

Commercial/Industrial Floodplain Development Permit

Doddridge County, WV Floodplain Management

This permit has been issued to **Blue Mountain**, **Inc.**, and is for the approved commercial and/or industrial development project associated with this permit that impacts the FEMA-designated floodplain and/or floodway of Doddridge County, WV, pursuant to the rules and regulations established by all applicable Federal, State and local laws and ordinances, including the Doddridge County Floodplain Ordinance. This permit must be posted at the site of work as to be clearly visible, and must remain posted during entirety of development.

Permit: #14-255 ~ Blue Mountain, Inc. ~ South Fork Bridge #1 /Sheep Run Road

Date Approved: 05/21/2015 Expires: 05/21/2016

Issued to: Blue Mountain, Inc.

POC: Edward Race, EIT, SIT

304-662-6486 Company Address: 10125 Mason Dixon Highway

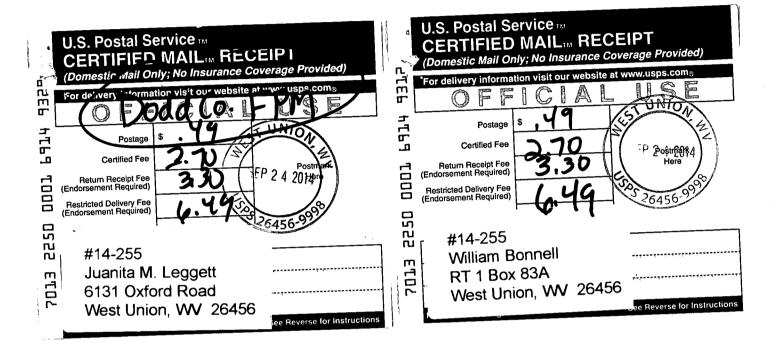
Burton, WV 26562

Project Address: Southwest District Lat/Long: 39.206402N/80.833848W

Purpose of development: Permanent bridge replacement.

Issued by: Edwin L. "Bo" Wriston, Doddridge County FPM (or designee)

Date: 05/21/2015

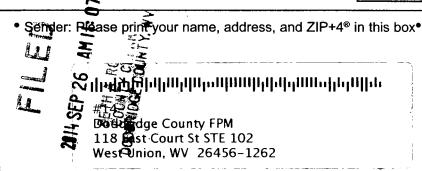


SENDER: COMPLETE THIS	SECTION	COMPLETE THIS SECTION ON DELIV	ERY
 Complete items 1, 2, and 3. item 4 if Restricted Delivery Print your name and address so that we can return the ca Attach this card to the back or on the front if space perm 	is desired. s on the reverse rd to you. of the mailpiece,		Pate of Delivery
Article Addressed to:		D. Is delivery address different from item If YES, enter delivery address below:	= ::::
#14-255 William Bonnell			
RT 1 Box 83A West Union, WV	26456	☐ Insured Mail ☐ Collect on De	pt for Merchandise livery
		4. Restricted Delivery? (Extra Fee)	☐ Yes
Article Number (Transfer from service label)	7013 2250	0001 6914 9315	
PS Form 3811, July 2013	Domestic Re	urn Receipt	

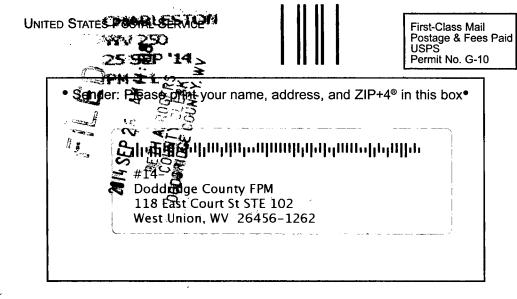
UNITED STATES POSTAL SERVICE



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



SENDER: COMPLETE THIS SECTION	COMPLETE THIS SECTION ON DELIVERY
 Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired. 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. 1. Article Addressed to: #14-255 Juanita M. Leggett 	A. Signature X Agent Agent Agent Addressee B. Deceived by (Printed Name) C. Date of Delivery 1 - 2 - 4 - 4 - 4 - 4 - 4 - 4 - 4 - 4 - 4
6131 Oxford Road West Union, WV 26456	3. Service Type ☐ Certified Mail® ☐ Priority Mall Express™ ☐ Registered ☐ Return Receipt for Merchandise ☐ Insured Mail ☐ Collect on Delivery 4. Restricted Delivery? (Extra Fee) ☐ Yes
2. Article Number (Transfer from service label) 7013 2250	0001 6914 9329
PS Form 3811, July 2013 Domestic Reti	urn Receipt



Legal Advertisement:

Doddridge County

Floodplain Permit Application

Please take notice that on the $5^{\rm th}$ day of August, 2014

Blue Mountain, Inc., CNX Gas Company, LLC

filed an application for a Floodplain Permit to develop land located at or about:

39.206402N / 80.833848W

Permit #14-255 South Fork Bridge #1

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 8, 2014**, delivered to:

Clerk of the County Court

118 E. Court Street, West Union, WV 26456

Beth A Rogers, Doddridge County Clerk

Edwin L. "Bo" Wriston. Doddridge County Flood Plain Manager



April 22, 2015

Mr. Bo Wriston Floodplain Coordinator Doddridge County Courthouse 118 East Court Street West Union, WV 26456

RE: Revised Submittals for Sheep Run Bridge Replacement

Dear Mr. Wriston:

On behalf of CNX Gas Company, we are re-submitting the Hydraulic Analysis Submittals for the Sheep Run Bridge Replacement. This particular project is located in Doddridge County on CR19/11 (South Fork Hughes River) at approximately Mile Post 2.45.

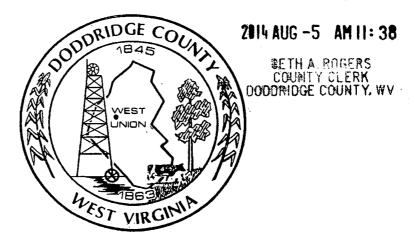
Should you have any questions or comments, please feel free to contact me at (304) 662-6486.

Sincerely,

Ed Race, EIT
Project Manager

Blue Mountain Inc.

Enclosures



Commercial/Industrial Floodplain Development Permit Application Doddridge County, WV Floodplain Management

This document is to be used for commercial and/or industrial development 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.

Permit Application #:	_ (To be completed by Floodplain Manager or designee)
Date Submitted:	
90 Day Window Date:	_

118 East Court Street; West Union, WV 26456

Permit	#	

Applicant Information:

Please provide all pertinent data.

Applicant Information	1 a 1 a 1	
Responsible Company Name: CNX Gas Con	npany LLC	
Corporate Mailing Address: One Energy Dr	ive, PO Box 1	248
City: Jane Lew	State: WV	Zip: 26378
Corporate Point of Contact (POC): Amanda V	Vright	
Corporate POC Title: Manager of Permitting		
Corporate POC Primary Phone: (304) 884-20	009	
Corporate POC Primary Email: AmandaWrig	ht@consolen	ergy.com
Corporate FEIN: 20-3170639	Corporate DU	NS:
Corporate Website: www.consolenergy.co	om	
Local Mailing Address: Same as above		
City:	State:	Zip:
Local Project Manager (PM):		<u> </u>
Local PM Primary Phone:		
Local PM Secondary Phone:		White the state of
Local PM Primary Email:	· · · · · · · · · · · · · · · · · · ·	- 1
Person Filing Application: Greg Currey, Bl	ue Mountain	Inc.
Applicant Title: Permitting Specialist		
Applicant Primary Phone: (304) 662-6486		
Applicant Secondary Phone: (304) 266-1198		
Applicant Primary Email: G.Currey@bluem	ntninc.com	

Permit	#			

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 proposal is to replace an existing bridge across County Route 19/11 with a
box culvert so that larger trucks and equipment associated with the gas industry
can safely pass. The culvert will be located in Sheep Run
(N 39.206402 W -80.833848) which is a tributary of the South Fork of the Hughes
River. Approximately 100 cubic yards of fill will be placed below the Ordinary High
Water Mark of Sheep Run to place this culvert. The placement of fill for this culvert
will impact approximately 440 square feet and 20 linear feet of Sheep Run.

Proposed Development:

 ${\it Please\ check\ all\ elements\ of\ the\ proposed\ project\ that\ apply.}$

Project Description: (Check all that apply)				
New Construction				
Commercial Structure				
Industrial Structure				
Pipeline				
Drill Pad				
Storage Yard/Facility				
Roadway Construction				
Bridge Culvert (Please circle)				
Utility placement				
Utility displacement				
Grade/Excavation/Fill	ı			
Watercourse Alteration				
Above ground chemical or HAZMAT storage tanks				
Above ground storage thanks (other)				
Below ground storage tanks (any)				
Well/Septic System				
Other				
If other, please describe:				

Permit	:#	

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 sources such as Google Earth, WV Flood Tool, etc. 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:	_ of			
Site/Property Information				,1'5 E V
Legal Description: NA N	lo private pro	perty will be impa	cted. This is the replaceme	ent
of a bridge on a county			.	
Physical Address/911 Add	ress:			
Decimal Latitude/Longitud	de:			
DMS Latitude/Longitude:				
District:	Мар:		Parcel:	
Land Book Description:				
Deed Book Reference:				
Tax Map Reference:				
		······································		
Existing Buildings/Use of P	'roperty:	······································		
Floodplain Location Data:	to be completed	l by Floodplain Mand	iger or designee)	() () - ()
Community:	Number:	Panel:	Suffix:	,
Location (Lat/Long):		Approximate	Elevation:	
		Estimated BI	E:	
Is the development in the floodway?			pment in the floodplain?	
U Yes U No	No Yes No Zone:			
Notes:				
	•			

Permit	#	

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: of			
Property Owner Data:			
Name of Primary Owner (PO): No	private property will	be impacted.	
PO Address:			
City:	State:	Zip:	
PO Primary Phone:	· · · · · · · · · · · · · · · · · · ·		
PO Secondary Phone:			
PO Primary Email:			
	and the stage of the second participation of the stage of the stage of the second participation of the stage of the second participation of th		
	and the second		4
Name of Primary Owner (PO):			<u></u> .
PO Address:			
City:	State:	Zip:	
PO Primary Phone:	1		
PO Secondary Phone:			
PO Primary Email:			
Mineral Rights Owner Data: (As Appl	icable)		
Name of Primary Owner (PO):			
PO Address:			
City:	State:	Zip:	
PO Primary Phone:			
PO Secondary Phone:			
PO Primary Email:			

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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	li . Ja	
C/SC Company Name:	<u> </u>	<u> La La</u>
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:		
Contractor/Sub-Contractor (C/SC) Information		
C/SC Company Name:	<u>** </u>	and the second s
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:		

Permit	#		

Engineering Firm Data:

Property Designation:

Please provide all pertinent data for engineering firm(s) 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.

Engineer Firm Information:		
Engineer Firm Name: Blue Mountain Inc.		
Engineer WV License Number: 4449		
Engineer Firm FEIN: 550704426	Engineer Firm	DUNS: 805979713
Engineer Firm Primary Point of Contact (POC):	Greg Currey	
Engineer Firm Primary POC Title: Permitting	Specialist	
Engineer Firm Mailing Address: 11023 Maso	n Dixon HWY	
City: Burton	State: WV	Zip-Code: 26562
Engineer Firm Office Phone: (304) 662-6486	6	
Engineer Firm Primary POC Phone: (304) 266	5-1198	
Engineer Firm Primary POC E-Mail: BMI@bli	uemtninc.com	
Engineer Firm Information		
Engineer Firm Information: Engineer Firm Name:		
Engineer Firm Name:	Engineer Firm	
Engineer Firm Name: Engineer WV License Number:		
Engineer Firm Name: Engineer WV License Number: Engineer Firm FEIN:		
Engineer Firm Name: Engineer WV License Number: Engineer Firm FEIN: Engineer Firm Primary Point of Contact (POC):		
Engineer Firm Name: Engineer WV License Number: Engineer Firm FEIN: Engineer Firm Primary Point of Contact (POC): Engineer Firm Primary POC Title:		
Engineer Firm Name: Engineer WV License Number: Engineer Firm FEIN: Engineer Firm Primary Point of Contact (POC): Engineer Firm Primary POC Title: Engineer Firm Mailing Address:	Engineer Firm	DUNS:
Engineer Firm Name: Engineer WV License Number: Engineer Firm FEIN: Engineer Firm Primary Point of Contact (POC): Engineer Firm Primary POC Title: Engineer Firm Mailing Address: City:	Engineer Firm	DUNS:

Permit	#
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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:	•	
	Leggett 7-5/5	<u> </u>
PO Address: 6131 Oxford RoAd	Loggott 1 0/0	
City: West Union	State: WV	Zip: 26456
PO Primary Phone: (304) 349-2353		
PO Secondary Phone: (304) 349-4365		
PO Primary Email:		
Adjacent Property Owner Data:	i de	
Name of Primary Owner (PO): William Bo	nnell 7-5/6	
PO Address: Rt 1 Box 83A		
City: West Union	State: WV	Zip: 26456
PO Primary Phone: (304) 349-4370		
PO Secondary Phone:		
PO Primary Email:		
Adjacent Property Owner Data:		
Name of Primary Owner (PO):		
PO Address:		
City:	State:	Zip:
PO Primary Phone:		
PO Secondary Phone:		
PO Primary Email:		
Adjacent Property Owner Data:		
Name of Primary Owner (PO):		
PO Address:		
City:	State:	Zip:
PO Primary Phone:	•	
PO Secondary Phone:		
PO Primary Email:		

Permit	#
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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. Two complete sets of plans and specifications are required when applying for a Floodplain Permit. The Floodplain Manager will retain one set, and one set will be dated and returned to the applicant when the permit is issued. A certified and licensed engineering firm should complete site plans.

A SITE PLAN MUST CONTAIN THE FOLLOWING INFORMATION: See Attachment 1

- 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 elevations is required.

Applicable Permits:

- 1) US Army Corps of Engineers Nationwide Permit 3 or 14.
- 2) Office of Land and Streams Stream Activity Permit
- 3) Department of Highways Bridge Agreement

Permit	#	

Applicant

Please	initial	beside	each	bullet	point,	print	name, sig	ın and	date.

rtify that I am authorized to submit this application for the primary project developer. 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.

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.

anderstand 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.

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. Inderstand 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.

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.

Tunderstand 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.

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.

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Permit	#	

Floodplain Manager Certification

I hereby certify that the applicant above has been notified of applicable compliance with the Doddridge County Floodplain Ordinance of May 21, 2013, and has provided a complete and accurate Permit Application including the following items:

Ü	Site Plan prepared by a certified and licensed engineering firm showing the nature, location, dimensions, and elevation of the property located within the floodplain, existing or proposed structures, location of proposed fill, location of storage of materials including fuel, location of drainage facilities, and location of utilities.		
	Written description, if applicable, describing the extent which the watercourse will be altered or relocated as a result of the proposed development.		
O	No-rise certification prepared by a certified and licensed engineering firm for all projects located in the floodway.		
	E911 Addressing data, if applicable, for proper addressing of proposed development.		
	Copies of all applicable Federal, State and local permits required for development before issuance of the Doddridge County Floodplain Permit.		
Ü	Permit fee received: Check #: Amount: \$		
Floodp	lain Manager or Designee		
Signatu	re: Date:		
Notes:			
·			

Permit #	

Permit Issuance

- o I certify that I am authorized to accept this granted Doddridge County Floodplain Permit for the primary project developer.
- I certify that all required Federal, State, and local permits required by law and/or ordinance for the approved development of this project have been properly attained, and are current and valid.
- o 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.
- o 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.
- o 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.
- I understand that the granted Doddridge County Floodplain Permit must be visibly displayed at the development site at or near floodplain or floodway activity. (Doddridge County Floodplain Manager will provide one (1) laminated permit for display. Additional copies are available upon request.)
- In signing this application, the primary developer 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.
- o 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.

Primary Developer Permit Recipient

Signature:	
Printed Name:	
Γitle:	
Floodplain Manager or Designee	
Signature	Data

Permit	#
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Floodplain Manager Checklist:

Date submitted, Date required for completion, date of public notice of permit application at commission meeting, date of paper notification, date of paper publication, permit payment received, payment data, payment cleared bank, date submitted to engineer, date report received from engineer, date permit issued/rejected, date of site visit and documentation

Last date for appeal
Appeal received
Appeal valid/invalid
Stop work order issued
Commission meeting
Last date for FPM decision appeal
FPM decision appeal received
Commission meeting
Board of Appeals public hearing
Final BOA decision

Date of work completion
Date of closeout



August 1, 2014

Mr. Bo Wriston, Doddridge County Floodplain Manager 118 East Court St. West Union, West Virginia 26456

Subject:

Commercial/Industrial Floodplain Development Permit Application

CNX Gas Company LLC

Proposed South Fork Bridge #1 Project Doddridge County, West Virginia Blue Mountain Inc. Project 0407-14

On behalf of CNX Gas Company LLC, Blue Mountain Inc. is submitting this Floodplain Development Permit Application for the proposed South Fork Bridge #1 Project, located in Doddridge County, West Virginia (39.206402 N, -80.833848 W).

The project entails the replacement of an existing bridge across County Route 19/11 with a box culvert so that larger trucks and equipment associated with the gas industry can safely pass. This culvert will be located in Sheep Run (N 39.206402, W -80.833848) which is a perennial tributary of the South Fork of the Hughes River. Approximately 100 cubic yards of fill will be placed below the "Ordinary High Water Mark" of Sheep Run to place this culvert. The placement of fill for this culvert will impact approximately 440 square feet and 20 linear feet of Sheep Run. The proposed stream impact from the culvert installation is unavoidable.

511

Please contact Greg Currey at 304-662-6486 or at BMI@bluemtninc.com if you have any questions regarding this request. Thank you very much for your assistance.

3

Respectfully,

Blue Mountain Inc.

Greg Currey

Permitting Specialist



Commercial/Industrial Floodplain Development Permit Application Doddridge County, WV Floodplain Management

This document is to be used for commercial and/or industrial development 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.

Permit Application #:	(To be completed by Floodplain Manager or designee)
Date Submitted:	
90 Day Window Date:	

Permit	#	

Applicant Information:

Please provide all pertinent data.

Applicant Information		•		
Responsible Company Name: CNX Gas Company LLC				
Corporate Mailing Address: One Energy Drive, PO Box 1248				
City: Jane Lew	State: WV	Zip: 26378		
Corporate Point of Contact (POC): Amanda V	Vright			
Corporate POC Title: Manager of Permitting				
Corporate POC Primary Phone: (304) 884-20	009			
Corporate POC Primary Email: AmandaWrig	ht@consolen	ergy.com		
Corporate FEIN: 20-3170639	Corporate DUN	NS:		
Corporate Website: www.consolenergy.co	om ·			
Local Mailing Address: Same as above				
City:	State:	Zip:		
Local Project Manager (PM):				
Local PM Primary Phone:				
Local PM Secondary Phone:				
Local PM Primary Email:				
Person Filing Application: Greg Currey, Blue Mountain Inc.				
Applicant Title: Permitting Specialist				
Applicant Primary Phone: (304) 662-6486				
Applicant Secondary Phone: (304) 266-1198				
Applicant Primary Email: G.Currey@bluem	ntninc.com			

Perm	it #	ŧ	

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:
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box culvert so that larger trucks and equipment associated with the gas industry
can safely pass. The culvert will be located in Sheep Run
(N 39.206402 W -80.833848) which is a tributary of the South Fork of the Hughes
River. Approximately 100 cubic yards of fill will be placed below the Ordinary High
Water Mark of Sheep Run to place this culvert. The placement of fill for this culvert
will impact approximately 440 square feet and 20 linear feet of Sheep Run.

Permit	#		

Proposed Development:

Please check all elements of the proposed project that apply.

Project Description: (Check all that apply)	
New Construction	
Commercial Structure	
Industrial Structure	
Pipeline	
Drill Pad	
Storage Yard/Facility	
Roadway Construction	
Bridge Culvert (Please circle)	<u>.</u>
Utility placement	
Utility displacement	
Grade/Excavation/Fill	
Watercourse Alteration	
Above ground chemical or HAZMAT storage tanks	
Above ground storage thanks (other)	
Below ground storage tanks (any)	
Well/Septic System	
Other	
If other, please describe:	
	=

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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 sources such as Google Earth, WV Flood Tool, etc. 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:	_ of			
				· · · · · · · · · · · · · · · · · · ·
Site/Property Information	:			
Legal Description: NA N	lo private pro	perty will be impac	ted. This	s is the replacement
of a bridge on a county	road.			
Physical Address/911 Add	ress:			
Decimal Latitude/Longitud	le:			
DMS Latitude/Longitude:		-		
District:	Мар:		Parcel:	
Land Book Description:	L			
				
Deed Book Reference:				
Tax Map Reference:				
Existing Buildings/Use of I	Property:			
Floodplain Location Data:	(to he complete	ed by Floodplain Manag	ner er de	cianaa)
Community:	Number:	Panel:	jei oi ues	Suffix:
Community:	Number:	ranei:		Sullix.
Location (Lat/Long):		Approximate	Elevation	:
		Estimated BFI	Ξ:	
Is the development in the	floodway?	Is the develop	ment in t	he floodplain?
O Yes O No		Yes	O _{No}	Zone:
Notes:				

Permit	#	

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: of			
Property Owner Data:			
Name of Primary Owner (PO):	o private property will	be impacted.	
PO Address:			
City:	State:	Zip:	
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 Ap	plicable)		
Name of Primary Owner (PO):			
PO Address:			
City:	State:	Zip:	
PO Primary Phone:			
PO Secondary Phone:			
PO Primary Email:	·		

Permit	#	

Contractor Data:

Property Designation:

of

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.

Contractor/Sub-Contractor (C/SC) In	formation:		
C/SC Company Name:			
C/SC WV License Number:	-		
C/SC FEIN:	C/SC DUN	IS:	
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:			
Contractor/Sub-Contractor (C/SC) In	formation		
C/SC Company Name:	ioi mation.		
C/SC WV License Number:			
C/SC FEIN:	C/SC DUN	IS:	
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:			

Permit	#

Engineering Firm Data:

Property Designation:

of_

Please provide all pertinent data for engineering firm(s) 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.

Engineer Firm Information:		
Engineer Firm Name: Blue Mountain Inc.		
Engineer WV License Number: 4449		
Engineer Firm FEIN: 550704426	Engineer Firm	DUNS: 805979713
Engineer Firm Primary Point of Contact (POC):	Greg Currey	
Engineer Firm Primary POC Title: Permitting	Specialist	
Engineer Firm Mailing Address: 11023 Maso	n Dixon HWY	
City: Burton	State: WV	Zip-Code: 26562
Engineer Firm Office Phone: (304) 662-6486	3	
Engineer Firm Primary POC Phone: (304) 266	S-1198	
Engineer Firm Primary POC E-Mail: BMI@bl	uemtninc.com	
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:		

Peri	mit	#	

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:		
Name of Primary Owner (PO): Juanita M. L	eaaett 7-5/5	
PO Address: 6131 Oxford RoAd	- 33	
City: West Union	State: WV	Zip: 26456
PO Primary Phone: (304) 349-2353		
PO Secondary Phone: (304) 349-4365		
PO Primary Email:		
Adjacent Property Owner Data:		
Name of Primary Owner (PO): William Bor	nell 7-5/6	
PO Address: Rt 1 Box 83A		
City: West Union	State: WV	Zip: 26456
PO Primary Phone: (304) 349-4370		
PO Secondary Phone:		
PO Primary Email:		
Adjacent Property Owner Data:		
Name of Primary Owner (PO):		
PO Address:		
City:	State:	Zip:
PO Primary Phone:		
PO Secondary Phone:		
PO Primary Email:		
Adjacent Property Owner Data:	·	
Name of Primary Owner (PO):		
PO Address:		
City:	State:	Zip:
PO Primary Phone:		
PO Secondary Phone:		
PO Primary Email:		

Permit	#

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. Two complete sets of plans and specifications are required when applying for a Floodplain Permit. The Floodplain Manager will retain one set, and one set will be dated and returned to the applicant when the permit is issued. A certified and licensed engineering firm should complete site plans.

A SITE PLAN MUST CONTAIN THE FOLLOWING INFORMATION: See Attachment 1

- 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
- 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 elevations is required.

Permit	#
	"

Applicable Permits:

- 1) US Army Corps of Engineers Nationwide Permit 3 or 14.
- 2) Office of Land and Streams Stream Activity Permit
- 3) Department of Highways Bridge Agreement

_		
Permit	#	

Applicant

Please initial beside each bullet point, print name, sign and date	Please	initial	beside	each	bullet	point.	print	name.	sian	and	date.
--	--------	---------	--------	------	--------	--------	-------	-------	------	-----	-------

o initial beside each bullet point, print name, sigh and date.

certify that the information included in this application is to the best of my knowledge true and

ertify that I am authorized to submit this application for the primary project developer.

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.

Tunderstand 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.

Lunderstand 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.

Funderstand 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. Independent 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.

funderstand 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.

Junderstand 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:

Applicant Printed Name:

Date:

urre

Doddridge County Commercial/Industrial Floodplain Development Permit Application

mi	+ #			
	mi	mit #	mit#	mit #

Floodplain Manager Certification

Doddri	by certify that the applicant above has been notified of applicable compliance with the idge County Floodplain Ordinance of May 21, 2013, and has provided a complete and te Permit Application including the following items:		
0	Site Plan prepared by a certified and licensed engineering firm showing the nature, location, dimensions, and elevation of the property located within the floodplain, existing or proposed structures, location of proposed fill, location of storage of materials including fuel, location of drainage facilities, and location of utilities.		
U -	Written description, if applicable, describing the extent which the watercourse will be altered or relocated as a result of the proposed development.		
	No-rise certification prepared by a certified and licensed engineering firm for all projects located in the floodway.		
	E911 Addressing data, if applicable, for proper addressing of proposed development.		
	Copies of all applicable Federal, State and local permits required for development before issuance of the Doddridge County Floodplain Permit.		
	Permit fee received: Check #: Amount: \$		
Floodp	olain Manager or Designee		
Signatu	ure: Date:		
Notes:			

Doddridge County Commercial/Industrial Floodplain Development Permit Application

Permit Issuance

- o I certify that I am authorized to accept this granted Doddridge County Floodplain Permit for the primary project developer.
- I certify that all required Federal, State, and local permits required by law and/or ordinance for the approved development of this project have been properly attained, and are current and valid.
- 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.
- o 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.
- o 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.
- I understand that the granted Doddridge County Floodplain Permit must be visibly displayed at the development site at or near floodplain or floodway activity. (Doddridge County Floodplain Manager will provide one (1) laminated permit for display. Additional copies are available upon request.)
- In signing this application, the primary developer 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.
- o 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.

Primary Developer Permit Recipient

Signature:	_
Printed Name:	_
Title:	_
Floodplain Manager or Designee	
Signature	Date

Doddridge County Commercial/Industrial Floodplain Development Permit Application

Permit	#	

Floodplain Manager Checklist:

Date submitted, Date required for completion, date of public notice of permit application at commission meeting, date of paper notification, date of paper publication, permit payment received, payment data, payment cleared bank, date submitted to engineer, date report received from engineer, date permit issued/rejected, date of site visit and documentation

Last date for appeal
Appeal received
Appeal valid/invalid
Stop work order issued
Commission meeting
Last date for FPM decision appeal
FPM decision appeal received
Commission meeting
Board of Appeals public hearing
Final BOA decision

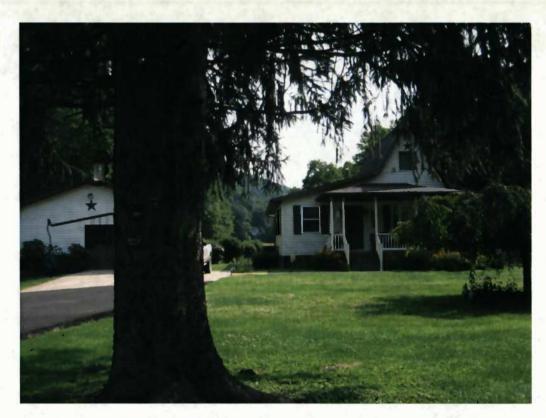
Date of work completion Date of closeout



Adjacent Home View 1



Adjacent Home View 2



Adjacent Home View 3



Adjacent Home & Garage View 4



Adjacent Home & Garage View 5



Sheep Run Temporary Bridge



Original Sheep Run Bridge View 1



Original Sheep Run Bridge View 2



Original Sheep Run Bridge View 3



May 21, 2015

Mr. Bo Wriston County Floodplain Coordinator Doddridge County Courthouse 118 East Court Street West Union, WV 26456

RE: Settled Landowner Dispute for Sheep Run Bridge Replacement

Dear Mr. Wriston:

Please see the attached planset that has been signed by Mr. Bonnell for the Sheep Run Bridge Replacement. This particular project is located in Doddridge County on CR19/11 (South Fork Hughes River) at approximately Mile Post 0.06. CNX is working with Mr. Bonnell and his lawyer to complete a formal Surface Use Agreement, but he did sign this set of plans indicating his intent to allow this project to temporarily impact his property.

If you could please let me know if this will suffice for the issuance of the Floodplain Permit, you can contact Anthony Farrell or myself at (304) 662-6486.

Sincerely,

Ed Race, EIT Project Manager

Blue Mountain Inc.

Enclosures

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HISTON OF PATROE PLACEMENT	-284
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- Anderson	Bill Bonnell 871 Hughes Rivard west Union, wu 26456 304-349-4370
en de la companya de	News Opy of Canal Budge

SITE DESIGN INFO PREPARED BY: COBALT PROFESSIONAL SERVICES, INC. 100 VALLEY ROLL ELECTRONIC TO SALES PROME TO SALES OF SALES VAL (TO) NOT SALES

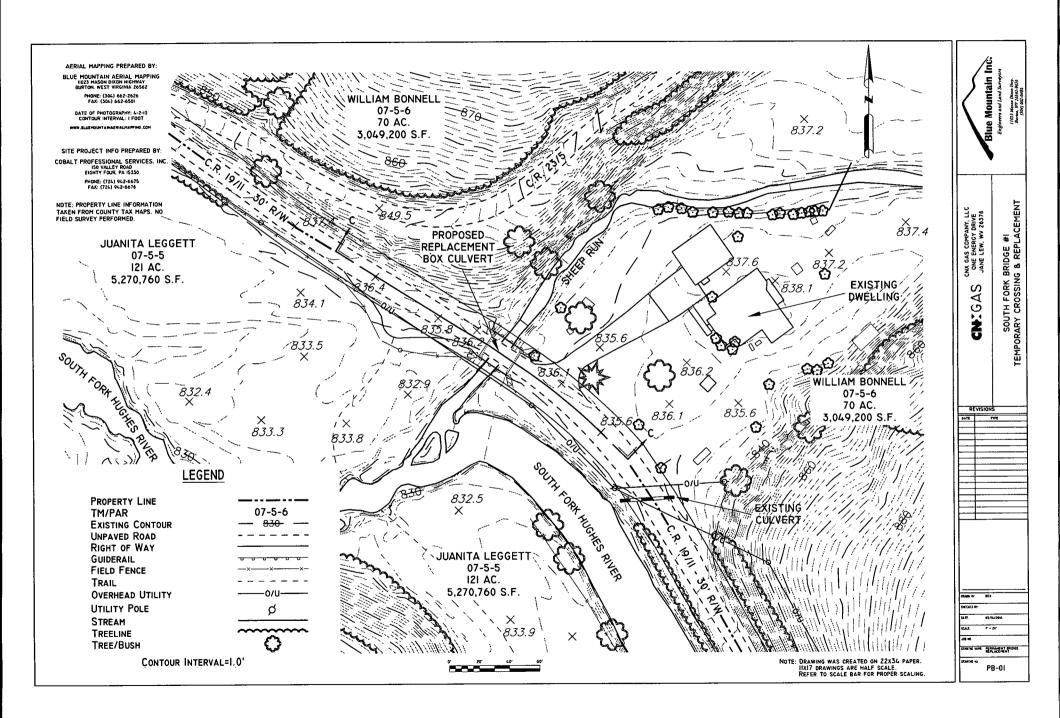
SOIL TYPES SHEEP RUN & SOUTH FORK HUGHES RIVER WATERSHEDS



CNIGAS

PROPOSED SHEEP RUN BRIDGE REPLACEMENT DODDRIDGE COUNTY, WV

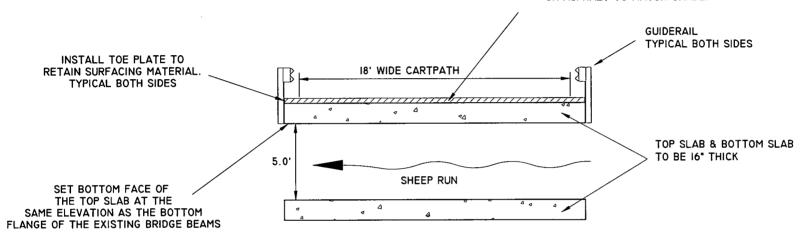
ST-0I



SITE PROJECT INFO PREPARED BY:
COBALT PROFESSIONAL SERVICES, INC.
ISO VALLEY ROAD
EIGHTY FORF, PA 15350
PHONE: (724) 942-6675
FAX: (724) 942-6678

SECTION 1-1

SURFACE TOP OF BOX CULVERT
WITH AASHTO #67 COARSE AGGREGATE
OR ASPHALT TO MATCH GRADE.



Blue Mountain Inc.
Enginers on Land Survyor
1103 Mana Chea Pre.
Page 1103 Mana Chea Pre.

CNX GAS COMPANY, LLC ONE ENERGY DRIVE JANE LEW, WV 26378

CNIGAS

REVISIONS
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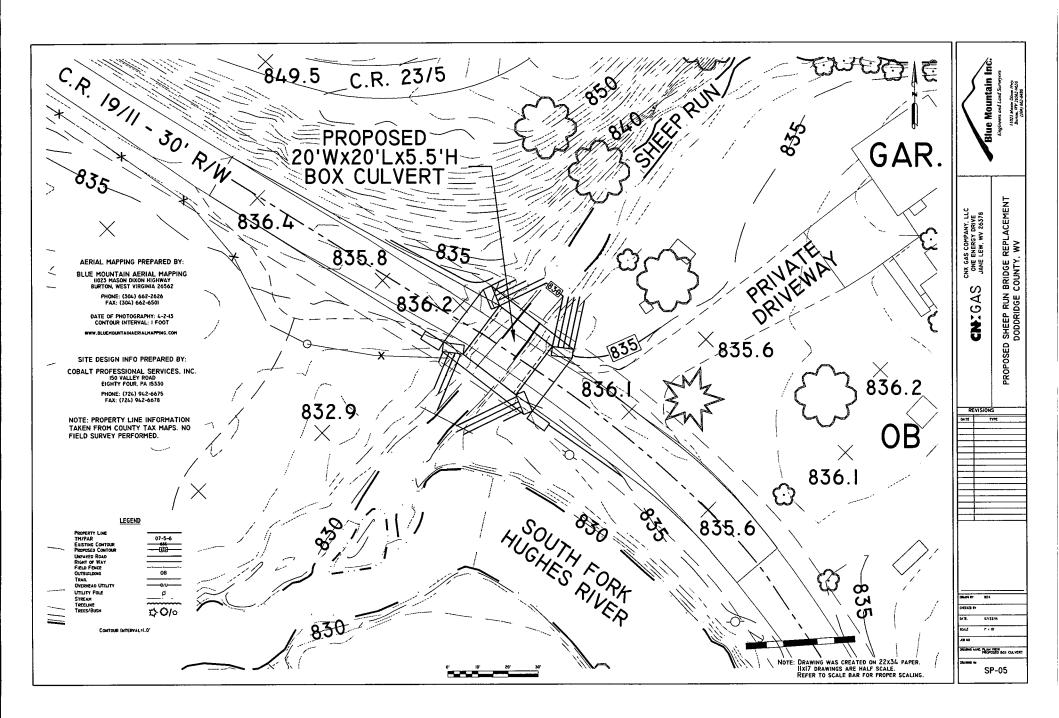
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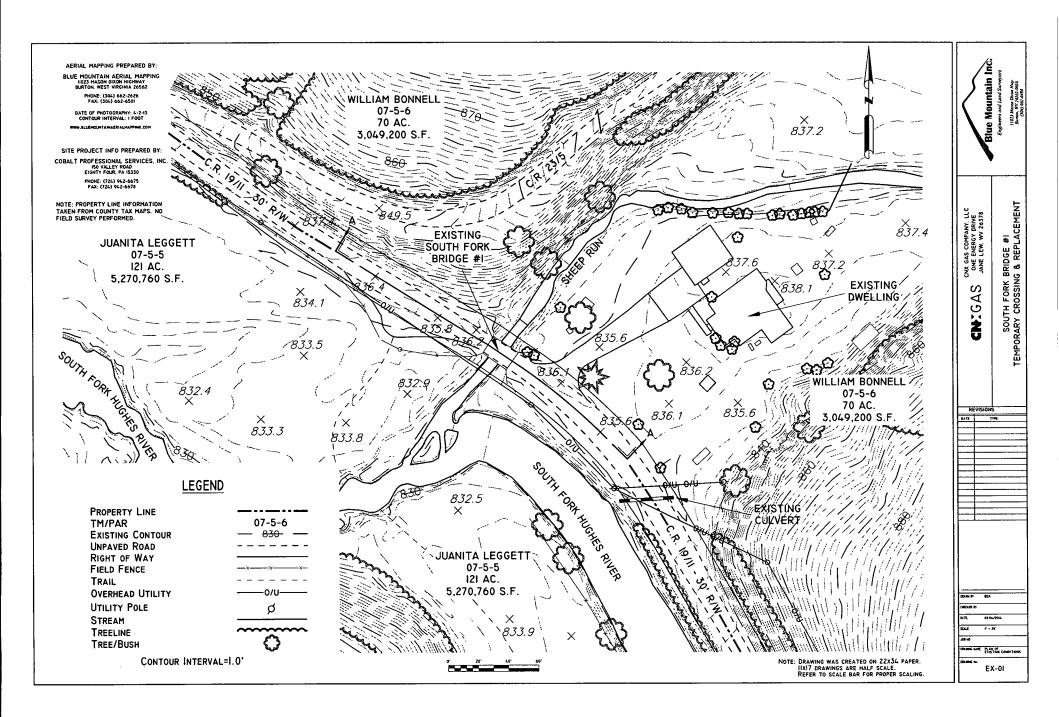
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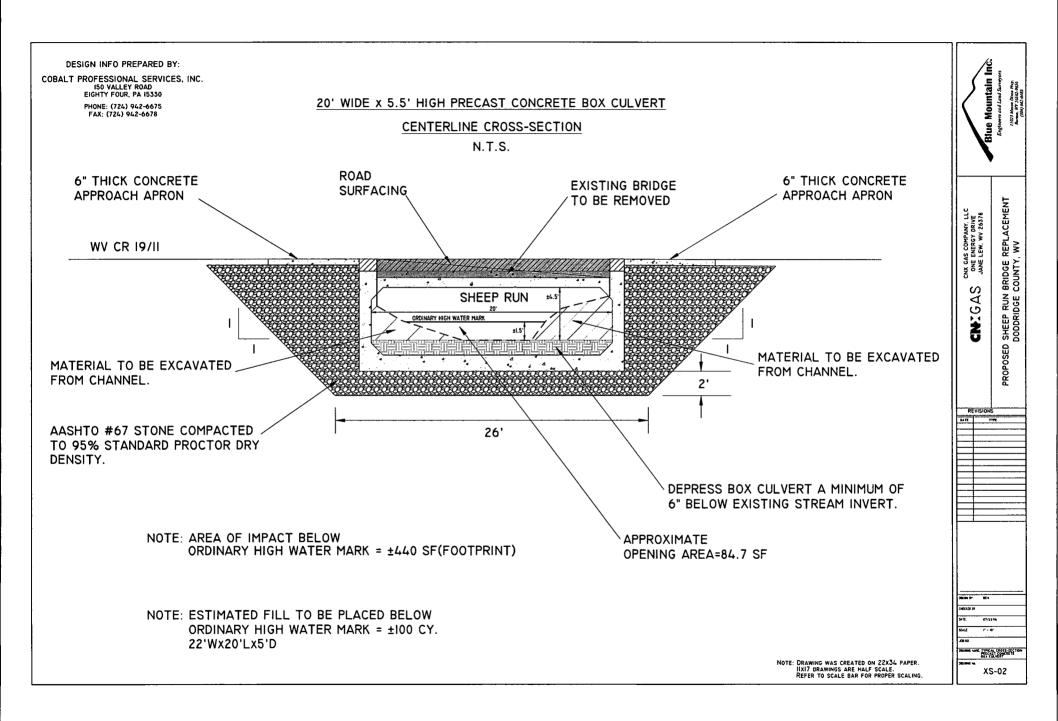
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NOTE: DRAWING WAS CREATED ON 22X34 PAPER. IIXI7 DRAWINGS ARE HALF SCALE.

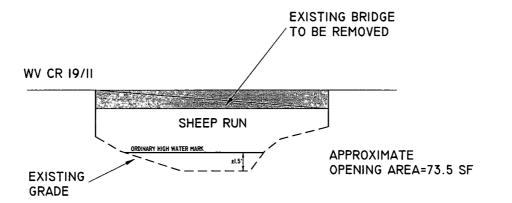






DRAWING INFO PREPARED BY:
COBALT PROFESSIONAL SERVICES, INC.
ISO VALLEY FOAD
EIGHTY FOUR, PA 15330
PHONE: 1724) 942-6675
FAX: (724) 942-6678

EXISTING STEEL & WOOD DECK BRIDGE ON WV CR 19/II @ MILE 2.45 CENTERLINE CROSS-SECTION N.T.S.



PROPOSED SHEEP RUN BRIDGE REPLACEMENT

PROPOSED SHEEP RUN BRIDGE REPLACEMENT

PROPOSED SHEEP RUN BRIDGE REPLACEMENT

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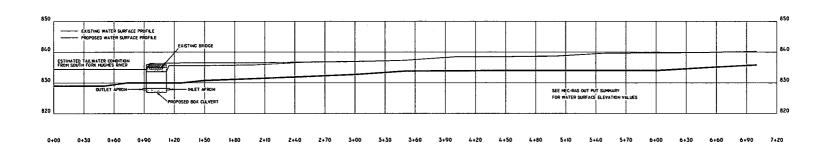
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TO NO CONTRACT TANK OF CHARGE LINES

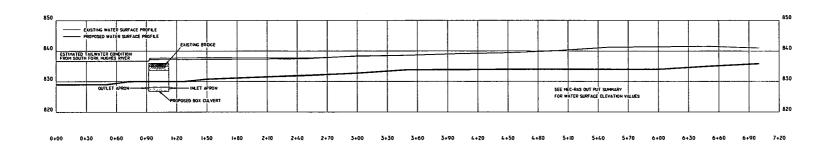
XS-0I

NOTE: DRAWING WAS CREATED ON 22X34 PAPER.
IIXI7 DRAWINGS ARE HALF SCALE.
REFER TO SCALE BAR FOR PROPER SCALING.

ESTIMATED WATER SURFACE PROFILES FOR THE 10 YR/24 HR STORM EVENT IN SHEEP RUN HOLLOW



ESTIMATED WATER SURFACE PROFILES FOR THE 100 YR/24 HR STORM EVENT IN SHEEP RUN HOLLOW



NOTE: DRAWING WAS CREATED ON 22X34 PAPER. 11X17 DRAWINGS ARE HALF SCALE. REFER TO SCALE BAR FOR PROPER SCALING.

Blue Mountain Inc.
Enginers and Land Surveyors
11021 Manse Dans 1494,
Barren, PT 5043-5066
GOAD 9665-488

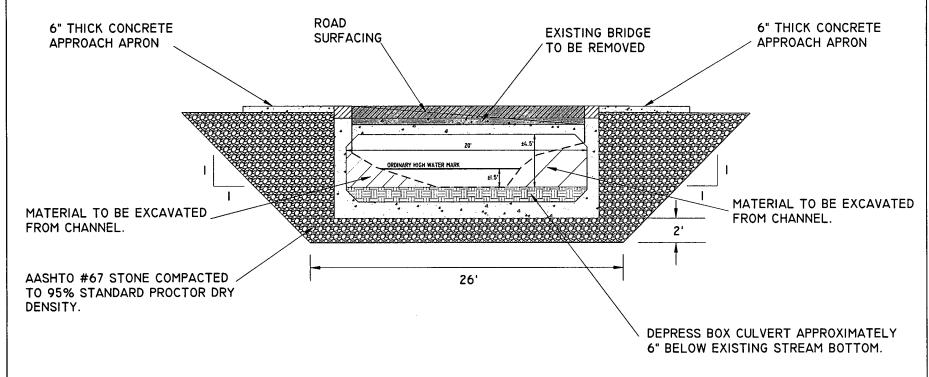
BOX CULVERT CROSSING ON SHEEP DODDRIDGE COUNTY, WV CNYGAS

REVISIONS

86/25/2914 CRIBING WINE WATER SURFACE PROFILE

PR-01

20' WIDE x 5.5' HIGH PRECAST CONCRETE BOX CULVERT CENTERLINE CROSS-SECTION N.T.S.



NOTE: AREA OF IMPACT BELOW ORDINARY HIGH WATER MARK = ±440 SF(FOOTPRINT)

NOTE: ESTIMATED FILL TO BE PLACED BELOW ORDINARY HIGH WATER MARK = ±100 CY. 22'Wx20'Lx5'D

NOTE: DRAWING WAS CREATED ON 22X34 PAPER. IIX17 DRAWINGS ARE HALF SCALE. REFER TO SCALE BAR FOR PROPER SCALING. Blue Mountain Inc. Erginers and Land Saroyors 1102) Mana Oleve (175)

ONE ENERGY DRIVE JANE LEW, WV 26378

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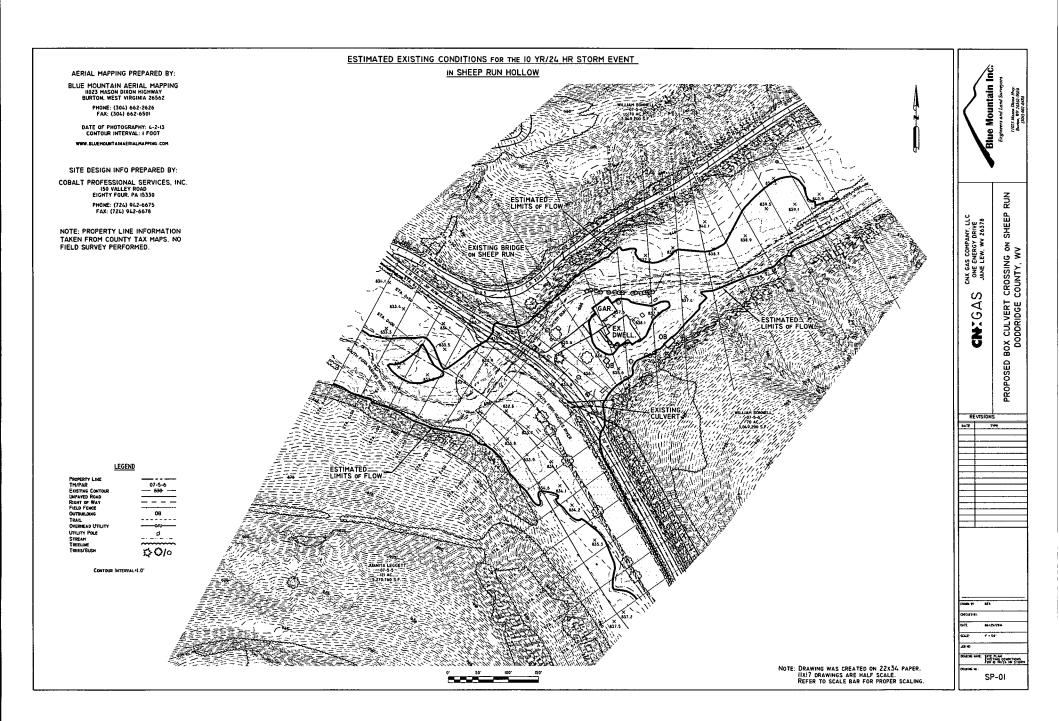
REVISIONS

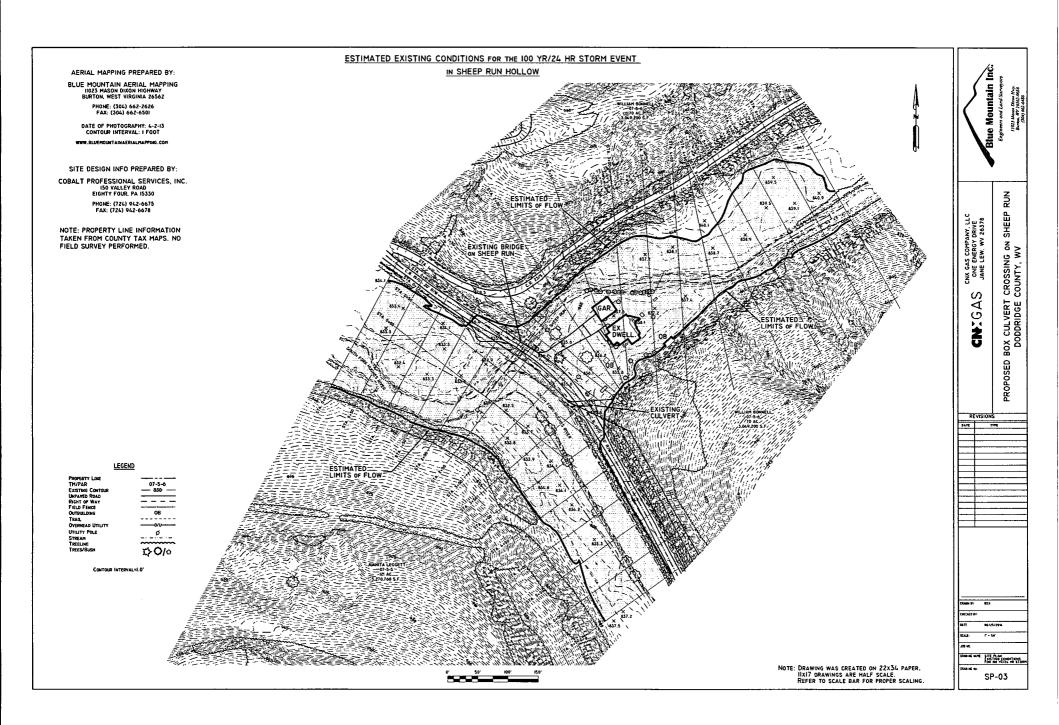
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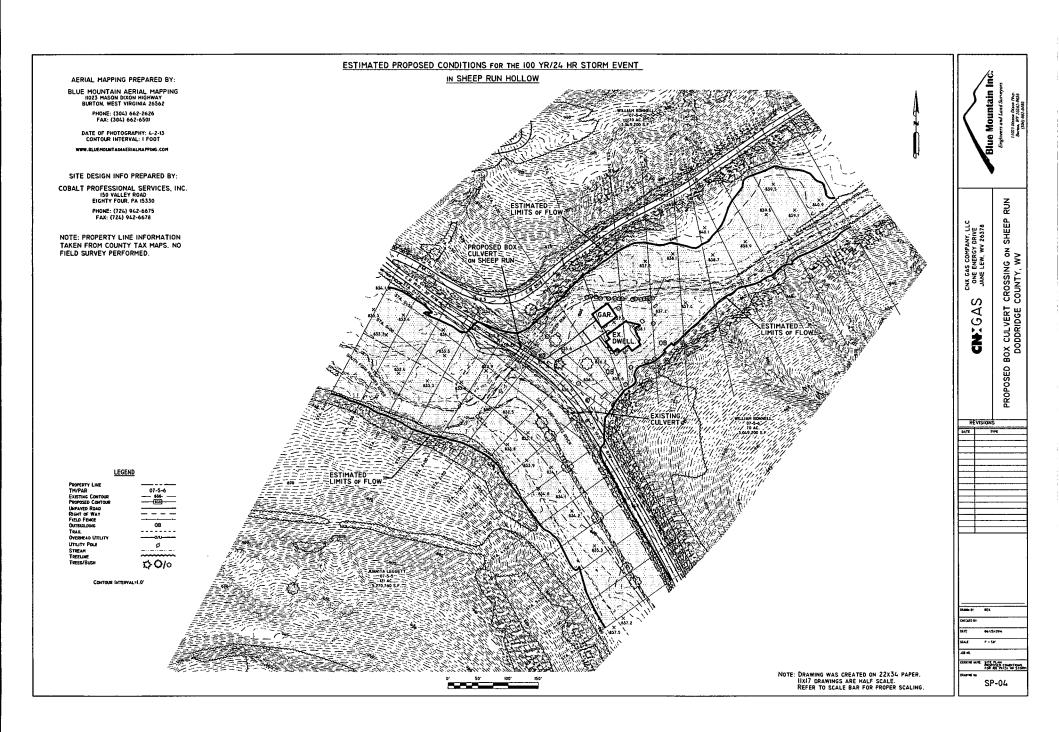
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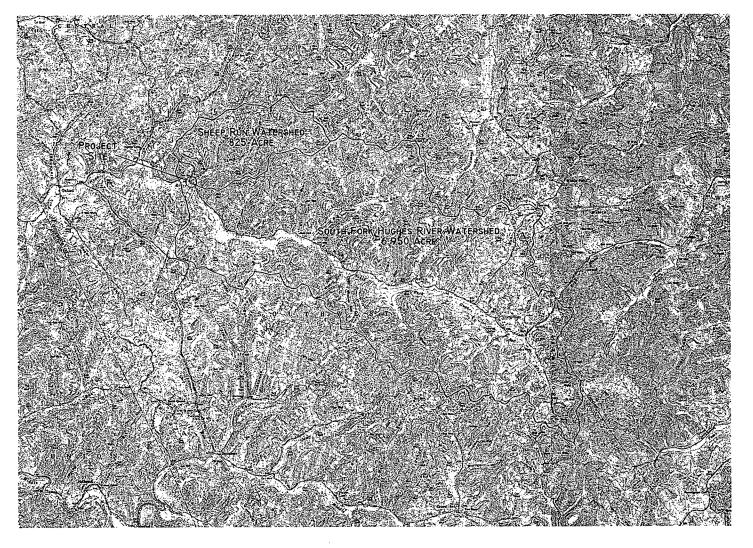






COBALT PROFESSIONAL SERVICES, INC.
150 VALLEY ROAD
EIGHTY FOUR PA 03300
PROME: (728) 042-0475
FAX: (728) 042-0678

WATERSHED LIMITS SHEEP RUN & SOUTH FORK HUGHES RIVER



CNIGAS

DELENG NAME WATERSHED

WS-01

NOTE DRAWING WAS CREATED ON 22134 PAPER. 1017 DRAWINGS ARE HALF SCALE REFER TO BARSCALE FOR PROPER SCALING.

PROPOSED SHEEP RUN BRIDGE REPLACEMENT DODDRIDGE COUNTY, WV

MAPPING TAKEN FROM USGS 7.5 MIN. QUADS OXFORD. WY & NEW MILTON, WY.

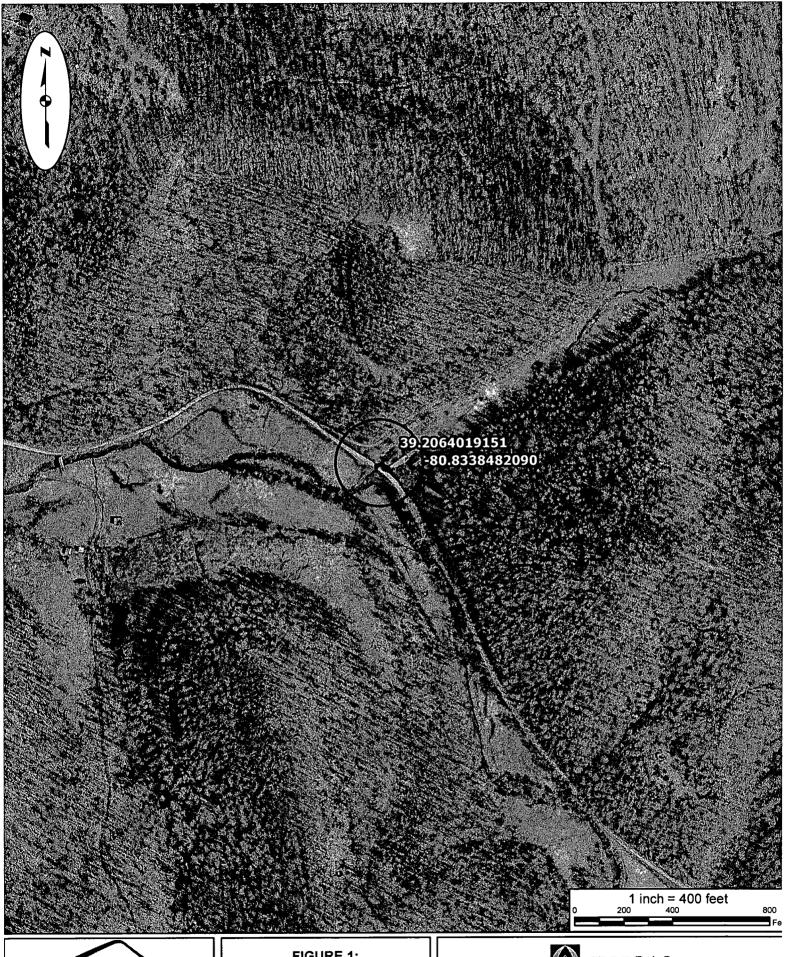
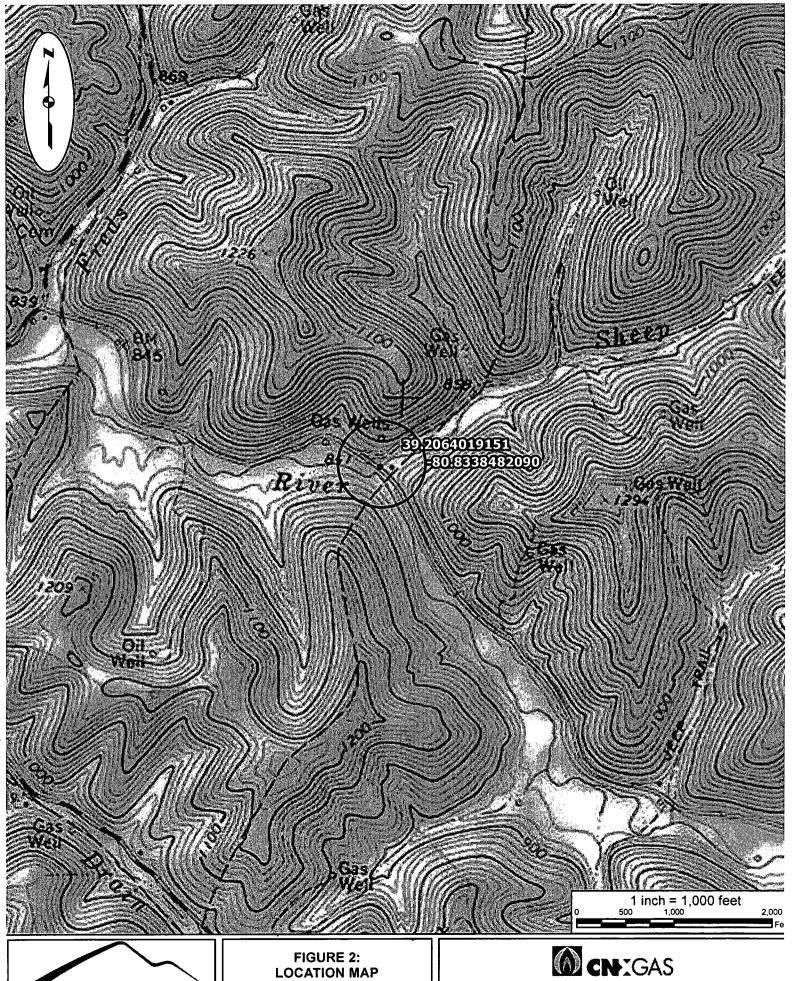




FIGURE 1: LOCATION MAP BMI Aerial Photography May 2013



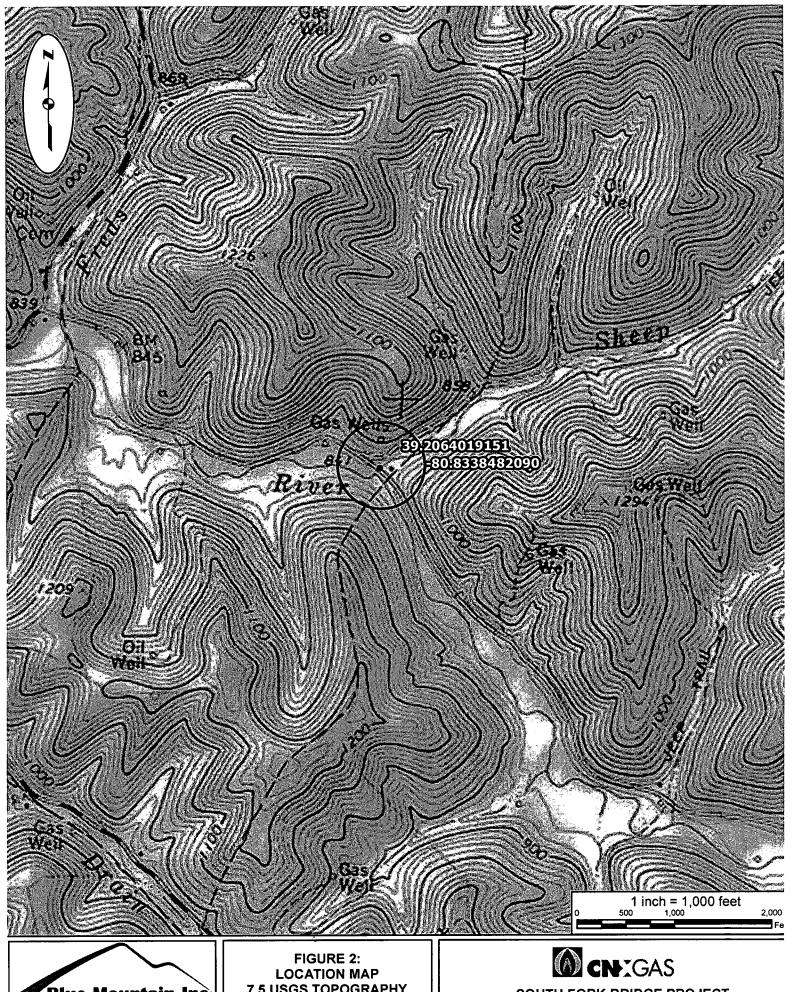
SOUTH FORK BRIDGE PROJECT DODDRIDGE COUNTY



Blue Mountain Inc. bme@bme.co 304.662.6486 www.bluemountaineng/neering.com

7.5 USGS TOPOGRAPHY **OXFORD WV MAP**

SOUTH FORK BRIDGE PROJECT **DODDRIDGE COUNTY**



Blue Mountain Inc.

bme@bme.co 304.662.6486

www.bluemountainengineering.com

7.5 USGS TOPOGRAPHY **OXFORD WV MAP**

SOUTH FORK BRIDGE PROJECT **DODDRIDGE COUNTY**

CNX GAS LLC

PROPOSED SHEEP RUN BRIDGE REPLACEMENT WV CR 19/II - MILE POST 2.45

LOCATE

DODDRIDGE COUNTY, WV

SCHEDULE OF DRAWINGS

DRAWING NO. T-01 DRAWING NO. WS-01 DRAWING NO. ST-01

DRAWING No. SP-01

DRAWING No. SP-02

TITLE SHEET
WATERSHED LIMITS
SOIL TYPES

SITE PLAN - EXISTING CONDITIONS - 10 YR/24 HR STORM SITE PLAN - PROPOSED CONDITIONS - 10 YR/24 HR STORM

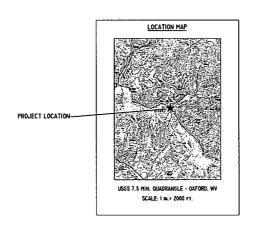
DRAWING NO. SP-03 DRAWING NO. SP-04 DRAWING NO. SP-05 DRAWING NO. PR-01

DRAWING No. XS-01 DRAWING No. XS-02 SITE PLAN - EXISTING CONDITIONS - 100 YR/24 HR STORM SITE PLAN - PROPOSED CONDITIONS - 100 YR/24 HR STORM

PLAN VIEW - PROPOSED BOX CULVERT

WATER SURFACE PROFILES FOR SHEEP RUN
TYPICAL CROSS-SECTION - EXISTING BRIDGE

TYPICAL CROSS-SECTION - PRECAST CONCRETE BOX CULVERT



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

Earl Ray Tomblin Governor Frank Jezioro
Director

July 14, 2014

Division of Natural Resources RIGHT OF ENTRY

Re: LS-14-VI/09-1002

CNX Gas Company LLC Amanda Wright c/o Blue Mountain, Inc. Attention: Greg Currey 11023 Mason Dixon Hwy. Burton, WV 26562-

Dear Ms. Wright:

The Division of Natural Resources hereby grants to you for a period of ten (10) years from the date hereof, a Right of Entry for the purpose of installing and maintaining a sixty-six inch by twenty foot (66"x20') box culvert in the streambed along Sheep Run of the South Fork Hughes River near Oxford in Doddridge County, West Virginia.

