FLOODPLAIN DELINEATION FOR

EAGLE BLUFF III

A Revision of FEMA Case #02-09-695R
FLOODPLAIN DELINEATION FOR EAGLE BLUFF II
SEC Job No. 1324002

FEMA Case# _____

Prepared for
Courtland Homes
5333 North 7th Street, Suite 305
Phoenix, Arizona 85014

Registered Professional Engineer (Civil)
CERTIFICATE NO.
38798
CESAR
PEREZ
Date Signed 2/20/04
ARIZONA U.S.A.

Prepared by
Cesar Perez, P.E.
Sage Engineering Corporation
3414 South 48th Street Suite 8
Phoenix, Arizona 85040
Telephone (480) 966-9971
Fax (480) 929-9902

February 20, 2004

sage engineering corporation

FEDERAL EMERGENCY MANAGEMENT AGENCY

PAYMENT INFORMATION FORM

Community Name: CITY OF PHOENIX

Project Identifier: EAGLE BLUFF III

THIS FORM MUST BE MAILED, ALONG WITH THE APPROPRIATE FEE, TO ONE OF TWO POST OFFICE BOXES (SEE BELOW) OR FAXED TO THE FAX NUMBER BELOW.

Type of Request:

MT-1 application fee
MT-2 application fee } (Insert **3173** as the P.O. Box number in the address below)

External Data Requests (EDRs) (Insert **398** as the P.O. Box number in the address below)

Federal Emergency Management Agency
Revisions Fee-Collection System Administrator
P.O. Box 3173
Merrifield, Virginia 22116
Fax: (703) 849-0282
Phone: (703) 849-0432

Request No.: (if known) Amount: 4000.00

☐ INITIAL FEE* ☐ FINAL FEE ☐ FEE BALANCE** ☐ MASTER CARD ☐ VISA ☑ CHECK ☐ MONEY ORDER

*Note: Applicable only for EDR and/or Alluvial Fan requests (as appropriate).

**Note: Applicable only if submitting a corrected fee for an ongoing request.

COMPLETE THIS SECTION ONLY IF PAYING BY CREDIT CARD

EXP. DATE

☐☐☐☐ — ☐☐☐☐ — ☐☐☐☐ — ☐☐☐☐ ☐☐ — ☐☐
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 Month Year

CARD NUMBER

Date _____ Signature

NAME *(AS IT APPEARS ON CARD)*:
(please print or type)

ADDRESS:
(for your credit card receipt-please print or type)

DAYTIME PHONE:

Sage engineering corporation

To Whom It May Concern: February 20, 2004

The riverine analysis for the Tributary Wash to Cave Creek was approved by FEMA under Case #02-09-695R. When that analysis was performed, Courtland Homes was in the process of developing the south side of the Tributary wash mentioned above. The name of that development is Eagle Bluff II. In designing Eagle Bluff II, the finished pad grades were set at approximately 2 feet above the water surface elevation of the floodway as shown in the FEMA Case Study entitled "Floodplain Delineation for Eagle Bluff II" mention above. When the grading of that development was complete, as-builts of the finished grades were submitted back to FEMA along with the "Floodplain Delineation" report to receive L.O.M.R. approval. That L.O.M.R. approval was received on November 13, 2003.

Courtland Homes is now in the process of developing the north side of the Tributary Wash to Cave Creek. This development is called Eagle Bluff III. The only access to this project is via 17th Street which crosses the Wash. The crossing involves the addition of box culverts to the already approved L.O.M.R. hydraulic model for Eagle Bluff II. This addition of the box culverts to the original hydraulic model has caused an increase in water surface elevation by approximately 0.20 feet in both the floodplain and floodway. This rise in elevation occurs for approximately 700 feet immediately upstream of the box culvert. The pad grades on each side of the Wash in this area have been set at a minimum of 2 feet above the floodway water surface elevation of the approved L.O.M.R. for Eagle Bluff II. This rise in water surface elevation has no adverse impact on the adjoining lots.

The purpose of this C.L.O.M.R. is to revise the Base Flood Elevations that were previously approved with the Eagle Bluff II L.O.M.R.. This new analysis does not change the floodway (encroachments).

Per City of Phoenix, once the submittal package to FEMA in complete, permits will be released to construct the box culvert.

Sincerely,

Registered Professional Engineer (Civil)
CERTIFICATE NO.
38799
CESAR
PEREZ
Date Signed 2/20/04
ARIZONA U.S.A.

Cesar Perez, P.E.
Project Manager

3414 south 48th street, suite 8, phoenix, az 85040 (480) 966-9971

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1.0 Introduction

1.1 Purpose of Study

This Flood Delineation Study for Eagle Bluff III revises and updates the information in the Delineation Study for Eagle Bluff II. In that study, base flood elevations (BFE) were determined and approved by FEMA on November 13, 2003 under FEMA Case #02-09-695R. In the approved study, the hydraulic model for a proposed street crossing which involved the use of box culverts to convey the flow under 17th Street were not included as part of that analysis. This analysis focuses on the Tributary Wash to Cave Creek and in no way affects the Tributary to the Tributary Wash to Cave Creek.

The City of Phoenix will use the information in this floodplain delineation study to regulate floodplain development, to promote sound land use practices, and for floodplain management.

When the Central Arizona Project Canal was built, (it replaced the old Verde Canal as shown on the USGS Quad Map), it was bermed on the north thereby setting up a flooding condition. A relief channel runs parallel to the CAP Canal, north of the berm. This channel directs any water to the northwest to the Cave Creek Wash. No detailed delineation was done at that time, probably because no residences or other flood hazards were north of the berm. An assumption that water would be impounded (Zone A—No defined elevations), was made and reflected on the FIRM Map.

This study is based on HEC-1 hydrology and HEC-RAS Hydraulics.

1.2 Authority for Study

Sage Engineering, Inc. performed the hydrologic and hydraulic analyses for this study, for Courtland Homes under contract #1324002. The project manager for the Eagle Bluff Floodplain Delineation Study is Cesar Perez. This study was completed in February 2004 and submitted to the City of Phoenix for Submittal to FEMA. Floodplain Management for the City of Phoenix performed an "administratively correct review"of the Study.

1.3 Location of Study

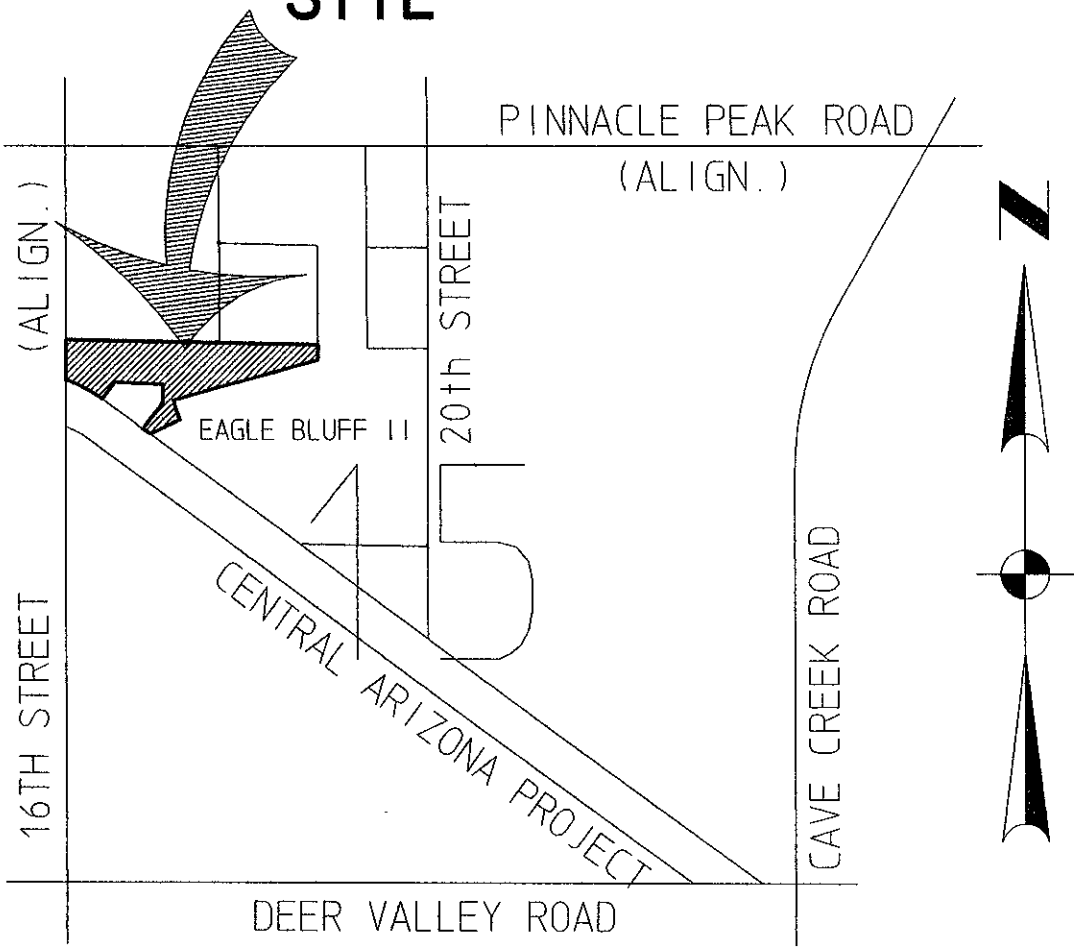
The Eagle Bluff FDS area is located within portions of the City of Phoenix, (Figure 1. 1). The flooding areas studied are generally located in Section 15 Township 4 North, Range 3 East. The Eagle Bluff Floodplain Delineation Study area includes reaches of riverine-like flow upstream of, and parallel to the CAP Canal.

These riverine-type floodplains are a combination of defined rivers and/or manmade channels. Storm water runoff flows through the site in existing washes and along dirt roadway/trails that parallel the CAP Canal. These floodplains were modeled using the HEC-RAS hydraulic model along the boundaries of the Eagle Bluff II property.

1.4 Summary of Methodology

A Hydrologic model was developed using the HEC-1 Model. Floodplain areas are delineated using the HEC-RAS computer models. Topographic data for HEC-RAS modeling was obtained from the by aerial method with a digital terrain model developed using Geopack.

EAGLE BLUFF III SITE



SECTION 15, T.4N., R.3E.
N.T.S.

VICINITY MAP

FIGURE 1.1

2.0 FEMA Forms and ADWR Abstracts

Study Documentation Abstract for FEMA Submittals		
2.1.1	Date Study Accepted	
2.1.2	Study Contractor: Contact Address Phone/Fax Email	Sage Engineering Corporation Cesar Perez, P.E. 3414 South 48th street suite 8 Phoenix, AZ 85040 (480)966-9971/(480)929-9901 cperez@sage-engr.com
2.1.3	FEMA Technical Reviewer Contractor: Contact Address Phone/Fax Email	 Michael Baker, Jr. Inc Alexandria, VA (703)960-8800
2.1.4	FEMA Regional Reviewer Phone Email	
2.1.5	State Technical Reviewer Phone Email	Brian Cosson Arizona Department of Water Resources (602)417-4100
2.1.6	Local Technical Reviewer Phone Email	Hasan Mushtaq Floodplain Administrator, City of Phoenix (602)262-4026
2.1.7	Reach Description	Tributary To Cave Creek Portions of FIRM # 04013C1210G (revised November 13, 2003) And FIRM #04013C1220G (Revised July 19, 2001
2.1.8	USGS Quadrangle Sheet	Union Hills, Arizona,7.5 Minute 10' C.I. Photo Date: 1954 Latest Photo Revision: 1973
2.1.9	FIRM Maps	Portions of FIRM # 04013C1210G (revised November 13, 2003) And FIRM #04013C1220G (Revised July 19, 2001)

FEDERAL EMERGENCY MANAGEMENT AGENCY

OVERVIEW & CONCURRENCE FORM

O.M.B No. 3067-0148
Expires September 30, 2005

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 1 hour 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, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (3067-0148). 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.**

A. REQUESTED RESPONSE FROM FEMA

This request is for a (check one):

☑ CLOMR: A letter from 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 FEMA officially revising the current NFIP map to show the changes to floodplains, regulatory floodway or flood elevations. (See Parts 60 & 65 of the NFIP Regulations.)

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	480301 48201C	0005D 0220G	02/08/83 09/28/90
040051	PHOENIX, CITY OF	AZ	04013C	1210G	11/13/03

2. Flooding Source: TRIBUTARY TO CAVE CREEK

3. Project Name/Identifier: EAGLE BLUFF III

4. FEMA zone designations affected: AE (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 ☐ 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 types of flooding and structures (check all that apply)

Types of Flooding: ☑ Riverine ☐ Coastal ☐ Shallow Flooding (e.g., Zones AO and AH)

☐ Alluvial fan ☐ Lakes ☐ Other (Attach Description)

Structures: ☐ Channelization ☐ Levee/Floodwall ☑ Bridge/Culvert

☐ Dam ☐ Fill ☐ Other, Attach Description

C. REVIEW FEE

Has the review fee for the appropriate request category been included? ☑ Yes Fee amount: $ 4000

☐ No, Attach Explanation

Please see the FEMA Web site at http://www.fema.gov/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: CESAR PEREZ	Company: SAGE ENGINEERING CORPORATION	
Mailing Address: 3414 S 48TH STREET SUITE 8 PHOENIX, AZ 85040	Daytime Telephone No.: (480) 966-9971	Fax No.: (480) 929-9901
	E-Mail Address: CPEREZ@SAGE-ENGR.COM	
Signature of Requester (required): Cesar Perez		Date: FEBRUARY 20, 2004

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 requirement that no fill be 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. 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: HASAN MUSHTAQ Ph.D., PE, CFM		Telephone No.: (602) 262-4960
Community Name: CITY OF PHOENIX	Community Official's Signature (required): H Mushtaq	Date: 4/6/04

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. 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: CESAR PEREZ	License No.: ARIZONA 38798	Expiration Date: MARCH 31,2006
Company Name: SAGE ENGINEERING CORPORATION	Telephone No.: (480) 966-9971	Fax No.: (480) 929-9901
Signature: Cesar Perez		Date: FEBRUARY 20, 2004

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

Form Name and (Number)	Required if ...
☐ Riverine Hydrology and 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)

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

O.M.B No. 3067-0148
Expires September 30, 2005

PAPERWORK REDUCTION ACT

Public reporting burden for this form is estimated to average 3 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, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (3067-0148). 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.**

Flooding Source: TRIBUTARY TO CAVE CREEK
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 2) ☐ 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.)	FIS (cfs)	Revised (cfs)
EAGLE BLUFF III	1100 ACRES	469	N/A

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

☐ Statistical Analysis of Gage Records ☐ Precipitation/Runoff Model [TR-20, HEC-1, HEC-HMS etc.]
☐ Regional Regression Equations ☑ Other (please attach description) HEC-1

Please enclose all relevant models in digital format, maps, computations (including computation of parameters) and documentation to support the new analysis. The document, "Numerical Models Accepted by FEMA for NFIP Usage" lists the models accepted by FEMA. This document can be found at: http://www.fema.gov/fhm/en_modl.shtm.

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

Was sediment transport considered? ☐ 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.

VELOCITIES ARE VERY LOW
TRANSPORT IS INSIGNIFICANT

B. HYDRAULICS

1. Reach to be Revised

	Description	Cross Section	Water-Surface Elevations (ft.) Effective	Proposed/Revised
Downstream Limit	REACH 112	.365	1518.58	1518.79
Upstream Limit	REACH 112	.431	1518.60	1518.80

2. Hydraulic Method Used

Hydraulic Analysis HEC-RAS [HEC-2 , HEC-RAS, Other (Attach description)]

B. HYDRAULICS (CONTINUED)

3. Pre-Submittal Review of Hydraulic Models

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. These review programs verify that the hydraulic estimates and assumptions in the model data are in accordance with NFIP requirements, and that the data are comparable with the assumptions and limitations of HEC-2/HEC-RAS. CHECK-2 and CHECK-RAS identify areas of potential error or concern. These tools do not replace engineering judgment. CHECK-2 and CHECK-RAS can be downloaded from http://www.fema.gov/fhm/frm_soft.shtm. We recommend that you review your HEC-2 and HEC-RAS models with CHECK-2 and CHECK-RAS. If you disagree with a message, please attach an explanation of why the message is not valid in this case. Review of your submittal and resolution of valid modeling discrepancies will result in reduced review time.

HEC-2/HEC-RAS models reviewed with CHECK-2/CHECK-RAS? ☐ Yes ☑ No

4. Models Submitted

Duplicate Effective Model*	Natural File Name:	Floodway File Name:
Corrected Effective Model*	Natural File Name:	Floodway File Name:
Existing or Pre-Project Conditions Model	Natural File Name:	Floodway File Name:
Revised or Post-Project Conditions Model	Natural File Name: PROFILE 1	Floodway File Name: PROFILE 2
Other - (attach description)	Natural File Name:	Floodway File Name:

*Not required for revisions to approximate 1%-annual-chance floodplains (Zone A) – for details, refer to the corresponding section of the instructions.

The document "Numerical Models Accepted by FEMA for NFIP Usage" lists the models accepted by FEMA. This document can be found at: http://www.fema.gov/fhm/en_modl.shtm.

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.).

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,** 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 of revision.

D. COMMON REGULATORY REQUIREMENTS

1. For CLOMR requests, do Base Flood Elevations (BFEs) increase? ☑ Yes ☐ No

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. ✔
- The proposed project encroaches upon a SFHA with BFEs established and would result in increases above 1.00 foot.

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 added. Elements and examples of regulatory floodway revision notification can be found in the MT-2 Form 2 Instructions.)

4. For LOMR requests, does this request require property owner notification and acceptance of BFE increases? ☐ Yes ☐ No

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

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE STRUCTURES FORM

O.M.B. No. 3067-0148
Expires September 30, 2005

PAPERWORK REDUCTION ACT

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, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (3067-0148). 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.**

Flooding Source:
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 Structure

1. **Name of Structure:**

Type (check one): ☐ Channelization ☑ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

Location of Structure:

Downstream Limit/Cross Section:

Upstream Limit/Cross Section:

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. Accessory Structures

The channelization includes (check one):

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

N/A

2. Drawing Checklist

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

3. 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):

4. 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.

C. BRIDGE/CULVERT

Flooding Source:

Name of Structure:

1. This revision reflects (check one):

- ☑ New bridge/culvert not modeled in the FIS
- ☐ Modified bridge/culvert previously modeled in the FIS
- ☐ New 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
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)
- ☑ Shape (culverts only)
- ☑ Material
- ☐ Beveling or Rounding
- ☐ Wing Wall Angle
- ☐ Skew Angle
- ☐ Distances Between Cross Sections
- ☐ Erosion Protection
- ☐ Low Chord Elevations – Upstream and Downstream
- ☑ Top of Road Elevations – Upstream and Downstream
- ☑ Structure Invert Elevations – Upstream and Downstream
- ☐ Stream Invert Elevations – Upstream and Downstream
- ☐ Cross-Section Locations

4. 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. VELOCITIES ARE VERY LOW

TRANSPORT IS INSIGNIFICANT

D. DAM

Flooding Source:

Name of Structure:

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

   ☐ Private organization Name of the agency or organization:
3. Does the project involve revised hydrology? ☐ Yes ☐ No

   If Yes, complete the Riverine Hydrology & Hydraulics Form (Form 2).
4. 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.

   N/A
5. Does the Base Flood Elevation behind the dam or downstream of the dam change?

   ☐ Yes ☐ No If Yes, complete the Riverine Hydrology & Hydraulics Form (Form 2) and complete the table below.

Stillwater Elevation Behind the Dam

FREQUENCY (% annual chance)	FIS	REVISED
10-year (10%)		
50-year (2%)		
100-year (1%)		
500-year (0.2%)		
Normal Pool Elevation		

6. 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?

N/A

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

2. Freeboard (continued)

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 landside is:

b. The maximum levee slope floodside 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_{100}	D_{50}	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)

N/A

4. Embankment Protection (continued)

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:

Sta. , depth to

strength ϕ = degrees, c = psf

slope: SS = (h) to (v)

(Repeat as needed on an added sheet for additional locations)

N/A

b. Specify the embankment stability analysis methodology used (e.g., circular arc, sliding block, infinite slope, etc.):

c. Summary of stability analysis results:

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.

E. LEVEE/FLOODWALL (CONTINUED)

6. Floodwall And Foundation Stability

a. Describe analysis submittal based on Code (check one):

☐ UBC (1988) or ☐ Other (specify):

b. Foundation scour protection is provided check box

☐ 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. 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.

N/A

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.

f. 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.

N/A

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.

N/A

E. LEVEE/FLOODWALL (CONTINUED)

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.

11. Maintenance Plan

a. Are the planned/installed works in full compliance with Part 65.10 of the NFIP Regulations? ☐ Yes ☐ No
If No, please attach supporting documentation.

12. Operations and Maintenance Plan

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

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.

N/A

APPROXIMATE SCALE IN FEET

1,000 500 0 1,000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA
AND INCORPORATED AREAS

PANEL 1210 OF 4350
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

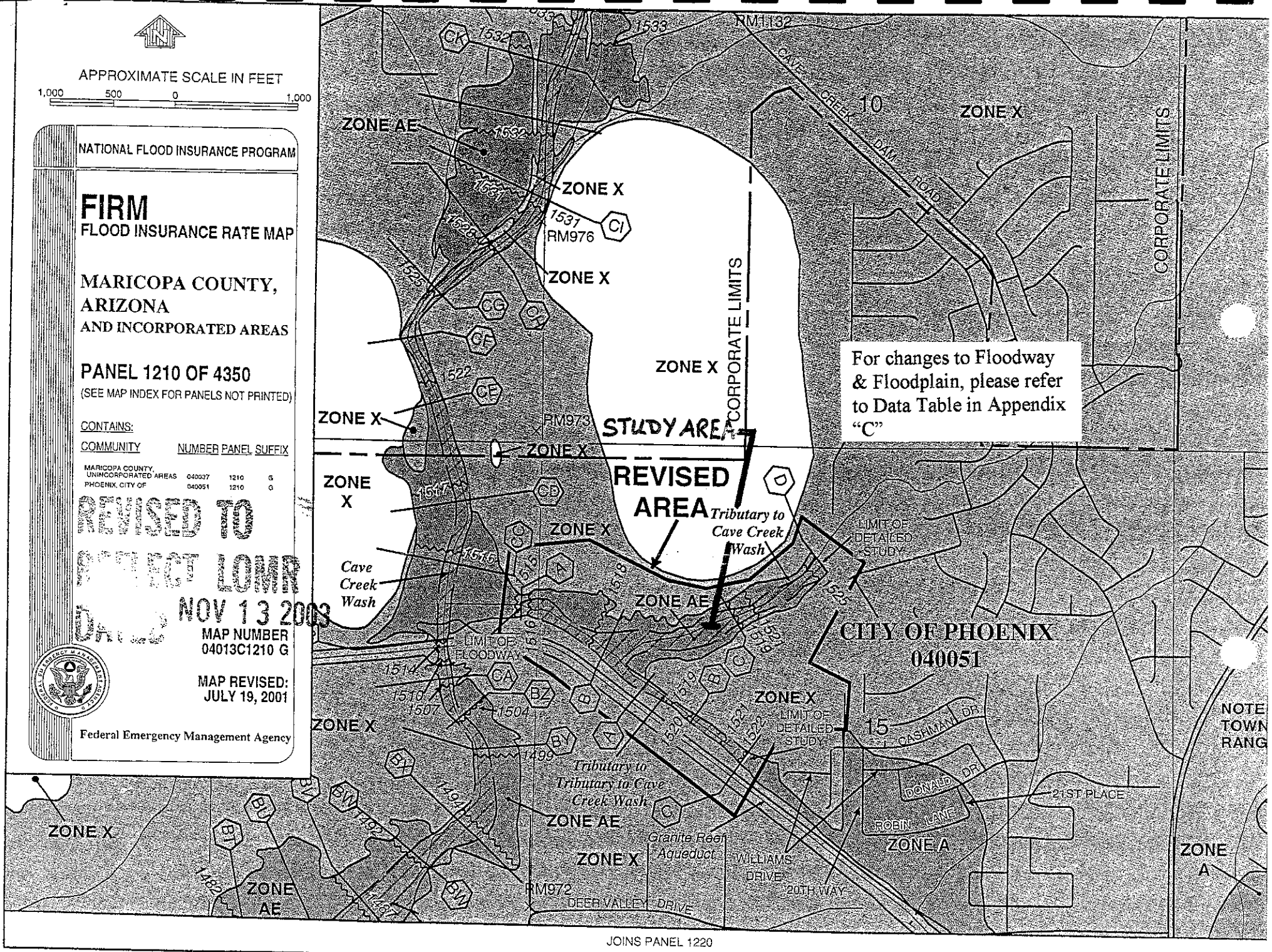
COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY, UNINCORPORATED AREAS	040037	1210	G
PHOENIX, CITY OF	040051	1210	G

REVISED TO REFLECT LOMR DATED NOV 13 2003

MAP NUMBER
04013C1210 G

MAP REVISED:
JULY 19, 2001

Federal Emergency Management Agency



3.0 Survey & Mapping Information

3.1 Field Survey Information

Sage Engineering crews conducted vertical control survey in February of 2002 to verify the Benchmark Elevations. All elevations within this FIS are based on RM 1132, which has an Elevation of 1562.67 per FIRM 04013C1210.

3.2 Mapping

Topographic mapping was provided by Kenney Aerial Mapping Inc. at 1 "=200' scale and with 1-foot contours. This mapping was based on survey data provided by Sage Engineering Corporation. Vertical elevations are based on the National Geodetic Vertical Datum of 1929. Horizontal control uses Arizona State Plane Coordinates based on the 1927 North American Datum. The flight date for the mapping was November 7, 2001.

4.0 Hydrology

4.1 Method Description

The hydrologic analysis is to provide runoff data (flows) for delineation of flood hazard areas upstream of Cave Creek along the CAP Canal. Runoff is computed for the 100-year, 24-hour storm. The resulting model will be used as a tool for managing the development of the watershed.

The HEC-1 Model was developed to determine the Rainfall runoff in the study area. The limits of the watershed were initially determined from the USGS Quadrangle Maps. After this, a field inspection was made to determine the validity of the drainage map. The watershed is a mix of residential developments and vacant desert landscape.

