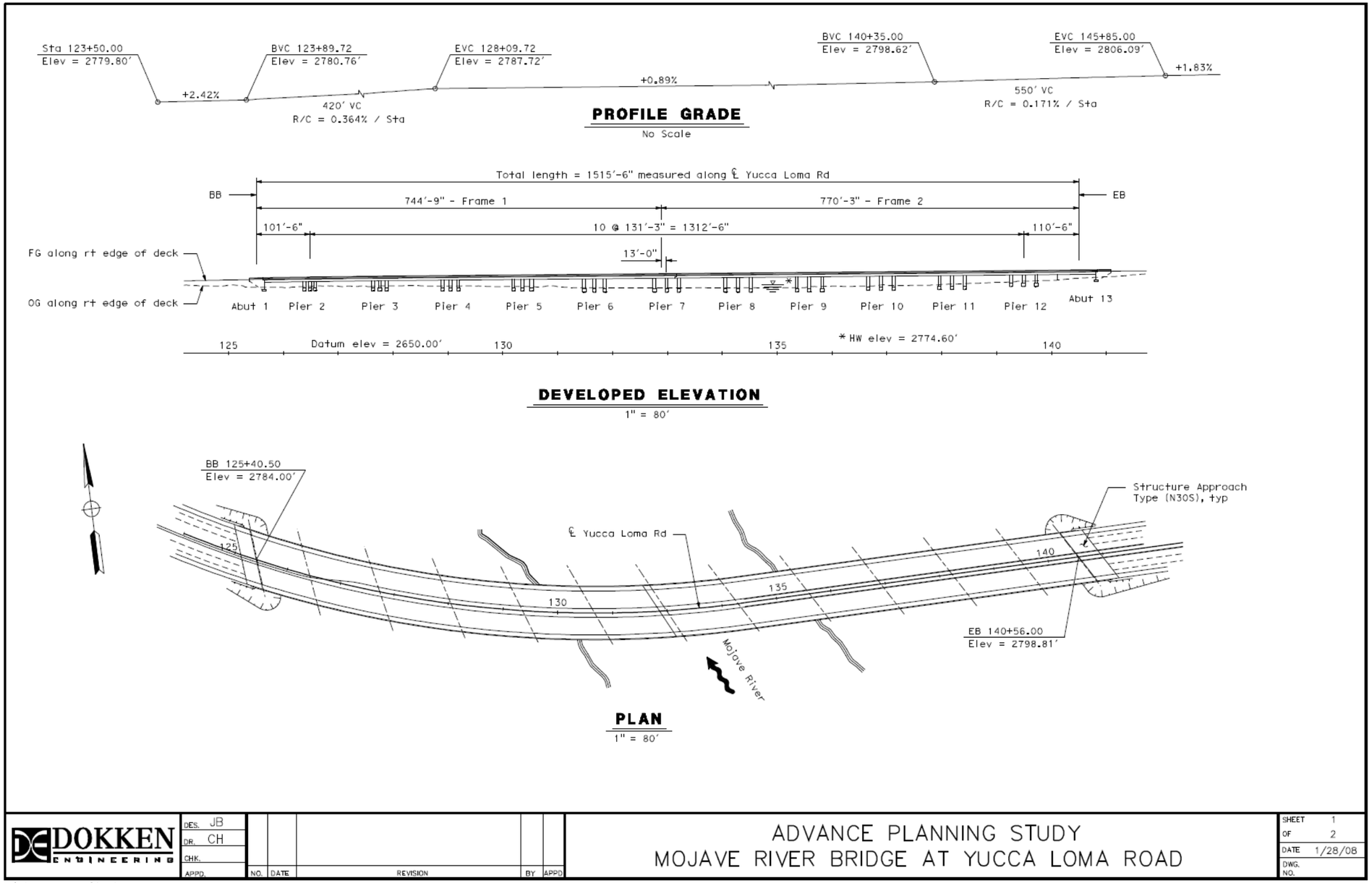
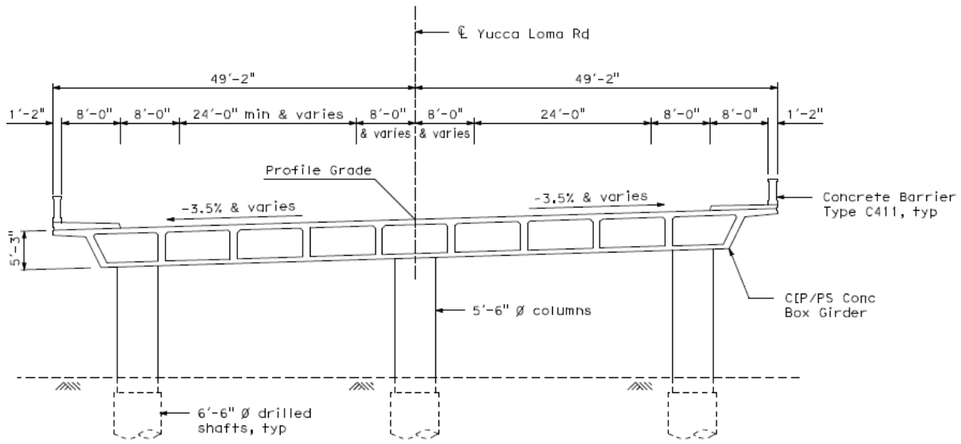


Figure 12. Proposed Mojave River Bridge Profile
Source: Bridge APS



TYPICAL SECTION
1/8" = 1'-0"

Date of estimate	=	1-28-08
Structure depth	=	5'-3"
Length	=	1,515'-6"
Width	=	98'-4"
Area	=	149,024 sf
Cost/□ ft including 10% mobilization & 25% contingency	=	$210.00
Total Cost	=	$31,295,040

DOKKEN ENGINEERING | DES. JB | DR. CH | CHK. | APPD. | NO. | DATE | REVISION | BY | APPD.

ADVANCE PLANNING STUDY
MOVAJE RIVER BRIDGE AT YUCCA LOMA ROAD

SHEET 2 OF 2 | DATE 1/28/08 | DWG. NO.

Figure 13. Proposed Mojave River Bridge, Typical Section
Source: Bridge APS

Table 15 summarizes the estimated 100- and 50-year WSEs and the channel average flow velocities for the proposed condition. Potential flow obstruction caused by the bridge piers and the left abutment would increase the 100- and 50-year WSEs of the Mojave River upstream of the proposed bridge. Obstruction caused by the proposed bridge structures also would reduce the channel average velocities on the upstream side. The maximum WSE increase between the existing and proposed condition with the design 100-year flow rate would be 0.50 ft, immediately upstream of the bridge.

Table 15. Proposed Condition, Mojave River

	Channel Bank Elevation	Q100		Q50	
		WSE	Velocity	WSE	Velocity
	(ft, NAVD)	(ft, NAVD)	(ft/sec)	(ft, NAVD)	(ft/sec)
Upstream End of the Study Limit (Station 2548*)	2778.57	2784.63	5.3	2783.75	4.7
Proposed Bridge Immediate Upstream (Station 200*)	2780.00	2777.00	5.9	2776.09	5.3
Inside Bridge Upstream Face (Station 150*)	2780.00	2776.53	7.6	2775.73	6.7
Inside Bridge Downstream Face (Station 150*)	2778.95	2775.98	6.8	2775.21	5.9
Proposed Bridge Immediate Downstream (Station 100*)	2778.95	2776.01	6.4	2775.23	5.6

*Refer to Figure 14

The elevation difference between the existing and proposed conditions gradually diminishes when moving upstream from the proposed bridge location (see Figure 14). At Station 998 (approximately 800 ft upstream from the proposed bridge), the elevation difference becomes less than 0.1 ft, which would be considered an insignificant elevation difference. Factors such as wind could vary the WSE by 0.1 ft. In addition, both the design 100- and 50-year flows would still be contained in the main channel. The floodplain width at the immediately upstream of the proposed bridge would increase from 1,078 ft to 1,095 ft, which would be an approximate 1.02% increase. Overall, the proposed Mojave River Bridge would only impact the 100-year WSE up to 800 ft upstream, with a maximum elevation increase of 0.50 ft at Stations 200 and 310.

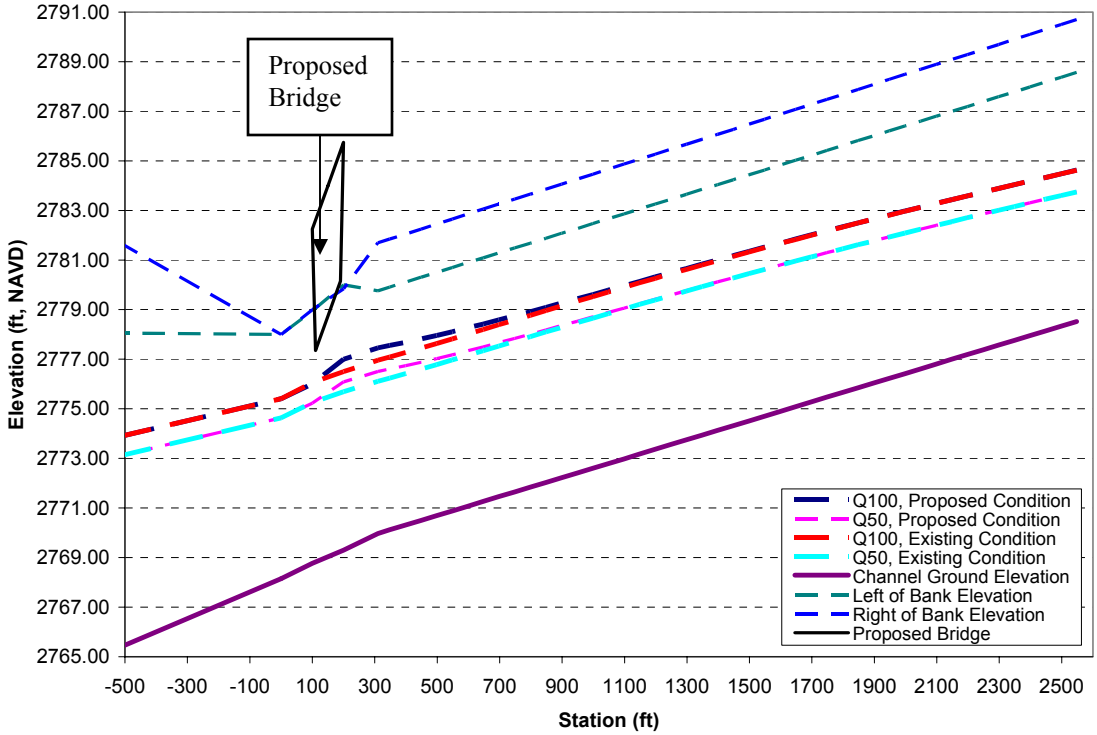


Figure 14. Water Surface Profiles, Existing and Proposed Conditions

3 PROJECT EVALUATION

3.1 Risk Associated with Implementation of the Action

As defined by Federal Highway Administration (FHWA), a significant encroachment is a highway encroachment and any direct support of likely base floodplain development that would involve one or more of the following construction or flood-related impacts: 1) a significant potential for interruption or termination of a transportation facility that is needed for emergency vehicles or that provides a community's only evacuation route; 2) a significant risk; or 3) a significant adverse impact on the natural and beneficial floodplain values.

This Project would have minimal risk associated with the construction of the four-lane bridge over the Mojave River. The Project would create an alternative access route for emergency vehicles, school buses, mail delivery vehicles and evacuation. In addition, the construction of the bridge would not require the closure of Yucca Loma Road or Yates Road.

The proposed bridge and widening of Yucca Loma Road and Yates Road, from two lanes to four lanes, would increase the impervious area within the Project limits by approximately 21.0 ac. The added impervious area would be approximately 0.0009% when compared to the total watershed area (see Table 16). Compared to the watershed area of the Mojave River, at the proposed bridge location (306.6 mi^2 = 196,224 ac), the increase of impervious area would be 0.01%. The area that changes from pervious to impervious would be minimal and would not impact the 100- and 50-year flows of the Mojave River. Thus, the added impervious area would have an insignificant impact to the watershed characteristics.

Table 16: Increase in Impervious Area

Proposed Actions	Added Impervious Area* (ac)	Watershed Area** (ac)	Percentage Increase in Area (percent)
Mojave River Bridge	4.0	2432,000	0.0002
Yucca Loma Road Widening	5.0	2432,000	0.0002
Yates Road Widening	13.0	2432,000	0.0005
Total	21.0	2432,000	0.0009

*Based on engineer's estimate
**3800 square miles (MWA, 2004)

3.2 Impacts on Natural and Beneficial Floodplain Values

Natural and beneficial floodplain values include, but are not limited to: fish, wildlife, plants, open space, natural beauty, scientific study, outdoor recreation, agriculture, aquaculture, forestry, natural moderation of floods, water quality maintenance and groundwater recharge [Regional Water Quality Control Board (RWQCB), 2007].

