January 6, 2016

Rettew
Atten: Dennis Strouse
One Robinson Plaza, Ste. 200
Pittsburgh, PA 15205

Re: Permit # 15-409
MOSA S017 Pipeline
Project # 092612090

Dear Mr. Strouse

We have received your floodplain permit application and this project is **NOT** in the FloodPlain.
Work can begin immediately. We have issued the project a permit number #15-409, so it can be quickly identified. Thank you for your time sending these project applications to us to allow our office to maintain a comprehensive record of the work conducted in our county.

George Eidel, FloodPlain MGT.

15-409

RETTEW

We answer to you.

One Robinson Plaza, Ste. 200, Pittsburgh, PA 15205 • Phone: (800) 738-8395
E-mail: rettew@rettew.com • Web site: rettew.com

Engineers
Planners
Surveyors
Landscape Architects
Environmental Consultants

December 29, 2015

George Eidel
Doddridge County Office of Emergency Services
118 East Court Street, Room 102
West Union, WV 26456

RE: MOSA S017 Pipeline
Flood Plain Coordination
Southwest Tax District, Doddridge County and
Union Tax District, Ritchie County, WV
EQM Gathering OPCO, LLC
RETTEW Project No. 092612090

Mr. Eidel,

On behalf of EQM Gathering OPCO, LLC (EQM), this letter is regarding the proposed MOSA S017 Pipeline project in Southwest Tax District, Doddridge County and Union Tax District, Ritchie County, West Virginia (**Figure 1: Topographic Basemap**). The buried natural gas pipeline will be constructed within the Left Fork Bone Creek and Straight Fork watersheds and will not impact any Floodway Zones (FIRM Panel 54085C0355C, effective 02/02/2012 and 54017C0300C, not printed/no special flood hazard areas), as shown on the attached **Figure 2: FEMA Basemap**.

The MOSA S017 Pipeline will involve the construction of a subsurface, midstream pipeline to facilitate oil and gas transfer between well pads and gathering lines in the area. The limits of disturbance (LOD) includes a 100-foot wide corridor in which the construction of the pipeline will take place. Four stream crossings and one wetland crossing will each include a temporary trench, up to two yards wide by up to two yards deep. Resources will be fully restored to pre-construction grade conditions following installation of the proposed pipeline. This project will not impact any FEMA 100-year floodplains or floodways.

If you should have any questions or need additional information, please do not hesitate to contact me at (570) 680-0808 or at dstrouse@rettew.com.

Sincerely,

Dennis Strouse
Senior Environmental Scientist

Enclosures

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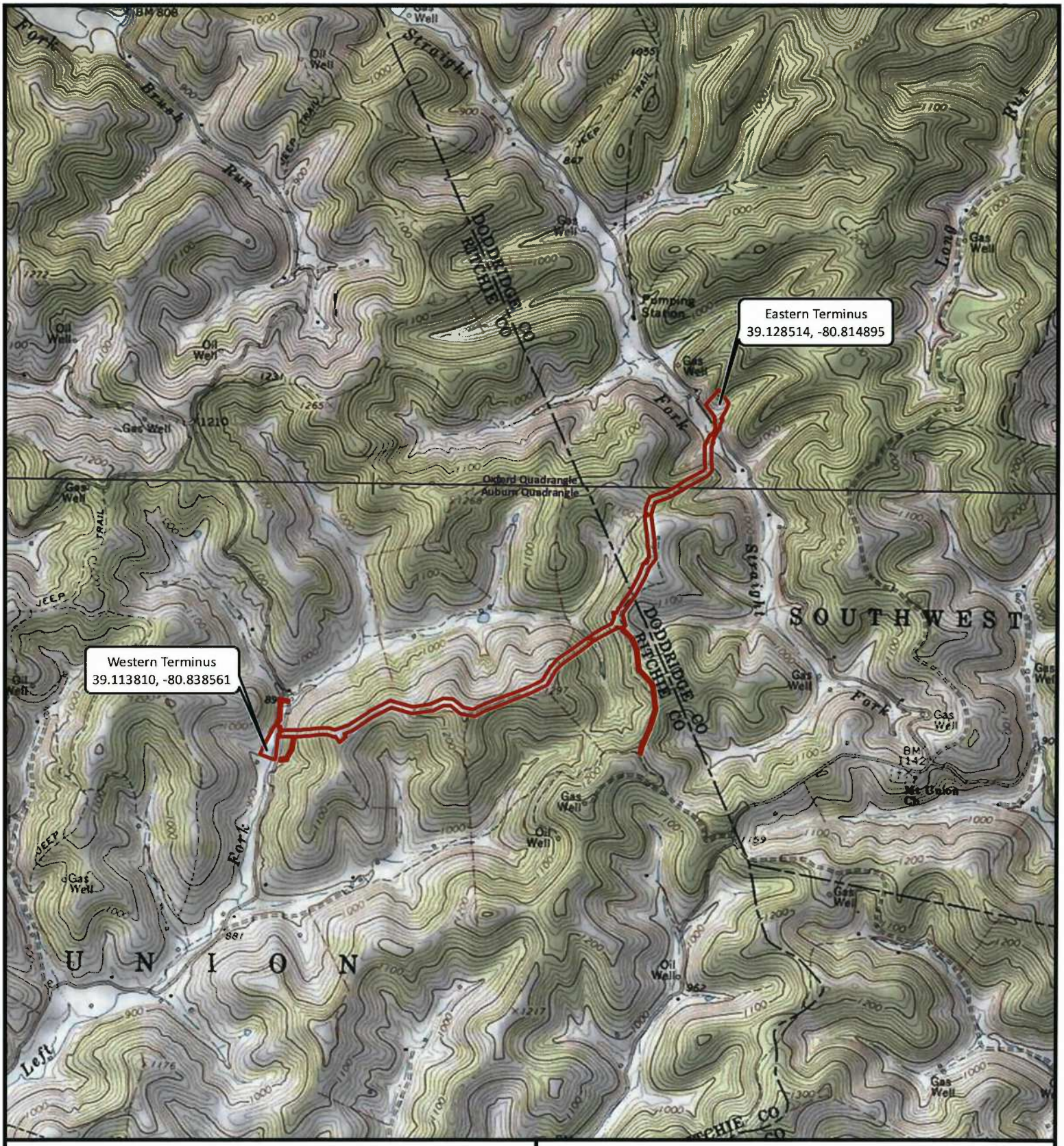

Limits of Disturbance (28.09 Acres)

Southwest Tax District, Doddridge County & Union Tax District, Ritchie County, WV
Oxford & Auburn, WV USGS 7.5' Topographic Quadrangles

12/29/2015

EQM Gathering OPCO, LLC

MOSA S017 Pipeline

Figure 1 - Topographic Basemap

Project No. 092612090

N W E S

0 1,000 2,000 Feet

1 inch = 2,000 feet

RETTEW

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EQM Gathering OPCO, LLC

MOSA S017 Pipeline

Figure 2 - FEMA Basemap

Southwest Tax District, Doddridge County & Union Tax District, Ritchie County, WV

Project No. 092612090

NHD Stream

Road

FEMA 100-yr Floodplain

Limits of Disturbance (28.09 Acres)

Tax District Boundary

N W E S

0 2,000 Feet

1 inch = 2,000 feet

Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

RETTEW

12/29/2015

Drawn By: jmeisenbach

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HYDRAULIC STUDY OF BUCKEYE CREEK

SHERWOOD GAS PROCESSING PLANT MASTER PLAN
DODDRIDGE COUNTY, WEST VIRGINIA

Prepared for:

MARKWEST LIBERTY MIDSTREAM & RESOURCES, LLC

Prepared by:

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.
PITTSBURGH, PENNSYLVANIA

CEC Project 110-811.5001

January 2014
(Revised March 2014)
(Revised March 25, 2014)
(Revised April 15, 2014)
(Revised November 14, 2014)

Civil & Environmental Consultants, Inc.

Pittsburgh

333 Baldwin Road | Pittsburgh, PA 15205 | p: 412-429-2324 f: 412-429-2114 | www.cecinc.com

14-123

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2014 JUL 15 PM 4:01

KEITH A. ROGERS
COUNTY CLERK
DODDRIDGE COUNTY, WV

David T. Richardson
Attorney at Law
DTR LAW APC
(Licensed in California, Texas, and West Virginia)
826 Orange Ave, #546
Coronado, CA 92118
(619) 991-5290
Fax: (619) 522-9260

July 15, 2015

Via Hand Delivery
Doddridge County Commission

RE: Appeal of Floodplain Permit #14-123

Dear Sir or Madam,

Please be advised that I have been retained by the Doddridge County Watershed Association (the "DCWA") in regards to their appeal of the above-referenced floodplain permit (the "Mark West Permit"). As the DCWA made clear in its Notice of Appeal, and as this letter will reiterate, numerous rules and requirements mandated by the Doddridge County Floodplain Ordinance (the "Ordinance") were not followed when the Mark West Permit was issued (i.e., rules and requirements that are directly related to public health, safety, and welfare as well as rules and requirements that are directly related to the protection of Constitutional Due Process Rights of residents of Doddridge County). While there were numerous rules and requirements that were not followed, this letter will identify the more important rules and requirements that were not followed. This letter will also explain why the Doddridge County Commission aka the Doddridge County Floodplain Appeals Board ("DCC") must revoke the Mark West Permit (and also explain why the Mark West Permit is automatically void and should simply be declared as such). Additionally, this letter will explain why Mark West's allegations regarding the DCWA lacking "standing" to appeal the Mark West Permit are incorrect (i.e., the allegations contained in the complaint Mark West filed in its recently dismissed lawsuit against the DCC).

By way of background, I represented the Huff Family in the lawsuit that EQT Production Co. filed against the DCC in regards to the revocation of a certain floodplain permit that had been previously issued to EQT which would have allowed EQT to construct a natural gas well-site in a floodplain situated at the Huff Farm. As you are aware, the Doddridge County Circuit Court ultimately declined to issue an order mandating that the DCC return said permit to EQT. The Court refused to order the return of EQT's permit because the Ordinance was constitutionally defective. Specifically, said ordinance failed to provide adequate Due Process (i.e., notice and an opportunity to be heard) to persons living near the sites of planned floodplain

developments/construction. The Huffs and the Fosters were deprived of Due Process because they did not receive notice of EQT's permit application, did not receive notice of the Floodplain Administrator's issuance of said floodplain permit, and were not afforded an opportunity to object to the application for and issuance of said floodplain permit.

Following the Court's ruling, the DCC amended the Doddridge County Floodplain Ordinance so as to ensure that the Due Process rights of residents living near planned floodplain developments were protected (the Ordinance was also amended so that it was better equipped to deal with the development and construction of large scale natural gas facilities in floodplains and floodways). As you are all well aware, the amendment process was a long and drawn out process that involved numerous revisions as well as numerous comments provided by several interested persons (and several of those comments were provided by myself and my mother-in-law/client, Joye Huff). After a number of months a new Ordinance was enacted by the DCC. This is the Ordinance that governs the Mark West Permit.

As the persons tasked with enacting the present Ordinance, the DCC surely knows that the Ordinance contains specific rules and requirements that was must be followed prior to the issuance of a floodplain permit. The DCC also knows that failure to follow these rules and requirements can have serious repercussions. The most severe and obvious repercussion is inadvertently putting the public health, safety, and welfare by not following the rules and requirements of the Ordinance (e.g., allowing construction in prohibited areas and/or allowing impermissible alterations of the floodway. Another repercussion from the issuance of floodplain permits in violation of the Ordinance is the possibility of significant sanctions from FEMA. One such sanction is suspension from the National Flood Insurance Program, and said suspension would result in Doddridge County and residents of Doddridge County no longer having access to either flood insurance or the federal disaster relief funds typically provided to flood prone areas (i.e., Special Flood Hazard Areas)(note, attached hereto as Exhibit "A" is a news article describing the plight of a small Pennsylvania town that failed to enforce the requirements of its own floodplain ordinance). Obviously, said sanction would have a devastating impact on the residents of Doddridge if it were ever implemented. Moreover, failure to follow the rules and requirements of the Ordinance (especially the ones related to Due Process) may subject Doddridge County to a lawsuit (and as was seen by the EQT v. the DCC/Huff/Foster case, lawsuits can be extremely costly as well as time consuming).

I mention the above for the following purposes: (a) to explain that I do know what I am talking about when it comes to the Ordinance (I spent a year and a half litigating a lawsuit that was solely about the Ordinance, and I then spent several months thereafter participating in the amendment process), (b) to assure the DCC that the DCWA is 100% correct when it states that the Ordinance was not followed when the Mark West Permit was issued, and (c) to make clear that that it is vitally important that the Ordinance's rules and requirements are followed because otherwise the County's residents could be harmed, the County's residents could lose their ability to obtain flood insurance and flood related federal disaster funds, and the County itself could face, yet another, costly lawsuit.

Several rules and requirements were not followed when the above-referenced floodplain permit was issued, but a handful are of particular importance due to public health, safety, and

welfare issues and due to Constitutional Due Process issues. In the interest of not confusing the issue, this letter will focus solely on these violations of the Ordinance (and not the numerous other violations that are not quite as severe).

Before I begin, I would like to say that I have noticed a pattern of the Ordinance's more important rules and requirements being treated as discretionary as opposed to mandatory. There is a reason why these rules and requirements are mandatory...they directly relate to protect people, their property, and their rights (and helps the County and its residents avoid lawsuits). As such, I respectfully request that the DCC and the Floodplain Administrator give consideration to making sure that when a provision in the Ordinance says "shall" that said provision be enforced.

A. Floodway Issues

There are several issues related to the Mark West permit's lack of compliance with the Ordinance's Floodway requirements. These issues are especially troublesome because the Floodway is the most dangerous portion of the floodplain in terms putting the public health, welfare, and safety at risk (i.e., putting people and their homes at risk of increased flooding and/or increased velocity of floodwaters).

The Ordinance describes the Floodway as "present[ing] increased risk to human life and property due to their relatively faster and deeper flowing waters", and the Ordinance mandates that the Floodway "shall be preserved to the greatest extent possible" (see Section 4.1(B), pg. 16 of the Ordinance). FEMA identifies the Floodway as "the stream channel that must remain open to permit passage of" the floodwaters "and anything in" the Floodway "is in the greatest danger during flooding". Basically, Floodways are to be left alone because they are a hazard (see FEMA info regarding "Floodway Analysis" attached hereto as Exhibit B). Additionally, interfering with and/or altering the Floodway can increase flooding. Floodways are used to accommodate flooding (i.e., by allowing the floodwaters to move forward), and if they are blocked by fill or by structures then the floodwaters can accumulate and the point of the blockage and the areas behind causing the height of the floodwaters to increase. Note, I realize that the Floodway sounds like a complicated thing, but it is really rather simple. The Floodway is the dry ground on either side of the normal water level of a creek, river, fork, stream, etc. (attached as Exhibit C is a sketch of a generic Floodway from a different floodplain ordinance).

Note, given the obvious importance of the Floodways and the danger caused by Floodways, it shouldn't come as a surprise that the Ordinance has several rules and requirements as to Floodways. Almost all of which are mandatory and not discretionary.

1. Mark West was required to delineate the Floodway and failed to do so.

Pursuant to the Ordinance, Mark West was required to delineate (i.e., identify) the Floodway in the site plans it submitted with its floodplain permit application (see Ordinance Section 5.4 (D), pg 24) (see attached NFIP map that was part of the Mark West Permit Application that identified the project site as being in an Approximated Area attached hereto as Exhibit "D"). Despite being required to delineate the Floodway(s), Mark West did not do so.

Pursuant to the Ordinance, whenever construction is planned in an Approximated

Floodplain that will be two acres or larger, the applicant must have a licensed engineer delineate (i.e., identify) the Floodway. Here, the development at issue in the Mark West Permit easily exceeds two acres. The site location map shows attached to the Mark West Permit application shows the area of disturbance to be enormous (see attached as Exhibit "E", said site location map), and a very conservative estimate of the area of disturbance is well over 2,000,000 square feet (i.e., at the very least 45 acres). Note, the requirement to delineate the Floodway is mandatory. It is not at the Floodplain Administrator's discretion. As such, Mark West's failure to delineate the floodway means that the Mark West Permit does not comply with the Ordinance. Additionally, the fact that the Floodplain Administrator issued the Mark West Permit without requiring the Floodway to be delineated means the Floodplain Administrator issued the Mark West Permit in violation of the Ordinance.

2. Fill in the Floodway.

Mark West intends to place large amounts of fill in the area identified in the site location map referenced above (i.e., "at various locations on the site")(see attached as exhibit "F" pg. 1 of Mark West's Jan. 2014 hydraulic study re the site). Since Mark West failed to delineate the Floodway as required by the Ordinance, there is no document that states that fill would be placed into the Floodway(s). But if Mark West had delineated the Floodway(s) as required by the Ordinance then it is almost certain that said delineation would show that fill would be (and already had been) placed in the Floodway(s). I say this because the Mark West project filled in two streams and/or tributaries of Buckeye Creek. By filling in the streams and/or tributaries Mark West literally put fill in the Floodways by filling the Floodways along with portions of the streams and/or tributaries. Further, Mark West built bridges over Buckeye Creek and is siting various new developments related to the site directly next to Buckeye Creek (e.g., a truck unloading area comprised of fill directly adjacent to Buckeye Creek). Given the proximity of these structures (and the fill related to them) to Buckeye Creek, it is almost certain fill has gone into the Floodway of Buckeye Creek.

The Ordinance has two main requirements as to the place of fill into a Floodway. One, fill cannot be placed in a floodway unless it has first been demonstrated that the fill will not cause ANY increase in the base flood elevation (i.e., no increase in flooding at all)(see Ordinance Section 6.1 (E), pg. 29). Two, no development shall be permitted in the Floodway where reasonable alternatives exist elsewhere, and Mark West had to demonstrate that there were no other "reasonable alternatives" before it could be issued the floodplain permit (see Ordinance Section 4.1(B)). If Mark West had delineated the Floodway(s) as required by the Ordinance, then it is almost certain that the results would have shown that Mark West was placing (and has already placed) fill in the floodplain without FIRST demonstrating that said fill would not cause ANY increase in the base flood elevation (i.e., the level of the floodwaters). Additionally, Mark West would have been required to demonstrate no other "reasonable alternatives" were available for its project site before the Floodplain Admin could have issued the Mark West Floodplain Permit. More importantly, it defies logic that if there has been filled placed in the Floodplain (especially to the extent that entire streams have been "filled"), that has not been even a slight rise in the Base Flood Elevation (in violation of 6.1(E)).

B. No Contractor Contracts Presented to Floodplain Administrator and None Saved in File.

Pursuant to the Ordinance, Mark West had to present copies of any and all contracts it entered into with any contractors in regards to the work to be done pursuant to the Mark West Floodplain Permit (see Ordinance Section 5.2 (H), pg. 20). Failure to do so within 14 days of the contracts being signed AUTOMATICALLY VOIDS the floodplain permit. Void means no appeal necessary. Void means the no hearing necessary. Void means the floodplain permit ceases to exist.

We know that Mark West hired at least one contractor to do work on the project (see the permit application --- Anderson Excavating). But there are no contractor contracts in the Mark West Permit File as required by the Ordinance (see attached as exhibit "G" Affidavit of Tammy Beamer). As such, the Mark West Floodplain Permit is void (i.e., automatically ceases to exist as if never applied for and issued...non-existent).

The reason why the Ordinance requires proof of the contractor contracts is related to public health, welfare, and safety. Specifically, the purpose of the requirement is to ensure that only licensed professionals are building large scale projects in floodplains. The point is, by ensuring only professionals are allowed to build in the floodplain, you are also presumably ensuring that the quality of work done will be of a professional level, and you will avoid a situation where someone unqualified is building something in a floodplain that is incapable of resisting floodwaters and, in the event of a flood, will break apart, explode, etc. I bring this hope so as to show that this is actually an extremely important provision, and there is a reason why persons who fail to comply with it have their floodplain permits voided.

C. Improper Notice Given to the Community in Violation of Constitutional Due Process Protections and in violation of the Floodplain Ordinance.

Note, the above issue is especially troublesome given the expense and heartache incurred by the parties to the EQT v. Doddridge/Huff/Foster as a result of the EQT floodplain permit that was issued in violation of the Due Process rights of the Huffs and the Fosters. That case ended because the original Ordinance was deemed unconstitutional for failing to provide adequate notice and opportunity to be heard for people like the Huffs and Fosters (i.e., persons who are having to deal with 3rd parties building potentially destructive floodplain projects on or near their property). If the Huffs and Fosters had been giving notice of the application for the EQT floodplain permit and an opportunity to object, then they might have been able to nip the matter in the bud and save everyone the expense and stress of a year and a half of litigation. Additionally, the whole point of amending the Ordinance was to rectify the issues with a lack of Due Process related to floodplain permits.

But all the changes in the world to the Ordinance don't do any good if rules and requirements are added to the Ordinance to provide for Due Process, but are NOT properly enforced.

Failure to Place Permit Info on the DCC Agenda.

The Ordinance requires that the specific information related to a floodplain permit (both

the application for and issuance of a permit) be placed on the DCC Agenda ahead of the DCC meeting at which the announcements will be made as to the floodplain permits (i.e., name of applicant and location of planned project). Last I checked the only info placed on the DCC Agendas related to Floodplain Permits was a generic statement that Floodplain Permits will be heard as Agenda Item No. X. No specific information is provided despite the requirments of the Ordinance and the requirements of Due Process.

Moreover, by failing to place the specific information regarding each floodplain permit on the Agenda, the entire legal advertisement notice process is essentially defeated (especially, when the ads don't run until after the deadline to object or appeal has expired, and I have seen those situations). The problem is, the legal advertisement does not state which date the announcement was made about the floodplain permit (regardless of whether the announcement is to say it was applied for or to say it was issued or denied). So, how is an interested party, like the DCWA, supposed to know when a permit is applied for or granted or denied if there isn't specific information provided on the Agenda? Are they supposed to attend every single DCC Hearing and just in case maybe an announcement will be made about a floodplain permit that matters to them?

In the case of the DCWA, notice regarding the application for the Mark West Permit was not placed on the DCC's Agenda (i.e., all a DCWA member would have seen was the generic statement that Floodplain Permits will be discussed). Further, the legal advertisement for the Mark West Permit Application states that the date that the permit was applied for was February 5, 2014. It also says anyone who wants to comment or object has until 20 days after the permit application was announced at the DCC meeting. Additionally, it says that the deadline to comment or object is February 25, 2014. Obviously, there is something seriously wrong with those dates.

One, in order for this to work, as mandated by the Ordinance, Mark West would have had to have applied for the Floodplain Permit on February 5, 2014, the clerk would have had to put it on the Agenda on February 5, 2014, and the DCC would had to have had a meeting on February 5, 2014 whereat the application was announced. Otherwise, it would be impossible for there to be 20 days for the comment and/or object period post-announcement (i.e., the deadline was February 25, 2014). Putting aside the sheer impossibility of, on the same day, an application being processed, an agenda being printed the same day, and a DCC meeting being held right after to announce the application, there is the obvious and huge problem in that the 5th of February was a Wednesday (and the DCC meets on Tuesday). As such, there could not have been an announcement on the February 5, 2014, and accordingly, the DCWA (and every other interested parties' Due Process rights were violated, and the rules and requirements contained in the Ordinance were violated). Additionally, the newspaper ad did not even run until February 11, 2014 (see attached as Exhibit H copies of all relevant legal ad documents). As such, not only were the DCWA members deprived of proper notice, they were also deprived of their rightful 20 day period to comment and/or object (given there was apparently no announcement at the DCC Meeting until, at the very least, almost a week after the Permit was applied for, at best they had 15 days of notice.

As such, not only was the Ordinance not followed as to the notice requirements, my clients also have a potential Due Process claim that they could bring against the DCC in order to

have the Mark West Floodplain Permit revoked.

The DCWA's Standing to Appeal

In the complaint Mark West filed against Doddridge County after the Stop Work Order was issued following the DCWA's appeal (a Stop Work Order that the Ordinance does not allow to be lifted until after the Appeal is decided...but I digress), Mark West alleged that the DCWA lacked the standing to appeal the Mark West Permit.

Mark West's argument is incorrect. The DCWA has standing to challenge the Mark West Permit. One, the DCWA is a legitimate organization dedicated to protecting the watersheds and water sources of Doddridge County. It was founded years ago in response to a leak and/or dump of chemicals into Buckeye Creek (i.e., the same creek that Mark West is building next to). The DCWA holds regular meetings and government officials regularly come to these meetings to give informational sessions, hold seminars, and discuss watershed related topics (obviously said government officials consider and treat the DCWA as the legitimate organization that it is). Objecting to and appealing a proposed floodplain project for the purposes of protecting the source of drinking water for West Union (i.e., the home of the DCWA and its members) and also protecting the very creek that pollution of which gave rise too the DCWA, is pretty much the definition of germane to the DCWA's purpose. Moreover, there are DCWA members who live very close to the site of the Mark West project, and who may be harmed by the project, and whose interests will be protected by the DCWA's appeal. In short, the DCWA has standing in its own right and also on behalf of its members.

Conclusion

Given the foregoing and given the grievous violation of the Ordinance (i.e., as to the rules and requirements protecting Public Health, Safety, and Welfare and as to the rules and requirements in regards to the violation of the DCWA member's Due Process Rights), the only correct choice is to revoke the Mark West Floodplain Permit and have Mark West resubmit another floodplain permit application that, unlike the one at issue here, actually conforms to the requirements of the Ordinance. The other alternative is to declare the Mark West Floodplain Permit void for failure to provide the Floodplain Administrator with copies of the contractor contracts (which would accomplish the same result). Otherwise, Doddridge County has issued a floodplain permit in violation of its own Ordinance, and as such, opens itself up to FEMA sanctions as well as the possibility of Court action.

Best regards,
/s/

David T. Richardson, Esq.

No Enforcement? No Insurance.

FEMA has sent a strong message to one Northeastern Pennsylvania town — start enforcing flood plain management statutes or lose your right to participate in the National Flood Insurance Program. The borough is now on probationary status as of October 1, 2012.

The reason: the borough is cited with failure to manage floodplain development in accordance with the Borough's floodplain program, and lack of adequate record keeping. That put the borough in a rather dire situation, but that wasn't the only issue facing West Pittston. It was also tasked with finding $2.56 million to cover cleanup costs after Tropical Storm Lee blew into town in 2011.

As recently as two weeks ago, the borough had taken out a loan in that amount. A risky move in itself, for if the borough did not receive federal funding by December 31st, the residents of West Pittston would end up paying.

Consider it an early Christmas gift – the federal government has come up with 75 percent of the borrowed amount, exactly one week after the borough took out the loan.

The borough is yet to be out of the deep end, so to speak. There's the matter of those unenforced statutes to be dealt with, along with that extra 25 percent in monies borrowed. If the borough does not comply with the National Flood Insurance Program guidelines by December 1, the town could be suspended from the program.

The impact of any potential suspension would be significant — there are currently 358 NFIP policies in force in the borough. As it stands, residents are able to still purchase flood insurance during the probationary period, but will now be faced with paying an additional $50 surcharge. Should the borough be suspended, residents will no longer have access to either flood insurance [illegible] deral disaster assistance usually afforded structures within Special Flood H[illegible] ionally, federal law prohibits federal agencies from making grants, loans, or gu[illegible] or construction of structures located in a SFHA.

In a population of just 4,868, tha[illegible]

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Nicholas Morici, spokesperson fo[illegible] ugh's problems stem from not following their own flood plain ordinances. "The Boro[illegible] 59 structures within its Special Flood Hazard Area (SFHA). The most recent inform[illegible] ugh indicates that only slightly over 25% of these structures have received the permits required by the local floodplain ordinance. The Borough is currently working to reach out to the citizens in the floodplain to determine the extent and severity of any violations that may have resulted from work that occurred without the required permit within the SFHA."

Morici says that each community that joins the NFIP is required to adopt a floodplain ordinances that meets

Ex A

or exceeds the minimum NFIP requirements of 44 Code of Federal Regulations, Part 60. "In exchange for adopting and enforcing a floodplain ordinance, the community and its citizens gain access to the benefits of participation in the NFIP: flood insurance, disaster assistance and mitigation grants."

According to Morici, communities are required to enforce their floodplain ordinances, as they do any building codes. (More information about construction in floodplains may be found at the FEMA website.)

West Pittston isn't the only borough with compliance issues. Morici shared with me a nine-page list of communities that have been suspended from the NFIP for failure to enforce their floodplain ordinance, as well as the reason for their suspension. Says Morici: "A number of communities nationwide have enforcement issues." (See Communities Suspended from NFIP.)

So what about the residents? How can they be protected despite their municipality's negligence to enforcement? Morici says there's little FEMA can do. "Although FEMA remains committed to helping the Borough maintain its eligibility for FEMA assistance and programs, FEMA is prohibited from providing flood insurance in a community unless the community enforces floodplain management measures that meet or exceed the minimum NFIP requirements of 44 Code of Federal Regulations, Part 60. "

In other words, no dice.

Related

News and Notes

Sinking Your Risk Management Plan

Found at RIMS: Opportunity

EX A

matter by locating the flood elevation on the ground via an elevation survey. This elevation represents the actual extent of flooding for that particular flood.

Note: Banks, lending institutions and others who must read the FIRM to determine if flood insurance is required must go by the map. They cannot make on-site interpretations based on data other than the FIRM. However, they may recommend that the property owner submit a request for a map revision or map amendment so the map can be officially changed to reflect the more accurate data (see Unit 4, Section D).

FLOODWAY ANALYSIS

The final step in preparing most riverine flood studies is to produce the floodway analysis, which identifies where encroachment by development will increase flood elevations significantly and worsen flood conditions.

The floodway is the stream channel and that portion of the adjacent floodplain that must remain open to permit passage of the base flood. Floodwaters generally are deepest and swiftest in the floodway, and anything in this area is in the greatest danger during a flood. FEMA has mapped designated floodways in more than 8,000 communities.

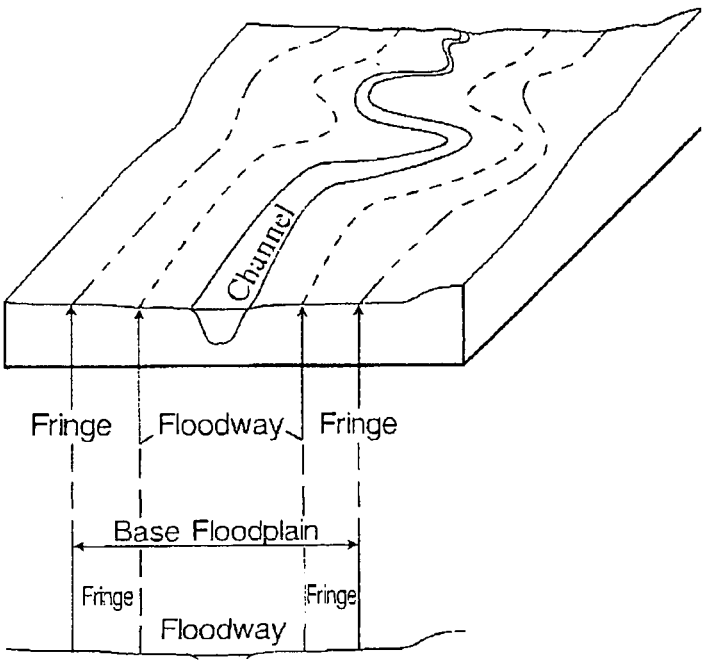


Figure 3-6: Floodway cross section and map

The remainder of the floodplain is called the flood fringe (Figure 3-6), where water may be shallower and slower. The floodway and the flood fringe together comprise the base floodplain or special flood hazard area. On the flood map these areas will be designated as Zone A1-30 or AE. NFIP minimum standards provide that other areas outside the boundaries of the floodway can be developed without further analysis. Consequently, most communities permit development in the flood fringe if the development is elevated or otherwise protected to the base flood level (or any higher state or local standards). Development in the floodway is allowed if it can be demonstrated that no rise in the base flood elevation will occur. It is recommended, however, that

Ex B

floodway development be discouraged or even prohibited because of the hazardous nature of this area.

A floodway analysis determines the boundaries of the floodway using these floodplain management concepts:

- Continued development in the floodplain will likely further obstruct flood flows, which will back water up or divert it to other properties.
- Properties on both sides of a river or stream should be treated equitably. The degree of obstruction permitted now for one should be permitted in the future for the other.
- Property owners should be allowed to develop their land, provided they do not obstruct flood flows, cause damage or create a nuisance to others. (A community may allow development in the flood fringe that cumulatively increases the BFE, but NFIP regulations specify that such total increases cannot exceed one foot at any point along the stream. Some states or communities have more restrictive standards that must be met.)

A floodway analysis is done with a computer program that can make the necessary calculations of the effects of further development. Beginning at both edges of the floodplain, the computer model starts "filling" the floodplain. This "squeezes" the floodwater toward the channel and causes the flood level to rise. At the point where this process reaches a one foot rise, the floodway boundaries are drawn (Figure 3-7).

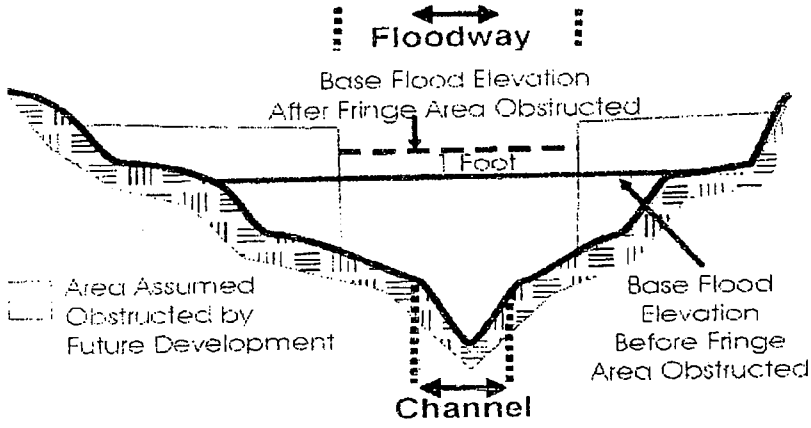


Figure 3-7: Computer floodway analysis

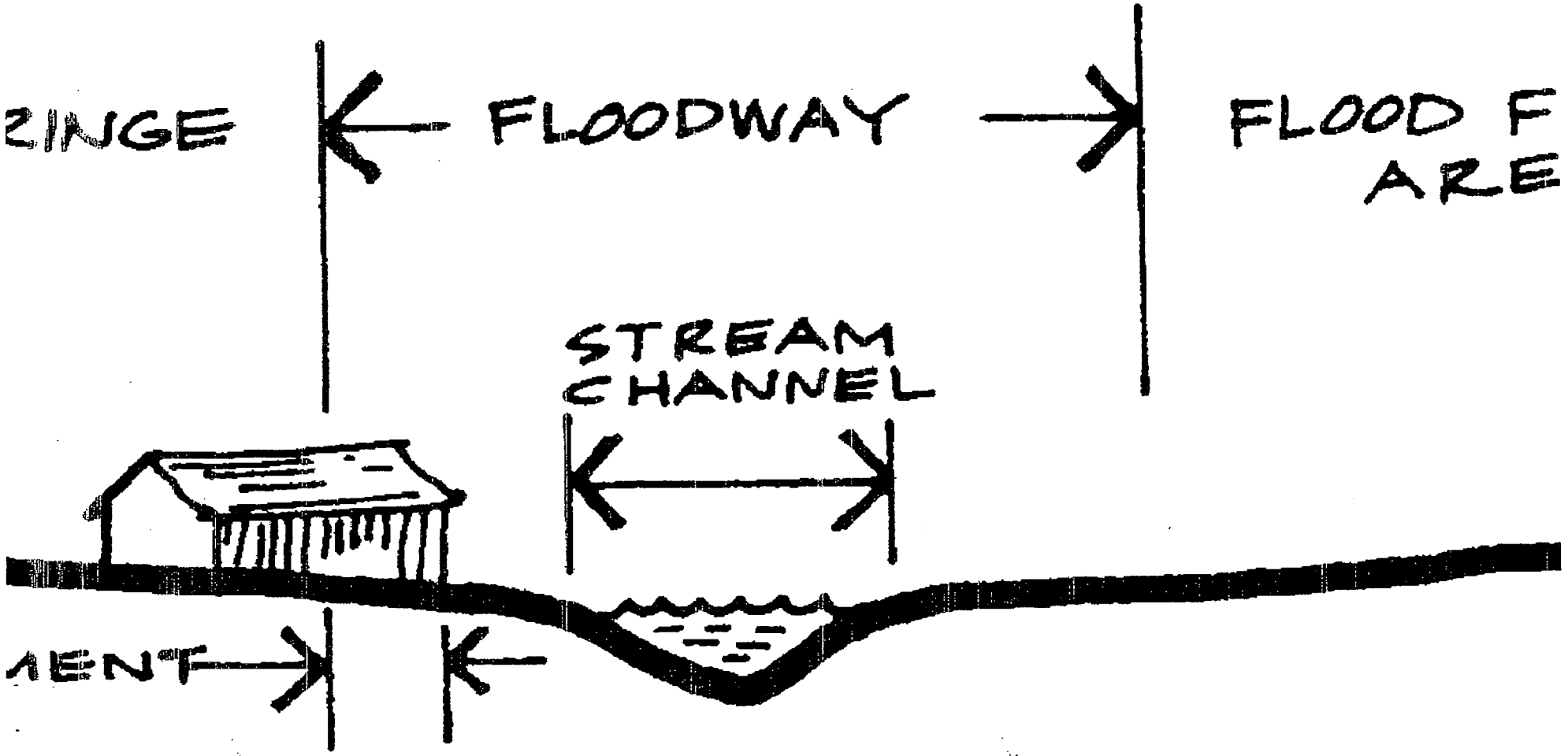
The floodway boundaries at each cross section are transferred to the topographic or contour map that shows the SFHA boundaries. The plotted points are connected to show the floodway and flood fringe on the floodplain map.

Not every cross section will show an exact one-foot rise. Topographic conditions and the need to "smooth out" the floodway line will result in some cross sections having increases of less than one foot.

Ex B

FLOOD PLAIN

FLOOD HAZARD AREA



OD PLAIN CROSS SE

EXC

MAP SCALE 1" = 1000'

500 0 1000 2000

FEET

METERS

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0140C

FIRM

FLOOD INSURANCE RATE MAP

DODDRIDGE COUNTY, WEST VIRGINIA AND INCORPORATED AREAS

PANEL 140 OF 325

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
DODDRIDGE COUNTY	540024	0140	C

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

MAP NUMBER
54017C0140C

MAP REVISED
OCTOBER 4, 2011

Federal Emergency Management Agency

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

Exhibit 3

P:\2011\110811.5001 FIG2 SOILS.mxd 1/27/2014 3:01 PM (cclark)

P:\2011\110811.5001-GIS\mxd

Civil & Environmental Consultants, Inc.
333 Baldwin Road - Pittsburgh, PA 15205-9072
412-429-2324 · 800-365-2324
www.cecinc.com

MARKWEST LIBERTY MIDSTREAM & RESOURCES, LLC
SHERWOOD GAS PROCESSING PLANTS 6 &7
DODDRIDGE COUNTY, WV

SOILS MAP

DRAWN BY:	CLC	CHECKED BY:	TGJ	APPROVED BY:		FIGURE NO:	2
DATE:	1/27/2014	SCALE:	1 " = 700 '	PROJECT NO:	110-811.5001		

1.0 INTRODUCTION

1.1 BACKGROUND

MarkWest Liberty Midstream & Resources, LLC (MarkWest) has contracted Civil & Environmental Consultants, Inc. (CEC) to perform a master plan flood study as part of the final buildout of the Sherwood Gas Processing Plant located approximately one-half-mile east of the intersection of U.S. Route 50 and County Route 20 along County Route 50/34 in Doddridge County, West Virginia. The final buildout includes the construction of Plants 6 through 10, de-ethanizers, and substation expansion. A Floodplain Permit was issued on August 28, 2013 to MarkWest for the Sherwood Gas Processing Plants 4 and 5 Expansion. This permit included grading improvements for Plants 1-5, the truck unloading area, an access road with a new bridge from County Road 50/34, and temporary stockpiles. An update to the Floodplain Permit was submitted on December 3, 2013 to include additional temporary stockpiles as part of the construction of the gas processing plants. The original permit is included in Appendix F.

MarkWest now plans to finalize grading as part of the final buildout construction plans. The earthmoving operations will include the removal of the temporary stockpiles adjacent to Buckeye Creek along with fill placement at various locations on the site to accommodate final plant construction. A site location map has been provided in Appendix A. The new Doddridge County Floodplain Application is included in Appendix F.

As part of the previously revised flood study of December 2013, CEC performed an additional survey to acquire more accurate and current topography for the stream, overbanks, and newly constructed bridge between stations 25+54.54 (Section T) and 0+00 (Section OO). The resulting existing surface utilized in the December 2013 flood study is also used in this Master Plan flood study. Water surface elevation increases in this flood study are indicative of the total impact of the proposed final Sherwood Gas Processing Plant development on the existing floodplain.

Ex F

STATE OF WEST VIRGINIA,
COUNTY OF DODDRIDGE, TO-WIT:

I, Tamela B. "Tammy" Beamer, after first being duly sworn, under oath, state that the following is true and that the following is my personal knowledge and belief, and I further state that if I were called to testify as to the following, I could and would do so competently and truthfully:

1. I am over the age of eighteen (18) years old.
2. I am a resident of Doddridge County, WV.
3. I am not a party to the appeal of Doddridge County Floodplain Permit #14-123.
4. I have no interest(s) (property, personal, financial, or otherwise) related to the project and land that are the subjects of Doddridge County Floodplain Permit #14-123.
5. As far as am I aware, none of my relatives have any interest(s) (property, personal, financial, or otherwise) related to the project and land that are the subjects of Doddridge County Floodplain Permit #14-123.
6. I am not a member of the Doddridge County Watershed Association, and none of my relatives are members of the Doddridge County Watershed Association.
7. On July 11th, 2014, I went to the Doddridge County Courthouse and reviewed Doddridge County's entire permit file related to Doddridge County Floodplain Permit #14-123.
8. I am familiar with what a contractor's contract looks like, and I would recognize one if I saw it.
9. While reviewing Doddridge County's entire permit file related to Doddridge County Floodplain Permit #14-123, I specifically looked to see if there were any contractor's contracts contained in said file.
10. After a thorough review of Doddridge County's entire permit file related Doddridge Floodplain Permit # 14-123 and after reviewing all documents contained in said permit file, I determined that there were not any contractor's contracts in said file.

This is my complete statement.

Dated this 14th of July, 2014.

Tamela B "Tammy" Beamer

Taken, subscribed and sworn before me in the county and state aforesaid this 14th day of July, 2014.

My commission expires: October 3, 2017

OFFICIAL SEAL
NOTARY PUBLIC
STATE OF WEST VIRGINIA
LINDA R. HAMILTON
HC 68, Box 9
West Union, West Virginia 26456
My Commission Expires Oct. 3

NOTARY PUBLIC

EXG

November 14, 2014

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

Dear Mr. Wriston:

Subject: Proposed Sherwood Gas Processing Plant Master Plan Modification
County Road 50/34
Doddridge County, West Virginia
CEC Project 110-811.5001

Civil & Environmental Consultants, Inc. (CEC) has been retained as a consultant to provide professional engineering services to MarkWest Liberty Midstream & Resources, LLC (MarkWest). Specifically, CEC is assisting MarkWest in finalizing the Sherwood Gas Processing Plant Master Plan grading by expanding to add Plants 6 through 11, including de-ethanizers, substation expansion, and an administration building and warehouse facility.

MarkWest was previously issued Floodplain Permit #14-123 for the original master plan. MarkWest now plans to finalize the site grading as part of the construction of the Gas Processing Plants 6 through 11, including de-ethanizers, substation expansion, and an administration building and warehouse facility. As such, on behalf of MarkWest, CEC is requesting a revision to the approved floodplain permit for the Sherwood Gas Processing Plant Master Plan.

MarkWest understands that all required local, state and federal permits and approvals must be obtained prior to beginning work within the floodplain. Based upon the information provided, the proposed project will comply with the requirements of Section 7.2.B of the Doddridge County Floodplain Ordinance which states: "All permits and plans shall be approved only after it has been determined that the proposed work to be undertaken will be in conformance with the requirements of this Ordinance, State and Federal Laws, Ordinances, and Regulations."

Please contact us at 412-429-2324 if you have any questions.

Very truly yours,

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.

Edward J. Fink, P.E., CPESC, CPSWQ
Project Manager

Richard P. Celender, C.E.T., CPESC, CPSWQ
Principal

Enclosures

cc: Richard Lowry (MarkWest Liberty Midstream & Resources, LLC)

110-811.5001-Master Plan-Floodplain-Cover Letter-11-14-14/P

HYDRAULIC STUDY OF BUCKEYE CREEK

SHERWOOD GAS PROCESSING PLANT MASTER PLAN
DODDRIDGE COUNTY, WEST VIRGINIA

Prepared for:

MARKWEST LIBERTY MIDSTREAM & RESOURCES, LLC

Prepared by:

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.
PITTSBURGH, PENNSYLVANIA

CEC Project 110-811.5001

January 2014
(Revised March 2014)
(Revised March 25, 2014)
(Revised April 15, 2014)
(Revised November 14, 2014)

TABLE OF CONTENTS

APPENDICES

1.0 INTRODUCTION

1.1 BACKGROUND

MarkWest Liberty Midstream & Resources, LLC (MarkWest) has contracted Civil & Environmental Consultants, Inc. (CEC) to perform a modification to the master plan flood study as part of the final buildout of the Sherwood Gas Processing Plant located approximately one-half-mile east of the intersection of U.S. Route 50 and County Route 20 along County Route 50/34 in Doddridge County, West Virginia. The final buildout includes the construction of Plants 6 through 11, De-ethanizer Plants 1-3, an administration building, warehouse, and additional equipment. A Floodplain Permit was issued on August 28, 2013 to MarkWest for the Sherwood Gas Processing Plants 4 and 5 Expansion. This permit included grading improvements for Plants 1-5, the truck unloading area, an access road with a new bridge from County Road 50/34, and temporary stockpiles. An update to the Floodplain Permit was approved on March 4, 2014 to include additional temporary stockpiles as part of the construction of the gas processing plants. The original master plan floodplain permit (Permit No. 14-123) included all previously permitted proposed development in addition to site grading associated with the construction of Sherwood Gas Processing Plants 6 through 11 (including de-ethanizers, and substation expansion). The master plan floodplain permit was approved on April 24, 2014. The previous permits are included in Appendix F.

