CERTIFIED MAIL®

George Eidel
Doddridge County OEM/CFM
108 Court St. Ste 1
West Union, WV 26456

7015 3430 0001 1569 6746

HASLER
$006.74⁰
08/08/2016 ZIP 26456
012E14643162
US POSTAGE

8/12/16

Ruth E. Phillips
1634 H Virginia Ave.
Harrisonburg, VA 22802

#16-430

NIXIE 231 DE 1 0008/31/16
RETURN TO SENDER
UNCLAIMED
UNABLE TO FORWARD

BC: 26456209501 *0271-06145-09-44

PLACE STICKER AT TOP OF ENVELOPE TO THE RIGHT
OF THE RETURN ADDRESS, FOLD AT DOTTED LINE

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.

Ruth E. Phillips
1634 H Virginia Ave.
Harrisonburg, VA 22802

#16-430

9590 9402 1601 5362 0149 84

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

COMPLETE THIS SECTION ON DELIVERY

A. Signature

X ☐ Agent ☐ Addressee

B. Received by *(Printed Name)* | C. Date of Delivery

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

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

Doddridge County Office of
Emergency Management/Floodplain Management
108 Court Street Suite 1
Tel 304-873-1343
doddridgecountyfpm@gmail.com

Dear Sir or Ma'am,

You are receiving this letter because you have been identified as a land surface and/or mineral rights owner for property or adjacent property related to the proposed development/project identified by the following page.

No action is required of you. This letter is simply to inform you of the proposed development.

If you would like to comment on this proposed project, or would like additional information, you may contact the Doddridge County Floodplain Manager at the above address.

Respectfully yours,

George Eidel

Doddridge County Floodplain Manager

Doddridge County Floodplain Permits

(Week of Aug 8, 2016)

Please take notice that on the **5th** day of **August, 2016**, **Antero Resources** filed an application for a Floodplain Permit **(#16-430)** to develop land located at or about **39.225942N,80.697414W continuing to 39.224881N,80.692367W**. 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 **September 6, 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 for the New Milton Compressor Station access road repairs to roadside ditches**

7015 3430 0001 1569 6739

U.S. Postal Service™
CERTIFIED MAIL® RECEIPT
Domestic Mail Only

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

OFFICIAL USE

Certified Mail Fee $ 3.45
Extra Services & Fees (check box, add fee as appropriate)
☑ Return Receipt (hardcopy) $ 2.80
☐ Return Receipt (electronic) $
☐ Certified Mail Restricted Delivery $
☐ Adult Signature Required $
☐ Adult Signature Restricted Delivery $
Postage $ .49
Total Postage and Fees $ 6.74

WEST UNION WV 8666-9956 AUG 9 2016 USPS 26456 Postmark Here

#16-430

Sent To
Street and Apt. No., or PO Box No.
City, State, ZIP+4®

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

7015 3430 0001 1569 6722

U.S. Postal Service™
CERTIFIED MAIL® RECEIPT
Domestic Mail Only

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

OFFICIAL USE

Certified Mail Fee $ 3.45
Extra Services & Fees (check box, add fee as appropriate)
☑ Return Receipt (hardcopy) $ 2.80
☐ Return Receipt (electronic) $
☐ Certified Mail Restricted Delivery $
☐ Adult Signature Required $
☐ Adult Signature Restricted Delivery $
Postage $ .49
Total Postage and Fees $ 6.74

WEST UNION WV 8666-9956 AUG 9 2016 USPS 26456 Postmark Here

#16-430

Sent To
Street and Apt. No., or PO Box No.
City, State, ZIP+4®

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

7015 3430 0001 1569 6760

U.S. Postal Service™
CERTIFIED MAIL® RECEIPT
Domestic Mail Only

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

OFFICIAL USE

Certified Mail Fee	$ 3.45
Extra Services & Fees (check box, add fee as appropriate)	
☑ Return Receipt (hardcopy)	$ 2.80
☐ Return Receipt (electronic)	$
☐ Certified Mail Restricted Delivery	$
☐ Adult Signature Required	$
☐ Adult Signature Restricted Delivery	$
Postage	$ .49
Total Postage and Fees	$ 6.74

WEST UNION, WV AUG 19 2016 Postmark Here USPS 26456-9998

#16-430

Sent To

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

City, State, ZIP+4®

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

7015 3430 0001 1569 6715

U.S. Postal Service™
CERTIFIED MAIL® RECEIPT
Domestic Mail Only

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

OFFICIAL USE

Certified Mail Fee	$ 3.45
Extra Services & Fees (check box, add fee as appropriate)	
☑ Return Receipt (hardcopy)	$ 2.80
☐ Return Receipt (electronic)	$
☐ Certified Mail Restricted Delivery	$
☐ Adult Signature Required	$
☐ Adult Signature Restricted Delivery	$
Postage	$ .49
Total Postage and Fees	$ 6.74

WEST UNION, WV AUG 9 2016 Postmark Here USPS 26456-9998

#16-430

Sent To

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

City, State, ZIP+4®

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

7015 3430 0001 1569 6692

U.S. Postal Service™
CERTIFIED MAIL® RECEIPT
Domestic Mail Only

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

OFFICIAL USE

Certified Mail Fee	$ 3.45
Extra Services & Fees (check box, add fee as appropriate)	
☑ Return Receipt (hardcopy)	$ 2.80
☐ Return Receipt (electronic)	$
☐ Certified Mail Restricted Delivery	$
☐ Adult Signature Required	$
☐ Adult Signature Restricted Delivery	$
Postage	$ .49
Total Postage and Fees	$ 6.74

WEST UNION, WV AUG - 9 2016 Postmark Here USPS 26456-9998

#16-430

Sent To

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

City, State, ZIP+4®

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

7015 3430 0001 1569 6708

U.S. Postal Service™
CERTIFIED MAIL® RECEIPT
Domestic Mail Only

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

OFFICIAL USE

Certified Mail Fee	$ 3.49
Extra Services & Fees (check box, add fee as appropriate)	
☑ Return Receipt (hardcopy)	$ 2.80
☐ Return Receipt (electronic)	$
☐ Certified Mail Restricted Delivery	$
☐ Adult Signature Required	$
☐ Adult Signature Restricted Delivery	$
Postage	$ .49
Total Postage and Fees	$ 6.74

AUG - 9 2016 Postmark Here USPS 26456-9998

#16-430

Sent To

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

City, State, ZIP+4®

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

7015 3430 0001 1569 6654

U.S. Postal Service™
CERTIFIED MAIL® RECEIPT
Domestic Mail Only

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

OFFICIAL USE

Certified Mail Fee	$ 3.45
Extra Services & Fees (check box, add fee as appropriate)	
☑ Return Receipt (hardcopy)	$ 2.80
☐ Return Receipt (electronic)	$
☐ Certified Mail Restricted Delivery	$
☐ Adult Signature Required	$
☐ Adult Signature Restricted Delivery	$
Postage	$ .49
Total Postage and Fees	$ 6.74

WEST UNION, WV AUG 9 2016 Postmark Here USPS 26456-9998

#16-430

Sent To

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

City, State, ZIP+4®

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

7015 3430 0001 1569 6753

U.S. Postal Service™
CERTIFIED MAIL® RECEIPT
Domestic Mail Only

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

OFFICIAL USE

Certified Mail Fee	$ 3.45
Extra Services & Fees (check box, add fee as appropriate)	
☑ Return Receipt (hardcopy)	$ 2.80
☐ Return Receipt (electronic)	$
☐ Certified Mail Restricted Delivery	$
☐ Adult Signature Required	$
☐ Adult Signature Restricted Delivery	$
Postage	$ .49
Total Postage and Fees	$ 6.74

AUG - 9 2016 Postmark Here USPS 26456-9998

#16-430

Sent To

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

City, State, ZIP+4®

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

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.

Kathryn Higdon Marshall
302 County Walk
Franklin, NC 28734

9590 9402 1601 5362 0135 98

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

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X LaVerne Williams ☐ Agent ☐ Addressee

B. Received by *(Printed Name)* LaVerne Williams C. Date of Delivery 29 JUL 18 2016

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

FRANKLIN NC 28734 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

USPS TRACKING #

9590 9402 7661 5362 0135 98

First-Class Mail
Postage & Fees Paid
USPS
Permit No. G-10

United States Postal Service

• Sender: Please print your name, address, and ZIP+4® in this box•

George Eidel
Doddridge County OEM/CFM
108 Court St. Ste 1
West Union, WV 26456

16-430

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.

Clinton D. & Kevin M. Means
143 Armstrong Ave.
West Union, WV 26456

9590 9402 1601 5362 0135 81

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

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X Nancy Means ☒ Agent ☐ Addressee

B. Received by *(Printed Name)* NANCY Means
C. Date of Delivery 5-1-16

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

16-430

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

First-Class Mail
Postage & Fees Paid
USPS
Permit No. G-10

United States Postal Service

• Sender: Please print your name, address, and ZIP+4® in this box•

George Eidel
Doddridge County OEM/CFM
108 Court St. Ste 1
West Union, WV 26456

116-430

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.

Ramonetta Phillips
3064 St. Johns Rd
Colliers, WV 26035

9590 9402 1601 5362 0149 77

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

COMPLETE THIS SECTION ON DELIVERY

A. Signature

X Ramonetta Phillips ☐ Agent ☐ Addressee

B. Received by *(Printed Name)* COLLIERS Ramonetta Phillips C. Date of Delivery

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

AUG 29 2016

WEST VIRGINIA 26035

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

First-Class Mail
Postage & Fees Paid
USPS
Permit No. G-10

United States Postal Service

• Sender: Please print your name, address, and ZIP+4® in this box•

George Eidel
Doddridge County OEM/CFM
108 Court St. Ste 1
West Union, WV 26456

16-430

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.

Marvin Leroy Phillips
PO Box 192
Rabun Gap, GA 30568

9590 9402 1601 5362 0149 91

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

COMPLETE THIS SECTION ON DELIVERY

A. Signature

X

☒ Agent
☐ Addressee

B. Received by *(Printed Name)*

C. Date of Delivery

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

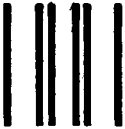
AUG 16 2016

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

USPS TRACKING #

9590 9402 1601 5362 0149 91



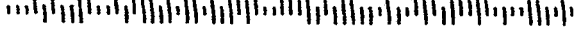
First-Class Mail
Postage & Fees Paid
USPS
Permit No. G-10

United States Postal Service

• Sender: Please print your name, address, and ZIP+4® in this box•

George Eidel
Doddridge County OEM/CFM
108 Court St. Ste 1
West Union, WV 26456

110-430



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.

COMPLETE THIS SECTION ON DELIVERY

A. Signature

X Elsie Reardon ☐ Agent ☐ Addressee

B. Received by *(Printed Name)* | C. Date of Delivery

delivery address different from item 1? ☐ Yes
YES, enter delivery address below: ☐ No

Louis R. Enlow
22975 SE Black Nuggett Rd APT 3
Issaquah, WA 98029

#16-430

9590 9402 1601 5362 0149 60

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

7015 3430 0001 1569 6760

3. Service Type

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

First-Class Mail
Postage & Fees Paid
USPS
Permit No. G-10

United States Postal Service

• Sender: Please print your name, address, and ZIP+4® in this box•

George Eidel
Doddridge County OEM/CFM
108 Court St. Ste 1
West Union, WV 26456

7015 3430 0001 1569 6746

U.S. Postal Service™

CERTIFIED MAIL® RECEIPT

Domestic Mail Only

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

OFFICIAL USE

Certified Mail Fee

$ 3.45

Extra Services & Fees (check box, add fee as appropriate)

- [x] Return Receipt (hardcopy) $ 2.80
- [ ] Return Receipt (electronic) $
- [ ] Certified Mail Restricted Delivery $
- [ ] Adult Signature Required $
- [ ] Adult Signature Restricted Delivery $

Postage

$ .49

Total Postage and Fees

$ 6.74

Postmark Here

#16-430

Sent To

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

City, State, ZIP+4®

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

CERTIFIED MAIL®

George Eidel
Doddridge County OEM/CFM
108 Court St. Ste 1
West Union, WV 26456

CHARLESTON
AUG '16

7015 3430 0001 1569 6692

HASLER
$006.74⁰
08/08/2016 ZIP 26456
012E14643162
US POSTAGE

IA

Comstock Irrevocable Trust
22975 SE Black Nuggett Rd APT 3
Issaquah, WA 98029

NIXIE 980 5E 1 0008/16/16

RETURN TO SENDER
NO SUCH NUMBER
UNABLE TO FORWARD

NSN
98029-699799
26456>2095

BC: 26456209501 *1871-05853-09-42

PLACE STICKER AT TOP OF ENVELOPE TO THE RIGHT
OF THE RETURN ADDRESS, FOLD AT DOTTED LINE

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.

COMPLETE THIS SECTION ON DELIVERY

A. Signature

X ☐ Agent ☐ Addressee

B. Received by *(Printed Name)* | C. Date of Delivery

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

Comstock Irrevocable Trust
22975 SE Black Nuggett Rd APT 3
Issaquah, WA 98029

9590 9402 1601 5362 0136 11

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

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

Doddridge County Office of
Emergency Management/Floodplain Management
108 Court Street Suite 1
Tel 304-873-1343
doddridgecountyfpm@gmail.com

Dear Sir or Ma'am,

You are receiving this letter because you have been identified as a land surface and/or mineral rights owner for property or adjacent property related to the proposed development/project identified by the following page.

No action is required of you. This letter is simply to inform you of the proposed development.

If you would like to comment on this proposed project, or would like additional information, you may contact the Doddridge County Floodplain Manager at the above address.

Respectfully yours,

George Eidel

Doddridge County Floodplain Manager

Doddridge County Floodplain Permits

(Week of Aug 8, 2016)

Please take notice that on the **5th** day of **August, 2016**, **Antero Resources** filed an application for a Floodplain Permit **(#16-430)** to develop land located at or about **39.225942N,80.697414W continuing to 39.224881N,80.692367W**. 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 **September 6, 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 for the New Milton Compressor Station access road repairs to roadside ditches**

CERTIFIED MAIL

George Eidel
Doddridge County OEM/CFM
108 Court St. Ste 1
West Union, WV 26456

CHARLESTON
250
AUG '16

7015 3430 0001 1569 6654

HASLER
$006.74⁰
08/08/2016 ZIP 26456
012E14643162
US POSTAGE

Silvestre Irrevocable Trust
22975 SE Black Nuggett Rd APT 3
Issaquah, WA 98029

IA

NIXIE 980 5E 1 0008/16/16

RETURN TO SENDER
NO SUCH NUMBER
UNABLE TO FORWARD

NSN
98029-699799
26456>2095

BC: 26456209501 *1871-05679-09-42

PLACE STICKER AT TOP OF ENVELOPE TO THE RIGHT OF THE RETURN ADDRESS. FOLD AT DOTTED LINE

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.

Silvestre Irrevocable Trust
22975 SE Black Nuggett Rd APT 3
Issaquah, WA 98029

9590 9402 1601 5362 0136 28

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

COMPLETE THIS SECTION ON DELIVERY

A. Signature

X ☐ Agent ☐ Addressee

B. Received by *(Printed Name)* | C. Date of Delivery

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

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

Doddridge County Office of
Emergency Management/Floodplain Management
108 Court Street Suite 1
Tel 304-873-1343
doddridgecountyfpm@gmail.com

Dear Sir or Ma'am,

You are receiving this letter because you have been identified as a land surface and/or mineral rights owner for property or adjacent property related to the proposed development/project identified by the following page.

No action is required of you. This letter is simply to inform you of the proposed development.

If you would like to comment on this proposed project, or would like additional information, you may contact the Doddridge County Floodplain Manager at the above address.

Respectfully yours,

George Eidel

Doddridge County Floodplain Manager

Doddridge County Floodplain Permits

(Week of Aug 8, 2016)

Please take notice that on the **5th** day of **August, 2016, Antero Resources** filed an application for a Floodplain Permit **(#16-430)** to develop land located at or about **39.225942N,80.697414W continuing to 39.224881N,80.692367W**. 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 **September 6, 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 for the New Milton Compressor Station access road repairs to roadside ditches**

CERTIFIED MAIL®

George Eidel
Doddridge County OEM/CFM
108 Court St. Ste 1
West Union, WV 26456

7015 3430 0001 1569 6708

HASLER

$006.74⁰
08/08/2016 ZIP 26456
012E14643162

US POSTAGE

UTF

Laverne Higdon Willliams
122 Green Acres Dr
Paris, TN 38242

NIXIE 381 7E 1 0008/13/16

RETURN TO SENDER
NOT DELIVERABLE AS ADDRESSED
UNABLE TO FORWARD

BC: 26456209501 *0871-03441-09-42

26456-02095

PLACE STICKER AT TOP OF ENVELOPE TO THE RIGHT
OF THE RETURN ADDRESS, FOLD AT DOTTED LINE

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.**

Laverne Higdon Willliams
122 Green Acres Dr
Paris, TN 38242

9590 9402 1601 5362 0136 04

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

COMPLETE THIS SECTION ON DELIVERY

A. Signature

X ☐ Agent ☐ Addressee

B. Received by *(Printed Name)* | C. Date of Delivery

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

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

Doddridge County Office of
Emergency Management/Floodplain Management
108 Court Street Suite 1
Tel 304-873-1343
doddridgecountyfpm@gmail.com

Dear Sir or Ma'am,

You are receiving this letter because you have been identified as a land surface and/or mineral rights owner for property or adjacent property related to the proposed development/project identified by the following page.

No action is required of you. This letter is simply to inform you of the proposed development.

If you would like to comment on this proposed project, or would like additional information, you may contact the Doddridge County Floodplain Manager at the above address.

Respectfully yours,

George Eidel

Doddridge County Floodplain Manager

Doddridge County Floodplain Permits

(Week of Aug 8, 2016)

Please take notice that on the **5th** day of **August, 2016, Antero Resources** filed an application for a Floodplain Permit **(#16-430)** to develop land located at or about **39.225942N,80.697414W continuing to 39.224881N,80.692367W**. 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 **September 6, 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 for the New Milton Compressor Station access road repairs to roadside ditches**

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 #: 16-430

Date Approved: September 6, 2016 **Expires: September 6, 2017**

Issued to: Antero Resources LLC

POC: Rachel Grzybek
304-842-4008

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

Project Address: Toms Fork

Firm: 54017C0230C

Lat/Long: 39.225942N, 80.697414W to 39.224881N, 80.692367W

Purpose of development: New Milton Compressor Station access road repairs to roadside ditches

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

George C. Eidel

Date: September 6, 2016

ANTERO MIDSTREAM
1615 WYNKOOP STREET
DENVER, COLORADO 80202

Vendor Name	Vendor No.	Date	Check Number	Check Total
DODDRIDGE COUNTY COMMISSION	43312	Aug-11-2016	104094	$500.00

INV #	INV DATE	DESCRIPTION	AMOUNT	DISCOUNTS	NET AMOUNT
KAD892016NM	08/09/16	NEW MILTON COMPRESSOR STATION ACCES	500.00	0.00	500.00

#16-430

FILED
2016 AUG 15 PM 1:21
BETH A. ROGERS, CLERK
DODDRIDGE COUNTY, WV

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 MIDSTREAM
1615 WYNKOOP STREET
DENVER, COLORADO 80202

Wells Fargo
Denver, CO

800 - AP ACCT WELLS FARGO

Check No. **104094** 11-24 / 412

Void After 90 Days

CHECK NUMBER	DATE	PAY EXACTLY
104094	Aug-11-2016	$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

⑈104094⑈ ⑆041203824⑆ 9657481710⑈

Doddridge County, West Virginia

RECEIPT NO: 7547 DATE: 2016/08/18

FROM: ANTERO MIDSTREAM **AMOUNT:** $ 500.00

FIVE HUNDRED DOLLARS AND 00 CENTS

FOR: #16-430 NEW MILTON COMPRESSOR STATION ACCESS
TOM'S FORK ROAD REPAIR

00000104094 FP-BUILDING PERMITS 020-318 **TOTAL:** $500.00

MICHAEL HEADLEY
SHERIFF &TREASURER

MEC
CLERK

Customer Copy

Antero Midstream Partners LP
ANTERO MIDSTREAM
1615 WYNKOOP STREET
DENVER, COLORADO 80202

Vendor Name	Vendor No.	Date	Check Number	Check Total
DODDRIDGE COUNTY COMMISSION	43312	Aug-11-2016	104094	$500.00

INV #	INV DATE	DESCRIPTION	AMOUNT	DISCOUNTS	NET AMOUNT
KAD892016NM	08/09/16	NEW MILTON COMPRESSOR STATION ACCES	500.00	0.00	500.00
		Tom's Fork Rd Repair			

#16-430

FILED
2016 AUG 15 PM 1:21

TOTAL INVOICES PAID ====>	500.00	0.00	500.00

DETACH AND RETAIN FOR TAX PURPOSES

Doddridge County Flood Plain Application Fee Calculator (if in Flood Plain)	
New Milton Compressor Station	
Estimated Construction Costs	$287,650.00
Amount over $100,000	$187,650.00
Drilling Oil and Gas Well Fee	$1,000.00
Deposit for additional charges	$1,000.00
$5 per $1,000 over $100,000	$938.25
Amount Due with application	$2,938.25

ANTERO RESOURCES CORPORATION
1625 17th STREET, SUITE 300
DENVER, COLORADO 80202

Vendor Name	Vendor No.	Date	Check Number	Check Total
DODDRIDGE COUNTY CLERK	45582	Jul-17-2013	33814	$2,938.25

VOUCHER	VENDOR INV #	INV DATE	TOTAL AMOUNT	PRIOR PMTS & DISCOUNTS	NET AMOUNT
07-AP-7334	COMPRESSORST	07/17/13	2,938.25	0.00	2,938.25
FLOOD PLAIN PERMIT - NEW MILTON COMPRESSOR STATION					
TOTAL INVOICES PAID					2,938.25

DETACH AND RETAIN FOR TAX PURPOSES

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

ANTERO RESOURCES

ANTERO RESOURCES CORPORATION
1625 17th STREET, SUITE 300
DENVER, COLORADO 80202

WELLS FARGO
DENVER, CO

Check No. 33814

11-24
1210

400 - AP ACCT WELLS FARGO

VOID AFTER 180 DAYS

CHECK NUMBER	DATE	PAY EXACTLY
33814	Jul-17-2013	$2,938.25

PAY EXACTLY $2,938dols25cts
TWO THOUSAND NINE HUNDRED THIRTY-EIGHT DOLLARS AND 25 CENTS

TO THE ORDER OF
DODDRIDGE COUNTY CLERK
135 COURT STREET ROOM 102
WEST UNION, WV 26456

⑈033814⑈ ⑆121000248⑆ 4124525841⑈

By: BH - MEH - AML
Asst. Chief Tax Deputy

W. C .Underwood Jr.
Sheriff of Doddridge County

The Person paying Money into the Treasury shall forthwith file one of these Receipts with the County Clerk

Doddridge County, West Virginia

No. 113

Date: July 19, 2013
Customer copy

Received: #13-038 ANTERO NEW MILTON COMPRESSOR STATION $2,938.25

In Payment For: 318 Building Permits (LP)

For: 12-Flood Plain Ordinance #20 Fund

By: BH - MEH - AML
Asst. Chief Tax Deputy

W. C .Underwood Jr.
Sheriff of Doddridge County

Doddridge County Floodplain Permits

(Week of Aug 8, 2016)

Please take notice that on the **5th** day of **August, 2016**, **Antero Resources** filed an application for a Floodplain Permit **(#16-430)** to develop land located at or about **39.225942N,80.697414W continuing to 39.224881N,80.692367W**. 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 **September 6, 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 for the New Milton Compressor Station access road repairs to roadside ditches**

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

June 22, 2016

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

Mr. Eidel:

Antero Midstream LLC would like to submit a Doddridge County Floodplain permit application for our ***New Milton Compressor Station Access Road Upgrade***. Our project is located in Doddridge County, New Milton District where the road begins at coordinates 39.225942N, 80.697414W and continues to coordinates 39.224881N, 80.692367W. Per the FIRM Map #54017C0230C, this location is **in** the floodplain.

Attached you will find the following:

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

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

Thank you in advance for your consideration.

Sincerely,

AUG 5 16 1:23PM

Rachel Grzybek
Environmental Specialist II
Floodplain Engineer
Antero Resources Corporation

Enclosures

Permit# 16-430

Project Name: Tom's Fork / New Milton Compressor Station Ditch Repair

Permittees Name: Antero Resources

Doddridge County, WV

Floodplain Development Permit Application

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 Brian Gillam

DATE 8-1-16

Doddridge County Commercial/Industrial
Floodplain Development Permit Application

Applicant Information:

Please provide all pertinent data.

Applicant Information		
Responsible Company Name: Antero Midstream, LLC.		
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 proposed work consists of regrading the surface of the existing access road to the New Milton Compressor Station to address drainage issues. Currently, sediment is being eroded from the access road and through culverts in heavy rain events, carrying sediment to the discharge area of the culverts and past the end of the riprap V-ditch along the north side of the access road. The proposed work involves regrading approximately 1,500 feet of the existing access road to facilitate runoff into the existing roadside ditch. Fresh stone will be rolled into the existing road using a compaction roller. The existing ditch along the north side of the access road will be cleaned, and new (larger) stone will be installed around the 13 culvert entrances. The 13 culverts will be cleaned, and new (larger) stone will be installed at the outlet of each culvert. Areas along the access road will be reseeded and mulched as necessary. Additional work will include taking a mini-excavator to the discharge area at the end of the roadside ditch, in the area northeast of the bridge, to clean up sediment transferred downslope. The area will be reseeded and mulched. A portion of the proposed project is located within the Toms Fork Zone AE flood hazard area according to the Flood Insurance Rate Map for Doddridge County, Map Panel #54017C0230C, with a map revised date of October 4, 2011.

Doddridge County Commercial/Industrial
Floodplain Development Permit Application

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)
[X]	Alteration	[]	Non-residential (floodproofing)
[]	Relocation	[]	Combined Use (res. & com.)
[]	Demolition	[]	Replacement
[]	Manufactured/Mobil Home		

B. OTHER DEVELOPMENT ACTIVITIES:

[] Fill [] Mining [] Drilling [] Pipelining
[X] Grading
[] Excavation (except for STRUCTURAL DEVELOPMENT checked above)
[] Watercourse Alteration (including dredging and channel modification)
[X] 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: TOM'S FK 147.86 AC		
Physical Address/911 Address: RT. 18		
Decimal Latitude/Longitude: 39.2259 N, 80.6974 W		
DMS Latitude/Longitude: 39°13'33.39"N, 80°41'50.69"W		
District: 6	**Map: 8**	**Parcel: 37**
Land Book Description:		
Deed Book Reference: AP42/141, WB38/170, WB33/405, 287/272, MS17/722		
Tax Map Reference: 09-06-0008-0037-0000		
Existing Buildings/Use of Property: There is an existing access road to the New Milton		
Compressor Station.		

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: 68 AC TOM'S FK		
Physical Address/911 Address: OFF RT. 18		
Decimal Latitude/Longitude: 39.2249 N, 80.6924 W		
DMS Latitude/Longitude: 39°13'29.57"N, 80°41'32.52"W		
District: 6	**Map: 8**	**Parcel: 39**
Land Book Description:		
Deed Book Reference: 261/37, 261/34		
Tax Map Reference: 09-06-0008-0039-0000		
Existing Buildings/Use of Property: There is an existing access road to the New Milton		
Compressor Station.		

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.

7015 3430 0001 1569 6753

Property Designation: __1__ of _2__		
Property Owner Data:		
Name of Primary Owner (PO): Ramonetta Phillips		
PO Address: 3064 St. Johns Rd		
City: Colliers	**State: WV**	**Zip: 26035**
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

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.

7015 3430 0001 1569 6746

Property Designation: 1 of 2

Property Owner Data:		
Name of Primary Owner (PO): Ruth E. Phillips		
PO Address: 1634 H Virginia Ave.		
City: Harrisonburg	**State: VA**	**Zip: 22802**
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

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.

7015 3430 0001 1569 6739

Property Designation: 1 of 2		

Property Owner Data:		
Name of Primary Owner (PO): Marvin Leroy Phillips		
PO Address: PO Box 192		
City: Rabun Gap	**State: GA**	**Zip: 30568**
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

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.

7015 3430 0001 1569 6722

Property Designation: 1 of 2

Property Owner Data:		
Name of Primary Owner (PO): Clinton D. and Kevin M. Means		
PO Address: 143 Armstrong Ave		
City: West Union	**State: WV**	**Zip: 26456**
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

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

7015 3430 0001 1569 6715

Property Designation: 1 of 2

Property Owner Data:		
Name of Primary Owner (PO): Kathryn Higdon Marshall		
PO Address: 302 Country Walk		
City: Franklin	**State: NC**	**Zip: 28734**
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

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.

7015 3430 0001 1569 6708

Property Designation: 1 of 2		
Property Owner Data:		
Name of Primary Owner (PO): Laverne Higdon Williams		
PO Address: 122 Green Acres Dr		
City: Paris	**State: TN**	**Zip: 38242**
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

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

7015 3430 0001 1569 6692

Property Designation: 2 of 2

Property Owner Data:		
Name of Primary Owner (PO): Comstock Irrevocable Trust		
PO Address: 22975 SE Black Nugget Rd APT 3		
City: Issaquah	**State: WA**	**Zip: 98029**
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

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: 2 of 2		

Property Owner Data: 7015 3430 0001 1569 6654		
Name of Primary Owner (PO): Silvestre Irrevocable Trust		
PO Address: 22975 SE Black Nugget Rd APT 3		
City: Issaquah	**State: WA**	**Zip: 98029**
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		
Name of Primary Owner (PO): Louis R. Enlow		
Physical Address: 22975 SE Black Nugget Rd APT 3		
City: Issaquah	**State: WA**	**Zip: 98029**
PO Primary Phone:		
PO Secondary Phone:		
PO Primary Email:		

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

Adjacent Property Owner Data: Downstream		
Name of Primary Owner (PO): Robert E. and Eunice N. Taylor		
Physical Address: Rt. 1 Box 90		
City: New Milton	**State: WV**	**Zip: 26411**
PO Primary Phone:		
PO Secondary Phone:		
PO Primary Email:		

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

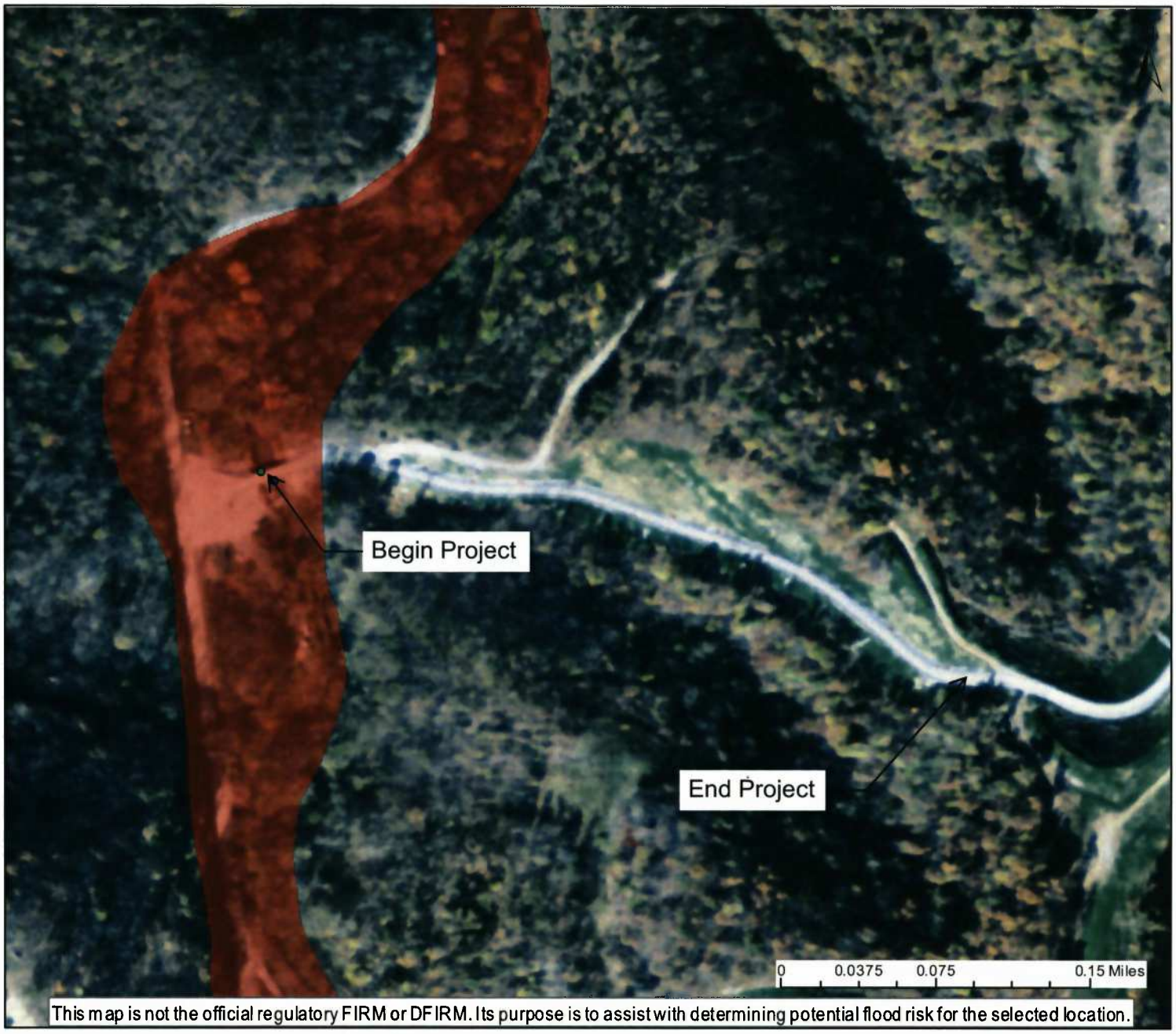
Please read print name, sign and date below:

- 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: Brian Gilmore Date: 8-1-16

Applicant Printed Name: BRIAN GILMORE

New Milton Access Road



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 July 25, 2016

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

FEMA Issued Flood Map: 54017C0230C

Watershed (HUC8):	Little Musringum-Middle Island (5
Elevation:	About 824 ft
Location (long, lat):	(80.697505 W,39.225992 N)
Location (UTM 17N):	(526110, 4341898)
Contacts:	Doddridge
CRS Information:	N/A
Parcel Number:	

DODDRIDGE COUNTY
UNINCORPORATED AREAS
540024

ZONE AE

827

Wolfpen Run

828

829

831

LIMIT OF STUDY

Meathouse Fork
ZONE AE

828

829

830

831

832

833

834

836

837

838

839

LIMIT OF STUDY

ZONE X

LIMIT OF STUDY

Lick Run

Approximate Project Location

270000 FT

265000 FT

JOINS PANEL 0235

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0230C

FIRM

FLOOD INSURANCE RATE MAP

DODDRIDGE COUNTY, WEST VIRGINIA AND INCORPORATED AREAS

PANEL 230 OF 325

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

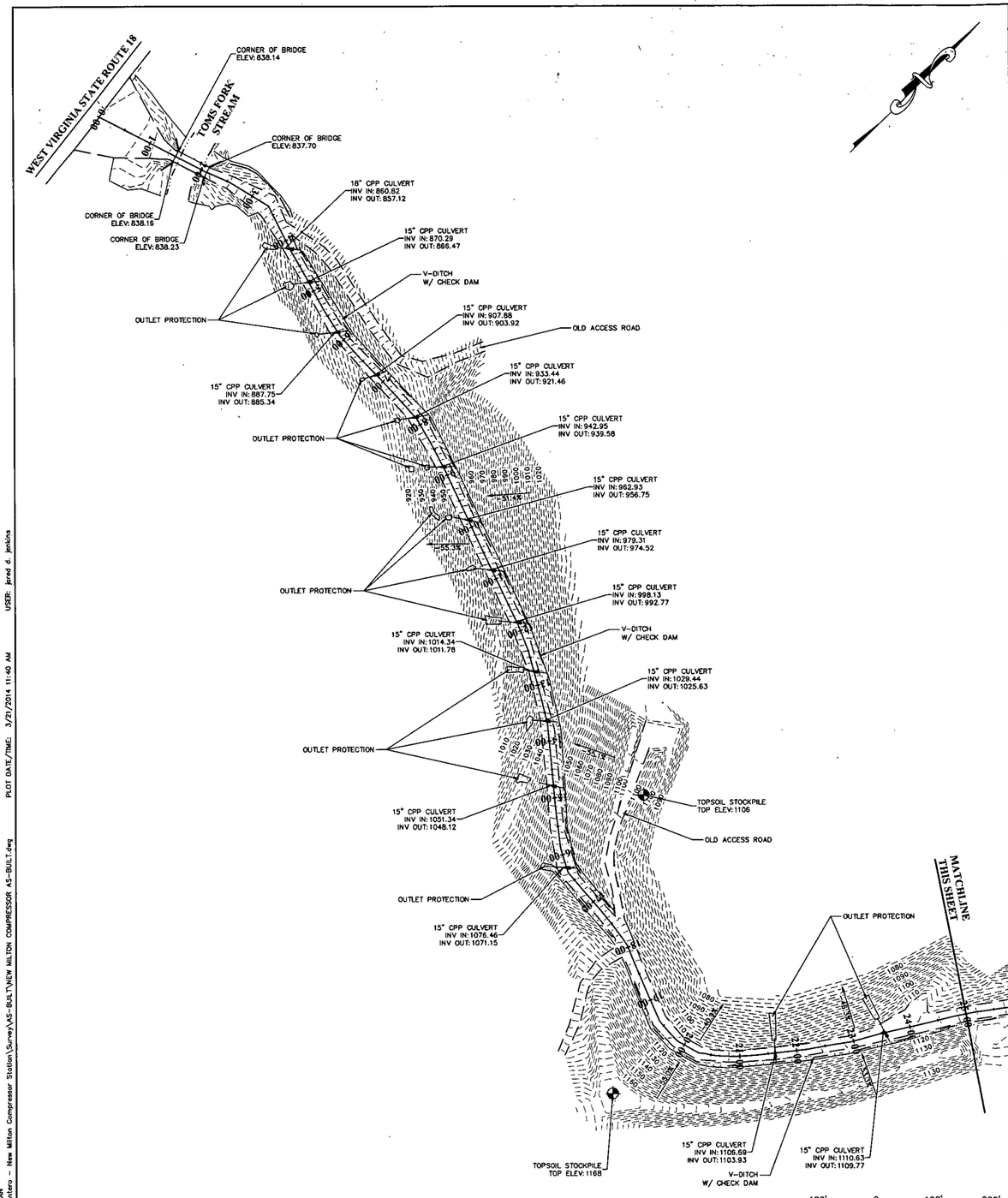
COMMUNITY	NUMBER	PANEL	SUFFIX
DODDRIDGE COUNTY	540024	0230	C

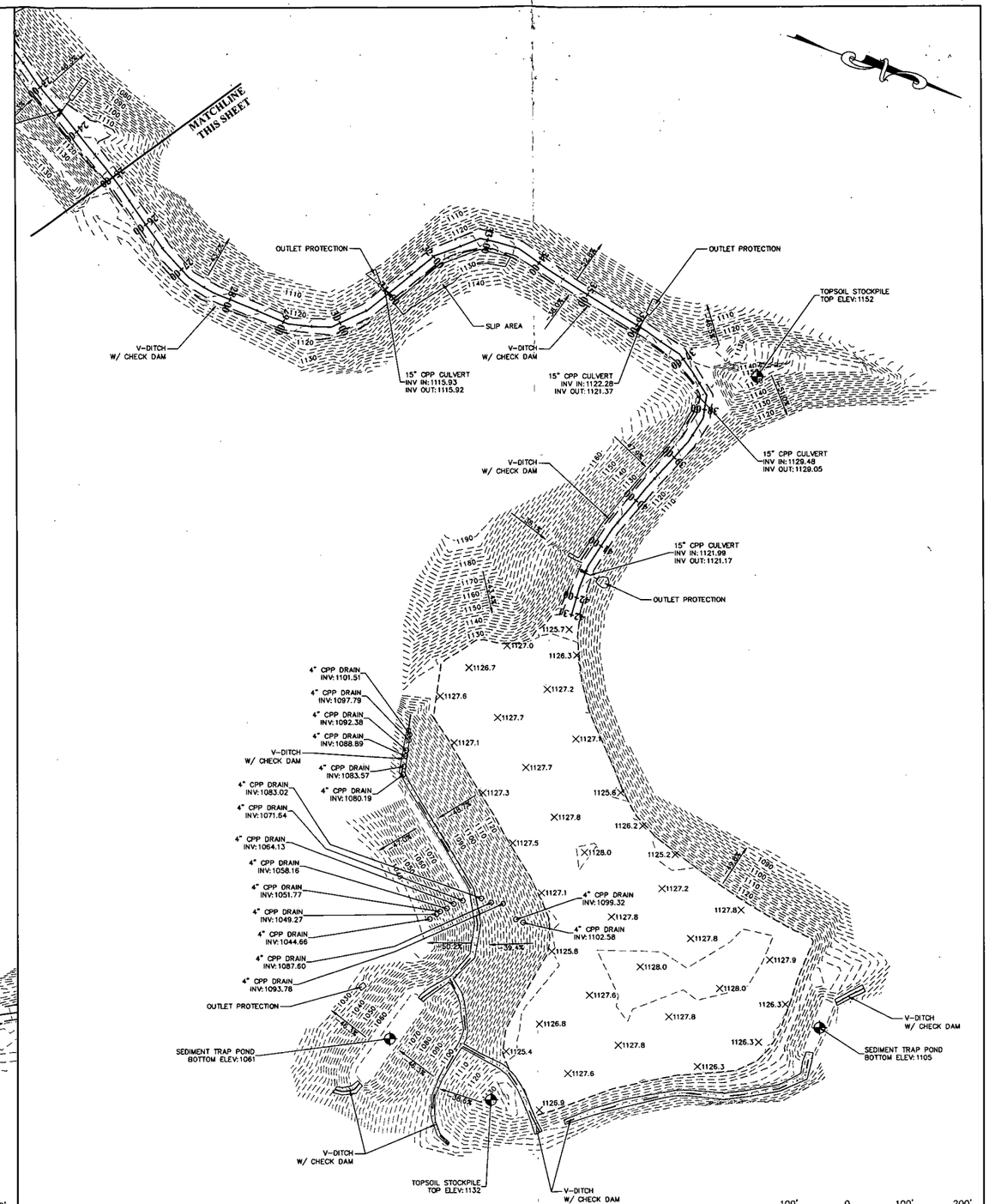
Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
54017C0230C

MAP REVISED
OCTOBER 4, 2011

Federal Emergency Management Agency





LAYOUT TAB: AS-BUILT PLAN
CAD FILE: R:\015-0159 Antero - New Milton Compressor Station\Survey\AS-BUILT\NEW MILTON COMPRESSOR AS-BUILT.dwg
USER: Jared d. Jenkins
PLOT DATE/TIME: 3/21/2014 11:40 AM

NO.	BY	DATE	DESCRIPTION

Antero Resources

SCALE: AS SHOWN	
DRAWN:	DATE:
CHECKED:	DATE:
APPROVED:	DATE:
SURVEY DATE:	
SURVEY BY:	
FIELD BOOK No.:	

THRASHER

PHASE No.	
CONTRACT No.	
PROJECT No.	101-015-0159

ANTERO RESOURCES CORPORATION
NEW MILTON COMPRESSOR STATION
AS-BUILT CONDITIONS
DODDRIDGE COUNTY, WEST VIRGINIA
PLAN SHEET

SHEET No. 1

July 27, 2016

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

Subject: Antero Midstream, LLC.
New Milton Compressor Station Access Road Upgrade
No-Rise Certificate
Doddridge County, West Virginia
CEC Project 163-065

Civil & Environmental Consultants, Inc. (CEC) is pleased to evaluate the potential floodplain impacts for the above referenced project on behalf of Antero Midstream, LLC., 535 White Oaks Blvd, Bridgeport, WV 26330. Antero Midstream, LLC. proposes to regrade the surface of the existing access road to the New Milton Compressor Station to address drainage issues. A portion of the project is located within the Toms Fork Zone AE flood hazard area according to the Flood Insurance Rate Map for Doddridge County, Map Panel #54017C0230C, with a map revised date of October 4, 2011. Currently, sediment is being eroded from the access road and through culverts during heavy rain events, which has led to sediment deposition at culvert outlets and downslope of the existing ditch along the north side of the access road. The proposed work involves regrading the existing access road to achieve a proper cross-slope to facilitate runoff into the existing roadside ditch. Furthermore, the existing culverts will be cleaned, and additional riprap will be placed at the inlet and outlet of each culvert. A mini-excavator will be used to remove sediment deposited downslope of the roadside ditch, in the area northeast of the bridge. Since the proposed work will not result in a decrease of the available floodplain storage area, the proposed project will not adversely affect the existing base flood elevation of Toms Fork.

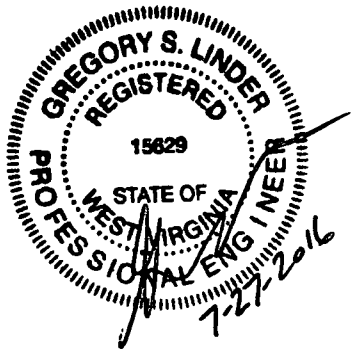
This no-rise certificate is provided in support of the floodplain development permit application. Your time and effort in reviewing this floodplain development permit application is appreciated. Please feel free to contact me at 304-933-3119 or via e-mail at glinder@cecinc.com or contact Ms. Rachel Grzybek at 304-842-4008 or via e-mail at rgrzybek@anteroresources.com if you have questions or need additional information.

Respectfully submitted,

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.

Andrew Darnell, EIT
Project Consultant

Greg Linder, P.E.
Project Manager



ANTERO RESOURCES CORPORATION
SCHEDULE OF QUANTITIES
NEW MILTON
COMPRESSOR STATION ACCESS ROAD

CLEARING & GRUBBING, EROSION & SEDIMENT CONTROLS

	QUANTITY	UNIT	UNIT COST	COST
MOBILIZATION	1.0	EA	$19,257.00	$19,257.00
CONSTRUCTION ENTRANCE	1.0	EA	$3,170.00	$3,170.00
CLEARING & GRUBBING	0.9	AC	$3,688.00	$3,392.96
TREE REMOVAL	0.4	AC	$4,460.00	$1,962.40
12" COMPOST FILTER SOCK DIVERSION	41.0	LF	$4.00	$164.00
SUPER SILT FENCE	186.2	LF	$9.00	$1,675.80
TOTAL				$29,622.16

SITE

	QUANTITY	UNIT	UNIT COST	COST
ACCESS ROADS EXCAVATION	15.8	CY	$5.00	$79.00
TOPSOIL	328.3	CY	$4.00	$1,313.20
TOTAL				$1,392.20

AGGREGATE SURFACING - SPREADING, COMPACTION, AND/OR INSTALLATION

	QUANTITY	UNIT	UNIT COST	COST
ACCESS ROADS 6" OR 4" MINUS CRUSHER RUN AGGREGATE (8" THICK)	493.8	TON	$3.00	$1,481.40
ACCESS ROAD 1 1/2" OR 3/4" CRUSHER RUN STONE (2" THICK)	123.6	TON	$3.00	$370.80
ACCESS ROADS GEOTEXTILE FABRIC (US 200)	1480.7	SY	$1.00	$1,480.70
TOTAL				$3,332.90

ROAD CULVERTS

	QUANTITY	UNIT	UNIT COST	COST
35' 10" x 11' 4" Contech Bridgecor #25A5 Arch Culvert	80.0	LF	$1,000.00	$80,000.00
GABION BASKET	100.0	EA	$170.00	$17,000.00
TOTAL				$97,000.00

SEEDING

	QUANTITY	UNIT	UNIT COST	COST
SITE SEEDING (LIME, FERTILIZER, SEEDING, AND HYDRO-MULCH w/TACK (HYC-2 OR EQUAL))	0.6	AC	$3,136.00	$1,944.32
TOTAL				$1,944.32

UNFORESEEN SITE CONDITIONS

	QUANTITY	UNIT	UNIT COST	COST
*ROCK CLAUSE - BLASTING		CY		$0.00
*ROCK CLAUSE - HOE RAMMING		CY		$0.00
*FRENCH DRAINS		FT		$0.00
*PHASE 1 FENCING - STEEL CORRUGATED PANELS w/"T" POST (10 FT CENTERS) - WETLAND PROTECTION		LF		$0.00
*PHASE 2 FENCING - SILT FENCE AND OR FILTER SOCK OUTSIDE OF PHASE 3 FENCING - WETLAND PROTECTION		LF		$0.00
*PHASE 3 FENCING - ORANGE SAFETY FENCE w/"T" POST (10FT CENTERS) - WETLAND PROTECTION		LF		$0.00
*SILT FENCE		LF		$0.00
*TEMPORARY SEEDING		AC		$0.00
*CONSTRUCTION STAKEOUT		HOUR		$0.00
GUARD RAIL	240.0	LF	$12.00	$2,880.00
* JUTE MATTING - SLOPE MATTING	739.3	SY	$2.00	$1,478.60
TOTAL				$4,358.60

GRAND TOTAL + Estimated 150,000 for Bridge **$287,650.18**

Doddridge County Flood Plain Application Fee Calculator (if in Flood Plain)	
New Milton Compressor Station	
Estimated Construction Costs	$287,650.00
Amount over $100,000	$187,650.00
Drilling Oil and Gas Well Fee	$1,000.00
Deposit for additional charges	$1,000.00
$5 per $1,000 over $100,000	$938.25
Amount Due with application	$2,938.25

NAVITUS
ENGINEERING INC.

151 Windy Hill Lane
Winchester, Virginia 22602
Telephone: (888) 662-4185

July 16, 2013

Doddridge County Commission
118 East Court Street
West Union, WV 26456

Attn: Dan Wellings, Doddridge County Floodplain Administrator

Re: New Milton Compressor Station Access Road Bridge Stream Crossing - Floodplain Analysis

Dear Mr. Wellings:

Navitus Engineering has completed a floodplain analysis of the proposed New Milton Compressor Station Access Road stream crossing over Toms Fork located south of West Union, along State Route 18 in Doddridge County, West Virginia. This site is located within a FEMA Flood Zone "AE", as shown on the Flood Insurance Rate Map (FIRM) from the National Flood Insurance Program (NFIP), Map Number 54017C0230C dated October 4, 2011. Being that the site is located in a Flood Zone "AE", base flood elevations for this area have been established and detailed study information was found in the Flood Insurance Study for Doddridge County, dated October 4, 2011.

In order to establish base flood elevations for this site, a hydrologic and hydraulic analysis was preformed as outlined in the current Doddridge County Floodplain Ordinance, enacted May 21st, 2013. Using field shot data, 10-foot interval topography converted from 3 meter West Virginia GIS Technical Center DEM data, and information taken from USGS 7.5 Minute Series Topographic Maps, a drainage analysis was performed for the Toms Fork drainage shed. Upon establishing the peak flow drainage calculations for the 100-year storm event, a HEC-RAS river analysis was conducted for a section of Toms Fork adjacent to the New Milton Compressor Station Access Road and Base Flood Elevations (BFE) were established. The established BFEs were compared to those found in the Flood Insurance Study as shown on the Summary of Computed Elevations found in the attached report. The established BFEs were similar to the BFEs found in the Flood Insurance Study, with the greatest difference in elevation being approximately 0.7'. The resulting BFEs were used to establish adjusted floodplain boundaries for the segment of Toms Fork being studied. These boundaries are shown on the attached Existing Conditions Plan. In addition to establishing BFEs, a proposed conditions analysis was performed to determine the impacts of the proposed entrance road and stream crossing over Toms Fork. The proposed grading and bridge were added into the cross sections and the manning's "n" values were adjusted where necessary. The model was run with these changes to determine the impacts of the proposed access road and bridge. The results of this analysis indicate that the proposed improvement will cause a maximum increase of 0.3' in the BFEs in this area and no upstream or downstream properties will be adversely impacted. The maximum increase in the BFE occurs at River Stations 17+26.403 and 18+11.557. The cross section at River Station 17+26.403 has an existing BFE of 831.4 and a proposed BFE of 831.7 and the cross section at River Station 18+11.557 has an existing BFE of 831.7 and a proposed BFE of 832.0. The New Milton Compressor Station Access Road Site

Plan (attached) contains a FEMA FIRM Map exhibit showing the proposed access road site overlaid on the FIRM Map. This map contains approximate property lines and owner information.

Attached are the following documents associated with this submission:

- A Floodplain Analysis of Toms Fork documenting the methods used for the analysis, drainage computations, cross sections, and a narrative to describe the analysis. Included with this analysis are exhibits that identify the existing and proposed 100-year floodplain.
- The New Milton Compressor Station Access Road Site Plan, prepared by Navitus Engineering, Inc. which includes additional site design and construction specifications.
- Project Cost Estimate
- Floodplain Permit Application Fee
- Doddridge County Improvement Location Permit Application

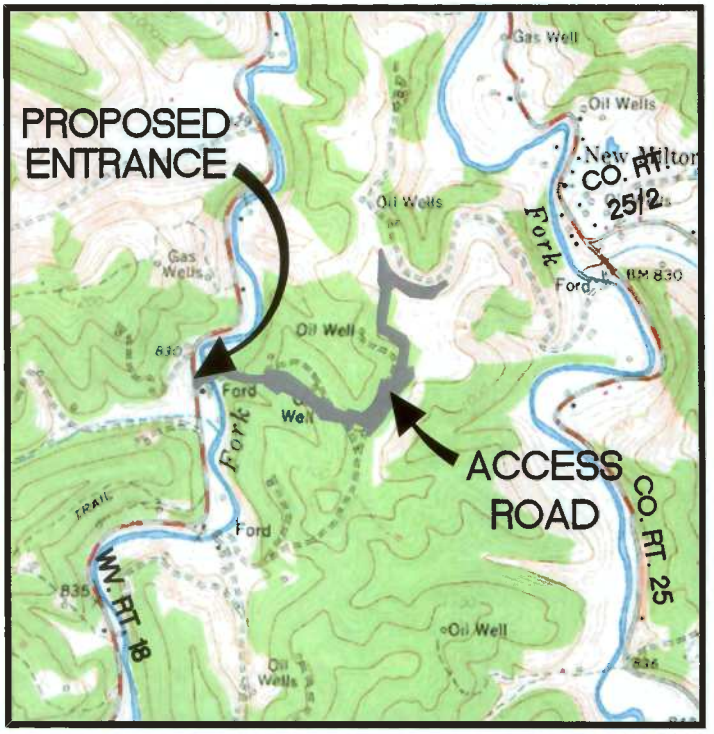
Should any questions or comments arise during the review, please let us know and we will work to address them. Copies of all permits required for this site will be provided by the operator. Please let me know if you should need additional information. You can reach me by phone (540) 336-9486 or email: dmurphy@navituseng.com.

Sincerely,
Navitus Engineering, Inc.

Daniel E. Murphy, CFM

FLOODPLAIN ANALYSIS OF TOMS FORK

NEW MILTON COMPRESSOR STATION ACCESS ROAD WITH BRIDGE



VICINITY MAP

1" = 2,000'

NAVITUS ENGINEERING INC.

151 Windy Hill Lane
Winchester, VA 22602
Telephone: (888) 662-4185
www.navituseng.com

Engineering • Survey • Environmental • GIS

Prepared For:

ANTERO RESOURCES
981 East Washington Avenue
Ellenboro, WV 26346
(304) 869-3405

Contacts:
Bill Prehm, Project Manager
(303) 807-4436
Anthony Smith, Field Engineer
(304) 673-6196
Mike Heaster, Land Agent
(304) 871-0085

CYRUS S. KUMP REGISTERED 19578 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

Designed By:
Navitus Engineering Inc.

Project Manager:
Dan Murphy, CFM
dmurphy@navituseng.com

Tax Parcel:
Map 8 Parcel 37

Location:
New Milton District, Doddridge County
West Virginia

Date: July 16, 2013

FN# ANT096

1. Objective

The objective of this floodplain analysis was to establish boundaries for the existing and proposed conditions of the 100 year base flood elevations (BFE). The proposed condition includes the installation of a 60' span steel bridge and an access road to provide access to a compressor station site where the entrance off of State Route 18 is within the FEMA Flood Zone "AE".

2. Existing Conditions

2.1. Property Description

This site is located in Doddridge County, West Virginia along Toms Fork and State Route 18 south of West Union in the New Milton District. The proposed access road entrance is located on the east side of State Route 18.

2.2. Floodplain Delineation

The approximate limit of the 100-year floodplain (a flood event that has a 1% chance of being equaled or exceeded in any given year) is shown on FEMA Flood Insurance Rate Map (FIRM) for Doddridge County on panels 54017C0230C effective October 4, 2011. This floodplain is located in flood zone designation "AE" and base flood elevations have been established. Detailed study information was found in the Flood Insurance Study for Doddridge County, dated October 4, 2011.

2.3. Floodplain Ordinance

This site is administered under the Doddridge County Floodplain Ordinance, enacted May 31st, 2013.

Per Section 4.3 of the ordinance, when a site is located in FEMA Flood Zone designation "AE" without Floodway Area, the Floodplain Administrator shall require the applicant to demonstrate that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the elevation of the 100-year flood more than one (1) foot at any point.

Per Section 4.5.A of the ordinance, any developer shall notify in writing, by certified mail, Doddridge County's Floodplain Administrator, the State Coordinating Office, and adjacent communities and any adjacent property owners of all such intended activities prior to the alteration of the stream. Copies of all required notifications must be submitted to the Federal Insurance Administration. In addition prior to issuing the local permit the Floodplain Administrator shall require copies of all necessary permits from those government agencies from which Federal or State Law requires approval.

Per Section 4.5.B a stream crossing analysis for the proposed permanent crossing of Toms Fork has been provided under separate cover and includes a cover letter signed by the

responsible professional, a detailed report, hydraulic and hydrologic computations and a sitemap detailing the planned construction.

Per Section 4.5.C of this ordinance the stream crossing has been designed with "best practice" techniques in mind. A 60' span steel bridge were selected to pass the base flow and 10 year storm events. The bridge will span the stream to allow for aquatic passage and preservation of the existing stream channel. The bridge was designed to be a permanent stream crossing. All fill utilized will be 2-4" clean rock aggregate with a 4-6" large angular durable rock base to minimize erosion during storm events. Concrete abutments and wing walls will be utilized to minimize scour around the culvert. Sandbag cofferdams and a dewatering bag system will be utilized during construction to minimize erosion and allow for construction in the stream channel.

Per Section 4.5.D of this ordinance the bridge will be properly anchored as required.

Per Section 4.5.E of this ordinance the Developer shall provide Doddridge County with all required legal agreements detailing inspections and maintenance.

Per Section 5.1 of this ordinance Permits are required for the construction of the permanent stream crossing. The format of the permit will coincide with the requirements set forth in Section 5.2 of the ordinance.

Per Section 6.1E of this ordinance the fill associated with this plan has been designed to not adversely affect adjacent properties. The access road and bridge were located to minimize floodway constriction and the height above the existing grade was minimized to allow as much flow as possible to be unimpeded. Impacts to the 100 year base flood elevation are demonstrated later in this report, however, increases to the 100 year base flood elevations were limited to approximately 1,052' upstream of the proposed culvert and returned to 0.0' of impact approximately 1,1052' upstream of the proposed culvert. Impacts downstream of the proposed culvert were limited approximately 45' downstream and returned to 0.0' of impact immediately. Fill as stated above shall consist of 2-4" clean rock aggregate with a 4-6" large angular durable rock base. No less than 2:1 slopes will be utilized in the construction of the proposed crossing.

Per Section 6.1F the structure has been placed with the longitudinal axis parallel to the direction of flood flow and to maintain the same flood-flow lines of the adjoining structures.

Per Section 6.1.I of this ordinance, no material or equipment storage shall be allowed within the vicinity of the entrance. The storage of all material and equipment shall be onsite and away from the entrance.

Per Section 6.1.K of this ordinance, a flow line is proposed adjacent to State Route 18 along the entrance to allow adequate drainage across the proposed entrance.

All other specific requirements covered in Section 6.1 of this ordinance are not applicable to this design. (Sections 6.1.A, 6.1.B, 6.1.C, 6.1.D, 6.1.F, 6.1.G, 6.1.H, 6.1.J, and 6.1.L)

The developer shall conform with all administrative procedures as outline in Article 7 of this ordinance.

2.4. Toms Fork Characteristics

Toms Fork is located in the New Milton District of Doddridge County and flows in a northern direction. The drainage area flowing to Toms Fork at the stream crossing is approximately 14.602 square miles of forested and agricultural land with an average basin slope of 36.04%.

3. Analysis Information

3.1. HEC-RAS

A HEC-RAS hydraulic analysis was performed for the portion of the Toms Fork that has an impact on the BFE's across the property. HEC-RAS is designed to perform one-dimensional hydraulic calculations for a full network of natural and constructed channels. The steady flow system is designed for applications in floodplain management and flood insurance studies.

3.2. Analysis Limits

The analysis information is based upon two foot interval aerial shot topography by Blue Mountain Aerial Mapping. The upstream analysis limit for Toms Fork is located approximately 1,337 feet upstream from the proposed stream crossing and represents the 28+65.327 section. The downstream analysis limit for Toms Fork is located approximately 1,564 feet downstream of the proposed stream crossing and represents the 10+00.000 section. These limits were selected so that the HEC-RAS model would accurately determine the base flood elevations on site and off site.

3.3. Flow Data

The hydrologic analysis utilized USDA soil surveys for computation of drainage shed curve numbers, aerial topography and 3 meter West Virginia GIS Technical Center DEM to determine the drainage area(s) and time of concentration path(s). The peak 100-year discharge within the inundation area was determined through TR-55 SCS methodology. Time of concentration paths were calculated utilizing the SCS lag method. The hydrologic calculations for the drainage area were performed using HEC-HMS. See the table below for a summary of the flow conditions, and see Supplement 1 for the complete Drainage Computations.

Stream	Drainage Area	Flow (cfs)	Note
Upper Toms Fork	8,212.48 Ac.	3765.8	Upper Reach
Middle Toms Fork	1,132.16 Ac.	949.4	Middle Reach
Lower Toms Fork	604.16 Ac.	666.8	Lower Reach

3.4. Cross Section Data

The cross sections were employed at significant changes in site features. This includes major bends in the stream channel, areas of major contraction and expansion of the floodplain area, upstream and downstream of existing culverts, and at building obstructions (cross sections were compiled using Aerial Mapping by Blue Mountain Aerial Mapping).

3.5. Manning's n-value

The channel and overbank areas were assigned manning's n-values based on field review, site photographs, and close inspection of existing aerial photography. The chart below describes the manning's n values used in this study.

Manning's n value	Description	Portion Used
.035	Clean, straight, full, no rifts or deep pools, stones and weeds	Main Channel
.1	Heavy stand of timber, few down trees, little undergrowth, flow below branches	Floodplains (Normal)
.013	Asphalt	Floodplains
.035	High grass	Floodplains
.033	Rip Rap Dry Rubble	Floodplains
.06	Light Brush and trees, in summer	Floodplains
.08	Heavy stand of timber, few down trees, little undergrowth, flow below branches	Floodplains (Minimum)

4. Results

4.1. Existing Conditions

Since the site is in Zone "AE" floodplain area as shown on the FIRM, there has been a detailed study analysis with one foot interval base flood elevations established within the Doddridge County Flood Insurance Study (FIS) effective October 4, 2011. An existing conditions model was prepared based upon aerial topography and existing drainage computations. This information was processed in HEC-RAS to determine the existing conditions of the Base Flood Elevations and then compared with the FIS for accuracy.

4.2. Proposed Conditions

The proposed conditions model was based on the proposed topography for the site access road and proposed bridge in the stream. This information was added into the existing conditions cross sections, and then was processed in HEC-RAS to determine the proposed conditions of the Base Flood Elevations. A summary of elevation changes showing the

existing and proposed BFEs at the various cross sections has been provided below. As shown in the table, the proposed development will not increase the existing BFEs more than 0.3' throughout the project area and return to 0.0' at the upstream and downstream termini of the study area.

NEW MILTON COMPRESSOR STATION ACCESS ROAD
FLOODPLAIN STUDY
SUMMARY OF COMPUTED ELEVATIONS

CROSS SECTION STATION	RIVER NAME	100 YEAR BASE FLOOD ELEVATION			
		DODDRIDGE COUNTY FIS MODEL*	EXISTING CONDITIONS MODEL	PROPOSED CONDITIONS MODEL	PROPOSED DIFFERENCE
2865.327	Toms Fork	833.5	833.9	833.9	0.0
2579.832	Toms Fork	833.0	833.7	833.7	0.0
2372.941	Toms Fork	832.8	833.2	833.3	+ 0.1
2123.812	Toms Fork	832.5	833.2	833.3	+ 0.1
2002.134	Toms Fork	832.3	832.8	832.9	+ 0.1
1929.868	Toms Fork	832.2	832.1	832.2	+ 0.1
1811.557	Toms Fork	832.1	831.7	832.0	+ 0.3
1726.403	Toms Fork	832.0	831.4	831.7	+ 0.3
1580.979	Toms Fork	831.8	831.6	831.8	+ 0.2
1528.223	Toms Fork	Bridge			
1483.221	Toms Fork	831.7	831.5	831.5	0.0
1421.670	Toms Fork	831.6	831.6	831.6	0.0
1293.596	Toms Fork	831.4	831.5	831.5	0.0
1000.000	Toms Fork	831.0	831.1	831.1	0.0

* ELEVATIONS ARE INTERPOLATED FROM DODDRIDGE COUNTY FIS EFFECTIVE OCTOBER 4, 2011.

5. Conclusion

The results of this floodplain analysis indicate that there will be minimal changes in the 100 year base flood elevation and no impacts to upstream and downstream adjacent properties along Toms Fork. The largest increase in base flood elevation is 0.3' and is located on site directly upstream of the stream crossing.

APPENDIX

Exhibit A	FIRM Panel 54017C0230C
Exhibit B	Overall Plan
Exhibit C	Existing Conditions Plan
Exhibit D	Proposed Conditions Plan
Supplement 1	Drainage Computations
Supplement 2	HEC-RAS Analysis –Existing Conditions Summary
Supplement 3	HEC-RAS Analysis –Proposed Conditions Summary w/ Cross Sections

Exhibit A

FIRM Panel 54017C0230C

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

METERS

PANEL 0230C

FIRM

FLOOD INSURANCE RATE MAP

DODDRIDGE COUNTY, WEST VIRGINIA AND INCORPORATED AREAS

PANEL 230 OF 325

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
DODDRIDGE COUNTY	540024	0230	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
54017C0230C

MAP REVISED
OCTOBER 4, 2011

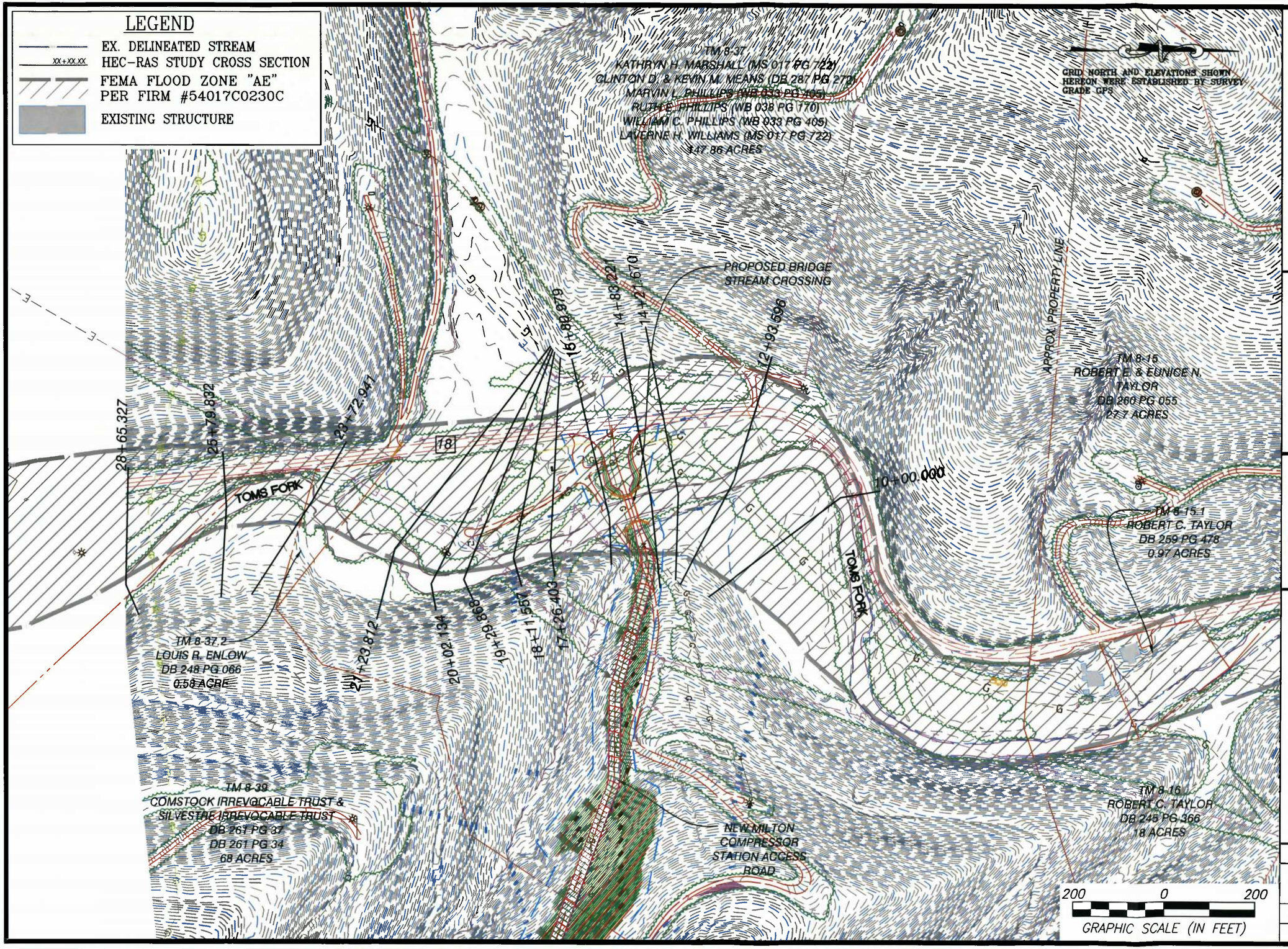
Federal Emergency Management Agency

NATIONAL FLOOD INSURANCE PROGRAM

JOINS PANEL 0235

Exhibit B

Overall Plan



NAVITUS ENGINEERING INC.
151 Windy Hill Lane
Winchester, Virginia 22602
Telephone: (888) 662-4185
www.navituseng.com
Engineering • Survey • Environmental • GIS

CYRUS S. KUMP
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
07/16/2013

ANTERO RESOURCES

THIS DOCUMENT WAS PREPARED FOR:
ANTERO RESOURCES CORPORATION

OVERALL PLAN

NEW MILTON
COMPRESSOR STATION ACCESS ROAD
NEW MILTON DISTRICT
DODDRIDGE COUNTY, WV

SCALE: 1" = 200'

NEW MILTON
JOB NO. ANT096

DATE: 07/16/2013

Exhibit C

Existing Conditions Plan

LEGEND

- EX. DELINEATED STREAM
- XX+XX.XX HEC-RAS STUDY CROSS SECTION
- FEMA FLOODPLAIN ZONE "AE"
- EXISTING 100-YR FLOODPLAIN

GRID NORTH AND ELEVATIONS SHOWN HEREON WERE ESTABLISHED BY SURVEY GRADE GPS

21+23.812, EX.=833.2
20+02.134, EX.=832.8
19+29.868, EX.=832.1
18+17.557, EX.=831.7
17+26.403, EX.=831.4
15+80.979, EX.=831.6
14+83.427, EX.=831.5
14+27.620, EX.=831.6
12+93.596, EX.=831.5
10+00.000, EX.=831.1

EX. OVERHEAD UTILITY
EX. BUILDING
EX. 18" CMP CULVERT
EX. TANKS
EX. 100 YEAR FLOODPLAIN
EX. STREAM FORD
EX. VALVE
EX. ACCESS ROAD
PERENNIAL STREAM 1 (TOMS FORK) PER KLEINFELDER WETLAND DELINEATION
EX. FEMA FLOOD ZONE "AE"
PP
18

50 0 50
GRAPHIC SCALE (IN FEET)

NAVITUS ENGINEERING INC.
151 Windy Hill Lane
Winchester, Virginia 22602
Telephone: (888) 662-4185
www.navituseng.com
Engineering • Survey • Environmental • GIS

CYRUS S. KUMP
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
07/16/2013

ANTERO RESOURCES
THIS DOCUMENT WAS PREPARED FOR: ANTERO RESOURCES CORPORATION

EXISTING CONDITIONS PLAN

NEW MILTON
COMPRESSOR STATION ACCESS ROAD
NEW MILTON DISTRICT
DODDRIDGE COUNTY, WV

SCALE: 1" = 50'

NEW MILTON
JOB NO. ANT096

DATE: 07/16/2013

Exhibit D

Proposed Conditions Plan

LEGEND

- EX. DELINEATED STREAM
- XX+XX.XX HEC-RAS STUDY CROSS SECTION
- FEMA FLOODPLAIN ZONE "AE"
- EXISTING 100-YR FLOODPLAIN
- PROPOSED 100-YR WSE

21+23.812, EX.=833.2, PR.=833.3, DIFF.=+0.7'
20+02.134, EX.=832.8, PR.=832.9, DIFF.=+0.4'
19+29.868, EX.=832.1, PR.=832.2, DIFF.=+0.1'
18+11.557, EX.=831.7, PR.=832.0, DIFF.=+0.3'
17+26.403, EX.=831.4, PR.=831.7, DIFF.=+0.3'
15+80.979, EX.=831.6, PR.=831.8, DIFF.=+0.2'
14+83.321, EX.=831.5, PR.=831.5, DIFF.=0.0'
14+21.600, EX.=831.6, PR.=831.6, DIFF.=0.0'
12+93.596, EX.=831.5, PR.=831.5, DIFF.=0.0'

GRID NORTH AND ELEVATIONS SHOWN HEREON WERE ESTABLISHED BY SURVEY GRADE GPS

EX. OVERHEAD UTILITY
EX. BUILDING
EX. 18" CMP CULVERT
EX. OVERHEAD UTILITY
EX. TANKS
EX. 100 YEAR FLOODPLAIN
EX. STREAM FORD
EX VALVE
EX. OVERHEAD UTILITY
EX. ACCESS ROAD
EX. BUILDING
EX. TANKS
EX. FEMA FLOOD ZONE "AE"
50' ACCESS ROAD W/ 4% NORMAL CROWN
LIMITS OF DISTURBANCE
PR. 100 YEAR FLOODPLAIN
16' WIDE STEEL BRIDGE W/ 8' DECK AND 30" BEAMS W/ HEADWALLS (60 LF) DESIGNED BY OTHERS
PERENNIAL STREAM 1 (TOMS FORK) PER KLEINFELDER WETLAND DELINEATION
10+00.000, EX.=831.7, PR.=831.1, DIFF.=0.0'
1+00
2+00
3+00
PP
18

50 0 50
GRAPHIC SCALE (IN FEET)

NAVITUS ENGINEERING INC.
151 Windy Hill Lane
Winchester, Virginia 22602
Telephone: (888) 662-4185
www.navituseng.com
Engineering • Survey • Environmental • GIS

CYRUS S. KUMP
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
07/16/2013

ANTERO RESOURCES
THIS DOCUMENT WAS PREPARED FOR: ANTERO RESOURCES CORPORATION

PROPOSED CONDITIONS PLAN

NEW MILTON
COMPRESSOR STATION ACCESS ROAD
NEW MILTON DISTRICT
DODDRIDGE COUNTY, WV

SCALE: 1" = 50'

NEW MILTON
JOB NO. ANT096

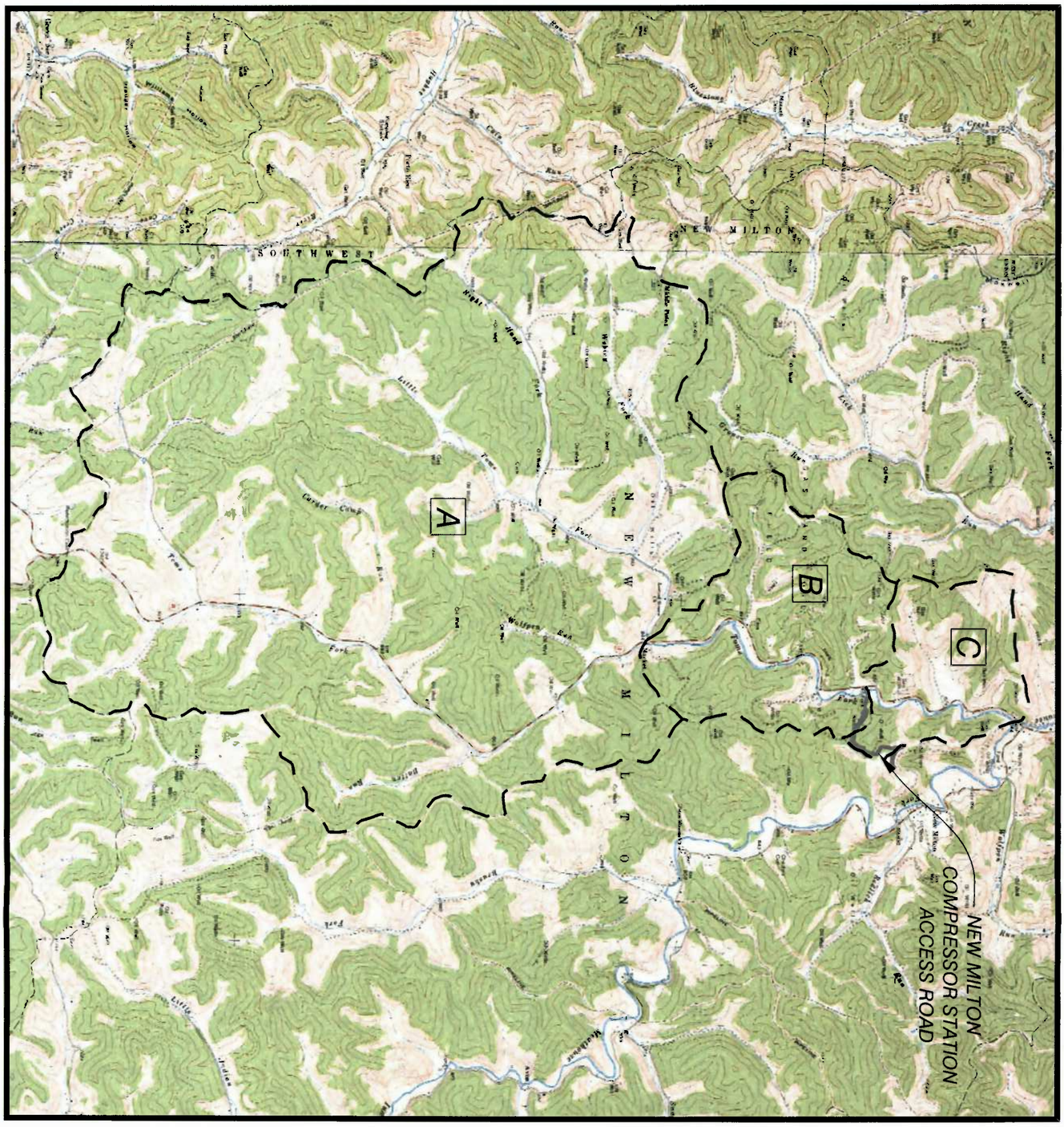
DATE: 07/16/2013

Supplement 1

Drainage Computations

DRAINAGE MAP

USGS 7.5 OXFORD QUAD MAP



USGS 7.5 NEW MILTON QUAD MAP

KEY	HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)
A	UPPER TOMS FORK	12.832
B	MIDDLE TOMS FORK	1.769
C	LOWER TOMS FORK	0.944
	TOTAL	15.545

WEST VIRGINIA STATE PLANE
COORDINATE SYSTEM
NORTH ZONE, NAD83
ELEVATION BASED ON NAVD88
ESTABLISHED BY SURVEY GRADE GPS
& OPUS POST-PROCESSING

4000 0 4000
GRAPHIC SCALE (IN FEET)

DRAINAGE MAP

NEW MILTON

COMPRESSOR STATION ACCESS ROAD

NEW MILTON DISTRICT
DODDRIDGE COUNTY, WV

ANTERO RESOURCES

THIS DOCUMENT WAS PREPARED FOR:
ANTERO RESOURCES CORPORATION

CYRUS B. KUHN
REGISTERED
15278
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
07/16/2013

NAVITUS
ENGINEERING INC.
151 Windy Hill Lane
Winchester, Virginia 22602
Telephone: (888) 662-4185
www.navituseng.com
Engineering • Survey • Environmental • GIS

SCALE: 1" = 4000'
NEW MILTON
JOB NO. ANT096
DATE: 07/16/2013

Supplement 2

HEC-RAS Analysis –Existing Conditions Summary

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: Saddle2
Project File : Saddle2.prj
Run Date and Time: 7/16/2013 7:49:15 PM

Project in English units

****

PLAN DATA

Plan Title: Existing
Plan File : X:\Navitus Jobfiles\Antero Resources\ANT096-Saddle\Engineering\Drainage Comp\Floodplain\Entrance-Crossing Study\Report\Computations\HEC-RAS\Revised Sections\Saddle2.p01

Geometry Title: Existing
Geometry File : X:\Navitus Jobfiles\Antero Resources\ANT096-Saddle\Engineering\Drainage Comp\Floodplain\Entrance-Crossing Study\Report\Computations\HEC-RAS\Revised Sections\Saddle2.g01

Flow Title : Existing-Revised
Flow File : X:\Navitus Jobfiles\Antero Resources\ANT096-Saddle\Engineering\Drainage Comp\Floodplain\Entrance-Crossing Study\Report\Computations\HEC-RAS\Revised Sections\Saddle2.f02

Plan Summary Information:

Number of:	Cross Sections	= 13	Multiple Openings	=	0
	Culverts	= 0	Inline Structures	=	0
	Bridges	= 0	Lateral Structures	=	0

Computational Information

Water surface calculation tolerance	= 0.001
Critical depth calculation tolerance	= 0.001
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: Existing-Revised
Flow File : X:\Navitus Jobfiles\Antero Resources\ANT096-Saddle\Engineering\Drainage Comp\Floodplain\Entrance-Crossing Study\Report\Computations\HEC-RAS\Revised Sections\Saddle2.f02

Flow Data (cfs)

River	Reach	RS	PF 1
Toms Fork	Toms Fork	2865.327	4015.3

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Toms Fork	Toms Fork	PF 1	Known WS = 833.5	Known WS = 831.1

****

GEOMETRY DATA

Geometry Title: Existing
Geometry File : X:\Navitus Jobfiles\Antero Resources\ANT096-Saddle\Engineering\Drainage Comp\Floodplain\Entrance-Crossing Study\Report\Computations\HEC-RAS\Revised Sections\Saddle2.g01

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 2865.327

INPUT
Description:
Station Elevation Data num= 100

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	2.89	848	3.73	847.42	5.78	846	8.24	844.95
10.3	844	12.9	842.79	14.63	842	20.51	841.56	22.47	841.4
26.09	841.11	32.66	841.36	44.49	841.93	44.56	841.93	44.57	841.93

44.6	841.93	49.67	841.3	52.98	840.89	54.84	840.66	56.84	840.4
56.98	840.39	59.93	840	62.2	838.99	64.42	838	66.42	837.11
68.93	836	77.13	835.38	80.1	835.15	89.55	834.48	91.63	834.33
96.42	834	96.46	834	103.31	833.74	108.11	833.57	115.2	833.31
120.18	833.17	144.96	832.42	149.19	832.28	158.3	832	161.69	831.77
162.91	831.7	163.61	831.66	172.16	831.13	177.1	830.87	181.93	830.59
192.98	830.03	193.14	830.02	193.52	830	195.11	829.63	202.28	828
203.58	827.9	204.23	827.86	205.83	827.75	208.78	827.55	218.92	826.86
225.69	826.43	226.36	826.39	227.77	826.3	228.45	826.25	232.59	826
233.5	824.89	234.03	824.24	234.61	823.57	239.85	823.64	241.59	823.67
250.02	823.8	269.19	824.13	281.09	824.36	281.53	824.87	281.9	825.29
282.64	826	283.77	827.33	285.69	827.68	287.35	828	290.48	828
292.08	828.23	293.87	828.48	299.55	829.32	303.22	829.8	304.12	830
305.84	831.05	306.98	831.74	307.38	832	309.66	833.4	310.6	834
312.52	835.18	313.8	836	315.48	837.04	316.99	838	318.62	839.12
319.93	840	321.46	841.28	322.33	842	324.02	843.41	324.73	844
326.6	845.56	327.13	846	329.22	847.75	329.52	848	331.9	850