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

- 1. No in stream work during the fish-spawning season (April 1-June 30).
- 2. Work should be completed as quickly as possible during low flows in designated work areas only.
- 3. All shore areas disturbed by this operation must be reshaped, seeded and mulched immediately upon completion of work. The prompt establishment of vegetative cover will reduce future damage from high water levels.
- 4. Green concrete must not be put in the stream (highly toxic to aquatic life).
- 5. Guidance should be obtained from NRCS (formerly SCS) and a registered engineer for the design and construction. Must allow for passage of at least ten-year flood flow.
- 6. Best management practices should be followed; measures such as hay bales must be used to reduce downstream siltation.

CNX Gas Company LLC LS-14-VI/09-1002 Page 2 July 14, 2014

- 7. Applicant is responsible for removing debris from in and around the installation periodically to prevent stream flow obstruction.
- 8. Durable head walls of logs, rock, or concrete shall be constructed at both the upstream and downstream ends of crossing to prevent erosion of fill material into the stream.
- 9. The State's issuance of this Right-of-Entry does not provide for the applicant to work outside the requested boundaries nor does the State assume any liability for the applicant's/landowner's construction activities. By accepting this Right-of-Entry, the applicant/landowner assumes liability for any/all damages caused by this activity to both upstream and downstream landowners.

Guidelines of Best Management Practices for Sediment and Erosion Control as outlined by the Section of Water Resources, Division of Environmental Protection must be followed. Copies of those guidelines are available from the Section of Water Resources, 601 57th Street S.E., Charleston, West Virginia 25304-2345, Telephone No. (304) 926-0440.

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

Your payment is now due and payable in the amount of \$100.00 to the Division of Natural Resources covering the first year's annual fee of this agreement. Your agreement will be effective upon receipt of your payment in full. You must notify this office in writing when this installation has been removed.

Sincerely.

Joe Scarberry, Supervisor Office of Land and Streams

JTS:cb

pc: DNR Fish Biologist

Mr. Mike Zeto, Environmental Enforcement

DNR Conservation Officers



DEPARTMENT OF THE ARMY

HUNTINGTON DISTRICT, CORPS OF ENGINEERS 502 EIGHTH STREET HUNTINGTON, WEST VIRGINIA 25701-2070

August 7, 2014

Regulatory Division
Energy Resource Branch
LRH-2014-00584- LKR-Sheep Run
South Fork Bridge #1

Ms. Amanda Wright CNX Gas Company LLC One Energy Drive, P.O. Box 1248 Jane Lew, West Virginia 26378

Dear Ms. Wright:

I refer to the information submitted to this office regarding the South Fork Bridge #1 Project, a linear transportation project. The proposed project will include the replacement of an existing bridge located over Sheep Run. According to the information provided, implementation of the proposed project will result in the discharge of dredged and/or fill material into approximately 20 linear feet of stream, referred to as Sheep Run, for the installation of a 20-foot wide by 5.5-foot high precast concrete box culvert. The purpose of the project is to install a box culvert in order to provide access to accommodate heavy equipment utilized for gas production operations. Sheep Run is an indirect tributary of the Little Kanawha River, a traditional navigable water of the United States (U.S.). The proposed project is located approximately seven (7) aerial miles southwest of West Union, in Doddridge County, West Virginia (39.206402°N, 80.833848°W). The project has been assigned the following Department of the Army (DA) No. LRH-2014-00584. Please reference this number on all future correspondence related to this project.

The U.S. Army Corps of Engineers (Corps) authority to regulate waters of the U.S. is based, in part, on the definitions and limits of jurisdiction contained in 33 CFR 328 and 33 CFR 329. Section 404 of the Clean Water Act requires that a DA permit be obtained prior to the discharge of dredged and/or fill material into waters of the U.S., including wetlands. Section 10 of the Rivers and Harbors Act of 1899 requires that a DA permit be obtained for any work in, on, over or under a navigable water.

To the extent the Corps has jurisdiction over the discharge of dredged and/or fill material associated with the proposed linear transportation activity, it has been determined the proposed project meets the criteria for Nationwide Permit Number (NWP) #14 (attached) under the February 21, 2012 Federal Register, Notice of Reissuance of Nationwide Permits (77 FR 10184) provided you comply with all terms and conditions of the enclosed material. A copy of this NWP can be found on our website at http://www.lrh.usace.army.mil/Missions/Regulatory.aspx.

Please be aware this nationwide permit authorization does not obviate the requirement to obtain other Federal, state, or local authorizations required by law. A copy of this NWP and verification letter must be supplied to your project engineer responsible for construction activities. A copy of the verification letter must be kept at the site during construction. Upon completion of the work, the attached certification must be signed and returned to this office.

If you have any questions concerning the above, please contact Ms. Audrey Richter at (304) 399-5257 or by email at Audrey.M.Richter@usace.army.mil.

Sincerely,

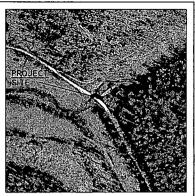
Samantha Dailey

Regulatory Project Manager

Energy Resource Branch

Enclosures





LOCATION MAP SCALE I*=200'

SOUTH FORK BRIDGE #1 TEMPORARY CROSSING & REPLACEMENT

LOCATE

DODDRIDGE COUNTY, WV

SCHEDULE OF DRAWINGS

DRAWING No. T-01 DRAWING No. EX-01 DRAWING No. TC-01 DRAWING No. TC-02 TITLE SHEET PLAN OF EXISTING CONDITIONS PLAN VIEW - 50' LONG PORTABLE BRIDGE ARRANGEMENT DRAWINGS - 50' TEMPORARY BRIDGE DRAWING No. TC-03 DRAWING No. PB-01 DRAWING No. PB-02 DRAWING No. XS-01

ESTIMATED LOADING - 50' TEMPORARY BRIDGE PERMANENT BRIDGE REPLACEMENT PRECAST CONCRETE BOX CULVERT DETAILS SECTIONS/PROFILES

> NOTE: DRAWING WAS CREATED ON 22X34 PAPER. IIXI7 DRAWINGS ARE HALF SCALE.

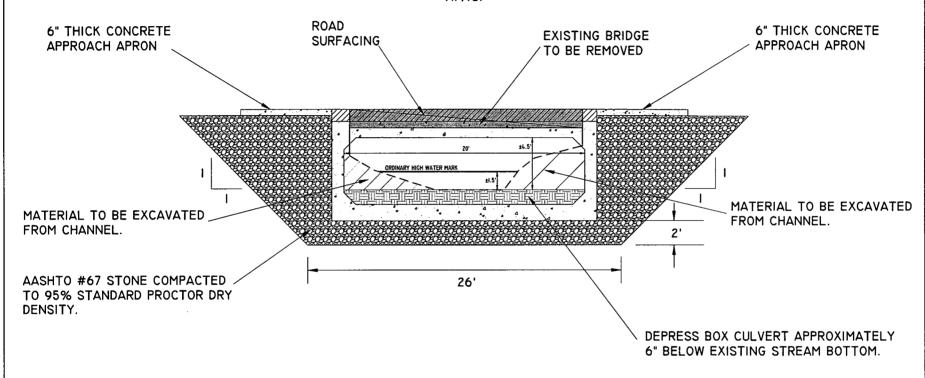
CNYGAS

W.T.S

T-01

20' WIDE x 5.5' HIGH PRECAST CONCRETE BOX CULVERT CENTERLINE CROSS-SECTION

N.T.S.



NOTE: AREA OF IMPACT BELOW

ORDINARY HIGH WATER MARK = ±440 SF(FOOTPRINT)

NOTE: ESTIMATED FILL TO BE PLACED BELOW ORDINARY HIGH WATER MARK = ±100 CY.

22'Wx20'Lx5'D

NOTE: DRAWING WAS CREATED ON 22X34 PAPER.
IIXI7 DRAWINGS ARE HALF SCALE.
REFER TO SCALE BAR FOR PROPER SCALING

Blue Mountain Inc.
Enginers and Land Surveyors
11(2) House Days (N.)
Pages, BY 7565-8699

ONE ENERGY DRIVE JANE LEW, WV 26378

CNXGAS (

ISIONS

DE 00/25/2016
E 00/25/2016
E 0-125/2016

COMMING NAME: TYPIC AL CROSS-SECTION
OF POTCAST COMMINE TO
BOX CAL YEST
COMMING NO.

XS-01



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

Earl Ray Tomblin
Governor

Frank Jezioro

Director

July 14, 2014

Division of Natural Resources RIGHT OF ENTRY

Re: LS-14-VI/09-1002

CNX Gas Company LLC Amanda Wright c/o Blue Mountain, Inc. Attention: Greg Currey 11023 Mason Dixon Hwy. Burton, WV 26562-

Dear Ms. Wright:

The Division of Natural Resources hereby grants to you for a period of ten (10) years from the date hereof, a Right of Entry for the purpose of installing and maintaining a sixty-six inch by twenty foot (66"x20') box culvert in the streambed along Sheep Run of the South Fork Hughes River near Oxford in Doddridge County, West Virginia.

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

- 1. No in stream work during the fish-spawning season (April 1-June 30).
- Work should be completed as quickly as possible during low flows in designated work areas only.
- 3. All shore areas disturbed by this operation must be reshaped, seeded and mulched immediately upon completion of work. The prompt establishment of vegetative cover will reduce future damage from high water levels.
- 4. Green concrete must not be put in the stream (highly toxic to aquatic life).
- 5. Guidance should be obtained from NRCS (formerly SCS) and a registered engineer for the design and construction. Must allow for passage of at least ten-year flood flow.
- 6. Best management practices should be followed; measures such as hay bales must be used to reduce downstream siltation.

CNX Gas Company LLC LS-14-VI/09-1002 Page 2 July 14, 2014

- 7. Applicant is responsible for removing debris from in and around the installation periodically to prevent stream flow obstruction.
- 8. Durable head walls of logs, rock, or concrete shall be constructed at both the upstream and downstream ends of crossing to prevent erosion of fill material into the stream.
- 9. The State's issuance of this Right-of-Entry does not provide for the applicant to work outside the requested boundaries nor does the State assume any liability for the applicant's/landowner's construction activities. By accepting this Right-of-Entry, the applicant/landowner assumes liability for any/all damages caused by this activity to both upstream and downstream landowners.

Guidelines of Best Management Practices for Sediment and Erosion Control as outlined by the Section of Water Resources, Division of Environmental Protection must be followed. Copies of those guidelines are available from the Section of Water Resources, 601 57th Street S.E., Charleston, West Virginia 25304-2345, Telephone No. (304) 926-0440.

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Your payment is now due and payable in the amount of \$100.00 to the Division of Natural Resources covering the first year's annual fee of this agreement. Your agreement will be effective upon receipt of your payment in full. You must notify this office in writing when this installation has been removed.

Sincerely,

Joe 7. Scarberry, Supervisor Office of Land and Streams

JTS:cb

pc: DNR Fish Biologist

Mr. Mike Zeto, Environmental Enforcement

DNR Conservation Officers

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS AGREEMENT CNX GAS COMPANY LLC STRUCTURE REPLACEMENT DODDRIDGE COUNTY

THIS AGREEMENT, executed in duplicate, made and entered into this ______ day of June, 2014, by and between the West Virginia Department of Transportation, Division of Highways, hereinafter called "Department," and CNX Gas Company, LLC, P.O. Box 1248, Jane Lew, WV 26378, hereinafter called "Company,"

- WHEREAS, to improve access to oil and gas operations in Doddridge County, Company desires perform temporary modifications to an existing drainage structure to allow for the passage of construction and drilling equipment and also to replace the existing bridge at no cost to the Department; and
- WHEREAS, Department considers it to be in the public interest to cooperate with Company to facilitate Company's implementation of the highway improvement, as it pertains to the State Highway System;
- NOW, THEREFORE, in consideration of the faithful performance of each party of the mutual covenants hereinafter set forth, Department and Company agree as follows:
- Company shall first obtain Department's approval regarding the proposed improvements Company desires to implement within or directly affecting the State Highway System and Company shall comply with the provisions described throughout this Agreement. Company acknowledges that execution of this Agreement does not constitute Department's approval of any part of Company's proposed work nor does execution of this Agreement represent Department's Notice to Proceed. Further, Company acknowledges that any work performed by Company, including work solely within Company's property that will directly affect Department's right-of-way, prior to receipt of Department's approval and notice to proceed with work pertaining to the State Highway System, is performed by Company with the understanding that subsequent review by Department of Company's plans and studies may result in necessary additional modifications to be performed at no cost to Department.
- II. Unless otherwise directed by Department, Company is to submit for Department's review and approval appropriate temporary bridge plans as well as replacement plans and related documents, all of which are collectively are referred to as the "Plans," prepared in accordance with Department's Directives, criteria, guidelines and publications, for the performance of work that will occur within or that will directly affect Department's right-of-way of CR 19/11. Department's approvals shall be in writing.
- III. The scope of Company's work as it pertains to the State Highway System, is to include placing of a temporary bridge over an existing structure crossing Sheep Run. Temporary construction will be performed by a contractor approved by Department.

In the event the temporary bridge is long enough to be considered a bridge as defined by National Bridge Inspection Standards (NBIS) and temporary bridge is in place in excess of 12 months, Company agrees to have the bridge inspected according to NBIS.

While the temporary bridge is in use, Company's engineer will be engaged to design a new replacement structure (Box Culvert). Replacement plans shall be completed in accordance with the WVDOH Standard Specifications for Roads and Bridges and will be approved by Department. Temporary Right of Way easements may be required for the placement of cofferdams for dewatering purposes during placement of the box culvert.

Once the replacement box culvert is designed and all federal, state, and local permits are in hand, Company will remove the temporary bridge and construct the box culvert. Construction of the box culvert will occur during an appropriate lapse in Company operations or after the operations are complete with completion no later than December 31, 2014. The Design Loading of the completed structure shall be HL-93.

- IV. After receipt of Department's written approval of the Plans-pertaining to the State Highway System and Department's authorization to proceed with construction and related work, Company then shall be authorized to construct Project as shown on the approved Plans, in accordance with Department's specifications, at no cost to Department.
- Prior to construction of Project, Department and Company shall review and document, as V. appropriate, the existing condition of the State Highway System to be affected by Project, and Department shall be notified of Company's anticipated construction schedule and Department shall have the right at all times to inspect the work pertaining to Project. Department shall provide full time inspection during the construction of the permanent box culvert. If the results of Department's inspection indicate that the work is not being performed in accordance with the approved Plans and/or specifications, Department then will report such fact to Company for appropriate remedial action. Department shall perform an additional inspection of the work within thirty (30) days after receipt by Department of notice from Company that the work is complete. Upon completion of said inspection, Department shall, in writing, accept the completed work associated with Project or reject the work. If rejected, any deficiencies in the construction performed by Company, which are disclosed by Department's inspection, shall be promptly corrected by and at the expense of Company. Neither Department's review of Company's Plans nor its inspection of Company's construction relieves Company of the duty imposed by West Virginia Code Section 17-16-1 et seq. to refrain from casting water upon the
- VI. Company shall secure the approvals and/or permits, if any, required by other governmental agencies, and shall comply with all applicable Federal, State, and local environmental regulations including, but not limited to, the National Environmental Policy Act, Section 404 of the Clean Water Act, Section 106 of the National Historic Preservation Act, Rare, Threatened and Endangered Species Act, State 401 Water Quality Certification, and hazardous waste requirements. Upon request of Department, Company shall furnish Department with acceptable documentation of such approvals, permits, and compliance.
- VII. In connection with Project, Company shall indemnify and hold Department harmless from and against any and all loss, damage, and liability, and from all claims for damages on account of or by reason of bodily injury, including death, which may be sustained, or claimed to be sustained, by any person or persons including employees of Department, and from and against any and all damages to property arising out of the Project, except if any such claim or liability results from
 - A. the sole negligence of Department; or
 - B. the willful misconduct or intentional unlawful acts of Department.

Further, upon request Company shall furnish evidence of having at least the minimum amounts of insurance required of the Contractor in Section 103.6 through and including Section 103.6.5 of the "West Virginia Division of Highways, Standard Specifications, Roads and Bridges, Adopted 2010," and supplements hereto. Company also shall require its contractor(s) to have the aforesaid minimum insurance coverage and to provide evidence, as necessary, that contractor has a current license and is qualified to perform work in West Virginia.

- VIII. The review and approval of Plans by Department does not relieve the applicant from errors or omissions in the design. The review and approval by Department is solely to identify patent or obvious defects or apparent deviations from current applicable design standards in the manner that the proposed work connects to the highway network maintained by Department. This review and approval does not relieve the applicant, their engineer, their contractor, or any other personnel working on behalf of the applicant from liability for the design and/or construction of Project.
- IX. As a result of implementation of Project, Company shall have no jurisdiction or control over Department's Right of Way.

X. This Agreement shall be binding up	on the successors and assigns of each party thereto.
IN WITNESS WHEREOF, the parties hereto authorized officers.	have caused their respective names to be signed by their duly
ATTEST:	WEST VIRGINIA DEPARTMENT OF TRANSPORTATION, DIVISION OF HIGHWAYS
Title: Executive Secretary	By: Gregory L. Bailey, P.E. Acting State Highway Engineer
ATTEST:	CNX GAS COMPANY, LLC
Title:	By: Amanda Weight Manager-Permitting
APPROVED AS TO FORM THIS 2 DAY OF 6 20 1 - 1 ATTORNEY LEGAL DIVISION WEST VIRGINIA DIVISION OF HIGHWAYS	(To be executed in duplicate) Distribution: Master File Company



Blue Mountain Inc. 11023 Mason Dixon Highway Burton, WV 26562

> Ph: (304) 662-6486 Fax: (304) 662-6501

July 8, 2014

Ms. Barbara Douglas, Ecological Services U.S. Fish and Wildlife Service 694 Beverly Pike Elkins, West Virginia 26241

RECEIVED

IUL 1 1 2014

WVF0

Dear Ms. Douglas:

Subject:

Database Review Request

CNX Gas Company LLC
Proposed South Fork Bridge #1
Doddridge County, West Virginia
Blue Mountain Inc. Project 0407-14

On behalf of CNX Gas Company LLC, Blue Mountain Inc. presents this request for a database review to identify known and likely occurrences of federal and state protected species and their designated critical habitats, federal candidate species, and state special concern and rare species within the vicinity of the proposed South Fork Bridge #1 project, located in Doddridge County, West Virginia (N 39.206402 W 80.833848). Also we are requesting information on other significant biological features, geologic features, and unique natural areas located on or near the pad site.

The project boundary is shown on the attached portions of the Oxford, West Virginia USGS quadrangle map. The project proposal is to replace an existing bridge across County Route 19/11 with a box culvert so that larger trucks and equipment associated with the gas industry can safely pass. This culvert will be located in Sheep Run (N 39.206402, W -80.833848) which is a tributary of the South Fork of the Hughes River. Approximately 100 cubic vards of fill will be



United States Department of the Interior

FISH AND WILDLIFE SERVICE

West Virginia Field Office 694 Beverly Pike Elkins, West Virginia 26241

In response to your letter above, we have made a "no effect" determination that the project will not affect federally-listed endangered or threatened species. Therefore no biological assessment or further section 7 consultation under the Endangered Species Act is required with the Fish and Wildlife Service. Should project plans change, or if additional information on listed and proposed species becomes available, this determination may be reconsidered.

Definitive determinations of the presence of waters of the United States, including wetlands, in the project area and the need for permits, if any, are made by the U.S. Army Corps of Engineers. They may be contacted at: Huntington District, Regulatory Branch, 50% Eighth Street, Huntington, West Virginia 25701, telephone (304) 399-5710.

Reviewer's signature and date

Field Supervisor's signature and date



=



DEPARTMENT OF THE ARMY

HUNTINGTON DISTRICT, CORPS OF ENGINEERS 502 EIGHTH STREET HUNTINGTON, WEST VIRGINIA 25701-2070

August 7, 2014

Regulatory Division
Energy Resource Branch
LRH-2014-00584- LKR-Sheep Run
South Fork Bridge #1

Ms. Amanda Wright CNX Gas Company LLC One Energy Drive, P.O. Box 1248 Jane Lew, West Virginia 26378

Dear Ms. Wright:

I refer to the information submitted to this office regarding the South Fork Bridge #1 Project, a linear transportation project. The proposed project will include the replacement of an existing bridge located over Sheep Run. According to the information provided, implementation of the proposed project will result in the discharge of dredged and/or fill material into approximately 20 linear feet of stream, referred to as Sheep Run, for the installation of a 20-foot wide by 5.5-foot high precast concrete box culvert. The purpose of the project is to install a box culvert in order to provide access to accommodate heavy equipment utilized for gas production operations. Sheep Run is an indirect tributary of the Little Kanawha River, a traditional navigable water of the United States (U.S.). The proposed project is located approximately seven (7) aerial miles southwest of West Union, in Doddridge County, West Virginia (39.206402°N, 80.833848°W). The project has been assigned the following Department of the Army (DA) No. LRH-2014-00584. Please reference this number on all future correspondence related to this project.

The U.S. Army Corps of Engineers (Corps) authority to regulate waters of the U.S. is based, in part, on the definitions and limits of jurisdiction contained in 33 CFR 328 and 33 CFR 329. Section 404 of the Clean Water Act requires that a DA permit be obtained prior to the discharge of dredged and/or fill material into waters of the U.S., including wetlands. Section 10 of the Rivers and Harbors Act of 1899 requires that a DA permit be obtained for any work in, on, over or under a navigable water.

To the extent the Corps has jurisdiction over the discharge of dredged and/or fill material associated with the proposed linear transportation activity, it has been determined the proposed project meets the criteria for Nationwide Permit Number (NWP) #14 (attached) under the February 21, 2012 Federal Register, Notice of Reissuance of Nationwide Permits (77 FR 10184) provided you comply with all terms and conditions of the enclosed material. A copy of this NWP can be found on our website at http://www.lrh.usace.army.mil/Missions/Regulatory.aspx.

Please be aware this nationwide permit authorization does not obviate the requirement to obtain other Federal, state, or local authorizations required by law. A copy of this NWP and verification letter must be supplied to your project engineer responsible for construction activities. A copy of the verification letter must be kept at the site during construction. Upon completion of the work, the attached certification must be signed and returned to this office.

If you have any questions concerning the above, please contact Ms. Audrey Richter at (304) 399-5257 or by email at Audrey.M.Richter@usace.army.mil.

Sincerely,

Samantha Dailey

Regulatory Project Manager

Energy Resource Branch

Enclosures



The Culture Center 1900 Kanawha Blvd., E. Charleston, WV 25305-0300

Randall Reid-Smith, Commissioner

Phone 304.558.0220 • www.wvculture.org Fax 304.558.2779 • TDD 304.558.3562

EEO/AA Employer

August 27, 2014

Mr. Greg Currey Blue Mountain, Inc. 11023 Mason Dixon Highway Burton, WV 26562

RE:

Proposed South Fork Bridge #1

FR#

14-992-DO

Dear Mr. Currey:

We have reviewed the above mentioned project to determine its effects to cultural resources. As required by Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulations, 36 CFR 800: "Protection of Historic Properties," we submit our comments.

According to the information submitted, CNX Gas Company, LLC proposes to replace an existing bridge across Doddridge County Route 19/11 with a box culvert, which will be placed in Sheep Run in Doddridge County, WV. The proposed project will involve placing approximately 100 cubic yards of fill below the ordinary high water mark of Sheep Run along 20 linear feet of the stream.

Archaeological Resources:

A search of our records indicates that no archaeological resources are located within the proposed project area. In addition, available information indicates the proposed project will be confined to previously disturbed terrain, which makes it unlikely that significant archaeological resources will be encountered. In our opinion, no significant archaeological properties are located within the proposed project area. However, if intact cultural properties are discovered while replacing the bridge, we ask that you cease all activity in the area of discovery and contact this office immediately.

Architectural Resources:

We have reviewed the submitted information, and determined that there are no architectural properties which are eligible for or listed in the National Register of Historic Places that will be affected by the proposed project. No further consultation is necessary regarding architectural resources; however, we ask that you contact our office if your project should change.

We appreciate the opportunity to be of service. If you have questions regarding our comments or the Section 106 process, please contact Lora A. Lamarre-DeMott, Senior Archaeologist, or Ernest E. Blevins, Structural Historian_at (304) 558-0240.

Deputy State Historic Preservation Officer



Edwin Wriston <doddridgecountyfpm@gmail.com>

more Sheep Run Bridge

2 messages

Gregory Currey < G. Currey @bluemtninc.com>

Fri. Oct 10, 2014 at 2:14 PM

To: "doddridgecountyfpm@gmail.com" <doddridgecountyfpm@gmail.com>

Cc: Doug Six < D.Six@bluemtninc.com>

Greg Currey |Blue Mountain, Inc.

Ph: (304) 662-6486 | Fax: (304) 662-6501 11023 Mason Dixon Highway | Burton, WV 26562

CONFIDENTIALITY NOTICE:

This communication is the property of Blue Mountain Inc. and may contain confidential and privileged information. Unauthorized use is strictly prohibited and may be unlawful. If you have received this communication in error, please contact the sender by reply e-mail and destroy all copies of the original message and any attachments.

4 attachments

Doddridge Floodplain Development Permit South Fork Bridge 1 Application (Draft).pdf 779K

SP-05-ProposedBox Culvert.pdf 354K

ST-01-Soil Types.pdf

T-01 - Title Sheet.pdf 575K

Gregory Currey <G.Currey@bluemtninc.com>

Fri, Oct 10, 2014 at 2:42 PM

To: "doddridgecountyfpm@gmail.com" <doddridgecountyfpm@gmail.com>

Cc: Doug Six < D.Six@bluemtninc.com>

Bo, I know these files are probably not in the order they should be. I believe we sent you all the information as a hard copy and on a CD. Bruce Konsugar with Cobalt Professional Services did all of the engineering work, drawings, and H& H Analysis. If you still think something is missing you should probably contact him. His phone # is 724-942-6675 and e-mail is cobaltprof@verizon.net. If you still think I can help you with something please feel free to contact me. Thanks.

Greg

P.S. I have also attached the Corps and Office of Land and Streams approval letters with this e-mail.

[Quoted text hidden]

4 attachments

XS-01-Bridge Section-Model.pdf 207K

T-01 - South Fork Bridge #1 Replacement - Title Sheet.pdf 856K

LRH 2014-00584 CNX Gas South Fork Bridge 1 TE Letter (NWP 14 Authorization Letter).pdf 62K

DNR (OLS) Right of Entry Approval.pdf 647K



Edwin Wriston < doddridgecountyfpm@gmail.com>

FW: Sheep Run Culvert Project

1 message

Bo Wriston

bowriston@hotmail.com>

Fri, Aug 8, 2014 at 9:08 PM

To: "doddridgecountyfpm@gmail.com" <doddridgecountyfpm@gmail.com>

Bo Wriston 304.629.3735 (c) bowriston@hotmail.com

"Remember, happiness doesn't depend on upon who you are, or what you have, it depends solely upon what you think." ~ Dale Carnegie

From: G.Currey@bluemtninc.com
To: bowriston@hotmail.com
CC: BMI@bluemtninc.com

Subject: Sheep Run Culvert Project Date: Fri, 8 Aug 2014 14:51:13 +0000

Bo, attached are the approvals for the Army Corps of Engineers permit and the Office of Land and Streams (DNR) permit. The two approvals we still need are yours and the Department of Highway. If you need anything at all from me, just please let me know. Thanks.

Greg

Greg Currey |Blue Mountain, Inc.

Ph: (304) 662-6486 | Fax: (304) 662-6501 11023 Mason Dixon Highway | Burton, WV 26562

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2 attachments

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- DNR (OLS) Right of Entry Approval.pdf 647K



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

Earl Ray Tomblin Governor

Fax (304) 558-6048 Telephone (304) 558-3225

Frank Jezioro Director

July 14, 2014

Division of Natural Resources RIGHT OF ENTRY

Re: LS-14-VI/09-1002

CNX Gas Company LLC Amanda Wright c/o Blue Mountain, Inc. Attention: Greg Currey 11023 Mason Dixon Hwy. Burton, WV 26562-

Dear Ms. Wright:

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

- No in stream work during the fish-spawning season (April 1-June 30). 1.
- Work should be completed as quickly as possible during low flows in 2. designated work areas only.
- All shore areas disturbed by this operation must be reshaped, seeded and 3. mulched immediately upon completion of work. The prompt establishment of vegetative cover will reduce future damage from high water levels.
- Green concrete must not be put in the stream (highly toxic to aquatic life). 4.
- Guidance should be obtained from NRCS (formerly SCS) and a registered 5. engineer for the design and construction. Must allow for passage of at least ten-year flood flow.
- Best management practices should be followed; measures such as hay 6. bales must be used to reduce downstream siltation.

CNX Gas Company LLC LS-14-VI/09-1002 Page 2 July 14, 2014

- 7. Applicant is responsible for removing debris from in and around the installation periodically to prevent stream flow obstruction.
- 8. Durable head walls of logs, rock, or concrete shall be constructed at both the upstream and downstream ends of crossing to prevent erosion of fill material into the stream.
- 9. The State's issuance of this Right-of-Entry does not provide for the applicant to work outside the requested boundaries nor does the State assume any liability for the applicant's/landowner's construction activities. By accepting this Right-of-Entry, the applicant/landowner assumes liability for any/all damages caused by this activity to both upstream and downstream landowners.

Guidelines of Best Management Practices for Sediment and Erosion Control as outlined by the Section of Water Resources, Division of Environmental Protection must be followed. Copies of those guidelines are available from the Section of Water Resources, 601 57th Street S.E., Charleston, West Virginia 25304-2345, Telephone No. (304) 926-0440.

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

Your payment is now due and payable in the amount of \$100.00 to the Division of Natural Resources covering the first year's annual fee of this agreement. Your agreement will be effective upon receipt of your payment in full. You must notify this office in writing when this installation has been removed.

Sincerely,

Joe 7. Scarberry, Supervisor Office of Land and Streams

JTS:cb

pc: DNR Fish Biologist
Mr. Mike Zeto, Environmental Enforcement
DNR Conservation Officers



DEPARTMENT OF THE ARMY HUNTINGTON DISTRICT, CORPS OF ENGINEERS 602 EIGHTH STREET HUNTINGTON, WEST VIRGINIA 25701-2070

August 7, 2014

Regulatory Division
Energy Resource Branch
LRH-2014-00584- LKR-Sheep Run
South Fork Bridge #1

Ms. Amanda Wright CNX Gas Company LLC One Energy Drive, P.O. Box 1248 Jane Lew, West Virginia 26378

Dear Ms. Wright:

I refer to the information submitted to this office regarding the South Fork Bridge #1 Project, a linear transportation project. The proposed project will include the replacement of an existing bridge located over Sheep Run. According to the information provided, implementation of the proposed project will result in the discharge of dredged and/or fill material into approximately 20 linear feet of stream, referred to as Sheep Run, for the installation of a 20-foot wide by 5.5-foot high precast concrete box culvert. The purpose of the project is to install a box culvert in order to provide access to accommodate heavy equipment utilized for gas production operations. Sheep Run is an indirect tributary of the Little Kanawha River, a traditional navigable water of the United States (U.S.). The proposed project is located approximately seven (7) aerial miles southwest of West Union, in Doddridge County, West Virginia (39.206402°N, 80.833848°W). The project has been assigned the following Department of the Army (DA) No. LRH-2014-00584. Please reference this number on all future correspondence related to this project.

The U.S. Army Corps of Engineers (Corps) authority to regulate waters of the U.S. is based, in part, on the definitions and limits of jurisdiction contained in 33 CFR 328 and 33 CFR 329. Section 404 of the Clean Water Act requires that a DA permit be obtained prior to the discharge of dredged and/or fill material into waters of the U.S., including wetlands. Section 10 of the Rivers and Harbors Act of 1899 requires that a DA permit be obtained for any work in, on, over or under a navigable water.

To the extent the Corps has jurisdiction over the discharge of dredged and/or fill material associated with the proposed linear transportation activity, it has been determined the proposed project meets the criteria for Nationwide Permit Number (NWP) #14 (attached) under the February 21, 2012 Federal Register, Notice of Reissuance of Nationwide Permits (77 FR 10184) provided you comply with all terms and conditions of the enclosed material. A copy of this NWP can be found on our website at http://www.lrh.usace.army.mil/Missions/Regulatory.aspx.

Please be aware this nationwide permit authorization does not obviate the requirement to obtain other Federal, state, or local authorizations required by law. A copy of this NWP and verification letter must be supplied to your project engineer responsible for construction activities. A copy of the verification letter must be kept at the site during construction. Upon completion of the work, the attached certification must be signed and returned to this office.

If you have any questions concerning the above, please contact Ms. Audrey Richter at (304) 399-5257 or by email at Audrey.M.Richter@usace.army.mil.

Sincerely,

Samantha Dailey

Regulatory Project Manager

Energy Resource Branch

Enclosures



Engineers and Land Surveyors

11023 Mason Dixon Hwy. Burton, WV 26562-9656 (304) 662-6486

HYDROLOGIC & HYDRAULIC ANALYSIS SHEEP RUN BRIDGE REPLACEMENT WV CR 19/11 - MILE POST 2.45

LOCATE

DODDRIDGE COUNTY, WV

REPORT PREPARED BY:

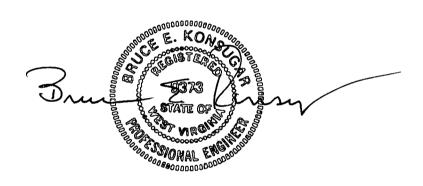
COBALT PROFESSIONAL SERVICES, INC. 150 VALLEY ROAD EIGHTY FOUR, PA 15330 724-942-6675

JULY 22, 2014

HYDROLOGIC & HYDRAULIC ANALYSIS SHEEP RUN BRIDGE REPLACEMENT WV CR 19/11 - MILE POST 2.45

LOCATE

DODDRIDGE COUNTY, WV



REPORT PREPARED BY:

COBALT PROFESSIONAL SERVICES, INC. 150 VALLEY ROAD EIGHTY FOUR, PA 15330

FOR

BLUE MOUNTAIN INC. 11023 MASON DIXON HIGHWAY BURTON, WV 26562-9656

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I. Purpose

CNX Gas LLC is proposing to upgrade an existing bridge structure on WV CR 19/11, Mile Post 2.45, to increase the available load carrying capacity of the crossing. The existing bridge, crossing Sheep Run near it's confluence with the South Fork Hughes River, is to be replaced with a pre-cast concrete box culvert having a 95 ton combination load bearing capacity. This report analyzes the anticipated affect the installation of the box culvert will have on the water surface elevations in Sheep Run during the design storm events.

II. Analysis

As stated, the location of the proposed bridge replacement is close to the confluence of Sheep Run and the South Fork Hughes River, close enough that the water surfaces generated in the South Fork Hughes River basin during the design storm events will influence the water surface elevations in Sheep Run at the location of the proposed bridge replacement. Consequently, this report looks at the anticipated water surface elevations in the South Fork Hughes River basin in its entirety, which includes the Sheep Run basin, and then looks at the anticipated water surface elevations in the Sheep Run Basin for the existing and proposed conditions, taking into account the tailwater condition from the South Fork Hughes River that will occur downstream of the bridge location.

III. Watersheds

The contributing watershed for the South Fork Hughes River basin (includes the Sheep Run basin) and the contributing watershed for the Sheep Run basin were estimated from the New Milton, WV and the Oxford, WV USGS 7.5 min Quadrangle Maps.

South Fork Hughes River Watershed = 6,950 ac.

Sheep Run Watershed = 825 ac.

Please see Dwg. No. WS-01, 'Watershed Maps' for the watershed limits.

IV. Runoff Discharge Methods

The West Virginia Department of Transportation-Division of Highways-Engineering Division-Drainage Manual-3rd Edition-December 2007 (WVDOH Drainage Manual) suggests three hydrologic runoff estimation methods: the Rational Method, the TR-55 Method, and the USGS Method. With 6,950 ac. and 825 ac. watersheds for the South Fork Hughes River basin and the Sheep Run basin respectively, the Rational Method, with a 0 to 200 ac. watershed range, was deemed not applicable. For this analysis, the TR-55 Method and the USGS Method were used initially to estimate peak runoff for the design storms.

V. <u>Design Storms</u>

From the WVDOH Drainage Manual, design storms for different facilities are determined based on the estimated Average Daily Traffic Volume (ADT). For WV CR 19/11, no hard traffic data exists, but it is estimated that the ADT is less than 400 vehicles per day. As per

Table 4-2, Design Storm Criteria, for Channels, Culverts, and Bridges the recommended Design Storm is the 10 yr. Frequency (10%) storm.

This report also analyzes the effects of the 100 yr. Frequency (1%) Design Storm.

VI. <u>Hydrologic Soil Groups</u>

From the NRCS Soil Survey of Doddridge County, WV, it appears that the primary soil types in the South Fork Hughes River basin, which includes the Sheep Run Basin, are the Gilpin-Peabody Complex and the Gilpin-Upshur Complex, both belonging to the Hydrologic Soil Group (HSG) C/D. Other soil types occurring in the watershed are the Kanawha Loam Complex, HSG B; Monongahela Silt Loam, HSG C; Sensabaugh Silt Loam, HSG B; and Vandalia Silt Loam, HSG D. The Vandalia Silt Loam is a very small percentage of the total in the watershed and therefore a Hydrologic Soil Group Classification of C was used for the watershed.

VII. Weighted Curve Number, CN

It is estimated that 85% of the watershed is in tree cover and 15% is pasture/meadow. From the WVDOH Drainage Manual, Table 4-9, Runoff Curve Numbers for Rural Areas, for Woods Only in Good Condition & HSG C, the CN is 70; for Meadow with Continuous Grass Cover & HSG C, the CN is 71. The Weighted CN is 70.2. WVDOH Drainage Manual Worksheet 4-1, Runoff Curve Number Determination, is included in the Appendix.

VIII. <u>Time of Concentration</u>

The TR-55 Method was used to calculate the Time of Concentration for both the South Fork Hughes River basin and the Sheep Run Basin. The computer program, Hydraflow Hydrographs v6.0, which uses the TR-55 Method to determine Time of Concentration, was used to perform the calculations for both the South Fork Hughes River Basin and the Sheep Run Basin.

Tc, South Fork Hughes River: 76 min./1.27 hr.

Tc, Sheep Run: 29.3 min./0.49 hr.

The program summary sheet is attached to WVDOH Drainage Manual Worksheet 4-2, Time of Concentration Calculation, and is included in the Appendix.

IX. Peak Discharge

A. South Fork Hughes River

From the WVDOH Drainage Manual, Form 4-1, Peak Discharge Computation Form, the peak discharges for the 10 yr./24 hr. design storm from the TR-55 Method and the USGS Method are 2,825 cfs and 2,006 cfs, respectively. As an additional check, the computer program Hydraflow Hydrographs v6.0 was also used to estimate the peak flow for the SCS Type II 10 yr./24 hr. design storm. From Hydraflow, the estimated peak runoff for the 10 yr./24 hr. storm is 2,988 cfs.

With watershed sizes of 6,950 ac. (10.86 sq. mi.) for the South Fork Hughes River basin and 825 ac. (1.29 sq. mi.) for the Sheep Run basin, and the USGS Method being recommended for watersheds over 10 sq. mi., the USGS Method was disregarded. This leaves the TR-55 Method and the Hydraflow program.

As Hydraflow has the added feature of generating the outflow hydrograph in 1 minute time intervals, and having very similar results to the TR-55 method, it was decided to use the results from Hydraflow, peak flow of 2,988 cfs and to also use Hydraflow to analyze the Sheep Run basin.

WVDOH Drainage Manual Form 4-1 and the Hydraflow output are included in the Appendix.

B. Sheep Run

From Hydraflow, the estimated peak flow for the 10 yr./24 hr. design storm for the Sheep Run basin is 695.5 cfs and occurs at 12.20 hours. However, the peak flow in the South Fork Hughes River occurs at 12.68 hours. From the discharge hydrograph for the South Fork Hughes River, at 12.20 hours the flow is 1,324 cfs. Therefore 1,324 cfs was used to determine the estimated water surface elevations in the South Fork Hughes River at the time of peak flow in the Sheep Run basin.

X. <u>Hydraulic Analysis</u>

A. 10yr/24 hr. Design Storm

The computer program Hec-Ras v4.1.0 was used to estimate the water surface profile in the South Fork Hughes River reach and in the Sheep run reach for the 10 yr./24 hr. design storm, for both the existing and proposed conditions. Typical sections of the existing bridge and the proposed pre-cast concrete box culvert are shown on Dwg. No. XS-01, Typical Cross-Section Existing Bridge' and Dwg. No. XS-02, Typical Cross-Section Precast Concrete Box Culvert'.

The first step was to establish a starting water surface elevation in the South Fork Hughes River reach. With an approximate existing channel slope of 0.5% for the study reach of the South Fork Hughes River, the flow regime is subcritical and therefore the most downstream station, Sta. 0+00, was used as the control section. From the computer program FlowMaster v6.1, with a flow of 1,324 cfs, the water surface elevation is estimated to be El. 832.70 ft. The next step was to plug this information into Hec-Ras to estimate the water surface profile for the South Fork Hughes River for the 10 yr./24 hr. design storm. A subcritical steady flow analysis was performed and the results are shown on Dwg. No. SP-01, 'Site Map-10 yr. Storm-Existing Conditions', and Dwg. No. SP-02, 'Site Map-10 yr. Storm-Proposed Conditions'.

This information was used to establish the tailwater/downstream water surface elevation for the Sheep Run study reach. The estimated water surface elevation at Sta. 2+50 in the South Fork Hughes River is approximately El. 834.40 ft. and was used as the downstream water surface elevation in Sheep Run.

The channel slope for the Sheep Run study reach varies from mild at the downstream end to steep at the upstream end. Therefore a mixed flow regime was run for Sheep Run and a water surface elevation was estimated for Sta. 7+00 using FlowMaster. From FlowMaster, for a design flow of 695.5 cfs, the estimated water surface elevation at Sta. 7+00 is approximately El. 839.09 ft.

These two water surface elevations were used to run a mixed flow regime steady flow analysis with Hec-Ras for the existing and proposed conditions in Sheep Run.

Results of the Hec-Ras run have been plotted in plan view on Dwg. No. SP-01, 'Site Map-10 yr. Storm-Existing Conditions' and Dwg. No. SP-02, 'Site Map-10 yr. Storm-Proposed Conditions'. The water surface profile for existing and proposed conditions for the 10 yr./24 hr. storm has been plotted on Dwg. No. PR-01, 'Water Surface Profiles'.

Summary output information from the Hec-Ras run has been included in the Appendix.

B. 100yr/24 hr. Design Storm

The computer program Hec-Ras v4.1.0 was used to estimate the water surface profile in the South Fork Hughes River reach and in the Sheep run reach for the 100 yr./24 hr. design storm, for both the existing and proposed conditions. Typical sections of the existing bridge and the proposed pre-cast concrete box culvert are shown on Dwg. No. XS-01, Typical Cross-Section Existing Bridge' and Dwg. No. XS-02, Typical Cross-Section Precast Concrete Box Culvert'.

The same procedure used to analyze the 10 yr./24 hr. storm was used to analyze the 100 yr./24 hr. storm. Estimated flow in the South Fork Hughes River basin is 3,710 cfs and in the Sheep Run basin the estimated flow is 1,648 cfs. The estimated water surface elevation at Sta. 0+00 of the South Fork Hughes River is El. 835.21 ft. for a flow of 3,710 cfs. From the Hec-Ras run, the estimated water surface elevation at Sta. 2+50 in the South Fork Hughes River is approximately El. 836.70 ft. and was used as the downstream water surface elevation in Sheep Run. The estimated water surface elevation at Sta. 7+00 of Sheep Run for 1,648 cfs is El. 840.97 ft. Using the water surface elevations at Sta. 2+50 of the South Fork Hughes River as the known downstream elevation and the water surface elevation at Sta. 0+00 of Sheep run as the known upstream elevation, a mixed flow regime steady flow analysis was run for Sheep Run for existing and proposed conditions.

Results of the Hec-Ras run have been plotted in plan view on Dwg. No. SP-03, 'Site Map-100 yr. Storm-Existing Conditions' and Dwg. No. SP-04, 'Site Map-100 yr. Storm-Proposed Conditions'. The water surface profile for existing and proposed conditions for the 100 yr./24 hr. storm has been plotted on Dwg. No. PR-01, 'Water Surface Profiles'.

Summary output information from the Hec-Ras run has been included in the Appendix.

XI. Results

This analysis indicates that for both the 10 yr./24 hr. design storm and the 100 yr./24 hr. design storm, the installation of the pre-cast concrete box in Sheep Run on WV Co. Rd. $19/11 \text{ will } \underline{\text{lower}}$ the expected water surface elevation over existing conditions. The expected drop in the water surface elevation for the 10 yr./24 hr. storm is 0.40 ft. to 0.50 ft. For the 100 yr./24 hr. storm the expected drop is 0.25 ft. to 0.35 ft.

APPENDIX

Worksheet 4-1 Runoff Curve Number Determination

	WORKS	HEET 4-1 RUNOFF CURVE	NUMBE	R DET	ERMIN	ATION		
CALCULATED BY:		DATE: 07-21-14 DATE: 07-21-14	PROJECT STATE PR			Run	Bridg	je Repl
Soil Name	Hydrologie Group	Cover Description percent impervious unconnected/connected impervious ratio	ous area	Table 4-9	Table 4-10 N Sonu	Chart 4-5	Area in mi ²	CN X Area
Gilpin- Peabody	C/D	15% Meadow	7	71			1.63	115.7
Gilpin- Upshur Kanawha	C/D	85% Woods		70	· ·		9.23	546.1
Loam Monongahela Silt Loam	B C							
Sensabaugh Silt Loam	В							
Vanadalia Silt Loam	D.							
		= Total CN X Area / Total A Weighted Curve N laximum Retention, S in	lumber	70 4.	. 2	per line	10.86	761.8
		Return Period in years ainfall Depth, P in inches unoff Depth, Q in inches	3.	5	Stor 100 5.2.2	2.5		
	24 hour Ra Runoff Dep	infall Depth from Table 4-11 th from Table 4-12 or Char	, or Map t 4-8	4-3 thro	ough M	ap 4-8		

Source: Urban Hydrology for Small Watersheds, TR-55, June 1986

Worksheet 4-2 Time of Concentration Calculation

WORKSHEET 4-2 TIME OF CONC	ENTRATION COMPUTATION
CALCULATED BY: BEK DATE: 07-21-14 CHECKED BY: BEK DATE: 07-21-14	PROJECT NAME: Sheep Run Bridge Replacements STATE PROJECT NUMBER:
Space for two sections per flow type ca	an be used for each worksheet.
Include a map, schematic or descr	iption of the flow segements
OVERLAND FLOW SEGMENT, SHEET FLOW TYPE	
Section ID Surface description (Table 4-5) Roughness coeff. n (Table 4-5) Flow length L in ft (should be ≤ 100 ft) 2 Yr 24 Hr rainfall depth P in inches (Map 4-3) Land slope S in ft / ft Computed travel time Tt in hours	* See Attached calculation sheets for Tc for South Fork Hughes River & Sheep Run Watersheds.
OVERLAND FLOW SEGMENT. SHALLOW CONCENTRATED FL Section ID	OW TYPE
Cover type	
Surface cover coefficient in equation	
Watercourse slope S in ft / ft	
Average velocity V in ft / s (Chart 4-7)	
Flow length in ft	
Computed travel time T_t in <u>hours</u>	+ = =
note: overland flow (sheet flow + shallow concent	trated flow should be < 200° urban areas, < 400° rural areas)
CHANNEL FLOW SEGMENT	
Section ID	
Cross sectional flow area A in ft ²	<u> </u>
Wetted flow perimter P in ft	
Hydraulic radius R = A / P in ft	
Channel slope S in ft / ft	
Mannings roughness coeff. n (Table 4-7)	
Velocity from Mannings equation, V in ft / s Flow length L in ft	
Computed travel time T _t in hours	+ = =
Watershed	time of concentration T _c in <u>hours</u>

Source: Urban Hydrology for Small Watersheds, TR-55, June 1986

Hyd. No. 1

So Fork Hughes River Storm frequency = 10 yrs

Sheet Flow

Manning's n-value	= 0.400
Flow length	= 100.0 ft
Two-year 24-hr precip.	= 2.55 in
Land slope	= 25.0 %

Travel Time = 8.8 min

Shallow Concentrated Flow

Flow length	= 300 ft
Watercourse slope	= 28.0 %
Surface description	= Unpaved
Average velocity	= 8.54 ft/s

Travel Time = 0.6 min

Channel Flow

Cross section flow area	= 80.0 sqft
Wetted perimeter	= 24.0 ft
Channel slope	= 0.8 %
Manning's n-value	= 0.035
Velocity	= 8.53 ft/s
Flow length	= 34140.0 ft

Travel Time = 66.7 min

Total Travel Time, Tc = 76.0 min

Hyd. No. 2

Sheep Run Storm frequency = 10 yrs

Sheet Flow

= 0.550Manning's n-value Flow length = 100.0 ftTwo-year 24-hr precip. = 2.55 in Land slope = 18.0 %

Travel Time = 12.9 min

Shallow Concentrated Flow

Flow length = 300 ft
Watercourse slope = 13.0 %
Surface description = Unpaved
Average velocity = 5.82 ft/s
Travel Time Flow length

 $= 0.9 \min$

Channel Flow

Cross section flow area = 18.4 sqftWetted perimeter $= 9.5 \, ft$ Channel slope = 3.6 % Manning's n-value = 0.040 Velocity = 11.01 ft/sFlow length = 10290.0 ft

Travel Time = 15.6 min

Total Travel Time, Tc = 29.3 min

Form 4-1 Peak Discharge Computation Form

PEAK DISCHARGE COMPUTATION FORM DR 4-1							
CALCULATED BY: BEK CHECKED BY: BEK	DATE: 07-21-14 PROJECT NAME: 07-21-14 STATE PROJECT N	Sheep Run Bridge Rep UMBER:	lacement				
LOCATION DESCRIPTION: So. Fork High Drainage area = 6,950 acres 10	ughes River	TO	·				
RATIONAL METHOD N.A.	TR - 55 5 acres - 16,000 acres	USGS METHOD 10 square miles - 1,618 square miles					
TIME OF CONCENTRATION OVERLAND FLOW SHEET FLOW	INFO FROM WORKSHEET 4-1 CN = 70.2 24 hr P = 3.5 in. Runoff Depth Q = 1.0 in.	REGION: FROM MAP 4-9					
$T_{t * h} = $ Min. SHALLOW CONCENTRATED FLOW $T_{t * c} = $ Min.	INFO FROM WORKSHEET 4-2	CENTRAL MOUNTAINS					
CHANNEL FLOW	$T_c = 1.27$ hr. INITIAL ABSTRATION (Table 4-13) $I_a = 0.85$ in.	WESTERN PLATEAUS 🔼					
$T_{t ch} = $ Min. $T_{c} = T_{tsh} + T_{tsc} + T_{tch} = $ Min. Method: Kirpich (rural areas)	UNIT PEAK DISCHARGE Q U	EQUATION: FROM TABLE 4-398					
Segments (urban areas)	USE To AND I a / P WITH CHART 4-8 = 260 cfs / mi ² / in	Eqn: $292A^{0.699}$ = 1,546.8 cfs					
Rainfall Intensity i =in/hr C A CA	POND AND SWAMP AREAS Percent of watershed	PRELIMINARY DESIGN DRAINAGE AREA 5 TO 10 MI ²					
Total	= <u>0</u> % (Table 4-8) Factor F _p = <u>1.0</u>	ADD THE STANDARD PREDICITION ERROR					
Weighted Coefficient "C" = C = Σ (CA) / Σ A	PEAK DISCHARGE $q_p = q_u (A \text{ in mi}^2) Q F_p$	= <u>29.7</u> % = 459.4 cfs					
Q =cfs	q _p = <u>2,825</u> cfs	Q = 2,006 cfs					
		X.A, Peak Discharge ghes River - H & H					

Source: Created by the WVDOH Hydraulic and Drainage Unit

Hyd. No. 1

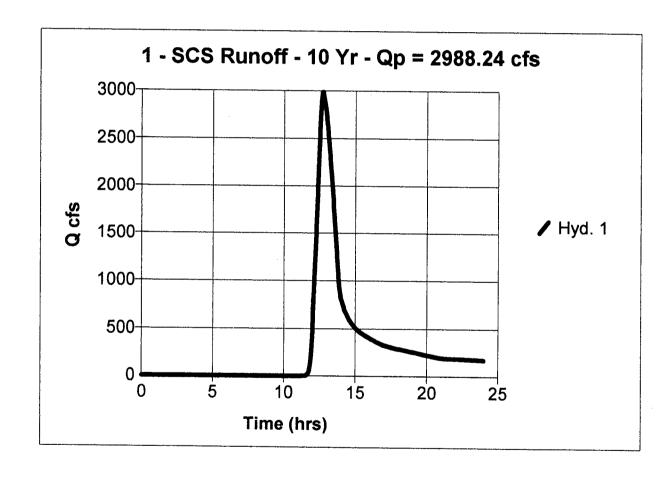
So Fork Hughes River

Hydrograph type = SCS Runoff Storm frequency = 10 yrs Drainage area = 6950.00 ac Basin Slope = 0.0 % Tc method = TR55

Total precip. = 3.50 in Storm duration = 24 hrs Peak discharge = 2988.24 cfs

Time interval = 1 min
Curve number = 70.2
Hydraulic length = 0 ft
Time of conc. (Tc) = 76 min
Distribution = Type II
Shape factor = 484

Total Volume = 25,145,960 cuft



Hyd. No. 1

So Fork Hughes River Storm frequency = 10 yrs

Sheet Flow

Manning's n-value = 0.400Flow length = 100.0 ft Two-year 24-hr precip. = 2.55 in Land slope = 25.0 %

Travel Time = 8.8 min

Shallow Concentrated Flow

Flow length = 300 ft
Watercourse slope = 28.0 %
Surface description = Unpaved
Average velocity = 8.54 ft/s

Travel Time = 0.6 min

Channel Flow

Cross section flow area = 80.0 sqft
Wetted perimeter = 24.0 ft
Channel slope = 0.8 %
Manning's n-value = 0.035
Velocity = 8.53 ft/s
Flow length = 34140.0 ft

Travel Time = 66.7 min

Total Travel Time, Tc = 76.0 min

English

Hyd. No. 1

So Fork Hughes River

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Drainage area = 6950.00 ac
Basin Slope = 0.0 %
Tc method = TR55
Total precip. = 3.50 in
Storm duration = 24 hrs

Peak discharge = 2988.24 cfs
Time interval = 1 min
Curve number = 70.2
Hydraulic length = 0 ft
Time of conc. (Tc) = 76 min
Distribution = Type II

Shape factor

Total Volume = 25,145,960 cuft

= 484

Hydrograph Discharge Table

Time Outflow Time C		Outflow	Outflow Time Outflow		Time Outflow		
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)
		·	•	• -	,	(0.0,
11.70	33.21	12.23	1459.71	12.77	2947.23	13.30	2150.50
11.72	39.29	12.25	1528.49	12.78	2933.92	13.32	2116.90
11.73	46.44	12.27	1597.70	12.80	2919.69	13.33	2082.96
11.75	54.82	12.28	1667.34	12.82	2904.54	13.35	2048.70
11.77	64.64	12.30	1737.32	12.83	2888.49	13.37	2014.10
11.78	76.24	12.32	1807.58	12.85	2871.55	13.38	1979.19
11.80	90.01	12.33	1878.02	12.87	2853.75	13.40	1943.96
11.82	106.38	12.35	1948.54	12.88	2835.10	13.42	1908.42
11.83	125.81	12.37	2019.02	12.90	2815.61	13.43	1872.58
11.85	148.83	12.38	2089.34	12.92	2795.31	13.45	1836.44
11.87	176.03	12.40	2159.35	12.93	2774.21	13.47	1800.01
11.88	208.03	12.42	2228.89	12.95	2752.34	13.48	1763.29
11.90	245.51	12.43	2297.77	12.97	2729.71	13.50	1726.30
11.92	289.18	12.45	2365.80	12.98	2706.33	13.52	1689.05
11.93	337.14	12.47	2432.76	13.00	2682.23	13.53	1651.57
11.95	389.19	12.48	2498.43	13.02	2657.43	13.55	1613.86
11.97	444.46	12.50	2562.53	13.03	2631.96	13.57	1575.96
11.98	502.06	12.52	2624.71	13.05	2605.82	13.58	1537.91
12.00	560.94	12.53	2684.42	13.07	2579.05	13.60	1499.73
12.02	620.60	12.55	2741.05	13.08	2551.67	13.62	1461.48
12.03	681.03	12.57	2793.91	13.10	2523.69	13.63	1423.19
12.05	742.21	12.58	2842.23	13.12	2495.14	13.65	1384.92
12.07	804.12	12.60	2885.19	13.13	2466.06	13.67	1346.73
12.08	866.75	12.62	2921.84	13.15	2436.45	13.68	1308.69
12.10	930.08	12.63	2951.16	13.17	2406.34	13.70	1270.87
12.12	994.10	12.65	2972.07	13.18	2375.76	13.72	1233.34
12.13	1058.77	12.67	2983.41	13.20	2344.74	13.73	1196.20
12.15	1124.10	12.68	2988.24 <<	13.22	2313.30	13.75	1159.54
12.17	1190.05	12.70	2986.84	13.23	2281.46	13.77	1123.49
12.18	1256.60	12.72	2980.60	13.25	2249.25	13.78	1088.27
12.20	1323.74	12.73	2970.97	13.27	2216.68	13.80	1054.09
12.22	1391.45	12.75	2959.58	13.28	2183.77	13.82	1021.23

