Guadalupe Floodplain Delineation Study

Town of Guadalupe, Maricopa County

Technical Data Notebook

Contract Number: FCD 2010C027 Assignment #1

Prepared for:

Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

Prepared by:

WEST Consultants, Inc.
8950 S. 52nd Street, Suite 210
Tempe, Arizona 85284

February 2012

Federal Emergency Management Agency

Washington, D.C. 20472

April 6, 2012

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable Hugh Hallman
Mayor, City of Tempe
P. O. Box 5002
Tempe, AZ 85280

IN REPLY REFER TO:

Case No.:	11-09-3942P
Community Name:	City of Tempe, AZ
Community No.:	040054
Effective Date of This Revision:	**August 10, 2012**

Dear Mayor Hallman:

You were sent a Letter of Map Revision (LOMR) dated March 29, 2012 for your community. Unfortunately, a mistake was discovered in the Summary of Elevations table after the mailing which resulted the corrections to the table and two of the Flood Insurance Rate Map (panels 04013C2165H and 04013C2630G). We have corrected all three documents and re-sending the LOMR with all the attachments for you to replace the LOMR you have received previously. We apologize any inconvenience this might have caused.

Sincerely,

Syed Qayum

Syed Qayum, CFM
National LOMR Technical Manager
Michael Baker Jr., Inc.

List of Enclosures:

- Letter of Map Revision Determination Document
- Annotated Flood Insurance Rate Map
- Annotated Flood Insurance Study Report

cc: (see attached list)

Courtesy Copy List – City of Tempe, AZ

The Honorable Alma Yolanda Solarez
Mayor, Town of Guadalupe

The Honorable Max W. Wilson
Chairman, Maricopa County
Board of Supervisors

Mr. Andy Goh
City Engineer
City of Tempe

Ms. Kathryn Gross
Flood Control District of Maricopa County

Federal Emergency Management Agency

Washington, D.C. 20472

March 29, 2012

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable Hugh Hallman
Mayor, City of Tempe
Post Office Box 5002
Tempe, AZ 85280

IN REPLY REFER TO:

Case No.:	11-09-3942P
Community Name:	City of Tempe, AZ
Community No.:	040054
Effective Date of This Revision:	**August 10, 2012**

Dear Mayor Hallman:

The Flood Insurance Study report and Flood Insurance Rate Map for your community have been revised by this Letter of Map Revision (LOMR). Please use the enclosed annotated map panel revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals issued in your community.

Additional documents are enclosed which provide information regarding this LOMR. Please see the List of Enclosures below to determine which documents are included. Other attachments specific to this request may be included as referenced in the Determination Document. If you have any questions regarding floodplain management regulations for your community or the National Flood Insurance Program (NFIP) in general, please contact the Consultation Coordination Officer for your community. If you have any technical questions regarding this LOMR, please contact the Director, Mitigation Division of the Department of Homeland Security's Federal Emergency Management Agency (FEMA) in Oakland, California, at (510) 627-7175, or the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP). Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Sincerely,

Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

For: Luis Rodriguez, P.E., Chief
Engineering Management Branch
Federal Insurance and Mitigation Administration

List of Enclosures:

- Letter of Map Revision Determination Document
- Annotated Flood Insurance Rate Map
- Annotated Flood Insurance Study Report

cc: (see attached list)

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Chairman, Maricopa County
Board of Supervisors

Mr. Andy Goh
City Engineer
City of Tempe

Ms. Kathryn Gross
Flood Control District of Maricopa County

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT

COMMUNITY AND REVISION INFORMATION		PROJECT DESCRIPTION	BASIS OF REQUEST
COMMUNITY	City of Tempe Maricopa County Arizona	OTHER RETENTION BASIN	HYDRAULIC ANALYSIS HYDROLOGIC ANALYSIS NEW TOPOGRAPHIC DATA
	COMMUNITY NO.: 040054		
IDENTIFIER	Guadalupe FDS	APPROXIMATE LATITUDE & LONGITUDE: 33.367, -111.957 SOURCE: Precision Mapping Streets DATUM: NAD 83	

ANNOTATED MAPPING ENCLOSURES	ANNOTATED STUDY ENCLOSURES
TYPE: FIRM* NO.: 04013C2630G DATE: September 30, 2005	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: September 30, 2005 SUMMARY OF DISCHARGES TABLE: 3 SUMMARY OF ELEVATIONS TABLE: 8

Enclosures reflect changes to flooding sources affected by this revision.
* FIRM - Flood Insurance Rate Map; ** FBFM - Flood Boundary and Floodway Map; *** FHBM - Flood Hazard Boundary Map

FLOODING SOURCE(S) & REVISED REACH(ES)

Highline Lateral - from approximately 700 feet upstream of Maricopa Freeway to just downstream of East Guadalupe Road

SUMMARY OF REVISIONS

Flooding Source	Effective Flooding	Revised Flooding	Increases	Decreases
Highline Lateral	Zone A	Zone AH	YES	YES
	No BFEs	BFEs	YES	NONE
	Zone X (shaded)	Zone AH	YES	NONE
	Zone A	Zone X (shaded)	NONE	YES

* BFEs - Base Flood Elevations

DETERMINATION

This document provides the determination from the Department of Homeland Security's Federal Emergency Management Agency (FEMA) regarding a request for a Letter of Map Revision (LOMR) for the area described above. Using the information submitted, we have determined that a revision to the flood hazards depicted in the Flood Insurance Study (FIS) report and/or National Flood Insurance Program (NFIP) map is warranted. This document revises the effective NFIP map, as indicated in the attached documentation. Please use the enclosed annotated map panels revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals in your community.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional Information about the NFIP is available on our website at http://www.fema.gov/business/nfip.

Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

125360 PT202.BKR11093942P.H17 102-I-A-C

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

OTHER COMMUNITIES AFFECTED BY THIS REVISION

CID Number: 040037 **Name:** Maricopa County, Arizona

AFFECTED MAP PANELS	AFFECTED PORTIONS OF THE FLOOD INSURANCE STUDY REPORT
TYPE: FIRM* NO.: 04013C2165H DATE: September 30, 2005 TYPE: FIRM* NO.: 04013C2630G DATE: September 30, 2005	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: September 30, 2005 SUMMARY OF DISCHARGES TABLE: 3 SUMMARY OF ELEVATIONS TABLE: 8

CID Number: 040111 **Name:** Town of Guadalupe, Arizona

AFFECTED MAP PANELS	AFFECTED PORTIONS OF THE FLOOD INSURANCE STUDY REPORT
TYPE: FIRM* NO.: 04013C2165H DATE: September 30, 2005 TYPE: FIRM* NO.: 04013C2630G DATE: September 30, 2005	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: September 30, 2005 SUMMARY OF DISCHARGES TABLE: 3 SUMMARY OF ELEVATIONS TABLE: 8

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional Information about the NFIP is available on our website at http://www.fema.gov/business/nfip.

Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

COMMUNITY INFORMATION

APPLICABLE NFIP REGULATIONS/COMMUNITY OBLIGATION

We have made this determination pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (P.L. 93-234) and in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, P.L. 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. Pursuant to Section 1361 of the National Flood Insurance Act of 1968, as amended, communities participating in the NFIP are required to adopt and enforce floodplain management regulations that meet or exceed NFIP criteria. These criteria, including adoption of the FIS report and FIRM, and the modifications made by this LOMR, are the minimum requirements for continued NFIP participation and do not supersede more stringent State/Commonwealth or local requirements to which the regulations apply.

COMMUNITY REMINDERS

We based this determination on the base (1-percent-annual-chance) flood discharges computed in the submitted hydrologic model. Future development of projects upstream could cause increased discharges, which could cause increased flood hazards. A comprehensive restudy of your community's flood hazards would consider the cumulative effects of development on discharges and could, therefore, indicate that greater flood hazards exist in this area.

Your community must regulate all proposed floodplain development and ensure that permits required by Federal and/or State/Commonwealth law have been obtained. State/Commonwealth or community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction or may limit development in floodplain areas. If your State/Commonwealth or community has adopted more restrictive or comprehensive floodplain management criteria, those criteria take precedence over the minimum NFIP requirements.

We will not print and distribute this LOMR to primary users, such as local insurance agents or mortgage lenders; instead, the community will serve as a repository for the new data. We encourage you to disseminate the information in this LOMR by preparing a news release for publication in your community's newspaper that describes the revision and explains how your community will provide the data and help interpret the NFIP maps. In that way, interested persons, such as property owners, insurance agents, and mortgage lenders, can benefit from the information.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional Information about the NFIP is available on our website at http://www.fema.gov/business/nfip.

Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

We have designated a Consultation Coordination Officer (CCO) to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Ms. Sally M. Ziolkowski
Director, Mitigation Division
Federal Emergency Management Agency, Region IX
1111 Broadway Street, Suite 1200
Oakland, CA 94607-4052
(510) 627-7175

STATUS OF THE COMMUNITY NFIP MAPS

We are processing a revised FIRM and FIS report for Maricopa County in our countywide format; therefore, we will not physically revise and republish the FIRM and FIS report for your community to incorporate the modifications made by this LOMR at this time. Preliminary copies of the countywide FIRM and FIS report, which present information from the effective FIRM and FIS report for your community and other incorporated communities in Maricopa County, were submitted to your community for review on December 3, 2010.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional Information about the NFIP is available on our website at http://www.fema.gov/business/nfip.

Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

PUBLIC NOTIFICATION OF REVISION

PUBLIC NOTIFICATION

A notice of changes will be published in the *Federal Register*. This information also will be published in your local newspaper on or about the dates listed below and through FEMA's Flood Hazard Mapping website at https://www.floodmaps.fema.gov/fhm/Scripts/bfe_main.asp.

LOCAL NEWSPAPER Name: *Arizona Business Gazette*
Dates: 04/05/2012 and 04/12/2012

Within 90 days of the second publication in the local newspaper, a citizen may request that we reconsider this determination. Any request for reconsideration must be based on scientific or technical data. Therefore, this letter will be effective only after the 90-day appeal period has elapsed and we have resolved any appeals that we receive during this appeal period. Until this LOMR is effective, the revised flood hazard determination information presented in this LOMR may be changed.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional Information about the NFIP is available on our website at http://www.fema.gov/business/nfip.

Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency

Washington, D.C. 20472

April 6, 2012

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable Max W. Wilson
Chairman, Maricopa County
Board of Supervisors
301 West Jefferson, 10th Floor
Phoenix, AZ 85003

IN REPLY REFER TO:

Case No.:	11-09-3942P
Community Name:	Maricopa County, AZ
Community No.:	040037
Effective Date of This Revision:	**August 10, 2012**

Dear Mr. Wilson:

You were sent a Letter of Map Revision (LOMR) dated March 29, 2012 for your community. Unfortunately, a mistake was discovered in the Summary of Elevations table after the mailing which resulted the corrections to the table and two of the Flood Insurance Rate Map (panels 04013C2165H and 04013C2630G). We have corrected all three documents and re-sending the LOMR with all the attachments for you to replace the LOMR you have received previously. We apologize any inconvenience this might have caused.

Sincerely,

Syed Qayum

Syed Qayum, CFM
National LOMR Technical Manager
Michael Baker Jr., Inc.

List of Enclosures:
- Letter of Map Revision Determination Document
- Annotated Flood Insurance Rate Map
- Annotated Flood Insurance Study Report

cc: (see attached list)

FLOOD CONTROL DISTRICT
RECEIVED
APR 10 '12

	CH & GM		FINANCE
	PIO		R.E.D.
	ADMIN		O & M
	FMS		P & PM
	ENG		FILE
	CONTRACTS		
ROUTING	KAG		

Courtesy Copy List – Maricopa County, AZ

The Honorable Hugh Hallman
Mayor, City of Tempe

The Honorable Alma Yolanda Solarez
Mayor, Town of Guadalupe

Mr. Timothy S. Phillips, P.E.
Chief Engineer and General Manager
Maricopa County

Ms. Kathryn Gross
Flood Control District of Maricopa County

Federal Emergency Management Agency

Washington, D.C. 20472

March 29, 2012

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable Max Wilson
Chairman, Maricopa County
Board of Supervisors
301 West Jefferson, 10th Floor
Phoenix, AZ 85003

IN REPLY REFER TO:

Case No.:	11-09-3942P
Community Name:	Maricopa County, AZ
Community No.:	040037
Effective Date of This Revision:	**August 10, 2012**

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Sincerely,

Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

For: Luis Rodriguez, P.E., Chief
Engineering Management Branch
Federal Insurance and Mitigation Administration

List of Enclosures:
- Letter of Map Revision Determination Document
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- Annotated Flood Insurance Study Report

cc: (see attached list)

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Mayor, City of Tempe

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Mr. Timothy S. Phillips, P.E.
Chief Engineer and General Manager
Maricopa County

Ms. Kathryn Gross
Flood Control District of Maricopa County

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT

COMMUNITY AND REVISION INFORMATION		PROJECT DESCRIPTION	BASIS OF REQUEST
COMMUNITY	Maricopa County Arizona (Unincorporated Areas)	OTHER RETENTION BASIN	HYDRAULIC ANALYSIS HYDROLOGIC ANALYSIS NEW TOPOGRAPHIC DATA
	COMMUNITY NO.: 040037		
IDENTIFIER	Guadalupe FDS	APPROXIMATE LATITUDE & LONGITUDE: 33.367, -111.957 SOURCE: Precision Mapping Streets DATUM: NAD 83	

ANNOTATED MAPPING ENCLOSURES	ANNOTATED STUDY ENCLOSURES
TYPE: FIRM* NO.: 04013C2165H DATE: September 30, 2005 TYPE: FIRM* NO.: 04013C2630G DATE: September 30, 2005	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: September 30, 2005 SUMMARY OF DISCHARGES TABLE: 3 SUMMARY OF ELEVATIONS TABLE: 8

Enclosures reflect changes to flooding sources affected by this revision.
* FIRM - Flood Insurance Rate Map; ** FBFM - Flood Boundary and Floodway Map; *** FHBM - Flood Hazard Boundary Map

FLOODING SOURCE(S) & REVISED REACH(ES)

Highline Lateral - from approximately 700 feet upstream of Maricopa Freeway to just downstream of East Guadalupe Road

SUMMARY OF REVISIONS

Flooding Source	Effective Flooding	Revised Flooding	Increases	Decreases
Highline Lateral	Zone A	Zone AH	YES	YES
	No BFEs	BFEs	YES	NONE
	Zone X (shaded)	Zone AH	YES	NONE
	Zone A	Zone X (shaded)	NONE	YES

DETERMINATION

This document provides the determination from the Department of Homeland Security's Federal Emergency Management Agency (FEMA) regarding a request for a Letter of Map Revision (LOMR) for the area described above. Using the information submitted, we have determined that a revision to the flood hazards depicted in the Flood Insurance Study (FIS) report and/or National Flood Insurance Program (NFIP) map is warranted. This document revises the effective NFIP map, as indicated in the attached documentation. Please use the enclosed annotated map panels revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals in your community.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional Information about the NFIP is available on our website at http://www.fema.gov/business/nfip.

Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

125360 PT202.BKR11093942P.H17 102-I-A-C

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

OTHER COMMUNITIES AFFECTED BY THIS REVISION

CID Number: 040054 **Name:** City of Tempe, Arizona

AFFECTED MAP PANELS	AFFECTED PORTIONS OF THE FLOOD INSURANCE STUDY REPORT
TYPE: FIRM* NO.: 04013C2630G DATE: September 30, 2005	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: September 30, 2005 SUMMARY OF DISCHARGES TABLE: 3 SUMMARY OF ELEVATIONS TABLE: 8

CID Number: 040111 **Name:** Town of Guadalupe, Arizona

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TYPE: FIRM* NO.: 04013C2165H DATE: September 30, 2005 TYPE: FIRM* NO.: 04013C2630G DATE: September 30, 2005	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: September 30, 2005 SUMMARY OF DISCHARGES TABLE: 3 SUMMARY OF ELEVATIONS TABLE: 8

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Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

COMMUNITY INFORMATION

APPLICABLE NFIP REGULATIONS/COMMUNITY OBLIGATION

We have made this determination pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (P.L. 93-234) and in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, P.L. 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. Pursuant to Section 1361 of the National Flood Insurance Act of 1968, as amended, communities participating in the NFIP are required to adopt and enforce floodplain management regulations that meet or exceed NFIP criteria. These criteria, including adoption of the FIS report and FIRM, and the modifications made by this LOMR, are the minimum requirements for continued NFIP participation and do not supersede more stringent State/Commonwealth or local requirements to which the regulations apply.

COMMUNITY REMINDERS

We based this determination on the base (1-percent-annual-chance) flood discharges computed in the submitted hydrologic model. Future development of projects upstream could cause increased discharges, which could cause increased flood hazards. A comprehensive restudy of your community's flood hazards would consider the cumulative effects of development on discharges and could, therefore, indicate that greater flood hazards exist in this area.

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Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

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Ms. Sally M. Ziolkowski
Director, Mitigation Division
Federal Emergency Management Agency, Region IX
1111 Broadway Street, Suite 1200
Oakland, CA 94607-4052
(510) 627-7175

STATUS OF THE COMMUNITY NFIP MAPS

We are processing a revised FIRM and FIS report for Maricopa County in our countywide format; therefore, we will not physically revise and republish the FIRM and FIS report for your community to incorporate the modifications made by this LOMR at this time. Preliminary copies of the countywide FIRM and FIS report, which present information from the effective FIRM and FIS report for your community and other incorporated communities in Maricopa County, were submitted to your community for review on December 3, 2010.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional Information about the NFIP is available on our website at http://www.fema.gov/business/nfip.

Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

PUBLIC NOTIFICATION OF REVISION

PUBLIC NOTIFICATION

A notice of changes will be published in the *Federal Register*. This information also will be published in your local newspaper on or about the dates listed below and through FEMA's Flood Hazard Mapping website at https://www.floodmaps.fema.gov/fhm/Scripts/bfe_main.asp.

LOCAL NEWSPAPER Name: *Arizona Business Gazette*
Dates: 04/05/2012 and 04/12/2012

Within 90 days of the second publication in the local newspaper, a citizen may request that we reconsider this determination. Any request for reconsideration must be based on scientific or technical data. Therefore, this letter will be effective only after the 90-day appeal period has elapsed and we have resolved any appeals that we receive during this appeal period. Until this LOMR is effective, the revised flood hazard determination information presented in this LOMR may be changed.

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Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

Table 3. Summary of Discharges Continued

Flooding Source and Location	Drainage Area (sq. miles)	Peak Discharges (cubic feet per second) 10-Year	50-Year	100-Year	500-year
Colony Wash (Continued)					
At Stoneridge Dam	0.85	__[1]	__[1]	94	__[1]
Above Sunburst Wash	0.43	__[1]	__[1]	461	__[1]
Cyprus Point Wash					
At Saguaro Boulevard	0.14	__[1]	__[1]	303	__[1]
Above Nicklaus Drive	0.09	__[1]	__[1]	193	__[1]
Emerald Wash					
At Saguaro Boulevard	0.61	__[1]	__[1]	529	__[1]
At Fountain Hills Boulevard	0.17	__[1]	__[1]	207	__[1]
Escalante Wash					
At McDowell Mountain Road	1.59	__[1]	__[1]	1,410	__[1]
Fountain Channel					
Above Colony Wash	1.64	__[1]	__[1]	885	__[1]
Approximately 1,450 feet upstream of El Lago Drive	0.26	__[1]	__[1]	451	__[1]
Greystone Wash					
At Sycamore Drive	0.38	__[1]	__[1]	396	__[1]
Hesperus Wash					
Above Boulder Drive	3.14	__[1]	__[1]	490	__[1]
Below Dam 36	2.91	__[1]	__[1]	330	__[1]
Above Dam 36	2.91	__[1]	__[1]	2,590	__[1]
Highline Lateral					
North Watershed West of Priest Drive	0.092	__[1]	__[1]	94	__[1]
NE Watershed at West Baseline Rd	0.111	__[1]	__[1]	106	__[1]
Central Watershed at Guadalupe Rd	0.325	__[1]	__[1]	219	__[1]
South Watershed at West Divot Drive	0.189	__[1]	__[1]	81	__[1]

REVISED DATA

REVISED TO
REFLECT LOMR
EFFECTIVE: August 10, 2012

__[1] Not Computed

Table 8. Summary of Elevations

Flooding Source and Location	Elevations (NGVD) 10-Year	50-Year	100-Year	500-Year
Highline Lateral				
North Watershed West of Priest Drive	--[1]	--[1]	1222.1	--[1]
NE Watershed at West Baseline Rd	--[1]	--[1]	1223.0	--[1]
Central Watershed at Guadalupe Rd	--[1]	--[1]	1223.0	--[1]
South Watershed at West Divot Drive	--[1]	--[1]	1224.2	--[1]

[1] **Data Not Available**

REVISED TO
REFLECT LOMR
EFFECTIVE: August 10, 2012

Legend

1% annual chance (100-Year) Floodplain

1% annual chance (100-Year) Floodway

0.2% annual chance (500-Year) Floodplain

MAP SCALE 1" = 1000'

500 0 1000 FEET

300 0 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2165H

FIRM
FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA

AND INCORPORATED AREAS

PANEL 2165 OF 4350

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY	040037	2165	H
GUADALUPE, TOWN OF	040111	2165	H
PHOENIX, CITY OF	040051	2165	H
TEMPE, CITY OF	040054	2165	H

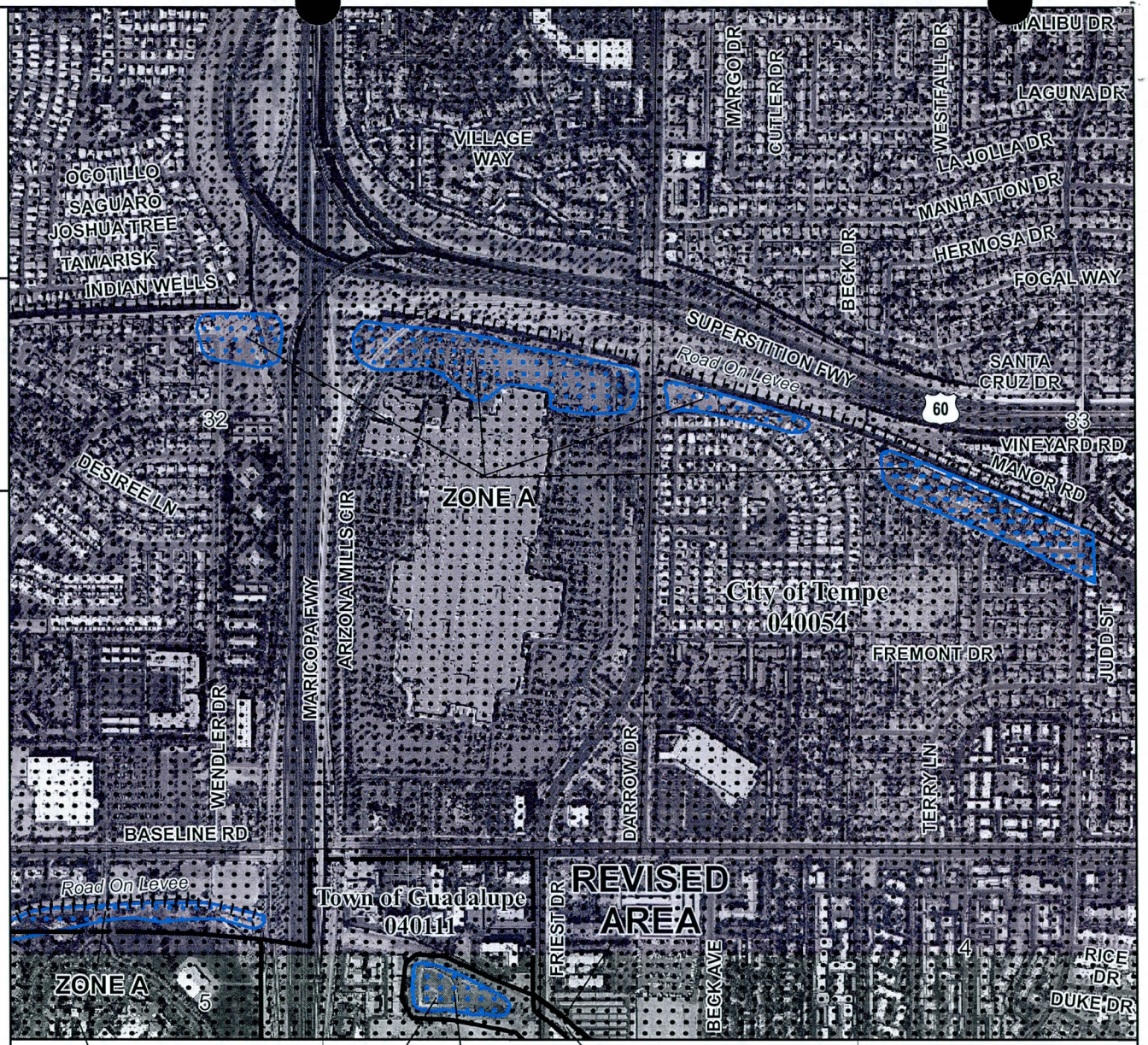
REVISED TO REFLECT LOMR EFFECTIVE: August 10, 2012

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 04013C2165H

MAP REVISED SEPTEMBER 30, 2005

Federal Emergency Management Agency



Legend

- 1% annual chance (100-Year) Floodplain
- 1% annual chance (100-Year) Floodway
- 0.2% annual chance (500-Year) Floodplain

MAP SCALE 1" = 1000'

500 0 1000 FEET

300 0 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2630G

FIRM
FLOOD INSURANCE RATE MAP

MARICOPA COUNTY,
ARIZONA
AND INCORPORATED AREAS

PANEL 2630 OF 4350

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY	040037	2630	G
CHANDLER, CITY OF	040040	2630	G
GUADALUPE, TOWN OF	040111	2630	G
PHOENIX, CITY OF	040051	2630	G
TEMPE, CITY OF	040054	2630	G

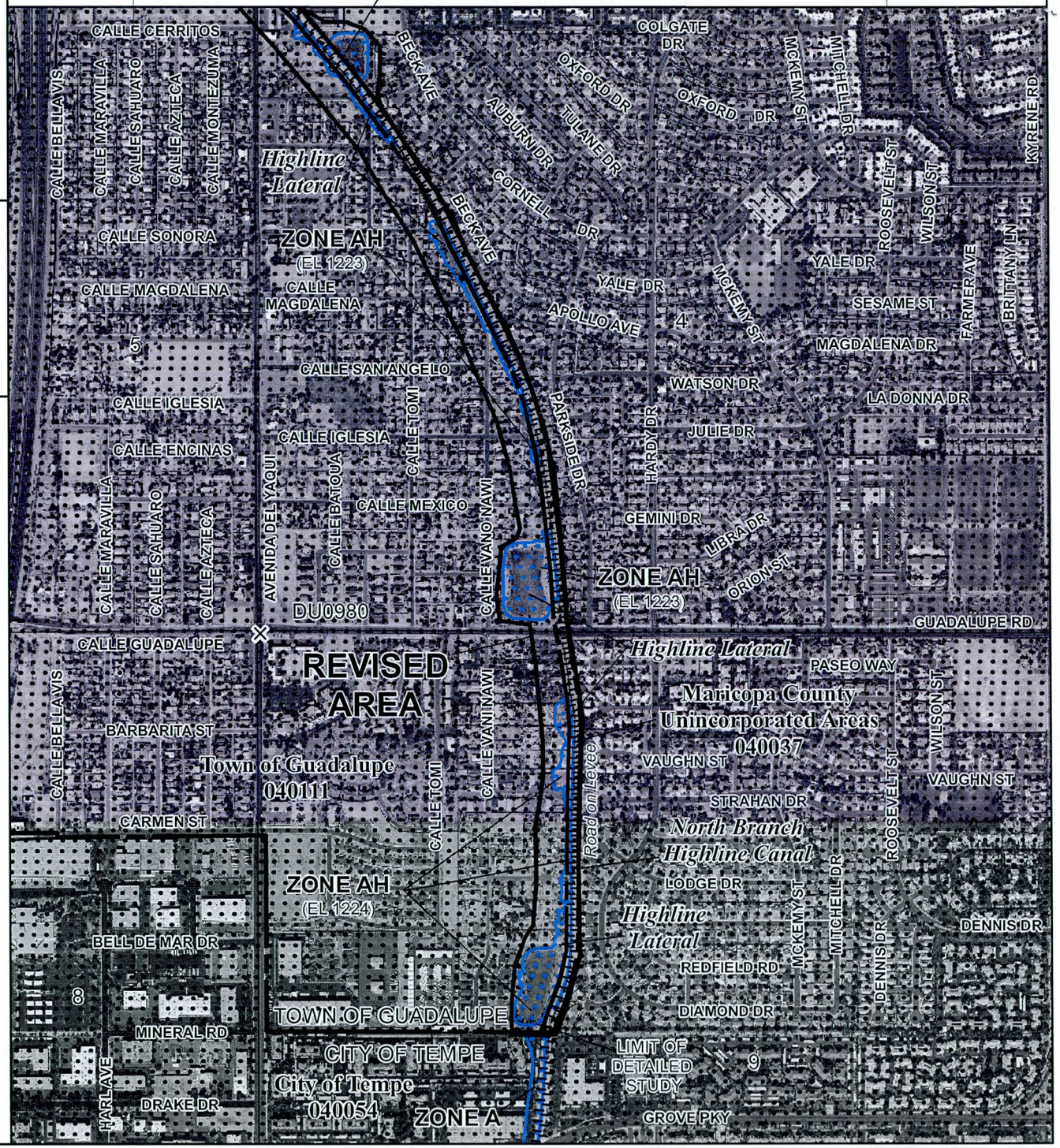
REVISED TO REFLECT LOMR EFFECTIVE: August 10, 2012

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
04013C2630G

MAP REVISED
SEPTEMBER 30, 2005

Federal Emergency Management Agency



Federal Emergency Management Agency

Washington, D.C. 20472

March 29, 2012

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable Alma Yolanda Solarez
Mayor, Town of Guadalupe
9241 South Avenida Del Yaqui
Guadalupe, AZ 85283

IN REPLY REFER TO:

Case No.:	11-09-3942P
Community Name:	Town of Guadalupe, AZ
Community No.:	040111
Effective Date of This Revision:	**August 10, 2012**

Dear Mayor Solarez:

The Flood Insurance Study report and Flood Insurance Rate Map for your community have been revised by this Letter of Map Revision (LOMR). Please use the enclosed annotated map panels revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals issued in your community.

Additional documents are enclosed which provide information regarding this LOMR. Please see the List of Enclosures below to determine which documents are included. Other attachments specific to this request may be included as referenced in the Determination Document. If you have any questions regarding floodplain management regulations for your community or the National Flood Insurance Program (NFIP) in general, please contact the Consultation Coordination Officer for your community. If you have any technical questions regarding this LOMR, please contact the Director, Mitigation Division of the Department of Homeland Security's Federal Emergency Management Agency (FEMA) in Oakland, California, at (510) 627-7175, or the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP). Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Sincerely,

Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

For: Luis Rodriguez, P.E., Chief
Engineering Management Branch
Federal Insurance and Mitigation Administration

List of Enclosures:

- Letter of Map Revision Determination Document
- Annotated Flood Insurance Rate Map
- Annotated Flood Insurance Study Report

cc: (see attached list)

Courtesy Copy List - Town of Guadalupe, AZ

The Honorable Max Wilson
Chairman, Maricopa County
Board of Supervisors

The Honorable Hugh Hallman
Mayor, City of Tempe

Mr. Gino Turrubiartes
Community Development Director
Town of Guadalupe

Ms. Kathryn Gross
Flood Control District of Maricopa County

Federal Emergency Management Agency

Washington, D.C. 20472

April 6, 2012

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable Alma Yolanda Solarez
Mayor, Town of Guadalupe
9241 South Avenida Del Yaqui
Guadalupe, AZ 85283

IN REPLY REFER TO:

Case No.:	11-09-3942P
Community Name:	Town of Guadalupe, AZ
Community No.:	040111
Effective Date of This Revision:	**August 10, 2012**

Dear Mayor Solarez:

You were sent a Letter of Map Revision (LOMR) dated March 29, 2012 for your community. Unfortunately, a mistake was discovered in the Summary of Elevations table after the mailing which resulted the corrections to the table and two of the Flood Insurance Rate Map (panels 04013C2165H and 04013C2630G). We have corrected all three documents and re-sending the LOMR with all the attachments for you to replace the LOMR you have received previously. We apologize any inconvenience this might have caused.

Sincerely,

Syed Qayum

Syed Qayum, CFM
National LOMR Technical Manager
Michael Baker Jr., Inc.

List of Enclosures:

- Letter of Map Revision Determination Document
- Annotated Flood Insurance Rate Map
- Annotated Flood Insurance Study Report

cc: (see attached list)

Courtesy Copy List - Town of Guadalupe, AZ

The Honorable Max W. Wilson
Chairman, Maricopa County
Board of Supervisors

The Honorable Hugh Hallman
Mayor, City of Tempe

Mr. Gino Turrubiartes
Community Development Director
Town of Guadalupe

Ms. Kathryn Gross
Flood Control District of Maricopa County

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT

COMMUNITY AND REVISION INFORMATION		PROJECT DESCRIPTION	BASIS OF REQUEST
COMMUNITY	Town of Guadalupe Maricopa County Arizona	OTHER RETENTION BASIN	HYDRAULIC ANALYSIS HYDROLOGIC ANALYSIS NEW TOPOGRAPHIC DATA
	COMMUNITY NO.: 040111		
IDENTIFIER	Guadalupe FDS	APPROXIMATE LATITUDE & LONGITUDE: 33.367, -111.957 SOURCE: Precision Mapping Streets DATUM: NAD 83	

ANNOTATED MAPPING ENCLOSURES	ANNOTATED STUDY ENCLOSURES
TYPE: FIRM* NO.: 04013C2630G DATE: September 30, 2005 TYPE: FIRM* NO.: 04013C2165H DATE: September 30, 2005	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: September 30, 2005 SUMMARY OF DISCHARGES TABLE: 3 SUMMARY OF ELEVATIONS TABLE: 8

Enclosures reflect changes to flooding sources affected by this revision.
* FIRM - Flood Insurance Rate Map; ** FBFM - Flood Boundary and Floodway Map; *** FHBM - Flood Hazard Boundary Map

FLOODING SOURCE(S) & REVISED REACH(ES)

Highline Lateral - from approximately 700 feet upstream of Maricopa Freeway to just downstream of East Guadalupe Road

SUMMARY OF REVISIONS

Flooding Source	Effective Flooding	Revised Flooding	Increases	Decreases
Highline Lateral	Zone A	Zone AH	YES	YES
	No BFEs	BFEs	NONE	YES
	Zone X (shaded)	Zone AH	NONE	YES
	Zone A	Zone X (shaded)	YES	NONE

DETERMINATION

This document provides the determination from the Department of Homeland Security's Federal Emergency Management Agency (FEMA) regarding a request for a Letter of Map Revision (LOMR) for the area described above. Using the information submitted, we have determined that a revision to the flood hazards depicted in the Flood Insurance Study (FIS) report and/or National Flood Insurance Program (NFIP) map is warranted. This document revises the effective NFIP map, as indicated in the attached documentation. Please use the enclosed annotated map panels revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals in your community.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional Information about the NFIP is available on our website at http://www.fema.gov/business/nfip.

Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

125360 PT202.BKR11093942P.H17 102-I-A-C

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

OTHER COMMUNITIES AFFECTED BY THIS REVISION

CID Number: 040037 **Name:** Maricopa County, Arizona

AFFECTED MAP PANELS	AFFECTED PORTIONS OF THE FLOOD INSURANCE STUDY REPORT
TYPE: FIRM* NO.: 04013C2165H DATE: September 30, 2005 TYPE: FIRM* NO.: 04013C2630G DATE: September 30, 2005	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: September 30, 2005 SUMMARY OF DISCHARGES TABLE: 3 SUMMARY OF ELEVATIONS TABLE: 8

CID Number: 040054 **Name:** City of Tempe, Arizona

AFFECTED MAP PANELS	AFFECTED PORTIONS OF THE FLOOD INSURANCE STUDY REPORT
TYPE: FIRM* NO.: 04013C2630G DATE: September 30, 2005	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: September 30, 2005 SUMMARY OF DISCHARGES TABLE: 3 SUMMARY OF ELEVATIONS TABLE: 8

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional Information about the NFIP is available on our website at http://www.fema.gov/business/nfip.

Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

COMMUNITY INFORMATION

APPLICABLE NFIP REGULATIONS/COMMUNITY OBLIGATION

We have made this determination pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (P.L. 93-234) and in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, P.L. 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. Pursuant to Section 1361 of the National Flood Insurance Act of 1968, as amended, communities participating in the NFIP are required to adopt and enforce floodplain management regulations that meet or exceed NFIP criteria. These criteria, including adoption of the FIS report and FIRM, and the modifications made by this LOMR, are the minimum requirements for continued NFIP participation and do not supersede more stringent State/Commonwealth or local requirements to which the regulations apply.

COMMUNITY REMINDERS

We based this determination on the base (1-percent-annual-chance) flood discharges computed in the submitted hydrologic model. Future development of projects upstream could cause increased discharges, which could cause increased flood hazards. A comprehensive restudy of your community's flood hazards would consider the cumulative effects of development on discharges and could, therefore, indicate that greater flood hazards exist in this area.

Your community must regulate all proposed floodplain development and ensure that permits required by Federal and/or State/Commonwealth law have been obtained. State/Commonwealth or community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction or may limit development in floodplain areas. If your State/Commonwealth or community has adopted more restrictive or comprehensive floodplain management criteria, those criteria take precedence over the minimum NFIP requirements.

We will not print and distribute this LOMR to primary users, such as local insurance agents or mortgage lenders; instead, the community will serve as a repository for the new data. We encourage you to disseminate the information in this LOMR by preparing a news release for publication in your community's newspaper that describes the revision and explains how your community will provide the data and help interpret the NFIP maps. In that way, interested persons, such as property owners, insurance agents, and mortgage lenders, can benefit from the information.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional Information about the NFIP is available on our website at http://www.fema.gov/business/nfip.

Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

We have designated a Consultation Coordination Officer (CCO) to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Ms. Sally M. Ziolkowski
Director, Mitigation Division
Federal Emergency Management Agency, Region IX
1111 Broadway Street, Suite 1200
Oakland, CA 94607-4052
(510) 627-7175

STATUS OF THE COMMUNITY NFIP MAPS

We are processing a revised FIRM and FIS report for Maricopa County in our countywide format; therefore, we will not physically revise and republish the FIRM and FIS report for your community to incorporate the modifications made by this LOMR at this time. Preliminary copies of the countywide FIRM and FIS report, which present information from the effective FIRM and FIS report for your community and other incorporated communities in Maricopa County, were submitted to your community for review on December 3, 2010.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional Information about the NFIP is available on our website at http://www.fema.gov/business/nfip.

Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

PUBLIC NOTIFICATION OF REVISION

PUBLIC NOTIFICATION

A notice of changes will be published in the *Federal Register*. This information also will be published in your local newspaper on or about the dates listed below and through FEMA's Flood Hazard Mapping website at https://www.floodmaps.fema.gov/fhm/Scripts/bfe_main.asp.

LOCAL NEWSPAPER Name: *Arizona Business Gazette*
Dates: 04/05/2012 and 04/12/2012

Within 90 days of the second publication in the local newspaper, a citizen may request that we reconsider this determination. Any request for reconsideration must be based on scientific or technical data. Therefore, this letter will be effective only after the 90-day appeal period has elapsed and we have resolved any appeals that we receive during this appeal period. Until this LOMR is effective, the revised flood hazard determination information presented in this LOMR may be changed.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional Information about the NFIP is available on our website at http://www.fema.gov/business/nfip.

Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

Guadalupe Floodplain Delineation Study

Town of Guadalupe, Maricopa County

Technical Data Notebook

Contract Number: FCD 2010C027 Assignment #1

Prepared for:

Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

Prepared by:

WEST Consultants, Inc.
8950 S. 52nd Street, Suite 210
Tempe, Arizona 85284

February 2012

Registered Professional Engineer (Civil)
CERTIFICATE NO.
41980
BRIAN THOMAS
WAHLIN
Date Signed 02-02-2012
ARIZONA, U.S.A.

Expires 3/31/2014

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Registered Professional Engineer (Civil)
CERTIFICATE NO.
41980
BRIAN THOMAS
WAHLIN
Date Signed 02-02-2012
ARIZONA, U.S.A.

Expires 3/31/2014

1. Introduction

The Flood Control District of Maricopa County (District) contracted WEST Consultants, Inc. (WEST) to prepare a Letter of Map Revision (LOMR) for the ponding areas in the Town of Guadalupe, Arizona (FCD contract 2010C027 Assignment #1). The effective floodplain along the Highline Lateral (canal) which is categorized as Zone A appears to simply be an approximate 150-foot buffer from the banks of the canal. The goal of this study was to update the Zone A floodplains with Zone AH floodplains that more accurately depict the ponding along the embankment of the canal. The study reach is located within the Town of Guadalupe in an incorporated portion of Maricopa County (T1S-R4E) as shown in Figure 1. The District provided 2-foot vertical resolution contours as well as some survey data along the Highline Lateral. The results of this study indicate smaller floodplain ponding areas behind the Highline Lateral than what are shown on the effective floodplain maps.

The U.S. Army Corps of Engineers (USACE) computer program HEC-1 1998 Version 4.1 (HEC-1 v 4.1, 1998) (HEC-1) was used to develop a hydrologic model for the area. The District's Drainage Design Management System v. 4.6.0 (DDMSW v. 4.6.0, 2010) (DDMSW) was used to develop sub-basin and routing parameters. The USACE's computer program HEC-RAS Version 4.1 (HEC-RAS v.4.1.0, 2010) (RAS) was used to model the hydraulic relationships between the various ponding areas along the Highline Lateral and to determine the actual ponding elevations. A Digital Elevation Model (DEM) was generated in ArcView GIS v. 9.3 2008 (ArcView GIS, v 9.3, 2008) (GIS) using the survey and contour data provided by the District. The DEM was used to determine ground elevation parameters needed for the HEC-1 model. It was also used to determine ponding volumes at various locations throughout the model and to determine flooding extents along the canal.

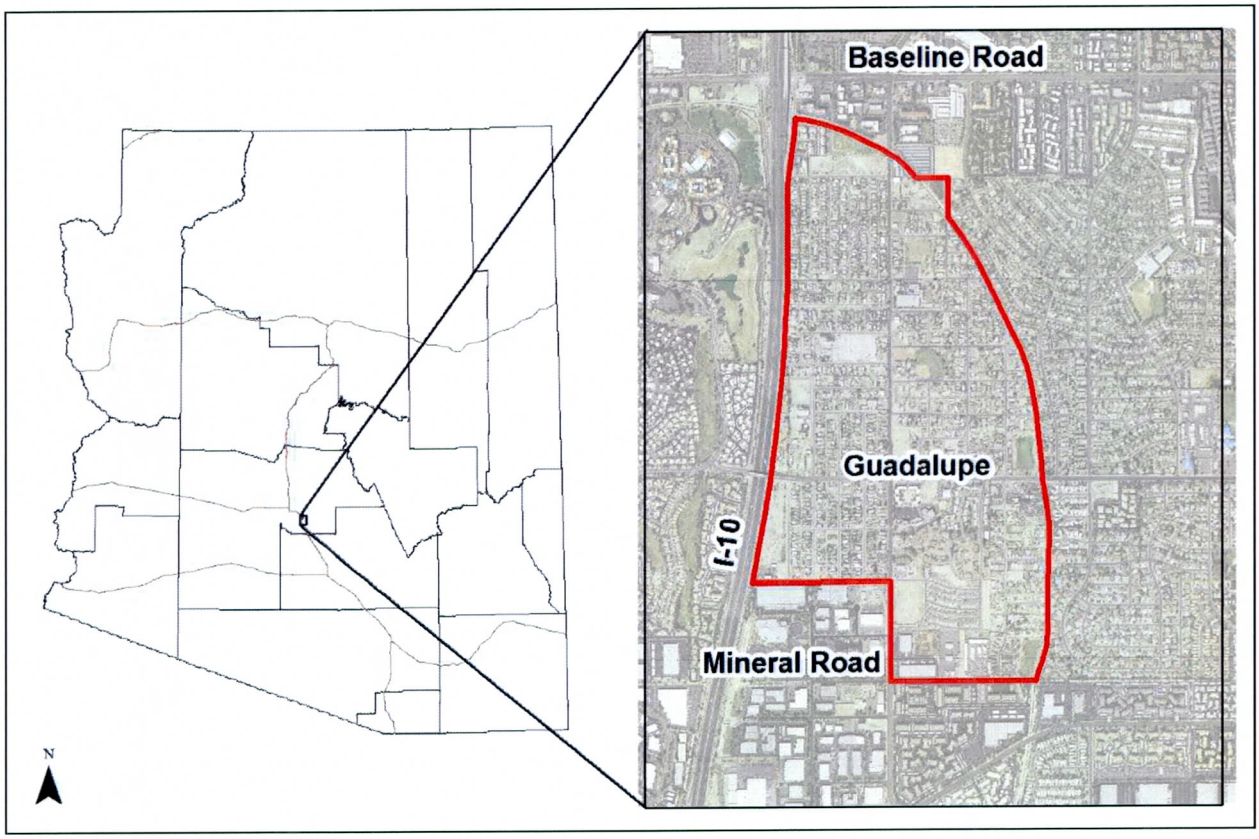


Figure 1. Project location map

2. ADWR/FEMA Forms

2.1. Study Documentation Abstract for FEMA Submittals

Study Documentation Abstract for FEMA Submittals	Initial Study		Restudy		CLOMR		LOMR	X	Other	

2.1.1	Date Study Accepted	
2.1.2	Study Contractor Contact(s) Address Phone Internal Reference Number	WEST Consultants, Inc. Brian Wahlin, Ph.D., P.E., D.WRE 8950 S. 52nd Street, Suite 210 Tempe, Arizona 85284 (480) 345-2155 FCDM001001
2.1.3	FEMA Technical Review Contractor Contact(s) Address Phone Internal Reference Number	
2.1.4	FEMA Regional Reviewer Phone	
2.1.5	State Technical Reviewer Phone	Arizona Department of Water Resources (602) 417-2400
2.1.6	Local Technical Reviewer Phone	Kathryn Gross, CFM, M.A. Flood Control District of Maricopa County (District) (602) 506-4837
2.1.7	Reach Description	West Side of Highline Lateral - FIRM Panels 2630B, and 2165H
2.1.8	USGS Quad Sheet(s) with original photo date & latest photo revision date	
2.1.9	Unique Conditions and Problems	
2.1.10	Coordination of Q's Discharges (Agency, Date, Comments)	

DEPARTMENT OF HOMELAND SECURITY
FEDERAL EMERGENCY MANAGEMENT AGENCY

OVERVIEW & CONCURRENCE FORM

O.M.B. NO. 1660-0016
Expires February 28, 2014

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 1 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless it displays a valid OMB control number. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 1800 South Bell Street, Arlington, VA 20958-3005, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

PRIVACY ACT STATEMENT

AUTHORITY: The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.

PRINCIPAL PURPOSE(S): This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).

ROUTINE USE(S): The information on this form may be disclosed as generally permitted under 5 U.S.C § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA/NFIP/LOMA-1 National Flood Insurance Program (NFIP); Letter of Map Amendment (LOMA) February 15, 2006, 71 FR 7990.

DISCLOSURE: The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a (NFIP) Flood Insurance Rate Maps (FIRM).

A. REQUESTED RESPONSE FROM DHS-FEMA

This request is for a: (check one)

☐ CLOMR: A letter from DHS-FEMA commenting on whether a proposed project, if built as proposed, would justify a map revision, or proposed hydrology changes (See 44 CFR Ch. 1, Parts 60, 65 & 72).

☒ LOMR: A letter from DHS-FEMA officially revising the current NFIP map to show the changes to floodplains, regulatory floodway, or flood elevations. (See 44 CFR Ch. 1, Parts 60, 65 & 72).

B. OVERVIEW

1. The NFIP map panel(s) affected for all impacted communities is (are):

Community No.	Community Name	State	Map No.	Panel No.	Effective Date
Ex: 480301 480287	City of Katy Harris County	TX TX	48473C 48201C	0005D 0220G	02/08/83 09/28/90
040111	Town of Guadalupe, Maricopa County	AZ	04013C	2630G	09/30/05
040111	Town of Guadalupe, Maricopa County	AZ	04013C	2165H	09/30/05

2. a Flooding Source: Highline Lateral

b. Types of Flooding: ☐ Riverine ☐ Coastal ☒ Shallow Flooding (e.g., Zones AO and AH) ☐ Alluvial fan ☐ Lakes ☐ Other (Attach Description)

3. Project Name/Identifier: Guadalupe FDS

4. FEMA Zone designations affected: A (Choices A, AH, AO, A1-A30, A99, AE, AR, V, V1-V30, VE, B, C, D, X)

5. Basis for Request and Type of Revision:

a. The basis for this revision request is (check all that apply)

- ☐ Physical Change
- ☐ Improved Methodology/Data
- ☐ Regulatory Floodway Revision
- ☐ Base Map Changes
- ☐ Coastal Analysis
- ☐ Hydraulic Analysis
- ☐ Hydrologic Analysis
- ☐ Corrections
- ☐ Weir-Dam Changes
- ☐ Levee Certification
- ☐ Alluvial Fan Analysis
- ☐ Natural Changes
- ☐ New Topographic Data
- ☐ Other (attach Description)

Note: A photograph and narrative description of the area of concern is not required, but is very helpful during review.

b. The area of revision encompasses the following structures (check all that apply)

Structures:
- ☐ Channelization
- ☐ Levee/Floodwall
- ☐ Bridge/Culvert
- ☐ Dam
- ☐ Fill
- ☐ Other (Attach Description)

6. ☐ Documentation of ESA compliance is submitted (required to initiate CLOMR review). Please refer to the instructions for more information

C. REVIEW FEE

Has the review fee for the appropriate request category been included?
☐ Yes, Fee Amount: $_____
☐ No, Attach Explanation

Please see the DHS-FEMA website at http://fema.gov/plan/prevent/fhm/frm_fees.shtm for Fee Amounts and Exemptions.

D. SIGNATURE

All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States code, Section 1001.

Name: Kathryn Gross	Company: Flood Control District of Maricopa County
Mailing Address: 2801 W. Durango St. Phoenix, AZ 85009	Daytime Telephone No.: 602 506-4837 / FAX No.: 602 506-4601
	EMAIL ADDRESS: Kag@mail.maricopa.gov
Signature of Requester (Required): Kathryn C	Date: 7/19/11

As the community official responsible for floodplain management, I hereby acknowledge that we have received and reviewed this Letter of of Map Revision (LOMR) or conditional LOMR request. Based upon the community's review, we find the completed or proposed project meets or is designed to meet all of the community floodplain management requirements, including the requirement for when fill is placed in the regulatory floodway, and that all necessary Federal, State, and local permits have been, or in the case of a conditional LOMR, will be obtained. For conditional LOMR request, the applicant has documented Endangered Species Act (ESA) compliance to DHS/FEMA prior to DHS/FEMA's review of the Conditional LOMR application. For LOMR request, I acknowledge that compliance with sections 9 and 10 of the ESA has been achieved independently of DHS/FEMA's process. For actions authorized, funded, or being carried out by Federal or State agencies, documentation from the agency showing its compliance with Section 7(a)(2) of the ESA will be submitted. In addition, we have determined that the land and any existing or proposed structures to be removed from the SFHA are or will be reasonably safe from flooding as defined in 44 CFR 65.2(c), and that we have available upon request by DHS/FEMA, all analyses and documentation used to make this determination.

Community Official's Name and Title: Gino Turrubiartes Community Dev. Dir.	Community Name: Town of Guadalupe
Mailing Address: 9241 S. Avenida del Yaqui Guadalupe AZ 85283	Daytime Telephone No.: 480-505-5399 / FAX No.: 480-505-5348
	EMAIL ADDRESS: gturrubiartes@guadalupe93.org
Community Official's signature (required):	Date: 08-17-2011

a. The basis for this revision request is (check all that apply)

- [x] Physical Change
- [x] Improved Methodology/Data
- [ ] Regulatory Floodway Revision
- [ ] Base Map Changes
- [ ] Coastal Analysis
- [ ] Hydraulic Analysis
- [ ] Hydrologic Analysis
- [ ] Corrections
- [ ] Weir-Dam Changes
- [ ] Levee Certification
- [ ] Alluvial Fan Analysis
- [ ] Natural Changes
- [x] New Topographic Data
- [ ] Other (attach Description)

Note: A photograph and narrative description of the area of concern is not required, but is very helpful during review.

b. The area of revision encompasses the following structures (check all that apply)

Structures:
- [ ] Channelization
- [ ] Levee/Floodwall
- [ ] Bridge/Culvert
- [ ] Dam
- [ ] Fill
- [x] Other (Attach Description)

6. [ ] Documentation of ESA compliance is submitted (required to initiate CLOMR review). Please refer to the instructions for more information

C. REVIEW FEE

Has the review fee for the appropriate request category been included?

- [x] Yes, Fee Amount: $_____
- [ ] No, Attach Explanation

Please see the DHS-FEMA website at http://fema.gov/plan/prevent/fhm/frm_fees.shtm for Fee Amounts and Exemptions.

D. SIGNATURE

All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States code, Section 1001.

Name Kathryn Gross, CFM, M.A.	Company Flood Control District of Maricopa County	
Mailing Address 2801 W. Durango Street Phoenix, AZ 85009	Daytime Telephone No. 602-506-4837	FAX No.
	EMAIL ADDRESS kag@mail.maricopa.gov	
Signature of Requester (Required)		Date 8/15/11

As the community official responsible for floodplain management, I hereby acknowledge that we have received and reviewed this Letter of of Map Revision (LOMR) or conditional LOMR request. Based upon the community's review, we find the completed or proposed project meets or is designed to meet all of the community floodplain management requirements, including the requirement for when fill is placed in the regulatory floodway, and that all necessary Federal, State, and local permits have been, or in the case of a conditional LOMR, will be obtained. For conditional LOMR request, the applicant has documented Endangered Species Act (ESA) compliance to DHS/FEMA prior to DHS/FEMA's review of the Conditional LOMR application. For LOMR request, I acknowledge that compliance with sections 9 and 10 of the ESA has been achieved independently of DHS/FEMA's process. For actions authorized, funded, or being carried out by Federal or State agencies, documentation from the agency showing its compliance with Section 7(a)(2) of the ESA will be submitted. In addition, we have determined that the land and any existing or proposed structures to be removed from the SFHA are or will be reasonably safe from flooding as defined in 44 CFR 65.2(c), and that we have available upon request by DHS/FEMA, all analyses and documentation used to make this determination.

Community Official's Name and Title Timothy S. Phillips, PE, Chief Engineer and General Manager	Community Name Maricopa County	
Mailing Address 2801 W. Durango Street Phoenix, AZ 85009	Daytime Telephone No.	FAX No.
	EMAIL ADDRESS	
Community Official's signature (required)		Date 8/16/11

a. The basis for this revision request is (check all that apply)

- ☐ Physical Change
- ☐ Improved Methodology/Data
- ☐ Regulatory Floodway Revision
- ☐ Base Map Changes
- ☐ Coastal Analysis
- ☐ Hydraulic Analysis
- ☐ Hydrologic Analysis
- ☐ Corrections
- ☐ Weir-Dam Changes
- ☐ Levee Certification
- ☐ Alluvial Fan Analysis
- ☐ Natural Changes
- ☐ New Topographic Data
- ☐ Other (attach Description)

Note: A photograph and narrative description of the area of concern is not required, but is very helpful during review.

b. The area of revision encompasses the following structures (check all that apply)

Structures:
- ☐ Channelization
- ☐ Levee/Floodwall
- ☐ Bridge/Culvert
- ☐ Dam
- ☐ Fill
- ☐ Other (Attach Description)

6. ☐ Documentation of ESA compliance is submitted (required to initiate CLOMR review). Please refer to the instructions for more information

C. REVIEW FEE

Has the review fee for the appropriate request category been included?
☐ Yes, Fee Amount: $_____
☐ No, Attach Explanation

Please see the DHS-FEMA website at http://fema.gov/plan/prevent/fhm/frm_fees.shtm for Fee Amounts and Exemptions.

D. SIGNATURE

All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States code, Section 1001.

Name: Kathryn Gross	Company: Flood Control District of Maricopa County
Mailing Address: 2801 W Durango St, Phoenix, AZ 85009	Daytime Telephone No.: 602 506 4837 / FAX No.:
	EMAIL ADDRESS: Kag@mail.maricopa.gov
Signature of Requester (Required)	Date: 8/15/11

As the community official responsible for floodplain management, I hereby acknowledge that we have received and reviewed this Letter of of Map Revision (LOMR) or conditional LOMR request. Based upon the community's review, we find the completed or proposed project meets or is designed to meet all of the community floodplain management requirements, including the requirement for when fill is placed in the regulatory floodway, and that all necessary Federal, State, and local permits have been, or in the case of a conditional LOMR, will be obtained. For conditional LOMR request, the applicant has documented Endangered Species Act (ESA) compliance to DHS/FEMA prior to DHS/FEMA's review of the Conditional LOMR application. For LOMR request, I acknowledge that compliance with sections 9 and 10 of the ESA has been achieved independently of DHS/FEMA's process. For actions authorized, funded, or being carried out by Federal or State agencies, documentation from the agency showing its compliance with Section 7(a)(2) of the ESA will be submitted. In addition, we have determined that the land and any existing or proposed structures to be removed from the SFHA are or will be reasonably safe from flooding as defined in 44 CFR 65.2(c), and that we have available upon request by DHS/FEMA, all analyses and documentation used to make this determination.

Community Official's Name and Title: Andy Goh, City Engineer	Community Name: City of Tempe
Mailing Address: 31st E. 5th Street, Tempe, AZ 85281, attention: Public Works / Engineering	Daytime Telephone No.: 480-350-8200 / FAX No.: 480-350-8591
	EMAIL ADDRESS: andy_goh@tempe.gov
Community Official's signature (required)	Date: 9/2/2011

CERTIFICATION BY REGISTRATION PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR

This certification is to be signed and sealed by a licensed land surveyor, registered professional engineer, or architect authorized by law to certify elevation information data, hydrologic and hydraulic analysis, and any other supporting information as per NFIP regulations paragraph 65.2(b) and as described in the MT-2 Forms instruction. All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Certifier's Name	License No.	Expiration Date
Brian Wahlin, Ph.D., P.E., D.WRE	41980	3/31/2014
Company Name	**Telephone No.**	**Fax No.**
WEST Consultants, Inc.	480-345-2155	480-345-2156
Signature	**E-mail Address**	**Date**
	bwahlin@westconsultants.com	7/7/11

Ensure the forms that are appropriate to your revision request are included in your submittal.

Form name and (Number)	Required if.....
☒ Riverine Hydrology & Hydraulics Form (Form 2)	New or revised discharges or water-surface elevations
☐ Riverine Structures Form (Form 3)	Channel is modified, addition/revision of bridge/culverts, addition/revision of levee/floodwall, addition/revision of dam
☐ Coastal Analysis Form (Form 4)	New or revised coastal elevations
☐ Coastal Structures Form (Form 5)	Addition/revision of coastal structure
☐ Alluvial Fan Flooding Form (Form 6)	Flood control measures on alluvial fans

Seal (optional)

DEPARTMENT OF HOMELAND SECURITY
FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

O.M.B. NO. 1660-0016
Expires February 28, 2014

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 3.5 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 1800 South Bell Street, Arlington VA 20958-3005, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

PRIVACY ACT STATEMENT

AUTHORITY: The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.

PRINCIPAL PURPOSE(S): This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).

ROUTINE USE(S): The information on this form may be disclosed as generally permitted under 5 U.S.C § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA/NFIP/LOMA-1 National Flood Insurance Program (NFIP); Letter of Map Amendment (LOMA) February 15, 2006, 71 FR 7990.

DISCLOSURE: The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a NFIP Flood Insurance Rate Maps (FIRM).

Flooding Source: Highline Lateral

Note: Fill out one form for each flooding source studied.

A. HYDROLOGY

1. Reason for New Hydrologic Analysis (check all that apply)

☐ Not revised (skip to section B) ☒ No existing analysis ☒ Improved data

☐ Alternative methodology ☐ Proposed Conditions (CLOMR) ☒ Changed physical condition of watershed

2. Comparison of Representative 1%-Annual-Chance Discharges

Location	Drainage Area (Sq. Mi.)	Effective FIS (cfs)	Revised (cfs)

3. Methodology for New Hydrologic Analysis (check all that apply)

☐ Statistical Analysis of Gage Records ☒ Precipitation/runoff Model Specify Model HEC-1

☐ Regional Regression Equations ☐ Other (please attach description)

Please enclose all relevant models in digital format, maps, computations (including computation of parameters), and documentation to support the new analysis.

4. Review/Approval of Analysis.

If your community requires a regional, state, or federal agency to review the hydrologic analysis, please attach evidence of approval/review.

5. Impacts of Sediment Transport on Hydrology

Is the hydrology for the revised flooding source(s) affected by sediment transport? ☐ Yes ☒ No

If Yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation for why sediment transport was not considered.

B. HYDRAULICS

1. Reach to be Revised

	Description	Cross Section	Water-Surface Elevations (ft.) Effective	Proposed/Revised
Downstream Limit		N/A	N/A	
Upstream Limit		N/A	N/A	

* Proposed/Revised elevations must tie-into the Effective elevations within 0.5 foot at the downstream and upstream limits of revision.

2. Hydraulic Method/Model Used HEC-RAS used to determine ponding elevations against Highline Lateral.

3. Pre-Submittal Review of Hydraulic Models

DHS/FEMA has developed two review programs, CHECK-2 and CHECK-RAS to aid in the review of HEC-2 and HEC-RAS hydraulic models, respectively. We recommend that you review your HEC-2 and HEC-RAS models with CHECK-2 and CHECK-RAS.

4. Models Submitted

	Natural Run File Name	Natural Run Plan Name	Floodway Run File Name	Floodway Run Plan Name	Datum
Duplicate Effective Model*					
Corrective Effective Model*					
Existing or Pre-Project Conditions Model					
Revised or Post-Project Conditions Model					
Other - (attach description)	Guadalupe FDS	6hour and 24hour			

* For details, refer to the corresponding section of the instructions.

☒ Digital Models Submitted? (Required)

C. MAPPING REQUIREMENTS

A certified topographic map must be submitted showing the following information (where applicable): the boundaries of the effective, existing, and proposed conditions 1%-annual-chance floodplain (for approximate Zone A revisions) or the boundaries of the 1% - and 0.2%-annual-chance floodplains and regulatory floodway (for detailed Zone AE, AO, and AH revisions); location and alignment of all cross sections with stationing control indicated; stream, road, and other alignments (e.g. dams, levees, etc.); current community easements and boundaries; boundaries of the requester's property; certification of a registered professional engineer registered in the subject State; location and description of reference marks; and the referenced vertical datum (NGVD, NAVD, etc.).

☒ Digital Mapping (GIS/CADD) Data Submitted

Topographic Information

Source Flood Control District Maricopa County Date 12/11/2008

Accuracy

Note that the boundaries of the existing or proposed conditions floodplains and regulatory floodway to be shown on the revised FIRM and/or FBFM must tie-in with the effective floodplain and regulatory floodway boundaries. Please attach **a copy of the effective FIRM and/or FBFM**, at the same scale as the original, annotated to show the boundaries of the revised 1%-and 0.2%-annual-chance floodplains and regulatory floodway that tie-in with the boundaries of the effective 1%-and 0.2%-annual-chance floodplain and regulatory floodway at the upstream and downstream limits of the area on revision.

☒ Annotated FIRM and/or FBFM (Required)

D. COMMON REGULATORY REQUIREMENTS*

1. For LOMR/CLOMR Requests, do Base Flood Elevations (BFEs) Increase? ☒ Yes ☐ No

   a. For CLOMR requests, if either of the following is true, please submit **evidence of compliance with Section 65.12 of the NFIP regulations:**

   - The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot compared to pre-project conditions.
   - The proposed project encroaches upon a SFHA with or without BFEs established and would result in increases above 1.00 foot compared to pre-prject conditions.

   b. Does this LOMR cause increase in the BFE and/or SFHA compared with the effective BFEs and/or SFHA? ☒ Yes ☐ No

   If Yes, **please attach proof of property owner notification and acceptance (if available).** Elements of and examples of property owner notifications can be found in the MT-2 Form Instructions.

2. Does the request involve the placement or proposed placement of fill? ☐ Yes ☒ No

   If Yes, the community must be able to certify that the area to be removed from the special hazard area, to include any structures or proposed structures, meets all of the standards of the local floodplain ordinances, and is reasonably safe from flooding in accordance with the NFIP regulations set forth at 44 CFR 60.3(A)(3),65.5(a)(4), and 65.6(a)(14). Please see the MT-2 instructions for more information.

3. For LOMR requests, is the regulatory floodway being revised? ☐ Yes ☒ No

   If Yes, attach evidence of regulatory floodway revison notification. As per paragraph 65.7(b)(1) of the NFIP regulations, notification is required for requests involving revisions to the regulatory floodway. (Not required for revisions to approximate 1%-annual-chance floodplains [studied Zone A designation] unless a regulatory floodway is being established. Elements and examples of regulatory floodway revision notification can be found in the MT-2 Form 2 instructions.)

4. For CLOMR requests, please submit documentation to FEMA and the community to show that you have complied with Sections 9 and 10 of the Endangered Species Act (ESA).

   For actions authorized, funded, or being carried out by Federal or State agencies, please submit documentation from the agency showing its compliance with Section 7(a)(2) of the ESA. Please see MT-2-Instructions for more detail.

* Not inclusive of all applicable regulatory requirements. For details, see 44 CFR parts 60 and 65.

Note to Section B – Hydraulics

The Highline Lateral is lined with elevated berms running parallel to the canal with the top of the berm located few feet above the existing surrounding ground. The existing topography in the study area is such that the storm water runoff from flood events would flow towards the canal and there is a potential for flooding on the upstream side of the canals. As a result, floodplain delineations are based on ponding areas rather than flow conveyance. The existing conditions indicate that the runoff from the watershed tends to collect in low-lying areas adjacent to the canal and has the potential to overtop the berms and enter the canal. Since some of the low lying areas with ponding potential are not well defined, the probability also exists that the ponding areas may join together or spill laterally into each other. For this purpose the water surface elevations for each ponding area was computed in HEC-RAS using storage areas with weirs connections between each ponding area and between the ponding areas and the canal.

An unsteady HEC-RAS model was created to represent the ponding areas. Each ponding area was represented with a storage area in HEC-RAS. The DSS files from HEC-1 were read into HEC-RAS at each storage area corresponding to the same concentration point in HEC-1. The resulting water surface elevations at each ponding location were then mapped in GIS based on the location of the concentration points and the surface elevation of the TIN. This procedure was repeated for both the 24-hour storm and the 6-hour storm in order to identify the worst case scenario for mapping the Zone AH floodplains.

As a result, the floodplain delineations were based on the water surface elevations computed using the HEC-RAS hydraulic model and mapped using the digital terrain model. The weir dimensions and characteristics were determined using Arcview GIS software and the TIN.

2.2. FEMA Forms

Forms required by FEMA are included in the text of this TDN following the ADWR forms. On Form 1 Section B5b, the "Other" box is checked requiring a description. The other structures encompassed by the area of revision are retention basins and storm drains.

On Form 2 section B4, a digital model was submitted. The digital model is an unsteady HEC-RAS model consisting of just storage areas. Its purpose is described in Section 5.

3. Surveying and Mapping Information

3.1. Field Survey Information

Survey data were provided by the District in the form of a GIS shape file and an Excel spreadsheet. The survey was completed on June 7, 2010 and was titled "Highline Canal Topo, Avenida Del Yaqui (Priest Drive) to Grove Parkway." The vertical datum was North American Vertical Datum of 1988 (NAVD88). The horizontal datum was North American Datum (NAD) 1983 HARN Arizona Central Zone, in units of international feet. This survey recorded high spots along the embankment of the Highline Lateral. It was merged with the existing mapping provided by the District.

3.2. Mapping

Topographic data from the District's mapping contract FCD 08-20 were provided by the District in the form of a GIS shape file and included contours at 2-foot vertical intervals. The vertical datum was NAVD88. The horizontal datum was NAD 1983 HARN Arizona Central Zone, in units of international feet. The flight date for the mapping was December 11, 2008.

The topography data provided by the District was combined with the survey data along the Highline Lateral to create a surface file which would more accurately represent the elevations near the critical ponding areas along the canal. To do this three dimensional lines were created connecting the points along the base of the canal and the peak of the embankment of the canal. These lines were combined with the topo data to create a Triangulated Irregular Network (TIN) within GIS. Using the lines instead of the survey points alone allowed the TIN to more accurately represent the elevation between each survey point.

4. Hydrology

4.1. Method Description

Approximate basin boundaries and flow paths were delineated using available tools within GIS using the DEM, survey data, and aerial photographs. The DEM was used to determine ground elevation parameters needed for the DDMSW/HEC-1 model. DDMSW was used to develop sub-basin and routing parameters. Based on site specific information some of the default DDMSW parameters were adjusted to more accurately represent the area. HEC-1 was used to develop a hydrologic model for the area. The flow schematics for this model are included in Appendix D. Both the 100–year, 6-hour and the 100–year, 24-hour storms were analyzed based on the national Oceanic and Atmospheric Administration (NOAA) – 14 rainfall data. Locations

of potential ponding along the canal were located, concentration points were placed in those locations and the HEC-1 model was programmed to output a Data Storage System (DSS) file at each of these locations.

4.2. Parameter Estimation

4.2.1. Drainage Area Boundaries

The Town of Guadalupe is bordered on the west by Interstate-10 and on the north and east by the Highline Lateral. The general slope of the land is to the northeast in the northern half of the Town and to the east and south east in the southern end of the Town. No off-site flows enter the Town of Guadalupe in the 100-year event. The Guadalupe study area was divided into four watersheds based on major concentration points, multiple field visits, and the approximate GIS watershed delineations. The four watersheds from north to south were named North Watershed, Northeast Basin Watershed, Central Watershed, and South Watershed. Figure 2 shows the study area boundary with the watershed divisions and major concentration points at the ultimate outfalls.

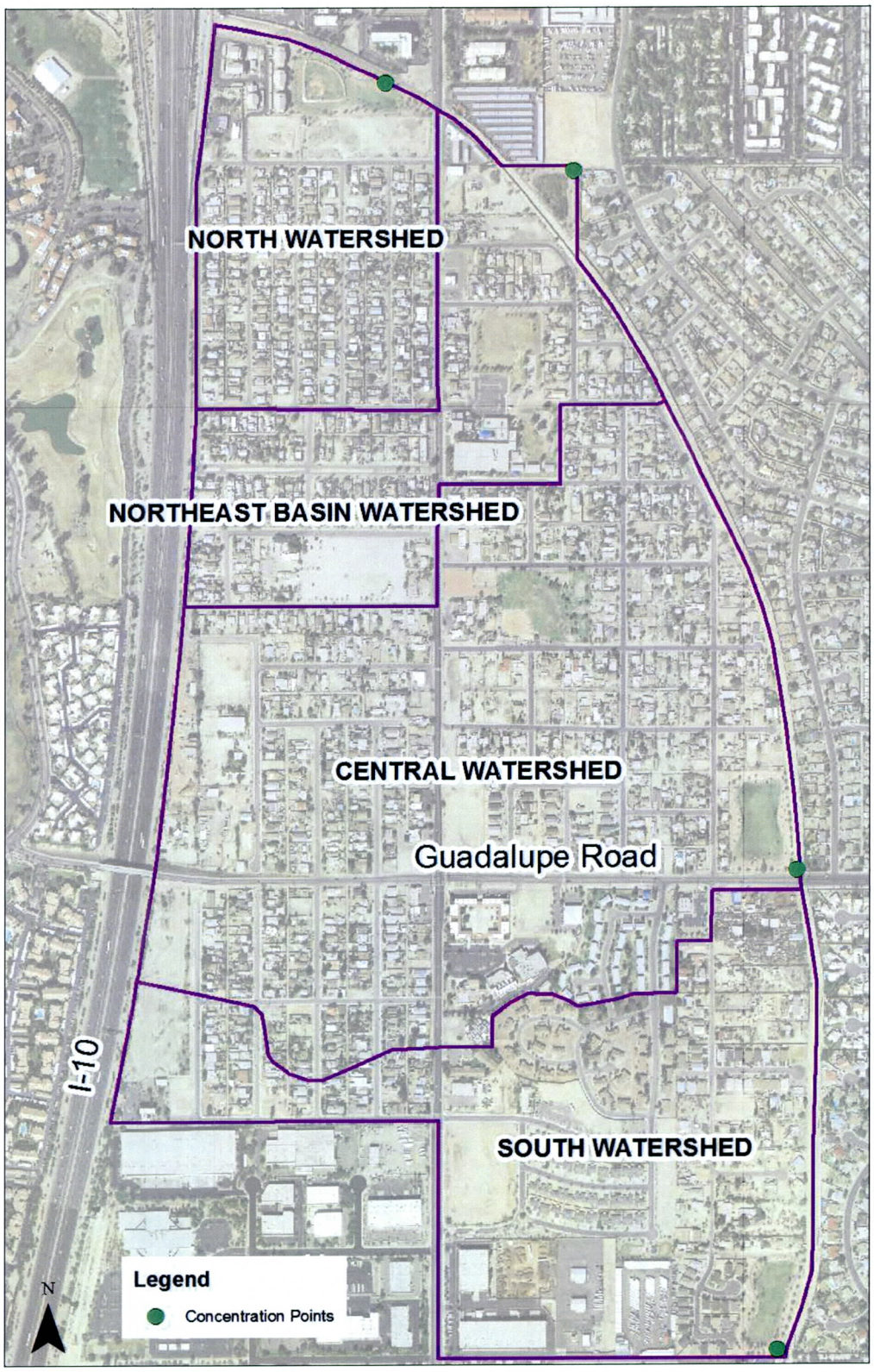


Figure 2. Major basins map

4.2.2. Sub-basin Boundaries and Concentration Points

The four watersheds were divided into smaller subbasins. The delineation of the subbasins was assisted using the approximate watershed basins delineated within GIS. The initial basins generated in GIS clearly showed the flow directions and approximate high and low areas throughout the study area. The final subbasin boundaries were decided based on the available topography, survey data, and through site visits by WEST and District personnel. The boundaries of the natural subbasins are influenced by the presence of the roadways and the canal.

The final sub-basin delineations are shown in Figure 3. The sub-basin name is composed of a number and a letter. A similar number represents a similar flow path destination or concentration point. The letter in the name usually represents the order. For example, A drains to B which combines with C and drains to D. Each set of numbers is contained within a watershed. The North Watershed consists of all the 1's, the Northeast Basin Watershed consists of all the 2's, the Central Watershed consists of all of the 3's and 4's, and the South Watershed consists of the 5's, 6's, 7's, and 8's (see Figure 3). For organizational reasons a schematic of each watershed was created. These schematics were used to assemble the HEC-1 model and HEC-RAS model in the correct sequence. The schematics are shown in Appendix D.3

4.2.3. Watershed Workmaps

Several watershed workmaps are included in the submittal. A full-sized Subbasin Map is included showing concentration points, flow paths, and routing reaches. A soils map is included showing subbasin boundaries along with the various soil types. A land use map showing the subbasin boundaries along with the various land use types is also included.

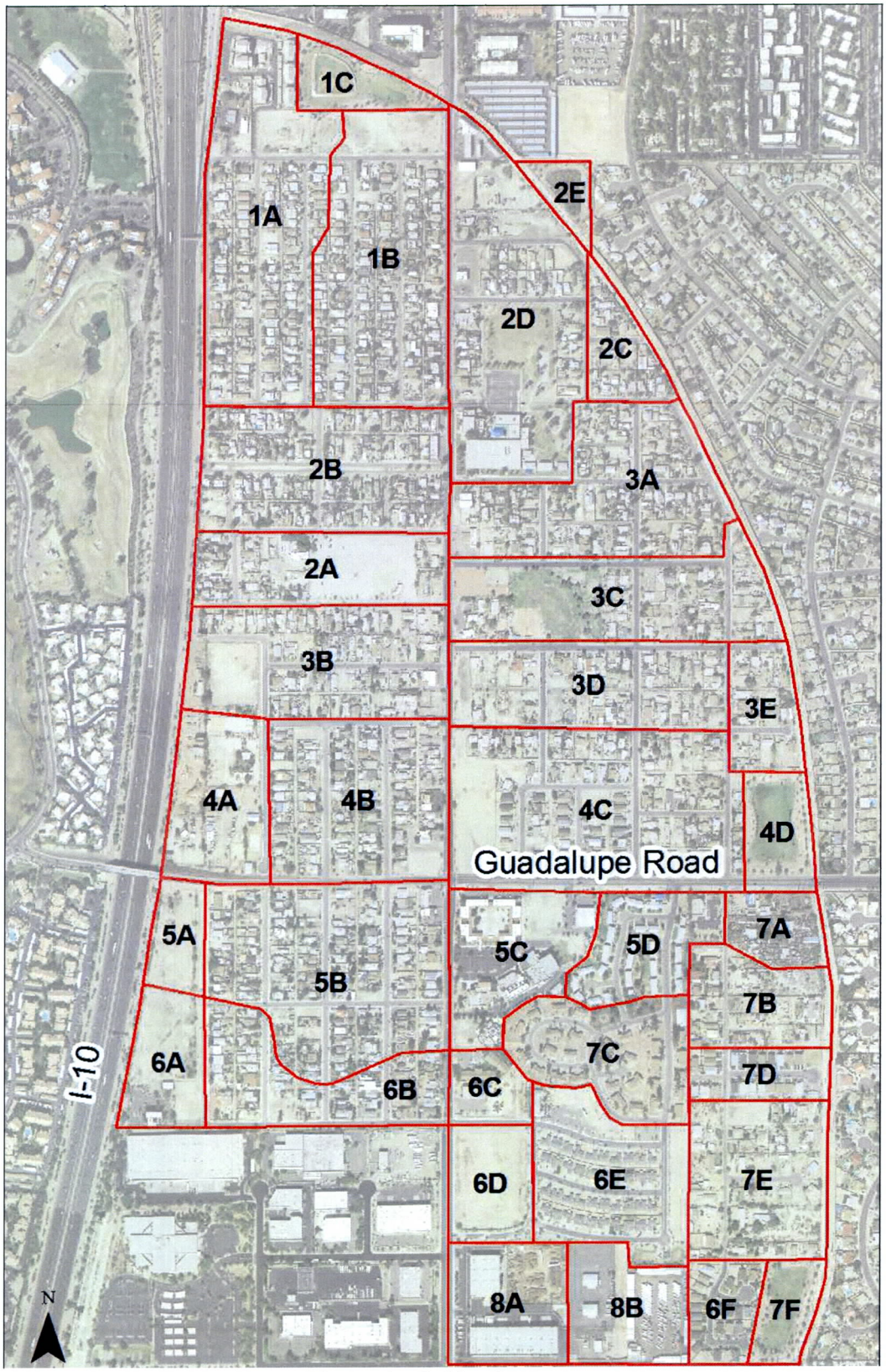


Figure 3. Subbasins map

4.2.4. Gage data

No gage data were available for this study.

4.2.5. Statistical Parameters

There was no available data record for precipitation, runoff, or discharge in the study watershed.

4.2.6. Precipitation

4.2.6.1. Precipitation

The rainfall data were obtained using the NOAA Atlas 14 through DDMSW. The project area shape file from GIS was imported into DDMSW and the values for different rainfall events were automatically computed. The rainfall for the 100-year, 24-hour storm was determined to be 3.45 inches and 2.52 inches for the 100–year, 6-hour storm. The results for all storm events are presented in Appendix D.1.

4.2.6.2. Rainfall Pattern

The Maricopa County 6-hour local storm distributions consist of five dimensionless storm patterns. The 24-hour storm distribution used in Maricopa County is the SCS Type II distribution. For more details on these rainfall patterns, see Maricopa County's Hydrology Manual (Flood Control District of Maricopa County, 2009).

The appropriate rainfall pattern is automatically selected by the DDMSW program.

4.2.6.3. Depth Area Reduction

The NOAA Atlas 14 rainfall depths from the isopluvial maps are point rainfalls for specified frequencies and durations. This is the depth of rainfall that is expected to occur at a point or points in a watershed for the specified frequency and duration. However, this depth is not the aerially-averaged rainfall over the basin that would occur during a storm. A reduction factor is used to convert the point rainfall to an equivalent uniform depth of rainfall over the entire watershed. As the watershed area increases, the reduction factor decreases, reflecting the greater non-homogeneity of rainfall for storms of larger areas.

Regional research by the Agricultural Research Service, U.S. Department of Agriculture, for the Walnut Gulch Experimental Watershed near Tombstone, Arizona, indicated that local storms are characterized by relatively small areas of high intensity rainfall resulting in depth-area reduction curves that decrease rapidly with increasing area. The U.S. Army Corps of Engineers studied historic storms in Arizona and published the results of those studies (U.S. Army Corps of Engineers, 1974).

For local storms (6-hour duration), the depth-area reduction curve that is to be used in Maricopa County is the curve developed by the U.S. Army Corps of Engineers for the August 1954 Queen Creek Storm (see Figure 4). For the 24-hour general storm, the depth-area reduction curve that is to be used in Maricopa County is shown in Figure 5. This curve is taken from Figure 15 of the National Weather Service HYDRO-40 (Zehr & Myers, 1984).

All depth-area reduction factors are coded directly into DDMSW.

Figure 4. Depth-area reduction for the 6-hour rainfall

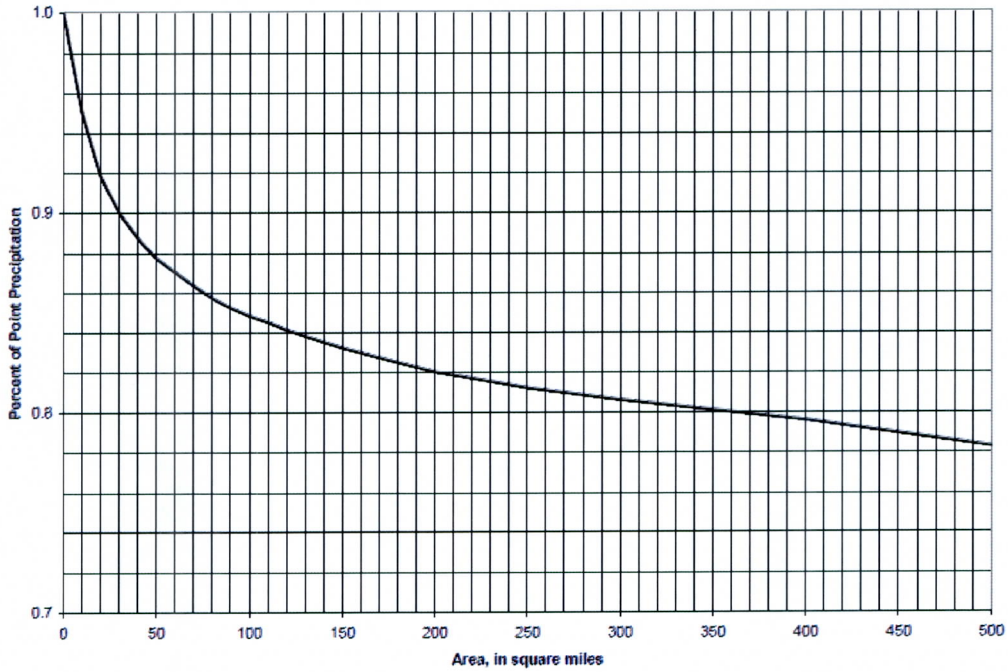


Figure 5. Depth-area reduction for the 24-hour rainfall

4.2.7. Physical Parameters

Physical modeling parameters for the subbasins were determined using available tools within GIS and DDMSW. Summary Tables of the subbasins physical parameters is provided in Appendix D.

4.2.7.1. Soils and Land Use

A land use data map was created based on aerial photography and site visits. The land use parameters were set according the Maricopa Association of Governments (MAG) standards. This shape file was referenced by DDMSW to determine correct landuse parameters within each subbasin.

The soil data for the Town of Guadalupe were obtained from the USDA NRCS Soil Data Mart. A shape file was created based on these data and was clipped to the Guadalupe region. This shape file was referenced by DDMSW to determine correct soil parameters within each subbasin.

4.2.7.2. Losses

The Green and Ampt method was used to calculate rainfall losses. Parameters for the calculation were obtained from landuse and soil data contained in the GIS shape files. All of the necessary variables were calculated automatically within the DDMSW program.

4.2.7.3. Unit Hydrograph

The District recommends the Clark unit hydrograph to route rainfall excess from the land's surface for watersheds or subbasins less than about 5 square miles in size with an upper limit of 10 square miles. The Clark unit hydrograph is also the preferred procedure for urban watersheds and, thus, was utilized in this study.

Time of concentration is defined as the travel time, during the corresponding period of most intense rainfall excess, for a flood wave to travel from the hydraulically most distant point in the watershed to the point of interest (concentration point). The District has specific procedures for calculating the time of concentration for use in the Clark unit hydrograph as outlined in District standards (Flood Control District of Maricopa County, 2009). The District has adopted an empirical equation for time of concentration with some procedural modifications from Papadakis and Kazan (1987).

Both he time of concentration and the Clark unit hydrograph procedures are coded directly into DDMSW.

4.2.8. Reach Routing

The flow routings were determined based on the topographic information, site visits, subbasin delineations and the location of the concentration points. The length and the slope of the reaches were obtained from ArcView. The cross-sections of the flow routings were modeled in DDMSW using normal depth. The cross-sections were described as roadways with a Manning's n value of 0.02. The width of each road was determined based on the aerial photographs. The slope of each was determined based on length and elevation variation according to the DEM.

4.2.9. Ponding Relationships

The areas with significant potential of ponding were identified after initial runs of the HEC-1 models. Upon identifying the areas of potential ponding, an elevation-storage relationship was developed for each area using the DEM in the ArcView GIS software. For each elevation in the ponding relationship, the storage capacity was determined using the volume calculation capability of the ArcView software. Each ponding or storage area was named after the subbasin in which it lies predominantly. Figure 6 shows the location of the areas of significant ponding.

Ponding relationships were developed between each ponding area in HEC-RAS. HEC-RAS was used because of its ability to correctly balance flows over weirs and through pipes simultaneously. DSS files were extracted from HEC-1 at each ponding area and were referenced as flow files in HEC-RAS. The storage area connections consist of weirs, pipes, or a combination of both. Most ponding areas have three weirs, one on the north side, one on the south side, and one on the east side. The north and south weirs represent spilling from one pond to another, and the weir on the east side represents spill from the ponding area into the canal. Additional storage area connections were created with a culvert and an artificially high weir to represent drainage storm drain pipe connections between certain ponds. The 10-year storm drain system was represented using the culvert routines in the storage area connections.

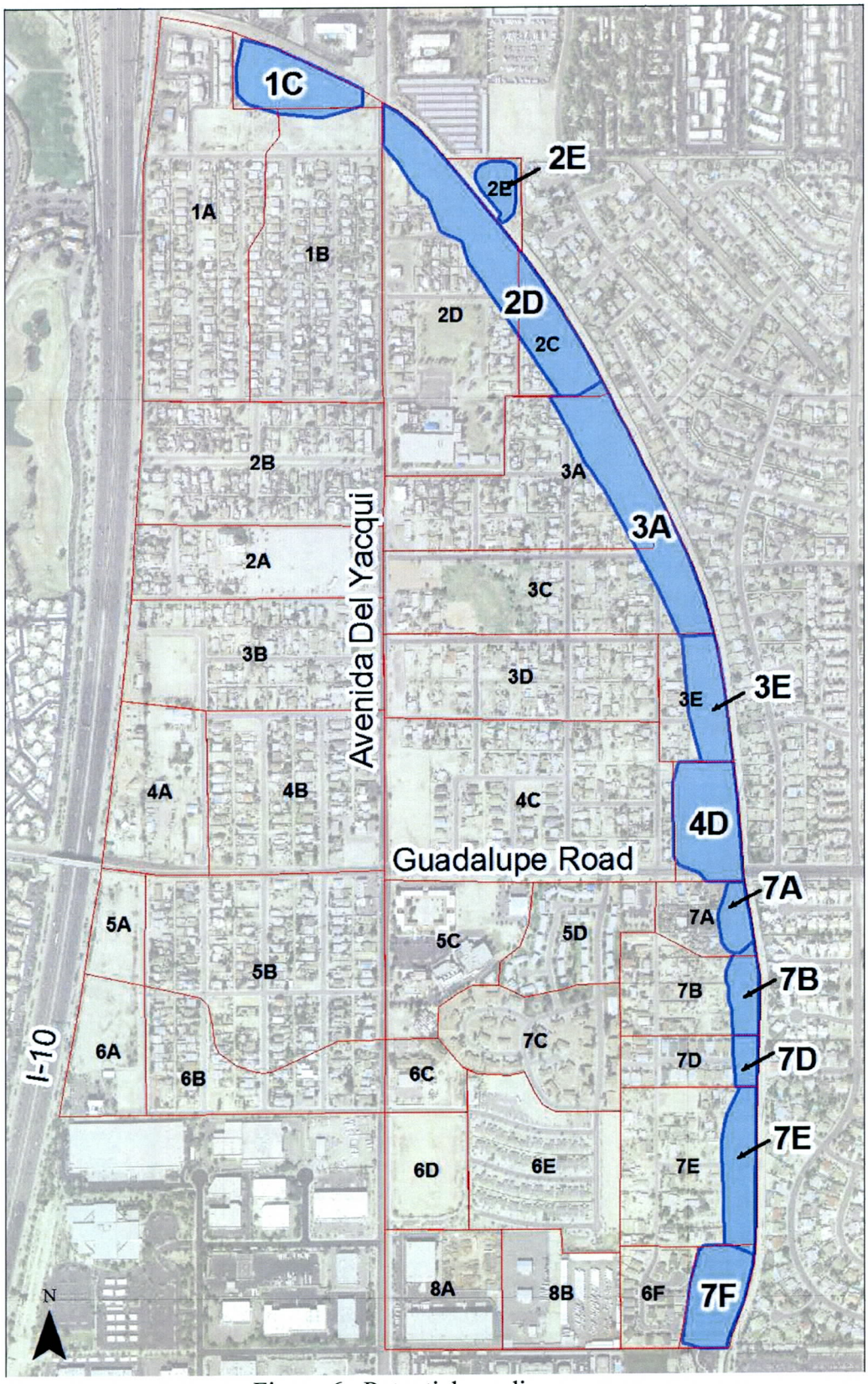


Figure 6. Potential ponding areas

4.2.9.1. North Watershed

Storage area 1C is located directly east of a baseball field in the North Watershed subbasin 1C. The baseball field and some surrounding area within 1C are lower than surrounding areas and for this reason were included in the stage/storage relationship developed in ArcView as shown in Figure 7. The stage storage relationship for 1C is represented in Table 1. Flows from subbasin 1A enter 1C through a small drainage ditch at the north east end of 1A. The apartment complex in the northern most section of 1A has a retention basin and appears to be designed to contains it own flows, but for a conservative measure these flows have been included in the flows stored in 1C. Flows from subbasin 1B enter 1C through a grated inlet structure just east of the storage basin along the west side of Avenida Del Yaqui. Flows overtopping basin 1C would most likely spill back onto Avenida Del Yaqui and flow north to the City of Tempe. Since 1C does not interact with the other potential ponding areas or the canal (which is underground at this location), it was not included in the HEC-RAS model. The WSE for 1C was determined by the HEC-1 output alone.