The watershed for this model consists of 1100 acres. It was divided into two Basins with separate areas. The main Basin has been divided into eight sub-basins (Sub-basins 1-9). The tributary basin has been divided into five sub-basins (sub-basins A- E). The Drainage areas used in the HEC-1 model are illustrated in Exhibit 1(Appendix A). Exhibit 2(Appendix A) is a composite aerial photo of the watershed that clarifies how modeling assumptions were made. The drainage areas are overlaid on the photos so that the percentage of land use for the sub-basins could be determined. The city of Phoenix requires detention in all of the newly developed areas. An assumption was made that this retention was equivalent to 15% of the developed areas (10 Acres developed = 1.5 acre-feet of detention).

4.2 Parameter Estimation

Parameter estimates were made using the SCS methodology for soil conditions and land use of the watershed. These parameters are summarized in Exhibit 3(Appendix A).

4.3 Problems encountered.

No problems were encountered in the study.

5.0 Hydraulics

5.1 Method Description

Two types of flood hazards along the upstream side of the embankments of the CAP Canal studied by detailed methods for the Eagle Bluff Floodplain Delineation Study: (1) ponding areas, and (2) riverine and/or sheet flow along the CAP Canal between adjacent ponding areas. Storm water runoff in the study area generally flows toward the southwest, following the natural topography of the watershed. The CAP Canal embankments are generally aligned northwest to southeast, creating obstructions to the southerly component of the natural runoff pattern. These obstructions divert the runoff to the northwest parallel to the CAP Canal embankments.

Riverine flow is modeled using HEC-RAS (Version 3.0.1 March 2001).

The starting water surface elevation was computed by the normal depth method. The calculated elevation is nearly equivalent to the elevation of 1515.0 that is the backwater elevation from Cave Creek. Elevation 1515.0 will remain the regulatory elevation in that section of the reach.

5.2 Parameter Estimation

5.2.1 Roughness Coefficients.

Manning's roughness coefficients, or "n" values, are determined using procedures adopted by the FCDMC. They are summarized below. They are based on hydraulic information and geomorphic data gathered during field reconnaissance trips.

Typical "N" Values for HEC-RAS Model

Description	Average Value	Range
Vacant Desert Land	0.045	0.035-0.055
Dirt/trailway Areas	0.030-0.035	0.030-0.045

In practice, "n" values were selected for each cross section based on features observed in the field

5.2.2 Expansion & Contraction Coefficients.

The default values of expansion and contraction coefficients, 0.1 and 0.3, respectively, are used in the HEC-RAS modeling.

5.3 Cross Section Description

HEC-RAS cross sections were spaced at 200-foot intervals; additional cross sections were added to the model immediately upstream and downstream of the north-south control feature to better model flow over the submerged obstruction. In general, cross sections are oriented perpendicular to their respective reaches.

Cross section stationing is also based on reach distance from Cave Creek for the tributary and reach distance upstream of the tributary for the tributary to the tributary. Cross section data are obtained from the digital terrain model developed using Geopak software, and are checked against the surveyed topographic data and the printed FCDMC topographic mapping for the study area.

5.4 Modeling Considerations

5.4.1 Hydraulic jump and Drop Analysis. No hydraulic jumps were modeled in the study area. No drop structures exist in the areas mapped by detailed methods.

5.5.2 Bridges & Culverts. There is only one culvert crossing in this study which is located at river station 0.338 in the Tributary to Cave Creek Wash (Reach 112). The first analysis approved by FEMA did not include the hydrology for this crossing. This analysis shows that there is a 0.20 foot rise in water surface elevation for approximately 700 feet upstream of the box culvert.

5.5 Floodway Modeling

The floodway was determined using the HEC-RAS Model, limiting the encroachment elevation to less than one foot. The encroachment station values that were originally used in the Delineation for Eagle Bluff II were not changed for this study. The boundary of the floodway remains the same while the water surface elevation of the floodway increases by 0.20 feet. This does not adversely affect the adjacent lots on either side of the wash since their pad grades were set at a minimum of 2 feet above the approved floodway water surface elevations. This increase in elevation occurs for 700 feet immediately north of the box culvert.

5.6 Problems Encountered During the Study

None.

5.7 Final Results

5.7.1 Hydraulic Analysis Results.

The HEC-RAS data sheets in Appendix B, summarizes the results of the hydraulic analysis for the box culvert.

5.7.2 Verification of Results.

The last table titled "WSE Comparison" presented in Appendix B compares the water surface elevations without the box culvert, as previously approved by FEMA, with the water surface elevations including the box culvert. The data will show that there was a .020 foot increase in WSE from the approved floodplain BFE as called out in the Delineation Study for Eagle Bluff II. Because the building pads on each side of the wash were set at 2 feet above the approved floodway WSE, the rise in WSE due to the addition of the box culvert has no adverse impact on the adjoining lots.

6.0 Erosion and Sediment Transport

No detailed erosion and sediment transport analyses were included in the Eagle Bluff II Floodplain Delineation Study. In general, the flood hazards considered in the study area included low velocity flow within existing washes/channels. The probable impact of scour and sedimentation on the flood hazards mapped for this study is insignificant.

7.0 Draft FIS Report Data

7.1 Summary of Discharges

The Discharges are summarized in the HEC-1 printout in Appendix A and on the work map in the pocket of Appendix D.

7.2 Floodway Data

Floodway data is tabulated in Appendix C and on the Workmap located in Appendix D

7.3 Annotated Flood Insurance Rate Map

The reduced-scale floodplain delineation maps are presented as Exhibit 3 in Appendix C.

7.4 Flood Profiles

The flood profiles are included in Appendix C.

Appendix A
Hydrologic Analysis
(HEC-1 Report)

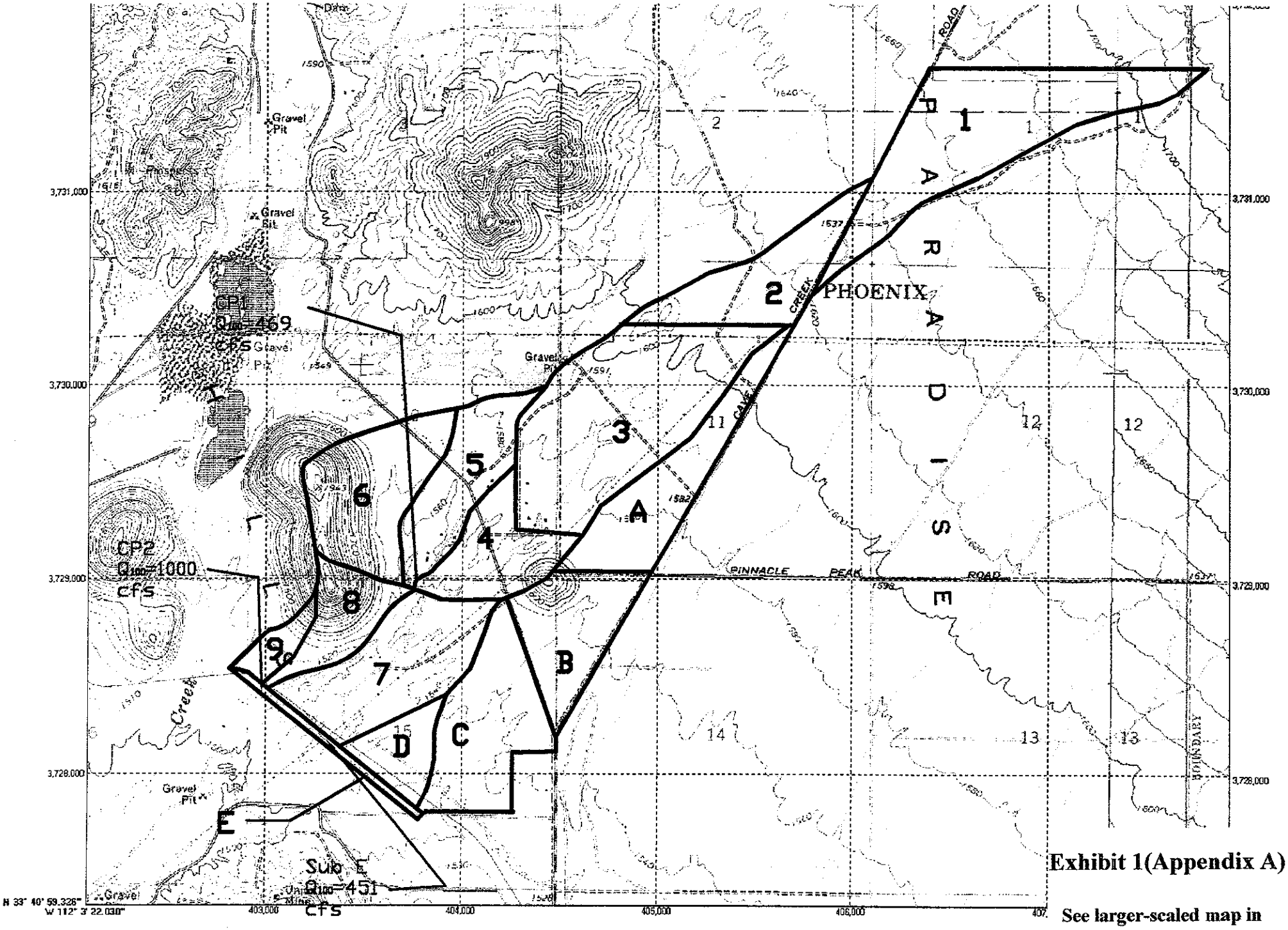


Exhibit 1(Appendix A)

See larger-scaled map in Pocket D--Drainage Map

Exhibit 2(Appendix A)

Drainage Areas
Properties

Sub-Area	Acres	Mi^2	Length	Slope	Gently Sloping Desert	Steep Native Desert	Residential (no Detention)	Residential (with Detention)
1	156.47	0.244	6095	1.23%	100%	_	_	_
2	76.63	0.120	3193	1.16%	97%	3%	_	_
3	183.18	0.286	4863	0.82%	94%	6%	_	_
4	67.75	0.106	2086	0.96%	_	_	12%	88%
5	67.50	0.105	3560	1.11%	4%	_	_	96%
6	92.04	0.144	2617	1.11%	14%	62%	12%	12%
7	131.55	0.206	1572	1.84%	_	33%	55%	7%
8	15.64	0.024	520	0.01%	25%	75%	_	_
		1.236						
A	122.23	0.191	4942	0.81%	97%	3%	_	_
B	70.69	0.110	1957	1.02%	_	24%	_	76%
C	99.99	0.156	3098	0.71%	11%	_	22%	67%
D	22.25	0.035	1200	0.50%	_	_	45%	55%
E	7.15	0.011	3115	0.01%	_	_	66%	34%
		0.492						

TOTAL	1.728	Mi^2

Soil information was obtained from maps provided and explained in the Soil Survey of Aguila-Carefree Area, Parts of Maricopa and Pinal Counties, Arizona. A portion of Sheet 34 is provided as Exhibit 3 (Below). Most of the undeveloped land in the watershed has soils that are classified as hydrologic group "B". The Hilly areas have soils that are classified as hydrologic group "C".

Soil Classifications

Soil#	Description	HEC-1
2	Antho, Calcareous Limy Fan, Gravelly Sandy Loam	B
18	Cherioni, Balsalt Hills, Extremely Stony Loam	C
52	Gachado, Volcanic Hills, Very Gravelly Sandy Clay Loam	C
90	Momoli, Sandy Loam Upland, Gravelly Sandy Loam	B
101	Rillito, Limy Upland	B
112	Tremant, (Non)Calcareaous Sandy Loam Upland Clay Loam	B
113	Tremant, (Non)Calcareaous Limy Fan, Gravelly Sandy Clay Loam	B
118	Tremant-Rillito complex	B

Exhibit 3(Appendix A)

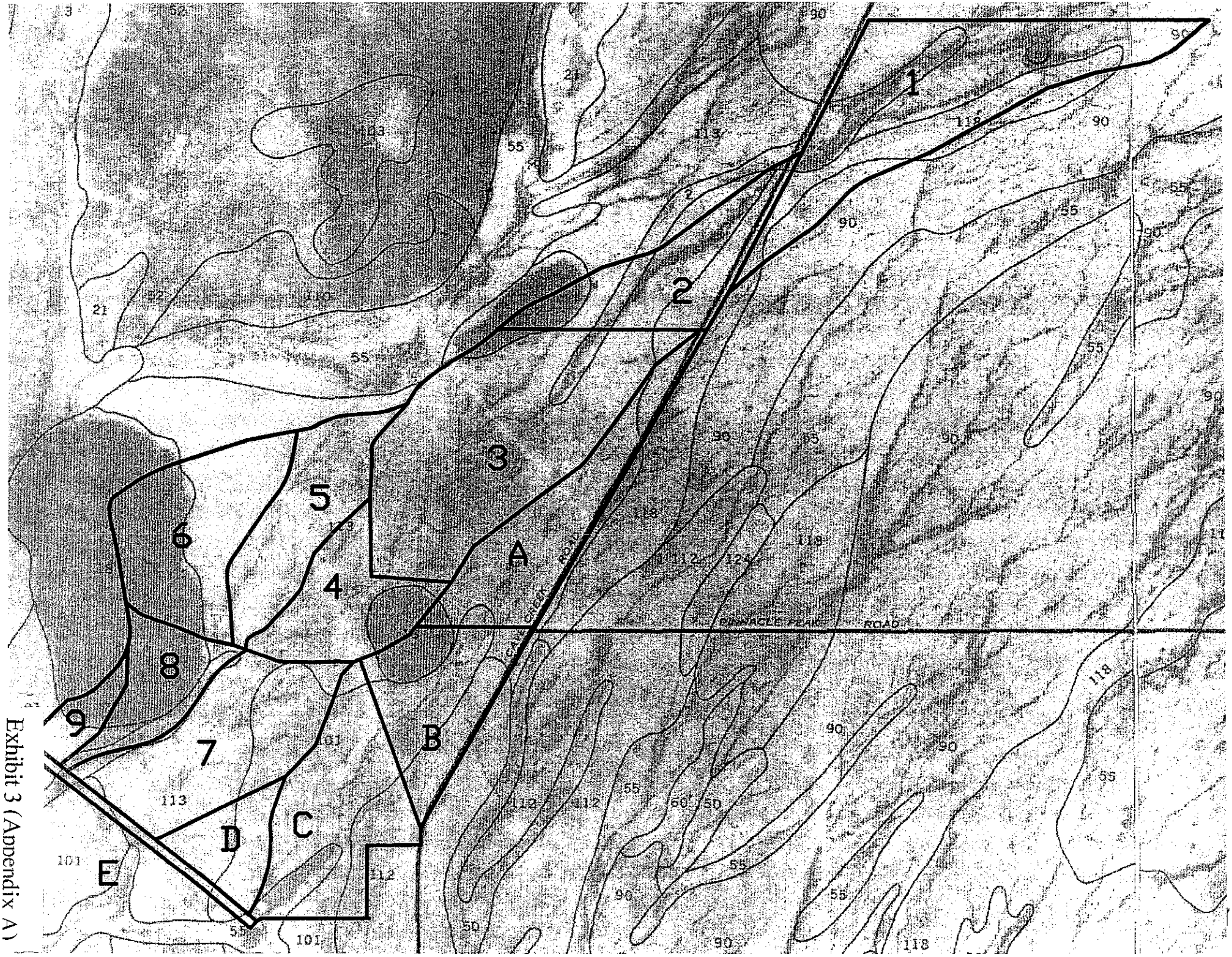


Exhibit 3 (Appendix A)

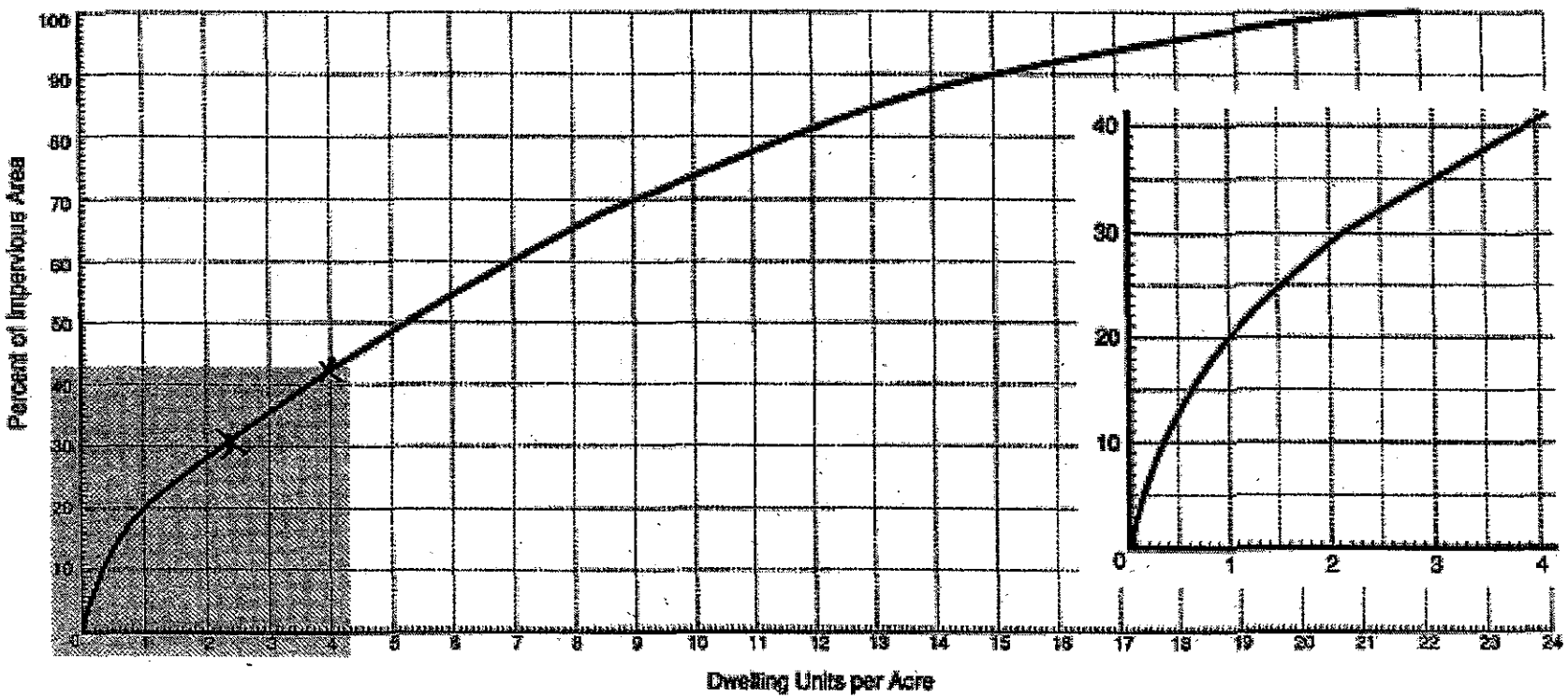


FIGURE 2.2-16

Percent of Impervious Area vs. Dwelling Density

Developed by Water Resources Associates, Inc. from data in Table 2.2a of TR-55, Urban Hydrology For Small Watersheds, and from discussions with Scottsdale city staff.

Runoff Curve Numbers for Urban Areas[1]

Cover type and hydrologic condition	Average % Impervious Area[2]	Curve numbers for hydrologic soil group A	B	C	D
Fully developed urban areas with vegetation established					
Open space (lawns, parks, golf courses, cemeteries, etc.)[3]:					
Poor condition (grass cover less that 50%)		68	79	86	89
Fair condition (grass cover 50-75%)		49	69	79	84
Good condition (grass cover greater than 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roads, driveways, etc. (excld. right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewer (excld. right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only)[4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1 to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	Not Applicable in Scottsdale			
Industrial	85				
Townhouse, duplexes	65				
Multi-Family	85				
Residential districts by average lot size: (See Figure 2.2-16)					
Developing Urban Areas					
Newly graded areas (pervious areas only, no vegetation)[5]		77	86	91	94

[1]Average runoff condition, and $I_a = 0.2S$; Table 2-2a, 210-VI-TR55, Second Ed., June 1986.
[2]The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition (not applicable in Scottsdale).
[3]CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.
[4]Composite CN's for natural desert landscaping should be computed based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.
[5]Composite CN's to use for the design of temporary measures during grading and construction should be computed based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

FIGURE 2.2-19

Runoff Curve Numbers for Urban Areas[1]

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUN   1998              *
*           VERSION 4.1                *
*                                      *
*  RUN DATE   22FEB02  TIME  11:36:05  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    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            CITY OF PHOENIX
   2          ID            FLOODPLAIN DELINEATION STUDY FOR
   3          ID            EAGLE BLUFF II(SUBDIVISION)
   4          ID            FULL BASIN 100-YEAR
   5          ID            FILE: EBIIFDS.DAT
              *DIAGRAM
              *
   6          IT       5                     289
   7          IO       5       0
              *

   8          KK    SUB1
   9          KM            SUBBASIN 1
  10          BA    0.244
  11          PH       0       0    0.73    1.43    2.43    2.69    2.87    3.20
  12          LS       0      77       0
  13          UK    1600    .005   0.050     100
  14          RK    6095  0.0123   0.050            TRAP       5       4
              *

  15          KK    SUB2
  16          KM            SUBBASIN 2
  17          BA    0.120
  18          LS       0      77       3       0      93      40
  19          UK     850    .005   0.050      97
  20          UK     500    0.06   0.055       3
  21          RK    3193  0.0160   0.050            TRAP       4       4     YES
              *

  22          KK    SUB3
  23          KM            SUBBASIN 3
  24          BA    0.286
  25          LS       0      77       3       0      93      33
  26          UK     850    .005   0.050      94
  27          UK     500    0.06   0.055       6
  28          RK   48623  0.0082   0.050            TRAP       4       4     YES
              *

  29          KK    SUB4
  30          KM            SUBBASIN 4
  31          BA    0.106
  32          LS       0      93      42
  33          UK     850    .003   0.050     100
  34          RK    2086  0.0096   0.050            TRAP       4       4     YES
              *

  35          KK    DET4
  36          KM   DETENTION FOR SUBBASIN 4
  37          DT    DET4     6.0
  38          DI       0    1000
  39          DQ       0    1000
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  40          KK    SUB5
  41          KM            SUBBASIN 5
  42          BA   0.105
  43          LS       0      77      10       0      93      42
  44          UK     850    .003   0.050      96
  45          UK     850    0.06   0.055       4
  46          RK    3560  0.0111   0.050            TRAP       4       4
              *

  47          KK    DET5
  48          KM   DETENTION FOR SUBBASIN 5
  49          DT    DET5     6.5
  50          DI       0    1000
  51          DQ       0    1000
              *

  52          KK    SUB6
  53          KM            SUBBASIN 6
  54          BA   0.144
  55          LS       0      88      20       0      93      42
  56          UK     300    .003   0.050      20
  57          UK    1500     .08   0.050      80
  58          RK    2617  0.0111   0.050            TRAP       4       4
              *

  59          KK    DET6
  60          KM   DETENTION FOR SUBBASIN 6
  61          DT    DET6     1.4
  62          DI       0    1000
  63          DQ       0    1000
              *

  64          KK     CP1
  65          KM           COMBINE BASINS 4,5,&6
  66          HC       3
              *

  67          KK    SUB7
  68          KM            SUBBASIN 7
  69          BA   0.106
  70          LS       0      93      40       0      93      40
  71          UK     850    0.05   0.050      01
  72          UK     500   0.005   0.050      99
  73          RK    2617  0.0184   0.050            TRAP       4       4
              *

  74          KK    DET7
  75          KM   DETENTION FOR SUBBASIN 7
  76          DT    DET7    0.9
  77          DI       0    1000
  78          DQ       0    1000
              *
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  79          KK    SUB8
  80          KM              SUBBASIN 8
  81          BA    .068
  82          LS       0       88        2
  83          UK     850     0.06    0.050      100
  84          RK    1500     0.05    0.050              TRAP        2        5
              *

  85          KK    SUBA
  86          KM              SUBBASIN A
  87          BA   0.191
              *      0        0      .68     1.38     2.34     2.60     2.79     3.20
  88          LS       0       77        0        0       88        0
  89          UK    1200     .005    0.050       97
  90          UK     500     0.06    0.055        3
  91          RK    4942   0.0081    0.050              TRAP        5        4
              *

  92          KK    SUBB
  93          KM              SUBBASIN B
  94          BA   0.110
  95          LS       0       88        0        0       88       30
  96          UK     850     .038    0.050       24
  97          UK     300     .005    0.050       76
  98          RK    1957   0.0102    0.050              TRAP        4        4      YES
              *

  99          KK    DETB
 100          KM   DETENTION FOR SUBBASIN B
 101          DT    DETB      5.0
 102          DI       0     1000
 103          DQ       0     1000
              *

 104          KK    SUBC
 105          KM              SUBBASIN C
 106          BA   0.156
 107          LS       0       77       05        0       93       38
 108          UK     250     .003    0.050       33
 109          UK     300    0.003    0.050       67
 110          RK    3098   0.0071    0.050              TRAP       10        2      YES
              *

 111          KK    DETC
 112          KM   DETENTION FOR SUBBASIN C
 113          DT    DETC      6.8
 114          DI       0     1000
 115          DQ       0     1000
              *
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 116          KK    SUBD
 117          KM            SUBBASIN D
 118          BA   0.035
 119          LS       0      93      38       0      77       0
 120          UK     250    .005   0.050      55
 121          UK     225    .005    .050      45
 122          RK    1200  0.0050   0.050            TRAP      10       2     YES
              *

 123          KK    DETD
 124          KM   DETENTION FOR SUBBASIN D
 125          DT    DETD     1.4
 126          DI       0    1000
 127          DQ       0    1000
              *

 128          KK    SUBE
 129          KM            SUBBASIN E
 130          BA   0.011
 131          LS       0      93      38
 132          UK     250    .005   0.050     100
 133          RK    3046  0.0005   0.050            TRAP      10       2     YES
              *

 134          KK    DETE
 135          KM   DETENTION FOR SUBBASIN E
 136          DT    DETE     0.2
 137          DI       0    1000
 138          DQ       0    1000
              *

 139          KK     CP2
 140          KM        COMBINE BASINS
 141          HC       4
              *

 142          KK    SUB9
 143          KM            SUBBASIN 9
 144          BA   0.024
 145          LS       0      88       5       0      77       5
 146          UK     850    0.05   0.050      35
 147          UK     500   0.008   0.050      65
 148          RK     636  0.0005   0.050            TRAP       4       4     YES
              *
 149          ZZ
```