	Outflow		Outflow		Outflow	Time	Outflow
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)
13.83	989.96	14.65	571.79	15.47	449.64	16.28	377.70
13.85	960.60	14.67	568.01	15.48	447.99	16.30	376.30
13.87	933.50	14.68	564.30	15.50	446.35	16.32	374.91
13.88	909.04	14.70	560.66	15.52	444.73	16.33	373.52
13.90	887.64	14.72	557.10	15.53	443.12	16.35	372.14
13.92	869.72	14.73	553.61	15.55	441.53	16.37	370.76
13.93	854.14	14.75	550.19	15.57	439.96	16.38	369.40
13.95	840.79	14.77	546.84	15.58	438.39	16.40	368.03
13.97	829.15	14.78	543.56	15.60	436.84	16.42	366.68
13.98	818.69	14.80	540.36	15.62	435.31	16.43	365.33
14.00	808.78	14.82	537.21	15.63	433.78	16.45	364.00
14.02	799.14	14.83	534.14	15.65	432.26	16.47	362.67
14.03	789.75	14.85	531.12	15.67	430.76	16.48	361.35
14.05	780.61	14.87	528.17	15.68	429.26	16.50	360.04
14.07	771.72	14.88	525.27	15.70	427.78	16.52	358.74
14.08	763.07	14.90	522.43	15.72	426.30	16.53	357.45
14.10	754.66	14.92	519.65	15.73	424.83	16.55	356.18
14.12	746.49	14.93	516.91	15.75	423.37	16.57	354.91
14.13	738.54	14.95	514.23	15.77	421.91	16.58	353.66
14.15	730.81	14.97	511.60	15.78	420.46	16.60	352.41
14.17	723.30	14.98	509.01	15.80	419.02	16.62	351.19
14.18	716.00	15.00	506.47	15.82	417.58	16.63	349.97
14.20	708.91	15.02	503.97	15.83	416.15	16.65	348.77
14.22	702.02	15.03	501.52	15.85	414.71	16.67	347.58
14.23	695.33	15.05	499.11	15.87	413.29	16.68	346.40
14.25 14.27	688.83	15.07	496.73	15.88	411.86	16.70	345.24
14.28	682.50 676.36	15.08 15.10	494.40	15.90	410.44	16.72	344.10
14.20	676.36	15.10 15.10	492.11	15.92	409.02	16.73	342.97
14.32	670.38	15.12 45.42	489.85	15.93	407.60	16.75	341.85
14.32	664.57 658.91	15.13 15.15	487.63	15.95	406.17	16.77	340.76
14.35	653.40	15.15 15.17	485.45	15.97	404.75	16.78	339.67
14.33	648.03	15.17 15.19	483.30	15.98	403.33	16.80	338.61
14.38	642.79	15.18 15.20	481.19	16.00	401.90	16.82	337.56
14.40	637.67	15.20	479.11 477.06	16.02	400.48	16.83	336.52
14.42	632.68	15.22	477.05 475.05	16.03	399.05	16.85	335.50
14.43	627.79	15.25	473.05 473.06	16.05	397.62	16.87	334.49
14.45	623.00	15.27	471.11	16.07 16.08	396.19	16.88	333.50
14.47	618.31	15.28	469.18	16.10	394.76 393.33	16.90	332.53
14.48	613.71	15.30	467.29	16.12	393.33	16.92	331.56
14.50	609.18	15.32	465.41	16.13	391.90	16.93	330.61
14.52	604.73	15.33	463.57			16.95	329.68
14.53	600.36	15.35	463.57	16.15 16.17	389.04 387.61	16.97	328.76
14.55	596.05	15.37	451.75 459.96	16.17 16.19	387.61	16.98	327.85
14.57	591.82	15.38	459.96 458.18	16.18 16.20	386.19	17.00	326.95
14.58	587.67	15.36	456.43	16.20 16.22	384.76	17.02	326.07
14.60	583.59	15.42		16.22 16.23	383.34	17.03	325.20
14.62	579.58	15.42	454.71 453.00	16.23 16.25	381.93	17.05	324.34
14.63	575.65	15.45	453.00 451.31	16.25	380.52	17.07	323.50
17.00	J7 J.05	10.40	451.31	16.27	379.11	17.08	322.66

Time	Outflow	Time	Outflow	Time	Outflow	Time	Outflow
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)
	-	•	,	•	,	(0.0,
17.10	321.84	17.92	291.35	18.73	265.49	19.55	238.56
17.12	321.03	17.93	290.83	18.75	264.95	19.57	238.00
17.13	320.23	17.95	290.31	18.77	264.41	19.58	237.44
17.15	319.44	17.97	289.79	18.78	263.87	19.60	236.88
17.17	318.66	17.98	289.28	18.80	263.33	19.62	236.32
17.18	317.90	18.00	288.76	18.82	262.78	19.63	235.76
17.20	317.14	18.02	288.24	18.83	262.24	19.65	235.20
17.22	316.40	18.03	287.72	18.85	261.70	19.67	234.64
17.23	315.66	18.05	287.20	18.87	261.16	19.68	234.08
17.25	314.93	18.07	286.68	18.88	260.62	19.70	233.52
17.27	314.22	18.08	286.16	18.90	260.07	19.72	232.95
17.28	313.51	18.10	285.64	18.92	259.53	19.73	232.39
17.30	312.81	18.12	285.12	18.93	258.98	19.75	231.83
17.32	312.12	18.13	284.60	18.95	258.44	19.77	231.26
17.33	311.44	18.15	284.07	18.97	257.89	19.78	230.70
17.35	310.77	18.17	283.55	18.98	257.35	19.80	230.13
17.37	310.11	18.18	283.03	19.00	256.80	19.82	229.57
17.38	309.45	18.20	282.50	19.02	256.26	19.83	229.00
17.40	308.80	18.22	281.98	19.03	255.71	19.85	228.44
17.42	308.16	18.23	281.45	19.05	255.16	19.87	227.87
17.43	307.53	18.25	280.93	19.07	254.62	19.88	227.30
17.45	306.90	18.27	280.40	19.08	254.07	19.90	226.74
17.47	306.28	18.28	279.88	19.10	253.52	19.92	226.17
17.48	305.67	18.30	279.35	19.12	252.97	19.93	225.60
17.50	305.06	18.32	278.82	19.13	252.42	19.95	225.04
17.52	304.46	18.33	278.29	19.15	251.87	19.97	224.47
17.53	303.87	18.35	277.76	19.17	251.32	19.98	223.90
17.55	303.28	18.37	277.24	19.18	250.77	20.00	223.33
17.57 17.58	302.70	18.38	276.71	19.20	250.22	20.02	222.76
17.60	302.12 301.55	18.40	276.18	19.22	249.67	20.03	222.19
17.62	301.55 300.98	18.42	275.65	19.23	249.12	20.05	221.62
17.63	300.42	18.43	275.12	19.25	248.57	20.07	221.05
17.65	299.86	18.45 18.47	274.58 274.05	19.27	248.01	20.08	220.49
17.67	299.31	18.48	274.05 273.52	19.28	247.46	20.10	219.92
17.68	298.76	18.50	273.52	19.30	246.91	20.12	219.35
17.70	298.21	18.52	272.99 272.46	19.32	246.35	20.13	218.79
17.72	297.67	18.53	272. 4 0 271.92	19.33	245.80	20.15	218.22
17.73	297.13	18.55	271.32	19.35	245.25	20.17	217.66
17.75	296.59	18.57	271.39	19.37 19.38	244.69	20.18	217.10
17.77	296.06	18.58	270.83		244.14	20.20	216.54
17.78	295.53	18.60	269.78	19.40	243.58	20.22	215.98
17.80	295.00	18.62	269.75	19.42	243.02	20.23	215.42
17.82	294.47	18.63	269.25 268.71	19.43 19.45	242.47	20.25	214.87
17.83	293.95	18.65	268.18	19.45 19.47	241.91 241.35	20.27	214.32
17.85	293.43	18.67	267.64	19.47	241.35 240.80	20.28	213.77
17.87	292.90	18.68	267.04	19.40		20.30	213.23
17.88	292.38	18.70	266.56	19.50	240.24	20.32	212.68
17.90	291.87	18.70	266.02		239.68	20.33	212.14
,,,,,,	201.07	10.72	200.02	19.53	239.12	20.35	211.61

Time	Outflow	Time (Outflow	Time -	- Outflow	Time	Outflow
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)
	•	•	·	`	,	(,
20.37	211.08	21.18	192.41	22.00	185.59	22.82	180.69
20.38	210.55	21.20	192.18	22.02	185.49	22.83	180.59
20.40	210.03	21.22	191.97	22.03	185.39	22.85	180.49
20.42	209.51	21.23	191.76	22.05	185.29	22.87	180.39
20.43	208.99	21.25	191.55	22.07	185.19	22.88	180.29
20.45	208.48	21.27	191.35	22.08	185.09	22.90	180.18
20.47	207.97	21.28	191.16	22.10	184.99	22.92	180.08
20.48	207.47	21.30	190.96	22.12	184.90	22.93	179.98
20.50	206.97	21.32	190.78	22.13	184.80	22.95	179.88
20.52	206.48	21.33	190.59	22.15	184.70	22.97	179.78
20.53	206.00	21.35	190.42	22.17	184.60	22.98	179.67
20.55	205.52	21.37	190.24	22.18	184.50	23.00	179.57
20.57	205.04	21.38	190.07	22.20	184.40	23.02	179.47
20.58	204.58	21.40	189.90	22.22	184.30	23.03	179.37
20.60	204.11	21.42	189.74	22.23	184.20	23.05	179.27
20.62	203.66	21.43	189.58	22.25	184.10	23.07	179.16
20.63	203.21	21.45	189.43	22.27	184.00	23.08	179.06
20.65	202.77	21.47	189.27	22.28	183.90	23.10	178.96
20.67	202.33	21.48	189.12	22.30	183.80	23.12	178.86
20.68	201.90	21.50	188.98	22.32	183.70	23.13	178.76
20.70	201.48	21.52	188.84	22.33	183.61	23.15	178.65
20.72	201.07	21.53	188.70	22.35	183.51	23.17	178.55
20.73	200.66	21.55	188.56	22.37	183.41	23.18	178.45
20.75	200.27	21.57	188.43	22.38	183.31	23.20	178.35
20.77	199.88	21.58	188.30	22.40	183.21	23.22	178.24
20.78 20.80	199.50	21.60	188.17	22.42	183.11	23.23	178.14
20.80	199.12 198.76	21.62	188.04	22.43	183.01	23.25	178.04
20.83		21.63	187.92	22.45	182.91	23.27	177.93
20.85	198.40	21.65	187.80	22.47	182.81	23.28	177.83
20.83	198.04 197.70	21.67	187.68	22.48	182.71	23.30	177.73
20.88	197.76	21.68 21.70	187.56 187.45	22.50	182.61	23.32	177.63
20.90	197.03	21.70	187.45 187.33	22.52	182.51	23.33	177.52
20.92	196.71	21.72	187.22	22.53 22.55	182.41 182.30	23.35	177.42
20.93	196.39	21.75	187.11	22.57	182.20	23.37	177.32
20.95	196.08	21.77	187.00	22.58	182.10	23.38 23.40	177.21
20.97	195.78	21.78	186.90	22.60	182.00	23.40 23.42	177.11
20.98	195.49	21.80	186.79	22.62	181.90	23.43	177.01 176.90
21.00	195.20	21.82	186.69	22.63	181.80	23.45	176.80
21.02	194.91	21.83	186.58	22.65	181.70	23.47	176.70
21.03	194.64	21.85	186.48	22.67	181.60	23.48	176.70
21.05	194.36	21.87	186.38	22.68	181.50	23.50	176.39
21.07	194.10	21.88	186.28	22.70	181.40	23.52	176.49
21.08	193.84	21.90	186.18	22.72	181.30	23.53	176.28
21.10	193.59	21.92	186.08	22.73	181.20	23.55	176.28
21.12	193.34	21.93	185.98	22.75	181.10	23.57	176.08
21.13	193.10	21.95	185.88	22.77	180.99	23.58	175.97
21.15	192.86	21.97	185.78	22.78	180.89	23.60	175.87
21.17	192.63	21.98	185.68	22.80	180.79	23.62	175.76
						20.02	5.7 5

Time Outflow	
(hrs	cfs)
23.63 23.65 23.67 23.68 23.70 23.72 23.73 23.75 23.77 23.78 23.80 23.82 23.83 23.85 23.87 23.88 23.90 23.92 23.93 23.95 23.97 23.98	175.66 175.56 175.45 175.35 175.24 175.14 175.03 174.93 174.83 174.72 174.62 174.51 174.41 174.30 174.20 174.09 173.99 173.88 173.78 173.67 173.57 173.46

...End

Hydrograph Plot

English

Hyd. No. 2

Sheep Run

Hydrograph type = SCS Runoff

Storm frequency = 10 yrs Drainage area = 825.00 ac

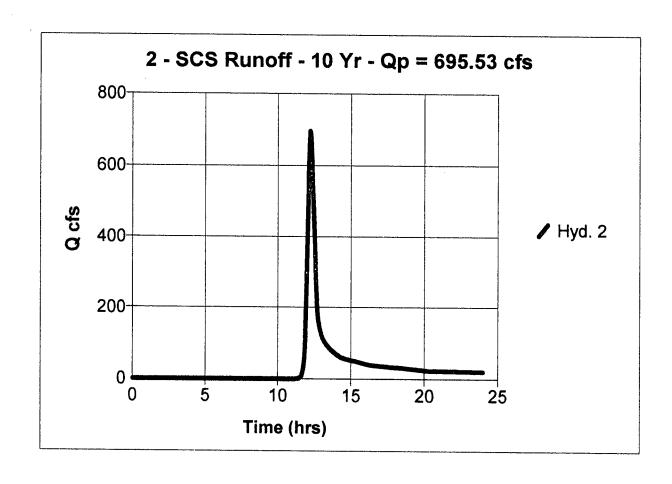
Basin Slope = 0.0 % Tc method = TR55 Total precip. = 3.50 in

Storm duration = 24 hrs

Peak discharge = 695.53 cfs
Time interval = 1 min
Curve number = 70.2
Hydraulic length = 0 ft

Time of conc. (Tc) = 29.3 min
Distribution = Type II
Shape factor = 484

Total Volume = 3,025,497 cuft



Hyd. No. 2

Sheep Run Storm frequency = 10 yrs

Sheet Flow

Manning's n-value = 0.550 Flow length = 100.0 ft Two-year 24-hr precip. = 2.55 in Land slope = 18.0 %

Land slope = 18.0 %

Travel Time = 12.9 min

Shallow Concentrated Flow

Flow length = 300 ft
Watercourse slope = 13.0 %
Surface description = Unpaved
Average velocity = 5.82 ft/s

Travel Time = 0.9 min

Channel Flow

Cross section flow area = 18.4 sqft
Wetted perimeter = 9.5 ft
Channel slope = 3.6 %
Manning's n-value = 0.040
Velocity = 11.01 ft/s
Flow length = 10290.0 ft

Travel Time = 15.6 min

Total Travel Time, Tc = 29.3 min

English

Hyd. No. 2

Sheep Run

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Drainage area = 825.00 ac
Basin Slope = 0.0 %
Tc method = TR55
Total precip. = 3.50 in
Storm duration = 24 hrs

Peak discharge = 695.53 cfs
Time interval = 1 min
Curve number = 70.2
Hydraulic length = 0 ft
Time of conc. (Tc) = 29.3 min
Distribution = Type II

Shape factor

Total Volume = 3,025,497 cuft

= 484

Hydrograph Discharge Table

(hrs cfs) (hrs cfs) (hrs cfs) 11.58 7.41 12.12 613.21 12.65 226.10 13.18 104.23 11.60 8.56 12.13 638.56 12.67 210.80 13.20 103.08 11.62 9.93 12.15 660.21 12.68 197.30 13.22 101.98 11.63 11.59 12.17 677.43 12.70 185.92 13.23 100.91 11.65 13.58 12.18 689.48 12.72 176.98 13.25 99.88 11.67 15.97 12.20 695.53 < 12.73 169.66 13.27 98.88 11.68 18.82 12.22 694.72 12.75 163.90 13.28 97.91 11.70 22.23 12.23 689.33 12.77 159.32 13.30 96.96 11.72 26.28 12.25 679.54 12.78 155.53 13.32 96.03 11.75 3	Time Outflow		Time	Outflow	Time Outflow		Time Outflow	
11.58 7.41 12.12 613.21 12.65 226.10 13.18 104.23 11.60 8.56 12.13 638.56 12.67 210.80 13.20 103.08 11.62 9.93 12.15 660.21 12.68 197.30 13.22 101.98 11.63 11.59 12.17 677.43 12.70 185.92 13.23 100.91 11.65 13.58 12.18 689.48 12.72 176.98 13.25 99.88 11.67 15.97 12.20 695.53 << 12.73 169.66 13.27 98.88 11.68 18.82 12.22 694.72 12.75 163.90 13.28 97.91 11.70 22.23 12.23 689.33 12.77 159.32 13.30 96.96 11.72 26.28 12.25 679.54 12.78 155.53 13.32 96.03 11.75 36.70 12.28 650.93 12.82 148.82 13.35 94.24	(hrs	cfs)	(hrs	cfs)				
11.60 8.56 12.13 638.56 12.67 210.80 13.20 103.08 11.62 9.93 12.15 660.21 12.68 197.30 13.22 101.98 11.63 11.59 12.17 677.43 12.70 185.92 13.23 100.91 11.65 13.58 12.18 689.48 12.72 176.98 13.25 99.88 11.67 15.97 12.20 695.53 <<					•	•	•	,
11.60 8.56 12.13 638.56 12.67 210.80 13.20 103.08 11.62 9.93 12.15 660.21 12.68 197.30 13.22 101.98 11.63 11.59 12.17 677.43 12.70 185.92 13.23 100.91 11.65 13.58 12.18 689.48 12.72 176.98 13.25 99.88 11.67 15.97 12.20 695.53 <					12.65	226.10	13.18	104.23
11.62 9.93 12.15 660.21 12.68 197.30 13.22 101.98 11.63 11.59 12.17 677.43 12.70 185.92 13.23 100.91 11.65 13.58 12.18 689.48 12.72 176.98 13.25 99.88 11.67 15.97 12.20 695.53 <					12.67	210.80	13.20	
11.63 11.59 12.17 677.43 12.70 185.92 13.23 100.91 11.65 13.58 12.18 689.48 12.72 176.98 13.25 99.88 11.67 15.97 12.20 695.53 <				660.21	12.68	197.30		
11.65 13.58 12.18 689.48 12.72 176.98 13.25 99.88 11.67 15.97 12.20 695.53 <				677.43	12.70	185.92		
11.67 15.97 12.20 695.53 <				689.48	12.72	176.98		
11.68 18.82 12.22 694.72 12.75 163.90 13.28 97.91 11.70 22.23 12.23 689.33 12.77 159.32 13.30 96.96 11.72 26.28 12.25 679.54 12.78 155.53 13.32 96.03 11.73 31.07 12.27 666.38 12.80 152.11 13.33 95.12 11.75 36.70 12.28 650.93 12.82 148.82 13.35 94.24				695.53 <<	12.73	169.66		
11.70 22.23 12.23 689.33 12.77 159.32 13.30 96.96 11.72 26.28 12.25 679.54 12.78 155.53 13.32 96.03 11.73 31.07 12.27 666.38 12.80 152.11 13.33 95.12 11.75 36.70 12.28 650.93 12.82 148.82 13.35 94.24					12.75	163.90		
11.72 26.28 12.25 679.54 12.78 155.53 13.32 96.03 11.73 31.07 12.27 666.38 12.80 152.11 13.33 95.12 11.75 36.70 12.28 650.93 12.82 148.82 13.35 94.24					12.77	159.32		
11.73 31.07 12.27 666.38 12.80 152.11 13.33 95.12 11.75 36.70 12.28 650.93 12.82 148.82 13.35 94.24				679.54	12.78	155.53		
11.75 36.70 12.28 650.93 12.82 148.82 13.35 94.24					12.80	152.11		
					12.82	148.82		
12.00	11.77	43.33	12.30	634.38	12.83	145.68	13.37	93.36
11.78 51.22 12.32 617.34 12.85 142.67 13.38 92.51						142.67	13.38	
11.80 60.63 12.33 599.82 12.87 139.79 13.40 91.67							13.40	
11.82 71.83 12.35 581.82 12.88 137.04 13.42 90.85							13.42	90.85
11.83 85.17 12.37 563.37 12.90 134.41 13.43 90.05							13.43	90.05
11.85 101.00 12.38 544.50 12.92 131.90 13.45 89.26							13.45	89.26
11.87 119.70 12.40 525.23 12.93 129.50 13.47 88.48							13.47	88.48
11.88 141.70 12.42 505.59 12.95 127.21 13.48 87.72							13.48	87.72
11.90 167.42 12.43 485.62 12.97 125.03 13.50 86.97							13.50	86.97
11.92 197.32 12.45 465.36 12.98 122.94 13.52 86.24							13.52	86.24
11.93 229.91 12.47 444.86 13.00 120.95 13.53 85.51							13.53	85.51
11.95 264.96 12.48 424.15 13.02 119.06 13.55 84.79							13.55	84.79
11.97 301.70 12.50 403.31 13.03 117.24 13.57 84.09							13.57	84.09
11.98 339.36 12.52 382.38 13.05 115.51 13.58 83.40							13.58	83.40
12.00 377.03 12.53 361.46 13.07 113.87 13.60 82.72								82.72
12.02 414.20 12.55 340.61 13.08 112.29 13.62 82.05								82.05
12.03 450.69 12.57 319.96 13.10 110.79 13.63 81.39							13.63	81.39
12.05 486.33 12.58 299.67 13.12 109.36 13.65 80.73								80.73
12.07 520.83 12.60 279.92 13.13 107.99 13.67 80.09								80.09
12.08 553.80 12.62 260.92 13.15 106.68 13.68 79.46								79.46
12.10 584.76 12.63 242.90 13.17 105.43 13.70 78.84	12.10	584./6	12.63	242.90	13.17	105.43	13.70	78.84

(hrs cfs) (hrs cfs) (hrs cfs) (hrs cfs) (hrs cfs) (hrs cfs) 13.72	Time	Outflow	Time	Outflow	Time	Outflow	Time	Outflow
13.72 78.22 14.53 56.97 15.35 48.79 16.17 40.32 13.73 77.61 14.55 56.76 15.37 48.62 16.18 40.15 13.75 77.02 14.57 56.56 15.38 48.45 16.20 39.99 13.77 76.42 14.58 56.37 15.40 48.28 16.22 39.84 13.78 75.84 14.60 56.18 15.42 48.11 16.23 39.69 13.80 75.26 14.62 56.00 15.43 47.94 16.25 39.54 13.82 74.69 14.63 55.82 15.45 47.78 16.27 39.40 13.83 74.13 14.65 55.64 15.47 47.61 16.28 39.26 13.85 73.57 14.67 55.47 15.48 47.44 16.30 39.12 13.87 73.02 14.68 55.31 15.50 47.27 16.32 38.99 13.88 72.48 14.70 55.14 15.52 47.09 16.33 38.87 13.90 71.94 14.72 54.98 15.53 46.92 16.35 38.75 13.92 71.40 14.73 54.82 15.55 46.75 16.37 38.63 13.97 70.87 14.77 54.80 15.59 46.41 16.40 38.42 13.97 69.83 14.78 54.38 15.50 46.24 16.42 38.31 13.98 69.31 14.80 54.18 15.60 46.24 16.42 38.31 14.00 68.80 14.82 54.02 15.63 46.91 16.43 38.22 14.00 68.80 14.82 54.02 15.63 46.91 16.43 38.21 14.00 68.80 14.82 54.02 15.63 46.94 16.45 38.12 14.00 68.29 14.88 53.70 15.67 45.55 16.83 38.12 14.00 68.29 14.88 53.70 15.67 45.55 16.83 38.12 14.00 68.29 14.88 53.30 15.70 45.55 16.83 38.12 14.00 68.29 14.88 53.30 15.70 45.50 16.53 37.69 14.01 66.31 14.80 54.18 15.62 46.07 16.43 38.22 14.00 68.29 14.88 53.70 15.67 45.55 16.87 38.03 14.78 65.35 16.55 16.85 37.77 14.00 66.79 14.85 53.70 15.67 45.55 16.87 38.03 14.00 68.80 14.82 54.02 15.63 46.94 16.42 38.31 14.00 68.29 14.88 53.39 15.70 45.50 16.53 37.69 14.15 63.35 14.00 68.30 14.82 53.00 15.75 44.68 16.55 37.77 14.00 66.31 14.90 53.22 15.72 45.03 16.53 37.69 14.15 63.35 14.93 52.90 15.75 44.88 16.57 37.54 14.15 64.43 14.97 52.58 15.80 44.16 16.60 37.33 14.18 63.55 14.93 52.90 15.75 44.55 16.58 16.59 37.75 14.15 64.89 14.99 14.99 52.58 15.79 42.40 16.78 37.33 14.20 63.11 14.90 53.22 15.72 45.03 16.53 37.69 14.22 62.70 15.03 51.93 14.99 62.42 15.80 44.16 16.60 37.33 14.20 63.12 15.00 52.26 15.82 43.98 16.63 37.94 14.25 64.90 14.87 53.50 54.40 16.80 36.65 37.79 14.25 64.90 14.90	(hrs	cfs)						
13.73	•	,	(0.07	(1113	Cisj	(1115	CIS)
13.73	13.72	78.22	14.53	56 97	15.35	18 70	16 17	40.22
13.75 77.02 14.57 56.56 15.38 48.45 16.20 39.99 13.77 76.42 14.58 56.37 15.40 48.28 16.22 39.84 13.78 75.84 14.60 56.18 15.42 48.11 16.23 39.69 13.80 75.26 14.62 56.00 15.43 47.94 16.25 39.54 13.82 74.69 14.63 55.82 15.45 47.78 16.27 39.40 13.83 74.13 14.65 55.64 15.47 47.61 16.28 39.26 13.85 73.57 14.67 55.47 15.48 47.44 16.30 39.12 13.87 73.02 14.68 55.31 15.50 47.27 16.32 38.99 13.88 72.48 14.70 55.14 15.52 47.09 16.33 38.87 13.90 71.94 14.72 54.98 15.53 46.92 16.35 38.75 13.92 71.40 14.73 54.82 15.55 46.75 16.37 38.63 13.93 70.87 14.75 54.66 15.57 46.58 16.38 38.52 13.95 70.35 14.77 54.50 15.58 46.41 16.40 38.42 13.97 69.83 14.78 54.34 15.60 46.24 16.42 38.31 13.98 69.31 14.80 54.18 15.62 46.07 16.43 38.22 14.00 68.80 14.82 54.02 15.63 45.89 16.45 38.12 14.00 68.80 14.82 54.02 15.63 45.89 16.45 38.12 14.00 68.80 14.82 54.02 15.63 45.89 16.45 38.12 14.00 68.80 14.82 54.02 15.63 45.89 16.45 38.12 14.00 68.80 14.82 54.02 15.63 45.89 16.45 38.12 14.00 68.80 14.82 54.02 15.63 45.89 16.45 38.12 14.00 68.80 14.82 54.02 15.63 45.89 16.45 38.12 14.00 68.80 14.82 54.02 15.63 45.89 16.45 38.12 14.00 68.80 14.82 54.02 15.63 45.89 16.45 38.12 14.00 68.80 14.82 54.02 15.63 45.89 16.45 38.12 14.01 66.79 14.85 53.70 15.67 45.55 16.47 38.03 14.03 67.79 14.85 53.70 15.67 45.55 16.47 38.03 14.03 67.79 14.85 53.70 15.67 45.55 16.47 38.03 14.10 66.90 14.89 53.29 15.70 45.00 16.52 37.77 14.08 66.31 14.90 53.22 15.72 45.03 16.53 37.69 14.10 65.83 14.92 53.06 15.73 44.66 16.55 37.61 14.11 63.99 14.95 52.24 15.80 44.16 16.62 37.33 14.11 63.99 14.95 52.42 15.80 44.16 16.62 37.33 14.13 64.89 14.95 52.52 15.72 45.03 16.63 37.94 14.14 63.99 14.95 52.68 15.89 15.70 42.20 16.52 37.77 14.08 66.31 14.90 53.22 15.70 45.03 16.63 37.94 14.17 63.99 14.95 52.00 52.09 15.75 44.68 16.59 37.69 14.10 65.83 14.92 53.06 15.73 44.86 16.56 37.07 14.25 61.90 15.07 51.61 15.88 43.28 16.63 37.07 14.26 64.93 14.95 52.52 15.98 51.79 52.20 16.52 37.77 14.27 61.52 15.08 51.44 15.90 43.11 16.72 36.94 14.33 60.11 15.15 50.79 15.97 42.40 16.82 36.65 14.33 60.11								
13.77 76.42 14.58 55.37 15.40 48.28 16.22 39.84 13.78 75.84 14.60 56.18 15.42 48.11 16.23 39.69 13.80 75.26 14.62 56.00 15.43 47.94 16.25 39.54 13.80 74.19 14.63 55.82 15.45 47.78 16.27 39.40 13.83 74.13 14.65 55.82 15.45 47.76 16.28 39.26 13.85 73.57 14.67 55.47 15.48 47.44 16.30 39.12 13.87 73.02 14.68 55.31 15.50 47.27 16.32 38.99 12.387 73.02 14.68 55.31 15.50 47.27 16.32 38.99 12.388 72.48 14.70 55.14 15.52 47.09 16.33 38.87 13.90 71.94 14.72 54.98 15.53 46.92 16.35 38.75 13.93 71.40 14.73 54.82 15.55 46.75 16.37 38.63 13.93 70.87 14.75 54.66 15.57 46.58 16.38 38.52 13.95 70.35 14.77 54.50 15.58 46.41 16.40 38.42 13.97 69.83 14.78 54.34 15.60 46.24 16.42 38.31 13.99 69.31 14.80 54.18 15.62 46.07 16.43 38.22 14.00 68.80 14.82 54.02 15.63 45.89 16.45 38.12 14.00 68.80 14.82 54.02 15.63 45.89 16.45 38.12 14.00 68.80 14.82 54.02 15.63 45.89 16.45 38.12 14.00 66.39 14.88 53.39 15.70 45.20 16.52 37.77 14.08 66.31 14.90 53.22 15.55 15.68 45.38 16.50 37.85 14.07 66.79 14.85 53.70 15.67 45.55 16.48 37.94 14.05 66.39 14.89 53.22 15.72 45.03 16.53 37.69 14.10 66.31 14.90 53.22 15.72 45.03 16.53 37.69 14.10 66.31 14.90 53.22 15.72 45.03 16.55 37.69 14.13 64.89 14.95 52.74 15.77 44.51 16.58 37.77 14.08 66.31 14.90 53.22 15.72 45.03 16.53 37.69 14.13 64.89 14.95 52.74 15.77 44.51 16.58 37.77 14.08 66.31 14.90 53.22 15.72 45.03 16.53 37.69 14.13 64.89 14.95 52.74 15.77 44.51 16.58 37.70 14.26 63.35 14.93 52.90 15.75 44.68 16.57 37.54 14.13 64.49 14.95 52.20 15.63 43.89 16.63 37.36 14.12 65.35 14.09 52.20 15.03 51.89 14.99 52.20 15.05 51.77 15.80 43.81 16.60 37.39 14.15 63.99 14.98 52.42 15.80 44.16 16.62 37.33 14.17 63.99 14.98 52.42 15.80 44.16 16.62 37.33 14.17 63.99 14.98 52.42 15.80 44.16 16.62 37.33 14.18 63.55 15.00 52.26 15.80 44.18 15.92 42.93 16.63 37.26 14.20 63.12 15.02 52.09 15.83 43.81 16.65 37.19 14.22 62.70 15.03 51.93 15.85 43.89 16.63 37.26 14.20 63.12 15.02 52.09 15.83 43.81 16.60 37.39 14.17 63.99 14.98 52.42 15.80 44.18 15.90 43.11 16.72 36.94 14.33 60.11 15.15 50.79 15.97 15.97 42.40 16.68 36.67 14.3	13.75	77.02						
13.76 75.84 14.60 56.18 15.42 48.11 16.23 39.69 13.80 75.26 14.62 56.00 15.43 47.94 16.25 39.54 13.82 74.69 14.63 55.82 15.45 47.78 16.27 39.40 13.83 74.13 14.65 55.64 15.47 47.61 16.28 39.26 13.85 73.57 14.67 55.64 15.47 47.61 16.28 39.26 13.85 73.57 14.67 55.64 15.47 47.61 16.28 39.26 13.85 73.57 14.67 55.64 15.47 47.61 16.28 39.26 13.85 73.57 14.67 55.47 15.48 47.44 16.30 39.12 13.87 73.02 14.88 55.31 15.50 47.27 16.32 38.99 13.88 72.48 14.70 55.14 15.52 47.09 16.33 38.87 13.90 77.94 14.72 54.98 15.53 46.92 16.35 38.75 13.90 77.94 14.73 54.82 15.55 46.75 16.37 38.63 13.99 70.87 14.75 54.66 15.57 46.58 16.38 38.52 13.95 70.35 14.77 54.50 15.58 46.41 16.40 38.42 13.97 69.83 14.78 54.34 15.60 46.24 16.42 38.31 13.98 69.31 14.80 54.18 15.62 46.07 16.43 38.22 14.00 68.80 14.82 54.02 15.63 45.89 16.45 38.12 14.00 68.80 14.82 54.02 15.63 45.89 16.45 38.12 14.00 68.80 14.82 54.02 15.63 45.89 16.45 38.12 14.00 68.80 14.82 54.02 15.63 45.89 16.45 38.12 14.00 66.31 14.80 54.18 15.62 46.07 16.43 38.22 14.00 66.80 14.82 53.00 15.67 45.55 16.48 37.94 14.05 67.29 14.87 53.55 15.68 45.38 16.50 37.85 14.07 66.79 14.85 53.70 15.67 45.55 16.48 37.94 14.05 67.29 14.87 53.55 15.68 45.38 16.50 37.85 14.07 66.99 14.88 53.39 15.70 45.20 16.52 37.77 14.08 66.31 14.90 53.22 15.72 45.03 16.53 37.69 14.10 66.83 14.92 53.06 15.75 44.68 16.57 37.54 14.10 66.89 14.95 52.74 15.77 44.51 16.62 37.33 14.17 63.99 14.88 53.39 15.70 57.74 44.68 16.57 37.54 14.18 63.55 15.00 52.20 15.75 44.68 16.57 37.54 14.18 63.55 15.00 52.20 15.75 44.68 16.67 37.13 14.18 63.55 15.00 52.20 15.75 44.68 16.67 37.13 14.18 63.55 15.00 52.20 15.75 44.68 16.67 37.13 14.20 62.29 15.05 51.77 15.87 43.48 16.60 37.39 14.12 63.55 15.00 52.20 15.75 44.68 16.67 37.33 14.17 63.99 14.98 52.42 15.80 44.16 16.60 37.33 14.17 63.99 14.98 52.42 15.80 44.18 16.66 37.19 14.22 62.70 15.03 51.93 15.85 43.81 16.63 37.00 14.27 61.52 15.08 51.44 15.90 43.11 16.72 36.94 14.20 63.12 15.02 50.09 15.75 44.68 16.65 37.19 14.22 62.70 15.03 51.93 15.85 43.84 16.63 37.07 14.25 61.90 15.77 50.66	13.77	76.42						
13.80 75.26 14.62 56.00 15.43 47.94 16.25 39.54 13.82 74.69 14.63 55.82 15.45 47.78 16.27 39.40 13.83 74.13 14.65 55.64 15.47 47.61 16.28 39.26 13.85 73.57 14.67 55.47 15.48 47.44 16.30 39.12 13.87 73.02 14.68 55.31 15.50 47.27 16.32 38.99 13.88 72.48 14.70 55.14 15.52 47.09 16.33 38.87 13.90 71.94 14.72 54.98 15.53 46.92 16.33 38.87 13.90 71.94 14.73 54.82 15.55 46.75 16.37 38.63 13.93 70.87 14.75 54.66 15.57 46.58 16.37 38.63 13.93 70.87 14.75 54.66 15.57 46.58 16.38 38.52 13.95 70.35 14.77 54.50 15.58 46.41 16.40 38.42 14.00 68.80 14.82 54.02 15.63 45.89 16.43 38.22 14.00 68.80 14.82 54.02 15.63 45.89 16.43 38.12 14.00 68.80 14.82 54.02 15.63 45.89 16.43 38.12 14.00 68.80 14.82 54.02 15.63 45.89 16.43 38.12 14.00 66.31 14.80 53.39 15.70 45.20 16.64 37.85 14.07 66.79 14.88 53.39 15.70 45.20 16.52 37.77 14.08 66.31 14.90 53.22 15.72 45.03 16.53 37.64 14.10 65.83 14.92 53.06 15.73 44.86 16.55 37.61 14.10 65.83 14.92 53.06 15.73 44.86 16.55 37.61 14.10 65.83 14.92 53.06 15.73 44.86 16.55 37.61 14.11 64.33 14.90 53.22 15.72 45.03 16.53 37.61 14.11 64.33 14.90 53.22 15.72 45.03 16.53 37.61 14.11 64.33 14.90 53.22 15.72 45.03 16.53 37.61 14.11 64.33 14.90 53.22 15.72 45.03 16.53 37.61 14.11 64.33 14.90 53.22 15.72 45.03 16.53 37.61 14.12 65.35 14.93 52.90 15.75 44.68 16.57 37.54 14.13 64.89 14.95 52.74 15.77 44.51 16.58 37.47 14.15 64.43 14.97 52.58 15.79 44.68 16.57 37.34 14.18 63.55 15.00 52.26 15.82 43.98 16.62 37.33 14.18 63.55 15.00 52.26 15.82 43.98 16.62 37.33 14.18 63.55 15.00 52.26 15.82 43.98 16.62 37.33 14.18 63.55 15.00 52.26 15.82 42.93 16.73 36.88 14.30 60.79 15.12 51.11 15.93 42.75 16.77 36.76 14.22 62.70 15.03 51.93 15.75 42.40 16.00 43.11 16.72 36.94 14.22 62.70 15.03 51.93 15.85 43.63 16.67 37.30 14.25 61.90 15.75 50.99 15.75 15.98 42.22 16.80 36.65 37.19 14.22 62.70 15.03 51.93 15.85 43.63 16.67 37.30 16.42 37.33 60.11 15.15 50.79 15.97 42.40 16.82 36.59 14.22 62.70 15.03 51.93 15.85 43.63 16.67 37.30 16.42 53.70 14.25 61.90 15.75 50.99 15.75 50.99 15.75 42.40 16.82 36.59 14.42 58.63 15.23 49.96	13.78	75.84						
13.82 74.69 14.63 55.82 15.45 47.78 16.27 39.40 13.85 74.13 14.65 55.64 15.47 47.61 16.28 39.26 13.85 73.02 14.68 55.47 15.48 47.44 16.30 39.12 13.87 73.02 14.68 55.31 15.50 47.27 16.32 38.99 13.98 72.48 14.70 55.14 15.52 47.09 16.33 38.87 13.90 71.94 14.72 54.98 15.53 46.92 16.35 38.75 13.92 71.40 14.73 54.82 15.53 46.75 16.37 38.63 13.95 70.35 14.77 54.50 15.58 46.41 16.40 38.42 13.98 70.85 14.77 54.50 15.58 46.21 16.42 38.31 13.99 70.83 14.78 54.50 15.69 46.24 16.42 38.22 14.00 68.80 14.82 54.02 15.63 45.89 16.45 <t< td=""><td>13.80</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>	13.80							
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14.07 66.79 14.88 53.39 15.70 45.20 16.52 37.77 14.08 66.31 14.90 53.22 15.72 45.03 16.53 37.69 14.10 65.83 14.92 53.06 15.73 44.86 16.55 37.61 14.12 65.35 14.93 52.90 15.75 44.68 16.57 37.54 14.13 64.89 14.95 52.74 15.77 44.51 16.58 37.47 14.15 64.43 14.97 52.58 15.78 44.33 16.60 37.39 14.17 63.99 14.98 52.42 15.80 44.16 16.62 37.33 14.17 63.99 14.98 52.42 15.80 44.16 16.62 37.33 14.18 63.55 15.00 52.26 15.82 43.98 16.63 37.26 14.20 63.12 15.02 52.09 15.83 43.81 16.65 37.13 14.23 62.29 15.05 51.77 15.87 43.46 16.68 <t< td=""><td></td><td>67.29</td><td></td><td></td><td>15.68</td><td>45.38</td><td></td><td></td></t<>		67.29			15.68	45.38		
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14.10 65.83 14.92 53.06 15.73 44.86 16.55 37.61 14.12 65.35 14.93 52.90 15.75 44.68 16.57 37.54 14.13 64.89 14.95 52.74 15.77 44.51 16.58 37.47 14.15 64.43 14.97 52.58 15.80 44.16 16.60 37.39 14.17 63.99 14.98 52.42 15.80 44.16 16.62 37.33 14.18 63.55 15.00 52.26 15.82 43.98 16.63 37.26 14.20 63.12 15.02 52.09 15.83 43.81 16.65 37.19 14.22 62.70 15.03 51.93 15.85 43.63 16.67 37.13 14.23 62.29 15.05 51.77 15.87 43.46 16.68 37.07 14.25 61.90 15.07 51.61 15.88 43.28 16.70 37.00 14.27 61.52 15.08 51.44 15.90 43.11 16.72 <t< td=""><td></td><td></td><td></td><td></td><td>15.72</td><td>45.03</td><td></td><td></td></t<>					15.72	45.03		
14.12 65.35 14.93 52.90 15.75 44.68 16.57 37.54 14.13 64.89 14.95 52.74 15.77 44.51 16.58 37.47 14.15 64.43 14.97 52.58 15.78 44.33 16.60 37.39 14.17 63.99 14.98 52.42 15.80 44.16 16.62 37.33 14.18 63.55 15.00 52.26 15.82 43.98 16.63 37.26 14.20 63.12 15.02 52.09 15.83 43.81 16.65 37.19 14.22 62.70 15.03 51.93 15.85 43.63 16.67 37.13 14.23 62.29 15.05 51.77 15.87 43.46 16.68 37.07 14.25 61.90 15.07 51.61 15.88 43.28 16.70 37.00 14.27 61.52 15.08 51.44 15.90 43.11 16.72 36.94 14.28 61.15 15.10 51.28 15.95 42.93 16.73 <t< td=""><td></td><td></td><td></td><td></td><td></td><td>44.86</td><td></td><td></td></t<>						44.86		
14.15 64.43 14.97 52.58 15.78 44.33 16.60 37.39 14.17 63.99 14.98 52.42 15.80 44.16 16.62 37.33 14.18 63.55 15.00 52.26 15.82 43.98 16.63 37.26 14.20 63.12 15.02 52.09 15.83 43.81 16.65 37.19 14.22 62.70 15.03 51.93 15.85 43.63 16.67 37.13 14.23 62.29 15.05 51.77 15.87 43.46 16.68 37.07 14.25 61.90 15.07 51.61 15.88 43.28 16.70 37.00 14.27 61.52 15.08 51.44 15.90 43.11 16.72 36.94 14.28 61.15 15.10 51.28 15.92 42.93 16.73 36.88 14.30 60.79 15.12 51.11 15.93 42.75 16.75 36.82 14.33 60.11 15.15 50.79 15.97 42.40 16.78 <t< td=""><td></td><td></td><td></td><td></td><td></td><td>44.68</td><td></td><td></td></t<>						44.68		
14.17 63.99 14.98 52.42 15.80 44.16 16.62 37.33 14.18 63.55 15.00 52.26 15.82 43.98 16.63 37.26 14.20 63.12 15.02 52.09 15.83 43.81 16.65 37.19 14.22 62.70 15.03 51.93 15.85 43.63 16.67 37.13 14.23 62.29 15.05 51.77 15.87 43.46 16.68 37.07 14.25 61.90 15.07 51.61 15.88 43.28 16.70 37.00 14.27 61.52 15.08 51.44 15.90 43.11 16.72 36.94 14.28 61.15 15.10 51.28 15.92 42.93 16.73 36.88 14.30 60.79 15.12 51.11 15.93 42.75 16.75 36.82 14.33 60.11 15.15 50.79 15.97 42.40 16.78 36.71 14.35 59.79 15.17 50.62 15.98 42.22 16.80 <t< td=""><td></td><td></td><td></td><td></td><td></td><td>44.51</td><td>16.58</td><td>37.47</td></t<>						44.51	16.58	37.47
14.18 63.55 15.00 52.26 15.82 43.98 16.63 37.26 14.20 63.12 15.02 52.09 15.83 43.81 16.65 37.19 14.22 62.70 15.03 51.93 15.85 43.63 16.67 37.13 14.23 62.29 15.05 51.77 15.87 43.46 16.68 37.07 14.25 61.90 15.07 51.61 15.88 43.28 16.70 37.00 14.27 61.52 15.08 51.44 15.90 43.11 16.72 36.94 14.28 61.15 15.10 51.28 15.92 42.93 16.73 36.88 14.30 60.79 15.12 51.11 15.93 42.75 16.75 36.82 14.32 60.44 15.13 50.95 15.95 42.58 16.77 36.76 14.33 60.11 15.15 50.79 15.97 42.40 16.78 36.71 14.35 59.79 15.18 50.46 16.00 42.04 16.82 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td>16.60</td><td>37.39</td></t<>							16.60	37.39
14.20 63.12 15.02 52.09 15.83 43.81 16.65 37.19 14.22 62.70 15.03 51.93 15.85 43.63 16.67 37.13 14.23 62.29 15.05 51.77 15.87 43.46 16.68 37.07 14.25 61.90 15.07 51.61 15.88 43.28 16.70 37.00 14.27 61.52 15.08 51.44 15.90 43.11 16.72 36.94 14.28 61.15 15.10 51.28 15.92 42.93 16.73 36.88 14.30 60.79 15.12 51.11 15.93 42.75 16.75 36.82 14.32 60.44 15.13 50.95 15.95 42.58 16.77 36.76 14.33 60.11 15.15 50.79 15.97 42.40 16.78 36.71 14.35 59.79 15.17 50.62 15.98 42.22 16.80 36.65 14.37 59.49 15.18 50.46 16.00 42.04 16.82 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td>16.62</td><td>37.33</td></t<>							16.62	37.33
14.22 62.70 15.03 51.93 15.85 43.63 16.67 37.13 14.23 62.29 15.05 51.77 15.87 43.46 16.68 37.07 14.25 61.90 15.07 51.61 15.88 43.28 16.70 37.00 14.27 61.52 15.08 51.44 15.90 43.11 16.72 36.94 14.28 61.15 15.10 51.28 15.92 42.93 16.73 36.88 14.30 60.79 15.12 51.11 15.93 42.75 16.75 36.82 14.32 60.44 15.13 50.95 15.95 42.58 16.77 36.76 14.33 60.11 15.15 50.79 15.97 42.40 16.78 36.71 14.35 59.79 15.17 50.62 15.98 42.22 16.80 36.65 14.37 59.49 15.18 50.46 16.00 42.04 16.82 36.59 14.40 58.91 15.22 50.12 16.03 41.69 16.85 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td>16.63</td><td>37.26</td></t<>							16.63	37.26
14.23 62.29 15.05 51.77 15.87 43.46 16.68 37.07 14.25 61.90 15.07 51.61 15.88 43.28 16.70 37.00 14.27 61.52 15.08 51.44 15.90 43.11 16.72 36.94 14.28 61.15 15.10 51.28 15.92 42.93 16.73 36.88 14.30 60.79 15.12 51.11 15.93 42.75 16.75 36.82 14.32 60.44 15.13 50.95 15.95 42.58 16.77 36.76 14.33 60.11 15.15 50.79 15.97 42.40 16.78 36.71 14.35 59.79 15.17 50.62 15.98 42.22 16.80 36.65 14.37 59.49 15.18 50.46 16.00 42.04 16.82 36.59 14.40 58.91 15.20 50.29 16.02 41.87 16.83 36.53 14.42 58.63 15.23 49.96 16.05 41.51 16.87 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td>16.65</td><td></td></t<>							16.65	
14.25 61.90 15.07 51.61 15.88 43.28 16.70 37.00 14.27 61.52 15.08 51.44 15.90 43.11 16.72 36.94 14.28 61.15 15.10 51.28 15.92 42.93 16.73 36.88 14.30 60.79 15.12 51.11 15.93 42.75 16.75 36.82 14.32 60.44 15.13 50.95 15.95 42.58 16.77 36.76 14.33 60.11 15.15 50.79 15.97 42.40 16.78 36.71 14.35 59.79 15.17 50.62 15.98 42.22 16.80 36.65 14.37 59.49 15.18 50.46 16.00 42.04 16.82 36.59 14.38 59.19 15.20 50.29 16.02 41.87 16.83 36.53 14.40 58.91 15.22 50.12 16.03 41.69 16.85 36.47 14.42 58.63 15.23 49.96 16.05 41.51 16.87 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td>16.67</td><td>37.13</td></t<>							16.67	37.13
14.27 61.52 15.08 51.44 15.90 43.11 16.72 36.94 14.28 61.15 15.10 51.28 15.92 42.93 16.73 36.88 14.30 60.79 15.12 51.11 15.93 42.75 16.75 36.82 14.32 60.44 15.13 50.95 15.95 42.58 16.77 36.76 14.33 60.11 15.15 50.79 15.97 42.40 16.78 36.71 14.35 59.79 15.17 50.62 15.98 42.22 16.80 36.65 14.37 59.49 15.18 50.46 16.00 42.04 16.82 36.59 14.38 59.19 15.20 50.29 16.02 41.87 16.83 36.53 14.40 58.91 15.22 50.12 16.03 41.69 16.85 36.47 14.42 58.63 15.23 49.96 16.05 41.51 16.87 36.41 14.45 58.11 15.27 49.63 16.08 41.16 16.90 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td>16.68</td><td></td></t<>							16.68	
14.28 61.15 15.10 51.28 15.92 42.93 16.73 36.88 14.30 60.79 15.12 51.11 15.93 42.75 16.75 36.82 14.32 60.44 15.13 50.95 15.95 42.58 16.77 36.76 14.33 60.11 15.15 50.79 15.97 42.40 16.78 36.71 14.35 59.79 15.17 50.62 15.98 42.22 16.80 36.65 14.37 59.49 15.18 50.46 16.00 42.04 16.82 36.59 14.38 59.19 15.20 50.29 16.02 41.87 16.83 36.53 14.40 58.91 15.22 50.12 16.03 41.69 16.85 36.47 14.42 58.63 15.23 49.96 16.05 41.51 16.87 36.41 14.43 58.37 15.25 49.79 16.07 41.34 16.88 36.35 14.45 58.11 15.28 49.46 16.10 40.99 16.92 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td>16.70</td><td>37.00</td></t<>							16.70	37.00
14.30 60.79 15.12 51.11 15.93 42.75 16.75 36.82 14.32 60.44 15.13 50.95 15.95 42.58 16.77 36.76 14.33 60.11 15.15 50.79 15.97 42.40 16.78 36.71 14.35 59.79 15.17 50.62 15.98 42.22 16.80 36.65 14.37 59.49 15.18 50.46 16.00 42.04 16.82 36.59 14.38 59.19 15.20 50.29 16.02 41.87 16.83 36.53 14.40 58.91 15.22 50.12 16.03 41.69 16.85 36.47 14.42 58.63 15.23 49.96 16.05 41.51 16.87 36.41 14.43 58.37 15.25 49.79 16.07 41.34 16.88 36.35 14.45 58.11 15.27 49.63 16.08 41.16 16.90 36.29 14.47 57.87 15.28 49.46 16.10 40.99 16.92 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td>16.72</td><td>36.94</td></t<>							16.72	36.94
14.32 60.44 15.13 50.95 15.95 42.58 16.77 36.76 14.33 60.11 15.15 50.79 15.97 42.40 16.78 36.71 14.35 59.79 15.17 50.62 15.98 42.22 16.80 36.65 14.37 59.49 15.18 50.46 16.00 42.04 16.82 36.59 14.38 59.19 15.20 50.29 16.02 41.87 16.83 36.53 14.40 58.91 15.22 50.12 16.03 41.69 16.85 36.47 14.42 58.63 15.23 49.96 16.05 41.51 16.87 36.41 14.43 58.37 15.25 49.79 16.07 41.34 16.88 36.35 14.45 58.11 15.27 49.63 16.08 41.16 16.90 36.29 14.47 57.87 15.28 49.46 16.10 40.99 16.92 36.23							16.73	36.88
14.33 60.11 15.15 50.79 15.97 42.40 16.78 36.71 14.35 59.79 15.17 50.62 15.98 42.22 16.80 36.65 14.37 59.49 15.18 50.46 16.00 42.04 16.82 36.59 14.38 59.19 15.20 50.29 16.02 41.87 16.83 36.53 14.40 58.91 15.22 50.12 16.03 41.69 16.85 36.47 14.42 58.63 15.23 49.96 16.05 41.51 16.87 36.41 14.43 58.37 15.25 49.79 16.07 41.34 16.88 36.35 14.45 58.11 15.27 49.63 16.08 41.16 16.90 36.29 14.47 57.87 15.28 49.46 16.10 40.99 16.92 36.23								
14.35 59.79 15.17 50.62 15.98 42.22 16.80 36.65 14.37 59.49 15.18 50.46 16.00 42.04 16.82 36.59 14.38 59.19 15.20 50.29 16.02 41.87 16.83 36.53 14.40 58.91 15.22 50.12 16.03 41.69 16.85 36.47 14.42 58.63 15.23 49.96 16.05 41.51 16.87 36.41 14.43 58.37 15.25 49.79 16.07 41.34 16.88 36.35 14.45 58.11 15.27 49.63 16.08 41.16 16.90 36.29 14.47 57.87 15.28 49.46 16.10 40.99 16.92 36.23								
14.37 59.49 15.18 50.46 16.00 42.04 16.82 36.59 14.38 59.19 15.20 50.29 16.02 41.87 16.83 36.53 14.40 58.91 15.22 50.12 16.03 41.69 16.85 36.47 14.42 58.63 15.23 49.96 16.05 41.51 16.87 36.41 14.43 58.37 15.25 49.79 16.07 41.34 16.88 36.35 14.45 58.11 15.27 49.63 16.08 41.16 16.90 36.29 14.47 57.87 15.28 49.46 16.10 40.99 16.92 36.23								
14.38 59.19 15.20 50.29 16.02 41.87 16.83 36.53 14.40 58.91 15.22 50.12 16.03 41.69 16.85 36.47 14.42 58.63 15.23 49.96 16.05 41.51 16.87 36.41 14.43 58.37 15.25 49.79 16.07 41.34 16.88 36.35 14.45 58.11 15.27 49.63 16.08 41.16 16.90 36.29 14.47 57.87 15.28 49.46 16.10 40.99 16.92 36.23								
14.40 58.91 15.22 50.12 16.03 41.69 16.85 36.47 14.42 58.63 15.23 49.96 16.05 41.51 16.87 36.41 14.43 58.37 15.25 49.79 16.07 41.34 16.88 36.35 14.45 58.11 15.27 49.63 16.08 41.16 16.90 36.29 14.47 57.87 15.28 49.46 16.10 40.99 16.92 36.23								
14.42 58.63 15.23 49.96 16.05 41.51 16.87 36.41 14.43 58.37 15.25 49.79 16.07 41.34 16.88 36.35 14.45 58.11 15.27 49.63 16.08 41.16 16.90 36.29 14.47 57.87 15.28 49.46 16.10 40.99 16.92 36.23								
14.43 58.37 15.25 49.79 16.07 41.34 16.88 36.35 14.45 58.11 15.27 49.63 16.08 41.16 16.90 36.29 14.47 57.87 15.28 49.46 16.10 40.99 16.92 36.23 14.48 57.63 15.28 16.08 16.10 16.92 36.23								
14.45 58.11 15.27 49.63 16.08 41.16 16.90 36.29 14.47 57.87 15.28 49.46 16.10 40.99 16.92 36.23 14.48 57.63 15.28 16.08 16.10 16.92 36.23								
14.47 57.87 15.28 49.46 16.10 40.99 16.92 36.23								
14.49 57.63 45.00 40.00								
ידידו טויסט 16 מיז אר אוני אוני אוני אוני אוני אריידו אוני אוני אוני אוני אוני אוני אוני אונ								
14.50 57.40 45.00 40.02 10.93 30.17						40.82	16.93	36.17
14.52 57.49 45.00 10.95 30.11								
14.52 57.18 15.33 48.96 16.15 40.48 16.97 36.05		37.10	10.00	40.50	10.15	40.48	16.97	36.05

Time	Outflow	Time	Outflow	Time	Outflow	Time	Outflow
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)
			•	•	,	(J.J,
16.98	35.99	17.80	32.99	18.62	29.85	19.43	26.59
17.00	35.93	17.82	32.92	18.63	29.78	19.45	26.52
17.02	35.87	17.83	32.86	18.65	29.72	19.47	26.45
17.03	35.81	17.85	32.80	18.67	29.65	19.48	26.39
17.05	35.75	17.87	32.74	18.68	29.58	19.50	26.32
17.07	35.69	17.88	32.67	18.70	29.52	19.52	26.25
17.08	35.63	17.90	32.61	18.72	29.45	19.53	26.18
17,10	35.57	17.92	32.55	18.73	29.39	19.55	26.11
17.12	35.51	17.93	32.48	18.75	29.32	19.57	26.05
17.13	35.45	17.95	32.42	18.77	29.26	19.58	25.98
17.15	35.39	17.97	32.36	18.78	29.19	19.60	25.91
17.17	35.33	17.98	32.29	18.80	29.12	19.62	25.84
17.18	35.27	18.00	32.23	18.82	29.06	19.63	25.78
17.20	35.21	18.02	32.17	18.83	28.99	19.65	25.71
17.22	35.15	18.03	32.10	18.85	28.93	19.67	25.64
17.23	35.09	18.05	32.04	18.87	28.86	19.68	25.57
17.25	35.03	18.07	31.97	18.88	28.79	19.70	25.50
17.27	34.97	18.08	31.91	18.90	28.73	19.72	25.43
17.28	34.91	18.10	31.85	18.92	28.66	19.73	25.37
17.30	34.84	18.12	31.78	18.93	28.60	19.75	25.30
17.32	34.78	18.13	31.72	18.95	28.53	19.77	25.23
17.33	34.72	18.15	31.66	18.97	28.46	19.78	25.16
17.35	34.66	18.17	31.59	18.98	28.40	19.80	25.09
17.37	34.60	18.18	31.53	19.00	28.33	19.82	25.02
17.38	34.54	18.20	31.46	19.02	28.26	19.83	24.96
17.40	34.48	18.22	31.40	19.03	28.20	19.85	24.89
17.42	34.42	18.23	31.34	19.05	28.13	19.87	24.82
17.43	34.35	18.25	31.27	19.07	28.06	19.88	24.75
17.45	34.29	18.27	31.21	19.08	28.00	19.90	24.68
17.47	34.23	18.28	31.14	19.10	27.93	19.92	24.61
17.48	34.17	18.30	31.08	19.12	27.86	19.93	24.54
17.50	34.11	18.32	31.01	19.13	27.80	19.95	24.48
17.52	34.05	18.33	30.95	19.15	27.73	19.97	24.41
17.53	33.98	18.35	30.89	19.17	27.66	19.98	24.34
17.55	33.92	18.37	30.82	19.18	27.60	20.00	24.27
17.57	33.86	18.38	30.76	19.20	27.53	20.02	24.20
17.58	33.80	18.40	30.69	19.22	27.46	20.03	24.13
17.60	33.74	18.42	30.63	19.23	27.40	20.05	24.06
17.62	33.67	18.43	30.56	19.25	27.33	20.07	24.00
17.63	33.61	18.45	30.50	19.27	27.26	20.08	23.93
17.65	33.55	18.47	30.43	19.28	27.19	20.10	23.86
17.67	33.49	18.48	30.37	19.30	27.13	20.12	23.80
17.68	33.42	18.50	30.30	19.32	27.06	20.12	23.73
17.70	33.36	18.52	30.24	19.33	26.99	20.15	23.67
17.72	33.30	18.53	30.17	19.35	26.93	20.17	23.61
17.73	33.24	18.55	30.11	19.37	26.86	20.18	23.54
17.75	33.17	18.57	30.04	19.38	26.79	20.20	23.48
17.77	33.11	18.58	29.98	19.40	26.72	20.22	23.43
17.78	33.05	18.60	29.91	19.42	26.66	20.23	23.37
			•		20.00	20.20	20.01

