SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

William B. & Cathy D. Wells
16 Gain Street
Salem, WV 26426

9590 9402 1601 5362 0149 08

2. Article Number *(Transfer from service label)*

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X Cathy D. Wells ☐ Agent ☐ Addressee

B. Received by *(Printed Name)* C. Wells | C. Date of Delivery 9/12

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

16-433

3. Service Type
☐ Adult Signature
☐ Adult Signature Restricted Delivery
☐ Certified Mail®
☐ Certified Mail Restricted Delivery
☐ Collect on Delivery
☐ Collect on Delivery Restricted Delivery
☐ Insured Mail
☐ Insured Mail Restricted Delivery (over $500)
☐ Priority Mail Express®
☐ Registered Mail™
☐ Registered Mail Restricted Delivery
☐ Return Receipt for Merchandise
☐ Signature Confirmation™
☐ Signature Confirmation Restricted Delivery

PS Form 3811, July 2015 PSN 7530-02-000-9053 Domestic Return Receipt

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

Deborah Mcie
1614 Buffalo Calf Road
Salem, WV 26426

16-433

9590 9402 1601 5362 0148 85

2. Article Number *(Transfer from service label)*

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X Deborah Mcie ☐ Agent ☐ Addressee

B. Received by *(Printed Name)* Deborah Mcie SALEM 26426 | C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☒ No

SEP 12 2016
USPS

3. Service Type
☐ Adult Signature
☐ Adult Signature Restricted Delivery
☐ Certified Mail®
☐ Certified Mail Restricted Delivery
☐ Collect on Delivery
☐ Collect on Delivery Restricted Delivery
☐ Insured Mail
☐ Insured Mail Restricted Delivery (over $500)
☐ Priority Mail Express®
☐ Registered Mail™
☐ Registered Mail Restricted Delivery
☐ Return Receipt for Merchandise
☐ Signature Confirmation™
☐ Signature Confirmation Restricted Delivery

PS Form 3811, July 2015 PSN 7530-02-000-9053 Domestic Return Receipt

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

Betty D. Garwood & Robert G. Price
1452 Buffalo Calf
Salem, WV 26426

9590 9402 1601 5362 0148 92

2. Article Number *(Transfer from service label)*

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X G. Price ☐ Agent ☒ Addressee

B. Received by *(Printed Name)* G. Price | C. Date of Delivery 9/10/16

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☒ No

16-433

3. Service Type
☐ Adult Signature
☐ Adult Signature Restricted Delivery
☐ Certified Mail®
☐ Certified Mail Restricted Delivery
☐ Collect on Delivery
☐ Collect on Delivery Restricted Delivery
☐ Insured Mail
☐ Insured Mail Restricted Delivery (over $500)
☐ Priority Mail Express®
☐ Registered Mail™
☐ Registered Mail Restricted Delivery
☐ Return Receipt for Merchandise
☐ Signature Confirmation™
☐ Signature Confirmation Restricted Delivery

PS Form 3811, July 2015 PSN 7530-02-000-9053 Domestic Return Receipt

7014 0150 0001 7356 9904

U.S. Postal Service™
CERTIFIED MAIL™ RECEIPT
(Domestic Mail Only; No Insurance Coverage Provided)

For delivery information visit our website at www.usps.com®

OFFICIAL USE

Postage	$ .49
Certified Fee	3.45
Return Receipt Fee (Endorsement Required)	2.80
Restricted Delivery Fee (Endorsement Required)	
Total Postage & Fees	$ 6.74

SMITHBURG, WV 26434
SEP - 8 2016
Postmark Here
USPS

16433

Sent To

Street, Apt. No.; or PO Box No.

City, State, ZIP+4

PS Form 3800, August 2006 See Reverse for Instructions

7014 0150 0001 7356 9928

U.S. Postal Service™
CERTIFIED MAIL™ RECEIPT
(Domestic Mail Only; No Insurance Coverage Provided)

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OFFICIAL USE

Postage	$ .49
Certified Fee	3.45
Return Receipt Fee (Endorsement Required)	2.80
Restricted Delivery Fee (Endorsement Required)	
Total Postage & Fees	$ 6.74

SMITHBURG, WV 26434
SEP - 8 2016
Postmark Here
USPS

16433

Sent To

Street, Apt. No.; or PO Box No.

City, State, ZIP+4

PS Form 3800, August 2006 See Reverse for Instructions

7014 0150 0001 7356 9935

U.S. Postal Service™
CERTIFIED MAIL™ RECEIPT
(Domestic Mail Only; No Insurance Coverage Provided)

For delivery information visit our website at www.usps.com®

OFFICIAL USE

Postage	$ .49
Certified Fee	3.45
Return Receipt Fee (Endorsement Required)	2.80
Restricted Delivery Fee (Endorsement Required)	
Total Postage & Fees	$ 6.74

SMITHBURG, WV 26434
SEP - 8 2016
Postmark Here
USPS

16433

Sent To

Street, Apt. No.; or PO Box No.

City, State, ZIP+4

PS Form 3800, August 2006 See Reverse for Instructions

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 #: 16-433
SUSIE JANE SLIP REPAIR

Date Approved: October 10, 2016 **Expires: October 10, 2017**

Issued to: ANTERO RESOURCES

POC: RACHEL GRZYBEK
304-842-4008

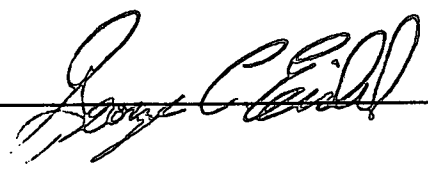
Company Address: 535 White Oaks Blvd. Bridgeport, WV 26330

Project Address: Buffalo Calf (CR 42)

Firm: 54017C0165C **Lat/Long: 39.257306N, 80.622708W**

Purpose of development: REPAIR A HILLSIDE WHERE A SLIP HAS OCCURED

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



Date: October 10, 2016

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
1615 WYNKOOP STREET
DENVER, COLORADO 80202

COPY

Vendor Name	Vendor No.	Date	Check Number	Check Total
DODDRIDGE COUNTY COMMISSION	43312	Oct-06-2016	140459	$500.00

INV #	INV DATE	DESCRIPTION	AMOUNT	DISCOUNTS	NET AMOUNT
KAD922016S	09/02/16	SUSIE JANE SLIP REPAIR FLOODPLAIN P	500.00	0.00	500.00

#16-433

COPY

TOTAL INVOICES PAID ====>	500.00	0.00	500.00

DETACH AND RETAIN FOR TAX PURPOSES

THIS CHECK HAS A COLORED FACE ON WHITE STOCK AND AN ARTIFICIAL WATERMARK ON THE BACK.

ANTERO RESOURCES
1615 WYNKOOP STREET
DENVER, COLORADO 80202

Wells Fargo
Denver, CO

400 - AP ACCT WELLS FARGO

Check No. **140459** 11-24 / 412

COPY

Void After 90 Days

CHECK NUMBER	DATE	PAY EXACTLY
140459	Oct-06-2016	$500.00

PAY EXACTLY $500dols00cts
Five Hundred Dollars and Zero Cents

TO THE ORDER OF
DODDRIDGE COUNTY COMMISSION
BETH A ROGERS, CLERK~118 EAST COURT STREET~ROOM 10
2
WEST UNION, WV 26456

⑈140459⑈ ⑆041203824⑆ 9647481952⑈

Doddridge County Floodplain Permits

(Week of September 19, 2016)

Please take notice that on the **6th** day of **September, 2016**, **Antero Resources** filed an application for a Floodplain Permit **(#16-433)** to develop land located at or about **39.257306N,80.622708W.** The Application is on file with the Clerk of the County Court and may be inspected or copied during regular business hours. Any interested persons who desire to comment shall present the same in writing by **October 11, 2016**(20 calendar days after the announcement at the regularly scheduled Doddridge County Commission Meeting) delivered to the Clerk of the County Court at 108 Court Street Ste. 1, West Union, WV 26456. **This project is to repair a hillside where a slip has occurred.**

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

September 02, 2016

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 would like to submit a Doddridge County Floodplain permit application for our ***Susie Jane Slip Repair***. Our project is located in Doddridge County, Greenbrier District where the repair is located at coordinates 39.256876N, 80.621743W. Per the FIRM Map #54017C0165C, this location is **in** the floodplain.

Attached you will find the following:

- Doddridge County Floodplain Permit Application
- No-Rise Certificate
- Design Plans
- WV Flood Tool Map
- FIRM Map

SEP 6 16 1:01PM

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 II
Floodplain Engineer
Antero Resources Corporation

Enclosures

Permit# 16-433

Project Name: Susie Jane Slip Repair

Permittees Name: Antero Resources

Doddridge County, WV

Floodplain Development Permit Application

SEP 6 16 1:01PM

This document is to be used for projects that impact/potentially impact 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.

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 _____

DATE 9/2/16

Doddridge County Commercial/Industrial
Floodplain Development Permit Application

Applicant Information:

Please provide all pertinent data.

Applicant Information		
Responsible Company Name: Antero Resources Corporation		
Corporate Mailing Address: 1615 Wynkoop Street		
City: Denver	**State: CO**	**Zip: 80202**
Corporate Point of Contact (POC):		
Corporate POC Title:		
Corporate POC Primary Phone:		
Corporate POC Primary Email:		
Corporate FEIN:	**Corporate DUNS:**	
Corporate Website: www.anteroresources.com		
Local Mailing Address: 535 White Oaks Blvd		
City: Bridgeport	**State: WV**	**Zip: 26330**
Local Project Manager (PM):		
Local PM Primary Phone:		
Local PM Secondary Phone:		
Local PM Primary Email:		
Person Filing Application: Rachel Grzybek		
Applicant Title: Environmental Specialist II		
Applicant Primary Phone: (304) 842-4008		
Applicant Secondary Phone: (304) 641-2396		
Applicant Primary Email: rgrzybek@anteroresources.com		

Doddridge County Commercial/Industrial
Floodplain Development Permit Application

Project Narrative:

Describe in detail the proposed development including project name/title, type of development, estimated start and completion timeline, and its potential impact on the floodplain. Use additional copies of this page as needed.

Project Narrative:
The Susie Jane Slip Repair project is located off of CR 42 (Buffalo Calf). A slip has occurred
on a hillside to the south of CR 42, affecting an existing driveway. During the repair of the slip
and existing driveway, soil in the project area will be excavated and placed in a temporary
stockpile. The stockpile shall be removed at the end of construction, which is estimated to
take 2 to 3 weeks. The proposed stockpile area is located within the Buffalo Calf Fork Zone A
flood hazard area, according to the Flood Insurance Rate Map for Doddridge County,
Map #54017C0165C with a map revised date of October 4, 2011. A HEC-RAS analysis of the
project area was performed, and the results show that the construction of the temporary
stockpile will raise the base flood elevation by 0.01 feet (0.12 inches) at the stockpile. Therefore,
the proposed temporary stockpile will have a negligible effect upon the flood elevations,
floodway elevations, and floodway widths of Buffalo Calf Fork.

Proposed Development:

Please check all elements of the proposed project thatapply.

DESCRIPTION OF WORK (CHECK ALL APPLICABLE BOXES)

A. STRUCTURAL DEVELOPMENT

	ACTIVITY		STRUCTURAL TYPE
[]	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 DEVELOPLMENT ACTIVITIES:

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

Doddridge County Commercial/Industrial
Floodplain Development Permit Application

Development Site/Property Information:

Please provide physical description of the site/property, along with pertinent ownership (surface and mineral rights) data as applicable. Attach appropriate maps from the WV Flood Tool showing location of proposed development. Use additional copies of this page if development spans multiple property boundaries. Designate each property by number (i.e. Property 1 of 1, Property 2 of 7, etc.)

Property Designation: _1__ of _2__

Site/Property Information:		
Legal Description: Buffalo Calf 31 AC		
Physical Address/911 Address: RT. 42		
Decimal Latitude/Longitude: 39.257306 N, 80.622708 W		
DMS Latitude/Longitude: 39° 15' 26.30" N, 80° 37' 21.75" W		
District: 4	**Map: 4**	**Parcel: 10.2**
Land Book Description:		
Deed Book Reference: 207/6		
Tax Map Reference: 09-04-0004-0010-0002		
Existing Buildings/Use of Property: There is an existing building, a driveway, and a pond on		
this property.		

Floodplain Location Data: ***(to be completed by Floodplain Manager or designee)***			
Community:	**Number:**	**Panel:**	**Suffix:**
Location (Lat/Long):		**Approximate Elevation:** **Estimated BFE:**	
Is the development in the floodway? ☐ **Yes** ☐ **No**		**Is the development in the floodplain?** ☐ **Yes** ☐ **No** **Zone: _____**	
Notes:			

Doddridge County Commercial/Industrial
Floodplain Development Permit Application

Development Site/Property Information:

Please provide physical description of the site/property, along with pertinent ownership (surface and mineral rights) data as applicable. Attach appropriate maps from the WV Flood Tool showing location of proposed development. Use additional copies of this page if development spans multiple property boundaries. Designate each property by number (i.e. Property 1 of 1, Property 2 of 7, etc.)

Property Designation: _2__ of _2__

Site/Property Information:		
Legal Description: Buffalo Calf 79.83 AC		
Physical Address/911 Address: RT. 42		
Decimal Latitude/Longitude: 39.256722 N, 80.621575 W		
DMS Latitude/Longitude: 39° 15' 24.20" N, 80° 37' 17.67" W		
District: 4	**Map: 4**	**Parcel: 10**
Land Book Description:		
Deed Book Reference: 207/6		
Tax Map Reference: 09-04-0004-0010-0000		
Existing Buildings/Use of Property: There is an existing building and a driveway on this		
property, but it is mostly wooded.		

Floodplain Location Data: ***(to be completed by Floodplain Manager or designee)***			
Community:	**Number:**	**Panel:**	**Suffix:**
Location (Lat/Long):		**Approximate Elevation:** **Estimated BFE:**	
Is the development in the floodway? ☐ **Yes** ☐ **No**		**Is the development in the floodplain?** ☐ **Yes** ☐ **No** **Zone: _____**	
Notes:			

Doddridge County Commercial/Industrial
Floodplain Development Permit Application

Property Owner Data:

Please provide data on current site/property landowner(s), both surface and mineral rights (as applicable). Use additional copies of this page as needed. Designate each page in relation to each property listed above.

Property Designation: _1 and 2__ of _2__

Property Owner Data:		
Name of Primary Owner (PO): Betty D. Garwood		
PO Address: 1452 Buffalo Calf		
City: Salem	**State: WV**	**Zip: 26426**
PO Primary Phone:		
PO Secondary Phone:		
PO Primary Email:		

Surface Rights Owner Data:		
Name of Primary Owner (PO):		
PO Address:		
City:	**State:**	**Zip:**
PO Primary Phone:		
PO Secondary Phone:		
PO Primary Email:		

Mineral Rights Owner Data: ***(As Applicable)***		
Name of Primary Owner (PO):		
PO Address:		
City:	**State:**	**Zip:**
PO Primary Phone:		
PO Secondary Phone:		
PO Primary Email:		

Doddridge County Commercial/Industrial
Floodplain Development Permit Application

Contractor Data:

Please provide all pertinent data for contractors and sub---contractors that may be participating in this project. Use additional copies of this page as needed. Designate each page in relation to each property listed above.

Property Designation: ____ of ____

Contractor/Sub-Contractor (C/SC) Information:		
C/SC Company Name:		
C/SC WV License Number:		
C/SC FEIN:	**C/SC DUNS:**	
Local C/SC Point of Contact (POC):		
Local C/SC POC Title:		
C/SC Mailing Address:		
City:	**State:**	**Zip-Code:**
Local C/SC Office Phone:		
Local C/SC POC Phone:		
Local C/SC POC E-Mail:		

Engineer Firm Information:		
Engineer Firm Name:		
Engineer WV License Number:		
Engineer Firm FEIN:	**Engineer Firm DUNS:**	
Engineer Firm Primary Point of Contact (POC):		
Engineer Firm Primary POC Title:		
Engineer Firm Mailing Address:		
City:	**State:**	**Zip-Code:**
Engineer Firm Office Phone:		
Engineer Firm Primary POC Phone:		
Engineer Firm Primary POC E-Mail:		

Adjacent and/or Affected Landowners Data

Please provide data for all adjacent and/or affected surface owners (both up and down stream) whose property may be impacted by proposed development as demonstrated by a floodplain study or survey. Use additional copies of this page as needed.

Adjacent Property Owner Data: Upstream		
1 Name of Primary Owner (PO): Deborah Mcie (Life)		
Physical Address: RT. 1 Box 403 1614 Buffalo Calf Rd		
City: Salem	State: WV	Zip: 26426
PO Primary Phone:		
PO Secondary Phone:		
PO Primary Email: 7014 0150 0001 7356 9935		

Adjacent Property Owner Data: Upstream		
2 Name of Primary Owner (PO): William B. and Cathy D. Wells		
Physical Address: 16 Gain St.		
City: Salem	State: WV	Zip: 26426
PO Primary Phone:		
PO Secondary Phone:		
PO Primary Email: 7014 0150 0001 7356 9904		

Adjacent Property Owner Data: Downstream		
3 Name of Primary Owner (PO): Betty D. Garwood and Robert G. Price		
Physical Address: 1452 Buffalo Calf		
City: Salem	State: WV	Zip: 26426
PO Primary Phone:		
PO Secondary Phone:		
PO Primary Email: 7014 0150 0001 7356 9928		

Adjacent Property Owner Data: Downstream		
Name of Primary Owner (PO):		
Physical Address:		
City:	State:	Zip:
PO Primary Phone:		
PO Secondary Phone:		
PO Primary Email:		

Site Plan

A Site Plan is an accurate and detailed map of the proposed development for this project. It shows the size, shape, location and special features of the project property, and the size and location of any development planned to the property, especially as that development will impact the floodplain and/or floodway. Site plans show what currently exists on the project property, and any changes or improvements you are proposing to make. **A certified and licensed engineering firm should complete site plans.**

A SITE PLAN MUST CONTAIN THE FOLLOWING INFORMATION:

1. Legal description of the parcel, north arrow and scale
2. All property lines and their dimensions
3. Names of adjacent roads, location of driveways
4. Location of sloughs, tributaries, streams, rivers, wetlands, ponds, and lakes, with setbacks indicated, and including FEMA floodplain data based on most updated FIRM.
5. Location, size, shape of all buildings, existing and proposed, with elevation of lowest floor indicated.
6. Location and dimensions of existing or proposed on-site sewage systems.
7. Location of all propane tanks, fuel tanks or other liquid storage tanks whether above ground or below ground level.
8. Location and dimensions of any proposed pipeline placement(s) into floodplain/floodway.
9. Location and dimensions of any roadway development into floodplain/floodway. *(Includes initial development access roads)*
10. Location and dimensions of any bridge and/or culvert development into floodplain/floodway.
11. Location and dimensions of any storage yard or facility into the floodplain/floodway.
12. Location of any existing utilities and/or proposed utility placement and/or displacement.
13. Location, dimensions and depth of any existing or proposed fill on site.
14. A survey showing the **existing ground elevations** of at least location on the building site. **ELEVATION NOTE**: All vertical datum will reference either NGVD 29 or NAVD 88. Assumed datum will not be acceptable unless the property is located in an area where vertical datum has not been published. For those areas where vertical datum has not been established, a site plan with contours, elevations using assumed datum, high water marks and existing water levels of sloughs, rivers, lakes or streams and proposed lowest floor elevation.