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	232.59	.035	287.35	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
232.59	287.35	212.2	282.13	186.24	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	834.43	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.57	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	833.86	Reach Len. (ft)	212.20	282.13	186.24
Crit W.S. (ft)		Flow Area (sq ft)	409.12	522.91	97.01
E.G. Slope (ft/ft)	0.001252	Area (sq ft)	409.12	522.91	97.01
Q Total (cfs)	4015.30	Flow (cfs)	455.58	3431.24	128.48
Top Width (ft)	210.17	Top Width (ft)	132.39	54.76	23.03
Vel Total (ft/s)	3.90	Avg. Vel. (ft/s)	1.11	6.56	1.32
Max Chl Dpth (ft)	10.29	Hydr. Depth (ft)	3.09	9.55	4.21
Conv. Total (cfs)	113459.8	Conv. (cfs)	12873.3	96955.9	3630.5
Length Wtd. (ft)	268.25	Wetted Per. (ft)	132.76	57.29	24.27
Min Ch El (ft)	823.57	Shear (lb/sq ft)	0.24	0.71	0.31
Alpha	2.43	Stream Power (lb/ft s)	331.90	0.00	0.00
Frctn Loss (ft)	0.27	Cum Volume (acre-ft)	19.22	20.54	6.95
C & E Loss (ft)	0.05	Cum SA (acres)	5.62	2.27	1.59

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 2579.832

INPUT

Description:

Station Elevation Data num= 93

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	2.44	848	2.66	847.82	4.89	846	5.28	845.68
7.32	844	7.99	843.55	10.04	842	12.78	841.08	16.18	840
20.07	838.81	22.77	838	31.3	838	32.34	838.23	36.84	839.24
45.36	839.17	54.84	838.89	61	838.03	61.18	838	62.93	837.73
65.72	837.27	73.51	836	74.45	835.56	77.9	834	80.43	832.85
82.31	832	84.12	831.18	87.67	829.59	88.79	829.09	90.47	828.4
91.43	828	93.28	827.16	95.87	826	99.12	824.4	99.91	824
100.45	823.72	100.69	823.6	100.92	823.47	143.75	823.47	144.94	823.92
145.14	824	151.82	825.23	155.09	825.97	155.22	826	157.83	826
174.68	826.59	176.96	826.69	179.05	826.72	180.73	826.74	182.27	826.82
183.75	826.84	185.06	826.91	186.58	826.95	188.92	827.07	190.49	827.12
195.23	827.34	196.43	827.39	197.44	827.44	206.09	827.82	206.63	827.85
210.34	828	214.91	828.57	218.82	829.06	221.21	829.36	222.27	829.51
225.8	830	227.87	830.31	228.23	830.38	230.19	830.82	233.42	831.47
235.56	832	238.7	832.97	242.37	834	244.36	834.61	248.21	835.78
248.76	835.95	248.94	836	254.04	837.23	256.99	838	257.34	838
262.74	838.68	270.79	839.6	273.44	840	283.77	841.65	285.91	842
289.24	842.78	294.7	844	303.19	845.52	305.76	846	310.28	847.08
313.75	847.86	314.38	848	323.1	850				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	95.87	.035	155.09	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
95.87	155.09	271.1	188.24	66.66	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	834.11	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.41	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	833.70	Reach Len. (ft)	271.10	188.24	66.66
Crit W.S. (ft)		Flow Area (sq ft)	67.00	584.27	480.81
E.G. Slope (ft/ft)	0.000851	Area (sq ft)	67.00	584.27	480.81
Q Total (cfs)	4015.30	Flow (cfs)	67.42	3295.57	652.31
Top Width (ft)	162.73	Top Width (ft)	17.31	59.22	86.20
Vel Total (ft/s)	3.55	Avg. Vel. (ft/s)	1.01	5.64	1.36
Max Chl Dpth (ft)	10.23	Hydr. Depth (ft)	3.87	9.87	5.58
Conv. Total (cfs)	137645.8	Conv. (cfs)	2311.1	112973.3	22361.4
Length Wtd. (ft)	183.85	Wetted Per. (ft)	18.94	60.11	86.83
Min Ch El (ft)	823.47	Shear (lb/sq ft)	0.19	0.52	0.29
Alpha	2.10	Stream Power (lb/ft s)	323.10	0.00	0.00
Frctn Loss (ft)	0.21	Cum Volume (acre-ft)	18.06	16.95	5.71
C & E Loss (ft)	0.03	Cum SA (acres)	5.26	1.90	1.35

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: Toms Fork
REACH: Toms Fork RS: 2372.941

INPUT
Description:
Station Elevation Data num= 105

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	1.82	848	2.33	847.47	3.36	846.39	3.78	846
6.59	844.33	7.14	844	10.17	842.28	10.68	842	13.68	840.29
14.22	840	17.19	838.31	17.76	838	19.76	837.02	21.03	837.71
30.82	836.97	45.33	836.96	53.11	837.04	58.14	836.39	62.87	836
70.69	835.06	78.76	834	82.37	833.41	90.69	832	92.24	831.76
95.46	831.2	102.19	830	104.15	829.57	105.93	829.26	108.63	828.71
111.2	828.33	113.43	828	114.56	827.83	114.6	827.82	114.66	827.81
114.94	827.78	118.37	827.27	120.84	826.94	122.59	826.68	127.81	826
128.07	825.95	128.15	825.95	128.23	825.93	131.37	825.41	132.07	825.31
133.39	825.14	134.95	824.85	136.9	824.63	140.69	824	140.95	824
141.56	823.88	142.39	823.69	142.76	823.59	143.18	823.47	161.64	823.47
162.23	823.66	162.96	823.86	163.49	824	170.49	824.97	178.34	826
184.38	826.66	190.63	827.37	196.22	828	204.78	828.89	209.26	829.26
213.01	829.61	214.44	829.73	215.21	829.78	215.72	829.81	218.51	830
221.09	830.31	222.16	830.45	226.82	831.04	233.45	832	259.72	833.51
267.46	833.9	270.43	834	277.5	834	293.51	834.86	300.19	835.16
303.03	835.27	310.96	835.62	312.48	835.69	319.76	836	323.88	836.36
332.03	837.03	340.66	837.87	342.02	838	347.21	839.1	350.16	839.67
350.48	839.73	351.82	840	353.9	840.42	357.17	841.11	360.16	841.74
361.41	842	366.93	843.14	371.51	844	376.07	845.15	379.47	846
382.67	846.77	388.2	848	388.9	848.16	389.32	848.25	397.14	850

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	136.9	.035	170.49	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
136.9	170.49	494.68	209.34	278.69	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	833.87	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.66	Wt. n-Val.	0.035	0.035	0.100
W.S. Elev (ft)	833.21	Reach Len. (ft)	494.68	209.34	278.69
Crit W.S. (ft)		Flow Area (sq ft)	239.21	315.42	309.90
E.G. Slope (ft/ft)	0.001691	Area (sq ft)	239.21	315.42	309.90
Q Total (cfs)	4015.30	Flow (cfs)	1126.07	2438.45	450.78

* Top Width (ft)	* 170.84	* Top Width (ft)	* 53.32	* 33.59 * 83.93 *
* Vel Total (ft/s)	* 4.64	* Avg. Vel. (ft/s)	* 4.71	* 7.73 * 1.45 *
* Max Chl Dpth (ft)	* 9.74	* Hydr. Depth (ft)	* 4.49	* 9.39 * 3.69 *
* Conv. Total (cfs)	* 97647.1	* Conv. (cfs)	* 27384.5	* 59300.1 * 10962.5 *
* Length Wtd. (ft)	* 267.77	* Wetted Per. (ft)	* 54.02	* 33.85 * 84.37 *
* Min Ch El (ft)	* 823.47	* Shear (lb/sq ft)	* 0.47	* 0.98 * 0.39 *
* Alpha	* 1.98	* Stream Power (lb/ft s)	* 397.14	* 0.00 * 0.00 *
* Frctn Loss (ft)	* 0.25	* Cum Volume (acre-ft)	* 17.10	* 15.01 * 5.11 *
* C & E Loss (ft)	* 0.12	* Cum SA (acres)	* 5.04	* 1.70 * 1.22 *

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: Toms Fork
REACH: Toms Fork RS: 2123.812

INPUT
Description:
Station Elevation Data num= 145

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	7.61	848.12	8.1	848	11.48	846.85	14.02	846
17.32	844.89	20.19	844	29.09	842.54	32.44	842	39.97	840.57
41	840.36	41.44	840.27	41.87	840.18	42.76	840	44.29	839.85
44.87	839.81	45.61	839.77	58.05	838.76	60.93	838.66	73.97	838
80.16	838	86.28	837.78	88.03	837.76	89.01	837.75	89.33	837.75
96.23	837.46	96.83	837.47	114.62	837.25	123.08	837.03	153.21	836.5
165.6	836.24	167.39	836.2	176.66	836	183.88	836	185.94	835.94
186.45	835.92	193.78	835.74	197.53	835.66	200.81	835.61	203.09	835.51
207.46	835.41	211.32	835.23	215.79	835.06	217.31	834.99	218.58	834.93
219.59	834.88	221.23	834.79	225.89	834.56	228.39	834.42	237.61	834
240.15	833.94	250.89	833.92	251.23	833.98	252.74	834.04	256.18	834.13
266.1	834.44	276.79	834.81	279.36	834.6	282	834.51	292.41	834.43
302.29	834.14	305	834	306.65	834	318.72	833.83	322.62	833.82
326.83	833.77	349.34	833.52	366.28	833.31	381.19	833.17	409.51	832.76
442.18	832	458.66	832	459.09	831.91	460.58	831.67	467.09	830.52
470.93	830	472.47	829.86	473.63	829.73	474.35	829.63	476.54	829.59
478.33	829.44	480.51	829.24	482.35	829.05	484.53	829.08	493.14	828.72
510.22	828	540.14	828	541.2	827.11	542.5	826	543.18	825.38
544.61	824	544.96	823.68	545.31	822.47	562.34	822.47	590.93	822.47
591.34	823.26	591.75	823.47	592.68	823.87	592.98	824	596.16	824.59
597.7	824.75	600.18	825.16	601.92	825.29	603.14	825.47	603.8	825.56
606.61	825.79	609.14	825.89	609.21	825.89	611.75	826	618.47	826
623.51	826.14	623.89	826.15	627.54	826.26	629.08	826.31	634.67	826.43
637.3	826.52	638.18	826.54	665.48	826.98	667.38	826.96	668.91	827.09
670.46	827.22	674.09	827.49	676.03	827.52	680.97	828	682.63	828.93
684.49	830	686.81	831.3	688.03	832	689.62	832.9	691.61	834

693.43	834.9	695.67	836	699.67	837.95	699.76	838	699.9	838.07
703.8	840	708.04	841.9	708.27	842	708.74	842.21	712.7	844
716.95	845.96	717.03	846	717.11	846.04	721.13	848	725.2	850

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	540.14	.035	611.75	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
540.14	611.75	4.85	111.36	132.72	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	833.50	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.26	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	833.24	Reach Len. (ft)	4.85	111.36	132.72
Crit W.S. (ft)		Flow Area (sq ft)	414.05	700.28	477.75
E.G. Slope (ft/ft)	0.000581	Area (sq ft)	414.05	700.28	477.75
Q Total (cfs)	4015.30	Flow (cfs)	271.80	3179.77	563.73
Top Width (ft)	316.78	Top Width (ft)	166.68	71.61	78.49
Vel Total (ft/s)	2.52	Avg. Vel. (ft/s)	0.66	4.54	1.18
Max Chl Dpth (ft)	10.77	Hydr. Depth (ft)	2.48	9.78	6.09
Conv. Total (cfs)	166543.1	Conv. (cfs)	11273.4	131887.8	23381.9
Length Wtd. (ft)	100.93	Wetted Per. (ft)	166.93	74.95	79.93
Min Ch El (ft)	822.47	Shear (lb/sq ft)	0.09	0.34	0.22
Alpha	2.60	Stream Power (lb/ft s)	725.20	0.00	0.00
Frctn Loss (ft)	0.08	Cum Volume (acre-ft)	13.40	12.57	2.59
C & E Loss (ft)	0.03	Cum SA (acres)	3.79	1.45	0.70

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: Toms Fork
REACH: Toms Fork RS: 2002.134

INPUT
Description:
Station Elevation Data num= 120

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	5.75	848.69	9.25	848	12.54	847.07	14.98	846.36
16.39	846	21.54	844.57	23.9	844	28.14	843.37	29.49	843.11
31.27	842.82	35.31	842	36.84	841.71	44.09	840.36	45.66	840.07
46.05	840	58.46	838.43	59.73	838.27	60.32	838.19	61.51	838
68.14	838	84.71	837.13	87.17	837.04	90.91	836.93	93.76	836.87
96.92	836.74	102.52	836.63	109.38	836.49	117.27	836.33	120.05	836.28

121.42	836.22	123.9	836.21	135.46	836	152.3	836	152.93	835.97
153.56	835.95	175.95	834.99	193.37	834.28	196.51	834.15	200.1	834
205.39	833.72	210.34	833.1	210.74	833.15	211.69	833.31	213.96	833.36
216.02	833.45	235.66	834	252.32	834	256.05	833.9	257.04	833.88
276.33	833.31	279.34	833.28	281.75	833.27	295.27	832.92	301.58	832.91
307.93	832.77	318.74	832.74	323.19	832.66	337.48	832.62	342.49	832.54
382.49	832.24	402.49	832	443.94	832	448.99	831.31	452.91	830.94
462.54	830	463.53	829.84	463.96	829.78	467.24	829.24	468.14	829.14
470.59	828.79	471.7	828.67	472.1	828.64	472.57	828.59	474.78	828.35
475.89	828.26	476.06	828.26	477.8	828	488.57	828	491.73	827.76
492.21	827.75	494.02	827.72	494.54	827.71	527.7	826.75	553.46	826
561.05	826	561.73	825.49	563.27	824	563.54	823.79	564.49	822.87
577.19	822.74	603.13	822.47	605.42	823.91	605.57	824	609.95	825.19
612.91	826	613.85	826.72	615.51	828	616.81	828.98	618.12	830
619.93	831.36	620.77	832	623.33	833.91	623.44	834	623.55	834.08
625.99	836	626.03	836.04	628.31	838	629.29	838.81	630.68	840
632.39	841.41	633.09	842	635.36	843.87	635.52	844	636.52	844.78
637.1	845.24	638.07	846	640.63	847.87	640.8	848	643.54	850

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	561.05	.035	612.91	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
561.05	612.91	5.33	72.27	84.5	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	833.38	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.58	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	832.80	Reach Len. (ft)	5.33	72.27	84.50
Crit W.S. (ft)		Flow Area (sq ft)	644.97	500.64	30.24
E.G. Slope (ft/ft)	0.001269	Area (sq ft)	644.97	500.64	30.24
Q Total (cfs)	4015.30	Flow (cfs)	634.08	3350.23	30.98
Top Width (ft)	315.31	Top Width (ft)	254.52	51.86	8.93
Vel Total (ft/s)	3.41	Avg. Vel. (ft/s)	0.98	6.69	1.02
Max Chl Dpth (ft)	10.33	Hydr. Depth (ft)	2.53	9.65	3.38
Conv. Total (cfs)	112718.3	Conv. (cfs)	17800.2	94048.5	869.7
Length Wtd. (ft)	64.92	Wetted Per. (ft)	254.81	53.79	11.23
Min Ch El (ft)	822.47	Shear (lb/sq ft)	0.20	0.74	0.21
Alpha	3.22	Stream Power (lb/ft s)	643.54	0.00	0.00
Frctn Loss (ft)	0.11	Cum Volume (acre-ft)	13.34	11.03	1.81
C & E Loss (ft)	0.06	Cum SA (acres)	3.77	1.29	0.57

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
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: Toms Fork
REACH: Toms Fork RS: 1929.868

INPUT
Description:
Station Elevation Data num= 127

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	9.69	848.14	10.44	848	16.57	846.52	19	846
22.06	845.27	23.4	844.99	28.18	844	28.7	843.91	29.27	843.8
34.05	842.91	38.56	842	39.24	841.89	39.57	841.83	44.23	841.11
46.52	840.64	48.15	840.39	49.88	840	53.06	839.56	57.34	839.03
62.7	838	63.49	838	95.81	836.27	101.33	836.06	101.57	836.05
103.51	836	104.46	836	106.48	835.94	113.45	835.8	113.98	835.79
120.44	835.67	140.38	835.62	141.17	835.63	142.8	835.61	144.74	835.58
147.99	835.47	148.7	835.47	152.05	835.32	153.09	835.29	166.02	834.72
167.81	834.65	171.79	834.47	182.48	834	186.18	832.37	186.98	832
189.63	832	190.59	832.17	191.57	832.36	193.59	832.72	211.11	833.08
214.56	833.17	215.19	833.21	215.57	833.24	217.58	833.36	229.11	834
235.48	834	243.03	833.47	247.63	833.34	262.04	832.65	276.26	832.35
277.28	832.32	293.07	832	355.46	832	360.25	831.81	388.23	831.91
390.46	831.9	394.56	832	411.75	832	413.92	831.91	418.69	831.72
420.02	831.67	421.45	831.61	434.07	831.52	435.68	831.52	435.95	831.61
436.19	831.7	437.05	832	451.01	832	457.66	831.46	460.43	831.24
464.27	830.93	466.72	830.73	472.68	830	477.88	828.1	478.17	828
487.76	826.55	489.16	826.33	495.7	826	497.25	826	519.34	826
520.31	825.28	522.18	824	522.87	823.57	523.4	823.17	523.76	822.87
527.6	822.84	528.89	822.83	532.08	822.8	552.31	822.57	560.43	822.47
561.98	823.63	562.39	824	563.46	824.74	565.18	826	566.72	827.13
568.04	828	569.7	829.21	570.9	830	572.63	831.25	573.74	832
575.53	833.28	576.58	834	577.39	834.76	578.84	836	579.87	837.17
580.64	838	581.81	839.35	582.42	840	583.77	841.56	584.18	842
585.76	843.84	585.91	844	586.04	844.16	586.72	844.95	587.6	846
589.67	848	591.96	850						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	519.34	.035	565.18	.1

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
519.34 565.18 5.86 118.14 110.15 .1 .3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	235.48	834	F

CROSS SECTION OUTPUT Profile #PF 1

* E.G. Elev (ft)	* 833.21	* Element	* Left OB	* Channel	* Right OB *

Vel Head (ft)	1.16	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	832.05	Reach Len. (ft)	5.86	118.14	110.15
Crit W.S. (ft)	829.15	Flow Area (sq ft)	294.11	414.19	25.96
E.G. Slope (ft/ft)	0.002530	Area (sq ft)	294.26	414.19	25.96
Q Total (cfs)	4015.30	Flow (cfs)	259.41	3720.50	35.39
Top Width (ft)	286.29	Top Width (ft)	231.82	45.84	8.63
Vel Total (ft/s)	5.47	Avg. Vel. (ft/s)	0.88	8.98	1.36
Max Chl Dpth (ft)	9.58	Hydr. Depth (ft)	1.29	9.04	3.01
Conv. Total (cfs)	79822.8	Conv. (cfs)	5156.9	73962.3	703.6
Length Wtd. (ft)	106.42	Wetted Per. (ft)	229.45	48.01	10.54
Min Ch El (ft)	822.47	Shear (lb/sq ft)	0.20	1.36	0.39
Alpha	2.50	Stream Power (lb/ft s)	591.96	0.00	0.00
Frctn Loss (ft)	0.25	Cum Volume (acre-ft)	13.28	10.27	1.76
C & E Loss (ft)	0.01	Cum SA (acres)	3.74	1.21	0.55

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water
surface that had the least amount of error between computed and assumed values.
Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 1811.557

INPUT
Description:
Station Elevation Data num= 127

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	8.09	848.68	9.6	848.44	12.25	848	15.63	847.32
17.53	847.03	22.85	846.14	23.34	846.05	23.62	846	29.14	845.01
29.7	844.93	31.77	844.59	35.22	844	38.73	843.44	40.77	843.25
44.36	842.76	49.7	842.06	50.03	842	54.63	840.79	58.16	840
60.2	839.66	63.13	839.24	66.64	838.88	68.31	838.67	72.99	838.13
73.95	838	87.5	836.44	90.85	836	91.66	836	100.94	835.61
101.33	835.59	110.34	835.25	110.4	835.24	121.22	834.87	124.68	834.79
125.19	834.78	128.31	834.73	131.18	834.66	139.14	834.59	139.43	834.59
145.89	834.47	154.04	834.29	161.88	834	163.25	834	165.31	833.16
168	832	173.5	832	173.52	832	175.04	832.3	193.36	832.94
194.25	832.97	194.4	832.96	194.97	833.03	195.62	833.08	208.04	834
229.9	834	238.7	833.13	240.06	833.08	246.53	832	265.48	832
303.93	831.45	312.8	831.4	332.62	831	353.67	831.77	354.78	831.72
359.46	831.02	369.02	830.99	369.43	831	369.91	830.99	370.02	830.99
370.53	830.98	370.91	830.97	389.65	830.53	394.54	830.38	401.08	830.18
406.7	830	407.31	829.79	412.33	828	413.45	827.6	414.68	827.16
417.14	826.3	417.99	826	443.82	826	444.09	825.85	445.72	825.04
447.77	824	447.95	823.91	449.82	822.87	459.79	822.8	489.1	822.47

489.21	822.59	489.36	822.75	490.51	824	490.88	824.38	492.37	826
493.93	827.55	494.37	828	497.57	830.56	499.37	832	499.82	832.35
501.88	834	503.33	835.14	504.41	836	505.89	837.68	506.17	838
506.24	838.08	507.77	840	508.33	840.71	509.35	842	510.56	843.55
510.91	844	511.55	844.84	512.54	846	513.19	846.66	514.51	848
516.01	849.18	517.12	850	518.94	851.43	519.47	851.82	519.7	852
521.72	853.59	522.26	854	524.41	855.7	524.8	856	527.06	857.79
527.34	858	530.07	860						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	443.82	.035	492.37	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
443.82	492.37	17.98	85.13	75.99	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	832.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.04	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	831.74	Reach Len. (ft)	17.98	85.13	75.99
Crit W.S. (ft)		Flow Area (sq ft)	268.92	424.04	18.26
E.G. Slope (ft/ft)	0.002415	Area (sq ft)	268.92	424.04	18.26
Q Total (cfs)	4015.30	Flow (cfs)	356.05	3637.59	21.66
Top Width (ft)	214.39	Top Width (ft)	159.16	48.55	6.68
Vel Total (ft/s)	5.65	Avg. Vel. (ft/s)	1.32	8.58	1.19
Max Chl Dpth (ft)	9.27	Hydr. Depth (ft)	1.69	8.73	2.73
Conv. Total (cfs)	81703.8	Conv. (cfs)	7245.0	74018.2	440.6
Length Wtd. (ft)	78.20	Wetted Per. (ft)	159.93	50.86	8.82
Min Ch El (ft)	822.47	Shear (lb/sq ft)	0.25	1.26	0.31
Alpha	2.10	Stream Power (lb/ft s)	530.07	0.00	0.00
Frctn Loss (ft)	0.21	Cum Volume (acre-ft)	13.24	9.14	1.70
C & E Loss (ft)	0.02	Cum SA (acres)	3.71	1.08	0.53

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water
surface that had the least amount of error between computed and assumed values.
Warning: Divided flow computed for this cross-section.

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 1726.403

INPUT
Description:
Station Elevation Data num= 111

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

0	850	7.69	848.75	12.67	848	13.53	847.86	13.88	847.81
14.58	847.69	23.99	846	24.2	845.96	24.7	845.87	35.04	844
35.58	844	35.72	843.97	36.71	843.76	44.45	842	50.81	840.91
56.16	840	62.16	839.16	70.39	838	76.77	836.99	82.9	836
107.43	834.59	111.92	834.32	113.55	834.23	114.44	834.18	115.04	834.14
118.29	834	133.54	833	145.97	832	153.68	832	153.78	832.03
154.17	832.11	170.85	832.35	172.32	832.36	172.33	832.36	172.33	832.35
172.36	832.35	172.46	832.35	172.61	832.34	172.88	832.33	173.84	832.26
177.54	832	261.15	832	263.09	831.66	263.15	831.66	264.41	831.43
264.73	831.44	265.31	831.48	266.23	831.31	267.04	831.34	274.24	831.18
277.67	831.06	279.87	830.91	303.11	830.11	303.13	830.11	303.2	830.11
313.87	830.99	332.27	830.68	338.82	830.44	346.78	830.13	350.22	830
354.85	828.9	358.99	828	361.29	827.15	364.99	826	368.69	826
374.3	826	386.59	824.73	394.79	824.26	396.56	824.16	399.37	824
400.62	823.5	401.24	823.25	402.13	822.87	415.76	822.73	440.37	822.47
441.28	823.54	441.62	824	442.72	825.29	443.28	826	446.77	827.59
447.66	828	451.15	831.19	452.07	832	453.87	833.62	454.27	834
454.56	834.26	456.73	836	458.44	837.72	458.72	838	459.92	839.21
460.72	840	461.32	840.61	462.7	842	463.86	843.24	464.51	844
465.71	845.39	466.11	845.85	466.23	846	466.54	846.24	468.77	848
470.01	848.97	471.31	850	472.48	850.91	473.86	852	474.93	852.84
476.4	854	477.37	854.77	478.94	856	481.17	857.79	481.43	858
485.12	860								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	399.37	.035	441.62	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
399.37	441.62	25.62	144.25	127.32	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	832.60	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.25	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	831.35	Reach Len. (ft)	25.62	144.25	127.32
Crit W.S. (ft)		Flow Area (sq ft)	318.03	363.95	35.79
E.G. Slope (ft/ft)	0.002988	Area (sq ft)	318.03	363.95	35.79
Q Total (cfs)	4015.30	Flow (cfs)	459.43	3496.90	58.97
Top Width (ft)	185.33	Top Width (ft)	133.37	42.25	9.71
Vel Total (ft/s)	5.59	Avg. Vel. (ft/s)	1.44	9.61	1.65
Max Chl Dpth (ft)	8.88	Hydr. Depth (ft)	2.38	8.61	3.68
Conv. Total (cfs)	73457.0	Conv. (cfs)	8404.9	63973.3	1078.8
Length Wtd. (ft)	130.95	Wetted Per. (ft)	134.08	43.20	12.39
Min Ch El (ft)	822.47	Shear (lb/sq ft)	0.44	1.57	0.54
Alpha	2.58	Stream Power (lb/ft s)	485.12	0.00	0.00
Frctn Loss (ft)	0.25	Cum Volume (acre-ft)	13.12	8.37	1.66
C & E Loss (ft)	0.21	Cum SA (acres)	3.65	0.99	0.52

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross

sections.
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: Toms Fork
REACH: Toms Fork RS: 1580.979

INPUT
Description:
Station Elevation Data num= 105

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	9.68	848	15.17	846.8	15.87	846.64	18.77	846
20.81	845.56	28	844	35.76	842.18	36.54	842	36.96	841.92
47.38	840	47.87	839.9	56.87	838	68.15	836.06	68.41	836.01
77.1	834.66	80.22	834.43	85.29	834	85.35	834	89.24	833.81
92.24	833.63	92.64	833.63	93.17	833.63	94.58	833.62	97.89	833.46
100.76	833.32	133.45	832	138.56	832	141.4	831.74	147.18	831.31
158.75	831.48	165.31	831.53	185.18	831.5	191.55	831.44	193.11	831.6
206.25	831.02	217.47	830.66	227.63	830.24	231.61	830.09	236.83	830
237.47	829.75	238.59	829.37	245.76	829.63	249.16	829.77	253.95	830
253.96	830	253.97	830	260.61	830	272.1	829.31	290.5	828
293.32	828	298.88	827.16	303.61	826.89	315.57	826	316.11	826
317.58	826	317.83	825.95	322.94	825.12	323.18	825.12	328.6	824.28
328.79	824.25	330.08	824	334.79	823.2	336.76	822.74	337.42	822.86
337.84	822.87	365.19	822.64	382.75	822.47	382.79	822.67	383	822.67
386.52	823.76	387.12	824	389.83	824.32	390.64	824.42	395.83	825.08
400.52	825.66	403.1	826	409.08	826.75	412.02	827.12	419.58	827.98
419.67	827.99	419.74	827.99	419.75	827.99	419.78	828	427.07	828
428.22	828.41	434.02	830	434.67	830.39	436.52	832	439.1	833.98
441.66	836	442.29	836.49	444.2	838	446.24	839.6	446.78	840
447.35	840.4	449.74	842	451.59	843.1	453.32	844	456.03	845.43
457.1	846	457.93	846.44	460.96	848	463.4	849.33	464.87	850

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	330.08	.035	387.12	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
330.08	387.12	123.76	97.42	118.65	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	832.14	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.56	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	831.59	Reach Len. (ft)	123.76	97.42	118.65
Crit W.S. (ft)		Flow Area (sq ft)	371.62	500.61	227.20

* E.G. Slope (ft/ft)	*0.001341	* Area (sq ft)	* 371.62	* 500.61	* 227.20	*	
* Q Total (cfs)	* 4015.30	* Flow (cfs)	* 383.83	* 3292.34	* 339.13	*	
* Top Width (ft)	* 292.23	* Top Width (ft)	* 186.26	* 57.04	* 48.93	*	
* Vel Total (ft/s)	* 3.65	* Avg. Vel. (ft/s)	* 1.03	* 6.58	* 1.49	*	
* Max Chl Dpth (ft)	* 9.12	* Hydr. Depth (ft)	* 2.00	* 8.78	* 4.64	*	
* Conv. Total (cfs)	*109636.6	* Conv. (cfs)	* 10480.5	* 89896.3	* 9259.8	*	
* Length Wtd. (ft)	* 102.95	* Wetted Per. (ft)	* 186.77	* 57.55	* 50.01	*	
* Min Ch El (ft)	* 822.47	* Shear (lb/sq ft)	* 0.17	* 0.73	* 0.38	*	
* Alpha	* 2.68	* Stream Power (lb/ft s)	* 464.87	* 0.00	* 0.00	*	
* Frctn Loss (ft)	* 0.14	* Cum Volume (acre-ft)	* 12.92	* 6.93	* 1.27	*	
* C & E Loss (ft)	* 0.02	* Cum SA (acres)	* 3.56	* 0.83	* 0.43	*	

Warning: Divided flow computed for this cross-section.

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 1483.221

INPUT
Description:
Station Elevation Data num= 119

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	5.81	848	7.38	847.46	9.29	846.8	11.59	846
12.45	845.72	17.64	844	22	842.63	23.96	842	28.51	840.53
30.08	840	35.58	838.12	35.95	838	37.05	837.65	42.19	836
46.82	834.38	47.91	834	52.05	832.41	53.12	832	53.33	831.92
58.38	830	59.39	830	69.2	829.64	77.21	829.39	84.78	829.19
91.53	828.99	94.05	828.92	103.42	828.67	104.03	828.65	110.46	828.46
112.7	828.4	114.09	828.37	119.86	828.27	120.77	828.25	122.62	828.22
123.19	828.21	132.4	828.09	132.67	828.09	133.01	828.08	134.54	828.07
135.22	828.07	135.64	828.07	139.19	828.09	139.28	828.09	139.61	828.09
139.88	828.09	140.15	828.09	143.01	828.18	152.35	828.3	153.73	828.36
156.58	828.49	168.1	828.8	176.97	829.32	188.61	830	189.36	830.1
191.09	830.42	197.36	830.41	210.1	830.63	218.76	830.09	220.05	830
220.87	830	270.1	828.71	272.93	828.65	299.31	828	302.7	827.77
303.52	827.77	306.38	827.68	320.02	827.07	325.65	826.82	326.24	826.81
328.46	826.79	353.75	826	356.58	826	357.24	825.45	359.31	824
360.1	823.52	362.29	822.03	382.46	822.33	401.54	822.42	405.94	823.87
406.29	824	408.51	824.33	415.99	825.23	420.95	825.86	422.22	826
425.52	827.67	426.14	828	429.24	829.72	429.75	830	429.89	830.02
440.71	831.89	441.32	832	444.32	832	480.07	833.73	485.11	834
492.49	835.38	495.7	836	499.07	836.62	506.5	838	512.87	839.45
515.34	840	519.08	840.85	521.04	841.23	522.71	841.52	523.54	841.67
525.58	842	527.64	842.31	530.45	842.83	534.69	843.56	536.71	844
536.83	844	543.95	845.16	545.09	845.34	549.15	846	554.58	846.76
563.93	848	564.84	848	566.68	848.39	572.35	850		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	356.58	.035	408.51	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
356.58	408.51	54.14	61.47	37.92	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	831.98	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.47	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	831.51	Reach Len. (ft)	54.14	61.47	37.92
Crit W.S. (ft)		Flow Area (sq ft)	851.06	461.38	120.42
E.G. Slope (ft/ft)	0.001285	Area (sq ft)	851.06	461.38	120.42
Q Total (cfs)	4015.30	Flow (cfs)	903.20	2954.38	157.72
Top Width (ft)	384.11	Top Width (ft)	302.17	51.93	30.00
Vel Total (ft/s)	2.80	Avg. Vel. (ft/s)	1.06	6.40	1.31
Max Chl Dpth (ft)	9.48	Hydr. Depth (ft)	2.82	8.88	4.01
Conv. Total (cfs)	112005.1	Conv. (cfs)	25194.4	82411.1	4399.7
Length Wtd. (ft)	59.23	Wetted Per. (ft)	302.65	53.46	31.23
Min Ch El (ft)	822.03	Shear (lb/sq ft)	0.23	0.69	0.31
Alpha	3.88	Stream Power (lb/ft s)	572.35	0.00	0.00
Frctn Loss (ft)	0.06	Cum Volume (acre-ft)	11.18	5.86	0.80
C & E Loss (ft)	0.05	Cum SA (acres)	2.86	0.70	0.33

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 1421.670

INPUT
Description:
Station Elevation Data num= 114

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	2.79	849.15	6.37	848	7.77	847.56	9.4	847.08
12.05	846.29	13.14	846	17.43	845.03	21.19	844.05	21.4	844
21.6	843.92	27.18	842	28.6	841.36	31.86	840	34.65	838.93
36.95	838	39.48	837.09	43.26	836.17	43.69	836.05	43.78	836.04
43.84	836.03	44.08	836	45.26	836	47.98	835.5	50.67	835.2
52.4	835.01	53.64	834.87	56.33	834.58	56.76	834.53	58.93	834.29
59.09	834.26	60.91	834	61.53	833.91	61.77	833.88	65.76	833.25
67.21	833.05	69.67	832.68	74.1	832	75.37	831.72	78.33	831.04
79.3	830.81	83.15	830	84.82	829.93	85.04	829.92	85.58	829.89
89.94	829.68	94.22	829.47	99.72	829.24	110.94	828.47	113.82	828.32
115.24	828.25	117.83	828	174.08	828	174.52	828.04	194.87	830
195.39	830.04	197.72	830.24	210.01	830.31	216.6	830.41	218.07	830.25
219.57	830.05	219.97	830	222.23	829.79	230.6	829.12	241.79	828.19
244.75	828	267.96	828	272.56	827.85	273.71	827.84	275.94	827.7
278.22	827.59	301.45	826	323.5	826	356.72	826	358.07	824.91

359.23	824	359.84	823.54	362.77	821.27	387.26	822.16	393.71	822.38
411.92	823.65	414.58	824	416.84	824	418.53	825.41	418.9	825.72
419.26	826	419.65	826.31	421.76	828	424.27	830	435.33	830.62
437.01	830.73	456.8	832	472.29	832.9	493.97	834	495.74	834.51
500.32	836	502.54	836.66	507.57	838	509.02	838.37	515.42	840
517.32	840.46	523.35	842	525.17	842.45	527.3	843.03	531.03	844
538.61	844.9	543.35	845.45	545.39	845.69	547.61	846	547.81	846
553.14	846.84	558.54	847.64	560.73	848	567.55	850		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	356.72	.035	424.27	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
356.72	424.27	284.66	127.14	14.01	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	831.87	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.32	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	831.56	Reach Len. (ft)	284.66	127.14	14.01
Crit W.S. (ft)		Flow Area (sq ft)	978.83	575.77	20.58
E.G. Slope (ft/ft)	0.000926	Area (sq ft)	978.83	575.77	20.58
Q Total (cfs)	4015.30	Flow (cfs)	1016.45	2990.82	8.03
Top Width (ft)	373.80	Top Width (ft)	280.64	67.55	25.61
Vel Total (ft/s)	2.55	Avg. Vel. (ft/s)	1.04	5.19	0.39
Max Chl Dpth (ft)	10.29	Hydr. Depth (ft)	3.49	8.52	0.80
Conv. Total (cfs)	131983.2	Conv. (cfs)	33410.6	98308.6	264.0
Length Wtd. (ft)	164.00	Wetted Per. (ft)	281.15	71.39	25.66
Min Ch El (ft)	821.27	Shear (lb/sq ft)	0.20	0.47	0.05
Alpha	3.14	Stream Power (lb/ft s)	567.55	0.00	0.00
Frctn Loss (ft)	0.12	Cum Volume (acre-ft)	10.04	5.13	0.74
C & E Loss (ft)	0.02	Cum SA (acres)	2.50	0.62	0.30

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 1293.596

INPUT
Description:
Station Elevation Data num= 131

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	4.12	848	8.06	846.06	8.17	846	8.81	845.68
12.19	844	12.67	843.76	16.32	842	21.32	840.26	22.02	840
22.88	839.69	23.71	839.41	27.76	838	30.51	837.06	33.76	836
35.14	835.59	43.54	835.21	44.85	835.17	45.09	835.16	45.37	835.14
46.01	835.06	52.66	834.02	52.75	834	52.76	834	52.81	833.98

57.47	832	61.78	831.6	64.46	831.35	70.98	830.78	77.87	830.09
78.18	830.06	78.72	830	83.23	829.79	84.2	829.74	90.44	829.43
96.17	829.17	104.55	828.86	106.6	828.82	107.4	828.77	113.81	829.28
116.59	829.47	116.83	829.46	116.9	829.46	127.6	828.54	136.41	828.39
140.21	828.11	141.37	828.01	141.44	828	146.09	826.7	148.09	826.12
148.31	826.05	148.61	826	150.46	826	151.22	826.07	153.3	826.23
153.77	826.17	156.73	826.29	164.02	826	170.8	826	174.64	825.61
175.18	825.62	175.49	825.64	183.13	825.23	183.52	825.24	184.54	825.29
187.88	825.12	189.56	825.18	209.18	825.12	214.39	825	221.13	824.84
227.6	824.69	228.7	824.66	236.9	824.44	243.38	824.3	257.03	824
259.48	822.47	260.32	821.95	260.94	821.57	261.45	821.27	308.31	821.27
308.52	821.4	308.8	821.51	310.32	821.96	310.46	822	314.14	823
319.94	824	319.95	824	323.41	824.63	327.21	825.87	327.4	825.93
327.57	826	328.17	826.28	331.9	828	333.47	828.78	334.86	829.52
335.72	830	337.6	830	376.51	830	434.08	831.68	435.98	831.69
439.81	831.83	440.38	831.83	444.86	831.97	445.9	832	450.97	832.69
452.42	832.95	456.13	833.55	457.6	833.77	459.01	834	463.1	834.77
468.93	836	473.04	836.97	475.41	837.5	477.76	838	482.57	838.97
485.12	839.48	487.6	840	490.72	840.62	493.43	841.09	495.45	841.46
498.55	842	501.14	842.35	510.55	844	510.81	844.04	520.74	845.8
521.82	845.99	521.85	846	522.07	846.04	533.57	848	536.16	848.49
544.51	850								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	257.03	.035	335.72	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
257.03	335.72	379.96	235.75	67.58	.1 .3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	831.73	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.24	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	831.49	Reach Len. (ft)	379.96	235.75	67.58
Crit W.S. (ft)		Flow Area (sq ft)	887.08	698.33	98.87
E.G. Slope (ft/ft)	0.000611	Area (sq ft)	887.08	698.33	98.87
Q Total (cfs)	4015.30	Flow (cfs)	895.91	3081.25	38.14
Top Width (ft)	364.64	Top Width (ft)	194.08	78.69	91.87
Vel Total (ft/s)	2.38	Avg. Vel. (ft/s)	1.01	4.41	0.39
Max Chl Dpth (ft)	10.22	Hydr. Depth (ft)	4.57	8.87	1.08
Conv. Total (cfs)	162409.9	Conv. (cfs)	36237.5	124629.8	1542.6
Length Wtd. (ft)	231.75	Wetted Per. (ft)	194.61	81.02	91.89
Min Ch El (ft)	821.27	Shear (lb/sq ft)	0.17	0.33	0.04
Alpha	2.67	Stream Power (lb/ft s)	544.51	0.00	0.00
Frctn Loss (ft)	0.21	Cum Volume (acre-ft)	3.95	3.27	0.72
C & E Loss (ft)	0.02	Cum SA (acres)	0.95	0.41	0.28

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: Toms Fork
REACH: Toms Fork RS: 1000.000

INPUT
Description:
Station Elevation Data num= 116

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	.26	849.64	1.5	848	2.99	846	3.07	845.88
4.81	843.56	5.98	842	6.08	841.88	7.5	840	7.81	839.63
9.02	838	9.72	837.47	11.66	836	13.76	834.45	14.37	834
16.27	832.6	17.09	832	17.85	831.92	30.72	830.59	44.39	830.01
44.63	830	45.04	829.98	46.91	829.91	49.1	829.82	56.19	828.94
64.04	828	65.22	827.34	67.37	826	68.79	825.02	70.4	824
72.12	823.16	74.22	822	74.83	821.71	75.57	821.27	103.45	821.27
104.71	821.26	104.99	821.33	105.34	821.44	106.87	822	111.85	823.77
112.67	824	117.18	825.27	120.39	826	125.39	826.29	127.25	826.41
131	826.54	132.8	826.64	134.71	826.73	135.12	826.75	136.89	826.83
139.24	826.93	141.51	827.02	146.36	827.18	148.33	827.25	149.98	827.29
151.35	827.32	153.84	827.41	154.85	827.43	156.24	827.48	157.49	827.51
158.19	827.53	158.7	827.55	160.43	827.56	160.84	827.58	161.3	827.6
161.9	827.63	163.96	827.58	164.7	827.62	166.92	827.51	167.83	827.56
168.62	827.6	169.33	827.64	173.57	827.47	209.25	827.32	211.63	827.36
213.59	827.39	215.1	827.41	220.28	827.46	247.59	828	260.33	828
264.01	828.05	265.31	828.07	266.01	828.08	267.24	828.1	349.67	828.76
354.21	828.9	359.57	829.06	360.66	829.06	365.65	829.23	369.72	829.39
372.38	829.49	376.5	829.66	382.67	829.92	383.11	829.93	384.54	830
398.78	831.6	401.74	832	404.21	832.82	407.8	834	411.97	835.59
413.07	836	414.97	836.81	417.7	838	419.82	838.96	422.17	840
426.51	841.74	427.16	842	428.24	842.38	432.79	844	437.73	845.68
438.63	846	439.07	846.15	440.44	846.61	443.79	847.72	444.64	848
450.39	850								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.013	49.1	.035	120.39	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
49.1	120.39	1	1	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	831.50	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.40	Wt. n-Val.	0.013	0.035	0.100
W.S. Elev (ft)	831.10	Reach Len. (ft)			
Crit W.S. (ft)	828.88	Flow Area (sq ft)	17.78	509.01	827.09

* E.G. Slope (ft/ft)	*0.001447	* Area (sq ft)	* 17.78	* 509.01	* 827.09	*
* Q Total (cfs)	* 4015.30	* Flow (cfs)	* 64.43	* 2974.55	* 976.32	*
* Top Width (ft)	* 368.54	* Top Width (ft)	* 23.31	* 71.29	* 273.94	*
* Vel Total (ft/s)	* 2.97	* Avg. Vel. (ft/s)	* 3.62	* 5.84	* 1.18	*
* Max Chl Dpth (ft)	* 9.84	* Hydr. Depth (ft)	* 0.76	* 7.14	* 3.02	*
* Conv. Total (cfs)	*105549.1	* Conv. (cfs)	* 1693.7	* 78191.2	* 25664.2	*
* Length Wtd. (ft)	*	* Wetted Per. (ft)	* 23.36	* 73.96	* 274.08	*
* Min Ch El (ft)	* 821.26	* Shear (lb/sq ft)	* 0.07	* 0.62	* 0.27	*
* Alpha	* 2.94	* Stream Power (lb/ft s)	* 450.39	* 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:Toms Fork

Reach	River Sta.	n1	n2	n3
*Toms Fork	2865.327	.1	.035	.1
*Toms Fork	2579.832	.1	.035	.1
*Toms Fork	2372.941	.035	.035	.1
*Toms Fork	2123.812	.1	.035	.1
*Toms Fork	2002.134	.1	.035	.1
*Toms Fork	1929.868	.1	.035	.1
*Toms Fork	1811.557	.1	.035	.1
*Toms Fork	1726.403	.1	.035	.1
*Toms Fork	1580.979	.1	.035	.1
*Toms Fork	1483.221	.1	.035	.1
*Toms Fork	1421.670	.1	.035	.1
*Toms Fork	1293.596	.1	.035	.1
*Toms Fork	1000.000	.013	.035	.1

SUMMARY OF REACH LENGTHS

River: Toms Fork

Reach	River Sta.	Left	Channel	Right
*Toms Fork	2865.327	212.2	282.13	186.24
*Toms Fork	2579.832	271.1	188.24	66.66
*Toms Fork	2372.941	494.68	209.34	278.69
*Toms Fork	2123.812	4.85	111.36	132.72
*Toms Fork	2002.134	5.33	72.27	84.5
*Toms Fork	1929.868	5.86	118.14	110.15
*Toms Fork	1811.557	17.98	85.13	75.99
*Toms Fork	1726.403	25.62	144.25	127.32

*Toms Fork	*	1580.979	* 123.76*	97.42*	118.65*
*Toms Fork	*	1483.221	* 54.14*	61.47*	37.92*
*Toms Fork	*	1421.670	* 284.66*	127.14*	14.01*
*Toms Fork	*	1293.596	* 379.96*	235.75*	67.58*
*Toms Fork	*	1000.000	* 1*	1*	1*

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Toms Fork

Reach	River Sta.	Contr.	Expan.
*Toms Fork	* 2865.327*	.1*	.3*
*Toms Fork	* 2579.832*	.1*	.3*
*Toms Fork	* 2372.941*	.1*	.3*
*Toms Fork	* 2123.812*	.1*	.3*
*Toms Fork	* 2002.134*	.1*	.3*
*Toms Fork	* 1929.868*	.1*	.3*
*Toms Fork	* 1811.557*	.1*	.3*
*Toms Fork	* 1726.403*	.1*	.3*
*Toms Fork	* 1580.979*	.1*	.3*
*Toms Fork	* 1483.221*	.1*	.3*
*Toms Fork	* 1421.670*	.1*	.3*
*Toms Fork	* 1293.596*	.1*	.3*
*Toms Fork	* 1000.000*	.1*	.3*

ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : Existing

River: Toms Fork Reach: Toms Fork RS: 2579.832 Profile: PF 1
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
River: Toms Fork Reach: Toms Fork RS: 2372.941 Profile: PF 1
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
River: Toms Fork Reach: Toms Fork RS: 2123.812 Profile: PF 1
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
River: Toms Fork Reach: Toms Fork RS: 2002.134 Profile: PF 1
Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.
River: Toms Fork Reach: Toms Fork RS: 1929.868 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program selected the water
surface that had the least amount of error between computed and assumed values.
Warning:Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: Toms Fork Reach: Toms Fork RS: 1811.557 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program selected the water
surface that had the least amount of error between computed and assumed values.
Warning:Divided flow computed for this cross-section.
River: Toms Fork Reach: Toms Fork RS: 1726.403 Profile: PF 1
Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
River: Toms Fork Reach: Toms Fork RS: 1580.979 Profile: PF 1
Warning:Divided flow computed for this cross-section.
River: Toms Fork Reach: Toms Fork RS: 1293.596 Profile: PF 1
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.

Supplement 3

HEC-RAS Analysis –Proposed Conditions Summary w/ Cross Sections

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

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

****

PROJECT DATA
Project Title: Saddle2
Project File : Saddle2.prj
Run Date and Time: 7/16/2013 7:51:50 PM

Project in English units

****

PLAN DATA

Plan Title: Bridge
Plan File : X:\Navitus Jobfiles\Antero Resources\ANT096-Saddle\Engineering\Drainage Comp\Floodplain\Entrance-Crossing Study\Report\Computations\HEC-RAS\Revised Sections\Saddle2.p02

Geometry Title: Bridge
Geometry File : X:\Navitus Jobfiles\Antero Resources\ANT096-Saddle\Engineering\Drainage Comp\Floodplain\Entrance-Crossing Study\Report\Computations\HEC-RAS\Revised Sections\Saddle2.g03

Flow Title : Existing-Revised
Flow File : X:\Navitus Jobfiles\Antero Resources\ANT096-Saddle\Engineering\Drainage Comp\Floodplain\Entrance-Crossing Study\Report\Computations\HEC-RAS\Revised Sections\Saddle2.f02

Plan Summary Information:

Number of:	Cross Sections	= 13	Multiple Openings	=	0
	Culverts	= 0	Inline Structures	=	0
	Bridges	= 1	Lateral Structures	=	0

Computational Information

Water surface calculation tolerance	= 0.001
Critical depth calculation tolerance	= 0.001
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: Existing-Revised
Flow File : X:\Navitus Jobfiles\Antero Resources\ANT096-Saddle\Engineering\Drainage Comp\Floodplain\Entrance-Crossing Study\Report\Computations\HEC-RAS\Revised Sections\Saddle2.f02

Flow Data (cfs)

River	Reach	RS	PF 1
Toms Fork	Toms Fork	2865.327	4015.3

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Toms Fork	Toms Fork	PF 1	Known WS = 833.5	Known WS = 831.1

****

GEOMETRY DATA

Geometry Title: Bridge
Geometry File : X:\Navitus Jobfiles\Antero Resources\ANT096-Saddle\Engineering\Drainage Comp\Floodplain\Entrance-Crossing Study\Report\Computations\HEC-RAS\Revised Sections\Saddle2.g03

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 2865.327

INPUT
Description:
Station Elevation Data num= 100

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	2.89	848	3.73	847.42	5.78	846	8.24	844.95
10.3	844	12.9	842.79	14.63	842	20.51	841.56	22.47	841.4
26.09	841.11	32.66	841.36	44.49	841.93	44.56	841.93	44.57	841.93

44.6	841.93	49.67	841.3	52.98	840.89	54.84	840.66	56.84	840.4
56.98	840.39	59.93	840	62.2	838.99	64.42	838	66.42	837.11
68.93	836	77.13	835.38	80.1	835.15	89.55	834.48	91.63	834.33
96.42	834	96.46	834	103.31	833.74	108.11	833.57	115.2	833.31
120.18	833.17	144.96	832.42	149.19	832.28	158.3	832	161.69	831.77
162.91	831.7	163.61	831.66	172.16	831.13	177.1	830.87	181.93	830.59
192.98	830.03	193.14	830.02	193.52	830	195.11	829.63	202.28	828
203.58	827.9	204.23	827.86	205.83	827.75	208.78	827.55	218.92	826.86
225.69	826.43	226.36	826.39	227.77	826.3	228.45	826.25	232.59	826
233.5	824.89	234.03	824.24	234.61	823.57	239.85	823.64	241.59	823.67
250.02	823.8	269.19	824.13	281.09	824.36	281.53	824.87	281.9	825.29
282.64	826	283.77	827.33	285.69	827.68	287.35	828	290.48	828
292.08	828.23	293.87	828.48	299.55	829.32	303.22	829.8	304.12	830
305.84	831.05	306.98	831.74	307.38	832	309.66	833.4	310.6	834
312.52	835.18	313.8	836	315.48	837.04	316.99	838	318.62	839.12
319.93	840	321.46	841.28	322.33	842	324.02	843.41	324.73	844
326.6	845.56	327.13	846	329.22	847.75	329.52	848	331.9	850

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	232.59	.035	287.35	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
232.59	287.35	212.2	282.13	186.24	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	834.46	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.57	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	833.90	Reach Len. (ft)	212.20	282.13	186.24
Crit W.S. (ft)		Flow Area (sq ft)	414.33	525.06	97.91
E.G. Slope (ft/ft)	0.001232	Area (sq ft)	414.33	525.06	97.91
Q Total (cfs)	4015.30	Flow (cfs)	459.17	3426.96	129.18
Top Width (ft)	211.27	Top Width (ft)	133.42	54.76	23.09
Vel Total (ft/s)	3.87	Avg. Vel. (ft/s)	1.11	6.53	1.32
Max Chl Dpth (ft)	10.33	Hydr. Depth (ft)	3.11	9.59	4.24
Conv. Total (cfs)	114379.4	Conv. (cfs)	13079.8	97619.9	3679.7
Length Wtd. (ft)	268.18	Wetted Per. (ft)	133.80	57.29	24.34
Min Ch El (ft)	823.57	Shear (lb/sq ft)	0.24	0.71	0.31
Alpha	2.44	Stream Power (lb/ft s)	331.90	0.00	0.00
Frctn Loss (ft)	0.27	Cum Volume (acre-ft)	18.41	20.67	6.74
C & E Loss (ft)	0.05	Cum SA (acres)	5.30	2.27	1.53

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 2579.832

INPUT

Description:
Station Elevation Data num= 93

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	2.44	848	2.66	847.82	4.89	846	5.28	845.68
7.32	844	7.99	843.55	10.04	842	12.78	841.08	16.18	840
20.07	838.81	22.77	838	31.3	838	32.34	838.23	36.84	839.24
45.36	839.17	54.84	838.89	61	838.03	61.18	838	62.93	837.73
65.72	837.27	73.51	836	74.45	835.56	77.9	834	80.43	832.85
82.31	832	84.12	831.18	87.67	829.59	88.79	829.09	90.47	828.4
91.43	828	93.28	827.16	95.87	826	99.12	824.4	99.91	824
100.45	823.72	100.69	823.6	100.92	823.47	143.75	823.47	144.94	823.92
145.14	824	151.82	825.23	155.09	825.97	155.22	826	157.83	826
174.68	826.59	176.96	826.69	179.05	826.72	180.73	826.74	182.27	826.82
183.75	826.84	185.06	826.91	186.58	826.95	188.92	827.07	190.49	827.12
195.23	827.34	196.43	827.39	197.44	827.44	206.09	827.82	206.63	827.85
210.34	828	214.91	828.57	218.82	829.06	221.21	829.36	222.27	829.51
225.8	830	227.87	830.31	228.23	830.38	230.19	830.82	233.42	831.47
235.56	832	238.7	832.97	242.37	834	244.36	834.61	248.21	835.78
248.76	835.95	248.94	836	254.04	837.23	256.99	838	257.34	838
262.74	838.68	270.79	839.6	273.44	840	283.77	841.65	285.91	842
289.24	842.78	294.7	844	303.19	845.52	305.76	846	310.28	847.08
313.75	847.86	314.38	848	323.1	850				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	95.87	.035	155.09	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
95.87	155.09	271.1	188.24	66.66	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	834.15	Element	0.100	0.035	0.100
Vel Head (ft)	0.41	Wt. n-Val.	271.10	188.24	66.66
W.S. Elev (ft)	833.74	Reach Len. (ft)	67.73	586.76	484.44
Crit W.S. (ft)		Flow Area (sq ft)	67.73	586.76	484.44
E.G. Slope (ft/ft)	*0.000838	Area (sq ft)	67.86	*3292.89	654.55
Q Total (cfs)	*4015.30	Flow (cfs)	17.40	59.22	86.35
Top Width (ft)	162.97	Top Width (ft)	1.00	5.61	1.35
Vel Total (ft/s)	3.53	Avg. Vel. (ft/s)	3.89	9.91	5.61
Max Chl Dpth (ft)	10.27	Hydr. Depth (ft)	2344.8	*113777.0	22616.3
Conv. Total (cfs)	*138738.2	Conv. (cfs)	19.04	60.11	86.99
Length Wtd. (ft)	183.84	Wetted Per. (ft)	0.19	0.51	0.29
Min Ch El (ft)	823.47	Shear (lb/sq ft)	323.10	0.00	0.00
Alpha	2.10	Stream Power (lb/ft s)	17.24	17.07	5.49
Frctn Loss (ft)	0.21	Cum Volume (acre-ft)	4.93	1.90	1.29
C & E Loss (ft)	0.02	Cum SA (acres)			

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: Toms Fork
REACH: Toms Fork RS: 2372.941

INPUT
Description:
Station Elevation Data num= 105

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	1.82	848	2.33	847.47	3.36	846.39	3.78	846
6.59	844.33	7.14	844	10.17	842.28	10.68	842	13.68	840.29
14.22	840	17.19	838.31	17.76	838	19.76	837.02	21.03	837.71
30.82	836.97	45.33	836.96	53.11	837.04	58.14	836.39	62.87	836
70.69	835.06	78.76	834	82.37	833.41	90.69	832	92.24	831.76
95.46	831.2	102.19	830	104.15	829.57	105.93	829.26	108.63	828.71
111.2	828.33	113.43	828	114.56	827.83	114.6	827.82	114.66	827.81
114.94	827.78	118.37	827.27	120.84	826.94	122.59	826.68	127.81	826
128.07	825.95	128.15	825.95	128.23	825.93	131.37	825.41	132.07	825.31
133.39	825.14	134.95	824.85	136.9	824.63	140.69	824	140.95	824
141.56	823.88	142.39	823.69	142.76	823.59	143.18	823.47	161.64	823.47
162.23	823.66	162.96	823.86	163.49	824	170.49	824.97	178.34	826
184.38	826.66	190.63	827.37	196.22	828	204.78	828.89	209.26	829.26
213.01	829.61	214.44	829.73	215.21	829.78	215.72	829.81	218.51	830
221.09	830.31	222.16	830.45	226.82	831.04	233.45	832	259.72	833.51
267.46	833.9	270.43	834	277.5	834	293.51	834.86	300.19	835.16
303.03	835.27	310.96	835.62	312.48	835.69	319.76	836	323.88	836.36
332.03	837.03	340.66	837.87	342.02	838	347.21	839.1	350.16	839.67
350.48	839.73	351.82	840	353.9	840.42	357.17	841.11	360.16	841.74
361.41	842	366.93	843.14	371.51	844	376.07	845.15	379.47	846
382.67	846.77	388.2	848	388.9	848.16	389.32	848.25	397.14	850

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	136.9	.035	170.49	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
136.9	170.49	494.68	209.34	278.69	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	833.91	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.65	Wt. n-Val.	0.035	0.035	0.100
W.S. Elev (ft)	833.26	Reach Len. (ft)	494.68	209.34	278.69
Crit W.S. (ft)		Flow Area (sq ft)	242.14	317.26	314.52
E.G. Slope (ft/ft)	0.001650	Area (sq ft)	242.14	317.26	314.52
Q Total (cfs)	4015.30	Flow (cfs)	1130.44	2431.91	452.95

Top Width (ft)	172.12	Top Width (ft)	53.65	33.59	84.88
Vel Total (ft/s)	4.59	Avg. Vel. (ft/s)	4.67	7.67	1.44
Max Chl Dpth (ft)	9.79	Hydr. Depth (ft)	4.51	9.44	3.71
Conv. Total (cfs)	98862.8	Conv. (cfs)	27833.1	59877.4	11152.4
Length Wtd. (ft)	268.00	Wetted Per. (ft)	54.35	33.85	85.32
Min Ch El (ft)	823.47	Shear (lb/sq ft)	0.46	0.97	0.38
Alpha	1.99	Stream Power (lb/ft s)	397.14	0.00	0.00
Frctn Loss (ft)	0.24	Cum Volume (acre-ft)	16.28	15.12	4.88
C & E Loss (ft)	0.12	Cum SA (acres)	4.71	1.70	1.16

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

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 2123.812

INPUT
Description:
Station Elevation Data num= 145

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	7.61	848.12	8.1	848	11.48	846.85	14.02	846
17.32	844.89	20.19	844	29.09	842.54	32.44	842	39.97	840.57
41	840.36	41.44	840.27	41.87	840.18	42.76	840	44.29	839.85
44.87	839.81	45.61	839.77	58.05	838.76	60.93	838.66	73.97	838
80.16	838	86.28	837.78	88.03	837.76	89.01	837.75	89.33	837.75
96.23	837.46	96.83	837.47	114.62	837.25	123.08	837.03	153.21	836.5
165.6	836.24	167.39	836.2	176.66	836	183.88	836	185.94	835.94
186.45	835.92	193.78	835.74	197.53	835.66	200.81	835.61	203.09	835.51
207.46	835.41	211.32	835.23	215.79	835.06	217.31	834.99	218.58	834.93
219.59	834.88	221.23	834.79	225.89	834.56	228.39	834.42	237.61	834
240.15	833.94	250.89	833.92	251.23	833.98	252.74	834.04	256.18	834.13
266.1	834.44	276.79	834.81	279.36	834.6	282	834.51	292.41	834.43
302.29	834.14	305	834	306.65	834	318.72	833.83	322.62	833.82
326.83	833.77	349.34	833.52	366.28	833.31	381.19	833.17	409.51	832.76
442.18	832	458.66	832	459.09	831.91	460.58	831.67	467.09	830.52
470.93	830	472.47	829.86	473.63	829.73	474.35	829.63	476.54	829.59
478.33	829.44	480.51	829.24	482.35	829.05	484.53	829.08	493.14	828.72
510.22	828	540.14	828	541.2	827.11	542.5	826	543.18	825.38
544.61	824	544.96	823.68	545.31	822.47	562.34	822.47	590.93	822.47
591.34	823.26	591.75	823.47	592.68	823.87	592.98	824	596.16	824.59
597.7	824.75	600.18	825.16	601.92	825.29	603.14	825.47	603.8	825.56
606.61	825.79	609.14	825.89	609.21	825.89	611.75	826	618.47	826
623.51	826.14	623.89	826.15	627.54	826.26	629.08	826.31	634.67	826.43
637.3	826.52	638.18	826.54	665.48	826.98	667.38	826.96	668.91	827.09
670.46	827.22	674.09	827.49	676.03	827.52	680.97	828	682.63	828.93
684.49	830	686.81	831.3	688.03	832	689.62	832.9	691.61	834

693.43	834.9	695.67	836	699.67	837.95	699.76	838	699.9	838.07
703.8	840	708.04	841.9	708.27	842	708.74	842.21	712.7	844
716.95	845.96	717.03	846	717.11	846.04	721.13	848	725.2	850

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	540.14	.035	611.75	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
540.14	611.75	4.85	111.36	132.72	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	833.55	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.25	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	833.30	Reach Len. (ft)	4.85	111.36	132.72
Crit W.S. (ft)		Flow Area (sq ft)	423.18	704.14	481.98
E.G. Slope (ft/ft)	0.000570	Area (sq ft)	423.18	704.14	481.98
Q Total (cfs)	4015.30	Flow (cfs)	272.81	3176.70	565.79
Top Width (ft)	322.61	Top Width (ft)	172.42	71.61	78.59
Vel Total (ft/s)	2.50	Avg. Vel. (ft/s)	0.64	4.51	1.17
Max Chl Dpth (ft)	10.83	Hydr. Depth (ft)	2.45	9.83	6.13
Conv. Total (cfs)	168236.2	Conv. (cfs)	11430.4	133100.0	23705.8
Length Wtd. (ft)	100.74	Wetted Per. (ft)	172.66	74.95	80.04
Min Ch El (ft)	822.47	Shear (lb/sq ft)	0.09	0.33	0.21
Alpha	2.62	Stream Power (lb/ft s)	725.20	0.00	0.00
Frctn Loss (ft)	0.08	Cum Volume (acre-ft)	12.50	12.66	2.34
C & E Loss (ft)	0.03	Cum SA (acres)	3.43	1.45	0.64

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: Toms Fork
REACH: Toms Fork RS: 2002.134

INPUT
Description:
Station Elevation Data num= 120

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	5.75	848.69	9.25	848	12.54	847.07	14.98	846.36
16.39	846	21.54	844.57	23.9	844	28.14	843.37	29.49	843.11
31.27	842.82	35.31	842	36.84	841.71	44.09	840.36	45.66	840.07
46.05	840	58.46	838.43	59.73	838.27	60.32	838.19	61.51	838
68.14	838	84.71	837.13	87.17	837.04	90.91	836.93	93.76	836.87
96.92	836.74	102.52	836.63	109.38	836.49	117.27	836.33	120.05	836.28

121.42	836.22	123.9	836.21	135.46	836	152.3	836	152.93	835.97
153.56	835.95	175.95	834.99	193.37	834.28	196.51	834.15	200.1	834
205.39	833.72	210.34	833.1	210.74	833.15	211.69	833.31	213.96	833.36
216.02	833.45	235.66	834	252.32	834	256.05	833.9	257.04	833.88
276.33	833.31	279.34	833.28	281.75	833.27	295.27	832.92	301.58	832.91
307.93	832.77	318.74	832.74	323.19	832.66	337.48	832.62	342.49	832.54
382.49	832.24	402.49	832	443.94	832	448.99	831.31	452.91	830.94
462.54	830	463.53	829.84	463.96	829.78	467.24	829.24	468.14	829.14
470.59	828.79	471.7	828.67	472.1	828.64	472.57	828.59	474.78	828.35
475.89	828.26	476.06	828.26	477.8	828	488.57	828	491.73	827.76
492.21	827.75	494.02	827.72	494.54	827.71	527.7	826.75	553.46	826
561.05	826	561.73	825.49	563.27	824	563.54	823.79	564.49	822.87
577.19	822.74	603.13	822.47	605.42	823.91	605.57	824	609.95	825.19
612.91	826	613.85	826.72	615.51	828	616.81	828.98	618.12	830
619.93	831.36	620.77	832	623.33	833.91	623.44	834	623.55	834.08
625.99	836	626.03	836.04	628.31	838	629.29	838.81	630.68	840
632.39	841.41	633.09	842	635.36	843.87	635.52	844	636.52	844.78
637.1	845.24	638.07	846	640.63	847.87	640.8	848	643.54	850

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	561.05	.035	612.91	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
561.05	612.91	5.33	72.27	84.5	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	833.44	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.57	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	832.87	Reach Len. (ft)	5.33	72.27	84.50
Crit W.S. (ft)		Flow Area (sq ft)	662.62	504.21	30.86
E.G. Slope (ft/ft)	0.001229	Area (sq ft)	662.62	504.21	30.86
Q Total (cfs)	4015.30	Flow (cfs)	647.47	3336.50	31.32
Top Width (ft)	318.53	Top Width (ft)	257.65	51.86	9.03
Vel Total (ft/s)	3.35	Avg. Vel. (ft/s)	0.98	6.62	1.02
Max Chl Dpth (ft)	10.40	Hydr. Depth (ft)	2.57	9.72	3.42
Conv. Total (cfs)	114531.9	Conv. (cfs)	18468.4	95170.0	893.5
Length Wtd. (ft)	64.58	Wetted Per. (ft)	257.93	53.79	11.34
Min Ch El (ft)	822.47	Shear (lb/sq ft)	0.20	0.72	0.21
Alpha	3.25	Stream Power (lb/ft s)	643.54	0.00	0.00
Frctn Loss (ft)	0.11	Cum Volume (acre-ft)	12.44	11.12	1.55
C & E Loss (ft)	0.05	Cum SA (acres)	3.40	1.29	0.50

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 1929.868

INPUT
Description:
Station Elevation Data num= 127

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	9.69	848.14	10.44	848	16.57	846.52	19	846
22.06	845.27	23.4	844.99	28.18	844	28.7	843.91	29.27	843.8
34.05	842.91	38.56	842	39.24	841.89	39.57	841.83	44.23	841.11
46.52	840.64	48.15	840.39	49.88	840	53.06	839.56	57.34	839.03
62.7	838	63.49	838	95.81	836.27	101.33	836.06	101.57	836.05
103.51	836	104.46	836	106.48	835.94	113.45	835.8	113.98	835.79
120.44	835.67	140.38	835.62	141.17	835.63	142.8	835.61	144.74	835.58
147.99	835.47	148.7	835.47	152.05	835.32	153.09	835.29	166.02	834.72
167.81	834.65	171.79	834.47	182.48	834	186.18	832.37	186.98	832
189.63	832	190.59	832.17	191.57	832.36	193.59	832.72	211.11	833.08
214.56	833.17	215.19	833.21	215.57	833.24	217.58	833.36	229.11	834
235.48	834	243.03	833.47	247.63	833.34	262.04	832.65	276.26	832.35
277.28	832.32	293.07	832	355.46	832	360.25	831.81	388.23	831.91
390.46	831.9	394.56	832	411.75	832	413.92	831.91	418.69	831.72
420.02	831.67	421.45	831.61	434.07	831.52	435.68	831.52	435.95	831.61
436.19	831.7	437.05	832	451.01	832	457.66	831.46	460.43	831.24
464.27	830.93	466.72	830.73	472.68	830	477.88	828.1	478.17	828
487.76	826.55	489.16	826.33	495.7	826	497.25	826	519.34	826
520.31	825.28	522.18	824	522.87	823.57	523.4	823.17	523.76	822.87
527.6	822.84	528.89	822.83	532.08	822.8	552.31	822.57	560.43	822.47
561.98	823.63	562.39	824	563.46	824.74	565.18	826	566.72	827.13
568.04	828	569.7	829.21	570.9	830	572.63	831.25	573.74	832
575.53	833.28	576.58	834	577.39	834.76	578.84	836	579.87	837.17
580.64	838	581.81	839.35	582.42	840	583.77	841.56	584.18	842
585.76	843.84	585.91	844	586.04	844.16	586.72	844.95	587.6	846
589.67	848	591.96	850						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	519.34	.035	565.18	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
519.34	565.18	5.86	118.14	110.15	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	235.48	834	F

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	833.28	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.11	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	832.17	Reach Len. (ft)	5.86	118.14	110.15
Crit W.S. (ft)	829.15	Flow Area (sq ft)	321.85	419.67	27.01

* E.G. Slope (ft/ft)	*0.002384	* Area (sq ft)	* 322.41	* 419.67	* 27.01	*	
* Q Total (cfs)	* 4015.30	* Flow (cfs)	* 287.68	* 3691.40	* 36.21	*	
* Top Width (ft)	* 293.29	* Top Width (ft)	* 238.66	* 45.84	* 8.80	*	
* Vel Total (ft/s)	* 5.22	* Avg. Vel. (ft/s)	* 0.89	* 8.80	* 1.34	*	
* Max Chl Dpth (ft)	* 9.70	* Hydr. Depth (ft)	* 1.37	* 9.16	* 3.07	*	
* Conv. Total (cfs)	* 82236.1	* Conv. (cfs)	* 5892.0	* 75602.4	* 741.7	*	
* Length Wtd. (ft)	* 109.66	* Wetted Per. (ft)	* 235.36	* 48.01	* 10.75	*	
* Min Ch El (ft)	* 822.47	* Shear (lb/sq ft)	* 0.20	* 1.30	* 0.37	*	
* Alpha	* 2.61	* Stream Power (lb/ft s)	* 591.96	* 0.00	* 0.00	*	
* Frctn Loss (ft)	* 0.25	* Cum Volume (acre-ft)	* 12.38	* 10.35	* 1.50	*	
* C & E Loss (ft)	* 0.03	* Cum SA (acres)	* 3.37	* 1.21	* 0.49	*	

Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 1811.557

INPUT
Description:
Station Elevation Data num= 127

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	8.09	848.68	9.6	848.44	12.25	848	15.63	847.32
17.53	847.03	22.85	846.14	23.34	846.05	23.62	846	29.14	845.01
29.7	844.93	31.77	844.59	35.22	844	38.73	843.44	40.77	843.25
44.36	842.76	49.7	842.06	50.03	842	54.63	840.79	58.16	840
60.2	839.66	63.13	839.24	66.64	838.88	68.31	838.67	72.99	838.13
73.95	838	87.5	836.44	90.85	836	91.66	836	100.94	835.61
101.33	835.59	110.34	835.25	110.4	835.24	121.22	834.87	124.68	834.79
125.19	834.78	128.31	834.73	131.18	834.66	139.14	834.59	139.43	834.59
145.89	834.47	154.04	834.29	161.88	834	163.25	834	165.31	833.16
168	832	173.5	832	173.52	832	175.04	832.3	193.36	832.94
194.25	832.97	194.4	832.96	194.97	833.03	195.62	833.08	208.04	834
229.9	834	238.7	833.13	240.06	833.08	246.53	832	265.48	832
303.93	831.45	312.8	831.4	332.62	831	353.67	831.77	354.78	831.72
359.46	831.02	369.02	830.99	369.43	831	369.91	830.99	370.02	830.99
370.53	830.98	370.91	830.97	389.65	830.53	394.54	830.38	401.08	830.18
406.7	830	407.31	829.79	412.33	828	413.45	827.6	414.68	827.16
417.14	826.3	417.99	826	443.82	826	444.09	825.85	445.72	825.04
447.77	824	447.95	823.91	449.82	822.87	459.79	822.8	489.1	822.47
489.21	822.59	489.36	822.75	490.51	824	490.88	824.38	492.37	826
493.93	827.55	494.37	828	497.57	830.56	499.37	832	499.82	832.35
501.88	834	503.33	835.14	504.41	836	505.89	837.68	506.17	838
506.24	838.08	507.77	840	508.33	840.71	509.35	842	510.56	843.55
510.91	844	511.55	844.84	512.54	846	513.19	846.66	514.51	848
516.01	849.18	517.12	850	518.94	851.43	519.47	851.82	519.7	852

521.72	853.59	522.26	854	524.41	855.7	524.8	856	527.06	857.79
527.34	858	530.07	860						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	443.82	.035	492.37	.1

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

443.82	492.37	17.98	85.13	75.99	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	832.99	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.02	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	831.98	Reach Len. (ft)	17.98	85.13	75.99
Crit W.S. (ft)		Flow Area (sq ft)	308.55	435.45	19.86
E.G. Slope (ft/ft)	0.002259	Area (sq ft)	308.55	435.45	19.86
Q Total (cfs)	4015.30	Flow (cfs)	314.84	3677.02	23.44
Top Width (ft)	232.40	Top Width (ft)	176.88	48.55	6.97
Vel Total (ft/s)	5.26	Avg. Vel. (ft/s)	1.02	8.44	1.18
Max Chl Dpth (ft)	9.51	Hydr. Depth (ft)	1.74	8.97	2.85
Conv. Total (cfs)	84485.4	Conv. (cfs)	6624.6	77367.7	493.1
Length Wtd. (ft)	78.01	Wetted Per. (ft)	177.65	50.86	9.20
Min Ch El (ft)	822.47	Shear (lb/sq ft)	0.24	1.21	0.30
Alpha	2.37	Stream Power (lb/ft s)	530.07	0.00	0.00
Frctn Loss (ft)	0.19	Cum Volume (acre-ft)	12.34	9.19	1.44
C & E Loss (ft)	0.01	Cum SA (acres)	3.34	1.08	0.47

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 1726.403

INPUT
Description:
Station Elevation Data num= 111

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	7.69	848.75	12.67	848	13.53	847.86	13.88	847.81
14.58	847.69	23.99	846	24.2	845.96	24.7	845.87	35.04	844
35.58	844	35.72	843.97	36.71	843.76	44.45	842	50.81	840.91
56.16	840	62.16	839.16	70.39	838	76.77	836.99	82.9	836
107.43	834.59	111.92	834.32	113.55	834.23	114.44	834.18	115.04	834.14
118.29	834	133.54	833	145.97	832	153.68	832	153.78	832.03
154.17	832.11	170.85	832.35	172.32	832.36	172.33	832.36	172.33	832.35
172.36	832.35	172.46	832.35	172.61	832.34	172.88	832.33	173.84	832.26
177.54	832	261.15	832	263.09	831.66	263.15	831.66	264.41	831.43
264.73	831.44	265.31	831.48	266.23	831.31	267.04	831.34	274.24	831.18
277.67	831.06	279.87	830.91	303.11	830.11	303.13	830.11	303.2	830.11

313.87	830.99	332.27	830.68	338.82	830.44	346.78	830.13	350.22	830
354.85	828.9	358.99	828	361.29	827.15	364.99	826	368.69	826
374.3	826	386.59	824.73	394.79	824.26	396.56	824.16	399.37	824
400.62	823.5	401.24	823.25	402.13	822.87	415.76	822.73	440.37	822.47
441.28	823.54	441.62	824	442.72	825.29	443.28	826	446.77	827.59
447.66	828	451.15	831.19	452.07	832	453.87	833.62	454.27	834
454.56	834.26	456.73	836	458.44	837.72	458.72	838	459.92	839.21
460.72	840	461.32	840.61	462.7	842	463.86	843.24	464.51	844
465.71	845.39	466.11	845.85	466.23	846	466.54	846.24	468.77	848
470.01	848.97	471.31	850	472.48	850.91	473.86	852	474.93	852.84
476.4	854	477.37	854.77	478.94	856	481.17	857.79	481.43	858
485.12	860								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	399.37	.035	441.62	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
399.37	441.62	25.62	144.25	127.32	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	832.80	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.09	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	831.71	Reach Len. (ft)	25.62	144.25	127.32
Crit W.S. (ft)		Flow Area (sq ft)	366.81	379.19	39.37
E.G. Slope (ft/ft)	0.002505	Area (sq ft)	366.81	379.19	39.37
Q Total (cfs)	4015.30	Flow (cfs)	525.18	3428.63	61.49
Top Width (ft)	188.95	Top Width (ft)	136.58	42.25	10.12
Vel Total (ft/s)	5.11	Avg. Vel. (ft/s)	1.43	9.04	1.56
Max Chl Dpth (ft)	9.24	Hydr. Depth (ft)	2.69	8.97	3.89
Conv. Total (cfs)	80222.1	Conv. (cfs)	10492.5	68500.9	1228.6
Length Wtd. (ft)	131.80	Wetted Per. (ft)	137.34	43.20	12.93
Min Ch El (ft)	822.47	Shear (lb/sq ft)	0.42	1.37	0.48
Alpha	2.68	Stream Power (lb/ft s)	485.12	0.00	0.00
Frctn Loss (ft)	0.23	Cum Volume (acre-ft)	12.20	8.40	1.39
C & E Loss (ft)	0.15	Cum SA (acres)	3.28	0.99	0.45

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 1580.979

INPUT
Description:
Station Elevation Data num= 105

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	9.68	848	15.17	846.8	15.87	846.64	18.77	846
20.81	845.56	28	844	35.76	842.18	36.54	842	36.96	841.92
47.38	840	47.87	839.9	56.87	838	68.15	836.06	68.41	836.01
77.1	834.66	80.22	834.43	85.29	834	85.35	834	89.24	833.81
92.24	833.63	92.64	833.63	93.17	833.63	94.58	833.62	97.89	833.46
100.76	833.32	133.45	832	138.56	832	141.4	831.74	147.18	831.31
158.75	831.48	165.31	831.53	185.18	831.5	191.55	831.44	193.11	831.6
206.25	831.02	217.47	830.66	227.63	830.24	231.61	830.09	236.83	830
237.47	829.75	238.59	829.37	245.76	829.63	249.16	829.77	253.95	830
253.96	830	253.97	830	260.61	830	272.1	829.31	290.5	828
293.32	828	298.88	827.16	303.61	826.89	315.57	826	316.11	826
317.58	826	317.83	825.95	322.94	825.12	323.18	825.12	328.6	824.28
328.79	824.25	330.08	824	334.79	823.2	336.76	822.74	337.42	822.86
337.84	822.87	365.19	822.64	382.75	822.47	382.79	822.67	383	822.67
386.52	823.76	387.12	824	389.83	824.32	390.64	824.42	395.83	825.08
400.52	825.66	403.1	826	409.08	826.75	412.02	827.12	419.58	827.98
419.67	827.99	419.74	827.99	419.75	827.99	419.78	828	427.07	828
428.22	828.41	434.02	830	434.67	830.39	436.52	832	439.1	833.98
441.66	836	442.29	836.49	444.2	838	446.24	839.6	446.78	840
447.35	840.4	449.74	842	451.59	843.1	453.32	844	456.03	845.43
457.1	846	457.93	846.44	460.96	848	463.4	849.33	464.87	850

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	330.08	.035	387.12	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
330.08	387.12	123.76	97.42	118.65	.1 .3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
182.24	289.41	833	F
459.1	456.57	833	F

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	832.42	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.58	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	831.84	Reach Len. (ft)	43.71	43.71	43.71
Crit W.S. (ft)	828.27	Flow Area (sq ft)	237.83	515.02	239.59
E.G. Slope (ft/ft)	*0.001298	Area (sq ft)	419.16	515.02	239.59
Q Total (cfs)	4015.30	Flow (cfs)	257.07	3395.60	362.63
Top Width (ft)	296.04	Top Width (ft)	189.78	57.04	49.22
Vel Total (ft/s)	4.05	Avg. Vel. (ft/s)	1.08	6.59	1.51
Max Chl Dpth (ft)	9.37	Hydr. Depth (ft)	2.88	9.03	4.87
Conv. Total (cfs)	*111448.3	Conv. (cfs)	7135.1	94248.1	10065.1
Length Wtd. (ft)	43.71	Wetted Per. (ft)	82.90	57.55	50.40
Min Ch El (ft)	822.47	Shear (lb/sq ft)	0.23	0.73	0.39
Alpha	2.26	Stream Power (lb/ft s)	464.87	0.00	0.00
Frctn Loss (ft)	0.08	Cum Volume (acre-ft)	11.96	6.91	0.98

* C & E Loss (ft)	*	0.05	* Cum SA (acres)	*	3.18	*	0.83	*	0.37	*

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

BRIDGE

RIVER: Toms Fork
REACH: Toms Fork RS: 1528.223

INPUT
Description:
Distance from Upstream XS = 43.71
Deck/Roadway Width = 18
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 7

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
167.15	831.47	0	316.08	838.58	328.22	838.58	835.41
386.19	838.58	835.41	403.716	838.58	467.81	840	
485.69	842	0					

Upstream Bridge Cross Section Data
Station Elevation Data num= 105

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	9.68	848	15.17	846.8	15.87	846.64	18.77	846
20.81	845.56	28	844	35.76	842.18	36.54	842	36.96	841.92
47.38	840	47.87	839.9	56.87	838	68.15	836.06	68.41	836.01
77.1	834.66	80.22	834.43	85.29	834	85.35	834	89.24	833.81
92.24	833.63	92.64	833.63	93.17	833.63	94.58	833.62	97.89	833.46
100.76	833.32	133.45	832	138.56	832	141.4	831.74	147.18	831.31
158.75	831.48	165.31	831.53	185.18	831.5	191.55	831.44	193.11	831.6
206.25	831.02	217.47	830.66	227.63	830.24	231.61	830.09	236.83	830
237.47	829.75	238.59	829.37	245.76	829.63	249.16	829.77	253.95	830
253.96	830	253.97	830	260.61	830	272.1	829.31	290.5	828
293.32	828	298.88	827.16	303.61	826.89	315.57	826	316.11	826
317.58	826	317.83	825.95	322.94	825.12	323.18	825.12	328.6	824.28
328.79	824.25	330.08	824	334.79	823.2	336.76	822.74	337.42	822.86
337.84	822.87	365.19	822.64	382.75	822.47	382.79	822.67	383	822.67
386.52	823.76	387.12	824	389.83	824.32	390.64	824.42	395.83	825.08
400.52	825.66	403.1	826	409.08	826.75	412.02	827.12	419.58	827.98
419.67	827.99	419.74	827.99	419.75	827.99	419.78	828	427.07	828
428.22	828.41	434.02	830	434.67	830.39	436.52	832	439.1	833.98

441.66	836	442.29	836.49	444.2	838	446.24	839.6	446.78	840
447.35	840.4	449.74	842	451.59	843.1	453.32	844	456.03	845.43
457.1	846	457.93	846.44	460.96	848	463.4	849.33	464.87	850

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	330.08	.035	387.12	.1

Bank Sta: Left Right Coeff Contr. Expan.