MarkWest now plans to finalize grading as part of the final buildout construction plans. The earthmoving operations will include the removal of the temporary stockpiles in the floodplain of Buckeye Creek along with placing fill at various locations on the site to accommodate final plant, administration building, and warehouse construction. Originally, MarkWest planned to construct two dry detention ponds at the plant to manage post-development stormwater runoff. MarkWest now intends to replace the two dry detention ponds with three underground detention tanks. The modification to the master plan flood study reflects the current final buildout construction plans. Previously permitted proposed development such as grading for Plants 1 through 5, the truck unloading area, and access road with a new bridge are included in the master plan flood study as new development in order to show the net impact of the Sherwood Gas

Processing Plant development on the floodplain. A site location map has been provided in Appendix A. The new Doddridge County Floodplain Application is included in Appendix F.

As part of the previously revised flood study of December 2013, CEC performed an additional survey to acquire more accurate and current topography for the stream, overbanks, and newly constructed bridge between stations 25+54.54 (Section T) and 0+00 (Section OO). Because the topography is no longer consistent with the original DEM data from the August 28, 2013 Floodplain Permit, water surface elevations cannot be compared between the original flood study and the master plan flood study. However, the existing conditions model in the master plan flood study represents the site prior to development, so the current study represents the cumulative impact of the final Sherwood Gas Processing Plant development on the floodplain.

1.2 PURPOSE

The purpose of this study is to perform a Hydrologic and Hydraulic (H&H) analysis of the existing 100-year floodplain of Buckeye Creek (prior to any plant construction) and estimate the effect on the floodplain by the final grading of the Sherwood Gas Processing Plant. The H&H analysis will be used to compare the existing and proposed 100-year floodplain water surface elevations (WSEs) of Buckeye Creek upstream and downstream of the proposed grading and newly constructed bridge. This comparison will show the theoretical impacts, if any, of the proposed Sherwood Gas Processing Plant Master Plan development along the study area of the creek as it relates to the 100-year floodplain WSEs.

1.3 SCOPE OF SERVICES

CEC has performed this H&H analysis of the existing and proposed conditions along a portion of Buckeye Creek upstream and downstream of the proposed grading improvements and newly constructed bridge for the 100-year floodplain WSEs. The following scope of services was performed in order to achieve the above-stated purpose:

- Additional topographic information was collected by CEC to supplement the available topographic digital elevation models (DEM, USGS 3-meter) provided by West Virginia Statewide Addressing and Mapping Board (WVSAMB). It included:
    - New bridge survey elevations;
    - Topographic survey of the access road from County Route 50/34; and
    - Topographic survey of existing grade at various locations along the reach.
- Performance of hydraulic analyses utilizing the Hydrologic Engineering Center River Analysis System (HEC-RAS) program to perform a detailed backwater analysis of Buckeye Creek for the existing and proposed conditions during the 100-year, 24-hour storm event. The study included:
    - Development of an appropriate number of stream cross-sections for use in the HEC-RAS model;
    - Development of a model of the existing terrain and floodplain, which was used as a baseline;
    - Development of a floodplain that delineated the boundary of the 100-year flood in Buckeye Creek under existing conditions; and
    - Development of a floodplain plan that delineated the boundary of the 100-year flood in Buckeye Creek under proposed conditions that includes all final grading.
- Preparation of this hydraulic analysis report that summarizes our calculations and findings.

1.4 AUTHORIZATION

This study was performed as authorized by MarkWest.

1.5 STANDARD OF CARE

The services provided by CEC were conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the civil engineering profession practicing contemporaneously under similar conditions in the locality of the project. No warranty, express or implied, is made.

2.0 HYDROLOGIC ANALYSIS

2.1 METHODOLOGY

The Federal Emergency Management Agency (FEMA) conducted a Flood Insurance Study (FIS) for Doddridge County, West Virginia, dated October 4, 2011. According to this study, Buckeye Creek discharges 5,150 cubic feet per second (cfs) at its upstream confluence with Long Run during the 100-year, 24-hour storm event. The FEMA FIS is included in Appendix B.

In order to maintain conditions similar to the FIS, the discharge of 5,150 cfs and the known water surface elevation of 811.00 were used during the hydraulic analysis, as described in Section 4. The FEMA Flood Insurance Rate Map is provided in Appendix B.

3.0 HYDRAULIC ANALYSIS

The U.S. Army Corps of Engineers HEC-RAS computer software was utilized to analyze the hydraulic capacity and project water surface elevations (WSEs) along Buckeye Creek during the 100-year, 24-hour design storm evaluations. The Buckeye Creek study area boundary extends from approximately 2,460 feet downstream of the new bridge location to approximately 1,045 feet upstream of the new bridge location. A map of the cross section locations utilized for the hydraulic analysis is located in Appendix D.

3.1 EXISTING CONDITIONS

A HEC-RAS model for the existing conditions was created using as-built survey information collected by CEC, DEM data, and the FEMA FIS for Doddridge County, WV dated October 4, 2011.

An existing bridge at Station 26+25.35, between cross-sections R and S, was previously permitted to be removed once the proposed bridge was constructed. The existing bridge is included in the existing conditions model, however it was removed on November 13, 2013.

New topography was also collected for the stream and overbanks between stations 25+54.54 (Section T) and 0+00 (Section NN) during the survey. This topography is more accurate and current than the DEM topography used in the original flood study, so it is used in place of the DEM topography in the existing flood study model, except in the area of the existing bridge.

The existing conditions HEC-RAS model is the same as the model included in the previously approved master plan floodplain permit. The HEC-RAS input and output data for the model is provided in Appendix C. The map in Appendix D also shows the estimated lateral extent of the floodplain resulting from the 100-year, 24-hour design storm.

Included in Appendix E is the HEC-RAS summary table for the estimated water surface elevations in Buckeye Creek resulting from the 100-year, 24-hour design storm at each analyzed cross-section based on the existing conditions.

3.2 PROPOSED CONDITIONS

The HEC-RAS model for the proposed conditions was developed by removing the existing bridge and adding the new bridge located at Station 24+60.04, between cross-sections U and V (approximately 165 feet downstream of the existing bridge). The new bridge is a 30 feet wide, 39.2 feet long, single span bridge, with a deck elevation of 812.00 feet (determined by the as-built survey). In addition, Buckeye Creek cross-sections were revised to include the proposed final grading. The finish grade elevations are shown on the map in Appendix D. The proposed plant grading is located between cross-sections H (31+54.54) and EE (16+04.54) and the proposed administration building and warehouse grading is located between cross-sections JJ (8+10.82) and NN (1+09.26).

The HEC-RAS input and output data for the proposed conditions model are provided in Appendix C. The HEC-RAS summary table for the proposed conditions at each cross section is included in the hydraulic calculations in Appendix E. In addition, a summary table for the comparison of the 100-year existing and proposed water surface elevations is located at the end of Appendix E.

4.0 CONCLUSIONS

The following conclusions are presented based on the results of engineering analyses using the HEC-RAS model.

4.1 EXISTING CONDITIONS

The existing conditions, as previously described, were evaluated to estimate the existing 100-year WSEs of Buckeye Creek. The existing bridge causes a backwater effect upstream of the bridge such that at Section R, one section upstream of the bridge, the 100-year WSE is 811.37. At Section Q, two sections upstream of the existing bridge, the 100-year WSE increases to 812.97. At Section P, three cross-sections upstream of the existing bridge, the 100-year WSE increases to 813.11. The backwater effect the existing bridge has on Buckeye Creek is approximately indicated three sections upstream of the bridge (approximately 130 feet).

Appendix E contains a summary table of the HEC-RAS results. Also provided are graphical results of the HEC-RAS analysis for the 100-year design storm at numerous sections along Buckeye Creek. Based on these analyses, the following conclusions were developed:

- The 100-year, 24-hour design storm will not overtop the existing bridge at Station 26+25.35; and
- The 100-year, 24-hour design storm will inundate approximately 53 acres, as shown in Drawing SP01 in Appendix D.
- The existing bridge will create a backwater effect of approximately 1.74 feet at approximately 130 feet upstream of the existing bridge.

4.2 PROPOSED CONDITIONS

The proposed HEC-RAS model was setup to analyze the hydraulic impacts of the proposed Sherwood Gas Processing Plant Master Plan development, including the new relocated bridge, on Buckeye Creek. The new bridge causes a backwater effect upstream of the bridge similar to

the backwater effect that was created by the existing bridge. At Section U, one section upstream of the new bridge, the 100-year WSE is 811.79. At Section T, two sections upstream of the new bridge, the 100-year WSE increases to 813.44. At Section S, three sections upstream of the new bridge, the 100-year WSE increases to 813.43. The backwater effect the proposed bridge has on Buckeye Creek is approximately indicated three sections upstream of the bridge (approximately 145 feet).

By comparing the existing and proposed 100-year WSEs at the third cross-section upstream of the existing bridge and new bridge (where the backwater effects are fully indicated), the new bridge backwater effect at the third cross-section upstream of the bridge (Section S) causes an approximate maximum increase in the 100-year backwater elevation of 0.32 feet when compared to the third cross-section upstream of the existing bridge backwater effect (Section P). Based upon the above, the proposed bridge can be shown not to adversely affect the subject property by not increasing the existing 100-year backwater elevation by more than one foot.

The maximum increase in WSE between existing and proposed conditions occurs at Station 30+04.54 (Section K). The existing WSE at Section K is 813.08 while the proposed WSE is 813.74. Therefore, the maximum WSE increase resulting from the proposed Sherwood Gas Processing Plant Master Plan development is 0.66 feet.

Appendix E contains a summary table of the HEC-RAS results. Also provided are graphical results of the HEC-RAS analysis for the 100-year design storm at numerous sections along Buckeye Creek. The section locations are shown in drawing SP01 in Appendix D. Based on these analyses, the following conclusions were developed:

- The proposed Sherwood Gas Processing Plant Master Plan development will not adversely affect the subject property or adjacent properties since the 100-year WSE has not been increased by more than one foot;
- The 100-year, 24-hour design storm will not overtop the new bridge at Station 24+60.04;
- The 100-year, 24-hour design storm will inundate approximately 37 acres as shown on Drawing SP01 in Appendix D;

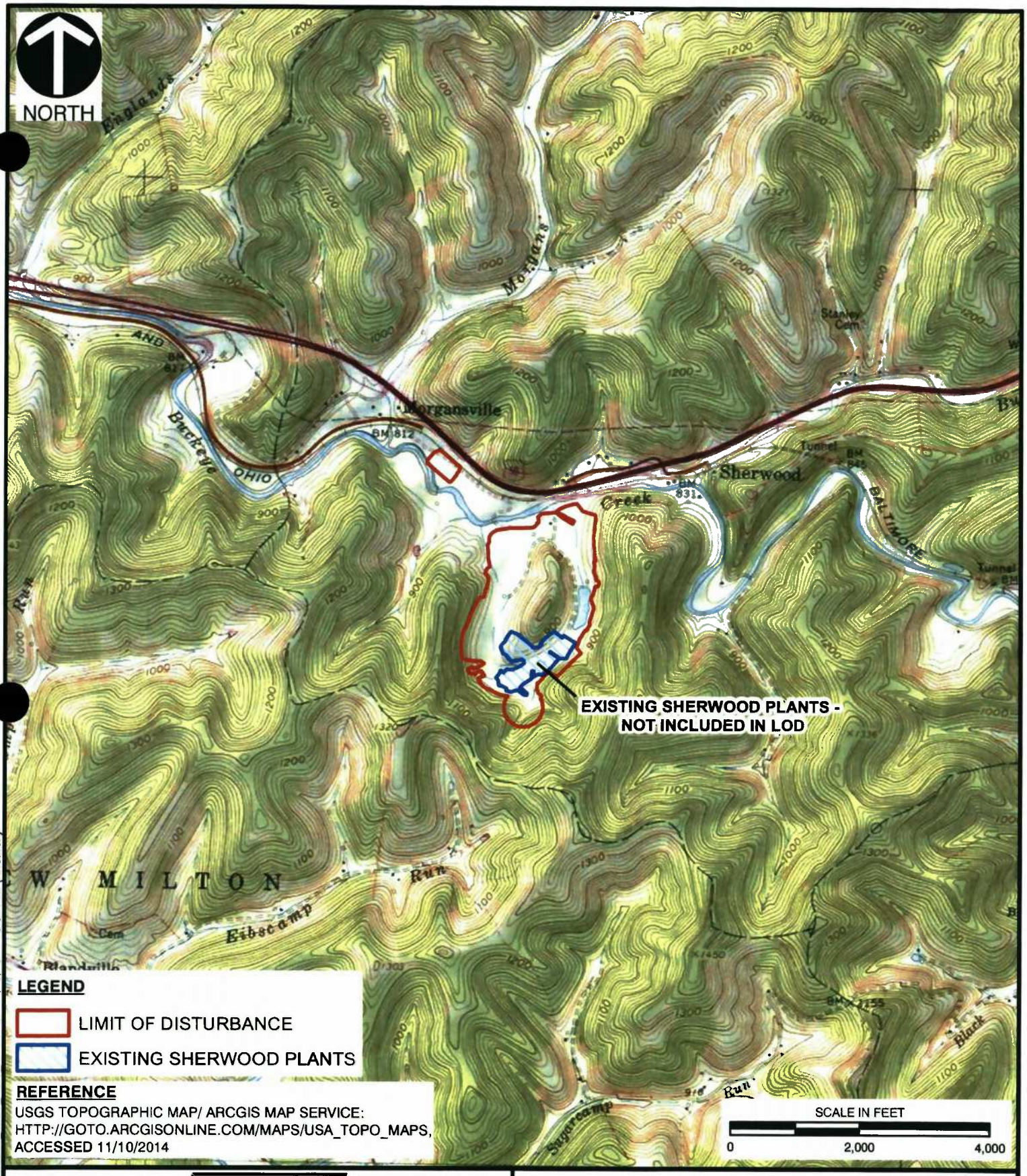
- The 100-year, 24-hour design storm will increase the flood elevation a maximum of 0.66 feet at Section K (Station 30+04.54); and
- The water surface elevation increase at Station 35+04.54, approximately 315 feet downstream from the subject property line, is 0.30 feet.

4.3 SUMMARY

The hydraulic analysis was prepared to provide a comparison between the post-development floodplain conditions along Buckeye Creek and the existing conditions. The proposed final grading and bridge will not adversely affect the subject property or the adjacent properties upstream or downstream of the subject property since the base flood elevation will not increase by more than one foot. Based upon the above condition, the project would comply with the Doddridge County Floodplain Ordinance.

APPENDIX A

SITE LOCATION AND SOILS MAPS



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SHERWOOD GAS PROCESSING PLANTS 6 &7
DODDRIDGE COUNTY, WV

SITE LOCATION MAP

DRAWN BY:	NJH	CHECKED BY:	TGJ	APPROVED BY:	EGF	FIGURE NO:	1
DATE:	11/10/2014	SCALE:	1 " = 2,000 '	PROJECT NO:	110-811.5001		

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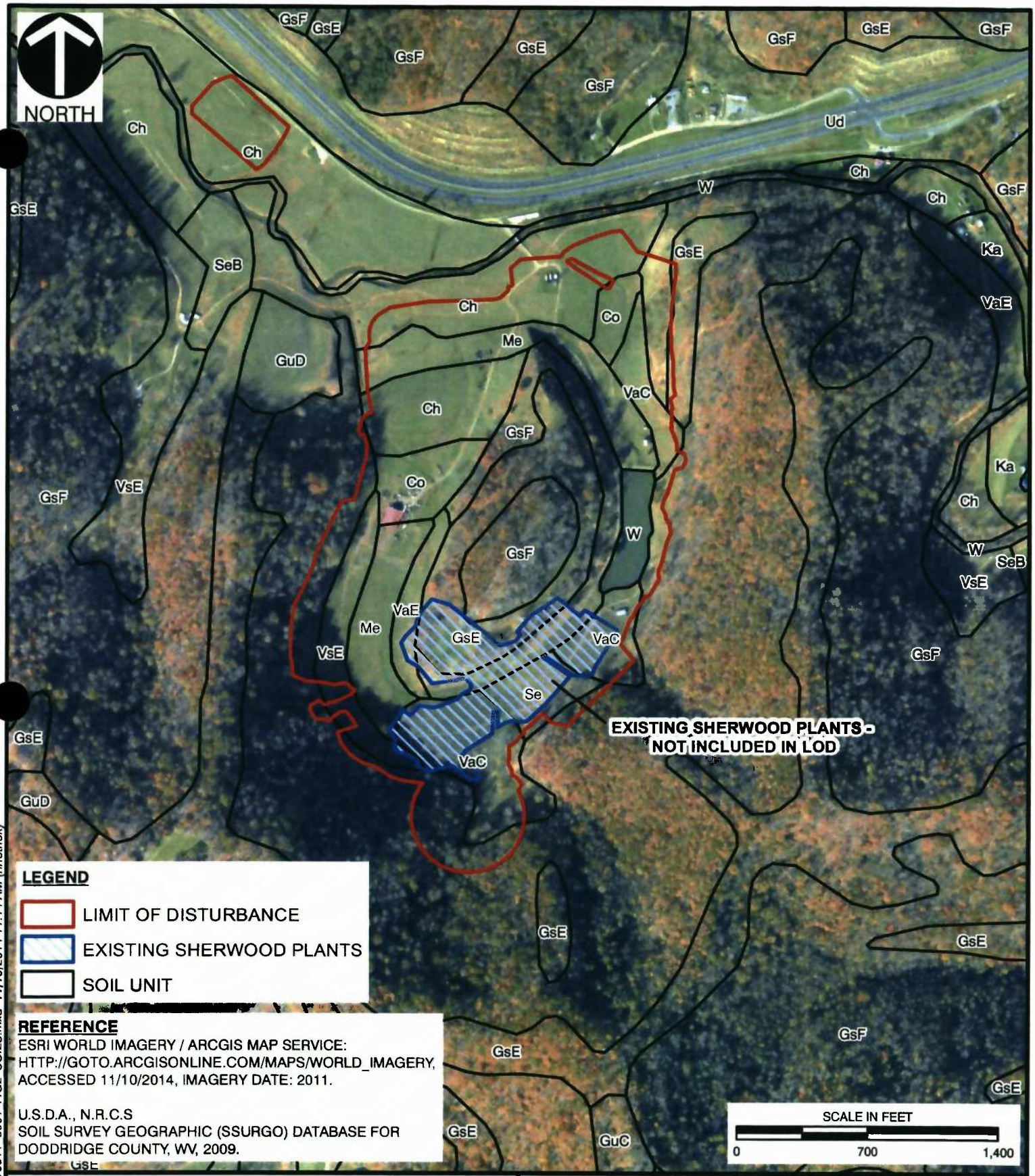

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MARKWEST LIBERTY MIDSTREAM & RESOURCES, LLC
SHERWOOD GAS PROCESSING PLANTS 6 &7
DODDRIDGE COUNTY, WV

SOILS MAP

DRAWN BY:	NJH	CHECKED BY:	TGJ	APPROVED BY:	EJF	FIGURE NO:	2
DATE:	11/10/2014	SCALE:	1 " = 700 '	PROJECT NO:	110-811.5001		

APPENDIX B

FEMA FLOOD INSURANCE STUDY AND RATE MAP

Sherwood Master Plan

This map is not the official regulatory FIRM or DFIRM. Its purpose is to assist with determining potential flood risk for the selected location.

Map Created on 11/10/2014

Location of the mouse click

Approximate Study (Zone A)

Detailed Study (Zone AE, AH, AO)

Floodway

Flood Water Depth (HEC-RAS)

Cross Section Line

Base Flood Elevation Line

DFIRM Panel (Map) Index

User Notes:

Disclaimer:

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

WV Flood Tool is supported by FEMA, WV NFIP Office, and WV GIS Technical Center

Flood Hazard Area:

Advisory Flood Height: N/A

Water Depth: N/A

Elevation: N/A

Location (long, lat):

Location (UTM 17N):

FEMA Issued Flood Map:

Contacts:

CRS Information:

Flood Profile: No Profile

HEC-RAS Model: No Model

Parcel Number:

MAP SCALE 1" = 1000'

500 0 1000 2000

FEET

METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0140C

FIRM

FLOOD INSURANCE RATE MAP

DODDRIDGE COUNTY, WEST VIRGINIA AND INCORPORATED AREAS

PANEL 140 OF 325

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
DODDRIDGE COUNTY	540024	0140	C

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

MAP NUMBER
54017C0140C

MAP REVISED
OCTOBER 4, 2011

Federal Emergency Management Agency

MAP SCALE 1" = 1000'

500 0 1000 2000

FEET

METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0145C

FIRM

FLOOD INSURANCE RATE MAP

DODDRIDGE COUNTY, WEST VIRGINIA AND INCORPORATED AREAS

PANEL 145 OF 325

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
DODDRIDGE COUNTY	540024	0145	C

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

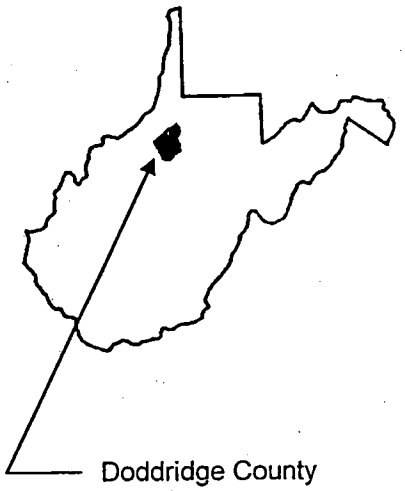
MAP NUMBER
54017C0145C

MAP REVISED
OCTOBER 4, 2011

Federal Emergency Management Agency

FLOOD INSURANCE STUDY

DODDRIDGE COUNTY, WEST VIRGINIA
AND INCORPORATED AREAS



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

Effective: October 4, 2011

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
54017CV000A

NOTICE TO
FLOOD INSURANCE STUDY USERS

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

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

Initial Countywide FIS Effective Date: March 18, 1991

Flood Insurance Study Revised: October 4, 2011

TABLE OF CONTENTS – Volume 1 – *October 4, 2011*

TABLE OF CONTENTS – Volume 1 – *October 4, 2011*

FIGURES

TABLES

EXHIBITS

FLOOD INSURANCE STUDY
DODDRIDGE COUNTY, WEST VIRGINIA
AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

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

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

1.2 Authority and Acknowledgments

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

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

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

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

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

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

1.3 Coordination

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

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

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

2.0 AREA STUDIED

2.1 Scope of Study

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

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

Table 1 – Areas Studied by Detailed Methods

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

Table 1 – Areas Studied by Detailed Methods - continued

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

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

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

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

2.2 Community Description

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

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

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

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

2.3 Principal Flood Problems

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

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

2.4 Flood Protection Measures

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

3.0 ENGINEERING METHODS

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

3.1 Hydrologic Analyses

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

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

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

Table 2 – Summary of Discharges

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

Table 2 – Summary of Discharges

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

3.2 Hydraulic Analyses

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

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

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

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

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

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

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

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

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

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

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

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

3.3 Vertical Datum

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

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

Table 3 – Vertical Datum Conversion Values

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

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

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

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

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

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

4.1 Floodplain Boundaries

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

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

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

4.2 Floodways

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

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

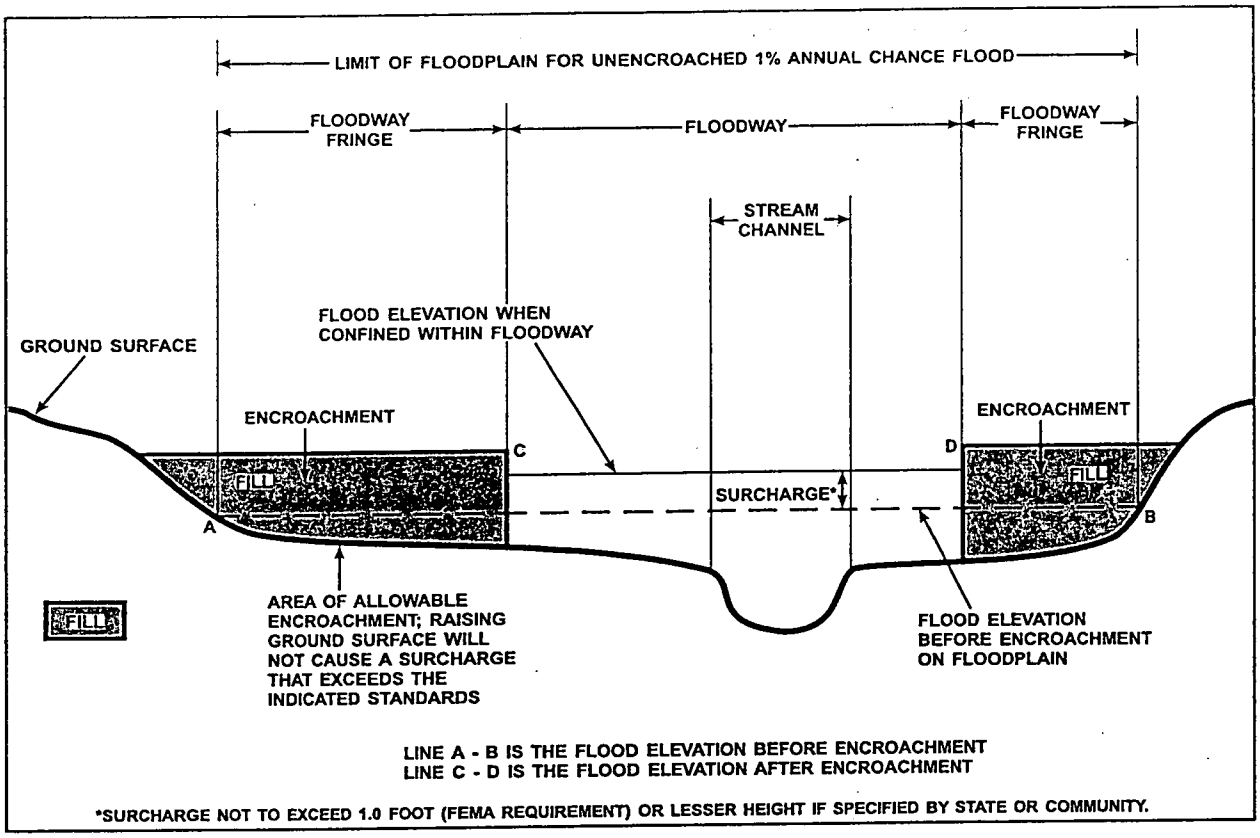


Figure 1 - Floodway Schematic

No floodways were calculated as part of this study.

5.0 INSURANCE APPLICATIONS

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

Zone A

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

Zone AE

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

Zone AH

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

Zone AO

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

Zone AR

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

Zone A99

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

Zone V

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

Zone VE

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

Zone X

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

Zone X (Future Base Flood)

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

Zone D

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

6.0 FLOOD INSURANCE RATE MAP

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

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

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

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

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

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

7.0 OTHER STUDIES

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

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

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

8.0 LOCATION OF DATA

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

9.0 BIBLIOGRAPHY AND REFERENCES

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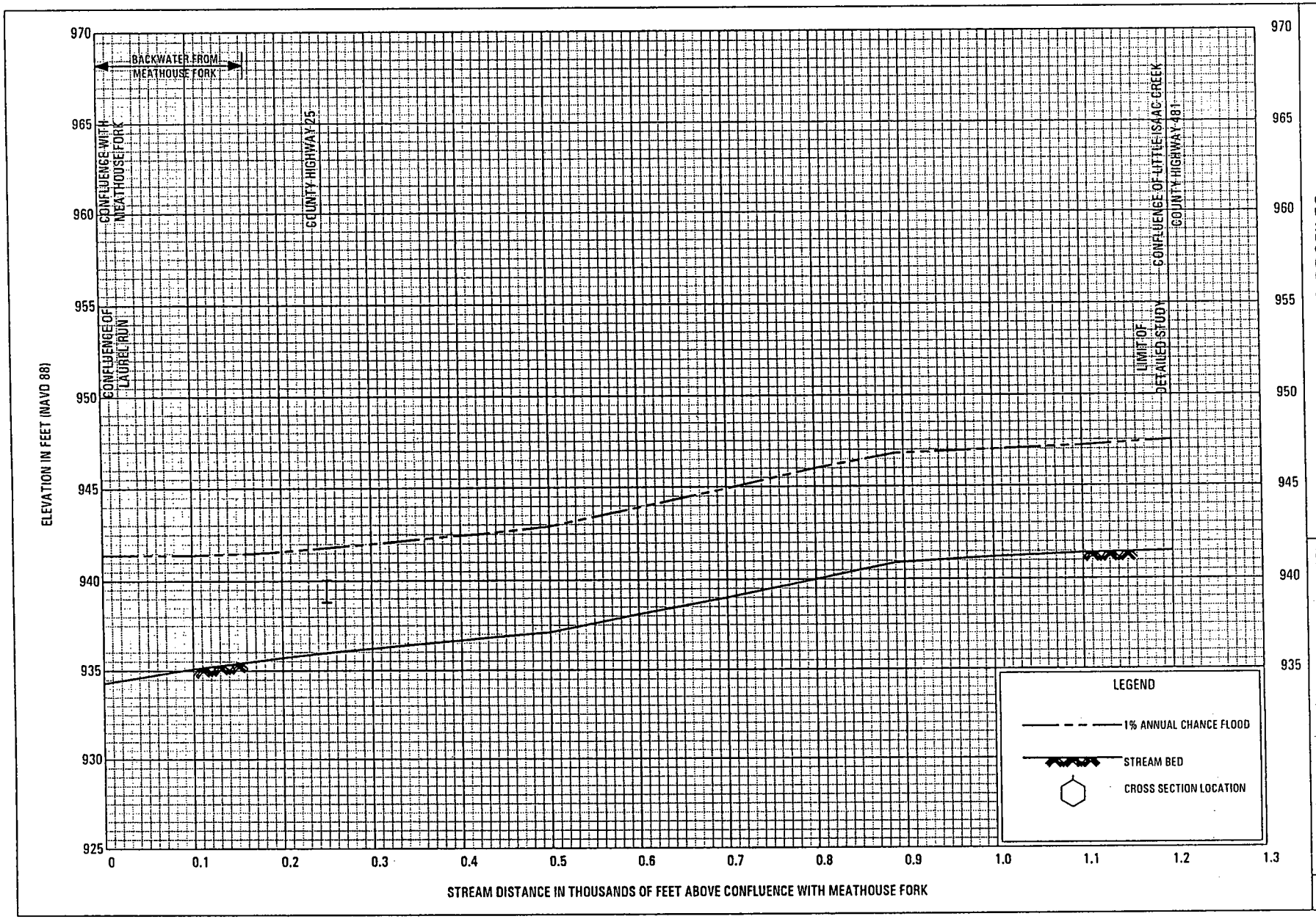
14. Federal Emergency Management Agency, Flood Insurance Study, Gilmer County and Incorporated Areas, West Virginia (Unpublished).



FLOOD PROFILES

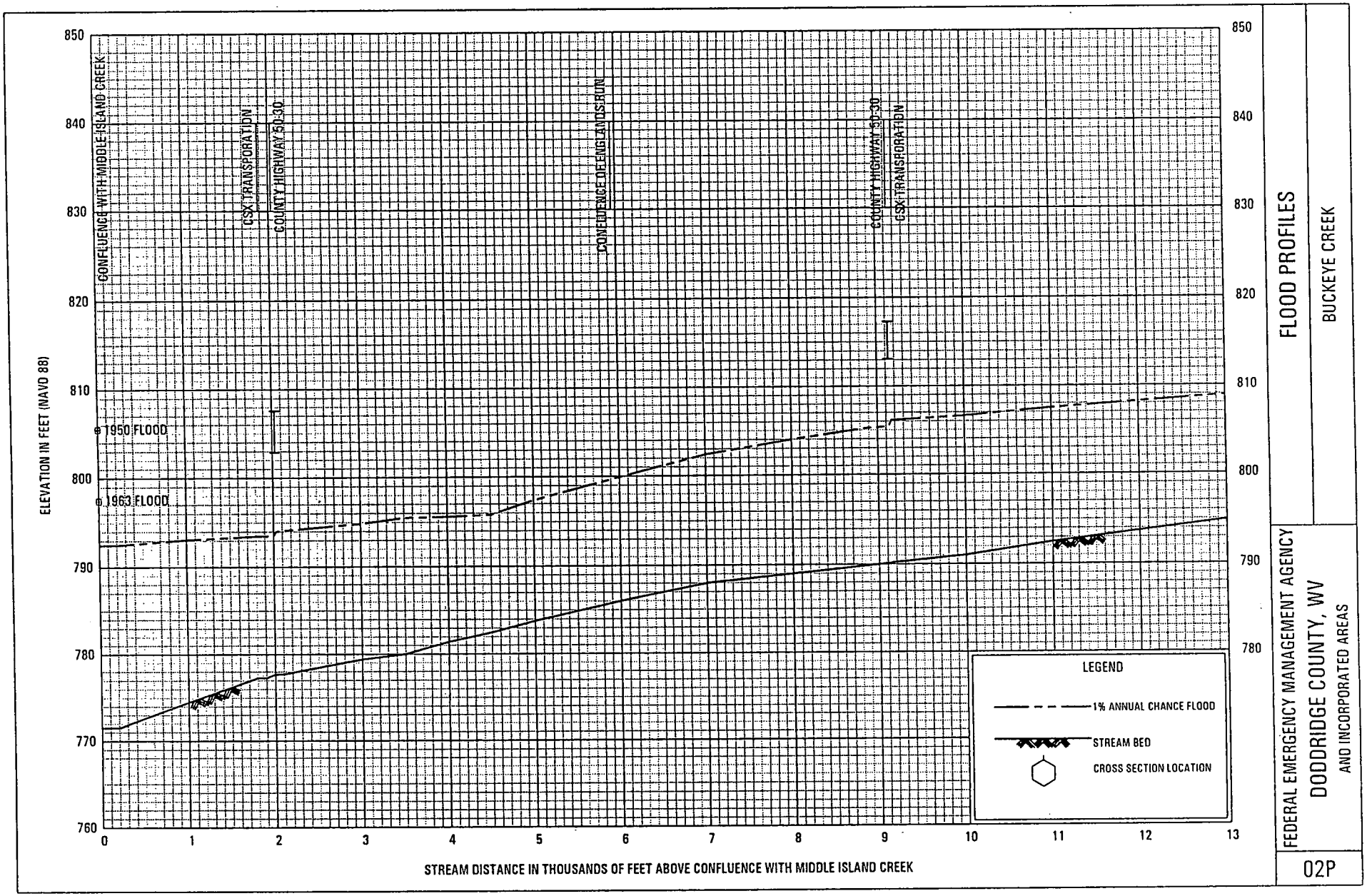
BIG ISAAC CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

01P



FLOOD PROFILES

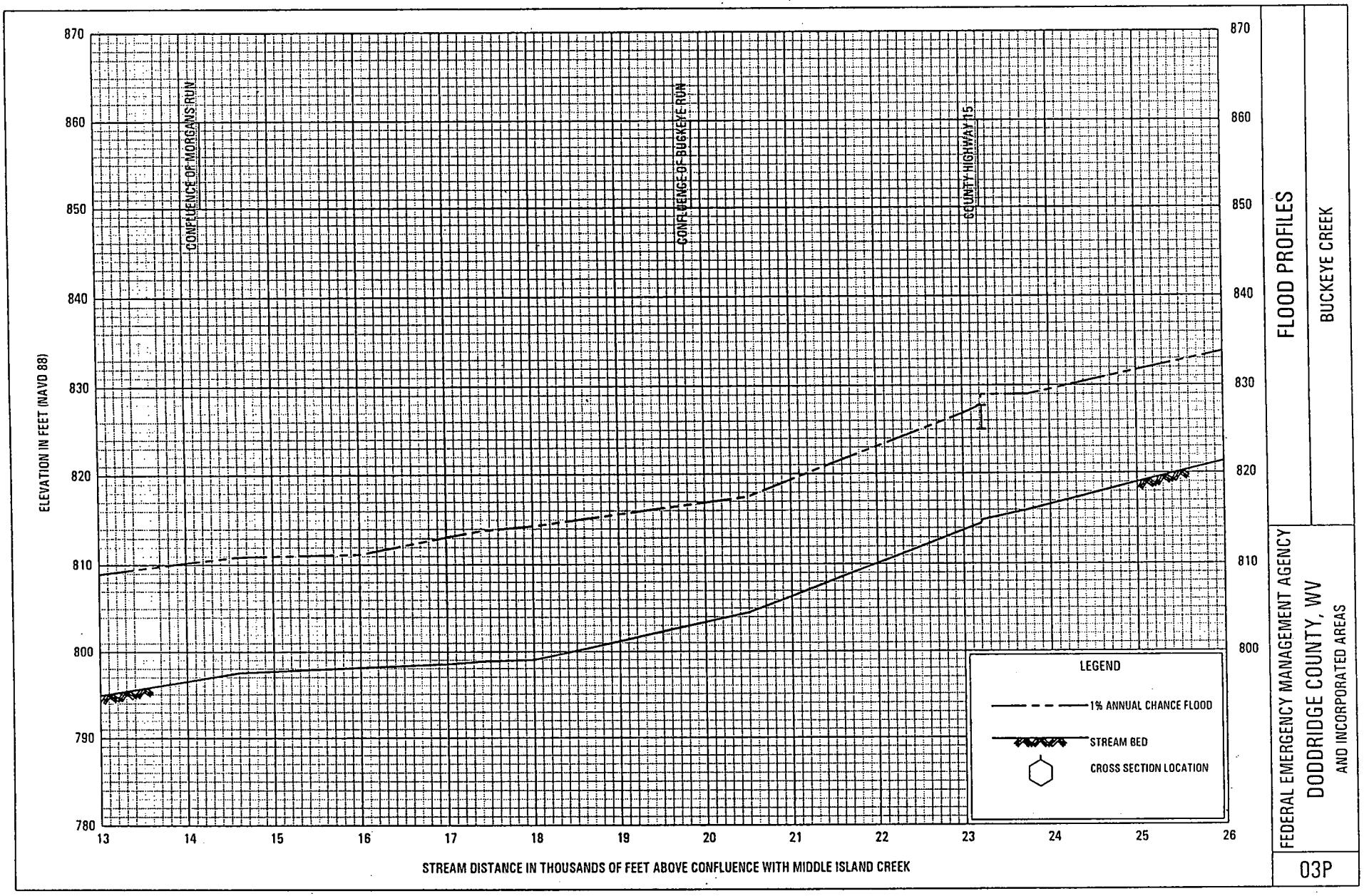
BUCKEYE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

02P



FLOOD PROFILES

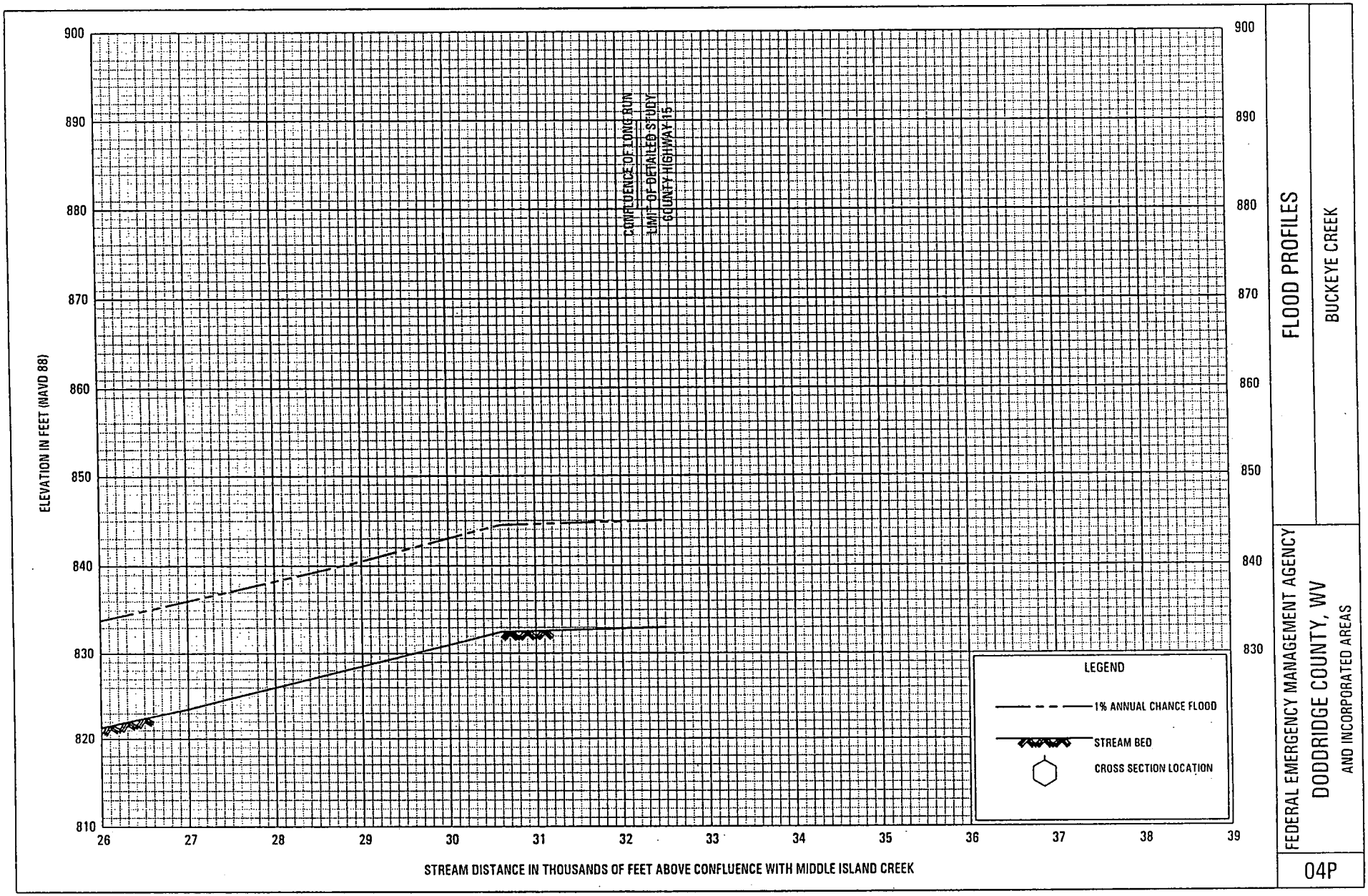
BUCKEYE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

03P



FLOOD PROFILES

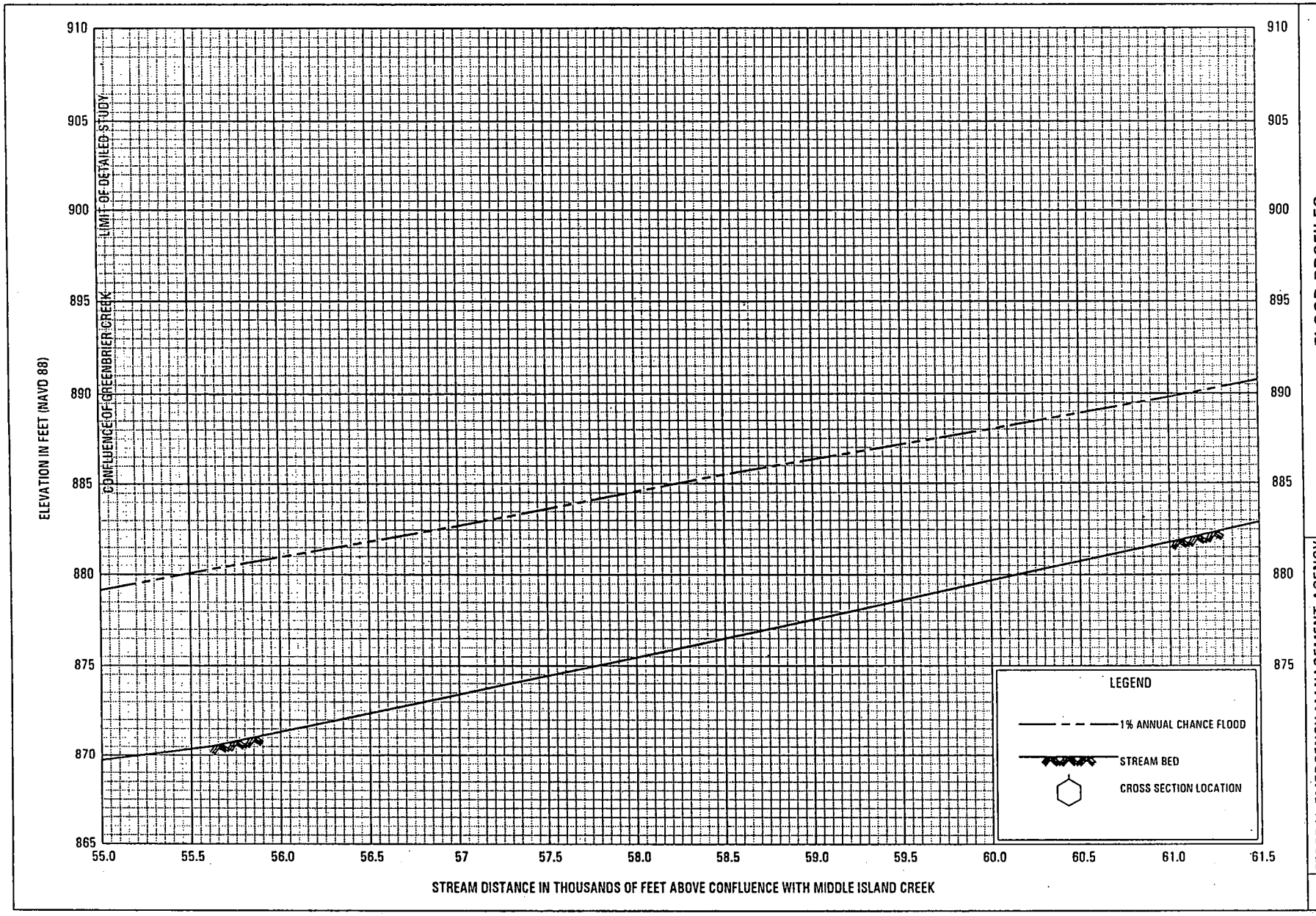
BUCKEYE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