```
                 SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

     8        SUB1
                 V
                 V
    15        SUB2 ***
                 V
                 V
    22        SUB3 ***
                 V
                 V
    29        SUB4 ***
                 .
                 .
    37           .------->    DET4
    35        DET4
                 .
                 .
    40           .        SUB5
                 .           .
                 .           .
    49           .           .------->    DET5
    47           .        DET5
                 .           .
                 .           .
    52           .           .        SUB6
                 .           .           .
                 .           .           .
    61           .           .           .------->    DET6
    59           .           .        DET6
                 .           .           .
                 .           .           .
    64         CP1.......................
                 .
                 .
    67           .        SUB7
                 .           .
                 .           .
    76           .           .------->    DET7
    74           .        DET7
                 .           .
                 .           .
    79           .           .        SUB8
                 .           .           .
                 .           .           .
    85           .           .           .        SUBA
                 .           .           .           V
                 .           .           .           V
    92           .           .           .        SUBB ***
                 .           .           .           .
                 .           .           .           .
   101           .           .           .           .------->    DETB
    99           .           .           .        DETB
                 .           .           .           V
```

```
                 .          .          .          V
  104            .          .          .       SUBC ***
                 .          .          .          .
                 .          .          .          .
  113            .          .          .          .-------->    DETC
  111            .          .          .       DETC
                 .          .          .          V
                 .          .          .          V
  116            .          .          .       SUBD ***
                 .          .          .          .
                 .          .          .          .
  125            .          .          .          .-------->    DETD
  123            .          .          .       DETD
                 .          .          .          V
                 .          .          .          V
  128            .          .          .       SUBE ***
                 .          .          .          .
                 .          .          .          .
  136            .          .          .          .-------->    DETE
  134            .          .          .       DETE
                 .          .          .          .
                 .          .          .          .
  139          CP2.......................................
                 V
                 V
  142         SUB9 ***
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUN   1998              *
*           VERSION 4.1                *
*                                      *
*  RUN DATE   22FEB02  TIME  11:36:05  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
                                CITY OF PHOENIX
                                FLOODPLAIN DELINEATION STUDY FOR
                                EAGLE BLUFF II(SUBDIVISION)
                                FULL BASIN 100-YEAR
                                FILE: EBIIFDS.DAT

  7 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN           5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         289  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2    0  ENDING DATE
                     NDTIME        0000  ENDING TIME
                     ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE   24.00 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
```

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	SUB1	125.	3.75	30.	8.	8.	.24		
+	HYDROGRAPH AT	SUB2	170.	3.75	46.	12.	12.	.36		
+	HYDROGRAPH AT	SUB3	209.	6.17	75.	23.	23.	.65		
+	HYDROGRAPH AT	SUB4	248.	3.25	99.	31.	31.	.76		
+	DIVERSION TO	DET4	248.	6.25	12.	3.	3.	.76		
+	HYDROGRAPH AT	DET4	215.	6.25	91.	28.	28.	.76		
+	HYDROGRAPH AT	SUB5	91.	3.50	16.	4.	4.	.10		
+	DIVERSION TO	DET5	91.	4.92	13.	3.	3.	.10		
+	HYDROGRAPH AT	DET5	12.	4.92	3.	1.	1.	.10		
+	HYDROGRAPH AT	SUB6	469.	3.17	41.	10.	10.	.14		
+	DIVERSION TO	DET6	41.	3.17	3.	1.	1.	.14		
+	HYDROGRAPH AT	DET6	469.	3.17	38.	10.	10.	.14		
+	3 COMBINED AT	CP1	469.	3.17	129.	38.	38.	1.00		
+	HYDROGRAPH AT	SUB7	335.	3.17	31.	8.	8.	.11		
+	DIVERSION TO	DET7	26.	3.17	2.	0.	0.	.11		
+	HYDROGRAPH AT	DET7	335.	3.17	29.	7.	7.	.11		
+	HYDROGRAPH AT	SUB8	195.	3.17	15.	4.	4.	.07		

+	HYDROGRAPH AT	SUBA	119.	3.67	24.	6.	6.	.19
+	HYDROGRAPH AT	SUBB	347.	3.17	50.	13.	13.	.30
+	DIVERSION TO	DETB	324.	3.25	10.	3.	3.	.30
+	HYDROGRAPH AT	DETB	272.	3.25	41.	10.	10.	.30
+	HYDROGRAPH AT	SUBC	490.	3.33	77.	20.	20.	.46
+	DIVERSION TO	DETC	376.	3.33	14.	3.	3.	.46
+	HYDROGRAPH AT	DETC	490.	3.33	65.	16.	16.	.46
+	HYDROGRAPH AT	SUBD	461.	3.42	71.	18.	18.	.49
+	DIVERSION TO	DETD	80.	3.42	3.	1.	1.	.49
+	HYDROGRAPH AT	DETD	461.	3.42	69.	18.	18.	.49
+	HYDROGRAPH AT	SUBE	451.	3.67	71.	18.	18.	.50
+	DIVERSION TO	DETE	9.	3.67	0.	0.	0.	.50
+	HYDROGRAPH AT	DETE	451.	3.67	71.	18.	18.	.50
+	4 COMBINED AT	CP2	1000.	3.17	244.	68.	68.	1.68
+	HYDROGRAPH AT	SUB9	947.	3.25	247.	69.	69.	1.71

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	INTERPOLATED TO COMPUTATION INTERVAL DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)
SUB1	MANE	4.66	125.31	225.72	1.19	5.00	124.51	225.00	1.19

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1575E+02 OUTFLOW= .1547E+02 BASIN STORAGE= .5363E-01 PERCENT ERROR= 1.4

SUB2	MANE	2.72	170.30	224.14	1.22	5.00	170.13	225.00	1.22

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1547E+02 EXCESS= .8416E+01 OUTFLOW= .2374E+02 BASIN STORAGE= .1507E-01 PERCENT ERROR= .6

SUB3	MANE	5.00	211.21	366.42	1.33	5.00	208.88	370.00	1.33

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2373E+02 EXCESS= .2067E+02 OUTFLOW= .4623E+02 BASIN STORAGE= .5054E+00 PERCENT ERROR= -5.3

SUB4	MANE	1.96	251.08	195.90	1.53	5.00	247.73	195.00	1.53

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4618E+02 EXCESS= .1561E+02 OUTFLOW= .6161E+02 BASIN STORAGE= .3635E-01 PERCENT ERROR= .2

SUB5	MANE	3.90	91.33	210.96	1.45	5.00	90.87	210.00	1.45

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .8198E+01 OUTFLOW= .8115E+01 BASIN STORAGE= .1339E-01 PERCENT ERROR= .8

SUB6	MANE	2.00	475.44	191.04	2.65	5.00	469.16	190.00	2.65

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .2040E+02 OUTFLOW= .2036E+02 BASIN STORAGE= .3994E-02 PERCENT ERROR= .2

SUB7	MANE	1.71	341.69	191.07	2.74	5.00	335.30	190.00	2.74

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1553E+02 OUTFLOW= .1550E+02 BASIN STORAGE= .4693E-02 PERCENT ERROR= .1

SUB8	MANE	.83	215.37	187.17	2.02	5.00	195.14	190.00	2.01

CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .7327E+01 OUTFLOW= .7314E+01 BASIN STORAGE= .8248E-03 PERCENT ERROR= .2

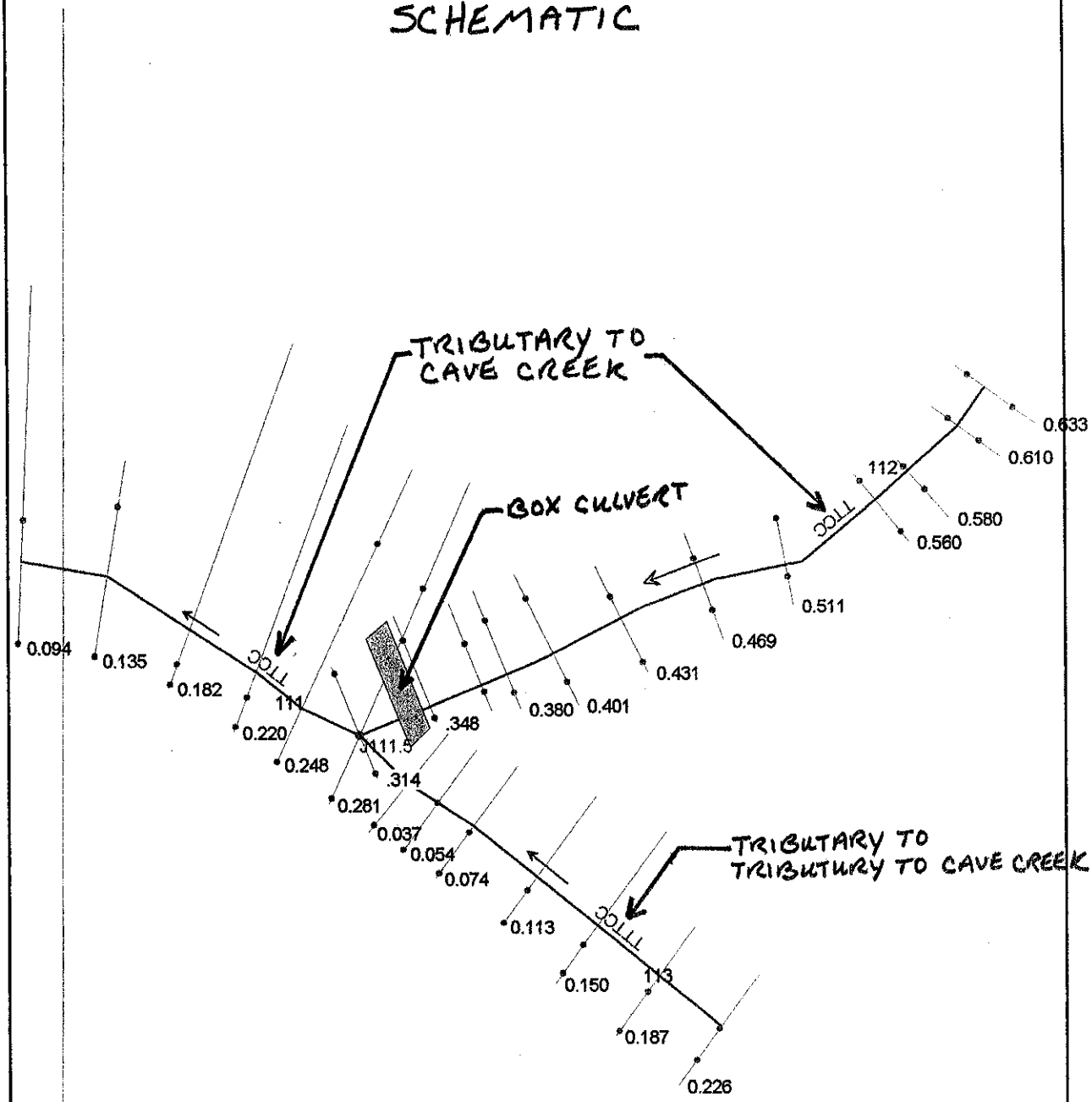
SUBA	MANE	4.41	120.22	218.99	1.22	5.00	119.40	220.00	1.22

```
CONTINUITY SUMMARY (AC-FT) - INFLOW= .0000E+00 EXCESS= .1257E+02 OUTFLOW= .1238E+02 BASIN STORAGE= .3145E-01 PERCENT ERROR=   1.2

            SUBB  MANE        1.58    348.14    190.40      1.60      5.00    347.35    190.00        1.60

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1239E+02 EXCESS= .1332E+02 OUTFLOW= .2560E+02 BASIN STORAGE= .4184E-02 PERCENT ERROR=    .4

            SUBC  MANE        1.82    502.71    200.36      1.61      5.00    490.08    200.00        1.61

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2061E+02 EXCESS= .1882E+02 OUTFLOW= .3924E+02 BASIN STORAGE= .1091E-01 PERCENT ERROR=    .5

            SUBD  MANE        1.01    509.90    202.65      1.38      5.00    460.67    205.00        1.38

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3253E+02 EXCESS= .3822E+01 OUTFLOW= .3630E+02 BASIN STORAGE= .3593E-02 PERCENT ERROR=    .1

            SUBE  MANE        2.55    450.95    218.60      1.36      5.00    450.78    220.00        1.36

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3485E+02 EXCESS= .1603E+01 OUTFLOW= .3658E+02 BASIN STORAGE= .3050E-01 PERCENT ERROR=   -.4

            SUB9  MANE        1.40   1010.37    193.34      1.50      5.00    946.86    195.00        1.50

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1344E+03 EXCESS= .2012E+01 OUTFLOW= .1363E+03 BASIN STORAGE= .2522E-01 PERCENT ERROR=    .1