Applicant

Please read print name, sign and date below:

- I certify that I am authorized to submit this application for the primary project developer.
- I certify that the information included in this application is to the best of my knowledge true and complete.
- I certify that all required Federal, State, and local permits required by law and/or ordinance for the above described development of this project have been properly attained, are current and valid, and must be presented with this application before a Doddridge County Floodplain Permit may be issued.
- I understand that if in the course of the development project additional permits become required that were not needed during the initial proposal, the primary developer must notify the Doddridge County Floodplain Manager within 48 hours of such need, and that a "Stop Work" order may be issued for all project work directly impacting the floodplain or floodway, until such time the required additional permits are acquired.
- I understand that once the floodplain permit is submitted, the application will be entered into official public record at the next regularly scheduled Doddridge County Commission meeting after the date of submittal.
- I understand that from the date of submittal of the fully completed permit application, the Doddridge County Floodplain Manager has ninety (90) days to make a determination to either grant or deny said permit application. During this approval period, the Doddridge County Floodplain Manager may, at his or her discretion, conduct a review and/or additional study of provided documentation by means of an independent engineering firm. All costs associated with said review and/or study must be reimbursed to the County before issuance of approved permit.
- I understand that during the approval period, the Doddridge County Floodplain Manager of designee may at his or her discretion conduct site visits and document conditions of proposed development pursuant to the permit application.
- I understand that once the Floodplain Permit is granted, the permit will be entered into official public record at the next scheduled Doddridge County Commission meeting after the date of issuance. Appeals to the permit may be made no later than twenty (20) days after said issuance. If a valid appeal is submitted, as determined by the Doddridge County Floodplain Manager, a "Stop Work" order will be issued for all project development directly involving the floodplain or floodway. A public hearing by the Doddridge County Appeals Board will be scheduled no less than ten (10) days after the next regularly scheduled Doddridge County Commission meeting.
- I understand that all decisions of the Doddridge County Appeals Board shall be final.
- **I understand issuance of a Floodplain Permit authorizes me to proceed with construction as proposed. A Certificate of Compliance is required upon substantial completion of the project.**
- In signing this application, the primary developer hereby grants the Doddridge County Floodplain Manager or designee the right to enter onto the above---described location to inspect the development work proposed, in progress, and/or completed.
- I understand that if I do not follow exactly the site---plan submitted and approved by this permit that a "Stop Work" order may be issued by the Wirt County Floodplain Manager and that I must stop all construction immediately until discrepancies of actual work vs. proposed work is resolved.

Applicant Signature: _____ Date: 9/2/16

Applicant Printed Name: Randy Kloberdanz

"NO-RISE" CERTIFICATION

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

It is further to certify that the attached technical data supports the fact that proposed Buffalo Calf Fork at Susie Jane will not impact the 100-year flood elevations, floodway elevations, or floodway widths greater than 0.01 feet on the Buffalo Calf Fork at published sections in the Flood Insurance Study for Doddridge County, West Virginia with effective date October 4, 2011.

The project proposes a temporary soil stockpile within the floodplain limits near Buffalo Calf Fork while repairing an existing driveway. The proposed construction shall stockpile the soil while repairs are undertaken, and then remove the stockpile at the end of construction which is estimated to take 2 to 3 weeks.

As the attached HEC-RAS computations show, the construction of the temporary stockpile will raise the base flood elevation 0.01 feet (0.12 inches) at the stockpile. The stockpile has been placed at the headwater to the culvert where the floodplain is controlled more by the downstream culvert than the cross-sectional area. Based upon this analysis, the proposed temporary stockpile will have a negligible effect upon the flood elevations, floodway elevations, and floodway widths.

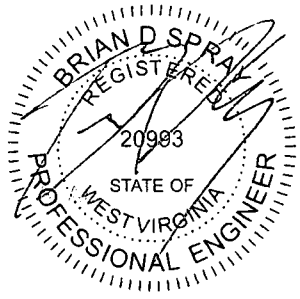
Attached are the following documents that support my findings:

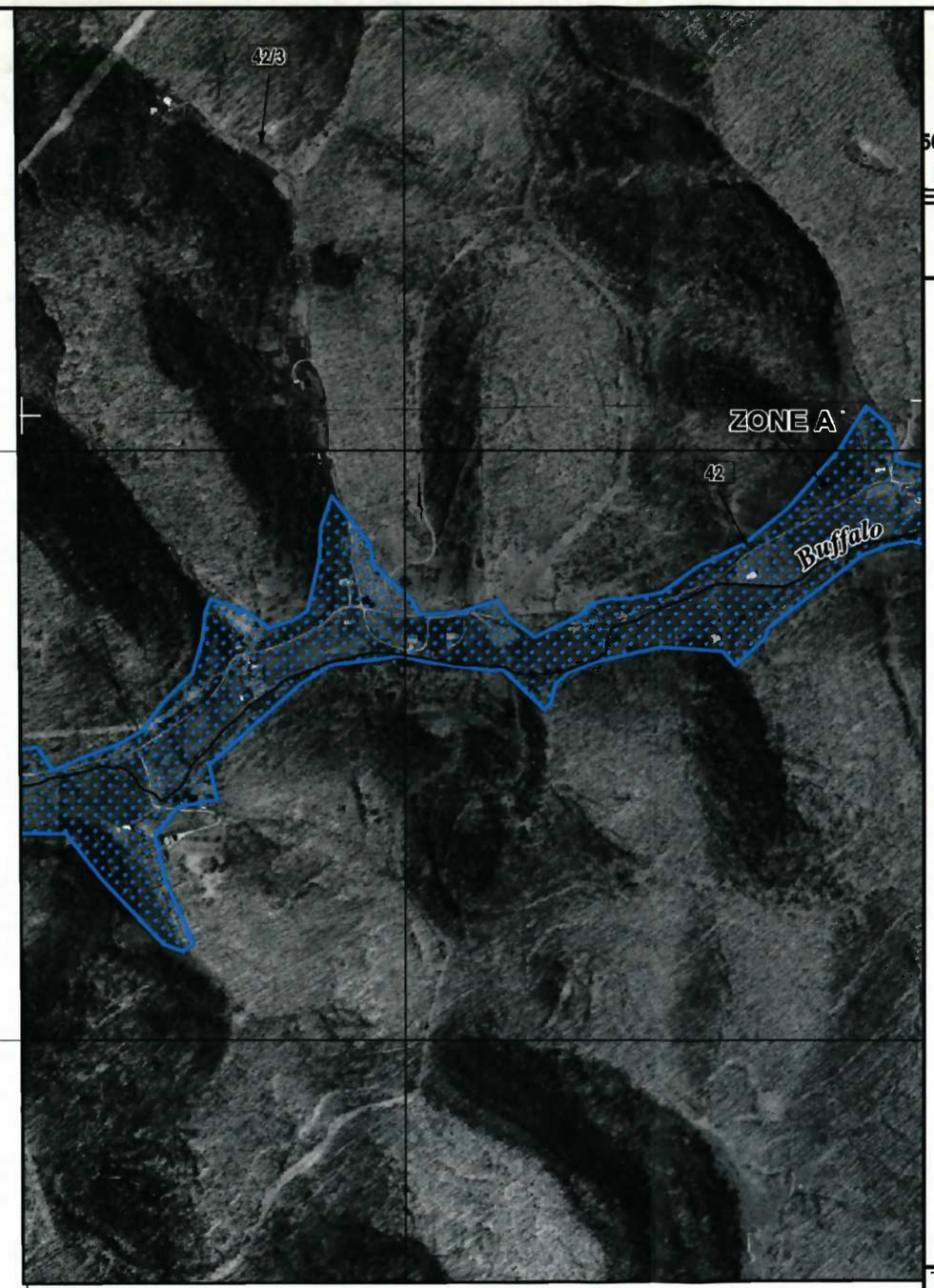
Susie Jane Site Plans, prepared by RETTEW Associates, Inc., dated September 11, 2014.
Flood Insurance Rate Map 54017C0165C for Doddridge County, West Virginia last revised October 4, 2011.
Floodplain Analysis for Susie Jane, prepared by RETTEW Associates, dated August 25, 2016

Date: August 26, 2016

Signature: _____

Title: Project Manager





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.

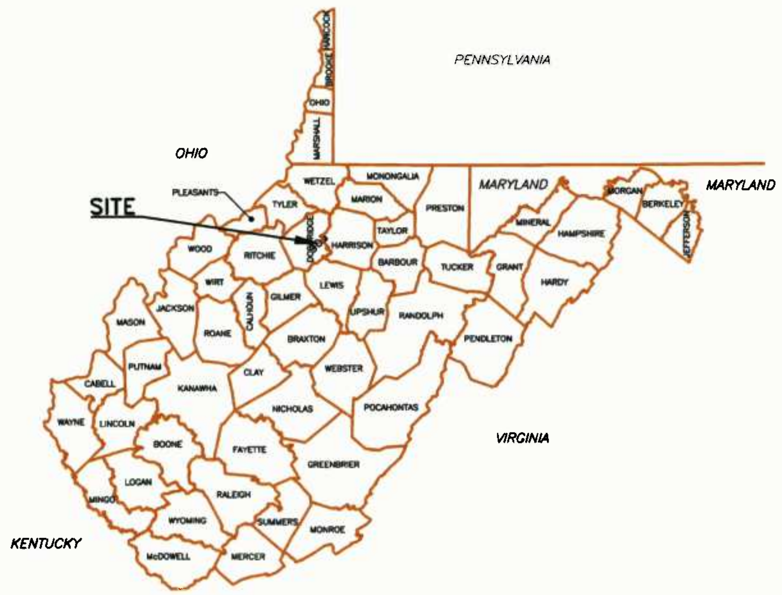
MAP NUMBER
54017C0165C

MAP REVISED
OCTOBER 4, 2011

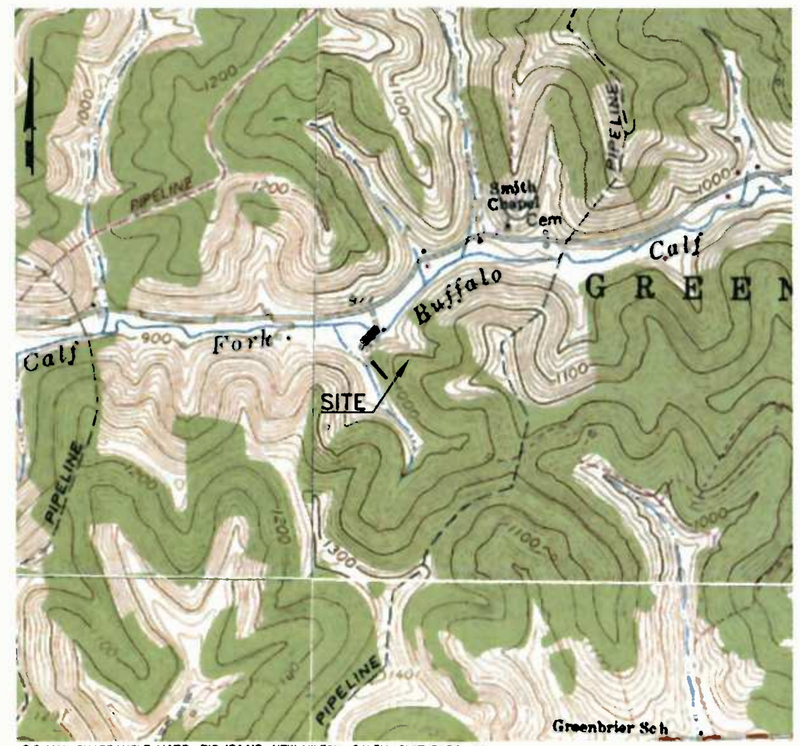
Federal Emergency Management Agency

SITE PLANS
FOR
SUSIE JANE

GREENBRIER DISTRICT, DODDRIDGE COUNTY, WEST VIRGINIA



LOCATION MAP
SCALE – 1"=200,000'



7.5 MIN. QUADRANGLE MAPS: BIG ISAAC, NEW MILTON, SALEM, SMITHBURG, WV

LOCATION MAP
SCALE – 1"=1000'

LIST OF DRAWINGS

1 OF 3. . . . . COVER SHEET
2 OF 3. . . . . SITE PLAN & PROFILE
3 OF 3. . . . . DETAILS

GENERAL NOTES

1. THE TOPOGRAPHIC DATA UTILIZED FOR THIS BASE MAPPING IS BASED ON BEST AVAILABLE THREE (3) METER DATA FROM WEST VIRGINIA GIS TECHNICAL CENTER (WVGISTC), AND THE STATE ADDRESSING AND MAPPING BOARD (SAMB).
2. PROPERTY BOUNDARIES, AND LANDOWNER INFORMATION SHOWN ON THIS PLAN ARE BASED ON AVAILABLE COUNTY GIS PARCEL DATA AND DEED REFERENCES. THIS INFORMATION IS FOR PLANNING PURPOSES ONLY.
3. EXISTING STRUCTURES, TREE LINES AND ROADWAYS HAVE BEEN LOCATED PER AVAILABLE ONLINE AERIAL PHOTOGRAPHY.
4. THE HORIZONTAL DATUM IS WEST VIRGINIA STATE PLANE, NORTH AMERICAN DATUM 1983 (NAD 83), NORTH ZONE.
5. THE VERTICAL DATUM IS WEST VIRGINIA STATE PLAN, NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88).
6. THE UTILITIES SHOWN ON THIS PLAN ARE FOR REFERENCE PURPOSES ONLY. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO VERIFY THE EXACT LOCATION PRIOR TO ANY EXCAVATION BY NOTIFYING MISS UTILITY OF WEST VIRGINIA AT 1-800-245-4848.
7. THE CUT & FILL SUMMARY CALCULATIONS PRESENTED ON THIS PLAN ARE FOR PERMITTING AND INFORMATIONAL PURPOSES ONLY. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO VERIFY EXISTING GRADES AND TO VERIFY EARTHWORK VOLUMES, METHODS AND PROCEDURES. ANY ISSUES ARE TO BE BROUGHT TO THE ENGINEER'S AND OWNER'S ATTENTION PRIOR TO COMMENCEMENT OF WORK.
8. ALL EXISTING UTILITIES HAVE BEEN SHOWN IN ACCORDANCE WITH THE BEST AVAILABLE INFORMATION.
9. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL ABOVE AND BELOW GROUND UTILITIES AND STRUCTURES AND WILL BE RESPONSIBLE FOR THE PROTECTION OF THESE UTILITIES AND STRUCTURES AT ALL TIMES.
10. THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO PROTECT THE EXISTING UTILITIES AND MAINTAIN UNINTERRUPTED SERVICE AND ANY DAMAGE DUE TO THE CONTRACTORS NEGLIGENCE SHALL BE REPAIRED IMMEDIATELY AND COMPLETELY AT HIS EXPENSE.
11. CONTRACTOR SHALL BE RESPONSIBLE FOR THE REPLACEMENT OF DAMAGED OR DESTROYED LANDSCAPE AND LAWNS.
12. CONTRACTOR SHALL VERIFY ALL DIMENSIONS ON THE PROJECT SITE PRIOR TO THE START OF CONSTRUCTION.
13. CONTRACTOR TO RELOCATE UTILITIES AS REQUIRED.
14. CONTRACTOR MAY WIDEN ACCESS ROAD DUE TO STEEP SLOPES IF DEEMED NECESSARY.
15. SEED AND MULCH ALL DISTURBED AREAS PER DETAILS.
16. ALL CLEARED TREE GRINDINGS SHOULD BE PLACED UPHILL OF SITE AND NOT STOCKPILED ON-SITE.
17. CONTRACTOR SHALL STOP WORK IMMEDIATELY AND CONTACT ANTERO AND APPROPRIATE RESPONSIBLE AUTHORITIES SHOULD ANY HISTORICAL ARTIFACTS (I.E. BONES, POTTERY, ETC.) ARE ENCOUNTERED DURING CONSTRUCTION.
18. MAINTAIN ACCESS ROADS WITH GRAVEL AS NEEDED.
19. CONSTRUCTION TRAFFIC SHALL USE ONLY ROADS WITHIN THE LIMITS OF DISTURBANCE MARKED ON THIS PLAN. ALL ACCESS ROADS (AR) ARE EXISTING AND WILL HAVE MINIMAL WIDENING AND MAINTENANCE.
20. CONTRACTOR TO REPLACE ACCESS ROAD CULVERTS AS NEEDED. CULVERTS THAT ARE CRUSHED, SILTED, DETERIORATING, AND BEYOND MAINTENANCE SHALL BE REPLACED IN KIND.

LOCAL ANTERO OFFICE

175 ELK CREEK ROAD
MT. CLARE, WV 26408
PHONE (304) 622-3842

535 WHITE OAKS BOULEVARD
BRIDGEPORT, WEST VIRGINIA 26330
(304)-842-4100 MAIN

WEST VIRGINIA 811
CALL BEFORE YOU DIG!
Dial 811 or 800.245.4848
Miss Utility of West Virginia

AT LEAST 48 HOURS, BUT NOT MORE THAN 10 WORKING DAYS (EXCLUDING WEEKENDS AND HOLIDAYS), PRIOR TO TO STARTING ANY EARTH DISTURBANCE ACTIVITIES, ALL CONTRACTORS INVOLVED IN THESE ACTIVITIES SHALL CONTACT MISS UTILITY OF WEST VIRGINIA AT 811 OR 1-800-245-4848.