Time	Outflow	Time	Outflow	Time	Outflow	Time	Outflow
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)
			•	•	. ,	(2	J.J,
20.25	23.32	21.07	22.30	21.88	21.73	22.70	21.14
20.27	23.26	21.08	22.29	21.90	21.71	22.72	21.12
20.28	23.21	21.10	22.28	21.92	21.70	22.73	21.11
20.30	23.17	21.12	22.26	21.93	21.69	22.75	21.10
20.32	23.12	21.13	22.25	21.95	21.68	22.77	21.09
20.33	23.08	21.15	22.24	21.97	21.67	22.78	21.07
20.35	23.04	21.17	22.23	21.98	21.65	22.80	21.06
20.37	23.00	21.18	22.22	22.00	21.64	22.82	21.05
20.38	22.96	21.20	22.21	22.02	21.63	22,83	21.04
20.40	22.93	21.22	22.19	22.03	21.62	22.85	21.03
20.42	22.90	21.23	22.18	22.05	21.61	22.87	21.01
20.43	22.87	21.25	22.17	22.07	21.59	22.88	21.00
20.45	22.84	21.27	22.16	22.08	21.58	22.90	20.99
20.47	22.81	21.28	22.15	22.10	21.57	22.92	20.98
20.48	22.78	21.30	22.14	22.12	21.56	22.93	20.96
20.50	22.76	21.32	22.13	22.13	21.55	22.95	20.95
20.52	22.74	21.33	22.11	22.15	21.53	22.97	20.94
20.53	22.71	21.35	22.10	22.17	21.52	22.98	20.93
20.55	22.69	21.37	22.09	22.18	21.51	23.00	20.92
20.57	22.67	21.38	22.08	22.20	21.50	23.02	20.90
20.58	22.66	21.40	22.07	22.22	21.49	23.03	20.89
20.60	22.64	21.42	22.06	22.23	21.47	23.05	20.88
20.62	22.62	21.43	22.04	22.25	21.46	23.07	20.87
20.63	22.61	21.45	22.03	22.27	21.45	23.08	20.85
20.65	22.59	21.47	22.02	22.28	21.44	23.10	20.84
20.67	22.58	21.48	22.01	22.30	21.43	23.12	20.83
20.68	22.57	21.50	22.00	22.32	21.41	23.13	20.82
20.70	22.55	21.52	21.99	22.33	21.40	23.15	20.80
20.72	22.54	21.53	21.97	22.35	21.39	23.17	20.79
20.73	22.53	21.55	21.96	22.37	21.38	23.18	20.78
20.75	22.52	21.57	21.95	22.38	21.37	23.20	20.77
20.77	22.51	21.58	21.94	22.40	21.35	23.22	20.75
20.78	22.49	21.60	21.93	22.42	21.34	23.23	20.74
20.80	22.48	21.62	21.91	22.43	21.33	23.25	20.73
20.82	22.47	21.63	21.90	22.45	21.32	23.27	20.72
20.83	22.46	21.65	21.89	22.47	21.31	23.28	20.70
20.85	22.45	21.67	21.88	22.48	21.29	23.30	20.69
20.87	22.44	21.68	21.87	22.50	21.28	23.32	20.68
20.88	22.43	21.70	21.86	22.52	21.27	23.33	20.67
20.90	22.41	21.72	21.84	22.53	21.26	23.35	20.65
20.92	22.40	21.73	21.83	22.55	21.25	23.37	20.64
20.93	22.39	21.75	21.82	22.57	21.23	23.38	20.63
20.95	22.38	21.77	21.81	22.58	21.22	23.40	20.62
20.97	22.37	21.78	21.80	22.60	21.21	23.42	20.61
20.98	22.36	21.80	21.78	22.62	21.20	23.43	20.59
21.00	22.34	21.82	21.77	22.63	21.18	23.45	20.58
21.02	22.33	21.83	21.76	22.65	21.17	23.47	20.57
21.03	22.32	21.85	21.75	22.67	21.16	23.48	20.56
21.05	22.31	21.87	21.74	22.68	21.15	23.50	20.54

Time (hrs	Outflow cfs)
23.52 23.53 23.55 23.57 23.58 23.60 23.62 23.63 23.65 23.67 23.72 23.73 23.75 23.77 23.78 23.80 23.82 23.83 23.85 23.87 23.83 23.93 23.93 23.93 23.93 23.97 23.98	20.53 20.52 20.51 20.49 20.48 20.47 20.46 20.44 20.43 20.42 20.40 20.39 20.38 20.37 20.35 20.35 20.35 20.32 20.30 20.29 20.28 20.27 20.25 20.24 20.23 20.22 20.20 20.19 20.18

...End

English

Hyd. No. 1

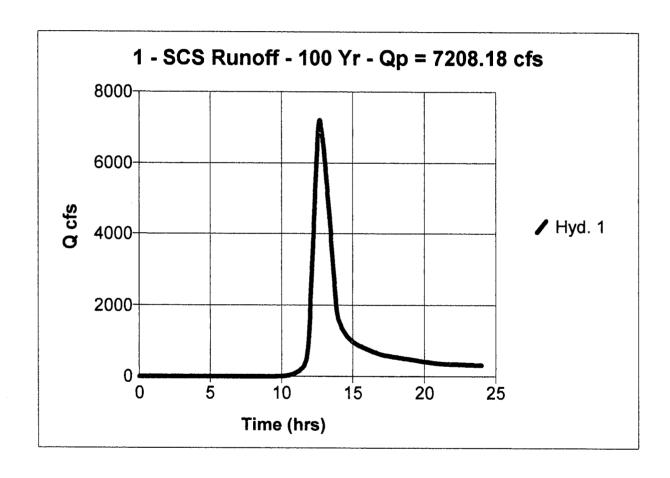
So Fork Hughes River

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Drainage area = 6950.00 ac
Basin Slope = 0.0 %
Tc method = TR55
Total precip. = 5.25 in
Storm duration = 24 hrs

Peak discharge = 7208.18 cfs
Time interval = 1 min
Curve number = 70.2
Hydraulic length = 0 ft
Time of conc. (Tc) = 76 min
Distribution = Type II

Shape factor = 484

Total Volume = 55,480,370 cuft



Hyd. No. 1

So Fork Hughes River Storm frequency = 100 yrs

Sheet Flow

Manning's n-value = 0.400 Flow length = 100.0 ft Two-year 24-hr precip. = 2.55 in Land slope = 25.0 %

Travel Time = 8.8 min

Shallow Concentrated Flow

Flow length = 300 ft
Watercourse slope = 28.0 %
Surface description = Unpaved
Average velocity = 8.54 ft/s

Travel Time = 0.6 min

Channel Flow

Cross section flow area = 80.0 sqft
Wetted perimeter = 24.0 ft
Channel slope = 0.8 %
Manning's n-value = 0.035
Velocity = 8.53 ft/s
Flow length = 34140.0 ft

Travel Time = 66.7 min

Total Travel Time, Tc = 76.0 min

English

Hyd. No. 1

So Fork Hughes River

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Drainage area = 6950.00 ac
Basin Slope = 0.0 %
Tc method = TR55
Total precip. = 5.25 in
Storm duration = 24 hrs

Peak discharge = 7208.18 cfs
Time interval = 1 min
Curve number = 70.2
Hydraulic length = 0 ft
Time of conc. (Tc) = 76 min
Distribution = Type II

Shape factor

Total Volume = 55,480,370 cuft

= 484

Hydrograph Discharge Table

Time	Outflow	Time	Outflow	Time	Time Outflow		Time Outflow		
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)		
10.82	72.23	11.35	205.24	11.88	995.06	12.42	5755.64		
10.83	75.01	11.37	211.52	11.90	1095.83	12.43	5903.37		
10.85	77.86	11.38	217.99	11.92	1209.80	12.45	6047.75		
10.87	80.79	11.40	224.65	11.93	1332.64	12.47	6188.29		
10.88	83.79	11.42	231.49	11.95	1463.84	12.48	6324.48		
10.90	86.88	11.43	238.54	11.97	1601.46	12.50	6455.75		
10.92	90.04	11.45	245.80	11.98	1743.58	12.52	6581.26		
10.93	93.28	11.47	253.26	12.00	1888.03	12.53	6699.75		
10.95	96.60	11.48	260.94	12.02	2033.75	12.55	6809.82		
10.97	100,00	11.50	268.84	12.03	2180.72	12.57	6910.02		
10.98	103.49	11.52	277.24	12.05	2328.89	12.58	6998.77		
11.00	107.06	11.53	286.07	12.07	2478.22	12.60	7074.42		
11.02	110.59	11.55	295.48	12.08	2628.67	12.62	7135.14		
11.03	114.21	11.57	305.63	12.10	2780.19	12.63	7179.02		
11.05	117.92	11.58	316.67	12.12	2932.75	12.65	7204.05		
11.07	121.72	11.60	328.80	12.13	3086.30	12.67	7208.18 <<		
11.08	125.63	11.62	342.18	12.15	3240.80	12.68	7198.35		
11.10	129.64	11.63	357.05	12.17	3396.20	12.70	7175.34		
11.12	133.76	11.65	373.60	12.18	3552.47	12.72	7142.20		
11.13	137.99	11.67	392.08	12.20	3709.55	12.73	7102.02		
11.15	142.33	11.68	412.73	12.22	3867.40	12.75	7058.23		
11.17	146.80	11.70	435.83	12.23	4025.97	12.77	7012.48		
11.18	151.39	11.72	461.67	12.25	4185.22	12.78	6964.81		
11.20	156.11	11.73	490.54	12.27	4344.68	12.80	6915.27		
11.22	160.97	11.75	522.77	12.28	4504.40	12.82	6863.88		
11.23	165.97	11.77	559.06	12.30	4664.12	12.83	6810.68		
11.25	171.11	11.78	600.00	12.32	4823.55	12.85	6755.73		
11.27	176.40	11.80	646.44	12.33	4982.38	12.87	6699.05		
11.28	181.84	11.82	699.29	12.35	5140.31	12.88	6640.69		
11.30	187.44	11.83	759.50	12.37	5296.97	12.90	6580.69		
11.32	193.20	11.85	828.11	12.38	5452.01	12.92	6519.09		
11.33	199.14	11.87	906.23	12.40	5605.03	12.93	6455.94		

Time	Outflow	Time	Outflow	Time	Outflow	Time	Outflow
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)
•	·	•	•	•	•	•	- · · - ,
12.95	6391.27	13.77	2274.02	14.58	1142.04	15.40	876.35
12.97	6325.12	13.78	2195.05	14.60	1133.76	15.42	872.86
12.98	6257.55	13.80	2119.04	14.62	1125.64	15.43	869.41
13.00	6188.60	13.82	2046.55	14.63	1117.67	15.45	866.00
13.02	6118.22	13.83	1978.16	14.65	1109.85	15.47	862.62
13.03	6046.56	13.85	1914.50	14.67	1102.18	15.48	859.29
13.05	5973.65	13.87	1856.25	14.68	1094.66	15.50	855.98
13.07	5899.55	13.88	1804.13	14.70	1087.29	15.52	852.71
13.08	5824.31	13.90	1758.89	14.72	1080.07	15.53	849.48
13.10	5747.99	13.92	1721.31	14.73	1073.00	15.55	846.27
13.12	5670.62	13.93	1688.78	14.75	1066.08	15.57	843.09
13.13	5592.27	13.95	1661.02	14.77	1059.30	15.58	839.94
13.15	5512.98	13.97	1636.88	14.78	1052.67	15.60	836.81
13.17	5432.80	13.98	1615.19	14.80	1046.17	15.62	833.71
13.18	5351.80	14.00	1594.69	14.82	1039.81	15.63	830.64
13.20	5270.02	14.02	1574.75	14.83	1033.58	15.65	827.59
13.22	5187.51	14.03	1555.36	14.85	1027.47	15.67	824.56
13.23	5104.32	14.05	1536.50	14.87	1021.49	15.68	821.55
13.25	5020.52	14.07	1518.17	14.88	1015.62	15.70	818.56
13.27	4936.14	14.08	1500.36	14.90	1009.88	15.72	815.59
13.28	4851.18	14.10	1483.06	14.92	1004.24	15.73	812.64
13.30	4765.66	14.12	1466.25	14.93	998.71	15.75	809.70
13.32	4679.58	14.13	1449.91	14.95	993.28	15.77	806.78
13.33	4592.98	14.15	1434.05	14.97	987.95	15.78	803.87
13.35	4505.84	14.17	1418.65	14.98	982.71	15.80	800.97
13.37	4418.20	14.18	1403.69	15.00	977.57	15.82	798.09
13.38	4330.05	14.20	1389.16	15.02	972.52	15.83	795.21
13.40	4241.42	14.22	1375.06	15.03	967.55	15.85	792.34
13.42	4152.32	14.23	1361.36	15.05	962.66	15.87	789.49
13.43	4062.76	14.25	1348.05	15.07	957.86	15.88	786.63
13.45	3972.74	14.27	1335.13	15.08	953.14	15.90	783.79
13.47	3882.30	14.28	1322.58	15.10	948.50	15.92	780.94
13.48	3791.44	14.30	1310.37	15.12	943.93	15.93	778.10
13.50	3700.17	14.32	1298.51	15.13	939.44	15.95	775.27
13.52	3608.67	14.33	1286.96	15.15	935.03	15.97	772.43
13.53	3516.91	14.35	1275.72	15.17	930.68	15.98	769.59
13.55	3424.99	14.37	1264.77	15.18	926.41	16.00	766.75
13.57	3333.02	14.38	1254.09	15.20	922.20	16.02	763.91
13.58	3241.11	14.40	1243.67	15.22	918.06	16.03	761.06
13.60	3149.37	14.42	1233.50	15.23	913.98	16.05	758.21
13.62	3057.94	14.43	1223.55	15.25	909.97	16.07	755.37
13.63	2966.93	14.45	1213.81	15.27	906.02	16.08	752.52
13.65	2876.51	14.47	1204.27	15.28	902.12	16.10	749.68
13.67	2786.82	14.48	1194.91	15.30	898.29	16.12	746.84
13.68	2698.03	14.50	1185.71	15.32	894.50	16.13	744.00
13.70	2610.30	14.52	1176.67	15.33	890.77	16.15	741.17
13.72	2523.83	14.53	1167.78	15.35	887.10	16.17	738.34
13.73	2438.80	14.55	1159.05	15.37	883.47	16.18	735.51
13.75	2355.43	14.57	1150.47	15.38	879.88	16.20	732.70

Time (hrs	Outflow cfs)	Time (hrs	Outflow cfs)	Time (hrs	Outflow cfs)	Time (hrs	Outflow cfs)
16.22	729.88	17.03	615.12	17.85	552.05	18.67	501.23
16.23	727.08	17.05	613.43	17.87	551.01	18.68	500.18
16.25	724.28	17.07	611.75	17.88	549.98	18.70	499.13
16.27	721.50	17.08	610.10	17.90	548.94	18.72	498.08
16.28	718.72	17.10	608.48	17.92	547.92	18.73	497.03
16.30	715.95	17.12	606.87	17.93	546.89	18.75	495.98
16.32	713.20	17.13	605.29	17.95	545.86	18.77	494.93
16,33	710.45	17.15	603.73	17.97	544.83	18.78	493.87
16.35	707.72	17.17	602.19	17.98	543.81	18.80	492.82
16.37	705.01	17.18	600.67	18.00	542.78	18.82	491.76
16.38	702.30	17.20	599.17	18.02	541.75	18.83	490.71
16.40	699.62	17.22	597.69	18.03	540.73	18.85	489.65
16.42	696.94	17.23	596.23	18.05	539.70	18.87	488.60
16.43	694.29	17.25	594.79	18.07	538.67	18.88	487.54
16.45	691.65	17.27	593.37	18.08	537.64	18.90	486.49
16. 4 7	689.03	17.28	591.97	18.10	536.61	18.92	485.43
16.48	686.43	17.30	590.58	18.12	535.58	18.93	484.37
16.50	683.85	17.32	589.22	18.13	534.55	18.95	483.31
16.52	681.29	17.33	587.86	18.15	533.51	18.97	482.25
16.53	678.75	17.35	586.53	18.17	532.48	18.98	481.19
16.55	676.23	17.37	585.21	18.18	531.45	19.00	480.13
16.57	673.74	17.38	583.91	18.20	530.41	19.02	479.07
16.58	671.27	17.40	582.62	18.22	529.38	19.03	478.01
16.60	668.82	17.42	581.35	18.23	528.34	19.05	476.95
16.62	666.40	17.43	580.09	18.25	527.31	19.07	475.89
16.63	664.00	17.45	578.85	18.27	526.27	19.08	474.83
16.65	661.63	17.47	577.61	18.28	525.23	19.10	473.76
16.67	659.29	17.48	576.40	18.30	524.20	19.12	472.70
16.68	656.97	17.50	575.19	18.32	523.16	19.13	471.64
16.70	654.68	17.52	574.00	18.33	522.12	19.15	470.57
16.72	652.43	17.53	572.82	18.35	521.08	19.17	469.51
16.73	650.20	17.55	571.65	18.37	520.04	19.18	468.44
16.75	648.01	17.57	570.49	18.38	519.00	19.20	467.38
16.77	645.84	17.58 17.60	569.34	18.40	517.96	19.22	466.31
16.78	643.71	17.60	568.20	18.42	516.92	19.23	465.24
16.80 16.82	641.60	17.62	567.07	18.43	515.88	19.25	464.18
16.83	639.53 637.49	17.63	565.96	18.45	514.84 513.70	19.27	463.11
16.85	635.47	17.65	564.85	18.47	513.79 540.75	19.28	462.04
16.87	633.49	17.67	563.74 562.65	18.48	512.75	19.30	460.97
16.88	631.53	17.68 17.70	562.65 561.56	18.50	511.70 540.66	19.32	459.90
16.90	629.60	17.70	560.48	18.52 18.53	510.66 500.63	19.33	458.83
16.92	627.70	17.72	559.41	18.55	509.62 508.57	19.35	457.76
16.93	625.83	17.75	558.34	18.57	506.57 507.52	19.37	456.69 455.63
16.95	623.98	17.75	555.3 4 557.28	18.58	507.52 506.48	19.38	455.62 454.55
16.97	622.16	17.77	557.26 556.22	18.60	505.43	19.40 19.42	454.55 453.48
16.98	620.36	17.70	555.17	18.62	503.43	19.42	453.46 452.41
17.00	618.59	17.82	554.13	18.63	503.33	19.45	452.41
17.02	616.84	17.83	553.08	18.65	503.33	19.45	450.26
	U,U.U-1	17.00	555.55	10.00	JUZ.20	13.41	4 50.20

	Outflow	Time			Outflow		Outflow
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)
19.48	449.19	20.20	206.44	24.40	250.07	04.00	0.40.04
19.50	448.11	20.30 20.32	396.41 395.37	21.12	358.37	21.93	343.81
19.52	447.04	20.32	393.37 394.35	21.13	357.90	21.95	343.61
19.53	445.96	20.35		21.15	357.44	21.97	343.41
19.55	444.89	20.33	393.33	21.17	357.00	21.98	343.21
19.55	443.81	20.37	392.31	21.18	356.56	22.00	343.01
19.58	442.73	20.40	391.31	21.20	356.13	22.02	342.81
19.60	441.66	20.40	390.31 389.32	21.22	355.71	22.03	342.61
19.62	440.58	20.42	388.33	21.23	355.30	22.05	342.41
19.63	439.50			21.25	354.90	22.07	342.21
19.65	439.30	20.45	387.36	21.27	354.51	22.08	342.01
19.67	430.43	20.47	386.39	21.28	354.12	22.10	341.81
19.68	437.35	20.48	385.44	21.30	353.75	22.12	341.61
19.70	435.19	20.50	384.49	21.32	353.38	22.13	341.41
19.70	434.11	20.52 20.53	383.56	21.33	353.02	22.15	341.21
19.72	433.03		382.63	21.35	352.67	22.17	341.01
19.75	431.95	20.55	381.72	21.37	352.33	22.18	340.81
19.73	431.95	20.57 20.58	380.81	21.38	351.99	22.20	340.61
19.77	430.67		379.92	21.40	351.67	22.22	340.40
19.78	429.76 428.70	20.60	379.04	21.42	351.34	22.23	340.20
19.80	420.70	20.62	378.17	21.43	351.03	22.25	340.00
19.82		20.63	377.31	21.45	350.72	22.27	339.80
19.85	426.54 425.45	20.65 20.67	376.47	21.47	350.42	22.28	339.60
19.83	423.43 424.37	20.68	375.64	21.48	350.13	22.30	339.40
19.88	424.37 423.29	20.70	374.82 374.02	21.50	349.84	22.32	339.20
19.90	422.20	20.70	374.02 373.23	21.52 21.53	349.56	22.33	339.00
19.92	421.12	20.72	373.23 372.45	21.55	349.28 349.01	22.35 22.37	338.80 338.59
19.93	420.03	20.75	372. 4 3 371.69	21.57	348.74	22.38 22.38	338.39
19.95	418.95	20.77	370.95	21.58	348.48	22.40	338.19
19.97	417.86	20.78	370.21	21.60	348.22	22.42	337.99
19.98	416.77	20.80	369.50	21.62	347.97	22.43	337.79
20.00	415.69	20.82	368.80	21.63	347.72	22.45	337.59
20.02	414.60	20.83	368.11	21.65	347.48	22.47	337.39
20.03	413.51	20.85	367.43	21.67	347.24	22.48	337.18
20.05	412.42	20.87	366.77	21.68	347.01	22.50	336.98
20.07	411.34	20.88	366.13	21.70	346.78	22.52	336.78
20.08	410.25	20.90	365.49	21.72	346.55	22.53	336.58
20.10	409.17	20.92	364.87	21.73	346.32	22.55	336.38
20.12	408.09	20.93	364.26	21.75	346.10	22.57	336.17
20.13	407.01	20.95	363.67	21.77	345.88	22.58	335.97
20.15	405.93	20.97	363.09	21.78	345.67	22.60	335.77
20.17	404.86	20.98	362.52	21.80	345.45	22.62	335.57
20.18	403.79	21.00	361.96	21.82	345.24	22.63	335.36
20.20	402.72	21.02	361.41	21.83	345.03	22.65	335.16
20.22	401.66	21.03	360.88	21.85	344.83	22.67	334.96
20.23	400.60	21.05	360.35	21.87	344.62	22.68	334.76
20.25	399.54	21.07	359.84	21.88	344.42	22.70	334.55
20.27	398.49	21.08	359.34	21.90	344.21	22.72	334.35
20.28	397.45	21.10	358.85	21.92	344.01	22.73	334.15
_ 3		21.10	200.00	£1.0£	0 1 1.0 1	22.10	00 4 .10

Time (hrs	Outflow cfs)	Time (hrs	Outflow cfs)
22.75 22.77 22.78 22.80 22.82 22.83 22.85 22.87 22.88 22.90 22.92 22.93 22.95 22.97 22.98 23.00 23.02 23.03 23.05 23.07 23.13 23.15 23.17 23.18 23.20 23.22 23.23 23.25 23.27 23.28 23.29	333.94 333.74 333.54 333.34 332.93 332.73 332.52 332.32 332.12 331.91 331.71 331.50 331.30 331.30 331.30 331.49 330.89 330.89 330.89 330.89 330.98 330.98 329.87 329.60 329.87 329.67 32	23.57 23.58 23.60 23.62 23.63 23.65 23.67 23.68 23.70 23.72 23.73 23.75 23.77 23.78 23.80 23.82 23.83 23.85 23.87 23.88 23.90 23.92 23.93 23.95 23.97 23.98	323.92 323.72 323.51 323.30 323.10 322.89 322.68 322.48 322.27 322.06 321.65 321.44 321.24 320.62 320.41 320.20 319.99 319.79 319.58 319.37 319.16 318.96 318.75

Hyd. No. 2

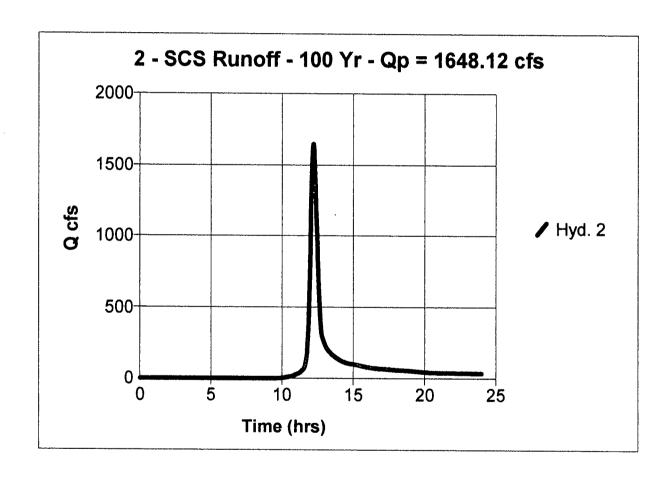
Sheep Run

Hydrograph type = SCS Runoff Storm frequency = 100 yrs Drainage area = 825.00 ac Basin Slope = 0.0 %

Tc method = TR55 Total precip. = 5.25 in Storm duration = 24 hrs Peak discharge = 1648.12 cfs
Time interval = 1 min
Curve number = 70.2
Hydraulic length = 0 ft

Time of conc. (Tc) = 29.3 min
Distribution = Type II
Shape factor = 484

Total Volume = 6,660,276 cuft



Hyd. No. 2

Sheep Run Storm frequency = 100 yrs

Sheet Flow

Manning's n-value = 0.550 Flow length = 100.0 ft Two-year 24-hr precip. = 2.55 in Land slope = 18.0 %

Travel Time = 12.9 min

Shallow Concentrated Flow

Flow length = 300 ft
Watercourse slope = 13.0 %
Surface description = Unpaved
Average velocity = 5.82 ft/s

Travel Time = 0.9 min

Channel Flow

Cross section flow area = 18.4 sqft
Wetted perimeter = 9.5 ft
Channel slope = 3.6 %
Manning's n-value = 0.040
Velocity = 11.01 ft/s
Flow length = 10290.0 ft

Travel Time = 15.6 min

Total Travel Time, Tc = 29.3 min

English

Hyd. No. 2

Sheep Run

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Drainage area = 825.00 ac
Basin Slope = 0.0 %
Tc method = TR55
Total precip. = 5.25 in
Storm duration = 24 hrs

Peak discharge = 1648.12 cfs
Time interval = 1 min
Curve number = 70.2
Hydraulic length = 0 ft
Time of conc (Tc) = 29.3 min

Time of conc. (Tc) = 29.3 min
Distribution = Type II
Shape factor = 484

Total Volume = 6,660,276 cuft

Hydrograph Discharge Table

	Outflow	Time	Outflow	Time	Outflow	Time	Outflow
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)
10.68 10.70 10.72 10.73 10.75 10.77 10.78 10.80 10.82 10.83	16.78 17.31 17.85 18.40 18.97 19.55 20.15 20.76 21.39 22.04	11.22 11.23 11.25 11.27 11.28 11.30 11.32 11.33 11.35	40.78 41.89 43.05 44.25 45.51 46.81 48.33 49.90 51.53 53.22	11.75 11.77 11.78 11.80 11.82 11.83 11.85 11.87 11.88	185.81 206.51 230.47 258.30 290.30 327.33 369.98 418.89 474.76 538.31	12.28 12.30 12.32 12.33 12.35 12.37 12.38 12.40 12.42 12.43	1502.34 1457.41 1411.62 1364.98 1317.55 1269.41 1220.66 1171.37 1121.65 1071.61
10.85 10.87 10.88 10.90 10.92 10.93 10.95 10.97 10.98 11.00 11.02 11.03 11.05 11.07 11.08 11.10	22.70 23.37 24.06 24.77 25.50 26.24 27.00 27.77 28.57 29.37 30.10 30.85 31.62 32.41 33.22 34.06 34.92	11.38 11.40 11.42 11.43 11.45 11.47 11.48 11.50 11.52 11.53 11.55 11.57 11.58 11.60 11.62 11.63 11.65	54.96 56.77 58.63 60.55 62.54 64.58 66.68 68.85 71.27 73.89 76.83 80.20 84.10 88.66 94.03 100.35 107.77	11.92 11.93 11.95 11.97 11.98 12.00 12.02 12.03 12.05 12.07 12.08 12.10 12.12 12.13 12.15 12.17	610.24 687.11 768.27 852.03 936.66 1020.24 1101.65 1180.52 1256.44 1328.78 1396.60 1458.85 1514.42 1562.14 1600.78 1628.95 1645.23	12.45 12.47 12.48 12.50 12.52 12.53 12.55 12.57 12.60 12.62 12.63 12.65 12.67 12.68 12.70 12.72	1021.34 970.97 920.63 870.44 820.56 771.15 722.39 674.55 627.99 583.15 540.45 500.37 463.39 430.06 400.94 376.62 357.70
11.13 11.15 11.17 11.18 11.20	35.81 36.74 37.69 38.68 39.71	11.67 11.68 11.70 11.72 11.73	116.46 126.61 138.41 152.06 167.78	12.20 12.22 12.23 12.25 12.27	1648.12 << 1636.08 1614.24 1583.16 1545.11	12.73 12.75 12.77 12.78 12.80	342.28 330.18 320.58 312.65 305.47

	Outflow		Outflow		Outflow	Time	Outflow
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)
40.00							•
12.82	298.60	13.63	159.03	14.45	112.05	15.27	94.80
12.83	292.03	13.65	157.70	14.47	111.55	15.28	94.46
12.85	285.74	13.67	156.40	14.48	111.07	15.30	94.13
12.87	279.74	13.68	155.11	14.50	110.60	15.32	93.79
12.88	274.01	13.70	153.84	14.52	110.15	15.33	93.46
12.90	268.53	13.72	152.59	14.53	109.72	15.35	93.12
12.92	263.31	13.73	151.36	14.55	109.30	15.37	92.78
12.93	258.32	13.75	150.14	14.57	108.89	15.38	92.45
12.95	253.57	13.77	148.94	14.58	108.50	15.40	92.11
12.97	249.04	13.78	147.75	14.60	108.11	15.42	91.77
12.98	244.71	13.80	146.59	14.62	107.74	15.43	91.44
13.00	240.59	13.82	145.43	14.63	107.37	15.45	91.10
13.02	236.65	13.83	144.29	14.65	107.01	15.47	90.76
13.03	232.90	13.85	143.16	14.67	106.66	15.48	90.42
13.05	229.32	13.87	142.05	14.68	106.32	15.50	90.08
13.07	225.91	13.88	140.94	14.70	105.98	15.52	89.74
13.08	222.65	13.90	139.85	14.72	105.65	15.53	89.41
13.10	219.55	13.92	138.77	14.73	105.32	15.55	89.07
13.12	216.59	13.93	137.70	14.75	104.99	15.57	88.73
13.13	213.76	13.95	136.64	14.77	104.67	15.58	88.39
13.15	211.05	13.97	135.59	14.78	104.34	15.60	88.05
13.17	208.47	13.98	134.55	14.80	104.02	15.62	87.70
13.18	205.99	14.00	133.52	14.82	103.69	15.63	87.36
13.20	203.62	14.02	132.50	14.83	103.37	15.65	87.02
13.22	201.33	14.03	131.49	14.85	103.04	15.67	86.68
13.23	199.13	14.05	130.48	14.87	102.72	15.68	86.34
13.25	197.00	14.07	129.49	14.88	102.39	15.70	86.00
13.27	194.94	14.08	128.52	14.90	102.07	15.72	85.65
13.28	192.93	14.10	127.55	14.92	101.74	15.73	85.31
13.30	190.98	14.12	126.60	14.93	101.41	15.75	84.97
13.32	189.06	14.13	125.67	14.95	101.08	15.77	84.63
13.33	187.19	14.15	124.76	14.97	100.76	15.78	84.28
13.35	185.36	14.17	123.86	14.98	100.43	15.80	83.94
13.37 13.38	183.57	14.18	122.98	15.00	100.10	15.82	83.59
	181.81	14.20	122.12	15.02	99.77	15.83	83.25
13.40 13.42	180.09 178.41	14.22	121.28	15.03	99.44	15.85	82.90
13.43	176.76	14.23	120.47	15.05	99.11	15.87	82.56
13.45	175.13	14.25	119.67	15.07	98.78	15.88	82.21
13.47	173.13	14.27	118.91	15.08	98.45	15.90	81.87
13.48	173.54	14.28	118.16	15.10	98.12	15.92	81.52
13.40	171.90	14.30	117.44	15.12	97.79	15.93	81.18
13.50	168.93	14.32	116.75	15.13	97.46	15.95	80.83
13.52	167.45	14.33	116.08	15.15	97.13	15.97	80.48
13.55	167.45 165.99	14.35	115.44	15.17	96.80	15.98	80.14
13.55	163.99	14.37	114.82	15.18	96.46	16.00	79.79
13.57	163.14	14.38	114.22	15.20	96.13	16.02	79.44
13.50	163.14	14.40	113.65	15.22	95.80	16.03	79.10
13.62	160.38	14.42	113.10	15.23	95.46	16.05	78.75
10.02	100.00	14.43	112.56	15.25	95.13	16.07	78.41

Time Outflow		Time	Outflow	Time Outflow		Time -	Time Outflow	
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	
		·	·	•	,	•	,	
16.08	78.07	16.90	68.43	17.72	62.49	18.53	56.38	
16.10	77.73	16.92	68.31	17.73	62.37	18.55	56.25	
16.12	77.39	16.93	68.20	17.75	62.24	18.57	56.13	
16.13	77.06	16.95	68.08	17.77	62.12	18.58	56.00	
16.15	76.73	16.97	67.96	17.78	62.00	18.60	55.87	
16.17	76.41	16.98	67.84	17.80	61.87	18.62	55.75	
16.18	76.09	17.00	67.72	17.82	61.75	18.63	55.62	
16.20	75.78	17.02	67.60	17.83	61.63	18.65	55.49	
16.22	75.48	17.03	67.48	17.85	61.50	18.67	55.37	
16.23	75.18	17.05	67.36	17.87	61.38	18.68	55.24	
16.25	74.89	17.07	67.24	17.88	61.25	18.70	55.11	
16.27	74.61	17.08	67.12	17.90	61.13	18.72	54.99	
16.28	74.34	17.10	66.99	17.92	61.01	18.73	54.86	
16.30	74.08	17.12	66.87	17.93	60.88	18.75	54.73	
16.32	73.82	17.13	66.75	17.95	60.76	18.77	54.61	
16.33	73.58	17.15	66.63	17.97	60.63	18.78	54.48	
16.35	73.34	17.17	66.51	17.98	60.51	18.80	54.35	
16.37	73.12	17.18	66.39	18.00	60.39	18.82	54.23	
16.38	72.90	17.20	66.27	18.02	60.26	18.83	54.10	
16.40	72.69	17.22	66.15	18.03	60.14	18.85	53.97	
16.42	72.48	17.23	66.03	18.05	60.01	18.87	53.84	
16.43	72.29	17.25	65.91	18.07	59.89	18.88	53.72	
16.45	72.10	17.27	65.79	18.08	59.76	18.90	53.59	
16.47	71.92	17.28	65.67	18.10	59.64	18.92	53.46	
16.48	71.74	17.30	65.54	18.12	59.52	18.93	53.33	
16.50	71.57	17.32	65.42	18.13	59.39	18.95	53.21	
16.52	71.41	17.33	65.30	18.15	59.27	18.97	53.08	
16.53	71.25	17.35	65.18	18.17	59.14	18.98	52.95	
16.55	71.09	17.37	65.06	18.18	59.02	19.00	52.82	
16.57	70.94	17.38	64.94	18.20	58.89	19.02	52.70	
16.58	70.80	17.40	64.81	18.22	58.77	19.03	52.57	
16.60	70.65	17.42	64.69	18.23	58.64	19.05	52.44	
16.62	70.52	17.43	64.57	18.25	58.52	19.07	52.31	
16.63	70.38	17.45	64.45	18.27	58.39	19.08	52.18	
16.65	70.25	17. 4 7	64.33	18.28	58.27	19.10	52.06	
16.67	70.12	17.48	64.21	18.30	58.14	19.12	51.93	
16.68	70.00	17.50	64.08	18.32	58.01	19.13	51.80	
16.70	69.87	17.52	63.96	18.33	57.89	19.15	51.67	
16.72	69.75	17.53	63.84	18.35	57.76	19.17	51.54	
16.73	69.63	17.55	63.72	18.37	57.64	19.18	51.42	
16.75	69.51	17.57	63.59	18.38	57.51	19.20	51.29	
16.77	69.39	17.58	63.47	18.40	57.39	19.22	51.16	
16.78	69.27	17.60	63.35	18.42	57.26	19.23	51.03	
16.80	69.15	17.62	63.23	18.43	57.14	19.25	50.90	
16.82	69.03	17.63	63.10	18.45	57.01	19.27	50.77	
16.83	68.91	17.65	62.98	18.47	56.88	19.28	50.65	
16.85	68.79	17.67	62.86	18.48	56.76	19.30	50.52	
16.87	68.67	17.68	62.73	18.50	56.63	19.32	50.39	
16.88	68.55	17.70	62.61	18.52	56.51	19.33	50.26	
				· - ·		. 5.30		

Time (hrs	Outflow cfs)	Time (Outflow cfs)	Time (hrs	Outflow cfs)	Time (hrs	Outflow cfs)
•		(J. J.	(013)	(1115	CIS
19.35	50.13	20.17	43.81	20.98	41.38	21.80	40.22
19.37	50.00	20.18	43.69	21.00	41.36	21.82	40.19
19.38	49.87	20.20	43.58	21.02	41.33	21.83	40.17
19.40	49.74	20.22	43.47	21.03	41.31	21.85	40.15
19.42	49.61	20.23	43.37	21.05	41.29	21.87	40.12
19.43	49.49	20.25	43.26	21.07	41.26	21.88	40.10
19.45	49.36	20.27	43.16	21.08	41.24	21.90	40.08
19.47	49.23	20.28	43.07	21.10	41.22	21.92	40.05
19.48	49.10	20.30	42.98	21.12	41.19	21.93	40.03
19.50	48.97	20.32	42.89	21.13	41.17	21.95	40.00
19.52	48.84	20.33	42.81	21.15	41.14	21.97	39.98
19.53	48.71	20.35	42.73	21.17	41.12	21.98	39.96
19.55	48.58	20.37	42.66	21.18	41.10	22.00	39.93
19.57	48.45	20.38	42.59	21.20	41.07	22.02	39.91
19.58	48.32	20.40	42.52	21.22	41.05	22.03	39.88
19.60	48.19	20.42	42.46	21.23	41.03	22.05	39.86
19.62	48.06	20.43	42.40	21.25	41.00	22.07	39.84
19.63	47.93	20.45	42.34	21.27	40.98	22.08	39.81
19.65	47.80	20.47	42.29	21.28	40.96	22.10	39.79
19.67	47.67	20.48	42.24	21.30	40.93	22.12	39.76
19.68	47.54	20.50	42.19	21.32	40.91	22.13	39.74
19.70	47.41	20.52	42.15	21.33	40.89	22.15	39.72
19.72	47.28	20.53	42.10	21.35	40.86	22.17	39.69
19.73	47.15	20.55	42.06	21.37	40.84	22.18	39.67
19.75	47.02	20.57	42.03	21.38	40.81	22.20	39.64
19.77	46.89	20.58	41.99	21.40	40.79	22.22	39.62
19.78	46.77	20.60	41.96	21.42	40.77	22.23	39.59
19.80	46.63	20.62	41.92	21.43	40.74	22.25	39.57
19.82	46.50	20.63	41.89	21.45	40.72	22.27	39.55
19.83	46.37	20.65	41.86	21.47	40.70	22.28	39.52
19.85	46.24	20.67	41.84	21.48	40.67	22.30	39.50
19.87	46.11	20.68	41.81	21.50	40.65	22.32	39.47
19.88	45.98 45.95	20.70	41.78	21.52	40.62	22.33	39.45
19.90 19.92	45.85 45.70	20.72	41.76	21.53	40.60	22.35	39.43
	45.72 45.50	20.73	41.73	21.55	40.58	22.37	39.40
19.93 19.95	45.59 45.46	20.75	41.71	21.57	40.55	22.38	39.38
19.93	45.33	20.77	41.68	21.58	40.53	22.40	39.35
19.98	45.20	20.78	41.66	21.60	40.51	22.42	39.33
20.00	45.20 45.07	20.80	41.64	21.62	40.48	22.43	39.30
20.00	44.94	20.82	41.61	21.63	40.46	22.45	39.28
20.02	44.81	20.83 20.85	41.59	21.65	40.43	22.47	39.26
20.05	44.68		41.57	21.67	40.41	22.48	39.23
20.03	44.66 44.55	20.87 20.88	41.54	21.68	40.39	22.50	39.21
20.07	44.42	20.88	41.52 41.50	21.70	40.36	22.52	39.18
20.00	44.30	20.90 20.92	41.50	21.72	40.34	22.53	39.16
20.10	44.17	20.92		21.73	40.31	22.55	39.14
20.12	44.05	20.93 20.95	41.45	21.75	40.29	22.57	39.11
20.15	43.93	20.95	41.43 41.40	21.77	40.27	22.58	39.09
	10.00	20.31	T1.4V	21.78	40.24	22.60	39.06

Time Outflow (hrs cfs)		Time (hrs	Outflow cfs)
22.62 22.63 22.65 22.67 22.68 22.70 22.72 22.73 22.75 22.77 22.78 22.80 22.82 22.83 22.85 22.90 22.92 22.93 22.95 22.97 22.98 23.00 23.02 23.03 23.05 23.10 23.12 23.13 23.15 23.17 23.18 23.20 23.22 23.23 23.25 23.27 23.28 23.27 23.28 23.27 23.28 23.27 23.28 23.27 23.28 23.27 23.28 23.27 23.28 23.27 23.28 23.27 23.28 23.27 23.28 23.27 23.28 23.27 23.27 23.28 23.27	39.04 39.01 38.99 38.97 38.94 38.92 38.89 38.87 38.84 38.75 38.77 38.75 38.77 38.65 38.65 38.65 38.55 38.53 38.53 38.43 38.43 38.43 38.31	23.43 23.45 23.47 23.48 23.50 23.52 23.53 23.55 23.57 23.58 23.60 23.62 23.63 23.65 23.67 23.68 23.70 23.72 23.73 23.75 23.77 23.80 23.82 23.83 23.85 23.87 23.88 23.90 23.92 23.93 23.95 23.95 23.97 23.98	37.84 37.81 37.79 37.76 37.74 37.72 37.69 37.67 37.64 37.52 37.59 37.57 37.44 37.42 37.39 37.37 37.34 37.32 37.39 37.37 37.35 37.25 37.25 37.25 37.25 37.25 37.20 37.17 37.15 37.10 37.07 37.05 37.02

South Fork Hughes River - Sta 0+00 - 10 Yr Storm Worksheet for Irregular Channel

Project Description		
Worksheet	So Fork Hughes Sta	
Flow Element	Irregular Channel	
Method	Manning's Formula	
Solve For	Channel Depth	

Input Data

.005000 ft/ft Slope

DischargeX32X00XX6X

1,324 cfs

Options

Current Roughness Metho oved Lotter's Method Open Channel Weighting Noved Lotter's Method Closed Channel Weighting Horton's Method

Results		
Mannings Coefficier	0.043	
Water Surface Eleve	832.70	ft
Elevation Range	8.00 to 839.00	
Flow Area	282.9	ft²
Wetted Perimeter	107.64	ft
Top Width	106.13	ft
Actual Depth	4.70	ft
Critical Elevation	831.17	ft
Critical Slope	0.020491	ft/ft
Velocity	4.68	ft/s
Velocity Head	0.34	ft
Specific Energy	833.04	ft
Froude Number	0.51	
Flow Type	Subcritical	

Roughness Segments				
Start Station	End Station	Mannings Coefficient		
0+06	1+53	0.045		
1+53	2+01	0.040		
2+01	2+49	0.045		

Natural Channel Points			
Station (ft)	Elevation (ft)		
0+06	839.00		
0+21	838.00		
0+22	837.00		
0+23	836.00		
0+27	835.00		
0+55	834.00		
1+20	833.00		
1+35	832.00		
1+48	831.00		
1+53	830.00		
1+55	829.00		
1+56	828.00		

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Page 1 of 2

South Fork Hughes River - Sta 0+00 - 10 Yr Storm Worksheet for Irregular Channel

Natural Channel Points				
Station (ft)	Elevation (ft)			
1+97	828.00			
1+98	829.00			
2+01	830.00			
2+05	831.00			
2+25	832.00			
2+33	833.00			
2+37	834.00			
2+39	835.00			
2+42	836.00			
2+45	837.00			
2+47	838.00			
2+49	839.00			

Sheep Run Sta 7+00 - 10 Yr Storm Worksheet for Irregular Channel

Project Description		
Worksheet	Sheep Run - Sta	
Flow Element	Irregular Channel	
Method	Manning's Formul	
Solve For	Channel Depth	

Input Data

Slope .029100 ft/ft

Discharge**来等某**数数数X

695.5 cfs

Options

Current Roughness Metho oved Lotter's Method Open Channel Weighting Noved Lotter's Method Closed Channel Weighting Horton's Method

Results		
Mannings Coefficier	0.045	
Water Surface Eleva	839.09	ft
Elevation Range	5.84 to 841.79	
Flow Area	73.6	ft²
Wetted Perimeter	33.86	ft
Top Width	32.85	ft
Actual Depth	3.25	ft
Critical Elevation	839.29	ft
Critical Slope	0.023129	ft/ft
Velocity	9.45	ft/s
Velocity Head	1.39	ft
Specific Energy	840.48	ft
Froude Number	1.11	
Flow Type	Supercritical	

Roughness Segments			
Start Station	End Station	Mannings Coefficient	
-0+32	0+27	0.045	

Natural Channel Points		
Station (ft)	Elevation (ft)	
-0+32	841.03	
-0+17	839.89	
-0+13	838.16	
-0+11	837.27	
-0+08	836.72	
-0+06	836.37	
-0+04	836.03	
-0+02	835.84	
0+00	835.97	
0+02	836.00	
0+06	836.00	
0+08	836.02	
0+11	836.58	
0+13	837.52	

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Sheep Run Sta 7+00 - 10 Yr Storm Worksheet for Irregular Channel

Natural Channel Points					
Station (ft)	Elevation (ft)				
0+15	838.22				
0+17	838,81				
0+21	839.97				
0+25	841.14				
0+27	841.79				

South Fork Hughes River - Sta 0+00 - 100 Yr Storm Worksheet for Irregular Channel

1
So Fork Hughes Sta
Irregular Channel
Manning's Formula
Channel Depth

Input Data
Slope .005000 ft/ft

3,710 cfs

Options

Current Roughness Metho oved Lotter's Method
Open Channel Weighting Noved Lotter's Method
Closed Channel Weighting Horton's Method

Results		
Mannings Coefficier	0.044	
Water Surface Eleva	835.21	ft
Elevation Range	8.00 to 839.00	
Flow Area	704.0	ft²
Wetted Perimeter	215.55	ft
Top Width	213.62	ft
Actual Depth	7.21	ft
Critical Elevation	833,68	ft
Critical Slope	0.020787	ft/ft
Velocity	5.27	ft/s
Velocity Head	0.43	ft
Specific Energy	835.64	ft
Froude Number	0.51	
Flow Type	Subcritical	

Roughness Segments						
Start Station	Mannings Coefficient					
0+06	1+53	0.045				
1+53	2+01	0.040				
2+01	2+49	0.045				

Natural Channel Points					
Station (ft)	Elevation (ft)				
0+06	839.00				
0+21	838.00				
0+22	837.00				
0+23	836.00 835.00				
0+27					
0+55	834.00				
1+20	833.00				
1+35	832.00				
1+48	831.00				
1+53	830.00				
1+55	829.00				
1+56	828.00				

South Fork Hughes River - Sta 0+00 - 100 Yr Storm Worksheet for Irregular Channel

Natural Channel Points					
Station (ft)	Elevation (ft)				
1+97	828.00				
1+98	829.00				
2+01	830.00				
2+05	831.00				
2+25	832.00				
2+33	833.00				
2+37	834.00				
2+39	835.00				
2+42	836.00				
2+45	837.00				
2+47	838.00				
2+49	839.00				

Sheep Run Sta 7+00 - 100 Yr Storm **Worksheet for Irregular Channel**

Project Description	1
Worksheet	Sheep Run - Sta
Flow Element	Irregular Channel
Method	Manning's Formul
Solve For	Channel Depth

Input Data

Slope .029100 ft/ft

Discharge XXXXXXXXX

1,648 cfs

Options

Current Roughness Metho oved Lotter's Method Open Channel Weighting Noved Lotter's Method **Closed Channel Weighting** Horton's Method

Results		
Mannings Coefficier	0.045	*******
Water Surface Eleva	840.97	ft
Elevation Range	5.84 to 841.79	
Flow Area	152.2	ft²
Wetted Perimeter	57.08	ft
Top Width	55.61	ft
Actual Depth	5.13	ft
Critical Elevation	841.27	ft
Critical Slope	0.021419	ft/ft
Velocity	10.83	ft/s
Velocity Head	1.82	ft
Specific Energy	842.80	ft
Froude Number	1.15	
Flow Type	Supercritical	

Roughness Segments						
Start Station	End Station	Mannings Coefficient				
-0+32	0+27	0.045				

Natural Channel Points				
Station (ft)				
-0+32	841.03			
-0+17	839.89			
-0+13	838.16			
-0+11	837.27			
-0+08	836.72			
-0+06	836.37			
-0+04	836.03			
-0+02	835.84			
0+00	835.97			
0+02	836.00			
0+06	836.00			
0+08	836.02			
0+11	836.58			
0+13	837.52			

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Sheep Run Sta 7+00 - 100 Yr Storm Worksheet for Irregular Channel

Natural Channel Points					
Station (ft)	Elevation (ft)				
0+15	838.22				
0+17	838.81				
0+21	839.97				
0+25	841.14				
0+27	841.79				

Hec-Ras Summary Output South Fork Hughes River Existing Conditions 10 yr/24 hr Storm & 100 yr/24 hr Storm

HEC-RAS Plan: SFH River: SFHughes Reach: 1

Reach	River Sta	Profile	Q Total	Min Ch Et	W.S. Elev	Crft W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	110000 # 01#
<u> </u>	650.000	10 Yr Storm	1324.00	830.00	835.47		835.94	0.002917	5.54	249.56	64.24	0.44
1	650.000	100 Yr Storm	3710.00	830.00	838.02		839.25	0.005202	9.29	475.82	132.74	0.62
1	600.000	10 Yr Storm	1324.00	830.00	835.41		835.78	0.002335	5.02	287.93	83.01	0.40
<u> </u>	600,000	100 Yr Storm	3710.00	830.00	838.12		838.91	0.003410	7.70	585.88	133.26	0.51
		 										
<u> </u>	550.000	10 Yr Storm	1324.00	830.00	835.19		835.64	0.002987	5.42	247.84	64.74	0.45
<u> </u>	550.000	100 Yr Storm	3710.00	830.00	837.36		838.64	0.005762	9.43	456.95	121.60	0.65
<u> </u>	500.000	10 Yr Storm	1324.00	830.00	834.99		835.48	0.003480	5.64	246.41	75.24	0.48
<u> </u>	500.000	100 Yr Storm	3710.00	830.00	836.95	836.28	838.32	0.006809	9.84	447.41	129.03	0.71
	- 											
<u>!</u>	450.000	10 Yr Storm	1324.00	829.96	834.85		835.30	0.003417	5.51	265.27	100.33	0.47
<u>!</u>	450.000	100 Yr Storm	3710.00	829.96	836.92		837.90	0.005239	8.64	528.20	143.37	0.62
		ļ										
	400.000	10 Yr Storm	1324.00	829.74	834.57		835.10	0.004413	5.92	249.73	136.91	0.53
<u> </u>	400.000	100 Yr Storm	3710.00	829.74	836.81		837.60	0.004589	7.88	582.72	167.13	0.58
		 										
<u>!</u>	350.000	10 Yr Storm	1324.00	829.46	834.43		834.87	0.003711	5.65	291.16	149.06	0.49
<u></u>	350.000	100 Yr Storm	3710.00	829.46	836.79		837.35	0.003089	7.00	715.10	193.08	0.49
		-								-		
	300.000	10 Yr Storm	1324.00	829.19	834.30		834.68	0.003350	5.44	318.84	142.68	0.47
<u> </u>	300.000	100 Yr Storm	3710.00	829.19	836.67		837.19	0.003013	6.95	719.02	189.41	0.48
	-	 										
	250.000	10 Yr Storm	1324.00	829.00	834.41		834.53	0.000778	3.06	518.90	157.12	0.24
	250.000	100 Yr Storm	3710.00	829.00	836.74		837.04	0.001208	4.89	962.33	198.95	0.31
	200 000	1011 01										
	200.000	10 Yr Storm	1324.00	828.79	834.24		834.47	0.001546	4.07	406.17	163.30	0.33
	200.000	100 Yr Storm	3710.00	828.79	836.53		836,95	0.001978	5.99	833.04	205.91	0.40
	450,000	40.14.04										
	150.000	10 Yr Storm	1324.00	828.33	833.29	832.69	834.25	0.007957	7.96	180.78	78.73	0.72
	150.000	100 Yr Storm	3710.00	828.33	835.46	835.40	836.69	0.007289	10.28	514.26	182.45	0.74
	100.000	10 Yr Storm	4004.00									
	100.000		1324.00	828.00	832.63	832.31	833.79	0.009370	8.84	167.51	82.24	0.78
	100.000	100 Yr Storm	3710.00	828.00	835.35		836.29	0.005268	9.37	587.78	184.90	0.64
	50.000	10 V- Ot	4004.00									
		10 Yr Storm	1324.00	828.00	832.84		833.29	0.004004	6.05	280.51	112.15	0.52
	50,000	100 Yr Storm	3710.00	828.00	835.39		835.97	0.003347	7.59	712.02	199.32	0.51
	0.000	40 /- 01										
	0.000	10 Yr Storm	1324.00	828.00	832.70	831.14	833,10	0.003121	5.16	282.57	106.23	0.46
	0.000	100 Yr Storm	3710.00	828.00	835.21	833.88	835.81	0.002983	6.99	710.54	213.29	0.48

Hec-Ras Summary Output Sheep Run Existing Conditions

10 yr/24 hr Storm & 100 yr/24 hr Storm

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chi
	1		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(8q ft)	(ft)	1
1	700.000	10 Yr Storm	695.50	835,84	840,27	839.27	840.83	0.007825	6.00	116.43	42.41	0.6
<u> </u>	700.000	100 yr Storm	1648.00	835.84	840.97	841.16	842.96	0.021415	11.41	150.66	55.30	
1	650.000	10 Yr Storm	695.50	835.00	839.86	838.92	840.46	0.006668	6.53	400.44	405.00	ļ
1	650.000	100 yr Storm	1648.00	835.00	841.46	840.97	842.00			126.11	105.99	
·	300.000	100 yr Olollir	1040.00	633.00	041.40	040.97	642.00	0.005137	7.18	335.60	141.71	0.5
1	600.000	10 Yr Storm	695.50	834.00	839.69		840.13	0.004875	5.50	154.65	110.85	0.4
<u> </u>	600.000	100 yr Storm	1648.00	834.00	841.34		841.74	0.003707	6.05	384.27	152.88	0.4
1	550.000	10 Yr Storm	695.50	834.00	839.63		839.90	0.002774	4.59	199.08	104.38	0.:
1	550.000	100 yr Storm	1648.00	834.00	841.19		841,57	0.003093	5.91	393.39	139.19	
												<u>u</u> .
1	500.000	10 Yr Storm	695.50	834.00	838.70	838,59	839.60	0.011017	8.32	110.10	66.79	0.7
!	500.000	100 yr Storm	1648.00	834.00	840.11	840.11	841.24	0.011538	10.40	232.11	102.20	0.7
1	450.000	10 Yr Storm	695.50	834.00	838.52		839,05	0.008520	5.88	124.41	67.52	0.6
1	450.000	100 yr Storm	1648.00	834.00	839.47	839.56	840.71	0.006526	9.40	206,81	102.94	
								0.01.10.0	0.10	200,01	102.04	<u></u>
<u> </u>	400.000	10 Yr Storm	695.50	833.86	838.44	837.78	838.67	0.003658	4.51	209.41	128.26	0.4
<u>!</u>	400.000	100 yr Storm	1648.00	833,86	839.15	838.76	839.73	0.007523	7.33	309.59	149.45	0.6
1	350.000	10 Yr Storm	695.50	833.82	837.29	837.29	838.26	0.046545	0.00	00.00	101.10	
<u></u>	350.000	100 yr Storm	1648.00	833.82	838.60	838.60	839.29	0.016515	8.26	98.88	124.40	
	1333,555	7. J. C.C	1010.00	030,02	030.00	030.00	039.29	0.009932	8.29	307.83	192.90	0.7
[300.000	10 Yr Storm	695.50	832.71	836.95	836.20	837.34	0.006067	5.34	153.20	139.96	0.5
1	300.000	100 yr Storm	1648.00	832.71	838.29	837.61	838.81	0.005893	6.70	346.75	222.91	
1	250.000	10 Yr Storm	695.50	832.00	836.78		837.09	0.003444	4.78	175.67	400.07	
1	250.000	100 yr Storm	1648.00	832.00	837.73	836.96	838.48	0.003444	7.87	315.01	128.67 201.03	
									7.54	0.0.0.	201.00	
<u>'</u>	200.000	10 Yr Storm	695.50	831.38	836.47		836.91	0.005497	6.63	165.50	156.14	0.5
<u> </u>	200.000	100 yr Storm	1648.00	831.38	837.78		838.19	0.004981	7.45	391.64	187.23	
1	150.000	10 Yr Storm	695.50	830.77	836.54		836.73	0.002097	3.98	258.69	470.00	
1 ,	150.000	100 yr Storm	1648.00	830.77	837.82		838.06	0.002097	4.91	493.12	176.26 188.18	
											100.10	
!	130.000	10 Yr Storm	695.50	830.22	836.50		836,69	0.001859	3.96	264.01	183.14	0.3
1	130.000	100 yr Storm	1648.00	830.22	837.79		838.03	0.002089	4.92	510.96	198.24	0.3
1	110.000	10 Yr Storm	695.50	830.00	836.40	834.28	836.64	0.004280	4.10	214.54	214.21	0.4
!	110.000	100 yr Storm	1648.00	830.00	837.73	836.77	837.98	0.001980	3.57	512.10	235.55	
1	109		Bridge									
 I	93.000	10 Yr Storm	695.50	830.00	834.18	834.18	835.75	0.026674	10.04	69.26	22.16	1.0
1	93.000	100 yr Storm	1648.00	830.00	835.79	836.33	837.43	0.023074	11.73	225.96	227.02	
 												
1	73.000	10 Yr Storm	695.50	829.99	834.35	833,33	834.54	0.008038	3.52	204.35	177.87	
<u> </u>	73.000	100 yr Storm	1648.00	829.99	836.68	834.61	836,76	0.000944	2.39	840.95	378.41	0.2
1	50.000	10 Yr Storm	695.50	829.00	834.42		834,45	0.000647	1.51	517.48	344.78	
1	50.000	100 yr Storm	1648.00	829.00	836.71		836.73	0.000219	1.37	1382.36	344.78	
							2-11. 7			. 302.30	300.00	0.1
<u> </u>	0.000	10 Yr Storm	695.50	829.00	834.40	831.54	834.43	0.000398	1.67	644.96	380.00	0.1
	0.000	100 yr Storm	1648.00	829.00	836.70	832.94	836,72	0.000166	1.45	1518.96	380.00	

Hec-Ras Summary Output Sheep Run Proposed Conditions 10 yr/24 hr Storm & 100 yr/24 hr Storm

Reach	River Sta	Profile	Reach: 1 Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Stope	Vel Chni	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(8q ft)	(ft)	
1	700.000	10 Yr Storm	695.50	835.84	840.25	839.27	840.82	0.007622	6.09	115.63	42.07	0.60
1	700.000	100 Yr Storm	1648.00	835.84	840.97	841.32	843.00	0.020835	11.54	150.66	55.30	1,03
1	650.000	10 Yr Storm	695.50	835,00	839.94	838.85	840.46	0.006417	5.84	135.23	116.57	0.56
1	650.000	100 Yr Storm	1648.00	835.00	841.51	840.90	842.00	0.004850	6.52	342.74	142.28	0.51
1	600,000	10 Yr Storm	695,50	834.00	839.74		840.17	0.004443	5.48	159.88	114.26	0.47
1	600.000	100 Yr Storm	1648.00	834.00	841.37		841.77	0.003560	6.10	388.96	153.12	0.4
1	550.000	10 Yr Storm	695.50	834.00	839.69		839.95	0.002568	4.56	205.48	106.39	0.3
1	550.000	100 Yr Storm	1648.00	834.00	841.23		841.60	0.002978	5.93	399.01	139.72	
4	500.000	10 Yr Storm	695.50	834.00	838.63	838.63	839.65	0.011506	8.91	105.67	63.74	0.7
1	500.000	100 Yr Storm	1648.00	834.00	840.18		841.29	0.010647	10.56	239.39	104.07	0.7
										400.00	00.40	0.6
1	450.000 450.000	10 Yr Storm	695.50 1648.00	834.00 834.00	838.49 839.42	837.74 839.60	839.05 840.76	0.008284 0.015235	6.08 9.85	122.89 201.56	66.49 101.39	
1	400.000	10 Yr Storm 100 Yr Storm	695.50 1648.00	833.86 833.86	838.43 839.13	837.80 838.79		0.003657	4.61 7.55	209.05 306.25	128.16 149.07	 _
	400.000	100 11 310111	1040.00	033.00	033.13	030.79	000.70	0.007143	1.00	500.10	140.07	
1	350.000	10 Yr Storm	695.50	833.82	837.29			0.016592	8.27	98.83	124.67	
1	350.000	100 Yr Storm	1648.00	833.82	838.61	838,61	839.29	0.009811	8.24	309.47	193,05	0.7
1	300.000	10 Yr Storm	695.50	832.71	836.86	836.20		0.006968	5.60	145.42	136.89	
1	300.000	100 Yr Storm	1648.00	. 832.71	838.48	837.75	838.87	0.004408	5.96	397.27	224,41	0.4
1	250.000	10 Yr Storm	695.50	832.00	836.65		837.00	0.003952	4.93	165.76	123,63	
1	250.000	100 Yr Storm	1648.00	832,00	837.50	836.94	838.50	0.009565	8.78	267.99	199.00	0.7
1	200.000	10 Yr Storm	695.50	831.38	835.96	835.80	836.71	0.010031	8.30	123.38	94.61	0.7
1	200.000	100 Yr Storm	1648.00	831.38	837.37	837.37	838.10	0.009052	9.58	315.76	183.96	0.7
1	150.000	10 Yr Storm	695.50	830.77	836.01	834.86	836.35	0.004023	5.06	175.23	131.75	0.4
1	150.000	100 Yr Storm	1648.00						5.50		185.28	
4	127.000	10 Yr Storm	695.50	830.00	835.96	<u> </u>	836.28	0.002471	4.78	188.16	150.53	0.4
1	127.000	100 Yr Storm	1648.00		+		837.73		5.53			
		1011 0	005.50	200.00	B20 04	000.00	020.00	0.004505	3.91	248.14	198.45	0.2
1	113.000	10 Yr Storm 100 Yr Storm	695.50 1648.00				+					
Ľ	11.151.551											
1	101	-	Culver	1	 	 	 			 		
1	91.000	10 Yr Storm	695.50	830.00	833.96	3	834.68	0.007718	6.83	101.84	25.72	
1	91.000	100 Yr Storm	1648.00	830.00	836.47	7	836.86	0.003509	6.14	429.94	264.99	0.4
1	73.000	10 Yr Storm	695.50	830.00	834.4	1	834.45	0.000618	1.72	440.75	180.90	5 0.1
1	73.000	100 Yr Storm	1648.00				836.74					
1				L		L	J	1	L	<u> </u>	1	
1	50.000	10 Yr Storm	695.50	829.00	834.43	3	834.44	0.000063	0.76	1010.75	345.8	B 0.0

0.000

10 Yr Storm 100 Yr Storm 695.50 1648.00

829.00

829.00

834.40

836.70

831.54

832.93

834.43

0.000388

1.73

644.96

1518.96

380.00

HYDROLOGIC AND HYDRAULIC ANALYSIS SHEEP RUN BRIDGE REPLACEMENT WV CR19/11 – MILE POST 2.45

FOR CNX GAS COMPANY LLC

DODDRIDGE COUNTY, WEST VIRGINIA

JULY 31, 2014 REVISED April 17th, 2015

Prepared By:

Blue Mountain, Inc.

