FUSCOE ENGINEERING

HYDRAULIC STUDY & NO-RISE

BELLA MAR

PREPARED FOR

RED TAIL ACQUISITIONS, LLC
2082 MICHELSON DRIVE, 4TH FLOOR
IRVINE, CA 92612

FUSCOE ENGINEERING, INC
6390 GREENWICH DR. STE 170
SAN DIEGO, CA 92122

PROJECT MANAGER:
BRYAN D. SMITH , P.E.

DATE PREPARED: DECEMBER 2019
FEI# 1621-001-01

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HYDRAULIC STUDY & NO-RISE CERTIFICATION
BELLA MAR APARTMENTS
PTS 631240

December 19,2019

Prepared Under the Responsible Charge of:

REGISTERED PROFESSIONAL ENGINEER
BRYAN D. SMITH
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EXP. 06/30/ 20
CIVIL
STATE OF CALIFORNIA

Bryan D. Smith, P.E. RCE 75822 EXP: 06-30-20

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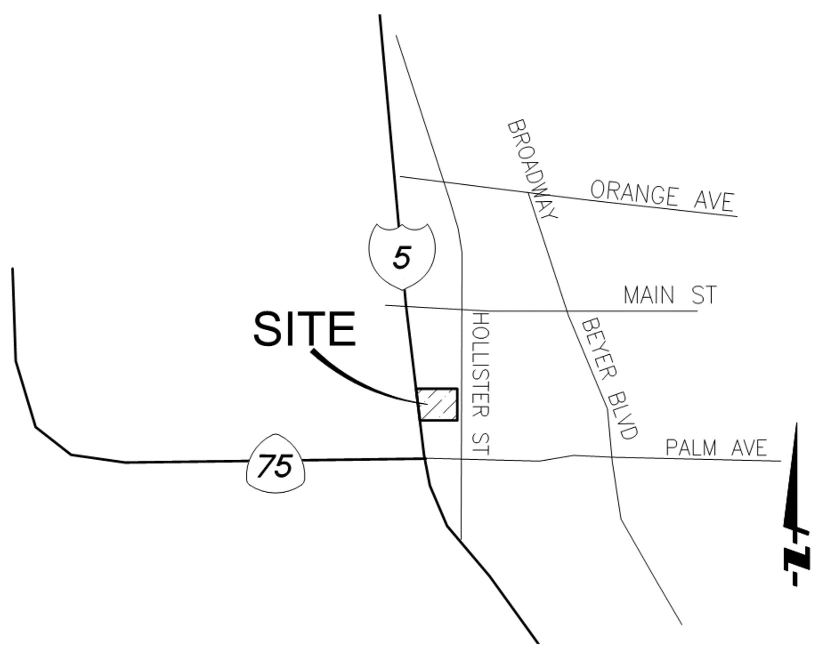
APPENDICES

INTRODUCTION

The project proposes entitlements for a residential (RM-2-5) development with 380 units over 15 buildings with associated recreation facilities, parking, and infrastructure over a 14.6 acre parcel located at 408 Hollister Street in San Diego, CA (APN 627-100-09). The project also includes modifications to Hollister Street to widen the road to a two-lane collector along the project frontage. The site is bordered by Hollister Street to the east, Interstate 5 to the west, Otay River to the north, and an existing driving range to the south. See vicinity map below for reference.



VICINITY MAP
NO SCALE

The existing project site is vacant and covered by light vegetation with mild slopes averaging less than 1%. The Otay River runs east to west, north of the northern property boundary. The development site is located entirely outside of the floodway, but within the 100-year flood fringe of the Otay River. Fill will be placed over the project site within the fringe to raise the proposed building floor elevations 2 feet above the Base Flood Elevation (BFE) of the river. No fill or grading is proposed within the regulatory floodway. This Hydraulic Study will show that the project will meet the City of San Diego and FEMA requirements for development within the flood fringe and will not alter the Base Flood Elevations (BFE) or expand the flood zone.

REGULATORY GUIDANCE DOCUMENTS

The site is located within a 100-year FEMA flood fringe (Zone AE), and is outside of the floodway (FIRM Number 06073C2154H), thus it must comply with the flood fringe regulations from both the City of San Diego *Municipal Code* and FEMA's *Code of Federal Regulations*. In the City's *Municipal Code* Chapter 14, Article 3, Division 1 (See Appendix A), the following development regulations are to be met:

- *Municipal Code Section 143.0145(f) "Flood Fringe. The applicable development regulations are those in the underlying zone, subject to the following supplemental regulations:*
  (1) Within the flood fringe of a Special Flood Hazard Area, permanent structures and fill for permanent structures, roads, and other development are allowed only if the following conditions are met:

  > *(A) The development or fill will not significantly adversely affect existing sensitive biological resources on-site or off-site;*
  > *(B) The development is capable of withstanding flooding and does not require or cause the construction of off-site flood protective works including artificial flood channels, revetments, and levees nor will it cause adverse impacts related to flooding of properties located upstream or downstream, nor will it increase or expand a (FIRM) Zone A; San Diego Municipal Code Chapter 14: General Regulations (9-2019) Ch. Art. Div. 14 3 1 37*
  > *(C) Grading and filling are limited to the minimum amount necessary to accommodate the proposed development, harm to the environmental values of the floodplain is minimized including peak flow storage capacity, and wetlands hydrology is maintained;*
  > *(D) The development neither significantly increases nor contributes to downstream bank erosion and sedimentation nor causes an increase in flood flow velocities or volume; and*
  > *(E) There will be no significant adverse water quality impacts to downstream wetlands, lagoons or other sensitive biological resources, and the development is in compliance with the requirements and regulations of the National Pollution Discharge Elimination System, as implemented by the City of San Diego.*
  > *(F) The design of the development incorporates the findings and recommendations of both a site specific and coastal watershed hydrologic study.*

  (2) All development that involves fill, channelization, or other alteration of a Special Flood Hazard Area is subject to the requirements for channelization in Section 143.0145(e)(5) and with FEMA regulations.

The proposed development meets the above criteria as shown in this analysis and in the environmental document prepared for the project. The hydraulic analysis results included in the appendix demonstrate that the project does not require or cause any rise in the water surface elevations, expand a FIRM Zone A, cause channelization, or contribute to downstream bank erosion.

HYDRAULIC ANALYSIS

Utilizing the HEC-RAS software, a hydraulic analysis was performed over the portion of the Otay River adjacent to the project site. Hardcopy HEC-2 output data was received from FEMA (December 1977) and was used as the basis for the existing conditions effective model. This effective model was used to run the existing conditions analysis and was created by importing the FEMA HEC-2 hardcopy data into HEC-RAS, because HEC-2 is a legacy program no longer provided by the Hydrologic Engineering Center. The effective model re-run results were compared to HEC-2 hardcopy results, the FIS, and the FIRM effective May 2016 (See Appendix B). Along the project limits, the results of the re-run achieved water surface elevations within 0.13ft of the hardcopy data, FIS study, and FIRM as shown in Table 1, page 5. Upstream of the project, at Section 'J', our re-run elevation was within 0.51ft of the hardcopy and remained constant from existing to proposed condition.

Cross-sections 'F' 'G', 'H', 'I', and 'J' were analyzed which correspond with the FEMA HEC-2 hardcopy cross-sections 107, 108, 109, 110, and 112. Section 107 was taken as the downstream limit of analysis (upstream side of the I-5 bridge) because the cross section will not be altered from the existing hardcopy model, which includes a blocked obstruction over the project limits. A Manning's factor of 0.045 was used in the portion of the channel adjacent to the site to model the natural stream. The 100-year flowrate for the Otay River was given as 22,000cfs in the FEMA HEC-2 Hardcopy data as well as the FIS Effective May 2016. All HEC-RAS results for the project are shown in Appendix E.

The geodetic datum of the Bella Mar project is NAVD88, where the data we received from FEMA is on NGVD29, resulting in a 2.2ft decrease from NAVD88 to NGVD29. The analysis in this report was done using NGVD29 to be consistent with the hardcopy FEMA data, however, the site topography and proposed grades on the Working Map (Appendix 'G') are shown in NAVD88.

EXISTING CONDITION

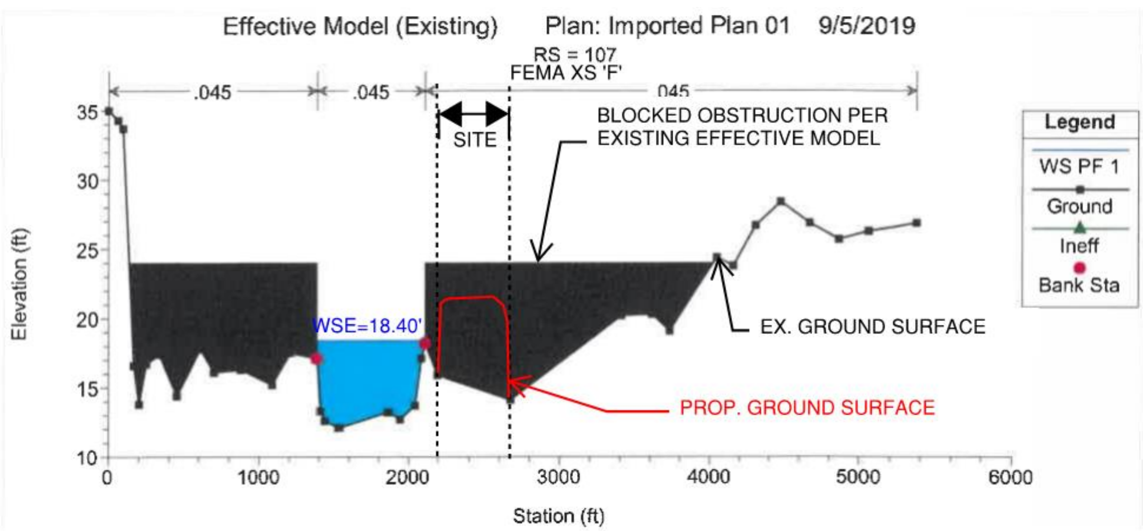
The Effective HEC-RAS Model was adapted from the FEMA HEC-2 hardcopy data dated December 1977, as electronic data from FEMA or the City of San Diego could not be obtained. The model's boundary conditions were set downstream at FIRM cross-section 'F' (FEMA HEC-2 hardcopy data cross-sections107). The FEMA 100-year Water Surface Elevations were held at the downstream edge condition at 18.4ft (NGVD29).

The analysis was bounded downstream at section 'F' because the project site falls within the area of a blocked obstruction in the effective model implying that any development of the site will not influence the water surface elevation. This blocked obstruction is present at sections 'F', 'G', and 'H', which presents itself as a station coupled with an elevation in the X3 line in the HEC-2 output data (See Appendix C). Per the HEC-2 manual, the X3 data lines specifies segments of the channel in which flow isn't being modelled due to an obstruction or ineffective flow areas. Although there is no topographical obstruction present at those specified sections of the channel, the obstruction is in place to model the contraction of the channel due to the presence of the bridge downstream of section 'F'. The results of the existing condition model are included in Appendix E and Table 1, on page 5.

PROPOSED CONDITION

The existing conditions model was revised to show the proposed grading conditions of the project per the Tentative Parcel Map. The site will be raised with fill to achieve building floor elevations a minimum of 2' above the 100-year flood elevation. The ground elevations were edited in the 'F', 'G', and 'H' cross-sections to reflect the proposed grading. The proposed grading occurs in an area which was modeled as a blocked obstruction in the existing effective model as shown in Figure 1 below. This indicates that a change in ground elevations in these areas will not have any impact to the water surface elevation. See Appendix E for all existing and proposed cross-sections which include similar blocked obstructions for all cross sections adjacent to the project.

Figure 1-
Comparison of Existing (black) and Proposed (red) ground surface at cross-section 'F'



The HEC-RAS analysis results confirm that no change in water surface elevation will occur as a result of the project. Table 1 shows the water surface elevation comparison between the FEMA hardcopy HEC-2 data, the Effective Existing Conditions model, and the Proposed Conditions model. The Effective Existing Conditions model matches the HEC-2 output data closely, within 0.51ft. The proposed conditions match the existing effective model exactly.

Table 1 – Summary of Findings

Cross-Sections		100-Year Water Surface Elevations, feet (Datum NGVD29)		
FIS Report	FEMA HEC-2	Existing Conditions (HEC-2 hardcopy)	Existing Conditions Re-run (HEC-RAS)	Proposed Conditions (HEC-RAS)
Downstream of Analysis				
F	107	18.40	18.40	18.40
G	108	21.80	21.93	21.93
H	109	23.50	23.59	23.59
I	110	25.80	25.82	25.82
Bridge (HEC-2 XS 111)				
J	112	26.70	26.19	26.19
Upstream of Analysis				

CONCLUSION

The site is located within a 100-year FEMA defined flood fringe and outside of the floodway (FIRM Number 06073C2154H) and will comply with flood fringe regulations from both the City of San Diego *Municipal Code* and FEMA's *Code of Federal Regulations*. Based on the HEC-RAS analyses in Appendix E, and as illustrated in Table 1, there will be no change in velocities or water surface elevation from existing to proposed conditions. The existing conditions effective model does not account for any flow occurring in the areas of the blocked obstructions, therefore the development or placement of fill within the blocked obstruction areas will not impact the carrying capacity or water surface elevations of the river. A No-Rise Certification has been included as Appendix 'A' to certify that there will be no impact to the 100-year flood elevation, floodway elevation, or floodway width.

APPENDIX A

NO-RISE CERTIFICATION

PRELIMINARY "NO-RISE" CERTIFICATION

This is to certify that I am a duly qualified registered professional engineer licensed to practice in the State of California.