NO.	DATE	REVISION

SCALE: AS NOTED

FOR RETTEW ASSOCIATES BY:

MANAGER: ANDREW LEVINE, PE	
DESIGN BY: KRM	CHKD BY: PJF
DRAWN BY: KRM	CHKD BY: PJF
SURV. CHIEF	FIELDBOOK NO. N/A

CLIENT
ANTERO RESOURCES CORPORATION
1615 WYNKOOP STREET
DENVER, COLORADO 80202

ANTERO RESOURCES

RETTEW
RETTEW Associates, Inc.
Twin Towers, 4955 Steubenville Pk, Ste 305
Pittsburgh, PA 15205
Phone (412) 446-1728 Fax (412) 446-1733
Email: rettew@rettew.com
Website: www.rettew.com
Engineers • Planners • Surveyors • Landscape Architects
Environmental Consultants

SITE PLANS FOR SUSIE JANE

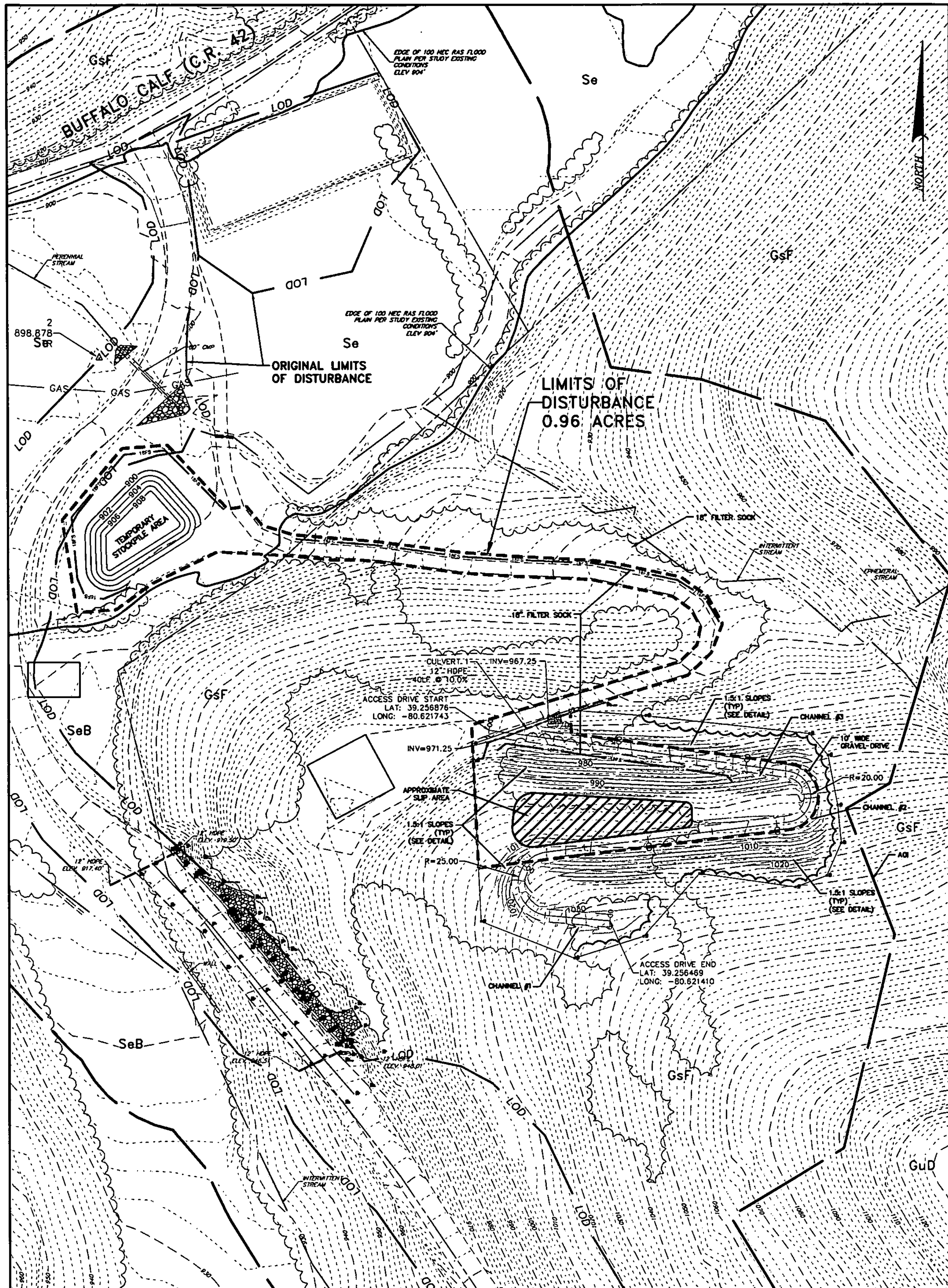
GREENBRIER DISTRICT DODDRIDGE COUNTY, WV

DATE: 9/11/2014

SHEET NO. 1 OF 3

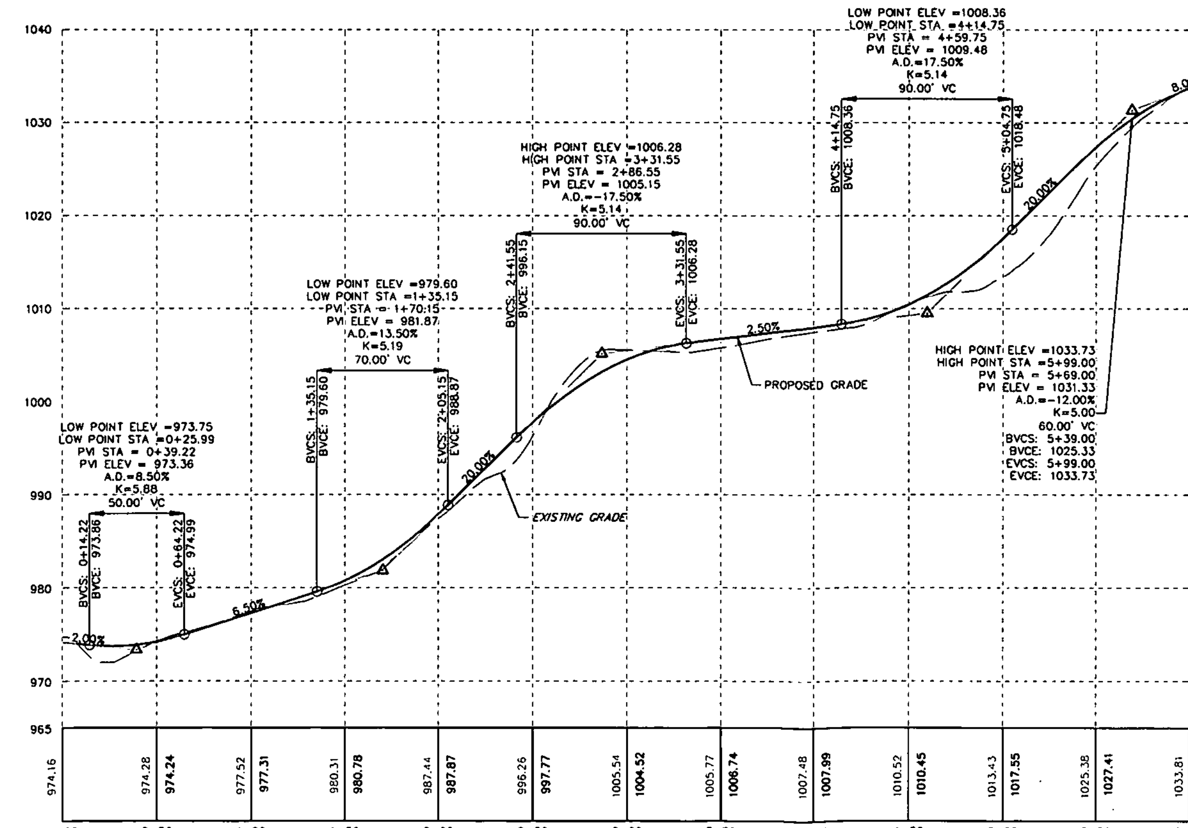
DWG. NO. 095452088

NOT FOR CONSTRUCTION/NOT FOR BIDDING



PLAN VIEW

SCALE 1"=50'



ACCESS DRIVE PROFILE

HORIZONTAL SCALE 1"=50'
VERTICAL SCALE 1"=5'

LEGEND

- EXISTING PROPERTY LINE
- EXISTING PAVEMENT
- EXISTING GRAVEL
- EXISTING TREELINE
- EXISTING TREE
- EXISTING CONTOUR LINE
- EXISTING OVERHEAD UTILITY
- EXISTING GASLINE
- EXISTING WETLAND
- EXISTING STREAM
- EXISTING AREA OF INTEREST
- PROPOSED GRAVEL
- PROPOSED MAJOR CONTOUR LINE
- PROPOSED MINOR CONTOUR LINE
- PROPOSED TREELINE
- LIMITS OF DISTURBANCE
- PROPOSED SUPER SILT FENCE (SSF)

CUT & FILL

	OPTION C
CUT	+1,094 CY
STONE (6")	+ 111 CY
FILL	- 518 CY
COMPACTION (10%)	- 109 CY
TOPSOIL (7")	- 578 CY
NET	= 0 CY

SCALE AS NOTED

NO.	DATE	REVISION

FOR RETTEW ASSOCIATES BY:

MANAGER: ANDREW LEVINE, PE
DESIGN BY: KRM | CHKD BY: PJF
DRAWN BY: KRM | CHKD BY: PJF
SURV. CHIEF: | FIELDBOOK NO. N/A

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SITE PLANS FOR SUSIE JANE

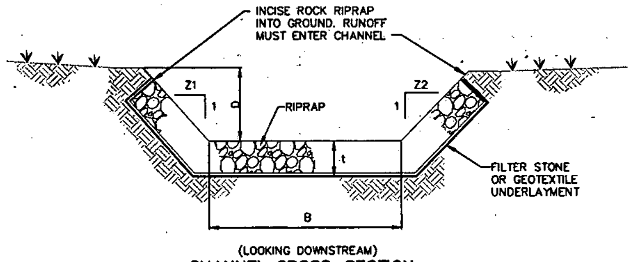
GREENBRIER DISTRICT DODDRIDGE COUNTY, WV

DATE: 9/11/2014

SHEET NO. 2 OF 3

DWG. NO. 095452088

NOT FOR CONSTRUCTION/NOT FOR BIDDING



(LOOKING DOWNSTREAM)
CHANNEL CROSS-SECTION

CHANNEL NO.	BOTTOM WIDTH B (FT)	DEPTH D (FT)	Z1 (FT)	Z2 (FT)	SIZE (d50)	STONE DEPTH (IN)	UNDERLAYMENT *	UNDER-LAYMENT THICKNESS (IN)
1-3	1	1	2	2	3	9	AASHTO #57	3

* GEOTEXTILE MAY BE SUBSTITUTED FOR CHANNEL SLOPES < 10%

NOTES:

FILTER STONE UNDERLAYMENT FOR BED SLOPES ≥ 0.10 FT/FT (10 %) SHALL BE USED.

CHANNEL DIMENSIONS ARE FOR THE COMPLETED CHANNEL AFTER ROCK PLACEMENT. CHANNEL MUST BE OVER-EXCAVATED A SUFFICIENT AMOUNT TO ALLOW FOR THE VOLUME OF ROCK PLACED WITHIN THE CHANNEL WHILE PROVIDING THE SPECIFIED FINISHED DIMENSIONS.

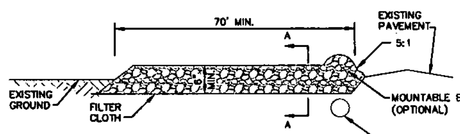
CHANNEL DIMENSIONS SHALL BE CONSTANTLY MAINTAINED. CHANNEL SHALL BE CLEANED WHENEVER TOTAL CHANNEL DEPTH IS REDUCED BY 25% AT ANY LOCATION. SEDIMENT DEPOSITS SHALL BE REMOVED WITHIN 24 HOURS OF DISCOVERY OR AS SOON AS SOIL CONDITIONS PERMIT ACCESS TO CHANNEL WITHOUT FURTHER DAMAGE.

DAMAGED LINING SHALL BE REPAIRED OR REPLACED WITHIN 48 HOURS OF DISCOVERY.

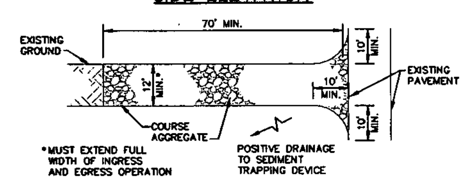
THE MINIMUM ROCK THICKNESS (t) SHALL BE 1.5 TIMES THE MAX ROCK SIZE.

RIPRAP CHANNEL

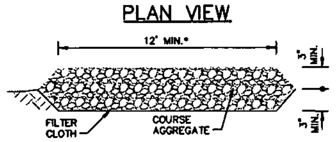
NOT TO SCALE



SIDE ELEVATION



PLAN VIEW

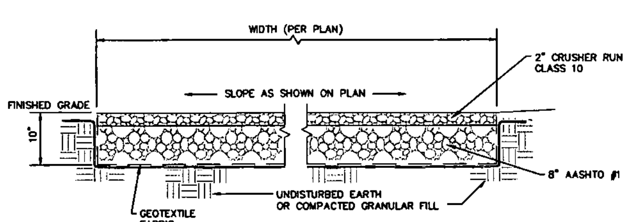


SECTION A-A

NOTES:
1. STABILIZED CONSTRUCTION ENTRANCES SHALL BE INSTALLED WHEREVER CONSTRUCTION TRAFFIC ENTERS AND LEAVES A SITE.
2. USE 2-4" STONE FOR LOW VOLUME ENTRANCES, LARGER STONE (4-6") FOR HEAVY USE OR MATERIAL DELIVERY ENTRANCES.
3. LENGTH IS AS REQUIRED, BUT NOT LESS THAN 70' (EXCEPT ON A SINGLE RESIDENCE LOT WHERE A 30' MIN. LENGTH WOULD APPLY).
4. THICKNESS SHOULD BE NOT LESS THAN 6".
5. THE WIDTH SHALL BE A MIN. OF 10', BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS AND EGRESS OCCURS.
6. GEOTEXTILE FABRIC SHALL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING OF STONE.
7. ALL SURFACE WATER FLOWING OR DIVERTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED ACROSS THE ENTRANCE. IF A CULVERT IS IMPRACTICAL, A MOUNTABLE BERM WITH 5:1 SLOPES SHALL BE USED.
8. IF NECESSARY, DIVERT ANY WATER RUNNING DOWN ACCESS ROAD TO A SEDIMENT TRAP LOCATED ON EITHER SIDE OF THE STABILIZED CONSTRUCTION ENTRANCE.
9. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT.
10. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY.
11. WHEELS ON ALL VEHICLES SHALL BE CLEANED TO REMOVE SEDIMENT PRIOR TO ENTRANCE ONTO PUBLIC RIGHTS-OF-WAY. IF WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH STONE AND WHICH DRAINS INTO APPROVED SEDIMENT TRAPPING DEVICE.
12. IF THE STREET IS WASHED PRECAUTIONS MUST BE TAKEN TO PREVENT MUDDY WATER FROM RUNNING INTO WATERWAYS OR STORM SEWERS.
13. INSPECTION AND NEEDED MAINTENANCE SHOULD BE PROVIDED DAILY BUT AT A MINIMUM EVERY SEVEN DAYS AND AFTER EVERY RAIN OF 0.5 INCH OR GREATER.

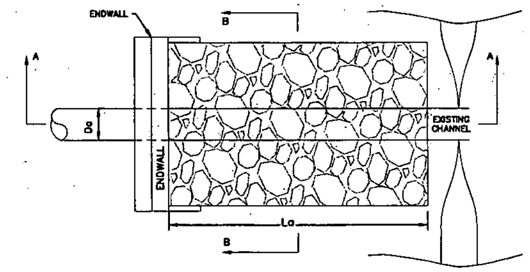
STABILIZED CONSTRUCTION ENTRANCE

NOT TO SCALE

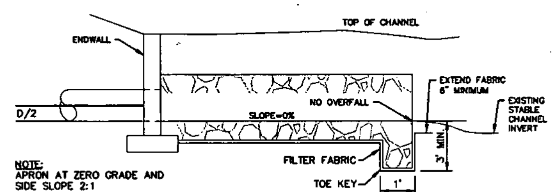


ACCESS ROAD CROSS-SECTION

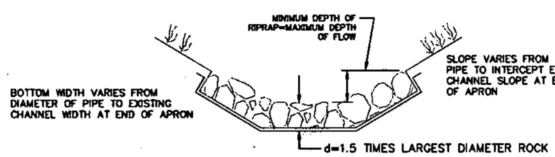
NOT TO SCALE



PLAN VIEW



PROFILE A-A



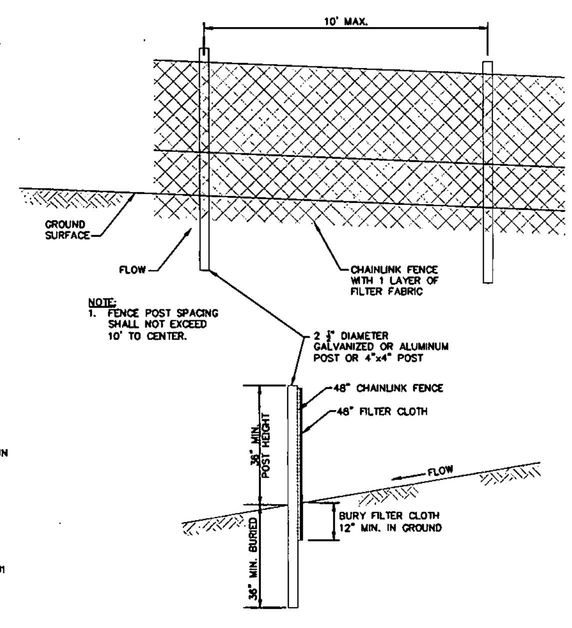
SECTION B-B

OUTLET NO.	PIPE DIA Wo (IN)	RIPRAP		APRON
		SIZE d50 (IN)	THICK. Rt (IN)	APRON LENGTH La (FT)
CULVERT #1	12	6	18	12

NOTES:
1. THE SUBGRADE FOR THE FILTER, RIRPRAP, OR GABION SHALL BE PREPARED TO THE REQUIRED LINES AND GRADES. ANY FILL REQUIRED IN THE SUBGRADE SHALL BE COMPACTED TO A DENSITY OF APPROXIMATELY THAT OF THE SURROUNDING UNDISTURBED MATERIAL.
2. THE ROCK OR GRAVEL SHALL CONFORM TO THE SPECIFIED GRADING LIMITS WHEN INSTALLED RESPECTIVELY IN THE RIPRAP OR FILTER.
3. FILTER CLOTH SHALL BE PROTECTED FROM PUNCHING, CUTTING, OR TEARING. ANY DAMAGE OTHER THAN AN OCCASIONAL SMALL HOLE SHALL BE REPAIRED BY PLACING ANOTHER PIECE OF CLOTH OVER THE DAMAGED PART OR BY COMPLETELY REPLACING THE CLOTH. ALL OVERLAPS, WHETHER FOR REPAIRS OR FOR JOINING TWO PIECES OF CLOTH SHALL BE A MINIMUM OF 1'.
4. STONE FOR THE RIPRAP OR GABION OUTLETS MAY BE PLACED BY EQUIPMENT. BOTH SHALL BE CONSTRUCTED TO THE FULL COURSE IN ONE OPERATION AND IN SUCH A MANNER AS TO VOID DISPLACEMENT OF UNDERLYING MATERIALS. THE STONE FOR RIPRAP OR GABION OUTLETS SHALL BE DELIVERED AND PLACED IN A MANNER THAT WILL ENSURE THAT IT IS REASONABLY HOMOGENEOUS WITH THE SMALLER STONES AND SPALLS FILLING THE VOIDS BETWEEN THE LARGER STONES. RIRPRAP SHALL BE PLACED IN A MANNER TO PREVENT DAMAGE TO THE FILTER BLANKET OR FILTER CLOTH. HAND PLACEMENT WILL BE REQUIRED TO THE EXTENT NECESSARY TO PREVENT DAMAGE TO THE PERMANENT WORKS.
5. THE RIPRAP OUTLET SHOULD BE INSPECTED AFTER HIGH FLOWS FOR EVIDENCE OF SCOUR BENEATH THE RIPRAP OR FOR DISLODGED STONES. IF A SIGNIFICANT NUMBER OF STONES HAVE BEEN DISLODGED IT WILL BE NECESSARY TO RECALCULATE STONE SIZE AND REPLACE THE EXISTING STONE WITH PROPERLY SIZED STONE. ANY REPAIRS MUST BE MADE IMMEDIATELY.