*** NORMAL END OF HEC-1 ***
```

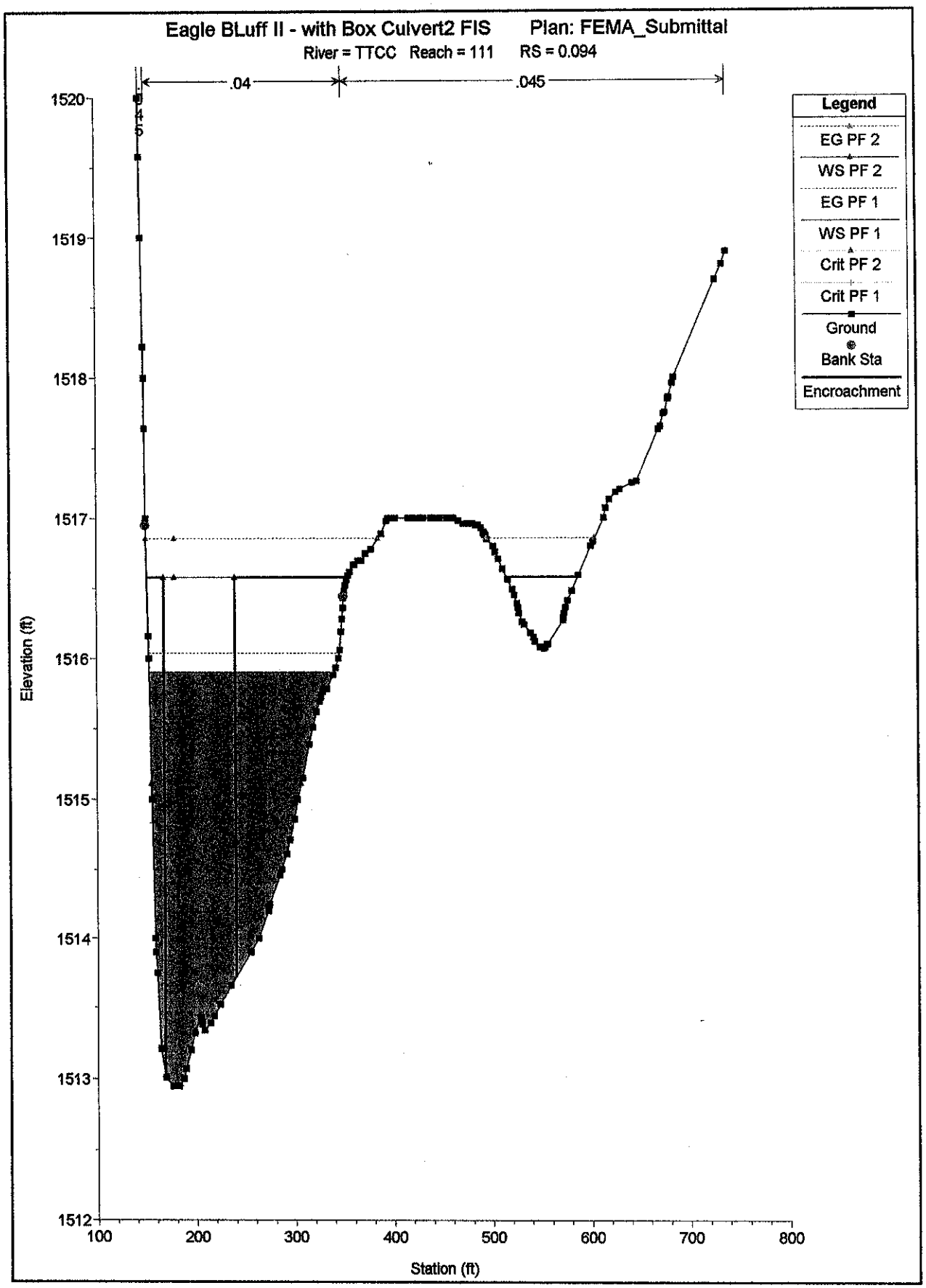
Appendix B

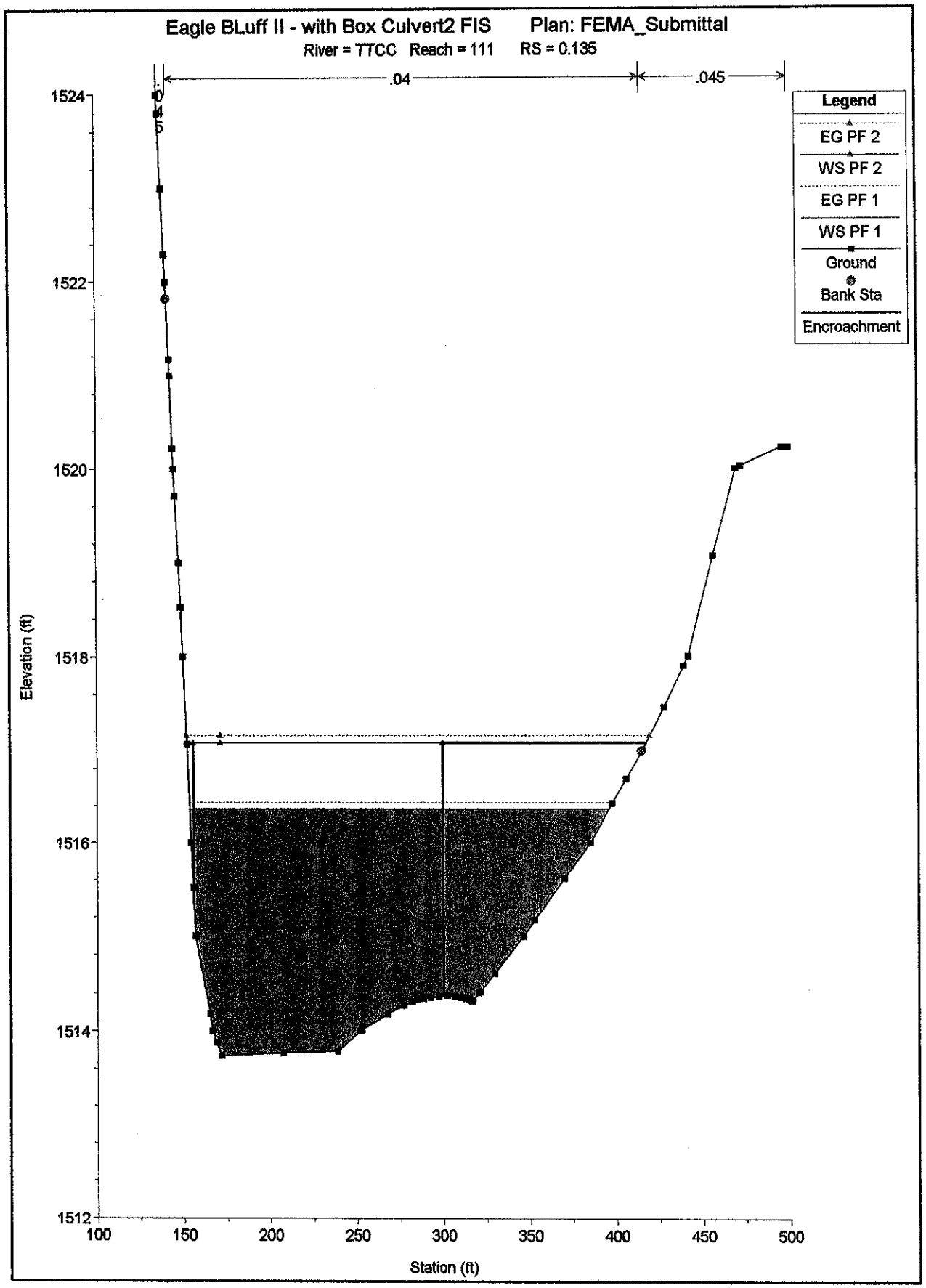
HEC-RAS REPORT

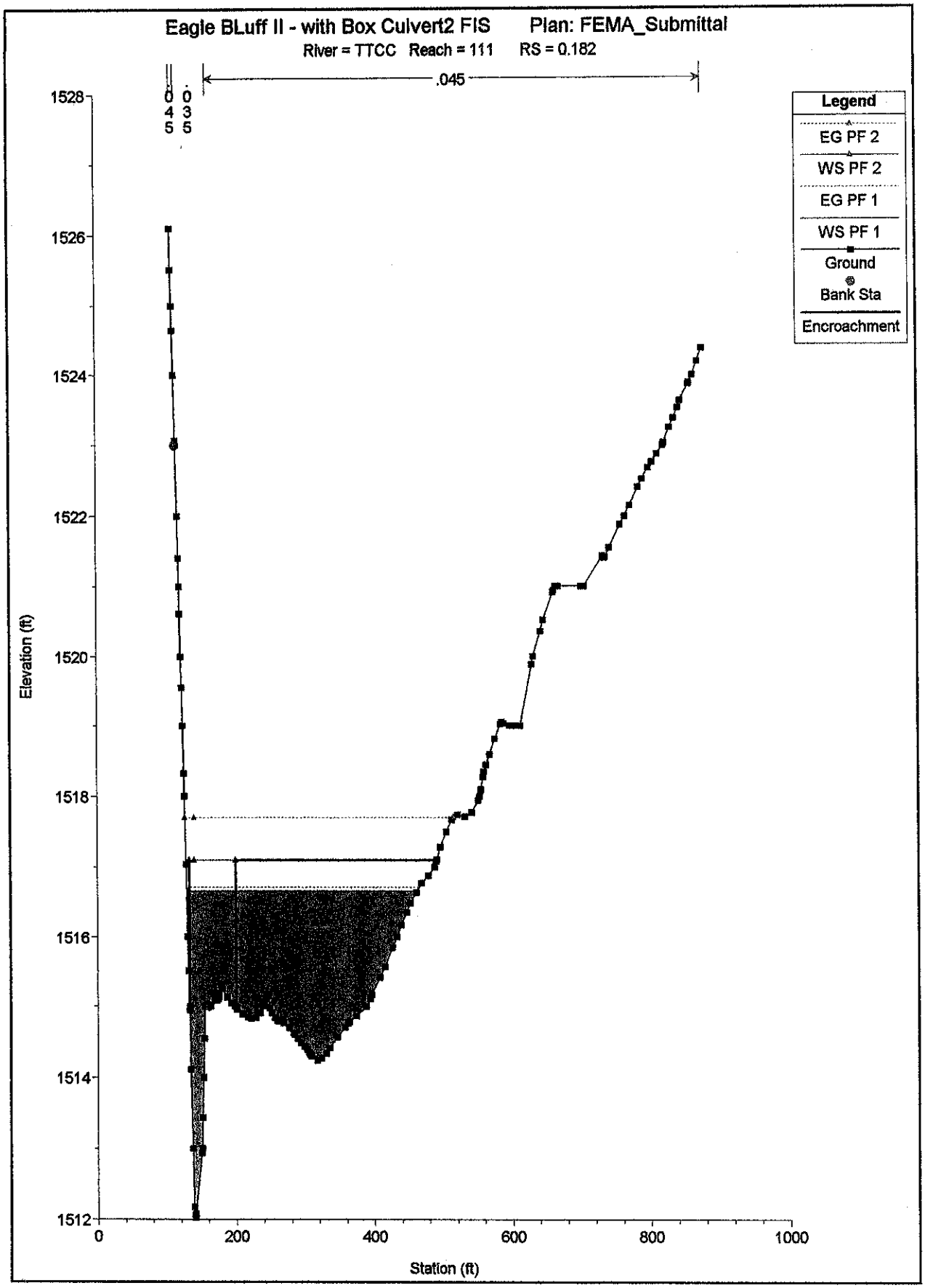
HYDRAULIC MODEL SCHEMATIC

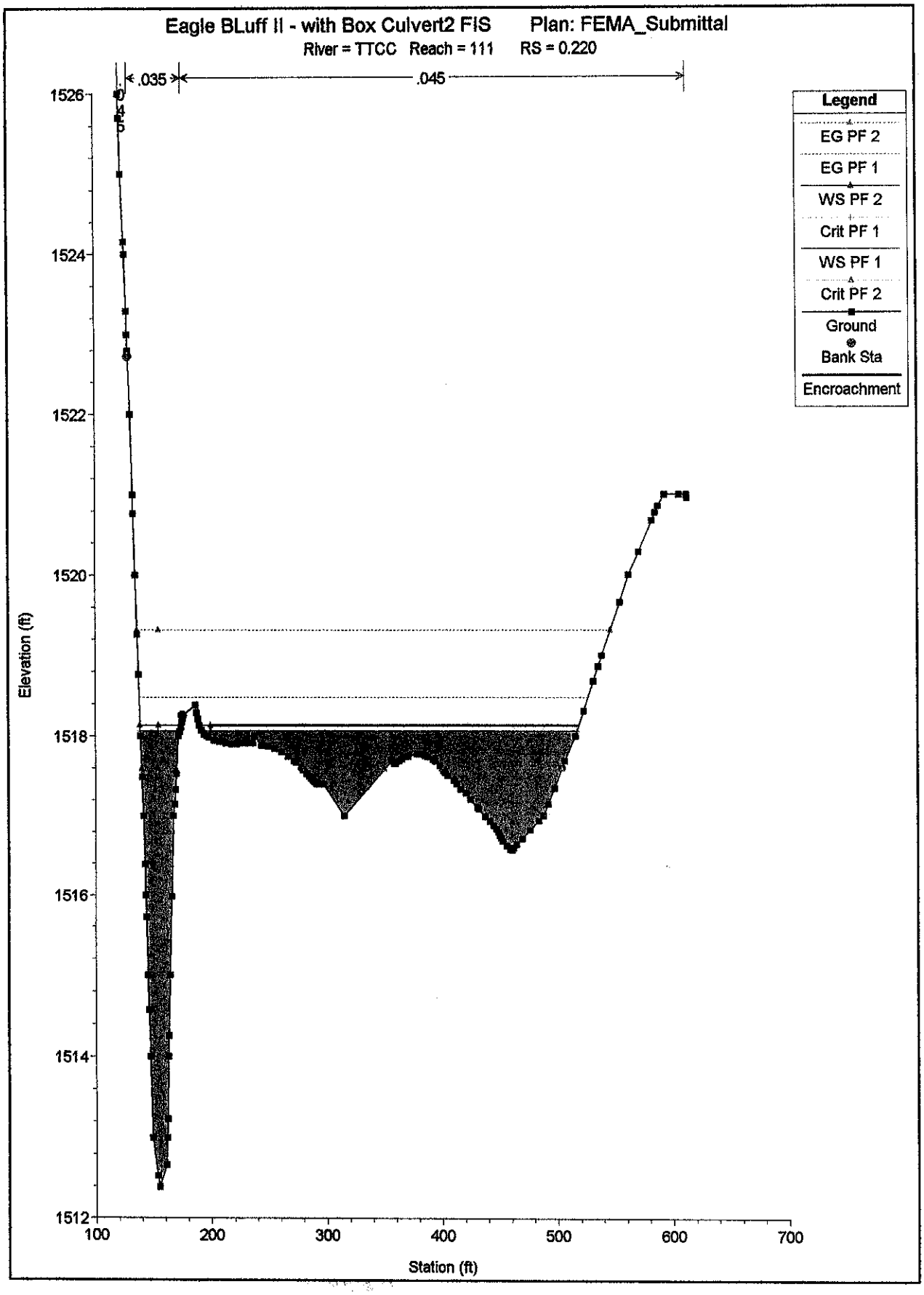


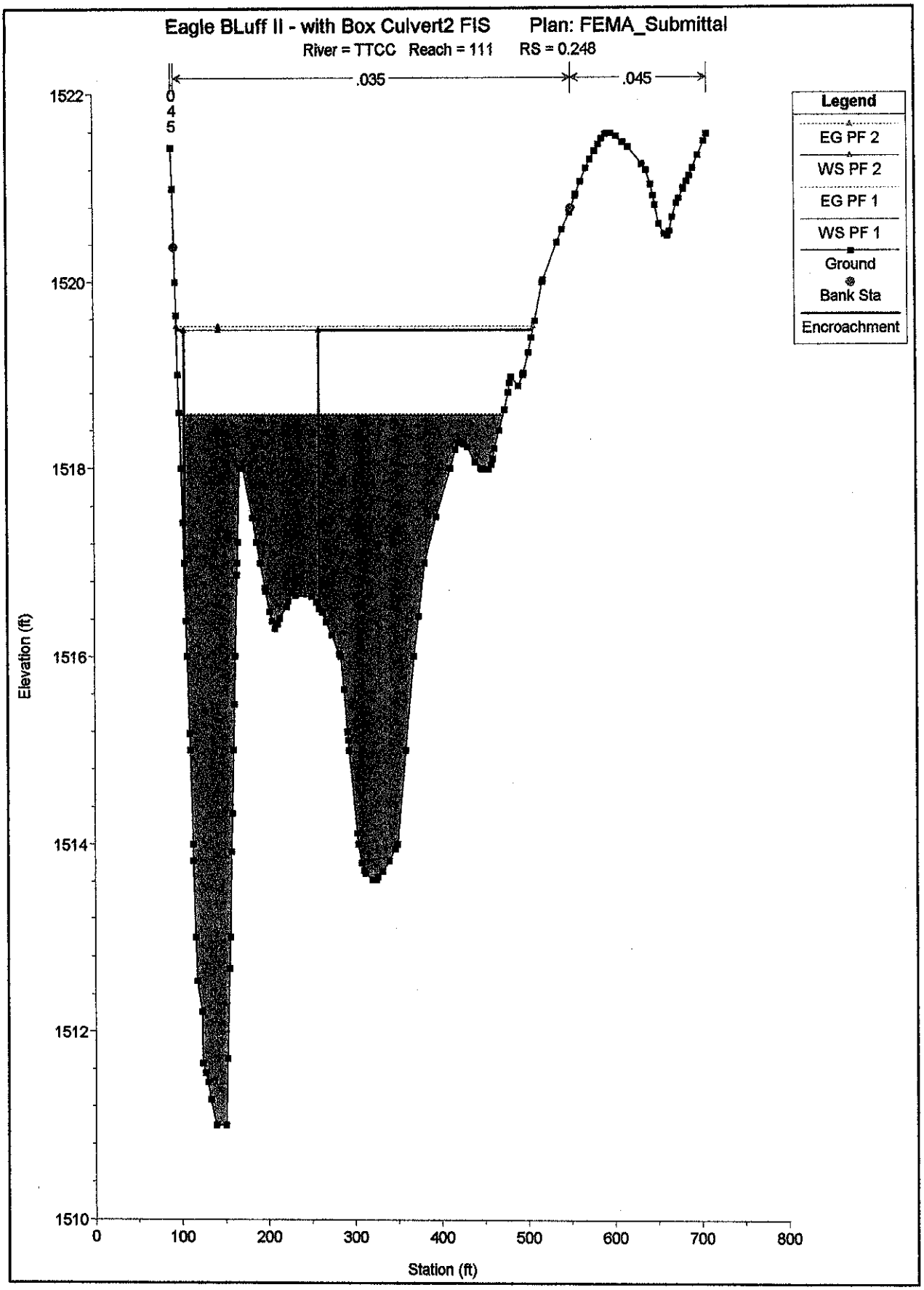
Partial GIS data

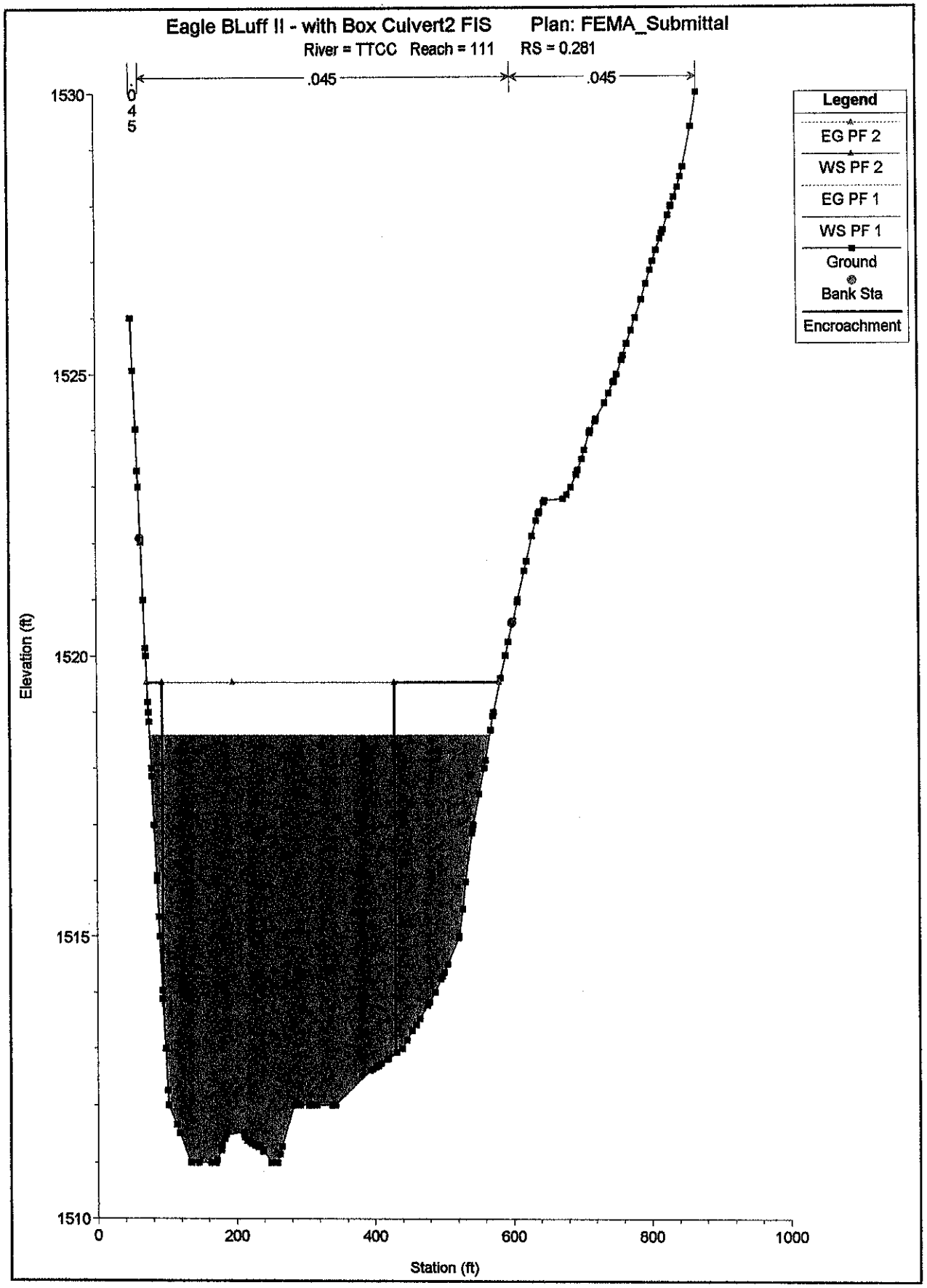

Eagle BLuff II - with Box Culvert2 FIS
Plan: FEMA_Submittal
River = TTCC Reach = 111
RS = 0.094
.04
.045
Legend
EG PF 2
WS PF 2
EG PF 1
WS PF 1
Crit PF 2
Crit PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
1520
1519
1518
1517
1516
1515
1514
1513
1512
100
200
300
400
500
600
700
800

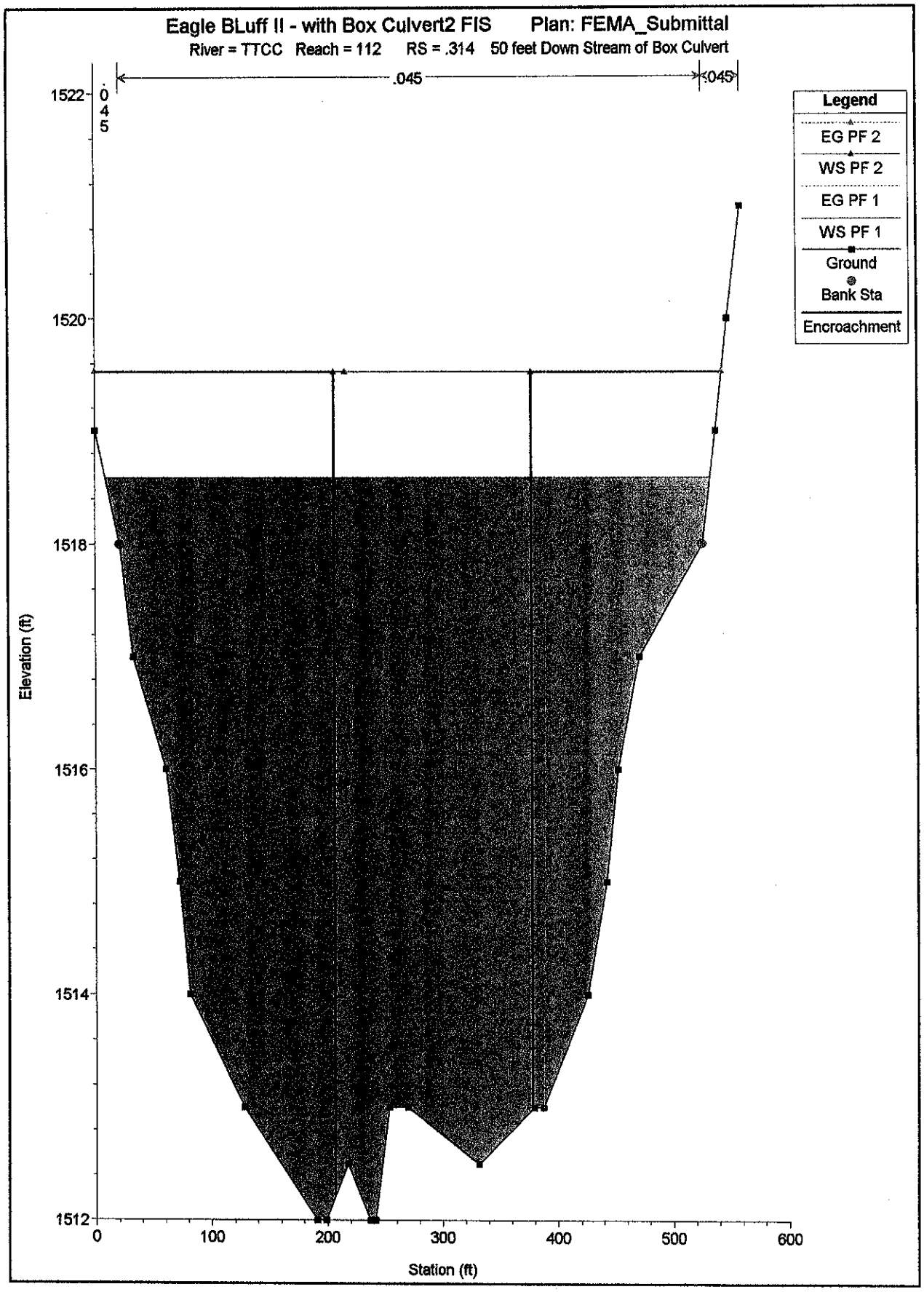

Eagle BLuff II - with Box Culvert2 FIS
Plan: FEMA_Submittal
River = TTCC Reach = 111
RS = 0.135
.04
.045
Legend
EG PF 2
WS PF 2
EG PF 1
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1524
1522
1520
1518
1516
1514
1512
100
150
200
250
300
350
400
450
500
Station (ft)

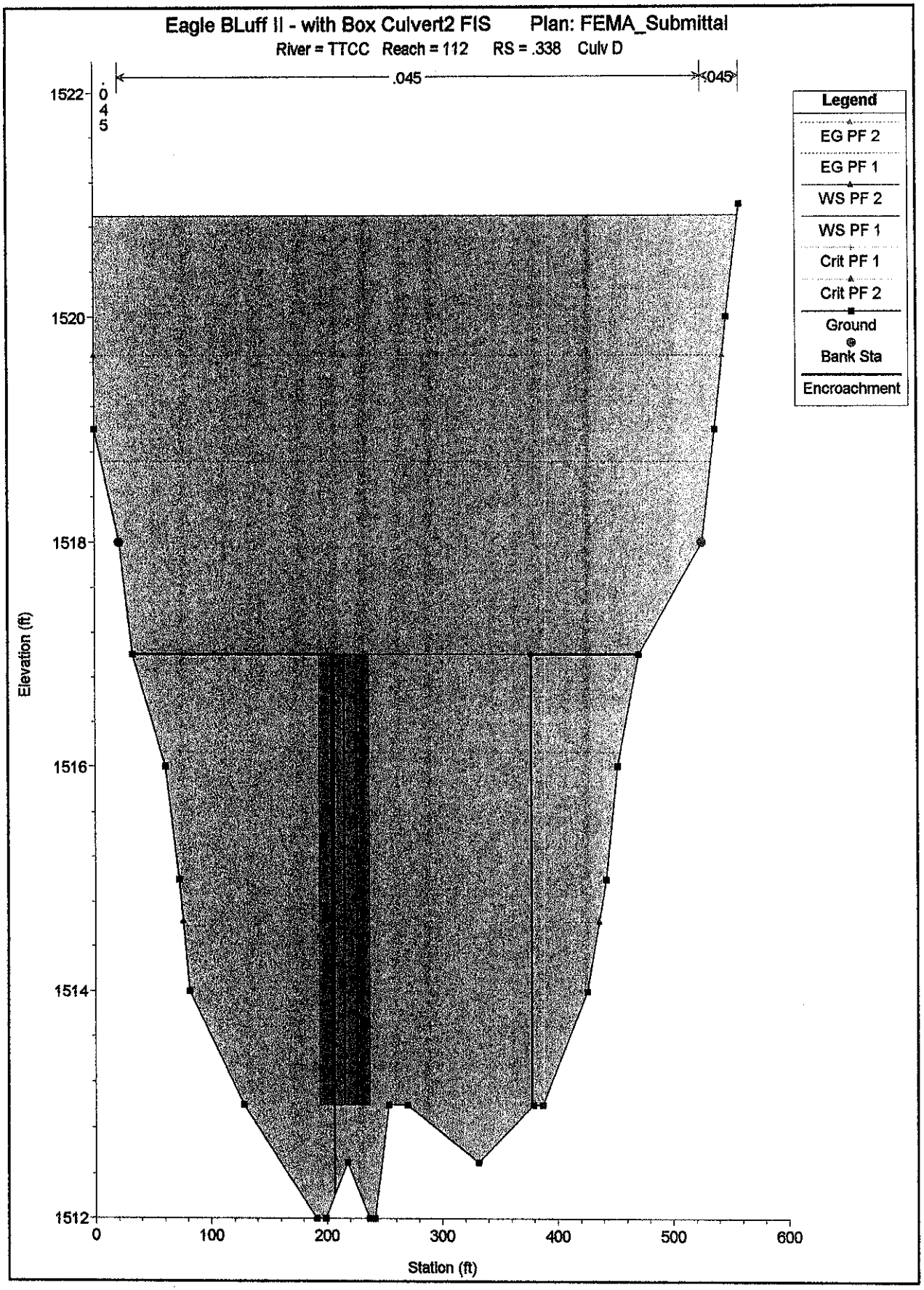

Eagle BLuff II - with Box Culvert2 FIS
Plan: FEMA_Submittal
River = TTCC Reach = 111 RS = 0.182
.045
.045
.035
Legend
EG PF 2
WS PF 2
EG PF 1
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1528
1526
1524
1522
1520
1518
1516
1514
1512
0
200
400
600
800
1000
Station (ft)

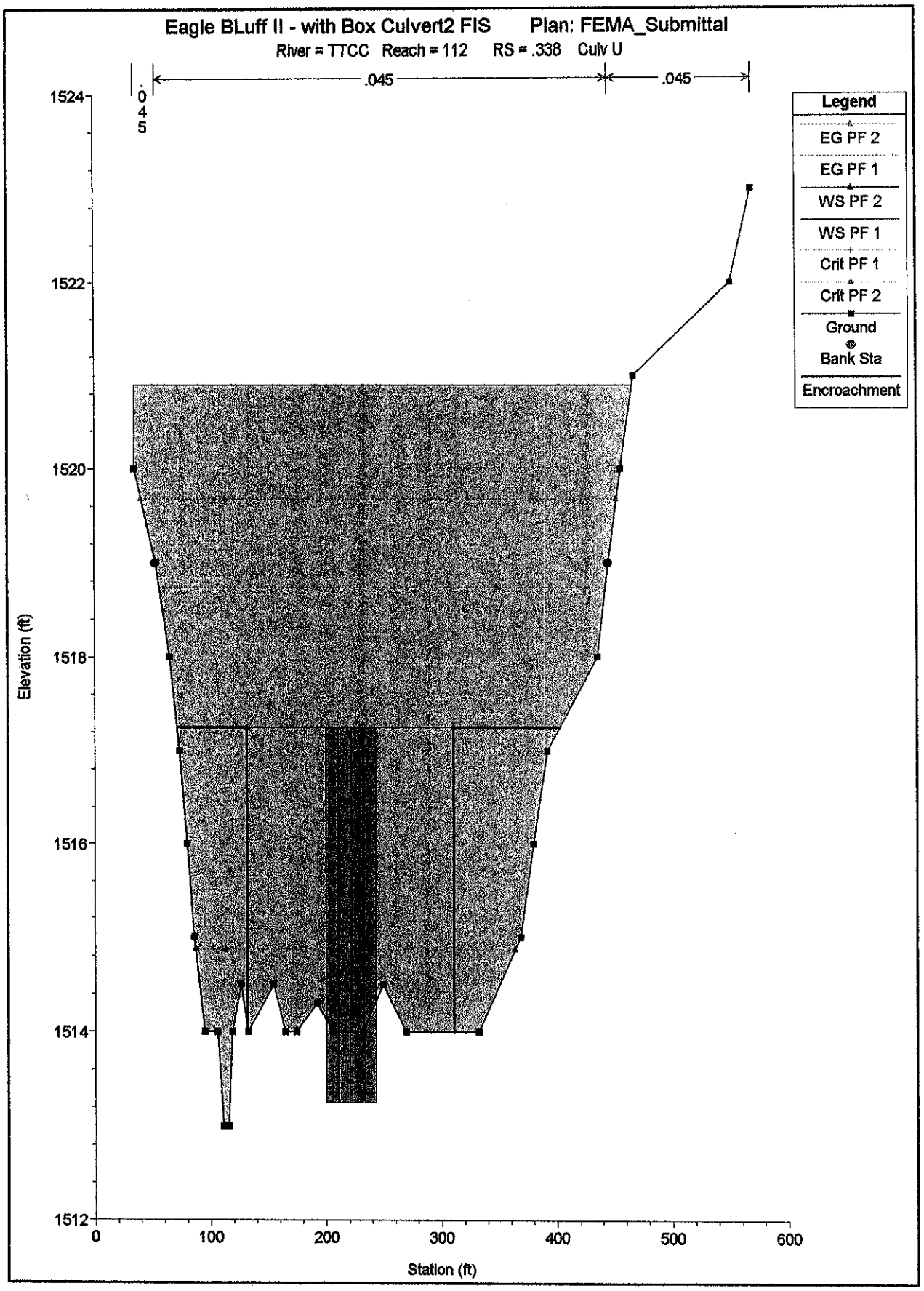

Eagle BLuff II - with Box Culvert2 FIS
Plan: FEMA_Submittal
River = TTCC Reach = 111 RS = 0.220
.035
.045
Legend
EG PF 2
EG PF 1
WS PF 2
Crit PF 1
WS PF 1
Crit PF 2
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
1526
1524
1522
1520
1518
1516
1514
1512
100
200
300
400
500
600
700

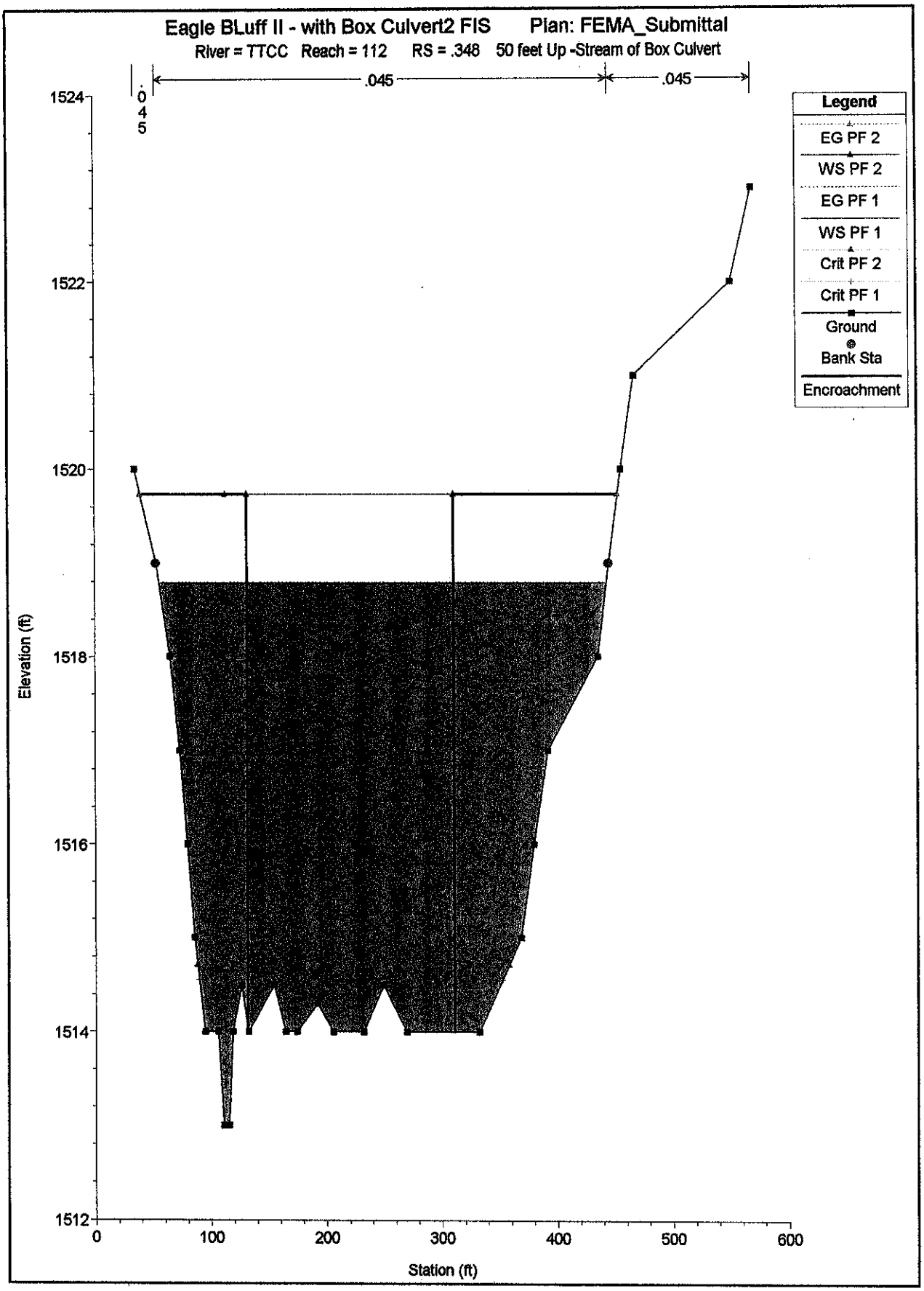

Eagle BLuff II - with Box Culvert2 FIS
Plan: FEMA_Submittal
River = TTCC Reach = 111 RS = 0.248
.035
.045
0
4
5
Legend
EG PF 2
WS PF 2
EG PF 1
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1522
1520
1518
1516
1514
1512
1510
0
100
200
300
400
500
600
700
800
Station (ft)

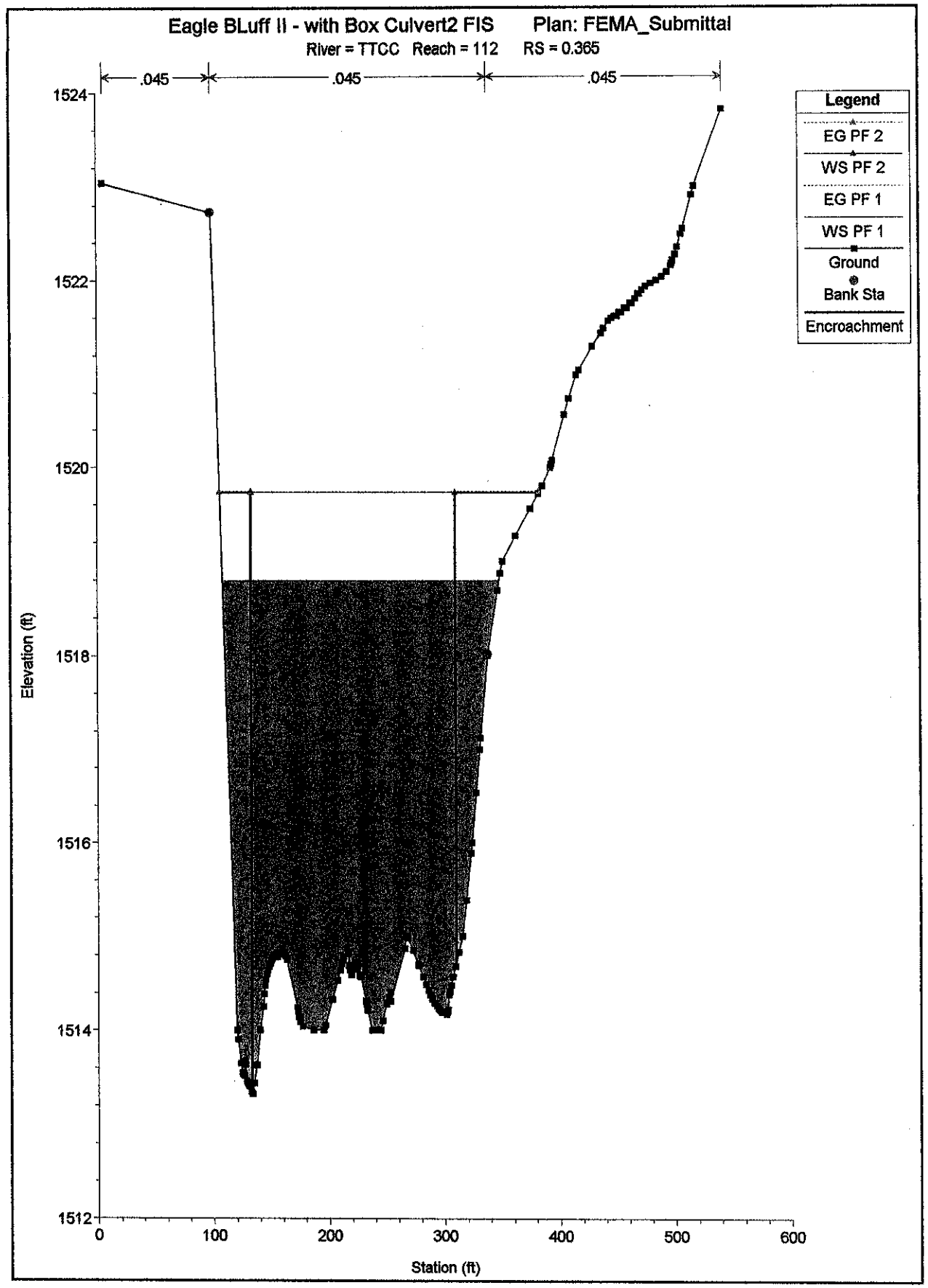

Eagle BLuff II - with Box Culvert2 FIS
Plan: FEMA_Submittal
River = TTCC Reach = 111
RS = 0.281
.045
.045
.045
Legend
EG PF 2
WS PF 2
EG PF 1
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1530
1525
1520
1515
1510
0
200
400
600
800
1000
Station (ft)

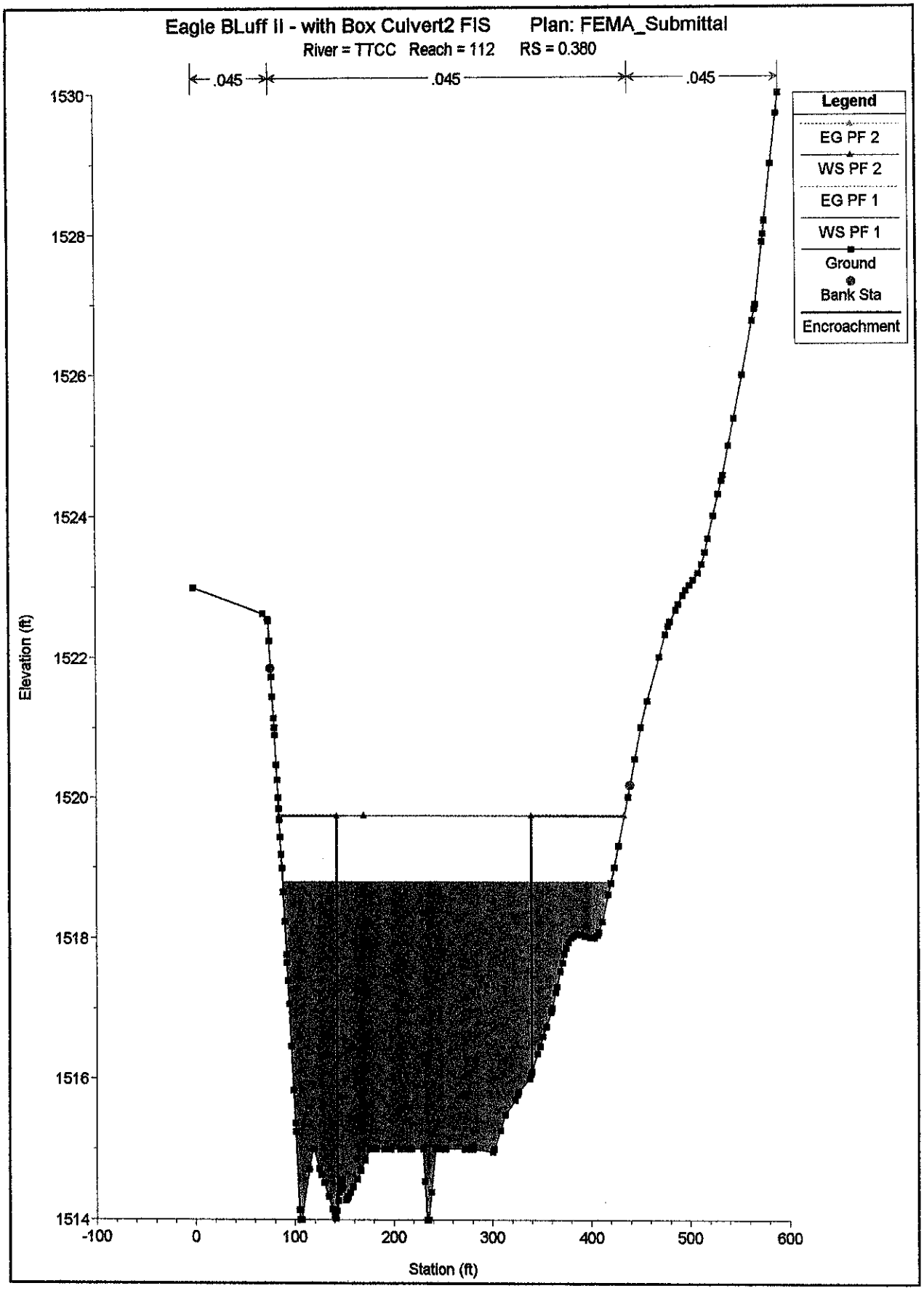

Eagle BLuff II - with Box Culvert2 FIS Plan: FEMA_Submittal
River = TTCC Reach = 112 RS = .314 50 feet Down Stream of Box Culvert
.045
.045
.045
Legend
EG PF 2
WS PF 2
EG PF 1
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1522
1520
1518
1516
1514
1512
0
100
200
300
400
500
600
Station (ft)

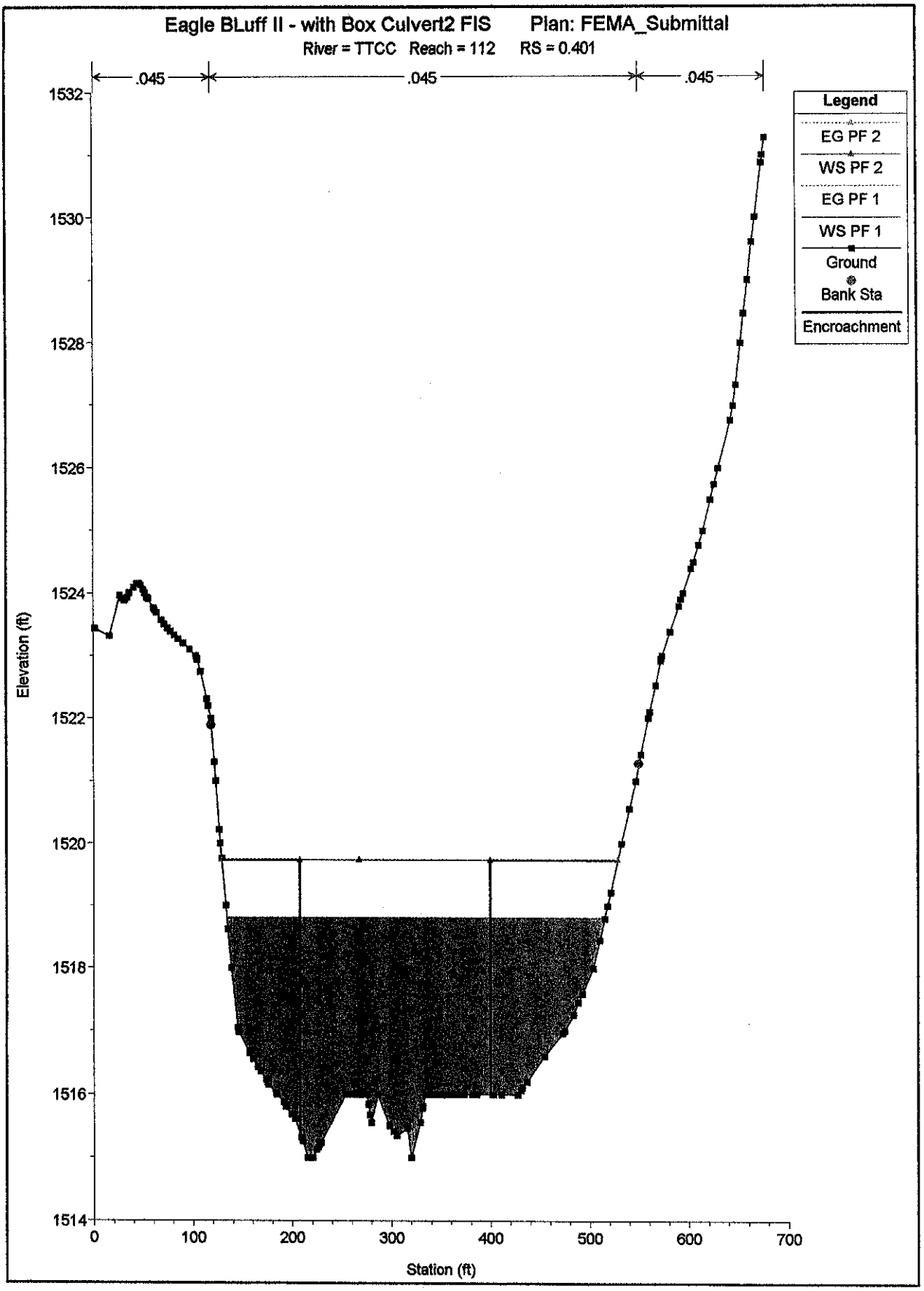

Eagle BLuff II - with Box Culvert2 FIS Plan: FEMA_Submittal
River = TTCC Reach = 112 RS = .338 Culv D
.045
.045
.045
Legend
EG PF 2
EG PF 1
WS PF 2
WS PF 1
Crit PF 1
Crit PF 2
Ground
Bank Sta
Encroachment
Elevation (ft)
1522
1520
1518
1516
1514
1512
0
100
200
300
400
500
600
Station (ft)

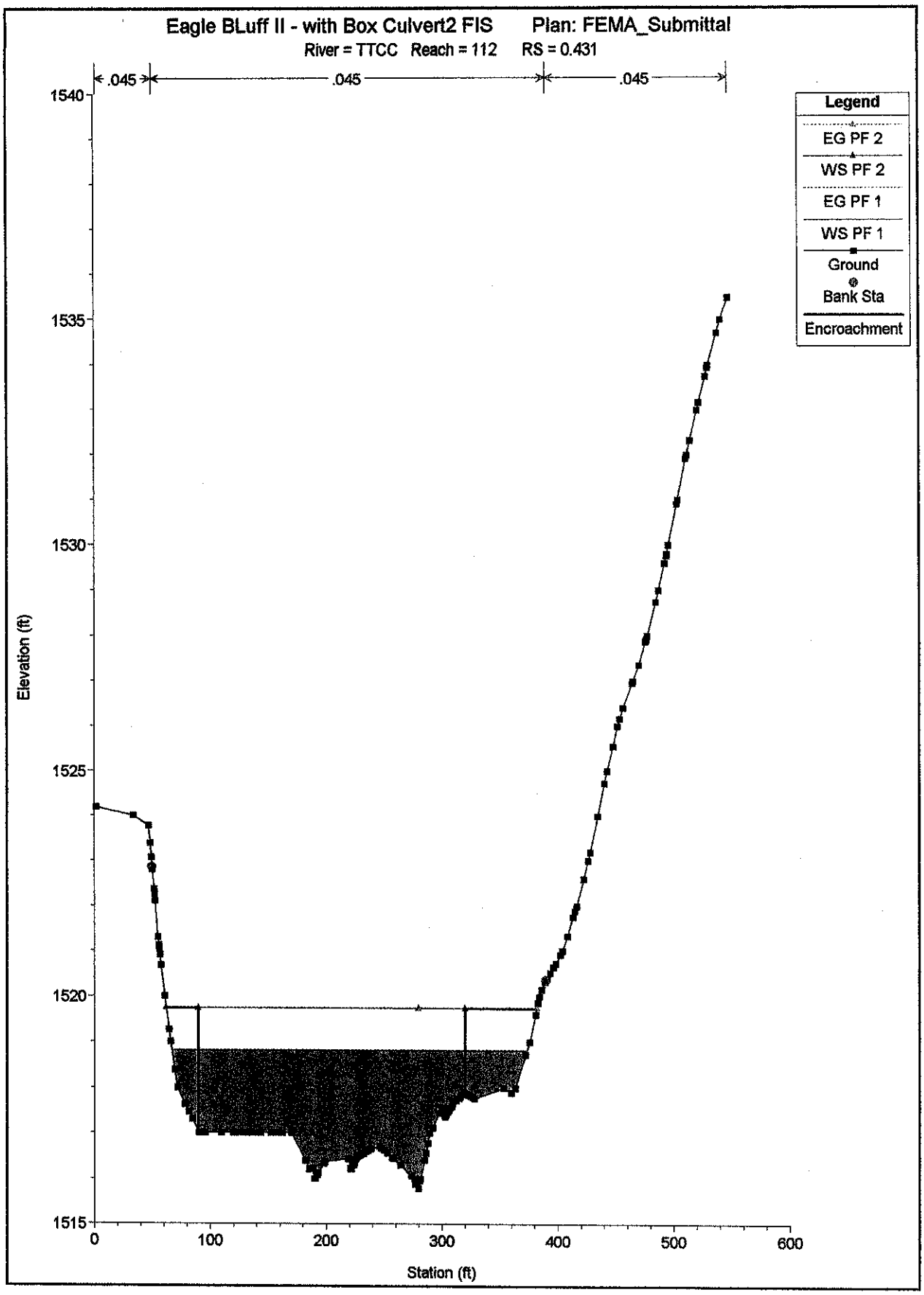

Eagle BLuff II - with Box Culvert2 FIS Plan: FEMA_Submittal
River = TTCC Reach = 112 RS = .338 Culv U
.045
.045
.045
Legend
EG PF 2
EG PF 1
WS PF 2
WS PF 1
Crit PF 1
Crit PF 2
Ground
Bank Sta
Encroachment
Elevation (ft)
1524
1522
1520
1518
1516
1514
1512
0
100
200
300
400
500
600
Station (ft)

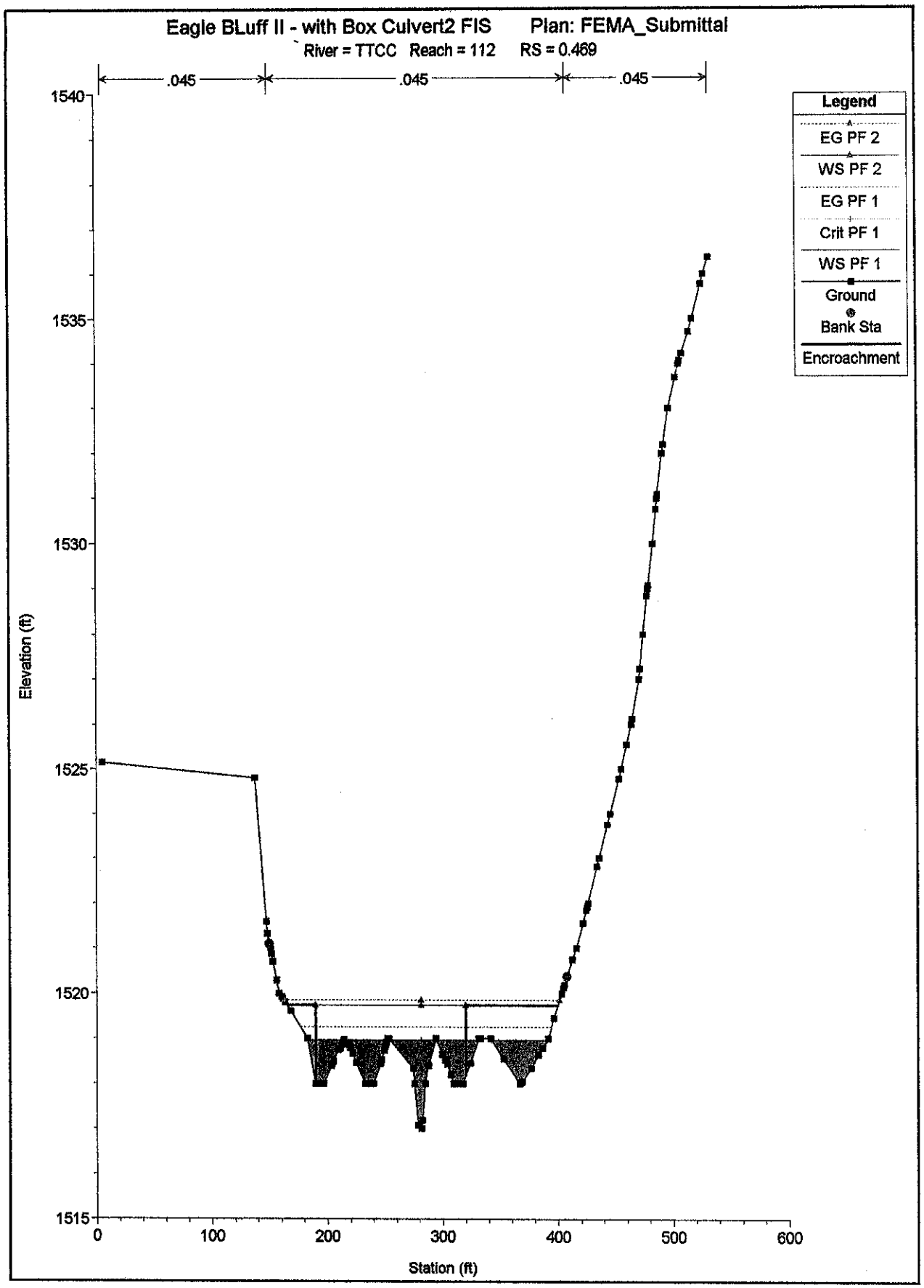

Eagle BLuff II - with Box Culvert2 FIS Plan: FEMA_Submittal
River = TTCC Reach = 112 RS = .348 50 feet Up -Stream of Box Culvert
.045
.045
.045
Legend
EG PF 2
WS PF 2
EG PF 1
WS PF 1
Crit PF 2
Crit PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1524
1522
1520
1518
1516
1514
1512
0
100
200
300
400
500
600
Station (ft)

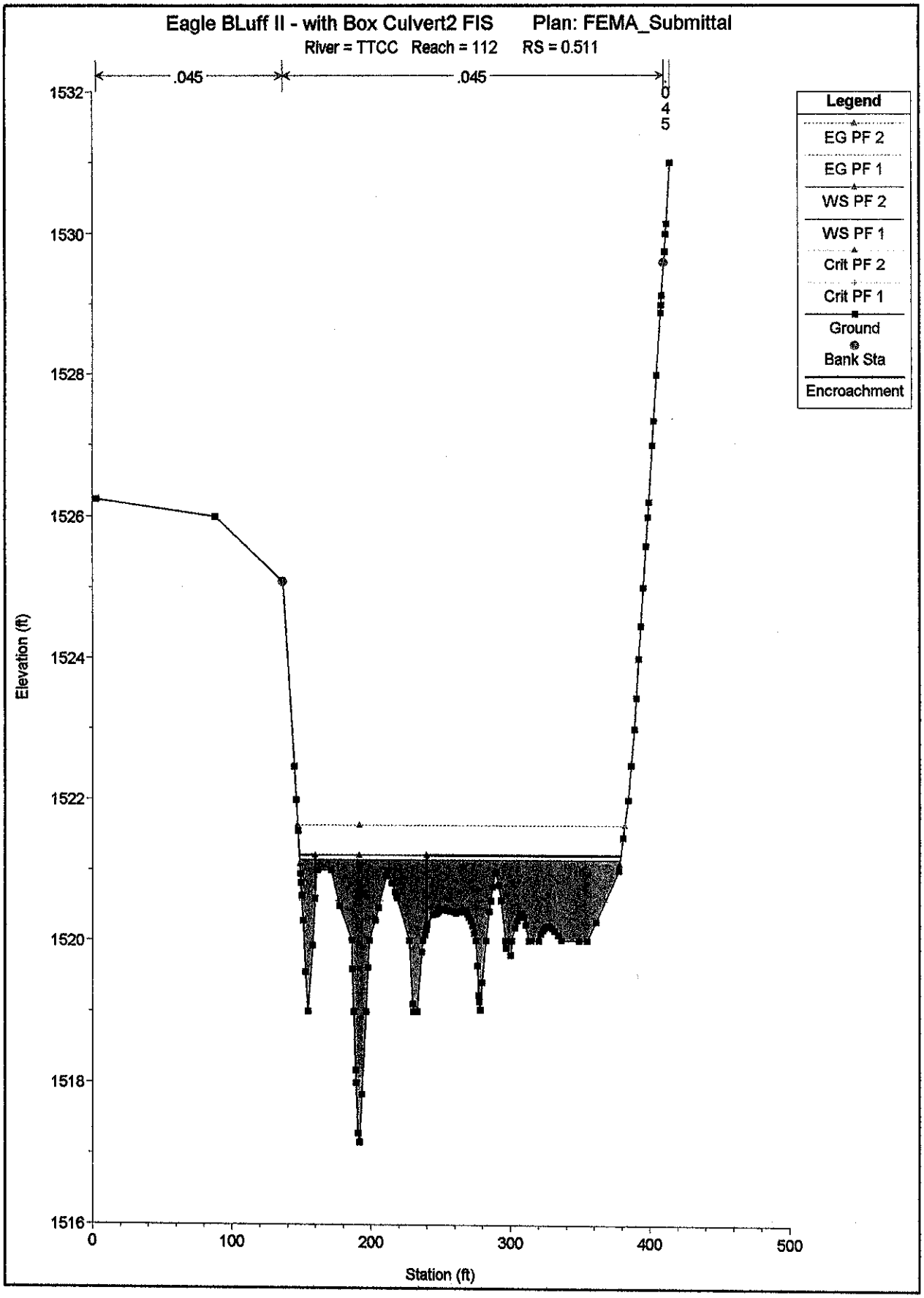

Eagle BLuff II - with Box Culvert2 FIS
Plan: FEMA_Submittal
River = TTCC Reach = 112 RS = 0.365
.045
.045
.045
Legend
EG PF 2
WS PF 2
EG PF 1
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1524
1522
1520
1518
1516
1514
1512
0
100
200
300
400
500
600
Station (ft)

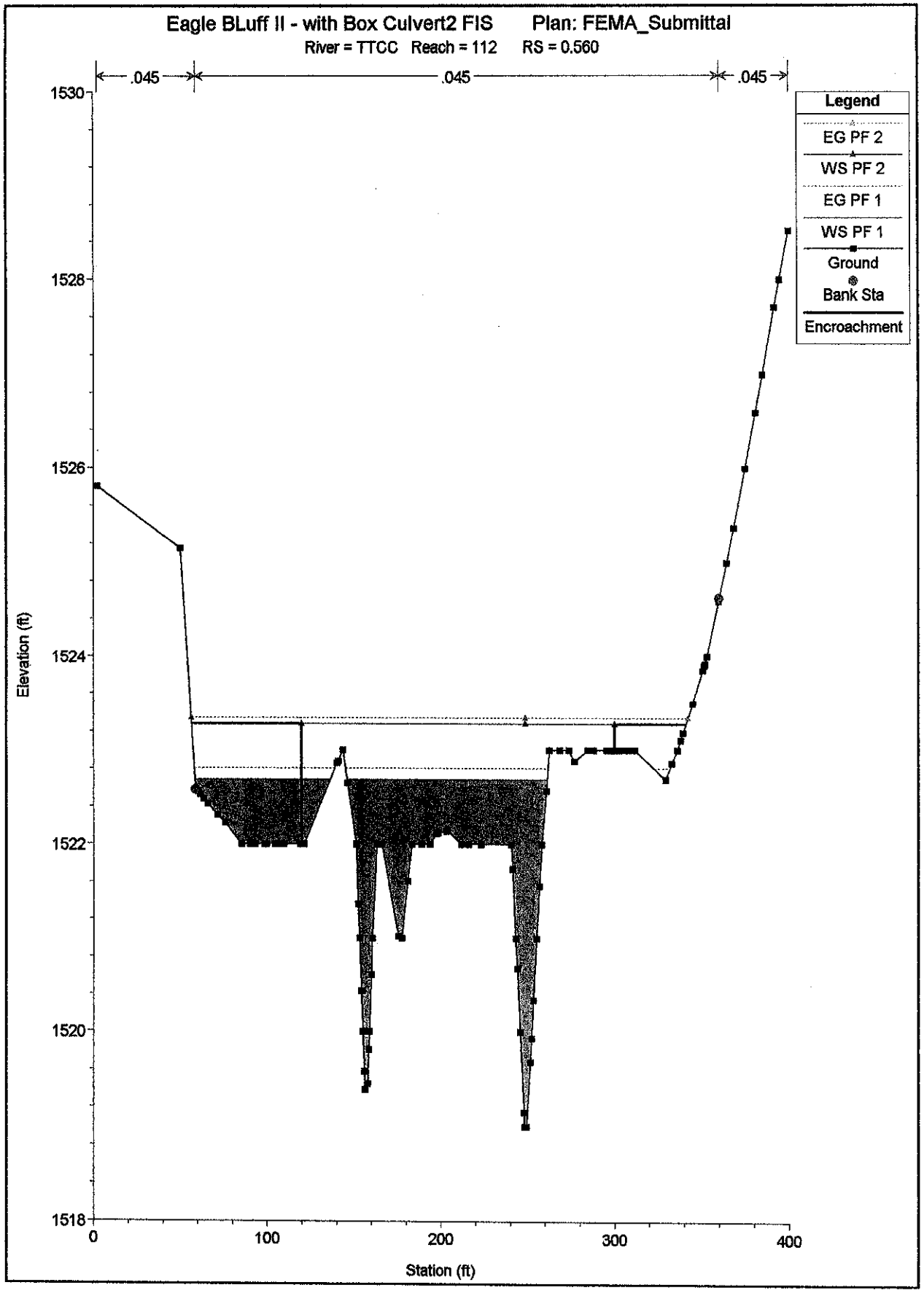

Eagle BLuff II - with Box Culvert2 FIS
Plan: FEMA_Submittal
River = TTCC Reach = 112 RS = 0.380
.045
.045
.045
Legend
EG PF 2
WS PF 2
EG PF 1
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1530
1528
1526
1524
1522
1520
1518
1516
1514
-100
0
100
200
300
400
500
600
Station (ft)

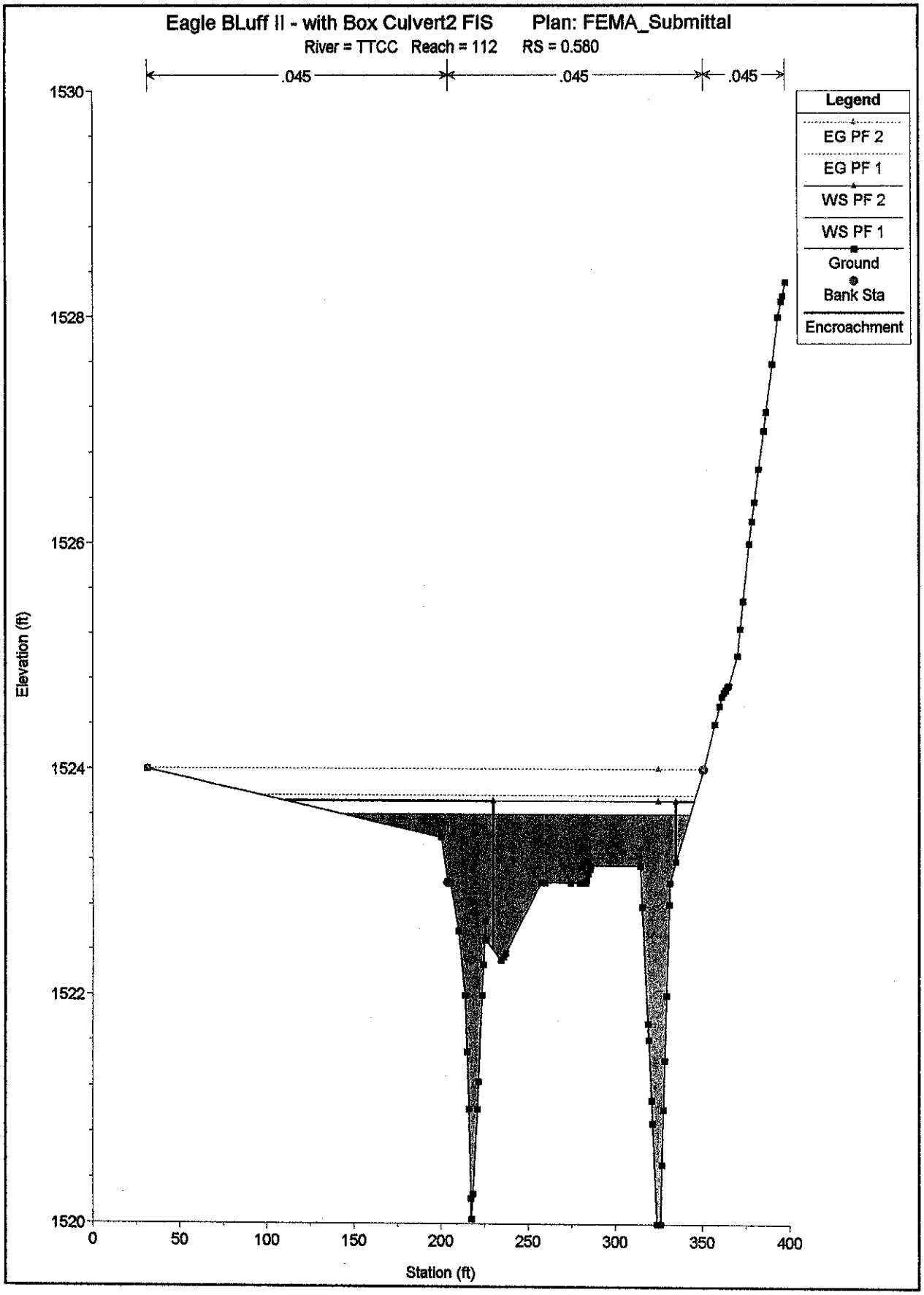

Eagle BLuff II - with Box Culvert2 FIS Plan: FEMA_Submittal
River = TTCC Reach = 112 RS = 0.401
.045
.045
.045
Legend
EG PF 2
WS PF 2
EG PF 1
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1532
1530
1528
1526
1524
1522
1520
1518
1516
1514
0
100
200
300
400
500
600
700
Station (ft)

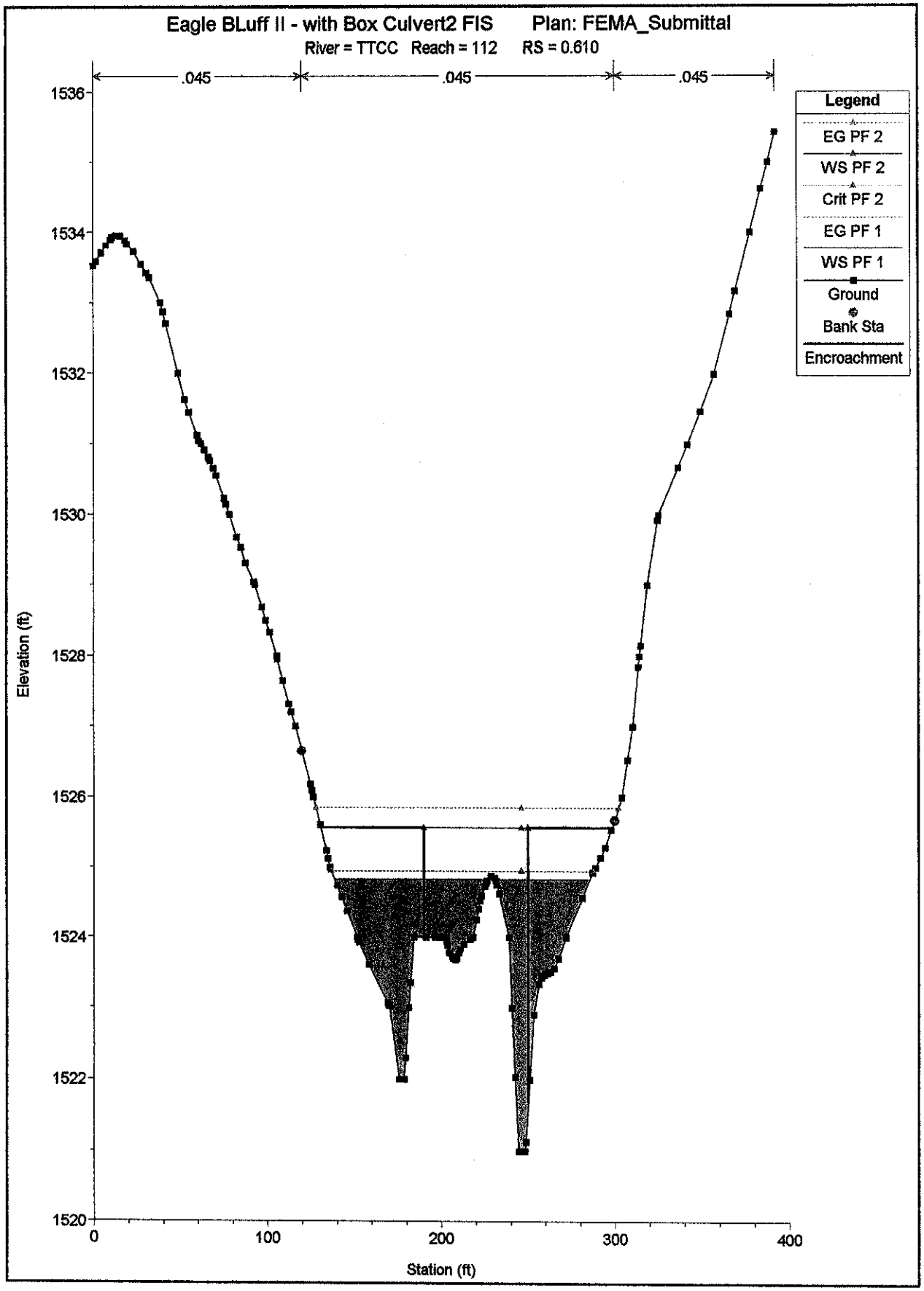