It is further to certify that the attached preliminary technical data supports the fact that proposed development Bella Mar Apartments, within the designated flood fringe delineated on either the County of San Diego Floodplain Maps or FEMA FIRMs, will not impact the 100-year flood elevations, floodway elevations, or floodway widths on the Otay River at published sections in the Flood Insurance Study for Otay Nestor dated May 2016, and will not impact the 100-year flood elevations, floodway elevations, or floodway widths at unpublished cross-sections in the vicinity of the proposed development.

Name of attached Study, Report or Analyses:

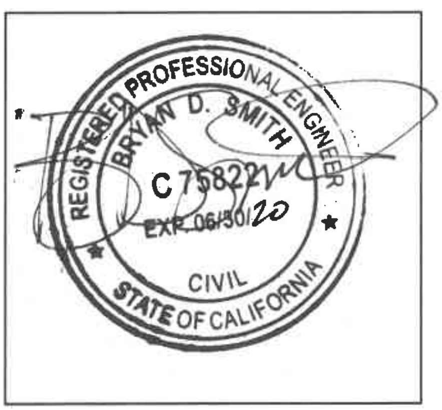
Hydraulic Study and No-Rise Report

Date of attached Study, Report or Analyses:

December 16, 2019

Date: December 16, 2019

Name: Bryan D. Smith, PE



Place signed seal here.

APPENDIX B

EXCERPTS FROM SAN DIEGO MUNICIPAL CODE

(D) All artificial channels shall consist of natural bottoms and sides and shall be designed and sized to accommodate existing and proposed riparian vegetation and other natural or proposed constraints. Where maintenance is proposed or required to keep vegetation at existing levels compatible with the design capacity of the channel, a responsible party shall be identified and a maintenance and monitoring process shall be established to the satisfaction of the City Engineer.

(6) *Development* shall not significantly adversely affect existing *sensitive biological resources* on-site or off-site.

(7) Within the Coastal Overlay Zone, no *structure* or portion thereof shall be erected, constructed, converted, established, altered or enlarged, or no landform alteration *grading*, placement or removal of vegetation, except that related to a historic and ongoing agricultural operation, or land division shall be permitted, provided:

(A) Parking lots, new roadways and roadway expansions shall be allowed only where indicated on an adopted *Local Coastal Program land use plan.*

(B) *Floodway* encroachments for utility and transportation crossings shall be offset by improvements or modifications to enable the passage of the *base flood*, in accordance with the FEMA standards and regulations provided in Section 143.0146.

(f) *Flood Fringe*. The applicable development regulations are those in the underlying zone, subject to the following supplemental regulations:

(1) Within the *flood fringe* of a *Special Flood Hazard Area*, permanent *structures* and *fill* for permanent *structures*, roads, and other *development* are allowed only if the following conditions are met:

(A) The *development* or *fill* will not significantly adversely affect existing *sensitive biological resources* on-site or off-site;

(B) The *development* is capable of withstanding *flooding* and does not require or cause the construction of off-site *flood* protective works including artificial *flood* channels, revetments, and levees nor will it cause adverse impacts related to *flooding* of properties located upstream or downstream, nor will it increase or expand a *(FIRM)* Zone A;

(C) *Grading* and *filling* are limited to the minimum amount necessary to accommodate the proposed *development*, harm to the environmental values of the floodplain is minimized including peak flow storage capacity, and *wetlands* hydrology is maintained;

(D) The *development* neither significantly increases nor contributes to downstream bank erosion and sedimentation nor causes an increase in *flood* flow velocities or volume; and

(E) There will be no significant adverse water quality impacts to downstream wetlands, lagoons or other *sensitive biological resources*, and the *development* is in compliance with the requirements and regulations of the National Pollution Discharge Elimination System, as implemented by the City of San Diego.

(F) The design of the *development* incorporates the findings and recommendations of both a site specific and coastal watershed hydrologic study.

(2) All *development* that involves *fill*, *channelization*, or other alteration of a *Special Flood Hazard Area* is subject to the requirements for *channelization* in Section 143.0145(e)(5) and with FEMA regulations.

(Amended 4-22-2002 by O-19051 N.S.; effective 10-8-2002.)
(Amended 11-13-08 by O-19805 N.S; effective 12-13-2008.)

§143.0146 Supplemental Regulations for Special Flood Hazard Areas

All proposed *development* within a *Special Flood Hazard Area* is subject to the following requirements and all other applicable requirements and regulations of FEMA.

(a) *Development* and Permit Review

(1) Where *base flood elevation* data has not been provided by the *Flood Insurance Study,* the City Engineer shall obtain, review, and utilize *base flood elevation* and *floodway* data available from federal or state sources, or require submittal of such data from the *applicant*. The City Engineer shall make interpretations, where needed, as to the location of the boundaries of the areas of the *Special Flood Hazard Area*, based on the best available engineering or scientific information.

(2) Proposed *development* in a *Special Flood Hazard Area* shall not adversely affect the *flood* carrying capacity of areas where *base flood elevations* have been determined but the *floodway* has not been designated. "Adversely affect" as used in this section means that the cumulative effect of the proposed *development*, when combined with all other existing and anticipated *development*, will not increase the water surface elevation of the *base flood* more than one foot at any point.

(3) In all cases where a watercourse is to be altered the City Engineer shall do the following:

(A) Notify affected, adjacent communities and the California Department of Water Resources of any proposed alteration or relocation of a watercourse and submit evidence of the notice to the Federal Insurance Administration;

(B) Require that the *flood* carrying capacity of the altered or relocated portion of the watercourse is maintained; and

(C) Secure and maintain for public inspection and availability the *certifications*, appeals, and variances required by these regulations.

(4) The *applicant* shall grant a flowage easement to the City for that portion of the property within a *floodway*.

(5) Appropriate agreements shall be secured between the *applicant* and the City to assure participation by the *applicant* or any successor in interest in financing of future *flood* control works.

(6) *Development* in a *Special Flood Hazard Area* shall not increase or expand a *FIRM* Zone A.

(7) In all *floodways*, any *encroachment*, including *fill*, new construction, significant modifications, and other *development* is prohibited unless *certification* by a registered professional engineer is provided demonstrating that *encroachments* will not result in any increase in *flood* levels during the occurrence of the *base flood* discharge except as allowed under Code of Federal Regulations Title 44, Chapter 1, Part 60.3(c)(13).

(b) Standards for *Subdivisions*

(1) All preliminary *subdivision* proposals shall identify the *Special Flood Hazard Area* and the elevation of the *base flood*.

(2) All final *subdivision maps* shall provide the elevation of proposed *structures* and pads. If the site is *filled* above the *base flood elevation*, the *lowest floor*, including *basement*, shall be certified to be 2 feet above the *base flood elevation* by a registered professional engineer or surveyor, and the *certification* shall be provided to the City Engineer.

(3) All *subdivisions* shall be designed to minimize *flood* damage.

(4) All *subdivisions* shall have public utilities and facilities such as sewer, gas, electrical, and water systems located and constructed to minimize *flood* damage.

(5) All *subdivisions* shall provide adequate drainage to reduce exposure to *flood* hazards.

(6) The final map shall bear the notation "Subject to Inundation" for those portions of the property with a *grade* lower than 2 feet above the *base flood elevation*.

(c) Standards of Construction

In all *Special Flood Hazard Areas*, the following standards apply for all *development*.

(1) All permitted, permanent *structures* and other significant improvements shall be anchored to prevent flotation, collapse, or lateral movement resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy.

(2) All permitted permanent *structures* and other significant improvements shall be constructed with materials and utility equipment resistant to *flood* damage.

(3) Construction methods and practices that minimize *flood* damage shall be used.

(4) All electrical, heating, ventilation, plumbing, and air conditioning equipment and other service facilities shall be designed and located to prevent water from entering or accumulating within the equipment components during conditions of *flooding*.

(5) *Breakaway walls* shall be certified by a registered engineer or architect to meet all applicable FEMA requirements. The *certification* shall be provided to the City Engineer before final inspection approval.

(6) New construction or *substantial improvement* of any *structure* shall have the *lowest floor*, including *basement*, elevated at least 2 feet above the *base flood elevation*. Upon completion of the *development*, the elevation of the *lowest floor*, including *basement*, shall be certified by a registered professional engineer or surveyor to be properly elevated. The *certification* shall be provided to the City Engineer before final inspection approval. The City Engineer reserves the right to require a preliminary *certification* before foundation inspection approval.

(7) New construction or *substantial improvement* of any *structure* in *FIRM* Zone AH or AO shall have the *lowest floor*, including *basement*, elevated above the highest adjacent *grade* at least 2 feet higher than the depth number specified on the *FIRM*, or at least 4 feet if no depth number is specified. Upon the completion of the *structure* the elevation of the *lowest floor*, including *basement*, shall be certified by a registered professional engineer or surveyor, to be properly elevated. The *certification* shall be provided to the City Engineer before final inspection approval. The City Engineer may require a preliminary *certification* before foundation inspection approval.

(8) Permitted nonresidential construction shall either be elevated as required by Section 143.0146(c)(6) or (7) or, together with attendant utility and sanitary facilities, meet the flood proofing requirements of FEMA. *Certification* by a registered professional engineer or architect that such requirements are met shall be provided to the City Engineer before final inspection approval. The City Engineer may require a preliminary *certification* before foundation inspection approval.

(9) Fully enclosed areas below the *lowest floor* that are subject to *flooding* shall be certified by a registered professional engineer or architect that they comply with the flood proofing requirements of FEMA. The *certification* shall be provided to the City Engineer before final inspection approval.

APPENDIX C

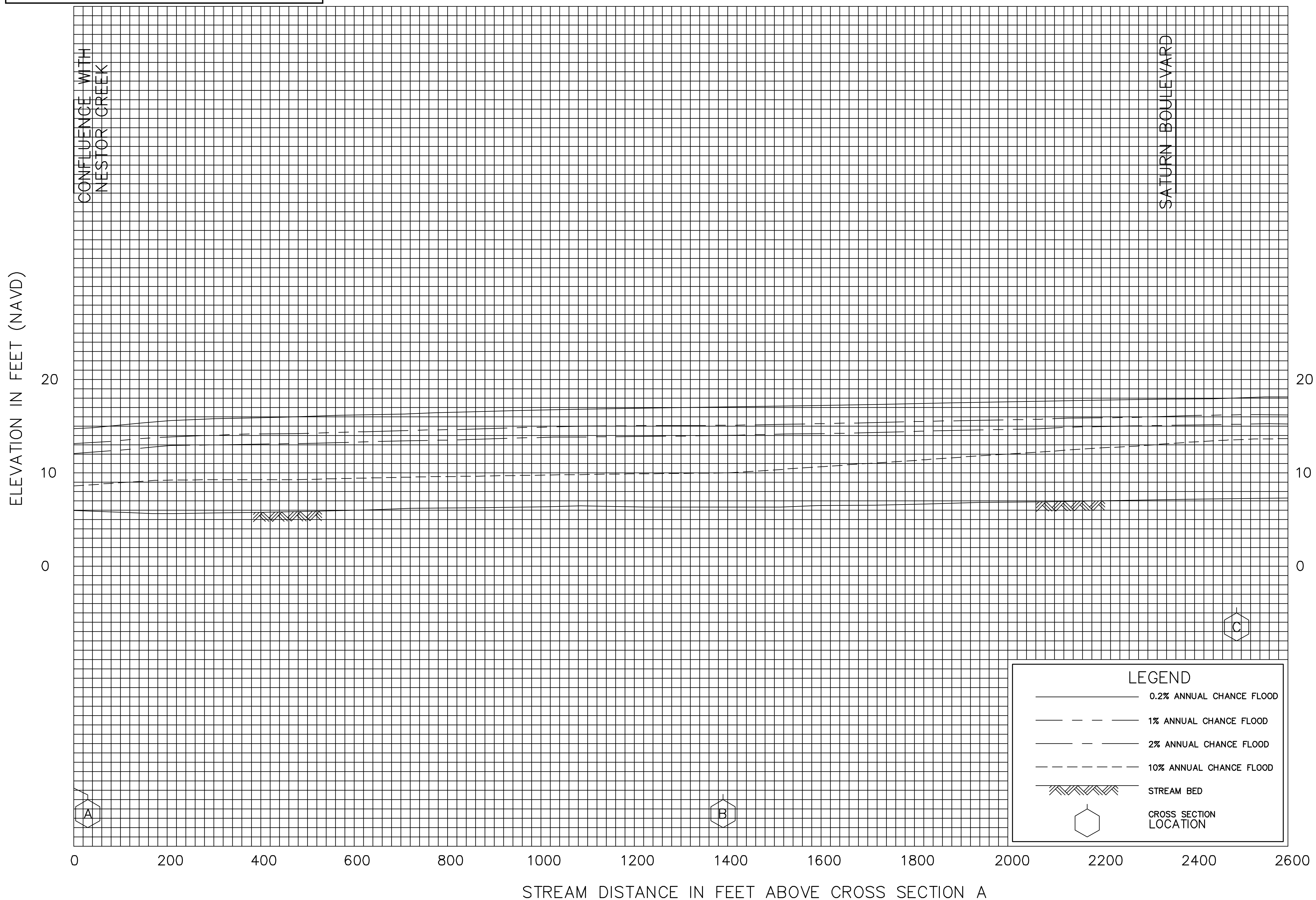
EXCERPTS FROM FEMA FLOOD INSURANCE STUDY

Table 4. Summary of Discharges (Cont'd)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs) 10-Year	50-Year	100-Year	500-Year
Nestor Creek					
At Palm Avenue	2.75	--[1]	--[1]	1,093	--[1]
At 19th Street	--[1]	--[1]	--[1]	864[2]	--[1]
At Elm Avenue	2.45	--[1]	--[1]	796[2]	--[1]
At Coronado Avenue	2.33	--[1]	--[1]	698[2]	--[1]
At Hollister Street	1.99	--[1]	--[1]	496[2]	--[1]
At 25th Street/Interstate 5	1.71	--[1]	--[1]	456[2]	--[1]
At San Diego and Arizona Eastern Railroad	1.40	515	800	945	2,155
North Branch Poway Creek					
At Sycamore Canyon Road	4.5	650	2,000	3,000	7,200
North Tributary to Santa Maria Creek					
At Mouth	1.6	100	600	1,100	2,900
Olive Creek					
At Mouth	1.0	--[1]	--[1]	1,370	--[1]
Otay River					
At Otay Valley Road	122.7	1,200	12,000	22,000	50,000
Pala Mesa Creek					
Approximately 265 Feet Upstream of Interstate Highway 15	2.1	--[1]	--[1]	1,700	--[1]
Pauma Creek					
At Apex of Alluvial Fan	14.7	1,550	6,270	10,480	30,460
Pilgrim Creek					
Upstream End of Oceanside Golf Course	14.0	--[1]	--[1]	5,775	--[1]
Downstream End of Oceanside Golf Course	14.0	--[1]	--[1]	1,440	
Just Upstream of the Confluence with Windmill Creek	15.8	--[1]	--[1]	2,020	--[1]
At Mouth	19.0	--[1]	--[1]	2,810	--[1]
Poggi Canyon Creek					
At City of Chula Vista Corporate Limit	3.74	180	830	1,280	2,470
At Confluence with Otay River	4.63	220	930	1,400	2,630

