Floodplain Development Permit

Doddridge County, WV Floodplain Management

This permit gives approval for the development/ project listed that impacts the FEMA-designated floodplain and/or floodway of Doddridge County, WV, pursuant to the rules and regulations established by all applicable Federal, State and local laws and ordinances, including the Doddridge County Floodplain Ordinance. This permit must be posted at the site of work as to be clearly visible, and must remain posted during entirety of development.

Permit: # 14-374

Date Approved: 09/15/2015 ☆ **Expires: 09/15/2016**

Issued to: Antero Resources
Susie Jane Bridge

POC: Rachel Grzybek
304-842-4008

Company Address: 535 White Oaks Blvd
Bridgeport, WV 26330

Project Address: Greenbrier District

Firm: #54017C0165C **Lat/Long: 39.257648N, 80.622713W**

Purpose of development: Permanent Bridge

Issued by: George C Eidel, Doddridge County FPM (*or designee*)

Date: 09/14/2015

For additional information regarding this permit, please contact Doddridge County Floodplain Manager at 304.873.2631, or via email at doddridgecountyfpm@gmail.com
118 East Court Street; West Union, WV 26456

ANTERO RESOURCES CORPORATION
1615 WYNKOOP STREET
DENVER, COLORADO 80202

Vendor Name	Vendor No.	Date	Check Number	Check Total
DODDRIDGE COUNTY COMMISSION	43312	Aug-26-2015	109364	$500.00

INV #	INV DATE	DESCRIPTION	AMOUNT	DISCOUNTS	NET AMOUNT
KAD8182015SJ	08/18/15	SUSIE JANE BRIDGE FLOODPLAIN FEE	500.00	0.00	500.00

Permit #15-374

Doddridge County, West Virginia

RECEIPT NO: 5362 DATE: 2015/08/31

FROM: ANTERO RESOURCES **AMOUNT:** $ 500.00

FIVE HUNDRED DOLLARS AND 00 CENTS

FOR: #15-374 SUSIE JANE BRIDGE

00000109364 FP-BUILDING PERMITS 020-318 **TOTAL:** $500.00

MICHAEL HEADLEY
SHERIFF &TREASURER

MEC
CLERK

Customer Copy

TOTAL INVOICES PAID ====>	500.00	0.00	500.00

DETACH AND RETAIN FOR TAX PURPOSES

Antero Resources
535 White Oaks Blvd.
Bridgeport, WV 26330
Office 304.842.4100
Fax 304.842.4102

August 17, 2015

Doddridge County Commission
Attn: George Eidel, Doddridge County Floodplain Manager
118 East Court Street, Room 102
West Union, WV 26456

Mr. Eidel:

Antero Resources Corporation (Antero) would like to submit a Doddridge County floodplain permit application for our Susie Jane Bridge. Our project is located in Doddridge County, Greenbrier District where the bridge will be located at coordinates 39.257648N, 80.622713W. Per the FIRM Map #54017C0165C, this location is **in** the floodplain.

Attached you will find the following:

- Doddridge County Floodplain Permit Application
- H&H Study
- Bid Sheet
- Property Owner Information
- WV Flood Tool Map
- FIRM Map

If you have any questions please feel free to contact me at (304) 842-4008.

Thank you in advance for your consideration.

Sincerely,

Rachel Grzybek
Environmental Specialist I
Floodplain Engineer
Antero Resources Corporation

Enclosures

#15-374

Susie Jane Bridge

DODDRIDGE COUNTY
FLOODPLAIN DEVELOPMENT PERMIT APPLICATION

SECTION 1: GENERAL PROVISIONS (APPLICANT TO READ AND SIGN)

1. No work may start until a permit is issued.
2. The permit may be revoked if any false statements are made herein.
3. If revoked, all work must cease until permit is re-issued.
4. Development shall not be used or occupied until a Certificate of Compliance is issued.
5. The permit will expire if no work is commenced within six months of issuance.
6. Applicant is hereby informed that other permits may be required to fulfill local, state, and federal requirements.
7. Applicant hereby gives consent to the Floodplain Administrator/Manager or his/her representative to make inspections to verify compliance.
8. **I, THE APPLICANT CERTIFY THAT ALL STATEMENTS HEREIN AND IN ATTACHMENTS TO THIS APPLICATION ARE, TO THE BEST OF MY KNOWLEDGE, TRUE AND ACCURATE.**

APPLICANT'S SIGNATURE KK

DATE 8/17/15

SECTION 2: PROPOSE DEVELOPMENT (TO BE COMPLETED BY APPLICANT).

IF THE APPLICANT IS NOT A NATURAL PERSON, THE NAME, ADDRESS, AND TELEPHONE NUMBER OF A NATURAL PERSON WHO SHALL BE APPOINTED BY THE APPLICANT TO RECEIVE NOTICE PURSUANT TO ANY PROVISION OF THE CURRENT DODDRIDGE COUNTY FLOODPLAIN ORDINANCE.

APPLICANT'S NAME: Randy Kloberdanz

ADDRESS: 1615 Wynkoop Street, Denver, CO 80202

TELEPHONE NUMBER: (303) 357-7310

BUILDER'S NAME: Antero Resources Corporation

ADDRESS: 1615 Wynkoop Strett, Denver, CO 80202

TELEPHONE NUMBER: (303)-357-7310

ENGINEER'S NAME:

ADDRESS:

TELEHONE NUMBER:

PROJECT LOCATION:

NAME OF SURFACE OWNER/OWNERS (IF NOT THE APPLICANT) Please see Surface Owner Table

ADDRESS OF SURFACE OWNER/OWNERS (IF NOT THE APPLICANT) Please see Surface Owner Table

DISTRICT:

DATE/FROM WHOM PROPERTY PURCHASED:

LAND BOOK DESCRIPTION: Please see Surface Owner Table

DEED BOOK REFERENCE: Please see Surface Owner Table

TAX MAP REFERENCE: Please see Surface Owner Table

EXISTING BUILDINGS/USES OF PROPERTY: None

NAME OF AT LEAST ONE ADULT RESIDING IN EACH RESIDENCE LOCATED UPON THE SUBJECT PROPERTY Please see Surface Owner Table

ADDRESS OF AT LEAST ONE ADULT RESIDING IN EACH RESIDENCE LOCATED UPON THE SUBJECT PROPERTY

To avoid delay in processing the application, please provide enough information to easily identify the project location.

DESCRIPTION OF WORK (CHECK ALL APPLICABLE BOXES)

A. STRUCTURAL DEVELOPMENT

ACTIVITY		STRUCTURAL TYPE	
X	New Structure	[]	Residential (1 – 4 Family)
[]	Addition	[]	Residential (more than 4 Family)
[]	Alteration	[]	Non-residential (floodproofing)
[]	Relocation	[]	Combined Use (res. & com.)
[]	Demolition	[]	Replacement
[]	Manufactured/Mobil Home		

B. OTHER DEVEOPLMENT ACTIVITIES:

[] Fill [] Mining [] Drilling [] Pipelining
[] Grading
[] Excavation (except for STRUCTURAL DEVELOPMENT checked above)
[] Watercourse Altercation (including dredging and channel modification)
[] Drainage Improvements (including culvert work)
X Road, Street, or Bridge Construction
[] Subdivision (including new expansion)
[] Individual Water or Sewer System
[] Other (please specify)

_____

C. STANDARD SITE PLAN OR SKETCH

1. **SUBMIT ALL STANDARD SITE PLANS, IF ANY HAVE BEEN PREPARED.**
2. **IF STANDARD SITE PLANS HAVE NOT BEEN PREPARED:**
   SKETCH ON A SEPARATE 8 ½ X 11 INCH SHEET OF PAPER THE SHAPE AND LOCATION OF THE LOT. SHOW THE LOCATION OF THE INTENDED CONSTRUCTION OR LAND USE INDICATING BUILDING SETBACKS, SIZE & HEIGHT. IDENTIFY EXISTING BUILDINGS, STRUCTURES OR LAND USES ON THE PROPERTY.
3. **SIGN AND DATE THE SKETCH.**

ACTUAL TOTAL CONSTRUCTION COSTS OF THE COMPLETE DEVELOPMENT IRRESPECTIVE OF WHETHER ALL OR ANY PART OF THE SUBJECT PROPOSED CONSTRUCTION PROJECT IS WITHIN THE FLOODPLAIN $ 30,000.00

D. ADJACENT AND/OR AFFECTED LANDOWNERS:

1. **NAME AND ADDRESS OF ALL OWNERS OF SURFACE TRACTS ADJACENT TO THE AREA OF THE SURFACE TRACT (UP & DOWN STREAM) UPON WHICH THE PROPOSED ACTIVITY WILL OCCUR AND ALL OTHER SURFACE OWNERS UP & DOWN STREAM) WHO OWN PROPERTY THAT MAY BE AFFECTED BY FLOODING AS IS DEMONSTRATED BY A FLOODPLAIN STUDY OR SURVEY (IF ONE HAS BEEN COMPLETED).**

NAME: Please see attached landowner
ADDRESS: information

NAME:
ADDRESS:

NAME:
ADDRESS:

NAME:
ADDRESS:

1. **NAME AND ADDRESS OF AT LEAST ONE ADULT RESIDING IN EACH RESIDENCE LOCATED UPON ANY ADJACENT PROPERTY AT THE TIME THE FLOODPLAIN PERMIT APPLICATION IS FILED AND THE NAME AND ADDRESS OF AT LEAST ONE ADULT RESIDING IN ANY HOME ON ANY PROPERTY THAT MAY BE AFFECTED BY FLOODING AS IS DEMONSTRATED BY A FLOODPLAIN STUDY OR SURVEY.**

NAME: Please see attached landowner
ADDRESS: information

NAME:
ADDRESS:

NAME:
ADDRESS:

NAME:
ADDRESS:

E. CONFIRMATION FORM

THE APPLICANT ACKNOWLEDGES, AGREES, AND CONFIRMS THAT HE/IT WILL PAY WITHIN 30 DAYS OF RECEIPT OF INVOICE BY THE COUNTY FOR ALL EXPENSES RELATIVE TO THE PERMIT APPLICATION PROCESS GREATER THAN THE REQUIRED DEPOSIT FOR EXPENSES INCLUDING:

(A) PERSONAL SERVICE OF PROCESS BY THE DODDRIDGE COUNTY SHERIFF AT THE RATES PERMITTED BY LAW FOR SUCH SERVICE.

(B) SERVICE BY CERTIFIED MAIL RETURN RECEIPT REQUESTED.

(C) PUBLICATION.

Property Owner Table-Doddridge County Floodplain Permit
Antero Resources Corporation-Susie Jane Bridge

Property Owner Name	Mailing Address	Parcel ID	Deed Book Reference
Host Properties-Inside Floodplain			
Garwood Betty D	Rt 1 Box 401, Salem, WV 26426	4-4-10.2	Book 207, Page 6
Properties Abutting Host Properties-Inside Floodplain			
Donohem Larry W	538 E Mohawk Dr, Malvern, OH 44644	4-4-1	Book 246, Page 687
Garwood Betty D	Rt Box 401, Salem, WV 26426	4-4-4	Book 208, Page 6
Mcie Deborah (Life)	Rt Box 403, Salem, WV 26426	4-4-4.1	Book 214, Page 98
Wells William B & Cathy D	16 Gain St, Salem, WV 26426	4-4-4.2	Book 239, Page 476
Garwood Betty D	Rt Box 401, Salem, WV 26426	4-4-10	Book 207, Page 6
Garwood Betty D	401 Buffalo Calf, Salem, WV 26426	4-4-30	Book 261, Page 408

(D) COURT REPORTING SERVICES AT ANY HEARINGS REQUESTED BY THE APPLICANT.

(E) CONSULTANTS AND/OR HEARING EXPERTS UTILIZED BY DODDRIDGE COUNTY FLOODPLAIN ADMINISTRATOR/MANAGER OR FLOODPLAIN APPEALS BOARD FOR REVIEW OF MATERIALS AND/OR TESTIMONY REGARDING THE EFFICACY OF GRANTING OR DENYING THE APPLICANT'S FLOODPLAIN PERMIT.

NAME (PRINT): Randy Kloberdanz

SIGNATURE: _____ **DATE:** 8/17/15

After completing SECTION 2, APPLICANT should submit form to Floodplain Administrator/Manager or his/her representative for review.

SECTION 3: FLOODPLAIN DETERMINATION (to be completed by Floodplain Administrator/Manager or his/her representative)

THE PROPOSED DEVELOPMENT:

THE PROPOSED DEVELOPMENT IS LOCATED ON:

FIRM Panel:_____

Dated:_____

[] Is **NOT** located in a Specific Flood Hazard Area (Notify applicant that the application review is complete and **NO FLOOPLAIN DEVELOPMENT PERMIT IS REQUIRED**).

[] Is located in Special Flood Hazard Area.

FIRM zone designation_____

100-Year flood elevation is:_____NGVD (MSL)

[] Unavailable

[] The proposed development is located in a floodway.

FBFM Panel No._____ Dated_____

[] See section 4 for additional instructions.

SIGNED_____ DATE_____

SECTION 4: ADDITIONAL INFORMATION REQUIRED (To be completed by Floodplain Administrator/Manager or his/her representative)

The applicant must submit the documents checked below before the application can be processed.

[] A plan showing the location of all existing structures, water bodies, adjacent roads, lot dimensions and proposed development.

[] Development plans, drawn to scale, and specifications, including where applicable: details for anchoring structures, storage tanks, proposed elevation of lowest floor, (including basement or crawl space), types of water resistant materials used below the first floor, details of flood proffing of utilities located below the first floor and details of enclosures below the first floor. Also_____

_____

[] Subdivision or other development plans (If the subdivision or development exceeds 50 lots or 5 acres, whichever is the lesser, the applicant must provide 100-year flood elevations if they are not otherwise available).

[] Plans showing the extent of watercourse relocation and/or landform alterations.

[] Top of new fill elevation_____Ft. NGVD (MSL).
For floodproofing structures applicant must attach certification from registered engineer or architect.

[] Certification from a registered engineer that the proposed activity in a regulatory floodway will not result in any increase in the height of the 100-year flood. A copy of all data and calculations supporting this finding must also be submitted.

[] Manufactured homes located in a floodplain area must have a West Virginia Contractor's License and a Manufactured Home Installation License as required by the Federal Emergency Management Agency (FEMA).

[] Other:

_____

_____

_____

SECTION 5: PERMIT DETERMINATION (To be completed by Floodplain Administrator/Manager or his/her representative)

I have determined that the proposed activity **(type is or is not)** in conformance with provisions of the Floodplain Ordinance adopted by the County Commission of Doddridge County on May 21, 2013. The permit is issued subject to the conditions attached to and made part of this permit.

SIGNED_____DATE_____

If the Floodplain Administrator/Manager found that the above was not in conformance with the provisions of the Doddridge County Floodplain Ordinance and/or denied that application, the applicant may complete an appealing process below.

APPEALS: Appealed to the County Commission of Doddridge County? [] Yes {} No
Hearing Date:_____
County Commission Decision - Approved [] Yes [] No

CONDITIONS:_____

_____

_____

_____

SECTION 6: AS-BUILT ELEVATIONS (To be submitted by APPLICANT before Certificate of Compliance is issued).

The following information must be provided for project structures. This section must be completed by a registered professional engineer or a licensed land surveyor (or attach a certification to this application).

COMPLETE 1 OR 2 BELOW:

1 Actual (As-Built) Elevation of the top of the lowest floor (including basement or crawl space is_____FT. NGVD (MSL)

2 Actual (As Built) elevation of floodproofing is_____FT. NGVD (MSL)

Note: Any work performed prior to submittal of the above information is at risk of the applicant.

SECTION 7: COMPLIANCE ACTION (To be completed by the Floodplain Administrator/Manager or his/her representative).

The Floodplain Administrator/Manager or his/her representative will complete this section as applicable based on inspection of the project to ensure compliance with the Doddridge County Floodplain Ordinance.

INSPECTIONS:

DATE:_____ **BY:**_____

DEFICIENCIES ? **Y/N**

COMMENTS_____

_____

_____

_____

_____

_____

SECTION 8: CERTIFICATE OF COMPLIANCE (To be completed by Floodplain Administrator/Manager or his/her representative).

Certificate of Compliance issued: DATE:_____ BY:_____

CERTIFICATE OF COMPLIANCE
FOR DEVELOPMENT IN SPECIAL FLOOD HAZARD AREA
(OWNER MUST RETAIN)

PERMIT NUMBER:_____

PERMIT DATE:_____

PURPOSE –

CONSTRUCTION LOCATION:_____

OWNER'S ADDRESS:_____

_____

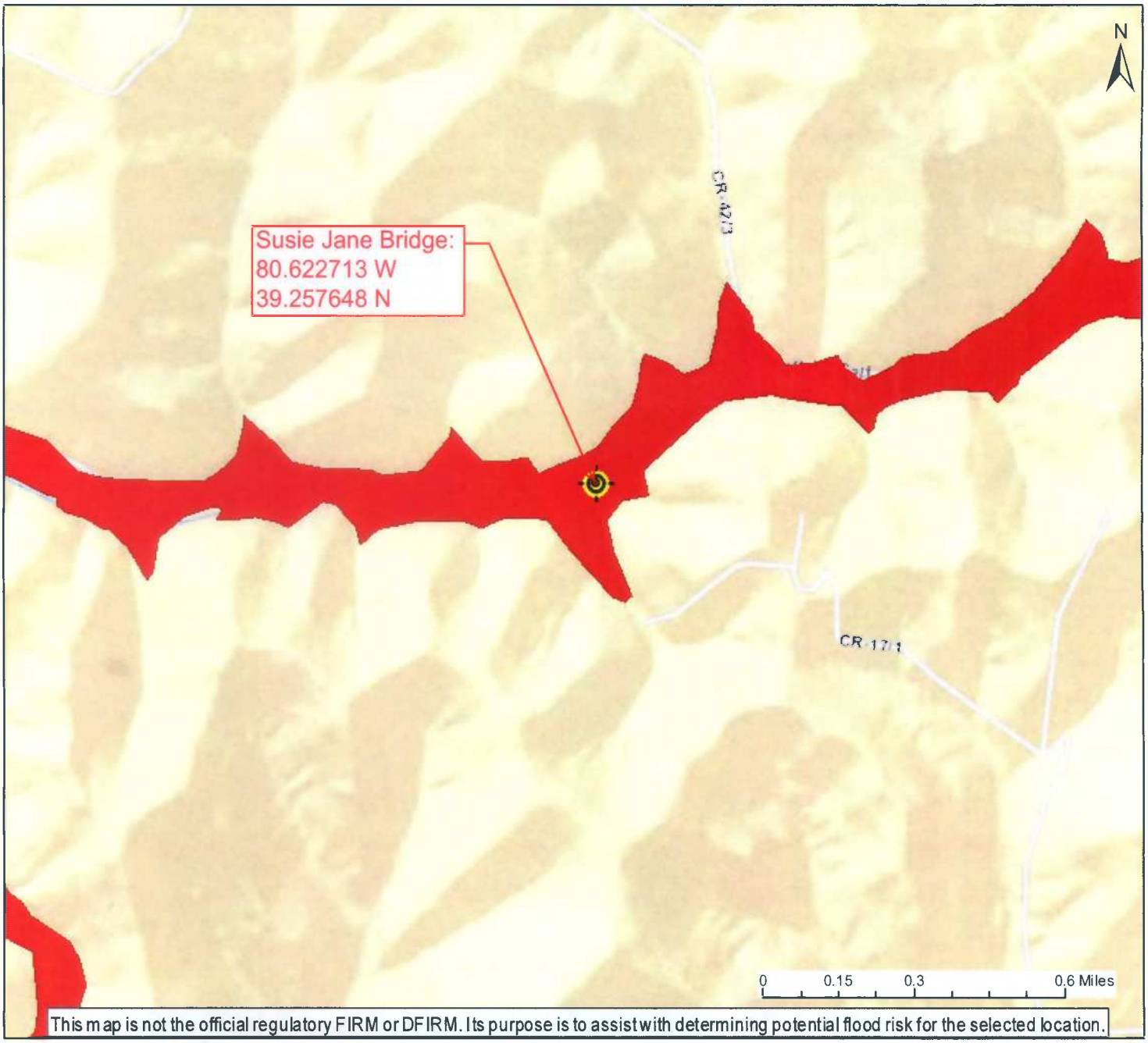
_____

THE FOLLOWING MUST BE COMPLETED BY THE FLOODPLAIN ADMINISTRATOR/MANAGER OR HIS/HER AGENT.

COMPLIANCE IS HEREBY CERTIFIED WITH THE REQUIREMENT OF THE FLOODPLAIN ORDINANCE ADOPTED BY THE COUNTY COMMISSION OF DODDRIDGE COUNTY ON MAY 21, 2013.

SIGNED_____DATE_____

WV Flood Map



User Notes:

Flood Hazard Zone

Flood Point of Interest

Disclaimer:

The online map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. To obtain more detailed information in areas where Base Flood Elevations have been determined, users are encouraged to consult the latest Flood Profile data contained in the official flood insurance study. These studies are available online at www.msc.fema.gov.

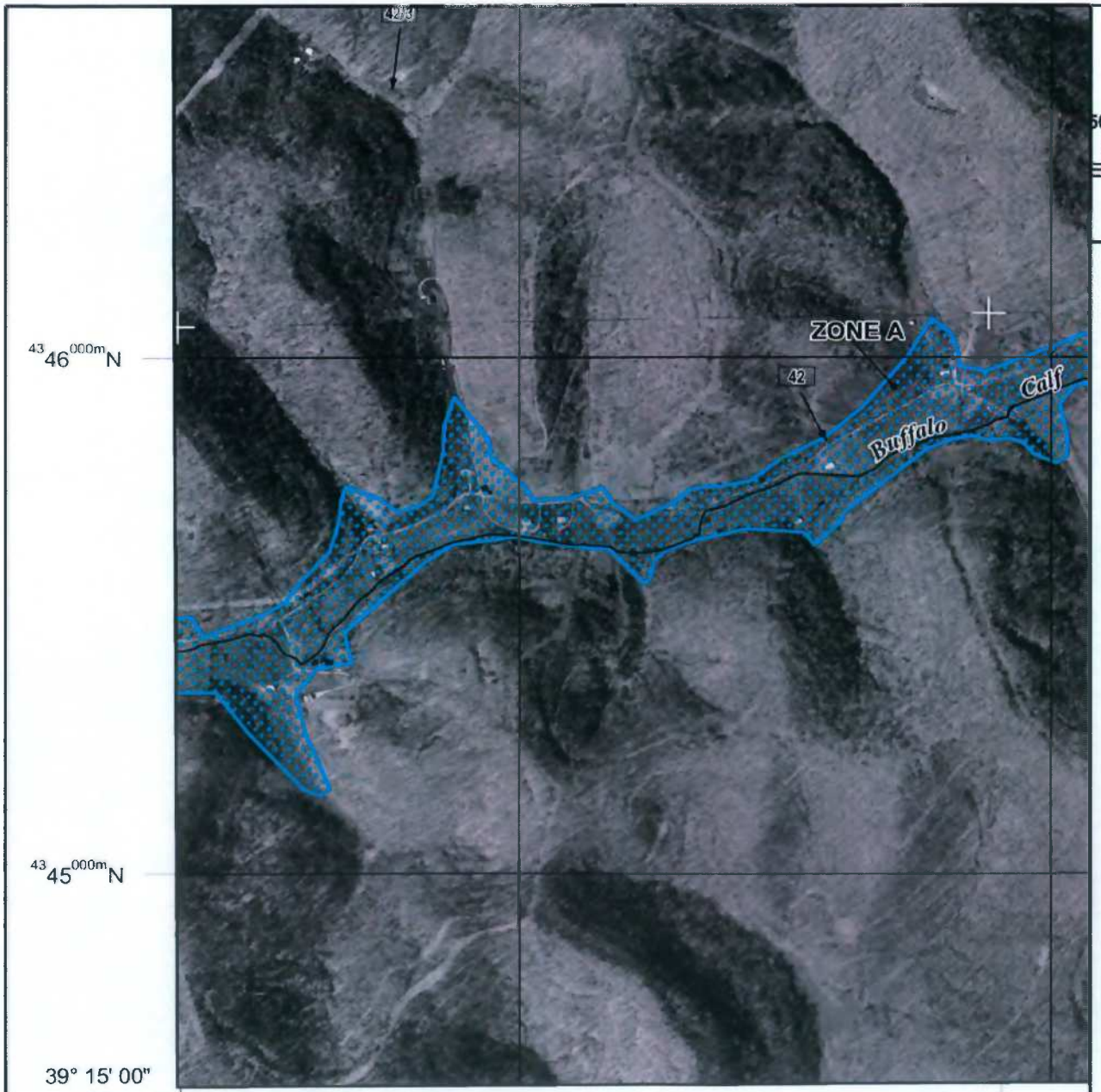
WV Flood Tool (http://www.MapWV.gov/flood) is supported by FEMA, WV NFIP Office, and WV GIS Technical Center.

Map created on August 17, 2015

Flood Hazard Area:

Flood Hazard Area: Location is WITHIN the FEMA 100-year floodplain.

FEMA Issued Flood Map:	54017C0165C
Watershed (HUC8):	Little Musringum-Middle Island (5
Elevation:	About 895 ft
Location (long, lat):	(80.622717 W,39.257649 N)
Location (UTM 17N):	(532551, 4345436)
Contacts:	Doddridge
CRS Information:	N/A
Parcel Number:	



MAP SCALE 1" = 1000'

500 0 1000 2000

FEET

METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0165C

FIRM

FLOOD INSURANCE RATE MAP

DODDRIDGE COUNTY, WEST VIRGINIA AND INCORPORATED AREAS

PANEL 165 OF 325

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
DODDRIDGE COUNTY	540024	0165	C

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

MAP NUMBER
54017C0165C

MAP REVISED
OCTOBER 4, 2011

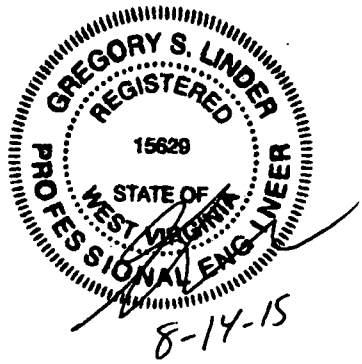
Federal Emergency Management Agency

HYDRAULIC STUDY

Susie Jane Bridge
Doddridge County, West Virginia

Prepared For:

Antero Resources Corporation
Bridgeport, West Virginia



August 2015

Civil & Environmental
Consultants, Inc.

TABLE OF CONTENTS

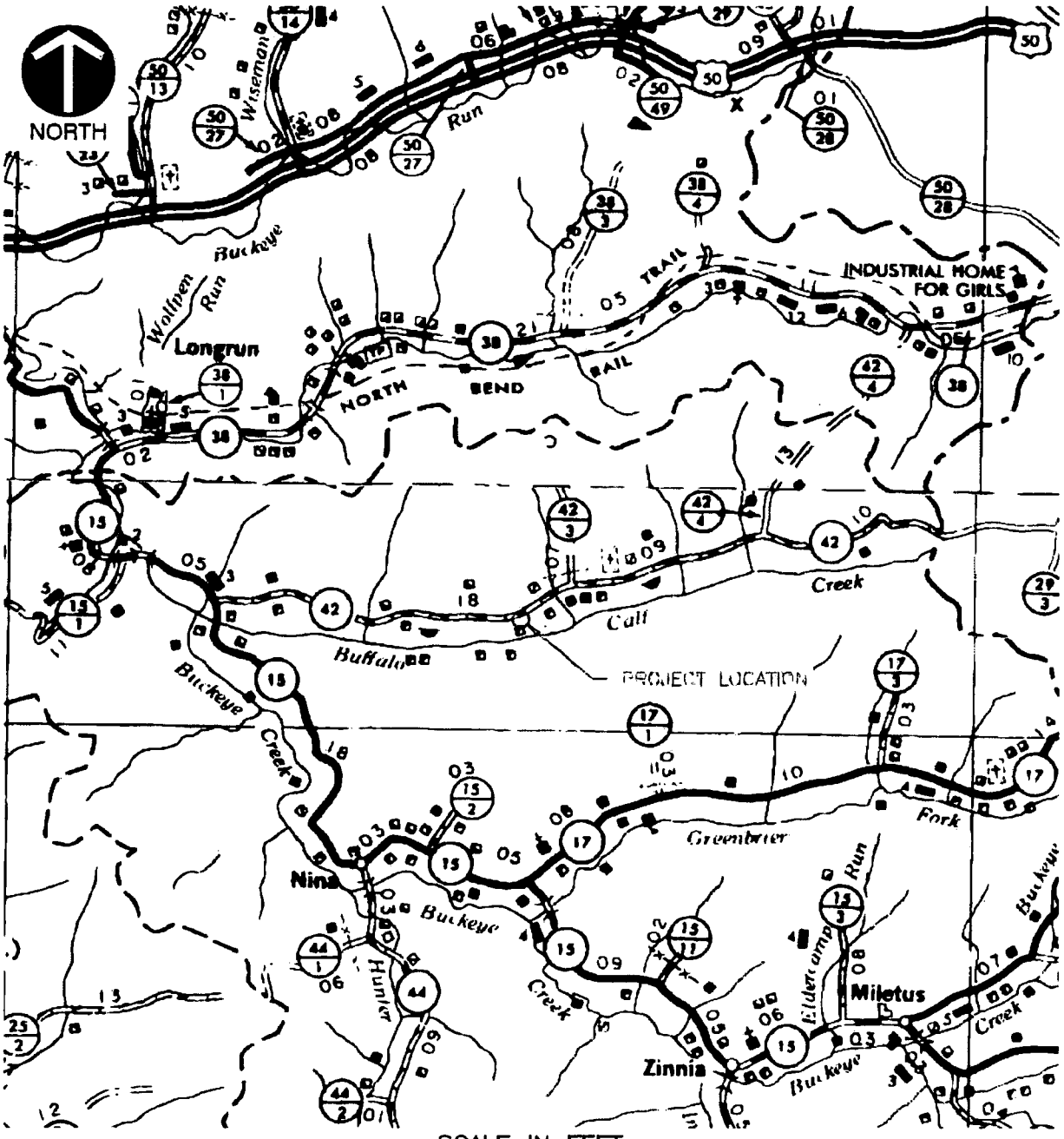
I. PROJECT DESCRIPTION

A. Narrative

The proposed project site is located along County Route 42 in Doddridge County, approximately four (4) miles southwest of Salem, WV. This hydraulic study is for the proposed Susie Jane Bridge for Antero Resources Corporation. The proposed bridge will replace an existing 60-inch high-density polyethylene (HDPE) culvert on Buffalo Calf Creek, which is a tributary of Buckeye Creek in Doddridge County, WV. According to the Federal Emergency Management Agency (FEMA), the proposed site is located within a Zone A Floodplain as designated on the Doddridge County Flood Insurance Rate Map (FIRM) Panel 54017C0165C. The purpose of this hydraulic study is not to investigate the existence or severity of flood hazards in the study area. The purpose of this hydraulic study is to determine the potential for adverse effects caused by the construction of the bridge relative to existing conditions and the potential impacts to the water levels and floodplain of Buffalo Calf Creek.

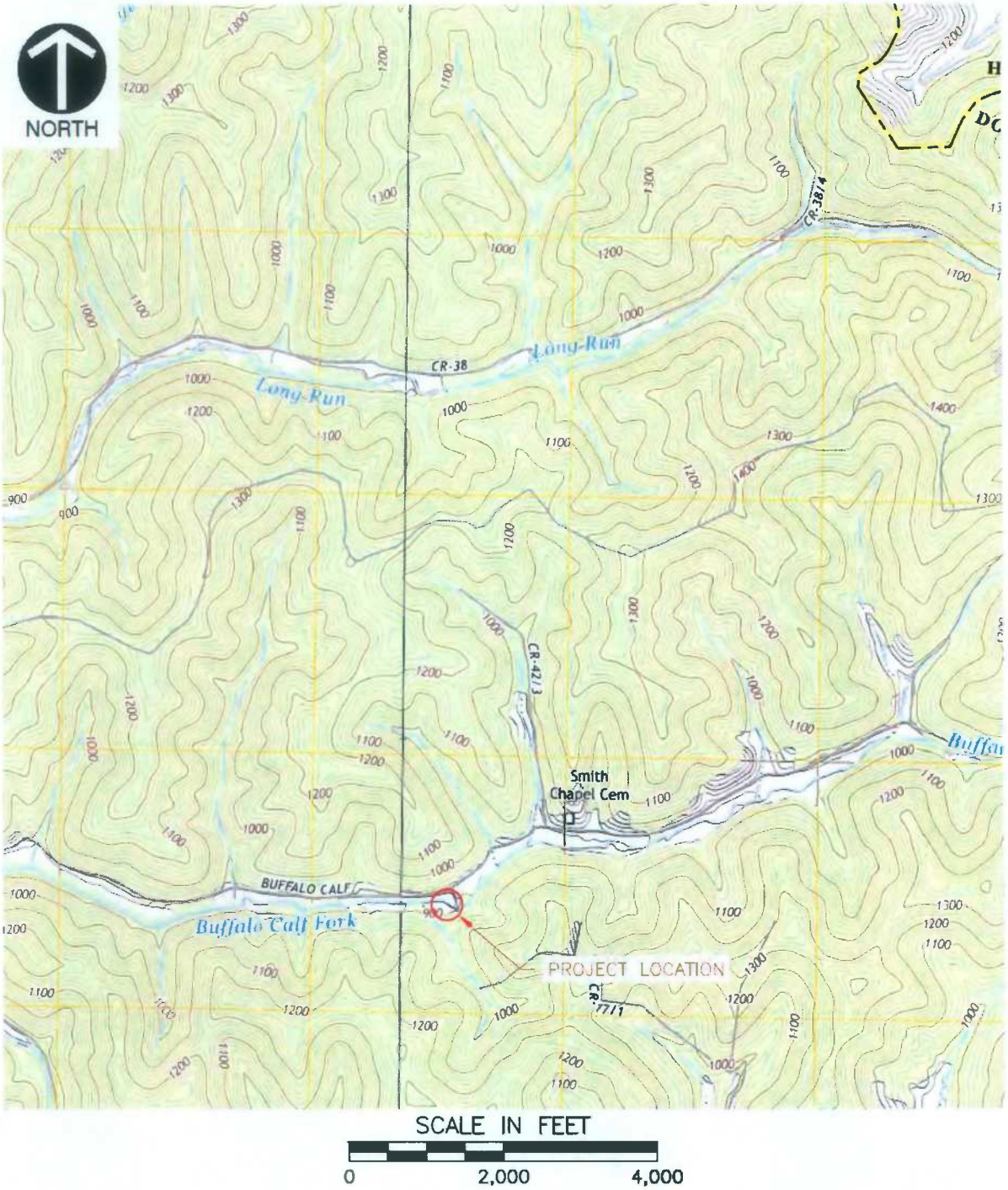
B. Location Maps

1. County Map



Scale: 1 Inch = 4,000 Feet

2. USGS Topographic Map



USGS 7 1/2 Minute Topographic Map – Smithburg and Salem Quadrangles
Scale: 1 Inch = 2,000 Feet

3. Situation Plan

See Appendix A – Site Plans

C. Field Observations

1. High Water Marks

There are no established landmarks in the project vicinity to determine a historic high water mark for Buffalo Calf Creek.

2. Features Relevant to the Hydraulic Analysis

The existing stream crossing consists of a 60-inch diameter HDPE culvert.

3. Verification of Manning's "n" Values

Manning's roughness coefficients were determined based on a site visit and aerial photography:

From Table 3.1 of the HEC-RAS Hydraulic Reference Manual:

Main Channel:
Clean, straight, full, no rifts or deep pools, with stones and weeds: 'n' value 0.035

Floodplain:
Pasture, no brush, short grass: 'n' value 0.030
Heavy stand of timber, few down trees, little undergrowth, flow below branches: 'n' value 0.100

The Manning's "n" values assigned to the left overbank (LOB), channel, and right overbank (ROB) for each cross-section are shown in the following table.

Cross-Section	River Station	Friction (n/K)	LOB	Channel	ROB
1	1799.59	n	0.1	0.035	0.03
2	1583.90	n	0.1	0.035	0.03
3	1398.58	n	0.1	0.035	0.03
4	1193.00	n	0.1	0.035	0.03
5	999.54	n	0.1	0.035	0.03
6	815.00	n	0.1	0.035	0.03
7	700.00	n	0.03	0.035	0.03
Crossing	675.00				
8	586.01	n	0.03	0.035	0.03
9	460.00	n	0.03	0.035	0.1
10	260.56	n	0.03	0.035	0.1
11	60.03	n	0.03	0.035	0.1

D. Pictures

Existing Crossing

Existing Culvert (Downstream)

Existing Culvert (Upstream)

Buffalo Calf Creek (Downstream of Crossing)

II. SUMMARY OF RESULTS

A. Analyses Performed:

Two HEC-RAS geometry files were created to analyze the existing and proposed stream crossings. The existing stream crossing was modeled as a 60-inch diameter HDPE culvert, with invert elevations based on field survey computations. The proposed stream crossing was modeled as a pre-fabricated bridge with a span length of thirty-five (35) feet. The bridge abutments were modeled at a slope of 1.5H:1V. The 100-year storm event (one (1) percent annual chance occurrence) was analyzed for comparison to the existing base flood elevation.