10125 Mason Dixon Hwy
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I. Purpose

CNX Gas Company LLC is proposing to upgrade an existing bridge structure on WV CR 19/11, Mile Post 2.45, to increase the available load carrying capacity of the crossing. The existing bridge, crossing Sheep Run near it's confluence with the South Fork Hughes River, is to be replaced with an aluminum box culvert having a 95 ton combination load bearing capacity. This report analyzes the anticipated affect the installation of the box culvert will have on the water surface elevations in Sheep Run during the design storm events.

II. Analysis

As stated, the location of the proposed bridge replacement is close to the confluence of Sheep Run and the South Fork Hughes River, close enough that the water surfaces generated in the South Fork Hughes River basin during the design storm events will influence the water surface elevations in Sheep Run at the location of the proposed bridge replacement.

Consequently, this report looks at the anticipated water surface elevations in the South Fork Hughes River basin in its entirety, which includes the Sheep Run basin, and then looks at the anticipated water surface elevations in the Sheep Run Basin for the existing and

proposed conditions, taking into account the tail water condition from the South Fork Hughes River that will occur downstream of the bridge location.

III. Watersheds

The contributing watershed for the South Fork Hughes River basin (includes the Sheep Run basin) and the contributing watershed for the Sheep Run basin were estimated from the New Milton, WV and the Oxford, WV USGS 7.5 min Quadrangle Maps.

South Fork Hughes River Watershed = 6,950 ac.

Sheep Run Watershed = 825 ac.

Please see Dwg. No. WS-01, 'Watershed Maps' for the watershed limits.

IV. Runoff Discharge Methods

The West Virginia Department of Transportation-Division of Highways-Engineering Division- Drainage Manual-3rd Edition-December 2007 (WVDOH Drainage Manual) suggests three hydrologic runoff estimation methods: the Rational Method, the TR-55 Method, and the USGS Method. With 6,950 ac. and 825 ac. watersheds for the South Fork Hughes River basin and the Sheep Run basin respectively, the Rational

Method, with a 0 to 200 ac. watershed range, was deemed not applicable. For this analysis, the TR-55 Method and the USGS Method were used initially to estimate peak runoff for the design storms.

V. Design Storms

From the WVDOH Drainage Manual, design storms for different facilities are determined based on the estimated Average Daily Traffic Volume (ADT). For WV CR 19/11, no hard traffic data exists, but it is estimated that the ADT is less than 400 vehicles per day. As per Table 4-2, Design Storm Criteria, for Channels, Culverts, and Bridges the recommended Design Storm is the 10 yr. Frequency (10%) storm.

This report also analyzes the effects of the 100 yr. Frequency (1%) Design Storm.

VI. Hydrologic Soil Groups

From the NRCS Soil Survey of Doddridge County, WV, it appears that the primary soil types in the South Fork Hughes River basin, which includes the Sheep Run Basin, are the Gilpin-Peabody Complex and the Gilpin-Upshur Complex, both belonging to the Hydrologic Soil Group (HSG) C/D. Other soil types occurring in the watershed are the Kanawha Loam Complex, HSG B; Monongahela Silt Loam, HSG C; Sensabaugh Silt Loam, HSG B; and Vandalia Silt Loam, HSG D. The Vandalia Silt Loam is a very small percentage of the total in the watershed and therefore a Hydrologic Soil Group Classification of C was used for the watershed.

VII. Weighted Curve Number, CN

It is estimated that 85% of the watershed is in tree cover and 15% is pasture/meadow. From the WVDOH Drainage Manual, Table 4-9, Runoff Curve Numbers for Rural Areas, for Woods Only in Good Condition & HSG C, the CN is 70; for Meadow with Continuous Grass Cover & HSG C, the CN is 71. The Weighted CN is 70.2. WVDOH Drainage Manual Worksheet 4-1, Runoff Curve Number Determination, is included in the Appendix.

VIII. Time of Concentration

The TR-55 Method was used to calculate the Time of Concentration for both the South Fork Hughes River basin and the Sheep Run Basin. The computer program, Hydraflow Hydrographs v6.0, which uses the TR-55 Method to determine Time of Concentration, was used to perform the calculations for both the South Fork Hughes River Basin and the Sheep Run Basin.

Tc, South Fork Hughes River: 76 min. / 1.27 hr.

Tc, Sheep Run: 29.3 min. / 0.49 hr.

The program summary sheet is attached to WVDOH Drainage Manual Worksheet 4-2, Time of Concentration Calculation, and is included in the Appendix.

IX. Peak Discharge

A. South Fork Hughes River

From the WVDOH Drainage Manual, Form 4-1, Peak Discharge Computation Form, the peak discharges for the 10 yr. / 24 hr. design storm from the TR-55 Method and the USGS Method are 2,825 cfs and 2,006 cfs, respectively. As an additional check, the computer program Hydraflow Hydrographs v6.0 was also used to estimate the peak flow for the SC\$ Type II 10 yr. / 24 hr. design storm. From Hydraflow, the estimated peak runoff for the 10 yr. / 24 hr. storm is 2,988 cfs.

With watershed sizes of 6,950 ac. (10.86 sq. mi.) for the South Fork Hughes River basin and 825 ac. (1.29 sq. mi.) for the Sheep Run basin, and the USGS Method being recommended for watersheds over 10 sq. mi., the USGS Method was disregarded. This leaves the TR-SS Method and the Hydraflow program.

As Hydraflow has the added feature of generating the outflow hydrograph in 1 minute time intervals, and having very similar results to the TR-SS method, it was decided to use the results from Hydraflow, peak flow of 2,988 cfs and to also use Hydraflow to analyze the Sheep Run basin.

WVDOH Drainage Manual Form 4-1 and the Hydraflow output are included in the Appendix.

B. Sheep Run

From Hydraflow, the estimated peak flow for the 10 yr. /24 hr. design storm for the Sheep Run basin is 69S.5 cfs and occurs at 12.20 hours. However, the peak flow in the South Fork Hughes River occurs at 12.68 hours. From the discharge hydrograph for the South Fork Hughes River, at 12.20 hours the flow is 1,324 cfs. Therefore 1,324 cfs was used to determine the estimated water surface elevations in the South Fork Hughes River at the time of peak flow in the Sheep Run basin.

X. Hydraulic Analysis

A. 10yr/24 hr. Design Storm

The computer program Hec-Ras v4.1.0 was used to estimate the water surface profile in the South Fork Hughes River reach and in the Sheep run reach for the 10 yr. / 24 hr. design storm, for both the existing and proposed conditions. Typical sections of the existing bridge and the proposed pre-cast concrete box culvert are shown on Dwg. No. XS-01, 'Typical Cross- Section Existing Bridge' and Dwg. No. XS-02, 'Typical Cross-Section Precast Concrete Box Culvert'.

The first step was to establish a starting water surface elevation in the South Fork Hughes River reach. With an approximate existing channel slope of 0.5% for the study reach of the South Fork Hughes River, the flow regime is subcritical and therefore the most downstream station, Sta. 0+00, was used as the control section. From the computer program Flow Master V6.1, with a flow of 1,324 cfs, the water surface elevation is estimated to be EL 832.70 ft.

The next step was to input this information into Hec-Ras to estimate the water surface profile for the South Fork Hughes River for the 10 yr. / 24 hr. design storm. A subcritical steady flow analysis was performed and the results are shown on Dwg. No. SP-01, 'Site Map-10 yr. Storm-Existing Conditions', and Dwg. No. SP-02, 'Site Map-10 yr. Storm-Proposed Conditions'.

This information was used to establish the tail water/downstream water surface elevation for the Sheep Run study reach. The estimated water surface elevation at Sta. 2+50 in the South Fork Hughes River is approximately EL 834.40 ft. and was used as the downstream water surface elevation in Sheep Run. The channel slope for the Sheep Run study reach varies from mild at the downstream end to steep at the upstream end. Therefore a mixed flow regime was run for Sheep Run and a water surface elevation was estimated for Sta. 7+00 using Flow Master. From Flow Master, for a design flow of 695.5 cfs, the estimated water surface elevation at Sta. 7+00 is approximately El. 839.09 ft.

These two water surface elevations were used to run a mixed flow regime steady flow analysis with Hec-Ras for the existing and proposed conditions in Sheep Run.

Results of the Hec-Ras run have been plotted in plan view on Dwg. No. SP-01, 'Site Map-10 yr. Storm-Existing Conditions' and Dwg. No. SP-02, 'Site Map-10 yr. Storm-Proposed Conditions'. The water surface profile for existing and proposed conditions for the 10 yr. / 24 hr. storm has been plotted on Dwg. No. PR-01, 'Water Surface Profiles'.

Summary output information from the Hec-Ras run has been included in the Appendix.

B. 100yr/24 hr. Design Storm

The computer program Hec-Ras v4.1.0 was used to estimate the water surface profile in the South Fork Hughes River reach and in the Sheep run reach for the 100 yr. / 24 hr. design storm, for both the existing and proposed conditions. Typical sections of the existing bridge and the proposed pre-cast concrete box culvert are shown on Dwg. No. XS-01, Typical Cross-Section Existing Bridge' and Dwg. No. XS-02, Typical Cross-Section Precast Concrete Box Culvert'.

The same procedure used to analyze the 10 yr. /24 hr. storm was used to analyze the 100 yr. /24 hr. storm. Estimated flow in the South Fork Hughes River basin is 3,710 cfs and in the Sheep Run basin the estimated flow is 1,648 cfs. The estimated water surface elevation at Sta. 0+00 of the South Fork Hughes River is El. 835.21 ft. for a flow of 3,710 cfs. From the Hec-Ras run, the estimated water surface elevation at Sta. 2+50 in the South Fork Hughes River is approximately El. 836.70 ft. and was used as the downstream water surface elevation in Sheep Run. The estimated water surface elevation at Sta. 7+00 of Sheep Run for 1,648 cfs is El. 840.97 ft. Using the water surface elevations at Sta. 2+50 of the South Fork Hughes River as the known downstream elevation and the water surface elevation at Sta. 0+00 of Sheep run as the known upstream elevation, a mixed flow regime steady flow analysis was run for Sheep Run for existing and proposed conditions.

Results of the Hec-Ras run have been plotted in plan view on Dwg. No. SP-03, 'Site Map- 100 yr. Storm-Existing Conditions' and Dwg. No. SP-04, 'Site Map-100 yr. Storm-Proposed Conditions'. The water surface profile for existing and proposed conditions for the 100 yr. / 24 hr. storm has been plotted on Dwg. No. PR-01, 'Water Surface Profiles'. Summary output information from the Hec-Ras run has been included in the Appendix.

XI. Results

This analysis indicates that for both the 10 yr. / 24 hr. design storm and the 100 yr. / 24 hr. design storm, the installation of the aluminum box in Sheep Run on WV Co. Rd. 19/11 will **lower** the expected water surface elevation over existing conditions. The expected drop in the water surface elevation for the 10 yr. / 24 hr. storm is 1.25 ft. to 1.35 ft. For the 100 yr. / 24 hr. storm the expected drop is 0.40 ft. to 0.50 ft.

<u>APPENDIX</u>

Worksheet 4-1 Runoff Curve Number Determination

	WORKS	EET 4-1 RUNOFF CURVE	NUMBE	R DE1	TERMIN	ATION		
CALCULATED BY:I		DATE: <u>07-21-</u> 14 DATE: <u>07-21-</u> 14	PROJECT NAME: Sheep STATE PROJECT NUMBER:		heep Run Bridge Rep MBER:			
Soil Name	Hydrologic Group	Cover Description percent impervious unconnected/connected impervious ratio	ous area	Table 4-9	Table 4-10 N Sonto	Chart 4.5	Area In mi ²	GN X Area
Gilpin- Peabody	C/D	15% Meadov	v .	. 71			1.63	115.7
Gilpin- Upshur	C/D	85% Woods		7.0				646.1
Kanawha Loam	В							
Monongahela Silt Loam					·			
Sensabaugh Silt Loam	В							
Vanadalia Silt Loam	D							
		Total CN X Area / Total A Weighted Curve Naximum Retention, S in	lumber				10.86	761.8
2	Ru 24 hour Rei	Return Period in years infall Depth, P in inches inoff Depth, Q in inches nfall Depth from Table 4-11 in from Table 4-12 or Char	3. 1.	5)	Storn 100 5.2 2,2	5		

Source: Urban Hydrology for Small Watersheds, TR-55, June 1986

Worksheet 4-2 Time of Concentration Calculation

WORKSHEET 4-2 TIME OF CONC	CENTRATION COMPUTATION
CALCULATED BY: REK DATE: 07-21-14 CHECKED BY: BEK DATE: 07-21-14	PROJECT NAME: Sheep Run Bridge Replace STATE PROJECT NUMBER:
Space for two sections per flow type	can be used for each worksheet.
Include a map, schematic or desc	ription of the flow segements
OVERLAND FLOW SEGMENT. SHEET FLOW TYPE	
Surface description (Table 4-5)	bee recached
Roughness coeff. n (Table 4-5)	calculation sheets
Flow length L in ft (should be ≤ 100 ft)	for Tc for South Fork Hughes River
2 Yr 24 Hr rainfall depth P in inches (Map 4-3)	& Sheep Run
Land slope S in ft /ft	Watersheds.
Computed travel time T _t in hours	
	- <u>-</u>
OVERLAND FLOW SEGMENT, SHALLOW CONCENTRATED F	LOW TYPE
Section ID	
Cover type	
Surface cover coefficient in equation	
Watercourse slope S in ft / ft	
Average velocity V in ft / s (Chart 4-7)	
Flow length in ft	
Computed travel time T_t in hours	+ = =
	ntrated flow should be < 200° urban areas, < 400° rural areas)
CHANNEL FLOW SEGMENT	
Section ID	
Cross sectional flow area A in ft ²	
Wetted flow perimter P in ft	
Hydraulic radius $R = A/P$ in ft	
Channel slope S in ft / ft	
Mannings roughness coeff. n (Table 4-7)	
Velocity from Mannings equation, V in ft / s	
Flow length L in ft	
Computed travel time Tt in hours	+ =
Watershed	d time of concentration T _c in <u>hours</u>

Source: Urban Hydrology for Small Watersheds, TR-55, June 1986

Hyd. No. 1

So Fork Hughes River Storm frequency = 10 yrs

Sheet Flow

Manning's n-value = 0.400 Flow length = 100.0 ft Two-year 24-hr precip. = 2.55 in Land slope = 25.0 %

Travel Time = 8.8 min

Shallow Concentrated Flow

Flow length = 300 ft
Watercourse slope = 28.0 %
Surface description = Unpaved
Average velocity = 8.54 ft/s

Travel Time = 0.6 min

Channel Flow

Cross section flow area = 80.0 sqft
Wetted perimeter = 24.0 ft
Channel slope = 0.8 %
Manning's n-value = 0.035
Velocity = 8.53 ft/s
Flow length = 34140.0 ft

Travel Time = 66.7 min

Total Travel Time, Tc = 76.0 min

Hyd. No. 2

Sheep Run Storm frequency = 10 yrs

Sheet Flow

Manning's n-value = 0.550Flow length $= 100.0 \, ft$ Two-year 24-hr precip. = 2.55 in Land slope = 18.0 %
Travel Time Land slope

= 12.9 min

Shallow Concentrated Flow

Flow length = 300 ftWatercourse slope = 13.0 % = Unpaved Surface description Average velocity = 5.82 ft/s

Travel Time = 0.9 min

Channel Flow

Cross section flow area = 18.4 sqft Wetted perimeter $= 9.5 \, \mathrm{ft}$ Channel slope = 3.6 % Manning's n-value = 0.040Velocity = 11.01 ft/sFlow length = 10290.0 ft

Travel Time = 15.6 min

Total Travel Time, Tc $= 29.3 \min$

Form 4-1 Peak Discharge Computation Form

PEAK DIS	CHARGE COMPUTATION FORM D	R 4-1	
CALCULATED BY: BEK CHECKED BY: BEK	DATE: 07-21-14 PROJECT NAME: 07-21-14 STATE PROJECT N	Sheep Run Bridge Replanation	ace:
LOCATION DESCRIPTION: SO. FORK H	lughes River	TO ERIOD:10YEARS	
RATIONAL METHOD N.A.		USGS METHOD 10 square miles - 1,619 equare miles	
TIME OF CONCENTRATION OVERLAND FLOW SHEET FLOW	INFO FROM WORKSHEET 4-1 CN = 70.2 24 hr P = 3.5 in.	REGION: FROM MAP 4-9	
T _{teh} = Min.	Runoff Depth Q = 1.0 in.	EASTERN PANHANDLE	
SHALLOW CONCENTRATED FLOW	INFO FROM WORKSHEET 4-2	CENTRAL MOUNTAINS	
T _{t so} = Min.	T _c = 1.27 hr. INITIAL ABSTRATION (Table 4-13)	WESTERN PLATEAUS 🔨	
$T_{t ch} = $ Min. $T_{c} = T_{tah} + T_{tac} + T_{tch} = $ Min.	i = 0.85 in. i = 0.24	EQUATION: 14	
Method: Kirpich (rural areas) Segments (urban areas)	UNIT PEAK DISCHARGE qu		
IDF REGION in/hr	USE To AND I a / P WITH CHART 4-8 $= 260 cfs / mi^2 / in$	Eqn: 292A ^{0.699} = 1,546.8 cfs	
C A CA	POND AND SWAMP AREAS	PRELIMINARY DESIGN	
	Percent of watershed	DRAINAGE AREA 5 TO 10 MI 2	
Total	= <u>0</u> % (Table 4-8) Factor F _p = <u>1.0</u>	ADD THE STANDARD PREDICITION ERROR	
	PEAK DISCHARGE	= <u>29.7</u> %	
Weighted Coefficient "C" = C = Σ (CA)/ΣA	$q_p = q_{ij} (A \text{ in mi}^2) Q F_p$	= 459.4 cfs	
Q =cfs	q _p = <u>2,825</u> cfs	Q = 2,006 cfs	
SELECTED DESIGN REASON FO DISCHARGE (BASED ON SEE SECTION SECTION SEE SECTION SECTION SEE SECTION SECTION SECTION SEE SECTION	N 4.3.4 South Fork Hu	X.A. Peak Discharge ghes River - H & H	
	Report.		

Source: Created by the WVDOH Hydraulic and Drainage Unit

Hydrograph Plot

English

Hyd. No. 1

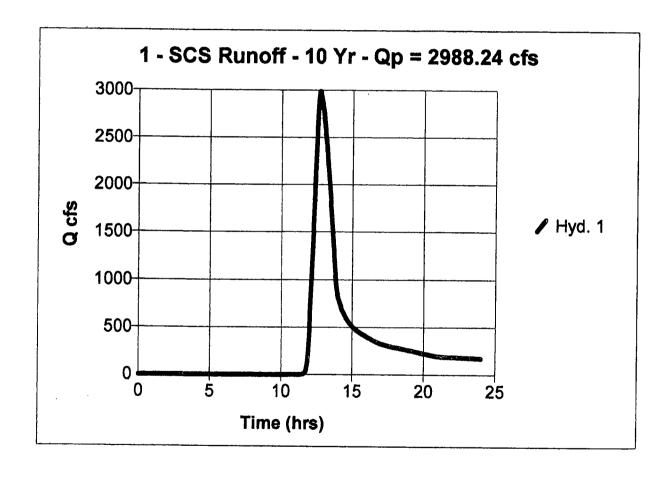
So Fork Hughes River

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Drainage area = 6950.00 ac
Basin Slope = 0.0 %
Tc method = TR55

Total precip. = 3.50 in Storm duration = 24 hrs Peak discharge = 2988.24 cfs Time interval = 1 min

Time interval = 1 min
Curve number = 70.2
Hydraulic length = 0 ft
Time of conc. (Tc) = 76 min
Distribution = Type II
Shape factor = 484

Total Volume = 25,145,960 cuft



Hyd. No. 1

So Fork Hughes River Storm frequency = 10 yrs

Sheet Flow

Manning's n-value = 0.400Flow length = 100.0 ftTwo-year 24-hr precip. = 2.55 in Land slope = 25.0 %

Travel Time = 8.8 min

Shallow Concentrated Flow

Flow length = 300 ftWatercourse slope = 28.0 %
Surface description = Unpaved
Average velocity = 8.54 ft/s

Travel Time

= 0.6 min

Channel Flow

Cross section flow area = 80.0 sqft Wetted perimeter = 24.0 ft Channel slope = 0.8 % Manning's n-value = 0.035 Velocity = 8.53 ft/sFlow length = 34140.0 ft

Travel Time = 66.7 min

Total Travel Time, Tc = 76.0 min

English

Hyd. No. 1

So Fork Hughes River

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Drainage area = 6950.00 ac
Basin Slope = 0.0 %
Tc method = TR55
Total precip. = 3.50 in
Storm duration = 24 hrs

Peak discharge = 2988.24 cfs
Time interval = 1 min
Curve number = 70.2

Curve number = 70.2

Hydraulic length = 0 ft

Time of conc. (Tc) = 76 min

Distribution = Type II

Shape factor = 484

Total Volume = 25,145,960 cuft

Hydrograph Discharge Table

Time Outflow		Time	Time Outflow		Outflow	Time Outflow		
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	
11.70	33.21	12.23	1459.71	12.77	2947.23	13.30	2150 50	
11.72	39.29	12.25	1528.49	12.78	2933.92	13.32	2150.50 2116.90	
11.73	46.44	12.27	1597.70	12.80	2919.69	13.33	2082.96	
11.75	54.82	12.28	1667.34	12.82	2904.54	13.35	2048.70	
11.77	64.64	12.30	1737.32	12.83	2888.49	13.37	2014.10	
11.78	76.24	12.32	1807.58	12.85	2871.55	13.38	1979.19	
11.80	90.01	12.33	1878.02	12.87	2853.75	13.40	1943.96	
11.82	106.38	12.35	1948.54	12.88	2835.10	13.42	1908.42	
11.83	125.81	12.37	2019.02	12,90	2815.61	13.43	1872.58	
11.85	148.83	12.38	2089.34	12.92	2795.31	13.45	1836.44	
11.87	176.03	12.40	2159.35	12.93	2774.21	13.47	1800.01	
11.88	208.03	12.42	2228.89	12.95	2752.34	13.48	1763.29	
11.90	245.51	12.43	2297.77	12.97	2729.71	13.50	1726.30	
11.92	289.18	12.45	2365.80	12.98	2706.33	13.52	1689.05	
11.93	337.14	12.47	2432.76	13.00	2682.23	13.53	1651.57	
11.95	389.19	12.48	2498.43	13.02	2657.43	13.55	1613.86	
11.97	444.46	12.50	2562.53	13.03	2631.96	13.57	1575.96	
11.98	502.06	12.52	2624.71	13.05	2605.82	13.58	1537.91	
12.00	560.94	12.53	2684.42	13.07	2579.05	13.60	1499.73	
12.02	620.60	12.55	2741.05	13.08	2551.67	13.62	1461.48	
12.03	681.03	12.57	2793.91	13.10	2523.69	13.63	1423.19	
12.05	742.21	12.58	2842.23	13.12	2495.14	13.65	1384.92	
12.07	804.12	12.60	2885.19	13.13	2466.06	13.67	1346.73	
12.08	866.75	12.62	2921.84	13.15	2436.45	13.68	1308.69	
12.10	930.08	12.63	2951.16	13.17	2406.34	13.70	1270.87	
12.12	994.10	12.65	2972.07	13.18	2375.76	13.72	1233.34	
12.13	1058.77	12.67	2983.41	13.20	2344.74	13.73	1196.20	
12.15	1124.10	12.68	2988.24 <<	13.22	2313.30	13.75	1159.54	
12.17	1190.05	12.70	2986.84	13.23	2281.46	13.77	1123.49	
12.18	1256.60	12.72	2980.60	13.25	2249.25	13.78	1088.27	
12.20	1323.74	12.73	2970.97	13.27	2216.68	13.80	1054.09	
12.22	1391.45	12.75	2959.58	13.28	2183.77	13.82	1021.23	

Time	Outflow	Time	Outflow	Time	Outflow	Time	Outflow
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)
•	•	•	,	(J.,	(0.07
13.83	989.96	14.65	571.79	15.47	449.64	16.28	377.70
13.85	960.60	14.67	568.01	15.48	447.99	16.30	376.30
13.87	933.50	14.68	564.30	15.50	446.35	16.32	374.91
13.88	909.04	14.70	560.66	15.52	444.73	16.33	373.52
13.90	887.64	14.72	557.10	15.53	443.12	16.35	372.14
13.92	869.72	14.73	553.61	15.55	441.53	16.37	370.76
13.93	854.14	14.75	550.19	15.57	439.96	16.38	369.40
13.95	840.79	14.77	546.84	15.58	438.39	16.40	368.03
13.97	829.15	14.78	543.56	15.60	436.84	16.42	366.68
13.98	818.69	14.80	540.36	15.62	435.31	16.43	365.33
14.00	808.78	14.82	537.21	15.63	433.78	16.45	364.00
14.02	799.14	14.83	534.14	15.65	432.26	16.47	362.67
14.03	789.75	14.85	531.12	15.67	430.76	16.48	361.35
14.05	780.61	14.87	528.17	15.68	429.26	16.50	360.04
14.07	771.72	14.88	525.27	15.70	427.78	16.52	358.74
14.08	763.07	14.90	522.43	15.72	426.30	16.53	357.45
14.10	754.66	14.92	519.65	15.73	424.83	16.55	356.18
14.12	746.49	14.93	516.91	15.75	423.37	16.57	354.91
14.13	738.54	14.95	514.23	15.77	421.91	16.58	353.66
14.15	730.81	14.97	511.60	15.78	420.46	16.60	352.41
14.17	723.30	14.98	509.01	15.80	419.02	16.62	351.19
14.18	716.00	15.00	506.47	15.82	417.58	16.63	349.97
14.20	708.91	15.02	503.97	15.83	416.15	16.65	348.77
14.22	702.02	15.03	501.52	15.85	414.71	16.67	347.58
14.23	695.33	15.05	499.11	15.87	413.29	16.68	346.40
14.25	688.83	15.07	496.73	15.88	411.86	16.70	345.24
14.27	682.50	15.08	494.40	15.90	410.44	16.72	344.10
14.28	676.36	15.10	492.11	15.92	409.02	16.73	342.97
14.30	670.38	15.12	489.85	15.93	407.60	16.75	341.85
14.32	664.57	15.13	487.63	15.95	406.17	16.77	340.76
14.33	658.91	15.15	485.45	15.97	404.75	16.78	339.67
14.35	653.40	15.17	483.30	15.98	403.33	16.80	338.61
14.37	648.03	15.18	481.19	16.00	401.90	16.82	337.56
14.38	642.79	15.20	479.11	16.02	400.48	16.83	336.52
14.40	637.67	15.22	477.06	16.03	399.05	16.85	335.50
14.42	632,68	15.23	475.05	16.05	397.62	16.87	334.49
14.43	627.79	15.25	473.06	16.07	396.19	16.88	333.50
14.45	623.00	15.27	471.11	16.08	394.76	16.90	332.53
14.47	618.31	15.28	469.18	16.10	393.33	16.92	331.56
14.48	613.71	15.30	467.29	16.12	391.90	16.93	330.61
14.50	609.18	15.32	465.41	16.13	390.47	16.95	329.68
14.52	604.73	15.33	463.57	16.15	389.04	16.97	328.76
14.53	600.36	15.35	461.75	16.17	387.61	16.98	327.85
14.55	596.05	15.37	459.96	16.18	386.19	17.00	326.95
14.57	591.82	15.38	458.18	16.20	384.76	17.02	326.07
14.58	587.67	15.40	456.43	16.22	383.34	17.03	325.20
14.60	583.59	15.42	454.71	16.23	381.93	17.05	324.34
14.62	579.58	15.43	453.00	16.25	380.52	17.07	323.50
14:63	575.65	15.45	451.31	16.27	379.11	17.07	
	-, -, -, -	10.70	-101.01	10.21	3/3.[]	17.00	322.66

Time	Time Outflow Time Outflow			Time	- Outflow	Time	Time Outflow		
(hrs	cfs)	(hrs	cfs)		(hrs	cfs)	(hrs	cfs)	
•	•	(5.5,		\	0.0,	(1113	0.3)	
17.10	321.84	17.92	291.35		18.73	265.49	19.55	238.56	
17.12	321.03	17.93	290.83		18.75	264.95	19.57	238.00	
17.13	320.23	17.95	290.31		18.77	264.41	19.58	237.44	
17.15	319.44	17.97	289.79		18.78	263.87	19.60	236.88	
17.17	318.66	17.98	289.28		18.80	263.33	19.62	236.32	
17.18	317.90	18.00	288.76		18.82	262.78	19.63	235.76	
. 17.20	317.14	18.02	288.24		18.83	262.24	19.65	235.20	
17.22	316.40	18.03	287.72		18.85	261.70	19.67	234.64	
17.23	315.66	18.05	287.20		18.87	261.16	19.68	234.08	
17.25	314.93	18.07	286.68		18.88	260.62	19.70	233.52	
17.27	314.22	18.08	286.16		18.90	260.07	19.72	232.95	
17.28	313.51	18.10	285.64		18.92	259.53	19.73	232.39	
17.30	312.81	18.12	285.12		18.93	258.98	19.75	231.83	
17.32	312.12	18.13	284.60		18.95	258.44	19.77	231.26	
17.33	311.44	18.15	284.07		18.97	257.89	19.78	230.70	
17.35	310.77	18.17	283,55		18.98	257.35	19.80	230.13	
17.37	310.11	18.18	283.03		19.00	256.80	19.82	229.57	
17.38	309.45	18.20	282.50		19.02	256.26	19.83	229.00	
17.40	308.80	18.22	281.98		19.03	255.71	19.85	228.44	
17.42	308.16	18.23	281.45		19.05	255.16	19.87	227.87	
17.43	307.53	18.25	280.93		19.07	254.62	19.88	227.30	
17.45	306.90	18.27	280.40		19.08	254.07	19.90	226.74	
17.47	306.28	18.28	279.88		19.10	253.52	19.92	226.17	
17.48	305.67	18.30	279.35		19.12	252.97	19.93	225.60	
17.50	305.06	18.32	278.82		19.13	252.42	19.95	225.04	
17.52	304.46	18.33	278.29		19.15	251.87	19.97	224.47	
17.53	303.87	18.35	277.76		19.17	251.32	19.98	223.90	
17.55	303.28	18.37	277.24		19.18	250.77	20.00	223.33	
17.57	302.70	18.38	276.71		19.20	250.22	20.02	222.76	
17.58	302.12	18.40	276.18		19.22	249.67	20.03	222.19	
17.60	301.55	18.42	275.65		19.23	249.12	20.05	221.62	
17.62	300.98	18.43	275.12		19.25	248.57	20.07	221.05	
17.63	300.42	18.45	274.58		19.27	248.01	20.08	220.49	
17.65	299.86	18.47	274.05		19.28	247.46	20.10	219.92	
17.67	299.31	18.48	273.52		19.30	246.91	20.12	219.35	
17.68	298.76	18.50	272.99		19.32	246.35	20.13	218.79	
17.70	298.21	18.52	272.46		19.33	245.80	20.15	218.22	
17.72	297.67	18.53	271.92		19.35	245.25	20.17	217.66	
17.73	297.13	18.55	271.39		19.37	244.69	20.18	217.10	
17.75	296.59	18.57	270.85		19.38	244.14	20.20	216.54	
17.77	296.06	18.58	270.32		19.40	243.58	20.22	215.98	
17.78	295.53	18.60	269.78		19.42	243.02	20.23	215.42	
17.80	295.00	18.62	269.25		19.43	242.47	20.25	214.87	
17.82 17.83	294.47	18.63	268.71		19.45	241.91	20.27	214.32	
17.85	293.95	18.65	268.18		19.47	241.35	20.28	213.77	
17.85	293.43	18.67	267.64		19.48	240.80	20.30	213.23	
17.88	292.90	18.68	267.10		19.50	240.24	20.32	212.68	
17.88	292.38	18.70	266.56	-	19.52	239.68	20.33	212.14	
17.50	291.87	18.72	266.02		19.53	239.12	20.35	211.61	

Time	Outflow	Time	Outflow	Time	Outflow	Time	Outflow
hrs (hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)
		·	-	•	•	•	•
20.37	211.08	21.18	192.41	22.00	185.59	22.82	180.69
20.38	210.55	21.20	192.18	22.02	185.49	22.83	180.59
20.40	210.03	21.22	191.97	22.03	185.39	22.85	180.49
20.42	209.51	.21.23	191.76	22.05	185.29	22.87	180.39
20.43	208.99	21.25	191.55	22.07	185.19	22.88	180.29
20.45	208.48	21.27	191.35	22.08	185.09	22.90	180.18
20.47	207.97	21.28	191.16	22.10	184.99	22.92	180.08
20.48	207.47	21.30	190.96	22.12	184.90	22.93	179.98
20.50	206.97	21.32	190.78	22.13	184.80	22.95	179.88
20.52	206.48	21.33	190.59	22.15	184.70	22.97	179.78
20.53	206.00	21.35	190.42	22.17	184.60	22.98	179.67
20.55	205.52	21.37	190.24	22.18	184.50	23.00	179.57
20.57	205.04	21.38	190.07	22.20	184.40	23.02	179.47
20.58	204.58	21.40	189.90	22.22	184.30	23.03	179.37
20.60	204.11	21.42	189.74	22.23	184.20	23.05	179.27
20.62	203.66	21.43	189.58	22.25	184.10	23.07	179.16
20.63	203.21	21.45	189.43	22.27	184.00	23.08	179.06
20.65	202.77	21.47	189.27	22.28	183.90	23.10	178.96
20.67	202.33	21.48	189.12	22.30	183.80	23.12	178.86
20.68	201.90	21.50	188.98	22.32	183.70	23.13	178.76
20.70	201.48	21.52	188.84	22.33	183.61	23.15	178.65
20.72	201.07	21.53	188.70	22.35	183.51	23,17	178.55
20.73	200.66	21.55	188.56	22.37	183.41	23.18	178.45
20.75	200.27	21.57	188.43	22.38	183.31	23.20	178.35
20.77	199.88	21.58	188.30	22.40	183.21	23.22	178.24
20.78	199.50	21.60	188.17	22.42	183.11	23.23	178.14
20.80	199.12	21.62	188.04	22.43	183.01	23.25	178.04
20.82	198.76	21.63	187.92	22.45	182.91	23.27	177.93
20.83	198.40	21.65	187.80	22.47	182.81	23.28	177.83
20.85	198.04	21.67	187.68	22.48	182.71	23.30	177.73
20.87	197.70	21.68	187.56	22.50	182.61	23.32	177.63
20.88	197.36	21.70	187.45	22.52	182.51	23.33	177.52
20.90	197.03	21.72	187.33	22.53	182.41	23.35	177.42
20.92	196.71	21.73	187.22	22.55	182.30	23.37	177.32
20.93	196.39	21.75	187.11	22.57	182.20	23.38	177.21
20.95	196.08	21.77	187.00	22.58	182.10	23.40	177.11
20.97	195.78	21.78	186.90	22.60	182.00	23.42	177.01
20.98	195.49	21.80	186.79	22.62	181.90	23.43	176.90
21.00	195.20	21.82	186.69	22.63	181.80	23.45	176.80
21.02	194.91	21.83	186.58	22.65	181.70	23.47	176.70
21.03	194.64	21.85	186.48	22.67	181.60	23.48	176.59
21.05	194.36	21.87	186.38	22.68	181.50	23.50	176.49
21.07	194.10	21.88	186.28	22.70	181.40	23,52	176.39
21.08	193.84	21.90	186.18	22.72	181.30	23.53	176.28
21.10	193.59	21.92	186.08	22.73	181.20	23.55	176.18
21.12	193.34	21.93	185.98	22.75	181.10	23.57	176.08
21.13	193.10	21.95	185.88	22.77	180.99	23.58	175.97
21.15	192.86	21.97	185.78	22.78	180.89	23.60	175.87
21.17	192.63	21.98	185.68	22.80	180.79	23.62	175.76
	= =					_0,0_	110,10

Time (hrs	Outflow cfs)
23.63	175.66
23.65	175.56
23.67	175.45
23.68	175.35
23.70	175.24
23.72	175.14
23.73	175.03
23.75	174.93
23.77	174.83
23.78	174.72
23.80	174.62
23.82	174.51
23.83	174.41
23.85	174.30
23.87	174.20
23.88	174.09
23.90	173.99
23.92	173.88
23.93	173.78
23.95	173.67
23.97	173.57
23.98	173.46

...End

Hydrograph Plot

English

Hyd. No. 2

Sheep Run

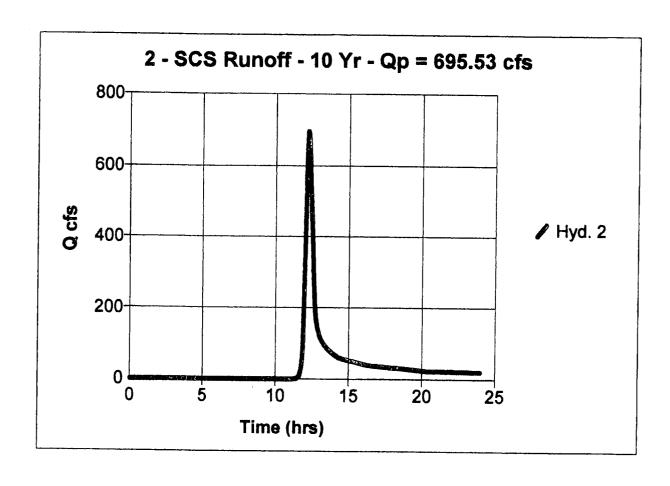
Hydrograph type = SCS Runoff Storm frequency = 10 yrs

Drainage area = 825.00 ac Basin Slope = 0.0 % Tc method = TR55

Total precip. = 3.50 in Storm duration = 24 hrs Peak discharge = 695.53 cfs
Time interval = 1 min
Curve number = 70.2
Hydraulic length = 0 ft
Time of conc. (Tc) = 29.3 min

Distribution = Type II
Shape factor = 484

Total Volume = 3,025,497 cuft



Hyd. No. 2

Sheep Run Storm frequency = 10 yrs

Sheet Flow

Manning's n-value = 0.550 Flow length = 100.0 ft Two-year 24-hr precip. = 2.55 in Land slope = 18.0 %

Land slope = 18.0 %

Travel Time = 12.9 min

Shallow Concentrated Flow

Flow length = 300 ft
Watercourse slope = 13.0 %
Surface description = Unpaved
Average velocity = 5.82 ft/s

Travel Time = 0.9 min

Channel Flow

Cross section flow area = 18.4 sqft
Wetted perimeter = 9.5 ft
Channel slope = 3.6 %
Manning's n-value = 0.040
Velocity = 11.01 ft/s
Flow length = 10290.0 ft

Travel Time = 15.6 min

Total Travel Time, Tc = 29.3 min

English

Hyd. No. 2

Sheep Run

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Drainage area = 825.00 ac
Basin Slope = 0.0 %
Tc method = TR55
Total precip. = 3.50 in
Storm duration = 24 hrs

Peak discharge = 695.53 cfs
Time interval = 1 min
Curve number = 70.2
Hydraulic length = 0 ft
Time of conc. (Tc) = 29.3 min
Distribution = Type II

Shape factor = 484

Total Volume = 3,025,497 cuft

Hydrograph Discharge Table

Time Outflow		Time	Time Outflow		Outflow	Time Outflow		
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	
11.58	7.41	12.12	613.21	10.65	206.40	10.10	101.00	
11.60	8.56	12.13	638.56	12.65 12.67	226.10	13.18	104.23	
11.62	9.93	12.15	660.21	12.68	210.80	13.20	103.08	
11.63	11.59	12.17	677.43	12.70	197.30 185.92	13.22	101.98	
11.65	13.58	12.18	689.48	12.70	176.98	13.23	100.91	
11.67	15.97	12.20	695.53 <<	12.72	169.66	13.25	99.88	
11.68	18.82	12.22	694.72	12.75	163.90	13.27	98.88	
11.70	22.23	12.23	689.33	12.77	159.32	13.28	97.91	
11.72	26.28	12.25	679.54	12.77	155.53	13.30 13.32	96.96	
11.73	31.07	12.27	666.38	12.70	152.11	13.32	96.03	
11.75	36.70	12.28	650.93	12.82	148.82	13.35	95,12 94,24	
11.77	43.33	12.30	634.38	12.83	145.68	13.37	94.24 93.36	
11.78	51.22	12.32	617.34	12.85	142.67	13.38	93.30	
11.80	60.63	12.33	599.82	12.87	139.79	13.40	91.67	
11.82	71.83	12.35	581.82	12.88	137.04	13.42	90.85	
11.83	85.17	12.37	563.37	12.90	134.41	13.43	90.05	
11.85	101.00	12.38	544.50	12.92	131.90	13.45	89.26	
11.87	119.70	12.40	525.23	12.93	129.50	13.47	88.48	
11.88	141.70	12.42	505.59	12.95	127.21	13.48	87.72	
11.90	167.42	12.43	485.62	12.97	125.03	13.50	8 6.97	
11.92	197.32	12.45	465.36	12.98	122.94	13.52	86.24	
11.93	229.91	12.47	444.86	13.00	120.95	13.53	85.51	
11.95	264.96	12.48	424.15	13.02	119.06	13.55	84.79	
11.97	301.70	12.50	403.31	13.03	117.24	13.57	84.09	
11.98	339.36	12.52	382.38	13.05	115.51	13.58	83.40	
12.00	377.03	12.53	361.46	13.07	113.87	13.60	82.72	
12.02	414.20	12.55	340.61	13.08	112.29	13.62	82.05	
12.03	450.69	12.57	319.96	13.10	110.79	13.63	81.39	
12.05	486.33	12.58	299.67	13.12	109.36	13.65	80.73	
12.07	520.83	12.60	279.92	13.13	107.99	13.67	80.09	
12.08	553.80	12.62	260.92	13.15	106.68	13.68	79.46	
12.10	584.76	12.63	242.90	13.17	105.43	13.70	78.84	

Time	Outflow	Time	Outflow	Time	- Outflow	Time	Outflow
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	
(0.07	(1113	UI3)	(iii)	Cisj	(1113	cfs)
13.72	78.22	14.53	56.97	15.35	48.79	16.17	40.32
13.73	77.61	14.55	56.76	15.37	48.62	16.17	40.32
13.75	77.02	14.57	56.56	15.38	48.45	16.20	39.99
13.77	76.42	14.58	56.37	15.40	48.28	16.22	39.84
13.78	75.84	14.60	56.18	15.42	48.11	16.23	39.69
13.80	75.26	14.62	56.00	15.43	47.94	16.25	39.54
13.82	74.69	14.63	55.82	15.45	47.78	16.27	39.40
13.83	74.13	14.65	55.64	15.47	47.61	16.28	39.26
13.85	73.57	14.67	55.47	15.48	47.44	16.30	39.12
13.87	73.02	14.68	55.31	15.50	47.27	16.32	38.99
13.88	72.48	14.70	55.14	15.52	47.09	16.33	38.87
13.90	71.94	14.72	54.98	15.53	46.92	16.35	38.75
13.92	71.40	14.73	54.82	15.55	46.75	16.37	38.63
13.93	70.87	14.75	54.66	15.57	46.58	16.38	38.52
13.95	70.35	14.77	54.50	15.58	46.41	16.40	38.42
13.97	69.83	14.78	54.34	15.60	46.24	16.42	38.31
13.98	69.31	14.80	54.18	15.62	46.07	16.43	38.22
14.00	68.80	14.82	54.02	15.63	45.89	16.45	38.12
14.02	68.29	14.83	53.86	15.65	45.72	16.47	38.03
14.03	67.79	14.85	53.70	15.67	45.55	16.48	37.94
14.05	67.29	14.87	53.55	15.68	45.38	16.50	37.85
14.07	66.79	14.88	53.39	15.70	45.20	16.52	37.77
14.08	66.31	14.90	53.22	15.72	45.03	16.53	37.69
14.10	65.83	14.92	53.06	15.73	44.86	16.55	37.61
14.12	65.35	14.93	52.90	15.75	44.68	16.57	37.54
14.13	64.89	14.95	52.74	15.77	44.51	16.58	37.47
14.15	64.43	14.97	52.58	15.78	44.33	16.60	37.39
14.17 14.18	63.99	14.98	52.42	15.80	44.16	16.62	37.33
14.10	63.55 63.12	15.00	52.26	15.82	43.98	16.63	37.26
14.22	62.70	15.02	52.09	15.83	43.81	16.65	37.19
14.23	62.29	15.03 15.05	51.93	15.85	43.63	16.67	37.13
14.25	61.90	15.05 15.07	51.77 51.61	15.87	43.46	16.68	37.07
14.27	61.52	15.07 15.08	51.61 51.44	15.88 15.90	43.28	16.70	37.00
14.28	61.15	15.10	51. 44 51.28		43.11	16.72	36.94
14.30	60.79	15.12	51.11	15.92 15.93	42.93 42.75	16.73	36.88
14.32	60.44	15.12	50.95	15.95	42.75 42.58	16.75	36.82
14.33	60.11	15.15	50.79	15.97	42.56 42.40	16.77 16.78	36.76 36.74
14.35	59.79	15.17	50.62	15.98	42.22	16.80	36.71 36.65
14.37	59.49	15.18	50.46	16.00	42.04	16.82	36.59
14.38	59.19	15.20	50.29	16.02	41.87	16.83	36.53
14.40	58.91	15.22	50.12	16.03	41.69	16.85	36.47
14.42	58.63	15.23	49.96	16.05	41.51	16.87	36.41
14.43	58.37	15.25	49.79	16.07	41.34	16.88	36.35
14.45	58.11	15.27	49.63	16.08	41.16	16.90	36.29
14.47	57.87	15.28	49.46	16.10	40.99	16.92	36.23
14.48	57.63	15.30	49.29	16.12	40.82	16.93	36.17
14.50	57.40	15.32	49.12	16.13	40.65	16.95	36.11
14.52	57.18	15.33	48.96	16.15	40.48	16.97	36.05
				-	· · · · · ·		

Time	Outflow	Time	Outflow	Time -	- Outflow	Time	Outflow
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)
	•	•	,	(****	0.0,	(1110	UIG)
16.98	35.99	17.80	32.99	18.62	29.85	19.43	26.59
17.00	35.93	17.82	32.92	18.63	29.78	19.45	26.52
17.02	35.87	17.83	32.86	18.65	29.72	19.47	26.45
17.03	35.81	17.85	32.80	18.67	29.65	19.48	26.39
17.05	35.75	17.87	32.74	18.68	29.58	19.50	26.32
17.07	35.69	17.88	32.67	18.70	29.52	19.52	26.25
17.08	35.63	17.90	32.61	18.72	29.45	19.53	26.18
17.10	35.57	17.92	32.55	18.73	29.39	19.55	26.11
17.12	35.51	17.93	32.48	18.75	29.32	19.57	26.05
17.13	35.45	17.95	32.42	18.77	29.26	19.58	25.98
17.15	35.39	17.97	32.36	18.78	29.19	19.60	25.91
17.17	35.33	17.98	32.29	18.80	29.12	19.62	25.84
17.18	35.27	18.00	32.23	18.82	29.06	19.63	25.78
17.20	35.21	18.02	32.17	18.83	28.99	19.65	25.71
17.22	35.15	18.03	32.10	18.85	28.93	19.67	25.64
17.23	35.09	18.05	32.04	18.87	28.86	19.68	25.57
17.25	35.03	18.07	31.97	18.88	28.79	19.70	25.50
17.27	34.97	18.08	31.91	18.90	28.73	19.72	25.43
17.28	34.91	18.10	31.85	18.92	28.66	19.73	25.37
17.30	34.84	18.12	31.78	18.93	28.60	19.75	25.30
17.32	34.78	18.13	31.72	18.95	28.53	19.77	25.23
17.33	34.72	18.15	31.66	18.97	28.46	19.78	25.16
17.35	34.66	18.17	31.59	18.98	28.40	19.80	25.09
17.37	34.60	18.18	31.53	19.00	28.33	19.82	25.02
17.38	34.54	18.20	31.46	19.02	28.26	19.83	24.96
17.40	34.48	18.22	31.40	19.03	28.20	19.85	24.89
17.42	34.42	18.23	31.34	19.05	28.13	19.87	24.82
17.43	34.35	18.25	31.27	19.07	28.06	19.88	24.75
17.45	34.29	18.27	31.21	19.08	28.00	19.90	24.68
17.47	34.23	18.28	31.14	19.10	27.93	19.92	24.61
17.48	34.17	18.30	31.08	19.12	27.86	19.93	24.54
17.50	34.11	18.32	31.01	19.13	27.80	19.95	24.48
17.52	34.05	18.33	30.95	19.15	27.73	19.97	24.41
17.53	33.98	18.35	30.89	19.17	27.66	19.98	24.34
17.55 17.57	33.92	18.37	30.82	19.18	27.60	20.00	24.27
	33.86	18.38	30.76	19.20	27.53	20.02	24.20
17.58	33.80	18.40	30.69	19.22	27.46	20.03	24.13
17.60	33.74	18.42	30.63	19.23	27.40	20.05	24.06
17.62	33.67	18.43	30.56	19.25	27.33	20.07	24.00
17.63	33.61	18.45	30.50	19.27	27.26	20.08	23.93
17.65	33.55	18.47	30.43	19.28	27.19	20.10	23.86
17.67	33.49	18.48	30.37	19.30	27.13	20.12	23.80
17.68	33.42	18.50	30.30	19.32	27.06	20.13	23.73
17.70	33.36	18.52	30.24	19.33	26.99	20.15	23.67
17.72	33.30	18.53	30.17	19.35	26.93	20.17	23.61
17.73	33.24	18.55	30.11	19.37	26.86	20.18	23.54
17.75 17.77	33.17	18.57	30.04	19.38	26.79	20.20	23.48
17.77	33.11	18.58	29.98	19.40	26.72	20.22	23.43
17.78	33.05	18.60	29.91	19.42	26.66	20.23	23.37

Time	Outflow	Time	Outflow	Time	Outflow	Time	Outflow
(hrs	cfs)	(hrs	cfs)	(hrs			
(1110	Olaj	(1119	Cisj	(1113	cfs)	(hrs	cfs)
20.25	23.32	21.07	22.30	21.88	21.73	22.70	24.4.4
20.27	23.26	21.08	22.29	21.90	21.73		21.14
20.28	23.21	21.10	22.28	21.92	21.70	22.72	21.12
20.30	23.17	21.12	22.26	21.93	21.70	22.73 22.75	21.11
20.32	23.12	21.13	22.25	21.95	21.68	22.75	21.10
20.33	23.08	21.15	22.24	21.97	21.67	22.77	21.09
20.35	23.04	21.17	22.23	21.98	21.65	22.78 22.80	21.07
20.37	23.00	21.18	22.22	22.00	21.64	22.80 22.82	21.06
20.38	22.96	21.20	22.21	22.02	21.63	22.83	21.05
20.40	22.93	21.22	22.19	22.02	21.62		21.04
20.42	22.90	21.23	22.18	22.05	21.61	22.85 22.87	21.03
20.43	22.87	21.25	22.17	22.07	21.59	22.88 22.88	21.01 21.00
20.45	22.84	21.27	22.16	22.08	21.58	22.90	20.99
20.47	22.81	21.28	22.15	22.10	21.57	22.92	20.98
20.48	22.78	21.30	22.14	22.12	21.56	22.93	20.96
20.50	22.76	21.32	22.13	22.13	21.55	22.95	20.95
20.52	22.74	21.33	22.11	22.15	21.53	22.97	20.94
20.53	22.71	21.35	22.10	22.17	21.52	22.98	20.93
20.55	22.69	21.37	22.09	22.18	21.51	23.00	20.92
20.57	22.67	21.38	22.08	22.20	21.50	23.02	20.90
20.58	22.66	21.40	22.07	22.22	21.49	23.03	20.89
20.60	22.64	21,42	22.06	22.23	21.47	23.05	20.88
20.62	22.62	21.43	22.04	22.25	21.46	23.07	20.87
20.63	22.61	21.45	22.03	22.27	21.45	23.08	20.85
20.65	22.59	21.47	22.02	22.28	21.44	23.10	20.84
20.67	22.58	21.48	22.01	22.30	21.43	23.12	20.83
20.68	22.57	21.50	22.00	22.32	21.41	23.13	20.82
20.70	22.55	21.52	21.99	22.33	21.40	23.15	20.80
20.72	22.54	21.53	21.97	22.35	21.39	23.17	20.79
20.73	22.53	21.55	21.96	22.37	21.38	23.18	20.78
20.75	22.52	21.57	21.95	22.38	21.37	23.20	20.77
20.77	22.51	21.58	21. 9 4	22.40	21.35	23.22	20.75
20.78	22.49	21.60	21.93	22.42	21.34	23.23	20.74
20.80	22.48	21.62	21.91	22.43	21.33	23.25	20.73
20.82	22.47	21.63	21.90	22.45	21.32	23.27	20.72
20.83	22.46	21.65	21.89	22.47	21.31	23.28	20.70
20.85	22.45	21.67	21.88	22.48	21.29	23.30	20.69
20.87	22.44	21.68	21.87	22,50	21.28	23.32	20.68
20.88 20.90	22.43	21.70	21.86	22.52	21.27	23.33	20.67
	22.41	21.72	21.84	22.53	21.26	23.35	20.65
20.92 20.93	22.40	21.73	21.83	22.55	21.25	23.37	20.64
20.95	22.39	21.75	21.82	22.57	21.23	23.38	20.63
20. 9 5 20.97	22.38 22.37	21.77	21.81	22.58	21.22	23.40	20.62
20.97	22.37 22.36	21.78	21.80	22.60	21.21	23.42	20.61
21.00	22.3 0 22.34	21.80	21.78	22.62	21.20	23.43	20.59
21.02	22.3 4 22.33	21.82 21.83	21.77	22.63	21.18	23.45	20.58
21.02	22.33 22.32	21.85	21.76	22.65	21.17	23.47	20.57
21.05	22.32	21.85	21.75	22.67	21.16	23.48	20.56
21.00	ZZ. U I	21.0/	21.74	22.68	21.15	23.50	20.54

Time	Outflow
(hrs	cfs)
23.52 23.53 23.55 23.57 23.58 23.60 23.62 23.63 23.65 23.67 23.68 23.70 23.72 23.73 23.75 23.77 23.78 23.80 23.82 23.83 23.85 23.85 23.85 23.85 23.85 23.90 23.92 23.93 23.95	20.53 20.52 20.51 20.49 20.48 20.47 20.46 20.43 20.42 20.40 20.39 20.38 20.37 20.35 20.34 20.33 20.32 20.30 20.29 20.28 20.27 20.25 20.24 20.23 20.22 20.20
23.97	20.19
23.98	20.18

...End

Hydrograph Plot

English

Hyd. No. 1

So Fork Hughes River

Hydrograph type = SCS Runoff Storm frequency = 100 yrs Drainage area = 6950.00 ac

Drainage area = 6950.00 a

Basin Slope = 0.0 %

Tc method = TR55

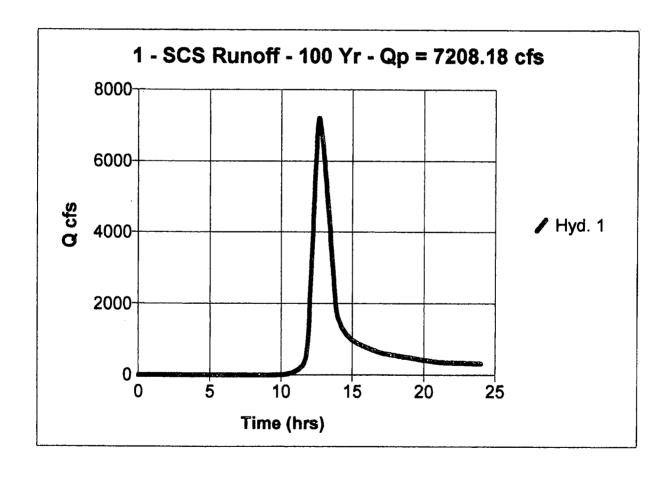
Total precip. = 5.25 in

Storm duration = 24 hrs

Peak discharge = 7208.18 cfs
Time interval = 1 min
Curve number = 70.2
Hydraulic length = 0 ft

Time of conc. (Tc) = 76 min
Distribution = Type II
Shape factor = 484

Total Volume = 55,480,370 cuft



Hyd. No. 1

So Fork Hughes River Storm frequency = 100 yrs

Sheet Flow

Manning's n-value	= 0.400
Flow length	= 100.0 ft
Two-year 24-hr precip.	= 2.55 in
Land slope	= 25.0 %

Travel Time = 8.8 min

Shallow Concentrated Flow

Flow length	= 300 ft
Watercourse slope	= 28.0 %
Surface description	= Unpaved
Average velocity	= 8.54 ft/s

Travel Time = 0.6 min

Channel Flow

Cross section flow area	= 80.0 sqft
Wetted perimeter	= 24.0 ft
Channel slope	= 0.8 %
Manning's n-value	= 0.035
Velocity	= 8.53 ft/s
Flow length	= 34140.0 ft

Travel Time = 66.7 min

Total Travel Time, Tc = 76.0 min

English

Hyd. No. 1

So Fork Hughes River

Hydrograph type = SCS Runoff Storm frequency = 100 yrs Drainage area = 6950.00 ac Basin Šlope = 0.0 % Tc method = TR55 Total precip. = 5.25 in Storm duration = 24 hrs