[1]Data Not Available
[2]Decrease Due to Construction of "Lot 6 Detention Basin" Upstream of Railroad

From Flood Insurance Report 6073VC008D



FLOOD PROFILES

OTAY RIVER

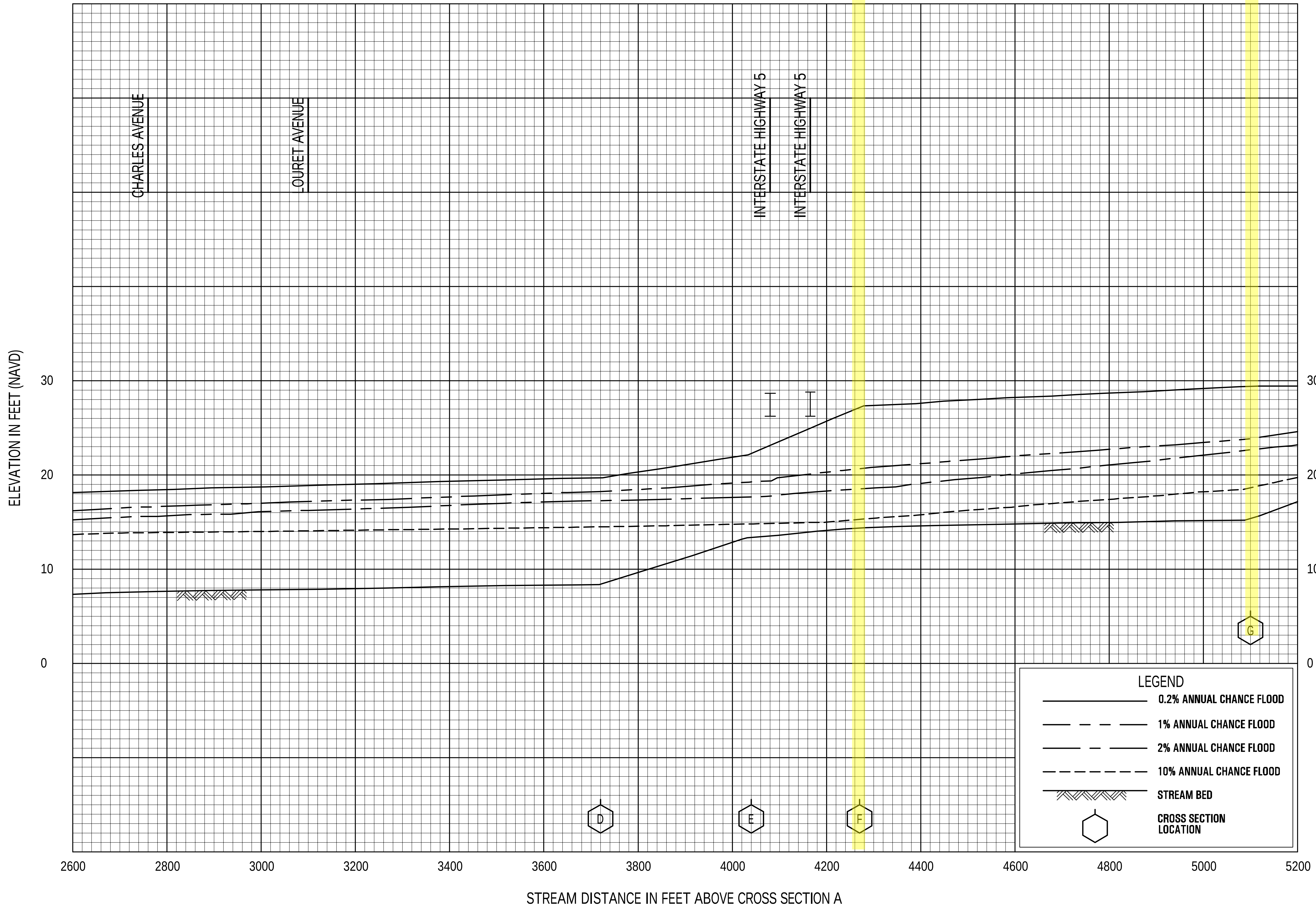
FEDERAL EMERGENCY MANAGEMENT AGENCY

SAN DIEGO COUNTY, CA

(AND INCORPORATED AREAS)

258AP

From Flood Insurance Report 6073VC008D



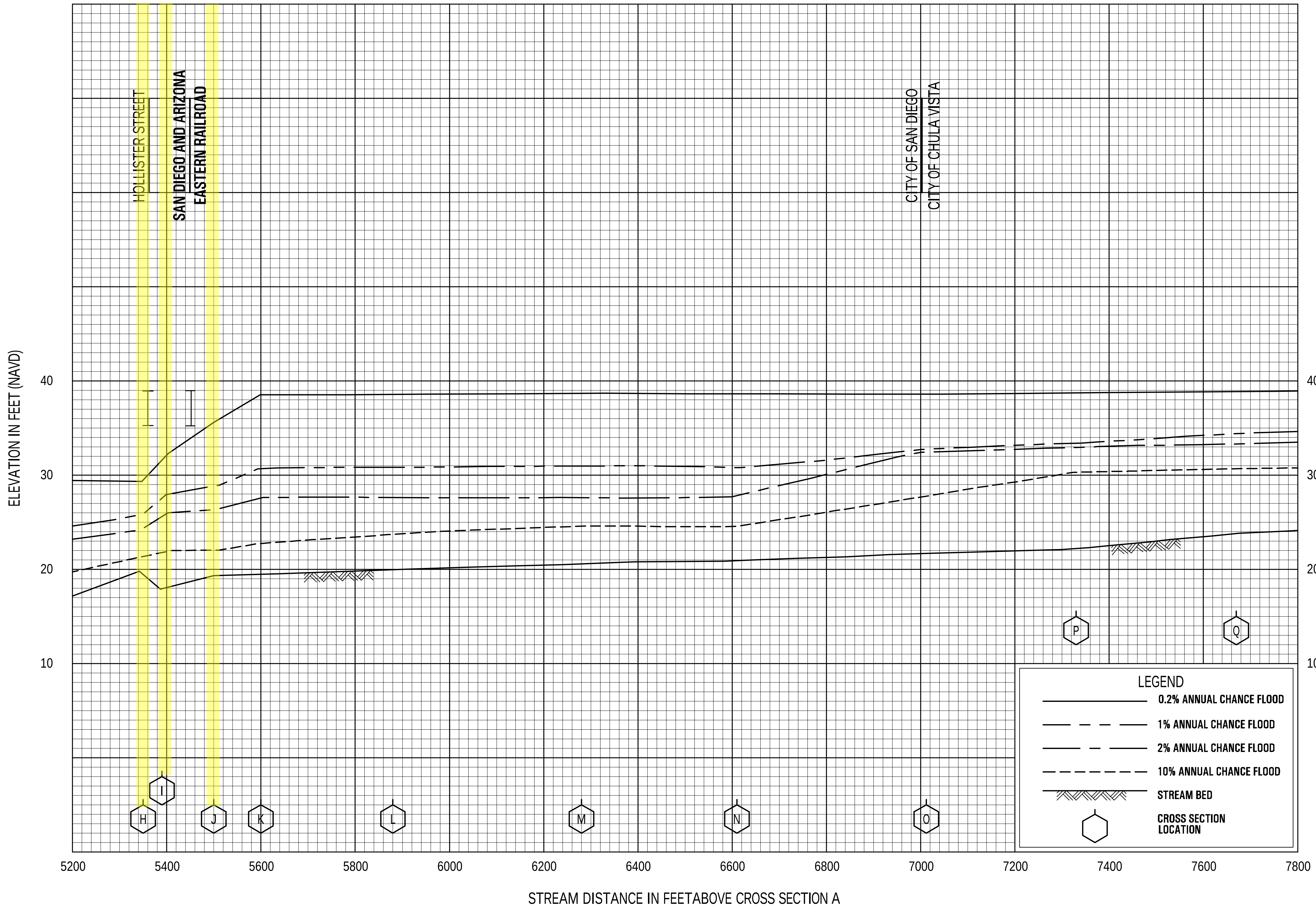
FLOOD PROFILES

OTAY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

SAN DIEGO COUNTY, CA
(AND INCORPORATED AREAS)

259AP



FLOOD PROFILES

OTAY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

SAN DIEGO COUNTY, CA
(AND INCORPORATED AREAS)

From Flood Insurance Report 6073VC004D

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Otay River								
A	0	2,533	4,688	4.7	13.2	13.2	13.2	0.0
B	1,390	2,110	9,474	2.3	15.2	15.2	16.1	0.9
C	2,490	2,300	4,084	5.4	16.3	16.3	16.8	0.5
D	3,720	1,662	7,917	2.8	18.2	18.2	18.9	0.7
E	4,040	642	1,928	11.4	19.3	19.3	19.4	0.1
F	4,270	722	3,819	5.8	20.6	20.6	20.6	0.0
G	5,100	641	2,883	7.6	24.0	24.0	24.0	0.0
H	5,350	360	1,767	12.4	25.7	25.7	25.7	0.0
I	5,390	320	2,711	8.1	28.0	28.0	28.0	0.0
J	5,500	304	2,359	9.3	28.9	28.9	28.9	0.0
K	5,600	440	4,010	5.5	30.8	30.8	30.8	0.0
L	5,880	740	4,511	4.9	30.8	30.8	30.9	0.1
M	6,280	1,020	7,451	2.9	30.9	30.9	31.5	0.6
N	6,610	1,225	7,933	2.8	30.9	30.9	31.7	0.8
O	7,012	1,243	4,824	4.6	32.8	32.8	32.9	0.1
P	7,330	1,035	3,833	5.7	33.3	33.3	33.8	0.5
Q	7,670	1,204	6,208	3.5	34.3	34.3	35.3	1.0
R	8,780	451	3,132	7.0	36.4	36.4	37.3	0.9
S	8,875	432	2,553	8.6	36.6	36.6	37.6	1.0
T	9,525	1,060	7,231	3.0	39.7	39.7	39.9	0.2
U	10,375	1,110	9,424	2.3	40.1	40.1	40.3	0.2
V	11,275	935	8,841	2.5	40.3	40.3	40.5	0.2
W	11,825	917	8,300	2.6	40.3	40.3	40.6	0.3
X	12,085	670	6,494	3.4	40.4	40.4	40.7	0.3
Y	12,395	403	1,798	12.2	42.9	42.9	42.9	0.0
Z	12,579	476	3,279	6.8	45.4	45.4	45.4	0.0