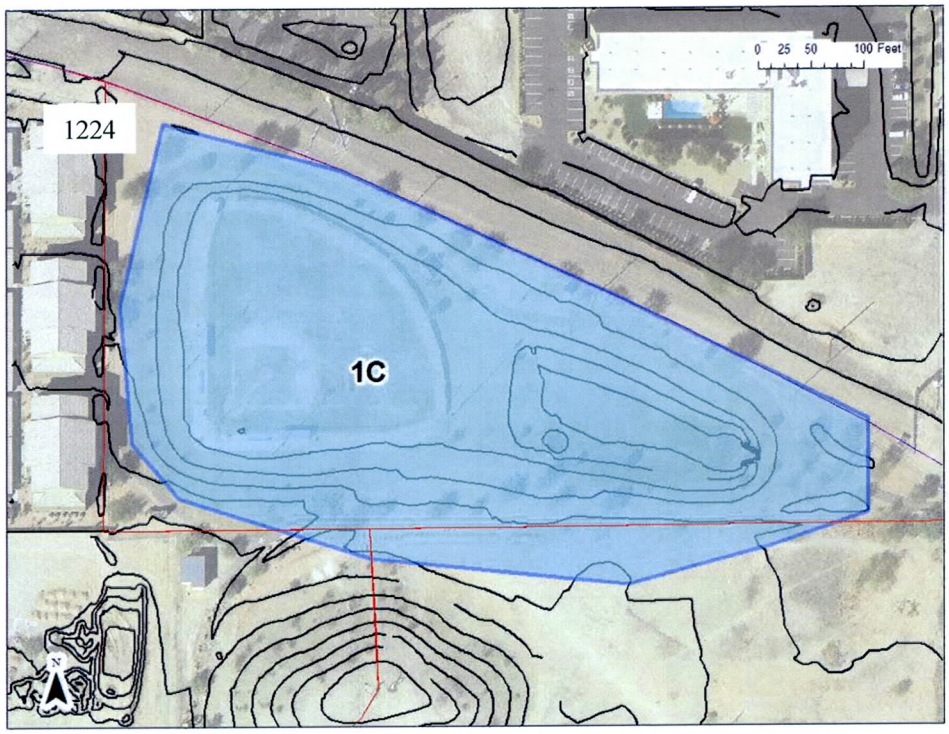


Figure 7. Ponding area 1C

Table 1. Stage storage relationship for ponding area 1C

Stage (ft)	1217	1218	1219	1220	1221	1222	1223	1224	1225	1226
Storage (ac-ft)	0.00	0.05	0.30	0.65	1.17	2.66	4.84	7.34	10.43	14.06

4.2.9.2. Northeast Basin Watershed

Storage area 2D is located along the Highline Lateral on the northeast edge of subbasin 2D. The low point of this storage area is the drainage inlet leading to retention basin 2E. This drainage inlet is the concentration point for all flows contributing to 2D. If the flows back-up at the drain the resulting ponding area will be along the canal and will back up into subbasin 2C as well. The ponding area included in this stage/storage relationship is shown in Figure 8. The stage storage relationship for 2D is represented in Table 2. If the ponding area fills it has the potential to spill into the canal and possibly into storage area 3A to the southeast. Flows entering the canal are assumed to be carried away and eliminated from the system. In the HEC-RAS model storage area 2D was connected to the canal and to 3A as a weir based on elevations from the TIN. It was also connected to 2E as weir with a culvert, with the weir elevation set artificially high to force flows through the culvert.

Storage Area 2Eis located directly across the canal from subbasin 2D and represents the Northwest Basin. It is the ultimate drainage point for all flow in the Northwest Basin Watershed. Flows entering 2E come from the drain inlet mentioned in the description of 2D, and flow through a pipe under the canal. Other than the drainage pipe the only water entering 2E is the rainfall that falls within 2E. The ponding area included in this stage/storage relationship is also shown in Figure 8. The stage storage relationship for 2E is represented in Table 3. If storage area 2E overflows the flows will most likely spill over the east side entering Tempe and leaving the system. In HEC-RAS 2E was only connected to 2D as described in the previous paragraph.

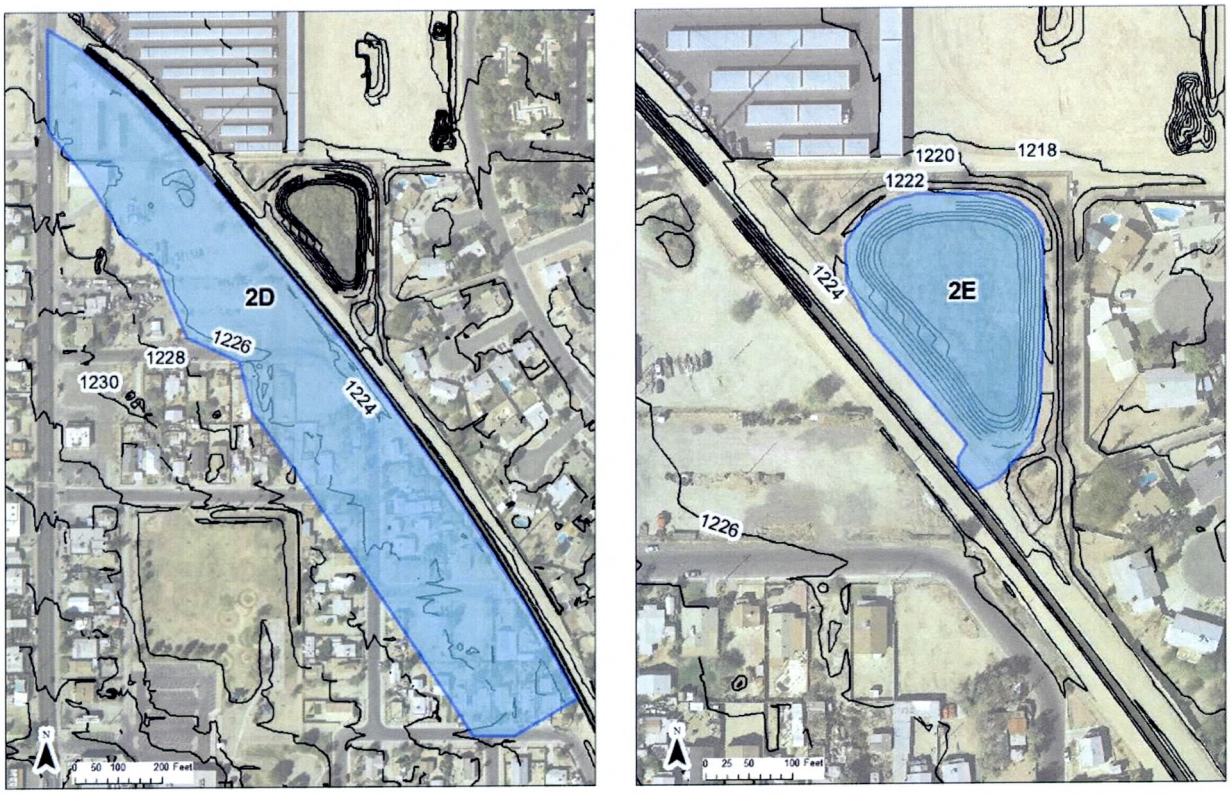


Figure 8. Ponding areas 2D and 2E

Table 2. Stage storage relationship for ponding area 2D

Stage (ft)	1222	1223	1224	1225	1226
Storage(ac-ft)	0.00	0.02	0.16	2.29	7.48

Table 3. Stage storage relationship for ponding area 2E

Stage (ft)	1210	1211	1212	1213	1214	1215	1216	1217
Storage(ac-ft)	0.00	0.01	0.07	0.63	1.22	1.86	2.54	3.25
Stage (ft)	1218	1219	1220	1221	1222	1223	1224	1225
Storage(ac-ft)	4.01	4.80	5.63	6.51	7.44	8.44	9.49	10.71

4.2.9.3. Central Watershed

Storage area 3A is located at the east end of subbasin 3A. The low point is a concrete line V-ditch built . A drainage inlet structure at the south end of the V-ditch carries flows through a pipe to retention basin 4D. Surface flows from 3A and 3C enter this drainage inlet as well and were included in the ponding calculations. Flows spilling over from storage area 3A have the potential to drain east into the canal, north to 2D, or south to 3E. The ponding area included in this stage/storage relationship is shown in Figure 9. The stage storage relationship for storage area 3A is represented in Table 4. In the HEC-RAS model storage area 3A has 4 connections. The connection to 2D, 3E and the canal were all weir connections based on the TIN. The fourth connection was to storage area 4D as a weir with a culvert. As with the connection between 2D and 2E, this weir was also set artificially high to force the flows through the culvert.

Storage area 3E is located along the canal on the east side of subbasin 3E. 3E receives flows from subbasins 3E and 3D. A drainage inlet structure along the east side of 3E connects it to storage area 4D. Flows overtopping this ponding area would most likely drain north to 3A but also have the potential to drain south to retention basin 4D and into the canal. The ponding area included in this stage/storage relationship is also shown in Figure 9. The stage storage relationship for storage area 3E is represented in Table 5. The storage area connections between 3E and the canal and between 3E and 3A were both weir connections based on the TIN. The connection between storage area 3E and storage area 4D was created as a weir with a culvert connection. In this instance the weir elevation were based on the TIN.

Storage area 4D is located in the southeast corner of the central watershed. It is the ultimate drainage point for all flows in the Central Watershed. If storage area4D overtops it has the potential to spill into the canal at which point the flows would leave the system. It also has potential to spill north to storage area 3E or south across Guadalupe Road into storage area 7A in the South Watershed. The ponding area included in this stage/storage relationship is shown in Figure 10. The stage storage relationship for storage area 4D is represented in Table 6. The drainage pipe from storage area 3A is modeled in HEC-RAS as a weir with a culvert connection

having the weir elevation set artificially high to force flows through the drain pipe. The connection with storage area 3E to the north is modeled in HEC-RAS with a weir and culvert connection with the weir based on the TIN. The connections between storage area 4D and the canal and between storage area 4D and 7A are both weir connections based on the TIN elevations.

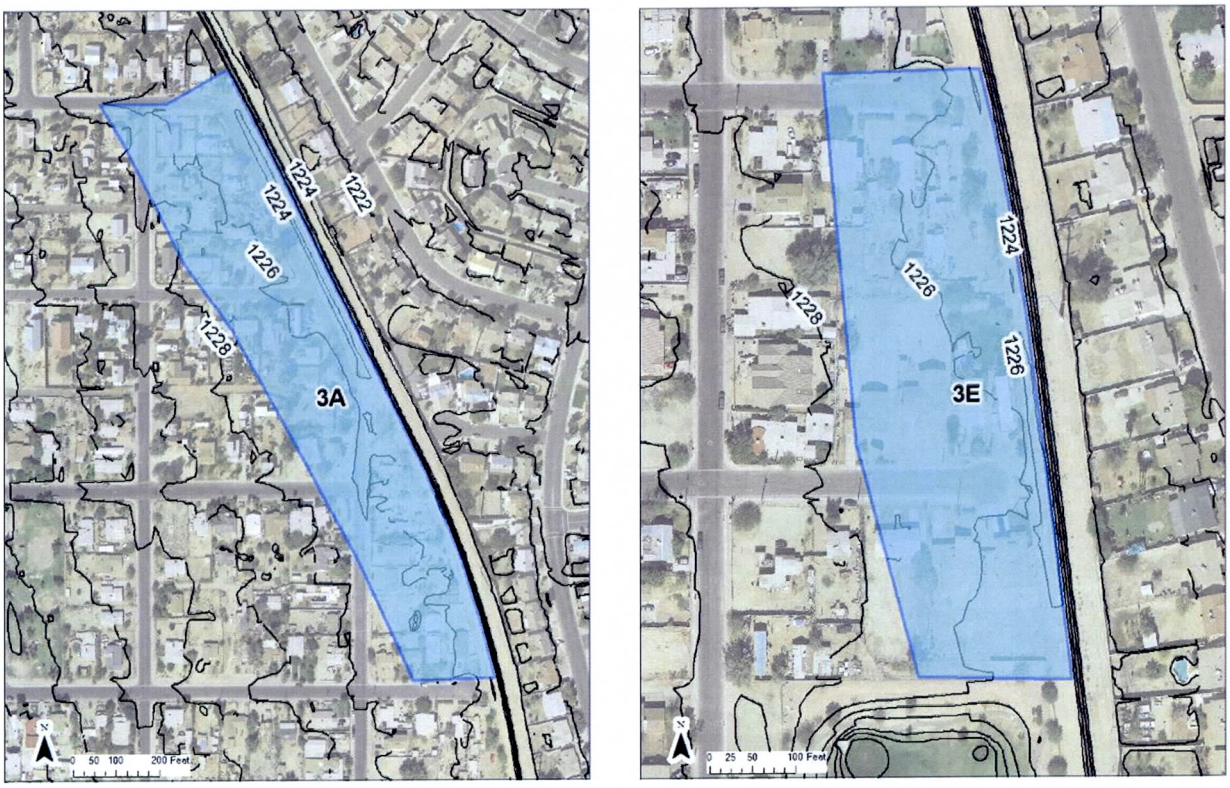


Figure 9. Ponding areas 3A and 3E

Table 4. Stage storage relationship for ponding area 3A

Stage (ft)	1222	1223	1224	1225	1226	1227
Storage(ac-ft)	0.00	0.04	0.16	0.95	3.38	9.31

Table 5. Stage storage relationship for ponding area 3E

Stage (ft)	1224	1225	1226	1227
Storage(ac-ft)	0.00	0.07	0.63	2.78

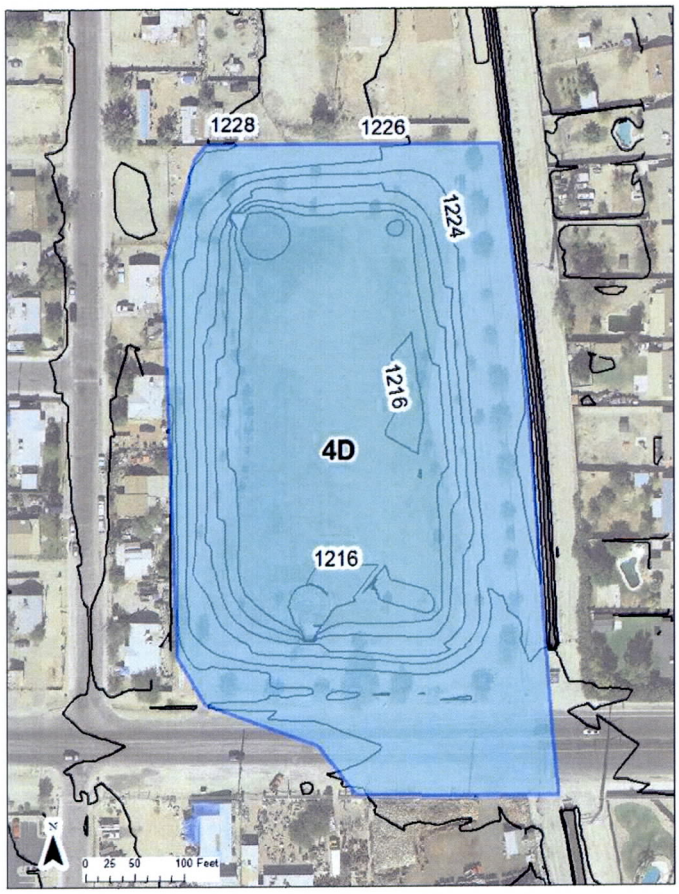


Figure 10. Ponding area 4D

Table 6. Stage storage relationship for ponding area 4D

Stage (ft)	1216	1217	1218	1219	1220	1221
Storage(ac-ft)	0.00	0.71	2.23	4.23	6.38	8.71
Stage (ft)	1222	1223	1224	1225	1226	1227
Storage(ac-ft)	11.23	13.94	16.86	20.11	23.87	28.26

4.2.9.4. South Watershed

Storage area 7A is a small storage area in the northeast corner of the South Watershed. Storage area 7A only receives flows from subbasin 7A with the potential to share flows with retention basin 4D to the north and 7B to the south. The storage capacity of storage area 7A is relatively small and overtopping flows generally drain into the canal. The ponding area included in this stage/storage relationship is shown in Figure 11. The stage storage relationship for storage area 7A is represented in Table 7. Storage area connections were established between 7A and 4D, 7A and the canal, and 7A and 7B all as weir connections with the elevations based on the TIN.

Storage area 7B is located just south of subbasin 7A along the Highline Lateral. A drainage inlet along the Highline Lateral collects flows from subbasin 7B and empties into storage area 7F. Storage area 7B also has the potential to share flows with 7A and 7D and to spill into the canal. The ponding area included in the stage/storage relationship for 7B is also shown in Figure 11. The stage storage relationship for storage area 7B is represented in Table 8. Weir connections were created in HEC-RAS between 7B and 7A, between 7B and 7D, and between 7B and the canal all with the weir elevations based on the TIN. A fourth connection was created between storage area 7B and storage area 7F as a weir culvert connection with the weir elevation set artificially high to force flows through the drainage pipe.

Storage area 7D is located just south of subbasin7B along the canal. Storage area 7D is contained by a block wall and has a retention basin at the downstream end capable of containing all of the flows contributed by subbasin7D. For conservative measurements the storage relationships were set up as though the wall did not exist. The ponding area included in this stage/storage relationship is shown in Figure 12. The stage storage relationship for storage area7D is represented in Table 9. Storage area weir connections were established between 7D and 7B, between 7D and 7E, and between 7D and the canal. All weir connections with 7D are based on TIN elevations.

Storage area 7E is located just north of storage area 7F. Flows from subbasin 7E pond along the canal and have the potential to spill into the canal or combine with 7F to the south or 7D to the north. A storm drainpipe also exists along the canal to the east and empties into retention basin 7F. The ponding area included in the stage/storage relationship for 7E is also shown in Figure 12. The stage storage relationship for storage area 7E is represented in Table 10. Storage area weir connections were established between 7E and 7D and between 7E and the canal. A weir/culvert connection was established between 7E and retention basin 7F. All weir elevations were based on the TIN elevations.

Storage area Basin 7F is the ultimate drainage location of the South Watershed. Flows overtopping storage area 7F would most likely drain back to basin 7E and over top into the canal. The ponding area included in the stage/storage relationship for 7F is shown in Figure 13. The stage storage relationship for storage area 7F is represented in Table 11. A storage area weir connection was established between 7F and the canal. The connection between 7F and 7E was set up as a weir/culvert connection with the weir elevations set to the TIN elevations. The connection between 7F and 7B was set up as a weir/culvert connection with an artificially high weir elevation to force flows through the storm drain pipe.

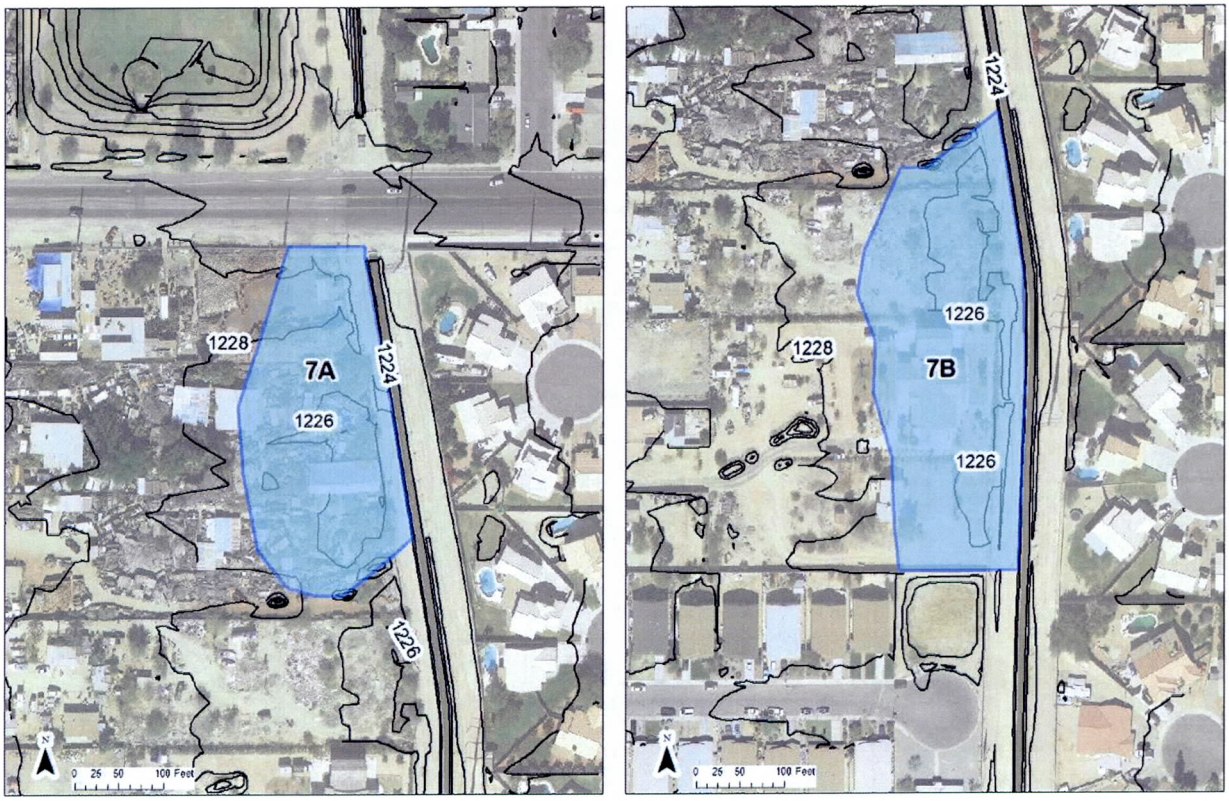


Figure 11. Ponding areas 7A and 7B

Table 7. Stage storage relationship for ponding area 7A

Stage (ft)	1225	1226	1227
Storage(ac-ft)	0.00	0.02	0.65

Table 8. Stage storage relationship for ponding area 7B

Stage (ft)	1225	1226	1227	1228
Storage(ac-ft)	0.00	0.02	1.12	2.75

Figure 12. Ponding areas 7D and 7E

Table 9. Stage storage relationship for ponding area 7D

Stage (ft)	1224	1225	1226	1227	1228
Storage(ac-ft)	0.00	0.16	0.36	0.96	1.79

Table 10. Stage storage relationship for ponding area 7E

Stage (ft)	1224	1225	1226	1227
Storage(ac-ft)	0.00	0.01	0.06	1.51

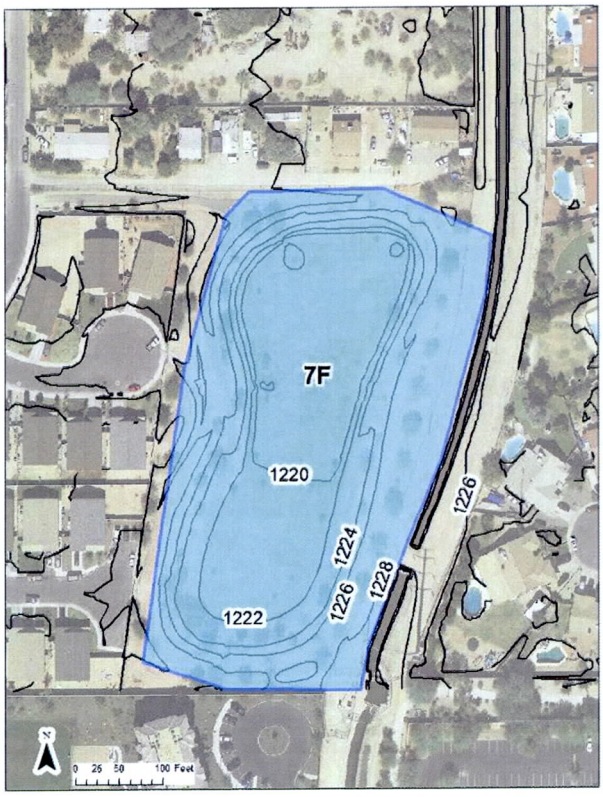


Figure 13. Ponding area 7F

Table 11. Stage storage relationship for ponding area 7F

Stage (ft)	1218	1219	1220	1221	1222	1223	1224
Storage(ac-ft)	0.00	0.20	0.77	1.72	2.90	4.47	6.26
Stage (ft)	1225	1226	1227	1228	1229	1230	
Storage(ac-ft)	8.27	10.48	13.40	16.65	20.33	24.09	

4.2.10. Diversions

Retention basins with the potential to retain a significant amount of water before the water reaches the ponding areas along the canal, referred to as internal retention areas, were identified using both the aerial photos and the DEM. The storage capacity for each basin was determined using the volume calculation capability of the ArcView software. Maximum storage capacities were calculated for each retention area using available volume calculating tools within GIS. These calculated volumes were entered into DDMSW as diversions. As an added conservative measure only 80% of each internal retention area's potential storage was used in the HEC-1 model. The diversions were set with large inflow parameters allowing the maximum volume to be diverted at each basin. Figure 14 shows the internal retention areas identified by WEST. Table 12 shows the capacity of each of these retention basins. Subbasin 6E has two notable

retention basins. For modeling purposes the volumes of the two retention basins were combined and the total volume was entered as the diversion for 6E.

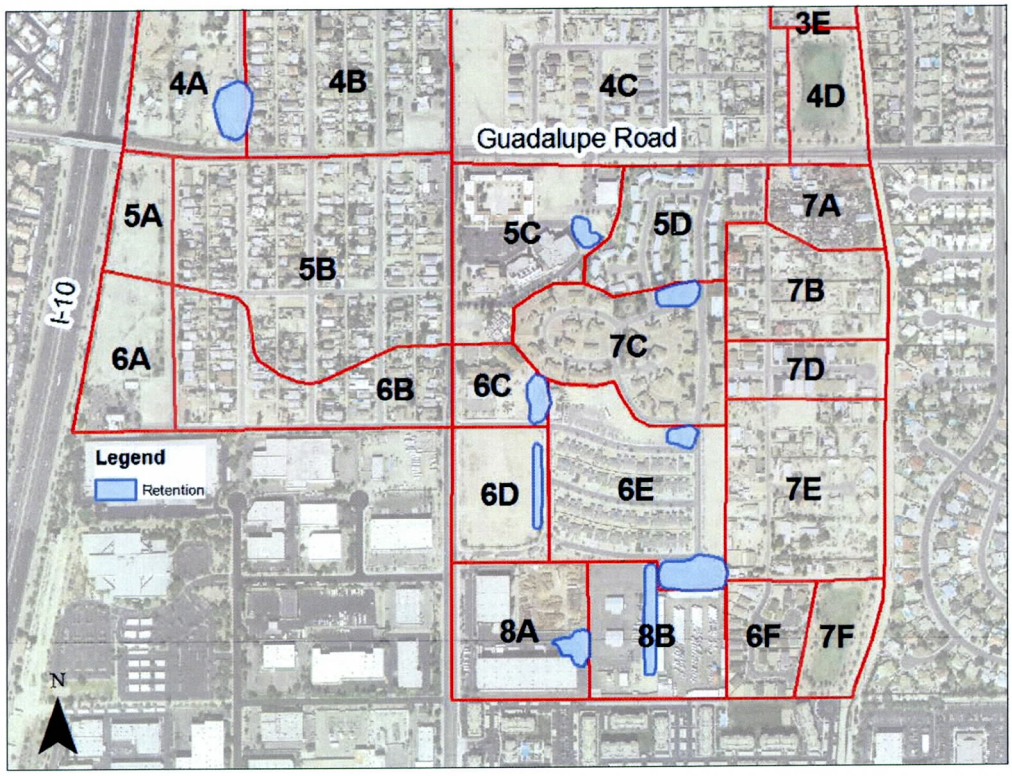


Figure 14. Internal retention basin locations

Table 12. Retention basin volumes

Basin	4A	5C	6C	6D	6E	7C	8A	8B
Maximum Volume (ac-ft)	0.40	0.41	0.54	0.29	0.29	0.40	1.19	0.23
80% Volume (ac-ft)	0.32	0.33	0.43	0.23	1.52	0.32	0.95	0.19

4.2.11. Problems Encountered During Study

None encountered.

4.2.12. Calibration

There are no stream or rain gages within the Town of Guadalupe. Thus, calibration to historic events is not possible.

4.2.13. Final Results

A peak flow value was obtained from each of the subbasins. Table 13 provides a summary of the resulting peak flow values from each of the subbasins and storage area concentration points. The flow hydrographs resulting from the HEC-1 models were applied to the HEC-RAS model in the appropriate location. These locations are also included in the table.

Table 13. Subbasin flow summary

Basin or Junction	100-yr 6-hr flow (cfs)	100-yr 24-hr flow (cfs)		Basin or Junction	100-yr 6-hr flow (cfs)	100-yr 24-hr flow (cfs)
1A	60	50		**4C**	80	67
1B	44	37		**5D**	19	16
1C	9	7		**4D**	18	15
1CJUNC	111	94		**4DJUNC**	270	219
2A	20	17		**7A**	16	13
2B	45	38		**7C**	20	17
2BJUNC	63	106		**7B**	19	16
2D	65	54		**7BJUNC**	30	28
2DJUNC	128	106		**7D**	11	9
2C	8	7		**7E**	24	21
2E	7	6		**6A**	10	9
3A	49	41		**6B**	21	18
3B	38	32		**6BJUNC**	29	25
3C	30	25		**6C**	10	8
3CJUNC	107	89		**6CJUNC**	32	30
3D	31	26		**8A**	24	19
3E	24	19		**6D**	8	7
3EJUNC	24	19		**6DJUNC**	27	22
4A	32	26		**8B**	28	23
4B	45	38		**6E**	26	22
4BJUNC	73	60		**6EJUNC**	84	80
5A	6	5		**6F**	17	14
5B	66	55		**6FJUNC**	84	80
5BJUNC	67	56		**7F**	11	9
5C	32	26		**7FJUNC**	84	81
5CJUNC	160	133				

4.2.14. Verification of Results

The resulting flows from the HEC-1 model seem reasonable. The flow values obtained from this updated study are lower than Sverdrup's original study (2001). The differences between the two studies can be explained by the difference precipitation data used. Sverdrup (2001) used NOAA Atlas 2 for their hydrologic study while this study used NOAA Atlas 14, which has lower precipitation for this area. As a comparison, the HEC-1 flows were compared to the USGS regression equations for the area. The Town of Guadalupe falls in Region 12 as described in the USGS Open File Report 93-419. The regression equations for Region 12 are functions of drainage area and mean basin elevation. A comparison of the HEC-1 flows to the regression equations flows is shown in Table 14. In general, the regression equations are of the same order of magnitude as the HEC-1 flows. However, the HEC-1 flows are typically higher than the flows reported by the regression equations.

Table 14. Comparison of subbasin flows to regression equation flows

Basin or Junction	100-yr 6-hr flow (cfs)	100-yr 24-hr flow (cfs)	Basin Area (mi^2)	Mean Basin Elevation / 1000 (ft)	100-year Regression Equation flow
1A	60	50	0.044	1.241	109
1B	44	37	0.041	1.236	101
1C	9	7	0.007	1.223	11
2A	20	17	0.020	1.257	43
2B	45	38	0.034	1.252	81
2D	65	54	0.045	1.231	112
2C	8	7	0.008	1.226	13
2E	7	6	0.004	1.220	5
3A	49	41	0.033	1.232	79
3B	38	32	0.032	1.260	75
3C	30	25	0.031	1.234	73
3D	31	26	0.026	1.238	59
3E	24	19	0.010	1.227	18
4A	32	26	0.018	1.272	37
4B	45	38	0.032	1.259	75
5A	6	5	0.006	1.277	9
5B	66	55	0.044	1.261	108
5C	32	26	0.019	1.248	40
4C	80	67	0.051	1.240	129
5D	19	16	0.014	1.237	27
4D	18	15	0.009	1.222	15
7A	16	13	0.007	1.228	11
7C	20	17	0.020	1.239	43
7B	19	16	0.014	1.230	28
7D	11	9	0.008	1.230	13
7E	24	21	0.024	1.230	54
6A	10	9	0.011	1.274	20
6B	21	18	0.020	1.262	43
6C	10	8	0.006	1.247	9
8A	24	19	0.016	1.245	32
6D	8	7	0.011	1.247	20
8B	28	23	0.014	1.237	27
6E	26	22	0.024	1.239	54
6F	17	14	0.008	1.232	13
7F	11	9	0.006	1.224	9

5. Hydraulics

5.1. Method Description

The Highline Lateral is lined with elevated berms running parallel to the canal with the top of the berm located few feet above the existing surrounding ground. The existing topography in the study area is such that the storm water runoff from flood events would flow towards the canal and there is a potential for flooding on the upstream side of the canals. As a result, floodplain delineations are based on ponding areas rather than flow conveyance. The existing conditions indicate that the runoff from the watershed tends to collect in low-lying areas adjacent to the canal and has the potential to overtop the berms and enter the canal. Since some of the low lying areas with ponding potential are not well defined, the probability also exists that the ponding areas may join together or spill laterally into each other. For this purpose the water surface elevations for each ponding area was computed in HEC-RAS using storage areas with weirs connections between each ponding area and between the ponding areas and the canal.

An unsteady HEC-RAS model was created to represent the ponding areas. Each ponding area was represented with a storage area in HEC-RAS. The DSS files from HEC-1 were read into HEC-RAS at each storage area corresponding to the same concentration point in HEC-1. The resulting water surface elevations at each ponding location were then mapped in GIS based on the location of the concentration points and the surface elevation of the TIN. This procedure was repeated for both the 24-hour storm and the 6-hour storm in order to identify the worst case scenario for mapping the Zone AH floodplains.

As a result, the floodplain delineations were based on the water surface elevations computed using the HEC-RAS hydraulic model and mapped using the digital terrain model. The weir dimensions and characteristics were determined using Arcview GIS software and the TIN.

5.2. Work Study Maps

Floodplain Workmaps were created based on the water surface elevation results from these storage areas.

5.3. Parameter Estimation

5.3.1. Roughness Coefficients

Roughness coefficients were not necessary since the hydraulic analysis was based solely on storage analysis using storage areas.

5.3.2. Expansion and Contraction Coefficients

Expansion and contraction coefficients were not necessary since the hydraulic analysis was based solely on storage analysis using storage areas.

5.4. Storage Area Descriptions

All storage areas except the Highline Lateral were designed based on the descriptions in Section 4.2.9. For the Highline Lateral, the stage-storage relationship is only used in the unsteady HEC-

RAS hydraulic model and not for mapping any floodplains. It is based on the 1965 as-built drawings obtained from SRP. These as-built drawings are included in Appendix E.5. It should be noted that the as-built drawings refer to the Highline Lateral as "Lat. 2.8 Western Canal". In order to calculate the storage volume in the lateral, the cross-sectional area of the lateral, based on the as-built drawings, was multiplied by the length of the lateral along the project area. This length was approximately 7,300 feet. The base elevation was set to 1210 feet for convenience in modeling within HEC-RAS. The exact base elevation of the lateral would be difficult to determine since it changes along the 7,300 foot length. Since this storage area is not used for mapping floodplains, the exact base elevation is not needed in order to calculate the storage capacity of the canal. According to the as-built drawings, the design flow depth of the canal is 3.7 feet, so the initial water surface elevation of the storage area used to model the Highline Lateral within HEC-RAS was set to 1213.7 feet. The calculated stage-storage values are listed in Table 15.

Table 15. Stage storage relationship for Highline Lateral

Elevation (ft)	**1210**	**1210.25**	**1210.5**	**1210.75**	**1211**	**1211.25**	**1211.5**
Volume (ac-ft)	0	0.139	0.304	0.495	0.712	0.956	1.225
Elevation (ft)	**1211.75**	**1212**	**1212.25**	**1212.5**	**1212.75**	**1213**	**1213.25**
Volume (ac-ft)	1.521	1.843	2.192	2.566	2.967	3.394	3.847
Elevation (ft)	**1213.5**	**1213.7**	**1213.75**	**1214**	**1214.25**	**1214.33**	
Volume (ac-ft)	4.326	4.728	4.831	5.363	5.92	6.104	

5.5. Modeling Considerations

5.5.1. Storm Drains – Culvert Analysis

The 10-year storm drain system was modeled using Storage Area Connections with Culvert option in HEC-RAS. Culvert or drain pipe information was obtained from the tables in Appendix E. The culvert invert elevations, overall lengths, and other pertinent information were coded the Storage Area Connection. In HEC-RAS, the culvert option in a Storage Area Connection also allows for weir flow over the top of the culvert. In areas where weir flow was not possible, the weir on the culvert was set to an arbitrarily high elevation to prevent overtopping under any circumstance. An example of where this was done is the Storage Area Connection between pond 3AST and 4DST. Water can flow from 3AST to 4DST via a storm drain pipe. However, these two basins are not adjacent to each other. Thus, any weir flow would not be able to flow from 3AST to 4DST and the weir elevation was raised artificially high on this particular Storage Area Connection. A second Storage Area Connection was added to 3AST to account for weir flow into pond 3EST, which is the pond adjacent to 3AST.

5.5.2. Storage Area Weirs

Weirs were established between each storage area and between the storage areas and the canal using the Storage Area Connection function inside HEC-RAS. Weir elevations were based on the available topographic data and the survey points. There were a few situations in which the weir elevation was set arbitrarily high, as explained in Section 5.5.1.

5.5.3. Using the Highline Lateral as a Storage Area

SRP personnel were interviewed to determine the normal mode of operation of the Highline Lateral in the area. According to SRP personnel, the Highline Lateral has never overtopped due to flood flows in the area near the Town of Guadalupe. Water can only enter the canal via a pumping station located several miles away. When storm events approach, SRP personnel turn off this pump in case large amount of storm flows enter the canal. Under normal conditions, the canal flows with approximately 0.6 feet of freeboard. SRP personnel indicated that the design flow for the canal was approximately 65 cfs.

As-built drawings were obtained from SRP and are included in Appendix E.5. The latest available as-built drawings for this area were completed in 1965. Under current conditions flows from the Highline Lateral enter a culvert upstream of Avenida del Yaqui and do not daylight again until downstream of the I-10, a distance of about 2000 feet. In the 1965 as-built drawings this culvert is approximately 200 feet long, indicating that the culvert was extended sometime between 1965 and today. Updated as-built drawings for the new culvert were not available from SRP. In performing hydraulic modeling on this culvert, it was assumed that the current culvert is simply an extension of the culvert described in the 1965 as-built drawings.

The next step was to determine the additional capacity of the Highline Lateral while it is operating under normal conditions. The culvert near Avenida del Yaqui is the controlling point with regards to the canal capacity. To estimate the canal capacity, a steady-state HEC-RAS model was created of the short portion of the canal upstream and downstream of the Avenida del Yaqui culvert. The culvert dimensions were based on the 1965 as-built drawings as well as the assumption mentioned above.

Two plans were created within this steady-state HEC-RAS model. The first was a series of three cross-sections of the canal, based on the as-built dimensions, slope, and roughness factor. This plan was used to determine the design flow. It was determined, based on the design flow depth, that the design flow is 68 cfs, which agrees well with the estimated design flow reported by SRP personnel. It was also determined that, given the 0.6 feet of freeboard, the maximum capacity of the canal is 95 cfs (assuming no culvert).

The second plan added the Avenida del Yaqui culvert and three more cross-sections downstream of the culvert. Additional cross-sections were also added near the culvert to represent the widening of the canal. This plan showed that the culvert was indeed the limiting factor for flow capacity. Instead of the maximum flow of 95 cfs as calculated without the culvert, only 83 cfs could pass through the culvert without raising the upstream water surface above the maximum depth of the canal. Thus, the additional capacity of the Highline Lateral was estimated as the difference between the maximum capacity (83 cfs) and the design flow (68 cfs), or 15 cfs.

Based on this calculation, it was assumed that the Highline Lateral could carry an additional 15 cfs under normal operating conditions without overtopping. This is a conservative estimate because it assumes that SRP personnel do not turn off the pumps to the Highline Lateral during the storm.

To address the storm flows entering the unsteady HEC-RAS model used for modeling the ponding against the canal, a lateral inflow hydrograph was added to the storage area used to depict the Highline Lateral. Under normal conditions, the flow entering the canal (modeled as a storage area in HEC-RAS) and the flow leaving the canal will be the same since there are no irrigation deliveries to the Town of Guadalupe. Thus, the net inflow to this storage area would be zero. During the storm events, it was assumed that 8 additional cfs would leave the Highline Lateral storage area. Note that in HEC-RAS the additional 8 cfs leaving the canal (storage area) is modeling as a -8 cfs net inflow. This value is less than the estimated additional capacity of 15 cfs. Under these conditions, the Highline Lateral does not overtop during either the 6-hour or 24-hour storm event. The 8 cfs used for the excess capacity was used to be conservative.

5.5.4. Use of a Dummy Reach

HEC-RAS requires a conveyance channel in order for it to run. In this analysis, conveyance was not considered and all hydraulic analysis was based completely on storage areas inside HEC-RAS. Since HEC-RAS requires a conveyance channel, a "dummy" channel was created. This dummy channel has an arbitrary geometry and boundary conditions. The dummy channel is not hydraulically connected to the storage areas used to model ponding against the Highline Lateral and, thus, have no impact on the results.

5.6. Problems Encountered During Study

There are some maximum iteration warnings during the very low flows of the hydrograph. These warnings disappear once the bulk of the hydrograph hits and, thus, they do not impact the overall results of the hydraulic model.

5.7. Calibration

There are no stream gages within the Town of Guadalupe. Thus, calibration to historic events is not possible.

5.8. Final Results

The maximum water surface elevations obtained in each of the ponding areas against the Highline Lateral is shown in Table 16.

Table 16. Maximum water surface elevations

	Max WSE (ft)	
	24 hr	**6 hr**
1CST	1224.1	1223.7
2DST	1224.0	1224.0
2EST	1224.0	1224.0
3AST	1225.0	1225.0
3EST	1225.0	1225.0
4DST	1225.0	1225.0
7AST	1225.7	1225.7
7BST	1226.1	1226.1
7DST	1226.1	1226.1
7EST	1226.1	1225.4
7FST	1226.1	1225.4

6. Erosion and Sediment Transport

Fixed bed hydraulic modeling was used throughout the study area. Since the area is mostly urban, erosion and sediment transport were not analyzed. These issues were outside the Scope of Work for this study and are not part of this report.

7. Draft FIS Report Data

7.1. Summary of Discharges

Not Applicable / Not Included

7.2. Floodway Data

Not Applicable / Not Included

7.3. Annotated Flood Insurance Rate Maps

Copies of draft annotated Flood Insurance Rate Maps are included in the Exhibit Maps section following the Appendices.

7.4. Flood Profiles

Not Applicable / Not Included

A.1 Referenced Documents

A.1. Referenced Documents

ArcView GIS, v 9.3. (2008). Desktop GIS for mapping, data integration and analysis, Environmental Systems Research Institute, Inc.

DDMSW v. 4.6.0. (2010). Flood Control District of Maricopa County, Drainage Design Management System.

Flood Control District of Maricopa County. (2009). *Drainage Design Manual for Maricopa County, Arizona: Hydrology.* Phoenix, AZ.

HEC-1 v 4.1. (1998). U.S. Army Corps of Engineers Hydrologic Enginineering Center.

HEC-GeoHMS v. 4.2. (2009). ArcView GIS Extension for ArcView 9.3, Hydrologic Engineering Center.

HEC-GeoRAS v.4.3.93. (2008). ArcView GIS Extension for ArcView 9.3, Hydrologic Engineering Center.

HEC-RAS v.4.1.0. (2010, January). U.S. Army Corps of Engineers Hydraulic Engineering Center. Davis, CA.

Papadakis, C. N., & Kazan, M. N. (1987). Time of concentration in small, rural watersheds. *Proceedings of the Engineering Hydrology Symposium* (pp. 633-638). Williamsburg, PA: ASCE.

Sverdrup Civil, Inc. (2001). *Guadalupe Drainage Improvement Project 10-Year Design.* Tempe.

U.S. Army Corps of Engineers. (1974). *Gila River Basin, Arizona, New River, and Phoenix City Streams: Design Memorandum No. 1, Hydrology Part 1.* Phoenix, AZ: Los Angeles District.

Zehr, R. M., & Myers, V. A. (1984). *Depth-area ratios in the semi-arid southwest United States.* Office of Hydrology. Silver Spring, MD: NOAA.

B.1 Special Problem Reports

Not Applicable / Not Included

B.2 Contact (telephone) Reports

Not Applicable / Not Included

B.3 Meeting Minutes or Reports

B.4 General Correspondence

Not Applicable / Not Included

MEMORANDUM

Date: Wednesday, 8 September 2010

Subject: Initial Guadalupe FDS sub-basins

To: Kathryn Gross, FCDMC

From: Brian Wahlin, WEST

Based on topography, field visits, and previous studies, WEST has developed some initial hydrologic basins for the Guadalupe Floodplain Delineation Study. Figure 1 below shows the initial sub-basins. In all figures, the blue line represents watershed boundaries, the red line represents sub-basin boundaries, and the green line represents sub-basin boundaries as defined in the previous study. The basin numbers are temporary and are for the purpose of this memo only. There are a few issues that we would like to discuss with the FCDMC regarding the definition of these sub-basins. These issues are summarized below.

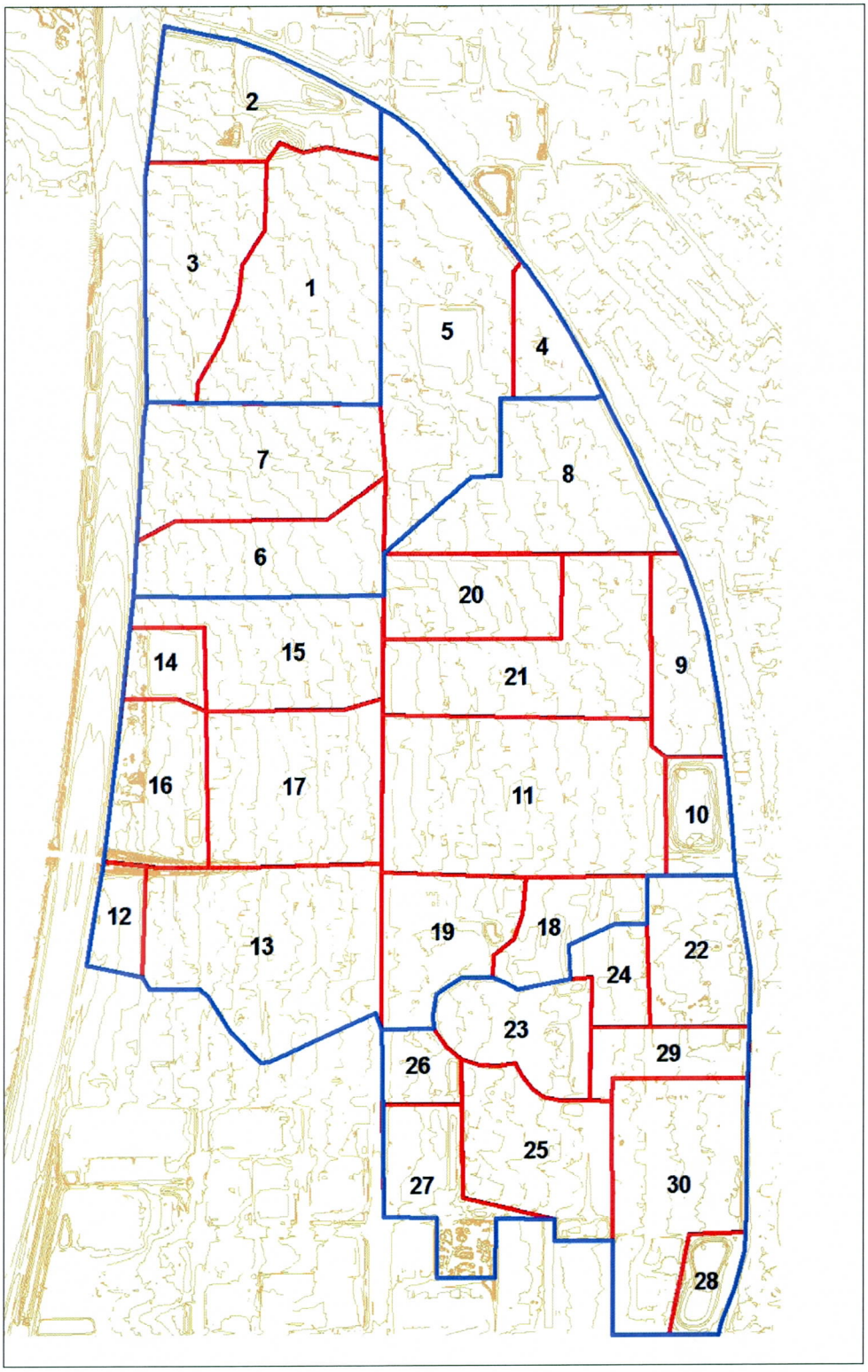


Figure 1. Initial sub-basins for the Guadalupe FDS

In Figure 2, sub-basins 12 and 13 have been cut short as a result of a noted grade break at these locations during the site visit. Does this seem accurate and or should the entire neighborhood be included as a conservative measure?

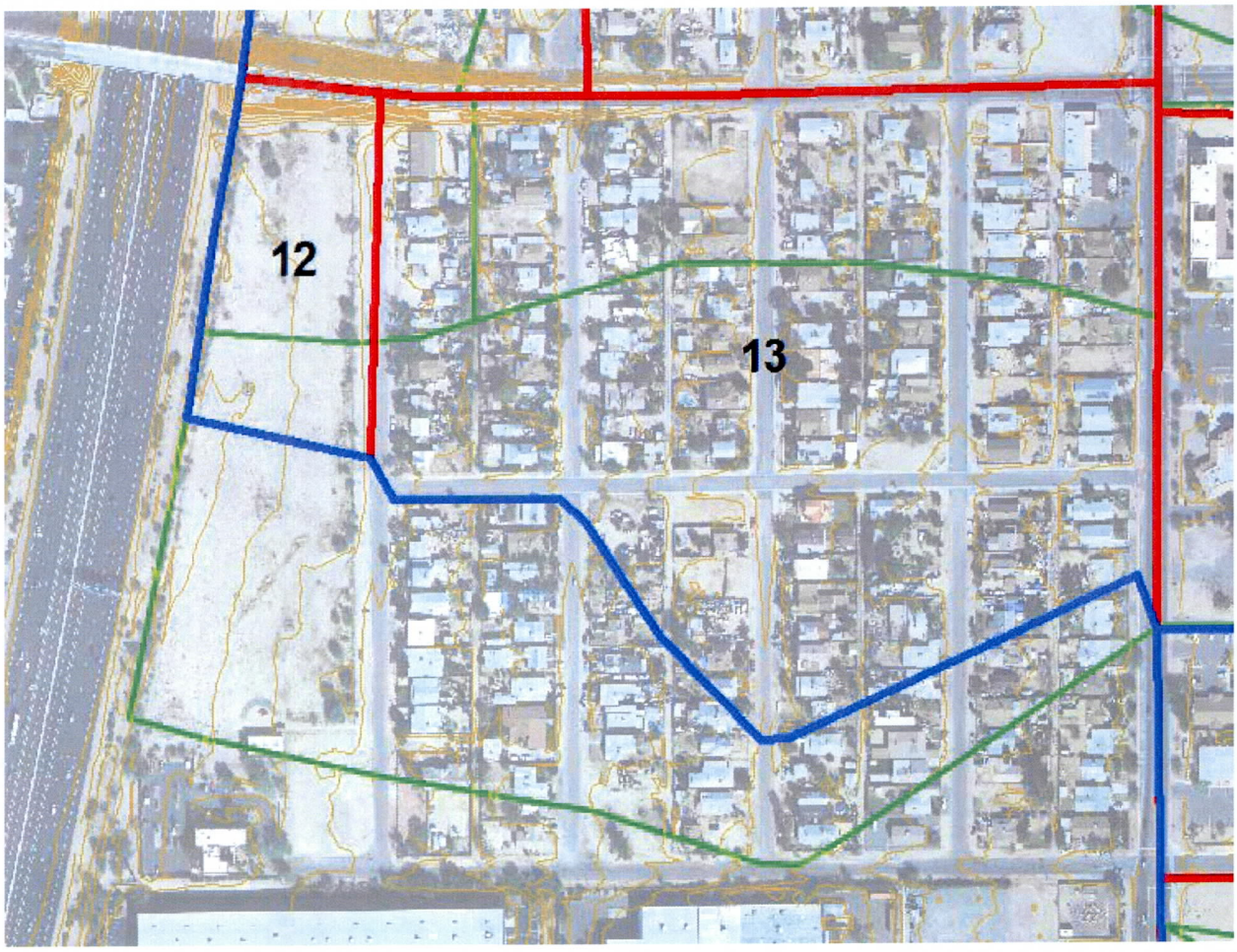


Figure 2. Close up view of sub-basins 12 and 13

In Figure 3, much of the commercial property below basins 25 and 27 has been removed from the watershed. There is one very deep retention basin for the lower left areas. The majority of these commercial lots are surrounded by a solid block wall. Only two small drainage blocks were found along the perimeter of the wall draining into the retention basin in the lower right hand corner of basin 25. Do you want to worry about these two small drainage blocks?

The wood yard (lowest part of basin 27) was included as a conservative measure since it is lined with a chain link fence, even though it is not clear where excess flows from this lot would go.

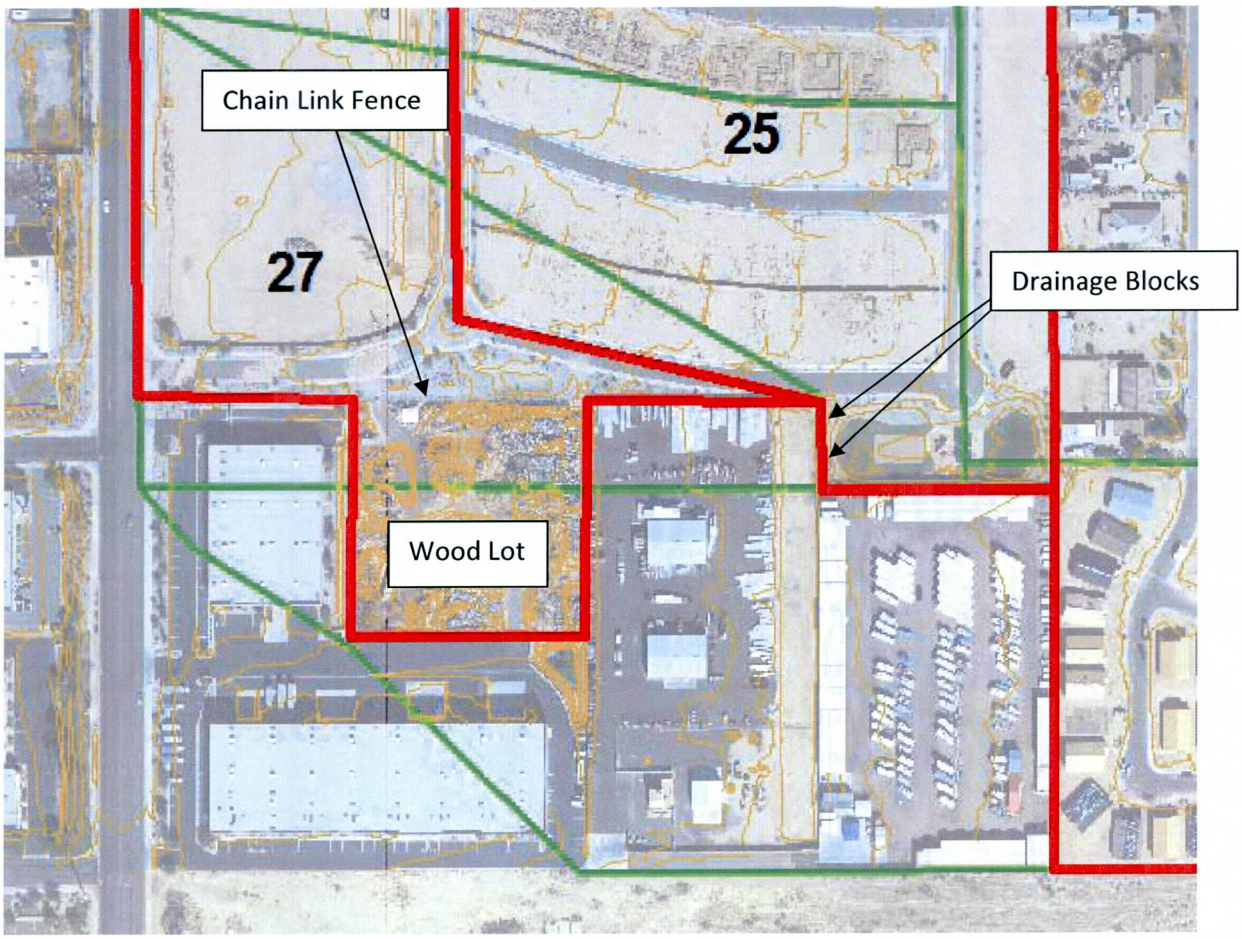


Figure 3. Close up view of sub-basin 25 and 27

The drainage path from the neighborhood south of the school was not very clear (see Figure 4). The flows go in a north-eastern direction but at the northeast corner of the neighborhood it appears that some flows cross the road and continue north while the rest flows east down the road. In addition, the flow paths were unclear in the neighborhood marked by the letter A in Figure 4. Because of this uncertainty, the neighborhood was divided in two by the diagonal blue line. Have the neighborhood flows into sub-basin 5 and the other half flows into sub-basin 8.

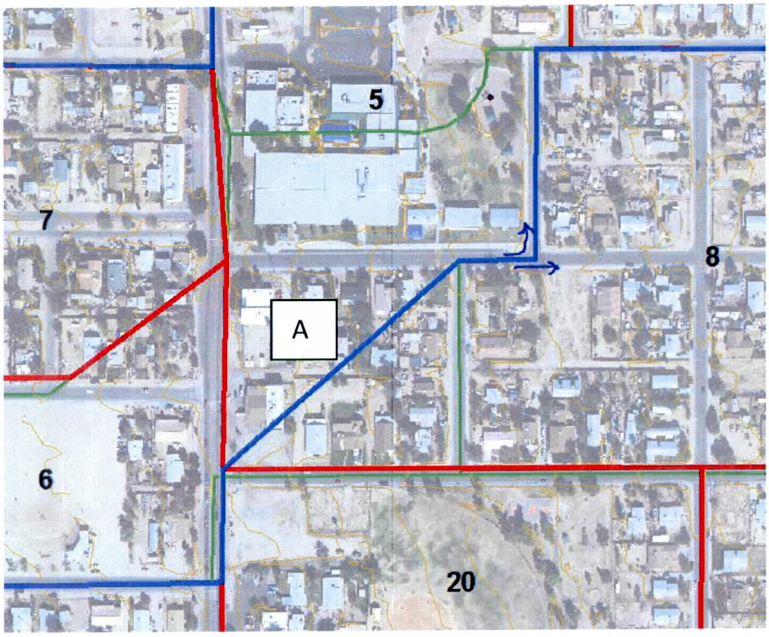


Figure 4. Close up view of sub-basins 5 and 8

September 20, 2010

Brian Wahlin, PhD. P.E. CFM
WEST Consultants Inc.
8950 South 52nd Street, Suite 210
Tempe, AZ 85284

Subject: Guadalupe FDS: Subbasin submittal of September 15, 2010

Dr. Wahlin:

I have reviewed the above listed submittal and have the following comments.

Subbasin boundaries

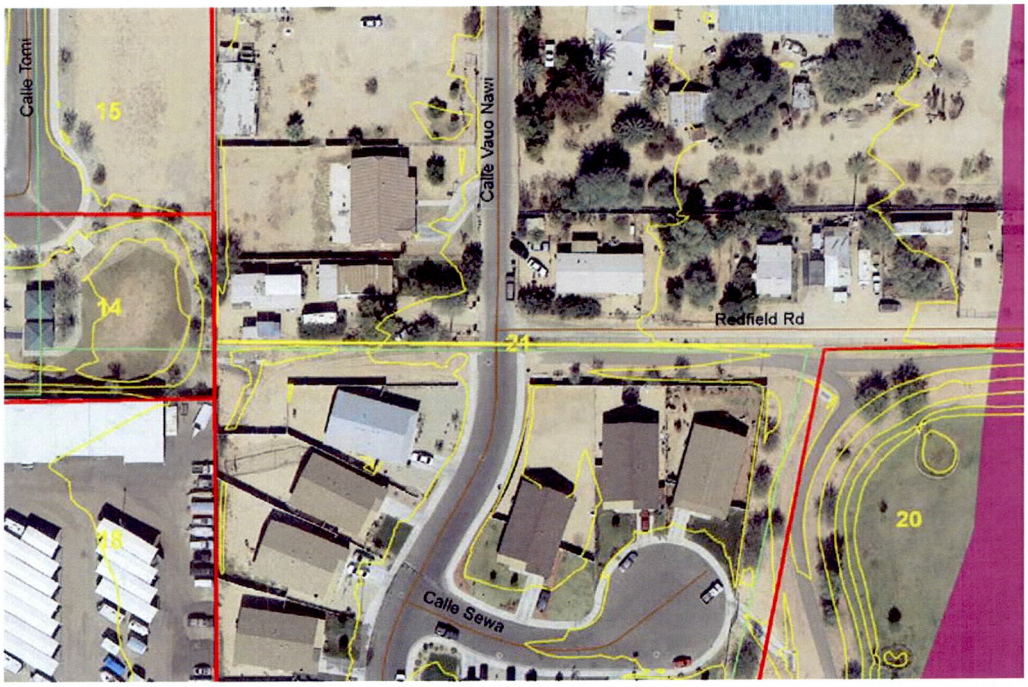
1. It is recommended that the boundaries be modified in certain locations. Recommended shifts are shown in the following graphics.

    - Consider moving the boundary further east between subbasins 2 and 3. (light blue line)

    - Possibly shift the boundary between subbasins 9 and 34. (yellow line)

- Consider shifting the boundary north between subbasins 27 and 29. (yellow line)

- Split subbasin 21 into two subbasins at the north end of the subdivision. (yellow line)



2. Remove subbasin 14 and include it in the area for subbasin 15.

3. Include the Northeast basin as a subbasin.

Subbasin Shapefile Attribute Table

1. Just a note, drnbsn_sub should actually have the north, northeast etc. naming and drnbsn_ul should have the subbasin numbers.

I have no more comments at this time.

If you have any questions, please contact me at (602) 506-4837, or kag@mail.maricopa.gov.

Sincerely,

Kathryn Gross, CFM, M.A.
Senior Hydrologist

GUADALUPE FLOODPLAIN DELINEATION STUDY

TECHNICAL MEMORANDUM

Date: September 27, 2010

To: Kathryn Gross – FCDMC

From: Brian Wahlin, Project Manager – WEST Consultants, Inc.
Riley Asburry – WEST Consultants, Inc.

Re: Response to Initial Sub-Basin Delineations

RESPONSE TO INITIAL SUB-BASIN DELINEATIONS

Below are the responses to the review of the initial sub-basin delineations summarized in a technical memorandum dated September 15, 2010.

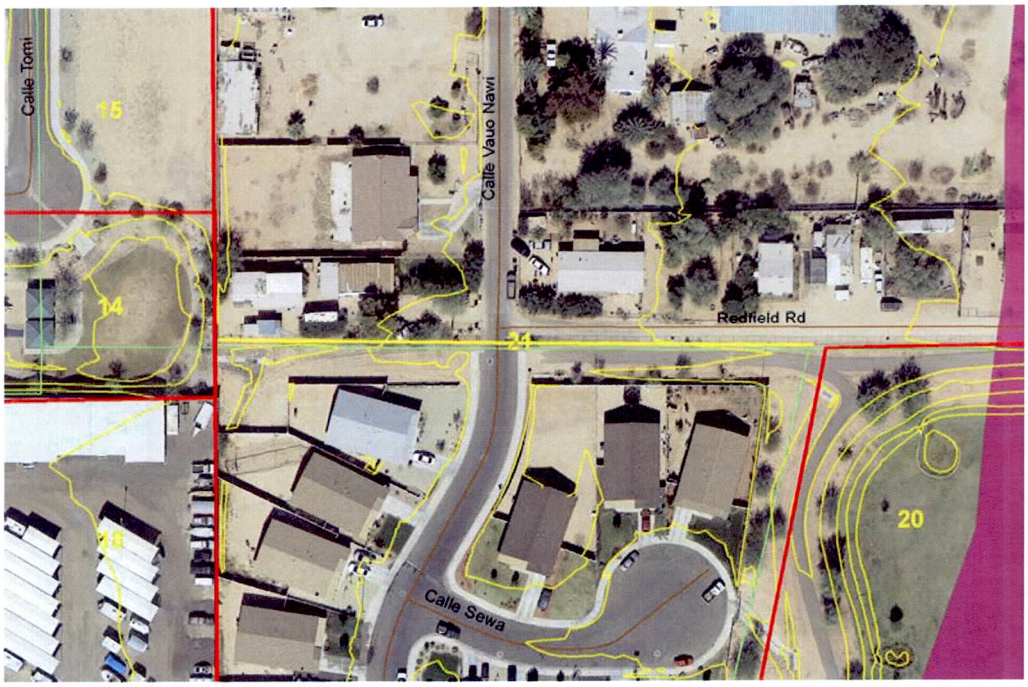
1. It is recommended that the boundaries be modified in certain locations. Recommended shifts are shown in the following graphics.

    - Consider moving the boundary further east between subbasins 2 and 3. (light blue line)
      WEST Response: Sub-basin boundary line has been moved as suggested.

- Possibly shift the boundary between subbasins 9 and 34. (yellow line)
  WEST Response: Sub-basin boundary line has been moved as suggested.

- Consider shifting the boundary north between subbasins 27 and 29. (yellow line)
  WEST Response: Sub-basin boundary line has been moved as suggested.

- Split subbasin 21 into two subbasins at the north end of the subdivision. (yellow line)
  WEST response: Sub-basin boundary line has been added as suggested.



2. Remove subbasin 14 and include it in the area for subbasin 15.
   WEST Response: Sub-basin 14 has been included in the area for sub-basin 15.

3. Include the Northeast basin as a subbasin.
   WEST Response: The northeast basin has been added and is now included as a sub-basin.

Subbasin Shapefile Attribute Table

1. Just a note, drnbsn_sub should actually have the north, northeast etc. naming and drnbsn_ul should have the subbasin numbers.
   WEST Response: Shape file attribute table has been updated accordingly.

GUADALUPE FLOODPLAIN DELINEATION STUDY

TECHNICAL MEMORANDUM

Date: September 27, 2010

To: Kathryn Gross – FCDMC

From: Brian Wahlin, Project Manager – WEST Consultants, Inc.
Riley Asburry – WEST Consultants, Inc.

Re: Response to Initial Sub-Basin Delineations

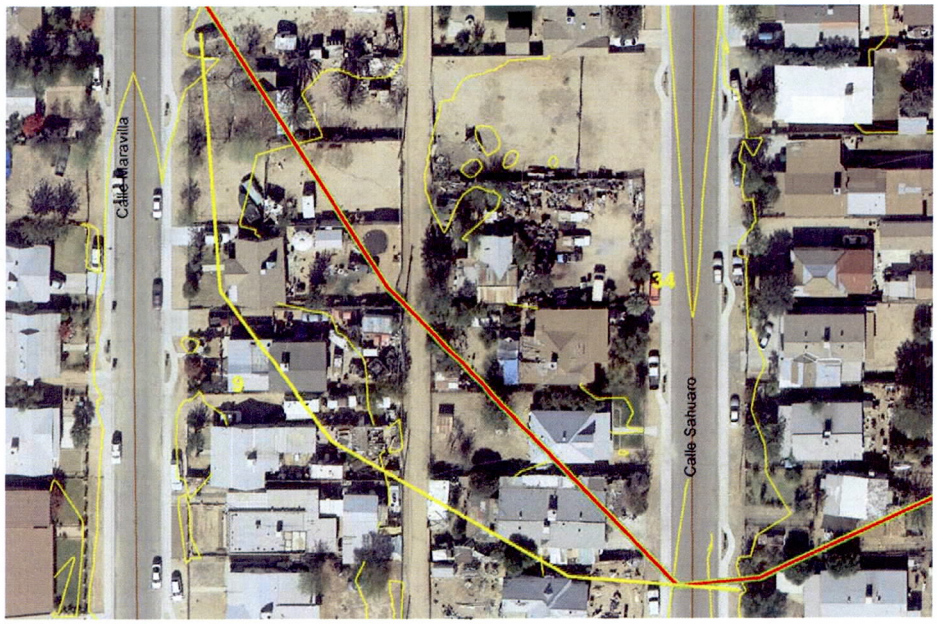
RESPONSE TO INITIAL SUB-BASIN DELINEATIONS

Below are the responses to the review of the initial sub-basin delineations summarized in a technical memorandum dated September 15, 2010.

1. It is recommended that the boundaries be modified in certain locations. Recommended shifts are shown in the following graphics.

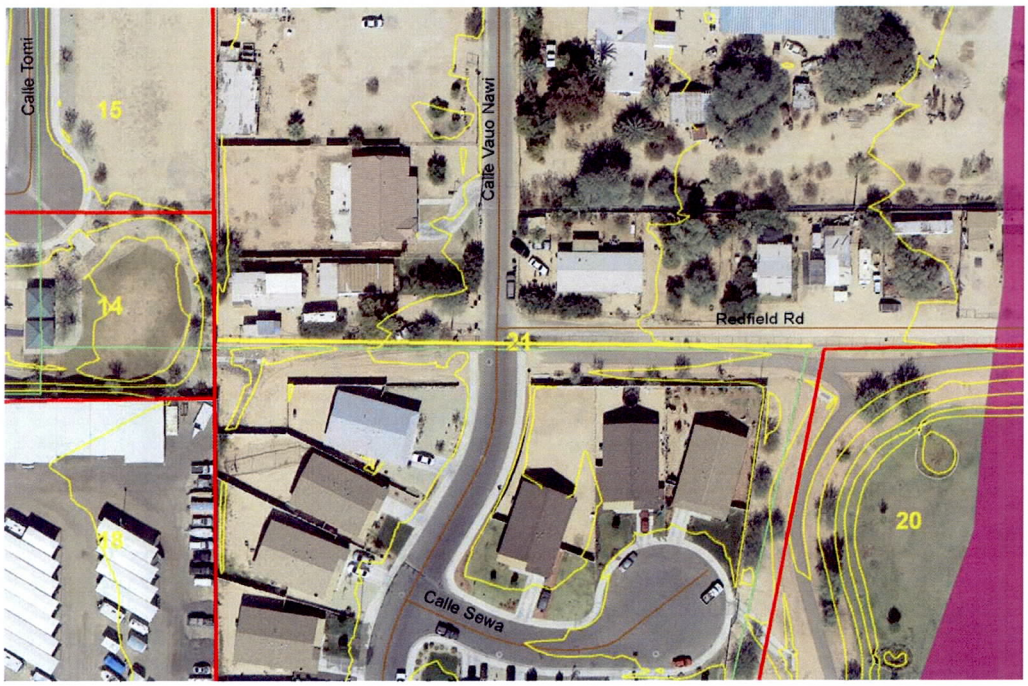
    - Consider moving the boundary further east between subbasins 2 and 3. (light blue line)
      WEST Response: Sub-basin boundary line has been moved as suggested.

- Possibly shift the boundary between subbasins 9 and 34. (yellow line)
  WEST Response: Sub-basin boundary line has been moved as suggested.



- Consider shifting the boundary north between subbasins 27 and 29. (yellow line)
  WEST Response: Sub-basin boundary line has been moved as suggested.

- Split subbasin 21 into two subbasins at the north end of the subdivision. (yellow line)
  WEST response: Sub-basin boundary line has been added as suggested.



2. Remove subbasin 14 and include it in the area for subbasin 15.
   WEST Response: Sub-basin 14 has been included in the area for sub-basin 15.

3. Include the Northeast basin as a subbasin.
   WEST Response: The northeast basin has been added and is now included as a sub-basin.

Subbasin Shapefile Attribute Table

1. Just a note, drnbsn_sub should actually have the north, northeast etc. naming and drnbsn_ul should have the subbasin numbers.
   WEST Response: Shape file attribute table has been updated accordingly.

September 29, 2010

Brian Wahlin, PhD. P.E. CFM
WEST Consultants Inc.
8950 South 52nd Street, Suite 210
Tempe, AZ 85284

Subject: Guadalupe FDS: Subbasin submittal of September 24, 2010

Dr. Wahlin:

I have reviewed the above listed submittal and have the following comments.

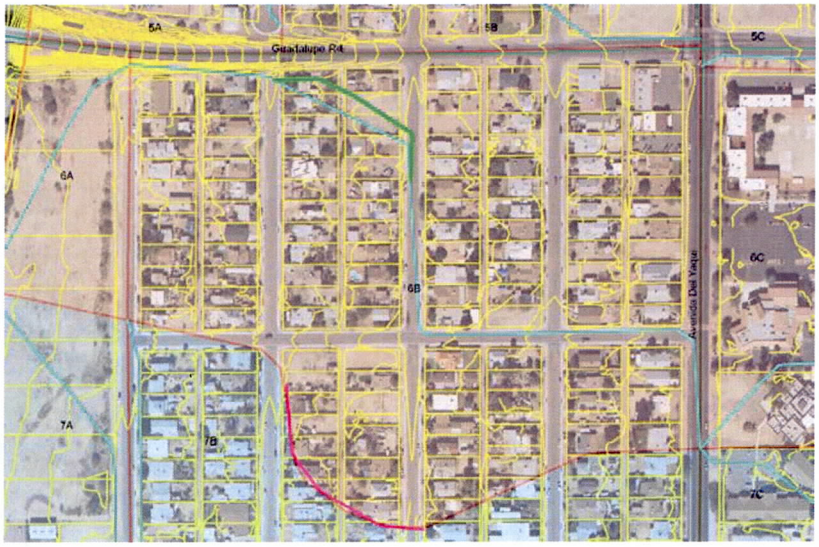
Subbasins

1. Subbasin delineations are reasonable and accepted.
2. Subbasin Naming: What happened to the ones (1A, 1B)? Consider starting with them.
3. Please use the same subbasin naming convention for the District's project basins. Do not use B1, B2, and B3.
4. Consider renaming subbasin 7E as an "8" subbasin. It appears to belong more in the 8's watershed than the 7's watershed. This can be discussed further if necessary.

Flow Paths

1. B1 – no flow path was included. Please include in next submittal.
2. B2 – no flow path was included. Please include in next submittal.
3. B3 – the flow path should end in the bottom of the basin.
4. B4 – the flow path should end in the bottom of the basin.
5. 3C – The flow path length may need to be trimmed. This can be discussed further.
6. 3D – Shorten the flow path to the low point just north of San Angelo.
7. 4C – Consider shortening the flow path to the beginning of the potential "ponding area".
8. 4E – Consider shortening the flow path to the beginning of the potential "ponding area".
9. 6B- Consider shifting the flow path based on the graphic attached at end of comments. Also consider shortening the flow path at the downstream end. This can be discussed further.
10. 6C – Presently the flow path slightly angles through a retention basin. Shift the line out of the basin.
11. 7D – Consider shortening the flow path to the street since most likely that is the lowest spot in this area.
12. 7E – Need to discuss which is the most appropriate direction for this flow path. I was considering taking the north portion of the street since the retention basin draining the area is located there.
13. 7F – the flow path should stop in the bottom of the basin.
14. 8B – Consider shortening the flow path to the beginning of the potential "ponding area". This can be discussed further.
15. 8C – the flow path should stop in the bottom of the basin.
16. 8D - Consider shortening the flow path to the beginning of the potential "ponding area". This can be discussed further.
17. 9A – it is recommended that the flow path end in the retention basin on the east side of the basin. This can be discussed further.
18. 9B – Consider shifting the flow path based on the graphic attached at the end of the comments.

6B modification – recommended modification shown in green



9B modification – recommended modification shown in green

Routing Paths – further discussion on the linework shown in this shape file is needed.

I have no more comments at this time.

If you have any questions, please contact me at (602) 506-4837, or kag@mail.maricopa.gov.

Sincerely,

Kathryn Gross, CFM, M.A.
Senior Hydrologist

September 29, 2010

Brian Wahlin, PhD. P.E. CFM
WEST Consultants Inc.
8950 South 52nd Street, Suite 210
Tempe, AZ 85284

Subject: Guadalupe FDS: Subbasin submittal of September 24, 2010

Dr. Wahlin:

I have reviewed the above listed submittal and have the following comments.

Subbasins

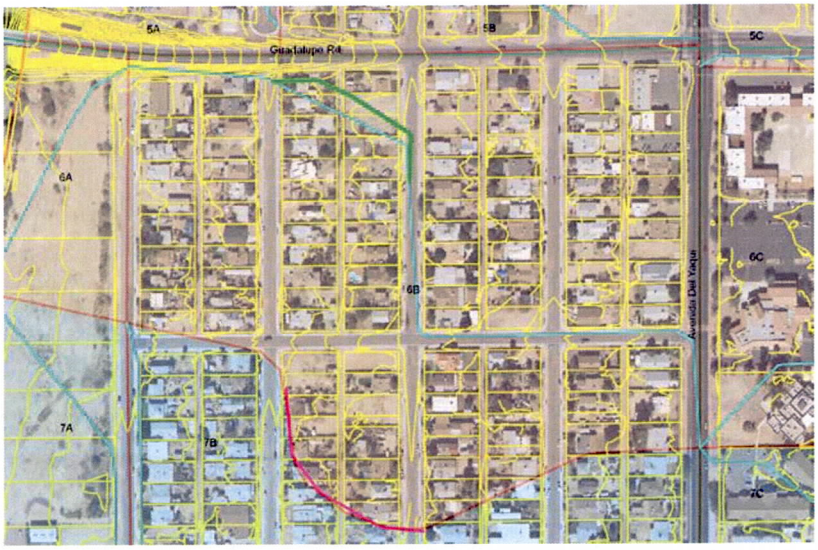
1. Subbasin delineations are reasonable and accepted.
2. Subbasin Naming: What happened to the ones (1A, 1B)? Consider starting with them.
   WEST Response: Attempting to match the District's naming convention which starts with 2A. Basins have been re-named to start with 1A.
3. Please use the same subbasin naming convention for the District's project basins. Do not use B1, B2, and B3.
   WEST Response: sub-basin naming convention changed to the same as the Districts
4. Consider renaming subbasin 7E as an "8" subbasin. It appears to belong more in the 8's watershed than the 7's watershed. This can be discussed further if necessary.
   WEST Response: As discussed, sub-basin number will remain the same and the flow split will be taken into account in the HEC-1 model.

Flow Paths

1. B1 – no flow path was included. Please include in next submittal.
   WEST Response: Flow path has been included
2. B2 – no flow path was included. Please include in next submittal.
   WEST Response: Flow path has been included
3. B3 – the flow path should end in the bottom of the basin.
   WEST Response: Flow path has been changed to end in the bottom of the basin
4. B4 – the flow path should end in the bottom of the basin.
   WEST Response: Flow path has been changed to end in the bottom of the basin
5. 3C – The flow path length may need to be trimmed. This can be discussed further.
   WEST Response: Flow path has been changed according to our discussion
6. 3D – Shorten the flow path to the low point just north of San Angelo.
   WEST Response: Flow path has been changed according to our discussion
7. 4C – Consider shortening the flow path to the beginning of the potential "ponding area".
   WEST Response: Flow path has been shortened according to our discussion
8. 4E – Consider shortening the flow path to the beginning of the potential "ponding area".
   WEST Response: Flow path has been shortened according to our discussion
9. 6B- Consider shifting the flow path based on the graphic attached at end of comments. Also consider shortening the flow path at the downstream end. This can be discussed further.
   WEST Response: Flow path has been changed to better follow the topography

10. 6C – Presently the flow path slightly angles through a retention basin. Shift the line out of the basin.
    WEST Response: Flow path has been left in the basin as this represents its most likely flow path
11. 7D – Consider shortening the flow path to the street since most likely that is the lowest spot in this area.
    WEST Response: Flow path has been changed to the street
12. 7E – Need to discuss which is the most appropriate direction for this flow path. I was considering taking the north portion of the street since the retention basin draining the area is located there.
    WEST Response: As discussed, the flow path will remain the same and the flow split will be taken into account in the HEC-1 model.
13. 7F – the flow path should stop in the bottom of the basin.
    WEST Response: As discussed, the flow path will remain the same and the retention basin low point will not modeled as the downstream elevation in the HEC-1 model.
14. 8B – Consider shortening the flow path to the beginning of the potential "ponding area". This can be discussed further.
    WEST Response: Flow path has been shortened according to our discussion
15. 8C – the flow path should stop in the bottom of the basin.
    WEST Response: As discussed, the flow path will remain the same and the retention basin low point will not modeled as the downstream elevation in the HEC-1 model.
16. 8D - Consider shortening the flow path to the beginning of the potential "ponding area". This can be discussed further.
    WEST Response: Flow path has been shortened according to our discussion
17. 9A – it is recommended that the flow path end in the retention basin on the east side of the basin. This can be discussed further.
    WEST Response: As discussed, the flow path will remain the same and the retention basin low point will not modeled as the downstream elevation in the HEC-1 model.
18. 9B – Consider shifting the flow path based on the graphic attached at the end of the comments.
    WEST Response: Flow path has been changed to better follow the topography

6B modification – recommended modification shown in green



9B modification – recommended modification shown in green

Routing Paths – further discussion on the linework shown in this shape file is needed.
WEST Response: Line work has been modified based on our discussion

I have no more comments at this time.
If you have any questions, please contact me at (602) 506-4837, or kag@mail.maricopa.gov.
Sincerely,

Kathryn Gross, CFM, M.A.
Senior Hydrologist

GUADALUPE FLOODPLAIN DELINEATION STUDY

TECHNICAL MEMORANDUM

Date: October 6, 2010

To: Kathryn Gross – FCDMC

From: Brian Wahlin, Project Manager – WEST Consultants, Inc.
Riley Asburry – WEST Consultants, Inc.

Re: Response to Guadalupe 9/29 comments

RESPONSE TO INITIAL SUB-BASIN DELINEATIONS

Below are the responses to the review of the initial sub-basin delineations summarized in a technical memorandum dated September 29, 2010.

Subbasins

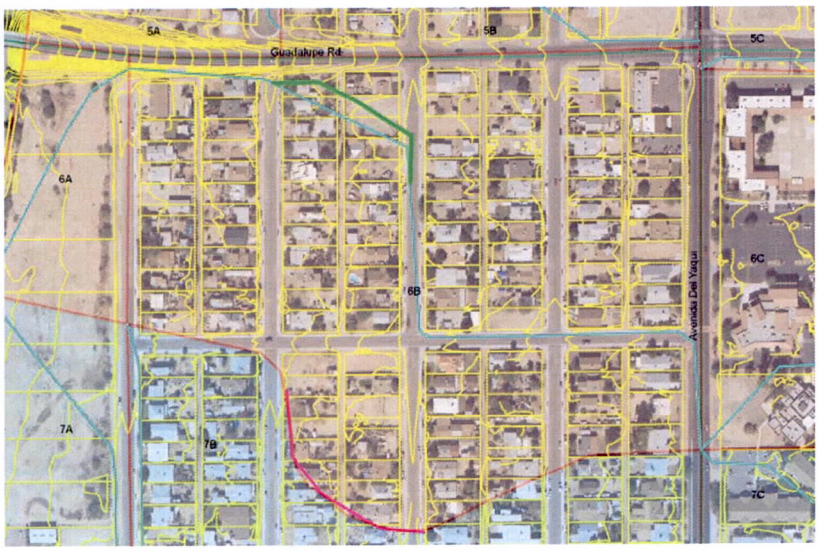
1. Subbasin delineations are reasonable and accepted.
2. Subbasin Naming: What happened to the ones (1A, 1B)? Consider starting with them.
   WEST Response: Basins have been re-named to start with 1A.
3. Please use the same subbasin naming convention for the District's project basins. Do not use B1, B2, and B3.
   WEST Response: Sub-basin naming convention changed to the same as the Districts
4. Consider renaming subbasin 7E as an "8" subbasin. It appears to belong more in the 8's watershed than the 7's watershed. This can be discussed further if necessary.
   WEST Response: Basin has been observed during rain flows and flow paths have been re-drawn and naming has been changed as suggested.

Flow Paths

1. B1 – no flow path was included. Please include in next submittal.
   WEST Response: Flow path has been included
2. B2 – no flow path was included. Please include in next submittal.
   WEST Response: Flow path has been included
3. B3 – the flow path should end in the bottom of the basin.
   WEST Response: Flow path has been changed to end in the bottom of the basin
4. B4 – the flow path should end in the bottom of the basin.
   WEST Response: Flow path has been changed to end in the bottom of the basin

5. 3C – The flow path length may need to be trimmed. This can be discussed further.
   WEST Response: Flow path has been changed according to the discussion at our coordination meeting
6. 3D – Shorten the flow path to the low point just north of San Angelo.
   WEST Response: Flow path has been changed according to the discussion at our coordination meeting
7. 4C – Consider shortening the flow path to the beginning of the potential "ponding area".
   WEST Response: Flow path has been shortened according to the discussion at our coordination meeting
8. 4E – Consider shortening the flow path to the beginning of the potential "ponding area".
   WEST Response: Flow path has been shortened according to the discussion at our coordination meeting
9. 6B- Consider shifting the flow path based on the graphic attached at end of comments. Also consider shortening the flow path at the downstream end. This can be discussed further.
   WEST Response: Flow path has been changed to better follow the topography
10. 6C – Presently the flow path slightly angles through a retention basin. Shift the line out of the basin.
    WEST Response: Flow path has been left in the basin as this represents its most likely flow path
11. 7D – Consider shortening the flow path to the street since most likely that is the lowest spot in this area.
    WEST Response: Flow path has been changed to the street
12. 7E – Need to discuss which is the most appropriate direction for this flow path. I was considering taking the north portion of the street since the retention basin draining the area is located there.
    WEST Response: Basin has been observed during rain flows and flow paths have been re-drawn and naming has been changed as suggested.
13. 7F – the flow path should stop in the bottom of the basin.
    WEST Response: As discussed, the flow path will remain the same and the retention basin low point will not be used as the downstream elevation in the HEC-1 model.
14. 8B – Consider shortening the flow path to the beginning of the potential "ponding area". This can be discussed further.
    WEST Response: Flow path has been shortened according to our discussion
15. 8C – the flow path should stop in the bottom of the basin.
    WEST Response: As discussed, the flow path will remain the same and the retention basin low point will not be used as the downstream elevation in the HEC-1 model.
16. 8D - Consider shortening the flow path to the beginning of the potential "ponding area". This can be discussed further.
    WEST Response: Flow path has been shortened according to the discussion at our coordination meeting
17. 9A – it is recommended that the flow path end in the retention basin on the east side of the basin. This can be discussed further.
    WEST Response: As discussed, the flow path will remain the same and the retention basin low point will not be used as the downstream elevation in the HEC-1 model.
18. 9B – Consider shifting the flow path based on the graphic attached at the end of the comments.
    WEST Response: Flow path has been changed to better follow the topography

6B modification – recommended modification shown in green



9B modification – recommended modification shown in green

Routing Paths – further discussion on the linework shown in this shape file is needed.
WEST Response: Line work has been modified according to the discussion at our coordination meeting

Board of Directors
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Flood Control District
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October 21, 2010

Brian Wahlin, PhD. P.E. CFM
WEST Consultants Inc.
8950 South 52nd Street, Suite 210
Tempe, AZ 85284

Subject: Guadalupe FDS: Subbasin Landuse and Soil Submittal of 101410

Dr. Wahlin:

I have reviewed the above listed submittal and have the following comments.

Landuse

Overall the determined landuses appear to be reasonable and are in alignment with MAG landuses. Some modifications are recommended and are listed below.

1. Subbasin 2A and 3C, the western property coded 140 is coded as a church in the MAG landuses which would have a code of 530.
2. It appears that MAG considers the majority of the area as single family high density with a density of 4-6 units. For subbasin 2C, 3A, 3C, 3D, and 3E consider changing the 140 code to 150.
3. For 5D and 7C, the 140 designation does not match MAG. MAG lists these areas as multifamily. It appears this area may be townhomes. A custom number and value may be necessary. This can be discussed further.
4. Depending on the use of 140 and 150, custom values may need to be developed as an average value between the two types of landuse and resulting loss parameters.

Soils

Overall soils appear reasonable for the subbasins.

Please keep in mind that the default parameters for any land use need to be evaluated/customized for the specific project.

I have no more comments at this time.

If you have any questions, please contact me at (602) 506-4837, or kag@mail.maricopa.gov.

Sincerely,

Kathryn Gross, CFM, M.A.
Senior Hydrologist

Flood Control District
of Maricopa County

Board of Directors
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November 10, 2010

Brian Wahlin, PhD. P.E. CFM
WEST Consultants Inc.
8950 South 52nd Street, Suite 210
Tempe, AZ 85284

Subject: Guadalupe FDS: DDMSW and HEC-1 Submittal of Nov. 1, 2010

Dr. Wahlin:

I have reviewed the above listed submittal and have the following comments.

Subbasin Parameters

Soils information

1. It appears the wrong soil type was input into DDMSW. Please correct Ve with Va for all necessary subbasins.

Landuse information

1. For Landuse 700 please consider an RTIMP value of 0.
2. For Landuse 190, a higher RTIMP may be needed in subbasins 1A and 1C.
3. For Landuse 530 in subbasins 2A and 3A consider using an RTIMP lower than 80.
4. For Landuse 570 in subbasin 2D, consider using a lower RTIMP and Vegetation percent value.
5. For subbasins 3B, 3D, 4A, 4B, 4C, 5A, 6A, 6C, 6D, the loss parameters associated with vacant land (900) may be more appropriate than 700. Please evaluate. The RTIMP and Vegetation percent associated with 700 do not appear reasonable for the locations.
6. For subbasins 8A and 8B, please consider a higher RTIMP and a lower vegetation percent.

Flow Paths

1. For subbasin 2D please verify the length entered into DDMSW. Presently, there is a discrepancy between DDMSW and the GIS length.
2. Verify bottom elevation of 7F.

Routings

1. Normal Depth routing should be used for all routes instead of Kinematic Wave.

2. Lengths and n values used appear reasonable.
3. Verify the slope for 5A and 6B.

Models

1. It is recommended that IT be changed to 3 instead of 5 (this might solve the item listed below).
2. For all models, the Tcs are being reported as out of range. Please evaluate the subbasin parameters to troubleshoot this problem.
3. Subbasin data for North, Northeast, Central, and South transferred appropriately.
4. Routings need to be updated to normal depth.
5. Schematic for North, Northeast, and South are reasonable. Some modifications to any of the schematics may be necessary depending on street split flows and the ponding analysis.
6. Schematic for Central potentially needs some modifications:
    - Either 4BRoute needs to combine with 5CJunct or its length will need to be extended.
    - 5CRoute needs to be located after 5CJunct, not after 4CJunct.
    - Consider adding 5D to 4CJunct.
    - Connect 3EJunct to 4DJunct.
7. Please include study information and model date in title blocks at the beginning of the model. Additional comment information will need to be added to the model as we progress. This will be discussed further at a later time.

For the next submittal please provide the DDMSW files, HEC-1 input and output files for both the 6-hour and 24-hour events.

I have no more comments at this time.

If you have any questions, please contact me at (602) 506-4837, or kag@mail.maricopa.gov.

Sincerely,

Kathryn Gross, CFM, M.A.
Senior Hydrologist

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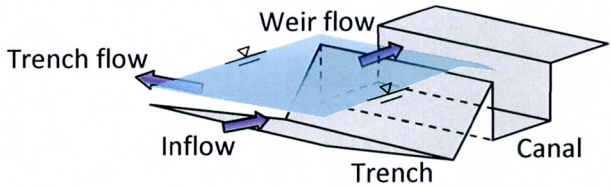
www.westconsultants.com

Date: November 16, 2010
MEMO: Guadalupe Ponding methodology

Kathryn:

As Brian mentioned to you yesterday, we believe we have found a way to model the ponding floodplain in Guadalupe that accounts for potential cross-flow between the concentration points.

In our earlier meetings, we discussed iterating the model until it appeared that a floodplain had been established that was reasonable from a hydraulic standpoint. In our research since then, however, we have found that this issue has been historically resolved through a "side channel spillway" analysis. It appears that FEMA has accepted this approach in the past, as it is built in to several of their accepted one-dimensional software programs (e.g. FEQ 9.98) We believe that actually applying these complex software packages would introduce unjustifiable complexity to an AH analysis, but the general methodology is useful to approximate the ponding area.



Methodology Sketch

As shown in the sketch above, the approach is to model segments along the canal to account for:

1. Volume in the adjacent trench and ponding area;
2. Weir flow into the canal;
3. Trench flow north to the next segment.

The process is simple enough to calculate the water surface elevations (WSE) within Excel given a 100 or so segments. The WSE can then be merged with the topography to create the floodplain. A preliminary model using rough numbers yielded a floodplain that varies between 10 and 100 feet width; of course, this must be treated as only a coarse estimate.

The approach eliminates the need for numerous iterations and potential criticism of our engineering judgment from FEMA and other authorities. It should provide the most accurate floodplain for steady state conditions, is conservative, but because it accounts for flow to the low weir sections, it should also reduce the expected floodplain width compared to previous studies.

Thanks!