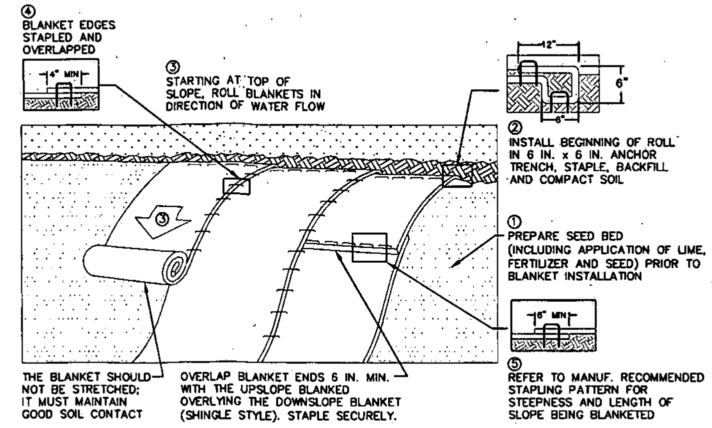
DISCHARGE TO CONFINED SECTION
OUTLET PROTECTION

NOT TO SCALE



SUPER SILT FENCE

NOT TO SCALE



NOTES:

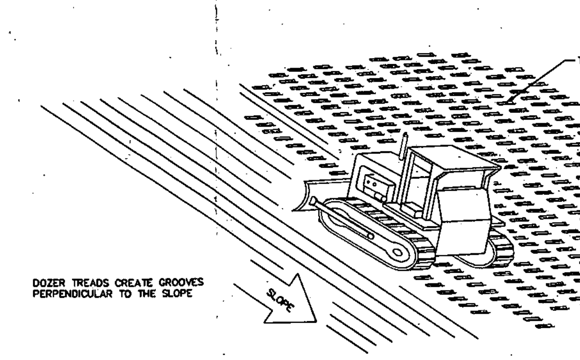
1. SEED AND SOIL AMENDMENTS SHALL BE APPLIED ACCORDING TO THE RATES IN THE PLAN DRAWINGS PRIOR TO INSTALLING THE BLANKET.
   SLOPE SURFACE SHALL BE FREE OF ROCKS, CLODS, STICKS, AND GRASS.
   BLANKET SHALL HAVE GOOD CONTINUOUS CONTACT WITH UNDERLYING SOIL THROUGHOUT ENTIRE LENGTH. LAY BLANKET LOOSELY AND STAKE OR STAPLE TO MAINTAIN DIRECT CONTACT WITH SOIL. DO NOT STRETCH BLANKET.
   THE BLANKET SHALL BE STAPLED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
2. BEGIN AT THE TOP OF THE SLOPE BY ANCHORING THE BLANKET IN A 6" DEEP X 6" WIDE TRENCH WITH APPROXIMATELY 12" OF BLANKET EXTENDED BEYOND THE UP-SLOPE PORTION OF THE TRENCH. ANCHOR THE BLANKET WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" PORTION OF BLANKET BACK OVER SEED AND COMPACTED SOIL. SECURE BLANKET OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" APART ACROSS THE WIDTH OF THE BLANKET.
3. ROLL THE BLANKET DOWN OR THE SLOPE. BLANKET WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL BLANKET MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE. WHEN USING THE DOT SYSTEM™, STAPLES/STAKES SHOULD BE PLACED THROUGH EACH OF THE COLORED DOTS CORRESPONDING TO THE APPROPRIATE STAPLE PATTERN.
4. THE EDGES OF PARALLEL BLANKET MUST BE STAPLED WITH 4" MINIMUM OVERLAP.
5. CONSECUTIVE BLANKET SPLICED DOWN THE SLOPE MUST BE PLACED END OVER END (SHINGLE STYLE) WITH A MINIMUM 6" OVERLAP. STAPLE THROUGH OVERLAPPED AREA, APPROXIMATELY 12" APART ACROSS ENTIRE BLANKET WIDTH.
6. PROVIDE ANCHOR TRENCH AT TOE OF SLOPE IN SIMILAR FASHION AS AT TOP OF SLOPE.
7. IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 6" MAY BE NECESSARY TO PROPERLY SECURE THE BLANKET.
8. BLANKETED AREAS SHALL BE INSPECTED WEEKLY AND AFTER EACH RUNOFF EVENT UNTIL PERENNIAL VEGETATION IS ESTABLISHED TO A MINIMUM UNIFORM 70% COVERAGE THROUGHOUT THE BLANKETED AREA. DAMAGED OR DISPLACED BLANKETS SHALL BE RESTORED OR REPLACED WITHIN 4 CALENDAR DAYS.

NOTE:
*HYDRAULICALLY APPLIED SLOPE BLANKET MAY BE USED AS AN EQUIVALENT TO SLOPE STABILIZATION MATTING.

SLOPE	SLOPE LENGTH	SLOPE LINING	STAPLE PATTERN
1.5:1 SLOPES	MAX. 100'	NAG SC250	D

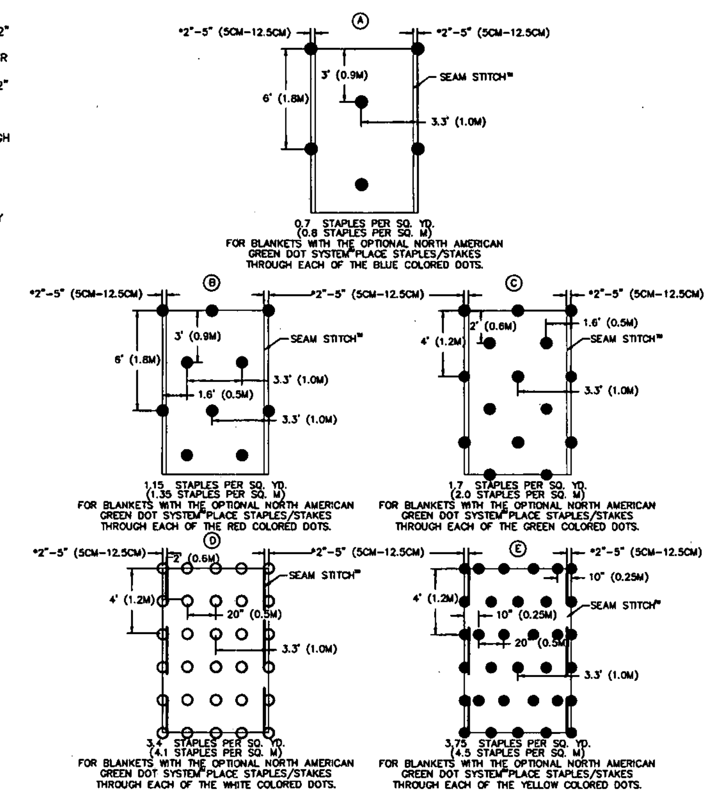
EROSION CONTROL BLANKET INSTALLATION

NOT TO SCALE



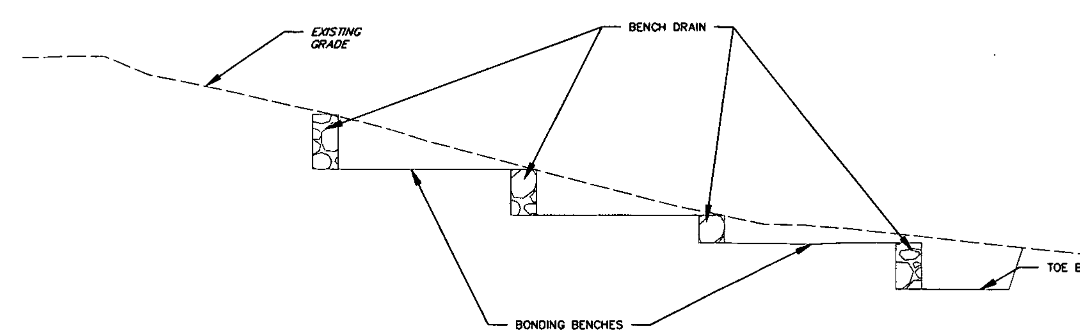
BULLDOZER TRACKING PROCEDURE

NOT TO SCALE



STAPLE PATTERN GUIDE

NOT TO SCALE



TYPICAL EMBANKMENT TOE KEY AND BONDING BENCH DETAIL

NOT TO SCALE

SCALE: AS NOTED

REVISION | NO. | DATE

FOR RETTEW ASSOCIATES BY:

MANAGER: ANDREW LEVINE, PE
DESIGN BY: KRM | CHKD BY: PJF
DRAWN BY: KRM | CHKD BY: PJF
SURV. CHIEF: | FIELDBOOK NO. N/A

CLIENT
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SITE PLANS FOR
SUSIE JANE

GREENBRIER DISTRICT DODDRIDGE COUNTY, WV

DATE: 9/11/2014

SHEET NO. 3 OF 3

DWG. NO. 095452088

NOT FOR CONSTRUCTION/NOT FOR BIDDING

RETTEW

We answer to you.

27 Trovato Street, Suite 1, Bridgeport, WV 26330
Phone: (800) 738-8395
E-mail: rettew@rettew.com • Web site: rettew.com

MEMORANDUM

TO:	File		
FROM:	Paul J. Fish, EIT		
CC:			
DATE:	August 25, 2016		
PROJECT NAME:	Susie Jane	**PROJECT NO.:**	095452088
SUBJECT:	Floodplain Analysis		

Overview:
The purpose of this memo is to provide a brief explanation of the floodplain analysis for a portion of Buffalo Calf Run for the Susie Jane project. This analysis was prepared to demonstrate that the construction of a temporary stockpile within the floodplain of this stream provides a negligible increase in flood elevation and does not increase floodplain elevations and floodway elevations greater than 0.01 feet, or floodway widths. A floodplain analysis has been provided to show the impact the construction a stockpile within the floodplain during the temporary nature of its existence.

Hydrology:
The peak flow for the 100-year storm event was established previously with the "HEC RAS Flood Plain Study of Susie Jane Drill Pad Entrance and Water Offload Pad", prepared by L&W Enterprises, Inc., dated May 2, 2013. The 100-year peak flow was found to be 1.007 cfs at this location.

Hydraulics and Results:
The channel and floodplain properties for Buffalo Calf Creek were established using as-built survey data. The Manning's η coefficients selected were from the normal range for the stream and overbank areas. The coefficient for the stream was $\eta = 0.035$ and for the overbanks was $\eta = 0.030$. Due to the flat gradient, a steady state analysis was performed using normal depth boundary conditions for the peak flow.

The flow data and stream properties were processed in HEC-RAS Version 4.1.0 to determine the Water Surface Elevation (WSE) of the floodplain. Two steady stream analyses of this section of the stream were performed. The pre-development analysis is the current state of the stream, without the construction of the temporary stockpile. The second analysis includes the construction of the stockpile within the floodplain. The supporting calculations for this analysis have been included and show an increase of 0.01 feet (0.12 inches) of the WSE at section 324.75. All other sections as analyzed show no increase in WSE. The hydraulic computations are attached.

LEGEND

- EXISTING PROPERTY LINE
- EXISTING PAVEMENT
- EXISTING GRAVEL
- EXISTING TREELINE
- EXISTING TREE
- EXISTING CONTOUR LINE (1450)
- EXISTING OVERHEAD UTILITY (OE)
- EXISTING GASLINE (G)
- EXISTING WETLAND
- EXISTING STREAM
- EXISTING AREA OF INTEREST
- PROPOSED GRAVEL
- PROPOSED MAJOR CONTOUR LINE (1450)
- PROPOSED MINOR CONTOUR LINE
- PROPOSED TREELINE
- LIMITS OF DISTURBANCE
- PROPOSED SUPER SILT FENCE (SSF)

LIMITS OF DISTURBANCE 0.96 ACRES

NORTH

PLAN VIEW

SCALE 1"=60'

DRAWN BY: JDN

DATE: 08/25/16

SCALE: AS NOTED

DWG. NO. 095452088

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Engineers • Planners • Surveyors • Landscape Architects
Environmental Consultants

FLOODPLAIN PLAN
FLOODPLAIN ANALYSIS

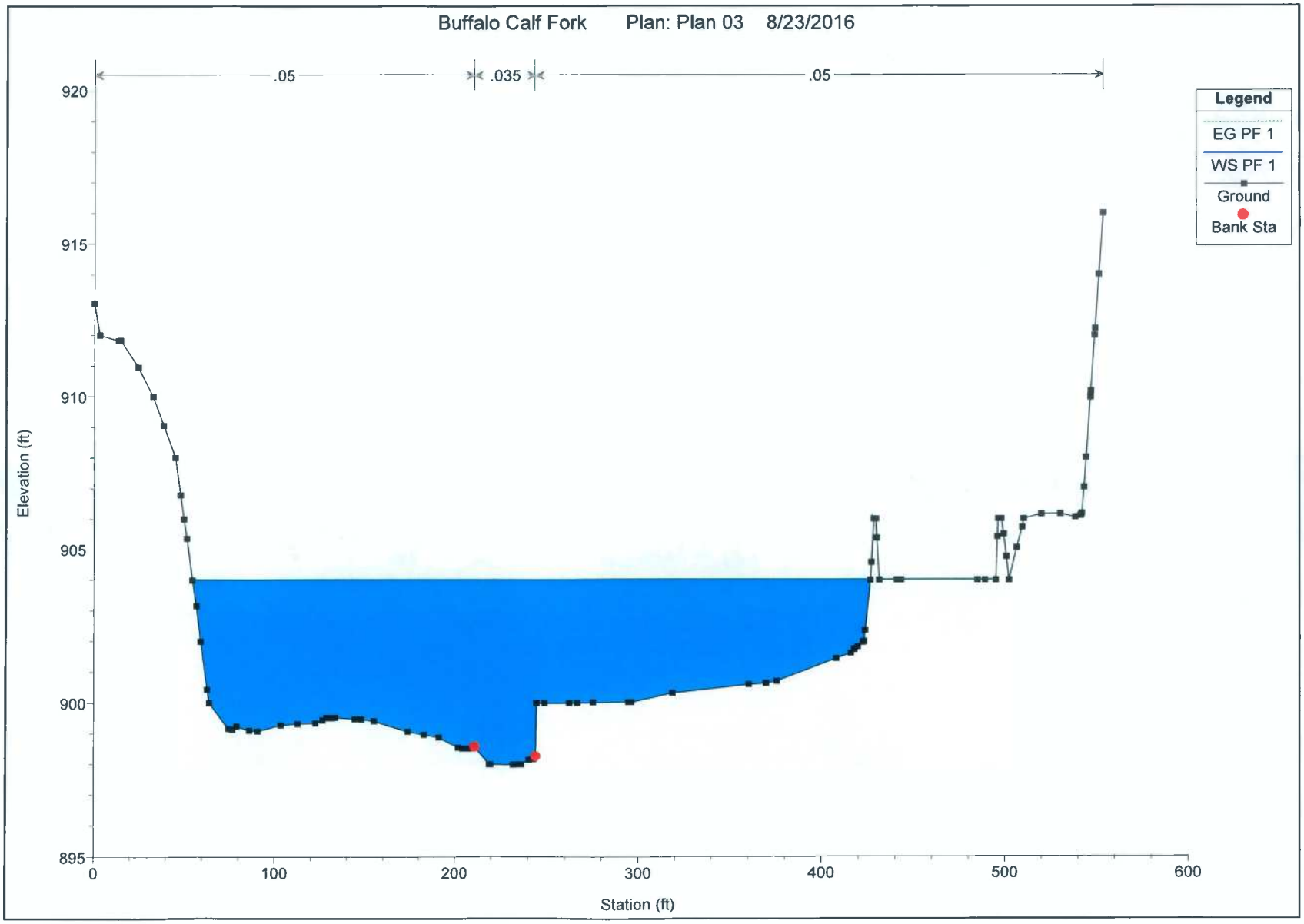
SUSIE JANE

GREENBRIER TAX DISTRICT DODDRIDGE COUNTY, WV

PRE-CONSTRUCTION CONDITIONS

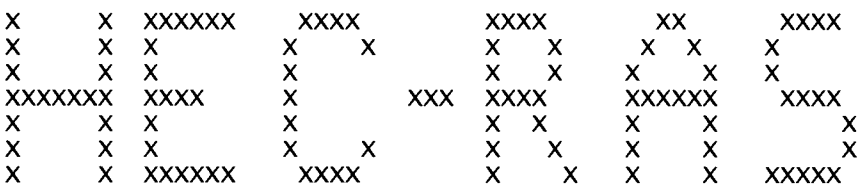
HEC-RAS Plan: Plan 02 River: Buffalo Calf For Reach: Buffalo Calf For Profile: PF 1

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)	
Buffalo Calf For	397.97	PF 1	1007.00	898.00	904.03		904.04	0.000185	1.80	1175.55	448.97	0.13
Buffalo Calf For	324.75	PF 1	1007.00	898.18	904.01	901.45	904.03	0.000203	1.64	1056.41	387.18	0.12
Buffalo Calf For	320		Culvert									
Buffalo Calf For	310.94	PF 1	1007.00	897.99	904.01		904.02	0.000061	1.08	1552.04	435.92	0.08
Buffalo Calf For	265.71	PF 1	1007.00	897.22	904.01	899.21	904.02	0.000039	0.93	1776.87	428.72	0.06
Buffalo Calf For	233		Culvert									
Buffalo Calf For	200	PF 1	1007.00	895.89	903.99	898.92	904.00	0.000030	0.88	1893.03	371.20	0.06


Buffalo Calf Fork Plan: Plan 03 8/23/2016
.05
.035
.05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
920
915
910
905
900
895
0
100
200
300
400
500
600
Station (ft)

BuffaloCalfFork.rep

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



PROJECT DATA
Project Title: Buffalo Calf Fork
Project File : BuffaloCalfFork.prj
Run Date and Time: 8/23/2016 8:01:46 AM

Project in English units

PLAN DATA

Plan Title: Plan 03
Plan File :
i:\Projects\09545\095452088\LD\Floodplain\SusieJane\HecRas\BuffaloCalfFork.p03

Geometry Title: Buffalo Calf Fork
Geometry File :
i:\Projects\09545\095452088\LD\Floodplain\SusieJane\HecRas\BuffaloCalfFork.g01

Flow Title : Buffalo Calf Fork
Flow File :
i:\Projects\09545\095452088\LD\Floodplain\SusieJane\HecRas\BuffaloCalfFork.f01

Plan Summary Information:

Number of:	Cross Sections	= 5	Multiple Openings	=	0
	Culverts	= 2	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: Buffalo Calf Fork
Flow File :
i:\Projects\09545\095452088\LD\Floodplain\SusieJane\HecRas\BuffaloCalfFork.f01

Flow Data (cfs)

River	Reach	RS	PF 1
Buffalo Calf For	Buffalo Calf For	397.97	1007

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Buffalo Calf For	Buffalo Calf For	PF 1		

Known WS = 903.99

GEOMETRY DATA

Geometry Title: Buffalo Calf Fork
Geometry File :
i:\Projects\09545\095452088\LD\Floodplain\SusieJane\HecRas\BuffaloCalfFork.g01

CROSS SECTION

RIVER: Buffalo Calf For
REACH: Buffalo Calf For RS: 397.97

INPUT
Description:
Station Elevation Data num= 136

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	939.28	2.97998	938.29	3.859985	938	4.440002	937.81	9.799988	936
10.83997	935.59	15.32001	934	18.21997	932.48	19.10999	932	22.45001	930.19
22.81	930	26.02997	928.26	26.51001	928	27.32001	927.57	30.22998	926
32.78998	924.62	33.94	924	34.91998	923.48	37.90997	922	40.83997	920.72
42.34998	920	45.70001	918.48	46.56	918	47.67999	917.37	50.22998	916
53.65997	914.08	53.78998	914	53.91998	913.93	58.16998	912	59.54999	911.72
69.90997	911	77.51001	910	80.28998	909.68	86.52997	908	86.87	907.95
88.64996	907.41	89.20001	907.22	92.52002	906	93.33002	905.18	95.20001	904
96.01001	903.49	7.95996	902	98.95001	900.92	100.32	900	102.42	898.22
102.87	898	107.63	898	111.32	898	113.4	898	118.56	898
120.73	898	121.63	898.55	124.1	900.02	127.91	900	132.62	900
139.56	900	144.03	900	151.86	900	168.12	900.02	174.92	900.02
183.99	900.02	192.41	900.03	253.63	900.85	269.72	901.12	298.42	901.4
303.37	901.46	308.24	901.49	324.08	901.86	328.08	902	330.61	902
334.03	902	337.56	902	345.17	902	356.36	902	370.8	902
372.4	902	374.86	902	393.86	902	405.5	902	406.07	902
406.72	902	414.89	902	418.26	902	423.43	902	428.02	902
430.38	902.04	504.59	903.08	515.21	903.34	535.83	903.81	544.02	904
550.24	905.45	552.48	906	553.09	906.35	555.75	908	557.4	909.13
558.86	910	560.82	911.32	561.91	912	564.13	913.48	564.8	914
566.22	915	567.95	916	571.94	916.2	572.94	916.25	573.91	916.22