B. Water Surface Elevation Table, Including Existing and Proposed Analyses

100-Year Rainfall Event (1,093 cfs)				
Cross-Section	**River Station**	**Existing (ft)**	**Proposed (ft)**	**Difference (ft)**
1	1799.59	907.54	907.54	0.00
2	1583.90	905.95	905.96	+0.01
3	1398.58	904.36	904.34	-0.02
4	1193.00	903.98	903.80	-0.18
5	999.54	903.76	903.49	-0.27
6	815.00	903.66	903.34	-0.32
7	700.00	903.68	903.38	-0.30
Crossing	675.00			
8	586.01	899.32	899.32	0.00
9	460.00	898.97	898.97	0.00
10	260.56	898.46	898.46	0.00
11	60.03	897.59	897.59	0.00

See Appendix D – HEC-RAS Profile Summary Tables.

C. Compliance with FEMA Criteria

FEMA permits the 100-year flood elevation to increase in surcharge up to one (1) foot in elevation with the proposed encroachment in place. Based on the HEC-RAS results, the proposed conditions at the site will decrease the 100-year flood elevation by 0.30 feet, satisfying the FEMA criteria.

D. Recommendation

The proposed Susie Jane Bridge for Antero Resources Corporation involves construction within the floodplain established by FEMA. However, the results of the hydraulic study indicate that the construction will not increase the water surface elevation of Buffalo Calf Creek under the 100-year storm event. Therefore, it is the engineer's opinion that the proposed construction will not cause adverse impacts to the floodplain of Buffalo Calf Creek.

E. Signature Block, Consultant, or In-House Designers

1. Preparer

   Andrew P. Darnell, E.I.T. (West Virginia Engineer Intern No. 9156)

2. Reviewer

   Gregory S. Linder, P.E. (West Virginia Registered Professional Engineer No. 15629)

3. Date

   August 7, 2015

4. Engineer's Seal on Final Report

   Gregory S. Linder, P.E. (West Virginia Registered Professional Engineer No. 15629)

III. AVAILABLE DATA

A. Flood Insurance Study

A Flood Insurance Study (FIS) for Doddridge County was initiated in January 1985 and completed in April 1990. The final Consultation and Coordination Officer's meeting for the county-wide FIS was held in April 2010. Buffalo Calf Creek was included among the areas studied by approximate methods, with no Base Flood Elevations (BFEs) or flood depths listed.

See Appendix B – FEMA Flood Insurance Study (FIS) Data.

B. Existing Hydrologic Data

No detailed hydrologic evaluation has been performed within the boundaries of this project site.

C. Existing Hydraulic Model from FEMA, USACE, NRCS, others

There is no existing hydraulic model for this project site.

IV. HYDROLOGY

A. Design Discharge Based on USGS Regression Equation

Since no detailed hydrologic analyses have been performed within the boundaries of this project, the design discharge of the 10-year and 100-year storm events were calculated using the USGS regression equations for the North Region of West Virginia. The hydraulic analysis was performed for the 100-year discharge. The 100-year flood has been adopted by FEMA as the base flood for floodplain management purposes.

See Appendix C – Design Discharge Calculations.

Frequency	Discharge
10-year	538 cfs
100-year	1,093 cfs

B. Boundary Conditions

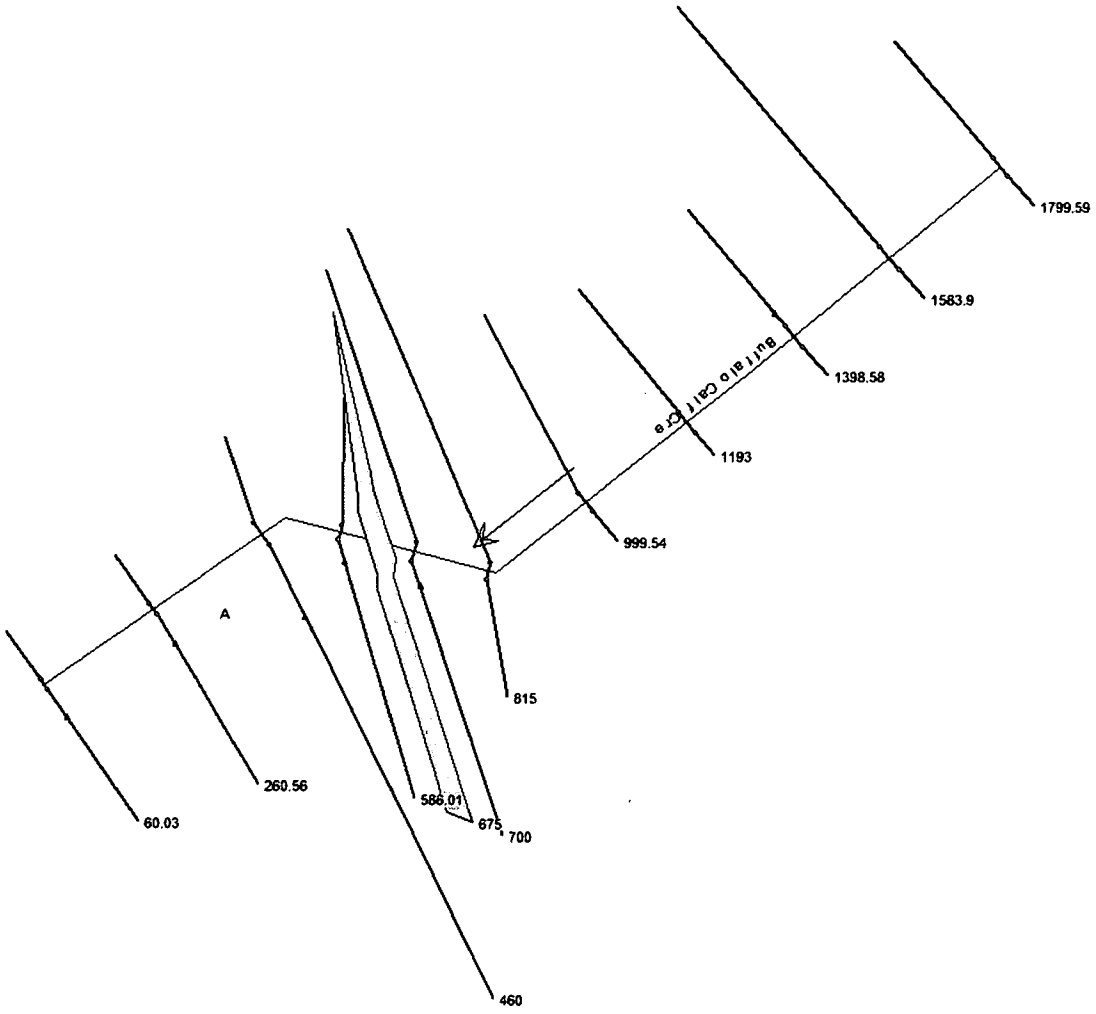
The boundary condition applicable to this hydraulic analysis is the Normal Depth slope at Cross-Section 11 (most downstream station), which is approximately 0.0040 ft/ft.

V. HYDRAULIC MODELING

A. Source of Model

HEC-RAS Version 4.1.0 was used to perform a hydraulic analysis to determine the adverse effects, if any, caused by the construction of the Susie Jane Bridge relative to existing conditions and the potential impacts to the water levels and floodplain of Buffalo Calf Creek. HEC-RAS 4.1.0 is the most current version of the river analysis software available from the Hydraulic Engineering Center of the U.S. Army Corps of Engineers.

B. Site Map with Cross-Sections



C. Explanation of Data and Methods

1. Manning's Values

Manning's roughness coefficients were determined based on a site visit and aerial photography of the project site. See Section I.C.3. for a detailed description of the Manning's values used.

2. Bridge Modeling Approach

The Bridge Modeling Approach used was Energy (Standard Step).

3. Ineffective Flow Areas

Ineffective flow areas were incorporated to account for areas in the cross-sectional geometry where ponded water will not be actively conveyed downstream.

4. Any Unusual Circumstances

There are no unusual circumstances specified in correlation with the hydraulic analysis of this project.

5. Table of HEC-RAS Plan Files

File Name	Description
152048 Existing	Existing Conditions Analysis
152048 Proposed	Proposed Conditions Analysis

See Appendix F - HEC-RAS Output Files

D. HEC-RAS Generated Tables

1. Profile Summary with Existing and Proposed Conditions

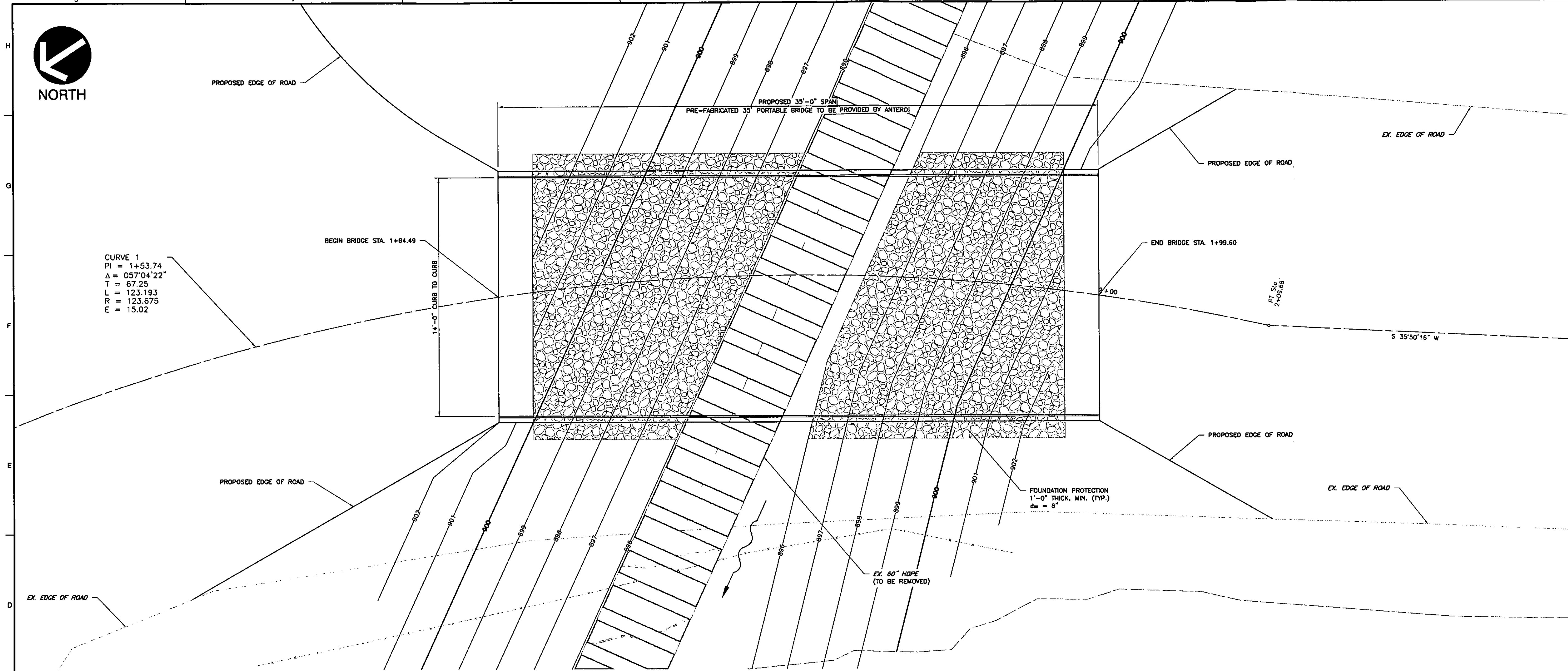
See Appendix D – HEC-RAS Profile Summary Tables.

2. Detailed Output Tables

See Appendix F – HEC-RAS Output Files

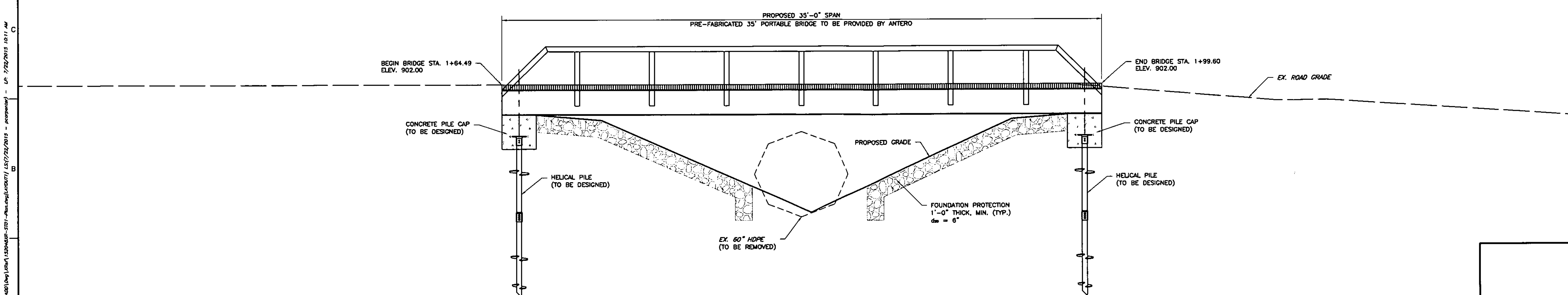
APPENDIX A

Site Plans



PLAN VIEW - PROPOSED TEMPORARY BRIDGE

SCALE: 1" = 3'



TYPICAL ELEVATION - PROPOSED TEMPORARY BRIDGE

SCALE: 1" = 3'

SCALE IN FEET
0 3 6

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Consultants, Inc.
99 Cambridge Place · Bridgeport, WV 26330
Ph: 304.933.3119 · 855.488.9539 · Fax: 304.933.3327
www.cecinc.com

ANTERO RESOURCES CORPORATION
SUSIE JANE BRIDGE
DODDRIDGE COUNTY, WEST VIRGINIA

PROPOSED TEMPORARY BRIDGE

DATE:	JULY 2015	DRAWN BY:	PWC
DWG SCALE:	1" = 3'	CHECKED BY:	DRAFT
PROJECT NO:			152-048
APPROVED BY:			DRAFT

DRAWING NO.: **SP01**

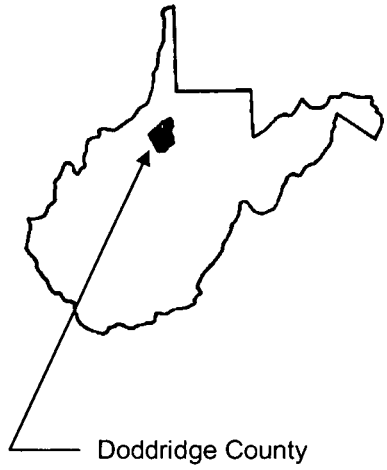
SHEET 1 OF 1

APPENDIX B

FEMA Flood Insurance Study (FIS) Data

FLOOD INSURANCE STUDY

DODDRIDGE COUNTY, WEST VIRGINIA
AND INCORPORATED AREAS



COMMUNITY NAME	COMMUNITY NUMBER
WEST UNION, TOWN OF	540025
DODDRIDGE COUNTY (UNINCORPORATED AREAS)	540024

Effective: October 4, 2011

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
54017CV000A

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) report may not contain all data available within the Community Map Repository. Please contact the Community Map Repository for any additional data.

The Federal Emergency Management Agency (FEMA) may revise and republish part or all of this FIS report at any time. In addition, FEMA may revise part of this FIS report by the Letter of Map Revision process, which does not involve republication or redistribution of the FIS report. Therefore, users should consult with community officials and check the Community Map Repository to obtain the most current FIS report components.

Initial Countywide FIS Effective Date: March 18, 1991

Flood Insurance Study Revised: October 4, 2011

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FLOOD INSURANCE STUDY
DODDRIDGE COUNTY, WEST VIRGINIA
AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This countywide format Flood Insurance Study investigates the existence and severity of flood hazards in the geographic area of Doddridge County, West Virginia, including the Town of West Union and the unincorporated areas of the county (hereinafter referred to collectively as Doddridge County); and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood-risk data for various areas of the community that will be used to establish actuarial flood insurance rates and to assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State or other jurisdictional agency will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses in this study were prepared by the U.S. Geological Survey (USGS) for the Federal Emergency Management Agency (FEMA) under Inter-Agency Agreement No. EMW-87-E- 2512. Within the Town of West Union, the work for this study was completed in May 1988; within the unincorporated areas of the county, the work for this study was completed in June 1988.

This digital conversion was prepared by the USACE, Huntington District, for FEMA, under Inter-Agency Agreement No. HSFE03-06-X-0023.

Base map information shown on the FIRM was provided by West Virginia Statewide Addressing and Mapping Board (SAMB). Imagery was captured at a scale of 1:24,000 in the Spring of 2003 for the purpose of producing natural color digital orthophotos at a two-foot pixel resolution.

The projection used in the preparation of this map is Universal Transverse Mercator (UTM) Zone 17, and the horizontal datum used is North American Datum of 1983 (NAD 83), GRS1980 spheroid. Corner coordinates shown on the FIRM are in latitude and longitude referenced to UTM, NAD 1983. Differences in the datum, spheroid, projection, or UTM zones used in the production of FIRMs for adjacent counties may

result in slight positional differences in map features at the county boundaries. These differences do not affect the accuracy of the information shown on the FIRM.

1.3 Coordination

On January 17, 1985, an initial Consultation and Coordination Officer's (CCO) meeting was held with representatives of FEMA, the county, and the USGS (the study contractor) to determine the streams to be studied by detailed methods. The Huntington District of the U. S. Army Corps of Engineers (USACE) and the Soil Conservation Service (SCS) were contacted for information pertinent to this study.

On April 18, 1990, a final CCO meeting was held with representatives of FEMA, the county, and the study contractor to review the results of the study. The final CCO meeting for the unincorporated areas of Doddridge County also served as the final CCO meeting for this countywide study, and was open to representatives from all communities within the county that were covered by this countywide study.

For this countywide FIS, the final CCO meeting was held on April 29, 2010, and attended by representatives of the Town of West Union and Doddridge County, West Virginia. All problems raised at that meeting have been addressed.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of Doddridge County, West Virginia, including communities listed in Section 1.1.

Table 1, "Areas Studied by Detailed Methods" lists the streams studied by detailed methods.

Table 1 – Areas Studied by Detailed Methods

Stream	Limits of Detailed Study
Middle Island Creek	From the downstream county boundary to the confluence of Meathouse Fork and Buckeye Creek
Buckeye Creek	From the confluence with Middle Island Creek to a point approximately 240 feet upstream of the confluence of Long Run, and from the confluence of Greenbrier Creek to the confluence of Traugh Fork
Meathouse Fork	From the confluence with Middle Island Creek to County Highway 56, and from a point approximately 1,600 feet downstream of County Highway 25-13 to the confluence of Laurel Run and Big Isaac Creek
McElroy Creek	From the confluence of Flint Run to the confluence of Big Battle Run

Table 1 – Areas Studied by Detailed Methods - continued

Stream	Limits of Detailed Study
Wilhelm Run	From the confluence with Arnold Creek to a point approximately 1.2 miles upstream
Long Run	From the confluence with Buckeye Creek to a point approximately 2.4 miles upstream
Toms Fork	From the confluence with Meathouse Fork to the confluence of Little Toms Fork
Greenbrier Creek	From the confluence with Buckeye Creek to a point approximately 1.9 miles upstream
Big Isaac Creek	From the confluence with Meathouse Fork to the confluence of Little Isaac Creek
Laurel Run	From the confluence with Meathouse Fork to a point approximately 0.9 mile upstream of the confluence with Meathouse Fork

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction through January 1990.

All or portions of the following streams were studied by approximate methods: Broad Run, Arnold Creek, Slaughter Run, Flint Run, Riggins Run, Robinson Fork, Big Battle Run, Skelton Run, Talkington Fork, Long Run, Bluestone Creek, Cove Creek, Indian Fork, Nutter Fork, Jockey Camp Run, Morgans Run, Buckeye Creek, Buffalo Calf Creek, Meathouse Fork, Little Toms Fork, Lick Run, Big Isaac Creek, Middle Fork, Dotson Run, Cabin Run, Leason Creek, Right Fork, Left Fork, Elk Lick Run, Pike Fork, Little Battle Run, Piggin Run, Brushy Fork, Rock Run, Wolfpen Run, Englands Run, Jockeycamp Run, Douglascamp Run, Traugh Fork, Bonnet Fork, the South Fork Hughes River, and Sycamore Fork. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and Doddridge County.

No Letters of Map Revision (LOMRs) were incorporated for the October 4, 2011, revision.

2.2 Community Description

Doddridge County is located in northern West Virginia. It is bordered by the unincorporated areas of Wetzel and Tyler Counties to the north; the unincorporated areas of Ritchie County to the west; the unincorporated areas of Harrison County to the east; and the unincorporated areas of Gilmer and Lewis Counties to the south. The total land

area contained within the county is approximately 321.6 square miles. In 2000, the population of the county was 7,491 (Reference 1).

The county seat is located in the Town of West Union. The total land area of the town is approximately 0.32 square miles, and the population was 806 in 2000 (Reference 1).

The climate of Doddridge County is temperate with a seasonal variation in temperature. The county is located in a region termed humid continental: humid because of the evenly spaced precipitation, and continental because of the yearly range in temperature. Mean annual precipitation of the county is approximately 45 inches. The average monthly temperatures in degrees Fahrenheit range from the mid-30's in winter to the low 70's in summer (Reference 2).

2.3 Principal Flood Problems

The principal flood problems of Doddridge County are the overflows of Middle Island Creek, Buckeye Creek, and Meathouse Fork. The history of flooding in the county indicates that flooding can occur at any time of the year. Large frontal storms or decaying tropical storms produce the worst flooding on the larger streams, while high intensity thunderstorms produce severe flooding on smaller drainage areas. Major floods have occurred in the county in 1875, 1950, 1963, and 1985.

The mountainous topography of the county is conducive to rapid rises on streams and also to fast runoff best described as flash flooding. This condition has been aggravated by human activities such as timbering in the county.

2.4 Flood Protection Measures

No major structural flood protection measures exist or are planned for the county.

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded once on the average during any 10-, 2-, 1-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 2-, 1-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent-annual-chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 1-percent-annual-chance (100-year) flood in any 50-year period is approximately 40 percent (4 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the county.

Discharge-frequency curves were developed on a regional basis that applies to West Virginia (References 3 and 4). For the streams studied by detailed methods, 1-percent-annual-chance flood elevations were determined through discharge-frequency relations and the Manning equation. Within the Town of West Union, flood elevations were determined through streamflow-station data relationships and the Manning's equation.

Peak discharge-drainage area relationships for each stream studied by detailed methods are presented in Table 2, "Summary of Discharges".

Table 2 – Summary of Discharges

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ. MILES)	PEAK DISCHARGE (CFS) 1-PERCENT-ANNUAL- CHANCE
MIDDLE ISLAND CREEK		
Upstream of Doddridge-Tyler County boundary	134.78	15,200
Approximately 0.1 mile downstream of confluence of Piggin Run	120.06	13,080
BUCKEYE CREEK		
At confluence with Middle Island Creek	38.62	7,350
Downstream of confluence of Long Run	22.62	5,150
Upstream of confluence of Greenbrier Creek	9.41	3,050
Downstream of confluence of Traugh Fork	1.52	1,310
MEATHOUSE FORK		
At confluence with Middle Island Creek	66.84	9,600
Downstream of confluence of Toms Fork	50.47	8,200
Downstream of confluence of Brushy Fork	29.87	6,050
Downstream of confluence of Laurel Run and Big Isaac Creek	3.76	2,230
MCELROY CREEK		
Upstream of confluence of Flint Run	61.95	9,250
Upstream of confluence of Rigging Run	51.23	8,300
Downstream of confluence of Talkington Fork	39.18	7,100
Downstream of confluence of Robinson Fork and Big Battle Run	20.75	4,900

Table 2 – Summary of Discharges

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ. MILES)	PEAK DISCHARGE (CFS) 1-PERCENT-ANNUAL- CHANCE
WILHELM RUN		
At confluence with Arnold Creek	3.29	2,070
Approximately 1.2 miles upstream of confluence with Arnold Creek	2.07	1,570
LONG RUN		
At confluence with Buckeye Creek	4.44	2,460
Approximately 2.4 miles upstream of confluence with Buckeye Creek	1.85	1,470
TOMS FORK		
At confluence with Meathouse Fork	15.27	4,100
Downstream of confluence of Little Toms Fork	12.58	3,650
GREENBRIER CREEK		
At confluence with Buckeye Creek	2.80	1,880
Approximately 1.9 miles upstream of confluence with Buckeye Creek	1.09	1,080
BIG ISAAC CREEK		
At confluence with Meathouse Fork	1.79	1,450
LAUREL RUN		
At confluence with Meathouse Fork	1.97	1,530
Upstream of confluence of Big Isaac Creek	1.57	1,340

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1) and the FIRM (Exhibit 2) where applicable.

Water-surface elevations of floods of the selected recurrence intervals were computed

using the USACE HEC-2 step-backwater computer program, and the results were published in a special flood hazard information report (References 5 and 6). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals.

Channel roughness factors (Manning's "n") used in the hydraulic computations were assigned on the basis of field surveys of the stream and floodplain areas. For Middle Island Creek, channel "n" values range from 0.040 to 0.045 and overbank "n" values range from 0.050 to 0.070. For Buckeye Creek and Meathouse Fork, channel "n" values range from 0.055 to 0.080.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

Qualifying benchmarks within a given jurisdiction that are catalogued by the National Geodetic Survey (NGS) and entered into the National Spatial Reference System (NSRS) as First or Second Order Vertical and have a vertical stability classification of A, B or C are shown and labeled on the FIRM with their 6-character NSRS Permanent Identifier.

Benchmarks catalogued by the NGS and entered into the NSRS vary widely in vertical stability classification. NSRS vertical stability classifications are as follows:

- Stability A: Monuments of the most reliable nature, expected to hold position/elevation (e.g. mounted in bedrock)
- Stability B: Monuments which generally hold their position/elevation (e.g. concrete bridge abutment)
- Stability C: Monuments which may be affected by surface ground movements (e.g. concrete monument below frost line)
- Stability D: Mark of questionable or unknown vertical stability (e.g. concrete monument above frost line, or steel witness post)

In addition to NSRS benchmarks, the FIRM may also show vertical control monuments established by a local jurisdiction; these monuments will be shown on the FIRM with the appropriate designations. Local monuments will only be placed on the FIRM if the community has requested that they be included, and if the monuments meet the aforementioned NSRS inclusion criteria.

To obtain current elevation, description, and/or location information for benchmarks shown on the FIRM for this jurisdiction, please contact the Information Services Branch of the NGS at (301) 713-3242, or visit their Web site at www.ngs.noaa.gov.

It is important to note that temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the Technical Support Data Notebook associated with the FIS report and FIRM for this community. Interested individuals may contact FEMA to access these data.

3.3 Vertical Datum

All elevations used in the original Doddridge county FIS reports were referenced to the National Geodetic Vertical Datum of 1929 (NGVD29), formerly referred to as Sea Level Datum of 1929. All flood elevations shown in this FIS report and on the FIRM are referenced to North American Vertical Datum of 1988 (NAVD88). Structure and ground elevations in the community must, therefore, be referenced to NAVD88. Elevation factors used to convert the NGVD29 elevation data of the previous Braxton county FIS reports to NAVD88 are summarized below. Elevation reference marks used in this study are shown on the maps.

The data points used to determine the conversion are listed in Table 3, "Vertical Datum Conversion Values".

Table 3 – Vertical Datum Conversion Values

USGS 7.5-Minute Quadrangle Name	Corner	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Conversion from NGVD29 to NAVD88 (foot)
Shirley	SE	39.375	80.750	-0.522
Center Point	SE	39.375	80.625	-0.515
Folsom	SE	39.375	80.500	-0.525
Pennsboro	SE	39.250	80.875	-0.554
West Union	SE	39.250	80.750	-0.515
Smithburg	SE	39.250	80.625	-0.502
Oxford	SE	39.125	80.750	-0.531
New Milton	SE	39.125	80.625	-0.522
			AVERAGE	**-0.500 foot**

All flood elevations shown in this FIS report and on the FIRM are referenced to NAVD88. A conversion factor of -.500 feet was applied to the NGVD29 elevations in Doddridge County to convert to NAVD88. Structure and ground elevations in the county must, therefore, be referenced to NAVD88. It is important to note that adjacent communities and counties may be referenced to NGVD29. This may result in differences in Base Flood Elevations (BFEs) across the community and county boundaries.

For more information on NAVD88, see the FEMA publication entitled "Converting the National Flood Insurance Program to the North American Vertical Datum of 1988" (FEMA, June 1992), or contact the National Geodetic Survey Information Services, NOAA, N/NGS12, National Geodetic Survey, SSMC-3, #9202, 1315 East-West Highway, Silver Spring, MD 20910-3282 (Internet address http://www.ngs.noaa.gov).

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each FIS provides 1-percent-annual-chance (100-year) flood elevations and

delineations of the 1- and 0.2-percent-annual-chance (500-year) floodplain boundaries and 1-percent-annual-chance floodway to assist communities in developing floodplain management measures. This information is presented on the FIRM and in many components of the FIS report, including Flood Profiles and Floodway Data Table. Users should reference the data presented in the FIS report as well as additional information that may be available at the local map repository before making flood elevation and/or floodplain boundary determinations.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent-annual-chance flood has been adopted by FEMA as the base flood for floodplain management purposes. For the streams studied in detail, the 1-percent-annual-chance floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24,000 with a contour interval of 20 feet (Reference 7).

For the streams studied by approximate methods, the boundaries of the 1-percent-annual-chance floodplain were delineated using the Flood Hazard Boundary Map (FHBM) for the Town of West Union and the FIS for the Unincorporated Areas of Doddridge County (References 8 and 9).

The 1-percent-annual-chance floodplain boundaries are shown on the FIRM (Exhibit 2). On this map, the 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE). Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 1-percent-annual-chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 1-percent-annual-chance flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced.

The area between the floodway and 1-percent-annual-chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 1-percent-annual-chance flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 1, "Floodway Schematic".

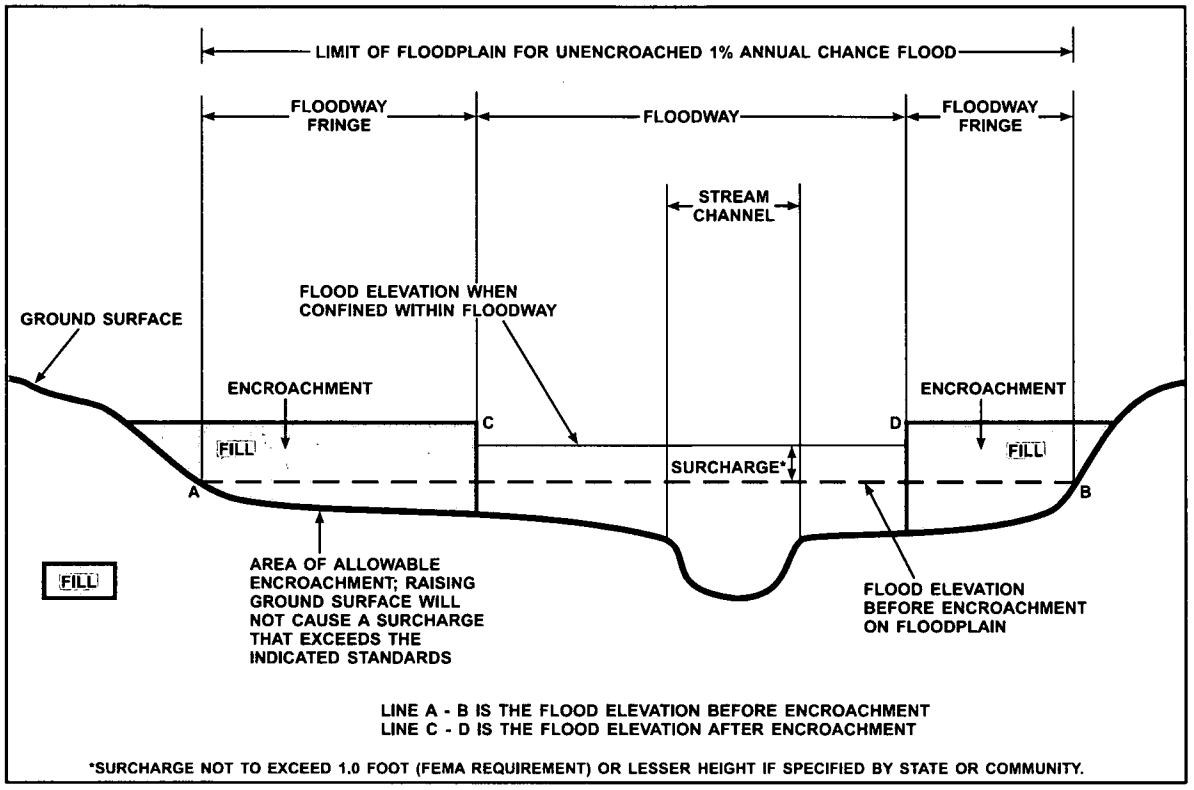


Figure 1 - Floodway Schematic

No floodways were calculated as part of this study.

5.0 INSURANCE APPLICATIONS

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance risk zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no (1-percent-annual-chance) BFEs or base flood depths are shown within this zone.

Zone AE

Zone AE is the flood insurance risk zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS by detailed methods. In most instances, whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance risk zone that corresponds to the areas of 1-percent-annual-chance shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance risk zone that corresponds to the areas of 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot base flood depths derived from the detailed hydraulic analyses are shown within this zone.

Zone AR

Zone AR is the flood insurance risk zone that corresponds to an area of special flood hazard formerly protected from the 1-percent-annual-chance flood event by a flood-control system that was subsequently decertified. Zone AR indicates that the former flood-control system is being restored to provide protection from the 1-percent-annual-chance or greater flood event.

Zone A99

Zone A99 is the flood insurance risk zone that corresponds to areas of the 1-percent-annual-chance floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No BFEs or depths are shown within this zone.

Zone V

Zone V is the flood insurance risk zone that corresponds to the 1-percent-annual-chance coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no BFEs are shown within this zone.

Zone VE

Zone VE is the flood insurance risk zone that corresponds to the 1-percent-annual-chance coastal floodplains that have additional hazards associated with storm waves. Whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance risk zone that corresponds to areas outside the 0.2-percent-annual-chance floodplain, areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1-foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent-annual-chance flood by levees. No BFEs or base flood depths are shown within this zone.

Zone X (Future Base Flood)

Zone X (Future Base Flood) is the flood insurance risk zone that corresponds to the 1-percent-annual-chance floodplains that are determined based on future-conditions hydrology. No BFEs or base flood depths are shown within this zone.

Zone D

Zone D is the flood insurance risk zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

6.0 FLOOD INSURANCE RATE MAP

The FIRM is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 1-percent-annual-chance floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 1- and 0.2-percent-annual-chance floodplain. The locations of selected cross sections used in the hydraulic analyses are shown where applicable.

The current FIRM presents flooding information for the entire geographic area of Doddridge County. Previously, separate FHBMs and/or FIRMs were prepared for each incorporated community with identified flood hazard areas and the unincorporated areas of the County. Historical map dates relating to pre-countywide maps prepared for each community are presented in Table 4, "Community Map History".

COMMUNITY NAME	INITIAL NFIP MAP DATE	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	INITIAL FIRM DATE	FIRM REVISIONS DATE
West Union, Town of	March 29, 1974	NONE	March 18, 1991	
Doddridge County (Unincorporated Areas)	November 8, 1974	June 3, 1977	March 18, 1991	

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

7.0 OTHER STUDIES

Flood Insurance Studies have been prepared for the unincorporated areas of Tyler, Ritchie and Harrison Counties, and for Lewis County and Incorporated Areas (References 10, 11, 12 and 13). The results of this study are in exact agreement with the results of those studies.

A FIS is currently being prepared for Gilmer County and Incorporated Areas (Reference 14). The results of that study will be in exact agreement with the results of this study.

Because it is based on more up-to-date analyses, this study supersedes the Flood Hazard Boundary Map for the Town of West Union and the FIS for the Unincorporated Areas of Doddridge County (References 8 and 9).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting Federal Insurance and Mitigation Division, FEMA Region III, One Independence Mall, Sixth Floor, 615 Chestnut Street, Philadelphia, PA 19106-4404.

9.0 BIBLIOGRAPHY AND REFERENCES

1. Holmes, Darrell E., West Virginia Blue Book, Chapman Printing, 2005.

2. U. S. Department of the Interior, Geological Survey, Hydrology of Area 8, Eastern Coal Province, West Virginia, January 1987.

3. U. S. Department of the Interior, Water-Resources Investigation 87-4111, Techniques for Estimating Flood-Depth Frequency Relations for Streams in West Virginia, by Jeffrey B. Wiley, 1987.

4. U. S. Department of the Interior, Geological Survey, in cooperation with the West Virginia Department of Highways, Runoff Studies on Small Drainage Areas by G. S. Runner, Washington, D. C., October 1980.

5. U. S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Generalized Computer Program, Davis, California, April 1984.

6. U. S. Army Corps of Engineers, Huntingdon District, Special Flood Hazard Information Report, Middle Island Creek and Tributaries, Doddridge County, West Virginia, October 1978.

