

# Sycamore Creek Floodplain Delineation Study in the Sunflower Community of Maricopa County, Arizona

## Technical Support Data Notebook for Letter of Map Revision Application



July 2014

## Jeffery Shelton - FCDX

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**From:** Paul Anderson <PMAnderson@mbakercorp.com>  
**Sent:** Wednesday, February 05, 2014 9:46 AM  
**To:** Jeffery Shelton - FCDX  
**Cc:** Tim Phillips - FCDX; Joseph Kuechenmeister  
**Subject:** RE: REVISION Request Received – Maricopa County, Arizona (Case Number 14-09-1495P) – Response Required

Hello Jeff,

I have done the pre-review for this case also already today. It seems we didn't get some of the information; I am not sure if there was a cd or anything that went missing. So for this reason, instead of sending out an AD letter, I will just list the things that we usually get on a CD for a review below and you can submit them to our eftp site which I have listed below also.

- 1) The report said that the hydrology information was in Appendix D but I didn't see the appendix so what I would need is all the information used for the model such as the soils and land use maps, calculations and data used for any curve numbers or Times of Concentration, etc and the models themselves. If the hydrology study was used somewhere else in the County and approved by FEMA I can also use that as proof if that is available.
- 2) I didn't see the hydraulic models on our upload.
- 3) I did get the two maps, however the contour information is a bit hard to read. So if I could get that possibly in digital format, it would help a great deal. Also from what Sarah said we are just going to put this information in a PMR, so if you could submit the mapping information in ArcMap GIS format, spatially referenced, that would also help a lot.

Those were the only things I saw, so when I get those things I can start the detailed review here soon. Let me know if you have any questions.

Our eftp site is: <http://eftp.mbakercorp.com/eftadhoc/>

Thanks,

Paul Anderson, P.E., CFM  
165 South Union Boulevard, Suite 200  
Lakewood, CO 80228  
P: 720-514-1121

---

**From:** Paul Anderson  
**Sent:** Wednesday, February 05, 2014 9:01 AM  
**To:** 'JefferyShelton@mail.maricopa.gov'  
**Cc:** [tsp@mail.maricopa.gov](mailto:tsp@mail.maricopa.gov); Joseph Kuechenmeister  
**Subject:** REVISION Request Received – Maricopa County, Arizona (Case Number 14-09-1495P) – Response Required

Dear Mr. Shelton:

We have received your request that the Department of Homeland Security's Federal Emergency Management Agency (FEMA) issue a revision to the flood hazard information on the applicable National Flood Insurance Program (NFIP) map for Maricopa County,

Arizona. This e-mail is being sent to officially acknowledge the receipt of your request and replaces the paper copy acknowledgement letters previously issued by FEMA. We ask that you please respond directly to this e-mail to verify that it has been received.

The case number assigned to your request is 14-09-1495P, and the project identifier is Sycamore Creek in the Sunflower Community.

We are reviewing your submitted data and will contact you if additional information is required to process your request.

If additional information is not required, we will issue a final letter of determination within 90 days of receiving your request.

If you have general questions about your request, FEMA policy, or the NFIP, 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, the case reviewer's contact information is listed below, or please contact the Revisions Coordinator for your request, Mr. Joseph Kuechenmeister, P.E., CFM, at [jkuechenmeister@mbakercorp.com](mailto:jkuechenmeister@mbakercorp.com) or at (720) 479-3181.

Please be assured we will do our best to respond to all inquiries in a timely manner.

Thank you,

Paul Anderson, P.E., CFM  
FEMA Production and Technical Services Contractor  
165 South Union Boulevard, Suite 200  
Lakewood, CO 80228  
720-514-1121  
[PMAnderson@mbakercorp.com](mailto:PMAnderson@mbakercorp.com)

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## Jeffery Shelton - FCDX

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**From:** Paul Anderson <PMAAnderson@mbakercorp.com>  
**Sent:** Wednesday, February 05, 2014 4:28 PM  
**To:** Jeffery Shelton - FCDX  
**Subject:** RE: Appendix Data and Contours – Maricopa County, Arizona (Case Number 14-09-1495P)

Jeff,  
Thanks for sending it over, I received it and have downloaded everything. If you can send the GeoRas shapefiles over that would be fine. We will need those to do the final mapping. But if you want to wait just in case the mapping changes, we can do that too.

Thanks,  
Paul

**From:** [jefferyshelton@mail.maricopa.gov](mailto:jefferyshelton@mail.maricopa.gov) [<mailto:jefferyshelton@mail.maricopa.gov>]  
**Sent:** Wednesday, February 05, 2014 4:13 PM  
**To:** Paul Anderson  
**Cc:** [jefferyshelton@mail.maricopa.gov](mailto:jefferyshelton@mail.maricopa.gov)  
**Subject:** Appendix Data and Contours – Maricopa County, Arizona (Case Number 14-09-1495P)



[jefferyshelton@mail.maricopa.gov](mailto:jefferyshelton@mail.maricopa.gov) has sent you attachments using Baker eFTP

Hi Paul,  
Please find those items you requested in the email you sent me today attached to this eftp. The CD that came with the report must have been misplaced. I have GeoRAS files too if that's helpful. Let me know if you need anything else or have any questions.  
Thanks,  
Jeff

### Message

**Text:** Jeff Shelton, P.E., Senior Civil Engineer  
Flood Control District of Maricopa County  
2801 W. Durango Street  
Phoenix, Arizona 85009

Direct: (602) 506-4486  
Fax: (602) 506-4601  
FCDMC Main: (602) 506-1501  
[jefferyshelton@mail.maricopa.gov](mailto:jefferyshelton@mail.maricopa.gov)

File(s) Uploaded:

APPENDIX (CD).zip  
ARCINFO.zip  
Contours.zip

To retrieve these attachments, click on the secure link below.

<https://eftp.mbakercorp.com:443?wtcQID=REhBWUxPUURaSTpDRjFDUEdCZQ==/>

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## Jeffery Shelton - FCDX

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**From:** Jeffery Shelton - FCDX  
**Sent:** Wednesday, March 26, 2014 10:57 AM  
**To:** 'Paul Anderson'  
**Subject:** RE: Appendix Data and Contours - Maricopa County, Arizona (Case Number 14-09-1495P)  
**Attachments:** Expanded Sunflower Hydrology Discussion.docx

Paul,  
Please find an expanded discussion of the hydrology attached. Sorry I'm getting this to you later than I wanted to. I was not able to find ADOT's hydrology report. Let me know if you have any other questions.  
Thanks,  
Jeff

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**From:** Jeffery Shelton - FCDX  
**Sent:** Monday, March 17, 2014 12:32 PM  
**To:** 'Paul Anderson'  
**Subject:** RE: Appendix Data and Contours - Maricopa County, Arizona (Case Number 14-09-1495P)

Paul,  
I will work to get you an expanded comparison of the hydrology and RRE by this Friday. We had an "open house" public meeting with the residents to discuss the results of the study. I did not hear any complaints that would lead me to believe that there would be any appeals filed.

Thanks,  
Jeff

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**From:** Paul Anderson [<mailto:PMAnderson@mbakercorp.com>]  
**Sent:** Monday, March 17, 2014 12:02 PM  
**To:** Jeffery Shelton - FCDX  
**Subject:** RE: Appendix Data and Contours - Maricopa County, Arizona (Case Number 14-09-1495P)

Jeff,  
I just talked to Sarah and it needs pretty good back up for the hydrology since it is going to be in the base map and have an appeal period. Thanks,

Paul

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**From:** Paul Anderson  
**Sent:** Thursday, March 13, 2014 11:12 AM  
**To:** 'Jeffery Shelton - FCDX'  
**Subject:** RE: Appendix Data and Contours - Maricopa County, Arizona (Case Number 14-09-1495P)

Jeff,  
I was looking over the data that was sent below. I don't see the models, data, etc., that was used to calculate the 23,581 cfs. Not sure if maybe I missed or didn't download something. The Appendix D information only had bridge hydraulic information. Please let me know.

Paul

---

**From:** Jeffery Shelton - FCDX [<mailto:JefferyShelton@mail.maricopa.gov>]  
**Sent:** Wednesday, February 05, 2014 5:19 PM  
**To:** Paul Anderson  
**Subject:** RE: Appendix Data and Contours - Maricopa County, Arizona (Case Number 14-09-1495P)

Let's wait for now.

---

**From:** Paul Anderson [<mailto:PMAnderson@mbakercorp.com>]  
**Sent:** Wednesday, February 05, 2014 4:28 PM  
**To:** Jeffery Shelton - FCDX  
**Subject:** RE: Appendix Data and Contours – Maricopa County, Arizona (Case Number 14-09-1495P)

Jeff,  
Thanks for sending it over, I received it and have downloaded everything. If you can send the GeoRas shapefiles over that would be fine. We will need those to do the final mapping. But if you want to wait just in case the mapping changes, we can do that too.