579.64	916	580.84	915.94	582.77	916	584.43	916.73	586.86	918
587.99	918.69	590.12	920	590.74	920.52	592.46	922	593.65	922.93
594.8	924	595.64	924.72	597.21	926	598.8	927.3	599.61	928
600.64	928.89	602.04	930	603.39	931.05	604.54	932	606.92	933.17
608.65	934	612.87	935.67	613.7	936	614.03	936.14	616.16	937
618.29	937.86	618.64	938	619.22	938.22	623.82	940	627.35	941.26
628.24	941.57								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100.32	.035	124.1	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
100.32	124.1	73.22	73.22	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	904.04	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.02	Wt. n-Val.	0.050	0.035
0.050				
W.S. Elev (ft)	904.03	Reach Len. (ft)	73.22	73.22
73.22				
Crit W.S. (ft)		Flow Area (sq ft)	10.27	137.48
1027.79				
E.G. Slope (ft/ft)	0.000185	Area (sq ft)	10.27	137.48
1027.79				
Q Total (cfs)	1007.00	Flow (cfs)	5.59	247.06
754.34				
Top Width (ft)	448.97	Top Width (ft)	5.16	23.78
420.03				
Vel Total (ft/s)	0.86	Avg. Vel. (ft/s)	0.54	1.80
0.73				
Max Chl Dpth (ft)	6.03	Hydr. Depth (ft)	1.99	5.78
2.45				
Conv. Total (cfs)	74036.9	Conv. (cfs)	411.3	18164.7
55460.9				
Length Wtd. (ft)	73.22	Wetted Per. (ft)	6.57	25.04
420.07				
Min Ch El (ft)	898.00	Shear (lb/sq ft)	0.02	0.06
0.03				
Alpha	1.63	Stream Power (lb/ft s)	628.24	0.00
0.00				
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	1.20	2.88
2.05				
C & E Loss (ft)	0.00	Cum SA (acres)	0.61	0.11
1.17				

CROSS SECTION

RIVER: Buffalo Calf For
REACH: Buffalo Calf For RS: 324.75

INPUT
Description:
Station Elevation Data num= 113

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	9342.960022		9326.070007	930.186.390015		9309.240021		928.22	
9.630005	92812.43002	926.2512.87003		92613.26001		925.75	16	924	

18.30002	922.41	18.91	92219.77002		921.4121.86002		920	24.66	918.02
24.70001	91824.74002		917.97	28.5	916	29.72	915.2331.70001		914
32.95001	913.22	34.91	912	36.19	911.1938.17001		91040.34003		908.63
41.37003	90843.45001		906.6744.59003		90646.02002		905.04	47.75	904
50.81003	903.2456.53003		90261.58002		90266.36002		902.13	69.91	902
76.63	901.58	82.19	901.293.73001		900.6999.12003		900.56	110.36	900.43
112.92	900.39	116.87	900.14	123.94	900.15	126.52	900.14	140.47	900.16
145.81	900.07	150.27	900.04	152.58	900	152.63	899.73	152.68	899.77
152.97	898.32	154.62	898.18	155.89	898.25	160.69	898.27	162.23	898.22
162.68	899.73	162.75	899.76	162.82	900	163.41	900	165.02	900
175.82	900	200.42	900.03	213.24	900.04	214.35	900.04	275.53	900.86
307.97	901.12	314.64	901.16	326.62	901.31	343.82	901.69	353.23	901.88
365.82	901.8	366.96	901.87	368.97	902	371.65	903.54	372.39	904
373.95	905.67	374.28	906	375.09	906	375.22	906	376.75	904.29
377.02	904	432.91	904	439.42	904	440.65	905.78	440.82	906
442.33	906	442.48	906	443.37	905.47	443.4	905.45	446.16	904
450.77	905.13	453.33	905.61	458.15	906	478.48	907.85	479.61	908
479.93	908.01	480.35	908	482.55	908	490.97	907.97	492.82	908
493.55	908.74	494.85	910	496.39	911.44	496.95	912	497.63	912.69
499.16	914	500.78	915.63	501.22	916	501.59	916.26	503.45	918
506.5	919.7	507.15	920	508.39	920.61				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	152.58	.035	162.82	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
152.58	162.82	13.81	13.81	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	904.03	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.02	Wt. n-Val.	0.050	0.035
0.050				
W.S. Elev (ft)	904.01	Reach Len. (ft)	13.81	13.81
13.81				
Crit W.S. (ft)	901.45	Flow Area (sq ft)	321.27	58.09
677.05				
E.G. Slope (ft/ft)	0.000203	Area (sq ft)	321.27	58.09
677.05				
Q Total (cfs)	1007.00	Flow (cfs)	286.76	95.49
624.75				
Top Width (ft)	387.18	Top Width (ft)	104.85	10.24
272.08				
Vel Total (ft/s)	0.95	Avg. Vel. (ft/s)	0.89	1.64
0.92				
Max Chl Dpth (ft)	5.83	Hydr. Depth (ft)	3.06	5.67
2.49				
Conv. Total (cfs)	70601.9	Conv. (cfs)	20105.0	6694.7
43802.2				
Length Wtd. (ft)	13.81	Wetted Per. (ft)	105.14	12.99
272.67				
Min Ch El (ft)	898.18	Shear (lb/sq ft)	0.04	0.06
0.03				
Alpha	1.11	Stream Power (lb/ft s)	508.39	0.00
0.00				
Frctn Loss (ft)		Cum Volume (acre-ft)	0.93	2.72
0.62				
C & E Loss (ft)		Cum SA (acres)	0.52	0.08
0.58				

CULVERT

RIVER: Buffalo Calf For
REACH: Buffalo Calf For RS: 320

INPUT
Description:
Distance from Upstream XS = .5
Deck/Roadway Width = 12
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
152.58	900	898	160	900.65	898	165	900	898

Upstream Bridge Cross Section Data
Station Elevation Data num= 113

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	9342.960022		9326.070007		930.186.390015		9309.240021		928.22
9.630005	92812.43002		926.2512.87003		92613.26001		925.75	16	924
18.30002	922.41	18.91	92219.77002		921.4121.86002		920	24.66	918.02
24.70001	91824.74002		917.97	28.5	916	29.72	915.2331.70001		914
32.95001	913.22	34.91	912	36.19	911.1938.17001		91040.34003		908.63
41.37003	90843.45001		906.6744.59003		90646.02002		905.04	47.75	904
50.81003	903.2456.53003		90261.58002		90266.36002		902.13	69.91	902
76.63	901.58	82.19	901.293.73001		900.6999.12003		900.56	110.36	900.43
112.92	900.39	116.87	900.14	123.94	900.15	126.52	900.14	140.47	900.16
145.81	900.07	150.27	900.04	152.58	900	152.63	899.73	152.68	899.77
152.97	898.32	154.62	898.18	155.89	898.25	160.69	898.27	162.23	898.22
162.68	899.73	162.75	899.76	162.82	900	163.41	900	165.02	900
175.82	900	200.42	900.03	213.24	900.04	214.35	900.04	275.53	900.86
307.97	901.12	314.64	901.16	326.62	901.31	343.82	901.69	353.23	901.88
365.82	901.8	366.96	901.87	368.97	902	371.65	903.54	372.39	904
373.95	905.67	374.28	906	375.09	906	375.22	906	376.75	904.29
377.02	904	432.91	904	439.42	904	440.65	905.78	440.82	906
442.33	906	442.48	906	443.37	905.47	443.4	905.45	446.16	904
450.77	905.13	453.33	905.61	458.15	906	478.48	907.85	479.61	908
479.93	908.01	480.35	908	482.55	908	490.97	907.97	492.82	908
493.55	908.74	494.85	910	496.39	911.44	496.95	912	497.63	912.69
499.16	914	500.78	915.63	501.22	916	501.59	916.26	503.45	918
506.5	919.7	507.15	920	508.39	920.61				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	152.58	.035	162.82	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
152.58	162.82	.1	.3

Downstream Deck/Roadway Coordinates
num= 3

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
218.9	898.5	898	240.7	900.65	898.1	251	900	898

Downstream Bridge Cross Section Data
Station Elevation Data num= 110

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	913.033.039978		91213.41998		911.8214.77002		911.8324.60999		910.95
32.71002	91038.65002		909.0645.26999		908	48.09	906.7849.92001		906
51.63	905.3654.64001		90456.86002		903.1659.32001		90262.89001		900.43

64.04999	90	74.64001	899.17	76.84	899.14	79.23001	899.24	86.28	899.11
90.84	899.09	103.58	899.29	112.91	899.33	122.83	899.35	126.77	899.44
128.96	899.53	130.36	899.52	131	899.52	131.69	899.52	132.35	899.52
133.74	899.53	144.45	899.48	147.97	899.47	148.14	899.47	155.25	899.41
173.91	899.07	182.9	898.97	191.17	898.88	201.76	898.55	204.35	898.52
207.73	898.52	211.05	898.58	219.21	898	219.63	898	231.98	897.99
234.85	898	236.56	898	240.68	898.15	243.05	898.18	244.27	898.27
244.36	898.3	244.84	900	249.19	900	262.63	900	267.01	900
275.37	900.01	294.73	900.02	296.5	900.02	318.77	900.32	360.66	900.6
370.06	900.64	375.86	900.71	408.26	901.45	416.02	901.62	416.06	901.62
417.88	901.74	418.01	901.75	419.93	901.83	422.61	901.97	422.65	901.97
423.19	902	423.87	902.36	426.76	904	427.28	904.58	428.61	906
428.94	906	429.61	906	430.17	905.37	431.41	904	441.12	904
443.3	904	485.07	904	489.18	904	495.09	904	496.06	905.41
496.39	906	497.59	906	498.16	906	499.44	905.49	500.82	904.76
502.26	904	506.54	905.05	509.54	905.72	510.36	906	519.97	906.15
530.32	906.16	538.67	906.05	541.47	906.1	541.72	906.12	542.15	906.17
543.29	907.03	544.58	908	546.8	909.97	546.84	910	546.86	910.02
547.05	910.19	549.11	912	549.37	912.22	551.4	914	553.69	916

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	211.05	.035	244.27	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
211.05	244.27	.1	.3

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

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Circular	2	

FHWA Chart # 1 - Concrete Pipe Culvert
FHWA Scale # 1 - Square edge entrance with headwall
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	.1	13.7	.024	.024	0	.5	1

Upstream Elevation = 898.18
Centerline Station = 160.7
Downstream Elevation = 898.1
Centerline Station = 240.7

CULVERT OUTPUT Profile #PF 1 Culv Group: Culvert #1

Q Culv Group (cfs)	2.33	Culv Full Len (ft)	13.70
# Barrels	1	Culv Vel US (ft/s)	0.74
Q Barrel (cfs)	2.33	Culv Vel DS (ft/s)	0.74
E.G. US. (ft)	904.03	Culv Inv El Up (ft)	898.18
W.S. US. (ft)	904.01	Culv Inv El Dn (ft)	898.10
E.G. DS (ft)	904.02	Culv Frctn Ls (ft)	0.00
W.S. DS (ft)	904.01	Culv Exit Loss (ft)	0.00
Delta EG (ft)	0.01	Culv Entr Loss (ft)	0.00
Delta WS (ft)	0.00	Q Weir (cfs)	1000.12
E.G. IC (ft)	904.03	Weir Sta Lft (ft)	47.70

E.G. OC (ft)	904.03	Weir Sta Rgt (ft)	446.28
Culvert Control	Outlet	Weir Submerg	1.00
Culv WS Inlet (ft)	900.18	Weir Max Depth (ft)	4.03
Culv WS Outlet (ft)	900.10	Weir Avg Depth (ft)	2.69
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	1041.48
Culv Crt Depth (ft)	0.53	Min El Weir Flow (ft)	900.01

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported inlet energy grade answer may not be valid.
Warning: During the culvert outlet control computations, the program could not balance the culvert/weir flow. The reported outlet energy grade answer may not be valid.

CROSS SECTION

RIVER: Buffalo Calf For
REACH: Buffalo Calf For RS: 310.94

INPUT
Description:
Station Elevation Data num= 110

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	913.03	3.039978	912	13.41998	911.82	14.77002	911.83	24.60999	910.95
32.71002	910	38.65002	909.06	45.26999	908	48.09	906.78	49.92001	906
51.63	905.36	54.64001	904	56.86002	903.16	59.32001	902	62.89001	900.43
64.04999	900	74.64001	899.17	76.84	899.14	79.23001	899.24	86.28	899.11
90.84	899.09	103.58	899.29	112.91	899.33	122.83	899.35	126.77	899.44
128.96	899.53	130.36	899.52	131	899.52	131.69	899.52	132.35	899.52
133.74	899.53	144.45	899.48	147.97	899.47	148.14	899.47	155.25	899.41
173.91	899.07	182.9	898.97	191.17	898.88	201.76	898.55	204.35	898.52
207.73	898.52	211.05	898.58	219.21	898	219.63	898	231.98	897.99
234.85	898	236.56	898	240.68	898.15	243.05	898.18	244.27	898.27
244.36	898.3	244.84	900	249.19	900	262.63	900	267.01	900
275.37	900.01	294.73	900.02	296.5	900.02	318.77	900.32	360.66	900.6
370.06	900.64	375.86	900.71	408.26	901.45	416.02	901.62	416.06	901.62
417.88	901.74	418.01	901.75	419.93	901.83	422.61	901.97	422.65	901.97
423.19	902	423.87	902.36	426.76	904	427.28	904.58	428.61	906
428.94	906	429.61	906	430.17	905.37	431.41	904	441.12	904
443.3	904	485.07	904	489.18	904	495.09	904	496.06	905.41
496.39	906	497.59	906	498.16	906	499.44	905.49	500.82	904.76
502.26	904	506.54	905.05	509.54	905.72	510.36	906	519.97	906.15
530.32	906.16	538.67	906.05	541.47	906.1	541.72	906.12	542.15	906.17
543.29	907.03	544.58	908	546.8	909.97	546.84	910	546.86	910.02
547.05	910.19	549.11	912	549.37	912.22	551.4	914	553.69	916

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	211.05	.035	244.27	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
211.05	244.27	45.23	45.23	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	904.02	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.050	0.035	0.050

W.S. Elev (ft)	904.01	Reach Len. (ft)	45.23	45.23	45.23
Crit W.S. (ft)		Flow Area (sq ft)	726.06	196.43	629.55
E.G. Slope (ft/ft)	0.000061	Area (sq ft)	726.06	196.43	629.55
Q Total (cfs)	1007.00	Flow (cfs)	465.42	212.07	329.51
Top Width (ft)	435.92	Top Width (ft)	156.44	33.22	246.27
Vel Total (ft/s)	0.65	Avg. Vel. (ft/s)	0.64	1.08	0.52
Max Chl Dpth (ft)	6.02	Hydr. Depth (ft)	4.64	5.91	2.56
Conv. Total (cfs)	129418.5	Conv. (cfs)	59815.5	27255.1	42347.9
Length Wtd. (ft)	45.23	Wetted Per. (ft)	157.31	33.25	248.12
Min Ch El (ft)	897.99	Shear (lb/sq ft)	0.02	0.02	0.01
Alpha	1.25	Stream Power (lb/ft s)	553.69	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	0.93	2.39	0.62
C & E Loss (ft)	0.00	Cum SA (acres)	0.47	0.08	0.50

Warning: Divided flow computed for this cross-section.

CROSS SECTION

RIVER: Buffalo Calf For
REACH: Buffalo Calf For RS: 265.71

INPUT
Description:
Station Elevation Data num= 139

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	922.61.369995		9222.650024		921.486.410034		9208.720032		919.08
11.35004	918	13.38	917.1716.04004		91619.21002		914.6920.76001		914
25.43005	913.436.48004		912.8651.82001		912.0556.72003		91258.07001		911.71
65.98004	911.181.02002		910	103.08	908.11	103.83	908	104.29	907.82
108.23	906	109	905.6	112.2	904	115.3	902.18	115.6	902
116.72	901.31	118.75	899.76	118.83	899.76	119.47	899.72	122.05	898.14
122.5	898.18	127.86	898.3	129.27	898.23	135.45	898.22	137.87	898.08
141.31	898.12	146.77	898.12	155.76	898.17	159.02	898.17	162.05	898.14
166.15	898.17	167.47	898.2	167.73	898.2	167.93	898.2	168.12	898.21
181.21	898	181.26	898	181.28	898	190.89	898	202.32	898.26
209.14	898.52	213.54	898.51	215.52	898.51	217.69	898.51	219.74	898.49
224.11	898.54	226.99	898.52	237.02	898.49	237.52	898.49	257.93	898.3
270.93	898.06	277.28	898.03	286.21	898	296.15	897.87	299.19	897.84
309.14	897.22	320.13	897.31	320.27	897.32	320.5	897.34	321.73	897.36
321.77	897.36	321.85	897.35	321.86	897.35	322.81	897.79	323.3	898
327.96	899.39	340.76	899.74	341.21	899.56	342	899.59	342.35	899.64
353.06	900	357.63	900	357.75	900	368.51	900	385.21	900
385.56	900	402.67	900.14	416.87	900.22	419.2	900.25	443.52	900.79
443.58	900.79	446.31	900.89	446.53	900.9	453.91	901.13	469.16	901.83
470.48	901.9	470.62	901.9	472.48	902	474.87	903.27	476.16	904
477.4	905.39	477.96	906	478.73	906	479.01	906	480.31	904.55
480.8	904	503.15	904	508.28	904	520.79	904	530.83	904

545.51	904	545.85	904.5	546.69	906	547.14	906	548.59	906
551.85	904.7	552.29	904.46	555.32	905.42	557.69	906	558.82	906
559.9901	906	562.02	906.03	566.29	906	577.5	905.89	579.88	905.87
580.45	905.86	581.61	905.88	589.16	906	590.47	907.35	591.14	908
592.19	909.12	593.06	910	594.63	911.63	595.01	912	595.52	912.41
597.38	914	598.51	915.06	599.61	916	601.4	918		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	299.19	.035	322.81	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
299.19	322.81	65.71	65.71	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	904.02	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	904.01	Reach Len. (ft)	65.71	65.71	65.71
Crit W.S. (ft)	899.21	Flow Area (sq ft)	1056.49	156.27	564.10
E.G. Slope (ft/ft)	0.000039	Area (sq ft)	1056.49	156.27	564.10
Q Total (cfs)	1007.00	Flow (cfs)	615.25	144.85	246.90
Top Width (ft)	428.72	Top Width (ft)	187.01	23.62	218.09
Vel Total (ft/s)	0.57	Avg. Vel. (ft/s)	0.58	0.93	0.44
Max Chl Dpth (ft)	6.79	Hydr. Depth (ft)	5.65	6.62	2.59
Conv. Total (cfs)	162002.7	Conv. (cfs)	98978.9	23303.5	39720.2
Length Wtd. (ft)	65.71	Wetted Per. (ft)	188.75	23.74	218.94
Min Ch El (ft)	897.22	Shear (lb/sq ft)	0.01	0.02	0.01
Alpha	1.18	Stream Power (lb/ft s)	601.40	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)		2.20	
C & E Loss (ft)		Cum SA (acres)	0.30	0.05	0.26