330.08	387.12	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
182.24	289.41	833	F
459.1	456.57	833	F

Downstream Deck/Roadway Coordinates num= 9

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
205.21	830.68	0	340.24	838.58		353.33	838.58	835.41
411.19	838.58	835.41	417.62	838.58		483.32	840	
502.13	842		535.53	845.45		563.93	848	0

Downstream Bridge Cross Section Data

Station Elevation Data num= 119

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	5.81	848	7.38	847.46	9.29	846.8	11.59	846
12.45	845.72	17.64	844	22	842.63	23.96	842	28.51	840.53
30.08	840	35.58	838.12	35.95	838	37.05	837.65	42.19	836
46.82	834.38	47.91	834	52.05	832.41	53.12	832	53.33	831.92
58.38	830	59.39	830	69.2	829.64	77.21	829.39	84.78	829.19
91.53	828.99	94.05	828.92	103.42	828.67	104.03	828.65	110.46	828.46
112.7	828.4	114.09	828.37	119.86	828.27	120.77	828.25	122.62	828.22
123.19	828.21	132.4	828.09	132.67	828.09	133.01	828.08	134.54	828.07
135.22	828.07	135.64	828.07	139.19	828.09	139.28	828.09	139.61	828.09
139.88	828.09	140.15	828.09	143.01	828.18	152.35	828.3	153.73	828.36
156.58	828.49	168.1	828.8	176.97	829.32	188.61	830	189.36	830.1
191.09	830.42	197.36	830.41	210.1	830.63	218.76	830.09	220.05	830
220.87	830	270.1	828.71	272.93	828.65	299.31	828	302.7	827.77
303.52	827.77	306.38	827.68	320.02	827.07	325.65	826.82	326.24	826.81
328.46	826.79	353.75	826	356.58	826	357.24	825.45	359.31	824
360.1	823.52	362.29	822.03	382.46	822.33	401.54	822.42	405.94	823.87
406.29	824	408.51	824.33	415.99	825.23	420.95	825.86	422.22	826
425.52	827.67	426.14	828	429.24	829.72	429.75	830	429.89	830.02
440.71	831.89	441.32	832	444.32	832	480.07	833.73	485.11	834
492.49	835.38	495.7	836	499.07	836.62	506.5	838	512.87	839.45
515.34	840	519.08	840.85	521.04	841.23	522.71	841.52	523.54	841.67
525.58	842	527.64	842.31	530.45	842.83	534.69	843.56	536.71	844
536.83	844	543.95	845.16	545.09	845.34	549.15	846	554.58	846.76
563.93	848	564.84	848	566.68	848.39	572.35	850		

```
Manning's n Values          num=        3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0      .1  356.58    .035  408.51      .1

Bank Sta: Left   Right    Coeff Contr.   Expan.
        356.58  408.51            .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
  221.06  238.64     832        F
  456.13  572.35     832        F

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

Number of Bridge Coefficient Sets =  1

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

High Flow Method
       Energy Only

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

BRIDGE OUTPUT  Profile #PF 1
*******************************************************************************************
* E.G. US. (ft)          *     832.42  * Element               *Inside BR US *Inside BR DS *
* W.S. US. (ft)          *     831.84  * E.G. Elev (ft)        *     832.28  *     832.17  *
* Q Total (cfs)          *    4015.30  * W.S. Elev (ft)        *     831.16  *     831.27  *
* Q Bridge (cfs)         *    4015.30  * Crit W.S. (ft)        *     828.20  *     828.43  *
* Q Weir (cfs)           *             * Max Chl Dpth (ft)     *       8.69  *       9.24  *
* Weir Sta Lft (ft)      *             * Vel Total (ft/s)      *       8.31  *       4.90  *
* Weir Sta Rgt (ft)      *             * Flow Area (sq ft)     *     483.15  *     820.27  *
* Weir Submerg           *             * Froude # Chl          *       0.51  *       0.44  *
* Weir Max Depth (ft)    *             * Specif Force (cu ft)  *    3072.77  *    3390.42  *
* Min El Weir Flow (ft)  *     831.32  * Hydr Depth (ft)       *       8.32  *       3.76  *
* Min El Prs (ft)        *     835.41  * W.P. Total (ft)       *      72.91  *     232.14  *
* Delta EG (ft)          *       0.43  * Conv. Total (cfs)     *    75493.0  *    87718.2  *
* Delta WS (ft)          *       0.34  * Top Width (ft)        *      58.04  *     218.16  *
```

* BR Open Area (sq ft)	* 724.25	* Frctn Loss (ft)	* 0.04	* 0.06	*
* BR Open Vel (ft/s)	* 8.31	* C & E Loss (ft)	* 0.07	* 0.13	*
* Coef of Q	*	* Shear Total (lb/sq ft)	* 1.17	* 0.46	*
* Br Sel Method	*Energy only	* Power Total (lb/ft s)	* 0.00	* 0.00	*

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 1483.221

INPUT
Description:
Station Elevation Data num= 119

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	5.81	848	7.38	847.46	9.29	846.8	11.59	846
12.45	845.72	17.64	844	22	842.63	23.96	842	28.51	840.53
30.08	840	35.58	838.12	35.95	838	37.05	837.65	42.19	836
46.82	834.38	47.91	834	52.05	832.41	53.12	832	53.33	831.92
58.38	830	59.39	830	69.2	829.64	77.21	829.39	84.78	829.19
91.53	828.99	94.05	828.92	103.42	828.67	104.03	828.65	110.46	828.46
112.7	828.4	114.09	828.37	119.86	828.27	120.77	828.25	122.62	828.22
123.19	828.21	132.4	828.09	132.67	828.09	133.01	828.08	134.54	828.07
135.22	828.07	135.64	828.07	139.19	828.09	139.28	828.09	139.61	828.09
139.88	828.09	140.15	828.09	143.01	828.18	152.35	828.3	153.73	828.36
156.58	828.49	168.1	828.8	176.97	829.32	188.61	830	189.36	830.1
191.09	830.42	197.36	830.41	210.1	830.63	218.76	830.09	220.05	830
220.87	830	270.1	828.71	272.93	828.65	299.31	828	302.7	827.77
303.52	827.77	306.38	827.68	320.02	827.07	325.65	826.82	326.24	826.81
328.46	826.79	353.75	826	356.58	826	357.24	825.45	359.31	824
360.1	823.52	362.29	822.03	382.46	822.33	401.54	822.42	405.94	823.87
406.29	824	408.51	824.33	415.99	825.23	420.95	825.86	422.22	826
425.52	827.67	426.14	828	429.24	829.72	429.75	830	429.89	830.02
440.71	831.89	441.32	832	444.32	832	480.07	833.73	485.11	834
492.49	835.38	495.7	836	499.07	836.62	506.5	838	512.87	839.45
515.34	840	519.08	840.85	521.04	841.23	522.71	841.52	523.54	841.67
525.58	842	527.64	842.31	530.45	842.83	534.69	843.56	536.71	844
536.83	844	543.95	845.16	545.09	845.34	549.15	846	554.58	846.76
563.93	848	564.84	848	566.68	848.39	572.35	850		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	356.58	.035	408.51	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
356.58	408.51	54.14	61.47	37.92	.1 .3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
221.06	238.64	832	F
456.13	572.35	832	F

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	831.99	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.48	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	831.51	Reach Len. (ft)	54.14	61.47	37.92
Crit W.S. (ft)	828.49	Flow Area (sq ft)	818.86	461.10	120.26
E.G. Slope (ft/ft)	0.001301	Area (sq ft)	849.46	461.10	120.26
Q Total (cfs)	4015.30	Flow (cfs)	886.99	2969.85	158.46
Top Width (ft)	384.06	Top Width (ft)	302.16	51.93	29.97
Vel Total (ft/s)	2.87	Avg. Vel. (ft/s)	1.08	6.44	1.32
Max Chl Dpth (ft)	9.47	Hydr. Depth (ft)	2.88	8.88	4.01
Conv. Total (cfs)	111310.6	Conv. (cfs)	24588.7	82329.0	4392.9
Length Wtd. (ft)	59.24	Wetted Per. (ft)	285.05	53.46	31.20
Min Ch El (ft)	822.03	Shear (lb/sq ft)	0.23	0.70	0.31
Alpha	3.77	Stream Power (lb/ft s)	572.35	0.00	0.00
Frctn Loss (ft)	0.06	Cum Volume (acre-ft)	11.18	5.86	0.80
C & E Loss (ft)	0.05	Cum SA (acres)	2.86	0.70	0.33

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 1421.670

INPUT
Description:
Station Elevation Data num= 114

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	2.79	849.15	6.37	848	7.77	847.56	9.4	847.08
12.05	846.29	13.14	846	17.43	845.03	21.19	844.05	21.4	844
21.6	843.92	27.18	842	28.6	841.36	31.86	840	34.65	838.93
36.95	838	39.48	837.09	43.26	836.17	43.69	836.05	43.78	836.04
43.84	836.03	44.08	836	45.26	836	47.98	835.5	50.67	835.2
52.4	835.01	53.64	834.87	56.33	834.58	56.76	834.53	58.93	834.29
59.09	834.26	60.91	834	61.53	833.91	61.77	833.88	65.76	833.25
67.21	833.05	69.67	832.68	74.1	832	75.37	831.72	78.33	831.04
79.3	830.81	83.15	830	84.82	829.93	85.04	829.92	85.58	829.89
89.94	829.68	94.22	829.47	99.72	829.24	110.94	828.47	113.82	828.32
115.24	828.25	117.83	828	174.08	828	174.52	828.04	194.87	830
195.39	830.04	197.72	830.24	210.01	830.31	216.6	830.41	218.07	830.25
219.57	830.05	219.97	830	222.23	829.79	230.6	829.12	241.79	828.19
244.75	828	267.96	828	272.56	827.85	273.71	827.84	275.94	827.7

278.22	827.59	301.45	826	323.5	826	356.72	826	358.07	824.91
359.23	824	359.84	823.54	362.77	821.27	387.26	822.16	393.71	822.38
411.92	823.65	414.58	824	416.84	824	418.53	825.41	418.9	825.72
419.26	826	419.65	826.31	421.76	828	424.27	830	435.33	830.62
437.01	830.73	456.8	832	472.29	832.9	493.97	834	495.74	834.51
500.32	836	502.54	836.66	507.57	838	509.02	838.37	515.42	840
517.32	840.46	523.35	842	525.17	842.45	527.3	843.03	531.03	844
538.61	844.9	543.35	845.45	545.39	845.69	547.61	846	547.81	846
553.14	846.84	558.54	847.64	560.73	848	567.55	850		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	356.72	.035	424.27	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
356.72	424.27	284.66	127.14	14.01	.1 .3

CROSS SECTION OUTPUT Profile #PF 1

Element	Left OB	Channel	Right OB
E.G. Elev (ft)	831.87		
Vel Head (ft)	0.32	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	831.56	Reach Len. (ft)	284.66	127.14	14.01
Crit W.S. (ft)		Flow Area (sq ft)	978.83	575.77	20.58
E.G. Slope (ft/ft)	0.000926	Area (sq ft)	978.83	575.77	20.58
Q Total (cfs)	4015.30	Flow (cfs)	1016.45	2990.82	8.03
Top Width (ft)	373.80	Top Width (ft)	280.64	67.55	25.61
Vel Total (ft/s)	2.55	Avg. Vel. (ft/s)	1.04	5.19	0.39
Max Chl Dpth (ft)	10.29	Hydr. Depth (ft)	3.49	8.52	0.80
Conv. Total (cfs)	131983.2	Conv. (cfs)	33410.6	98308.6	264.0
Length Wtd. (ft)	164.00	Wetted Per. (ft)	281.15	71.39	25.66
Min Ch El (ft)	821.27	Shear (lb/sq ft)	0.20	0.47	0.05
Alpha	3.14	Stream Power (lb/ft s)	567.55	0.00	0.00
Frctn Loss (ft)	0.12	Cum Volume (acre-ft)	10.04	5.13	0.74
C & E Loss (ft)	0.02	Cum SA (acres)	2.50	0.62	0.30

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 1293.596

INPUT
Description:
Station Elevation Data num= 131

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	4.12	848	8.06	846.06	8.17	846	8.81	845.68
12.19	844	12.67	843.76	16.32	842	21.32	840.26	22.02	840
22.88	839.69	23.71	839.41	27.76	838	30.51	837.06	33.76	836
35.14	835.59	43.54	835.21	44.85	835.17	45.09	835.16	45.37	835.14

46.01	835.06	52.66	834.02	52.75	834	52.76	834	52.81	833.98
57.47	832	61.78	831.6	64.46	831.35	70.98	830.78	77.87	830.09
78.18	830.06	78.72	830	83.23	829.79	84.2	829.74	90.44	829.43
96.17	829.17	104.55	828.86	106.6	828.82	107.4	828.77	113.81	829.28
116.59	829.47	116.83	829.46	116.9	829.46	127.6	828.54	136.41	828.39
140.21	828.11	141.37	828.01	141.44	828	146.09	826.7	148.09	826.12
148.31	826.05	148.61	826	150.46	826	151.22	826.07	153.3	826.23
153.77	826.17	156.73	826.29	164.02	826	170.8	826	174.64	825.61
175.18	825.62	175.49	825.64	183.13	825.23	183.52	825.24	184.54	825.29
187.88	825.12	189.56	825.18	209.18	825.12	214.39	825	221.13	824.84
227.6	824.69	228.7	824.66	236.9	824.44	243.38	824.3	257.03	824
259.48	822.47	260.32	821.95	260.94	821.57	261.45	821.27	308.31	821.27
308.52	821.4	308.8	821.51	310.32	821.96	310.46	822	314.14	823
319.94	824	319.95	824	323.41	824.63	327.21	825.87	327.4	825.93
327.57	826	328.17	826.28	331.9	828	333.47	828.78	334.86	829.52
335.72	830	337.6	830	376.51	830	434.08	831.68	435.98	831.69
439.81	831.83	440.38	831.83	444.86	831.97	445.9	832	450.97	832.69
452.42	832.95	456.13	833.55	457.6	833.77	459.01	834	463.1	834.77
468.93	836	473.04	836.97	475.41	837.5	477.76	838	482.57	838.97
485.12	839.48	487.6	840	490.72	840.62	493.43	841.09	495.45	841.46
498.55	842	501.14	842.35	510.55	844	510.81	844.04	520.74	845.8
521.82	845.99	521.85	846	522.07	846.04	533.57	848	536.16	848.49
544.51	850								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	257.03	.035	335.72	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
257.03	335.72	379.96	235.75	67.58	.1 .3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	831.73	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.24	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	831.49	Reach Len. (ft)	379.96	235.75	67.58
Crit W.S. (ft)		Flow Area (sq ft)	887.08	698.33	98.87
E.G. Slope (ft/ft)	0.000611	Area (sq ft)	887.08	698.33	98.87
Q Total (cfs)	4015.30	Flow (cfs)	895.91	3081.25	38.14
Top Width (ft)	364.64	Top Width (ft)	194.08	78.69	91.87
Vel Total (ft/s)	2.38	Avg. Vel. (ft/s)	1.01	4.41	0.39
Max Chl Dpth (ft)	10.22	Hydr. Depth (ft)	4.57	8.87	1.08
Conv. Total (cfs)	162409.9	Conv. (cfs)	36237.5	124629.8	1542.6
Length Wtd. (ft)	231.75	Wetted Per. (ft)	194.61	81.02	91.89
Min Ch El (ft)	821.27	Shear (lb/sq ft)	0.17	0.33	0.04
Alpha	2.67	Stream Power (lb/ft s)	544.51	0.00	0.00
Frctn Loss (ft)	0.21	Cum Volume (acre-ft)	3.95	3.27	0.72
C & E Loss (ft)	0.02	Cum SA (acres)	0.95	0.41	0.28

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: Toms Fork
REACH: Toms Fork RS: 1000.000

INPUT
Description:
Station Elevation Data num= 116

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	.26	849.64	1.5	848	2.99	846	3.07	845.88
4.81	843.56	5.98	842	6.08	841.88	7.5	840	7.81	839.63
9.02	838	9.72	837.47	11.66	836	13.76	834.45	14.37	834
16.27	832.6	17.09	832	17.85	831.92	30.72	830.59	44.39	830.01
44.63	830	45.04	829.98	46.91	829.91	49.1	829.82	56.19	828.94
64.04	828	65.22	827.34	67.37	826	68.79	825.02	70.4	824
72.12	823.16	74.22	822	74.83	821.71	75.57	821.27	103.45	821.27
104.71	821.26	104.99	821.33	105.34	821.44	106.87	822	111.85	823.77
112.67	824	117.18	825.27	120.39	826	125.39	826.29	127.25	826.41
131	826.54	132.8	826.64	134.71	826.73	135.12	826.75	136.89	826.83
139.24	826.93	141.51	827.02	146.36	827.18	148.33	827.25	149.98	827.29
151.35	827.32	153.84	827.41	154.85	827.43	156.24	827.48	157.49	827.51
158.19	827.53	158.7	827.55	160.43	827.56	160.84	827.58	161.3	827.6
161.9	827.63	163.96	827.58	164.7	827.62	166.92	827.51	167.83	827.56
168.62	827.6	169.33	827.64	173.57	827.47	209.25	827.32	211.63	827.36
213.59	827.39	215.1	827.41	220.28	827.46	247.59	828	260.33	828
264.01	828.05	265.31	828.07	266.01	828.08	267.24	828.1	349.67	828.76
354.21	828.9	359.57	829.06	360.66	829.06	365.65	829.23	369.72	829.39
372.38	829.49	376.5	829.66	382.67	829.92	383.11	829.93	384.54	830
398.78	831.6	401.74	832	404.21	832.82	407.8	834	411.97	835.59
413.07	836	414.97	836.81	417.7	838	419.82	838.96	422.17	840
426.51	841.74	427.16	842	428.24	842.38	432.79	844	437.73	845.68
438.63	846	439.07	846.15	440.44	846.61	443.79	847.72	444.64	848
450.39	850								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.013	49.1	.035	120.39	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
49.1	120.39	1	1	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	831.50	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.40	Wt. n-Val.	0.013	0.035	0.100
W.S. Elev (ft)	831.10	Reach Len. (ft)			

Crit W.S. (ft)	828.88	Flow Area (sq ft)	17.78	509.01	827.09	
E.G. Slope (ft/ft)	0.001447	Area (sq ft)	17.78	509.01	827.09	
Q Total (cfs)	4015.30	Flow (cfs)	64.43	2974.55	976.32	
Top Width (ft)	368.54	Top Width (ft)	23.31	71.29	273.94	
Vel Total (ft/s)	2.97	Avg. Vel. (ft/s)	3.62	5.84	1.18	
Max Chl Dpth (ft)	9.84	Hydr. Depth (ft)	0.76	7.14	3.02	
Conv. Total (cfs)	105549.1	Conv. (cfs)	1693.7	78191.2	25664.2	
Length Wtd. (ft)		Wetted Per. (ft)	23.36	73.96	274.08	
Min Ch El (ft)	821.26	Shear (lb/sq ft)	0.07	0.62	0.27	
Alpha	2.94	Stream Power (lb/ft s)	450.39	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:Toms Fork

Reach	River Sta.	n1	n2	n3
Toms Fork	2865.327	.1	.035	.1
Toms Fork	2579.832	.1	.035	.1
Toms Fork	2372.941	.035	.035	.1
Toms Fork	2123.812	.1	.035	.1
Toms Fork	2002.134	.1	.035	.1
Toms Fork	1929.868	.1	.035	.1
Toms Fork	1811.557	.1	.035	.1
Toms Fork	1726.403	.1	.035	.1
Toms Fork	1580.979	.1	.035	.1
Toms Fork	1528.223	Bridge		
Toms Fork	1483.221	.1	.035	.1
Toms Fork	1421.670	.1	.035	.1
Toms Fork	1293.596	.1	.035	.1
Toms Fork	1000.000	.013	.035	.1

SUMMARY OF REACH LENGTHS

River: Toms Fork

Reach	River Sta.	Left	Channel	Right
Toms Fork	2865.327	212.2	282.13	186.24
Toms Fork	2579.832	271.1	188.24	66.66
Toms Fork	2372.941	494.68	209.34	278.69
Toms Fork	2123.812	4.85	111.36	132.72
Toms Fork	2002.134	5.33	72.27	84.5
Toms Fork	1929.868	5.86	118.14	110.15

*Toms Fork	*	1811.557	* 17.98*	85.13*	75.99*
*Toms Fork	*	1726.403	* 25.62*	144.25*	127.32*
*Toms Fork	*	1580.979	* 123.76*	97.42*	118.65*
*Toms Fork	*	1528.223	*Bridge *	*	*
*Toms Fork	*	1483.221	* 54.14*	61.47*	37.92*
*Toms Fork	*	1421.670	* 284.66*	127.14*	14.01*
*Toms Fork	*	1293.596	* 379.96*	235.75*	67.58*
*Toms Fork	*	1000.000	* 1*	1*	1*

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Toms Fork

Reach	River Sta.	Contr.	Expan.
*Toms Fork	* 2865.327*	.1*	.3*
*Toms Fork	* 2579.832*	.1*	.3*
*Toms Fork	* 2372.941*	.1*	.3*
*Toms Fork	* 2123.812*	.1*	.3*
*Toms Fork	* 2002.134*	.1*	.3*
*Toms Fork	* 1929.868*	.1*	.3*
*Toms Fork	* 1811.557*	.1*	.3*
*Toms Fork	* 1726.403*	.1*	.3*
*Toms Fork	* 1580.979*	.1*	.3*
*Toms Fork	* 1528.223*Bridge *	*	
*Toms Fork	* 1483.221*	.1*	.3*
*Toms Fork	* 1421.670*	.1*	.3*
*Toms Fork	* 1293.596*	.1*	.3*
*Toms Fork	* 1000.000*	.1*	.3*

ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : Bridge

River: Toms Fork Reach: Toms Fork RS: 2579.832 Profile: PF 1
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
River: Toms Fork Reach: Toms Fork RS: 2372.941 Profile: PF 1
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
River: Toms Fork Reach: Toms Fork RS: 2123.812 Profile: PF 1
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
River: Toms Fork Reach: Toms Fork RS: 2002.134 Profile: PF 1

Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

River: Toms Fork Reach: Toms Fork RS: 1929.868 Profile: PF 1

Warning:Divided flow computed for this cross-section.

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

River: Toms Fork Reach: Toms Fork RS: 1726.403 Profile: PF 1

Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

River: Toms Fork Reach: Toms Fork RS: 1580.979 Profile: PF 1

Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

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.

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.

River: Toms Fork Reach: Toms Fork RS: 1528.223 Profile: PF 1 Upstream

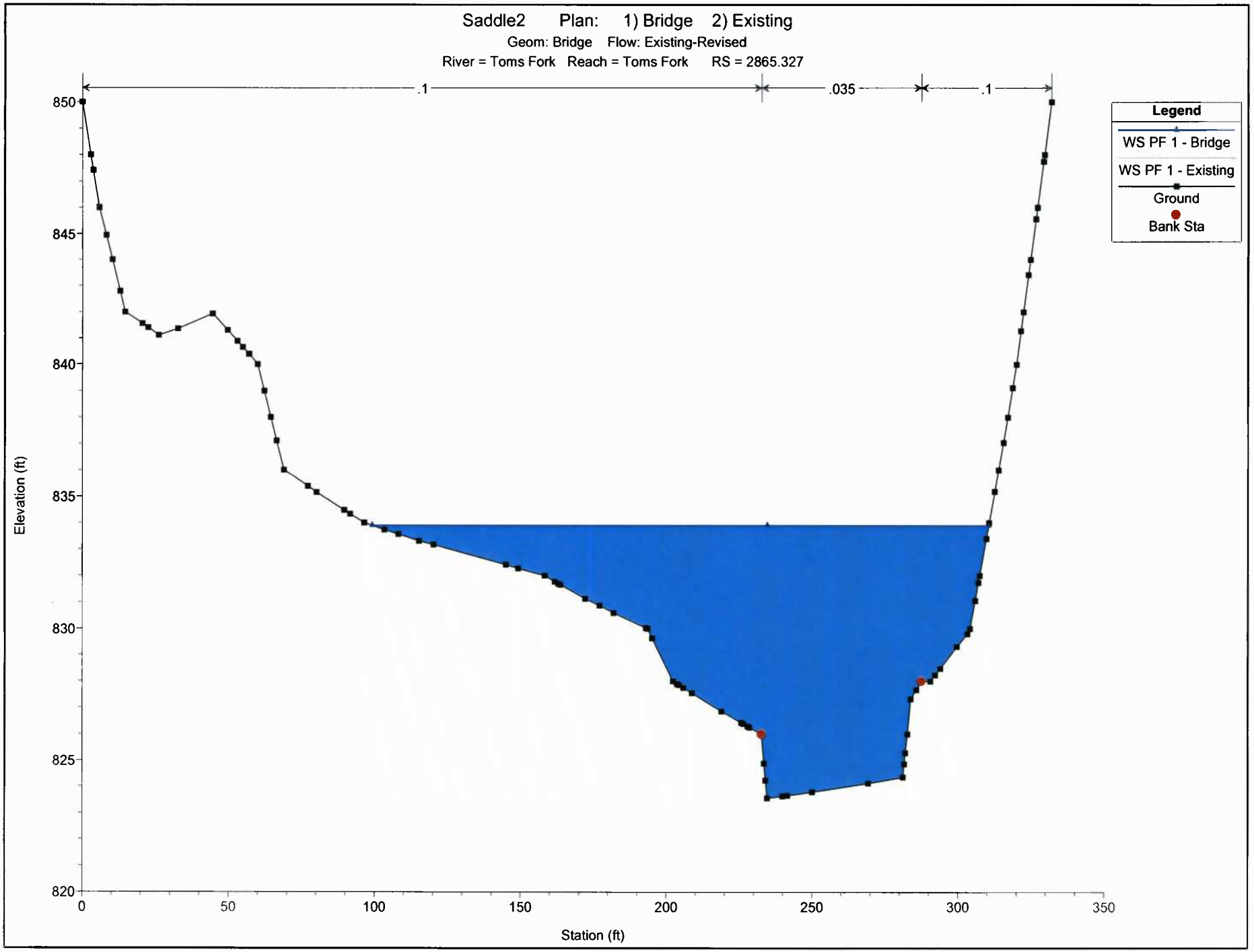
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.

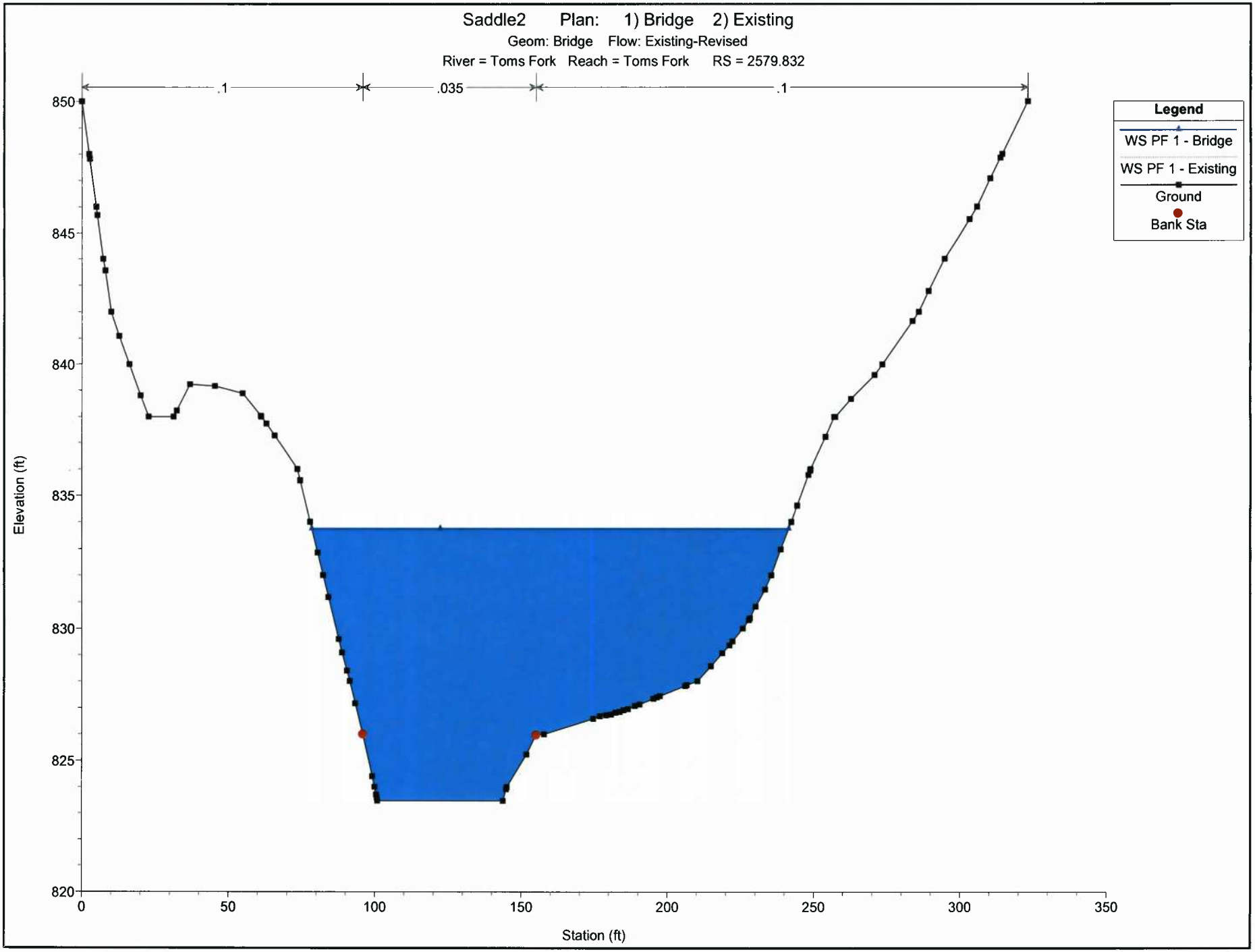
River: Toms Fork Reach: Toms Fork RS: 1483.221 Profile: PF 1

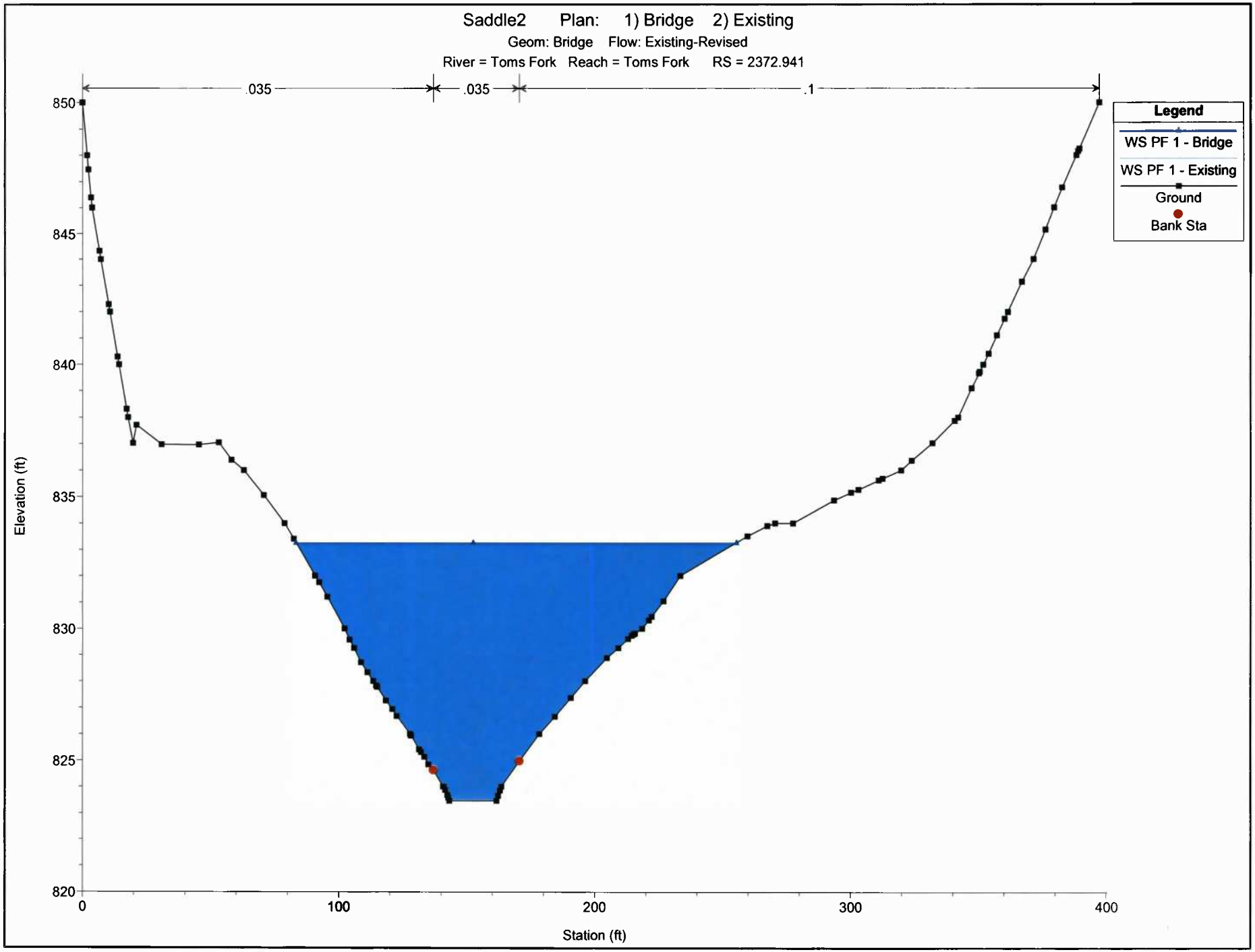
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.

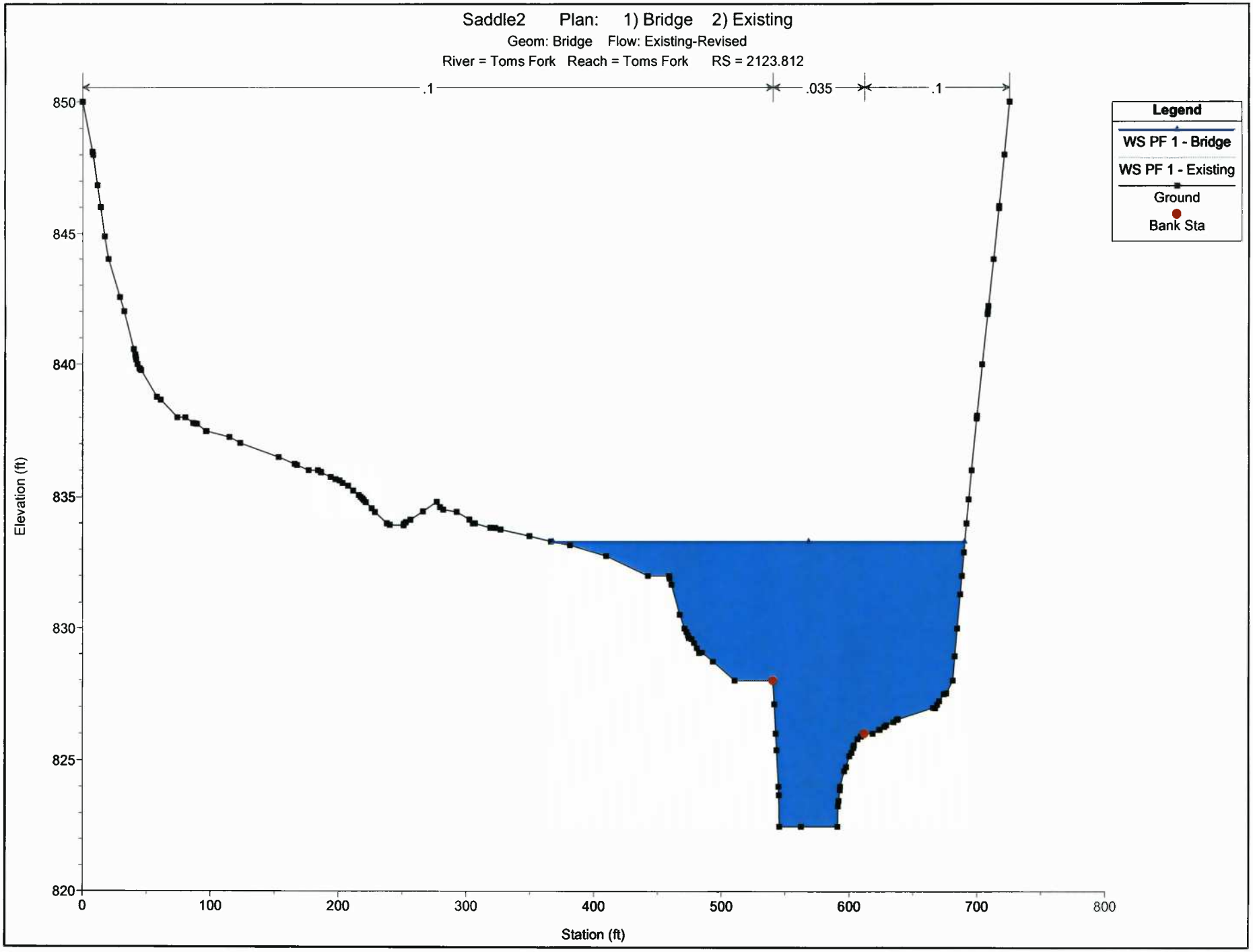
River: Toms Fork Reach: Toms Fork RS: 1293.596 Profile: PF 1

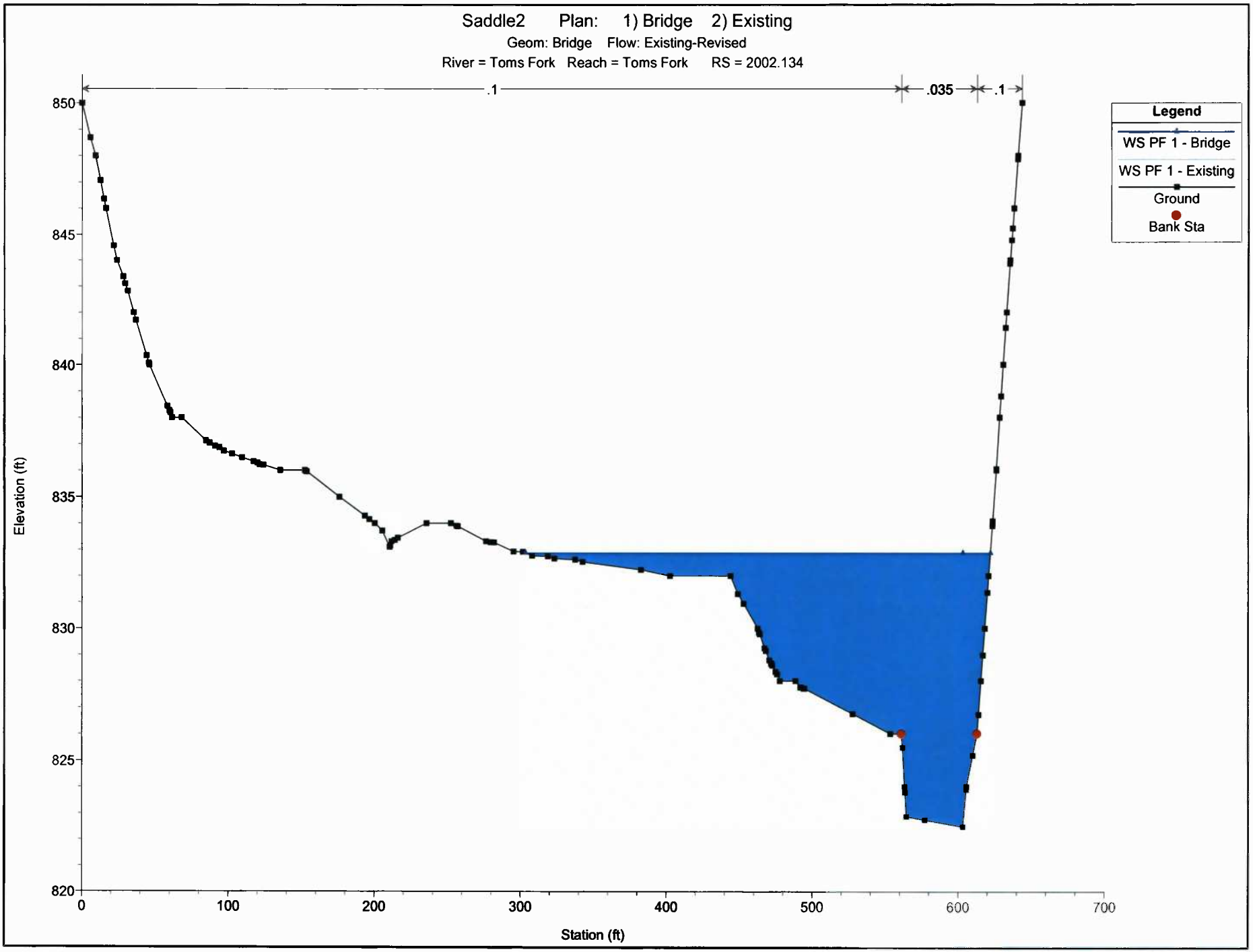
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

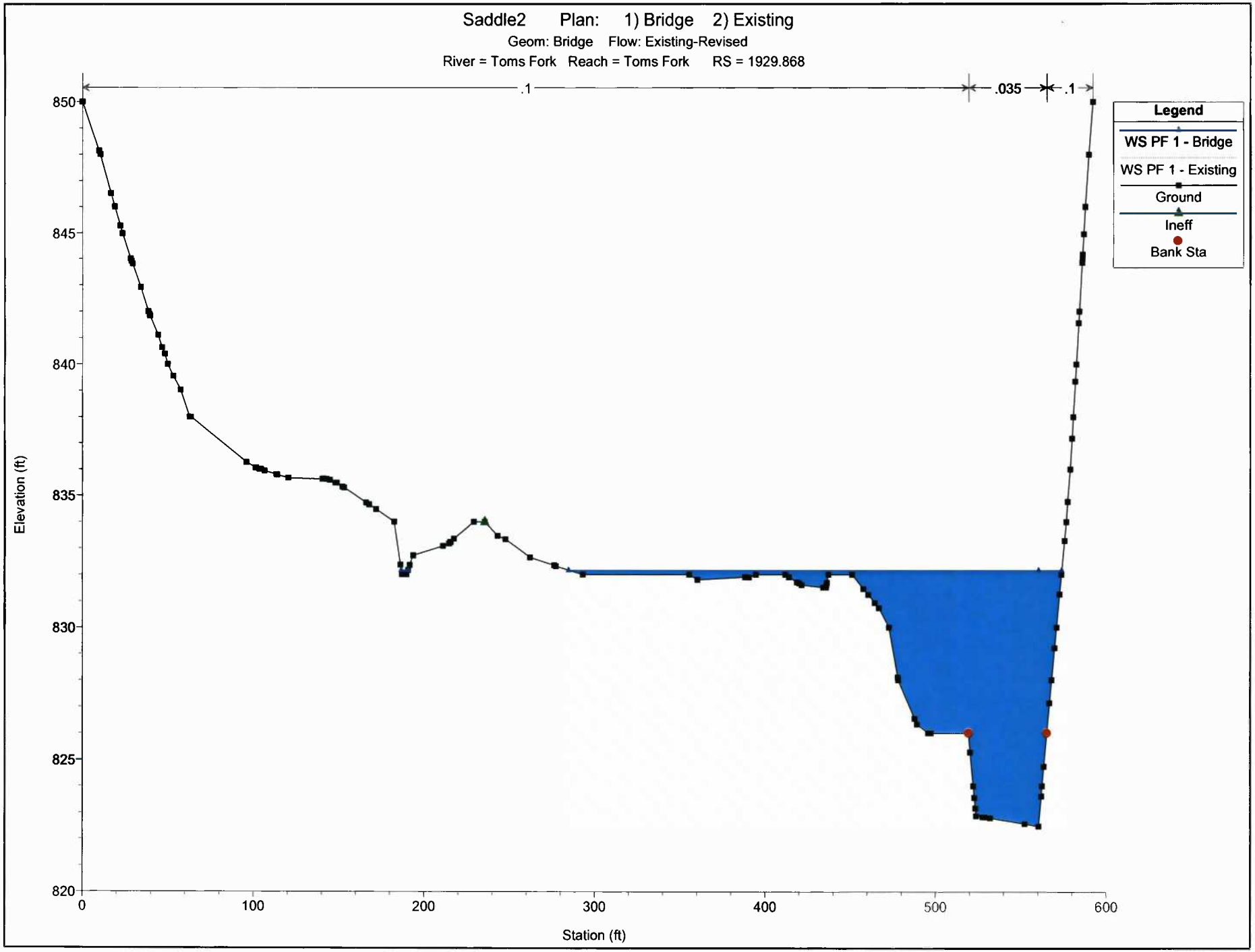

Saddle2 Plan: 1) Bridge 2) Existing
Geom: Bridge Flow: Existing-Revised
River = Toms Fork Reach = Toms Fork RS = 2865.327
.1
.035
.1
Legend
WS PF 1 - Bridge
WS PF 1 - Existing
Ground
Bank Sta
Elevation (ft)
850
845
840
835
830
825
820
0
50
100
150
200
250
300
350
Station (ft)

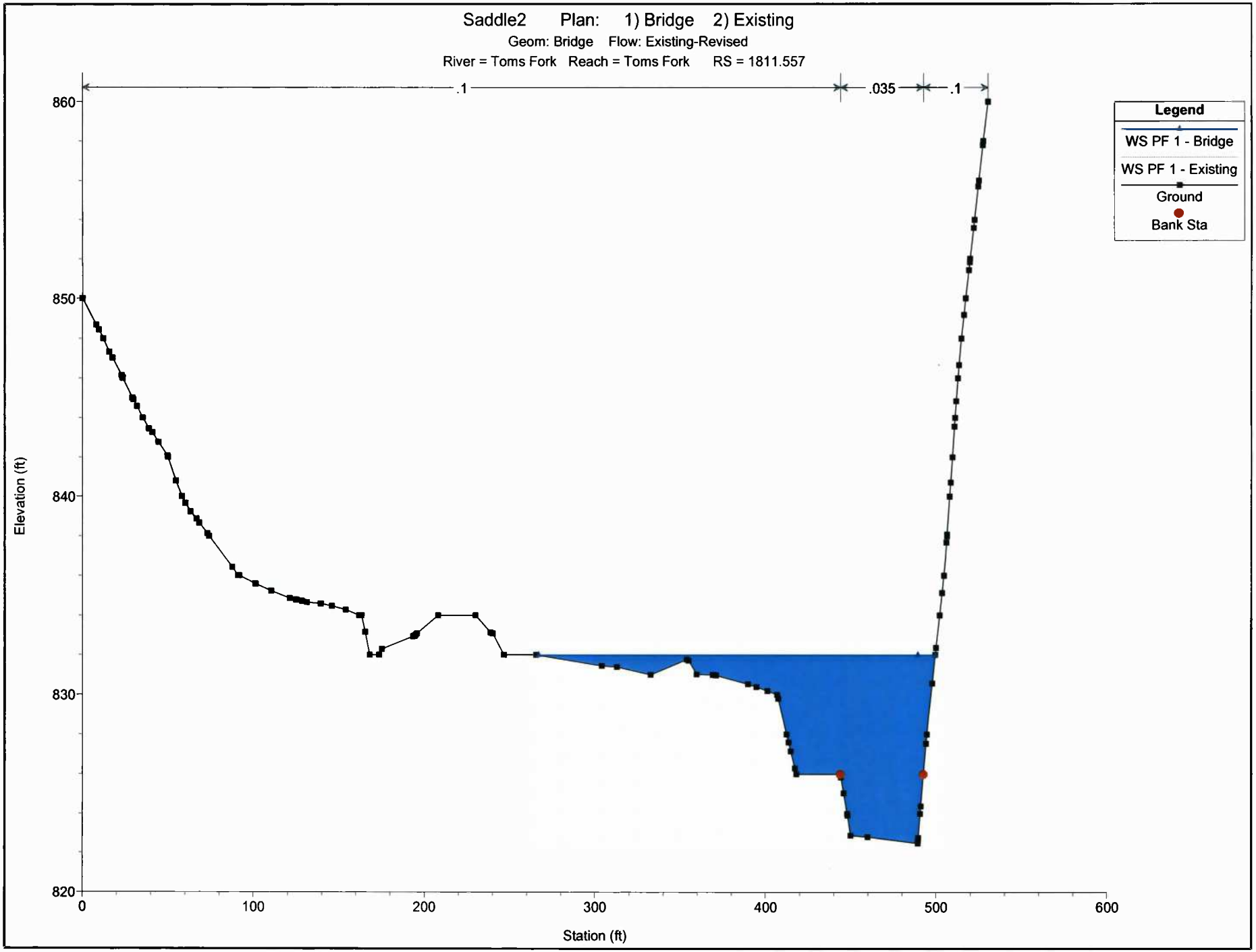

Saddle2 Plan: 1) Bridge 2) Existing
Geom: Bridge Flow: Existing-Revised
River = Toms Fork Reach = Toms Fork RS = 2579.832
.1
.035
.1
Legend
WS PF 1 - Bridge
WS PF 1 - Existing
Ground
Bank Sta
Elevation (ft)
850
845
840
835
830
825
820
0
50
100
150
200
250
300
350
Station (ft)

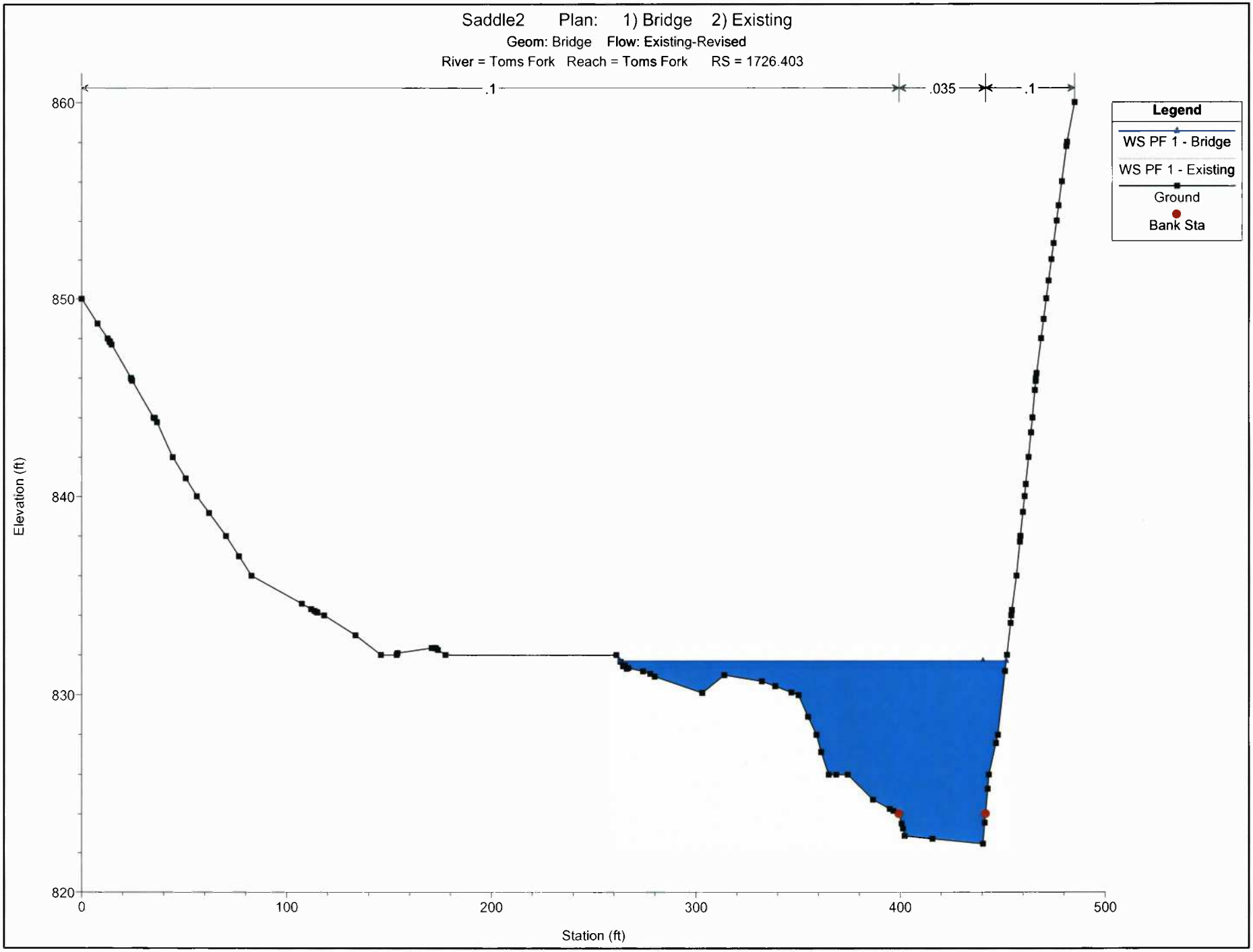

Saddle2 Plan: 1) Bridge 2) Existing
Geom: Bridge Flow: Existing-Revised
River = Toms Fork Reach = Toms Fork RS = 2372.941
.035
.035
.1
Legend
WS PF 1 - Bridge
WS PF 1 - Existing
Ground
Bank Sta
Elevation (ft)
850
845
840
835
830
825
820
0
100
200
300
400
Station (ft)

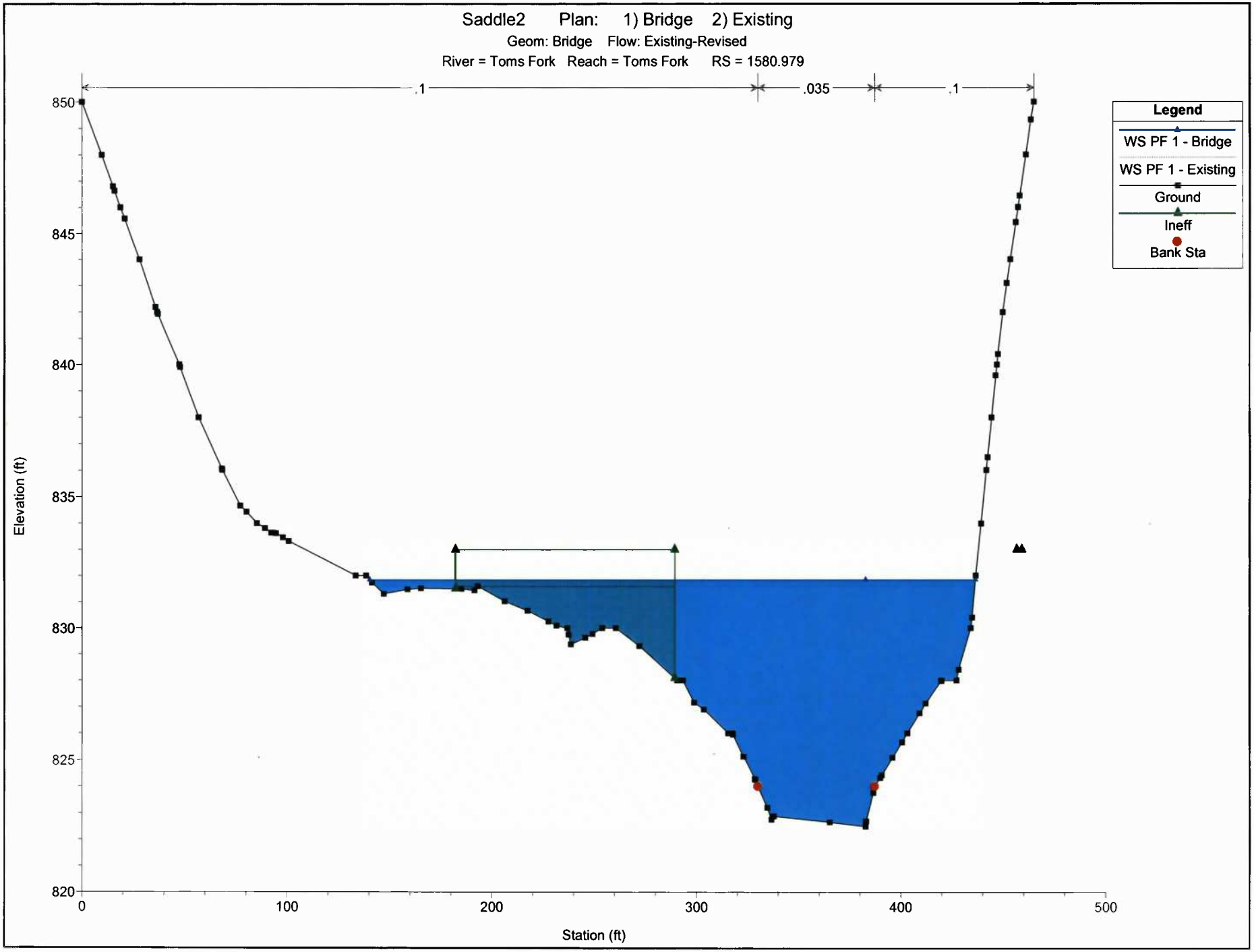

Saddle2 Plan: 1) Bridge 2) Existing
Geom: Bridge Flow: Existing-Revised
River = Toms Fork Reach = Toms Fork RS = 2123.812
.1
.035
.1
Legend
WS PF 1 - Bridge
WS PF 1 - Existing
Ground
Bank Sta
Elevation (ft)
850
845
840
835
830
825
820
0
100
200
300
400
500
600
700
800
Station (ft)

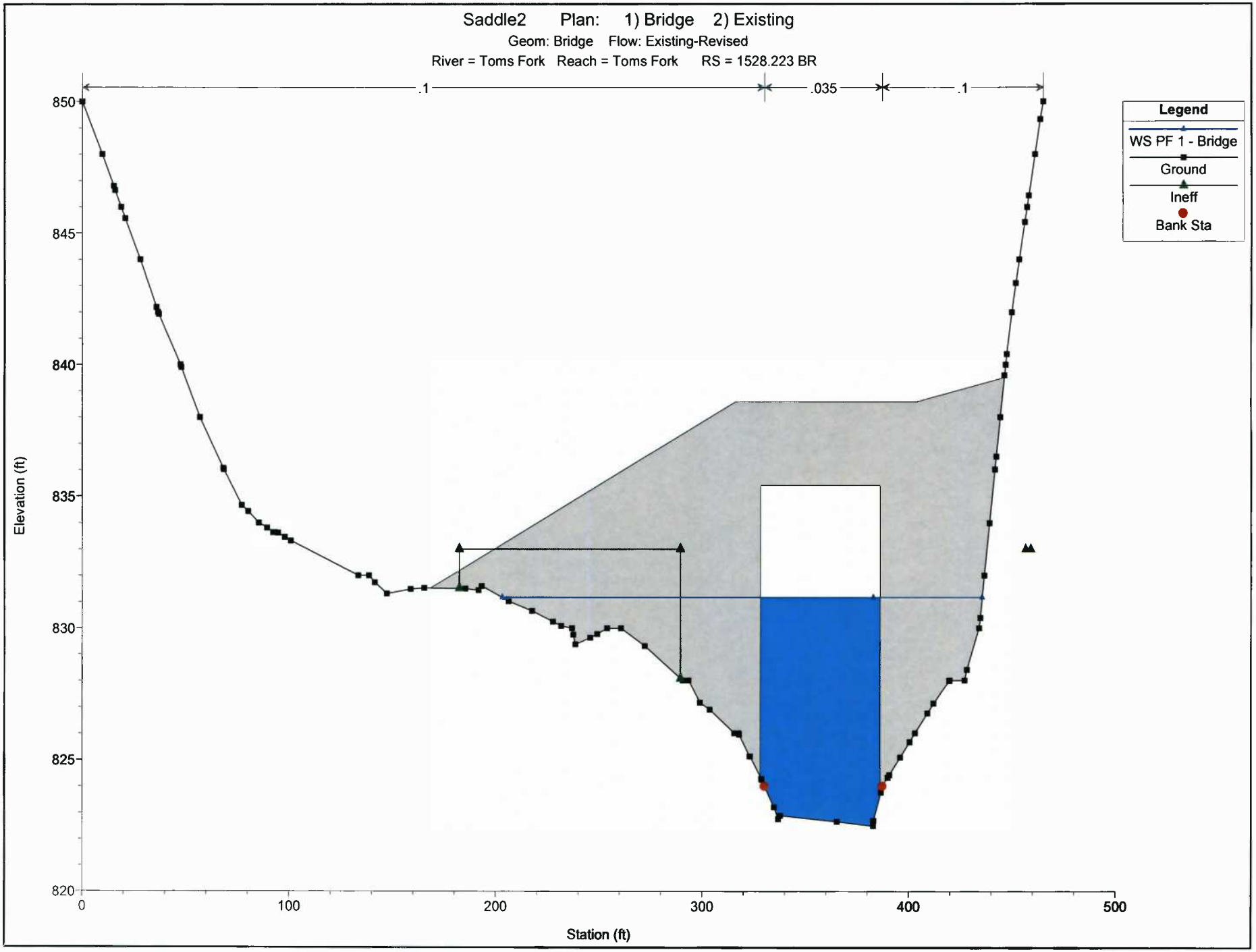

Saddle2 Plan: 1) Bridge 2) Existing
Geom: Bridge Flow: Existing-Revised
River = Toms Fork Reach = Toms Fork RS = 2002.134
.1
.035
.1
Legend
WS PF 1 - Bridge
WS PF 1 - Existing
Ground
Bank Sta
Elevation (ft)
850
845
840
835
830
825
820
0
100
200
300
400
500
600
700
Station (ft)

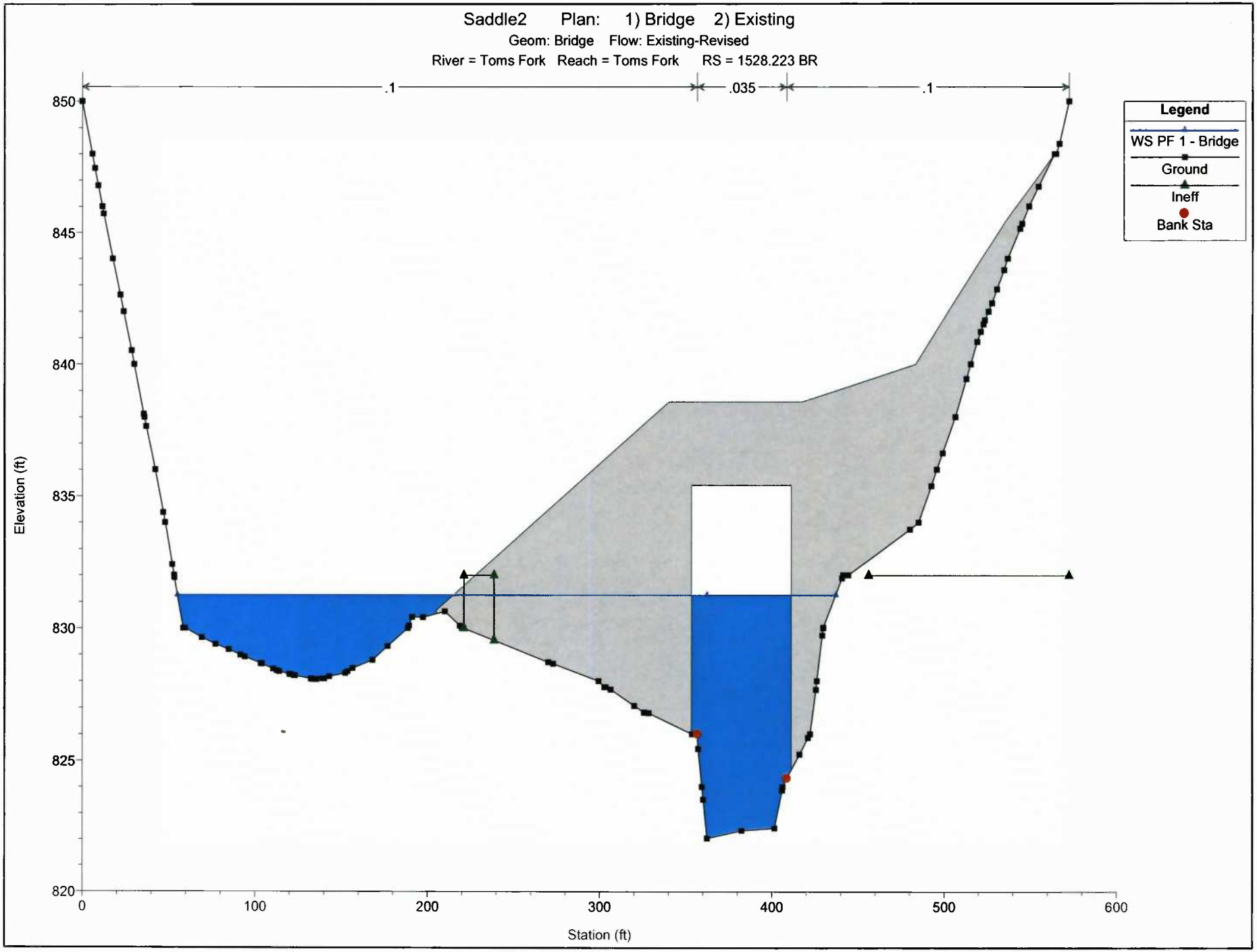

Saddle2 Plan: 1) Bridge 2) Existing
Geom: Bridge Flow: Existing-Revised
River = Toms Fork Reach = Toms Fork RS = 1929.868
.1
.035
.1
Legend
WS PF 1 - Bridge
WS PF 1 - Existing
Ground
Ineff
Bank Sta
Elevation (ft)
850
845
840
835
830
825
820
0
100
200
300
400
500
600
Station (ft)

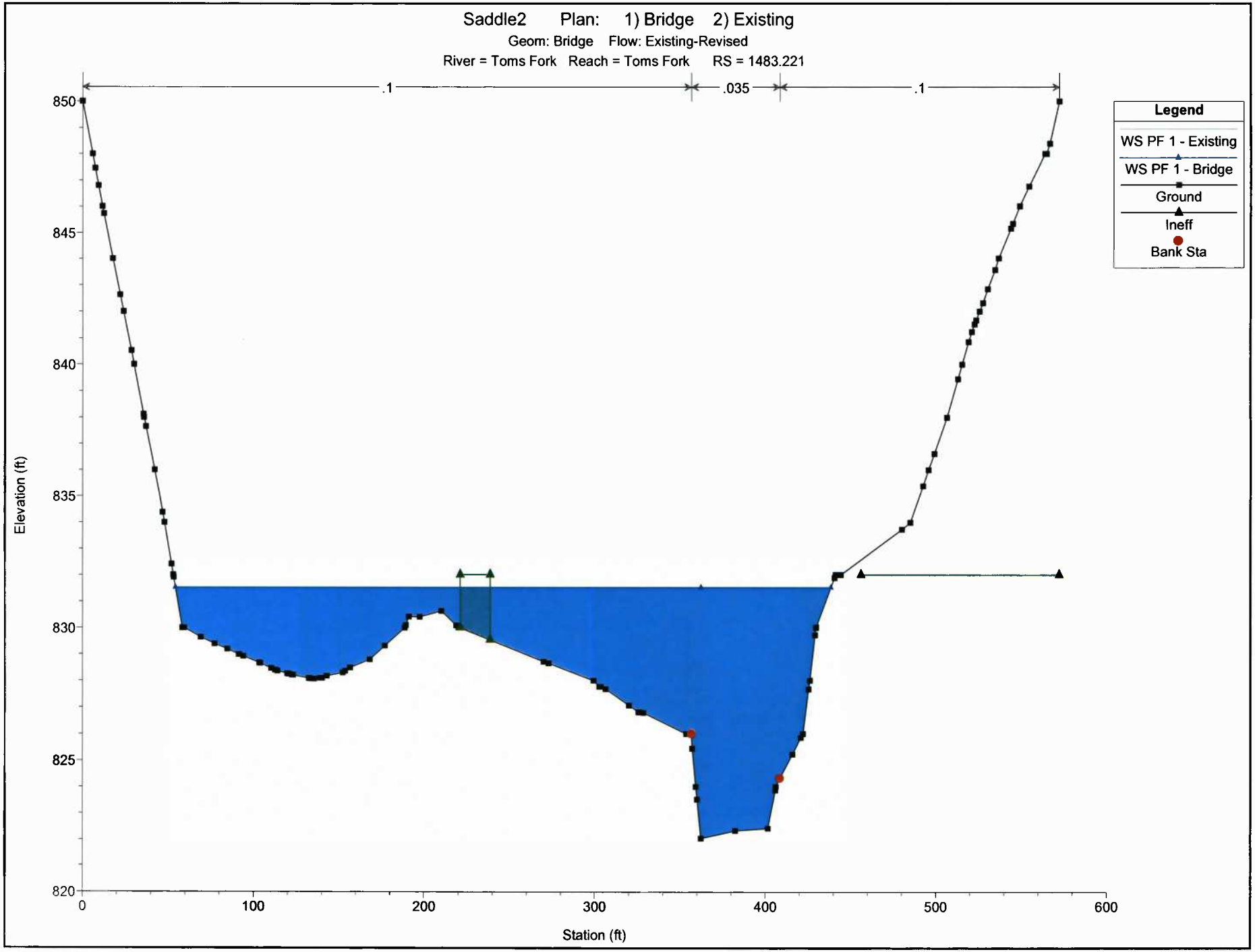

Saddle2 Plan: 1) Bridge 2) Existing
Geom: Bridge Flow: Existing-Revised
River = Toms Fork Reach = Toms Fork RS = 1811.557
.1
.035
.1
Legend
WS PF 1 - Bridge
WS PF 1 - Existing
Ground
Bank Sta
Elevation (ft)
860
850
840
830
820
0
100
200
300
400
500
600
Station (ft)

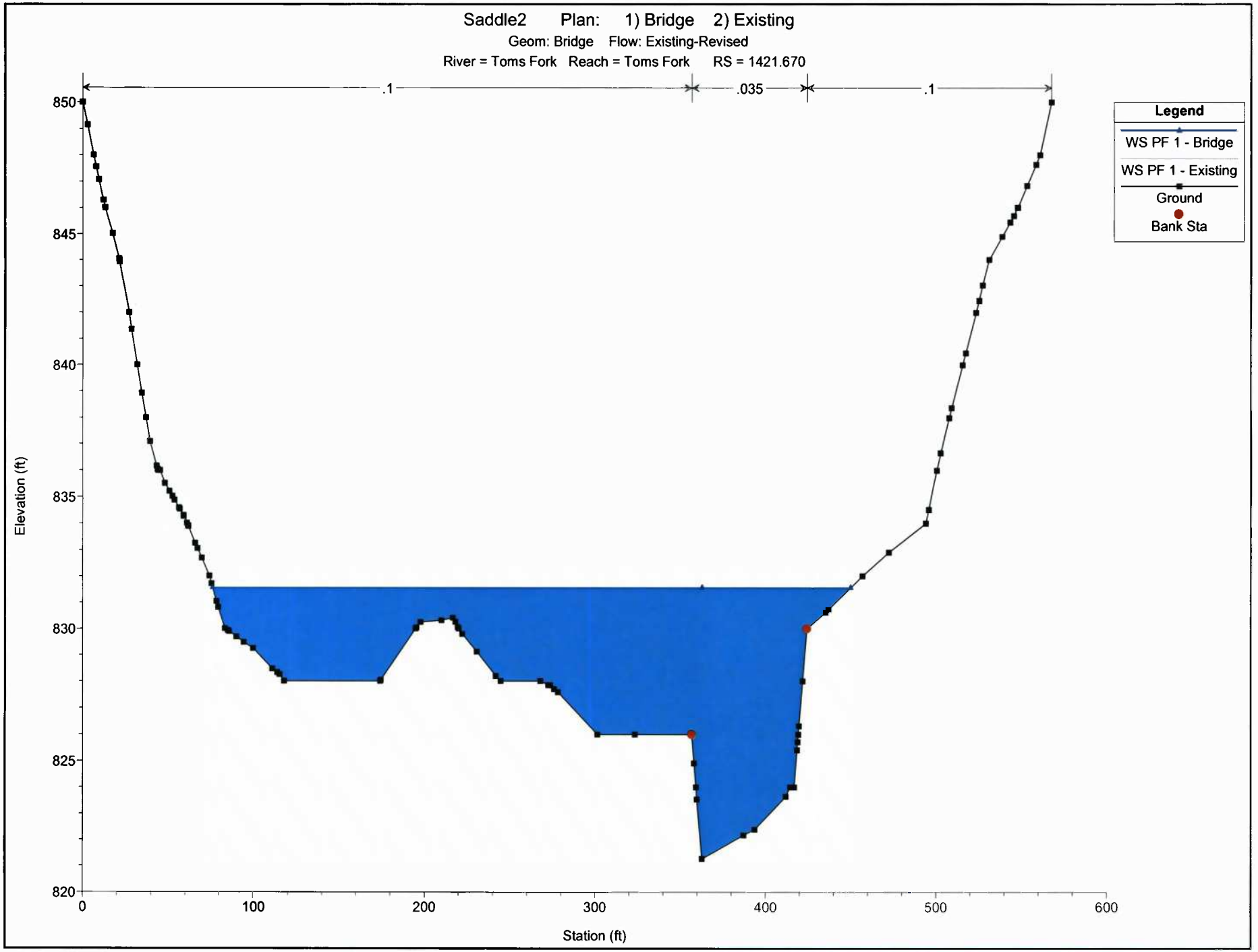

Saddle2 Plan: 1) Bridge 2) Existing
Geom: Bridge Flow: Existing-Revised
River = Toms Fork Reach = Toms Fork RS = 1726.403
.1
.035
.1
Legend
WS PF 1 - Bridge
WS PF 1 - Existing
Ground
Bank Sta
Elevation (ft)
860
850
840
830
820
0
100
200
300
400
500
Station (ft)

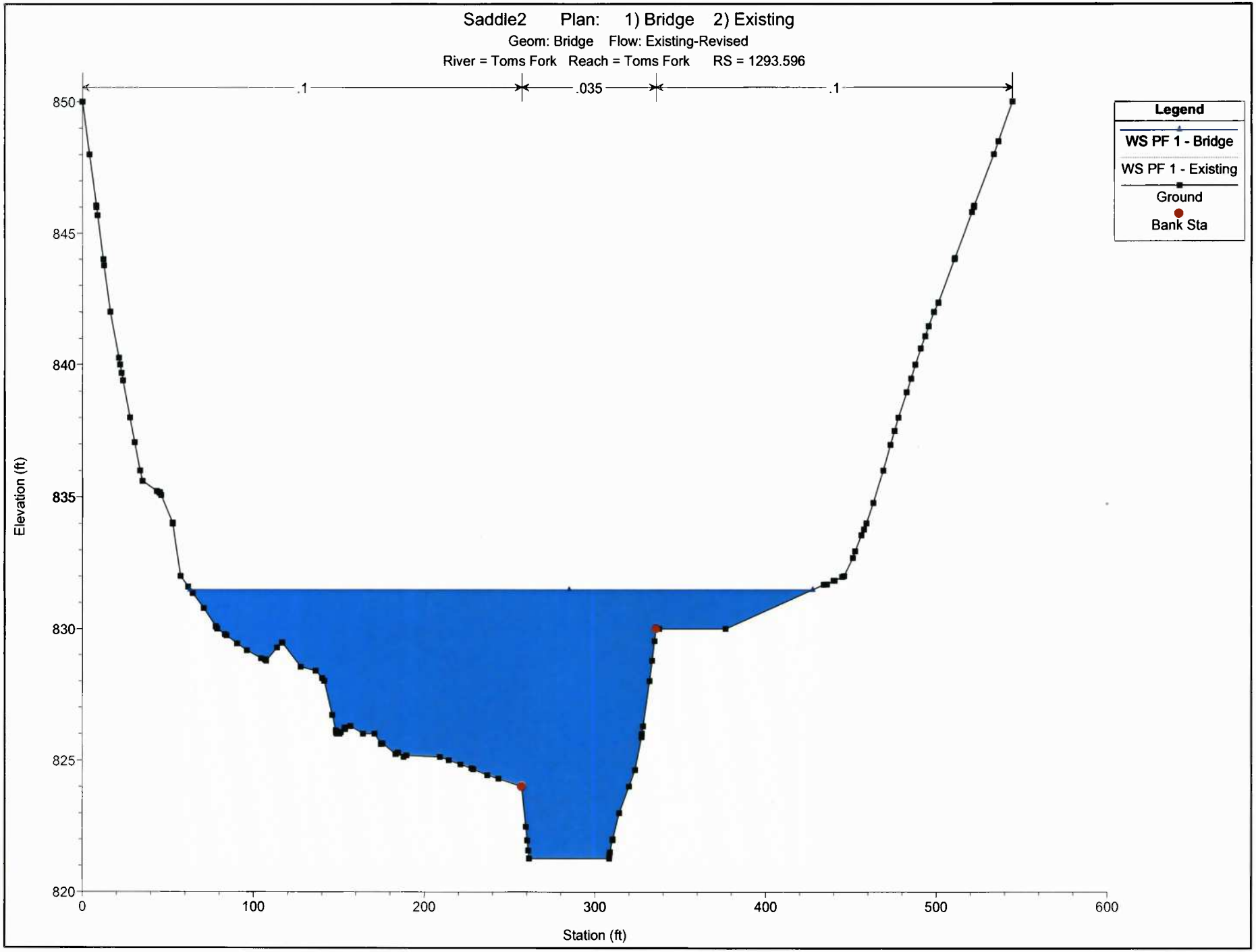

Saddle2 Plan: 1) Bridge 2) Existing
Geom: Bridge Flow: Existing-Revised
River = Toms Fork Reach = Toms Fork RS = 1580.979
.1
.035
.1
Legend
WS PF 1 - Bridge
WS PF 1 - Existing
Ground
Ineff
Bank Sta
Elevation (ft)
850
845
840
835
830
825
820
0
100
200
300
400
500
Station (ft)

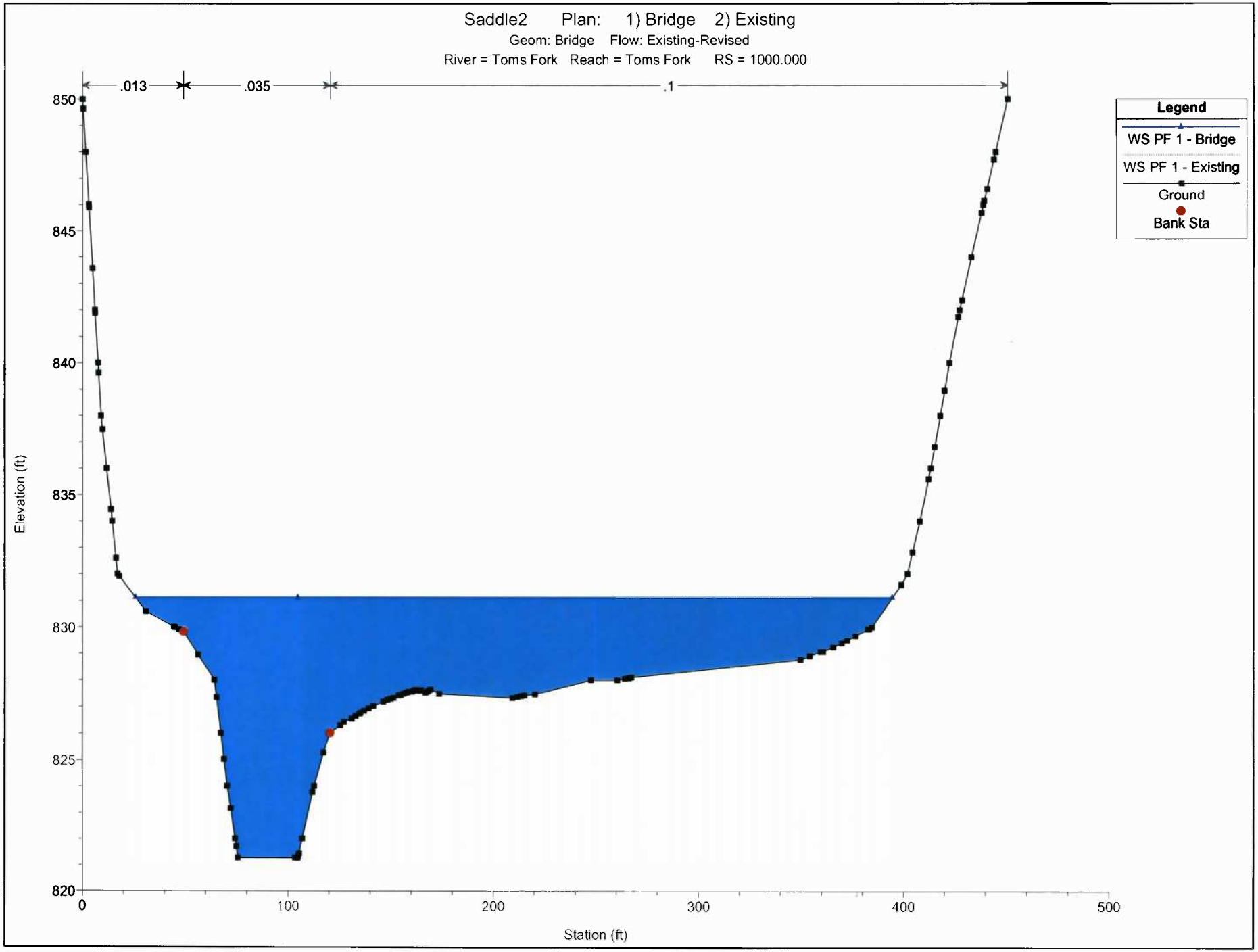

Saddle2 Plan: 1) Bridge 2) Existing
Geom: Bridge Flow: Existing-Revised
River = Toms Fork Reach = Toms Fork RS = 1528.223 BR
.1
.035
.1
Legend
WS PF 1 - Bridge
Ground
Ineff
Bank Sta
Elevation (ft)
850
845
840
835
830
825
820
0
100
200
300
400
500
Station (ft)


Saddle2 Plan: 1) Bridge 2) Existing
Geom: Bridge Flow: Existing-Revised
River = Toms Fork Reach = Toms Fork RS = 1528.223 BR
.1
.035
.1
Legend
WS PF 1 - Bridge
Ground
Ineff
Bank Sta
Elevation (ft)
850
845
840
835
830
825
820
0
100
200
300
400
500
600
Station (ft)


Saddle2 Plan: 1) Bridge 2) Existing
Geom: Bridge Flow: Existing-Revised
River = Toms Fork Reach = Toms Fork RS = 1483.221
.1
.035
.1
Legend
WS PF 1 - Existing
WS PF 1 - Bridge
Ground
Ineff
Bank Sta
Elevation (ft)
850
845
840
835
830
825
820
0
100
200
300
400
500
600
Station (ft)


Saddle2 Plan: 1) Bridge 2) Existing
Geom: Bridge Flow: Existing-Revised
River = Toms Fork Reach = Toms Fork RS = 1421.670
.1
.035
.1
Legend
WS PF 1 - Bridge
WS PF 1 - Existing
Ground
Bank Sta
Elevation (ft)
850
845
840
835
830
825
820
0
100
200
300
400
500
600
Station (ft)


Saddle2 Plan: 1) Bridge 2) Existing
Geom: Bridge Flow: Existing-Revised
River = Toms Fork Reach = Toms Fork RS = 1293.596
.1
.035
.1
Legend
WS PF 1 - Bridge
WS PF 1 - Existing
Ground
Bank Sta
Elevation (ft)
850
845
840
835
830
825
820
0
100
200
300
400
500
600
Station (ft)


Saddle2 Plan: 1) Bridge 2) Existing
Geom: Bridge Flow: Existing-Revised
River = Toms Fork Reach = Toms Fork RS = 1000.000
.013
.035
.1
Legend
WS PF 1 - Bridge
WS PF 1 - Existing
Ground
Bank Sta
Elevation (ft)
850
845
840
835
830
825
820
0
100
200
300
400
500
Station (ft)

NAVITUS
ENGINEERING INC.

151 Windy Hill Lane
Winchester, Virginia 22602
Telephone: (888) 662-4185

July 16, 2013

Doddridge County Commission
118 East Court Street
West Union, WV 26456

Attn: Dan Wellings, Doddridge County Floodplain Administrator

Re: New Milton Compressor Station Access Road Culvert Stream Crossing - Floodplain Analysis

Dear Mr. Wellings:

Navitus Engineering has completed a floodplain analysis of the proposed New Milton Compressor Station Access Road stream crossing over Toms Fork located south of West Union, along State Route 18 in Doddridge County, West Virginia. This site is located within a FEMA Flood Zone "AE", as shown on the Flood Insurance Rate Map (FIRM) from the National Flood Insurance Program (NFIP), Map Number 54017C0230C dated October 4, 2011. Being that the site is located in a Flood Zone "AE", base flood elevations for this area have been established and detailed study information was found in the Flood Insurance Study for Doddridge County, dated October 4, 2011.

In order to establish base flood elevations for this site, a hydrologic and hydraulic analysis was preformed as outlined in the current Doddridge County Floodplain Ordinance, enacted May 21st, 2013. Using field shot data, 10-foot interval topography converted from 3 meter West Virginia GIS Technical Center DEM data, and information taken from USGS 7.5 Minute Series Topographic Maps, a drainage analysis was performed for the Toms Fork drainage shed. Upon establishing the peak flow drainage calculations for the 100-year storm event, a HEC-RAS river analysis was conducted for a section of Toms Fork adjacent to the New Milton Compressor Station Access Road and Base Flood Elevations (BFE) were established. The established BFEs were compared to those found in the Flood Insurance Study as shown on the Summary of Computed Elevations found in the attached report. The established BFEs were similar to the BFEs found in the Flood Insurance Study, with the greatest difference in elevation being approximately 0.7'. The resulting BFEs were used to establish adjusted floodplain boundaries for the segment of Toms Fork being studied. These boundaries are shown on the attached Existing Conditions Plan. In addition to establishing BFEs, a proposed conditions analysis was performed to determine the impacts of the proposed entrance road and stream crossing over Toms Fork. The proposed grading and culverts were added into the cross sections and the manning's "n" values were adjusted where necessary. The model was run with these changes to determine the impacts of the proposed access road and culverts. The results of this analysis indicate that the proposed improvement will cause a maximum increase of 0.5' in the BFEs in this area and no upstream or downstream properties will be adversely impacted. The maximum increase in the BFE occurs at River Station 17+26.403 and has an existing BFE of 831.4 and a proposed BFE of 831.9. The New Milton Compressor Station Access Road Site Plan (attached) contains a FEMA FIRM Map exhibit showing the proposed access road site overlaid on the FIRM Map. This map contains approximate property lines and owner information.