Thanks,  
Paul

**From:** [jefferyshelton@mail.maricopa.gov](mailto:jefferyshelton@mail.maricopa.gov) [<mailto:jefferyshelton@mail.maricopa.gov>]  
**Sent:** Wednesday, February 05, 2014 4:13 PM  
**To:** Paul Anderson  
**Cc:** [jefferyshelton@mail.maricopa.gov](mailto:jefferyshelton@mail.maricopa.gov)  
**Subject:** Appendix Data and Contours – Maricopa County, Arizona (Case Number 14-09-1495P)



[jefferyshelton@mail.maricopa.gov](mailto:jefferyshelton@mail.maricopa.gov) has sent you attachments using Baker eFTP

Hi Paul,  
Please find those items you requested in the email you sent me today attached to this eftp. The CD that came with the report must have been misplaced. I have GeoRAS files too if that's helpful. Let me know if you need anything else or have any questions.  
Thanks,  
Jeff

**Message**  
**Text:**

Jeff Shelton, P.E., Senior Civil Engineer  
Flood Control District of Maricopa County  
2801 W. Durango Street  
Phoenix, Arizona 85009

Direct: (602) 506-4486  
Fax: (602) 506-4601  
FCDMC Main: (602) 506-1501

[jefferyshelton@mail.maricopa.gov](mailto:jefferyshelton@mail.maricopa.gov)

File(s) Uploaded:

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Contours.zip

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<https://eftp.mbakercorp.com:443?wtcQID=REhBWUxPUURaSTpDRjFDUEdCZQ==/>

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#### SECTION 4: Hydrology

The hydrology used in this study was produced by ADOT in 1993 during the design of the new State Route 87 and corresponding bridges for Sycamore Creek. It was developed in the Location Study Drainage Report dated 1989, Project No. F-053-1-313PE, by NBS/Lowery Consulting Engineers. This report has not been located. The Bridge Drainage Study which summarizes the hydrology and focuses on the hydraulics for the bridge is in Appendix D. In that report they state that the hydrology was performed prior to 1993, so the old ADOT SCS method was used to estimate the discharge. ADOT updated their Highway Drainage Design Manual in 1993. The old ADOT SCS method included the ADOT publication "Addendum to Hydrologic Design For Highway Drainage in Arizona", SCS Technical Release No. 55 "Urban Hydrology for Small Watersheds", and SCS Type II rainfall distribution included in the TR-20 computer program. TR-20 uses an input rainstorm to compute the time of concentration and surface water runoff and includes routing and combining hydrographs. Soil maps and SCS curve numbers are used to account for soil and watershed losses. The Bridge Drainage Study report states that the vegetative cover type is predominantly mountain brush with ten to thirty percent cover density. The soil within this area of the Tonto National Forest was determined to be type C.

Even though the ADOT hydrology is dated, we feel it is the most accurate hydrology available and preferable over using USGS Regional Regression Equations.

In Appendix D are two graphs showing the results of Region 12 USGS Regional Regression Equation (RRE). To compare, ADOT's estimated 100-year discharge is 23,581 cfs; the 100-year discharge from the Region 12 RRE is 14,151 cfs (see SunflowerRRE.pdf). In USGS Water-Supply Paper 2433, Method for Estimating Magnitude and Frequency of Floods in the Southwestern United States (Thomas, et al., 1997), the equations are most applicable to watershed less than 200 square miles. This watershed is 36.2 square miles which is well within the bounds of the equation. The graph in SunflowerRRE-Comparison.pdf found in Appendix D compares the ADOT 100-year discharge estimate with the RRE estimate. Even though a discharge of 23,581 cfs is 1.67 times the discharge calculated from the RRE it is still well below the RRE envelope curve for the study area also show on the graph.

On September 5, 1970 USGS gage 09510150 Sycamore Creek Near Sunflower, AZ reached 16,100 cfs. This gage is 1.2 miles downstream of Sunflower and the State Route 87 bridges. The watershed contributing to the gage is 52.3 square miles. The gage was in operation from 1962 to 1976. If you apply the RRE to the gage watershed the calculated 100-year discharge is 17,200 cfs. This combined with the ADOT hydrology indicated to us that the RRE might be underestimating the 100-year discharge for this watershed. We used the ADOT 100-year peak discharge estimate to delineate the floodplain for Sycamore Creek.



# NATIONAL FLOOD INSURANCE PROGRAM

FEMA PRODUCTION AND TECHNICAL SERVICES CONTRACTOR

April 8, 2014

Mr. Jeffery C. Shelton, P.E.  
Project Engineer  
Flood Control District of Maricopa County  
2801 West Durango Street  
Phoenix, AZ 85009

IN REPLY REFER TO:  
Case No.: 14-09-1495P  
Community: Maricopa County, AZ  
Community No.: 040037

316-AD

Dear Mr. Shelton:

This responds to your request dated January 24, 2012, 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:	Sycamore Creek in the Sunflower Community
Flooding Source:	Sycamore Creek
FIRM Panel(s) Affected:	Not Printed

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/firm\\_fees.shtm](http://www.fema.gov/plan/prevent/fhm/firm_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/fees 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.

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LOMC Clearinghouse, 847 South Pickett Street, Alexandria, VA 22304 PH: 1-877-FEMA MAP

BakerAECOM, under contract with the FEDERAL EMERGENCY MANAGEMENT AGENCY, is a  
Production and Technical Services Contractor for the National Flood Insurance Program

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, Mr. Paul Anderson, P.E., CFM, by e-mail at [PMAnderson@mbakerintl.com](mailto:PMAnderson@mbakerintl.com) or by telephone at 720-514-1121, or the Revisions Coordinator for your request, Mr. Joseph Kuechenmeister, P.E., CFM, at [jkuechenmeister@mbakercorp.com](mailto:jkuechenmeister@mbakercorp.com) or at (720) 479-3181.

Sincerely,



Syed Qayum, CFM  
LOMR Technical Manager  
BakerAECOM

Enclosure

cc: Mr. Timothy S. Phillips, P.E.  
Chief Engineer & General Manager  
Flood Control District of Maricopa County



# 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.: 14-09-1495P

Requester: Mr. Jeffery C. Shelton, P.E.

Community: Maricopa County, AZ

Community No.: 040037

The issues listed below must be addressed before we can continue the review of your request.

1. The submitted hydrology summary entitled, "Expanded Sunflower Hydrology Discussion," prepared by the Flood Control District states that a TR-20 model was created to analyze the base (1-percent-annual-chance) flood discharge along Sycamore Creek. Please submit the original TR-20 model or recreate this model in an updated hydrologic model format so that the resulting discharge can be accurately reviewed. In addition, TR-20 is generally only used for smaller watersheds or those under 25 square miles. In the above-referenced summary it states that the watershed for Sycamore Creek is approximately 32 square miles. Please submit the hydrologic model in a format that can model watersheds greater than 25 square miles.
2. Please submit or recreate the drainage basin maps, rainfall depth, soils, time of concentration, and curve number data discussed in the above-mentioned summary.
3. The above-mentioned summary mentions that the resulting discharges are within the RRE (Regional Regression Equation) curves. Our review reveals that the discharge of 23,581 cfs (cubic feet per second) is outside of the Average Standard Error of Prediction for Region 12 as noted in the report entitled, "The National Flood-Frequency Program – Methods for Estimating Flood Magnitude and Frequency in rural Areas in Arizona." Please revise the discharge to be within this Standard Error or explain why this is not necessary.
4. The base floodplain topwidth shown in the existing conditions HEC-RAS hydraulic analysis at cross section 0.45 does not match the approximate base floodplain topwidth shown on the topographic work map entitled, "Sycamore Creek Floodplain Delineation Study in the Sunflower Community of Maricopa County, Arizona," prepared by the Flood Control District of Maricopa County, Arizona, dated August 23, 2013. Please provide an explanation for these discrepancies, or make the appropriate changes.
5. Our review reveals that Cross Section 0.00 was not on the above-referenced topographic workmap. Please include this cross section or explain why this is not necessary.
6. Our review revealed that the model parameters for the bridge decks at Highway 87 differ from the as-built plans entitled "Sta. 2499+ Sycamore Creek Bridges NB & SB SB Bridge Elevation," and "Sta. 2499+ Sycamore Creek Bridges NB & SB NB Bridge Elevation," prepared by the Arizona Department of Transportation Intermodal Transportation Division – Bridge Group, dated January 1997. Please revise the submitted HEC-RAS models to reflect the correct as built parameters shown on the above-mentioned plans.

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LOMC Clearinghouse, 847 South Pickett Street, Alexandria, VA 22304 PH: 1-877-FEMA MAP

BakerAECOM, under contract with the FEDERAL EMERGENCY MANAGEMENT AGENCY, is a  
Production and Technical Services Contractor for the National Flood Insurance Program

2

7. Please provide GIS data for the above-referenced topographic work map that includes a cross section file so that we can accurately review the modeled cross section data compared to the topography.

Please send the required data and/or fee directly to us at the address shown at the bottom of the first page. For identification purposes, please include the case number referenced above on all correspondence.



# Flood Control District of Maricopa County

## Board of Directors

Denny Barney, District 1  
Steve Chucri, District 2  
Andrew Kunasek, District 3  
Clint L. Hickman, District 4  
Mary Rose Wilcox, District 5

[www.fcd.maricopa.gov](http://www.fcd.maricopa.gov)

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

April 18, 2014

Paul Anderson, P.E., CFM  
FEMA Production and Technical Services Contractor  
165 South Union Boulevard, Suite 200  
Lakewood, CO 80228

Mr. Anderson,

This letter addresses the engineering review issues you provided on April 8, 2014 with respect to the Letter of Map Revision Request sent to the LOMC Clearinghouse dated January 24, 2012. Incidentally, the date on the LOMR Request is incorrect. It should have been January 24, 2014. The following list contains information identifying the request.

Case No.: 14-09-1495P  
Community: Maricopa County, AZ  
Community No.: 040037  
Identifier: Sycamore Creek in the Sunflower Community  
Flooding Source: Sycamore Creek  
FIRM Panel(s) Affected: Not Printed

The review issues have been restated in italics below. A response to the issue is offered immediately after.

- 1. The submitted hydrology summary entitled, "Expanded Sunflower Hydrology Discussion," prepared by the Flood Control District states that a TR-20 model was created to analyze the base (1-percentannual-chance) flood discharge along Sycamore Creek. Please submit the original TR-20 model or recreate this model in an updated hydrologic model format so that the resulting discharge can be accurately reviewed. In addition, TR-20 is generally only used for smaller watersheds or those under 25 square miles. In the above-referenced summary it states that the watershed for Sycamore Creek is approximately 32 square miles. Please submit the hydrologic model in a format that can model watersheds greater than 25 square miles.*

Requester Response: We have decided to use the USGS Regional Regression Equation to calculate the hydrology to identify the approximate flood hazard Zone A for Sycamore Creek. See Appendix D attached for hydrology calculations.

April 18, 2014

2. *Please submit or recreate the drainage basin maps, rainfall depth, soils, time of concentration, and curve number data discussed in the above-mentioned summary.*

Requester Response: The USGS Regional Regression Equation was used instead of NRCS (formally SCS) methods to calculate the hydrology. A watershed map is included as Exhibit A in Appendix D. The area calculated is a little different from what ADOT reported. The ADOT report has the watershed area at 36.2 square miles. The area shown in Exhibit A is 33.3 square miles.