Eagle BLuff II - with Box Culvert2 FIS Plan: FEMA_Submittal
River = TTCC Reach = 112 RS = 0.431
.045
.045
.045
Legend
EG PF 2
WS PF 2
EG PF 1
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1540
1535
1530
1525
1520
1515
0
100
200
300
400
500
600
Station (ft)

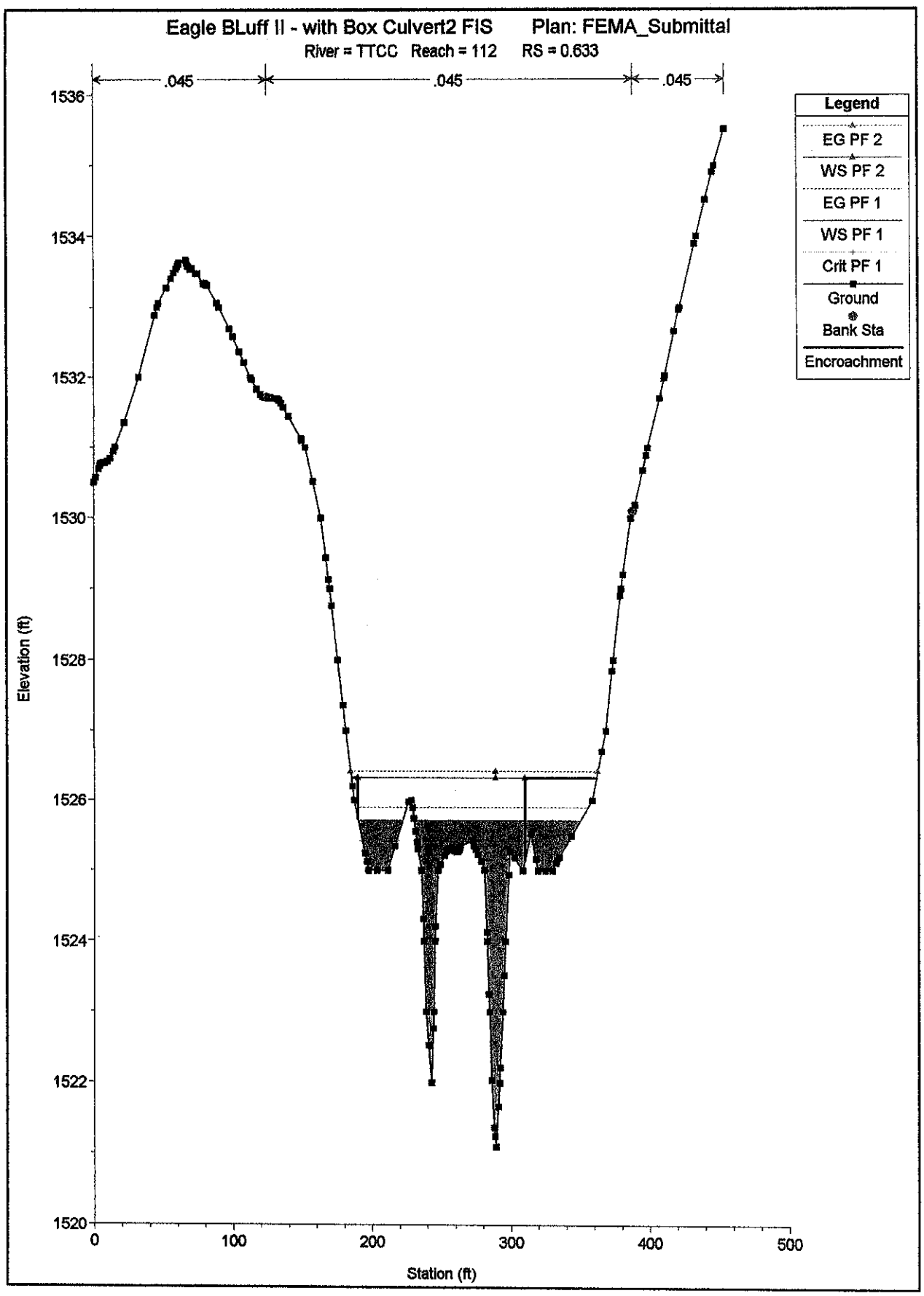

Eagle BLuff II - with Box Culvert2 FIS
Plan: FEMA_Submittal
River = TTCC Reach = 112 RS = 0.469
.045
.045
.045
Legend
EG PF 2
WS PF 2
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1540
1535
1530
1525
1520
1515
0
100
200
300
400
500
600
Station (ft)

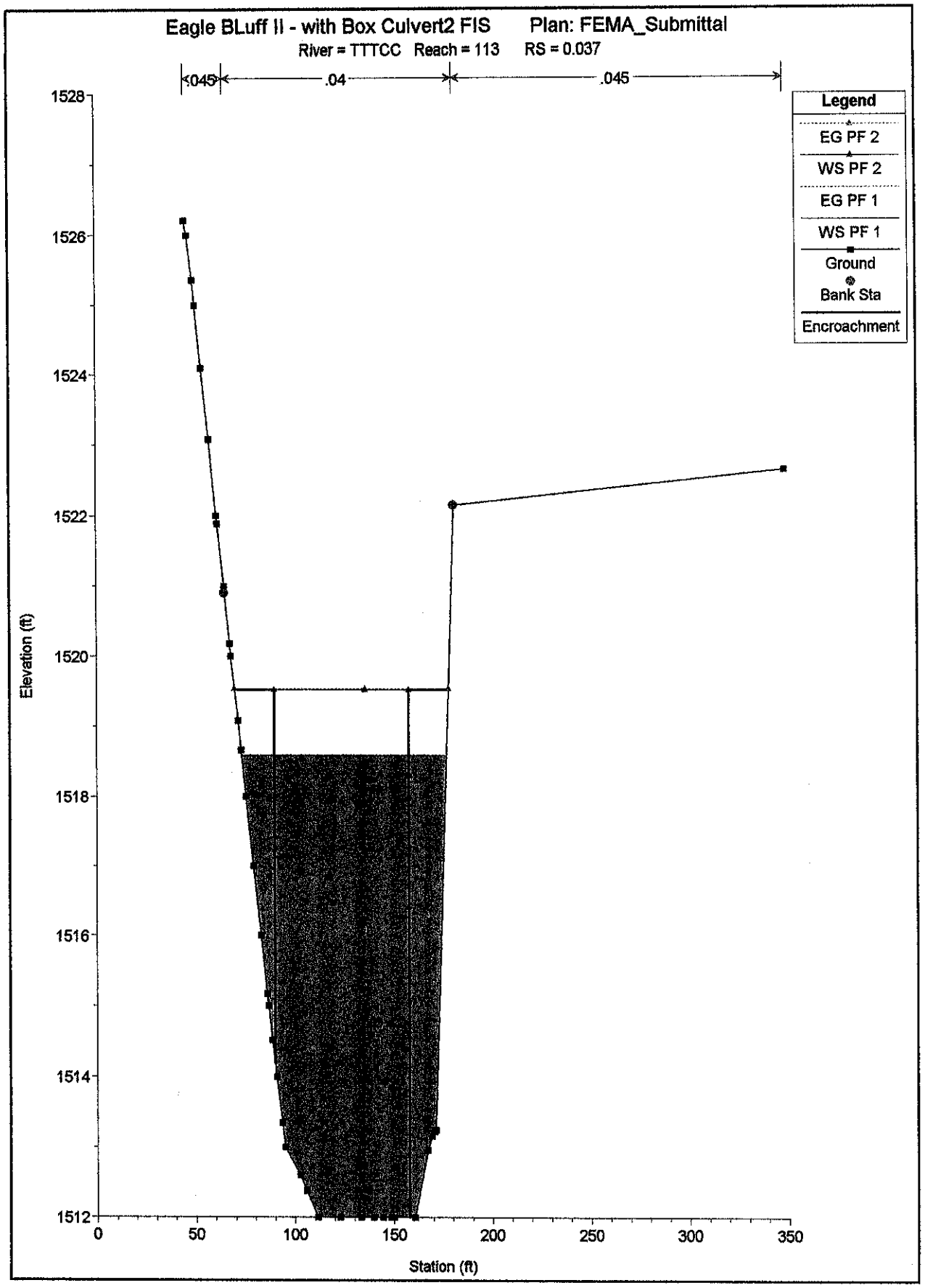

Eagle BLuff II - with Box Culvert2 FIS Plan: FEMA_Submittal
River = TTCC Reach = 112 RS = 0.511
.045
.045
.045
Legend
EG PF 2
EG PF 1
WS PF 2
WS PF 1
Crit PF 2
Crit PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1532
1530
1528
1526
1524
1522
1520
1518
1516
0
100
200
300
400
500
Station (ft)

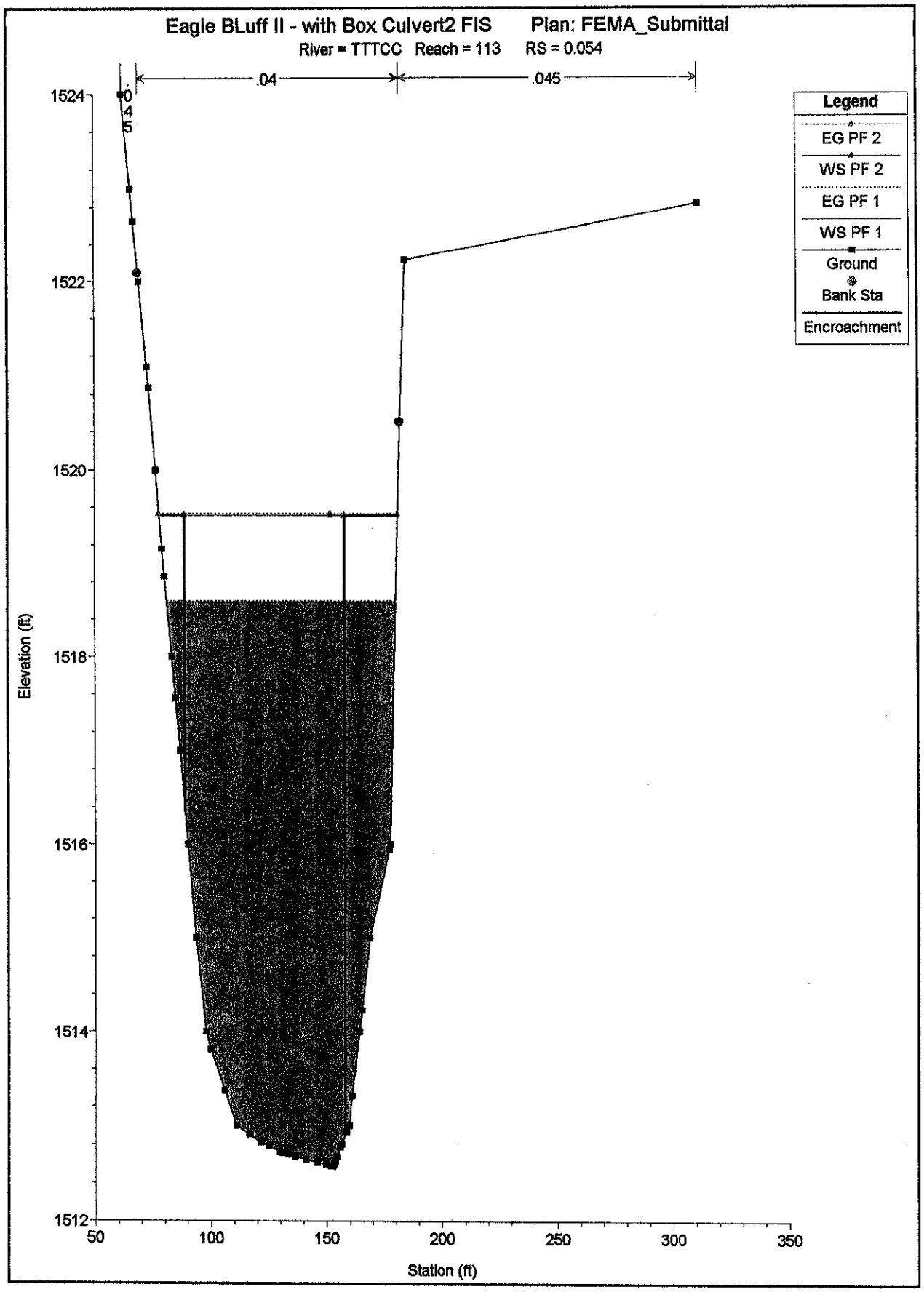

Eagle BLuff II - with Box Culvert2 FIS Plan: FEMA_Submittal
River = TTCC Reach = 112 RS = 0.560
.045
.045
.045
Legend
EG PF 2
WS PF 2
EG PF 1
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1530
1528
1526
1524
1522
1520
1518
0
100
200
300
400
Station (ft)

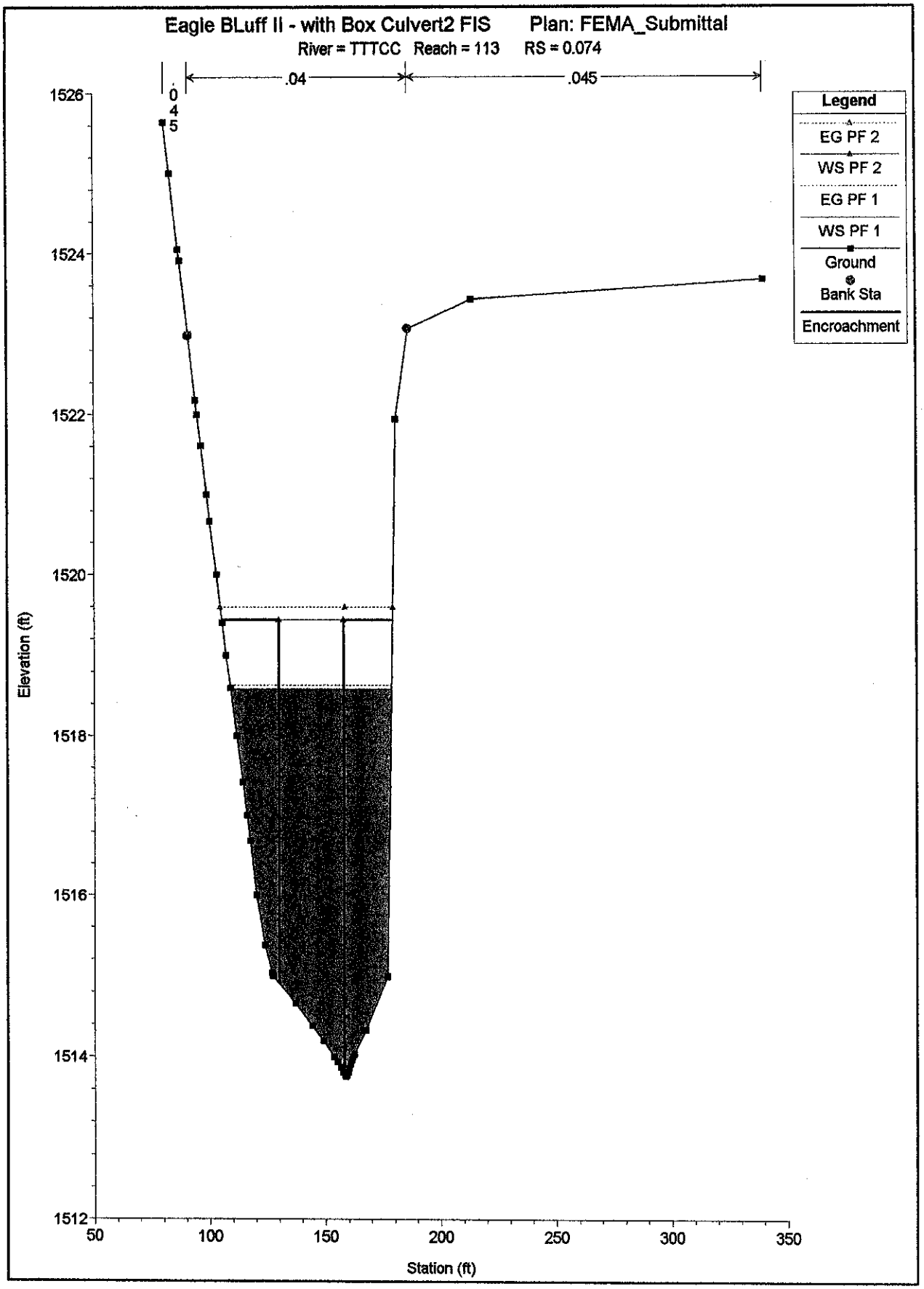

Eagle BLuff II - with Box Culvert2 FIS Plan: FEMA_Submittal
River = TTCC Reach = 112 RS = 0.580
.045
.045
.045
Legend
EG PF 2
EG PF 1
WS PF 2
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1530
1528
1526
1524
1522
1520
0
50
100
150
200
250
300
350
400
Station (ft)

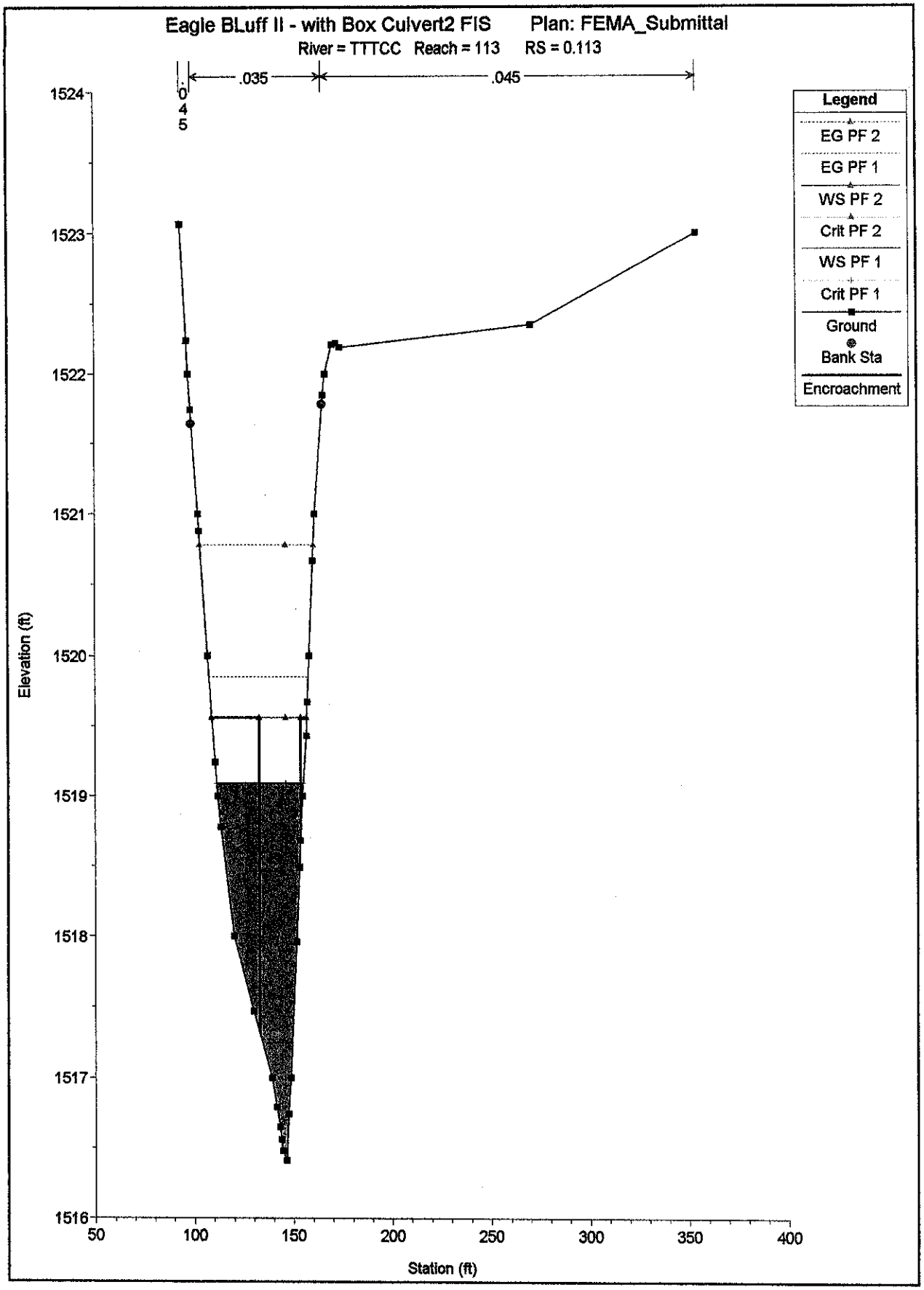

Eagle BLuff II - with Box Culvert2 FIS Plan: FEMA_Submittal
River = TTCC Reach = 112 RS = 0.610
.045
.045
.045
Legend
EG PF 2
WS PF 2
Crit PF 2
EG PF 1
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1536
1534
1532
1530
1528
1526
1524
1522
1520
0
100
200
300
400
Station (ft)

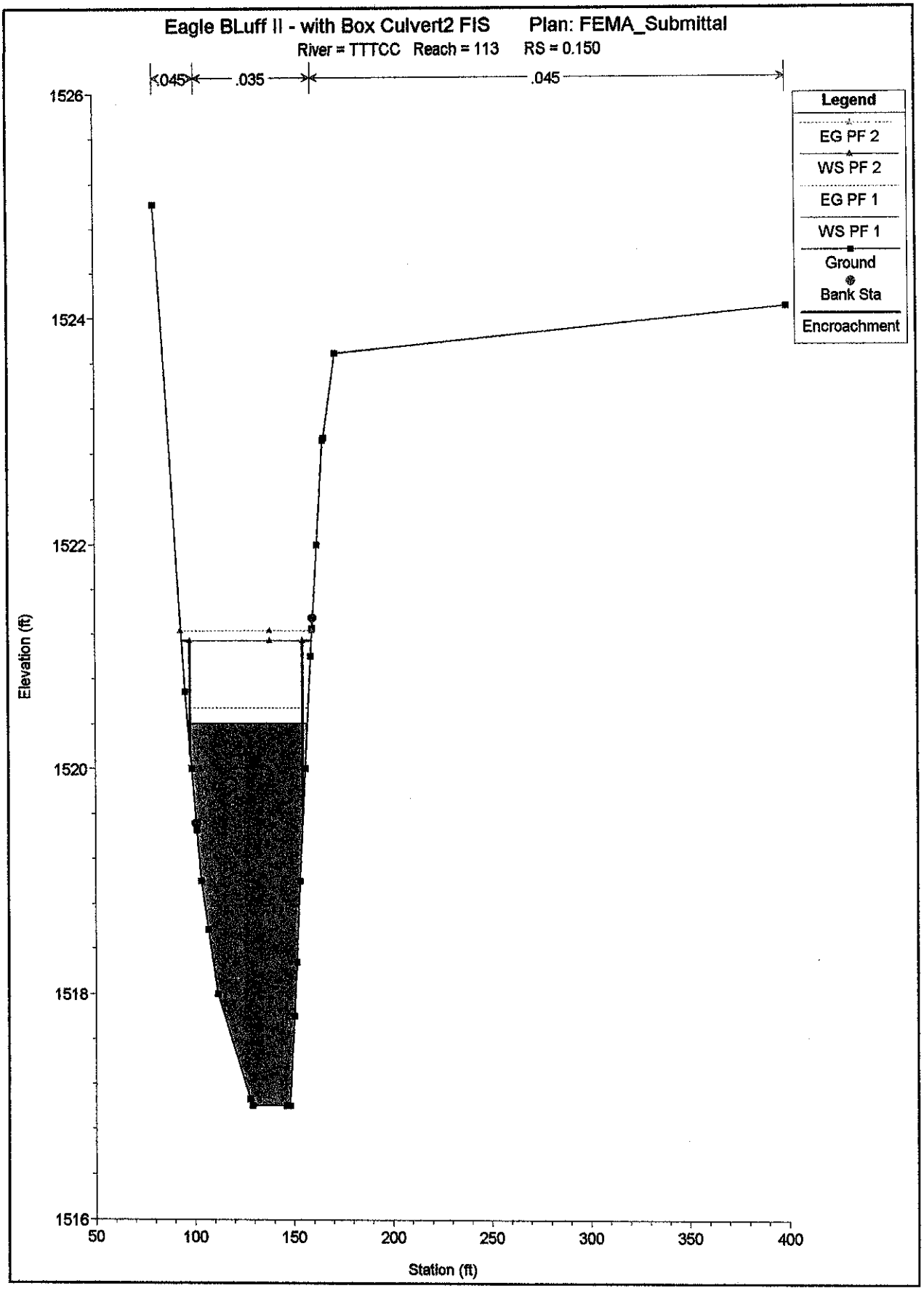

Eagle BLuff II - with Box Culvert2 FIS Plan: FEMA_Submittal
River = TTCC Reach = 112 RS = 0.633
.045
.045
.045
Legend
EG PF 2
WS PF 2
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1536
1534
1532
1530
1528
1526
1524
1522
1520
0
100
200
300
400
500
Station (ft)

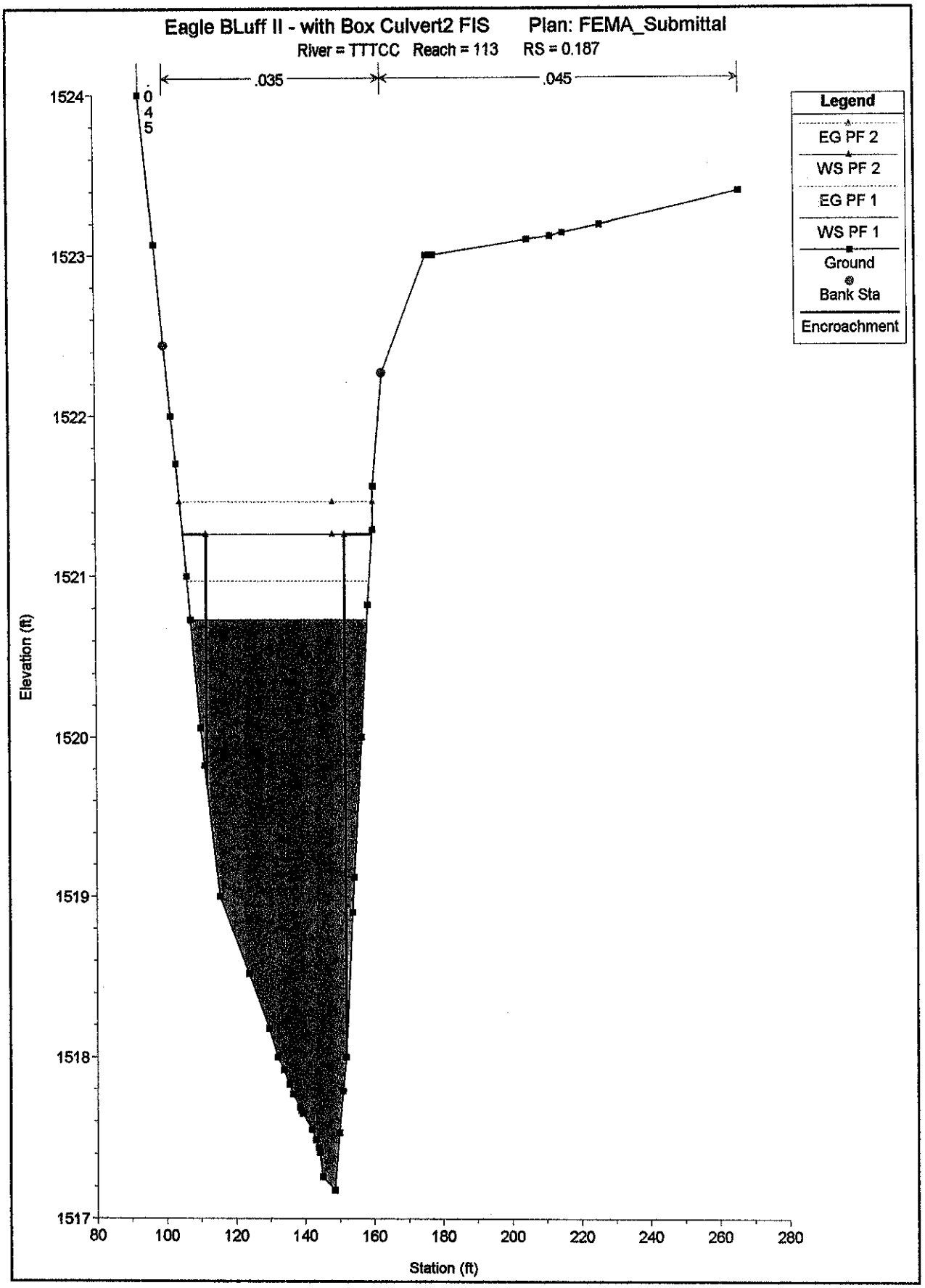

Eagle BLuff II - with Box Culvert2 FIS
Plan: FEMA_Submittal
River = TTTCC Reach = 113 RS = 0.037
.045
.04
.045
Legend
EG PF 2
WS PF 2
EG PF 1
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1528
1526
1524
1522
1520
1518
1516
1514
1512
0
50
100
150
200
250
300
350
Station (ft)

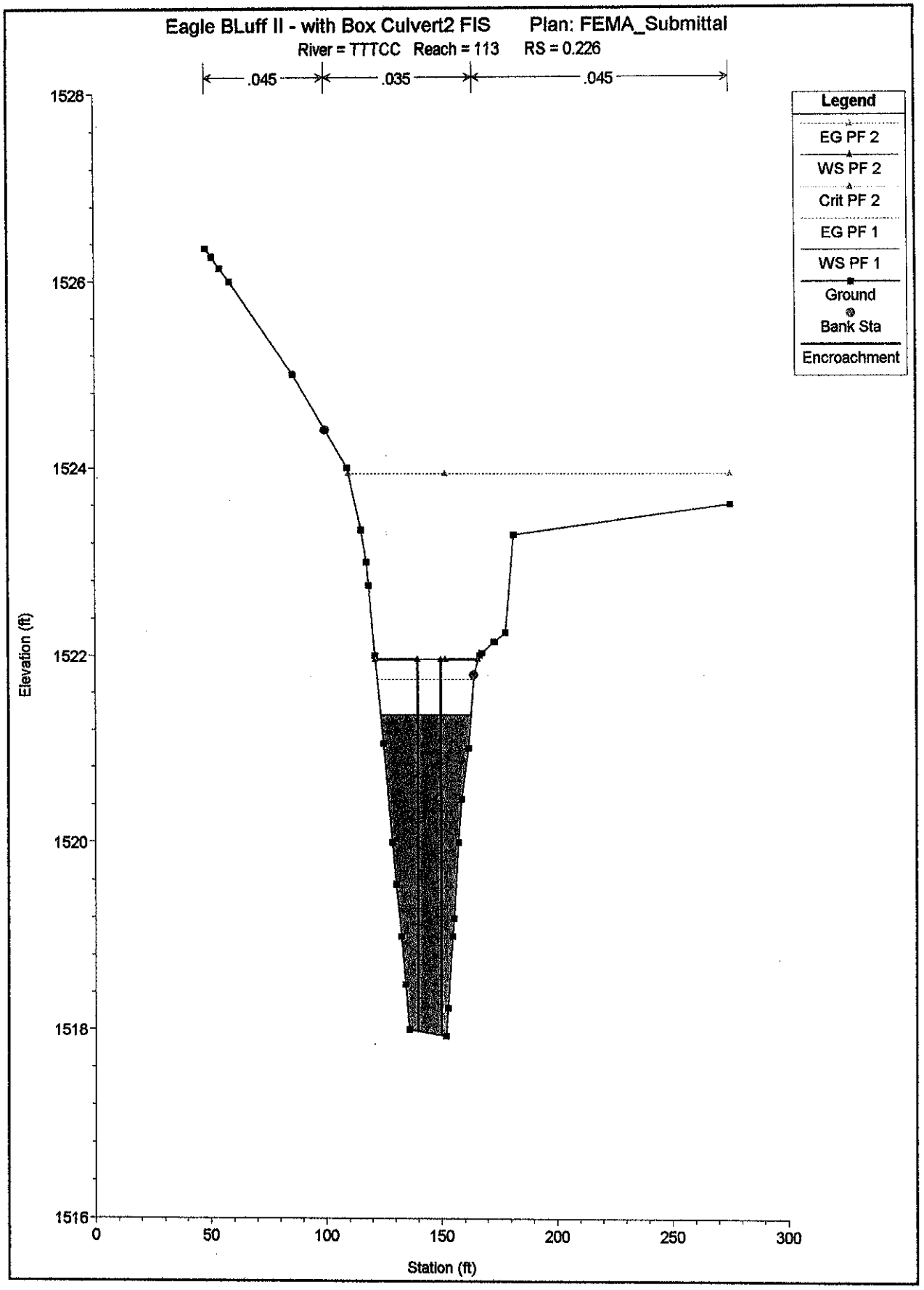

Eagle BLuff II - with Box Culvert2 FIS Plan: FEMA_Submittal
River = TTTCC Reach = 113 RS = 0.054
.04
.045
.045
Legend
EG PF 2
WS PF 2
EG PF 1
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1524
1522
1520
1518
1516
1514
1512
50
100
150
200
250
300
350
Station (ft)


Eagle BLuff II - with Box Culvert2 FIS
Plan: FEMA_Submittal
River = TTTCC Reach = 113 RS = 0.074
.04
.045
0
4
5
Legend
EG PF 2
WS PF 2
EG PF 1
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1526
1524
1522
1520
1518
1516
1514
1512
50
100
150
200
250
300
350
Station (ft)


Eagle BLuff II - with Box Culvert2 FIS Plan: FEMA_Submittal
River = TTTCC Reach = 113 RS = 0.113
.035
.045
.045
Legend
EG PF 2
EG PF 1
WS PF 2
Crit PF 2
WS PF 1
Crit PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1524
1523
1522
1521
1520
1519
1518
1517
1516
50
100
150
200
250
300
350
400
Station (ft)


Eagle BLuff II - with Box Culvert2 FIS
Plan: FEMA_Submittal
River = TTTCC Reach = 113 RS = 0.150
.045
.035
.045
Legend
EG PF 2
WS PF 2
EG PF 1
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1526
1524
1522
1520
1518
1516
50
100
150
200
250
300
350
400
Station (ft)


Eagle BLuff II - with Box Culvert2 FIS
Plan: FEMA_Submittal
River = TTTCC Reach = 113 RS = 0.187
.035
.045
.045
Legend
EG PF 2
WS PF 2
EG PF 1
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
1517
1518
1519
1520
1521
1522
1523
1524
80
100
120
140
160
180
200
220
240
260
280


Eagle BLuff II - with Box Culvert2 FIS
Plan: FEMA_Submittal
River = TTTCC Reach = 113 RS = 0.226
.045
.035
.045
Legend
EG PF 2
WS PF 2
Crit PF 2
EG PF 1
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1528
1526
1524
1522
1520
1518
1516
0
50
100
150
200
250
300
Station (ft)

HEC-RAS Plan: FEMA

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
111	0.094	1000.00	1512.95	1515.90	1514.83	1516.04	0.003001	2.99	334.16	186.95	0.39
111	0.094	1000.00	1512.95	1516.58	1515.11	1516.86	0.003004	4.24	235.74	72.00	0.41
111	0.135	1000.00	1513.74	1516.36		1516.44	0.001451	2.17	460.61	241.98	0.28
111	0.135	1000.00	1513.74	1517.08		1517.16	0.000855	2.25	443.83	144.00	0.23
111	0.182	1000.00	1512.03	1516.66		1516.71	0.001102	2.78	582.52	332.64	0.29