7. U. S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 20 Feet: Big Isaac, West Virginia, 1964, Photorevised 1976; Center Point, West Virginia, 1961, Photorevised 1976; New Milton, West Virginia, 1965, Photorevised, 1976; Smithburg, West Virginia, 1961, Photorevised 1976; West Union, West Virginia, 1961, Photorevised 1976.

8. U. S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Town of West Union, Doddridge County, West Virginia, April 2, 1976.

9. U. S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, Unincorporated Areas of Doddridge County, West Virginia, Washington, D.C., June 3, 1977.

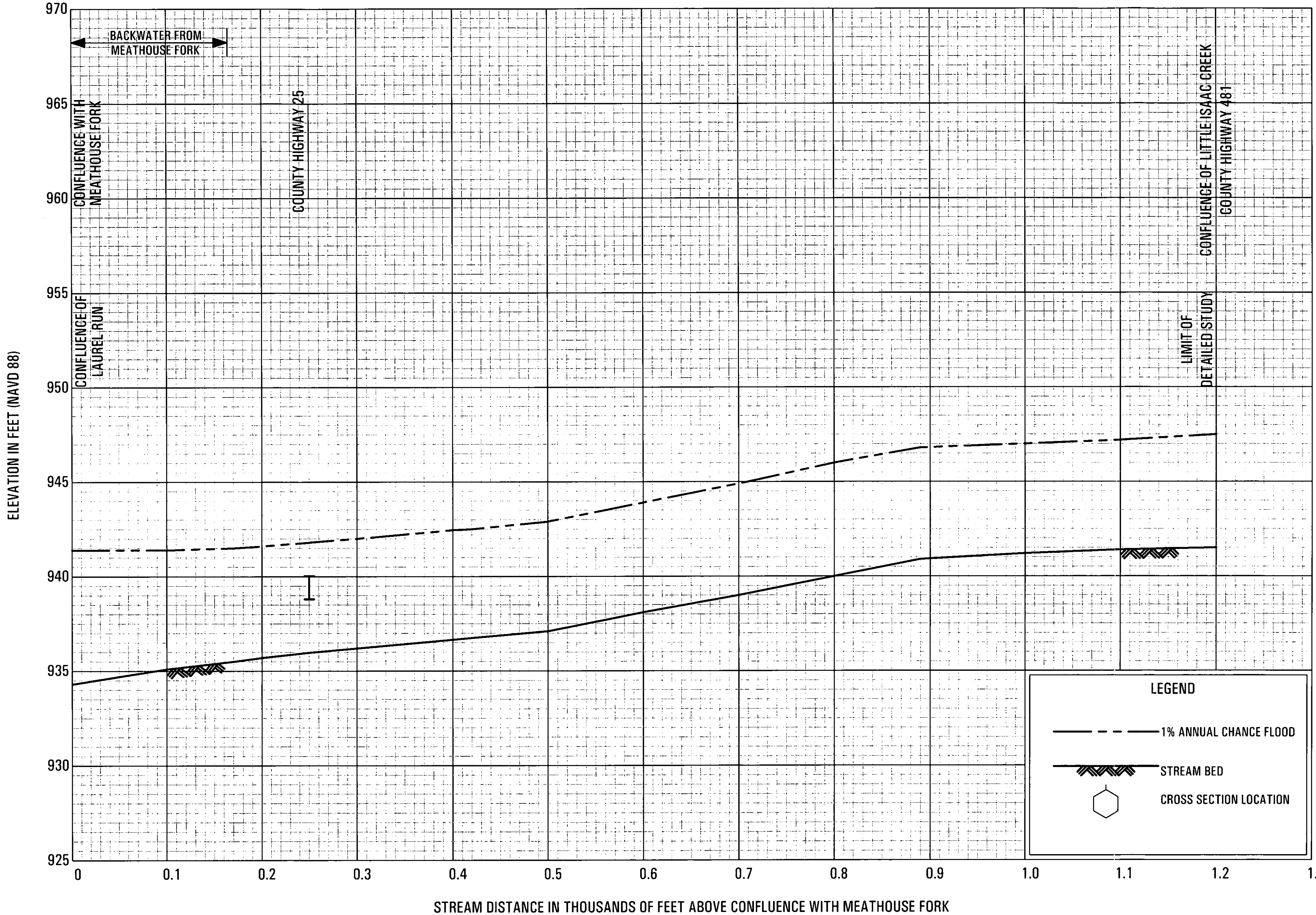
10. Federal Emergency Management Agency, Flood Insurance Study, Unincorporated Areas of Tyler County, West Virginia, Washington, D. C., November 4, 1988.

11. Federal Emergency Management Agency, Flood Insurance Study, Unincorporated Areas of Harrison County, West Virginia, Washington, D. C., July 4, 1988.

12. Federal Emergency Management Agency, Flood Insurance Study, Lewis County and Incorporated Areas, West Virginia, Washington, D.C., July 1, 1987.

13. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, Unincorporated Areas of Ritchie County, West Virginia, Washington, D.C., December 11, 1981.

14. Federal Emergency Management Agency, Flood Insurance Study, Gilmer County and Incorporated Areas, West Virginia (Unpublished).



FLOOD PROFILES

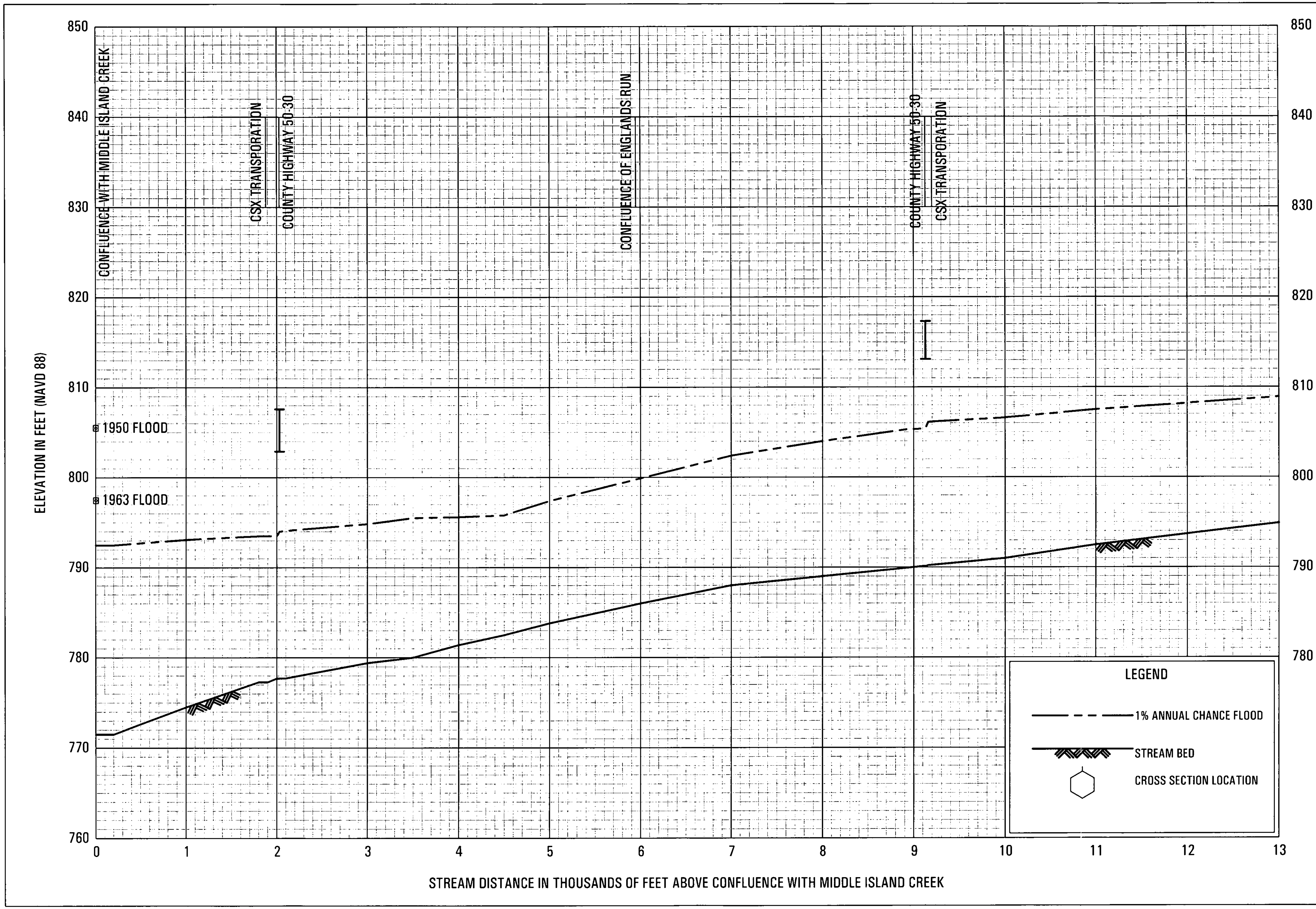
BIG ISAAC CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

01P



FLOOD PROFILES

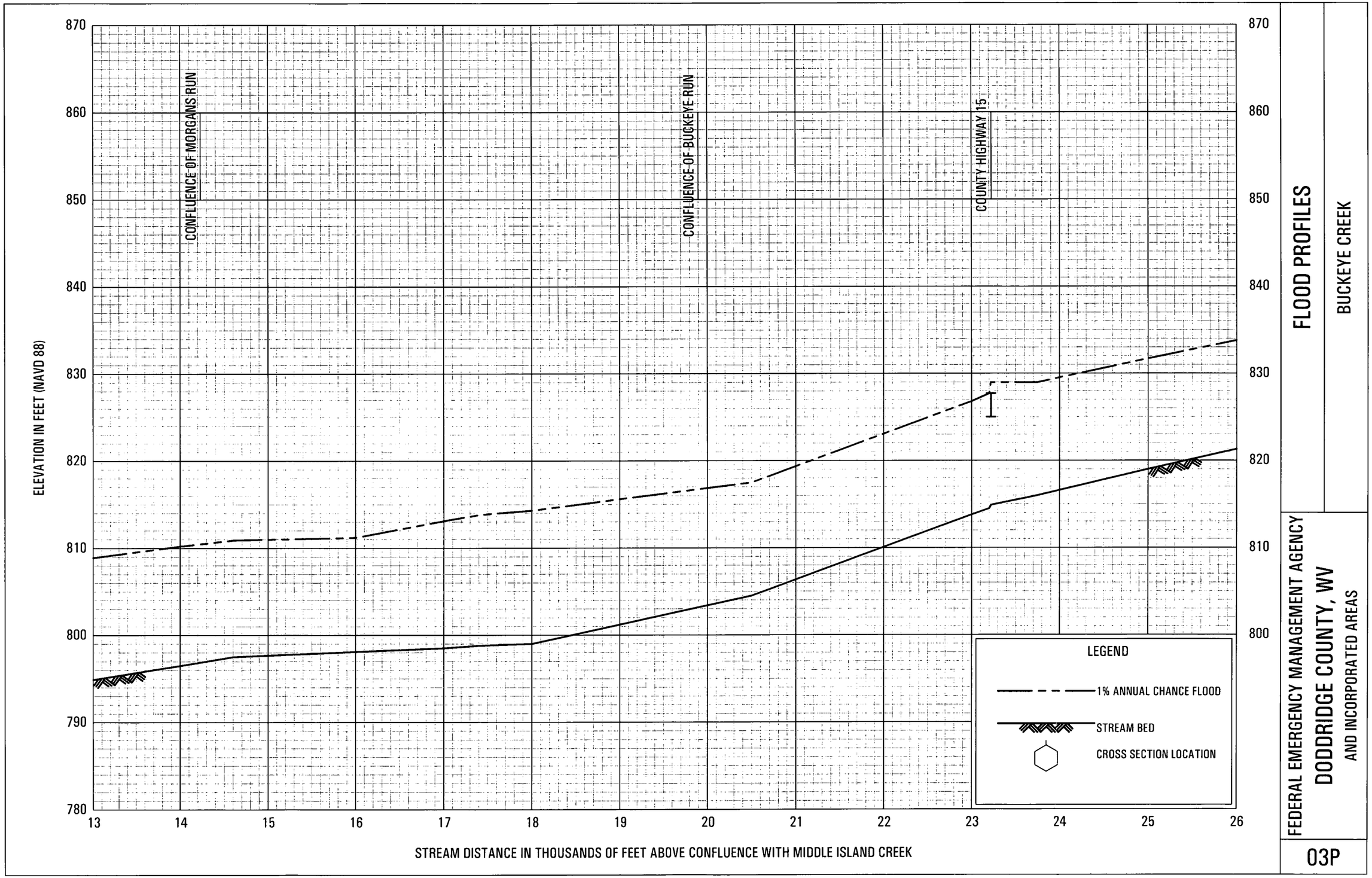
BUCKEYE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

02P



FLOOD PROFILES

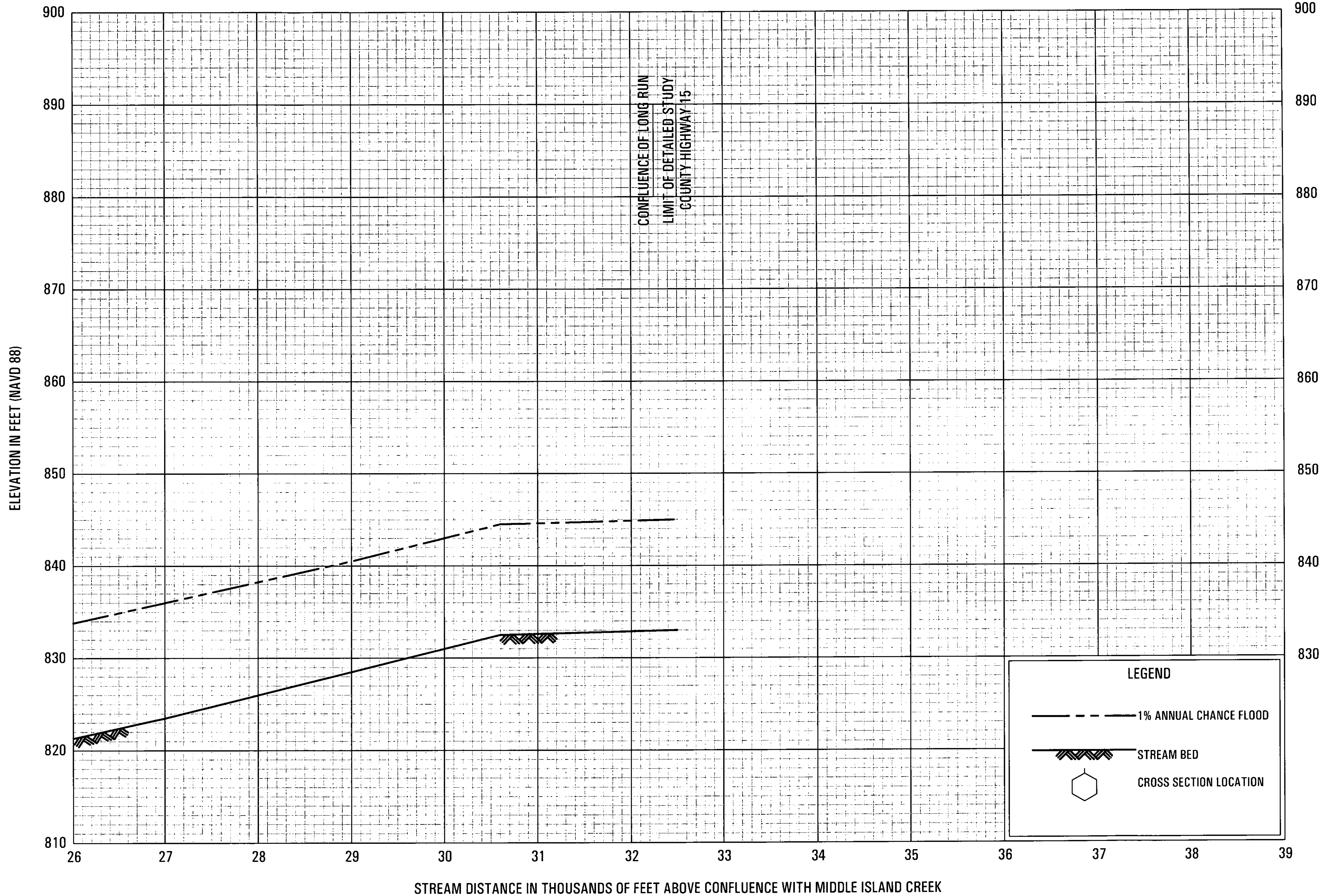
BUCKEYE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

03P



FLOOD PROFILES

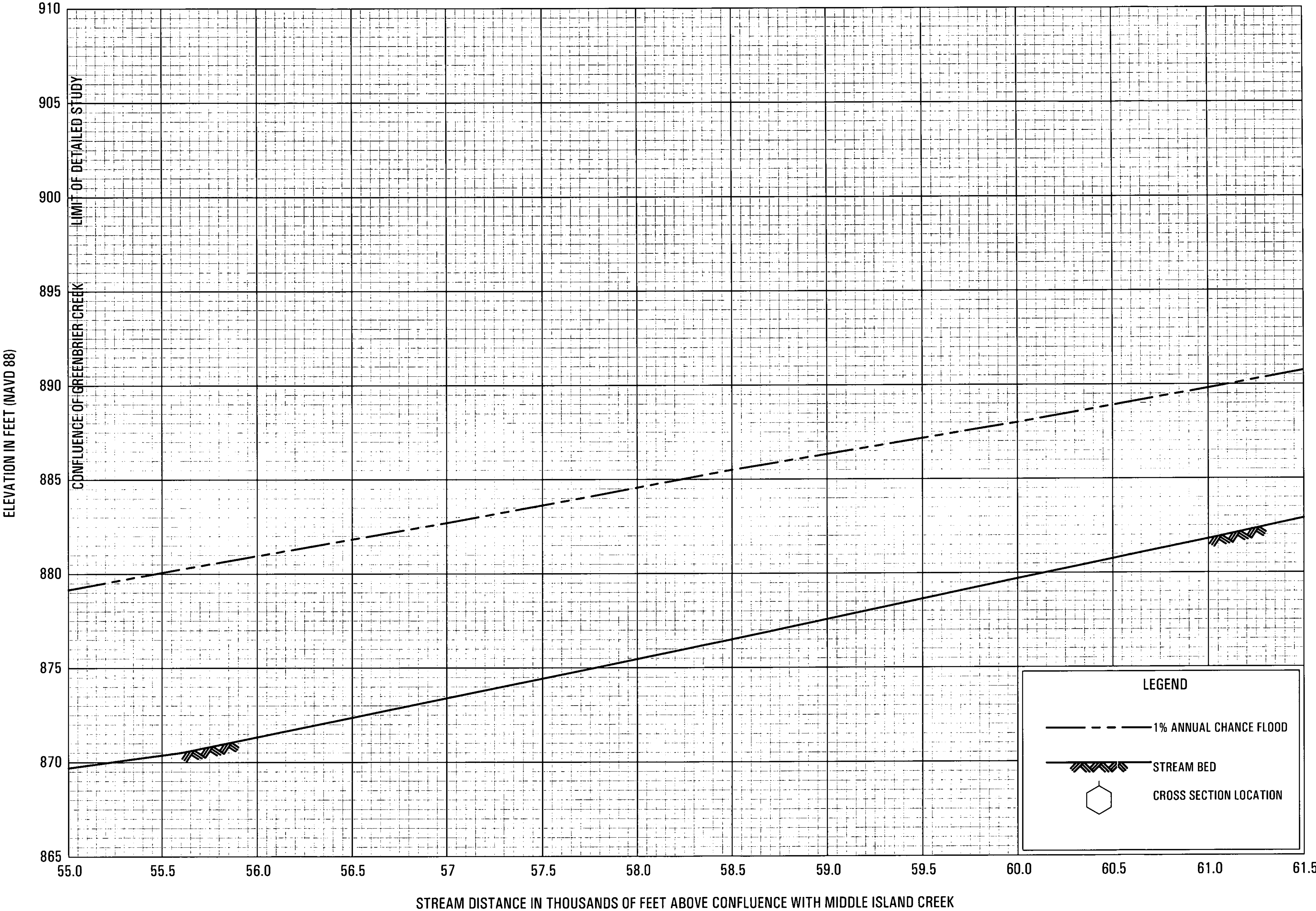
BUCKEYE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

04P



FLOOD PROFILES

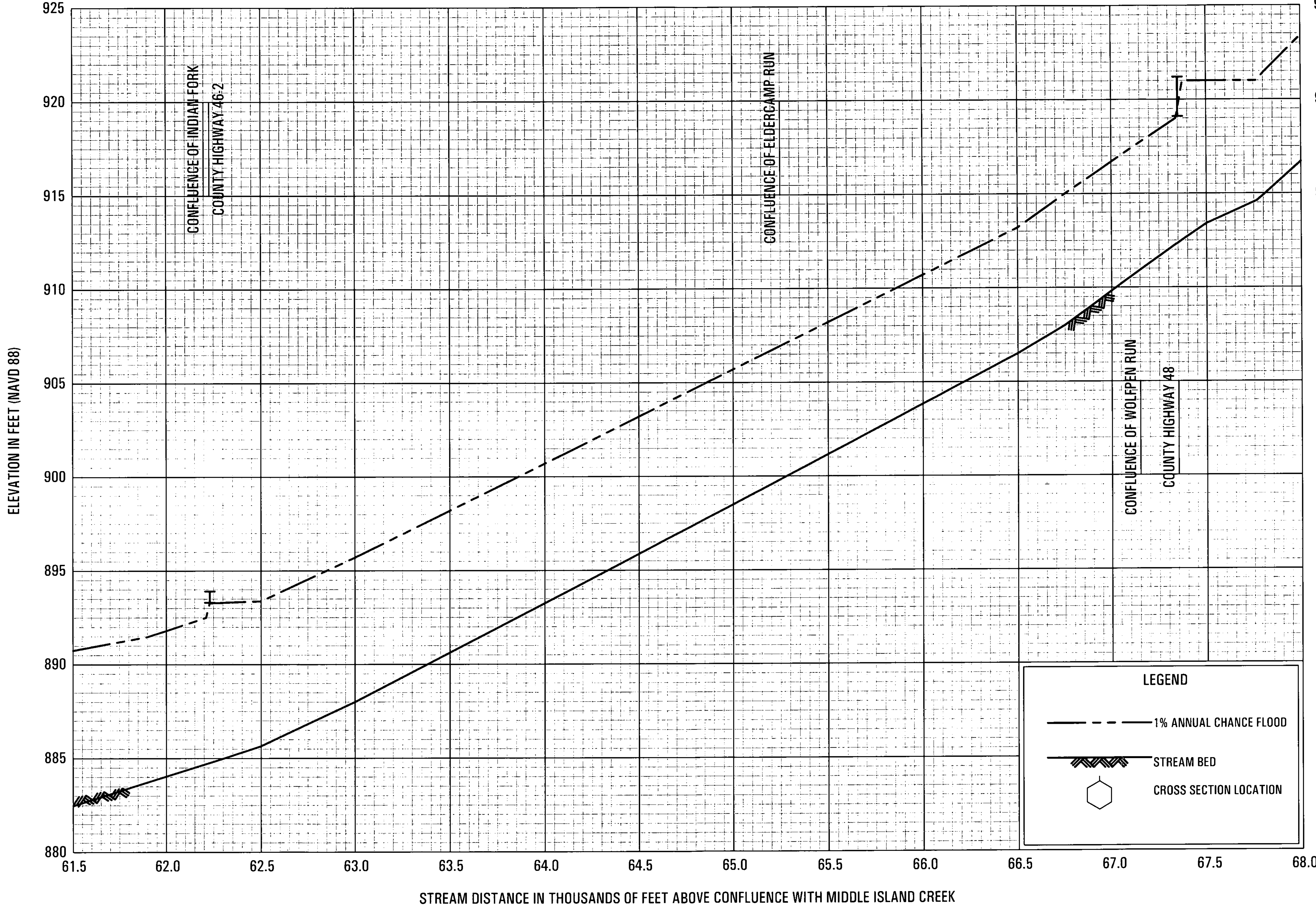
BUCKEYE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

05P



FLOOD PROFILES

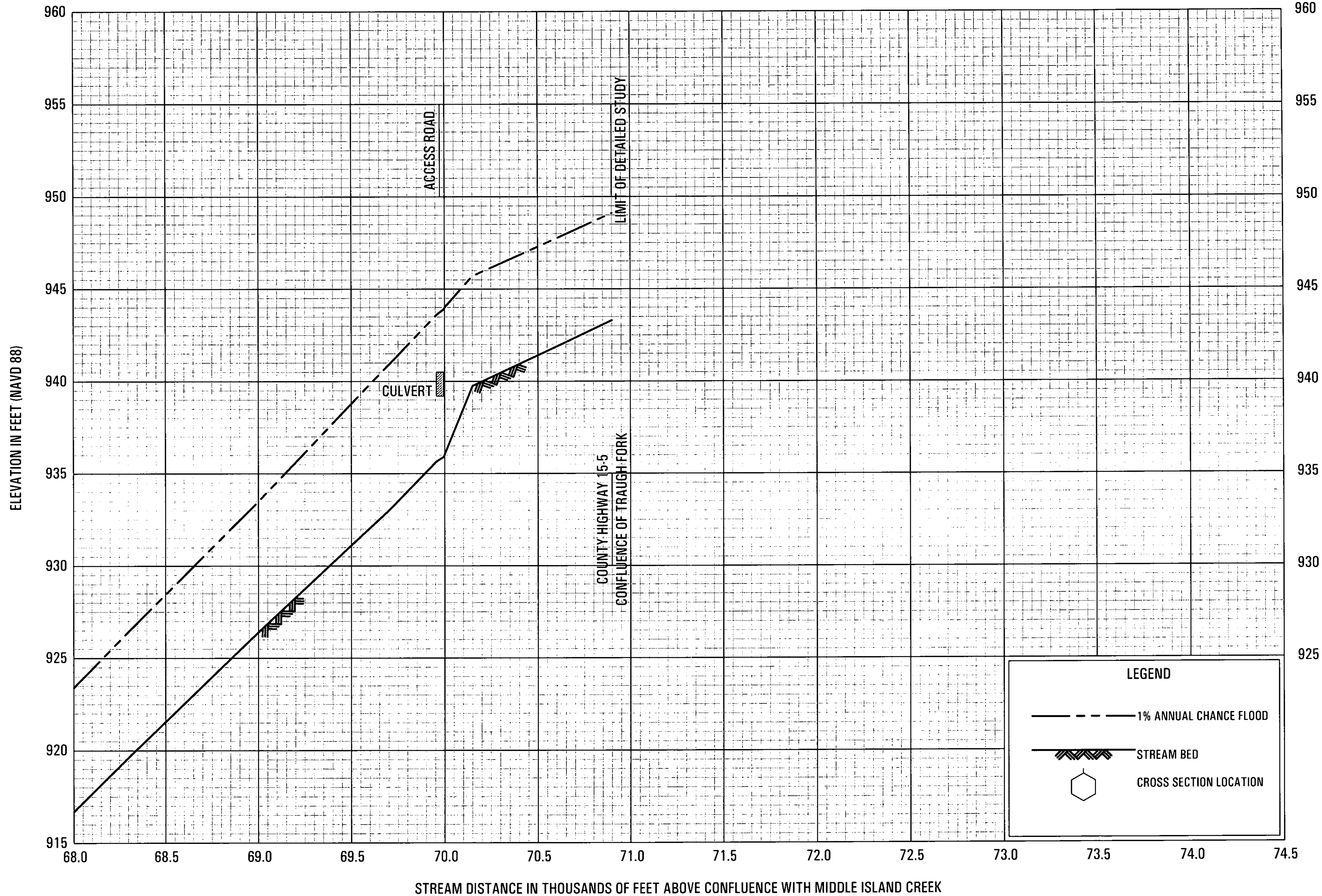
BUCKEYE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

06P



FLOOD PROFILES

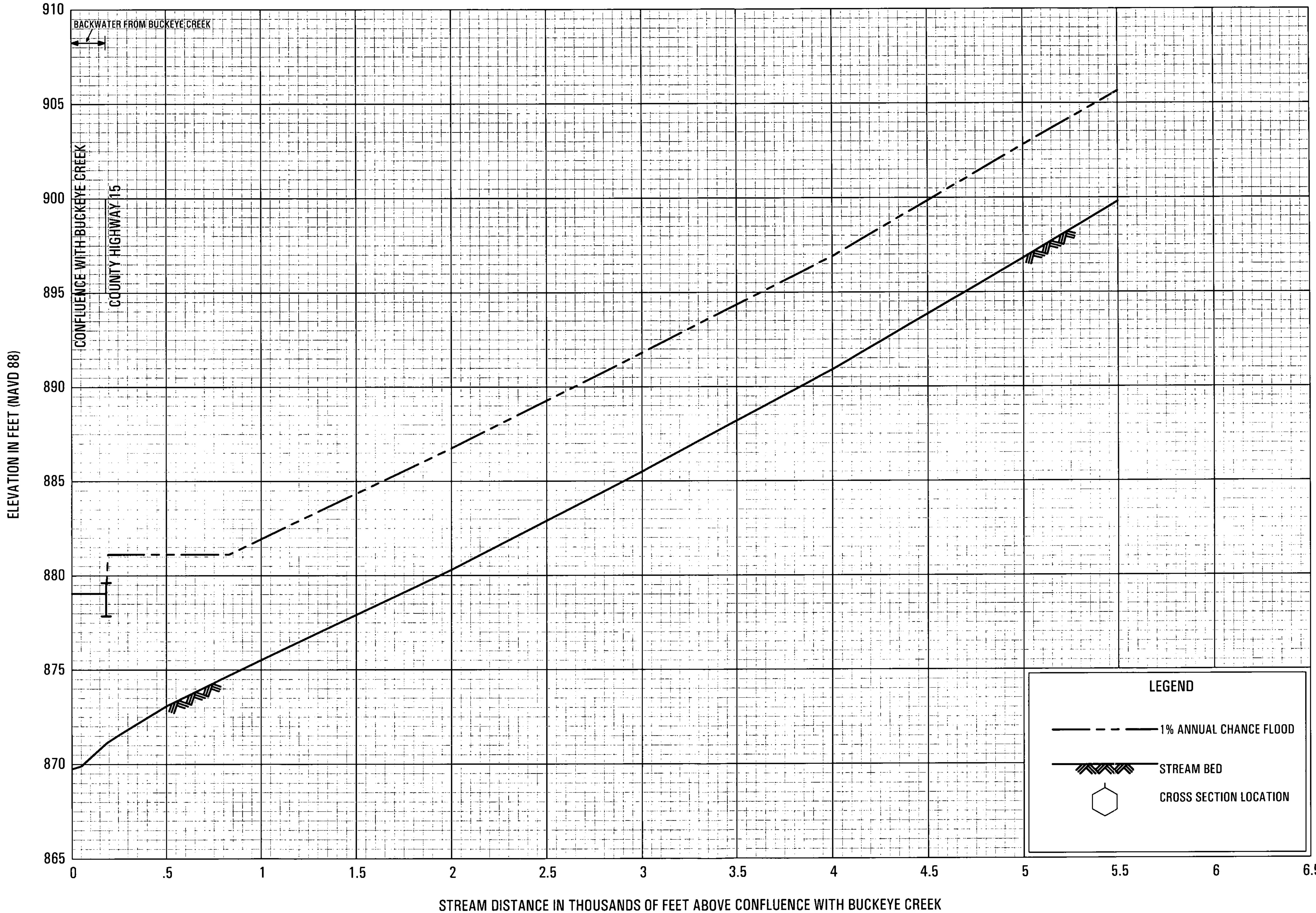
BUCKEYE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

07P



FLOOD PROFILES

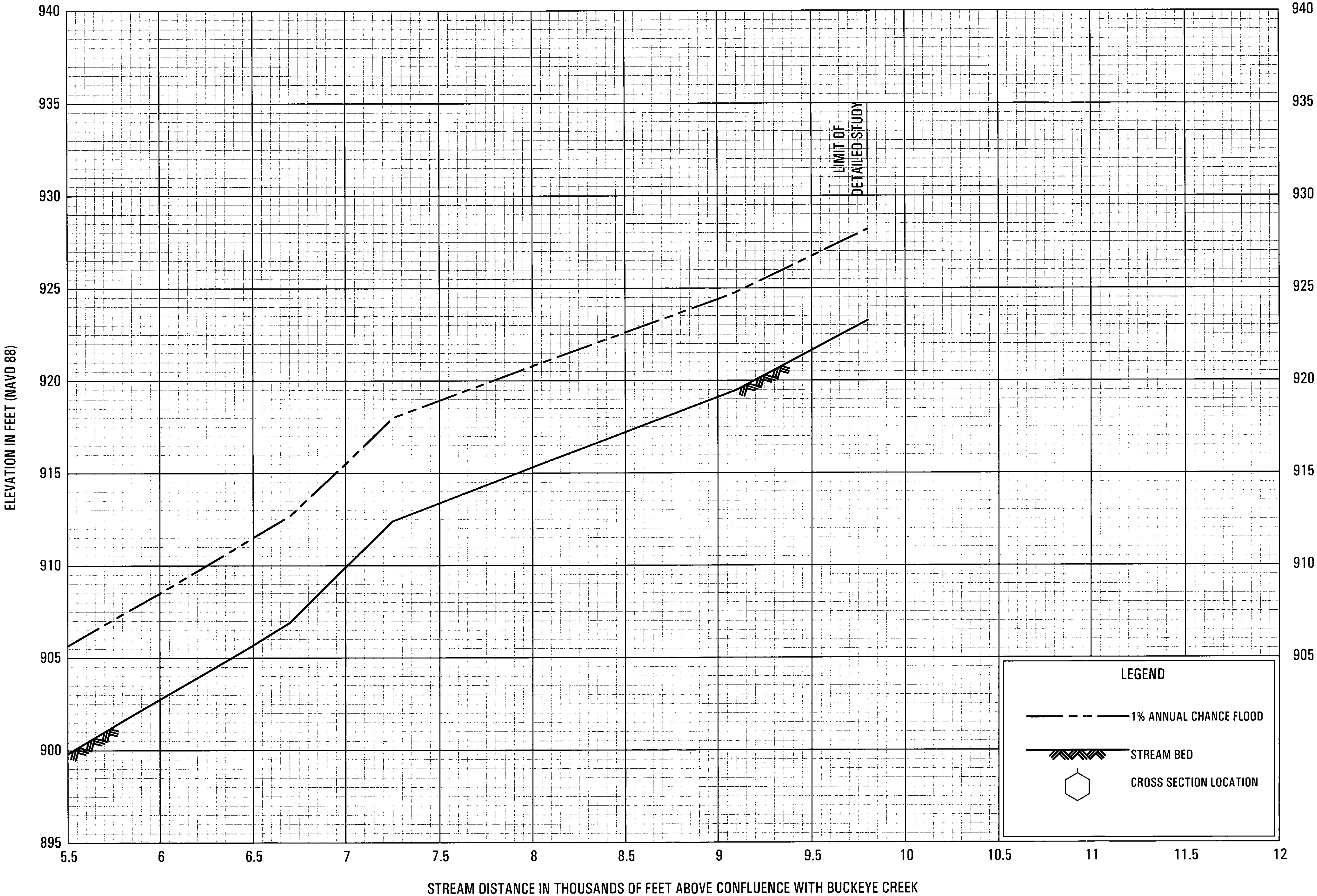
GREENBRIER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