The reach of the Mojave River within the Project location is mostly dry during the year and cannot support fish or any other aquatic species. Based on preliminary calculations, 4.0 ac in the floodplain would be temporarily impacted from bridge construction. This area includes the left and right banks of the Mojave River, which have moderate vegetation growth. The construction of the bridge may potentially impact the native vegetation habitat at the Project site.

3.3 Support of Probable Incompatible Floodplain Development

As defined by FHWA, development such as commercial or urban spread would facilitate or otherwise support incompatible base floodplain development.

The purpose of the Project is to reduce congestion at the two existing bridges over the Mojave River. It would not promote development within the floodplain. In the Project vicinity, the 100-year floodplain is contained in the main channel of the Mojave River. Existing residential developments adjacent to the left and right banks of the Mojave River are outside of the 100-year floodplain. In addition, the development potential within the FEMA 100-year floodplain is severely restricted (Town of Apple Valley, 2008). Overall, the proposed Project would not support incompatible floodplain development.

3.4 Measures to Minimize Floodplain Impacts Associated with the Action

There would be minimal floodplain impacts associated with this Project. The proposed Project would add approximately 21 ac of impervious area; although this is only a 0.01% increase to the Mojave River's watershed area within the Project location. The proposed flow rate increase of the Mojave River would be negligible.

The proposed bridge structure would obstruct flow and increase the 100-year WSE up to 0.50 ft. However, there would not be a levee failure or bank overtopping of the Mojave River with the installation of the proposed bridge. In addition, according to the hydraulic analysis, the change in 100-year floodplain width would also be insignificant. Overall, Project's possible impact to the floodplain would be minimal.

A measure to reduce the increase of the 100-year WSE would be setting back the location of the left abutment of the proposed bridge to the outside of the 100-year floodplain. If obstruction from the left abutment is eliminated, the 100-year WSE increase of the proposed condition would drop roughly 0.2 ft at the upstream face of the bridge.

3.5 Measures to Restore and Preserve the Natural and Beneficial Floodplain Values Impacted by this Action

Most of the environmental impacts resulting from construction could be mitigated with standard measures, revegetation, best management practices (BMPs) and other activities that would meet the requirements that are part of the Project's permit conditions.

One of the environmental impacts requiring non-standard measures is the potential permanent loss of vegetation from the construction of bridge piers. Transplanting existing vegetation may also be required to reduce the projected loss of vegetation. In addition, dewatering may be required during construction because of the presence of groundwater.

3.6 Practicability of Alternatives to any Significant Encroachments

As defined by the FHWA, risk is a consequence associated with the probability of flooding attributed to an encroachment. This includes the potential for property loss and hazard to life during the service life of the bridge and roadway.

According to the FIRM, the 100-year floodplain within the Project location is contained in the Mojave River main channel. Overall, there are no significant encroachments at the Project location with the current proposed bridge alignment and profile. Therefore, other alternatives were not considered for this Project.

3.7 Practicability of Alternatives to any Longitudinal Encroachments

As defined by FHWA, a longitudinal encroachment is an action within the limits of the base floodplain that is parallel to the direction of the flow.

The alignment of the proposed Mojave River Bridge would not be longitudinal to the direction of the flow. The left and right overbanks of the Mojave River at the Project location would be outside of the 100-year floodplain. In addition, modifications are not proposed to the main channel of the Mojave River. Overall, the Project would not have any longitudinal encroachment. Thus, alternatives were not considered for this Project.

4 REFERENCES

California Regional Water Quality Control Board San Francisco Bay Region. (January 2007). *San Francisco Bay Basin (Region 2) Water Quality Control Plan* (Basin Plan).

City of Victorville. (October 2007). *City of Victorville General Plan.*

City of Victorville Engineering Department. *City of Victorville, 24-Hour Traffic Counts*. <http://ci.victorville.ca.us/uploadedFiles/CityDepartments/Engineering/24hrtrafficcounts.pdf> (Last accessed: August 15, 2008).

Federal Emergency Management Agency. (April 5, 2006). *Frequently Asked Questions: General Information.* <http://www.fema.gov/plan/prevent/fhm/fq_gen13.shtm> (Last accessed: August 15, 2008).

Federal Emergency Management Agency. (August 28, 2008a). *Flood Insurance Study, San Bernardino County, California, and Incorporated Areas. Flood Insurance Study Number 06071CV001A.*

Federal Emergency Management Agency. (August 28, 2008b). *Flood Insurance Rate Map, Panel 5820 of 9400 – Map Number 06071C5820H*.

Geotechnics, Incorporated. (September 11, 2008). *Sieve Analysis*, forwarded by John Bishop, Dokken Engineering, to Chris Sewell, WRECO.

Mojave Water Agency. (September 2004). *2004 Regional Water Management Plan* <http://www.cityofhesperia.us//images/Site005/documents/Water/2005/2005_SupReport_pp37-62.pdf> (Last accessed: August 15, 2008).

Rivertech, Incorporated. (September 1994). *Reconnaissance Level Analysis – Mojave River Crossing, Yucca Loma Road to Green Tree Boulevard*.

Town of Apple Valley. (May 2008). *Town of Apple Valley, Land Use Element*. <http://www.applevalley.org/Modules/ShowDocument.aspx?documentid=1085> (Last accessed: August 15, 2008).

Town of Apple Valley. *Traffic Counts*. <http://www.applevalley.org/Modules/ShowDocument.aspx?documentid=1152> (Last accessed: August 15, 2008).

United States Army Corps of Engineers. (September 1985). *Reservoir Regulation Manual for Mojave River Dam, Mojave River Basin, California.* <http://www.spl.usace.army.mil/resreg/htdocs/Mojave/MojvExternalDocument.pdf> (Last accessed: August 15, 2008).

United States Army Corps of Engineers. (February 9, 2006). *Mojave River Dam*. <http://www.spl.usace.army.mil/resreg/htdocs/mojv.html> (Last accessed: August 15, 2008).

United States Geological Survey. National Water Information System: Web Interface (USGS 2008a) <http://nwis.waterdata.usgs.gov/ca/nwis/nwisman/?site_no=10261500&agency_cd=USGS> (Last accessed: September 12, 2008).

United States Geological Survey. National Water Information System: Web Interface (USGS 2008b) <http://waterdata.usgs.gov/nwis/nwisman/?site_no=10261100&agency_cd=USGS> (Last accessed: September 12, 2008).

Figure 804.7A
Technical Information for Location Hydraulic Study

Dist. 8 Co. San Bernardino Rte. Yucca Loma Road and Yates Road P.M N/A

Project No. N/A Bridge No. N/A

Floodplain Description:

The 100-year floodplain is contained in the Mojave River main channel.

1. Description of Proposal (Include physical barriers i.e. concrete barriers, soundwalls, etc. and design elements to minimize floodplain impacts)

2. ADT: Current N/A Projected 29,800 (at 2035)

3.	Hydraulic Data: Base Flood	Q_{100}	32,400	WSE_{100}	2777.00	
	The flood of record, if greater than Q_{100}	Q_{100}	70,600*	WSE_{100}	N/A	
	Overtopping flood	Q	N/A	WSE	N/A	
4.	Are NFIP maps and studies available?	Yes	√	No		

*This was recorded in 1936, before completion of the Mojave River Dam.

5.	Attach map with flood limits outlined showing all buildings or other improvements within the base floodplain. Potential Q100 backwater damages:	Yes	No
	A. Residences?	√	
	B. Other Bldgs?	√	
	C. Crops?		√
	D. Natural and beneficial Floodplain Values?	√	
6.	Type of Traffic		
	A. Emergency supply or evacuation route?	√	
	B. Emergency vehicle access?	√	
	C. Practicable detour available?	√	
	D. School bus or mail route?	√	

7. Estimated duration of traffic interruption for 100-year event N/A

8. Estimated value of Q_{100} flood damage (if any) – moderate risk level.

A.	Roadway	$
B.	Property	$
	Total	$

9. Assessment of Level of Risk

Low	√	Moderate	High

For High Risk projects, during design phase, additional Design Study Risk Analysis may be necessary to determine design alternative

Prepared By:

2/5/2009

Signature – Hydraulic Engineer
(Item numbers 3, 4, 5, 7, 9)

Date

Is there any longitudinal encroachment, significant encroachment, or any support of incompatible Floodplain development?

No √ Yes

If yes, provide evaluation and discussion of practicability of alternatives in accordance with 23 CFR 650.113

Information developed to comply with the Federal requirements for the Location Hydraulic Study shall be retained in the project files.

Signature – Project Manager
(Item numbers, 1, 2, 6, 8)

Date

Figure 804.7B
Floodplain Evaluation Report Summary

Dist.	8	Co.	San Bernardino	Rte.	Yucca Loma Road and Yates Road	P.M	
Project No.			Bridge No.				
Limit:							
Eastern Limit: intersection of Yucca Loma Road and Apple Valley Road Western Limit: intersection of Green Tree Boulevard and Hesperia Road							
Floodplain Description:							
The 100-year floodplain is contained in the Mojave River main channel.							

		Yes	No
1.	Is the proposed action a longitudinal encroachment of the base floodplain?		√
2.	Are the risks associated with the implementation of the proposed action significant?		√
3.	Will the proposed action support probable incompatible floodplain development?		√
4.	Are there any significant impacts on natural and beneficial floodplain values?		√
5.	Routine construction procedures are required to minimize impacts on the floodplain. Are there any special mitigation measures necessary to minimize impacts or restore and preserve natural and beneficial floodplain values? If yes, explain.		√
6.	Does the proposed action constitute a significant floodplain encroachment as defined in 23 CFR, Section 650.105(q)?		√
7.	Are Location Hydraulic Studies that document the above answers on file? If not, explain.	√	

Prepared By:

Signature – Hydraulic Engineer, WRECO — Date: 2/5/2009

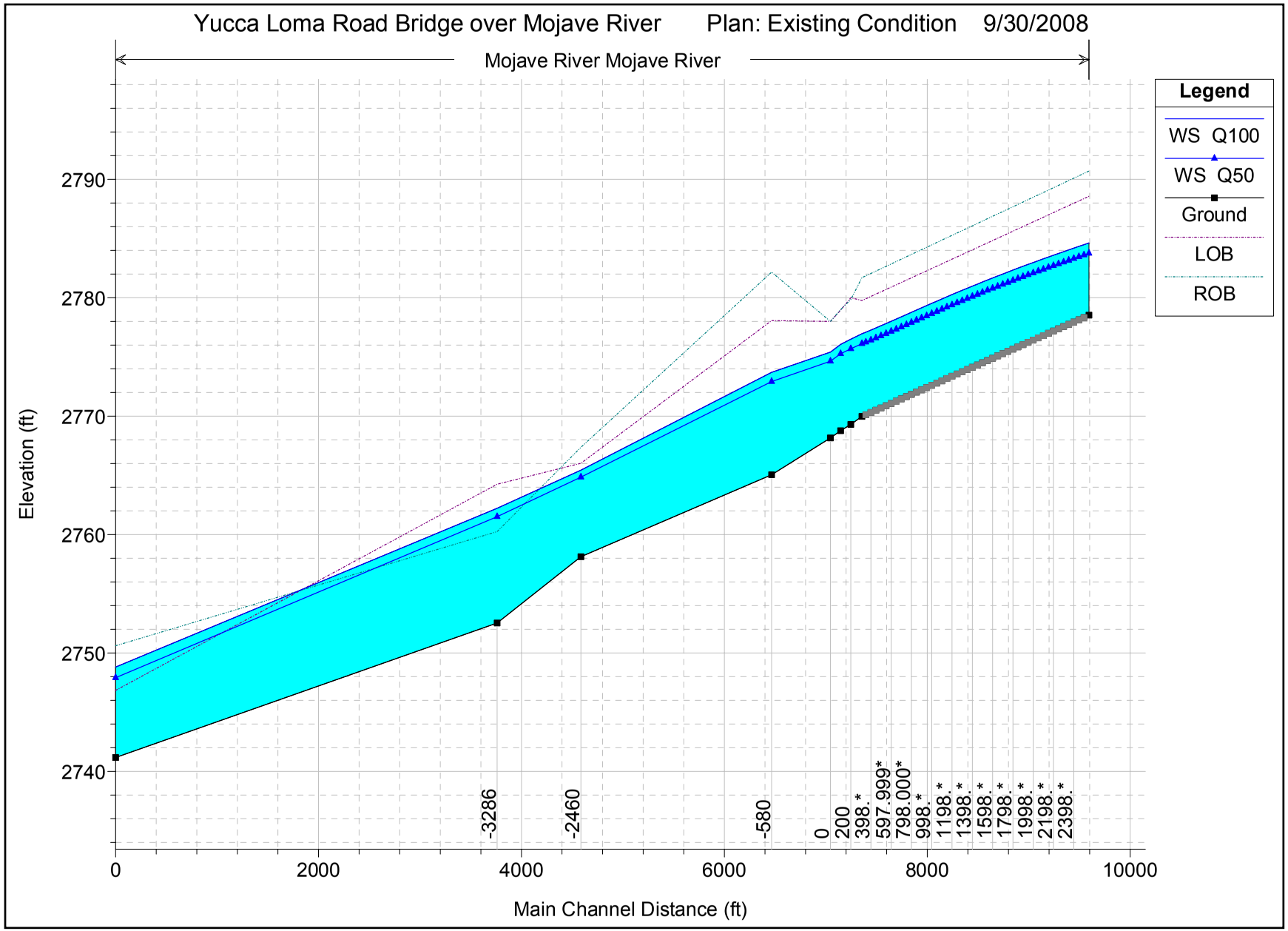
Approved By:

Signature – Dist. Hydraulic Engineer — Date

Signature – Dist. Environmental Branch Chief — Date

Signature – Dis. Project Engineer — Date

Appendix A Hydraulic Analysis: Existing Condition



1 in Horiz. = 1400 ft 1 in Vert. = 12 ft

HEC-RAS Plan: Existing River: Mojave River Reach: Mojave River

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	LOB Elev	ROB Elev
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(ft)	(ft)
Mojave River	2548	Q100	32400.00	2778.52	2784.62	2782.24	2785.06	0.002826	5.3	6141.96	1176.31	0.41	2788.57	2790.70
Mojave River	2548	Q50	24100.00	2778.52	2783.75	2781.71	2784.09	0.002861	4.7	5114.36	1171.16	0.40	2788.57	2790.70
Mojave River	2498.*	Q100	32400.00	2778.33	2784.48		2784.91	0.002842	5.3	6119.72	1170.96	0.41	2788.37	2790.50
Mojave River	2498.*	Q50	24100.00	2778.33	2783.60		2783.95	0.002873	4.7	5096.35	1164.90	0.40	2788.37	2790.50
Mojave River	2448.*	Q100	32400.00	2778.14	2784.33		2784.77	0.002860	5.3	6097.19	1165.92	0.41	2788.18	2790.30
Mojave River	2448.*	Q50	24100.00	2778.14	2783.46		2783.80	0.002889	4.7	5077.48	1158.97	0.40	2788.18	2790.30
Mojave River	2398.*	Q100	32400.00	2777.95	2784.19		2784.63	0.002879	5.3	6074.57	1161.12	0.41	2787.98	2790.10
Mojave River	2398.*	Q50	24100.00	2777.95	2783.31		2783.66	0.002906	4.8	5058.50	1153.38	0.40	2787.98	2790.10
Mojave River	2348.*	Q100	32400.00	2777.76	2784.04		2784.48	0.002898	5.4	6053.08	1156.58	0.41	2787.78	2789.90
Mojave River	2348.*	Q50	24100.00	2777.76	2783.16		2783.51	0.002922	4.8	5040.65	1148.23	0.40	2787.78	2789.90
Mojave River	2298.*	Q100	32400.00	2777.57	2783.89		2784.34	0.002918	5.4	6030.89	1151.85	0.41	2787.59	2789.69
Mojave River	2298.*	Q50	24100.00	2777.57	2783.01		2783.37	0.002943	4.8	5021.66	1143.47	0.40	2787.59	2789.69
Mojave River	2248.*	Q100	32400.00	2777.38	2783.74		2784.19	0.002939	5.4	6009.04	1147.70	0.42	2787.39	2789.49
Mojave River	2248.*	Q50	24100.00	2777.38	2782.86		2783.22	0.002963	4.8	5003.46	1139.01	0.40	2787.39	2789.49
Mojave River	2198.*	Q100	32400.00	2777.19	2783.59		2784.04	0.002960	5.4	5987.98	1143.82	0.42	2787.19	2789.29
Mojave River	2198.*	Q50	24100.00	2777.19	2782.71		2783.07	0.002984	4.8	4985.37	1134.66	0.41	2787.19	2789.29
Mojave River	2148.*	Q100	32400.00	2777.00	2783.44		2783.89	0.002983	5.4	5965.72	1139.98	0.42	2787.00	2789.09
Mojave River	2148.*	Q50	24100.00	2777.00	2782.55		2782.92	0.003007	4.9	4966.25	1130.41	0.41	2787.00	2789.09
Mojave River	2098.*	Q100	32400.00	2776.80	2783.28		2783.74	0.003005	5.5	5944.77	1136.20	0.42	2786.80	2788.89
Mojave River	2098.*	Q50	24100.00	2776.80	2782.40		2782.77	0.003029	4.9	4948.34	1126.35	0.41	2786.80	2788.89
Mojave River	2048.*	Q100	32400.00	2776.61	2783.13		2783.59	0.003032	5.5	5922.85	1133.22	0.42	2786.60	2788.69
Mojave River	2048.*	Q50	24100.00	2776.61	2782.25		2782.62	0.003050	4.9	4929.57	1121.67	0.41	2786.60	2788.69
Mojave River	1998.*	Q100	32400.00	2776.42	2782.97		2783.44	0.003059	5.5	5901.92	1130.84	0.42	2786.41	2788.49
Mojave River	1998.*	Q50	24100.00	2776.42	2782.09		2782.46	0.003070	4.9	4911.73	1116.98	0.41	2786.41	2788.49
Mojave River	1948.*	Q100	32400.00	2776.23	2782.81		2783.28	0.003088	5.5	5881.33	1128.95	0.43	2786.21	2788.29
Mojave River	1948.*	Q50	24100.00	2776.23	2781.93		2782.31	0.003094	4.9	4894.11	1113.37	0.41	2786.21	2788.29
Mojave River	1898.*	Q100	32400.00	2776.04	2782.66		2783.13	0.003113	5.5	5861.93	1126.54	0.43	2786.01	2788.08
Mojave River	1898.*	Q50	24100.00	2776.04	2781.77		2782.15	0.003117	4.9	4877.40	1110.05	0.42	2786.01	2788.08
Mojave River	1848.*	Q100	32400.00	2775.85	2782.50		2782.97	0.003140	5.5	5841.98	1124.22	0.43	2785.82	2787.88
Mojave River	1848.*	Q50	24100.00	2775.85	2781.62		2782.00	0.003141	5.0	4860.19	1106.74	0.42	2785.82	2787.88

HEC-RAS Plan: Existing River: Mojave River Reach: Mojave River (Continued)

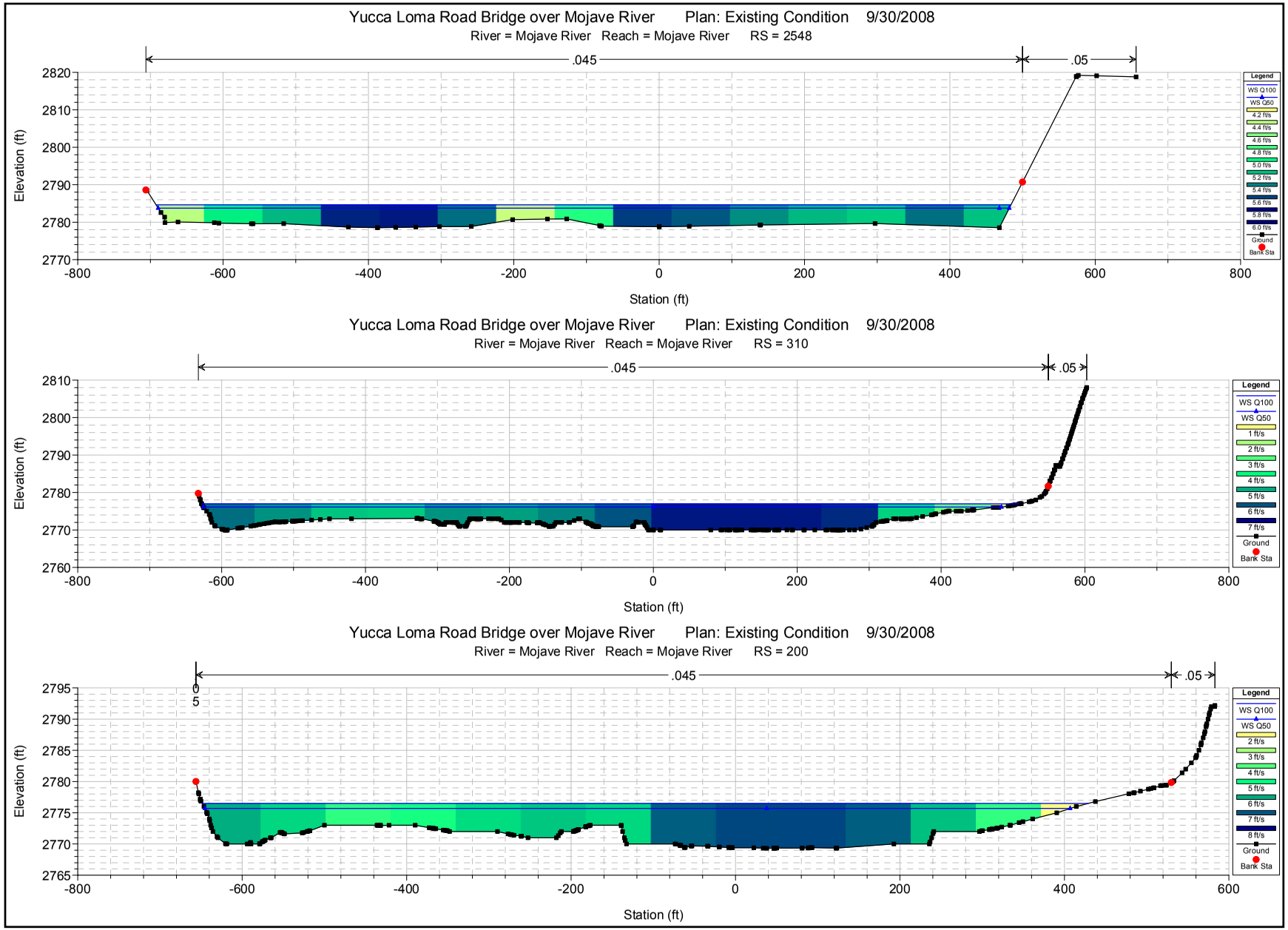
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	LOB Elev	ROB Elev
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(ft)	(ft)
Mojave River	1798.*	Q100	32400.00	2775.66	2782.33		2782.81	0.003171	5.6	5820.08	1122.09	0.43	2785.62	2787.68
Mojave River	1798.*	Q50	24100.00	2775.66	2781.45		2781.84	0.003165	5.0	4843.18	1103.30	0.42	2785.62	2787.68
Mojave River	1748.*	Q100	32400.00	2775.47	2782.17		2782.65	0.003203	5.6	5798.46	1119.94	0.43	2785.42	2787.48
Mojave River	1748.*	Q50	24100.00	2775.47	2781.29		2781.68	0.003191	5.0	4824.88	1099.74	0.42	2785.42	2787.48
Mojave River	1698.*	Q100	32400.00	2775.28	2782.00		2782.49	0.003235	5.6	5777.08	1118.01	0.43	2785.22	2787.28
Mojave River	1698.*	Q50	24100.00	2775.28	2781.13		2781.52	0.003227	5.0	4806.31	1098.29	0.42	2785.22	2787.28
Mojave River	1648.*	Q100	32400.00	2775.09	2781.83		2782.33	0.003267	5.6	5756.40	1116.13	0.44	2785.03	2787.08
Mojave River	1648.*	Q50	24100.00	2775.09	2780.96		2781.35	0.003266	5.0	4788.27	1097.96	0.42	2785.03	2787.08
Mojave River	1598.*	Q100	32400.00	2774.89	2781.67		2782.16	0.003293	5.6	5737.94	1114.01	0.44	2784.83	2786.88
Mojave River	1598.*	Q50	24100.00	2774.89	2780.79		2781.19	0.003300	5.1	4771.75	1097.02	0.43	2784.83	2786.88
Mojave River	1548.*	Q100	32400.00	2774.70	2781.50		2781.99	0.003324	5.7	5718.22	1112.15	0.44	2784.63	2786.68
Mojave River	1548.*	Q50	24100.00	2774.70	2780.62		2781.02	0.003333	5.1	4753.94	1094.98	0.43	2784.63	2786.68
Mojave River	1498.*	Q100	32400.00	2774.51	2781.32		2781.83	0.003352	5.7	5700.44	1110.48	0.44	2784.44	2786.48
Mojave River	1498.*	Q50	24100.00	2774.51	2780.45		2780.85	0.003364	5.1	4737.77	1093.07	0.43	2784.44	2786.48
Mojave River	1448.*	Q100	32400.00	2774.32	2781.15		2781.66	0.003382	5.7	5681.56	1108.75	0.44	2784.24	2786.27
Mojave River	1448.*	Q50	24100.00	2774.32	2780.28		2780.68	0.003398	5.1	4720.46	1091.33	0.43	2784.24	2786.27
Mojave River	1398.*	Q100	32400.00	2774.13	2780.98		2781.48	0.003411	5.7	5664.54	1107.29	0.45	2784.04	2786.07
Mojave River	1398.*	Q50	24100.00	2774.13	2780.10		2780.51	0.003429	5.1	4704.44	1089.46	0.43	2784.04	2786.07
Mojave River	1348.*	Q100	32400.00	2773.94	2780.80		2781.31	0.003437	5.7	5647.98	1105.69	0.45	2783.85	2785.87
Mojave River	1348.*	Q50	24100.00	2773.94	2779.93		2780.34	0.003461	5.1	4688.53	1087.92	0.44	2783.85	2785.87
Mojave River	1298.*	Q100	32400.00	2773.75	2780.62		2781.14	0.003476	5.8	5631.46	1106.89	0.45	2783.65	2785.67
Mojave River	1298.*	Q50	24100.00	2773.75	2779.75		2780.16	0.003493	5.2	4672.84	1086.33	0.44	2783.65	2785.67
Mojave River	1248.*	Q100	32400.00	2773.56	2780.45		2780.96	0.003523	5.8	5616.12	1110.34	0.45	2783.45	2785.47
Mojave River	1248.*	Q50	24100.00	2773.56	2779.57		2779.99	0.003522	5.2	4658.39	1084.41	0.44	2783.45	2785.47
Mojave River	1198.*	Q100	32400.00	2773.37	2780.26		2780.78	0.003559	5.8	5600.20	1110.98	0.45	2783.26	2785.27
Mojave River	1198.*	Q50	24100.00	2773.37	2779.39		2779.81	0.003550	5.2	4643.65	1082.29	0.44	2783.26	2785.27
Mojave River	1148.*	Q100	32400.00	2773.18	2780.08		2780.60	0.003594	5.8	5584.87	1111.50	0.46	2783.06	2785.07
Mojave River	1148.*	Q50	24100.00	2773.18	2779.21		2779.63	0.003580	5.2	4629.18	1080.79	0.44	2783.06	2785.07
Mojave River	1098.*	Q100	32400.00	2772.98	2779.90		2780.42	0.003630	5.8	5570.80	1112.64	0.46	2782.86	2784.87
Mojave River	1098.*	Q50	24100.00	2772.98	2779.02		2779.45	0.003606	5.2	4616.50	1079.19	0.44	2782.86	2784.87