04P



FLOOD PROFILES

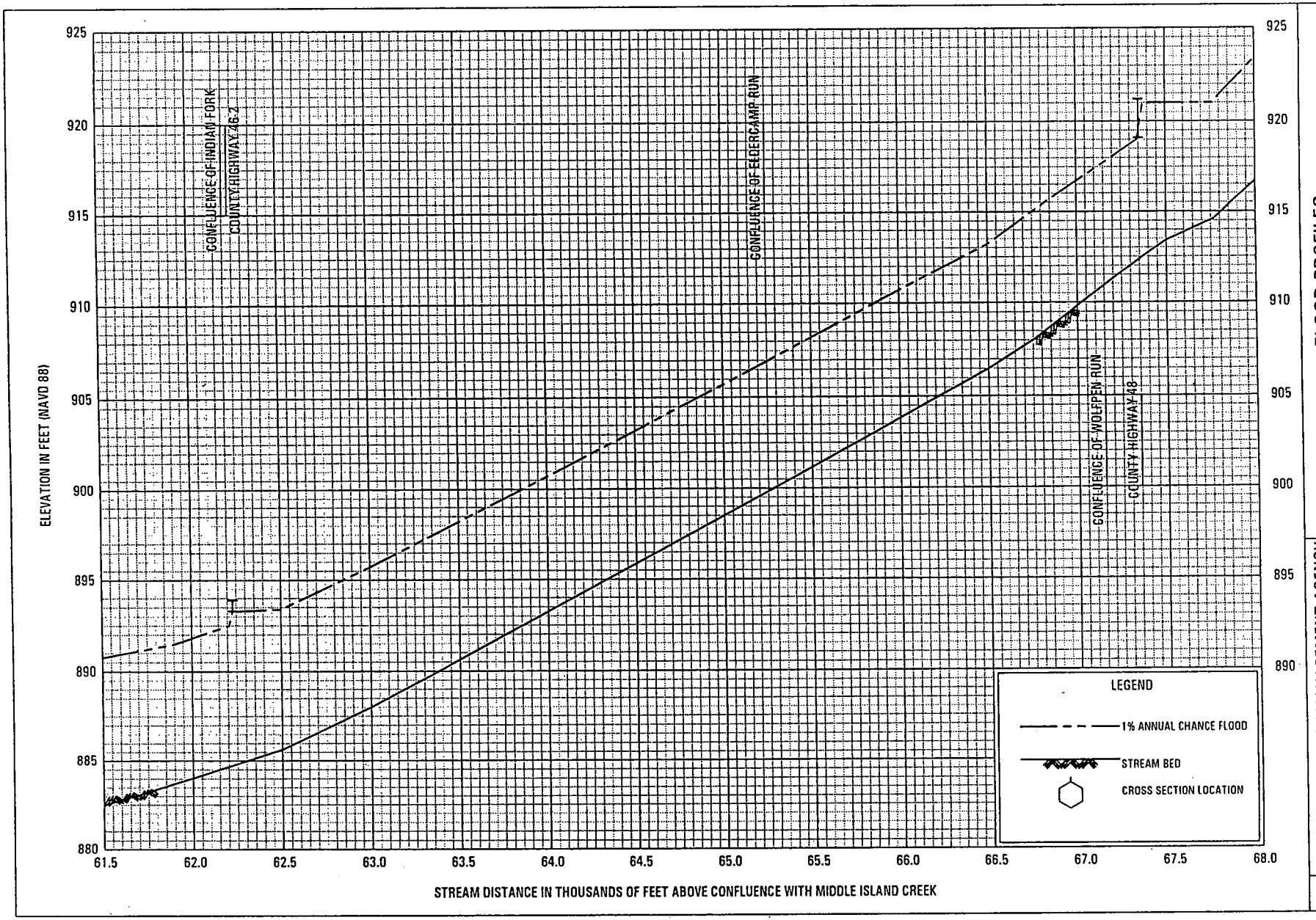
BUCKEYE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

05P



FLOOD PROFILES

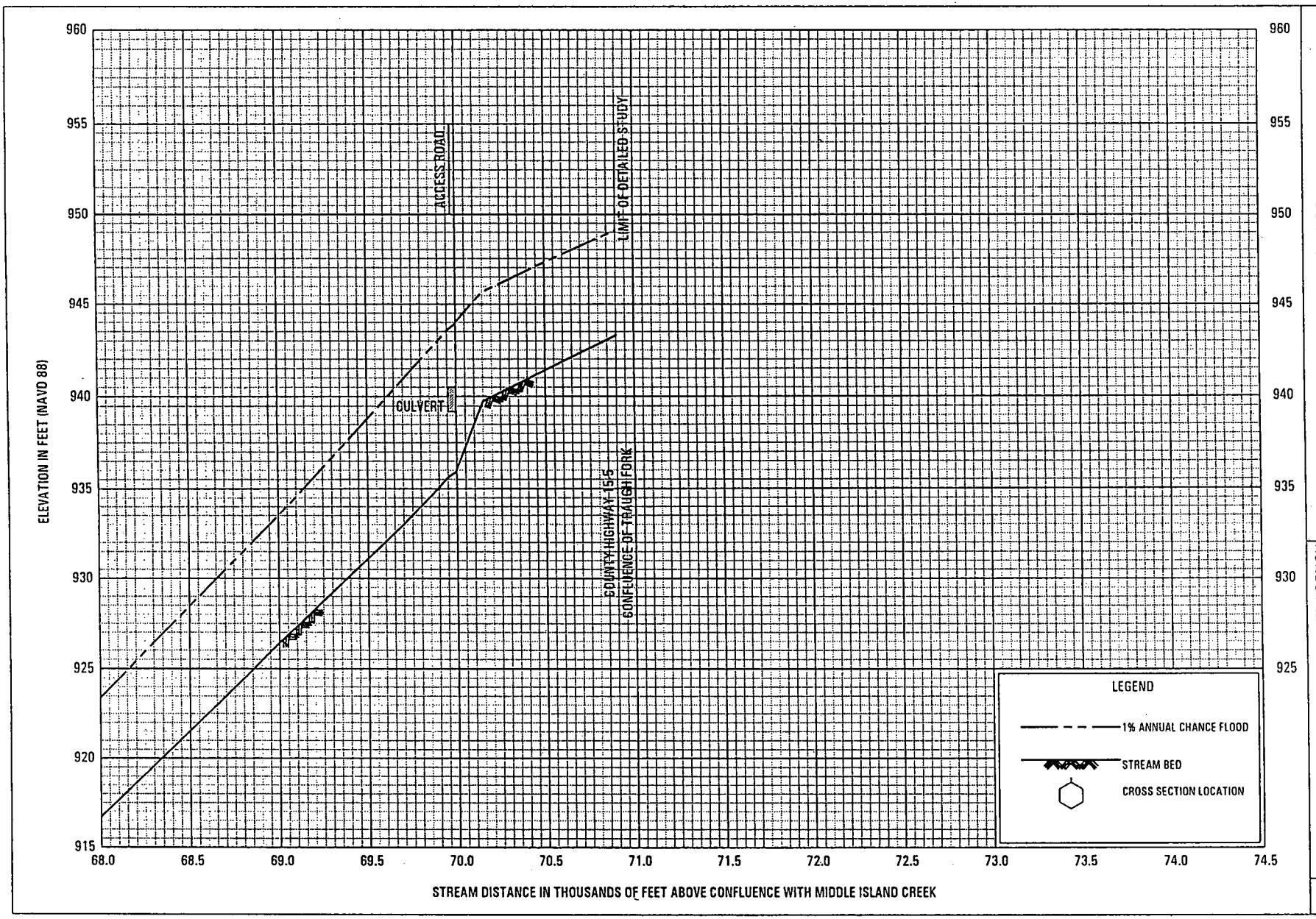
BUCKEYE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

06P



FLOOD PROFILES

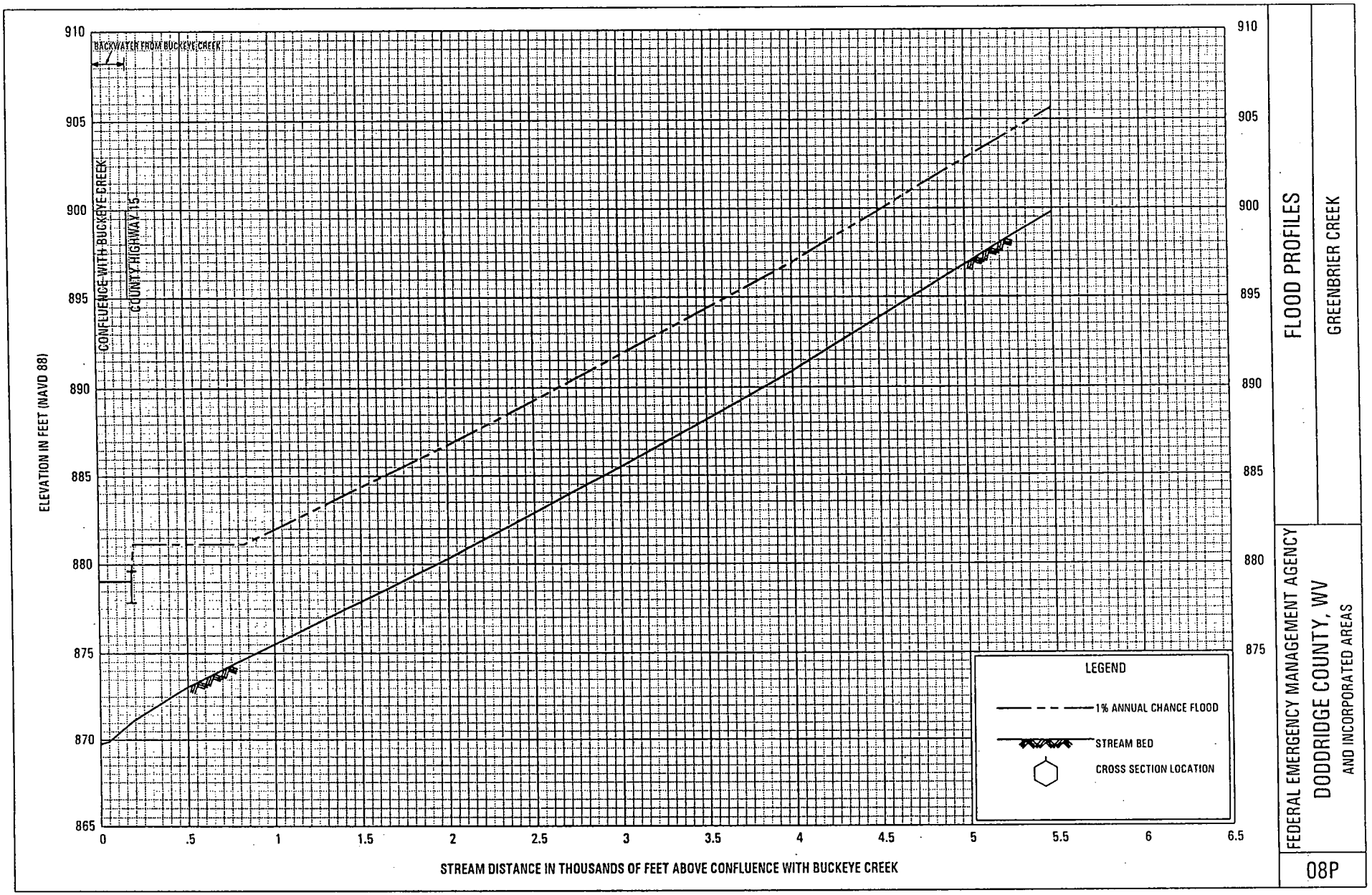
BUCKEYE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

07P



FLOOD PROFILES

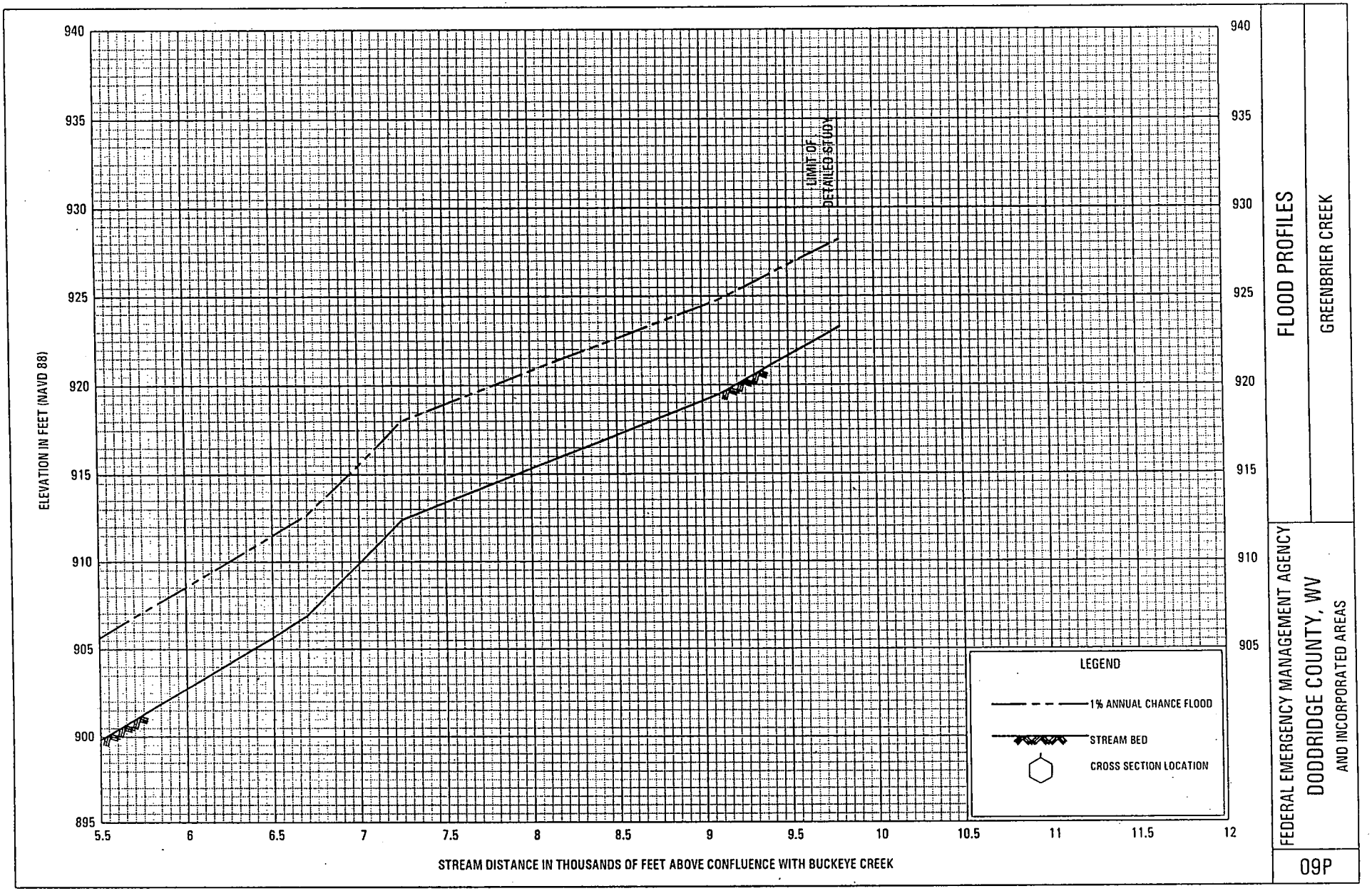
GREENBRIER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

08P



FLOOD PROFILES

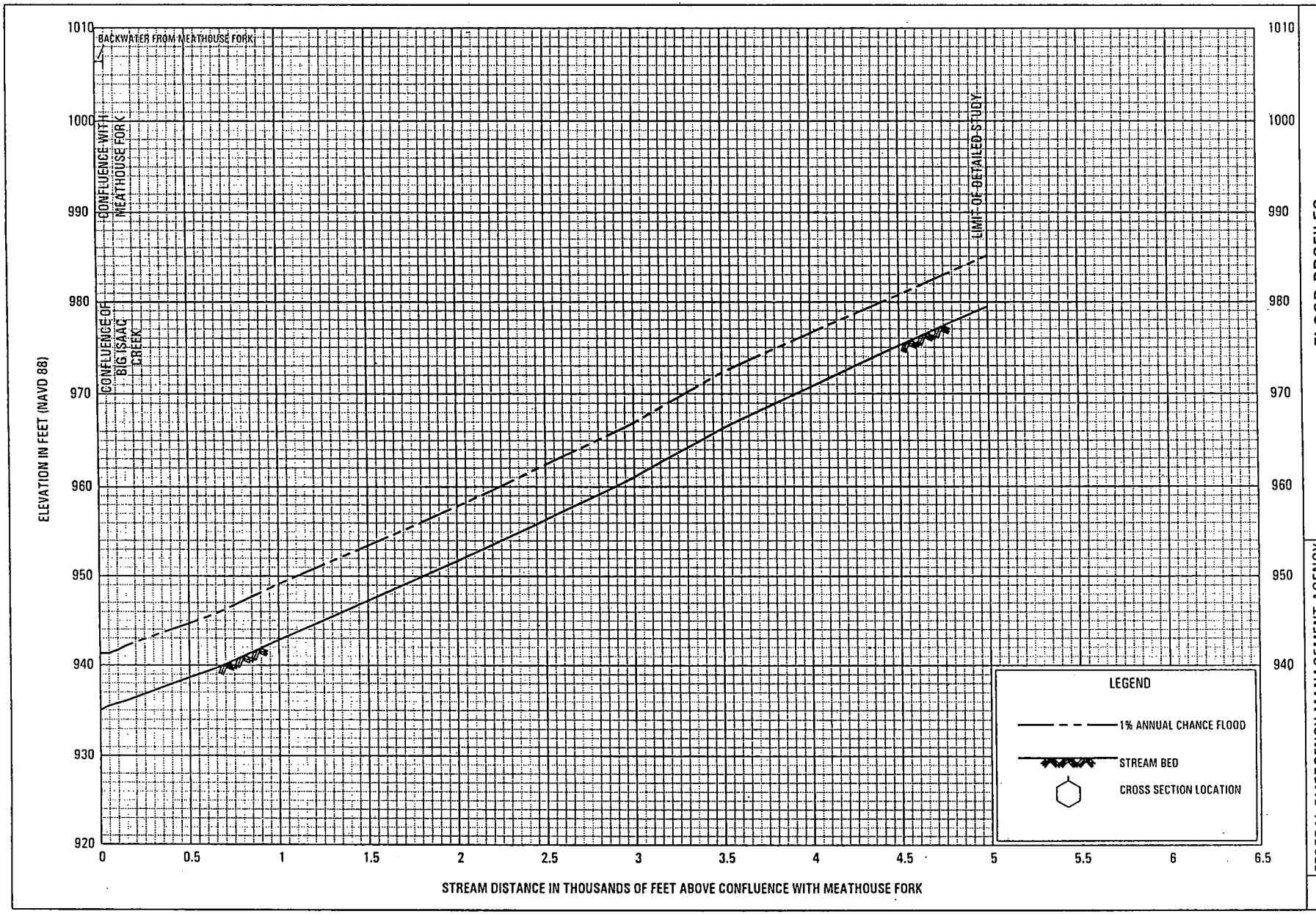
GREENBRIER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

09P



FLOOD PROFILES

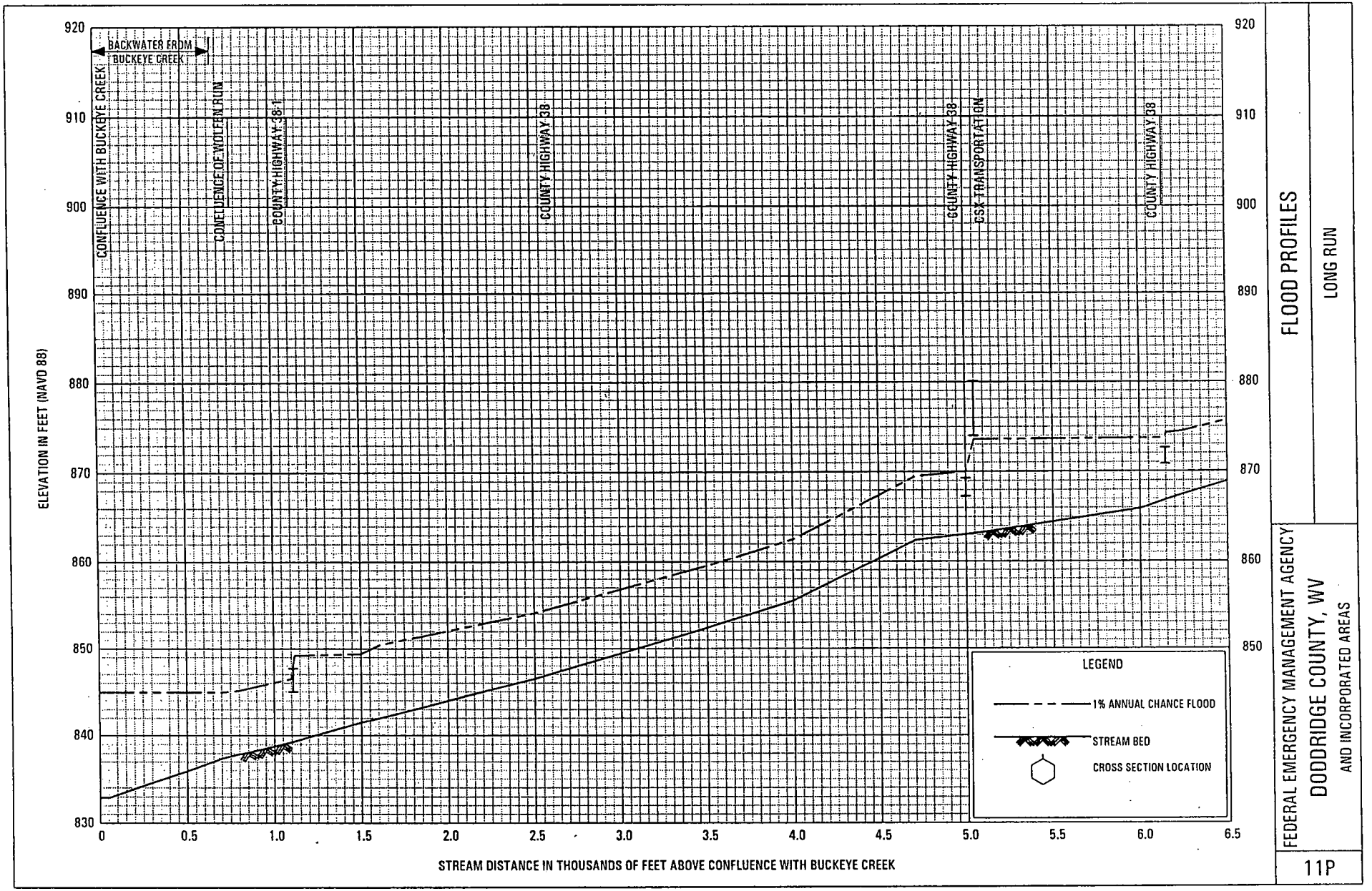
LAUREL RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

10P



FLOOD PROFILES

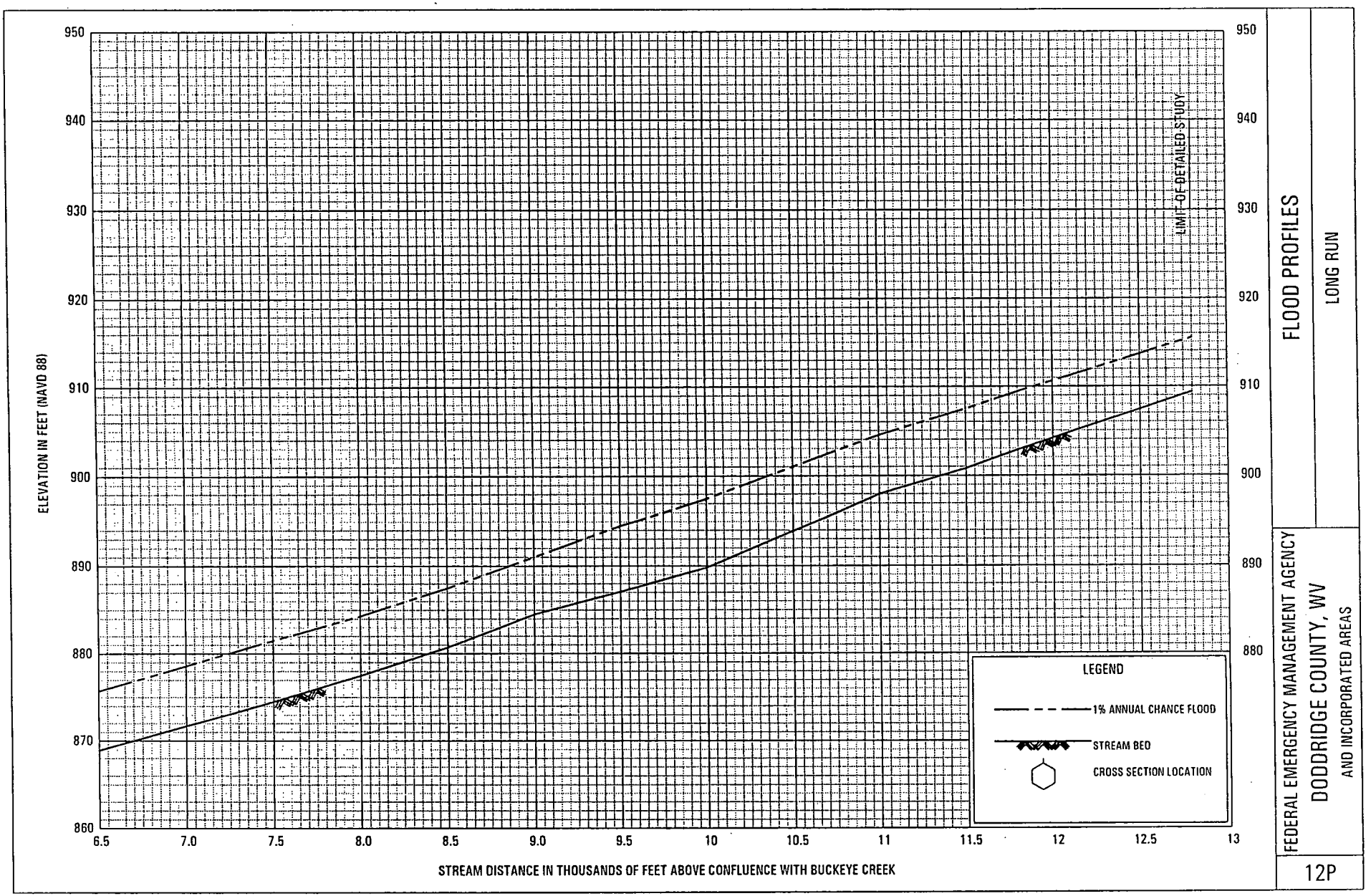
LONG RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

11P



FLOOD PROFILES

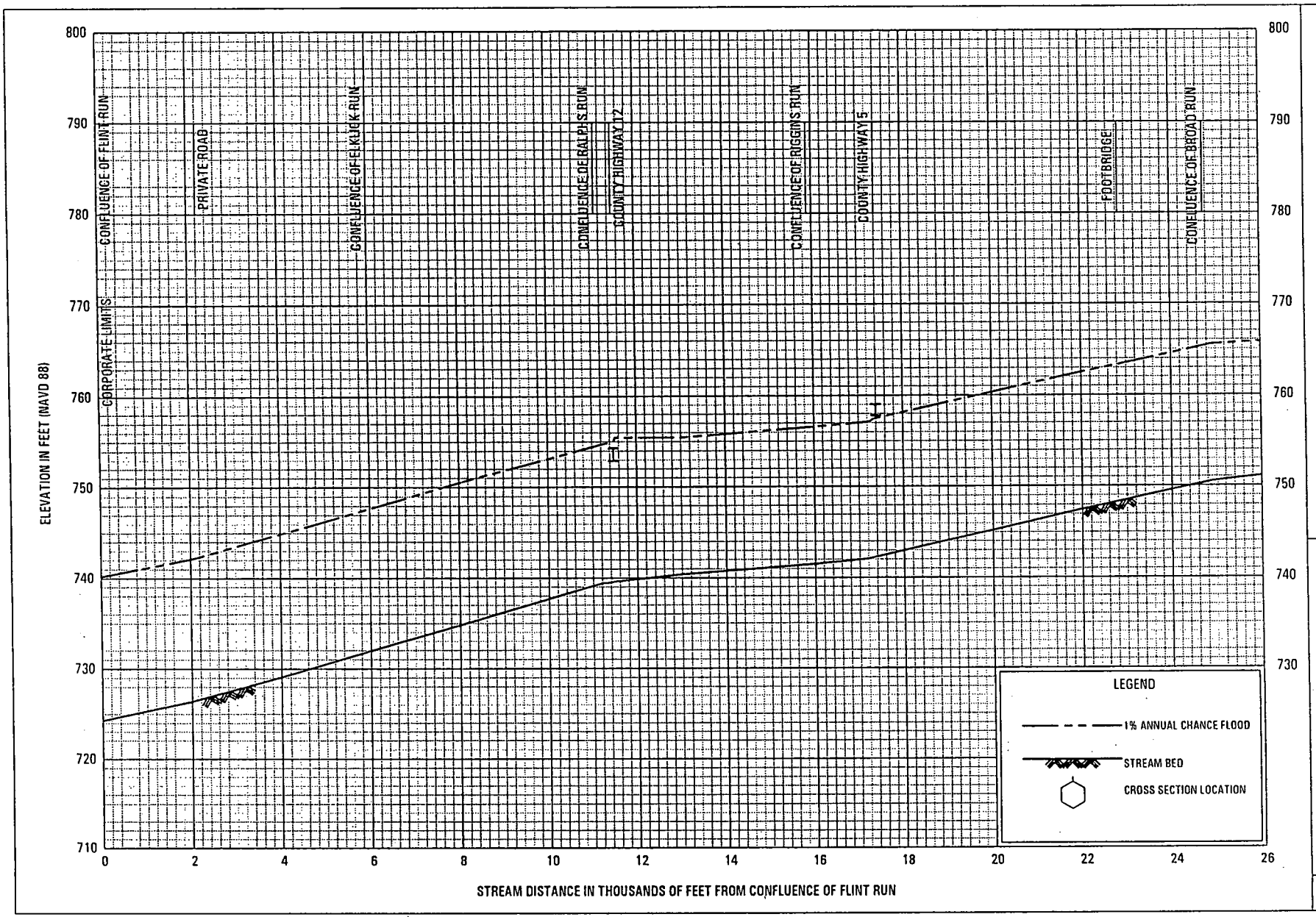
LONG RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

12P



FLOOD PROFILES

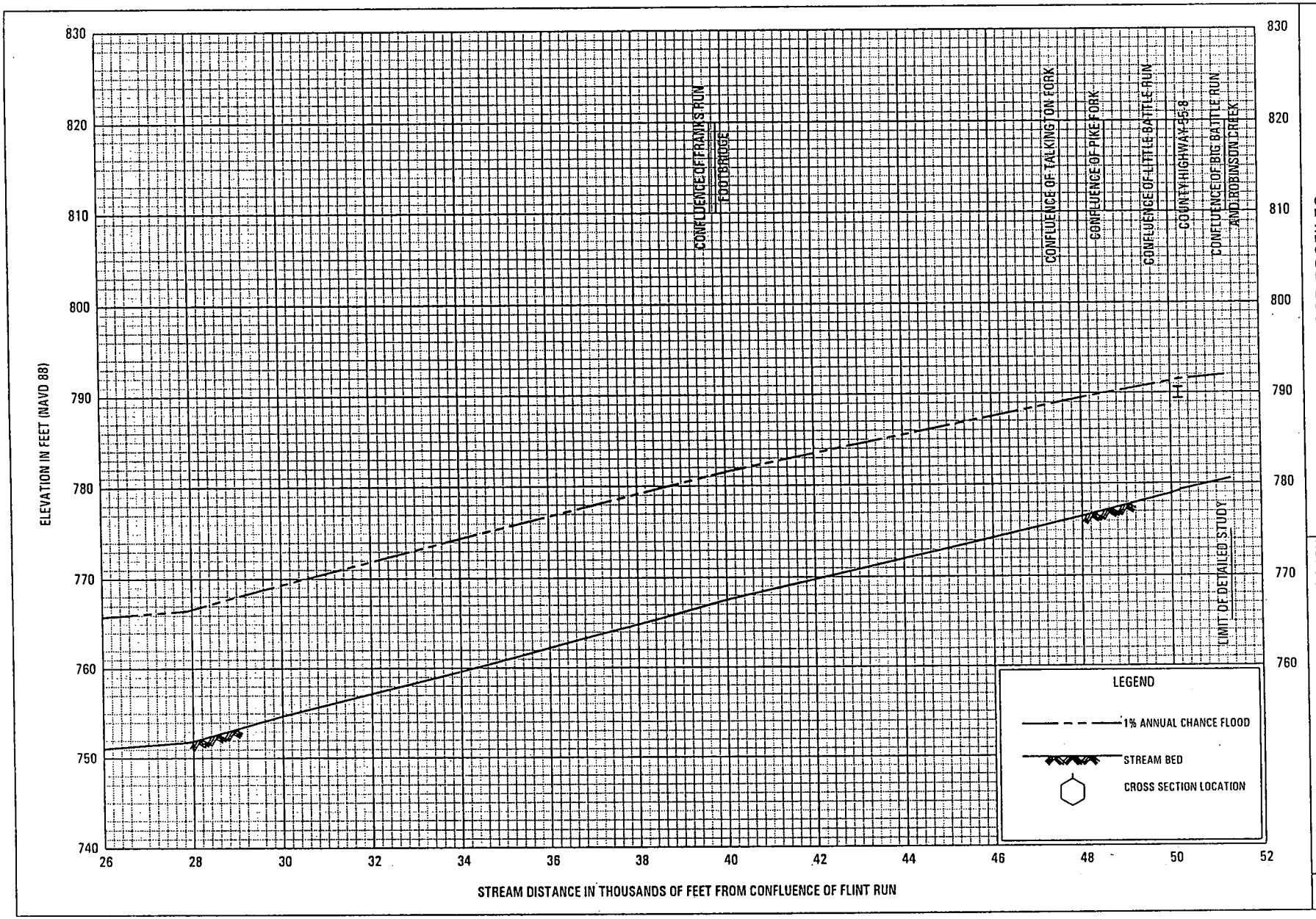
MCELROY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

13P



FLOOD PROFILES

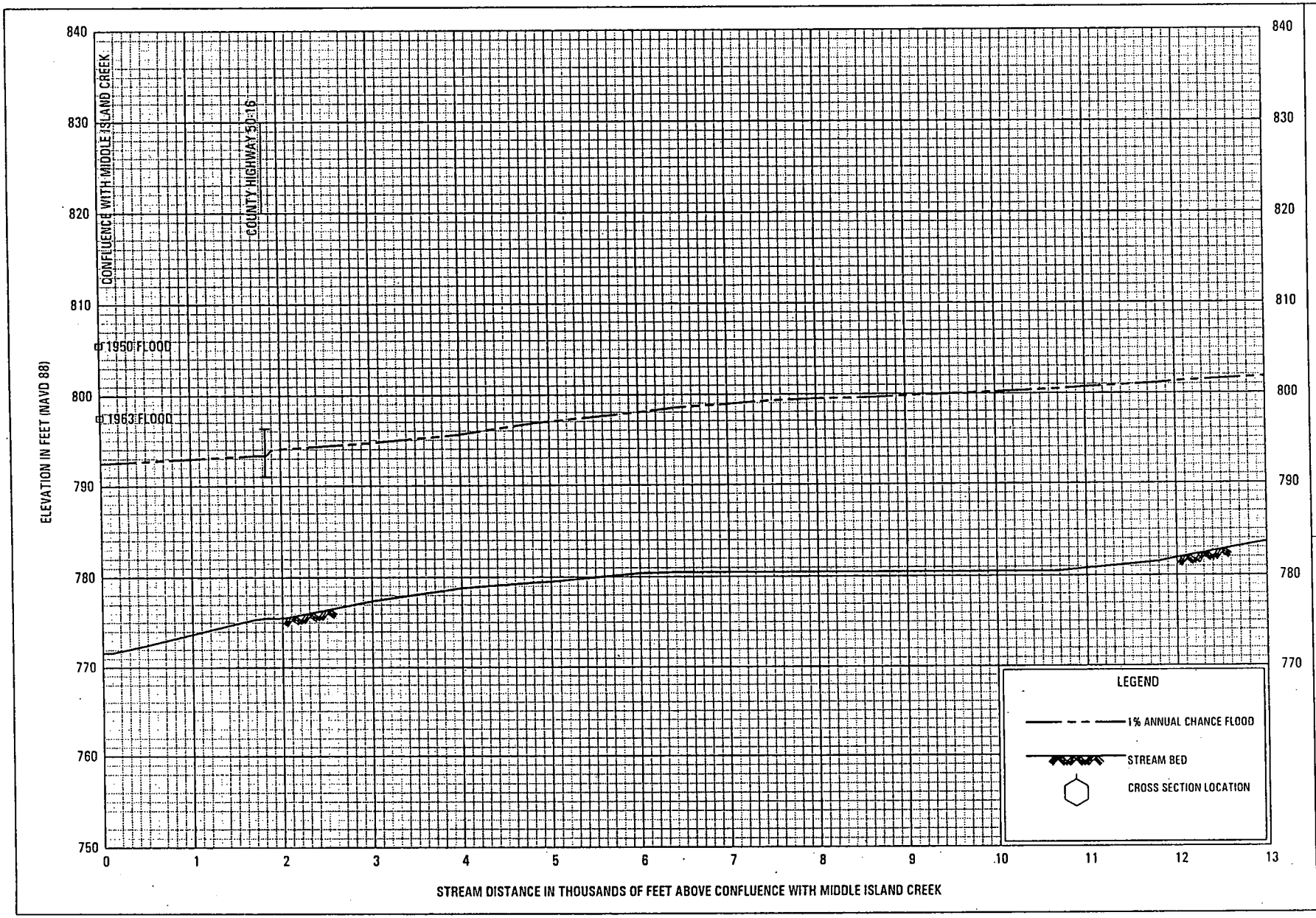
MCELROY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

14P



FLOOD PROFILES

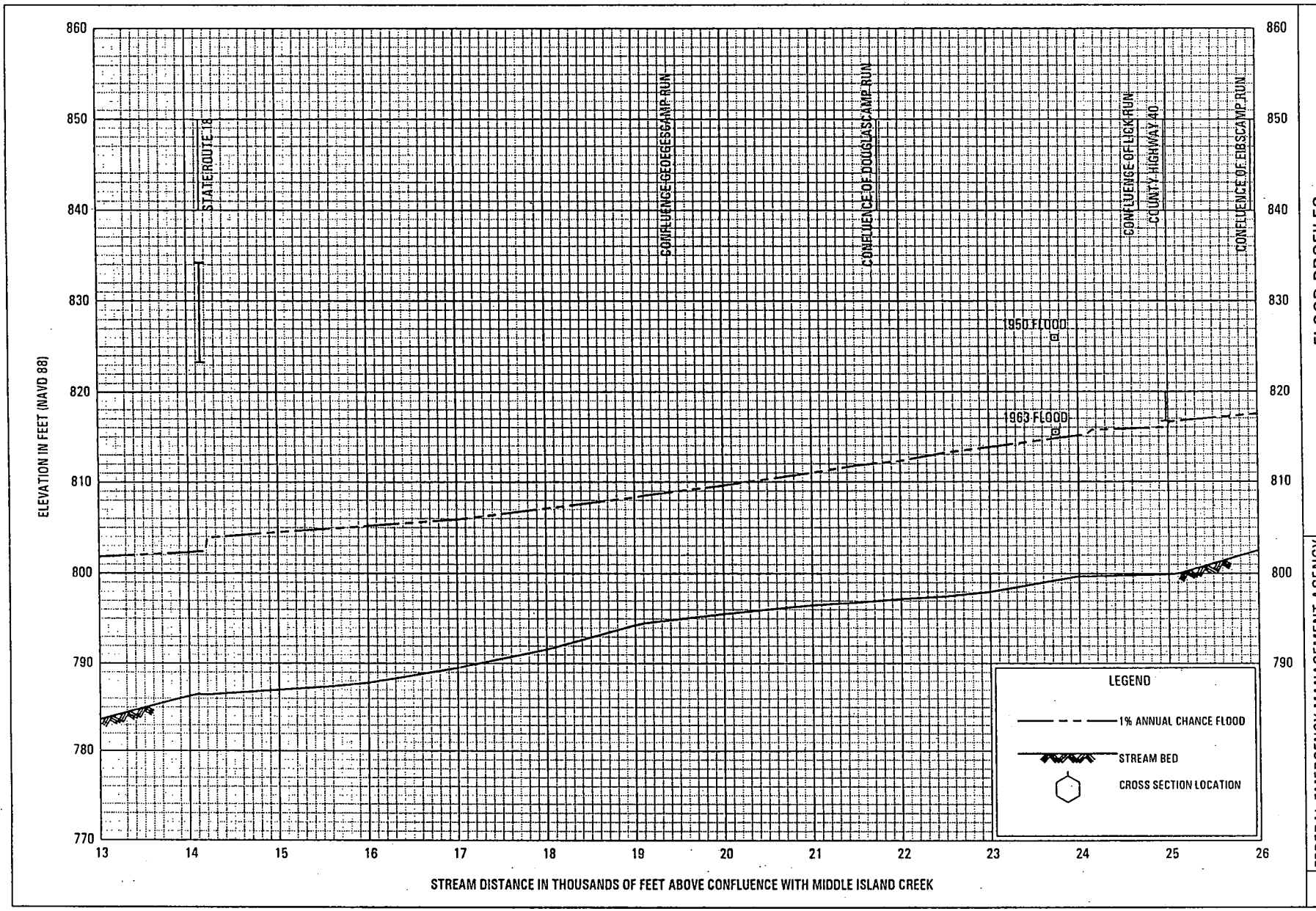
MEATHOUSE FORK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

15P



FLOOD PROFILES

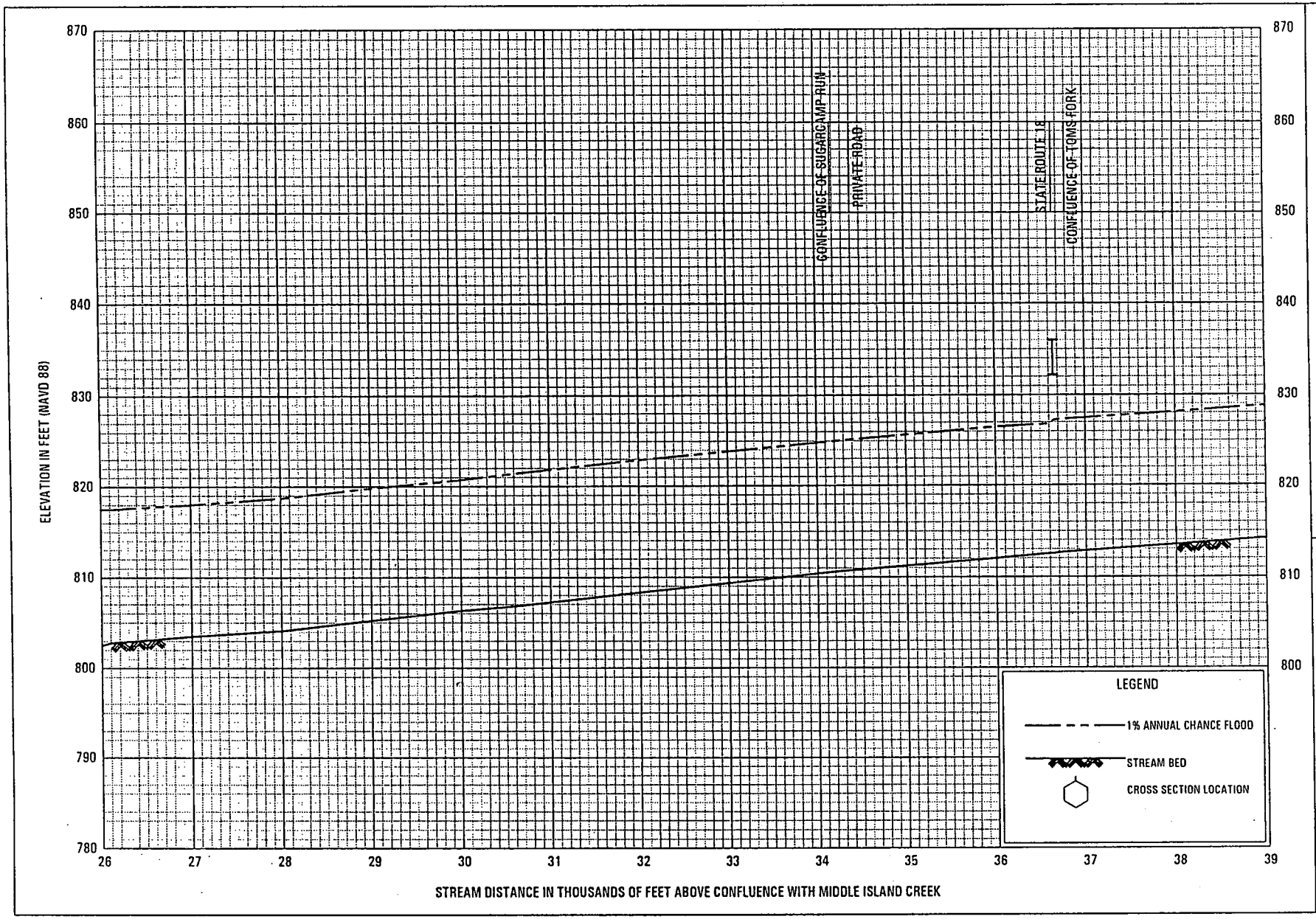
MEATHOUSE FORK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