08P



FLOOD PROFILES

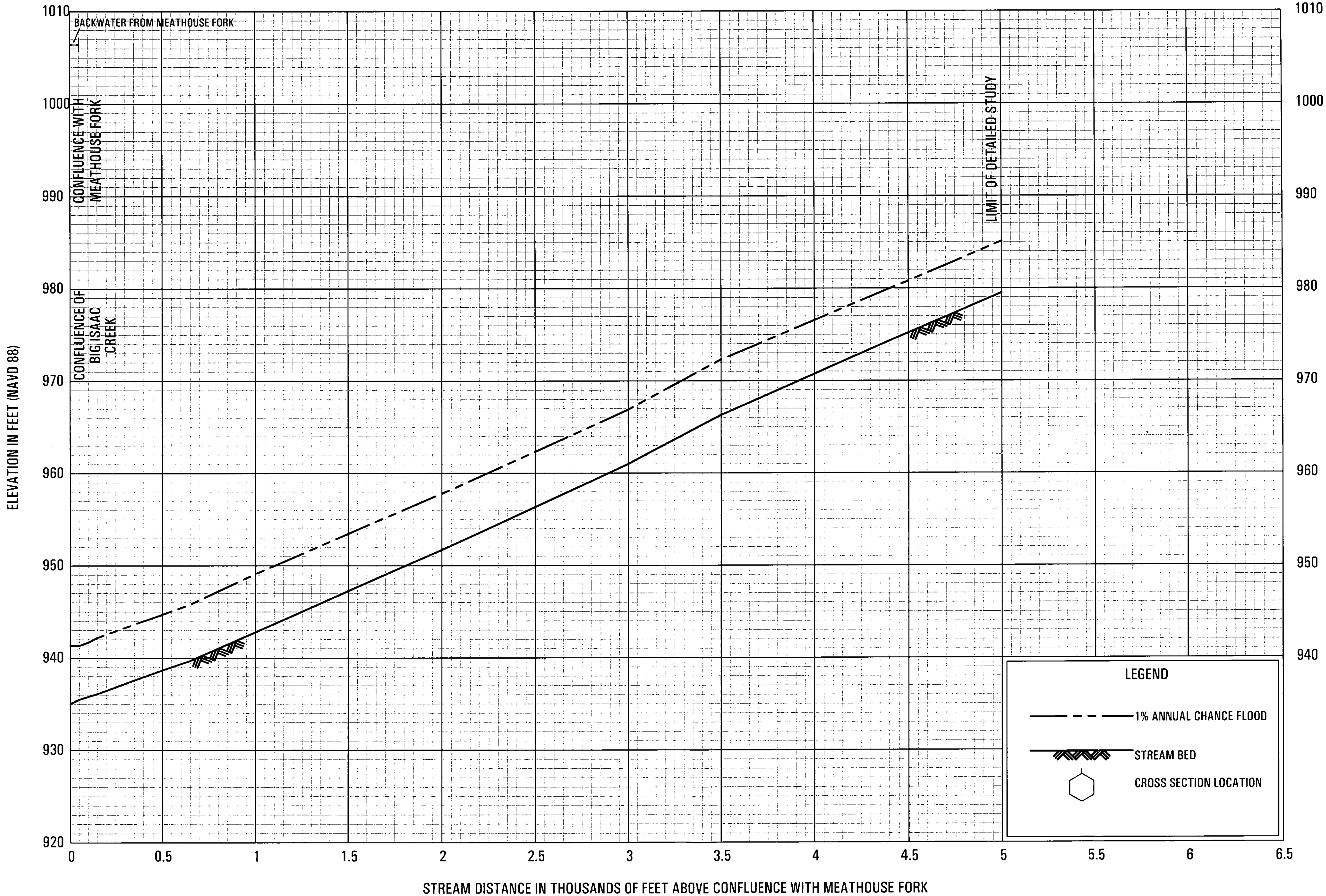
GREENBRIER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

09P



FLOOD PROFILES

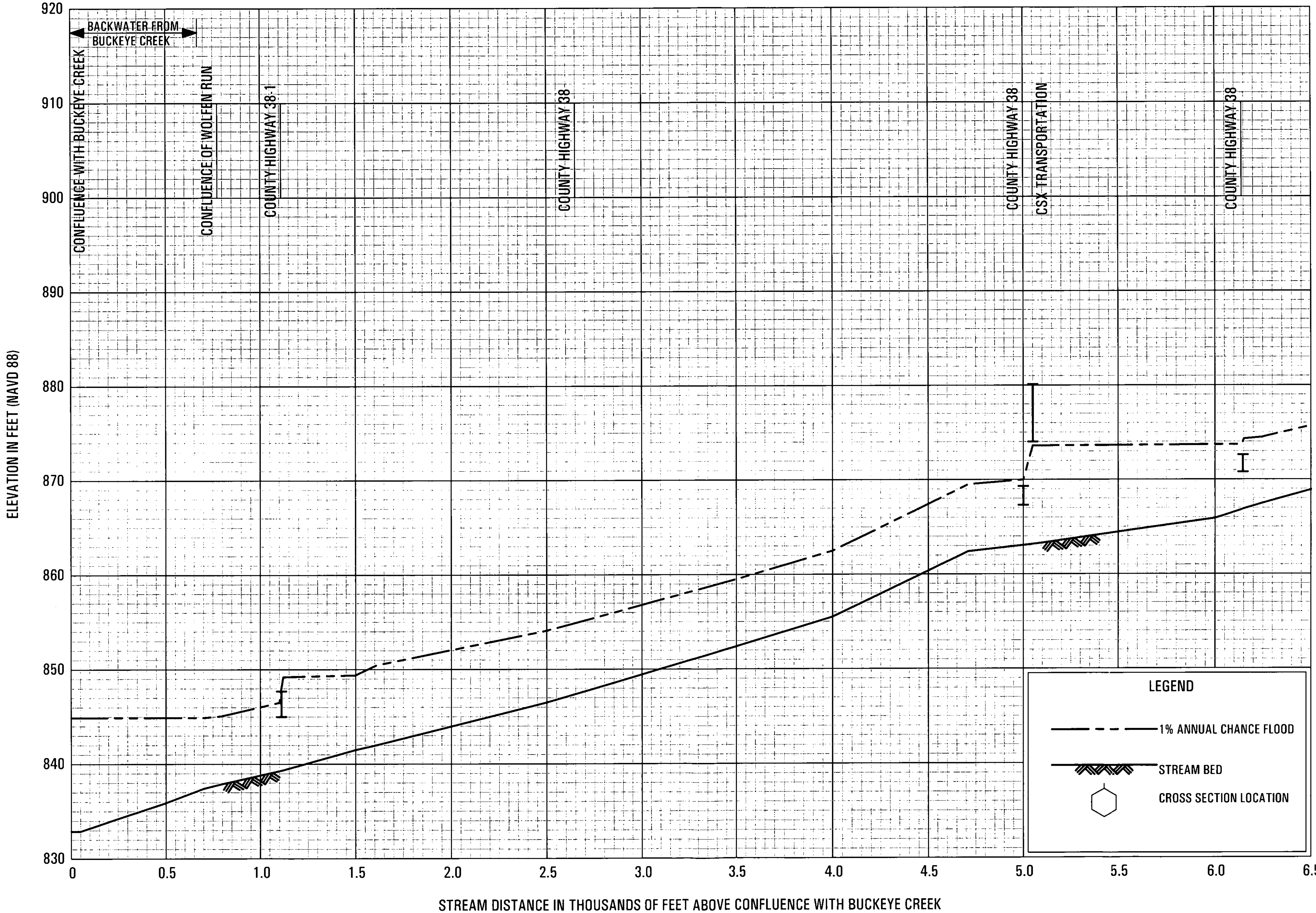
LAUREL RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

10P



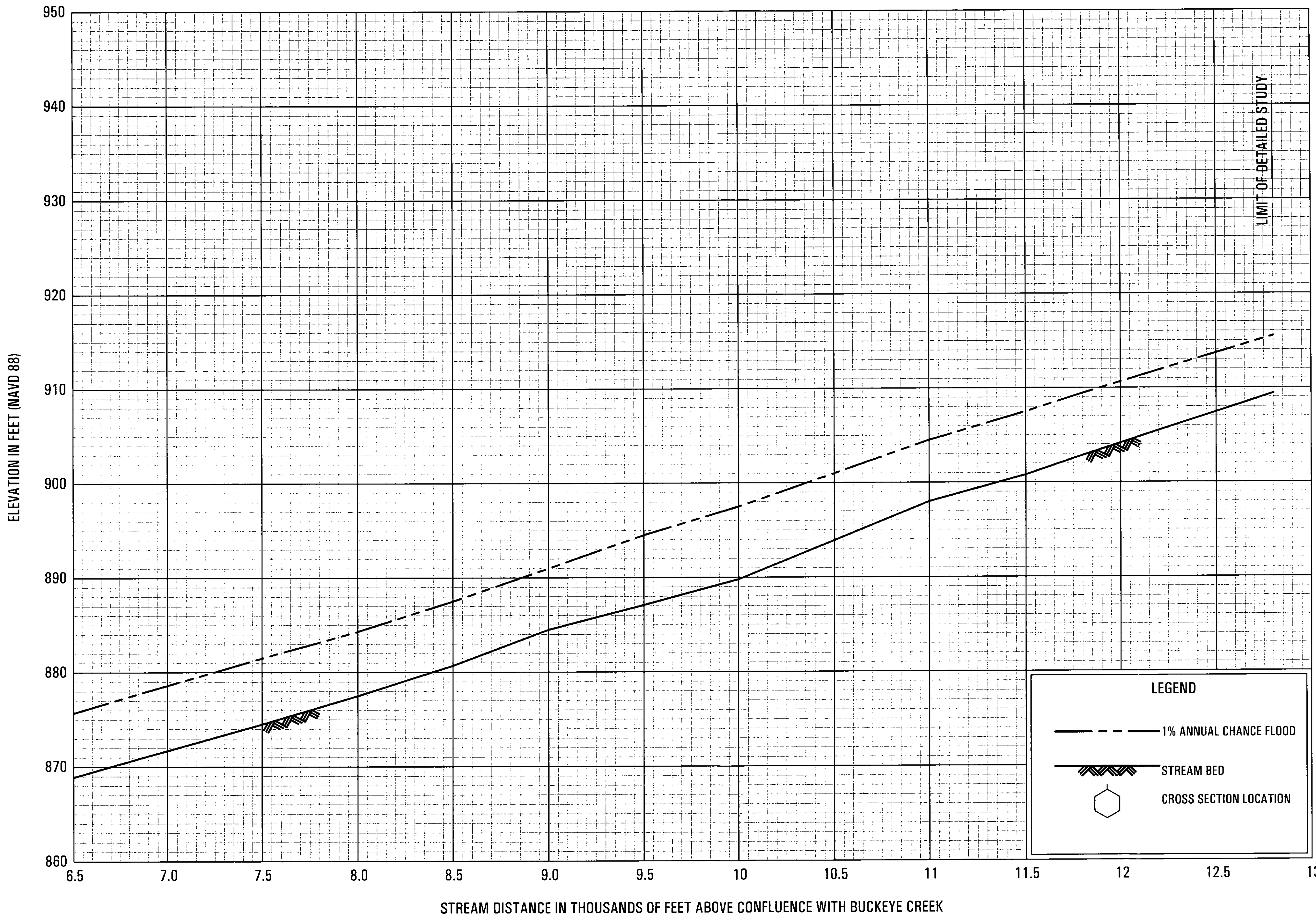
FLOOD PROFILES

LONG RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS



FLOOD PROFILES

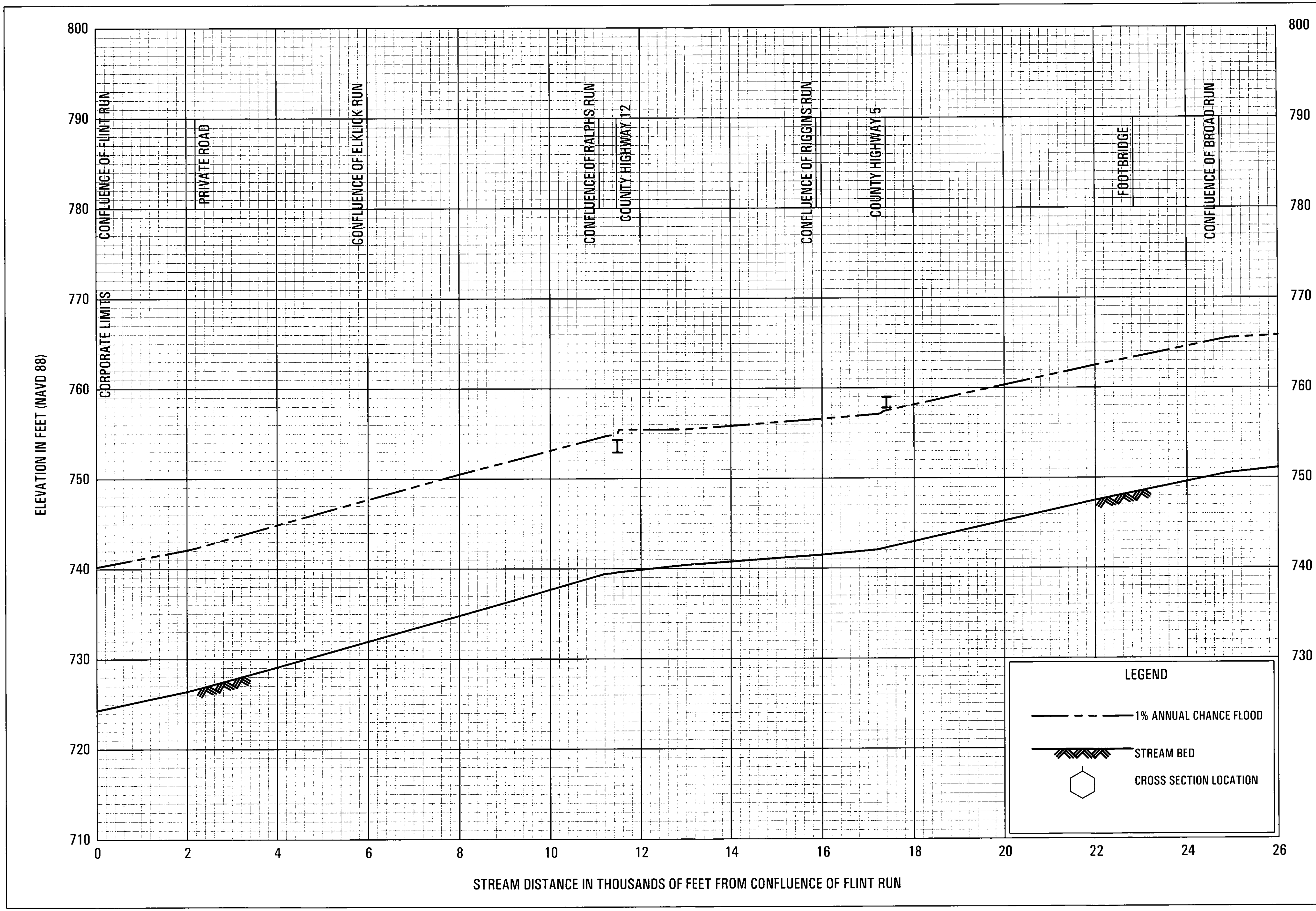
LONG RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

12P



FLOOD PROFILES

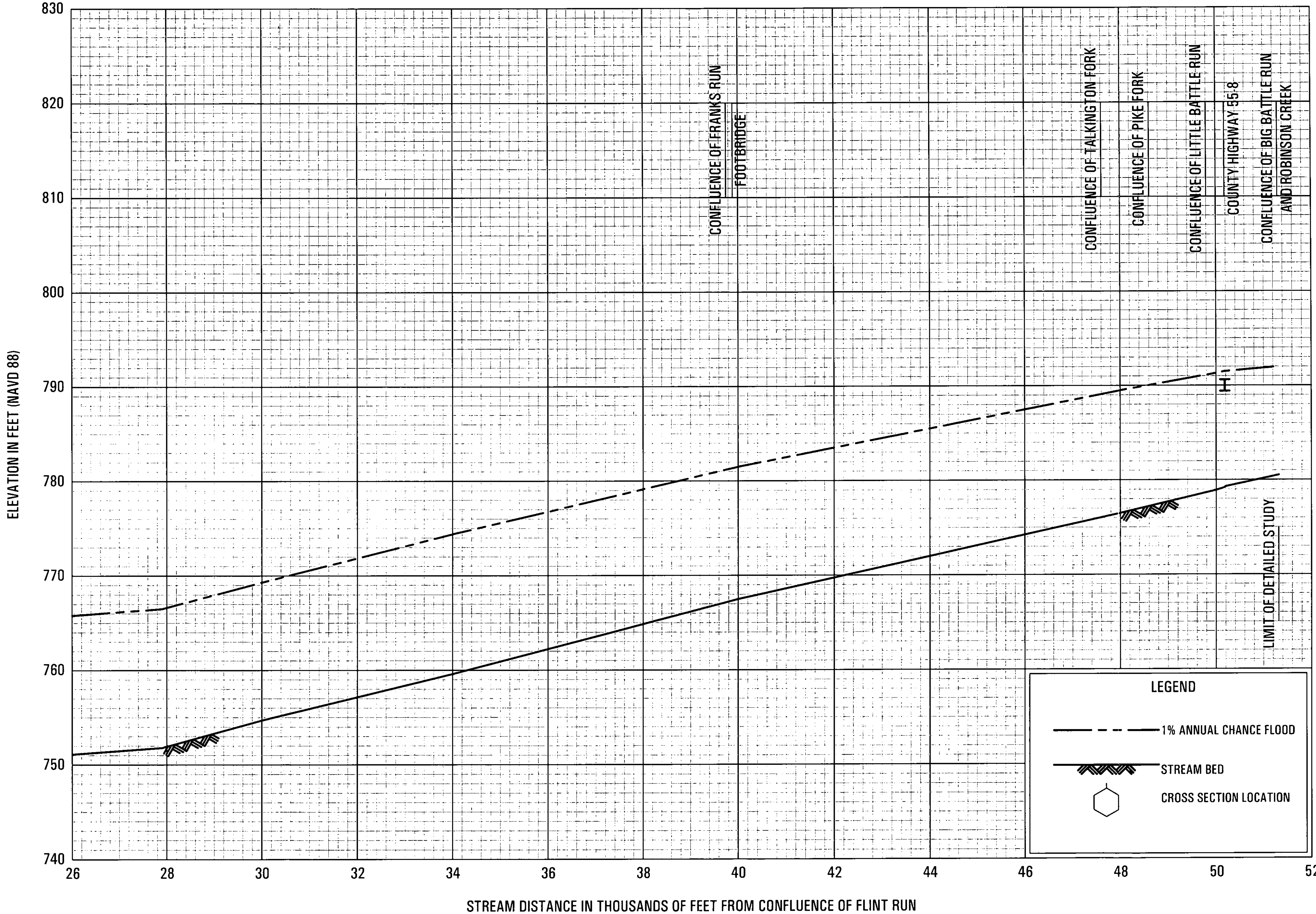
MCELROY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

13P



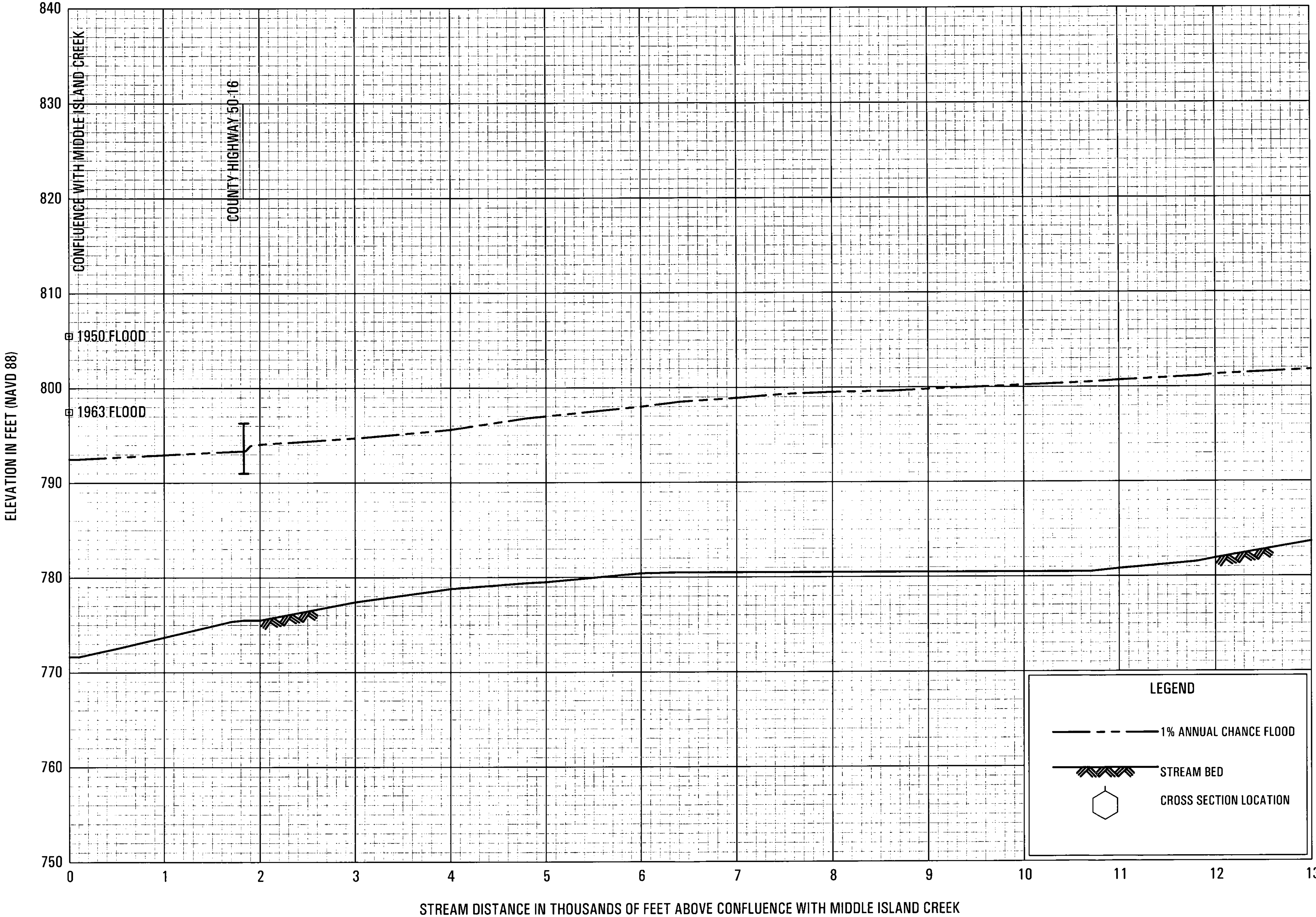
FLOOD PROFILES

MCELROY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS



FLOOD PROFILES

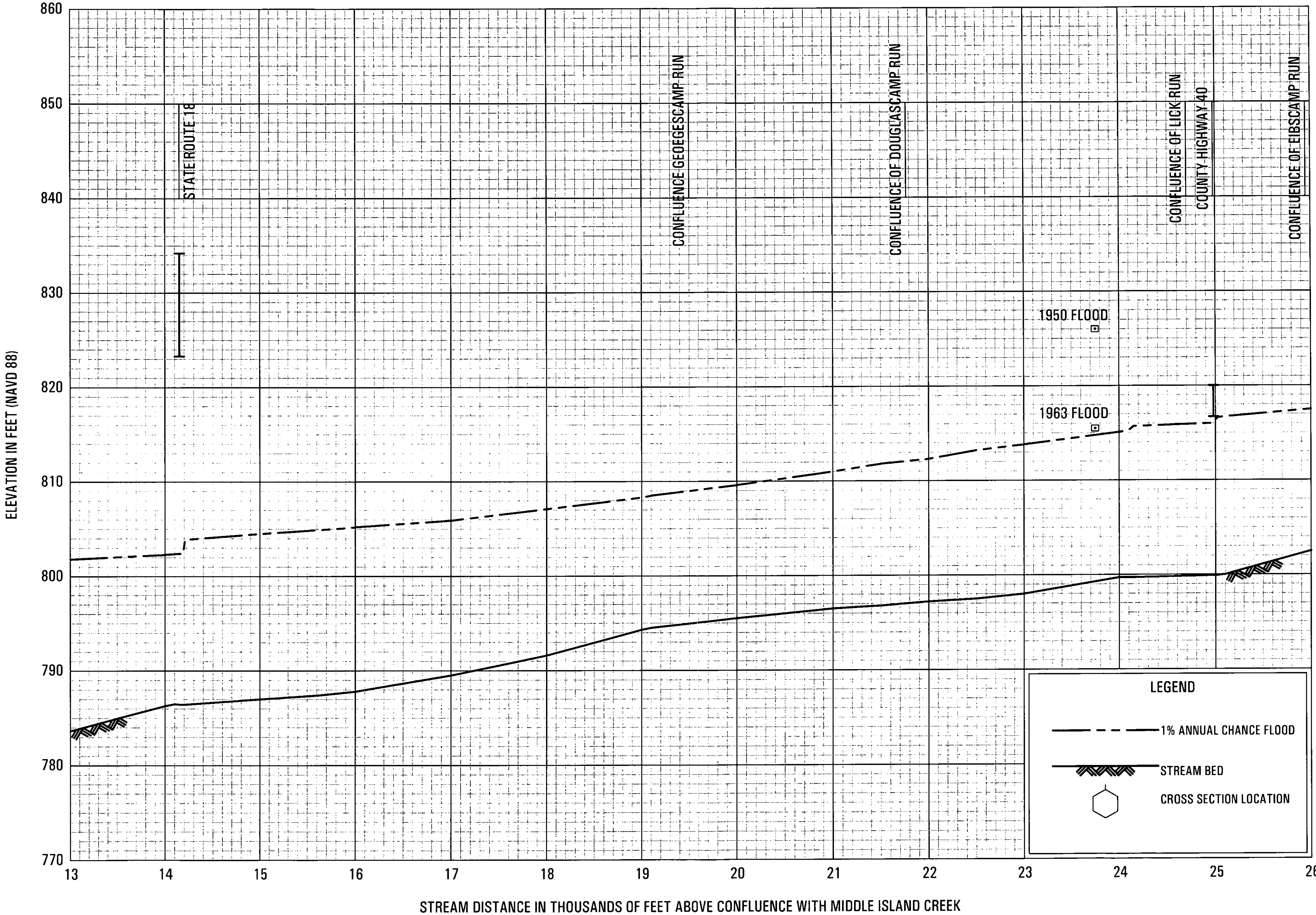
MEATHOUSE FORK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

15P



FLOOD PROFILES

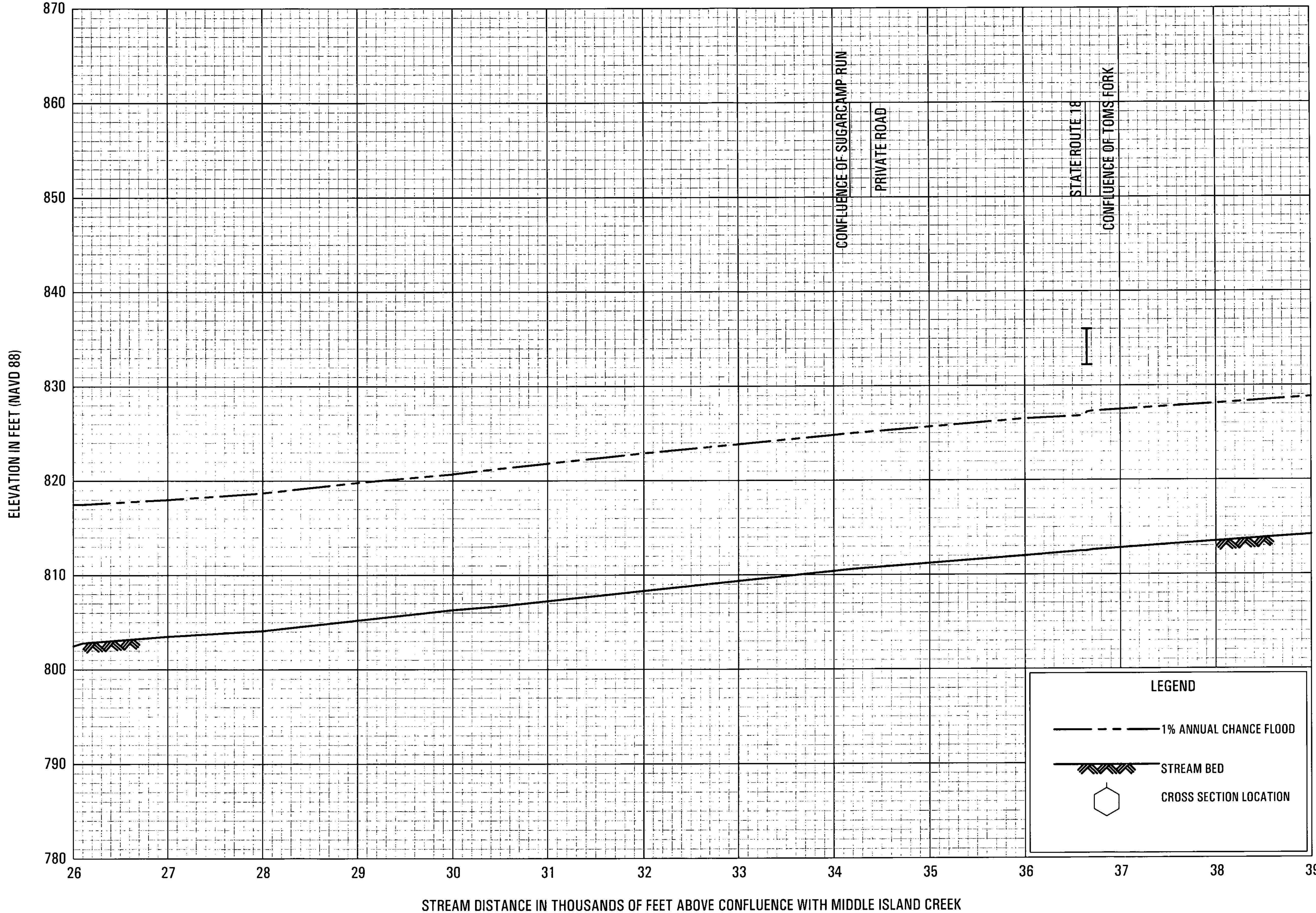
MEATHOUSE FORK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

16P



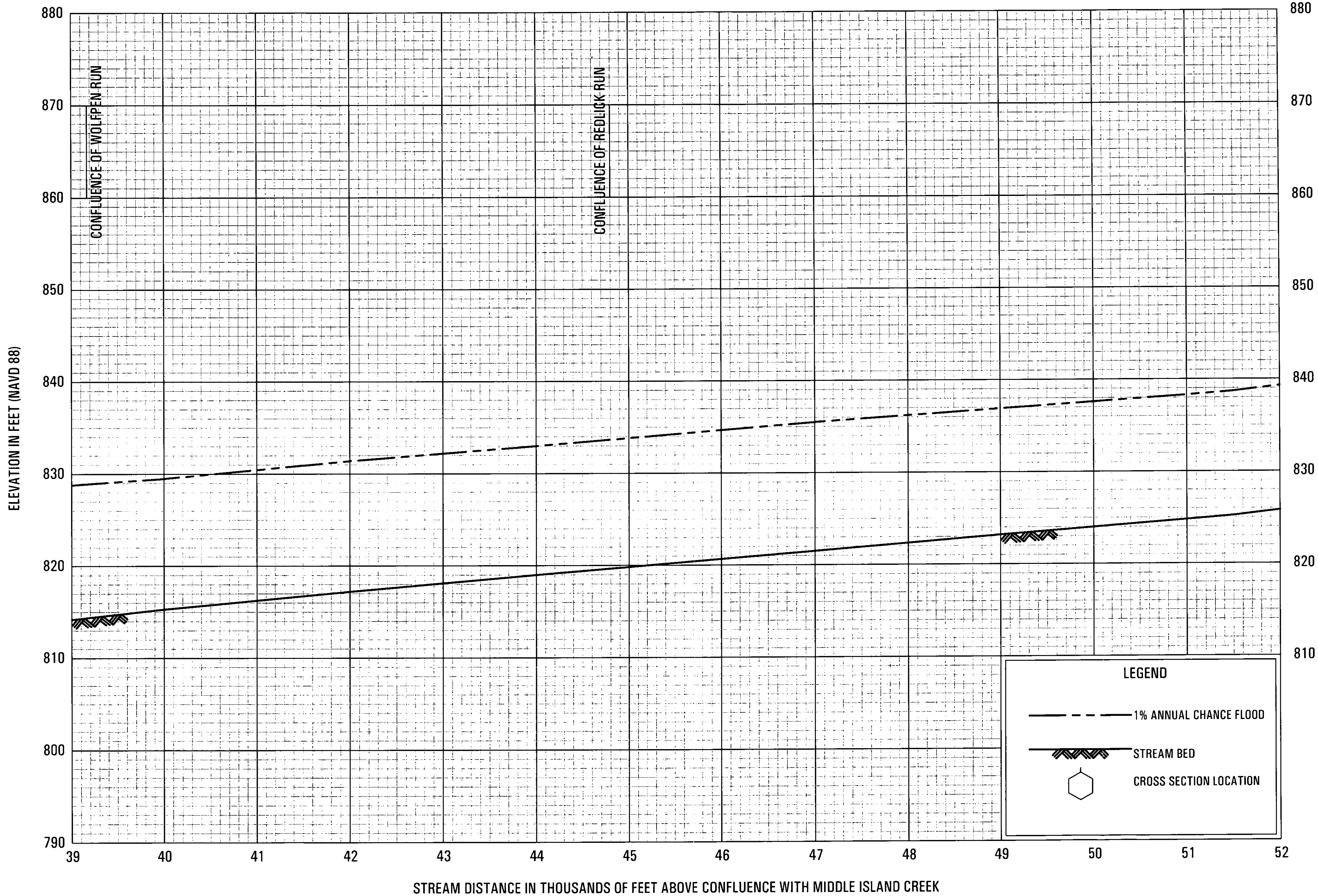
FLOOD PROFILES

MEATHOUSE FORK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS



FLOOD PROFILES

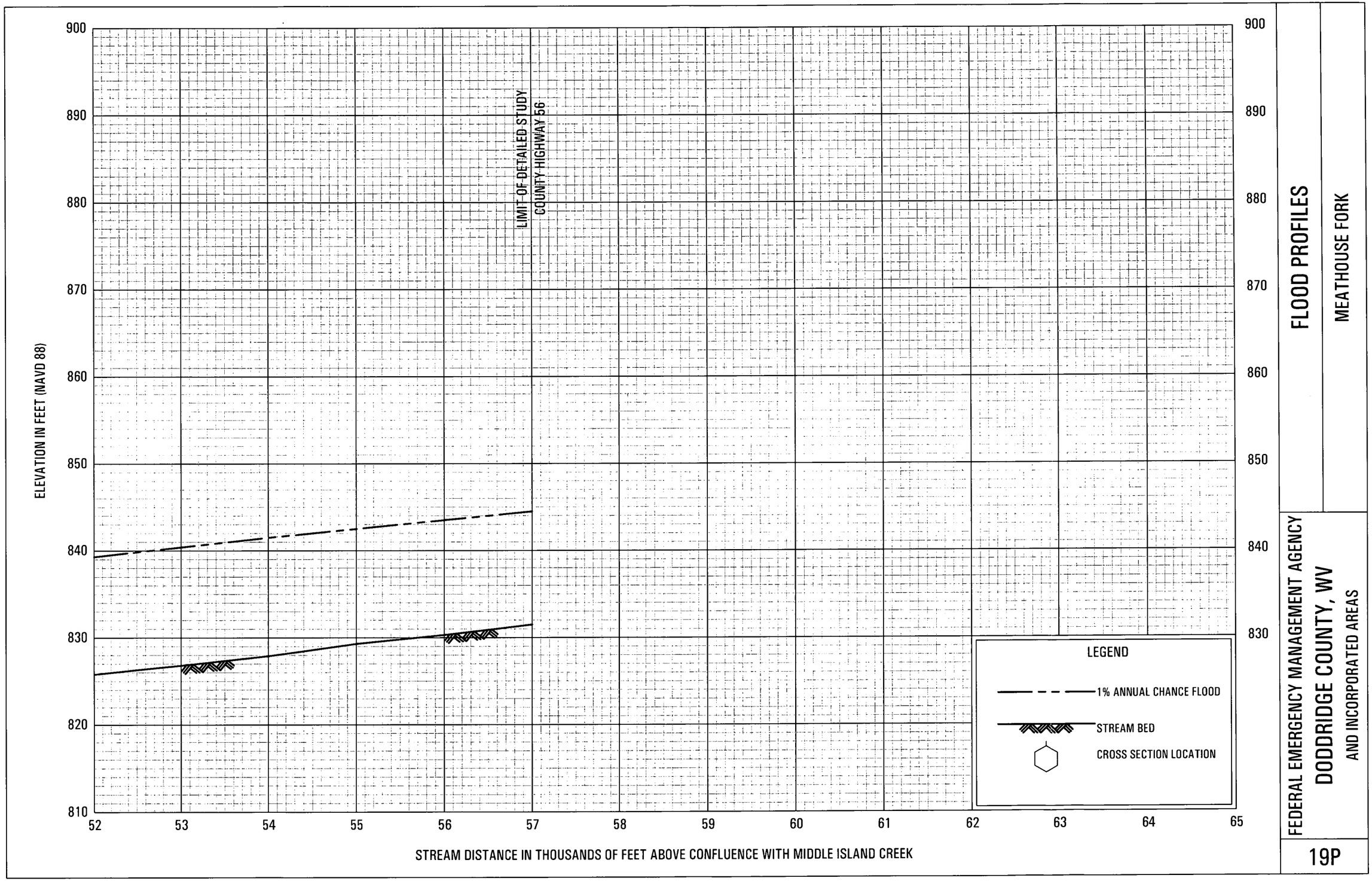
MEATHOUSE FORK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