HEC-RAS Plan: Existing River: Mojave River Reach: Mojave River (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	LOB Elev	ROB Elev
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(ft)	(ft)
Mojave River	1048.*	Q100	32400.00	2772.79	2779.71		2780.24	0.003663	5.8	5557.08	1113.37	0.46	2782.67	2784.67
Mojave River	1048.*	Q50	24100.00	2772.79	2778.84		2779.27	0.003633	5.2	4603.76	1077.73	0.45	2782.67	2784.67
Mojave River	998.*	Q100	32400.00	2772.60	2779.52		2780.05	0.003690	5.8	5546.02	1113.90	0.46	2782.47	2784.46
Mojave River	998.*	Q50	24100.00	2772.60	2778.65		2779.08	0.003653	5.2	4593.74	1076.22	0.45	2782.47	2784.46
Mojave River	948.*	Q100	32400.00	2772.41	2779.34		2779.87	0.003715	5.9	5535.99	1114.57	0.46	2782.27	2784.26
Mojave River	948.*	Q50	24100.00	2772.41	2778.47		2778.90	0.003671	5.3	4584.89	1074.83	0.45	2782.27	2784.26
Mojave River	898.*	Q100	32400.00	2772.22	2779.15		2779.68	0.003738	5.9	5527.44	1115.39	0.46	2782.08	2784.06
Mojave River	898.*	Q50	24100.00	2772.22	2778.28		2778.71	0.003685	5.3	4577.51	1073.48	0.45	2782.08	2784.06
Mojave River	848.*	Q100	32400.00	2772.03	2778.96		2779.49	0.003758	5.9	5521.45	1116.60	0.47	2781.88	2783.86
Mojave River	848.*	Q50	24100.00	2772.03	2778.10		2778.53	0.003733	5.3	4572.03	1080.64	0.45	2781.88	2783.86
Mojave River	798.000*	Q100	32400.00	2771.84	2778.77		2779.31	0.003773	5.9	5517.12	1117.81	0.47	2781.68	2783.66
Mojave River	798.000*	Q50	24100.00	2771.84	2777.91		2778.34	0.003765	5.3	4567.26	1084.71	0.45	2781.68	2783.66
Mojave River	748.000*	Q100	32400.00	2771.65	2778.58		2779.12	0.003806	5.9	5515.05	1123.91	0.47	2781.49	2783.46
Mojave River	748.000*	Q50	24100.00	2771.65	2777.72		2778.15	0.003777	5.3	4564.78	1085.70	0.45	2781.49	2783.46
Mojave River	697.999*	Q100	32400.00	2771.46	2778.39		2778.93	0.003811	5.9	5516.02	1125.40	0.47	2781.29	2783.26
Mojave River	697.999*	Q50	24100.00	2771.46	2777.53		2777.96	0.003783	5.3	4565.45	1087.44	0.45	2781.29	2783.26
Mojave River	647.999*	Q100	32400.00	2771.27	2778.20		2778.73	0.003810	5.9	5519.13	1126.85	0.47	2781.09	2783.06
Mojave River	647.999*	Q50	24100.00	2771.27	2777.34		2777.77	0.003784	5.3	4568.25	1089.31	0.45	2781.09	2783.06
Mojave River	597.999*	Q100	32400.00	2771.07	2778.01		2778.54	0.003805	5.9	5524.70	1128.37	0.47	2780.90	2782.85
Mojave River	597.999*	Q50	24100.00	2771.07	2777.15		2777.58	0.003772	5.3	4574.72	1090.47	0.45	2780.90	2782.85
Mojave River	548.*	Q100	32400.00	2770.88	2777.82		2778.35	0.003787	5.9	5536.01	1130.16	0.47	2780.70	2782.65
Mojave River	548.*	Q50	24100.00	2770.88	2776.97		2777.39	0.003748	5.3	4585.98	1091.88	0.45	2780.70	2782.65
Mojave River	498.*	Q100	32400.00	2770.69	2777.63		2778.16	0.003759	5.8	5551.59	1131.51	0.46	2780.50	2782.45
Mojave River	498.*	Q50	24100.00	2770.69	2776.78		2777.21	0.003715	5.2	4601.56	1093.69	0.45	2780.50	2782.45
Mojave River	448.*	Q100	32400.00	2770.50	2777.45		2777.97	0.003718	5.8	5572.35	1132.76	0.46	2780.31	2782.25
Mojave River	448.*	Q50	24100.00	2770.50	2776.60		2777.02	0.003668	5.2	4622.39	1095.57	0.45	2780.31	2782.25
Mojave River	398.*	Q100	32400.00	2770.31	2777.27		2777.79	0.003663	5.8	5599.53	1133.74	0.46	2780.11	2782.05
Mojave River	398.*	Q50	24100.00	2770.31	2776.42		2776.84	0.003605	5.2	4650.72	1097.80	0.44	2780.11	2782.05
Mojave River	348.*	Q100	32400.00	2770.12	2777.09		2777.60	0.003596	5.8	5633.64	1135.17	0.45	2779.91	2781.85
Mojave River	348.*	Q50	24100.00	2770.12	2776.24		2776.66	0.003560	5.1	4684.90	1107.68	0.44	2779.91	2781.85