111	0.182	1000.00	1512.03	1517.10		1517.70	0.005671	6.98	178.60	67.00	0.65
111	0.220	1000.00	1512.39	1518.06	1518.06	1518.47	0.004755	6.15	305.43	358.50	0.60
111	0.220	1000.00	1512.39	1518.13	1517.59	1519.32	0.009873	8.73	115.47	45.72	0.86
111	0.248	1000.00	1511.00	1518.56		1518.58	0.000145	0.99	1012.47	373.97	0.11
111	0.248	1000.00	1511.00	1519.48		1519.52	0.000202	1.53	654.96	155.00	0.13
111	0.281	1000.00	1511.00	1518.58		1518.58	0.000011	0.35	2837.26	490.84	0.03
111	0.281	1000.00	1511.00	1519.52		1519.53	0.000009	0.39	2596.53	335.00	0.02
112	.314	469.00	1512.00	1518.58		1518.58	0.000005	0.20	2328.99	523.46	0.02
112	.314	469.00	1512.00	1519.52		1519.53	0.000012	0.40	1174.86	171.00	0.03
112	.338	Culvert									
112	.348	469.00	1513.00	1518.79	1514.55	1518.79	0.000015	0.32	1486.58	387.22	0.03
112	.348	469.00	1514.00	1519.73	1514.72	1519.73	0.000022	0.47	1003.71	179.00	0.03
112	0.365	469.00	1513.32	1518.79		1518.79	0.000034	0.49	950.80	239.16	0.04
112	0.365	469.00	1513.32	1519.73		1519.73	0.000026	0.50	944.05	177.00	0.04
112	0.380	469.00	1514.00	1518.79		1518.79	0.000041	0.45	1042.10	332.21	0.04
112	0.380	469.00	1514.00	1519.73		1519.73	0.000031	0.50	929.69	197.00	0.04
112	0.401	469.00	1515.00	1518.79		1518.80	0.000058	0.47	989.60	380.82	0.05
112	0.401	469.00	1515.00	1519.73		1519.74	0.000056	0.61	770.13	192.00	0.05
112	0.431	469.00	1515.79	1518.80		1518.82	0.000327	0.87	539.36	306.40	0.12
112	0.431	469.00	1515.79	1519.74		1519.75	0.000103	0.68	684.90	230.00	0.07
112	0.469	469.00	1517.00	1518.96	1518.96	1519.25	0.036341	4.30	108.98	192.11	1.01
112	0.469	469.00	1517.00	1519.74		1519.85	0.004347	2.63	178.09	130.00	0.40
112	0.511	469.00	1517.16	1521.14	1520.57	1521.21	0.004412	2.12	221.26	229.91	0.38
112	0.511	469.00	1517.16	1521.21	1521.09	1521.64	0.023244	5.27	89.06	80.00	0.88
112	0.560	469.00	1519.00	1522.69		1522.81	0.008657	2.79	168.38	192.76	0.52
112	0.560	469.00	1519.00	1523.28		1523.35	0.002909	2.05	228.29	180.00	0.32
112	0.580	469.00	1520.00	1523.60		1523.77	0.009991	3.29	148.11	200.20	0.58
112	0.580	469.00	1520.00	1523.72		1524.01	0.016752	4.30	109.11	105.00	0.74
112	0.610	469.00	1521.00	1524.83		1524.95	0.005671	2.76	169.66	142.95	0.45
112	0.610	469.00	1521.00	1525.57	1524.95	1525.85	0.008502	4.26	110.05	60.00	0.55
112	0.633	469.00	1521.10	1525.70	1525.42	1525.89	0.013666	3.51	133.78	151.02	0.66
112	0.633	469.00	1521.10	1526.32		1526.42	0.003268	2.48	188.95	120.00	0.35

LEGEND:

111	0.094	FLOODPLAIN DATA
111	0.094	FLOODWAY DATA

HEC-RAS Plan: FEMA River: TTTCC Reach: 113

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
113	0.037	451.00	1512.00	1518.58		1518.59	0.000051	0.80	562.93	103.77	0.06
113	0.037	451.00	1512.00	1519.52		1519.53	0.000054	0.91	494.41	68.00	0.06
113	0.054	451.00	1512.58	1518.58		1518.60	0.000091	0.97	462.65	99.05	0.08
113	0.054	451.00	1512.58	1519.52		1519.53	0.000079	1.03	436.88	69.00	0.07
113	0.074	451.00	1513.76	1518.58		1518.64	0.000470	1.83	246.81	69.71	0.17
113	0.074	451.00	1513.79	1519.44		1519.60	0.001280	3.18	141.66	28.00	0.25
113	0.113	451.00	1516.41	1519.09	1519.09	1519.85	0.016313	6.98	64.58	43.64	1.01
113	0.113	451.00	1516.41	1519.56	1519.56	1520.78	0.016485	8.88	50.78	21.00	1.01
113	0.150	451.00	1517.00	1520.40		1520.54	0.001401	3.02	151.03	60.64	0.33
113	0.150	451.00	1517.00	1521.14		1521.23	0.000628	2.38	192.03	57.00	0.22
113	0.187	451.00	1517.18	1520.73		1520.97	0.002979	3.93	114.62	50.90	0.46
113	0.187	451.00	1517.18	1521.26		1521.46	0.001847	3.60	125.10	40.00	0.36
113	0.226	451.00	1517.93	1521.36		1521.74	0.004561	4.95	91.06	39.10	0.57
113	0.226	451.00	1517.94	1521.96	1521.96	1523.94	0.024354	11.28	39.98	10.00	0.99

CULVERT (FLOODPLAIN)

Plan: FEMA TTCC 112 RS: .338 Profile: PF 1 Culvert ID: Culvert #1

Culv Q (cfs)	469.00	Culv Ful Lngh (ft)	80.00
# Barrels	4	Culv Vel US (ft/s)	2.93
Q Barrel (cfs)	117.25	Culv Vel DS (ft/s)	2.93
E.G. US. (ft)	1518.79	Culv Inv El Up (ft)	1513.25
W.S. US. (ft)	1518.79	Culv Inv El Dn (ft)	1513.00
E.G. DS (ft)	1518.58	Culv Frctn Ls (ft)	0.02
W.S. DS (ft)	1518.58	Culv Ext Lss (ft)	0.13
Delta EG (ft)	0.21	Culv Ent Lss (ft)	0.05
Delta WS (ft)	0.21	Q Weir (cfs)	
E.G. IC (ft)	1515.76	Weir Sta Lft (ft)	
E.G. OC (ft)	1518.79	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	1517.25	Weir Max Depth (ft)	
Culv WS Outlet (ft)	1517.00	Weir Avg Depth (ft)	
Culv Nml Depth (ft)		Wr Flw Area (sq ft)	
Culv Crt Depth (ft)	1.62	Min El Weir Flow (ft)	1520.91

CULVERT (FLOODWAY)

Plan: FEMA TTCC 112 RS: .338 Profile: PF 2 Culvert ID: Culvert #1

Culv Q (cfs)	469.00	Culv Ful Lngh (ft)	80.00
# Barrels	4	Culv Vel US (ft/s)	2.93
Q Barrel (cfs)	117.25	Culv Vel DS (ft/s)	2.93