18P



FLOOD PROFILES

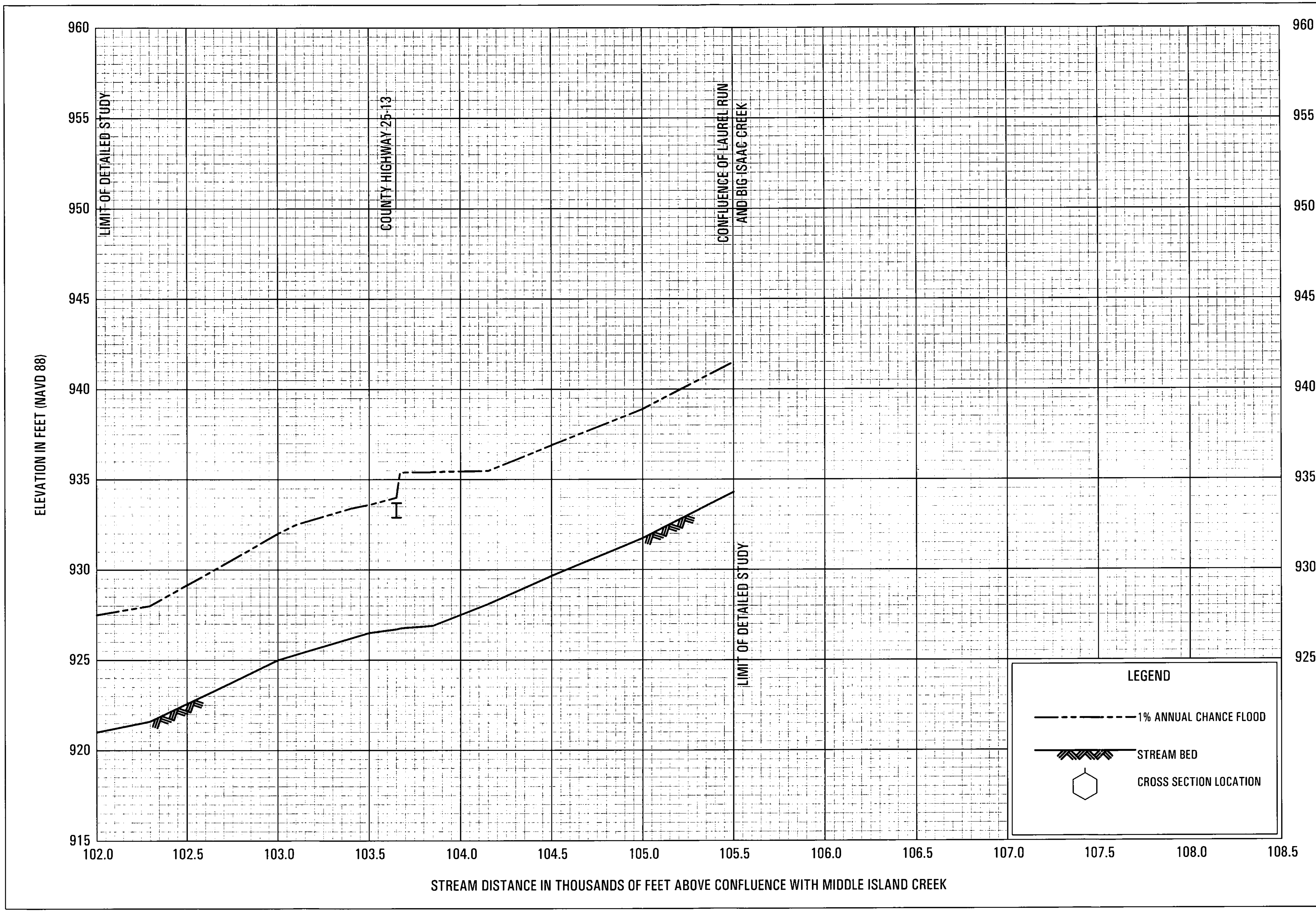
MEATHOUSE FORK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

19P



FLOOD PROFILES

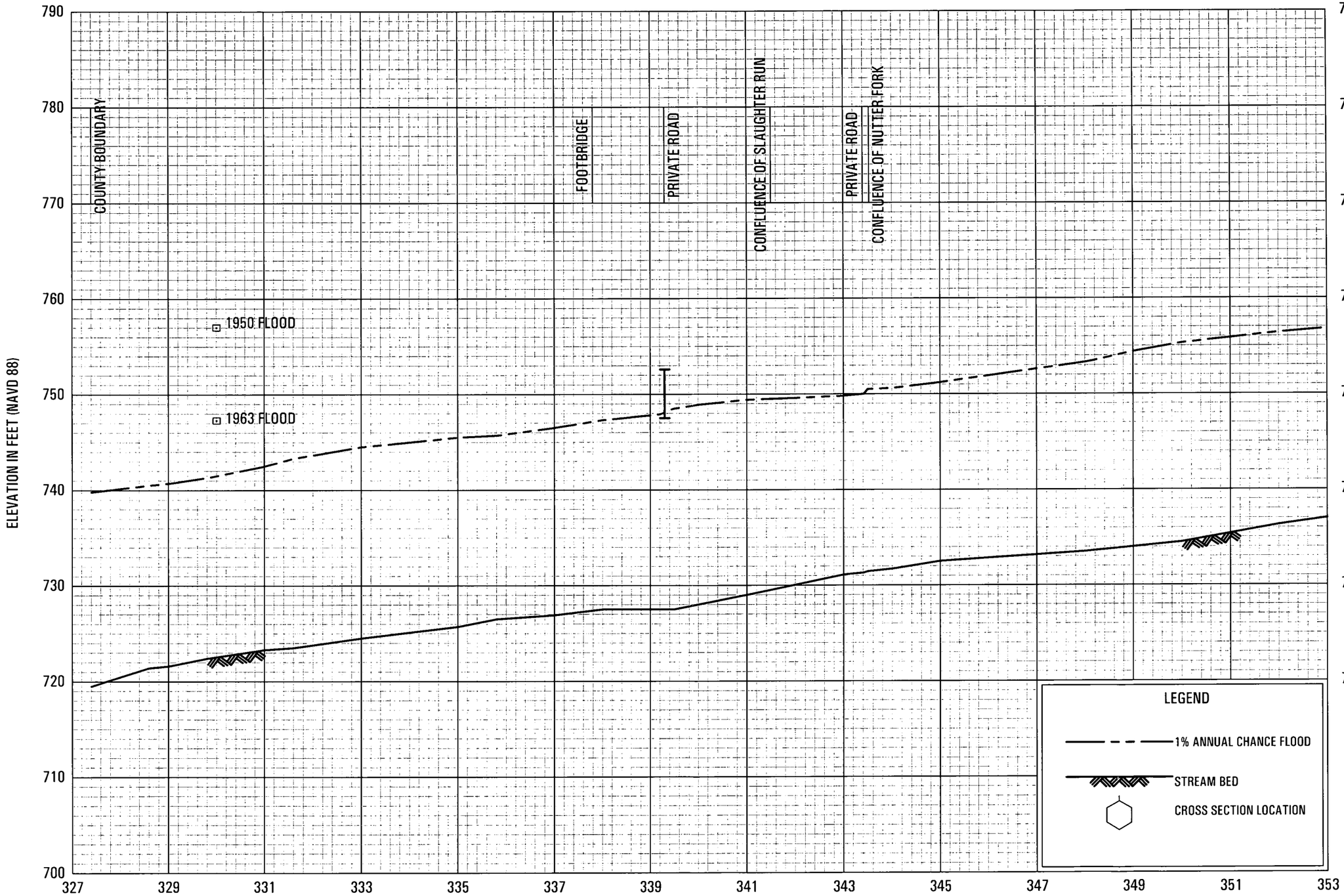
MEATHOUSE FORK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

20P



FLOOD PROFILES

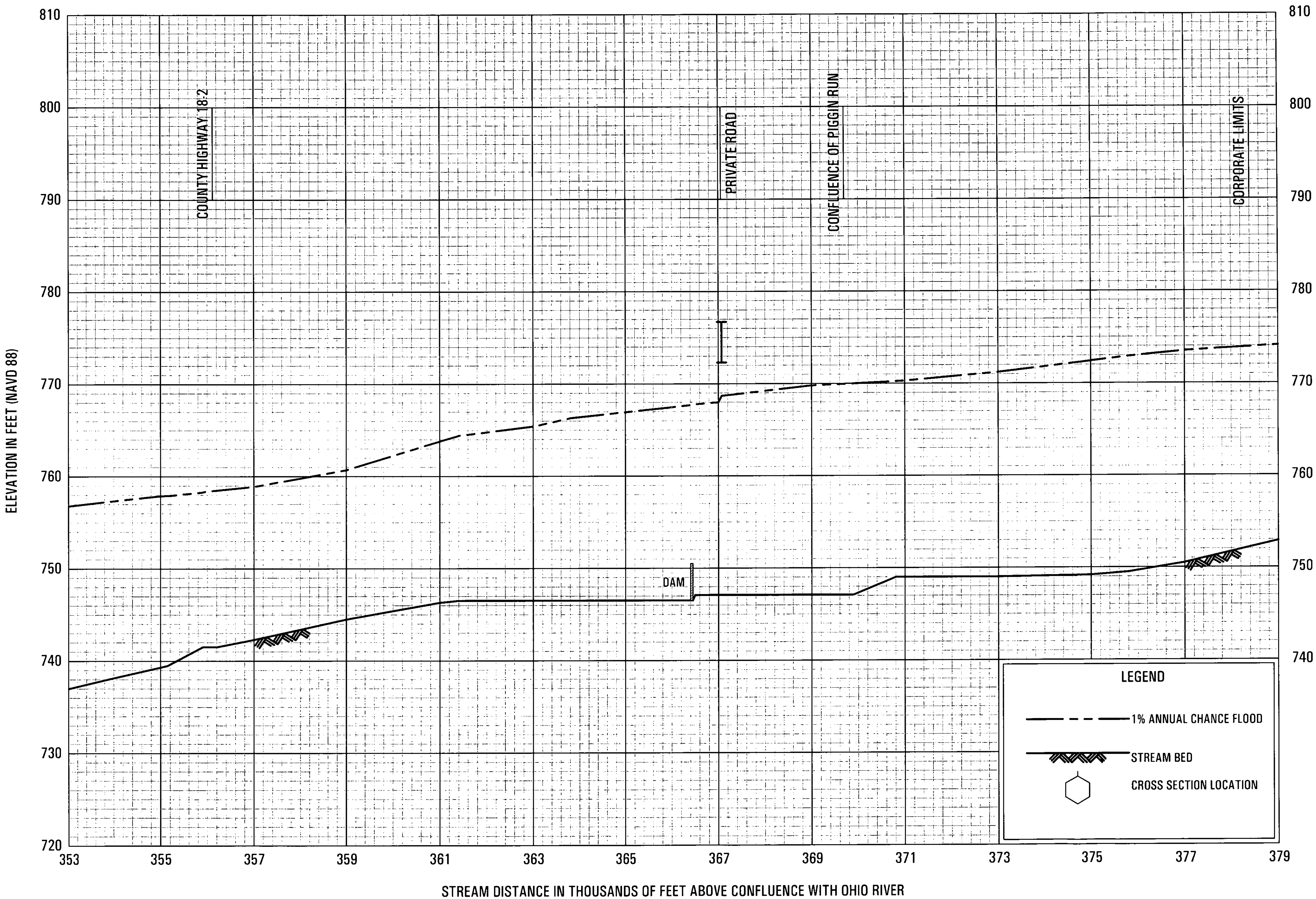
MIDDLE ISLAND CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

21P



FLOOD PROFILES

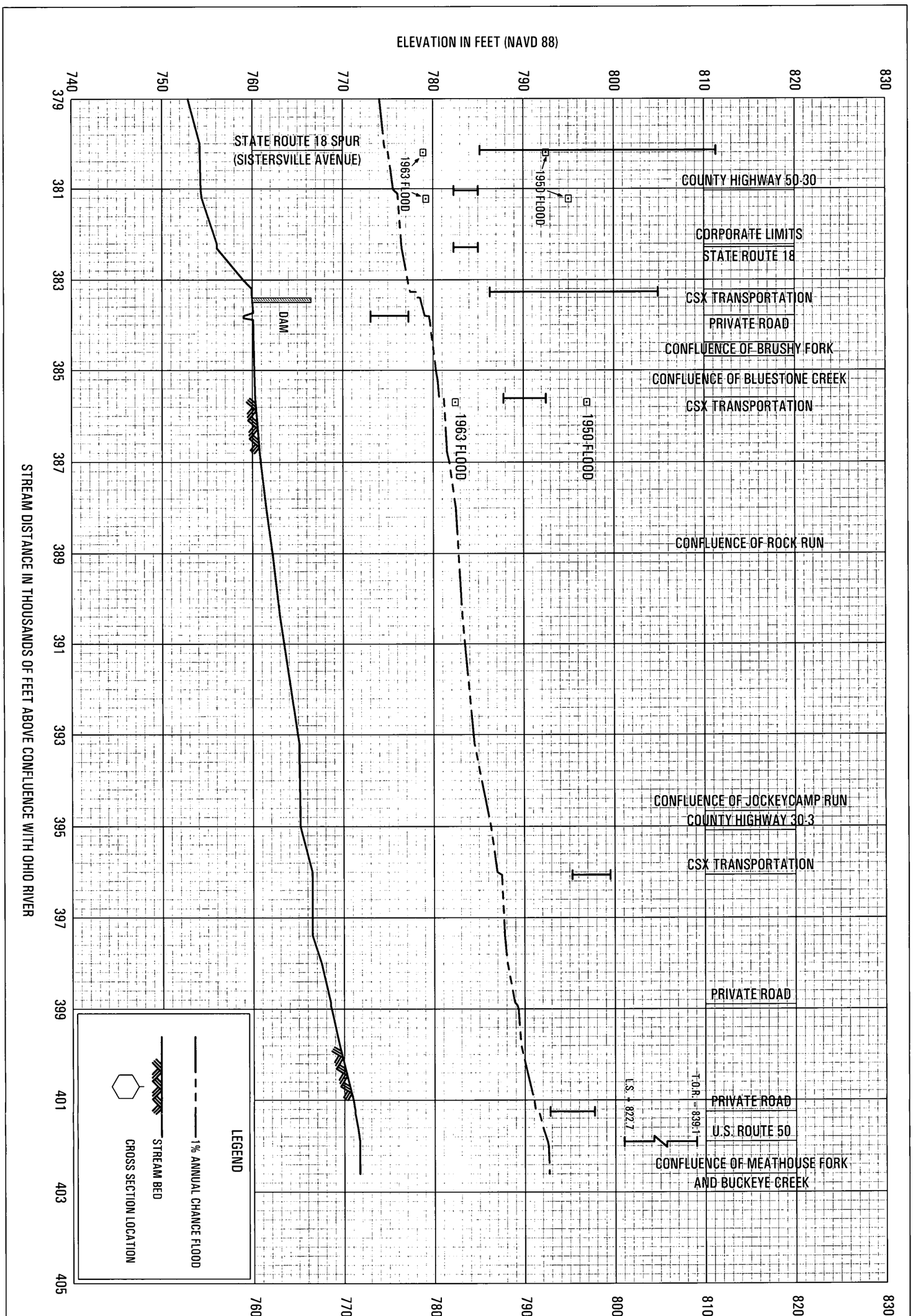
MIDDLE ISLAND CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

22P



23P

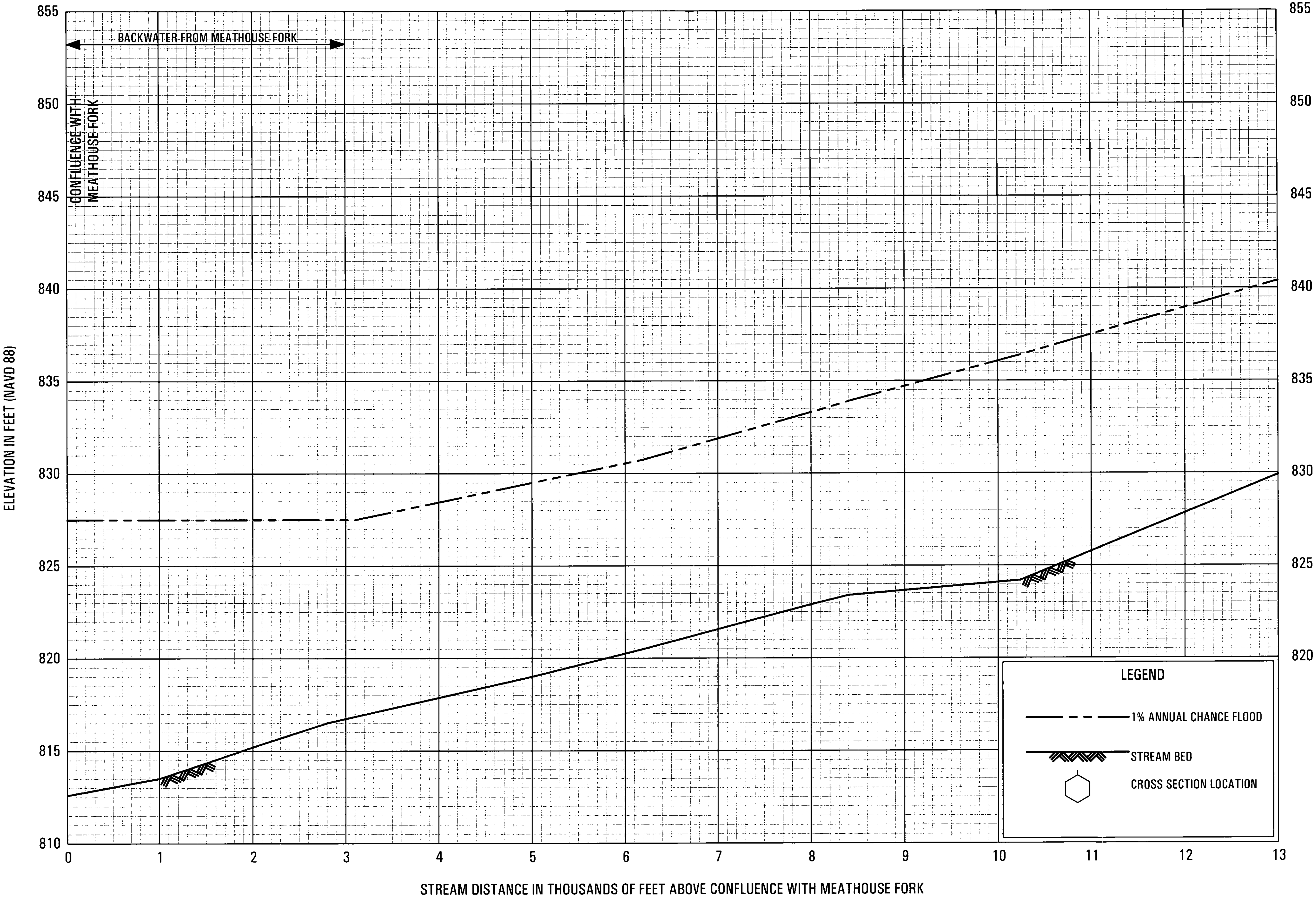
FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

FLOOD PROFILES

MIDDLE ISLAND CREEK



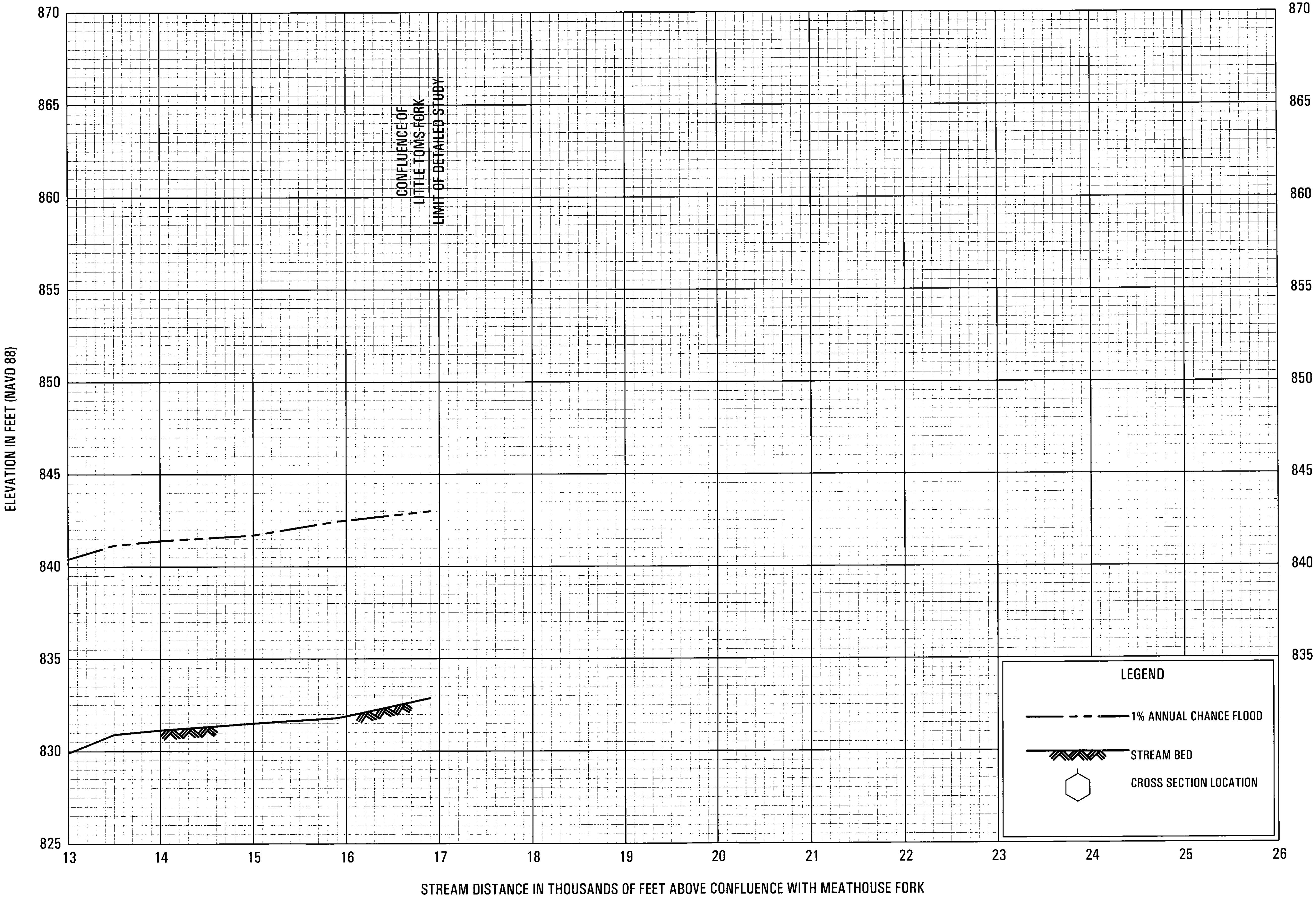
FLOOD PROFILES

TOMS FORK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS



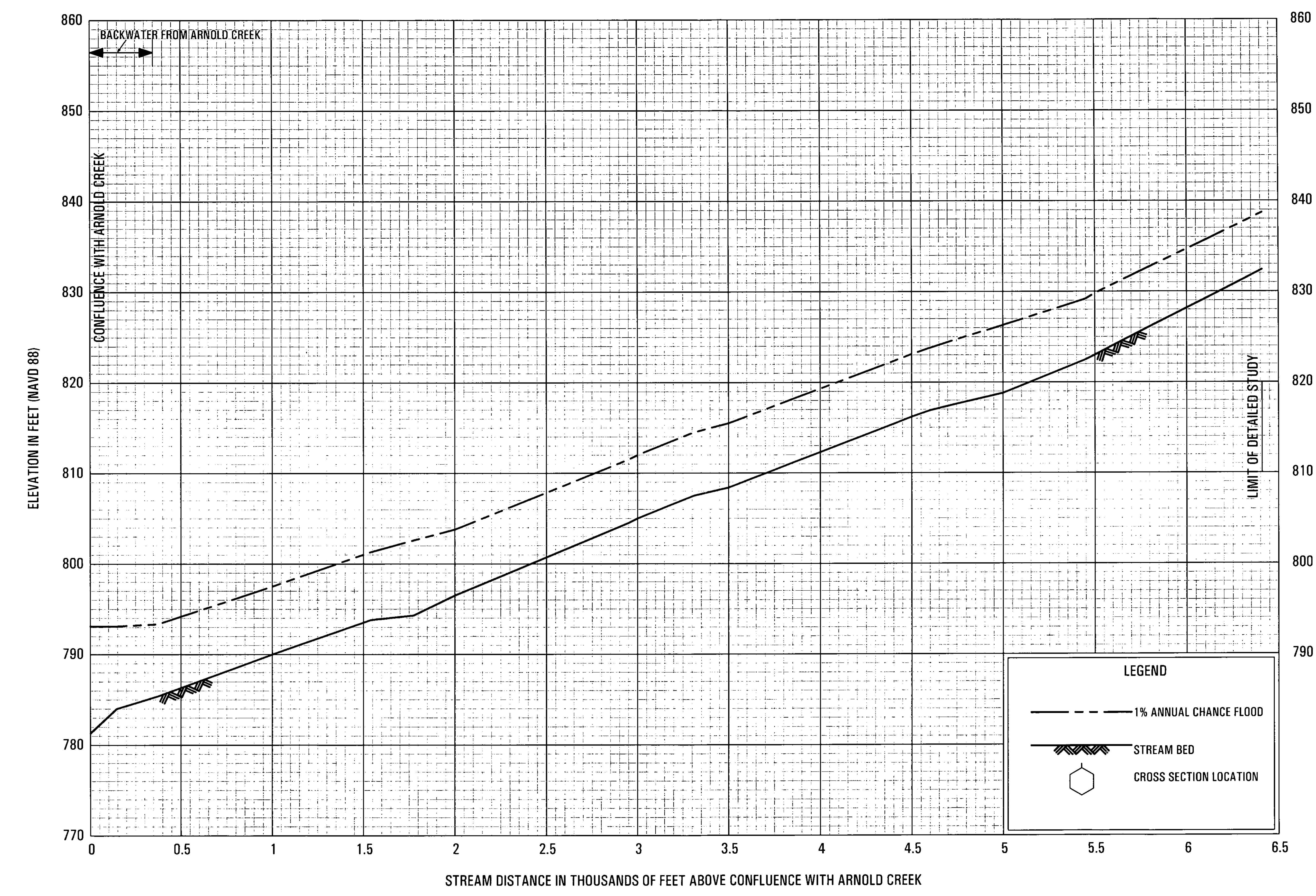
FLOOD PROFILES

TOMS FORK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS



FLOOD PROFILES

WILHELM RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

APPENDIX C

Design Discharge Calculations

152-048	Susie Jane Culvert	Prepared by: HPU 6/12/15

Drainage Area = 1,287 acres = 2.01 miles^2

USGS Regression Equation, Multi Rural

$Q_{10} = 341\,A^{0.653} = (341)(2.01)^{0.653} = 538$ cfs

$Q_{100} = 722\,A^{0.594} = (722)(2.01)^{0.594} = 1{,}093$ cfs

APPENDIX D

HEC-RAS Profile Summary Tables

HEC-RAS Plan: Existing River: Buffalo Calf For Reach: A Profile: 100 yr

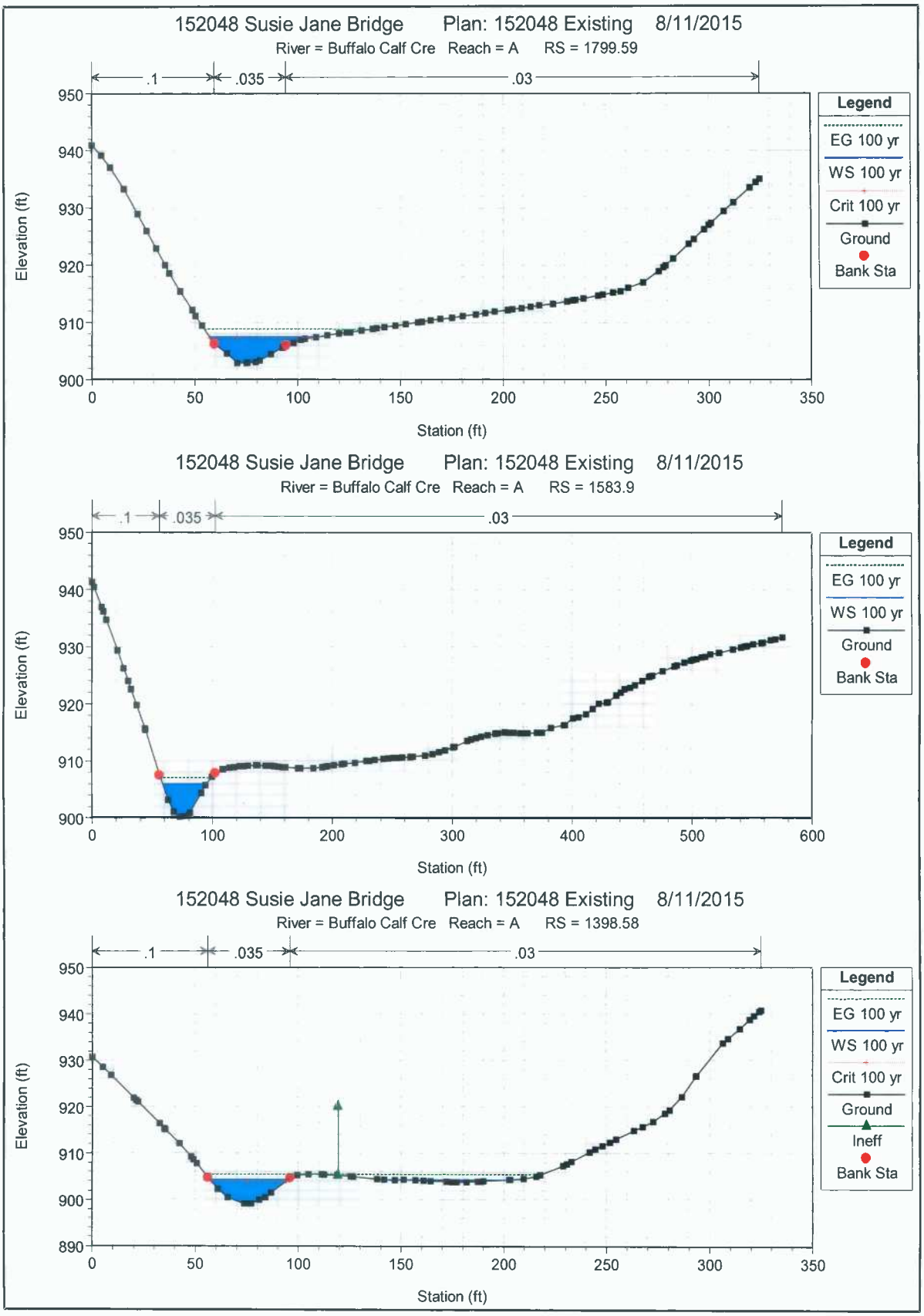
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
A	1799.59	100 yr	1093.00	902.91	907.54	907.34	908.74	0.008857	8.92	130.27	53.38	0.85
A	1583.9	100 yr	1093.00	900.20	905.95		906.98	0.007094	8.14	134.30	36.84	0.75
A	1398.58	100 yr	1093.00	899.10	904.36	903.92	905.50	0.008876	8.58	127.34	102.45	0.83
A	1193	100 yr	1093.00	898.37	903.98		904.33	0.002712	5.15	237.06	91.80	0.47
A	999.54	100 yr	1093.00	897.30	903.76		903.97	0.001113	4.16	330.32	122.37	0.32
A	815	100 yr	1093.00	895.64	903.66		903.78	0.000774	3.56	575.16	244.79	0.25
A	700	100 yr	1093.00	894.85	903.68	899.35	903.73	0.000130	1.79	707.40	294.01	0.12
A	675		Culvert									
A	586.01	100 yr	1093.00	894.00	899.32	899.32	900.28	0.008115	8.70	149.92	155.47	0.76
A	460	100 yr	1093.00	893.00	898.97	897.59	899.07	0.000705	2.95	460.35	347.40	0.25
A	260.56	100 yr	1093.00	892.20	898.46	897.44	898.82	0.002233	5.41	241.29	148.67	0.41
A	60.03	100 yr	1093.00	891.40	897.59	897.20	898.21	0.004002	7.16	205.08	160.87	0.53

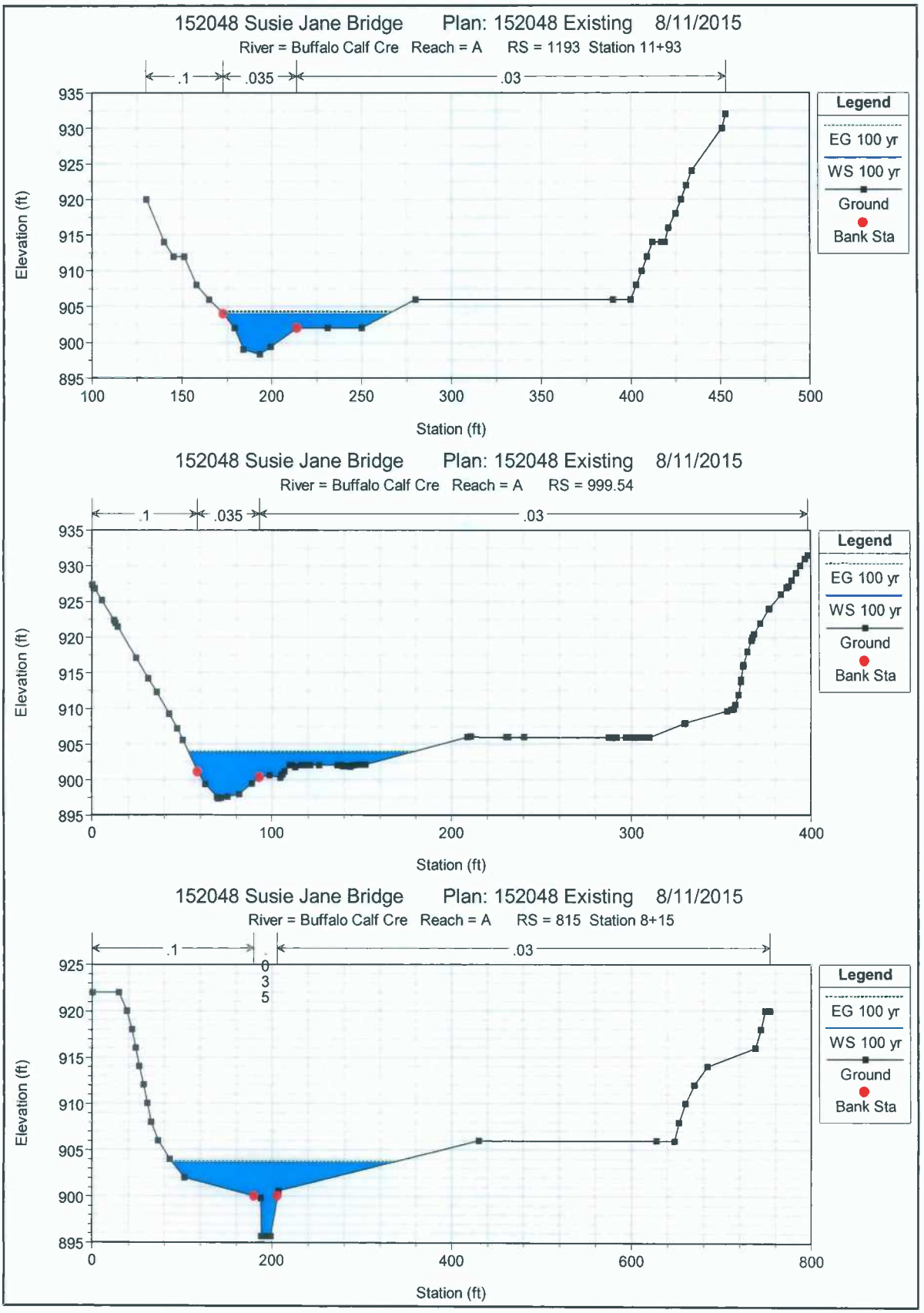
HEC-RAS Plan: Proposed River: Buffalo Calf For Reach: A Profile: 100 yr

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
A	1799.59	100 yr	1093.00	902.91	907.54	907.34	908.74	0.008859	8.92	130.26	53.38	0.85
A	1583.9	100 yr	1093.00	900.20	905.96		906.98	0.007057	8.12	134.57	36.88	0.75
A	1398.58	100 yr	1093.00	899.10	904.34	903.92	905.50	0.009021	8.63	126.60	101.13	0.84
A	1193	100 yr	1093.00	898.37	903.80		904.21	0.003330	5.57	220.23	89.85	0.52
A	999.54	100 yr	1093.00	897.30	903.49		903.75	0.001454	4.59	298.27	117.95	0.37
A	815	100 yr	1093.00	895.64	903.34		903.50	0.001094	4.09	498.59	228.88	0.30
A	700	100 yr	1093.00	894.85	903.38	899.35	903.43	0.000158	1.92	658.22	288.22	0.13
A	651.8		Bridge									
A	586.01	100 yr	1093.00	894.00	899.32	899.32	900.28	0.008115	8.70	149.92	155.47	0.76
A	460	100 yr	1093.00	893.00	898.97	897.59	899.07	0.000705	2.95	460.35	347.40	0.25
A	260.56	100 yr	1093.00	892.20	898.46	897.44	898.82	0.002233	5.41	241.29	148.67	0.41
A	60.03	100 yr	1093.00	891.40	897.59	897.20	898.21	0.004002	7.16	205.08	160.87	0.53