HEC-RAS Plan: Existing River: Mojave River Reach: Mojave River (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	LOB Elev	ROB Elev
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(ft)	(ft)
Mojave River	310	Q100	32400.00	2769.97	2776.96		2777.47	0.003536	5.7	5664.54	1136.31	0.45	2779.76	2781.70
Mojave River	310	Q50	24100.00	2769.97	2776.11		2776.52	0.003490	5.1	4716.16	1109.46	0.44	2779.76	2781.70
Mojave River	200	Q100	32400.00	2769.30	2776.50		2777.06	0.003822	6.0	5416.87	1077.64	0.47	2780.00	2779.84
Mojave River	200	Q50	24100.00	2769.30	2775.69		2776.12	0.003660	5.3	4551.23	1052.39	0.45	2780.00	2779.84
Mojave River	100	Q100	32400.00	2768.77	2776.06		2776.64	0.004243	6.2	5263.70	1084.52	0.49	2778.95	2779.00
Mojave River	100	Q50	24100.00	2768.77	2775.26		2775.73	0.004123	5.5	4412.43	1064.70	0.47	2778.95	2779.00
Mojave River	0	Q100	32400.00	2768.15	2775.41		2776.13	0.005888	6.8	4746.10	1073.75	0.57	2778.00	2778.00
Mojave River	0	Q50	24100.00	2768.15	2774.64		2775.22	0.005987	6.1	3928.66	1038.22	0.56	2778.00	2778.00
Mojave River	-580	Q100	32400.00	2765.04	2773.70		2774.02	0.002247	4.6	7067.03	1406.98	0.36	2778.06	2782.15
Mojave River	-580	Q50	24100.00	2765.04	2772.92		2773.17	0.002152	4.0	5977.13	1396.98	0.34	2778.06	2782.15
Mojave River	-2460	Q100	32400.00	2758.13	2765.43		2766.14	0.010258	6.7	4804.12	2127.53	0.79	2766.01	2767.37
Mojave River	-2460	Q50	24100.00	2758.13	2764.84		2765.52	0.010238	6.6	3650.67	1739.68	0.80	2766.01	2767.37
Mojave River	-3286	Q100	32400.00	2752.52	2762.21	2760.43	2762.43	0.002361	3.8	8571.12	2906.56	0.39	2764.25	2760.25
Mojave River	-3286	Q50	24100.00	2752.52	2761.50	2759.62	2761.71	0.002465	3.7	6556.64	2762.41	0.42	2764.25	2760.25
Mojave River	-7046	Q100	32400.00	2741.16	2748.81	2746.95	2749.58	0.005331	7.1	4572.47	869.13	0.54	2746.84	2750.61
Mojave River	-7046	Q50	24100.00	2741.16	2747.91	2746.30	2748.53	0.005335	6.3	3797.13	854.03	0.53	2746.84	2750.61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.05
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Station (ft)
Legend
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WS Q50
Ground
Bank Sta
Yucca Loma Road Bridge over Mojave River Plan: Existing Condition 9/30/2008
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.05
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
Ground
Bank Sta
Yucca Loma Road Bridge over Mojave River Plan: Existing Condition 9/30/2008
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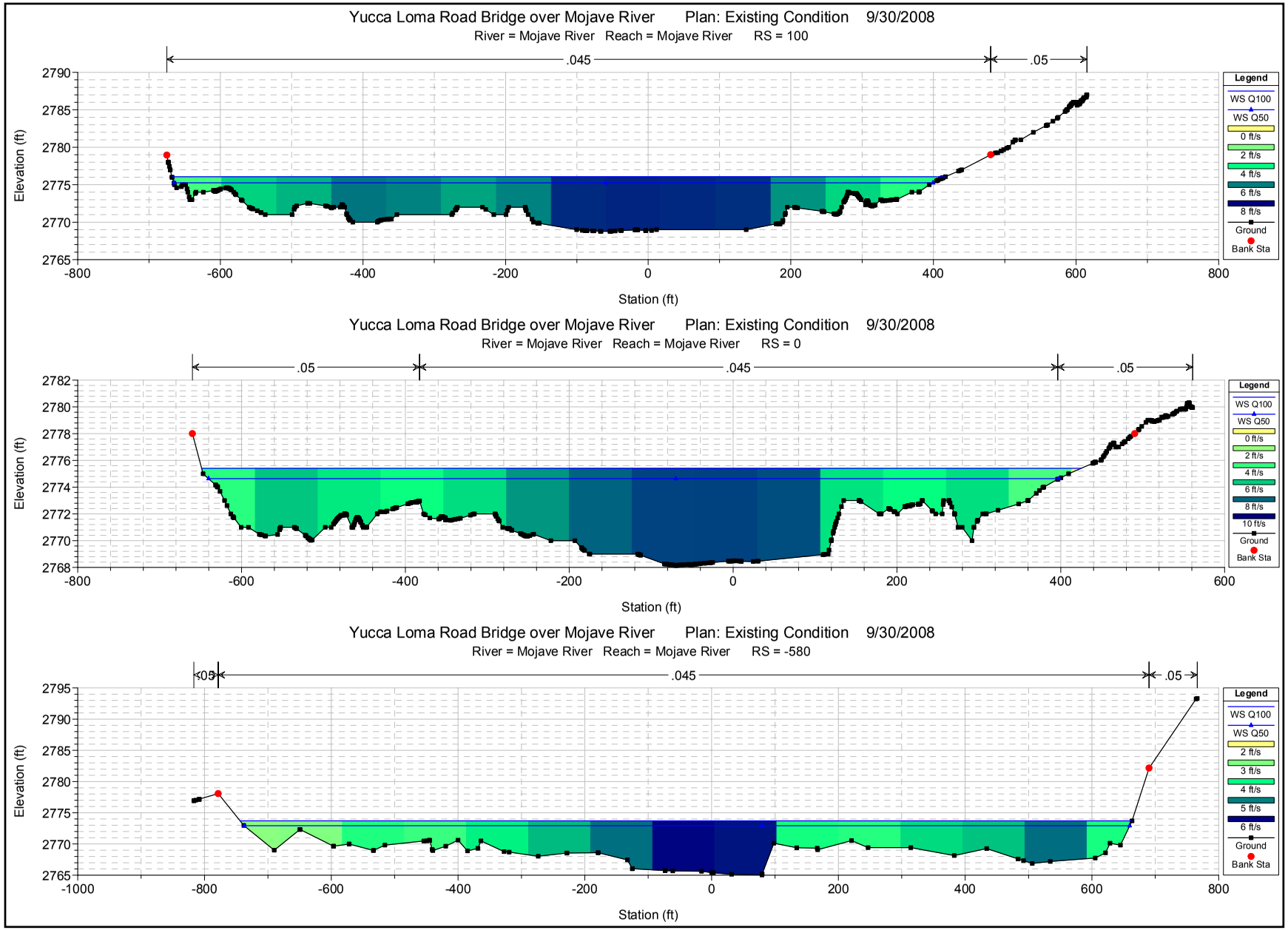
.05
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
Ground
Bank Sta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.05
Elevation (ft)
Station (ft)
Legend
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WS Q50
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
Ground
Bank Sta
Yucca Loma Road Bridge over Mojave River Plan: Existing Condition 9/30/2008
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.05
.045
.05
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta
Yucca Loma Road Bridge over Mojave River Plan: Existing Condition 9/30/2008
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.045
.05
Elevation (ft)
Station (ft)
Legend
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WS Q50
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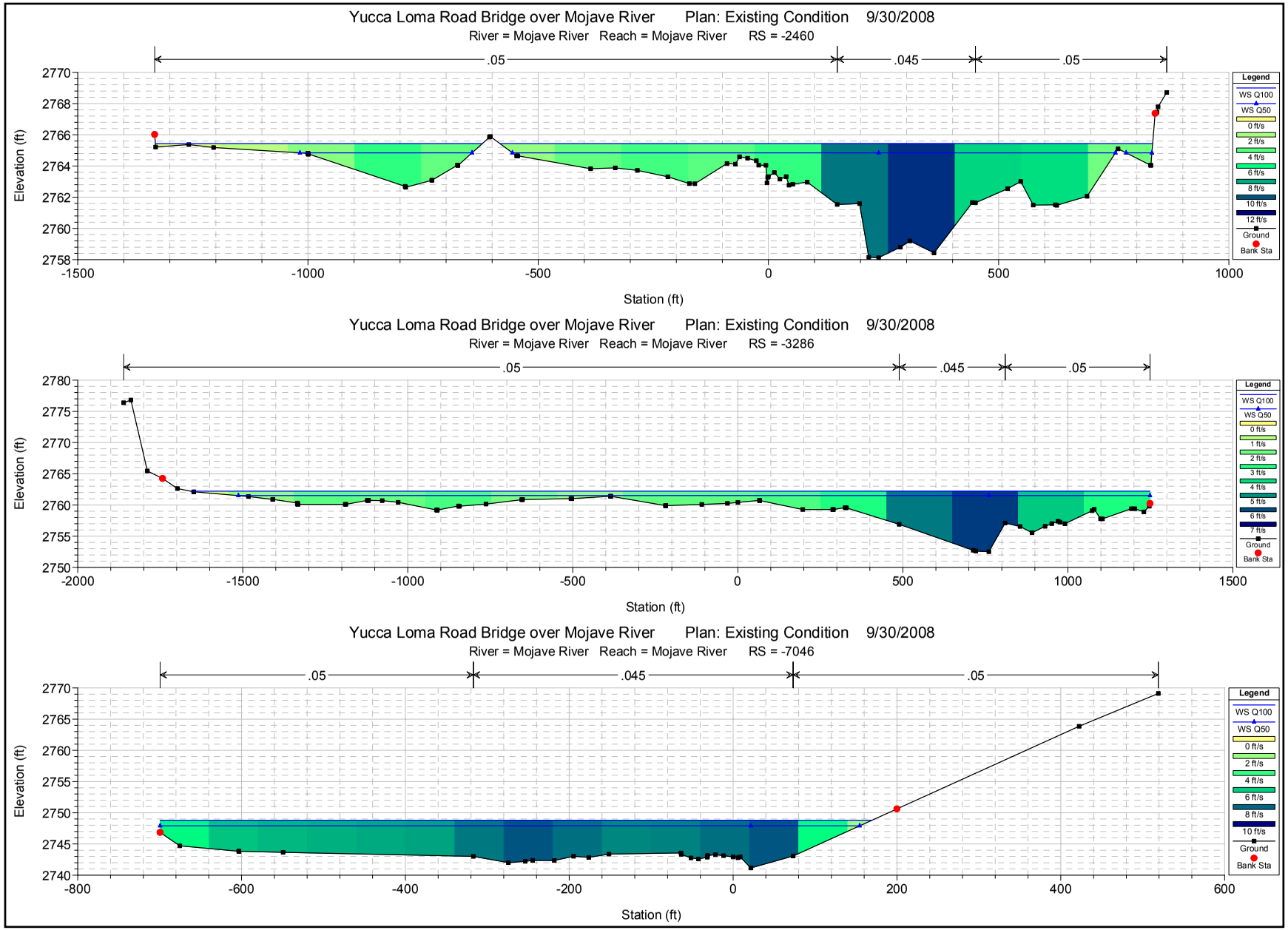
3 ft/s
4 ft/s
5 ft/s
6 ft/s
Ground
Bank Sta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.045
.05
Elevation (ft)
Station (ft)
Legend
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WS Q50
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Bank Sta
Yucca Loma Road Bridge over Mojave River Plan: Existing Condition 9/30/2008
River = Mojave River Reach = Mojave River RS = -3286
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.045
.05
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
7 ft/s
Ground
Bank Sta
Yucca Loma Road Bridge over Mojave River Plan: Existing Condition 9/30/2008
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.045
.05
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
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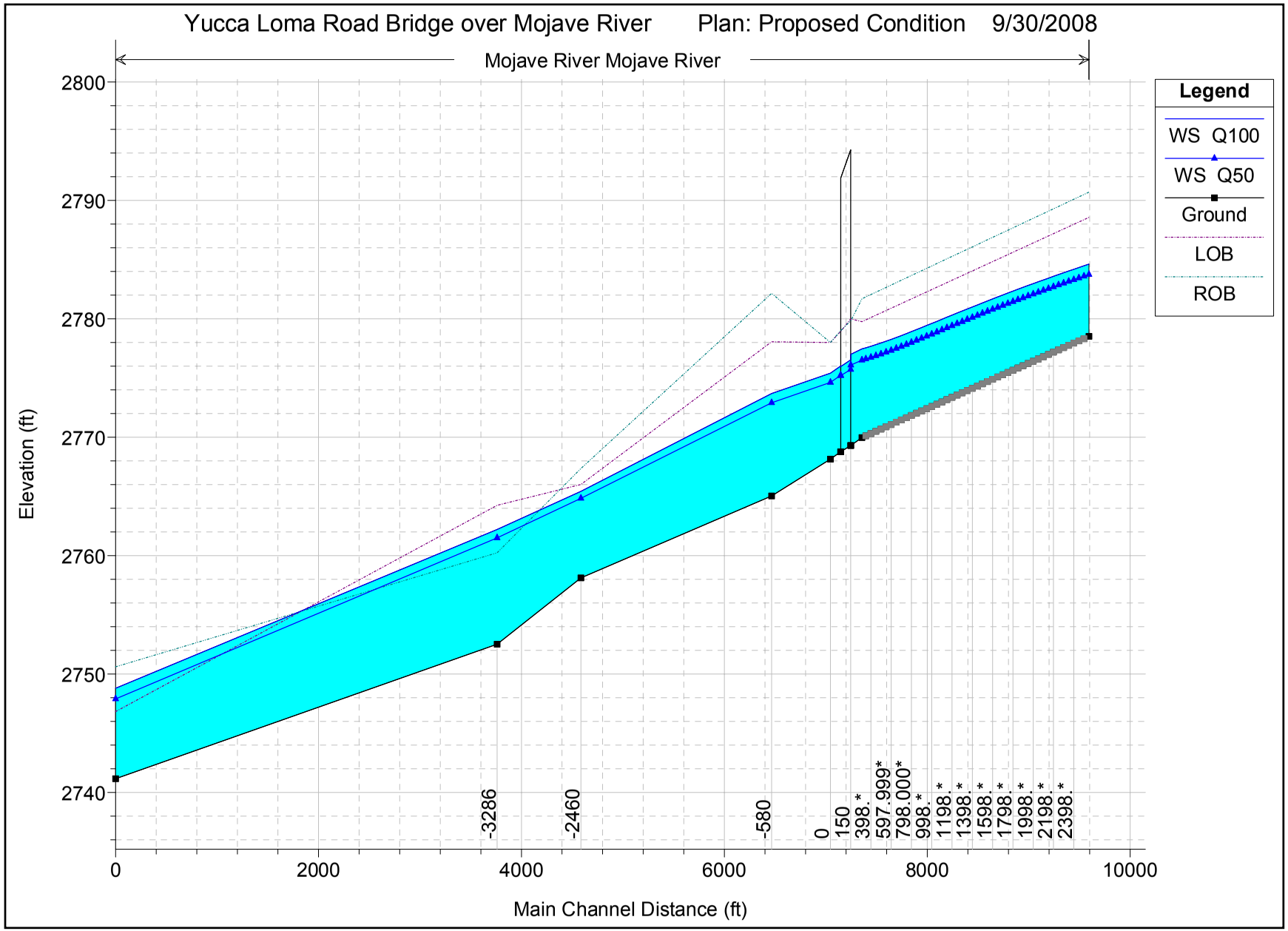
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta

Appendix B Hydraulic Analysis: Proposed Condition



1 in Horiz. = 1400 ft 1 in Vert. = 12 ft

HEC-RAS Plan: Proposed River: Mojave River Reach: Mojave River

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	LOB Elev	ROB Elev
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(ft)	(ft)
Mojave River	2548	Q100	32400.00	2778.52	2784.63	2782.24	2785.06	0.002823	5.3	6143.97	1176.32	0.41	2788.57	2790.70
Mojave River	2548	Q50	24100.00	2778.52	2783.75	2781.71	2784.09	0.002860	4.7	5114.94	1171.17	0.40	2788.57	2790.70
Mojave River	2498.*	Q100	32400.00	2778.33	2784.48		2784.92	0.002839	5.3	6122.00	1170.97	0.41	2788.37	2790.50
Mojave River	2498.*	Q50	24100.00	2778.33	2783.60		2783.95	0.002872	4.7	5096.92	1164.91	0.40	2788.37	2790.50
Mojave River	2448.*	Q100	32400.00	2778.14	2784.33		2784.77	0.002857	5.3	6099.47	1165.94	0.41	2788.18	2790.30
Mojave River	2448.*	Q50	24100.00	2778.14	2783.46		2783.81	0.002887	4.7	5078.33	1158.98	0.40	2788.18	2790.30
Mojave River	2398.*	Q100	32400.00	2777.95	2784.19		2784.63	0.002876	5.3	6076.84	1161.13	0.41	2787.98	2790.10
Mojave River	2398.*	Q50	24100.00	2777.95	2783.31		2783.66	0.002904	4.8	5059.35	1153.39	0.40	2787.98	2790.10
Mojave River	2348.*	Q100	32400.00	2777.76	2784.04		2784.48	0.002894	5.4	6055.63	1156.59	0.41	2787.78	2789.90
Mojave River	2348.*	Q50	24100.00	2777.76	2783.16		2783.51	0.002921	4.8	5041.49	1148.24	0.40	2787.78	2789.90
Mojave River	2298.*	Q100	32400.00	2777.57	2783.89		2784.34	0.002913	5.4	6033.71	1151.90	0.41	2787.59	2789.69
Mojave River	2298.*	Q50	24100.00	2777.57	2783.01		2783.37	0.002941	4.8	5022.78	1143.48	0.40	2787.59	2789.69
Mojave River	2248.*	Q100	32400.00	2777.38	2783.74		2784.19	0.002933	5.4	6012.40	1147.73	0.41	2787.39	2789.49
Mojave River	2248.*	Q50	24100.00	2777.38	2782.86		2783.22	0.002961	4.8	5004.58	1139.02	0.40	2787.39	2789.49
Mojave River	2198.*	Q100	32400.00	2777.19	2783.59		2784.04	0.002954	5.4	5991.61	1143.86	0.42	2787.19	2789.29
Mojave River	2198.*	Q50	24100.00	2777.19	2782.71		2783.07	0.002981	4.8	4986.75	1134.68	0.41	2787.19	2789.29
Mojave River	2148.*	Q100	32400.00	2777.00	2783.44		2783.90	0.002976	5.4	5969.90	1140.02	0.42	2787.00	2789.09
Mojave River	2148.*	Q50	24100.00	2777.00	2782.56		2782.92	0.003004	4.9	4967.91	1130.42	0.41	2787.00	2789.09
Mojave River	2098.*	Q100	32400.00	2776.80	2783.29		2783.75	0.002997	5.4	5949.49	1136.25	0.42	2786.80	2788.89
Mojave River	2098.*	Q50	24100.00	2776.80	2782.40		2782.77	0.003025	4.9	4950.27	1126.36	0.41	2786.80	2788.89
Mojave River	2048.*	Q100	32400.00	2776.61	2783.13		2783.60	0.003022	5.5	5928.38	1133.31	0.42	2786.60	2788.69
Mojave River	2048.*	Q50	24100.00	2776.61	2782.25		2782.62	0.003046	4.9	4931.76	1121.68	0.41	2786.60	2788.69
Mojave River	1998.*	Q100	32400.00	2776.42	2782.98		2783.44	0.003048	5.5	5908.27	1130.94	0.42	2786.41	2788.49
Mojave River	1998.*	Q50	24100.00	2776.42	2782.09		2782.47	0.003064	4.9	4914.46	1117.00	0.41	2786.41	2788.49
Mojave River	1948.*	Q100	32400.00	2776.23	2782.82		2783.29	0.003076	5.5	5888.50	1129.11	0.42	2786.21	2788.29
Mojave River	1948.*	Q50	24100.00	2776.23	2781.94		2782.31	0.003088	4.9	4897.10	1113.41	0.41	2786.21	2788.29
Mojave River	1898.*	Q100	32400.00	2776.04	2782.66		2783.14	0.003099	5.5	5869.90	1126.65	0.43	2786.01	2788.08
Mojave River	1898.*	Q50	24100.00	2776.04	2781.78		2782.16	0.003109	4.9	4880.92	1110.11	0.41	2786.01	2788.08
Mojave River	1848.*	Q100	32400.00	2775.85	2782.50		2782.98	0.003124	5.5	5851.04	1124.35	0.43	2785.82	2787.88
Mojave River	1848.*	Q50	24100.00	2775.85	2781.62		2782.00	0.003132	5.0	4864.24	1106.80	0.42	2785.82	2787.88

HEC-RAS Plan: Proposed River: Mojave River Reach: Mojave River (Continued)

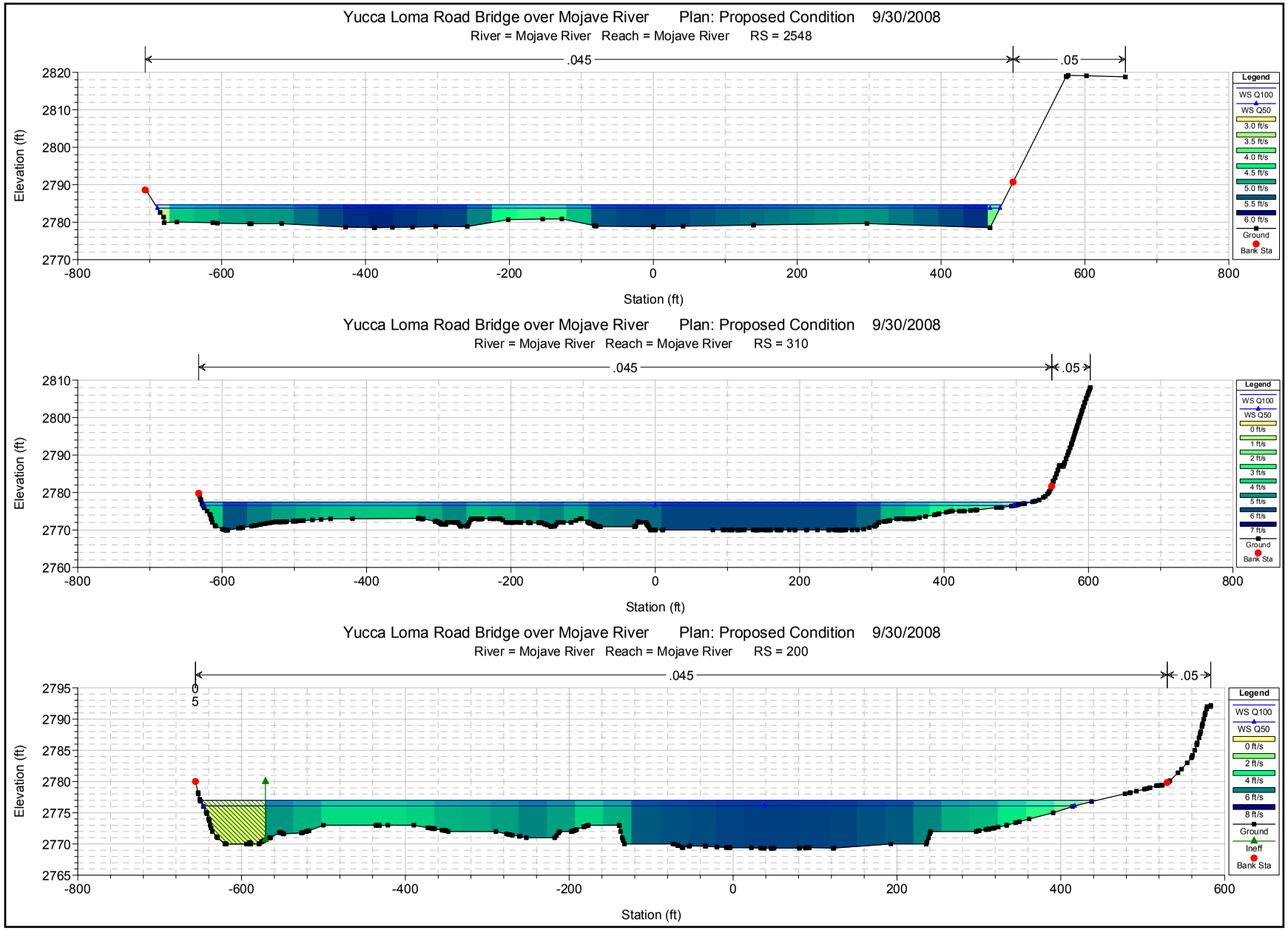
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	LOB Elev	ROB Elev
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(ft)	(ft)
Mojave River	1798.*	Q100	32400.00	2775.66	2782.34		2782.82	0.003149	5.6	5832.69	1122.29	0.43	2785.62	2787.68
Mojave River	1798.*	Q50	24100.00	2775.66	2781.46		2781.84	0.003155	5.0	4847.76	1103.36	0.42	2785.62	2787.68
Mojave River	1748.*	Q100	32400.00	2775.47	2782.18		2782.66	0.003178	5.6	5812.68	1120.17	0.43	2785.42	2787.48
Mojave River	1748.*	Q50	24100.00	2775.47	2781.30		2781.68	0.003180	5.0	4829.97	1099.81	0.42	2785.42	2787.48
Mojave River	1698.*	Q100	32400.00	2775.28	2782.02		2782.50	0.003206	5.6	5793.19	1118.27	0.43	2785.22	2787.28
Mojave River	1698.*	Q50	24100.00	2775.28	2781.13		2781.52	0.003214	5.0	4812.21	1098.47	0.42	2785.22	2787.28
Mojave River	1648.*	Q100	32400.00	2775.09	2781.85		2782.34	0.003233	5.6	5774.66	1116.38	0.43	2785.03	2787.08
Mojave River	1648.*	Q50	24100.00	2775.09	2780.97		2781.36	0.003251	5.0	4795.24	1098.21	0.42	2785.03	2787.08
Mojave River	1598.*	Q100	32400.00	2774.89	2781.68		2782.18	0.003255	5.6	5758.62	1114.32	0.44	2784.83	2786.88
Mojave River	1598.*	Q50	24100.00	2774.89	2780.80		2781.19	0.003282	5.0	4780.05	1097.18	0.43	2784.83	2786.88
Mojave River	1548.*	Q100	32400.00	2774.70	2781.52		2782.01	0.003281	5.6	5741.57	1112.54	0.44	2784.63	2786.68
Mojave River	1548.*	Q50	24100.00	2774.70	2780.63		2781.03	0.003312	5.1	4763.56	1095.17	0.43	2784.63	2786.68
Mojave River	1498.*	Q100	32400.00	2774.51	2781.35		2781.84	0.003303	5.7	5726.74	1110.94	0.44	2784.44	2786.48
Mojave River	1498.*	Q50	24100.00	2774.51	2780.46		2780.86	0.003338	5.1	4748.98	1093.29	0.43	2784.44	2786.48
Mojave River	1448.*	Q100	32400.00	2774.32	2781.18		2781.68	0.003326	5.7	5711.34	1109.29	0.44	2784.24	2786.27
Mojave River	1448.*	Q50	24100.00	2774.32	2780.29		2780.69	0.003368	5.1	4733.52	1091.59	0.43	2784.24	2786.27
Mojave River	1398.*	Q100	32400.00	2774.13	2781.01		2781.51	0.003347	5.7	5698.07	1107.89	0.44	2784.04	2786.07
Mojave River	1398.*	Q50	24100.00	2774.13	2780.12		2780.52	0.003394	5.1	4719.60	1089.78	0.43	2784.04	2786.07
Mojave River	1348.*	Q100	32400.00	2773.94	2780.84		2781.34	0.003364	5.7	5686.05	1106.38	0.44	2783.85	2785.87
Mojave River	1348.*	Q50	24100.00	2773.94	2779.94		2780.35	0.003420	5.1	4706.33	1088.30	0.43	2783.85	2785.87
Mojave River	1298.*	Q100	32400.00	2773.75	2780.66		2781.17	0.003399	5.7	5674.75	1109.44	0.44	2783.65	2785.67
Mojave River	1298.*	Q50	24100.00	2773.75	2779.77		2780.18	0.003444	5.1	4693.52	1086.79	0.44	2783.65	2785.67
Mojave River	1248.*	Q100	32400.00	2773.56	2780.49		2781.00	0.003429	5.7	5665.23	1112.12	0.45	2783.45	2785.47
Mojave River	1248.*	Q50	24100.00	2773.56	2779.59		2780.00	0.003463	5.1	4682.48	1084.83	0.44	2783.45	2785.47
Mojave River	1198.*	Q100	32400.00	2773.37	2780.32		2780.82	0.003448	5.7	5657.20	1112.65	0.45	2783.26	2785.27
Mojave River	1198.*	Q50	24100.00	2773.37	2779.42		2779.83	0.003478	5.2	4672.99	1082.80	0.44	2783.26	2785.27
Mojave River	1148.*	Q100	32400.00	2773.18	2780.14		2780.65	0.003465	5.7	5650.88	1113.76	0.45	2783.06	2785.07
Mojave River	1148.*	Q50	24100.00	2773.18	2779.24		2779.65	0.003494	5.2	4664.55	1081.54	0.44	2783.06	2785.07
Mojave River	1098.*	Q100	32400.00	2772.98	2779.96		2780.48	0.003479	5.7	5646.39	1114.83	0.45	2782.86	2784.87
Mojave River	1098.*	Q50	24100.00	2772.98	2779.06		2779.48	0.003505	5.2	4657.89	1080.13	0.44	2782.86	2784.87