Brent

Board of Directors
Fulton Brock, District 1
Don Stapley, District 2
Andrew Kunasek, District 3
Max Wilson, District 4
Mary Rose Wilcox, District 5

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January 19, 2011

Brian Wahlin, PhD. P.E. CFM
WEST Consultants Inc.
8950 South 52nd Street, Suite 210
Tempe, AZ 85284

Subject: Guadalupe FDS: DDMSW and HEC-1 Submittal of December 10, 2010

Dr. Wahlin:

I have reviewed the above listed submittal and have the following comments. At this time only the 6-hr model and DDMSW were reviewed. For the next submittal make sure that any recommended changes listed below are made to the 24-hr models as well. Full review of the 24-hr models and DDMSW files will occur with the next submittal.

Subbasin and Routing Parameters

1. Subbasin soil parameters for the 4 Major Basins are reasonable and approved.
2. Subbasin landuse parameters for the 4 Major Basins are reasonable and approved.
3. For the 4 Major Basins, the Tc and R calculation were left blank in the DDMSW which resulted in values of zero on the UC card in all models. Please make sure to click update in the subbasin window in DDMSW for all Major Basins so that the Tc and R records will populate.
4. Routing parameters for the 4 Major Basins are reasonable and approved.

Retention Modeling

1. For modeling purposes, please use diversion records instead of storage records to model the retention in the watersheds. Assign a volume in the DT record. The volume used in the model should be 80% of what is actually calculated as storage for any given retention basin. It is recommended that a table be developed to show the actual and 80% volumes used for each retention record.
2. Retention volumes. Determined volumes appear reasonable.
3. For Subbasin 6E, there are two retention basins in this subbasin. Please make sure that the volumes of both are accounted for in the model.
4. For Subbasin 6D, consider adding a retention diversion for the shallow, long basin at the east end of the subbasin.

5. For subbasins 8A and 8B, it appears that the retention volumes for these two basins have been switched. Please correct.

Ponding Storage Relationships

1. Please do not use the Top of Dam fields in DDMSW.
2. Outflow information for each pond shall be determined by developing a weir equation for the length of the potential ponding limit. Where storm drains can take flows to other basins, use culvert or storm drain calculations to determine what discharge is capable of being diverted for the pond elevations used in the storage relationship. The storm drain calculations and weir equation results will then be combined to determine the appropriate SQ records to use. Diversion records can be applied on the "downstream" side of the pond to re-separate out the canal overflow and storm drain data.
3. Volumes for the identified ponds appear reasonable.
4. Should a ponding relationship be developed for the area against the canal in subbasin 2C and 3E?

Model Schematic

1. Schematic looks reasonable for MB1 and MB2.
2. For MB3 a few corrections need to be made.
   - 3AST needs to follow 3CJUNCT. Presently it comes after 3D.
   - 3EST should most likely connect to 4DJUNCT so that flow entering the storm drain or from overtopping south will be counted in the basin.
3. For MB4, it is recommended that 7EST be connected to the 7FJUNC to capture any storm drain flows that would be directed to the basin.
4. Some modifications to any of the schematics may be necessary depending on street split flows and the ponding analysis.

Please include study information and model date in title blocks at the beginning of the model. Additional comment information will need to be added to the model as we progress. This will be discussed further at a later time.

Prior to the next submittal, it is recommended that we have a meeting to discuss the specific details that need to be added to the model for each pond now that we have basic water surface information data.

For the next submittal please provide the DDMSW files, HEC-1 input and output files for both the 6-hour and 24-hour events.

I have no more comments at this time.

If you have any questions, please contact me at (602) 506-4837, or kag@mail.maricopa.gov.

Sincerely,

Kathryn Gross, CFM, M.A.
Senior Hydrologist

GUADALUPE FLOODPLAIN DELINEATION STUDY

TECHNICAL MEMORANDUM

Date: February 9, 2011

To: Kathryn Gross – FCDMC

From: Brian Wahlin, Project Manager – WEST Consultants, Inc.
Riley Asburry – WEST Consultants, Inc.

Re: Response to Guadalupe 1/19 comments

RESPONSE TO DDMSW AND HEC-1 DECEMBER 2010 SUBMITTAL COMMENTS

Below are the responses to the review of the DDMSW and HEC-1 December 2010 submittal comments.

Subbasin and Routing Parameters

1. Subbasin soil parameters for the 4 Major Basins are reasonable and approved.
   WEST Response: Noted.

2. Subbasin landuse parameters for the 4 Major Basins are reasonable and approved.
   WEST Response: Noted.

3. For the 4 Major Basins, the Tc and R calculations were left blank in the DDMSW which resulted in values of zero on the UC card in all models. Please make sure to click update in the subbasin window in DDMSW for all Major Basins so that the Tc and R records will populate.
   WEST Response: Issue resolved with DDMSW program modification.

4. Routing parameters for the 4 Major Basins are reasonable and approved.
   WEST Response: Noted.

Retention Modeling

1. For modeling purposes please use diversion records instead of storage records to model the retention in the watersheds. Assign a volume in the DT record. The volume used in the model should be 80% of what is actually calculated as storage for any given retention basin.

It is recommended that a table be developed to show the actual and the 80% volumes used for each retention record.
WEST Response: Internal retention basins have been changed from storage records to diversion records. The volume assigned in the DT record now represents 80% of the calculated volume. A table has been created to actual storage and 80%.

2. Retention volumes. Determined volumes appear reasonable.
   WEST Response: Noted.

3. For Subbasin 6E, there are two retention basins in this subbasin. Please make sure that the volumes of both are accounted for.
   WEST Response: Volume for north basin added

4. For Subbasin 6D, consider adding a retention diversion for the shallow, long basin at the east end of the subbasin.
   WEST Response: Retention diversion added.

5. For Subbasin 8A and 8B, it appears that the retention volumes for these two basins have been switched.
   WEST Response: Retention volumes have been corrected.

Ponding Storage Relationships

1. Please do not use the Top of Dam fields in DDMSW.
   WEST Response: Top of Dam fields have been cleared from the records and are not used in the DDMSW model.

2. Outflow information for each pond shall be determined by developing a weir equation for the length of the potential ponding limit. Where storm drains can take flows to other basins, use storm drain calculations to determine what discharge is capable of being diverted for the pond elevations used in the storage relationship. The storm drain calculations and weir equation results will then be combined to determine the appropriate SQ records to use. Diversion records can be applied on the "downstream" side of the pond to re-separate out the canal overflow and stormdrain data.
   WEST Response: As discussed in our Jan. 27th 2011 meeting – The 10yr flow (as defined in the Nov. 2001 Drainage Improvement Report) has been diverted from each storage pond to the retention basins in order to determine the relationship. From here a decision will be made as how to best represent the basin relationships.

3. Volumes for the identified ponds appear reasonable.
   WEST Response: Noted.

4. Should a ponding relationship be developed for the area against the canal in subbasin 3C and 3E?
   WEST Response: Ponding for 3E and 3C has been combined.

Model Schematic

1. Schematic looks reasonable for MB1 and MB2.
   WEST Response: Noted.

2. For MB3 a few corrections need to be made:
   - 3AST needs to follow 3CJUNCT. Presently it comes after 3D.
   - 3EST should most likely connect to 4DJUNCT so that flow entering the storm drain or from overtopping the south will be counted in the basin.

   WEST Response: 3AST has been changed to follow 3CJUNC. Flow has also been diverted from 3EST to 4DJUNC. Further relationship between the two areas will be discussed.

3. For MB4, it is recommended that 7EST be connected to the 7FJUNC to capture any storm drain flows that would be directed to the basin.
   WEST Response: Flow has been diverted from 7EST to 7FJUNC. Further relationship will be discussed.

4. Some modifications to any of the schematics may be necessary depending on street split flows and the ponding analysis.
   WEST Response: The major street split flows are fully contained within individual sub-basins to lessen the impact of split flows.

Additional Comments

1. Please include study information and model date in title blocks at the beginnings of the model.
   WEST Response: Study information and Model Date is included in the title blocks.

2. Please provide DDMSW files, HEC-1 input and output files for both the 6-hour and 24-hour events.
   WEST Response: Will provide the above mentioned files.

Board of Directors
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February 17, 2011

Brian Wahlin, PhD. P.E. CFM
WEST Consultants Inc.
8950 South 52nd Street, Suite 210
Tempe, AZ 85284

Subject: Guadalupe FDS: DDMSW and HEC-1 Submittal of February 8, 2011

Dr. Wahlin:

I have reviewed the above listed submittal and have the following comments.

Subbasin and Routing Parameters

1. Subbasin parameters (soils, landuse, Tc and Rs) for the 24 and 6 hour models are reasonable and approved.

2. Routing parameters for the 24 and 6 hour models are reasonable and approved.

Retention Modeling

1. Retention diversions and volumes used for the 6 and 24 hour models appear reasonable and are approved.

Storm Drain Diversions

1. Regarding the diversion discharges, additional information is necessary to describe where the discharge values come from. This can be discussed at our next meeting.

2. 2CDDIV – appears reasonable; however, I would like to discuss a different approach. Could we divert the capacity of the pipe approaching the last inlet and use the last inlet discharges as SQ records in the storage relationship?

3. 3ADIV – appears reasonable; however, please verify the discharge. The pipe reach in 3A has a capacity for 28 cfs when I read the tables.

4. 3EDIV – Consider changing this name to 3DDIV and consider moving it prior to 3E concentration point since this portion of the storm drain is away from the canal.

5. New 3EDIV – another storm drain diversion is potentially needed. Storm drain 6 occurs along the canal and does not appear to be included in the modeling. Consider adding it.

6. New 3CDIV – consider adding another storm drain diversion for the flows going to the storm drain within subbasin 3C.

7. 7BDIV – appears reasonable.

8. 7EDIV – appears reasonable.

Ponding Storage Relationships

1. For both the 6 hour and 24 hour model, 1CST still has the Top of Dam fields filled out in DDMSW. Please remove for next submittal.

2. 2DST – Elevations and Volumes appear reasonable.

3. 2EST – Elevations and Volumes appear reasonable.

4. 3AST – elevations and Volumes appear reasonable.

5. 3EST – Elevations and volumes appear reasonable.

6. 4DST – Elevations and volumes appear reasonable.

7. 7AST – It is recommended to add a volume at 1227 back into the relationship. Elevations and volumes appear reasonable.

8. 7BST – Elevations and volumes appear reasonable.

9. 7DST – Elevations and volumes appear reasonable.

10. 7EST - Elevations and volumes appear reasonable.

11. 7FST – Elevations and volumes appear reasonable.

6 –hr and 24-hr Models

1. Major Basin 1 – Data and schematic appear reasonable. 1CST needs to be updated to remove the dam storage relationship cards. This will occur when DDMSW is corrected as noted above.

2. Major Basin 2
   - Data is fine.
   - Schematic – Leave 2DST hanging and move 2EJUNCT to just before 2EST.
   - We will also need to discuss possible modifications to the storm drain diversion as listed above.

3. Major Basin 3
    - Data is fine.
    - Schematic – Might need to put the storm drain diversion right after the 3D routing (flows will be diverted before 3E). Might need to add a Diversion for Storm Drain 6 on the east side of 3E before 3EST.

4. Major Basin 4
    - Data is fine.
    - Schematic
        i. Consider locating 6CDV immediately after 6C in the schematic; however, due to the position of the main retention basin in the subbasin, it is still possible to leave it in its current position as well.
        ii. Consider locating 6EDV immediately after 6E in the schematic; however, due to the position of the main retention basin in the subbasin, it is still possible to leave it in its current position as well.
    - Further discussion is necessary regarding the possibility of incorporating DTDIV3 and DTDIV4 into their respective storage relationships.

5. Please add KO cards for full output for each Storage relationship in the models.

I have no more comments at this time.

If you have any questions, please contact me at (602) 506-4837, or kag@mail.maricopa.gov.

Sincerely,

Kathryn Gross, CFM, M.A.
Senior Hydrologist

GUADALUPE FLOODPLAIN DELINEATION STUDY

TECHNICAL MEMORANDUM

Date: March 7, 2011

To: Kathryn Gross – FCDMC

From: Brian Wahlin, Project Manager – WEST Consultants, Inc.
Riley Asburry – WEST Consultants, Inc.

Re: Response to Guadalupe 2/17 sub-comments

RESPONSE TO DDMSW AND HEC-1 DECEMBER 2010 SUBMITTAL COMMENTS

Below are the responses to the review of the DDMSW and HEC-1 February 2011 submittal comments.

Subbasin and Routing Parameters

1. Subbasin soil parameters (Soils, Landuse, Tc and Rs) for the 24 and 6 hour models are reasonable and approved.
   WEST Response: Noted.

2. Routing parameters for the 24 and 6 hour models are reasonable and approved.
   WEST Response: Noted.

Retention Modeling

1. Retention diversions and volumes used for the 24 and 6 hour models appear reasonable and are approved.
   WEST Response: Noted.

Storm Drain Diversions

1. Regarding the diversion discharges, additional information is necessary to describe where the discharge values come from. This can be discussed at our next meeting.
   WEST Response: Diversion flows are updated and are based on the values shown in the Nov. 2001 report Appendix C "Storm Drain Hydraulic Calculations"

2. 2CDDIV – appears reasonable; however I would like to discuss a different approach. Could we divert the capacity of the pipe approaching the last inlet and use the last inlet discharges as SQ records in the storage relationship?
   WEST Response: The capacity of the pipe has been diverted (119 cfs) and the last inlet discharges (17 cfs) has been included in the storage.

3. 3ADIV – appears reasonable; however, please verify the discharge. The pipe reach in 3A has a capacity for 28 cfs when I read the tables.
   WEST Response: The flow capture capacity for 3A and 3C combined before reaching 3AST has been verified to be 79 cfs as shown in Appendix C of the Nov. 2001 Drainage Report.

4. 3EDIV – Consider changing this name to 3DDIV and consider moving it prior to 3E concentration point since this portion of the storm drain is away from the canal.
   WEST Response: 3EDIV has been separated from 3DDIV.

5. New 3EDIV – another storm drain diversion is potentially needed. Storm drain 6 occurs along the canal and does not appear to be included in the modeling consider adding it.
   WEST Response: 3EDIV has been separated from 3DDIV.

6. New 3CDIV – consider adding another storm drain diversion for the flows going to the storm drain within subbasin 3C.
   WEST Response: The flow diversions for 3A and 3C combine and flow through Storm Drain 2 together, for this reason they were left combined.

7. 7BDIV – appears reasonable.
   WEST Response: Noted.

8. 7EDIV – appears reasonable.
   WEST Response: Noted.

Ponding Storage Relationships

1. For both the 6 hour and the 24 hour model, 1CST still has the Top of Dam filled out in DDMSW. Please remove for next submittal.
   WEST Response: Top of dam information has been removed from 1CST.

2. 2DST – Elevations and Volumes appear reasonable.
   WEST Response: Noted.

3. 2EST – Elevations and Volumes appear reasonable.
   WEST Response: Noted.

4. 3AST – Elevations and Volumes appear reasonable.
   WEST Response: Noted.

5. 3EST – Elevations and Volumes appear reasonable.
   WEST Response: Noted.

6. 4DST – Elevations and Volumes appear reasonable.
   WEST Response: Noted.

7. 7AST – It is recommended to add a volume at 1227 back into the relationship. Elevations and volumes appear reasonable.
   WEST Response: Volume has been added back into 7AST.

8. 7BST – Elevations and Volumes appear reasonable.
   WEST Response: Noted.

9. 7DST – Elevations and Volumes appear reasonable.
   WEST Response: Noted.

10. 7EST – Elevations and Volumes appear reasonable.
    WEST Response: Noted.

11. 7FST – Elevations and Volumes appear reasonable.
    WEST Response: Noted.

6-hr and 24-hr Models

1. Major Basin 1 – data and schematic appear reasonable. 1CST needs to be updated to remove the dam storage relationship cards. This will occur when DDMSW is corrected as noted above.
   WEST Response: Dam storage relationship removed.

2. Major Basin 2:
   - Data is fine.
   - Schematic – Leave 2DST hanging and move 2EJUNCT to just before 2EST.
   - We will also need to discuss possible modifications of the storm drain diversion as listed above.

   WEST Response: Schematic changed as described

3. Major Basin 3:
   - Data is fine
   - Schematic – Might need to put the storm drain diversion right after the 3D routing (flows will be diverted before 3E). Might need to add Diversion for Storm Drain 6 on the east side of 3E before 3EST.

   WEST Response: 3DDIV for Storm Drain 2 separated from 3EDIV for Storm Drain 6 and placed appropriately.

4. Major Basin 4:
   - Data is fine
   - Schematic

i. Consider locating 6CDV immediately after 6C in the schematic; however, due to the position of the main retention basin in the subbasin, it is still possible to leave it in its current position as well.

ii. Consider locating 6EDV immediately after 6E in the schematic; however, due to the position of the main retention basin in the subbasin, it is still possible to leave it in its current position as well.

- Further discussion is needed regarding the possibility of incorporating DTDIV3 and DTDIV4 into their respective storage relationships.

WEST Response: 6C changed because of location of basin, 6E left as is. Retrieval and DT card ID's changed to more clearly represent diversion location; For example:
Diversion ID – 7EDIV
Retrieval ID – R7EDV
DT Card – DT7EDV

5. Please add KO cards for full output for each storage relationship in the models.
WEST Response: This will be done manually before each submittal.

Board of Directors
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Flood Control District
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March 11, 2011

Brian Wahlin, PhD. P.E. CFM
WEST Consultants Inc.
8950 South 52nd Street, Suite 210
Tempe, AZ 85284

Subject: Guadalupe FDS: Weir Data submittal of 3/10/11

Dr. Wahlin:

I have reviewed the above listed submittal and have the following comments.

Canal Weirs

1. Future submittals will need to have the canal weir location incorporated into the shape file.

2. Certain ponding area canal weirs extend beyond the subbasin weir locations. It is recommended that the canal weir length be the length between the two subbasin weir locations for the pond. This may result in either the canal weir length and data being modified for the next submittal or the weir location. We can discuss this further if necessary. This is occurring on 2DST-Canal, 3ST Canal, 4DST-Canal, 7AST-Canal, 7BST-Canal, 7DST-Canal, 7EST-Canal, 7FST-Canal.

3. Data being used to develop the weirs appears reasonable.

Subbasin Weirs

1. For most wiers shown in the shape file, the length needs to be trimmed so that the data starts on the west canal bank.

2. For 2DST-3AST, consider shifting the left side (looking downstream)of the cross-section so that the line is more parallel to the road. This would catch the rest of the ridgeline located through the homes in that area.

3. For 3EST-4DST, consider moving the weir location to the actual subbasin boundary.

4. For 4DST-7AST, consider moving the weir location to Guadalupe Road as the ultimate weir outfall for 7A and cut the weir data out of the DEM.

5. For 7DST-7EST, consider moving the weir location to the actual subbasin boundary.

6. For 7EST-7FST, consider shifting the boundary to the slight ridgeline just north of the District basin.

I have no more comments at this time.

If you have any questions, please contact me at (602) 506-4837, or kag@mail.maricopa.gov.

Sincerely,

Kathryn Gross, CFM, M.A.
Senior Hydrologist

GUADALUPE FLOODPLAIN DELINEATION STUDY

TECHNICAL MEMORANDUM

Date: March 22, 2011

To: Kathryn Gross – FCDMC

From: Brian Wahlin, Project Manager – WEST Consultants, Inc.
Riley Asburry – WEST Consultants, Inc.

Re: Response to Guadalupe 2/17 sub-comments

RESPONSE TO DDMSW AND HEC-1 DECEMBER 2010 SUBMITTAL COMMENTS

Below are the responses to the review of the DDMSW and HEC-1 February 2011 submittal comments.

Canal Weirs

1. Future submittals will need to have the canal weir location incorporated into the shape file.
   WEST Response: Noted.

2. Certain ponding area canal weirs extend beyond the subbasin weir locations. It is recommended that the canal weir length be the length between the two subbasin weir locations for the pond. This may result in either the canal weir length and data being modified for the next submittal or the weir location. We can discuss this further if necessary. This is occurring on 2DST-Canal, 3ST Canal, 4DST-Canal, 7AST-Canal, 7BST-Canal, 7DST-Canal, 7EST-Canal, 7FST-Canal.
   WEST Response: Canal weir lengths have been adjusted (points interpolated) to stay within the subbasin weir locations.

3. Data being used to develop the weirs appears reasonable.
   WEST Response: Noted

Subbasin Weirs

1. For most weirs shown in the shape file, the length needs to be trimmed so that the data starts on the west canal bank.
   WEST Response: The shape file has been updated, now weirs start on the west canal bank.

2. For 2DST-3AST, consider shifting the left side (looking downstream)of the cross-section so that the line is more parallel to the road. This would catch the rest of the ridgeline located through the homes in that area.
   WEST Response: The weir location has been adjusted to best follow the ridgeline based on the surface information we have.

3. For 3EST-4DST, consider moving the weir location to the actual subbasin boundary.
   WEST Response: Weir location has been moved to the subbasin boundary

4. For 4DST-7AST, consider moving the weir location to Guadalupe Road as the ultimate weir outfall for 7A and cut the weir data out of the DEM.
   WEST Response: Weir location has been moved to the subbasin boundary to best follow the ridgeline based on the surface information we have.

5. For 7DST-7EST, consider moving the weir location to the actual subbasin boundary.
   WEST Response: Weir location has been moved to the subbasin boundary

6. For 7EST-7FST, consider shifting the boundary to the slight ridgeline just north of the District basin.
   WEST Response: The weir location has been adjusted to best follow the ridgeline north of the basin.

Flood Control District
of Maricopa County

Board of Directors
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April 5, 2011

Brian Wahlin, PhD. P.E. CFM
WEST Consultants Inc.
8950 South 52nd Street, Suite 210
Tempe, AZ 85284

Subject: Guadalupe FDS: HEC-RAS ponding submittal of 3/21/11

Dr. Wahlin:

I have reviewed the above listed submittal and have the following comments.

RAS Storage Volumes

1. It appears that there were some modifications to the storage volumes associated with elevations for most pond locations. However, the modified storage volumes appear reasonable.

RAS Storage Area Connections

1. All ponding locations have the appropriate connections.

2. Canal Weirs. All canal weir calculations appear reasonable. Data appears correctly placed into RAS.

3. Ponding Area weirs. Most weir data appears reasonable from the contour data. Some weir locations changed from the last submittal. Make sure to update the weir calculation spreadsheet and include it with the next submittal.

    - For the 4DST to 7AST weir, please look into the last few data points on this weir near the canal. The top of basin 4DST is at 1226. However, the weir is using the canal low point just at the south end of the roadway at 1225. Consider removing the canal elevation points and use roadway points instead at this location. This can be discussed further.
    - For 7AST to 7BST weir, should the stock piles represented as high points in the cross-section be removed from the weir data?

4. Storm Drain modeling using Culvert connections. Overall the concept and data seem reasonable. However, the method needs to be discussed further to provide additional clarification regarding the decisions behind pipe sizes, inverts chosen and determined lengths for the pond connections.

    - 3AST to 4DST – appears to be using Storm Drain 2 information. Using full length but only the invert elevations and pipe size from the first few segments? What about storm drain 6?
    - 3EST to 4DST – appears to be using Storm Drain 6 information. Using lengths and inverts from SD6 calc sheet. This one seems reasonable.
    - 7BST to 7FST – appears to be using Storm Drain 5 information. Invert information and length seem reasonable. Uses the smaller pipe size for the system.
    - 7EST to 7DST – appears to be using Storm Drain 5 information. Invert information and length seem reasonable. Uses the larger pipe size for the system.

5. Canal wier locations need to be incorporated into the weir shape file.

Inflow Hydrographs

1. All inflow hydrographs for each model appear reasonable.

Hydrology model

1. Hydrology models overall appear reasonable.

2. For Major Basin 3, one of the storm drains for the model from subbasin 3D/3E remains in the model and is combined with the 4D combination. What is the reason for leaving this storm drain diversion in the model?

I have no more comments at this time.

If you have any questions, please contact me at (602) 506-4837, or kag@mail.maricopa.gov.

Sincerely,

Kathryn Gross, CFM, M.A.
Senior Hydrologist

GUADALUPE FLOODPLAIN DELINEATION STUDY

TECHNICAL MEMORANDUM

Date: April 11, 2011

To: Kathryn Gross – FCDMC

From: Brian Wahlin, Project Manager – WEST Consultants, Inc.
Riley Asburry – WEST Consultants, Inc.

Re: Response to Guadalupe 4/05 comments

RESPONSE TO HEC-RAS PONDING SUBMITTAL 3/21/11 COMMENTS

Below are the responses to the review of the DDMSW and HEC-1 February 2011 submittal comments.

RAS Storage Volumes

1. It appears that there were some modifications to the storage volumes associated with elevations for most pond locations. However, the modified storage volumes appear reasonable.
   WEST Response: The stage storage relationships have been slightly adjusted based on the shifts of many of the weir locations per the previous comments from the FCD. These latest estimates represent a more accurate ponding area according to the survey data and surface information.

RAS Storage Area Connections

1. All ponding locations have the appropriate connections.
   WEST Response: Noted.

2. Canal Weirs. All canal weir calculations appear reasonable. Data appears correctly placed into RAS.
   WEST Response: Noted.

3. Ponding Area Weirs. Most weir data appears reasonable from the contour data. Some weir locations changed from the last submittal. Make sure to update the weir calculation spreadsheet and include it with the next submittal.
   WEST Response: The weir calculation spreadsheet is no longer being used with the new

method of calculating weir data within RAS. However, a spreadsheet for weir data is still being maintained for the purpose of data organization and possible weir profile figures for the report.

- For the 4DST to 7AST weir, please look into the last few data points on this weir near the canal. The top of basin 4DST is at 1226. However, the weir is using the canal low point just at the south end of the roadway at 1225. Consider removing the canal elevation points and use the roadway points instead at this location. This can be discussed further.
  WEST Response: The weir data has been changed to end at the survey point on the roadway at an elevation of 1226.66

- For 7ASt to 7BST weir, should the stock piles represented as high points in the cross-section be removed from the weir data?
  WEST Response: Stock piles have been removed from data set.

4. Storm Drain modeling using Culvert connections. Overall the concept and data seem reasonable. However, the method needs to be discussed further to provide additional clarification regarding the decisions behind pipe sizes, inverts chosen and determined lengths for the pond connections.
   - 3AST to 4DST – appears to be using Storm Drain 2 information. Using full length but only the invert elevations and pipe size from the first few segments? What about storm drain 6?
     WEST Response: Connection has been updated to use the invert elevations for the full length. The pipe size remains the same as the inlet pipe (smallest).

   - 3EST to 4DST – appears to be using Storm Drain 6 information. Using lengths and inverts from SD6 calc sheet. This one seems reasonable.
     WEST Response: Noted

   - 7BST to 7FST appears to be using Storm Drain 5 information. Invert information and length seem reasonable. Uses the smallest pipe size for the system.
     WEST Response: Noted

   - 7EST to 7FST appears to be using Storm Drain 5 information. Invert information and length seem reasonable. Uses the larger pipe size for the system.
     WEST Response: Noted

5. Canal weir locations need to be incorporated into the weir shape file.
   WEST Response: A separate shape file has been created for the Canal weirs for display purposes.

Inflow hydrographs

1. All inflow hydrographs for each model appear reasonable.
   WEST Response: Noted

Hydrology Model

1. Hydrology models overall appear reasonable.
   WEST Response: Noted

2. For Major Basin 3, one of the storm drains for the model from subbasin 3D/3E remains in the model and is combined with the 4D combination. What is the reason for leaving this storm drain diversion in the model?
   WEST Response: Since some flows accumulating in basin 3D had to be diverted before the remaining flows enter 3E, it was decided the best modeling approach was to allow the diversion and overflows to take place within DDMSW (HEC1).

Comment from email dated April 5, 2011

1. "I realized that I should have put a comment regarding placing comments in the HEC1 models at the retention diversions and the one storm drain diversion. Maybe it would be a good idea to place a comment at each concentration point or subbasin where the information is being placed in the RAS model too."
   WEST Response: Comments placed in HEC1 and RAS models.

Board of Directors
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Max Wilson, District 4
Mary Rose Wilcox, District 5

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May 6, 2011

Brian Wahlin, PhD. P.E. CFM
WEST Consultants Inc.
8950 South 52nd Street, Suite 210
Tempe, AZ 85284

Subject: Guadalupe FDS: Guadalupe FDS TDN submittal of 4/26/2011

Dr. Wahlin:

I have reviewed the above listed submittal and have the following comments.

TDN Comments and Organization

1. Included with this comment letter is another Word document that provides a skeleton outline of recommendations for modifying the current TDN layout for Section 4.

2. Title of TDN needs to be changed. The proper study name is Guadalupe Floodplain Delineation Study.

3. The majority of the comments are included in the track-changes version of the Word document sent on 4/26/11.

4. Section 3. Do I still need to get you sealed survey points? If the seal is on a paper you have or the CD please make sure a copy of it is in Appendix C.3.

5. For all the Ponding area figures, please add some contour labels. Or the figure in the text could just be a graphic but an additional figure or map would be included in the Appendix with the contours labeled.

6. For the ponding area discussions, the text needs to be clarified for the id names, constructed basin names, and subbasin names. It is recommended that all Ponding areas be called either ponding area or storage areas and subbasin be placed in front of any subbasin id discussed. The constructed basins could be described by their geographic names; however, this could be discussed further if necessary.

7. Within the ponding area discussions, the reference to the canal changes. Some state the canal. Others state the Highline Canal. And other times it is referred to as highline canal. Should it be referred to as the Highline Canal at the beginning of each storage area discussion then use canal for the rest of the text?

8. Street Diversion Section. Remove this section if there were no street diversions modeled. If there were, please add additional text stating where the diversions were in the watershed. This section will also need to move to the Diversion Section (4.2.7.6).

9. A recommended approach to Section 5 has been entered into the track changes document being submitted with this letter.

10. Appendix E. Include excerpts for the storm drain sheets and map in this appendix.

Hydrology Workmaps

1. A full size Subbasin Map with concentration points and flow paths and routing reaches needs to be submitted. An aerial background could be included. Contours and streets should be included as the minimum background information.

2. A soils map needs to be included. This should have subbasin boundaries and soils shown. This map could be submitted as an 11x17.

3. A landuse map needs to be included. This should have subbasin boundaries and landuses shown. This map could be submitted as an 11x17.

4. A schematic map needs to be included. This should have the subbasin boundaries plus the schematic graphics of the watersheds shown. This map can be discussed further.

Floodplain Workmaps

1. In several instances the draft digital floodplain I received a few weeks ago does not match what is shown on the workmaps. I am assuming that what is shown on the workmaps is the updated version since the digital submittal did come with a caveat.

2. An additional work map should be included to show the delineation of ponding area 1C. The digital pond 1C 24 hr floodplain is too large. The delineation should be drawn to the 1224 contour located within the basin.

3. For all sheets.
    - State that the mapping and ground control survey was performed under a separate FCD contract, contract number 08-20. I will see if I can track down company names but those may not be necessary.
    - Revise the placement of the jurisdiction labels. Note that there are two sets of boundary lines. The west boundary is the boundary between Guadalupe and Uninc. Maricopa Co. and the right is the boundary between Uninc. Maricopa Co. and Tempe. So Uninc. Maricopa County will need to be added to the mix.
    - Include the pond names on the study sheets.

- Please include the controlling storm identifier under each WSEL.
- Please limit the water surface elevation to the tenths place on the maps.

4. For sheets 1 and 2. It does not appear that the contours delivered to the consultant from the District are being used. They need to match the contour product provided from contract number 08-20.

5. Cover Sheet.
   - The title of the study "Guadalupe FDS" needs to be included in the title block, not "sources of mapping…"
   - Please include the street layout and some street labels.
   - Add the assignment number to the contract number.

6. Sheet 1 of 2
   - Pond 1C needs to be added to the map.
   - In two locations there are breaks in the ponding linework that do not correspond to ponding area divisions. Please remove these breaks.
   - Street linework and labels need to be added to the map.
   - Section boundaries need to be added to the map.
   - Please provide a screened aerial as the background or include the building footprints if available in the mapping product.
   - The correct study names needs to be included on the maps.
   - The contract number needs to be corrected on the maps.

7. Sheet 2 of 2
   - The WSEL information needs to be corrected on the map for ponds 7BST, 7DST, and 7EST.
   - Street linework and labels need to be added to the map.
   - Section boundaries need to be added to the map.
   - Please provide a screened aerial as the background or include the building footprints if available in the mapping product.
   - The correct study names needs to be included on the maps.
   - The contract number needs to be corrected on the maps.

Technical Files

DDMSW files

1. The following refer to both the 6 and 24 hour DDMSW files.

2. Subbasin data in ddmsw is reasonable. Matches previous submittals.

3. For MB 2, the diversion records need to be removed from the file.

4. For MB3, remove the old diversion records for 3ACDIV and 3EDIV from the file.

5. For MB4, remove the old diversion records for 7BDV, 7DDV, and 7EDV from the file.

6. Routings in DDMSW are reasonable. Match previous approved submittals.

7. Remove all storage information from DDMSW for all major basins, except Major basin 1.

HEC-1 models

1. For the 6-hour and 24-hour models for MB 2, MB3, and MB4, remove the storage relationships from the HEC-1 models. Each storage area combine should be left as a hanging hydrograph.

2. HEC-1model naming convention should reflect study name. This can be discussed further.

3. Models match models submitted back in March. Is there an updated version? The response to comments mentions adding comments at each combination where an inflow hydrograph. This will need to be included in the final models.

4. Make sure for final TDN (or draft final) that the digital model run date and time and the hard copy model run date and time match.

HEC-RAS models

1. Hydrographs appear to be imported appropriately.

2. Storage areas appear reasonably modeled.

3. Weirs are reasonably modeled.

4. Storm drains are reasonably modeled as culverts.

5. In the main comments window, add the contract and assignment number as well.

Annotated Panels

1. An additional exhibit or modification to this exhibit may be needed since Pond 1C is not shown on this annotated panel. The floodplains fall on two panels. That should be reflected on the exhibit as well.

2. Please verify all water surface elevations shown. They do not match the study data.

3. Please add the datum used (prefer NAVD 88) after or below every water surface elevation shown.

4. Consider using a white outline or maybe bolder boundary for each pond so they stand out a little better.

FEMA Forms

1. Form 1
    - Section A. Check the LOMR box not the CLOMR box.

- Section B2a. The flooding Source is the Highline Canal (or whatever other name we agree on at a later date)
- Section B5a. Consider adding Physical Change, and New Topography as checked boxes. Uncheck Revision to Floodway.
- Section B5b. Remove all the current checks. Possibly add a check in "Other" and list retention basin and storm drain.
- 3 signature forms will be necessary. One for Guadalupe, one for Tempe, and one for Unincorporated Maricopa County.

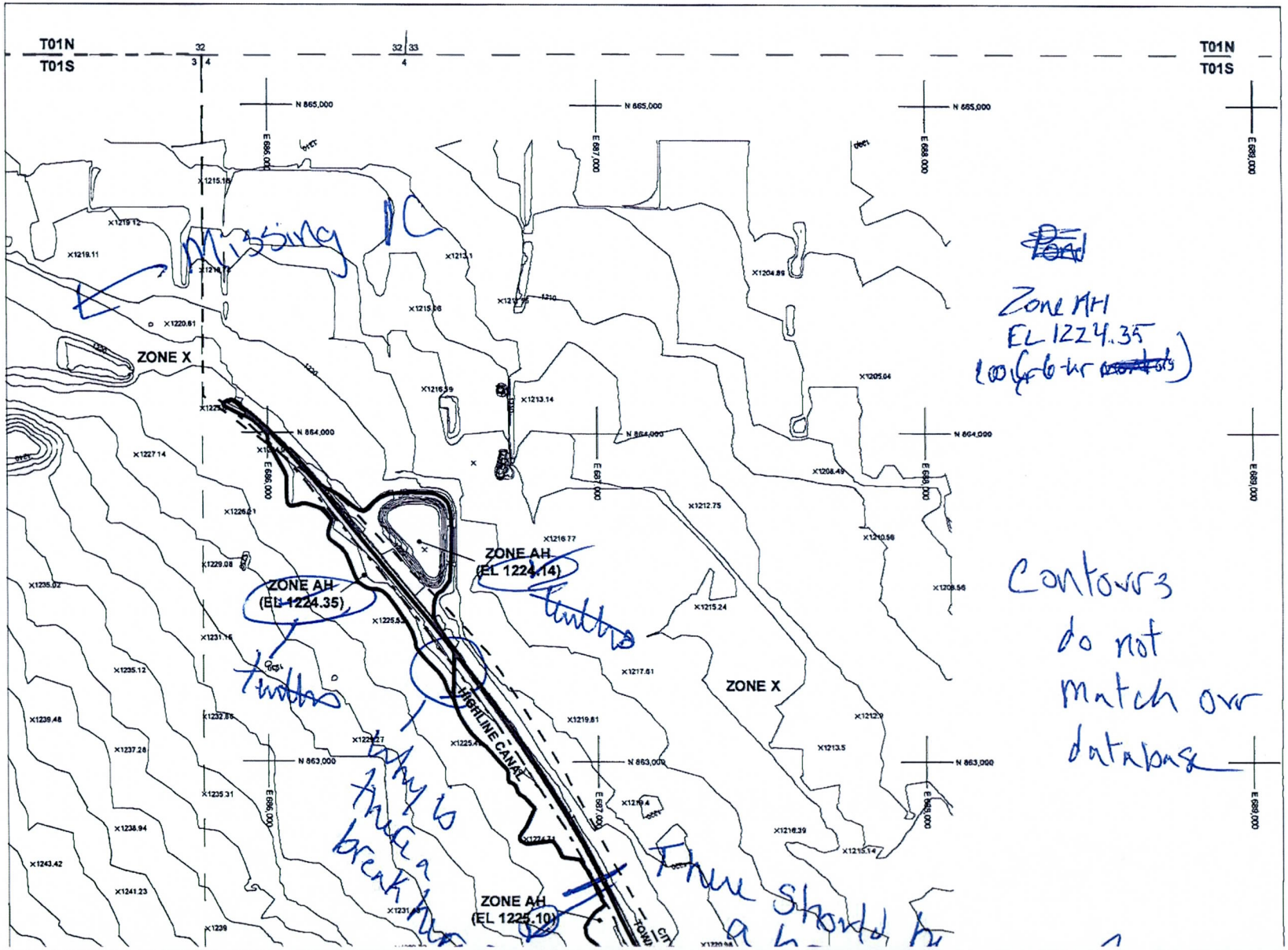
2. Form 2
    - Correct flooding source.
    - Section A1. Add a check to "no existing analysis".
    - Section B4. Attach a description for what HEC-RAS was used for in this study.
    - Sections B, C, and D provide checks in the appropriate boxes.

I have no more comments at this time.

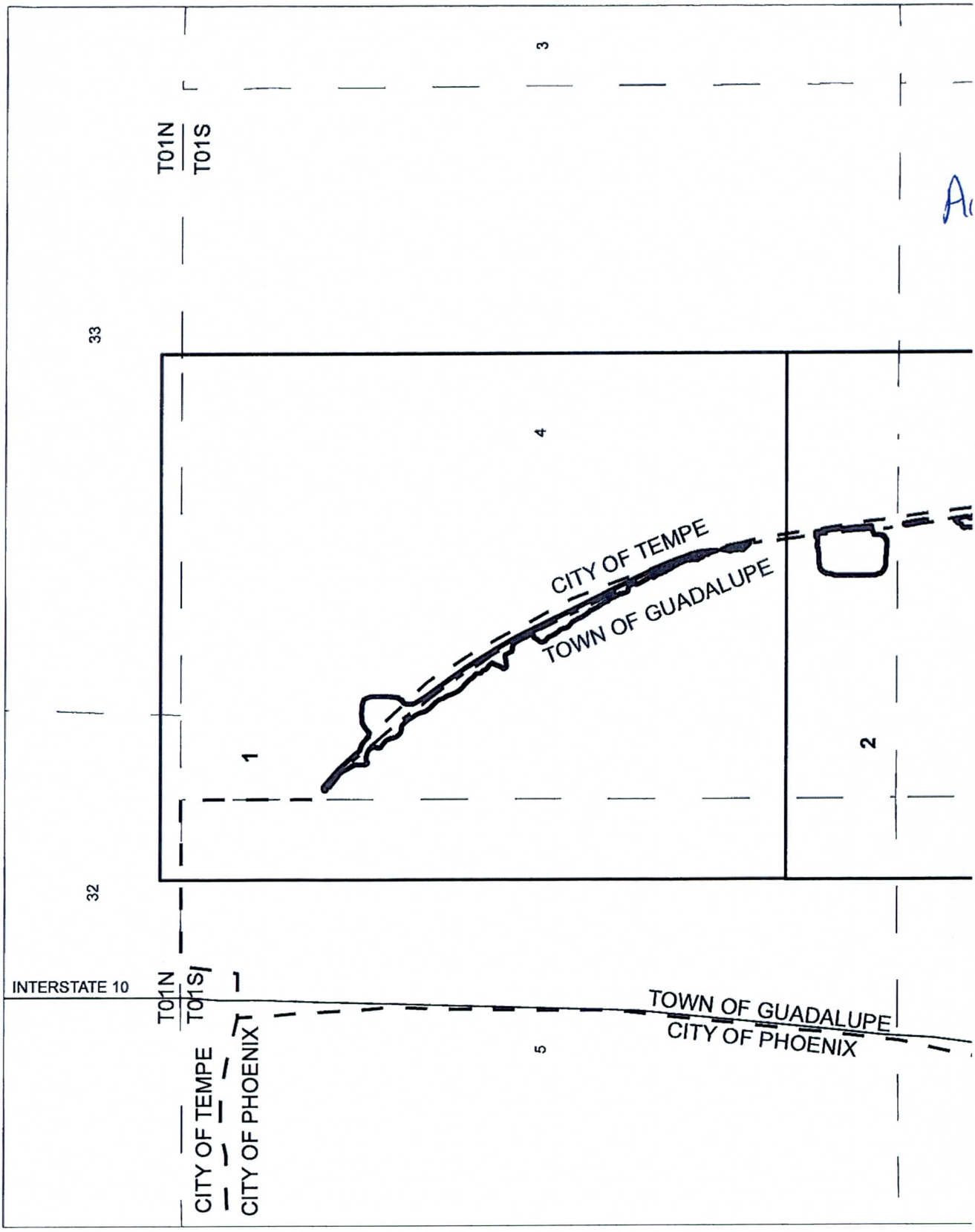
If you have any questions, please contact me at (602) 506-4837, or kag@mail.maricopa.gov.

Sincerely,

Kathryn Gross, CFM, M.A.
Senior Hydrologist

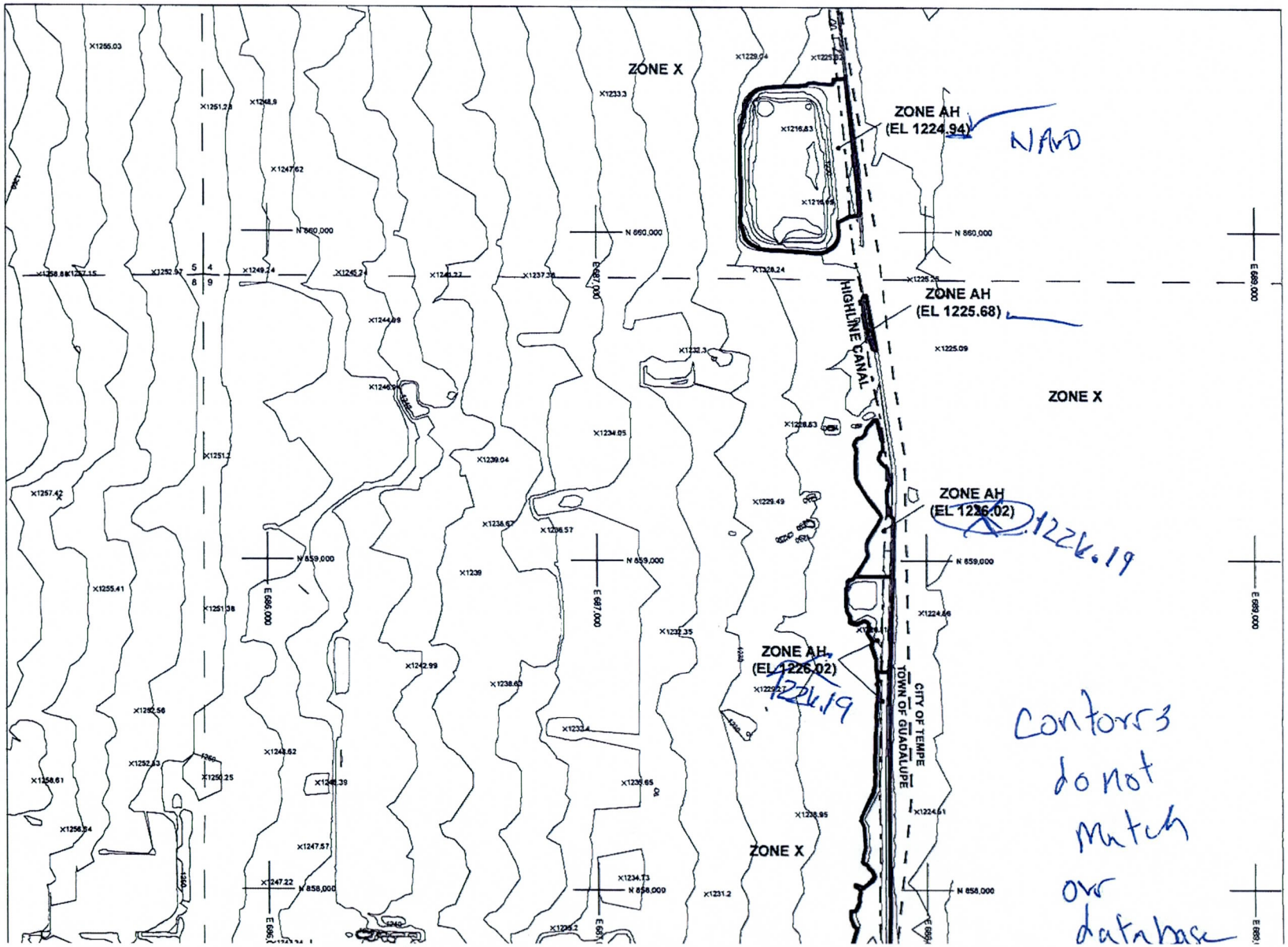


THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1" = 200' HORIZONTAL SCALE AND 5' CONTOUR INTERVALS.



THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1" = 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS.

MATCH LINE SHEET 1



THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1" = 200' HORIZONTAL SCALE AND 5' CONTOUR INTERVALS

Flood Control District
of Maricopa County

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May 26, 2011

Brian Wahlin, PhD. P.E. CFM
WEST Consultants Inc.
8950 South 52nd Street, Suite 210
Tempe, AZ 85284

Subject: Guadalupe FDS: Guadalupe FDS TDN submittal of 5/20/2011

Dr. Wahlin:

I have reviewed the above listed submittal and have the following comments.

TDN Comments and Organization

1. All previous comments have been addressed.

2. Some minor changes are needed on the FEMA forms.

    - FEMA Form 1, Community Acknolwegdment form, Section D. For the Town just include the Community name. I will have the Town fill in the other specific information.
    - FEMA Form 2 Section C: Put a check in digital mapping. You are providing the sealed document. The District will provide the digital topo file.
    - FEMA Form 2 Section D1a and D1b. These boxes need to be checked yes since we are establishing a BFE.

3. In the hydrology section, could you please reference the location of the model schematics in Appendix D.

4. An additional divider, B.7 FEMA Correspondence is needed. The District can provide if necessary.

5. For Appendix C. The District will provide the sealed field survey information for C.3.

6. For Section 5.5.1 please make a reference to the storm drain sheets located in the appendix. For ease of review consider either adding additional information that would guide to which information was used specifically for each storage area culvert or possibly provide a table in the appendix and highlight the used information in the storm drain tables.

7. Consider re-naming the RAS project to "GuadalupeFDS".

8. Appendix E. Please include a RAS report for the 6-hour model as well or see if both plans can be printed in same report.

9. Appendix E. Could an exhibit be created showing the canal survey points?

Hydrology Workmaps

1. Schematic Map. Remove this exhibit. Based on the information being shown on the subbasin map, a full blown schematic map may not be necessary.

2. Soils Exhibit. Please include a project title (Guadalupe FDS) on the exhibit. Please present the soils data by soil unit for easier verification in DDMSW.

3. Landuse Exhibit. Please include a project title (Guadalupe FDS) on the exhibit. A legend is needed listing the landuse codes.

4. Subbasin Map appears reasonable. If possible, could the aerial photograph be screened a little more or the contours emphasized a little more so that the contour data is easily visible. It is a little light at the moment.

Floodplain Workmaps

1. For all sheets:
    - Please correct the study name: Guadalupe Floodplain Delineation Study.
    - Please include ERM information using points from the County's GDACs information (minimum of 1 per sheet is recommended, not sure we can accomplish it in this small a watershed though).
    - The contour data shown on the map does not match the contours in the District's database. This will need to be revised on Sheets 1 and 2.

2. Cover Sheet: appears reasonable.

3. Sheet 1 of 2
    - Please revise the delineation for Pond 1C it should be drawn within the ball park basin and if necessary the north basin of the apartment complex.
    - It appears that the floodplain limits for 2D, 3A and 3E have been modified from the last submittal. Should there be a separation between 3A and 3E?
    - The Legend needs to include the section, township and range information. Provide a note on the map stating what Range the area is located in.

4. Sheet 2 of 2
    - Correct the WSEL listed for Pond 7B. The WSEL should be 1226.2 from the 24-hr model.The WSEL information needs to be corrected on the map for ponds 7BST, 7DST, and 7EST.

- Modify the tie-in location at the southern end of the delineation. Start the Zone A boundary just south of the Tempe city boundary.
- The Legend needs to include the section, township and range information. Provide a note on the map stating what Township and Range the area is located in.

Technical Files

1. DDMSW files are reasonable.

2. HEC-1 models are reasonable. Still need to discuss if names of files will be modified.

3. HEC-RAS model is reasonable. Still need to add contract number to comment box.

Annotated Panels (provided digitally)

1. Annotated panels look reasonable.

I have no more comments at this time.

If you have any questions, please contact me at (602) 506-4837, or kag@mail.maricopa.gov.

Sincerely,

Kathryn Gross, CFM, M.A.
Senior Hydrologist

GUADALUPE FLOODPLAIN DELINEATION STUDY

TECHNICAL MEMORANDUM

Date: May 31, 2011

To: Kathryn Gross – FCDMC

From: Brian Wahlin, Project Manager – WEST Consultants, Inc.
Riley Asburry – WEST Consultants, Inc.

Re: Response to Guadalupe 5/06 comments

RESPONSE TO Guadalupe FDS TDN 4/26/2011 submittal comments

Below are the responses to the review of the TDN 4/26/2011 submittal comments.

TDN Comments and Organization

1. Included with this comment letter is another Word document that provides a skeleton outline of recommendations for modifying the current TDN layout for Section 4.
   WEST Response: Recommended outline has been followed

2. Title of TDN needs to be changed. The proper study name is Guadalupe Floodplain Delineation Study.
   WEST Response: Title has been changed

3. The majority of the comments are included in the track-changes version of the Word document sent on 4/26/11.
   WEST Response: Noted

4. Section 3. Do I still need to get you sealed survey points? If the seal is on a paper you have or the CD please make sure a copy of it is in appendix C.3.
   WEST Response: Yes, we still need the sealed survey points.

5. For all the ponding area figures, please add some contour labels. Or the figure in the text could just be a graphic but an addition figure or map would be included in the Appendix with the contours labeled.
   WEST Response: Contour labels have been added to the figures.

6. For the ponding area discussions, the text needs to be clarified for the id names, constructed basin names, and subbasin names. It is recommended that all ponding areas be called either ponding area or storage areas and subbasins be placed in front of any subbasin id discussed. The constructed basins could be described by their geographic names; however, this could be discussed further if necessary.
   WEST Response: Ponding areas and storage areas have been renamed according to your recommendations.

7. Within the ponding area discussions, the reference to the canal changes. Some state the canal. Others state the Highline Canal. And other times it is referred to as highline canal. Should it be referred to as the Highline Canal at the beginning of each storage area discussion then use canal for the rest of the text?
   WEST Response: References to the canal have been changed as suggested.

8. Street diversion section. Remove this section if there were no street diversions modeled. If there were, please add additional text stating where the diversions were in the watershed. This section will also need to be moved to the Diversion Section (4.2.7.6)
   WEST Response: Street diversion section has been removed.

9. A recommended approach to Section 5 has been entered into the track changes document submitted with this letter.
   WEST Response: The recommended approach to section 5 has been followed.

10. Appendix E. Include excerpts for the storm drain sheets and map in this appendix.
    WEST Response: excerpt for the storm drain sheets have been included in Appendix E.

Hydrology Workmaps

1. A full size Subbasin Map with concentration points and flow paths and routing reaches needs to be submitted. An aerial background could be included. Contours and streets should be included as the minimum background information.
   WEST Response: A full size Subbasin Map as described is now included with the TDN

2. A soils map needs to be included. This should have subbasin boundaries and soils shown. This map could be submitted as an 11x17.
   WEST Response: An 11x17 soils map as described is now included in the TDN.

3. A landuse map needs to be included. This should have subbasin boundaries and landuse shown. This map could be submitted as an 11x17.
   WEST Response: An 11x17 landuse map as described is now included in the TDN.

1. A schematic map needs to be included. This should have subbasin boundaries the schematic graphics of the watershed shown. This map can be discussed further.
   WEST Response: An 11x17 schematic map as described is now included in the TDN.

Floodplain Workmaps

1. In several instances the draft digital floodplain I received a few weeks ago does not match what is shown on the Workmaps. I am assuming that what is shown on the Workmaps is the updated version since the digital submittal did come with a caveat.
   WEST Response: Yes, the Workmaps show the updated version.

2. An additional work map should be included to show the delineation of ponding area 1C. The digital pond 1C 24 hour floodplain is too large. The delineation should be drawn to the 1224 contour located within the basin.
   WEST Response: Digital pond 1C is now included in the Workmaps and follows the 1224 contour closely (WSE = 1224.1).

3. For all sheets:
   - State the mapping and ground control survey was performed under a separate FCD contract, contact number 08-20. I will see if I can track down company names but those may not be necessary.
     WEST Response: Statement has been added to all sheets.

   - Revise the placement of the jurisdiction labels. Note that there are two sets of boundary lines. The west boundary is the boundary between Guadalupe and Uninc. Maricopa Co. and the right is the boundary between Uninc. Maricopa Co. and Tempe. So Uninc. Maricopa Co. will need to be added to the mix.
     WEST Response: Uninc. Maricopa Co. is now included where appropriate.

   - Include the pond names on the study sheets.
     WEST Response: Pond names have been added to the study sheets.

   - Please include the controlling storm identifier under each WSEL.
     WEST Response: The controlling storm identifier has been added.

   - Please limit the water surface elevation to the tenths place on the maps.
     WEST Response: WSE has been rounded to the tenths place.

4. For sheets 1 and 2. It does not appear that the contours delivered to the consultant from the District are being used. They need to match the contour product provided from the contract number 8-20.
   WEST Response: To be discussed in next meeting

5. Cover Sheet
   - The title of the study "Guadalupe FCS" needs to be included in the title block, not "sources of mapping…"
     WEST Response: the title has been added to the title block.

   - Please include the street layout and some street labels.
     WEST Response: Street layout and labels have been added.

   - Add the assignment number to the contract number.

WEST Response: Assignment number has been added.

6. Sheet 1 of 2
   - Pond 1C needs to be added to the map.
     WEST Response: Pond 1C has been added.

   - In two locations there are breaks in the ponding linework that do not correspond to ponding area divisions. Please remove these breaks.
     WEST Response: Breaks in line work have been removed at these locations.

   - Street linework and labels need to be added to the map.
     WEST Response: Labels have been added to the map.

   - Section boundaries need to be added to the map.
     WEST Response: Section boundaries have been added to the map.

   - Please provide a screened aerial as the background or include the building footprints if available in the mapping product.
     WEST Response: Screened aerial image has been added.

   - The correct study names needs to be included on the maps.
     WEST Response: Correct study names have been added.

   - The contract number needs to be corrected on the maps.
     WEST Response: Contract number has been corrected.

7. Sheet 2 of 2
   - The WSEL information needs to be corrected on the map for ponds 7BST, 7DST, and 7EST.
     WEST Response: WSE info has been corrected.
   - Street linework and labels need to be added to the map.
     WEST Response: Line work and labels have been added to the maps.

   - Section boundaries need to be added to the map.
     WEST Response:Section boundaries have been added to the map.

   - Please provide a screened aerial as the background or include the building footprints if available in the mapping product.
     WEST Response: Screened Aerial has been added.

   - The correct study names needs to be included on the maps.
     WEST Response: Correct study names have been included.

- The contract number needs to be corrected on the maps.
  WEST Response: Contract number has been corrected.

DDMSW files

1. The following refer to both the 6 and 24 hour DDMSW files.

2. Subbasin data in ddmsw is reasonable. Matches previous submittals.
   WEST Response: Noted.

3. For MB2, the diversion records need to be removed from the file.
   WEST Response: Diversion records have been removed.

4. For MB3, remove the old diversion records for 3ACDIV and 3EDIV from the file.
   WEST Response: Diversion records have been removed.

5. For MB4, remove the old diversion records for 7BDV, 7DDV, and 7EDV from the file.
   WEST Response: Diversion records have been removed.

6. Routings in DDMSW are reasonable. Match previous approved submittals.
   WEST Response: Routing matches previous submittals.

7. Remove all storage information from DDMSW for all major basins, except Major basin 1.
   WEST Response: Storage information has been removed except in MB 01. .

HEC-1 models

1. For the 6-hour and 24 hour models for MB2, MB3, and MB4, remove the storage relationships from the HEC-1 models. Each storage area combine should be left as a hanging hydrograph.
   WEST Response: Storage information has been removed.

2. HEC-1 model naming convention should reflect study name. This can be discussed further.
   WEST Response: Naming convention has been updated.

3. Models match models submitted back in March. Is there an updated version? The response to comments mentions adding comments at each combination where an inflow hydrograph. This will need to be included in the final models.
   WEST Response: New revised model has been sent.

4. Make sure for final TDN (or draft final) that the digital model run date and time and the hard copy model run date and time match.
   WEST Response: Run date and time will be set to match.

HEC-RAS models

1. Hydrographs appear to be imported appropriately.
   WEST Response: Noted.

2. Storage areas appear reasonably modeled.
   WEST Response: Noted.

3. Weirs are reasonably modeled.
   WEST Response: Noted.

4. Storm drains are reasonably modeled as culvers.
   WEST Response: Noted.

5. In the main comments window, add the contract assignment number as well.
   WEST Response: Contract and assignment numbers have been added.

Annotated Panels

1. An additional exhibit or modification to this exhibit may be needed since Pond 1C is not shown on this annotated panel. The floodplains fall on two panels. That should be reflected on the exhibit as well.
   WEST Response: Pond 1C has been added.

2. Please verify all water surface elevations shown. They do not match the study data.
   WEST Response: WSE's have been updated.

3. Please add the datum used (prefer NAVD 88) after or below every water surface elevation shown.
   WEST Response: Datum has been added below each WSE.

4. Consider using a white outline or maybe bolder boundary for each pond so they stand out a little better.
   WEST Response: Outline has been updated to stand out better.

FEMA Forms

1. Form 1
   - Section A. Check the LOMR box not the CLOMR box.
     WEST Response: Changed accordingly.

   - Section B2a. The flooding Source is the Highline Canal (or whatever other name we agree on at a later date).
     WEST Response: Changed to Highline lateral

- Section B5a. Consider adding Physical Change, and New Topography as checked boxes. Uncheck Revision to Floodway.
  WEST Response: Boxes have been checked accordingly.

- Section B5b. Remove all the current checks. Possibly add a check in "Other" and list retention basin and storm drain.
  WEST Response: Boxes have been checked accordingly.

- 3 signature forms will be necessary. One for Guadalupe, one for Tempe, and one for Unincorporated Maricopa County.
  WEST Response: Noted.

2. Form 2

- Correct flooding source.
  WEST Response: Corrected.

- Section A1. Add a check to "no existing analysis".
  WEST Response: Check added.

- Section B4. Attach a description for what HEC-RAS was used for in this study.
  WEST Response: Description added.

- Sections B, C, and D provide checks in the appropriate boxes.
  WEST Response: Boxes have been checked accordingly.

GUADALUPE FLOODPLAIN DELINEATION STUDY

TECHNICAL MEMORANDUM

Date: June 2, 2011

To: Kathryn Gross – FCDMC

From: Brian Wahlin, Project Manager – WEST Consultants, Inc.
Riley Asburry – WEST Consultants, Inc.

Re: Response to Guadalupe 5/26 comments

RESPONSE TO Guadalupe FDS TDN 5/20/2011 submittal comments

Below are the responses to the review of the TDN 5/20/2011 submittal comments.

TDN Comments and Organization

1. All previous comments have been addressed.
   WEST Response: Noted

2. Some minor changes are needed on the FEMA forms.

   - FEMA Form 1, Community Acknowledgment form, Section D. For the Town just include the Community name. I will have the Town fill in the other specific information.
     WEST Response: Community info has been removed

   - FEMA Form 2 Section C: Put a check in digital mapping. You are providing the sealed document. The District will provide the digital topo file.
     WEST Response: Check has been added.

   - FEMA Form 2 Section D1a and D1b. These boxes need to be checked yes since we are establishing a BFE.
     WEST Response: Boxes have been checked.

3. In the hydrology section, could you please reference the location of the model schematics in Appendix D?
   WEST Response: The schematic drawings have been referenced in section 4.1.

4. An additional divider, B.7 FEMA Correspondence is needed. The District can provide if necessary.
   WEST Response: Divider has been added

5. For Appendix C. The District will provide the sealed field survey information for C.3.
   WEST Response: Noted

6. For Section 5.5.1 please make a reference to the storm drain sheets located in the appendix. For ease of review consider either adding additional information that would guide to which information was used specifically for each storage area culvert or possibly provide a table in the appendix and highlight the used information in the storm drain tables.
   WEST Response: Reference has been made in 5.5.1 and details have been written on the tables as to what information was used

7. Consider re-naming the RAS project to "GuadalupeFDS".
   WEST Response: RAS model has been renamed to Guadalupe FDS.

8. Appendix E. Please include a RAS report for the 6-hour model as well or see if both plans can be printed in same report.
   WEST Response:

9. Appendix E. Could an exhibit be created showing the canal survey points?
   WEST Response: Survey points and elevations have been added to the Appendix D figures.

Hydrology Workmaps

1. Schematic Map. Remove this exhibit. Based on the information being shown on the subbasin map, a full blown schematic map may not be necessary.
   WEST Response: Schematic Map has been removed

2. Soils Exhibit. Please include a project title (Guadalupe FDS) on the exhibit. Please present the soils data by soil unit for easier verification in DDMSW.
   WEST Response: Project Title and soil unit data has been added to the exhibit

3. Landuse Exhibit. Please include a project title (Guadalupe FDS) on the exhibit. A legend is needed listing the landuse codes.
   WEST Response: Project title has been added and a Legend has been added.

4. Subbasin Map appears reasonable. If possible, could the aerial photograph be screened a little more or the contours emphasized a little more so that the contour data is easily visible. It is a little light at the moment.
   WEST Response: Aerial has been screened back and contours have been darkened.

Floodplain Workmaps

1. For all sheets:
    - Please correct the study name: Guadalupe Floodplain Delineation Study.
      WEST Response: Study name has been corrected.

    - Please include ERM information using points from the County's GDACs information (minimum of 1 per sheet is recommended, not sure we can accomplish it in this small a watershed though).
      WEST Response: ERM info has been added.

    - The contour data shown on the map does not match the contours in the District's database. This will need to be revised on Sheets 1 and 2.
      WEST Response: Contour lines have been changed to the correct data.

2. Cover Sheet: appears reasonable.
   WEST Response: Noted.

3. Sheet 1 of 2
    - Please revise the delineation for Pond 1C it should be drawn within the ball park basin and if necessary the north basin of the apartment complex.
      WEST Response: Pond 1C has been revised as specified.

    - It appears that the floodplain limits for 2D, 3A and 3E have been modified from the last submittal. Should there be a separation between 3A and 3E?
      WEST Response: 3A and 3E are correct, according to the new topo there is no separation between them.

    - The Legend needs to include the section, township and range information. Provide a note on the map stating what Range the area is located in.
      WEST Response: Legend has been added.

4. Sheet 2 of 2
    - Correct the WSEL listed for Pond 7B. The WSEL should be 1226.2 from the 24-hr model. The WSEL information needs to be corrected on the map for ponds 7BST, 7DST, and 7EST.
      WEST Response: WSEL has been corrected for all ponds.

    - Modify the tie-in location at the southern end of the delineation. Start the Zone A boundary just south of the Tempe city boundary.
      WEST Response: Tie in location has been modified as specified.

    - The Legend needs to include the section, township and range information. Provide a note on the map stating what Township and Range the area is located in.
      WEST Response: Legend has been added.

Technical Files

1. DDMSW files are reasonable.
   WEST Response: Noted.

2. HEC-1 models are reasonable. Still need to discuss if names of files will be modified.
   WEST Response: Name will not be changed.

3. HEC-RAS model is reasonable. Still need to add contract number to comment box.
   WEST Response: Contract number has been added.

Annotated Panels (provided digitally)

1. Annotated panels look reasonable.
   WEST Response: Noted.

Flood Control District
of Maricopa County

Board of Directors
Fulton Brock, District 1
Don Stapley, District 2
Andrew Kunasek, District 3
Max Wilson, District 4
Mary Rose Wilcox, District 5

www.fcd.maricopa.gov

2801 West Durango Street
Phoenix, Arizona 85009
Phone: 602-506-1501
Fax: 602-506-4601
TT: 602-505-5897

June 23, 2011

Brian Wahlin, PhD. P.E. CFM
WEST Consultants Inc.
8950 South 52nd Street, Suite 210
Tempe, AZ 85284

Subject: Guadalupe FDS: Guadalupe FDS TDN submittal of 6/2/2011

Dr. Wahlin:

I have reviewed the above listed submittal and have the following comments.

Overall the TDN submittal is reasonable and accepted. Please provide updated FEMA forms with your seal (new forms were issued by FEMA last week), a sealed title page, sealed workmaps and updated project CD based on the information below.

1. The 24-hr HEC-RAS report needs to be included in Appendix E.

2. A few changes on the Floodplain workmaps are requested.

    1. For sheets one and two:
        - Consider thinning out the floodplain boundary line.
        - Add roads and road names to the index map on each sheet.
        - Remove the hydraulic base line from the map and the legend.
        - Add the section line symbol to the legend.
        - Add the GDAC point descriptions to the Title Block under the datum information. They would be referred to as Elevation Reference Marks (ERMS). I have attached a scan of how they should appear in the Title block.
        - The placement of the Section numbers within the sections themselves needs to be discussed. At first I thought random numbers were floating around on the maps. These numbers may not be necessary.

    2. For sheet one: Please verify the section number label 3 used at the section lines. Should it be a 5?

I have no more comments at this time. Go ahead and submit the final TDN when you have addressed the above comments.

If you have any questions, please contact me at (602) 506-4837, or kag@mail.maricopa.gov.

Sincerely,

Kathryn Gross, CFM, M.A.
Senior Hydrologist

GUADALUPE FLOODPLAIN DELINEATION STUDY

TECHNICAL MEMORANDUM

Date: June 28, 2011

To: Kathryn Gross – FCDMC

From: Brian Wahlin, Project Manager – WEST Consultants, Inc.
Riley Asburry – WEST Consultants, Inc.

Re: Response to Guadalupe 6/23 comments

RESPONSE TO Guadalupe FDS TDN 6/2/2011 submittal sub comments

Below are the responses to the review of the TDN 6/2/2011 submittal sub comments.

1. The 24-hr HEC-RAS report needs to be included in Appendix E.
2. A few Changes on the floodplain Workmaps are requested. For sheets 1 and 2:
   - Consider thinning out the floodplain boundary line.
     WEST Response: Lines have been thinned.
   - Add roads and road names to the index map on each sheet.
     WEST Response: Road names have been added to the index maps.
   - Remove the hydraulic base line from the map and legend.
     WEST Response: Line has been removed.
   - Add the section line symbol to the legend.
     WEST Response: Line symbol has been added.
   - Add the GDAC point descriptions to the Title Block under the datum information. They would be referred to as Elevation Reference Marks (ERMs). I have attached a scan of how they should appear in the title block.
     WEST Response: GDAC description has been added.
   - The placement of the section numbers within the sections themselves need to be discussed. At first I thought random numbers were floating around on the maps. These numbers may not be necessary.
     WEST Response: The placement of section numbers has not been changed. A section number label has been added to the legend for clarification.
3. For sheet one:
   - Please verify the section number label 3 used at the section lines. Should it be a 5?
     WEST Response: Section label has been changed to 5.

B.5 Contract Documents

FCDMC 2010C027
Work Assignment #1
Scope of Services
Guadalupe Floodplain Delineation Study

General

The purpose of this assignment is to update the Zone A floodplain delineation located along the Highline Canal within the community of the Town of Guadalupe. The updated floodplain delineation will be approximately 1.7 linear miles along the Highline Canal between the Interstate-10 Baseline Road off-ramp and Mineral Road. The study will encompass the development of hydrologic and hydraulic analyses in support of a Zone AH floodplain delineation.

1. Task 1 Coordination

   1.1. Within fourteen (14) days of the NTP, the CONSULTANT will submit a project schedule to the DISTRICT's Project Manager showing coordination meetings and completion dates for each task identified in the scope of work (SOW). The CONSULTANT will update this project schedule when appropriate.

   1.2. The CONSULTANT will participate in regular coordination meetings (at least every four [4] weeks) with the DISTRICT's Project Manager and in milestone coordination meetings in the development of the hydrologic and hydraulic analyses. The CONSULTANT is responsible for the minutes of any meetings. Coordination and milestone meetings should be combined whenever possible.

   1.3. The CONSULTANT will submit an estimate of the monthly billing within fourteen (14) days of the NTP. Thereafter, this estimate will be updated and submitted to the DISTRICT's project manager at least ten (10) days before the end of each quarter.

   1.4. The CONSULTANT will submit monthly progress reports at least five (5) days before submittal of monthly invoices. The report shall be brief and should be no longer than two (2) typed pages. At a minimum, the monthly report shall contain the following:

      a. A description of the work accomplished by task during the reporting month.
      b. Percent (%) completed for the month and percent (%) cumulative completed for each task.
      c. A brief description of the work to be accomplished in the month following, and
      d. A description of any problems encountered.

1.5. The DISTRICT is responsible for placing the legal advertising at the beginning of the study and of notifying the public of the study. The advertisement will be run in a widely circulated newspaper twice, with approximately one (1) week between runs. The advertisement will also run twice in a local newspaper that serves the area being studied. After the newspapers run the advertisement, the DISTRICT will supply the CONSULTANT with the original affidavit of publication from each newspaper for each day that the advertisement ran for placement in the TDN.

1.6. If necessary, the DISTRICT will notify property-owners by mail to obtain any necessary Rights-of-Entry at the request of the CONSULTANT within the study area. The DISTRICT will provide the CONSULTANT with a list of all the property owners notified and a copy of the Rights-of-Entry letter.

1.7. The DISTRICT will prepare and mail a project flyer to individuals within the existing floodplain. This flyer will be mailed to announce the beginning of the study and inform them of its purpose and scope.

1.8. The CONSULTANT will attend one (1) public meeting in conjunction with this study. The meetings will be to inform the public and obtain public comment on the study results and shall take place prior to the submittal of the final report to FEMA. The DISTRICT will be responsible for the preparation of the graphic displays for these meetings. At least one (1) representative from the CONSULTANT will attend the meeting. The CONSULTANT will respond to the public's comments and make revisions to the study if necessary.

1.9. CONSULTANT/DISTRICT Performance Evaluations will be performed. An informal evaluation will be performed at the completion of the hydrologic analysis. A formal evaluation will be performed at the completion of the project upon receipt of all deliverables.

2. Task 2 Survey

2.1. The CONSULTANT will notify the DISTRICT of any survey needs. The DISTRICT will provide any survey data to the CONSULTANT.

3. Task 3 Hydrology

3.1. The CONSULTANT will review the existing reports and HEC-1 models for this area.

3.2. The hydrologic study of the watershed will be delivered to the DISTRICT under separate cover from the hydraulic analysis. The CONSULTANT shall use the U.S. Army Corps of Engineers computer program HEC-1, 1997 Version 4.1 to develop a hydrologic model for the area. The latest version of the DISTRICT's DDMSW software should be used to develop subbasin and routing parameters.

Using appropriate hydrologic judgment, subbasins are to be identified that provide reasonable depiction of the watershed condition. The subbasins must be as homogeneous as possible, using watershed area, watershed type (mountainous and flat lands or urban and undeveloped areas), and time of concentration as criteria. Subbasin break-downs will be done in sufficient detail to provide peak discharges at structures, major road crossings, confluences, and any other control feature located along the canal being studied. An appropriate time step and number of ordinates is to be selected that allows for complete calculation of the flood hydrograph without sacrificing resolution of the flood peak.

3.3. The CONSULTANT will use the existing subbasin delineation as a guide.

3.4. The peak discharges for the 100-year 6- and 24-hour storms will be developed.

3.5. The Drainage Design Manual for Maricopa County, Volume I, Hydrology, Revision June 2010 shall be used. The latest version of DDMSW, may also be used in conjunction with the manual. The specific hydrologic techniques to be used in this study are:

a. Rainfall Depth: Point precipitation values will be determined using the information and procedures described in the Drainage Design Manual for Maricopa County, Volume I, Hydrology (2010).
b. Rainfall Distribution: Peak discharges and peak volumes for the 100- year 6-hour storm will be estimated using the DISTRICT's Distribution(s). Peak discharges and peak volumes for the 100-year 24-hour storm will be estimated using the SCS Type II rainfall distribution.
c. Areal Reduction: The point precipitation values will be areally reduced for critical concentration areas. Modifications to the original methodologies (Areal reduction for the 6-hour rainfall duration will be applied using the curves in the Drainage Design Manual for Maricopa County, Volume I, Hydrology (2010). NOAA HYDRO-40 will be used with the 24-hour rainfall reduction) will be necessary due to watershed constraints. The modified methods will need to be approved by the DISTRICT prior to application in the modeling.
d. Rainfall Excess: The Green and Ampt methodology will be used for estimating the rainfall losses.
e. Unit Hydrograph: The Clark and S-Graph method should be used following the procedures outlined in the Drainage Design Manual for Maricopa County, Volume I, Hydrology (2010). The choices in methodology will be to the discretion of the CONSULTANT, with consent from the DISTRICT.
f. Time of Concentration and S-Graph Lag: Time of Concentration or S-graph lag should be calculated using DDMSW.
g. Channel Routing: Channel routing will be accomplished using the methods in the Drainage Design Manual for Maricopa County, Volume I, Hydrology (2010). The choice of methodology will be at the discretion of the CONSULTANT, with consent from the DISTRICT. Average cross sections

will be developed using the available mapping and field reconnaissance data. Sufficient field cross sections will be taken to ensure that routing reaches are reasonable and representative of field conditions. Where necessary, the HEC-1 routing parameters for the reaches that may be modeled using HEC-RAS will be adjusted after the HEC-RAS cross sections are available. The resulting velocities and depths, for all reaches, must be assessed for realistic values.

h. Reservoir Routing: Detailed analysis of structures and ponding areas will be accomplished using the Modified Puls reservoir routing option of HEC-1. Stage versus discharge tables for hydraulic structures will be estimated using appropriate hydraulic methodology.

3.6. The DISTRICT will provide appropriate references to facilitate parameter estimation.

3.7. The CONSULTANT shall clearly identify and incorporate appropriate comments in the hydrologic model.

3.8. Retention volume shall be accounted for in the modeling.

3.8.1. The CONSULTANT shall identify any retention basins located in the watershed based on the provided aerial photography and topographic mapping. Retention basin volume will be determined from the topographic mapping.

3.8.2. Retention volume shall be modeled using diversion records.

3.8.3. Basin efficiency shall be taken into consideration when determining volume to be modeled and the potential for flow passing the inlets.

3.9. Where necessary, significant storm drain systems between subbasins shall be modeled using diversion records. Diversion discharges will be based on simple pipe capacity calculations at controlling sections of the storm drain or at the subbasin boundary. The CONSULTANT will identify and make recommendations of where storm drain diversions are necessary and present that information to the DISTRICT project manager for approval.

3.10. Where necessary, major street intersection diversions will be developed using slope-area methods. Areas will be derived from typical street sections. Slopes will be derived from the two (2) foot topography provided to the CONSULTANT from the DISTRICT. The CONSULTANT will identify and make recommendations of where street intersection diversions are necessary and present that information to the DISTRICT project manager for approval.

3.11. All calculations, or assumptions used in developing subbasin and routing parameters shall be documented and made a part of the appendix for the hydrology report.

3.12. Output of the computer model must be reviewed to see if the peak flows and volumes are realistic. Adjustments to input for obtaining the most realistic results are normal to the scope.

3.13. Every attempt must be made to recover historic stream gage and flooding data, and use it to compare with the results obtained by the hydrologic model. Where gage data is unavailable, the CONSULTANT shall compare the study results to the results of adjacent studies. Major differences must be discussed in the final report.

3.14. The CONSULTANT is required to obtain the approval of the DISTRICT at each of the following steps (submittals should be made in a digital format, final hard copies should match the approved digital files):

a. Subbasin boundaries
b. Soil maps, watershed boundary maps, land use maps and HEC-1 parameter estimation
c. HEC-1 flow diagram and input parameters
d. Locations of hydraulic barriers
e. HEC-1 results

3.15. The CONSULTANT will attend two (2) field trips with DISTRICT staff. One (1) field trip at the start of the project to scope out the critical points of the watershed and problem areas and the second field trip may be scheduled at the end of the modeling for verification of the results.

3.16. The CONSULTANT shall meet with the DISTRICT as necessary to discuss critical modeling issues and to address review comments. These meetings are to be combined with progress meetings when possible.

3.17. The Hydrologic Report

3.17.1. The findings of the hydrologic study will be presented in Section 3 of the Technical Data Notebook and will be prepared in accordance with ADWR State Standards Attachment 1-97 (SSA 1-97). The report will be organized as specified by the DISTRICT, following SSA 1-97 format.

3.17.2. Tables and Figures for the appendices:

3.17.3. Topographic base map(s) showing the subbasins, routing reaches, Tc flow paths or lag flow paths, major man-made structures, and references (i.e.,

street names, Township, Range, Section, etc.) at a scale of one (1) inch = 2000 feet.

3.17.4. Soils map(s) at the same scale as the base map (with References).

3.17.5. Land use map(s) at the same scale as above (with References).

3.17.6. Schematic map for the HEC-1 showing the subbasins (area, Tc), the flow paths, the routing reaches (length, slope, friction, width, velocities, transmission losses, etc.), order of combining the hydrographs, channel, pipe or culvert dimensions (where appropriate). On the final version of the HEC-1 schematic include peak discharges at major concentration points. Include street names as well.

3.17.7. Pertinent data on all the structures in the watershed (such as spillway elevation, rating curves, etc.).

3.17.8. One set of study maps (i.e., subbasin boundary maps, flow path maps, soils maps, land use maps) to be folded and delivered in a binder.

3.18. Hydrology GIS/CADD submittal. It is recommended that the Hydrology CADD deliverables be developed using the same digital files that the analysis is being performed with. The files will undergo concurrent review from first digital submittal. Final submittal to the DISTRICT should be when the Hydrology Report is approved. The line work used to develop the hydrology maps should be the basis for the GIS/CADD deliverables.

3.19. Specific deviations from this hydrologic scope shall not be undertaken without the specific written concurrence from the DISTRICT.

4. Task 4 Floodplain Delineation

4.1. Floodplain delineations must be obtained using the most appropriate modeling and methodology approved by the DISTRICT and acceptable to FEMA. The CONSULTANT will prepare the study using the guidelines established in FEMA's Guidelines and Specifications for Flood Hazard Mapping Partners, February 2002(Appendix C (2009)), and FIA Document 12, Appeals, Revisions, and Amendments to Flood Insurance Maps, December 1993.

4.2. The delineation work shall meet requirements for floodplain delineations as prescribed by FEMA and the Arizona Department of Water Resources.

4.3. The delineation study shall be based on the final results of the hydrologic study as directed by the DISTRICT.

4.4. The CONSULTANT is to make refinements to the modeling based on review of the model results by the DISTRICT, ADWR, FEMA, and FEMA's Technical Evaluation Contractor. The CONSULTANT shall review the model results for reasonableness. Adjustments to the input parameters for obtaining the most realistic results are normal to the scope.

4.5. Floodplain Delineation – Ponding Areas

4.5.1. The CONSULTANT shall identify and model all hydraulic controls along the canal. The location of all control points will be identified on a map and submitted to the DISTRICT for approval.

4.5.2. Stage/Storage/Discharge relationships will need to be developed at all critical locations along the canal. Detailed analysis of structures and ponding areas shall be accomplished using the Modified Puls reservoir routing option within HEC-1. Stage/Storage/Discharge tables for hydraulic structures shall be estimated using appropriate hydraulic methodologies approved by the DISTRICT. The CONSULTANT shall provide the DISTRICT with the water surface elevations for these ponding areas and identify them as Zone AH.

4.5.3. The existing canal elevation shall be used when developing the Stage/Storage/Discharge relationships.

4.5.4. The canal will be assumed to be operating at full capacity.

4.5.5. Openings should be included in the storage relationship.

4.5.6. Any flows in excess of the Stage/Storage/Discharge relationship at the canal shall be diverted out of the model.

4.6. Floodplain Delineation – Conveyance – HEC-RAS modeling

4.6.1. Where appropriate, the CONSULTANT will delineate up to 1 mile of conveyance areas between the ponding areas with water surface elevations, BFE's and identify these delineations as Zone AE. The Consultant will get approval from the DISTRICT's Project Manager before moving forward with this task. The CONSULTANT will use the U.S. Army Corps of Engineers latest release of HEC-RAS for this task.

4.6.2. Field Reconnaissance

4.6.2.1. The CONSULTANT will conduct a field reconnaissance of the full study reach. This will include observation of channel and floodplain conditions for estimating Manning's "n" values; photographic documentation of floodplain characteristics; determination of channel bank stations; observation of possible overflow areas; inspection of levees or other flood control structures; and measurement of bridge dimensions.

4.6.3. Manning's "n" values are to be determined using the methodology in the USGS report, Estimated Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona, April 1991. Copies of the report are available through the DISTRICT.

4.6.4. A draft report on the field reconnaissance will be submitted to the DISTRICT for review and approval prior to beginning the HEC-RAS modeling. The report will present the determination of channel and overbank "n" values using captioned color photographs or color photocopies. The report will also discuss floodplain conditions affecting the delineation, describe structures and obstructions, and provide color photos or photocopies of major hydraulic structures. Photo locations, structures, and "n" values will be displayed on reduced scale mapping and included in the Final Report. This report will be included in Appendix E of the TDN.

4.6.5. Cross Sections

4.6.5.1. The location and alignment of cross sections and channel centerline will be submitted for the DISTRICT's review and approval before digitizing the cross section data. Cross section stationing will be from left to right looking downstream with the thalweg as station 10,000. Cross sections will be spaced approximately every five hundred (500) feet, unless geographic or structural constraints dictate otherwise, and will extend the full width of the area inundated by 100-year floodwaters. Identification of cross sections will be in river miles, increasing upstream. The stationing will tie into the specified river mile of the existing FEMA studies. The cross section may need to be reoriented or altered after running the HEC-RAS model to ensure that they are perpendicular to flow per FEMA criteria. Cross sections developed by the HEC-RAS interpolation feature are not to be used.

4.6.5.2. All cross-section plots will show water surface profiles, ineffective flow areas, "n" values, encroachments, channel stationing and other pertinent information. All plots are to be accompanied by a legend. These plots should be available at all reviews.

4.6.5.3. Bridges and culverts must be modeled according to HEC-RAS modeling requirements for the selected routine. Where multiple bridges occur, each bridge will be modeled separately.

4.6.5.4. Side weirs will be modeled in HEC-RAS where the hydraulics indicates water surface elevations are above the canal bank. The results will be input back into the hydrology model.

4.7. The CONSULTANT must obtain DISTRICT approval at each of the following steps:

a. Ponded floodplain delineation.
b. Field reconnaissance report and estimation of Manning's "n" values for conveyance corridors, necessary.
c. Alignment of the cross sections and channel centerline for conveyance corridors, if necessary.
d. Conveyance corridor floodplain delineation, if necessary.
e. Flood zones must be determined according to FEMA criteria and clearly labeled on the final drawings.

4.8. The findings of the floodplain delineation study will be presented in Section 4 of the Technical Data Notebook and will be prepared in accordance with ADWR State Standards Attachment 1-97 (SSA 1-97). The report will be organized as specified by the DISTRICT standards, following SSA 1-97 format.

4.9. The CONSULTANT shall fill out all the forms required by FEMA for the submittal of a Floodplain Delineation Study. The forms will be included in Section 2 of the TDN.

4.10. Hydraulics GIS/CADD submittal. It is recommended that the Hydraulics CADD deliverables be developed using the same digital files that the analysis is being performed with. The files will undergo concurrent review from first digital submittal. Final submittal to the DISTRICT should be when Section 4 of the TDN is approved. The line work used to develop the floodplain workmaps should be the basis for the GIS/CADD deliverables.

5. Task 5 Digital Data

5.1. Digital data shall be delivered following either the HIS specifications (3.1), the CADD specifications (1.0) or the shape file specifications. All pertinent Hydrology and Floodplain files should be submitted as well as project and data quality files.

6. Task 6 Deliverables

6.1. Prior to FEMA Submittal: The DISTRICT will deliver the following items to the CONSULTANT for inclusion into the TDN before delivering the FEMA submittal package:

6.1.1. Copies of the Original Affidavits of Publication of the legal advertisements to be included in the Technical Data Notebook.

6.1.2. If bound separately from the Technical Data Notebook, three (3) copies of the field survey notes and office calculations.

6.1.3. Submittal to Local Jurisdictions: Once the DISTRICT has approved the preliminary Technical Data Notebook the CONSULTANT shall provide copies to the local jurisdiction for their review and comments. The CONSULTANT shall address the comments from the local jurisdictions through the DISTRICT.

6.2. FEMA Submittal: The CONSULTANT will submit the following items to the DISTRICT for review by FEMA and any other appropriate governmental agency. All of the following products are considered deliverables for the FEMA submittal:

6.2.1. Two (2) complete sets of blackline topographic base maps with the floodplain delineations shown. All drawings will be signed and sealed by persons of appropriate professional registration(s). Each registrant will provide a specific statement as to what service they performed.

6.2.2. Two (2) complete copies of the Technical Data Notebook, including HEC-1 and HEC-RAS input/output files on cd. The Technical Data Notebook will be prepared in accordance with ADWR State Standards Attachment 1-97 (SSA 1-97). The notebook will be organized as specified by the DISTRICT, following SSA 1-97 format.

6.2.3. Two (2) sets of Annotated FIRM panels showing the proposed delineation.

6.3. Final Submittal: The following products are considered deliverables for the final submittal to the DISTRICT after FEMA approval is issued:

6.3.1. Four (4) complete sets of sealed blackline topographic base maps with the floodplain delineations shown. All drawings will be signed and sealed by persons of appropriate professional registration(s). Each registrant will provide a specific statement as to what service they performed.

6.3.2. All remaining hydrologic and floodplain delineation data in conformance with the DISTRICT's HIS Specifications.

6.3.3. Two (2) complete copies of the Technical Data Notebook including HEC-1 and HEC-RAS input/output files on cd. The Technical Data Notebook will be prepared in accordance with ADWR State Standards Attachment 1-97 (SSA 1-97). The notebook will be organized as specified by the DISTRICT, following SSA 1-97 format. This submittal of the Technical Data Notebook shall include any correspondence and/or meeting minutes with the reviewing agencies and shall reflect any revisions required by those reviewing agencies. Revisions may include, but are not limited to, modifications to the

delineation maps, the HEC-1 model, the HEC-RAS model, and/or the Final Report.

6.3.4. 2 (2) sets of cds containing the complete TDN submittal in pdf format.

6.3.5. The CONSULTANT will submit the hydrology and hydraulic HIS deliverables

Schedule

Draft subbasin submittal: 30 days after NTP
Draft subbasin parameters submittal: 60 days after NTP
Draft "watershed" model (no ponds) submittal: 75 days after NTP
Draft model with ponds submittal: 120 days after NTP
Final model submittal: 150 days after NTP
Draft TDN submittal: 165 days after NTP
Final TDN submittal: 195 days after NTP

The work performed under this scope is based on time and materials. Progress reports in support of requested payments will be provided with the invoice.

B.6 Public Information

PUBLIC OPEN HOUSE
Casa Abierta para El Público

Tuesday, July 19, 2011
Martes, Julio 19, 2011
6:00–7:30PM
Town of Guadalupe Town Hall
9241 South Avenida del Yaqui

Guadalupe Floodplain Delineation Study

Learn about a revised floodplain delineation along the Highline Canal between the I-10/Baseline Road off-ramp and Mineral Road.

Estudio para Delinear las Zonas de Inundación de Guadalupe

Asista a esta presentación para aprender sobre el estudio de zonas de inundación.

www.fcd.maricopa.gov

Project Schedule

When the study is completed, the final results will be sent to the Federal Emergency Management Agency (FEMA) for approval and adoption, which takes approximately nine months. FEMA will use the study results to update the Flood Insurance Rate Maps (FIRM) for the National Flood Insurance Program. Until the FIRMs are updated, the District will use the study data as the "best available information" for floodplain management.

Itinerario del Proyecto

Cuando el estudio es completado, los resultados finales serán enviados a Federal Emergency Management Agency (FEMA) para la aprobación y la adopción, que toma aproximadamente nueve meses. FEMA utilizará los resultados de estudio para actualizar los Mapas de la Tasa de Seguro de Inundación (FIRM) para el Programa Nacional de Seguro de Inundación. Hasta que las FIRMs sean actualizadas, el Distrito utilizará los datos de estudio como el "mejor información disponible" para la gestión de zonas inundadas.

Floodplain Management

The Flood Control District of Maricopa County manages the floodplains within the Town of Guadalupe. The District's floodplain studies allow for sound floodplain management so that future development will not negatively affect the movement of floodwaters.

Administración de las Zonas de Inundación

El Distrito de Control de Inundaciones del Condado Maricopa administra las zonas de inundación dentro de la Ciudad de Guadalupe. Los estudios permiten la administración conciente para las zonas de inundación para que el desarrollo futuro no afecte de forma adversa el movimiento de las aguas de inundación.

Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

July 2011

Guadalupe Floodplain Delineation Study

Estudio para Delinear las Zonas de Inundación de Guadalupe

Public Open House

Casa Abierta para El Público

Maricopa County Supervisor:
Mary Rose Wilcox, District 5/Distrito 5

Town of Guadalupe:
Alma Yolanda Solarez, Mayor/El Alcalde

www.fcd.maricopa.gov

Guadalupe Floodplain Delineation Study

Estudio para Delinear las Zonas de Inundación de Guadalupe

You Are Invited to an Open House

The Flood Control District of Maricopa County (District) and the Town of Guadalupe invite all interested persons to attend an Open House presenting the results of the Guadalupe Floodplain Delineation Study within the limits of the Town of Guadalupe. The study revises the floodplain delineation along the Highline Canal along the eastern boundary of the Town of Guadalupe between the I-10/Baseline Road off-ramp to Mineral Road. You are receiving this flyer because some portion of your property may be within or adjacent to an existing floodplain in the study area.

Es Invitado a una Casa Abierta

El Distrito de Control de Inundaciones del Condado Maricopa (Distrito) y el Pueblo de Guadalupe invita a todas las personas interesadas en asistir una Casa Abierta que presenta los resultados del estudio de Delineación de zonas de inundación de Guadalupe dentro de los límites del Pueblo de Guadalupe. El estudio revisa la delineación de zonas de inundación por el Canal de Highline por la frontera oriental del Pueblo de Guadalupe entre la de-rampa del Camino I-10/Baseline al Camino Mineral. Usted esta recibiendo este folleto porque alguna porción de su propiedad puede estar dentro o adyacente a una zonas de inundación existen en el área del estudio.

Public Open House
Casa Abierta para El Público

Tuesday, July 19, 2011
Martes, Julio 19, 2011
6:00 – 7:30 p.m.
Town of Guadalupe Town Hall
9241 South Avenida del Yaqui
Guadalupe, Arizona 85283

Project Overview

The study used updated detailed mapping and technical analyses to re-evaluate the extent of flood-prone areas adjacent to the Highline Canal along the northern and eastern border of the Town of Guadalupe.