[1] Feet above Cross Section A

TABLE 13

FEDERAL EMERGENCY MANAGEMENT AGENCY
SAN DIEGO COUNTY, CA
AND INCORPORATED AREAS

FLOODWAY DATA

OTAY RIVER

APPENDIX D

EXCERPTS FROM THE FEMA HARDCOPY HEC-2 DATA

GR	10.000	2931.000	5.400	2989.000	5.700	3182.000	5.700	3330.000	5.400	3433.000
GR	12.400	3458.000	15.500	3470.000	10.000	3490.000	5.200	3543.000	4.200	3560.000
GR	8.000	3575.000	13.000	3610.000	18.500	3640.000	0.000	0.000	0.000	0.000
ET	103.000	0.000	4.100	2330.000	4497.000	0.000	0.000	0.000	0.000	0.000
X1	103.000	45.000	4403.000	4496.000	280.000	420.000	330.000	0.000	0.000	0.000
GR	25.000	0.000	23.100	97.000	20.700	166.000	20.200	250.000	17.800	412.000
GR	17.200	431.000	17.600	477.000	14.800	499.000	14.300	544.000	15.000	662.000
GR	14.000	849.000	8.200	864.000	12.400	882.000	10.900	1146.000	11.900	1322.000
GR	12.200	1601.000	11.300	1827.000	11.800	2122.000	12.100	2386.000	11.800	2491.000
GR	11.700	2794.000	11.800	2988.000	13.300	3153.000	16.600	3167.000	16.200	3184.000
GR	9.400	3205.000	8.900	3287.000	8.600	3434.000	8.900	3558.000	9.200	3651.000
GR	8.300	3714.000	15.300	3742.000	6.800	3771.000	6.600	3895.000	6.800	4054.000
GR	7.200	4170.000	5.900	4265.000	6.100	4372.000	15.500	4403.000	5.700	4441.000
GR	7.100	4464.000	6.300	4496.000	19.300	4527.000	19.600	4545.000	19.600	4559.000
NC	0.000	0.000	0.000	0.400	0.500	0.000	0.000	0.000	0.000	0.000
ET	104.000	0.000	4.100	3575.000	5875.000	0.000	0.000	0.000	0.000	0.000
X1	104.000	62.000	5087.000	5137.000	660.000	1400.000	1100.000	0.000	0.000	0.000
GR	30.000	0.000	29.500	118.000	29.500	262.000	26.200	293.000	22.900	460.000
GR	19.600	618.000	17.500	640.000	16.800	683.000	19.100	710.000	19.300	762.000
GR	16.000	808.000	11.300	947.000	10.800	1003.000	14.600	1107.000	14.600	1320.000
GR	14.300	1516.000	8.800	1524.000	13.300	1555.000	14.500	1695.000	13.900	1755.000
GR	13.100	1775.000	14.500	1834.000	13.300	1894.000	14.700	2025.000	16.500	2236.000
GR	16.400	2312.000	15.300	2391.000	15.800	2464.000	14.600	2535.000	14.700	2599.000
GR	14.400	2679.000	13.800	2885.000	13.600	3028.000	13.900	3181.000	13.500	3366.000
GR	12.700	3643.000	14.700	3795.000	14.600	3866.000	13.700	3989.000	15.000	4076.000
GR	14.700	4187.000	14.600	4352.000	14.900	4510.000	13.400	4536.000	13.500	4616.000
GR	12.500	4787.000	12.900	4827.000	12.400	4928.000	12.300	5087.000	5.200	5110.000
GR	11.100	5137.000	11.200	5267.000	11.200	5388.000	11.300	5576.000	12.000	5750.000
GR	11.100	5821.000	12.100	5937.000	13.000	6034.000	12.700	6102.000	11.500	6211.000
GR	9.000	6217.000	41.600	6307.000	0.000	0.000	0.000	0.000	0.000	0.000
ET	104.100	0.000	4.100	1080.000	2842.000	0.000	0.000	0.000	0.000	0.000
X1	104.100	46.000	1323.000	1520.000	1270.000	1020.000	1230.000	0.000	0.000	0.000
X3	10.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	23.000	0.000	18.200	20.000	18.000	55.000	15.200	95.000	14.700	190.000
GR	14.600	330.000	14.600	510.000	14.800	615.000	14.800	630.000	13.700	648.000
GR	13.500	700.000	14.000	800.000	14.200	940.000	12.900	995.000	13.800	1058.000
GR	14.700	1100.000	10.000	1180.000	10.000	1190.000	10.000	1285.000	10.000	1305.000
GR	10.200	1323.000	9.600	1348.000	6.600	1418.000	6.200	1478.000	10.000	1520.000
GR	12.800	1562.000	13.500	1660.000	12.700	1807.000	11.300	1900.000	14.500	1930.000
GR	14.500	1960.000	13.700	1970.000	13.500	2150.000	13.500	2400.000	13.000	2550.000
GR	12.000	2715.000	12.000	2885.000	12.000	2905.000	10.500	2925.000	13.300	2965.000
GR	12.000	3105.000	14.200	3218.000	10.200	3230.000	10.200	3240.000	30.000	3272.000
GR	41.600	3310.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ET	0.000	0.000	4.100	6384.000	7026.000	0.000	0.000	0.000	0.000	0.000
X1	105.000	38.000	6384.000	7025.000	400.000	230.000	320.000	0.000	0.000	0.000
X3	10.000	0.000	0.000	0.000	0.000	0.000	0.000	23.500	23.000	0.000
GR	28.700	3076.000	31.800	3199.000	37.200	3347.000	24.200	3473.000	21.900	3651.000
GR	21.600	3655.000	18.400	3383.000	16.100	4151.000	13.700	4356.000	12.900	4603.000
GR	15.700	4909.000	17.400	5161.000	20.400	5448.000	21.900	5651.000	21.800	5388.000
GR	22.100	5963.000	20.500	6206.000	18.000	6384.000	11.800	6411.000	11.500	6506.000
GR	16.300	6550.000	18.400	6653.000	17.300	6748.000	13.100	6830.000	11.100	6953.000
GR	11.300	6994.000	13.600	7025.000	14.500	7140.000	15.000	7286.000	14.200	7446.000
GR	13.600	7626.000	12.900	7788.000	12.800	7976.000	13.100	8107.000	15.500	8195.000
GR	16.000	8392.000	16.000	8404.000	43.600	8468.000	0.000	0.000	0.000	0.000
SB	0.900	1.400	2.500	0.000	461.000	76.000	5148.000	1.500	11.900	11.400
ET	107.000	0.000	4.100	1388.000	2111.000	0.000	0.000	0.000	0.000	0.000
X1	107.000	37.000	1388.000	2110.000	230.000	230.000	230.000	0.000	0.000	0.000
X2	0.000	1.000	24.000	20.000	3.000	0.000	0.000	0.000	0.000	0.000
X3	10.000	0.000	0.000	1388.000	24.000	2110.000	24.000	0.000	0.000	0.000
BT	33.000	155.000	20.000	0.000	203.000	20.000	0.000	251.000	20.000	0.000
ET	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	22.000	0.000	[illegible]

B.O.* @107

*BLOCKED OBSTRUCTION

BT	22.200	0.000	877.000	22.500	0.000	1089.000	24.500	0.000	1211.000	24.500
BT	0.000	1388.000	26.000	0.000	1388.000	26.000	23.500	1410.000	26.000	23.700
BT	1440.000	26.200	13.800	1529.000	26.500	24.000	1540.000	26.500	24.000	1540.000
BT	26.500	12.100	1860.000	26.600	13.200	1860.000	26.600	24.000	1871.000	26.600
BT	24.000	1942.000	26.600	24.000	2043.000	26.500	24.000	2085.000	26.600	24.000
BT	2110.000	26.500	24.000	2110.000	26.500	0.000	2161.000	26.400	0.000	2676.000
BT	23.800	0.000	3414.000	22.000	0.000	3614.000	22.200	0.000	3734.000	23.400
BT	0.000	4052.000	25.800	0.000	4162.000	26.000	0.000	4314.000	26.700	0.000
GR	35.000	0.000	34.300	63.000	33.700	96.000	16.600	168.000	13.800	203.000
GR	16.700	251.000	17.400	334.000	14.400	453.000	17.800	613.000	16.100	703.000
GR	16.300	877.000	15.200	1089.000	17.500	1211.000	17.100	1388.000	13.300	1410.000
GR	12.600	1440.000	12.100	1529.000	12.100	1540.000	13.200	1860.000	13.200	1871.000
GR	12.700	1942.000	13.700	2043.000	17.100	2085.000	18.200	2110.000	15.900	2161.000
GR	14.100	2676.000	20.200	3414.000	20.300	3614.000	19.100	3734.000	24.400	4052.000
GR	23.800	4162.000	26.700	4314.000	28.400	4483.000	26.900	4676.000	25.700	4872.000
GR	26.300	5063.000	26.900	5380.000	0.000	0.000	0.000	0.000	0.000	0.000
NC	0.045	0.045	0.045	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ET	108.000	0.000	4.100	2650.000	3310.000	0.000	0.000	0.000	0.000	0.000

B.O.* @ 108?

X1	108.000	74.000	2665.000	3182.000	780.000	1100.000	830.000	0.000	0.000	0.000
X3	0.000	0.000	0.000	2550.000	0.000	3310.000	0.000	0.000	0.000	0.000
GR	40.300	0.000	41.500	161.000	42.200	341.000	41.800	439.000	39.500	570.000
GR	39.000	628.000	40.000	463.000	40.000	695.000	38.800	647.000	37.700	983.000
GR	37.500	1027.000	39.100	1172.000	40.700	1249.000	39.800	1322.000	40.100	1383.000
GR	21.400	1423.000	20.200	1510.000	18.800	1650.000	17.800	1810.000	17.500	2000.000
GR	18.200	2063.000	19.000	2184.000	19.100	2301.000	20.500	2368.000	20.300	2484.000
GR	21.100	2516.000	18.700	2528.000	20.400	2542.000	20.900	2665.000	19.300	2683.000
GR	13.000	2722.000	13.000	2761.000	13.000	2837.000	16.700	2899.000	15.000	2914.000
GR	21.100	2949.000	16.700	2979.000	18.400	3043.000	19.400	3141.000	22.900	3182.000
GR	19.200	3200.000	21.700	3217.000	18.500	3243.000	20.300	3260.000	15.500	3263.000
GR	15.600	3266.000	20.100	3273.000	18.700	3284.000	18.500	3318.000	19.900	3330.000
GR	19.500	3415.000	18.700	3552.000	18.700	3608.000	20.100	3639.000	21.200	3690.000
GR	19.200	3779.000	19.600	3892.000	19.800	3969.000	20.200	4060.000	20.500	4179.000
GR	20.600	4303.000	21.200	4447.000	21.400	4595.000	21.900	4654.000	21.500	4708.000
GR	20.000	4727.000	22.300	4879.000	22.900	4992.000	24.200	5095.000	26.800	5187.000
GR	31.900	5207.000	30.900	5221.000	35.100	5315.000	40.000	5387.000	0.000	0.000
ET	0.000	0.000	4.100	2735.000	3095.000	0.000	0.000	0.000	0.000	0.000

*BLOCKED OBSTRUCTION

B.O.* @ 109?

X1	109.000	36.000	2852.000	3017.000	250.000	250.000	250.000	0.000	0.000	0.000
X3	10.000	0.000	0.000	2735.000	0.000	3095.000	0.000	0.000	0.000	109.000
GR	42.200	0.000	42.600	195.000	42.300	347.000	40.900	528.000	40.700	625.000
GR	40.200	838.000	38.800	1036.000	37.000	1177.000	36.100	1317.000	34.100	1474.000
GR	28.400	1709.000	20.700	1848.000	19.500	2000.000	19.400	2225.000	20.200	2448.000
GR	21.700	2578.000	20.800	2665.000	17.600	2852.000	18.700	3017.000	22.000	3137.000
GR	22.300	3248.000	22.000	3393.000	22.400	3554.000	22.100	3715.000	21.800	3863.000
GR	23.000	3997.000	22.400	4192.000	22.600	4362.000	23.300	4515.000	24.200	4618.000
GR	24.700	4758.000	25.800	4922.000	28.600	5067.000	34.100	5228.000	39.900	5369.000
GR	45.000	5530.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ET	110.000	0.000	4.100	2700.000	3025.000	0.000	0.000	0.000	0.000	0.000

No B.O.*

X1	110.000	47.000	2700.000	3020.000	40.000	40.000	40.000	0.000	0.000	0.000
X3	10.000	0.000	0.000	0.000	0.000	0.000	0.000	33.000	40.000	0.000
GR	41.700	0.000	42.800	111.000	43.500	282.000	43.700	446.000	44.100	582.000
GR	42.300	737.000	42.100	954.000	41.200	1139.000	41.000	1362.000	40.500	1528.000
GR	38.700	1571.000	38.800	1582.000	40.800	1603.000	39.300	1702.000	33.600	1739.000
GR	27.300	1827.000	25.300	2000.000	21.400	2145.000	20.600	2305.000	21.500	2500.000
GR	21.400	2624.000	20.100	2700.000	17.800	2777.000	15.800	2834.000	16.800	2902.000
GR	16.300	2944.000	18.900	3020.000	20.600	3112.000	20.600	3213.000	20.400	3355.000
GR	21.900	3513.000	21.800	3577.000	20.600	3656.000	21.400	3757.000	21.000	3893.000
GR	21.000	4026.000	20.500	4178.000	21.000	4308.000	21.800	4450.000	21.300	4521.000
GR	23.800	4585.000	23.600	4633.000	24.300	4758.000	25.400	4904.000	30.700	5088.000
GR	36.100	5244.000	45.000	5501.000	0.000	0.000	0.000	0.000	0.000	0.000
SB	0.900	1.250	3.000	0.000	335.000	100.000	4620.000	1.000	17.000	17.000
ET	112.000	0.000	4.100	2736.000	3050.000	0.000	0.000	0.000	0.000	0.000
X1	112.000	58.000	2736.000	3040.000	110.000	110.000	110.000	0.000	0.000	0.000