Attached are the following documents associated with this submission:

- A Floodplain Analysis of Toms Fork documenting the methods used for the analysis, drainage computations, cross sections, and a narrative to describe the analysis. Included with this analysis are exhibits that identify the existing and proposed 100-year floodplain.
- The New Milton Compressor Station Access Road Site Plan, prepared by Navitus Engineering, Inc. which includes additional site design and construction specifications.
- Project Cost Estimate
- Floodplain Permit Application Fee
- Doddridge County Improvement Location Permit Application

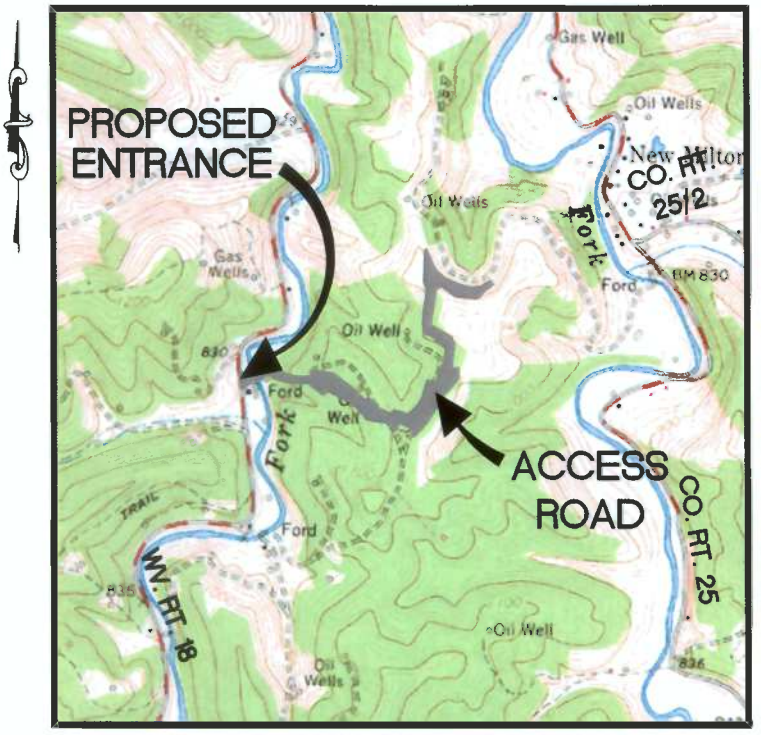
Should any questions or comments arise during the review, please let us know and we will work to address them. Copies of all permits required for this site will be provided by the operator. Please let me know if you should need additional information. You can reach me by phone (540) 336-9486 or email: dmurphy@navituseng.com.

Sincerely,
Navitus Engineering, Inc.

Daniel E. Murphy, CFM

FLOODPLAIN ANALYSIS OF TOMS FORK

NEW MILTON COMPRESSOR STATION ACCESS ROAD WITH CULVERTS



VICINITY MAP

1" = 2,000'

NAVITUS ENGINEERING INC.

151 Windy Hill Lane
Winchester, VA 22602
Telephone: (888) 662-4185
www.navituseng.com

Engineering • Survey • Environmental • GIS

Prepared For:

ANTERO RESOURCES
981 East Washington Avenue
Ellenboro, WV 26346
(304) 869-3405

Contacts:
Bill Prehm, Project Manager
(303) 807-4436
Anthony Smith, Field Engineer
(304) 673-6196
Mike Heaster, Land Agent
(304) 871-0085

CYRUS S. KUMP REGISTERED 19578 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

Designed By:
Navitus Engineering Inc.

Project Manager:
Dan Murphy, CFM
dmurphy@navituseng.com

Tax Parcel:
Map 8 Parcel 37

Location:
New Milton District, Doddridge County
West Virginia

Date: July 16, 2013

FN# ANT096

1. Objective

The objective of this floodplain analysis was to establish boundaries for the existing and proposed conditions of the 100 year base flood elevations (BFE). The proposed condition includes the installation of two (2) 35'-10"x11'-4" Contech Bridgecor #25A5 Arch Culverts and an access road to provide access to a compressor station site where the entrance off of State Route 18 is within the FEMA Flood Zone "AE".

2. Existing Conditions

2.1. Property Description

This site is located in Doddridge County, West Virginia along Toms Fork and State Route 18 south of West Union in the New Milton District. The proposed access road entrance is located on the east side of State Route 18.

2.2. Floodplain Delineation

The approximate limit of the 100-year floodplain (a flood event that has a 1% chance of being equaled or exceeded in any given year) is shown on FEMA Flood Insurance Rate Map (FIRM) for Doddridge County on panels 54017C0230C effective October 4, 2011. This floodplain is located in flood zone designation "AE" and base flood elevations have been established. Detailed study information was found in the Flood Insurance Study for Doddridge County, dated October 4, 2011.

2.3. Floodplain Ordinance

This site is administered under the Doddridge County Floodplain Ordinance, enacted May 31st, 2013.

Per Section 4.3 of the ordinance, when a site is located in FEMA Flood Zone designation "AE" without Floodway Area, the Floodplain Administrator shall require the applicant to demonstrate that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the elevation of the 100-year flood more than one (1) foot at any point.

Per Section 4.5.A of the ordinance, any developer shall notify in writing, by certified mail, Doddridge County's Floodplain Administrator, the State Coordinating Office, and adjacent communities and any adjacent property owners of all such intended activities prior to the alteration of the stream. Copies of all required notifications must be submitted to the Federal Insurance Administration. In addition prior to issuing the local permit the Floodplain Administrator shall require copies of all necessary permits from those government agencies from which Federal or State Law requires approval.

Per Section 4.5.B a stream crossing analysis for the proposed permanent crossing of Toms Fork has been provided under separate cover and includes a cover letter signed by the

responsible professional, a detailed report, hydraulic and hydrologic computations and a sitemap detailing the planned construction.

Per Section 4.5.C of this ordinance the stream crossing has been designed with "best practice" techniques in mind. Two (2) 35'-10"x11'-4" Contech Bridgecor #25A5 Arch Culverts were selected to pass the base flow and 10 year storm events. The culverts will be bottomless to allow for aquatic passage and preservation of the existing stream channel. The culverts were designed to be a permanent stream crossing. All fill utilized will be 2-4" clean rock aggregate with a 4-6" large angular durable rock base to minimize erosion during storm events. Gabion basket wing walls will be utilized to minimize scour around the culvert. Sandbag cofferdams and a dewatering bag system will be utilized during construction to minimize erosion and allow for construction in the stream channel.

Per Section 4.5.D of this ordinance the culverts will be properly anchored as required.

Per Section 4.5.E of this ordinance the Developer shall provide Doddridge County with all required legal agreements detailing inspections and maintenance.

Per Section 5.1 of this ordinance Permits are required for the construction of the permanent stream crossing. The format of the permit will coincide with the requirements set forth in Section 5.2 of the ordinance.

Per Section 6.1E of this ordinance the fill associated with this plan has been designed to not adversely affect adjacent properties. The access road and culverts were located to minimize floodway constriction and the height above the existing grade was minimized to allow as much flow as possible to be unimpeded. Impacts to the 100 year base flood elevation are demonstrated later in this report, however, increases to the 100 year base flood elevations were limited to approximately 1,337' upstream of the proposed culvert and returned to 0.0' of impact approximately 1,337' upstream of the proposed culvert. Impacts downstream of the proposed culvert were limited approximately 45' downstream and returned to 0.0' of impact immediately. Fill as stated above shall consist of 2-4" clean rock aggregate with a 4-6" large angular durable rock base. No less than 2:1 slopes will be utilized in the construction of the proposed crossing.

Per Section 6.1F the structure has been placed with the longitudinal axis parallel to the direction of flood flow and to maintain the same flood-flow lines of the adjoining structures.

Per Section 6.1.I of this ordinance, no material or equipment storage shall be allowed within the vicinity of the entrance. The storage of all material and equipment shall be onsite and away from the entrance.

Per Section 6.1.K of this ordinance, a flow line is proposed adjacent to State Route 18 along the entrance to allow adequate drainage across the proposed entrance.

All other specific requirements covered in Section 6.1 of this ordinance are not applicable to this design. (Sections 6.1.A, 6.1.B, 6.1.C, 6.1.D, 6.1.F, 6.1.G, 6.1.H, 6.1.J, and 6.1.L)

The developer shall conform with all administrative procedures as outline in Article 7 of this ordinance.

2.4. Toms Fork Characteristics

Toms Fork is located in the New Milton District of Doddridge County and flows in a northern direction. The drainage area flowing to Toms Fork at the stream crossing is approximately 14.602 square miles of forested and agricultural land with an average basin slope of 36.04%.

3. Analysis Information

3.1. HEC-RAS

A HEC-RAS hydraulic analysis was performed for the portion of the Toms Fork that has an impact on the BFE's across the property. HEC-RAS is designed to perform one-dimensional hydraulic calculations for a full network of natural and constructed channels. The steady flow system is designed for applications in floodplain management and flood insurance studies.

3.2. Analysis Limits

The analysis information is based upon two foot interval aerial shot topography by Blue Mountain Aerial Mapping. The upstream analysis limit for Toms Fork is located approximately 1,337 feet upstream from the proposed stream crossing and represents the 28+65.327 section. The downstream analysis limit for Toms Fork is located approximately 1,564 feet downstream of the proposed stream crossing and represents the 10+00.000 section. These limits were selected so that the HEC-RAS model would accurately determine the base flood elevations on site and off site.

3.3. Flow Data

The hydrologic analysis utilized USDA soil surveys for computation of drainage shed curve numbers, aerial topography and 3 meter West Virginia GIS Technical Center DEM to determine the drainage area(s) and time of concentration path(s). The peak 100-year discharge within the inundation area was determined through TR-55 SCS methodology. Time of concentration paths were calculated utilizing the SCS lag method. The hydrologic calculations for the drainage area were performed using HEC-HMS. See the table below for a summary of the flow conditions, and see Supplement 1 for the complete Drainage Computations.

Stream	Drainage Area	Flow (cfs)	Note
Upper Toms Fork	8,212.48 Ac.	3765.8	Upper Reach
Middle Toms Fork	1,132.16 Ac.	949.4	Middle Reach
Lower Toms Fork	604.16 Ac.	666.8	Lower Reach

3.4. Cross Section Data

The cross sections were employed at significant changes in site features. This includes major bends in the stream channel, areas of major contraction and expansion of the floodplain area, upstream and downstream of existing culverts, and at building obstructions (cross sections were compiled using Aerial Mapping by Blue Mountain Aerial Mapping).

3.5. Manning's n-value

The channel and overbank areas were assigned manning's n-values based on field review, site photographs, and close inspection of existing aerial photography. The chart below describes the manning's n values used in this study.

Manning's n value	Description	Portion Used
.035	Clean, straight, full, no rifts or deep pools, stones and weeds	Main Channel
.1	Heavy stand of timber, few down trees, little undergrowth, flow below branches	Floodplains (Normal)
.013	Asphalt	Floodplains
.035	High grass	Floodplains
.033	Rip Rap Dry Rubble	Floodplains
.06	Light Brush and trees, in summer	Floodplains
.08	Heavy stand of timber, few down trees, little undergrowth, flow below branches	Floodplains (Minimum)

4. Results

4.1. Existing Conditions

Since the site is in Zone "AE" floodplain area as shown on the FIRM, there has been a detailed study analysis with one foot interval base flood elevations established within the Doddridge County Flood Insurance Study (FIS) effective October 4, 2011. An existing conditions model was prepared based upon aerial topography and existing drainage computations. This information was processed in HEC-RAS to determine the existing conditions of the Base Flood Elevations and then compared with the FIS for accuracy.

4.2. Proposed Conditions

The proposed conditions model was based on the proposed topography for the site access road and proposed culverts in the stream. This information was added into the existing conditions cross sections, and then was processed in HEC-RAS to determine the proposed conditions of the Base Flood Elevations. A summary of elevation changes showing the

existing and proposed BFEs at the various cross sections has been provided below. As shown in the table, the proposed development will not increase the existing BFEs more than 0.5' throughout the project area and return to 0.0' at the upstream and downstream termini of the study area.

NEW MILTON COMPRESSOR STATION ACCESS ROAD FLOODPLAIN STUDY SUMMARY OF COMPUTED ELEVATIONS

CROSS SECTION STATION	RIVER NAME	100 YEAR BASE FLOOD ELEVATION			
		DODDRIDGE COUNTY FIS MODEL*	EXISTING CONDITIONS MODEL	PROPOSED CONDITIONS MODEL	PROPOSED DIFFERENCE
2865.327	Toms Fork	833.5	833.9	833.9	0.0
2579.832	Toms Fork	833.0	833.7	833.8	+ 0.1
2372.941	Toms Fork	832.8	833.2	833.3	+ 0.1
2123.812	Toms Fork	832.5	833.2	833.4	+ 0.2
2002.134	Toms Fork	832.3	832.8	832.9	+ 0.1
1929.868	Toms Fork	832.2	832.1	832.3	+ 0.2
1811.557	Toms Fork	832.1	831.7	832.1	+ 0.4
1726.403	Toms Fork	832.0	831.4	831.9	+ 0.5
1580.979	Toms Fork	831.8	831.6	832.0	+ 0.4
1528.223	Toms Fork	Culvert			
1483.221	Toms Fork	831.7	831.5	831.5	0.0
1421.670	Toms Fork	831.6	831.6	831.6	0.0
1293.596	Toms Fork	831.4	831.5	831.5	0.0
1000.000	Toms Fork	831.0	831.1	831.1	0.0

* ELEVATIONS ARE INTERPOLATED FROM DODDRIDGE COUNTY FIS EFFECTIVE OCTOBER 4, 2011.

5. Conclusion

The results of this floodplain analysis indicate that there will be minimal changes in the 100 year base flood elevation and no impacts to upstream and downstream adjacent properties along Toms Fork. The largest increase in base flood elevation is 0.5' and is located on site directly upstream of the stream crossing.

APPENDIX

Exhibit A	FIRM Panel 54017C0230C
Exhibit B	Overall Plan
Exhibit C	Existing Conditions Plan
Exhibit D	Proposed Conditions Plan
Supplement 1	Drainage Computations
Supplement 2	HEC-RAS Analysis –Existing Conditions Summary
Supplement 3	HEC-RAS Analysis –Proposed Conditions Summary w/ Cross Sections

Exhibit A

FIRM Panel 54017C0230C

MAP SCALE 1" = 1000'

500 0 1000 2000

FEET

METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0230C

FIRM

FLOOD INSURANCE RATE MAP

DODDRIDGE COUNTY, WEST VIRGINIA AND INCORPORATED AREAS

PANEL 230 OF 325

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
DODDRIDGE COUNTY	540024	0230	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
54017C0230C

MAP REVISED
OCTOBER 4, 2011

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

DODDRIDGE COUNTY, WV AND INCORPORATED AREAS PANEL 0235

Exhibit B

Overall Plan

LEGEND

- EX. DELINEATED STREAM
- XX+XX.XX HEC-RAS STUDY CROSS SECTION
- FEMA FLOOD ZONE "AE" PER FIRM #54017C0230C
- EXISTING STRUCTURE

TM 8-37
KATHRYN H. MARSHALL (MS 017 PG 722)
CLINTON D. & KEVIN M. MEANS (DB 287 PG 278)
MARVIN L. PHILLIPS (WB 033 PG 405)
RUTH E. PHILLIPS (WB 038 PG 170)
WILLIAM C. PHILLIPS (WB 033 PG 405)
LAVERNE H. WILLIAMS (MS 017 PG 722)
147.86 ACRES

GRID NORTH AND ELEVATIONS SHOWN HEREON WERE ESTABLISHED BY SURVEY GRADE GPS

PROPOSED CULVERT STREAM CROSSING

APPROX. PROPERTY LINE

TM 8-15
ROBERT E. & EUNICE N. TAYLOR
DB 260 PG 055
27.7 ACRES

TM 8-15.1
ROBERT C. TAYLOR
DB 259 PG 478
0.97 ACRES

TM 8-16
ROBERT C. TAYLOR
DB 248 PG 366
18 ACRES

TM 8-37.2
LOUIS R. ENLOW
DB 248 PG 066
0.58 ACRE

TM 8-39
COMSTOCK IRREVOCABLE TRUST &
SILVESTRE IRREVOCABLE TRUST
DB 261 PG 37
DB 261 PG 34
68 ACRES

NEW MILTON COMPRESSOR STATION ACCESS ROAD

TOMS FORK

18

10+00.000
14+22.970
15+88.879
16+83.599
23+72.941
25+79.832
28+65.327
21+23.872
20+02.134
19+29.899
18+11.557
17+26.403

200 0 200
GRAPHIC SCALE (IN FEET)

NAVITUS ENGINEERING INC.
151 Windy Hill Lane
Winchester, Virginia 22602
Telephone: (888) 662-4185
www.navituseng.com
Engineering • Survey • Environmental • GIS

CYRUS S. KUMP
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
07/16/2013

ANTERO RESOURCES

THIS DOCUMENT WAS PREPARED FOR: ANTERO RESOURCES CORPORATION

OVERALL PLAN

NEW MILTON
COMPRESSOR STATION ACCESS ROAD
NEW MILTON DISTRICT
DODDRIDGE COUNTY, WV

SCALE: 1" = 200'
NEW MILTON
JOB NO. ANT096
DATE: 07/16/2013

Exhibit C

Existing Conditions Plan

LEGEND

- EX. DELINEATED STREAM
- XX+XX.XX HEC-RAS STUDY CROSS SECTION
- FEMA FLOODPLAIN ZONE "AE"
- EXISTING 100-YR FLOODPLAIN

GRID NORTH AND ELEVATIONS SHOWN HEREON WERE ESTABLISHED BY SURVEY GRADE GPS

21+23.812, EX.=833.2
20+02.134, EX.=832.8
19+29.868, EX.=832.1
18+17.557, EX.=831.7
17+26.403, EX.=831.4
15+80.979, EX.=831.16
14+83.221, EX.=831.5
14+21.670, EX.=831.6
12+93.596, EX.=831.5
10+00.000, EX.=831.1

EX. OVERHEAD UTILITY
EX. BUILDING
EX. 18" CMP CULVERT
EX. 100 YEAR FLOODPLAIN
EX. TANKS
EX. STREAM FORD
EX VALVE
EX. ACCESS ROAD
PERENNIAL STREAM 1 (TOMS FORK) PER KLEINFELDER WETLAND DELINEATION
EX. FEMA FLOOD ZONE "AE"
PP
18
050
040
030

50 0 50
GRAPHIC SCALE (IN FEET)

NAVITUS ENGINEERING INC.
151 Windy Hill Lane
Winchester, Virginia 22602
Telephone: (888) 662-4185
www.navituseng.com
Engineering • Survey • Environmental • GIS

CYRUS S. KUMP
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
07/16/2013

ANTERO RESOURCES

THIS DOCUMENT WAS PREPARED FOR: ANTERO RESOURCES CORPORATION

EXISTING CONDITIONS PLAN

NEW MILTON COMPRESSOR STATION ACCESS ROAD

NEW MILTON DISTRICT
DODDRIDGE COUNTY, WV

SCALE: 1" = 50'

NEW MILTON
JOB NO. ANT096

DATE: 07/16/2013

Exhibit D

Proposed Conditions Plan

LEGEND

- EX. DELINEATED STREAM
- XX+XX.XX HEC-RAS STUDY CROSS SECTION
- FEMA FLOODPLAIN ZONE "AE"
- EXISTING 100-YR FLOODPLAIN
- PROPOSED 100-YR WSE

GRID NORTH AND ELEVATIONS SHOWN HEREON WERE ESTABLISHED BY SURVEY GRADE GPS

21+23.812, EX.=833.2, PR.=833.4, DIFF.=+0.2'
20+02.134, EX.=832.8, PR.=832.9, DIFF.=+0.1'
19+29.868, EX.=832.1, PR.=832.3, DIFF.=+0.2'
18+11.557, EX.=831.7, PR.=832.1, DIFF.=+0.4'
17+26.403, EX.=831.4, PR.=831.9, DIFF.=+0.5'
15+80.979, EX.=831.6, PR.=832.0, DIFF.=+0.4'
14+83.324, EX.=831.5, PR.=831.5, DIFF.=0.0'
14+21.670, EX.=831.6, PR.=831.6, DIFF.=0.0'
12+93.596, EX.=831.5, PR.=831.5, DIFF.=0.0'
10+00.000, EX.=837.1, PR.=837.1, DIFF.=0.0'

EX. OVERHEAD UTILITY
EX. BUILDING
EX. 18" CMP CULVERT
EX. TANKS
EX. 100 YEAR FLOODPLAIN
EX. STREAM FORD
EX. VALVE
EX. ACCESS ROAD
EX. BUILDING
EX. FEMA FLOOD ZONE "AE"
50' ACCESS ROAD W/ 4% NORMAL CROWN
LIMITS OF DISTURBANCE
PR. 100 YEAR FLOODPLAIN
TWO 35'-10"x11'-4" CONTECH BRIDGECOR #2545 ARCH CULVERTS (40 LF @ 0.7%)
PROPOSED 3'x3'x6' GABION BASKET HEADWALL
PERENNIAL STREAM 1 (TOMS FORK) PER KLEINFELDER WETLAND DELINEATION
PP
18
1+00
2+00
3+00

50 0 50
GRAPHIC SCALE (IN FEET)

NAVITUS ENGINEERING INC.
151 Windy Hill Lane
Winchester, Virginia 22602
Telephone: (888) 662-4185
www.navituseng.com
Engineering • Survey • Environmental • GIS

CYRUS S. KUMP
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
07/16/2013

ANTERO RESOURCES

THIS DOCUMENT WAS PREPARED FOR: ANTERO RESOURCES CORPORATION

PROPOSED CONDITIONS PLAN

NEW MILTON
COMPRESSOR STATION ACCESS ROAD
NEW MILTON DISTRICT
DODDRIDGE COUNTY, WV

SCALE: 1" = 50'

NEW MILTON
JOB NO. ANT096

DATE: 07/16/2013

Supplement 1

Drainage Computations

DRAINAGE MAP

USGS 7.5 OXFORD QUAD MAP

USGS 7.5 NEW MILTON QUAD MAP

WEST VIRGINIA STATE PLANE
COORDINATE SYSTEM
NORTH ZONE, NAD83
ELEVATION BASED ON NAVD88
ESTABLISHED BY SURVEY GRADE GPS
& OPUS POST-PROCESSING

KEY	HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)
A	UPPER TOMS FORK	12.832
B	MIDDLE TOMS FORK	1.769
C	LOWER TOMS FORK	0.944
	TOTAL	15.545

4000 0 4000
GRAPHIC SCALE (IN FEET)

NAVITUS ENGINEERING INC.
151 Windy Hill Lane
Winchester, Virginia 22602
Telephone: (888) 662-4185
www.navituseng.com
Engineering • Survey • Environmental • GIS

CYRUS S. KUMP
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
07/16/2013

ANTERO RESOURCES

THIS DOCUMENT WAS PREPARED FOR: ANTERO RESOURCES CORPORATION

DRAINAGE MAP

NEW MILTON COMPRESSOR STATION ACCESS ROAD

NEW MILTON DISTRICT
DODDRIDGE COUNTY, WV

SCALE: 1" = 4000'

NEW MILTON
JOB NO. ANT096

DATE: 07/16/2013

Project: New Milton Simulation Run: Existing

Start of Run:	11Jul2013, 00:00	Basin Model:	Existing
End of Run:	12Jul2013, 00:05	Meteorologic Model:	100 YR
Compute Time:	11Jul2013, 08:20	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Toms Fork	12.832	3765.8	11Jul2013, 14:10	1397
Reach-1	12.832	3765	11Jul2013, 14:40	1380.7
Middle Toms Fork	1.77	949.1	11Jul2013, 12:55	199.5
Junction-1	14.602	4015.3	11Jul2013, 14:35	1580.2
Reach-2	14.602	4015.1	11Jul2013, 14:55	1567.8
Lower Toms Fork	0.944	666.8	11Jul2013, 12:35	107.3
Downstream	15.546	4101.3	11Jul2013, 14:55	1675.1

Supplement 2

HEC-RAS Analysis –Existing Conditions Summary

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: Saddle2
Project File : Saddle2.prj
Run Date and Time: 7/16/2013 7:49:15 PM

Project in English units

****

PLAN DATA

Plan Title: Existing
Plan File : X:\Navitus Jobfiles\Antero Resources\ANT096-Saddle\Engineering\Drainage Comp\Floodplain\Entrance-Crossing Study\Report\Computations\HEC-RAS\Revised Sections\Saddle2.p01

Geometry Title: Existing
Geometry File : X:\Navitus Jobfiles\Antero Resources\ANT096-Saddle\Engineering\Drainage Comp\Floodplain\Entrance-Crossing Study\Report\Computations\HEC-RAS\Revised Sections\Saddle2.g01

Flow Title : Existing-Revised
Flow File : X:\Navitus Jobfiles\Antero Resources\ANT096-Saddle\Engineering\Drainage Comp\Floodplain\Entrance-Crossing Study\Report\Computations\HEC-RAS\Revised Sections\Saddle2.f02

Plan Summary Information:

Number of:	Cross Sections	= 13	Multiple Openings	=	0
	Culverts	= 0	Inline Structures	=	0
	Bridges	= 0	Lateral Structures	=	0

Computational Information
Water surface calculation tolerance = 0.001
Critical depth calculation tolerance = 0.001
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: Existing-Revised
Flow File : X:\Navitus Jobfiles\Antero Resources\ANT096-Saddle\Engineering\Drainage Comp\Floodplain\Entrance-Crossing Study\Report\Computations\HEC-RAS\Revised Sections\Saddle2.f02

Flow Data (cfs)

River	Reach	RS	PF 1
Toms Fork	Toms Fork	2865.327	4015.3

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Toms Fork	Toms Fork	PF 1	Known WS = 833.5	Known WS = 831.1

****

GEOMETRY DATA

Geometry Title: Existing
Geometry File : X:\Navitus Jobfiles\Antero Resources\ANT096-Saddle\Engineering\Drainage Comp\Floodplain\Entrance-Crossing Study\Report\Computations\HEC-RAS\Revised Sections\Saddle2.g01

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 2865.327

INPUT
Description:
Station Elevation Data num= 100

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	2.89	848	3.73	847.42	5.78	846	8.24	844.95
10.3	844	12.9	842.79	14.63	842	20.51	841.56	22.47	841.4
26.09	841.11	32.66	841.36	44.49	841.93	44.56	841.93	44.57	841.93

44.6	841.93	49.67	841.3	52.98	840.89	54.84	840.66	56.84	840.4
56.98	840.39	59.93	840	62.2	838.99	64.42	838	66.42	837.11
68.93	836	77.13	835.38	80.1	835.15	89.55	834.48	91.63	834.33
96.42	834	96.46	834	103.31	833.74	108.11	833.57	115.2	833.31
120.18	833.17	144.96	832.42	149.19	832.28	158.3	832	161.69	831.77
162.91	831.7	163.61	831.66	172.16	831.13	177.1	830.87	181.93	830.59
192.98	830.03	193.14	830.02	193.52	830	195.11	829.63	202.28	828
203.58	827.9	204.23	827.86	205.83	827.75	208.78	827.55	218.92	826.86
225.69	826.43	226.36	826.39	227.77	826.3	228.45	826.25	232.59	826
233.5	824.89	234.03	824.24	234.61	823.57	239.85	823.64	241.59	823.67
250.02	823.8	269.19	824.13	281.09	824.36	281.53	824.87	281.9	825.29
282.64	826	283.77	827.33	285.69	827.68	287.35	828	290.48	828
292.08	828.23	293.87	828.48	299.55	829.32	303.22	829.8	304.12	830
305.84	831.05	306.98	831.74	307.38	832	309.66	833.4	310.6	834
312.52	835.18	313.8	836	315.48	837.04	316.99	838	318.62	839.12
319.93	840	321.46	841.28	322.33	842	324.02	843.41	324.73	844
326.6	845.56	327.13	846	329.22	847.75	329.52	848	331.9	850

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	232.59	.035	287.35	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
232.59	287.35	212.2	282.13	186.24	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	834.43	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.57	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	833.86	Reach Len. (ft)	212.20	282.13	186.24
Crit W.S. (ft)		Flow Area (sq ft)	409.12	522.91	97.01
E.G. Slope (ft/ft)	0.001252	Area (sq ft)	409.12	522.91	97.01
Q Total (cfs)	4015.30	Flow (cfs)	455.58	3431.24	128.48
Top Width (ft)	210.17	Top Width (ft)	132.39	54.76	23.03
Vel Total (ft/s)	3.90	Avg. Vel. (ft/s)	1.11	6.56	1.32
Max Chl Dpth (ft)	10.29	Hydr. Depth (ft)	3.09	9.55	4.21
Conv. Total (cfs)	113459.8	Conv. (cfs)	12873.3	96955.9	3630.5
Length Wtd. (ft)	268.25	Wetted Per. (ft)	132.76	57.29	24.27
Min Ch El (ft)	823.57	Shear (lb/sq ft)	0.24	0.71	0.31
Alpha	2.43	Stream Power (lb/ft s)	331.90	0.00	0.00
Frctn Loss (ft)	0.27	Cum Volume (acre-ft)	19.22	20.54	6.95
C & E Loss (ft)	0.05	Cum SA (acres)	5.62	2.27	1.59

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 2579.832

INPUT

Description:
Station Elevation Data num= 93

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	2.44	848	2.66	847.82	4.89	846	5.28	845.68
7.32	844	7.99	843.55	10.04	842	12.78	841.08	16.18	840
20.07	838.81	22.77	838	31.3	838	32.34	838.23	36.84	839.24
45.36	839.17	54.84	838.89	61	838.03	61.18	838	62.93	837.73
65.72	837.27	73.51	836	74.45	835.56	77.9	834	80.43	832.85
82.31	832	84.12	831.18	87.67	829.59	88.79	829.09	90.47	828.4
91.43	828	93.28	827.16	95.87	826	99.12	824.4	99.91	824
100.45	823.72	100.69	823.6	100.92	823.47	143.75	823.47	144.94	823.92
145.14	824	151.82	825.23	155.09	825.97	155.22	826	157.83	826
174.68	826.59	176.96	826.69	179.05	826.72	180.73	826.74	182.27	826.82
183.75	826.84	185.06	826.91	186.58	826.95	188.92	827.07	190.49	827.12
195.23	827.34	196.43	827.39	197.44	827.44	206.09	827.82	206.63	827.85
210.34	828	214.91	828.57	218.82	829.06	221.21	829.36	222.27	829.51
225.8	830	227.87	830.31	228.23	830.38	230.19	830.82	233.42	831.47
235.56	832	238.7	832.97	242.37	834	244.36	834.61	248.21	835.78
248.76	835.95	248.94	836	254.04	837.23	256.99	838	257.34	838
262.74	838.68	270.79	839.6	273.44	840	283.77	841.65	285.91	842
289.24	842.78	294.7	844	303.19	845.52	305.76	846	310.28	847.08
313.75	847.86	314.38	848	323.1	850				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	95.87	.035	155.09	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
95.87	155.09	271.1	188.24	66.66	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	834.11	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.41	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	833.70	Reach Len. (ft)	271.10	188.24	66.66
Crit W.S. (ft)		Flow Area (sq ft)	67.00	584.27	480.81
E.G. Slope (ft/ft)	0.000851	Area (sq ft)	67.00	584.27	480.81
Q Total (cfs)	4015.30	Flow (cfs)	67.42	3295.57	652.31
Top Width (ft)	162.73	Top Width (ft)	17.31	59.22	86.20
Vel Total (ft/s)	3.55	Avg. Vel. (ft/s)	1.01	5.64	1.36
Max Chl Dpth (ft)	10.23	Hydr. Depth (ft)	3.87	9.87	5.58
Conv. Total (cfs)	137645.8	Conv. (cfs)	2311.1	112973.3	22361.4
Length Wtd. (ft)	183.85	Wetted Per. (ft)	18.94	60.11	86.83
Min Ch El (ft)	823.47	Shear (lb/sq ft)	0.19	0.52	0.29
Alpha	2.10	Stream Power (lb/ft s)	323.10	0.00	0.00
Frctn Loss (ft)	0.21	Cum Volume (acre-ft)	18.06	16.95	5.71
C & E Loss (ft)	0.03	Cum SA (acres)	5.26	1.90	1.35

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: Toms Fork
REACH: Toms Fork RS: 2372.941

INPUT
Description:
Station Elevation Data num= 105

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	1.82	848	2.33	847.47	3.36	846.39	3.78	846
6.59	844.33	7.14	844	10.17	842.28	10.68	842	13.68	840.29
14.22	840	17.19	838.31	17.76	838	19.76	837.02	21.03	837.71
30.82	836.97	45.33	836.96	53.11	837.04	58.14	836.39	62.87	836
70.69	835.06	78.76	834	82.37	833.41	90.69	832	92.24	831.76
95.46	831.2	102.19	830	104.15	829.57	105.93	829.26	108.63	828.71
111.2	828.33	113.43	828	114.56	827.83	114.6	827.82	114.66	827.81
114.94	827.78	118.37	827.27	120.84	826.94	122.59	826.68	127.81	826
128.07	825.95	128.15	825.95	128.23	825.93	131.37	825.41	132.07	825.31
133.39	825.14	134.95	824.85	136.9	824.63	140.69	824	140.95	824
141.56	823.88	142.39	823.69	142.76	823.59	143.18	823.47	161.64	823.47
162.23	823.66	162.96	823.86	163.49	824	170.49	824.97	178.34	826
184.38	826.66	190.63	827.37	196.22	828	204.78	828.89	209.26	829.26
213.01	829.61	214.44	829.73	215.21	829.78	215.72	829.81	218.51	830
221.09	830.31	222.16	830.45	226.82	831.04	233.45	832	259.72	833.51
267.46	833.9	270.43	834	277.5	834	293.51	834.86	300.19	835.16
303.03	835.27	310.96	835.62	312.48	835.69	319.76	836	323.88	836.36
332.03	837.03	340.66	837.87	342.02	838	347.21	839.1	350.16	839.67
350.48	839.73	351.82	840	353.9	840.42	357.17	841.11	360.16	841.74
361.41	842	366.93	843.14	371.51	844	376.07	845.15	379.47	846
382.67	846.77	388.2	848	388.9	848.16	389.32	848.25	397.14	850

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	136.9	.035	170.49	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
136.9	170.49	494.68	209.34	278.69	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	833.87	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.66	Wt. n-Val.	0.035	0.035	0.100
W.S. Elev (ft)	833.21	Reach Len. (ft)	494.68	209.34	278.69
Crit W.S. (ft)		Flow Area (sq ft)	239.21	315.42	309.90
E.G. Slope (ft/ft)	0.001691	Area (sq ft)	239.21	315.42	309.90
Q Total (cfs)	4015.30	Flow (cfs)	1126.07	2438.45	450.78

Top Width (ft)	170.84	Top Width (ft)	53.32	33.59	83.93
Vel Total (ft/s)	4.64	Avg. Vel. (ft/s)	4.71	7.73	1.45
Max Chl Dpth (ft)	9.74	Hydr. Depth (ft)	4.49	9.39	3.69
Conv. Total (cfs)	97647.1	Conv. (cfs)	27384.5	59300.1	10962.5
Length Wtd. (ft)	267.77	Wetted Per. (ft)	54.02	33.85	84.37
Min Ch El (ft)	823.47	Shear (lb/sq ft)	0.47	0.98	0.39
Alpha	1.98	Stream Power (lb/ft s)	397.14	0.00	0.00
Frctn Loss (ft)	0.25	Cum Volume (acre-ft)	17.10	15.01	5.11
C & E Loss (ft)	0.12	Cum SA (acres)	5.04	1.70	1.22

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: Toms Fork
REACH: Toms Fork RS: 2123.812

INPUT
Description:
Station Elevation Data num= 145

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	7.61	848.12	8.1	848	11.48	846.85	14.02	846
17.32	844.89	20.19	844	29.09	842.54	32.44	842	39.97	840.57
41	840.36	41.44	840.27	41.87	840.18	42.76	840	44.29	839.85
44.87	839.81	45.61	839.77	58.05	838.76	60.93	838.66	73.97	838
80.16	838	86.28	837.78	88.03	837.76	89.01	837.75	89.33	837.75
96.23	837.46	96.83	837.47	114.62	837.25	123.08	837.03	153.21	836.5
165.6	836.24	167.39	836.2	176.66	836	183.88	836	185.94	835.94
186.45	835.92	193.78	835.74	197.53	835.66	200.81	835.61	203.09	835.51
207.46	835.41	211.32	835.23	215.79	835.06	217.31	834.99	218.58	834.93
219.59	834.88	221.23	834.79	225.89	834.56	228.39	834.42	237.61	834
240.15	833.94	250.89	833.92	251.23	833.98	252.74	834.04	256.18	834.13
266.1	834.44	276.79	834.81	279.36	834.6	282	834.51	292.41	834.43
302.29	834.14	305	834	306.65	834	318.72	833.83	322.62	833.82
326.83	833.77	349.34	833.52	366.28	833.31	381.19	833.17	409.51	832.76
442.18	832	458.66	832	459.09	831.91	460.58	831.67	467.09	830.52
470.93	830	472.47	829.86	473.63	829.73	474.35	829.63	476.54	829.59
478.33	829.44	480.51	829.24	482.35	829.05	484.53	829.08	493.14	828.72
510.22	828	540.14	828	541.2	827.11	542.5	826	543.18	825.38
544.61	824	544.96	823.68	545.31	822.47	562.34	822.47	590.93	822.47
591.34	823.26	591.75	823.47	592.68	823.87	592.98	824	596.16	824.59
597.7	824.75	600.18	825.16	601.92	825.29	603.14	825.47	603.8	825.56
606.61	825.79	609.14	825.89	609.21	825.89	611.75	826	618.47	826
623.51	826.14	623.89	826.15	627.54	826.26	629.08	826.31	634.67	826.43
637.3	826.52	638.18	826.54	665.48	826.98	667.38	826.96	668.91	827.09
670.46	827.22	674.09	827.49	676.03	827.52	680.97	828	682.63	828.93
684.49	830	686.81	831.3	688.03	832	689.62	832.9	691.61	834

693.43	834.9	695.67	836	699.67	837.95	699.76	838	699.9	838.07
703.8	840	708.04	841.9	708.27	842	708.74	842.21	712.7	844
716.95	845.96	717.03	846	717.11	846.04	721.13	848	725.2	850

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	540.14	.035	611.75	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
540.14	611.75	4.85	111.36	132.72	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

Element	Left OB	Channel	Right OB
E.G. Elev (ft)	833.50		
Vel Head (ft)	0.26		
W.S. Elev (ft)	833.24		
Crit W.S. (ft)			
E.G. Slope (ft/ft)	0.000581		
Q Total (cfs)	4015.30		
Top Width (ft)	316.78	166.68	71.61	78.49
Vel Total (ft/s)	2.52	0.66	4.54	1.18
Max Chl Dpth (ft)	10.77	2.48	9.78	6.09
Conv. Total (cfs)	166543.1	11273.4	131887.8	23381.9
Length Wtd. (ft)	100.93	166.93	74.95	79.93
Min Ch El (ft)	822.47		
Alpha	2.60		
Frctn Loss (ft)	0.08		
C & E Loss (ft)	0.03		
Wt. n-Val.		0.100	0.035	0.100
Reach Len. (ft)		4.85	111.36	132.72
Flow Area (sq ft)		414.05	700.28	477.75
Area (sq ft)		414.05	700.28	477.75
Flow (cfs)		271.80	3179.77	563.73
Top Width (ft)		166.68	71.61	78.49
Avg. Vel. (ft/s)		0.66	4.54	1.18
Hydr. Depth (ft)		2.48	9.78	6.09
Conv. (cfs)		11273.4	131887.8	23381.9
Wetted Per. (ft)		166.93	74.95	79.93
Shear (lb/sq ft)		0.09	0.34	0.22
Stream Power (lb/ft s)		725.20	0.00	0.00
Cum Volume (acre-ft)		13.40	12.57	2.59
Cum SA (acres)		3.79	1.45	0.70

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: Toms Fork
REACH: Toms Fork RS: 2002.134

INPUT
Description:
Station Elevation Data num= 120

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	5.75	848.69	9.25	848	12.54	847.07	14.98	846.36
16.39	846	21.54	844.57	23.9	844	28.14	843.37	29.49	843.11
31.27	842.82	35.31	842	36.84	841.71	44.09	840.36	45.66	840.07
46.05	840	58.46	838.43	59.73	838.27	60.32	838.19	61.51	838
68.14	838	84.71	837.13	87.17	837.04	90.91	836.93	93.76	836.87
96.92	836.74	102.52	836.63	109.38	836.49	117.27	836.33	120.05	836.28

121.42	836.22	123.9	836.21	135.46	836	152.3	836	152.93	835.97
153.56	835.95	175.95	834.99	193.37	834.28	196.51	834.15	200.1	834
205.39	833.72	210.34	833.1	210.74	833.15	211.69	833.31	213.96	833.36
216.02	833.45	235.66	834	252.32	834	256.05	833.9	257.04	833.88
276.33	833.31	279.34	833.28	281.75	833.27	295.27	832.92	301.58	832.91
307.93	832.77	318.74	832.74	323.19	832.66	337.48	832.62	342.49	832.54
382.49	832.24	402.49	832	443.94	832	448.99	831.31	452.91	830.94
462.54	830	463.53	829.84	463.96	829.78	467.24	829.24	468.14	829.14
470.59	828.79	471.7	828.67	472.1	828.64	472.57	828.59	474.78	828.35
475.89	828.26	476.06	828.26	477.8	828	488.57	828	491.73	827.76
492.21	827.75	494.02	827.72	494.54	827.71	527.7	826.75	553.46	826
561.05	826	561.73	825.49	563.27	824	563.54	823.79	564.49	822.87
577.19	822.74	603.13	822.47	605.42	823.91	605.57	824	609.95	825.19
612.91	826	613.85	826.72	615.51	828	616.81	828.98	618.12	830
619.93	831.36	620.77	832	623.33	833.91	623.44	834	623.55	834.08
625.99	836	626.03	836.04	628.31	838	629.29	838.81	630.68	840
632.39	841.41	633.09	842	635.36	843.87	635.52	844	636.52	844.78
637.1	845.24	638.07	846	640.63	847.87	640.8	848	643.54	850

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	561.05	.035	612.91	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
561.05	612.91	5.33	72.27	84.5	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	833.38	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.58	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	832.80	Reach Len. (ft)	5.33	72.27	84.50
Crit W.S. (ft)		Flow Area (sq ft)	644.97	500.64	30.24
E.G. Slope (ft/ft)	0.001269	Area (sq ft)	644.97	500.64	30.24
Q Total (cfs)	4015.30	Flow (cfs)	634.08	3350.23	30.98
Top Width (ft)	315.31	Top Width (ft)	254.52	51.86	8.93
Vel Total (ft/s)	3.41	Avg. Vel. (ft/s)	0.98	6.69	1.02
Max Chl Dpth (ft)	10.33	Hydr. Depth (ft)	2.53	9.65	3.38
Conv. Total (cfs)	112718.3	Conv. (cfs)	17800.2	94048.5	869.7
Length Wtd. (ft)	64.92	Wetted Per. (ft)	254.81	53.79	11.23
Min Ch El (ft)	822.47	Shear (lb/sq ft)	0.20	0.74	0.21
Alpha	3.22	Stream Power (lb/ft s)	643.54	0.00	0.00
Frctn Loss (ft)	0.11	Cum Volume (acre-ft)	13.34	11.03	1.81
C & E Loss (ft)	0.06	Cum SA (acres)	3.77	1.29	0.57

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
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: Toms Fork
REACH: Toms Fork RS: 1929.868

INPUT
Description:
Station Elevation Data num= 127

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	9.69	848.14	10.44	848	16.57	846.52	19	846
22.06	845.27	23.4	844.99	28.18	844	28.7	843.91	29.27	843.8
34.05	842.91	38.56	842	39.24	841.89	39.57	841.83	44.23	841.11
46.52	840.64	48.15	840.39	49.88	840	53.06	839.56	57.34	839.03
62.7	838	63.49	838	95.81	836.27	101.33	836.06	101.57	836.05
103.51	836	104.46	836	106.48	835.94	113.45	835.8	113.98	835.79
120.44	835.67	140.38	835.62	141.17	835.63	142.8	835.61	144.74	835.58
147.99	835.47	148.7	835.47	152.05	835.32	153.09	835.29	166.02	834.72
167.81	834.65	171.79	834.47	182.48	834	186.18	832.37	186.98	832
189.63	832	190.59	832.17	191.57	832.36	193.59	832.72	211.11	833.08
214.56	833.17	215.19	833.21	215.57	833.24	217.58	833.36	229.11	834
235.48	834	243.03	833.47	247.63	833.34	262.04	832.65	276.26	832.35
277.28	832.32	293.07	832	355.46	832	360.25	831.81	388.23	831.91
390.46	831.9	394.56	832	411.75	832	413.92	831.91	418.69	831.72
420.02	831.67	421.45	831.61	434.07	831.52	435.68	831.52	435.95	831.61
436.19	831.7	437.05	832	451.01	832	457.66	831.46	460.43	831.24
464.27	830.93	466.72	830.73	472.68	830	477.88	828.1	478.17	828
487.76	826.55	489.16	826.33	495.7	826	497.25	826	519.34	826
520.31	825.28	522.18	824	522.87	823.57	523.4	823.17	523.76	822.87
527.6	822.84	528.89	822.83	532.08	822.8	552.31	822.57	560.43	822.47
561.98	823.63	562.39	824	563.46	824.74	565.18	826	566.72	827.13
568.04	828	569.7	829.21	570.9	830	572.63	831.25	573.74	832
575.53	833.28	576.58	834	577.39	834.76	578.84	836	579.87	837.17
580.64	838	581.81	839.35	582.42	840	583.77	841.56	584.18	842
585.76	843.84	585.91	844	586.04	844.16	586.72	844.95	587.6	846
589.67	848	591.96	850						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	519.34	.035	565.18	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff	Contr.	Expan.
519.34	565.18	5.86	118.14	110.15	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	235.48	834	F

CROSS SECTION OUTPUT Profile #PF 1

* E.G. Elev (ft)	* 833.21	* Element	* Left OB	* Channel	* Right OB *

* Vel Head (ft)	* 1.16	* Wt. n-Val.	* 0.100	* 0.035	* 0.100 *
* W.S. Elev (ft)	* 832.05	* Reach Len. (ft)	* 5.86	* 118.14	* 110.15 *
* Crit W.S. (ft)	* 829.15	* Flow Area (sq ft)	* 294.11	* 414.19	* 25.96 *
* E.G. Slope (ft/ft)	*0.002530	* Area (sq ft)	* 294.26	* 414.19	* 25.96 *
* Q Total (cfs)	* 4015.30	* Flow (cfs)	* 259.41	* 3720.50	* 35.39 *
* Top Width (ft)	* 286.29	* Top Width (ft)	* 231.82	* 45.84	* 8.63 *
* Vel Total (ft/s)	* 5.47	* Avg. Vel. (ft/s)	* 0.88	* 8.98	* 1.36 *
* Max Chl Dpth (ft)	* 9.58	* Hydr. Depth (ft)	* 1.29	* 9.04	* 3.01 *
* Conv. Total (cfs)	* 79822.8	* Conv. (cfs)	* 5156.9	* 73962.3	* 703.6 *
* Length Wtd. (ft)	* 106.42	* Wetted Per. (ft)	* 229.45	* 48.01	* 10.54 *
* Min Ch El (ft)	* 822.47	* Shear (lb/sq ft)	* 0.20	* 1.36	* 0.39 *
* Alpha	* 2.50	* Stream Power (lb/ft s)	* 591.96	* 0.00	* 0.00 *
* Frctn Loss (ft)	* 0.25	* Cum Volume (acre-ft)	* 13.28	* 10.27	* 1.76 *
* C & E Loss (ft)	* 0.01	* Cum SA (acres)	* 3.74	* 1.21	* 0.55 *

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water
surface that had the least amount of error between computed and assumed values.
Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 1811.557

INPUT
Description:
Station Elevation Data num= 127

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	8.09	848.68	9.6	848.44	12.25	848	15.63	847.32
17.53	847.03	22.85	846.14	23.34	846.05	23.62	846	29.14	845.01
29.7	844.93	31.77	844.59	35.22	844	38.73	843.44	40.77	843.25
44.36	842.76	49.7	842.06	50.03	842	54.63	840.79	58.16	840
60.2	839.66	63.13	839.24	66.64	838.88	68.31	838.67	72.99	838.13
73.95	838	87.5	836.44	90.85	836	91.66	836	100.94	835.61
101.33	835.59	110.34	835.25	110.4	835.24	121.22	834.87	124.68	834.79
125.19	834.78	128.31	834.73	131.18	834.66	139.14	834.59	139.43	834.59
145.89	834.47	154.04	834.29	161.88	834	163.25	834	165.31	833.16
168	832	173.5	832	173.52	832	175.04	832.3	193.36	832.94
194.25	832.97	194.4	832.96	194.97	833.03	195.62	833.08	208.04	834
229.9	834	238.7	833.13	240.06	833.08	246.53	832	265.48	832
303.93	831.45	312.8	831.4	332.62	831	353.67	831.77	354.78	831.72
359.46	831.02	369.02	830.99	369.43	831	369.91	830.99	370.02	830.99
370.53	830.98	370.91	830.97	389.65	830.53	394.54	830.38	401.08	830.18
406.7	830	407.31	829.79	412.33	828	413.45	827.6	414.68	827.16
417.14	826.3	417.99	826	443.82	826	444.09	825.85	445.72	825.04
447.77	824	447.95	823.91	449.82	822.87	459.79	822.8	489.1	822.47

489.21	822.59	489.36	822.75	490.51	824	490.88	824.38	492.37	826
493.93	827.55	494.37	828	497.57	830.56	499.37	832	499.82	832.35
501.88	834	503.33	835.14	504.41	836	505.89	837.68	506.17	838
506.24	838.08	507.77	840	508.33	840.71	509.35	842	510.56	843.55
510.91	844	511.55	844.84	512.54	846	513.19	846.66	514.51	848
516.01	849.18	517.12	850	518.94	851.43	519.47	851.82	519.7	852
521.72	853.59	522.26	854	524.41	855.7	524.8	856	527.06	857.79
527.34	858	530.07	860						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	443.82	.035	492.37	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
443.82	492.37	17.98	85.13	75.99	.1 .3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	832.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.04	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	831.74	Reach Len. (ft)	17.98	85.13	75.99
Crit W.S. (ft)		Flow Area (sq ft)	268.92	424.04	18.26
E.G. Slope (ft/ft)	0.002415	Area (sq ft)	268.92	424.04	18.26
Q Total (cfs)	4015.30	Flow (cfs)	356.05	3637.59	21.66
Top Width (ft)	214.39	Top Width (ft)	159.16	48.55	6.68
Vel Total (ft/s)	5.65	Avg. Vel. (ft/s)	1.32	8.58	1.19
Max Chl Dpth (ft)	9.27	Hydr. Depth (ft)	1.69	8.73	2.73
Conv. Total (cfs)	81703.8	Conv. (cfs)	7245.0	74018.2	440.6
Length Wtd. (ft)	78.20	Wetted Per. (ft)	159.93	50.86	8.82
Min Ch El (ft)	822.47	Shear (lb/sq ft)	0.25	1.26	0.31
Alpha	2.10	Stream Power (lb/ft s)	530.07	0.00	0.00
Frctn Loss (ft)	0.21	Cum Volume (acre-ft)	13.24	9.14	1.70
C & E Loss (ft)	0.02	Cum SA (acres)	3.71	1.08	0.53

Warning: The energy equation could not be balanced within the specified number of iterations. The program selected the water
surface that had the least amount of error between computed and assumed values.
Warning: Divided flow computed for this cross-section.

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 1726.403

INPUT
Description:
Station Elevation Data num= 111

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

0	850	7.69	848.75	12.67	848	13.53	847.86	13.88	847.81
14.58	847.69	23.99	846	24.2	845.96	24.7	845.87	35.04	844
35.58	844	35.72	843.97	36.71	843.76	44.45	842	50.81	840.91
56.16	840	62.16	839.16	70.39	838	76.77	836.99	82.9	836
107.43	834.59	111.92	834.32	113.55	834.23	114.44	834.18	115.04	834.14
118.29	834	133.54	833	145.97	832	153.68	832	153.78	832.03
154.17	832.11	170.85	832.35	172.32	832.36	172.33	832.36	172.33	832.35
172.36	832.35	172.46	832.35	172.61	832.34	172.88	832.33	173.84	832.26
177.54	832	261.15	832	263.09	831.66	263.15	831.66	264.41	831.43
264.73	831.44	265.31	831.48	266.23	831.31	267.04	831.34	274.24	831.18
277.67	831.06	279.87	830.91	303.11	830.11	303.13	830.11	303.2	830.11
313.87	830.99	332.27	830.68	338.82	830.44	346.78	830.13	350.22	830
354.85	828.9	358.99	828	361.29	827.15	364.99	826	368.69	826
374.3	826	386.59	824.73	394.79	824.26	396.56	824.16	399.37	824
400.62	823.5	401.24	823.25	402.13	822.87	415.76	822.73	440.37	822.47
441.28	823.54	441.62	824	442.72	825.29	443.28	826	446.77	827.59
447.66	828	451.15	831.19	452.07	832	453.87	833.62	454.27	834
454.56	834.26	456.73	836	458.44	837.72	458.72	838	459.92	839.21
460.72	840	461.32	840.61	462.7	842	463.86	843.24	464.51	844
465.71	845.39	466.11	845.85	466.23	846	466.54	846.24	468.77	848
470.01	848.97	471.31	850	472.48	850.91	473.86	852	474.93	852.84
476.4	854	477.37	854.77	478.94	856	481.17	857.79	481.43	858
485.12	860								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	399.37	.035	441.62	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
399.37	441.62	25.62	144.25	127.32	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	832.60	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.25	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	831.35	Reach Len. (ft)	25.62	144.25	127.32
Crit W.S. (ft)		Flow Area (sq ft)	318.03	363.95	35.79
E.G. Slope (ft/ft)	0.002988	Area (sq ft)	318.03	363.95	35.79
Q Total (cfs)	4015.30	Flow (cfs)	459.43	3496.90	58.97
Top Width (ft)	185.33	Top Width (ft)	133.37	42.25	9.71
Vel Total (ft/s)	5.59	Avg. Vel. (ft/s)	1.44	9.61	1.65
Max Chl Dpth (ft)	8.88	Hydr. Depth (ft)	2.38	8.61	3.68
Conv. Total (cfs)	73457.0	Conv. (cfs)	8404.9	63973.3	1078.8
Length Wtd. (ft)	130.95	Wetted Per. (ft)	134.08	43.20	12.39
Min Ch El (ft)	822.47	Shear (lb/sq ft)	0.44	1.57	0.54
Alpha	2.58	Stream Power (lb/ft s)	485.12	0.00	0.00
Frctn Loss (ft)	0.25	Cum Volume (acre-ft)	13.12	8.37	1.66
C & E Loss (ft)	0.21	Cum SA (acres)	3.65	0.99	0.52

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross

sections.
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: Toms Fork
REACH: Toms Fork RS: 1580.979

INPUT
Description:
Station Elevation Data num= 105

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	9.68	848	15.17	846.8	15.87	846.64	18.77	846
20.81	845.56	28	844	35.76	842.18	36.54	842	36.96	841.92
47.38	840	47.87	839.9	56.87	838	68.15	836.06	68.41	836.01
77.1	834.66	80.22	834.43	85.29	834	85.35	834	89.24	833.81
92.24	833.63	92.64	833.63	93.17	833.63	94.58	833.62	97.89	833.46
100.76	833.32	133.45	832	138.56	832	141.4	831.74	147.18	831.31
158.75	831.48	165.31	831.53	185.18	831.5	191.55	831.44	193.11	831.6
206.25	831.02	217.47	830.66	227.63	830.24	231.61	830.09	236.83	830
237.47	829.75	238.59	829.37	245.76	829.63	249.16	829.77	253.95	830
253.96	830	253.97	830	260.61	830	272.1	829.31	290.5	828
293.32	828	298.88	827.16	303.61	826.89	315.57	826	316.11	826
317.58	826	317.83	825.95	322.94	825.12	323.18	825.12	328.6	824.28
328.79	824.25	330.08	824	334.79	823.2	336.76	822.74	337.42	822.86
337.84	822.87	365.19	822.64	382.75	822.47	382.79	822.67	383	822.67
386.52	823.76	387.12	824	389.83	824.32	390.64	824.42	395.83	825.08
400.52	825.66	403.1	826	409.08	826.75	412.02	827.12	419.58	827.98
419.67	827.99	419.74	827.99	419.75	827.99	419.78	828	427.07	828
428.22	828.41	434.02	830	434.67	830.39	436.52	832	439.1	833.98
441.66	836	442.29	836.49	444.2	838	446.24	839.6	446.78	840
447.35	840.4	449.74	842	451.59	843.1	453.32	844	456.03	845.43
457.1	846	457.93	846.44	460.96	848	463.4	849.33	464.87	850

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	330.08	.035	387.12	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
330.08	387.12	123.76	97.42	118.65	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	832.14	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.56	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	831.59	Reach Len. (ft)	123.76	97.42	118.65
Crit W.S. (ft)		Flow Area (sq ft)	371.62	500.61	227.20

* E.G. Slope (ft/ft)	*0.001341	* Area (sq ft)	* 371.62	* 500.61	* 227.20	*
* Q Total (cfs)	* 4015.30	* Flow (cfs)	* 383.83	* 3292.34	* 339.13	*
* Top Width (ft)	* 292.23	* Top Width (ft)	* 186.26	* 57.04	* 48.93	*
* Vel Total (ft/s)	* 3.65	* Avg. Vel. (ft/s)	* 1.03	* 6.58	* 1.49	*
* Max Chl Dpth (ft)	* 9.12	* Hydr. Depth (ft)	* 2.00	* 8.78	* 4.64	*
* Conv. Total (cfs)	*109636.6	* Conv. (cfs)	* 10480.5	* 89896.3	* 9259.8	*
* Length Wtd. (ft)	* 102.95	* Wetted Per. (ft)	* 186.77	* 57.55	* 50.01	*
* Min Ch El (ft)	* 822.47	* Shear (lb/sq ft)	* 0.17	* 0.73	* 0.38	*
* Alpha	* 2.68	* Stream Power (lb/ft s)	* 464.87	* 0.00	* 0.00	*
* Frctn Loss (ft)	* 0.14	* Cum Volume (acre-ft)	* 12.92	* 6.93	* 1.27	*
* C & E Loss (ft)	* 0.02	* Cum SA (acres)	* 3.56	* 0.83	* 0.43	*

Warning: Divided flow computed for this cross-section.

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 1483.221

INPUT
Description:
Station Elevation Data num= 119

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	5.81	848	7.38	847.46	9.29	846.8	11.59	846
12.45	845.72	17.64	844	22	842.63	23.96	842	28.51	840.53
30.08	840	35.58	838.12	35.95	838	37.05	837.65	42.19	836
46.82	834.38	47.91	834	52.05	832.41	53.12	832	53.33	831.92
58.38	830	59.39	830	69.2	829.64	77.21	829.39	84.78	829.19
91.53	828.99	94.05	828.92	103.42	828.67	104.03	828.65	110.46	828.46
112.7	828.4	114.09	828.37	119.86	828.27	120.77	828.25	122.62	828.22
123.19	828.21	132.4	828.09	132.67	828.09	133.01	828.08	134.54	828.07
135.22	828.07	135.64	828.07	139.19	828.09	139.28	828.09	139.61	828.09
139.88	828.09	140.15	828.09	143.01	828.18	152.35	828.3	153.73	828.36
156.58	828.49	168.1	828.8	176.97	829.32	188.61	830	189.36	830.1
191.09	830.42	197.36	830.41	210.1	830.63	218.76	830.09	220.05	830
220.87	830	270.1	828.71	272.93	828.65	299.31	828	302.7	827.77
303.52	827.77	306.38	827.68	320.02	827.07	325.65	826.82	326.24	826.81
328.46	826.79	353.75	826	356.58	826	357.24	825.45	359.31	824
360.1	823.52	362.29	822.03	382.46	822.33	401.54	822.42	405.94	823.87
406.29	824	408.51	824.33	415.99	825.23	420.95	825.86	422.22	826
425.52	827.67	426.14	828	429.24	829.72	429.75	830	429.89	830.02
440.71	831.89	441.32	832	444.32	832	480.07	833.73	485.11	834
492.49	835.38	495.7	836	499.07	836.62	506.5	838	512.87	839.45
515.34	840	519.08	840.85	521.04	841.23	522.71	841.52	523.54	841.67
525.58	842	527.64	842.31	530.45	842.83	534.69	843.56	536.71	844
536.83	844	543.95	845.16	545.09	845.34	549.15	846	554.58	846.76
563.93	848	564.84	848	566.68	848.39	572.35	850		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	356.58	.035	408.51	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
356.58	408.51	54.14	61.47	37.92	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	831.98	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.47	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	831.51	Reach Len. (ft)	54.14	61.47	37.92
Crit W.S. (ft)		Flow Area (sq ft)	851.06	461.38	120.42
E.G. Slope (ft/ft)	0.001285	Area (sq ft)	851.06	461.38	120.42
Q Total (cfs)	4015.30	Flow (cfs)	903.20	2954.38	157.72
Top Width (ft)	384.11	Top Width (ft)	302.17	51.93	30.00
Vel Total (ft/s)	2.80	Avg. Vel. (ft/s)	1.06	6.40	1.31
Max Chl Dpth (ft)	9.48	Hydr. Depth (ft)	2.82	8.88	4.01
Conv. Total (cfs)	112005.1	Conv. (cfs)	25194.4	82411.1	4399.7
Length Wtd. (ft)	59.23	Wetted Per. (ft)	302.65	53.46	31.23
Min Ch El (ft)	822.03	Shear (lb/sq ft)	0.23	0.69	0.31
Alpha	3.88	Stream Power (lb/ft s)	572.35	0.00	0.00
Frctn Loss (ft)	0.06	Cum Volume (acre-ft)	11.18	5.86	0.80
C & E Loss (ft)	0.05	Cum SA (acres)	2.86	0.70	0.33

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 1421.670

INPUT
Description:
Station Elevation Data num= 114

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	2.79	849.15	6.37	848	7.77	847.56	9.4	847.08
12.05	846.29	13.14	846	17.43	845.03	21.19	844.05	21.4	844
21.6	843.92	27.18	842	28.6	841.36	31.86	840	34.65	838.93
36.95	838	39.48	837.09	43.26	836.17	43.69	836.05	43.78	836.04
43.84	836.03	44.08	836	45.26	836	47.98	835.5	50.67	835.2
52.4	835.01	53.64	834.87	56.33	834.58	56.76	834.53	58.93	834.29
59.09	834.26	60.91	834	61.53	833.91	61.77	833.88	65.76	833.25
67.21	833.05	69.67	832.68	74.1	832	75.37	831.72	78.33	831.04
79.3	830.81	83.15	830	84.82	829.93	85.04	829.92	85.58	829.89
89.94	829.68	94.22	829.47	99.72	829.24	110.94	828.47	113.82	828.32
115.24	828.25	117.83	828	174.08	828	174.52	828.04	194.87	830
195.39	830.04	197.72	830.24	210.01	830.31	216.6	830.41	218.07	830.25
219.57	830.05	219.97	830	222.23	829.79	230.6	829.12	241.79	828.19
244.75	828	267.96	828	272.56	827.85	273.71	827.84	275.94	827.7
278.22	827.59	301.45	826	323.5	826	356.72	826	358.07	824.91

359.23	824	359.84	823.54	362.77	821.27	387.26	822.16	393.71	822.38
411.92	823.65	414.58	824	416.84	824	418.53	825.41	418.9	825.72
419.26	826	419.65	826.31	421.76	828	424.27	830	435.33	830.62
437.01	830.73	456.8	832	472.29	832.9	493.97	834	495.74	834.51
500.32	836	502.54	836.66	507.57	838	509.02	838.37	515.42	840
517.32	840.46	523.35	842	525.17	842.45	527.3	843.03	531.03	844
538.61	844.9	543.35	845.45	545.39	845.69	547.61	846	547.81	846
553.14	846.84	558.54	847.64	560.73	848	567.55	850		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	356.72	.035	424.27	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
356.72	424.27	284.66	127.14	14.01	.1 .3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	831.87	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.32	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	831.56	Reach Len. (ft)	284.66	127.14	14.01
Crit W.S. (ft)		Flow Area (sq ft)	978.83	575.77	20.58
E.G. Slope (ft/ft)	0.000926	Area (sq ft)	978.83	575.77	20.58
Q Total (cfs)	4015.30	Flow (cfs)	1016.45	2990.82	8.03
Top Width (ft)	373.80	Top Width (ft)	280.64	67.55	25.61
Vel Total (ft/s)	2.55	Avg. Vel. (ft/s)	1.04	5.19	0.39
Max Chl Dpth (ft)	10.29	Hydr. Depth (ft)	3.49	8.52	0.80
Conv. Total (cfs)	131983.2	Conv. (cfs)	33410.6	98308.6	264.0
Length Wtd. (ft)	164.00	Wetted Per. (ft)	281.15	71.39	25.66
Min Ch El (ft)	821.27	Shear (lb/sq ft)	0.20	0.47	0.05
Alpha	3.14	Stream Power (lb/ft s)	567.55	0.00	0.00
Frctn Loss (ft)	0.12	Cum Volume (acre-ft)	10.04	5.13	0.74
C & E Loss (ft)	0.02	Cum SA (acres)	2.50	0.62	0.30

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 1293.596

INPUT
Description:
Station Elevation Data num= 131

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	4.12	848	8.06	846.06	8.17	846	8.81	845.68
12.19	844	12.67	843.76	16.32	842	21.32	840.26	22.02	840
22.88	839.69	23.71	839.41	27.76	838	30.51	837.06	33.76	836
35.14	835.59	43.54	835.21	44.85	835.17	45.09	835.16	45.37	835.14
46.01	835.06	52.66	834.02	52.75	834	52.76	834	52.81	833.98

57.47	832	61.78	831.6	64.46	831.35	70.98	830.78	77.87	830.09
78.18	830.06	78.72	830	83.23	829.79	84.2	829.74	90.44	829.43
96.17	829.17	104.55	828.86	106.6	828.82	107.4	828.77	113.81	829.28
116.59	829.47	116.83	829.46	116.9	829.46	127.6	828.54	136.41	828.39
140.21	828.11	141.37	828.01	141.44	828	146.09	826.7	148.09	826.12
148.31	826.05	148.61	826	150.46	826	151.22	826.07	153.3	826.23
153.77	826.17	156.73	826.29	164.02	826	170.8	826	174.64	825.61
175.18	825.62	175.49	825.64	183.13	825.23	183.52	825.24	184.54	825.29
187.88	825.12	189.56	825.18	209.18	825.12	214.39	825	221.13	824.84
227.6	824.69	228.7	824.66	236.9	824.44	243.38	824.3	257.03	824
259.48	822.47	260.32	821.95	260.94	821.57	261.45	821.27	308.31	821.27
308.52	821.4	308.8	821.51	310.32	821.96	310.46	822	314.14	823
319.94	824	319.95	824	323.41	824.63	327.21	825.87	327.4	825.93
327.57	826	328.17	826.28	331.9	828	333.47	828.78	334.86	829.52
335.72	830	337.6	830	376.51	830	434.08	831.68	435.98	831.69
439.81	831.83	440.38	831.83	444.86	831.97	445.9	832	450.97	832.69
452.42	832.95	456.13	833.55	457.6	833.77	459.01	834	463.1	834.77
468.93	836	473.04	836.97	475.41	837.5	477.76	838	482.57	838.97
485.12	839.48	487.6	840	490.72	840.62	493.43	841.09	495.45	841.46
498.55	842	501.14	842.35	510.55	844	510.81	844.04	520.74	845.8
521.82	845.99	521.85	846	522.07	846.04	533.57	848	536.16	848.49
544.51	850								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	257.03	.035	335.72	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
257.03	335.72	379.96	235.75	67.58	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	831.73	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.24	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	831.49	Reach Len. (ft)	379.96	235.75	67.58
Crit W.S. (ft)		Flow Area (sq ft)	887.08	698.33	98.87
E.G. Slope (ft/ft)	0.000611	Area (sq ft)	887.08	698.33	98.87
Q Total (cfs)	4015.30	Flow (cfs)	895.91	3081.25	38.14
Top Width (ft)	364.64	Top Width (ft)	194.08	78.69	91.87
Vel Total (ft/s)	2.38	Avg. Vel. (ft/s)	1.01	4.41	0.39
Max Chl Dpth (ft)	10.22	Hydr. Depth (ft)	4.57	8.87	1.08
Conv. Total (cfs)	162409.9	Conv. (cfs)	36237.5	124629.8	1542.6
Length Wtd. (ft)	231.75	Wetted Per. (ft)	194.61	81.02	91.89
Min Ch El (ft)	821.27	Shear (lb/sq ft)	0.17	0.33	0.04
Alpha	2.67	Stream Power (lb/ft s)	544.51	0.00	0.00
Frctn Loss (ft)	0.21	Cum Volume (acre-ft)	3.95	3.27	0.72
C & E Loss (ft)	0.02	Cum SA (acres)	0.95	0.41	0.28

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: Toms Fork
REACH: Toms Fork RS: 1000.000

INPUT
Description:
Station Elevation Data num= 116

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	.26	849.64	1.5	848	2.99	846	3.07	845.88
4.81	843.56	5.98	842	6.08	841.88	7.5	840	7.81	839.63
9.02	838	9.72	837.47	11.66	836	13.76	834.45	14.37	834
16.27	832.6	17.09	832	17.85	831.92	30.72	830.59	44.39	830.01
44.63	830	45.04	829.98	46.91	829.91	49.1	829.82	56.19	828.94
64.04	828	65.22	827.34	67.37	826	68.79	825.02	70.4	824
72.12	823.16	74.22	822	74.83	821.71	75.57	821.27	103.45	821.27
104.71	821.26	104.99	821.33	105.34	821.44	106.87	822	111.85	823.77
112.67	824	117.18	825.27	120.39	826	125.39	826.29	127.25	826.41
131	826.54	132.8	826.64	134.71	826.73	135.12	826.75	136.89	826.83
139.24	826.93	141.51	827.02	146.36	827.18	148.33	827.25	149.98	827.29
151.35	827.32	153.84	827.41	154.85	827.43	156.24	827.48	157.49	827.51
158.19	827.53	158.7	827.55	160.43	827.56	160.84	827.58	161.3	827.6
161.9	827.63	163.96	827.58	164.7	827.62	166.92	827.51	167.83	827.56
168.62	827.6	169.33	827.64	173.57	827.47	209.25	827.32	211.63	827.36
213.59	827.39	215.1	827.41	220.28	827.46	247.59	828	260.33	828
264.01	828.05	265.31	828.07	266.01	828.08	267.24	828.1	349.67	828.76
354.21	828.9	359.57	829.06	360.66	829.06	365.65	829.23	369.72	829.39
372.38	829.49	376.5	829.66	382.67	829.92	383.11	829.93	384.54	830
398.78	831.6	401.74	832	404.21	832.82	407.8	834	411.97	835.59
413.07	836	414.97	836.81	417.7	838	419.82	838.96	422.17	840
426.51	841.74	427.16	842	428.24	842.38	432.79	844	437.73	845.68
438.63	846	439.07	846.15	440.44	846.61	443.79	847.72	444.64	848
450.39	850								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.013	49.1	.035	120.39	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
49.1	120.39	1	1	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	831.50	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.40	Wt. n-Val.	0.013	0.035	0.100
W.S. Elev (ft)	831.10	Reach Len. (ft)			
Crit W.S. (ft)	828.88	Flow Area (sq ft)	17.78	509.01	827.09

E.G. Slope (ft/ft)	0.001447	Area (sq ft)	17.78	509.01	827.09	
Q Total (cfs)	4015.30	Flow (cfs)	64.43	2974.55	976.32	
Top Width (ft)	368.54	Top Width (ft)	23.31	71.29	273.94	
Vel Total (ft/s)	2.97	Avg. Vel. (ft/s)	3.62	5.84	1.18	
Max Chl Dpth (ft)	9.84	Hydr. Depth (ft)	0.76	7.14	3.02	
Conv. Total (cfs)	105549.1	Conv. (cfs)	1693.7	78191.2	25664.2	
Length Wtd. (ft)		Wetted Per. (ft)	23.36	73.96	274.08	
Min Ch El (ft)	821.26	Shear (lb/sq ft)	0.07	0.62	0.27	
Alpha	2.94	Stream Power (lb/ft s)	450.39	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:Toms Fork

Reach	River Sta.	n1	n2	n3
Toms Fork	2865.327	.1	.035	.1
Toms Fork	2579.832	.1	.035	.1
Toms Fork	2372.941	.035	.035	.1
Toms Fork	2123.812	.1	.035	.1
Toms Fork	2002.134	.1	.035	.1
Toms Fork	1929.868	.1	.035	.1
Toms Fork	1811.557	.1	.035	.1
Toms Fork	1726.403	.1	.035	.1
Toms Fork	1580.979	.1	.035	.1
Toms Fork	1483.221	.1	.035	.1
Toms Fork	1421.670	.1	.035	.1
Toms Fork	1293.596	.1	.035	.1
Toms Fork	1000.000	.013	.035	.1

SUMMARY OF REACH LENGTHS

River: Toms Fork

Reach	River Sta.	Left	Channel	Right
Toms Fork	2865.327	212.2	282.13	186.24
Toms Fork	2579.832	271.1	188.24	66.66
Toms Fork	2372.941	494.68	209.34	278.69
Toms Fork	2123.812	4.85	111.36	132.72
Toms Fork	2002.134	5.33	72.27	84.5
Toms Fork	1929.868	5.86	118.14	110.15
Toms Fork	1811.557	17.98	85.13	75.99
Toms Fork	1726.403	25.62	144.25	127.32

*Toms Fork	*	1580.979	*	123.76*	97.42*	118.65*
*Toms Fork	*	1483.221	*	54.14*	61.47*	37.92*
*Toms Fork	*	1421.670	*	284.66*	127.14*	14.01*
*Toms Fork	*	1293.596	*	379.96*	235.75*	67.58*
*Toms Fork	*	1000.000	*	1*	1*	1*

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Toms Fork

Reach	River Sta.	Contr.	Expan.
*Toms Fork	* 2865.327*	.1*	.3*
*Toms Fork	* 2579.832*	.1*	.3*
*Toms Fork	* 2372.941*	.1*	.3*
*Toms Fork	* 2123.812*	.1*	.3*
*Toms Fork	* 2002.134*	.1*	.3*
*Toms Fork	* 1929.868*	.1*	.3*
*Toms Fork	* 1811.557*	.1*	.3*
*Toms Fork	* 1726.403*	.1*	.3*
*Toms Fork	* 1580.979*	.1*	.3*
*Toms Fork	* 1483.221*	.1*	.3*
*Toms Fork	* 1421.670*	.1*	.3*
*Toms Fork	* 1293.596*	.1*	.3*
*Toms Fork	* 1000.000*	.1*	.3*

ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : Existing

River: Toms Fork Reach: Toms Fork RS: 2579.832 Profile: PF 1
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
River: Toms Fork Reach: Toms Fork RS: 2372.941 Profile: PF 1
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
River: Toms Fork Reach: Toms Fork RS: 2123.812 Profile: PF 1
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
River: Toms Fork Reach: Toms Fork RS: 2002.134 Profile: PF 1
Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.
River: Toms Fork Reach: Toms Fork RS: 1929.868 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program selected the water
surface that had the least amount of error between computed and assumed values.
Warning:Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: Toms Fork Reach: Toms Fork RS: 1811.557 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program selected the water
surface that had the least amount of error between computed and assumed values.
Warning:Divided flow computed for this cross-section.
River: Toms Fork Reach: Toms Fork RS: 1726.403 Profile: PF 1
Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
River: Toms Fork Reach: Toms Fork RS: 1580.979 Profile: PF 1
Warning:Divided flow computed for this cross-section.
River: Toms Fork Reach: Toms Fork RS: 1293.596 Profile: PF 1
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.