At the Open House, maps of the updated floodplain delineation will be on display and representatives from the District, the District's consultant, and the Town of Guadalupe will be available to discuss the study and answer your questions.

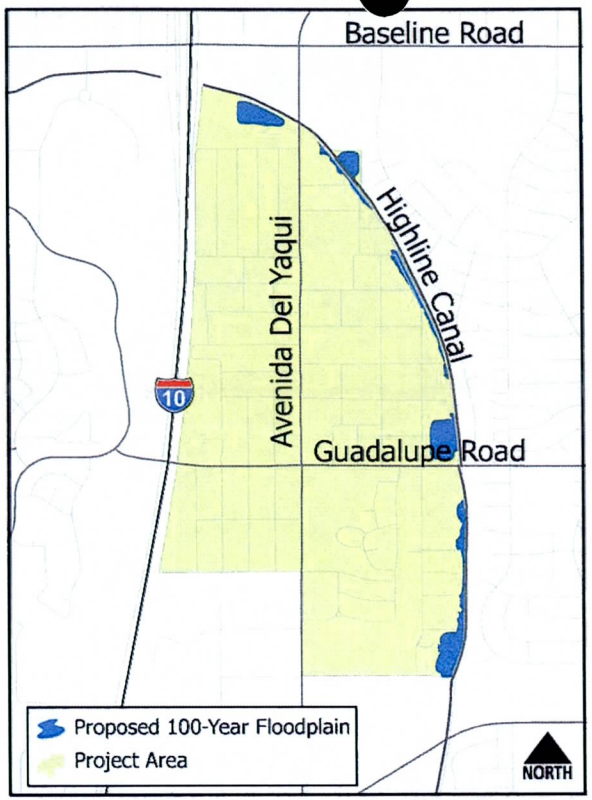
The proposed delineation replaces the existing Zone A floodplain with a detailed Zone AH floodplain. The modification results in changes in floodplain widths (both increases and decreases) and establishes Base Flood Elevations associated with the Zone AH designations (both increases and decreases) along and near the Highline Canal.

Descripción del Proyecto

El estudio utilizó actualizó detalló cartografía y técnico analizado para reevaluar la extensión de áreas de inundación-pronos adyacentes al Canal de Highline por la frontera del norte y oriental del Pueblo de Guadalupe.

En la Casa Abierta, mapas de la delineación actualizada de zonas inundadas estarán en exhibición y los representantes del Distrito, consultor del Distrito, y del Pueblo de Guadalupe estarán disponibles para discutir el estudio y contestar sus preguntas.

La delineación propuesto reemplaza la existente Zona A zonas inundación con una Zona detallada AH la zona inundación. La modificación tiene como resultado cambios en anchuras de zonas de inundación (los dos aumentos y reducir) y establece Elevaciones de Inundación de Base se asociaron con la Zona AH designaciones (los dos aumentos y reducir) adelante y cerca del Canal de Highline.



Map not to scale.

Contact/Información para Contacto

Kathryn Gross
Senior Hydrologist/Administrador del Proyecto de Distrito
Flood Control District of Maricopa County/El Distrito de Control de Inundaciones del Condado Maricopa
602-506-1501
kag@mail.maricopa.gov

Gino Turrubiartes
Community Development Director/ Director de Desarrollo de la Comunidad
Town of Guadalupe/Ciudad de Guadalupe
480-505-5399
gturrubiartes@guadalupeaz.org

B.7 FEMA

GUADALUPE FLOODPLAIN DELINEATION STUDY

TECHNICAL MEMORANDUM

Date: February 1, 2012

To: Syed Qayum- LOMR Technical Manager
Kathryn Gross – FCDMC

From: Brian Wahlin, Project Manager – WEST Consultants, Inc.
Riley Asburry – WEST Consultants, Inc.

Re: Response to Guadalupe 11/16/2011 FEMA Comments
Case No. 11-09-3942P

RESPONSE TO LETTER OF MAP REVISION (LOMR) REQUEST FROM FEMA:

Please provide evidence that the Highline Lateral canal has enough capacity to contain the flow from the base (1-percent-annual-chance) flood that overtops the canals berms or model the canal as flowing full in your analysis. The submitted HEC-RAS hydraulic model assumes that the canal is not full, and will have capacity to take or store all the base flow. Typically with canals that cross flooding sources, it is assumed that the canal is already running full.

WEST RESPONSE:

In an effort to provide evidence that the Highline Lateral has the capacity to contain the base flood that overtops the canals berms, the following procedure was followed:

1. Obtain as-builts for the Highline Lateral from the Salt River Project (SRP);
2. Interview personnel at SRP to determine their normal mode of operation for the canal;
3. Determine the storage volume available in the canal under normal operation mode;
4. Determine additional capacity in the canal under normal operation mode; and
5. Update hydraulic model and corresponding floodplain maps.

As-built drawings were obtained from SRP and are included in as an enclosure to this letter. The latest available as-built drawings for this area were completed in 1965. Under current conditions flows from the Highline Lateral enter a culvert upstream of Avenida del Yaqui and do not daylight again until downstream of the I-10, a distance of about 2000 feet. In the 1965 as-built drawings this

culvert is approximately 200 feet long, indicating that the culvert was extended sometime between 1965 and today. Updated as-built drawings for the new culvert were not available from SRP. In performing hydraulic modeling on this culvert, it was assumed that the current culvert is simply an extension of the culvert described in the 1965 as-built drawings.

SRP personnel were then interviewed to determine the normal mode of operation of the Highline Lateral in the area. According to SRP personnel, the Highline Lateral has never overtopped due to flood flows in the area near the Town of Guadalupe. Water can only enter the canal via a pumping station located several miles away. When storm events approach, SRP personnel turn off this pump in case large amount of storm flows enter the canal. Under normal conditions, the canal flows with approximately 0.6 feet of freeboard. SRP personnel indicated that the design flow for the canal was approximately 65 cfs.

The unsteady HEC-RAS model depicting the ponding against the Highline Lateral was then updated to reflect the storage available under normal operating conditions (i.e., the top 0.6 feet of the canal). Thus, the model was updated to reflect the conditions where the Highline Lateral is operating under normal conditions.

The next step was to determine the additional capacity of the Highline Lateral while it is operating under normal conditions. The culvert near Avenida del Yaqui is the controlling point with regards to the canal capacity. To estimate the canal capacity, a steady-state HEC-RAS model was created of the short portion of the canal upstream and downstream of the Avenida del Yaqui culvert. The culvert dimensions were based on the 1965 as-built drawings as well as the assumption mentioned above.

Two plans were created within this steady-state HEC-RAS model. The first was a series of three cross-sections of the canal, based on the as-built dimensions, slope, and roughness factor. This plan was used to determine the design flow. It was determined, based on the design flow depth, that the design flow is 68 cfs, which agrees well with the estimated design flow reported by SRP personnel. It was also determined that, given the 0.6 feet of freeboard, the maximum capacity of the canal is 95 cfs (assuming no culvert).

The second plan added the Avenida del Yaqui culvert and three more cross-sections downstream of the culvert. Additional cross-sections were also added near the culvert to represent the widening of the canal. This plan showed that the culvert was indeed the limiting factor for flow capacity. Instead of the maximum flow of 95 cfs as calculated without the culvert, only 83 cfs could pass through the culvert without raising the upstream water surface above the maximum depth of the canal. Thus, the additional capacity of the Highline Lateral was estimated as the difference between the maximum capacity (83 cfs) and the design flow (68 cfs), or 15 cfs.

Based on this calculation, it was assumed that the Highline Lateral could carry an additional 15 cfs under normal operating conditions without overtopping. This is a conservative estimate because it assumes that SRP personnel do not turn off the pumps to the Highline Lateral during the storm.

To address the storm flows entering the unsteady HEC-RAS model used for modeling the ponding against the canal, a lateral inflow hydrograph was added to the storage area used to depict the Highline Lateral. Under normal conditions, the flow entering the canal (modeled as a storage area in HEC-RAS) and the flow leaving the canal will be the same since there are no irrigation deliveries to the Town of Guadalupe. Thus, the net inflow to this storage area would be zero. During the storm events, it was assumed that 8 additional cfs would leave the Highline Lateral storage area. Note that in HEC-RAS the additional 8 cfs leaving the canal (storage area) is modeling as a -8 cfs net inflow. This value is less than the estimated additional capacity of 15 cfs. Under these conditions, the Highline Lateral does not overtop during either the 6-hour or 24-hour storm event. The 8 cfs used for the excess capacity was used to be conservative. Over all, this modeling approach is conservative because:

1. The unsteady HEC-RAS model depicts the situation where the Highline Lateral is at normal operating conditions;
2. The unsteady HEC-RAS model assumes that SRP does not turn off the pumps into the Highline Lateral;
3. The excess capacity used in the unsteady HEC-RAS model is less than the estimated excess capacity; and
4. The excess capacity is used only during the actual storm event.

Updating the unsteady HEC-RAS model in this manner resulted in minor changes to the Water Surface Elevations (WSE) in the various ponding areas. These changes were less than 0.01 feet. The work maps and annotated FIRM panels were updated to reflect these new WSEs. Additional information supporting these findings can be found in the Guadalupe Flood Delineation Study Technical Data Notebook in section 5.5.3 with supporting documentation located in Appendix E.5.

NATIONAL FLOOD INSURANCE PROGRAM

FEMA PRODUCTION AND TECHNICAL SERVICES CONTRACTOR

November 16, 2011

Mr. Brian Wahlin, Ph.D., P.E., D.WRE
Project Manager
West Consultants, Inc.
8950 South 52nd Street, Suite 210
Tempe, AZ 85284

IN REPLY REFER TO:
Case No.: 11-09-3942P
Community: Town of Guadalupe, AZ
Community No.: 040111

316-AD

Dear Mr. Wahlin:

This responds to your request dated July 2011, that the Department of Homeland Security's Federal Emergency Management Agency (FEMA) issue a revision to the Flood Insurance Rate Map (FIRM) for Maricopa County, Arizona and Incorporated Areas. Pertinent information about the request is listed below.

Identifier:	Guadalupe FDS
Flooding Source:	Highline Lateral
FIRM Panel(s) Affected:	04013C2630G and 04013C2165H

The data required to complete our review, which must be submitted within 90 days of the date of this letter, are listed on the enclosed summary.

If we do not receive the required data within 90 days, we will suspend our processing of your request. Any data submitted after 90 days will be treated as an original submittal and will be subject to all submittal/payment procedures, including the flat review and processing fee for requests of this type established by the current fee schedule. A copy of the notice summarizing the current fee schedule, which was published in the *Federal Register,* is available on the FEMA website at http://www.fema.gov/plan/prevent/fhm/frm_fees.shtm for your information.

FEMA receives a very large volume of requests and cannot maintain inactive requests for an indefinite period of time. Therefore, we are unable to grant extensions for the submission of required data/fee for revision requests. If a requester is informed by letter that additional data are required to complete our review of a request, the data/fee **must** be submitted within 90 days of the date of the letter. Any fees already paid will be forfeited for any request for which the requested data are not received within 90 days.

If you have general questions about your request, FEMA policy, or the National Flood Insurance Program, please call the FEMA Map Information eXchange (FMIX), toll free, at 1-877-FEMA MAP (1-877-336-2627). If you have specific questions concerning your request, please contact your case reviewer, Mrs. Sloane Weidmann, by e-mail at sweidmann@mbakercorp.com or by telephone at (720) 514-1116, or the Revisions Coordinator for your request, Mrs. Jaclyn Bloor, CFM, at jbloor@mbakercorp.com or at (720) 479-3160.

Sincerely,

Syed Qayum

Syed Qayum, CFM
LOMR Technical Manager
BakerAECOM

Enclosure

cc: Ms. Kathryn Gross, CFM, M.A.
Flood Control District of Maricopa County

Mr. Gino Turrubiartes
Community Development Director
Town of Guadalupe

bcc: Regional Administrator R9-MT
State Coordinator
PTS Case File: MBJ/JMB/SNW

NATIONAL FLOOD INSURANCE PROGRAM

FEMA PRODUCTION AND TECHNICAL SERVICES CONTRACTOR

Summary of Additional Data Required to Support a
Letter of Map Revision (LOMR)

Case No.: 11-09-3942P

Requester: Mr. Brian Wahlin, Ph.D., P.E., D.WRE

Community: Town of Guadalupe, AZ

Community No.: 040111

The issue listed below must be addressed before we can continue the review of your request.

Please provide evidence that the Highline Lateral canal has enough capacity to contain the flow from the base (1-percent-annual-chance) flood that overtops the canals berms or model the canal as flowing full in your analysis. The submitted HEC-RAS hydraulic model assumes that the canal is not full, and will have capacity to take or store all the base flow. Typically with canals that cross flooding sources, it is assumed that the canal is already running full.

Please send the required data and/or fee directly to us at the address shown at the bottom of this page. For identification purposes, please include the case number referenced above on all correspondence.

Flood Control District
of Maricopa County

Board of Directors
Fulton Brock, District 1
Don Stapely, District 2
Andrew Kunasek, District 3
Max Wilson, District 4
Mary Rose Wilcox, District 5

www.fcd.maricopa.gov

2801 West Durango Street
Phoenix, Arizona 85009
Phone: 602-506-1501
Fax: 602-506-4601
TT: 602-505-5897

August 31, 2011

LOMR Manager
LOMC Clearinghouse
7390 Coca Cola Drive, Suite 204
Hanover, MD 21076

Subject: Guadalupe Floodplain Delineation Study (FCD Contract FCD2010C027) by WEST Consultants, Inc.

Communities: Town of Guadalupe, Community No. 040111
Unincorporated Maricopa County, Community No. 040037
City of Tempe, Community No. 040054

Flooding Sources: Highline Canal Lateral

FIRM panels affected: 04013C2165H 04013C2630G

LOMR Manager:

Enclosed is the technical supporting data for the Guadalupe Floodplain Delineation Study. This study includes hydrology and the re-delineation of 1.7 linear miles of Zone A floodplain to Zone AH floodplain along the Highline Canal Lateral within the Town of Guadalupe, Unincorporated Maricopa County and a portion of City of Tempe. The study area is located in the central portion of Maricopa County.

The results are presented in one Technical Data Notebook. Hydrologic and hydraulic information is located in Sections 4 and 5. The FEMA forms are located in Section 2. A full-size set of floodplain delineation work maps are located at the back of the Notebook. Annotated FIRM panels are located under the tab "Exhibit Maps". Digital versions of the hydrologic and hydraulic analysis are included on the CD in the front pocket of the Notebook. Information regarding public notification is presented in Appendix B.6.

The digital floodplain limits and topographic contours are included on a CD "GIS Data for Guadalupe FDS". The CD is located in the front pocket of the Notebook as well.

If you have any questions, please contact me at (602) 506-4837, or kag@mail.maricopa.gov.

Sincerely,

Kathryn Gross, CFM, M.A.
Hydrology and Hydraulics Branch

Enclosure

Copy to:

Beth Norton
Engineering Management Section
Mitigation Division
Federal Emergency Management Agency
500 C Street SW
Washington, D.C. 20472-0001

Brian Cosson, CFM
NFIP State Coordinator
Arizona Department of Water Resources
Office of Dam Safety and Flood Mitigation
3550 N. Central Ave.
Phoenix, AZ 85012

Robert Bezek, CFM
Federal Emergency Management Agency
Region IX
1111 Broadway, Suite 1200
Oakland, CA 94607

Gino Turrubiartes, Community Development Director
Town of Guadalupe
9241 South Avenida Del Yaqui
Guadalupe, Arizona 85283-2598

Andy Goh, P.E.
City of Tempe
31 E. Fifth Street
Tempe, Arizona 85281

Brian Wahlin, P.E.
WEST Consultants, Inc
8950 S. 52nd Street, Suite 210
Tempe, AZ 85284

C.1 Survey Field Notes for Aerial Mapping Control

C.1. Survey Field Notes for Aerial Mapping Control

The Flood Control District of Maricopa County
DXF Metadata

This file contains the metadata information about the DXF file(s). The naming convention for all files, except contours, created from FCDMC projects is <filename>-<project id>.DXF. For example, the bridges are named BRIDGE-<project id>.DXF (ex: BRIDGE-6666.DXF). The project id number is used to link the DXF files to the metadata information about the project. Using the example, you would look for the project id assigned a value of 6666 in this file to find the metadata information about the data associated with this project.

The contours are named ELV-<project id>-<topo id>.DXF (ex: ELV-6666-100.DXF). Using this example, you would look for the project id assigned a value of 6666 in this file to find the metadata information about this project. Additionally, you would look for the topo id assigned a value of 100 within the project id to find the specific topographic information associated with the data. The contour text is delivered in a file named ELV-<project id>-TEXT.DXF. The project id is used in the same way as in the examples above.

Project ID.....1012
Contract Number.....FCD 91-11
Project Name.....Hohokam ADMS

Topo ID.....100
  Flight date.....01/13/1992
  Contour Interval...4'
  DTM Data.....No
  Vertical Datum.....NGVD29
  Horizontal Datum...Stateplane NAD83, Arizona Central, International Feet

---

Project ID.....1113
Contract Number.....FCD 99-63
Project Name.....Western/Highline Lateral Mapping

Topo ID.....100
  Flight date.....04/03/2000
  Contour Interval...2'
  DTM Data.....Yes
  Vertical Datum.....NGVD29
  Horizontal Datum...Stateplane NAD83, Arizona Central, International Feet

---

Project ID.....1202
Contract Number.....FCD 01-52
Project Name.....Guadalupe FRS Mapping

Topo ID.....700
  Flight date.....04/17/2002
  Contour Interval...2'
  DTM Data.....Yes
  Vertical Datum.....NAVD88
  Horizontal Datum...Stateplane NAD83, Arizona Central, International Feet

---

Project ID.....1208
Contract Number.....FCD XX-XX
Project Name.....Countywide 10 Foot Contour Mapping

Topo ID.....300
  Flight date.....12/17/2000
  Contour Interval...10'
  DTM Data.....Yes
  Vertical Datum.....NAVD88
  Horizontal Datum...Stateplane NAD83, Arizona Central, International Feet

Topo ID.....450
  Flight date.....12/27/2000
  Contour Interval...10'
  DTM Data.....Yes
  Vertical Datum.....NAVD88
  Horizontal Datum...Stateplane NAD83, Arizona Central, International Feet

---

Project ID.....1291
Contract Number.....FCD 08-20
Project Name.....Phoenix-Tempe Area Mapping

Topo ID.....300
  Flight date.....12/11/2008
  Contour Interval...2'
  DTM Data.....Yes
  Vertical Datum.....NAVD88
  Horizontal Datum...Stateplane NAD83, Arizona Central, International Feet

---

Date extracted: June 21, 2010

C.2 Survey Field Notes for Hydrologic Modeling

Not Applicable / Not Included

C.3 Survey Field Notes for Hydraulic Modeling

Guadalupe Area Flood Delineation Study Survey Report:

At the request of the, Floodplain Delineation Branch Hydrologist Kathryn Gross Flood Control District surveyors were requested to field survey additional topography observations in the Sections 4 and 9 Township 1 South, Range 4 East of the Gila and Salt River Meridian.
The work was accomplished on July 1st, 2010.
Observations were gathered with RTK GPS procedures utilizing a Trimble 5800 Rover connected to the AZGPS radio system. Reduction and checking was performed by Trimble Geomatics Office Software and results were provided by an excel format spreadsheet. Field accuracy is plus or minus .10ft at the 95% confidence level.

The control used for the work is a portion of the Maricopa County Geodetic Densification and Cadastral Survey System (GDACS) control network. Observations were conducted on the NAVD 88 vertical datum. All coordinate data is displayed in NAD 1983/92 State Plane Coordinates, Arizona Central Zone.
The survey was conducted by me and under my direct supervision and the information herein is true and correct to the best of my knowledge and belief.

John R. Stock, RLS, #25087 CFM#US-04-01065

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
25087
JOHN R.
STOCK
Date Signed 8-22-2011
ARIZONA U.S.A.

Expires 6-30-2013

Highline Canal Topo 7-1-10
Avienda Del Yaqui (Priest Drive) to Grove Parkway

Meta Data:
Vertical Datum: NAVD 88
Coordinate System: US State Plane 1983
Zone: Arizona Central 0202
Datum: NAD 1983 (NSRS 2007)
Geoid Model: Geoid03AZ

LEGEND	
CONC	Concrete
GB	Grade Brea
NG	Natural Grc
RD	Road
TB	Top of Banl

LOWEST GRADE BREAK ADJACENT TO CANAL (West Side of Canal)

Point #	Northing	Easting	Elevation	Description
100	864100.4	685853.5	1225.22	NG
101	864094	685860.7	1225.1	GB
102	864091.2	685864	1224.28	GRATE
103	864026.6	685943.1	1224.76	NG
104	863962.3	686016.3	1224.26	NG
105	863885.3	686088.6	1223.82	NG
106	863806.8	686150	1223.62	NG
107	863730.2	686213.4	1223.68	NG
108	863652.5	686277.1	1223.94	NG
109	863575.1	686341.9	1223.52	NG
110	863497.8	686404.9	1223.53	NG
111	863414.2	686469.4	1223.13	NG
112	863378.5	686495.1	1221.43	GRATE
113	863369.7	686501.1	1222.12	GB
114	863360.8	686507.6	1220.96	GRATE
115	863279.4	686570.2	1223.21	NG
116	863198.2	686630.9	1223.71	NG
117	863117.1	686691.5	1223.98	NG
118	863029.8	686749.6	1224.23	NG
119	862945.3	686803.2	1223.83	NG
120	862864.6	686855.4	1224.13	NG
121	862779	686906.6	1224.09	NG
122	862699.8	686951.3	1224.17	NG
123	862610.9	686999.4	1224.1	NG
124	862521.3	687043.6	1224.94	NG
125	862501.3	687052.4	1225	GB
126	862489.4	687054.1	1223.22	NG
127	862400.7	687097.8	1223.02	NG
128	862309.2	687143.8	1222.41	NG
129	862259.5	687167.7	1222.39	CONC CANAL
130	862168.9	687211.5	1222.19	CONC CANAL
131	862076.6	687256.2	1221.94	CONC CANAL

132	861983.7	687301.1	1221.61	CONC CANAL
133	861892.9	687338	1221.32	CONC CANAL
134	861876.7	687337.7	1221.26	GRATE
135	861874.6	687356.1	1221.88	CONC CANAL
136	861870.4	687358.8	1224.22	GB
137	861765.8	687410.4	1224.02	NG
138	861675.8	687453.9	1224.2	NG
139	861586.7	687495.8	1224.59	NG
140	861492.9	687531.7	1224.75	NG
141	861396.6	687567.3	1224.53	NG
142	861350.4	687580.1	1224.25	GRATE
143	861252.3	687609.4	1224.85	GRATE
144	861158.5	687632.7	1224.87	NG
145	861119.7	687642.1	1224.06	GRATE
146	861019.3	687663.6	1224.4	NG
147	860916	687682	1225.33	NG
148	860816.8	687693.7	1224.9	NG
149	860717.5	687706.4	1224.96	NG
150	860660	687712.2	1224.34	GRATE
151	860639.3	687714.2	1226.48	GB
152	860542.6	687725.8	1224.59	NG
153	860519.6	687727.9	1224.15	GRATE
154	860419.8	687739.5	1225.09	NG
155	860321.2	687751	1225	NG
156	860213.7	687762.2	1225.19	NG
157	860113.9	687767.6	1225.36	NG
158	860015.4	687774.1	1225.15	NG
159	859930.5	687784.1	1225.65	NG
160	859808.4	687805.6	1226.66	NG
161	859790	687796.7	1226.17	NG
162	859692.6	687814.9	1225.83	NG
163	859597.2	687828.2	1225.74	NG
164	859501.6	687846	1226	NG
165	859402.2	687864.1	1226.11	NG
166	859305.4	687879.5	1226.18	NG
167	859203.4	687878.1	1225.18	NG
168	859140.7	687878.8	1225.67	GB
169	859137.1	687878.8	1225.11	GRATE
170	859035	687870.6	1225.24	NG
171	858935.3	687866.8	1225.55	NG
172	858832.6	687864	1225.94	NG
173	858727.7	687861.2	1225.63	NG
174	858676.3	687861.2	1224.87	GRATE
175	858664.4	687860.9	1226.15	GB
176	858562.2	687858.3	1225.83	NG
177	858453.8	687856.8	1225.12	NG
178	858379.6	687854.8	1224.38	GRATE

179	858361.4	687854.3	1225.67	GB
180	858259.1	687853.8	1225.49	NG
181	858155.9	687855	1225.07	NG
182	858090.5	687854.7	1223.69	GRATE
183	858072.5	687854.5	1225.72	GB
184	857972.3	687854	1225.23	NG
185	857873.6	687854.1	1224.87	NG
186	857794.4	687855.3	1224.09	GRATE
187	857782.7	687852	1226.22	GB
188	857680.8	687841.4	1226.08	NG
189	857583	687822.8	1225.84	NG
190	857486.9	687793.9	1226.01	NG
191	857394.8	687753.6	1226.85	NG
192	857301.7	687716.4	1227.27	NG
193	857233.3	687687.1	1228.48	NG
194	857152	687678.1	1228.57	NG
195	857051	687668.4	1228.03	NG
196	856948.7	687661.8	1227.63	NG
197	856844.9	687662.4	1227.52	NG
198	856743.8	687653.6	1227.16	NG
199	856642.1	687642.6	1226.68	NG
200	856543.8	687630.3	1227.11	NG
201	856485.4	687626.6	1228.87	NG

CANAL TOP OF BANK

Point #	Northing	Easting	Elevation	Description
2400	864091.3	685891.1	1223.68	TB @ RD
2401	864050.1	685942.7	1224.53	TB
2402	863995.8	686004.4	1224.69	TB
2403	863927.6	686070.5	1224.52	TB
2404	863856	686133.1	1224.34	TB
2405	863728.5	686237.2	1224.97	TB
2406	863571.7	686366.4	1224.62	TB
2407	863407.7	686499.3	1224.67	TB
2408	863256.9	686612	1224.95	TB
2409	863091.1	686729.5	1225.39	TB
2410	862923.4	686839.5	1225.28	TB
2411	862785.5	686921.9	1225.19	TB
2412	862614.6	687014.6	1224.66	TB
2413	862512.1	687066.6	1225.25	TB @ GATE STRUCTURE
2414	862343.8	687150.7	1224.81	TB
2415	862172.8	687232.7	1225.2	TB
2416	861993.2	687320.3	1225.41	TB
2417	861810.8	687408.1	1225.42	TB
2418	861637.2	687492.2	1225.51	TB

2419	861449.8	687567.2	1225.23	TB
2420	861268.5	687624.5	1225.68	TB
2421	861077	687670.7	1225.52	TB
2422	860906.4	687698.6	1225.69	TB
2423	860750.5	687717.8	1225.84	TB
2424	860559.5	687741.7	1226.04	TB
2425	860380.2	687763.3	1225.61	TB
2426	860190.8	687784.3	1226.13	TB
2427	860033.1	687792.8	1226.04	TB
2428	859958.8	687797.7	1225.43	TB @ RD
2429	859790.2	687812.6	1225.47	TB @ RD
2430	859632.8	687840.4	1225.7	TB
2431	859435.8	687871.4	1226.34	TB
2432	859289	687894.3	1226.37	TB
2433	859170.6	687896.7	1226.33	TB
2434	858965.4	687889	1226.6	TB
2435	858765.1	687882.2	1227.12	TB
2436	858564.1	687877.3	1226.75	TB
2437	858352.6	687874.7	1226.41	TB
2438	858150.2	687873.6	1226.7	TB
2439	857943.9	687872.3	1226.25	TB
2440	857783.5	687871.1	1226.79	TB
2441	857655.9	687858.2	1226.56	TB
2442	857540	687830.1	1226.8	TB
2443	857451.2	687798.7	1226.62	TB
2444	857374.8	687767.9	1227.37	TB - CANAL TUNNELS UNDERGROUND
2445	857370.4	687775.7	1227.26	TB - CANAL TUNNELS UNDERGROUND
2446	857368.8	687783.8	1227.25	TB - CANAL TUNNELS UNDERGROUND
2447	857343.4	687776.5	1227.83	TB - CANAL TUNNELS UNDERGROUND
2448	857350.1	687768.6	1227.81	TB - CANAL TUNNELS UNDERGROUND
2449	857352.1	687757.7	1227.73	TB - CANAL TUNNELS UNDERGROUND
2450	857317.9	687745.3	1228.51	TB
2451	857262.1	687723.8	1228.6	TB
2452	857237	687720.1	1228.96	TB @ FENCE
2453	857173.9	687709.2	1228.89	TB @ FENCE
2454	857147.3	687700.5	1228.63	TB
2455	857053.7	687689.2	1228.35	TB
2456	856900.7	687683.9	1228.2	TB
2457	856720.1	687666.8	1228.23	TB
2458	856581.3	687653.1	1227.98	TB
2459	856508.1	687645.8	1227.48	TB @ RD
2460	856506.5	687665.8	1228.18	TB @ RD
2461	856583.6	687673	1226.72	TB
2462	856719.5	687688	1226.94	TB
2463	856907.5	687705.4	1227.38	TB
2464	857054.2	687712.1	1228.16	TB
2465	857149.3	687720.6	1228.84	TB

2466	857170.6	687728	1228.94	TB @ FENCE
2467	857244.1	687737.9	1228.83	TB @ FENCE
2468	857258.5	687741.3	1229.12	TB
2469	857314.4	687764	1228.41	TB
2470	857448.3	687813.1	1226.36	TB
2471	857535.9	687845.3	1226.55	TB
2472	857661.6	687874.2	1226.52	TB
2473	857783.6	687886.7	1226.84	TB
2474	857940.5	687889	1227.27	TB
2475	858150.1	687889.1	1227.17	TB
2476	858352.1	687890.2	1226.99	TB
2477	858564	687893.2	1226.75	TB
2478	858763.7	687899.3	1226.57	TB
2479	858970.3	687905.1	1225.93	TB
2480	859166.3	687911.6	1226	TB
2481	859283.4	687910.4	1225.81	TB
2482	859439.9	687886.8	1225.97	TB
2483	859634.7	687854.9	1225.84	TB
2484	859791.8	687830	1225.48	TB @ RD
2485	859959.5	687815.1	1225.48	TB @ RD
2486	860033.9	687809.8	1225.48	TB
2487	860189.6	687800.3	1225.25	TB
2488	860383.5	687778.4	1225.18	TB
2489	860566.5	687756.3	1225.13	TB
2490	860756.7	687733.4	1225.36	TB
2491	860913	687714.3	1225.49	TB
2492	861082.7	687685.1	1225.15	TB
2493	861276.2	687639.1	1224.95	TB
2494	861451.9	687583.2	1225.23	TB
2495	861640.6	687508	1225.04	TB
2496	861817.6	687422.6	1224.89	TB
2497	861997.6	687336.3	1225.07	TB
2498	862177.1	687248.7	1224.88	TB
2499	862345.6	687167.4	1224.78	TB
2500	862517.7	687084.2	1224.86	TB @ GATE STRUCTURE
2501	862621.9	687029.8	1224.28	TB
2502	862789	686940.7	1224.26	TB
2503	862925.1	686860.6	1224.58	TB
2504	863101.2	686745	1224.16	TB
2505	863260.4	686630.7	1223.92	TB
2506	863415.4	686515.9	1224.23	TB
2507	863581.2	686382.8	1224.28	TB
2508	863732.8	686258	1224.28	TB
2509	863863.7	686149.4	1224.17	TB
2510	863938.3	686084.7	1224.06	TB
2511	864011.4	686014.4	1223.8	TB
2512	864060.9	685958.1	1223.85	TB

2513 864106 685902.1 1224.07 TB @ RD

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
25087
JOHN R.
STOCK
Date Signed 8/22/2011
ARIZONA U.S.A.

6-30-2013

D.1 Precipitation Data

D.1. Precipitation Data

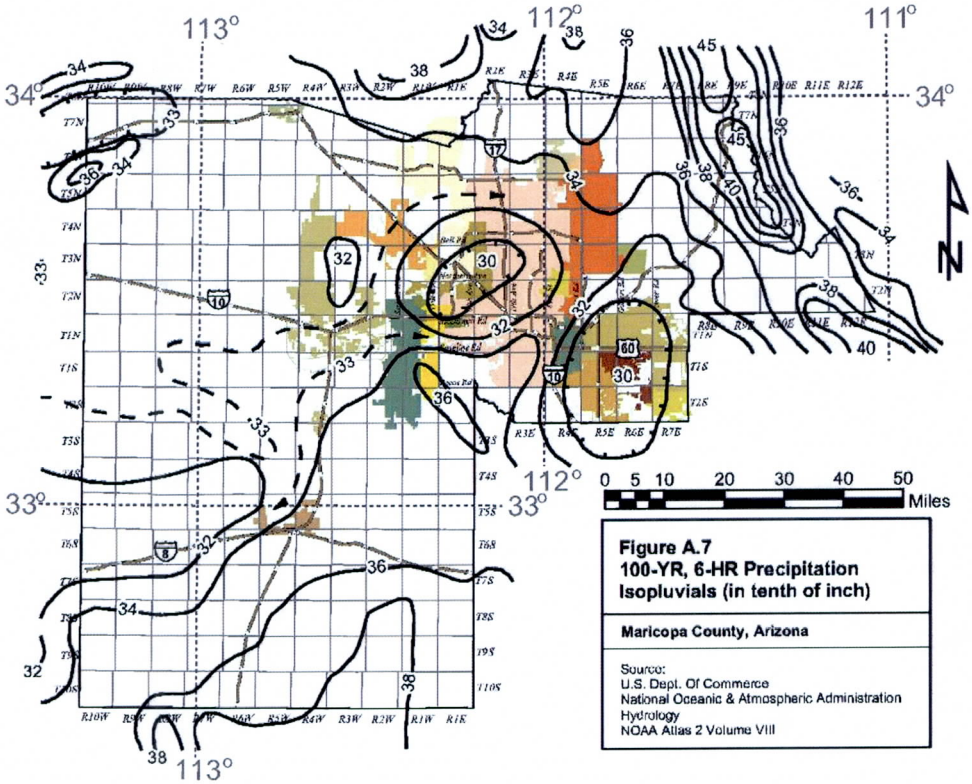


Figure D1-1. 100-year, 6-hour isopluvial map

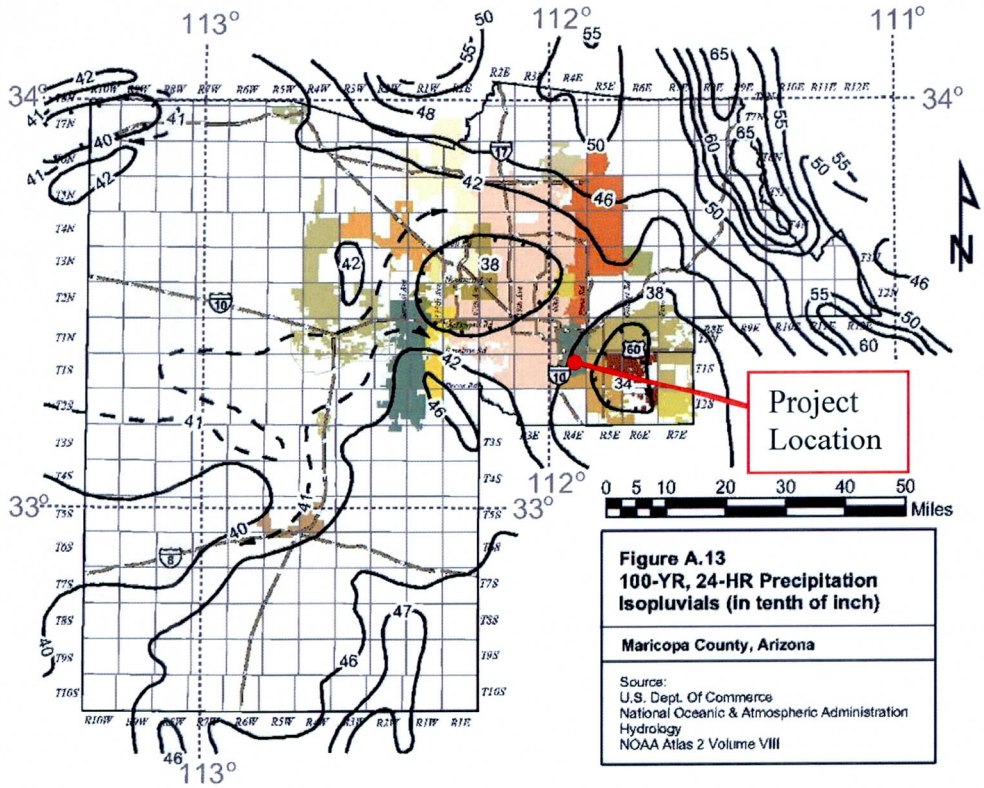


Figure D1-2. 100-year, 24-hour isopluvial map

Flood Control District of Maricopa County
Drainage Design Management System
RAINFALL DATA
Project Reference: GUADALUPE_6HR

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ID	Method	Duration	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
DEFAULT	NOAA14	5 MIN	0.238	0.323	0.389	0.477	0.546	0.615
	NOAA14	10 MIN	0.362	0.492	0.591	0.726	0.831	0.937
	NOAA14	15 MIN	0.448	0.609	0.733	0.899	1.030	1.161
	NOAA14	30 MIN	0.603	0.821	0.987	1.211	1.387	1.564
	NOAA14	1 HOUR	0.747	1.016	1.221	1.499	1.717	1.935
	NOAA14	2 HOUR	0.868	1.163	1.387	1.693	1.926	2.169
	NOAA14	3 HOUR	0.933	1.225	1.458	1.783	2.041	2.311
	NOAA14	6 HOUR	1.091	1.400	1.646	1.980	2.244	2.520
	NOAA14	12 HOUR	1.215	1.539	1.793	2.139	2.402	2.673
	NOAA14	24 HOUR	1.455	1.882	2.223	2.692	3.061	3.448

D.2 Physical Parameter Calculations

Area ID	Book Number	Map Unit	Soil ID	Area (sq mi)	Area (%)	XKSAT	Rock Percent (%)	Effective Rock (%)
Major Basin ID: 01								
1A	655	Va	6556221	0.009	20.50	0.40	-	100
	655	AnA	655204720	0.002	3.40	0.40	-	100
	655	AnB	655204722	0.032	72.90	0.40	-	100
	655	AoB	655204922	0.001	3.20	0.40	-	100
1B	655	Va	6556221	0.037	90.60	0.40	-	100
	655	AnA	655204720	0.001	1.70	0.40	-	100
	655	AnB	655204722	0.003	7.60	0.40	-	100
1C	655	Va	6556221	0.004	50.70	0.40	-	100
	655	AnA	655204720	0.004	49.30	0.40	-	100

Area ID	Book Number	Map Unit	Soil ID	Area (sq mi)	Area (%)	XKSAT	Rock Percent (%)	Effective Rock (%)
Major Basin ID: 02								
2A	655	Va	6556221	0.011	54.70	0.40	-	100
	655	AnB	655204722	0.009	45.30	0.40	-	100
2B	655	Va	6556221	0.020	60.60	0.40	-	100
	655	AnB	655204722	0.013	39.40	0.40	-	100
2C	655	Va	6556221	0.008	100.00	0.40	-	100
2D	655	Va	6556221	0.043	95.60	0.40	-	100
	655	AnA	655204720	0.002	4.40	0.40	-	100
2E	655	Va	6556221	0.003	76.90	0.40	-	100
	655	AnA	655204720	0.001	23.10	0.40	-	100

Area ID	Book Number	Map Unit	Soil ID	Area (sq mi)	Area (%)	XKSAT	Rock Percent (%)	Effective Rock (%)
Major Basin ID: 03								
3A	655	Va	6556221	0.033	100.00	0.40	-	100
3B	655	Va	6556221	0.020	63.30	0.40	-	100
	655	AnB	655204722	0.012	36.70	0.40	-	100
3C	655	Va	6556221	0.031	100.00	0.40	-	100
3D	655	Va	6556221	0.026	100.00	0.40	-	100
3E	655	Va	6556221	0.010	100.00	0.40	-	100
4A	655	Va	6556221	0.004	24.30	0.40	-	100
	655	AnB	655204722	0.003	18.10	0.40	-	100
	655	AoB	655204922	0.010	57.60	0.40	-	100
4B	655	Va	6556221	0.032	100.00	0.40	-	100
4C	655	Va	6556221	0.051	100.00	0.40	-	100
4D	655	Va	6556221	0.009	100.00	0.40	-	100
5A	655	Va	6556221	0.001	9.50	0.40	-	100
	655	AoB	655204922	0.006	90.50	0.40	-	100
5B	655	Va	6556221	0.044	99.50	0.40	-	100
	655	AoB	655204922	0.000	0.50	0.40	-	100
5C	655	Va	6556221	0.019	100.00	0.40	-	100
5D	655	Va	6556221	0.014	100.00	0.40	-	100

Area ID	Book Number	Map Unit	Soil ID	Area (sq mi)	Area (%)	XKSAT	Rock Percent (%)	Effective Rock (%)
Major Basin ID: 04								
6A	655	Va	6556221	0.004	34.20	0.40	-	100
	655	AoB	655204922	0.007	65.80	0.40	-	100
6B	655	Va	6556221	0.020	100.00	0.40	-	100
6C	655	Va	6556221	0.006	100.00	0.40	-	100
6D	655	Va	6556221	0.011	100.00	0.40	-	100
6E	655	Va	6556221	0.024	100.00	0.40	-	100
6F	655	Va	6556221	0.008	100.00	0.40	-	100
7A	655	Va	6556221	0.007	100.00	0.40	-	100
7B	655	Va	6556221	0.014	100.00	0.40	-	100
7C	655	Va	6556221	0.020	100.00	0.40	-	100
7D	655	Va	6556221	0.008	100.00	0.40	-	100
7E	655	Va	6556221	0.024	100.00	0.40	-	100
7F	655	Va	6556221	0.006	100.00	0.40	-	100
8A	655	Va	6556221	0.016	100.00	0.40	-	100
8B	655	Va	6556221	0.014	100.00	0.40	-	100

Sub Basin	Land Use Code	Area (sq mi)	Area (%)	Initial Loss (IA)	Percent Impervious (RTIMP)	Vegetation Cover (%)	DTHETA	Kb
Major Basin ID: 01								
1A	150	0.031	68.8	0.25	30	50.0	NORMAL	0.031
	190	0.006	13.5	0.25	75	10.0	NORMAL	0.031
	220	0.004	8.5	0.10	80	65.0	NORMAL	0.031
	700	0.000	0.2	0.10	0	75.0	NORMAL	0.060
	900	0.004	9.0	0.35	0	25.0	DRY	0.060
		0.045	**100.0**					
1B	150	0.035	86.7	0.25	30	50.0	NORMAL	0.031
	320	0.000	0.5	0.15	55	60.0	NORMAL	0.031
	700	0.000	0.5	0.10	0	75.0	NORMAL	0.060
	900	0.005	12.3	0.35	0	25.0	DRY	0.060
		0.041	**100.0**					
1C	190	0.000	2.7	0.25	75	10.0	NORMAL	0.036
	700	0.007	97.3	0.10	0	75.0	NORMAL	0.071
		0.007	**100.0**					

Sub Basin	Land Use Code	Area (sq mi)	Area (%)	Initial Loss (IA)	Percent Impervious (RTIMP)	Vegetation Cover (%)	DTHETA	Kb
Major Basin ID: 02								
2A	150	0.006	30.3	0.25	30	50.0	NORMAL	0.033
	530	0.006	28.9	0.10	45	30.0	NORMAL	0.033
	900	0.008	40.8	0.35	0	25.0	DRY	0.065
		0.020	**100.0**					
2B	150	0.034	100.0	0.25	30	50.0	NORMAL	0.032
		0.034	**100.0**					
2C	140	0.008	100.0	0.25	30	50.0	NORMAL	0.036
		0.008	**100.0**					
2D	140	0.010	22.7	0.25	30	50.0	NORMAL	0.031
	150	0.005	11.7	0.25	30	50.0	NORMAL	0.031
	220	0.002	3.5	0.10	80	65.0	NORMAL	0.031
	320	0.003	5.5	0.15	55	60.0	NORMAL	0.031
	520	0.018	39.7	0.29	45	80.0	NORMAL	0.031
	570	0.008	16.8	0.10	10	10.0	NORMAL	0.031
		0.045	**99.9**					
2E	570	0.000	5.0	0.10	10	10.0	NORMAL	0.037
	700	0.004	95.0	0.10	0	75.0	NORMAL	0.074
		0.004	**100.0**					

Sub Basin	Land Use Code	Area (sq mi)	Area (%)	Initial Loss (IA)	Percent Impervious (RTIMP)	Vegetation Cover (%)	DTHETA	Kb
Major Basin ID: 03								
3A	150	0.033	99.4	0.25	30	50.0	NORMAL	0.032
	520	0.000	0.3	0.29	45	80.0	NORMAL	0.032
	530	0.000	0.3	0.10	45	30.0	NORMAL	0.032
		0.034	**100.0**					
3B	150	0.025	80.0	0.25	30	50.0	NORMAL	0.032
	900	0.006	20.0	0.35	0	25.0	DRY	0.062
		0.032	**100.0**					
3C	150	0.021	68.5	0.25	30	50.0	NORMAL	0.032
	530	0.000	0.7	0.10	45	30.0	NORMAL	0.032
	700	0.009	30.8	0.10	0	75.0	NORMAL	0.062
		0.031	**100.0**					
3D	150	0.025	94.7	0.25	30	50.0	NORMAL	0.032
	700	0.000	0.8	0.10	0	75.0	NORMAL	0.063
	900	0.001	4.6	0.35	0	25.0	DRY	0.063
		0.026	**100.1**					
3E	150	0.010	100.0	0.25	30	50.0	NORMAL	0.035
		0.010	**100.0**					
4A	150	0.001	2.8	0.25	30	50.0	NORMAL	0.033
	580	0.017	95.5	0.10	80	75.0	NORMAL	0.033
	900	0.000	1.7	0.35	0	25.0	DRY	0.065
		0.018	**100.0**					
4B	150	0.031	95.9	0.25	30	50.0	NORMAL	0.032
	900	0.001	4.1	0.35	0	25.0	DRY	0.062
		0.032	**100.0**					
4C	150	0.041	80.4	0.25	30	50.0	NORMAL	0.031
	220	0.001	1.4	0.10	80	65.0	NORMAL	0.031
	230	0.001	2.5	0.10	80	75.0	NORMAL	0.031
	580	0.000	0.6	0.10	80	75.0	NORMAL	0.031
	700	0.000	0.6	0.10	0	75.0	NORMAL	0.059
	900	0.007	14.5	0.35	0	25.0	DRY	0.059
		0.051	**100.0**					
4D	580	0.001	13.6	0.10	80	75.0	NORMAL	0.035
	700	0.008	86.4	0.10	0	75.0	NORMAL	0.070
		0.009	**100.0**					
5A	150	0.000	4.8	0.25	30	50.0	NORMAL	0.036
	900	0.006	95.2	0.35	0	25.0	DRY	0.072
		0.006	**100.0**					
5B	150	0.044	100.0	0.25	30	50.0	NORMAL	0.031
		0.044	**100.0**					
5C	150	0.000	1.0	0.25	30	50.0	NORMAL	0.033
	220	0.001	6.3	0.10	80	65.0	NORMAL	0.033
	230	0.014	74.3	0.10	80	75.0	NORMAL	0.033
	900	0.004	18.3	0.35	0	25.0	DRY	0.065
		0.019	**99.9**					
5D	150	0.014	95.8	0.25	30	50.0	NORMAL	0.034
	220	0.000	2.1	0.10	80	65.0	NORMAL	0.034
	900	0.000	2.1	0.35	0	25.0	DRY	0.067
		0.014	**100.0**					

Sub Basin	Land Use Code	Area (sq mi)	Area (%)	Initial Loss (IA)	Percent Impervious (RTIMP)	Vegetation Cover (%)	DTHETA	Kb
Major Basin ID: 04								
6A	150	0.000	2.7	0.25	30	50.0	NORMAL	0.035
	900	0.011	97.3	0.35	0	25.0	DRY	0.068
		0.011	**100.0**					
6B	150	0.020	99.0	0.25	30	50.0	NORMAL	0.033
	230	0.000	1.0	0.10	80	75.0	NORMAL	0.033
		0.020	**100.0**					
6C	150	0.000	3.2	0.25	30	50.0	NORMAL	0.036
	230	0.004	66.1	0.10	80	75.0	NORMAL	0.036
	900	0.002	30.6	0.35	0	25.0	DRY	0.072
		0.006	**99.9**					
6D	150	0.002	13.9	0.25	30	50.0	NORMAL	0.035
	230	0.000	1.9	0.10	80	75.0	NORMAL	0.035
	900	0.009	84.3	0.35	0	25.0	DRY	0.068
		0.011	**100.1**					
6E	150	0.017	71.9	0.25	30	50.0	NORMAL	0.033
	700	0.001	5.8	0.10	0	75.0	NORMAL	0.064
	900	0.005	22.3	0.35	0	25.0	DRY	0.064
		0.024	**100.0**					
6F	120	0.000	3.9	0.30	5	30.0	NORMAL	0.036
	150	0.007	94.8	0.25	30	50.0	NORMAL	0.036
	700	0.000	1.3	0.10	0	75.0	NORMAL	0.070
		0.008	**100.0**					
7A	150	0.000	2.7	0.25	30	50.0	NORMAL	0.036
	580	0.007	97.3	0.10	80	75.0	NORMAL	0.036
		0.007	**100.0**					
7B	120	0.009	65.9	0.30	5	30.0	NORMAL	0.034
	150	0.004	30.4	0.25	30	50.0	NORMAL	0.034
	580	0.001	3.6	0.10	80	75.0	NORMAL	0.034
		0.014	**99.9**					
7C	150	0.020	99.0	0.25	30	50.0	NORMAL	0.033
	230	0.000	1.0	0.10	80	75.0	NORMAL	0.033
		0.020	**100.0**					
7D	120	0.000	1.3	0.30	5	30.0	NORMAL	0.036
	150	0.007	91.3	0.25	30	50.0	NORMAL	0.036
	900	0.001	7.5	0.35	0	25.0	DRY	0.070
		0.008	**100.1**					
7E	120	0.022	90.8	0.30	5	30.0	NORMAL	0.033
	900	0.002	9.2	0.35	0	25.0	DRY	0.064
		0.024	**100.0**					
7F	700	0.006	100.0	0.10	0	75.0	NORMAL	0.072
		0.006	**100.0**					
8A	300	0.012	74.4	0.15	95	2.0	NORMAL	0.034
	570	0.004	25.6	0.10	10	10.0	NORMAL	0.034
		0.016	**100.0**					
8B	300	0.014	100.0	0.15	95	2.0	NORMAL	0.034
		0.014	**100.0**					

Flood Control District of Maricopa County
Drainage Design Management System
SUB BASINS
Project Reference: GUADALUPE_6HR

Area ID	Sub Basin Parameters						Rainfall Losses						Return Period Parameters					
	Area (sq mi)	Length (mi)	Slope (ft/mi)	Adj Slope	Time-Area	Kb	IA (in)	DTHETA	PSIF (in)	XKSAT (in/hr)	RTIMP (%)		2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
Major Basin ID: 01																		
1A	0.044	0.42	68.0	68.0	URBAN	0.034	0.25	0.26	3.95	0.55	38	**Tc (Hrs)**	0.373	0.373	0.373	0.336	0.316	0.297
												Vel (f/s)	1.65	1.65	1.65	1.83	1.95	2.07
												R (Hrs)	0.367	0.367	0.367	0.327	0.305	0.285
1B	0.041	0.45	52.8	52.8	URBAN	0.035	0.26	0.26	3.95	0.56	26	**Tc (Hrs)**	0.452	0.452	0.452	0.402	0.375	0.351
												Vel (f/s)	1.46	1.46	1.46	1.64	1.76	1.88
												R (Hrs)	0.500	0.500	0.500	0.439	0.407	0.378
1C	0.007	0.12	118.3	118.3	URBAN	0.070	0.10	0.25	3.95	0.68	2	**Tc (Hrs)**	0.309	0.309	0.309	0.265	0.243	0.224
												Vel (f/s)	0.57	0.57	0.57	0.66	0.72	0.79
												R (Hrs)	0.312	0.312	0.312	0.263	0.239	0.218

* Non default value or value out of range

Area ID	Sub Basin Parameters: Area (sq mi)	Length (mi)	Slope (ft/mi)	Adj Slope	Time-Area	Kb	Rainfall Losses: IA (in)	DTHETA	PSIF (in)	XKSAT (in/hr)	RTIMP (%)		Return Period Parameters: 2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
Major Basin ID: 02																		
2A	0.020	0.34	74.6	74.6	URBAN	0.046	0.25	0.29	3.95	0.51	22	**Tc (Hrs)**	0.414	0.414	0.414	0.367	0.342	0.319
												Vel (f/s)	1.20	1.20	1.20	1.36	1.46	1.56
												R (Hrs)	0.546	0.546	0.546	0.477	0.441	0.409
2B	0.034	0.38	71.1	71.1	URBAN	0.032	0.25	0.25	3.95	0.58	30	**Tc (Hrs)**	0.354	0.354	0.354	0.317	0.296	0.277
												Vel (f/s)	1.57	1.57	1.57	1.76	1.88	2.01
												R (Hrs)	0.370	0.370	0.370	0.327	0.303	0.283
2C	0.008	0.22	33.5	33.5	URBAN	0.036	0.25	0.25	3.95	0.58	30	**Tc (Hrs)**	0.361	0.361	0.361	0.323	0.302	0.283
												Vel (f/s)	0.89	0.89	0.89	1.00	1.07	1.14
												R (Hrs)	0.558	0.558	0.558	0.493	0.458	0.426
2D	0.045	0.38	55.7	55.7	URBAN	0.031	0.23	0.25	3.95	0.60	36	**Tc (Hrs)**	0.365	0.365	0.365	0.328	0.308	0.289
												Vel (f/s)	1.53	1.53	1.53	1.70	1.81	1.93
												R (Hrs)	0.326	0.326	0.326	0.290	0.270	0.252
2E	0.004	0.06	195.0	195.0	URBAN	0.073	0.10	0.25	3.95	0.68	1	**Tc (Hrs)**	0.193	0.193	0.193	0.165	0.151	0.139
												Vel (f/s)	0.46	0.46	0.46	0.53	0.58	0.63
												R (Hrs)	0.146	0.146	0.146	0.123	0.111	0.102

Flood Control District of Maricopa County
Drainage Design Management System
SUB BASINS
Project Reference: GUADALUPE_6HR

Area ID	Sub Basin Parameters: Area (sq mi)	Length (mi)	Slope (ft/mi)	Adj Slope	Time-Area	Kb	Rainfall Losses: IA (in)	DTHETA	PSIF (in)	XKSAT (in/hr)	RTIMP (%)		Return Period Parameters: 2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
Major Basin ID: 03																		
3A	0.033	0.31	65.5	65.5	URBAN	0.032	0.25	0.25	3.95	0.58	30	**Tc (Hrs)**	0.328	0.328	0.328	0.294	0.275	0.257
												Vel (f/s)	1.39	1.39	1.39	1.55	1.65	1.77
												R (Hrs)	0.294	0.294	0.294	0.260	0.241	0.225
3B	0.032	0.37	77.9	77.9	URBAN	0.038	0.27	0.27	3.95	0.56	24	**Tc (Hrs)**	0.387	0.387	0.387	0.343	0.319	0.298
												Vel (f/s)	1.40	1.40	1.40	1.58	1.70	1.82
												R (Hrs)	0.414	0.414	0.414	0.362	0.334	0.310
3C	0.031	0.41	60.7	60.7	URBAN	0.041	0.20	0.25	3.95	0.61	21	**Tc (Hrs)**	0.463	0.463	0.463	0.410	0.381	0.356
												Vel (f/s)	1.30	1.30	1.30	1.47	1.58	1.69
												R (Hrs)	0.558	0.558	0.558	0.488	0.450	0.417
3D	0.026	0.36	61.3	61.3	URBAN	0.034	0.25	0.25	3.95	0.57	28	**Tc (Hrs)**	0.376	0.376	0.376	0.336	0.314	0.294
												Vel (f/s)	1.40	1.40	1.40	1.57	1.68	1.80
												R (Hrs)	0.442	0.442	0.442	0.389	0.361	0.336
3E	0.010	0.06	61.3	61.3	URBAN	0.035	0.25	0.25	3.95	0.58	30	**Tc (Hrs)**	0.155*	0.155*	0.155*	0.138*	0.129*	0.121*
												Vel (f/s)	0.57	0.57	0.57	0.64	0.68	0.73
												R (Hrs)	0.068	0.068	0.068	0.060	0.055	0.052
4A	0.018	0.24	36.2	36.2	URBAN	0.034	0.11	0.25	3.95	0.68	77	**Tc (Hrs)**	0.296	0.296	0.296	0.274	0.260	0.248
												Vel (f/s)	1.19	1.19	1.19	1.28	1.35	1.42
												R (Hrs)	0.302	0.302	0.302	0.277	0.262	0.248
4B	0.032	0.30	52.0	52.0	URBAN	0.033	0.25	0.25	3.95	0.57	29	**Tc (Hrs)**	0.354	0.354	0.354	0.316	0.295	0.277
												Vel (f/s)	1.24	1.24	1.24	1.39	1.49	1.59
												R (Hrs)	0.317	0.317	0.317	0.280	0.260	0.242
4C	0.051	0.31	70.4	70.4	URBAN	0.035	0.26	0.26	3.95	0.57	28	**Tc (Hrs)**	0.341	0.341	0.341	0.304	0.284	0.266
												Vel (f/s)	1.33	1.33	1.33	1.50	1.60	1.71
												R (Hrs)	0.240	0.240	0.240	0.211	0.195	0.182
4D	0.009	0.07	198.6	198.6	URBAN	0.065	0.10	0.25	3.95	0.69	11	**Tc (Hrs)**	0.181	0.181	0.181	0.158*	0.146*	0.136*
												Vel (f/s)	0.57	0.57	0.57	0.65	0.70	0.75
												R (Hrs)	0.097	0.097	0.097	0.083	0.076	0.070

* Non default value or value out of range

Area ID	Sub Basin Parameters: Area (sq mi)	Length (mi)	Slope (ft/mi)	Adj Slope	Time-Area	Kb	Rainfall Losses: IA (in)	DTHETA	PSIF (in)	XKSAT (in/hr)	RTIMP (%)		Return Period Parameters: 2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
Major Basin ID: 03																		
5A	0.006	0.12	55.9	55.9	URBAN	0.070	0.35	0.35	3.95	0.47	1	**Tc (Hrs)**	0.417	0.417	0.417	0.342	0.310	0.285
												Vel (f/s)	0.42	0.42	0.42	0.51	0.57	0.62
												R (Hrs)	0.474	0.474	0.474	0.381	0.341	0.311
5B	0.044	0.34	66.8	66.8	URBAN	0.031	0.25	0.25	3.95	0.58	30	**Tc (Hrs)**	0.336	0.336	0.336	0.301	0.281	0.264
												Vel (f/s)	1.48	1.48	1.48	1.66	1.77	1.89
												R (Hrs)	0.276	0.276	0.276	0.244	0.226	0.211
5C	0.019	0.24	46.9	46.9	URBAN	0.039	0.15	0.27	3.95	0.64	65	**Tc (Hrs)**	0.306	0.306	0.306	0.281	0.267	0.253
												Vel (f/s)	1.15	1.15	1.15	1.25	1.32	1.39
												R (Hrs)	0.304	0.304	0.304	0.277	0.261	0.246
5D	0.014	0.23	59.1	59.1	URBAN	0.035	0.25	0.25	3.95	0.58	30	**Tc (Hrs)**	0.306	0.306	0.306	0.274	0.256	0.240
												Vel (f/s)	1.10	1.10	1.10	1.23	1.32	1.41
												R (Hrs)	0.350	0.350	0.350	0.309	0.286	0.267

Area ID	Sub Basin Parameters: Area (sq mi)	Length (mi)	Slope (ft/mi)	Adj Slope	Time-Area	Kb	Rainfall Losses: IA (in)	DTHETA	PSIF (in)	XKSAT (in/hr)	RTIMP (%)		Return Period Parameters: 2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
Major Basin ID: 04																		
6A	0.011	0.17	57.9	57.9	URBAN	0.067	0.35	0.35	3.95	0.47	1	**Tc (Hrs)**	0.478	0.478	0.478	0.393	0.356	0.328
												Vel (f/s)	0.52	0.52	0.52	0.63	0.70	0.76
												R (Hrs)	0.517	0.517	0.517	0.416	0.373	0.340
7F	0.006	0.05	114.6	114.6	URBAN	0.072	0.10	0.25	3.95	0.69		**Tc (Hrs)**	0.210	0.210	0.210	0.178	0.163*	0.150*
												Vel (f/s)	0.35	0.35	0.35	0.41	0.45	0.49
												R (Hrs)	0.110	0.110	0.110	0.092	0.083	0.076
6B	0.020	0.38	62.1	62.1	URBAN	0.033	0.25	0.25	3.95	0.58	31	**Tc (Hrs)**	0.373	0.373	0.373	0.334	0.313	0.293
												Vel (f/s)	1.49	1.49	1.49	1.67	1.78	1.90
												R (Hrs)	0.531	0.531	0.531	0.470	0.436	0.407
6C	0.006	0.13	55.7	55.7	URBAN	0.047	0.18	0.28	3.95	0.62	54	**Tc (Hrs)**	0.246	0.246	0.246	0.224	0.212	0.200
												Vel (f/s)	0.78	0.78	0.78	0.85	0.90	0.95
												R (Hrs)	0.281	0.281	0.281	0.254	0.238	0.224
6D	0.011	0.20	33.3	33.3	URBAN	0.063	0.33	0.33	3.95	0.49	6	**Tc (Hrs)**	0.561	0.561	0.561	0.473	0.432	0.399
												Vel (f/s)	0.52	0.52	0.52	0.62	0.68	0.74
												R (Hrs)	0.702	0.702	0.702	0.581	0.525	0.481
6E	0.024	0.29	41.0	41.0	URBAN	0.041	0.26	0.27	3.95	0.56	22	**Tc (Hrs)**	0.439	0.439	0.439	0.388	0.360	0.337
												Vel (f/s)	0.97	0.97	0.97	1.10	1.18	1.26
												R (Hrs)	0.461	0.461	0.461	0.402	0.371	0.344
6F	0.008	0.08	51.2	51.2	URBAN	0.036	0.25	0.25	3.95	0.58	29	**Tc (Hrs)**	0.192	0.192	0.192	0.172	0.161*	0.150*
												Vel (f/s)	0.61	0.61	0.61	0.68	0.73	0.78
												R (Hrs)	0.123	0.123	0.123	0.109	0.101	0.094
7A	0.007	0.10	41.0	41.0	URBAN	0.036	0.10	0.25	3.95	0.68	79	**Tc (Hrs)**	0.188	0.188	0.188	0.174	0.166*	0.158*
												Vel (f/s)	0.78	0.78	0.78	0.84	0.88	0.93
												R (Hrs)	0.155	0.155	0.155	0.143	0.135	0.128
7B	0.014	0.18	35.9	35.9	URBAN	0.034	0.28	0.25	3.95	0.52	15	**Tc (Hrs)**	0.335	0.335	0.335	0.294	0.273	0.254
												Vel (f/s)	0.79	0.79	0.79	0.90	0.97	1.04
												R (Hrs)	0.317	0.317	0.317	0.275	0.253	0.234

* Non default value or value out of range

Area ID	Sub Basin Parameters: Area (sq mi)	Length (mi)	Slope (ft/mi)	Adj Slope	Time-Area	Kb	Rainfall Losses: IA (in)	DTHETA	PSIF (in)	XKSAT (in/hr)	RTIMP (%)		Return Period Parameters: 2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
Major Basin ID: 04																		
7C	0.020	0.36	39.4	39.4	URBAN	0.033	0.25	0.25	3.95	0.58	31	**Tc (Hrs)**	0.418	0.418	0.418	0.375	0.350	0.329
												Vel (f/s)	1.26	1.26	1.26	1.41	1.51	1.60
												R (Hrs)	0.578	0.578	0.578	0.511	0.474	0.442
7D	0.008	0.17	49.1	49.1	URBAN	0.038	0.26	0.26	3.95	0.57	27	**Tc (Hrs)**	0.296	0.296	0.296	0.264	0.246	0.230
												Vel (f/s)	0.84	0.84	0.84	0.94	1.01	1.08
												R (Hrs)	0.364	0.364	0.364	0.320	0.296	0.275
7E	0.024	0.28	29.6	29.6	URBAN	0.035	0.30	0.26	3.95	0.49	5	**Tc (Hrs)**	0.481	0.481	0.481	0.415	0.382	0.353
												Vel (f/s)	0.85	0.85	0.85	0.99	1.08	1.16
												R (Hrs)	0.497	0.497	0.497	0.422	0.385	0.353
8A	0.016	0.23	12.5	12.5	URBAN	0.034	0.14	0.25	3.95	0.40	73	**Tc (Hrs)**	0.402	0.402	0.402	0.372	0.353	0.336
												Vel (f/s)	0.84	0.84	0.84	0.91	0.96	1.00
												R (Hrs)	0.438	0.438	0.438	0.402	0.379	0.359
8B	0.014	0.21	36.0	36.0	URBAN	0.034	0.15	0.25	3.95	0.40	95	**Tc (Hrs)**	0.262	0.262	0.262	0.244	0.233	0.222
												Vel (f/s)	1.18	1.18	1.18	1.26	1.32	1.39
												R (Hrs)	0.274	0.274	0.274	0.253	0.240	0.228

D.3 Hydrograph Routing Data

Route ID	LOB N	Chan N	ROB N	Length (ft)	Slope (ft/ft)	Max Elev (ft)		1.	2.	3.	4.	5.	6.	7.	8.
NORMAL DEPTH															
Major Basin 02															
2ART	0.030	0.020	0.030	688.00	0.0090	2.00	X:	-	30.00	30.00	45.00	55.00	70.00	70.00	100.00
							Y:	0.80	0.50	-	0.20	0.20	-	0.50	0.80
2BJRT	0.030	0.020	0.030	1,578.00	0.0110	2.00	X:	-	30.00	30.00	45.00	55.00	70.00	70.00	100.00
							Y:	0.80	0.50	-	0.20	0.20	-	0.50	0.80

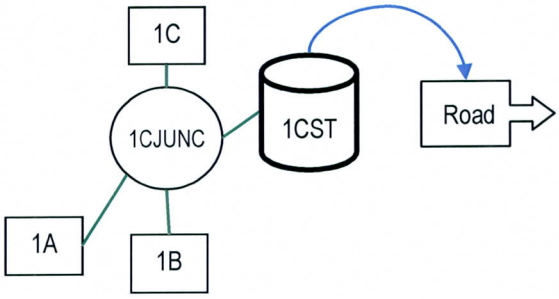
Route ID	LOB N	Chan N	ROB N	Length (ft)	Slope (ft/ft)	Max Elev (ft)		1.	2.	3.	4.	5.	6.	7.	8.
NORMAL DEPTH															
Major Basin 03															
3BRT	0.030	0.020	0.030	1,970.00	0.0120	2.00	X:	-	30.00	30.00	41.00	49.00	60.00	60.00	90.00
							Y:	0.80	0.50	-	0.20	0.20	-	0.50	0.80
3DRT	0.030	0.020	0.030	329.00	0.0120	2.00	X:	-	30.00	30.00	41.00	49.00	60.00	60.00	90.00
							Y:	0.80	0.50	-	0.20	0.20	-	0.50	0.80
4ASRT	0.035	0.035	0.035	1,059.00	0.0150	2.00	X:	-	15.00	30.00	45.00	55.00	70.00	85.00	100.00
							Y:	0.80	-	0.30	5.00	0.50	0.30	-	0.80
4BJRT	0.035	0.020	0.035	837.00	0.0130	2.00	X:	-	15.00	30.00	50.00	60.00	80.00	95.00	110.00
							Y:	0.80	-	0.30	0.50	0.50	0.30	-	0.80
5ART	0.035	0.025	0.035	1,812.00	0.0130	2.00	X:	-	30.00	30.00	41.00	49.00	60.00	60.00	90.00
							Y:	0.80	0.50	-	0.20	0.20	-	0.50	0.80
5BJRT	0.035	0.020	0.035	1,197.00	0.0090	2.00	X:	-	15.00	30.00	41.00	49.00	60.00	75.00	90.00
							Y:	0.80	-	0.30	0.50	0.50	0.30	-	0.80
5CJRT	0.035	0.035	0.035	786.00	0.0130	2.00	X:	-	15.00	30.00	41.00	49.00	60.00	75.00	90.00
							Y:	0.80	-	0.30	0.50	0.50	0.30	-	0.80

Route ID	LOB N	Chan N	ROB N	Length (ft)	Slope (ft/ft)	Max Elev (ft)		1.	2.	3.	4.	5.	6.	7.	8.
NORMAL DEPTH															
Major Basin 04															
6ART	0.035	0.020	0.035	1,323.00	0.0150	2.00	X:	-	30.00	30.00	41.00	49.00	60.00	60.00	90.00
							Y:	0.80	0.50	-	0.20	0.20	-	0.50	0.80
6BJRT	0.035	0.020	0.035	461.00	0.0130	2.00	X:	-	30.00	30.00	41.00	49.00	60.00	60.00	90.00
							Y:	0.80	0.50	-	0.20	0.20	-	0.50	0.80
6CJRT	0.035	0.020	0.035	1,402.00	0.0080	2.00	X:	-	30.00	30.00	41.00	49.00	60.00	60.00	90.00
							Y:	0.80	0.50	-	0.20	0.20	-	0.50	0.80
6DJRT	0.035	0.020	0.035	874.00	0.0130	2.00	X:	-	30.00	30.00	41.00	49.00	60.00	60.00	90.00
							Y:	0.80	0.50	-	49.00	0.20	-	0.50	0.80
6ESRT	0.035	0.035	0.035	432.00	0.0100	2.00	X:	-	15.00	30.00	41.00	49.00	60.00	75.00	90.00
							Y:	0.80	-	0.30	0.50	0.50	0.30	-	0.80
7CSRT	0.035	0.035	0.035	834.00	0.0100	2.00	X:	-	15.00	30.00	41.00	49.00	60.00	75.00	90.00
							Y:	0.80	-	0.30	0.50	0.50	0.30	-	0.80

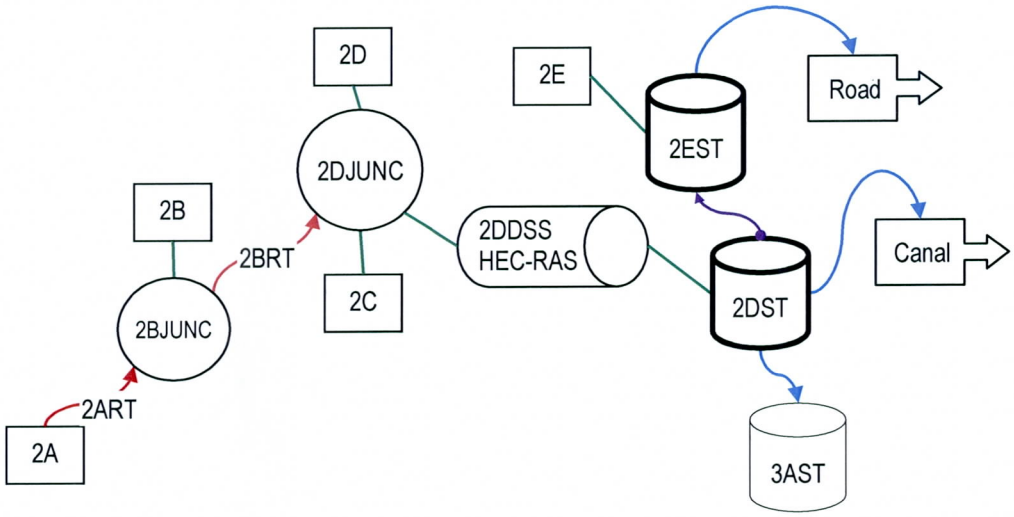
LEGEND

- Sub-basin
- Junction
- Flow out
- Storage Basin
- Ponding Area
- Overland Flow Path
- Channel Routing
- Weir Overflow
- Storm Drain Routing
- Storm Drain and Weir

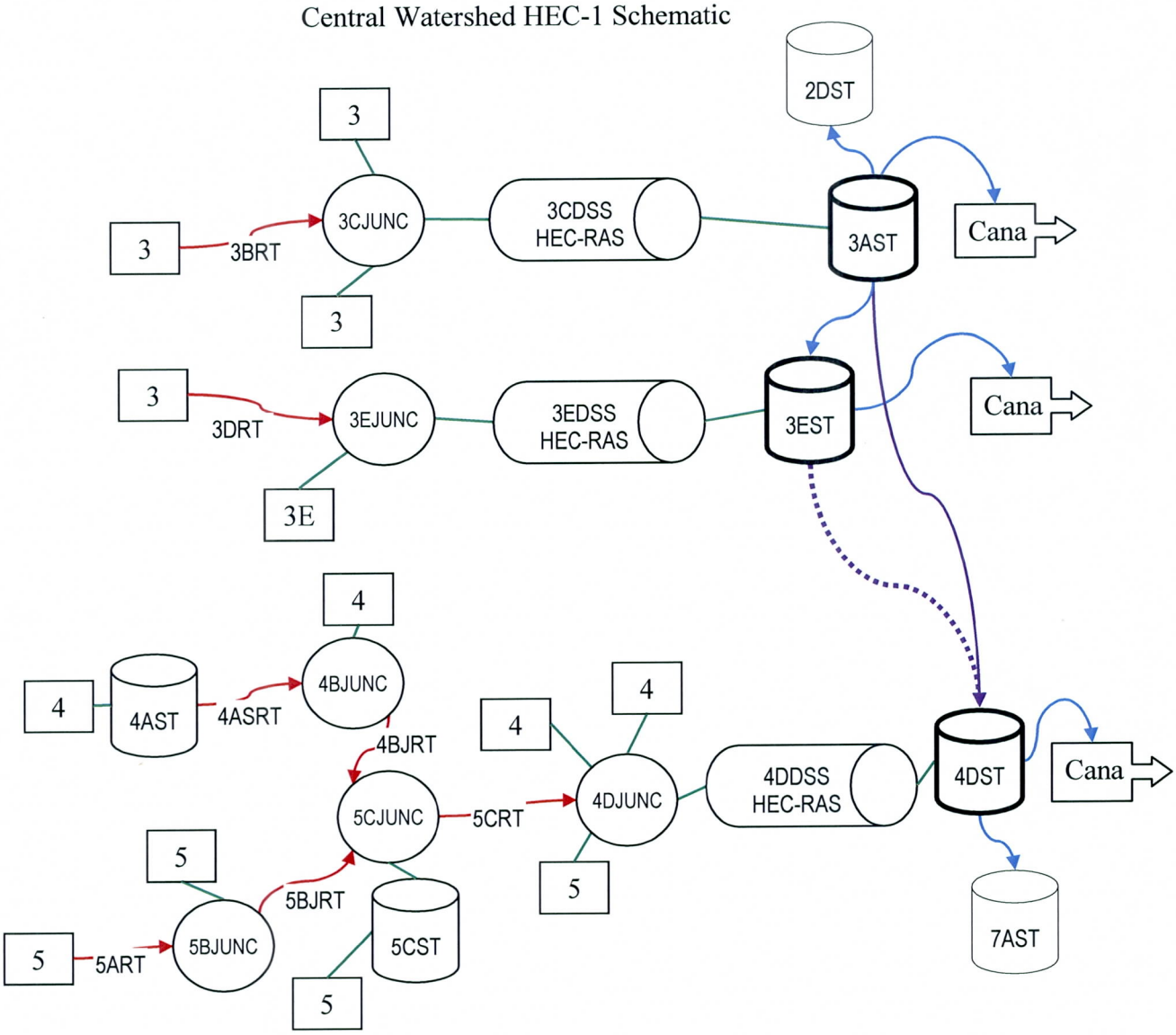
Northern Watershed
HEC-1 Schematic



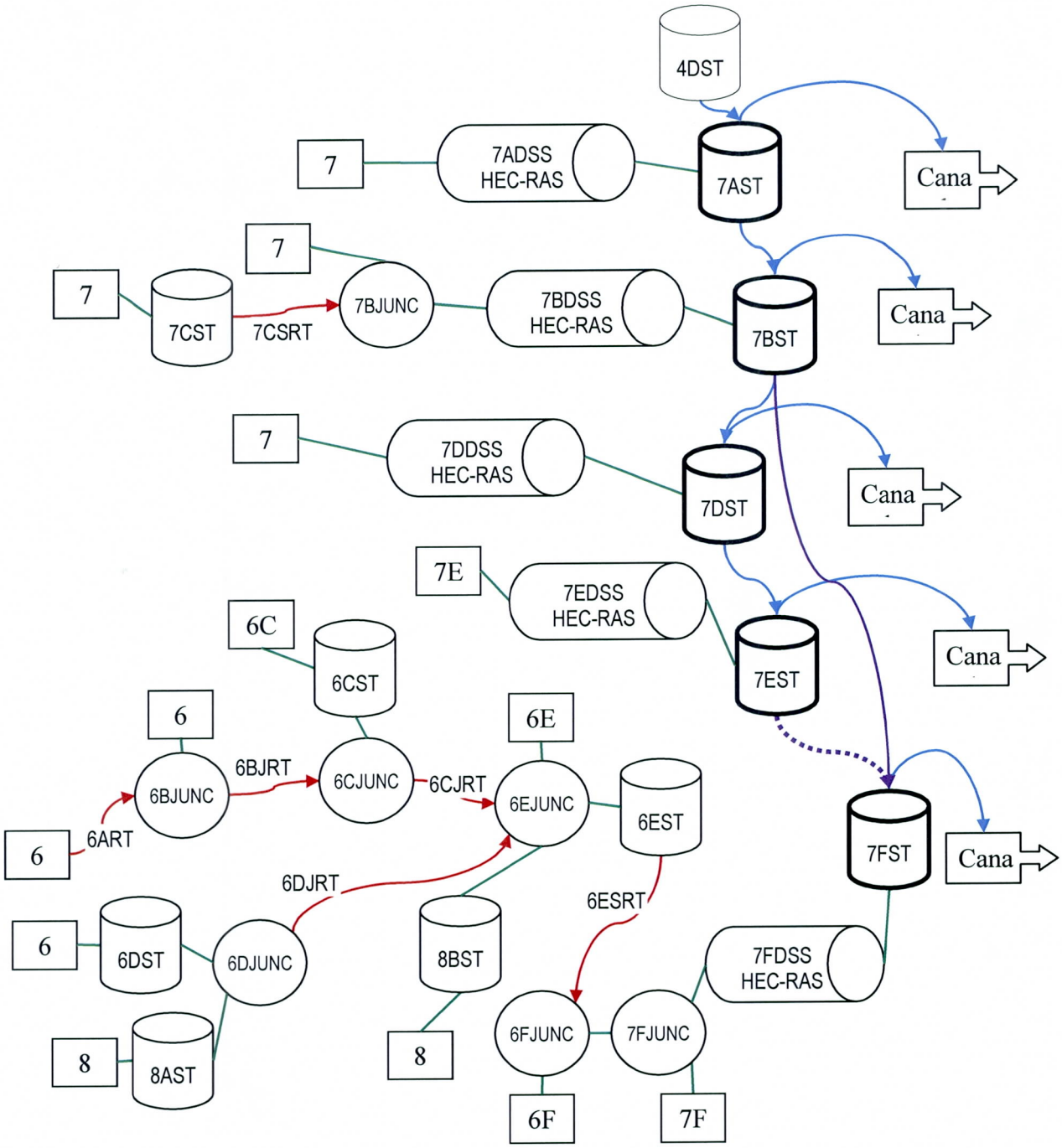
Northeastern Watershed
HEC-1 Schematic



Central Watershed HEC-1 Schematic



Southern Watershed HEC-1 Schematic



D.4 Reservoir Routing Data

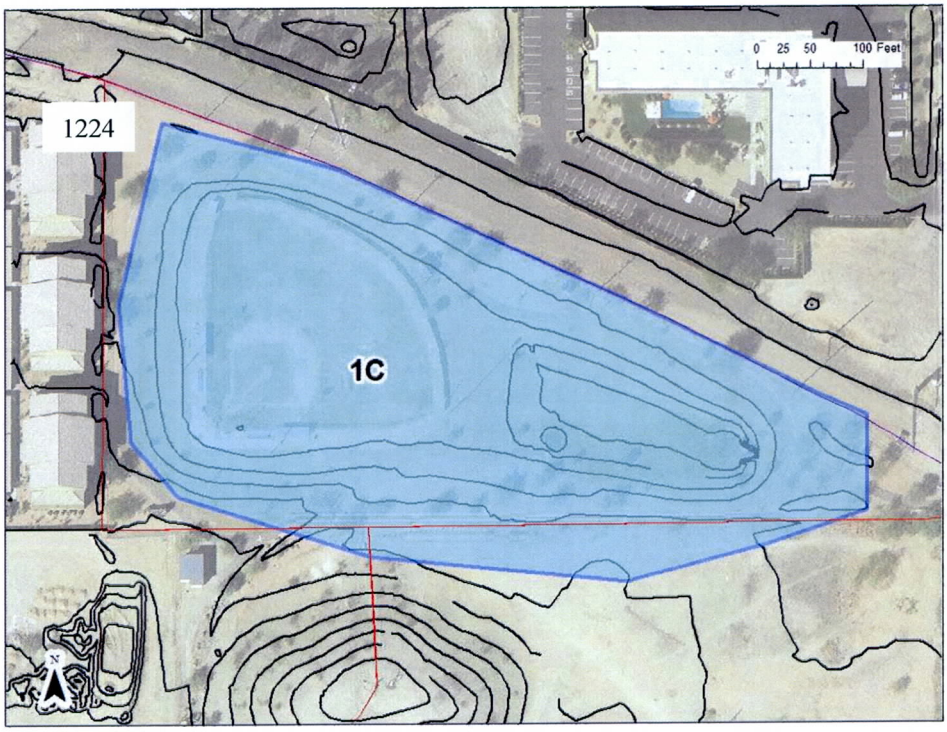


Figure D4-1. Ponding area 1C

Table D4-1. Stage storage relationship for ponding area 1C

Stage (ft)	1217	1218	1219	1220	1221	1222	1223	1224	1225	1226
Storage (ac-ft)	0.00	0.05	0.30	0.65	1.17	2.66	4.84	7.34	10.43	14.06

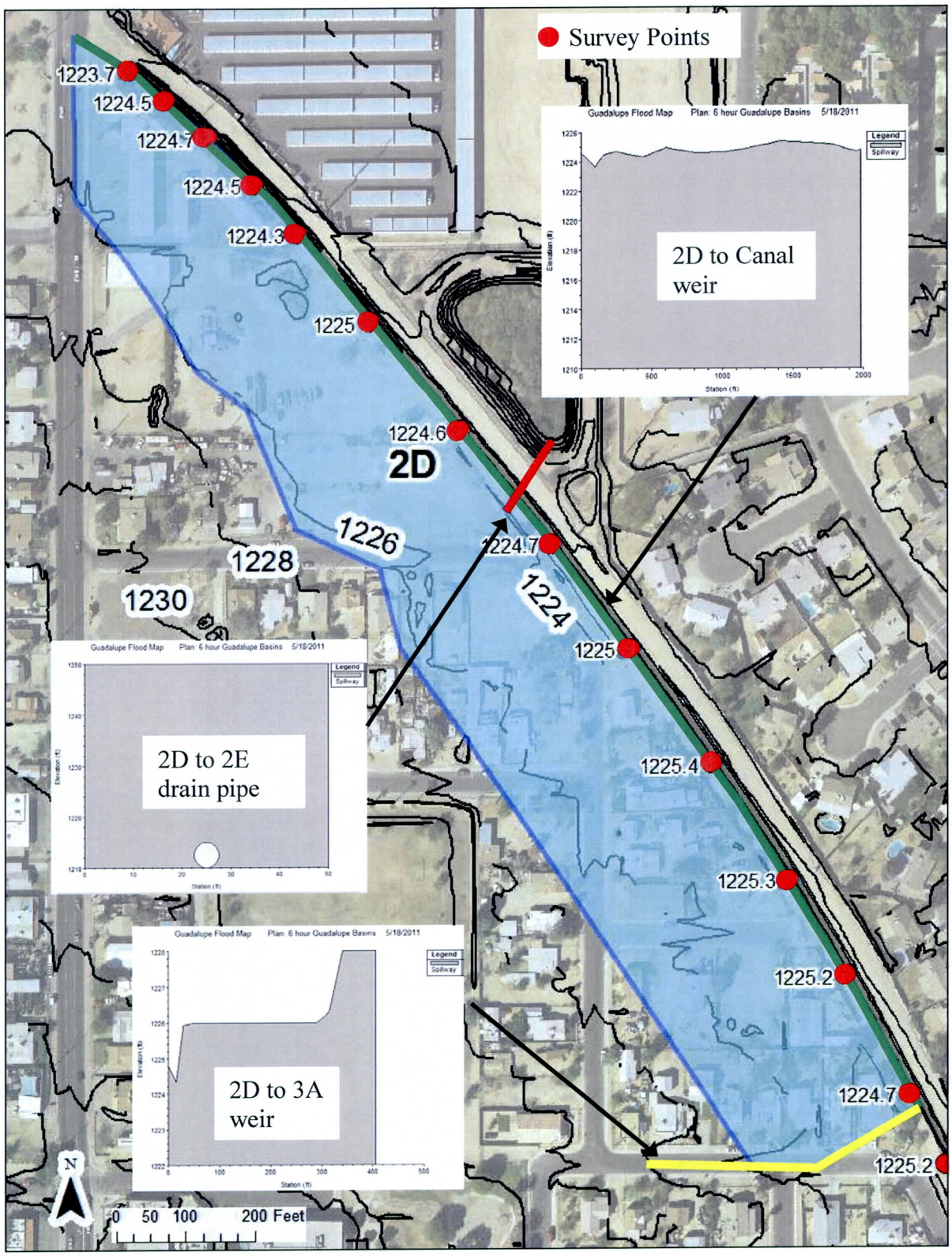


Figure D4-2. Pond and weirs 2D

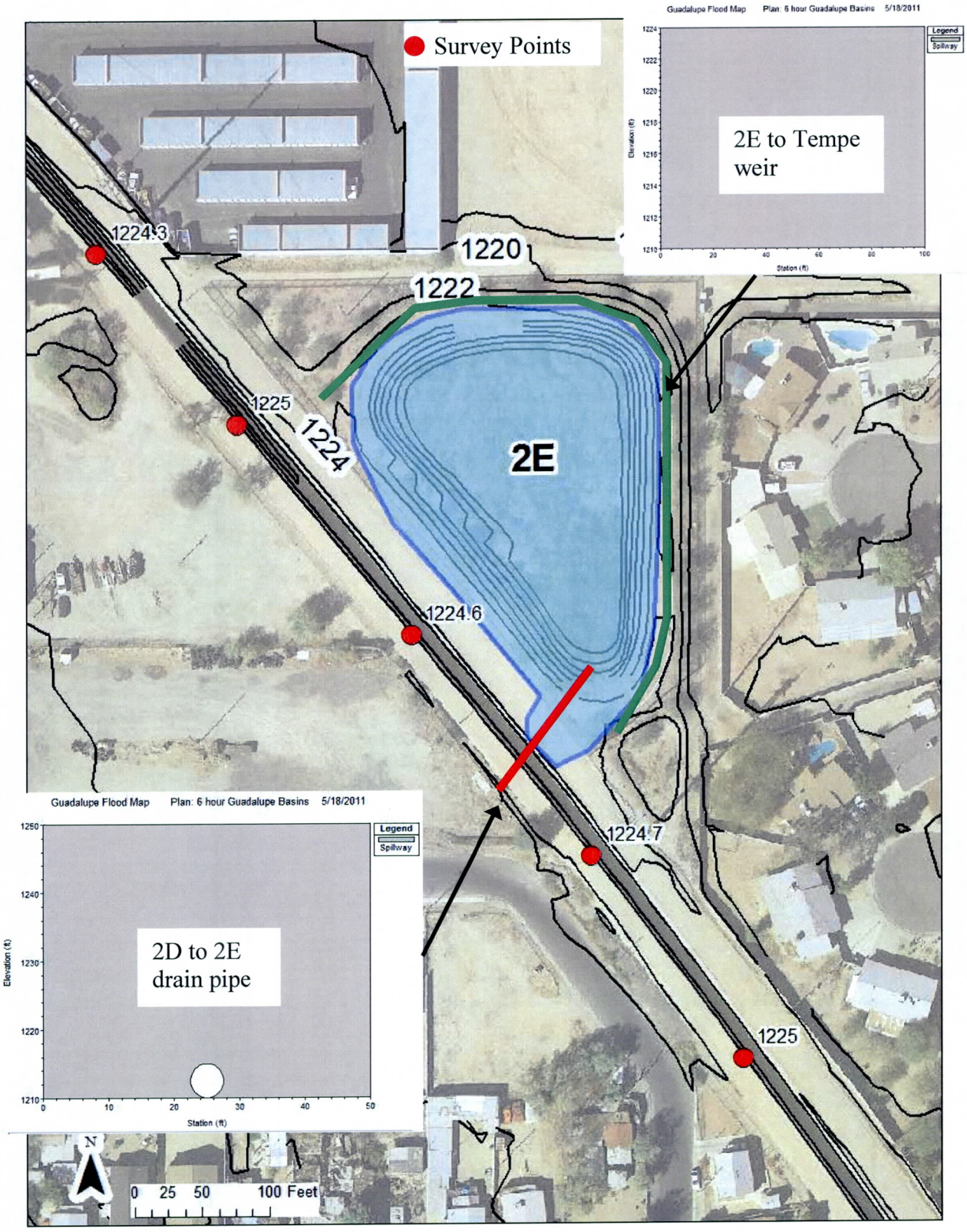


Figure D4-3. Pond and weirs 2E

Table D4-2. Stage storage relationship for ponding area 2D

Stage (ft)	1222	1223	1224	1225	1226
Storage(ac-ft)	0.00	0.02	0.16	2.29	7.48

Table D4-3. Stage storage relationship for ponding area 2E

Stage (ft)	1210	1211	1212	1213	1214	1215	1216	1217
Storage(ac-ft)	0.00	0.01	0.07	0.63	1.22	1.86	2.54	3.25
Stage (ft)	1218	1219	1220	1221	1222	1223	1224	1225
Storage(ac-ft)	4.01	4.80	5.63	6.51	7.44	8.44	9.49	10.71

Table D4-4._Weir XS between 2D and 3A

STA	EL
0	1224.79
16	1224.35
28	1225.84
29	1225.93
29	1225.93
49	1226.00
290	1226.00
295	1226.06
295	1226.06
308	1226.22
309	1226.23
310	1226.25
311	1226.25
314	1226.31
314	1226.32
314	1226.32
339	1228.00
406	1228.00

Table D4-5. Weir XS between 2D and the Canal

STA (ft)	EL (ft)
0	1224.60
100	1223.68
166	1224.53
248	1224.69
343	1224.52
437	1224.34
601	1224.97
804	1224.62
1015	1224.67
1203	1224.95
1405	1225.39
1604	1225.28
1764	1225.19
1955	1224.66
1981	1224.80