3. *The above-mentioned summary mentions that the resulting discharges are within the RRE (Regional Regression Equation) curves. Our review reveals that the discharge of 23,581 cfs (cubic feet per second) is outside of the Average Standard Error of Prediction for Region 12 as noted in the report entitled, "The National Flood-Frequency Program – Methods for Estimating Flood Magnitude and Frequency in rural Areas in Arizona." Please revise the discharge to be within this Standard Error or explain why this is not necessary.*

Requester Response: The updated discharge calculated by RRE is 13,523 cfs. This is within the Standard Error.

4. *The base floodplain topwidth shown in the existing conditions HEC-RAS hydraulic analysis at cross section 0.45 does not match the approximate base floodplain topwidth shown on the topographic work map entitled, "Sycamore Creek Floodplain Delineation Study in the Sunflower Community of Maricopa County, Arizona," prepared by the Flood Control District of Maricopa County, Arizona, dated August 23, 2013. Please provide an explanation for these discrepancies, or make the appropriate changes.*

Requester Response: The base floodplain topwidth has been updated in HEC-RAS and GIS shapefile due to new hydrology. Cross section 0.45 has also been modified to include the effect of the grading and drainage plan as shown on Haught Grading and Drainage Plans.pdf in Appendix C.5 in your case file.

5. *Our review reveals that Cross Section 0.00 was not on the above-referenced topographic workmap. Please include this cross section or explain why this is not necessary.*

Requester Response: Cross section 0.00 is included on the topographic workmap in the report submitted. There is no floodplain mapping on the workmap between cross section 0.08 and 0.00. This was done to give HEC-RAS some space to converge on a more accurate backwater depth due to the use of a normal depth slope for the downstream reach boundary condition. This is a standard practice for detailed floodplain modeling. Since the product of the analysis is approximate, Zone A, we could map all the way to the first cross section. Our preference is to allow the model a cross section to converge and to use the highway bridges as an identifying limit of the floodplain.

6. *Our review revealed that the model parameters for the bridge decks at Highway 87 differ from the as-built plans entitled "Sta. 2499+ Sycamore Creek Bridges NB & SB SB Bridge Elevation," and "Sta. 2499+ Sycamore Creek Bridges NB & SB NB Bridge Elevation," prepared by the Arizona Department of Transportation Intermodal Transportation Division – Bridge Group, dated January 1997. Please revise the submitted HEC-RAS models to reflect the correct as built parameters shown on the above-mentioned plans.*

Sycamore Creek in the Sunflower Community, Case No.: 14-09-1495P

Page 3 of 3

April 18, 2014

Requester Response: The elevations along the bridge center line on pages 248 and 249 are at the roadway deck. On page 247 the typical cross section detail calls out the girder height as 6'-10 Typ. The Type 'A' Barrier height is not called out on that page. The detail for that barrier is in Appendix E.5 attached. The Type "A" height is 2'-8. The heights were rounded to 6' for the girder and 3' for the barrier. Those heights were then applied the elevations on pages 248 and 249. That makes the deck height 9'. After running the model and seeing that the water surface elevation doesn't get near the deck, we left the rounded heights in the model.

7. *Please provide GIS data for the above-referenced topographic work map that includes a cross section file so that we can accurately review the modeled cross section data compared to the topography.*

Requester Response: The floodplain, baseline, and cross sections are provided in the FloodplainShapefile folder under Appendix E.5 attached.

If you have any questions, please call me at (602) 506-4486 or email [JefferyShelton@mail.maricopa.gov](mailto:JefferyShelton@mail.maricopa.gov).

Sincerely,



Jeff Shelton, P.E., Senior Civil Engineer

Enclosure: Digital Files



# NATIONAL FLOOD INSURANCE PROGRAM

FEMA PRODUCTION AND TECHNICAL SERVICES CONTRACTOR

May 9, 2014

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

IN REPLY REFER TO:  
Case No.: 14-09-1495P  
Community: Maricopa County, AZ  
Community No.: 040034

316-PMR

Dear Mr. Barney:

This is in reference to a request for a revision to the effective Flood Insurance Rate Map (FIRM) and Flood Insurance Study (FIS) report for your community. Information pertinent to this revision request is listed below.

Requester:	Mr. Jeffrey Shelton, P.E.
Flooding Source:	Sycamore Creek
FIRM Panel Affected:	*04013C0600L and *04013C1000L (Panels Not Printed)

We have completed our review of the submitted data and determined that the FIRM and FIS report should be revised as Physical Map Revision (PMR). As a result of this PMR, the flood hazard information along Sycamore Creek will be revised from just downstream to approximately 7,000 feet upstream of State Highway 87.

We are currently preparing a revised FIRM and FIS report for the Maricopa County, and Incorporated Areas. FEMA Region IX has programmed funds to process the PMR as part of the revised FIRM and Flood Insurance Study (FIS) report for Maricopa County, Arizona and Incorporated Areas (effective map for your community). Preliminary copies of the FIRM and FIS report will be distributed for review in approximately 5 months. We will incorporate the modifications required by this PMR into the preliminary FIRM before it is distributed, and the modifications will be also included when the FIRM becomes effective.

In order to provide your community with the most up-to-date information possible, we request that your community review the affected FIRM panels and revised FIS report to determine if any additional changes are warranted. Examples of possible changes include updates to corporate limits and new streets. To assist us in processing the revised FIRM and FIS report in a timely manner, we request that your community submit the changes within 30 days of the date of this letter. Please submit any requested changes, along with supporting documentation (e.g. annotated copies of FIRM panels, corporate limits map, topographic mapping), to us at the address shown at the bottom of the first page.

Any changes to the affected FIRM panel or FIS report for your community that are received during this 30-day period will be reviewed and incorporated, as appropriate, before we initiate the revision and republication process. We will send preliminary copies of the revised FIRM and FIS report to your community for review. At that time, your community will have an additional 30 days to provide information to support other changes to the affected portions of the FIS report and map. We will review all information submitted during that 30-day period and incorporate it, as appropriate, before the FIS report and map are republished and distributed.

LOMC Clearinghouse, 847 South Pickett Street, Alexandria, VA 22304 PH: 1-877-FEMA MAP

BakerAECOM, under contract with the FEDERAL EMERGENCY MANAGEMENT AGENCY, is a  
Production and Technical Services Contractor for the National Flood Insurance Program

Your submittal of requested changes during the initial 30-day period will facilitate the revision and republication process. While it may be possible to incorporate requested changes later, it will probably cause significant delays in the revision and republication process. Therefore, if the data to support additional changes are not immediately available, or if additional time is needed, please inform us immediately.

If you have general questions about this case, the review and revision process, 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 this case, please call the Revisions Coordinator for this request, Mr. Joseph Kuechenmeister, P.E., CFM, at [jkuechenmeister@mbakerintl.com](mailto:jkuechenmeister@mbakerintl.com) or at (720) 479-3181.

Sincerely,



Syed Qayum, CFM  
LOMR Technical Manager  
BakerAECOM

cc: Mr. Tim Murphy, P.E.  
Mitigation Planning & Technical Programs Manager  
Floodplain Management and Services Division  
Flood Control District of Maricopa County

Ms. Kelli Sertich, AICP, CFM  
FMS Division Manger  
Flood Control District of Maricopa County

Mr. Brian Cosson, CFM  
NFIP State Manager  
Arizona Department of Water Resources

Mr. Kevin Lavalley  
GIS Analyst  
Flood Control District of Maricopa County

Mr. Jeffery C. Shelton, P.E.  
Project Engineer  
Flood Control District of Maricopa County

# Sycamore Creek Floodplain Delineation Study in the Sunflower Community of Maricopa County, Arizona

Technical Support Data Notebook  
for Letter of Map Revision Application



July 2014



Sycamore Creek Floodplain Delineation Study in the  
Sunflower Community of Maricopa County, Arizona

Technical Support Data Notebook  
for Letter of Map Revision Application

Prepared by:

Flood Control District of Maricopa County  
2801 W. Durango Street  
Phoenix, Arizona 85009  
FCDMC Main: (602) 506-1501



EXPIRES 3-31-15

January 2014 - Updated July 2014

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**EXHIBITS**

- Exhibit 1 Work Study Map Sheet 1 of 2
- Exhibit 2 Work Study Map Sheet 2 of 2

## **SECTION 1: Introduction**

This Technical Support Data Notebook supports the results of the flood engineering analysis produced by the Flood Control District of Maricopa County (FCDMC) so that FEMA can develop the DFIRM database and FIRM for the Sunflower community. Following that process, the goal of this submittal is to have the MT2 group review the engineering and floodplain mapping contained herein and coordinate the remaining DFIRM production with Michael Baker Corporation (FEMA Region IX PTS) in Lakewood, Colorado and the submitter. This report is formatted to meet Arizona Department of Water Resources State Standard 1, Dated August 2012 (Arizona Department of Water Resources, 2012).