Supplement 3

HEC-RAS Analysis –Proposed Conditions Summary w/ Cross Sections

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

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

****

PROJECT DATA
Project Title: Saddle2
Project File : Saddle2.prj
Run Date and Time: 7/16/2013 7:50:49 PM

Project in English units

****

PLAN DATA

Plan Title: Culvert
Plan File : X:\Navitus Jobfiles\Antero Resources\ANT096-Saddle\Engineering\Drainage Comp\Floodplain\Entrance-Crossing Study\Report\Computations\HEC-RAS\Revised Sections\Saddle2.p03

Geometry Title: Culvert
Geometry File : X:\Navitus Jobfiles\Antero Resources\ANT096-Saddle\Engineering\Drainage Comp\Floodplain\Entrance-Crossing Study\Report\Computations\HEC-RAS\Revised Sections\Saddle2.g02

Flow Title : Existing-Revised
Flow File : X:\Navitus Jobfiles\Antero Resources\ANT096-Saddle\Engineering\Drainage Comp\Floodplain\Entrance-Crossing Study\Report\Computations\HEC-RAS\Revised Sections\Saddle2.f02

Plan Summary Information:

Number of:	Cross Sections	= 13	Multiple Openings	=	0
	Culverts	= 1	Inline Structures	=	0
	Bridges	= 0	Lateral Structures	=	0

Computational Information

Water surface calculation tolerance	= 0.001
Critical depth calculation tolerance	= 0.001
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: Existing-Revised
Flow File : X:\Navitus Jobfiles\Antero Resources\ANT096-Saddle\Engineering\Drainage Comp\Floodplain\Entrance-Crossing Study\Report\Computations\HEC-RAS\Revised Sections\Saddle2.f02

Flow Data (cfs)

River	Reach	RS	PF 1
Toms Fork	Toms Fork	2865.327	4015.3

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Toms Fork	Toms Fork	PF 1	Known WS = 833.5	Known WS = 831.1

****

GEOMETRY DATA

Geometry Title: Culvert
Geometry File : X:\Navitus Jobfiles\Antero Resources\ANT096-Saddle\Engineering\Drainage Comp\Floodplain\Entrance-Crossing Study\Report\Computations\HEC-RAS\Revised Sections\Saddle2.g02

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 2865.327

INPUT
Description:
Station Elevation Data num= 100

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	2.89	848	3.73	847.42	5.78	846	8.24	844.95
10.3	844	12.9	842.79	14.63	842	20.51	841.56	22.47	841.4
26.09	841.11	32.66	841.36	44.49	841.93	44.56	841.93	44.57	841.93

44.6	841.93	49.67	841.3	52.98	840.89	54.84	840.66	56.84	840.4
56.98	840.39	59.93	840	62.2	838.99	64.42	838	66.42	837.11
68.93	836	77.13	835.38	80.1	835.15	89.55	834.48	91.63	834.33
96.42	834	96.46	834	103.31	833.74	108.11	833.57	115.2	833.31
120.18	833.17	144.96	832.42	149.19	832.28	158.3	832	161.69	831.77
162.91	831.7	163.61	831.66	172.16	831.13	177.1	830.87	181.93	830.59
192.98	830.03	193.14	830.02	193.52	830	195.11	829.63	202.28	828
203.58	827.9	204.23	827.86	205.83	827.75	208.78	827.55	218.92	826.86
225.69	826.43	226.36	826.39	227.77	826.3	228.45	826.25	232.59	826
233.5	824.89	234.03	824.24	234.61	823.57	239.85	823.64	241.59	823.67
250.02	823.8	269.19	824.13	281.09	824.36	281.53	824.87	281.9	825.29
282.64	826	283.77	827.33	285.69	827.68	287.35	828	290.48	828
292.08	828.23	293.87	828.48	299.55	829.32	303.22	829.8	304.12	830
305.84	831.05	306.98	831.74	307.38	832	309.66	833.4	310.6	834
312.52	835.18	313.8	836	315.48	837.04	316.99	838	318.62	839.12
319.93	840	321.46	841.28	322.33	842	324.02	843.41	324.73	844
326.6	845.56	327.13	846	329.22	847.75	329.52	848	331.9	850

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	232.59	.035	287.35	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
232.59	287.35	212.2	282.13	186.24	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	834.50	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.56	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	833.94	Reach Len. (ft)	212.20	282.13	186.24
Crit W.S. (ft)		Flow Area (sq ft)	419.77	527.29	98.85
E.G. Slope (ft/ft)	0.001212	Area (sq ft)	419.77	527.29	98.85
Q Total (cfs)	4015.30	Flow (cfs)	462.90	3422.51	129.89
Top Width (ft)	212.40	Top Width (ft)	134.49	54.76	23.15
Vel Total (ft/s)	3.84	Avg. Vel. (ft/s)	1.10	6.49	1.31
Max Chl Dpth (ft)	10.37	Hydr. Depth (ft)	3.12	9.63	4.27
Conv. Total (cfs)	115338.3	Conv. (cfs)	13296.7	98310.6	3731.0
Length Wtd. (ft)	268.11	Wetted Per. (ft)	134.87	57.29	24.42
Min Ch El (ft)	823.57	Shear (lb/sq ft)	0.24	0.70	0.31
Alpha	2.45	Stream Power (lb/ft s)	331.90	0.00	0.00
Frctn Loss (ft)	0.27	Cum Volume (acre-ft)	17.76	21.18	6.63
C & E Loss (ft)	0.05	Cum SA (acres)	5.72	2.27	1.60

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 2579.832

INPUT

Description:
Station Elevation Data num= 93

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	2.44	848	2.66	847.82	4.89	846	5.28	845.68
7.32	844	7.99	843.55	10.04	842	12.78	841.08	16.18	840
20.07	838.81	22.77	838	31.3	838	32.34	838.23	36.84	839.24
45.36	839.17	54.84	838.89	61	838.03	61.18	838	62.93	837.73
65.72	837.27	73.51	836	74.45	835.56	77.9	834	80.43	832.85
82.31	832	84.12	831.18	87.67	829.59	88.79	829.09	90.47	828.4
91.43	828	93.28	827.16	95.87	826	99.12	824.4	99.91	824
100.45	823.72	100.69	823.6	100.92	823.47	143.75	823.47	144.94	823.92
145.14	824	151.82	825.23	155.09	825.97	155.22	826	157.83	826
174.68	826.59	176.96	826.69	179.05	826.72	180.73	826.74	182.27	826.82
183.75	826.84	185.06	826.91	186.58	826.95	188.92	827.07	190.49	827.12
195.23	827.34	196.43	827.39	197.44	827.44	206.09	827.82	206.63	827.85
210.34	828	214.91	828.57	218.82	829.06	221.21	829.36	222.27	829.51
225.8	830	227.87	830.31	228.23	830.38	230.19	830.82	233.42	831.47
235.56	832	238.7	832.97	242.37	834	244.36	834.61	248.21	835.78
248.76	835.95	248.94	836	254.04	837.23	256.99	838	257.34	838
262.74	838.68	270.79	839.6	273.44	840	283.77	841.65	285.91	842
289.24	842.78	294.7	844	303.19	845.52	305.76	846	310.28	847.08
313.75	847.86	314.38	848	323.1	850				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	95.87	.035	155.09	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
95.87	155.09	271.1	188.24	66.66	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	834.19	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.40	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	833.78	Reach Len. (ft)	271.10	188.24	66.66
Crit W.S. (ft)		Flow Area (sq ft)	68.49	589.33	488.19
E.G. Slope (ft/ft)	0.000824	Area (sq ft)	68.49	589.33	488.19
Q Total (cfs)	4015.30	Flow (cfs)	68.32	3290.13	656.85
Top Width (ft)	163.22	Top Width (ft)	17.49	59.22	86.51
Vel Total (ft/s)	3.50	Avg. Vel. (ft/s)	1.00	5.58	1.35
Max Chl Dpth (ft)	10.31	Hydr. Depth (ft)	3.91	9.95	5.64
Conv. Total (cfs)	139869.5	Conv. (cfs)	2380.0	114608.8	22880.8
Length Wtd. (ft)	183.82	Wetted Per. (ft)	19.15	60.11	87.15
Min Ch El (ft)	823.47	Shear (lb/sq ft)	0.18	0.50	0.29
Alpha	2.11	Stream Power (lb/ft s)	323.10	0.00	0.00
Frctn Loss (ft)	0.21	Cum Volume (acre-ft)	16.57	17.56	5.38
C & E Loss (ft)	0.02	Cum SA (acres)	5.35	1.90	1.37

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 2372.941

INPUT
Description:
Station Elevation Data num= 105

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	1.82	848	2.33	847.47	3.36	846.39	3.78	846
6.59	844.33	7.14	844	10.17	842.28	10.68	842	13.68	840.29
14.22	840	17.19	838.31	17.76	838	19.76	837.02	21.03	837.71
30.82	836.97	45.33	836.96	53.11	837.04	58.14	836.39	62.87	836
70.69	835.06	78.76	834	82.37	833.41	90.69	832	92.24	831.76
95.46	831.2	102.19	830	104.15	829.57	105.93	829.26	108.63	828.71
111.2	828.33	113.43	828	114.56	827.83	114.6	827.82	114.66	827.81
114.94	827.78	118.37	827.27	120.84	826.94	122.59	826.68	127.81	826
128.07	825.95	128.15	825.95	128.23	825.93	131.37	825.41	132.07	825.31
133.39	825.14	134.95	824.85	136.9	824.63	140.69	824	140.95	824
141.56	823.88	142.39	823.69	142.76	823.59	143.18	823.47	161.64	823.47
162.23	823.66	162.96	823.86	163.49	824	170.49	824.97	178.34	826
184.38	826.66	190.63	827.37	196.22	828	204.78	828.89	209.26	829.26
213.01	829.61	214.44	829.73	215.21	829.78	215.72	829.81	218.51	830
221.09	830.31	222.16	830.45	226.82	831.04	233.45	832	259.72	833.51
267.46	833.9	270.43	834	277.5	834	293.51	834.86	300.19	835.16
303.03	835.27	310.96	835.62	312.48	835.69	319.76	836	323.88	836.36
332.03	837.03	340.66	837.87	342.02	838	347.21	839.1	350.16	839.67
350.48	839.73	351.82	840	353.9	840.42	357.17	841.11	360.16	841.74
361.41	842	366.93	843.14	371.51	844	376.07	845.15	379.47	846
382.67	846.77	388.2	848	388.9	848.16	389.32	848.25	397.14	850

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	136.9	.035	170.49	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
136.9	170.49	494.68	209.34	278.69	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	833.96	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.64	Wt. n-Val.	0.035	0.035	0.100
W.S. Elev (ft)	833.32	Reach Len. (ft)	494.68	209.34	278.69
Crit W.S. (ft)		Flow Area (sq ft)	245.16	319.14	319.31
E.G. Slope (ft/ft)	0.001608	Area (sq ft)	245.16	319.14	319.31
Q Total (cfs)	4015.30	Flow (cfs)	1134.88	2425.21	455.21
Top Width (ft)	173.43	Top Width (ft)	53.98	33.59	85.86
Vel Total (ft/s)	4.54	Avg. Vel. (ft/s)	4.63	7.60	1.43
Max Chl Dpth (ft)	9.85	Hydr. Depth (ft)	4.54	9.50	3.72
Conv. Total (cfs)	100120.2	Conv. (cfs)	28297.8	60471.9	11350.5

Length Wtd. (ft)	268.28	Wetted Per. (ft)	54.69	33.85	86.30
Min Ch El (ft)	823.47	Shear (lb/sq ft)	0.45	0.95	0.37
Alpha	1.99	Stream Power (lb/ft s)	397.14	0.00	0.00
Frctn Loss (ft)	0.24	Cum Volume (acre-ft)	15.59	15.60	4.76
C & E Loss (ft)	0.12	Cum SA (acres)	5.13	1.70	1.24

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: Toms Fork
REACH: Toms Fork RS: 2123.812

INPUT
Description:
Station Elevation Data num= 145

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	7.61	848.12	8.1	848	11.48	846.85	14.02	846
17.32	844.89	20.19	844	29.09	842.54	32.44	842	39.97	840.57
41	840.36	41.44	840.27	41.87	840.18	42.76	840	44.29	839.85
44.87	839.81	45.61	839.77	58.05	838.76	60.93	838.66	73.97	838
80.16	838	86.28	837.78	88.03	837.76	89.01	837.75	89.33	837.75
96.23	837.46	96.83	837.47	114.62	837.25	123.08	837.03	153.21	836.5
165.6	836.24	167.39	836.2	176.66	836	183.88	836	185.94	835.94
186.45	835.92	193.78	835.74	197.53	835.66	200.81	835.61	203.09	835.51
207.46	835.41	211.32	835.23	215.79	835.06	217.31	834.99	218.58	834.93
219.59	834.88	221.23	834.79	225.89	834.56	228.39	834.42	237.61	834
240.15	833.94	250.89	833.92	251.23	833.98	252.74	834.04	256.18	834.13
266.1	834.44	276.79	834.81	279.36	834.6	282	834.51	292.41	834.43
302.29	834.14	305	834	306.65	834	318.72	833.83	322.62	833.82
326.83	833.77	349.34	833.52	366.28	833.31	381.19	833.17	409.51	832.76
442.18	832	458.66	832	459.09	831.91	460.58	831.67	467.09	830.52
470.93	830	472.47	829.86	473.63	829.73	474.35	829.63	476.54	829.59
478.33	829.44	480.51	829.24	482.35	829.05	484.53	829.08	493.14	828.72
510.22	828	540.14	828	541.2	827.11	542.5	826	543.18	825.38
544.61	824	544.96	823.68	545.31	822.47	562.34	822.47	590.93	822.47
591.34	823.26	591.75	823.47	592.68	823.87	592.98	824	596.16	824.59
597.7	824.75	600.18	825.16	601.92	825.29	603.14	825.47	603.8	825.56
606.61	825.79	609.14	825.89	609.21	825.89	611.75	826	618.47	826
623.51	826.14	623.89	826.15	627.54	826.26	629.08	826.31	634.67	826.43
637.3	826.52	638.18	826.54	665.48	826.98	667.38	826.96	668.91	827.09
670.46	827.22	674.09	827.49	676.03	827.52	680.97	828	682.63	828.93
684.49	830	686.81	831.3	688.03	832	689.62	832.9	691.61	834
693.43	834.9	695.67	836	699.67	837.95	699.76	838	699.9	838.07
703.8	840	708.04	841.9	708.27	842	708.74	842.21	712.7	844
716.95	845.96	717.03	846	717.11	846.04	721.13	848	725.2	850

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	540.14	.035	611.75	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
540.14	611.75	4.85	111.36	132.72	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	833.60	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.25	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	833.35	Reach Len. (ft)	4.85	111.36	132.72
Crit W.S. (ft)		Flow Area (sq ft)	432.87	708.11	486.34
E.G. Slope (ft/ft)	0.000558	Area (sq ft)	432.87	708.11	486.34
Q Total (cfs)	4015.30	Flow (cfs)	275.19	3172.43	567.68
Top Width (ft)	327.53	Top Width (ft)	177.24	71.61	78.69
Vel Total (ft/s)	2.47	Avg. Vel. (ft/s)	0.64	4.48	1.17
Max Chl Dpth (ft)	10.88	Hydr. Depth (ft)	2.44	9.89	6.18
Conv. Total (cfs)	170048.2	Conv. (cfs)	11654.4	134352.7	24041.2
Length Wtd. (ft)	100.66	Wetted Per. (ft)	177.48	74.95	80.15
Min Ch El (ft)	822.47	Shear (lb/sq ft)	0.08	0.33	0.21
Alpha	2.64	Stream Power (lb/ft s)	725.20	0.00	0.00
Frctn Loss (ft)	0.08	Cum Volume (acre-ft)	11.74	13.13	2.18
C & E Loss (ft)	0.03	Cum SA (acres)	3.82	1.45	0.71

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: Toms Fork
REACH: Toms Fork RS: 2002.134

INPUT
Description:
Station Elevation Data num= 120

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	5.75	848.69	9.25	848	12.54	847.07	14.98	846.36
16.39	846	21.54	844.57	23.9	844	28.14	843.37	29.49	843.11
31.27	842.82	35.31	842	36.84	841.71	44.09	840.36	45.66	840.07
46.05	840	58.46	838.43	59.73	838.27	60.32	838.19	61.51	838
68.14	838	84.71	837.13	87.17	837.04	90.91	836.93	93.76	836.87
96.92	836.74	102.52	836.63	109.38	836.49	117.27	836.33	120.05	836.28
121.42	836.22	123.9	836.21	135.46	836	152.3	836	152.93	835.97
153.56	835.95	175.95	834.99	193.37	834.28	196.51	834.15	200.1	834
205.39	833.72	210.34	833.1	210.74	833.15	211.69	833.31	213.96	833.36
216.02	833.45	235.66	834	252.32	834	256.05	833.9	257.04	833.88

276.33	833.31	279.34	833.28	281.75	833.27	295.27	832.92	301.58	832.91
307.93	832.77	318.74	832.74	323.19	832.66	337.48	832.62	342.49	832.54
382.49	832.24	402.49	832	443.94	832	448.99	831.31	452.91	830.94
462.54	830	463.53	829.84	463.96	829.78	467.24	829.24	468.14	829.14
470.59	828.79	471.7	828.67	472.1	828.64	472.57	828.59	474.78	828.35
475.89	828.26	476.06	828.26	477.8	828	488.57	828	491.73	827.76
492.21	827.75	494.02	827.72	494.54	827.71	527.7	826.75	553.46	826
561.05	826	561.73	825.49	563.27	824	563.54	823.79	564.49	822.87
577.19	822.74	603.13	822.47	605.42	823.91	605.57	824	609.95	825.19
612.91	826	613.85	826.72	615.51	828	616.81	828.98	618.12	830
619.93	831.36	620.77	832	623.33	833.91	623.44	834	623.55	834.08
625.99	836	626.03	836.04	628.31	838	629.29	838.81	630.68	840
632.39	841.41	633.09	842	635.36	843.87	635.52	844	636.52	844.78
637.1	845.24	638.07	846	640.63	847.87	640.8	848	643.54	850

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	561.05	.035	612.91	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
561.05	612.91	5.33	72.27	84.5	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	833.49	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.56	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	832.93	Reach Len. (ft)	5.33	72.27	84.50
Crit W.S. (ft)		Flow Area (sq ft)	679.33	507.54	31.44
E.G. Slope (ft/ft)	0.001199	Area (sq ft)	679.33	507.54	31.44
Q Total (cfs)	4015.30	Flow (cfs)	652.05	3331.54	31.71
Top Width (ft)	327.29	Top Width (ft)	266.32	51.86	9.11
Vel Total (ft/s)	3.30	Avg. Vel. (ft/s)	0.96	6.56	1.01
Max Chl Dpth (ft)	10.46	Hydr. Depth (ft)	2.55	9.79	3.45
Conv. Total (cfs)	115965.4	Conv. (cfs)	18831.7	96217.8	915.9
Length Wtd. (ft)	64.31	Wetted Per. (ft)	266.60	53.79	11.45
Min Ch El (ft)	822.47	Shear (lb/sq ft)	0.19	0.71	0.21
Alpha	3.31	Stream Power (lb/ft s)	643.54	0.00	0.00
Frctn Loss (ft)	0.10	Cum Volume (acre-ft)	11.68	11.58	1.39
C & E Loss (ft)	0.05	Cum SA (acres)	3.79	1.29	0.58

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 1929.868

INPUT
Description:
Station Elevation Data num= 127

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

0	850	9.69	848.14	10.44	848	16.57	846.52	19	846
22.06	845.27	23.4	844.99	28.18	844	28.7	843.91	29.27	843.8
34.05	842.91	38.56	842	39.24	841.89	39.57	841.83	44.23	841.11
46.52	840.64	48.15	840.39	49.88	840	53.06	839.56	57.34	839.03
62.7	838	63.49	838	95.81	836.27	101.33	836.06	101.57	836.05
103.51	836	104.46	836	106.48	835.94	113.45	835.8	113.98	835.79
120.44	835.67	140.38	835.62	141.17	835.63	142.8	835.61	144.74	835.58
147.99	835.47	148.7	835.47	152.05	835.32	153.09	835.29	166.02	834.72
167.81	834.65	171.79	834.47	182.48	834	186.18	832.37	186.98	832
189.63	832	190.59	832.17	191.57	832.36	193.59	832.72	211.11	833.08
214.56	833.17	215.19	833.21	215.57	833.24	217.58	833.36	229.11	834
235.48	834	243.03	833.47	247.63	833.34	262.04	832.65	276.26	832.35
277.28	832.32	293.07	832	355.46	832	360.25	831.81	388.23	831.91
390.46	831.9	394.56	832	411.75	832	413.92	831.91	418.69	831.72
420.02	831.67	421.45	831.61	434.07	831.52	435.68	831.52	435.95	831.61
436.19	831.7	437.05	832	451.01	832	457.66	831.46	460.43	831.24
464.27	830.93	466.72	830.73	472.68	830	477.88	828.1	478.17	828
487.76	826.55	489.16	826.33	495.7	826	497.25	826	519.34	826
520.31	825.28	522.18	824	522.87	823.57	523.4	823.17	523.76	822.87
527.6	822.84	528.89	822.83	532.08	822.8	552.31	822.57	560.43	822.47
561.98	823.63	562.39	824	563.46	824.74	565.18	826	566.72	827.13
568.04	828	569.7	829.21	570.9	830	572.63	831.25	573.74	832
575.53	833.28	576.58	834	577.39	834.76	578.84	836	579.87	837.17
580.64	838	581.81	839.35	582.42	840	583.77	841.56	584.18	842
585.76	843.84	585.91	844	586.04	844.16	586.72	844.95	587.6	846
589.67	848	591.96	850						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	519.34	.035	565.18	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
519.34	565.18	5.86	118.14	110.15	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	235.48	834	F

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	833.34	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.05	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	832.28	Reach Len. (ft)	5.86	118.14	110.15
Crit W.S. (ft)	829.15	Flow Area (sq ft)	348.92	424.90	28.02
E.G. Slope (ft/ft)	0.002253	Area (sq ft)	349.99	424.90	28.02
Q Total (cfs)	4015.30	Flow (cfs)	314.97	3663.34	36.98
Top Width (ft)	299.91	Top Width (ft)	245.12	45.84	8.96
Vel Total (ft/s)	5.01	Avg. Vel. (ft/s)	0.90	8.62	1.32
Max Chl Dpth (ft)	9.81	Hydr. Depth (ft)	1.45	9.27	3.13
Conv. Total (cfs)	84593.0	Conv. (cfs)	6635.7	77178.1	779.2
Length Wtd. (ft)	109.20	Wetted Per. (ft)	240.98	48.01	10.94

* Min Ch El (ft)	* 822.47	* Shear (lb/sq ft)	* 0.20	* 1.24	* 0.36	*	
* Alpha	* 2.71	* Stream Power (lb/ft s)	* 591.96	* 0.00	* 0.00	*	
* Frctn Loss (ft)	* 0.24	* Cum Volume (acre-ft)	* 11.62	* 10.80	* 1.33	*	
* C & E Loss (ft)	* 0.02	* Cum SA (acres)	* 3.76	* 1.21	* 0.56	*	

Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 1811.557

INPUT
Description:
Station Elevation Data num= 127

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	8.09	848.68	9.6	848.44	12.25	848	15.63	847.32
17.53	847.03	22.85	846.14	23.34	846.05	23.62	846	29.14	845.01
29.7	844.93	31.77	844.59	35.22	844	38.73	843.44	40.77	843.25
44.36	842.76	49.7	842.06	50.03	842	54.63	840.79	58.16	840
60.2	839.66	63.13	839.24	66.64	838.88	68.31	838.67	72.99	838.13
73.95	838	87.5	836.44	90.85	836	91.66	836	100.94	835.61
101.33	835.59	110.34	835.25	110.4	835.24	121.22	834.87	124.68	834.79
125.19	834.78	128.31	834.73	131.18	834.66	139.14	834.59	139.43	834.59
145.89	834.47	154.04	834.29	161.88	834	163.25	834	165.31	833.16
168	832	173.5	832	173.52	832	175.04	832.3	193.36	832.94
194.25	832.97	194.4	832.96	194.97	833.03	195.62	833.08	208.04	834
229.9	834	238.7	833.13	240.06	833.08	246.53	832	265.48	832
303.93	831.45	312.8	831.4	332.62	831	353.67	831.77	354.78	831.72
359.46	831.02	369.02	830.99	369.43	831	369.91	830.99	370.02	830.99
370.53	830.98	370.91	830.97	389.65	830.53	394.54	830.38	401.08	830.18
406.7	830	407.31	829.79	412.33	828	413.45	827.6	414.68	827.16
417.14	826.3	417.99	826	443.82	826	444.09	825.85	445.72	825.04
447.77	824	447.95	823.91	449.82	822.87	459.79	822.8	489.1	822.47
489.21	822.59	489.36	822.75	490.51	824	490.88	824.38	492.37	826
493.93	827.55	494.37	828	497.57	830.56	499.37	832	499.82	832.35
501.88	834	503.33	835.14	504.41	836	505.89	837.68	506.17	838
506.24	838.08	507.77	840	508.33	840.71	509.35	842	510.56	843.55
510.91	844	511.55	844.84	512.54	846	513.19	846.66	514.51	848
516.01	849.18	517.12	850	518.94	851.43	519.47	851.82	519.7	852
521.72	853.59	522.26	854	524.41	855.7	524.8	856	527.06	857.79
527.34	858	530.07	860						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	443.82	.035	492.37	.1

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
443.82 492.37 17.98 85.13 75.99 .1 .3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	229.9	834	F

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	833.08	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.99	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	832.09	Reach Len. (ft)	17.98	85.13	75.99
Crit W.S. (ft)	828.93	Flow Area (sq ft)	330.43	440.93	20.66
E.G. Slope (ft/ft)	0.002159	Area (sq ft)	330.97	440.93	20.66
Q Total (cfs)	4015.30	Flow (cfs)	320.32	3670.83	24.14
Top Width (ft)	259.71	Top Width (ft)	204.04	48.55	7.12
Vel Total (ft/s)	5.07	Avg. Vel. (ft/s)	0.97	8.33	1.17
Max Chl Dpth (ft)	9.62	Hydr. Depth (ft)	1.67	9.08	2.90
Conv. Total (cfs)	86410.0	Conv. (cfs)	6893.4	78997.0	519.6
Length Wtd. (ft)	77.71	Wetted Per. (ft)	198.63	50.86	9.38
Min Ch El (ft)	822.47	Shear (lb/sq ft)	0.22	1.17	0.30
Alpha	2.47	Stream Power (lb/ft s)	530.07	0.00	0.00
Frctn Loss (ft)	0.17	Cum Volume (acre-ft)	11.57	9.63	1.27
C & E Loss (ft)	0.00	Cum SA (acres)	3.73	1.08	0.54

Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 1726.403

INPUT
Description:
Station Elevation Data num= 111

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	7.69	848.75	12.67	848	13.53	847.86	13.88	847.81
14.58	847.69	23.99	846	24.2	845.96	24.7	845.87	35.04	844
35.58	844	35.72	843.97	36.71	843.76	44.45	842	50.81	840.91
56.16	840	62.16	839.16	70.39	838	76.77	836.99	82.9	836
107.43	834.59	111.92	834.32	113.55	834.23	114.44	834.18	115.04	834.14
118.29	834	133.54	833	145.97	832	153.68	832	153.78	832.03
154.17	832.11	170.85	832.35	172.32	832.36	172.33	832.36	172.33	832.35
172.36	832.35	172.46	832.35	172.61	832.34	172.88	832.33	173.84	832.26
177.54	832	261.15	832	263.09	831.66	263.15	831.66	264.41	831.43
264.73	831.44	265.31	831.48	266.23	831.31	267.04	831.34	274.24	831.18
277.67	831.06	279.87	830.91	303.11	830.11	303.13	830.11	303.2	830.11

313.87	830.99	332.27	830.68	338.82	830.44	346.78	830.13	350.22	830
354.85	828.9	358.99	828	361.29	827.15	364.99	826	368.69	826
374.3	826	386.59	824.73	394.79	824.26	396.56	824.16	399.37	824
400.62	823.5	401.24	823.25	402.13	822.87	415.76	822.73	440.37	822.47
441.28	823.54	441.62	824	442.72	825.29	443.28	826	446.77	827.59
447.66	828	451.15	831.19	452.07	832	453.87	833.62	454.27	834
454.56	834.26	456.73	836	458.44	837.72	458.72	838	459.92	839.21
460.72	840	461.32	840.61	462.7	842	463.86	843.24	464.51	844
465.71	845.39	466.11	845.85	466.23	846	466.54	846.24	468.77	848
470.01	848.97	471.31	850	472.48	850.91	473.86	852	474.93	852.84
476.4	854	477.37	854.77	478.94	856	481.17	857.79	481.43	858
485.12	860								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	399.37	.035	441.62	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
399.37	441.62	25.62	144.25	127.32	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	832.90	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.02	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	831.88	Reach Len. (ft)	25.62	144.25	127.32
Crit W.S. (ft)		Flow Area (sq ft)	389.41	386.16	41.05
E.G. Slope (ft/ft)	0.002315	Area (sq ft)	389.41	386.16	41.05
Q Total (cfs)	4015.30	Flow (cfs)	555.18	3397.53	62.59
Top Width (ft)	190.08	Top Width (ft)	137.52	42.25	10.31
Vel Total (ft/s)	4.92	Avg. Vel. (ft/s)	1.43	8.80	1.52
Max Chl Dpth (ft)	9.41	Hydr. Depth (ft)	2.83	9.14	3.98
Conv. Total (cfs)	83449.8	Conv. (cfs)	11538.2	70610.8	1300.8
Length Wtd. (ft)	131.54	Wetted Per. (ft)	138.29	43.20	13.18
Min Ch El (ft)	822.47	Shear (lb/sq ft)	0.41	1.29	0.45
Alpha	2.72	Stream Power (lb/ft s)	485.12	0.00	0.00
Frctn Loss (ft)	0.22	Cum Volume (acre-ft)	11.42	8.82	1.22
C & E Loss (ft)	0.14	Cum SA (acres)	3.66	0.99	0.52

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 1580.979

INPUT
Description:
Station Elevation Data num= 105

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	9.68	848	15.17	846.8	15.87	846.64	18.77	846

20.81	845.56	28	844	35.76	842.18	36.54	842	36.96	841.92
47.38	840	47.87	839.9	56.87	838	68.15	836.06	68.41	836.01
77.1	834.66	80.22	834.43	85.29	834	85.35	834	89.24	833.81
92.24	833.63	92.64	833.63	93.17	833.63	94.58	833.62	97.89	833.46
100.76	833.32	133.45	832	138.56	832	141.4	831.74	147.18	831.31
158.75	831.48	165.31	831.53	185.18	831.5	191.55	831.44	193.11	831.6
206.25	831.02	217.47	830.66	227.63	830.24	231.61	830.09	236.83	830
237.47	829.75	238.59	829.37	245.76	829.63	249.16	829.77	253.95	830
253.96	830	253.97	830	260.61	830	272.1	829.31	290.5	828
293.32	828	298.88	827.16	303.61	826.89	315.57	826	316.11	826
317.58	826	317.83	825.95	322.94	825.12	323.18	825.12	328.6	824.28
328.79	824.25	330.08	824	334.79	823.2	336.76	822.74	337.42	822.86
337.84	822.87	365.19	822.64	382.75	822.47	382.79	822.67	383	822.67
386.52	823.76	387.12	824	389.83	824.32	390.64	824.42	395.83	825.08
400.52	825.66	403.1	826	409.08	826.75	412.02	827.12	419.58	827.98
419.67	827.99	419.74	827.99	419.75	827.99	419.78	828	427.07	828
428.22	828.41	434.02	830	434.67	830.39	436.52	832	439.1	833.98
441.66	836	442.29	836.49	444.2	838	446.24	839.6	446.78	840
447.35	840.4	449.74	842	451.59	843.1	453.32	844	456.03	845.43
457.1	846	457.93	846.44	460.96	848	463.4	849.33	464.87	850

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	330.08	.035	387.12	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
330.08	387.12	123.76	97.42	118.65	.1 .3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
182.24	294.39	833	F
450.58	456.57	833	F

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	832.54	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.56	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	831.98	Reach Len. (ft)	123.76	97.42	118.65
Crit W.S. (ft)	828.25	Flow Area (sq ft)	229.86	523.17	246.63
E.G. Slope (ft/ft)	*0.001236	Area (sq ft)	446.38	523.17	246.63
Q Total (cfs)	4015.30	Flow (cfs)	243.76	3401.25	370.29
Top Width (ft)	297.76	Top Width (ft)	191.34	57.04	49.38
Vel Total (ft/s)	4.02	Avg. Vel. (ft/s)	1.06	6.50	1.50
Max Chl Dpth (ft)	9.51	Hydr. Depth (ft)	2.90	9.17	4.99
Conv. Total (cfs)	*114213.5	Conv. (cfs)	6933.7	96747.0	10532.9
Length Wtd. (ft)	97.42	Wetted Per. (ft)	79.47	57.55	50.62
Min Ch El (ft)	822.47	Shear (lb/sq ft)	0.22	0.70	0.38
Alpha	2.24	Stream Power (lb/ft s)	464.87	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	11.18	7.32	0.80
C & E Loss (ft)		Cum SA (acres)	3.56	0.83	0.43

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: Toms Fork
REACH: Toms Fork RS: 1528.223

INPUT
Description:
Distance from Upstream XS = 40.2
Deck/Roadway Width = 25
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
167.15	831.47	822	316.08	838.58	822	403.716	838.58	822
467.81	840	822	485.69	842	822			

Upstream Bridge Cross Section Data
Station Elevation Data num= 105

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	9.68	848	15.17	846.8	15.87	846.64	18.77	846
20.81	845.56	28	844	35.76	842.18	36.54	842	36.96	841.92
47.38	840	47.87	839.9	56.87	838	68.15	836.06	68.41	836.01
77.1	834.66	80.22	834.43	85.29	834	85.35	834	89.24	833.81
92.24	833.63	92.64	833.63	93.17	833.63	94.58	833.62	97.89	833.46
100.76	833.32	133.45	832	138.56	832	141.4	831.74	147.18	831.31
158.75	831.48	165.31	831.53	185.18	831.5	191.55	831.44	193.11	831.6
206.25	831.02	217.47	830.66	227.63	830.24	231.61	830.09	236.83	830
237.47	829.75	238.59	829.37	245.76	829.63	249.16	829.77	253.95	830
253.96	830	253.97	830	260.61	830	272.1	829.31	290.5	828
293.32	828	298.88	827.16	303.61	826.89	315.57	826	316.11	826
317.58	826	317.83	825.95	322.94	825.12	323.18	825.12	328.6	824.28
328.79	824.25	330.08	824	334.79	823.2	336.76	822.74	337.42	822.86
337.84	822.87	365.19	822.64	382.75	822.47	382.79	822.67	383	822.67
386.52	823.76	387.12	824	389.83	824.32	390.64	824.42	395.83	825.08
400.52	825.66	403.1	826	409.08	826.75	412.02	827.12	419.58	827.98
419.67	827.99	419.74	827.99	419.75	827.99	419.78	828	427.07	828
428.22	828.41	434.02	830	434.67	830.39	436.52	832	439.1	833.98
441.66	836	442.29	836.49	444.2	838	446.24	839.6	446.78	840
447.35	840.4	449.74	842	451.59	843.1	453.32	844	456.03	845.43
457.1	846	457.93	846.44	460.96	848	463.4	849.33	464.87	850

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	330.08	.035	387.12	.1

Bank Sta: Left Right Coeff Contr. Expan.
330.08 387.12 .1 .3
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
182.24	294.39	833	F
450.58	456.57	833	F

Downstream Deck/Roadway Coordinates
num= 7

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
205.21	830.68	822	340.24	838.58	822	417.62	838.58	822
483.32	840	822	502.13	842	822	535.53	845.45	822
563.93	848	822						

Downstream Bridge Cross Section Data
Station Elevation Data num= 119

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	5.81	848	7.38	847.46	9.29	846.8	11.59	846
12.45	845.72	17.64	844	22	842.63	23.96	842	28.51	840.53
30.08	840	35.58	838.12	35.95	838	37.05	837.65	42.19	836
46.82	834.38	47.91	834	52.05	832.41	53.12	832	53.33	831.92
58.38	830	59.39	830	69.2	829.64	77.21	829.39	84.78	829.19
91.53	828.99	94.05	828.92	103.42	828.67	104.03	828.65	110.46	828.46
112.7	828.4	114.09	828.37	119.86	828.27	120.77	828.25	122.62	828.22
123.19	828.21	132.4	828.09	132.67	828.09	133.01	828.08	134.54	828.07
135.22	828.07	135.64	828.07	139.19	828.09	139.28	828.09	139.61	828.09
139.88	828.09	140.15	828.09	143.01	828.18	152.35	828.3	153.73	828.36
156.58	828.49	168.1	828.8	176.97	829.32	188.61	830	189.36	830.1
191.09	830.42	197.36	830.41	210.1	830.63	218.76	830.09	220.05	830
220.87	830	270.1	828.71	272.93	828.65	299.31	828	302.7	827.77
303.52	827.77	306.38	827.68	320.02	827.07	325.65	826.82	326.24	826.81
328.46	826.79	353.75	826	356.58	826	357.24	825.45	359.31	824
360.1	823.52	362.29	822.03	382.46	822.33	401.54	822.42	405.94	823.87
406.29	824	408.51	824.33	415.99	825.23	420.95	825.86	422.22	826
425.52	827.67	426.14	828	429.24	829.72	429.75	830	429.89	830.02
440.71	831.89	441.32	832	444.32	832	480.07	833.73	485.11	834
492.49	835.38	495.7	836	499.07	836.62	506.5	838	512.87	839.45
515.34	840	519.08	840.85	521.04	841.23	522.71	841.52	523.54	841.67
525.58	842	527.64	842.31	530.45	842.83	534.69	843.56	536.71	844
536.83	844	543.95	845.16	545.09	845.34	549.15	846	554.58	846.76
563.93	848	564.84	848	566.68	848.39	572.35	850		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	356.58	.035	408.51	.1

Bank Sta: Left Right Coeff Contr. Expan.
356.58 408.51 .1 .3
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
221.06	261.25	832	F
445.63	572.35	832	F

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

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Arch	11.33	35.83

FHWA Chart # 41- Arch; Corrugated metal
FHWA Scale # 1 - 90 Degree headwall
Solution Criteria = Highest U.S. EG

Culvert Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
32.68	40	.022	.035	0	.5	.3

Number of Barrels = 2
Upstream Elevation = 822.66
Centerline Stations

Sta.	Sta.
339.42	377.91

Downstream Elevation = 822.38
Centerline Stations

Sta.	Sta.
364.26	402.7

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

Q Culv Group (cfs)	3901.78	Culv Full Len (ft)	
# Barrels	2	Culv Vel US (ft/s)	7.00
Q Barrel (cfs)	1950.89	Culv Vel DS (ft/s)	6.89
E.G. US. (ft)	832.55	Culv Inv El Up (ft)	822.66
W.S. US. (ft)	831.98	Culv Inv El Dn (ft)	822.38
E.G. DS (ft)	831.99	Culv Frctn Ls (ft)	0.10
W.S. DS (ft)	831.49	Culv Exit Loss (ft)	0.07
Delta EG (ft)	0.55	Culv Entr Loss (ft)	0.38
Delta WS (ft)	0.49	Q Weir (cfs)	113.52
E.G. IC (ft)	829.99	Weir Sta Lft (ft)	119.98
E.G. OC (ft)	832.55	Weir Sta Rgt (ft)	182.24
Culvert Control	Outlet	Weir Submerg	0.03
Culv WS Inlet (ft)	831.40	Weir Max Depth (ft)	1.23
Culv WS Outlet (ft)	831.33	Weir Avg Depth (ft)	0.75
Culv Nml Depth (ft)	5.75	Weir Flow Area (sq ft)	46.96
Culv Crt Depth (ft)	4.51	Min El Weir Flow (ft)	831.32

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: Toms Fork
REACH: Toms Fork RS: 1483.221

INPUT
Description:
Station Elevation Data num= 119

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	5.81	848	7.38	847.46	9.29	846.8	11.59	846
12.45	845.72	17.64	844	22	842.63	23.96	842	28.51	840.53
30.08	840	35.58	838.12	35.95	838	37.05	837.65	42.19	836
46.82	834.38	47.91	834	52.05	832.41	53.12	832	53.33	831.92
58.38	830	59.39	830	69.2	829.64	77.21	829.39	84.78	829.19
91.53	828.99	94.05	828.92	103.42	828.67	104.03	828.65	110.46	828.46
112.7	828.4	114.09	828.37	119.86	828.27	120.77	828.25	122.62	828.22
123.19	828.21	132.4	828.09	132.67	828.09	133.01	828.08	134.54	828.07
135.22	828.07	135.64	828.07	139.19	828.09	139.28	828.09	139.61	828.09
139.88	828.09	140.15	828.09	143.01	828.18	152.35	828.3	153.73	828.36
156.58	828.49	168.1	828.8	176.97	829.32	188.61	830	189.36	830.1
191.09	830.42	197.36	830.41	210.1	830.63	218.76	830.09	220.05	830
220.87	830	270.1	828.71	272.93	828.65	299.31	828	302.7	827.77
303.52	827.77	306.38	827.68	320.02	827.07	325.65	826.82	326.24	826.81
328.46	826.79	353.75	826	356.58	826	357.24	825.45	359.31	824
360.1	823.52	362.29	822.03	382.46	822.33	401.54	822.42	405.94	823.87
406.29	824	408.51	824.33	415.99	825.23	420.95	825.86	422.22	826
425.52	827.67	426.14	828	429.24	829.72	429.75	830	429.89	830.02
440.71	831.89	441.32	832	444.32	832	480.07	833.73	485.11	834
492.49	835.38	495.7	836	499.07	836.62	506.5	838	512.87	839.45
515.34	840	519.08	840.85	521.04	841.23	522.71	841.52	523.54	841.67
525.58	842	527.64	842.31	530.45	842.83	534.69	843.56	536.71	844
536.83	844	543.95	845.16	545.09	845.34	549.15	846	554.58	846.76
563.93	848	564.84	848	566.68	848.39	572.35	850		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	356.58	.035	408.51	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
356.58	408.51	54.14	61.47	37.92	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
221.06	261.25	832	F
445.63	572.35	832	F

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	831.99	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.50	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	831.49	Reach Len. (ft)	54.14	61.47	37.92
Crit W.S. (ft)	828.49	Flow Area (sq ft)	764.27	460.44	119.88
E.G. Slope (ft/ft)	0.001340	Area (sq ft)	845.60	460.44	119.88
Q Total (cfs)	4015.30	Flow (cfs)	848.00	3007.06	160.24
Top Width (ft)	383.95	Top Width (ft)	302.12	51.93	29.90
Vel Total (ft/s)	2.99	Avg. Vel. (ft/s)	1.11	6.53	1.34
Max Chl Dpth (ft)	9.46	Hydr. Depth (ft)	2.92	8.87	4.01
Conv. Total (cfs)	109670.2	Conv. (cfs)	23161.6	82132.0	4376.7
Length Wtd. (ft)	59.27	Wetted Per. (ft)	262.39	53.46	31.13
Min Ch El (ft)	822.03	Shear (lb/sq ft)	0.24	0.72	0.32
Alpha	3.62	Stream Power (lb/ft s)	572.35	0.00	0.00
Frctn Loss (ft)	0.07	Cum Volume (acre-ft)	11.18	5.86	0.80
C & E Loss (ft)	0.06	Cum SA (acres)	2.86	0.70	0.33

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 1421.670

INPUT
Description:
Station Elevation Data num= 114

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	2.79	849.15	6.37	848	7.77	847.56	9.4	847.08
12.05	846.29	13.14	846	17.43	845.03	21.19	844.05	21.4	844
21.6	843.92	27.18	842	28.6	841.36	31.86	840	34.65	838.93
36.95	838	39.48	837.09	43.26	836.17	43.69	836.05	43.78	836.04
43.84	836.03	44.08	836	45.26	836	47.98	835.5	50.67	835.2
52.4	835.01	53.64	834.87	56.33	834.58	56.76	834.53	58.93	834.29
59.09	834.26	60.91	834	61.53	833.91	61.77	833.88	65.76	833.25
67.21	833.05	69.67	832.68	74.1	832	75.37	831.72	78.33	831.04
79.3	830.81	83.15	830	84.82	829.93	85.04	829.92	85.58	829.89
89.94	829.68	94.22	829.47	99.72	829.24	110.94	828.47	113.82	828.32
115.24	828.25	117.83	828	174.08	828	174.52	828.04	194.87	830
195.39	830.04	197.72	830.24	210.01	830.31	216.6	830.41	218.07	830.25
219.57	830.05	219.97	830	222.23	829.79	230.6	829.12	241.79	828.19
244.75	828	267.96	828	272.56	827.85	273.71	827.84	275.94	827.7
278.22	827.59	301.45	826	323.5	826	356.72	826	358.07	824.91
359.23	824	359.84	823.54	362.77	821.27	387.26	822.16	393.71	822.38
411.92	823.65	414.58	824	416.84	824	418.53	825.41	418.9	825.72
419.26	826	419.65	826.31	421.76	828	424.27	830	435.33	830.62
437.01	830.73	456.8	832	472.29	832.9	493.97	834	495.74	834.51
500.32	836	502.54	836.66	507.57	838	509.02	838.37	515.42	840

517.32	840.46	523.35	842	525.17	842.45	527.3	843.03	531.03	844
538.61	844.9	543.35	845.45	545.39	845.69	547.61	846	547.81	846
553.14	846.84	558.54	847.64	560.73	848	567.55	850		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	356.72	.035	424.27	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
356.72	424.27	284.66	127.14	14.01	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	831.87	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.32	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	831.56	Reach Len. (ft)	284.66	127.14	14.01
Crit W.S. (ft)		Flow Area (sq ft)	978.83	575.77	20.58
E.G. Slope (ft/ft)	0.000926	Area (sq ft)	978.83	575.77	20.58
Q Total (cfs)	4015.30	Flow (cfs)	1016.45	2990.82	8.03
Top Width (ft)	373.80	Top Width (ft)	280.64	67.55	25.61
Vel Total (ft/s)	2.55	Avg. Vel. (ft/s)	1.04	5.19	0.39
Max Chl Dpth (ft)	10.29	Hydr. Depth (ft)	3.49	8.52	0.80
Conv. Total (cfs)	131983.2	Conv. (cfs)	33410.6	98308.6	264.0
Length Wtd. (ft)	164.00	Wetted Per. (ft)	281.15	71.39	25.66
Min Ch El (ft)	821.27	Shear (lb/sq ft)	0.20	0.47	0.05
Alpha	3.14	Stream Power (lb/ft s)	567.55	0.00	0.00
Frctn Loss (ft)	0.12	Cum Volume (acre-ft)	10.04	5.13	0.74
C & E Loss (ft)	0.02	Cum SA (acres)	2.50	0.62	0.30

CROSS SECTION

RIVER: Toms Fork
REACH: Toms Fork RS: 1293.596

INPUT
Description:
Station Elevation Data num= 131

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	4.12	848	8.06	846.06	8.17	846	8.81	845.68
12.19	844	12.67	843.76	16.32	842	21.32	840.26	22.02	840
22.88	839.69	23.71	839.41	27.76	838	30.51	837.06	33.76	836
35.14	835.59	43.54	835.21	44.85	835.17	45.09	835.16	45.37	835.14
46.01	835.06	52.66	834.02	52.75	834	52.76	834	52.81	833.98
57.47	832	61.78	831.6	64.46	831.35	70.98	830.78	77.87	830.09
78.18	830.06	78.72	830	83.23	829.79	84.2	829.74	90.44	829.43
96.17	829.17	104.55	828.86	106.6	828.82	107.4	828.77	113.81	829.28
116.59	829.47	116.83	829.46	116.9	829.46	127.6	828.54	136.41	828.39
140.21	828.11	141.37	828.01	141.44	828	146.09	826.7	148.09	826.12

148.31	826.05	148.61	826	150.46	826	151.22	826.07	153.3	826.23
153.77	826.17	156.73	826.29	164.02	826	170.8	826	174.64	825.61
175.18	825.62	175.49	825.64	183.13	825.23	183.52	825.24	184.54	825.29
187.88	825.12	189.56	825.18	209.18	825.12	214.39	825	221.13	824.84
227.6	824.69	228.7	824.66	236.9	824.44	243.38	824.3	257.03	824
259.48	822.47	260.32	821.95	260.94	821.57	261.45	821.27	308.31	821.27
308.52	821.4	308.8	821.51	310.32	821.96	310.46	822	314.14	823
319.94	824	319.95	824	323.41	824.63	327.21	825.87	327.4	825.93
327.57	826	328.17	826.28	331.9	828	333.47	828.78	334.86	829.52
335.72	830	337.6	830	376.51	830	434.08	831.68	435.98	831.69
439.81	831.83	440.38	831.83	444.86	831.97	445.9	832	450.97	832.69
452.42	832.95	456.13	833.55	457.6	833.77	459.01	834	463.1	834.77
468.93	836	473.04	836.97	475.41	837.5	477.76	838	482.57	838.97
485.12	839.48	487.6	840	490.72	840.62	493.43	841.09	495.45	841.46
498.55	842	501.14	842.35	510.55	844	510.81	844.04	520.74	845.8
521.82	845.99	521.85	846	522.07	846.04	533.57	848	536.16	848.49
544.51	850								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	257.03	.035	335.72	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
257.03	335.72	379.96	235.75	67.58	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	831.73	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.24	Wt. n-Val.	0.100	0.035	0.100
W.S. Elev (ft)	831.49	Reach Len. (ft)	379.96	235.75	67.58
Crit W.S. (ft)		Flow Area (sq ft)	887.08	698.33	98.87
E.G. Slope (ft/ft)	0.000611	Area (sq ft)	887.08	698.33	98.87
Q Total (cfs)	4015.30	Flow (cfs)	895.91	3081.25	38.14
Top Width (ft)	364.64	Top Width (ft)	194.08	78.69	91.87
Vel Total (ft/s)	2.38	Avg. Vel. (ft/s)	1.01	4.41	0.39
Max Chl Dpth (ft)	10.22	Hydr. Depth (ft)	4.57	8.87	1.08
Conv. Total (cfs)	162409.9	Conv. (cfs)	36237.5	124629.8	1542.6
Length Wtd. (ft)	231.75	Wetted Per. (ft)	194.61	81.02	91.89
Min Ch El (ft)	821.27	Shear (lb/sq ft)	0.17	0.33	0.04
Alpha	2.67	Stream Power (lb/ft s)	544.51	0.00	0.00
Frctn Loss (ft)	0.21	Cum Volume (acre-ft)	3.95	3.27	0.72
C & E Loss (ft)	0.02	Cum SA (acres)	0.95	0.41	0.28

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: Toms Fork
REACH: Toms Fork RS: 1000.000

INPUT
Description:
Station Elevation Data num= 116

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	850	.26	849.64	1.5	848	2.99	846	3.07	845.88
4.81	843.56	5.98	842	6.08	841.88	7.5	840	7.81	839.63
9.02	838	9.72	837.47	11.66	836	13.76	834.45	14.37	834
16.27	832.6	17.09	832	17.85	831.92	30.72	830.59	44.39	830.01
44.63	830	45.04	829.98	46.91	829.91	49.1	829.82	56.19	828.94
64.04	828	65.22	827.34	67.37	826	68.79	825.02	70.4	824
72.12	823.16	74.22	822	74.83	821.71	75.57	821.27	103.45	821.27
104.71	821.26	104.99	821.33	105.34	821.44	106.87	822	111.85	823.77
112.67	824	117.18	825.27	120.39	826	125.39	826.29	127.25	826.41
131	826.54	132.8	826.64	134.71	826.73	135.12	826.75	136.89	826.83
139.24	826.93	141.51	827.02	146.36	827.18	148.33	827.25	149.98	827.29
151.35	827.32	153.84	827.41	154.85	827.43	156.24	827.48	157.49	827.51
158.19	827.53	158.7	827.55	160.43	827.56	160.84	827.58	161.3	827.6
161.9	827.63	163.96	827.58	164.7	827.62	166.92	827.51	167.83	827.56
168.62	827.6	169.33	827.64	173.57	827.47	209.25	827.32	211.63	827.36
213.59	827.39	215.1	827.41	220.28	827.46	247.59	828	260.33	828
264.01	828.05	265.31	828.07	266.01	828.08	267.24	828.1	349.67	828.76
354.21	828.9	359.57	829.06	360.66	829.06	365.65	829.23	369.72	829.39
372.38	829.49	376.5	829.66	382.67	829.92	383.11	829.93	384.54	830
398.78	831.6	401.74	832	404.21	832.82	407.8	834	411.97	835.59
413.07	836	414.97	836.81	417.7	838	419.82	838.96	422.17	840
426.51	841.74	427.16	842	428.24	842.38	432.79	844	437.73	845.68
438.63	846	439.07	846.15	440.44	846.61	443.79	847.72	444.64	848
450.39	850								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.013	49.1	.035	120.39	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
49.1	120.39	1	1	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	831.50	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.40	Wt. n-Val.	0.013	0.035	0.100
W.S. Elev (ft)	831.10	Reach Len. (ft)			
Crit W.S. (ft)	828.88	Flow Area (sq ft)	17.78	509.01	827.09
E.G. Slope (ft/ft)	0.001447	Area (sq ft)	17.78	509.01	827.09
Q Total (cfs)	4015.30	Flow (cfs)	64.43	2974.55	976.32
Top Width (ft)	368.54	Top Width (ft)	23.31	71.29	273.94
Vel Total (ft/s)	2.97	Avg. Vel. (ft/s)	3.62	5.84	1.18
Max Chl Dpth (ft)	9.84	Hydr. Depth (ft)	0.76	7.14	3.02

Conv. Total (cfs)	105549.1	Conv. (cfs)	1693.7	78191.2	25664.2	
Length Wtd. (ft)		Wetted Per. (ft)	23.36	73.96	274.08	
Min Ch El (ft)	821.26	Shear (lb/sq ft)	0.07	0.62	0.27	
Alpha	2.94	Stream Power (lb/ft s)	450.39	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:Toms Fork

Reach	River Sta.	n1	n2	n3
Toms Fork	2865.327	.1	.035	.1
Toms Fork	2579.832	.1	.035	.1
Toms Fork	2372.941	.035	.035	.1
Toms Fork	2123.812	.1	.035	.1
Toms Fork	2002.134	.1	.035	.1
Toms Fork	1929.868	.1	.035	.1
Toms Fork	1811.557	.1	.035	.1
Toms Fork	1726.403	.1	.035	.1
Toms Fork	1580.979	.1	.035	.1
Toms Fork	1528.223	Culvert		
Toms Fork	1483.221	.1	.035	.1
Toms Fork	1421.670	.1	.035	.1
Toms Fork	1293.596	.1	.035	.1
Toms Fork	1000.000	.013	.035	.1

SUMMARY OF REACH LENGTHS

River: Toms Fork

Reach	River Sta.	Left	Channel	Right
Toms Fork	2865.327	212.2	282.13	186.24
Toms Fork	2579.832	271.1	188.24	66.66
Toms Fork	2372.941	494.68	209.34	278.69
Toms Fork	2123.812	4.85	111.36	132.72
Toms Fork	2002.134	5.33	72.27	84.5
Toms Fork	1929.868	5.86	118.14	110.15
Toms Fork	1811.557	17.98	85.13	75.99
Toms Fork	1726.403	25.62	144.25	127.32
Toms Fork	1580.979	123.76	97.42	118.65
Toms Fork	1528.223	Culvert		
Toms Fork	1483.221	54.14	61.47	37.92
Toms Fork	1421.670	284.66	127.14	14.01

*Toms Fork	*	1293.596	* 379.96*	235.75*	67.58*
*Toms Fork	*	1000.000	* 1*	1*	1*

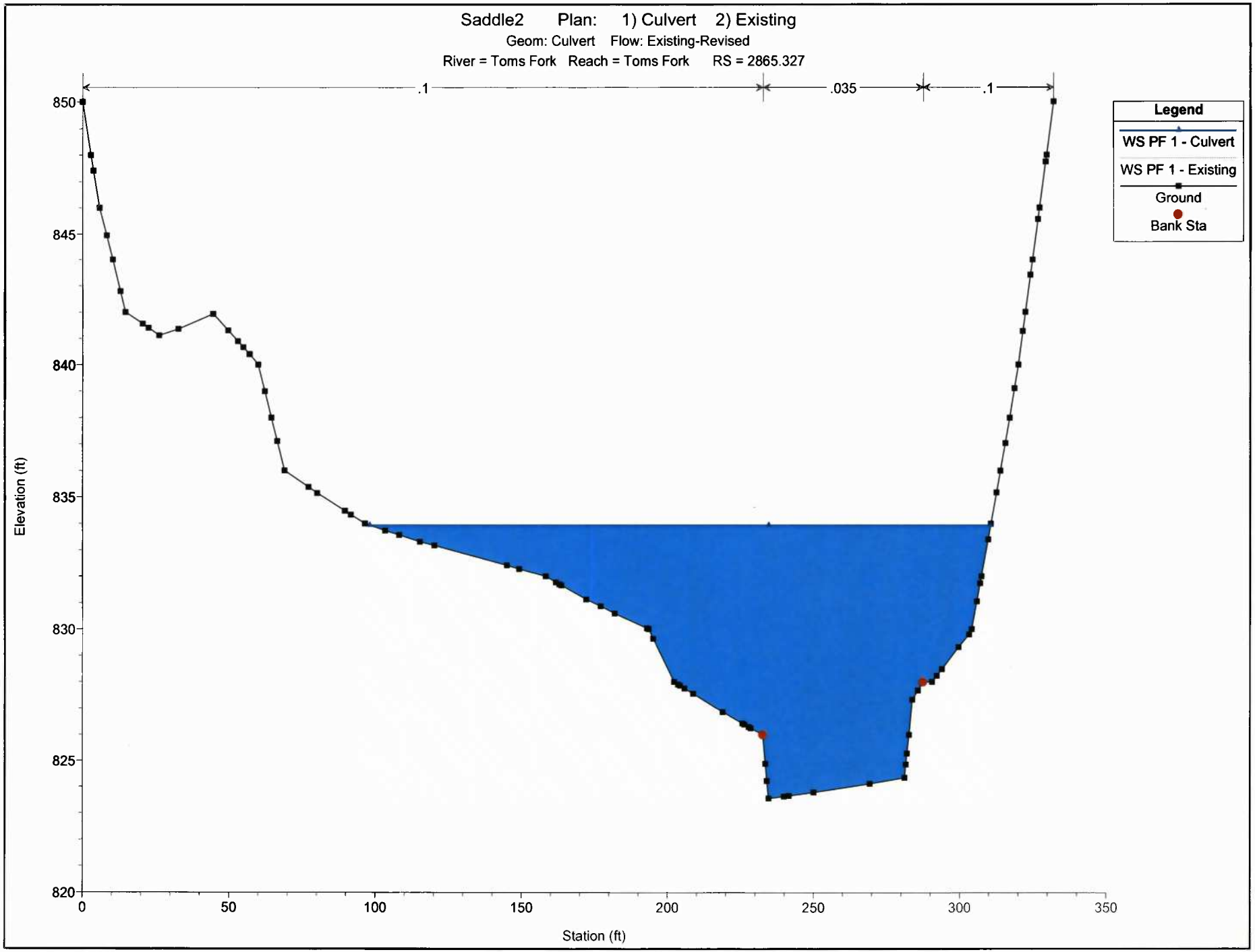
SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Toms Fork

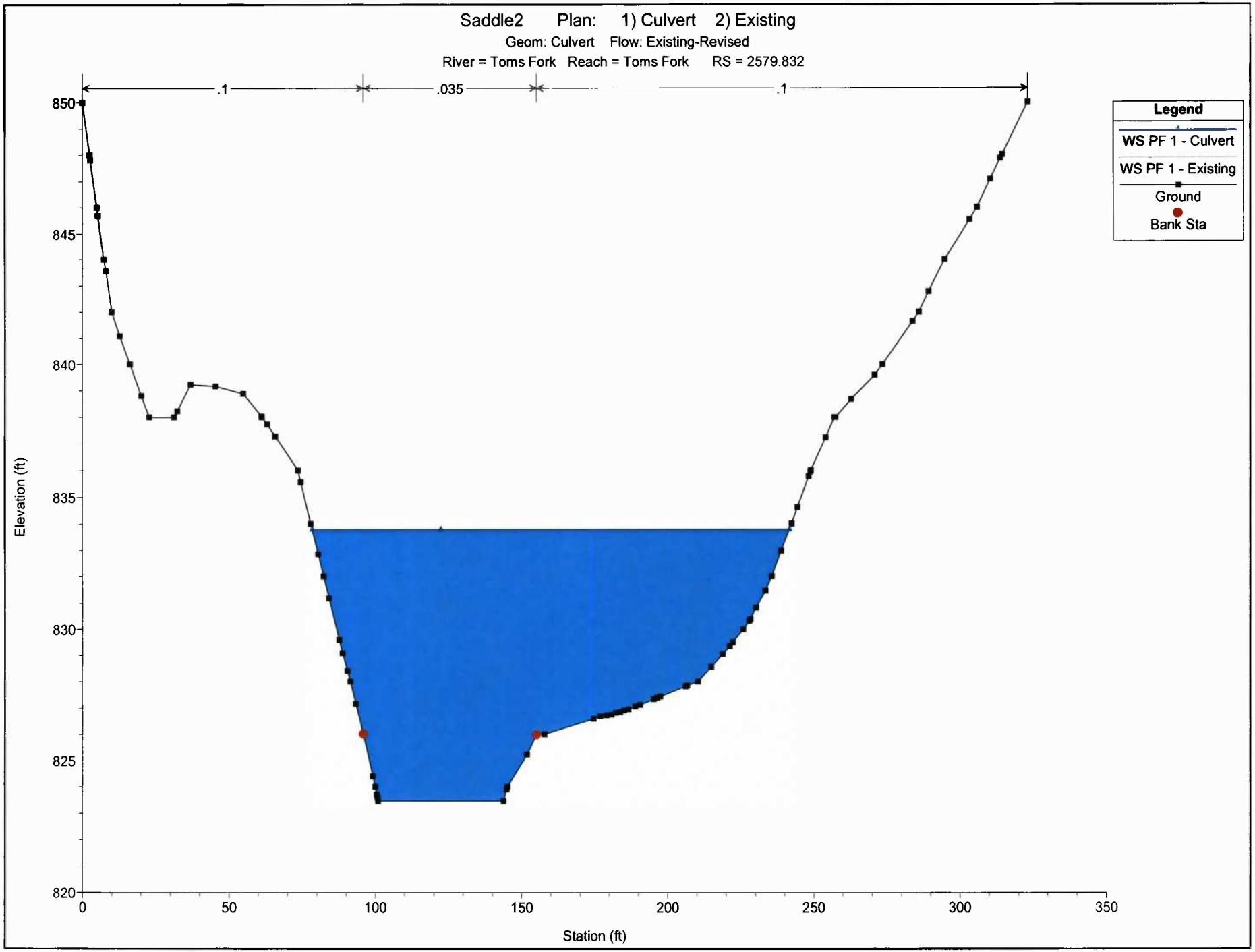
Reach	River Sta.	Contr.	Expan.
*Toms Fork	2865.327	.1	.3
*Toms Fork	2579.832	.1	.3
*Toms Fork	2372.941	.1	.3
*Toms Fork	2123.812	.1	.3
*Toms Fork	2002.134	.1	.3
*Toms Fork	1929.868	.1	.3
*Toms Fork	1811.557	.1	.3
*Toms Fork	1726.403	.1	.3
*Toms Fork	1580.979	.1	.3
*Toms Fork	1528.223 Culvert		
*Toms Fork	1483.221	.1	.3
*Toms Fork	1421.670	.1	.3
*Toms Fork	1293.596	.1	.3
*Toms Fork	1000.000	.1	.3

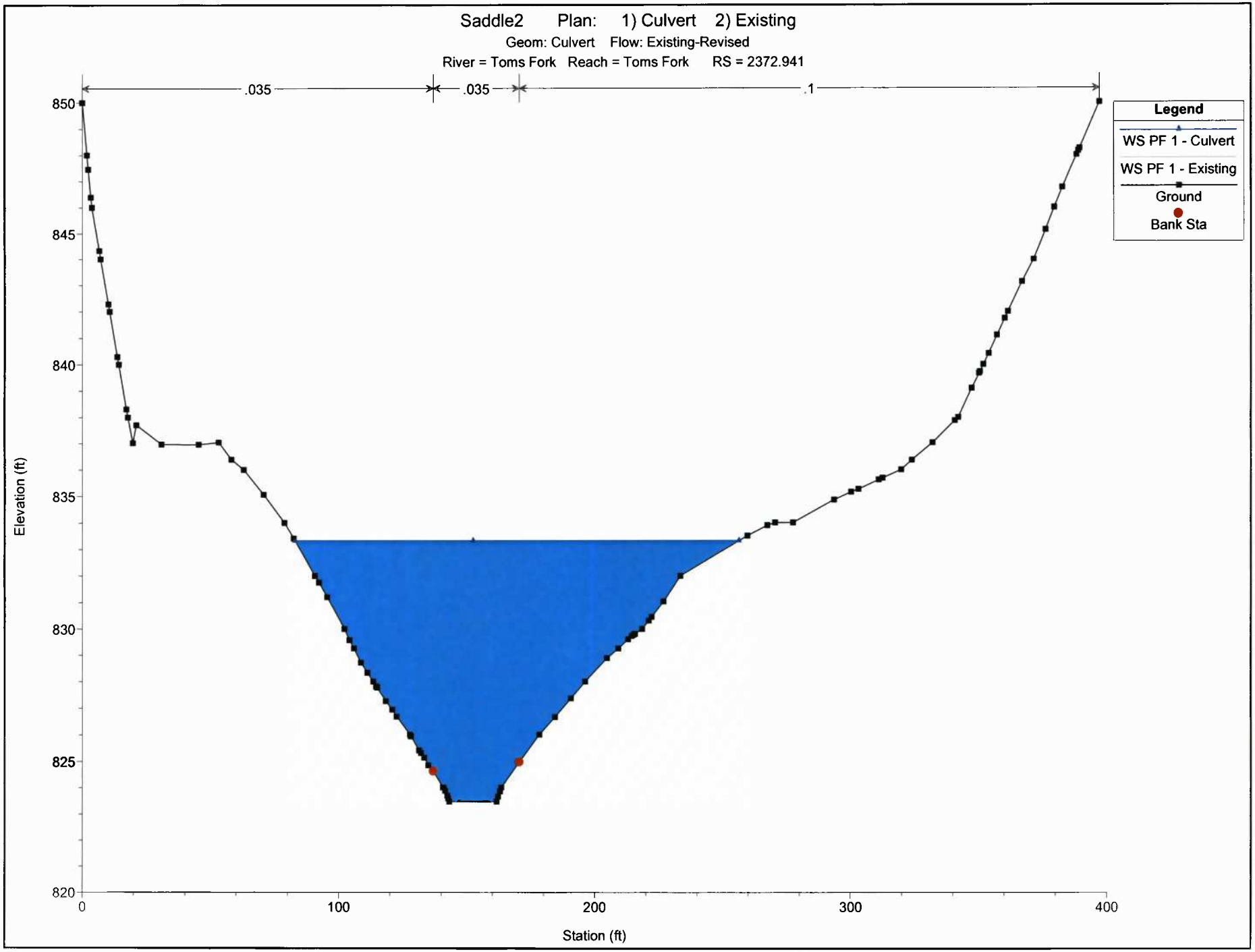
ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : Existing

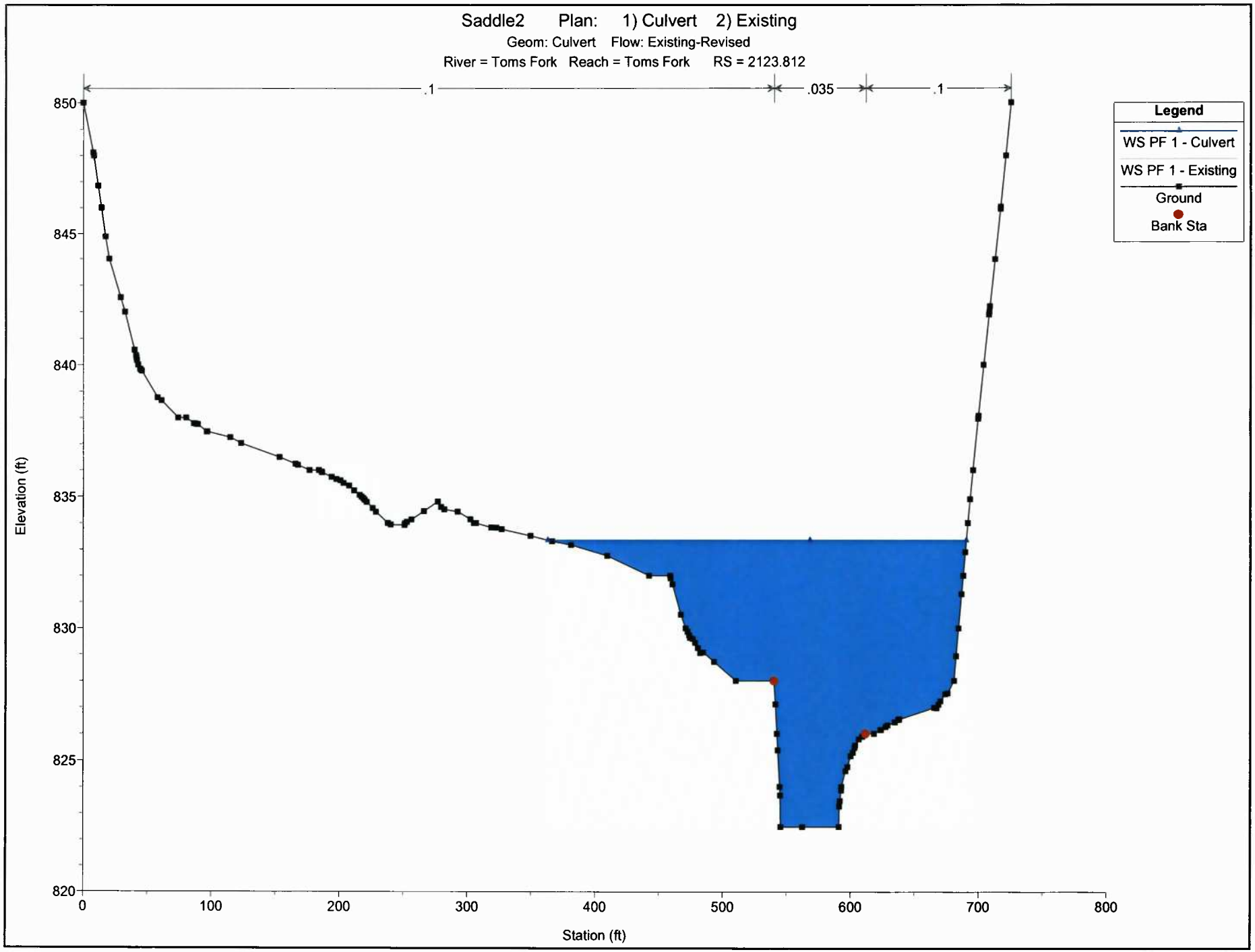
River: Toms Fork Reach: Toms Fork RS: 2579.832 Profile: PF 1
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
River: Toms Fork Reach: Toms Fork RS: 2372.941 Profile: PF 1
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
River: Toms Fork Reach: Toms Fork RS: 2123.812 Profile: PF 1
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
River: Toms Fork Reach: Toms Fork RS: 2002.134 Profile: PF 1
Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
River: Toms Fork Reach: Toms Fork RS: 1929.868 Profile: PF 1

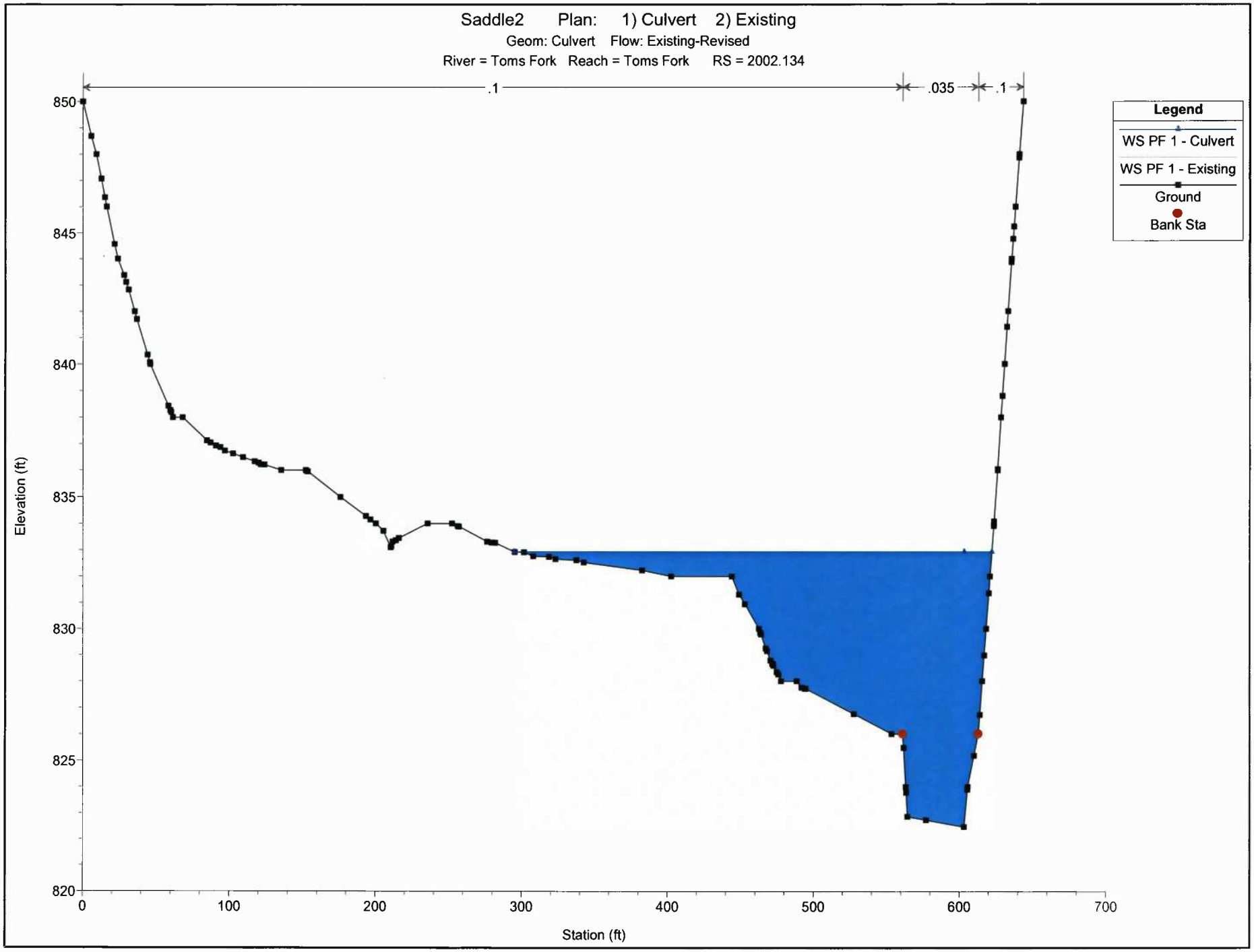
Warning:The energy equation could not be balanced within the specified number of iterations. The program selected the water
surface that had the least amount of error between computed and assumed values.
Warning:Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: Toms Fork Reach: Toms Fork RS: 1811.557 Profile: PF 1
Warning:The energy equation could not be balanced within the specified number of iterations. The program selected the water
surface that had the least amount of error between computed and assumed values.
Warning:Divided flow computed for this cross-section.
River: Toms Fork Reach: Toms Fork RS: 1726.403 Profile: PF 1
Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
River: Toms Fork Reach: Toms Fork RS: 1580.979 Profile: PF 1
Warning:Divided flow computed for this cross-section.
River: Toms Fork Reach: Toms Fork RS: 1293.596 Profile: PF 1
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.

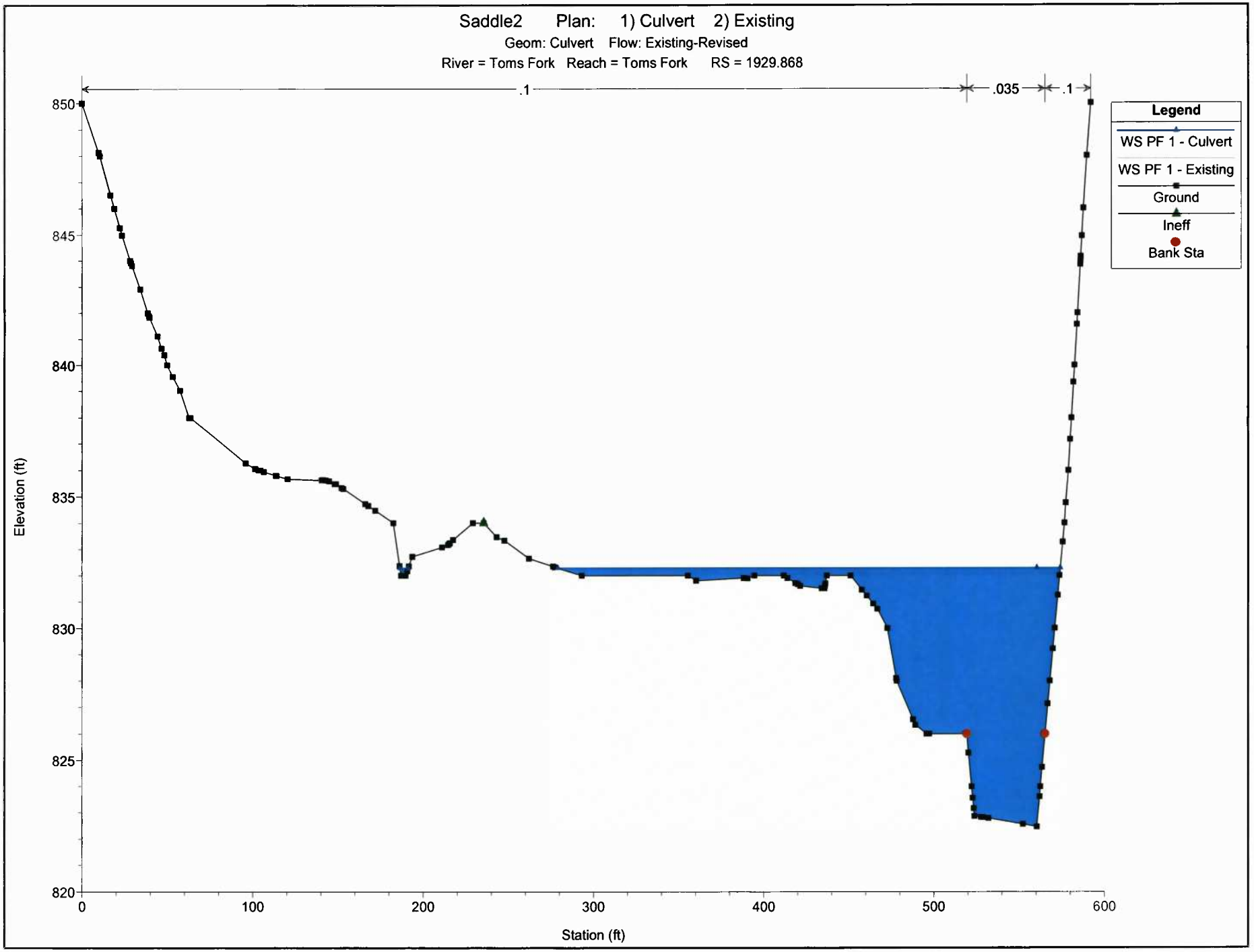

Saddle2 Plan: 1) Culvert 2) Existing
Geom: Culvert Flow: Existing-Revised
River = Toms Fork Reach = Toms Fork RS = 2865.327
.1
.035
.1
Legend
WS PF 1 - Culvert
WS PF 1 - Existing
Ground
Bank Sta
Elevation (ft)
850
845
840
835
830
825
820
0
50
100
150
200
250
300
350
Station (ft)

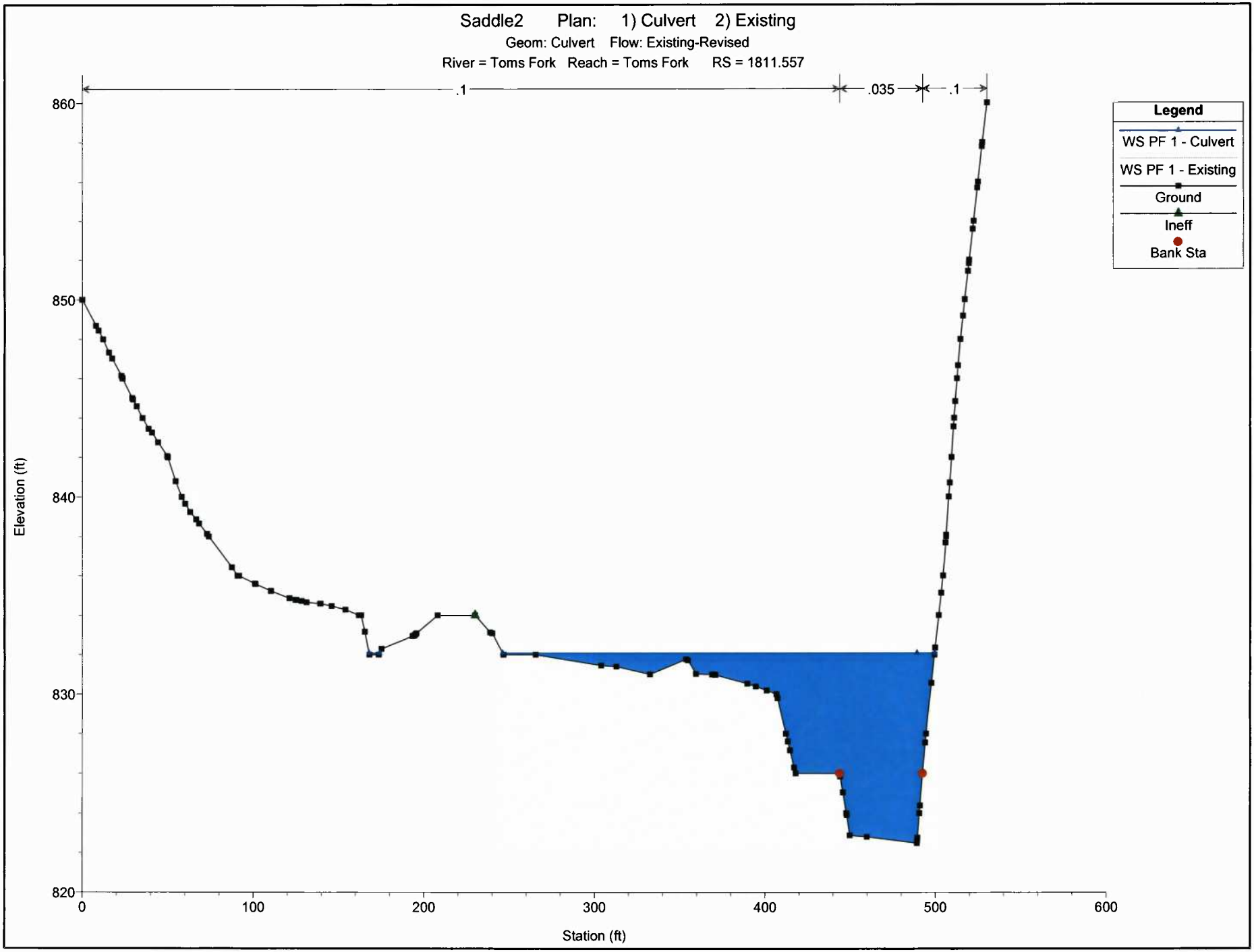

Saddle2 Plan: 1) Culvert 2) Existing
Geom: Culvert Flow: Existing-Revised
River = Toms Fork Reach = Toms Fork RS = 2579.832
.1
.035
.1
Legend
WS PF 1 - Culvert
WS PF 1 - Existing
Ground
Bank Sta
Elevation (ft)
850
845
840
835
830
825
820
0
50
100
150
200
250
300
350
Station (ft)

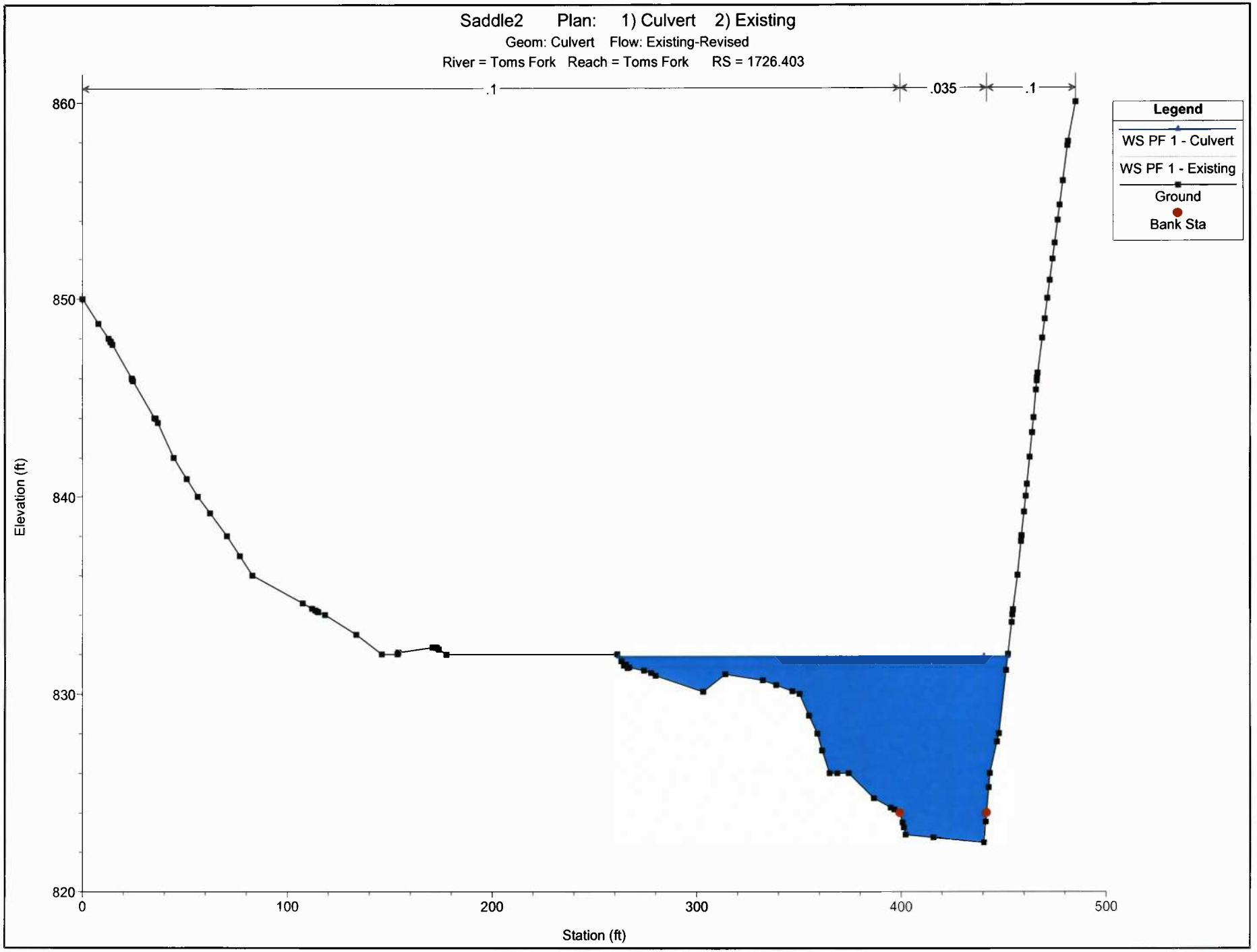

Saddle2 Plan: 1) Culvert 2) Existing
Geom: Culvert Flow: Existing-Revised
River = Toms Fork Reach = Toms Fork RS = 2372.941
.035
.035
.1
Legend
WS PF 1 - Culvert
WS PF 1 - Existing
Ground
Bank Sta
Elevation (ft)
850
845
840
835
830
825
820
0
100
200
300
400
Station (ft)

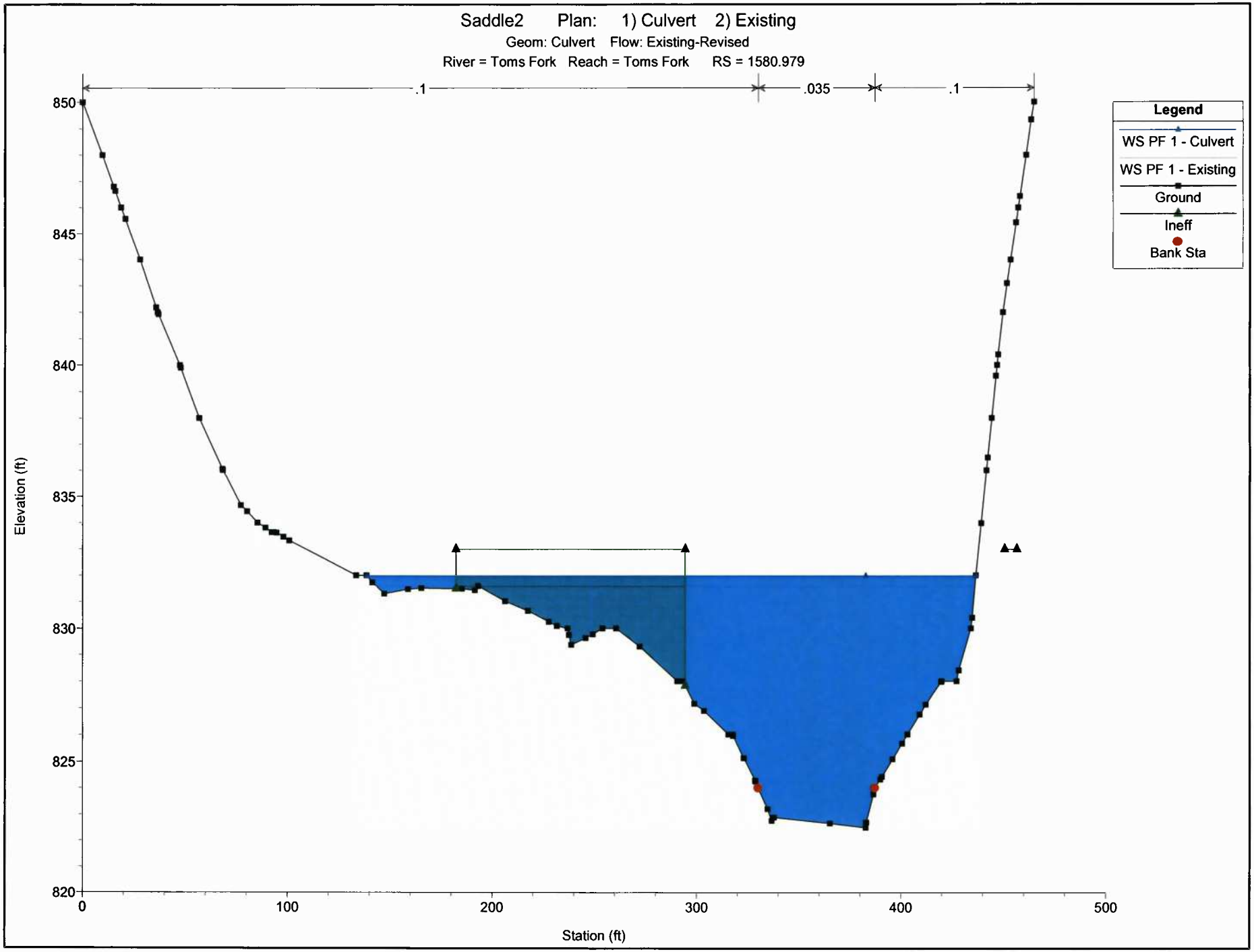

Saddle2 Plan: 1) Culvert 2) Existing
Geom: Culvert Flow: Existing-Revised
River = Toms Fork Reach = Toms Fork RS = 2123.812
.1
.035
.1
Legend
WS PF 1 - Culvert
WS PF 1 - Existing
Ground
Bank Sta
Elevation (ft)
850
845
840
835
830
825
820
0
100
200
300
400
500
600
700
800
Station (ft)

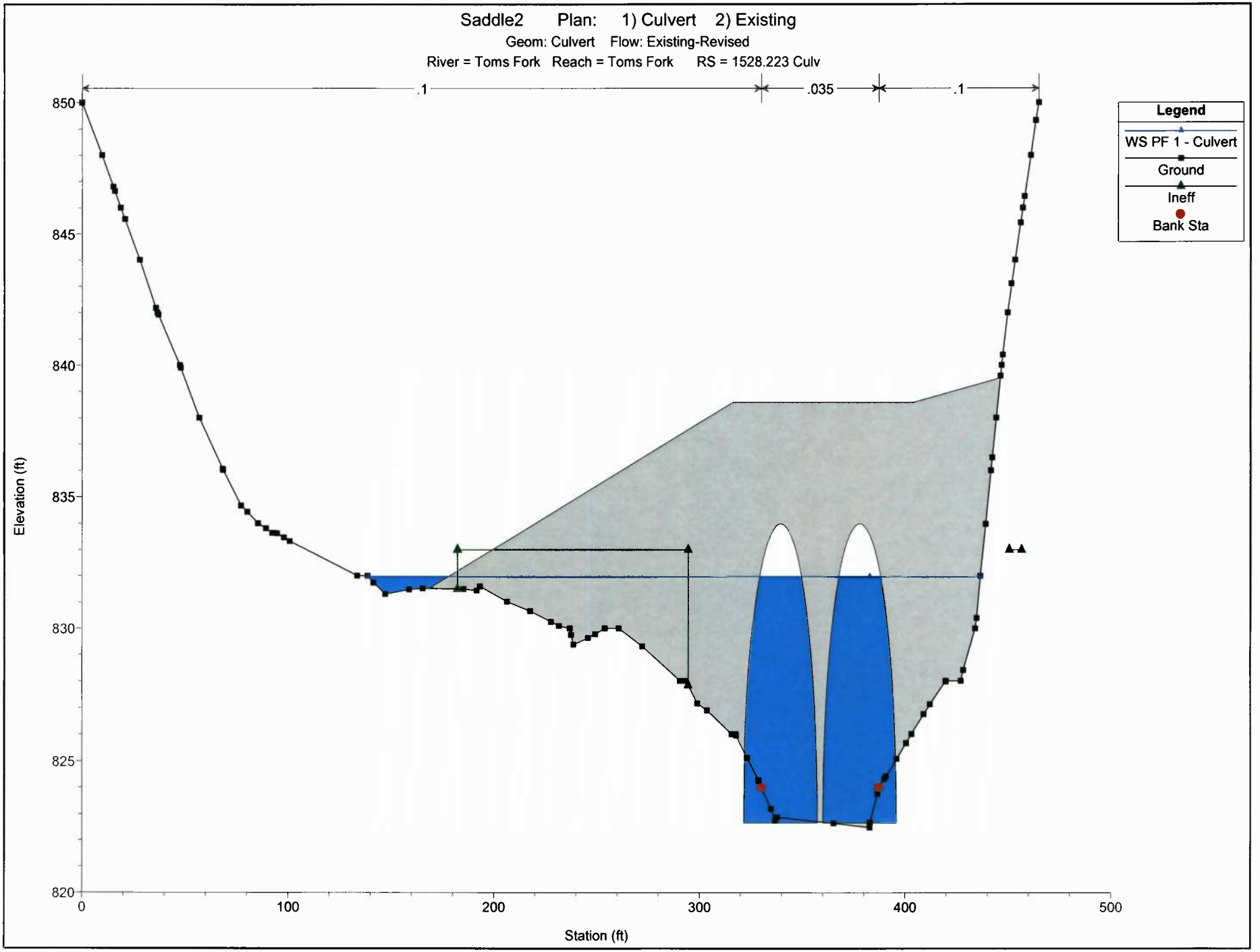

Saddle2 Plan: 1) Culvert 2) Existing
Geom: Culvert Flow: Existing-Revised
River = Toms Fork Reach = Toms Fork RS = 2002.134
.1
.035
.1
Legend
WS PF 1 - Culvert
WS PF 1 - Existing
Ground
Bank Sta
Elevation (ft)
850
845
840
835
830
825
820
0
100
200
300
400
500
600
700
Station (ft)