HEC-RAS Plan: Proposed River: Mojave River Reach: Mojave River (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	LOB Elev	ROB Elev
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(ft)	(ft)
Mojave River	1048.*	Q100	32400.00	2772.79	2779.79		2780.30	0.003488	5.7	5644.16	1115.83	0.45	2782.67	2784.67
Mojave River	1048.*	Q50	24100.00	2772.79	2778.89		2779.30	0.003512	5.2	4652.99	1078.84	0.44	2782.67	2784.67
Mojave River	998.*	Q100	32400.00	2772.60	2779.61		2780.13	0.003488	5.7	5646.50	1116.81	0.45	2782.47	2784.46
Mojave River	998.*	Q50	24100.00	2772.60	2778.71		2779.13	0.003508	5.2	4652.11	1077.53	0.44	2782.47	2784.46
Mojave River	948.*	Q100	32400.00	2772.41	2779.44		2779.95	0.003482	5.7	5651.54	1118.00	0.45	2782.27	2784.26
Mojave River	948.*	Q50	24100.00	2772.41	2778.53		2778.95	0.003499	5.2	4653.95	1076.39	0.44	2782.27	2784.26
Mojave River	898.*	Q100	32400.00	2772.22	2779.27		2779.78	0.003471	5.7	5660.03	1119.43	0.45	2782.08	2784.06
Mojave River	898.*	Q50	24100.00	2772.22	2778.36		2778.77	0.003504	5.2	4658.42	1080.07	0.44	2782.08	2784.06
Mojave River	848.*	Q100	32400.00	2772.03	2779.09		2779.60	0.003452	5.7	5673.35	1121.41	0.45	2781.88	2783.86
Mojave River	848.*	Q50	24100.00	2772.03	2778.18		2778.60	0.003515	5.2	4666.85	1087.32	0.44	2781.88	2783.86
Mojave River	798.000*	Q100	32400.00	2771.84	2778.92		2779.43	0.003445	5.7	5690.08	1127.88	0.45	2781.68	2783.66
Mojave River	798.000*	Q50	24100.00	2771.84	2778.01		2778.42	0.003494	5.2	4677.90	1088.82	0.44	2781.68	2783.66
Mojave River	748.000*	Q100	32400.00	2771.65	2778.75		2779.25	0.003409	5.7	5712.03	1129.70	0.44	2781.49	2783.46
Mojave River	748.000*	Q50	24100.00	2771.65	2777.84		2778.25	0.003465	5.1	4693.93	1091.22	0.44	2781.49	2783.46
Mojave River	697.999*	Q100	32400.00	2771.46	2778.59		2779.08	0.003363	5.6	5740.04	1131.88	0.44	2781.29	2783.26
Mojave River	697.999*	Q50	24100.00	2771.46	2777.67		2778.07	0.003422	5.1	4715.64	1093.54	0.43	2781.29	2783.26
Mojave River	647.999*	Q100	32400.00	2771.27	2778.42		2778.91	0.003309	5.6	5773.65	1134.52	0.44	2781.09	2783.06
Mojave River	647.999*	Q50	24100.00	2771.27	2777.50		2777.90	0.003365	5.1	4742.67	1095.44	0.43	2781.09	2783.06
Mojave River	597.999*	Q100	32400.00	2771.07	2778.27		2778.75	0.003236	5.6	5816.16	1136.48	0.43	2780.90	2782.85
Mojave River	597.999*	Q50	24100.00	2771.07	2777.34		2777.73	0.003293	5.0	4778.00	1097.75	0.43	2780.90	2782.85
Mojave River	548.*	Q100	32400.00	2770.88	2778.11		2778.59	0.003150	5.5	5867.25	1138.17	0.43	2780.70	2782.65
Mojave River	548.*	Q50	24100.00	2770.88	2777.18		2777.57	0.003205	5.0	4821.76	1100.47	0.42	2780.70	2782.65
Mojave River	498.*	Q100	32400.00	2770.69	2777.96		2778.43	0.003053	5.5	5926.79	1140.03	0.42	2780.50	2782.45
Mojave River	498.*	Q50	24100.00	2770.69	2777.03		2777.41	0.003104	4.9	4874.08	1103.69	0.41	2780.50	2782.45
Mojave River	448.*	Q100	32400.00	2770.50	2777.82		2778.27	0.002951	5.4	5995.87	1143.87	0.42	2780.31	2782.25
Mojave River	448.*	Q50	24100.00	2770.50	2776.88		2777.25	0.003013	4.9	4935.88	1113.70	0.41	2780.31	2782.25
Mojave River	398.*	Q100	32400.00	2770.31	2777.68		2778.13	0.002830	5.3	6075.66	1145.71	0.41	2780.11	2782.05
Mojave River	398.*	Q50	24100.00	2770.31	2776.74		2777.10	0.002882	4.8	5008.68	1117.17	0.40	2780.11	2782.05
Mojave River	348.*	Q100	32400.00	2770.12	2777.56		2777.98	0.002702	5.3	6165.94	1147.89	0.40	2779.91	2781.85
Mojave River	348.*	Q50	24100.00	2770.12	2776.61		2776.96	0.002740	4.7	5092.46	1121.23	0.39	2779.91	2781.85

HEC-RAS Plan: Proposed River: Mojave River Reach: Mojave River (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	LOB Elev	ROB Elev
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(ft)	(ft)
Mojave River	310	Q100	32400.00	2769.97	2777.46		2777.88	0.002600	5.2	6241.79	1149.73	0.39	2779.76	2781.70
Mojave River	310	Q50	24100.00	2769.97	2776.51		2776.85	0.002625	4.7	5164.21	1124.19	0.38	2779.76	2781.70
Mojave River	200	Q100	32400.00	2769.30	2777.00	2774.61	2777.54	0.003360	5.9	5495.69	1095.25	0.45	2780.00	2779.84
Mojave River	200	Q50	24100.00	2769.30	2776.09	2774.01	2776.52	0.003287	5.3	4581.63	1064.01	0.43	2780.00	2779.84
Mojave River	150		Bridge											
Mojave River	100	Q100	32400.00	2768.77	2776.01	2774.08	2776.65	0.004306	6.4	5077.63	1083.33	0.50	2778.95	2779.00
Mojave River	100	Q50	24100.00	2768.77	2775.23	2773.41	2775.72	0.004048	5.6	4302.07	1063.97	0.47	2778.95	2779.00
Mojave River	0	Q100	32400.00	2768.15	2775.41		2776.13	0.005888	6.8	4746.10	1073.75	0.57	2778.00	2778.00
Mojave River	0	Q50	24100.00	2768.15	2774.64		2775.22	0.005987	6.1	3928.66	1038.22	0.56	2778.00	2778.00
Mojave River	-580	Q100	32400.00	2765.04	2773.70		2774.02	0.002247	4.6	7067.03	1406.98	0.36	2778.06	2782.15
Mojave River	-580	Q50	24100.00	2765.04	2772.92		2773.17	0.002152	4.0	5977.13	1396.98	0.34	2778.06	2782.15
Mojave River	-2460	Q100	32400.00	2758.13	2765.43		2766.14	0.010258	6.7	4804.12	2127.53	0.79	2766.01	2767.37
Mojave River	-2460	Q50	24100.00	2758.13	2764.84		2765.52	0.010238	6.6	3650.67	1739.68	0.80	2766.01	2767.37
Mojave River	-3286	Q100	32400.00	2752.52	2762.21	2760.43	2762.43	0.002361	3.8	8571.12	2906.56	0.39	2764.25	2760.25
Mojave River	-3286	Q50	24100.00	2752.52	2761.50	2759.62	2761.71	0.002465	3.7	6556.64	2762.41	0.42	2764.25	2760.25
Mojave River	-7046	Q100	32400.00	2741.16	2748.81	2746.95	2749.58	0.005331	7.1	4572.47	869.13	0.54	2746.84	2750.61
Mojave River	-7046	Q50	24100.00	2741.16	2747.91	2746.30	2748.53	0.005335	6.3	3797.13	854.03	0.53	2746.84	2750.61


Yucca Loma Road Bridge over Mojave River Plan: Proposed Condition 9/30/2008
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Elevation (ft)
Station (ft)
Legend
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WS Q50
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3.5 ft/s
4.0 ft/s
4.5 ft/s
5.0 ft/s
5.5 ft/s
6.0 ft/s
Ground
Bank Sta
Yucca Loma Road Bridge over Mojave River Plan: Proposed Condition 9/30/2008
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.045
.05
Elevation (ft)
Station (ft)
Legend
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WS Q50
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1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
7 ft/s
Ground
Bank Sta
Yucca Loma Road Bridge over Mojave River Plan: Proposed Condition 9/30/2008
River = Mojave River Reach = Mojave River RS = 200
.045
.05
Elevation (ft)
Station (ft)
Legend
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WS Q50
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2 ft/s
4 ft/s
6 ft/s
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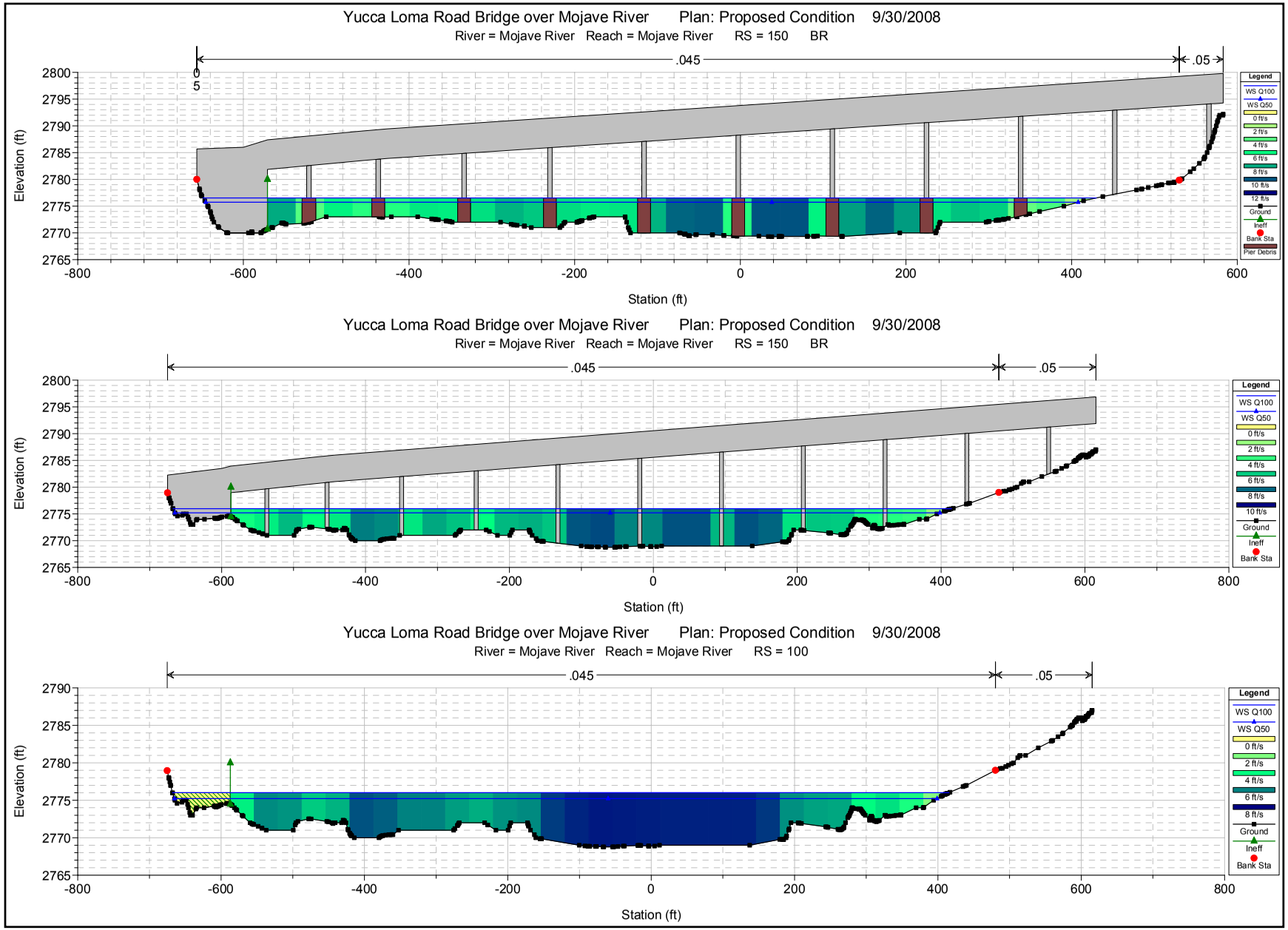
Ground
Ineff
Bank Sta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.05
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5
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Station (ft)
Legend
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WS Q50
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Ineff
Bank Sta
Pier Debris
Yucca Loma Road Bridge over Mojave River Plan: Proposed Condition 9/30/2008
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.05
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Ineff
Bank Sta
Yucca Loma Road Bridge over Mojave River Plan: Proposed Condition 9/30/2008
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.045
.05
Elevation (ft)
Station (ft)
Legend
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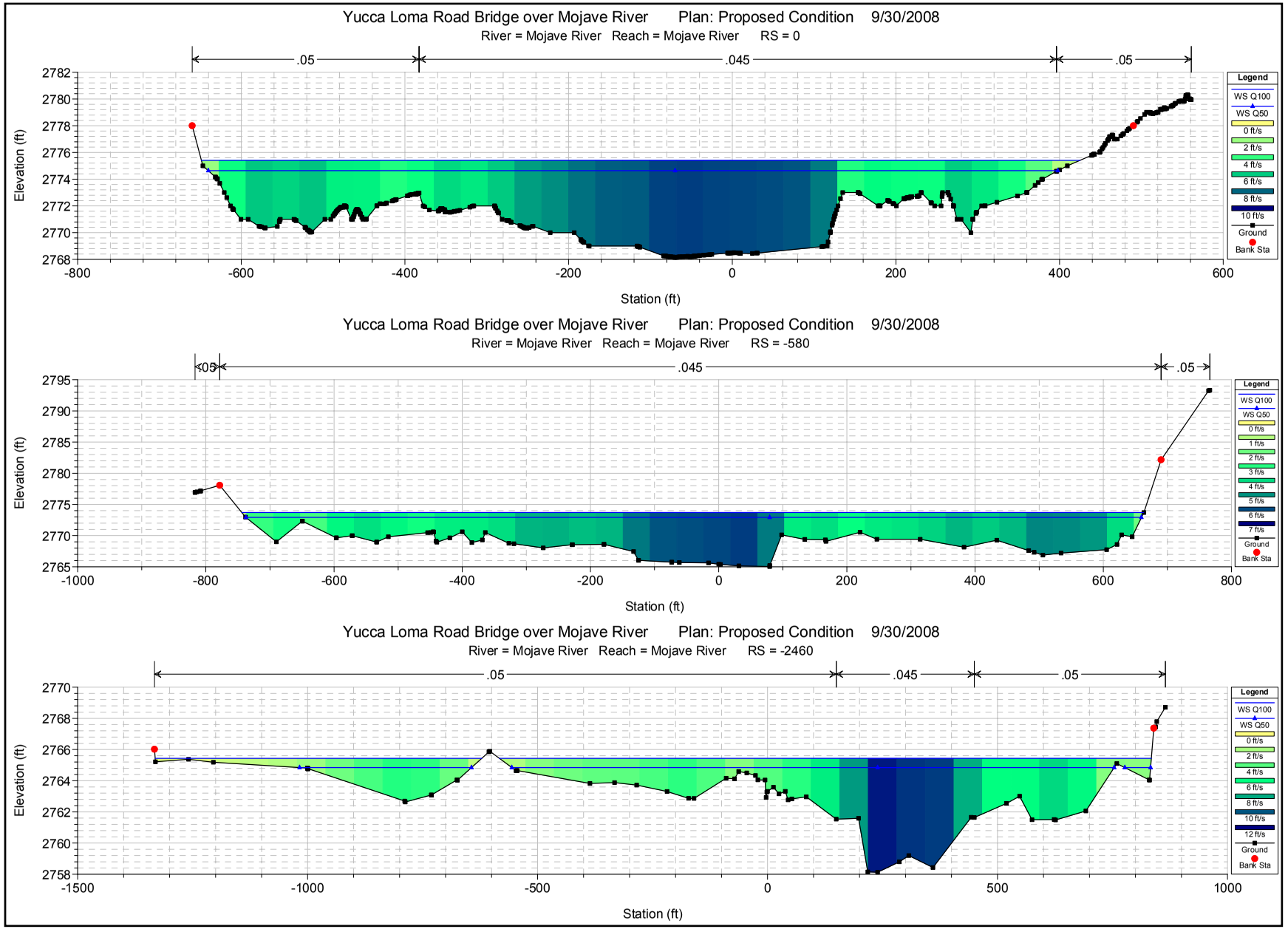
WS Q50
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
Ground
Ineff
Bank Sta