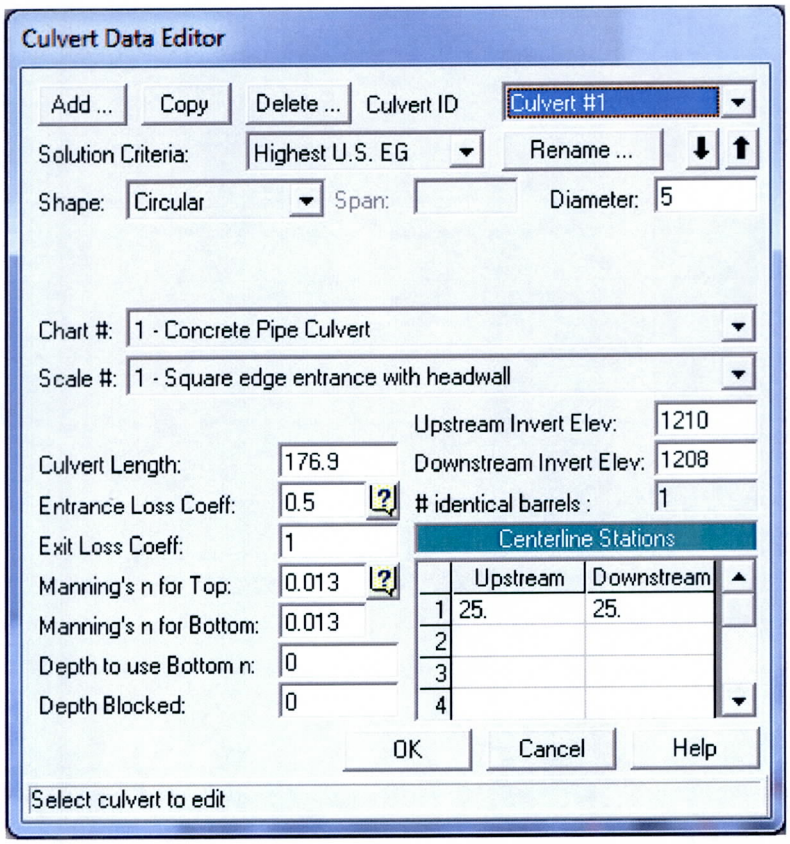


Figure D4-4. Culvert data for connection between 2D and 2E

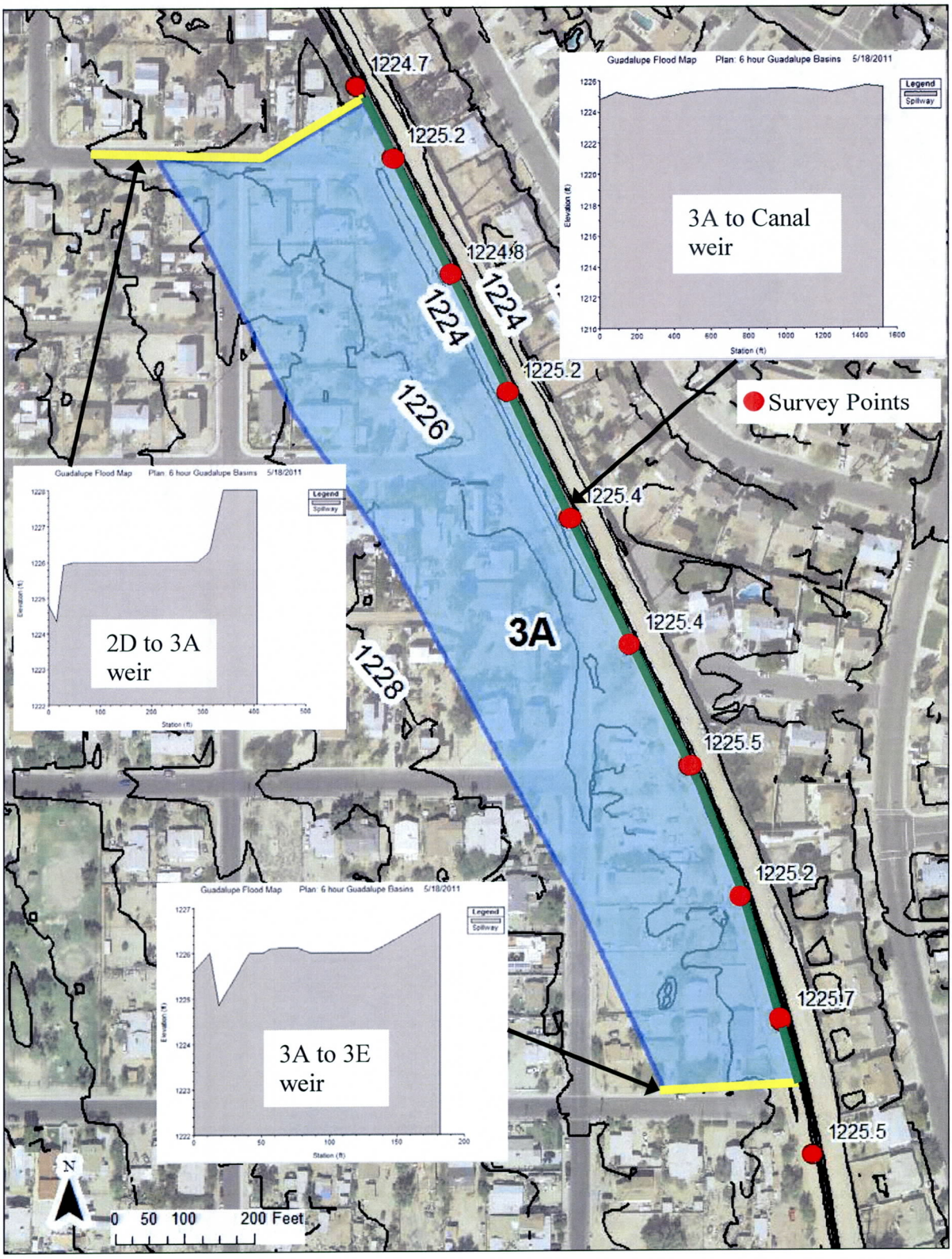


Figure D4-5. Pond and weirs 3A

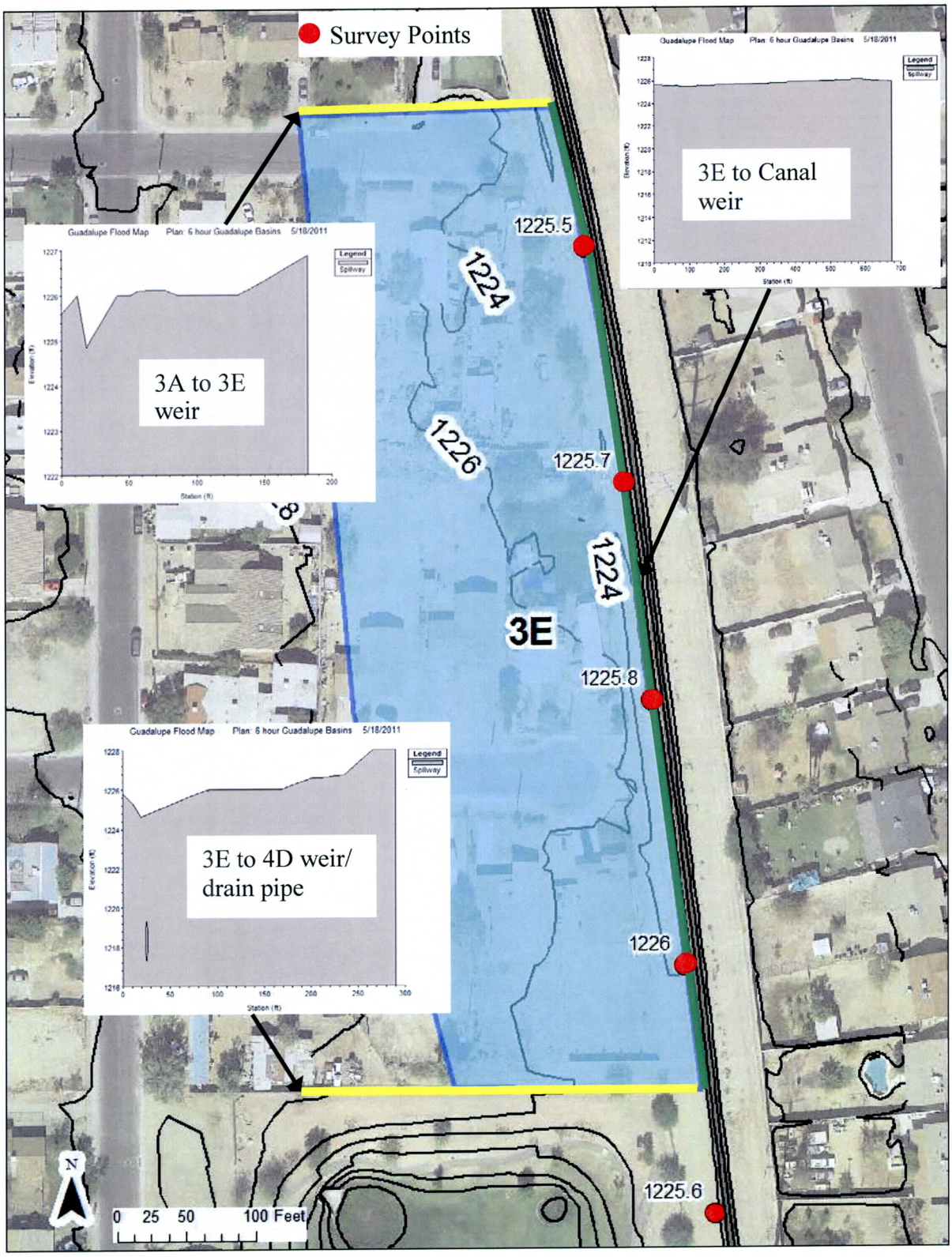


Figure D4-6. Pond and weirs 3E

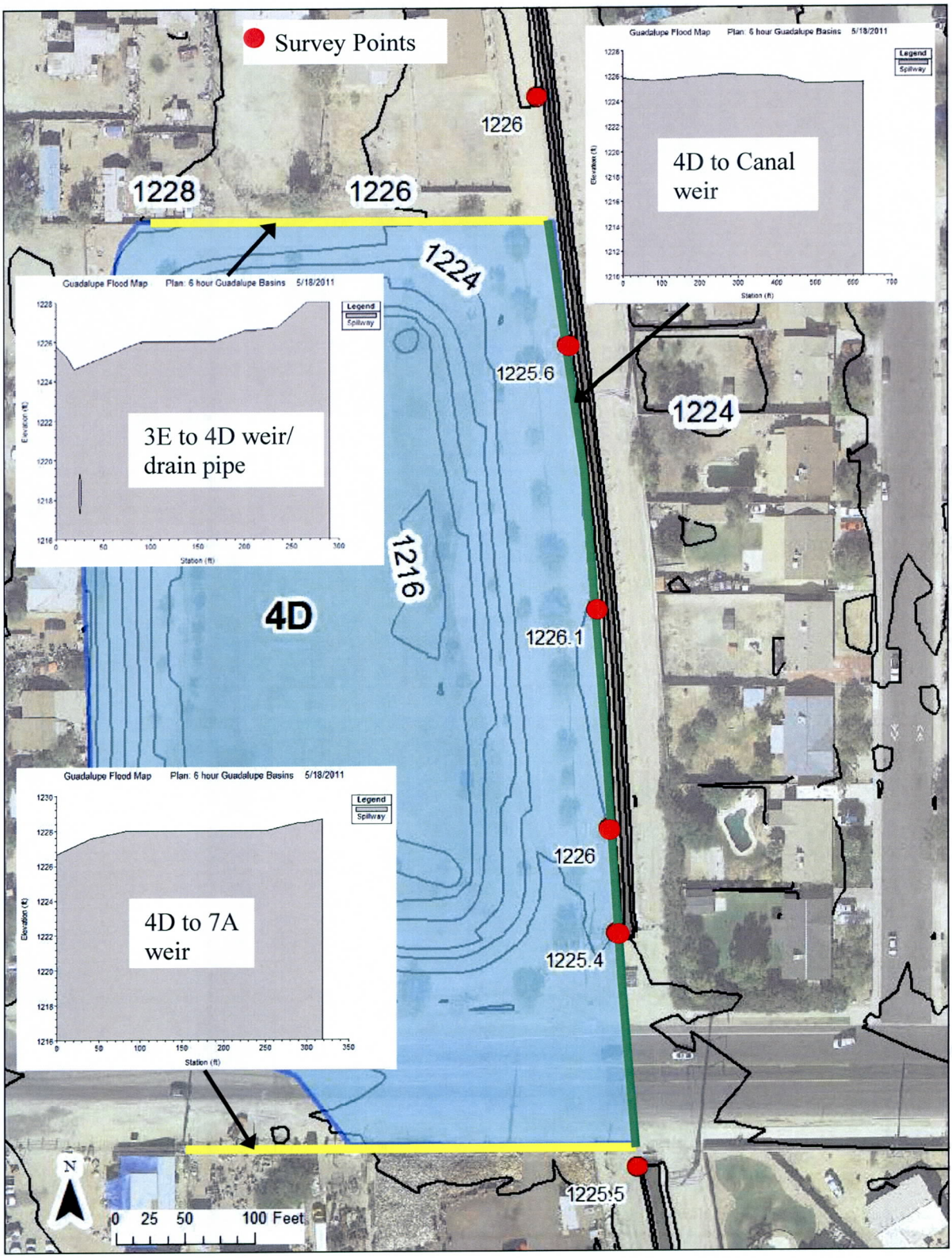


Figure D4-7. Pond and weirs 4D

Table D4-6. Stage storage relationship for ponding area 3A

Stage (ft)	1222	1223	1224	1225	1226	1227
Storage(ac-ft)	0.00	0.04	0.16	0.95	3.38	9.31

Table D4-7. Stage storage relationship for ponding area 3E

Stage (ft)	1224	1225	1226	1227
Storage(ac-ft)	0.00	0.07	0.63	2.78

Table D4-8. Stage storage relationship for ponding area 4D

Stage (ft)	1216	1217	1218	1219	1220	1221
Storage(ac-ft)	0.00	0.71	2.23	4.23	6.38	8.71
Stage (ft)	1222	1223	1224	1225	1226	1227
Storage(ac-ft)	11.23	13.94	16.86	20.11	23.87	28.26

Table D4-9. Weir XS between 3A and 3E

STA	EL
0	1225.61
7.37	1225.86
11.29	1226
11.7	1226
13.12	1225.75
18.37	1224.87
41.1	1226
50.79	1226
56.62	1226.1
57.75	1226.1
65.76	1226.12
74.25	1226.12
76.7	1226.11
85.89	1226
130.49	1226
135.34	1226.09
135.57	1226.09
137.11	1226.1
137.46	1226.1
181.99	1226.87

Table D4-10. Weir XS between 3A and Canal

STA (ft)	EL (ft)
0	1224.795
88	1225.248
273	1224.806
460	1225.202
658	1225.405
858	1225.42
1049	1225.509
1247	1225.227
1432	1225.684
1525	1225.604

Table D4-11. Weir XS between 3E and Canal

STA (ft)	EL (ft)
0	1225.604
94	1225.522
256	1225.694
402	1225.835
581	1226.035
673	1225.806

Table D4-12. Weir XS between 4D and Canal

STA (ft)	EL (ft)
0	1225.806
78	1225.613
257	1226.132
403	1226.038
472	1225.432
626	1225.469

Table D4-13. Weir XS between 4D and 7A

STA (ft)	EL (ft)
0	1226.66
41.46	1227.57
73.59	1227.88
79.04	1227.94
80.03	1227.94
84.53	1228
252.52	1228
253.26	1228.01
254.38	1228.02
254.59	1228.02
256.15	1228.04
257.53	1228.05
258.95	1228.07
290.22	1228.41
290.35	1228.41
313.09	1228.64

Table D4-14. Weir XS between 3E and 4D

STA (ft)	EL (ft)
0	1225.82
10.33	1225.31
18.86	1224.62
73.34	1225.72
88.84	1225.97
90.45	1225.97
90.52	1225.96
90.83	1225.99
91.17	1226
168.64	1226
201.14	1226.58
212.64	1226.6
212.91	1226.61
218.52	1226.62
220.22	1226.66
227.23	1226.67
228.6	1226.7
232.37	1226.71
232.54	1226.71
235.28	1226.72
266.04	1228
289.78	1228

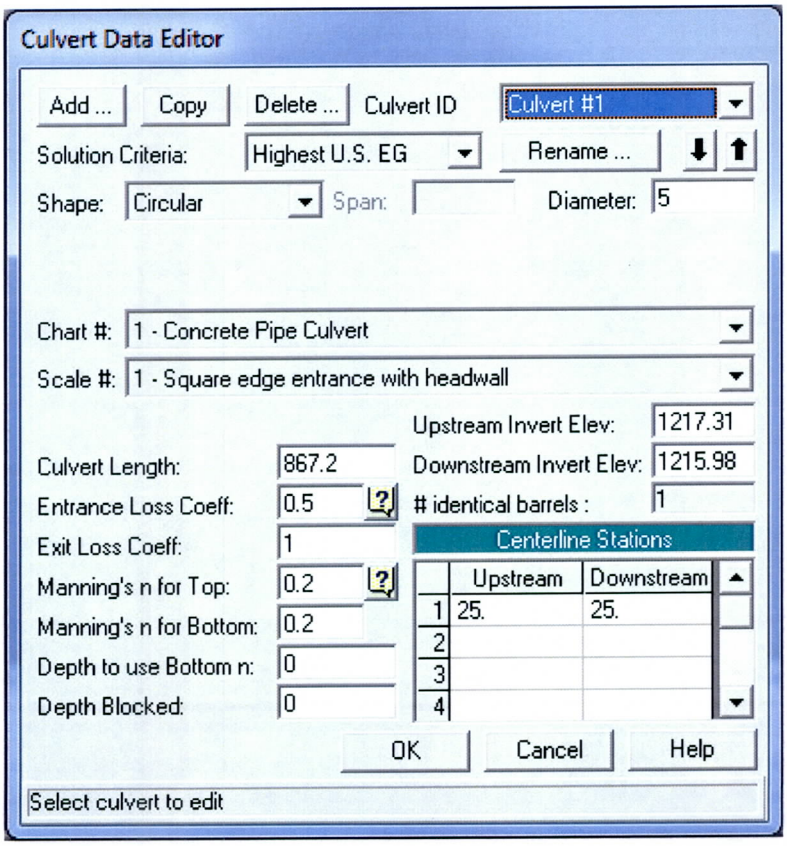


Figure D4-8. Culvert data for connection between 3E and 4D

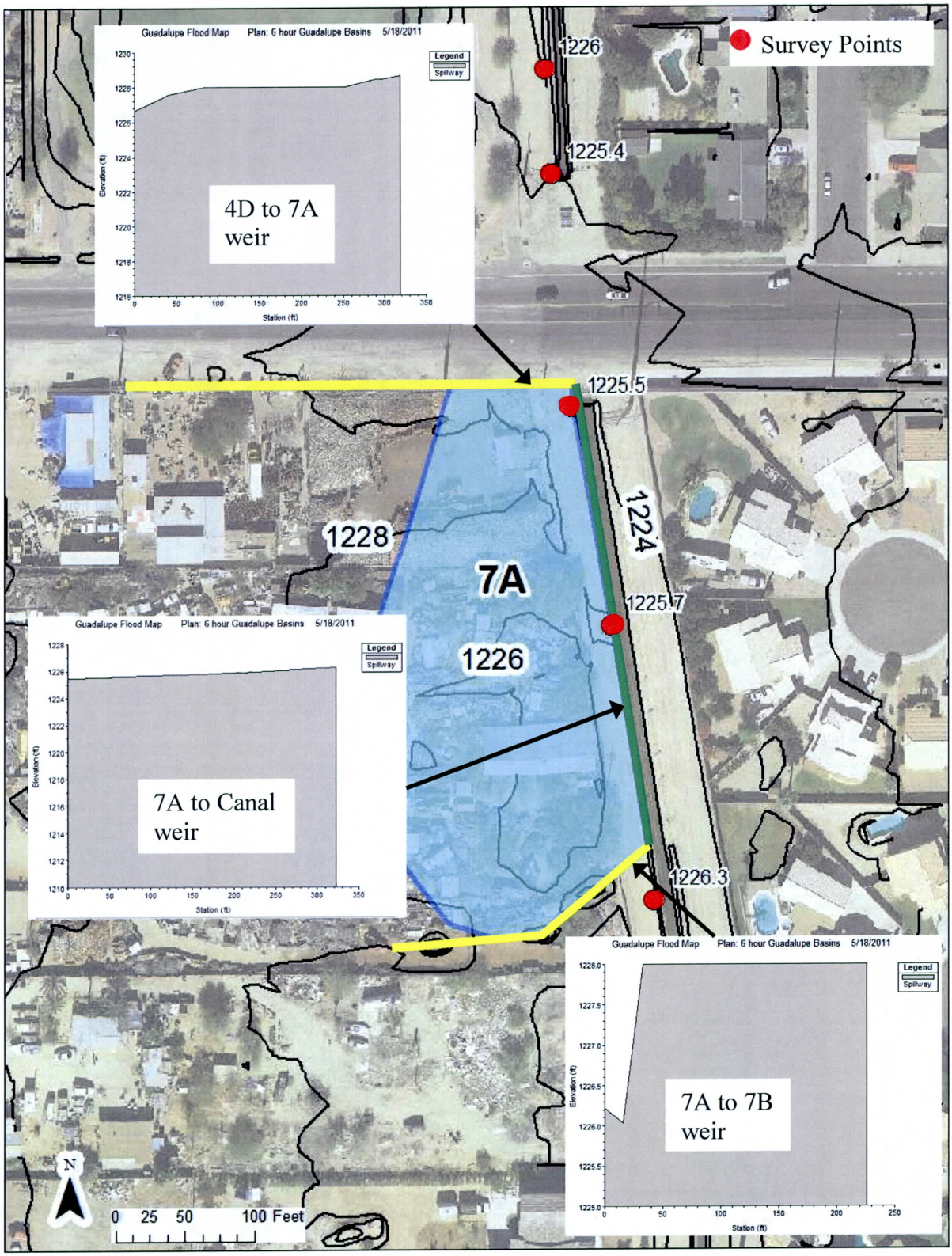


Figure D4-9. Pond and weirs 7A

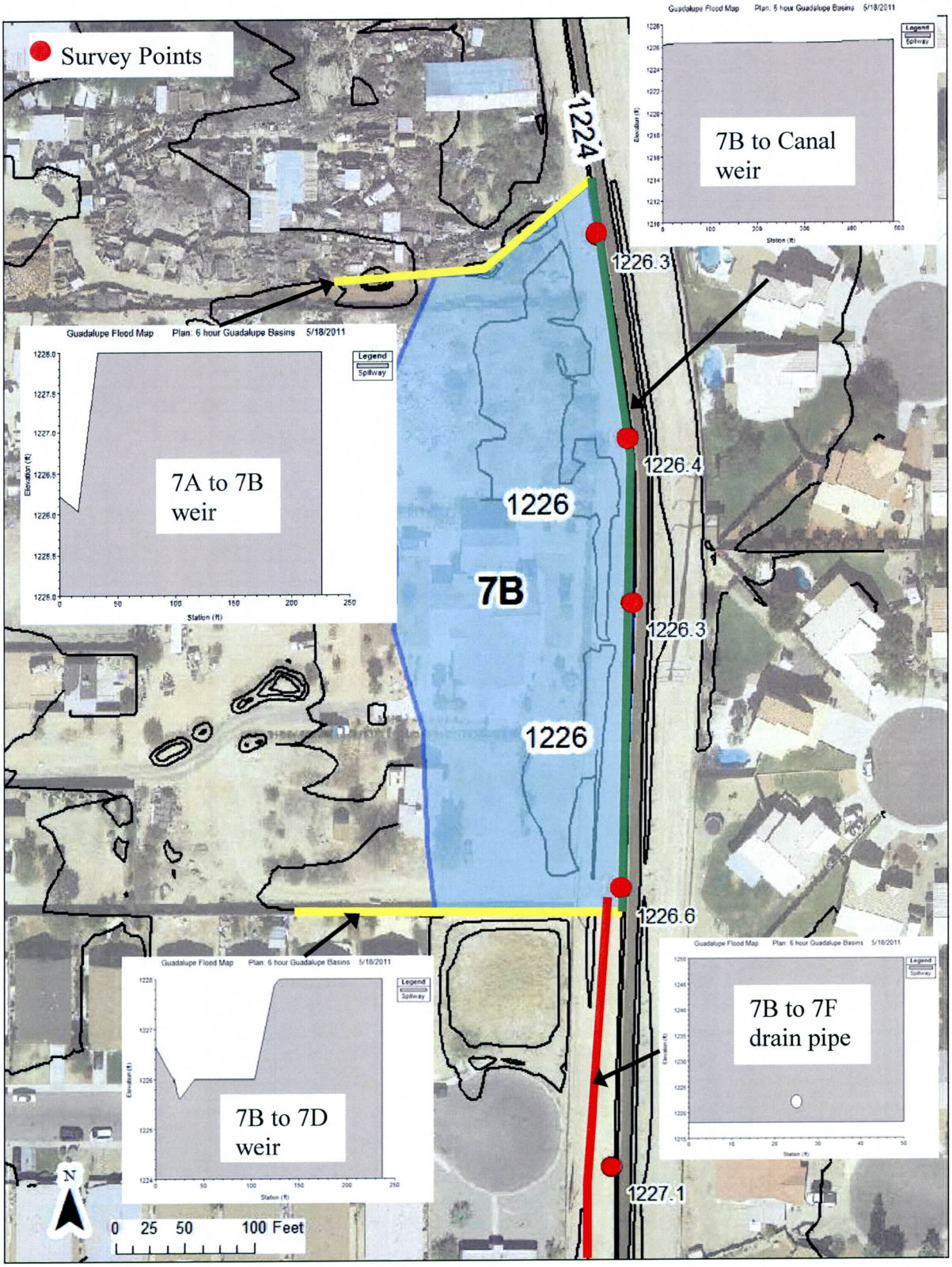


Figure D4-10. Pond and weirs 7B

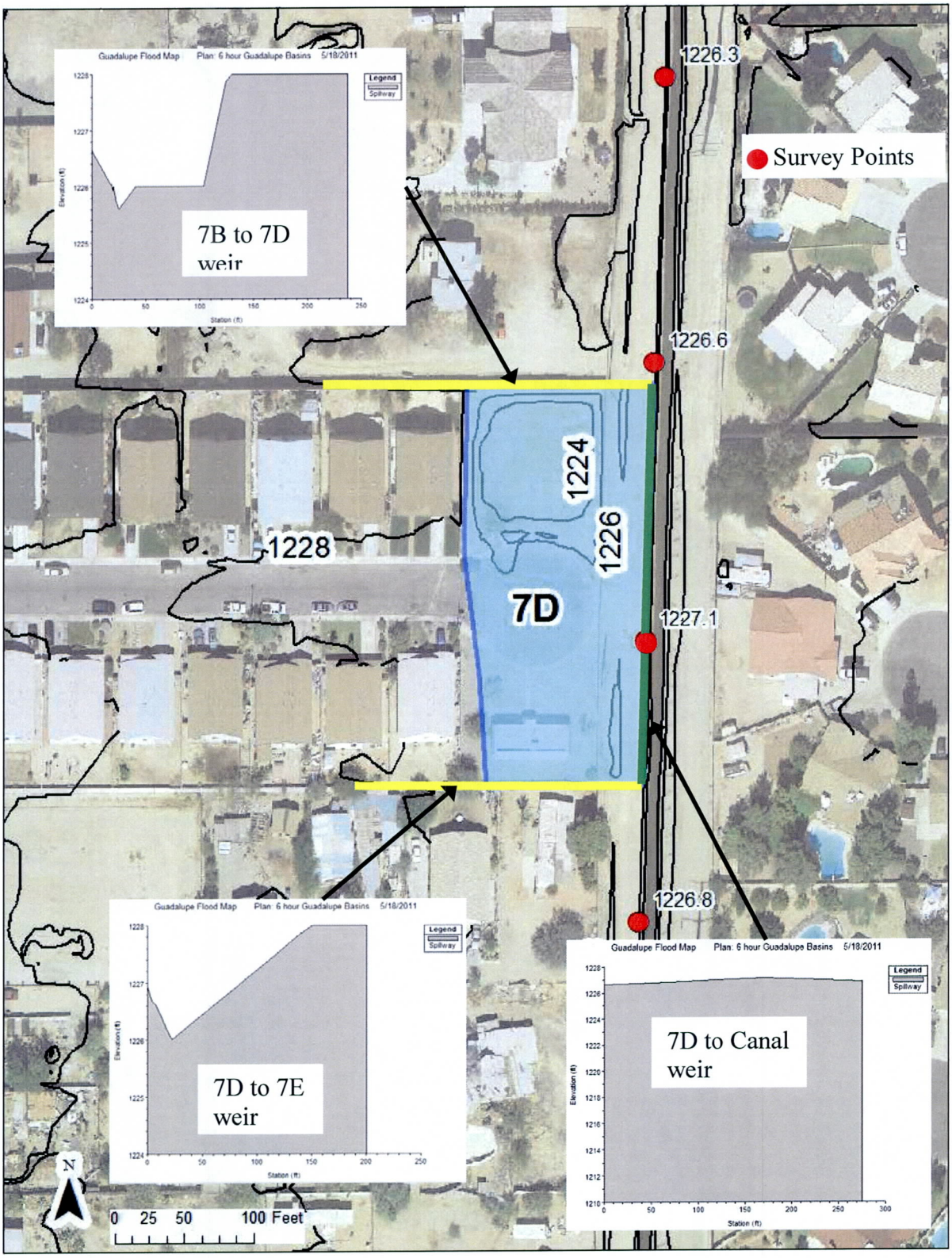


Figure D4-11. Pond and weirs 7D

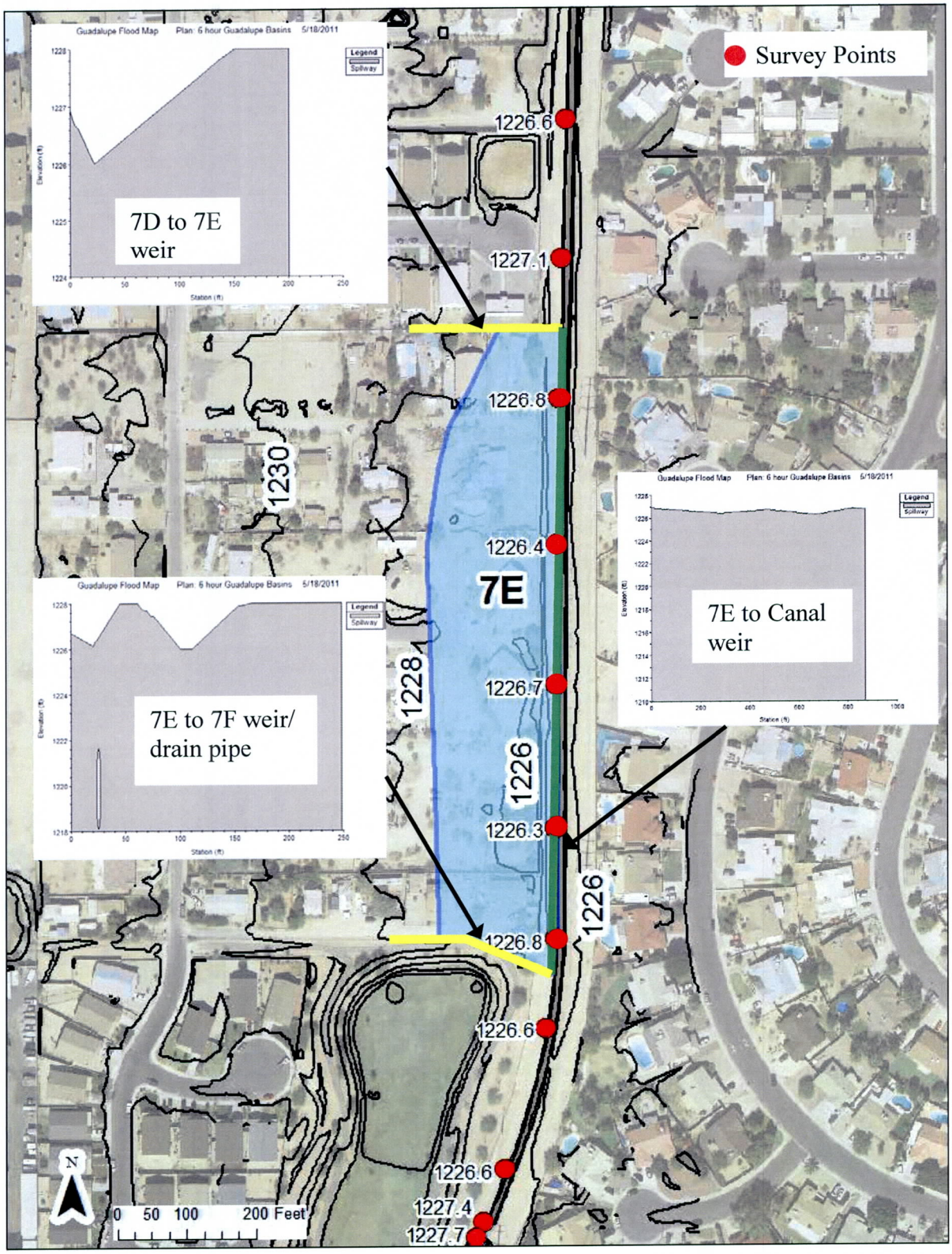


Figure D4-12. Pond and weirs 7E

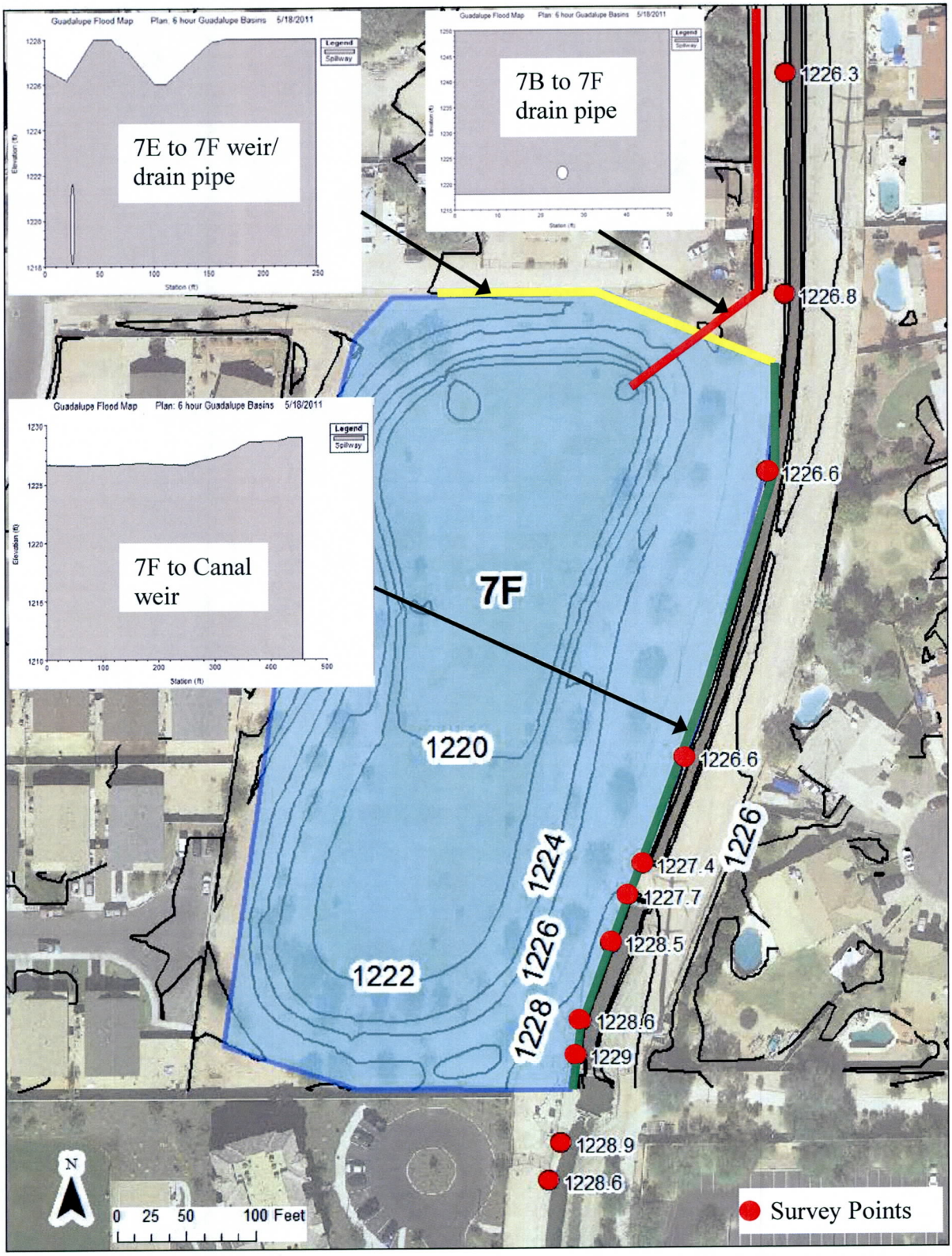


Figure D4-13. Pond and weirs 7F

Table D4-15. Stage storage relationship for ponding area 7A

Stage (ft)	1225	1226	1227
Storage(ac-ft)	0.00	0.02	0.65

Table D4-16. Stage storage relationship for ponding area 7B

Stage (ft)	1225	1226	1227	1228
Storage(ac-ft)	0.00	0.02	1.12	2.75

Table D4-17. Stage storage relationship for ponding area 7D

Stage (ft)	1224	1225	1226	1227	1228
Storage(ac-ft)	0.00	0.16	0.36	0.96	1.79

Table D4-18. Stage storage relationship for ponding area 7E

Stage (ft)	1224	1225	1226	1227
Storage(ac-ft)	0.00	0.01	0.06	1.51

Table D4-19. Stage storage relationship for ponding area 7F

Stage (ft)	1218	1219	1220	1221	1222	1223	1224
Storage(ac-ft)	0.00	0.20	0.77	1.72	2.90	4.47	6.26
Stage (ft)	1225	1226	1227	1228	1229	1230	
Storage(ac-ft)	8.27	10.48	13.40	16.65	20.33	24.09	

Table D4-20. Weir XS between 7B and Canal

STA (ft)	EL (ft)
0	1226.234
31	1226.337
175	1226.371
286	1226.327
473	1226.598
488	1226.64

Table D4-21. Weir XS between 7A and 7B

STA (ft)	EL (ft)
0	1226.22
16.16	1226.04
33.09	1228
69.06	1228
88.02	1228
112.44	1228
147.66	1228
206.32	1228
225.93	1228

Table D4-22. Weir XS between 7A and Canal

STA (ft)	EL (ft)
0	1225.469
6	1225.47
161	1225.7
323	1226.234

Table D4-23. Weir XS between 7B and 7D

STA (ft)	EL (ft)
0	1226.64
10.67	1226.27
17.3	1226.05
18.42	1226.03
19.47	1225.93
19.68	1225.98
19.83	1226
20.02	1225.97
21.51	1225.83
21.8	1225.77
25	1225.61
25.23	1225.61
40.58	1226
103.68	1226
123.99	1227.88
130.13	1228
237.22	1228

Table D4-24. Weir XS between 7D and Canal

STA (ft)	EL (ft)
0	1226.64
170	1227.117
275	1226.911

Table D4-25. Weir XS between 7D and 7E

STA (ft)	EL (ft)
0	1226.93
3.51	1226.72
4.96	1226.67
7.45	1226.62
18.88	1226.13
22.47	1226.01
22.61	1226.01
120.71	1227.55
121.66	1227.57
137.96	1227.83
138.2	1227.83
139.99	1227.86
140.07	1227.86
141.1	1227.87
142.21	1227.89
150.47	1228
200.83	1228

Table D4-26._Weir XS between 7E and Canal

STA (ft)	EL (ft)
0	1226.911
82	1226.751
281	1226.405
472	1226.701
668	1226.25
820	1226.794
871	1226.693

Table D4-27. Weir XS between 7E and 7F

STA (ft)	EL (ft)
0	1226.7
19.16	1226.18
19.97	1226.16
22.54	1226.34
22.91	1226.37
23.5	1226.41
25.7	1226.58
28.68	1226.8
44.56	1228
60.98	1228

Table D4-28._Weir XS between 7F and Canal

STA (ft)	EL (ft)
0	1226.693
67	1226.559
170	1226.8
247	1226.617
312	1227.367
331	1227.729
361	1228.514
409	1228.596
432	1228.96
456	1228.931

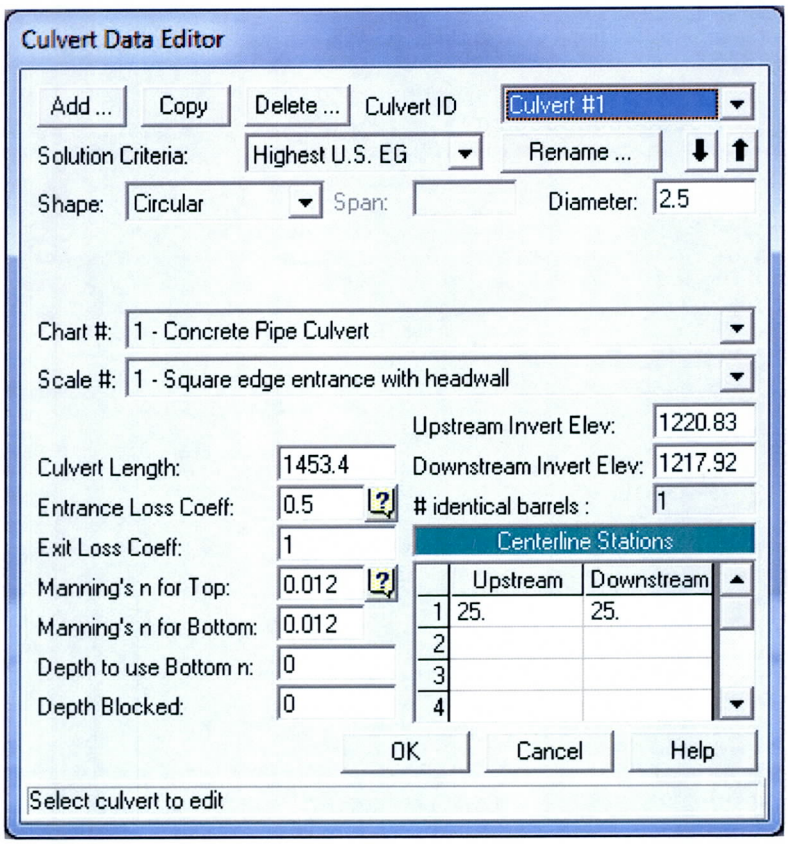


Figure D4-14. Culvert data for connection between 7B and 7F

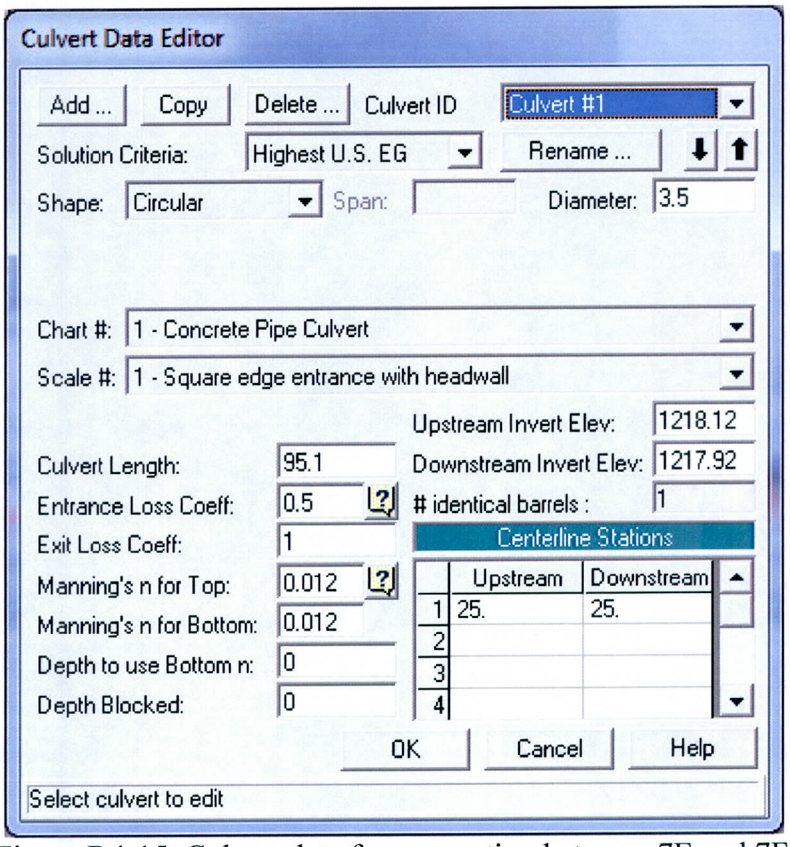


Figure D4-15. Culvert data for connection between 7E and 7F

D.5 Flow Splits and Diversion Data

D.5. Flow Splits and Diversions Data

Diversions were used to represent internal retention basins as described in Section 4.2.4.

D.6 Hydrologic Calculations

```
1****************************************
 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *              JUN   1998              *
 *           VERSION 4.1                *
 *                                      *
 *  RUN DATE   18MAY11  TIME  09:17:59  *
 *                                      *
 ****************************************
```

```
****************************************
*                                      *
*   U.S. ARMY CORPS OF ENGINEERS       *
*   HYDROLOGIC ENGINEERING CENTER      *
*         609 SECOND STREET            *
*      DAVIS, CALIFORNIA 95616         *
*          (916) 756-1104              *
*                                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X       XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   1          ID        Flood Control District of Maricopa County
   2          ID        GUADALUPE_6HR - FCDM001001 Guadalupe FDS
   3          ID        100 YEAR
   4          ID        6 Hour  Storm
   5          ID        Unit Hydrograph: Clark
   6          ID        05/18/2011
   7          ID        Major Basin 01, North Watershed
```

```
 8          ID        WEST Consultants, Inc. - Riley Asburry
 9          ID        WSE for 1CST computed through HEC1, not RAS.
10          IT       3 01JAN11    0000    2000
11          IN      15
12          IO       5
            *DIAGRAM
            *
            *

13          KK      1A   BASIN
14          BA   0.044
15          PB   2.517
16          PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
17          PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
18          PC   0.962   0.972   0.983   0.991   1.000
19          LG    0.25    0.26    3.95    0.55      38
20          UC   0.297   0.285
21          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
22          UA     100
            *

23          KK      1B   BASIN
24          BA   0.041
25          LG    0.26    0.26    3.95    0.56      26
26          UC   0.351   0.378
27          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
28          UA     100
            *

29          KK      1C   BASIN
30          BA   0.007
31          LG    0.10    0.25    3.95    0.68       2
32          UC   0.224   0.218
33          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
34          UA     100
            *

35          KK  1CJUNC COMBINE
36          KM    Combined flows from 1A, 1B, and 1C
37          HC       3
38          ZW      A=1CJUNC    C=FLOW    F=COMP
            *
```



```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
```

```
39          KK    1CST STORAGE
40          KM    WSE computed in HEC1, not RAS
41          KO
42          RS       1    STOR
43          SV            0.05    0.30    0.65    1.17    2.66    4.84    7.34   10.43   14.06
44          SQ
45          SE  1217.0 1218.00 1219.00 1220.00 1221.00 1222.00 1223.00 1224.00 1225.00 1226.00
            *
46          ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    13          1A
                 .
                 .
    23           .          1B
                 .           .
                 .           .
    29           .           .          1C
                 .           .           .
                 .           .           .
    35      1CJUNC.......................
                 V
                 V
    39        1CST

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

```
1****************************************
 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *               JUN   1998             *
 *            VERSION 4.1               *
 *                                      *
 *  RUN DATE   18MAY11  TIME  09:17:59  *
 *                                      *
 ****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
                                Flood Control District of Maricopa County
                                GUADALUPE_6HR - FCDM001001 Guadalupe FDS
                                100 YEAR
                                6 Hour  Storm
                                Unit Hydrograph: Clark
                                05/18/2011
                                Major Basin 01, North Watershed
                                WEST Consultants, Inc. - Riley Asburry
                                WSE for 1CST computed through HEC1, not RAS.

 12 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN           3  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1JAN11  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ        2000  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      5JAN11  ENDING DATE
                     NDTIME        0357  ENDING TIME
                      ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL     .05 HOURS
                       TOTAL TIME BASE   99.95 HOURS

         ENGLISH UNITS
              DRAINAGE AREA          SQUARE MILES
              PRECIPITATION DEPTH    INCHES
              LENGTH, ELEVATION      FEET
              FLOW                   CUBIC FEET PER SECOND
              STORAGE VOLUME         ACRE-FEET
              SURFACE AREA           ACRES
              TEMPERATURE            DEGREES FAHRENHEIT
   -----DSS---ZOPEN:  Existing File Opened,  File: 01-6HR.DSS
                      Unit:  71;  DSS Version: 6-JG
-----DSS---ZWRITE Unit  71; Vers.    7:  /1CJUNC/1CJUNC/FLOW/31DEC1910/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    7:  /1CJUNC/1CJUNC/FLOW/01JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    7:  /1CJUNC/1CJUNC/FLOW/02JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    7:  /1CJUNC/1CJUNC/FLOW/03JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    7:  /1CJUNC/1CJUNC/FLOW/04JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    7:  /1CJUNC/1CJUNC/FLOW/05JAN1911/3MIN/COMP/
```

*** ***

```
            **************
            *            *
  39 KK     *      1CST  *      STORAGE
            *            *
            **************

  41 KO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                  RUNOFF SUMMARY
                                            FLOW IN CUBIC FEET PER SECOND
                                          TIME IN HOURS,  AREA IN SQUARE MILES

                                     PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION        STATION   FLOW    PEAK                                           AREA      STAGE     MAX STAGE
+                                                        6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                             1A      60.    4.10          7.          2.          1.       .04

          HYDROGRAPH AT
+                             1B      44.    4.15          6.          1.          0.       .04

          HYDROGRAPH AT
+                             1C       9.    4.05          1.          0.          0.       .01

          3 COMBINED AT
+                          1CJUNC     111.    4.10         13.          3.          1.       .09

          ROUTED TO
+                           1CST       0.     .00          0.          0.          0.       .09
+                                                                                          1223.70        7.55
```

*** NORMAL END OF HEC-1 ***

```
-----DSS---ZCLOSE Unit:  71,   File: 01-6HR.DSS
           Pointer Utilization:   .25
           Number of Records:      6
           File Size:     23.9  Kbytes
           Percent Inactive:    .0
```

```
1****************************************
 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *              JUN   1998              *
 *           VERSION 4.1                *
 *                                      *
 *  RUN DATE   18MAY11  TIME  09:18:22  *
 *                                      *
 ****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID        Flood Control District of Maricopa County
  2           ID        GUADALUPE_24HR - FCDM001001 Guadalupe FDS
  3           ID        100 YEAR
  4           ID        24 Hour Storm
  5           ID        Unit Hydrograph: Clark
  6           ID        05/18/2011
  7           ID        Major Basin 01, North Watershed
```

```
 8          ID        WEST Consultants, Inc. - Riley Asburry
 9          ID        WSE for 1CST computed through HEC1, not RAS.
10          IT       3 01JAN11    0000    2000
11          IN      15
12          IO       5
            *DIAGRAM
            *
            *

13          KK      1A   BASIN
14          BA   0.044
15          PB   3.446
16          PC   0.000   0.002   0.005   0.008   0.011   0.014   0.017   0.020   0.023   0.026
17          PC   0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056   0.060
18          PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
19          PC   0.110   0.115   0.120   0.126   0.133   0.140   0.147   0.155   0.163   0.172
20          PC   0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
21          PC   0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
22          PC   0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
23          PC   0.913   0.918   0.922   0.926   0.930   0.934   0.938   0.942   0.946   0.950
24          PC   0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977   0.980
25          PC   0.983   0.986   0.989   0.992   0.995   0.998   1.000
26          LG    0.25    0.26    3.95    0.55      38
27          UC   0.298   0.286
28          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
29          UA     100
            *

30          KK      1B   BASIN
31          BA   0.041
32          LG    0.26    0.26    3.95    0.56      26
33          UC   0.350   0.376
34          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
35          UA     100
            *

36          KK      1C   BASIN
37          BA   0.007
38          LG    0.10    0.25    3.95    0.68       2
39          UC   0.221   0.215
40          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
41          UA     100
            *
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  42          KK  1CJUNC COMBINE
  43          KM    Combined flows from 1A, 1B, and 1C
  44          HC       3
  45          ZW      A=1CJUNC    C=FLOW    F=COMP
              *

  46          KK    1CST STORAGE
  47          KM    WSE computed in HEC1, not RAS
  48          KO
  49          RS       1    STOR
  50          SV            0.05    0.30    0.65    1.17    2.66    4.84    7.34   10.43   14.06
  51          SQ
  52          SE  1217.0 1218.00 1219.00 1220.00 1221.00 1222.00 1223.00 1224.00 1225.00 1226.00
              *
  53          ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   13          1A
               .
               .
   30          .          1B
               .           .
               .           .
   36          .           .          1C
               .           .           .
               .           .           .
   42      1CJUNC.......................
               V
               V
   46        1CST

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *              JUN   1998              *
 *           VERSION 4.1                *
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
```

```
*                                        *
*  RUN DATE   18MAY11  TIME  09:18:22     *
*                                        *
******************************************
```

```
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
                    Flood Control District of Maricopa County
                    GUADALUPE_24HR - FCDM001001 Guadalupe FDS
                    100 YEAR
                    24 Hour Storm
                    Unit Hydrograph: Clark
                    05/18/2011
                    Major Basin 01, North Watershed
                    WEST Consultants, Inc. - Riley Asburry
                    WSE for 1CST computed through HEC1, not RAS.

 12 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN           3  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1JAN11  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ        2000  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      5JAN11  ENDING DATE
                     NDTIME        0357  ENDING TIME
                     ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL     .05 HOURS
                       TOTAL TIME BASE   99.95 HOURS

         ENGLISH UNITS
              DRAINAGE AREA          SQUARE MILES
              PRECIPITATION DEPTH    INCHES
              LENGTH, ELEVATION      FEET
              FLOW                   CUBIC FEET PER SECOND
              STORAGE VOLUME         ACRE-FEET
              SURFACE AREA           ACRES
              TEMPERATURE            DEGREES FAHRENHEIT
 -----DSS---ZOPEN:  Existing File Opened,  File: 01-24HR.DSS
```

```
                    Unit:  71;  DSS Version: 6-JG
-----DSS---ZWRITE Unit  71; Vers.    6:  /1CJUNC/1CJUNC/FLOW/31DEC1910/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /1CJUNC/1CJUNC/FLOW/01JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /1CJUNC/1CJUNC/FLOW/02JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /1CJUNC/1CJUNC/FLOW/03JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /1CJUNC/1CJUNC/FLOW/04JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /1CJUNC/1CJUNC/FLOW/05JAN1911/3MIN/COMP/


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
  46 KK     *      1CST  *      STORAGE
            *            *
            **************

  48 KO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE
1
                                                  RUNOFF SUMMARY
                                             FLOW IN CUBIC FEET PER SECOND
                                           TIME IN HOURS,  AREA IN SQUARE MILES

                                     PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
         OPERATION        STATION    FLOW    PEAK                                           AREA      STAGE     MAX STAGE
+                                                        6-HOUR     24-HOUR     72-HOUR

         HYDROGRAPH AT
+                            1A       50.   12.10          7.          2.          1.        .04

         HYDROGRAPH AT
+                            1B       37.   12.15          5.          2.          1.        .04

         HYDROGRAPH AT
+                            1C        7.   12.05          1.          0.          0.        .01

         3 COMBINED AT
+                         1CJUNC      94.   12.10         12.          4.          1.        .09

         ROUTED TO
```

```
+                          1CST        0.     .00          0.          0.          0.        .09
+                                                                                                   1224.07       25.25


*** NORMAL END OF HEC-1 ***


   -----DSS---ZCLOSE Unit:  71,   File: 01-24HR.DSS
             Pointer Utilization:   .25
             Number of Records:      6
             File Size:     23.9  Kbytes
             Percent Inactive:    .0
```

```
1****************************************
 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *              JUN   1998              *
 *           VERSION 4.1                *
 *                                      *
 *  RUN DATE   18MAY11  TIME  09:19:11  *
 *                                      *
 ****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1

HEC-1 INPUT


```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   1          ID        Flood Control District of Maricopa County
   2          ID        GUADALUPE_24HR - FCDM001001 Guadalupe FDS
   3          ID        100 YEAR
   4          ID        24 Hour Storm
   5          ID        Unit Hydrograph: Clark
   6          ID        05/18/2011
   7          ID        Major Basin 02, Northeast Basin Watershed
```

```
ID        WEST Consultants, Inc. - Riley Asburry
ID        2DST and 2EST in HEC1 for schematic purposes, WSE computed in RAS.
ID        DSS imported into RAS at 2DST and 2EST
IT       2 01JAN11    0000    2000
IN      15
IO       5
*DIAGRAM
*
*

KK      2A   BASIN
BA   0.020
PB   3.446
PC   0.000   0.002   0.005   0.008   0.011   0.014   0.017   0.020   0.023   0.026
PC   0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056   0.060
PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
PC   0.110   0.115   0.120   0.126   0.133   0.140   0.147   0.155   0.163   0.172
PC   0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
PC   0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
PC   0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
PC   0.913   0.918   0.922   0.926   0.930   0.934   0.938   0.942   0.946   0.950
PC   0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977   0.980
PC   0.983   0.986   0.989   0.992   0.995   0.998   1.000
LG    0.25    0.29    3.95    0.51      22
UC   0.317   0.405
UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
UA     100
*

KK    2ART   ROUTE
RS       3    FLOW
RC   0.030   0.020   0.030     688  0.0090    2.00
RX    0.00   30.00   30.00   45.00   55.00   70.00   70.00  100.00
RY    0.80    0.50    0.00    0.20    0.20    0.00    0.50    0.80
*

KK      2B   BASIN
BA   0.034
LG    0.25    0.25    3.95    0.58      30
UC   0.278   0.283
UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
UA     100
*
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  42          KK  2BJUNC COMBINE
  43          HC       2
              *

  44          KK   2BJRT   ROUTE
  45          RS       3    FLOW
  46          RC   0.030   0.020   0.030    1578  0.0110    2.00
  47          RX    0.00   30.00   30.00   45.00   55.00   70.00   70.00  100.00
  48          RY    0.80    0.50    0.00    0.20    0.20    0.00    0.50    0.80
              *

  49          KK      2D   BASIN
  50          BA   0.045
  51          LG    0.23    0.25    3.95    0.60      36
  52          UC   0.291   0.254
  53          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
  54          UA     100
              *

  55          KK      2C   BASIN
  56          BA   0.008
  57          LG    0.25    0.25    3.95    0.58      30
  58          UC   0.284   0.427
  59          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
  60          UA     100
              *

  61          KK  2DJUNC COMBINE
  62          KM   Combined flows from 2A, 2B, 2C, and 2D. Total flow exported as DSS file and
  63          KM   imported into HEC RAS at 2DST
  64          HC       3
  65          ZW      A=2DJUNC    C=FLOW    F=COMP

  66          KK      2E   BASIN
  67          KM   DSS imported to HEC RAS at 2EST
  68          BA   0.004
  69          LG    0.10    0.25    3.95    0.68       1
  70          UC   0.137   0.100
  71          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
  72          UA     100
  73          ZW      A=2E    C=FLOW    F=COMP
              *
```

```
            74          ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    14          2A
                 V
                 V
    31        2ART
                 .
                 .
    36           .          2B
                 .           .
                 .           .
    42      2BJUNC............
                 V
                 V
    44       2BJRT
                 .
                 .
    49           .          2D
                 .           .
                 .           .
    55           .           .          2C
                 .           .           .
                 .           .           .
    61      2DJUNC........................
                 .
                 .
    66           .          2E

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *              JUN   1998              *
 *           VERSION 4.1                *
 *                                      *
 *  RUN DATE   18MAY11  TIME  09:19:11  *
 *                                      *
 ****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
                              Flood Control District of Maricopa County
                              GUADALUPE_24HR - FCDM001001 Guadalupe FDS
                              100 YEAR
                              24 Hour Storm
                              Unit Hydrograph: Clark
                              05/18/2011
                              Major Basin 02, Northeast Basin Watershed
                              WEST Consultants, Inc. - Riley Asburry
                              2DST and 2EST in HEC1 for schematic purposes, WSE computed in RAS.
                              DSS imported into RAS at 2DST and 2EST

 13 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN           2  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1JAN11  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ        2000  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      3JAN11  ENDING DATE
                     NDTIME        1838  ENDING TIME
                     ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL     .03 HOURS
                       TOTAL TIME BASE   66.63 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT
   -----DSS---ZOPEN:  Existing File Opened,  File: 02-24HR.DSS
                      Unit:  71;  DSS Version: 6-JG
-----DSS---ZWRITE Unit  71; Vers.    5:  /2DJUNC/2DJUNC/FLOW/31DEC1910/2MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    5:  /2DJUNC/2DJUNC/FLOW/01JAN1911/2MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    5:  /2DJUNC/2DJUNC/FLOW/02JAN1911/2MIN/COMP/
```

```
-----DSS---ZWRITE Unit  71; Vers.    5:  /2DJUNC/2DJUNC/FLOW/03JAN1911/2MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /2E/2E/FLOW/31DEC1910/2MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /2E/2E/FLOW/01JAN1911/2MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /2E/2E/FLOW/02JAN1911/2MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /2E/2E/FLOW/03JAN1911/2MIN/COMP/
1
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	2A	17.	12.13	2.	1.	0.	.02		
+	ROUTED TO	2ART	17.	12.20	2.	1.	0.	.02		
+									.31	12.20
+	HYDROGRAPH AT	2B	38.	12.10	5.	1.	1.	.03		
+	2 COMBINED AT	2BJUNC	53.	12.13	7.	2.	1.	.05		
+	ROUTED TO	2BJRT	51.	12.20	7.	2.	1.	.05		
+									.46	12.20
+	HYDROGRAPH AT	2D	54.	12.10	6.	2.	1.	.05		
+	HYDROGRAPH AT	2C	7.	12.10	1.	0.	0.	.01		
+	3 COMBINED AT	2DJUNC	106.	12.13	14.	5.	2.	.11		
+	HYDROGRAPH AT	2E	6.	12.03	0.	0.	0.	.00		

```
*** NORMAL END OF HEC-1 ***


   -----DSS---ZCLOSE Unit:  71,   File: 02-24HR.DSS
             Pointer Utilization:   .25
             Number of Records:      8
             File Size:     35.8  Kbytes
             Percent Inactive:    .0
```

```
1****************************************
 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *              JUN   1998              *
 *           VERSION 4.1                *
 *                                      *
 *  RUN DATE   18MAY11  TIME  09:18:46  *
 *                                      *
 ****************************************
```

```
****************************************
*                                      *
*   U.S. ARMY CORPS OF ENGINEERS       *
*   HYDROLOGIC ENGINEERING CENTER      *
*         609 SECOND STREET            *
*      DAVIS, CALIFORNIA 95616         *
*          (916) 756-1104              *
*                                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID        Flood Control District of Maricopa County
  2           ID        GUADALUPE_6HR - FCDM001001 Guadalupe FDS
  3           ID        100 YEAR
  4           ID        6 Hour  Storm
  5           ID        Unit Hydrograph: Clark
  6           ID        05/18/2011
  7           ID        Major Basin 02, Northeast Basin Watershed
```

```
 8          ID        WEST Consultants, Inc. - Riley Asburry
 9          ID        2DST and 2EST in HEC1 for schematic purposes, WSE computed in RAS.
10          ID        DSS imported into RAS at 2DST and 2EST
11          IT       2 01JAN11    0000    2000
12          IN      15
13          IO       5
            *DIAGRAM
            *
            *

14          KK      2A   BASIN
15          BA   0.020
16          PB   2.517
17          PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
18          PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
19          PC   0.962   0.972   0.983   0.991   1.000
20          LG    0.25    0.29    3.95    0.51      22
21          UC   0.319   0.409
22          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
23          UA     100
            *

24          KK    2ART   ROUTE
25          RS       3    FLOW
26          RC   0.030   0.020   0.030     688  0.0090    2.00
27          RX    0.00   30.00   30.00   45.00   55.00   70.00   70.00  100.00
28          RY    0.80    0.50    0.00    0.20    0.20    0.00    0.50    0.80
            *

29          KK      2B   BASIN
30          BA   0.034
31          LG    0.25    0.25    3.95    0.58      30
32          UC   0.277   0.283
33          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
34          UA     100
            *

35          KK  2BJUNC COMBINE
36          HC       2
            *

37          KK   2BJRT   ROUTE
38          RS       3    FLOW
39          RC   0.030   0.020   0.030    1578  0.0110    2.00
40          RX    0.00   30.00   30.00   45.00   55.00   70.00   70.00  100.00
```

```
          41          RY    0.80    0.50    0.00    0.20    0.20    0.00    0.50    0.80
                      *
1                                                HEC-1 INPUT                                                PAGE  2

        LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


          42          KK      2D   BASIN
          43          BA   0.045
          44          LG    0.23    0.25    3.95    0.60      36
          45          UC   0.289   0.252
          46          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
          47          UA     100
                      *

          48          KK      2C   BASIN
          49          BA   0.008
          50          LG    0.25    0.25    3.95    0.58      30
          51          UC   0.283   0.426
          52          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
          53          UA     100
                      *

          54          KK  2DJUNC COMBINE
          55          KM   Combined flows from 2A, 2B, 2C, and 2D. Total flow exported as DSS file and
          56          KM   imported into HEC RAS at 2DST
          57          HC       3
          58          ZW      A=2DJUNC    C=FLOW    F=COMP
                      *

          59          KK      2E   BASIN
          60          KM   DSS imported to HEC RAS at 2EST
          61          BA   0.004
          62          LG    0.10    0.25    3.95    0.68       1
          63          UC   0.139   0.102
          64          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
          65          UA     100
          66          ZW      A=2E    C=FLOW    F=COMP
                      *
          67          ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW
```

```
 NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

  14          2A
               V
               V
  24        2ART
               .
               .
  29           .          2B
               .           .
               .           .
  35      2BJUNC............
               V
               V
  37       2BJRT
               .
               .
  42           .          2D
               .           .
               .           .
  48           .           .          2C
               .           .           .
               .           .           .
  54      2DJUNC........................
               .
               .
  59           .          2E

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *               JUN   1998              *
 *            VERSION 4.1                *
 *                                       *
 *  RUN DATE   18MAY11  TIME  09:18:46   *
 *                                       *
 *****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************
```

```
                                100 YEAR
                                6 Hour  Storm
                                Unit Hydrograph: Clark
                                05/18/2011
                                Major Basin 02, Northeast Basin Watershed
                                WEST Consultants, Inc. - Riley Asburry
                                2DST and 2EST in HEC1 for schematic purposes, WSE computed in RAS.
                                DSS imported into RAS at 2DST and 2EST

  13 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           2  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1JAN11  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        2000  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      3JAN11  ENDING DATE
                      NDTIME        1838  ENDING TIME
                      ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL     .03 HOURS
                       TOTAL TIME BASE   66.63 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT
    -----DSS---ZOPEN:  Existing File Opened,  File: 02-6HR.DSS
                       Unit:  71;  DSS Version: 6-JG
 -----DSS---ZWRITE Unit  71; Vers.    8:  /2DJUNC/2DJUNC/FLOW/31DEC1910/2MIN/COMP/
 -----DSS---ZWRITE Unit  71; Vers.    8:  /2DJUNC/2DJUNC/FLOW/01JAN1911/2MIN/COMP/
 -----DSS---ZWRITE Unit  71; Vers.    8:  /2DJUNC/2DJUNC/FLOW/02JAN1911/2MIN/COMP/
 -----DSS---ZWRITE Unit  71; Vers.    8:  /2DJUNC/2DJUNC/FLOW/03JAN1911/2MIN/COMP/
 -----DSS---ZWRITE Unit  71; Vers.    7:  /2E/2E/FLOW/31DEC1910/2MIN/COMP/
 -----DSS---ZWRITE Unit  71; Vers.    7:  /2E/2E/FLOW/01JAN1911/2MIN/COMP/
 -----DSS---ZWRITE Unit  71; Vers.    7:  /2E/2E/FLOW/02JAN1911/2MIN/COMP/
 -----DSS---ZWRITE Unit  71; Vers.    7:  /2E/2E/FLOW/03JAN1911/2MIN/COMP/
1
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	2A	20.	4.13	3.	1.	0.	.02		
+	ROUTED TO	2ART	20.	4.17	3.	1.	0.	.02		
+									.33	4.17
+	HYDROGRAPH AT	2B	45.	4.10	5.	1.	0.	.03		
+	2 COMBINED AT	2BJUNC	63.	4.13	7.	2.	1.	.05		
+	ROUTED TO	2BJRT	61.	4.20	7.	2.	1.	.05		
+									.50	4.20
+	HYDROGRAPH AT	2D	65.	4.10	7.	2.	1.	.05		
+	HYDROGRAPH AT	2C	8.	4.10	1.	0.	0.	.01		
+	3 COMBINED AT	2DJUNC	128.	4.13	16.	4.	1.	.11		
+	HYDROGRAPH AT	2E	7.	4.03	0.	0.	0.	.00		

*** NORMAL END OF HEC-1 ***

-----DSS---ZCLOSE Unit: 71, File: 02-6HR.DSS
Pointer Utilization: .25

```
Number of Records:      8
File Size:     35.8  Kbytes
Percent Inactive:    .0
```

```
1****************************************
 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *              JUN   1998              *
 *           VERSION 4.1                *
 *                                      *
 *  RUN DATE   18MAY11  TIME  09:19:54  *
 *                                      *
 ****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID        Flood Control District of Maricopa County
  2           ID        GUADALUPE_24HR - FCDM001001 Guadalupe FDS
  3           ID        100 YEAR
  4           ID        24 Hour Storm
  5           ID        Unit Hydrograph: Clark
  6           ID        05/18/2011
  7           ID        Major Basin 03, Central Basin
```

```
 8          ID        WEST Consultants, Inc. - Riley Asburry
 9          ID        3AST, 3EST and 4DST in HEC1 for schematic purposes, WSE computed in RAS.
10          ID        DSS imported into RAS at 3AST, 3EST and 4DST from 3CJUNC, 3EJUNC, and
11          ID        4DJUNC respectively.
12          IT       3 01JAN11    0000    2000
13          IN      15
14          IO       5
            *DIAGRAM
            *
            *

15          KK      3A   BASIN
16          BA   0.033
17          PB   3.442
18          PC   0.000   0.002   0.005   0.008   0.011   0.014   0.017   0.020   0.023   0.026
19          PC   0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056   0.060
20          PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
21          PC   0.110   0.115   0.120   0.126   0.133   0.140   0.147   0.155   0.163   0.172
22          PC   0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
23          PC   0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
24          PC   0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
25          PC   0.913   0.918   0.922   0.926   0.930   0.934   0.938   0.942   0.946   0.950
26          PC   0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977   0.980
27          PC   0.983   0.986   0.989   0.992   0.995   0.998   1.000
28          LG    0.25    0.25    3.95    0.58      30
29          UC   0.257   0.225
30          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
31          UA     100
            *

32          KK      3B   BASIN
33          BA   0.032
34          LG    0.27    0.27    3.95    0.56      24
35          UC   0.297   0.308
36          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
37          UA     100
            *

38          KK    3BRT   ROUTE
39          RS       3    FLOW
40          RC   0.030   0.020   0.030    1970  0.0120    2.00
41          RX    0.00   30.00   30.00   41.00   49.00   60.00   60.00   90.00
42          RY    0.80    0.50    0.00    0.20    0.20    0.00    0.50    0.80
            *
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  43          KK      3C   BASIN
  44          BA   0.031
  45          LG    0.20    0.25    3.95    0.61      21
  46          UC   0.354   0.415
  47          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
  48          UA     100
              *

  49          KK  3CJUNC COMBINE
  50          KM   DSS file imported to HEC RAS at 3AST
  51          HC       3
  52          ZW      A=3CJUNC    C=FLOW    F=COMP
              *

  53          KK      3D   BASIN
  54          BA   0.026
  55          LG    0.25    0.25    3.95    0.57      28
  56          UC   0.293   0.335
  57          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
  58          UA     100
              *

  59          KK   3DDIV  DIVERT
  60          KM   Represents storm drain system connecting 3D to 4D
  61          DT  DT3DDV   100.0    62.0
  62          DI     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  63          DQ     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
              *

  64          KK    3DRT   ROUTE
  65          RS       3    FLOW
  66          RC   0.030   0.020   0.030     329  0.0120    2.00
  67          RX    0.00   30.00   30.00   41.00   49.00   60.00   60.00   90.00
  68          RY    0.80    0.50    0.00    0.20    0.20    0.00    0.50    0.80
              *

  69          KK      3E   BASIN
  70          BA   0.010
  71          LG    0.25    0.25    3.95    0.58      30
  72          UC   0.121   0.052
  73          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
```

```
 74          UA     100
             *

 75          KK  3EJUNC COMBINE
 76          KM   DSS imported to HEC RAS at 3EST
 77          HC       2
 78          ZW      A=3EJUNC    C=FLOW    F=COMP
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 79          KK      4A   BASIN
 80          BA   0.018
 81          LG    0.11    0.25    3.95    0.68      77
 82          UC   0.254   0.255
 83          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 84          UA     100
             *

 85          KK    4ADV  DIVERT
 86          KM   Represents retention basin in 4A
 87          DT  DT4ADV     0.3  1000.0
 88          DI     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 89          DQ     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
             *

 90          KK   4ASRT   ROUTE
 91          RS       3    FLOW
 92          RC   0.035   0.035   0.035    1059  0.0150    2.00
 93          RX    0.00   15.00   30.00   45.00   55.00   70.00   85.00  100.00
 94          RY    0.80    0.00    0.30    5.00    0.50    0.30    0.00    0.80
             *

 95          KK      4B   BASIN
 96          BA   0.032
 97          LG    0.25    0.25    3.95    0.57      29
 98          UC   0.277   0.241
 99          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
100          UA     100
             *

101          KK  4BJUNC COMBINE
102          HC       2
```

```
                *

103             KK   4BJRT   ROUTE
104             RS       3    FLOW
105             RC   0.035   0.020   0.035     837  0.0130    2.00
106             RX    0.00   15.00   30.00   50.00   60.00   80.00   95.00  110.00
107             RY    0.80    0.00    0.30    0.50    0.50    0.30    0.00    0.80
                *

108             KK      5A   BASIN
109             BA   0.006
110             LG    0.35    0.35    3.95    0.47       1
111             UC   0.276   0.300
112             UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
113             UA     100
                *
```



```
LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

114             KK    5ART   ROUTE
115             RS       3    FLOW
116             RC   0.035   0.025   0.035    1812  0.0130    2.00
117             RX    0.00   30.00   30.00   41.00   49.00   60.00   60.00   90.00
118             RY    0.80    0.50    0.00    0.20    0.20    0.00    0.50    0.80
                *

119             KK      5B   BASIN
120             BA   0.044
121             LG    0.25    0.25    3.95    0.58      30
122             UC   0.264   0.211
123             UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
124             UA     100
                *

125             KK  5BJUNC COMBINE
126             HC       2
                *

127             KK   5BJRT   ROUTE
128             RS       3    FLOW
129             RC   0.035   0.020   0.035    1197  0.0090    2.00
130             RX    0.00   15.00   30.00   41.00   49.00   60.00   75.00   90.00
131             RY    0.80    0.00    0.30    0.50    0.50    0.30    0.00    0.80
```

```
                *

132             KK      5C   BASIN
133             BA   0.019
134             LG    0.15    0.27    3.95    0.64      65
135             UC   0.258   0.252
136             UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
137             UA     100
                *

138             KK    5CDV  DIVERT
139             KM   Represents retention basin in 5C
140             DT  DT5CDV     0.3  1000.0
141             DI     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
142             DQ     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
                *

143             KK  5CJUNC COMBINE
144             HC       3
                *

145             KK   5CJRT   ROUTE
146             RS       3    FLOW
147             RC   0.035   0.035   0.035     786  0.0130    2.00
148             RX    0.00   15.00   30.00   41.00   49.00   60.00   75.00   90.00
149             RY    0.80    0.00    0.30    0.50    0.50    0.30    0.00    0.80
                *
```



```
LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

150             KK      4C   BASIN
151             BA   0.051
152             LG    0.26    0.26    3.95    0.57      28
153             UC   0.265   0.181
154             UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
155             UA     100
                *

156             KK      5D   BASIN
157             BA   0.014
158             LG    0.25    0.25    3.95    0.58      30
159             UC   0.240   0.267
160             UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
```

```
161          UA     100
             *

162          KK      4D   BASIN
163          BA   0.009
164          LG    0.10    0.25    3.95    0.69      11
165          UC   0.135   0.070
166          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
167          UA     100
             *

168          KK   R3DDVRETRIEVE
169          DR  DT3DDV
             *

170          KK  4DJUNC COMBINE
171          KM   DSS imported to HEC RAS at 4DST
172          HC       5
173          ZW      A=4DJUNC    C=FLOW    F=COMP
             *
174          ZZ
```

1

```
                SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    15          3A
                 .
                 .
    32           .          3B
                 .           V
                 .           V
    38           .        3BRT
                 .           .
                 .           .
    43           .           .          3C
                 .           .           .
                 .           .           .
    49      3CJUNC.......................
                 .
                 .
    53           .          3D
                 .           .
```

```
                .           .
61              .           .-------> DT3DDV
59              .       3DDIV
                .           V
                .           V
64              .        3DRT
                .           .
                .           .
69              .           .          3E
                .           .           .
                .           .           .
75              .      3EJUNC............
                .           .
                .           .
79              .           .          4A
                .           .           .
                .           .           .
87              .           .           .-------> DT4ADV
85              .           .        4ADV
                .           .           V
                .           .           V
90              .           .       4ASRT
                .           .           .
                .           .           .
95              .           .           .          4B
                .           .           .           .
                .           .           .           .
101             .           .      4BJUNC............
                .           .           V
                .           .           V
103             .           .       4BJRT
                .           .           .
                .           .           .
108             .           .           .          5A
                .           .           .           V
                .           .           .           V
114             .           .           .        5ART
                .           .           .           .
                .           .           .           .
119             .           .           .           .          5B
                .           .           .           .           .
                .           .           .           .           .
125             .           .           .      5BJUNC............
                .           .           .           V
                .           .           .           V
```

```
127          .          .          .      5BJRT
             .          .          .          .
             .          .          .          .
132          .          .          .          .         5C
             .          .          .          .          .
             .          .          .          .          .
140          .          .          .          .          .-------> DT5CDV
138          .          .          .          .       5CDV
             .          .          .          .          .
             .          .          .          .          .
143          .          .     5CJUNC.......................
             .          .          V
             .          .          V
145          .          .      5CJRT
             .          .          .
             .          .          .
150          .          .          .         4C
             .          .          .          .
             .          .          .          .
156          .          .          .          .         5D
             .          .          .          .          .
             .          .          .          .          .
162          .          .          .          .          .         4D
             .          .          .          .          .          .
             .          .          .          .          .          .
169          .          .          .          .          .          .          .<------- DT3DDV
168          .          .          .          .          .          .      R3DDV
             .          .          .          .          .          .          .
             .          .          .          .          .          .          .
170          .          .     4DJUNC.............................................
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUN   1998              *
*           VERSION 4.1                *
*                                      *
*  RUN DATE   18MAY11  TIME  09:19:54  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
                              Flood Control District of Maricopa County
                              GUADALUPE_24HR - FCDM001001 Guadalupe FDS
                              100 YEAR
                              24 Hour Storm
                              Unit Hydrograph: Clark
                              05/18/2011
                              Major Basin 03, Central Basin
                              WEST Consultants, Inc. - Riley Asburry
                              3AST, 3EST and 4DST in HEC1 for schematic purposes, WSE computed in RAS.
                              DSS imported into RAS at 3AST, 3EST and 4DST from 3CJUNC, 3EJUNC, and
                              4DJUNC respectively.

 14 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN           3  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1JAN11  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ        2000  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      5JAN11  ENDING DATE
                     NDTIME        0357  ENDING TIME
                      ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL     .05 HOURS
                       TOTAL TIME BASE   99.95 HOURS

         ENGLISH UNITS
              DRAINAGE AREA         SQUARE MILES
              PRECIPITATION DEPTH   INCHES
              LENGTH, ELEVATION     FEET
              FLOW                  CUBIC FEET PER SECOND
              STORAGE VOLUME        ACRE-FEET
              SURFACE AREA          ACRES
              TEMPERATURE           DEGREES FAHRENHEIT
   -----DSS---ZOPEN:  Existing File Opened,  File: 03-24HR.DSS
                      Unit:  71;  DSS Version: 6-JG
-----DSS---ZWRITE Unit  71; Vers.    4:  /3CJUNC/3CJUNC/FLOW/31DEC1910/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /3CJUNC/3CJUNC/FLOW/01JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /3CJUNC/3CJUNC/FLOW/02JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /3CJUNC/3CJUNC/FLOW/03JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /3CJUNC/3CJUNC/FLOW/04JAN1911/3MIN/COMP/
```

```
-----DSS---ZWRITE Unit  71; Vers.    4:  /3CJUNC/3CJUNC/FLOW/05JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /3EJUNC/3EJUNC/FLOW/31DEC1910/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /3EJUNC/3EJUNC/FLOW/01JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /3EJUNC/3EJUNC/FLOW/02JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /3EJUNC/3EJUNC/FLOW/03JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /3EJUNC/3EJUNC/FLOW/04JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /3EJUNC/3EJUNC/FLOW/05JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /4DJUNC/4DJUNC/FLOW/31DEC1910/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /4DJUNC/4DJUNC/FLOW/01JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /4DJUNC/4DJUNC/FLOW/02JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /4DJUNC/4DJUNC/FLOW/03JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /4DJUNC/4DJUNC/FLOW/04JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /4DJUNC/4DJUNC/FLOW/05JAN1911/3MIN/COMP/
1
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	3A	41.	12.10	4.	1.	0.	.03		
+	HYDROGRAPH AT	3B	32.	12.10	4.	1.	0.	.03		
+	ROUTED TO	3BRT	30.	12.25	4.	1.	0.	.03		
+									.41	12.25
+	HYDROGRAPH AT	3C	25.	12.15	4.	1.	0.	.03		
+	3 COMBINED AT	3CJUNC	89.	12.15	12.	4.	1.	.10		
+	HYDROGRAPH AT	3D	26.	12.10	3.	1.	0.	.03		
+	DIVERSION TO	DT3DDV	26.	.00	3.	1.	0.	.03		
	HYDROGRAPH AT									

+	3DDIV	0.	.00	0.	0.	0.	.03		
ROUTED TO									
+	3DRT	0.	.00	0.	0.	0.	.03		
+								.00	15.10
HYDROGRAPH AT									
+	3E	19.	12.00	1.	0.	0.	.01		
2 COMBINED AT									
+	3EJUNC	19.	12.00	1.	0.	0.	.04		
HYDROGRAPH AT									
+	4A	26.	12.10	4.	1.	0.	.02		
DIVERSION TO									
+	DT4ADV	1.	12.10	0.	0.	0.	.02		
HYDROGRAPH AT									
+	4ADV	26.	12.10	4.	1.	0.	.02		
ROUTED TO									
+	4ASRT	25.	12.20	4.	1.	0.	.02		
+								.42	12.20
HYDROGRAPH AT									
+	4B	38.	12.10	4.	1.	0.	.03		
2 COMBINED AT									
+	4BJUNC	60.	12.10	8.	3.	1.	.05		
ROUTED TO									
+	4BJRT	59.	12.20	8.	3.	1.	.05		
+								.55	12.20
HYDROGRAPH AT									
+	5A	5.	12.10	0.	0.	0.	.01		
ROUTED TO									
+	5ART	4.	12.40	0.	0.	0.	.01		
+								.22	12.40
HYDROGRAPH AT									
+	5B	55.	12.10	6.	2.	1.	.04		

```
          2 COMBINED AT
+                        5BJUNC       56.   12.10          6.          2.          1.        .05
          ROUTED TO
+                         5BJRT       52.   12.20          6.          2.          1.        .05
+                                                                                          .59       12.20
          HYDROGRAPH AT
+                           5C        26.   12.10          4.          1.          0.        .02
          DIVERSION TO
+                        DT5CDV        1.   12.10          0.          0.          0.        .02
          HYDROGRAPH AT
+                          5CDV       26.   12.10          4.          1.          0.        .02
          3 COMBINED AT
+                        5CJUNC      133.   12.20         18.          6.          2.        .12
          ROUTED TO
+                         5CJRT      132.   12.25         18.          6.          2.        .12
+                                                                                          .81       12.25
          HYDROGRAPH AT
+                           4C        67.   12.05          7.          2.          1.        .05
          HYDROGRAPH AT
+                           5D        16.   12.10          2.          1.          0.        .01
          HYDROGRAPH AT
+                           4D        15.   12.00          1.          0.          0.        .01
          HYDROGRAPH AT
+                        R3DDV        26.   12.10          3.          1.          0.        .00
          5 COMBINED AT
+                        4DJUNC      219.   12.15         31.          9.          3.        .19


 *** NORMAL END OF HEC-1 ***


    -----DSS---ZCLOSE Unit:  71,   File: 03-24HR.DSS
```

```
Pointer Utilization:   .25
Number of Records:     18
File Size:     57.5  Kbytes
Percent Inactive:    .0
```

```
1****************************************
 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *              JUN   1998              *
 *           VERSION 4.1                *
 *                                      *
 *  RUN DATE   18MAY11  TIME  09:19:33  *
 *                                      *
 ****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   1          ID        Flood Control District of Maricopa County
   2          ID        GUADALUPE_6HR - FCDM001001 Guadalupe FDS
   3          ID        100 YEAR
   4          ID        6 Hour  Storm
   5          ID        Unit Hydrograph: Clark
   6          ID        05/18/2011
   7          ID        Major Basin 03, Central Basin
```

```
 8          ID        WEST Consultants, Inc. - Riley Asburry
 9          ID        3AST, 3EST and 4DST in HEC1 for schematic purposes, WSE computed in RAS.
10          ID        DSS imported into RAS at 3AST, 3EST and 4DST from 3CJUNC, 3EJUNC, and
11          ID        4DJUNC respectively.
12          IT       3 01JAN11    0000    2000
13          IN      15
14          IO       5
            *DIAGRAM
            *
            *

15          KK      3A   BASIN
16          BA   0.033
17          PB   2.510
18          PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
19          PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
20          PC   0.962   0.972   0.983   0.991   1.000
21          LG    0.25    0.25    3.95    0.58      30
22          UC   0.257   0.225
23          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
24          UA     100
            *

25          KK      3B   BASIN
26          BA   0.032
27          LG    0.27    0.27    3.95    0.56      24
28          UC   0.298   0.310
29          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
30          UA     100
            *

31          KK    3BRT   ROUTE
32          RS       3    FLOW
33          RC   0.030   0.020   0.030    1970  0.0120    2.00
34          RX    0.00   30.00   30.00   41.00   49.00   60.00   60.00   90.00
35          RY    0.80    0.50    0.00    0.20    0.20    0.00    0.50    0.80
            *

36          KK      3C   BASIN
37          BA   0.031
38          LG    0.20    0.25    3.95    0.61      21
39          UC   0.356   0.417
40          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
41          UA     100
            *
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  42          KK  3CJUNC COMBINE
  43          KM   DSS file imported to HEC RAS at 3AST
  44          HC       3
  45          ZW      A=3CJUNC    C=FLOW    F=COMP
              *

  46          KK      3D   BASIN
  47          BA   0.026
  48          LG    0.25    0.25    3.95    0.57      28
  49          UC   0.294   0.336
  50          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
  51          UA     100
              *

  52          KK   3DDIV  DIVERT
  53          KM   Represents storm drain system connecting 3D to 4D
  54          DT  DT3DDV   100.0    62.0
  55          DI     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  56          DQ     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
              *

  57          KK    3DRT   ROUTE
  58          RS       3    FLOW
  59          RC   0.030   0.020   0.030     329  0.0120    2.00
  60          RX    0.00   30.00   30.00   41.00   49.00   60.00   60.00   90.00
  61          RY    0.80    0.50    0.00    0.20    0.20    0.00    0.50    0.80
              *

  62          KK      3E   BASIN
  63          BA   0.010
  64          LG    0.25    0.25    3.95    0.58      30
  65          UC   0.121   0.052
  66          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
  67          UA     100
              *

  68          KK  3EJUNC COMBINE
  69          KM   DSS imported to HEC RAS at 3EST
  70          HC       2
  71          ZW      A=3EJUNC    C=FLOW    F=COMP
```

```
                *

 72             KK      4A   BASIN
 73             BA   0.018
 74             LG    0.11    0.25    3.95    0.68      77
 75             UC   0.248   0.248
 76             UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 77             UA     100
                *
```



```
LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 78             KK    4ADV  DIVERT
 79             KM   Represents retention basin in 4A
 80             DT  DT4ADV     0.3  1000.0
 81             DI     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 82             DQ     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
                *

 83             KK   4ASRT   ROUTE
 84             RS       3    FLOW
 85             RC   0.035   0.035   0.035    1059  0.0150    2.00
 86             RX    0.00   15.00   30.00   45.00   55.00   70.00   85.00  100.00
 87             RY    0.80    0.00    0.30    5.00    0.50    0.30    0.00    0.80
                *

 88             KK      4B   BASIN
 89             BA   0.032
 90             LG    0.25    0.25    3.95    0.57      29
 91             UC   0.277   0.242
 92             UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 93             UA     100
                *

 94             KK  4BJUNC COMBINE
 95             HC       2
                *

 96             KK   4BJRT   ROUTE
 97             RS       3    FLOW
 98             RC   0.035   0.020   0.035     837  0.0130    2.00
 99             RX    0.00   15.00   30.00   50.00   60.00   80.00   95.00  110.00
100             RY    0.80    0.00    0.30    0.50    0.50    0.30    0.00    0.80
```

```
                *

101             KK      5A   BASIN
102             BA   0.006
103             LG    0.35    0.35    3.95    0.47       1
104             UC   0.285   0.311
105             UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
106             UA     100
                *

107             KK    5ART   ROUTE
108             RS       3    FLOW
109             RC   0.035   0.025   0.035    1812  0.0130    2.00
110             RX    0.00   30.00   30.00   41.00   49.00   60.00   60.00   90.00
111             RY    0.80    0.50    0.00    0.20    0.20    0.00    0.50    0.80
                *

112             KK      5B   BASIN
113             BA   0.044
114             LG    0.25    0.25    3.95    0.58      30
115             UC   0.264   0.211
116             UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
117             UA     100
                *
```



```
LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


118             KK  5BJUNC COMBINE
119             HC       2
                *

120             KK   5BJRT   ROUTE
121             RS       3    FLOW
122             RC   0.035   0.020   0.035    1197  0.0090    2.00
123             RX    0.00   15.00   30.00   41.00   49.00   60.00   75.00   90.00
124             RY    0.80    0.00    0.30    0.50    0.50    0.30    0.00    0.80
                *

125             KK      5C   BASIN
126             BA   0.019
127             LG    0.15    0.27    3.95    0.64      65
128             UC   0.253   0.246
129             UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
```

```
130          UA     100
             *

131          KK    5CDV  DIVERT
132          KM   Represents retention basin in 5C
133          DT  DT5CDV     0.3  1000.0
134          DI     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
135          DQ     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
             *

136          KK  5CJUNC COMBINE
137          HC       3
             *

138          KK   5CJRT   ROUTE
139          RS       3    FLOW
140          RC   0.035   0.035   0.035     786  0.0130    2.00
141          RX    0.00   15.00   30.00   41.00   49.00   60.00   75.00   90.00
142          RY    0.80    0.00    0.30    0.50    0.50    0.30    0.00    0.80
             *

143          KK      4C   BASIN
144          BA   0.051
145          LG    0.26    0.26    3.95    0.57      28
146          UC   0.266   0.182
147          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
148          UA     100
             *

149          KK      5D   BASIN
150          BA   0.014
151          LG    0.25    0.25    3.95    0.58      30
152          UC   0.240   0.267
153          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
154          UA     100
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

155          KK      4D   BASIN
156          BA   0.009
157          LG    0.10    0.25    3.95    0.69      11
158          UC   0.136   0.070
```

```
159          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
160          UA     100
             *

161          KK   R3DDVRETRIEVE
162          DR  DT3DDV
             *

163          KK  4DJUNC COMBINE
164          KM   DSS imported to HEC RAS at 4DST
165          HC       5
166          ZW      A=4DJUNC    C=FLOW    F=COMP
             *
167          ZZ
```

1

```
                SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    15          3A
                 .
                 .
    25           .          3B
                 .           V
                 .           V
    31           .        3BRT
                 .           .
                 .           .
    36           .           .          3C
                 .           .           .
                 .           .           .
    42      3CJUNC.......................
                 .
                 .
    46           .          3D
                 .           .
                 .           .
    54           .           .-------->  DT3DDV
    52           .       3DDIV
                 .           V
                 .           V
    57           .        3DRT
                 .           .
```