E.G. US. (ft)	1519.73	Culv Inv El Up (ft)	1513.25
W.S. US. (ft)	1519.73	Culv Inv El Dn (ft)	1513.00
E.G. DS (ft)	1519.53	Culv Frctn Ls (ft)	0.02
W.S. DS (ft)	1519.52	Culv Ext Lss (ft)	0.13
Delta EG (ft)	0.21	Culv Ent Lss (ft)	0.05
Delta WS (ft)	0.21	Q Weir (cfs)	
E.G. IC (ft)	1515.76	Weir Sta Lft (ft)	
E.G. OC (ft)	1519.73	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	1517.25	Weir Max Depth (ft)	
Culv WS Outlet (ft)	1517.00	Weir Avg Depth (ft)	
Culv Nml Depth (ft)		Wr Flw Area (sq ft)	
Culv Crt Depth (ft)	1.62	Min El Weir Flow (ft)	1520.91

FLOODWAY ENCROACHMENT TABLE

HEC-RAS Plan: FEMA

Reach	River Sta	W.S. Elev	Prof Delta WS	E.G. Elev	Top Width Act	Q Left	Q Channel	Q Right	Enc Sta L	Ch Sta L	Ch Sta R	Enc Sta R
		(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)
111	0.094	1515.90		1516.04	186.95		1000.00			150.00	350.00	
111	0.094	1516.58	0.68	1516.86	72.00		1000.00		168.00	150.00	350.00	240.00
111	0.135	1516.36		1516.44	241.98		1000.00			141.00	415.00	
111	0.135	1517.08	0.72	1517.16	144.00		1000.00		156.00	141.00	415.00	300.00
111	0.182	1516.66		1516.71	332.64		255.31	744.69		115.00	161.00	
111	0.182	1517.10	0.44	1517.70	67.00		705.42	294.58	133.00	115.00	161.00	200.00
111	0.220	1518.06		1518.47	358.50		687.46	312.54		129.00	176.00	
111	0.220	1518.13	0.08	1519.32	45.72		999.22	0.78	122.00	129.00	176.00	200.00
111	0.248	1518.56		1518.58	373.97		1000.00			93.64	552.89	
111	0.248	1519.48	0.92	1519.52	155.00		1000.00		105.00	93.64	552.89	260.00
111	0.281	1518.58		1518.58	490.84		1000.00			64.00	601.00	
111	0.281	1519.52	0.95	1519.53	335.00		1000.00		95.00	64.00	601.00	430.00
112	.314	1518.58		1518.58	523.46	0.11	468.82	0.06		21.39	525.79	
112	.314	1519.52	0.94	1519.53	171.00		469.00		207.00	21.39	525.79	378.00
112	.338	Culvert										
112	.348	1518.79		1518.79	387.22		469.00			53.24	444.97	
112	.348	1519.73	0.94	1519.73	179.00		469.00		132.00	53.24	444.97	311.00
112	0.365	1518.79		1518.79	239.16		468.63	0.37		98.98	338.00	
112	0.365	1519.73	0.94	1519.73	177.00		469.00		133.00	98.98	338.00	310.00
112	0.380	1518.79		1518.79	332.21		469.00			76.95	440.00	
112	0.380	1519.73	0.94	1519.73	197.00		469.00		143.00	76.95	440.00	340.00
112	0.401	1518.79		1518.80	380.82		469.00			119.00	550.00	
112	0.401	1519.73	0.94	1519.74	192.00		469.00		208.00	119.00	550.00	400.00
112	0.431	1518.80		1518.82	306.40		469.00			50.00	390.00	
112	0.431	1519.74	0.94	1519.75	230.00		469.00		90.00	50.00	390.00	320.00
112	0.469	1518.96		1519.25	192.11		469.00			150.00	408.00	
112	0.469	1519.74	0.78	1519.85	130.00		469.00		190.00	150.00	408.00	320.00

FLOODWAY ENCROACHMENT TABLE

HEC-RAS Plan: FEMA (Continued)

Reach	River Sta	W.S. Elev	Prof Delta WS	E.G. Elev	Top Wdth Act	Q Left	Q Channel	Q Right	Enc Sta L	Ch Sta L	Ch Sta R	Enc Sta R
		(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)
112	0.511	1521.14		1521.21	229.91		469.00			136.81	410.00	
112	0.511	1521.21	0.06	1521.64	80.00		469.00		160.00	136.81	410.00	240.00
112	0.560	1522.69		1522.81	192.76	0.01	468.99			59.00	360.00	
112	0.560	1523.28	0.59	1523.35	180.00		469.00		120.00	59.00	360.00	300.00
112	0.580	1523.60		1523.77	200.20	6.10	462.90			204.37	350.82	
112	0.580	1523.72	0.12	1524.01	105.00		469.00		230.00	204.37	350.82	335.00
112	0.610	1524.83		1524.95	142.95		469.00			120.00	300.00	
112	0.610	1525.57	0.74	1525.85	60.00		469.00		190.00	120.00	300.00	250.00
112	0.633	1525.70		1525.89	151.02		469.00			125.00	388.00	
112	0.633	1526.32	0.62	1526.42	120.00		469.00		190.00	125.00	388.00	310.00

FLOODWAY ENCROACHMENT TABLE

HEC-RAS Plan: FEMA River: TTTCC Reach: 113

Reach	River Sta	W.S. Elev (ft)	Prof Delta WS (ft)	E.G. Elev (ft)	Top Wdth Act (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Enc Sta L (ft)	Ch Sta L (ft)	Ch Sta R (ft)	Enc Sta R (ft)
113	0.037	1518.58		1518.59	103.77		451.00			65.00	181.17	
113	0.037	1519.52	0.94	1519.53	68.00		451.00		90.00	65.00	181.17	158.00
113	0.054	1518.58		1518.60	99.05		451.00			69.00	182.08	
113	0.054	1519.52	0.94	1519.53	69.00		451.00		89.00	69.00	182.08	158.00
113	0.074	1518.58		1518.64	69.71		451.00			91.00	186.18	
113	0.074	1519.44	0.86	1519.60	28.00		451.00		130.00	91.00	186.18	158.00
113	0.113	1519.09		1519.85	43.64		451.00			99.00	165.00	
113	0.113	1519.56	0.47	1520.78	21.00		451.00		133.00	99.00	165.00	154.00
113	0.150	1520.40		1520.54	60.64	1.38	449.62			101.00	160.00	
113	0.150	1521.14	0.74	1521.23	57.00	3.22	447.78		98.00	101.00	160.00	155.00
113	0.187	1520.73		1520.97	50.90		451.00			100.00	163.06	
113	0.187	1521.26	0.53	1521.46	40.00		451.00		112.00	100.00	163.06	152.00
113	0.226	1521.36		1521.74	39.10		451.00			100.00	164.38	
113	0.226	1521.96	0.60	1523.94	10.00		451.00		140.00	100.00	164.38	150.00