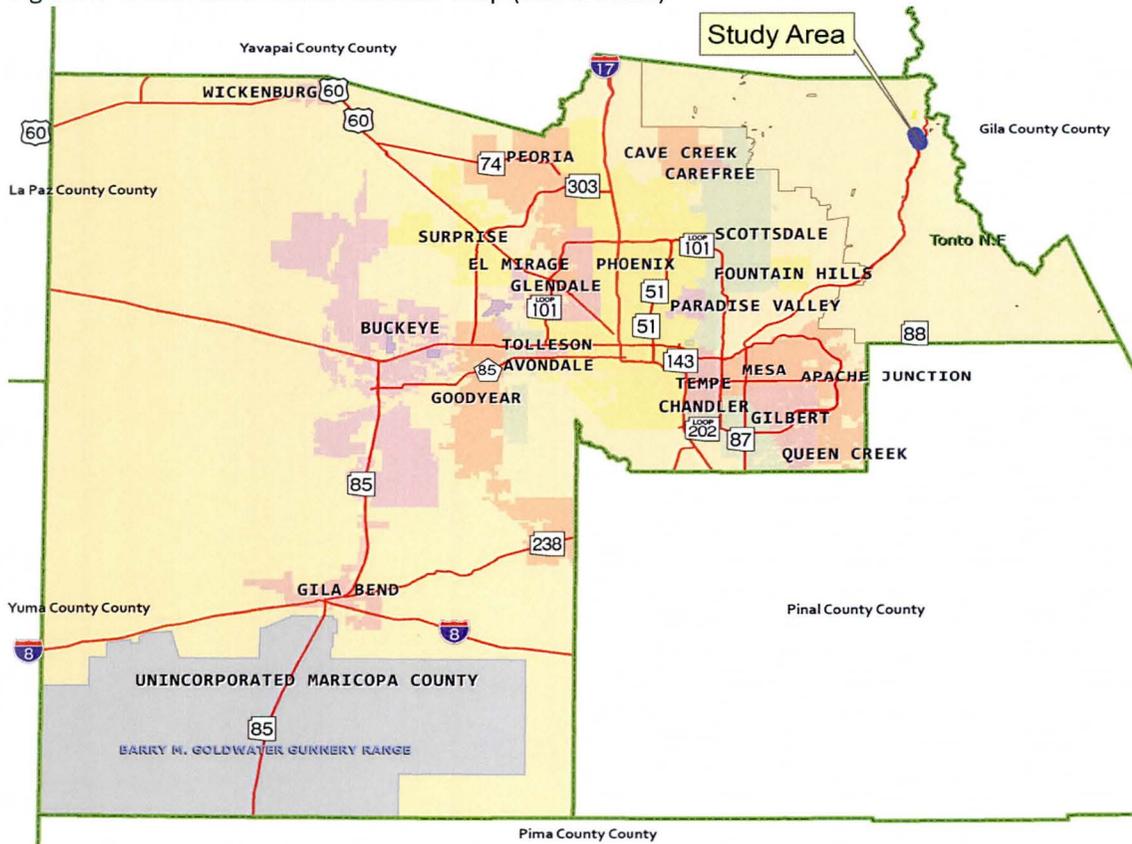
### 1.1 Purpose and Authority

The purpose of this study and application is to delineate a floodplain for the community of Sunflower in unincorporated Maricopa County so that they may have an estimate of the flood hazard from Sycamore Creek. The watershed for Sycamore Creek was burned in the Sunflower Fire that started May 12, 2012. Shortly after the fire ended the community was made aware of the increased flood hazard by the U.S. Forest Service and the Flood Control District of Maricopa County. This study assesses the flood hazard from Sycamore Creek with the watershed fully recovered from the fire.

### 1.2 Location of Study

The area under study is about 59 miles from downtown Phoenix on the State Route 87 also known as the Beeline Highway. The latitude and longitude are 33.868342 and -111.466808 respectively. The Sunflower community consists of approximately 60 private properties within the Tonto National Forest. The figure below shows the location graphically.

Figure 1: Sunflower Arizona Location Map (not to scale)



### 1.3 Hydrologic and Hydraulic Overview

The hydrology used in this study was derived from USGS Regional Regression Equations (RRE) (Thomas, et al., 1997). The watershed area and average elevation were input into the equation to calculate the 100-year return interval peak discharge.

The hydraulic model is the US Army Corps of Engineers program HEC-RAS 4.1.0 (U.S. Army Corps of Engineers, 2010). The model geometry was extracted with the aid of HEC-GeoRAS 10.0 (U.S. Army Corps of Engineers, 2012) and Esri ArcMap 10.0 (Environmental Systems Research Institute, 2011). The topography used is ten foot contour interval FCDMC developed from countywide aerial photography. The model is 1.44 linear miles and the proposed Special Flood Hazard Area is Zone A.

### SECTION 2: FEMA forms

The next 17 pages are the FEMA's MT-2 forms required for a LOMR application.

U.S. 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
Example: 480301 480287	City of Katy Harris County	TX TX	48473C 48201C	0005D 0220G	02/08/83 09/28/90
040037	Maricopa County, Unincorporated Areas of	AZ	04013C	1000L	Not Prin
040037	Maricopa County, Unincorporated Areas of	AZ	04013C	0600L	Not Prin

2. a. Flooding Source: Sycamore Creek

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

3. Project Name/Identifier: Sycamore Creek in the Sunflower Community

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: \$5,300  
 No, Attach Explanation

Please see the DHS-FEMA Web site at [http://www.fema.gov/plan/prevent/fhm/fhm\\_fees.shtm](http://www.fema.gov/plan/prevent/fhm/fhm_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: Jeffery C. Shelton, P.E.	Company: Flood Control District of Maricopa Co.	
Mailing Address: Flood Control District of Maricopa Co. 2801 W. Durango Street Phoenix, AZ 85009	Daytime Telephone No.: 602-506-4486	Fax No.:
	E-Mail Address: JefferyShelton@mail.maricopa.gov	
Signature of Requester (required): 	Date: 1-15-14	

As the community official responsible for floodplain management, I hereby acknowledge that we have received and reviewed this Letter 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 requirements 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 requests, the applicant has documented Endangered Species Act (ESA) compliance to FEMA prior to FEMA's review of the Conditional LOMR application. For LOMR requests, I acknowledge that compliance with Sections 9 and 10 of the ESA has been achieved independently of 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 44CFR 65.2(c), and that we have available upon request by FEMA, all analyses and documentation used to make this determination.

Community Official's Name and Title: Timothy S. Phillips, P.E., Chief Engineer and General Manager	Community Name: Maricopa County	
Mailing Address: Flood Control District of Maricopa County 2801 W. Durango Street Phoenix, AZ 85009	Daytime Telephone No.: 602-506-1501	Fax No.:
	E-Mail Address: tsp@mail.maricopa.gov	
Community Official's Signature (required): 	Date: 1/22/14	

### CERTIFICATION BY REGISTERED 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 Instructions. 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.

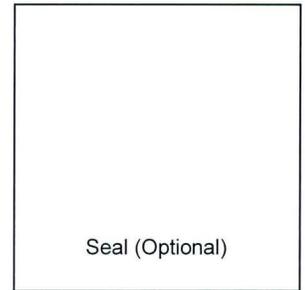
Certifier's Name: Jeffery C. Shelton	License No.: 43846	Expiration Date: 03/31/15
Company Name: Flood Control District of Maricopa Co.	Telephone No.: 602-506-4486	Fax No.:
Signature: 	Date: 1-15-14	E-Mail Address: jefferyshelton@mail.maricopa.gov

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

**Form Name and (Number)**

**Required if ...**

- |   |   |
|---|---|
| <input checked="" type="checkbox"/> Riverine Hydrology and Hydraulics Form (Form 2) | New or revised discharges or water-surface elevations   |
| <input checked="" type="checkbox"/> Riverine Structures Form (Form 3)               | Channel is modified, addition/revision of bridge/culverts, addition/revision of levee/floodwall, addition/revision of dam |
| <input type="checkbox"/> Coastal Analysis Form (Form 4)                             | New or revised coastal elevations   |
| <input type="checkbox"/> Coastal Structures Form (Form 5)                           | Addition/revision of coastal structure  |
| <input type="checkbox"/> Alluvial Fan Flooding Form (Form 6)                        | Flood control measures on alluvial fans   |



U.S. 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: Sycamore Creek

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

**A. HYDROLOGY**

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

- |  |  |  |
|--|--|--|
| <input type="checkbox"/> Not revised (skip to section B) | <input checked="" type="checkbox"/> No existing analysis | <input type="checkbox"/> Improved data                           |
| <input type="checkbox"/> Alternative methodology         | <input type="checkbox"/> Proposed Conditions (CLOMR)     | <input type="checkbox"/> Changed physical condition of watershed |

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

Location	Drainage Area (Sq. Mi.)	Effective/FIS (cfs)	Revised (cfs)
Sunflower Bridge SR 87	33.3	N/A	13,523

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

- |   |  |
|---|--|
| <input type="checkbox"/> Statistical Analysis of Gage Records     | <input type="checkbox"/> Precipitation/Runoff Model → Specify Model: _____ |
| <input checked="" type="checkbox"/> Regional Regression Equations | <input type="checkbox"/> 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..

## B. HYDRAULICS

1. Reach to be Revised

	Description	Cross Section	Water-Surface Elevations (ft.)	
			Effective	Proposed/Revised
Downstream Limit*	<u>State Route 87</u>	<u>0.08</u>	<u>N/A</u>	<u>Zone A</u>
Upstream Limit*	<u>Private Property Parcel Limit</u>	<u>1.44</u>	<u>N/A</u>	<u>Zone A</u>

\*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 4.0.0, GeoRAS 10.0, ArcGIS 10.0

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.

<u>Models Submitted</u>	<u>Natural Run</u>		<u>Floodway Run</u>		<u>Datum</u>
	File Name:	Plan Name:	File Name:	Plan Name:	
Duplicate Effective Model*	_____	_____	_____	_____	_____
Corrected Effective Model*	_____	_____	_____	_____	_____
Existing or Pre-Project Conditions Model	File Name: <u>Sunflower.prj</u>	Plan Name: <u>Sunflower-ZoneA</u>	_____	_____	NAVD88
Revised or Post-Project Conditions Model	_____	_____	_____	_____	_____
Other - (attach description)	_____	_____	_____	_____	_____

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

Digital Models Submitted? (Required)

## C. MAPPING REQUIREMENTS

A **certified topographic work 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 (preferred)

Topographic Information: Maricopa County Countywide 10-Foot Contours

Source: Maricopa County Date: March 14, 2001

Accuracy: +/- Half the Countour Interval (Five Feet)

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-project conditions.
- b. Does this LOMR request 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 2 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 flood 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 revision 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 the MT-2 instructions for more detail.