16P



FLOOD PROFILES

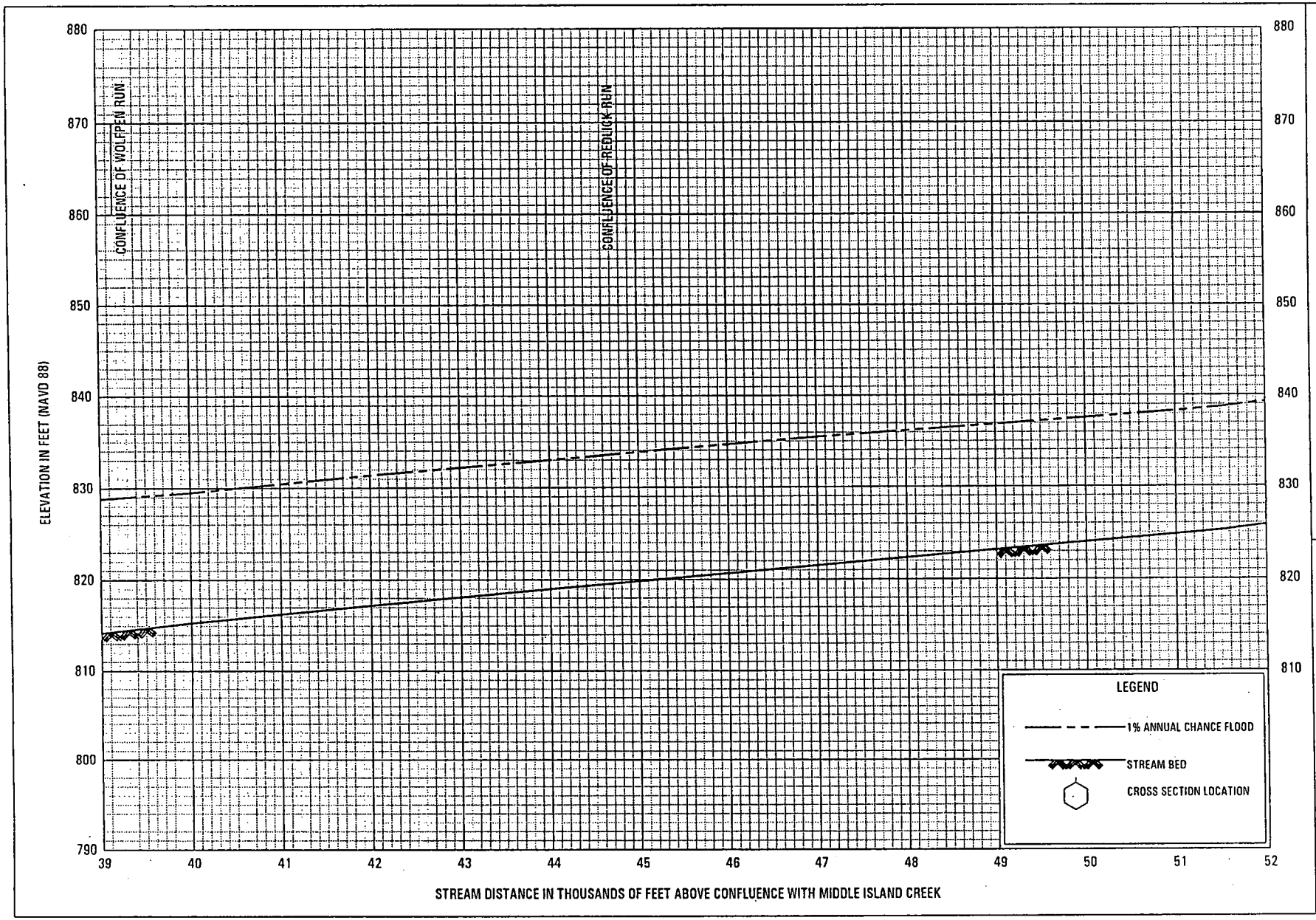
MEATHOUSE FORK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

17P



FLOOD PROFILES

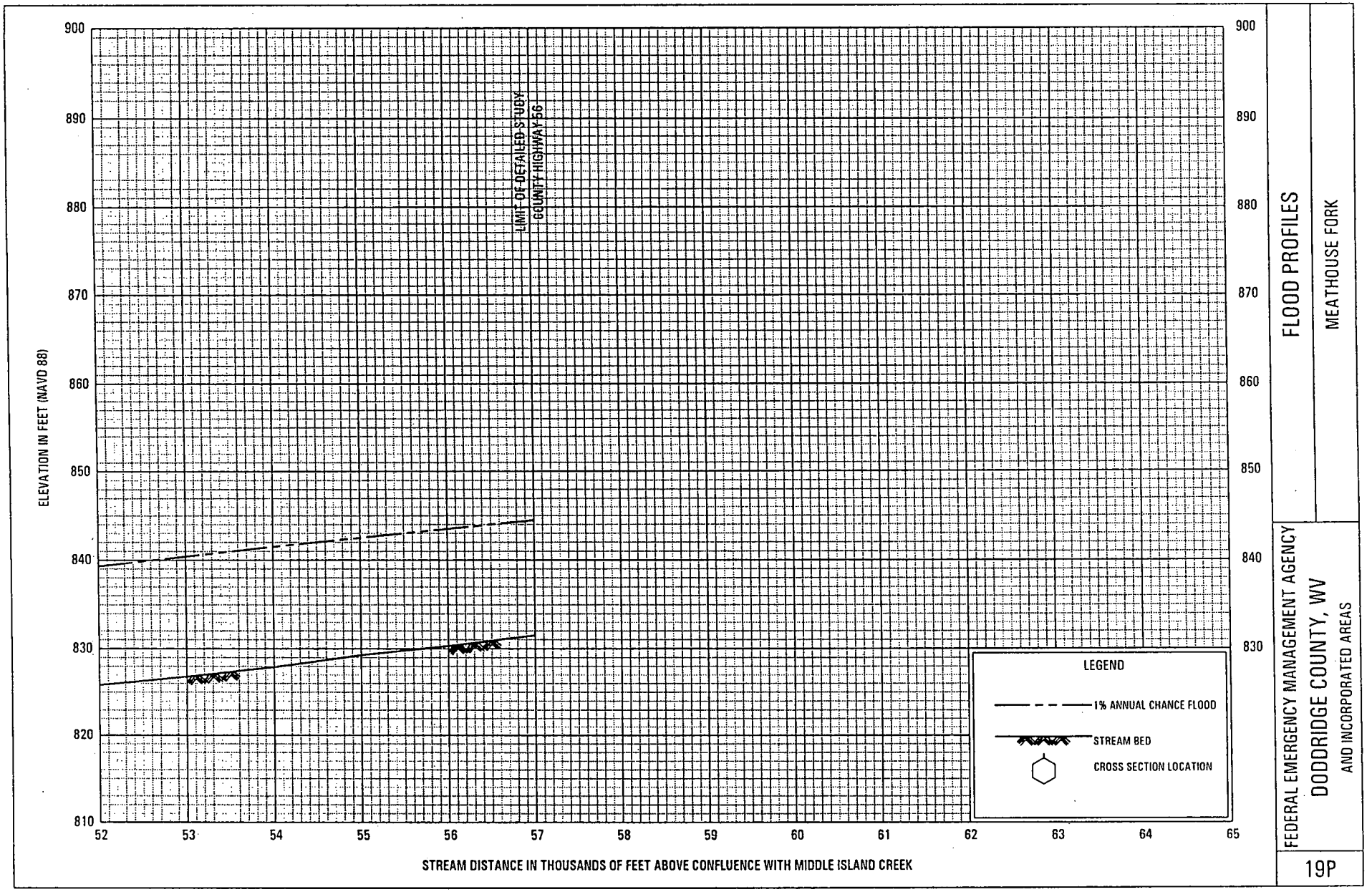
MEATHOUSE FORK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

18P



FLOOD PROFILES

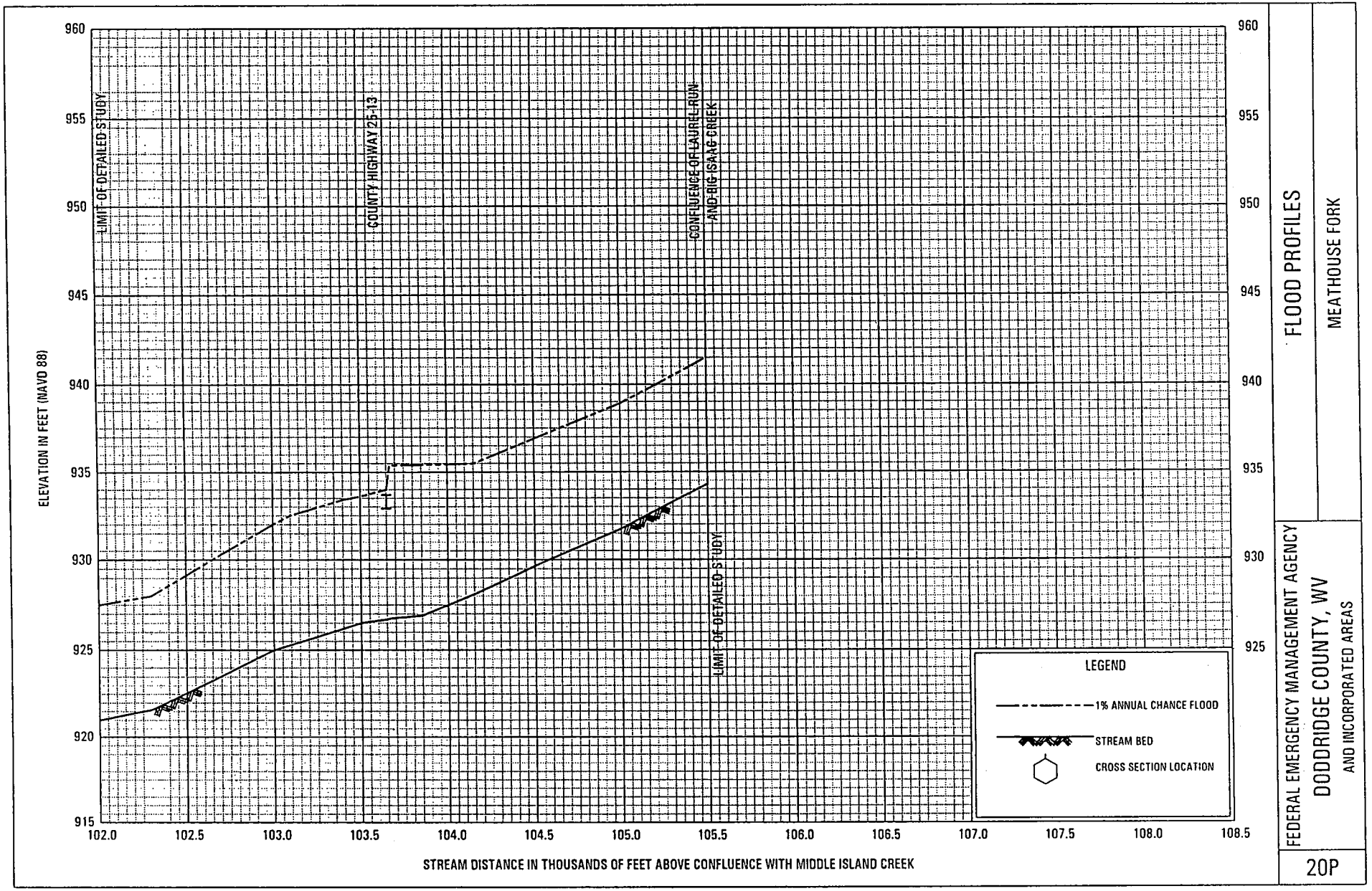
MEATHOUSE FORK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

19P



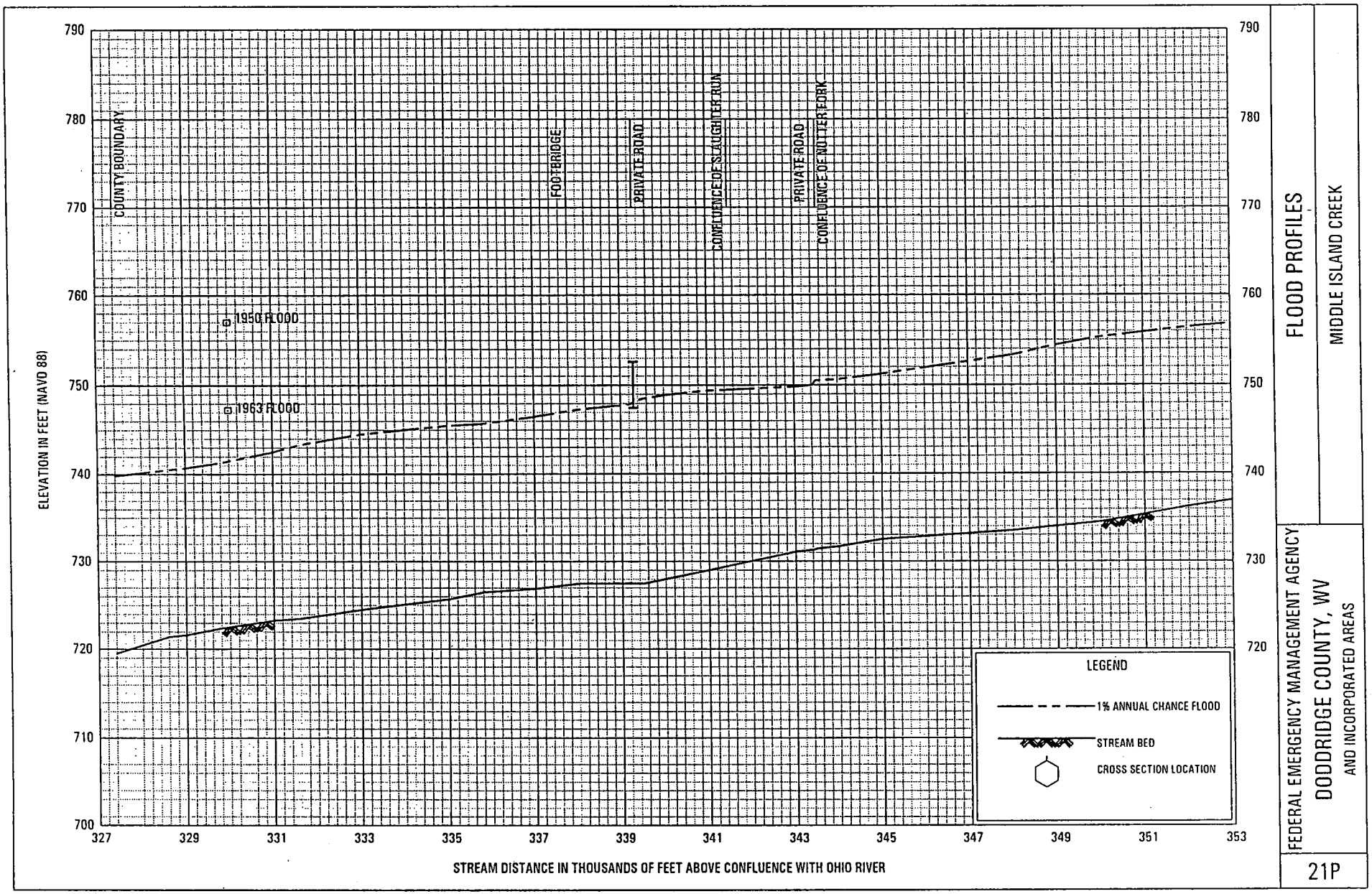
FLOOD PROFILES

MEATHOUSE FORK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS



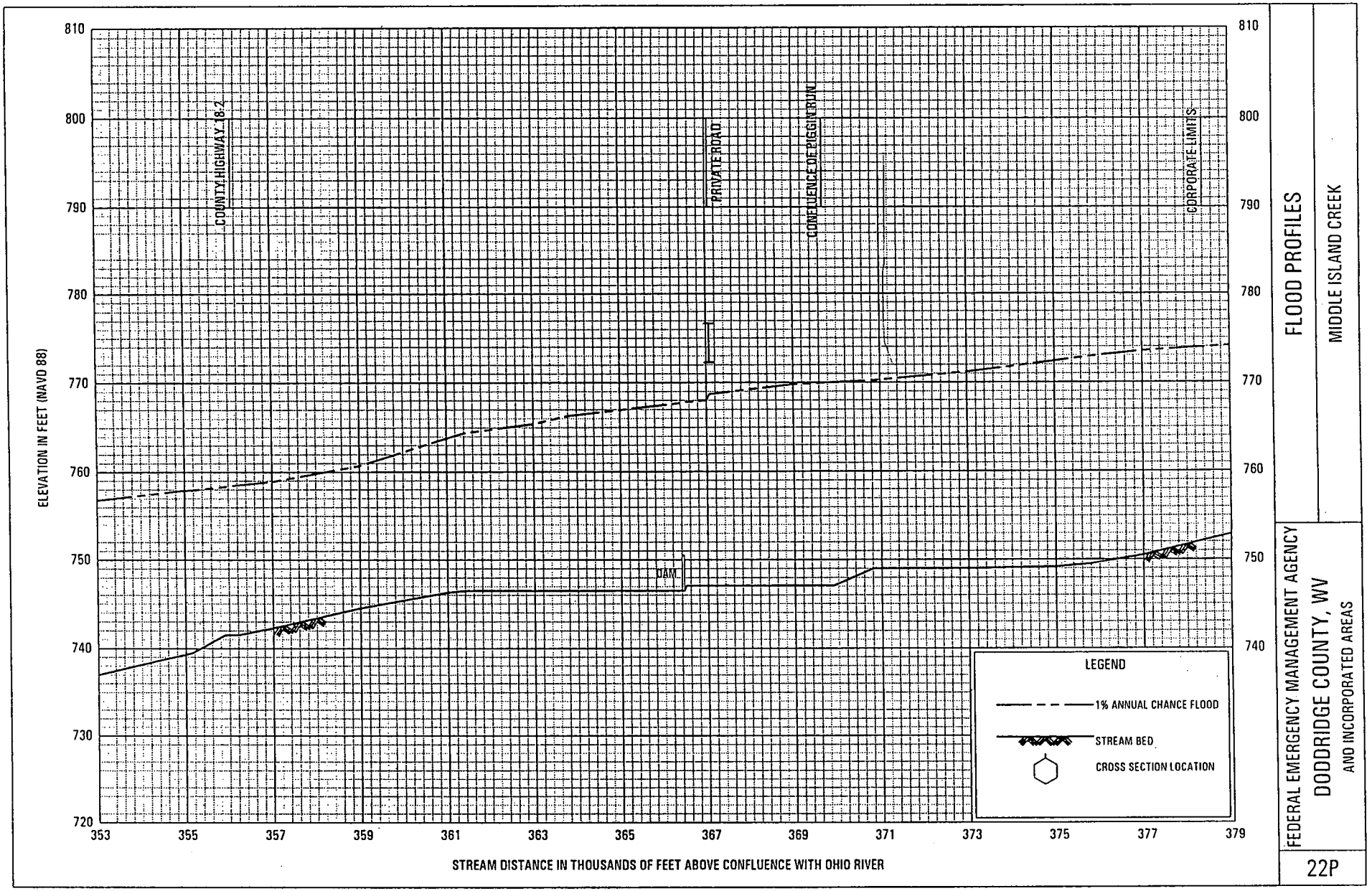
FLOOD PROFILES

MIDDLE ISLAND CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS



FLOOD PROFILES

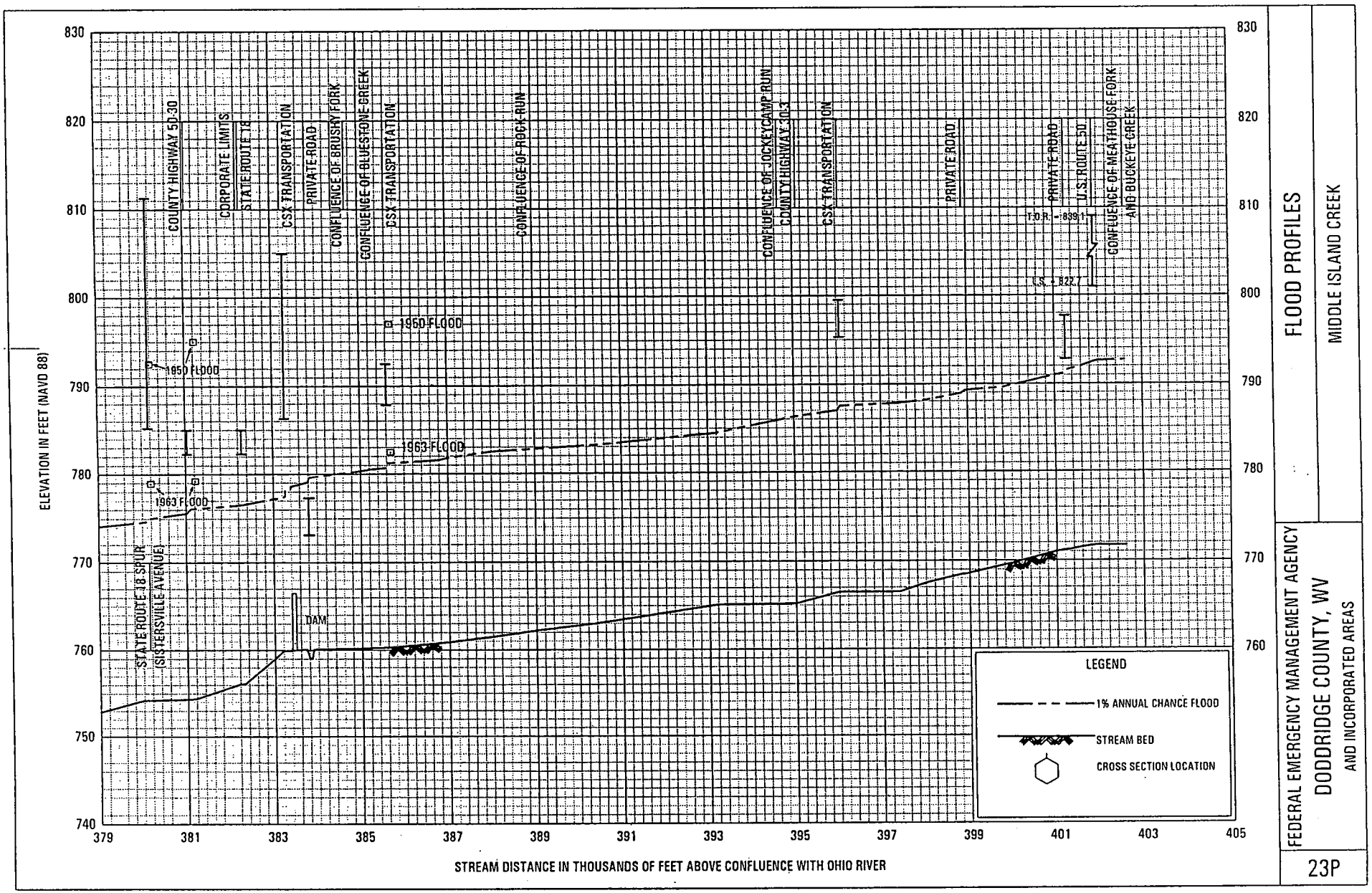
MIDDLE ISLAND CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

22P



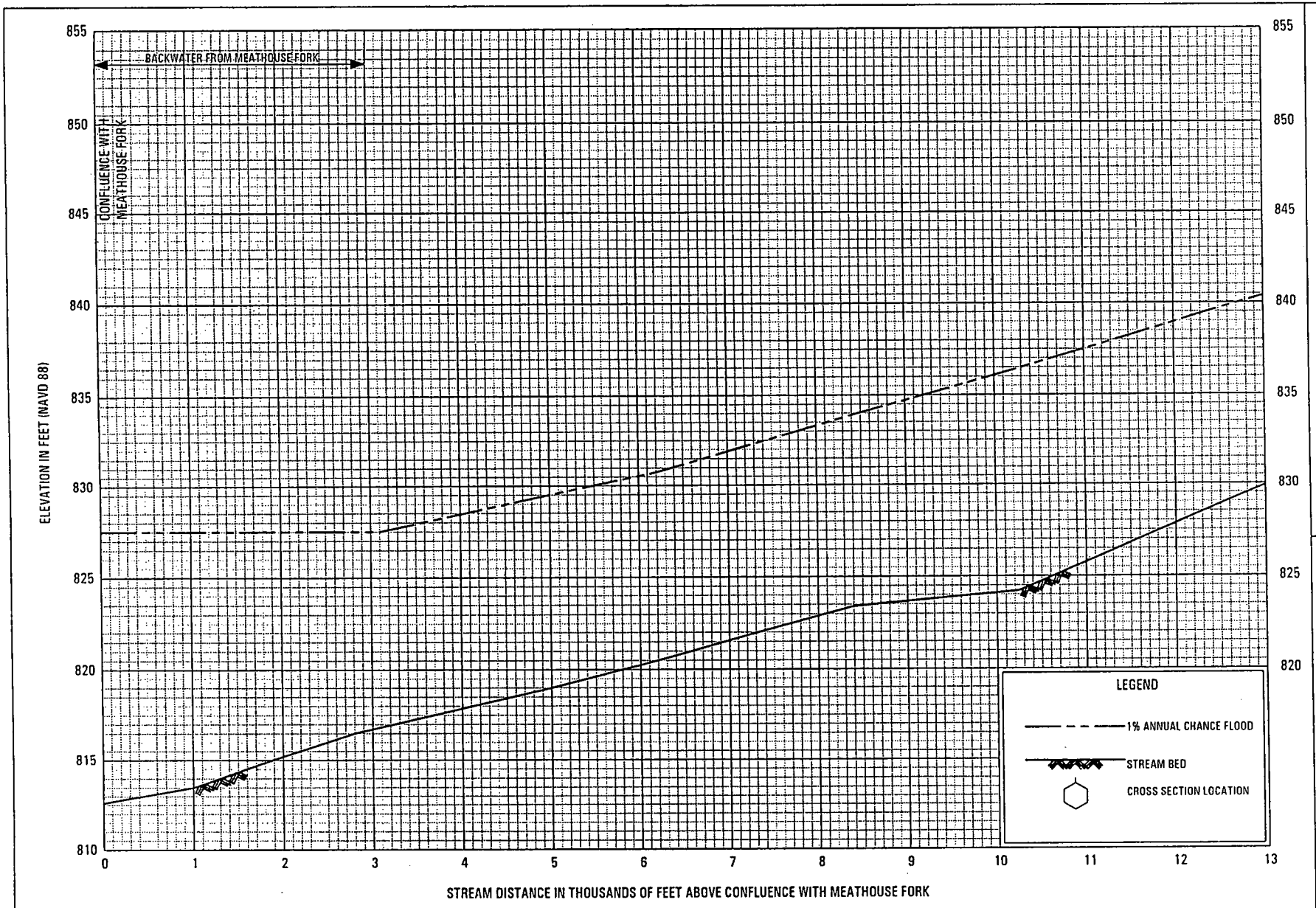
FLOOD PROFILES

MIDDLE ISLAND CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS



FLOOD PROFILES

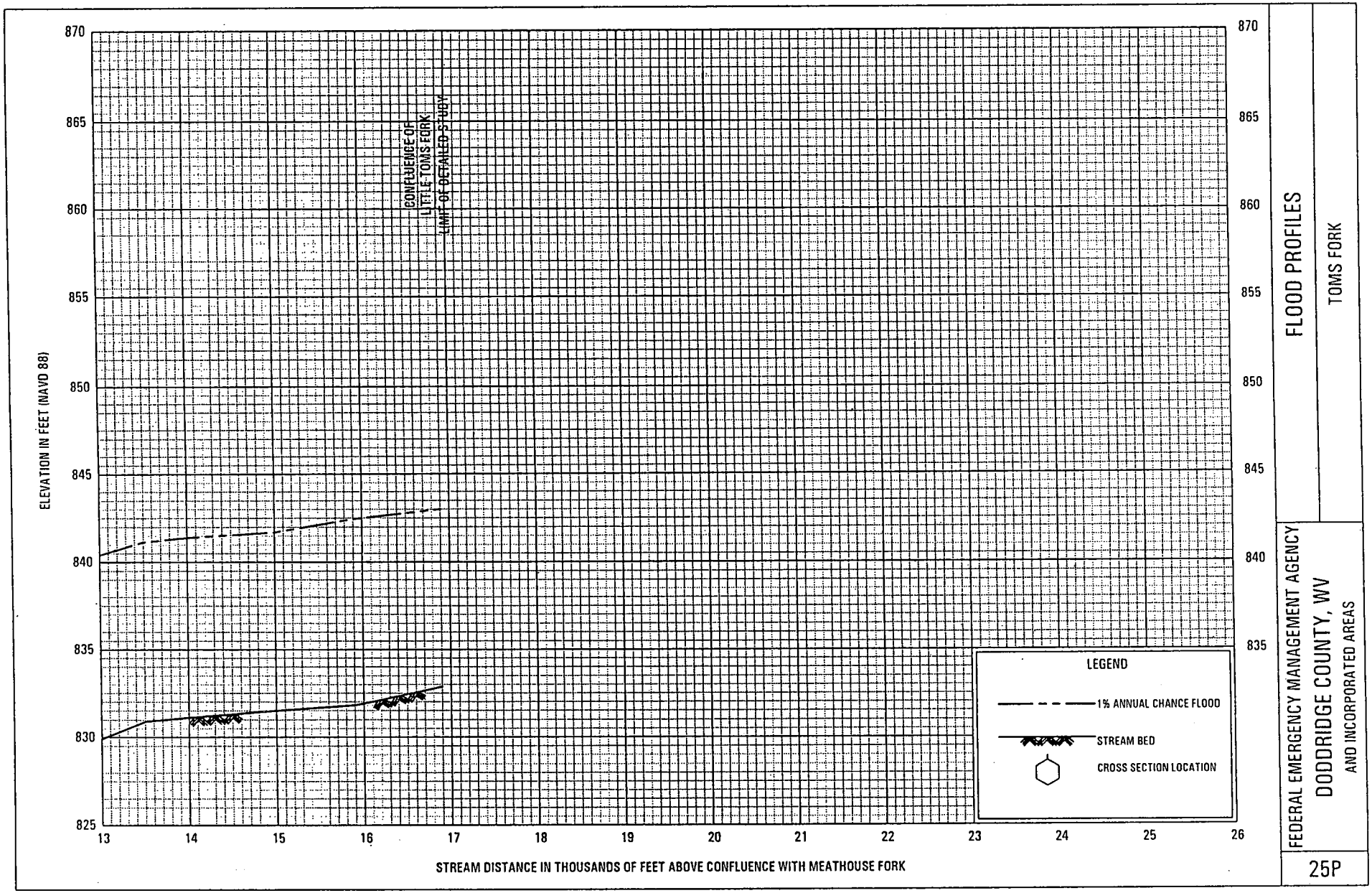
TOMS FORK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

24P



FLOOD PROFILES

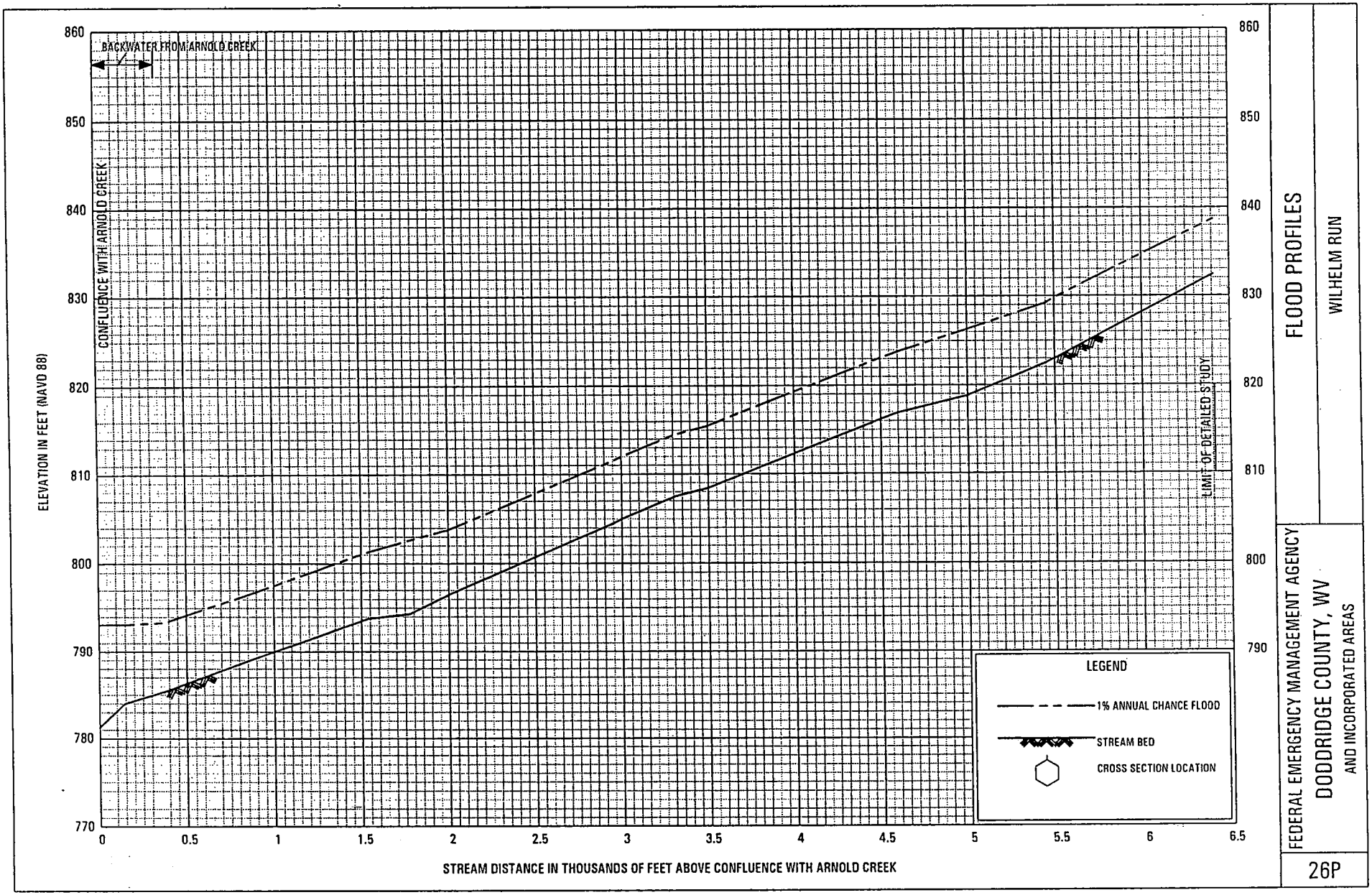
TOMS FORK

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

25P



FLOOD PROFILES

WILHELM RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

DODDRIDGE COUNTY, WV

AND INCORPORATED AREAS

APPENDIX C

HYDRAULIC CALCULATIONS FOR EXISTING AND PROPOSED CONDITIONS

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

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

EXISTING

PREPARED BY: TGJ 3/25/2014
CHECKED BY: ARG 26-MAR-2014

****

PROJECT DATA
Project Title: 110-811_Sherwood FB HH
Project File : 110-811_SherwoFBHH.prj
Run Date and Time: 3/25/2014 10:33:28 AM

Project in English units

Project Description:
MarkWest Liberty Midstream & Resources, LLC
CEC #110-811
4600 J. Barry Ct., Suite 500
Canonsburg, PA 15317

January 2014
(Revised March 25, 2014)

Sherwood Gas
Processing Plant - Full Buildout - Flood Study
Construction in a Floodway
Study for Approval of final grading.

FEMA Zones A, AE, and X from the
Doddridge County Indiana FIS Study shown on FEMA FIRM Panel # 54017C0080 B,
effective October 4, 2011.

CEC Engineering Team:
Principal: Rick Celender,
C.E.T., CPESC, CPSWQ
Project Manager: Andy Gullone, P.E., CPESC
Hydraulic
Modelers: Tim Johnston
Reviewers: Andy Gullone, Rick Celender

Model
Creation:
Existing (Pre-project): CEC Created Model File, "110-811_Sherwood
FB HH," Plan File, "110-811_Existing 01-23-2014."
Proposed (Post-project):
CEC Created Model File, "110-811_Sherwood FB HH," Plan File, "110-811_Proposed
1-23-2014."
Geometry file created in HEC-RAS.
Steady flow file created from
Doddridge County FIS, October 4, 2011.

Data Sources:
Geometry - Surface
created from West Virginia Statewide Addressing and Mapping Board DEM blended with field topo survey of the bridge, existing access road from County Route 50/34, and various locations along the reach.
Flow - Total Buckeye Creek
100-year flow = 5,150 CFS.
Downstream Boundary - Known Water Surface Elevation
= 811. Approximate stream distance of 3,504 feet on profile.

****

PLAN DATA

Plan Title: 110-811_Existing 01-23-2014
Plan File : p:\2011\110-811\-Calculations\TASK 5001 PLANTS 6 AND 7\Flood Study\110-811_SherwoFBHH.p03

Geometry Title: 110-811_Existing_Rev_02-26-2014
Geometry File : p:\2011\110-811\-Calculations\TASK 5001 PLANTS 6 AND 7\Flood Study\110-811_SherwoFBHH.g02

Flow Title : 110-811_100Year
Flow File : p:\2011\110-811\-Calculations\TASK 5001 PLANTS 6 AND 7\Flood Study\110-811_SherwoFBHH.f01

Plan Description:
Existing Geometry, 100-year storm, subcritical analysis

Plan Summary Information:

Number of:	Cross Sections	= 38	Multiple Openings	=	0
	Culverts	= 0	Inline Structures	=	0
	Bridges	= 1	Lateral Structures	=	0

Computational Information

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

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

****

FLOW DATA

Flow Title: 110-811_100Year
Flow File : p:\2011\110-811\-Calculations\TASK 5001 PLANTS 6 AND 7\Flood Study\110-811_SherwoFBHH.f01

Flow Data (cfs)

River	Reach	RS	100-Year

```
* Buckeye Creek   Buckeye Creek   3504.54 *              5150 *
**************************************************************

Boundary Conditions
**************************************************************************************
********************
* River           Reach           Profile          *          Upstream
    Downstream    *
**************************************************************************************
********************
* Buckeye Creek   Buckeye Creek   100-Year          *
   Known WS = 811 *
**************************************************************************************
********************

**************************************************************************************

GEOMETRY DATA

Geometry Title: 110-811_Existing_Rev_02-26-2014
Geometry File : p:\2011\110-811\-Calculations\TASK 5001 PLANTS 6 AND 7\Flood
Study\110-811_SherwoFBHH.g02

CROSS SECTION


RIVER: Buckeye Creek
REACH: Buckeye Creek      RS: 3504.54

INPUT
Description: A
Station Elevation Data    num=     147
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
**************************************************************************************
    -100  838.81  -98.96  838.29  -98.75  838.18   -98.4     838  -96.95  837.26
   -96.1  836.83   -95.4  836.48  -94.48     836  -93.69  835.59  -92.75   835.1
  -91.68  834.54  -90.65     834  -89.58  833.44  -88.38  832.81  -87.57  832.38
  -86.84     832  -85.95  831.54  -85.41  831.26   -84.5  830.79  -83.05  830.02
  -83.01     830  -81.27  829.11   -79.1     828  -79.08  827.99  -79.07  827.99
  -77.37  827.11  -75.99  826.41  -75.64  826.23  -75.18     826  -74.04   825.4
  -73.22  824.97  -72.55  824.62  -71.39     824  -70.83   823.7  -70.35  823.45
   -69.1  822.78  -67.62     822  -67.26  821.81  -67.01  821.68   -65.6  820.94
  -64.29  820.25  -64.09  820.15  -63.81     820  -62.65  819.38  -61.84  818.95
  -61.13  818.57  -60.06     818  -60.02  817.91  -59.96  817.79  -59.91  817.69
  -59.87  817.59  -59.83   817.5   -59.8  817.43  -59.77  817.35  -59.73  817.28
   -59.7  817.21  -59.67  817.15  -59.65  817.09  -59.62  817.04   -59.6  816.99
  -59.58  816.94  -59.56  816.89  -59.54  816.85  -59.46  816.69  -59.15  815.06
  -47.25  813.56     -46  813.25  -45.85  813.22  -44.79  812.96  -43.56  812.66
   -42.3  812.35  -41.93  812.27  -41.36  808.97  -40.43     808  -40.31     808
  -40.27     808  -40.22     808  -40.14     808  -38.54  807.48  -34.04     806
  -33.41  805.89  -32.05  805.65  -25.82  804.54  -22.76  804.44  -19.68  804.44
   -19.3  804.44  -14.73  804.44   -5.05  804.44       0  804.44      .9  804.44
    5.75  804.44    15.3  804.44   16.43  804.44   19.72  804.44   21.76  804.67
   25.81     806   28.84  806.95    32.2     808   35.74  808.98    39.4     810
   43.29  811.02   47.05     812   49.55  812.68   54.41     814   56.85  814.55
   63.18     816   63.21     816   63.24     816   63.62  816.01   63.71     816
   63.73     816    63.9     816   64.26     816   66.98     816   71.15     816
   79.48     816   89.67     816   95.77     816   97.03     816   99.05     816
  101.29     816  101.88     816  102.53     816   103.1  816.19  110.92     818
  112.97  819.63  113.44     820  115.04  821.27  116.39     822  119.11  823.46
  119.51     824  120.78  825.71     121     826  121.65  826.89  122.64     828
  123.43  828.89  124.41     830  125.72  831.48  126.18     832  126.52  832.39
  127.95     834  129.37  835.19  130.09  835.93  132.25  835.95  133.34     836
```

134.36 836.19 136.69 836.42

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-100	.05	-41.93	.035	49.55	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-41.93	49.55	50	50	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	814.76	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.80	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	813.96	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)		Flow Area (sq ft)	6.21	716.90	3.01
E.G. Slope (ft/ft)	0.001962	Area (sq ft)	6.21	716.90	3.01
Q Total (cfs)	5150.00	Flow (cfs)	6.55	5140.58	2.88
Top Width (ft)	104.68	Top Width (ft)	8.49	91.48	4.71
Vel Total (ft/s)	7.09	Avg. Vel. (ft/s)	1.05	7.17	0.95
Max Chl Dpth (ft)	9.52	Hydr. Depth (ft)	0.73	7.84	0.64
Conv. Total (cfs)	116272.7	Conv. (cfs)	147.8	116060.0	64.9
Length Wtd. (ft)	50.00	Wetted Per. (ft)	8.67	96.27	4.88
Min Ch El (ft)	804.44	Shear (lb/sq ft)	0.09	0.91	0.08
Alpha	1.02	Stream Power (lb/ft s)	136.69	0.00	0.00
Frctn Loss (ft)	0.11	Cum Volume (acre-ft)	118.78	53.63	65.97
C & E Loss (ft)	0.03	Cum SA (acres)	36.21	5.02	14.49

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 3454.54

INPUT
Description: B
Station Elevation Data num= 121

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-106.13	826.76	-105.83	826.61	-105.52	826.46	-104.57	826	-104.45	825.95
-104.42	825.93	-103.35	825.44	-102.97	825.27	-102.28	824.95	-101.55	824.59
-101.24	824.44	-100.37	824	-100.19	823.91	-99.27	823.46	-98.9	823.29
-98.27	822.98	-97.55	822.65	-97.23	822.49	-96.16	822	-96.15	821.99
-96.14	821.99	-94.96	821.48	-94.61	821.32	-93.85	820.99	-93.19	820.71
-92.79	820.53	-91.86	820.13	-91.79	820.1	-91.59	820	-90.51	819.47

-90.04	819.26	-89.22	818.86	-88.25	818.41	-87.98	818.28	-87.37	818
-87.36	818	-87.35	818	-87.19	817.14	-86.99	814.66	-83.41	814.33
-78.27	814.15	-64.45	812.92	-42.91	811.21	-42.79	809.16	-42.41	809.13
-42.01	809.09	-41.6	809.06	-41.18	809.02	-40.66	808.97	-40.11	808.93
-39.53	808.88	-37.2	808.63	-36.6	808.56	-35.97	808.48	-35.28	808.4
-32.94	808.07	-32.49	808	-31.34	807.77	-31	807.7	-29.05	807.31
-28.01	807.09	-26.05	806.67	-25.06	806.46	-22.96	806	-22.17	805.82
-21.82	805.74	-19.4	805.19	-17.82	804.84	-16.67	804.58	-14.08	804.38
-13.68	804.38	-6.61	804.38	0	804.38	17.4	804.38	17.52	804.38
23.35	805.7	24.35	806	28.89	807.47	30.57	808	37.14	809.7
38.3	810	39.73	810.36	46.16	812	52.62	813.62	54.12	814
61.82	815.78	62.8	816	62.86	816	62.93	816	62.98	816
63.03	816	63.08	816	63.12	816	63.16	816	63.2	816
63.43	816	72.23	816	72.53	816	77.56	816	88.82	816
92.29	816	92.47	816	93.12	816	93.64	816	96.03	816
98.64	816	99.53	816	101.36	816	103.41	816	105.44	816
108.77	817.27	110.92	818	112.2	819.74	112.38	820	113.85	822
113.85	822.01	115.45	823.6	115.85	824	116.26	824.42	117.85	826
118.35	826.5								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-106.13	.05	-42.79	.035	30.57	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-42.79	30.57	52	50	50 .1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	814.61	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.10	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	813.52	Reach Len. (ft)	52.00	50.00	50.00
Crit W.S. (ft)		Flow Area (sq ft)	33.63	573.48	59.26
E.G. Slope (ft/ft)	0.002677	Area (sq ft)	33.63	573.48	59.26
Q Total (cfs)	5150.00	Flow (cfs)	55.34	4919.94	174.72
Top Width (ft)	123.34	Top Width (ft)	28.35	73.36	21.63
Vel Total (ft/s)	7.73	Avg. Vel. (ft/s)	1.65	8.58	2.95
Max Chl Dpth (ft)	9.14	Hydr. Depth (ft)	1.19	7.82	2.74
Conv. Total (cfs)	99529.3	Conv. (cfs)	1069.5	95083.1	3376.7
Length Wtd. (ft)	50.02	Wetted Per. (ft)	30.38	74.31	22.32
Min Ch El (ft)	804.38	Shear (lb/sq ft)	0.19	1.29	0.44
Alpha	1.18	Stream Power (lb/ft s)	118.35	0.00	0.00
Frctn Loss (ft)	0.15	Cum Volume (acre-ft)	118.76	52.89	65.94
C & E Loss (ft)	0.02	Cum SA (acres)	36.19	4.92	14.47

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 3404.54

INPUT
Description: C
Station Elevation Data num= 120

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-130.31	819.94	-130.16	819.85	-127.95	818.4	-127.34	818	-124.36	816.46
-123.5	816	-122.92	815.91	-122.44	815.86	-122.09	815.81	-121.89	815.78
-121.74	815.75	-121.45	815.71	-121.31	815.69	-121.19	815.68	-121.09	815.66
-121	815.65	-120.93	815.64	-120.86	815.64	-120.81	815.63	-120.78	815.51
-118.73	815.9	-118.62	815.92	-118.37	815.95	-117.79	815.59	-115.95	814.65
-112.35	813.89	-102.14	815.26	-94.41	813.55	-93.69	813.6	-93.3	813.59
-91.7	813.84	-89.86	814.09	-85.86	814.99	-84.7	814.77	-82.96	814.52
-77.51	814.54	-69.06	813.8	-67.38	813.67	-52.48	812.03	-42.72	810.75
-39.01	809.99	-38.2	809.83	-38.11	809.8	-37.46	809.6	-37.3	809.57
-37.12	809.53	-36.94	809.5	-36.74	809.46	-36.53	809.42	-35.73	809.24
-35.55	809.2	-35.23	809.14	-34.89	809.07	-34.51	809	-34.1	808.92
-33.65	808.83	-33.15	808.73	-32.59	808.62	-31.98	808.5	-31.02	808.31
-30.29	808.16	-29.54	808	-29.5	808	-28.02	807.66	-20.74	806
-15	804.51	-12.96	804.32	-3.54	804.32	0	804.32	4.45	804.32
15.59	804.32	24.88	805.99	24.9	806	29.51	807.42	31.4	808
35.16	808.93	39.43	810	41.01	810.41	47.1	812	50.37	812.89
54.45	814	59.19	815.18	62.48	816	62.51	816	62.55	816
62.56	816	63.15	816	63.19	816	63.22	816	63.23	816
63.24	816	63.25	816	63.26	816	63.27	816	63.28	816
73.18	816	75.76	816	76.08	816	82.98	816	89.81	816
92.74	816	96.15	815.99	98.06	815.99	99.09	815.99	104.95	816
110.42	817.6	111.76	818	112.3	818.75	113.18	820	113.8	820.86
114.59	822	115.75	823.64	116.01	824	117.38	825.93	117.43	826
117.52	826.13	118.81	828	119.32	828.72	120.21	830	120.39	830.24