"WSE COMPARISON"

Eagle Bluff III

Comparison of "Floodplain" and "Floodway" water surface elevations before and after construction of box culvert

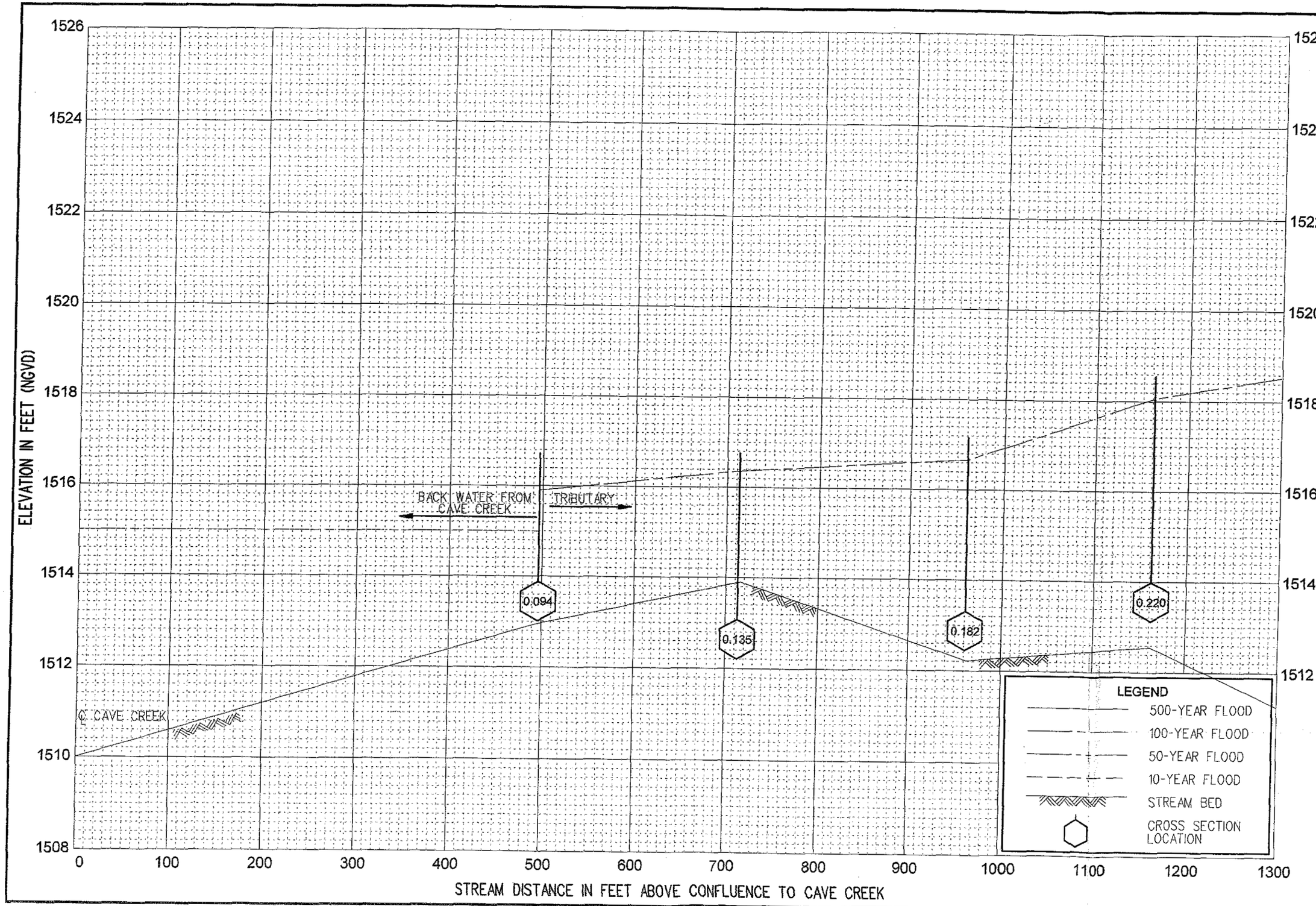
		Flood Plain		Flood Way	
	River Station	**No Culvert**	**With Culvert**	**No Culvert**	**With Culvert**
DOWNSTREAM	0.094	1515.93	1515.90	1516.58	1516.58
	0.135	1516.38	1516.36	1517.08	1517.08
	0.182	1516.66	1516.66	1517.10	1517.10
	0.220	1518.06	1518.06	1518.13	1518.13
	0.248	1518.56	1518.56	1519.48	1519.48
	0.281	1518.58	1518.58	1519.52	1519.52
	0.314	This section not part of original CLOMR	1518.58	This section not part of original CLOMR	1519.52
	0.338	**CULVERT**		**CULVERT**	
UPSTREAM	0.348	This section not part of original CLOMR	1518.79	This section not part of original CLOMR	1519.73
	0.365	1518.58	1518.79	1519.52	1519.73
	0.380	1518.58	1518.79	1519.52	1519.73
	0.401	1518.58	1518.79	1519.53	1519.73
	0.431	1518.60	1518.80	1519.54	1519.74
	0.469	1518.96	1518.95	1519.53	1519.74
	0.511	1521.14	1521.15	1521.40	1521.21
	0.560	1522.69	1522.68	1523.23	1523.28

Shaded areas indicate no change in WSE when adding Box Culvert

Building pad grades have been set at 2 feet above the shaded floodway WSE

Appendix C

Flood Profiles

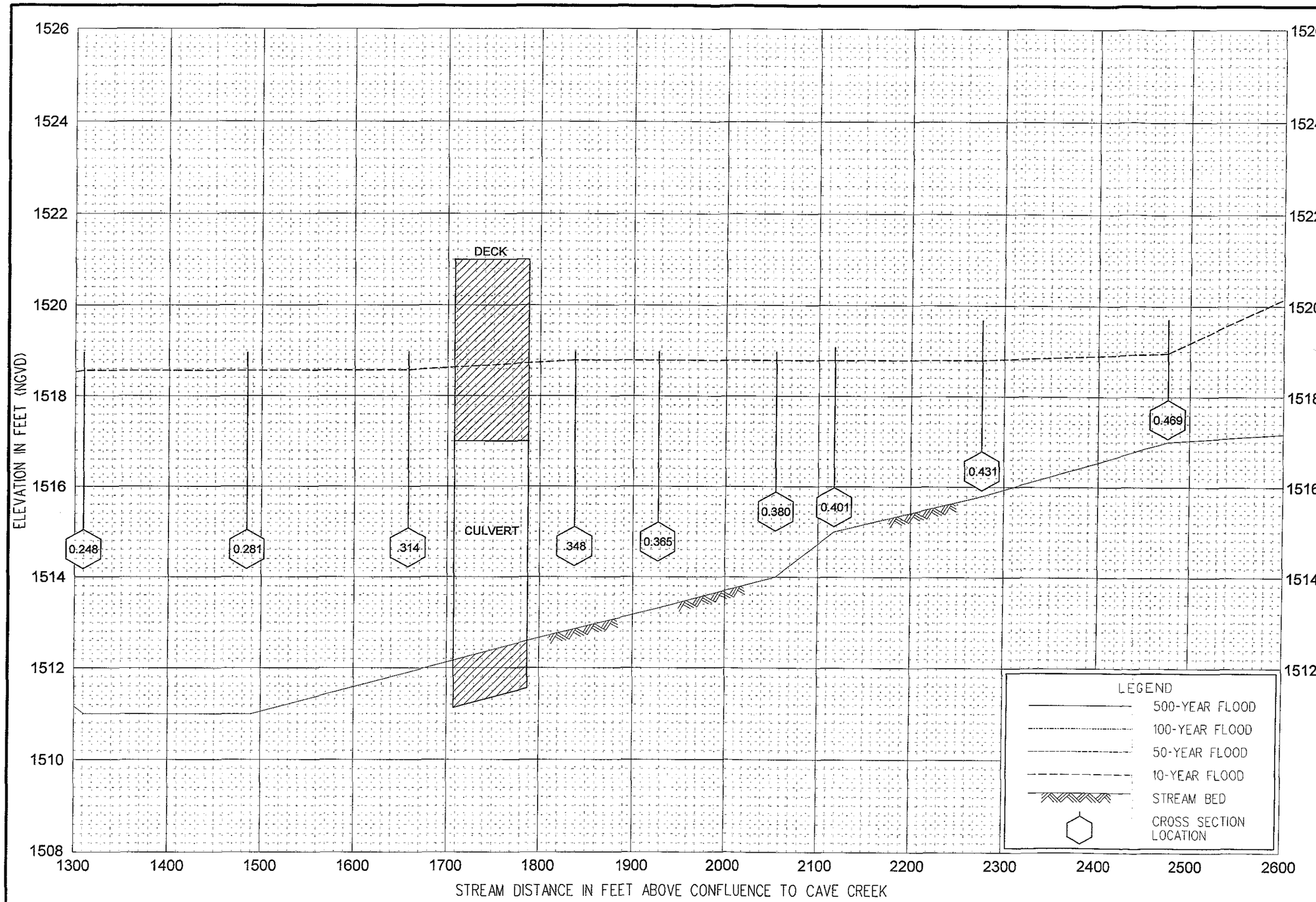


FLOOD PROFILES

TRIBUTARY TO CAVE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
CITY OF PHOENIX, AZ
MARICOPA

01P

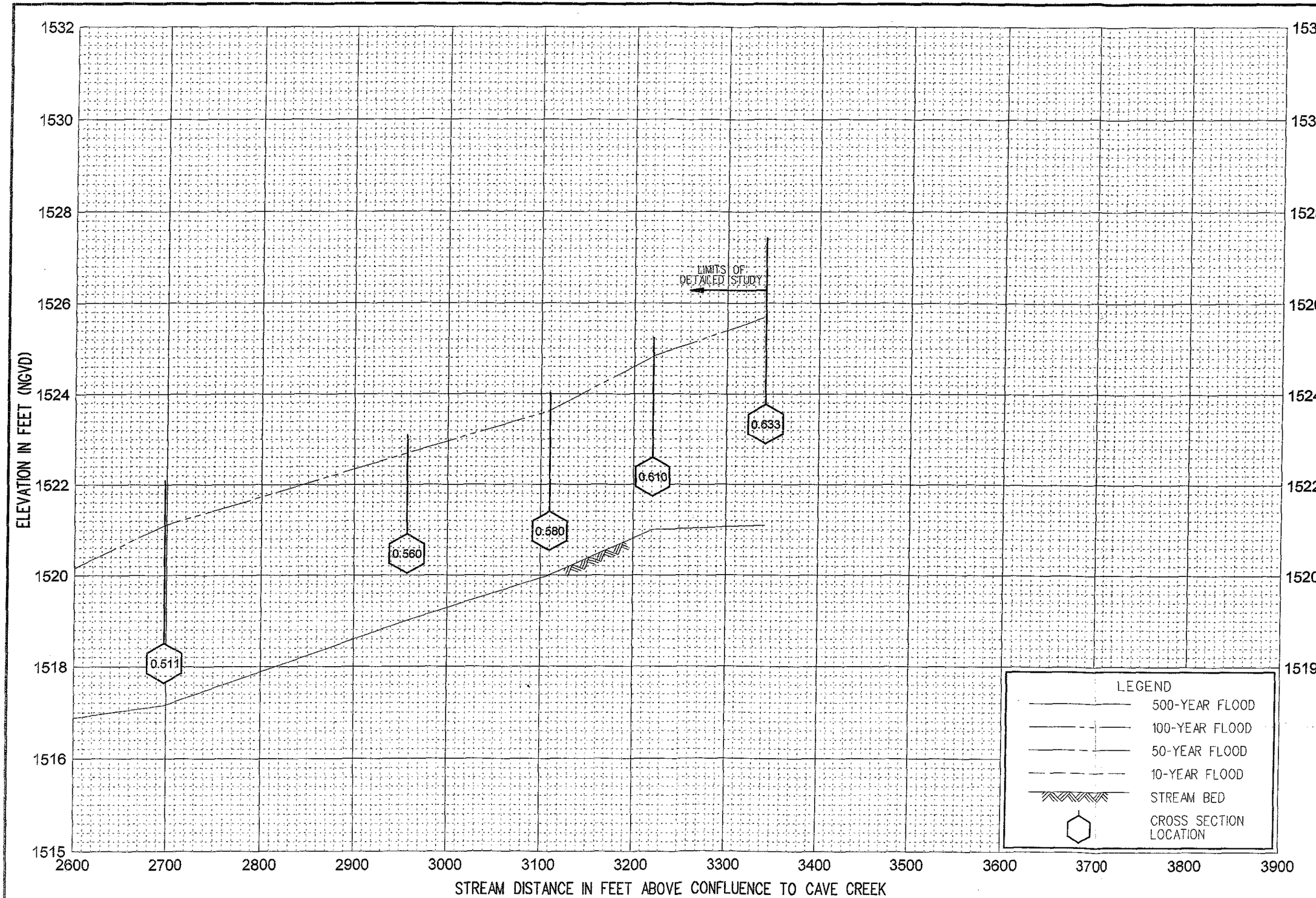


FLOOD PROFILES

TRIBUTARY TO CAVE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
CITY OF PHOENIX, AZ
MARICOPA

02P

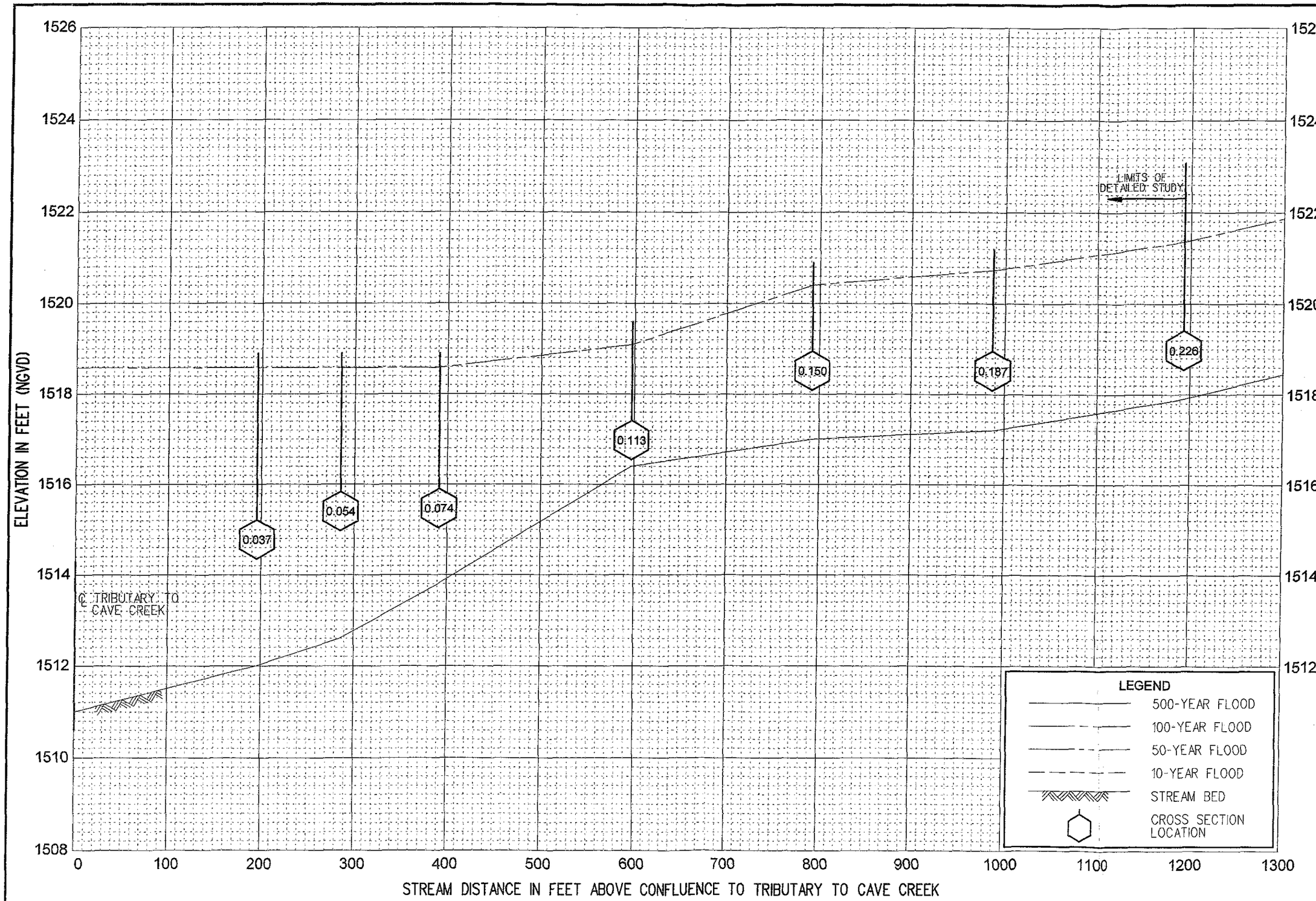


FLOOD PROFILES

TRIBUTARY TO CAVE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
CITY OF PHOENIX, AZ
MARICOPA

03P



FLOOD PROFILES

TRIBUTARY TO TRIBUTARY TO CAVE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
CITY OF PHOENIX, AZ
MARICOPA

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION		
CROSS SECTION	DISTANCE (Mi)	WIDTH (FT)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (FT/S)	FLOODPLAIN	FLOODWAY	INCREASE (FT)
0.000	0.000	N/A	N/A	N/A	1515.0	1515.0	0.0
0.094	0.094	72	235	4.2	1515.9	1516.5	0.6
0.135	0.135	144	444	2.3	1516.4	1517.1	0.7
0.182	0.182	67	179	7.0	1516.7	1517.1	0.4
0.220	0.220	46	115	8.7	1518.1	1518.1	0.0
0.248	0.248	155	655	1.5	1518.6	1519.5	0.9
0.281	0.281	335	2597	0.4	1518.6	1519.5	0.9
0.314	0.314	171	1175	0.4	1518.6	1519.5	0.9
0.348	0.348	179	1004	0.5	1518.8	1519.7	0.9
0.365	0.365	177	944	0.5	1518.8	1519.7	0.9
0.380	0.380	197	929	0.5	1518.8	1519.7	0.9
0.401	0.401	192	770	0.6	1518.8	1519.7	0.9
0.431	0.431	230	685	0.7	1518.8	1519.7	0.9
0.469	0.469	130	178	2.6	1519.0	1519.7	0.7
0.511	0.511	80	89	5.3	1521.1	1521.2	0.1
0.560	0.560	180	228	2.0	1522.7	1523.3	0.6
0.580	0.580	105	110	4.3	1523.6	1523.7	0.1
0.610	0.610	60	110	4.3	1524.8	1525.6	0.8
0.633	0.633	120	189	2.5	1525.7	1526.3	0.6

FEDERAL EMERGENCY MANAGEMENT AGENCY **MARICOPA COUNTY, AZ** **AND INCORPORATED AREAS**	**FLOODWAY DATA** **Tributary to Cave Creek**

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION		
CROSS SECTION	DISTANCE (Mi)	WIDTH (FT)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (FT/S)	FLOODPLAIN	FLOODWAY	INCREASE (FT)
0.037	0.037	68	494	0.9	1518.6	1519.5	0.9
0.054	0.054	69	437	1.0	1518.6	1519.5	0.9
0.074	0.074	28	142	3.2	1518.6	1519.4	0.8
0.113	0.113	21	51	8.9	1519.1	1519.6	0.5
0.150	0.150	57	192	2.4	1520.4	1521.1	0.7
0.187	0.187	40	125	3.6	1520.7	1521.3	0.6
0.226	0.226	10	40	11.3	1521.4	1522.0	0.6

FEDERAL EMERGENCY MANAGEMENT AGENCY **MARICOPA COUNTY, AZ** **AND INCORPORATED AREAS**	**FLOODWAY DATA** **Tributary Tributary to Cave Creek**

Appendix D
Pocket
Drainage/Work Map

FLOOD PLAIN DELINEATION FOR EAGLE BLUFF II & III

EAGLE BLUFF III

EAGLE BLUFF II

LIMITS OF DETAILED STUDY

FLOOD PLAIN

FLOOD WAY

CULVERT

TRACT

CIELO GRANDE AVENUE

PATRICK LANE

CASHMAN RD

19TH STREET

19TH WAY

DALEY LANE

MOUNTAIN COURT

BOOK 504 PAGE 6

RETENTION AREA 90' ELECTRIC EASEMENT

RETENTION 100YR-2HR

MOUNTAINGATE II
BOOK 400 PAGE 17

MOUNTAINGATE
BOOK 400 PAGE 18
R1-6

UNSUBDIVIDED

EAGLE BLUFF II VICINITY MAP

SECTION 15, T.4N., R.3E

N.T.S.

COUNTY / PHOENIX — PINNACLE PEAK ROAD (ALIGN.) — 7th STREET — 20th — 16th STREET (ALIGN.) — CENTRAL ARIZONA PROJECT — CAVE CREEK ROAD — DEER VALLEY ROAD

SCALE: 1"=100'

FEMA CASE # _____

SHEET 1 OF 1

WORK MAP

PREPARED FOR:

COURTLAND HOMES
5333 N. 7TH STREET
SUITE #305
PHOENIX, ARIZONA 85014
(480)275-6722

PREPARED BY:

Sage engineering corporation
3414 S. 48th ST. -- SUITE 8
PHOENIX, ARIZONA 85040
(480)966-9971

FILE/1324002/LEGAL_SKETCHES/BOXCLOMR-EXHIB

Appendix E
Sleeve
(Disk)

HEC-1 Files (Hydrology)
HEC-RAS Files (Hydraulics)