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

**RIVERINE STRUCTURES FORM**

**PAPERWORK BURDEN DISCLOSURE NOTICE**

Public reporting burden for this form is estimated to average 7 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 20598-3005, 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.**

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**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; 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: Sycamore Creek

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

**A. GENERAL**

Complete the appropriate section(s) for each Structure listed below:

- Channelization.....complete Section B
- Bridge/Culvert.....complete Section C
- Dam.....complete Section D
- Levee/Floodwall.....complete Section E
- Sediment Transport.....complete Section F (if required)

Description Of Modeled Structure

1. Name of Structure: Sycamore Creek Bridges NB & SB  
Type (check one):     Channelization                     Bridge/Culvert                     Levee/Floodwall                     Dam  
Location of Structure: State Route 87 Mile Post 218.29, Latitude 33.868342 Longitude -111.466808  
Downstream Limit/Cross Section: 0.08  
Upstream Limit/Cross Section: 0.13
2. Name of Structure: \_\_\_\_\_  
Type (check one):     Channelization                     Bridge/Culvert                     Levee/Floodwall                     Dam  
Location of Structure: \_\_\_\_\_  
Downstream Limit/Cross Section: \_\_\_\_\_  
Upstream Limit/Cross Section: \_\_\_\_\_
3. Name of Structure: \_\_\_\_\_  
Type (check one)     Channelization                     Bridge/Culvert                     Levee/Floodwall                     Dam  
Location of Structure: \_\_\_\_\_  
Downstream Limit/Cross Section: \_\_\_\_\_  
Upstream Limit/Cross Section: \_\_\_\_\_

**NOTE: FOR MORE STRUCTURES, ATTACH ADDITIONAL PAGES AS NEEDED.**

B. CHANNELIZATION

Flooding Source: \_\_\_\_\_

Name of Structure: \_\_\_\_\_

1. Hydraulic Considerations

The channel was designed to carry \_\_\_\_\_ (cfs) and/or the \_\_\_\_\_-year flood.

The design elevation in the channel is based on (check one):

- Subcritical flow
- Critical flow
- Supercritical flow
- Energy grade line

If there is the potential for a hydraulic jump at the following locations, check all that apply and attach an explanation of how the hydraulic jump is controlled without affecting the stability of the channel.

- Inlet to channel
- Outlet of channel
- At Drop Structures
- At Transitions
- Other locations (specify): \_\_\_\_\_

2. Channel Design Plans

Attach the plans of the channelization certified by a registered professional engineer, as described in the instructions.

3. Accessory Structures

The channelization includes (check one):

- Levees [Attach Section E (Levee/Floodwall)]
- Drop structures
- Superelevated sections
- Transitions in cross sectional geometry
- Debris basin/detention basin [Attach Section D (Dam/Basin)]
- Energy dissipator
- Weir
- Other (Describe): \_\_\_\_\_

4. Sediment Transport Considerations

Are the hydraulics of the channel 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.

C. BRIDGE/CULVERT

Flooding Source: Sycamore Creek

Name of Structure: Sycamore Creek Bridges NB & SB, Owner: ADOT

1. This revision reflects (check one):

- Bridge/culvert not modeled in the FIS
- Modified bridge/culvert previously modeled in the FIS
- Revised analysis of bridge/culvert previously modeled in the FIS

2. Hydraulic model used to analyze the structure (e.g., HEC-2 with special bridge routine, WSPRO, HY8): HEC-RAS 4.1.0  
If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structures. Attach justification.

3. Attach plans of the structures certified by a registered professional engineer. The plan detail and information should include the following (check the information that has been provided):

- Dimensions (height, width, span, radius, length)
- Distances Between Cross Sections
- Shape (culverts only)
- Erosion Protection
- Material
- Low Chord Elevations – Upstream and Downstream
- Beveling or Rounding
- Top of Road Elevations – Upstream and Downstream
- Wing Wall Angle
- Structure Invert Elevations – Upstream and Downstream
- Skew Angle
- Stream Invert Elevations – Upstream and Downstream
- Cross-Section Locations

4. Sediment Transport Considerations

Are the hydraulics of the structure affected by sediment transport?  Yes  No

If Yes, then fill out Section F (Sediment Transport) of Form 3. If no, then attach an explanation.

**D. DAM/BASIN**

Flooding Source: \_\_\_\_\_  
 Name of Structure: \_\_\_\_\_

1. This request is for (check one):       Existing dam/basin     New dam/basin     Modification of existing dam/basin
2. The dam/basin was designed by (check one):  Federal agency     State agency     Private organization     Local government agency

Name of the agency or organization: \_\_\_\_\_

3. The Dam was permitted as (check one):     Federal Dam                       State Dam

Provide the permit or identification number (ID) for the dam and the appropriate permitting agency or organization

Permit or ID number \_\_\_\_\_ Permitting Agency or Organization \_\_\_\_\_

- a.     Local Government Dam     Private Dam

Provided related drawings, specification and supporting design information.

4. Does the project involve revised hydrology?     Yes     No

If Yes, complete the Riverine Hydrology & Hydraulics Form (Form 2).

Was the dam/basin designed using critical duration storm? (must account for the maximum volume of runoff)

Yes, provide supporting documentation with your completed Form 2.

No, provide a written explanation and justification for not using the critical duration storm.

5. Does the submittal include debris/sediment yield analysis?     Yes     No

If Yes, then fill out Section F (Sediment Transport). If No, then attach your explanation for why debris/sediment analysis was not considered?

6. Does the Base Flood Elevation behind the dam/basin or downstream of the dam/basin change?     Yes     No

If Yes, complete the Riverine Hydrology & Hydraulics Form (Form 2) and complete the table below.

FREQUENCY (% annual chance)	Stillwater Elevation Behind the Dam/Basin	
	FIS	REVISED
10-year (10%)	_____	_____
50-year (2%)	_____	_____
100-year (1%)	_____	_____
500-year (0.2%)	_____	_____
Normal Pool Elevation	_____	_____

7. Please attach a copy of the formal Operation and Maintenance Plan

**E. LEVEE/FLOODWALL**

1. System Elements

a. This Levee/Floodwall analysis is based on (check one):

- upgrading of an existing levee/floodwall system       a newly constructed levee/floodwall system       reanalysis of an existing levee/floodwall system

b. Levee elements and locations are (check one):

- earthen embankment, dike, berm, etc.      Station \_\_\_\_ to \_\_\_\_  
 structural floodwall      Station \_\_\_\_ to \_\_\_\_  
 Other (describe):      Station \_\_\_\_ to \_\_\_\_

c. Structural Type (check one):  monolithic cast-in place reinforced concrete     reinforced concrete masonry block     sheet piling  
 Other (describe): \_\_\_\_\_

d. Has this levee/floodwall system been certified by a Federal agency to provide protection from the base flood?

Yes     No

If Yes, by which agency? \_\_\_\_\_

e. Attach certified drawings containing the following information (indicate drawing sheet numbers):

- 1. Plan of the levee embankment and floodwall structures. Sheet Numbers: \_\_\_\_\_
- 2. A profile of the levee/floodwall system showing the Base Flood Elevation (BFE), levee and/or wall crest and foundation, and closure locations for the total levee system. Sheet Numbers: \_\_\_\_\_
- 3. A profile of the BFE, closure opening outlet and inlet invert elevations, type and size of opening, and kind of closure. Sheet Numbers: \_\_\_\_\_
- 4. A layout detail for the embankment protection measures. Sheet Numbers: \_\_\_\_\_
- 5. Location, layout, and size and shape of the levee embankment features, foundation treatment, Floodwall structure, closure structures, and pump stations. Sheet Numbers: \_\_\_\_\_

2. Freeboard

a. The minimum freeboard provided above the BFE is:

Riverine

- 3.0 feet or more at the downstream end and throughout  Yes  No
- 3.5 feet or more at the upstream end  Yes  No
- 4.0 feet within 100 feet upstream of all structures and/or constrictions  Yes  No

Coastal

- 1.0 foot above the height of the one percent wave associated with the 1%-annual-chance stillwater surge elevation or maximum wave runup (whichever is greater).  Yes  No
- 2.0 feet above the 1%-annual-chance stillwater surge elevation  Yes  No

Please note, occasionally exceptions are made to the minimum freeboard requirement. If an exception is requested, attach documentation addressing Paragraph 65.10(b)(1)(ii) of the NFIP Regulations.

If No is answered to any of the above, please attach an explanation.

b. Is there an indication from historical records that ice-jamming can affect the BFE?  Yes  No

If Yes, provide ice-jam analysis profile and evidence that the minimum freeboard discussed above still exists.

3. Closures

a. Openings through the levee system (check one):  exists  does not exist

If opening exists, list all closures:

Channel Station	Left or Right Bank	Opening Type	Highest Elevation for Opening Invert	Type of Closure Device

(Extend table on an added sheet as needed and reference)

Note: Geotechnical and geologic data

In addition to the required detailed analysis reports, data obtained during field and laboratory investigations and used in the design analysis for the following system features should be submitted in a tabulated summary form. (Reference U.S. Army Corps of Engineers [USACE] EM-1110-2-1906 Form 2086.)

4. Embankment Protection

- a. The maximum levee slope land side is: \_\_\_\_\_
- b. The maximum levee slope flood side is: \_\_\_\_\_
- c. The range of velocities along the levee during the base flood is: \_\_\_\_\_ (min.) to \_\_\_\_\_ (max.)
- d. Embankment material is protected by (describe what kind): \_\_\_\_\_
- e. Riprap Design Parameters (check one):  Velocity  Tractive stress  
Attach references

Reach	Sideslope	Flow Depth	Velocity	Curve or Straight	Stone Riprap			Depth of Toedown
					D <sub>100</sub>	D <sub>50</sub>	Thickness	
Sta to								
Sta to								
Sta to								
Sta to								
Sta to								
Sta to								

(Extend table on an added sheet as needed and reference each entry)

- f. Is a bedding/filter analysis and design attached?  Yes  No
- g. Describe the analysis used for other kinds of protection used (include copies of the design analysis):

Attach engineering analysis to support construction plans.