X2	0.000	0.000	1.000	33.500	36.000	0.000	0.000	0.000	0.000	0.000
X3	10.000	0.000	0.000	0.000	0.000	0.000	0.000	41.000	43.000	0.000
BT	12.000	1763.000	37.500	0.000	2078.000	36.600	0.000	2146.000	36.500	0.000
BT	2736.000	36.000	0.000	2736.000	36.000	33.000	3040.000	36.500	33.500	3040.000
BT	36.500	0.000	4565.000	42.500	0.000	4565.000	42.500	39.500	4650.000	43.000
BT	40.000	4650.000	43.000	0.000	5407.000	44.500	0.000	0.000	0.000	0.000
GR	42.290	0.000	43.200	127.000	44.700	238.000	44.900	356.000	46.300	495.000
GR	46.200	577.000	46.200	601.000	44.700	682.000	40.500	819.000	40.300	944.000
GR	40.200	1108.000	40.700	1275.000	41.300	1434.000	41.700	1598.000	41.400	1727.000
GR	40.600	1763.000	22.900	1802.000	19.500	1885.000	18.200	2000.000	17.600	2078.000
GR	18.000	2146.000	16.700	2224.000	18.900	2294.000	21.000	2350.000	20.500	2432.000
GR	19.200	2517.000	19.500	2578.000	18.100	2651.000	19.400	2677.000	17.100	2736.000
GR	18.500	2772.000	17.500	2872.000	20.700	2955.000	18.700	2988.000	21.700	3012.000
GR	21.100	3040.000	22.000	3102.000	21.700	3178.000	20.000	3272.000	22.600	3310.000
GR	21.900	3422.000	21.700	3500.000	22.300	3600.000	22.300	3690.000	21.900	3796.000
GR	21.400	3957.000	20.900	4150.000	21.300	4331.000	22.400	4565.000	23.200	4650.000
GR	23.800	4712.000	26.500	4881.000	33.300	5140.000	35.800	5233.000	37.700	5286.000
GR	44.500	5407.000	44.600	5510.000	45.400	5541.000	45.000	5621.000	0.000	0.000
ET	113.000	0.000	4.100	1990.000	2430.000	0.000	0.000	0.000	0.000	0.000
X1	113.000	65.000	2219.000	2404.000	100.000	100.000	100.000	0.000	0.000	0.000
X3	10.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	50.300	0.000	47.200	65.000	41.600	184.000	40.200	335.000	40.300	514.000
GR	42.200	685.000	43.000	936.000	42.200	1037.000	43.500	1076.000	19.500	1138.000
GR	18.900	1200.000	18.900	1355.000	19.000	1500.000	19.700	1521.000	19.300	1522.000
GR	23.300	1529.000	17.300	1567.000	17.300	1597.000	17.300	1612.000	17.300	1651.000
GR	17.300	1704.000	17.300	1758.000	17.300	1795.000	17.300	1809.000	17.300	1840.000
GR	23.200	1872.000	19.500	1884.000	18.400	2022.000	19.000	2066.000	18.700	2089.000
GR	17.300	2124.000	21.000	2180.000	21.800	2219.000	17.300	2266.000	17.300	2307.000
GR	18.500	2348.000	20.900	2404.000	21.000	2504.000	21.400	2602.000	21.100	2714.000
GR	20.800	2768.000	23.500	2807.000	21.500	2911.000	22.300	3004.000	22.300	3095.000
GR	26.400	3127.000	21.700	3156.000	21.200	3272.000	21.400	3421.000	21.900	3537.000
GR	22.100	3629.000	21.800	3732.000	23.400	3761.000	24.000	3885.000	24.500	3929.000
GR	24.200	3971.000	26.200	4173.000	30.900	4363.000	33.100	4379.000	33.200	4413.000
GR	36.800	4521.000	38.900	4584.000	43.200	4613.000	46.700	4729.000	50.000	4890.000
ET	113.100	0.000	4.100	710.000	1450.000	0.000	0.000	0.000	0.000	0.000
X1	113.100	41.000	1228.000	1290.000	250.000	280.000	280.000	0.000	0.000	0.000
X3	10.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	30.500	0.000	23.000	40.000	19.000	70.000	19.000	80.000	20.000	282.000
GR	20.400	368.000	20.200	490.000	20.200	510.000	20.000	527.000	17.800	550.000
GR	17.800	663.000	20.000	[illegible]	18.200	760.000	21.500	800.000	21.500	933.000
GR	25.000	950.000	27.000	1052.000	25.300	1161.000	23.500	1213.000	23.500	1228.000
GR	17.800	1240.000	18.700	1290.000	23.000	1397.000	23.700	1545.000	22.400	1596.000
GR	22.000	1700.000	22.500	1840.000	25.000	1980.000	25.200	2041.000	24.000	2106.000
GR	21.800	2238.000	22.400	2351.000	25.300	2467.000	27.200	2605.000	26.000	2640.000
GR	26.300	2680.000	26.300	2808.000	26.300	2860.000	29.500	[illegible]	31.400	2977.000
GR	31.700	3190.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NC	0.000	0.000	0.000	0.100	0.300	0.000	0.000	0.000	0.000	0.000
ET	114.000	0.000	4.100	970.000	1990.000	0.000	0.000	0.000	0.000	0.000
X1	114.000	36.000	1691.000	1785.000	400.000	400.000	400.000	0.000	0.000	0.000
GR	50.000	0.000	48.900	210.000	48.200	352.000	22.900	425.000	22.600	463.000
GR	23.800	717.000	23.800	1061.000	19.800	1098.000	18.900	1145.000	25.000	1197.000
GR	23.500	1317.000	18.700	1347.000	19.200	1446.000	22.600	1528.000	21.500	1617.000
GR	26.000	1660.000	25.300	1691.000	18.400	1732.000	18.400	1738.000	24.200	1764.000
GR	28.600	1785.000	23.000	1814.000	23.000	1851.000	20.500	1874.000	19.700	2045.000
GR	22.400	2067.000	21.700	2242.000	25.900	2257.000	24.300	2505.000	27.900	2817.000
GR	28.400	3127.000	31.100	3424.000	32.100	3753.000	32.600	3836.000	48.100	3867.000
GR	50.000	3959.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ET	115.000	0.000	4.100	545.000	1770.000	0.000	0.000	0.000	0.000	0.000
X1	115.000	31.000	1486.000	1543.000	330.000	330.000	330.000	0.000	0.000	0.000
GR	50.000	0.000	24.400	140.000	25.600	415.000	25.500	747.000	22.400	909.000
GR	23.600	1028.000	20.000	1061.900	20.000	1081.000	24.100	1098.000	25.300	1142.000
GR	18.900	1172.000	18.400	[illegible]	[illegible]	[illegible]	20.200	[illegible]	18.900	1505.000

APPENDIX E

FLOOD INSURANCE RATE MAP (FIRM)

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations (BFEs) shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) Zone 11. The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242** or visit its website at http://www.ngs.noaa.gov/.

Base map information shown on this FIRM was provided in digital format by the USDA National Agriculture Imagery Program (NAIP). this information was photogrammetrically compiled at a scale of 1:24,000 from aerial photography dated 2009.

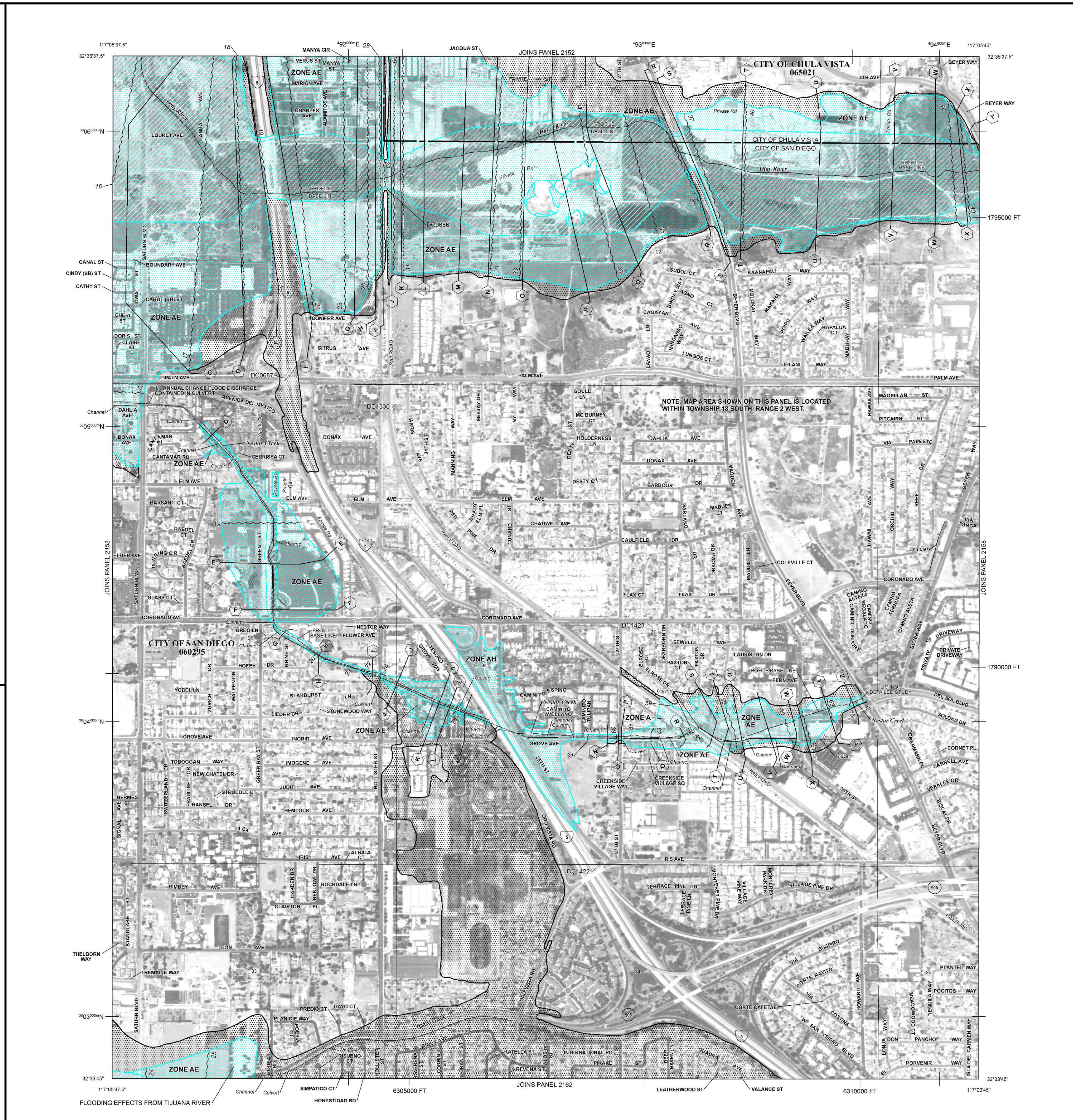
This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables *in the Flood Insurance Study report (which contains authoritative hydraulic data)* may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Map Service Center website or by calling the FEMA Map Information eXchange.

The **"profile base lines"** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the "profile base line", in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Areas to be protected from 1% annual chance flood event by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary
0.2% annual chance floodplain boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities

513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

(A)——(A)	Cross section line
(23)- - - -(23)	Transect line
97°07'30", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
4275000mE	1000-meter Universal Transverse Mercator grid ticks, zone 11
6000000 FT	5000-foot grid values: California State Plane coordinate system, Zone VI (FIPSZONE = 406), Lambert projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
● M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
June 19, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
May 16, 2012 - to update corporate limits, to add roads and road names, to incorporate previously issued Letters of Map Revision, and to update map elevations to North American Vertical Datum of 1988.
April 5, 2016 - to remove Provisionally Accredited Levee note

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 250 500 750 1,000 FEET
150 0 150 300 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2154H

FIRM
FLOOD INSURANCE RATE MAP
SAN DIEGO COUNTY, CALIFORNIA
AND INCORPORATED AREAS

PANEL 2154 OF 2375

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
CHULA VISTA, CITY OF	065021	2154	H
SAN DIEGO, CITY OF	060295	2154	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.