Yucca Loma Road Bridge over Mojave River Plan: Proposed Condition 9/30/2008
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.045
.05
Elevation (ft)
Station (ft)
Legend
WS Q100
WS Q50
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta
Yucca Loma Road Bridge over Mojave River Plan: Proposed Condition 9/30/2008
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.045
.05
Elevation (ft)
Station (ft)
Legend
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WS Q50
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1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
7 ft/s
Ground
Bank Sta
Yucca Loma Road Bridge over Mojave River Plan: Proposed Condition 9/30/2008
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.045
.05
Elevation (ft)
Station (ft)
Legend
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WS Q50
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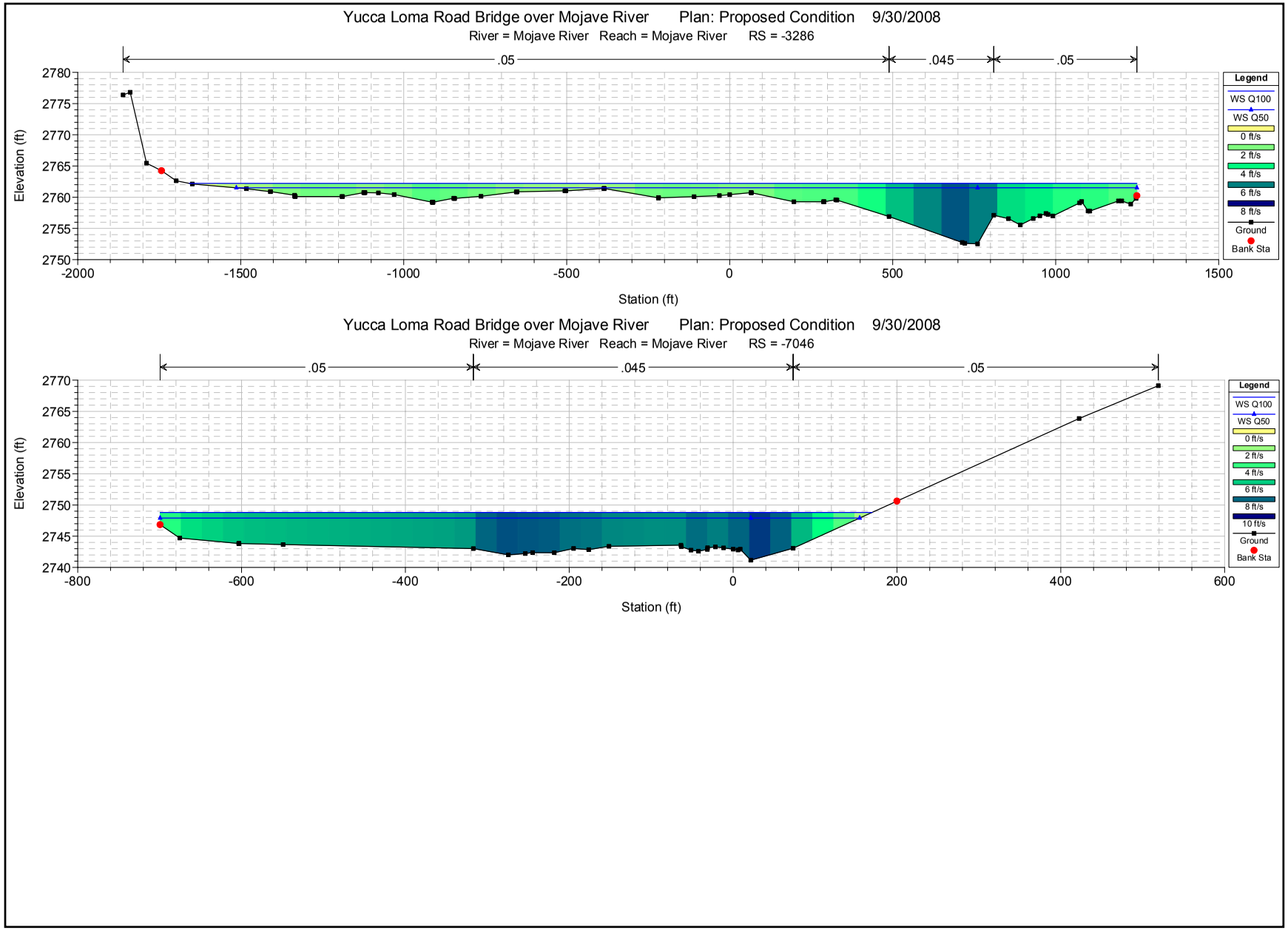
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Bank Sta


Yucca Loma Road Bridge over Mojave River Plan: Proposed Condition 9/30/2008
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.045
.05
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2770
2765
2760
2755
2750
-2000
-1500
-1000
-500
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500
1000
1500
Station (ft)
Legend
WS Q100
WS Q50
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
Ground
Bank Sta
Yucca Loma Road Bridge over Mojave River Plan: Proposed Condition 9/30/2008
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.045
.05
Elevation (ft)
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2765
2760
2755
2750
2745
2740
-800
-600
-400
-200
0
200
400
600
Station (ft)
Legend
WS Q100
WS Q50
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta

Appendix C FEMA Floodplain Map

tional Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

0 1000 2000 FEET

METERS

NFIP

PANEL 5820H

FIRM

FLOOD INSURANCE RATE MAP

SAN BERNARDINO COUNTY, CALIFORNIA AND INCORPORATED AREAS

PANEL 5820 OF 9400

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
APPLE VALLEY, TOWN OF	060752	5820	H
SAN BERNARDINO COUNTY	060270	5820	H
VICTORVILLE, CITY OF	065068	5820	H

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06071C5820H

MAP REVISED
AUGUST 28, 2008

Federal Emergency Management Agency

NATIONAL FLOOD INSURANCE PROGRAM

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

tional Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

0 1000 2000 FEET

METERS

JOINS PANEL 5820

6780000 FT

6785000 FT

117°15'00"

34°30'00"

San Bernardino County
Unincorporated Areas
060270

Town of
Apple Valley
060752

ZONE A

ZONE X

ZONE X

ZONE A

ZONE X

ZONE X

ZONE X

WARNING: This area is shown as being protected from the 1-percent-annual-chance or greater flood hazard by levee, dike, or other structure that has been provisionally accredited. For explanation, see the Notes to Users.

WARNING: Provisionally Accredited Levee. For explanation, see the Notes to Users.

WARNING: Provisionally Accredited Levee. For explanation, see the Notes to Users.

WARNING: Provisionally Accredited Levee. For explanation, see the

$^{38}17^{000m}$N

$^{38}16^{000m}$N

$^{38}15^{000m}$N

RAILROAD

RANCHO BONITA ROAD

SPRING VALLEY PARKWAY

SEAGULL DRIVE

TROUT LANE

BONITO COURT

ROAD

HAVASU

Levee

Mojave River

VISTA POINT DRIVE

COUNTRY CLUB DRIVE

ROLLING RIDGE DRIVE

RIDGECREST ROAD

TAMARISK ROAD

SAGE HEN ROAD

PEBBLE BEACH DRIVE

RAIN SHADOW ROAD

KNOLLWOOD COURT

KALIN RANCH DRIVE

PINEHURST TERRACE

APPALOOSA ROAD

SHETLAND ROAD

SAN BERNARDINO COUNTY

CITY OF VICTORVILLE

HUERTA ROAD

TOWN OF APPLE VALLEY

SAN BERNARDINO COUNTY

CITY OF VICTORVILLE

TOWN OF APPLE VALLEY

25

26

35

36

EV1414

Y COINCIDENT
ATE LIMITS

410

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 6485H

FIRM

FLOOD INSURANCE RATE MAP

SAN BERNARDINO
COUNTY,
CALIFORNIA
AND INCORPORATED AREAS
PANEL 6485 OF 9400

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
APPLE VALLEY, TOWN OF	060752	6485	H
HESPERIA, CITY OF	060733	6485	H
SAN BERNARDINO COUNTY	060270	6485	H
VICTORVILLE, CITY OF	065068	6485	H

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06071C6485H

MAP REVISED
AUGUST 28, 2008

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Appendix D Project Photos

Photo 1. Yucca Loma Road, Terminus at the Mojave River

Source: Google Earth Street View

Photo 2. Yates Road, Terminus at the Mojave River

Source: Google Earth Street View

Photo 3. Mojave River, River Channel

Photo 4. Mojave River, Debris and Vegetation at the bank