APPENDIX E

HEC-RAS Cross-Section Reports


152048 Susie Jane Bridge Plan: 152048 Existing 8/11/2015
River = Buffalo Calf Cre Reach = A RS = 1799.59
.1
.035
.03
Elevation (ft)
Station (ft)
Legend
EG 100 yr
WS 100 yr
Crit 100 yr
Ground
Bank Sta
152048 Susie Jane Bridge Plan: 152048 Existing 8/11/2015
River = Buffalo Calf Cre Reach = A RS = 1583.9
.1
.035
.03
Elevation (ft)
Station (ft)
Legend
EG 100 yr
WS 100 yr
Ground
Bank Sta
152048 Susie Jane Bridge Plan: 152048 Existing 8/11/2015
River = Buffalo Calf Cre Reach = A RS = 1398.58
.1
.035
.03
Elevation (ft)
Station (ft)
Legend
EG 100 yr
WS 100 yr
Crit 100 yr
Ground
Ineff
Bank Sta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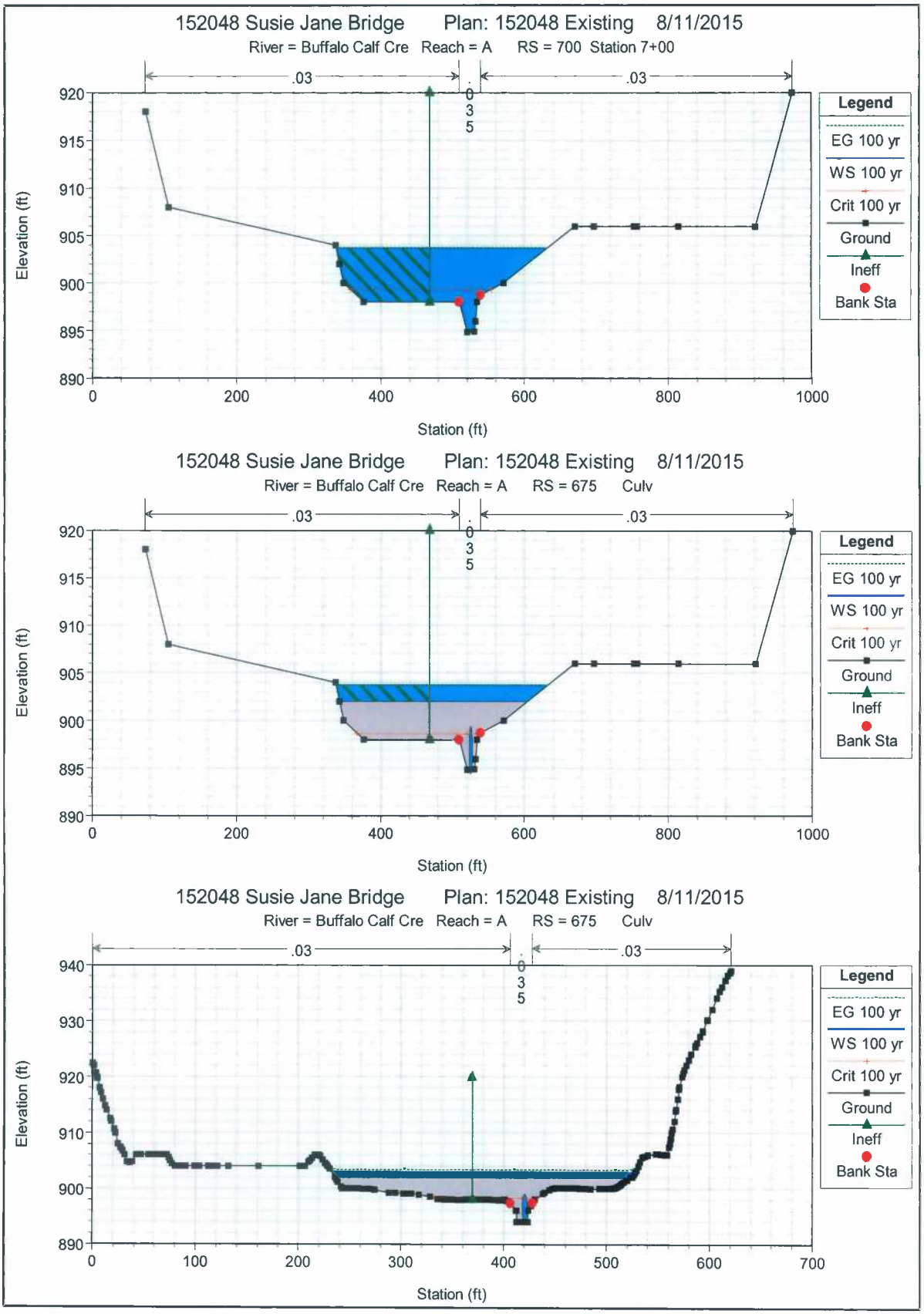
.1
.035
.03
Elevation (ft)
Station (ft)
Legend
EG 100 yr
WS 100 yr
Ground
Bank Sta
152048 Susie Jane Bridge Plan: 152048 Existing 8/11/2015
River = Buffalo Calf Cre Reach = A RS = 999.54
.1
.035
.03
Elevation (ft)
Station (ft)
Legend
EG 100 yr
WS 100 yr
Ground
Bank Sta
152048 Susie Jane Bridge Plan: 152048 Existing 8/11/2015
River = Buffalo Calf Cre Reach = A RS = 815 Station 8+15
.1
.03
Elevation (ft)
Station (ft)
Legend
EG 100 yr
WS 100 yr
Ground
Bank Sta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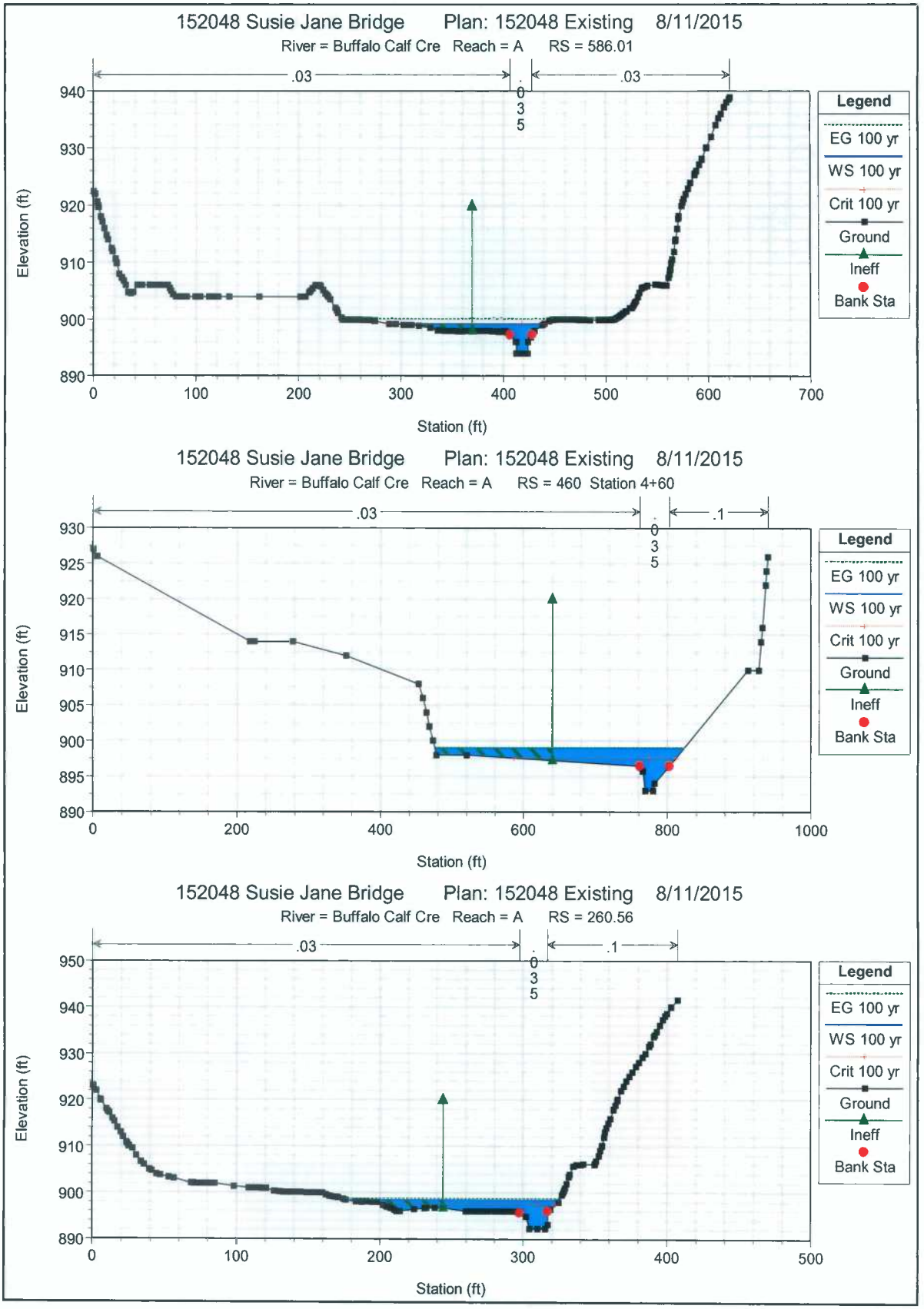
.03
.03
0
3
5
Legend
EG 100 yr
WS 100 yr
Crit 100 yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
152048 Susie Jane Bridge Plan: 152048 Existing 8/11/2015
River = Buffalo Calf Cre Reach = A RS = 675 Culv
.03
.03
0
3
5
Legend
EG 100 yr
WS 100 yr
Crit 100 yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
152048 Susie Jane Bridge Plan: 152048 Existing 8/11/2015
River = Buffalo Calf Cre Reach = A RS = 675 Culv
.03
.03
0
3
5
Legend
EG 100 yr
WS 100 yr
Crit 100 yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)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River = Buffalo Calf Cre Reach = A RS = 586.01
.03
.03
0
3
5
Legend
EG 100 yr
WS 100 yr
Crit 100 yr
Ground
Ineff
Bank Sta
Elevation (ft)
940
930
920
910
900
890
0
100
200
300
400
500
600
700
Station (ft)
152048 Susie Jane Bridge Plan: 152048 Existing 8/11/2015
River = Buffalo Calf Cre Reach = A RS = 460 Station 4+60
.03
.1
0
3
5
Legend
EG 100 yr
WS 100 yr
Crit 100 yr
Ground
Ineff
Bank Sta
Elevation (ft)
930
925
920
915
910
905
900
895
890
0
200
400
600
800
1000
Station (ft)
152048 Susie Jane Bridge Plan: 152048 Existing 8/11/2015
River = Buffalo Calf Cre Reach = A RS = 260.56
.03
.1
0
3
5
Legend
EG 100 yr
WS 100 yr
Crit 100 yr
Ground
Ineff
Bank Sta
Elevation (ft)
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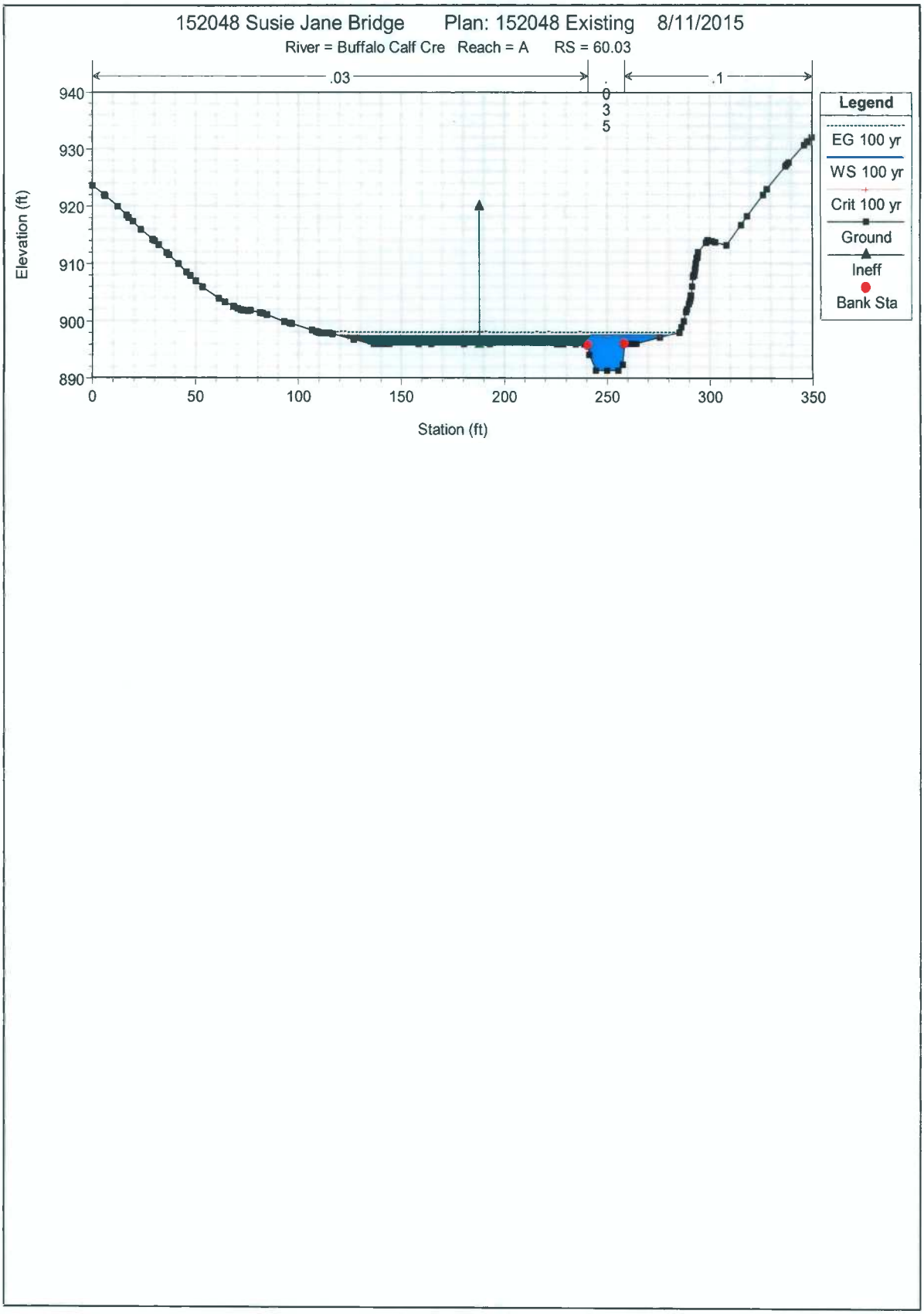
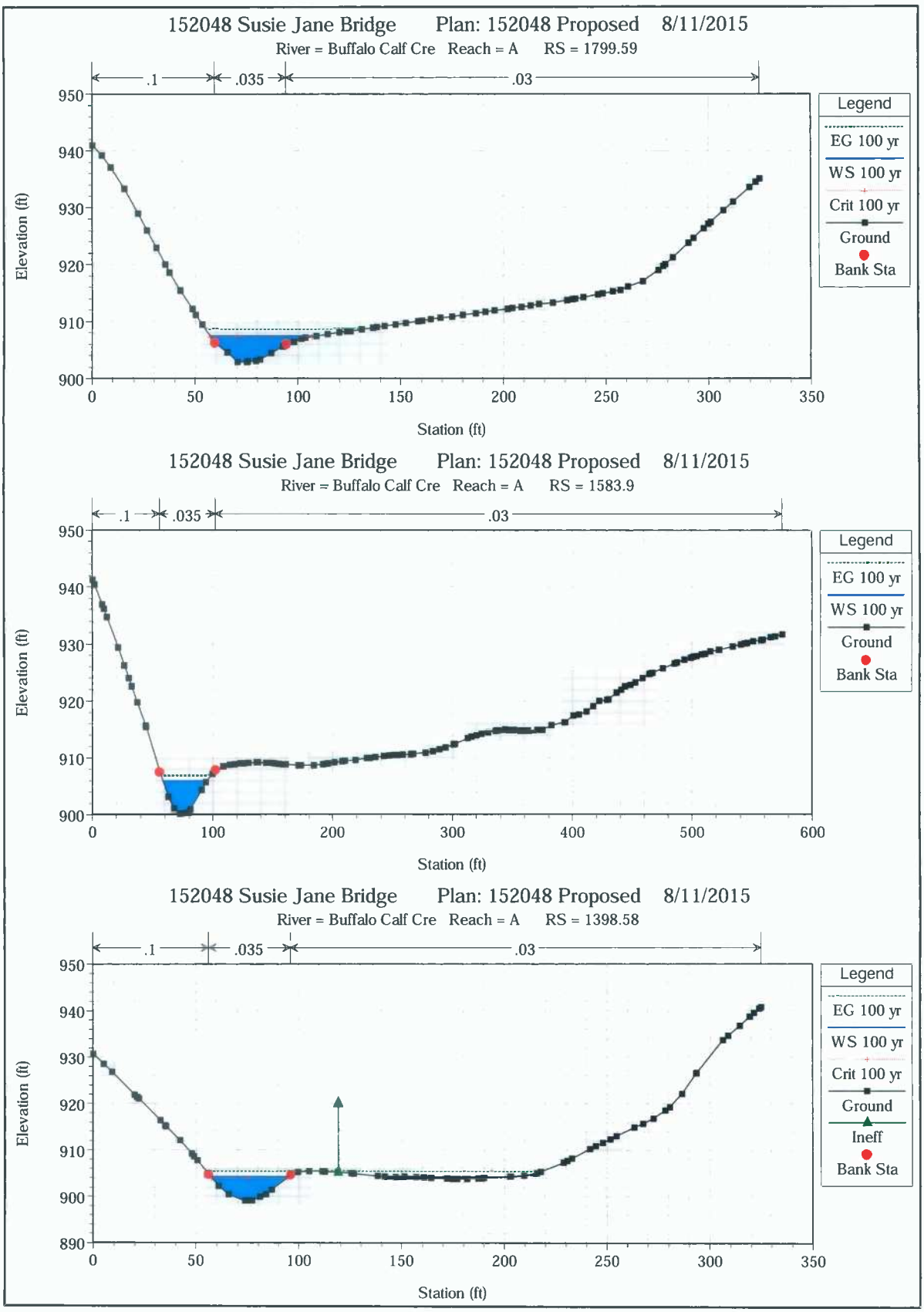
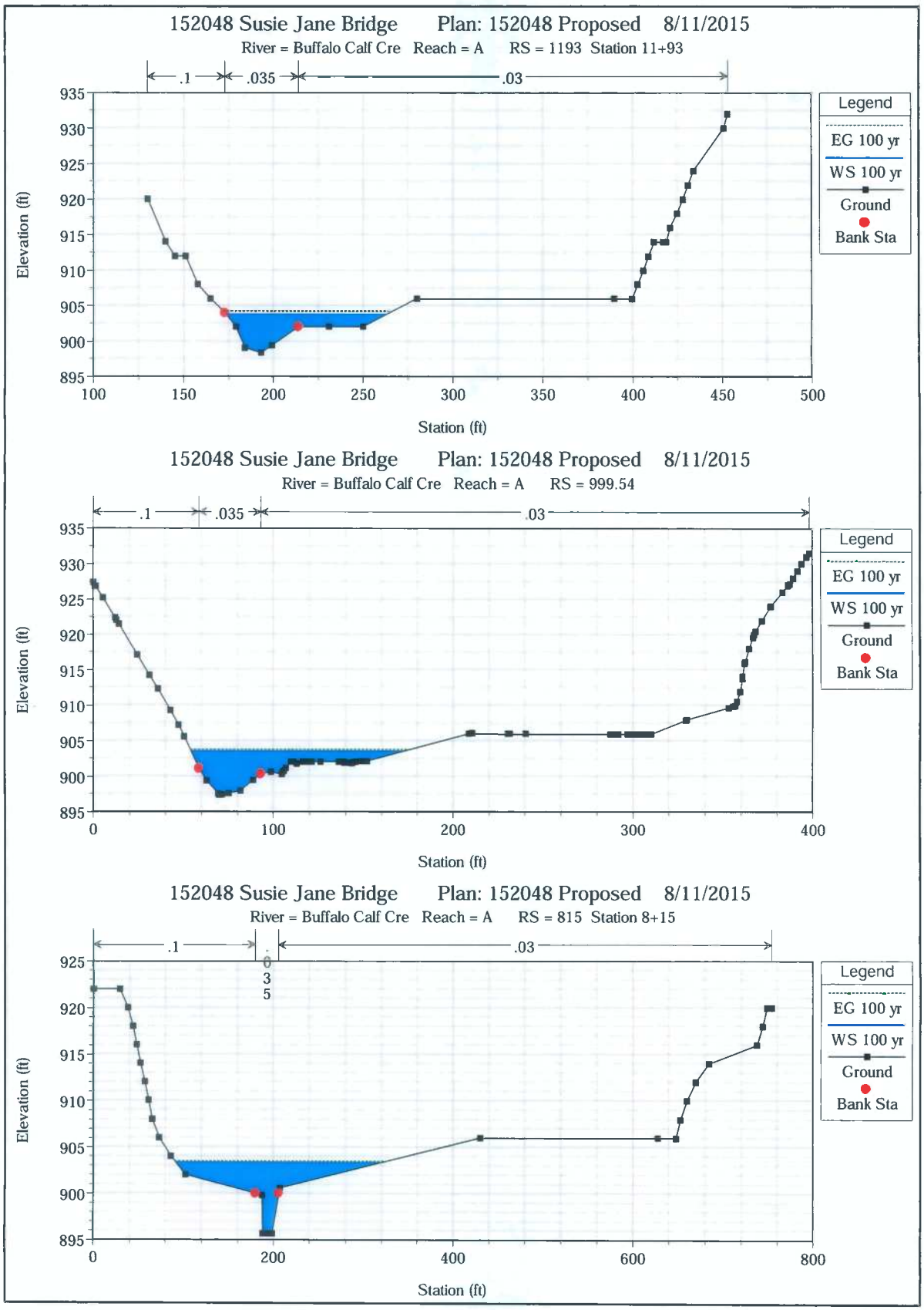
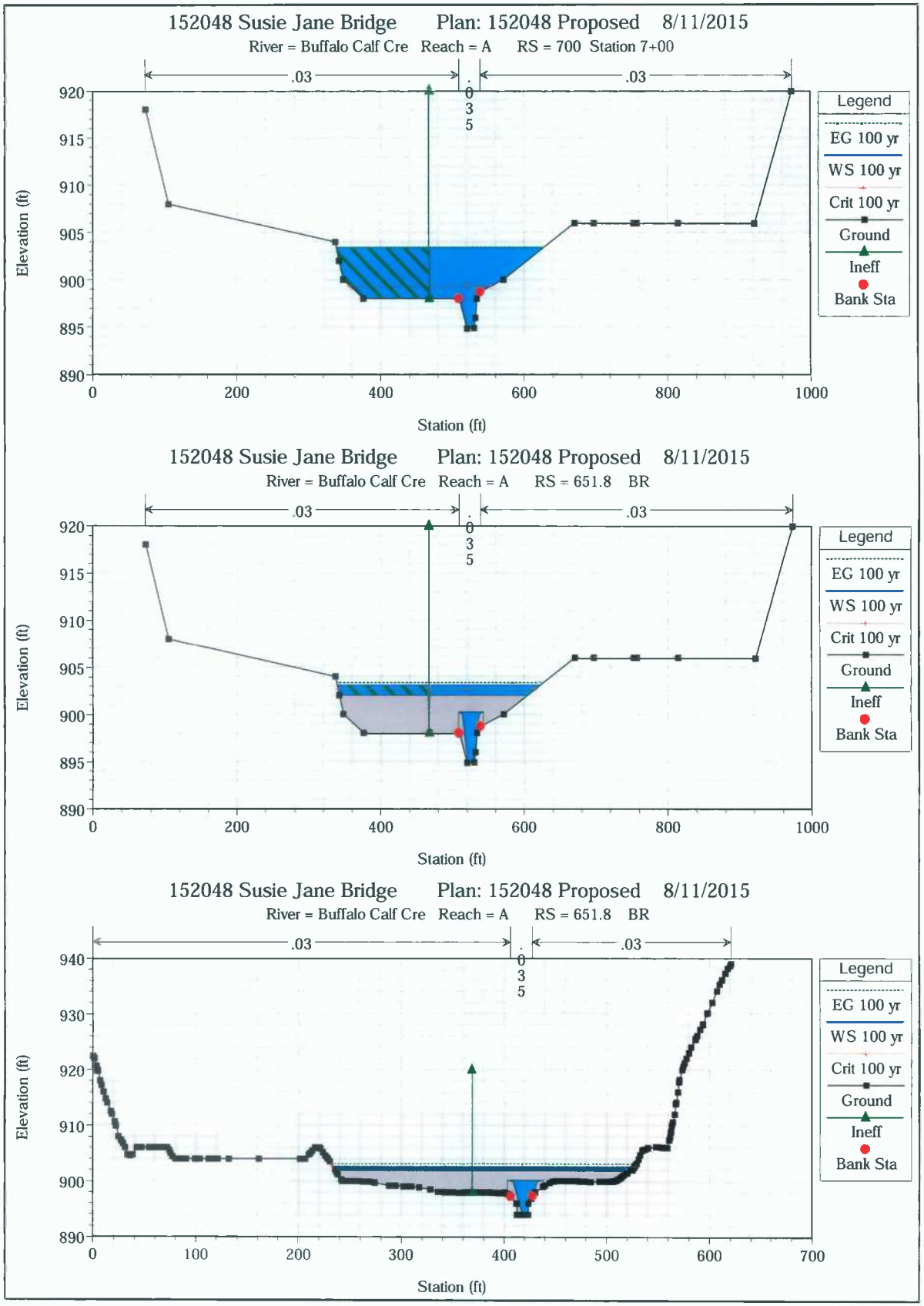
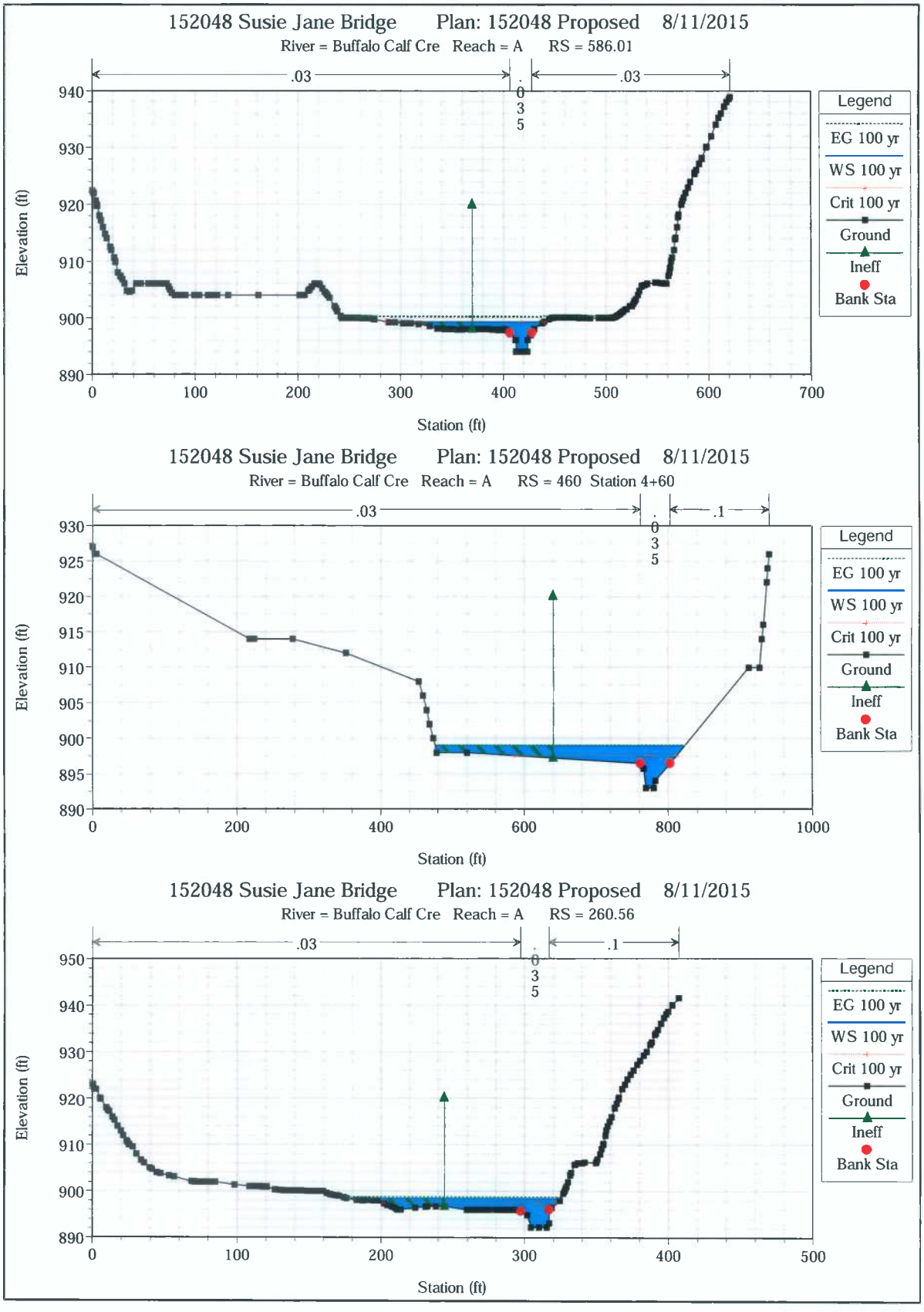
940
930
920
910
900
890
0
100
200
300
400
500
Station (ft)

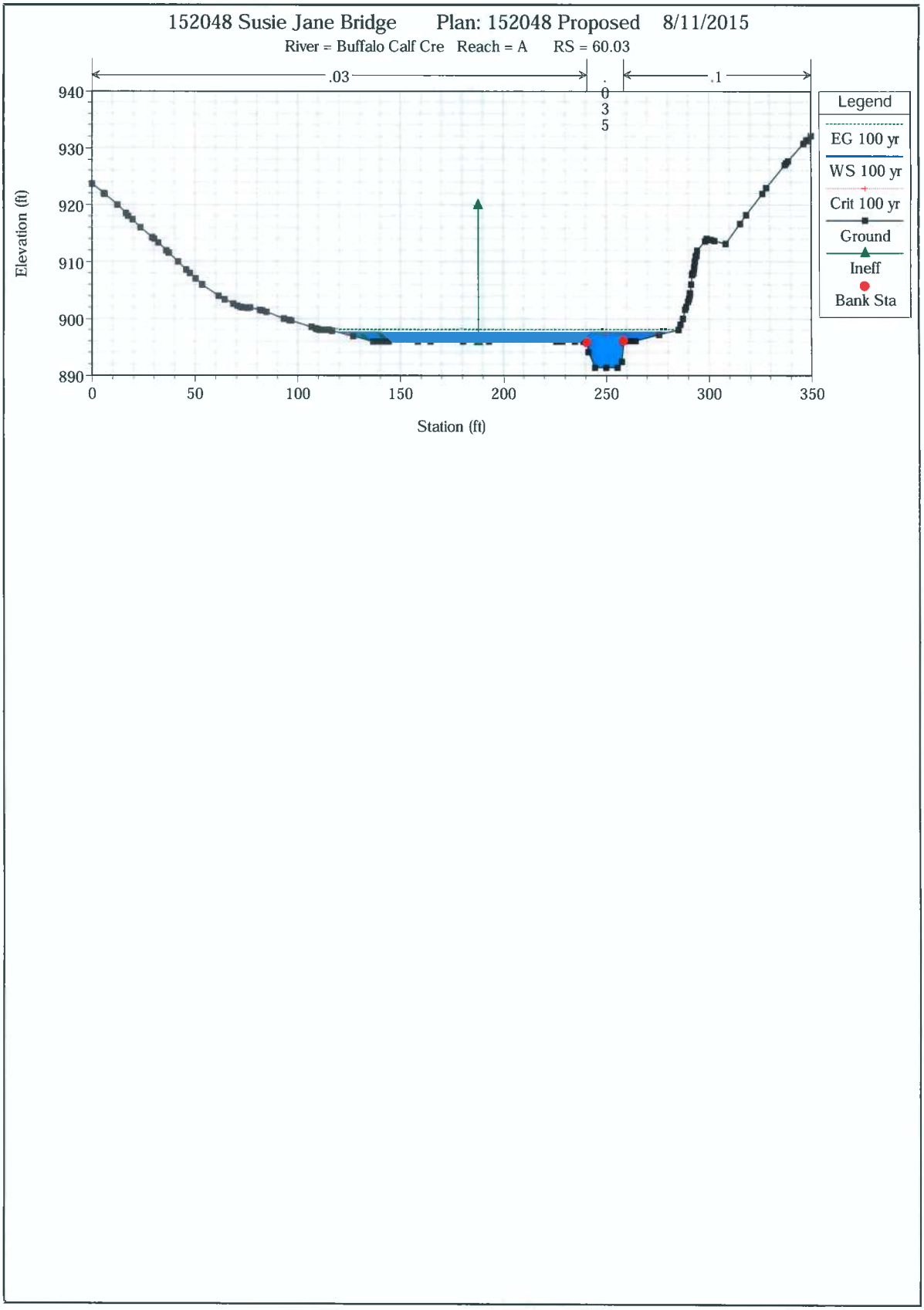

152048 Susie Jane Bridge Plan: 152048 Existing 8/11/2015
River = Buffalo Calf Cre Reach = A RS = 60.03
.03
.035
.1
Elevation (ft)
940
930
920
910
900
890
0
50
100
150
200
250
300
350
Station (ft)
Legend
EG 100 yr
WS 100 yr
Crit 100 yr
Ground
Ineff
Bank Sta


152048 Susie Jane Bridge Plan: 152048 Proposed 8/11/2015
River = Buffalo Calf Cre Reach = A RS = 1799.59
.1
.035
.03
Elevation (ft)
950
940
930
920
910
900
0
50
100
150
200
250
300
350
Station (ft)
Legend
EG 100 yr
WS 100 yr
Crit 100 yr
Ground
Bank Sta
152048 Susie Jane Bridge Plan: 152048 Proposed 8/11/2015
River = Buffalo Calf Cre Reach = A RS = 1583.9
.1
.035
.03
Elevation (ft)
950
940
930
920
910
900
0
100
200
300
400
500
600
Station (ft)
Legend
EG 100 yr
WS 100 yr
Ground
Bank Sta
152048 Susie Jane Bridge Plan: 152048 Proposed 8/11/2015
River = Buffalo Calf Cre Reach = A RS = 1398.58
.1
.035
.03
Elevation (ft)
950
940
930
920
910
900
890
0
50
100
150
200
250
300
350
Station (ft)
Legend
EG 100 yr
WS 100 yr
Crit 100 yr
Ground
Ineff
Bank Sta


152048 Susie Jane Bridge Plan: 152048 Proposed 8/11/2015
River = Buffalo Calf Cre Reach = A RS = 1193 Station 11+93
.1
.035
.03
Elevation (ft)
Station (ft)
Legend
EG 100 yr
WS 100 yr
Ground
Bank Sta
152048 Susie Jane Bridge Plan: 152048 Proposed 8/11/2015
River = Buffalo Calf Cre Reach = A RS = 999.54
.1
.035
.03
Elevation (ft)
Station (ft)
Legend
EG 100 yr
WS 100 yr
Ground
Bank Sta
152048 Susie Jane Bridge Plan: 152048 Proposed 8/11/2015
River = Buffalo Calf Cre Reach = A RS = 815 Station 8+15
.1
.03
Elevation (ft)
Station (ft)
Legend
EG 100 yr
WS 100 yr
Ground
Bank Sta


152048 Susie Jane Bridge Plan: 152048 Proposed 8/11/2015
River = Buffalo Calf Cre Reach = A RS = 700 Station 7+00
.03
.035
.03
Legend
EG 100 yr
WS 100 yr
Crit 100 yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
152048 Susie Jane Bridge Plan: 152048 Proposed 8/11/2015
River = Buffalo Calf Cre Reach = A RS = 651.8 BR
.03
.035
.03
Legend
EG 100 yr
WS 100 yr
Crit 100 yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
152048 Susie Jane Bridge Plan: 152048 Proposed 8/11/2015
River = Buffalo Calf Cre Reach = A RS = 651.8 BR
.03
.035
.03
Legend
EG 100 yr
WS 100 yr
Crit 100 yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


152048 Susie Jane Bridge Plan: 152048 Proposed 8/11/2015
River = Buffalo Calf Cre Reach = A RS = 586.01
.03
.035
.03
Legend
EG 100 yr
WS 100 yr
Crit 100 yr
Ground
Ineff
Bank Sta
Elevation (ft)
940
930
920
910
900
890
0
100
200
300
400
500
600
700
Station (ft)
152048 Susie Jane Bridge Plan: 152048 Proposed 8/11/2015
River = Buffalo Calf Cre Reach = A RS = 460 Station 4+60
.03
.035
.1
Legend
EG 100 yr
WS 100 yr
Crit 100 yr
Ground
Ineff
Bank Sta
Elevation (ft)
930
925
920
915
910
905
900
895
890
0
200
400
600
800
1000
Station (ft)
152048 Susie Jane Bridge Plan: 152048 Proposed 8/11/2015
River = Buffalo Calf Cre Reach = A RS = 260.56
.03
.035
.1
Legend
EG 100 yr
WS 100 yr
Crit 100 yr
Ground
Ineff
Bank Sta
Elevation (ft)
950
940
930
920
910
900
890
0
100
200
300
400
500
Station (ft)


152048 Susie Jane Bridge Plan: 152048 Proposed 8/11/2015
River = Buffalo Calf Cre Reach = A RS = 60.03
.03
.035
.1
Elevation (ft)
940
930
920
910
900
890
0
50
100
150
200
250
300
350
Station (ft)
Legend
EG 100 yr
WS 100 yr
Crit 100 yr
Ground
Ineff
Bank Sta