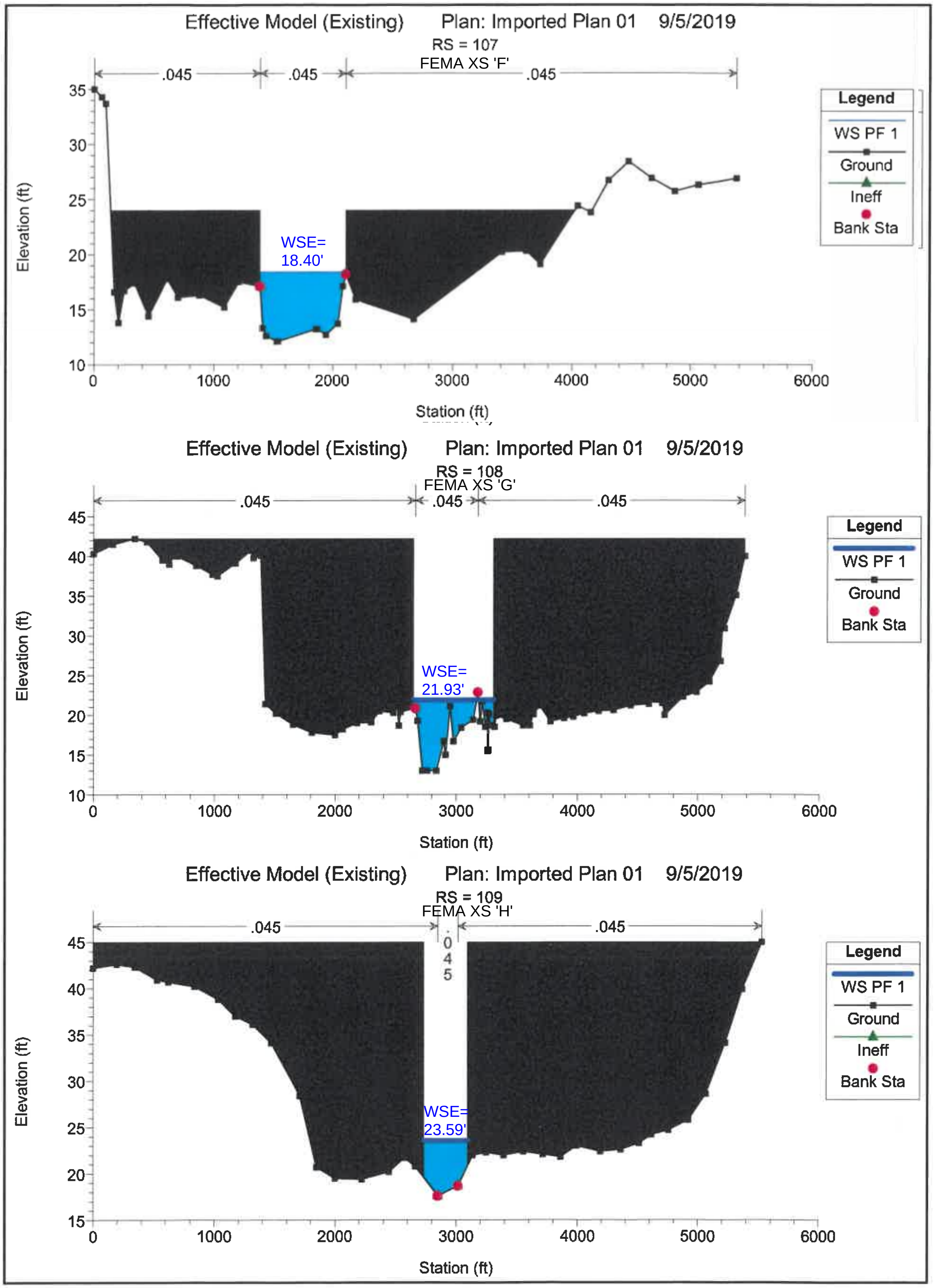
MAP NUMBER
06073C2154H

MAP REVISED
APRIL 5, 2016

Federal Emergency Management Agency

APPENDIX F

HEC-RAS ANALYSIS AND CROSS-SECTIONS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Station (ft)
Legend
WS PF 1
Ground
Ineff
Bank Sta
Effective Model (Existing) Plan: Imported Plan 01 9/5/2019
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.045
.045
WSE=
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Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Effective Model (Existing) Plan: Imported Plan 01 9/5/2019
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WSE=
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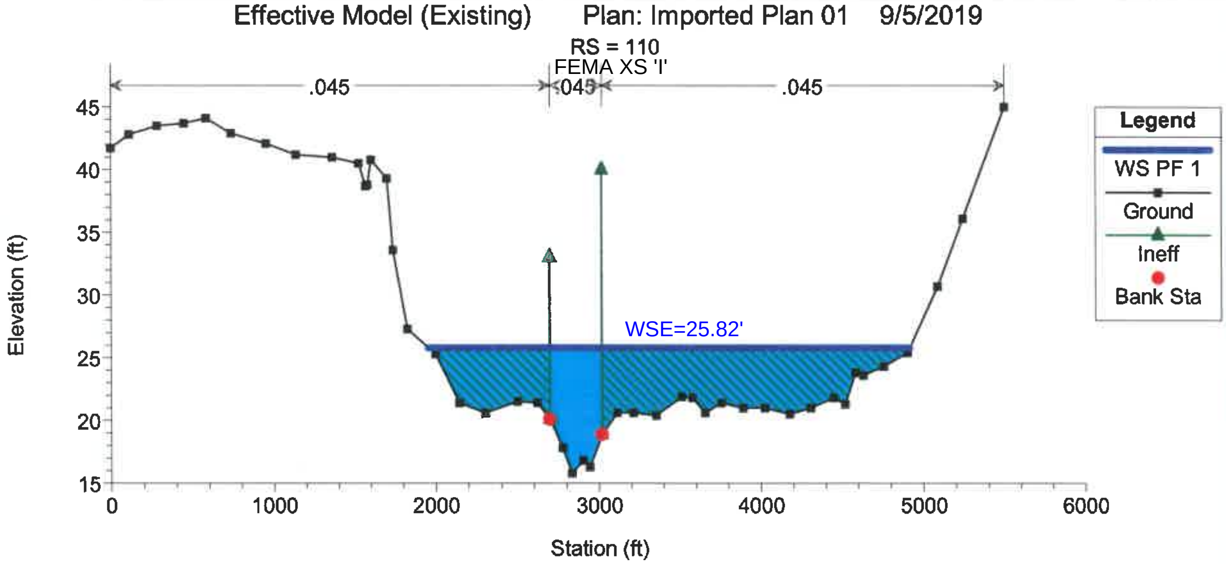
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Ineff
Bank Sta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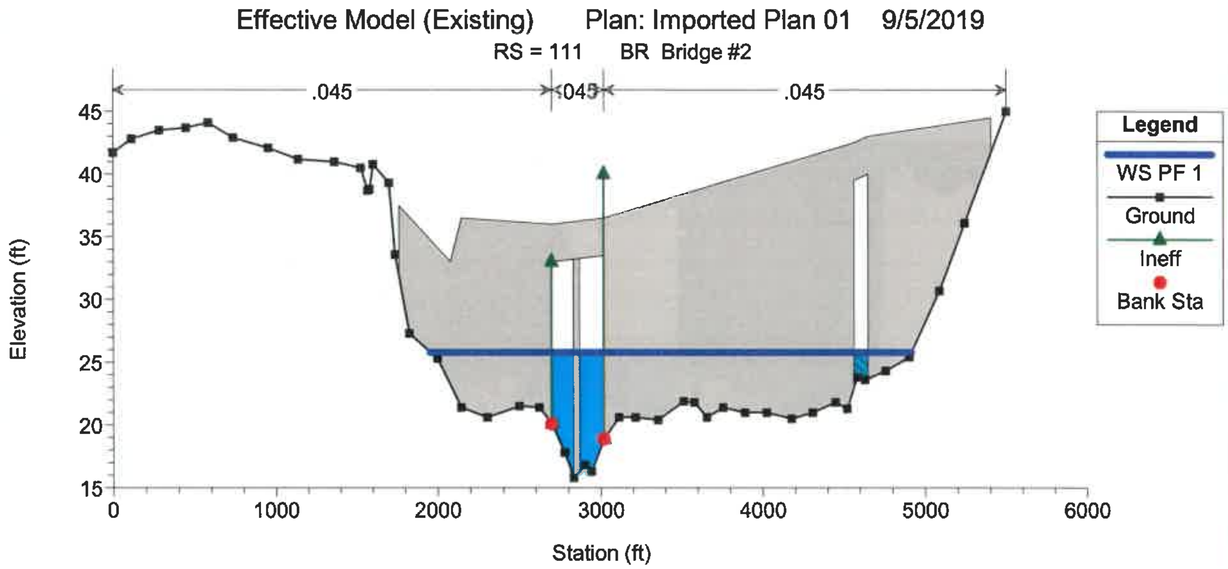
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Ineff
Bank Sta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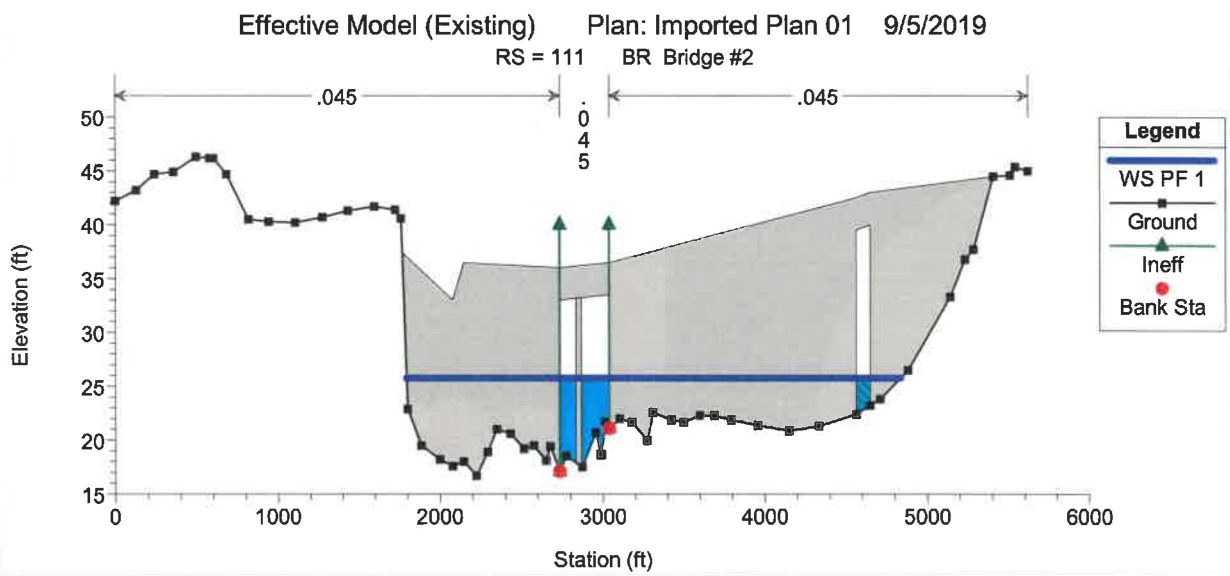
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Ineff
Bank Sta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.045
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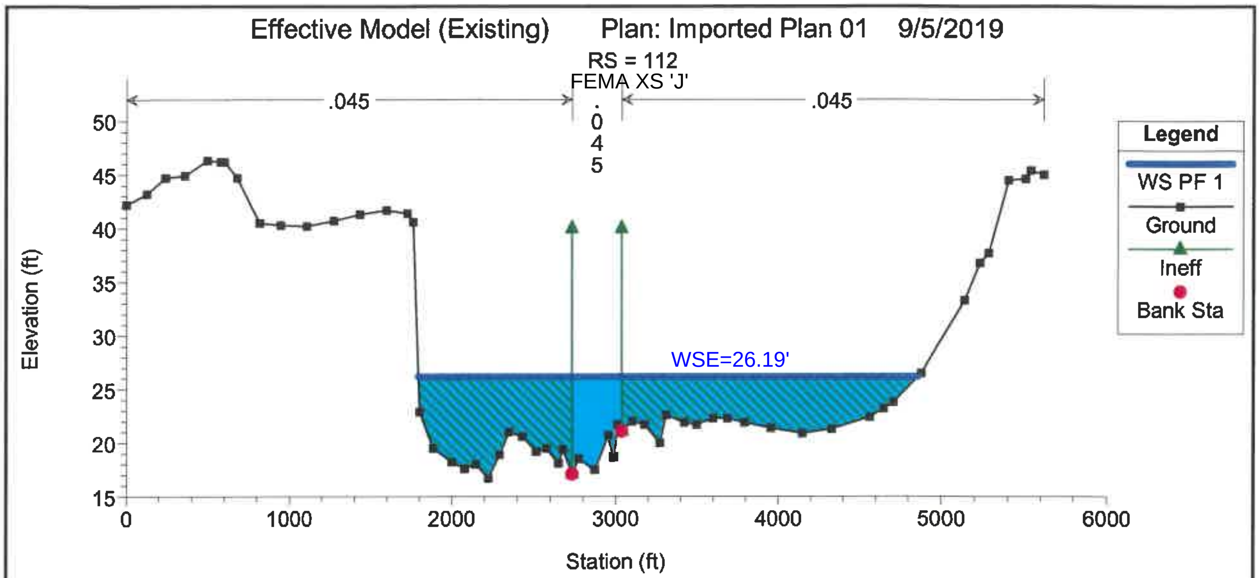
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Ineff
Bank Sta



Effective Model (Existing) Plan: Imported Plan 01 9/5/2019
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FEMA XS 'J'
.045
.045
.045
Elevation (ft)
Station (ft)
WSE=26.19'
Legend
WS PF 1
Ground
Ineff
Bank Sta

EFFECTIVE MODEL (EXISTING)

FEMA XS 'J'

Plan: Imported Pla RIVER-1 Reach-1 RS: 112 Profile: PF 1

E.G. Elev (ft)	27.74	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.55	Wt. n-Val.		0.045	
W.S. Elev (ft)	26.19	Reach Len. (ft)	1.00	1.00	1.00
Crit W.S. (ft)	24.41	Flow Area (sq ft)		2200.91	
E.G. Slope (ft/ft)	0.006553	Area (sq ft)	6706.83	2200.91	7561.97
Q Total (cfs)	22000.00	Flow (cfs)		22000.00	
Top Width (ft)	3066.71	Top Width (ft)	941.24	304.00	1821.46
Vel Total (ft/s)	10.00	Avg. Vel. (ft/s)		10.00	
Max Chl Dpth (ft)	9.49	Hydr. Depth (ft)		7.24	
Conv. Total (cfs)	271773.8	Conv. (cfs)		271773.8	
Length Wtd. (ft)	1.00	Wetted Per. (ft)		304.35	
Min Ch El (ft)	17.10	Shear (lb/sq ft)		2.96	
Alpha	1.00	Stream Power (lb/ft s)		29.57	
Frctn Loss (ft)		Cum Volume (acre-ft)	3.62	78.61	10.16
C & E Loss (ft)		Cum SA (acres)	0.93	14.54	3.30

BRIDGE (UPSTREAM)

Plan: Imported Pla RIVER-1 Reach-1 RS: 111 BR U Profile: PF 1

E.G. Elev (ft)	28.09	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.27	Wt. n-Val.		0.045	
W.S. Elev (ft)	25.82	Reach Len. (ft)	108.00	108.00	108.00
Crit W.S. (ft)	24.99	Flow Area (sq ft)		1820.89	
E.G. Slope (ft/ft)	0.012144	Area (sq ft)		1820.89	256.42
Q Total (cfs)	22000.00	Flow (cfs)		22000.00	
Top Width (ft)	356.00	Top Width (ft)		271.00	85.00
Vel Total (ft/s)	12.08	Avg. Vel. (ft/s)		12.08	
Max Chl Dpth (ft)	8.72	Hydr. Depth (ft)		6.72	
Conv. Total (cfs)	199635.9	Conv. (cfs)		199635.9	
Length Wtd. (ft)	108.00	Wetted Per. (ft)		300.97	
Min Ch El (ft)	17.10	Shear (lb/sq ft)		4.59	
Alpha	1.00	Stream Power (lb/ft s)		55.42	
Frctn Loss (ft)		Cum Volume (acre-ft)	3.54	78.57	10.07
C & E Loss (ft)		Cum SA (acres)	0.92	14.54	3.28

BRIDGE (DOWNSTREAM)