Peak discharge = 7208.18 cfsTime interval = 1 min Curve number = 70.2Hydraulic length = 0 ftTime of conc. (Tc) = 76 min Distribution = Type II Shape factor

Total Volume = 55,480,370 cuft

= 484

Hydrograph Discharge Table

Time	Outflow	Time	Outflow	Time	Outflow	Time	Outflow
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)
10.82	72.23	11.35	205.24	11.88	995.06	40.40	E755 6 A
10.83	75.01	11.37	211.52	11.90	1095.83	12.42 12.43	5755.64 5003.37
10.85	77.86	11.38	217.99	11.92	1209.80		5903.37
10.87	80.79	11.40	224.65	11.93	1332.64	12.45	6047.75
10.88	83.79	11.42	231.49	11.95	1463.84	12.47	6188.29
10.90	86.88	11.43	231.49	11.97	1601.46	12.48	6324.48
10.92	90.04	11.45	245.80	11.98	1743.58	12.50	6455.75
10.93	93.28	11.47	253.26	12.00	1888.03	12.52 12.53	6581.26 6600.75
10.95	96.60	11.48	260.94	12.02	2033.75	12.55	6699.75 6809.82
10.97	100.00	11.50	268.84	12.03	2180.72	12.55	6910.02
10.98	103.49	11.52	277.24	12.05	2328.89	12.58	6998.77
11.00	107.06	11.53	286.07	12.07	2478.22	12.56	7074.42
11.02	110.59	11.55	295.48	12.08	2628.67	12.62	7135.14
11.03	114.21	11.57	305.63	12.10	2780.19	12.63	7179.02
11.05	117.92	11.58	316.67	12.12	2932.75	12.65	7204.05
11.07	121.72	11.60	328.80	12.13	3086.30	12.67	7208.18 <<
11.08	125.63	11.62	342.18	12.15	3240.80	12.68	7198.35
11.10	129.64	11.63	357.05	12.17	3396.20	12.70	7175.34
11.12	133.76	11.65	373.60	12.18	3552.47	12.72	7142.20
11.13	137.99	11.67	392.08	12.20	3709.55	12.73	7102.02
11.15	142.33	11.68	412.73	12.22	3867.40	12.75	7058.23
11.17	146.80	11.70	435.83	12.23	4025.97	12.77	7012.48
11.18	151.39	11.72	461.67	12.25	4185.22	12.78	6964.81
11.20	156.11	11.73	490.54	12.27	4344.68	12.80	6915.27
11.22	160.97	11.75	522.77	12.28	4504.40	12.82	6863.88
11.23	165.97	11.77	559.06	12.30	4664.12	12.83	6810.68
11.25	171.11	11.78	600.00	12.32	4823.55	12.85	6755.73
11.27	176.40	11.80	646.44	12.33	4982.38	12.87	6699.05
11.28	181.84	11.82	699.29	12.35	5140.31	12.88	6640.69
11.30	187.44	11.83	759.50	12.37	5296.97	12.90	6580.69
11.32	193.20	11.85	828.11	12.38	5452.01	12.92	6519.09
11.33	199.14	11.87	906.23	12.40	5605.03	12.93	6455.94
= =		, ,,,,,	300.20	16.70	3000.00	12.33	0400.84

Time	Outflow	Time	Outflow	Time	Outflow	Time	Outflow
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)
•	•	•	,	(J.,	(0.0,
12.95	6391.27	13.77	2274.02	14.58	1142.04	15.40	876.35
12.97	6325.12	13.78	2195.05	14.60	1133.76	15.42	872.86
12.98	6257.55	13.80	2119.04	14.62	1125.64	15.43	869.41
13.00	6188.60	13.82	2046.55	14.63	1117.67	15.45	866.00
13.02	6118.22	13.83	1978.16	14.65	1109.85	15.47	862.62
13.03	6046.56	13.85	1914.50	14.67	1102.18	15.48	859.29
13.05	5973.65	13.87	1856.25	14.68	1094.66	15.50	855.98
13.07	5899.55	13.88	1804.13	14.70	1087.29	15.52	852.71
13.08	5824.31	13.90	1758.89	14.72	1080.07	15.53	849.48
13.10	5747.99	13.92	1721.31	14.73	1073.00	15.55	846.27
13.12	5670.62	13.93	1688.78	14.75	1066.08	15.57	843.09
13.13	5592.27	13.95	1661.02	14.77	1059.30	15.58	839.94
13.15	5512.98	13.97	1636.88	14.78	1052.67	15.60	836.81
13.17	5432.80	13.98	1615.19	14.80	1046.17	15.62	833.71
13.18	5351.80	14.00	1594.69	14.82	1039.81	15.63	830.64
13.20	5270.02	14.02	1574.75	14.83	1033.58	15.65	827.59
13.22	5187.51	14.03	1555.36	14.85	1027.47	15.67	824.56
13.23	5104.32	14.05	1536.50	14.87	1021.49	15.68	821.55
13.25	5020.52	14.07	1518.17	14.88	1015.62	15.70	818.56
13.27	4936.14	14.08	1500.36	14.90	1009.88	15.72	815.59
13.28	4851.18	14.10	1483.06	14.92	1004.24	15.73	812.64
13.30	4765.66	14.12	1466.25	14.93	.998.71	15.75	809.70
13.32	4679.58	14.13	1449.91	14.95	993.28	15.77	806.78
13.33	4592.98	14.15	1434.05	14.97	987.95	15.78	803.87
13.35	4505.84	14.17	1418.65	14.98	982.71	15.80	800.97
13.37	4418.20	14.18	1403.69	15.00	977.57	15.82	798.09
13.38	4330.05	14.20	1389.16	15.02	972.52	15.83	795.21
13.40	4241.42	14.22	1375.06	15.03	967.55	15.85	792.34
13.42	4152.32	14.23	1361.36	15.05	962.66	15.87	789.49
13.43	4062.76	14.25	1348.05	15.07	957.86	15.88	786.63
13.45	3972.74	14.27	1335.13	15.08	953.14	15.90	783.79
13.47	3882.30	14.28	1322.58	15.10	948.50	15.92	780.94
13.48	3791.44	14.30	1310.37	15.12	943.93	15.93	778.10
13.50	3700.17	14.32	1298.51	15.13	939.44	15.95	775.27
13.52	3608.67	14.33	1286.96	15.15	935.03	15.97	772.43
13.53	3516.91	14.35	1275.72	15.17	930.68	15.98	769.59
13.55	3424.99	14.37	1264.77	15.18	926.41	16.00	766.75
13.57	3333.02	14.38	1254.09	15.20	922.20	16.02	763.91
13.58	3241.11	14.40	1243.67	15.22	918.06	16.03	761.06
13.60	3149.37	14.42	1233.50	15.23	913.98	16.05	758.21
13.62	3057.94	14.43	1223.55	15.25	909.97	16.07	755.37
13.63	2966.93	14.45	1213.81	15.27	906.02	16.08	752.52
13.65	2876.51	14.47	1204.27	15.28	902.12	16.10	749.68
13.67	2786.82	14.48	1194.91	15.30	898.29	16.12	746.84
13.68	2698.03	14.50	1185.71	15.32	894.50	16.13	744.00
13.70	2610.30	14.52	1176.67	15.33	890.77	16.15	741.17
13.72	2523.83	14.53	1167.78	15.35	887.10	16.17	738.34
13.73	2438.80	14.55	1159.05	15.37	883.47	16.18	735.51
13.75	2355.43	14.57	1150.47	15.38	879.88	16.20	732.70

Time	Outflow	Time	Outflow	Time	Outflow	Time	Outflow
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)
•	•	• • • • • • • • • • • • • • • • • • • •	,	\	J.,	(•	J.J,
16.22	729.88	17.03	615,12	17.85	552.05	18.67	501.23
16.23	727.08	17.05	613.43	17.87	551.01	18.68	500.18
16.25	724.28	17.07	611.75	17.88	549.98	18.70	499.13
16.27	721.50	17.08	610.10	17.90	548.94	18.72	498.08
16.28	718.72	17.10	608.48	17.92	547.92	18.73	497.03
16.30	715.95	17.12	606.87	17.93	546.89	18.75	495.98
16.32	713.20	17.13	605.29	17.95	545.86	18.77	494.93
16.33	710.45	17.15	603.73	17.97	544.83	18.78	493.87
16.35	707.72	17.17	602.19	17.98	543.81	18.80	492.82
16.37	705.01	17.18	600.67	18.00	542.78	18.82	492.02
16.38	702.30	17.10	599.17	18.02	541.75	18.83	490.71
16.40	699.62	17.22	597.69	18.03	540.73	18.85	489.65
16.42	696.94	17.23	596.23	18.05	539.70	18.87	
16.43	694.29	17.25	594.79	18.07	538.67		488.60
16.45	691.65	17.27	593.37	18.08	537.64	18.88	487.54
16.47	689.03	17.28	593.37 591.97	18.10	536.61	18.90	486.49
16.48	686.43	17.30	590.58	18.12	535.58	18.92	485.43
16.50	683.85	17.32	589.22			18.93	484.37
16.52	681.29	17.32		18.13	534.55 533.54	18.95	483.31
16.53	678.75		587.86 586.53	18.15	533.51	18.97	482.25
16.55	676.73	17.35	586.53	18.17	532.48	18.98	481.19
16.55	673.74	17.37	585.21	18.18	531.45	19.00	480.13
		17.38	583.91	18.20	530.41	19.02	479.07
16.58	671.27	17.40	582.62	18.22	529.38	19.03	478.01
16.60	668.82	17.42	581.35	18.23	528.34	19.05	476.95
16.62	666.40	17.43	580.09	18.25	527.31	19.07	475.89
16.63	664.00	17.45	578.85	18.27	526.27	19.08	474.83
16.65	661.63	17.47	577.61	18.28	525.23	19.10	473.76
16.67	659.29	17.48	576.40	18.30	524.20	19.12	472.70
16.68	656.97	17.50	575.19	18.32	523.16	19,13	471.64
16.70	654.68	17.52	574.00	18.33	522.12	19.15	470.57
16.72	652.43	17.53	572.82	18.35	521.08	19.17	469.51
16.73	650.20	17.55	571.65	18.37	520.04	19.18	468.44
16.75	648.01	17.57	570.49	18.38	519.00	19.20	467.38
16.77	645.84	17.58	569.34	18.40	517.96	19.22	466.31
16.78	643.71	17.60	568.20	18.42	516.92	19.23	465.24
16.80	641.60	17.62	567.07	18.43	515.88	19.25	464.18
16.82	639.53	17.63	565.96	18.45	514.84	19.27	463.11
16.83	637.49	17.65	564.85	18.47	513.79	19.28	462.04
16.85	635.47	17.67	563.74	18.48	512.75	19.30	460.97
16.87	633.49	17.68	562.65	18.50	511.70	19.32	459.90
16.88	631.53	17.70	561.56	18.52	510.66	19.33	458.83
16.90	629.60	17.72	560.48	18.53	509.62	19.35	457.76
16.92	627.70	17.73	559.41	18.55	508.57	19.37	456.69
16.93	625.83	17.75	558.34	18.57	507.52	19.38	455.62
16.95	623.98	17.77	557.28	18.58	506.48	19.40	454.55
16.97	622.16	17.78	556.22	18.60	505.43	19.42	453.48
16.98	620.36	17.80	555.17	18.62	504.38	19.43	452.41
17.00	618.59	17.82	554.13	18.63	503.33	19.45	451.33
17.02	616.84	17.83	553.08	18.65	502.28	19.47	450.26
						. =	

Time	Outflow	Time	Outflow	Time	Outflow	Time	Outflow
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	
(1110	uis,	(1113	Cisj	(iiiə	CISI	(1115	cfs)
19.48	449.19	20.30	396.41	21.12	358.37	21.93	343.81
19.50	448.11	20.32	395.37	21.13	357.90	21.95	343,61
19.52	447.04	20.33	394.35	21.15	357.44	21.97	343.41
19.53	445.96	20.35	393.33	21.17	357.00		
19.55	444.89	20.37	392.31	21.17	356.56	21.98	343.21
19.57	443.81	20.38	391.31	21.20	356.13	22.00 22.02	343.01
19.58	442.73	20.40	390.31	21.22	355.71	22.02 22.03	342.81 342.61
19.60	441.66	20.42	389.32	21.23	355.30	22.05 22.05	342.41
19.62	440.58	20.43	388.33	21.25	354.90	22.03 22.07	342.21
19.63	439.50	20.45	387.36	21.27	354.51	22.07 22.08	342.21
19.65	438.43	20.47	386.39	21.28	354.12	22.10	341.81
19.67	437.35	20.48	385.44	21.30	353.75	22.12	341.61
19.68	436.27	20.50	384.49	21.32	353.78	22.13	341.41
19.70	435.19	20.52	383.56	21.33	353.02	22.15	341.21
19.72	434.11	20.53	382.63	21.35	352.67	22.13 22.17	341.01
19.73	433.03	20.55	381.72	21.37	352.33	22.18	340.81
19.75	431.95	20.57	380.81	21.38	351.99	22.20	340.61
19.77	430.87	20.58	379.92	21.40	351.67	22.22	340.40
19.78	429.78	20.60	379.04	21.42	351.34	22.23	340.20
19.80	428.70	20.62	378.17	21.43	351.03	22.25	340.00
19.82	427.62	20.63	377.31	21.45	350.72	22.27	339.80
19.83	426.54	20.65	376.47	21.47	350.42	22.28	339.60
19.85	425.45	20.67	375.64	21.48	350.13	22.30	339.40
19.87	424.37	20.68	374.82	21.50	349.84	22.32	339.20
19.88	423.29	20.70	374.02	21.52	349.56	22.33	339.00
19.90	422.20	20.72	373.23	21.53	349.28	22.35	338.80
19.92	421.12	20.73	372.45	21.55	349.01	22.37	338.59
19.93	420.03	20.75	371.69	21.57	348.74	22.38	338.39
19.95	418.95	20.77	370.95	21.58	348.48	22.40	338.19
19.97	417.86	20.78	370.21	21.60	348.22	22.42	337.99
19.98	416.77	20.80	369.50	21.62	347.97	22.43	337.79
20.00	415.69	20.82	368.80	21.63	347.72	22.45	337.59
20.02	414.60	20.83	368.11	21.65	347.48	22.47	337.39
20.03	413.51	20.85	367.43	21.67	347.24	22.48	337.18
20.05	412.42	20.87	366.77	21.68	347.01	22.50	336.98
20.07	411.34	20.88	366.13	21.70	346.78	22.52	336.78
20.08	410.25	20.90	365.49	21.72	346.55	22.53	336.58
20.10	409.17	20.92	364.87	21.73	346.32	22.55	336.38
20.12	408.09	20.93	364.26	21.75	346.10	22.57	336.17
20.13	407.01	20.95	363.67	21.77	345.88	22.58	335.97
20.15	405.93	20.97	363.09	21.78	345.67	22.60	335.77
20.17	404.86	20.98	362.52	21.80	345.45	22.62	335.57
20.18	403.79	21.00	361.96	21.82	345.24	22.63	335.36
20.20	402.72	21.02	361.41	21.83	345.03	22.65	335.16
20.22	401.66	21.03	360.88	21.85	344.83	22.67	334.96
20.23	400.60	21.05	360.35	21.87	344.62	22.68	334.76
20.25	399.54	21.07	359.84	21.88	344.42	22.70	334.55
20.27	398.49	21.08	359.34	21.90	344.21	22.72	334.35
20.28	397.45	21.10	358.85	21.92	344.01	22.73	334.15

	Outflow	Time	Outflow
(hrs	cfs)	(hrs	cfs)
22.75 22.77 22.78 22.80 22.82 22.83 22.85 22.87 22.88 22.90 22.92 22.93 22.95 22.97 22.98 23.00 23.02 23.03 23.05 23.17 23.18 23.20 23.21	333.94 333.74 333.74 333.54 333.13 332.93 332.73 332.52 332.32 332.12 331.91 331.50 331.30 331.30 331.30 331.49 330.89 330.89 330.89 330.89 330.89 330.89 329.87 329.67 329.67 329.85 329.85 329.85 328.65 32	23.57 23.58 23.60 23.62 23.63 23.65 23.67 23.68 23.70 23.72 23.73 23.75 23.77 23.78 23.80 23.82 23.83 23.85 23.87 23.88 23.90 23.92 23.93 23.95 23.97 23.98	323.92 323.72 323.51 323.30 323.10 322.89 322.68 322.48 322.27 322.06 321.86 321.86 321.24 321.03 320.82 320.62 320.41 320.20 319.99 319.79 319.58 319.37 319.16 318.96 318.75

Hydrograph Plot

English

Hyd. No. 2

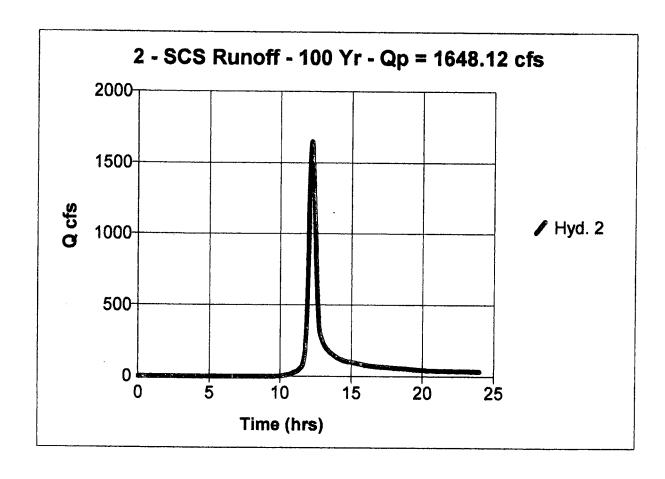
Sheep Run

Hydrograph type = SCS Runoff Storm frequency = 100 yrs Drainage area = 825.00 ac Basin Slope = 0.0 %

Tc method = TR55 Total precip. = 5.25 in Storm duration = 24 hrs Peak discharge = 1648.12 cfs
Time interval = 1 min
Curve number = 70.2
Hydraulic length = 0 ft

Time of conc. (Tc) = 29.3 min
Distribution = Type II
Shape factor = 484

Total Volume = 6,660,276 cuft



Hyd. No. 2

Sheep Run Storm frequency = 100 yrs

Sheet Flow

Manning's n-value = 0.550 Flow length = 100.0 ft Two-year 24-hr precip. = 2.55 in Land slope = 18.0 %

Travel Time = 12.9 min

Shallow Concentrated Flow

Flow length = 300 ft
Watercourse slope = 13.0 %
Surface description = Unpaved
Average velocity = 5.82 ft/s

Travel Time = 0.9 min

Channel Flow

Cross section flow area = 18.4 sqft
Wetted perimeter = 9.5 ft
Channel slope = 3.6 %
Manning's n-value = 0.040
Velocity = 11.01 ft/s
Flow length = 10290.0 ft

Travel Time = 15.6 min

Total Travel Time, Tc = 29.3 min

English

Hyd. No. 2

Sheep Run

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Drainage area = 825.00 ac
Basin Slope = 0.0 %
Tc method = TR55
Total precip. = 5.25 in
Storm duration = 24 hrs

Peak discharge = 1648.12 cfs
Time interval = 1 min
Curve number = 70.2
Hydraulic length = 0 ft
Time of conc. (Tc) = 29.3 min
Distribution = Type II

Shape factor = 484

Total Volume = 6,660,276 cuft

Hydrograph Discharge Table

Time Outflow		Time	Time Outflow		Time Outflow		Time Outflow	
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	
10.69	16.70	44.00	40.70	44 ==				
10.68 10.70	16.78	11.22	40.78	11.75	185.81	12.28	1502.34	
	17.31	11.23	41.89	11.77	206.51	12.30	1457.41	
10.72	17.85	11.25	43.05	11.78	230.47	12.32	1411.62	
10.73	18.40	11.27	44.25	11.80	258.30	12.33	1364.98	
10.75	18.97	11.28	45.51	11.82	290.30	12.35	1317.55	
10.77	19.55	11.30	46.81	11.83	327.33	12.37	1269.41	
10.78	20.15	11.32	48.33	11.85	369.98	12.38	1220.66	
10.80	20.76	11.33	49.90	11.87	418.89	12.40	1171.37	
10.82	21.39	11.35	51.53	11.88	474.76	12.42	1121.65	
10.83	22.04	11.37	53.22	11.90	538.31	12.43	1071.61	
10.85	22.70	11.38	54.96	11.92	610.24	12.45	1021.34	
10.87	23.37	11.40	56.77	11.93	687.11	12.47	970.97	
10.88	24.06	11.42	58.63	11.95	768.27	12.48	920.63	
10.90	24.77	11.43	60.55	11.97	852.03	12.50	870.44	
10.92	25.50	11.45	62.54	11.98	936.66	12.52	820.56	
10.93	26.24	11.47	64.58	12.00	1020.24	12.53	771.15	
10.95	27.00	11.48	66.68	12.02	1101.65	12.55	722.39	
10.97	27.77	11.50	68.85	12.03	1180.52	12.57	674.55	
10.98	28.57	11.52	71.27	12.05	1256.44	12.58	627.99	
11.00	29.37	11.53	73.89	12.07	1328.78	12.60	583.15	
11.02	30.10	11.55	76.83	12.08	1396.60	12.62	540.45	
11.03	30.85	11.57	80.20	12.10	1458.85	12.63	500.37	
11.05	31.62	11.58	84.10	12.12	1514.42	12.65	463.39	
11.07	32.41	11.60	88.66	12.13	1562.14	12.67	430.06	
11.08	33.22	11.62	94.03	12.15	1600.78	12.68	400.94	
11.10	34.06	11.63	100.35	12.17	1628.95	12.70	376.62	
11.12	34.92	11.65	107.77	12.18	1645.23	12.72	357.70	
11.13	35.81	11.67	116.46	12.20	1648.12 <<	12.73	342.28	
11.15	36.74	11.68	126.61	12.22	1636.08	12.75	330.18	
11.17	37.69	11.70	138.41	12.23	1614.24	12.77	320.58	
11.18	38.68	11.72	152.06	12.25	1583.16	12.78	312.65	
11.20	39.71	11.73	167.78	12.27	1545.11	12.80	305.47	

(hrs cfs) (hrs cfs) (hrs cfs) 12.82 298.60 13.63 159.03 14.45 112.05 15.27 94.80 12.83 292.03 13.65 157.70 14.47 111.55 152.28 94.61 12.86 2265.74 13.68 155.11 14.50 110.60 15.32 93.79 12.88 274.01 13.70 153.84 14.52 110.15 15.33 93.79 12.80 224.01 13.70 153.84 14.52 110.15 15.33 93.79 12.90 268.53 13.72 152.59 14.53 109.72 15.35 93.79 12.92 263.31 13.73 151.36 14.55 109.30 15.37 92.78 12.95 253.57 13.77 148.94 14.58 108.50 15.40 92.11 12.95 249.04 13.78 147.56 14.60 108.11 15.42 91.77 12.98	Time	Outflow	Time	Outflow	Time	Outflow	Time	Outflow
12.82 298.60 13.63 159.03 14.45 112.05 15.27 94.80 12.85 282.03 13.65 157.70 14.47 111.55 15.28 94.46 12.85 285.74 13.67 156.40 14.48 111.07 15.30 94.13 12.87 279.74 13.68 155.11 14.50 110.60 15.32 93.79 12.88 274.01 13.70 153.84 14.52 110.15 15.33 93.46 12.90 286.53 13.72 152.59 14.53 109.72 15.35 93.12 12.92 263.31 13.73 151.36 14.55 109.30 15.37 92.78 12.93 268.32 13.75 150.14 14.57 108.89 15.39 22.45 12.95 258.57 13.77 148.94 14.58 108.50 15.40 92.11 12.97 249.04 13.78 147.75 14.60 108.11 15.42 91.77 12.98 244.71 13.80 146.59 14.62 107.74 15.43 91.74 13.00 240.59 13.82 145.43 14.63 107.37 154.5 91.10 13.02 236.65 13.83 144.29 14.65 107.01 15.47 90.76 13.03 232.90 13.85 143.16 14.67 106.66 15.48 90.42 13.05 229.32 13.87 142.05 14.68 106.32 15.50 90.08 13.07 225.91 13.88 140.94 14.70 105.98 15.52 89.74 13.10 219.55 13.92 138.77 14.73 105.32 15.55 89.07 13.13 21.10 219.55 13.92 138.77 14.73 105.32 15.55 89.07 13.13 21.10 219.55 13.92 138.77 14.73 105.32 15.55 89.07 13.13 21.10 219.55 13.95 138.64 14.77 104.67 15.58 83.90 13.15 13.15 211.05 13.95 13.95 13.55 14.60 104.02 15.55 89.07 13.15 13.05 29.32 13.87 13.55 13.92 138.77 14.73 105.32 15.55 89.07 13.15 21.05 13.95 13.95 13.664 14.77 104.67 15.58 83.90 13.15	(hrs	cfs)						
12.83 282.03 13.65 157.70 14.47 111.55 15.28 94.46 12.85 285.74 13.67 156.40 14.48 111.07 15.30 94.41 12.87 279.74 13.68 155.11 14.50 110.60 15.32 93.79 12.88 274.01 13.70 153.84 14.52 110.15 15.33 93.46 12.90 288.53 13.72 152.59 14.53 109.72 15.35 93.12 12.99 283.31 13.73 151.36 14.55 109.30 15.37 92.78 12.93 258.32 13.75 150.14 14.57 108.89 15.38 92.45 12.95 253.57 13.77 148.94 14.58 106.50 15.40 92.11 12.97 249.04 13.78 147.75 14.60 108.11 15.42 91.77 12.98 244.71 13.80 146.59 14.62 107.74 15.43 91.44 13.00 240.59 13.82 145.43 14.63 107.37 15.45 91.10 13.02 236.65 13.83 144.29 14.65 107.01 15.47 90.76 13.03 232.90 13.85 143.16 14.67 106.66 15.48 90.42 13.05 229.32 13.87 142.05 14.68 106.32 15.50 90.08 13.07 225.91 13.88 140.94 14.70 105.98 15.52 89.74 13.00 222.65 13.90 139.85 14.72 105.65 15.53 89.41 13.10 219.55 13.92 138.77 14.73 105.32 15.55 89.07 13.12 216.59 13.93 137.70 14.75 104.99 15.57 88.73 13.13 213.76 13.95 138.64 14.77 104.67 105.98 15.52 89.74 13.08 222.65 13.99 13.95 13.64 14.78 104.99 15.57 88.73 13.13 213.76 13.95 138.64 14.77 104.67 15.58 83.99 13.15 13.15 211.05 13.97 135.59 14.78 104.99 15.57 88.73 13.13 213.76 13.95 138.64 14.77 104.67 15.58 83.99 13.15 13.15 211.05 13.97 135.59 14.78 104.99 15.57 88.73 13.13 213.76 13.95 138.64 14.77 104.67 15.58 83.99 13.15 13.15 21.05 13.97 135.59 14.78 104.39 15.57 88.73 13.13 213.76 13.95 138.64 14.77 104.67 15.58 83.99 13.15 13.15 21.05 13.97 135.59 14.78 104.34 15.60 88.05 13.17 208.47 13.98 134.55 14.80 104.02 15.62 87.70 13.18 205.99 14.00 133.52 15.55 89.07 13.18 205.99 14.00 133.52 14.85 103.04 15.67 86.68 13.23 199.13 14.03 131.49 14.85 103.04 15.67 86.68 13.23 199.13 14.03 131.49 14.85 103.04 15.67 86.60 13.25 14.89 100.40 15.82 83.59 13.30 180.98 14.10 127.55 14.99 100.74 15.73 85.31 13.30 180.98 14.10 127.55 14.99 100.40 15.82 83.59 13.30 180.99 14.10 127.55 14.99 100.70 15.82 83.59 13.30 180.99 14.10 127.55 14.99 100.40 15.82 83.59 13.30 180.99 14.10 127.55 14.99 100.40 15.82 83.59 13.30 180.99 14.10 127.55 14.99 100.40 15.88 82.21 13.40	•	,	(J.J,	(0	013)	(1113	CIS
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13.55 165.99 14.37 114.82 15.18 96.46 16.00 79.79 13.57 164.55 14.38 114.22 15.20 96.13 16.02 79.44								80.48
13.57 164.55 14.38 114.22 15.20 96.13 16.02 79.44								
10.50 400.44							16.00	79.79
73.00 763.14 14.40 113.65 15.22 05.80 46.00 76.40								79.44
10.00 /9.10			14.40	113.65	15.22	95.80	16.03	79.10
13.60 161.75 14.42 113.10 15.23 95.46 16.05 78.75							16.05	78.75
13.62 160.38 14.43 112.56 15.25 95.13 16.07 78.41	13.62	160.38	14.43	112.56	15.25	95.13	16.07	

Time	Outflow	Time	Outflow	Time	- Outflow	Time	Outflow
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	
\	J. J.	(0	0137	(ins	Cisj	(1115	cfs)
16.08	78.07	16.90	68.43	17.72	62.49	18.53	56.38
16.10	77.73	16.92	68.31	17.73	62.37	18.55	56.25
16.12	77.39	16.93	68.20	17.75	62.24	18.57	56.23 56.13
16.13	77.06	16.95	68.08	17.77	62.12	18.58	56.00
16.15	76.73	16.97	67.96	17.78	62.00	18.60	55.87
16.17	76.41	16.98	67.84	17.80	61.87	18.62	55.75
16.18	76.09	17.00	67.72	17.82	61.75	18.63	55.62
16.20	75.78	17.02	67.60	17.83	61.63	18.65	55.49
16.22	75.48	17.03	67.48	17.85	61.50	18.67	55.37
16.23	75.18	17.05	67.36	17.87	61,38	18.68	55.24
16.25	74.89	17.07	67.24	17.88	61.25	18.70	55.11
16.27	74.61	17.08	67.12	17.90	61.13	18.72	54.99
16.28	74.34	17.10	66.99	17.92	61.01	18.73	54.86
16.30	74.08	17.12	66,87	17.93	60.88	18.75	54.73
16.32	73.82	17.13	66.75	17.95	60.76	18.77	54.61
16.33	73.58	17.15	66.63	17.97	60.63	18.78	54.48
16.35	73.34	17.17	66.51	17.98	60.51	18.80	54.35
16.37 16.38	73.12	17.18	66.39	18.00	60.39	18.82	54.23
16.40	72.90	17.20	66.27	18.02	60.26	18.83	54.10
16.42	72.69 72.48	17.22	66.15	18.03	60.14	18.85	53.97
16.43	72.40 72.29	17.23 17.25	66.03	18.05	60.01	18.87	53.84
16.45	72.29 72.10	17.25 17.27	65.91 65.70	18.07	59.89 50.70	18.88	53.72
16.47	71.92	17.28	65.79 65.67	18.08	59.76	18.90	53.59
16.48	71.74	17.30	65.54	18.10	59.64 50.50	18.92	53.46
16.50	71.57	17.32	65.42	18.12 18.13	59.52 59.39	18.93	53.33
16.52	71.41	17.33	65.30	18.15	59.39 59.27	18.95 18.97	53.21
16.53	71.25	17.35	65.18	18.17	59.14	18.98	53.08 52.95
16.55	71.09	17.37	65.06	18.18	59.02	19.00	52.82
16.57	70.94	17.38	64.94	18.20	58.89	19.02	52.70
16.58	70.80	17.40	64.81	18.22	58.77	19.03	52.57
16.60	70.65	17.42	64.69	18.23	58.64	19.05	52.44
16.62	70.52	17.43	64.57	18.25	58.52	19.07	52.31
16.63	70.38	17.45	64.45	18.27	58.39	19.08	52.18
16.65	70.25	17.47	64.33	18.28	58.27	19.10	52.06
16.67	70.12	17.48	64.21	18.30	58.14	19.12	51.93
16.68	70.00	17.50	64.08	18.32	58.01	19.13	51.80
16.70	69.87	17.52	63.96	18.33	57.89	19.15	51.67
16.72	69.75	17.53	63.84	18.35	57.76	19.17	51.54
16.73	69.63	17.55	63.72	18.37	57.64	19.18	51.42
16.75	69.51	17.57	63.59	18.38	57.51	19.20	51.29
16.77	69.39	17.58	63.47	18.40	57.39	19.22	51.16
16.78	69.27	17.60	63.35	18.42	57.26	19.23	51.03
16.80	69.15	17.62	63.23	18.43	57.14	19.25	50.90
16.82	69.03	17.63	63.10	18.45	57.01	19.27	50.77
16.83 16.85	68.91 69.70	17.65	62.98	18.47	56.88	19.28	50.65
16.87	68.79 68.67	17.67	62.86	18.48	56.76	19.30	50.52
16.88	68.55	17.68	62.73	18.50	56.63	19.32	50.39
10.00	00.00	17.70	62.61	18.52	56 .51	19.33	50.26

Time Outflow		Time	Time Outflow		Time Outflow		Time Outflow	
(hrs	cfs)	(hrs	cfs)					
(0.3)	(1113	CIS)	(hrs	cfs)	(hrs	cfs)	
19.35	50.13	20.17	43.81	20.98	41.38	24 90	40.00	
19.37	50.00	20.18	43.69	21.00	41.36	21.80	40.22	
19.38	49.87	20.20	43.58	21.02	41.33	21.82	40.19	
19.40	49.74	20.22	43.47	21.02		21.83	40.17	
19.42	49.61	20.23	43.37	21.05	41.31	21.85	40.15	
19.43	49.49	20.25	43.26	21.07	41.29 41.26	21.87	40.12	
19.45	49.36	20.27	43.16	21.08		21.88	40.10	
19.47	49.23	20.28	43.07	21.10	41.24 41.22	21.90	40.08	
19.48	49.10	20.30	42.98	21.12	41.19	21.92	40.05	
19.50	48.97	20.32	42.89	21.12	41.13	21.93	40.03	
19.52	48.84	20.33	42.81	21.15	41.17	21.95	40.00	
19.53	48.71	20.35	42.73	21.17	41.12	21.97	39.98	
19.55	48.58	20.37	42.66	21.18	41.10	21.98	39.96 39.93	
19.57	48.45	20.38	42.59	21.20	41.07	22.00		
19.58	48.32	20.40	42.52	21.22	41.05	22.02 22.03	39.91 39.88	
19.60	48.19	20.42	42.46	21.23	41.03	22.05 22.05	39.86	
19.62	48.06	20.43	42.40	21.25	41.00	22.03	39.84	
19.63	47.93	20.45	42.34	21.27	40.98	22.08	39.8 1	
19.65	47.80	20.47	42.29	21.28	40.96	22.10	39.79	
19.67	47.67	20.48	42.24	21.30	40.93	22.12	39.76	
19.68	47.54	20.50	42.19	21,32	40.91	22.13	39.74	
19.70	47.41	20.52	42.15	21.33	40.89	22.15	39.72	
19.72	47.28	20.53	42.10	21.35	40.86	22.17	39.69	
19.73	47.15	20.55	42.06	21.37	40.84	22.18	39.67	
19.75	47.02	20.57	42.03	21.38	40.81	22.20	39.64	
19.77	46.89	20.58	41.99	21.40	40.79	22.22	39.62	
19.78	46.77	20.60	41.96	21.42	40.77	22.23	39.59	
19.80	46.63	20.62	41.92	21.43	40.74	22.25	39.57	
19.82	46.50	20.63	41.89	21.45	40.72	22.27	39.55	
19.83	46.37	20.65	41.86	21.47	40.70	22.28	39.52	
19,85	46.24	20.67	41.84	21.48	40.67	22.30	39.50	
19.87	46.11	20.68	41.81	21.50	40.65	22.32	39.47	
19.88	45.98	20.70	41.78	21.52	40.62	22.33	39.45	
19.90	45.85	20.72	41.76	21.53	40.60	22.35	39.43	
19.92	45.72	20.73	41.73	21.55	40.58	22.37	39.40	
19.93	45.59	20.75	41.71	21.57	40.55	22.38	39.38	
19.95	45.46	20.77	41.68	21.58	40.53	22.40	39.35	
19.97	45.33 45.33	20.78	41.66	21.60	40.51	22.42	39.33	
19.98	45.20 45.07	20.80	41.64	21.62	40.48	22.43	39.30	
20.00 20.02	45.07 44.04	20.82	41.61	21.63	40.46	22.45	39.28	
20.02	44.94	20.83	41.59	21.65	40.43	22.47	39.26	
20.03	44.81	20.85	41.57	21.67	40.41	22.48	39.23	
20.05	44.68 44.55	20.87	41.54	21.68	40.39	. 22.50	39.21	
20.07	44.55 44.42	20.88	41.52	21.70	40.36	22.52	39.18	
20.08	44.42 44.30	20.90	41.50	21.72	40.34	22.53	39.16	
20.10	44 .30 44.17	20.92 20.93	41.47	21.73	40.31	22.55	39.14	
20.12	44.05	20.93 20.95	41.45	21.75	40.29	22.57	39.11	
20.15	43.93	20.95 20.97	41.43	21.77	40.27	22.58	39.09	
20.10	70.00	20.91	41.40	21.78	40.24	22.60	39.06	

Hydrograph Discharge Table

Time (hrs	Outflow cfs)	Time (hrs	Outflow cfs)
22.62 22.63 22.65 22.67 22.68 22.70 22.72 22.73 22.75 22.77 22.78 22.80 22.82 22.83 22.85 22.87 22.90 22.92 22.93 22.95 22.97 22.98 23.00 23.02 23.03 23.12 23.13 23.15 23.17 23.18 23.20 23.22 23.23 23.25 23.27 23.28 23.27 23.28 23.27 23.28 23.27 23.28 23.27 23.28 23.27 23.28 23.27 23.28 23.27 23.28 23.27 23.28 23.27 23.28 23.27 23.28 23.27 23.28 23.27 23.28 23.27 23.28 23.27 23.28 23.27 23.27 23.28 23.27 23.27 23.28 23.27 23.27 23.27 23.27 23.28 23.27	39.04 39.01 38.99 38.97 38.94 38.89 38.87 38.82 38.79 38.75 38.72 38.70 38.65 38.65 38.65 38.53 38.53 38.45 38.45 38.31	23.43 23.45 23.47 23.48 23.50 23.52 23.53 23.55 23.57 23.58 23.60 23.62 23.63 23.65 23.67 23.78 23.78 23.78 23.78 23.80 23.82 23.83 23.85 23.87 23.88 23.90 23.92 23.93 23.95 23.97 23.98	37.84 37.81 37.79 37.76 37.72 37.69 37.67 37.64 37.52 37.59 37.54 37.52 37.49 37.42 37.39 37.37 37.34 37.32 37.39 37.37 37.32 37.25 37.25 37.25 37.15 37.15 37.15 37.15 37.15 37.15 37.15 37.15

South Fork Hughes River - Sta 0+00 - 10 Yr Storm Worksheet for Irregular Channel

Project Description		
Worksheet	So Fork Hughes Sta	
Flow Element	Irregular Channel	
Method Manning's Form		
Solve For Channel Depth		

Input Data

Slope .005000 ft/ft

Discharg(X32X00XX6X

1,324 cfs

Options

Current Roughness Metho oved Lotter's Method Open Channel Weighting Foved Lotter's Method Closed Channel Weighting Horton's Method

Results		
Mannings Coefficier	0.043	
Water Surface Elevi	832.70	ft
Elevation Range	8.00 to 839.00	
Flow Area	282.9	ft²
Wetted Perimeter	107.64	ft
Top Width	106.13	ft
Actual Depth	4.70	ft
Critical Elevation	831.17	ft
Critical Slope	0.020491	ft/ft
Velocity	4.68	ft/s
Velocity Head	0.34	ft
Specific Energy	833.04	ft
Froude Number	0.51	
Flow Type	Subcritical	

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+06	1+53	0.045
1+53	2+01	0.040
2+01	2+49	0.045

Natural Channel Points		
Station (ft)	Elevation (ft)	
0+06	839.00	
0+21	838.00	
0+22	837.00	
0+23	836.00	
0+27	835.00	
0+55	834.00	
1+20	833.00	
1+35	832.00	
1+48	831.00	
1+53	830.00	
1+55	829.00	
1+56	828.00	

South Fork Hughes River - Sta 0+00 - 10 Yr Storm Worksheet for Irregular Channel

Natural Channel Points		
Station (ft)	Elevation (ft)	
1+97	828.00	
1+98	829.00	
2+01	830.00	
2+05	831.00	
2+25	832.00	
2+33	833.00	
2+37	834.00	
2+39	835.00	
2+42	836.00	
2+45	837.00	
2+47	838.00	
2+49	839.00	

Sheep Run Sta 7+00 - 10 Yr Storm Worksheet for Irregular Channel

Project Description	1
Worksheet	Sheep Run - Sta
Flow Element	irregular Channel
Method Manning's Forr	
Solve For Channel Depth	

Input Data

Slope .029100 ft/ft

695.5 cfs

Options

Current Roughness Metho oved Lotter's Method Open Channel Weighting I oved Lotter's Method Closed Channel Weighting Horton's Method

Results		
Mannings Coefficier	0.045	
Water Surface Eleva	839.09	ft
Elevation Range	5.84 to 841.79	
Flow Area	73.6	ft²
Wetted Perimeter	33.86	ft
Top Width	32.85	ft
Actual Depth	3.25	ft
Critical Elevation	839.29	ft
Critical Slope	0.023129	ft/ft
Velocity	9.45	ft/s
Velocity Head	1.39	ft
Specific Energy	840.48	ft
Froude Number	1.11	
Flow Type	Supercritical	

Roughness Segments		
Start Station	End Station	Mannings Coefficient
-0+32	0+27	0.045

Natural Channel Points		
Station (ft)	Elevation (ft)	
-0+32	841.03	
-0+17	839.89	
-0+13	838.16	
-0+11	837.27	
-0+08	836.72	
-0+06	836.37	
-0+04	836.03	
-0+02	835.84	
0+00	835.97	
0+02	836.00	
0+06	836.00	
80+0	836.02	
0+11	836.58	
0+13	837.52	

Page 1 of 2

Sheep Run Sta 7+00 - 10 Yr Storm Worksheet for Irregular Channel

Natural Channel Points		
Station Elevation (ft) (ft)		
0+15	838.22	
0+17	838.81	
0+21	839.97	
0+25	841.14	
0+27	841.79	

South Fork Hughes River - Sta 0+00 - 100 Yr Storm Worksheet for Irregular Channel

Project Description		
Worksheet	So Fork Hughes Sta	
Flow Element	Irregular Channel	
Method	Manning's Formula	
Solve For	Channel Depth	

Input Data

Slope .005000 ft/ft

Discharg XXXXXXXXX

3,710 cfs

Options

Current Roughness Metho oved Lotter's Method Open Channel Weighting Foved Lotter's Method Closed Channel Weighting Horton's Method

Results		
Mannings Coefficier	0.044	
Water Surface Elevi	835.21	ft
Elevation Range	8.00 to 839.00	
Flow Area	704.0	ft²
Wetted Perimeter	215.55	ft
Top Width	213.62	ft
Actual Depth	7.21	ft
Critical Elevation	833.68	ft
Critical Slope	0.020787	ft/ft
Velocity	5.27	ft/s
Velocity Head	0.43	ft
Specific Energy	835.64	ft
Froude Number	0.51	
Flow Type	Subcritical	

Roughness Segments							
Start End Mannir Station Station Coeffic							
0+06	1+53	0.045					
1+53	2+01	0.040					
2+01	2+49	0.045					

Natural Chi	annel Points			
Station (ft)	Elevation (ft)			
0+06	839.00			
0+21	838.00			
0+22	837.00			
0+23	836.00 835.00			
0+27				
0+55	834.00			
1+20	833.00			
1+35	832.00			
1+48	831.00			
1+53	830.00			
1+55	829.00			
1+56	828.00			

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South Fork Hughes River - Sta 0+00 - 100 Yr Storm Worksheet for Irregular Channel

Natural Ch	annel Points
Station (ft)	Elevation (ft)
1+97	828.00
1+98	829.00
2+01	830.00
2+05	831.00
2+25	832.00
2+33	833.00
2+37	834.00
2+39	835.00
2+42	836.00
2+45	837.00
2+47	838.00
2+49	839.00

Sheep Run Sta 7+00 - 100 Yr Storm Worksheet for Irregular Channel

Project Description	1
Worksheet	Sheep Run - Sta
Flow Element	irregular Channel
Method	Manning's Formul
Solve For	Channel Depth

Input Data

Slope .029100 ft/ft

Discharge XXXXXXXXX

1,648 cfs

Options

Current Roughness Metho oved Lotter's Method Open Channel Weighting Foved Lotter's Method **Closed Channel Weighting** Horton's Method

Results		
Mannings Coefficier	0.045	
Water Surface Elevi	840.97	ft
Elevation Range	5.84 to 841.79	
Flow Area	152.2	ft²
Wetted Perimeter	57.08	ft
Top Width	55.61	ft
Actual Depth	5.13	ft
Critical Elevation	841.27	ft
Critical Slope	0.021419	ft/ft
Velocity	10.83	ft/s
Velocity Head	1.82	ft
Specific Energy	842.80	ft
Froude Number	1.15	
Flow Type	Supercritical	

Roughness Segments										
Start Station	End Station	Mannings Coefficient								
-0+32 0+27 0.04										

Natural Channel Points							
Station (ft)	Elevation (ft)						
-0+32	841.03						
-0+17	839.89						
-0+13	838,16						
-0+11	837.27						
-0+08	836.72						
-0+06	836.37						
-0+04	836.03						
-0+02	835.84						
0+00	835.97						
0+02	836.00						
0+08	836.00						
0+08	836.02						
0+11	836.58						
0+13	837.52						

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Cobait Professional Services, Inc.

Sheep Run Sta 7+00 - 100 Yr Storm Worksheet for Irregular Channel

Natural Ch	Natural Channel Points							
Station (ft)	Elevation (ft)							
0+15	838.22							
0+17	838.81							
0+21	839,97							
0+25	841.14							
0+27	841.79							

Hec-Ras Summary Output South Fork Hughes River Existing Conditions 10 yr/24 hr Storm & 100 yr/24 hr Storm

HEC-RAS	Plan: SFH	River: 8	FHughes	Reach: 1
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Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Off W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Frouds # Chi
	-	 	(cfs)	(11)	(ft)	(f)	(ft)	(R/ft)	(ft/a)	(aq ft)	(ft)	1.0220 0111
<u> </u>	650.000	10 Yr Storm	1324.00	830.00	835.47		835.94	0.002917	5.54	249.58	64.24	0.4
<u>. </u>	650.000	100 Yr Storm	3710.00	830.00	838.02		839.25	0.005202	9.29	475.82	132.74	0.63
	1000 000		·									
<u> </u>	600.000	10 Yr Storm	1324.00	830.00	835.41		835.78	0.002335	5.02	287.83	83,01	0.40
<u>' </u>	600,000	100 Yr Storm	3710.00	830.00	838.12		838.91	0.003410	7.70	585.88	133.26	0.5
	550 000	-										
	550,000 550,000	10 Yr Storm	1324.00	830.00	835.19		835.64	0.002987	5.42	247.84	64.74	0.49
<u>' </u>	220.000	100 Yr Storm	3710.00	830.00	837.38		838.64	0.005762	9.43	456.95	121.60	0.65
	500.000	1011										
<u> </u>	500.000	10 Yr Storm	1324.00	830.00	834.99		835.48	0.003480	5.64	248.41	75.24	0.48
<u>'</u>	500.000	100 Yr Storm	3710.00	830.00	838.95	836.28	838.32	0.006809	9.84	447.41	129.03	0.71
	1.00	 	l									
<u>'</u>	450.000	10 Yr Storm	1324.00	829.98	834.85		835.30	0.003417	5.51	265.27	100.33	0.47
<u>'</u>	450.000	100 Yr Storm	3710.00	829.98	836.92		837.90	0.005239	8.64	528.20	143.37	0.62
	-		 								1,43,51	0.02
<u> </u>	400.000	10 Yr Storm	1324.00	829.74	834.57		835.10	0.004413	5.92	249.73	136.91	0.53
	400.000	100 Yr Storm	3710.00	829.74	836.81		837.60	0.004589	7.88	582.72	167,13	0.58
			 									
<u> </u>	350.000	10 Yr Storm	1324.00	829.46	834.43	l	834.87	0.003711	5.65	291.16	149.06	0.49
	350.000	100 Yr Storm	3710.00	829.48	836.79		837.35	0.003089	7.00	715.10	193.08	0.49
			ļ								15 3.00	<u> </u>
	300.000	10 Yr Storm	1324.00	829.19	834.30		834.68	0.003350	5.44	318.84	142.68	0.47
	300.000	100 Yr Storm	3710.00	829.19	836.67		837.19	0.003013	6.95	719.02	169.41	0.48
——												
	250.000	10 Yr Storm	1324.00	829.00	834.41		834.53	0.000778	3.06	518.90	157.12	0.24
	250.000	100 Yr Storm	3710.00	829.00	836.74		837.04	0.001208	4.89	982.33	198.95	0.31
	 		ļ									
		10 Yr Storm	1324.00	828.79	834.24		834.47	0.001546	4.07	406,17	183.30	0.33
	200.000	100 Yr Storm	3710.00	828.79	836.53		838.95	0.001978	5.99	833,04	205.91	0.40
	· · · · · ·											
		10 Yr Storm	1324.00	828.33	833.29	832.68	834.25	0.007957	7.96	180.78	78,73	0.72
	150.000	100 Yr Storm	3710.00	828.33	835,46	835.40	836.69	0.007289	10.28	514.26	182.45	0.74
			ļI									
		10 Yr Storm	1324.00	828.00	832.63	832.31	833.79	0.009370	8.84	187.51	82,24	0.78
	100.000	100 Yr Storm	3710.00	828.00	635.35		836.29	0.005268	9.37	587.78	184.90	0.64
	 											
		10 Yr Storm	1324.00	828.00	832.84		833.29	0.004004	6.05	280.51	112.15	0.52
	50.000	100 Yr Storm	3710.00	628.00	835.39		835.97	0.003347	7.59	712.02	199.32	0.51
												0.07
		10 Yr Storm	1324.00	828.00	832.70	831.14	833.10	0.003121	5.16	282.57	108.23	0.48
	0.000	100 Yr Storm	3710.00	828.00	835.21	833.68	835.61	0.002983	6.99	710.54	213.29	0.48

Hec-Ras Summary Output Sheep Run

Existing Conditions 10 yr/24 hr Storm & 100 yr/24 hr Storm

Reach	River Sta	River: SheepRun Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chni	Flow Area	Top Width	Froude # Chi
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(eq ft)	(ft)	PIUCUS R CIII
1	700.000	10 Yr Storm	695.50	835,84	840,27	839.27	840.83	0.007825	6.00	116.43	42.41	0.6
1	700.000	100 yr Storm	1648.00	835,84	840,97	841.16	842.96	0.021415	11.41	150.68	55.30	1.0
								3,2,1,0		100.00		1.0
1	650.000	10 Yr Storm	695.50	835.00	839.88	838.92	840.46	0.006868	6.53	126,11	105.99	0.50
1	650.000	100 yr Storm	1648.00	835.00	841.46	840.97	842.00	0.005137	7.18	335.60	141.71	0.53
												
1	600.000	10 Yr Storm	695.50	834,00	839.89		840.13	0.004875	5.50	154.65	110.85	0.49
<u> </u>	600.000	100 yr Storm	1648.00	834.00	841.34		841.74	0.003707	6.05	384.27	152.88	0.4
-	550.000	10 Yr Storm	 									
1	550.000	100 yr Storm	695.50 1648.00	834.00	839.63		839.90	0.002774	4.59	199.08	104.38	0.30
<u> </u>	330.000	100 yr atomi	1048.00	834.00	841.19		841,57	0.003093	5.91	393.39	139,19	0.42
1	500,000	10 Yr Storm	695.50	834.00	838.70	838.59	600.00					
1	500.000	100 yr Storm	1648.00	834.00	840.11	840.11	839.60 841.24	0.011017	8.32	110.10	68.79	0.73
		7	10.00	504.00	0.70,17	040.11	041.24	0.011538	10.40	232.11	102.20	0.79
1	450.000	10 Yr Storm	695.50	834.00	838.52		839.05	0.008520	5.68	124.41		
1	450.000	100 yr Storm	1648.00	834.00	839.47	839.56	840.71	0.014876	9.40	206.81	67,52 102,94	0.62 0.86
								2.014070		200.01	102.04	<u>U.80</u>
1	400.000	10 Yr Storm	695,50	833.88	838.44	837.78	838.67	0.003658	4.51	209.41	128.26	0.49
1	400.000	100 yr Storm	1848.00	833,86	839.15	838.76	839.73	0.007523	7.33	309.59	149.45	0.63
												0.00
<u> </u>	350.000	10 Yr Storm	695.50	833.82	837.29	837.29	838.26	0.016515	8.26	98.88	124.40	0.87
<u> </u>	350.000	100 yr Storm	1648.00	833.82	838.60	838.60	839.29	0.009932	8.29	307.83	192.90	0.72
	-		1									
!	300.000	10 Yr Storm	695.50	832.71	838.95	836.20	837.34	0.006087	5.34	153.20	139.98	0.54
<u>'</u>	300.000	100 yr Storm	1648.00	832.71	838,29	837.61	838.81	0.005893	6.70	346.75	222.91	0.56
 	240.000	40.77-01										
 	250.000 250.000	10 Yr Storm	695.50	832.00	836.78		637.09	0.003444	4.78	175.67	128.67	0.42
	200.000	100 yr Storm	1648.00	832.00	837,73	636.96	838.48	0.006999	7.87	315.01	201.03	0.63
	200.000	10 Yr Storm	695.50	831.38	000.47			-				
	200.000	100 yr Storm	1648.00	831.38	836.47 837.78		838.91	0.005497	8.63	165.50	156.14	0.54
	1	100)/ 010/11	10-0.00	031.30	831.18		838.19	0.004981	7.45	391.64	187.23	0.54
	150.000	10 Yr Storm	695.50	830.77	836.54		838,73	0.002097	3.98	252.00	470.00	
	150.000	100 yr Storm	1648.00	830.77	837.82		838.06	0.002279	4,91	258.69 493.12	176.28	0.33
								0.002270	4.01	483.12	188.18	0.36
	130.000	10 Yr Storm	695.50	830.22	836.50		836.69	0.001859	3.98	284.01	183,14	0.32
	130.000	100 yr Storm	1848.00	830.22	837.79		838.03	0.002089	4.92	510.98	198.24	0.35
										0.0.00	100.27	
	110.000	10 Yr Storm	695.50	830.00	836,40	834.28	836.64	0.004280	4.10	214.54	214.21	0.42
	110.000	100 yr Storm	1648.00	830.00	837.73	836.77	837.98	0.001980	3.57	512.10	235.55	0.30
	ļ											
	109	<u> </u>	Bridge									
	00 000	44 11 21	 									
	93.000	10 Yr Storm	695.50	830.00	834.18	834.18	835.75	0.026874	10.04	69.26	22.16	1.00
	83.000	100 yr Storm	1648.00	830.00	835.79	636.33	837.43	0.022054	11.73	225.98	227.02	0.95
	72 000	40 V- 00										
	73.000 73.000	10 Yr Storm	696.50	829,99	834.35	833.33	834.54	0.008038	3.52	204.35	177.87	0.54
	7.5.000	100 yr Storm	1648.00	829.89	836,68	834.61	836.76	0.000944	2.39	840.95	378.41	0.22
	50.000	10 Yr Storm	695.50	000.00	904.45	 +						
	50.000	100 yr Storm	1848.00	829.00	834.42		834.45	0.000647	1.51	517.48	344.78	0.17
		-co ji qibili	1040,00	829.00	836.71		838.73	0.000219	1.37	1382.38	380.00	0.11
	0.000	10 Yr Storm	695.50	829.00	834.40	931.64	P24 /2	0.000055	4.00			
	0.000	100 yr Storm	1848.00			831.54	834.43	0.000398	1.87	644.96	380.00	0.14
~	1	100 yi Gidin	1040.00	829.00	836.70	832.94	836.72	0.000168	1.45	1518.96	380.00	0.

HEC-RAS SUMMARY OUTPUT SHEEP RUN PROPOSED CONDITIONS

10 yr/24 hr STORM & 100 yr/24 hr STORM

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
ı	700	10 Yr Storm		835.84	840.25	839.27	840.82	0.007622	6.09	115.63	42.07	0.6
1	700	100 Yr Storm	1648	835.84	840.97	841.32	843	0.020835	11.54	150.66	55.3	1.03
											1	1
1	650	10 Yr Storm	695.5	835	839.94	838.85	840.46	0.006417	5.84	135.23	116.57	0.56
1	650	100 Yr Storm	1648	835	841.51	840.9	842	0.00485	6.52	342.74	142.28	0.51
											†	
1	600	10 Yr Storm	695.5	834	839.74		840.17	0.004443	5.48	159.88	114.26	0.47
1	600	100 Yr Storm	1648	834	841.37	· · · · · · · · · · · · · · · · · · ·	841.77	0.00356	6.1	388.96	153.12	0.45
	1					· · · · ·						
1	550	10 Yr Storm	695.5	834	839.69		839.95	0.002568	4.56	205.48	106.39	0.37
1	550	100 Yr Storm	1648	834	841.23		841.6	0.002978	5.93	399.01	139.72	0.42
				-			-	1	1			1333
1	500	10 Yr Storm	695.5	834	838.63	838.63	839.65	0.011506	8.91	105.67	63.74	0.76
1	500	100 Yr Storm	1648	834	840.18	840.18	841.29	0.010647	10.56	239.39	104.07	0.77
-		200 11 0101111	20,0		3,0.10	3.0.10	1	3.023047	10.00			
1	450	10 Yr Storm	695.5	834	838.49	837.74	839.05	0.008284	6.06	122.9	66.49	0.62
1	450	100 Yr Storm	1648	834	839.42	839.6	840.76	0.008284	9.85	201.56	101.39	0.88
<u>+</u>	730	200 17 300111	12070	1034	000.42	333.0	10-10.70	0.013233	1.03	1202.30		10.00
1	400	10 Yr Storm	695.5	833.86	838.44	837.8	838.68	0.003657	4.61	209.06	128.16	0.43
1	400	100 Yr Storm	1648	833.86	839.13	838.79	839.73	0.003637	7.55	306.25	149.07	0.64
1	400	100 H Storm	1048	033.60	037.13	030./9	039./3	0.007749	7.55	300.23	143.07	0.04
	250	10 Vu Chaum	COE E	022.02	027.20	027.20	020.27	0.016502	8.27	00.02	124.67	0.88
1	350	10 Yr Storm	695.5	833.82	837.29	837.29	838.27	0.016592		98.83	 	+
1	350	100 Yr Storm	1648	833.82	838.61	838.61	839.29	0.009811	8.24	309.47	193.05	0.72
_		1011 0	co= =	200 74	225.00	225.2	007.0	0.005746		447.0	407.54	0.56
1	300	10 Yr Storm	695.5	832.71	836.88	836.2	837.3	0.006746	5.54	147.2	137.51	0.56
1	300	100 Yr Storm	1648	832.71	838.48	837.75	838.87	0.004408	5.96	397.27	224.41	0.49
		.							ļ		ļ	<u> </u>
1	250	10 Yr Storm	695.5	832	836.68		837.02	0.003821	4.87	168.1	124.85	0.44
1	250	100 Yr Storm	1648	832	837.5	836.94	838.5	0.009565	8.78	267.99	199	0.72
										<u> </u>		
1	200	10 Yr Storm	695.5	831.38	835.8	835.8	836.7	0.012324	8.96	112.29	86.66	0.79
1	200	100 Yr Storm	1648	831.38	837.37	837.37	838.1	0.009052	9.58	315.76	183.96	0.72
1	150	10 Yr Storm	695.5	830.77	834.62	834.86	835.94	0.024417	9.28	78.1	44.29	1.03
1	150	100 Yr Storm	1648	830.77	837.22	836.71	837.62	0.004206	6.2	396.01	183.14	0.48
									<u> </u>			
1	127	10 Yr Storm	695.5	830	834.15	834.17	835.48	0.01856	9.27	75.23	31.46	1.01
1	127	100 Yr Storm	1648	830	837.1		837.54	0.003289	6.43	391.57	193.01	0.48
1	113	10 Yr Storm	695.5	830	834.46	832.86	835.06	0.005639	6.18	112.56	25.22	0.52
1	113	100 Yr Storm	1648	830	837.19	836.32	837.45	0.002068	5.04	495	217.95	0.33
												I
1	101	1	Culvert						1			
-											1	
1	91	10 Yr Storm	695.5	830	833.96	1	834.68	0.007718	6.83	101.84	25.72	0.6
1	91	100 Yr Storm	1648	830	836.47	†	836.86	0.003509	6.14	429.94	264.99	0.43
	t -	1	 		1		1		1	1	1	1
1	73	10 Yr Storm	695.5	830	834.41		834.45	0.000618	1.72	440.75	180.96	0.17
1	73	100 Yr Storm	1648	830	836.69	†	836.74	0.00043	2.07	1071.52	378.69	0.16
-	,,,	200 11 300111	12070	1550	030.03	 	330.74	0.00043	12.07	10,102	13,0.03	15.20
1	50	10 Yr Storm	695.5	829	834.43	 	834.44	0.000063	0.76	1010.75	345.88	0.06
	50	100 Yr Storm	1648	829	836.71	 	836.73	0.000007	1.04	1875.26	380	0.06
1	130	TOO 11 Storm	1048	1029	1030./1	 	030./3	0.00007	1.04	10/3.20	1360	0.07
1	-	10 Va Ct	COT T	920	024.4	921.54	924.42	0.000300	1 72	644.96	380	0.14
1	0	10 Yr Storm	695.5	829	834.4	831.54	834.43	0.000388	1.73			
1	0	100 Yr Storm	1648	829	836.7	832.93	836.72	0.000165	1.49	1518.96	380	0.1

23/10				EMENT:	Kirn yy	
4.00	n disku	Doddri	dge Cou rmit Ap	nty, de	meril 1	i i
Please	ake notic	ihar o	rmit Ap	plication	Vugust,42	
Blue Mou	ıntain: İr	c.aCNX	Gas Co	mpany:	LLC filed	v 1 4
application	n for a	Fläodn	lain Per	mie real	avalar la	ind
located at	or about	39.2064	02N/80	833848W	Permit#	14
255(Sout with the C	lerk of th	rioge:#i	, al he	Applicat	on islon	Ωţe
orcopied	naringire	guiar, Du	isiness/h	urs. As t	us projec	f is
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County D	oddridg	County	Floodp	ain Man	igement l	ias
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Edwin L.	'Bo'' Wr	istón, D	ddridge	County	Flood Pla	iñ
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STATE OF WEST VIRGINIA, COUNTY OF DODDRIDGE, TO WIT

I, Virginia Nicholson, Editor of THE HERALD RECORD, a weekly newspaper published regularly, in Doddridge County, West Virginia, Do Hereby Certify That the Accompanying Legal Notice Entitled: Floodplain, Permit

application
Permit \$ 14-255
was published in said paper for
successive weeks beginning with the issue
of August 19th 2014 and
ending with the issue of
August 26 th 2014 and
that said notice contains 1.8.9
WORD SPACE at
amounts to the sum of \$ 2.1.7.4
FOR FIRST PUBLICATION, SECOND PUBLICATION IS 75% OF THE FIRST PUBLICATION
s 16,3.1and each publication thereafter
38.05 TOTAL
EDITOR
Virginia Mucholson
SWORN TO AND SUBSCRIBED
BEFORE ME THIS THE
OF August 2014
NOTARY PUBLIC

OFFICIAL SEAL
Notary Public, State Of West Virginia
LAURA J ADAMS
212 Edmond Street

West Union, WV 28456
My Commission Expires June 14, 2023

CNX GAS LLC

PROPOSED SHEEP RUN BRIDGE REPLACEMENT WV CR 19/II - MILE POST 2.45

LOCATE

DODDRIDGE COUNTY, WV

SCHEDULE OF DRAWINGS

DRAWING NO. T-01 DRAWING NO. WS-01 DRAWING NO. ST-01 DRAWING NO. SP-01 DRAWING NO. SP-02

TITLE SHEET
WATERSHED LIMITS

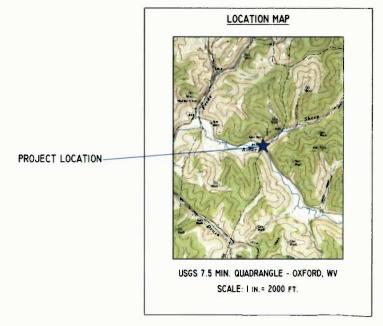
SOIL TYPES

SITE PLAN - EXISTING CONDITIONS - 10 YR/24 HR STORM SITE PLAN - PROPOSED CONDITIONS - 10 YR/24 HR STORM

DRAWING No. SP-03
DRAWING No. SP-04
DRAWING No. SP-05
DRAWING No. PR-01
DRAWING No. XS-01

DRAWING NO. XS-02

SITE PLAN - EXISTING CONDITIONS - 100 YR/24 HR STORM SITE PLAN - PROPOSED CONDITIONS - 100 YR/24 HR STORM PLAN VIEW - PROPOSED BOX CULVERT WATER SURFACE PROFILES FOR SHEEP RUN TYPICAL CROSS-SECTION - EXISTING BRIDGE TYPICAL CROSS-SECTION - PRECAST CONCRETE BOX CULVERT





NOTE: DRAWING WAS CREATED ON 22X34 PAPER.
IIX17 DRAWINGS ARE HALF SCALE.
REFER TO SCALE BAR FOR PROPER SCALING.