5. Embankment And Foundation Stability

- a. Identify locations and describe the basis for selection of critical location for analysis:  
\_\_\_\_\_
  - Overall height: Sta.: \_\_\_\_\_, height \_\_\_\_\_ ft.
  - Limiting foundation soil strength:  
Strength  $\phi$  = \_\_\_\_\_ degrees, c = \_\_\_\_\_ psf  
Slope: SS = \_\_\_\_\_ (h) to \_\_\_\_\_ (v)  
(Repeat as needed on an added sheet for additional locations)
- b. Specify the embankment stability analysis methodology used (e.g., circular arc, sliding block, infinite slope, etc.):  
\_\_\_\_\_
- c. Summary of stability analysis results:

**E. LEVEE/FLOODWALL (CONTINUED)**

5. Embankment And Foundation Stability (continued)

Case	Loading Conditions	Critical Safety Factor	Criteria (Min.)
I	End of construction		1.3
II	Sudden drawdown		1.0
III	Critical flood stage		1.4
IV	Steady seepage at flood stage		1.4
VI	Earthquake (Case I)		1.0

(Reference: USACE EM-1110-2-1913 Table 6-1)

d. Was a seepage analysis for the embankment performed?  Yes  No

If Yes, describe methodology used:

e. Was a seepage analysis for the foundation performed?  Yes  No

f. Were uplift pressures at the embankment landside toe checked?  Yes  No

g. Were seepage exit gradients checked for piping potential?  Yes  No

h. The duration of the base flood hydrograph against the embankment is \_\_\_\_\_ hours.

Attach engineering analysis to support construction plans.

6. Floodwall And Foundation Stability

a. Describe analysis submittal based on Code (check one):  UBC (1988)  Other (specify): \_\_\_\_\_

b. Stability analysis submitted provides for:  Overturning  Sliding If not, explain: \_\_\_\_\_

c. Loading included in the analyses were:  Lateral earth @  $P_A =$  \_\_\_\_\_ psf;  $P_p =$  \_\_\_\_\_ psf

Surcharge-Slope @ \_\_\_\_\_,  surface \_\_\_\_\_ psf

Wind @  $P_w =$  \_\_\_\_\_ psf

Seepage (Uplift); \_\_\_\_\_  Earthquake @  $P_{eq} =$  \_\_\_\_\_ %g

1%-annual-chance significant wave height: \_\_\_\_\_ ft.

1%-annual-chance significant wave period: \_\_\_\_\_ sec.

d. Summary of Stability Analysis Results: Factors of Safety.  
Itemize for each range in site layout dimension and loading condition limitation for each respective reach.

Loading Condition	Criteria (Min)		Sta	To	Sta	To
	Overturn	Sliding	Overturn	Sliding	Overturn	Sliding
Dead & Wind	1.5	1.5				
Dead & Soil	1.5	1.5				
Dead, Soil, Flood, & Impact	1.5	1.5				
Dead, Soil, & Seismic	1.3	1.3				

(Ref: FEMA 114 Sept 1986; USACE EM 1110-2-2502)  
Note: (Extend table on an added sheet as needed and reference)

**E. LEVEE/FLOODWALL (CONTINUED)**

6. Floodwall And Foundation Stability (continued)

e. Foundation bearing strength for each soil type:

Bearing Pressure	Sustained Load (psf)	Short Term Load (psf)
Computed design maximum		
Maximum allowable		

f. Foundation scour protection  is,  is not provided. If provided, attach explanation and supporting documentation:

Attach engineering analysis to support construction plans.

7. Settlement

a. Has anticipated potential settlement been determined and incorporated into the specified construction elevations to maintain the established freeboard margin?  Yes  No

b. The computed range of settlement is \_\_\_\_\_ ft. to \_\_\_\_\_ ft.

c. Settlement of the levee crest is determined to be primarily from :  Foundation consolidation  Embankment compression  
 Other (Describe): \_\_\_\_\_

d. Differential settlement of floodwalls  has  has not been accommodated in the structural design and construction.

Attach engineering analysis to support construction plans.

8. Interior Drainage

a. Specify size of each interior watershed:

Draining to pressure conduit: \_\_\_\_\_ acres

Draining to ponding area: \_\_\_\_\_ acres

b. Relationships Established

Ponding elevation vs. storage  Yes  No

Ponding elevation vs. gravity flow  Yes  No

Differential head vs. gravity flow  Yes  No

c. The river flow duration curve is enclosed:  Yes  No

d. Specify the discharge capacity of the head pressure conduit: \_\_\_\_\_ cfs

e. Which flooding conditions were analyzed?

- Gravity flow (Interior Watershed)  Yes  No
- Common storm (River Watershed)  Yes  No
- Historical ponding probability  Yes  No
- Coastal wave overtopping  Yes  No

If No for any of the above, attach explanation.

e. Interior drainage has been analyzed based on joint probability of interior and exterior flooding and the capacities of pumping and outlet facilities to provide the established level of flood protection.  Yes  No If No, attach explanation.

g. The rate of seepage through the levee system for the base flood is \_\_\_\_\_ cfs

h. The length of levee system used to drive this seepage rate in item g: \_\_\_\_\_ ft.

**E. LEVEE/FLOODWALL (CONTINUED)**

8. Interior Drainage (continued)

i. Will pumping plants be used for interior drainage?  Yes  No

If Yes, include the number of pumping plants: \_\_\_\_\_ For each pumping plant, list:

	Plant #1	Plant #2
The number of pumps		
The ponding storage capacity		
The maximum pumping rate		
The maximum pumping head		
The pumping starting elevation		
The pumping stopping elevation		
Is the discharge facility protected?		
Is there a flood warning plan?		
How much time is available between warning and flooding?		

Will the operation be automatic?  Yes  No  
 If the pumps are electric, are there backup power sources?  Yes  No

(Reference: USACE EM-1110-2-3101, 3102, 3103, 3104, and 3105)

Include a copy of supporting documentation of data and analysis. Provide a map showing the flooded area and maximum ponding elevations for all interior watersheds that result in flooding.

9. Other Design Criteria

a. The following items have been addressed as stated:

- Liquefaction  is  is not a problem
- Hydrocompaction  is  is not a problem
- Heave differential movement due to soils of high shrink/swell  is  is not a problem

b. For each of these problems, state the basic facts and corrective action taken:

Attach supporting documentation

c. If the levee/floodwall is new or enlarged, will the structure adversely impact flood levels and/or flow velocities floodside of the structure?  
 Yes  No Attach supporting documentation

d. Sediment Transport Considerations:

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

10. Operational Plan And Criteria

- a. Are the planned/installed works in full compliance with Part 65.10 of the NFIP Regulations?  Yes  No
- b. Does the operation plan incorporate all the provisions for closure devices as required in Paragraph 65.10(c)(1) of the NFIP regulations?  
 Yes  No
- c. Does the operation plan incorporate all the provisions for interior drainage as required in Paragraph 65.10(c)(2) of the NFIP regulations?  
 Yes  No If the answer is No to any of the above, please attach supporting documentation.

**E. LEVEE/FLOODWALL (CONTINUED)**

11. Maintenance Plan

Please attach a copy of the formal maintenance plan for the levee/floodwall

12. Operations and Maintenance Plan

Please attach a copy of the formal Operations and Maintenance Plan for the levee/floodwall.

**CERTIFICATION OF THE LEVEE DOCUMENTATION**

This certification is to be signed and sealed by a licensed registered professional engineer authorized by law to certify elevation information data, hydrologic and hydraulic analysis, and any other supporting information as per NFIP regulations paragraph 65.10(e) and as described in the MT-2 Forms Instructions. 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: \_\_\_\_\_

Company Name: \_\_\_\_\_ Telephone No.: \_\_\_\_\_ Fax No.: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_ E-Mail Address: \_\_\_\_\_

**F. SEDIMENT TRANSPORT**

Flooding Source: \_\_\_\_\_

Name of Structure: \_\_\_\_\_

If there is any indication from historical records that sediment transport (including scour and deposition) can affect the Base Flood Elevation (BFE); and/or based on the stream morphology, vegetative cover, development of the watershed and bank conditions, there is a potential for debris and sediment transport (including scour and deposition) to affect the BFEs, then provide the following information along with the supporting documentation:

Sediment load associated with the base flood discharge: Volume \_\_\_\_\_ acre-feet

Debris load associated with the base flood discharge: Volume \_\_\_\_\_ acre-feet

Sediment transport rate \_\_\_\_\_ (percent concentration by volume)

Method used to estimate sediment transport: \_\_\_\_\_

Most sediment transport formulas are intended for a range of hydraulic conditions and sediment sizes; attach a detailed explanation for using the selected method.

Method used to estimate scour and/or deposition: \_\_\_\_\_

Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport: \_\_\_\_\_

Please note that bulked flows are used to evaluate the performance of a structure during the base flood; however, FEMA does not map BFEs based on bulked flows.

If a sediment analysis has not been performed, an explanation as to why sediment transport (including scour and deposition) will not affect the BFEs or structures must be provided.

### SECTION 3: Survey and Mapping Information

#### 3.1 Digital Projection Information

The digital projection for the digital terrain model, triangulated irregular network, topography and the floodplain mapping results of this study are in the table below.

Table 1: Digital Projection Information

<b>Projected Coordinate System:</b>	NAD_1983_HARN_StatePlane_Arizona_Central_FIPS_0202_Feet_Intl
<b>Projection:</b>	Transverse_Mercator
<b>False_Easting:</b>	700000.00000000
<b>False_Northing:</b>	0.00000000
<b>Central_Meridian:</b>	-111.91666667
<b>Scale_Factor:</b>	0.99990000
<b>Latitude_Of_Origin:</b>	31.00000000
<b>Linear Unit:</b>	Foot
<b>Geographic Coordinate System:</b>	GCS_North_American_1983_HARN
<b>Datum:</b>	D_North_American_1983_HARN
<b>Prime Meridian:</b>	Greenwich
<b>Angular Unit:</b>	Degree

#### 3.2 Field Survey and As-Built Information

No field survey was completed for this study. As-built information for the highway bridges over Sycamore was collected from ADOT offices in downtown Phoenix. Pertinent excerpts from those as-built plans are included on the data disk in Appendix C.5. Also included in Appendix C.5 are grading and drainage plans for the Haught residence. This residence was built after the 10-foot topography was developed.