APPENDIX F

HEC-RAS Output Files

152048SusieJaneB.rep

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X      X   X     X  X    X
X     X  X        X           X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X           X  X     X    X        X
X     X  X        X    X      X   X    X    X        X
X     X  XXXXXX    XXXX       X    X   X    X   XXXXX
```

PROJECT DATA
Project Title: 152048 Susie Jane Bridge
Project File : 152048SusieJaneB.prj
Run Date and Time: 8/7/2015 3:01:11 PM

Project in English units

Project Description:
Entrance across Buffalo Fork in Doddridge Co

PLAN DATA

Plan Title: 152048 Existing
Plan File : p:\2015\152-048\-Calculations\HEC-RAS\152048SusieJaneB.p01

Geometry Title: 152048 Existing Geo
Geometry File :
p:\2015\152-048\-Calculations\HEC-RAS\152048SusieJaneB.g02

Flow Title : 152048 Flow
Flow File :
p:\2015\152-048\-Calculations\HEC-RAS\152048SusieJaneB.f03

Plan Summary Information:

Number of:	Cross Sections	= 11	Multiple Openings	=	0
	Culverts	= 1	Inline Structures	=	0
	Bridges	= 0	Lateral Structures	=	0

Computational Information

Water surface calculation tolerance	= 0.01
Critical depth calculation tolerance	= 0.01
Maximum number of iterations	= 20
Maximum difference tolerance	= 0.3
Flow tolerance factor	= 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: 152048 Flow
Flow File : p:\2015\152-048\-Calculations\HEC-RAS\152048SusieJaneB.f03

Flow Data (cfs)

River	Reach	RS	100 yr
Buffalo Calf For	A	1799.59	1093

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Buffalo Calf For	A	100 yr		

Normal S = 0.004

GEOMETRY DATA

Geometry Title: 152048 Existing Geo
Geometry File : p:\2015\152-048\-Calculations\HEC-RAS\152048SusieJaneB.g02

CROSS SECTION

RIVER: Buffalo Calf For
REACH: A RS: 1799.59

INPUT
Description:
Station Elevation Data num= 76

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	9414.570007	939.218.890015	937.05	15.56	933.27	22.06	928.92		
26.54001	925.99	31.12	922.9535.39999	92037.51999	918.59	42.75	915.45		
48.5	912.1650.10001	911.253.35001	909.4859.48001	906.2265.48001	904.61				
70.47	902.91	75	902.9375.57001	902.9479.50999	903.03	81.45	903.34		
86.86	904.4492.42999	905.5894.21001	905.93	97.8	906.43	101.56	907		
103.41	907.15	108.9	907.45	114.4	907.77	120.02	908.05	123.61	908.23
125.38	908.3	130.96	908.6	136.36	908.9	138.31	909.02	142.25	909.22
147.34	909.45	152.32	909.72	158.33	910.05	160.36	910.13	164.48	910.39
169.31	910.63	175.06	910.82	180.29	911.13	186.7	911.45	191.27	911.68
195.74	911.9	202.25	912.2	204.46	912.32	208.93	912.56	213.24	912.78
217.45	912.99	224.22	913.3	231.15	913.74	233.86	913.91	235.2	914
239.16	914.25	246.18	914.7	248.56	914.87	253.38	915.22	257.17	915.52
260.87	916.07	268.15	917.03	275.6	919.03	277.96	919.66	279.13	920.04
282.58	921.22	290.11	923.75	292.67	924.61	297.83	926.35	300.02	927.07
301.1	927.43	307.37	929.51	312.08	931.01	320.06	933.55	323.06	934.51
325	935.12								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.159.48001	.03594.21001	.03		

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
59.48001	94.21001	212.14	215.69	223.27	.1	.3

CROSS SECTION

RIVER: Buffalo Calf For
REACH: A RS: 1583.9

INPUT
Description:
Station Elevation Data num= 128

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	941.31	70.07	940.43	80.17	936.98	9.27002	936.17	11.76001	934.72
20.92999	929.37	26.20001	926.25	30.10999	924.03	32.59003	922.61	37.23999	919.8
44.25	915.66	44.57001	915.45	55.91998	907.51	62.94	903.19	67.57999	901.1
72.91	900.2	75	900.26	79.23999	900.38	80.04999	900.46	81.31	900.9
90.89999	904.35	94.31	905.69	99.69	907.13	102.56	907.84	108.58	908.55
114.23	908.74	118.06	908.9	122.85	909.07	125.89	909.01	129.98	909.14
136.43	909.17	137.55	909.18	144.25	909.13	149.21	909.09	151.38	909.05
154.8	908.95	158.52	908.86	160.88	908.83	171.44	908.72	172.54	908.7
173.17	908.69	184.2	908.68	191.54	908.86	194.18	908.93	195.86	908.99
201.32	909.16	207.53	909.35	209.91	909.42	219.19	909.65	228.28	909.95
229.85	909.98	230.85	910	235.31	910.11	242.51	910.28	246.66	910.37
251.25	910.45	254.17	910.5	258.39	910.57	265.03	910.68	265.84	910.71
267.24	910.73	277.5	910.93	283.4	911.15	289.16	911.49	294.06	911.81
300.82	912.36	301.19	912.4	301.77	912.45	312.49	913.45	315.46	913.7
320.14	913.96	324.15	914.19	329.73	914.5	335.81	914.75	336.86	914.81
338.51	914.82	343.99	914.96	347.47	914.9	351.13	914.9	356.88	914.82
359.13	914.81	363.05	914.83	370.8	914.87	375.25	914.9	382.46	915.76
393.63	916.24	393.93	916.29	394.12	916.3	401.06	917.5	405.78	917.65
412	918.17	417.45	919.04	422.46	919.98	429.11	920.19	430.37	920.28
436.73	921.48	440.77	921.96	443.86	922.59	448.74	922.84	452.43	923.28
458.86	924.01	464.1	924.66	465.27	924.84	467.11	924.93	475.76	925.76
485.48	926.61	487.42	926.76	493.8	927.25	499.08	927.58	500.93	927.75
503.85	927.88	508.07	928.19	510.74	928.31	515.2	928.67	522.22	928.93
522.41	928.94	522.73	928.96	534.07	929.54	540.59	929.88	543.74	930.06
545.73	930.12	550.87	930.49	557.39	930.68	558	930.74	558.97	930.76
565.14	931.18	569.06	931.34	575	931.68				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.155	91998	.035	102.56	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
55.91998	102.56	181.23	185.32	193.71	.1	.3

CROSS SECTION

RIVER: Buffalo Calf For
REACH: A RS: 1398.58

INPUT
Description:
Station Elevation Data num= 75

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	930.69	4.98999	928.55	9.100006	926.79	20.17999	921.85	21.17999	921.42
22.01999	921.05	32.54001	916.35	34.95001	915.28	35.37	915.09	42.13	912.07
47.88	909.25	49.12	908.63	50.57001	907.85	6.10001	904.69	60.81	902.24
65.76001	900.39	73.73	899.1	75	899.1	77.05	899.18	0.96001	899.88
84.03999	900.42	86.66	901.47	96.14999	904.57	99.59	905.19	104.99	905.46

111.34	905.41	111.98	905.4	112.52	905.38	118.96	905.2	125.45	905.01
125.95	904.99	126.54	904.97	138.37	904.46	141.73	904.35	146.9	904.2
151.3	904.26	156.92	904.21	160.87	904.1	164.23	904	172.12	903.9
174.84	903.84	177.16	903.83	181.82	903.81	187.31	903.93	188.81	903.95
190.08	903.98	202.5	904.28	203.01	904.29	209.76	904.51	215.94	905.06
217.7	905.29	228.87	907.31	230.72	907.67	232.89	908.16	241.79	910.22
244.69	910.82	248.09	911.53	251.67	912.27	254.72	912.95	263.28	914.79
267.65	915.64	272.63	916.73	278.47	918.51	280.58	919.2	286.59	922.12
293.51	926.46	293.58	926.5	293.67	926.55	306.43	933.62	308.86	934.57
314.53	936.76	319.36	938.62	321.52	939.43	324.05	940.39	325	940.74

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.156	10001	.035	96.14999	.03

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

56.10001	96.14999	202.21	205.58	213.16	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
119.12	325	920	F

CROSS SECTION

RIVER: Buffalo Calf For
REACH: A RS: 1193

INPUT
Description: Station 11+93
Station 0+60
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
130	920	140	914	145	912	151	912	158	908
165	906	173	904	179	902	184	899	193	898.37
199	899.37	214	902	231	902	250	902	280	906
390	906	400	906	403	908	406	910	409	912
412	914	417	914	419	914	421	916	425	918
428	920	431	922	434	924	451	930	453	932

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
130	.1	173	.035	214	.03

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

173	214	186.08	193.46	196.77	.1	.3

CROSS SECTION

RIVER: Buffalo Calf For
REACH: A RS: 999.54

INPUT
Description:
Station Elevation Data num= 109

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	927.38	1.329987	926.85	5.329987	925.17	12	922.37	12.81	922.03
14.01999	921.51	24.28998	917.11	31.14999	914.23	35.76999	912.29	42.67999	909.21
47.23999	907.22	50.29999	905.54	58.71997	901.09	62.73999	899.39	69.44998	897.49
69.91998	897.34	70.19998	897.3	71.32999	897.39	75	897.58	81.67999	897.95
88.59998	899.49	3.15997	900.32	98.62997	900.56	104.64	900.23	104.98	900.61
105	900.61	105.74	900.72	106.89	901.12	109.66	902.01	110.05	902
110.53	902	111.1	902	112.88	901.76	116.26	902.02	117.78	902.03

118.97	902.04	120.2	902.05	121.19	902.04	126.09	902.02	136.49	902
136.88	902	137.57	902	138.95	902	139.57	901.88	141.67	901.86
143.73	901.84	144.13	901.96	145.42	902.02	148.99	902.08	149.69	902.08
151.96	902.12	208.98	906	210.7	906.07	230.51	905.99	231.49	905.99
231.64	905.99	240.38	905.98	287.64	905.98	288.02	905.98	288.7	905.99
289.37	905.99	290.43	905.99	291.93	906	297.26	906	297.61	906
298.35	906	300.4	906	302.07	906	302.58	906	302.89	906
304.15	906	304.31	906	305.18	906	305.85	906	308.31	906
309.58	906	309.62	906	310.23	906	329.68	907.98	330.04	908
353.29	909.73	355.73	909.9	356.29	909.94	357.02	910	357.67	910.61
359.5	912	360.78	913.81	360.9	914	360.96	914.12	362.1	916
362.15	916.02	362.43	916.22	364.5	918	366.83	919.58	367.36	920
368.13	920.47	371.81	922	376.66	923.98	376.73	924	376.75	924.01
376.8	924.02	383.43	926	386.45	926.96	387.37	927.18	389.38	928
391.71	928.98	394.04	930	396.7	930.99	398.11	931.53		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.158	71997	.035	93.15997	.03

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

Left	Right	Left	Channel	Right	Coeff	Contr.	Expan.
58.71	99793.15997		209.86	184.54	151.87	.1	.3

CROSS SECTION

RIVER: Buffalo Calf For
REACH: A RS: 815

INPUT
Description: Station 8+15
Station 4+38
Station 438
Station 4+38
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	922	29	922	38	920	44	918	48	916
52	914	57	912	61	910	65	908	73	906
86	904	102	902	180	900	187	899.79	188	895.64
194	895.64	198	895.64	206	900	207	900.59	430	906
628	906	648	906	653	908	660	910	670	912
685	914	738	916	744	918	749	920	754	920

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	180	.035	206	.03

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

Left	Right	Left	Channel	Right	Coeff	Contr.	Expan.
180	206		138.15	115	87.05	.1	.3

CROSS SECTION

RIVER: Buffalo Calf For
REACH: A RS: 700

INPUT
Description: Station 7+00
Station Elevation Data num= 21

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
73	918	105	908	337	904	342	902	348	900
376	898	468	898	509	898	520	894.85	530	894.89
532	896	534	898	539	898.75	571	900	670	906

697	906	752	906	757	906	814	906	922	906
973	920								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
73	.03	509	.035	539	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
509	539	108.97	113.99	118.19	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
73	468	920	F

CULVERT

RIVER: Buffalo Calf For
REACH: A RS: 675

INPUT
Description:
Distance from Upstream XS = 38.4
Deck/Roadway Width = 33
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	902	890	800	902	890

Upstream Bridge Cross Section Data
Station Elevation Data num= 21

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
73	918	105	908	337	904	342	902	348	900
376	898	468	898	509	898	520	894.85	530	894.89
532	896	534	898	539	898.75	571	900	670	906
697	906	752	906	757	906	814	906	922	906
973	920								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
73	.03	509	.035	539	.03

Bank Sta: Left	Right	Coeff Contr.	Expan.
509	539	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
73	468	920	F

Downstream Deck/Roadway Coordinates
num= 2

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
0	902	890	600	902	890

Downstream Bridge Cross Section Data
Station Elevation Data num= 317

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	922.48	.0399	922.46.8200073	922.031.080017	922.021.109985	922.02
1.429993	9223.080017	920.643.950012	9204.369995	919.72	7	918
8.280029	917.149.859985	91612.23999	914.7613.82001	91417.22998	912.45
18.20001	91221.03998	910.6122.03003	910	22.38	909.8424.82001	908
26.79999	907.3527.59998	907.1829.16003	906.7430.84003	90633.41998	904.76
34.20001	904.73	36.19	904.638.15002	904.7342.40002	90642.91998	906
42.98999	90645.57001	90645.89001	906	46.38	90647.01001	906

54.23999	90654.53003	906	54.88	90655.33002	90655.34998	906			
58.51001	906	59.5	90661.29999	906	62.12	90662.82001	906		
65.48999	90669.92999		90670.64001	90672.16998		90673.90002	905.51		
75.46002	905	77.06	904.479.65002	90482.16003		90485.17999	904		
85.66998	90486.32001		904	87.06	90487.41003		90488.28998	904	
89.97998	90490.16998		90498.92999		904	100.17	904	100.9	904
101.88	904	101.93	904	103.42	904	103.46	904	112.29	904
116.06	904	121.47	904	131.96	904	160.94	904	201.02	904
206.29	904	209.79	904.71	211.43	905	213.3	905.44	215.97	905.91
216.27	905.97	216.44	906	218.33	906	220.08	906	221.14	905.88
223.74	905.2	225.84	904.6	227.69	904.19	228.49	904	230.34	903.52
235.31	902	236.65	901.64	236.89	901.59	238.12	901.13	241.37	900.32
242.19	900.08	242.5	900	245.26	899.99	245.57	899.99	245.98	899.99
249.49	899.97	250.19	899.97	251.29	899.96	252.23	899.96	252.98	899.96
254.07	899.95	255.23	899.94	256.2	899.94	257	899.94	257.28	899.93
257.6	899.93	258.68	899.93	262.53	899.89	263.37	899.88	263.92	899.88
265.67	899.87	268.59	899.84	268.68	899.84	268.76	899.84	273.3	899.82
274.41	899.75	287.87	899.21	294.44	899.17	302.29	899.06	304.33	899.05
306.31	899.03	308.28	899.02	309.74	899.01	317.14	898.85	328.29	898.51
335.61	898.08	337.06	898.09	338.29	898.06	339.89	898.05	340.33	898.05
342.56	898.02	343.69	898	344.16	898	345.43	898	345.54	898
345.55	898	348.49	897.99	350.06	897.98	355.52	897.96	357.55	897.96
359.87	897.96	362.53	897.97	365.82	897.98	366.86	897.98	368.9	897.99
369.42	897.99	373.99	897.98	378.98	898	379.7	897.98	382.85	897.98
386	897.98	386.03	897.98	386.07	897.98	386.11	897.97	386.16	897.97
389.35	897.92	390.38	897.9	392.22	897.89	394.95	897.9	395.33	897.85
397.58	897.87	399.91	897.92	400.49	897.95	401.1	897.99	401.11	897.99
401.12	897.99	401.13	897.99	403.4	897.77	405.26	897.63	406.55	897.33
412.01	896.01	412.35	896.01	412.39	894	414.18	894	416.14	894
420.38	894	421.36	894	422.06	894	422.54	894	422.58	894
422.92	894	423.23	894	423.27	894	423.31	894	423.85	896.02
426.51	896.86	428.15	897.35	430.52	898	438.08	899.04	439.91	899.25
444.5	899.71	447.45	899.99	447.57	899.99	447.82	899.99	448.25	900
448.4	900	450.38	900.05	452.5	900.06	455.78	900.06	459.45	900.06
463.14	900.05	465.14	900.05	467.16	900.04	467.29	900.04	468.52	900.03
469.77	900.03	471.84	900.05	473.86	900	473.89	900	473.93	900
474.54	900	475.24	900	475.94	900	477.05	900	477.14	900
478.98	900	479	900	479.01	900	479.12	900	484.48	899.91
493.04	899.96	498.33	899.98	499.77	899.98	501.36	899.98	503.04	899.98
504	899.97	505.44	899.99	505.55	899.99	505.79	899.99	506.17	900
506.22	900	506.23	900	506.59	900.01	506.83	900.01	507.26	900.02
508.34	900.02	509.87	900.21	510.6	900.28	512.33	900.5	513.84	900.68
514.9	900.83	516.58	901.07	518.94	901.39	520.1	901.54	523.34	901.99
523.44	901.99	523.74	901.99	524.43	902	524.73	902	524.9	902
524.97	902.01	525.29	902.02	526.53	902.45	527.49	902.74	528.15	902.93
529.13	903.23	531.13	904	532.49	904.71	534.82	905.52	535.47	905.64
537.6	905.74	540.16	905.97	540.34	906	547.91	906.19	549.88	906.21
553.08	906.12	555.13	906.07	556.44	906.03	557.09	906	557.57	905.99
557.84	905.99	558.31	905.99	558.67	906	559.08	906	560.91	907.34
561.7	908	562.3	908.7	562.7	908.93	563.69	910	564.32	910.61
566.15	912	567.42	913.83	567.53	914	567.63	914.1	569.4	916
570.54	917.79	570.77	918	571	918.17	573.48	920	574.67	920.6
576.07	921.17	577.52	922	579.86	922.97	582.17	924	586.27	925.34
587	925.61	588.23	926	591.11	927.1	593.47	928	593.87	928.18
598	930	598.16	930.08	602.67	932	602.69	932.01	602.72	932.02
607.21	934	610.27	935.25	612.42	936	615.55	937.2	618.05	938
619.92	938.56	621.13	938.91						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	406.55	.035	428.15	.03

Bank Sta: Left Right Coeff Contr. Expan.

406.55 428.15 .1 .3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	369.42	920	F

Upstream Embankment side slope = 1 horiz. to 1.0 vertical
Downstream Embankment side slope = 1 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98
Elevation at which weir flow begins = 899
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Circular	5	

FHWA Chart # 55- Circular Culvert
FHWA Scale # 1 - Smooth tapered inlet throat
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	25	63	.012	.012	0	.9	1

Upstream Elevation = 894.4
Centerline Station = 525
Downstream Elevation = 894
Centerline Station = 420.38

CROSS SECTION

RIVER: Buffalo Calf For
REACH: A RS: 586.01

INPUT
Description:
Station Elevation Data num= 317

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	922.48	.0399	922.46.8200073		922.031.080017		922.021.109985		922.02
1.429993	9223.080017		920.643.950012		9204.369995		919.72	7	918
8.280029	917.149.859985		91612.23999		914.7613.82001		91417.22998		912.45
18.20001	91221.03998		910.6122.03003		910	22.38	909.8424.82001		908
26.79999	907.3527.59998		907.1829.16003		906.7430.84003		90633.41998		904.76
34.20001	904.73	36.19	904.638.15002		904.7342.40002		90642.91998		906
42.98999	90645.57001		90645.89001		906	46.38	90647.01001		906
54.23999	90654.53003		906	54.88	90655.33002		90655.34998		906
58.51001	906	59.5	90661.29999		906	62.12	90662.82001		906
65.48999	90669.92999		90670.64001		90672.16998		90673.90002		905.51
75.46002	905	77.06	904.479.65002		90482.16003		90485.17999		904
85.66998	90486.32001		904	87.06	90487.41003		90488.28998		904
89.97998	90490.16998		90498.92999		904	100.17	904	100.9	904
101.88	904	101.93	904	103.42	904	103.46	904	112.29	904
116.06	904	121.47	904	131.96	904	160.94	904	201.02	904
206.29	904	209.79	904.71	211.43	905	213.3	905.44	215.97	905.91
216.27	905.97	216.44	906	218.33	906	220.08	906	221.14	905.88
223.74	905.2	225.84	904.6	227.69	904.19	228.49	904	230.34	903.52
235.31	902	236.65	901.64	236.89	901.59	238.12	901.13	241.37	900.32
242.19	900.08	242.5	900	245.26	899.99	245.57	899.99	245.98	899.99
249.49	899.97	250.19	899.97	251.29	899.96	252.23	899.96	252.98	899.96
254.07	899.95	255.23	899.94	256.2	899.94	257	899.94	257.28	899.93
257.6	899.93	258.68	899.93	262.53	899.89	263.37	899.88	263.92	899.88
265.67	899.87	268.59	899.84	268.68	899.84	268.76	899.84	273.3	899.82

274.41	899.75	287.87	899.21	294.44	899.17	302.29	899.06	304.33	899.05
306.31	899.03	308.28	899.02	309.74	899.01	317.14	898.85	328.29	898.51
335.61	898.08	337.06	898.09	338.29	898.06	339.89	898.05	340.33	898.05
342.56	898.02	343.69	898	344.16	898	345.43	898	345.54	898
345.55	898	348.49	897.99	350.06	897.98	355.52	897.96	357.55	897.96
359.87	897.96	362.53	897.97	365.82	897.98	366.86	897.98	368.9	897.99
369.42	897.99	373.99	897.98	378.98	898	379.7	897.98	382.85	897.98
386	897.98	386.03	897.98	386.07	897.98	386.11	897.97	386.16	897.97
389.35	897.92	390.38	897.9	392.22	897.89	394.95	897.9	395.33	897.85
397.58	897.87	399.91	897.92	400.49	897.95	401.1	897.99	401.11	897.99
401.12	897.99	401.13	897.99	403.4	897.77	405.26	897.63	406.55	897.33
412.01	896.01	412.35	896.01	412.39	894	414.18	894	416.14	894
420.38	894	421.36	894	422.06	894	422.54	894	422.58	894
422.92	894	423.23	894	423.27	894	423.31	894	423.85	896.02
426.51	896.86	428.15	897.35	430.52	898	438.08	899.04	439.91	899.25
444.5	899.71	447.45	899.99	447.57	899.99	447.82	899.99	448.25	900
448.4	900	450.38	900.05	452.5	900.06	455.78	900.06	459.45	900.06
463.14	900.05	465.14	900.05	467.16	900.04	467.29	900.04	468.52	900.03
469.77	900.03	471.84	900.05	473.86	900	473.89	900	473.93	900
474.54	900	475.24	900	475.94	900	477.05	900	477.14	900
478.98	900	479	900	479.01	900	479.12	900	484.48	899.91
493.04	899.96	498.33	899.98	499.77	899.98	501.36	899.98	503.04	899.98
504	899.97	505.44	899.99	505.55	899.99	505.79	899.99	506.17	900
506.22	900	506.23	900	506.59	900.01	506.83	900.01	507.26	900.02
508.34	900.02	509.87	900.21	510.6	900.28	512.33	900.5	513.84	900.68
514.9	900.83	516.58	901.07	518.94	901.39	520.1	901.54	523.34	901.99
523.44	901.99	523.74	901.99	524.43	902	524.73	902	524.9	902
524.97	902.01	525.29	902.02	526.53	902.45	527.49	902.74	528.15	902.93
529.13	903.23	531.13	904	532.49	904.71	534.82	905.52	535.47	905.64
537.6	905.74	540.16	905.97	540.34	906	547.91	906.19	549.88	906.21
553.08	906.12	555.13	906.07	556.44	906.03	557.09	906	557.57	905.99
557.84	905.99	558.31	905.99	558.67	906	559.08	906	560.91	907.34
561.7	908	562.3	908.7	562.7	908.93	563.69	910	564.32	910.61
566.15	912	567.42	913.83	567.53	914	567.63	914.1	569.4	916
570.54	917.79	570.77	918	571	918.17	573.48	920	574.67	920.6
576.07	921.17	577.52	922	579.86	922.97	582.17	924	586.27	925.34
587	925.61	588.23	926	591.11	927.1	593.47	928	593.87	928.18
598	930	598.16	930.08	602.67	932	602.69	932.01	602.72	932.02
607.21	934	610.27	935.25	612.42	936	615.55	937.2	618.05	938
619.92	938.56	621.13	938.91						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	406.55	.035	428.15	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
406.55	428.15	104.3	126.01	142.62	.1 .3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	369.42	920	F

CROSS SECTION

RIVER: Buffalo Calf For
REACH: A RS: 460

INPUT
Description: Station 4+60
Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	927	5	926	218	914	224	914	278	914
352	912	453	908	459	906	464	904	468	902

473	900	478	898	520	898	762	896.5	766	895.71
769	893	780	893	782	894	803	896.5	912	910
927	910	930	914	932	916	937	922	938	924
940	926								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	762	.035	803	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
762	803	190.69	199.44 206.02	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	640	920	F

CROSS SECTION

RIVER: Buffalo Calf For
REACH: A RS: 260.56

INPUT
Description:
Station Elevation Data num= 233

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	923.07	.25	922.94	2.230011	922	5.200012	920.09	5.320007	920.02
5.369995	920	5.660004	919.85	9.420013	918	10.41	917.5	11.5	917.18
13.58002	916	14.91	915.4	17.34	914	19.45001	913	21.14999	912
23.5	910.84	24.14001	910.56	25.20001	910.06	25.33002	910	25.41	909.97
27.59	909.49	30.17001	908	33.46002	906.71	35.55002	906	39.51001	905
41.11002	904.74	4.24002	904	47.07001	903.77	52.86002	903.31	56.26001	903.04
68.60001	902.05	69.62	902.04	70.29001	902	70.63	902	71.71002	902
71.93002	902	72.35001	902	72.57001	902	72.89001	902	73.28	902
73.58002	902	74.23001	902	74.53	902	74.77002	902	75.17001	902
75.73001	902.01	76.14001	902.01	76.68002	902	77.47	902	77.70001	902
78.20001	901.99	78.47	901.99	78.98001	901.98	79.86002	901.96	79.89999	901.96
79.94	901.96	81.86002	901.96	82.29001	901.96	84.81	901.94	98	901.36
108.66	901.07	110.23	901.06	111.94	900.99	113.81	901.01	115.73	901.03
117.85	900.98	120.22	900.91	120.64	900.9	126.14	900.28	126.31	900.29
126.55	900.28	129.77	900.19	130.07	900.19	130.56	900.18	131.93	900.16
133.16	900.14	136.13	900.12	136.77	900.12	137.45	900.12	139.66	900.09
140.46	900.09	142.08	900.1	144.71	900.07	148.82	900.03	149.69	900.03
150.12	900.03	150.75	900.03	151.78	900.02	152.71	900.02	153.28	900.02
154.24	900.02	155.52	900.02	158.48	900	158.83	900	159.14	900
159.26	900	159.33	900	159.51	900	159.62	900	162.26	899.61
164.58	899.29	166.16	899.22	168.11	899.12	169.33	899.06	170.75	898.98
174.24	898.66	176.03	898.5	183.13	898.04	184.63	898.05	185.61	898.08
186.69	898.03	186.93	898.03	187.33	898.03	187.36	898.02	187.66	898.03
190.84	898.06	194.64	898	194.71	898	194.91	898	195.85	898
197.37	898	197.78	897.94	201.97	897.38	204.35	897.1	205.66	896.94
207.59	896.66	209.8	896.31	211.6	896.01	211.93	896	211.98	896
212.08	896	212.54	896	213.33	896.08	213.55	896.07	213.73	896.07
223.97	896.49	230.94	896.69	231.14	896.68	232.46	896.71	238.38	896.77
244.05	896.76	259.86	896.05	261.01	896	261.67	896	265.44	896
269.06	896	269.51	896	269.58	896	269.66	896	272.81	896
274.81	896	275.4	896	280.05	896	280.31	896	283.37	896
284.65	896	287.83	896	288.88	896	289.86	896	291.4	896
291.85	896	292.81	896	293.74	896	294.15	896	294.64	896
295.15	896	295.7	896	296.2	896	296.76	896	297.5	896
297.74	895.7	301.74	894.91	304.55	892.2	310.05	892.2	315.55	892.2
317.05	893.2	317.18	896	318.71	896.4	324.54	898	326.99	899.55
327.92	900	328.46	900.53	329.17	901	330.06	902	331.88	903.54
332.4	904	334.87	905.73	335	905.78	337	906	338.4	906.03

339.06	906.03	339.58	906.03	340.05	906.08	342	906.29	349.64	906.18
349.91	906.34	350.02	906.4	350.83	906.83	352.6	908	353.77	909.08
354.65	910	354.89	910.27	356.35	912	356.98	913.05	358.05	914
359.16	914.91	360.35	916	362.77	917.91	362.87	918	364	918.83
365.25	919.8	365.56	920	365.77	920.14	368.15	922	369.83	922.95
371.73	924	373.83	925.07	375.73	926	378.54	927.19	380.39	928
383.07	929.15	385.02	930	387.58	931.47	388.51	932	390.94	933.62
391.5	934	392.66	934.7	394.89	936	397.06	937.22	398.58	938
399.81	938.59	402.96	940	407.54	941.55				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	297.74	.035	317.18	.1

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
297.74 317.18 203.61 200.53 196.92 .1 .3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	244.05	920	F

CROSS SECTION

RIVER: Buffalo Calf For
REACH: A RS: 60.03

INPUT
Description:
Station Elevation Data num= 123

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	923.63	5.690002	922	5.850006	921.95	6.26001	921.83	12.20999	920
16.38	918.52	17.67999	918	19.51999	917.42	3.60001	916	29.20999	914.27
30.20999	914	32.13	913.33	6.01001	912	37.26999	911.55	41.79999	910
45.70999	908.57	47.38	908	50.09	907.04	53.35001	906	53.47	905.97
61.32999	904	64.28	903.41	68.34	902.64	70.39001	902.26	72.12	902
73.01001	901.94	73.20001	901.94	75.42999	901.85	76.66	901.89	81.54001	901.51
82.56	901.4	84.62	901.14	93.06	900	95.87	899.72	96.84	899.64
106.6	898.48	108.69	898.24	109.4	898.16	109.73	898.12	110.63	898
110.79	898	111.83	898	112.59	898	113.75	898	114	898
115.06	898	115.07	898	116.56	897.86	126.8	896.94	136.66	896
138.3	896	138.95	896	141.86	896	143.19	896	143.34	896
143.9	896	144.16	896	158.4	896	164.61	896	180.42	896
187.99	896	192.99	896	225.6	896	228.16	896	228.7	896
234.89	896	238.95	896	239.18	896	239.31	895.98	240.79	895.77
241.5	894.11	244.5	891.4	250	891.4	255.5	891.4	257.5	892.4
258.54	896.01	261.13	896.01	263.72	896.01	263.85	896.01	264.2	896.01
275.6	897.19	285.19	898	286.13	898.94	287.15	900	288.46	901.6
288.89	902	289.7	902.96	290.32	903.5	290.59	904	290.79	904.45
290.83	904.49	291.38	906	291.88	907.7	292.07	907.97	292.12	907.97
292.4	907.99	292.5	908	292.75	908.68	292.82	909.01	292.87	909.17
293.18	910	293.7	910.96	293.96	910.98	294.11	911.14	294.29	912
298.2	913.62	299	914	299.07	914.02	301.26	913.87	302.87	913.67
308.35	913.16	315.25	916.66	318.24	918.2	326.19	921.98	328.13	922.95
337.13	926.93	338.02	927.35	338.75	927.66	346.42	930.7	347.78	931.24
347.91	931.29	348.07	931.35	350	932.09				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	240.79	.035	258.54	.1

Bank Sta: Left Right Coeff Contr. Expan.
240.79 258.54 .1 .3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	187.99	920	F

SUMMARY OF MANNING'S N VALUES

River:Buffalo Calf For

Reach	River Sta.	n1	n2	n3
A	1799.59	.1	.035	.03
A	1583.9	.1	.035	.03
A	1398.58	.1	.035	.03
A	1193	.1	.035	.03
A	999.54	.1	.035	.03
A	815	.1	.035	.03
A	700	.03	.035	.03
A	675	Culvert		
A	586.01	.03	.035	.03
A	460	.03	.035	.1
A	260.56	.03	.035	.1
A	60.03	.03	.035	.1

SUMMARY OF REACH LENGTHS

River: Buffalo Calf For

Reach	River Sta.	Left	Channel	Right
A	1799.59	212.14	215.69	223.27
A	1583.9	181.23	185.32	193.71
A	1398.58	202.21	205.58	213.16
A	1193	186.08	193.46	196.77
A	999.54	209.86	184.54	151.87
A	815	138.15	115	87.05
A	700	108.97	113.99	118.19
A	675	Culvert		
A	586.01	104.3	126.01	142.62
A	460	190.69	199.44	206.02
A	260.56	203.61	200.53	196.92
A	60.03			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Buffalo Calf For

Reach	River Sta.	Contr.	Expan.
A	1799.59	.1	.3
A	1583.9	.1	.3
A	1398.58	.1	.3
A	1193	.1	.3
A	999.54	.1	.3
A	815	.1	.3
A	700	.1	.3
A	675	Culvert	

A	586.01	.1	.3
A	460	.1	.3
A	260.56	.1	.3
A	60.03	.1	.3

152048SusieJaneB.rep

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX         XXXX       XX      XXXX
X     X  X        X    X       X   X     X  X    X
X     X  X        X            X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X            X  X     X    X        X
X     X  X        X    X       X   X    X    X        X
X     X  XXXXXX    XXXX        X    X   X    X   XXXXX
```

PROJECT DATA
Project Title: 152048 Susie Jane Bridge
Project File : 152048SusieJaneB.prj
Run Date and Time: 8/7/2015 3:00:53 PM

Project in English units

Project Description:
Entrance across Buffalo Fork in Doddridge Co

PLAN DATA

Plan Title: 152048 Proposed
Plan File : p:\2015\152-048\-Calculations\HEC-RAS\152048SusieJaneB.p02

Geometry Title: 152048 Proposed Geo
Geometry File :
p:\2015\152-048\-Calculations\HEC-RAS\152048SusieJaneB.g03

Flow Title : 152048 Flow
Flow File :
p:\2015\152-048\-Calculations\HEC-RAS\152048SusieJaneB.f03

Plan Summary Information:

Number of:	Cross Sections	= 11	Multiple Openings	=	0
	Culverts	= 0	Inline Structures	=	0
	Bridges	= 1	Lateral Structures	=	0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: 152048 Flow
Flow File : p:\2015\152-048\-Calculations\HEC-RAS\152048SusieJaneB.f03

Flow Data (cfs)

River	Reach	RS	100 yr
Buffalo Calf For	A	1799.59	1093

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Buffalo Calf For	A	100 yr		

Normal S = 0.004

GEOMETRY DATA

Geometry Title: 152048 Proposed Geo
Geometry File : p:\2015\152-048\-Calculations\HEC-RAS\152048SusieJaneB.g03

CROSS SECTION

RIVER: Buffalo Calf For
REACH: A RS: 1799.59

INPUT
Description:
Station Elevation Data num= 76

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	9414.570007		939.218.890015		937.05	15.56	933.27	22.06	928.92
26.54001	925.99	31.12	922.9535.39999		92037.51999		918.59	42.75	915.45
48.5	912.1650.10001		911.253.35001		909.4859.48001		906.2265.48001		904.61
70.47	902.91	75	902.9375.57001		902.9479.50999		903.03	81.45	903.34
86.86	904.4492.42999		905.5894.21001		905.93	97.8	906.43	101.56	907
103.41	907.15	108.9	907.45	114.4	907.77	120.02	908.05	123.61	908.23
125.38	908.3	130.96	908.6	136.36	908.9	138.31	909.02	142.25	909.22
147.34	909.45	152.32	909.72	158.33	910.05	160.36	910.13	164.48	910.39
169.31	910.63	175.06	910.82	180.29	911.13	186.7	911.45	191.27	911.68
195.74	911.9	202.25	912.2	204.46	912.32	208.93	912.56	213.24	912.78
217.45	912.99	224.22	913.3	231.15	913.74	233.86	913.91	235.2	914
239.16	914.25	246.18	914.7	248.56	914.87	253.38	915.22	257.17	915.52
260.87	916.07	268.15	917.03	275.6	919.03	277.96	919.66	279.13	920.04
282.58	921.22	290.11	923.75	292.67	924.61	297.83	926.35	300.02	927.07
301.1	927.43	307.37	929.51	312.08	931.01	320.06	933.55	323.06	934.51
325	935.12								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.159.48001		.03594.21001		.03

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      59.4800194.21001           212.14  215.69  223.27             .1       .3