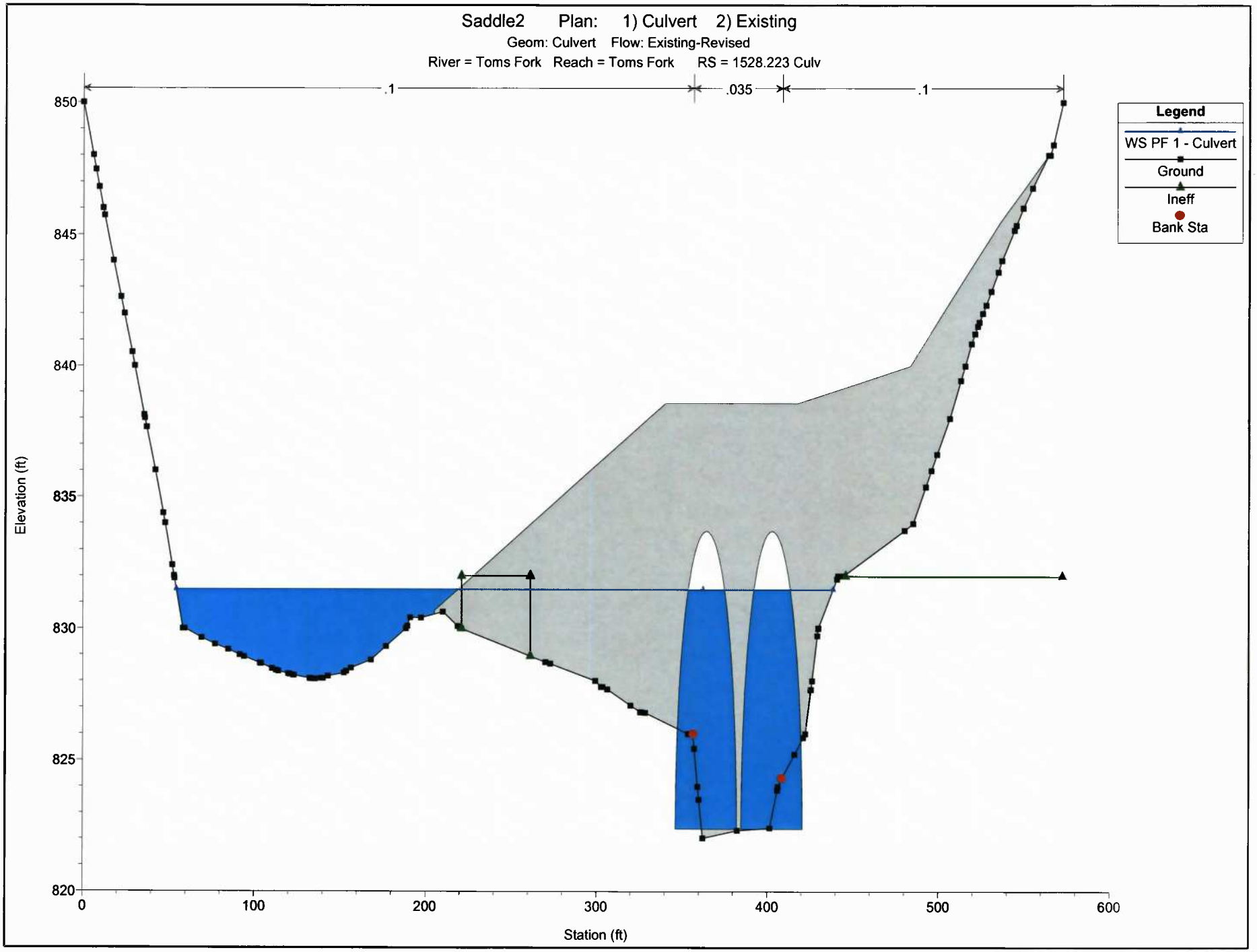

Saddle2 Plan: 1) Culvert 2) Existing
Geom: Culvert Flow: Existing-Revised
River = Toms Fork Reach = Toms Fork RS = 1929.868
.1
.035
.1
Legend
WS PF 1 - Culvert
WS PF 1 - Existing
Ground
Ineff
Bank Sta
Elevation (ft)
850
845
840
835
830
825
820
0
100
200
300
400
500
600
Station (ft)

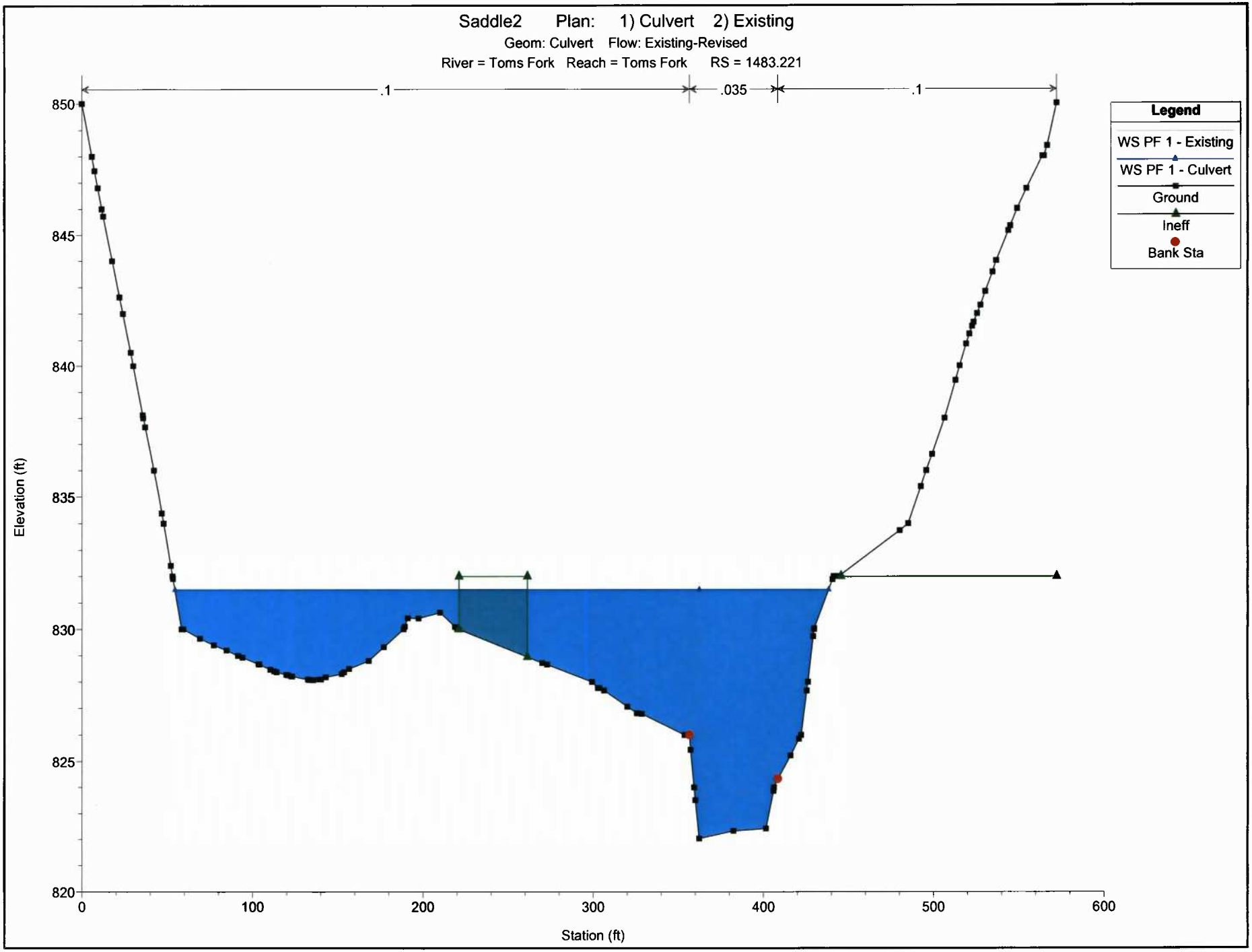

Saddle2 Plan: 1) Culvert 2) Existing
Geom: Culvert Flow: Existing-Revised
River = Toms Fork Reach = Toms Fork RS = 1811.557
.1
.035
.1
Legend
WS PF 1 - Culvert
WS PF 1 - Existing
Ground
Ineff
Bank Sta
Elevation (ft)
860
850
840
830
820
0
100
200
300
400
500
600
Station (ft)

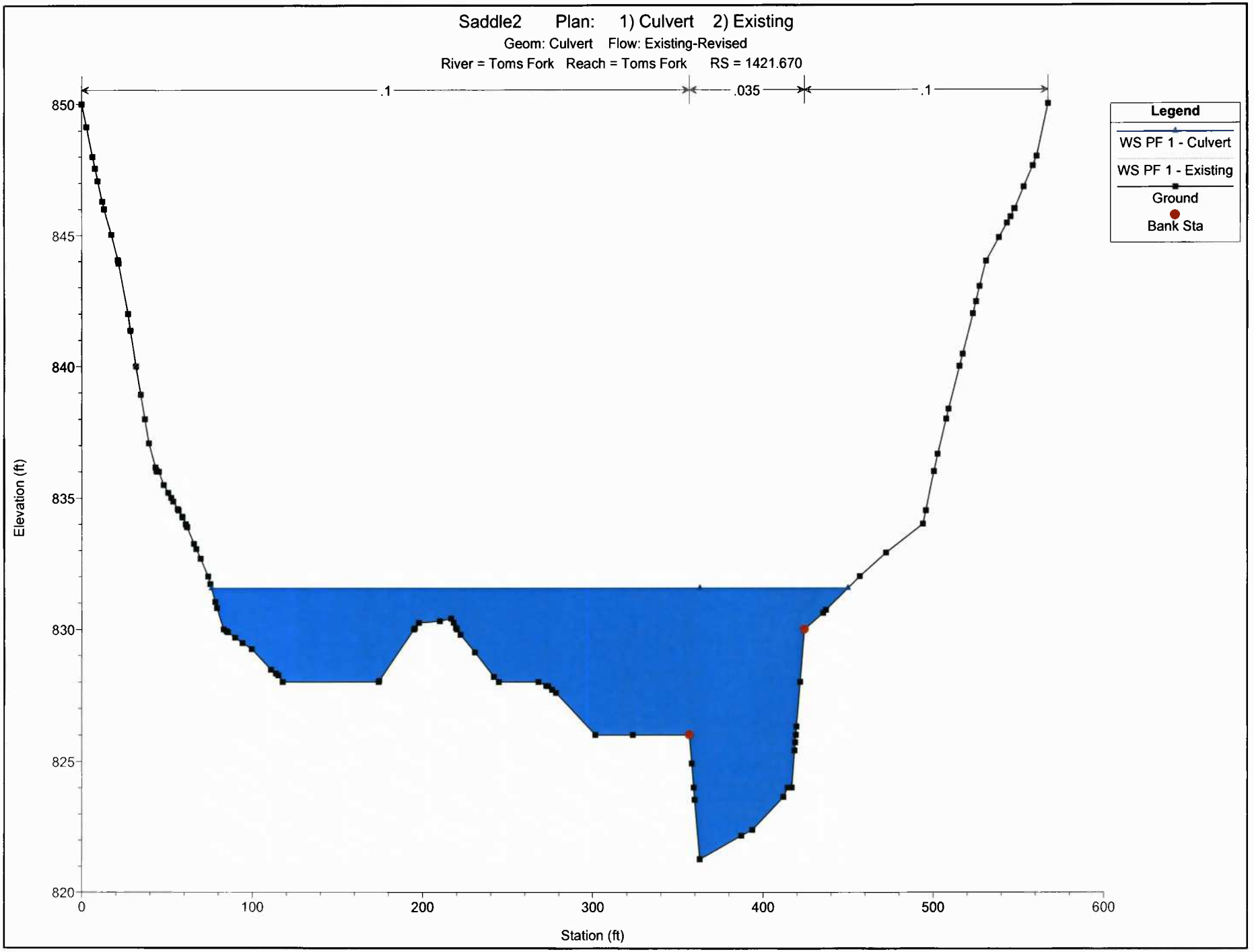

Saddle2 Plan: 1) Culvert 2) Existing
Geom: Culvert Flow: Existing-Revised
River = Toms Fork Reach = Toms Fork RS = 1726.403
.1
.035
.1
Legend
WS PF 1 - Culvert
WS PF 1 - Existing
Ground
Bank Sta
Elevation (ft)
860
850
840
830
820
0
100
200
300
400
500
Station (ft)

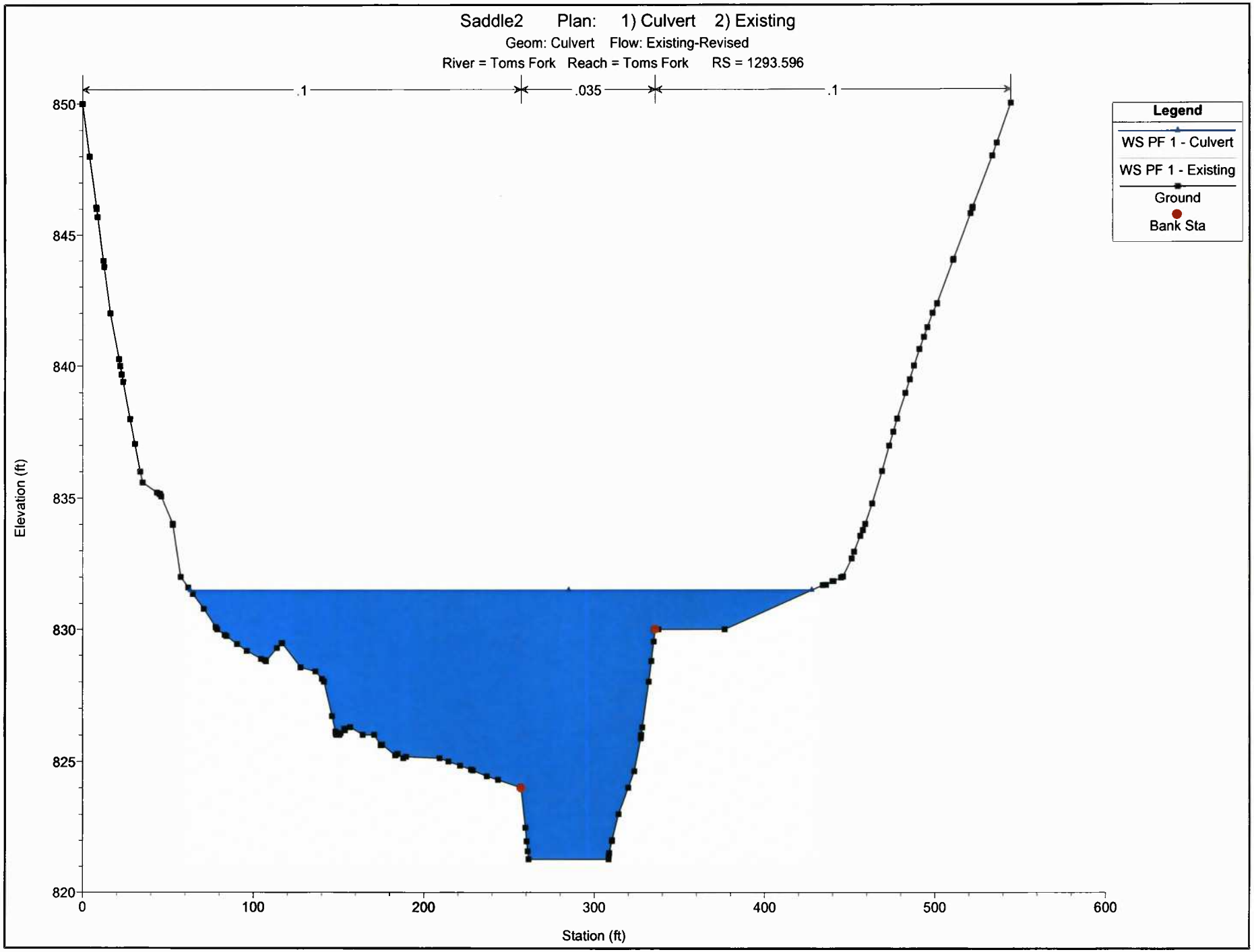

Saddle2 Plan: 1) Culvert 2) Existing
Geom: Culvert Flow: Existing-Revised
River = Toms Fork Reach = Toms Fork RS = 1580.979
.1
.035
.1
Legend
WS PF 1 - Culvert
WS PF 1 - Existing
Ground
Ineff
Bank Sta
Elevation (ft)
850
845
840
835
830
825
820
0
100
200
300
400
500
Station (ft)

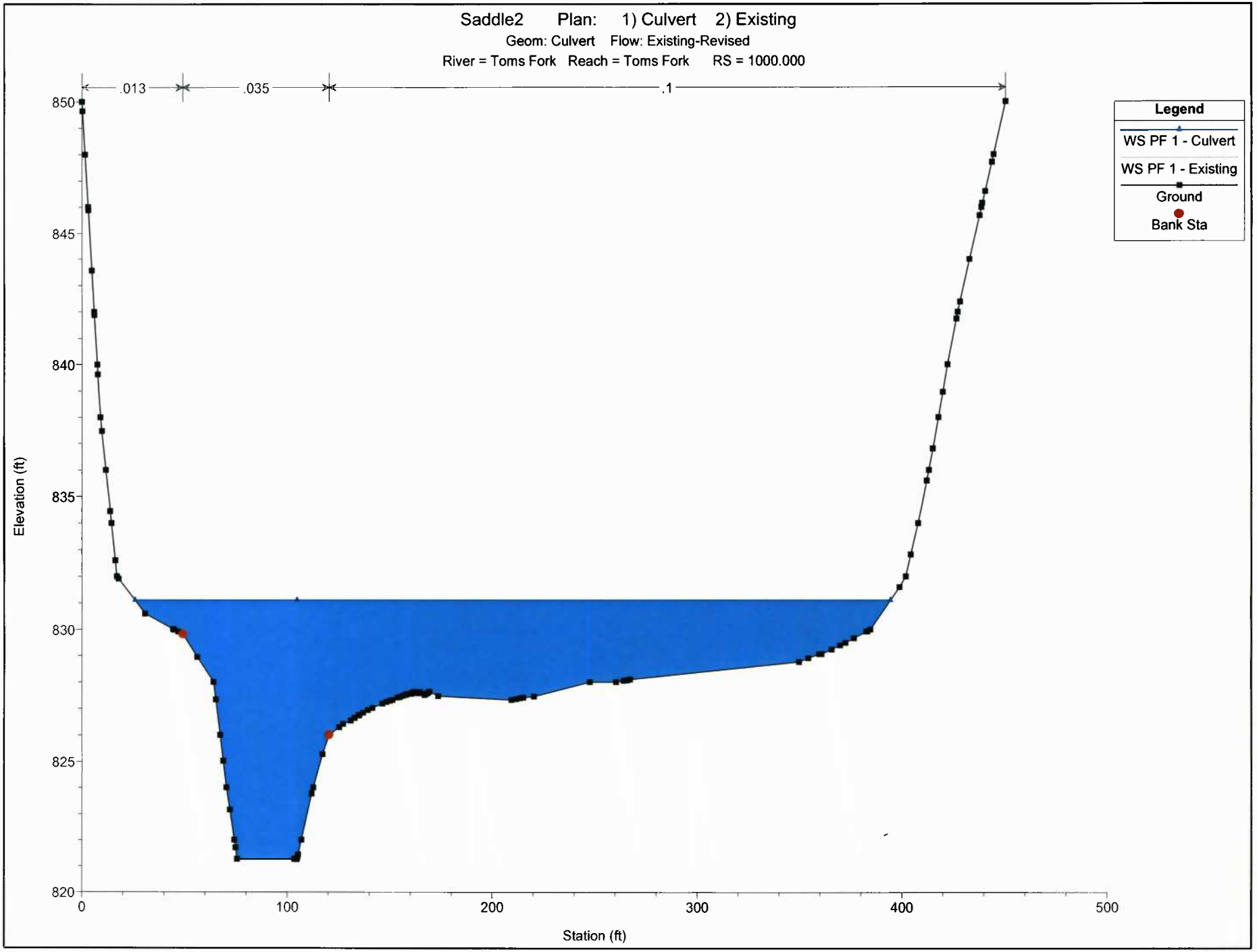

Saddle2 Plan: 1) Culvert 2) Existing
Geom: Culvert Flow: Existing-Revised
River = Toms Fork Reach = Toms Fork RS = 1528.223 Culv
.1
.035
.1
Legend
WS PF 1 - Culvert
Ground
Ineff
Bank Sta
Elevation (ft)
850
845
840
835
830
825
820
0
100
200
300
400
500
Station (ft)


Saddle2 Plan: 1) Culvert 2) Existing
Geom: Culvert Flow: Existing-Revised
River = Toms Fork Reach = Toms Fork RS = 1528.223 Culv
.1
.035
.1
Legend
WS PF 1 - Culvert
Ground
Ineff
Bank Sta
Elevation (ft)
850
845
840
835
830
825
820
0
100
200
300
400
500
600
Station (ft)


Saddle2 Plan: 1) Culvert 2) Existing
Geom: Culvert Flow: Existing-Revised
River = Toms Fork Reach = Toms Fork RS = 1483.221
.1
.035
.1
Legend
WS PF 1 - Existing
WS PF 1 - Culvert
Ground
Ineff
Bank Sta
Elevation (ft)
850
845
840
835
830
825
820
0
100
200
300
400
500
600
Station (ft)

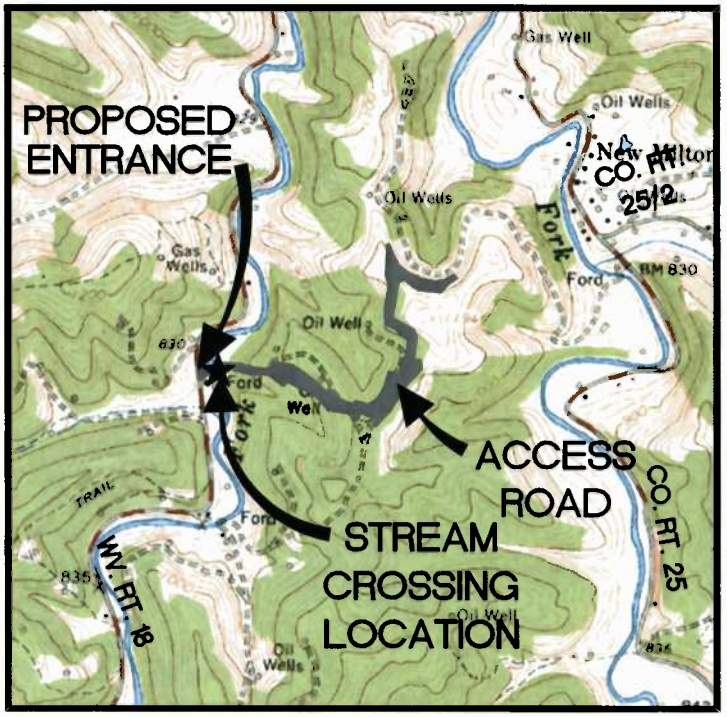

Saddle2 Plan: 1) Culvert 2) Existing
Geom: Culvert Flow: Existing-Revised
River = Toms Fork Reach = Toms Fork RS = 1421.670
.1
.035
.1
Legend
WS PF 1 - Culvert
WS PF 1 - Existing
Ground
Bank Sta
Elevation (ft)
850
845
840
835
830
825
820
0
100
200
300
400
500
600
Station (ft)


Saddle2 Plan: 1) Culvert 2) Existing
Geom: Culvert Flow: Existing-Revised
River = Toms Fork Reach = Toms Fork RS = 1293.596
.1
.035
.1
Legend
WS PF 1 - Culvert
WS PF 1 - Existing
Ground
Bank Sta
Elevation (ft)
850
845
840
835
830
825
820
0
100
200
300
400
500
600
Station (ft)


Saddle2 Plan: 1) Culvert 2) Existing
Geom: Culvert Flow: Existing-Revised
River = Toms Fork Reach = Toms Fork RS = 1000.000
.013
.035
.1
Legend
WS PF 1 - Culvert
WS PF 1 - Existing
Ground
Bank Sta
Elevation (ft)
850
845
840
835
830
825
820
0
100
200
300
400
500
Station (ft)

STREAM CROSSING "A"
STORMWATER COMPUTATIONS

NEW MILTON COMPRESSOR STATION
ACCESS ROAD WITH BRIDGE



VICINITY MAP
1" = 2,000'

NAVITUS
ENGINEERING INC.

151 Windy Hill Lane
Winchester, VA 22602
Telephone: (888) 662-4185
www.navituseng.com

Engineering • Survey • Environmental • GIS

Prepared For:

ANTERO RESOURCES
981 East Washington Avenue
Ellenboro, WV 26346
(304) 869-3405

Contacts:
Bill Prehm, Project Manager
(303) 807-4436
Anthony Smith, Field Engineer
(304) 673-6196
Mike Heaster, Land Agent
(304) 871-0085

CYRUS S. KUMP
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

Designed By:
Navitus Engineering Inc.

Project Manager:
Dan Murphy, CFM
dmurphy@navituseng.com

Tax Parcel:
Map 8 Parcel 37

Location:
New Milton District, Doddridge County
West Virginia

Date: July 16, 2013

FN# ANT096

New Milton Compressor Station
Access Road with Bridge

STREAM CROSSING "A"

STORMWATER COMPUTATIONS

Sections

SECTION 1

Overview

The intent of this project is to construct a gravel access road to a compressor station and associated facilities. This project will include a permanent stream crossing. Toms Fork which has been classified as a Perennial stream per the wetlands report conducted by Kleinfelder dated July 15, 2013, will be crossed at station 01+92.735 of the proposed access road.

Drainage Narrative

Using the SCS Method and HEC-HMS, we determined the 1, 10, and 100-year rainfall events at the stream crossing study point. We then used HEC-RAS to design the bridge and to determine the existing and proposed water surface elevations. The Floodplain Analysis conducted by Navitus Engineering shows the complete HEC-RAS model and computations including the base flood elevations and the impacts to the associated water surface elevations. Stream Crossing "A" has a drainage area of 9345.7 Acres. Design flows are provided in the drainage calculations in Section 3.

The permanent stream crossing was designed per the West Virginia Department of Environmental Protection Erosion and Sediment Control Best Management Practice Manual 2006 edition, Section 3.21-21. Per this manual, any structure that will remain in place 6 months or longer shall be large enough to convey the flow from a 10-year frequency, 24 hour duration storm. This bridge is sized to handle the computed 10-year storm event flow of 1,790.5 cfs and the 100 year storm event.

The stream crossing was also designed as a permanent structure in accordance with the U.S. Army Corps of Engineering Nationwide 14 Permit. The structure is a 60' span steel beam bridge with concrete abutments and a clear width of 57'. The bridge shall span the existing stream bed to allow for aquatic passage. No green concrete shall be used in the crossing. The permanent stream crossing will impact 98.5' of the perennial stream, Toms Fork to allow room for construction activities. The structural components of the bridge are being designed by others.

A complete copy of the Floodplain Analysis for Toms Fork on the proposed bridge can be provided upon request.

SECTION 2

NRCS Soils Report

Hydrologic Soil Group—Doddridge County, West Virginia
(Stream Crossing A)

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Soil Ratings
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads

MAP INFORMATION

Map Scale: 1:34,100 if printed on B size (11" × 17") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 17N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Doddridge County, West Virginia
Survey Area Data: Version 8, Apr 2, 2009

Date(s) aerial images were photographed: 8/25/2007

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Doddridge County, West Virginia (WV017)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
Ch	Chagrin silt loam	B	149.2	1.6%
Co	Cotaco silt loam	C	7.3	0.1%
GpE	Gilpin-Peabody complex, 25 to 35 percent slopes	D	5.2	0.1%
GsE	Gilpin-Peabody complex, 15 to 35 percent slopes, very stony	C	1,903.9	20.4%
GsF	Gilpin-Peabody complex, 35 to 70 percent slopes, very stony	C	5,505.4	58.9%
GuC	Gilpin-Upshur complex, 8 to 15 percent slopes	D	167.9	1.8%
GuD	Gilpin-Upshur complex, 15 to 25 percent slopes	D	814.4	8.7%
Ka	Kanawha loam	B	32.2	0.3%
Me	Melvin silt loam	D	4.6	0.0%
Se	Sensabaugh silt loam	B	188.9	2.0%
SeB	Sensabaugh silt loam, 3 to 8 percent slopes, rarely flooded	B	451.6	4.8%
VaC	Vandalia silt loam, 8 to 15 percent slopes	D	3.2	0.0%
VaD	Vandalia silt loam, 15 to 25 percent slopes	D	48.9	0.5%
VaE	Vandalia silt loam, 25 to 35 percent slopes	D	7.9	0.1%
VsE	Vandalia silt loam, 15 to 35 percent slopes, very stony	D	54.9	0.6%
Totals for Area of Interest			**9,345.7**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

SECTION 3

SCS TR-55
Drainage Computations

Project: New Milton Simulation Run: Existing

Start of Run:	11Jul2013, 00:00	Basin Model:	Existing
End of Run:	12Jul2013, 00:05	Meteorologic Model:	2 YR
Compute Time:	11Jul2013, 08:20	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Toms Fork	12.832	696	11Jul2013, 14:25	304.9
Reach-1	12.832	696	11Jul2013, 14:55	299.7
Middle Toms Fork	1.77	167.5	11Jul2013, 13:00	44.2
Junction-1	14.602	753.3	11Jul2013, 14:50	343.9
Reach-2	14.602	753.2	11Jul2013, 15:10	340
Lower Toms Fork	0.944	116.4	11Jul2013, 12:40	23.9
Downstream	15.546	775.9	11Jul2013, 15:10	363.9

Project: New Milton Simulation Run: Existing

Start of Run:	11Jul2013, 00:00	Basin Model:	Existing
End of Run:	12Jul2013, 00:05	Meteorologic Model:	10 YR
Compute Time:	11Jul2013, 08:20	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Toms Fork	12.832	1668.9	11Jul2013, 14:15	659.9
Reach-1	12.832	1668.7	11Jul2013, 14:45	650.7
Middle Toms Fork	1.77	417.2	11Jul2013, 12:55	94.8
Junction-1	14.602	1790.6	11Jul2013, 14:40	745.5
Reach-2	14.602	1790.5	11Jul2013, 15:00	738.6
Lower Toms Fork	0.944	293.8	11Jul2013, 12:35	51.1
Downstream	15.546	1835.4	11Jul2013, 15:00	789.7

Project: New Milton Simulation Run: Existing

Start of Run:	11Jul2013, 00:00	Basin Model:	Existing
End of Run:	12Jul2013, 00:05	Meteorologic Model:	100 YR
Compute Time:	11Jul2013, 08:20	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Toms Fork	12.832	3765.8	11Jul2013, 14:10	1397
Reach-1	12.832	3765	11Jul2013, 14:40	1380.7
Middle Toms Fork	1.77	949.1	11Jul2013, 12:55	199.5
Junction-1	14.602	4015.3	11Jul2013, 14:35	1580.2
Reach-2	14.602	4015.1	11Jul2013, 14:55	1567.8
Lower Toms Fork	0.944	666.8	11Jul2013, 12:35	107.3
Downstream	15.546	4101.3	11Jul2013, 14:55	1675.1

SECTION 4

HEC-RAS Bridge Table

Reach	River Sta	Profile	Plan	E.G. Elev (ft)	W.S. Elev (ft)	Crit W.S. (ft)	Frctn Loss (ft)	C & E Loss (ft)	Top Width (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Vel Chnl (ft/s)
Toms Fork	1726.403	PF 1	Existing	832.6	831.35		0.25	0.21	185.33	459.43	3496.9	58.97	9.61
Toms Fork	1726.403	PF 1	Bridge	832.8	831.71		0.23	0.15	188.95	525.18	3428.63	61.49	9.04
Toms Fork	1580.979	PF 1	Existing	832.14	831.59		0.14	0.02	292.23	383.83	3292.34	339.13	6.58
Toms Fork	1580.979	PF 1	Bridge	832.42	831.84	828.27	0.08	0.05	296.04	257.07	3395.6	362.63	6.59
Toms Fork	1528.223BR U	PF 1	Bridge	832.28	831.16	828.2	0.04	0.07	58.04	13.92	4001.38		8.52
Toms Fork	1528.223BR D	PF 1	Bridge	832.17	831.27	828.43	0.06	0.13	218.16	391.9	3603.86	19.55	8.03
Toms Fork	1483.221	PF 1	Existing	831.98	831.51		0.06	0.05	384.11	903.2	2954.38	157.72	6.4
Toms Fork	1483.221	PF 1	Bridge	831.99	831.51	828.49	0.06	0.05	384.06	886.99	2969.85	158.46	6.44
Toms Fork	1421.67	PF 1	Existing	831.87	831.56		0.12	0.02	373.8	1016.45	2990.82	8.03	5.19
Toms Fork	1421.67	PF 1	Bridge	831.87	831.56		0.12	0.02	373.8	1016.45	2990.82	8.03	5.19

SECTION 5

Stream Crossing "A" Details

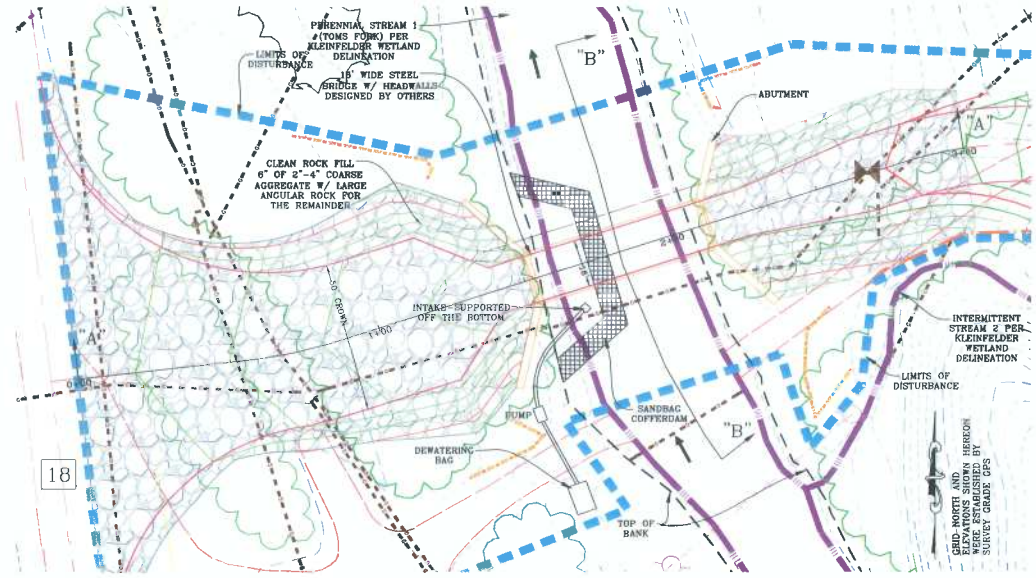
STREAM CROSSING "A" ALTERNATE DETAILS

GENERAL STREAM CROSSING NOTES:

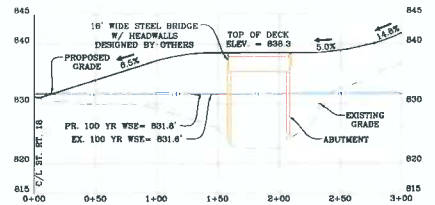
1) 2" TO 4" COARSE AGGREGATE OR LARGER SHALL BE USED TO FORM THE FIRST 6" OF FILL FOR THE CROSSING. THE REMAINDER OF MATERIAL SHALL BE ONLY LARGE ANGULAR DURABLE ROCK. "DO NOT USE ERODIBLE MATERIAL FOR CONSTRUCTION OF THE CROSSING."
2) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
3) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
4) ABUTMENTS AND WINGWALLS ON THE UPSTREAM AND DOWNSTREAM SIDE OF THE BRIDGE INSTALLATION SHALL BE INSTALLED TO REDUCE STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
5) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
6) GREEN CONCRETE SHALL NOT BE PLACED IN CONTACT WITH FLOWING WATER.
7) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
8) THE CROSSING MUST BE INSPECTED AFTER EVERY RAIN EVENT OF 0.5 INCHES OR MORE AND ONCE A WEEK TO ENSURE THAT THE CULVERTS, STREAMBED, AND STREAM BANKS ARE MAINTAINED AND NOT DAMAGED. NEVER ALLOW THE CULVERTS TO BECOME CLOGGED WITH DEBRIS AND REMOVE ANY OBSTRUCTIONS IMMEDIATELY.

PUMP AND DEWATERING NOTES:

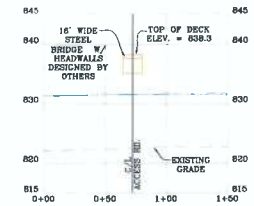
1) CONSTRUCTION SHOULD BE PERFORMED DURING LOW FLOW PERIODS.
2) PUMP(S) AND DEWATERING BAG SHOULD BE SUFFICIENTLY LARGE TO CONTAIN THE ENTIRE STREAM AREA BEING DAMMED.
3) THE COFFERDAM CONSTRUCTED MUST BE IMPERVIOUS TO WATER.
4) THE INLET OF THE PUMP(S) IS TO BE SUSPENDED ABOVE THE STREAMBED IN ORDER TO PREVENT SUCKING MUD AND SEDIMENT.



STREAM CROSSING "A" ALTERNATE SECTIONS



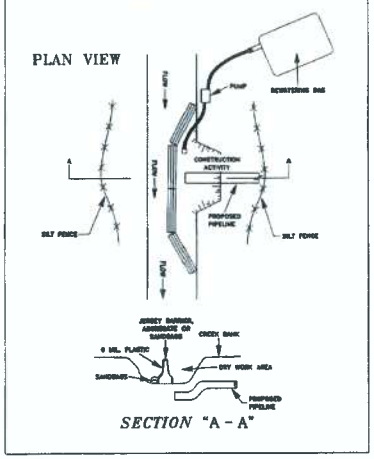
CROSS SECTION "A–A"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B–B"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

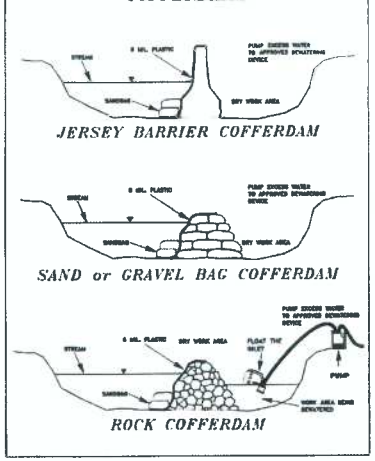
NOTE:
1. SEE STREAM CROSSING REPORT AND FLOODPLAIN ANALYSIS OF TOMS FORK BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATIONS.
2. ANTERO RESOURCES SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "A".

COFFERDAM CROSSING



SECTION "A - A"

COFFERDAMS



LEGEND

X-SECTION GRID INDEX	
X-SECTION GRID INTERMEDIATE	
X-SECTION PROPOSED GRADE	
X-SECTION EXISTING GRADE	
X-SECTION WATER SURFACE	
MATCHLINE	

LEGEND

EX. INDEX CONTOUR	700	PROP. INDEX CONTOUR	700
EX. INTERMEDIATE CONTOUR		PROP. INTERMEDIATE CONTOUR	
EX. PROPERTY LINE		PROP. INDEX CONTOUR (ROAD)	700
EX. ROAD EDGE OF GRAVEL/DIRT		PROP. INTERMEDIATE CTR (ROAD)	
EX. ROAD EDGE OF PAVEMENT		PROP. LIMITS OF DISTURBANCE	
EX. ROAD CENTERLINE		PROP. WELL HEAD	
EX. DITCHLINE		PROP. PERIMETER SAFETY FENCE	
EX. CULVERT		PROP. ACCESS GATE WITH EMERGENCY LIFELINE	
EX. FENCELINE		PROP. ROAD EDGE OF GRAVEL	
EX. OVERHEAD UTILITY		PROP. ROAD CENTERLINE	
EX. POWER POLE/GUY WIRE		PROP. V-DITCH W/ CHECK DAMS	
EX. GASLINE	G	PROP. CULVERT W/ RIP-RAP	
EX. TREELINE		PROP. COMPOST FILTER SOCK	
EX. DELINEATED STREAM		PROP. SUPER SILT FENCE	SSF
EX. DELINEATED WETLAND		MATCHLINE	
EX. BUILDING		BRUSH PILE SEDIMENT BARRIER	
100' WETLAND/STREAM BUFFER			
DELINEATION STUDY AREA			

NAVITUS ENGINEERING INC.
Engineering Survey Environmental GIS
(304) 906-4116
www.navitusengineering.com

REVISION | DATE

ANTERO RESOURCES
THIS DOCUMENT WAS PREPARED FOR ANTERO RESOURCES CORPORATION

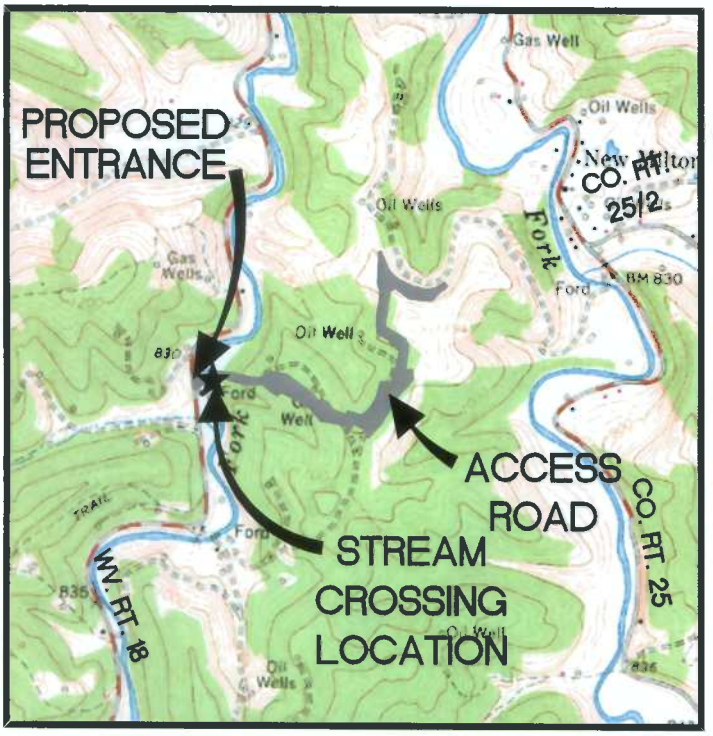
STREAM CROSSING "A" ALTERNATE DETAILS

NEW MILTON
COMPRESSOR STATION ACCESS ROAD
NEW MILTON DISTRICT
DODDRIDGE COUNTY, WEST VIRGINIA

CHRISTOPHER S. TACY — 19378 — STATE OF WEST VIRGINIA — PROFESSIONAL ENGINEER
07/16/2013

DATE: 07/16/2013
SCALE: AS SHOWN
SHEET 15 OF 20

STREAM CROSSING "A"
STORMWATER COMPUTATIONS
NEW MILTON COMPRESSOR STATION
ACCESS ROAD WITH CULVERTS



VICINITY MAP
1" = 2,000'

NAVITUS
ENGINEERING INC.

151 Windy Hill Lane
Winchester, VA 22602
Telephone: (888) 662-4185
www.navituseng.com

Engineering • Survey • Environmental • GIS

Prepared For:

ANTERO RESOURCES
981 East Washington Avenue
Ellenboro, WV 26346
(304) 869-3405

Contacts:
Bill Prehm, Project Manager
(303) 807-4436
Anthony Smith, Field Engineer
(304) 673-6196
Mike Heaster, Land Agent
(304) 871-0085

CYRUS S. KUMP
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

Designed By:
Navitus Engineering Inc.

Project Manager:
Dan Murphy, CFM
dmurphy@navituseng.com

Tax Parcel:
Map 8 Parcel 37

Location:
New Milton District, Doddridge County
West Virginia

Date: July 16, 2013

FN# ANT096

New Milton Compressor Station
Access Road with Culverts

STREAM CROSSING "A"

STORMWATER COMPUTATIONS

Sections

SECTION 1

Overview

The intent of this project is to construct a gravel access road to a compressor station and associated facilities. This project design will include a permanent stream crossing and access. The compressor station was designed by others. Toms Fork which has been classified as a Perennial stream per the wetlands report conducted by Kleinfelder dated July 15, 2013, will be crossed at station 01+92.735 of the proposed access road.

Drainage Narrative

Using the SCS Method and HEC-HMS, we determined the 1, 10, and 100-year rainfall events at the stream crossing study point. We then used HY-8 to design the culvert and to determine the base flow water surface elevation for each rainfall event. Stream Crossing "A" has a drainage area of 9345.7 Acres. Design flows are provided in the drainage calculations in Section 3.

The permanent stream crossing was designed per the West Virginia Department of Environmental Protection Erosion and Sediment Control Best Management Practice Manual 2006 edition, Section 3.21-21. Per this manual, any structure that will remain in place 6 months or longer shall be large enough to convey the flow from a 10-year frequency, 24 hour duration storm. This culvert is sized to handle the computed 10-year storm event flow of 1,790.5 cfs.

The stream crossing was also designed as a permanent structure in accordance with the U.S. Army Corps of Engineering Nationwide 14 Permit. The structure is two (2) 35'-10" x 11'-4" Contech Bridgecor #25A5 Arch Culverts that shall be bottomless to allow for aquatic passage. The culverts are 40.0 LF with a slope of 0.7%. The stream crossing will contain clean rock fill made of 2-4" aggregate 50 feet on each side of the culvert with large angular rock below. No green concrete shall be used in the crossing. The permanent stream crossing will impact 98.5' of the perennial stream, Toms Fork.

SECTION 2

NRCS Soils Report

Hydrologic Soil Group—Doddridge County, West Virginia
(Stream Crossing A)

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Political Features

- Cities

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads

MAP INFORMATION

Map Scale: 1:34,100 if printed on B size (11" × 17") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 17N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Doddridge County, West Virginia
Survey Area Data: Version 8, Apr 2, 2009

Date(s) aerial images were photographed: 8/25/2007

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Doddridge County, West Virginia (WV017)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
Ch	Chagrin silt loam	B	149.2	1.6%
Co	Cotaco silt loam	C	7.3	0.1%
GpE	Gilpin-Peabody complex, 25 to 35 percent slopes	D	5.2	0.1%
GsE	Gilpin-Peabody complex, 15 to 35 percent slopes, very stony	C	1,903.9	20.4%
GsF	Gilpin-Peabody complex, 35 to 70 percent slopes, very stony	C	5,505.4	58.9%
GuC	Gilpin-Upshur complex, 8 to 15 percent slopes	D	167.9	1.8%
GuD	Gilpin-Upshur complex, 15 to 25 percent slopes	D	814.4	8.7%
Ka	Kanawha loam	B	32.2	0.3%
Me	Melvin silt loam	D	4.6	0.0%
Se	Sensabaugh silt loam	B	188.9	2.0%
SeB	Sensabaugh silt loam, 3 to 8 percent slopes, rarely flooded	B	451.6	4.8%
VaC	Vandalia silt loam, 8 to 15 percent slopes	D	3.2	0.0%
VaD	Vandalia silt loam, 15 to 25 percent slopes	D	48.9	0.5%
VaE	Vandalia silt loam, 25 to 35 percent slopes	D	7.9	0.1%
VsE	Vandalia silt loam, 15 to 35 percent slopes, very stony	D	54.9	0.6%
Totals for Area of Interest			**9,345.7**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

SECTION 3

SCS TR-55
Drainage Computations

Project: New Milton Simulation Run: Existing

Start of Run:	11Jul2013, 00:00	Basin Model:	Existing
End of Run:	12Jul2013, 00:05	Meteorologic Model:	2 YR
Compute Time:	11Jul2013, 08:20	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Toms Fork	12.832	696	11Jul2013, 14:25	304.9
Reach-1	12.832	696	11Jul2013, 14:55	299.7
Middle Toms Fork	1.77	167.5	11Jul2013, 13:00	44.2
Junction-1	14.602	753.3	11Jul2013, 14:50	343.9
Reach-2	14.602	753.2	11Jul2013, 15:10	340
Lower Toms Fork	0.944	116.4	11Jul2013, 12:40	23.9
Downstream	15.546	775.9	11Jul2013, 15:10	363.9

Project: New Milton Simulation Run: Existing

Start of Run:	11Jul2013, 00:00	Basin Model:	Existing
End of Run:	12Jul2013, 00:05	Meteorologic Model:	10 YR
Compute Time:	11Jul2013, 08:20	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Toms Fork	12.832	1668.9	11Jul2013, 14:15	659.9
Reach-1	12.832	1668.7	11Jul2013, 14:45	650.7
Middle Toms Fork	1.77	417.2	11Jul2013, 12:55	94.8
Junction-1	14.602	1790.6	11Jul2013, 14:40	745.5
Reach-2	14.602	1790.5	11Jul2013, 15:00	738.6
Lower Toms Fork	0.944	293.8	11Jul2013, 12:35	51.1
Downstream	15.546	1835.4	11Jul2013, 15:00	789.7

Project: New Milton Simulation Run: Existing

Start of Run:	11Jul2013, 00:00	Basin Model:	Existing
End of Run:	12Jul2013, 00:05	Meteorologic Model:	100 YR
Compute Time:	11Jul2013, 08:20	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Toms Fork	12.832	3765.8	11Jul2013, 14:10	1397
Reach-1	12.832	3765	11Jul2013, 14:40	1380.7
Middle Toms Fork	1.77	949.1	11Jul2013, 12:55	199.5
Junction-1	14.602	4015.3	11Jul2013, 14:35	1580.2
Reach-2	14.602	4015.1	11Jul2013, 14:55	1567.8
Lower Toms Fork	0.944	666.8	11Jul2013, 12:35	107.3
Downstream	15.546	4101.3	11Jul2013, 14:55	1675.1

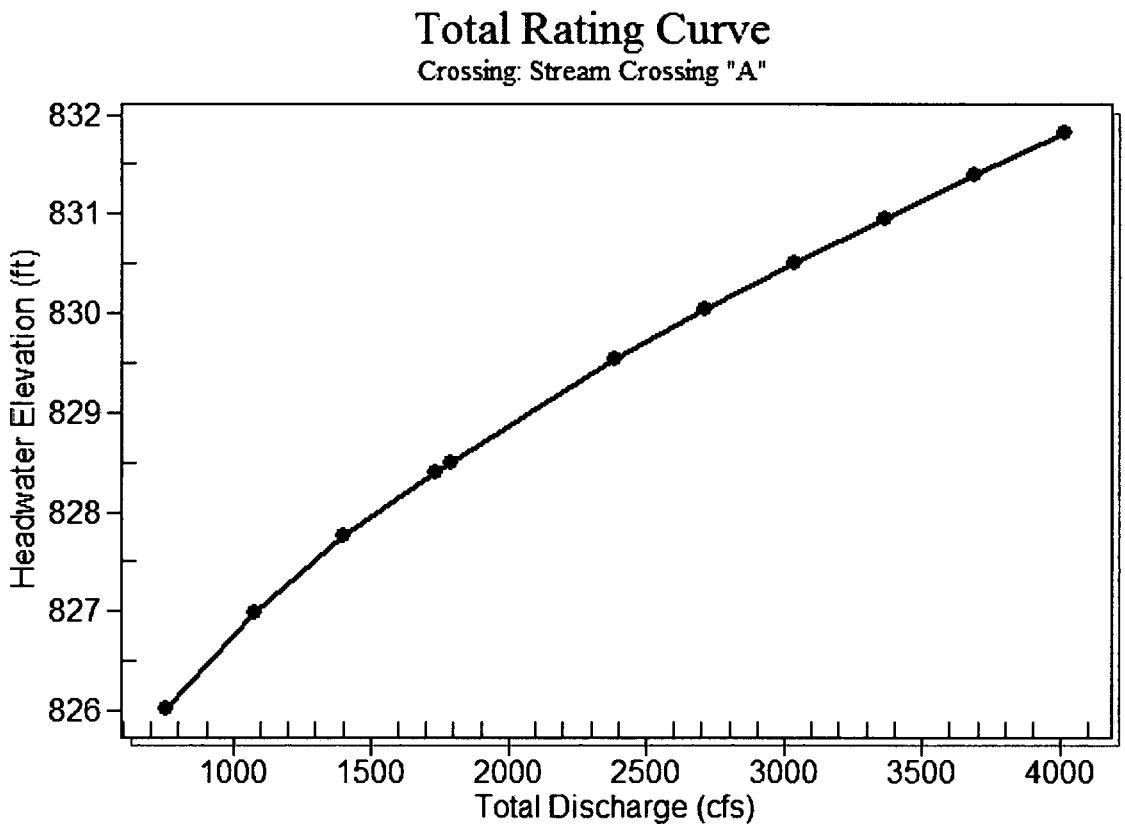
SECTION 4

HY-8 Culvert Analysis Report

HY-8 Culvert Analysis Report

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
826.03	753.30	753.30	0.00	1
826.99	1079.50	1079.50	0.00	1
827.76	1405.70	1405.70	0.00	1
828.39	1731.90	1731.90	0.00	1
828.50	1790.60	1790.60	0.00	1
829.53	2384.30	2384.30	0.00	1
830.03	2710.50	2710.50	0.00	1
830.51	3036.70	3036.70	0.00	1
830.96	3362.90	3362.90	0.00	1
831.40	3689.10	3689.10	0.00	1
831.83	4015.30	4015.30	0.00	1
838.58	8121.08	8121.08	0.00	Overtopping

Table 1 - Summary of Culvert Flows at Crossing: Stream Crossing "A"



Rating Curve Plot for Crossing: Stream Crossing "A"

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
753.30	753.30	826.03	2.565	3.371	3-M1t	1.988	1.493	3.325	3.435	3.271	4.538
1079.50	1079.50	826.99	3.246	4.332	3-M1t	2.474	1.936	4.215	4.325	3.719	4.688
1405.70	1405.70	827.76	3.875	5.099	3-M1t	2.939	2.308	4.884	4.994	4.211	4.789
1731.90	1731.90	828.39	4.459	5.730	3-M1t	3.358	2.648	5.398	5.508	4.734	4.930
1790.60	1790.60	828.50	4.559	5.836	3-M1t	3.429	2.709	5.481	5.591	4.828	4.956
2384.30	2384.30	829.53	5.505	6.870	3-M1t	4.145	3.293	6.277	6.387	5.720	5.060
2710.50	2710.50	830.03	6.002	7.371	3-M1t	4.518	3.578	6.626	6.736	6.219	5.133
3036.70	3036.70	830.51	6.500	7.846	3-M1t	4.892	3.863	6.933	7.043	6.719	5.213
3362.90	3362.90	830.96	6.998	8.297	3-M1t	5.269	4.148	7.210	7.320	7.217	5.295
3689.10	3689.10	831.40	7.492	8.736	3-M1t	5.660	4.388	7.464	7.574	7.714	5.376
4015.30	4015.30	831.83	7.915	9.168	3-M1t	6.052	4.627	7.686	7.796	8.219	5.476

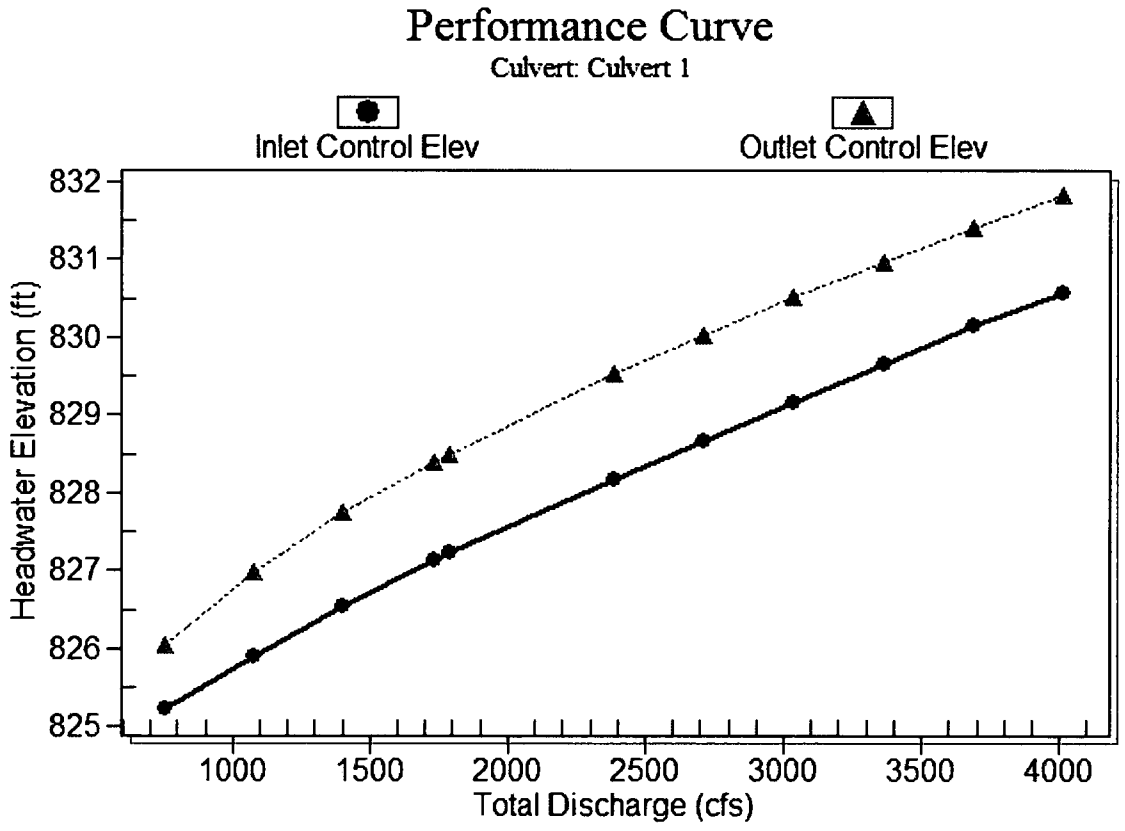
Table 2 - Culvert Summary Table: Culvert 1

****

Inlet Elevation (invert): 822.66 ft, Outlet Elevation (invert): 822.38 ft

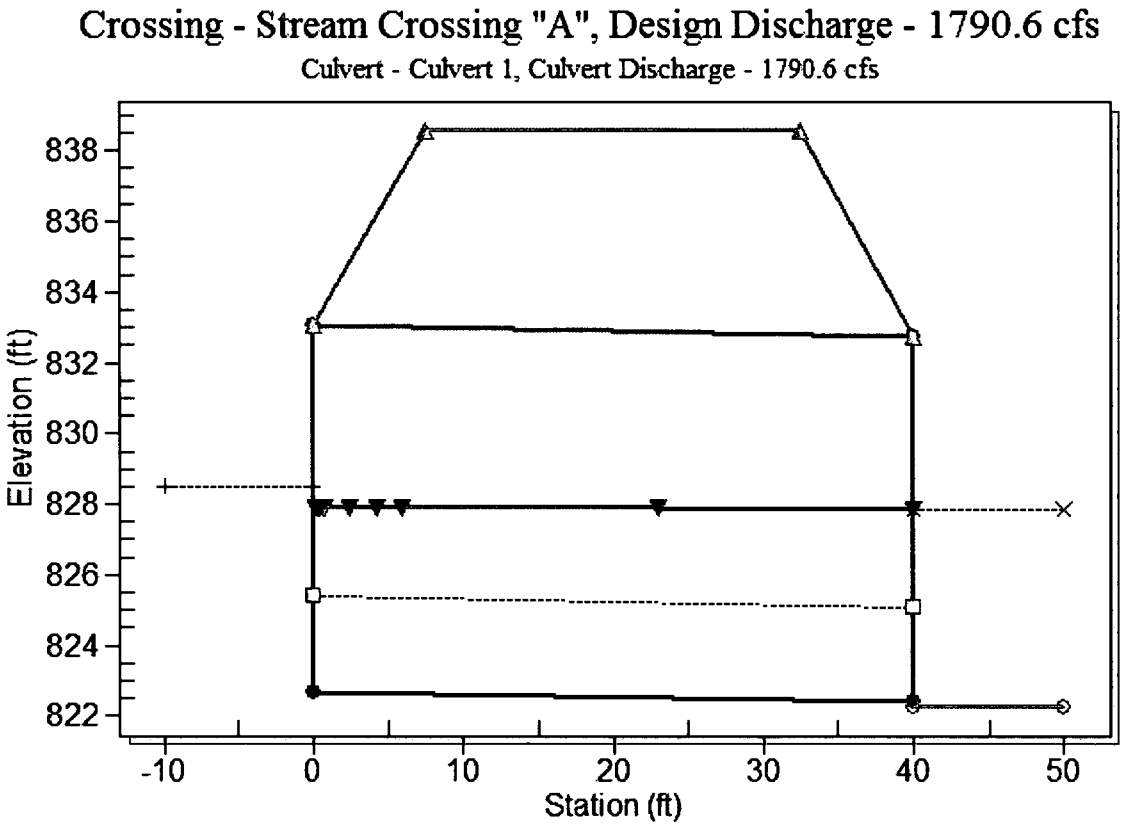
Culvert Length: 40.00 ft, Culvert Slope: 0.0070

****



Culvert Performance Curve Plot: Culvert 1

Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 822.66 ft

Outlet Station: 40.00 ft

Outlet Elevation: 822.38 ft

Number of Barrels: 2

Culvert Data Summary - Culvert 1

Barrel Shape: User Defined

Barrel Span: 34.89 ft

Barrel Rise: 10.38 ft

Barrel Material: Corrugated Metal Riveted or Welded

Embedment: 0.00 in

Barrel Manning's n: 0.0240 (top and sides)

Manning's n: 0.0350 (bottom)

Inlet Type: Conventional

Inlet Edge Condition: Square Edge with Headwall

Inlet Depression: NONE

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
753.30	825.70	3.43	4.54	0.71	0.50
1079.50	826.60	4.33	4.69	0.89	0.50
1405.70	827.26	4.99	4.79	1.03	0.50
1731.90	827.78	5.51	4.93	1.13	0.51
1790.60	827.86	5.59	4.96	1.15	0.51
2384.30	828.66	6.39	5.06	1.32	0.51
2710.50	829.01	6.74	5.13	1.39	0.51
3036.70	829.31	7.04	5.21	1.45	0.52
3362.90	829.59	7.32	5.29	1.51	0.52
3689.10	829.84	7.57	5.38	1.56	0.52
4015.30	830.07	7.80	5.48	1.61	0.52

Table 3 - Downstream Channel Rating Curve (Crossing: Stream Crossing "A")

Tailwater Channel Data - Stream Crossing "A"

Tailwater Channel Option: Irregular Channel

Channel Slope: 0.0033

User Defined Channel Cross-Section:

Coord No.	Station (ft)	Elevation (ft)	Manning's n
1	0.00	830.62	0.0350
2	9.95	830.00	0.0350
3	93.44	828.00	0.0350
4	149.89	826.00	0.0350
5	152.58	824.00	0.0350
6	154.39	822.27	0.0350
7	177.13	822.38	0.0350
8	194.49	822.46	0.0350
9	199.90	824.00	0.0350
10	216.57	826.00	0.0350
11	220.16	828.00	0.0350
12	223.64	830.00	0.0350
13	235.94	832.00	0.0000

Roadway Data for Crossing: Stream Crossing "A"

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

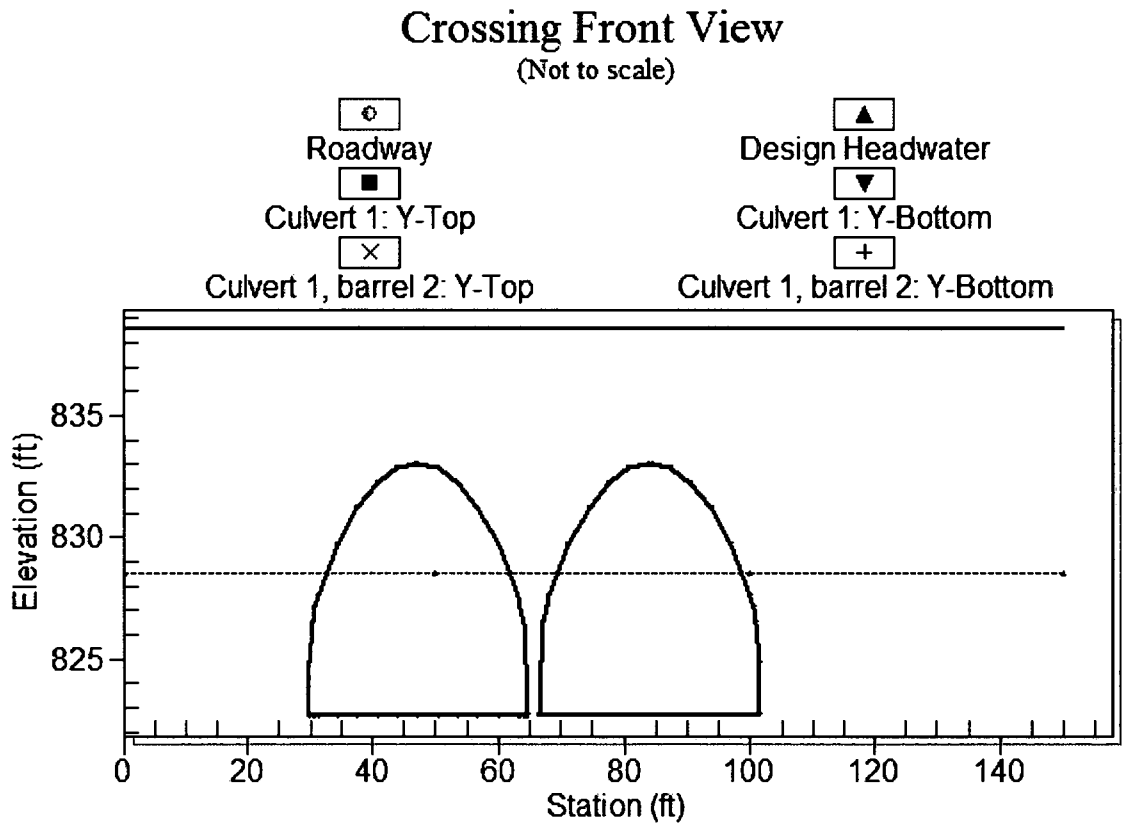
Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	838.58
1	50.00	838.58
2	100.00	838.58
3	150.00	838.58

Roadway Surface: Gravel

Roadway Top Width: 25.00 ft

Crossing Front View (Roadway Profile): Stream Crossing "A"



SECTION 5

Stream Crossing "A" Details

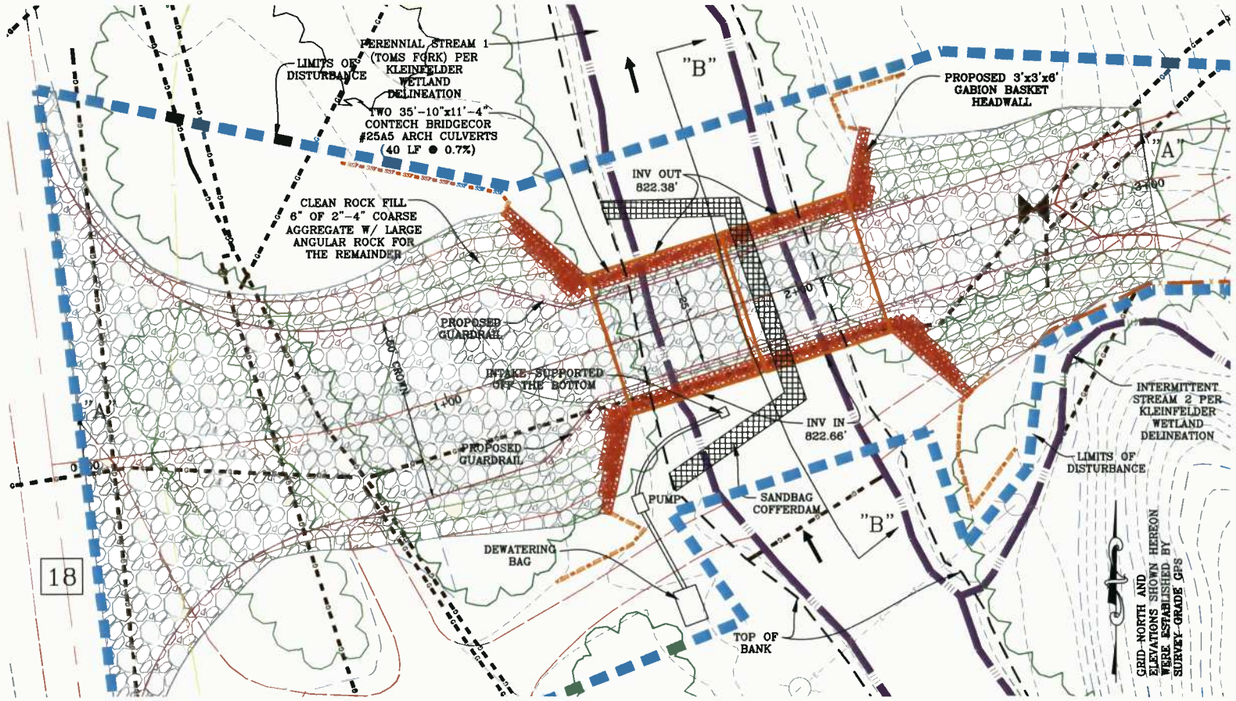
GENERAL STREAM CROSSING NOTES:

1) 2" TO 4" COARSE AGGREGATE OR LARGER SHALL BE USED TO FORM THE FIRST 6" OF FILL FOR THE CROSSING. THE REMAINDER OF MATERIAL SHALL BE ONLY LARGE ANGULAR DURABLE ROCK. "DO NOT USE ERODIBLE MATERIAL FOR CONSTRUCTION OF THE CROSSING."
2) IF MULTIPLE CULVERTS ARE USED, THEY SHALL BE SEPARATED BY AT LEAST 18 INCHES OF COMPACTED AGGREGATE FILL.
3) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
4) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
5) GABION WALLS ON THE UPSTREAM AND DOWNSTREAM SIDE OF THE CULVERT INSTALLATION SHALL BE INSTALLED TO REDUCE STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
6) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
7) GREEN CONCRETE SHALL NOT BE PLACED IN CONTACT WITH FLOWING WATER.
8) WHEN THE CROSSING HAS SERVED ITS PURPOSE, ALL STRUCTURES INCLUDING CULVERTS, BEDDING, AND FILTER CLOTH SHALL BE REMOVED. REMOVAL OF THE STRUCTURE AND CLEAN UP OF THE AREA SHOULD BE ACCOMPLISHED WITHOUT CONSTRUCTION EQUIPMENT WORKING IN THE WATERWAY CHANNEL. UPON REMOVAL OF THE STRUCTURE, THE STREAM BANK SHALL IMMEDIATELY BE STABILIZED.
9) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
10) THE CROSSING MUST BE INSPECTED AFTER EVERY RAIN EVENT OF 0.5 INCHES OR MORE AND ONCE A WEEK TO ENSURE THAT THE CULVERTS, STREAMBED, AND STREAM BANKS ARE MAINTAINED AND NOT DAMAGED. NEVER ALLOW THE CULVERTS TO BECOME CLOGGED WITH DEBRIS AND REMOVE ANY OBSTRUCTIONS IMMEDIATELY.
11) FLUSHING IS NOT AN APPROVED METHOD TO BE UTILIZED FOR CULVERT CLEANOUT.

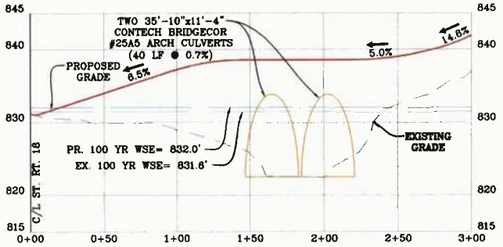
PUMP AND DEWATERING NOTES:

1) CONSTRUCTION SHOULD BE PERFORMED DURING LOW FLOW PERIODS.
2) PUMP(S) AND DEWATERING BAG SHOULD BE SUFFICIENTLY LARGE TO CONTAIN THE ENTIRE STREAM AREA BEING DAMMED.
3) THE COFFERDAM CONSTRUCTED MUST BE IMPERVIOUS TO WATER.
4) THE INLET OF THE PUMP(S) IS TO BE SUSPENDED ABOVE THE STREAMBED IN ORDER TO PREVENT SUCKING MUD AND SEDIMENT.

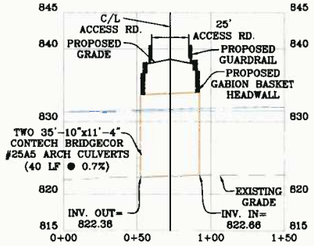
STREAM CROSSING "A" DETAILS



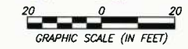
STREAM CROSSING "A" SECTIONS



CROSS SECTION "A-A"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

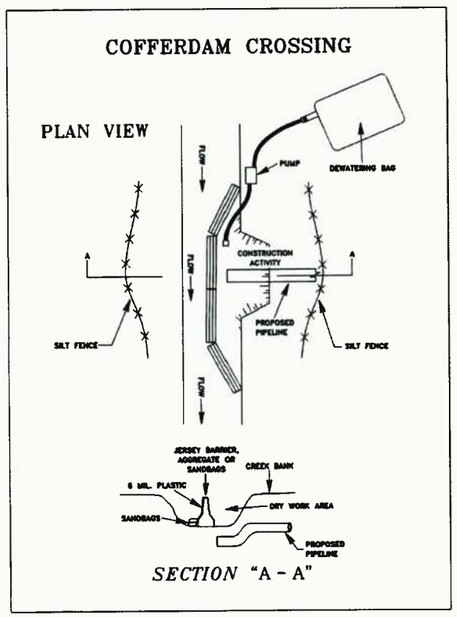


CROSS SECTION "B-B"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

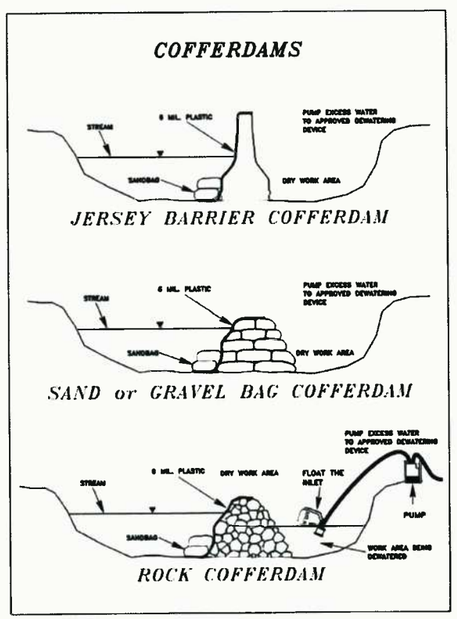


NOTE:
1. SEE STREAM CROSSING REPORT AND FLOODPLAIN ANALYSIS OF TOMS FORK BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATIONS.
2. ANTERO RESOURCES SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "A".

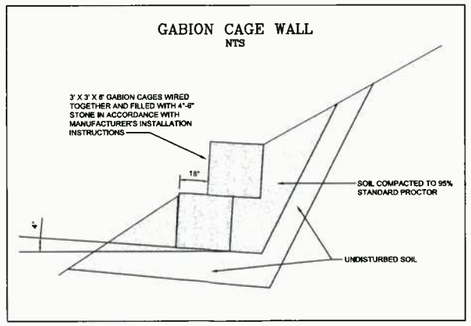
COFFERDAM CROSSING



COFFERDAMS



GABION CAGE WALL
NTS



LEGEND

X-SECTION GRID INDEX	
X-SECTION GRID INTERMEDIATE	
X-SECTION PROPOSED GRADE	
X-SECTION EXISTING GRADE	
X-SECTION WATER SURFACE	
MATCHLINE	

LEGEND

EX. INDEX CONTOUR	700	PROP. INDEX CONTOUR	700
EX. INTERMEDIATE CONTOUR		PROP. INTERMEDIATE CONTOUR	
EX. PROPERTY LINE		PROP. INDEX CONTOUR (ROAD)	700
EX. ROAD EDGE OF GRAVEL/DIRT		PROP. INTERMEDIATE CTR (ROAD)	
EX. ROAD EDGE OF PAVEMENT		PROP. LIMITS OF DISTURBANCE	
EX. ROAD CENTERLINE		PROP. WELL HEAD	
EX. DITCHLINE		PROP. PERIMETER SAFETY FENCE	X X
EX. CULVERT		PROP. ACCESS GATE WITH EMERGENCY LIFELINE	
EX. FENCELINE		PROP. ROAD EDGE OF GRAVEL	
EX. OVERHEAD UTILITY		PROP. ROAD CENTERLINE	
EX. POWER POLE/GUY WIRE		PROP. V-DITCH W/ CHECK DAMS	
EX. GASLINE	G	PROP. CULVERT W/ RIP-RAP	
EX. TREELINE		PROP. COMPOST FILTER SOCK	X
EX. DELINEATED STREAM		PROP. SUPER SILT FENCE	SSF SSF
EX. DELINEATED WETLAND		MATCHLINE	
EX. BUILDING		BRUSH PILE SEDIMENT BARRIER	
100' WETLAND/STREAM BUFFER			
DELINEATION STUDY AREA			

Engineering Survey Environmental GIS
NAVITUS ENGINEERING INC.
151 Windy Hill Lane
Weston, West Virginia 26452
Telephone: (888) 662-4185
www.navituseng.com

REVISION | DATE

ANTERO RESOURCES
THIS DOCUMENT WAS PREPARED FOR ANTERO RESOURCES CORPORATION

STREAM CROSSING "A" DETAILS

NEW MILTON
COMPRESSOR STATION ACCESS ROAD
NEW MILTON DISTRICT
DODDRIDGE COUNTY, WEST VIRGINIA

STATE OF WEST VIRGINIA — PROFESSIONAL ENGINEER — 07/16/2013

DATE: 07/16/2013
SCALE: AS SHOWN
SHEET 14 OF 20

NEW MILTON COMPRESSOR STATION ACCESS ROAD

SITE DESIGN & CONSTRUCTION PLAN, EROSION & SEDIMENT CONTROL PLANS

NEW MILTON DISTRICT, DODDRIDGE COUNTY, WEST VIRGINIA
TOMS FORK & MEATHOUSE FORK WATERSHEDS

LOCATION COORDINATES

ACCESS ROAD ENTRANCE
LATITUDE: 39.225844 LONGITUDE: -80.698042 (NAD 83)
N 4341882.65 E 526063.78 (UTM NAD83, ZONE 17 METERS)

GENERAL DESCRIPTION

THE ACCESS ROAD(S) ARE BEING CONSTRUCTED TO AID IN THE DEVELOPMENT OF A NATURAL GAS COMPRESSOR STATION. THE COMPRESSOR STATION PAD SITE IS BY OTHERS.

FLOODPLAIN NOTE

THE PROPOSED SITE IS LOCATED WITHIN FEMA FLOOD ZONE "X" PER FEMA FLOOD MAPS #54017C0230C & #54017C0235C. THE PROPOSED SITE ENTRANCE IS LOCATED IN FEMA FLOOD ZONE "AE" PER FEMA FLOOD MAP #54017C0230C.

MISS UTILITY STATEMENT

ANTERO RESOURCES CORPORATION WILL NOTIFY MISS UTILITY OF WEST VIRGINIA FOR THE LOCATING OF UTILITIES PRIOR TO THIS PROJECT DESIGN; TICKET #1319350188.
IN ADDITION, MISS UTILITY WILL BE CONTACTED BY THE CONTRACTOR PRIOR TO THE START OF CONSTRUCTION FOR THIS PROJECT.

ENTRANCE PERMIT

ANTERO RESOURCES CORPORATION WILL OBTAIN AN ENCROACHMENT PERMIT (FORM MM-109) FROM THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS, PRIOR TO COMMENCEMENT OF CONSTRUCTION ACTIVITIES.

GEOTECHNICAL NOTE

NO SOIL STUDIES OR SUBSURFACE INVESTIGATIONS WERE PERFORMED AND ANALYZED FOR THE DESIGN OF THIS SITE. A SUBSURFACE INVESTIGATION SHALL BE PERFORMED PRIOR TO CONSTRUCTION ACTIVITES.

ENVIRONMENTAL NOTES

WETLAND DELINEATIONS WERE PERFORMED JULY, 2013 BY KLEINFELDER TO REVIEW THE SITE FOR WATERS AND WETLANDS THAT ARE MOST LIKELY WITHIN THE REGULATORY PURVIEW OF THE U.S. ARMY CORPS OF ENGINEERS (USACE) AND/OR THE WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION (WVDEP). THE JULY 15, 2013 JURISDICTIONAL FEATURES MAP WAS PREPARED BY KLEINFELDER AND SUMMARIZES THE RESULTS OF THE FIELD DELINEATION. THE MAP DOES NOT, IN ANY WAY, REPRESENT A JURISDICTIONAL DETERMINATION OF THE LANDWARD LIMITS OF WATERS AND WETLANDS WHICH MAY BE REGULATED BY THE USACE OR THE WVDEP. IT IS STRONGLY RECOMMENDED THAT THE AFOREMENTIONED AGENCIES BE CONSULTED IN AN EFFORT TO GAIN WRITTEN CONFIRMATION OF THE DELINEATION SHOWN ON THIS EXHIBIT PRIOR TO ENGAGING CONSTRUCTION ON THE PROPERTY DESCRIBED HEREIN. THE DEVELOPER SHALL OBTAIN THE APPROPRIATE PERMITS FROM THE FEDERAL AND/OR STATE REGULATORY AGENCIES PRIOR TO ANY PROPOSED IMPACTS TO WATERS OF THE U.S., INCLUDING WETLAND FILLS AND STREAM CROSSINGS.

NEW MILTON COMPRESSOR STATION PERENNIAL STREAM IMPACT (LINEAR FEET)				
Stream and Impact Cause	Culvert (LF)	Inlets/Outlets Structures (LF)	Const. Disturb to LOD (LF)	Total Impact (LF)
Stream 1 (Access Rd "A")	40	0	58.5	98.5
			Total	98.5

PROJECT CONTACTS

OPERATOR:
ANTERO RESOURCES APPALACHIAN CORPORATION
981 EAST WASHINGTON AVENUE
ELLENBORO, WV 26346
PHONE: (304) 869-3405
FAX: (304) 869-3408

ELI WAGONER - ENVIRONMENTAL ENGINEER
OFFICE: (304) 622-3842, EXT. 311 CELL: (304) 476-9770

ANTHONY SMITH - FIELD ENGINEER
OFFICE: (304) 869-3405 CELL: (304) 673-8196

BILL PREHM - PROJECT MANAGER
CELL: (303) 807-4436

MICK HEASTER - LAND AGENT
CELL: (304) 871-0085

ENGINEER/SURVEYOR:
NAVITUS ENGINEERING, INC.
CYRUS S. KUMP, PE - PROJECT MANAGER/ENGINEER
OFFICE: (888) 662-4185 CELL: (540) 686-6747

ENVIRONMENTAL:
KLEINFELDER
RUSSELL PERKINS - PROJECT MANAGER
OFFICE: (410) 850-0404 CELL: (443) 857-4545

RESTRICTIONS NOTES:

1. THERE IS A PERENNIAL STREAM IMPACT THAT WILL NEED TO BE PERMITTED BY THE APPROPRIATE AGENCIES.

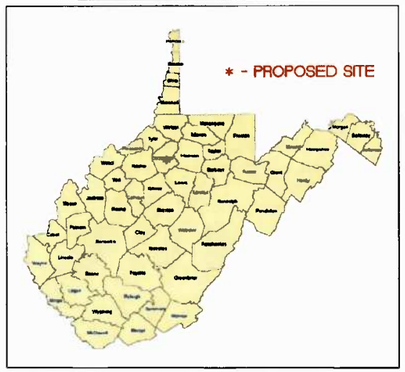
USGS 7.5 NEW MILTON QUAD MAP

2000 0 2000
SCALE: 1" = 2000'

WEST VIRGINIA STATE PLANE COORDINATE SYSTEM
NORTH ZONE, NAD83
ELEVATION BASED ON NAVD88
ESTABLISHED BY SURVEY GRADE GPS & OPUS POST-PROCESSING

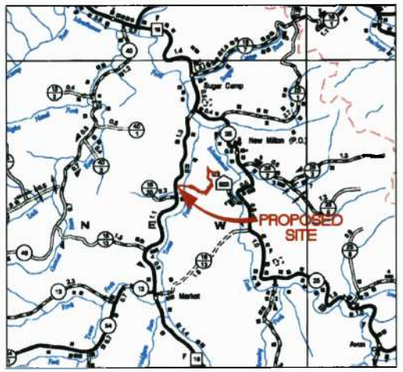
SHEET INDEX

WEST VIRGINIA COUNTY MAP



(NOT TO SCALE)

WVDOH COUNTY ROAD MAP



5000 0 5000
SCALE: 1" = 5000'

NEW MILTON COMPRESSOR STATION ACCESS ROAD LIMITS OF DISTURBANCE AREA (AC)	
Total Site	
Access Road "A" (4419')	**13.41**
Excess/Topsoil Material Stockpiles	3.62
Total Affected Area	**17.03**
Total Wooded Acres Disturbed	12.18
Impacts to Kathryn H. Marshall, Clinton D. & Kevin M. Means, Marvin L. Phillips, Ruth E. Phillips, William C. Phillips, Laverne H. Williams TM 8-37	
Access Road "A" (1081')	3.46
Total Affected Area	**3.46**
Total Wooded Acres Disturbed	2.45
Impacts to Comstock Irrevocable Trust & Silvestre Irrevocable Trust TM 8-39	
Access Road "A" (1023')	3.76
Excess/Topsoil Material Stockpiles	1.30
Total Affected Area	**5.06**
Total Wooded Acres Disturbed	4.28
Impacts to Roger A., II & Stacey L. McClain TM 8-40	
Access Road "A" (2315')	6.19
Excess/Topsoil Material Stockpiles	2.32
Total Affected Area	**8.51**
Total Wooded Acres Disturbed	5.45

MISS Utility of West Virginia
1-800-245-4848
West Virginia State Law
(Section XIV: Chapter 24-C)
Requires that you call two business days before you dig in the state of West Virginia.
IT'S THE LAW!!