#### 3.3 Mapping

The topographic mapping was extracted from countywide aerial imagery. The contour interval is 10 feet and accuracy is +/- half the contour interval or five feet.

#### 3.4 Elevation Reference Marks

There are two Elevation Reference Marks on the work map exhibits. They are identified as survey point ID 24690 and 24682. These points can be found on Maricopa County Department of Transportation (MCDOT) Land Survey website. The web address for MCDOT's interactive map is <http://www.fcd.maricopa.gov/Maps/gismaps/apps/gdacs/application/index.cfm>.

### SECTION 4: Hydrology

The hydrology used in this study was derived from USGS RRE as stated earlier. In Appendix D are two graphs showing the results of the RRE calculation. RRE-Sycamore Creek in the Sunflower Community.pdf shows the results of the RRE calculation. SunflowerRRE-Comparison.pdf shows the 100-

year RRE calculation compared to ADOT's 100-year design discharge used to design the bridge over Sycamore Creek in Sunflower. The 100-year discharge from the equation is 14,151 cfs compared to ADOT's design discharge of 23,581 cfs. In USGS Water-Supply Paper 2433, Method for Estimating Magnitude and Frequency of Floods in the Southwestern United States (Thomas, et al., 1997), the equations are most applicable to watershed less than 200 square miles. This watershed is 36.2 square miles, which is well within the bounds of the equation.

During FEMA's review of a prior version of this report, they stated a preference to use the RRE for the delineation of Sycamore Creek because the ADOT discharge is outside of the Average Standard Error of Prediction for Region 12. It is for this reason that the RRE was used to delineate Sycamore Creek in Sunflower. The drainage study for the ADOT Bridge is included in Appendix D for reference.

## **SECTION 5: Hydraulics**

### 5.1 Method Description

The study area is essentially a private property island within the Tonto National Forest in the far northeastern part of Maricopa County. The terrain is mountainous and Sycamore Creek is a confined stream at the bottom of a small valley. The extent of hydraulic modeling is from just beyond the State Route 87 bridges for Sycamore Creek at the downstream end to almost a mile and a half upstream.

### 5.2 Work Study Maps

The study work maps were developed using aerial photography and topography from the FCDMC. The aerial photography was flown in November 2012. The topography is ten foot contour interval and was developed in 2001. Full size (24" x 36") work maps are in the Exhibits section of the report after the appendix.

### 5.3 Parameter Estimation

#### 5.3.1 Roughness Coefficients

GeoRAS and ArcMap were used to extract the topographic surface and roughness coefficient for hydraulic modeling. Manning's roughness coefficient polygons of the wash area were developed to automatically populate the HEC-RAS model with a roughness coefficient. These coefficients were selected using the method outlined in "Selection of Manning's Roughness Coefficient for Natural and Constructed Vegetated and Non-Vegetated Channels, and Vegetation Maintenance Plan Guidelines for Vegetated Channels in Central Arizona" (Phillips & Tadayon, 2006). Before the selection of the roughness coefficient, the study area was broken into sub-areas by relative vegetation density and bed material composition. A table called Manning's Calculation Table is in Appendix E.1. It summarizes the base coefficient and adjustments for each sub-area. The table, Descriptions of Manning's Areas, refers to photographs by number. These photos are also in Appendix E.1. The figure in Appendix E.1, Sycamore Creek Floodplain Delineation Manning's Exhibit, shows the physical extent of the sub-areas. A summary of the final Manning's coefficient and corresponding subarea number are in the table below.

Table 2: Manning's Coefficient Summary

Sub Area Number	Manning's Coefficient
1	0.085
2	0.110
3	0.020
4	0.080
5	0.040
6	0.045
7	0.045
8	0.054
9	0.078
10	0.030
11	0.030
12	0.040
13	0.098

### 5.3.2 Expansion and Contraction Coefficients

All expansion and contraction coefficients are set at 0.3 and 0.1 respectively. These are the values for cross sections with gradual transitions and subcritical flow. Typically these values would be increased to 0.5 and 0.3 for bridge cross sections. Since the bridges for State Route 87 over Sycamore Creek provided more than ample space for the 100-year peak discharge, the coefficients for the bridge sections were kept at 0.3 and 0.1.

### 5.4 Cross Section Description

Cross section spacing varied from 89 feet between cross section bounding a bridge to 1024 feet between cross sections along the creek. Cross section spacing was varied to avoid tributaries and to identify typical areas to calculate the extents of flooding.

### 5.5 Modeling Considerations

#### 5.5.1 Hydraulic Jump and Drop Analysis

The maximum Froude number achieved in HEC-RAS is 0.94 while running the model with a supercritical flow regime. Several cross sections default to critical depth due to the steep slopes in the project area. Average slopes are greater than 1%. The final model was limiting the flow regime to subcritical.

#### 5.5.2 Bridges and Culverts

A bridge for the northbound and southbound State Route 87 overpass was included in the model. The bridges are at a skew to the perpendicular direction of flow in the creek. A skew of 26 degrees was evaluated in a test model. This resulted in a maximum difference of 0.46 feet vertically localized near the bridge. Given the contour interval and approximate nature of the Special Flood Hazard Area requested, Zone A, the skew was looked at as a minor effect. The skew is not in the final model used for floodplain mapping so that the as-built plans would be easier for the reviewer to verify against the model.

### 5.5.3 Levees and Dikes

No levees or dikes were modeled or identified in the study area.

### 5.5.4 Non-Levee Embankments

No non-levee embankments were modeled or identified in the study area.

### 5.5.5 Islands and Flow Splits

There is divided flow at cross sections 1.15 and 1.44. They were dealt with by applying ineffective flow area to the area separated from the main wash area.

### 5.5.6 Ineffective Flow Areas

At cross section 0.00 there is some ineffective flow area in the right overbank. It is due to the upstream roadway abutment and fill material elevating the roadway to meet the bridge deck. Water coming through the bridge does not have conveyance access to the far right side of the first cross section. Also See Section 5.5.5 above for other ineffective flow areas.

### 5.5.7 Supercritical Flow

The steady flow analysis is set to keep the flow regime at subcritical. HEC-RAS defaulted to critical depth for several cross sections. The highest three Froude numbers calculated are 0.89, 0.81, and 0.77.

## 5.6 Floodway Modeling

No floodway was modeled in this study. The proposed floodplain is Zone A.

## 5.7 Issues Encountered During the Study

### 5.7.1 Special Issues and Solutions

As was mentioned in Section 1, the Sunflower Fire in May of 2012 (Laford, 2012) has had an effect on the watershed contributing to Sycamore Creek and the study reach. Few references are available that describe the vegetative recovery of desert watersheds from fire. An effort was made to discuss the issue with neighboring communities particularly Pima County which has been witness to relatively recent fires in natural desert watersheds. An anecdotal estimate of the time it takes this type of watershed to substantively recover from fire is three to five years, with grasses returning within the first year or two. This estimate is from a hydrologic perspective, meaning the type of vegetation might differ from what existed before the fire but the percent of ground cover and sediment load of the watershed are essentially what they were before the fire. In addition to that, many of the areas burned have rock outcrops with no vegetation. Assuming the three to five year time frame is valid, it was determined that the available hydrology completed before the fire occurred should be used to delineate the floodplain because the effect of the fire would be short lived.

### 5.7.2 Modeling Warning and Error Messages

There are warnings for divided flow as was discussed in Section 5.5.5. There are warnings for velocity head change, conveyance ratio, and energy loss at most cross sections due to steep slopes in the study area.

## 5.8 Calibration

No calibration was calculated for this study.

## 5.9 Final Results

### 5.9.1 Hydraulic Analysis Results

The floodplain was mapped to the digital terrain model (DTM) used by GeoRAS to extract ground surface data. The grading plan for the Haught residence was incorporated into GeoRAS geometry used for modeling and floodplain mapping. The residence was built after the 10-foot topography was developed. The grading plans show that the building pad is at elevation 3452 and the Finished Floor Elevation is 3452.8. The cross section at the residence, 0.45, has a water surface of 3448.49. A summary table of HEC-RAS results is below.

Table 3: Summary of HEC-RAS Results

River Sta	Q Total (cfs)	W.S. Elev (ft)	E.G. Elev (ft)	Invert Slope	Vel Chnl (ft/s)	Max Chl Dpth (ft)	Top Width (ft)	Froude # Chl
0.00	13523	3420.72	3421.99		5.11	4.76	714.44	0.45
0.08	13523	3425.20	3426.03	0.0090	3.83	5.65	605.67	0.33
0.09	Bridge							
0.10	13523	3426.30	3427.03	0	3.54	5.54	613.16	0.30
0.11	13523	3426.70	3427.59	-0.0116	3.39	6.97	613.09	0.30
0.12	Bridge							
0.13	13523	3427.61	3428.21	0.0000	3.68	6.82	642.62	0.29
0.25	13523	3434.65	3436.24	0.0115	10.43	6.44	458.69	TRUE
0.35	13523	3442.38	3442.98	0.0136	3.29	7.55	768.46	0.26
0.45	13523	3448.49	3450.92	0.0100	8.50	8.08	307.33	0.63
0.61	13523	3459.67	3460.52	0.0107	6.96	10.13	426.04	0.42
0.81	13523	3469.14	3470.74	0.0104	9.04	8.94	398.49	0.69
1.02	13523	3485.59	3487.76	0.0136	11.33	10.42	202.65	0.77
1.15	13523	3495.73	3497.01	0.0145	9.26	10.49	268.01	0.55
1.32	13523	3510.97	3513.80	0.0145	13.54	12.26	123.23	0.81
1.44	13523	3521.57	3522.02	0.0127	5.75	15.25	318.42	0.31

### 5.9.2 Verification or Comparison of Results

There was no verification of hydraulic modeling results completed for this study.