CROSS SECTION


RIVER: Buffalo Calf For
REACH: A                  RS: 1583.9

INPUT
Description:
Station Elevation Data    num=     128
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   941.31.570007  940.437.830017  936.98 9.27002  936.1711.76001  934.72
20.92999  929.3726.20001  926.2530.10999  924.0332.59003  922.6137.23999   919.8
   44.25  915.6644.57001  915.4555.91998  907.51   62.94  903.1967.57999   901.1
   72.91   900.2       75  900.2679.23999  900.3880.04999  900.46   81.31   900.9
90.89999  904.35   94.31  905.69   99.69  907.13  102.56  907.84  108.58  908.55
  114.23  908.74  118.06   908.9  122.85  909.07  125.89  909.01  129.98  909.14
  136.43  909.17  137.55  909.18  144.25  909.13  149.21  909.09  151.38  909.05
   154.8  908.95  158.52  908.86  160.88  908.83  171.44  908.72  172.54   908.7
  173.17  908.69   184.2  908.68  191.54  908.86  194.18  908.93  195.86  908.99
  201.32  909.16  207.53  909.35  209.91  909.42  219.19  909.65  228.28  909.95
  229.85  909.98  230.85     910  235.31  910.11  242.51  910.28  246.66  910.37
  251.25  910.45  254.17   910.5  258.39  910.57  265.03  910.68  265.84  910.71
  267.24  910.73   277.5  910.93   283.4  911.15  289.16  911.49  294.06  911.81
  300.82  912.36  301.19   912.4  301.77  912.45  312.49  913.45  315.46   913.7
  320.14  913.96  324.15  914.19  329.73   914.5  335.81  914.75  336.86  914.81
  338.51  914.82  343.99  914.96  347.47   914.9  351.13   914.9  356.88  914.82
  359.13  914.81  363.05  914.83   370.8  914.87  375.25   914.9  382.46  915.76
  393.63  916.24  393.93  916.29  394.12   916.3  401.06   917.5  405.78  917.65
     412  918.17  417.45  919.04  422.46  919.98  429.11  920.19  430.37  920.28
  436.73  921.48  440.77  921.96  443.86  922.59  448.74  922.84  452.43  923.28
  458.86  924.01   464.1  924.66  465.27  924.84  467.11  924.93  475.76  925.76
  485.48  926.61  487.42  926.76   493.8  927.25  499.08  927.58  500.93  927.75
  503.85  927.88  508.07  928.19  510.74  928.31   515.2  928.67  522.22  928.93
  522.41  928.94  522.73  928.96  534.07  929.54  540.59  929.88  543.74  930.06
  545.73  930.12  550.87  930.49  557.39  930.68     558  930.74  558.97  930.76
  565.14  931.18  569.06  931.34     575  931.68

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0      .155.91998    .035  102.56     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      55.91998  102.56           181.23  185.32  193.71             .1       .3

CROSS SECTION


RIVER: Buffalo Calf For
REACH: A                  RS: 1398.58

INPUT
Description:
Station Elevation Data    num=      75
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  930.69 4.98999  928.559.100006  926.7920.17999  921.8521.17999  921.42
22.01999  921.0532.54001  916.3534.95001  915.28   35.37  915.09   42.13  912.07
   47.88  909.25   49.12  908.6350.57001   907.856.10001  904.69   60.81  902.24
65.76001  900.39   73.73   899.1      75   899.1   77.05   899.180.96001  899.88
84.03999  900.42   86.66  901.4796.14999  904.57   99.59  905.19  104.99  905.46
```

111.34	905.41	111.98	905.4	112.52	905.38	118.96	905.2	125.45	905.01
125.95	904.99	126.54	904.97	138.37	904.46	141.73	904.35	146.9	904.2
151.3	904.26	156.92	904.21	160.87	904.1	164.23	904	172.12	903.9
174.84	903.84	177.16	903.83	181.82	903.81	187.31	903.93	188.81	903.95
190.08	903.98	202.5	904.28	203.01	904.29	209.76	904.51	215.94	905.06
217.7	905.29	228.87	907.31	230.72	907.67	232.89	908.16	241.79	910.22
244.69	910.82	248.09	911.53	251.67	912.27	254.72	912.95	263.28	914.79
267.65	915.64	272.63	916.73	278.47	918.51	280.58	919.2	286.59	922.12
293.51	926.46	293.58	926.5	293.67	926.55	306.43	933.62	308.86	934.57
314.53	936.76	319.36	938.62	321.52	939.43	324.05	940.39	325	940.74

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.156	.10001	.03596	.14999	.03

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

56.10001	96.14999		202.21	205.58	213.16	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
119.12	325	920	F

CROSS SECTION

RIVER: Buffalo Calf For
REACH: A RS: 1193

INPUT
Description: Station 11+93
Station 0+60
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
130	920	140	914	145	912	151	912	158	908
165	906	173	904	179	902	184	899	193	898.37
199	899.37	214	902	231	902	250	902	280	906
390	906	400	906	403	908	406	910	409	912
412	914	417	914	419	914	421	916	425	918
428	920	431	922	434	924	451	930	453	932

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
130	.1	173	.035	214	.03

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

173	214		186.08	193.46	196.77	.1	.3

CROSS SECTION

RIVER: Buffalo Calf For
REACH: A RS: 999.54

INPUT
Description:
Station Elevation Data num= 109

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	927.38	1.329987	926.85	5.329987	925.17	12	922.37	12.81	922.03
14.01999	921.51	24.28998	917.11	31.14999	914.23	35.76999	912.29	42.67999	909.21
47.23999	907.22	50.29999	905.54	58.71997	901.09	62.73999	899.39	69.44998	897.49
69.91998	897.34	70.19998	897.37	1.32999	897.39	75	897.58	81.67999	897.95
88.59998	899.49	3.15997	900.32	98.62997	900.56	104.64	900.23	104.98	900.61
105	900.61	105.74	900.72	106.89	901.12	109.66	902.01	110.05	902
110.53	902	111.1	902	112.88	901.76	116.26	902.02	117.78	902.03

118.97	902.04	120.2	902.05	121.19	902.04	126.09	902.02	136.49	902
136.88	902	137.57	902	138.95	902	139.57	901.88	141.67	901.86
143.73	901.84	144.13	901.96	145.42	902.02	148.99	902.08	149.69	902.08
151.96	902.12	208.98	906	210.7	906.07	230.51	905.99	231.49	905.99
231.64	905.99	240.38	905.98	287.64	905.98	288.02	905.98	288.7	905.99
289.37	905.99	290.43	905.99	291.93	906	297.26	906	297.61	906
298.35	906	300.4	906	302.07	906	302.58	906	302.89	906
304.15	906	304.31	906	305.18	906	305.85	906	308.31	906
309.58	906	309.62	906	310.23	906	329.68	907.98	330.04	908
353.29	909.73	355.73	909.9	356.29	909.94	357.02	910	357.67	910.61
359.5	912	360.78	913.81	360.9	914	360.96	914.12	362.1	916
362.15	916.02	362.43	916.22	364.5	918	366.83	919.58	367.36	920
368.13	920.47	371.81	922	376.66	923.98	376.73	924	376.75	924.01
376.8	924.02	383.43	926	386.45	926.96	387.37	927.18	389.38	928
391.71	928.98	394.04	930	396.7	930.99	398.11	931.53		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.158	71997	.03	593.15997	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
58.71997	93.15997	209.86	184.54	151.87	.1 .3

CROSS SECTION

RIVER: Buffalo Calf For
REACH: A RS: 815

INPUT
Description: Station 8+15
Station 4+38
Station 438
Station 4+38
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	922	29	922	38	920	44	918	48	916
52	914	57	912	61	910	65	908	73	906
86	904	102	902	180	900	187	899.79	188	895.64
194	895.64	198	895.64	206	900	207	900.59	430	906
628	906	648	906	653	908	660	910	670	912
685	914	738	916	744	918	749	920	754	920

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	180	.035	206	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
180	206	138.15	115	87.05	.1 .3

CROSS SECTION

RIVER: Buffalo Calf For
REACH: A RS: 700

INPUT
Description: Station 7+00
Station Elevation Data num= 21

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
73	918	105	908	337	904	342	902	348	900
376	898	468	898	509	898	520	894.85	530	894.89
532	896	534	898	539	898.75	571	900	670	906

```
     697      906      752      906      757      906      814      906      922      906
     973      920

Manning's n Values          num=        3
      Sta   n Val      Sta   n Val      Sta   n Val
       73     .03      509    .035      539     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.    Expan.
           509     539           108.97  113.99  118.19              .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
      73     468     920        F

BRIDGE


RIVER: Buffalo Calf For
REACH: A                    RS: 651.8

INPUT
Description:
Distance from Upstream XS =    48.2
Deck/Roadway Width        =      14
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=        6
      Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
        0      902      890   507.5      902      890   507.5      902  900.25
    542.5      902  900.25   542.5      902      890     800      902      890

Upstream Bridge Cross Section Data
Station Elevation Data    num=       21
      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       73      918      105      908      337      904      342      902      348      900
      376      898      468      898      509      898      520   894.85      530   894.89
      532      896      534      898      539   898.75      571      900      670      906
      697      906      752      906      757      906      814      906      922      906
      973      920

Manning's n Values          num=        3
      Sta   n Val      Sta   n Val      Sta   n Val
       73     .03      509    .035      539     .03

Bank Sta: Left   Right    Coeff Contr.    Expan.
           509     539              .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
      73     468     920        F

Downstream  Deck/Roadway Coordinates
    num=        6
      Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
        0      902      890  402.88      902      890  402.88      902  900.25
   437.88      902  900.25  437.88      902      890     600      902      890

Downstream Bridge Cross Section Data
Station Elevation Data    num=      317
      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
        0   922.48    .0399  922.46.8200073  922.031.080017  922.021.109985  922.02
1.429993     9223.080017  920.643.950012     9204.369995  919.72        7      918
8.280029  917.149.859985     91612.23999  914.7613.82001     91417.22998  912.45
18.20001     91221.03998  910.6122.03003      910   22.38  909.8424.82001      908
26.79999  907.3527.59998  907.1829.16003  906.7430.84003     90633.41998  904.76
```

34.20001	904.73	36.19	904.63	8.15002	904.73	42.40002	90642.91998	906
42.98999	90645.57001		90645.89001		906	46.38	90647.01001	906
54.23999	90654.53003		906	54.88	90655.33002		90655.34998	906
58.51001	906	59.5	90661.29999		906	62.12	90662.82001	906
65.48999	90669.92999		90670.64001		90672.16998		90673.90002	905.51
75.46002	905	77.06	904.47	9.65002	90482.16003		90485.17999	904
85.66998	90486.32001		904	87.06	90487.41003		90488.28998	904
89.97998	90490.16998		90498.92999		904	100.17	904	100.9	904
101.88	904	101.93	904	103.42	904	103.46	904	112.29	904
116.06	904	121.47	904	131.96	904	160.94	904	201.02	904
206.29	904	209.79	904.71	211.43	905	213.3	905.44	215.97	905.91
216.27	905.97	216.44	906	218.33	906	220.08	906	221.14	905.88
223.74	905.2	225.84	904.6	227.69	904.19	228.49	904	230.34	903.52
235.31	902	236.65	901.64	236.89	901.59	238.12	901.13	241.37	900.32
242.19	900.08	242.5	900	245.26	899.99	245.57	899.99	245.98	899.99
249.49	899.97	250.19	899.97	251.29	899.96	252.23	899.96	252.98	899.96
254.07	899.95	255.23	899.94	256.2	899.94	257	899.94	257.28	899.93
257.6	899.93	258.68	899.93	262.53	899.89	263.37	899.88	263.92	899.88
265.67	899.87	268.59	899.84	268.68	899.84	268.76	899.84	273.3	899.82
274.41	899.75	287.87	899.21	294.44	899.17	302.29	899.06	304.33	899.05
306.31	899.03	308.28	899.02	309.74	899.01	317.14	898.85	328.29	898.51
335.61	898.08	337.06	898.09	338.29	898.06	339.89	898.05	340.33	898.05
342.56	898.02	343.69	898	344.16	898	345.43	898	345.54	898
345.55	898	348.49	897.99	350.06	897.98	355.52	897.96	357.55	897.96
359.87	897.96	362.53	897.97	365.82	897.98	366.86	897.98	368.9	897.99
369.42	897.99	373.99	897.98	378.98	898	379.7	897.98	382.85	897.98
386	897.98	386.03	897.98	386.07	897.98	386.11	897.97	386.16	897.97
389.35	897.92	390.38	897.9	392.22	897.89	394.95	897.9	395.33	897.85
397.58	897.87	399.91	897.92	400.49	897.95	401.1	897.99	401.11	897.99
401.12	897.99	401.13	897.99	403.4	897.77	405.26	897.63	406.55	897.33
412.01	896.01	412.35	896.01	412.39	894	414.18	894	416.14	894
420.38	894	421.36	894	422.06	894	422.54	894	422.58	894
422.92	894	423.23	894	423.27	894	423.31	894	423.85	896.02
426.51	896.86	428.15	897.35	430.52	898	438.08	899.04	439.91	899.25
444.5	899.71	447.45	899.99	447.57	899.99	447.82	899.99	448.25	900
448.4	900	450.38	900.05	452.5	900.06	455.78	900.06	459.45	900.06
463.14	900.05	465.14	900.05	467.16	900.04	467.29	900.04	468.52	900.03
469.77	900.03	471.84	900.05	473.86	900	473.89	900	473.93	900
474.54	900	475.24	900	475.94	900	477.05	900	477.14	900
478.98	900	479	900	479.01	900	479.12	900	484.48	899.91
493.04	899.96	498.33	899.98	499.77	899.98	501.36	899.98	503.04	899.98
504	899.97	505.44	899.99	505.55	899.99	505.79	899.99	506.17	900
506.22	900	506.23	900	506.59	900.01	506.83	900.01	507.26	900.02
508.34	900.02	509.87	900.21	510.6	900.28	512.33	900.5	513.84	900.68
514.9	900.83	516.58	901.07	518.94	901.39	520.1	901.54	523.34	901.99
523.44	901.99	523.74	901.99	524.43	902	524.73	902	524.9	902
524.97	902.01	525.29	902.02	526.53	902.45	527.49	902.74	528.15	902.93
529.13	903.23	531.13	904	532.49	904.71	534.82	905.52	535.47	905.64
537.6	905.74	540.16	905.97	540.34	906	547.91	906.19	549.88	906.21
553.08	906.12	555.13	906.07	556.44	906.03	557.09	906	557.57	905.99
557.84	905.99	558.31	905.99	558.67	906	559.08	906	560.91	907.34
561.7	908	562.3	908.7	562.7	908.93	563.69	910	564.32	910.61
566.15	912	567.42	913.83	567.53	914	567.63	914.1	569.4	916
570.54	917.79	570.77	918	571	918.17	573.48	920	574.67	920.6
576.07	921.17	577.52	922	579.86	922.97	582.17	924	586.27	925.34
587	925.61	588.23	926	591.11	927.1	593.47	928	593.87	928.18
598	930	598.16	930.08	602.67	932	602.69	932.01	602.72	932.02
607.21	934	610.27	935.25	612.42	936	615.55	937.2	618.05	938
619.92	938.56	621.13	938.91						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	406.55	.035	428.15	.03

```
Bank Sta: Left   Right    Coeff Contr.   Expan.
        406.55  428.15            .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
       0  369.42     920       F

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Abutments =  2

Abutment Data
Upstream     num=        5
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   507.5     890   507.5  900.25     513     900  521.61  894.51  521.61     890
Downstream     num=        5
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  402.88     890  402.88  900.25  408.38     900  416.99  894.51  416.99     890

Abutment Data
Upstream     num=        5
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  528.39     890  528.39  894.51     537     900   542.5  900.25   542.5     890
Downstream     num=        5
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  423.77     890  423.77  894.51  432.38     900  437.88  900.25  437.88     890

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Buffalo Calf For
REACH: A                    RS: 586.01

INPUT
Description:
Station Elevation Data    num=     317
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  922.48    .0399  922.46.8200073  922.031.080017  922.021.109985  922.02
1.429993     9223.080017  920.643.950012     9204.369995  919.72       7     918
8.280029  917.149.859985     91612.23999  914.7613.82001     91417.22998  912.45
18.20001     91221.03998  910.6122.03003     910   22.38  909.8424.82001     908
```

26.79999	907.35	27.59998	907.18	29.16003	906.74	30.84003	90633.41998		904.76
34.20001	904.73	36.19	904.63	8.15002	904.73	42.40002	90642.91998		906
42.98999	90645.57001		90645.89001		906	46.38	90647.01001		906
54.23999	90654.53003		906	54.88	90655.33002		90655.34998		906
58.51001	906	59.5	90661.29999		906	62.12	90662.82001		906
65.48999	90669.92999		90670.64001		90672.16998		90673.90002		905.51
75.46002	905	77.06	904.47	9.65002	90482.16003		90485.17999		904
85.66998	90486.32001		904	87.06	90487.41003		90488.28998		904
89.97998	90490.16998		90498.92999		904	100.17	904	100.9	904
101.88	904	101.93	904	103.42	904	103.46	904	112.29	904
116.06	904	121.47	904	131.96	904	160.94	904	201.02	904
206.29	904	209.79	904.71	211.43	905	213.3	905.44	215.97	905.91
216.27	905.97	216.44	906	218.33	906	220.08	906	221.14	905.88
223.74	905.2	225.84	904.6	227.69	904.19	228.49	904	230.34	903.52
235.31	902	236.65	901.64	236.89	901.59	238.12	901.13	241.37	900.32
242.19	900.08	242.5	900	245.26	899.99	245.57	899.99	245.98	899.99
249.49	899.97	250.19	899.97	251.29	899.96	252.23	899.96	252.98	899.96
254.07	899.95	255.23	899.94	256.2	899.94	257	899.94	257.28	899.93
257.6	899.93	258.68	899.93	262.53	899.89	263.37	899.88	263.92	899.88
265.67	899.87	268.59	899.84	268.68	899.84	268.76	899.84	273.3	899.82
274.41	899.75	287.87	899.21	294.44	899.17	302.29	899.06	304.33	899.05
306.31	899.03	308.28	899.02	309.74	899.01	317.14	898.85	328.29	898.51
335.61	898.08	337.06	898.09	338.29	898.06	339.89	898.05	340.33	898.05
342.56	898.02	343.69	898	344.16	898	345.43	898	345.54	898
345.55	898	348.49	897.99	350.06	897.98	355.52	897.96	357.55	897.96
359.87	897.96	362.53	897.97	365.82	897.98	366.86	897.98	368.9	897.99
369.42	897.99	373.99	897.98	378.98	898	379.7	897.98	382.85	897.98
386	897.98	386.03	897.98	386.07	897.98	386.11	897.97	386.16	897.97
389.35	897.92	390.38	897.9	392.22	897.89	394.95	897.9	395.33	897.85
397.58	897.87	399.91	897.92	400.49	897.95	401.1	897.99	401.11	897.99
401.12	897.99	401.13	897.99	403.4	897.77	405.26	897.63	406.55	897.33
412.01	896.01	412.35	896.01	412.39	894	414.18	894	416.14	894
420.38	894	421.36	894	422.06	894	422.54	894	422.58	894
422.92	894	423.23	894	423.27	894	423.31	894	423.85	896.02
426.51	896.86	428.15	897.35	430.52	898	438.08	899.04	439.91	899.25
444.5	899.71	447.45	899.99	447.57	899.99	447.82	899.99	448.25	900
448.4	900	450.38	900.05	452.5	900.06	455.78	900.06	459.45	900.06
463.14	900.05	465.14	900.05	467.16	900.04	467.29	900.04	468.52	900.03
469.77	900.03	471.84	900.05	473.86	900	473.89	900	473.93	900
474.54	900	475.24	900	475.94	900	477.05	900	477.14	900
478.98	900	479	900	479.01	900	479.12	900	484.48	899.91
493.04	899.96	498.33	899.98	499.77	899.98	501.36	899.98	503.04	899.98
504	899.97	505.44	899.99	505.55	899.99	505.79	899.99	506.17	900
506.22	900	506.23	900	506.59	900.01	506.83	900.01	507.26	900.02
508.34	900.02	509.87	900.21	510.6	900.28	512.33	900.5	513.84	900.68
514.9	900.83	516.58	901.07	518.94	901.39	520.1	901.54	523.34	901.99
523.44	901.99	523.74	901.99	524.43	902	524.73	902	524.9	902
524.97	902.01	525.29	902.02	526.53	902.45	527.49	902.74	528.15	902.93
529.13	903.23	531.13	904	532.49	904.71	534.82	905.52	535.47	905.64
537.6	905.74	540.16	905.97	540.34	906	547.91	906.19	549.88	906.21
553.08	906.12	555.13	906.07	556.44	906.03	557.09	906	557.57	905.99
557.84	905.99	558.31	905.99	558.67	906	559.08	906	560.91	907.34
561.7	908	562.3	908.7	562.7	908.93	563.69	910	564.32	910.61
566.15	912	567.42	913.83	567.53	914	567.63	914.1	569.4	916
570.54	917.79	570.77	918	571	918.17	573.48	920	574.67	920.6
576.07	921.17	577.52	922	579.86	922.97	582.17	924	586.27	925.34
587	925.61	588.23	926	591.11	927.1	593.47	928	593.87	928.18
598	930	598.16	930.08	602.67	932	602.69	932.01	602.72	932.02
607.21	934	610.27	935.25	612.42	936	615.55	937.2	618.05	938
619.92	938.56	621.13	938.91						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val

0	.03	406.55	.035	428.15	.03

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

	406.55	428.15		104.3	126.01	142.62	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	369.42	920	F

CROSS SECTION

RIVER: Buffalo Calf For
REACH: A RS: 460

INPUT
Description: Station 4+60
Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	927	5	926	218	914	224	914	278	914
352	912	453	908	459	906	464	904	468	902
473	900	478	898	520	898	762	896.5	766	895.71
769	893	780	893	782	894	803	896.5	912	910
927	910	930	914	932	916	937	922	938	924
940	926								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	762	.035	803	.1

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

	762	803		190.69	199.44	206.02	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	640	920	F

CROSS SECTION

RIVER: Buffalo Calf For
REACH: A RS: 260.56

INPUT
Description:
Station Elevation Data num= 233

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	923.07	.25	922.942.230011		9225.200012		920.095.320007		920.02
5.369995		9205.660004	919.859.420013		918	10.41	917.5	11.5	917.18
13.58002	916	14.91	915.4	17.34	91419.45001		91321.14999		912
23.5	910.8424.14001		910.5625.20001		910.0625.33002		910	25.41	909.97
27.59	909.4930.17001		90833.46002		906.7135.55002		90639.51001		905
41.11002	904.744.24002		90447.07001		903.7752.86002		903.3156.26001		903.04
68.60001	902.05	69.62	902.0470.29001		902	70.63	90271.71002		902
71.93002		90272.35001	90272.57001		90272.89001		902	73.28	902
73.58002		90274.23001	902	74.53	90274.77002		90275.17001		902
75.73001	902.0176.14001		902.0176.68002		902	77.47	90277.70001		902
78.20001	901.99	78.47	901.9978.98001		901.9879.86002		901.9679.89999		901.96
79.94	901.9681.86002		901.9682.29001		901.96	84.81	901.94	98	901.36
108.66	901.07	110.23	901.06	111.94	900.99	113.81	901.01	115.73	901.03
117.85	900.98	120.22	900.91	120.64	900.9	126.14	900.28	126.31	900.29
126.55	900.28	129.77	900.19	130.07	900.19	130.56	900.18	131.93	900.16
133.16	900.14	136.13	900.12	136.77	900.12	137.45	900.12	139.66	900.09
140.46	900.09	142.08	900.1	144.71	900.07	148.82	900.03	149.69	900.03
150.12	900.03	150.75	900.03	151.78	900.02	152.71	900.02	153.28	900.02

154.24	900.02	155.52	900.02	158.48	900	158.83	900	159.14	900
159.26	900	159.33	900	159.51	900	159.62	900	162.26	899.61
164.58	899.29	166.16	899.22	168.11	899.12	169.33	899.06	170.75	898.98
174.24	898.66	176.03	898.5	183.13	898.04	184.63	898.05	185.61	898.08
186.69	898.03	186.93	898.03	187.33	898.03	187.36	898.02	187.66	898.03
190.84	898.06	194.64	898	194.71	898	194.91	898	195.85	898
197.37	898	197.78	897.94	201.97	897.38	204.35	897.1	205.66	896.94
207.59	896.66	209.8	896.31	211.6	896.01	211.93	896	211.98	896
212.08	896	212.54	896	213.33	896.08	213.55	896.07	213.73	896.07
223.97	896.49	230.94	896.69	231.14	896.68	232.46	896.71	238.38	896.77
244.05	896.76	259.86	896.05	261.01	896	261.67	896	265.44	896
269.06	896	269.51	896	269.58	896	269.66	896	272.81	896
274.81	896	275.4	896	280.05	896	280.31	896	283.37	896
284.65	896	287.83	896	288.88	896	289.86	896	291.4	896
291.85	896	292.81	896	293.74	896	294.15	896	294.64	896
295.15	896	295.7	896	296.2	896	296.76	896	297.5	896
297.74	895.7	301.74	894.91	304.55	892.2	310.05	892.2	315.55	892.2
317.05	893.2	317.18	896	318.71	896.4	324.54	898	326.99	899.55
327.92	900	328.46	900.53	329.17	901	330.06	902	331.88	903.54
332.4	904	334.87	905.73	335	905.78	337	906	338.4	906.03
339.06	906.03	339.58	906.03	340.05	906.08	342	906.29	349.64	906.18
349.91	906.34	350.02	906.4	350.83	906.83	352.6	908	353.77	909.08
354.65	910	354.89	910.27	356.35	912	356.98	913.05	358.05	914
359.16	914.91	360.35	916	362.77	917.91	362.87	918	364	918.83
365.25	919.8	365.56	920	365.77	920.14	368.15	922	369.83	922.95
371.73	924	373.83	925.07	375.73	926	378.54	927.19	380.39	928
383.07	929.15	385.02	930	387.58	931.47	388.51	932	390.94	933.62
391.5	934	392.66	934.7	394.89	936	397.06	937.22	398.58	938
399.81	938.59	402.96	940	407.54	941.55				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	297.74	.035	317.18	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
297.74	317.18	203.61	200.53 196.92	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	244.05	920	F

CROSS SECTION

RIVER: Buffalo Calf For
REACH: A RS: 60.03

INPUT
Description:
Station Elevation Data num= 123

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	923.635.690002		9225.850006	921.95 6.26001		921.8312.20999			920
16.38	918.5217.67999		91819.51999	917.423.60001		91629.20999			914.27
30.20999	914	32.13	913.336.01001	91237.26999		911.5541.79999			910
45.70999	908.57	47.38	908	50.09	907.0453.35001		906	53.47	905.97
61.32999	904	64.28	903.41	68.34	902.6470.39001		902.26	72.12	902
73.01001	901.9473.20001		901.9475.42999	901.85	76.66	901.8981.54001			901.51
82.56	901.4	84.62	901.14	93.06	900	95.87	899.72	96.84	899.64
106.6	898.48	108.69	898.24	109.4	898.16	109.73	898.12	110.63	898
110.79	898	111.83	898	112.59	898	113.75	898	114	898
115.06	898	115.07	898	116.56	897.86	126.8	896.94	136.66	896
138.3	896	138.95	896	141.86	896	143.19	896	143.34	896
143.9	896	144.16	896	158.4	896	164.61	896	180.42	896
187.99	896	192.99	896	225.6	896	228.16	896	228.7	896

234.89	896	238.95	896	239.18	896	239.31	895.98	240.79	895.77
241.5	894.11	244.5	891.4	250	891.4	255.5	891.4	257.5	892.4
258.54	896.01	261.13	896.01	263.72	896.01	263.85	896.01	264.2	896.01
275.6	897.19	285.19	898	286.13	898.94	287.15	900	288.46	901.6
288.89	902	289.7	902.96	290.32	903.5	290.59	904	290.79	904.45
290.83	904.49	291.38	906	291.88	907.7	292.07	907.97	292.12	907.97
292.4	907.99	292.5	908	292.75	908.68	292.82	909.01	292.87	909.17
293.18	910	293.7	910.96	293.96	910.98	294.11	911.14	294.29	912
298.2	913.62	299	914	299.07	914.02	301.26	913.87	302.87	913.67
308.35	913.16	315.25	916.66	318.24	918.2	326.19	921.98	328.13	922.95
337.13	926.93	338.02	927.35	338.75	927.66	346.42	930.7	347.78	931.24
347.91	931.29	348.07	931.35	350	932.09				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	240.79	.035	258.54	.1

Bank Sta: Left	Right	Coeff Contr.	Expan.
240.79	258.54	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	187.99	920	F

SUMMARY OF MANNING'S N VALUES

River:Buffalo Calf For

Reach	River Sta.	n1	n2	n3
A	1799.59	.1	.035	.03
A	1583.9	.1	.035	.03
A	1398.58	.1	.035	.03
A	1193	.1	.035	.03
A	999.54	.1	.035	.03
A	815	.1	.035	.03
A	700	.03	.035	.03
A	651.8	Bridge		
A	586.01	.03	.035	.03
A	460	.03	.035	.1
A	260.56	.03	.035	.1
A	60.03	.03	.035	.1

SUMMARY OF REACH LENGTHS

River: Buffalo Calf For

Reach	River Sta.	Left	Channel	Right
A	1799.59	212.14	215.69	223.27
A	1583.9	181.23	185.32	193.71
A	1398.58	202.21	205.58	213.16
A	1193	186.08	193.46	196.77
A	999.54	209.86	184.54	151.87
A	815	138.15	115	87.05
A	700	108.97	113.99	118.19
A	651.8	Bridge		
A	586.01	104.3	126.01	142.62
A	460	190.69	199.44	206.02

A	260.56	203.61	200.53	196.92
A	60.03			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Buffalo Calf For

Reach	River Sta.		Contr.	Expan.
A	1799.59		.1	.3
A	1583.9		.1	.3
A	1398.58		.1	.3
A	1193		.1	.3
A	999.54		.1	.3
A	815		.1	.3
A	700		.1	.3
A	651.8	Bridge		
A	586.01		.1	.3
A	460		.1	.3
A	260.56		.1	.3
A	60.03		.1	.3

ANTERO RESOURCES CORPORATION

SCHEDULE OF QUANTITIES

BRIDGE MATERIALS	PRICE
TOTAL	$20,000.00
OTHER MATERIALS	PRICE
TOTAL	$2,000.00
EQUIPMENT AND LABOR	PRICE
TOTAL	$8,000.00
TOTAL	$30,000.00

Susie Jane Bridge:

Surface Owner Information

DIVISION OF NATURAL RESOURCES
324 Fourth Avenue, Room 200
South Charleston WV 25303-1228
TDD (304) 558-1439
TDD 1-800-354-6087
Fax (304) 558-6048
Telephone (304) 558-3225

Earl Ray Tomblin
Governor

Robert A. Fala
Director

November 29, 2012

Division of Natural Resources
RIGHT OF ENTRY
AMENDED SEPTEMBER 4, 2015

Re: LS-12-VI/09-1422

Antero Resources Corporation
c/o Jason Cook
4198 Cox Road
Suite 114
Glen Allen, VA 23060-

Dear Sir or Madam:

The Division of Natural Resources hereby grants to you for a period of ten (10) years from the date hereof, a Right of Entry to install, use and maintain a fourteen foot by thirty-five foot (14'x35') bridge in order to access Suzie Jane Well Pad Site (SWV-DFW-001) along Buffalo Calf Creek near Salem in Doddridge County, West Virginia.

This Right of Entry is subject to the following terms and conditions:

1. No in stream work during the fish-spawning season (April 1-June 30).

2. Work should be completed as quickly as possible during low flows in designated work areas only.

3. Any streambed disturbance should be restricted to the immediate area. In stream use of equipment should be kept to a minimum.

4. All shore areas disturbed by this operation must be reshaped, seeded and mulched immediately upon completion of work. The prompt establishment of vegetative cover will reduce future damage from high water levels.

5. Green concrete must not be put in the stream (highly toxic to aquatic life).

6. Guidance should be obtained from NRCS (formerly SCS) and a registered engineer for the design and construction. Must allow for passage of at least ten-year year flood flow.

7. Best management practices should be followed; measures such as hay bales must be used to reduce downstream siltation.

8. Applicant is responsible for removing debris from in and around the installation periodically to prevent stream flow obstruction.

9. Durable head walls of logs, crossties, rock, or concrete shall be constructed at both the upstream and downstream ends of crossing to prevent erosion of fill material into the stream.

10. The State's issuance of this Right-of-Entry does not provide for the applicant to work outside the requested boundaries nor does the State assume any liability for the applicant's/landowner's construction activities. By accepting this Right-of-Entry, the applicant/landowner assumes liability for any/all damages caused by this activity to both upstream and downstream landowners.

Guidelines of Best Management Practices for Sediment and Erosion Control as outlined by the Section of Water Resources, Division of Environmental Protection must be followed. Copies of those guidelines are available from the Section of Water Resources, Telephone No. (304) 926-0440.

The issuance of this Right of Entry by the Division of Natural Resources does not preclude the necessity for you to obtain a permit from the U.S. Corps of Engineers District Office, Permit Section, or any other state or federal permits which may be required by law, nor does this Right of Entry negate the need to comply with the West Virginia Water Pollution Control Act and/or the State Environmental Quality Board's administrative regulations, applicant is also responsible for determining if the proposed activity is located within an identified flood plain and it is the applicant's responsibility for contacting the local governmental agency in charge of that program and obtaining a flood plain development permit for it. This Right of Entry does not grant any rights or privileges, or permission to enter upon or to cross the property of any other person, nor is permission granted to remove any material that lies upon the property of any other persons. Work should be completed in as brief a period as possible and within one year from the date of this letter. In the event you fail or refuse to comply with any of the terms or conditions herein, this Right of Entry will be canceled and considered null and void and the Division will reject further applications.

We acknowledge your payment in the amount of $100.00 to the Division of Natural Resources covering the first year's annual fee of this agreement. You must notify this office in writing when this installation has been removed.

Sincerely,

Joe T. Scarberry, Supervisor
Office of Land and Streams

JTS:cb

pc: DNR Fish Biologist
Jeremy Bandy, Environmental Enforcement
DNR Conservation Officers

Gmail

More

COMPOSE

Inbox (1)

Starred

Important

Sent Mail

More labels

George

No recent chats
Start a new one

Rachel Grzybek Aug 18
Sure will. I'll be by either later today or tomorrow to deliver the Susie Jan...

Rachel Grzybek <rgrzybek@anteroresources.com> 10:48 AM (25 minutes ago)
to me

Hi George,

Please find the OLS permit for the Susie Jane Bridge attached. This is the only other permit required for this project, so you should have all that is needed. If not please let me know!
I will be swinging by today with a hard copy for your records.

Let me know if you have any questions.

Thanks,

Rachel Grzybek
Phone: (304) 842-4008
Cell: (304) 641-2396
rgrzybek@anteroresources.com

From: Rachel Grzybek
Sent: Tuesday, August 18, 2015 9:25 AM
To: 'George Eidel'
Subject: RE: Susie Jane Bridge-Antero

The Doddridge Independent

The Doddridge Independent

PUBLISHER'S CERTIFICATE

I, Michael D. Zorn, Publisher of The Doddridge Independent, A newspaper of general circulation published in the town of West Union, Doddridge County, West Virginia, do hereby certify that:

Floodplain Permit Application # 15-374
Please take notice that on the 17th day of August, 2015
Antero Resources Corporation
filed an application for a Floodplain Permit to develop land located at or about:
15-374- Antero Resources Corporation
Bridge Location: Buffalo Calf Co. Rt. 42
Coordinates: 39.257648N, 80.622713W

was published in The Doddridge Independent
2 times commencing on Friday, August 21, 2015 and
Ending on Friday, August 28, 2015 at the request of:

George Eidel, Doddridge County Floodplain Manager & Doddridge County Commission

Given under my hand this Tuesday, September 8, 2015

The publisher's fee for said publication is:

$ 25.27 1st Run/$ 18.95 Subsequent Runs
This Legal Ad Total: $ 44.22

Michael D. Zorn
Publisher of The Doddridge Independent

Subscribed to and sworn to before me on
this date: 9 / 8 / 15

Notary Public in and for Doddridge County

My Commission expires on May
The 17th day of ~~September~~ 2019

OFFICIAL SEAL
NOTARY PUBLIC
STATE OF WEST VIRGINIA
PAMELA R. STINESPRING
P. O. BOX 81
WEST UNION, WV 26456
My commission expires May 17, 2019

Doddridge County
Floodplain Permit Application # 15-374
Please take notice that on the 17th day of August, 2015
Antero Resources Corporation
filed an application for a Floodplain Permit to develop land located at or about:
15-374- Antero Resources Corporation
Bridge
Location: Buffalo Calf Co. Rt. 42
Coordinates: 39.257648N, 80.622713W
Received: 08/18/2015
Announced: 08/18/2015
Publication Date: Week of 08/17/2015
20-Day Comment Period Window (from Commission Meeting)
08/18/2015
The Application is on file with the Clerk of the County Court and may be inspected or copied during regular business hours. As this project is outside the FEMA identified floodplain of Doddridge County, Doddridge County Floodplain Management has no regulatory authority. Any interested persons who desire to comment shall present the same in writing by August 28, 2015, delivered to:
Clerk of the County Court
118 E. Court Street, West Union, WV 26456
Beth A Rogers, Doddridge County Clerk
George Eidel, Doddridge County Flood Plain Manager
8/21 - 8/28