Plan: Imported Pla RIVER-1 Reach-1 RS: 111 BR D Profile: PF 1

E.G. Elev (ft)	27.18	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.36	Wt. n-Val.		0.045	
W.S. Elev (ft)	25.82	Reach Len. (ft)	1.00	1.00	1.00
Crit W.S. (ft)	23.25	Flow Area (sq ft)		2351.47	
E.G. Slope (ft/ft)	0.005531	Area (sq ft)		2351.47	186.63
Q Total (cfs)	22000.00	Flow (cfs)		22000.00	
Top Width (ft)	369.00	Top Width (ft)		284.00	85.00
Vel Total (ft/s)	9.36	Avg. Vel. (ft/s)		9.36	
Max Chl Dpth (ft)	9.95	Hydr. Depth (ft)		8.28	
Conv. Total (cfs)	295819.1	Conv. (cfs)		295819.1	
Length Wtd. (ft)	1.00	Wetted Per. (ft)		316.22	
Min Ch El (ft)	15.87	Shear (lb/sq ft)		2.57	

EFFECTIVE MODEL (EXISTING)

Plan: Imported Pla RIVER-1 Reach-1 RS: 111 BR D Profile: PF 1 (Continued)

Alpha	1.00	Stream Power (lb/ft s)		24.02	
Frctn Loss (ft)		Cum Volume (acre-ft)	3.54	73.39	9.52
C & E Loss (ft)		Cum SA (acres)	0.92	13.85	3.06

FEMA XS 'I'

Plan: Imported Pla RIVER-1 Reach-1 RS: 110 Profile: PF 1

E.G. Elev (ft)	26.85	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.03	Wt. n-Val.		0.045	
W.S. Elev (ft)	25.82	Reach Len. (ft)	40.00	40.00	40.00
Crit W.S. (ft)		Flow Area (sq ft)		2703.50	
E.G. Slope (ft/ft)	0.003531	Area (sq ft)	2995.96	2703.50	7998.03
Q Total (cfs)	22000.00	Flow (cfs)		22000.00	
Top Width (ft)	2963.16	Top Width (ft)	744.70	320.00	1898.47
Vel Total (ft/s)	8.14	Avg. Vel. (ft/s)		8.14	
Max Chl Dpth (ft)	10.02	Hydr. Depth (ft)		8.45	
Conv. Total (cfs)	370210.4	Conv. (cfs)		370210.4	
Length Wtd. (ft)	40.00	Wetted Per. (ft)		320.12	
Min Ch El (ft)	15.80	Shear (lb/sq ft)		1.86	
Alpha	1.00	Stream Power (lb/ft s)		15.15	
Frctn Loss (ft)	0.27	Cum Volume (acre-ft)	3.51	73.34	9.43
C & E Loss (ft)	0.56	Cum SA (acres)	0.91	13.84	3.04

FEMA XS 'H'

Plan: Imported Pla RIVER-1 Reach-1 RS: 109 Profile: PF 1

E.G. Elev (ft)	26.02	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.43	Wt. n-Val.	0.045	0.045	0.045
W.S. Elev (ft)	23.59	Reach Len. (ft)	250.00	250.00	250.00
Crit W.S. (ft)	23.59	Flow Area (sq ft)	583.13	896.79	297.38
E.G. Slope (ft/ft)	0.016769	Area (sq ft)	583.13	896.79	297.38
Q Total (cfs)	22000.00	Flow (cfs)	7114.15	11853.85	3032.00
Top Width (ft)	360.00	Top Width (ft)	117.00	165.00	78.00
Vel Total (ft/s)	12.38	Avg. Vel. (ft/s)	12.20	13.22	10.20
Max Chl Dpth (ft)	5.99	Hydr. Depth (ft)	4.98	5.44	3.81
Conv. Total (cfs)	169889.6	Conv. (cfs)	54937.3	91538.4	23413.9
Length Wtd. (ft)	250.00	Wetted Per. (ft)	121.00	165.00	80.77
Min Ch El (ft)	17.60	Shear (lb/sq ft)	5.05	5.69	3.85
Alpha	1.02	Stream Power (lb/ft s)	61.55	75.21	39.30
Frctn Loss (ft)	2.36	Cum Volume (acre-ft)	1.86	71.68	5.62
C & E Loss (ft)	0.77	Cum SA (acres)	0.51	13.62	2.13

EFFECTIVE MODEL (EXISTING)

FEMA XS 'G'

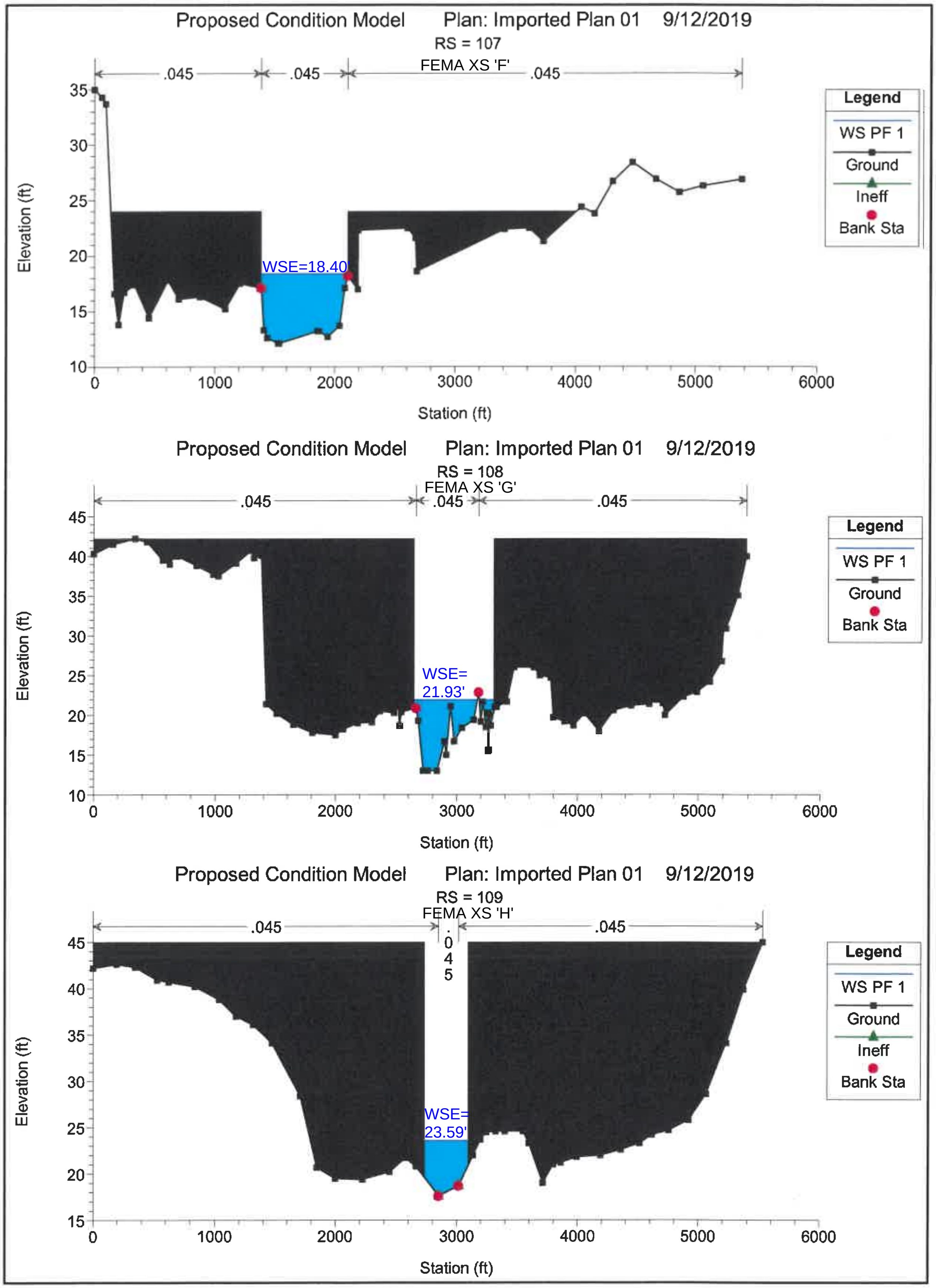
Plan: Imported Pla RIVER-1 Reach-1 RS: 108 Profile: PF 1

E.G. Elev (ft)	22.82	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.89	Wt. n-Val.	0.045	0.045	0.045
W.S. Elev (ft)	21.93	Reach Len. (ft)	780.00	830.00	1100.00
Crit W.S. (ft)	20.46	Flow Area (sq ft)	15.93	2657.77	307.67
E.G. Slope (ft/ft)	0.006038	Area (sq ft)	15.93	2657.77	307.67
Q Total (cfs)	22000.00	Flow (cfs)	40.61	20568.01	1391.38
Top Width (ft)	643.95	Top Width (ft)	15.00	505.66	123.29
Vel Total (ft/s)	7.38	Avg. Vel. (ft/s)	2.55	7.74	4.52
Max Chl Dpth (ft)	8.93	Hydr. Depth (ft)	1.06	5.26	2.50
Conv. Total (cfs)	283113.5	Conv. (cfs)	522.6	264685.5	17905.4
Length Wtd. (ft)	838.49	Wetted Per. (ft)	16.09	507.42	131.50
Min Ch El (ft)	13.00	Shear (lb/sq ft)	0.37	1.97	0.88
Alpha	1.05	Stream Power (lb/ft s)	0.95	15.28	3.99
Frctn Loss (ft)	3.71	Cum Volume (acre-ft)	0.14	61.48	3.88
C & E Loss (ft)	0.18	Cum SA (acres)	0.13	11.70	1.56

FEMA XS 'F'

Plan: Imported Pla RIVER-1 Reach-1 RS: 107 Profile: PF 1

E.G. Elev (ft)	18.92	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.52	Wt. n-Val.		0.045	
W.S. Elev (ft)	18.40	Reach Len. (ft)			
Crit W.S. (ft)	16.08	Flow Area (sq ft)		3795.75	
E.G. Slope (ft/ft)	0.003383	Area (sq ft)		3795.75	
Q Total (cfs)	22000.00	Flow (cfs)		22000.00	
Top Width (ft)	722.00	Top Width (ft)		722.00	
Vel Total (ft/s)	5.80	Avg. Vel. (ft/s)		5.80	
Max Chl Dpth (ft)	6.30	Hydr. Depth (ft)		5.26	
Conv. Total (cfs)	378254.7	Conv. (cfs)		378254.7	
Length Wtd. (ft)		Wetted Per. (ft)		724.01	
Min Ch El (ft)	12.10	Shear (lb/sq ft)		1.11	
Alpha	1.00	Stream Power (lb/ft s)		6.42	
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			



Proposed Condition Model Plan: Imported Plan 01 9/12/2019
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.045
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WSE=18.40'
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Ineff
Bank Sta
Proposed Condition Model Plan: Imported Plan 01 9/12/2019
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.045
.045
WSE=
21.93'
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Proposed Condition Model Plan: Imported Plan 01 9/12/2019
RS = 109
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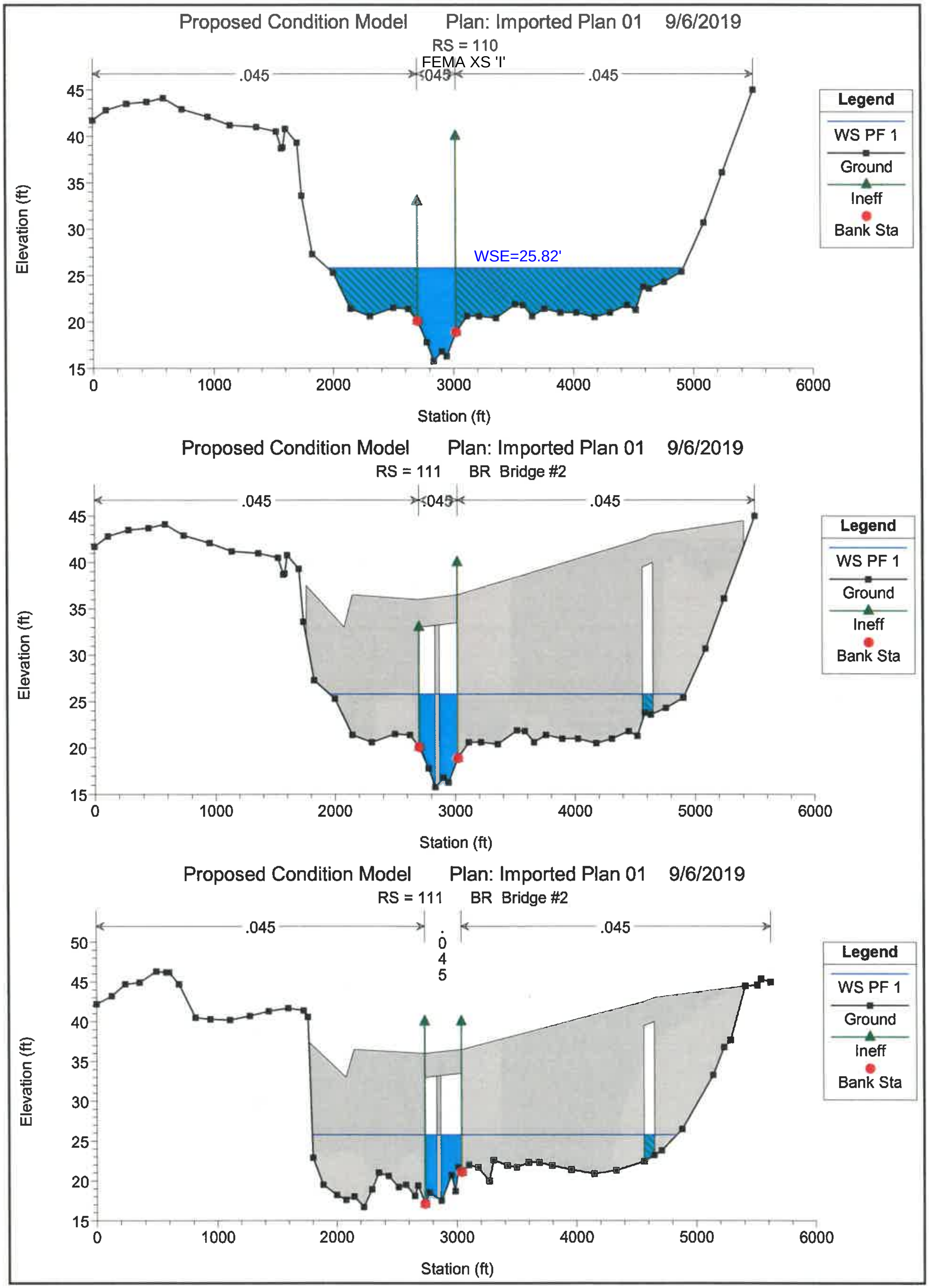
WSE=
23.59'
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Ineff
Bank Sta