Blue Mountain Inc.
Engineers and Land Surveyors
11023 Mason Dison Hwy.
Buron, WY 25582-9656

ONE ENERGY DRIVE

CAS CHEE

REVISIONS

PAIE	ITPE					
4/17/15	NEW CULVERT DESIGN					
	-					
_	-					

DRAWN BY:	EER
CHECKED BY	WPF
DATE	07/22/1/

SCALE: 1" = 10"

DRAWING NAME: TITLE S

T-0I

Blue Mountain I

PROPOSED SHEEP RUN BRIDGE REPLACEMENT DODDRIDGE COUNTY, WV

CNIGAS

REVISIONS

RAWING NAME: WATERSHED

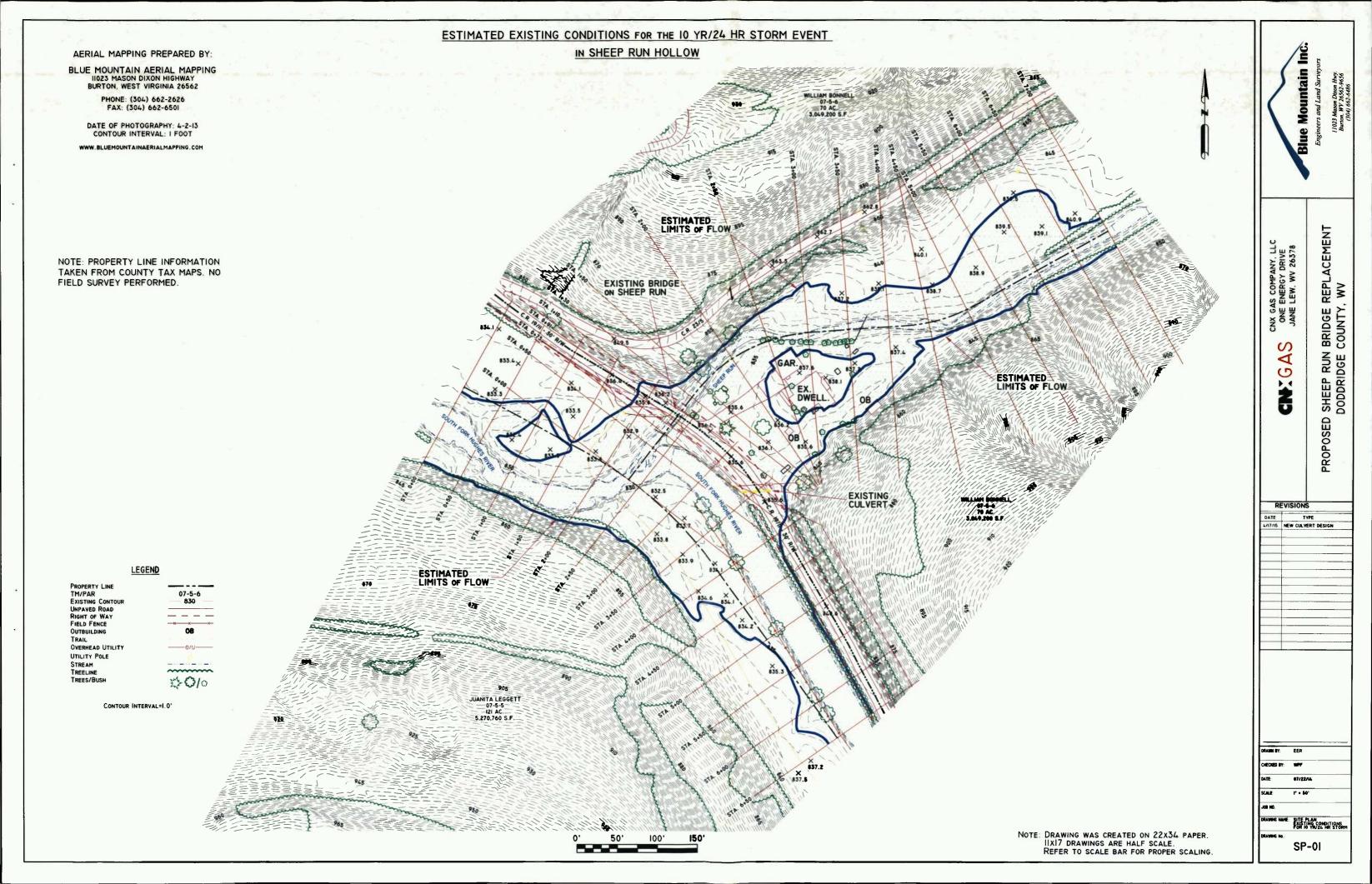
WS-01

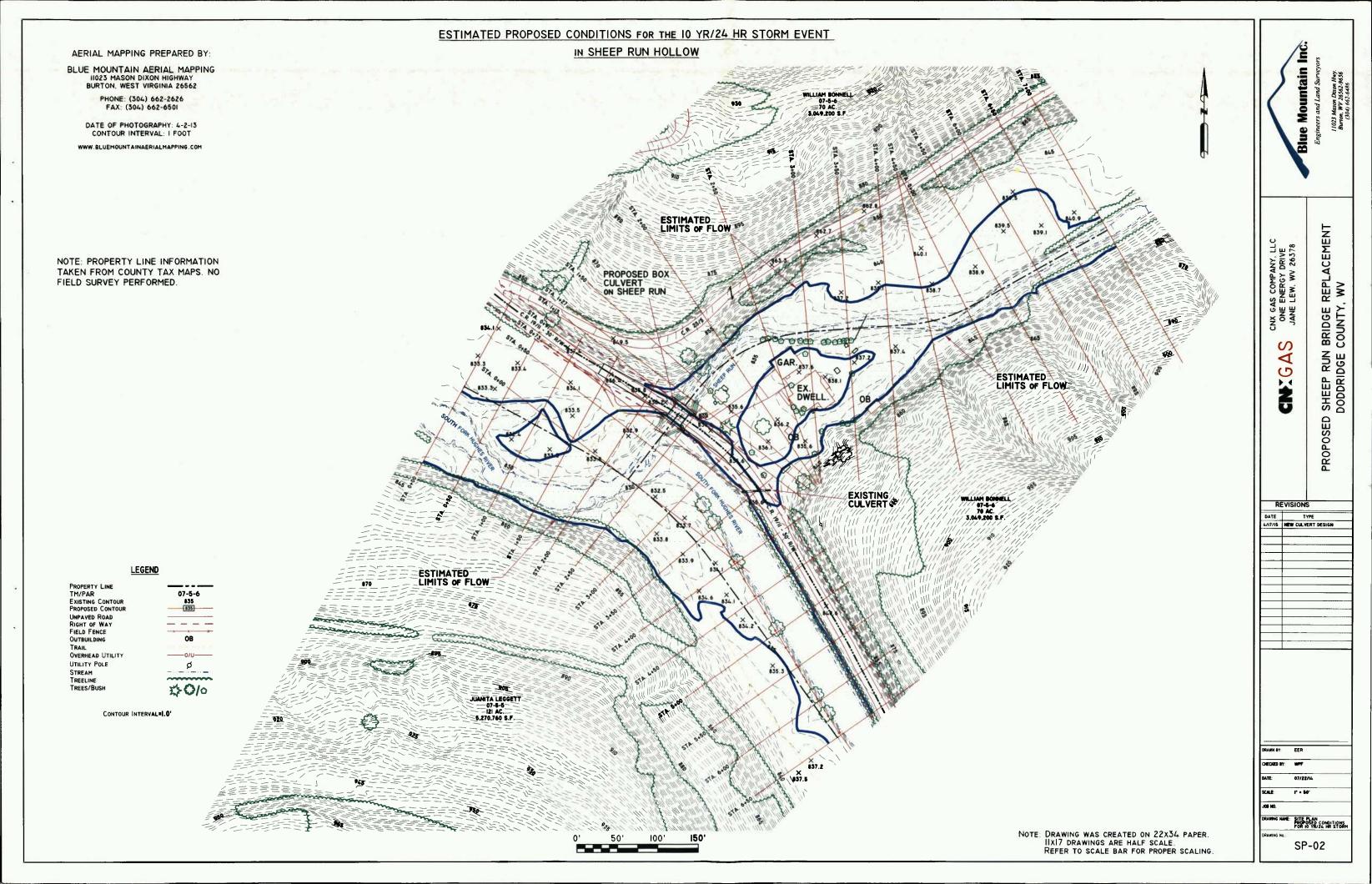
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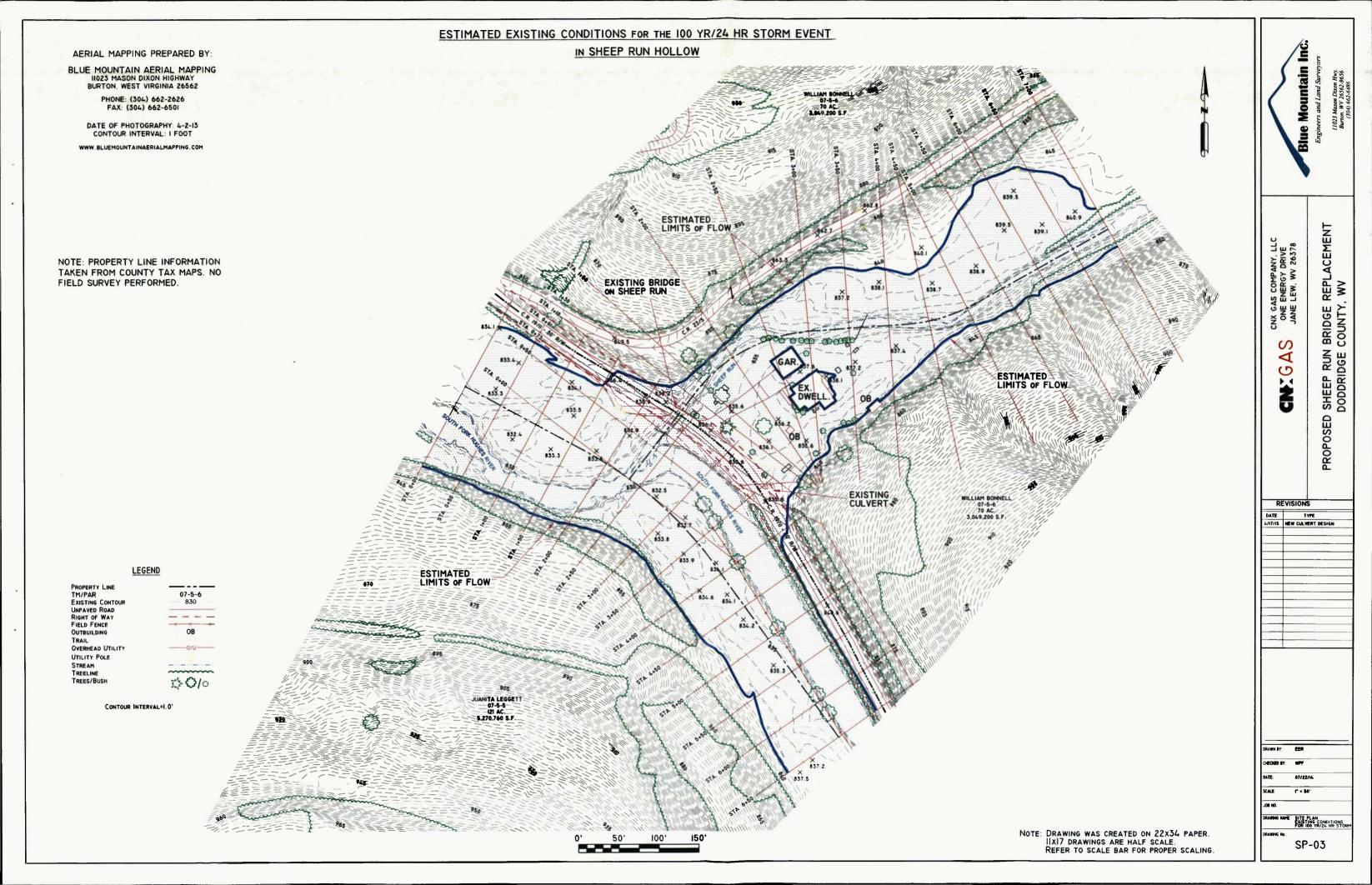
SHEEP RUN BRIDGE REPLACEMENT DODDRIDGE COUNTY, WV

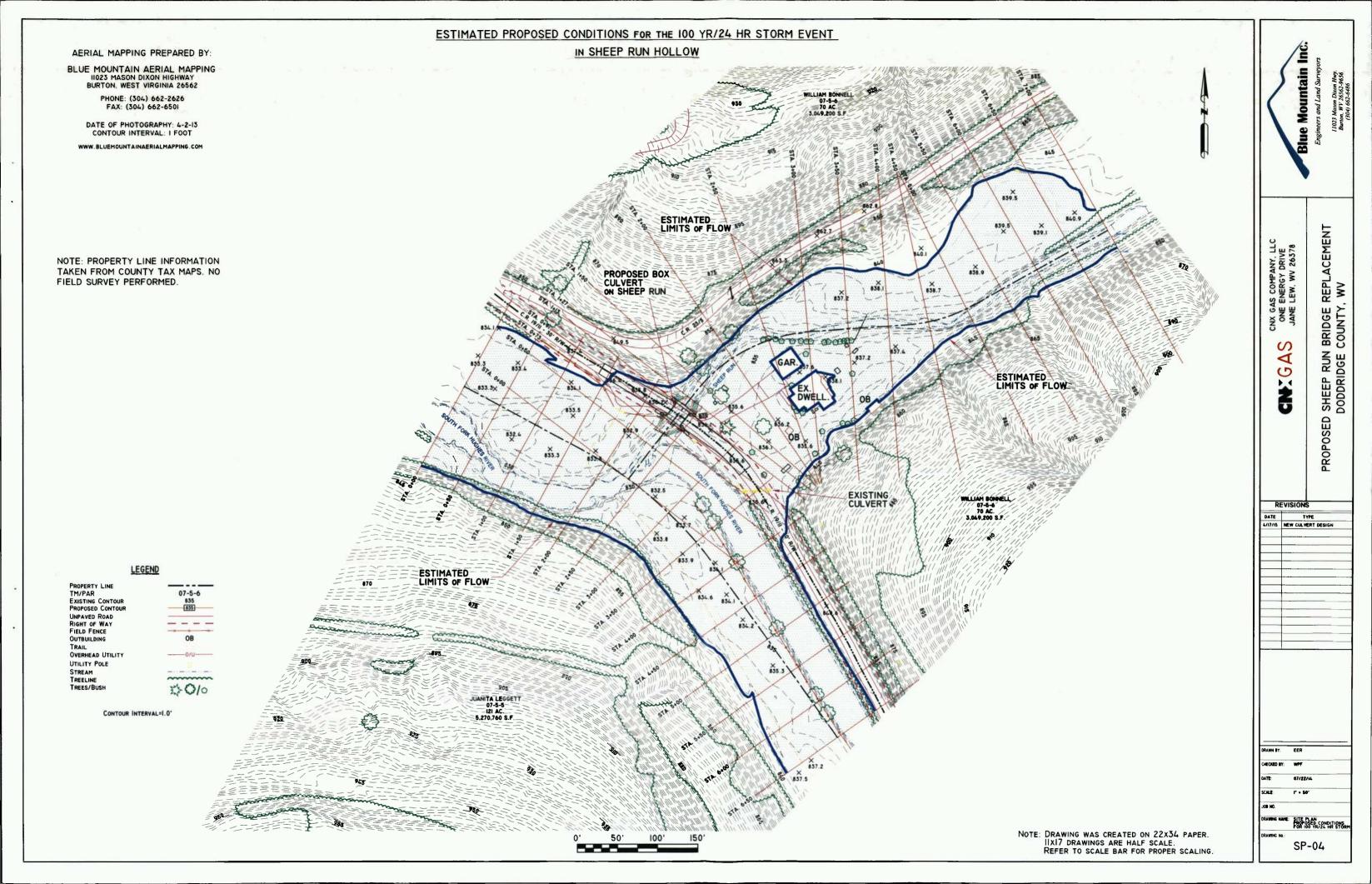
REVISIONS

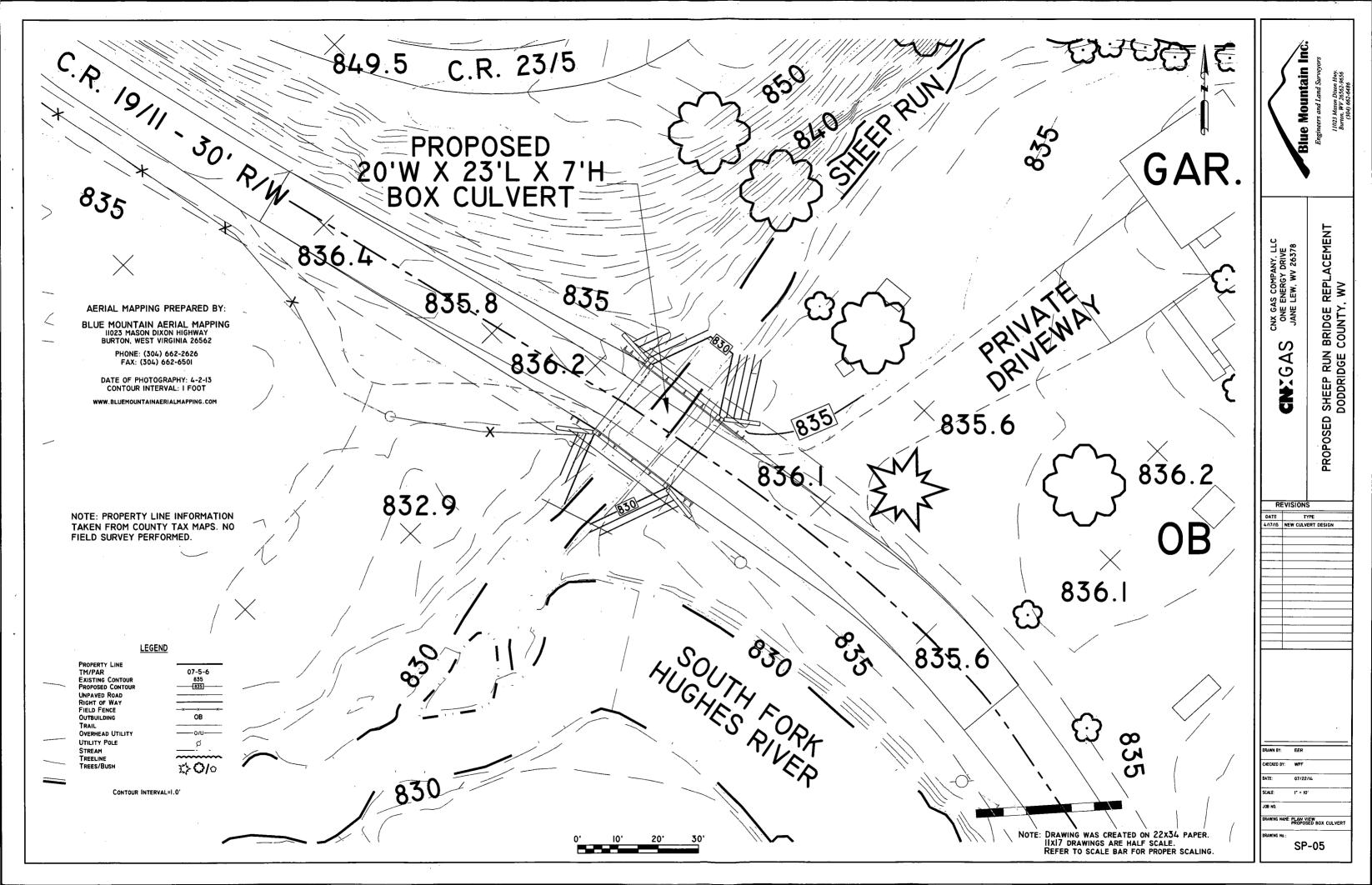
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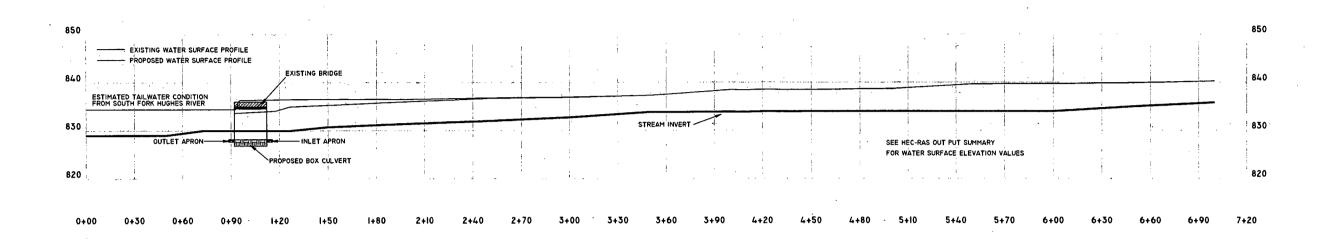




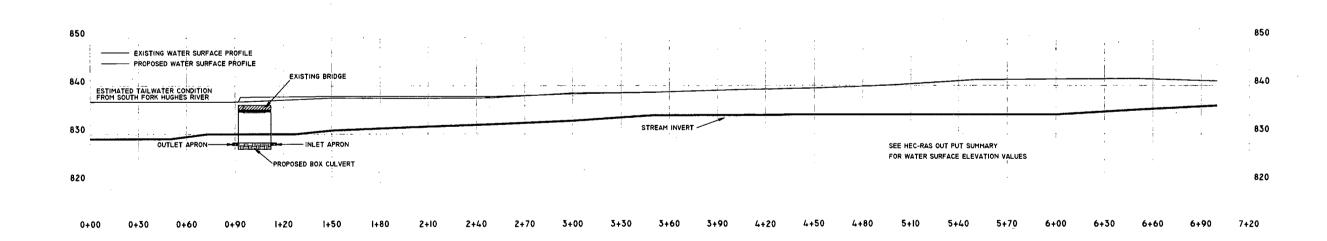




ESTIMATED WATER SURFACE PROFILES FOR THE 10 YR/24 HR STORM EVENT IN SHEEP RUN



ESTIMATED WATER SURFACE PROFILES FOR THE 100 YR/24 HR STORM EVENT IN SHEEP RUN



NOTE: DRAWING WAS CREATED ON 22X34 PAPER. IIXI7 DRAWINGS ARE HALF SCALE.
REFER TO SCALE BAR FOR PROPER SCALING. Blue Mountain Inc.
Engineers and Land Surveyors

SHEEP RUN BRIDGE REPLACEMENT DODDRIDGE COUNTY, WV CNX GAS COMPANY; LLC ONE ENERGY DRIVE JANE LEW, WV 26378 CNYGAS PROPOSED REVISIONS

DATE TYPE

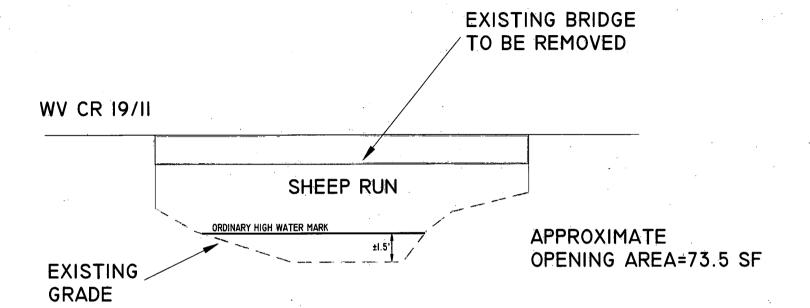
L/17/15 NEW CULVERT DESIGN

DRAWN BY: EER CHECKED BY: WPF SCALE:

ORAWING NAME: WATER SURFACE PROFIL

PR-0I

EXISTING STEEL & WOOD DECK BRIDGE ON WV CR 19/II @ MILE 2.45 CENTERLINE CROSS-SECTION N.T.S.



Blue Mountain Inc.
Engineers and Land Surveyors
11023 Magno Dison Hive.

PROPOSED SHEEP RUN BRIDGE REPLACEMENT DODDRIDGE COUNTY, WV

CNYGAS

REVISIONS
DATE TYPE
4/17/15 NEW CULVERT DESIGN

DRAWN BY: EER

CHECKED BY: WPF

DATE: 07/22/14

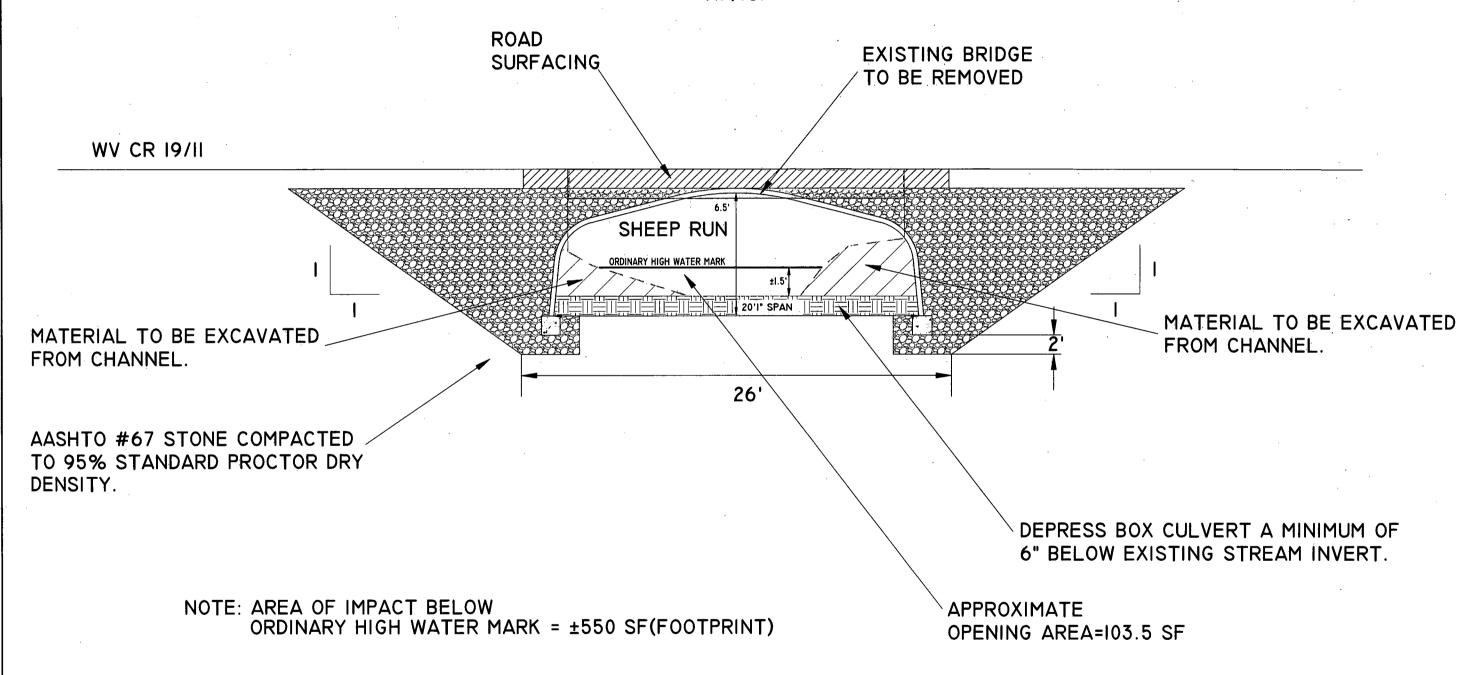
SCALE: N.T.S.

JOB NO.

DRAWING NAME: TYPICAL CROSS-SECTION EXISTING BRIDGE

XS-01

23' WIDE x 6.5' HIGH ALUMINUM BOX CULVERT CENTERLINE CROSS-SECTION N.T.S.



NOTE: ESTIMATED FILL TO BE PLACED BELOW ORDINARY HIGH WATER MARK = ±135 CY. 23'Wx24'Lx6.5'D

NOTE: DRAWING WAS CREATED ON 22X34 PAPER. IIX17 DRAWINGS ARE HALF SCALE. REFER TO SCALE BAR FOR PROPER SCALING.

Blue Mountain Inc.
Engineers and Land Surveyors
11023 Maxon Dixon Hwy.

ONE ENERGY DRIVE IANE LEW, WV 26378

CAS CAS

REVISIONS

DATE TYPE
4/17/15 NEW CULVERT DESIGN

DRAWN BY: EER

CHECKED BY: WPF

DATE: 07/22/14

SCALE: N.T.S.

JOB NO.

RAWING NAME: TYPICAL CROSS-SECTION PRECAST CONCRETE BOX CULVERT

XS-02

CNX GAS COMPANY, LLC

PROPOSED BRIDGE REPLACEMENT ON SHEEP RUN WV CR 19/II - MILE POST 2.45

LOCATE

DODDRIDGE COUNTY, WV

SCHEDULE OF DRAWINGS

DRAWING NO. T-01
DRAWING NO. GEN-01
DRAWING NO. ES-01
DRAWING NO. PL-01

DRAWING No. PL-02

TITLE SHEET
GENERAL NOTES
EROSION AND SEDIMENT CONTROL PLAN
PLAN OF EXISTING CONDITIONS
PLAN OF PROPOSED CONDITIONS

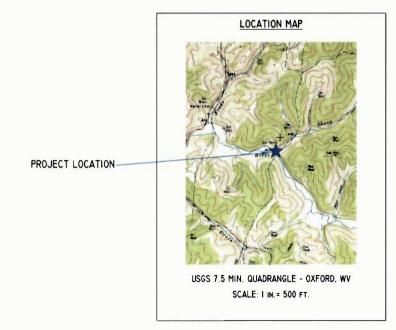
DRAWING No. PL-03 DRAWING No. SECT-01 DRAWING No. SECT-02

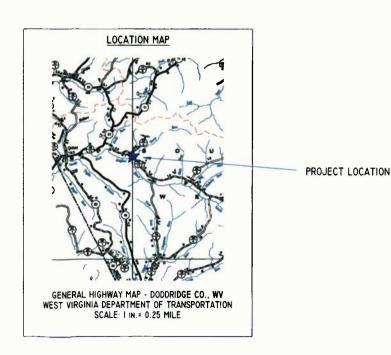
DRAWING No. TR-01 DRAWING No. TR-02 PLAN OF PROPOSED CONDITIONS-DETAILS

SECTIONS SECTIONS

TRAFFIC CONTROL DETOUR PLAN

TRAFFIC CONTROL DETOUR PLAN-DETAILS





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STATE OF THE S

NOTE: DRAWING WAS CREATED ON 22x34 PAPER.
IIX17 DRAWINGS ARE HALF SCALE.
REFER TO SCALE BAR FOR PROPER SCALING.

Blue Mountain Inc.
Engineers and Land Surveyors

JENT ON SHEEP R

CNEGAS

REVISIONS

DATE TYPE
4/17/15 NEW CULVERT DESIGN

TRAINN BY: EER

THECKED BY: WPPF

WATE: 08/15/14

CCALE 1" = 10"

NAMING NAME: TITLE SHEET

LAWING No.:

T-01

GENERAL NOTES

GOVERNING SPECIFICATIONS

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION, DIVISION OF HIGHWAYS, STANDARD SPECIFICATIONS FOR ROADS AND BRIDGES, ADOPTED 2010, AND THESE PLANS AND DOCUMENTS, ARE THE GOVERNING CRITERIA APPLICABLE TO THIS PROJECT.

EROSION AND SEDIMENT CONTROL

DETAILS NOT SHOWN IN THE PLANS SHALL BE IN ACCORDANCE WITH THE WEST VIRGINIA DIVISION OF HIGHWAYS EROSION AND SEDIMENT CONTROL MANUAL, DATED MARCH I, 2003. IN THE EVENT THAT TEMPORARY EROSION AND POLLUTION CONTROL MEASURES ARE REQUIRED DUE TO THE CONTRACTORS NEGLIGENCE, CARELESSNESS OR FAILURE TO INSTALL CONTROLS REQUIRED BY THIS WORK, SUCH WORK SHALL BE PERFORMED BY THE CONTRACTOR AT HIS EXPENSE.

PRIOR TO STARTING ANY CONSTRUCTION ACTIVITIES, EROSION AND SEDIMENT CONTROL MEASURES AS SHOWN ON DWG. No. ES-01, EROSION AND SEDIMENT CONTROL PLAN, ARE TO BE INSTALLED TO THE LINES AND GRADES INDICATED.

THE CONTRACTOR IS TO NAME AN INDIVIDUAL TO REVIEW THE EROSION CONTROL MEASURES AT A MINIMUM OF ONCE PER WEEK, AND AFTER EVERY STORM EVENT. ALL PREVENTATIVE AND REMEDIAL MAINTENANCE WORK, INCLUDING CLEAN OUT, REPAIR, REPLACEMENT, REGRADING, RESEEDING, REMULCHING MUST BE PERFORMED IMMEDIATELY. IF EROSION AND SEDIMENT CONTROLS FAIL TO PERFORM AS EXPECTED, REPLACEMENT OR MODIFICATION OF THE INSTALLED CONTROLS WILL BE REQUIRED.

EXISTING UTILITIES

THE LOCATION OF ALL KNOWN UTILITIES ARE SHOWN ON THE PLANS BASED ON THE BEST AVAILABLE INFORMATION. IT IS THE CONTRACTORS RESPONSIBILITY TO DETERMINE THE LOCATION AND STATUS OF ALL UTILITIES AND TO MAKE A ONE CALL PRIOR TO ANY CONSTRUCTION ACTIVITIES IN ACCORDANCE WITH LOCAL REQUIREMENTS. THE CONTRACTOR WILL BE RESPONSIBLE FOR ANY DAMAGE OR DISRUPTION TO UTILITY LINES.

BENCH MARKS

THE CONTRACTOR SHALL ATTEMPT TO HOLD BENCH MARK LOCATIONS THROUGHOUT THE LIFE OF THE PROJECT. IN THE EVENT THAT A BENCHMARK IS DISTURBED, THE CONTRACTOR, AS DIRECTED BY THE PROJECT ENGINEER, WILL REESTABLISH OR RELOCATE THE BENCHMARK. NO ADDITIONAL PAYMENT OR COMPENSATION WILL BE MADE FOR THIS WORK.

VERIFICATION OF DIMENSIONS

THE CONTRACTOR IS RESPONSIBLE FOR THE VERIFICATION OF ALL ELEVATIONS AND PLAN DIMENSIONS PRIOR TO ORDERING MATERIALS FOR CONSTRUCTION OF ITEMS IN THIS PROJECT.

VERIFICATION OF CROSS SECTIONS

THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING EXISTING GRADE AS INDICATED ON THE CROSS SECTIONS PRIOR TO THE START OF ANY CONSTRUCTION.

ASPHALT PAVING

ASPHALT PAVING FOR THIS PROJECT WILL BE IN ACCORDANCE WITH SECTION 401 OF THE WVDOH STANDARD SPECIFICATIONS FOR ROADS AND BRIDGES. THE HOT MIX ASPHALT FOR THIS PROJECT SHALL BE MARSHALL HEAVY MIX DESIGN.

REVEGETATION

ALL DISTURBED AREAS ARE TO BE SEEDED, MULCHED, AND FERTILIZED IN ACCORDANCE WITH SECTION 652 OF THE WVDOH STANDARD SPECIFICATIONS FOR ROADS AND BRIDGES.

TRAFFIC CONTROL

TRAFFIC CONTROL FOR THIS PROJECT SHALL BE IN ACCORDANCE WITH SECTION 636 OF THE WVDOH STANDARD SPECIFICATIONS FOR ROADS AND BRIDGES, AND DWG. No. TR-01, TRAFFIC CONTROL DETOUR PLAN, AND DWG. No. TR-02, TRAFFIC CONTROL DETOUR PLAN-DETAILS.

Blue Mountain Inc.
Engineers and Land Surveyors

T ON SHEEP RI

REPLACEMEN

g B SED BRIDGE REP WV (

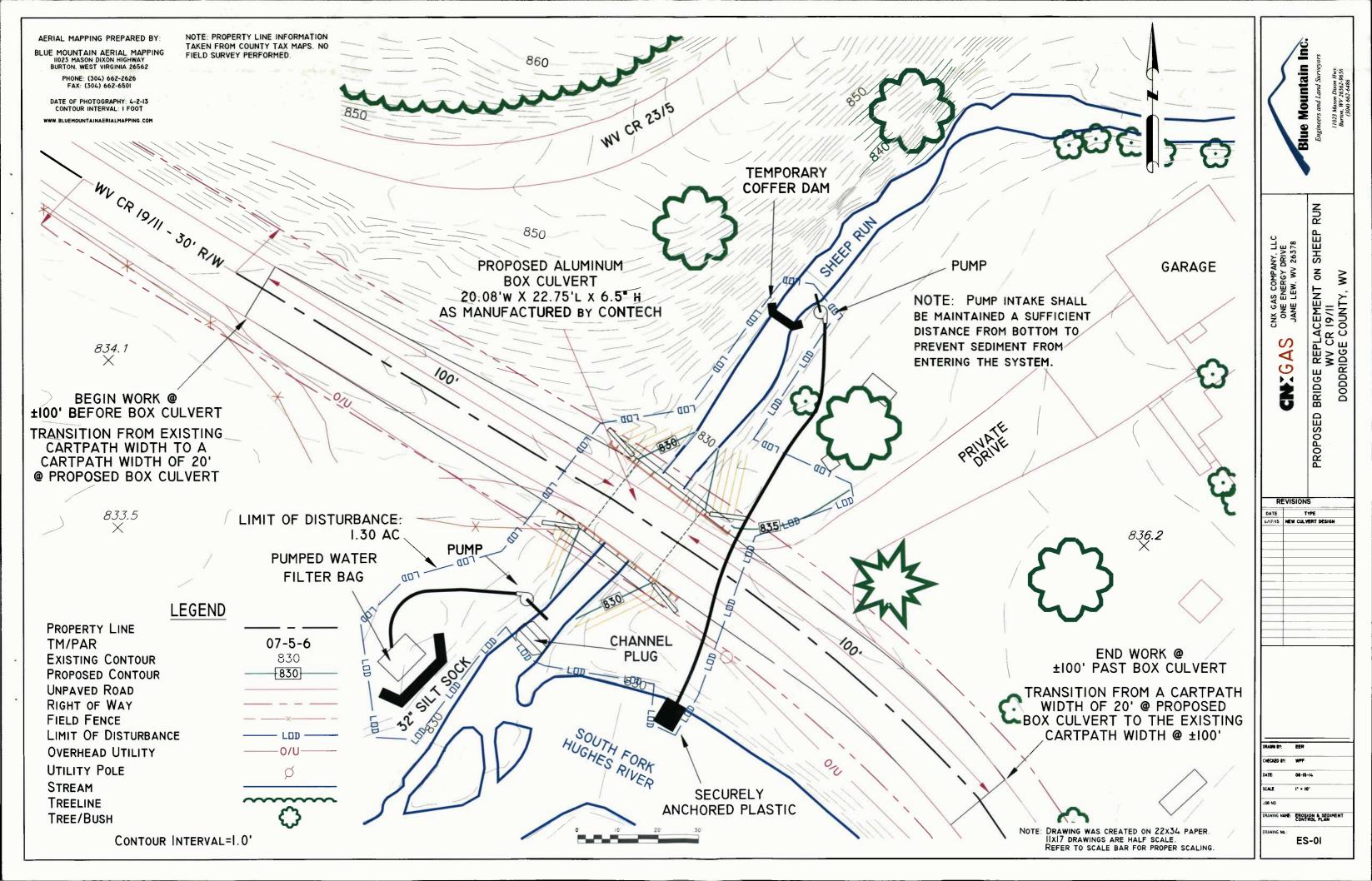
REVISIONS
ATE TYPE
117/IS NEW CULVERT DESIGN

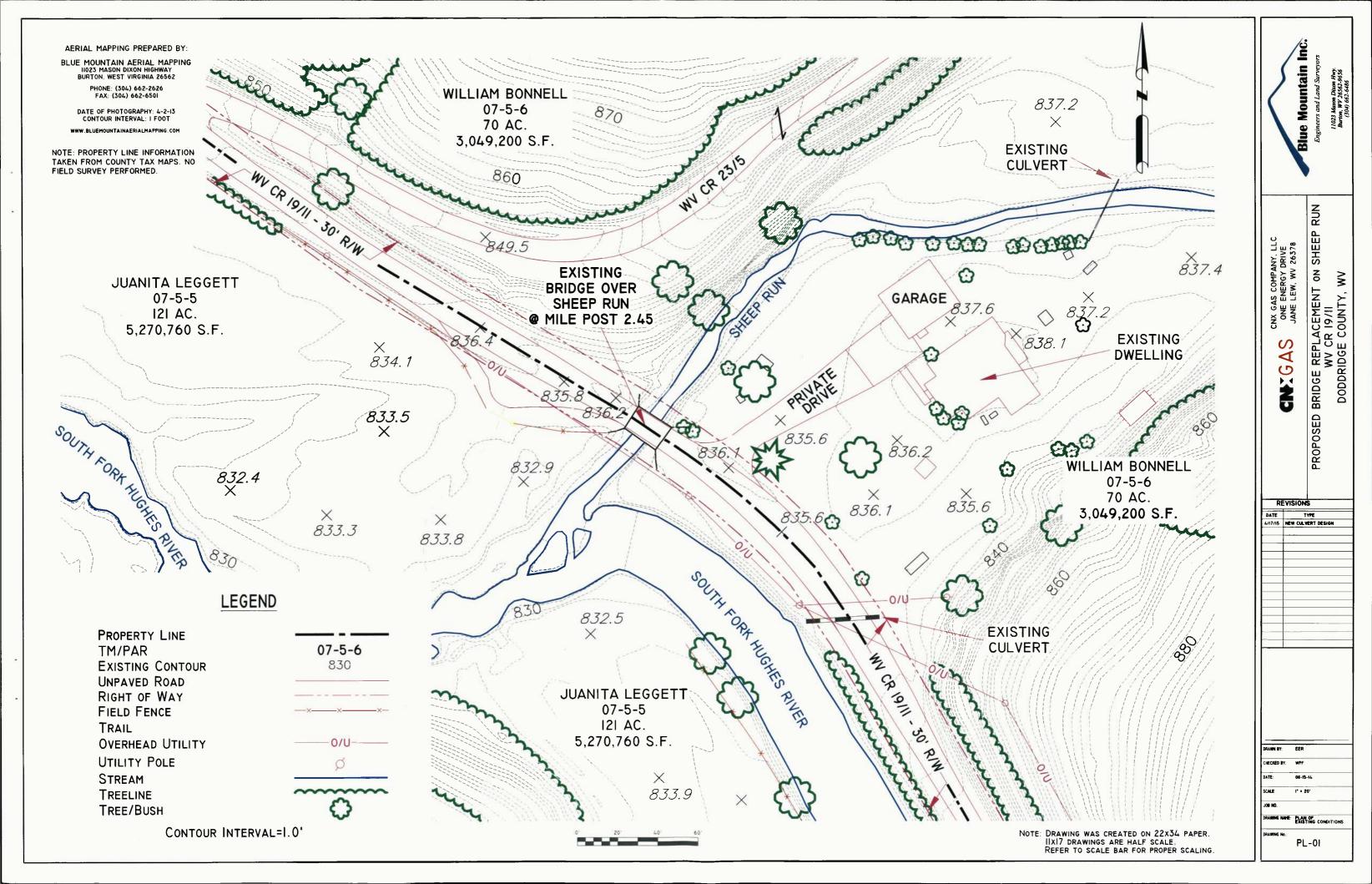
DRAWN BY: EER
CHECKED BY: WPF
DATE: 06-15-14
SCALE: N.A.

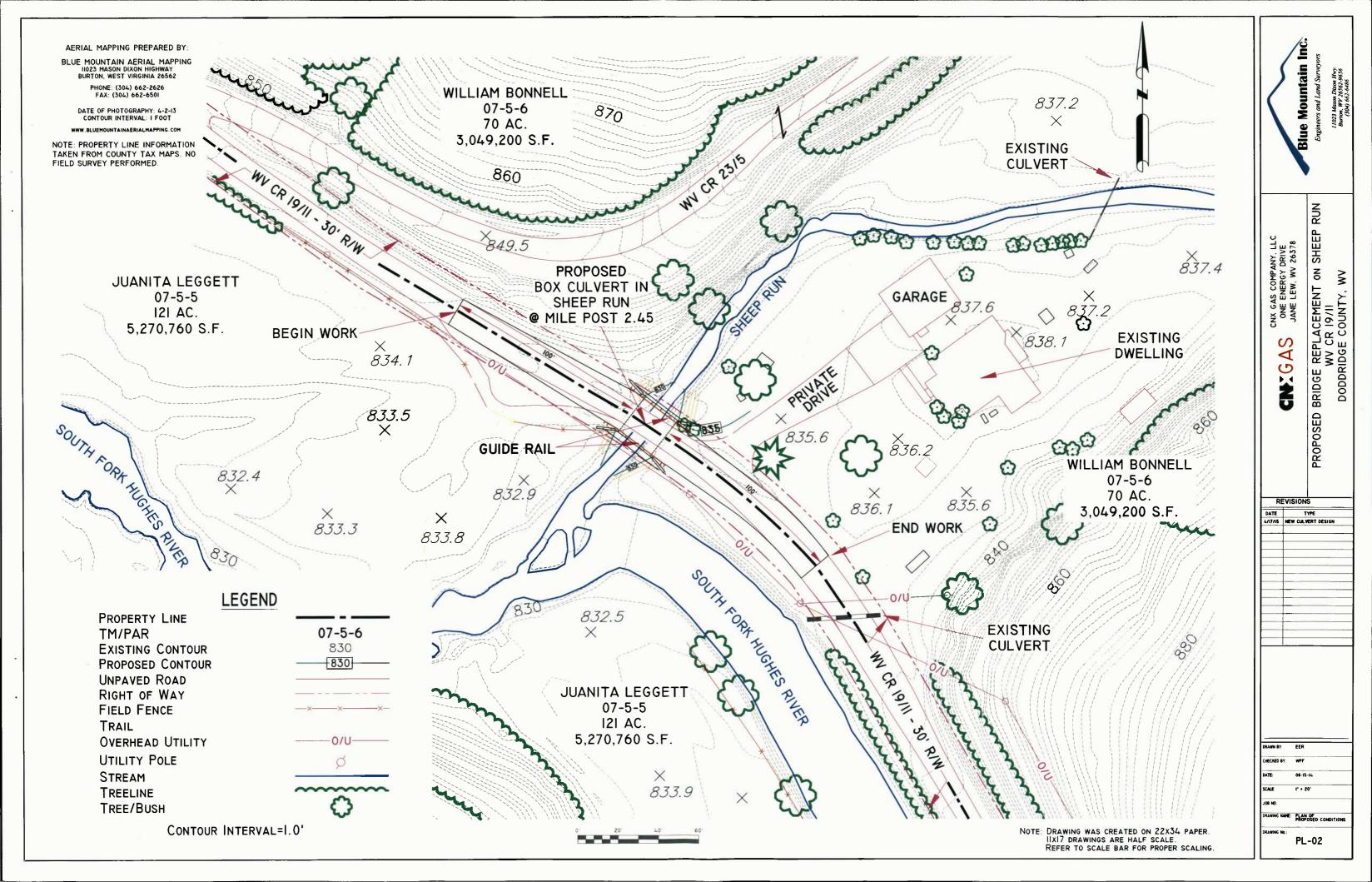
B NO.
AWING MAME: GENERAL NOTES

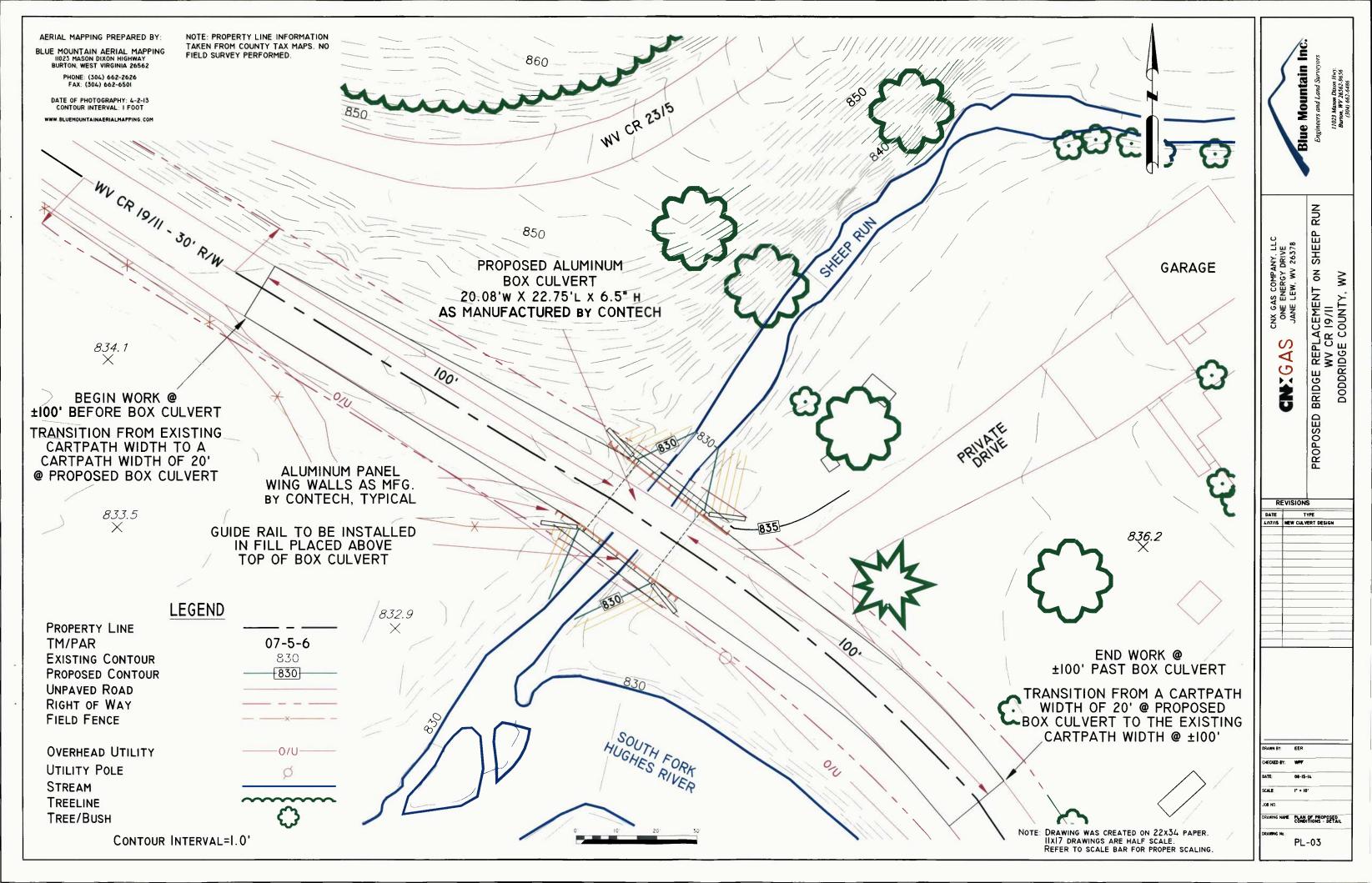
GEN-01

NOTE: DRAWING WAS CREATED ON 22X34 PAPER.
IIX17 DRAWINGS ARE HALF SCALE.
REFER TO SCALE BAR FOR PROPER SCALING.



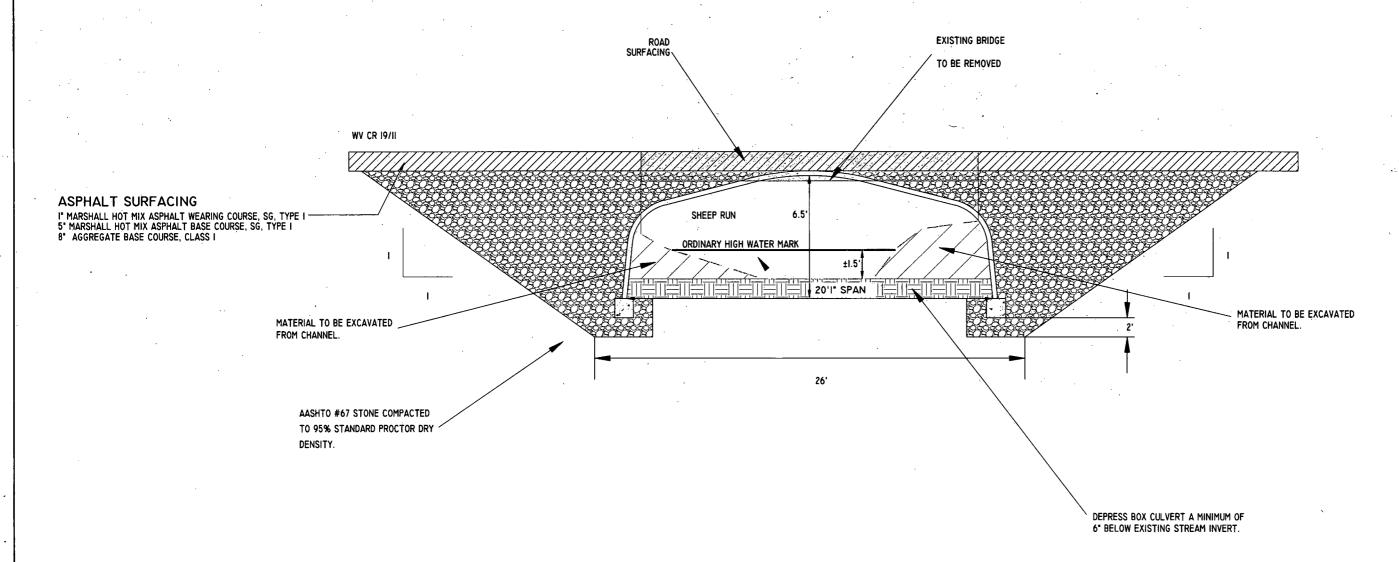






NOTE: ASPHALT SURFACING TO EXTEND 100' FROM EDGE OF BOX CULVERT IN BOTH DIRECTIONS, MAKING A SMOOTH TRANSITION FROM THE EXISTING CARTPATH WIDTH TO A MINIMUM 20' CARTPATH WIDTH AT BOX CULVERT.

SECTION ALONG CENTERLINE OF WV CR 19/11 N.T.S.



Note: Drawing was created on 22x34 paper. IIx17 drawings are half scale. Refer to scale bar for proper scaling. Blue Mountain Inc.

LEW, WV 26378

NT ON SHEEP RUN

PROPOSED BRIDGE REPLACEMENT ON WY CR 19/11

DODDRIDGE COUNTY, WV

CNIGAS

REVISIONS

DATE TYPE
4/17/15 NEW CULVERT DESIGN

CHECKED BY: WPF

DATE: 08-15-14

SCALE: 1' = 5'

JOB NO.

DRAWING MANE: SECTYCLUS

SECT-01

SECTION ALONG CENTERLINE OF WV CR 19/11
N.T.S.