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-130.31	.05	-39.01	.035	31.4	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-39.01	31.4	55	50	50	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	814.44	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.33	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	813.11	Reach Len. (ft)	55.00	50.00	50.00
Crit W.S. (ft)		Flow Area (sq ft)	32.26	520.54	51.49
E.G. Slope (ft/ft)	0.003501	Area (sq ft)	32.26	520.54	51.49
Q Total (cfs)	5150.00	Flow (cfs)	70.07	4912.22	167.71
Top Width (ft)	113.48	Top Width (ft)	23.29	70.41	19.78
Vel Total (ft/s)	8.52	Avg. Vel. (ft/s)	2.17	9.44	

3.26								
* Max Chl Dpth (ft)	* 8.79	* Hydr. Depth (ft)	* 1.39	* 7.39	*			
2.60								
* Conv. Total (cfs)	* 87032.6	* Conv. (cfs)	* 1184.2	* 83014.2	*			
2834.3								
* Length Wtd. (ft)	* 50.20	* Wetted Per. (ft)	* 23.51	* 71.50	*			
20.43								
* Min Ch El (ft)	* 804.32	* Shear (lb/sq ft)	* 0.30	* 1.59	*			
0.55								
* Alpha	* 1.18	* Stream Power (lb/ft s)	* 120.39	* 0.00	*			
0.00								
* Frctn Loss (ft)	* 0.15	* Cum Volume (acre-ft)	* 118.72	* 52.26	*			
65.88								
* C & E Loss (ft)	* 0.09	* Cum SA (acres)	* 36.16	* 4.84	*			
14.45								

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CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 3354.54

INPUT
Description: D
Station Elevation Data num= 109

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-161.95	820.72	-159	819.1	-154.74	817.2	-151.93	815.9	-147.17	813.71
-145.77	813.06	-126.21	812.54	-124.87	812.51	-123.36	812.51	-123.07	812.53
-122.06	812.55	-122.03	812.53	-115.94	812.57	-115.14	812.59	-114.95	812.57
-103.12	812.35	-88.28	812.14	-82.76	812.08	-54.87	809.98	-52.64	809.81
-41.07	809.2	-39.11	809.06	-36.85	808.62	-36.78	808.61	-36.71	808.61
-36.64	808.6	-36.56	808.59	-36.14	808.54	-35.65	808.48	-35.49	808.45
-35.3	808.43	-35.09	808.4	-34.83	808.36	-34.53	808.32	-34.16	808.27
-33.7	808.2	-33.12	808.12	-32.28	808.01	-32.21	808	-31.45	807.84
-22.89	806	-21.17	805.62	-18.11	804.96	-15.26	804.34	-13.7	804.25
-13.63	804.25	-13.6	804.25	-13.5	804.25	-.57	804.25	0	804.25
4.84	804.25	8.21	804.25	16.71	804.25	17.49	804.25	26.48	806
31.46	807.35	33.9	808	38.76	809.37	40.95	810	46.89	811.73
47.8	812	48.18	812.11	54.65	814	57.78	814.8	62.56	816
62.6	816	62.66	816	62.67	816	62.73	816	62.74	816
62.91	816	63.02	816	63.12	816	63.22	816	63.3	816
63.38	816	63.45	816	63.52	816	63.58	816	63.63	816
63.69	816	63.74	816	63.78	816	63.83	816	64.54	816
66.78	816.01	67.1	816.01	67.7	816.01	68.02	816.01	68.26	816.01
71.84	816.01	73.95	816.01	74.22	816.01	85.96	816	89.03	815.99
91.01	815.98	96.63	815.95	100.33	815.97	106.93	816	112.68	817.78
113.29	818	113.56	818.18	115.15	820	116.54	821.58	116.9	822
118.58	823.91	118.65	824	118.98	824.38	119.3	824.8		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-161.95	.05	-36.56	.035	33.9	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-36.56	33.9	35	50	50	.1	.3

CROSS SECTION OUTPUT Profile #100-Year
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* E.G. Elev (ft)	* 814.19	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 1.02	* Wt. n-Val.	* 0.050	* 0.035	* 0.050 *
* W.S. Elev (ft)	* 813.17	* Reach Len. (ft)	* 35.00	* 50.00	* 50.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 170.79	* 549.92	* 46.67 *
* E.G. Slope (ft/ft)	*0.002626	* Area (sq ft)	* 170.79	* 549.92	* 46.67 *
* Q Total (cfs)	* 5150.00	* Flow (cfs)	* 349.53	* 4669.44	* 131.04 *
* Top Width (ft)	* 197.82	* Top Width (ft)	* 109.45	* 70.46	* 17.91 *
* Vel Total (ft/s)	* 6.71	* Avg. Vel. (ft/s)	* 2.05	* 8.49	* 2.81 *
* Max Chl Dpth (ft)	* 8.92	* Hydr. Depth (ft)	* 1.56	* 7.80	* 2.61 *
* Conv. Total (cfs)	*100493.1	* Conv. (cfs)	* 6820.4	* 91115.7	* 2557.0 *
* Length Wtd. (ft)	* 48.95	* Wetted Per. (ft)	* 109.64	* 71.33	* 18.64 *
* Min Ch El (ft)	* 804.25	* Shear (lb/sq ft)	* 0.26	* 1.26	* 0.41 *
* Alpha	* 1.46	* Stream Power (lb/ft s)	* 119.30	* 0.00	* 0.00 *
* Frctn Loss (ft)	* 0.13	* Cum Volume (acre-ft)	* 118.59	* 51.64	* 65.82 *
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 36.08	* 4.76	* 14.43 *

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CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 3304.54

INPUT
Description: E
Station Elevation Data num= 112

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-193.15	818.45	-183.47	814.34	-183.16	814.28	-176.73	813.26	-163.3	813.13
-138.32	812.35	-120.78	812.28	-86.53	811.72	-71.47	811.24	-56.51	810.18
-43	809.27	-36.76	808.75	-36.03	808.62	-36	808.61	-35.97	808.61
-35.94	808.6	-35.9	808.6	-35.86	808.59	-35.82	808.58	-35.77	808.58
-35.72	808.57	-35.67	808.56	-35.62	808.55	-35.57	808.54	-35.45	808.52
-35.38	808.51	-35.31	808.49	-35.22	808.47	-35.13	808.45	-35.02	808.43
-34.88	808.4	-34.73	808.37	-34.53	808.33	-34.3	808.28	-33.99	808.22
-33.59	808.13	-33.11	808.03	-32.95	808	-29.62	807.39	-22.04	806
-15.25	804.68	-11.71	804.25	-11.66	804.25	0	804.25	11.43	804.25
12.59	804.25	14.93	804.25	22.78	805.33	26.75	806	35.39	807.94
35.56	807.97	35.68	808	36.05	808.12	42.24	810	48.06	811.81
48.44	811.93	48.47	811.94	48.67	812	48.97	812.09	55.11	814
58.52	814.76	64.02	816	64.05	816	64.06	816	64.11	816
64.12	816	64.16	816	64.18	816	64.21	816	64.23	816
64.27	816	64.29	816	64.51	816	64.55	816	64.59	816
64.63	816	64.66	816	64.7	816	64.72	816	64.98	816
65.48	816	65.86	816	66.57	816	71.47	816.01	72.7	816.02
72.75	816.02	73.29	816.02	74.51	816.02	75.35	816.02	84.84	816
93.89	815.84	94	815.84	95.83	815.82	98.76	815.86	102.88	815.92

106.57	816	109.76	817.28	111.63	818	113.65	818.64	117.46	820
123.18	821.49	124.76	821.91	125.09	822	125.17	822	125.18	822
125.45	822.01	125.65	822.02	126.04	822.04	126.82	822.08	127.57	822.09
152.93	822.56	166.8	822.78						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-193.15	.05	-36.76	.035	35.39	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-36.76	35.39	55	50	47	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	814.06	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.02	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	813.04	Reach Len. (ft)	55.00	50.00	47.00
Crit W.S. (ft)		Flow Area (sq ft)	184.21	546.89	42.81
E.G. Slope (ft/ft)	0.002738	Area (sq ft)	184.21	546.89	42.81
Q Total (cfs)	5150.00	Flow (cfs)	373.41	4655.25	121.33
Top Width (ft)	212.43	Top Width (ft)	123.65	72.15	16.63
Vel Total (ft/s)	6.65	Avg. Vel. (ft/s)	2.03	8.51	2.83
Max Chl Dpth (ft)	8.79	Hydr. Depth (ft)	1.49	7.58	2.57
Conv. Total (cfs)	98425.8	Conv. (cfs)	7136.6	88970.3	2318.9
Length Wtd. (ft)	50.47	Wetted Per. (ft)	123.76	72.91	17.40
Min Ch El (ft)	804.25	Shear (lb/sq ft)	0.25	1.28	0.42
Alpha	1.49	Stream Power (lb/ft s)	166.80	0.00	0.00
Frctn Loss (ft)	0.12	Cum Volume (acre-ft)	118.45	51.02	65.77
C & E Loss (ft)	0.09	Cum SA (acres)	35.98	4.68	14.41

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 3254.54

INPUT
Description: F
Station Elevation Data num= 117

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-240.13	819.89	-227.21	814.66	-216.19	812.98	-198.11	812.16	-175.25	811.94
-165.06	811.8	-160.59	811.79	-152.22	811.82	-122.44	811.41	-109.35	811.26
-104.94	811.11	-102.58	811.05	-67.55	810.05	-42.46	809.03	-36.68	808.81

-36.67	808.63	-36.63	808.62	-36.6	808.62	-36.56	808.61	-36.51	808.6
-36.47	808.59	-36.42	808.58	-36.36	808.57	-36.3	808.56	-36.24	808.55
-36.18	808.54	-36.1	808.52	-35.72	808.43	-35.62	808.41	-35.52	808.39
-35.41	808.37	-35.28	808.34	-35.14	808.31	-34.99	808.27	-34.82	808.23
-34.63	808.18	-34.4	808.13	-34.14	808.06	-33.88	808	-31.55	807.56
-23.17	806	-20.88	805.53	-17.84	804.92	-15.28	804.39	-13.32	804.12
-7.98	804.12	-6.03	804.12	-.01	804.12	0	804.12	4.38	804.12
7.24	804.12	15.16	804.12	15.2	804.12	15.21	804.12	15.81	804.12
16.56	804.21	16.72	804.23	28.47	806	32.29	806.81	35.63	807.52
37.86	808	42.77	809.48	44.49	810	46.47	810.68	50.28	812
53.04	812.93	56.3	814	60.48	814.91	63.23	815.52	63.61	815.59
64.3	815.74	65.6	816	65.65	816	65.74	816	65.87	816
65.99	816	66.12	816	66.23	816	66.36	816	66.47	816
66.61	816	66.72	816	66.85	816	66.96	816	67.1	816
67.21	816	67.34	816	67.45	816	67.55	816	67.63	816
67.97	816	68.02	816	68.06	816	68.1	816	68.14	816
68.72	816	68.76	816	69.87	816.02	70.51	816.02	71.52	816.02
71.91	816.03	77.35	816	78.14	816	85.05	814.92	90.53	814.08
91.07	814	91.75	814	98.34	814	102.59	815.16	106.43	816
110.08	817.66	110.84	818	113.36	819.15	115.21	820	116.17	820.22
116.63	820.29	122.85	821.87						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-240.13	.05	-36.68	.035	37.86	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-36.68	37.86	43	50	52	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	813.86	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.73	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	813.13	Reach Len. (ft)	43.00	50.00	52.00
Crit W.S. (ft)		Flow Area (sq ft)	350.98	581.23	41.57
E.G. Slope (ft/ft)	0.002015	Area (sq ft)	350.98	581.23	41.57
Q Total (cfs)	5150.00	Flow (cfs)	729.27	4318.44	102.30
Top Width (ft)	270.79	Top Width (ft)	180.47	74.54	15.78
Vel Total (ft/s)	5.29	Avg. Vel. (ft/s)	2.08	7.43	2.46
Max Chl Dpth (ft)	9.01	Hydr. Depth (ft)	1.94	7.80	2.63
Conv. Total (cfs)	114733.7	Conv. (cfs)	16246.9	96207.8	2279.0
Length Wtd. (ft)	48.90	Wetted Per. (ft)	180.55	75.50	16.59
Min Ch El (ft)	804.12	Shear (lb/sq ft)	0.24	0.97	0.32
Alpha	1.68	Stream Power (lb/ft s)	122.85	0.00	0.00
Frctn Loss (ft)	0.09	Cum Volume (acre-ft)	118.11	50.37	65.72
C & E Loss (ft)	0.02	Cum SA (acres)	35.79	4.59	14.39

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CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 3204.54

INPUT
Description: G
Station Elevation Data num= 99

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-283.58	819.8	-266.29	814.14	-266.24	814.12	-266.23	814.12	-266.09	814.11
-217.5	811.93	-217.38	811.93	-173.11	811.45	-163.78	811.46	-160.93	811.43
-155.76	811.36	-150	811.26	-144.17	811.18	-124.33	810.91	-109.74	810.72
-100.63	810.59	-93.13	810.46	-70.42	809.9	-50.46	809.14	-38.7	808.69
-33.59	808.48	-31.92	807.96	-31.88	807.94	-31.83	807.93	-31.78	807.91
-31.73	807.89	-31.68	807.88	-31.63	807.86	-31.57	807.84	-31.51	807.81
-31.44	807.79	-31.37	807.77	-31.29	807.74	-31.2	807.71	-31.1	807.69
-30.89	807.62	-30.78	807.58	-30.66	807.54	-30.52	807.5	-30.38	807.45
-30.22	807.4	-29.76	807.22	-29.6	807.16	-29.42	807.08	-29.23	807
-28.94	806.91	-28.61	806.8	-28.23	806.67	-27.79	806.53	-27.29	806.36
-26.69	806.17	-26.19	806	-21.56	805.01	-18.47	804.35	-16.86	804.05
-8.24	804.05	-2.99	804.05	0	804.05	3.37	804.05	15.21	804.05
15.24	804.05	16.56	804.21	27.88	806	30.45	806.52	37.81	808
39.9	808.63	44.4	810	47.91	811.09	50.79	812	54.71	813.27
56.99	814	57.54	814.1	57.74	814.13	60.08	814.54	62.07	814.88
63.39	815.06	64.64	815.27	69.51	816	69.65	816	69.72	816
69.9	816	69.98	816	70.07	816	70.16	816	70.17	816
70.18	816	70.19	816	70.2	816	71.28	816	71.34	816
71.39	816	71.44	816	71.49	816	88.72	817.7	91.55	818
96.32	818.82	102.84	820	107.71	820.7	116.72	821.98		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-283.58	.05	-33.59	.035	37.81	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-33.59	37.81	44	50	51	.1	.3

CROSS SECTION OUTPUT Profile #100-Year
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E.G. Elev (ft)	813.74	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.65	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	813.09	Reach Len. (ft)	44.00	50.00	51.00
Crit W.S. (ft)		Flow Area (sq ft)	451.32	571.37	42.16
E.G. Slope (ft/ft)	0.001817	Area (sq ft)	451.32	571.37	42.16
Q Total (cfs)	5150.00	Flow (cfs)	952.68	4099.91	97.41
Top Width (ft)	297.47	Top Width (ft)	209.73	71.40	16.34
Vel Total (ft/s)	4.84	Avg. Vel. (ft/s)	2.11	7.18	2.31
Max Chl Dpth (ft)	9.04	Hydr. Depth (ft)	2.15	8.00	

2.58							
* Conv. Total (cfs)	*120822.6	* Conv. (cfs)	* 22350.6	* 96186.6	* 2285.3		
* Length Wtd. (ft)	* 48.76	* Wetted Per. (ft)	* 209.80	* 72.36	* 17.11		
* Min Ch El (ft)	* 804.05	* Shear (lb/sq ft)	* 0.24	* 0.90	* 0.28		
* Alpha	* 1.79	* Stream Power (lb/ft s)	* 116.72	* 0.00	* 0.00		
* Frctn Loss (ft)	* 0.08	* Cum Volume (acre-ft)	* 117.72	* 49.71	* 65.67		
* C & E Loss (ft)	* 0.03	* Cum SA (acres)	* 35.60	* 4.51	* 14.37		

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CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 3154.54

INPUT
Description: H
Station Elevation Data num= 114

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-344.06	820.17	-341.76	819.33	-335.3	817.11	-317.4	813.56	-307.81	813.2
-291.22	811.81	-276.12	811.8	-258.35	811.75	-229.19	811.76	-224.11	811.69
-215.03	811.6	-171.68	811.14	-151.63	811.01	-147.14	810.92	-145.09	810.87
-117.3	810.47	-103.72	810.29	-98.64	810.21	-79.31	809.67	-63.22	809.32
-54.02	808.86	-34.08	808.02	-31.16	807.11	-31.09	807.09	-31.01	807.06
-30.93	807.04	-30.84	807.02	-30.75	806.99	-30.65	806.96	-30.55	806.93
-30.44	806.9	-30.32	806.86	-30.2	806.83	-30.06	806.79	-29.91	806.74
-29.75	806.7	-29.57	806.66	-29.38	806.61	-28.95	806.49	-28.71	806.42
-28.43	806.33	-28.13	806.24	-27.79	806.14	-27.4	806.02	-27.33	806
-25.54	805.56	-19.16	804	-17.81	803.9	-14.84	803.9	-12.95	803.9
-11.52	803.9	-10.4	803.9	-9.49	803.9	-8.03	803.9	-7.43	803.9
-6.92	803.9	-6.49	803.9	-6.11	803.9	-5.77	803.9	-5.54	803.9
-5.32	803.9	0	803.9	3.09	803.9	3.31	803.9	3.55	803.9
3.82	803.9	4.15	803.9	4.52	803.9	4.96	803.9	5.47	803.9
6.08	803.9	6.81	803.9	7.72	803.9	8.87	803.9	10.64	803.9
13.16	803.9	14.82	804	20.71	805.01	26.47	806	34.72	807.69
36.26	808	41.95	809.75	42.76	810	43.86	810.36	48.82	812
51.4	812.8	55.27	814	56.44	814.25	58.83	814.76	62.79	815.6
64.71	816	64.81	816	65.06	816	65.18	816	65.22	816
65.34	816	66.33	816	66.69	816	71	816	71.46	816
71.82	816	76.48	816.77	77.53	816.86	80.56	817.14	83.2	817.46
87.71	817.86	89.18	817.99	89.27	818	89.46	818.03	100.7	820
108.63	821.17	115.16	822	115.51	822	115.58	822		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-344.06	.05	-34.08	.035	34.72	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-34.08	34.72	48	50	52	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

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* E.G. Elev (ft)	* 813.63	* Element	* Left OB	* Channel *

Right OB									
Vel Head (ft)	0.55	Wt. n-Val.	0.050	0.035	0.050				
W.S. Elev (ft)	813.08	Reach Len. (ft)	48.00	50.00	52.00				
Crit W.S. (ft)		Flow Area (sq ft)	604.09	564.34	49.05				
E.G. Slope (ft/ft)	0.001571	Area (sq ft)	604.09	564.34	49.05				
Q Total (cfs)	5150.00	Flow (cfs)	1209.94	3828.97	111.09				
Top Width (ft)	358.66	Top Width (ft)	272.28	68.80	17.58				
Vel Total (ft/s)	4.23	Avg. Vel. (ft/s)	2.00	6.78	2.26				
Max Chl Dpth (ft)	9.18	Hydr. Depth (ft)	2.22	8.20	2.79				
Conv. Total (cfs)	129951.7	Conv. (cfs)	30530.9	96617.7	2803.1				
Length Wtd. (ft)	49.53	Wetted Per. (ft)	272.38	69.69	18.39				
Min Ch El (ft)	803.90	Shear (lb/sq ft)	0.22	0.79	0.26				
Alpha	1.97	Stream Power (lb/ft s)	115.58	0.00	0.00				
Frctn Loss (ft)	0.07	Cum Volume (acre-ft)	117.18	49.05	65.62				
C & E Loss (ft)	0.03	Cum SA (acres)	35.36	4.43	14.35				

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CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 3104.54

INPUT
Description: I
Station Elevation Data num= 109

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-383.34	816.88	-380.41	816.27	-361.18	811.96	-358.34	811.62	-338.46	811.1
-330.45	811.09	-301.63	811.16	-297.15	811.2	-278.53	811.33	-275.53	811.33
-225.16	811.18	-203.03	811.34	-171.74	811.16	-165.14	811.09	-154.69	810.93
-154.09	810.93	-138.76	810.85	-128.69	810.69	-108.79	810.52	-62.36	809.45
-61.73	809.43	-61.33	809.43	-61.1	809.42	-34.68	808.63	-32.1	807.88
-32.06	807.85	-32.01	807.83	-31.95	807.8	-31.9	807.77	-31.84	807.74
-31.78	807.71	-31.72	807.68	-31.65	807.64	-31.58	807.61	-31.5	807.57
-31.37	807.53	-31.23	807.48	-30.68	807.28	-30.54	807.22	-30.4	807.16
-30.24	807.1	-30.08	807.03	-29.9	806.95	-29.7	806.87	-29.49	806.78
-29.26	806.69	-29.02	806.58	-28.7	806.46	-28.35	806.33	-27.96	806.18
-27.52	806.01	-27.48	806	-22.31	804.38	-21.08	804	-11.63	803.47
-11.58	803.47	-11.54	803.47	-11.44	803.47	-7.05	803.47	-4.63	803.47
-2.3	803.47	-.93	803.47	0	803.47	2.92	803.47	3.66	803.47
3.67	803.47	8.94	803.47	13.25	803.47	15.58	804	23.04	805.4
26.21	806	31.87	807.14	36.15	808	38.74	808.76	43	810
46.9	811.41	48.53	812	53.61	813.61	54.83	814	54.97	814.03
55.06	814.05	64.07	816	64.37	816	64.47	816	64.78	816
64.82	816	64.83	816	64.85	816	64.86	816	64.88	816
68.81	816	71.72	816	73.12	816	74.23	816	84.17	817.64
87	818	87.13	818	91.93	818.78	99.35	820	104.37	820.67

104.41	820.68	115.25	822	115.59	822	115.69	822	124.72	822.11
135.24	822.23	144.49	822.33	144.6	822.33	151.56	822.39		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-383.34	.05	-34.68	.035	36.15	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-34.68	36.15	22	50	48	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	813.53	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.45	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	813.07	Reach Len. (ft)	22.00	50.00	48.00
Crit W.S. (ft)		Flow Area (sq ft)	745.42	587.81	41.19
E.G. Slope (ft/ft)	0.001327	Area (sq ft)	745.42	587.81	41.19
Q Total (cfs)	5150.00	Flow (cfs)	1384.72	3683.45	81.83
Top Width (ft)	418.07	Top Width (ft)	331.47	70.83	15.77
Vel Total (ft/s)	3.75	Avg. Vel. (ft/s)	1.86	6.27	1.99
Max Chl Dpth (ft)	9.60	Hydr. Depth (ft)	2.25	8.30	2.61
Conv. Total (cfs)	141367.7	Conv. (cfs)	38010.6	101111.0	2246.1
Length Wtd. (ft)	42.28	Wetted Per. (ft)	331.65	72.08	16.57
Min Ch El (ft)	803.47	Shear (lb/sq ft)	0.19	0.68	0.21
Alpha	2.07	Stream Power (lb/ft s)	151.56	0.00	0.00
Frctn Loss (ft)	0.05	Cum Volume (acre-ft)	116.44	48.39	65.57
C & E Loss (ft)	0.02	Cum SA (acres)	35.02	4.35	14.33

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 3054.54

INPUT
Description: J
Station Elevation Data num= 97

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-429.24	820.02	-421.03	817.24	-412.97	815.16	-397.1	811.6	-374.14	811.01
-367.57	810.72	-352.22	810.82	-334.91	810.87	-315.95	811.01	-280.2	811.02
-262.38	810.97	-222.98	811.25	-208.79	811.28	-204.94	811.31	-200.98	811.37
-183.88	811.19	-166.39	810.98	-163.8	810.96	-152.84	810.92	-122.32	810.87
-114.52	810.84	-84.08	809.91	-75.91	809.69	-67.79	809.61	-35.1	809.26

-35.07	808.53	-34.81	808.37	-34.74	808.35	-34.67	808.33	-34.6	808.31
-34.52	808.29	-34.44	808.26	-34.36	808.24	-34.27	808.21	-34.17	808.18
-33.73	808	-33.7	808	-33.64	808	-33.6	808	-33.59	808
-33.58	808	-33.56	808	-33.54	808	-31.01	807.15	-27.53	806
-23.61	804.75	-21.27	804	-16.03	803.04	-12.18	803.04	-12.13	803.04
-12.11	803.04	-11.95	803.04	-11.89	803.04	-4.65	803.04	-2.06	803.04
0	803.04	1.54	803.04	2.63	803.04	6.59	803.04	7.86	803.04
9.9	803.04	14.57	803.48	17.29	804	21.31	804.85	26.85	806
28.59	806.34	33.57	807.34	35.91	807.81	36.86	808	38.61	808.46
44.41	810	49.01	811.58	50.23	812	51.33	812.33	57.04	814
66.81	815.06	75.8	816	75.82	816	75.86	816	75.89	816
75.91	816	75.93	816	75.94	816	75.95	816	75.96	816
77.14	816	78.3	816.19	78.68	816.24	79.1	816.3	79.86	816.42
81.74	816.76	83.22	816.97	89.82	818	93.81	818.77	99.8	820
105.59	821.09	110.84	821.97						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-429.24	.05	-35.1	.035	38.61	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-35.1	38.61	23	50	53	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	813.46	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	813.07	Reach Len. (ft)	23.00	50.00	53.00
Crit W.S. (ft)		Flow Area (sq ft)	832.95	622.01	36.20
E.G. Slope (ft/ft)	0.001149	Area (sq ft)	832.95	622.01	36.20
Q Total (cfs)	5150.00	Flow (cfs)	1444.53	3642.42	63.05
Top Width (ft)	457.49	Top Width (ft)	368.54	73.71	15.24
Vel Total (ft/s)	3.45	Avg. Vel. (ft/s)	1.73	5.86	1.74
Max Chl Dpth (ft)	10.03	Hydr. Depth (ft)	2.26	8.44	2.38
Conv. Total (cfs)	151934.1	Conv. (cfs)	42616.3	107457.7	1860.0
Length Wtd. (ft)	41.95	Wetted Per. (ft)	368.74	75.78	15.93
Min Ch El (ft)	803.04	Shear (lb/sq ft)	0.16	0.59	0.16
Alpha	2.11	Stream Power (lb/ft s)	110.84	0.00	0.00
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	116.04	47.70	65.52
C & E Loss (ft)	0.02	Cum SA (acres)	34.85	4.27	14.31

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 3004.54

INPUT
Description: K
Station Elevation Data num= 102

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-469.9	819.55	-464.82	817.83	-445.16	812.74	-439.76	811.53	-432.36	811.33
-408.99	810.29	-370.93	810.49	-362.09	810.6	-358.19	810.65	-356.83	810.66
-304.24	810.68	-285.06	810.58	-250.46	810.66	-226.31	810.87	-201.92	811.25
-180.38	811.02	-178.06	811.01	-142.44	810.98	-125	810.7	-123.4	810.68
-103.48	810.53	-85.36	810	-63.3	809.72	-38.45	809.01	-35.94	808.19
-35.5	808.15	-35.41	808.15	-35.32	808.14	-35.23	808.13	-35.07	808.12
-34.91	808.11	-34.74	808.1	-34.56	808.09	-34.37	808.07	-34.17	808.06
-33.97	808.05	-33.76	808.03	-33.54	808.02	-33.31	808.01	-33.23	808
-33.22	808	-29.25	806.47	-28.04	806	-24.92	804.84	-22.64	804
-21.26	803.52	-19.32	802.84	-16.91	802.19	-16.85	802.19	-16.82	802.19
-16.69	802.19	-5.82	802.19	-3.39	802.19	-1.15	802.19	.55	802.19
5.22	802.19	7.83	802.19	15.01	804	17.99	804.66	24.08	806
28.83	806.92	34.36	808	39.34	809.23	42.42	810	43.7	810.36
46.48	811.12	48.67	811.73	49.66	812	51.94	812.56	53.3	812.86
55.11	813.29	58.2	813.97	58.24	813.98	58.31	814	58.32	814
58.46	814	58.5	814	58.52	814	58.54	814	58.56	814
58.91	814.04	59.21	814.08	59.5	814.11	59.78	814.15	60.05	814.18
60.31	814.21	60.56	814.25	60.8	814.28	65.04	814.69	65.28	814.71
67.85	814.94	69.06	815.07	71.32	815.3	73.81	815.51	77.92	815.88
78.98	816	81.68	816.58	88.8	818	91.98	818.82	96.72	820
100.95	821.02	104.2	821.84						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-469.9	.05	-38.45	.035	34.36	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-38.45	34.36	36	50	48	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	813.39	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.31	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	813.08	Reach Len. (ft)	36.00	50.00	48.00
Crit W.S. (ft)		Flow Area (sq ft)	998.74	634.20	50.33
E.G. Slope (ft/ft)	0.000931	Area (sq ft)	998.74	634.20	50.33
Q Total (cfs)	5150.00	Flow (cfs)	1644.44	3422.48	83.08
Top Width (ft)	500.68	Top Width (ft)	408.01	72.81	19.86
Vel Total (ft/s)	3.06	Avg. Vel. (ft/s)	1.65	5.40	1.65
Max Chl Dpth (ft)	10.89	Hydr. Depth (ft)	2.45	8.71	2.53
Conv. Total (cfs)	168767.0	Conv. (cfs)	53888.8	112155.8	2722.4
Length Wtd. (ft)	44.84	Wetted Per. (ft)	408.25	74.60	20.50

* Min Ch El (ft)	* 802.19	* Shear (lb/sq ft)	* 0.14	* 0.49	* 0.14	*		
* Alpha	* 2.16	* Stream Power (lb/ft s)	* 104.20	* 0.00	* 0.00	*		
* Frctn Loss (ft)	* 0.04	* Cum Volume (acre-ft)	* 115.56	* 46.98	* 65.47	*		
* C & E Loss (ft)	* 0.03	* Cum SA (acres)	* 34.64	* 4.18	* 14.29	*		

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CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 2954.54

INPUT
Description: L
Station Elevation Data num= 103

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-509.9	819.95	-504.94	818.22	-502.96	817.64	-479.97	811.59	-461.37	810.54
-447.19	809.9	-436.37	809.96	-403.73	810.08	-396.99	810.15	-359.14	810.32
-344.07	810.32	-312.63	810.14	-291.29	810.11	-285.49	810.1	-260.08	810.18
-242.17	810.32	-187.74	811.09	-186.83	811.08	-186.73	811.08	-185.37	811.08
-160.81	810.67	-133.05	810.2	-130.8	810.14	-120.98	809.94	-119.28	809.94
-113.78	809.93	-103.13	809.97	-93.69	809.92	-69.28	809.54	-67.94	809.52
-52.45	809.04	-45.11	808.85	-35.47	808.67	-31.5	808.25	-31.42	808.24
-31.35	808.22	-31.26	808.21	-31.16	808.19	-31.04	808.18	-30.92	808.16
-30.8	808.15	-30.67	808.13	-30.53	808.11	-29.89	808	-29.86	808
-29.83	808	-29.8	808	-29.75	808	-29.74	808	-29.73	808
-29.72	808	-29.7	808	-29.05	807.78	-23.67	806	-21.63	805.31
-17.79	804	-10.69	802.19	-10.66	802.19	-10.4	802.19	0	802.19
9.16	802.19	11.62	802.51	18.63	804	24.79	805.33	27.88	806
35.22	807.49	37.75	808	46.11	809.77	47.2	810	53.42	811.42
56	812	58.23	812.39	59.06	812.53	61.48	812.94	62.86	813.17
63.48	813.27	64.67	813.47	67.71	813.95	68.01	814	68.09	814
68.17	814	74.52	814.69	76.39	814.89	77.77	815.04	78.82	815.15
86.29	816	88.24	816.57	94.41	818	97.98	819.07	101.06	820
106.62	821.6	108.05	822	110.66	822.46	119.91	823.94	120.29	824
120.3	824	125.67	824.01	128.68	824.01	130.18	824.02	131.37	824.02
132.17	824.03	141.52	824.19	144.3	824.23				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-509.9	.05	-31.5	.035	35.22	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-31.5	35.22	36	50	48	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

* E.G. Elev (ft)	* 813.33	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.23	* Wt. n-Val.	* 0.050	* 0.035	* 0.050 *
* W.S. Elev (ft)	* 813.10	* Reach Len. (ft)	* 36.00	* 50.00	* 48.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 1310.63	* 598.24	* 74.34 *

* E.G. Slope (ft/ft)	*0.000725	* Area (sq ft)	* 1310.63	* 598.24	* 74.34 *
* Q Total (cfs)	* 5150.00	* Flow (cfs)	* 2125.10	* 2910.33	* 114.58 *
* Top Width (ft)	* 548.18	* Top Width (ft)	* 454.22	* 66.72	* 27.24 *
* Vel Total (ft/s)	* 2.60	* Avg. Vel. (ft/s)	* 1.62	* 4.86	* 1.54 *
* Max Chl Dpth (ft)	* 10.91	* Hydr. Depth (ft)	* 2.89	* 8.97	* 2.73 *
* Conv. Total (cfs)	*191230.1	* Conv. (cfs)	* 78909.2	*108066.4	* 4254.5 *
* Length Wtd. (ft)	* 44.00	* Wetted Per. (ft)	* 454.52	* 68.16	* 27.82 *
* Min Ch El (ft)	* 802.19	* Shear (lb/sq ft)	* 0.13	* 0.40	* 0.12 *
* Alpha	* 2.15	* Stream Power (lb/ft s)	* 144.30	* 0.00	* 0.00 *
* Frctn Loss (ft)	* 0.03	* Cum Volume (acre-ft)	* 114.60	* 46.27	* 65.40 *
* C & E Loss (ft)	* 0.02	* Cum SA (acres)	* 34.29	* 4.10	* 14.27 *

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CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 2904.54

INPUT
Description: M
Station Elevation Data num= 136

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-555.08	818.17	-551.53	817.23	-533.87	812.12	-525.42	811.56	-494.28	809.71
-465.28	809.62	-444.08	809.58	-434.14	809.66	-422.93	809.74	-392.27	810.04
-348.18	810.06	-339.93	810.08	-336.85	810.04	-323.3	810.05	-294.13	810.01
-287.65	810.03	-244.02	810.11	-235.05	810.23	-208.28	810.47	-187.1	810.73
-185.09	810.59	-179.54	810.57	-153.52	809.97	-147.04	809.8	-143.48	809.78
-131.45	809.67	-109.41	809.57	-105.87	809.47	-105.74	809.47	-73.37	809.04
-65.8	808.97	-57.78	808.78	-50.48	808.91	-36.42	808.86	-35.58	808.5
-32.25	807.93	-29.14	806.3	-25.8	805.38	-22.8	804.42	-20.89	804
-20.73	803.97	-20.58	803.93	-20.41	803.9	-20.24	803.86	-20.06	803.82
-19.87	803.78	-19.67	803.73	-19.45	803.68	-19.23	803.64	-19	803.58
-18.75	803.53	-18.49	803.47	-18.21	803.41	-18.2	803.41	-16.63	802.28
-16.25	802	-8.17	802	-3.39	802	0	802	2.06	802
10.99	802	11.25	802	11.76	802	12.15	802.07	12.83	802.2
18.97	803.35	22.4	804	25.48	804.72	30.97	806	31.31	806.08
31.62	806.15	34.08	806.73	36.43	807.28	36.84	807.37	37.52	807.53
37.56	807.54	37.59	807.55	37.62	807.55	37.65	807.56	37.68	807.56
37.7	807.57	37.94	807.62	37.96	807.63	38.35	807.71	38.38	807.71
38.4	807.72	38.42	807.72	38.87	807.81	38.9	807.82	38.92	807.83
39.41	807.93	39.44	807.93	39.96	808.04	40.52	808.15	41.11	808.27
41.15	808.28	41.79	808.41	41.84	808.42	43.87	808.86	44.37	808.96
44.9	809.07	45.41	809.17	45.95	809.28	46.53	809.39	47.15	809.52
47.83	809.65	49.22	809.95	49.46	810	51.94	810.54	58.66	812
59.36	812.09	59.65	812.13	63.68	812.64	65.81	812.9	68.23	813.21
72.37	813.72	73.02	813.8	74.71	814	79.31	814.6	82.93	815.09
86.03	815.5	89.61	816	89.68	816	93.22	817.02	96.64	818
100.75	819.42	102.44	820	107.15	821.46	108.87	822	113.42	823.17
116.74	824	116.77	824	116.78	824	116.88	824	116.89	824

117.07 824.01

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-555.08	.05	-36.42	.035	41.79	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-36.42	41.79	42	49.96	51	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	813.28	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.15	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	813.13	Reach Len. (ft)	42.00	49.96	51.00
Crit W.S. (ft)		Flow Area (sq ft)	1588.48	703.40	54.66
E.G. Slope (ft/ft)	0.000495	Area (sq ft)	1588.48	703.40	54.66
Q Total (cfs)	5150.00	Flow (cfs)	2266.53	2824.53	58.94
Top Width (ft)	604.95	Top Width (ft)	500.94	78.21	25.81
Vel Total (ft/s)	2.19	Avg. Vel. (ft/s)	1.43	4.02	1.08
Max Chl Dpth (ft)	11.13	Hydr. Depth (ft)	3.17	8.99	2.12
Conv. Total (cfs)	231441.3	Conv. (cfs)	101858.2	126934.4	2648.7
Length Wtd. (ft)	46.37	Wetted Per. (ft)	501.18	80.26	26.26
Min Ch El (ft)	802.00	Shear (lb/sq ft)	0.10	0.27	0.06
Alpha	2.02	Stream Power (lb/ft s)	117.07	0.00	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	113.40	45.52	65.33
C & E Loss (ft)	0.01	Cum SA (acres)	33.89	4.02	14.24

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 2854.58

INPUT
Description: N
Station Elevation Data num= 136

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-604.74	818.03	-587.39	813.47	-585.09	812.8	-577.61	812.3	-543.57	809.78
-498.5	809.63	-494.24	809.57	-493.32	809.62	-490.35	809.6	-464.42	809.7
-449.62	809.77	-442.77	809.62	-433.61	809.82	-392.69	810.06	-389.49	810.07
-346.11	809.57	-337.27	809.58	-300.9	809.69	-284.47	809.73	-253.74	809.76
-239.62	809.94	-231.28	810.08	-222.63	810.03	-219.09	810.11	-207.99	810.26
-195.77	810.2	-192.67	809.81	-189.75	809.76	-188.94	809.79	-181.12	809.87

-161.13	809.86	-154.94	809.75	-148.17	809.64	-131.76	809.27	-129.32	809.24
-116.92	809.12	-99.47	808.99	-99.27	808.99	-99.21	808.99	-87.45	808.85
-82.36	808.91	-76.54	808.84	-69.24	808.81	-62.26	808.9	-35.56	808.9
-34.29	808.35	-33.72	808.09	-31.28	806.16	-31.27	806.16	-31.24	806.14
-27.8	804.33	-27.74	804.32	-27.67	804.3	-27.61	804.29	-27.54	804.27
-27.46	804.25	-27.39	804.23	-27.3	804.21	-27.21	804.19	-27.11	804.17
-27.01	804.14	-26.89	804.12	-26.77	804.09	-26.64	804.06	-26.49	804.02
-26.4	804	-24.06	802.5	-23.28	802	-4.28	802	0	802
14.53	802	19.83	802.93	25.91	804	26.55	804.15	26.9	804.23
26.94	804.25	26.96	804.25	27.08	804.29	27.12	804.3	27.23	804.33
27.28	804.35	27.38	804.38	27.43	804.4	27.53	804.43	27.59	804.45
28.53	804.72	28.64	804.74	28.75	804.77	28.87	804.79	29	804.82
29.39	804.91	29.49	804.94	29.6	804.97	29.75	805	29.91	805.04
30.09	805.09	30.28	805.13	30.48	805.18	30.7	805.24	30.95	805.3
31.21	805.36	31.5	805.43	31.85	805.52	32.24	805.61	32.68	805.72
33.18	805.84	34.31	806.12	34.94	806.28	35.68	806.46	36.54	806.68
37.56	806.94	38.78	807.25	40.46	807.67	42.6	808.2	45.44	808.91
49.4	809.9	49.81	810	57.71	811.96	57.86	812	66.98	813.82
67.88	814	67.97	814	68.01	814	68.24	814	87.56	815.69
88.39	815.76	90.98	816	94.53	817.23	96.75	818	100.5	819.34
102.36	820	103.49	820.39	108.11	822	109.79	822.45	115.56	824
115.88	824.04								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-604.74	.05	-35.56	.035	45.44	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-35.56	45.44	40	50.04	52	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	813.25	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.12	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	813.13	Reach Len. (ft)	40.00	50.04	52.00
Crit W.S. (ft)		Flow Area (sq ft)	1854.07	761.16	36.46
E.G. Slope (ft/ft)	0.000374	Area (sq ft)	1854.07	761.16	36.46
Q Total (cfs)	5150.00	Flow (cfs)	2393.81	2723.35	32.84
Top Width (ft)	649.77	Top Width (ft)	550.67	81.00	18.09
Vel Total (ft/s)	1.94	Avg. Vel. (ft/s)	1.29	3.58	0.90
Max Chl Dpth (ft)	11.13	Hydr. Depth (ft)	3.37	9.40	2.01
Conv. Total (cfs)	266224.9	Conv. (cfs)	123745.8	140781.4	1697.7
Length Wtd. (ft)	45.03	Wetted Per. (ft)	550.88	83.71	18.59
Min Ch El (ft)	802.00	Shear (lb/sq ft)	0.08	0.21	0.05
Alpha	2.00	Stream Power (lb/ft s)	115.88	0.00	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	111.74	44.68	65.28
C & E Loss (ft)	0.01	Cum SA (acres)	33.38	3.93	

14.21 *
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CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 2804.54

INPUT
Description: O
Station Elevation Data num= 224

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-636.99	817.78	-620.56	813.37	-593.74	811.22	-573.43	809.84	-567.39	809.75
-532.59	809.32	-523.1	809.82	-493.13	809.57	-486.12	809.6	-483.76	809.54
-473.25	809.31	-455.93	809.7	-446.03	809.76	-418.52	809.68	-391.12	809.35
-371.75	809.21	-353.59	809.07	-320.57	809.32	-310.49	809.4	-285.69	809.54
-264.41	809.57	-260.62	809.62	-252.37	809.53	-243.1	809.46	-235.49	809.62
-210.66	809.92	-203.19	809.88	-197.84	809.23	-197.64	809.22	-194.22	809.36
-191.11	809.39	-177.26	809.36	-170.33	809.28	-164.3	809.01	-153.82	808.7
-139.84	808.71	-132.13	808.6	-123.32	808.22	-121.92	808.15	-120.95	808.13
-107.12	808.07	-104.82	808.04	-97.1	807.93	-90.23	807.96	-83.62	808.09
-65.83	808.29	-65.47	808.31	-61.61	808.39	-41.95	809.2	-35.53	809.4
-35.51	809.4	-34.23	808.97	-33.63	808.75	-31.2	806.83	-31.19	806.83
-29.7	805.77	-29.59	805.69	-29.57	805.68	-25.99	803.68	-25.99	803.67
-25.98	803.66	-25.97	803.64	-25.95	803.62	-25.94	803.61	-25.92	803.59
-25.91	803.57	-25.89	803.55	-25.87	803.53	-25.85	803.5	-25.84	803.48
-25.82	803.46	-25.8	803.43	-25.78	803.4	-25.75	803.38	-25.73	803.35
-25.71	803.32	-25.68	803.29	-25.67	803.27	-23.62	802	-12.29	802
-8.16	802	-.98	802	0	802	18.54	802	18.64	802.02
18.75	802.05	18.76	802.05	18.87	802.08	18.97	802.1	19.06	802.12
19.15	802.15	19.24	802.17	19.32	802.19	19.35	802.19	19.44	802.21
19.51	802.23	19.59	802.25	19.66	802.27	19.73	802.28	19.8	802.3
19.86	802.31	19.92	802.33	19.98	802.34	20.04	802.36	20.09	802.37
20.15	802.38	20.21	802.4	20.26	802.41	20.31	802.42	20.36	802.43
20.41	802.45	20.46	802.46	20.5	802.47	20.55	802.48	20.59	802.49
20.63	802.5	20.67	802.51	20.71	802.52	20.75	802.53	20.78	802.53
20.82	802.54	20.85	802.55	20.88	802.56	20.92	802.57	20.95	802.57
20.98	802.58	21.08	802.61	21.11	802.61	21.14	802.62	21.17	802.63
21.2	802.64	21.23	802.64	21.26	802.65	21.29	802.66	21.31	802.66
21.34	802.67	21.36	802.67	21.39	802.68	21.41	802.69	21.44	802.69
21.46	802.7	21.48	802.7	21.5	802.71	21.53	802.71	21.55	802.72
21.57	802.72	21.59	802.73	21.61	802.73	21.63	802.74	21.65	802.74
21.66	802.75	21.68	802.75	21.7	802.75	21.72	802.76	21.74	802.76
21.75	802.77	21.89	802.8	21.91	802.8	23.53	803.12	23.69	803.16
23.71	803.17	23.81	803.19	24.81	805.05	24.86	805.07	25.04	805.13
25.21	805.2	25.38	805.26	25.55	805.32	25.64	805.35	26.14	805.53
37.03	807.89	42.61	809.52	47.89	809.79	48.09	809.82	48.29	809.86
49.56	810.15	49.78	810.2	50.02	810.26	50.26	810.32	50.54	810.38
50.84	810.45	51.15	810.51	51.47	810.58	51.81	810.66	52.17	810.74
52.9	810.9	53.26	810.98	53.64	811.07	54.04	811.17	54.47	811.27
55.97	811.53	56.29	811.59	56.63	811.67	57.01	811.75	57.43	811.84
57.9	811.94	58.18	812	66	813.35	69.49	813.96	69.71	814
75.94	814.59	80	814.97	82.33	815.19	83.84	815.33	85.64	815.5
87.9	815.68	88.33	815.71	90.91	815.91	91.03	815.92	92.13	816
93.67	816.33	94.43	816.53	96.39	816.99	98.88	817.68	99.33	817.79
100.04	818	105.58	819.9	105.87	820	106.47	820.21	111.67	822
117.68	823.92	117.92	824	118.6	824.19	124.8	825.92		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val