NAVITUS ENGINEERING INC.
Engineering Survey Environmental GIS
151 Windy Hill Lane
Winchester, Virginia 22602
Telephone: (888) 662-4185
www.navituseng.com

DATE
REVISION

ANTERO RESOURCES
THIS DOCUMENT WAS PREPARED FOR ANTERO RESOURCES CORPORATION

COVER SHEET
NEW MILTON
COMPRESSOR STATION ACCESS ROAD
NEW MILTON DISTRICT
DODDRIDGE COUNTY, WEST VIRGINIA

CYRUS S. KUMP
REGISTERED
19378
STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER
07/16/2013

DATE: 07/16/2013
SCALE: AS SHOWN
SHEET 1 OF 20

CONSTRUCTION AND E&S CONTROL NOTES

CONSTRUCTION NOTES:

1. THE CONTRACTOR IS TO VERIFY FIELD CONDITIONS PRIOR TO AND DURING CONSTRUCTION AND WILL NOTIFY NAVITUS ENGINEERING AT (888) 662-4185 IMMEDIATELY OF ANY DISCREPANCIES BETWEEN ACTUAL FIELD CONDITIONS AND THE APPROVED PLAN. ANY WORK PERFORMED BY THE CONTRACTOR AFTER THE FINDING OF SUCH DISCREPANCIES SHALL BE DONE AT THE CONTRACTOR'S RISK.
2. METHODS AND MATERIALS USED IN THE CONSTRUCTION OF THE IMPROVEMENTS HEREIN SHALL CONFORM TO THE CURRENT COUNTY CONSTRUCTION STANDARDS AND SPECIFICATIONS AND/OR CURRENT WV DEP EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE MANUAL STANDARDS AND SPECIFICATIONS. SHOULD A CONFLICT BETWEEN THE DESIGN, SPECIFICATIONS, AND PLANS OCCUR, THE MOST STRINGENT REQUIREMENT WILL APPLY. THE APPROVAL OF THESE PLANS IN NO WAY RELIEVES THE DEVELOPER OR HIS AGENT OF THE RESPONSIBILITIES CONTAINED IN THE WV DEP EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE MANUAL.
3. AN APPROVED SET OF PLANS AND ALL APPLICABLE PERMITS MUST BE AVAILABLE AT THE CONSTRUCTION SITE. ALSO, A REPRESENTATIVE OF THE DEVELOPER MUST BE AVAILABLE AT ALL TIMES.
4. THE CONTRACTOR SHALL PROVIDE ADEQUATE MEANS OF CLEANING MUD FROM TRUCKS AND/OR OTHER EQUIPMENT PRIOR TO ENTERING PUBLIC STREETS, AND IT IS THE CONTRACTOR'S RESPONSIBILITY TO CLEAN STREETS, ALLAY DUST, AND TO TAKE WHATEVER MEASURES ARE NECESSARY TO INSURE THAT THE STREETS ARE MAINTAINED IN A CLEAN, MUD AND DUST FREE CONDITION AT ALL TIMES.
5. THE LOCATION OF EXISTING UTILITIES SHOWN IN THESE PLANS ARE FROM FIELD LOCATIONS. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO VERIFY THE EXACT HORIZONTAL AND VERTICAL LOCATION OF ALL EXISTING UTILITIES AS NEEDED PRIOR TO CONSTRUCTION. THE CONTRACTOR SHALL INFORM THE ENGINEER OF ANY CONFLICTS ARISING FROM HIS EXISTING UTILITY VERIFICATION AND THE PROPOSED CONSTRUCTION.
6. THE CONTRACTOR SHALL PROVIDE NOTIFICATION TO THE APPROPRIATE UTILITY COMPANY PRIOR TO CONSTRUCTION OF WATER AND/OR GAS PIPE LINES. INFORMATION SHOULD ALSO BE OBTAINED FROM THE APPROPRIATE AUTHORITY CONCERNING PERMITS, CUT SHEETS, AND CONNECTIONS TO EXISTING LINES.
7. THE CONTRACTOR WILL BE RESPONSIBLE FOR THE REPAIR OF ANY DAMAGES TO THE EXISTING STREETS AND UTILITIES WHICH OCCURS AS A RESULT OF HIS CONSTRUCTION PROJECT WITHIN OR CONTIGUOUS TO THE EXISTING RIGHT-OF-WAY.
8. WHEN GRADING IS PROPOSED WITHIN EASEMENTS OF UTILITIES, LETTERS OF PERMISSION FROM ALL INVOLVED COMPANIES MUST BE OBTAINED PRIOR TO GRADING AND/OR SITE DEVELOPMENT.
9. THE DEVELOPER WILL BE RESPONSIBLE FOR THE RELOCATION OF ANY UTILITIES WHICH IS REQUIRED AS A RESULT OF HIS PROJECT. THE RELOCATION SHOULD BE DONE PRIOR TO CONSTRUCTION.
10. THESE PLANS IDENTIFY THE LOCATION OF ALL KNOWN GRAVESITES. GRAVESITES SHOWN ON THIS PLAN WILL BE PROTECTED IN ACCORDANCE WITH STATE LAW. IN THE EVENT GRAVESITES ARE DISCOVERED DURING CONSTRUCTION, THE OWNER AND ENGINEER MUST BE NOTIFIED IMMEDIATELY.
11. THE CONTRACTOR(S) SHALL NOTIFY OPERATORS WHO MAINTAIN UNDERGROUND UTILITY LINES IN THE AREA OF PROPOSED EXCAVATING OR BLASTING AT LEAST TWO (2) WORKING DAYS, BUT NOT MORE THAN TEN (10) WORKING DAYS, PRIOR TO COMMENCEMENT OF EXCAVATION OR DEMOLITION.
12. CONTRACTOR TO CONTACT OPERATOR AND ENGINEER IF GROUNDWATER IS ENCOUNTERED DURING CONSTRUCTION.
13. THE CONTRACTOR SHALL SCHEDULE A PRE-CONSTRUCTION MEETING WITH THE EROSION AND SEDIMENT CONTROL INSPECTOR 2 DAYS PRIOR TO THE START OF CONSTRUCTION.
14. THE CONTRACTOR IS RESPONSIBLE FOR ALL FILL MATERIAL TESTING REQUIRED DURING THE CONSTRUCTION OF THIS PROJECT. ALL MATERIAL TESTS SHALL BE CONDUCTED BY A CERTIFIED MATERIALS TESTING LABORATORY AND A CERTIFICATION OF THE MATERIALS TESTED SHALL BE PROVIDED BY A LICENSED PROFESSIONAL ENGINEER REPRESENTING THE LABORATORY. ALL TEST RESULTS SHALL BE SUBMITTED TO THE ENGINEER CERTIFYING THE CONSTRUCTED FACILITY. FAILURE TO CONDUCT THE DENSITY TEST SHALL BE CAUSE FOR NON-ACCEPTANCE OF THE CONSTRUCTED FACILITY.
15. SATISFACTORY MATERIALS FOR USE AS FILL FOR PAD AREAS INCLUDE MATERIALS CLASSIFIED IN ASTM D-2487 AS GW, GP, GM, GC, SW, SP, SM, SC, ML, AND CL GROUPS. MOISTURE CONTENT WILL BE CONTROLLED IN ACCORDANCE WITH THE STANDARD PROCTOR TEST (ASTM-D698) RESULTS. GENERALLY, UNSATISFACTORY MATERIALS INCLUDE MATERIALS CLASSIFIED IN ASTM D-2487 AS PT, CH, MH, OL, OH, AND ANY SOIL TOO WET TO FACILITATE COMPACTION. CH AND MH SOILS MAY BE USED SUBJECT TO APPROVAL OF THE ENGINEER. SOILS SHALL HAVE A MINIMUM DRY DENSITY OF 92LB/CF PER ASTM D-698 AND SHALL HAVE A PLASTICITY INDEX LESS THAN 17.
16. CONTRACTOR SHALL SUBMIT A GENERIC GROUNDWATER PROTECTION PLAN (GPP) TO THE WV DEP GROUNDWATER PROGRAM. THE GROUNDWATER PROTECTION PLAN SHALL BE ADHERED TO DURING CONSTRUCTION.
17. THE CONTRACTOR IS RESPONSIBLE FOR CONSTRUCTING THE SITE IN ACCORDANCE WITH THE DESIGN PLANS AND CONSTRUCTION DOCUMENTS AND THE SCOPE OF WORK SHALL CONFORM WITH THE GRADES, BERMS, DEPTHS, DIMENSIONS, ETC. SHOWN HEREON.

SITE CLEANUP & RECYCLE PROGRAM

1. GARBAGE, FUELS OR ANY SUBSTANCE HARMFUL TO HUMAN, AQUATIC OR FISH LIFE, WILL BE PREVENTED FROM ENTERING SPRINGS, STREAMS, PONDS, LAKES, WETLANDS OR ANY WATER COURSE OR WATER BODY.
2. OILS, FUELS, LUBRICANTS AND COOLANTS WILL BE PLACED IN SUITABLE CONTAINERS AND DISPOSED PROPERLY.
3. ALL TRASH AND GARBAGE WILL BE COLLECTED AND DISPOSED PROPERLY.
4. ALL SEDIMENT REMOVED FROM SEDIMENT CAPTURING DEVICES SHALL BE PLACED ON THE TOPSOIL STOCKPILE, THEN SEEDED AND MULCHED, AS NECESSARY. ALTERNATIVELY, THE REMOVED SEDIMENT CAN BE TRANSPORTED TO A SITE WITH AN APPROVED PERMIT.
5. ALL POLLUTION AND EMERGENCY SPILLS SHALL BE IMMEDIATELY REPORTED TO THE WVDEP OFFICE OF OIL AND GAS. (EMERGENCY #1-800-642-3074)

EROSION AND SEDIMENT CONTROL NARRATIVE

PROJECT DESCRIPTION: THE PURPOSE OF THIS PROJECT IS TO CONSTRUCT AN ACCESS ROAD(S) TO AID IN THE DEVELOPMENT OF A NATURAL GAS COMPRESSOR STATION. THE ACCESS ROAD ENTRANCE TO THE PROPOSED SITE IS LOCATED ON THE EAST SIDE OF WV. RT. 18, 1.2 MILES SOUTH OF THE INTERSECTION OF WV RT. 18 & CO RT. 25 IN NEW MILTON DISTRICT, DODDRIDGE COUNTY, WEST VIRGINIA. THE TOTAL APPROXIMATE LAND DISTURBANCE ASSOCIATED WITH THIS PROJECT IS 17.03 ACRES.

EXISTING SITE CONDITIONS: THE EXISTING SITE IS APPROXIMATELY 71.5% WOODED. THE TOPOGRAPHY RANGES FROM MODERATE TO STEEP TERRAIN (2% TO 60% SLOPES). PRESENT ON SITE ARE EXISTING GAS PIPELINES AND EXISTING GAS WELLS. ALSO PRESENT ARE ACCESS ROADS, STRUCTURES, OVERHEAD UTILITIES, TWO PEM WETLANDS, ONE PERENNIAL STREAM, ONE INTERMITTENT STREAM, FIVE EPHEMERAL STREAMS, AND ONE POND. THE SITE IS LOCATED ON A RIDGE AND DRAINS TO TOMS FORK & MEATHOUSE FORK. NO EROSION WAS NOTICED ON SITE.

ADJACENT PROPERTY: THE SITE IS BORDERED BY FORESTED LANDS ON ALL SIDES.

CRITICAL AREAS: THE AREA(S) SHOWN ALONG THE FIELD DELINEATED STREAMS, WETLANDS, AND PONDS, AS SHOWN ON THE PLANS, ARE DESIGNATED AS CRITICAL AREA(S), IF PRESENT. ALL 3:1 SLOPES AND STEEPER, DITCHES, AND OTHER CONTROLS SHALL BE CONSIDERED CRITICAL EROSION AREAS. THESE AREAS SHALL BE MONITORED AND MAINTAINED DAILY AND AFTER EACH RAINFALL OF 0.5 INCHES OR GREATER. COMPOST FILTER SOCKS ARE TO BE USED TO PROTECT THESE FIELD DELINEATED AREA(S) FROM SEDIMENT LEAVING THE SITE. ADDITIONALLY, ORANGE SAFETY FENCE IS RECOMMENDED TO BE INSTALLED ABOVE/AROUND THESE AREA(S), TO SERVE AS A PHYSICAL BARRIER, ENSURING THE AREA(S) ARE NOT DISTURBED. THE LOCAL GOVERNING AUTHORITY WILL HAVE THE AUTHORITY TO RECOMMEND THE PLACEMENT OF ADDITIONAL EROSION CONTROL MEASURES IN THESE AREAS IF IT BECOMES EVIDENT DURING CONSTRUCTION THAT THE ONES IN PLACE ARE NOT FUNCTIONING SUFFICIENTLY.

SOILS: NO SOIL STUDIES OR SUBSURFACE INVESTIGATIONS WERE PERFORMED AND ANALYZED FOR THE DESIGN OF THIS SITE. A SUBSURFACE INVESTIGATION SHALL BE PERFORMED PRIOR TO CONSTRUCTION ACTIVITIES.

OFF SITE AREAS: THERE ARE NO BORROW AREA(S) OR EXPORT STOCKPILE AREA(S) OUTSIDE OF THE PROPOSED LIMITS OF DISTURBANCE FOR THIS PROJECT.

EROSION AND SEDIMENT CONTROL MEASURES: UNLESS OTHERWISE INDICATED, ALL VEGETATIVE AND STRUCTURAL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE CONSTRUCTED AND MAINTAINED ACCORDING TO MINIMUM STANDARDS AND SPECIFICATIONS OF THE CURRENT WEST VIRGINIA EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE MANUAL.

STRUCTURAL PRACTICES:

1. INSTALL ORANGE SAFETY FENCE TO ENSURE NO DISTURBANCE TO THE DELINEATED AREA(S).
2. INSTALL TEMPORARY CONSTRUCTION ENTRANCE.
3. INSTALL COMPOST FILTER SOCKS AS SHOWN ON THE PLANS TO REMOVE SEDIMENT FROM RUNOFF. SELECTIVELY REMOVE TREES REQUIRED TO INSTALL COMPOST FILTER SOCK IN WOODED AREAS. CLEARING AND GRUBBING SHALL BE KEPT AT A MINIMUM TO INSTALL E&S CONTROLS.
4. EROSION CONTROL BLANKETS (JUTE MATTING) SHALL BE PLACED ON ALL CRITICAL SLOPES (3:1 OR GREATER) AND AS NEEDED TO STABILIZE DISTURBED AREAS.
5. FILL SLOPE SURFACE SHALL BE LEFT IN A ROUGHENED CONDITION TO REDUCE EROSION. CONTRACTOR SHALL REDIRECT RUNOFF AWAY FROM THE FILL SLOPE BY INSTALLING EARTHEN DIVERSION BERMS AND DIVERTING THE RUNOFF TO SEDIMENT TRAPPING DEVICES.
6. INSTALL V-DITCHES, DITCH RELIEF CULVERTS, AND OUTLET PROTECTION (RIP-RAP APRONS) AS SHOWN ON THE PLANS.

DEVICES LISTED ABOVE ARE CONSIDERED MINIMUM EROSION AND SEDIMENT CONTROLS. ADDITIONAL CONTROL MEASURES MAY BE NECESSARY DUE TO CONTRACTOR PHASING OR OTHER UNFORESEEN CONDITIONS. IMMEDIATELY UPON DISCOVERING UNFORESEEN CIRCUMSTANCES POSING THE POTENTIAL FOR ACCELERATED EROSION AND/OR SEDIMENT POLLUTION, THE CONTRACTOR SHALL IMPLEMENT APPROPRIATE BMP'S TO MINIMIZE THE POTENTIAL FOR EROSION AND SEDIMENT POLLUTION. ALL MEASURES SHALL BE CONSTRUCTED AND MAINTAINED ACCORDING TO MINIMUM STANDARDS AND SPECIFICATIONS OF THE CURRENT WEST VIRGINIA EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE MANUAL.

PERMANENT STABILIZATION: ALL AREAS LEFT UNCOVERED BY EITHER BUILDINGS OR PAVEMENT SHALL BE STABILIZED WITH PERMANENT SEEDING IMMEDIATELY FOLLOWING FINISH GRADING AND WITHIN SEVEN (7) DAYS. AT NO TIME SHALL LAND LAY DORMANT LONGER THAN TWENTY-ONE (21) DAYS.

MAINTENANCE PROGRAM: DURING CONSTRUCTION ACTIVITIES, ALL CONTROL MEASURES SHALL BE INSPECTED DAILY BY THE SITE SUPERINTENDENT OR HIS REPRESENTATIVE AND WITHIN TWENTY-FOUR (24) HOURS AFTER ANY SIGNIFICANT RAIN EVENT, WHICH SHALL BE DEFINED AS RAINFALL OF TWO (2) INCHES OR MORE IN A SIX (6) HOUR PERIOD. ONCE CONSTRUCTION ACTIVITIES HAVE CONCLUDED, THE SITE SHALL BE INSPECTED EVERY TWO (2) WEEKS FOR THE LIFE OF THE FACILITY AND WITHIN TWENTY-FOUR (24) HOURS OF A SIGNIFICANT RAIN EVENT AS DEFINED ABOVE. ANY DAMAGED STRUCTURAL MEASURES ARE TO BE REPAIRED, BY THE END OF THE DAY, OR AT THE EARLIEST TIME IN WHICH IT IS SAFE TO DO SO. SEEDED AREAS SHALL BE CHECKED REGULARLY TO ENSURE THAT A GOOD STAND OF GRASS IS MAINTAINED. ALL AREAS SHALL BE FERTILIZED AND RESEEDED AS NEEDED UNTIL GRASS IS ESTABLISHED.

TRAPPED SEDIMENT IS TO BE REMOVED AS REQUIRED TO MAINTAIN 50% TRAP AND/OR SOCK EFFICIENCY AND DISPOSED OF BY SPREADING ON THE STOCKPILE.

INLET OF DITCH RELIEF CULVERTS SHALL BE CHECKED REGULARLY FOR SEDIMENT BUILD-UP. IF THE GRAVEL OUTLET IS CLOGGED BY SEDIMENT, IT SHALL BE REMOVED AND CLEANED OR REPLACED IMMEDIATELY.

SEDIMENT TRACKED ONTO ANY PUBLIC ROADWAY OR SIDEWALK SHALL BE RETURNED TO THE CONSTRUCTION SITE BY THE END OF EACH WORK DAY AND DISPOSED IN THE MANNER DESCRIBED IN THIS PLAN. IN NO CASE SHALL THE SEDIMENT BE WASHED, SHOVELED OR SWEPT INTO ANY ROADSIDE DITCH, CULVERT OR SURFACE WATER.

ANY DISTURBED AREAS ALONG THE ACCESS ROAD SHALL BE STABILIZED PRIOR TO THE END OF EACH DAY WITH EITHER ROCK STABILIZATION OR SEEDING AND MULCHING METHODS.

NOTE: THE WV DEP RETAINS THE RIGHT TO ADD AND/OR MODIFY THESE EROSION AND SEDIMENT CONTROL MEASURES DURING THE CONSTRUCTION PROCESS, WITHIN REASON, TO ENSURE ADEQUATE PROTECTION TO THE PUBLIC AND THE ENVIRONMENT.

SEEDING (SOIL STABILIZATION):
1. CONTRACTOR SHALL APPLY SEED AND STABILIZATION IN ACCORDANCE WITH THE WV DEP EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE (BMP) MANUAL, BASED UPON SITE SPECIFIC SOIL CHARACTERISTICS.
2. WHEREVER SEEDING IS TO BE APPLIED TO STEEP SLOPES (≥ 3H:1V), SEED MIXTURES SHOULD BE SELECTED THAT ARE APPROPRIATE FOR STEEP SLOPES.

DUST CONTROL:
1. TEMPORARY SEEDING SHALL BE APPLIED TO ALL DISTURBED AREAS SUBJECT TO LITTLE OR NO CONSTRUCTION TRAFFIC.
2. ALL HAUL ROADS AND OTHER HEAVY TRAFFIC ROUTES SHALL BE SPRINKLED WITH WATER UNTIL THE SURFACE IS WET AND REPEATED AS NEEDED TO CONTROL DUST.

CONSTRUCTION SEQUENCE

THE DEVELOPMENT OF THIS SITE SHALL BE CONSISTENT WITH THE FOLLOWING GENERAL SEQUENCE OF CONSTRUCTION. THE CONTRACTOR SHALL IMPLEMENT, MAINTAIN, AND OPERATE ALL PROPOSED EROSION AND SEDIMENT CONTROL MEASURES TO EFFECTIVELY MITIGATE THE HAZARD OF ACCELERATED EROSION AND SEDIMENTATION TO ACCEPTABLE LEVELS. MINOR DEVIATIONS FROM THIS SEQUENCE SHALL BE EXECUTED BY THE PROJECT'S SUPERINTENDENT AS NEEDED TO ELIMINATE ANY POTENTIAL EROSIVE CONDITION THAT MAY ARISE FOR THE DURATION OF THE PROJECT. THE WV DEP OFFICE OF OIL AND GAS SHALL BE NOTIFIED OF ANY AND ALL SUCH DEVIATIONS FROM THE APPROVED PLANS.

1. A PRE-CONSTRUCTION CONFERENCE WITH THE CONTRACTOR AND THE APPROPRIATE EROSION AND SEDIMENT CONTROL INSPECTOR 48 HOURS PRIOR TO BEGINNING WORK TO REVIEW THE CONSTRUCTION DRAWINGS AND PROVIDE ANY REQUESTED GUIDANCE.
2. STAKE THE LIMITS OF CONSTRUCTION AND MARK ALL IDENTIFIED WETLANDS, STREAMS, AND OTHER AREAS OF CONCERN FOR CONSTRUCTION ACTIVITIES. INSTALL SIGNS TO DESIGNATE THE AREAS AND ORANGE SAFETY FENCE TO IDENTIFY IMPORTANT PROJECT ATTRIBUTES SUCH AS APPROVED ACCESS ROADS, NO REFUELING ZONES, WETLANDS/STREAM BOUNDS, ETC.
3. CONSTRUCT THE ROCK CONSTRUCTION ENTRANCE. ALL VEHICLES ENTERING AND EXITING THE SITE SHALL DO SO VIA THE ROCK CONSTRUCTION ENTRANCE.
4. CONSTRUCT ALL BMP'S AS SOON AS CLEARING AND GRUBBING OPERATIONS ALLOW. DIVERSIONS AND SEDIMENT TRAP(S)/BASIN(S) SHALL BE SEEDED AND MULCHED IMMEDIATELY.
5. IF APPLICABLE, CONVEY UPSLOPE DRAINAGE AROUND THE ACCESS ROAD AREA BY CONSTRUCTING ALL DIVERSION BERM(S) AND/OR COMPOST FILTER SOCK DIVERSION(S) AS SHOWN ON THE PLANS.
6. CLEAR AND GRUB THE SITE. ALL WOODY MATERIAL, BRUSH, TREES, STUMPS, LARGE ROOTS, BOULDERS, AND DEBRIS SHALL BE CLEARED FROM THE SITE AREA AND KEPT TO THE MINIMUM NECESSARY FOR PROPER CONSTRUCTION, INCLUDING THE INSTALLATION OF NECESSARY SEDIMENT CONTROLS. TREES SIX INCHES IN DIAMETER AND LARGER SHALL BE CUT AND LOGS STACKED. SMALLER TREES, BRUSH, & STUMPS SHALL BE CUT AND/OR GRUBBED AND WINDROWED IN APPROPRIATE AREAS FOR USE AS BRUSH PILE SEDIMENT BARRIERS (AS SHOWN ON THE PLANS), WILDLIFE HABITATS, BURNED (AS PER WV FOREST FIRE LAWS), REMOVED FROM SITE, OR DISPOSED OF BY OTHER METHODS APPROVED BY WV DEP.
7. IF APPLICABLE, INSTALL ALL WETLAND OR STREAM CROSSINGS AS SHOWN ON THE PLANS.
8. STRIP THE TOPSOIL FROM THE ACCESS ROAD. ALL STRIPPED TOPSOIL SHALL BE STOCKPILED IN AREAS SHOWN IN THE PLANS AND IMMEDIATELY STABILIZED. ADDITIONAL BMP MEASURES SHALL BE CONSTRUCTED AROUND TOPSOIL STOCKPILES, IF NECESSARY.
9. CONSTRUCT THE ACCESS ROAD. ALL FILL AREAS SHALL BE "KEYED IN" AND COMPACTED IN HORIZONTAL LIFTS WITH A MAXIMUM LOOSE LIFT THICKNESS OF 12" AND MAXIMUM PARTICLE SIZE OF LESS THAN 6". ALL FILL SHALL BE COMPACTED BY A VIBRATING SHEEPSFOOT ROLLER TO 95% PER THE STANDARD PROCTOR TEST (ASTM-D698). MOISTURE CONTENT WILL BE CONTROLLED IN ACCORDANCE WITH THE STANDARD PROCTOR TEST (ASTM-D698) RESULTS. DITCH RELIEF CULVERTS SHALL BE INSTALLED AT A GRADE OF 1-8% TO MINIMIZE OUTLET VELOCITIES TO THE EXTENT POSSIBLE. INSTALL OUTLET PROTECTION ONCE DITCH RELIEF CULVERTS ARE INSTALLED, AS SHOWN ON PLANS. STABILIZE THE ROAD WITH GEOTEXTILE FABRIC & STONE AND SIDE SLOPES AS SPECIFIED WITH PERMANENT SEEDING. EXCESS MATERIAL SHALL BE STOCKPILED (IF NECESSARY) IN AREAS SHOWN IN THE PLANS AND IMMEDIATELY STABILIZED. ALL DITCH LINES SHALL BE CLEANED PRIOR TO INSTALLATION OF LINED PROTECTION.
10. ALL BMP'S MUST REMAIN IN PLACE AND FUNCTIONAL UNTIL ALL AREAS WITHIN THE LIMIT OF DISTURBANCE ARE COMPLETE AND PERMANENTLY STABILIZED. MAINTENANCE MUST INCLUDE INSPECTION OF ALL EROSION AND SEDIMENT CONTROLS AFTER EACH RUNOFF EVENT IN EXCESS OF 0.5" AND ON A BIWEEKLY BASIS.
11. THE CONSTRUCTION SITE SHOULD BE STABILIZED AS SOON AS POSSIBLE AFTER COMPLETION. ESTABLISHMENT OF FINAL COVER MUST BE INITIATED NO LATER THAN 7 DAYS AFTER REACHING FINAL GRADE. A NOTICE OF TERMINATION MUST BE FILED WITH THE WV DEP WHEN THE SITE REACHES FINAL STABILIZATION. FINAL STABILIZATION MEANS THAT ALL SOIL-DISTURBING ACTIVITIES ARE COMPLETED, AND THAT EITHER A PERMANENT VEGETATIVE COVER WITH A DENSITY OF 70% OR GREATER HAS BEEN ESTABLISHED OR THAT THE SURFACE HAS BEEN STABILIZED BY HARD COVER SUCH AS PAVEMENT OR BUILDINGS. IT SHOULD BE NOTED THAT THE 70% REQUIREMENT REFERS TO THE TOTAL AREA VEGETATED AND NOT JUST A PERCENT OF THE SITE.
12. ALL PERMANENT SEDIMENT CONTROL MEASURES CAN BE REMOVED AFTER THE SITE IS PERMANENTLY STABILIZED AND APPROVAL IS RECEIVED FROM THE WVDEP.
13. ANY AREAS DISTURBED BY REMOVAL OF CONTROLS SHALL BE REPAIRED, STABILIZED, AND PERMANENTLY SEEDED.

NAVITUS ENGINEERING INC.
Engineering | Survey | Environmental | GIS
151 Windy Hill Lane
Winchester, Virginia 22602
Telephone: (888) 662-4185
www.navituseng.com

DATE	REVISION

ANTERO RESOURCES
THIS DOCUMENT WAS PREPARED FOR: ANTERO RESOURCES CORPORATION

CONSTRUCTION AND E&S CONTROL NOTES

NEW MILTON
COMPRESSOR STATION ACCESS ROAD
NEW MILTON DISTRICT
DODDRIDGE COUNTY, WEST VIRGINIA

STANLEY E. KING II
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
07/16/2013

DATE: 07/16/2013
SCALE: N/A
SHEET 2 OF 20

MATERIAL QUANTITIES

MATERIAL QUANTITIES

ACCESS ROAD SITE: NEW MILTON COMPRESSOR STATION

	Item Description			Quantity	Unit	Unit Cost	Item Total
1.0	Mobilization						
	(Limited to 10% of Total Base Bid)			1.0	LS	$	$
2.0	Erosion & Sediment Control						
	2.1	Clearing and Grubbing					
		2.1.1	Wooded	12.18	AC	$	$
		2.1.2	Open Field	4.85	AC	$	$
	2.2	Super Silt Fence		186.2	LF	$	$
	2.3	12" Compost Filter Sock		3,496.7	LF	$	$
	2.4	18" Compost Filter Sock		911.3	LF	$	$
	2.5	24" Compost Filter Sock		128.0	LF	$	$
	2.6	32" Compost Filter Sock		430.4	LF	$	$
	2.7	12" Compost Sock Diversion		764.7	LF	$	$
	2.8	Jute Matting - Slope Matting		402,783.2	SF	$	$
	2.9	Ditch Lining - Synthetic Matting (TRM)		16,500.8	SF	$	$
3.0	Unclassified Earthwork						
	3.1	Access Road "A"					
		3.1.1	Topsoil Removal to Stockpile (Assume 6" Depth)	6,930.2	CY	$	$
		3.1.2	Excavation (Cut to Compact Fill)	16,802.8	CY	$	$
		3.1.3	Excavation (Export to Stockpile)	17,880.8	CY	$	$
	3.2	Excavation/Undiggable Material (Hammering)			CY	$	$
	3.3	Excavation/Undiggable Material (Blasting)			CY	$	$
4.0	Stone and Aggregate Surfacing						
	4.1	Construction Entrance					
		4.1.1	6"-4" Crusher Run (10" Depth)	280.7	TONS	$	$
		4.1.2	Geotextile Fabric (US 200 or Equal)	6,087.8	SF	$	$
	4.2	Access Road "A"					
		4.2.1	6"-4" Crusher Run (8" Depth)	4,508.3	TONS	$	$
		4.2.2	3/4"-1 1/2" Crusher Run (2" Depth)	1,128.8	TONS	$	$
		4.2.3	Geotextile Fabric (US 200 or Equal)	121,117.2	SF	$	$
		4.2.4	Clean Rock Fill (2"-4" Coarse Aggregate)	2,982.0	TONS	$	$
	4.3	4" Rip Rap (Outlets/Level Spreaders) 18" Depth		374.2	TONS	$	$
	4.4	4" Rip Rap (Rock-Lined Ditches) 6" Depth		361.7	TONS	$	$
	4.5	Rock Fill Check Dams (#4 Stone)		22.5	TONS	$	$
5.0	Ditch Relief and Drainage Culverts						
	5.1	15" CPP (total)		687.5	LF	$	$
	5.2	35' 10" x 11' 4" Contech Bridgecor #25A5 Arch Culvert (total)		80.0	LF	$	$
6.0	Miscellaneous						
	6.1	Seeding and Mulching					
		6.1.1	Temporary Seeding (Vegetation & Mulch)	0.0	AC	$	$
		6.1.2	Permanent Seeding (Vegetation & Mulch / Fertilizer/ Lime)	14.2	AC	$	$
		6.1.3	Lime, Fertilizer, Seeding, and Hydro-Mulch w/tack (HYC2 or Equal)		AC	$	$
	6.2	3'x3'x6' Gabion Basket		100.0	EA	$	$

NOTE:

1. THE SQUARE FOOTAGE FOR THE GEOTEXTILE FABRIC DOES NOT ACCOUNT FOR MATERIAL OVERLAP AND WASTE.

NAVITUS ENGINEERING INC.
Engineering Survey Environmental GIS
151 Windy Hill Lane
Winchester, Virginia 22602
Telephone: (888) 662-4185
www.navituseng.com

DATE | REVISION

ANTERO RESOURCES
THIS DOCUMENT WAS PREPARED FOR: ANTERO RESOURCES CORPORATION

MATERIAL QUANTITIES

NEW MILTON
COMPRESSOR STATION ACCESS ROAD
NEW MILTON DISTRICT
DODDRIDGE COUNTY, WEST VIRGINIA

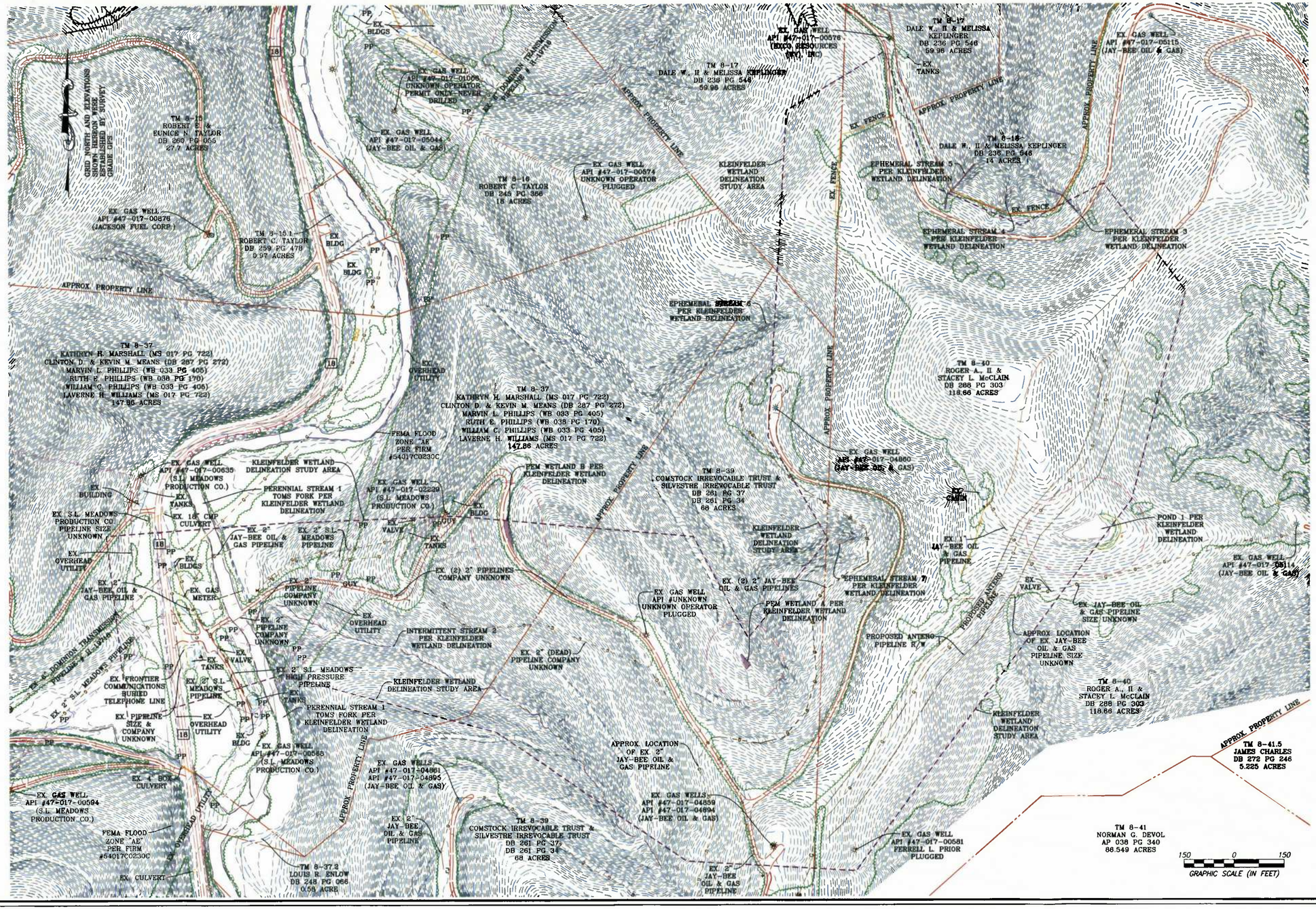
CYRUS S. KING
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
07/16/2013

DATE: 07/16/2013
SCALE: N/A
SHEET 3 OF 20

EXISTING CONDITIONS

GENERAL NOTES:

1. THE TOPOGRAPHIC INFORMATION SHOWN HEREON IS BASED ON MARCH 30, 2013 AERIAL PHOTOGRAPHY COMPILED JULY, 2013 BY BLUE MOUNTAIN AERIAL MAPPING, BURTON, WEST VIRGINIA.
2. THE PROPERTY LINES SHOWN HEREON DO NOT REPRESENT A BOUNDARY SURVEY ON ANY OF THE PARCELS SHOWN. PROPERTY CORNERS AND LINES PERTINENT TO THE ACCESS ROAD LOCATION ARE BASED ON A FIELD SURVEY. THE REMAINDER OF THE PROPERTY LINES ARE BASED ON COUNTY REAL ESTATE TAX MAPS, GIS INFORMATION AND DEEDS OF RECORD.
3. UTILITIES AND THEIR LOCATIONS AS SHOWN HEREON ARE BASED ON: A) OBSERVABLE EVIDENCE OF THOSE VISIBLE, ABOVE-GROUND FACILITIES, FEATURES, AND MARKERS WHICH WERE FOUND ON THE SUBJECT PROPERTY AT THE TIME OF SURVEY PERFORMED BY NAVITUS ENGINEERING AND B) FIELD MARKINGS PLACED BY UTILITY COMPANIES IN RESPONSE TO THE WV 811 TICKET SUBMITTED BY NAVITUS ENGINEERING. NAVITUS ENGINEERING CANNOT GUARANTEE THE ACCURACY OF THE UTILITY MARKINGS PERFORMED BY OTHERS OR THAT ALL UTILITIES EXISTING WITHIN THE LIMITS OF THIS PLAN ARE SHOWN. ANY UTILITIES ENCOUNTERED SUBSEQUENT TO PLAN APPROVAL OR DURING CONSTRUCTION THAT ARE NOT SHOWN ON THE PLAN SHOULD BE REPORTED TO NAVITUS ENGINEERING AND ANTERO RESOURCES APPALACHIAN CORPORATION.



LEGEND

- EX. INDEX CONTOUR
- EX. INTERMEDIATE CONTOUR
- EX. PROPERTY LINE
- EX. ROAD EDGE OF GRAVEL/DIRT
- EX. ROAD EDGE OF PAVEMENT
- EX. ROAD CENTERLINE
- EX. DITCHLINE
- EX. CULVERT
- EX. FENCELINE
- EX. OVERHEAD UTILITY
- EX. POWER POLE/GUY WIRE
- EX. GASLINE
- EX. TREELINE
- EX. DELINEATED STREAM
- EX. DELINEATED WETLAND
- EX. BUILDING
- DELINEATION STUDY AREA

Engineering | Survey | Environmental | GIS

NAVITUS ENGINEERING INC.
151 Windy Hill Lane
Winchester, Virginia 22602
Telephone: (888) 662-4185
www.navituseng.com

DATE	REVISION

ANTERO RESOURCES
THIS DOCUMENT WAS PREPARED FOR: ANTERO RESOURCES CORPORATION

EXISTING CONDITIONS

NEW MILTON
COMPRESSOR STATION ACCESS ROAD
NEW MILTON DISTRICT
DODDRIDGE COUNTY, WEST VIRGINIA

CHARLES B. KING REGISTERED 0576 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER
07/16/2013

DATE: 07/16/2013

SCALE: 1" = 150'

SHEET 4 OF 20

OVERALL PLAN SHEET INDEX & VOLUMES

Access Road "A"		
Topsoil Removal:	6,930.2	C.Y.
Total Cut:	34,683.6	C.Y. (Cut/Swell=1)
Total Fill:	16,802.8	C.Y. (Fill Shrink=1)
Cut slope percent grade:	50.00	%, slope ratio: 2:1
Fill slope percent grade:	50.00	%, slope ratio: 2:1
Gravel (10" Depth):	3,758.0	C.Y.

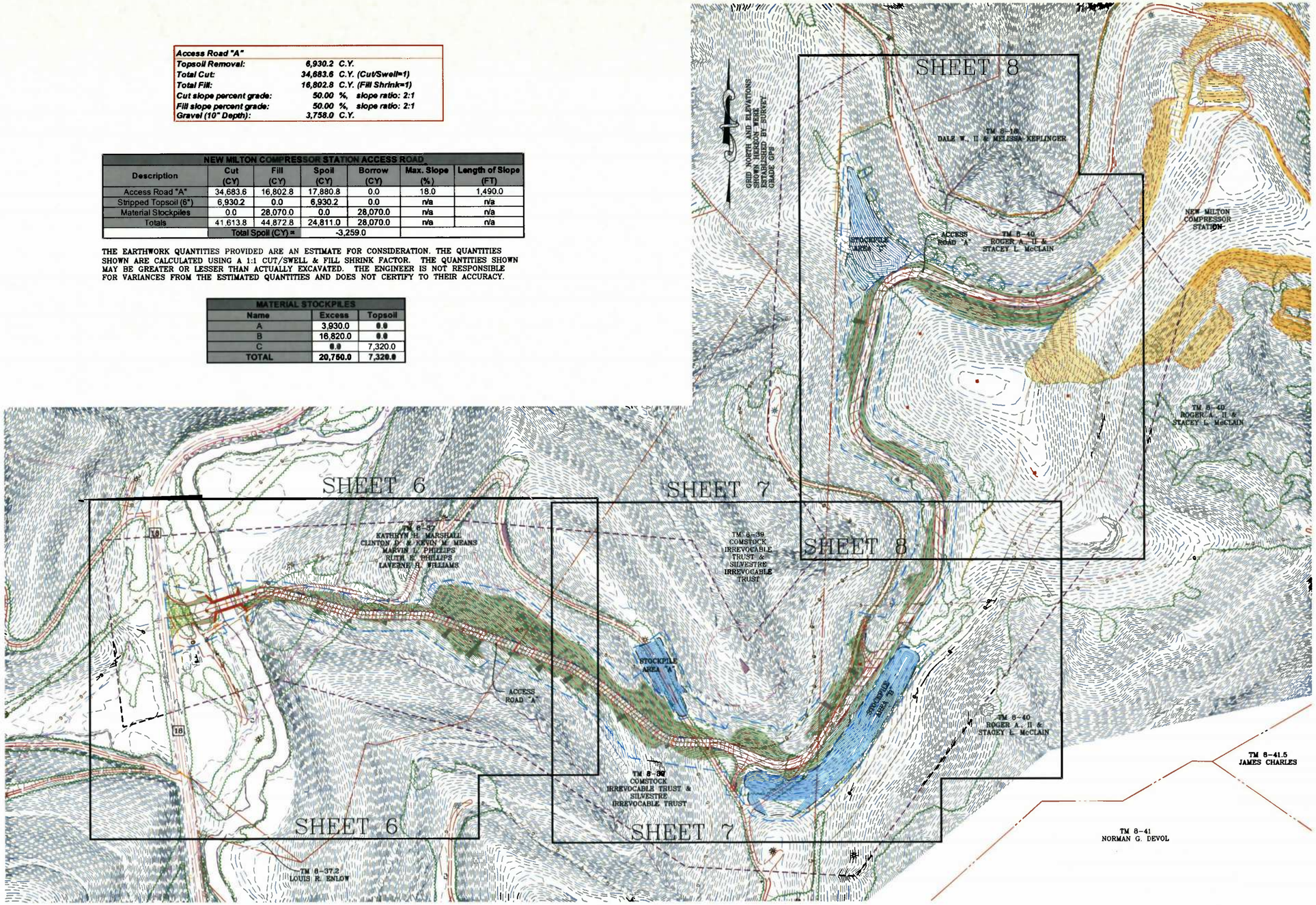
NEW MILTON COMPRESSOR STATION ACCESS ROAD

Description	Cut (CY)	Fill (CY)	Spoil (CY)	Borrow (CY)	Max. Slope (%)	Length of Slope (FT)
Access Road "A"	34,683.6	16,802.8	17,880.8	0.0	18.0	1,490.0
Stripped Topsoil (6")	6,930.2	0.0	6,930.2	0.0	n/a	n/a
Material Stockpiles	0.0	28,070.0	0.0	28,070.0	n/a	n/a
Totals	41,613.8	44,872.8	24,811.0	28,070.0	n/a	n/a
	Total Spoil (CY) =		-3,259.0			

THE EARTHWORK QUANTITIES PROVIDED ARE AN ESTIMATE FOR CONSIDERATION. THE QUANTITIES SHOWN ARE CALCULATED USING A 1:1 CUT/SWELL & FILL SHRINK FACTOR. THE QUANTITIES SHOWN MAY BE GREATER OR LESSER THAN ACTUALLY EXCAVATED. THE ENGINEER IS NOT RESPONSIBLE FOR VARIANCES FROM THE ESTIMATED QUANTITIES AND DOES NOT CERTIFY TO THEIR ACCURACY.

MATERIAL STOCKPILES

Name	Excess	Topsoil
A	3,930.0	0.0
B	16,820.0	0.0
C	0.0	7,320.0
TOTAL	20,750.0	7,320.0



NAVITUS ENGINEERING INC.
Engineering Survey Environmental GIS
151 Windy Hill Lane
Winchester, Virginia 22602
Telephone: (888) 662-4185
www.navituseng.com

DATE	REVISION

ANTERO RESOURCES
THIS DOCUMENT WAS PREPARED FOR:
ANTERO RESOURCES CORPORATION

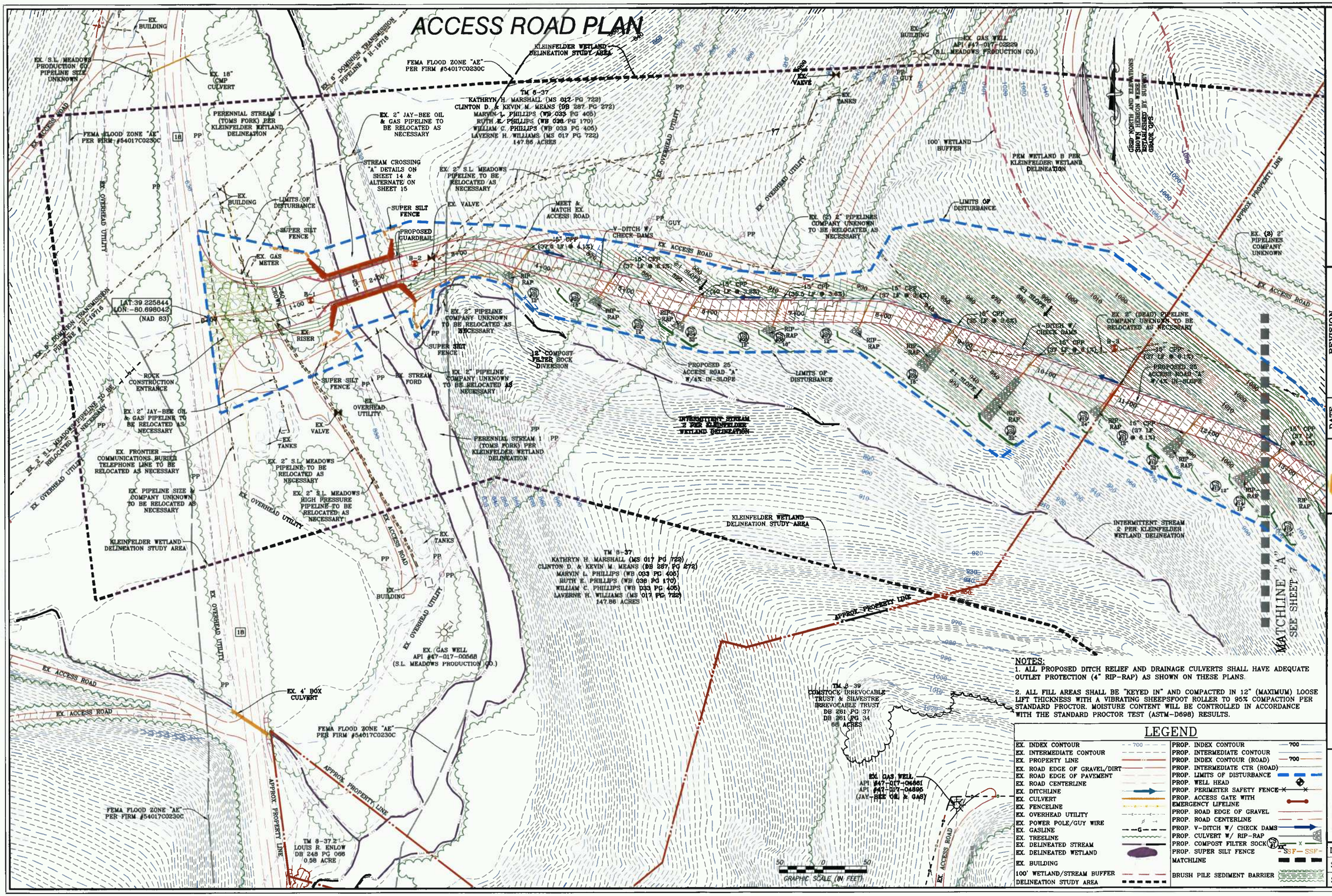
OVERALL PLAN SHEET INDEX & VOLUMES

NEW MILTON
COMPRESSOR STATION ACCESS ROAD
NEW MILTON DISTRICT
DODDRIDGE COUNTY, WEST VIRGINIA

CHRIS S. JONES REGISTERED PROFESSIONAL ENGINEER STATE OF WEST VIRGINIA
07/16/2013

DATE: 07/16/2013
SCALE: 1" = 150'
SHEET 5 OF 20

ACCESS ROAD PLAN



NOTES:

1. ALL PROPOSED DITCH RELIEF AND DRAINAGE CULVERTS SHALL HAVE ADEQUATE OUTLET PROTECTION (4" RIP-RAP) AS SHOWN ON THESE PLANS.

2. ALL FILL AREAS SHALL BE "KEYED IN" AND COMPACTED IN 12" (MAXIMUM) LOOSE LIFT THICKNESS WITH A VIBRATING SHEEPSFOOT ROLLER TO 95% COMPACTION PER STANDARD PROCTOR. MOISTURE CONTENT WILL BE CONTROLLED IN ACCORDANCE WITH THE STANDARD PROCTOR TEST (ASTM-D698) RESULTS.

LEGEND

EX. INDEX CONTOUR	PROP. INDEX CONTOUR
EX. INTERMEDIATE CONTOUR	PROP. INTERMEDIATE CONTOUR
EX. PROPERTY LINE	PROP. INDEX CONTOUR (ROAD)
EX. ROAD EDGE OF GRAVEL/DIRT	PROP. INTERMEDIATE CTR (ROAD)
EX. ROAD EDGE OF PAVEMENT	PROP. LIMITS OF DISTURBANCE
EX. ROAD CENTERLINE	PROP. WELL HEAD
EX. DITCHLINE	PROP. PERIMETER SAFETY FENCE
EX. CULVERT	PROP. ACCESS GATE WITH EMERGENCY LIFELINE
EX. FENCELINE	PROP. ROAD EDGE OF GRAVEL
EX. OVERHEAD UTILITY	PROP. ROAD CENTERLINE
EX. POWER POLE/GUY WIRE	PROP. V-DITCH W/ CHECK DAMS
EX. GASLINE	PROP. CULVERT W/ RIP-RAP
EX. TREELINE	PROP. COMPOST FILTER SOCK
EX. DELINEATED STREAM	PROP. SUPER SILT FENCE
EX. DELINEATED WETLAND	MATCHLINE
EX. BUILDING	BRUSH PILE SEDIMENT BARRIER
100' WETLAND/STREAM BUFFER	
DELINEATION STUDY AREA	

NAVITUS ENGINEERING INC.
Engineering · Survey · Environmental · GIS
151 Windy Hill Lane
Winchester, Virginia 22602
Telephone: (888) 662-4185
www.navituseng.com

DATE	REVISION

ANTERO RESOURCES
THIS DOCUMENT WAS PREPARED FOR:
ANTERO RESOURCES CORPORATION

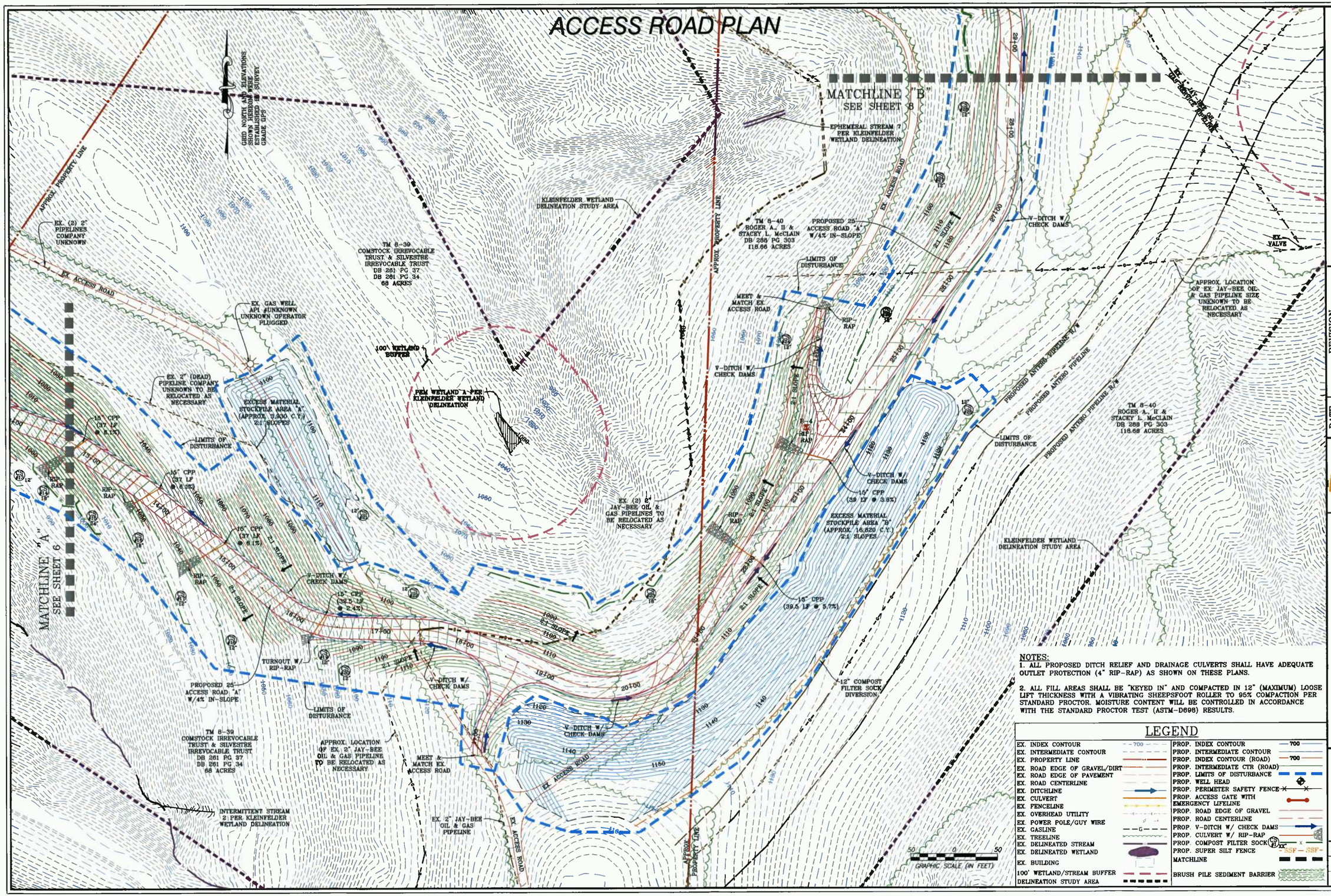
ACCESS ROAD PLAN

NEW MILTON
COMPRESSOR STATION ACCESS ROAD
NEW MILTON DISTRICT
DODDRIDGE COUNTY, WEST VIRGINIA

CHAD S. KIRBY
REGISTERED
PROFESSIONAL ENGINEER
STATE OF WEST VIRGINIA
07/16/2013

DATE: 07/16/2013
SCALE: 1" = 50'
SHEET 6 OF 20

ACCESS ROAD PLAN



NOTES:

1. ALL PROPOSED DITCH RELIEF AND DRAINAGE CULVERTS SHALL HAVE ADEQUATE OUTLET PROTECTION (4" RIP-RAP) AS SHOWN ON THESE PLANS.

2. ALL FILL AREAS SHALL BE "KEYED IN" AND COMPACTED IN 12" (MAXIMUM) LOOSE LIFT THICKNESS WITH A VIBRATING SHEEPSFOOT ROLLER TO 95% COMPACTION PER STANDARD PROCTOR. MOISTURE CONTENT WILL BE CONTROLLED IN ACCORDANCE WITH THE STANDARD PROCTOR TEST (ASTM-D698) RESULTS.

LEGEND

EX. INDEX CONTOUR	PROP. INDEX CONTOUR
EX. INTERMEDIATE CONTOUR	PROP. INTERMEDIATE CONTOUR
EX. PROPERTY LINE	PROP. INDEX CONTOUR (ROAD)
EX. ROAD EDGE OF GRAVEL/DIRT	PROP. INTERMEDIATE CTR (ROAD)
EX. ROAD EDGE OF PAVEMENT	PROP. LIMITS OF DISTURBANCE
EX. ROAD CENTERLINE	PROP. WELL HEAD
EX. DITCHLINE	PROP. PERIMETER SAFETY FENCE
EX. CULVERT	PROP. ACCESS GATE WITH EMERGENCY LIFELINE
EX. FENCELINE	PROP. ROAD EDGE OF GRAVEL
EX. OVERHEAD UTILITY	PROP. ROAD CENTERLINE
EX. POWER POLE/GUY WIRE	PROP. V-DITCH W/ CHECK DAMS
EX. GASLINE	PROP. CULVERT W/ RIP-RAP
EX. TREELINE	PROP. COMPOST FILTER SOCK
EX. DELINEATED STREAM	PROP. SUPER SILT FENCE
EX. DELINEATED WETLAND	MATCHLINE
EX. BUILDING	BRUSH PILE SEDIMENT BARRIER
100' WETLAND/STREAM BUFFER	
DELINEATION STUDY AREA	

NAVITUS ENGINEERING INC.
Engineering · Survey · Environmental · GIS
151 Windy Hill Lane
Winchester, Virginia 22602
Telephone: (888) 662-4185
www.navituseng.com

DATE	REVISION

ANTERO RESOURCES
THIS DOCUMENT WAS PREPARED FOR:
ANTERO RESOURCES CORPORATION

ACCESS ROAD PLAN

NEW MILTON
COMPRESSOR STATION ACCESS ROAD
NEW MILTON DISTRICT
DODDRIDGE COUNTY, WEST VIRGINIA

CHRIS S. KLINE — REGISTERED — 2576 — STATE OF WEST VIRGINIA — PROFESSIONAL ENGINEER
07/16/2013

DATE: 07/16/2013
SCALE: 1" = 50'
SHEET 7 OF 20

ACCESS ROAD PLAN

LEGEND

EX. INDEX CONTOUR	PROP. INDEX CONTOUR
EX. INTERMEDIATE CONTOUR	PROP. INTERMEDIATE CONTOUR
EX. PROPERTY LINE	PROP. INDEX CONTOUR (ROAD)
EX. ROAD EDGE OF GRAVEL/DIRT	PROP. INTERMEDIATE CTR (ROAD)
EX. ROAD EDGE OF PAVEMENT	PROP. LIMITS OF DISTURBANCE
EX. ROAD CENTERLINE	PROP. WELL HEAD
EX. DITCHLINE	PROP. PERIMETER SAFETY FENCE
EX. CULVERT	PROP. ACCESS GATE WITH EMERGENCY LIFELINE
EX. FENCELINE	PROP. ROAD EDGE OF GRAVEL
EX. OVERHEAD UTILITY	PROP. ROAD CENTERLINE
EX. POWER POLE/GUY WIRE	PROP. V-DITCH W/ CHECK DAMS
EX. GASLINE	PROP. CULVERT W/ RIP-RAP
EX. TREELINE	PROP. COMPOST FILTER SOCK
EX. DELINEATED STREAM	PROP. SUPER SILT FENCE
EX. DELINEATED WETLAND	MATCHLINE
EX. BUILDING	BRUSH PILE SEDIMENT BARRIER
100' WETLAND/STREAM BUFFER	
DELINEATION STUDY AREA	

NOTES:
1. ALL PROPOSED DITCH RELIEF AND DRAINAGE CULVERTS SHALL HAVE ADEQUATE OUTLET PROTECTION (4" RIP-RAP) AS SHOWN ON THESE PLANS.

2. ALL FILL AREAS SHALL BE "KEYED IN" AND COMPACTED IN 12" (MAXIMUM) LOOSE LIFT THICKNESS WITH A VIBRATING SHEEPSFOOT ROLLER TO 95% COMPACTION PER STANDARD PROCTOR. MOISTURE CONTENT WILL BE CONTROLLED IN ACCORDANCE WITH THE STANDARD PROCTOR TEST (ASTM-D698) RESULTS.

GRID NORTH AND ELEVATIONS SHOWN HEREON WERE ESTABLISHED BY SURVEY GRADE GPS

NEW MILTON COMPRESSOR STATION (DESIGNED BY OTHERS)

EX. TRAIL

PROPOSED ANTERO PIPELINE R/W

PROPOSED ANTERO PIPELINE

PROPOSED ANTERO PIPELINE R/W

100' POND BUFFER

KLEINFELDER WETLAND DELINEATION STUDY AREA

POND 1 PER KLEINFELDER WETLAND DELINEATION

EPHEMERAL STREAM 3 PER KLEINFELDER WETLAND DELINEATION

EPHEMERAL STREAM 4 PER KLEINFELDER WETLAND DELINEATION

TM 8-10
DALE W., II & MELISSA KEPLINGER
DB 236 PG 546
14 ACRES

TM 8-40
ROGER A., II & STACEY L. McCLAIN
DB 288 PG 303
116.66 ACRES

LIMITS OF DISTURBANCE

RIP-RAP

18" CMP (43.5 LF @ 4.2%)

V-DITCH W/ CHECK DAMS

B-10

B-6

B-5

B-9

B-8

B-7

EX. GATE

EX. CABIN

EX. FENCE

KLEINFELDER WETLAND DELINEATION STUDY AREA

PROPOSED 25' ACCESS ROAD "A" W/4% IN-SLOPE

EPHEMERAL STREAM 5 PER KLEINFELDER WETLAND DELINEATION

TM 8-17
DALE W., II & MELISSA KEPLINGER
DB 236 PG 546
59.96 ACRES

EX. ACCESS ROAD

TOPSOIL STOCKPILE AREA "C"
(APPROX. 7,320 C.Y.)
3:1 SLOPES

12" COMPOST FILTER SOCK DIVERSION

V-DITCH W/ CHECK DAMS

16" CPP (40 LF @ 5.8%)

15" CPP (51 LF @ 8.7%)

2:1 SLOPE

RIP-RAP

PROPOSED 25' ACCESS ROAD "A" W/4% IN-SLOPE

EX. (2) 2" JAY-BEE OIL & GAS PIPELINE

EPHEMERAL STREAM 7 PER KLEINFELDER WETLAND DELINEATION

MATCHLINE "B" (SEE SHEET 7)

APPROX. PROPERTY LINE

TM 8-39
COMSTOCK IRREVOCABLE TRUST & SILVESTRE IRREVOCABLE TRUST
DB 261 PG 37
DB 261 PG 34
68 ACRES

50 0 50
GRAPHIC SCALE (IN FEET)

NAVITUS ENGINEERING INC.
Engineering Survey Environmental GIS
151 Windy Hill Lane
Winchester, Virginia 22602
Telephone: (888) 662-4185
www.navituseng.com

DATE	REVISION

ANTERO RESOURCES
THIS PLAN PREPARED FOR: ANTERO RESOURCES CORPORATION

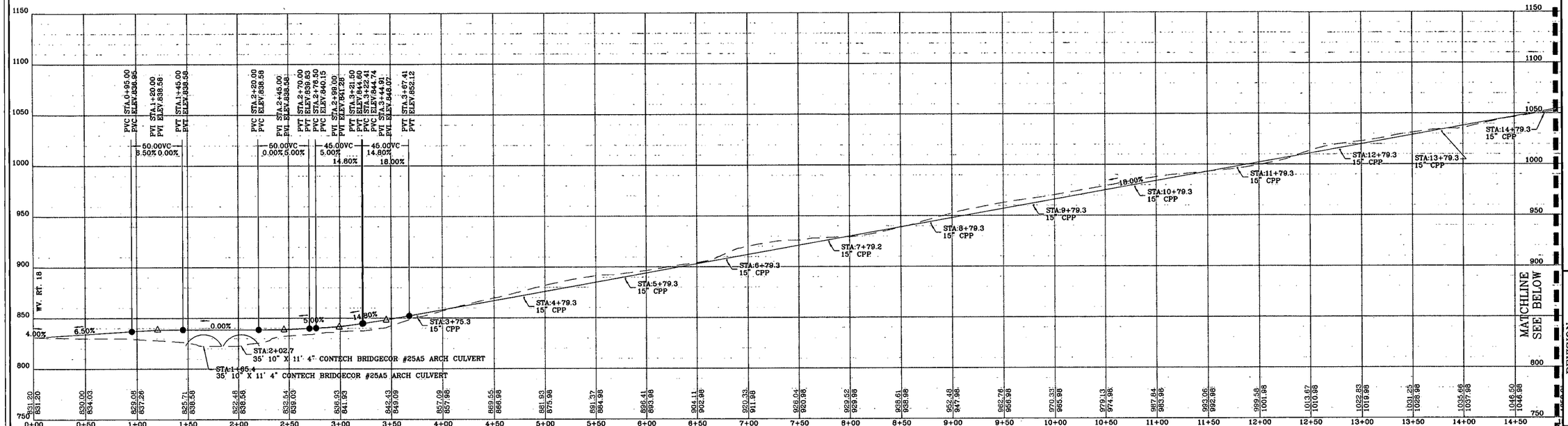
ACCESS ROAD PLAN

NEW MILTON
COMPRESSOR STATION ACCESS ROAD
NEW MILTON DISTRICT
DODDRIDGE COUNTY, WEST VIRGINIA

CHAD B. KNIGHT
REGISTERED
PROFESSIONAL ENGINEER
STATE OF WEST VIRGINIA
07/16/2013

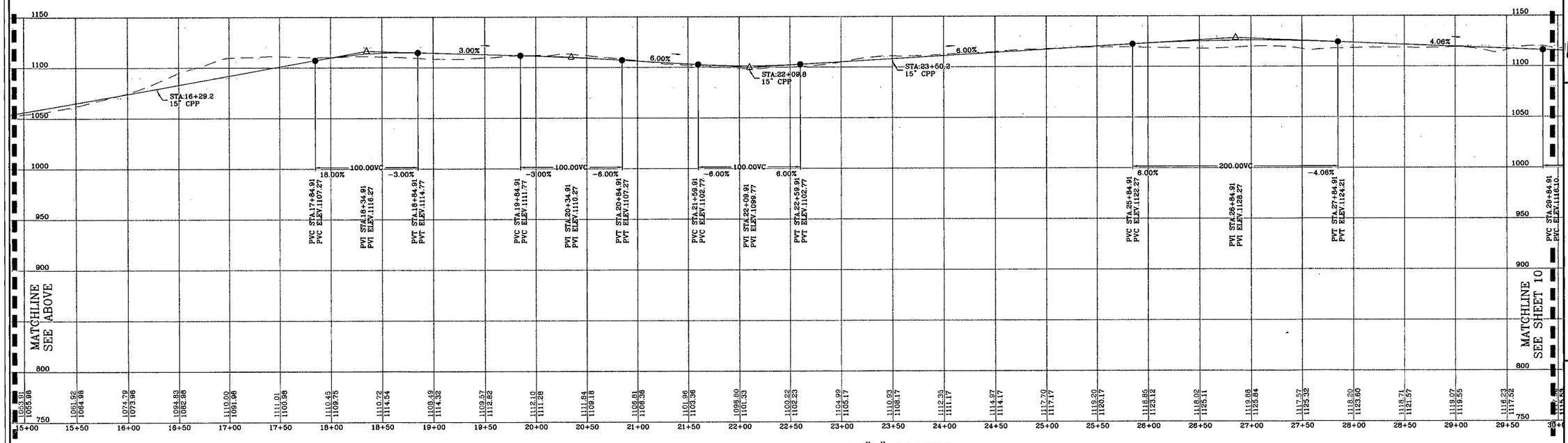
DATE: 07/16/2013
SCALE: 1" = 50'
SHEET 8 OF 20

ACCESS ROAD PROFILES



ACCESS ROAD "A" PROFILE

SCALE: HORIZ. 1" = 50' VERT. 1" = 50'



ACCESS ROAD "A" PROFILE

SCALE: HORIZ. 1" = 50' VERT. 1" = 50'

LEGEND

X-SECTION GRID INDEX	
X-SECTION GRID INTERMEDIATE	
X-SECTION PROPOSED GRADE	
X-SECTION EXISTING GRADE	
X-SECTION WATER SURFACE	
MATCHLINE	

NAVITUS ENGINEERING INC.
Engineering Survey Environmental GIS
151 Windy Hill Lane
Winchester, Virginia 22602
Telephone: (888) 662-4185
www.navitusenp.com

NO.	REVISION	DATE

ANTERO RESOURCES
THIS DOCUMENT WAS PREPARED FOR: ANTERO RESOURCES CORPORATION

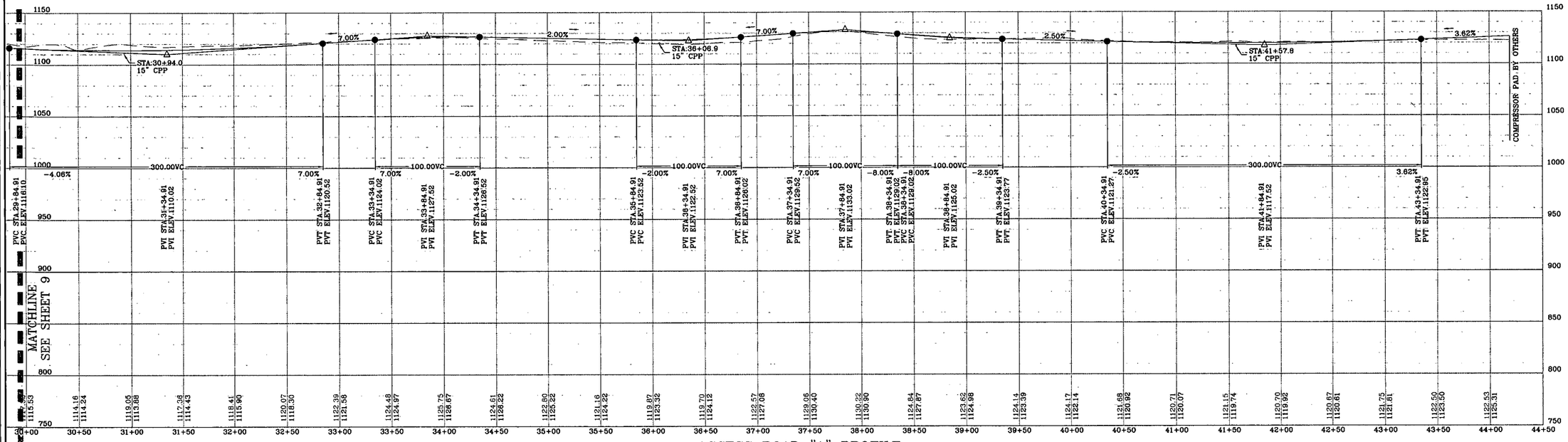
ACCESS ROAD PROFILES

NEW MILTON
COMPRESSOR STATION ACCESS ROAD
NEW MILTON DISTRICT
DODDRIDGE COUNTY, WEST VIRGINIA

CHRIS S. KING
10578
STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER
07/16/2013

DATE: 07/16/2013
SCALE: AS SHOWN
SHEET 9 OF 20

ACCESS ROAD PROFILES



ACCESS ROAD "A" PROFILE

SCALE: HORIZ. 1" = 50' VERT. 1" = 50'

LEGEND	
X-SECTION GRID INDEX	
X-SECTION GRID INTERMEDIATE	
X-SECTION PROPOSED GRADE	
X-SECTION EXISTING GRADE	
X-SECTION WATER SURFACE	
MATCHLINE	

NAVITUS ENGINEERING INC.
Engineering Survey Environmental GIS
151 Windy Hill Lane
Winchester, Virginia 22602
Telephone: (888) 662-4185
www.navituseng.com

DATE	REVISION

ANTERO RESOURCES
THIS DOCUMENT WAS PREPARED FOR:
ANTERO RESOURCES CORPORATION

ACCESS ROAD PROFILES

NEW MILTON
COMPRESSOR STATION ACCESS ROAD
NEW MILTON DISTRICT
DODDRIDGE COUNTY, WEST VIRGINIA

CHRIS B. KUHL
REGISTERED
9576
STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER
07/16/2013

DATE: 07/16/2013

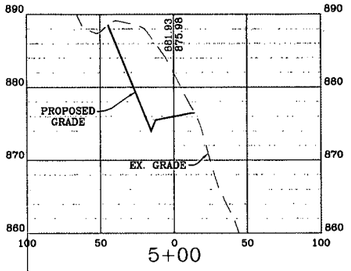
SCALE: AS SHOWN

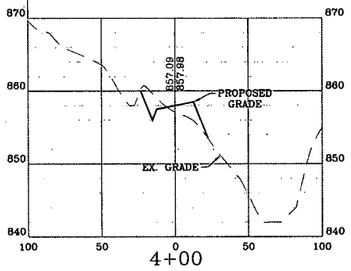
SHEET 10 OF 20

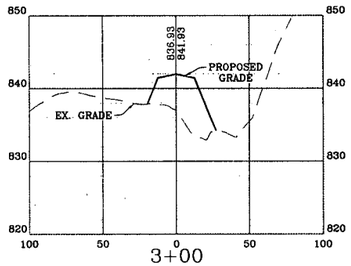
ACCESS ROAD SECTIONS

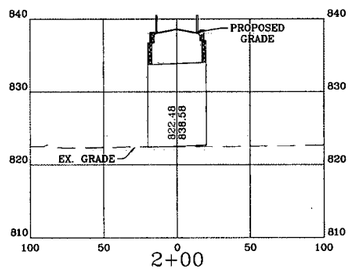
ACCESS ROAD "A" CROSS-SECTIONS

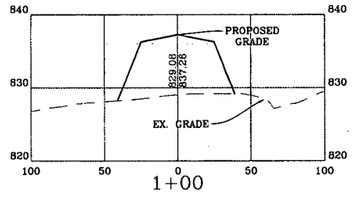
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

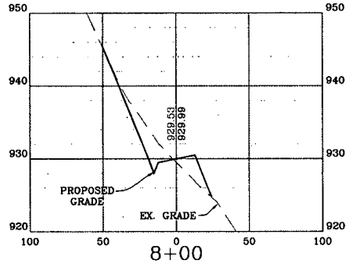


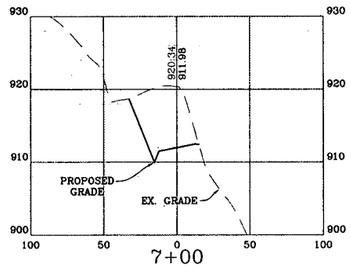


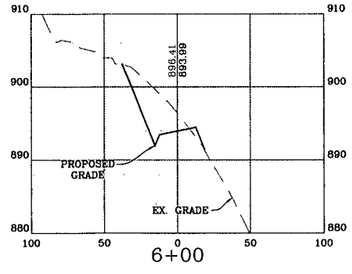


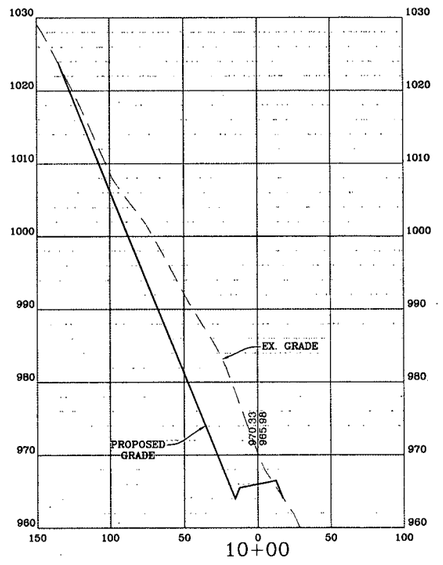


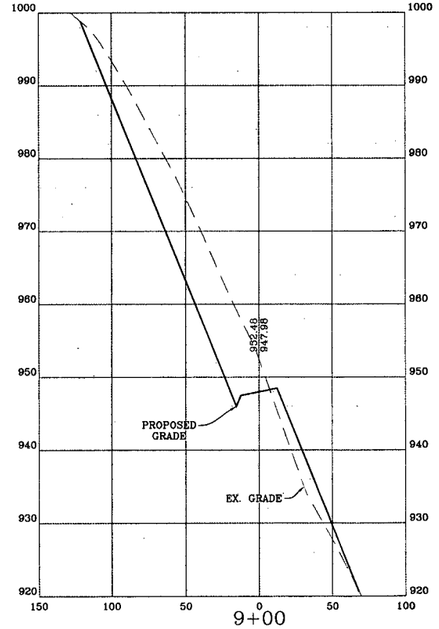


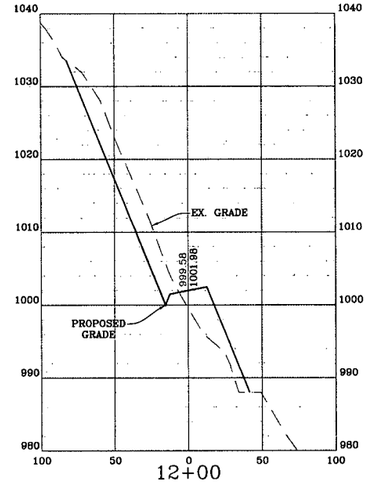


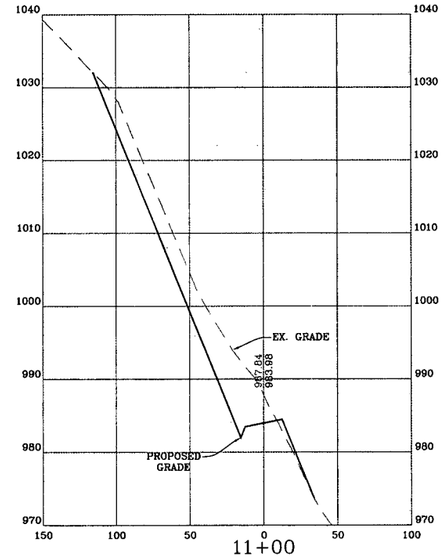


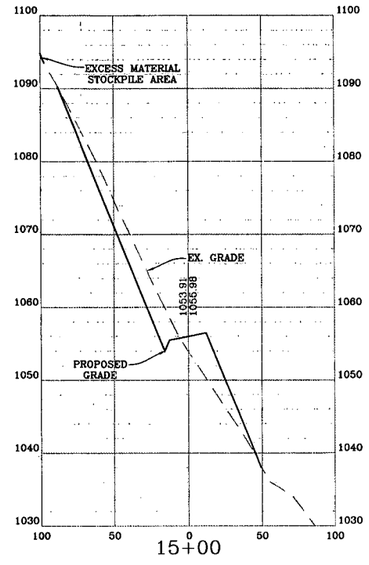


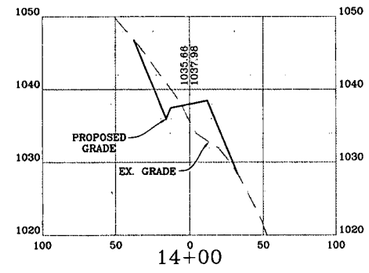


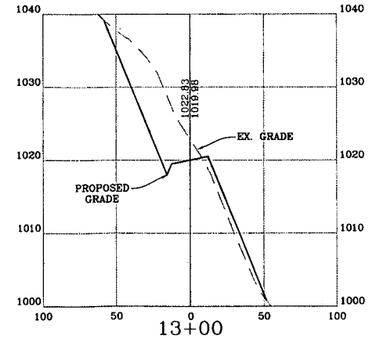












LEGEND

- X-SECTION GRID INDEX
- X-SECTION GRID INTERMEDIATE
- X-SECTION PROPOSED GRADE
- X-SECTION EXISTING GRADE
- X-SECTION WATER SURFACE
- MATCHLINE

NOTE:
1. ALL CUT & FILL SLOPES ALONG THE ACCESS ROAD SHALL BE 2:1 UNLESS STATED OTHERWISE.

Engineering Survey Environmental GIS

NAVITUS ENGINEERING INC.