```
                .           .
 62             .           .          3E
                .           .           .
                .           .           .
 68             .      3EJUNC............
                .           .
                .           .
 72             .           .          4A
                .           .           .
                .           .           .
 80             .           .           .-------> DT4ADV
 78             .           .        4ADV
                .           .           V
                .           .           V
 83             .           .       4ASRT
                .           .           .
                .           .           .
 88             .           .           .          4B
                .           .           .           .
                .           .           .           .
 94             .           .      4BJUNC............
                .           .           V
                .           .           V
 96             .           .       4BJRT
                .           .           .
                .           .           .
101             .           .           .          5A
                .           .           .           V
                .           .           .           V
107             .           .           .        5ART
                .           .           .           .
                .           .           .           .
112             .           .           .           .          5B
                .           .           .           .           .
                .           .           .           .           .
118             .           .           .      5BJUNC............
                .           .           .           V
                .           .           .           V
120             .           .           .       5BJRT
                .           .           .           .
                .           .           .           .
125             .           .           .           .          5C
                .           .           .           .           .
                .           .           .           .           .
133             .           .           .           .           .-------> DT5CDV
```

```
 131          .          .          .          .       5CDV
              .          .          .          .          .
              .          .          .          .          .
 136          .          .     5CJUNC.......................
              .          .          V
              .          .          V
 138          .          .      5CJRT
              .          .          .
              .          .          .
 143          .          .          .         4C
              .          .          .          .
              .          .          .          .
 149          .          .          .          .         5D
              .          .          .          .          .
              .          .          .          .          .
 155          .          .          .          .          .         4D
              .          .          .          .          .          .
              .          .          .          .          .          .
 162          .          .          .          .          .          .          .<-------  DT3DDV
 161          .          .          .          .          .          .      R3DDV
              .          .          .          .          .          .          .
              .          .          .          .          .          .          .
 163          .          .     4DJUNC.............................................
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUN   1998              *
*           VERSION 4.1                *
*                                      *
*  RUN DATE   18MAY11  TIME  09:19:33  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

Flood Control District of Maricopa County
GUADALUPE_6HR - FCDM001001 Guadalupe FDS
100 YEAR
6 Hour Storm
Unit Hydrograph: Clark
05/18/2011

```
                              Major Basin 03, Central Basin
                              WEST Consultants, Inc. - Riley Asburry
                              3AST, 3EST and 4DST in HEC1 for schematic purposes, WSE computed in RAS.
                              DSS imported into RAS at 3AST, 3EST and 4DST from 3CJUNC, 3EJUNC, and
                              4DJUNC respectively.

 14 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN           3  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1JAN11  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ        2000  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      5JAN11  ENDING DATE
                     NDTIME        0357  ENDING TIME
                      ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL     .05 HOURS
                       TOTAL TIME BASE   99.95 HOURS

         ENGLISH UNITS
              DRAINAGE AREA          SQUARE MILES
              PRECIPITATION DEPTH    INCHES
              LENGTH, ELEVATION      FEET
              FLOW                   CUBIC FEET PER SECOND
              STORAGE VOLUME         ACRE-FEET
              SURFACE AREA           ACRES
              TEMPERATURE            DEGREES FAHRENHEIT
   -----DSS---ZOPEN:  Existing File Opened,  File: 03-6HR.DSS
                      Unit:  71;  DSS Version: 6-JG
-----DSS---ZWRITE Unit  71; Vers.    4:  /3CJUNC/3CJUNC/FLOW/31DEC1910/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /3CJUNC/3CJUNC/FLOW/01JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /3CJUNC/3CJUNC/FLOW/02JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /3CJUNC/3CJUNC/FLOW/03JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /3CJUNC/3CJUNC/FLOW/04JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /3CJUNC/3CJUNC/FLOW/05JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /3EJUNC/3EJUNC/FLOW/31DEC1910/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /3EJUNC/3EJUNC/FLOW/01JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /3EJUNC/3EJUNC/FLOW/02JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /3EJUNC/3EJUNC/FLOW/03JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /3EJUNC/3EJUNC/FLOW/04JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /3EJUNC/3EJUNC/FLOW/05JAN1911/3MIN/COMP/
```

```
-----DSS---ZWRITE Unit  71; Vers.    4:  /4DJUNC/4DJUNC/FLOW/31DEC1910/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /4DJUNC/4DJUNC/FLOW/01JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /4DJUNC/4DJUNC/FLOW/02JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /4DJUNC/4DJUNC/FLOW/03JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /4DJUNC/4DJUNC/FLOW/04JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    4:  /4DJUNC/4DJUNC/FLOW/05JAN1911/3MIN/COMP/
1
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	3A	49.	4.10	5.	1.	0.	.03		
+	HYDROGRAPH AT	3B	38.	4.10	4.	1.	0.	.03		
+	ROUTED TO	3BRT	36.	4.20	4.	1.	0.	.03		
+									.45	4.20
+	HYDROGRAPH AT	3C	30.	4.15	4.	1.	0.	.03		
+	3 COMBINED AT	3CJUNC	107.	4.15	13.	3.	1.	.10		
+	HYDROGRAPH AT	3D	31.	4.10	4.	1.	0.	.03		
+	DIVERSION TO	DT3DDV	31.	.00	4.	1.	0.	.03		
+	HYDROGRAPH AT	3DDIV	0.	.00	0.	0.	0.	.03		
+	ROUTED TO	3DRT	0.	.00	0.	0.	0.	.03		
+									.00	7.65
	HYDROGRAPH AT									

+		3E	24.	4.00	1.	0.	0.	.01	
	2 COMBINED AT								
+		3EJUNC	24.	4.00	1.	0.	0.	.04	
	HYDROGRAPH AT								
+		4A	32.	4.10	4.	1.	0.	.02	
	DIVERSION TO								
+		DT4ADV	5.	4.10	1.	0.	0.	.02	
	HYDROGRAPH AT								
+		4ADV	32.	4.10	3.	1.	0.	.02	
	ROUTED TO								
+		4ASRT	30.	4.20	3.	1.	0.	.02	
+									.45 4.20
	HYDROGRAPH AT								
+		4B	45.	4.10	5.	1.	0.	.03	
	2 COMBINED AT								
+		4BJUNC	73.	4.10	8.	2.	1.	.05	
	ROUTED TO								
+		4BJRT	72.	4.20	8.	2.	1.	.05	
+									.58 4.20
	HYDROGRAPH AT								
+		5A	6.	4.10	1.	0.	0.	.01	
	ROUTED TO								
+		5ART	4.	4.35	1.	0.	0.	.01	
+									.22 4.35
	HYDROGRAPH AT								
+		5B	66.	4.10	6.	2.	1.	.04	
	2 COMBINED AT								
+		5BJUNC	67.	4.10	7.	2.	1.	.05	
	ROUTED TO								
+		5BJRT	63.	4.20	7.	2.	1.	.05	
+									.63 4.20

```
          HYDROGRAPH AT
+                          5C        32.    4.10          4.          1.          0.        .02

          DIVERSION TO
+                       DT5CDV         5.    4.10          1.          0.          0.        .02

          HYDROGRAPH AT
+                         5CDV        32.    4.10          3.          1.          0.        .02

          3 COMBINED AT
+                       5CJUNC       160.    4.15         18.          5.          2.        .12

          ROUTED TO
+                        5CJRT       161.    4.20         18.          5.          2.        .12
+                                                                                        .87       4.20

          HYDROGRAPH AT
+                          4C        80.    4.10          7.          2.          1.        .05

          HYDROGRAPH AT
+                          5D        19.    4.10          2.          1.          0.        .01

          HYDROGRAPH AT
+                          4D        18.    4.00          1.          0.          0.        .01

          HYDROGRAPH AT
+                       R3DDV        31.    4.10          4.          1.          0.        .00

          5 COMBINED AT
+                      4DJUNC       270.    4.15         32.          8.          3.        .19


 *** NORMAL END OF HEC-1 ***


    -----DSS---ZCLOSE Unit:  71,   File: 03-6HR.DSS
              Pointer Utilization:   .25
              Number of Records:     18
              File Size:     57.5  Kbytes
              Percent Inactive:    .0
```

```
1****************************************
 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *              JUN   1998              *
 *           VERSION 4.1                *
 *                                      *
 *  RUN DATE   18MAY11  TIME  09:20:38  *
 *                                      *
 ****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X                X
XXXXXXX  XXXX     X        XXXXX   X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX          XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID        Flood Control District of Maricopa County
  2           ID        GUADALUPE_24HR - FCDM001001 Guadalupe FDS
  3           ID        100 YEAR
  4           ID        24 Hour Storm
  5           ID        Unit Hydrograph: Clark
  6           ID        05/18/2011
  7           ID        Major Basin 04, South Watershed
```

```
ID        WEST Consultants, Inc. - Riley Asburry
ID        7AST, 7BST, 7DST, 7EST and 7FST in HEC1 for schematic purposes,
ID        WSE computed in RAS.
ID        DSS imported into RAS at 7AST, 7BST, 7DST, 7EST
ID        and  7FST from 7A, 7BJUNC, 7D, 7E and 7FJUNC respectively.
IT       3 01JAN11    0000    2000
IN      15
IO       5
*DIAGRAM
*
*

KK      7A   BASIN
KM   DSS imported to HEC RAS at 7AST
BA   0.007
PB   3.445
PC   0.000   0.002   0.005   0.008   0.011   0.014   0.017   0.020   0.023   0.026
PC   0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056   0.060
PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
PC   0.110   0.115   0.120   0.126   0.133   0.140   0.147   0.155   0.163   0.172
PC   0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
PC   0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
PC   0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
PC   0.913   0.918   0.922   0.926   0.930   0.934   0.938   0.942   0.946   0.950
PC   0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977   0.980
PC   0.983   0.986   0.989   0.992   0.995   0.998   1.000
LG    0.10    0.25    3.95    0.68      79
UC   0.162   0.131
UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
UA     100
ZW      A=7A    C=FLOW    F=COMP
*

KK      7C   BASIN
BA   0.020
LG    0.25    0.25    3.95    0.58      31
UC   0.329   0.442
UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
UA     100
*

KK    7CDV  DIVERT
KM   Represents the retention basin in 7C
DT  DT7CDV     0.3  1000.0
DI     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
```

```
 45          DQ     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
             *
1                                          HEC-1 INPUT                                          PAGE  2

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 46          KK   7CSRT   ROUTE
 47          RS       3    FLOW
 48          RC   0.035   0.035   0.035     834  0.0100    2.00
 49          RX    0.00   15.00   30.00   41.00   49.00   60.00   75.00   90.00
 50          RY    0.80    0.00    0.30    0.50    0.50    0.30    0.00    0.80
             *

 51          KK      7B   BASIN
 52          BA   0.014
 53          LG    0.28    0.25    3.95    0.52      15
 54          UC   0.250   0.230
 55          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 56          UA     100
             *

 57          KK  7BJUNC COMBINE
 58          KM   DSS imported to RAS at 7BST
 59          HC       2
 60          ZW      A=7BJUNC    C=FLOW    F=COMP
             *

 61          KK      7D   BASIN
 62          KM   DSS imported to RAS at 7DST
 63          BA   0.008
 64          LG    0.26    0.26    3.95    0.57      27
 65          UC   0.230   0.275
 66          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 67          UA     100
 68          ZW      A=7D    C=FLOW    F=COMP
             *

 69          KK      7E   BASIN
 70          KM   DSS imported to RAS at 7EST
 71          BA   0.024
 72          LG    0.30    0.26    3.95    0.49       5
 73          UC   0.344   0.342
 74          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 75          UA     100
```

```
 76          ZW      A=7E    C=FLOW    F=COMP
             *

 77          KK      6A   BASIN
 78          BA   0.011
 79          LG    0.35    0.35    3.95    0.47       1
 80          UC   0.318   0.328
 81          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 82          UA     100
             *
1                                        HEC-1 INPUT                                        PAGE  3

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 83          KK    6ART   ROUTE
 84          RS       3    FLOW
 85          RC   0.035   0.020   0.035    1323  0.0150    2.00
 86          RX    0.00   30.00   30.00   41.00   49.00   60.00   60.00   90.00
 87          RY    0.80    0.50    0.00    0.20    0.20    0.00    0.50    0.80
             *

 88          KK      6B   BASIN
 89          BA   0.020
 90          LG    0.25    0.25    3.95    0.58      31
 91          UC   0.294   0.407
 92          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 93          UA     100
             *

 94          KK  6BJUNC COMBINE
 95          HC       2
             *

 96          KK   6BJRT   ROUTE
 97          RS       3    FLOW
 98          RC   0.035   0.020   0.035     461  0.0130    2.00
 99          RX    0.00   30.00   30.00   41.00   49.00   60.00   60.00   90.00
100          RY    0.80    0.50    0.00    0.20    0.20    0.00    0.50    0.80
             *

101          KK      6C   BASIN
102          BA   0.006
103          LG    0.18    0.28    3.95    0.62      54
104          UC   0.203   0.228
```

```
105          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
106          UA     100
             *

107          KK    6CDV  DIVERT
108          KM   Represents retention basin in 6C
109          DT  DT6CDV     0.4  1000.0
110          DI     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
111          DQ     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
             *

112          KK  6CJUNC COMBINE
113          HC       2
             *

114          KK   6CJRT   ROUTE
115          RS       3    FLOW
116          RC   0.035   0.020   0.035    1402  0.0080    2.00
117          RX    0.00   30.00   30.00   41.00   49.00   60.00   60.00   90.00
118          RY    0.80    0.50    0.00    0.20    0.20    0.00    0.50    0.80
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

119          KK      8A   BASIN
120          BA   0.016
121          LG    0.14    0.25    3.95    0.40      73
122          UC   0.343   0.368
123          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
124          UA     100
             *

125          KK    8ADV  DIVERT
126          KM   Represents retention basin in 8A
127          DT  DT8ADV     1.0  1000.0
128          DI     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
129          DQ     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
             *

130          KK      6D   BASIN
131          BA   0.011
132          LG    0.33    0.33    3.95    0.49       6
133          UC   0.389   0.468
```

```
134          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
135          UA     100
             *

136          KK    6DDV  DIVERT
137          DT  DT6DDV     0.2  1000.0
138          DI     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
139          DQ     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
             *

140          KK  6DJUNC COMBINE
141          HC       2
             *

142          KK   6DJRT   ROUTE
143          RS       3    FLOW
144          RC   0.035   0.020   0.035     874  0.0130    2.00
145          RX    0.00   30.00   30.00   41.00   49.00   60.00   60.00   90.00
146          RY    0.80    0.50    0.00   49.00    0.20    0.00    0.50    0.80
             *

147          KK      8B   BASIN
148          BA   0.014
149          LG    0.15    0.25    3.95    0.40      95
150          UC   0.229   0.236
151          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
152          UA     100
             *

153          KK    8BDV  DIVERT
154          KM   Represents retention basin in 8B
155          DT  DT8BDV     0.2  1000.0
156          DI     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
157          DQ     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

158          KK      6E   BASIN
159          BA   0.024
160          LG    0.26    0.27    3.95    0.56      22
161          UC   0.335   0.342
162          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
```

```
UA     100
*

KK  6EJUNC COMBINE
HC       4
*

KK    6EDV  DIVERT
KM   Represents retention basins in 6E
DT  DT6EDV     1.5  1000.0
DI     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
DQ     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
*

KK   6ESRT   ROUTE
RS       3    FLOW
RC   0.035   0.035   0.035     432  0.0100    2.00
RX    0.00   15.00   30.00   41.00   49.00   60.00   75.00   90.00
RY    0.80    0.00    0.30    0.50    0.50    0.30    0.00    0.80
*

KK      6F   BASIN
BA   0.008
LG    0.25    0.25    3.95    0.58      29
UC   0.150   0.094
UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
UA     100
*

KK  6FJUNC COMBINE
HC       2
*

KK      7F   BASIN
BA   0.006
LG    0.10    0.25    3.95    0.69       0
UC   0.148   0.075
UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
UA     100
*

KK  7FJUNC COMBINE
KM   DSS imported to HEC RAS at 7FST
HC       2
ZW      A=7FJUNC    C=FLOW    F=COMP
```

```
                    *
          194       ZZ
1
                 SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   16          7A
               .
               .
   35          .          7C
               .           .
               .           .
   43          .           .-------->  DT7CDV
   41          .        7CDV
               .           V
               .           V
   46          .       7CSRT
               .           .
               .           .
   51          .           .          7B
               .           .           .
               .           .           .
   57          .      7BJUNC............
               .           .
               .           .
   61          .           .          7D
               .           .           .
               .           .           .
   69          .           .           .          7E
               .           .           .           .
               .           .           .           .
   77          .           .           .           .          6A
               .           .           .           .           V
               .           .           .           .           V
   83          .           .           .           .        6ART
               .           .           .           .           .
               .           .           .           .           .
   88          .           .           .           .           .          6B
               .           .           .           .           .           .
               .           .           .           .           .           .
   94          .           .           .           .      6BJUNC............
               .           .           .           .           V
```

```
                 .         .         .         .         V
 96              .         .         .         .      6BJRT
                 .         .         .         .         .
                 .         .         .         .         .
101              .         .         .         .         .          6C
                 .         .         .         .         .           .
                 .         .         .         .         .           .
109              .         .         .         .         .           .-------> DT6CDV
107              .         .         .         .         .        6CDV
                 .         .         .         .         .           .
                 .         .         .         .         .           .
112              .         .         .         .      6CJUNC............
                 .         .         .         .         V
                 .         .         .         .         V
114              .         .         .         .      6CJRT
                 .         .         .         .         .
                 .         .         .         .         .
119              .         .         .         .         .          8A
                 .         .         .         .         .           .
                 .         .         .         .         .           .
127              .         .         .         .         .           .-------> DT8ADV
125              .         .         .         .         .        8ADV
                 .         .         .         .         .           .
                 .         .         .         .         .           .
130              .         .         .         .         .           .          6D
                 .         .         .         .         .           .           .
                 .         .         .         .         .           .           .
137              .         .         .         .         .           .           .-------> DT6DDV
136              .         .         .         .         .           .        6DDV
                 .         .         .         .         .           .           .
                 .         .         .         .         .           .           .
140              .         .         .         .         .      6DJUNC............
                 .         .         .         .         .           V
                 .         .         .         .         .           V
142              .         .         .         .         .      6DJRT
                 .         .         .         .         .           .
                 .         .         .         .         .           .
147              .         .         .         .         .           .          8B
                 .         .         .         .         .           .           .
                 .         .         .         .         .           .           .
155              .         .         .         .         .           .           .-------> DT8BDV
153              .         .         .         .         .           .        8BDV
                 .         .         .         .         .           .           .
                 .         .         .         .         .           .           .
158              .         .         .         .         .           .           .          6E
```

```
                .         .         .         .         .         .         .         .
                .         .         .         .         .         .         .         .
  164           .         .         .         .      6EJUNC.....................................
                .         .         .         .         .
                .         .         .         .         .
  168           .         .         .         .         .-------> DT6EDV
  166           .         .         .         .       6EDV
                .         .         .         .         V
                .         .         .         .         V
  171           .         .         .         .      6ESRT
                .         .         .         .         .
                .         .         .         .         .
  176           .         .         .         .         .         6F
                .         .         .         .         .          .
                .         .         .         .         .          .
  182           .         .         .         .      6FJUNC............
                .         .         .         .         .
                .         .         .         .         .
  184           .         .         .         .         .         7F
                .         .         .         .         .          .
                .         .         .         .         .          .
  190           .         .         .         .      7FJUNC............
```

```
(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUN   1998              *
*           VERSION 4.1                *
*                                      *
*  RUN DATE   18MAY11  TIME  09:20:38  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

Flood Control District of Maricopa County
GUADALUPE_24HR - FCDM001001 Guadalupe FDS
100 YEAR
24 Hour Storm
Unit Hydrograph: Clark
05/18/2011
Major Basin 04, South Watershed

```
                              WEST Consultants, Inc. - Riley Asburry
                              7AST, 7BST, 7DST, 7EST and 7FST in HEC1 for schematic purposes,
                              WSE computed in RAS.
                              DSS imported into RAS at 7AST, 7BST, 7DST, 7EST
                              and  7FST from 7A, 7BJUNC, 7D, 7E and 7FJUNC respectively.

 15 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN           3  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1JAN11  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ        2000  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      5JAN11  ENDING DATE
                     NDTIME        0357  ENDING TIME
                     ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL     .05 HOURS
                       TOTAL TIME BASE   99.95 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT
   -----DSS---ZOPEN:  Existing File Opened,  File: 04-24HR.DSS
                      Unit:  71;  DSS Version: 6-JG
-----DSS---ZWRITE Unit  71; Vers.    6:  /7A/7A/FLOW/31DEC1910/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7A/7A/FLOW/01JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7A/7A/FLOW/02JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7A/7A/FLOW/03JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7A/7A/FLOW/04JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7A/7A/FLOW/05JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7BJUNC/7BJUNC/FLOW/31DEC1910/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7BJUNC/7BJUNC/FLOW/01JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7BJUNC/7BJUNC/FLOW/02JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7BJUNC/7BJUNC/FLOW/03JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7BJUNC/7BJUNC/FLOW/04JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7BJUNC/7BJUNC/FLOW/05JAN1911/3MIN/COMP/
```

```
-----DSS---ZWRITE Unit  71; Vers.    6:  /7D/7D/FLOW/31DEC1910/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7D/7D/FLOW/01JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7D/7D/FLOW/02JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7D/7D/FLOW/03JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7D/7D/FLOW/04JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7D/7D/FLOW/05JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7E/7E/FLOW/31DEC1910/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7E/7E/FLOW/01JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7E/7E/FLOW/02JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7E/7E/FLOW/03JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7E/7E/FLOW/04JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7E/7E/FLOW/05JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7FJUNC/7FJUNC/FLOW/31DEC1910/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7FJUNC/7FJUNC/FLOW/01JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7FJUNC/7FJUNC/FLOW/02JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7FJUNC/7FJUNC/FLOW/03JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7FJUNC/7FJUNC/FLOW/04JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7FJUNC/7FJUNC/FLOW/05JAN1911/3MIN/COMP/
1
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	7A	13.	12.05	2.	1.	0.	.01		
+	HYDROGRAPH AT	7C	17.	12.15	3.	1.	0.	.02		
+	DIVERSION TO	DT7CDV	2.	12.15	0.	0.	0.	.02		
+	HYDROGRAPH AT	7CDV	17.	12.15	3.	1.	0.	.02		
+	ROUTED TO	7CSRT	16.	12.25	3.	1.	0.	.02		
+									.38	12.25
+	HYDROGRAPH AT	7B	16.	12.10	2.	0.	0.	.01		

	2 COMBINED AT								
+		7BJUNC	28.	12.15	4.	1.	0.	.03	
	HYDROGRAPH AT								
+		7D	9.	12.10	1.	0.	0.	.01	
	HYDROGRAPH AT								
+		7E	21.	12.15	2.	1.	0.	.02	
	HYDROGRAPH AT								
+		6A	9.	12.15	1.	0.	0.	.01	
	ROUTED TO								
+		6ART	9.	12.25	1.	0.	0.	.01	
+									.25 12.25
	HYDROGRAPH AT								
+		6B	18.	12.10	3.	1.	0.	.02	
	2 COMBINED AT								
+		6BJUNC	25.	12.20	4.	1.	0.	.03	
	ROUTED TO								
+		6BJRT	25.	12.20	4.	1.	0.	.03	
+									.38 12.20
	HYDROGRAPH AT								
+		6C	8.	12.05	1.	0.	0.	.01	
	DIVERSION TO								
+		DT6CDV	8.	12.25	1.	0.	0.	.01	
	HYDROGRAPH AT								
+		6CDV	5.	12.25	0.	0.	0.	.01	
	2 COMBINED AT								
+		6CJUNC	30.	12.25	4.	1.	0.	.04	
	ROUTED TO								
+		6CJRT	28.	12.35	4.	1.	0.	.04	
+									.44 12.35
	HYDROGRAPH AT								
+		8A	19.	12.15	3.	1.	0.	.02	

	DIVERSION TO								
+		DT8ADV	19.	12.20	2.	1.	0.	.02	
	HYDROGRAPH AT								
+		8ADV	19.	12.20	2.	1.	0.	.02	
	HYDROGRAPH AT								
+		6D	7.	12.15	1.	0.	0.	.01	
	DIVERSION TO								
+		DT6DDV	7.	12.30	0.	0.	0.	.01	
	HYDROGRAPH AT								
+		6DDV	6.	12.30	1.	0.	0.	.01	
	2 COMBINED AT								
+		6DJUNC	22.	12.30	3.	1.	0.	.03	
	ROUTED TO								
+		6DJRT	22.	12.30	3.	1.	0.	.03	
+									.54 12.30
	HYDROGRAPH AT								
+		8B	23.	12.05	4.	1.	0.	.01	
	DIVERSION TO								
+		DT8BDV	1.	12.05	0.	0.	0.	.01	
	HYDROGRAPH AT								
+		8BDV	23.	12.05	4.	1.	0.	.01	
	HYDROGRAPH AT								
+		6E	22.	12.15	3.	1.	0.	.02	
	4 COMBINED AT								
+		6EJUNC	80.	12.30	13.	4.	1.	.10	
	DIVERSION TO								
+		DT6EDV	32.	12.30	3.	1.	0.	.10	
	HYDROGRAPH AT								
+		6EDV	80.	12.30	12.	3.	1.	.10	
	ROUTED TO								

```
+                        6ESRT        79.   12.35          12.          3.          1.        .10
+                                                                                                          .70        12.35

         HYDROGRAPH AT
+                           6F        14.   12.00           1.          0.          0.        .01

         2 COMBINED AT
+                       6FJUNC        80.   12.35          13.          4.          1.        .11

         HYDROGRAPH AT
+                           7F         9.   12.00           0.          0.          0.        .01

         2 COMBINED AT
+                       7FJUNC        81.   12.35          13.          4.          1.        .12


 *** NORMAL END OF HEC-1 ***


    -----DSS---ZCLOSE Unit:  71,   File: 04-24HR.DSS
              Pointer Utilization:   .26
              Number of Records:     30
              File Size:     82.6  Kbytes
              Percent Inactive:    .0
```

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUN   1998              *
*           VERSION 4.1                *
*                                      *
*  RUN DATE   18MAY11  TIME  09:20:18  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*   U.S. ARMY CORPS OF ENGINEERS       *
*   HYDROLOGIC ENGINEERING CENTER      *
*         609 SECOND STREET            *
*      DAVIS, CALIFORNIA 95616         *
*          (916) 756-1104              *
*                                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X    X        XX
X     X  X        X              X
XXXXXXX  XXXX     X       XXXXX  X
X     X  X        X              X
X     X  X        X    X         X
X     X  XXXXXXX   XXXXX        XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   1          ID       Flood Control District of Maricopa County
   2          ID       GUADALUPE_6HR - FCDM001001 Guadalupe FDS
   3          ID       100 YEAR
   4          ID       6 Hour  Storm
   5          ID       Unit Hydrograph: Clark
   6          ID       05/18/2011
   7          ID       Major Basin 04, South Watershed
```

```
ID        WEST Consultants, Inc. - Riley Asburry
ID        7AST, 7BST, 7DST, 7EST and 7FST in HEC1 for schematic purposes,
ID        WSE computed in RAS.
ID        DSS imported into RAS at 7AST, 7BST, 7DST, 7EST
ID        and  7FST from 7A, 7BJUNC, 7D, 7E and 7FJUNC respectively.
IT       3 01JAN11    0000    2000
IN      15
IO       5
*DIAGRAM
*
*

KK      7A   BASIN
KM   DSS imported to HEC RAS at 7AST
BA   0.007
PB   2.514
PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
PC   0.962   0.972   0.983   0.991   1.000
LG    0.10    0.25    3.95    0.68      79
UC   0.158   0.128
UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
UA     100
ZW      A=7A    C=FLOW    F=COMP
*

KK      7C   BASIN
BA   0.020
LG    0.25    0.25    3.95    0.58      31
UC   0.329   0.442
UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
UA     100
*

KK    7CDV  DIVERT
KM   Represents the retention basin in 7C
DT  DT7CDV     0.3  1000.0
DI     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
DQ     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
*

KK   7CSRT   ROUTE
RS       3    FLOW
RC   0.035   0.035   0.035     834  0.0100    2.00
RX    0.00   15.00   30.00   41.00   49.00   60.00   75.00   90.00
```

```
 43          RY    0.80    0.00    0.30    0.50    0.50    0.30    0.00    0.80
             *
1                                          HEC-1 INPUT                                                    PAGE  2

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 44          KK      7B   BASIN
 45          BA   0.014
 46          LG    0.28    0.25    3.95    0.52      15
 47          UC   0.254   0.234
 48          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 49          UA     100
             *

 50          KK  7BJUNC COMBINE
 51          KM   DSS imported to RAS at 7BST
 52          HC       2
 53          ZW      A=7BJUNC    C=FLOW    F=COMP
             *

 54          KK      7D   BASIN
 55          KM   DSS imported to RAS at 7DST
 56          BA   0.008
 57          LG    0.26    0.26    3.95    0.57      27
 58          UC   0.230   0.275
 59          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 60          UA     100
 61          ZW      A=7D    C=FLOW    F=COMP
             *

 62          KK      7E   BASIN
 63          KM   DSS imported to RAS at 7EST
 64          BA   0.024
 65          LG    0.30    0.26    3.95    0.49       5
 66          UC   0.353   0.353
 67          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 68          UA     100
 69          ZW      A=7E    C=FLOW    F=COMP
             *

 70          KK      6A   BASIN
 71          BA   0.011
 72          LG    0.35    0.35    3.95    0.47       1
 73          UC   0.328   0.340
```

```
 74          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 75          UA     100
             *

 76          KK    6ART   ROUTE
 77          RS       3    FLOW
 78          RC   0.035   0.020   0.035    1323  0.0150    2.00
 79          RX    0.00   30.00   30.00   41.00   49.00   60.00   60.00   90.00
 80          RY    0.80    0.50    0.00    0.20    0.20    0.00    0.50    0.80
             *
1                                          HEC-1 INPUT                                          PAGE  3

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 81          KK      6B   BASIN
 82          BA   0.020
 83          LG    0.25    0.25    3.95    0.58      31
 84          UC   0.293   0.407
 85          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 86          UA     100
             *

 87          KK  6BJUNC COMBINE
 88          HC       2
             *

 89          KK   6BJRT   ROUTE
 90          RS       3    FLOW
 91          RC   0.035   0.020   0.035     461  0.0130    2.00
 92          RX    0.00   30.00   30.00   41.00   49.00   60.00   60.00   90.00
 93          RY    0.80    0.50    0.00    0.20    0.20    0.00    0.50    0.80
             *

 94          KK      6C   BASIN
 95          BA   0.006
 96          LG    0.18    0.28    3.95    0.62      54
 97          UC   0.200   0.224
 98          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
 99          UA     100
             *

100          KK    6CDV  DIVERT
101          KM   Represents retention basin in 6C
102          DT  DT6CDV     0.4  1000.0
```

```
103          DI     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
104          DQ     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
             *

105          KK  6CJUNC COMBINE
106          HC       2
             *

107          KK   6CJRT   ROUTE
108          RS       3    FLOW
109          RC   0.035   0.020   0.035    1402  0.0080    2.00
110          RX    0.00   30.00   30.00   41.00   49.00   60.00   60.00   90.00
111          RY    0.80    0.50    0.00    0.20    0.20    0.00    0.50    0.80
             *

112          KK      8A   BASIN
113          BA   0.016
114          LG    0.14    0.25    3.95    0.40      73
115          UC   0.336   0.359
116          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
117          UA     100
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

118          KK    8ADV  DIVERT
119          KM   Represents retention basin in 8A
120          DT  DT8ADV     1.0  1000.0
121          DI     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
122          DQ     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
             *

123          KK      6D   BASIN
124          BA   0.011
125          LG    0.33    0.33    3.95    0.49       6
126          UC   0.399   0.481
127          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
128          UA     100
             *

129          KK    6DDV  DIVERT
130          DT  DT6DDV     0.2  1000.0
131          DI     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
```

```
132          DQ     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
             *

133          KK  6DJUNC COMBINE
134          HC       2
             *

135          KK   6DJRT   ROUTE
136          RS       3    FLOW
137          RC   0.035   0.020   0.035     874  0.0130    2.00
138          RX    0.00   30.00   30.00   41.00   49.00   60.00   60.00   90.00
139          RY    0.80    0.50    0.00   49.00    0.20    0.00    0.50    0.80
             *

140          KK      8B   BASIN
141          BA   0.014
142          LG    0.15    0.25    3.95    0.40      95
143          UC   0.222   0.228
144          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
145          UA     100
             *

146          KK    8BDV  DIVERT
147          KM   Represents retention basin in 8B
148          DT  DT8BDV     0.2  1000.0
149          DI     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
150          DQ     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
             *

151          KK      6E   BASIN
152          BA   0.024
153          LG    0.26    0.27    3.95    0.56      22
154          UC   0.337   0.344
155          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
156          UA     100
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

157          KK  6EJUNC COMBINE
158          HC       4
             *
```

```
159          KK    6EDV  DIVERT
160          KM   Represents retention basins in 6E
161          DT  DT6EDV     1.5  1000.0
162          DI     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
163          DQ     0.0  1000.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
             *

164          KK   6ESRT   ROUTE
165          RS       3    FLOW
166          RC   0.035   0.035   0.035     432  0.0100    2.00
167          RX    0.00   15.00   30.00   41.00   49.00   60.00   75.00   90.00
168          RY    0.80    0.00    0.30    0.50    0.50    0.30    0.00    0.80
             *

169          KK      6F   BASIN
170          BA   0.008
171          LG    0.25    0.25    3.95    0.58      29
172          UC   0.150   0.094
173          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
174          UA     100
             *

175          KK  6FJUNC COMBINE
176          HC       2
             *

177          KK      7F   BASIN
178          BA   0.006
179          LG    0.10    0.25    3.95    0.69       0
180          UC   0.150   0.076
181          UA       0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
182          UA     100
             *

183          KK  7FJUNC COMBINE
184          KM   DSS imported to HEC RAS at 7FST
185          HC       2
186          ZW      A=7FJUNC    C=FLOW    F=COMP
             *
187          ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT
LINE (V) ROUTING (---->) DIVERSION OR PUMP FLOW

```
NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

16          7A
             .
             .
28           .          7C
             .           .
             .           .
36           .           .-------> DT7CDV
34           .        7CDV
             .           V
             .           V
39           .       7CSRT
             .           .
             .           .
44           .           .          7B
             .           .           .
             .           .           .
50           .      7BJUNC............
             .           .
             .           .
54           .           .          7D
             .           .           .
             .           .           .
62           .           .           .          7E
             .           .           .           .
             .           .           .           .
70           .           .           .           .          6A
             .           .           .           .           V
             .           .           .           .           V
76           .           .           .           .        6ART
             .           .           .           .           .
             .           .           .           .           .
81           .           .           .           .           .          6B
             .           .           .           .           .           .
             .           .           .           .           .           .
87           .           .           .           .      6BJUNC............
             .           .           .           .           V
             .           .           .           .           V
89           .           .           .           .       6BJRT
             .           .           .           .           .
             .           .           .           .           .
94           .           .           .           .           .          6C
             .           .           .           .           .           .
             .           .           .           .           .           .
```

```
102                                                  .-------> DT6CDV
100                                            6CDV
                                                  .
                                                  .
105                                      6CJUNC............
                                              V
                                              V
107                                       6CJRT
                                                  .
                                                  .
112                                                  8A
                                                  .
                                                  .
120                                                  .-------> DT8ADV
118                                            8ADV
                                                  .
                                                  .
123                                                  .          6D
                                                  .           .
                                                  .           .
130                                                  .           .-------> DT6DDV
129                                                  .        6DDV
                                                  .           .
                                                  .           .
133                                            6DJUNC............
                                                  V
                                                  V
135                                            6DJRT
                                                  .
                                                  .
140                                                  .          8B
                                                  .           .
                                                  .           .
148                                                  .           .-------> DT8BDV
146                                                  .        8BDV
                                                  .           .
                                                  .           .
151                                                  .           .          6E
                                                  .           .           .
                                                  .           .           .
157                                      6EJUNC...................................
                                              .
                                              .
161                                           .-------> DT6EDV
159                                        6EDV
```

```
                .         .         .         .         V
                .         .         .         .         V
  164           .         .         .         .      6ESRT
                .         .         .         .         .
                .         .         .         .         .
  169           .         .         .         .         .         6F
                .         .         .         .         .          .
                .         .         .         .         .          .
  175           .         .         .         .      6FJUNC............
                .         .         .         .         .
                .         .         .         .         .
  177           .         .         .         .         .         7F
                .         .         .         .         .          .
                .         .         .         .         .          .
  183           .         .         .         .      7FJUNC............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1****************************************
 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *              JUN   1998              *
 *           VERSION 4.1                *
 *                                      *
 *  RUN DATE   18MAY11  TIME  09:20:18  *
 *                                      *
 ****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

Flood Control District of Maricopa County
GUADALUPE_6HR - FCDM001001 Guadalupe FDS
100 YEAR
6 Hour Storm
Unit Hydrograph: Clark
05/18/2011
Major Basin 04, South Watershed
WEST Consultants, Inc. - Riley Asburry
7AST, 7BST, 7DST, 7EST and 7FST in HEC1 for schematic purposes,
WSE computed in RAS.
DSS imported into RAS at 7AST, 7BST, 7DST, 7EST
and 7FST from 7A, 7BJUNC, 7D, 7E and 7FJUNC respectively.

```
  15 IO          OUTPUT CONTROL VARIABLES
```

```
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                     NMIN          3  MINUTES IN COMPUTATION INTERVAL
                    IDATE     1JAN11  STARTING DATE
                    ITIME       0000  STARTING TIME
                       NQ       2000  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE     5JAN11  ENDING DATE
                   NDTIME       0357  ENDING TIME
                   ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL     .05 HOURS
                      TOTAL TIME BASE   99.95 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT
   -----DSS---ZOPEN:  Existing File Opened,  File: 04-6HR.DSS
                      Unit:  71;  DSS Version: 6-JG
-----DSS---ZWRITE Unit  71; Vers.    6:  /7A/7A/FLOW/31DEC1910/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7A/7A/FLOW/01JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7A/7A/FLOW/02JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7A/7A/FLOW/03JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7A/7A/FLOW/04JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7A/7A/FLOW/05JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7BJUNC/7BJUNC/FLOW/31DEC1910/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7BJUNC/7BJUNC/FLOW/01JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7BJUNC/7BJUNC/FLOW/02JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7BJUNC/7BJUNC/FLOW/03JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7BJUNC/7BJUNC/FLOW/04JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7BJUNC/7BJUNC/FLOW/05JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7D/7D/FLOW/31DEC1910/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7D/7D/FLOW/01JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7D/7D/FLOW/02JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7D/7D/FLOW/03JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7D/7D/FLOW/04JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7D/7D/FLOW/05JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7E/7E/FLOW/31DEC1910/3MIN/COMP/
```

```
-----DSS---ZWRITE Unit  71; Vers.    6:  /7E/7E/FLOW/01JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7E/7E/FLOW/02JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7E/7E/FLOW/03JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7E/7E/FLOW/04JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    6:  /7E/7E/FLOW/05JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    2:  /7FJUNC/7FJUNC/FLOW/31DEC1910/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    2:  /7FJUNC/7FJUNC/FLOW/01JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    2:  /7FJUNC/7FJUNC/FLOW/02JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    2:  /7FJUNC/7FJUNC/FLOW/03JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    2:  /7FJUNC/7FJUNC/FLOW/04JAN1911/3MIN/COMP/
-----DSS---ZWRITE Unit  71; Vers.    2:  /7FJUNC/7FJUNC/FLOW/05JAN1911/3MIN/COMP/
1
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	7A	16.	4.05	2.	0.	0.	.01		
+	HYDROGRAPH AT	7C	20.	4.15	3.	1.	0.	.02		
+	DIVERSION TO	DT7CDV	11.	4.15	1.	0.	0.	.02		
+	HYDROGRAPH AT	7CDV	20.	4.15	2.	1.	0.	.02		
+	ROUTED TO	7CSRT	19.	4.30	2.	1.	0.	.02		
+									.41	4.30
+	HYDROGRAPH AT	7B	19.	4.10	2.	0.	0.	.01		
+	2 COMBINED AT	7BJUNC	30.	4.25	4.	1.	0.	.03		
+	HYDROGRAPH AT	7D	11.	4.10	1.	0.	0.	.01		

	HYDROGRAPH AT								
+	7E	24.	4.15	2.	1.	0.	.02		
	HYDROGRAPH AT								
+	6A	10.	4.15	1.	0.	0.	.01		
	ROUTED TO								
+	6ART	10.	4.25	1.	0.	0.	.01		
+								.26	4.25
	HYDROGRAPH AT								
+	6B	21.	4.10	3.	1.	0.	.02		
	2 COMBINED AT								
+	6BJUNC	29.	4.20	4.	1.	0.	.03		
	ROUTED TO								
+	6BJRT	30.	4.20	4.	1.	0.	.03		
+								.40	4.20
	HYDROGRAPH AT								
+	6C	10.	4.05	1.	0.	0.	.01		
	DIVERSION TO								
+	DT6CDV	10.	4.30	1.	0.	0.	.01		
	HYDROGRAPH AT								
+	6CDV	5.	4.30	0.	0.	0.	.01		
	2 COMBINED AT								
+	6CJUNC	32.	4.30	4.	1.	0.	.04		
	ROUTED TO								
+	6CJRT	31.	4.35	4.	1.	0.	.04		
+								.45	4.35
	HYDROGRAPH AT								
+	8A	24.	4.15	4.	1.	0.	.02		
	DIVERSION TO								
+	DT8ADV	24.	4.30	2.	1.	0.	.02		
	HYDROGRAPH AT								
+	8ADV	19.	4.30	2.	0.	0.	.02		

	HYDROGRAPH AT								
+		6D	8.	4.20	1.	0.	0.	.01	
	DIVERSION TO								
+		DT6DDV	8.	4.30	0.	0.	0.	.01	
	HYDROGRAPH AT								
+		6DDV	7.	4.30	1.	0.	0.	.01	
	2 COMBINED AT								
+		6DJUNC	27.	4.30	2.	1.	0.	.03	
	ROUTED TO								
+		6DJRT	25.	4.40	2.	1.	0.	.03	
+									.57 4.40
	HYDROGRAPH AT								
+		8B	28.	4.05	4.	1.	0.	.01	
	DIVERSION TO								
+		DT8BDV	1.	4.05	0.	0.	0.	.01	
	HYDROGRAPH AT								
+		8BDV	28.	4.05	3.	1.	0.	.01	
	HYDROGRAPH AT								
+		6E	26.	4.15	3.	1.	0.	.02	
	4 COMBINED AT								
+		6EJUNC	84.	4.35	13.	3.	1.	.10	
	DIVERSION TO								
+		DT6EDV	59.	4.35	3.	1.	0.	.10	
	HYDROGRAPH AT								
+		6EDV	84.	4.35	10.	2.	1.	.10	
	ROUTED TO								
+		6ESRT	83.	4.40	10.	2.	1.	.10	
+									.71 4.40
	HYDROGRAPH AT								
+		6F	17.	4.00	1.	0.	0.	.01	
	2 COMBINED AT								

```
+                        6FJUNC        84.    4.40          11.          3.          1.        .11

         HYDROGRAPH AT
+                            7F        11.    4.00           1.          0.          0.        .01

         2 COMBINED AT
+                        7FJUNC        84.    4.40          11.          3.          1.        .12


 *** NORMAL END OF HEC-1 ***


    -----DSS---ZCLOSE Unit:  71,   File: 04-6HR.DSS
              Pointer Utilization:   .26
              Number of Records:     36
              File Size:    103.6  Kbytes
              Percent Inactive:    .0
```

E.1 Roughness Coefficient Estimation

Not Applicable/Not Included

E.2 Cross Section Plots

Not Applicable/Not Included

E.3 Expansion and Contraction Coefficients

Not Applicable / Not Included

E.4 Analysis of Structures

E.4. Analysis of Structures

The 10-year drainage system was modeled as culverts in the HEC-RAS pond model as discussed in Section 5.5.1. Drain pipes were modeled as culverts connecting the multiple ponding areas using the Storage Area Connections feature in HEC-RAS. A sample weir/culvert connection is shown in Figure . Figure show the rough layout of storage areas with connections as displayed in the HEC-RAS model.

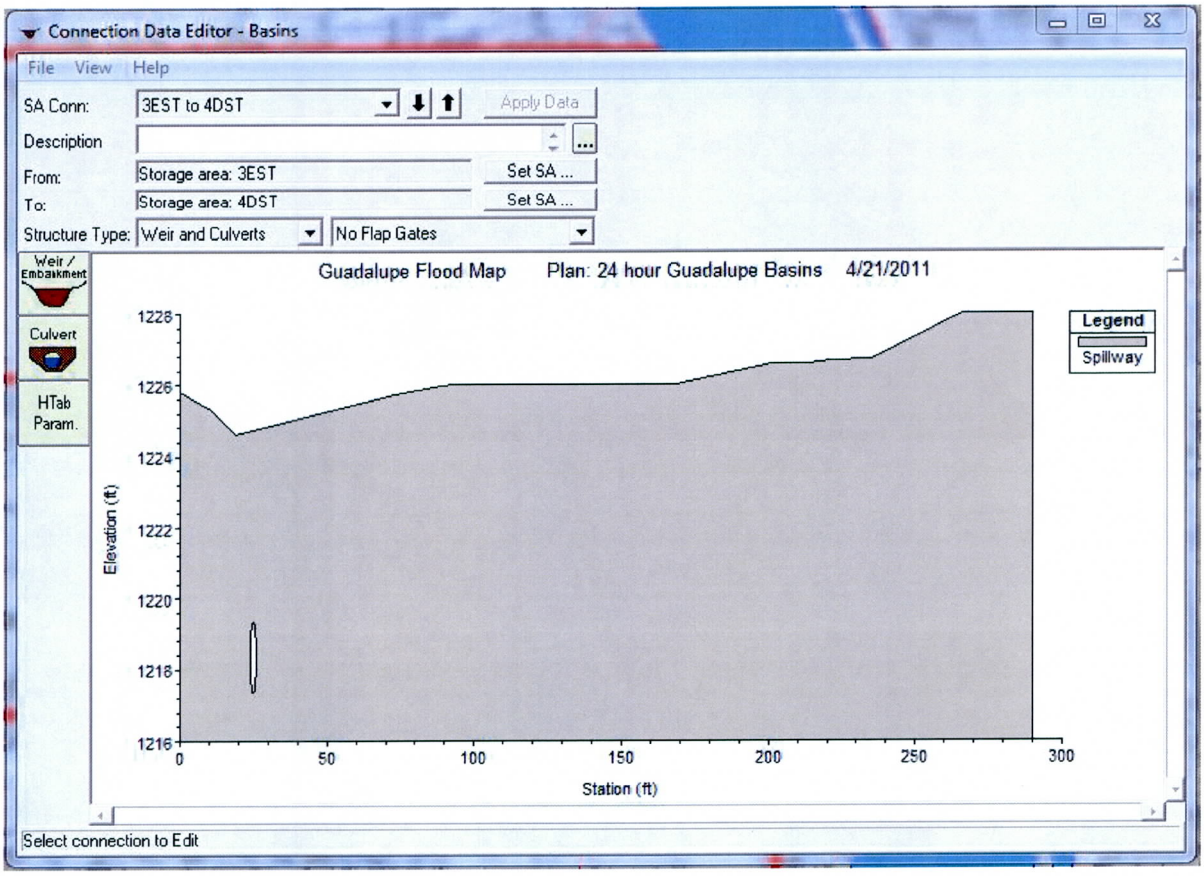


Figure E4-1. Storage connection with culvert and weir

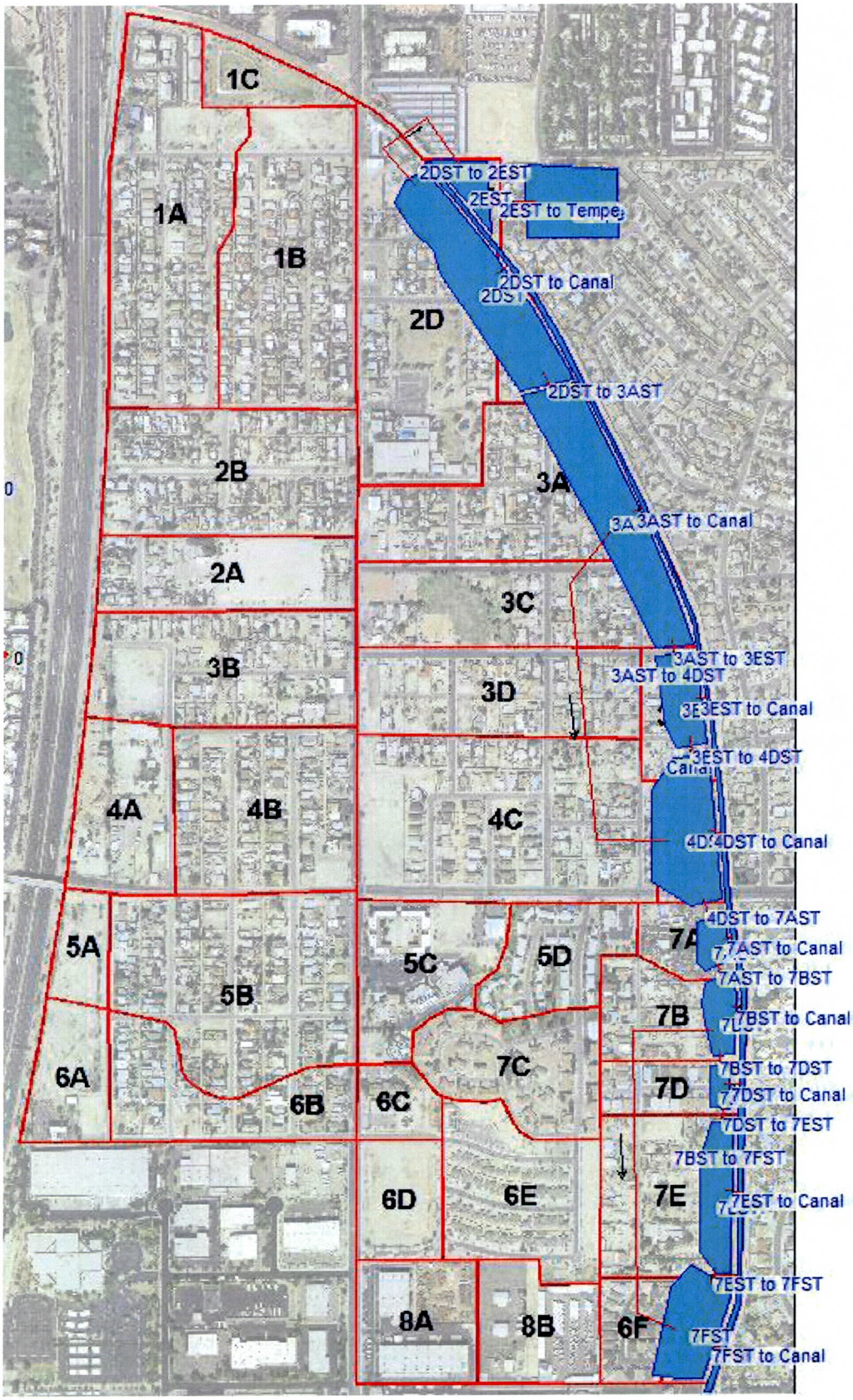


Figure E4-2. Storage area connections

GUADALUPE DRAINAGE IMPROVEMENT PROJECT
10-YEAR DESIGN

Property of
Flood Control District of MC Library
Please Return to
2801 W. Durango
Phoenix, AZ 85009

(PCN No. 035-02-31)

FINAL DRAINAGE REPORT

November, 2001

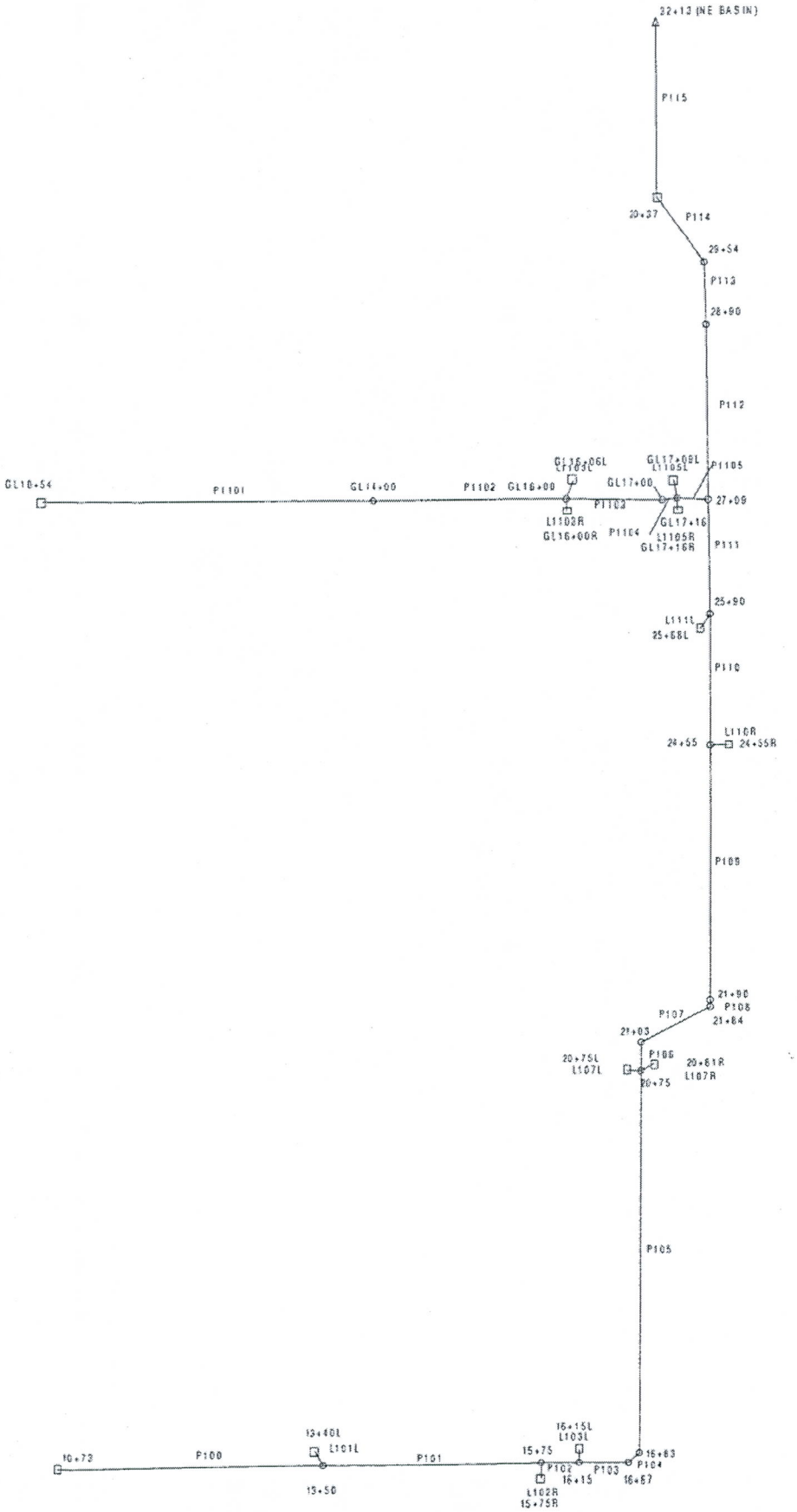
Prepared for
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Prepared by

SVERDRUP CIVIL, INC.
875 West Elliot Road
Suite 201
Tempe, Arizona 85284

Registered Professional Engineer (Civil)
Certificate No. 26882
DANIEL E. STOUGH
Date Signed 11-05-01
ARIZONA U.S.A.

Scenario: STORM DRAIN 1, MAGDALENA/BATOUA: 10-yr



Title: STM DRN 1
p:\...\600disc\610drain\610estmdr\sd01_batoua.stm
09/12/01 05:24:34 PM © Haestad Methods, Inc.

Sverdrup Civil, Inc
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Project Engineer: Dan Stough
StormCAD v3.0 [319]
Page 1 of 1

Scenario: STORM DRA[illegible]1 [illegible]AGDALENA/BATOUA: 10-yr

Inlet Report

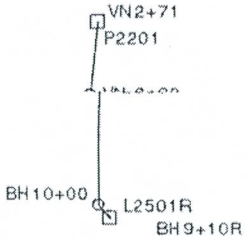
INLET	Inlet	Slotted Drain Length (ft)	Ground Elev (ft)	Grate Elev (ft)	Sump Elev (ft)	Addtnl Carryover (cfs)	Capture Effic (%)	Clog (%)	Total Inlet Addtnl Flow (cfs)	Intercept Addtnl Flow (cfs)	Bypass Addtnl Flow (cfs)	Bypass Target	Gutter or Ditch Depth (ft)	Gutter or Ditch Spread (ft)	Gutter Long Slope (ft/ft)
10+73	Generic Default 100%		1,239.98	1,239.98	1,233.35	26.00	100.0		26.00	26.00	0.00		0.00	0.00	
13+40L	Slot ADOT C-13.60	20.00	1,235.90	1,235.90	1,231.90	3.00	91.8		3.00	2.75	0.25	16+15L	0.24	8.79	0.020000
15+75R	Slot ADOT C-13.60	10.00	1,233.16	1,233.16	1,229.16	2.00	71.0		2.00	1.42	0.58	16+15L	0.22	7.86	0.015000
16+15L	Slot ADOT C-13.60	20.00	1,232.25	1,232.25	1,228.25	3.00	100.0		3.83	3.83	0.00		0.18	5.98	
20+75L	Slot ADOT C-13.60	20.00	1,229.04	1,229.04	1,225.04	4.00	96.6		4.00	3.86	0.14	25+68L	0.31	12.27	0.007000
20+81R	Slot ADOT C-13.60	20.00	1,228.90	1,228.90	1,224.90	4.00	93.1		4.00	3.72	0.28	24+55R	0.29	11.42	0.010000
24+55R	Slot ADOT C-13.60	20.00	1,225.57	1,225.57	1,221.57	4.00	88.5		4.28	3.78	0.49	30+37	0.28	11.13	0.013000
25+68L	Slot ADOT C-13.60	20.00	1,224.54	1,224.54	1,220.54	4.00	94.7		4.14	3.92	0.22	30+37	0.30	12.11	0.008000
30+37	Ditch ADOT C-15.90 DBL WIDE		1,223.50	1,220.50	1,210.00	10.00	100.0	50.0	11.61	11.61	0.00		0.36	8.15	
GL10+54	Generic Default 100%		1,231.34	1,231.34	1,224.57	43.00	100.0		43.00	43.00	0.00		0.00	0.00	
GL16+00R	Slot ADOT C-13.60	20.00	1,225.32	1,225.32	1,221.32	4.00	90.1		4.00	3.60	0.40	GL17+16R	0.28	10.83	0.013000
GL16+06L	Slot ADOT C-13.60	20.00	1,225.11	1,225.11	1,221.11	4.00	88.3		4.00	3.53	0.47	GL17+09L	0.27	10.52	0.015000
GL17+09L	Slot ADOT C-13.60	20.00	1,223.83	1,223.83	1,219.83	4.00	91.8		4.47	4.10	0.36	30+37	0.30	12.19	0.009000
GL17+16R	Slot ADOT C-13.60	20.00	1,223.84	1,223.84	1,219.84	4.00	87.8		4.40	3.86	0.54	30+37	0.29	11.25	0.013000

Scenario: STORM DRAIN 1 AGDALENA/BATOUA: 10-yr

Combined Pipe/Node Report

Pipe	Up. Node	Dn. Node	System Q (cfs)	Length (ft)	Size	Material	Up Sump (ft)	Up Invert (ft)	Dn Invert (ft)	S (ft/ft)	Energy Slope (ft/ft)	Critical Slope (ft/ft)	Velocity Out (ft/s)	Up Gr Elev (ft)	HGL In (ft)	HGL Out (ft)	Cap (cfs)
L101L	13+40L	13+50	2.75	17.50	18 inch	HDPE SMOOTH	1,231.90	1,231.90	1,231.50	0.022857	0.011819	0.004326	6.30	1,235.90	1,232.53	1,231.94	17.20
L102R	15+75R	15+75	1.42	15.00	18 inch	HDPE SMOOTH	1,229.16	1,229.16	1,227.00	0.144000	0.009883	0.004179	0.80	1,233.16	1,229.61	1,229.61	43.18
L103L	16+15L	16+15	3.83	14.70	18 inch	HDPE SMOOTH	1,228.25	1,228.25	1,227.10	0.078231	0.001155	0.004566	2.17	1,232.25	1,229.26	1,229.31	31.83
L107L	20+75L	20+75	3.86	15.70	18 inch	HDPE SMOOTH	1,225.04	1,225.04	1,221.80	0.206369	0.159543	0.004576	2.19	1,229.04	1,225.79	1,223.51	51.69
L107R	20+81R	20+75	3.72	14.60	18 inch	HDPE SMOOTH	1,224.90	1,224.66	1,221.80	0.195890	0.147322	0.004543	2.11	1,228.90	1,225.40	1,223.47	50.36
L110R	24+55R	24+55	3.78	19.40	18 inch	HDPE SMOOTH	1,221.57	1,221.57	1,218.50	0.158247	0.126297	0.004558	2.14	1,225.57	1,222.31	1,220.08	45.27
L111L	25+68L	25+90	3.92	18.40	18 inch	HDPE SMOOTH	1,220.54	1,220.54	1,218.00	0.138043	0.131169	0.004590	2.99	1,224.54	1,221.30	1,219.04	42.28
L1103L	GL16+06L	GL16+00	3.53	20.80	18 inch	HDPE SMOOTH	1,221.11	1,221.11	1,219.08	0.097596	0.012319	0.004491	2.00	1,225.11	1,221.83	1,221.79	35.55
L1103R	GL16+00R	GL16+00	3.60	11.40	18 inch	HDPE SMOOTH	1,221.32	1,221.32	1,219.08	0.196491	0.051358	0.004508	2.04	1,225.32	1,222.04	1,221.68	50.44
L1105L	GL17+09L	GL17+16	4.10	20.40	18 inch	HDPE SMOOTH	1,219.83	1,219.83	1,216.50	0.163235	0.052756	0.004641	2.32	1,223.83	1,220.61	1,219.75	45.97
L1105R	GL17+16R	GL17+16	3.86	11.50	18 inch	HDPE SMOOTH	1,219.84	1,219.84	1,217.00	0.246957	0.087903	0.004574	2.18	1,223.84	1,220.59	1,219.80	56.55
P100	10+73	13+50	26.00	276.70	30 inch	HDPE SMOOTH	1,233.35	1,233.35	1,230.70	0.009577	0.008879	0.004972	9.25	1,239.98	1,235.09	1,232.09	43.48
P101	13+50	15+75	28.75	225.00	30 inch	HDPE SMOOTH	1,227.68	1,227.68	1,226.34	0.005956	0.004155	0.005346	5.86	1,236.48	1,230.12	1,229.19	34.29
P102	15+75	16+15	30.17	74.00	30 inch	HDPE SMOOTH	1,226.34	1,226.34	1,226.10	0.003243	0.004611	0.005561	6.15	1,233.12	1,229.14	1,228.80	25.30
P103	16+15	16+67	34.00	122.60	30 inch	HDPE SMOOTH	1,226.10	1,226.10	1,225.79	0.002529	0.005495	0.006235	8.14	1,232.55	1,228.73	1,227.77	22.34
P104	16+67	16+83	34.00	16.10	36 inch	HDPE SMOOTH	1,223.28	1,223.28	1,223.19	0.005590	0.004626	0.004210	6.70	1,232.00	1,225.17	1,225.21	54.02
P105	16+83	20+75	34.00	392.50	36 inch	HDPE SMOOTH	1,223.19	1,223.19	1,220.84	0.005987	0.005845	0.004210	6.26	1,231.90	1,225.08	1,222.99	55.91
P106	20+75	21+03	41.59	25.90	36 inch	HDPE SMOOTH	1,220.84	1,220.84	1,220.67	0.006564	0.005158	0.004723	7.11	1,228.66	1,222.94	1,222.98	58.54
P107	21+03	21+84	41.59	71.80	36 inch	HDPE SMOOTH	1,220.67	1,220.67	1,219.25	0.019777	0.019270	0.004723	7.11	1,229.00	1,222.77	1,221.56	101.61
P108	21+84	21+90	41.59	6.20	36 inch	HDPE SMOOTH	1,219.25	1,219.25	1,219.16	0.014516	0.005764	0.004723	8.92	1,228.00	1,221.35	1,221.04	87.05
P109	21+90	24+55	41.59	261.40	36 inch	HDPE SMOOTH	1,218.15	1,218.15	1,217.09	0.004055	0.003669	0.004723	6.60	1,228.00	1,220.39	1,219.59	46.01
P110	24+55	25+90	45.37	138.70	36 inch	HDPE SMOOTH	1,217.09	1,217.09	1,216.55	0.003893	0.004031	0.005032	7.50	1,226.20	1,219.54	1,218.95	45.08
P111	25+90	27+09	49.29	118.30	48 inch	HDPE SMOOTH	1,215.55	1,215.55	1,215.08	0.003973	0.000904	0.003376	4.00	1,224.77	1,218.93	1,218.87	98.08
P112	27+09	28+90	107.39	181.90	48 inch	HDPE SMOOTH	1,215.08	1,215.08	1,214.35	0.004013	0.004165	0.005194	9.00	1,224.00	1,218.74	1,217.96	98.58
P113	28+90	29+54	107.39	63.50	48 inch	HDPE SMOOTH	1,214.35	1,214.35	1,214.10	0.003937	0.004290	0.005194	9.23	1,223.07	1,217.89	1,217.59	97.64
P114	29+54	30+37	107.39	82.30	48 inch	HDPE SMOOTH	1,214.10	1,214.10	1,210.00	0.049818	0.048369	0.005194	9.03	1,221.40	1,217.24	1,213.59	347.31
P115	30+37	32+13 (NE BA	119.00	176.90	60 inch	Concrete	1,210.00	1,210.00	1,208.00	0.011306	0.002118	0.003511	6.06	1,223.50	1,213.12	1,213.50	299.99
P1101	GL10+54	GL14+00	43.00	346.00	30 inch	HDPE SMOOTH	1,224.57	1,224.57	1,222.49	0.006012	0.009224	0.008472	9.43	1,231.34	1,228.06	1,224.68	34.45
P1102	GL14+00	GL16+00	43.00	200.20	30 inch	HDPE SMOOTH	1,219.78	1,219.78	1,218.58	0.005994	0.009365	0.008472	8.76	1,227.83	1,223.85	1,221.97	34.40
P1103	GL16+00	GL17+00	50.14	100.00	30 inch	HDPE SMOOTH	1,218.58	1,218.58	1,217.99	0.005900	0.012580	0.011049	10.61	1,225.26	1,221.68	1,220.29	34.13
P1104	GL17+00	GL17+16	50.14	15.80	36 inch	HDPE SMOOTH	1,215.45	1,215.45	1,215.42	0.001899	0.004815	0.005485	7.09	1,224.32	1,219.16	1,219.08	31.48
P1105	GL17+16	27+09	58.10	33.60	36 inch	HDPE SMOOTH	1,215.42	1,215.42	1,215.35	0.002083	0.006466	0.006427	8.22	1,224.27	1,218.96	1,218.74	32.98

Scenario: STORM DRAIN 2, Vauo Nawi: 10-yr



Inlet Report

INLET	Inlet	Slotted Drain Length (ft)	Ground Elev (ft)	Grate Elev (ft)	Sump Elev (ft)	Addtnl Carryover (cfs)	Capture Effic (%)	Clog (%)	Total Inlet Addtnl Flow (cfs)	Intercept Addtnl Flow (cfs)	Bypass Addtnl Flow (cfs)	Bypass Target	Gutter or Ditch Depth (ft)	Gutter or Ditch Spread (ft)	Gutter Long Slope (ft/ft)
10+62R	Ditch MAG 535 - TYPE F		1,228.80	1,226.30	1,222.30	2.00	100.0	50.0	2.00	2.00	0.00		0.17	4.03	
13+55R	Slot ADOT C-13.60	10.00	1,227.67	1,227.67	1,223.67	2.00	92.1		2.42	2.22	0.19	18+07R	0.32	12.88	0.00200
18+07R	Slot ADOT C-13.60	10.00	1,226.38	1,226.38	1,222.38	2.00	94.1		2.19	2.06	0.13	19+40R	0.31	12.39	0.00200
19+40R	Slot ADOT C-13.60	10.00	1,226.05	1,226.05	1,222.05	2.00	89.0		2.76	2.46	0.30	VN0+50R	0.33	13.58	0.00200
BH9+10R	Slot ADOT C-13.60	20.00	1,227.66	1,227.66	1,223.66	10.00	100.0		10.00	10.00	0.00		0.34	14.03	
BH11+81R	Slot ADOT C-13.60	20.00	1,227.50	1,227.50	1,223.50	8.00	100.0		8.00	8.00	0.00		0.29	11.67	
IG10+60	Generic Default 100%		1,245.08	1,245.08	1,240.00	36.00	100.0		36.00	36.00	0.00		0.00	0.00	
IG14+80R	Slot ADOT C-13.60	20.00	1,238.94	1,238.94	1,234.94	4.00	88.2		4.00	3.53	0.47	IG15+80R	0.27	10.50	0.01510
IG15+80R	Slot ADOT C-13.60	20.00	1,237.73	1,237.73	1,233.73	4.00	95.6		4.47	4.27	0.20	IG19+90RL	0.32	13.10	0.00630
IG17+00L	Slot ADOT C-13.60	20.00	1,235.59	1,235.59	1,230.19	4.00	92.4		4.00	3.70	0.30	IG19+90RL	0.29	11.29	0.01060
IG19+90RL	Slot ADOT C-13.60	20.00	1,232.26	1,232.26	1,228.26	4.00	83.7		4.50	3.76	0.73	IG20+85RL	0.27	10.74	0.01710
IG20+85RL	Slot ADOT C-13.60	20.00	1,230.69	1,230.69	1,226.69	4.00	82.7		4.73	3.92	0.82	IG24+78RL	0.28	11.04	0.01660
IG24+78RL	Slot ADOT C-13.60	20.00	1,227.20	1,227.20	1,223.20	4.00	86.9		4.82	4.18	0.63	19+40R	0.30	11.92	0.01170
MX10+42	Generic Default 100%		1,233.08	1,233.08	1,226.89	60.00	100.0		60.00	60.00	0.00		0.00	0.00	
MX14+60RL	Slot ADOT C-13.60	20.00	1,228.16	1,228.16	1,224.16	4.00	89.6		4.00	3.58	0.42	13+55R	0.27	10.75	0.01350
SA10+60	Generic Default 100%		1,242.56	1,242.56	1,237.77	13.00	100.0		13.00	13.00	0.00		0.00	0.00	
SA13+14RL	Slot ADOT C-13.60	20.00	1,238.30	1,238.30	1,234.30	4.00	83.6		4.00	3.34	0.66	SA16+74R	0.26	9.75	0.02170
SA16+74RL	Slot ADOT C-13.60	20.00	1,233.19	1,233.19	1,229.19	4.00	89.3		4.66	4.16	0.50	SA19+85R	0.30	12.07	0.01030
SA19+85RL	Slot ADOT C-13.60	20.00	1,229.73	1,229.73	1,225.73	5.00	86.1		5.50	4.73	0.76	SA20+69R	0.32	13.08	0.00960
SA20+69RL	Slot ADOT C-13.60	20.00	1,228.77	1,228.77	1,224.77	6.00	78.4		6.76	5.30	1.46	SA24+93R	0.33	13.70	0.01150
SA24+93RL	Slot ADOT C-13.60	40.00	1,225.96	1,225.96	1,220.96	16.00	95.9		17.46	16.74	0.72	VN0+50R	0.50	21.90	0.00680
VN0+50R	Slot ADOT C-13.60	20.00	1,225.50	1,225.50	1,221.50	2.00	100.0		3.03	3.03	0.00		0.15	4.68	
VN2+71	Generic MAG 501-5 DROP 36		1,224.60	1,221.50	1,218.84	26.00	100.0		26.00	26.00	0.00		0.00	0.00	

Scenario: STORM DR 2, Vauo Nawi: 10-yr

Combined Pipe/Node Report

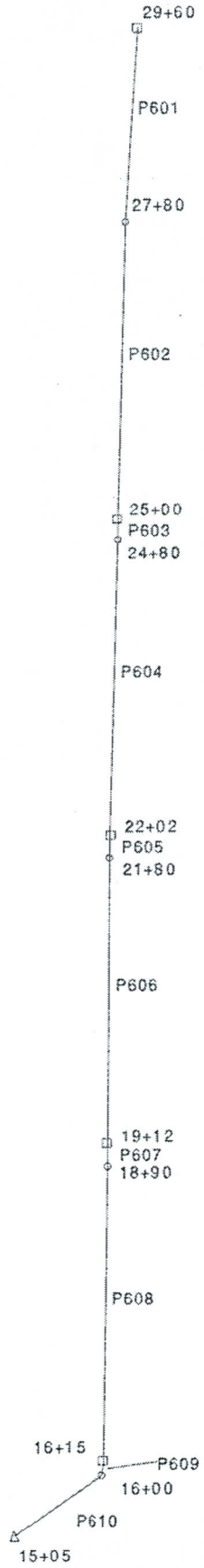
Pipe	Up. Node	Dn. Node	System Q (cfs)	Length (ft)	Size	Material	Up Sump (ft)	Up Invert (ft)	Dn Invert (ft)	S (ft/ft)	Energy Slope (ft/ft)	Critical Slope (ft/ft)	Velocity Out (ft/s)	Up Gr Elev (ft)	HGL In (ft)	HGL Out (ft)	Cap (cfs)
L203R	19+40R	19+06	2.46	39.00	18 inch	HDPE SMOOTH	1,222.05	1,222.05	1,219.00	0.07821	0.00047	0.00427	1.39	1,226.05	1,224.21	1,224.19	31.82
L204R	18+07R	18+07	2.06	15.90	18 inch	HDPE SMOOTH	1,222.38	1,222.38	1,220.00	0.14969	0.00033	0.00422	1.17	1,226.38	1,224.53	1,224.52	44.02
L207R	13+55R	13+55	2.22	15.40	18 inch	HDPE SMOOTH	1,223.67	1,223.67	1,220.00	0.23831	0.06740	0.00424	1.26	1,227.67	1,224.23	1,223.38	55.55
L210R	10+62R	10+62	2.00	12.80	18 inch	HDPE SMOOTH	1,222.30	1,222.30	1,218.50	0.29687	0.09136	0.00421	1.13	1,228.80	1,222.83	1,221.84	62.00
L2101L	SA13+14RL	SA13+60	3.34	49.00	18 inch	HDPE SMOOTH	1,234.30	1,234.30	1,233.00	0.02653	0.01807	0.00445	7.79	1,238.30	1,235.00	1,233.44	18.53
L2103R	SA16+74RL	SA16+60	4.16	24.10	18 inch	HDPE SMOOTH	1,229.19	1,229.19	1,228.60	0.02448	0.01067	0.00466	2.51	1,233.19	1,229.97	1,229.93	17.80
L2104L	SA19+85RL	SA19+60	4.73	30.10	18 inch	HDPE SMOOTH	1,225.73	1,225.73	1,224.00	0.05748	0.00231	0.00483	2.68	1,229.73	1,226.57	1,226.72	27.28
L2105R	SA20+69RL	SA20+69	5.30	19.20	18 inch	HDPE SMOOTH	1,224.77	1,224.77	1,223.50	0.06615	0.00215	0.00503	3.00	1,228.77	1,226.15	1,226.12	29.27
L2203R	VN0+50R	VN0+50	3.03	16.40	18 inch	HDPE SMOOTH	1,221.50	1,221.50	1,219.00	0.15244	0.00071	0.00437	1.71	1,225.50	1,224.87	1,224.85	44.43
L2303R	IG14+80R	IG14+80	3.53	20.10	18 inch	HDPE SMOOTH	1,234.94	1,234.94	1,232.00	0.14627	0.04668	0.00449	2.00	1,238.94	1,235.66	1,234.94	43.52
L2304R	IG15+80R	IG15+55	4.27	33.00	18 inch	HDPE SMOOTH	1,233.73	1,233.73	1,231.50	0.06758	0.02155	0.00469	2.42	1,237.73	1,234.52	1,234.04	29.58
L2305L	IG17+00L	IG16+60	3.70	47.10	18 inch	HDPE SMOOTH	1,230.19	1,230.19	1,229.00	0.02527	0.01365	0.00453	2.09	1,235.59	1,230.92	1,230.50	18.09
L2306R	IG19+90RL	IG19+75	3.76	24.50	18 inch	HDPE SMOOTH	1,228.26	1,228.26	1,225.20	0.12490	0.10585	0.00455	2.17	1,232.26	1,229.00	1,226.63	40.21
L2307R	IG20+85RL	IG20+85	3.92	20.40	18 inch	HDPE SMOOTH	1,226.69	1,226.69	1,224.50	0.10735	0.08340	0.00459	2.23	1,230.69	1,227.45	1,225.97	37.28
L2309L	IG24+78RL	IG24+78	4.18	9.80	18 inch	HDPE SMOOTH	1,223.20	1,223.20	1,220.00	0.32653	0.00135	0.00466	2.37	1,227.20	1,225.41	1,225.39	65.02
L2403R	MX14+60RL	MX14+40	3.58	31.70	18 inch	HDPE SMOOTH	1,224.16	1,224.16	1,220.50	0.11546	0.02909	0.00450	2.03	1,228.16	1,224.88	1,224.18	38.67
L2501R	BH9+10R	BH10+00	10.00	14.60	24 inch	HDPE SMOOTH	1,223.66	1,223.66	1,221.40	0.15479	0.14458	0.00443	3.96	1,227.66	1,224.79	1,222.90	96.42
L2502R	BH11+81R	BH11+81	8.00	8.50	18 inch	HDPE SMOOTH	1,223.50	1,223.50	1,223.00	0.05882	0.01376	0.00633	8.94	1,227.50	1,224.60	1,223.76	27.60
P-2107L	SA24+93RL	SA24+80	16.74	16.80	24 inch	HDPE SMOOTH	1,220.96	1,220.96	1,220.00	0.05714	0.00466	0.00584	5.33	1,225.96	1,225.24	1,225.16	58.58
P201	23+01(SD2)	19+06	76.30	395.50	54 inch	Concrete	1,217.90	1,217.94	1,217.31	0.00159	0.00151	0.00397	4.80	1,225.98	1,224.71	1,224.12	78.48
P202	19+06	18+49	78.76	55.50	60 inch	Concrete	1,217.31	1,217.31	1,217.23	0.00144	0.00091	0.00360	4.01	1,226.78	1,224.10	1,224.05	98.88
P203	18+49	18+07	138.13	31.90	60 inch	Concrete	1,217.23	1,217.23	1,217.17	0.00188	0.00281	0.00445	7.03	1,226.52	1,224.01	1,223.92	112.95
P204	18+07	14+46	140.19	362.30	60 inch	Concrete	1,217.17	1,217.17	1,216.63	0.00149	0.00290	0.00449	7.14	1,226.73	1,223.88	1,222.83	100.54
P205	14+46	14+02	140.19	42.00	66 inch	Concrete	1,216.63	1,216.63	1,216.57	0.00143	0.00174	0.00387	5.90	1,227.84	1,222.81	1,222.74	126.92
P206	14+02	13+55	203.78	24.20	66 inch	Concrete	1,216.57	1,216.57	1,216.51	0.00248	0.00368	0.00478	8.58	1,228.00	1,222.69	1,222.60	167.20
P207	13+55	11+59	206.00	201.10	66 inch	Concrete	1,216.51	1,216.51	1,216.22	0.00144	0.00376	0.00482	8.67	1,228.00	1,222.55	1,221.80	127.52
P208	11+59	11+36	206.00	22.20	66 inch	Concrete	1,216.22	1,216.22	1,216.18	0.00180	0.00327	0.00482	8.82	1,228.14	1,221.51	1,221.43	142.54
P209	11+36	10+62	224.00	69.70	66 inch	Concrete	1,216.18	1,216.18	1,216.07	0.00158	0.00388	0.00517	10.01	1,228.40	1,221.36	1,220.98	133.40
P210	10+62	10+00	226.00	58.30	66 inch	Concrete	1,216.07	1,216.07	1,215.98	0.00154	0.00439	0.00521	11.59	1,227.50	1,220.91	1,220.19	131.93
P2101	SA10+60	SA13+60	13.00	299.70	30 inch	HDPE SMOOTH	1,237.77	1,237.27	1,232.05	0.01742	0.01727	0.00381	4.61	1,242.56	1,238.48	1,233.45	58.64
P2102	SA13+60	SA16+60	16.34	299.80	30 inch	HDPE SMOOTH	1,232.05	1,232.05	1,228.27	0.01261	0.01238	0.00403	4.87	1,237.48	1,233.42	1,229.89	49.89
P2103	SA16+60	SA19+60	20.50	300.00	30 inch	HDPE SMOOTH	1,228.27	1,228.27	1,224.51	0.01253	0.01183	0.00437	4.76	1,233.59	1,229.81	1,226.56	49.74
P2104	SA19+60	SA20+69	25.24	109.70	30 inch	HDPE SMOOTH	1,223.46	1,223.46	1,223.24	0.00201	0.00323	0.00488	5.14	1,230.36	1,226.52	1,226.17	19.90
P2105	SA20+69	SA21+60	30.54	90.30	30 inch	HDPE SMOOTH	1,223.40	1,223.40	1,223.06	0.00377	0.00472	0.00562	6.22	1,228.91	1,226.06	1,225.64	27.26
P2106	SA21+60	SA24+80	30.54	320.70	36 inch	HDPE SMOOTH	1,222.55	1,222.55	1,220.37	0.00680	0.00179	0.00402	4.32	1,228.54	1,225.62	1,225.04	59.57

Scenario: STOR[illegible]D[illegible]IN 2, Vauo Nawi: 10-yr

Combined Pipe/Node Report

Pipe	Up. Node	Dn. Node	System Q (cfs)	Length (ft)	Size	Material	Up Sump (ft)	Up Invert (ft)	Dn Invert (ft)	S (ft/ft)	Energy Slope (ft/ft)	Critical Slope (ft/ft)	Velocity Out (ft/s)	Up Gr Elev (ft)	HGL In (ft)	HGL Out (ft)	Cap (cfs)
P2107	SA24+80	SA25+23	47.28	33.10	54 inch	HDPE SMOOTH	1,218.12	1,218.12	1,217.93	0.00574	0.00049	0.00304	2.97	1,226.19	1,225.04	1,225.02	161.40
P2108	SA25+23	23+01(SD2)	47.28	15.80	54 inch	HDPE SMOOTH	1,217.93	1,217.93	1,217.90	0.00190	0.00049	0.00304	2.97	1,226.02	1,224.92	1,224.91	92.82
P2201	VN2+71	VN 2+00	26.00	88.60	36 inch	HDPE SMOOTH	1,218.84	1,218.84	1,218.74	0.00113	0.00129	0.00380	3.68	1,224.60	1,225.27	1,225.16	24.27
P2202	VN 2+00	VN0+50	26.00	150.00	36 inch	HDPE SMOOTH	1,218.74	1,218.74	1,218.51	0.00153	0.00129	0.00380	3.68	1,225.48	1,225.11	1,224.92	28.29
P2203	VN0+50	VN0+08	29.03	42.00	36 inch	HDPE SMOOTH	1,218.51	1,218.51	1,218.45	0.00143	0.00161	0.00394	4.11	1,225.90	1,224.85	1,224.79	27.31
P2204	VN0+08	23+01(SD2)	29.03	12.40	36 inch	HDPE SMOOTH	1,218.45	1,218.45	1,218.44	0.00081	0.00161	0.00394	4.11	1,226.20	1,224.76	1,224.74	20.52
P2301	IG10+60	IG13+60	36.00	300.80	30 inch	HDPE SMOOTH	1,240.00	1,240.00	1,235.50	0.01496	0.01320	0.00665	11.84	1,245.08	1,242.04	1,236.99	54.35
P2302	IG13+60	IG14+80	36.00	119.80	30 inch	HDPE SMOOTH	1,231.79	1,231.79	1,231.08	0.00593	0.00656	0.00665	7.33	1,240.93	1,234.97	1,234.18	34.21
P2303	IG14+80	IG15+55	39.53	75.10	30 inch	HDPE SMOOTH	1,231.08	1,231.08	1,230.63	0.00599	0.00791	0.00749	8.05	1,239.11	1,234.09	1,233.49	34.39
P2304	IG15+55	IG16+60	43.80	105.30	30 inch	HDPE SMOOTH	1,230.63	1,230.63	1,230.01	0.00589	0.00934	0.00873	9.56	1,237.80	1,233.38	1,232.21	34.09
P2305	IG16+60	IG19+75	47.50	314.50	36 inch	HDPE SMOOTH	1,227.88	1,227.88	1,226.01	0.00595	0.00590	0.00523	8.85	1,236.34	1,230.12	1,228.14	55.71
P2306	IG19+75	IG20+85	51.27	112.60	36 inch	HDPE SMOOTH	1,223.70	1,223.70	1,223.05	0.00577	0.00573	0.00560	8.46	1,232.50	1,226.03	1,225.45	54.90
P2307	IG20+85	IG22+60	55.18	172.50	42 inch	HDPE SMOOTH	1,223.05	1,223.05	1,222.01	0.00603	0.00260	0.00421	5.76	1,231.04	1,225.40	1,225.44	84.63
P2308	IG22+60	IG24+78	55.18	218.50	42 inch	HDPE SMOOTH	1,219.26	1,219.26	1,218.39	0.00398	0.00256	0.00421	5.74	1,229.48	1,225.40	1,224.84	68.77
P2309	IG24+78	18+49	59.37	49.90	42 inch	HDPE SMOOTH	1,218.39	1,218.39	1,218.20	0.00381	0.00297	0.00440	6.17	1,227.37	1,224.79	1,224.64	67.25
P2401	MX10+42	MX11+60	60.00	119.20	36 inch	HDPE SMOOTH	1,226.89	1,226.89	1,226.19	0.00587	0.00620	0.00669	9.53	1,233.08	1,229.61	1,228.69	55.37
P2402	MX11+60	MX14+40	60.00	279.10	36 inch	HDPE SMOOTH	1,223.67	1,223.67	1,222.01	0.00595	0.00612	0.00669	9.53	1,231.77	1,226.41	1,224.51	55.72
P2403	MX14+40	14+02	63.58	61.30	42 inch	HDPE SMOOTH	1,218.84	1,218.84	1,218.48	0.00587	0.00340	0.00461	6.61	1,228.60	1,223.71	1,223.50	83.52
P2501	BH10+00	BH11+81	10.00	181.60	24 inch	HDPE SMOOTH	1,221.40	1,221.40	1,220.67	0.00402	0.00175	0.00443	3.22	1,228.00	1,222.78	1,222.59	15.54
P2502	BH11+81	11+36	18.00	36.90	24 inch	HDPE SMOOTH	1,220.67	1,220.67	1,218.27	0.06504	0.00535	0.00622	5.73	1,227.62	1,222.38	1,222.29	62.50

Scenario: STORM DRAIN 5, Highline South: 10-yr



Title: STM DRN 5
p:\...\610drain\610estmdr\sd05_hilinsou.stm
09/13/01 09:13:26 AM © Haestad Methods, Inc. 37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Sverdrup Civil, Inc

Project Engineer: Dan Stough
StormCAD v3.0 [319]
Page 1 of 1

Scenario: STORM DRAIN 5, Highline South: 10-yr

Area Inlet Report

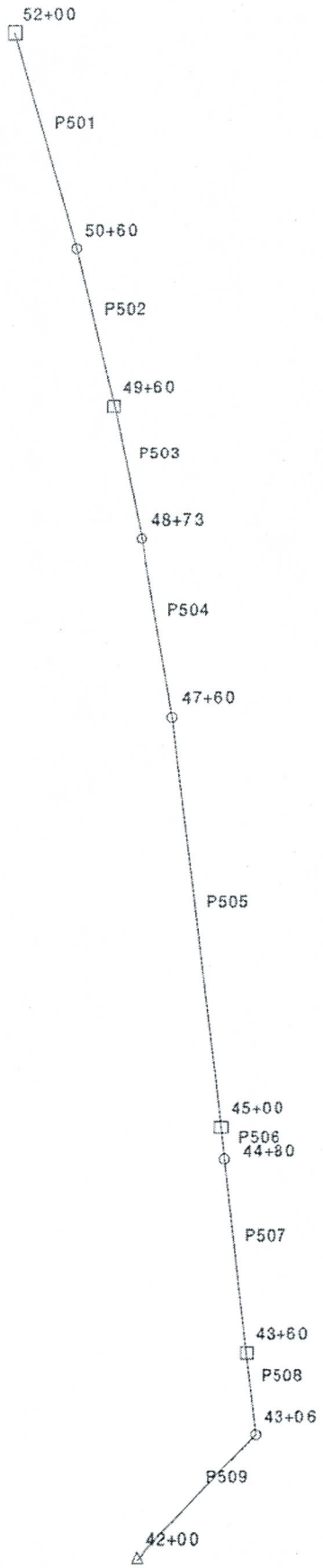
INLET	Inlet	Ground Elev (ft)	Grate Elev (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Ou (ft)	Sump Elev (ft)	Addtnl Carryover (cfs)	Capture Effic (%)	Clog (%)	Total Inlet Addtnl Flow (cfs)	Intercept Addtnl Flow (cfs)	Bypass Addtnl Flow (cfs)	Gutter or Ditch Depth (ft)	Gutter or Ditch Spread (ft)
16+15	Ditch MAG 538 - TYPE H DBL	1,225.30	1,223.27	1,221.18	1,221.16	1,218.15	10.00	100.0	50.0	10.00	10.00	0.00	0.52	6.09
19+12	Ditch MAG 538 - TYPE H DBL	1,225.00	1,222.92	1,221.63	1,221.60	1,218.74	10.00	100.0	50.0	10.00	10.00	0.00	0.52	6.09
22+02	Ditch MAG 538 - TYPE H DBL	1,225.00	1,223.50	1,222.12	1,222.10	1,219.32	3.00	100.0	50.0	3.00	3.00	0.00	0.23	4.39
25+00	Ditch MAG 538 - TYPE H DBL	1,225.60	1,224.00	1,222.52	1,222.51	1,219.92	14.00	100.0	50.0	14.00	14.00	0.00	0.65	6.87
29+60	Ditch MAG 535 - TYPE F DOUBL	1,225.00	1,224.00	1,222.76	1,222.76	1,220.83	14.00	100.0	50.0	14.00	14.00	0.00	0.80	8.82

Scenario: STORM DRAIN 5, Highline South: 10-yr

Combined Pipe/Node Report

Pipe	Up. Node	Dn. Node	System Q (cfs)	Length (ft)	Size	Material	Up Sump (ft)	Up Invert (ft)	Dn Invert (ft)	S (ft/ft)	Energy Slope (ft/ft)	Critical Slope (ft/ft)	Velocity Out (ft/s)	Up Gr Elev (ft)	HGL In (ft)	HGL Out (ft)	Cap (cfs)
P601	29+60	27+80	14.00	179.50	30 inch	HDPE SMOOTH	1,220.83	1,220.83	1,220.47	0.002006	0.001011	0.003868	3.12	1,225.00	1,222.76	1,222.61	19.90
P602	27+80	25+00	14.00	280.00	36 inch	HDPE SMOOTH	1,220.47	1,220.47	1,219.92	0.001964	0.000415	0.003394	2.15	1,225.05	1,222.61	1,222.52	32.02
P603	25+00	24+80	28.00	20.10	36 inch	HDPE SMOOTH	1,219.92	1,219.92	1,219.88	0.001990	0.001378	0.003893	4.30	1,225.60	1,222.51	1,222.48	32.23
P604	24+80	22+02	28.00	278.60	36 inch	HDPE SMOOTH	1,219.88	1,219.88	1,219.32	0.002010	0.001335	0.003893	4.07	1,225.00	1,222.46	1,222.12	32.39
P605	22+02	21+80	31.00	21.40	36 inch	HDPE SMOOTH	1,219.32	1,219.32	1,219.27	0.002336	0.001584	0.004042	4.51	1,225.00	1,222.10	1,222.07	34.92
P606	21+80	19+12	31.00	268.30	36 inch	HDPE SMOOTH	1,219.27	1,219.27	1,218.74	0.001975	0.001600	0.004042	4.44	1,225.00	1,222.05	1,221.63	32.11
P607	19+12	18+90	41.00	21.80	36 inch	HDPE SMOOTH	1,218.74	1,218.74	1,218.69	0.002294	0.002791	0.004678	5.91	1,225.00	1,221.60	1,221.54	34.60
P608	18+90	16+15	41.00	275.80	42 inch	HDPE SMOOTH	1,218.69	1,218.69	1,218.15	0.001958	0.001373	0.003690	4.63	1,224.50	1,221.52	1,221.18	48.23
P609	16+15	16+00	51.00	12.80	42 inch	HDPE SMOOTH	1,218.15	1,218.15	1,218.12	0.002344	0.002018	0.004039	5.79	1,225.30	1,221.16	1,221.13	52.76
P610	16+00	15+05	51.00	95.10	42 inch	HDPE SMOOTH	1,218.12	1,218.12	1,217.92	0.002103	0.002614	0.004039	6.71	1,225.50	1,220.80	1,220.50	49.98

Scenario: STORM DRAIN 6 - C. BASIN 1-FOOT DEEP



Scenario: STORM Drain 6, Highline, Central: 10-yr

Area Inlet Report

INLET	Inlet	Ground Elev (ft)	Grate Elev (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Out (ft)	Sump Elev (ft)	Addtnl Carryover (cfs)	Capture Effic (%)	Clog (%)	Total Inlet Addtnl Flow (cfs)	Intercept Addtnl Flow (cfs)	Bypass Addtnl Flow (cfs)	Gutter or Ditch Depth (ft)	Gutter or Ditch Spread (ft)
43+60	Ditch MAG 538 - TYPE H DBL	1,224.40	1,223.34	1,219.55	1,219.55	1,217.35	1.00	100.0	50.0	1.00	1.00	0.00	0.13	3.77
45+00	Ditch MAG 535 - TYPE F DOUBL	1,224.80	1,223.55	1,219.57	1,219.56	1,218.12	1.00	100.0	50.0	1.00	1.00	0.00	0.10	3.57
49+60	Ditch MAG 535 - TYPE F DOUBL	1,224.00	1,223.22	1,219.69	1,219.69	1,219.03	1.00	100.0	50.0	1.00	1.00	0.00	0.08	3.45
52+00	Ditch MAG 535 - TYPE F	1,224.00	1,223.23	1,219.92	1,219.92	1,219.51	1.00	100.0	50.0	1.00	1.00	0.00	0.11	3.66

Scenario: STORM DRAIN 6, Highline, Central: 10-yr

Combined Pipe/Node Report

Pipe	Up. Node	Dn. Node	System Q (cfs)	Length (ft)	Size	Material	Up Sump (ft)	Up Invert (ft)	Dn Invert (ft)	S (ft/ft)	Energy Slope (ft/ft)	Critical Slope (ft/ft)	Velocity Out (ft/s)	Up Gr Elev (ft)	HGL In (ft)	HGL Out (ft)	Cap (cfs)
P501	52+00	50+60	1.00	139.90	24 inch	HDPE SMOOTH	1,219.51	1,219.51	1,219.24	0.001930	0.001785	0.003986	1.91	1,224.00	1,219.92	1,219.69	10.77
P502	50+60	49+60	1.00	100.00	24 inch	HDPE SMOOTH	1,219.24	1,219.24	1,219.03	0.002100	0.000849	0.003986	1.25	1,224.00	1,219.68	1,219.63	11.23
P503	49+60	48+73	2.00	86.40	24 inch	HDPE SMOOTH	1,219.03	1,219.03	1,218.87	0.001852	0.001661	0.003826	2.38	1,224.00	1,219.63	1,219.50	10.55
P504	48+73	47+60	2.00	113.50	24 inch	HDPE SMOOTH	1,218.87	1,218.87	1,218.64	0.002026	0.001051	0.003826	1.78	1,224.00	1,219.49	1,219.41	11.03
P505	47+60	45+00	2.00	259.90	24 inch	HDPE SMOOTH	1,218.64	1,218.64	1,218.12	0.002001	0.000318	0.003826	0.98	1,223.98	1,219.41	1,219.36	10.96
P506	45+00	44+80	3.00	20.20	24 inch	HDPE SMOOTH	1,218.12	1,218.12	1,218.08	0.001980	0.000281	0.003797	1.42	1,224.80	1,219.36	1,219.36	10.91
P507	44+80	43+60	3.00	121.40	24 inch	HDPE SMOOTH	1,218.08	1,218.08	1,217.35	0.006013	0.000174	0.003797	0.95	1,224.38	1,219.35	1,219.35	19.00
P508	43+60	43+06	4.00	52.30	24 inch	HDPE SMOOTH	1,217.35	1,217.35	1,217.03	0.006119	0.000266	0.003823	1.27	1,224.40	1,219.35	1,219.33	19.17
P509	43+06	42+00	4.00	106.30	24 inch	HDPE SMOOTH	1,217.03	1,217.03	1,215.50	0.014393	0.000266	0.003823	1.27	1,223.90	1,219.33	1,219.30	29.40

Scenario: STORM DRAIN 6 - C. BASIN 1-FOOT DEEP

Combined Pipe/Node Report

Pipe	Up. Node	Dn. Node	System Q (cfs)	Length (ft)	Size	Material	Up Sump (ft)	Up Invert (ft)	Dn Invert (ft)	S (ft/ft)	Energy Slope (ft/ft)	Critical Slope (ft/ft)	Velocity Out (ft/s)	Up Gr Elev (ft)	HGL In (ft)	HGL Out (ft)	Cap (cfs)
P501	52+00	50+60	1.00	139.90	24 inch	HDPE SMOOTH	1,219.51	1,219.51	1,219.24	0.001930	0.001803	0.003986	1.93	1,224.00	1,219.92	1,219.68	10.77
P502	50+60	49+60	1.00	100.00	24 inch	HDPE SMOOTH	1,219.24	1,219.24	1,219.03	0.002100	0.000886	0.003986	1.28	1,224.00	1,219.68	1,219.63	11.23
P503	49+60	48+73	2.00	86.40	24 inch	HDPE SMOOTH	1,219.03	1,219.03	1,218.87	0.001852	0.001910	0.003826	2.65	1,224.00	1,219.62	1,219.45	10.55
P504	48+73	47+60	2.00	113.50	24 inch	HDPE SMOOTH	1,218.87	1,218.87	1,218.64	0.002026	0.001989	0.003826	2.61	1,224.00	1,219.45	1,219.23	11.03
P505	47+60	45+00	2.00	259.90	24 inch	HDPE SMOOTH	1,218.64	1,218.64	1,218.12	0.002001	0.001735	0.003826	2.08	1,223.98	1,219.22	1,218.81	10.96
P506	45+00	44+80	3.00	20.20	24 inch	HDPE SMOOTH	1,218.12	1,218.12	1,218.08	0.001980	0.002729	0.003797	3.65	1,224.80	1,218.80	1,218.70	10.91
P507	44+80	43+60	3.00	121.40	24 inch	HDPE SMOOTH	1,218.08	1,218.08	1,217.35	0.006013	0.005775	0.003797	2.99	1,224.38	1,218.68	1,218.06	19.00
P508	43+60	43+06	4.00	52.30	24 inch	HDPE SMOOTH	1,217.35	1,217.35	1,217.03	0.006119	0.005970	0.003823	3.66	1,224.40	1,218.05	1,217.79	19.17
P509	43+06	42+00	4.00	106.30	24 inch	HDPE SMOOTH	1,217.03	1,217.03	1,215.50	0.014393	0.013059	0.003823	2.55	1,223.90	1,217.73	1,216.50	29.40

E.5 Hydraulic Calculations

E.5. Hydraulic Calculations

Table E5-1 lists each storage area basin with its maximum water surface elevation for both the 24-hour storm and the 6-hour storm.

Table E5-2 and E5-3 list the profile output tables from HEC-RAS for the 24-hour and 6-hour storms, respectively.

Table E5-1. Maximum water surface elevations

	Max WSE (ft)	
	24 hr	**6 hr**
1CST	1224.1	1223.7
2DST	1224.0	1224.0
2EST	1224.0	1224.0
3AST	1225.0	1225.0
3EST	1225.0	1225.0
4DST	1225.0	1225.0
7AST	1225.7	1225.7
7BST	1226.1	1226.1
7DST	1226.1	1226.1
7EST	1226.1	1225.4
7FST	1226.1	1225.4

Table E5-2. 24-hour storage area summary table

Storage Area	W.S. Elev (ft)	SA Min El (ft)	Net Flux (cfs)	SA Area (acres)	SA Volume (acre-ft)
2DST	1224.0	1222	-3.75	2.13	0.22
2EST	1224.0	1210	2.26	1.22	9.52
3AST	1225.0	1222	-39.64	0.79	0.91
3EST	1225.0	1224	-2.81	0.56	0.08
4DST	1225.0	1216	18.63	3.76	20.15
7AST	1225.7	1225	-13.04	0.02	0.01
7BST	1226.1	1225	3.35	1.1	0.11
7DST	1226.1	1224	-4.56	0.6	0.41
7EST	1226.1	1224	-1.87	1.45	0.16
7FST	1226.1	1218	3.04	2.92	10.69
Canal	1214.1	1210	37.2	2.23	5.54

Tempe	1210.0	1210	1.19	1000	0

Table E5-3. 6-hour storage area summary table

Storage Area	W.S. Elev (ft)	SA Min El (ft)	Net Flux (cfs)	SA Area (acres)	SA Volume (acre-ft)
2DST	1224.0	1222	1.16	2.13	0.18
2EST	1224.0	1210	0	1.22	9.5
3AST	1225.0	1222	-37.73	0.79	0.91
3EST	1225.0	1224	-0.17	0.07	0.07
4DST	1225.0	1216	15.16	3.25	20.11
7AST	1225.7	1225	-16.03	0.02	0.01
7BST	1226.1	1225	-3.84	1.1	0.15
7DST	1226.1	1224	-6.13	0.6	0.43
7EST	1225.4	1224	0.41	0.05	0.03
7FST	1225.4	1218	9.37	2.21	9.12
Canal	1213.8	1210	37.79	2.13	4.95
Tempe	1210.0	1210	0	1000	0

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X      X   X     X  X    X
X     X  X        X           X   X    X    X   X
XXXXXXX  XXXX     X       XXX XXXX     XXXXXX    XXXX
X     X  X        X           X  X     X    X        X
X     X  X        X    X      X   X    X    X        X
X     X  XXXXXX    XXXX       X    X   X    X   XXXXX
```

****

PROJECT DATA
Project Title: Highline Lateral Canal
Project File : Highline_Lateral.prj
Run Date and Time: 2/2/2012 2:06:31 PM

Project in English units

Project Description:
Calibration model used to determine excess capacity of culvert at Avenide del Yaqui for the Highline Lateral Canal.