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 -636.99     .05  -35.53    .035   42.61     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        -35.53   42.61                50      50      60             .1      .3

CROSS SECTION OUTPUT  Profile #100-Year
*************************************************************************************
***********
* E.G. Elev (ft)         *  813.23  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.09  * Wt. n-Val.            *   0.050  *   0.035  *
  0.050  *
* W.S. Elev (ft)         *  813.14  * Reach Len. (ft)       *   50.00  *   50.00  *
  60.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     * 2166.15  *  725.98  *
  45.01  *
* E.G. Slope (ft/ft)     *0.000319  * Area (sq ft)          * 2166.15  *  725.98  *
  45.01  *
* Q Total (cfs)          * 5150.00  * Flow (cfs)           * 2760.23  * 2351.84  *
  37.93  *
* Top Width (ft)         *  682.42  * Top Width (ft)       *  582.12  *   78.14  *
  22.16  *
* Vel Total (ft/s)       *    1.75  * Avg. Vel. (ft/s)     *    1.27  *    3.24  *
   0.84  *
* Max Chl Dpth (ft)      *   11.14  * Hydr. Depth (ft)     *    3.72  *    9.29  *
   2.03  *
* Conv. Total (cfs)      *288337.5  * Conv. (cfs)          *154539.3  *131674.6  *
 2123.6  *
* Length Wtd. (ft)       *   50.10  * Wetted Per. (ft)     *  582.37  *   82.21  *
  22.50  *
* Min Ch El (ft)         *  802.00  * Shear (lb/sq ft)     *    0.07  *    0.18  *
   0.04  *
* Alpha                  *    1.84  * Stream Power (lb/ft s) *  124.80  *    0.00  *
   0.00  *
* Frctn Loss (ft)        *    0.02  * Cum Volume (acre-ft) *  109.90  *   43.83  *
  65.23  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)       *   32.86  *    3.84  *
  14.19  *
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CROSS SECTION


RIVER: Buckeye Creek
REACH: Buckeye Creek      RS: 2754.54

INPUT
Description: P
Station Elevation Data    num=     168
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*************************************************************************************
 -699.01  815.93 -697.79  815.61 -665.41  812.92 -625.31  809.39 -622.52  809.03
 -621.43  808.74 -620.24  808.77 -617.21  808.47  -615.7  809.01 -614.94   809.2
 -612.78   809.4 -602.34  810.16 -597.05  810.51 -583.44  810.88 -579.93  811.01
 -565.86  810.75 -532.33  809.93 -525.05  809.13 -523.29     809 -520.08  809.08
 -508.02  809.38  -501.8  809.78 -500.21  809.87 -489.56   810.2 -459.58  810.12
 -459.49  810.12 -459.48  810.12 -459.41  810.12  -423.2  809.72 -415.83   809.8
 -403.62  809.88 -385.41  809.95 -375.96  810.15 -357.95  810.41 -340.63   810.6
 -319.94  811.16 -304.14  811.19 -294.46  811.26 -270.82  811.15 -265.45  810.91
 -261.08  810.78 -246.74  810.16 -241.79  810.23 -235.18  810.34 -234.12   810.4
 -231.13  810.38 -198.52  809.87 -197.68  809.58  -194.2  808.77 -193.07  808.52
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-178.48	807.88	-177.88	807.85	-177.82	807.85	-164.45	807.34	-162.67	807.33
-155.89	807.28	-155.32	806.98	-153.6	807.57	-151.86	807.58	-138.74	807.52
-135.54	807.51	-132.75	807.16	-130.02	806.85	-127	806.75	-124.24	806.57
-118.5	806.53	-110.43	805.94	-108.29	805.37	-106.35	805.03	-104.76	805.01
-102.17	805.14	-99.69	805.76	-99.06	805.87	-98.96	805.86	-98.42	805.92
-84.59	807.47	-83.07	807.51	-83.03	807.51	-82.25	807.53	-68.99	807.62
-59.02	807.76	-50.91	807.97	-37.84	808.52	-37.49	808.63	-35.61	808.13
-29.14	805.37	-23.52	803.77	-22.8	802.87	-22.74	802.78	-22.67	802.68
-22.58	802.55	-22.48	802.41	-22.35	802.23	-22.33	802.2	-22.28	802.17
-22.01	802	-18.39	802	-17.92	802	-13.41	802	-12.3	802
-8.44	802	-6.69	802	-3.47	802	-1.09	802	0	802
2.18	802	7.06	802	9.46	802	15.81	802	16.72	802
21.18	802	21.2	802	21.25	802.02	21.31	802.03	21.36	802.04
21.41	802.05	21.46	802.07	21.51	802.08	21.55	802.09	21.6	802.1
21.65	802.11	21.69	802.12	21.73	802.13	21.78	802.14	21.82	802.15
21.86	802.16	21.89	802.17	21.93	802.18	25.86	802.95	25.9	802.96
25.91	802.96	25.93	802.96	28.32	807.37	28.33	807.37	28.38	807.39
28.42	807.41	28.47	807.42	28.51	807.44	28.53	807.45	28.66	807.49
31.44	808.11	45.69	812.31	49.98	813.62	59.57	813.62	60.31	813.64
61.18	813.66	62.21	813.69	63.5	813.72	65.11	813.76	67.15	813.81
69.83	813.88	73.34	813.96	74.76	814	74.91	814	91.42	815.35
99.32	816	102.78	816.84	107.54	818	111.72	819.44	113.34	820
114.82	820.51	119.14	822	124.37	823.8	124.94	824	126.17	824.38
131.32	826	136.21	827.34	138.39	827.91				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-699.01	.05	-37.49	.035	28.66	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-37.49	28.66	51	50	58	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

* E.G. Elev (ft)	813.21	Element	Left OB	Channel	Right OB
* Vel Head (ft)	0.10	Wt. n-Val.	0.050	0.035	0.050
* W.S. Elev (ft)	813.11	Reach Len. (ft)	51.00	50.00	58.00
* Crit W.S. (ft)		Flow Area (sq ft)	2218.36	664.85	57.16
* E.G. Slope (ft/ft)	0.000334	Area (sq ft)	2218.36	664.85	57.16
* Q Total (cfs)	5150.00	Flow (cfs)	2786.10	2302.25	61.65
* Top Width (ft)	716.03	Top Width (ft)	630.22	66.15	19.65
* Vel Total (ft/s)	1.75	Avg. Vel. (ft/s)	1.26	3.46	1.08
* Max Chl Dpth (ft)	11.11	Hydr. Depth (ft)	3.52	10.05	2.91
* Conv. Total (cfs)	281598.4	Conv. (cfs)	152342.2	125885.2	3371.1
* Length Wtd. (ft)	50.56	Wetted Per. (ft)	631.52	70.59	20.45
* Min Ch El (ft)	802.00	Shear (lb/sq ft)	0.07	0.20	0.06
* Alpha	2.03	Stream Power (lb/ft s)	138.39	0.00	0.00
* Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	107.38	43.03	

```
  65.16  *
* C & E Loss (ft)          *    0.01  * Cum SA (acres)          *   32.17  *    3.75  *
  14.16  *
*******************************************************************************
***********

CROSS SECTION


RIVER: Buckeye Creek
REACH: Buckeye Creek       RS: 2704.54

INPUT
Description: Q
Station Elevation Data     num=     154
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
 -748.45  816.02  -700.4  811.68 -692.77  810.93 -683.87  809.81 -680.17  809.65
 -677.45  809.68 -674.56  810.19 -673.33  810.49    -666  811.13 -662.97  811.41
 -637.33  811.61 -634.04  811.63 -631.87  811.61 -583.36  810.81 -582.01  810.82
 -577.31  810.68 -571.55  811.45 -562.03  811.58 -551.48  811.55    -539  811.63
 -517.08  811.43 -503.81  811.42 -480.94  811.33 -472.87  811.32 -443.55  811.19
 -439.45  811.22 -390.14   811.6 -383.12  811.66 -350.21  812.11 -346.85  812.08
 -333.68   812.1 -333.26   812.1 -319.39  812.02 -296.26  811.96 -289.76  811.86
 -274.92  811.73 -266.98  811.52 -260.88  811.65 -254.36  811.35 -248.44  811.18
 -234.05  810.76  -220.2  810.35 -189.97  809.52 -189.63  809.44 -185.63  809.13
 -184.53  808.98 -176.48  808.66 -164.04  808.06 -132.48  807.88 -131.43  807.87
 -131.03  807.87  -128.5  807.82 -127.59   807.8  -97.03  807.18  -93.87  807.15
  -65.52  808.11  -59.38  808.03  -40.14  808.49  -33.94  808.23  -32.14  808.15
  -31.27  808.03  -31.03  807.98  -30.36  807.89  -29.98  807.71  -28.02  805.88
   -27.8  805.81  -27.78   805.8  -27.75  805.79  -27.72  805.78  -27.69  805.77
   -27.6  805.74  -27.39  805.67  -27.27  805.61  -27.07  805.53   -26.7  805.38
  -25.82  805.02  -20.72  802.94  -18.43     802  -17.88     802  -17.79     802
   -12.4     802  -11.38     802    -6.9     802   -6.87     802   -4.92     802
   -1.38     802       0     802    1.76     802    4.54     802    5.55     802
    9.02     802   10.62     802   16.34     802   16.72     802   18.59     802
   19.75  802.24    20.4  802.37   21.76  802.65   22.53   802.8   23.02   802.9
   23.36  802.97   23.61  803.02    23.8  803.06   23.95  803.09   24.07  803.12
   24.17  803.14   24.26  803.16   24.33  803.17   24.39  803.19   24.45   803.2
    24.5  803.21   24.54  803.22   24.58  803.22   24.61  803.23   24.64  803.24
   24.67  803.24    24.7  803.25   24.72  803.25   24.74  803.26   24.76  803.26
   24.78  803.26    24.8  803.27   24.81  803.27   24.83  803.27   24.84  803.28
   24.85  803.28   24.86  803.28   24.88  803.28   25.13  803.34      30  808.07
   30.08  808.22   30.78  808.43    49.1  815.09  102.85  815.17   114.4     816
  114.46     816  114.54     816  114.59     816   114.7     816  115.25  816.16
   116.5  816.52  121.57     818  127.43  819.88  127.81     820  128.27  820.15
  133.84     822   139.7  823.91  139.98     824  140.39  824.13  146.22     826
   150.1  827.24  152.47     828  157.76   829.1  161.88  829.95

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*******************************************
 -748.45     .05  -33.94    .035      30     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.    Expan.
        -33.94      30                51   43.25      43             .1       .3

CROSS SECTION OUTPUT  Profile #100-Year
*******************************************************************************
***********
* E.G. Elev (ft)           *  813.17  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)            *    0.21  * Wt. n-Val.             *   0.050  *   0.035  *
```

0.050	*									
* W.S. Elev (ft)	*	812.97	*	Reach Len. (ft)	*	51.00	*	43.25	*	
43.00	*									
* Crit W.S. (ft)	*		*	Flow Area (sq ft)	*	1625.95	*	626.52	*	
31.94	*									
* E.G. Slope (ft/ft)	*	0.000629	*	Area (sq ft)	*	1625.95	*	626.52	*	
31.94	*									
* Q Total (cfs)	*	5150.00	*	Flow (cfs)	*	2164.32	*	2944.78	*	
40.90	*									
* Top Width (ft)	*	757.90	*	Top Width (ft)	*	680.70	*	63.94	*	
13.26	*									
* Vel Total (ft/s)	*	2.25	*	Avg. Vel. (ft/s)	*	1.33	*	4.70	*	
1.28	*									
* Max Chl Dpth (ft)	*	10.97	*	Hydr. Depth (ft)	*	2.39	*	9.80	*	
2.41	*									
* Conv. Total (cfs)	*	205359.1	*	Conv. (cfs)	*	86303.3	*	117424.8	*	
1631.0	*									
* Length Wtd. (ft)	*	44.88	*	Wetted Per. (ft)	*	681.19	*	67.54	*	
14.18	*									
* Min Ch El (ft)	*	802.00	*	Shear (lb/sq ft)	*	0.09	*	0.36	*	
0.09	*									
* Alpha	*	2.63	*	Stream Power (lb/ft s)	*	161.88	*	0.00	*	
0.00	*									
* Frctn Loss (ft)	*	0.06	*	Cum Volume (acre-ft)	*	105.13	*	42.29	*	
65.10	*									
* C & E Loss (ft)	*	0.14	*	Cum SA (acres)	*	31.40	*	3.68	*	
14.14	*									

****
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Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 2661.29

INPUT
Description: R
Station Elevation Data num= 146

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-783.32	816.92	-733.81	811.97	-729.95	811.66	-716.71	810.33	-715.94	810.19
-714.02	810.18	-707.96	809.91	-707.14	810.05	-704.49	810.53	-699.47	810.98
-692.88	811.53	-667.52	811.89	-662.99	811.93	-644.31	811.73	-617.72	811.48
-613.76	811.45	-611.42	811.47	-607.17	810.96	-602.21	811.53	-589.62	811.81
-582.69	811.99	-577.88	811.93	-553	811.55	-533.67	811.35	-517	811.32
-503.59	811.16	-484.32	811.15	-482.21	811.18	-460.37	811.51	-433.39	811.71
-408.66	811.94	-400	812.03	-396.5	812.04	-378.35	811.9	-366.17	811.81
-356.25	811.79	-352.92	811.8	-325.51	811.94	-315.59	811.84	-300.04	811.69
-296.75	811.66	-295.78	811.65	-293.27	811.68	-283.04	811.61	-275.48	811.56
-272.25	811.41	-270.84	811.41	-260.52	811.18	-255.37	811.1	-251.05	811.01
-243.46	810.92	-229.93	810.51	-225.49	810.37	-218.08	810.2	-193.64	809.53
-159.48	808.73	-159.26	808.71	-158.2	808.66	-149.61	808.37	-138.25	808.02
-108.81	808.05	-104.98	807.98	-98.95	808.1	-76.28	808.02	-66.27	807.74
-50.69	807.61	-35.72	807.37	-30.35	806.7	-28.35	806.46	-21.76	804.95
-15.72	804.22	-15.2	803.46	-14.95	803.31	-14.93	803.28	-14.91	803.25
-14.89	803.21	-14.86	803.17	-14.83	803.13	-14.8	803.08	-14.77	803.02

-14.73	802.96	-14.69	802.89	-14.63	802.8	-14.58	802.71	-14.51	802.6
-14.43	802.47	-14.33	802.31	-14.21	802.11	-14.14	802	-10.62	802
-9.76	802	-3.66	802	-1.11	802	0	802	3.28	802
7.57	802	10.21	802	16.23	802	17.12	802	20.6	802
20.72	802.01	20.95	802.03	21.16	802.04	21.36	802.06	21.55	802.07
21.72	802.09	27.88	802.57	31.67	806.67	33.46	808.35	46.36	812.63
47.42	812.95	50.63	813.48	56.04	813.65	57.86	813.75	101.72	813.93
102.64	813.94	103.63	813.96	104.68	813.97	105.74	813.98	106.86	813.99
107.53	814	107.58	814	109.13	814.12	109.42	814.15	113.04	814.43
114.04	814.51	115.48	814.62	117.7	814.79	121.05	815.06	124.84	815.34
126.67	815.49	132.02	815.89	132.34	815.91	133.53	816	136.37	816.61
137.94	816.96	139.77	817.36	142.54	818	143.12	818.18	144.56	818.64
147.7	819.64	148.85	820	152.27	821.08	155.2	822	157.11	822.61
158.68	823.11								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-783.32	.05	-28.35	.035	31.67	.05

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

	-28.35	31.67		134	57.86	63	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-783.32	-26.57	812.2	T
36.35	158.68	812.2	T

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	812.98	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.61	Wt. n-Val.		0.035	0.050
W.S. Elev (ft)	811.37	Reach Len. (ft)	7.83	7.83	7.83
Crit W.S. (ft)	809.07	Flow Area (sq ft)		499.45	14.25
E.G. Slope (ft/ft)	0.003540	Area (sq ft)	628.70	508.55	20.66
Q Total (cfs)	5150.00	Flow (cfs)		5102.44	47.56
Top Width (ft)	416.99	Top Width (ft)	346.08	60.02	10.89
Vel Total (ft/s)	10.03	Avg. Vel. (ft/s)		10.22	3.34
Max Chl Dpth (ft)	9.37	Hydr. Depth (ft)		8.58	3.05
Conv. Total (cfs)	86563.4	Conv. (cfs)		85764.1	799.3
Length Wtd. (ft)	7.83	Wetted Per. (ft)		61.40	5.50
Min Ch El (ft)	802.00	Shear (lb/sq ft)		1.80	0.57
Alpha	1.03	Stream Power (lb/ft s)	158.68	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	103.81	41.73	65.07
C & E Loss (ft)		Cum SA (acres)	30.80	3.62	14.12

BRIDGE

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 2625.35

INPUT
Description:
Distance from Upstream XS = 7.83
Deck/Roadway Width = 15
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 10

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-402.08	811.37	0	-279	812.09	0	-47.53	812.2	0
-31.61	812.2	0	-26.57	812.2	810	0	812.2	810
36.35	812.2	810	39.52	812.2	0	59.65	812.2	0
110	812.2	0						

Upstream Bridge Cross Section Data
Station Elevation Data num= 146

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-783.32	816.92	-733.81	811.97	-729.95	811.66	-716.71	810.33	-715.94	810.19
-714.02	810.18	-707.96	809.91	-707.14	810.05	-704.49	810.53	-699.47	810.98
-692.88	811.53	-667.52	811.89	-662.99	811.93	-644.31	811.73	-617.72	811.48
-613.76	811.45	-611.42	811.47	-607.17	810.96	-602.21	811.53	-589.62	811.81
-582.69	811.99	-577.88	811.93	-553	811.55	-533.67	811.35	-517	811.32
-503.59	811.16	-484.32	811.15	-482.21	811.18	-460.37	811.51	-433.39	811.71
-408.66	811.94	-400	812.03	-396.5	812.04	-378.35	811.9	-366.17	811.81
-356.25	811.79	-352.92	811.8	-325.51	811.94	-315.59	811.84	-300.04	811.69
-296.75	811.66	-295.78	811.65	-293.27	811.68	-283.04	811.61	-275.48	811.56
-272.25	811.41	-270.84	811.41	-260.52	811.18	-255.37	811.1	-251.05	811.01
-243.46	810.92	-229.93	810.51	-225.49	810.37	-218.08	810.2	-193.64	809.53
-159.48	808.73	-159.26	808.71	-158.2	808.66	-149.61	808.37	-138.25	808.02
-108.81	808.05	-104.98	807.98	-98.95	808.1	-76.28	808.02	-66.27	807.74
-50.69	807.61	-35.72	807.37	-30.35	806.7	-28.35	806.46	-21.76	804.95
-15.72	804.22	-15.2	803.46	-14.95	803.31	-14.93	803.28	-14.91	803.25
-14.89	803.21	-14.86	803.17	-14.83	803.13	-14.8	803.08	-14.77	803.02
-14.73	802.96	-14.69	802.89	-14.63	802.8	-14.58	802.71	-14.51	802.6
-14.43	802.47	-14.33	802.31	-14.21	802.11	-14.14	802	-10.62	802
-9.76	802	-3.66	802	-1.11	802	0	802	3.28	802
7.57	802	10.21	802	16.23	802	17.12	802	20.6	802
20.72	802.01	20.95	802.03	21.16	802.04	21.36	802.06	21.55	802.07
21.72	802.09	27.88	802.57	31.67	806.67	33.46	808.35	46.36	812.63
47.42	812.95	50.63	813.48	56.04	813.65	57.86	813.75	101.72	813.93
102.64	813.94	103.63	813.96	104.68	813.97	105.74	813.98	106.86	813.99
107.53	814	107.58	814	109.13	814.12	109.42	814.15	113.04	814.43
114.04	814.51	115.48	814.62	117.7	814.79	121.05	815.06	124.84	815.34
126.67	815.49	132.02	815.89	132.34	815.91	133.53	816	136.37	816.61
137.94	816.96	139.77	817.36	142.54	818	143.12	818.18	144.56	818.64
147.7	819.64	148.85	820	152.27	821.08	155.2	822	157.11	822.61
158.68	823.11								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-783.32	.05	-28.35	.035	31.67	.05

Bank Sta: Left Right Coeff Contr. Expan.
-28.35 31.67 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-783.32	-26.57	812.2	T
36.35	158.68	812.2	T

Downstream Deck/Roadway Coordinates
num= 11

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-445.44	811.52	0	-304.77	812.2	0	-47.53	812.2	0
-31.61	812.2	0	-26.57	812.2	810	0	812.2	810
36.35	812.2	810	39.52	812.2	0	59.65	812.2	0
109.91	812.2	0	140	812.2	0			

Downstream Bridge Cross Section Data
Station Elevation Data num= 168

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-894.09	816.87	-876.52	814.4	-831.94	811.38	-830.85	811.3	-830.72	811.29
-823.48	810.55	-823.34	810.52	-820.05	810.19	-818.82	810.68	-818.75	810.7
-818.67	810.71	-815.87	811.16	-809.43	811	-784.07	810.46	-778.22	810.36
-745.9	810.51	-718.61	810.5	-715.28	810.48	-707.53	810.45	-704.06	810.44
-703.62	810.45	-664.69	810.04	-638.25	809.64	-625.96	809.74	-618.61	809.75
-599.23	809.86	-584.82	810.13	-569.62	810.31	-551.66	810.8	-528.92	811.45
-528.79	811.47	-527.09	811.55	-522.26	811.71	-510.94	811.18	-500.7	811.56
-476.48	811.6	-467.12	811.53	-464.76	811.52	-461.95	811.56	-432.04	811.7
-423.95	811.73	-418.48	811.69	-391.41	811.38	-372.01	811.72	-371.95	811.67
-370.07	811.7	-368.61	811.83	-363.43	811.89	-350.22	811.76	-349.4	811.76
-345.61	811.67	-321.9	811.34	-318.71	811.36	-304.07	810.9	-302.05	810.88
-294.79	810.9	-289.51	810.85	-280.21	810.76	-274.05	810.67	-272.54	810.58
-247.3	810.31	-242.95	810.26	-226.04	809.86	-208.97	809.51	-201.01	809.47
-196.58	809.5	-179.02	809.17	-163.54	808.91	-155.16	808.84	-147.64	808.66
-138.16	808.75	-136.69	808.74	-128.47	808.6	-126.5	808.4	-112.75	808.41
-101.83	808.22	-87.87	808.42	-79.46	808.57	-70.73	808.12	-56.58	807.63
-41.5	806.76	-36.54	806.63	-31.16	806.57	-28.47	806.55	-26.43	806.53
-26.25	806.42	-25.52	805.98	-22.05	802.88	-21.93	802.8	-21.2	802.12
-21.19	802.1	-21.17	802.09	-21.15	802.08	-21.12	802.07	-21.1	802.06
-21.08	802.04	-21.06	802.03	-21.03	802.02	-21.01	802	-3.33	802
0	802	8.49	802	12.86	802	19.91	802	21.64	802.22
23.61	802.46	24.81	802.61	25.62	802.71	26.21	802.79	26.65	802.84
27	802.88	27.27	802.92	27.5	802.95	27.69	802.97	27.71	802.97
27.85	802.99	27.99	803.01	28.11	803.02	28.22	803.04	28.31	803.05
28.39	803.06	28.47	803.07	28.54	803.08	28.6	803.08	28.65	803.09
28.7	803.1	28.75	803.1	28.79	803.11	28.83	803.11	28.87	803.12
28.9	803.12	28.93	803.12	28.96	803.13	28.99	803.13	29.01	803.14
29.04	803.14	29.06	803.14	29.08	803.14	29.1	803.15	29.12	803.15
29.14	803.15	29.16	803.15	29.37	803.21	29.76	803.33	29.88	803.36
35.8	806.62	35.86	806.64	36.09	806.68	36.39	806.71	46.81	807.54
52.56	807.93	59.22	809.23	65.51	809.86	65.97	809.9	73.35	810.89
79.45	811.7	80.35	811.82	80.79	811.87	94.07	812.91	95.32	813.03
98.75	813.24	107.94	813.92	114.81	814.09	117.15	814.33	128.42	814.96
128.96	814.96	139.38	815.3	141.42	815.61				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-894.09	.05	-26.43	.035	35.8	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
-26.43	35.8	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-894.09	-26.57	811	T
36.35	141.42	811	T

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

Number of Bridge Coefficient Sets =  1

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

High Flow Method
       Pressure and Weir flow
           Submerged Inlet Cd          =
           Submerged Inlet + Outlet Cd =      .8
           Max Low Cord                =