151 Windy Hill Lane
Winchester, Virginia 22602
Telephone: (888) 662-4185
www.navituseng.com

REVISION

DATE

ANTERO RESOURCES

THIS DOCUMENT WAS PREPARED FOR: ANTERO RESOURCES CORPORATION

ACCESS ROAD SECTIONS

NEW MILTON

COMPRESSOR STATION ACCESS ROAD

NEW MILTON DISTRICT
DODDRIDGE COUNTY, WEST VIRGINIA

STEVEN S. KUHN
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
07/16/2013

DATE: 07/16/2013

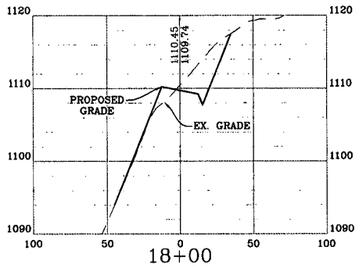
SCALE: AS SHOWN

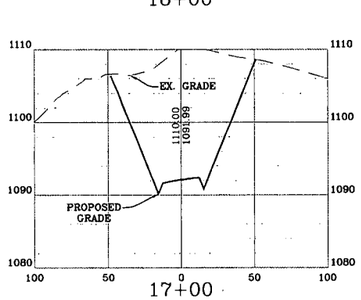
SHEET 11 OF 20

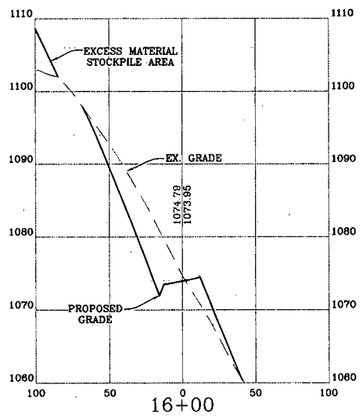
ACCESS ROAD SECTIONS

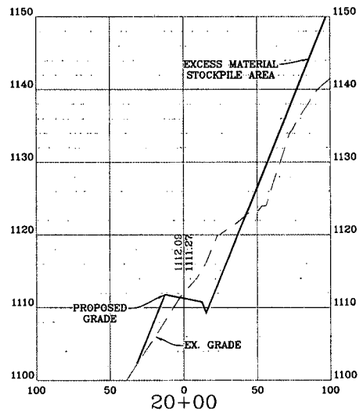
ACCESS ROAD "A" CROSS-SECTIONS

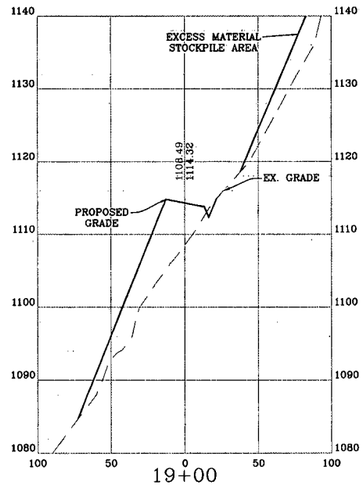
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

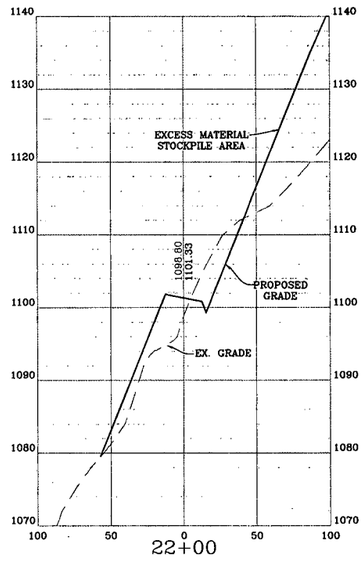


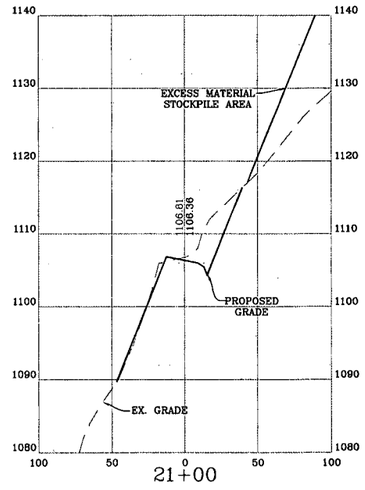


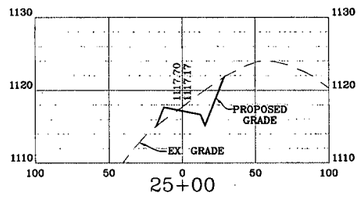


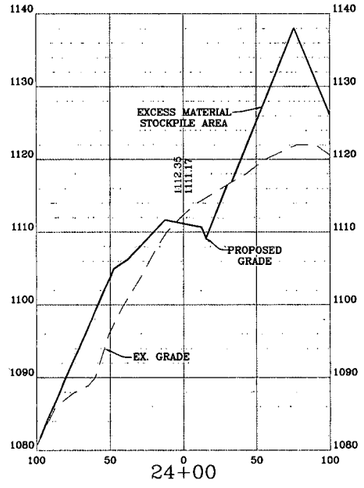


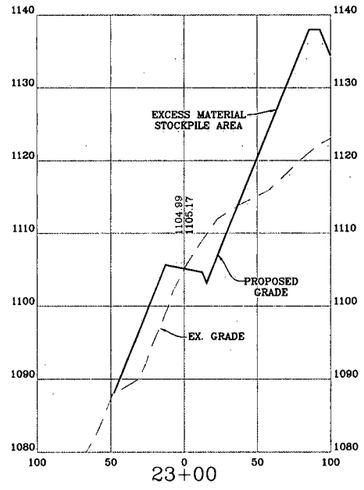


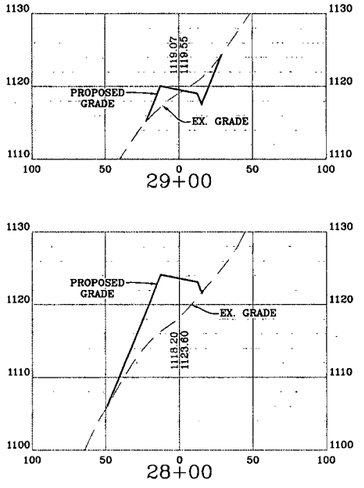


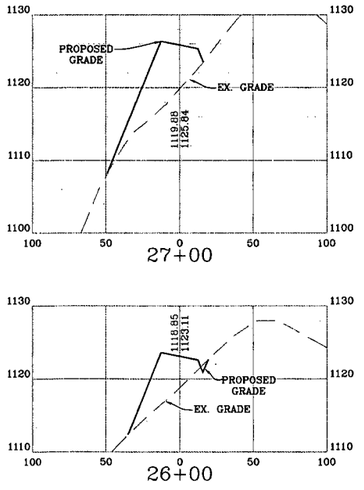












LEGEND

X-SECTION GRID INDEX	
X-SECTION GRID INTERMEDIATE	
X-SECTION PROPOSED GRADE	
X-SECTION EXISTING GRADE	
X-SECTION WATER SURFACE	
MATCHLINE	

NOTE:
1. ALL CUT & FILL SLOPES ALONG THE ACCESS ROAD SHALL BE 2:1 UNLESS STATED OTHERWISE.

Engineering Survey Environmental GIS

NAVITUS ENGINEERING INC.

151 Windy Hill Lane
Winchester, Virginia 22602
Telephone: (888) 662-4185
www.navitusenp.com

REVISION

DATE

ANTERO RESOURCES
THIS DOCUMENT WAS PREPARED FOR: ANTERO RESOURCES CORPORATION

ACCESS ROAD SECTIONS

NEW MILTON
COMPRESSOR STATION ACCESS ROAD
NEW MILTON DISTRICT
DODDRIDGE COUNTY, WEST VIRGINIA

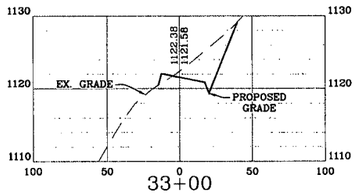
CHRIS S. KING
REGISTERED
9578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
07/16/2013

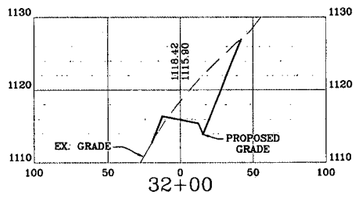
DATE: 07/16/2013
SCALE: AS SHOWN
SHEET 12 OF 20

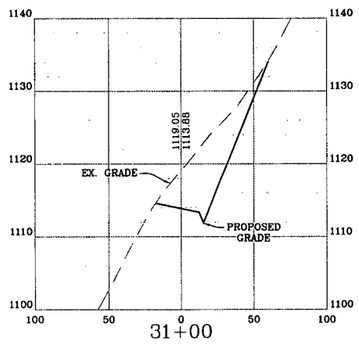
ACCESS ROAD SECTIONS

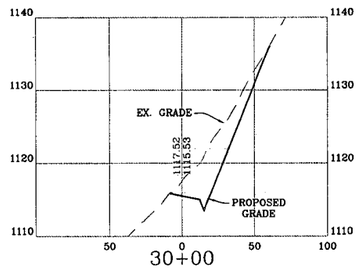
ACCESS ROAD "A" CROSS-SECTIONS

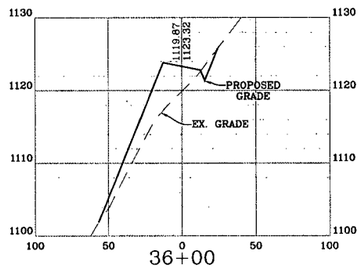
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

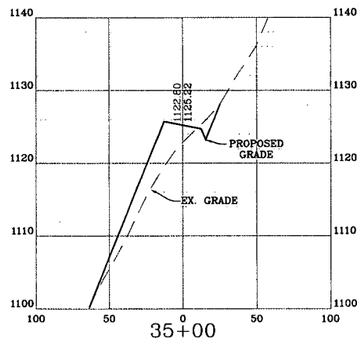


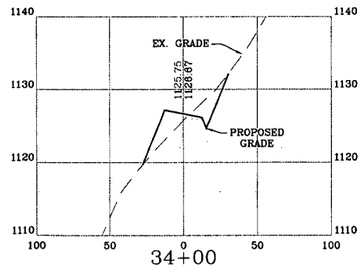


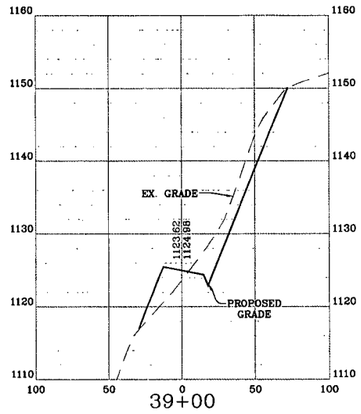


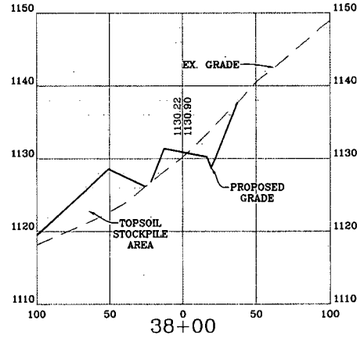


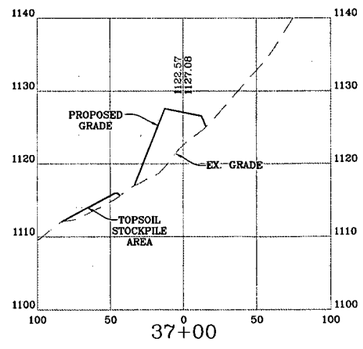


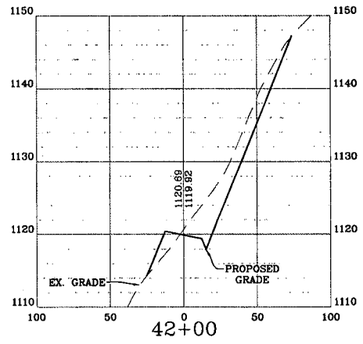


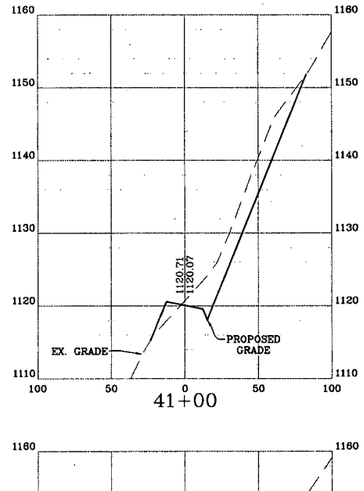


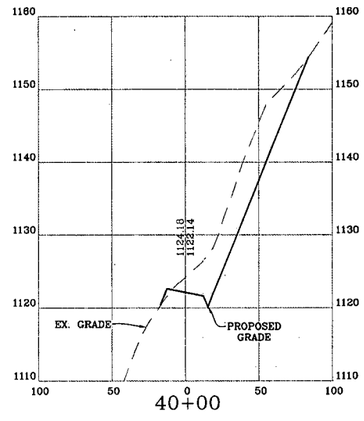


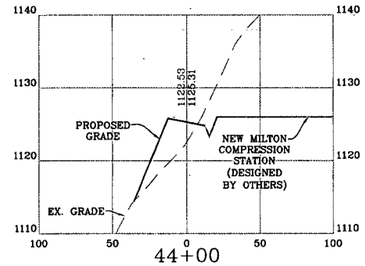


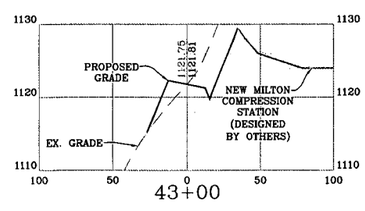












LEGEND

- X-SECTION GRID INDEX
- X-SECTION GRID INTERMEDIATE
- X-SECTION PROPOSED GRADE
- X-SECTION EXISTING GRADE
- X-SECTION WATER SURFACE
- MATCHLINE

NOTE:
1. ALL CUT & FILL SLOPES ALONG THE ACCESS ROAD SHALL BE 2:1 UNLESS STATED OTHERWISE.

Engineering Survey Environmental GIS

NAVITUS ENGINEERING INC.

151 Windy Hill Lane
Winchester, Virginia 22602
Telephone: (888) 662-4185
www.navituseng.com

DATE	REVISION

ANTERO RESOURCES
THIS DOCUMENT WAS PREPARED FOR: ANTERO RESOURCES CORPORATION

ACCESS ROAD SECTIONS

NEW MILTON
COMPRESSOR STATION ACCESS ROAD
NEW MILTON DISTRICT
DODDRIDGE COUNTY, WEST VIRGINIA

CHRIS S. KING
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
07/16/2013

DATE: 07/16/2013
SCALE: AS SHOWN
SHEET 13 OF 20

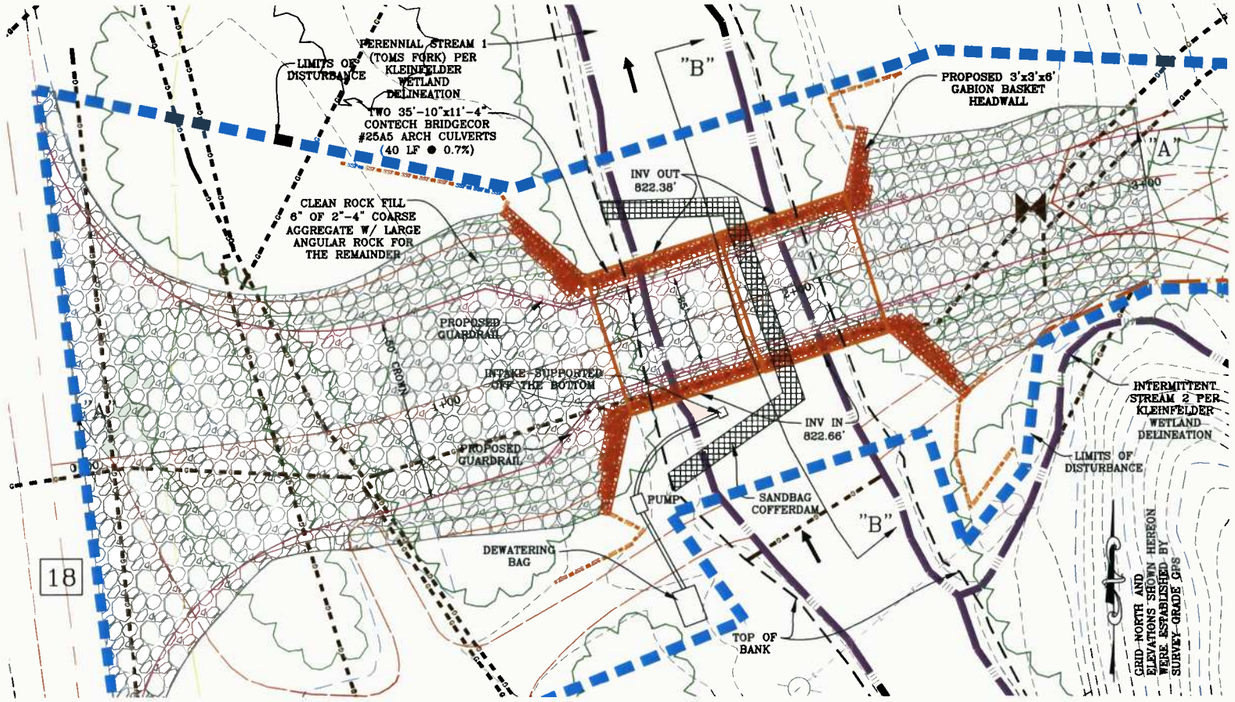
GENERAL STREAM CROSSING NOTES:

1) 2" TO 4" COARSE AGGREGATE OR LARGER SHALL BE USED TO FORM THE FIRST 6" OF FILL FOR THE CROSSING. THE REMAINDER OF MATERIAL SHALL BE ONLY LARGE ANGULAR DURABLE ROCK. "DO NOT USE ERODIBLE MATERIAL FOR CONSTRUCTION OF THE CROSSING."
2) IF MULTIPLE CULVERTS ARE USED, THEY SHALL BE SEPARATED BY AT LEAST 18 INCHES OF COMPACTED AGGREGATE FILL.
3) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
4) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
5) GABION WALLS ON THE UPSTREAM AND DOWNSTREAM SIDE OF THE CULVERT INSTALLATION SHALL BE INSTALLED TO REDUCE STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
6) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
7) GREEN CONCRETE SHALL NOT BE PLACED IN CONTACT WITH FLOWING WATER.
8) WHEN THE CROSSING HAS SERVED ITS PURPOSE, ALL STRUCTURES INCLUDING CULVERTS, BEDDING, AND FILTER CLOTH SHALL BE REMOVED. REMOVAL OF THE STRUCTURE AND CLEAN UP OF THE AREA SHOULD BE ACCOMPLISHED WITHOUT CONSTRUCTION EQUIPMENT WORKING IN THE WATERWAY CHANNEL. UPON REMOVAL OF THE STRUCTURE, THE STREAM BANK SHALL IMMEDIATELY BE STABILIZED.
9) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
10) THE CROSSING MUST BE INSPECTED AFTER EVERY RAIN EVENT OF 0.5 INCHES OR MORE AND ONCE A WEEK TO ENSURE THAT THE CULVERTS, STREAMBED, AND STREAM BANKS ARE MAINTAINED AND NOT DAMAGED. NEVER ALLOW THE CULVERTS TO BECOME CLOGGED WITH DEBRIS AND REMOVE ANY OBSTRUCTIONS IMMEDIATELY.
11) FLUSHING IS NOT AN APPROVED METHOD TO BE UTILIZED FOR CULVERT CLEANOUT.

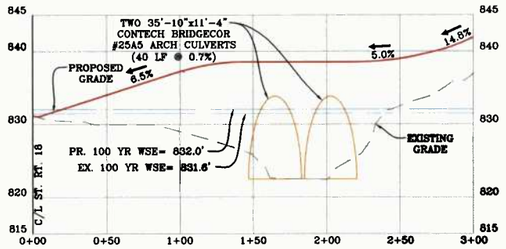
PUMP AND DEWATERING NOTES:

1) CONSTRUCTION SHOULD BE PERFORMED DURING LOW FLOW PERIODS.
2) PUMP(S) AND DEWATERING BAG SHOULD BE SUFFICIENTLY LARGE TO CONTAIN THE ENTIRE STREAM AREA BEING DAMMED.
3) THE COFFERDAM CONSTRUCTED MUST BE IMPERVIOUS TO WATER.
4) THE INLET OF THE PUMP(S) IS TO BE SUSPENDED ABOVE THE STREAMBED IN ORDER TO PREVENT SUCKING MUD AND SEDIMENT.

STREAM CROSSING "A" DETAILS

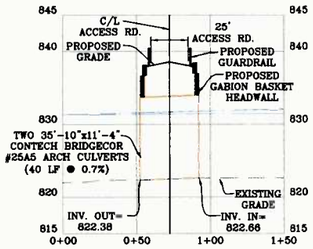


STREAM CROSSING "A" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

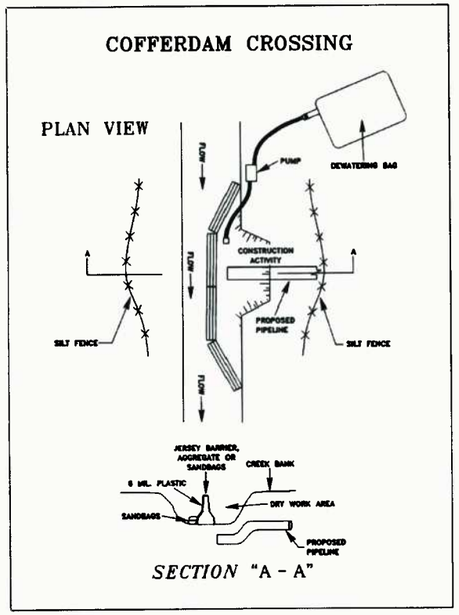


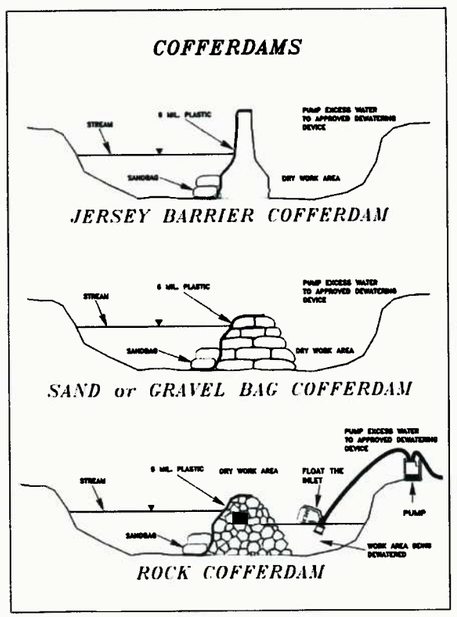
CROSS SECTION "B-B"

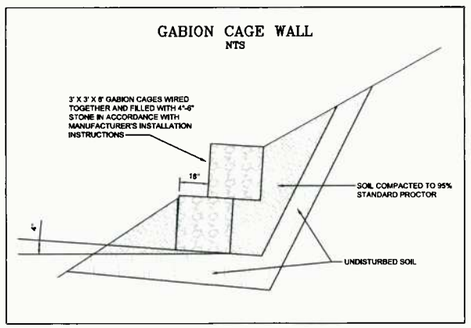
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

NOTE:

1. SEE STREAM CROSSING REPORT AND FLOODPLAIN ANALYSIS OF TOMS FORK BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATIONS.
2. ANTERO RESOURCES SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "A".







LEGEND

X-SECTION GRID INDEX	
X-SECTION GRID INTERMEDIATE	
X-SECTION PROPOSED GRADE	
X-SECTION EXISTING GRADE	
X-SECTION WATER SURFACE	
MATCHLINE	

LEGEND

EX. INDEX CONTOUR	700	PROP. INDEX CONTOUR	700
EX. INTERMEDIATE CONTOUR		PROP. INTERMEDIATE CONTOUR	
EX. PROPERTY LINE		PROP. INDEX CONTOUR (ROAD)	700
EX. ROAD EDGE OF GRAVEL/DIRT		PROP. INTERMEDIATE CTR (ROAD)	
EX. ROAD EDGE OF PAVEMENT		PROP. LIMITS OF DISTURBANCE	
EX. ROAD CENTERLINE		PROP. WELL HEAD	
EX. DITCHLINE		PROP. PERIMETER SAFETY FENCE	
EX. CULVERT		PROP. ACCESS GATE WITH EMERGENCY LIFELINE	
EX. FENCELINE		PROP. ROAD EDGE OF GRAVEL	
EX. OVERHEAD UTILITY		PROP. ROAD CENTERLINE	
EX. POWER POLE/GUY WIRE		PROP. V-DITCH W/ CHECK DAMS	
EX. GASLINE	-G-	PROP. CULVERT W/ RIP-RAP	
EX. TREELINE		PROP. COMPOST FILTER SOCK	
EX. DELINEATED STREAM		PROP. SUPER SILT FENCE	-SSF-
EX. DELINEATED WETLAND		MATCHLINE	
EX. BUILDING		BRUSH PILE SEDIMENT BARRIER	
100' WETLAND/STREAM BUFFER			
DELINEATION STUDY AREA			

NAVITUS ENGINEERING INC.
Engineering Survey Environmental GIS
151 Windy Hill Lane
Winchester, Virginia 22602
Telephone: (888) 662-4185
www.navitusengr.com

DATE	REVISION

ANTERO RESOURCES
THIS DOCUMENT WAS PREPARED FOR: ANTERO RESOURCES CORPORATION

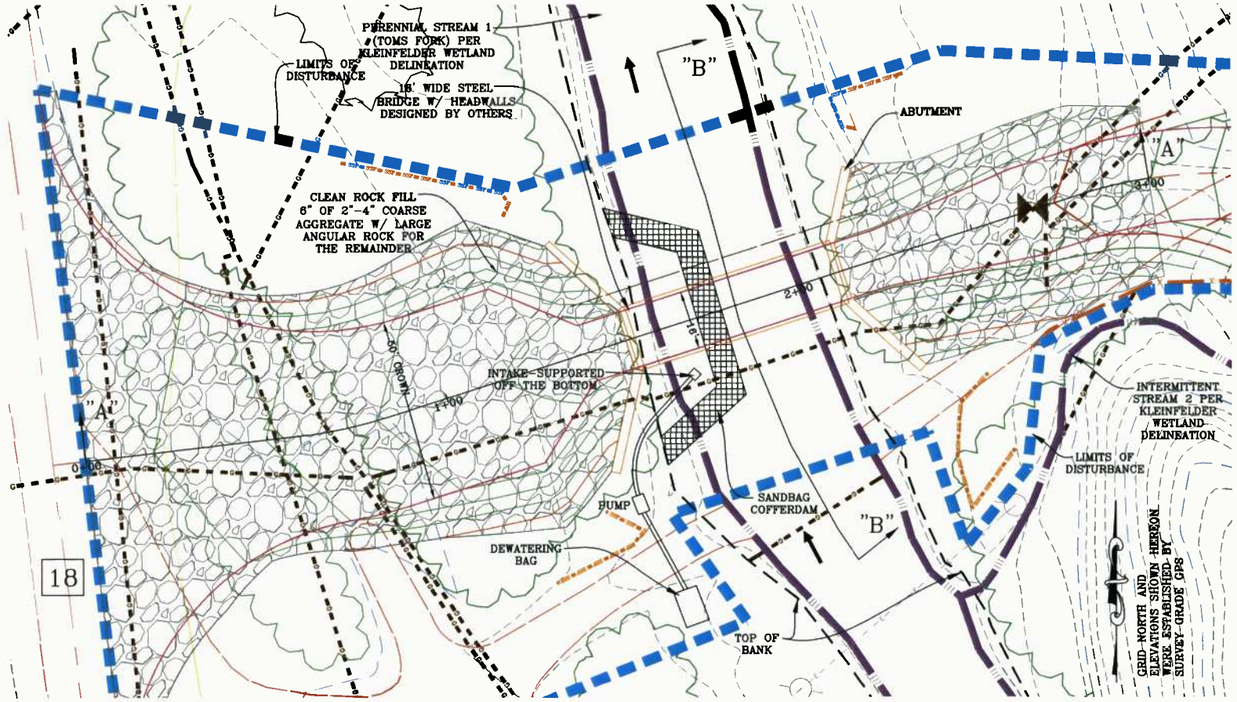
STREAM CROSSING "A" DETAILS

NEW MILTON
COMPRESSOR STATION ACCESS ROAD
NEW MILTON DISTRICT
DODDRIDGE COUNTY, WEST VIRGINIA

LUKE S. KLAVON REGISTERED PROFESSIONAL ENGINEER STATE OF WEST VIRGINIA
07/16/2013

DATE: 07/16/2013
SCALE: AS SHOWN
SHEET 14 OF 20

STREAM CROSSING "A" ALTERNATE DETAILS



20 0 20
GRAPHIC SCALE (IN FEET)

NOTE:
1. SEE STREAM CROSSING REPORT AND FLOODPLAIN ANALYSIS OF TOMS FORK BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATIONS.
2. ANTERO RESOURCES SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "A".

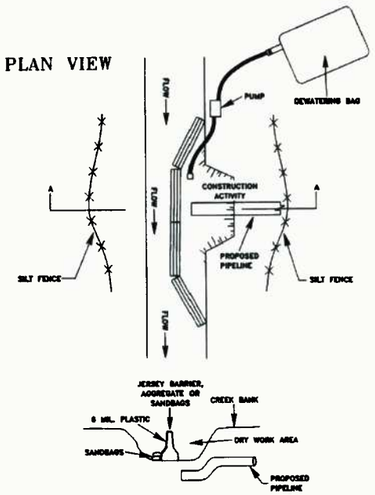
GENERAL STREAM CROSSING NOTES:

1) 2" TO 4" COARSE AGGREGATE OR LARGER SHALL BE USED TO FORM THE FIRST 6" OF FILL FOR THE CROSSING. THE REMAINDER OF MATERIAL SHALL BE ONLY LARGE ANGULAR DURABLE ROCK. "DO NOT USE ERODIBLE MATERIAL FOR CONSTRUCTION OF THE CROSSING."
2) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
3) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
4) ABUTMENTS AND WINGWALLS ON THE UPSTREAM AND DOWNSTREAM SIDE OF THE BRIDGE INSTALLATION SHALL BE INSTALLED TO REDUCE STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
5) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
6) GREEN CONCRETE SHALL NOT BE PLACED IN CONTACT WITH FLOWING WATER.
7) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
8) THE CROSSING MUST BE INSPECTED AFTER EVERY RAIN EVENT OF 0.5 INCHES OR MORE AND ONCE A WEEK TO ENSURE THAT THE CULVERTS, STREAMBED, AND STREAM BANKS ARE MAINTAINED AND NOT DAMAGED. NEVER ALLOW THE CULVERTS TO BECOME CLOGGED WITH DEBRIS AND REMOVE ANY OBSTRUCTIONS IMMEDIATELY.

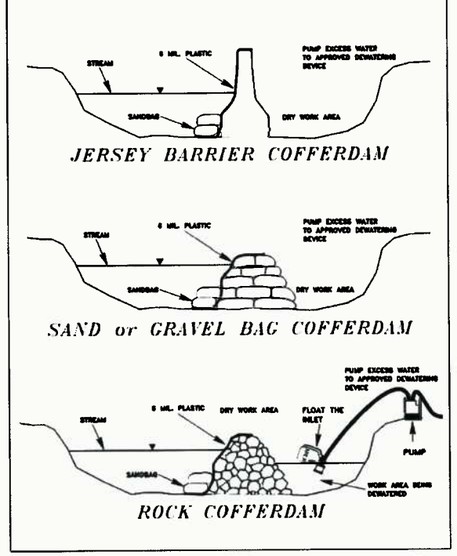
PUMP AND DEWATERING NOTES:

1) CONSTRUCTION SHOULD BE PERFORMED DURING LOW FLOW PERIODS.
2) PUMP(S) AND DEWATERING BAG SHOULD BE SUFFICIENTLY LARGE TO CONTAIN THE ENTIRE STREAM AREA BEING DAMMED.
3) THE COFFERDAM CONSTRUCTED MUST BE IMPERVIOUS TO WATER.
4) THE INLET OF THE PUMP(S) IS TO BE SUSPENDED ABOVE THE STREAMBED IN ORDER TO PREVENT SUCKING MUD AND SEDIMENT.

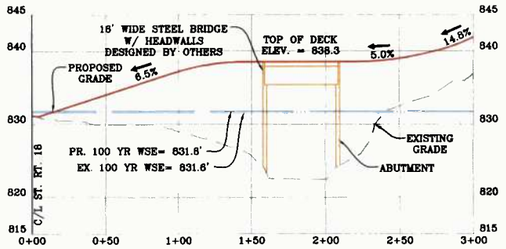
COFFERDAM CROSSING



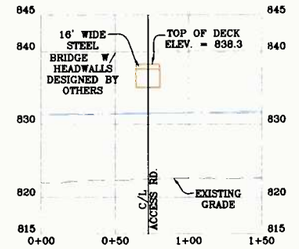
COFFERDAMS



STREAM CROSSING "A" ALTERNATE SECTIONS



CROSS SECTION "A-A"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

LEGEND

X-SECTION GRID INDEX	
X-SECTION GRID INTERMEDIATE	
X-SECTION PROPOSED GRADE	
X-SECTION EXISTING GRADE	
X-SECTION WATER SURFACE	
MATCHLINE	

LEGEND

EX. INDEX CONTOUR	700	PROP. INDEX CONTOUR	700
EX. INTERMEDIATE CONTOUR		PROP. INTERMEDIATE CONTOUR	
EX. PROPERTY LINE		PROP. INDEX CONTOUR (ROAD)	700
EX. ROAD EDGE OF GRAVEL/DIRT		PROP. INTERMEDIATE CTR (ROAD)	
EX. ROAD EDGE OF PAVEMENT		PROP. LIMITS OF DISTURBANCE	
EX. ROAD CENTERLINE		PROP. WELL HEAD	
EX. DITCHLINE		PROP. PERIMETER SAFETY FENCE	
EX. CULVERT		PROP. ACCESS GATE WITH EMERGENCY LIFELINE	
EX. FENCELINE		PROP. ROAD EDGE OF GRAVEL	
EX. OVERHEAD UTILITY		PROP. ROAD CENTERLINE	
EX. POWER POLE/GUY WIRE		PROP. V-DITCH W/ CHECK DAMS	
EX. GASLINE	G	PROP. CULVERT W/ RIP-RAP	
EX. TREELINE		PROP. COMPOST FILTER SOCK	
EX. DELINEATED STREAM		PROP. SUPER SILT FENCE	SSF SSF
EX. DELINEATED WETLAND		MATCHLINE	
EX. BUILDING		BRUSH PILE SEDIMENT BARRIER	
100' WETLAND/STREAM BUFFER			
DELINEATION STUDY AREA			

NAVITUS ENGINEERING INC.
Engineering Survey Environmental GIS
151 Windy Hill Lane
Weirton, West Virginia 26062
Telephone: (888) 952-4185
www.navitusengineering.com

DATE	REVISION

ANTERO RESOURCES
THIS DOCUMENT WAS PREPARED FOR ANTERO RESOURCES CORPORATION

STREAM CROSSING "A" ALTERNATE DETAILS

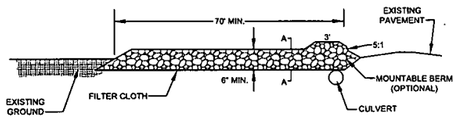
NEW MILTON
COMPRESSOR STATION ACCESS ROAD
NEW MILTON DISTRICT
DODDRIDGE COUNTY, WEST VIRGINIA

CHRIS S. KLINE
REGISTERED
9576
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
07/16/2013

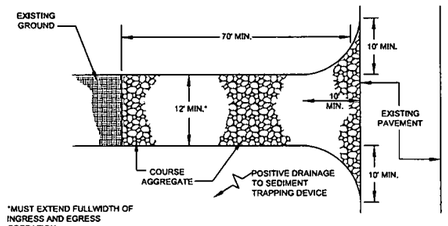
DATE: 07/16/2013
SCALE: AS SHOWN
SHEET 15 OF 20

FIGURE 3.02.1

STONE CONSTRUCTION ENTRANCE

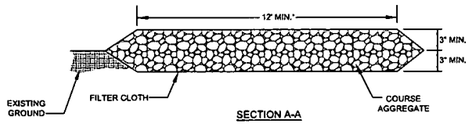


SIDE ELEVATION



*MUST EXTEND FULLWIDTH OF INGRESS AND EGRESS OPERATION

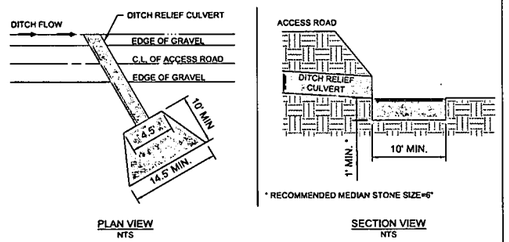
PLAN VIEW



SECTION A-A

SOURCE: ADAPTED from the 1983 Maryland Standards for Soil Erosion and Sediment Control and Va. DSWC

TYPICAL DITCH RELIEF CULVERT OUTLET TREATMENT



PLAN VIEW
NTS

SECTION VIEW
NTS

NOTE:
ALL DITCH LINE PROTECTION SHALL BE INSTALLED AS RECOMMENDED IN THE WEST VIRGINIA EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE (BMP) MANUAL. DITCH LINE PROTECTION SHALL BE BASED ON THE FOLLOWING GRADES:

1. LESS THAN 3% – GRASSED
2. 3–8% – GRASS WITH ROLLED EROSION CONTROL PRODUCTS (RECP)
3. GREATER THAN 9% – RIPRAP OR EQUIVALENT GEOTEXTILE

IF HIGH EROSIVE SOILS ARE ENCOUNTERED DURING CONSTRUCTION, THE ENGINEER SHOULD BE CONTACTED FOR FURTHER EVALUATION.

Modified Figure 3.1 – Typical Roadside Ditch Section
Sump at Ditch Relief Culvert

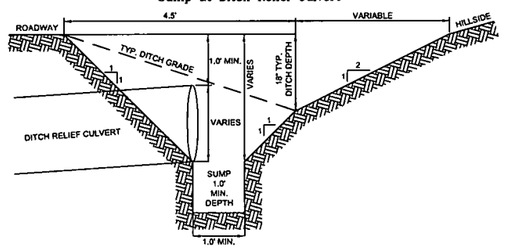
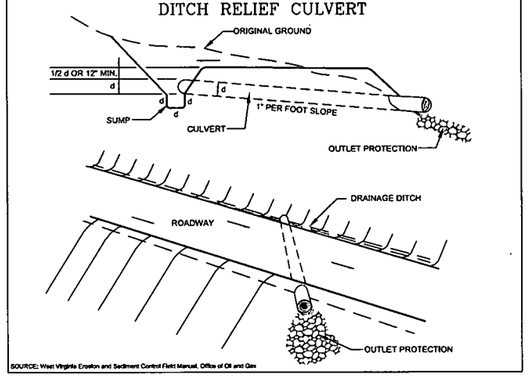


FIGURE II-4

DITCH RELIEF CULVERT



SOURCE: West Virginia Erosion and Sediment Control Field Manual, Office of Oil and Gas

Table II-5

Pipe Sizes for Culverts Across Roads		
Drainage Area (Ac)	Pipe Diameter (In)	Pipe Capacity (Cfs)
10	15	5
20	18	9
30	21	12
50	24	18
80	27	24
100	30	29
300	36	60
500	42	85

Table II-6

Spacing of Culverts	
Road Grade %	Distance (Ft)
2-5	500-300
6-10	300-200
11-15	200-100
16-20	100

TURNOUT

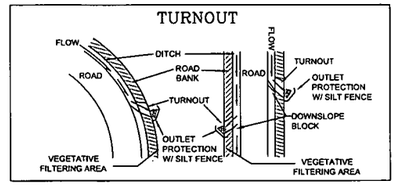
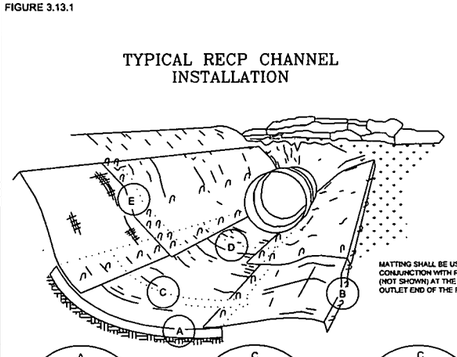


FIGURE 3.13.1

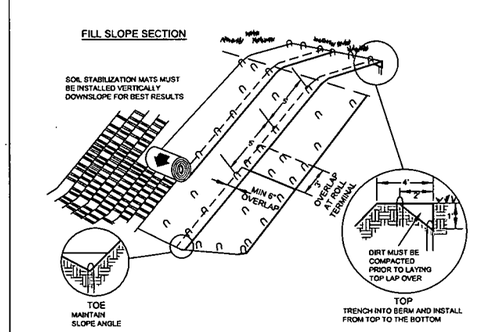
TYPICAL RECP CHANNEL INSTALLATION



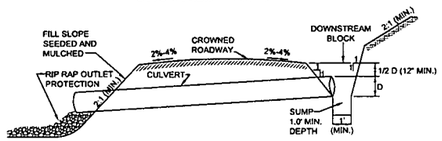
SOURCE: VA DCR-DSWC AND NORTH AMERICAN GREEN

FIGURE 3.13.2

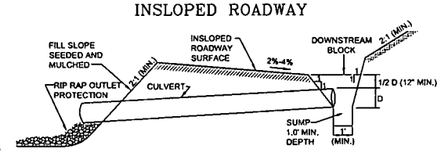
ROLLED EROSION CONTROL PRODUCTS



CROWNED ROADWAY



INSLOPED ROADWAY



Cut and fill slopes shall be stabilized immediately upon completion of roadway grading. These areas shall be blanketed wherever they are located within 50 feet of a surface water or within 100 feet of a surface water where a suitable vegetative filter strip does not exist.

A durable top dressing shall be provided for soils having low strength.

Roadside ditches shall be provided with adequate protection lining.

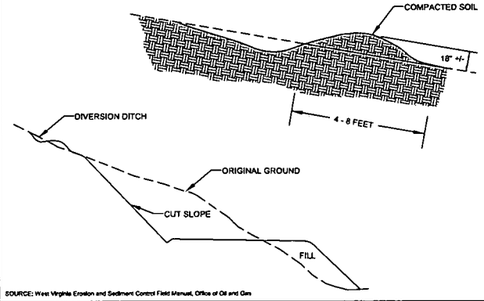
Adequately sized culverts or other suitable cross drains shall be provided at all seeps, springs, and drainageways.

Roadway shall be inspected weekly and after each runoff event. Damaged roadways, ditches, or cross drains shall be repaired immediately.

SOURCE: PA DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF OIL AND GAS MANAGEMENT 8000-PM-OG0011 APPENDIX A BMP CONSTRUCTION DETAILS (MODIFIED)

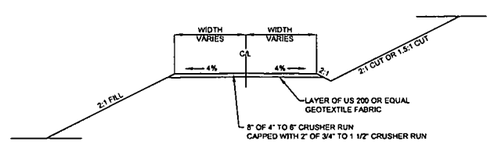
FIGURE II-3

DIVERSION DITCH – TEMPORARY



SOURCE: West Virginia Erosion and Sediment Control Field Manual, Office of Oil and Gas

TYPICAL ROAD CROSS SECTION DETAIL



NAVITUS ENGINEERING INC.
Engineering Survey Environmental GIS
151 Windy Hill Lane
Winchester, Virginia 22602
Telephone: (888) 662-4185
www.navituseng.com

DATE	REVISION

ANTERO RESOURCES
THIS DOCUMENT WAS PREPARED FOR: ANTERO RESOURCES CORPORATION

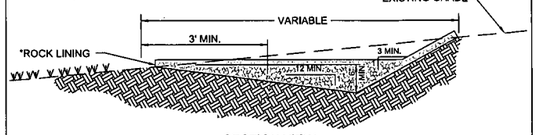
CONSTRUCTION DETAILS

NEW MILTON
COMPRESSOR STATION ACCESS ROAD
NEW MILTON DISTRICT
DODDRIDGE COUNTY, WEST VIRGINIA

CRAIG S. KLUG
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
07/16/2013

DATE: 07/16/2013
SCALE: N/A
SHEET 16 OF 20

STANDARD CONSTRUCTION DETAIL
Rocked Level Spreader

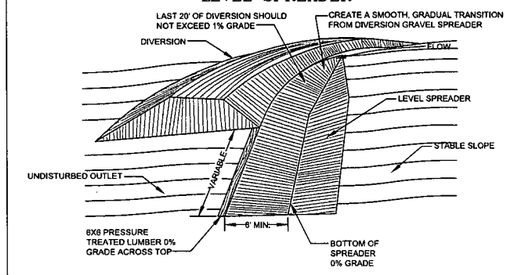


SECTION VIEW
NTS

*All Level Spreader rock shall be a minimum of R4.

FIGURE 3.02.1

LEVEL SPREADER



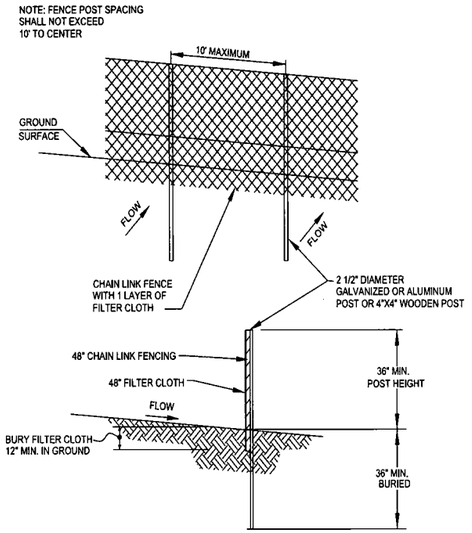
PERSPECTIVE VIEW

NOTE: ALL TEMPORARY BERMS, SWALES AND LEVEL SPREADER DITCHES MUST RECEIVE TEMPORARY SEEDING AND MULCHING AFTER INSTALLATION

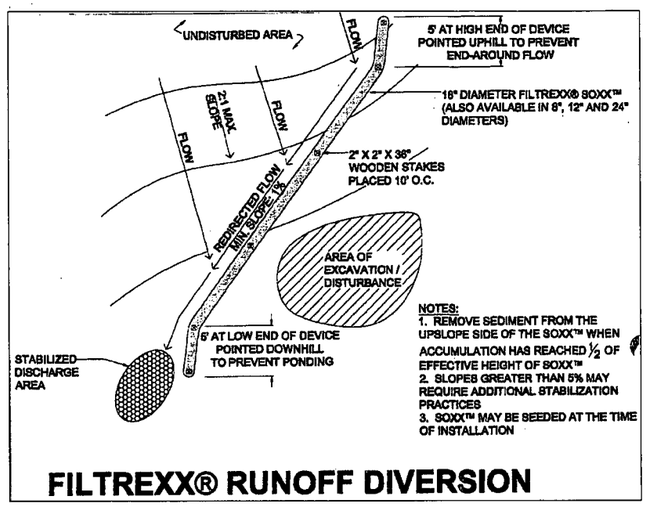
SOURCE: ADAPTED FROM N.C. E&S Control Planning and Design Manual and VA DESC

FIGURE II-11c

SUPER SILT FENCE

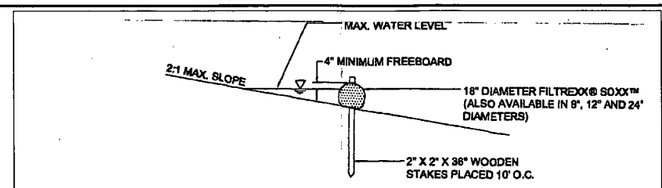


A SUPER SILT FENCE IS A TEMPORARY BARRIER OF GEOTEXTILE FABRIC OVER CHAIN LINK FENCE. SUPER SILT FENCE SHOULD BE PLACED AS CLOSE TO THE CONTOUR AS POSSIBLE. NO SECTION OF SUPER SILT FENCE SHOULD EXCEED A GRADE OF 5 PERCENT FOR MORE THAN A DISTANCE OF 20 FEET. CHAIN LINK FENCE SHALL BE FASTENED SECURELY TO THE FENCE POSTS WITH WIRE TIES OR STAPLES. GEOTEXTILE FABRIC SHALL BE FASTENED SECURELY TO THE CHAIN LINK FENCE WITH TIES SPACED EVERY 24 INCHES AT THE TOP AND MID-SECTIONS. GEOTEXTILE FABRIC SHALL BE EMBEDDED A MINIMUM OF 12 INCHES INTO THE GROUND. WHEN 2 SECTIONS OF GEOTEXTILE FABRIC ADJOIN EACH OTHER, THEY SHALL BE OVERLAPPED BY 6 INCHES AND FOLDED. METAL POSTS AS SPECIFIED BY WV DOT CAN BE REPLACED BY PRESSURE-TREATED 4" X 4" POSTS. SUPER SILT FENCE SHOULD BE INSPECTED AT A MINIMUM ONCE EVERY 7 CALENDAR DAYS OR WITHIN 24 HOURS AFTER ANY STORM EVENT GREATER THAN 0.5 INCHES OF RAIN PER 24 HOUR PERIOD. ANY REQUIRED REPAIRS SHALL BE MADE IMMEDIATELY.

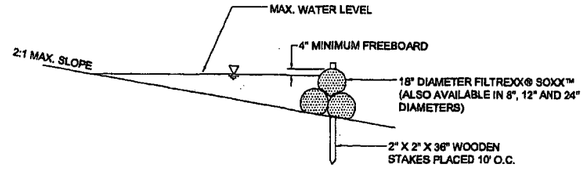


NOTES:
1. REMOVE SEDIMENT FROM THE UPSLOPE SIDE OF THE SOXX™ WHEN ACCUMULATION HAS REACHED ½ OF EFFECTIVE HEIGHT OF SOXX™
2. SLOPES GREATER THAN 5% MAY REQUIRE ADDITIONAL STABILIZATION PRACTICES
3. SOXX™ MAY BE SEEDED AT THE TIME OF INSTALLATION

FILTREXX® RUNOFF DIVERSION



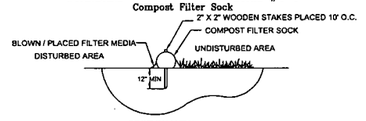
SINGLE INSTALLATION SECTION
NTS



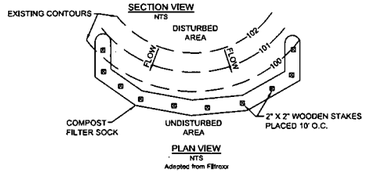
PYRAMID INSTALLATION SECTION
NTS

FILTREXX® RUNOFF DIVERSION SECTIONS
NTS

STANDARD CONSTRUCTION DETAIL #4-1
Compost Filter Sock



SECTION VIEW
NTS



PLAN VIEW
NTS
Adapted from Filtrexx

Sock fabric shall meet standards of Table 4.1. Compost shall meet the following standards:

Organic Matter Content	80% -100% (dry weight basis)
Organic Portion	Fibrous and elongated
pH	5.5-8.0
Moisture Content	35%-55%
Particle Size	98% pass through 1" screen
Soluble Salt Concentration	5.0 dS Maximum

Compost Filter Sock shall be placed at existing level grade. Both ends of the sock shall be extended at least 8 feet up the slope at 45 degrees to the main sock alignment. Maximum slope length above any sock shall not exceed manufacturer's maximum permissible slope length.

Traffic shall not be permitted to cross filter socks.

Accumulated Sediment shall be removed when it reaches 1/2 the above ground height of the sock and disposed in the manner described elsewhere in the plan.

Socks shall be inspected weekly and after each runoff event. Damaged socks shall be repaired according to manufacturer's specifications or replaced within 24 hours of inspection.

Biodegradable filter socks shall be replaced after 6 months; photodegradable socks after 1 year. Polypropylene socks shall be replaced according to manufacturer's recommendations.

Upon stabilization of the area tributary to the sock, stakes shall be removed. The sock may be left in place and vegetated or removed. In the latter case, the mesh shall be cut open and the mulch spread as a soil supplement.

In the event the ground is frozen, #5 rebar with safety caps shall be used instead of wooden stakes to anchor the filter sock. Once the ground thaws the rebar anchors shall be removed and replaced with 2" x 2" wooden stakes and installed as shown in the detail above.

Table 4.1
Compost Sock Fabric Minimum Specifications

Material Type	3 mil HDPE	5 mil HDPE	5 mil HDPE	Multi-Filament Polypropylene (MFPP)	Heavy Duty Multi-Filament Polypropylene (HDMFPP)
Material Characteristics	Photo-degradable	Photo-degradable	Bio-degradable	Photo-degradable	Photo-degradable
Sock Diameters	12" 18"	12" 18" 24" 32"	12" 18" 24" 32"	12" 18" 24" 32"	12" 18" 24" 32"
Mesh Opening	3/8"	3/8"	3/8"	3/8"	1/8"
Textile Strength		26 psi	26 psi	44 psi	205 psi
Ultraviolet Stability % Original Strength (ASTM G-155)	23% at 1000 hr.	23% at 1000 hr.		100% at 1000 hr.	100% at 1000 hr.
Minimum Functional Longevity	6 months	9 months	6 months	1 year	2 years
Two-ply systems					
Inner Containment Netting	HDPE biaxial net				
	Continuously wound				
	Fusion-welded junctures				
	3/4" x 3/4" Max. aperture size				
Outer Filtration Mesh	Composite Polypropylene Fabric (Woven layer & non-woven fleece mechanically fused via needle punch)				
	3/16" Max. aperture size				
Sock fabrics composed of burlap may be used on projects lasting 6 months or less.					

FIGURE II-10

BRUSH PILE SEDIMENT BARRIER

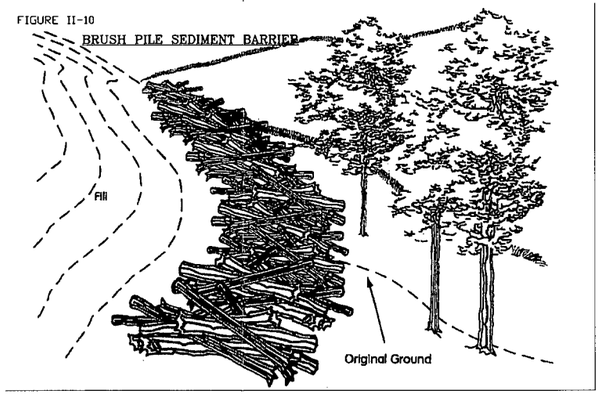
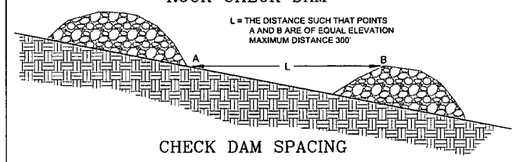
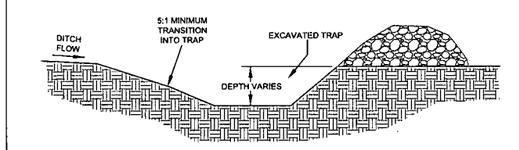


FIGURE 3.05.2

ROCK CHECK DAM



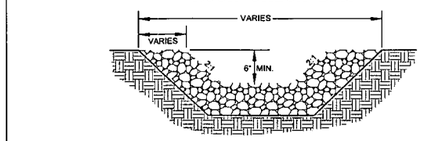
CHECK DAM SPACING



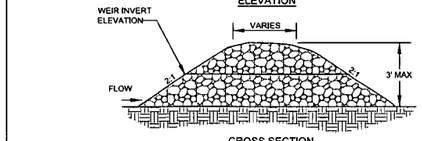
CHECK DAM WITH SUMP

FIGURE 3.05.1

ROCK CHECK DAM



ELEVATION



CROSS SECTION

Engineering Survey Environmental GIS

NAVITUS ENGINEERING INC.
151 Windy Hill Lane
Winchester, Virginia 22602
Telephone: (888) 662-4185
www.navituseng.com

DATE	REVISION

ANTERO RESOURCES
THIS DOCUMENT WAS PREPARED FOR:
ANTERO RESOURCES CORPORATION

CONSTRUCTION DETAILS

NEW MILTON
COMPRESSOR STATION ACCESS ROAD
NEW MILTON DISTRICT
DODDRIDGE COUNTY, WEST VIRGINIA

JAMES B. NAVITUS
REGISTERED
15678
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
07/16/2013

DATE: 07/16/2013
SCALE: N/A
SHEET 17 OF 20

REVEGETATION

Taken from the
West Virginia Erosion and Sediment Control Field Manual
West Virginia Division of Environmental Protection Office of Oil and Gas
Charleston, W.Va.
Section IV

Temporary Seeding

a. General Conditions Where Practice Applies
Where exposed soil surfaces are not to be fine-graded or worked for periods longer than 21 days. Temporary vegetative cover with sediment controls must be established where runoff will go directly into a stream. Immediately upon construction of the site (site includes road and location), vegetation must be established on road bank and location slopes. A permanent vegetative cover shall be applied to areas that will be left un-worked for a period of more than six months.

b. Seed Mixtures and Planting Dates
Refer to Tables 2 through 4 for recommended dates to establish vegetative cover and the approved lists of temporary and permanent plant species, and planting rates. Table 3 gives recommended types of temporary vegetation, rates of application, and optimum seeding dates. In situations where another cover is desired, contact the local soil conservation district for seeding recommendations.

c. Seed Application
Apply seed by broadcasting, drilling, or by hydroseed according to the rates indicates in Table IV-3. Perform all planting operations at right angles to the slope. Necessary site preparation and roughening of the soil surface should be done just prior to seeding. Seedbed preparation may not be required on newly disturbed areas.

Permanent Seeding

a. General
Permanent vegetative cover will be established where no further soil disturbance is anticipated or needed. Soil fertility and pH level should be tested and adjusted according to seed species planted. Planting of permanent vegetative covers must be performed on all disturbed areas after completion of the drilling process. Any site that contains significant amounts of topsoil shall have the topsoil removed and stockpiled when feasible. Topsoil should not be added to slopes steeper than 2:1 unless a good bonding to the sub-layer can be achieved. After proper grading and seedbed preparation, the vegetation will reestablish ground cover for the control of surface water runoff erosion.
All required seedbed preparation and loosening of soil by disking or dozer tracking should be performed just prior to seeding. If seedbed preparation is not feasible, 50% more seed shall be added to the recommended rates shown in Tables IV-3 and IV-4.
When hydroseeding, seedbed preparation may not be necessary if adequate site preparation was performed. Incorporate the appropriate amount of lime and/or fertilizer in the slurry mix when hydroseeding.
When hydroseeding, first mix the lime, fertilizer, and hydro-mulch in the recommended amount of water. Mix the seed and inoculants together within one hour prior to planting, and add to the slurry just before seeding. Apply the slurry uniformly over the prepared site. Assure that agitation is continuous throughout the seeding operation and the mix is applied within one hour of initial mixing.

b. Lime and Fertilizer
1. Lime shall be applied to all permanent seedings. The pH of the soil is to be determined and lime applied accordingly. Once the pH is known, select the amount of lime to be applied from Table IV-5.
2. Fertilizer shall be applied in all permanent seedings. Apply the equivalent for 500 lbs. minimum 10-20-20 fertilizer per acre or use the amount of fertilizer and lime recommended by a certified soil test.
3. Application: For best results and maximum benefits, the lime and fertilizer are to be applied at the time of seedbed preparation.

c. Permanent Seed Mixtures
Planners should take into consideration the species makeup of the existing pasture and the landowner's future pasture management plans when recommending seed mixtures. Selection: From Tables IV 4a and b, Permanent Seeding Mixtures Suitable for Establishment in West Virginia.
Notes:
1. All legumes must be planted with the proper inoculants prior to seeding.
2. 'Lathco' Flatpea is potentially poisonous to some livestock.
3. Only endophyte free varieties of Tall Fescue should be used. Tall Fescue and Crownvetch are also very invasive species, non-native to WV.
4. For unprepared seedbeds or seeding outside the optimum timeframes, add 50% more seed to the specified rate. Mixtures in Table 4b are more wildlife and farm friendly; those listed in bold are suitable for use in shaded woodland settings. Mixtures in italic are suitable for use in filter strips.

d. Seeding for Wildlife Habitat
Consider the use of the native plants or locally adapted plants when selecting cover types and species for wildlife habitat. Wildlife friendly species or mixes that have multiple values should be considered. See wildlife friendly species/mixtures in Table IV-4b. Consider selecting no or low maintenance long-lived plants adaptable to sites which may be difficult to maintain with equipment.

Mulching

a. General Organic Mulches
The application of straw, hay or other suitable materials to the soil surface to prevent erosion. Straw made from wheat or oats is the preferred mulch, the use of hay is permissible, but not encouraged due to the risk of spreading invasive species. Mulch must be applied to all temporary and permanent seeding on all disturbed areas. Depending on site conditions, in critical areas such as waterways or steep slopes, additional or substitute soil protective measures may be used if deemed necessary. Examples include jute mesh and soil stabilization blankets or erosion control matting.
Areas that have been temporarily or permanently seeded should be mulched immediately following seeding. Mulches conserve desirable soil properties, reduce soil moisture loss, prevent crusting and sealing of the soil surface and provide a suitable microclimate for seed germination.
Areas that cannot be seeded because of the season should be mulched to provide some protection to the soil surface. An organic mulch, straw or hay should be used and the area then seeded as soon as weather or seasonal conditions permit. Do not use fiber mulch (cellulose-hydroseed) alone for this practice; at normal application rates it will not give the soil protection of other types of mulch.
Wood cellulose fiber mulch is used in hydroseeding operations and applied as part of the slurry. It creates the best seed-soil contact when applied over the top of (as a separate operation) newly seeded areas. Fiber mulch does not alone provide sufficient protection on highly erodible soils, or during less than favorable growing conditions. Fiber mulch should not be used alone during the dry summer months or when used for late fall mulch cover. Use straw mulch during these periods and fiber mulch may be used to tack (anchor) the straw mulch. Fiber mulch is well suited for steep slopes, critical areas and areas susceptible to wind.

b. Chemical Mulches, Soil Binders and Tackifiers
A wide range of synthetic spray on materials are marketed to stabilize and protect the soil surface. These are mixed with water and sprayed over the mulch and to the soil. They may be used alone in some cases as temporary stabilizers, or in conjunction with fiber mulch, straw or hay.
When used alone most chemical mulches do not have the capability to insulate the soil or retain soil moisture that organic mulches have.

c. Specifications
From Table IV-6 select the type of mulch and rate of application that will best suit the conditions at the site.

d. Anchoring
Depending on the field situation, mulch may not stay in place because of wind action or rapid water runoff. In such cases, mulch is to be anchored mechanically or with mulch netting.
1. Mechanical Anchoring
Apply mulch and pull mulch anchoring tool over the mulch. When a disk is used set the disk straight and pull across slope. Mulch material should be tucked into the soil about three inches.
2. Mulch netting
Follow manufacturer's recommendation when positioning and stapling the mulch netting in the soil.

Table IV-1
Recommended Seeding Dates

Planting Dates	Suitability
March 1 - April 15 and August 1 - October 1	Best Seeding Periods
April 15 - August 1	HIGH RISK - moisture stress likely
October 1 - December 1	HIGH RISK - freeze damage to young seedlings
December 1 - March 1	Good seeding period. Dormant seeding

Table 2
Acceptable Fertilization Recommendation

Species	N (lbs/ac)	P2O5 (lbs/ac)	Example Rec.* (per acre)
Cool Season Grass	40	80	400 lbs. 10-20-20
CS Grass & Legume	30	60	300 lbs. 10-20-20
Temporary Cover	40	40	200 lbs. 19-19-19

Table 3
Temporary Cover

Species	Seeding Rate (lbs/acre)	Optimum Seeding Dates	Drainage	pH Range
Annual Ryegrass	40	3/1 - 6/15 or 8/15 - 9/15	Well - Poorly	5.5 - 7.5
Field Bromegrass	40	3/1 - 6/15 or 8/15 - 9/15	Well - Mod. Well	6.0 - 7.0
Spring Oats	96	3/1 - 6/15	Well - Poorly	5.5 - 7.0
Sundangrass	40	5/15 - 8/15	Well - Poorly	5.5 - 7.5
Winter Rye	168	8/15 - 10/15	Well - Poorly	5.5 - 7.5
Winter Wheat	180	8/15 - 11/15	Well - Mod. Well	5.5 - 7.0
Japanese Millet	30	6/15 - 8/15	Well	4.5 - 7.0
Redtop	5	3/1 - 6/15	Well	4.0 - 7.5
Annual Ryegrass	26	3/1 - 6/15	Well - Poorly	5.5 - 7.5
Spring Oats	64	3/1 - 6/15	Well - Poorly	5.5 - 7.5

NOTE: *These rates should be increased by 50% if planted April 15 - August 1 and October 1 - March 1.*

Tables IV 1-4 taken from Natural Resources Conservation Service Manual 'Critical Area Planting'

Table 4a
Permanent Seeding Mixture

Species/Mixture	Seeding Rate (lbs/acre)	Soil Drainage preference	pH Range
Crownvetch /	10 - 15	Well - Mod. Well	5.0 - 7.5
Tall Fescue	30		
Crownvetch /	10 - 15	Well - Mod. Well	5.0 - 7.5
Perennial Ryegrass	20		
Flatpea or Perennial Pea /	**20**	**Well - Mod. Well**	**4.0 - 8.0**
Tall Fescue	**15**		
Ladino Clover /	30		
Serecia Lespedeza /	25	Well - Mod. Well	4.5 - 7.5
Tall Fescue	2		
Tall Fescue /	*40*		
Ladino Clover /	*3*	*Well - Mod. Well*	*5.0 - 7.5*
Redtop	*3*		
Crownvetch /	10		
Tall Fescue /	20	Well - Mod. Well	5.0 - 7.5
Redtop	3		
Tall Fescue /	40		
Birdsfoot Trefoil /	10	Well - Mod. Well	5.0 - 7.5
Redtop	3		
Serecia Lespedeza /	25		
Tall Fescue /	30	Well - Mod. Well	4.5 - 7.5
Redtop	3		
Redtop /	30		
Tall Fescue /	3	Well - Mod. Well	5.0 - 7.5
Creeping Red	50		
Tall Fescue	*50*	*Well - Poorly*	*4.5 - 7.5*
Perennial Ryegrass /	**10**		
Tall Fescue /	**15**	**Well -Poorly**	**5.8 - 8.0**
Lathco Flatpea *	**20**		

** 'Lathco' Flatpea is potentially poisonous to some livestock. All legumes should be planted with proper inoculants prior to seeding. For unprepared seedbeds or seeding outside the optimum timeframe, add 50% more seed to the specified rate.*

Mixtures listed in bold are suitable for use in shaded woodland settings; those in italics are suitable for use in filter strips.

Table 4b
Wildlife and Farm Friendly Seed Mixtures

Species/Mixture	Seeding Rate (lbs/acre)	Soil Drainage preference	pH Range
KY Bluegrass /	20		
Redtop /	3	Well - Mod. Well	5.5 - 7.5
Ladino Clover or Birdsfoot Trefoil	2 / 10		
Timothy /	5	Well - Mod. Well	6.5 - 8.0
Alfalfa	12		
Timothy /	5	Well - Poorly	5.5 - 7.5
Birdsfoot Trefoil	8		
Orchardgrass /	*10*		
Ladino Clover /	*2*	*Well - Mod. Well*	*5.5 - 7.5*
Redtop	*3*		
Orchardgrass /	*10*	*Well - Mod. Well*	*5.5 - 7.5*
Ladino Clover	*2*		
Orchardgrass /	*20*	*Well - Mod. Well*	*5.5 - 7.5*
Perennial Ryegrass	*10*		
Creeping Red Fescue /	**30**	**Well - Mod. Well**	**5.5 - 7.5**
Perennial Ryegrass	**10**		
Orchardgrass or KY Bluegrass	20	Well - Mod. Well	6.0 - 7.5
Birdsfoot Trefoil /	10		
Redtop /	5	Well - Mod. Well	5.5 - 7.5
Orchardgrass	20		
Lathco Flatpea */	**30**	**Well - Mod. Well**	**5.5 - 7.5**
Perennial Ryegrass	**20**		
Lathco Flatpea */	30	Well - Mod. Well	5.5 - 7.5
Orchardgrass	20		

** 'Lathco' Flatpea is potentially poisonous to some livestock. All legumes should be planted with proper inoculants prior to seeding. For unprepared seedbeds or seeding outside the optimum timeframe, add 50% more seed to the specified rate.*

Mixtures listed in bold are suitable for use in shaded woodland settings; those in italics are suitable for use in filter strips.

Table IV-5
Lime and Fertilizer Application Table

pH of Soil	Lime in Tons per Acre	Fertilizer, Lbs., per Acre (10-20-20 or Equivalent)
Above 6.0	2	500
5.0 to 6.0	3	500
Below 5.0	4	500

The pH can be determined with a portable pH testing kit or by sending the soil samples to a soil testing laboratory. When 4 tons of lime per acre are applied it must be incorporated into the soil by disking, backblading or tracking up and down the slope.

Table IV-6
Mulch Materials Rates and Uses

Material	Minimum Rates per acre	Coverage	Remarks
Hay or Straw	2 to 3 Tons	Cover 75% to 90%	Subject to wind blowing or washing unless
	100 to 150 bales	of Surface	tied down
Wood Fiber	1000 to 1500 lbs	Cover all	For hydroseeding
Pulp Fiber		Disturbed Areas	
Wood - Cellulose			
Recirculated Paper			

NAVITUS ENGINEERING INC.
Engineering | Survey | Environmental | GIS
151 Windy Hill Lane
Winchester, Virginia 22602
Telephone: (888) 662-4185
www.navituseng.com

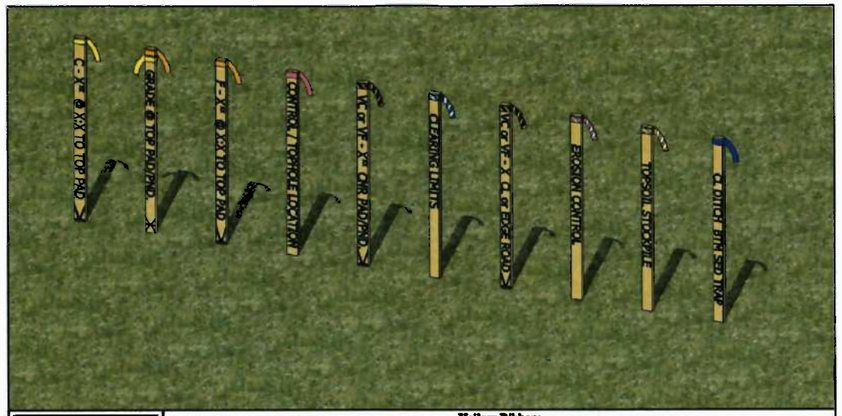
DATE	REVISION

ANTERO RESOURCES
THIS DOCUMENT WAS PREPARED FOR: ANTERO RESOURCES CORPORATION

CONSTRUCTION DETAILS
NEW MILTON COMPRESSOR STATION ACCESS ROAD
NEW MILTON DISTRICT
DODDRIDGE COUNTY, WEST VIRGINIA

CHRIS S. KLUG
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
07/16/2013

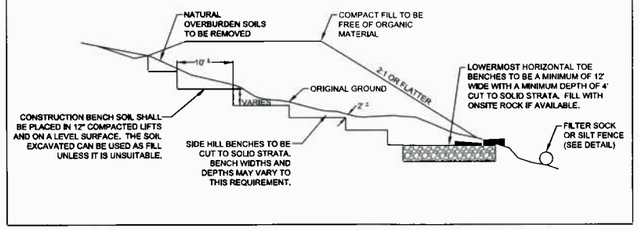
DATE: 07/16/2013
SCALE: N/A
SHEET 18 OF 20



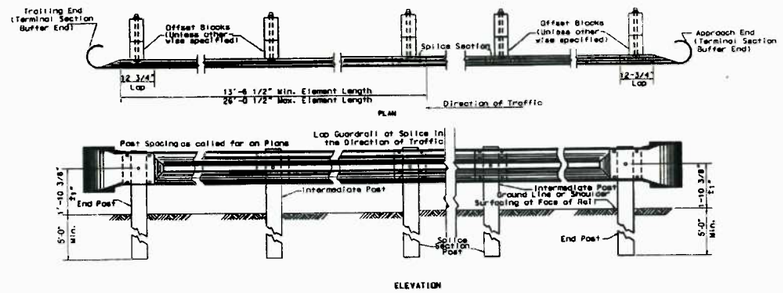
	Yellow Ribbon: Yellow Ribbon used to indicate top of Cuts (C) Cut to be determined at time of stakeout Slope determined by site design
	Yellow & Orange Ribbon: Yellow and Orange Ribbon used to indicate Grade at Top of Pad/Pond/Pit
	Orange Ribbon: Orange Ribbon used to indicate toes of Fills (F) Fill to be determined at time of stakeout Slope determined by site design
	Pink Ribbon: Pink Ribbon used to indicate Top Hole Location Pink Ribbon used to indicate Survey Control Location
	Pink & Black Stripe Ribbon: Pink & Black Stripe Ribbon used to indicate Vertical Cut (VC) at Pad/Pond/Pit corner or edge Pink & Black Stripe Ribbon used to indicate Vertical Fill (VF) at Pad/Pond/Pit corner or edge Vertical Cut/Vertical Fill to be determined at time of stakeout
	Blue & White Stripe Ribbon: Blue & White Stripe Ribbon used to indicate clearing limits/construction limits
	Orange & Black Stripe Ribbon: Orange & Black Stripe Ribbon used to indicate Vertical Cut (VC) at Centerline or edge of access road Orange & Black Stripe Ribbon used to indicate Vertical Fill (VF) at centerline or edge of access road
	Pink & White Stripe Ribbon: Pink & White Stripe Ribbon used to indicate Erosion and Sediment Control Structures Silt Fence (SF) Reinforced Filter Fence (RFF) Super Silt Fence (SSF) Filter Sock (FS)
	Orange & White Stripe Ribbon: Orange & White Stripe Ribbon used to indicate Topsoil Stockpile Locations
	Blue Ribbon: Blue Ribbon used to indicate Centerline (℄) Ditch Blue Ribbon used to indicate Bottom (BTM) Sediment Traps

ANTERO RESOURCES APPALACHIAN CORPORATION STANDARD RIBBON COLOR SCHEME
PROVIDED BY ANTERO RESOURCES APPALACHIAN CORPORATION

COMPACT FILL BENCH DETAIL



TYPICAL GUARDRAIL INSTALLATION
(UNANCHORED ENDS - WOOD POSTS AND BLOCKS SHOWN)



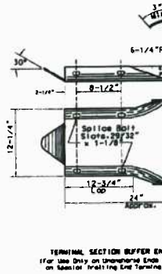
NOTES

Guardrail shall be secured to the blocks, posts and to other elements by 5/8" dia. bolts and nuts conforming to the details herein and to the requirements of 712.4 of the Standard Specifications, except that the material for nuts shall conform to ASTM A563, Grade A or better.

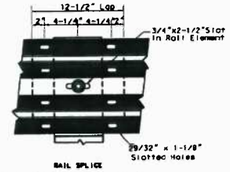
Approach and Trailing End Treatments shall be as shown or specified on the Plans or directed by the Engineer. Approach and trailing ends shall be anchored unless otherwise specified on the Plans. The specific anchor terminal to be utilized shall be as shown or specified.

The pay quantity of guardrail will be the Linear Feet of guardrail measured along the face of the rail from center to center of end posts. Cost of the Terminal Section Buffer End shall be included in the cost of the Guardrail.

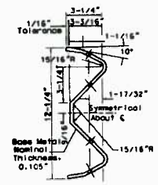
The approach slope to the face of all guardrail shall be 10:1 or flatter.



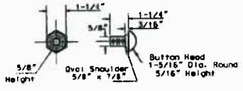
TERMINAL SECTION BUFFER END
(For Use Only on Unanchored Ends and on Special Trailing End Terminal)



RAIL SPLICE
Eight (8) Splice Bolts are to be used at all Rail Splices



SECTION
RAIL ELEMENT

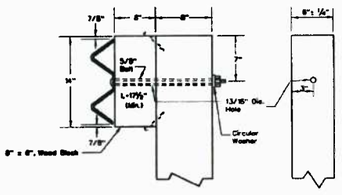


NUT
POST BOLT: Similar Except Length
SPLICE BOLT

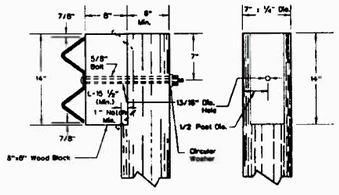
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

GUARDRAIL ELEMENT

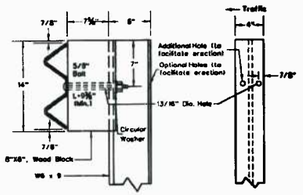
STANDARD SHEET GR1



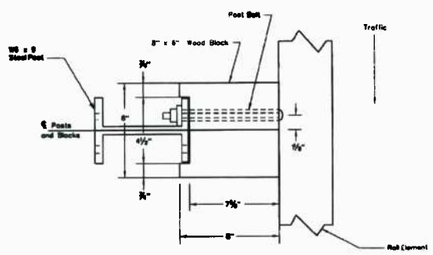
WOOD GUARDRAIL POST (RECTANGULAR)



WOOD GUARDRAIL POST (ROUND)



STEEL GUARDRAIL POST
(WOOD BLOCK)



PLAN

NOTES

GENERAL:

Only one type of block, steel or wood, shall be used throughout any project, unless otherwise specified. Blocks for "block-outs" shall be used on all posts except when otherwise noted on Plans. When blocks are not provided, the post details will be as shown herein, except the ⅝" bolt minimum length will be reduced as required, the 1" minimum notch for the wood guardrail post (round) is not be used, and nails for block stability will not be needed. For steel posts without blocks, details of the posts shall conform to the "Steel GuardrailPost (Wood Block)" details herein, with the additional holes (to facilitate erection) being optional.

The circular washers shall be made of steel and galvanized in accordance with 711 in accordance with the requirements of AASHTO M232.

WOOD POSTS:

Wood posts and blocks shall be the same type (species).

Wood posts shall be pressure-treated after notching, in accordance with Section 710.3 of the specifications.

The 1" (minimum) notch dimension as shown for round wooden posts shall be located along the vertical centerline for the entire upper 14" of the post and shall apply regardless of whether the post is notched (as shown) or otherwise cut or sawed to form a vertical flat plane and then, at some location below the top 14", is angularly sliced out to the surface of the post.

Post length will be 6' ± ½" unless otherwise noted.

STEEL POSTS:

Blocks shall be centered on their posts and the center of the block holes, for bolts connecting rails to blocks, shall be horizontally offset 1-1/8" from the center of the steel posts toward the post edge facing approaching traffic for both steel and wood blocks, as shown for wood blocks on the Plan view of the Block Stop Detail. Post length will be 6' ± ½" unless other wise noted.

WOOD BLOCKS:

The type (species) of wood for blocks is to be one of the types (species) permitted by specifications for wood posts. Wood blocks shall be pressure-treated in conformance with the requirements for wood posts. However, creosote oil is not permitted as a preservative in the pressure treatment of wood blocks to be erected on steel posts. 8" x 8" wood blocks shall be positioned so that the 8" x 14" faces of the blocks are the contact faces for the rail elements and the posts in order to achieve the blockout dimension shown. When wood block is used adjacent to a wood post, the block shall be nailed to the post with a galvanized steel 10d common nail. The nails to be driven into the center of the top or bottom of the block

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

GUARDRAIL POSTS AND BLOCKS

STANDARD SHEET GR2

NAVITUS ENGINEERING INC.
Engineering Survey Environmental GIS
151 Windy Hill Lane
Winchester, Virginia 22602
Telephone: (888) 662-4185
www.navitusengr.com

REVISION

DATE

ANTERO RESOURCES
THIS DOCUMENT WAS PREPARED FOR:
ANTERO RESOURCES CORPORATION

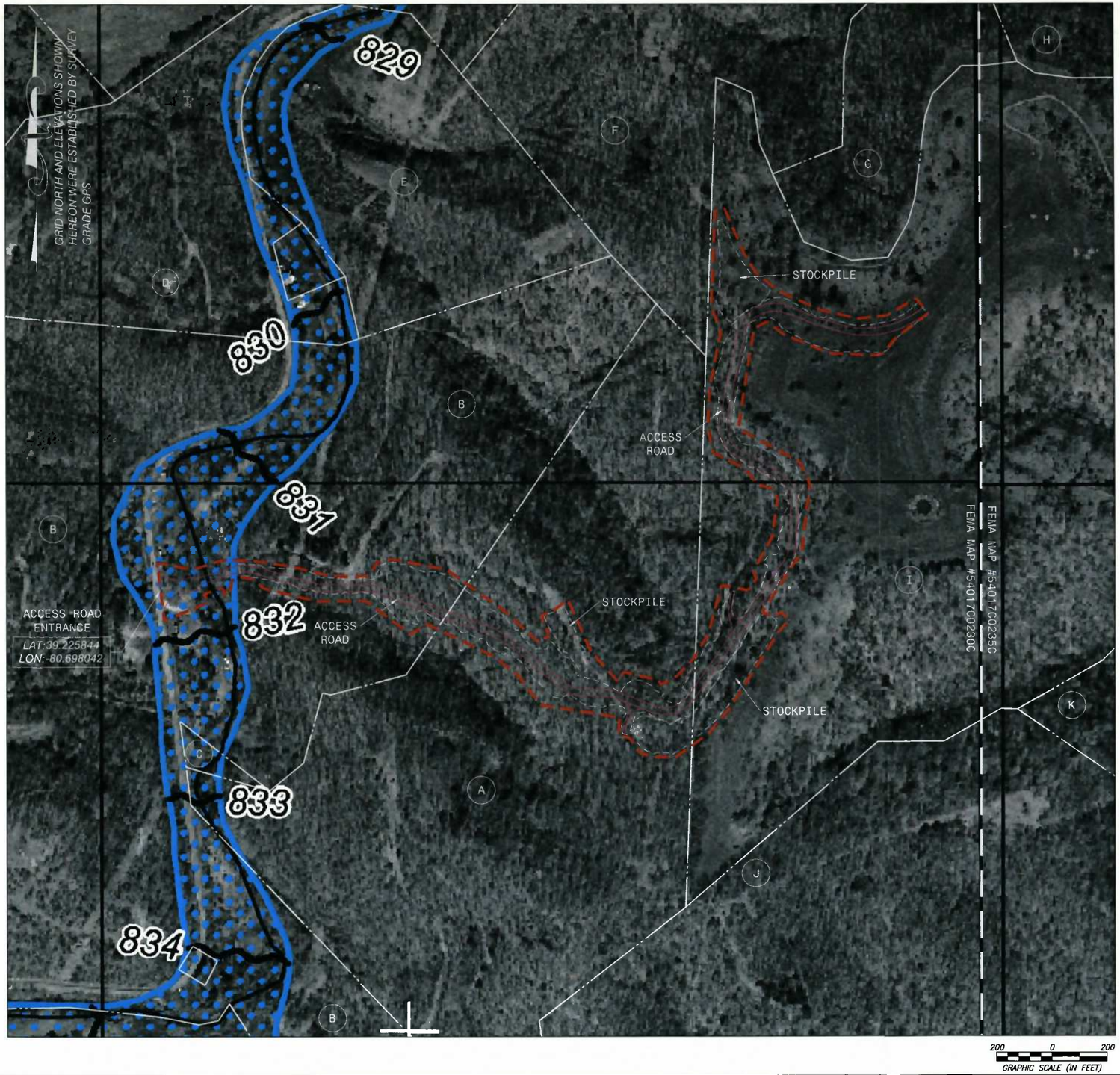
CONSTRUCTION DETAILS

NEW MILTON
COMPRESSOR STATION ACCESS ROAD
NEW MILTON DISTRICT
DODDRIDGE COUNTY, WEST VIRGINIA

CHAD B. KLINE
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
07/16/2013

DATE: 07/16/2013
SCALE: N/A
SHEET 19 OF 20

FIRM EXHIBIT



LANDOWNER TABULATION

A
TM 8-39
COMSTOCK IRREVOCABLE TRUST
& SILVESTRE IRREVOCABLE TRUST
DB 261 PG 037 & DB 261 PG 034
68 ACRES
191 SADDLETREE DR. KALA POINT,
PORT TOWNSEND, WA 98368

B
TM 8-37
KATHRYN H. MARSHALL (MS 017 PG 722)
CLINTON D. & KEVIN M. MEANS (DB 287 PG 272)
MARVIN L. PHILLIPS (WB 033 PG 405)
RUTH E. PHILLIPS (WB 038 PG 170)
WILLIAM C. PHILLIPS (WB 033 PG 405)
LAVERNE H. WILLIAMS (MS 017 PG 722)
147.86 ACRES
RT 2 BOX 478
WEST UNION, WV 26456

C
TM 8-37.2
LOUIS R. ENLOW
DB 248 PG 066
0.58 ACRE
191 SADDLETREE DR. KALA POINT,
PORT TOWNSEND, WA 98368

D
TM 8-15
ROBERT E. & EUNICE N. TAYLOR
DB 260 PG 055
27.7 ACRES
RT 1 BOX 90
NEW MILTON, WV 26411

E
TM 8-16
ROBERT C. TAYLOR
DB 245 PG 366
18 ACRES
7289 WV RT 18 S
NEW MILTON, WV 26411

F
TM 8-17
DALE W. II & MELISSA KEPLINGER
DB 236 PG 546
59.96 ACRES
RR 1 BOX 191A
ELLENBORO, WV 26346

G
TM 8-18
DALE W. II & MELISSA KEPLINGER
DB 236 PG 546
14 ACRES
RR 1 BOX 191A
ELLENBORO, WV 26346

H
TM 8-19
CHARLES L. PEARCY II & ELIZABETH ANN SMITH
WB 021 PG 187, 23 ACRES
516 KINNEY ST
BRIDGEPORT, WV 26330

I
TM 8-40
ROGER A., II & STACY L. McCLAIN
DB 288 PG 303
118.66 ACRES
RT 2 BOX 330
NEW MILTON, WV 26411

J
TM 8-41
NORMAN G. DEVOL
AP 038 PG 340
86.549 ACRES
820 RACE STREET
PARKERSBURG, WV 26101

K
TM 8-41.5
JAMES CHARLES
DB 272 PG 246
5.225 ACRES
PO BOX 81
NEW MILTON, WV 26411

FLOODPLAIN NOTE

THE PROPOSED SITE IS LOCATED WITHIN FEMA FLOOD ZONE "X" PER FEMA FLOOD MAPS #54017C0230C & #54017C0235C. THE PROPOSED SITE ENTRANCE IS LOCATED IN FEMA FLOOD ZONE "AE" PER FEMA FLOOD MAP #54017C0230C.

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0230C

FIRM
FLOOD INSURANCE RATE MAP
DODDRIDGE COUNTY, WEST VIRGINIA
AND INCORPORATED AREAS

PANEL 230 OF 325
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
DODDRIDGE COUNTY	540024	0230	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
54017C0230C
MAP REVISED
OCTOBER 4, 2011

Federal Emergency Management Agency

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0235C

FIRM
FLOOD INSURANCE RATE MAP
DODDRIDGE COUNTY, WEST VIRGINIA
AND INCORPORATED AREAS

PANEL 235 OF 325
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
DODDRIDGE COUNTY	540024	0235	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
54017C0235C
MAP REVISED
OCTOBER 4, 2011

Federal Emergency Management Agency

NAVITUS ENGINEERING INC.
Engineering Survey Environmental GIS
151 Windy Hill Lane
Walkersville, MD 21793
Telephone: (888) 662-4185
www.navituseng.com

DATE	REVISION

ANTERO RESOURCES
THIS DOCUMENT WAS PREPARED FOR:
ANTERO RESOURCES CORPORATION

FIRM EXHIBIT

NEW MILTON
COMPRESSOR STATION ACCESS ROAD
NEW MILTON DISTRICT
DODDRIDGE COUNTY, WEST VIRGINIA

CHAD S. KINSEY
REGISTERED
PROFESSIONAL ENGINEER
STATE OF WEST VIRGINIA
07/16/2013

DATE: 07/16/2013
SCALE: 1" =200'
SHEET 20 OF 20