2-2-12 WEST Consultants
RIley
Asburry

Model created based on As-built documents finished in 1965.
As-builts provided by SRP.

****

PLAN DATA

Plan Title: canal w culvert
Plan File : P:\FCDM001001 Guadalupe FDS\Models\RAS\2-2-12\Highline Lateral Canal\Highline_Lateral.p02

Geometry Title: canal w culvert
Geometry File : P:\FCDM001001 Guadalupe FDS\Models\RAS\2-2-12\Highline Lateral Canal\Highline_Lateral.g02

Flow Title : canal w culvert
Flow File : P:\FCDM001001 Guadalupe FDS\Models\RAS\2-2-12\Highline Lateral Canal\Highline_Lateral.f02

Plan Description:
Added culvert, extra cross-sections DS of culvert, and wided cross-sections near the culvert to represent existing conditions.

Plan Summary Information:

Number of:	Cross Sections =	8	Multiple Openings =	0
	Culverts =	1	Inline Structures =	0

```
            Bridges        =    0    Lateral Structures =    0

Computational Information
    Water surface calculation tolerance  =  0.01
    Critical depth calculation tolerance =  0.01
    Maximum number of iterations         =  20
    Maximum difference tolerance         =  0.3
    Flow tolerance factor                =  0.001

Computation Options
    Critical depth computed only where necessary
    Conveyance Calculation Method: At breaks in n values only
    Friction Slope Method:         Average Conveyance
    Computational Flow Regime:     Subcritical Flow


*****************************************************************************

FLOW DATA

Flow Title: canal w culvert
Flow File : P:\FCDM001001 Guadalupe FDS\Models\RAS\2-2-12\Highline Lateral
Canal\Highline_Lateral.f02

Flow Data (cfs)
*****************************************************************************
* River           Reach           RS      *          Design             Max *
* highline        canal           700     *              68              83 *
*****************************************************************************

Boundary Conditions
*****************************************************************************************************
*******
* River           Reach           Profile          *            Upstream
Downstream    *
*****************************************************************************************************
*******
* highline        canal           Design           *                                Normal S =
0.00027 *
* highline        canal           Max              *                                Normal S =
0.00027 *
*****************************************************************************************************
*******

*****************************************************************************

GEOMETRY DATA

Geometry Title: canal w culvert
Geometry File : P:\FCDM001001 Guadalupe FDS\Models\RAS\2-2-12\Highline Lateral
Canal\Highline_Lateral.g02

CROSS SECTION


RIVER: highline
REACH: canal              RS: 700

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Description:
Station Elevation Data    num=       4
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```

```
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Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
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Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0   13.84              100     100     100             .1       .3

CROSS SECTION OUTPUT  Profile #Design
*****************************************************************************************
* E.G. Elev (ft)          * 1221.51  * Element                 *  Left OB *  Channel * Right OB *
* Vel Head (ft)           *    0.09  * Wt. n-Val.              *          *   0.014  *          *
* W.S. Elev (ft)          * 1221.42  * Reach Len. (ft)         *  100.00  *  100.00  *  100.00  *
* Crit W.S. (ft)          *          * Flow Area (sq ft)       *          *   28.01  *          *
* E.G. Slope (ft/ft)      *0.000224  * Area (sq ft)            *          *   28.01  *          *
* Q Total (cfs)           *   68.00  * Flow (cfs)               *          *   68.00  *          *
* Top Width (ft)          *   12.26  * Top Width (ft)           *          *   12.26  *          *
* Vel Total (ft/s)        *    2.43  * Avg. Vel. (ft/s)         *          *    2.43  *          *
* Max Chl Dpth (ft)       *    3.67  * Hydr. Depth (ft)         *          *    2.29  *          *
* Conv. Total (cfs)       *  4545.8  * Conv. (cfs)              *          *  4545.8  *          *
* Length Wtd. (ft)        *  100.00  * Wetted Per. (ft)         *          *   14.82  *          *
* Min Ch El (ft)          * 1217.74  * Shear (lb/sq ft)         *          *    0.03  *          *
* Alpha                   *    1.00  * Stream Power (lb/ft s)   *   13.84  *    0.00  *    0.00  *
* Frctn Loss (ft)         *    0.02  * Cum Volume (acre-ft)     *          *    0.35  *          *
* C & E Loss (ft)         *    0.00  * Cum SA (acres)           *          *    0.20  *          *
*****************************************************************************************

CROSS SECTION OUTPUT  Profile #Max
*****************************************************************************************
* E.G. Elev (ft)          * 1222.03  * Element                 *  Left OB *  Channel * Right OB *
* Vel Head (ft)           *    0.09  * Wt. n-Val.              *          *   0.014  *          *
* W.S. Elev (ft)          * 1221.94  * Reach Len. (ft)         *  100.00  *  100.00  *  100.00  *
* Crit W.S. (ft)          *          * Flow Area (sq ft)       *          *   34.73  *          *
* E.G. Slope (ft/ft)      *0.000188  * Area (sq ft)            *          *   34.73  *          *
* Q Total (cfs)           *   83.00  * Flow (cfs)               *          *   83.00  *          *
* Top Width (ft)          *   13.57  * Top Width (ft)           *          *   13.57  *          *
* Vel Total (ft/s)        *    2.39  * Avg. Vel. (ft/s)         *          *    2.39  *          *
* Max Chl Dpth (ft)       *    4.19  * Hydr. Depth (ft)         *          *    2.56  *          *
* Conv. Total (cfs)       *  6056.4  * Conv. (cfs)              *          *  6056.4  *          *
* Length Wtd. (ft)        *  100.00  * Wetted Per. (ft)         *          *   16.49  *          *
* Min Ch El (ft)          * 1217.74  * Shear (lb/sq ft)         *          *    0.02  *          *
* Alpha                   *    1.00  * Stream Power (lb/ft s)   *   13.84  *    0.00  *    0.00  *
* Frctn Loss (ft)         *    0.02  * Cum Volume (acre-ft)     *          *    0.40  *          *
* C & E Loss (ft)         *    0.00  * Cum SA (acres)           *          *    0.21  *          *
*****************************************************************************************

CROSS SECTION


RIVER: highline
REACH: canal              RS: 600

INPUT
Description:
Station Elevation Data    num=       4
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*************************************************************
       01222.022    5.421217.722    8.421217.722   13.841222.022
```

```
Manning's n Values          num=        3
     Sta   n Val      Sta   n Val      Sta   n Val
***********************************************
       0    .014       0    .014    13.84    .014

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0   13.84               80      80      80             .1       .3

CROSS SECTION OUTPUT  Profile #Design
*****************************************************************************************
* E.G. Elev (ft)          * 1221.49  * Element                 *  Left OB *  Channel * Right OB *
* Vel Head (ft)           *    0.09  * Wt. n-Val.              *          *   0.014  *          *
* W.S. Elev (ft)          * 1221.39  * Reach Len. (ft)         *   80.00  *   80.00  *   80.00  *
* Crit W.S. (ft)          *          * Flow Area (sq ft)       *          *   28.01  *          *
* E.G. Slope (ft/ft)      *0.000224  * Area (sq ft)            *          *   28.01  *          *
* Q Total (cfs)           *   68.00  * Flow (cfs)               *          *   68.00  *          *
* Top Width (ft)          *   12.26  * Top Width (ft)           *          *   12.26  *          *
* Vel Total (ft/s)        *    2.43  * Avg. Vel. (ft/s)         *          *    2.43  *          *
* Max Chl Dpth (ft)       *    3.67  * Hydr. Depth (ft)         *          *    2.29  *          *
* Conv. Total (cfs)       *  4544.8  * Conv. (cfs)              *          *  4544.8  *          *
* Length Wtd. (ft)        *   80.00  * Wetted Per. (ft)         *          *   14.82  *          *
* Min Ch El (ft)          * 1217.72  * Shear (lb/sq ft)         *          *    0.03  *          *
* Alpha                   *    1.00  * Stream Power (lb/ft s)   *   13.84  *    0.00  *    0.00  *
* Frctn Loss (ft)         *    0.02  * Cum Volume (acre-ft)     *          *    0.29  *          *
* C & E Loss (ft)         *    0.00  * Cum SA (acres)           *          *    0.17  *          *
*****************************************************************************************

CROSS SECTION OUTPUT  Profile #Max
*****************************************************************************************
* E.G. Elev (ft)          * 1222.01  * Element                 *  Left OB *  Channel * Right OB *
* Vel Head (ft)           *    0.09  * Wt. n-Val.              *          *   0.014  *          *
* W.S. Elev (ft)          * 1221.92  * Reach Len. (ft)         *   80.00  *   80.00  *   80.00  *
* Crit W.S. (ft)          *          * Flow Area (sq ft)       *          *   34.77  *          *
* E.G. Slope (ft/ft)      *0.000187  * Area (sq ft)            *          *   34.77  *          *
* Q Total (cfs)           *   83.00  * Flow (cfs)               *          *   83.00  *          *
* Top Width (ft)          *   13.58  * Top Width (ft)           *          *   13.58  *          *
* Vel Total (ft/s)        *    2.39  * Avg. Vel. (ft/s)         *          *    2.39  *          *
* Max Chl Dpth (ft)       *    4.20  * Hydr. Depth (ft)         *          *    2.56  *          *
* Conv. Total (cfs)       *  6066.8  * Conv. (cfs)              *          *  6066.8  *          *
* Length Wtd. (ft)        *   80.00  * Wetted Per. (ft)         *          *   16.50  *          *
* Min Ch El (ft)          * 1217.72  * Shear (lb/sq ft)         *          *    0.02  *          *
* Alpha                   *    1.00  * Stream Power (lb/ft s)   *   13.84  *    0.00  *    0.00  *
* Frctn Loss (ft)         *    0.01  * Cum Volume (acre-ft)     *          *    0.32  *          *
* C & E Loss (ft)         *    0.00  * Cum SA (acres)           *          *    0.18  *          *
*****************************************************************************************

CROSS SECTION


RIVER: highline
REACH: canal              RS: 520

INPUT
Description:
Station Elevation Data     num=        4
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
*************************************************************
       0     1222     5.42   1217.7     8.42   1217.7    13.84     1222

Manning's n Values          num=        3
     Sta   n Val      Sta   n Val      Sta   n Val
***********************************************
```

```
        0    .014       0    .014   13.84    .014

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0   13.84               20      20      20             .1       .3

CROSS SECTION OUTPUT  Profile #Design
*********************************************************************************************
* E.G. Elev (ft)         * 1221.47  * Element                 *  Left OB *  Channel * Right OB *
* Vel Head (ft)          *    0.09  * Wt. n-Val.              *          *   0.014  *          *
* W.S. Elev (ft)         * 1221.38  * Reach Len. (ft)         *   20.00  *   20.00  *   20.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)       *          *   28.06  *          *
* E.G. Slope (ft/ft)     *0.000223  * Area (sq ft)            *          *   28.06  *          *
* Q Total (cfs)          *   68.00  * Flow (cfs)               *          *   68.00  *          *
* Top Width (ft)         *   12.27  * Top Width (ft)           *          *   12.27  *          *
* Vel Total (ft/s)       *    2.42  * Avg. Vel. (ft/s)         *          *    2.42  *          *
* Max Chl Dpth (ft)      *    3.68  * Hydr. Depth (ft)         *          *    2.29  *          *
* Conv. Total (cfs)      *  4556.1  * Conv. (cfs)              *          *  4556.1  *          *
* Length Wtd. (ft)       *   20.00  * Wetted Per. (ft)         *          *   14.83  *          *
* Min Ch El (ft)         * 1217.70  * Shear (lb/sq ft)         *          *    0.03  *          *
* Alpha                  *    1.00  * Stream Power (lb/ft s)   *   13.84  *    0.00  *    0.00  *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)     *          *    0.23  *          *
* C & E Loss (ft)        *    0.02  * Cum SA (acres)           *          *    0.15  *          *
*********************************************************************************************

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
0.7 or greater than 1.4.
          This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #Max
*********************************************************************************************
* E.G. Elev (ft)         * 1221.99  * Element                 *  Left OB *  Channel * Right OB *
* Vel Head (ft)          *    0.09  * Wt. n-Val.              *          *   0.014  *          *
* W.S. Elev (ft)         * 1221.90  * Reach Len. (ft)         *   20.00  *   20.00  *   20.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)       *          *   34.87  *          *
* E.G. Slope (ft/ft)     *0.000186  * Area (sq ft)            *          *   34.87  *          *
* Q Total (cfs)          *   83.00  * Flow (cfs)               *          *   83.00  *          *
* Top Width (ft)         *   13.59  * Top Width (ft)           *          *   13.59  *          *
* Vel Total (ft/s)       *    2.38  * Avg. Vel. (ft/s)         *          *    2.38  *          *
* Max Chl Dpth (ft)      *    4.20  * Hydr. Depth (ft)         *          *    2.57  *          *
* Conv. Total (cfs)      *  6089.5  * Conv. (cfs)              *          *  6089.5  *          *
* Length Wtd. (ft)       *   20.00  * Wetted Per. (ft)         *          *   16.52  *          *
* Min Ch El (ft)         * 1217.70  * Shear (lb/sq ft)         *          *    0.02  *          *
* Alpha                  *    1.00  * Stream Power (lb/ft s)   *   13.84  *    0.00  *    0.00  *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)     *          *    0.26  *          *
* C & E Loss (ft)        *    0.02  * Cum SA (acres)           *          *    0.16  *          *
*********************************************************************************************

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
0.7 or greater than 1.4.
          This may indicate the need for additional cross sections.

CROSS SECTION


RIVER: highline
REACH: canal              RS: 500

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*************************************************************
```

```
       0    1222    5.42  1217.7   14.42  1217.7   19.84    1222

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
**********************************************
       0    .014       0    .014   19.84    .014

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0   19.84              200     200     200             .1       .3

CROSS SECTION OUTPUT  Profile #Design
*****************************************************************************************
* E.G. Elev (ft)         * 1221.45  * Element                * Left OB * Channel * Right OB *
* Vel Head (ft)          *    0.03  * Wt. n-Val.             *         *   0.014 *         *
* W.S. Elev (ft)         * 1221.42  * Reach Len. (ft)        * 200.00  * 200.00  * 200.00  *
* Crit W.S. (ft)         * 1218.84  * Flow Area (sq ft)      *         *   50.90 *         *
* E.G. Slope (ft/ft)     *0.000049  * Area (sq ft)           *         *   50.90 *         *
* Q Total (cfs)          *   68.00  * Flow (cfs)             *         *   68.00 *         *
* Top Width (ft)         *   18.37  * Top Width (ft)         *         *   18.37 *         *
* Vel Total (ft/s)       *    1.34  * Avg. Vel. (ft/s)       *         *    1.34 *         *
* Max Chl Dpth (ft)      *    3.72  * Hydr. Depth (ft)       *         *    2.77 *         *
* Conv. Total (cfs)      *  9757.1  * Conv. (cfs)            *         *  9757.1 *         *
* Length Wtd. (ft)       *  200.00  * Wetted Per. (ft)       *         *   20.97 *         *
* Min Ch El (ft)         * 1217.70  * Shear (lb/sq ft)       *         *    0.01 *         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *   19.84  *    0.00 *    0.00 *
* Frctn Loss (ft)        *          * Cum Volume (acre-ft)   *         *    0.22 *         *
* C & E Loss (ft)        *          * Cum SA (acres)         *         *    0.14 *         *
*****************************************************************************************

CROSS SECTION OUTPUT  Profile #Max
*****************************************************************************************
* E.G. Elev (ft)         * 1221.97  * Element                * Left OB * Channel * Right OB *
* Vel Head (ft)          *    0.03  * Wt. n-Val.             *         *   0.014 *         *
* W.S. Elev (ft)         * 1221.94  * Reach Len. (ft)        * 200.00  * 200.00  * 200.00  *
* Crit W.S. (ft)         * 1218.99  * Flow Area (sq ft)      *         *   60.87 *         *
* E.G. Slope (ft/ft)     *0.000044  * Area (sq ft)           *         *   60.87 *         *
* Q Total (cfs)          *   83.00  * Flow (cfs)             *         *   83.00 *         *
* Top Width (ft)         *   19.70  * Top Width (ft)         *         *   19.70 *         *
* Vel Total (ft/s)       *    1.36  * Avg. Vel. (ft/s)       *         *    1.36 *         *
* Max Chl Dpth (ft)      *    4.24  * Hydr. Depth (ft)       *         *    3.09 *         *
* Conv. Total (cfs)      * 12487.3  * Conv. (cfs)            *         * 12487.3 *         *
* Length Wtd. (ft)       *  200.00  * Wetted Per. (ft)       *         *   22.65 *         *
* Min Ch El (ft)         * 1217.70  * Shear (lb/sq ft)       *         *    0.01 *         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *   19.84  *    0.00 *    0.00 *
* Frctn Loss (ft)        *          * Cum Volume (acre-ft)   *         *    0.24 *         *
* C & E Loss (ft)        *          * Cum SA (acres)         *         *    0.15 *         *
*****************************************************************************************

CULVERT


RIVER: highline
REACH: canal              RS: 400

INPUT
Description:
Distance from Upstream XS =       1
Deck/Roadway Width        =     198
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
```

```
************************************************
       0    1222       0   19.84    1222       0

Upstream Bridge Cross Section Data
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
****************************************************************
       0    1222    5.42  1217.7   14.42  1217.7   19.84    1222

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0    .014       0    .014   19.84    .014

Bank Sta: Left   Right    Coeff Contr.   Expan.
             0   19.84             .1       .3

Downstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************
       0  1221.8       0   19.84  1221.8       0

Downstream Bridge Cross Section Data
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
****************************************************************
       0  1221.8    5.42  1217.5   14.42  1217.5   19.84  1221.8

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0    .014       0    .014   19.84    .014

Bank Sta: Left   Right    Coeff Contr.   Expan.
             0   19.84             .1       .3

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Culverts =  1

Culvert Name     Shape      Rise    Span
Culvert #1      Circular       5
FHWA Chart # 1 - Concrete Pipe Culvert
FHWA Scale # 2 - Groove end entrance with headwall
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit Loss
Coef
                 1     198     .013     .013        0                    .2                 1
Upstream   Elevation =  1215.5
           Centerline Station =  9.92
Downstream Elevation =  1214.4
           Centerline Station =  9.92

CROSS SECTION
```

RIVER: highline
REACH: canal RS: 300

INPUT
Description:
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1221.8	5.42	1217.5	14.42	1217.5	19.84	1221.8

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.014	0	.014	19.84	.014

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	19.84	20	20	20	.1	.3

CROSS SECTION OUTPUT Profile #Design

E.G. Elev (ft)	1221.12	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.		0.014	
W.S. Elev (ft)	1221.09	Reach Len. (ft)	20.00	20.00	20.00
Crit W.S. (ft)		Flow Area (sq ft)		48.51	
E.G. Slope (ft/ft)	0.000055	Area (sq ft)		48.51	
Q Total (cfs)	68.00	Flow (cfs)		68.00	
Top Width (ft)	18.04	Top Width (ft)		18.04	
Vel Total (ft/s)	1.40	Avg. Vel. (ft/s)		1.40	
Max Chl Dpth (ft)	3.59	Hydr. Depth (ft)		2.69	
Conv. Total (cfs)	9130.9	Conv. (cfs)		9130.9	
Length Wtd. (ft)	20.00	Wetted Per. (ft)		20.55	
Min Ch El (ft)	1217.50	Shear (lb/sq ft)		0.01	
Alpha	1.00	Stream Power (lb/ft s)	19.84	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)		0.12	
C & E Loss (ft)	0.01	Cum SA (acres)		0.06	

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #Max

E.G. Elev (ft)	1221.47	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.		0.014	
W.S. Elev (ft)	1221.44	Reach Len. (ft)	20.00	20.00	20.00
Crit W.S. (ft)		Flow Area (sq ft)		54.97	
E.G. Slope (ft/ft)	0.000058	Area (sq ft)		54.97	
Q Total (cfs)	83.00	Flow (cfs)		83.00	
Top Width (ft)	18.93	Top Width (ft)		18.93	
Vel Total (ft/s)	1.51	Avg. Vel. (ft/s)		1.51	
Max Chl Dpth (ft)	3.94	Hydr. Depth (ft)		2.90	
Conv. Total (cfs)	10853.5	Conv. (cfs)		10853.5	
Length Wtd. (ft)	20.00	Wetted Per. (ft)		21.67	
Min Ch El (ft)	1217.50	Shear (lb/sq ft)		0.01	
Alpha	1.00	Stream Power (lb/ft s)	19.84	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)		0.14	
C & E Loss (ft)	0.01	Cum SA (acres)		0.06	

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: highline
REACH: canal RS: 280

INPUT
Description:
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1221.8	5.42	1217.5	8.42	1217.5	13.84	1221.8

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.014	0	.014	13.84	.014

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	13.84	80	80	80	.1	.3

CROSS SECTION OUTPUT Profile #Design

E.G. Elev (ft)	1221.11	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.		0.014	
W.S. Elev (ft)	1221.00	Reach Len. (ft)	80.00	80.00	80.00
Crit W.S. (ft)		Flow Area (sq ft)		25.97	
E.G. Slope (ft/ft)	0.000274	Area (sq ft)		25.97	
Q Total (cfs)	68.00	Flow (cfs)		68.00	
Top Width (ft)	11.83	Top Width (ft)		11.83	
Vel Total (ft/s)	2.62	Avg. Vel. (ft/s)		2.62	
Max Chl Dpth (ft)	3.50	Hydr. Depth (ft)		2.20	
Conv. Total (cfs)	4107.5	Conv. (cfs)		4107.5	
Length Wtd. (ft)	80.00	Wetted Per. (ft)		14.27	
Min Ch El (ft)	1217.50	Shear (lb/sq ft)		0.03	
Alpha	1.00	Stream Power (lb/ft s)	13.84	0.00	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)		0.11	
C & E Loss (ft)	0.00	Cum SA (acres)		0.05	

CROSS SECTION OUTPUT Profile #Max

E.G. Elev (ft)	1221.46	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.12	Wt. n-Val.		0.014	
W.S. Elev (ft)	1221.35	Reach Len. (ft)	80.00	80.00	80.00
Crit W.S. (ft)		Flow Area (sq ft)		30.17	
E.G. Slope (ft/ft)	0.000274	Area (sq ft)		30.17	
Q Total (cfs)	83.00	Flow (cfs)		83.00	
Top Width (ft)	12.69	Top Width (ft)		12.69	
Vel Total (ft/s)	2.75	Avg. Vel. (ft/s)		2.75	
Max Chl Dpth (ft)	3.84	Hydr. Depth (ft)		2.38	
Conv. Total (cfs)	5018.6	Conv. (cfs)		5018.6	
Length Wtd. (ft)	80.00	Wetted Per. (ft)		15.37	
Min Ch El (ft)	1217.50	Shear (lb/sq ft)		0.03	
Alpha	1.00	Stream Power (lb/ft s)	13.84	0.00	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)		0.13	
C & E Loss (ft)	0.00	Cum SA (acres)		0.05	

CROSS SECTION

RIVER: highline
REACH: canal RS: 200

INPUT
Description:
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1221.77	5.42	1217.47	8.42	1217.47	13.84	1221.77

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.014	0	.014	13.84	.014

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	13.84	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #Design

E.G. Elev (ft)	1221.09	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.		0.014	
W.S. Elev (ft)	1220.98	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		26.06	
E.G. Slope (ft/ft)	0.000271	Area (sq ft)		26.06	
Q Total (cfs)	68.00	Flow (cfs)		68.00	
Top Width (ft)	11.85	Top Width (ft)		11.85	
Vel Total (ft/s)	2.61	Avg. Vel. (ft/s)		2.61	
Max Chl Dpth (ft)	3.51	Hydr. Depth (ft)		2.20	
Conv. Total (cfs)	4128.3	Conv. (cfs)		4128.3	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		14.30	
Min Ch El (ft)	1217.47	Shear (lb/sq ft)		0.03	
Alpha	1.00	Stream Power (lb/ft s)	13.84	0.00	0.00
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)		0.06	
C & E Loss (ft)	0.00	Cum SA (acres)		0.03	

CROSS SECTION OUTPUT Profile #Max

E.G. Elev (ft)	1221.44	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.12	Wt. n-Val.		0.014	
W.S. Elev (ft)	1221.32	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		30.27	
E.G. Slope (ft/ft)	0.000271	Area (sq ft)		30.27	
Q Total (cfs)	83.00	Flow (cfs)		83.00	
Top Width (ft)	12.71	Top Width (ft)		12.71	
Vel Total (ft/s)	2.74	Avg. Vel. (ft/s)		2.74	
Max Chl Dpth (ft)	3.85	Hydr. Depth (ft)		2.38	
Conv. Total (cfs)	5042.0	Conv. (cfs)		5042.0	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		15.40	
Min Ch El (ft)	1217.47	Shear (lb/sq ft)		0.03	
Alpha	1.00	Stream Power (lb/ft s)	13.84	0.00	0.00
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)		0.07	
C & E Loss (ft)	0.00	Cum SA (acres)		0.03	

CROSS SECTION

RIVER: highline
REACH: canal RS: 100

INPUT
Description:
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1221.74	5.42	1217.44	8.42	1217.44	13.84	1221.74

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.014	0	.014	13.84	.014

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	13.84	1	1	1	.1	.3

CROSS SECTION OUTPUT Profile #Design

E.G. Elev (ft)	1221.06	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.		0.014	
W.S. Elev (ft)	1220.95	Reach Len. (ft)			
Crit W.S. (ft)	1219.35	Flow Area (sq ft)		26.10	
E.G. Slope (ft/ft)	0.000270	Area (sq ft)		26.10	
Q Total (cfs)	68.00	Flow (cfs)		68.00	
Top Width (ft)	11.86	Top Width (ft)		11.86	
Vel Total (ft/s)	2.61	Avg. Vel. (ft/s)		2.61	
Max Chl Dpth (ft)	3.51	Hydr. Depth (ft)		2.20	
Conv. Total (cfs)	4136.0	Conv. (cfs)		4136.0	
Length Wtd. (ft)		Wetted Per. (ft)		14.31	
Min Ch El (ft)	1217.44	Shear (lb/sq ft)		0.03	
Alpha	1.00	Stream Power (lb/ft s)	13.84	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

CROSS SECTION OUTPUT Profile #Max

E.G. Elev (ft)	1221.41	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.12	Wt. n-Val.		0.014	
W.S. Elev (ft)	1221.30	Reach Len. (ft)			
Crit W.S. (ft)	1219.57	Flow Area (sq ft)		30.31	
E.G. Slope (ft/ft)	0.000270	Area (sq ft)		30.31	
Q Total (cfs)	83.00	Flow (cfs)		83.00	
Top Width (ft)	12.72	Top Width (ft)		12.72	
Vel Total (ft/s)	2.74	Avg. Vel. (ft/s)		2.74	
Max Chl Dpth (ft)	3.86	Hydr. Depth (ft)		2.38	
Conv. Total (cfs)	5050.6	Conv. (cfs)		5050.6	
Length Wtd. (ft)		Wetted Per. (ft)		15.41	
Min Ch El (ft)	1217.44	Shear (lb/sq ft)		0.03	
Alpha	1.00	Stream Power (lb/ft s)	13.84	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

SUMMARY OF MANNING'S N VALUES

River:highline

Reach	River Sta.	n1	n2	n3
canal	700	.014	.014	.014
canal	600	.014	.014	.014
canal	520	.014	.014	.014
canal	500	.014	.014	.014
canal	400	Culvert		
canal	300	.014	.014	.014
canal	280	.014	.014	.014
canal	200	.014	.014	.014
canal	100	.014	.014	.014

SUMMARY OF REACH LENGTHS

River: highline

Reach	River Sta.	Left	Channel	Right
canal	700	100	100	100
canal	600	80	80	80
canal	520	20	20	20
canal	500	200	200	200
canal	400	Culvert		
canal	300	20	20	20
canal	280	80	80	80
canal	200	100	100	100
canal	100	1	1	1

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: highline

Reach	River Sta.	Contr.	Expan.
canal	700	.1	.3
canal	600	.1	.3
canal	520	.1	.3
canal	500	.1	.3
canal	400	Culvert	
canal	300	.1	.3
canal	280	.1	.3
canal	200	.1	.3
canal	100	.1	.3

ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : culvert

River: highline Reach: canal RS: 520 Profile: Design
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
River: highline Reach: canal RS: 520 Profile: Max

Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
River: highline Reach: canal RS: 300 Profile: Design
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
River: highline Reach: canal RS: 300 Profile: Max
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X       X   X     X  X    X
X     X  X        X            X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X            X  X     X    X        X
X     X  X        X    X       X   X    X    X        X
X     X  XXXXXX    XXXX        X    X   X    X   XXXXX
```

****

PROJECT DATA
Project Title: Guadalupe FDS
Project File : Guadalupe_FDS.prj
Run Date and Time: 1/25/2012 11:58:19 AM

Project in English units

Project Description:
WEST Consultants Inc. 01/25/2012
Guadalupe Floodplain Delineation
Study
This model was created to represent the ponding areas along the Highline Lateral. The two cross-sections and reach provided are only to make RAS functional and do not represent any portion of Guadalupe. DDMSW was used to create a HEC1 file, which was manually updated to output dss files refferenced by RAS. One more basin (1C) was represented sufficiently by the HEC1 model and is not represented in RAS.

January 2012 - updated to include a more accurate depiction of the storage in the Highline Lateral.

****

PLAN DATA

Plan Title: 6 hour Guadalupe Basins
Plan File : P:\FCDM001001 Guadalupe FDS\Models\RAS\1-26-12\Guadalupe FDS\Guadalupe_FDS.p02

Geometry Title: Basins
Geometry File : P:\FCDM001001 Guadalupe FDS\Models\RAS\1-26-12\Guadalupe FDS\Guadalupe_FDS.g02

Flow Title :
Flow File :

Plan Description:
Represents flows from the 6hr storm event as computed by DDMSW (HEC1)

Plan Summary Information:
Number of: Cross Sections = 2 Multiple Openings = 0
Culverts = 0 Inline Structures = 0

```
            Bridges        =    0    Lateral Structures =    0

Computational Information
    Water surface calculation tolerance  =  0.01
    Critical depth calculation tolerance =  0.01
    Maximum number of iterations         =  20
    Maximum difference tolerance         =  0.3
    Flow tolerance factor                =  0.001

Computation Options
    Critical depth computed only where necessary
    Conveyance Calculation Method: At breaks in n values only
    Friction Slope Method:         Average Conveyance
    Computational Flow Regime:     Subcritical Flow


*******************************************************************************

GEOMETRY DATA

Geometry Title: Basins
Geometry File : P:\FCDM001001 Guadalupe FDS\Models\RAS\1-26-12\Guadalupe FDS\Guadalupe_FDS.g02

CROSS SECTION


RIVER: Guadalupe
REACH: dummy              RS: 10

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
***************************************************************
       0     100      10      90      20      90      30     100

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0    .014       0    .014      30    .014

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0      30               10      10      10            .1        .3

CROSS SECTION OUTPUT  Profile #Max WS
*************************************************************************************************
* E.G. Elev (ft)         *   99.00  * Element                *  Left OB *  Channel * Right OB *
* Vel Head (ft)          *    0.00  * Wt. n-Val.             *          *   0.014  *          *
* W.S. Elev (ft)         *   99.00  * Reach Len. (ft)        *   10.00  *   10.00  *   10.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      *          *  171.00  *          *
* E.G. Slope (ft/ft)     *0.000000  * Area (sq ft)           *          *  171.00  *          *
* Q Total (cfs)          *   10.00  * Flow (cfs)              *          *   10.00  *          *
* Top Width (ft)         *   28.00  * Top Width (ft)          *          *   28.00  *          *
* Vel Total (ft/s)       *    0.06  * Avg. Vel. (ft/s)        *          *    0.06  *          *
* Max Chl Dpth (ft)      *    9.00  * Hydr. Depth (ft)        *          *    6.11  *          *
* Conv. Total (cfs)      * 51808.7  * Conv. (cfs)             *          * 51808.7  *          *
* Length Wtd. (ft)       *   10.00  * Wetted Per. (ft)        *          *   35.46  *          *
* Min Ch El (ft)         *   90.00  * Shear (lb/sq ft)        *          *    0.00  *          *
* Alpha                  *    1.00  * Stream Power (lb/ft s)  *   30.00  *    0.00  *    0.00  *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)    *          *    0.04  *          *
* C & E Loss (ft)        *          * Cum SA (acres)          *          *    0.01  *          *
*************************************************************************************************
```

CROSS SECTION

RIVER: Guadalupe
REACH: dummy RS: 0

INPUT
Description:
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	99.98	10	89.98	20	89.98	30	99.98

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.014	0	.014	30	.014

Bank Sta: Left	Right	Coeff Contr.	Expan.
0	30	.1	.3

CROSS SECTION OUTPUT Profile #Max WS

E.G. Elev (ft)	99.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.		0.014	
W.S. Elev (ft)	99.00	Reach Len. (ft)			
Crit W.S. (ft)	90.29	Flow Area (sq ft)		171.56	
E.G. Slope (ft/ft)	0.000000	Area (sq ft)		171.56	
Q Total (cfs)	10.00	Flow (cfs)		10.00	
Top Width (ft)	28.04	Top Width (ft)		28.04	
Vel Total (ft/s)	0.06	Avg. Vel. (ft/s)		0.06	
Max Chl Dpth (ft)	9.02	Hydr. Depth (ft)		6.12	
Conv. Total (cfs)	52036.5	Conv. (cfs)		52036.5	
Length Wtd. (ft)		Wetted Per. (ft)		35.51	
Min Ch El (ft)	89.98	Shear (lb/sq ft)		0.00	
Alpha	1.00	Stream Power (lb/ft s)	30.00	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

STORAGE AREA: 2DST
Volume Method : Rating Curve

Elevation	Volume
1222	0
1223	.02
1224	.16
1225	2.29
1226	7.48

STORAGE AREA OUTPUT Profile #Max WS

W.S. Elev (ft)	1224.01	2DST to 2EST	-3.44
SA Min El (ft)	1222.00	2DST to 3AST	12.99
SA Area (acres)	2.13	2DST to Canal	-12.56
SA Volume (acre-ft)	0.19		
Inflow (cfs)	12.99		
Outflow (cfs)	16.01		
Net Flux (cfs)	-3.02		

STORAGE AREA: 2EST
Volume Method : Rating Curve

Elevation	Volume
1210	0
1211	.01
1212	.07
1213	.63
1214	1.22
1215	1.86
1216	2.54
1217	3.25
1218	4.01
1219	4.8
1220	5.63
1221	6.51
1222	7.44
1223	8.44
1224	9.49
1225	10.71

STORAGE AREA OUTPUT Profile #Max WS

W.S. Elev (ft)	1224.01	2DST to 2EST	3.44
SA Min El (ft)	1210.00	2EST to Tempe	-0.35
SA Area (acres)	1.22		
SA Volume (acre-ft)	9.50		
Inflow (cfs)	3.44		
Outflow (cfs)	0.35		
Net Flux (cfs)	3.10		

STORAGE AREA: 3AST
Volume Method : Rating Curve

Elevation	Volume
1222	0
1223	.04
1224	.16
1225	.95
1226	3.38
1227	9.31

STORAGE AREA OUTPUT Profile #Max WS

W.S. Elev (ft)	1224.94	2DST to 3AST	-12.99
SA Min El (ft)	1222.00	3AST to 3EST	0.21
SA Area (acres)	0.79	3AST to 4DST	-17.79
SA Volume (acre-ft)	0.90	3AST to Canal	-8.29
Inflow (cfs)	0.21		
Outflow (cfs)	39.07		
Net Flux (cfs)	-38.86		

STORAGE AREA: 3EST
Volume Method : Rating Curve

Elevation	Volume

1224	0
1225	.07
1226	.63
1227	2.78

STORAGE AREA OUTPUT Profile #Max WS

W.S. Elev (ft)	1225.01	3AST to 3EST	-0.21
SA Min El (ft)	1224.00	3EST to 4DST	0.00
SA Area (acres)	0.56	3EST to Canal	0.00
SA Volume (acre-ft)	0.08		
Inflow (cfs)	0.00		
Outflow (cfs)	0.21		
Net Flux (cfs)	-0.21		

STORAGE AREA: 4DST
Volume Method : Rating Curve

Elevation	Volume
1216	0
1217	.71
1218	2.23
1219	4.23
1220	6.38
1221	8.71
1222	11.23
1223	13.94
1224	16.86
1225	20.11
1226	23.87
1227	28.26

STORAGE AREA OUTPUT Profile #Max WS

W.S. Elev (ft)	1225.01	3AST to 4DST	17.79
SA Min El (ft)	1216.00	3EST to 4DST	0.00
SA Area (acres)	3.76	4DST to 7AST	0.00
SA Volume (acre-ft)	20.15	4DST to Canal	0.00
Inflow (cfs)	17.79		
Outflow (cfs)	0.00		
Net Flux (cfs)	17.79		

STORAGE AREA: 7AST
Volume Method : Rating Curve

Elevation	Volume
1225	0
1226	.02
1227	.65

STORAGE AREA OUTPUT Profile #Max WS

W.S. Elev (ft)	1225.68	4DST to 7AST	0.00
SA Min El (ft)	1225.00	7AST to 7BST	0.20
SA Area (acres)	0.02	7AST to Canal	-16.21
SA Volume (acre-ft)	0.01		
Inflow (cfs)	0.20		
Outflow (cfs)	16.21		

```
* Net Flux (cfs)      *  -16.01  *                      *          *
*****************************************************************
```

STORAGE AREA: 7BST
Volume Method : Rating Curve

Elevation	Volume
1225	0
1226	.02
1227	1.12
1228	2.75

```
STORAGE AREA OUTPUT  Profile #Max WS
*****************************************************************
* W.S. Elev (ft)      * 1226.12  * 7AST to 7BST        *    -0.20 *
* SA Min El (ft)      * 1225.00  * 7BST to 7DST        *     0.00 *
* SA Area (acres)     *    1.10  * 7BST to 7FST        *    -9.35 *
* SA Volume (acre-ft) *    0.15  * 7BST to Canal       *     0.00 *
* Inflow (cfs)        *    0.00  *                     *          *
* Outflow (cfs)       *    9.55  *                     *          *
* Net Flux (cfs)      *   -9.55  *                     *          *
*****************************************************************
```

STORAGE AREA: 7DST
Volume Method : Rating Curve

Elevation	Volume
1224	0
1225	.16
1226	.36
1227	.96
1228	1.79

```
STORAGE AREA OUTPUT  Profile #Max WS
*****************************************************************
* W.S. Elev (ft)      * 1226.12  * 7BST to 7DST        *     0.00 *
* SA Min El (ft)      * 1224.00  * 7DST to 7EST        *    -0.43 *
* SA Area (acres)     *    0.60  * 7DST to Canal       *     0.00 *
* SA Volume (acre-ft) *    0.43  *                     *          *
* Inflow (cfs)        *    0.00  *                     *          *
* Outflow (cfs)       *    0.43  *                     *          *
* Net Flux (cfs)      *   -0.43  *                     *          *
*****************************************************************
```

STORAGE AREA: 7EST
Volume Method : Rating Curve

Elevation	Volume
1224	0
1225	.01
1226	.06
1227	1.51

```
STORAGE AREA OUTPUT  Profile #Max WS
*****************************************************************
* W.S. Elev (ft)      * 1225.39  * 7DST to 7EST        *     0.43 *
* SA Min El (ft)      * 1224.00  * 7EST to 7FST        *     0.00 *
* SA Area (acres)     *    0.05  * 7EST to Canal       *     0.00 *
* SA Volume (acre-ft) *    0.03  *                     *          *
```

```
* Inflow (cfs)        *    0.43  *                      *          *
* Outflow (cfs)       *    0.00  *                      *          *
* Net Flux (cfs)      *    0.43  *                      *          *
*****************************************************************
```

STORAGE AREA: 7FST
Volume Method : Rating Curve

Elevation	Volume
1218	0
1219	.2
1220	.77
1221	1.72
1222	2.9
1223	4.47
1224	6.26
1225	8.27
1226	10.48
1227	13.4
1228	16.65
1229	20.33
1230	24.09

STORAGE AREA OUTPUT Profile #Max WS

```
*****************************************************************
* W.S. Elev (ft)      * 1225.39  * 7BST to 7FST        *     9.35 *
* SA Min El (ft)      * 1218.00  * 7EST to 7FST        *     0.00 *
* SA Area (acres)     *    2.21  * 7FST to Canal       *     0.00 *
* SA Volume (acre-ft) *    9.13  *                      *          *
* Inflow (cfs)        *    9.35  *                      *          *
* Outflow (cfs)       *    0.00  *                      *          *
* Net Flux (cfs)      *    9.35  *                      *          *
*****************************************************************
```

STORAGE AREA: Canal
Volume Method : Rating Curve

Elevation	Volume
1150	0
1150.25	.139
1150.5	.304
1150.75	.495
1151	.712
1151.25	.956
1151.5	1.225
1151.75	1.521
1152	1.843
1152.25	2.192
1152.5	2.566
1152.75	2.967
1153	3.394
1153.25	3.847
1153.5	4.326
1153.7	4.728
1153.75	4.831
1154	5.363
1154.25	5.92
1154.33	6.104

STORAGE AREA OUTPUT Profile #Max WS

```
*****************************************************************
* W.S. Elev (ft)       * 1153.84  * 2DST to Canal       *    12.56 *
* SA Min El (ft)       * 1150.00  * 3AST to Canal       *     8.29 *
* SA Area (acres)      *    2.13  * 3EST to Canal       *     0.00 *
* SA Volume (acre-ft)  *    5.01  * 4DST to Canal       *     0.00 *
* Inflow (cfs)         *   37.07  * 7AST to Canal       *    16.21 *
* Outflow (cfs)        *    0.00  * 7BST to Canal       *     0.00 *
* Net Flux (cfs)       *   37.07  * 7DST to Canal       *     0.00 *
*                      *          * 7EST to Canal       *     0.00 *
*                      *          * 7FST to Canal       *     0.00 *
*****************************************************************


STORAGE AREA: Tempe
Volume Method : Area times depth
         Area : 1000
     Min Elev : 1210

STORAGE AREA OUTPUT  Profile #Max WS
*****************************************************************
* W.S. Elev (ft)       * 1210.00  * 2EST to Tempe       *     0.35 *
*****************************************************************


CONNECTION: 2DST to 2EST


Number of Culverts =  1

Culvert Name     Shape      Rise    Span
Culvert #1      Circular       5
FHWA Chart # 1 - Concrete Pipe Culvert
FHWA Scale # 1 - Square edge entrance with headwall
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit Loss
Coef
                     176.9     .012     .012        0                   .5                 1
Upstream   Elevation =  1210
           Centerline Station =  25
Downstream Elevation =  1208
           Centerline Station =  25

STORAGE AREA CONNECTION OUTPUT  Profile #Max WS  Culv Group:  Culvert #1
*********************************************************************
* Q Culv Group (cfs)     *    3.44  * Culv Full Len (ft)     *  176.90  *
* # Barrels              *       1  * Culv Vel US (ft/s)     *    0.18  *
* Q Barrel (cfs)         *    3.44  * Culv Vel DS (ft/s)     *    0.18  *
* E.G. US. (ft)          * 1224.01  * Culv Inv El Up (ft)    * 1210.00  *
* W.S. US. (ft)          * 1224.01  * Culv Inv El Dn (ft)    * 1208.00  *
* E.G. DS (ft)           * 1224.01  * Culv Frctn Ls (ft)     *    0.00  *
* W.S. DS (ft)           * 1224.01  * Culv Exit Loss (ft)    *    0.00  *
* Delta EG (ft)          *    0.00  * Culv Entr Loss (ft)    *    0.00  *
* Delta WS (ft)          *    0.00  * Q Weir (cfs)           *          *
* E.G. IC (ft)           * 1210.65  * Weir Sta Lft (ft)      *          *
* E.G. OC (ft)           * 1224.01  * Weir Sta Rgt (ft)      *          *
* Culvert Control        *  Outlet  * Weir Submerg           *          *
* Culv WS Inlet (ft)     * 1215.00  * Weir Max Depth (ft)    *          *
* Culv WS Outlet (ft)    * 1213.00  * Weir Avg Depth (ft)    *          *
* Culv Nml Depth (ft)    *          * Weir Flow Area (sq ft) *          *
* Culv Crt Depth (ft)    *    0.50  * Min El Weir Flow (ft)  * 1250.01  *
*********************************************************************
```

CONNECTION: 2DST to 3AST

STORAGE AREA CONNECTION OUTPUT Profile #Max WS Inl Struct:

E.G. Elev (ft)	1224.94	Q Gates (cfs)	
W.S. Elev (ft)	1224.94	Q Gate Group (cfs)	0.00
Q Total (cfs)	-12.99	Gate Open Ht (ft)	
Q Weir (cfs)		Gate #Open	
Weir Flow Area (sq ft)	7.25	Gate Area (sq ft)	1.00
Weir Sta Lft (ft)	0.00	Gate Submerg	0.00
Weir Sta Rgt (ft)	20.43	Gate Invert (ft)	0.00
Weir Max Depth (ft)	0.59	Gate Weir Coef	0.000
Weir Avg Depth (ft)	0.35		
Weir Coef (ft^1/2)	3.000	Q Breach (cfs)	
Weir Submerg	0.00	Breach Avg Velocity (ft/s)	
Min El Weir Flow (ft)	1224.36	Breach Flow Area (sq ft)	
Wr Top Wdth (ft)	20.43		

CONNECTION: 2DST to Canal

STORAGE AREA CONNECTION OUTPUT Profile #Max WS Inl Struct:

E.G. Elev (ft)	1224.01	Q Gates (cfs)	
W.S. Elev (ft)	1224.01	Q Gate Group (cfs)	0.00
Q Total (cfs)	12.56	Gate Open Ht (ft)	
Q Weir (cfs)	12.56	Gate #Open	
Weir Flow Area (sq ft)	10.28	Gate Area (sq ft)	1.00
Weir Sta Lft (ft)	63.92	Gate Submerg	0.00
Weir Sta Rgt (ft)	125.84	Gate Invert (ft)	0.00
Weir Max Depth (ft)	0.33	Gate Weir Coef	0.000
Weir Avg Depth (ft)	0.17		
Weir Coef (ft^1/2)	3.000	Q Breach (cfs)	
Weir Submerg	0.00	Breach Avg Velocity (ft/s)	
Min El Weir Flow (ft)	1223.69	Breach Flow Area (sq ft)	
Wr Top Wdth (ft)	61.92		

CONNECTION: 2EST to Tempe

STORAGE AREA CONNECTION OUTPUT Profile #Max WS Inl Struct:

E.G. Elev (ft)	1224.01	Q Gates (cfs)	
W.S. Elev (ft)	1224.01	Q Gate Group (cfs)	0.00
Q Total (cfs)	0.35	Gate Open Ht (ft)	
Q Weir (cfs)	0.35	Gate #Open	
Weir Flow Area (sq ft)	1.10	Gate Area (sq ft)	1.00
Weir Sta Lft (ft)	0.00	Gate Submerg	0.00
Weir Sta Rgt (ft)	100.00	Gate Invert (ft)	0.00
Weir Max Depth (ft)	0.01	Gate Weir Coef	0.000
Weir Avg Depth (ft)	0.01		
Weir Coef (ft^1/2)	3.000	Q Breach (cfs)	
Weir Submerg	0.00	Breach Avg Velocity (ft/s)	
Min El Weir Flow (ft)	1224.01	Breach Flow Area (sq ft)	
Wr Top Wdth (ft)	100.00		

CONNECTION: 3AST to 3EST

```
STORAGE AREA CONNECTION OUTPUT  Profile #Max WS  Inl Struct:
**********************************************************************
* E.G. Elev (ft)          * 1225.01  * Q Gates (cfs)          *          *
* W.S. Elev (ft)          * 1225.01  * Q Gate Group (cfs)     *    0.00  *
* Q Total (cfs)           *   -0.21  * Gate Open Ht (ft)      *          *
* Q Weir (cfs)            *-7151725000000000000000000000000000.00  * Gate #Open              *
*
* Weir Flow Area (sq ft) *    0.26  * Gate Area (sq ft)      *    1.00  *
* Weir Sta Lft (ft)       *   17.52  * Gate Submerg           *    0.00  *
* Weir Sta Rgt (ft)       *   21.23  * Gate Invert (ft)       *    0.00  *
* Weir Max Depth (ft)     *    0.14  * Gate Weir Coef         *   0.000  *
* Weir Avg Depth (ft)     *    0.07  *                        *          *
* Weir Coef (ft^1/2)      *   3.000  * Q Breach (cfs)         *          *
* Weir Submerg            *    0.03  * Breach Avg Velocity (ft/s)*          *
* Min El Weir Flow (ft)   * 1224.88  * Breach Flow Area (sq ft)*          *
* Wr Top Wdth (ft)        *    3.70  *                        *          *
**********************************************************************
```

CONNECTION: 3AST to 4DST

```
Number of Culverts =  1

Culvert Name     Shape      Rise    Span
Culvert #1      Circular       5
FHWA Chart # 1 - Concrete Pipe Culvert
FHWA Scale # 1 - Square edge entrance with headwall
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit Loss
Coef
                     867.2     .012     .012        0                  .5                1
Upstream   Elevation =  1217.31
           Centerline Station =  25
Downstream Elevation =  1215.98
           Centerline Station =  25

STORAGE AREA CONNECTION OUTPUT  Profile #Max WS  Culv Group:  Culvert #1
**********************************************************************
* Q Culv Group (cfs)      *  -17.79  * Culv Full Len (ft)      *  867.20  *
* # Barrels               *       1  * Culv Vel US (ft/s)      *   -0.91  *
* Q Barrel (cfs)          *  -17.79  * Culv Vel DS (ft/s)      *   -0.91  *
* E.G. US. (ft)           * 1224.94  * Culv Inv El Up (ft)     * 1217.31  *
* W.S. US. (ft)           * 1225.00  * Culv Inv El Dn (ft)     * 1215.98  *
* E.G. DS (ft)            * 1225.00  * Culv Frctn Ls (ft)      *    0.03  *
* W.S. DS (ft)            * 1220.98  * Culv Exit Loss (ft)     *    0.01  *
* Delta EG (ft)           *    0.05  * Culv Entr Loss (ft)     *    0.01  *
* Delta WS (ft)           *    4.02  * Q Weir (cfs)            *          *
* E.G. IC (ft)            * 1217.56  * Weir Sta Lft (ft)       *          *
* E.G. OC (ft)            * 1225.00  * Weir Sta Rgt (ft)       *          *
* Culvert Control         *  Outlet  * Weir Submerg            *          *
* Culv WS Inlet (ft)      * 1222.31  * Weir Max Depth (ft)     *          *
* Culv WS Outlet (ft)     * 1220.98  * Weir Avg Depth (ft)     *          *
* Culv Nml Depth (ft)     *          * Weir Flow Area (sq ft) *          *
* Culv Crt Depth (ft)     *    1.16  * Min El Weir Flow (ft)   * 1250.01  *
**********************************************************************
```

CONNECTION: 3AST to Canal

STORAGE AREA CONNECTION OUTPUT Profile #Max WS Inl Struct:

E.G. Elev (ft)	1224.94	Q Gates (cfs)	
W.S. Elev (ft)	1224.94	Q Gate Group (cfs)	0.00
Q Total (cfs)	8.29	Gate Open Ht (ft)	
Q Weir (cfs)	8.29	Gate #Open	
Weir Flow Area (sq ft)	10.48	Gate Area (sq ft)	1.00
Weir Sta Lft (ft)	0.00	Gate Submerg	0.00
Weir Sta Rgt (ft)	337.68	Gate Invert (ft)	0.00
Weir Max Depth (ft)	0.15	Gate Weir Coef	0.000
Weir Avg Depth (ft)	0.07		
Weir Coef (ft^1/2)	3.000	Q Breach (cfs)	
Weir Submerg	0.00	Breach Avg Velocity (ft/s)	
Min El Weir Flow (ft)	1224.81	Breach Flow Area (sq ft)	
Wr Top Wdth (ft)	150.74		

CONNECTION: 3EST to 4DST

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Circular	2	

FHWA Chart # 1 - Concrete Pipe Culvert
FHWA Scale # 1 - Square edge entrance with headwall
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
		158.6	.012	.012	0	.5	1

Upstream Elevation = 1217.35
Centerline Station = 25
Downstream Elevation = 1215.5
Centerline Station = 25

STORAGE AREA CONNECTION OUTPUT Profile #Max WS Culv Group: Culvert #1

Q Culv Group (cfs)		Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	
Q Barrel (cfs)		Culv Vel DS (ft/s)	
E.G. US. (ft)	1224.94	Culv Inv El Up (ft)	1217.35
W.S. US. (ft)		Culv Inv El Dn (ft)	1215.50
E.G. DS (ft)	1224.94	Culv Frctn Ls (ft)	
W.S. DS (ft)	1225.01	Culv Exit Loss (ft)	
Delta EG (ft)		Culv Entr Loss (ft)	
Delta WS (ft)		Q Weir (cfs)	
E.G. IC (ft)		Weir Sta Lft (ft)	
E.G. OC (ft)		Weir Sta Rgt (ft)	
Culvert Control		Weir Submerg	
Culv WS Inlet (ft)		Weir Max Depth (ft)	
Culv WS Outlet (ft)		Weir Avg Depth (ft)	
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	
Culv Crt Depth (ft)		Min El Weir Flow (ft)	1224.63

Note: For this profile, the culvert does not have any flow.

CONNECTION: 3EST to Canal

STORAGE AREA CONNECTION OUTPUT Profile #Max WS Inl Struct:

E.G. Elev (ft)	1225.01	Q Gates (cfs)	
W.S. Elev (ft)	1225.01	Q Gate Group (cfs)	0.00
Q Total (cfs)	0.00	Gate Open Ht (ft)	
Q Weir (cfs)		Gate #Open	
Weir Flow Area (sq ft)		Gate Area (sq ft)	1.00
Weir Sta Lft (ft)		Gate Submerg	0.00
Weir Sta Rgt (ft)		Gate Invert (ft)	0.00
Weir Max Depth (ft)		Gate Weir Coef	0.000
Weir Avg Depth (ft)			
Weir Coef (ft^1/2)		Q Breach (cfs)	
Weir Submerg		Breach Avg Velocity (ft/s)	
Min El Weir Flow (ft)	1225.53	Breach Flow Area (sq ft)	
Wr Top Wdth (ft)			

CONNECTION: 4DST to 7AST

STORAGE AREA CONNECTION OUTPUT Profile #Max WS Inl Struct:

E.G. Elev (ft)	1225.68	Q Gates (cfs)	
W.S. Elev (ft)	1225.68	Q Gate Group (cfs)	0.00
Q Total (cfs)	0.00	Gate Open Ht (ft)	
Q Weir (cfs)		Gate #Open	
Weir Flow Area (sq ft)		Gate Area (sq ft)	1.00
Weir Sta Lft (ft)		Gate Submerg	0.00
Weir Sta Rgt (ft)		Gate Invert (ft)	0.00
Weir Max Depth (ft)		Gate Weir Coef	0.000
Weir Avg Depth (ft)			
Weir Coef (ft^1/2)		Q Breach (cfs)	
Weir Submerg		Breach Avg Velocity (ft/s)	
Min El Weir Flow (ft)	1226.67	Breach Flow Area (sq ft)	
Wr Top Wdth (ft)			

CONNECTION: 4DST to Canal

STORAGE AREA CONNECTION OUTPUT Profile #Max WS Inl Struct:

E.G. Elev (ft)	1225.01	Q Gates (cfs)	
W.S. Elev (ft)	1225.01	Q Gate Group (cfs)	0.00
Q Total (cfs)	0.00	Gate Open Ht (ft)	
Q Weir (cfs)		Gate #Open	
Weir Flow Area (sq ft)		Gate Area (sq ft)	1.00
Weir Sta Lft (ft)		Gate Submerg	0.00
Weir Sta Rgt (ft)		Gate Invert (ft)	0.00
Weir Max Depth (ft)		Gate Weir Coef	0.000
Weir Avg Depth (ft)			
Weir Coef (ft^1/2)		Q Breach (cfs)	
Weir Submerg		Breach Avg Velocity (ft/s)	
Min El Weir Flow (ft)	1225.44	Breach Flow Area (sq ft)	
Wr Top Wdth (ft)			

CONNECTION: 7AST to 7BST

```
STORAGE AREA CONNECTION OUTPUT  Profile #Max WS  Inl Struct:
**********************************************************************
* E.G. Elev (ft)          * 1226.12  * Q Gates (cfs)           *          *
* W.S. Elev (ft)          * 1226.12  * Q Gate Group (cfs)      *    0.00  *
* Q Total (cfs)           *   -0.20  * Gate Open Ht (ft)       *          *
* Q Weir (cfs)            *-68018950000000000000000000000000000.00  * Gate #Open              *
*
* Weir Flow Area (sq ft) *    0.33  * Gate Area (sq ft)       *    1.00  *
* Weir Sta Lft (ft)       *    8.80  * Gate Submerg            *    0.00  *
* Weir Sta Rgt (ft)       *   16.87  * Gate Invert (ft)        *    0.00  *
* Weir Max Depth (ft)     *    0.08  * Gate Weir Coef          *   0.000  *
* Weir Avg Depth (ft)     *    0.04  *                         *          *
* Weir Coef (ft^1/2)      *   3.000  * Q Breach (cfs)          *          *
* Weir Submerg            *    0.00  * Breach Avg Velocity (ft/s)*          *
* Min El Weir Flow (ft)   * 1226.05  * Breach Flow Area (sq ft)*          *
* Wr Top Wdth (ft)        *    8.06  *                         *          *
**********************************************************************
```

CONNECTION: 7AST to Canal

```
STORAGE AREA CONNECTION OUTPUT  Profile #Max WS  Inl Struct:
**********************************************************************
* E.G. Elev (ft)          * 1225.68  * Q Gates (cfs)           *          *
* W.S. Elev (ft)          * 1225.68  * Q Gate Group (cfs)      *    0.00  *
* Q Total (cfs)           *   16.21  * Gate Open Ht (ft)       *          *
* Q Weir (cfs)            *   16.21  * Gate #Open              *          *
* Weir Flow Area (sq ft) *   16.14  * Gate Area (sq ft)       *    1.00  *
* Weir Sta Lft (ft)       *    0.00  * Gate Submerg            *    0.00  *
* Weir Sta Rgt (ft)       *  147.59  * Gate Invert (ft)        *    0.00  *
* Weir Max Depth (ft)     *    0.21  * Gate Weir Coef          *   0.000  *
* Weir Avg Depth (ft)     *    0.11  *                         *          *
* Weir Coef (ft^1/2)      *   3.000  * Q Breach (cfs)          *          *
* Weir Submerg            *    0.00  * Breach Avg Velocity (ft/s)*          *
* Min El Weir Flow (ft)   * 1225.48  * Breach Flow Area (sq ft)*          *
* Wr Top Wdth (ft)        *  147.59  *                         *          *
**********************************************************************
```

CONNECTION: 7BST to 7DST

```
STORAGE AREA CONNECTION OUTPUT  Profile #Max WS  Inl Struct:
**********************************************************************
* E.G. Elev (ft)          * 1226.12  * Q Gates (cfs)           *          *
* W.S. Elev (ft)          * 1226.12  * Q Gate Group (cfs)      *    0.00  *
* Q Total (cfs)           *    0.00  * Gate Open Ht (ft)       *          *
* Q Weir (cfs)            *    0.00  * Gate #Open              *          *
* Weir Flow Area (sq ft) *   14.97  * Gate Area (sq ft)       *    1.00  *
* Weir Sta Lft (ft)       *   15.13  * Gate Submerg            *    0.00  *
* Weir Sta Rgt (ft)       *  105.00  * Gate Invert (ft)        *    0.00  *
* Weir Max Depth (ft)     *    0.51  * Gate Weir Coef          *   0.000  *
* Weir Avg Depth (ft)     *    0.17  *                         *          *
* Weir Coef (ft^1/2)      *   3.000  * Q Breach (cfs)          *          *
* Weir Submerg            *    1.00  * Breach Avg Velocity (ft/s)*          *
* Min El Weir Flow (ft)   * 1225.62  * Breach Flow Area (sq ft)*          *
```

```
* Wr Top Wdth (ft)        *   89.86  *                          *          *
***********************************************************************
```

CONNECTION: 7BST to 7FST

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Circular	2.5	

FHWA Chart # 1 - Concrete Pipe Culvert
FHWA Scale # 1 - Square edge entrance with headwall
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
		1453.4	.012	.012	0	.5	1

Upstream Elevation = 1220.83
Centerline Station = 25
Downstream Elevation = 1217.92
Centerline Station = 25

STORAGE AREA CONNECTION OUTPUT Profile #Max WS Culv Group: Culvert #1

Q Culv Group (cfs)	9.35	Culv Full Len (ft)	1453.40
# Barrels	1	Culv Vel US (ft/s)	1.90
Q Barrel (cfs)	9.35	Culv Vel DS (ft/s)	1.90
E.G. US. (ft)	1226.12	Culv Inv El Up (ft)	1220.83
W.S. US. (ft)	1226.12	Culv Inv El Dn (ft)	1217.92
E.G. DS (ft)	1225.39	Culv Frctn Ls (ft)	0.64
W.S. DS (ft)	1225.39	Culv Exit Loss (ft)	0.06
Delta EG (ft)	0.73	Culv Entr Loss (ft)	0.03
Delta WS (ft)	0.73	Q Weir (cfs)	
E.G. IC (ft)	1222.27	Weir Sta Lft (ft)	
E.G. OC (ft)	1226.12	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	1223.33	Weir Max Depth (ft)	
Culv WS Outlet (ft)	1220.42	Weir Avg Depth (ft)	
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	1.02	Min El Weir Flow (ft)	1250.01

CONNECTION: 7BST to Canal

STORAGE AREA CONNECTION OUTPUT Profile #Max WS Inl Struct:

E.G. Elev (ft)	1226.12	Q Gates (cfs)	
W.S. Elev (ft)	1226.12	Q Gate Group (cfs)	0.00
Q Total (cfs)	0.00	Gate Open Ht (ft)	
Q Weir (cfs)		Gate #Open	
Weir Flow Area (sq ft)		Gate Area (sq ft)	1.00
Weir Sta Lft (ft)		Gate Submerg	0.00
Weir Sta Rgt (ft)		Gate Invert (ft)	0.00
Weir Max Depth (ft)		Gate Weir Coef	0.000
Weir Avg Depth (ft)			
Weir Coef (ft^1/2)		Q Breach (cfs)	
Weir Submerg		Breach Avg Velocity (ft/s)	
Min El Weir Flow (ft)	1226.24	Breach Flow Area (sq ft)	
Wr Top Wdth (ft)			

CONNECTION: 7DST to 7EST

STORAGE AREA CONNECTION OUTPUT Profile #Max WS Inl Struct:

E.G. Elev (ft)	1226.12	Q Gates (cfs)	
W.S. Elev (ft)	1226.12	Q Gate Group (cfs)	0.00
Q Total (cfs)	0.43	Gate Open Ht (ft)	
Q Weir (cfs)	0.43	Gate #Open	
Weir Flow Area (sq ft)	0.60	Gate Area (sq ft)	1.00
Weir Sta Lft (ft)	19.12	Gate Submerg	0.00
Weir Sta Rgt (ft)	29.74	Gate Invert (ft)	0.00
Weir Max Depth (ft)	0.11	Gate Weir Coef	0.000
Weir Avg Depth (ft)	0.06		
Weir Coef (ft^1/2)	3.000	Q Breach (cfs)	
Weir Submerg	0.00	Breach Avg Velocity (ft/s)	
Min El Weir Flow (ft)	1226.02	Breach Flow Area (sq ft)	
Wr Top Wdth (ft)	10.62		

CONNECTION: 7DST to Canal

STORAGE AREA CONNECTION OUTPUT Profile #Max WS Inl Struct:

E.G. Elev (ft)	1226.12	Q Gates (cfs)	
W.S. Elev (ft)	1226.12	Q Gate Group (cfs)	0.00
Q Total (cfs)	0.00	Gate Open Ht (ft)	
Q Weir (cfs)		Gate #Open	
Weir Flow Area (sq ft)		Gate Area (sq ft)	1.00
Weir Sta Lft (ft)		Gate Submerg	0.00
Weir Sta Rgt (ft)		Gate Invert (ft)	0.00
Weir Max Depth (ft)		Gate Weir Coef	0.000
Weir Avg Depth (ft)			
Weir Coef (ft^1/2)		Q Breach (cfs)	
Weir Submerg		Breach Avg Velocity (ft/s)	
Min El Weir Flow (ft)	1226.65	Breach Flow Area (sq ft)	
Wr Top Wdth (ft)			

CONNECTION: 7EST to 7FST

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Circular	3.5	

FHWA Chart # 1 - Concrete Pipe Culvert
FHWA Scale # 1 - Square edge entrance with headwall
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
		95.1	.012	.012	0	.5	1

Upstream Elevation = 1218.12
Centerline Station = 25
Downstream Elevation = 1217.92
Centerline Station = 25

```
STORAGE AREA CONNECTION OUTPUT  Profile #Max WS  Culv Group:  Culvert #1
***********************************************************************
* Q Culv Group (cfs)     *          * Culv Full Len (ft)     *          *
* # Barrels              *       1  * Culv Vel US (ft/s)     *          *
* Q Barrel (cfs)         *          * Culv Vel DS (ft/s)     *          *
* E.G. US. (ft)          * 1225.39  * Culv Inv El Up (ft)    * 1218.12  *
* W.S. US. (ft)          *          * Culv Inv El Dn (ft)    * 1217.92  *
* E.G. DS (ft)           * 1225.39  * Culv Frctn Ls (ft)     *          *
* W.S. DS (ft)           * 1225.39  * Culv Exit Loss (ft)    *          *
* Delta EG (ft)          *          * Culv Entr Loss (ft)    *          *
* Delta WS (ft)          *          * Q Weir (cfs)           *          *
* E.G. IC (ft)           *          * Weir Sta Lft (ft)      *          *
* E.G. OC (ft)           *          * Weir Sta Rgt (ft)      *          *
* Culvert Control        *          * Weir Submerg           *          *
* Culv WS Inlet (ft)     *          * Weir Max Depth (ft)    *          *
* Culv WS Outlet (ft)    *          * Weir Avg Depth (ft)    *          *
* Culv Nml Depth (ft)    *          * Weir Flow Area (sq ft) *          *
* Culv Crt Depth (ft)    *          * Min El Weir Flow (ft)  * 1226.01  *
***********************************************************************
```

Note: For this profile, the culvert does not have any flow.

CONNECTION: 7EST to Canal

```
STORAGE AREA CONNECTION OUTPUT  Profile #Max WS  Inl Struct:
***********************************************************************
* E.G. Elev (ft)         * 1225.39  * Q Gates (cfs)          *          *
* W.S. Elev (ft)         * 1225.39  * Q Gate Group (cfs)     *    0.00  *
* Q Total (cfs)          *    0.00  * Gate Open Ht (ft)      *          *
* Q Weir (cfs)           *          * Gate #Open             *          *
* Weir Flow Area (sq ft) *          * Gate Area (sq ft)      *    1.00  *
* Weir Sta Lft (ft)      *          * Gate Submerg           *    0.00  *
* Weir Sta Rgt (ft)      *          * Gate Invert (ft)       *    0.00  *
* Weir Max Depth (ft)    *          * Gate Weir Coef         *   0.000  *
* Weir Avg Depth (ft)    *          *                        *          *
* Weir Coef (ft^1/2)     *          * Q Breach (cfs)         *          *
* Weir Submerg           *          * Breach Avg Velocity (ft/s)*          *
* Min El Weir Flow (ft)  * 1226.26  * Breach Flow Area (sq ft)*          *
* Wr Top Wdth (ft)       *          *                        *          *
***********************************************************************
```

CONNECTION: 7FST to Canal

```
STORAGE AREA CONNECTION OUTPUT  Profile #Max WS  Inl Struct:
***********************************************************************
* E.G. Elev (ft)         * 1225.39  * Q Gates (cfs)          *          *
* W.S. Elev (ft)         * 1225.39  * Q Gate Group (cfs)     *    0.00  *
* Q Total (cfs)          *    0.00  * Gate Open Ht (ft)      *   99.00  *
* Q Weir (cfs)           *          * Gate #Open             *          *
* Weir Flow Area (sq ft) *          * Gate Area (sq ft)      *    1.00  *
* Weir Sta Lft (ft)      *          * Gate Submerg           *    0.00  *
* Weir Sta Rgt (ft)      *          * Gate Invert (ft)       *    0.00  *
* Weir Max Depth (ft)    *          * Gate Weir Coef         *   0.000  *
* Weir Avg Depth (ft)    *          *                        *          *
* Weir Coef (ft^1/2)     *          * Q Breach (cfs)         *          *
* Weir Submerg           *          * Breach Avg Velocity (ft/s)*          *
* Min El Weir Flow (ft)  * 1226.57  * Breach Flow Area (sq ft)*          *
* Wr Top Wdth (ft)       *          *                        *          *
```

****

****

SUMMARY OF MANNING'S N VALUES

River:Guadalupe

Reach	River Sta.	n1	n2	n3
dummy	10	.014	.014	.014
dummy	0	.014	.014	.014

****

SUMMARY OF REACH LENGTHS

River: Guadalupe

Reach	River Sta.	Left	Channel	Right
dummy	10	10	10	10
dummy	0			

****

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Guadalupe

Reach	River Sta.	Contr.	Expan.
dummy	10	.1	.3
dummy	0	.1	.3

****

ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : 6hour

No Errors, Warnings or Notes in Computations

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X       X   X     X  X    X
X     X  X        X            X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X            X  X     X    X        X
X     X  X        X    X       X   X    X    X        X
X     X  XXXXXX    XXXX        X    X   X    X   XXXXX
```

****

PROJECT DATA
Project Title: Guadalupe FDS
Project File : Guadalupe_FDS.prj
Run Date and Time: 1/26/2012 11:15:36 AM

Project in English units

Project Description:
WEST Consultants Inc. 01/25/2012
Guadalupe Floodplain Delineation
Study
This model was created to represent the ponding areas along the Highline Lateral. The two cross-sections and reach provided are only to make RAS functional and do not represent any portion of Guadalupe. DDMSW was used to create a HEC1 file, which was manually updated to output dss files refferenced by RAS. One more basin (1C) was represented sufficiently by the HEC1 model and is not represented in RAS.

January 2012 - updated to include a more accurate depiction of the storage in the Highline Lateral.

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PLAN DATA

Plan Title: 24 hour Guadalupe Basins
Plan File : P:\FCDM001001 Guadalupe FDS\Models\RAS\1-26-12\Guadalupe FDS\Guadalupe_FDS.p01

Geometry Title: Basins
Geometry File : P:\FCDM001001 Guadalupe FDS\Models\RAS\1-26-12\Guadalupe FDS\Guadalupe_FDS.g02

Flow Title :
Flow File :

Plan Description:
Represents flows from the 24hr storm event as computed by DDMSW (HEC1)

Plan Summary Information:
Number of: Cross Sections = 2 Multiple Openings = 0
Culverts = 0 Inline Structures = 0

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            Bridges        =    0    Lateral Structures =    0

Computational Information
    Water surface calculation tolerance  =  0.01
    Critical depth calculation tolerance =  0.01
    Maximum number of iterations         =  20
    Maximum difference tolerance         =  0.3
    Flow tolerance factor                =  0.001

Computation Options
    Critical depth computed only where necessary
    Conveyance Calculation Method: At breaks in n values only
    Friction Slope Method:         Average Conveyance
    Computational Flow Regime:     Subcritical Flow


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GEOMETRY DATA

Geometry Title: Basins
Geometry File : P:\FCDM001001 Guadalupe FDS\Models\RAS\1-26-12\Guadalupe FDS\Guadalupe_FDS.g02

CROSS SECTION


RIVER: Guadalupe
REACH: dummy              RS: 10

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
***************************************************************
       0     100      10      90      20      90      30     100

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .014       0    .014      30    .014

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0      30               10      10      10             .1       .3

CROSS SECTION OUTPUT  Profile #Max WS
*************************************************************************************************
* E.G. Elev (ft)         *   99.00  * Element                 *  Left OB *  Channel * Right OB *
* Vel Head (ft)          *    0.00  * Wt. n-Val.              *          *   0.014  *          *
* W.S. Elev (ft)         *   99.00  * Reach Len. (ft)         *   10.00  *   10.00  *   10.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)       *          *  171.00  *          *
* E.G. Slope (ft/ft)     *0.000000  * Area (sq ft)            *          *  171.00  *          *
* Q Total (cfs)          *   10.00  * Flow (cfs)              *          *   10.00  *          *
* Top Width (ft)         *   28.00  * Top Width (ft)          *          *   28.00  *          *
* Vel Total (ft/s)       *    0.06  * Avg. Vel. (ft/s)        *          *    0.06  *          *
* Max Chl Dpth (ft)      *    9.00  * Hydr. Depth (ft)        *          *    6.11  *          *
* Conv. Total (cfs)      * 51808.7  * Conv. (cfs)             *          * 51808.7  *          *
* Length Wtd. (ft)       *   10.00  * Wetted Per. (ft)        *          *   35.46  *          *
* Min Ch El (ft)         *   90.00  * Shear (lb/sq ft)        *          *    0.00  *          *
* Alpha                  *    1.00  * Stream Power (lb/ft s)  *   30.00  *    0.00  *    0.00  *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)    *          *    0.04  *          *
* C & E Loss (ft)        *          * Cum SA (acres)          *          *    0.01  *          *
*************************************************************************************************
```

CROSS SECTION

RIVER: Guadalupe
REACH: dummy RS: 0

INPUT
Description:
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	99.98	10	89.98	20	89.98	30	99.98

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.014	0	.014	30	.014

Bank Sta: Left	Right	Coeff Contr.	Expan.
0	30	.1	.3

CROSS SECTION OUTPUT Profile #Max WS

E.G. Elev (ft)	99.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.		0.014	
W.S. Elev (ft)	99.00	Reach Len. (ft)			
Crit W.S. (ft)	90.29	Flow Area (sq ft)		171.56	
E.G. Slope (ft/ft)	0.000000	Area (sq ft)		171.56	
Q Total (cfs)	10.00	Flow (cfs)		10.00	
Top Width (ft)	28.04	Top Width (ft)		28.04	
Vel Total (ft/s)	0.06	Avg. Vel. (ft/s)		0.06	
Max Chl Dpth (ft)	9.02	Hydr. Depth (ft)		6.12	
Conv. Total (cfs)	52036.5	Conv. (cfs)		52036.5	
Length Wtd. (ft)		Wetted Per. (ft)		35.51	
Min Ch El (ft)	89.98	Shear (lb/sq ft)		0.00	
Alpha	1.00	Stream Power (lb/ft s)	30.00	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

STORAGE AREA: 2DST
Volume Method : Rating Curve

Elevation	Volume
1222	0
1223	.02
1224	.16
1225	2.29
1226	7.48

STORAGE AREA OUTPUT Profile #Max WS

W.S. Elev (ft)	1224.02	2DST to 2EST	-5.97
SA Min El (ft)	1222.00	2DST to 3AST	13.31
SA Area (acres)	2.13	2DST to Canal	-13.52
SA Volume (acre-ft)	0.21		
Inflow (cfs)	13.31		
Outflow (cfs)	19.49		
Net Flux (cfs)	-6.18		

STORAGE AREA: 2EST
Volume Method : Rating Curve

Elevation	Volume
1210	0
1211	.01
1212	.07
1213	.63
1214	1.22
1215	1.86
1216	2.54
1217	3.25
1218	4.01
1219	4.8
1220	5.63
1221	6.51
1222	7.44
1223	8.44
1224	9.49
1225	10.71

STORAGE AREA OUTPUT Profile #Max WS

W.S. Elev (ft)	1224.02	2DST to 2EST	5.97
SA Min El (ft)	1210.00	2EST to Tempe	-0.79
SA Area (acres)	1.22		
SA Volume (acre-ft)	9.51		
Inflow (cfs)	5.97		
Outflow (cfs)	0.79		
Net Flux (cfs)	5.18		

STORAGE AREA: 3AST
Volume Method : Rating Curve

Elevation	Volume
1222	0
1223	.04
1224	.16
1225	.95
1226	3.38
1227	9.31

STORAGE AREA OUTPUT Profile #Max WS

W.S. Elev (ft)	1224.95	2DST to 3AST	-13.31
SA Min El (ft)	1222.00	3AST to 3EST	0.27
SA Area (acres)	0.79	3AST to 4DST	-18.80
SA Volume (acre-ft)	0.91	3AST to Canal	-9.22
Inflow (cfs)	0.27		
Outflow (cfs)	41.33		
Net Flux (cfs)	-41.07		

STORAGE AREA: 3EST
Volume Method : Rating Curve

Elevation	Volume

1224	0
1225	.07
1226	.63
1227	2.78

STORAGE AREA OUTPUT Profile #Max WS

W.S. Elev (ft)	1225.03	3AST to 3EST	-0.27
SA Min El (ft)	1224.00	3EST to 4DST	0.00
SA Area (acres)	0.56	3EST to Canal	0.00
SA Volume (acre-ft)	0.08		
Inflow (cfs)	0.00		
Outflow (cfs)	0.27		
Net Flux (cfs)	-0.27		

STORAGE AREA: 4DST
Volume Method : Rating Curve

Elevation	Volume
1216	0
1217	.71
1218	2.23
1219	4.23
1220	6.38
1221	8.71
1222	11.23
1223	13.94
1224	16.86
1225	20.11
1226	23.87
1227	28.26

STORAGE AREA OUTPUT Profile #Max WS

W.S. Elev (ft)	1225.03	3AST to 4DST	18.80
SA Min El (ft)	1216.00	3EST to 4DST	0.00
SA Area (acres)	3.76	4DST to 7AST	0.00
SA Volume (acre-ft)	20.21	4DST to Canal	0.00
Inflow (cfs)	18.80		
Outflow (cfs)	0.00		
Net Flux (cfs)	18.80		

STORAGE AREA: 7AST
Volume Method : Rating Curve

Elevation	Volume
1225	0
1226	.02
1227	.65

STORAGE AREA OUTPUT Profile #Max WS

W.S. Elev (ft)	1225.66	4DST to 7AST	0.00
SA Min El (ft)	1225.00	7AST to 7BST	0.04
SA Area (acres)	0.02	7AST to Canal	-13.24
SA Volume (acre-ft)	0.01		
Inflow (cfs)	0.04		
Outflow (cfs)	13.24		

```
* Net Flux (cfs)      *  -13.20  *                      *          *
*****************************************************************
```

STORAGE AREA: 7BST
Volume Method : Rating Curve

Elevation	Volume
1225	0
1226	.02
1227	1.12
1228	2.75

```
STORAGE AREA OUTPUT  Profile #Max WS
*****************************************************************
* W.S. Elev (ft)       * 1226.08  * 7AST to 7BST        *    -0.04 *
* SA Min El (ft)       * 1225.00  * 7BST to 7DST        *     0.00 *
* SA Area (acres)      *    1.10  * 7BST to 7FST        *    -0.97 *
* SA Volume (acre-ft)  *    0.11  * 7BST to Canal       *     0.00 *
* Inflow (cfs)         *    0.00  *                     *          *
* Outflow (cfs)        *    1.01  *                     *          *
* Net Flux (cfs)       *   -1.01  *                     *          *
*****************************************************************
```

STORAGE AREA: 7DST
Volume Method : Rating Curve

Elevation	Volume
1224	0
1225	.16
1226	.36
1227	.96
1228	1.79

```
STORAGE AREA OUTPUT  Profile #Max WS
*****************************************************************
* W.S. Elev (ft)       * 1226.08  * 7BST to 7DST        *     0.00 *
* SA Min El (ft)       * 1224.00  * 7DST to 7EST        *    -0.15 *
* SA Area (acres)      *    0.60  * 7DST to Canal       *     0.00 *
* SA Volume (acre-ft)  *    0.41  *                     *          *
* Inflow (cfs)         *    0.00  *                     *          *
* Outflow (cfs)        *    0.15  *                     *          *
* Net Flux (cfs)       *   -0.15  *                     *          *
*****************************************************************
```

STORAGE AREA: 7EST
Volume Method : Rating Curve

Elevation	Volume
1224	0
1225	.01
1226	.06
1227	1.51

```
STORAGE AREA OUTPUT  Profile #Max WS
*****************************************************************
* W.S. Elev (ft)       * 1226.07  * 7DST to 7EST        *     0.15 *
* SA Min El (ft)       * 1224.00  * 7EST to 7FST        *    -2.84 *
* SA Area (acres)      *    1.45  * 7EST to Canal       *     0.00 *
* SA Volume (acre-ft)  *    0.16  *                     *          *
```

```
* Inflow (cfs)        *    0.15  *                      *          *
* Outflow (cfs)       *    2.84  *                      *          *
* Net Flux (cfs)      *   -2.69  *                      *          *
*****************************************************************
```

STORAGE AREA: 7FST
Volume Method : Rating Curve

Elevation	Volume
1218	0
1219	.2
1220	.77
1221	1.72
1222	2.9
1223	4.47
1224	6.26
1225	8.27
1226	10.48
1227	13.4
1228	16.65
1229	20.33
1230	24.09

STORAGE AREA OUTPUT Profile #Max WS

```
*****************************************************************
* W.S. Elev (ft)      * 1226.07  * 7BST to 7FST        *     0.97 *
* SA Min El (ft)      * 1218.00  * 7EST to 7FST        *     2.84 *
* SA Area (acres)     *    2.92  * 7FST to Canal       *     0.00 *
* SA Volume (acre-ft) *   10.70  *                      *          *
* Inflow (cfs)        *    3.80  *                      *          *
* Outflow (cfs)       *    0.00  *                      *          *
* Net Flux (cfs)      *    3.80  *                      *          *
*****************************************************************
```

STORAGE AREA: Canal
Volume Method : Rating Curve

Elevation	Volume
1150	0
1150.25	.139
1150.5	.304
1150.75	.495
1151	.712
1151.25	.956
1151.5	1.225
1151.75	1.521
1152	1.843
1152.25	2.192
1152.5	2.566
1152.75	2.967
1153	3.394
1153.25	3.847
1153.5	4.326
1153.7	4.728
1153.75	4.831
1154	5.363
1154.25	5.92
1154.33	6.104

STORAGE AREA OUTPUT Profile #Max WS

```
*****************************************************************
* W.S. Elev (ft)       * 1153.78  * 2DST to Canal       *    13.52 *
* SA Min El (ft)       * 1150.00  * 3AST to Canal       *     9.22 *
* SA Area (acres)      *    2.13  * 3EST to Canal       *     0.00 *
* SA Volume (acre-ft)  *    4.90  * 4DST to Canal       *     0.00 *
* Inflow (cfs)         *   35.98  * 7AST to Canal       *    13.24 *
* Outflow (cfs)        *    0.00  * 7BST to Canal       *     0.00 *
* Net Flux (cfs)       *   35.98  * 7DST to Canal       *     0.00 *
*                      *          * 7EST to Canal       *     0.00 *
*                      *          * 7FST to Canal       *     0.00 *
*****************************************************************


STORAGE AREA: Tempe
Volume Method : Area times depth
         Area : 1000
     Min Elev : 1210

STORAGE AREA OUTPUT  Profile #Max WS
*****************************************************************
* W.S. Elev (ft)       * 1210.00  * 2EST to Tempe       *     0.79 *
*****************************************************************


CONNECTION: 2DST to 2EST


Number of Culverts =  1

Culvert Name     Shape      Rise    Span
Culvert #1      Circular       5
FHWA Chart # 1 - Concrete Pipe Culvert
FHWA Scale # 1 - Square edge entrance with headwall
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit Loss
Coef
                     176.9     .012     .012        0                  .5                 1
Upstream   Elevation =  1210
           Centerline Station =  25
Downstream Elevation =  1208
           Centerline Station =  25

STORAGE AREA CONNECTION OUTPUT  Profile #Max WS  Culv Group:  Culvert #1
*********************************************************************
* Q Culv Group (cfs)     *    5.97  * Culv Full Len (ft)     *  176.90  *
* # Barrels              *       1  * Culv Vel US (ft/s)     *    0.30  *
* Q Barrel (cfs)         *    5.97  * Culv Vel DS (ft/s)     *    0.30  *
* E.G. US. (ft)          * 1224.02  * Culv Inv El Up (ft)    * 1210.00  *
* W.S. US. (ft)          * 1224.02  * Culv Inv El Dn (ft)    * 1208.00  *
* E.G. DS (ft)           * 1224.02  * Culv Frctn Ls (ft)     *    0.00  *
* W.S. DS (ft)           * 1224.02  * Culv Exit Loss (ft)    *    0.00  *
* Delta EG (ft)          *    0.00  * Culv Entr Loss (ft)    *    0.00  *
* Delta WS (ft)          *    0.00  * Q Weir (cfs)           *          *
* E.G. IC (ft)           * 1210.87  * Weir Sta Lft (ft)      *          *
* E.G. OC (ft)           * 1224.02  * Weir Sta Rgt (ft)      *          *
* Culvert Control        *  Outlet  * Weir Submerg           *          *
* Culv WS Inlet (ft)     * 1215.00  * Weir Max Depth (ft)    *          *
* Culv WS Outlet (ft)    * 1213.00  * Weir Avg Depth (ft)    *          *
* Culv Nml Depth (ft)    *          * Weir Flow Area (sq ft) *          *
* Culv Crt Depth (ft)    *    0.67  * Min El Weir Flow (ft)  * 1250.01  *
*********************************************************************
```

CONNECTION: 2DST to 3AST

STORAGE AREA CONNECTION OUTPUT Profile #Max WS Inl Struct:

E.G. Elev (ft)	1224.95	Q Gates (cfs)	
W.S. Elev (ft)	1224.95	Q Gate Group (cfs)	0.00
Q Total (cfs)	-13.31	Gate Open Ht (ft)	
Q Weir (cfs)		Gate #Open	
Weir Flow Area (sq ft)	7.37	Gate Area (sq ft)	1.00
Weir Sta Lft (ft)	0.00	Gate Submerg	0.00
Weir Sta Rgt (ft)	20.48	Gate Invert (ft)	0.00
Weir Max Depth (ft)	0.60	Gate Weir Coef	0.000
Weir Avg Depth (ft)	0.36		
Weir Coef (ft^1/2)	3.000	Q Breach (cfs)	
Weir Submerg	0.00	Breach Avg Velocity (ft/s)	
Min El Weir Flow (ft)	1224.36	Breach Flow Area (sq ft)	
Wr Top Wdth (ft)	20.48		

CONNECTION: 2DST to Canal

STORAGE AREA CONNECTION OUTPUT Profile #Max WS Inl Struct:

E.G. Elev (ft)	1224.02	Q Gates (cfs)	
W.S. Elev (ft)	1224.02	Q Gate Group (cfs)	0.00
Q Total (cfs)	13.52	Gate Open Ht (ft)	
Q Weir (cfs)	13.52	Gate #Open	
Weir Flow Area (sq ft)	10.90	Gate Area (sq ft)	1.00
Weir Sta Lft (ft)	62.83	Gate Submerg	0.00
Weir Sta Rgt (ft)	126.61	Gate Invert (ft)	0.00
Weir Max Depth (ft)	0.34	Gate Weir Coef	0.000
Weir Avg Depth (ft)	0.17		
Weir Coef (ft^1/2)	3.000	Q Breach (cfs)	
Weir Submerg	0.00	Breach Avg Velocity (ft/s)	
Min El Weir Flow (ft)	1223.69	Breach Flow Area (sq ft)	
Wr Top Wdth (ft)	63.78		

CONNECTION: 2EST to Tempe

STORAGE AREA CONNECTION OUTPUT Profile #Max WS Inl Struct:

E.G. Elev (ft)	1224.02	Q Gates (cfs)	
W.S. Elev (ft)	1224.02	Q Gate Group (cfs)	0.00
Q Total (cfs)	0.79	Gate Open Ht (ft)	
Q Weir (cfs)	0.79	Gate #Open	
Weir Flow Area (sq ft)	1.90	Gate Area (sq ft)	1.00
Weir Sta Lft (ft)	0.00	Gate Submerg	0.00
Weir Sta Rgt (ft)	100.00	Gate Invert (ft)	0.00
Weir Max Depth (ft)	0.02	Gate Weir Coef	0.000
Weir Avg Depth (ft)	0.02		
Weir Coef (ft^1/2)	3.000	Q Breach (cfs)	
Weir Submerg	0.00	Breach Avg Velocity (ft/s)	
Min El Weir Flow (ft)	1224.01	Breach Flow Area (sq ft)	
Wr Top Wdth (ft)	100.00		

CONNECTION: 3AST to 3EST

```
STORAGE AREA CONNECTION OUTPUT  Profile #Max WS  Inl Struct:
************************************************************************
* E.G. Elev (ft)          * 1225.03  * Q Gates (cfs)           *          *
* W.S. Elev (ft)          * 1225.03  * Q Gate Group (cfs)      *    0.00  *
* Q Total (cfs)           *   -0.27  * Gate Open Ht (ft)       *          *
* Q Weir (cfs)            *-904126100000000000000000000000000000.00  * Gate #Open              *
*
* Weir Flow Area (sq ft) *    0.32  * Gate Area (sq ft)       *    1.00  *
* Weir Sta Lft (ft)       *   17.44  * Gate Submerg            *    0.00  *
* Weir Sta Rgt (ft)       *   21.51  * Gate Invert (ft)        *    0.00  *
* Weir Max Depth (ft)     *    0.16  * Gate Weir Coef          *   0.000  *
* Weir Avg Depth (ft)     *    0.08  *                         *          *
* Weir Coef (ft^1/2)      *   3.000  * Q Breach (cfs)          *          *
* Weir Submerg            *    0.01  * Breach Avg Velocity (ft/s)*          *
* Min El Weir Flow (ft)   * 1224.88  * Breach Flow Area (sq ft)*          *
* Wr Top Wdth (ft)        *    4.07  *                         *          *
************************************************************************
```

CONNECTION: 3AST to 4DST

```
Number of Culverts =  1

Culvert Name      Shape      Rise    Span
Culvert #1       Circular       5
FHWA Chart # 1 - Concrete Pipe Culvert
FHWA Scale # 1 - Square edge entrance with headwall
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit Loss
Coef
                     867.2     .012     .012        0                   .5                1
Upstream   Elevation =  1217.31
           Centerline Station =  25
Downstream Elevation =  1215.98
           Centerline Station =  25

STORAGE AREA CONNECTION OUTPUT  Profile #Max WS  Culv Group:  Culvert #1
************************************************************************
* Q Culv Group (cfs)      *  -18.80  * Culv Full Len (ft)      *  867.20  *
* # Barrels               *       1  * Culv Vel US (ft/s)      *   -0.96  *
* Q Barrel (cfs)          *  -18.80  * Culv Vel DS (ft/s)      *   -0.96  *
* E.G. US. (ft)           * 1224.95  * Culv Inv El Up (ft)     * 1217.31  *
* W.S. US. (ft)           * 1225.01  * Culv Inv El Dn (ft)     * 1215.98  *
* E.G. DS (ft)            * 1225.01  * Culv Frctn Ls (ft)      *    0.04  *
* W.S. DS (ft)            * 1220.98  * Culv Exit Loss (ft)     *    0.01  *
* Delta EG (ft)           *    0.06  * Culv Entr Loss (ft)     *    0.01  *
* Delta WS (ft)           *    4.03  * Q Weir (cfs)            *          *
* E.G. IC (ft)            * 1217.61  * Weir Sta Lft (ft)       *          *
* E.G. OC (ft)            * 1225.01  * Weir Sta Rgt (ft)       *          *
* Culvert Control         *  Outlet  * Weir Submerg            *          *
* Culv WS Inlet (ft)      * 1222.31  * Weir Max Depth (ft)     *          *
* Culv WS Outlet (ft)     * 1220.98  * Weir Avg Depth (ft)     *          *
* Culv Nml Depth (ft)     *          * Weir Flow Area (sq ft) *          *
* Culv Crt Depth (ft)     *    1.20  * Min El Weir Flow (ft)  * 1250.01  *
************************************************************************
```

CONNECTION: 3AST to Canal

STORAGE AREA CONNECTION OUTPUT Profile #Max WS Inl Struct:

E.G. Elev (ft)	1224.95	Q Gates (cfs)	
W.S. Elev (ft)	1224.95	Q Gate Group (cfs)	0.00
Q Total (cfs)	9.22	Gate Open Ht (ft)	
Q Weir (cfs)	9.22	Gate #Open	
Weir Flow Area (sq ft)	11.41	Gate Area (sq ft)	1.00
Weir Sta Lft (ft)	0.00	Gate Submerg	0.00
Weir Sta Rgt (ft)	340.50	Gate Invert (ft)	0.00
Weir Max Depth (ft)	0.15	Gate Weir Coef	0.000
Weir Avg Depth (ft)	0.07		
Weir Coef (ft^1/2)	3.000	Q Breach (cfs)	
Weir Submerg	0.00	Breach Avg Velocity (ft/s)	
Min El Weir Flow (ft)	1224.81	Breach Flow Area (sq ft)	
Wr Top Wdth (ft)	157.23		

CONNECTION: 3EST to 4DST

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Circular	2	

FHWA Chart # 1 - Concrete Pipe Culvert
FHWA Scale # 1 - Square edge entrance with headwall
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
		158.6	.012	.012	0	.5	1

Upstream Elevation = 1217.35
Centerline Station = 25
Downstream Elevation = 1215.5
Centerline Station = 25

STORAGE AREA CONNECTION OUTPUT Profile #Max WS Culv Group: Culvert #1

Q Culv Group (cfs)		Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	
Q Barrel (cfs)		Culv Vel DS (ft/s)	
E.G. US. (ft)	1224.95	Culv Inv El Up (ft)	1217.35
W.S. US. (ft)		Culv Inv El Dn (ft)	1215.50
E.G. DS (ft)	1224.95	Culv Frctn Ls (ft)	
W.S. DS (ft)	1225.03	Culv Exit Loss (ft)	
Delta EG (ft)		Culv Entr Loss (ft)	
Delta WS (ft)		Q Weir (cfs)	
E.G. IC (ft)		Weir Sta Lft (ft)	
E.G. OC (ft)		Weir Sta Rgt (ft)	
Culvert Control		Weir Submerg	
Culv WS Inlet (ft)		Weir Max Depth (ft)	
Culv WS Outlet (ft)		Weir Avg Depth (ft)	
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	
Culv Crt Depth (ft)		Min El Weir Flow (ft)	1224.63

Note: For this profile, the culvert does not have any flow.