Blue Mountain Inc.
Engineers and Land Surveyors

ELEW, WV 26378 ENT ON SHEEP RUN

PROPOSED BRIDGE REPLACEMENT ON WV CR 19/11

DODDRIDGE COUNTY, WV

REVISIONS

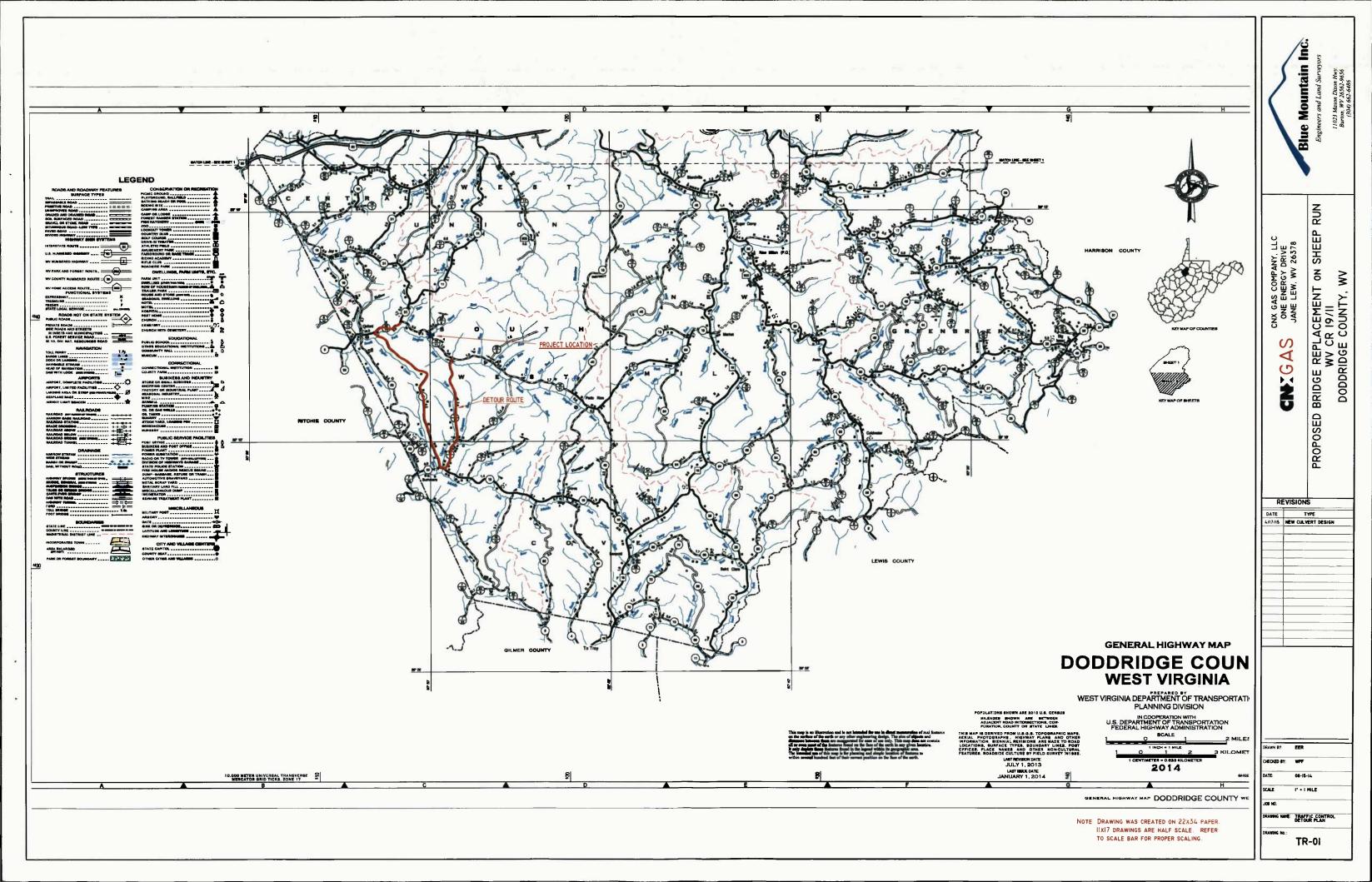
DATE TYPE
4/17/15 NEW CULVERT DESIGN

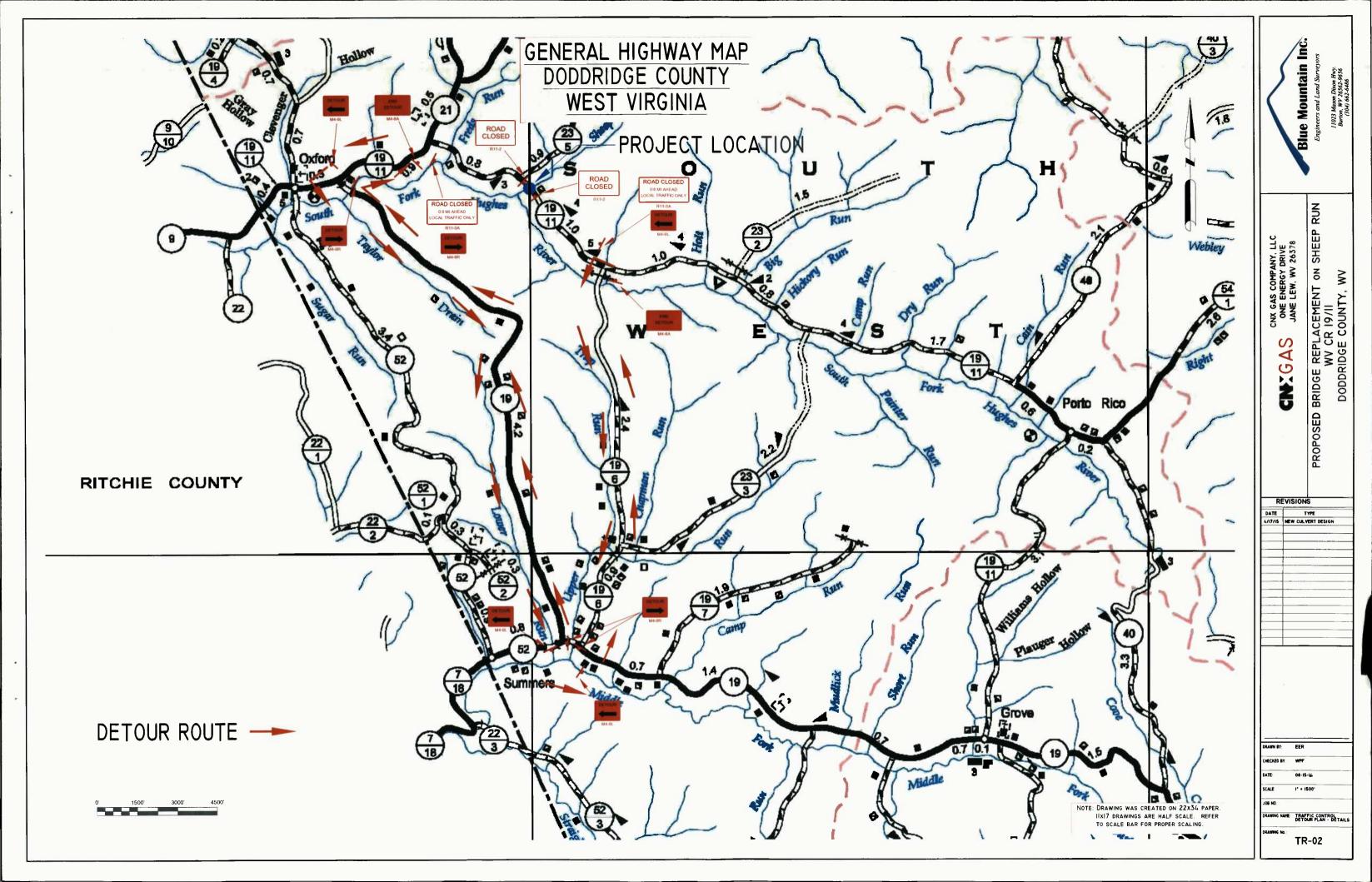
RAWN BY: EER
HECKED BY: WPF
ATE: 08-15-14

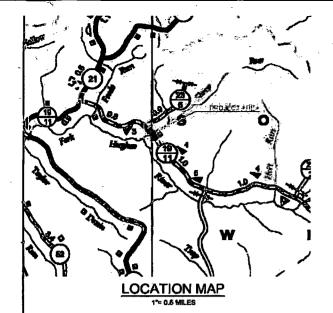
JOB NO. (* * 5*

SECT-02

Note: Drawing was created on 22x34 paper. IIx17 drawings are half scale. Refer to scale bar for proper scaling.











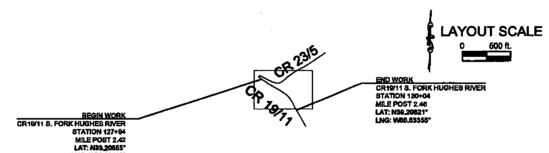
CNX GAS COMPANY, LLC One Energy Drive Jane Lew, WV 26378

COUNTY ROUTE 19/11 (SOUTH FORK HUGHES RIVER)

DISTRICT 4
SOUTHWEST DISTRICT
DODDRIDGE COUNTY

SHEEP RUN BRIDGE REPLACEMENT

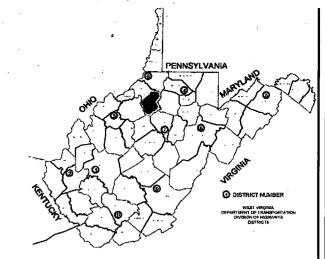
	STATION		STATION		Ħ	1	(ILE(S)	
ROADWAY	127+84	TO	128+85	=	101.00	=	0.019	
BOX CULVERT	128+85	ŤŌ	129+05	=	20.00	=	0.004	
ROADWAY	129+05	TO	130+04	=	99.00	=	0.019	
	TOTAL DE	O IEC	TIENGTH	=	220.00	=	0.042	





Engineers and Land Surveyors

11023 Mason Dixon Hwy. Burton, WV 26562-9656 (304) 662-6486

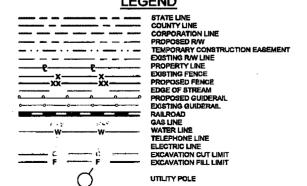


TYPE OF CONSTRUCTION BRIDGE REPLACEMENT

S	Sheet List Table							
Sheet Number	Sheet Title							
1	TITLE SHEET							
2	TYPICAL SECTIONS							
3	QUANTITY TABLES							
4	GENERAL NOTES							
5	EXISTING SITE PLAN							
6	PROPOSED SITE PLAN							
7	E&S PLAN							
8	E&S DETAILS							

William M. Bonsell William 15

DESIGN DESIGNATION A.D.T. (20) = DATA A.D.T. (20) = NOT D.H.V. = AVAILABLE D. = T. = V. * 35 M.P.H.



PRELIMINARY

Note: Drawing was created on 22x34 paper. 11x17 drawings are half scale. Refer to scale bar for proper scaling.

Blue Mountain I
Engineers and Land Surveyors
11023 Mann Drow thro.
Borna, 177,2456,5658

ONE ENERGY DRIVE JANE LEW, WV 26378

RUN BRIDGE REPLACEMENT
TITLE SHEET

GNXGAS

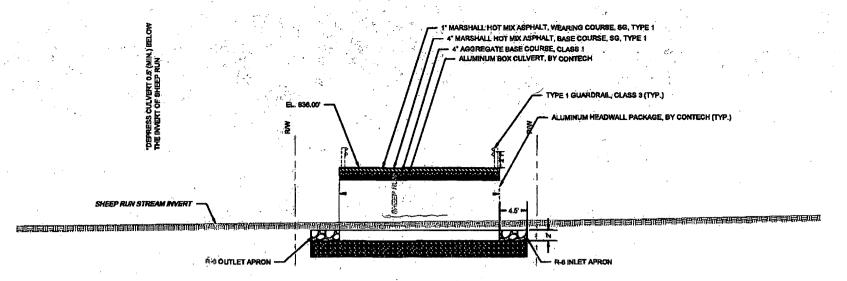
ATE TYPE

REVISIONS

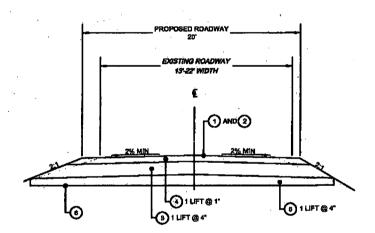
WAN BY: EER CKED BY: WPF E: 54122015

3 NO. 0498-14

SHEET 1 OF 8



CR 19/11 STA 128+85 TO 129+05 NTS



<u>CR 19/11</u> STA 127+84 TO 128+85 STA 129+05 TO 130+04 NTS

LEGE

- (1) EXISTING ROADH
- (2) ITEM 415005-001: REMOVE EXISTING PAVEMENT SURFACE
-) ITEM 401001-020: MARBHALL HMA BASE COURSE, SG, TYPE 1
- TEM 401002-020: MARSHALL HMA WEARING COURSE, SG, TYPE 2
- TTEL STYPE AND EARDINE FOR CERABATION

PRELIMINARY

Note: Drawing was created on 22x34 paper. 11x17 drawings are half scale. Refer to scale bar for proper scaling.

Blue Mountain In

(GAS COMPANY LLC NE ENERGY DRIVE NE LEW, WV 26378

SHEEP RUN BRIDGE F

REVISIONS
ATE TYPE

N BY: CER

DATE: 6/11/2015

SCALE: AS SHOWN

SHEET 2 OF 8

		·			
QUANTITY SUMMARY					
ITEM NO.	DESCRIPTION	APPROXIMATE QUANTITIES	UNITS		
201001-000	CLEARING AND GRUBBING	1	LS		
204001-000	MOBILIZATION	1	LS		
207001-001	UNCLASSIFIED EXCAVATION	150	CY		
207034-000	FABRIC FOR SEPARATION	475	SY		
212004-000	COFFERDAM	1.	LS		
218001-001	R-6 RIP-RAP	70	TN		
307001-001	AGGREGATE BASE COURSE, CLASS 1	92	TN		
307001-002	AASHTO #67 STONE	265	TN		
401001-020	MARSHALL HMA BASE COURSE, SG, TYPE 1	107	TN		
401002-020	MARSHALL HMA WEARING COURSE, SG, TYPE 1	30	TN		
415005-001	REMOVE EXISTING PAVEMENT SURFACE	500	SY		
607001-001	TYPE 1 GUARDRAIL, CLASS 3	76	LF		
608001-002	RE-LOCATE FARM FENCE	112	LF		
608007-001	VEHICULAR GATE, FARM FIELD	1	EA		
636001-001	TRAFFIC CONTROL	1	LS		
637001-001	WATER FOR DUST PALLATIVE	0.2500	MG		
642012-001	8" COMPOST FILTER SOCK	185	LĘ .		
642012-002	32" COMPOST FILTER SOCK	31	LF		
652002-001	FERTILIZER, 10-20-10	0.0800	TON		
652003-002	SEED MIXTURE, D	6	LBS		
652004-001	STRAW OR HAY FOR MULCH	0.7300	TON		
999999-001	REMOVE EXISTING BRIDGE	1	LS		
999999-002	INSTALL ALUMINUM BOX CULVERT, FOUNDATIONS, & WINGWALLS	1	LS		

*ALL LABOR, MATERIAL, AND EQUIPMENT RELATED TO THE DE-WATERING OF THE CULVERT WORK AREA SHALL BE INCIDENTAL TO ITEM #212004-000, COFFERDAM

PRELIMINARY

Note: Drawing was created on 22x34 paper. 11x17 drawings are half scale. Refer to scale bar for proper scaling.

Blue Mountain Inc Engineers and Land Sirveyors

K GAS COMPANY LLC INE ENERGY DRIVE INE LEW, WY 26378

(A) CNXGAS

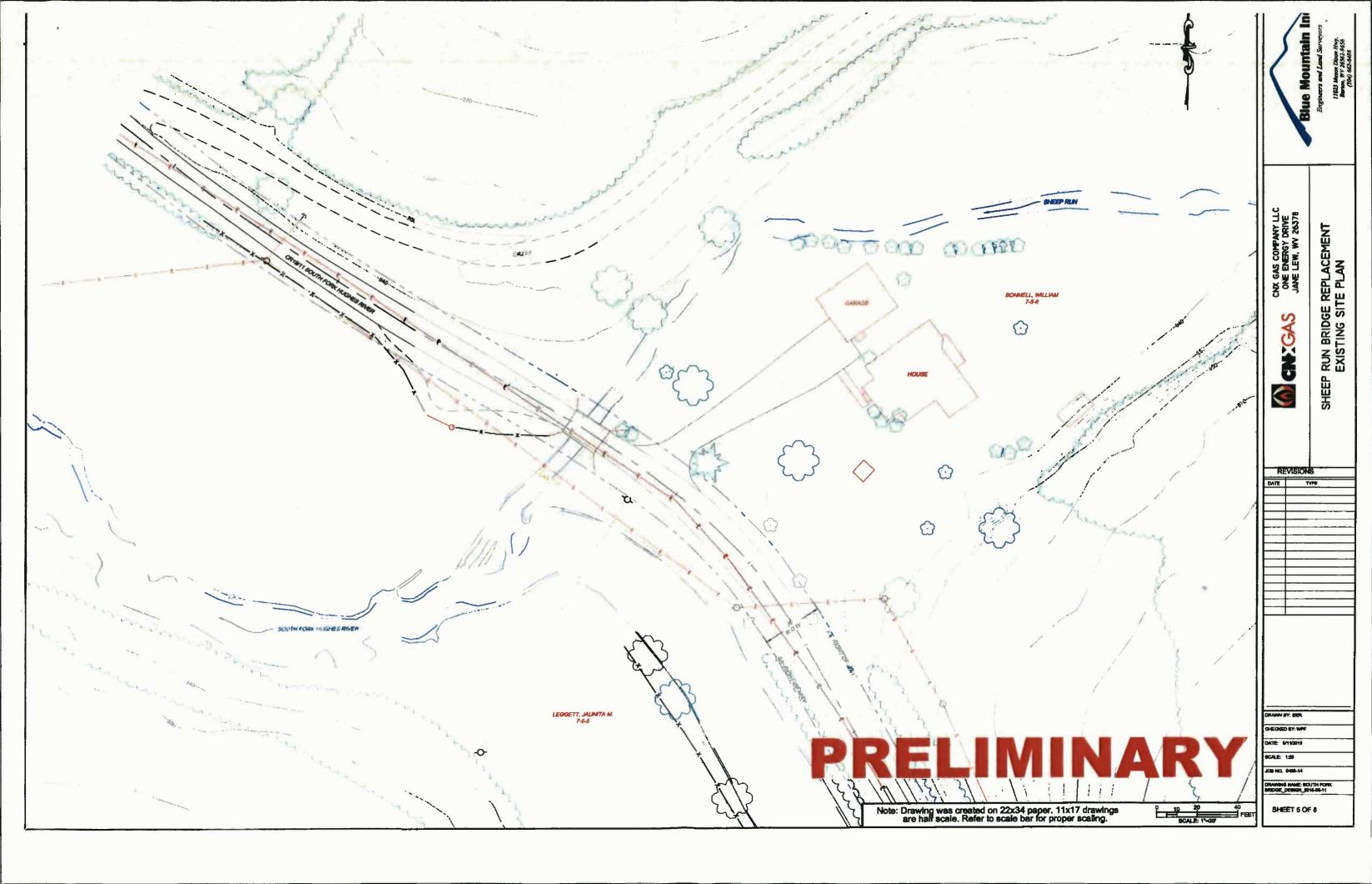
DATE TYPE

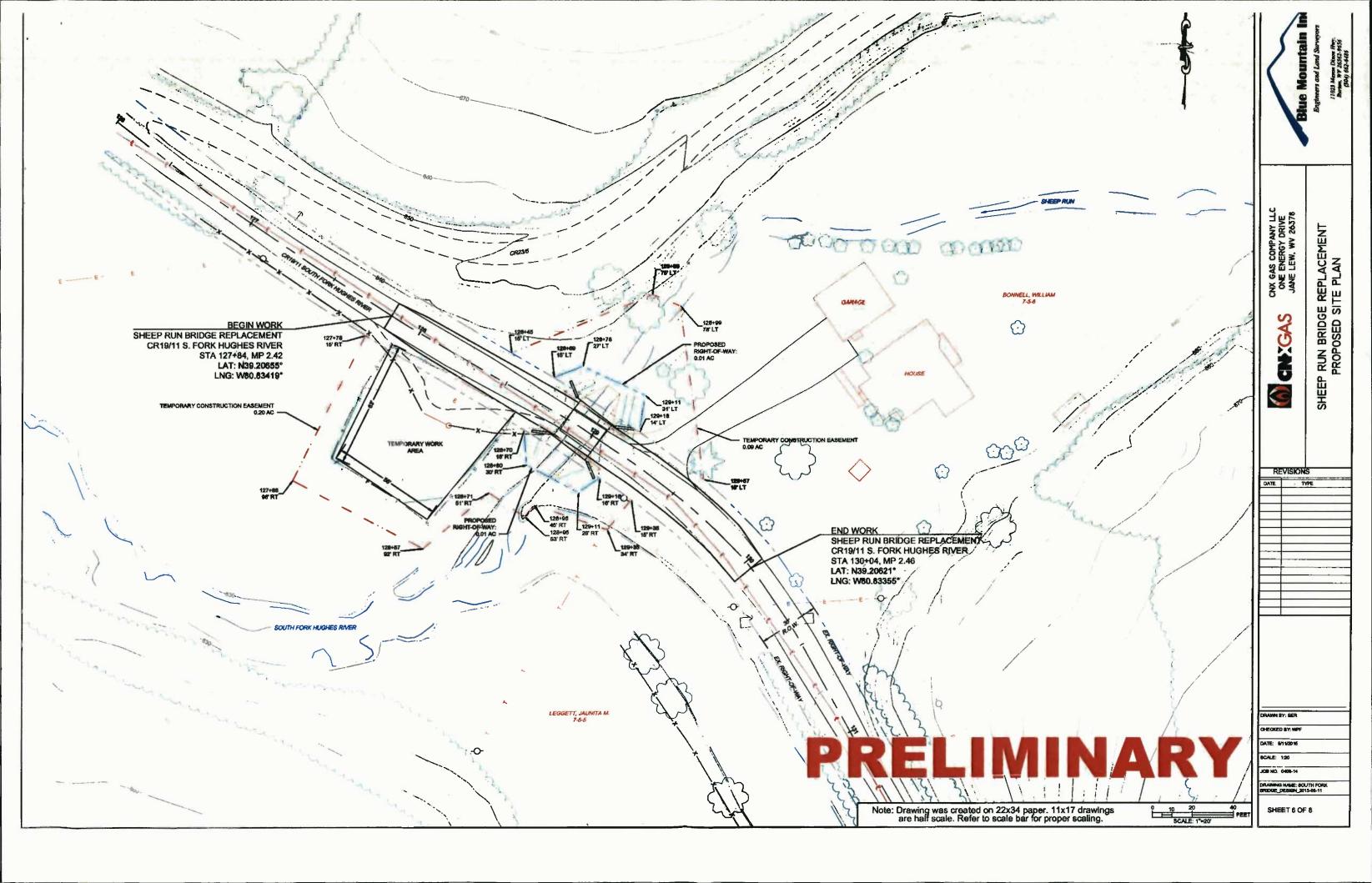
DRAWN BY: EER

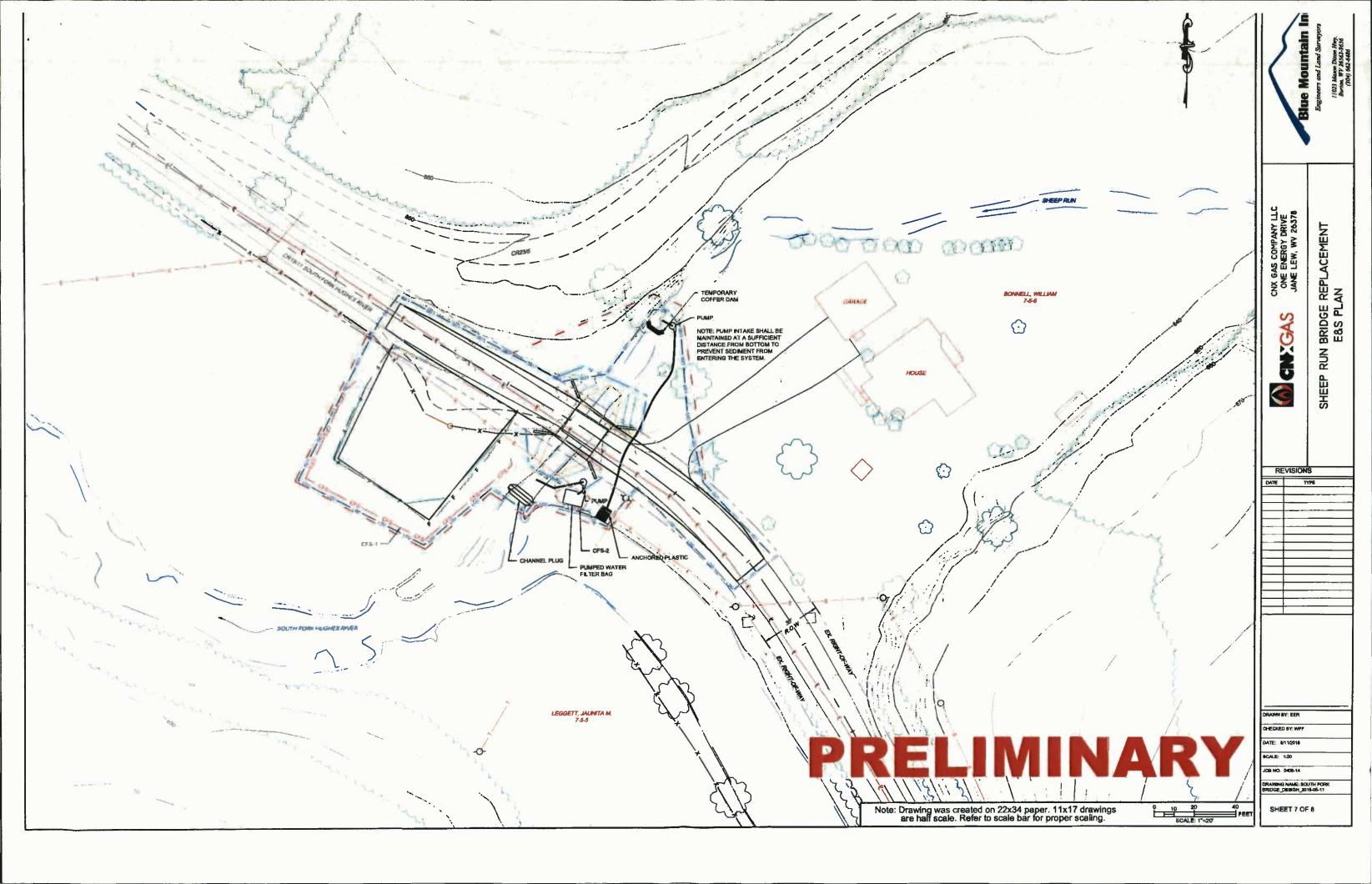
NTE: 5/11/2016

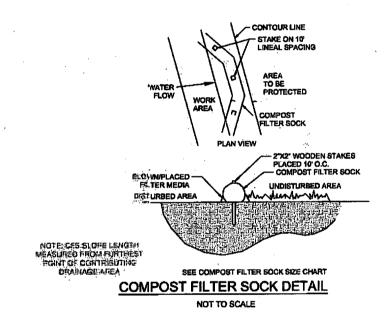
09 NO. 0498-14

SHEET 3 OF 8









COMPOST FILTER SOCK SIZE CHART

, sock#	SEZE (IN)	SLOPE (%)	ACTUAL SLOPE LENGTH (FT)	MAX SLOPE LENGTH (FT)	SOCK: LENGTH (FT)	LOCATION
CF8-1	8.	3	93	320	185	WORK AREA
CF8-2	32				31	FILTER BAG

Note: Drawing was created on 22x34 paper. 11x17 drawings are half scale. Refer to scale bar for proper scaling.

Blue Mountain In

SHEEP RUN BRIDGE REPLACEMENT
E&S DETAILS

(A) CNXGAS

REVISIONS
DATE TYPE

WN BY: EÉR

CHECKED BY: WP

DATE: 5/11/2015 SCALE: AS SHOWN

INO, 0408-14

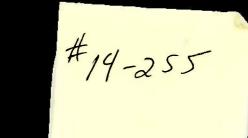
SHEET 8 OF 8

CNX GAS L.C

PROPOSED SHEEP RUN BRIDGE REPLACEMENT WW CR 19/11 -: MILE POST 2.45

LOCATE

DODDRIDGE COUNTY, WW



SCHEDULE OF DRAWINGS

DRAWING NO. 11-01 DRAWING NO. WS-01 DRAWING NO. ST O DRAWING NO. SP-01 DRAWING No. SP-02 TITLE SHEET WATERSHED LIME'S SOIL TYPES

SITE PLAN - EXISTING CONDITIONS - 10 YR/24 FR STORM SITE PLAN - PROPOSED CONDITIONS - 10 YR/24 HR STORM

PROJECT LÓGAT ON-

DRAWING NO. SP-03 DRAWING NO. STEPLE

DRAWING NO. SP 05 DRAWING NO. PROH D. RAWING NO. XS-OI

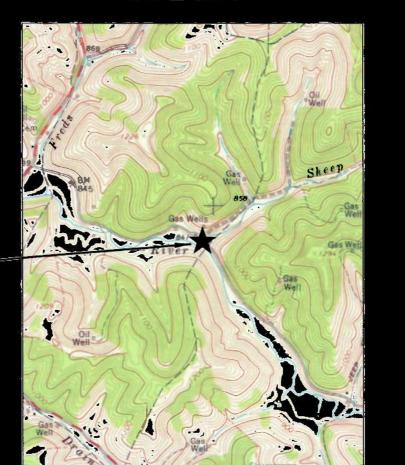
DRAWIKĆ NO. XS-02

PIAN VIEW - PROPOSED BOX CULVERT

TYPICAL CROSS SECTION FIXSTING BRIDGE

TYPICAL CROSS-SECTION - PRECAST CONCRETE BOX C'I VERT

LOCATION MAP



USCS 1.5 MIN. QUADRANGLE - 0X-080, WV SCALE: 1 N. : 2000 F.

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DRAWING NO.

XIV DRAWINGS ARE HALF SCA E. Refer to scale bar for proper scating

Note: Drawine was created up 22354, paper.

SITE DESIGN INFO PREPARED BY:

COBALT PROFESSIONAL SERVICES, INC.

150 VALLEY ROAD

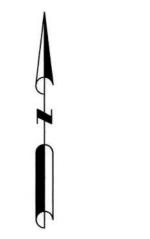
EIGHTY FOUR, PA 15330

PHONE: (724) 942-6675

FAX: (724) 942-6678

WATERSHED LIMITS SHEEP RUN & SOUTH FORK HUGHES RIVER









CINA GAS CUMPANY, LLC
ONE ENERGY DRIVE
JOHN WY 26378

PROPOSED SHEEP RUN BRIDGE REPLACEMENT
DODDRIDGE COUNTY, WV

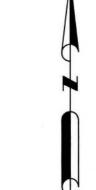
DRAWN BY:	BEK
CHECKED BY:	
DATE:	07/22/14
SCALE:	I" = 2000'
JOB NO.	
DRAWING NAME:	WATERSHED LIMITS

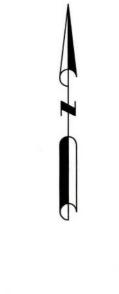
WS-01

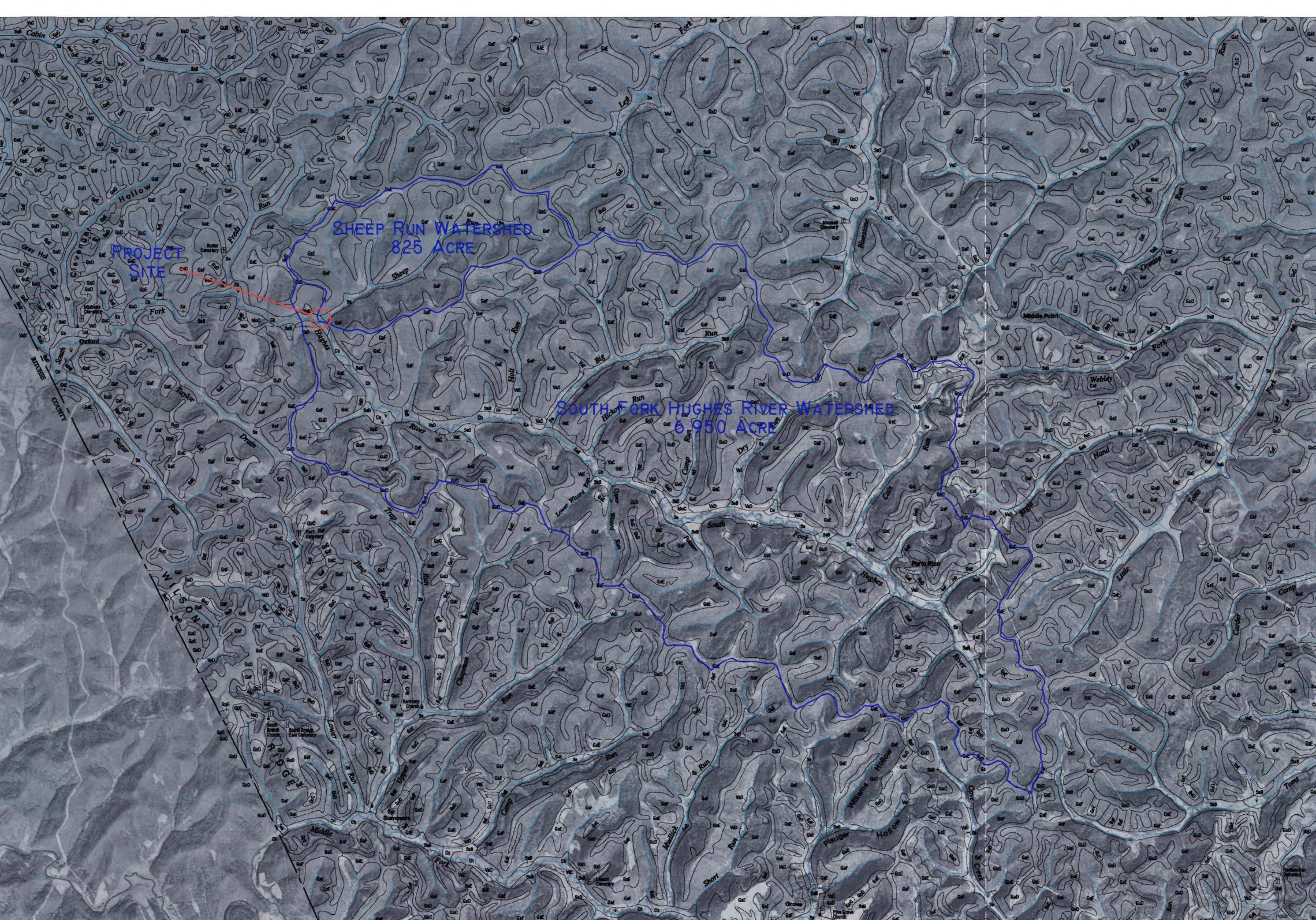
SITE DESIGN INFO PREPARED BY: COBALT PROFESSIONAL SERVICES, INC. 150 VALLEY ROAD EIGHTY FOUR, PA 15330 PHONE: (724) 942-6675 FAX: (724) 942-6678

SOIL TYPES SHEEP RUN & SOUTH FORK HUGHES RIVER WATERSHEDS









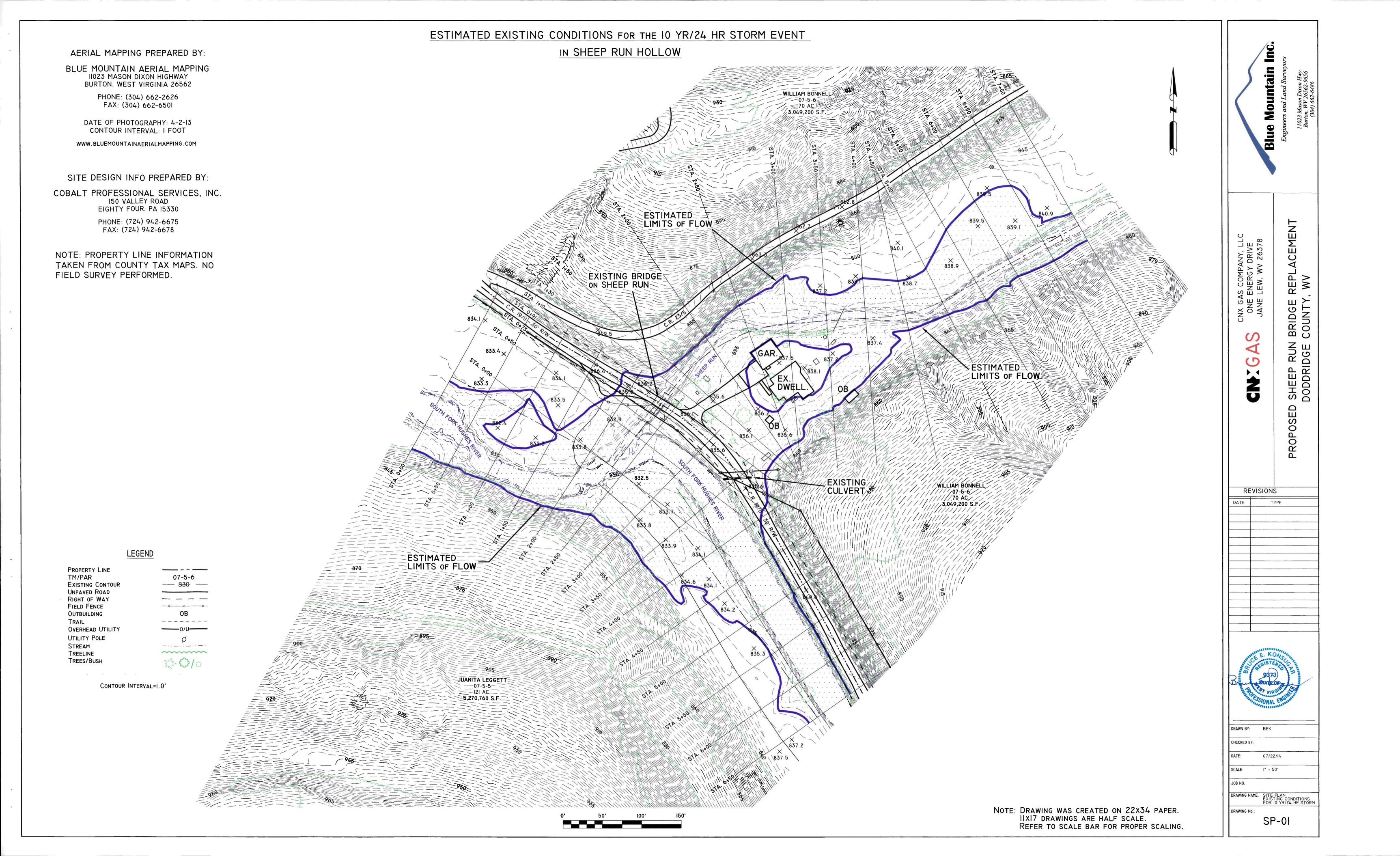
BRIDGE R COUNTY, SHEEP RUN DODDRIDGE (PROPOSED

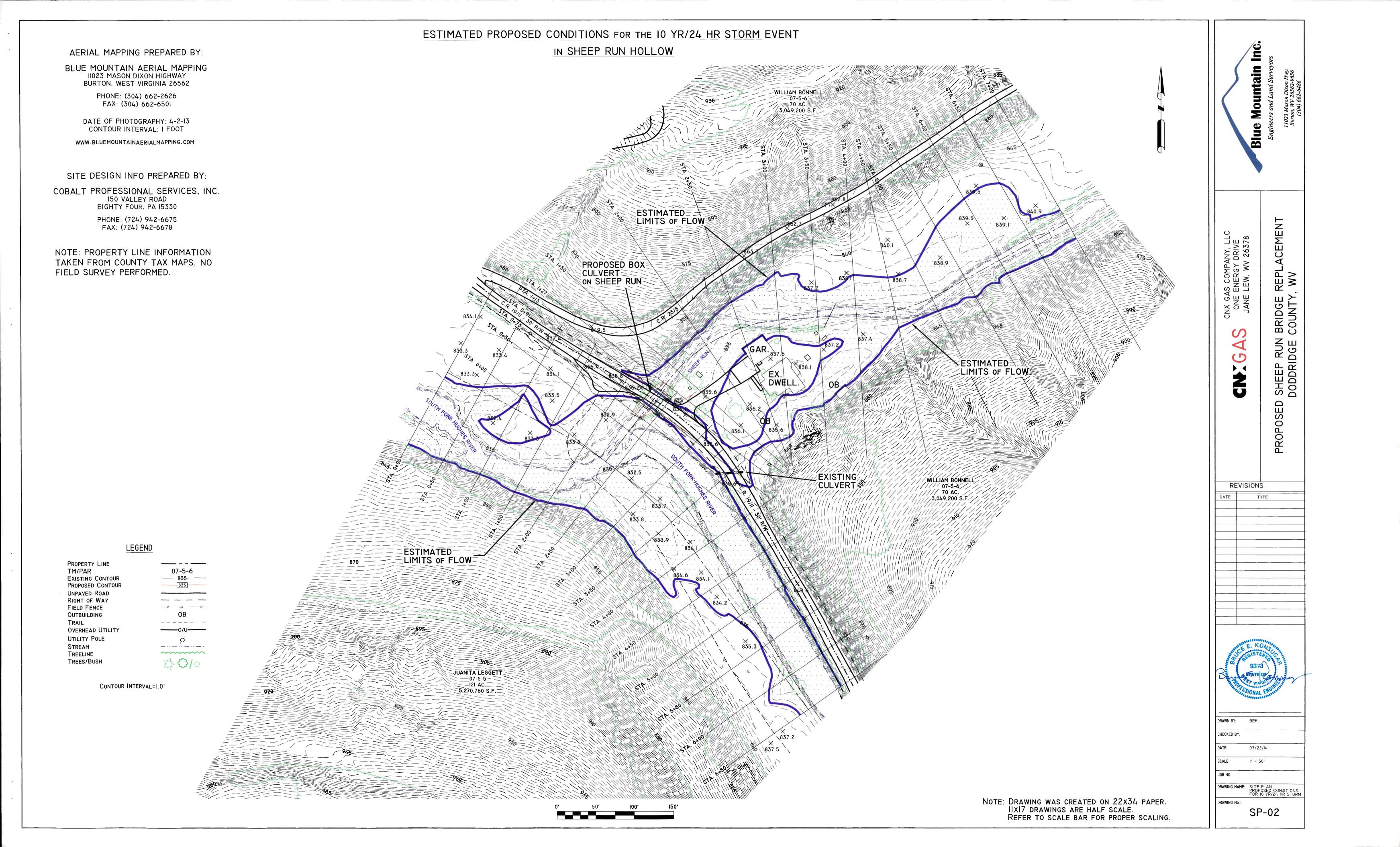
REVISIONS

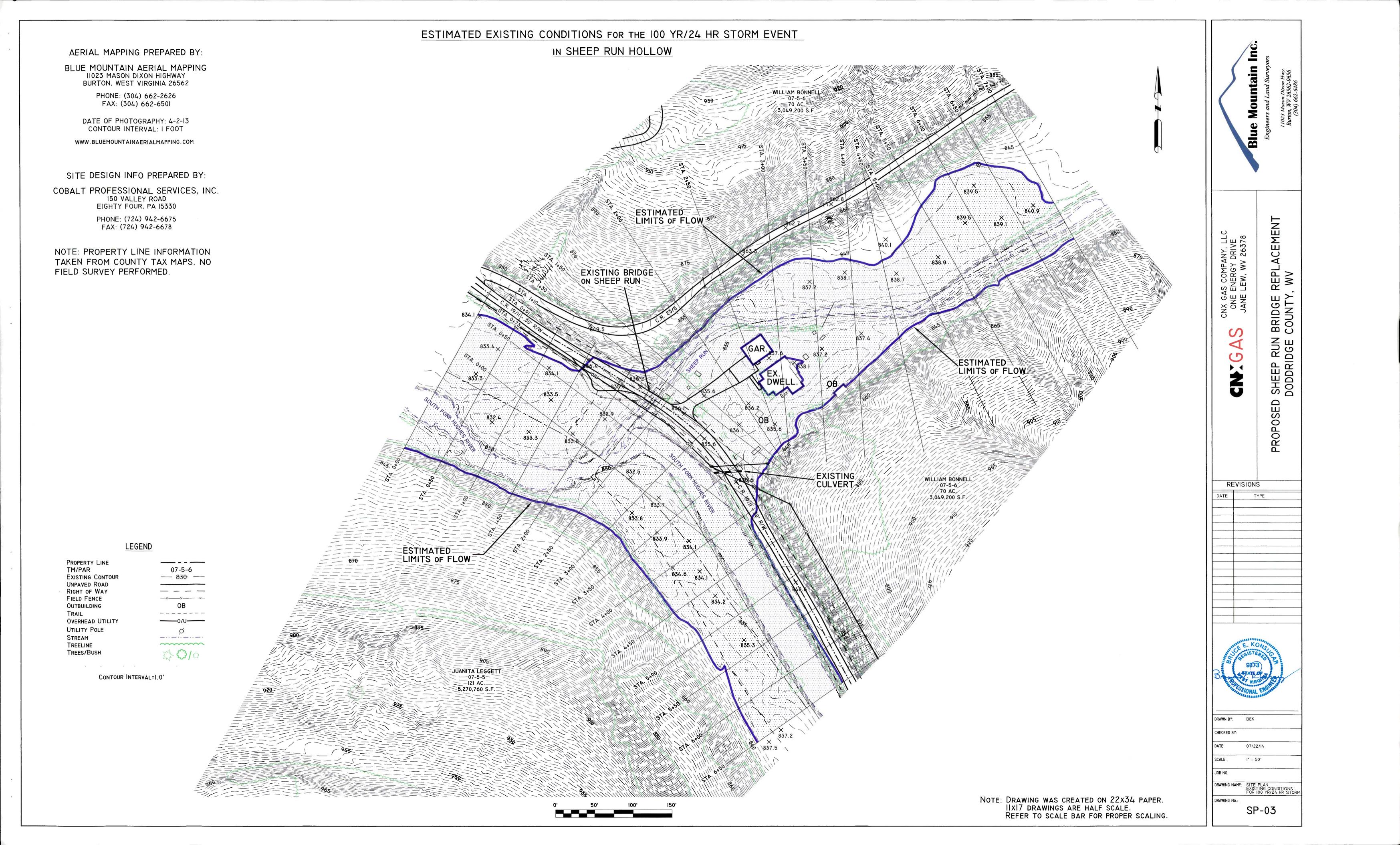
DRAWN BY: BEK CHECKED BY:

DRAWING NAME: SOIL TYPES

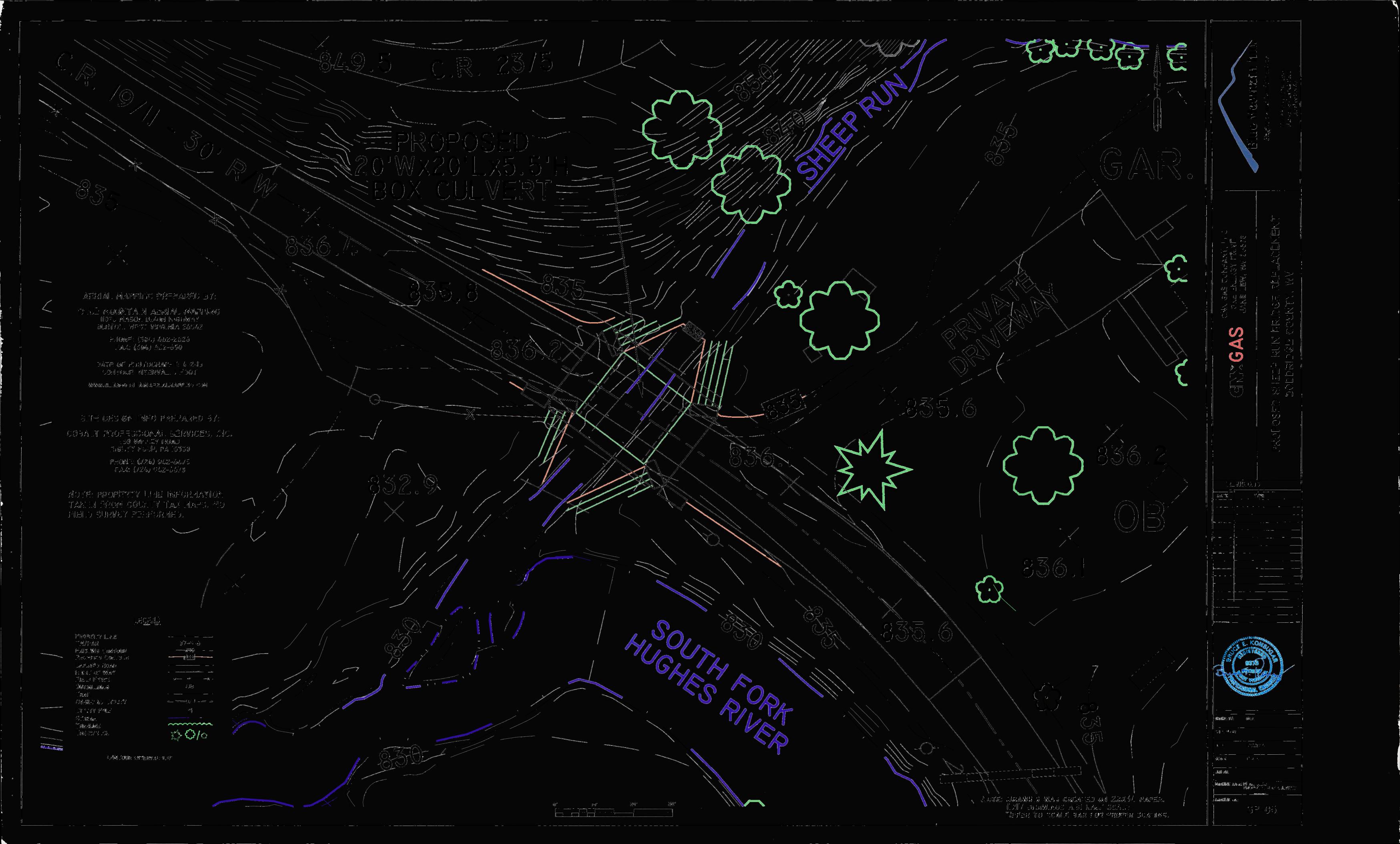
ST-0I







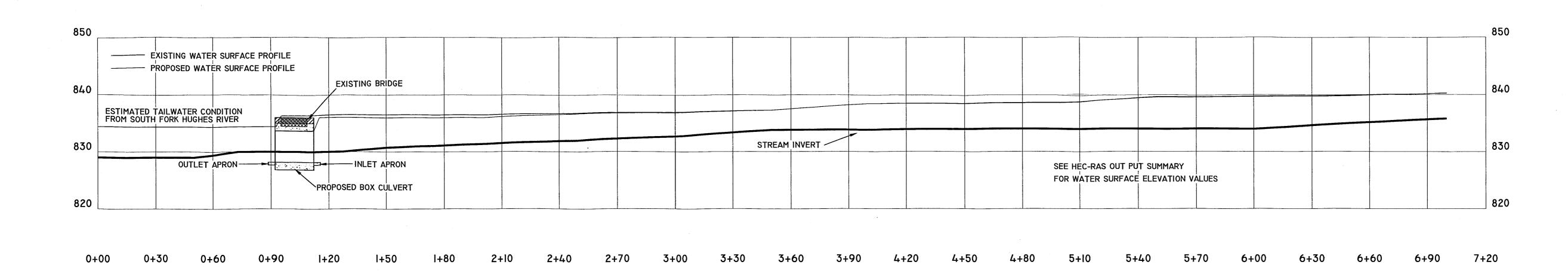
ESTIMATED PROPOSED CONDITIONS FOR THE 100 YR/24 HR STORM EVENT IN SHEEP RUN HOLLOW AERIAL MAPPING PREPARED BY: BLUE MOUNTAIN AERIAL MAPPING II023 MASON DIXON HIGHWAY BURTON, WEST VIRGINIA 26562 PHONE: (304) 662-2626 07-5-6 70 AC. 3,049,200 S.F. FAX: (304) 662-6501 DATE OF PHOTOGRAPHY: 4-2-13 CONTOUR INTERVAL: I FOOT WWW.BLUEMOUNTAINAERIALMAPPING.COM SITE DESIGN INFO PREPARED BY: COBALT PROFESSIONAL SERVICES, INC.
150 VALLEY ROAD
EIGHTY FOUR, PA 15330 ESTIMATED LIMITS OF FLOW ACEMENT PHONE: (724) 942-6675 FAX: (724) 942-6678 NOTE: PROPERTY LINE INFORMATION TAKEN FROM COUNTY TAX MAPS. NO PROPOSED BOX REPL, , WV FIELD SURVEY PERFORMED. CULVERT ON SHEEP RUN BRIDGE R COUNTY, SHEEP RUN DODDRIDGE (ESTIMATED LIMITS OF FLOW ED PROPOSE EXISTING CULVERT REVISIONS LEGEND ESTIMATED
LIMITS OF FLOW PROPERTY LINE TM/PAR EXISTING CONTOUR PROPOSED CONTOUR UNPAVED ROAD RIGHT OF WAY FIELD FENCE OUTBUILDING TRAIL _ _ _ _ _ _ _ OVERHEAD UTILITY UTILITY POLE STREAM _.._.._. ~~~~~ TREELINE TREES/BUSH JUANITA LEGGETT 07-5-5 — 121 AC. 5,270,760 S.F. CONTOUR INTERVAL=1.0' DRAWN BY: BEK CHECKED BY: DATE: 07/22/14 SCALE: I" = 50' DRAWING NAME: SITE PLAN
PROPOSED CONDITIONS
FOR 100 YR/24 HR STORM NOTE: DRAWING WAS CREATED ON 22X34 PAPER.
IIXI7 DRAWINGS ARE HALF SCALE.
REFER TO SCALE BAR FOR PROPER SCALING. DRAWING No.: SP-04



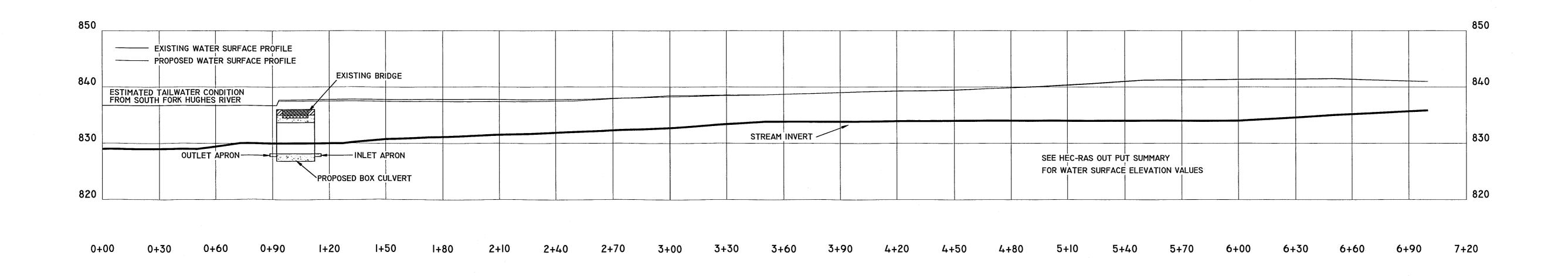
DESIGN INFO PREPARED BY:

COBALT PROFESSIONAL SERVICES, INC.
150 VALLEY ROAD
EIGHTY FOUR, PA 15330
PHONE: (724) 942-6675
FAX: (724) 942-6678

ESTIMATED WATER SURFACE PROFILES FOR THE 10 YR/24 HR STORM EVENT IN SHEEP RUN



ESTIMATED WATER SURFACE PROFILES FOR THE 100 YR/24 HR STORM EVENT IN SHEEP RUN



Mountain eers and Land Surveyo Blue BRIDGE REPLACEMENT COUNTY, WV SHEEP RUN DODDRIDGE (CNTG, PROPOSED REVISIONS DATE TYPE 07/22/14 SCALE: I" = 50' DRAWING NAME: WATER SURFACE PROFILES

PR-0I

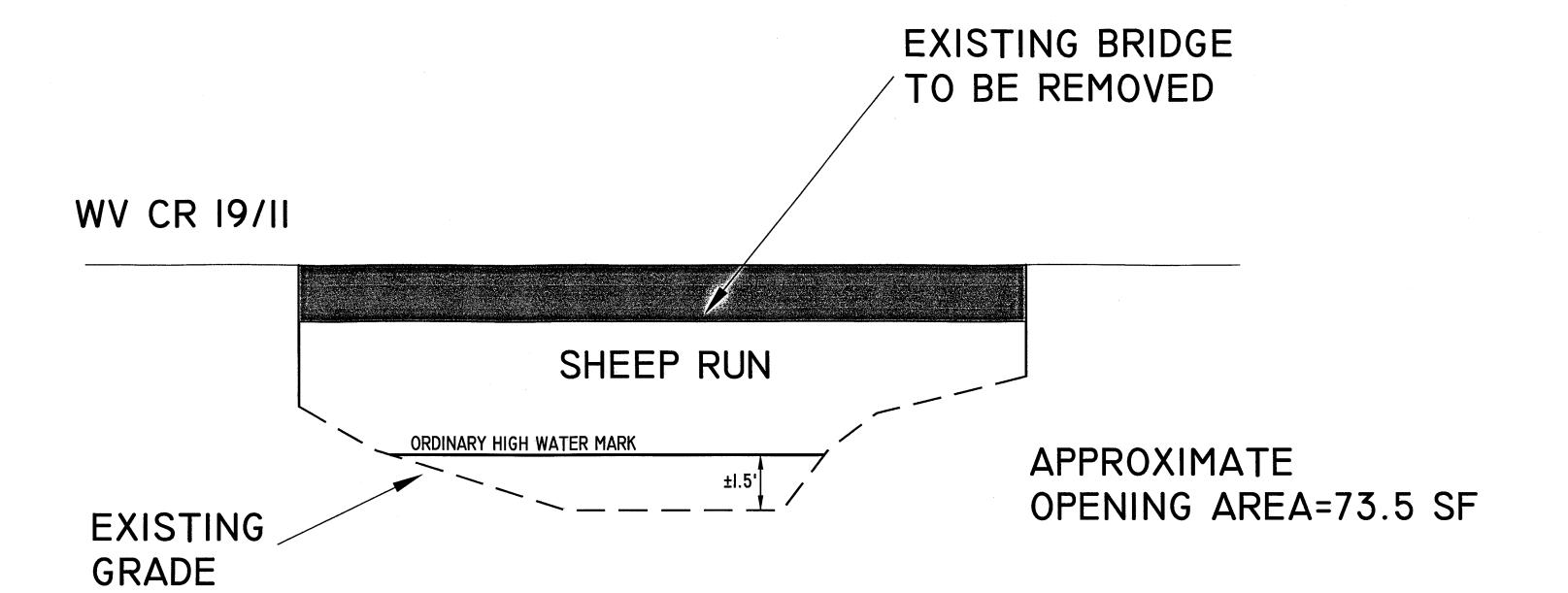
Note: Drawing was created on 22x34 paper.
IIxI7 drawings are half scale.
Refer to scale bar for proper scaling.

DRAWING INFO PREPARED BY:

COBALT PROFESSIONAL SERVICES, INC.
150 VALLEY ROAD
EIGHTY FOUR, PA 15330

PHONE: (724) 942-6675 FAX: (724) 942-6678

EXISTING STEEL & WOOD DECK BRIDGE ON WV CR 19/II @ MILE 2.45 CENTERLINE CROSS-SECTION N.T.S.





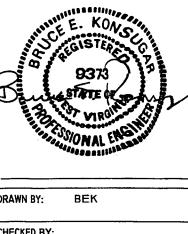
NE LEW, WV 26378

CNIGAS

PROPOSED SHEEP RUN BRIDGE REPLACEMENT DODDRIDGE COUNTY, WV

	REVISIONS				
	DATE	Т	YPE		
		-			

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l					



DRAWN BY: BEK

CHECKED BY:

DATE: 07/22/I4

SCALE: N. T.S.

JOB NO.

DRAWING NAME: TYPICAL CROSS-SECTION EXISTING BRIDGE

XS-OI

Note: Drawing was created on 22x34 paper.
IIx17 drawings are half scale.
Refer to scale bar for proper scaling.

DESIGN INFO PREPARED BY: COBALT PROFESSIONAL SERVICES, INC. I50 VALLEY ROAD EIGHTY FOUR, PA I5330 20' WIDE x 5.5' HIGH PRECAST CONCRETE BOX CULVERT PHONE: (724) 942-6675 FAX: (724) 942-6678 CENTERLINE CROSS-SECTION N.T.S. ROAD 6" THICK CONCRETE 6" THICK CONCRETE EXISTING BRIDGE SURFACING APPROACH APRON APPROACH APRON TO BE REMOVED WV CR 19/11 SHEEP RUN ORDINARY HIGH WATER MARK MATERIAL TO BE EXCAVATED MATERIAL TO BE EXCAVATED FROM CHANNEL. FROM CHANNEL. AASHTO #67 STONE COMPACTED 26' TO 95% STANDARD PROCTOR DRY DENSITY. DEPRESS BOX CULVERT A MINIMUM OF 6" BELOW EXISTING STREAM INVERT. NOTE: AREA OF IMPACT BELOW APPROXIMATE ORDINARY HIGH WATER MARK = ± 440 SF(FOOTPRINT) OPENING AREA=84.7 SF NOTE: ESTIMATED FILL TO BE PLACED BELOW ORDINARY HIGH WATER MARK = ±100 CY.

22'Wx20'Lx5'D

Blue Mountain Inc.
Engineers and Land Surveyors

11023 Mason Dixon Hwy.

CNX GAS COMPANY, LLC ONE ENERGY DRIVE JANE LEW. WV 26378

CNYGAS

PROPOSED SHEEP

Barrie OF VIROLET

DRAWN BY: BEK

CHECKED BY:

DATE: 07/22/14

SCALE: I* = 10'

JOB NO.

DRAWING NAME: TYPICAL CROSS-SECTION PRECAST CONCRETE BOX CULVERT

XS-02

Note: Drawing was created on 22x34 paper.
IIXI7 drawings are half scale.
Refer to scale bar for proper scaling