## **SECTION 6: Erosion, Sediment Transport, and Geomorphic Analysis**

Generally, the impact from sediment transport on hydrology is considered to be within the margin of error for hydrology in Maricopa County. Unusual site conditions, watersheds or particular project demands may prompt a hydrologist or engineer to consider sediment transport in their analysis. Even though a significant portion of the watershed was burned by fire, the hazard from that event is relatively short lived. A general estimate of the time it takes for vegetation to recovery in a deserted watershed after a fire is three to five years as discussed in section 5.7.1.

## **SECTION 7: Draft FIS Data**

### 7.1 Summary of Discharges

The discharged used for the entire HEC-RAS modeled reach is 13,523 cfs.

### 7.2 Floodway Data

No floodway was developed for this Zone A study.

### 7.3 Annotated Flood Insurance Rate Maps

There are no printed FIRM's in the study area.

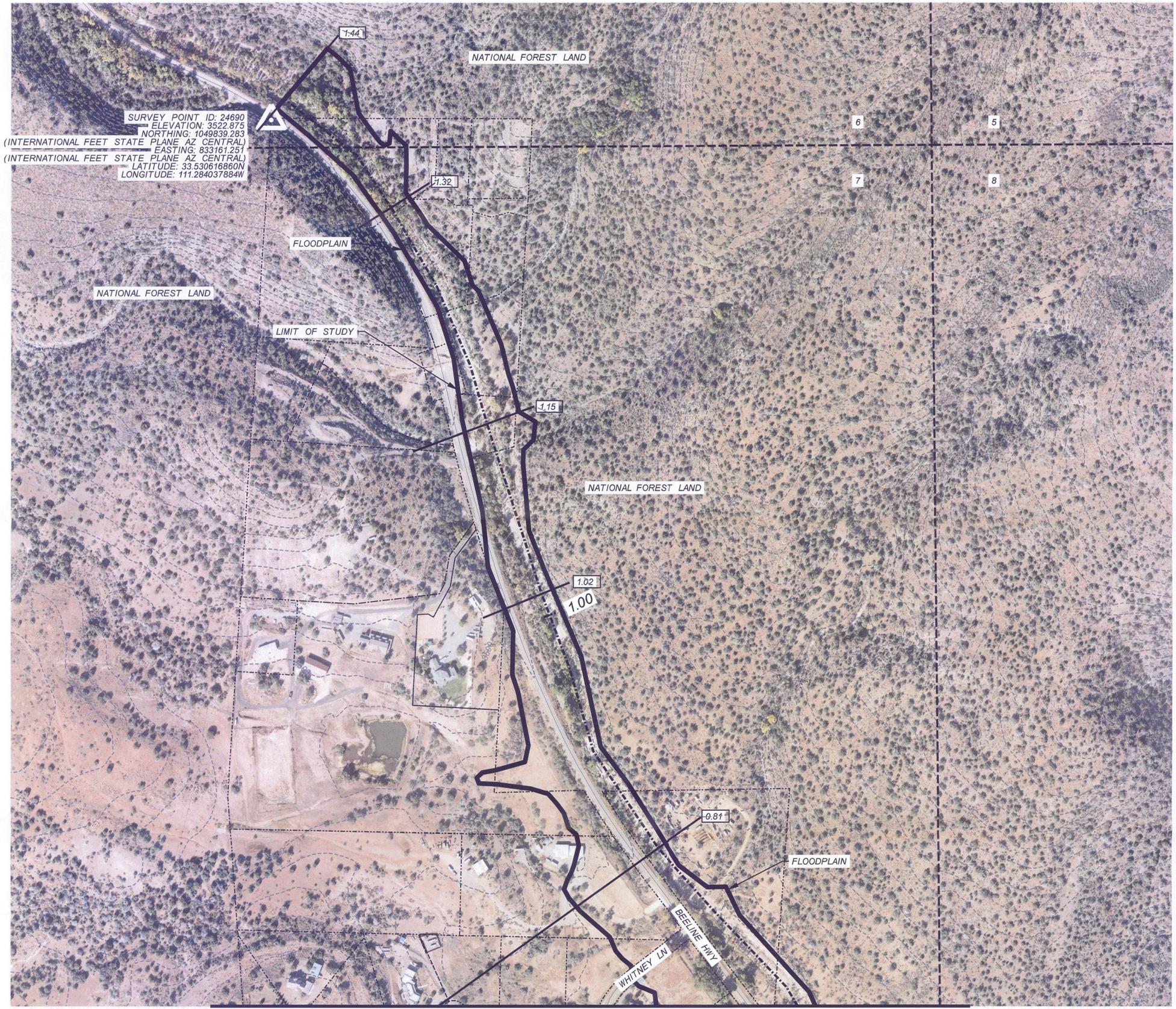
### 7.4 Flood Profiles

Flood profiles were not developed for this Zone A study.

# APPENDICIES

## EXHIBITS

- |           |                             |
|-----------|-----------------------------|
| Exhibit 1 | Work Study Map Sheet 1 of 2 |
| Exhibit 2 | Work Study Map Sheet 2 of 2 |



SURVEY POINT ID: 24690  
 ELEVATION: 3522.875  
 NORTHING: 1049839.283  
 (INTERNATIONAL FEET STATE PLANE AZ CENTRAL)  
 EASTING: 833161.251  
 (INTERNATIONAL FEET STATE PLANE AZ CENTRAL)  
 LATITUDE: 33.530616860N  
 LONGITUDE: 111.284037884W

MATCHLINE SEE SHEET 2

**LEGEND**

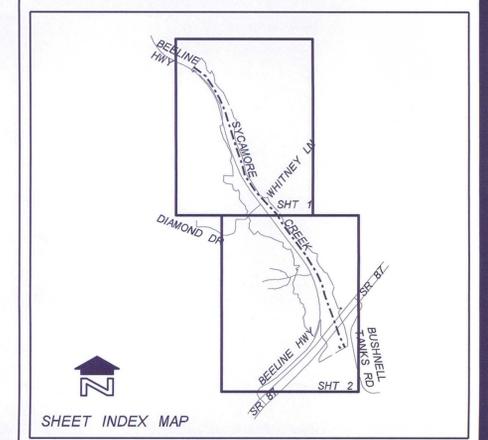
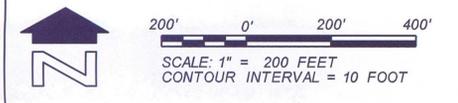
- 100-YR FLOODPLAIN BOUNDARY (ZONE A)
- HYDRAULIC BASE LINE WITH RIVER MILE
- CROSS SECTION
- PARCEL LINE (PRIVATE)
- EXISTING 10' CONTOUR
- SECTION LINE
- RIVER MILE
- ELEVATION REFERENCE MARK

**ELEVATION REFERENCE**

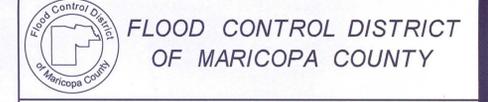
- 1- ALL ELEVATIONS ARE BASED ON VERTICAL DATUM OF 88 (NAVD 88)
- 2- HORIZONTAL DATUM 83 (NAD 83) CENTRAL ZONE

**NOTES**

- 1- THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 10,000 UNLESS NOTED OTHERWISE
- 2- 100-YR DISCHARGE: 13,523 CFS



NO.	REVISION	BY	DATE
2			
1			



**FLOOD CONTROL DISTRICT OF MARICOPA COUNTY**

SYCAMORE CREEK FLOODPLAIN DELINEATION STUDY IN THE SUNFLOWER COMMUNITY OF MARICOPA COUNTY, ARIZONA



	BY	DATE
DESIGN		
DESIGN CHK.	JCS	07/14/14
PLANS	FDK	07/21/14
PLANS CHK.	JCS	07/25/14

MATCHLINE SEE SHEET 1



SURVEY POINT ID: 24682  
 ELEVATION: 3426.888  
 NORTHING: 104356.938  
 EASTING: 836000.349  
 (INTERNATIONAL FEET STATE PLANE AZ CENTRAL)  
 LATITUDE: 33.52039484N  
 LONGITUDE: 111.280702585W

**LEGEND**

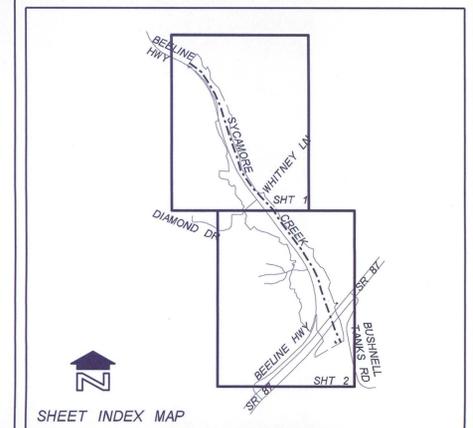
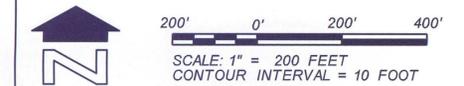
- 100-YR FLOODPLAIN BOUNDARY (ZONE A)
- HYDRAULIC BASE LINE WITH RIVER MILE 0.50
- CROSS SECTION
- PARCEL LINE (PRIVATE)
- EXISTING 10' CONTOUR
- SECTION LINE
- RIVER MILE
- ELEVATION REFERENCE MARK

**ELEVATION REFERENCE**

- 1- ALL ELEVATIONS ARE BASED ON VERTICAL DATUM OF 88 (NAVD 88)
- 2- HORIZONTAL DATUM 83 (NAD 83) CENTRAL ZONE

**NOTES**

- 1- THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 10,000 UNLESS NOTED OTHERWISE
- 2- 100-YR DISCHARGE: 13,523 CFS



NO.	REVISION	BY	DATE
2			
1			



**FLOOD CONTROL DISTRICT OF MARICOPA COUNTY**

**SYCAMORE CREEK FLOODPLAIN DELINEATION STUDY IN THE SUNFLOWER COMMUNITY OF MARICOPA COUNTY, ARIZONA**



**FLOOD CONTROL DISTRICT MARICOPA COUNTY, ARIZONA**

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DESIGN		
DESIGN CHK.	JCS	07/14/14
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