CONNECTION: 3EST to Canal

STORAGE AREA CONNECTION OUTPUT Profile #Max WS Inl Struct:

E.G. Elev (ft)	1225.03	Q Gates (cfs)	
W.S. Elev (ft)	1225.03	Q Gate Group (cfs)	0.00
Q Total (cfs)	0.00	Gate Open Ht (ft)	
Q Weir (cfs)		Gate #Open	
Weir Flow Area (sq ft)		Gate Area (sq ft)	1.00
Weir Sta Lft (ft)		Gate Submerg	0.00
Weir Sta Rgt (ft)		Gate Invert (ft)	0.00
Weir Max Depth (ft)		Gate Weir Coef	0.000
Weir Avg Depth (ft)			
Weir Coef (ft^1/2)		Q Breach (cfs)	
Weir Submerg		Breach Avg Velocity (ft/s)	
Min El Weir Flow (ft)	1225.53	Breach Flow Area (sq ft)	
Wr Top Wdth (ft)			

CONNECTION: 4DST to 7AST

STORAGE AREA CONNECTION OUTPUT Profile #Max WS Inl Struct:

E.G. Elev (ft)	1225.66	Q Gates (cfs)	
W.S. Elev (ft)	1225.66	Q Gate Group (cfs)	0.00
Q Total (cfs)	0.00	Gate Open Ht (ft)	
Q Weir (cfs)		Gate #Open	
Weir Flow Area (sq ft)		Gate Area (sq ft)	1.00
Weir Sta Lft (ft)		Gate Submerg	0.00
Weir Sta Rgt (ft)		Gate Invert (ft)	0.00
Weir Max Depth (ft)		Gate Weir Coef	0.000
Weir Avg Depth (ft)			
Weir Coef (ft^1/2)		Q Breach (cfs)	
Weir Submerg		Breach Avg Velocity (ft/s)	
Min El Weir Flow (ft)	1226.67	Breach Flow Area (sq ft)	
Wr Top Wdth (ft)			

CONNECTION: 4DST to Canal

STORAGE AREA CONNECTION OUTPUT Profile #Max WS Inl Struct:

E.G. Elev (ft)	1225.03	Q Gates (cfs)	
W.S. Elev (ft)	1225.03	Q Gate Group (cfs)	0.00
Q Total (cfs)	0.00	Gate Open Ht (ft)	
Q Weir (cfs)		Gate #Open	
Weir Flow Area (sq ft)		Gate Area (sq ft)	1.00
Weir Sta Lft (ft)		Gate Submerg	0.00
Weir Sta Rgt (ft)		Gate Invert (ft)	0.00
Weir Max Depth (ft)		Gate Weir Coef	0.000
Weir Avg Depth (ft)			
Weir Coef (ft^1/2)		Q Breach (cfs)	
Weir Submerg		Breach Avg Velocity (ft/s)	
Min El Weir Flow (ft)	1225.44	Breach Flow Area (sq ft)	
Wr Top Wdth (ft)			

CONNECTION: 7AST to 7BST

```
STORAGE AREA CONNECTION OUTPUT  Profile #Max WS  Inl Struct:
***********************************************************************
* E.G. Elev (ft)          * 1226.08  * Q Gates (cfs)           *          *
* W.S. Elev (ft)          * 1226.08  * Q Gate Group (cfs)      *    0.00  *
* Q Total (cfs)           *   -0.04  * Gate Open Ht (ft)       *          *
* Q Weir (cfs)            *-1358788000000000000000000000000000.00  * Gate #Open              *
*
* Weir Flow Area (sq ft) *    0.09  * Gate Area (sq ft)       *    1.00  *
* Weir Sta Lft (ft)       *   12.30  * Gate Submerg            *    0.00  *
* Weir Sta Rgt (ft)       *   16.53  * Gate Invert (ft)        *    0.00  *
* Weir Max Depth (ft)     *    0.04  * Gate Weir Coef          *   0.000  *
* Weir Avg Depth (ft)     *    0.02  *                         *          *
* Weir Coef (ft^1/2)      *   3.000  * Q Breach (cfs)          *          *
* Weir Submerg            *    0.00  * Breach Avg Velocity (ft/s)*          *
* Min El Weir Flow (ft)   * 1226.05  * Breach Flow Area (sq ft)*          *
* Wr Top Wdth (ft)        *    4.23  *                         *          *
***********************************************************************
```

CONNECTION: 7AST to Canal

```
STORAGE AREA CONNECTION OUTPUT  Profile #Max WS  Inl Struct:
***********************************************************************
* E.G. Elev (ft)          * 1225.66  * Q Gates (cfs)           *          *
* W.S. Elev (ft)          * 1225.66  * Q Gate Group (cfs)      *    0.00  *
* Q Total (cfs)           *   13.24  * Gate Open Ht (ft)       *          *
* Q Weir (cfs)            *   13.24  * Gate #Open              *          *
* Weir Flow Area (sq ft) *   13.72  * Gate Area (sq ft)       *    1.00  *
* Weir Sta Lft (ft)       *    0.00  * Gate Submerg            *    0.00  *
* Weir Sta Rgt (ft)       *  136.07  * Gate Invert (ft)        *    0.00  *
* Weir Max Depth (ft)     *    0.19  * Gate Weir Coef          *   0.000  *
* Weir Avg Depth (ft)     *    0.10  *                         *          *
* Weir Coef (ft^1/2)      *   3.000  * Q Breach (cfs)          *          *
* Weir Submerg            *    0.00  * Breach Avg Velocity (ft/s)*          *
* Min El Weir Flow (ft)   * 1225.48  * Breach Flow Area (sq ft)*          *
* Wr Top Wdth (ft)        *  136.07  *                         *          *
***********************************************************************
```

CONNECTION: 7BST to 7DST

```
STORAGE AREA CONNECTION OUTPUT  Profile #Max WS  Inl Struct:
***********************************************************************
* E.G. Elev (ft)          * 1226.08  * Q Gates (cfs)           *          *
* W.S. Elev (ft)          * 1226.08  * Q Gate Group (cfs)      *    0.00  *
* Q Total (cfs)           *    0.00  * Gate Open Ht (ft)       *          *
* Q Weir (cfs)            *    0.00  * Gate #Open              *          *
* Weir Flow Area (sq ft) *   11.50  * Gate Area (sq ft)       *    1.00  *
* Weir Sta Lft (ft)       *   16.31  * Gate Submerg            *    0.00  *
* Weir Sta Rgt (ft)       *  104.58  * Gate Invert (ft)        *    0.00  *
* Weir Max Depth (ft)     *    0.47  * Gate Weir Coef          *   0.000  *
* Weir Avg Depth (ft)     *    0.13  *                         *          *
* Weir Coef (ft^1/2)      *   3.000  * Q Breach (cfs)          *          *
* Weir Submerg            *    1.00  * Breach Avg Velocity (ft/s)*          *
* Min El Weir Flow (ft)   * 1225.62  * Breach Flow Area (sq ft)*          *
```

```
* Wr Top Wdth (ft)        *   88.27  *                          *          *
***********************************************************************
```

CONNECTION: 7BST to 7FST

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Circular	2.5	

FHWA Chart # 1 - Concrete Pipe Culvert
FHWA Scale # 1 - Square edge entrance with headwall
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
		1453.4	.012	.012	0	.5	1

Upstream Elevation = 1220.83
Centerline Station = 25
Downstream Elevation = 1217.92
Centerline Station = 25

STORAGE AREA CONNECTION OUTPUT Profile #Max WS Culv Group: Culvert #1

Q Culv Group (cfs)	0.97	Culv Full Len (ft)	1453.40
# Barrels	1	Culv Vel US (ft/s)	0.20
Q Barrel (cfs)	0.97	Culv Vel DS (ft/s)	0.20
E.G. US. (ft)	1226.08	Culv Inv El Up (ft)	1220.83
W.S. US. (ft)	1226.08	Culv Inv El Dn (ft)	1217.92
E.G. DS (ft)	1226.07	Culv Frctn Ls (ft)	0.01
W.S. DS (ft)	1226.07	Culv Exit Loss (ft)	0.00
Delta EG (ft)	0.01	Culv Entr Loss (ft)	0.00
Delta WS (ft)	0.01	Q Weir (cfs)	
E.G. IC (ft)	1221.26	Weir Sta Lft (ft)	
E.G. OC (ft)	1226.08	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	1223.33	Weir Max Depth (ft)	
Culv WS Outlet (ft)	1220.42	Weir Avg Depth (ft)	
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	0.32	Min El Weir Flow (ft)	1250.01

CONNECTION: 7BST to Canal

STORAGE AREA CONNECTION OUTPUT Profile #Max WS Inl Struct:

E.G. Elev (ft)	1226.08	Q Gates (cfs)	
W.S. Elev (ft)	1226.08	Q Gate Group (cfs)	0.00
Q Total (cfs)	0.00	Gate Open Ht (ft)	
Q Weir (cfs)		Gate #Open	
Weir Flow Area (sq ft)		Gate Area (sq ft)	1.00
Weir Sta Lft (ft)		Gate Submerg	0.00
Weir Sta Rgt (ft)		Gate Invert (ft)	0.00
Weir Max Depth (ft)		Gate Weir Coef	0.000
Weir Avg Depth (ft)			
Weir Coef (ft^1/2)		Q Breach (cfs)	
Weir Submerg		Breach Avg Velocity (ft/s)	
Min El Weir Flow (ft)	1226.24	Breach Flow Area (sq ft)	
Wr Top Wdth (ft)			

CONNECTION: 7DST to 7EST

STORAGE AREA CONNECTION OUTPUT Profile #Max WS Inl Struct:

E.G. Elev (ft)	1226.08	Q Gates (cfs)	
W.S. Elev (ft)	1226.08	Q Gate Group (cfs)	0.00
Q Total (cfs)	0.15	Gate Open Ht (ft)	
Q Weir (cfs)	0.15	Gate #Open	
Weir Flow Area (sq ft)	0.26	Gate Area (sq ft)	1.00
Weir Sta Lft (ft)	20.29	Gate Submerg	0.00
Weir Sta Rgt (ft)	27.26	Gate Invert (ft)	0.00
Weir Max Depth (ft)	0.07	Gate Weir Coef	0.000
Weir Avg Depth (ft)	0.04		
Weir Coef (ft^1/2)	3.000	Q Breach (cfs)	
Weir Submerg	0.71	Breach Avg Velocity (ft/s)	
Min El Weir Flow (ft)	1226.02	Breach Flow Area (sq ft)	
Wr Top Wdth (ft)	6.97		

CONNECTION: 7DST to Canal

STORAGE AREA CONNECTION OUTPUT Profile #Max WS Inl Struct:

E.G. Elev (ft)	1226.08	Q Gates (cfs)	
W.S. Elev (ft)	1226.08	Q Gate Group (cfs)	0.00
Q Total (cfs)	0.00	Gate Open Ht (ft)	
Q Weir (cfs)		Gate #Open	
Weir Flow Area (sq ft)		Gate Area (sq ft)	1.00
Weir Sta Lft (ft)		Gate Submerg	0.00
Weir Sta Rgt (ft)		Gate Invert (ft)	0.00
Weir Max Depth (ft)		Gate Weir Coef	0.000
Weir Avg Depth (ft)			
Weir Coef (ft^1/2)		Q Breach (cfs)	
Weir Submerg		Breach Avg Velocity (ft/s)	
Min El Weir Flow (ft)	1226.65	Breach Flow Area (sq ft)	
Wr Top Wdth (ft)			

CONNECTION: 7EST to 7FST

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Circular	3.5	

FHWA Chart # 1 - Concrete Pipe Culvert
FHWA Scale # 1 - Square edge entrance with headwall
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
		95.1	.012	.012	0	.5	1

Upstream Elevation = 1218.12
Centerline Station = 25
Downstream Elevation = 1217.92
Centerline Station = 25

```
STORAGE AREA CONNECTION OUTPUT  Profile #Max WS  Culv Group:  Culvert #1
***********************************************************************
* Q Culv Group (cfs)      *   -2.39  * Culv Full Len (ft)      *   95.10  *
* # Barrels               *       1  * Culv Vel US (ft/s)      *   -0.25  *
* Q Barrel (cfs)          *   -2.39  * Culv Vel DS (ft/s)      *   -0.25  *
* E.G. US. (ft)           * 1226.07  * Culv Inv El Up (ft)     * 1218.12  *
* W.S. US. (ft)           * 1226.07  * Culv Inv El Dn (ft)     * 1217.92  *
* E.G. DS (ft)            * 1226.07  * Culv Frctn Ls (ft)      *    0.00  *
* W.S. DS (ft)            * 1226.07  * Culv Exit Loss (ft)     *    0.00  *
* Delta EG (ft)           *    0.00  * Culv Entr Loss (ft)     *    0.00  *
* Delta WS (ft)           *    0.00  * Q Weir (cfs)            *    0.45  *
* E.G. IC (ft)            * 1218.60  * Weir Sta Lft (ft)       *   99.15  *
* E.G. OC (ft)            * 1226.07  * Weir Sta Rgt (ft)       *  112.80  *
* Culvert Control         *  Outlet  * Weir Submerg            *    0.97  *
* Culv WS Inlet (ft)      * 1221.62  * Weir Max Depth (ft)     *    0.07  *
* Culv WS Outlet (ft)     * 1221.42  * Weir Avg Depth (ft)     *    0.07  *
* Culv Nml Depth (ft)     *          * Weir Flow Area (sq ft) *    0.90  *
* Culv Crt Depth (ft)     *    0.46  * Min El Weir Flow (ft)  * 1226.01  *
***********************************************************************

Warning: During the culvert inlet control computations, the program could not balance the
culvert/weir flow.  The reported inlet
         energy grade answer may not be valid.


CONNECTION: 7EST to Canal


STORAGE AREA CONNECTION OUTPUT  Profile #Max WS  Inl Struct:
***********************************************************************
* E.G. Elev (ft)          * 1226.07  * Q Gates (cfs)           *          *
* W.S. Elev (ft)          * 1226.07  * Q Gate Group (cfs)      *    0.00  *
* Q Total (cfs)           *    0.00  * Gate Open Ht (ft)       *          *
* Q Weir (cfs)            *          * Gate #Open              *          *
* Weir Flow Area (sq ft)  *          * Gate Area (sq ft)       *    1.00  *
* Weir Sta Lft (ft)       *          * Gate Submerg            *    0.00  *
* Weir Sta Rgt (ft)       *          * Gate Invert (ft)        *    0.00  *
* Weir Max Depth (ft)     *          * Gate Weir Coef          *   0.000  *
* Weir Avg Depth (ft)     *          *                         *          *
* Weir Coef (ft^1/2)      *          * Q Breach (cfs)          *          *
* Weir Submerg            *          * Breach Avg Velocity (ft/s)*          *
* Min El Weir Flow (ft)   * 1226.26  * Breach Flow Area (sq ft)*          *
* Wr Top Wdth (ft)        *          *                         *          *
***********************************************************************


CONNECTION: 7FST to Canal


STORAGE AREA CONNECTION OUTPUT  Profile #Max WS  Inl Struct:
***********************************************************************
* E.G. Elev (ft)          * 1226.07  * Q Gates (cfs)           *          *
* W.S. Elev (ft)          * 1226.07  * Q Gate Group (cfs)      *    0.00  *
* Q Total (cfs)           *    0.00  * Gate Open Ht (ft)       *   99.00  *
* Q Weir (cfs)            *          * Gate #Open              *          *
* Weir Flow Area (sq ft)  *          * Gate Area (sq ft)       *    1.00  *
* Weir Sta Lft (ft)       *          * Gate Submerg            *    0.00  *
* Weir Sta Rgt (ft)       *          * Gate Invert (ft)        *    0.00  *
* Weir Max Depth (ft)     *          * Gate Weir Coef          *   0.000  *
* Weir Avg Depth (ft)     *          *                         *          *
* Weir Coef (ft^1/2)      *          * Q Breach (cfs)          *          *
* Weir Submerg            *          * Breach Avg Velocity (ft/s)*          *
```

```
* Min El Weir Flow (ft)  * 1226.57  * Breach Flow Area (sq ft)*          *
* Wr Top Wdth (ft)       *          *                          *          *
*********************************************************************

*******************************************************************************

SUMMARY OF MANNING'S N VALUES

River:Guadalupe
*****************************************************************
*     Reach      *   River Sta.   *   n1    *   n2    *   n3    *
*****************************************************************
*dummy            *    10          *     .014*     .014*     .014*
*dummy            *    0           *     .014*     .014*     .014*
*****************************************************************

*******************************************************************************

SUMMARY OF REACH LENGTHS

River: Guadalupe
*****************************************************************
*     Reach      *   River Sta.   *  Left   * Channel *  Right  *
*****************************************************************
*dummy            *    10          *       10*       10*       10*
*dummy            *    0           *         *         *         *
*****************************************************************

*******************************************************************************

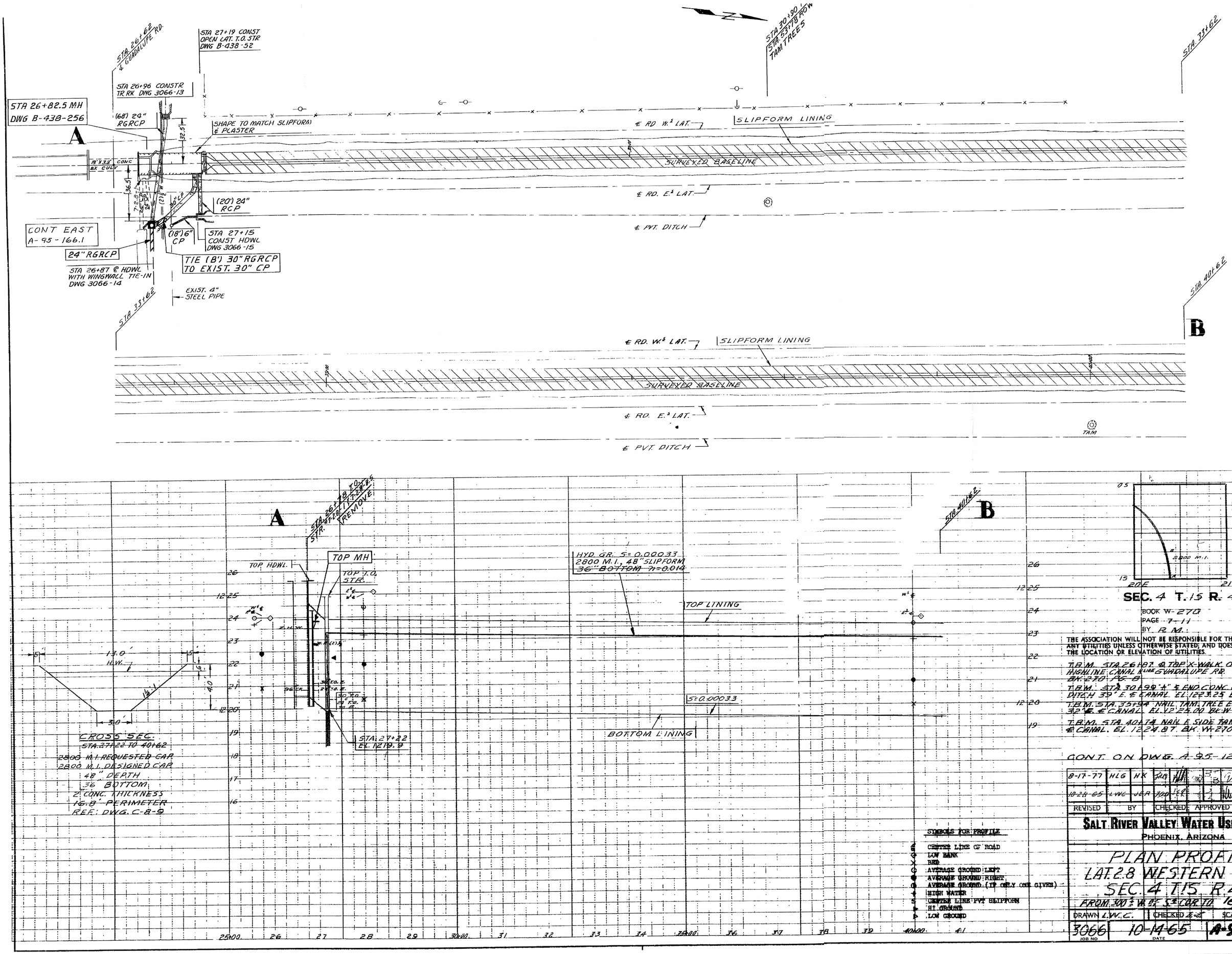
SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Guadalupe

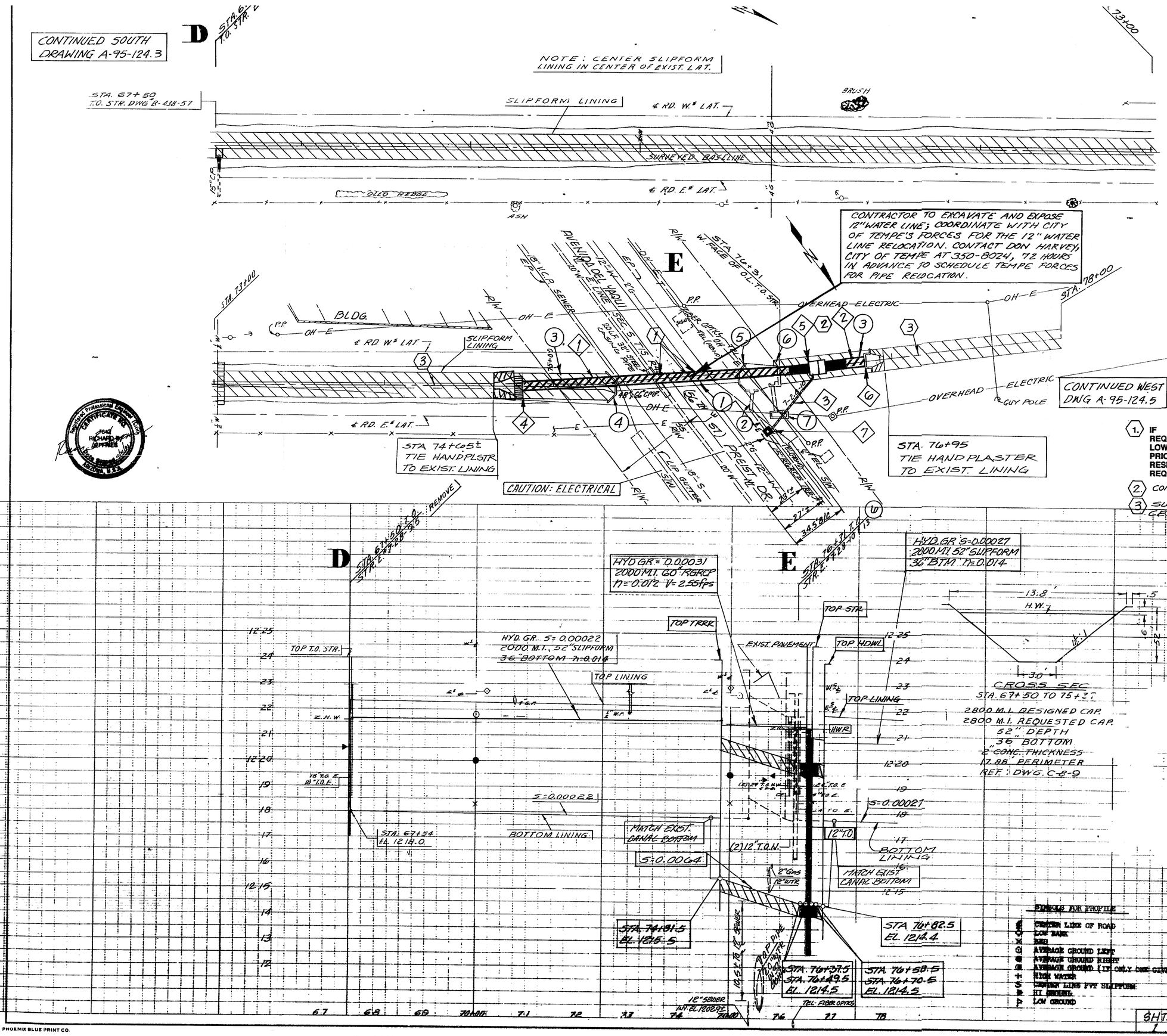
*****************************************************
*     Reach      *   River Sta.   * Contr.  * Expan.  *
*****************************************************
*dummy            *    10      *       .1*       .3*
*dummy            *    0       *       .1*       .3*
*****************************************************

*******************************************************************************

ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : 24hr

No Errors, Warnings or Notes in Computations
```


STA 26+62 ℄ GUADALUPE RD.
STA 27+19 CONST OPEN LAT. T.O. STR DWG B-438-52
STA 26+96 CONSTR TR RK DWG 3066-13
STA 26+82.5 M.H DWG B-438-256
(68') 24" RGRCP
SHAPE TO MATCH SLIPFORM & PLASTER
A
8'X3.5' CONC BX CULV
36.5'
32.5'
7'-2.8"
24"CP
30"CP
(2)
(20') 24" RCP
CONT EAST A-95-166.1
(18') 6" CP
STA 27+15 CONST HDWL DWG 3066-15
24" RGRCP
TIE (8') 30" RGRCP TO EXIST. 30" CP
STA 26+87 @ HDWL WITH WINGWALL TIE-IN DWG 3066-14
EXIST. 4" STEEL PIPE
STA 33+62
STA 30+90 L STA. 53+78 R ROW TAM TREES
STA 33+62
℄ RD W.½ LAT.
SLIPFORM LINING
SURVEYED BASELINE
℄ RD. E.½ LAT.
℄ PVT. DITCH
STA 40+62
B
℄ RD. W.½ LAT.
SLIPFORM LINING
SURVEYED BASELINE
℄ RD. E.½ LAT.
℄ PVT. DITCH
TAM
A
STA 26+48 TO STA 27+20 TRACK TO BE REMOVED
TOP MH
TOP HDWL.
TOP T.O. STR.
HYD GR. S=0.00033 2800 M.I., 48" SLIPFORM 36" BOTTOM n=0.014
TOP LINING
S=0.00033
BOTTOM LINING
STA 27+22 EL. 1219.9
13.0' H.W.
4.0'
3.0'
CROSS SEC.
STA 27+22 TO 40+62
2800 M.I. REQUESTED CAP.
2800 M.I. DESIGNED CAP.
48" DEPTH
36" BOTTOM
2" CONC. THICKNESS
16.8' PERIMETER
REF: DWG. C-8-9
B
STA 40+62
SYMBOLS FOR PROFILE
CENTER LINE OF ROAD
LOW BANK
BED
AVERAGE GROUND LEFT
AVERAGE GROUND RIGHT
AVERAGE GROUND (IF ONLY ONE GIVEN)
HIGH WATER
CENTER LINE PVT SLIPFORM
HI GROUND
LOW GROUND
2800 M.I.
20E
21E
SEC. 4 T. 15 R. 4E
BOOK W-270
PAGE 7-11
BY R.M.
THE ASSOCIATION WILL NOT BE RESPONSIBLE FOR THE RELOCATION OF ANY UTILITIES UNLESS OTHERWISE STATED, AND DOES NOT GUARANTEE THE LOCATION OR ELEVATION OF UTILITIES.
T.B.M. STA 26+97 @ TOP X-WALK OVER 96" CK HIGHLINE CANAL W. SIDE GUADALUPE RD. EL. 1223.83 BK. 270 PG. 8
T.B.M. STA 30+98 4" ℄ END CONC. CULV. ℄ PVT DITCH 35' E. ℄ CANAL EL. 1223.25 BK. W-270 PG. 8
T.B.M. STA. 35+94 NAIL TAM TREE E. SIDE CANAL 32' E. ℄ CANAL EL. V225.00 BK. W-270 PG. 8
T.B.M. STA. 40+74 NAIL E. SIDE TAM TREE 2 RW ℄ CANAL EL. 1224.87 BK. W-270 PG. 8
CONT. ON DWG. A-95-124.2
8-17-77 HLG HK JAR
10-28-65 LWC JAR
REVISED BY CHECKED APPROVED DESCRIPTION
DESIGN STA 26+82.5 SLIPFORM LINING
SALT RIVER VALLEY WATER USERS' ASS'N
PHOENIX, ARIZONA
PLAN PROFILE
LAT. 2.8 WESTERN CANAL
SEC. 4 T.15 R.4E
FROM 300' ± W. OF S. ¼ COR. TO 16/17 COR.
DRAWN L.W.C. CHECKED SCALE 1" = 30'
3066 10-14-65 A-95-124.1
JOB NO DATE DRAWING NO



NO.	STA. TO STA.		SIZE X L.F.
1	75+34	76+06	48" X 66" CMP X 72 L.F.
2	76+14 (11'R)	76+23 (37'R)	15" C.P. X 28 L.F.
3	74+65	76+95	3' S.F. X 133 L.F.

REMOVE STRUCTURE FILL AND COMPACT HOLE

NO.	STATION	TYPE
4	75+34	HDWL.
5	76+06	HDWL.
6	76+31	O.L. T.O. STR.
7	76+23	O.L. T.O. STR.

NEW IRRIGATION PIPE

NO.	STA. TO STA.		SIZE X L.F.	TYPE
1	74+81.5	76+37.5	60" X 156'	RGRCP
2	76+70.5	76+82.5	60" X 12'	RGRCP
3	76+24	76+44	24" X 31'	RGRCP

NOTE: ALL RGRCP TO BE CLASS III PIPE.

NEW IRRIGATION STRUCTURE

NO.	STATION	REMARKS
4	74+81.5	HDWL/TRRK DWG. A-910-W1.22 CENTER IN EXISTING SLIPFORM
5	76+49	T.O. STR. DWG. B-438-419 CENTER IN EXISTING SLIPFORM
6	76+82.5	HDWL DWG. A-910-W1.23 CENTER IN EXISTING SLIPFORM
7	76+23	MH #1 DWG. A-910-W1.25 CENTER ON EXISTING 15' RGRCP

1. IF EXISTING UTILITY DOES NOT MEET CLEARANCE REQUIREMENTS WITH PROPOSED SRP PIPELINE, IT IS TO BE LOWERED TO CLEAR PIPELINE BY A MINIMUM OF TWO FEET PRIOR TO SRP PIPELINE INSTALLATION. CONTACT THE RESPECTIVE UTILITY COMPANY FOR COST AND SCHEDULE REQUIREMENTS FOR RELOCATION.
2. CONSTRUCTION BY SRP
3. SURVEY BASELINE AND CONSTRUCTION ℄ CENTER OF THE EXISTING SLIPFORM AND C.M.

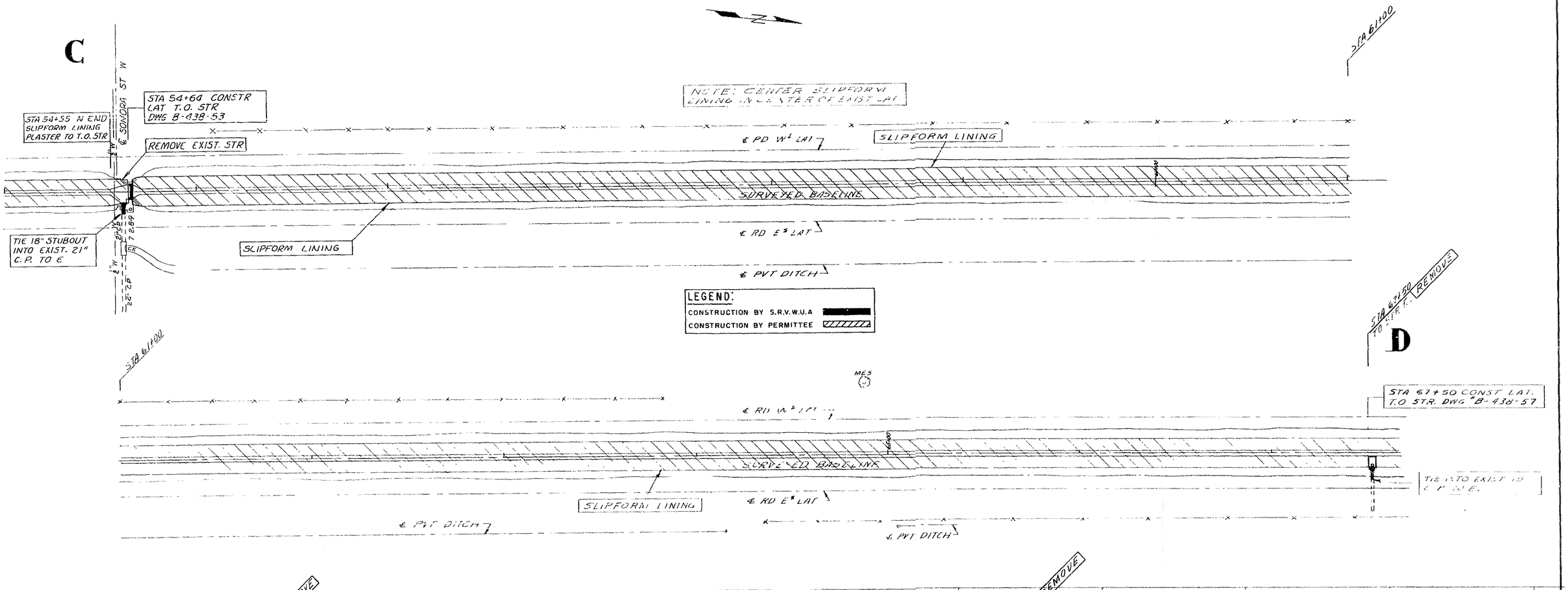
08/09/91	EAP	KLA					DESIGN CHANGE STA 74+65 STA.
12/17/89	BEC	DJS	RBJ				DESIGN SLIPFORM LINING
10-28-65	L.W.E.	J.E.R.					
REVISED	BY	CHECKED	APPROVED				DESCRIPTION

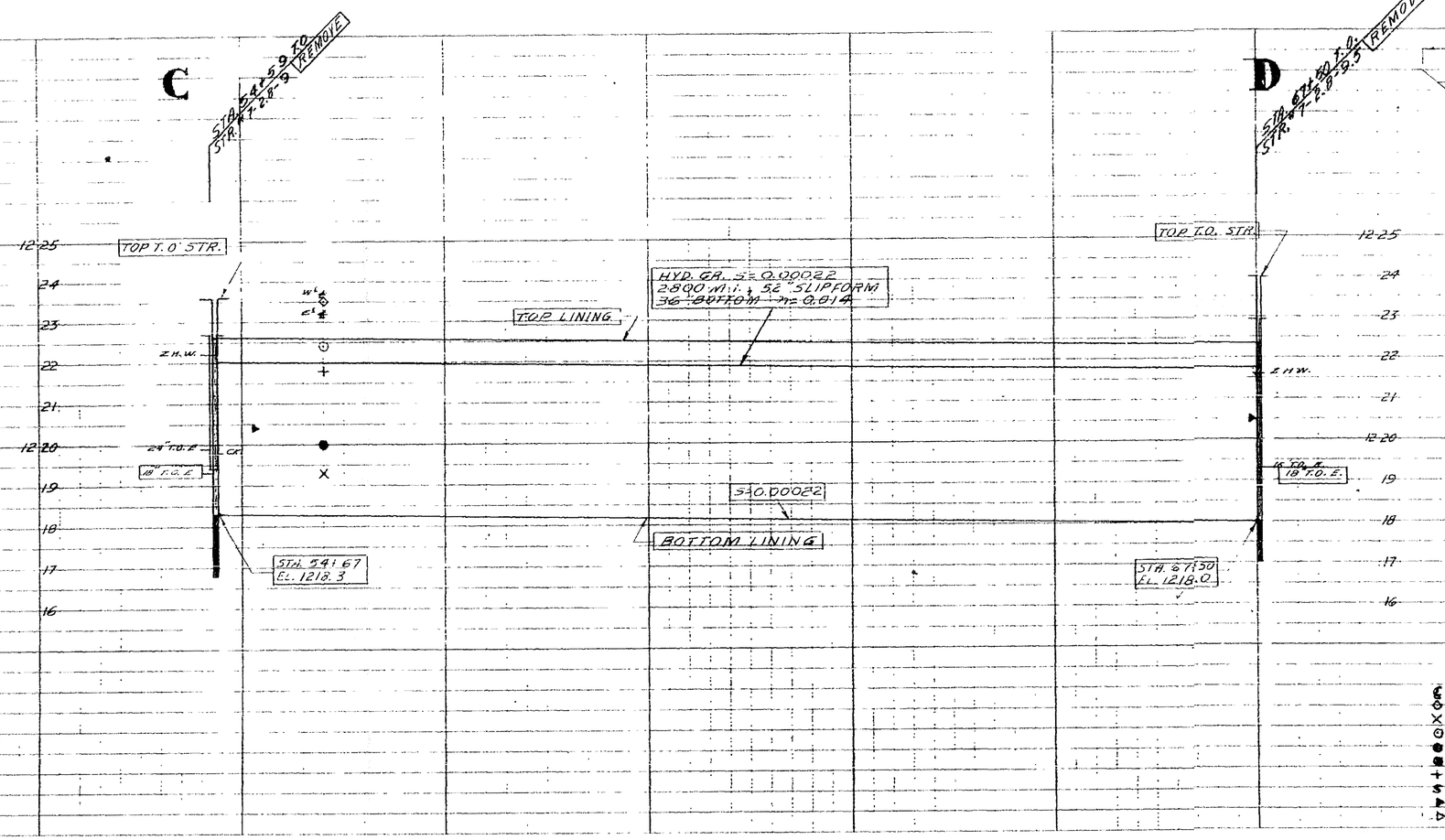
SALT RIVER VALLEY WATER USERS' ASS'N
PHOENIX, ARIZONA

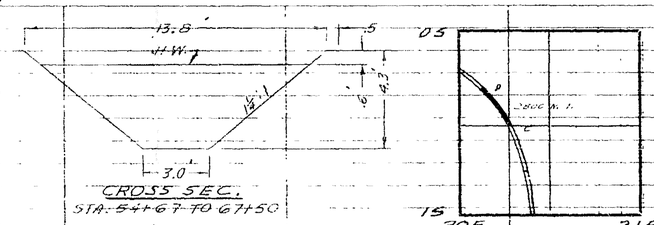
PLAN PROFILE
LAT. 28 WESTERN CANAL
SEC. 4 T.15 R.4E
FROM 900± S.E. OF 16/3 COR. TO 16/3 CO.

DRAWN L.W.E. | CHECKED | SCALE 1" = 20'
SHT. 1 | JOB NO. 3066 | DATE 10-14-65 | DRAWING NO. A-95-124

PHOENIX BLUE PRINT CO.
PRINTED IN U.S.A. ON 100% RAG PAPER MADE IN U.S.A.
EUGENE DIETZGEN CO.







2800 W.I. DESIGNED CAP.
~~2600 W.I. REQUESTED CAP.~~
52" DEPTH
36" BOTTOM
2" CONC THICKNESS
17.88' PERIMETER
REF: DWG. C-8-9

SEC. 4 T. 15 R. 4E

BOOK W-270
PAGE 12-13
BY R.M.

THE ASSOCIATION WILL NOT BE RESPONSIBLE FOR THE RELOCATION OF ANY UTILITIES UNLESS OTHERWISE STATED, AND DOES NOT GUARANTEE THE LOCATION OR ELEVATION OF UTILITIES.

T.B.M. STA. 54+59.5 "+" X-WALK OVER 24" T.O. TO E. #7-28-9. EL. 1222.70 BK. W-270 PG. 8
T.B.M. STA. 60+00 SMALL NAIL W. SIDE PVT SLIPFORM 39' E. ℄ CANAL EL. 1220.78 BK. W-270 PG. 8
T.B.M. STA. 64+80 NAIL E. SIDE MES. TREE 37' W. ℄ CANAL. BK. W-270 PG. B EL. 1221.50
T.B.M. STA. 67+50 "+" TOP STR. #7-28-9.5 E. SIDE CANAL. BK. W-270 PG. 8 EL. 1222.96

CONT. FROM DWG. A-95-124.2
CONT. ON DWG. A-95-124.4

REVISED	BY	CHECKED	APPROVED	DESCRIPTION
10-28-65	LWC	JEA		SLIPFORM LINING

SYMBOLS FOR PROFILE
℄ CENTER LINE OF ROAD
◇ LOW BANK
X BED
⊙ AVERAGE GROUND LEFT
● AVERAGE GROUND RIGHT
◉ AVERAGE GROUND (IF ONLY ONE GIVEN)
+ HIGH WATER
S CENTER LINE PVT SLIPFORM
▶ HI GROUND
◁ LOW GROUND

SALT RIVER VALLEY WATER USERS' ASS'N
PHOENIX, ARIZONA

PLAN PROFILE
LAT. 28 WESTERN CANAL
SEC 4 T15 R4E
FROM 16/12 COR. TO 900± SE. OF 16/13 COR.

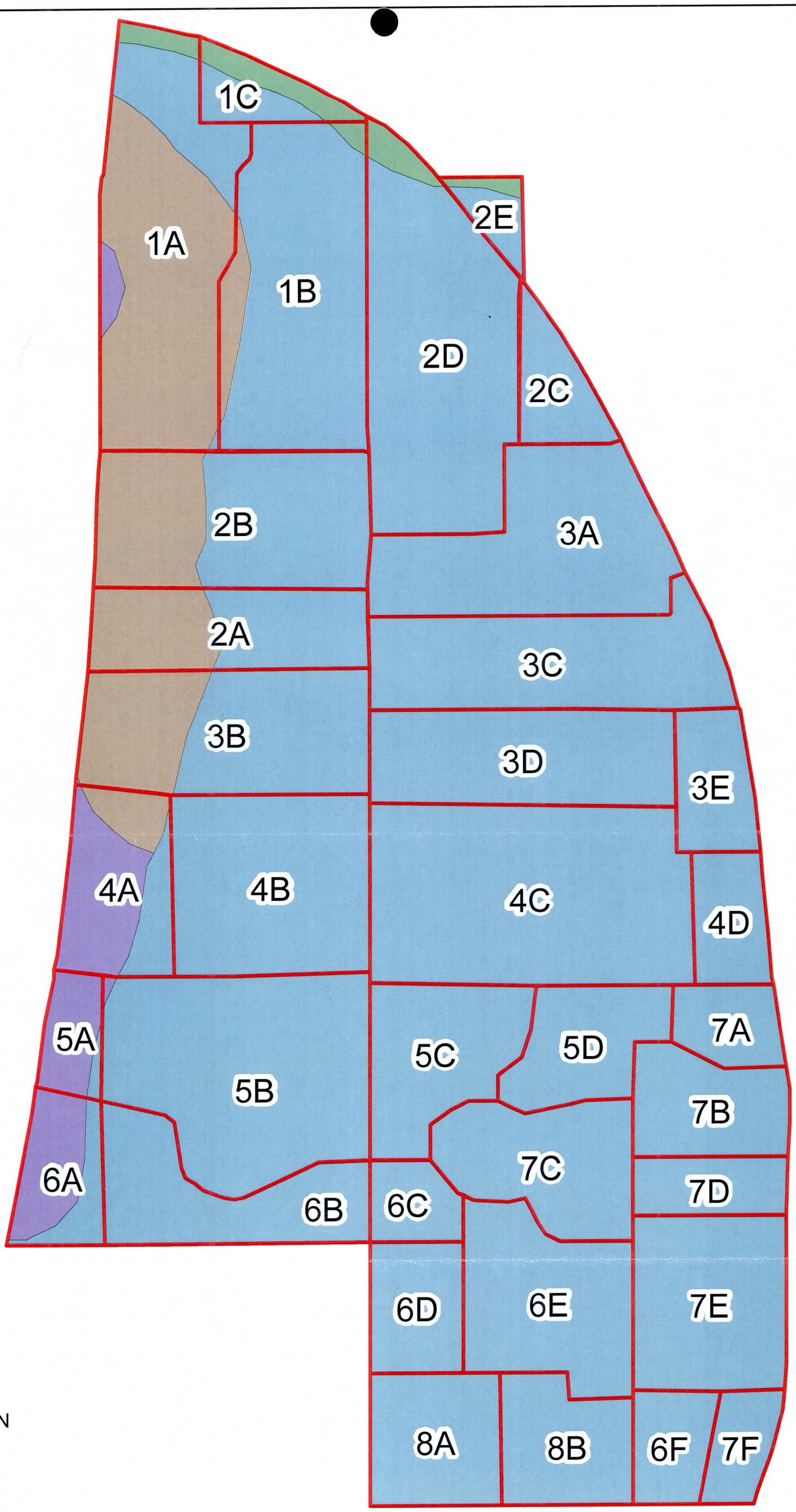
DRAWN L.W.C. | CHECKED | SCALE 1" = 30'

F. Erosion and Sedimention Transport Analysis Supporting Documentation

Not Applicable / Not Included

Exhibit Maps

Hydrology watershed maps
Hydrology soils maps
Hydrology land-use maps
Hydraulics work study map index
Hydraulics work study maps
Annotated FIRM panels



Legend

DRNBSN

SOIL_Clip

SLTYP_DFN

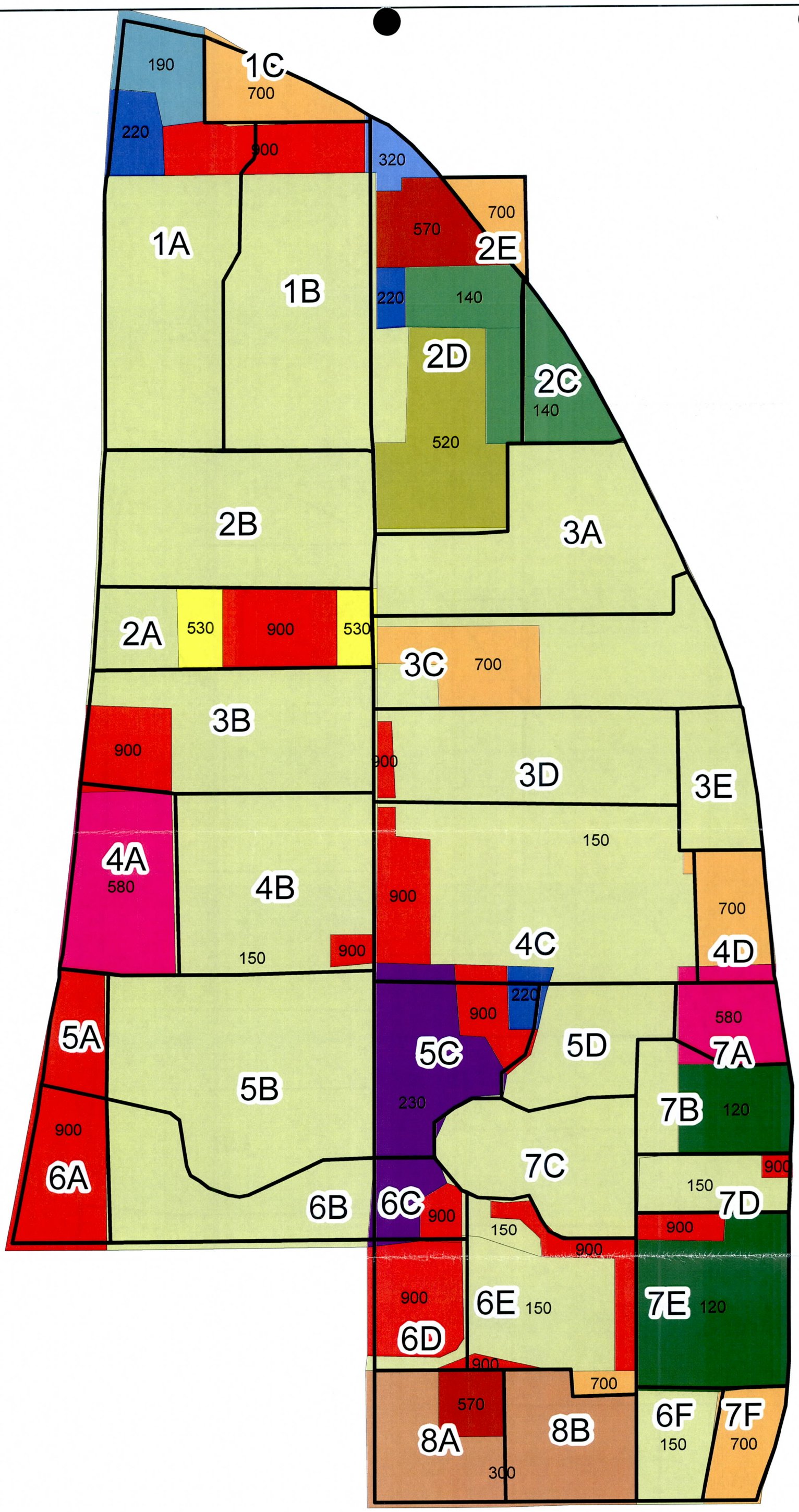
- AdB, Antho gravelly sandy loam, 1 to 3 percent slopes
- AbA, Antho sandy loam, 0 to 1 percent slopes
- AbB, Antho sandy loam, 1 to 3 percent slopes
- Va, Valencia sandy loam

Guadalupe FDS
Soils Map

0 250 500 1,000 Feet

N

WEST CONSULTANTS, INC.



N

0 245 490 980 Feet

Guadalupe FDS

Landuse Map

WEST CONSULTANTS, INC.

Flood Control District
of Maricopa County

INTEROFFICE MEMORANDUM

Date: July 7, 2011

To: Timothy S. Phillips, P.E., Chief Engineer and General Manager

From: Kathryn Gross, CFM, Engineering Division

Subject: Guadalupe Floodplain Delineation Study (FCD2010C027 Assignment #1)

The Guadalupe Floodplain Delineation Study is ready for use as the best available technical information. The study will be sent to FEMA for review once the public meeting has been held and the necessary Overview and Concurrence forms are signed by the Town of Guadalupe, the City of Tempe, and the District.

The background on the study includes the following:

The Guadalupe FDS includes new hydrology and the re-delineation of 1.7 linear miles of approximate Zone A delineations with detailed AH floodplain delineations along the Highline Canal lateral between I-10 and Mineral Road. The topographic basis for the study is 2-foot contour interval mapping in NAVD88 vertical datum from contract FCD2008C020. The study-consultant is WEST Consultants, Inc. The District's project manager and study technical reviewer is Kathryn Gross. The floodplains are contained within the Town of Guadalupe, City of Tempe, and unincorporated Maricopa County. The District manages the floodplains within the Town and the City of Tempe does their own floodplain management.

Please concur and authorize below the use of this new study.

7/7/11 Project Manager/Technical Reviewer Date:	7/12/11 Timothy S. Phillips, P.E. Date: Chief Engineer and General Manager
7.7.11 Hydrology/Hydraulics Branch Manager Date:	7/7/2011 Engineering Division Manager Date:
7.11.11 PPM Division Manager Date:	7/12/2011 FMS Division Manager Date:

2801 West Durango Street Phoenix, Arizona 85009 Phone: 602-506-1501 Fax: 602-506-4601

Federal Emergency Management Agency

Washington, D.C. 20472

April 6, 2012

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable Max W. Wilson
Chairman, Maricopa County
Board of Supervisors
301 West Jefferson, 10th Floor
Phoenix, AZ 85003

IN REPLY REFER TO:

Case No.:	11-09-3942P
Community Name:	Maricopa County, AZ
Community No.:	040037
Effective Date of This Revision:	**August 10, 2012**

Dear Mr. Wilson:

You were sent a Letter of Map Revision (LOMR) dated March 29, 2012 for your community. Unfortunately, a mistake was discovered in the Summary of Elevations table after the mailing which resulted the corrections to the table and two of the Flood Insurance Rate Map (panels 04013C2165H and 04013C2630G). We have corrected all three documents and re-sending the LOMR with all the attachments for you to replace the LOMR you have received previously. We apologize any inconvenience this might have caused.

Sincerely,

Syed Qayum

Syed Qayum, CFM
National LOMR Technical Manager
Michael Baker Jr., Inc.

List of Enclosures:
- Letter of Map Revision Determination Document
- Annotated Flood Insurance Rate Map
- Annotated Flood Insurance Study Report

cc: (see attached list)

FLOOD CONTROL DISTRICT
RECEIVED
APR 10

	CH & GM		FINANCE
	PIO		R.E.D.
	ADMIN		O & M
	FMS		P & PM
	ENG		FILE
	CONTRACTS		
ROUTING	KAG		

Federal Emergency Management Agency

Washington, D.C. 20472

March 29, 2012

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable Max Wilson
Chairman, Maricopa County
Board of Supervisors
301 West Jefferson, 10th Floor
Phoenix, AZ 85003

IN REPLY REFER TO:

Case No.:	11-09-3942P
Community Name:	Maricopa County, AZ
Community No.:	040037
Effective Date of This Revision:	**August 10, 2012**

Dear Mr. Wilson:

The Flood Insurance Study report and Flood Insurance Rate Map for your community have been revised by this Letter of Map Revision (LOMR). Please use the enclosed annotated map panels revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals issued in your community.

Additional documents are enclosed which provide information regarding this LOMR. Please see the List of Enclosures below to determine which documents are included. Other attachments specific to this request may be included as referenced in the Determination Document. If you have any questions regarding floodplain management regulations for your community or the National Flood Insurance Program (NFIP) in general, please contact the Consultation Coordination Officer for your community. If you have any technical questions regarding this LOMR, please contact the Director, Mitigation Division of the Department of Homeland Security's Federal Emergency Management Agency (FEMA) in Oakland, California, at (510) 627-7175, or the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP). Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Sincerely,

Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

For: Luis Rodriguez, P.E., Chief
Engineering Management Branch
Federal Insurance and Mitigation Administration

List of Enclosures:
- Letter of Map Revision Determination Document
- Annotated Flood Insurance Rate Map
- Annotated Flood Insurance Study Report

cc: (see attached list)

FLIGHT DATE: 06/07/2010

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1" = 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS.

AERIAL MAPPING AND GROUND CONTROL SURVEY PERFORMED UNDER CONTRACT NO. 08-20

LEGEND

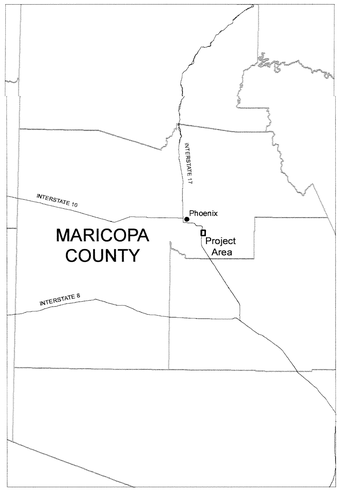
1% ANNUAL CHANCE FLOOD BOUNDARY

HYDRAULIC BASELINE

COUNTY/TOWN BOUNDARY

NOTES

ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1988. CONVERSION FACTOR TO 1929 NGVD VARIES BY SHEET, SEE SHEET OF INTEREST FOR CONVERSION FACTOR.



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GUADALUPE FLOODPLAIN DELINEATION STUDY

F.C.D. CONTRACT NUMBER 2010C027
ASSIGNMENT NUMBER 1

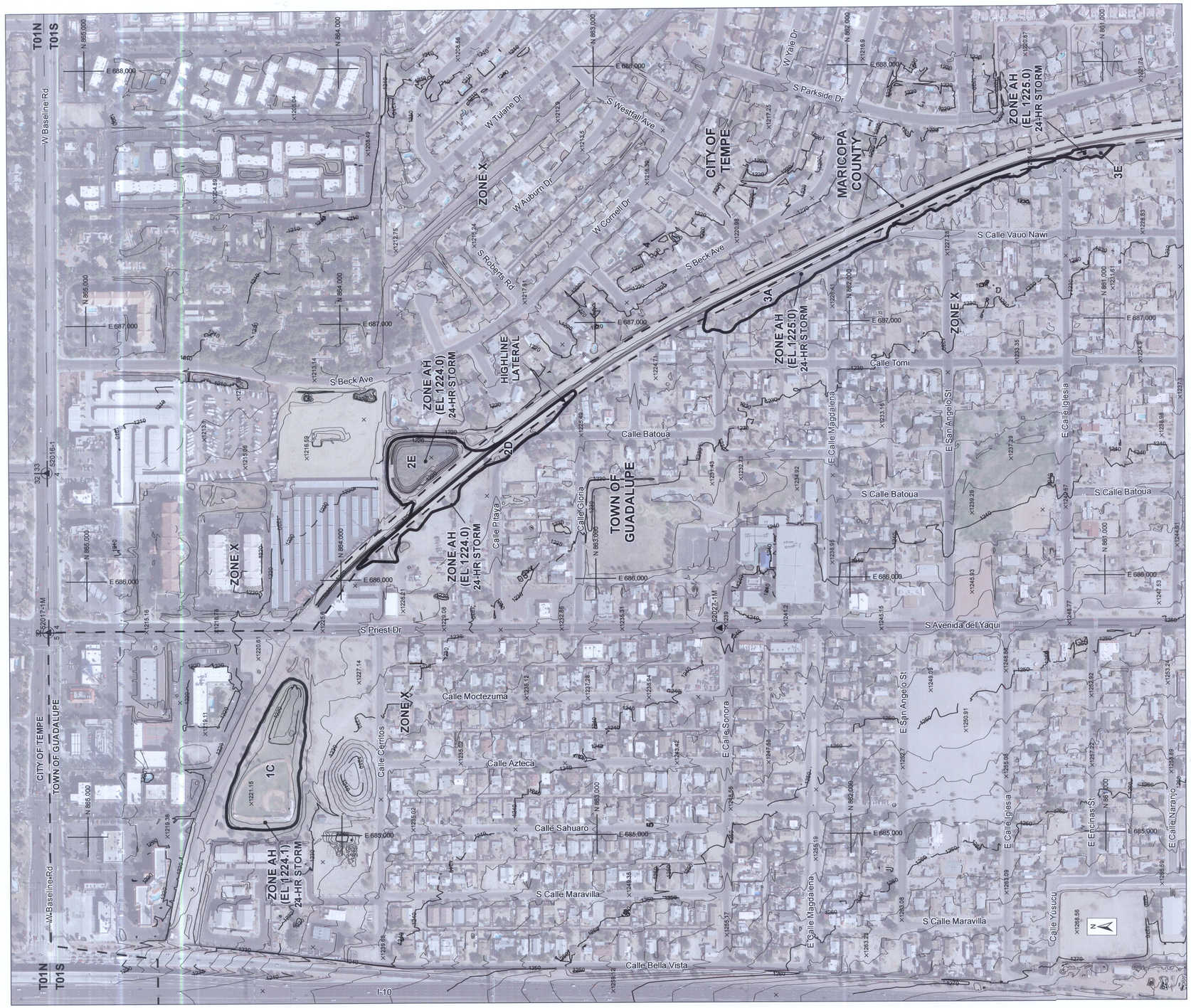
Registered Professional Engineer (Civil) CERTIFICATE NO. 41980 BRIAN THOMAS WAHLIN Date Signed 03-26-2012 ARIZONA, U.S.A.

Expires 3/31/2014

WEST Consultants, Inc.
8950 S. 52nd Street, Suite 210
Tempe, AZ 85284-1043, 480-345-2155

	BY	DATE
DESIGN	---	---
DESIGN CHECK	---	---
PLANS	SJV	2/12
PLANS CHECK	BTW	2/12

COVER SHEET



200 100 0 200 400

SCALE: 1" = 200 FEET
CONTOUR INTERVAL = 2 FEET

FLIGHT DATE: 06/07/2010

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1" = 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS.

AERIAL MAPPING AND GROUND CONTROL SURVEY PERFORMED UNDER CONTRACT NO. 08-20

LEGEND

1% ANNUAL CHANCE FLOOD BOUNDARY	
0.2% ANNUAL CHANCE FLOOD BOUNDARY	
CORPORATE LIMITS	TOWN OF GUADALUPE / CITY OF TEMPE
ELEV. REFERENCE MARK	▲
SECTION LINE AND ID	5

ELEVATION REFERENCE MARKS

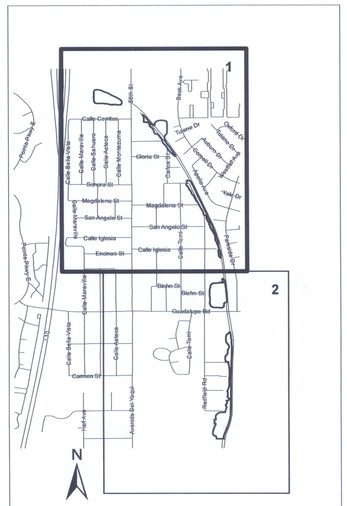
NOTE: ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988.
ELEVATION CONVERSION FACTOR:
NGVD29 ELEV. = NAVD88 ELEV. - 2.00 FT.

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
52016-1	1206.127	FD STN IN HH 1.75' DN. NOT MARKED
52017-1M	1209.856	FD 1 1/4" IP IN HH 1.1' DN. STAMPED "T1NR4E S32 T1SR43 S5 S4 29891 2003"
52027-1M	1237.782	FD 1" IP IN HH 0.50' DN. STAMPED "T1SR4E 1/4 S5 S4 2003 29891"

NOTES

1) ALL AREAS DESIGNATED ZONE X ARE UNSHADED ZONE X, EXCEPT WHERE NOTED.

2) AREA LOCATED IN TOWNSHIP 1N, RANGE 4E, SECTIONS 32-33; AND TOWNSHIP 1S, RANGE 4E, SECTIONS 4-5.



SHEET INDEX MAP

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

GUADALUPE
FLOODPLAIN DELINEATION STUDY

F.C.D. CONTRACT NUMBER 2010C027
ASSIGNMENT NUMBER 1

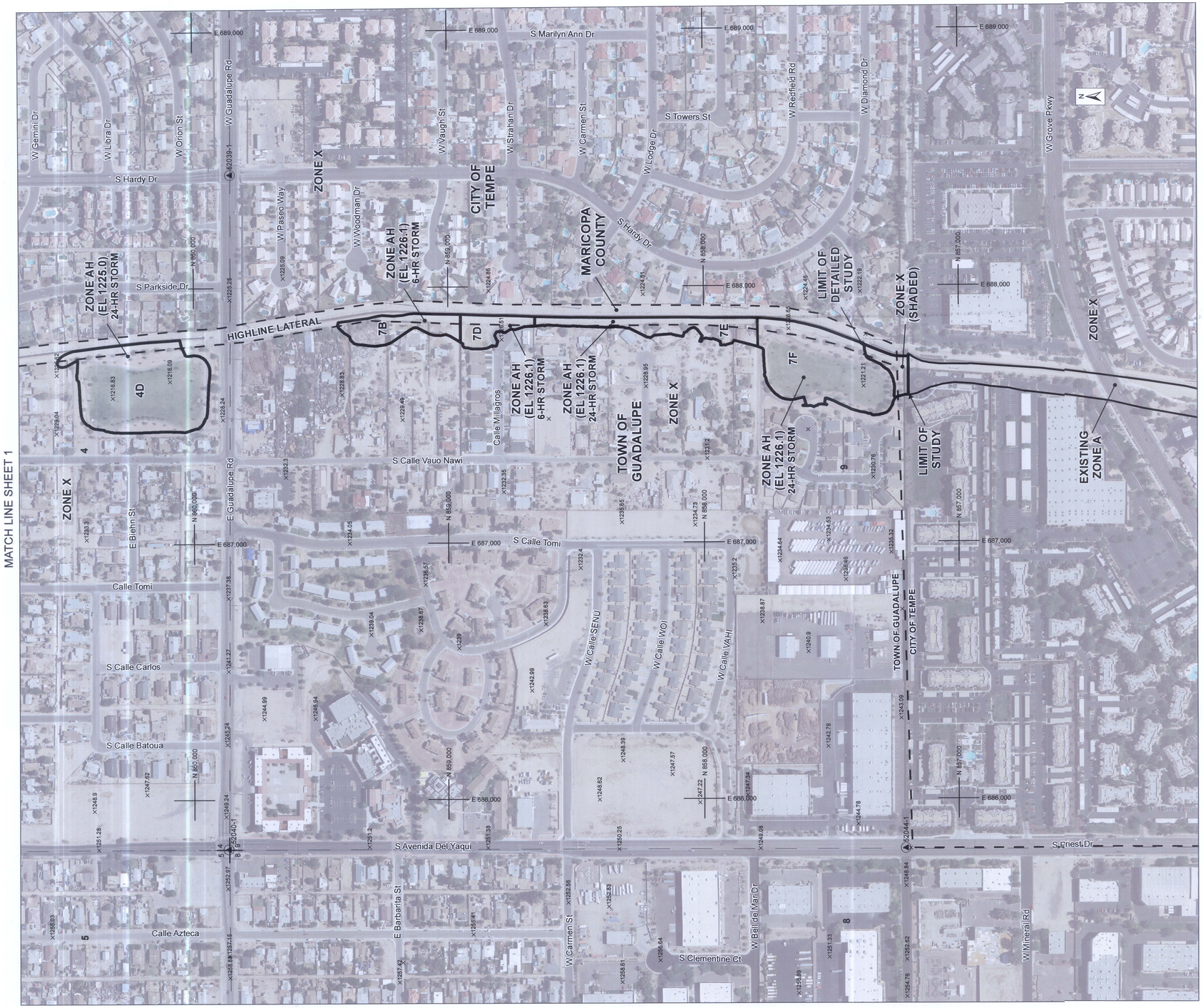
Registered Professional Engineer (Civil)
CERTIFICATE NO. 41980
BRIAN THOMAS WAHLIN
Date Signed 02-20-2012
ARIZONA, U.S.A.
Expires 3/31/2014

WEST Consultants, Inc.

	BY	DATE
DESIGN	—	—
DESIGN CHECK	—	—
PLANS	SJV	2/12
PLANS CHECK	BTW	2/12

SHEET 1 OF 2

MATCH LINE SHEET 1



200 100 0 200 400

SCALE: 1" = 200 FEET
CONTOUR INTERVAL = 2 FEET

FLIGHT DATE: 06/07/2010

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1" = 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS.

AERIAL MAPPING AND GROUND CONTROL SURVEY PERFORMED UNDER CONTRACT NO. 08-20

LEGEND

1% ANNUAL CHANCE FLOOD BOUNDARY	
0.2% ANNUAL CHANCE FLOOD BOUNDARY	
CORPORATE LIMITS	TOWN OF GUADALUPE / CITY OF TEMPE
ELEV. REFERENCE MARK	▲
SECTION LINE AND ID	5

ELEVATION REFERENCE MARKS

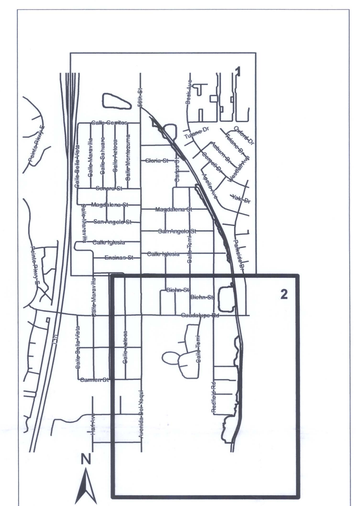
NOTE: ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988.
ELEVATION CONVERSION FACTOR:
NGVD29 ELEV. = NAVD88 ELEV. - 2.00 FT.

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
52039-1	1218.412	FD 3" C.O. TEMPE BC IN HH 0.7' DN. NOT MARKED
52040-1	1250.459	FD 3" C.O. TEMPE BC IN HH 0.45' DN. NOT MARKED
52044-1	1246.888	FD 3" C.O. TEMPE BC IN HH 0.45' DN. NOT MARKED

NOTES

1) ALL AREAS DESIGNATED ZONE X ARE UNSHADED ZONE X, EXCEPT WHERE NOTED.

2) AREA LOCATED IN TOWNSHIP 1N, RANGE 4E, SECTIONS 32-33; AND TOWNSHIP 1S, RANGE 4E, SECTIONS 4-5.



SHEET INDEX MAP

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

GUADALUPE
FLOODPLAIN DELINEATION STUDY

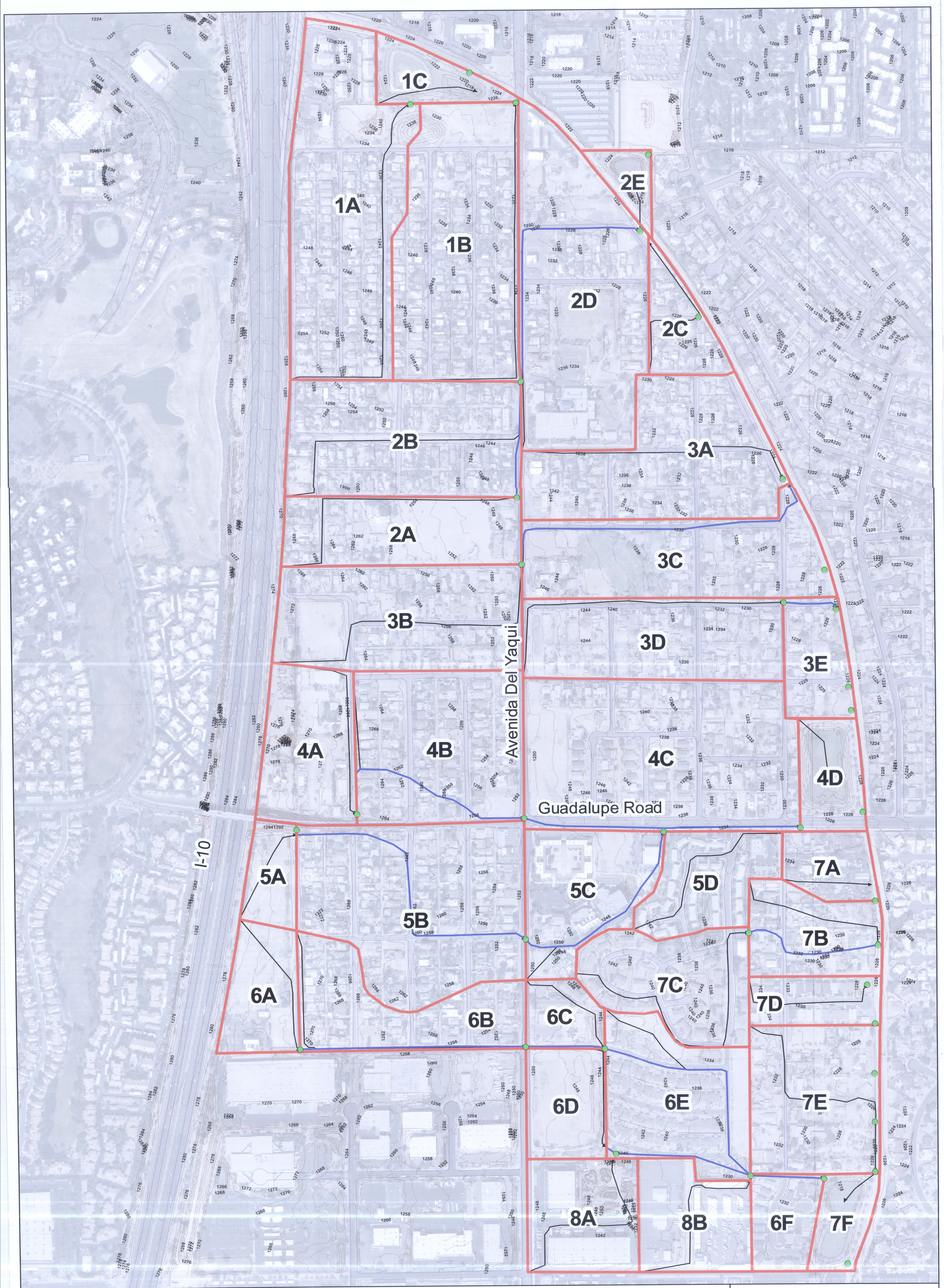
F.C.D. CONTRACT NUMBER 2010C027
ASSIGNMENT NUMBER 1

Registered Professional Engineer (Civil)
CERTIFICATE NO.
41980
BRIAN THOMAS WAHLIN
Date Signed 03-30-2012
ARIZONA, U.S.A.
Expires 3/31/2014

WEST Consultants, Inc.

	BY	DATE
DESIGN	—	—
DESIGN CHECK	—	—
PLANS	SJV	2/12
PLANS CHECK	BTW	2/12

SHEET 2 OF 2



Legend

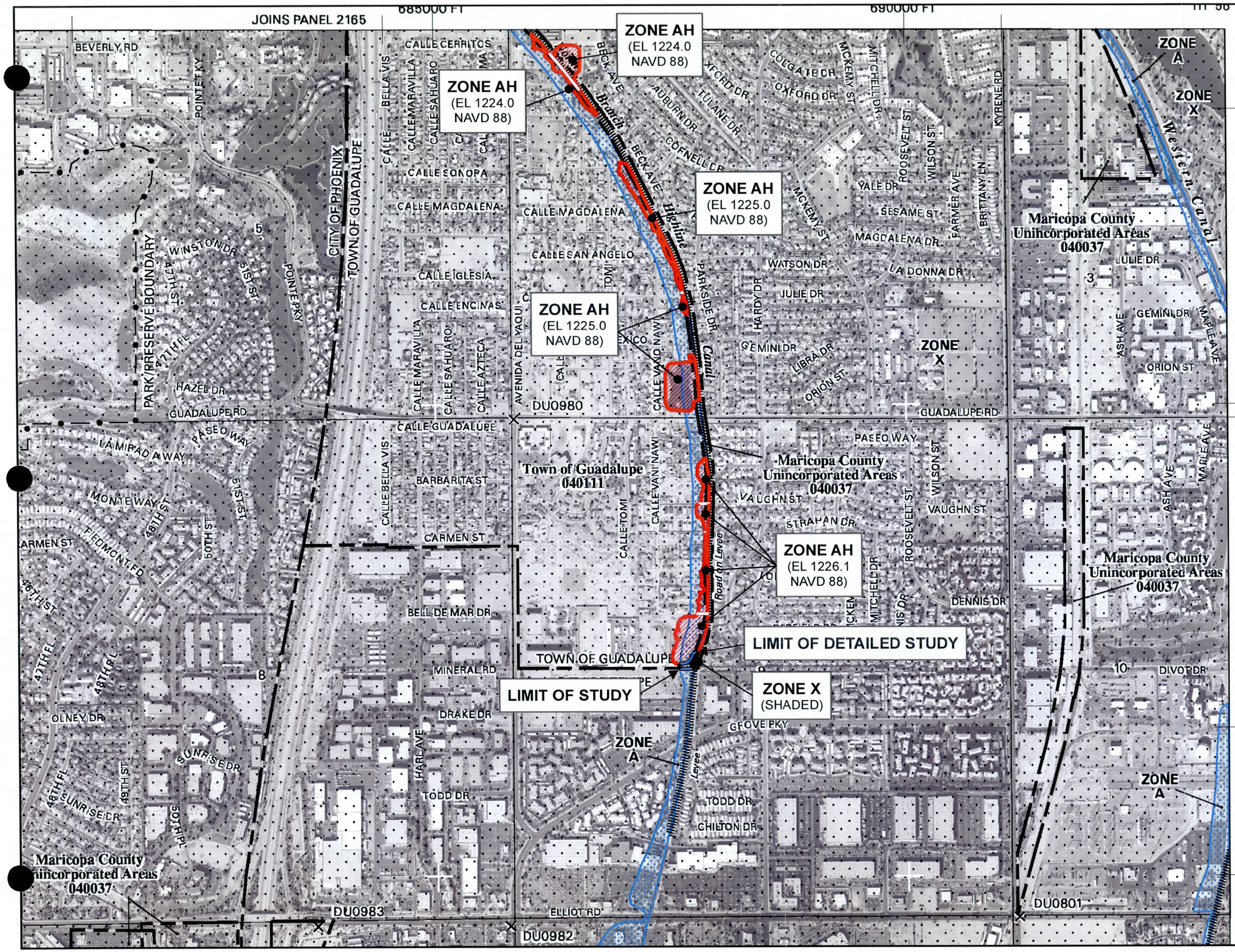
- Concentration Points
- Subbasin
- Elevation Contours
- Routing Path
- LONGEST FLOWPATH

Guadalupe Flood Delineation Study
Subbasin Map

N

0 245 490 980 Feet

WEST CONSULTANTS, INC.



LEGEND

- PROFILE BASELINE
- 1% ANNUAL CHANCE FLOOD
- REVISED ZONE AH
- REVISED ZONE X (SHADED)

N

APPROXIMATE SCALE

1,000 500 0 1,000 FEET

NFIP

PANEL 2630B

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

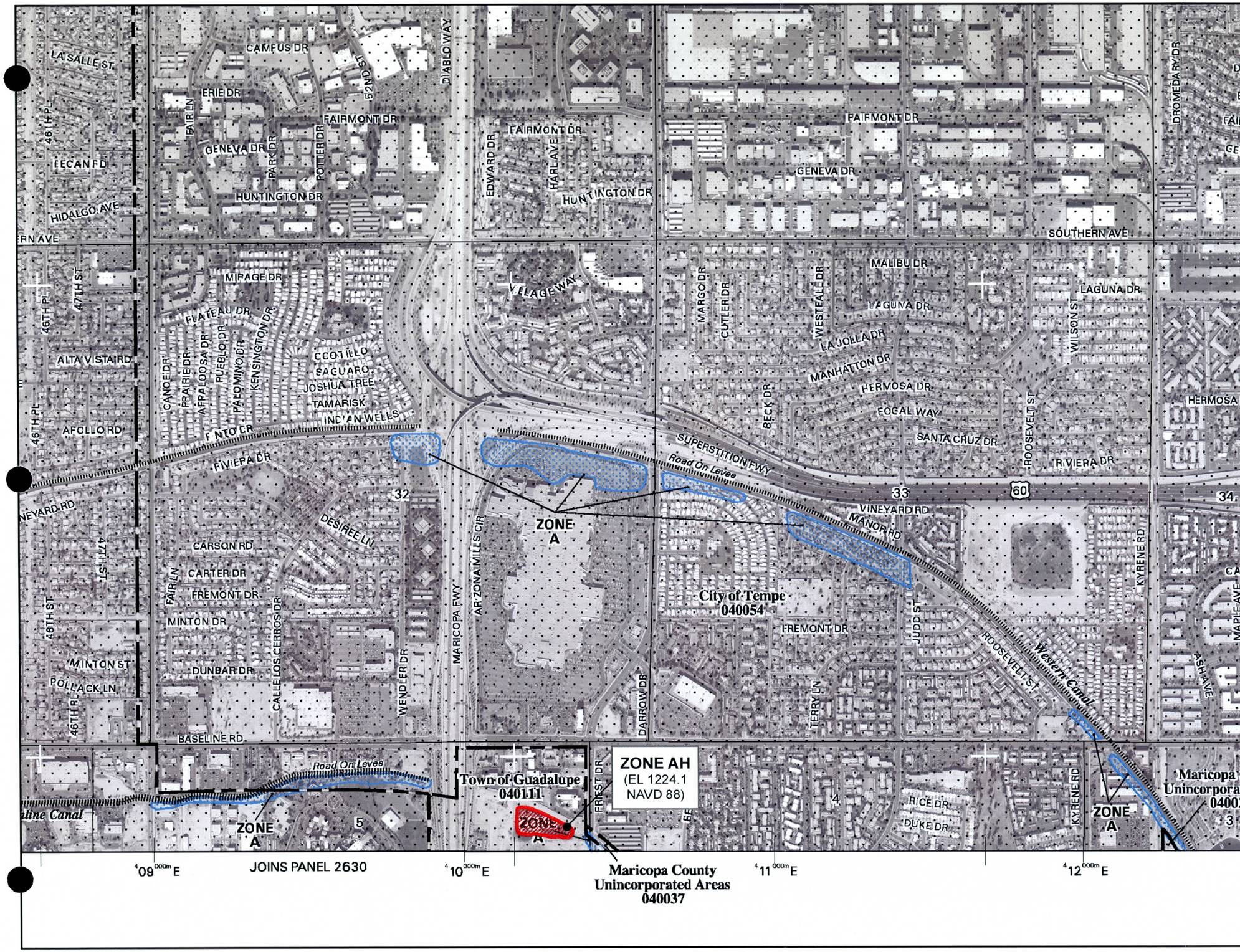
MARICOPA COUNTY, ARIZONA
(AND INCORPORATED AREAS)

ONLY PANEL PRINTED

COMMUNITY-PANEL NUMBER
04013C2630G

EFFECTIVE DATE
SEPTEMBER 30, 2005

Federal Emergency Management Agency



LEGEND

- PROFILE BASELINE
- 1% ANNUAL CHANCE FLOOD
- REVISED ZONE AH
- REVISED ZONE X (SHADED)

N

APPROXIMATE SCALE

1,000 500 0 1,000 FEET

NFIP

PANEL 2165H

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA
(AND INCORPORATED AREAS)

ONLY PANEL PRINTED

COMMUNITY-PANEL NUMBER
04013C2165H

EFFECTIVE DATE
SEPTEMBER 30, 2005

Federal Emergency Management Agency