Proposed Condition Model Plan: Imported Plan 01 9/6/2019
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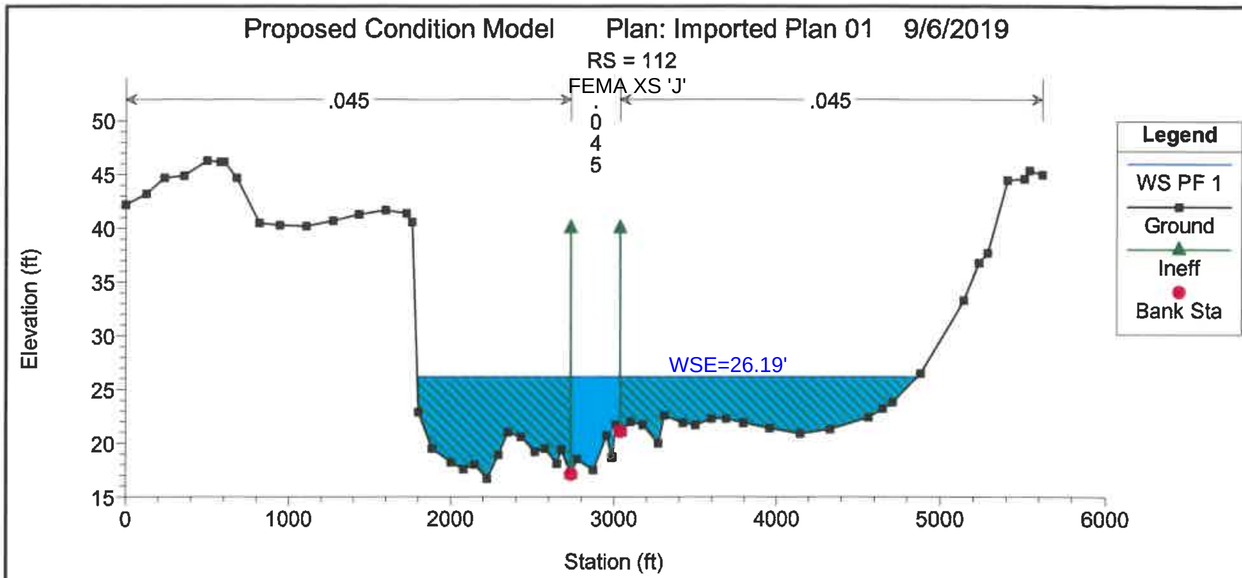
.045
.045
WSE=25.82'
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Ineff
Bank Sta
Proposed Condition Model Plan: Imported Plan 01 9/6/2019
RS = 111 BR Bridge #2
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Ineff
Bank Sta
Proposed Condition Model Plan: Imported Plan 01 9/6/2019
RS = 111 BR Bridge #2
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Ineff
Bank Sta



Proposed Condition Model Plan: Imported Plan 01 9/6/2019
RS = 112
FEMA XS 'J'
.045
.045
.045
WSE=26.19'
Legend
WS PF 1
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
50
45
40
35
30
25
20
15
0
1000
2000
3000
4000
5000
6000

PROPOSED MODEL

FEMA XS 'J'

Plan: Imported Pla RIVER-1 Reach-1 RS: 112 Profile: PF 1

E.G. Elev (ft)	27.74	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.55	Wt. n-Val.		0.045	
W.S. Elev (ft)	26.19	Reach Len. (ft)	1.00	1.00	1.00
Crit W.S. (ft)	24.41	Flow Area (sq ft)		2200.91	
E.G. Slope (ft/ft)	0.006553	Area (sq ft)	6706.83	2200.91	7561.97
Q Total (cfs)	22000.00	Flow (cfs)		22000.00	
Top Width (ft)	3066.71	Top Width (ft)	941.24	304.00	1821.46
Vel Total (ft/s)	10.00	Avg. Vel. (ft/s)		10.00	
Max Chl Dpth (ft)	9.49	Hydr. Depth (ft)		7.24	
Conv. Total (cfs)	271773.9	Conv. (cfs)		271773.9	
Length Wtd. (ft)	1.00	Wetted Per. (ft)		304.35	
Min Ch El (ft)	17.10	Shear (lb/sq ft)		2.96	
Alpha	1.00	Stream Power (lb/ft s)		29.57	
Frctn Loss (ft)		Cum Volume (acre-ft)	3.62	78.65	9.79
C & E Loss (ft)		Cum SA (acres)	0.93	14.55	3.30

BRIDGE (UPSTREAM)

Plan: Imported Pla RIVER-1 Reach-1 RS: 111 BR U Profile: PF 1

E.G. Elev (ft)	28.09	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.27	Wt. n-Val.		0.045	
W.S. Elev (ft)	25.82	Reach Len. (ft)	108.00	108.00	108.00
Crit W.S. (ft)	24.99	Flow Area (sq ft)		1820.89	
E.G. Slope (ft/ft)	0.012144	Area (sq ft)		1820.89	256.42
Q Total (cfs)	22000.00	Flow (cfs)		22000.00	
Top Width (ft)	356.00	Top Width (ft)		271.00	85.00
Vel Total (ft/s)	12.08	Avg. Vel. (ft/s)		12.08	
Max Chl Dpth (ft)	8.72	Hydr. Depth (ft)		6.72	
Conv. Total (cfs)	199636.0	Conv. (cfs)		199636.0	
Length Wtd. (ft)	108.00	Wetted Per. (ft)		300.97	
Min Ch El (ft)	17.10	Shear (lb/sq ft)		4.59	
Alpha	1.00	Stream Power (lb/ft s)		55.42	
Frctn Loss (ft)		Cum Volume (acre-ft)	3.54	78.61	9.70
C & E Loss (ft)		Cum SA (acres)	0.92	14.54	3.28

BRIDGE (DOWNSTREAM)

Plan: Imported Pla RIVER-1 Reach-1 RS: 111 BR D Profile: PF 1

E.G. Elev (ft)	27.18	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.36	Wt. n-Val.		0.045	
W.S. Elev (ft)	25.82	Reach Len. (ft)	1.00	1.00	1.00
Crit W.S. (ft)	23.25	Flow Area (sq ft)		2351.47	
E.G. Slope (ft/ft)	0.005531	Area (sq ft)		2351.47	186.63
Q Total (cfs)	22000.00	Flow (cfs)		22000.00	
Top Width (ft)	369.00	Top Width (ft)		284.00	85.00
Vel Total (ft/s)	9.36	Avg. Vel. (ft/s)		9.36	
Max Chl Dpth (ft)	9.95	Hydr. Depth (ft)		8.28	
Conv. Total (cfs)	295819.3	Conv. (cfs)		295819.3	
Length Wtd. (ft)	1.00	Wetted Per. (ft)		316.22	
Min Ch El (ft)	15.87	Shear (lb/sq ft)		2.57	

PROPOSED MODEL

Plan: Imported Pla RIVER-1 Reach-1 RS: 111 BR D Profile: PF 1 (Continued)

Alpha	1.00	Stream Power (lb/ft s)		24.02	
Frctn Loss (ft)		Cum Volume (acre-ft)	3.54	73.43	9.15
C & E Loss (ft)		Cum SA (acres)	0.92	13.85	3.07

FEMA XS 'I'

Plan: Imported Pla RIVER-1 Reach-1 RS: 110 Profile: PF 1

E.G. Elev (ft)	26.85	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.03	Wt. n-Val.		0.045	
W.S. Elev (ft)	25.82	Reach Len. (ft)	40.00	40.00	40.00
Crit W.S. (ft)		Flow Area (sq ft)		2703.50	
E.G. Slope (ft/ft)	0.003531	Area (sq ft)	2995.96	2703.50	7998.03
Q Total (cfs)	22000.00	Flow (cfs)		22000.00	
Top Width (ft)	2963.17	Top Width (ft)	744.70	320.00	1898.47
Vel Total (ft/s)	8.14	Avg. Vel. (ft/s)		8.14	
Max Chl Dpth (ft)	10.02	Hydr. Depth (ft)		8.45	
Conv. Total (cfs)	370210.5	Conv. (cfs)		370210.5	
Length Wtd. (ft)	40.00	Wetted Per. (ft)		320.12	
Min Ch El (ft)	15.80	Shear (lb/sq ft)		1.86	
Alpha	1.00	Stream Power (lb/ft s)		15.15	
Frctn Loss (ft)	0.27	Cum Volume (acre-ft)	3.51	73.38	9.06
C & E Loss (ft)	0.56	Cum SA (acres)	0.91	13.84	3.04

FEMA XS 'H'

Plan: Imported Pla RIVER-1 Reach-1 RS: 109 Profile: PF 1

E.G. Elev (ft)	26.02	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.43	Wt. n-Val.	0.045	0.045	0.045
W.S. Elev (ft)	23.59	Reach Len. (ft)	250.00	250.00	250.00
Crit W.S. (ft)	23.59	Flow Area (sq ft)	583.13	896.79	297.38
E.G. Slope (ft/ft)	0.016769	Area (sq ft)	583.13	896.79	297.38
Q Total (cfs)	22000.00	Flow (cfs)	7114.15	11853.85	3032.00
Top Width (ft)	360.00	Top Width (ft)	117.00	165.00	78.00
Vel Total (ft/s)	12.38	Avg. Vel. (ft/s)	12.20	13.22	10.20
Max Chl Dpth (ft)	5.99	Hydr. Depth (ft)	4.98	5.44	3.81
Conv. Total (cfs)	169889.6	Conv. (cfs)	54937.3	91538.4	23413.9
Length Wtd. (ft)	250.00	Wetted Per. (ft)	121.00	165.00	80.77
Min Ch El (ft)	17.60	Shear (lb/sq ft)	5.05	5.69	3.85
Alpha	1.02	Stream Power (lb/ft s)	61.55	75.21	39.30
Frctn Loss (ft)	2.38	Cum Volume (acre-ft)	1.86	71.72	5.25
C & E Loss (ft)	0.76	Cum SA (acres)	0.51	13.62	2.13

PROPOSED MODEL

FEMA XS 'G'

Plan: Imported Pla RIVER-1 Reach-1 RS: 108 Profile: PF 1

E.G. Elev (ft)	22.84	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.90	Wt. n-Val.	0.045	0.045	0.045
W.S. Elev (ft)	21.94	Reach Len. (ft)	780.00	830.00	1100.00
Crit W.S. (ft)	20.50	Flow Area (sq ft)	16.03	2660.99	283.61
E.G. Slope (ft/ft)	0.006108	Area (sq ft)	16.03	2660.99	283.61
Q Total (cfs)	22000.00	Flow (cfs)	41.24	20725.67	1233.09
Top Width (ft)	644.05	Top Width (ft)	15.00	505.73	123.32
Vel Total (ft/s)	7.43	Avg. Vel. (ft/s)	2.57	7.79	4.35
Max Chl Dpth (ft)	8.94	Hydr. Depth (ft)	1.07	5.26	2.30
Conv. Total (cfs)	281501.2	Conv. (cfs)	527.7	265195.4	15778.1
Length Wtd. (ft)	837.52	Wetted Per. (ft)	16.10	507.50	129.68
Min Ch El (ft)	13.00	Shear (lb/sq ft)	0.38	2.00	0.83
Alpha	1.05	Stream Power (lb/ft s)	0.98	15.57	3.63
Frctn Loss (ft)	3.73	Cum Volume (acre-ft)	0.14	61.51	3.58
C & E Loss (ft)	0.19	Cum SA (acres)	0.13	11.70	1.56

FEMA XS 'F'

Plan: Imported Pla RIVER-1 Reach-1 RS: 107 Profile: PF 1

E.G. Elev (ft)	18.92	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.52	Wt. n-Val.		0.045	
W.S. Elev (ft)	18.40	Reach Len. (ft)			
Crit W.S. (ft)	16.08	Flow Area (sq ft)		3795.75	
E.G. Slope (ft/ft)	0.003383	Area (sq ft)		3795.75	
Q Total (cfs)	22000.00	Flow (cfs)		22000.00	
Top Width (ft)	722.00	Top Width (ft)		722.00	
Vel Total (ft/s)	5.80	Avg. Vel. (ft/s)		5.80	
Max Chl Dpth (ft)	6.30	Hydr. Depth (ft)		5.26	
Conv. Total (cfs)	378254.7	Conv. (cfs)		378254.7	
Length Wtd. (ft)		Wetted Per. (ft)		724.01	
Min Ch El (ft)	12.10	Shear (lb/sq ft)		1.11	
Alpha	1.00	Stream Power (lb/ft s)		6.42	
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

APPENDIX G

HEC RAS WORK MAP

HEC-RAS WORKING MAP

NOTE: ELEVATIONS SHOWN ON THIS WORKING MAP ARE PER GEODETIC DATUM NAVD88, WHICH IS 2.2' HIGHER THAN THE DATUM USED IN THE REPORT (NGVD29).