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

BRIDGE OUTPUT  Profile #100-Year
**********************************************************************************
*********
* E.G. US. (ft)          *     812.98  * Element                *Inside BR US
*Inside BR DS *
* W.S. US. (ft)          *     811.37  * E.G. Elev (ft)         *     812.98  *
812.55  *
* Q Total (cfs)          *    5150.00  * W.S. Elev (ft)         *     811.37  *
811.37  *
* Q Bridge (cfs)         *    3745.66  * Crit W.S. (ft)         *     809.07  *
808.56  *
* Q Weir (cfs)           *    1404.34  * Max Chl Dpth (ft)      *       9.37  *
 9.37  *
* Weir Sta Lft (ft)      *    -743.89  * Vel Total (ft/s)       *       4.96  *
 3.11  *
* Weir Sta Rgt (ft)      *      47.59  * Flow Area (sq ft)      *    1039.14  *
1658.36  *
* Weir Submerg           *       0.00  * Froude # Chl           *       0.70  *
 0.61  *
* Weir Max Depth (ft)    *       0.78  * Specif Force (cu ft)  *    4101.22  *
4082.60  *
* Min El Weir Flow (ft)  *     812.21  * Hydr Depth (ft)       *             *
 5.36  *
* Min El Prs (ft)        *     810.00  * W.P. Total (ft)       *     129.82  *
444.82  *
* Delta EG (ft)          *       0.43  * Conv. Total (cfs)     *             *
       *
* Delta WS (ft)          *       0.26  * Top Width (ft)        *             *
309.33  *
* BR Open Area (sq ft)   *     427.46  * Frctn Loss (ft)       *             *
       *
* BR Open Vel (ft/s)     *       8.76  * C & E Loss (ft)       *             *
       *
* Coef of Q              *             * Shear Total (lb/sq ft) *             *
       *
```

* Br Sel Method * Press/Weir * Power Total (lb/ft s) * -783.32 * -894.09 *

****

Note: The downstream water surface is above the minimum elevation required for orifice flow. The orifice flow equation was used for pressure flow.

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

Note: For the cross section inside the bridge at the upstream end, the water surface and energy have been projected from the upstream cross section. The selected bridge modeling method does not compute answers inside the bridge.

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

Note: For the cross section inside the bridge at the downstream end, the water surface and energy have been projected from the downstream cross section. The selected bridge modeling method does not compute answers inside the bridge.

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 2603.43

INPUT
Description: S
Station Elevation Data num= 168

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-894.09	816.87	-876.52	814.4	-831.94	811.38	-830.85	811.3	-830.72	811.29
-823.48	810.55	-823.34	810.52	-820.05	810.19	-818.82	810.68	-818.75	810.7
-818.67	810.71	-815.87	811.16	-809.43	811	-784.07	810.46	-778.22	810.36
-745.9	810.51	-718.61	810.5	-715.28	810.48	-707.53	810.45	-704.06	810.44
-703.62	810.45	-664.69	810.04	-638.25	809.64	-625.96	809.74	-618.61	809.75
-599.23	809.86	-584.82	810.13	-569.62	810.31	-551.66	810.8	-528.92	811.45
-528.79	811.47	-527.09	811.55	-522.26	811.71	-510.94	811.18	-500.7	811.56
-476.48	811.6	-467.12	811.53	-464.76	811.52	-461.95	811.56	-432.04	811.7
-423.95	811.73	-418.48	811.69	-391.41	811.38	-372.01	811.72	-371.95	811.67
-370.07	811.7	-368.61	811.83	-363.43	811.89	-350.22	811.76	-349.4	811.76
-345.61	811.67	-321.9	811.34	-318.71	811.36	-304.07	810.9	-302.05	810.88
-294.79	810.9	-289.51	810.85	-280.21	810.76	-274.05	810.67	-272.54	810.58
-247.3	810.31	-242.95	810.26	-226.04	809.86	-208.97	809.51	-201.01	809.47
-196.58	809.5	-179.02	809.17	-163.54	808.91	-155.16	808.84	-147.64	808.66
-138.16	808.75	-136.69	808.74	-128.47	808.6	-126.5	808.4	-112.75	808.41
-101.83	808.22	-87.87	808.42	-79.46	808.57	-70.73	808.12	-56.58	807.63
-41.5	806.76	-36.54	806.63	-31.16	806.57	-28.47	806.55	-26.43	806.53
-26.25	806.42	-25.52	805.98	-22.05	802.88	-21.93	802.8	-21.2	802.12
-21.19	802.1	-21.17	802.09	-21.15	802.08	-21.12	802.07	-21.1	802.06
-21.08	802.04	-21.06	802.03	-21.03	802.02	-21.01	802	-3.33	802
0	802	8.49	802	12.86	802	19.91	802	21.64	802.22
23.61	802.46	24.81	802.61	25.62	802.71	26.21	802.79	26.65	802.84
27	802.88	27.27	802.92	27.5	802.95	27.69	802.97	27.71	802.97
27.85	802.99	27.99	803.01	28.11	803.02	28.22	803.04	28.31	803.05
28.39	803.06	28.47	803.07	28.54	803.08	28.6	803.08	28.65	803.09
28.7	803.1	28.75	803.1	28.79	803.11	28.83	803.11	28.87	803.12
28.9	803.12	28.93	803.12	28.96	803.13	28.99	803.13	29.01	803.14
29.04	803.14	29.06	803.14	29.08	803.14	29.1	803.15	29.12	803.15
29.14	803.15	29.16	803.15	29.37	803.21	29.76	803.33	29.88	803.36
35.8	806.62	35.86	806.64	36.09	806.68	36.39	806.71	46.81	807.54
52.56	807.93	59.22	809.23	65.51	809.86	65.97	809.9	73.35	810.89

79.45	811.7	80.35	811.82	80.79	811.87	94.07	812.91	95.32	813.03
98.75	813.24	107.94	813.92	114.81	814.09	117.15	814.33	128.42	814.96
128.96	814.96	139.38	815.3	141.42	815.61				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-894.09	.05	-26.43	.035	35.8	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-26.43	35.8	66 48.89	51	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-894.09	-26.57	811	T
36.35	141.42	811	T

CROSS SECTION OUTPUT Profile #100-Year

* E.G. Elev (ft)	* 812.55	* Element	* Left OB	* Channel * Right OB *
* Vel Head (ft)	* 1.44	* Wt. n-Val.	* 0.050	* 0.035 * 0.050 *
* W.S. Elev (ft)	* 811.11	* Reach Len. (ft)	* 66.00	* 48.89 * 51.00 *
* Crit W.S. (ft)	* 808.56	* Flow Area (sq ft)	* 64.38	* 530.49 * 6.82 *
* E.G. Slope (ft/ft)	*0.003137	* Area (sq ft)	* 800.22	* 530.49 * 96.43 *
* Q Total (cfs)	* 5150.00	* Flow (cfs)	* 25.02	* 5121.47 * 3.52 *
* Top Width (ft)	* 672.15	* Top Width (ft)	* 570.68	* 62.23 * 39.24 *
* Vel Total (ft/s)	* 8.56	* Avg. Vel. (ft/s)	* 0.39	* 9.65 * 0.52 *
* Max Chl Dpth (ft)	* 9.11	* Hydr. Depth (ft)	* 0.11	* 8.52 * 0.17 *
* Conv. Total (cfs)	* 91946.9	* Conv. (cfs)	* 446.7	* 91437.5 * 62.8 *
* Length Wtd. (ft)	* 49.25	* Wetted Per. (ft)	* 570.97	* 64.85 * 39.53 *
* Min Ch El (ft)	* 802.00	* Shear (lb/sq ft)	* 0.02	* 1.60 * 0.03 *
* Alpha	* 1.27	* Stream Power (lb/ft s)	* 141.42	* 0.00 * 0.00 *
* Frctn Loss (ft)	* 0.13	* Cum Volume (acre-ft)	* 103.26	* 41.09 * 65.03 *
* C & E Loss (ft)	* 0.28	* Cum SA (acres)	* 30.36	* 3.59 * 14.11 *

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

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 2554.54

INPUT

Description: T
Station Elevation Data num= 139

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-980.71	816.65	-966.99	815.72	-911.36	811.71	-908.48	811.07	-902.49	810.68
-900.98	810.45	-899.91	810.48	-897.13	810.75	-896.07	811.03	-892.29	811.28
-887.6	811.56	-880.22	811.58	-864.67	810.85	-857.47	811.08	-844.2	810.59
-827.89	810.55	-810.53	810.54	-808.89	810.49	-793.01	810.03	-739.04	809.86
-733.68	809.8	-724.34	809.77	-692.73	809.42	-688.21	809.41	-662.05	809.38
-655.02	809.41	-652.17	809.09	-622.65	809.43	-607.5	809.45	-561.09	809.11
-552.41	809.15	-549.56	809.18	-504.79	809.52	-502.65	809.58	-492.03	810.02
-479.47	810.44	-478.93	810.37	-477.23	810.45	-472.11	810.51	-457.61	810.92
-451.18	810.99	-440.74	811.54	-437.51	811.53	-416.3	811.75	-415.69	811.75
-415.3	811.74	-414.24	811.88	-400.27	813.22	-381.79	814.19	-377.69	814.34
-372.13	814.15	-345.57	813.99	-344.8	813.99	-331.37	813.94	-304.29	813.83
-291.47	813.82	-282.04	813.66	-265.95	813.24	-255.64	813.03	-243.09	812.44
-238.48	812.34	-220.12	812.29	-217.37	812.29	-210.91	812.01	-200.05	811.45
-195.07	811.43	-178.84	811.24	-167.69	811.33	-160.54	811.31	-139.86	811.31
-129.03	811.32	-105.31	811.26	-98.54	811.22	-75.44	810.6	-68.79	810.44
-65.81	810.3	-51.67	809.76	-46.88	809.31	-43.87	809.05	-34.16	808.14
-31.74	807.97	-30.75	807.66	-29.78	807.07	-25.71	804.6	-25.19	804.28
-24.27	803.72	-20.91	801.64	-14.53	801.01	-13.49	800.98	-4.76	801.32
-4.06	801.36	-3.06	801.36	-3.03	801.36	-2.99	801.36	-2.95	801.36
-2.9	801.36	-2.84	801.37	-2.78	801.37	-2.17	801.38	0	801.42
13.69	801.68	15.73	802.24	21.21	803.74	26.6	805.12	29.74	806
30.15	806.06	30.83	806.16	30.99	806.18	37.76	807.72	42.93	807.76
45.16	807.86	51.27	808.01	53.64	808.06	72.68	808.47	86.63	808.59
94.2	808.73	118.85	810.47	122.89	810.79	123.74	810.9	152.29	815.32
160.72	815.76	161.08	815.74	161.18	815.74	161.39	815.75	161.98	815.77
171.11	815.96	171.87	815.94	183.22	815.73	183.71	815.73	184.32	815.73
184.46	815.73	188.65	815.68	189.99	815.55	191.72	815.42	192.1	815.42
192.46	815.56	192.97	815.92	193.47	816.19	198.2	817.61		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-980.71	.05	-30.75	.035	37.76	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-30.75	37.76	293 200.01	191	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
-950.83	-400.77	814.31	F

CROSS SECTION OUTPUT Profile #100-Year

* E.G. Elev (ft)	* 812.14	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.87	* Wt. n-Val.	* 0.050	* 0.035	* 0.050 *
* W.S. Elev (ft)	* 811.27	* Reach Len. (ft)	* 293.00	* 200.01	* 191.00 *
* Crit W.S. (ft)	* 809.13	* Flow Area (sq ft)	* 85.62	* 562.53	* 213.76 *
* E.G. Slope (ft/ft)	*0.002231	* Area (sq ft)	* 705.30	* 562.53	* 213.76 *
* Q Total (cfs)	* 5150.00	* Flow (cfs)	* 126.92	* 4482.87	* 540.21 *
* Top Width (ft)	* 686.37	* Top Width (ft)	* 529.49	* 68.51	* 88.37 *
* Vel Total (ft/s)	* 5.98	* Avg. Vel. (ft/s)	* 1.48	* 7.97	* 2.53 *

* Max Chl Dpth (ft)	* 10.29	* Hydr. Depth (ft)	* 1.01	* 8.21	* 2.42	*		
* Conv. Total (cfs)	*109034.1	* Conv. (cfs)	* 2687.2	* 94909.8	* 11437.1	*		
* Length Wtd. (ft)	* 216.34	* Wetted Per. (ft)	* 84.95	* 71.01	* 88.49	*		
* Min Ch El (ft)	* 800.98	* Shear (lb/sq ft)	* 0.14	* 1.10	* 0.34	*		
* Alpha	* 1.57	* Stream Power (lb/ft s)	* 198.20	* 0.00	* 0.00	*		
* Frctn Loss (ft)	* 0.26	* Cum Volume (acre-ft)	* 102.12	* 40.48	* 64.85	*		
* C & E Loss (ft)	* 0.18	* Cum SA (acres)	* 29.53	* 3.51	* 14.03	*		

****

Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 2354.53

INPUT
Description: W
Station Elevation Data num= 273

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-500.98	823.09	-475.76	815.71	-473	814.91	-469.19	814.37	-464.75	813.08
-456.29	811.56	-452.29	810.91	-442.76	810.55	-436.56	810.3	-393.36	808.35
-372.59	807.93	-360.28	807.95	-359.42	807.95	-358.55	807.96	-357.68	807.96
-356.8	807.97	-355.93	807.97	-355.05	807.98	-354.16	807.98	-353.27	807.99
-352.39	807.99	-351.49	808	-350.6	808	-349.7	808.01	-348.79	808.01
-347.89	808.02	-346.98	808.02	-346.07	808.03	-345.15	808.03	-344.24	808.04
-343.31	808.04	-342.39	808.05	-341.46	808.05	-340.53	808.06	-339.59	808.06
-338.66	808.07	-337.71	808.07	-336.77	808.08	-335.82	808.08	-334.87	808.09
-333.91	808.09	-332.96	808.1	-331.99	808.1	-331.03	808.11	-330.06	808.11
-328.11	808.13	-327.13	808.13	-326.15	808.14	-325.16	808.14	-324.17	808.15
-323.17	808.15	-322.18	808.16	-321.18	808.16	-319.16	808.18	-318.15	808.18
-317.13	808.19	-316.11	808.19	-315.09	808.2	-314.06	808.2	-311.99	808.22
-310.95	808.22	-309.91	808.23	-308.86	808.23	-307.81	808.24	-306.75	808.24
-304.63	808.26	-303.56	808.26	-302.49	808.27	-301.41	808.27	-299.25	808.29
-298.16	808.29	-295.97	808.31	-294.87	808.31	-293.77	808.32	-292.66	808.32
-290.42	808.34	-289.3	808.34	-288.17	808.35	-287.04	808.35	-284.76	808.37
-283.62	808.37	-281.32	808.39	-280.16	808.39	-277.83	808.41	-276.65	808.41
-274.29	808.43	-273.11	808.43	-270.72	808.45	-269.52	808.45	-267.1	808.47
-265.89	808.47	-262.33	808.5	-261.12	808.5	-256.41	808.54	-255.17	808.54
-254.04	808.55	-253.97	808.55	-252.85	808.56	-252.78	808.56	-251.67	808.57
-251.59	808.57	-250.48	808.58	-249.3	808.58	-249.21	808.59	-248.02	808.59
-246.93	808.6	-246.82	808.6	-245.75	808.61	-245.63	808.61	-244.57	808.62
-243.51	808.62	-242.47	808.63	-242.34	808.63	-241.3	808.64	-241.16	808.64
-240.14	808.65	-239.98	808.65	-238.97	808.66	-237.62	808.66	-236.64	808.67
-236.45	808.67	-235.47	808.68	-235.27	808.68	-234.3	808.69	-233.14	808.69
-232.91	808.7	-231.73	808.7	-230.81	808.71	-230.56	808.71	-229.65	808.72

-229.38	808.72	-228.49	808.73	-227.33	808.73	-227.02	808.74	-225.84	808.74
-225.01	808.75	-224.67	808.75	-223.85	808.76	-223.49	808.76	-222.69	808.77
-221.54	808.77	-221.13	808.78	-219.96	808.78	-219.23	808.79	-218.78	808.79
-218.08	808.8	-216.93	808.8	-216.42	808.81	-215.78	808.81	-215.24	808.82
-214.07	808.82	-213.5	808.83	-212.89	808.83	-212.36	808.84	-211.22	808.84
-210.53	808.85	-210.09	808.85	-209.35	808.86	-208.18	808.86	-207.84	808.87
-206.72	808.87	-205.82	808.88	-205.62	808.88	-204.64	808.89	-204.51	808.89
-203.46	808.9	-201.16	808.9	-200.9	808.91	-198.19	808.91	-198.07	808.92
-196.33	808.92	-196.11	808.93	-194.44	808.93	-194.08	808.94	-192.3	808.94
-191.74	808.95	-190.43	808.95	-189.66	808.96	-189.04	808.96	-187.97	808.97
-187.81	808.97	-186.47	808.98	-186.13	808.98	-184.95	808.99	-184.44	808.99
-183.41	809	-182.76	809	-181.85	809.01	-181.07	809.01	-180.28	809.02
-179.38	809.02	-178.69	809.03	-177.7	809.03	-177.1	809.04	-176.01	809.04
-175.49	809.05	-174.33	809.05	-173.88	809.06	-172.64	809.07	-172.26	809.07
-170.96	809.08	-170.64	809.08	-169.27	809.09	-169.01	809.09	-167.59	809.1
-167.37	809.1	-165.9	809.11	-165.74	809.11	-164.22	809.12	-164.1	809.12
-162.53	809.13	-162.45	809.13	-159.16	809.15	-158.92	809.15	-158.11	809.16
-157.18	809.16	-156.25	809.17	-155.32	809.17	-153.5	809.19	-152.59	809.19
-151.7	809.2	-150.81	809.2	-149.92	809.21	-143.84	809.14	-140.97	809.14
-139.56	809.13	-131.4	809.13	-130.09	809.12	-122.5	809.12	-121.28	809.11
-113.06	809.11	-111.93	809.1	-103.26	809.1	-102.22	809.09	-94.24	809.09
-93.28	809.08	-72.9	809.08	-53.64	808.83	-53.3	808.83	-42.92	808.79
-36.84	808.13	-23.47	806.92	-19.51	804.16	-12.79	800.05	-10.78	799.14
-7.5	798.07	-3.16	797.95	-.23	798.13	0	798.16	7.77	799.04
12.76	799.53	14.53	799.99	19.12	802.85	22.1	804.84	29.43	805.45
40.13	805.82	47.52	806.56	48.05	806.59	49.68	806.84	53.14	806.92
59.06	807.23	74.02	807.96	88.07	809.49	111.46	811.68	126.83	812.75
130.88	812.86	132.22	812.98	148.01	813.9	183.36	815.24	188.34	815.39
189.8	815.43	195.35	815.57	196.04	814.68				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-500.98	.05	-23.47	.035	22.1	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-23.47	22.1	144	48.15	69	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	811.70	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.27	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	811.43	Reach Len. (ft)	144.00	48.15	69.00
Crit W.S. (ft)		Flow Area (sq ft)	1143.18	501.79	313.90
E.G. Slope (ft/ft)	0.000761	Area (sq ft)	1143.18	501.79	313.90
Q Total (cfs)	5150.00	Flow (cfs)	1792.52	2751.89	605.58
Top Width (ft)	564.25	Top Width (ft)	432.01	45.57	86.67
Vel Total (ft/s)	2.63	Avg. Vel. (ft/s)	1.57	5.48	1.93
Max Chl Dpth (ft)	13.48	Hydr. Depth (ft)	2.65	11.01	3.62
Conv. Total (cfs)	186678.6	Conv. (cfs)	64975.9	99751.3	21951.4
Length Wtd. (ft)	85.74	Wetted Per. (ft)	432.21	49.52	86.96

* Min Ch El (ft)	*	797.95	* Shear (lb/sq ft)	*	0.13	*	0.48	*	0.17 *
* Alpha	*	2.51	* Stream Power (lb/ft s)	*	196.04	*	0.00	*	0.00 *
* Frctn Loss (ft)	*	0.06	* Cum Volume (acre-ft)	*	95.90	*	38.04	*	63.69 *
* C & E Loss (ft)	*	0.02	* Cum SA (acres)	*	26.29	*	3.25	*	13.65 *

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CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 2306.38

INPUT
Description: X
Station Elevation Data num= 140

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-600	815.04	-596.19	813.22	-584.78	812.21	-583.55	812.22	-579.05	812
-578.87	811.96	-558.88	811.42	-541.39	811.12	-534.26	811.07	-528.51	810.88
-490.74	810.6	-487.37	810.58	-487.09	810.57	-483.51	810.51	-442.65	810.06
-413.39	808.76	-404	808.13	-396.13	807.99	-392.09	807.99	-391.95	808
-390.23	808	-390.08	808.01	-388.39	808.01	-388.23	808.02	-386.4	808.02
-386.23	808.03	-384.64	808.03	-384.45	808.04	-382.75	808.04	-382.56	808.05
-380.95	808.05	-380.74	808.06	-379.03	808.06	-378.81	808.07	-376.99	808.07
-376.75	808.08	-375.31	808.08	-375.06	808.09	-373.27	808.09	-373.01	808.1
-371.39	808.1	-371.11	808.11	-369.69	808.11	-369.4	808.12	-270.12	808.39
-269.44	808.39	-268.76	808.4	-268.07	808.4	-267.39	808.41	-266.7	808.41
-266	808.42	-265.31	808.42	-264.61	808.43	-263.21	808.43	-262.51	808.44
-261.8	808.44	-261.09	808.45	-260.38	808.45	-259.66	808.46	-258.94	808.46
-258.22	808.47	-257.5	808.47	-256.77	808.48	-256.04	808.48	-255.31	808.49
-254.57	808.49	-253.84	808.5	-252.35	808.5	-251.61	808.51	-250.86	808.51
-250.1	808.52	-249.35	808.52	-248.59	808.53	-247.83	808.53	-247.07	808.54
-246.3	808.54	-245.53	808.55	-244.76	808.55	-243.98	808.56	-243.2	808.56
-242.42	808.57	-241.63	808.57	-240.85	808.58	-240.05	808.58	-239.26	808.59
-238.46	808.59	-237.66	808.6	-221.08	808.63	-194.05	808.39	-190.81	808.4
-189.5	808.43	-176.68	808.62	-165.82	808.85	-165.44	808.85	-165.05	808.86
-163.92	808.86	-163.54	808.87	-162.06	808.87	-161.7	808.88	-160.61	808.88
-67.79	807.94	-61.68	807.94	-61.46	807.95	-55.48	807.95	-55.3	807.96
-53.7	807.96	-46.53	807.87	-42.07	807.83	-25.4	807	-23.53	805.77
-14.98	799.89	-14.31	799.59	-10.39	798.34	-9.53	798.4	-4.34	798.44
0	798.76	2.37	798.93	3.33	799.04	3.92	799.19	9.66	800.26
13.12	802.38	17.84	805.01	36.45	805.24	44.58	806.39	58.79	806.64
63.08	806.74	90.19	807.54	99.16	807.86	114.68	808.3	122.11	808.58
141.52	810.58	154.18	811.63	158.79	812.07	163.4	812.37	166.83	812.49
196.42	813.78	204.95	814.18	207.15	814.28	209.93	814.36	240.28	815.28

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-600	.05	-25.4	.035	17.84	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-25.4	17.84	90	51.84	42	.1	.3

CROSS SECTION OUTPUT Profile #100-Year
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* E.G. Elev (ft)	*	811.61	* Element	*	Left OB	*	Channel *

Right OB					
* Vel Head (ft)	* 0.19	* Wt. n-Val.	* 0.050	* 0.035	* 0.050 *
* W.S. Elev (ft)	* 811.42	* Reach Len. (ft)	* 90.00	* 51.84	* 42.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 1354.51	* 461.50	* 516.45 *
* E.G. Slope (ft/ft)	*0.000648	* Area (sq ft)	* 1354.51	* 461.50	* 516.45 *
* Q Total (cfs)	* 5150.00	* Flow (cfs)	* 1906.69	* 2283.32	* 959.99 *
* Top Width (ft)	* 710.67	* Top Width (ft)	* 533.59	* 43.24	* 133.84 *
* Vel Total (ft/s)	* 2.21	* Avg. Vel. (ft/s)	* 1.41	* 4.95	* 1.86 *
* Max Chl Dpth (ft)	* 13.08	* Hydr. Depth (ft)	* 2.54	* 10.67	* 3.86 *
* Conv. Total (cfs)	*202300.6	* Conv. (cfs)	* 74897.8	* 89692.8	* 37710.1 *
* Length Wtd. (ft)	* 65.18	* Wetted Per. (ft)	* 533.69	* 47.12	* 134.10 *
* Min Ch El (ft)	* 798.34	* Shear (lb/sq ft)	* 0.10	* 0.40	* 0.16 *
* Alpha	* 2.51	* Stream Power (lb/ft s)	* 240.28	* 0.00	* 0.00 *
* Frctn Loss (ft)	* 0.04	* Cum Volume (acre-ft)	* 91.77	* 37.50	* 63.03 *
* C & E Loss (ft)	* 0.02	* Cum SA (acres)	* 24.70	* 3.20	* 13.47 *

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CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 2254.54

INPUT
Description: Y
Station Elevation Data num= 228

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-710.8	813.44	-709.97	813.28	-708.61	813.03	-707.74	812.99	-702.01	812.28
-700	811.99	-699.21	811.96	-699.07	811.96	-686.39	811.6	-681.01	811.55
-658.05	811.53	-637	811.35	-632.92	811.32	-619.88	810.88	-619.82	810.63
-610.1	808.98	-609.64	808.98	-609.18	808.97	-607.32	808.97	-606.84	808.96
-605.42	808.96	-604.93	808.95	-603.67	808.96	-603.19	808.97	-602.19	808.97
-601.67	808.98	-601.18	808.98	-600.67	808.99	-600.17	808.99	-599.67	809
-599.16	809	-598.66	809.01	-598.16	809.01	-597.66	809.02	-597.15	809.02
-595.66	809.05	-595.17	809.05	-593.69	809.08	-593.22	809.08	-592.71	809.09
-592.25	809.1	-591.73	809.11	-591.28	809.11	-590.76	809.12	-590.31	809.13
-589.23	809.15	-588.85	809.16	-588.28	809.17	-587.9	809.17	-587.32	809.18
-586.95	809.19	-586.37	809.2	-586	809.21	-585.41	809.21	-583.55	809.24
-582.89	809.26	-582.25	809.27	-579.5	809.33	-579.19	809.34	-578.43	809.36
-578.14	809.37	-577.37	809.4	-577.08	809.4	-576.3	809.43	-576	809.44
-575.19	809.46	-574.91	809.47	-574.09	809.49	-573.57	809.51	-572.68	809.53
-572.44	809.54	-571.59	809.57	-571.36	809.57	-570.49	809.6	-570.28	809.6
-569.39	809.63	-569.2	809.64	-568.29	809.66	-568.11	809.67	-567.18	809.7
-567.02	809.7	-566.07	809.73	-565.93	809.73	-564.96	809.76	-564.84	809.76
-563.85	809.79	-563.74	809.8	-562.74	809.83	-562.65	809.83	-561.62	809.86
-561.55	809.86	-560.51	809.89	-560.45	809.89	-559.39	809.92	-558.26	809.96
-558.14	809.96	-557.05	809.99	-556.82	810	-556	810	-554.99	810.01

-553.02	810.01	-552.06	810.02	-551.11	810.02	-543.84	810	-501.31	810
-501.07	809.99	-499.91	809.97	-498.78	809.94	-497.68	809.92	-496.71	809.9
-495.76	809.87	-494.82	809.85	-494.24	809.85	-493.22	809.82	-493.12	809.82
-492.13	809.79	-491.86	809.78	-490.87	809.75	-489.9	809.73	-488.97	809.7
-488.8	809.7	-487.94	809.67	-487.75	809.67	-486.9	809.65	-486.7	809.64
-485.87	809.62	-485.65	809.62	-484.82	809.6	-484.59	809.59	-483.78	809.57
-483.54	809.57	-482.73	809.55	-482.48	809.54	-481.69	809.52	-481.41	809.52
-480.63	809.5	-480.55	809.5	-480.26	809.49	-479.63	809.49	-479.33	809.48
-478.73	809.48	-478.42	809.47	-477.54	809.45	-477.22	809.44	-476.36	809.42
-476.02	809.41	-475.18	809.39	-474.82	809.39	-474	809.36	-473.62	809.36
-472.82	809.33	-472.36	809.33	-470.39	809.28	-469.96	809.28	-469.2	809.26
-468.76	809.25	-468.02	809.23	-467.57	809.23	-446.83	808.86	-445.12	808.82
-443.57	808.78	-442.84	808.76	-442.78	808.76	-423.48	808.33	-423.16	808.32
-422.85	808.32	-422.26	808.3	-421.99	808.3	-411.23	808	-355.26	808
-305.73	808.14	-305.47	808.15	-304.16	808.15	-303.9	808.16	-302.55	808.16
-302.28	808.17	-301.17	808.17	-300.89	808.18	-299.47	808.18	-299.19	808.19
-298.02	808.19	-297.73	808.2	-296.54	808.2	-296.23	808.21	-295.01	808.21
-294.7	808.22	-293.45	808.22	-293.13	808.23	-252.94	808.31	-239.24	808.19
-207.69	808.26	-176.3	808.43	-167.71	808.62	-50.35	807.51	-26.21	806.95
-22.65	804.84	-15.41	799.87	-12.68	798.81	-11.48	798.53	-7.82	799.05
-5.45	799.34	-.27	799.85	0	799.86	1.79	799.91	8.44	800.17
10.39	800.27	12.02	801.53	18.58	804.69	33.45	805.08	33.64	805.09
33.75	805.11	41.59	806.49	61.29	806.74	63.84	806.78	69.72	806.8
99.43	807.45	99.94	807.47	126.43	807.87	140.95	808.4	142.39	808.43
163.62	809.25	175.01	810.36	176.19	810.47	193.42	812.18	221.23	813.76
226.1	814.12	234.24	814.56	253.92	815.17				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-710.8	.05	-26.21	.035	18.58	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-26.21	18.58	90	50	45	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	811.56	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.12	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	811.43	Reach Len. (ft)	90.00	50.00	45.00
Crit W.S. (ft)		Flow Area (sq ft)	1721.13	463.64	639.25
E.G. Slope (ft/ft)	0.000476	Area (sq ft)	1721.13	463.64	639.25
Q Total (cfs)	5150.00	Flow (cfs)	2201.24	1937.17	1011.60
Top Width (ft)	832.81	Top Width (ft)	620.69	44.79	167.33
Vel Total (ft/s)	1.82	Avg. Vel. (ft/s)	1.28	4.18	1.58
Max Chl Dpth (ft)	12.90	Hydr. Depth (ft)	2.77	10.35	3.82
Conv. Total (cfs)	236093.6	Conv. (cfs)	100912.3	88806.3	46375.1
Length Wtd. (ft)	68.70	Wetted Per. (ft)	621.10	48.38	167.60
Min Ch El (ft)	798.53	Shear (lb/sq ft)	0.08	0.28	0.11
Alpha	2.33	Stream Power (lb/ft s)	253.92	0.00	

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   0.00  *
* Frctn Loss (ft)        *    0.02  * Cum Volume (acre-ft)   *   88.59  *   36.95  *
  62.48  *
* C & E Loss (ft)        *    0.02  * Cum SA (acres)         *   23.51  *    3.15  *
  13.33  *
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CROSS SECTION


RIVER: Buckeye Creek
REACH: Buckeye Creek       RS: 2204.54

INPUT
Description: Z
Station Elevation Data    num=     165
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
  -920.1  820.14 -896.19  814.15 -895.12  814.33 -893.31  813.88 -892.86  813.34
 -892.27   813.3 -892.03  813.32 -876.99  813.58 -876.65  813.55 -876.47  813.56
 -876.24  813.54 -872.18  813.51 -870.87  813.28 -869.03  813.08 -868.31  812.86
 -855.14  813.35 -849.65  813.23  -812.3  812.37 -806.56  812.06 -779.56   810.8
 -766.96   810.5 -766.64  810.49 -765.57  810.49  -765.2  810.48 -764.43  810.48
 -764.03  810.47 -763.26  810.47 -762.89  810.46 -761.51  810.46 -758.71  810.45
 -757.65  810.45  -757.1  810.44 -756.54  810.44 -755.96  810.43 -755.35  810.43
 -736.34  810.09 -727.76     810 -724.67     810 -723.11  809.93 -722.72   809.9
 -720.45  809.79 -720.19  809.78 -718.07  809.67 -715.71  809.55 -715.15  809.52
 -713.35  809.43    -711   809.3 -710.14  809.25 -708.66  809.18 -707.65  809.11
 -706.33  809.05 -705.16  808.97 -704.01  808.91 -702.67  808.83  -701.7  808.78
  -700.2  808.68  -699.4  808.64 -695.15  808.37 -694.71  808.35 -692.62  808.21
 -690.13  808.04 -689.45     808  -685.9  807.81 -682.12   807.6 -679.11  807.44
 -677.88  807.38 -671.69  807.04 -669.67  806.94 -668.04  806.85 -665.59  806.72
 -664.32  806.65 -661.42   806.5  -657.4  806.28 -657.06  806.27 -656.63  806.24
 -652.82  806.04 -652.75  806.04 -652.03     806 -593.71     806 -593.13  806.02
 -588.37   806.2  -584.4  806.36 -581.06  806.48 -573.44  806.78 -573.35  806.78
 -572.14  806.82 -570.81  806.86 -569.34   806.9 -567.72  806.95 -565.91     807
 -558.99  807.21 -557.23  807.27 -555.81  807.33 -554.58  807.37 -553.51  807.41
 -552.56  807.45 -551.72  807.48 -550.97  807.51  -550.3  807.53 -550.16  807.53
 -549.52  807.56 -548.94  807.58 -548.41   807.6 -547.93  807.62 -547.49  807.63
 -547.14  807.65 -546.81  807.66 -546.51  807.67 -546.19  807.68 -545.62   807.7
 -545.36  807.71 -536.11     808 -297.24     808  -281.9  808.03 -280.46  808.02
 -277.08  808.03 -262.39  808.11 -202.84  808.29 -173.64   807.9  -170.7  807.89
  -159.9   807.7 -148.14  807.54 -117.32  807.28   -93.7  807.48  -78.23  807.81
  -46.46  808.15  -36.05  807.73  -24.39  806.89  -16.87  802.56  -12.29   799.9
  -10.83  799.57    -3.6  798.81    -.66  799.18       0  799.22    5.47  799.58
    7.65  799.65    9.47  799.75   15.49  800.09   17.16  801.36   19.95  804.35
    25.2   804.7   29.78  804.99   36.45  806.08   39.89  806.63   55.27  806.92
   59.82  806.89   85.88  806.81  100.95  807.11  118.08  807.56  134.44  807.79
  136.61  807.85  149.16  807.76  170.32  807.81  189.32  808.47  190.53  808.49
   191.3  808.57  191.95  808.65  200.96  809.38   215.3  810.83  226.77  812.05
  229.06  812.33  231.06  812.53  233.55  812.84  257.98  814.32  265.36  814.85

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
  -920.1     .05  -24.39    .035   19.95     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        -24.39   19.95               74      50      44            .1       .3

CROSS SECTION OUTPUT  Profile #100-Year
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* E.G. Elev (ft)	* 811.51	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.05	* Wt. n-Val.	* 0.050	* 0.035	* 0.050 *
* W.S. Elev (ft)	* 811.46	* Reach Len. (ft)	* 74.00	* 50.00	* 44.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 2701.08	* 472.71	* 782.92 *
* E.G. Slope (ft/ft)	*0.000236	* Area (sq ft)	* 2701.08	* 472.71	* 782.92 *
* Q Total (cfs)	* 5150.00	* Flow (cfs)	* 2850.12	* 1416.15	* 883.73 *
* Top Width (ft)	* 1014.95	* Top Width (ft)	* 769.33	* 44.34	* 201.28 *
* Vel Total (ft/s)	* 1.30	* Avg. Vel. (ft/s)	* 1.06	* 3.00	* 1.13 *
* Max Chl Dpth (ft)	* 12.65	* Hydr. Depth (ft)	* 3.51	* 10.66	* 3.89 *
* Conv. Total (cfs)	*334996.2	* Conv. (cfs)	*185394.0	* 92117.5	* 57484.7 *
* Length Wtd. (ft)	* 61.88	* Wetted Per. (ft)	* 769.55	* 48.07	* 201.61 *
* Min Ch El (ft)	* 798.81	* Shear (lb/sq ft)	* 0.05	* 0.15	* 0.06 *
* Alpha	* 1.95	* Stream Power (lb/ft s)	* 265.36	* 0.00	* 0.00 *
* Frctn Loss (ft)	* 0.01	* Cum Volume (acre-ft)	* 84.03	* 36.42	* 61.74 *
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 22.07	* 3.10	* 13.14 *

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 2154.54

INPUT
Description: AA
Station Elevation Data num= 240

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-1050.25	820.63	-1046.01	819.69	-1013.47	813.55	-1012.08	813.09	-1010.95	813.03
-1007.66	812.6	-1006.09	811.8	-1005.58	811.43	-1004.49	811.76	-1001.75	812.04
-989.06	811.69	-985.15	811.91	-983.65	811.94	-979.51	811.82	-936.54	810.46
-928.74	810.18	-887.18	809.85	-877.57	809.89	-877.45	809.89	-874.23	809.92
-873.47	809.93	-872.44	809.95	-870.94	809.97	-868.31	810	-868.11	810
-866.76	809.98	-862.23	809.89	-861.9	809.89	-860.39	809.86	-840.5	809.5
-840.11	809.5	-839.76	809.49	-839.4	809.49	-839.03	809.48	-838.65	809.48
-838.27	809.47	-837.88	809.47	-837.48	809.46	-837.07	809.46	-836.64	809.45
-836.21	809.45	-835.29	809.43	-834.8	809.43	-834.3	809.42	-791.76	808.77
-791.35	808.77	-790.71	808.76	-790.31	808.76	-789.67	808.75	-789.27	808.75
-788.62	808.74	-788.23	808.74	-787.57	808.73	-787.19	808.73	-786.53	808.72
-786.15	808.72	-785.48	808.71	-785.12	808.71	-784.44	808.7	-784.08	808.7
-783.41	808.69	-782.8	808.69	-782.12	808.68	-781.77	808.68	-781.08	808.67
-780.73	808.67	-780.03	808.66	-779.69	808.66	-778.99	808.65	-778.65	808.65
-777.94	808.64	-777.61	808.64	-776.89	808.63	-776.56	808.63	-775.85	808.62
-775.52	808.62	-774.8	808.61	-774.49	808.61	-773.76	808.6	-773.45	808.59
-772.71	808.58	-772.41	808.58	-771.67	808.57	-771.38	808.57	-770.63	808.56
-770.34	808.56	-769.59	808.55	-769.3	808.55	-768.54	808.54	-768.27	808.54

-755.87	808.33	-754.97	808.31	-754.81	808.31	-753.89	808.29	-753.74	808.29
-752.82	808.27	-752.67	808.27	-751.74	808.25	-751.61	808.25	-750.66	808.23
-750.54	808.23	-749.59	808.21	-749.47	808.21	-748.51	808.19	-748.41	808.18
-747.01	808.18	-746.94	808.17	-745.76	808.17	-745.04	808.16	-744.9	808.16
-737.16	808	-722.98	808	-705.02	807.3	-704.02	807.25	-701.59	807.16
-700.41	807.1	-697	806.95	-695.48	806.88	-693.78	806.81	-692.11	806.73
-690.19	806.63	-688.92	806.58	-687.86	806.53	-686.95	806.5	-680.97	806.2
-677.18	806.02	-676.84	806	-628.87	806	-624.75	806.11	-623.33	806.14
-621.96	806.18	-621.8	806.18	-619.64	806.26	-617.64	806.32	-615.79	806.38
-613.24	806.47	-612.44	806.5	-612.16	806.5	-611.37	806.52	-611.08	806.53
-610.3	806.55	-610	806.55	-609.26	806.58	-608.94	806.58	-608.55	806.59
-607.55	806.62	-607.22	806.62	-606.55	806.64	-606.21	806.64	-605.55	806.66
-605.2	806.67	-604.55	806.68	-604.19	806.69	-603.55	806.7	-603.18	806.71
-602.55	806.72	-602.16	806.73	-601.54	806.74	-601.12	806.74	-600.5	806.76
-600.1	806.76	-599.49	806.78	-599.08	806.78	-598.48	806.8	-597.21	806.8
-586.51	807.05	-585.97	807.05	-585.09	807.07	-584.53	807.07	-584.1	807.08
-583.54	807.08	-583.12	807.09	-582.51	807.09	-582.08	807.1	-581.52	807.1
-581.1	807.11	-580.52	807.11	-580.11	807.12	-579.13	807.12	-578.55	807.13
-577.56	807.13	-576.79	807.15	-576.19	807.15	-575.81	807.16	-574.83	807.16
-574.23	807.17	-573.24	807.17	-572.87	807.18	-572.26	807.18	-570.36	807.19
-569.13	807.19	-543.02	808	-182.12	808	-177.95	807.96	-177.84	807.96
-139.2	807.49	-77.02	808.07	-43.93	808.02	-37.15	807.53	-21.68	806.24
-11.01	799.74	-10.69	799.54	-10.59	799.52	-5.56	798.6	-5.29	798.62
3.35	798.83	3.54	798.82	12.36	799.3	12.69	799.28	17.23	800.15
17.56	800.21	18.08	800.51	22.06	801.88	28.84	804.5	30.21	804.68
31.01	804.81	38.21	806.5	53.53	806.9	56.01	806.89	83.27	805.56
90.16	805.89	97.72	805.35	98.09	805.33	98.41	805.31	119.58	805.49
134.35	805.66	139.08	805.15	140.47	805.07	142.84	805.35	145.72	805.7
173.74	807.13	185.9	807.67	200.7	808.17	219.31	808.96	227.19	809.44
230.22	809.96	238.42	810.98	255.45	812.86	266.7	813.74	275.06	814.33

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-1050.25	.05	-21.68	.035	38.21	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-21.68	38.21	63	48.8	47	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	811.50	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	811.46	Reach Len. (ft)	63.00	48.80	47.00
Crit W.S. (ft)		Flow Area (sq ft)	3182.74	603.31	928.67
E.G. Slope (ft/ft)	0.000163	Area (sq ft)	3182.74	603.31	928.67
Q Total (cfs)	5150.00	Flow (cfs)	2710.09	1474.98	964.93
Top Width (ft)	1211.03	Top Width (ft)	946.59	59.89	204.56
Vel Total (ft/s)	1.09	Avg. Vel. (ft/s)	0.85	2.44	1.04
Max Chl Dpth (ft)	12.86	Hydr. Depth (ft)	3.36	10.07	4.54
Conv. Total (cfs)	403391.3	Conv. (cfs)	212277.4	115532.4	75581.5
Length Wtd. (ft)	56.27	Wetted Per. (ft)	946.79	62.98	

204.91	*									
* Min Ch El (ft)	*	798.60	*	Shear (lb/sq ft)	*	0.03	*	0.10	*	
0.05	*									
* Alpha	*	1.92	*	Stream Power (lb/ft s)	*	275.06	*	0.00	*	
0.00	*									
* Frctn Loss (ft)	*	0.01	*	Cum Volume (acre-ft)	*	79.03	*	35.80	*	
60.88	*									
* C & E Loss (ft)	*	0.00	*	Cum SA (acres)	*	20.61	*	3.04	*	
12.93	*									

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Warning: Divided flow computed for this cross-section.

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 2105.74

INPUT
Description: BB
Station Elevation Data num= 200

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-1284.71	828.4	-1264.69	825.28	-1263.81	824.96	-1255.01	824.13	-1251.56	823.73
-1212.64	819.73	-1195.99	817.6	-1171.48	814.52	-1154.57	811.39	-1154.51	811.39
-1152.14	811.04	-1146.22	810.54	-1138.02	810.11	-1130.04	809.79	-1118.28	809.73
-1102.85	809.11	-1094.7	808.94	-1092.67	808.85	-1081.42	809.01	-1046.4	808.93
-1040.72	808.97	-1038.97	808.94	-1035.49	808.84	-992.45	809.89	-987.58	810
-938.5	810	-913.54	809.72	-907.64	809.6	-907.57	809.6	-906.11	809.58
-904.69	809.55	-898.14	809.45	-895.76	809.41	-894.62	809.4	-891.36	809.34
-890.32	809.33	-890.09	809.32	-889.08	809.31	-887.57	809.28	-887.02	809.28
-886.05	809.26	-885.48	809.25	-884.53	809.24	-883.95	809.23	-883.02	809.21
-882.41	809.2	-881.5	809.19	-880.88	809.18	-867.82	808.94	-866.93	808.93
-865.98	808.91	-865.12	808.9	-864.15	808.88	-863.32	808.86	-862.31	808.84
-861.52	808.83	-860.39	808.81	-859.63	808.8	-858.47	808.77	-857.74	808.76
-856.55	808.74	-855.85	808.73	-854.63	808.7	-853.97	808.69	-852.7	808.66
-852.56	808.66	-850.64	808.63	-849.3	808.6	-848.72	808.59	-847.34	808.56
-846.81	808.55	-843.44	808.48	-842.97	808.48	-841.48	808.45	-841.06	808.44
-840.69	808.43	-840.29	808.42	-839.89	808.42	-839.51	808.41	-839.14	808.41
-838.43	808.39	-838.09	808.39	-837.76	808.38	-837.69	808.38	-832.66	808.3
-831.42	808.27	-827.51	808.21	-826.14	808.18	-823.27	808.14	-823.16	808.13
-821.7	808.11	-821.62	808.11	-820.13	808.08	-820.07	808.08	-818.57	808.06
-815.34	808	-742.79	808	-655.57	806.72	-655.26	806.72	-654.72	806.74
-654.43	806.75	-654.15	806.75	-645.4	807.05	-644.35	807.05	-643.86	807.06
-640.51	807.06	-640.44	807.07	-638.73	807.1	-638.13	807.12	-636.88	807.14
-636.24	807.16	-635.57	807.17	-634.89	807.19	-634.2	807.2	-632.75	807.24
-631.09	807.27	-620.02	807.57	-619.11	807.6	-618.17	807.62	-617.2	807.65
-614.9	807.71	-612.76	807.75	-610.73	807.81	-610.24	807.81	-610.12	807.82
-609.89	807.82	-602.84	808	-143.09	808	-135.89	807.88	-134.92	807.87
-134.16	807.85	-134.09	807.85	-127.27	807.75	-115.54	807.75	-111.92	807.81
-109.05	807.88	-107.52	807.88	-106.87	807.89	-105.45	807.89	-104.68	807.9
-103.86	807.9	-102.99	807.91	-101.07	807.91	-90.85	807.94	-89.1	807.94
-77.29	807.99	-69.47	807.99	-68.7	808	-60.94	808	-60.01	807.99
-57.27	807.99	-55.07	807.82	-38.23	806.81	-35.2	806.61	-34.55	806.6
-34.29	806.56	-33.82	806.54	-19.98	805.6	-19	805.03	-11.8	800.15
-7.71	799.5	-5.17	799.19	0	799.12	1.4	799.11	4.01	798.92
10.22	798.03	12.53	797.84	16.97	798.1	18.46	798.17	19.54	798.4
23.6	799.5	26.39	801.64	29.68	803.93	34.42	805.9	38.23	806.07
42.74	806.3	47.09	806.22	62.78	806.13	63.27	806.12	63.62	806.12
64.44	806.15	83.44	806.15	91.23	806.63	94.72	806.8	100.52	806.83
132.42	807.25	132.77	807.26	132.86	807.26	133.05	807.27	173.39	808.66

193.45	809.45	210.92	809.38	236.84	810.04	248.49	810.08	253.06	810.27
259.03	810.45	272.22	811.95	279.37	812.68	292.07	813.79	296.17	814.12

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-1284.71	.05	-19.98	.035	34.42	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-19.98	34.42	190 202.35	215	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	811.49	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	811.45	Reach Len. (ft)	190.00	202.35	215.00
Crit W.S. (ft)		Flow Area (sq ft)	3589.67	607.54	787.18
E.G. Slope (ft/ft)	0.000161	Area (sq ft)	3589.67	607.54	787.18
Q Total (cfs)	5150.00	Flow (cfs)	2918.29	1563.93	667.78
Top Width (ft)	1422.68	Top Width (ft)	1134.90	54.40	233.38
Vel Total (ft/s)	1.03	Avg. Vel. (ft/s)	0.81	2.57	0.85
Max Chl Dpth (ft)	13.61	Hydr. Depth (ft)	3.16	11.17	3.37
Conv. Total (cfs)	405600.4	Conv. (cfs)	229836.4	123171.1	52592.9
Length Wtd. (ft)	196.94	Wetted Per. (ft)	1135.13	58.22	233.53
Min Ch El (ft)	797.84	Shear (lb/sq ft)	0.03	0.11	0.03
Alpha	2.32	Stream Power (lb/ft s)	296.17	0.00	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	74.13	35.12	59.95
C & E Loss (ft)	0.01	Cum SA (acres)	19.11	2.97	12.70

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 1903.41

INPUT
Description: CC
Station Elevation Data num= 299

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-1413.08	816.72	-1407.17	816.44	-1397.75	816.01	-1388.84	815.67	-1377.66	815.3
-1366.03	814.77	-1359.93	814.45	-1351.29	814.1	-1335.15	813.35	-1330.71	813.1
-1329.95	813.06	-1327.67	812.99	-1311.67	812.18	-1308.35	812.07	-1306.25	810.9
-1302.09	807.29	-1301.39	807.14	-1295.3	807.3	-1292.12	807.21	-1288.74	807.57
-1286.35	807.86	-1281.48	808.5	-1273.69	809.7	-1271.01	810.13	-1270.85	810.19

-1265.96	810.47	-1263.08	810.63	-1256.33	810.92	-1254.83	810.96	-1254.52	810.97
-1250.44	811.04	-1235.5	811.18	-1232.76	811.29	-1226.9	811.26	-1221.86	811.26
-1192.42	811.42	-1178.27	811.68	-1173.41	811.87	-1164.4	811.94	-1147.89	811.78
-1132.78	811.57	-1120.92	811.3	-1104.29	810.83	-1092.34	809.98	-1084.47	809.39
-1078.79	809.03	-1060.74	808.69	-1034.31	808.1	-1002.08	807.01	-988.32	806.88
-983.24	806.72	-979.96	806.54	-962.01	805.21	-957.69	804.98	-957.01	805.11
-947.73	806.94	-947.71	807.06	-945.84	807.99	-944.47	807.48	-858.15	808
-799.47	808	-736.49	807.13	-689.04	806.61	-688.74	806.61	-628.45	806.52
-628.28	806.53	-628.11	806.53	-627.93	806.54	-627.75	806.54	-627.57	806.55
-627.38	806.55	-627.19	806.56	-627	806.56	-626.8	806.57	-626.6	806.57
-626.4	806.58	-626.19	806.59	-625.97	806.59	-625.76	806.6	-625.53	806.6
-625.31	806.61	-625.07	806.62	-624.83	806.62	-624.59	806.63	-624.07	806.65
-623.81	806.65	-623.55	806.66	-622.7	806.69	-622.41	806.69	-621.8	806.71
-620.81	806.74	-619.38	806.78	-618.6	806.8	-618.2	806.82	-616.86	806.85
-616.41	806.87	-615.45	806.89	-614.95	806.91	-614.43	806.92	-613.34	806.96
-612.77	806.97	-611.56	807.01	-610.92	807.02	-609.58	807.06	-608.87	807.08
-608.13	807.11	-607.36	807.13	-606.49	807.15	-605.65	807.18	-604.78	807.2
-602.91	807.26	-601.92	807.28	-587.74	807.73	-586.05	807.79	-584.26	807.85
-582.34	807.91	-580.28	807.98	-579.52	808	-497.85	808	-489.92	807.75
-488.12	807.69	-484.48	807.58	-483.72	807.56	-482.13	807.51	-481.69	807.5
-480.17	807.45	-479.66	807.44	-478.21	807.4	-477.65	807.38	-476.26	807.34
-475.65	807.32	-474.32	807.28	-473.66	807.27	-472.47	807.23	-471.77	807.21
-468.8	807.13	-468	807.11	-466.97	807.08	-466.13	807.06	-465.15	807.03
-464.11	807.01	-461.88	806.95	-459.38	806.89	-458.02	806.86	-456.71	806.82
-455.33	806.79	-453.87	806.75	-452.92	806.72	-451.38	806.69	-450.52	806.66
-448.13	806.6	-440.76	806.39	-439.42	806.36	-439.1	806.35	-436.3	806.29
-431.15	806.17	-427.32	806.09	-425.27	806.04	-423.45	806	-374	806
-373.56	806.01	-372.23	806.02	-370.93	806.04	-369.65	806.05	-368.39	806.07
-367.15	806.08	-365.72	806.1	-365.57	806.1	-358.39	806.22	-357.27	806.23
-354.06	806.29	-342.7	806.44	-335.04	806.52	-334.69	806.53	-333.81	806.54
-333.44	806.55	-332.57	806.57	-332.19	806.57	-331.34	806.59	-330.94	806.59
-330.1	806.61	-329.69	806.61	-328.43	806.64	-327.61	806.65	-327.35	806.66
-326.9	806.66	-326.02	806.68	-325.56	806.68	-324.69	806.7	-324.22	806.71
-323.37	806.72	-322.88	806.73	-322.04	806.74	-321.54	806.75	-320.71	806.77
-320.2	806.77	-319.39	806.79	-319.27	806.79	-318.73	806.8	-317.94	806.81
-317.39	806.82	-316.6	806.83	-316.04	806.84	-315.27	806.86	-314.69	806.86
-313.94	806.88	-292.28	807.29	-291.62	807.31	-290.98	807.32	-290.48	807.33
-290	807.33	-287.07	807.39	-286.61	807.4	-286.15	807.4	-285.72	807.41
-284.96	807.43	-261.22	807.95	-261.14	807.96	-260.71	807.96	-259.22	807.99
-258.97	808	-191.55	808	-160.29	808.57	-159.61	808.57	-158.94	808.58
-154.42	808.58	-153.85	808.59	-138.43	808.58	-137.74	808.57	-135.64	808.57
-134.94	808.56	-132.25	808.56	-131.6	808.55	-129.06	808.55	-128.42	808.54
-125.81	808.54	-125.15	808.53	-122.41	808.53	-103.56	808	-61.32	808
-61.14	807.99	-60.4	808	-59.58	808	-57.87	807.98	-57.25	807.68
-56.22	807.71	-40.74	807.96	-40.56	807.88	-39.48	807.93	-39.31	807.9
-38.39	807.84	-31.6	806.91	-23.04	804.62	-18.39	802.72	-15.31	799.68
-13.61	799.14	-11.15	798.59	-8.71	798.6	-4.88	798.82	-2.24	798.91
0	799.21	2.77	799.59	5.36	799.74	15.86	800.78	19.21	801.07
25.98	801.39	28.13	801.7	34.86	801.78	40.98	802.22	64.91	803.69
67.69	803.76	85.92	804.31	102.91	804.36	107.15	804.41	109.56	804.63
123.37	806.87	124.99	806.92	138.39	807.04	154.02	807.98	175.38	808.83
193.46	809.77	211.27	810.13	232.8	810.02	248.61	809.84	261.98	809.75
286.4	809.66	312.77	809.79	322.37	809.86	329.27	809.78	332.46	809.82
341.59	809.72	361.96	809.56	373.32	809.63	394.07	809.51	398.94	809.45
403.05	809.94	422.39	812.19	432.81	813.02	439.57	813.46		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-1413.08	.05	-18.39	.035	28.13	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-18.39	28.13	512 298.87	86	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	811.46	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	811.44	Reach Len. (ft)	512.00	298.87	86.00
Crit W.S. (ft)		Flow Area (sq ft)	4455.71	530.61	1318.23
E.G. Slope (ft/ft)	0.000097	Area (sq ft)	4455.71	530.61	1318.23
Q Total (cfs)	5150.00	Flow (cfs)	3175.30	1101.72	872.98
Top Width (ft)	1658.44	Top Width (ft)	1224.15	46.52	387.78
Vel Total (ft/s)	0.82	Avg. Vel. (ft/s)	0.71	2.08	0.66
Max Chl Dpth (ft)	12.85	Hydr. Depth (ft)	3.64	11.41	3.40
Conv. Total (cfs)	522094.5	Conv. (cfs)	321904.3	111689.8	88500.4
Length Wtd. (ft)	376.86	Wetted Per. (ft)	1227.59	48.06	388.23
Min Ch El (ft)	798.59	Shear (lb/sq ft)	0.02	0.07	0.02
Alpha	1.96	Stream Power (lb/ft s)	439.57	0.00	0.00
Frctn Loss (ft)	0.05	Cum Volume (acre-ft)	56.59	32.48	54.75
C & E Loss (ft)	0.00	Cum SA (acres)	13.96	2.74	11.16

Warning: Divided flow computed for this cross-section.

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 1604.54

INPUT
Description: DD
Station Elevation Data num= 120

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-254.5	820.31	-253.81	820	-249.36	818.13	-249.04	818	-248.71	817.86
-244.27	816	-241.75	814.97	-239.41	814	-235.77	812.52	-234.46	812
-232.56	811.25	-229.43	810	-228.2	809.57	-224.74	808.38	-223.94	808.1
-223.65	808	-223.48	808	-221.86	808	-221.07	808	-220.61	808.01
-220.31	808.01	-220.09	808.01	-219.93	808.01	-219.8	808.01	-219.7	808.01