CULVERT

RIVER: Buffalo Calf For
REACH: Buffalo Calf For RS: 233

INPUT
Description:
Distance from Upstream XS = .1
Deck/Roadway Width = 58.7
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 5

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
288.2	900	896	310	901.67	896	320.1	901.67	896
336	901.67	896	340	900.75	896			

Upstream Bridge Cross Section Data

Station Elevation Data num= 139

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	922.61	369995	922	2.650024	921.48	6.410034	9208	.720032	919.08
11.35004	918	13.38	917.17	16.04004	916	19.21002	914.69	20.76001	914
25.43005	913.43	6.48004	912.86	51.82001	912.05	56.72003	912	58.07001	911.71
65.98004	911.18	1.02002	910	103.08	908.11	103.83	908	104.29	907.82
108.23	906	109	905.6	112.2	904	115.3	902.18	115.6	902
116.72	901.31	118.75	899.76	118.83	899.76	119.47	899.72	122.05	898.14
122.5	898.18	127.86	898.3	129.27	898.23	135.45	898.22	137.87	898.08
141.31	898.12	146.77	898.12	155.76	898.17	159.02	898.17	162.05	898.14
166.15	898.17	167.47	898.2	167.73	898.2	167.93	898.2	168.12	898.21
181.21	898	181.26	898	181.28	898	190.89	898	202.32	898.26
209.14	898.52	213.54	898.51	215.52	898.51	217.69	898.51	219.74	898.49
224.11	898.54	226.99	898.52	237.02	898.49	237.52	898.49	257.93	898.3
270.93	898.06	277.28	898.03	286.21	898	296.15	897.87	299.19	897.84
309.14	897.22	320.13	897.31	320.27	897.32	320.5	897.34	321.73	897.36
321.77	897.36	321.85	897.35	321.86	897.35	322.81	897.79	323.3	898
327.96	899.39	340.76	899.74	341.21	899.56	342	899.59	342.35	899.64
353.06	900	357.63	900	357.75	900	368.51	900	385.21	900
385.56	900	402.67	900.14	416.87	900.22	419.2	900.25	443.52	900.79
443.58	900.79	446.31	900.89	446.53	900.9	453.91	901.13	469.16	901.83
470.48	901.9	470.62	901.9	472.48	902	474.87	903.27	476.16	904
477.4	905.39	477.96	906	478.73	906	479.01	906	480.31	904.55
480.8	904	503.15	904	508.28	904	520.79	904	530.83	904
545.51	904	545.85	904.5	546.69	906	547.14	906	548.59	906
551.85	904.7	552.29	904.46	555.32	905.42	557.69	906	558.82	906
559.9901	906	562.02	906.03	566.29	906	577.5	905.89	579.88	905.87
580.45	905.86	581.61	905.88	589.16	906	590.47	907.35	591.14	908
592.19	909.12	593.06	910	594.63	911.63	595.01	912	595.52	912.41
597.38	914	598.51	915.06	599.61	916	601.4	918		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	299.19	.035	322.81	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
299.19	322.81	.1	.3

Downstream Deck/Roadway Coordinates

num= 5

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
421	898.67	898	432.8	900.25	896	444.85	900.25	896
457.1	900.25	896	466	898.67	896			

Downstream Bridge Cross Section Data

Station Elevation Data num= 139

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	912.83	12.66003	912.61	4.64001	912.51	15.44	912.47	15.65002	912.45
15.67004	912.44	15.69	912.44	15.71002	912.43	22.07001	912.96	22.29999	912.97
22.33002	912.96	48.12	912.94	50.02002	912.84	53.32001	912.65	61.46002	912
69.54004	910.87	6.14001	910.45	85.87	910	94.40002	909.65	116.99	908.51
124.74	908.14	126.91	908	129.45	907.8	155.02	906	166.5	904.7
171.39	904	178.74	904	181.42	904	186.71	904	189.75	904
196.03	904	208.79	904	211.61	904.05	214.12	904.1	215.17	904.12
218.43	904.07	221.18	904	222.7	903.58	228.61	902.25	229.37	902.07
229.71	902	236.14	900.45	238.11	900	245.16	899.21	255.33	898.59
258.94	898.29	263.35	898	283.85	898	288.12	898	299.05	898
300.21	898	300.82	898	307.25	898.14	314.21	898.15	319.26	898.15

319.27	898.15	335.83	898.21	336.38	898.21	336.5	898.2	336.51	898.2
343.9	898.13	354.58	898.06	354.59	898.06	354.69	898.04	367.29	898.03
372.72	897.98	383.41	897.99	388.22	898	392.84	898	403.3	898.04
410.04	897.67	411.71	898	417.38	898	421.14	898	427.14	898
432.87	896.88	436.65	896	440.2	895.94	441.48	895.92	443.71	895.89
446.24	895.92	451.73	896	456.29	896.73	465.11	898	467.6	898.04
469.35	898.16	470.17	898.16	471.62	898.18	488.68	898.76	511.26	899.95
511.86	899.98	522.03	900.19	522.26	900.2	522.86	900.22	526.35	900.27
527.02	900.24	527.72	900.26	531.45	900.16	543.26	900.52	545.53	900.47
554.91	900.89	555.03	900.89	555.92	900.91	558.55	900.97	558.9	900.97
579.22	902	589.08	903.09	592.45	904	594.54	904	595.87	904
597.08	904	597.54	904	600.38	904.06	603.96	904.12	607.56	904.06
610.22	904	615.52	904	616.06	904	616.34	904.1	619.55	906
621.15	907.54	621.62	908	621.88	908.29	623.61	910	624.28	910.73
625.5	912	627.36	913.68	627.77	914	628.07	914.24	630.35	916
631.52	916.96	632.84	918	635.62	919.61	636.39	920	637.06	920.35
640.56	922	643.15	923.24	644.93	924	645.08	924.08		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	427.14	.035	465.11	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
427.14	465.11	.1	.3

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

Number of Culverts = 1

Culvert Name Shape Rise Span
Culvert #1 Circular 5
FHWA Chart # 2 - Corrugated Metal Pipe Culvert
FHWA Scale # 3 - Pipe projecting from fill
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
1	.1	58.7	.24	.24	0	.5	1

Upstream Elevation = 895.81
Centerline Station = 320
Downstream Elevation = 894.5
Centerline Station = 440.5

CULVERT OUTPUT Profile #PF 1 Culv Group: Culvert #1

Q Culv Group (cfs)	2.66	Culv Full Len (ft)	58.70
# Barrels	1	Culv Vel US (ft/s)	0.14
Q Barrel (cfs)	2.66	Culv Vel DS (ft/s)	0.14
E.G. US. (ft)	904.02	Culv Inv El Up (ft)	895.81
W.S. US. (ft)	904.01	Culv Inv El Dn (ft)	894.50
E.G. DS (ft)	904.00	Culv Frctn Ls (ft)	0.02
W.S. DS (ft)	903.99	Culv Exit Loss (ft)	0.00
Delta EG (ft)	0.02	Culv Entr Loss (ft)	0.00
Delta WS (ft)	0.02	Q Weir (cfs)	1004.34
E.G. IC (ft)	904.00	Weir Sta Lft (ft)	112.19
E.G. OC (ft)	904.02	Weir Sta Rgt (ft)	545.51
Culvert Control	Outlet	Weir Submerg	1.00

Culv WS Inlet (ft)	900.81	Weir Max Depth (ft)	6.03
Culv WS Outlet (ft)	899.50	Weir Avg Depth (ft)	3.76
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	1609.97
Culv Crt Depth (ft)	0.44	Min El Weir Flow (ft)	897.98

Warning: During subcritical analysis, while trying to calculate culvert and weir flow, the program could not get a balance of
energy within the specified tolerance and number of trials. The program used the solution with the minimum error.
Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported inlet
energy grade answer may not be valid.

CROSS SECTION

RIVER: Buffalo Calf For
REACH: Buffalo Calf For RS: 200

INPUT
Description:
Station Elevation Data num= 139

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	912.83	12.66003	912.61	4.64001	912.51	15.44	912.47	15.65002	912.45
15.67004	912.44	15.69	912.44	15.71002	912.43	22.07001	912.96	22.29999	912.97
22.33002	912.96	48.12	912.94	50.02002	912.84	53.32001	912.65	61.46002	912
69.54004	910.87	6.14001	910.45	85.87	91	094.40002	909.65	116.99	908.51
124.74	908.14	126.91	908	129.45	907.8	155.02	906	166.5	904.7
171.39	904	178.74	904	181.42	904	186.71	904	189.75	904
196.03	904	208.79	904	211.61	904.05	214.12	904.1	215.17	904.12
218.43	904.07	221.18	904	222.7	903.58	228.61	902.25	229.37	902.07
229.71	902	236.14	900.45	238.11	900	245.16	899.21	255.33	898.59
258.94	898.29	263.35	898	283.85	898	288.12	898	299.05	898
300.21	898	300.82	898	307.25	898.14	314.21	898.15	319.26	898.15
319.27	898.15	335.83	898.21	336.38	898.21	336.5	898.2	336.51	898.2
343.9	898.13	354.58	898.06	354.59	898.06	354.69	898.04	367.29	898.03
372.72	897.98	383.41	897.99	388.22	898	392.84	898	403.3	898.04
410.04	897.67	411.71	898	417.38	898	421.14	898	427.14	898
432.87	896.88	436.65	896	440.2	895.94	441.48	895.92	443.71	895.89
446.24	895.92	451.73	896	456.29	896.73	465.11	898	467.6	898.04
469.35	898.16	470.17	898.16	471.62	898.18	488.68	898.76	511.26	899.95
511.86	899.98	522.03	900.19	522.26	900.2	522.86	900.22	526.35	900.27
527.02	900.24	527.72	900.26	531.45	900.16	543.26	900.52	545.53	900.47
554.91	900.89	555.03	900.89	555.92	900.91	558.55	900.97	558.9	900.97
579.22	902	589.08	903.09	592.45	904	594.54	904	595.87	904
597.08	904	597.54	904	600.38	904.06	603.96	904.12	607.56	904.06
610.22	904	615.52	904	616.06	904	616.34	904.1	619.55	906
621.15	907.54	621.62	908	621.88	908.29	623.61	910	624.28	910.73
625.5	912	627.36	913.68	627.77	914	628.07	914.24	630.35	916
631.52	916.96	632.84	918	635.62	919.61	636.39	920	637.06	920.35
640.56	922	643.15	923.24	644.93	924	645.08	924.08		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	427.14	.035	465.11	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
427.14	465.11	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	904.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	903.99	Reach Len. (ft)			
Crit W.S. (ft)	898.92	Flow Area (sq ft)	1136.68	280.63	475.72
E.G. Slope (ft/ft)	0.000030	Area (sq ft)	1136.68	280.63	475.72
Q Total (cfs)	1007.00	Flow (cfs)	575.62	245.55	185.83
Top Width (ft)	371.20	Top Width (ft)	205.92	37.97	127.30
Vel Total (ft/s)	0.53	Avg. Vel. (ft/s)	0.51	0.88	0.39
Max Chl Dpth (ft)	8.10	Hydr. Depth (ft)	5.52	7.39	3.74
Conv. Total (cfs)	184221.3	Conv. (cfs)	105303.6	44921.7	33996.0
Length Wtd. (ft)		Wetted Per. (ft)	206.52	38.33	127.58
Min Ch El (ft)	895.89	Shear (lb/sq ft)	0.01	0.01	0.01
Alpha	1.28	Stream Power (lb/ft s)	645.08	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

SUMMARY OF MANNING'S N VALUES

River:Buffalo Calf For

Reach	River Sta.	n1	n2	n3
Buffalo Calf For	397.97	.05	.035	.05
Buffalo Calf For	324.75	.05	.035	.05
Buffalo Calf For	320	Culvert		
Buffalo Calf For	310.94	.05	.035	.05
Buffalo Calf For	265.71	.05	.035	.05
Buffalo Calf For	233	Culvert		
Buffalo Calf For	200	.05	.035	.05

SUMMARY OF REACH LENGTHS

River: Buffalo Calf For

Reach	River Sta.	Left	Channel	Right
Buffalo Calf For	397.97	73.22	73.22	73.22
Buffalo Calf For	324.75	13.81	13.81	13.81
Buffalo Calf For	320	Culvert		
Buffalo Calf For	310.94	45.23	45.23	45.23

Buffalo Calf For	265.71	65.71	65.71	65.71
Buffalo Calf For	233	Culvert		
Buffalo Calf For	200			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Buffalo Calf For

Reach	River Sta.	Contr.	Expan.
Buffalo Calf For	397.97	.1	.3
Buffalo Calf For	324.75	.1	.3
Buffalo Calf For	320	Culvert	
Buffalo Calf For	310.94	.1	.3
Buffalo Calf For	265.71	.1	.3
Buffalo Calf For	233	Culvert	
Buffalo Calf For	200	.1	.3

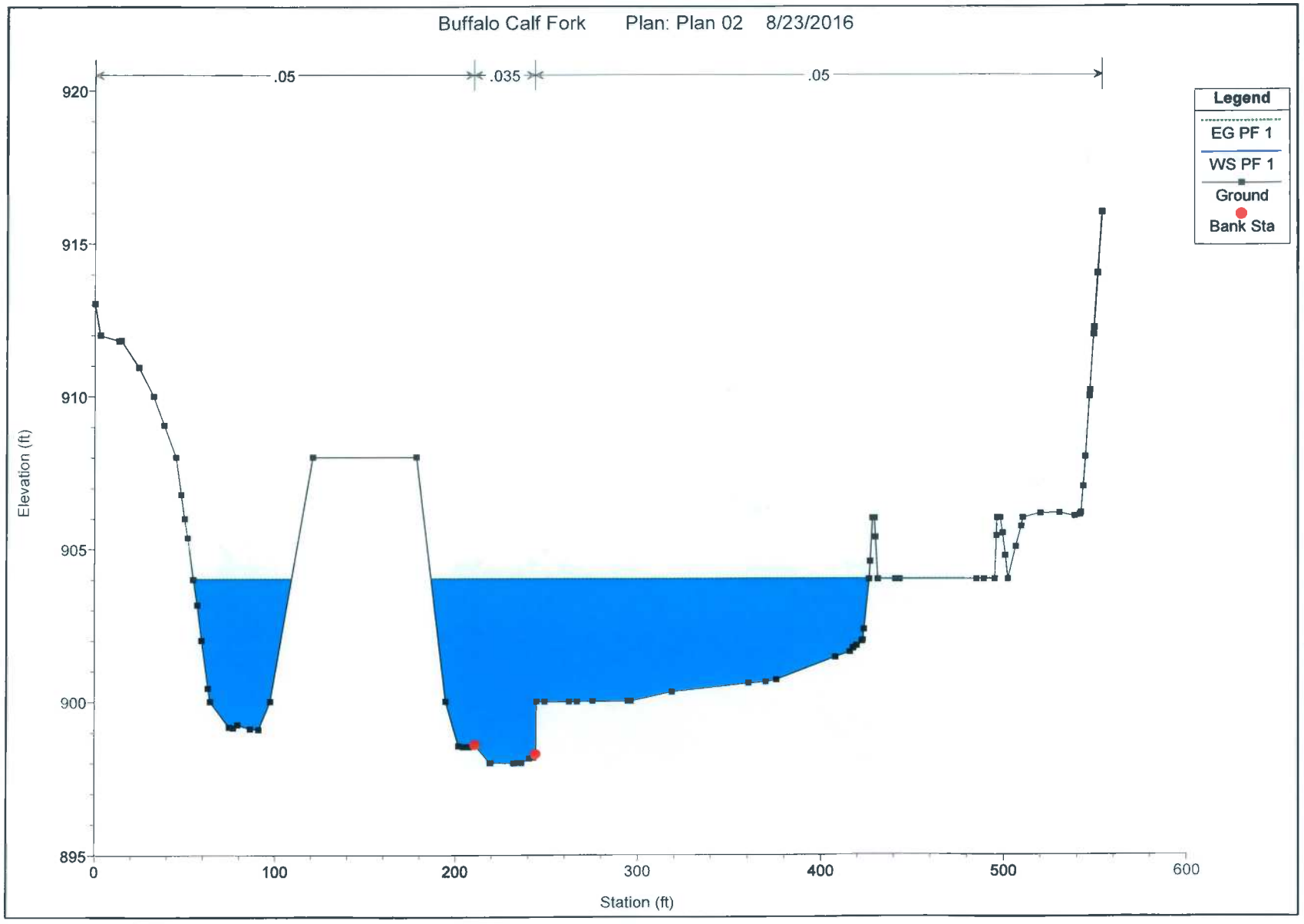
Profile Output Table - Standard Table 1

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)		
Buffalo Calf For	397.97	PF 1	1007.00	898.00	904.03	
904.04	0.000185	1.80	1175.55	448.97	0.13	
Buffalo Calf For	324.75	PF 1	1007.00	898.18	904.01	
901.45 904.03	0.000203	1.64	1056.41	387.18	0.12	
Buffalo Calf For	320		Culvert			
Buffalo Calf For	310.94	PF 1	1007.00	897.99	904.01	
904.02	0.000061	1.08	1552.04	435.92	0.08	
Buffalo Calf For	265.71	PF 1	1007.00	897.22	904.01	
899.21 904.02	0.000039	0.93	1776.87	428.72	0.06	
Buffalo Calf For	233		Culvert			
Buffalo Calf For	200	PF 1	1007.00	895.89	903.99	
898.92 904.00	0.000030	0.88	1893.03	371.20	0.06	

POST-CONSTRUCTION CONDITIONS

HEC-RAS Plan: Plan 02 River: Buffalo Calf For Reach: Buffalo Calf For Profile: PF 1

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)	
Buffalo Calf For	397.97	PF 1	1007.00	898.00	904.03		904.05	0.000184	1.79	1177.11	448.99	0.13
Buffalo Calf For	324.75	PF 1	1007.00	898.18	904.02	901.45	904.03	0.000203	1.64	1057.76	387.21	0.12
Buffalo Calf For	320		Culvert									
Buffalo Calf For	310.94	PF 1	1007.00	897.99	904.01		904.02	0.000124	1.54	1122.10	358.54	0.11
Buffalo Calf For	265.71	PF 1	1007.00	897.22	904.01	899.21	904.02	0.000039	0.93	1776.87	428.72	0.06
Buffalo Calf For	233		Culvert									
Buffalo Calf For	200	PF 1	1007.00	895.89	903.99	898.92	904.00	0.000030	0.88	1893.03	371.20	0.06


Buffalo Calf Fork Plan: Plan 02 8/23/2016
.05
.035
.05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
920
915
910
905
900
895
0
100
200
300
400
500
600
Station (ft)

BuffaloCalfFork.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: Buffalo Calf Fork
Project File : BuffaloCalfFork.prj
Run Date and Time: 8/23/2016 7:44:38 AM

Project in English units

PLAN DATA

Plan Title: Plan 02
Plan File :
i:\Projects\09545\095452088\LD\Floodplain\SusieJane\HecRas\BuffaloCalfFork.p02

Geometry Title: Buffalo Calf Fork w/stockpile
Geometry File :
i:\Projects\09545\095452088\LD\Floodplain\SusieJane\HecRas\BuffaloCalfFork.g02

Flow Title : Buffalo Calf Fork
Flow File :
i:\Projects\09545\095452088\LD\Floodplain\SusieJane\HecRas\BuffaloCalfFork.f01

Plan Summary Information:

Number of:	Cross Sections	= 5	Multiple Openings	=	0
	Culverts	= 2	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: Buffalo Calf Fork
Flow File :
i:\Projects\09545\095452088\LD\Floodplain\SusieJane\HecRas\BuffaloCalfFork.f01

Flow Data (cfs)

River	Reach	RS	PF 1
Buffalo Calf For	Buffalo Calf For	397.97	1007

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Buffalo Calf For	Buffalo Calf For	PF 1		

Known WS = 903.99

GEOMETRY DATA

Geometry Title: Buffalo Calf Fork w/stockpile
Geometry File :
i:\Projects\09545\095452088\LD\Floodplain\SusieJane\HecRas\BuffaloCalfFork.g02

CROSS SECTION

RIVER: Buffalo Calf For
REACH: Buffalo Calf For RS: 397.97

INPUT
Description:
Station Elevation Data num= 136

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	939.28	2.97998	938.29	3.859985	9384.440002		937.81	9.799988	936
10.83997	935.59	15.32001	9341	8.21997	932.48	19.10999	9322	2.45001	930.19
22.81	9302	6.02997	928.26	26.51001	9282	7.32001	927.57	30.22998	926
32.78998	924.62	33.94	9243	4.91998	923.48	37.90997	9224	0.83997	920.72
42.34998	9204	5.70001	918.48	46.56	9184	7.67999	917.37	50.22998	916
53.65997	914.08	53.78998	9145	3.91998	913.93	58.16998	9125	9.54999	911.72
69.90997	9117	7.51001	9108	0.28998	909.68	86.52997	908	86.87	907.95
88.64996	907.41	89.20001	907.22	92.52002	9069	3.33002	905.18	95.20001	904
96.01001	903.49	7.95996	9029	8.95001	900.92	100.32	900	102.42	898.22
102.87	898	107.63	898	111.32	898	113.4	898	118.56	898
120.73	898	121.63	898.55	124.1	900.02	127.91	900	132.62	900
139.56	900	144.03	900	151.86	900	168.12	900.02	174.92	900.02
183.99	900.02	192.41	900.03	253.63	900.85	269.72	901.12	298.42	901.4
303.37	901.46	308.24	901.49	324.08	901.86	328.08	902	330.61	902
334.03	902	337.56	902	345.17	902	356.36	902	370.8	902
372.4	902	374.86	902	393.86	902	405.5	902	406.07	902
406.72	902	414.89	902	418.26	902	423.43	902	428.02	902
430.38	902.04	504.59	903.08	515.21	903.34	535.83	903.81	544.02	904
550.24	905.45	552.48	906	553.09	906.35	555.75	908	557.4	909.13
558.86	910	560.82	911.32	561.91	912	564.13	913.48	564.8	914
566.22	915	567.95	916	571.94	916.2	572.94	916.25	573.91	916.22

579.64	916	580.84	915.94	582.77	916	584.43	916.73	586.86	918
587.99	918.69	590.12	920	590.74	920.52	592.46	922	593.65	922.93
594.8	924	595.64	924.72	597.21	926	598.8	927.3	599.61	928
600.64	928.89	602.04	930	603.39	931.05	604.54	932	606.92	933.17
608.65	934	612.87	935.67	613.7	936	614.03	936.14	616.16	937
618.29	937.86	618.64	938	619.22	938.22	623.82	940	627.35	941.26
628.24	941.57								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	100.32	.035	124.1	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
100.32	124.1	73.22	73.22	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	904.05	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.02	Wt. n-Val.	0.050	0.035
0.050				
W.S. Elev (ft)	904.03	Reach Len. (ft)	73.22	73.22
73.22				
Crit W.S. (ft)		Flow Area (sq ft)	10.29	137.57
1029.25				
E.G. Slope (ft/ft)	0.000184	Area (sq ft)	10.29	137.57
1029.25				
Q Total (cfs)	1007.00	Flow (cfs)	5.59	246.81
754.59				
Top Width (ft)	448.99	Top Width (ft)	5.17	23.78
420.04				
Vel Total (ft/s)	0.86	Avg. Vel. (ft/s)	0.54	1.79
0.73				
Max Chl Dpth (ft)	6.03	Hydr. Depth (ft)	1.99	5.79
2.45				
Conv. Total (cfs)	74186.2	Conv. (cfs)	412.2	18182.9
55591.0				
Length Wtd. (ft)	73.22	Wetted Per. (ft)	6.58	25.04
420.08				
Min Ch El (ft)	898.00	Shear (lb/sq ft)	0.02	0.06
0.03				
Alpha	1.63	Stream Power (lb/ft s)	628.24	0.00
0.00				
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	0.98	2.89
2.05				
C & E Loss (ft)	0.00	Cum SA (acres)	0.56	0.11
1.17				

CROSS SECTION

RIVER: Buffalo Calf For
REACH: Buffalo Calf For RS: 324.75

INPUT
Description:
Station Elevation Data num= 113

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	9342.960022		9326.070007	930.186.390015		9309.240021		928.22	
9.630005	92812.43002	926.2512.87003		92613.26001		925.75	16	924	

18.30002	922.41	18.91	92219.77002		921.4121.86002		920	24.66	918.02
24.70001	91824.74002		917.97	28.5	916	29.72	915.2331.70001		914
32.95001	913.22	34.91	912	36.19	911.1938.17001		91040.34003		908.63
41.37003	90843.45001		906.6744.59003		90646.02002		905.04	47.75	904
50.81003	903.2456.53003		90261.58002		90266.36002		902.13	69.91	902
76.63	901.58	82.19	901.293.73001		900.6999.12003		900.56	110.36	900.43
112.92	900.39	116.87	900.14	123.94	900.15	126.52	900.14	140.47	900.16
145.81	900.07	150.27	900.04	152.58	900	152.63	899.73	152.68	899.77
152.97	898.32	154.62	898.18	155.89	898.25	160.69	898.27	162.23	898.22
162.68	899.73	162.75	899.76	162.82	900	163.41	900	165.02	900
175.82	900	200.42	900.03	213.24	900.04	214.35	900.04	275.53	900.86
307.97	901.12	314.64	901.16	326.62	901.31	343.82	901.69	353.23	901.88
365.82	901.8	366.96	901.87	368.97	902	371.65	903.54	372.39	904
373.95	905.67	374.28	906	375.09	906	375.22	906	376.75	904.29
377.02	904	432.91	904	439.42	904	440.65	905.78	440.82	906
442.33	906	442.48	906	443.37	905.47	443.4	905.45	446.16	904
450.77	905.13	453.33	905.61	458.15	906	478.48	907.85	479.61	908
479.93	908.01	480.35	908	482.55	908	490.97	907.97	492.82	908
493.55	908.74	494.85	910	496.39	911.44	496.95	912	497.63	912.69
499.16	914	500.78	915.63	501.22	916	501.59	916.26	503.45	918
506.5	919.7	507.15	920	508.39	920.61				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	152.58	.035	162.82	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
152.58	162.82	13.81	13.81	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	904.03	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.02	Wt. n-Val.	0.050	0.035
0.050				
W.S. Elev (ft)	904.02	Reach Len. (ft)	13.81	13.81
13.81				
Crit W.S. (ft)	901.45	Flow Area (sq ft)	321.63	58.13
678.00				
E.G. Slope (ft/ft)	0.000203	Area (sq ft)	321.63	58.13
678.00				
Q Total (cfs)	1007.00	Flow (cfs)	286.79	95.42
624.79				
Top Width (ft)	387.21	Top Width (ft)	104.86	10.24
272.11				
Vel Total (ft/s)	0.95	Avg. Vel. (ft/s)	0.89	1.64
0.92				
Max Chl Dpth (ft)	5.84	Hydr. Depth (ft)	3.07	5.68
2.49				
Conv. Total (cfs)	70724.7	Conv. (cfs)	20142.2	6701.6
43880.9				
Length Wtd. (ft)	13.81	Wetted Per. (ft)	105.14	12.99
272.71				
Min Ch El (ft)	898.18	Shear (lb/sq ft)	0.04	0.06
0.03				
Alpha	1.11	Stream Power (lb/ft s)	508.39	0.00
0.00				
Frctn Loss (ft)		Cum Volume (acre-ft)	0.70	2.72
0.62				
C & E Loss (ft)		Cum SA (acres)	0.46	0.08
0.58				

CULVERT

RIVER: Buffalo Calf For
REACH: Buffalo Calf For RS: 320

INPUT
Description:
Distance from Upstream XS = .5
Deck/Roadway Width = 12
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 3

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
152.58	900	160	900.65	898	165	900	898

Upstream Bridge Cross Section Data
Station Elevation Data num= 113

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	9342.960022		9326.070007		930.186.390015		9309.240021		928.22
9.630005	92812.43002		926.2512.87003		92613.26001		925.75	16	924
18.30002	922.41	18.91	92219.77002		921.4121.86002		920	24.66	918.02
24.70001	91824.74002		917.97	28.5	916	29.72	915.2331.70001		914
32.95001	913.22	34.91	912	36.19	911.1938.17001		91040.34003		908.63
41.37003	90843.45001		906.6744.59003		90646.02002		905.04	47.75	904
50.81003	903.2456.53003		90261.58002		90266.36002		902.13	69.91	902
76.63	901.58	82.19	901.293.73001		900.6999.12003		900.56	110.36	900.43
112.92	900.39	116.87	900.14	123.94	900.15	126.52	900.14	140.47	900.16
145.81	900.07	150.27	900.04	152.58	900	152.63	899.73	152.68	899.77
152.97	898.32	154.62	898.18	155.89	898.25	160.69	898.27	162.23	898.22
162.68	899.73	162.75	899.76	162.82	900	163.41	900	165.02	900
175.82	900	200.42	900.03	213.24	900.04	214.35	900.04	275.53	900.86
307.97	901.12	314.64	901.16	326.62	901.31	343.82	901.69	353.23	901.88
365.82	901.8	366.96	901.87	368.97	902	371.65	903.54	372.39	904
373.95	905.67	374.28	906	375.09	906	375.22	906	376.75	904.29
377.02	904	432.91	904	439.42	904	440.65	905.78	440.82	906
442.33	906	442.48	906	443.37	905.47	443.4	905.45	446.16	904
450.77	905.13	453.33	905.61	458.15	906	478.48	907.85	479.61	908
479.93	908.01	480.35	908	482.55	908	490.97	907.97	492.82	908
493.55	908.74	494.85	910	496.39	911.44	496.95	912	497.63	912.69
499.16	914	500.78	915.63	501.22	916	501.59	916.26	503.45	918
506.5	919.7	507.15	920	508.39	920.61				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	152.58	.035	162.82	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
152.58	162.82	.1	.3

Downstream Deck/Roadway Coordinates
num= 3

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
218.9	898.5	898	240.7	900.65	898.1	251	900	898

Downstream Bridge Cross Section Data
Station Elevation Data num= 97

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	913.033.039978		91213.41998		911.8214.77002		911.8324.60999		910.95
32.71002	91038.65002		909.0645.26999		908	48.09	906.7849.92001		906
51.63	905.3654.64001		90456.86002		903.1659.32001		90262.89001		900.43

64.04999	90074.64001	899.17	76.84	899.1479.23001	899.24	86.28	899.11		
90.84	899.09	97.4	900	121.2	908	178.6	908	194.7	900
201.76	898.55	204.35	898.52	207.73	898.52	211.05	898.58	219.21	898
219.63	898	231.98	897.99	234.85	898	236.56	898	240.68	898.15
243.05	898.18	244.27	898.27	244.36	898.3	244.84	900	249.19	900
262.63	900	267.01	900	275.37	900.01	294.73	900.02	296.5	900.02
318.77	900.32	360.66	900.6	370.06	900.64	375.86	900.71	408.26	901.45
416.02	901.62	416.06	901.62	417.88	901.74	418.01	901.75	419.93	901.83
422.61	901.97	422.65	901.97	423.19	902	423.87	902.36	426.76	904
427.28	904.58	428.61	906	428.94	906	429.61	906	430.17	905.37
431.41	904	441.12	904	443.3	904	485.07	904	489.18	904
495.09	904	496.06	905.41	496.39	906	497.59	906	498.16	906
499.44	905.49	500.82	904.76	502.26	904	506.54	905.05	509.54	905.72
510.36	906	519.97	906.15	530.32	906.16	538.67	906.05	541.47	906.1
541.72	906.12	542.15	906.17	543.29	907.03	544.58	908	546.8	909.97
546.84	910	546.86	910.02	547.05	910.19	549.11	912	549.37	912.22
551.4	914	553.69	916						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	211.05	.035	244.27	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
211.05	244.27	.1	.3

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

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Circular	2	

FHWA Chart # 1 - Concrete Pipe Culvert
FHWA Scale # 1 - Square edge entrance with headwall
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
1	.1	13.7	.024	.024	0	.5	1

Upstream Elevation = 898.18
Centerline Station = 160.7
Downstream Elevation = 898.1
Centerline Station = 240.7

CULVERT OUTPUT Profile #PF 1 Culv Group: Culvert #1

Q Culv Group (cfs)	2.37	Culv Full Len (ft)	13.70
# Barrels	1	Culv Vel US (ft/s)	0.75
Q Barrel (cfs)	2.37	Culv Vel DS (ft/s)	0.75
E.G. US. (ft)	904.03	Culv Inv El Up (ft)	898.18
W.S. US. (ft)	904.02	Culv Inv El Dn (ft)	898.10
E.G. DS (ft)	904.02	Culv Frctn Ls (ft)	0.01
W.S. DS (ft)	904.01	Culv Exit Loss (ft)	0.00
Delta EG (ft)	0.01	Culv Entr Loss (ft)	0.00
Delta WS (ft)	0.01	Q Weir (cfs)	996.66
E.G. IC (ft)	904.03	Weir Sta Lft (ft)	47.70
E.G. OC (ft)	904.03	Weir Sta Rgt (ft)	446.29
Culvert Control	Outlet	Weir Submerg	1.00

Culv WS Inlet (ft)	900.18	Weir Max Depth (ft)	4.03
Culv WS Outlet (ft)	900.10	Weir Avg Depth (ft)	2.69
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	1042.83
Culv Crt Depth (ft)	0.54	Min El Weir Flow (ft)	900.01

Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported inlet energy grade answer may not be valid.

CROSS SECTION

RIVER: Buffalo Calf For
REACH: Buffalo Calf For RS: 310.94

INPUT
Description:
Station Elevation Data num= 97

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	913.03	3.039978	912	13.41998	911.82	14.77002	911.83	24.60999	910.95
32.71002	910	38.65002	909.06	45.26999	908	48.09	906.78	49.92001	906
51.63	905.36	54.64001	904	56.86002	903.16	59.32001	902	62.89001	900.43
64.04999	900	74.64001	899.17	76.84	899.14	79.23001	899.24	86.28	899.11
90.84	899.09	97.4	900	121.2	908	178.6	908	194.7	900
201.76	898.55	204.35	898.52	207.73	898.52	211.05	898.58	219.21	898
219.63	898	231.98	897.99	234.85	898	236.56	898	240.68	898.15
243.05	898.18	244.27	898.27	244.36	898.3	244.84	900	249.19	900
262.63	900	267.01	900	275.37	900.01	294.73	900.02	296.5	900.02
318.77	900.32	360.66	900.6	370.06	900.64	375.86	900.71	408.26	901.45
416.02	901.62	416.06	901.62	417.88	901.74	418.01	901.75	419.93	901.83
422.61	901.97	422.65	901.97	423.19	902	423.87	902.36	426.76	904
427.28	904.58	428.61	906	428.94	906	429.61	906	430.17	905.37
431.41	904	441.12	904	443.3	904	485.07	904	489.18	904
495.09	904	496.06	905.41	496.39	906	497.59	906	498.16	906
499.44	905.49	500.82	904.76	502.26	904	506.54	905.05	509.54	905.72
510.36	906	519.97	906.15	530.32	906.16	538.67	906.05	541.47	906.1
541.72	906.12	542.15	906.17	543.29	907.03	544.58	908	546.8	909.97
546.84	910	546.86	910.02	547.05	910.19	549.11	912	549.37	912.22
551.4	914	553.69	916						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	211.05	.035	244.27	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
211.05	244.27	45.23	45.23	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	904.02	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.02	Wt. n-Val.	0.050	0.035
0.050				
W.S. Elev (ft)	904.01	Reach Len. (ft)	45.23	45.23
45.23				
Crit W.S. (ft)		Flow Area (sq ft)	297.73	196.24
628.13				
E.G. Slope (ft/ft)	0.000124	Area (sq ft)	297.73	196.24
628.13				
Q Total (cfs)	1007.00	Flow (cfs)	233.61	303.05

470.33					
Top Width (ft)	358.54	Top Width (ft)	79.10	33.22	
246.22					
Vel Total (ft/s)	0.90	Avg. Vel. (ft/s)	0.78	1.54	
0.75					
Max Chl Dpth (ft)	6.02	Hydr. Depth (ft)	3.76	5.91	
2.55					
Conv. Total (cfs)	90417.9	Conv. (cfs)	20976.1	27211.1	
42230.8					
Length Wtd. (ft)	45.23	Wetted Per. (ft)	81.76	33.25	
248.07					
Min Ch El (ft)	897.99	Shear (lb/sq ft)	0.03	0.05	
0.02					
Alpha	1.39	Stream Power (lb/ft s)	553.69	0.00	
0.00					
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	0.70	2.39	
0.62					
C & E Loss (ft)	0.00	Cum SA (acres)	0.43	0.08	
0.50					

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Buffalo Calf For
REACH: Buffalo Calf For RS: 265.71

INPUT
Description:
Station Elevation Data num= 139

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	922.61.369995		9222.650024		921.486.410034		9208.720032		919.08
11.35004	918	13.38	917.1716.04004		91619.21002		914.6920.76001		914
25.43005	913.436.48004		912.8651.82001		912.0556.72003		91258.07001		911.71
65.98004	911.181.02002		910	103.08	908.11	103.83	908	104.29	907.82
108.23	906	109	905.6	112.2	904	115.3	902.18	115.6	902
116.72	901.31	118.75	899.76	118.83	899.76	119.47	899.72	122.05	898.14
122.5	898.18	127.86	898.3	129.27	898.23	135.45	898.22	137.87	898.08
141.31	898.12	146.77	898.12	155.76	898.17	159.02	898.17	162.05	898.14
166.15	898.17	167.47	898.2	167.73	898.2	167.93	898.2	168.12	898.21
181.21	898	181.26	898	181.28	898	190.89	898	202.32	898.26
209.14	898.52	213.54	898.51	215.52	898.51	217.69	898.51	219.74	898.49
224.11	898.54	226.99	898.52	237.02	898.49	237.52	898.49	257.93	898.3
270.93	898.06	277.28	898.03	286.21	898	296.15	897.87	299.19	897.84
309.14	897.22	320.13	897.31	320.27	897.32	320.5	897.34	321.73	897.36
321.77	897.36	321.85	897.35	321.86	897.35	322.81	897.79	323.3	898
327.96	899.39	340.76	899.74	341.21	899.56	342	899.59	342.35	899.64
353.06	900	357.63	900	357.75	900	368.51	900	385.21	900
385.56	900	402.67	900.14	416.87	900.22	419.2	900.25	443.52	900.79
443.58	900.79	446.31	900.89	446.53	900.9	453.91	901.13	469.16	901.83
470.48	901.9	470.62	901.9	472.48	902	474.87	903.27	476.16	904
477.4	905.39	477.96	906	478.73	906	479.01	906	480.31	904.55
480.8	904	503.15	904	508.28	904	520.79	904	530.83	904
545.51	904	545.85	904.5	546.69	906	547.14	906	548.59	906
551.85	904.7	552.29	904.46	555.32	905.42	557.69	906	558.82	906
559.9901	906	562.02	906.03	566.29	906	577.5	905.89	579.88	905.87
580.45	905.86	581.61	905.88	589.16	906	590.47	907.35	591.14	908

592.19	909.12	593.06	910	594.63	911.63	595.01	912	595.52	912.41	
597.38	914	598.51	915.06	599.61	916	601.4	918			

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	299.19	.035	322.81	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
299.19	322.81	65.71	65.71	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	904.02	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	904.01	Reach Len. (ft)	65.71	65.71	65.71
Crit W.S. (ft)	899.21	Flow Area (sq ft)	1056.49	156.27	564.10
E.G. Slope (ft/ft)	0.000039	Area (sq ft)	1056.49	156.27	564.10
Q Total (cfs)	1007.00	Flow (cfs)	615.25	144.85	246.90
Top Width (ft)	428.72	Top Width (ft)	187.01	23.62	218.09
Vel Total (ft/s)	0.57	Avg. Vel. (ft/s)	0.58	0.93	0.44
Max Chl Dpth (ft)	6.79	Hydr. Depth (ft)	5.65	6.62	2.59
Conv. Total (cfs)	162002.7	Conv. (cfs)	98978.9	23303.5	39720.2
Length Wtd. (ft)	65.71	Wetted Per. (ft)	188.75	23.74	218.94
Min Ch El (ft)	897.22	Shear (lb/sq ft)	0.01	0.02	0.01
Alpha	1.18	Stream Power (lb/ft s)	601.40	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)		2.20	
C & E Loss (ft)		Cum SA (acres)	0.30	0.05	0.26

CULVERT

RIVER: Buffalo Calf For
REACH: Buffalo Calf For RS: 233

INPUT
Description:
Distance from Upstream XS = .1
Deck/Roadway Width = 58.7
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 5

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
288.2	900	896	310	901.67	896	320.1	901.67	896
336	901.67	896	340	900.75	896			

Upstream Bridge Cross Section Data
Station Elevation Data num= 139

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	922.61	369995	9222	.650024	921.486	.410034	9208	.720032	919.08
11.35004	918	13.38	917.17	16.04004	916	19.21002	914.69	20.76001	914
25.43005	913.43	6.48004	912.86	51.82001	912.05	56.72003	912	58.07001	911.71
65.98004	911.18	1.02002	910	103.08	908.11	103.83	908	104.29	907.82
108.23	906	109	905.6	112.2	904	115.3	902.18	115.6	902
116.72	901.31	118.75	899.76	118.83	899.76	119.47	899.72	122.05	898.14
122.5	898.18	127.86	898.3	129.27	898.23	135.45	898.22	137.87	898.08
141.31	898.12	146.77	898.12	155.76	898.17	159.02	898.17	162.05	898.14
166.15	898.17	167.47	898.2	167.73	898.2	167.93	898.2	168.12	898.21
181.21	898	181.26	898	181.28	898	190.89	898	202.32	898.26
209.14	898.52	213.54	898.51	215.52	898.51	217.69	898.51	219.74	898.49
224.11	898.54	226.99	898.52	237.02	898.49	237.52	898.49	257.93	898.3
270.93	898.06	277.28	898.03	286.21	898	296.15	897.87	299.19	897.84
309.14	897.22	320.13	897.31	320.27	897.32	320.5	897.34	321.73	897.36
321.77	897.36	321.85	897.35	321.86	897.35	322.81	897.79	323.3	898
327.96	899.39	340.76	899.74	341.21	899.56	342	899.59	342.35	899.64
353.06	900	357.63	900	357.75	900	368.51	900	385.21	900
385.56	900	402.67	900.14	416.87	900.22	419.2	900.25	443.52	900.79
443.58	900.79	446.31	900.89	446.53	900.9	453.91	901.13	469.16	901.83
470.48	901.9	470.62	901.9	472.48	902	474.87	903.27	476.16	904
477.4	905.39	477.96	906	478.73	906	479.01	906	480.31	904.55
480.8	904	503.15	904	508.28	904	520.79	904	530.83	904
545.51	904	545.85	904.5	546.69	906	547.14	906	548.59	906
551.85	904.7	552.29	904.46	555.32	905.42	557.69	906	558.82	906
559.9901	906	562.02	906.03	566.29	906	577.5	905.89	579.88	905.87
580.45	905.86	581.61	905.88	589.16	906	590.47	907.35	591.14	908
592.19	909.12	593.06	910	594.63	911.63	595.01	912	595.52	912.41
597.38	914	598.51	915.06	599.61	916	601.4	918		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	299.19	.035	322.81	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
299.19	322.81	.1	.3

Downstream Deck/Roadway Coordinates
num= 5

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
421	898.67	898	432.8	900.25	896	444.85	900.25	896
457.1	900.25	896	466	898.67	896			

Downstream Bridge Cross Section Data
Station Elevation Data num= 139

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	912.83	12.66003	912.61	4.64001	912.51	15.44	912.47	15.65002	912.45
15.67004	912.44	15.69	912.44	15.71002	912.43	22.07001	912.96	22.29999	912.97
22.33002	912.96	48.12	912.94	50.02002	912.84	53.32001	912.65	61.46002	912
69.54004	910.87	6.14001	910.45	85.87	910	94.40002	909.65	116.99	908.51
124.74	908.14	126.91	908	129.45	907.8	155.02	906	166.5	904.7
171.39	904	178.74	904	181.42	904	186.71	904	189.75	904
196.03	904	208.79	904	211.61	904.05	214.12	904.1	215.17	904.12
218.43	904.07	221.18	904	222.7	903.58	228.61	902.25	229.37	902.07
229.71	902	236.14	900.45	238.11	900	245.16	899.21	255.33	898.59
258.94	898.29	263.35	898	283.85	898	288.12	898	299.05	898
300.21	898	300.82	898	307.25	898.14	314.21	898.15	319.26	898.15
319.27	898.15	335.83	898.21	336.38	898.21	336.5	898.2	336.51	898.2
343.9	898.13	354.58	898.06	354.59	898.06	354.69	898.04	367.29	898.03
372.72	897.98	383.41	897.99	388.22	898	392.84	898	403.3	898.04
410.04	897.67	411.71	898	417.38	898	421.14	898	427.14	898

432.87	896.88	436.65	896	440.2	895.94	441.48	895.92	443.71	895.89
446.24	895.92	451.73	896	456.29	896.73	465.11	898	467.6	898.04
469.35	898.16	470.17	898.16	471.62	898.18	488.68	898.76	511.26	899.95
511.86	899.98	522.03	900.19	522.26	900.2	522.86	900.22	526.35	900.27
527.02	900.24	527.72	900.26	531.45	900.16	543.26	900.52	545.53	900.47
554.91	900.89	555.03	900.89	555.92	900.91	558.55	900.97	558.9	900.97
579.22	902	589.08	903.09	592.45	904	594.54	904	595.87	904
597.08	904	597.54	904	600.38	904.06	603.96	904.12	607.56	904.06
610.22	904	615.52	904	616.06	904	616.34	904.1	619.55	906
621.15	907.54	621.62	908	621.88	908.29	623.61	910	624.28	910.73
625.5	912	627.36	913.68	627.77	914	628.07	914.24	630.35	916
631.52	916.96	632.84	918	635.62	919.61	636.39	920	637.06	920.35
640.56	922	643.15	923.24	644.93	924	645.08	924.08		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	427.14	.035	465.11	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
427.14	465.11	.1	.3

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

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Circular	5	

FHWA Chart # 2 - Corrugated Metal Pipe Culvert
FHWA Scale # 3 - Pipe projecting from fill
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
1	.1	58.7	.24	.24	0	.5	1

Upstream Elevation = 895.81
Centerline Station = 320
Downstream Elevation = 894.5
Centerline Station = 440.5

CULVERT OUTPUT Profile #PF 1 Culv Group: Culvert #1

Q Culv Group (cfs)	2.66	Culv Full Len (ft)	58.70
# Barrels	1	Culv Vel US (ft/s)	0.14
Q Barrel (cfs)	2.66	Culv Vel DS (ft/s)	0.14
E.G. US. (ft)	904.02	Culv Inv El Up (ft)	895.81
W.S. US. (ft)	904.01	Culv Inv El Dn (ft)	894.50
E.G. DS (ft)	904.00	Culv Frctn Ls (ft)	0.02
W.S. DS (ft)	903.99	Culv Exit Loss (ft)	0.00
Delta EG (ft)	0.02	Culv Entr Loss (ft)	0.00
Delta WS (ft)	0.02	Q Weir (cfs)	1004.34
E.G. IC (ft)	904.00	Weir Sta Lft (ft)	112.19
E.G. OC (ft)	904.02	Weir Sta Rgt (ft)	545.51
Culvert Control	Outlet	Weir Submerg	1.00
Culv WS Inlet (ft)	900.81	Weir Max Depth (ft)	6.03
Culv WS Outlet (ft)	899.50	Weir Avg Depth (ft)	3.76
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	1609.97
Culv Crt Depth (ft)	0.44	Min El Weir Flow (ft)	897.98

Warning: During subcritical analysis, while trying to calculate culvert and weir flow, the program could not get a balance of
energy within the specified tolerance and number of trials. The program used the solution with the minimum error.
Warning: The weir over culvert is submerged.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported inlet
energy grade answer may not be valid.

CROSS SECTION

RIVER: Buffalo Calf For
REACH: Buffalo Calf For RS: 200

INPUT
Description:
Station Elevation Data num= 139

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	912.83	12.66003	912.61	4.64001	912.51	15.44	912.47	15.65002	912.45
15.67004	912.44	15.69	912.44	15.71002	912.43	22.07001	912.96	22.29999	912.97
22.33002	912.96	48.12	912.94	50.02002	912.84	53.32001	912.65	61.46002	912
69.54004	910.87	6.14001	910.45	85.87	910	94.40002	909.65	116.99	908.51
124.74	908.14	126.91	908	129.45	907.8	155.02	906	166.5	904.7
171.39	904	178.74	904	181.42	904	186.71	904	189.75	904
196.03	904	208.79	904	211.61	904.05	214.12	904.1	215.17	904.12
218.43	904.07	221.18	904	222.7	903.58	228.61	902.25	229.37	902.07
229.71	902	236.14	900.45	238.11	900	245.16	899.21	255.33	898.59
258.94	898.29	263.35	898	283.85	898	288.12	898	299.05	898
300.21	898	300.82	898	307.25	898.14	314.21	898.15	319.26	898.15
319.27	898.15	335.83	898.21	336.38	898.21	336.5	898.2	336.51	898.2
343.9	898.13	354.58	898.06	354.59	898.06	354.69	898.04	367.29	898.03
372.72	897.98	383.41	897.99	388.22	898	392.84	898	403.3	898.04
410.04	897.67	411.71	898	417.38	898	421.14	898	427.14	898
432.87	896.88	436.65	896	440.2	895.94	441.48	895.92	443.71	895.89
446.24	895.92	451.73	896	456.29	896.73	465.11	898	467.6	898.04
469.35	898.16	470.17	898.16	471.62	898.18	488.68	898.76	511.26	899.95
511.86	899.98	522.03	900.19	522.26	900.2	522.86	900.22	526.35	900.27
527.02	900.24	527.72	900.26	531.45	900.16	543.26	900.52	545.53	900.47
554.91	900.89	555.03	900.89	555.92	900.91	558.55	900.97	558.9	900.97
579.22	902	589.08	903.09	592.45	904	594.54	904	595.87	904
597.08	904	597.54	904	600.38	904.06	603.96	904.12	607.56	904.06
610.22	904	615.52	904	616.06	904	616.34	904.1	619.55	906
621.15	907.54	621.62	908	621.88	908.29	623.61	910	624.28	910.73
625.5	912	627.36	913.68	627.77	914	628.07	914.24	630.35	916
631.52	916.96	632.84	918	635.62	919.61	636.39	920	637.06	920.35
640.56	922	643.15	923.24	644.93	924	645.08	924.08		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	427.14	.035	465.11	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
427.14	465.11	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	904.00	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.01	Wt. n-Val.	0.050	0.035

0.050					
W.S. Elev (ft)	903.99	Reach Len. (ft)			
Crit W.S. (ft)	898.92	Flow Area (sq ft)	1136.68	280.63	475.72
E.G. Slope (ft/ft)	0.000030	Area (sq ft)	1136.68	280.63	475.72
Q Total (cfs)	1007.00	Flow (cfs)	575.62	245.55	185.83
Top Width (ft)	371.20	Top Width (ft)	205.92	37.97	127.30
Vel Total (ft/s)	0.53	Avg. Vel. (ft/s)	0.51	0.88	0.39
Max Chl Dpth (ft)	8.10	Hydr. Depth (ft)	5.52	7.39	3.74
Conv. Total (cfs)	184221.3	Conv. (cfs)	105303.6	44921.7	33996.0
Length Wtd. (ft)		Wetted Per. (ft)	206.52	38.33	127.58
Min Ch El (ft)	895.89	Shear (lb/sq ft)	0.01	0.01	0.01
Alpha	1.28	Stream Power (lb/ft s)	645.08	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

SUMMARY OF MANNING'S N VALUES

River:Buffalo Calf For

Reach	River Sta.	n1	n2	n3
Buffalo Calf For	397.97	.05	.035	.05
Buffalo Calf For	324.75	.05	.035	.05
Buffalo Calf For	320	Culvert		
Buffalo Calf For	310.94	.05	.035	.05
Buffalo Calf For	265.71	.05	.035	.05
Buffalo Calf For	233	Culvert		
Buffalo Calf For	200	.05	.035	.05

SUMMARY OF REACH LENGTHS

River: Buffalo Calf For

Reach	River Sta.	Left	Channel	Right
Buffalo Calf For	397.97	73.22	73.22	73.22
Buffalo Calf For	324.75	13.81	13.81	13.81
Buffalo Calf For	320	Culvert		
Buffalo Calf For	310.94	45.23	45.23	45.23
Buffalo Calf For	265.71	65.71	65.71	65.71
Buffalo Calf For	233	Culvert		
Buffalo Calf For	200			

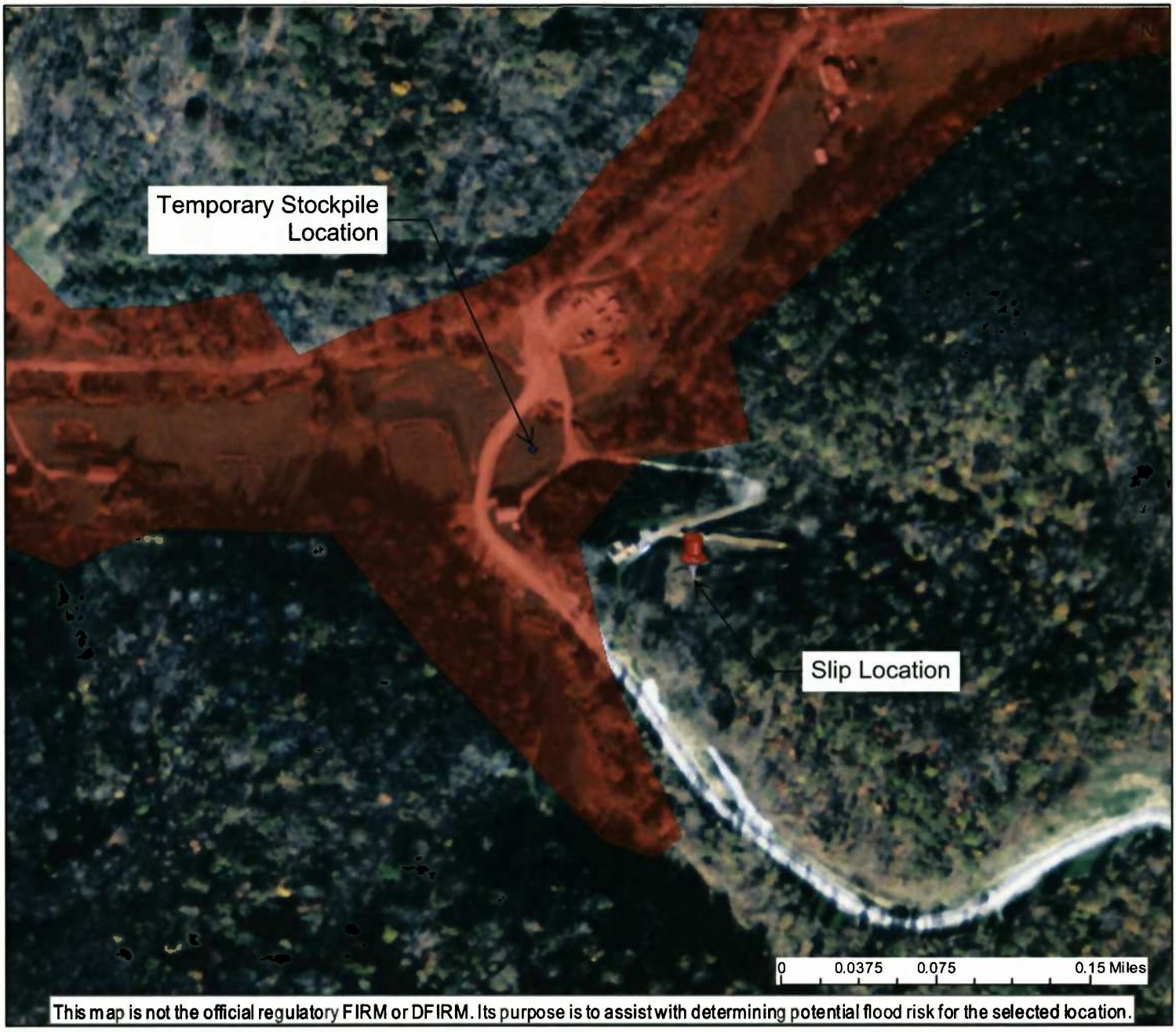
SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Buffalo Calf For

Reach	River Sta.	Contr.	Expan.
Buffalo Calf For	397.97	.1	.3
Buffalo Calf For	324.75	.1	.3
Buffalo Calf For	320	Culvert	
Buffalo Calf For	310.94	.1	.3
Buffalo Calf For	265.71	.1	.3
Buffalo Calf For	233	Culvert	
Buffalo Calf For	200	.1	.3

Profile Output Table - Standard Table 1

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	
(ft) (ft)	(ft/ft)	(ft/s)	(cfs) (sq ft)	(ft) (ft)	(ft)	
Buffalo Calf For	397.97	PF 1	1007.00	898.00	904.03	
904.05	0.000184	1.79	1177.11	448.99	0.13	
Buffalo Calf For	324.75	PF 1	1007.00	898.18	904.02	
901.45 904.03	0.000203	1.64	1057.76	387.21	0.12	
Buffalo Calf For	320		Culvert			
Buffalo Calf For	310.94	PF 1	1007.00	897.99	904.01	
904.02	0.000124	1.54	1122.10	358.54	0.11	
Buffalo Calf For	265.71	PF 1	1007.00	897.22	904.01	
899.21 904.02	0.000039	0.93	1776.87	428.72	0.06	
Buffalo Calf For	233		Culvert			
Buffalo Calf For	200	PF 1	1007.00	895.89	903.99	
898.92 904.00	0.000030	0.88	1893.03	371.20	0.06	

Susie Jane Slip Repair



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 29, 2016

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 897 ft
Location (long, lat):	(80.622717 W,39.257343 N)
Location (UTM 17N):	(532551, 4345402)
Contacts:	Doddridge
CRS Information:	N/A
Parcel Number:	

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

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