-219.62	808.01	-219.56	808.01	-219.5	808.01	-219.45	808.01	-219.42	808.01
-219.4	808.01	-219.38	808.01	-219.31	808.01	-219.29	808.01	-219.27	808.01
-219.26	808.01	-219.22	808.01	-219.21	808.01	-219.2	808.01	-219.19	808.01
-219.18	808.01	-219.17	808.01	-219.17	808.05	-218.46	808.05	-218.07	808.25
-208.9	807.97	-202.66	807.8	-202.47	807.73	-199.15	806.81	-197.39	806.65
-185.15	805.67	-168.49	805.12	-165.13	805.01	-163.48	805.02	-161.69	805.03
-150.76	805.17	-148.36	804.05	-144.6	801.99	-144.14	801.94	-143.94	801.8
-140.03	799.92	-137.84	799.77	-137.23	799.58	-137.01	799.73	-134.93	801.41

-134.51	801.43	-126.72	801.94	-117.53	801.92	-102.19	801.63	-88	801.53
-78.33	801.45	-66.67	801.3	-53.5	801.47	-51.58	801.47	-36.89	801.33
-18.11	800.66	-15.8	800.56	-15.31	800.44	-11.66	798.9	-2.59	797.82
-2.27	797.8	-1.95	797.77	0	797.54	4.56	797	9.86	796.53
9.89	796.53	14.62	798.12	14.69	798.14	14.81	798.26	20.33	807.16
23.78	807.16	38.24	807.17	53.5	807.14	57.16	807.14	70.39	807.14
74	807.13	112.25	806.72	127.42	806.39	151.27	806.51	160.35	807.08
183.69	807.64	190.99	807.66	210.11	808.16	216.56	808.05	241.85	807.55
242.96	807.5	249.5	807.18	265.56	806.74	289.15	808.84	301.45	809.04
322.56	809.76	342.42	809.63	360.59	809.45	381.97	809.41	400.9	809.43
411.27	809.32	419.05	810.3	430.18	811.75	441.82	812.55	451.46	813.19

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-254.5	.05	-15.8	.035	20.33	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-15.8	20.33	149 184.82	41	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	811.40	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	811.35	Reach Len. (ft)	149.00	184.82	41.00
Crit W.S. (ft)		Flow Area (sq ft)	1713.42	459.70	1358.78
E.G. Slope (ft/ft)	0.000177	Area (sq ft)	1713.42	459.70	1358.78
Q Total (cfs)	5150.00	Flow (cfs)	2665.06	1284.07	1200.87
Top Width (ft)	659.94	Top Width (ft)	217.02	36.13	406.80
Vel Total (ft/s)	1.46	Avg. Vel. (ft/s)	1.56	2.79	0.88
Max Chl Dpth (ft)	14.82	Hydr. Depth (ft)	7.90	12.72	3.34
Conv. Total (cfs)	386773.2	Conv. (cfs)	200150.6	96435.3	90187.4
Length Wtd. (ft)	128.00	Wetted Per. (ft)	219.87	41.85	407.09
Min Ch El (ft)	796.53	Shear (lb/sq ft)	0.09	0.12	0.04
Alpha	1.59	Stream Power (lb/ft s)	451.46	0.00	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	20.33	29.08	52.11
C & E Loss (ft)	0.00	Cum SA (acres)	5.49	2.46	10.38

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 1419.72

INPUT

Description: EE
Station Elevation Data num= 82

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-133.24	824.56	-130.81	824	-124.37	822.44	-122.58	822	-118.66	821.04
-114.37	820	-112.36	819.49	-106.45	818	-101.64	816.16	-98.65	815.34
-97.21	814.61	-89.43	814.27	-83.42	814	-82.62	813.97	-80.92	813.88
-75.91	810	-75.9	810	-72.82	810.28	-72.74	810.29	-71.16	810.43
-60.51	809.88	-58.71	809.82	-58.63	809.84	-57.68	809.87	-55.63	809.3
-52.04	808.3	-48.95	808.06	-43.9	807.61	-33.31	807.36	-29.68	807.31
-18.8	797.35	-18.51	797.15	-18.37	797.12	-9.34	796.76	-8.3	796.83
-1.89	796.37	-.01	796.51	0	796.51	5.24	797.45	10.42	797.23
15.88	797.82	25.35	798.02	28.91	797.99	35.53	800.94	37.02	801.47
37.8	801.6	46.24	803.46	74.68	805.31	77.76	805.47	79.29	805.55
80.95	805.57	112.25	806.16	129.82	806.8	146.42	807.27	181.61	807.14
183.67	807.12	193.95	807.06	228.2	806.84	237.5	806.83	265.27	806.79
281.86	806.66	304.04	806.21	331.38	805.94	344.68	806.3	350.86	806.46
385.2	806.66	387.18	806.61	399.69	807.42	427.18	809.24	432.84	809.27
465.47	809.54	480.67	809.4	493.5	809.13	509.05	808.96	518.95	808.89
532.2	808.89	549.9	809.02	555.9	809.02	563.05	809.83	577.38	811.63
584.8	812.16	599.7	813.15						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-133.24	.05	-29.68	.035	46.24	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-29.68	46.24	173	185.67	44	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	811.38	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.09	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	811.29	Reach Len. (ft)	173.00	185.67	44.00
Crit W.S. (ft)		Flow Area (sq ft)	116.41	941.47	2092.18
E.G. Slope (ft/ft)	0.000197	Area (sq ft)	116.41	941.47	2092.18
Q Total (cfs)	5150.00	Flow (cfs)	86.90	2879.95	2183.15
Top Width (ft)	652.23	Top Width (ft)	47.89	75.92	528.42
Vel Total (ft/s)	1.63	Avg. Vel. (ft/s)	0.75	3.06	1.04
Max Chl Dpth (ft)	14.92	Hydr. Depth (ft)	2.43	12.40	3.96
Conv. Total (cfs)	366923.6	Conv. (cfs)	6191.5	205188.9	155543.3
Length Wtd. (ft)	125.81	Wetted Per. (ft)	48.62	80.94	528.76
Min Ch El (ft)	796.37	Shear (lb/sq ft)	0.03	0.14	0.05
Alpha	2.13	Stream Power (lb/ft s)	599.70	0.00	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	17.20	26.11	50.49
C & E Loss (ft)	0.01	Cum SA (acres)	5.04	2.22	9.94

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CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 1234.05

INPUT
Description: FF
Station Elevation Data num= 125

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-206.29	819.46	-200.65	818	-197.84	817.3	-192.78	816	-189.46	815.12
-185.16	814	-177.52	812.02	-177.45	812	-177.24	811.95	-169.56	810
-163.3	808.42	-161.62	808	-160.3	807.77	-150.98	806	-149.55	805.99
-141.69	805.98	-141.5	805.98	-140.88	805.98	-133.89	805.95	-130.64	805.94
-129.27	805.94	-125.41	805.92	-125.27	805.92	-119.66	805.91	-119.47	805.91
-113.88	805.9	-113.72	805.9	-113.55	805.9	-109.15	805.89	-108.89	805.89
-108.61	805.89	-79.16	805.07	-45.36	804.14	-44.53	804.12	-43.45	804.1
-40.44	804.07	-38.68	804.06	-38.54	804.07	-38.37	804.07	-37.77	804.01
-37.24	804.01	-37.19	804	-30.78	802.5	-29.84	802	-26.29	800.22
-25.87	800	-25.24	799.69	-24.32	799.25	-21.9	798	-21.56	798
-18.9	798	-18.8	798	-18.64	798	-17.59	798	-6.79	798
-.56	798	0	798	12.11	798	12.88	798	16.74	798
19.43	799.16	21.39	800	22.15	800.53	22.62	800.82	24.24	801.82
24.53	802	24.55	802.01	24.8	802.16	25.01	802.28	25.19	802.38
25.35	802.48	25.49	802.56	25.62	802.63	25.72	802.69	25.82	802.75
25.91	802.8	25.99	802.85	26.06	802.9	26.13	802.94	26.19	802.97
26.24	803.01	26.29	803.04	26.34	803.07	26.39	803.09	26.43	803.12
26.47	803.14	26.5	803.16	26.54	803.18	26.57	803.2	26.6	803.22
26.63	803.24	26.66	803.24	54.23	804.14	56.94	804.2	74.1	806.44
77.21	806.52	80.14	806.6	85.51	806.59	126.38	806.77	130.45	806.77
167.98	806.63	179.11	806.59	180.44	806.58	215.96	806.5	220.86	806.45
248.62	806.24	255.71	806.16	256.04	806.17	276.79	805.61	282.15	805.6
287.71	805.65	319.14	806.74	339.94	807.72	355.88	808.41	377.43	808.5
408.02	808.34	427.41	808.18	441.89	808.29	466.55	808.44	473.08	808.48
487.87	810.16	499.3	811.52	507.36	812.1	507.64	812.12	523.13	813.21

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-206.29	.05	-37.19	.035	26.66	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-37.19	26.66	117 131.34	192.99	.1	.3

CROSS SECTION OUTPUT Profile #100-Year
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* E.G. Elev (ft)	* 811.35	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.06	* Wt. n-Val.	* 0.050	* 0.035	* 0.050 *
* W.S. Elev (ft)	* 811.28	* Reach Len. (ft)	* 117.00	* 131.34	* 192.99 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 748.73	* 770.55	* 2034.00 *
* E.G. Slope (ft/ft)	*0.000169	* Area (sq ft)	* 748.73	* 770.55	* 2034.00 *
* Q Total (cfs)	* 5150.00	* Flow (cfs)	* 891.95	* 2176.63	* 2081.42 *

* Top Width (ft)	*	671.93	* Top Width (ft)	*	137.42	*	63.85	*	470.65 *
* Vel Total (ft/s)	*	1.45	* Avg. Vel. (ft/s)	*	1.19	*	2.82	*	1.02 *
* Max Chl Dpth (ft)	*	13.28	* Hydr. Depth (ft)	*	5.45	*	12.07	*	4.32 *
* Conv. Total (cfs)	*396595.9		* Conv. (cfs)	*	68688.3	*167620.0			*160287.7 *
* Length Wtd. (ft)	*	151.19	* Wetted Per. (ft)	*	138.05	*	66.44	*	471.05 *
* Min Ch El (ft)	*	798.00	* Shear (lb/sq ft)	*	0.06	*	0.12	*	0.05 *
* Alpha	*	1.92	* Stream Power (lb/ft s)	*	523.13	*	0.00	*	0.00 *
* Frctn Loss (ft)	*	0.03	* Cum Volume (acre-ft)	*	15.48	*	22.46	*	48.40 *
* C & E Loss (ft)	*	0.00	* Cum SA (acres)	*	4.67	*	1.92	*	9.44 *

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CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 1102.70

INPUT
Description: GG
Station Elevation Data num= 117

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-289.51	823.17	-284.72	822.19	-283.86	822	-283.27	821.86	-274.9	820
-267.4	818.33	-265.91	818	-264.06	817.59	-257.15	816	-249.19	814.26
-248.06	814	-239.53	812.19	-238.72	812	-237.74	811.8	-228.6	810
-224.13	809.14	-217.49	808	-212.35	807.38	-210.24	807.28	-205.93	806.82
-205.12	806.75	-199.07	806.63	-196.69	806.46	-195.3	806.37	-195.04	806.35
-193.44	806.27	-192.41	806.23	-183.22	806.24	-178.07	806.21	-172.74	806.18
-171.92	806.16	-171.25	806.15	-161.2	806.03	-158.18	806.03	-156.25	806.02
-151.54	806.03	-151.43	806.03	-146.32	806.01	-146.26	806.01	-142.51	806
-133.64	805.85	-132.12	805.82	-129.94	805.78	-114.43	805.52	-102.78	805.34
-97.86	805.26	-93.46	805.2	-90.78	805.15	-87.77	805.1	-80.07	804.98
-73.86	804.89	-67.18	804.76	-58.77	804.6	-42.37	804.25	-31.66	804.01
-31.15	804.01	-29.92	804.01	-28.29	804	-27.99	804	-27.33	804
-26.85	804	-25.69	803.66	-25.11	803.49	-22.2	802	-19.2	800.47
-18.27	800	-17.41	799.56	-14.62	798	-7.66	798	0	798
1.73	798	17.37	798	17.58	798	18.13	798	18.51	798.19
22.22	800	24.75	801.24	26.32	802	28.22	802.93	31	804
31.94	804	41.11	804.07	45.61	804.3	54.04	804.54	83.33	805.28
91.06	805.49	94.01	805.59	95.91	805.61	132.94	806.3	136.29	806.33
139.49	806.35	164.42	806.54	183.4	806.63	186.37	806.61	231.26	806.05
238.05	806.05	275.37	806.2	280.92	806.2	282.25	806.21	307.77	807.46
324.8	809.33	330.91	809.81	335.5	810.13	336.15	810.18	372.12	812.23
372.24	812.18	373.78	812.33	375.76	812.44	382.54	812.44	392.23	812.55
401.64	812.64	414.95	812.72	417.44	812.75	433.14	812.79	442.12	812.72
464.37	812.83	472.75	812.9						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-289.51	.05	-25.69	.035	31	.05

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

-25.69 31 138.99 130.59 147.99 .1 .3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	811.32	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	811.25	Reach Len. (ft)	138.99	130.59	147.99
Crit W.S. (ft)		Flow Area (sq ft)	1123.69	678.76	1543.08
E.G. Slope (ft/ft)	0.000185	Area (sq ft)	1123.69	678.76	1543.08
Q Total (cfs)	5150.00	Flow (cfs)	1392.40	1990.72	1766.88
Top Width (ft)	589.97	Top Width (ft)	209.28	56.69	324.00
Vel Total (ft/s)	1.54	Avg. Vel. (ft/s)	1.24	2.93	1.15
Max Chl Dpth (ft)	13.25	Hydr. Depth (ft)	5.37	11.97	4.76
Conv. Total (cfs)	378186.5	Conv. (cfs)	102249.7	146187.4	129749.4
Length Wtd. (ft)	138.17	Wetted Per. (ft)	209.73	59.40	324.23
Min Ch El (ft)	798.00	Shear (lb/sq ft)	0.06	0.13	0.06
Alpha	1.77	Stream Power (lb/ft s)	472.75	0.00	0.00
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	12.97	20.27	40.48
C & E Loss (ft)	0.00	Cum SA (acres)	4.21	1.74	7.67

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 972.12

INPUT
Description: HH
Station Elevation Data num= 163

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-326.96	813.78	-325.06	813.78	-324.62	813.77	-312.1	813.79	-311.71	813.79
-311.3	813.78	-310.79	813.77	-310.71	813.77	-310.04	813.76	-309.09	813.74
-299.86	813.58	-299.5	813.58	-299.13	813.57	-296.5	813.51	-289.07	813.22
-281.87	812.99	-279.84	812.9	-276.56	812.81	-272.63	812.68	-270.91	812.59
-269.58	812.52	-264.51	812.38	-258.25	812.17	-257.11	812.12	-253.96	812.01
-252.79	812	-247.85	811.77	-247.06	811.74	-246.01	811.7	-235.69	811.04
-234.51	810.98	-230.45	810.9	-224.77	810.76	-217.17	810.53	-213.54	810.36
-203.45	810	-201.81	809.91	-179	808.59	-178.36	808.56	-174.95	808.41
-168.88	808	-168.86	807.99	-167.73	807.99	-167.72	807.99	-166.02	807.98
-162.03	807.97	-158.82	807.97	-157.81	807.96	-156.68	807.96	-153.18	807.93
-152.17	807.93	-147.01	807.71	-124.98	806.82	-98.36	806.05	-98.02	806.03
-96.39	806	-96.31	806	-91.58	805.99	-90.9	805.99	-90.29	805.98
-88.68	805.98	-87.34	805.98	-85.9	805.97	-82.63	805.96	-80.47	805.95
-78.95	805.94	-77.59	805.94	-55.94	805.33	-51.01	805.29	-46.29	805.27

-42.91	805.22	-39.87	805.19	-36.91	805.19	-33.31	804.55	-30.41	804.02
-30.31	804.02	-30.21	804	-28.09	802.54	-27.19	802	-25.5	801.1
-22.96	800	-18.37	797.56	-17.49	797.56	-17.43	797.56	-17.42	797.56
-13.96	797.56	0	797.56	1.22	797.56	14.24	797.56	17.93	797.56
20.45	798	26.11	799.94	26.31	800	32.11	801.03	32.83	802
49.01	803.35	49.44	803.36	55.53	803.3	55.72	803.39	56.74	803.46
60.16	803.53	85.01	805.01	113.83	805.2	119.81	805.24	126.8	805.29
131.99	805.27	139.45	805.25	147.43	805.3	150.86	805.04	162.7	804.62
166.24	804.54	176.45	805.43	177.27	805.48	179.3	805.58	201.26	806.42
208.15	807.25	223.45	808.52	236.82	809.7	252.78	811.09	252.86	811.07
252.99	811.08	255.67	811.11	272.38	811.61	292.88	811.69	300.43	811.78
310.06	811.68	312.5	811.63	314.79	811.65	317.61	811.73	317.72	811.84
317.8	811.83	320.16	811.81	334.73	811.83	341.58	811.8	343.41	811.9
345.47	811.78	346.96	811.81	348.55	811.78	352.07	811.8	367.83	811.79
370.45	811.82	383.76	811.8	383.94	811.82	395.49	811.86	398.25	811.88
398.32	812.08	398.42	811.98	398.86	812.41	408.62	812.42	418.24	812.27
427.48	812.07	437.72	811.84	443.56	811.77	454.65	811.84	466.98	811.99
475.86	812.18	480.39	812.38	482.7	812.57	490.96	812.47	496.51	812.45
496.72	812.45	505.62	812.64	511.92	812.78				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-326.96	.05	-30.21	.035	32.83	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-30.21	32.83	168 161.32	108	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	811.29	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.10	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	811.18	Reach Len. (ft)	168.00	161.32	108.00
Crit W.S. (ft)		Flow Area (sq ft)	764.22	793.48	1203.93
E.G. Slope (ft/ft)	0.000228	Area (sq ft)	764.22	793.48	1203.93
Q Total (cfs)	5150.00	Flow (cfs)	817.49	2681.48	1651.03
Top Width (ft)	496.01	Top Width (ft)	207.71	63.04	225.26
Vel Total (ft/s)	1.86	Avg. Vel. (ft/s)	1.07	3.38	1.37
Max Chl Dpth (ft)	13.62	Hydr. Depth (ft)	3.68	12.59	5.34
Conv. Total (cfs)	340731.2	Conv. (cfs)	54086.5	177410.4	109234.3
Length Wtd. (ft)	140.95	Wetted Per. (ft)	207.94	65.65	225.68
Min Ch El (ft)	797.56	Shear (lb/sq ft)	0.05	0.17	0.08
Alpha	1.94	Stream Power (lb/ft s)	511.92	0.00	0.00
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	9.96	18.07	35.81
C & E Loss (ft)	0.00	Cum SA (acres)	3.54	1.56	6.74

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 810.82

INPUT
Description: II
Station Elevation Data num= 159

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-216.91	814	-209.47	814	-201.74	814	-195.8	813.64	-188.84	813.23
-185.45	813.15	-179.25	812.94	-152.13	813.27	-151.81	813.26	-149.47	813.17
-146.37	813.02	-146.36	813.01	-146.32	813.02	-140.6	812.84	-136.23	812.99
-129.02	812.75	-127.18	812.76	-123.2	812.8	-119.29	812.67	-118.82	812.66
-111.87	812.43	-109.55	812.36	-100.54	812.03	-99.84	812	-98.62	811.93
-97.8	811.89	-83.42	811.14	-76.85	810.72	-74.41	810.56	-73.74	810.51
-71.49	810.36	-66.78	810	-61.45	809.65	-58.64	809.44	-52.08	808.96
-50.37	808.85	-41.46	808	-38.34	807.75	-37.59	807.68	-36.09	807.5
-24.8	806	-20.35	804.6	-18.41	804	-18.33	803.94	-15.01	802
-12.97	800.82	-11.05	800	-10.24	799.15	-8.85	797.3	0	797.3
3.17	797.3	10.08	797.3	17.92	797.3	24.85	797.3	27.53	798
27.87	801.86	28.46	802.53	32.36	803.16	42.61	804.76	59.3	804.95
77.03	805.06	103.24	805.26	119.26	805.35	128.03	805.42	149.59	805.57
160.78	805.68	192.07	805.53	197.51	805.48	238.72	804.72	239.38	804.7
240.47	804.67	256.38	804.26	262.57	804.13	266.56	804.18	293.85	808.49
296.89	808.94	300.24	809.22	329.56	811.43	333.28	811.66	333.32	811.67
333.59	811.64	340.57	811.73	344.49	811.76	350.15	811.95	362.33	812.32
365.48	812.39	381.25	812.44	388.26	812.42	396.23	812.36	413.4	812.25
424.49	812.31	455.96	812.46	456.15	812.5	459.79	812.5	467.99	812.4
475.02	812.37	475.36	812.37	475.71	812.37	476.06	812.37	486.93	812.37
487.23	812.37	487.54	812.37	487.85	812.37	488.18	812.37	488.5	812.37
488.83	812.37	489.17	812.37	489.52	812.38	497.79	812.49	497.9	812.49
498.02	812.49	498.14	812.49	498.28	812.49	498.41	812.49	498.56	812.48
498.71	812.48	498.87	812.48	499.04	812.48	499.21	812.48	499.39	812.48
499.57	812.48	499.76	812.48	499.96	812.48	500.17	812.48	500.38	812.49
500.59	812.49	500.81	812.49	501.04	812.49	501.11	812.49	501.27	812.49
501.51	812.49	501.75	812.49	501.99	812.49	502.24	812.49	502.49	812.49
502.74	812.49	503	812.49	503.25	812.49	503.51	812.49	503.76	812.49
504.02	812.49	504.27	812.5	504.52	812.5	504.78	812.5	505.02	812.5
505.27	812.5	505.51	812.5	505.75	812.51	505.98	812.51	506.21	812.51
506.43	812.51	506.65	812.52	506.86	812.52	507.07	812.52	507.27	812.52
507.46	812.53	507.64	812.53	507.82	812.53	524.88	812.93		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-216.91	.05	-20.35	.035	42.61	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-20.35	42.61	200 178.48	258	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	811.25	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.12	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	811.13	Reach Len. (ft)	200.00	178.48	258.00
Crit W.S. (ft)		Flow Area (sq ft)	154.26	725.62	

1505.53 *								
* E.G. Slope (ft/ft)	*0.000312	* Area (sq ft)	*	154.26	*	725.62	*	
1505.53 *								
* Q Total (cfs)	* 5150.00	* Flow (cfs)	*	146.49	*	2598.76	*	
2404.74 *								
* Top Width (ft)	* 408.81	* Top Width (ft)	*	62.89	*	62.96	*	
282.95 *								
* Vel Total (ft/s)	* 2.16	* Avg. Vel. (ft/s)	*	0.95	*	3.58	*	
1.60 *								
* Max Chl Dpth (ft)	* 13.83	* Hydr. Depth (ft)	*	2.45	*	11.53	*	
5.32 *								
* Conv. Total (cfs)	*291710.3	* Conv. (cfs)	*	8297.8	*147201.3			
*136211.3 *								
* Length Wtd. (ft)	* 218.44	* Wetted Per. (ft)	*	63.35	*	69.47	*	
283.43 *								
* Min Ch El (ft)	* 797.30	* Shear (lb/sq ft)	*	0.05	*	0.20	*	
0.10 *								
* Alpha	* 1.65	* Stream Power (lb/ft s)	*	524.88	*	0.00	*	
0.00 *								
* Frctn Loss (ft)	* 0.05	* Cum Volume (acre-ft)	*	8.18	*	15.25	*	
32.46 *								
* C & E Loss (ft)	* 0.02	* Cum SA (acres)	*	3.02	*	1.33	*	
6.11 *								

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CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 632.35

INPUT
Description: JJ
Station Elevation Data num= 135

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-233.17	814	-232.97	814	-232.29	814	-231.37	814	-229.74	814
-227.54	813.99	-224.26	813.99	-217.08	813.99	-215.69	813.99	-206.84	813.98
-205.84	813.98	-204.78	813.98	-194.69	813.99	-163.17	813.97	-158.17	813.97
-152.63	813.96	-146.75	813.97	-144.86	813.97	-139.53	813.97	-138.59	813.97
-138.16	813.97	-136.9	813.97	-134.88	813.97	-127.78	813.97	-125.89	813.97
-121.27	813.96	-116.23	813.98	-115.18	813.97	-115.16	813.97	-113.57	813.97
-103.05	813.98	-102.55	813.98	-96.44	814	-96.4	814	-96.31	814
-96.25	814	-92.59	813.97	-89.12	813.99	-89.1	813.99	-88.87	813.99
-88.46	813.99	-77.63	814	-76.17	814.02	-76.04	814.02	-75.04	814
-72.8	813.99	-71.53	814	-68.29	814.02	-67.62	814.01	-67.06	814
-63.13	813.78	-62.61	813.72	-62.43	813.69	-57.74	813.21	-57.27	813.17
-52.18	812.77	-48.03	812	-43.2	810.5	-41.72	810	-40.18	809.46
-37.42	808	-35.59	807.07	-33.62	806	-31.7	804.92	-29.9	804
-27.7	802.73	-26.29	802	-22.66	800.11	-22.45	800	-22.1	799.82
-21.65	799.6	-20.99	799.31	-19.21	798.49	-18.32	796.97	-6.82	796.97
-2.66	796.97	0	796.97	.16	796.97	11.62	796.97	15.58	798
15.79	798.01	16.67	798.01	16.75	798.07	16.96	798.08	20.03	798.26
21.03	798.28	27.17	798.57	31.86	800.77	32.51	802.17	32.91	802.6
36.36	804.21	36.53	804.25	37.02	804.34	47.09	805.42	47.49	805.46
49.7	805.63	55.05	805.93	68.74	806.02	86.07	805.93	99.48	805.93
103.38	805.75	123.57	805.98	131.93	806.3	155.1	806.45	176.93	806.19
200.24	806.3	221.51	806.49	244.67	806.72	265.49	806.59	289.74	806.31
312.41	806.09	337.11	806.03	356.2	805.86	381.78	805.86	408.47	805.68
427.73	805.75	446.84	805.64	455	805.63	460.39	805.71	465.48	805.94
478.6	806.16	486.66	806.62	496.58	808.09	504.39	809.32	521.17	811.33
528.01	812.14	528.42	812.31	528.56	812.35	529.4	812.29	529.44	812.28

529.77 812.28 529.97 812.27 537.83 812.44 544.99 812.58 545.64 812.59

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-233.17	.05	-52.18	.035	37.02	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-52.18	37.02	239 198.36	80	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	811.18	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	Wt. n-Val.		0.035	0.050
W.S. Elev (ft)	811.11	Reach Len. (ft)	239.00	198.36	80.00
Crit W.S. (ft)		Flow Area (sq ft)		888.20	2336.33
E.G. Slope (ft/ft)	0.000189	Area (sq ft)		888.20	2336.33
Q Total (cfs)	5150.00	Flow (cfs)		2418.72	2731.28
Top Width (ft)	564.55	Top Width (ft)		82.20	482.35
Vel Total (ft/s)	1.60	Avg. Vel. (ft/s)		2.72	1.17
Max Chl Dpth (ft)	14.14	Hydr. Depth (ft)		10.81	4.84
Conv. Total (cfs)	374563.3	Conv. (cfs)		175915.6	198647.7
Length Wtd. (ft)	136.17	Wetted Per. (ft)		88.15	482.78
Min Ch El (ft)	796.97	Shear (lb/sq ft)		0.12	0.06
Alpha	1.65	Stream Power (lb/ft s)	545.64	0.00	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	7.83	11.95	21.08
C & E Loss (ft)	0.00	Cum SA (acres)	2.87	1.03	3.85

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 433.99

INPUT
Description: KK
Station Elevation Data num= 97

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-229.28	815.19	-223.93	814	-216.01	812.28	-214.67	812	-213.65	811.85
-199.66	810	-199.48	810	-199.29	810	-197.88	809.99	-194.25	809.96
-194.23	809.96	-190.38	809.95	-185.59	809.93	-178.39	809.93	-174.76	809.91
-173.86	809.91	-173.11	809.91	-135.76	808.85	-130.79	808.72	-124.61	808.57
-120.21	808.48	-106.09	808.19	-104.62	808.16	-97.07	808.01	-96.21	808
-91.4	808	-90.61	808	-79.64	807.53	-70.25	807.22	-64	807.02

-57.82	806.79	-47.76	806.4	-45.29	806.3	-42.52	806.21	-41.03	806.16
-37.62	806.01	-36.96	806.01	-36.96	806	-33.53	804.27	-32.99	804
-30.1	802.54	-28.88	802	-28.63	801.88	-24.46	800	-22.46	799.07
-20.14	796.7	-12.23	796.7	-4.22	796.7	-1.01	796.7	0	796.7
12.22	796.7	14.57	799.05	16.69	800	17.49	800.3	22.91	802
23.15	802	25.9	802.22	28.38	802.57	34	802.72	35.29	802.76
46.96	803	49.07	803.48	55.32	804.73	65.63	804.46	75.14	804.3
82.19	804.93	83.76	805.01	94.64	805.48	107.93	805.05	115.02	805.14
115.99	805.19	132.95	805.87	140.41	806.12	179.17	805.81	186.1	805.75
218.99	805.95	229.65	806.12	243.46	805.89	273.03	805.79	295.71	805.5
315.95	805.54	342.46	805.87	360.5	806.18	374.77	806.1	406.56	805.76
412.8	805.7	423.66	805.74	441.5	805.56	452.35	805.52	466.16	806.57
471.85	806.85	475.67	807.36	490.39	809.41	494.83	809.91	511.44	811.92
511.84	812.08	511.9	812.12						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-229.28	.05	-36.96	.035	28.38	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-36.96	28.38	150.99	144.27	75.99	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	811.15	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	811.10	Reach Len. (ft)	150.99	144.27	75.99
Crit W.S. (ft)		Flow Area (sq ft)	444.32	788.87	2529.67
E.G. Slope (ft/ft)	0.000148	Area (sq ft)	444.32	788.87	2529.67
Q Total (cfs)	5150.00	Flow (cfs)	303.77	2061.26	2784.97
Top Width (ft)	712.65	Top Width (ft)	171.02	65.34	476.29
Vel Total (ft/s)	1.37	Avg. Vel. (ft/s)	0.68	2.61	1.10
Max Chl Dpth (ft)	14.40	Hydr. Depth (ft)	2.60	12.07	5.31
Conv. Total (cfs)	422843.5	Conv. (cfs)	24941.4	169240.6	228661.6
Length Wtd. (ft)	108.76	Wetted Per. (ft)	171.16	69.45	476.88
Min Ch El (ft)	796.70	Shear (lb/sq ft)	0.02	0.11	0.05
Alpha	1.82	Stream Power (lb/ft s)	511.90	0.00	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	6.61	8.13	16.61
C & E Loss (ft)	0.00	Cum SA (acres)	2.41	0.69	2.97

CROSS SECTION

RIVER: Buckeye Creek

REACH: Buckeye Creek RS: 289.71

INPUT
Description: LL
Station Elevation Data num= 117

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-348.33	816.57	-348.24	816.54	-347.81	816.44	-345.95	816	-342.84	815.36
-339.64	814.72	-336.02	814	-328.13	813.43	-322.18	813.05	-305.65	812
-302.14	811.76	-298.26	811.43	-280.91	810	-279.28	809.93	-246.45	808.55
-235.55	808	-235.47	808	-231.89	808	-230.12	808	-225.75	808
-220.81	808	-220.77	808	-216.44	808	-211.33	808	-195.52	808
-194.47	808	-194.45	808	-184.64	808	-182.43	808	-178.88	808.05
-178.72	808.05	-178.43	808.06	-178.1	808.06	-172.71	808.2	-168.02	808.31
-160.86	808.55	-144.31	808.1	-141.52	808.02	-137.87	808.02	-133.47	808.03
-127.35	808.03	-116.67	808.04	-91.7	808.03	-68.94	808.02	-63.03	808.02
-59.01	808.02	-55.88	808.02	-55.76	808.02	-55.73	808.02	-53.31	808.01
-52.54	808.01	-49.34	808.01	-47.14	808.01	-46.11	808.01	-43.69	808.01
-42.03	808.01	-41.16	808	-36.46	808	-36.18	807.96	-34.84	807.82
-34.01	807.45	-33.88	807.41	-30.5	806	-28.59	805.2	-25.72	804
-24.06	803.13	-22.27	802	-20.72	801.07	-18.75	800	-17.18	799.08
-15.4	796.46	-1.4	796.46	0	796.46	1.93	796.46	6.13	796.46
16.91	796.46	18.38	798	18.87	798	19.47	798	19.95	798.46
21.23	799.6	21.7	799.87	24.37	800.38	35.61	802.38	50.22	802.63
53.88	802.69	63.02	802.91	78.8	802.53	78.99	802.53	82.81	802.65
94.02	803.02	100.69	804.05	109.95	805.3	112.56	805.37	144.08	805.37
153.1	805.31	186.57	805.2	205.42	805.47	226.33	805.61	253.41	805.45
264.38	805.23	289.6	805.11	294.8	805.28	315.35	805.29	333.93	805.43
339.25	805.41	361.21	806.06	367.63	805.99	382.77	805.65	385.82	805.7
412.49	806.66	414.12	806.72	415.41	806.89	435.44	809.42	453.47	811.42
458.91	812.07	459.37	812.2						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-348.33	.05	-34.84	.035	35.61	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-34.84	35.61	142 180.45	179	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	811.14	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	811.09	Reach Len. (ft)	142.00	180.45	179.00
Crit W.S. (ft)		Flow Area (sq ft)	707.26	825.10	2378.05
E.G. Slope (ft/ft)	0.000137	Area (sq ft)	707.26	825.10	2378.05
Q Total (cfs)	5150.00	Flow (cfs)	480.47	2020.46	2649.07
Top Width (ft)	744.61	Top Width (ft)	259.28	70.45	414.88
Vel Total (ft/s)	1.32	Avg. Vel. (ft/s)	0.68	2.45	1.11
Max Chl Dpth (ft)	14.63	Hydr. Depth (ft)	2.73	11.71	5.73
Conv. Total (cfs)	439699.1	Conv. (cfs)	41021.7	172504.1	226173.4

* Length Wtd. (ft)	*	174.95	* Wetted Per. (ft)	*	259.40	*	75.50	*	415.36	*
* Min Ch El (ft)	*	796.46	* Shear (lb/sq ft)	*	0.02	*	0.09	*	0.05	*
* Alpha	*	1.75	* Stream Power (lb/ft s)	*	459.37	*	0.00	*	0.00	*
* Frctn Loss (ft)	*	0.03	* Cum Volume (acre-ft)	*	4.62	*	5.46	*	12.33	*
* C & E Loss (ft)	*	0.00	* Cum SA (acres)	*	1.66	*	0.47	*	2.19	*

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CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 109.26

INPUT
Description: MM
Station Elevation Data num= 85

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-420.57	814.39	-419.2	814	-407.77	813.42	-407.7	813.42	-379.04	812
-378.22	811.99	-334.8	811.11	-302.12	810.46	-279.5	810	-278.77	810
-199.19	808.01	-198.67	808	-196.73	808	-196.71	808	-160.16	807.18
-150.67	806.97	-143.98	806.83	-123.71	806.44	-101.58	806	-100.78	806
-92.21	805.99	-80.49	805.97	-77.36	805.97	-69.5	805.98	-53.95	806
-46.87	806	-41.13	806	-38.95	806	-35.79	806	-33.95	804.99
-32.14	804	-29.75	802.69	-28.49	802	-26.52	800.92	-25.03	800
-24.55	799.7	-20.63	798	-13.87	796.17	-7.1	796.17	-6.45	796.17
-5.34	796.17	-3.06	796.17	0	796.17	9.83	796.17	10.32	798
11.65	798	12.28	798	15.39	799.59	16.21	800	18.42	801.13
20.26	802	23.7	803.6	24.16	803.84	24.46	804	25.31	804.27
25.55	804.34	26.05	804.45	33.05	806	33.29	806	34.24	806
36.49	805.83	40.87	805.6	49.87	805.76	78.79	805.59	114.93	804.96
121.77	804.87	141.12	804.61	165.89	804.29	192.3	804.3	201.03	804.39
211.75	804.67	229.66	805	247.1	805.46	263.63	805.77	272.64	805.95
279.01	806.31	286.81	806.72	289.32	807.18	307.42	809.78	309.29	809.95
325.74	811.48	328.02	811.69	328.25	811.72	328.26	811.72	328.83	811.89

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-420.57	.05	-35.79	.035	33.05	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-35.79	33.05	105.99	109.26	120	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

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* E.G. Elev (ft)	*	811.10	* Element	*	Left OB	*	Channel	*	Right OB	*
* Vel Head (ft)	*	0.07	* Wt. n-Val.	*	0.050	*	0.035	*	0.050	*
* W.S. Elev (ft)	*	811.03	* Reach Len. (ft)	*	105.99	*	109.26	*	120.00	*
* Crit W.S. (ft)	*		* Flow Area (sq ft)	*	914.88	*	791.16	*	1564.78	*
* E.G. Slope (ft/ft)	*	0.000200	* Area (sq ft)	*	914.88	*	791.16	*	1564.78	*

* Q Total (cfs)	* 5150.00	* Flow (cfs)	* 817.04	* 2302.15	* 2030.81 *
* Top Width (ft)	* 651.91	* Top Width (ft)	* 295.18	* 68.84	* 287.89 *
* Vel Total (ft/s)	* 1.57	* Avg. Vel. (ft/s)	* 0.89	* 2.91	* 1.30 *
* Max Chl Dpth (ft)	* 14.86	* Hydr. Depth (ft)	* 3.10	* 11.49	* 5.44 *
* Conv. Total (cfs)	*364262.0	* Conv. (cfs)	* 57789.4	*162832.3	*143640.3 *
* Length Wtd. (ft)	* 113.08	* Wetted Per. (ft)	* 295.24	* 74.12	* 288.24 *
* Min Ch El (ft)	* 796.17	* Shear (lb/sq ft)	* 0.04	* 0.13	* 0.07 *
* Alpha	* 1.85	* Stream Power (lb/ft s)	* 328.83	* 0.00	* 0.00 *
* Frctn Loss (ft)	* 0.02	* Cum Volume (acre-ft)	* 1.97	* 2.11	* 4.23 *
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 0.76	* 0.18	* 0.74 *

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CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 0

INPUT
Description: NN
Station Elevation Data num= 115

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-417.03	813.82	-412.45	812.94	-406.81	812	-406.1	812	-405.22	812
-395.28	811.74	-380.91	811.39	-371.41	811.15	-364.68	810.99	-359.42	810.86
-355.34	810.77	-345.4	810.64	-340.02	810.54	-336.02	810.47	-325.13	810.34
-312.35	810.19	-297.14	810.01	-296.43	810	-296.02	810	-295.59	810
-285.2	809.91	-274.56	809.84	-274.54	809.84	-273.77	809.83	-272.94	809.82
-262.55	809.73	-253.03	809.67	-251.8	809.66	-250.49	809.65	-241.36	809.57
-232.98	809.51	-230.33	809.49	-227.4	809.46	-224.11	809.42	-220.35	809.37
-208.38	809.22	-174.4	808.34	-171.28	808.24	-167.82	808.24	-159.55	808.19
-158.48	808.19	-156.58	808.18	-145.99	808.1	-143.06	808.1	-141.48	808.1
-141.47	808.1	-141.45	808.1	-141.41	808.1	-139.97	808.09	-136.44	808.09
-134.24	808.08	-131.11	808.06	-127.77	808.05	-120.4	808.02	-118.91	808.01
-118.39	808.01	-117.91	808.01	-117.81	808.01	-115.67	808	-113.81	807.99
-106.61	807.86	-105.72	807.84	-104.61	807.82	-104.57	807.82	-102.61	807.78
-99.96	807.71	-94.79	807.56	-82.5	807.22	-39.63	806	-38.69	806
-32.64	804.46	-31.48	804	-29.07	802.86	-27.45	802	-25.43	800.91
-24.71	800.57	-23.51	800	-21.41	799	-19.3	798	-10.6	796
-.12	796	-.06	796	0	796	11.36	796	20.55	798
22.64	798.89	25.23	800	25.29	800.03	25.3	800.03	29.05	802
30.21	802.61	33.02	804	35.92	804.98	37.94	804.98	38.95	804.98
39.77	804.98	55.66	804.9	86.81	804.9	121.46	804.49	134.69	804.4
178.19	803.99	181.7	803.96	182	803.96	184.59	803.99	228.44	804.47
248.69	805.15	255.51	805.29	257.89	805.39	258.14	805.47	259.94	805.87
277.19	809.69	294.63	811.77	300.3	812.2	300.82	812.43	300.99	812.54

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-417.03	.05	-38.69	.035	35.92	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-38.69	35.92	0	0	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	811.08	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	811.00	Reach Len. (ft)			
Crit W.S. (ft)	803.91	Flow Area (sq ft)	705.56	889.77	1504.49
E.G. Slope (ft/ft)	0.000191	Area (sq ft)	705.56	889.77	1504.49
Q Total (cfs)	5150.00	Flow (cfs)	484.14	2637.88	2027.98
Top Width (ft)	653.27	Top Width (ft)	326.41	74.61	252.25
Vel Total (ft/s)	1.66	Avg. Vel. (ft/s)	0.69	2.96	1.35
Max Chl Dpth (ft)	15.00	Hydr. Depth (ft)	2.16	11.93	5.96
Conv. Total (cfs)	372848.1	Conv. (cfs)	35050.7	190976.4	146821.0
Length Wtd. (ft)		Wetted Per. (ft)	326.46	78.27	252.83
Min Ch El (ft)	796.00	Shear (lb/sq ft)	0.03	0.14	0.07
Alpha	1.91	Stream Power (lb/ft s)	300.99	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

SUMMARY OF MANNING'S N VALUES

River:Buckeye Creek

Reach	River Sta.	n1	n2	n3
Buckeye Creek	3504.54	.05	.035	.05
Buckeye Creek	3454.54	.05	.035	.05
Buckeye Creek	3404.54	.05	.035	.05
Buckeye Creek	3354.54	.05	.035	.05
Buckeye Creek	3304.54	.05	.035	.05
Buckeye Creek	3254.54	.05	.035	.05
Buckeye Creek	3204.54	.05	.035	.05
Buckeye Creek	3154.54	.05	.035	.05
Buckeye Creek	3104.54	.05	.035	.05
Buckeye Creek	3054.54	.05	.035	.05
Buckeye Creek	3004.54	.05	.035	.05
Buckeye Creek	2954.54	.05	.035	.05
Buckeye Creek	2904.54	.05	.035	.05
Buckeye Creek	2854.58	.05	.035	.05
Buckeye Creek	2804.54	.05	.035	.05
Buckeye Creek	2754.54	.05	.035	.05

*Buckeye Creek	*	2704.54	* .05*	.035*	.05*
*Buckeye Creek	*	2661.29	* .05*	.035*	.05*
*Buckeye Creek	*	2625.35	*Bridge *	*	*
*Buckeye Creek	*	2603.43	* .05*	.035*	.05*
*Buckeye Creek	*	2554.54	* .05*	.035*	.05*
*Buckeye Creek	*	2354.53	* .05*	.035*	.05*
*Buckeye Creek	*	2306.38	* .05*	.035*	.05*
*Buckeye Creek	*	2254.54	* .05*	.035*	.05*
*Buckeye Creek	*	2204.54	* .05*	.035*	.05*
*Buckeye Creek	*	2154.54	* .05*	.035*	.05*
*Buckeye Creek	*	2105.74	* .05*	.035*	.05*
*Buckeye Creek	*	1903.41	* .05*	.035*	.05*
*Buckeye Creek	*	1604.54	* .05*	.035*	.05*
*Buckeye Creek	*	1419.72	* .05*	.035*	.05*
*Buckeye Creek	*	1234.05	* .05*	.035*	.05*
*Buckeye Creek	*	1102.70	* .05*	.035*	.05*
*Buckeye Creek	*	972.12	* .05*	.035*	.05*
*Buckeye Creek	*	810.82	* .05*	.035*	.05*
*Buckeye Creek	*	632.35	* .05*	.035*	.05*
*Buckeye Creek	*	433.99	* .05*	.035*	.05*
*Buckeye Creek	*	289.71	* .05*	.035*	.05*
*Buckeye Creek	*	109.26	* .05*	.035*	.05*
*Buckeye Creek	*	0	* .05*	.035*	.05*

SUMMARY OF REACH LENGTHS

River: Buckeye Creek

Reach	River Sta.	Left	Channel	Right
*Buckeye Creek	* 3504.54	* 50*	50*	50*
*Buckeye Creek	* 3454.54	* 52*	50*	50*
*Buckeye Creek	* 3404.54	* 55*	50*	50*
*Buckeye Creek	* 3354.54	* 35*	50*	50*
*Buckeye Creek	* 3304.54	* 55*	50*	47*
*Buckeye Creek	* 3254.54	* 43*	50*	52*
*Buckeye Creek	* 3204.54	* 44*	50*	51*
*Buckeye Creek	* 3154.54	* 48*	50*	52*
*Buckeye Creek	* 3104.54	* 22*	50*	48*
*Buckeye Creek	* 3054.54	* 23*	50*	53*
*Buckeye Creek	* 3004.54	* 36*	50*	48*
*Buckeye Creek	* 2954.54	* 36*	50*	48*
*Buckeye Creek	* 2904.54	* 42*	49.96*	51*
*Buckeye Creek	* 2854.58	* 40*	50.04*	52*
*Buckeye Creek	* 2804.54	* 50*	50*	60*
*Buckeye Creek	* 2754.54	* 51*	50*	58*
*Buckeye Creek	* 2704.54	* 51*	43.25*	43*
*Buckeye Creek	* 2661.29	* 134*	57.86*	63*
*Buckeye Creek	* 2625.35	*Bridge *	*	*
*Buckeye Creek	* 2603.43	* 66*	48.89*	51*
*Buckeye Creek	* 2554.54	* 293*	200.01*	191*
*Buckeye Creek	* 2354.53	* 144*	48.15*	69*
*Buckeye Creek	* 2306.38	* 90*	51.84*	42*
*Buckeye Creek	* 2254.54	* 90*	50*	45*
*Buckeye Creek	* 2204.54	* 74*	50*	44*
*Buckeye Creek	* 2154.54	* 63*	48.8*	47*
*Buckeye Creek	* 2105.74	* 190*	202.35*	215*
*Buckeye Creek	* 1903.41	* 512*	298.87*	86*
*Buckeye Creek	* 1604.54	* 149*	184.82*	41*
*Buckeye Creek	* 1419.72	* 173*	185.67*	44*

*Buckeye Creek	*	1234.05	* 117*	131.34*	192.99*
*Buckeye Creek	*	1102.70	* 138.99*	130.59*	147.99*
*Buckeye Creek	*	972.12	* 168*	161.32*	108*
*Buckeye Creek	*	810.82	* 200*	178.48*	258*
*Buckeye Creek	*	632.35	* 239*	198.36*	80*
*Buckeye Creek	*	433.99	* 150.99*	144.27*	75.99*
*Buckeye Creek	*	289.71	* 142*	180.45*	179*
*Buckeye Creek	*	109.26	* 105.99*	109.26*	120*
*Buckeye Creek	*	0	* 0*	0*	0*

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Buckeye Creek

Reach	River Sta.	Contr.	Expan.
*Buckeye Creek	3504.54	.1	.3
*Buckeye Creek	3454.54	.1	.3
*Buckeye Creek	3404.54	.1	.3
*Buckeye Creek	3354.54	.1	.3
*Buckeye Creek	3304.54	.1	.3
*Buckeye Creek	3254.54	.1	.3
*Buckeye Creek	3204.54	.1	.3
*Buckeye Creek	3154.54	.1	.3
*Buckeye Creek	3104.54	.1	.3
*Buckeye Creek	3054.54	.1	.3
*Buckeye Creek	3004.54	.1	.3
*Buckeye Creek	2954.54	.1	.3
*Buckeye Creek	2904.54	.1	.3
*Buckeye Creek	2854.58	.1	.3
*Buckeye Creek	2804.54	.1	.3
*Buckeye Creek	2754.54	.1	.3
*Buckeye Creek	2704.54	.1	.3
*Buckeye Creek	2661.29	.3	.5
*Buckeye Creek	2625.35	*Bridge	*
*Buckeye Creek	2603.43	.3	.5
*Buckeye Creek	2554.54	.1	.3
*Buckeye Creek	2354.53	.1	.3
*Buckeye Creek	2306.38	.1	.3
*Buckeye Creek	2254.54	.1	.3
*Buckeye Creek	2204.54	.1	.3
*Buckeye Creek	2154.54	.1	.3
*Buckeye Creek	2105.74	.1	.3
*Buckeye Creek	1903.41	.1	.3
*Buckeye Creek	1604.54	.1	.3
*Buckeye Creek	1419.72	.1	.3
*Buckeye Creek	1234.05	.1	.3
*Buckeye Creek	1102.70	.1	.3
*Buckeye Creek	972.12	.1	.3
*Buckeye Creek	810.82	.1	.3
*Buckeye Creek	632.35	.1	.3
*Buckeye Creek	433.99	.1	.3
*Buckeye Creek	289.71	.1	.3
*Buckeye Creek	109.26	.1	.3
*Buckeye Creek	0	.1	.3

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

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X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X      X   X     X  X    X
X     X  X        X           X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X           X  X      X    X        X
X     X  X        X    X      X   X     X    X        X
X     X  XXXXXX    XXXX       X    X    X    X   XXXXX
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PREPARED BY: TGJ 11/7/2014 CHECKED BY: ARG 10-NOV-2014

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PROJECT DATA
Project Title: 110-811_Sherwood FB HH
Project File : 110-811_SherwoFBHH.prj
Run Date and Time: 11/7/2014 1:16:12 PM

Project in English units

Project Description:
MarkWest Liberty Midstream & Resources, LLC
CEC #110-811
4600 J. Barry Ct., Suite 500
Canonsburg, PA 15317

January 2014
(Revised March 25, 2014)
(Revised October 5,
2014)

Sherwood Gas Processing Plant - Full Buildout + Administrative Building - Flood Study
Construction in a Floodway Study for Approval of final grading.

FEMA Zones A, AE, and X from the Doddridge County West Virginia FIS Study shown on FEMA FIRM Panel # 54017C0080 B, effective October 4, 2011.

CEC Engineering Team:
Principal: Rick Celender, C.E.T., CPESC, CPSWQ
Project Manager: Andy Gullone, P.E., CPESC
Hydraulic Modelers: Tim Johnston
Reviewers: Andy Gullone, Rick Celender

Model Creation:
Existing (Pre-project): CEC Created Model File, "110-811_Sherwood FB HH," Plan File, "110-811_Existing 01-23-2014."
Proposed (Post-project): CEC Created Model File, "110-811_Sherwood FB HH," Plan File, "110-811_Proposed 1-23-2014."
Geometry file created in HEC-RAS.

Steady flow file created from
Doddridge County FIS, October 4, 2011.

Data Sources:
Geometry - Surface
created from West Virginia Statewide Addressing and Mapping Board DEM blended with field topo survey of the bridge, existing access road from County Route 50/34, and various locations along the reach.
Flow - Total Buckeye Creek
100-year flow = 5,150 CFS.
Downstream Boundary - Known Water Surface Elevation
= 811. Approximate stream distance of 3,504 feet on profile.

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PLAN DATA

Plan Title: 110-811_Proposed 10-10-2014
Plan File : p:\2011\110-811\-Calculations\TASK 5001 PLANTS 6 AND 7\Flood Study\110-811_SherwoFBHH.p02

Geometry Title: 110-811_Proposed 10-05-2014
Geometry File : p:\2011\110-811\-Calculations\TASK 5001 PLANTS 6 AND 7\Flood Study\110-811_SherwoFBHH.g03

Flow Title : 110-811_100Year
Flow File : p:\2011\110-811\-Calculations\TASK 5001 PLANTS 6 AND 7\Flood Study\110-811_SherwoFBHH.f01

Plan Description:
Proposed Geometry, 100-year storm, subcritical analysis

Plan Summary Information:

Number of:	Cross Sections	= 41	Multiple Openings	=	0
	Culverts	= 0	Inline Structures	=	0
	Bridges	= 1	Lateral Structures	=	0

Computational Information

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

Computation Options

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

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FLOW DATA

Flow Title: 110-811_100Year
Flow File : p:\2011\110-811\-Calculations\TASK 5001 PLANTS 6 AND 7\Flood Study\110-811_SherwoFBHH.f01

Flow Data (cfs)

River	Reach	RS	100-Year
Buckeye Creek	Buckeye Creek	3504.54	5150

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Buckeye Creek	Buckeye Creek	100-Year	Known WS = 811	

GEOMETRY DATA

Geometry Title: 110-811_Proposed 10-05-2014
Geometry File : p:\2011\110-811\-Calculations\TASK 5001 PLANTS 6 AND 7\Flood Study\110-811_SherwoFBHH.g03

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 3504.54

INPUT
Description: A
Station Elevation Data num= 147

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-100	838.81	-98.96	838.29	-98.75	838.18	-98.4	838	-96.95	837.26
-96.1	836.83	-95.4	836.48	-94.48	836	-93.69	835.59	-92.75	835.1
-91.68	834.54	-90.65	834	-89.58	833.44	-88.38	832.81	-87.57	832.38
-86.84	832	-85.95	831.54	-85.41	831.26	-84.5	830.79	-83.05	830.02
-83.01	830	-81.27	829.11	-79.1	828	-79.08	827.99	-79.07	827.99
-77.37	827.11	-75.99	826.41	-75.64	826.23	-75.18	826	-74.04	825.4
-73.22	824.97	-72.55	824.62	-71.39	824	-70.83	823.7	-70.35	823.45
-69.1	822.78	-67.62	822	-67.26	821.81	-67.01	821.68	-65.6	820.94
-64.29	820.25	-64.09	820.15	-63.81	820	-62.65	819.38	-61.84	818.95
-61.13	818.57	-60.06	818	-60.02	817.91	-59.96	817.79	-59.91	817.69
-59.87	817.59	-59.83	817.5	-59.8	817.43	-59.77	817.35	-59.73	817.28
-59.7	817.21	-59.67	817.15	-59.65	817.09	-59.62	817.04	-59.6	816.99
-59.58	816.94	-59.56	816.89	-59.54	816.85	-59.46	816.69	-59.15	815.06
-47.25	813.56	-46	813.25	-45.85	813.22	-44.79	812.96	-43.56	812.66
-42.3	812.35	-41.93	812.27	-41.36	808.97	-40.43	808	-40.31	808
-40.27	808	-40.22	808	-40.14	808	-38.54	807.48	-34.04	806
-33.41	805.89	-32.05	805.65	-25.82	804.54	-22.76	804.44	-19.68	804.44
-19.3	804.44	-14.73	804.44	-5.05	804.44	0	804.44	.9	804.44
5.75	804.44	15.3	804.44	16.43	804.44	19.72	804.44	21.76	804.67
25.81	806	28.84	806.95	32.2	808	35.74	808.98	39.4	810
43.29	811.02	47.05	812	49.55	812.68	54.41	814	56.85	814.55
63.18	816	63.21	816	63.24	816	63.62	816.01	63.71	816
63.73	816	63.9	816	64.26	816	66.98	816	71.15	816
79.48	816	89.67	816	95.77	816	97.03	816	99.05	816
101.29	816	101.88	816	102.53	816	103.1	816.19	110.92	818
112.97	819.63	113.44	820	115.04	821.27	116.39	822	119.11	823.46
119.51	824	120.78	825.71	121	826	121.65	826.89	122.64	828

123.43	828.89	124.41	830	125.72	831.48	126.18	832	126.52	832.39	
127.95	834	129.37	835.19	130.09	835.93	132.25	835.95	133.34	836	
134.36	836.19	136.69	836.42							

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-100	.05	-41.93	.035	49.55	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-41.93	49.55	50	50	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	815.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.74	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	814.26	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)		Flow Area (sq ft)	9.14	744.56	4.63
E.G. Slope (ft/ft)	0.001726	Area (sq ft)	9.14	744.56	4.63
Q Total (cfs)	5150.00	Flow (cfs)	9.92	5135.38	4.69
Top Width (ft)	108.39	Top Width (ft)	10.89	91.48	6.02
Vel Total (ft/s)	6.79	Avg. Vel. (ft/s)	1.09	6.90	1.01
Max Chl Dpth (ft)	9.82	Hydr. Depth (ft)	0.84	8.14	0.77
Conv. Total (cfs)	123972.4	Conv. (cfs)	238.9	123620.5	113.0
Length Wtd. (ft)	50.00	Wetted Per. (ft)	11.09	96.27	6.23
Min Ch El (ft)	804.44	Shear (lb/sq ft)	0.09	0.83	0.08
Alpha	1.03	Stream Power (lb/ft s)	136.69	0.00	0.00
Frctn Loss (ft)	0.10	Cum Volume (acre-ft)	79.86	55.05	55.97
C & E Loss (ft)	0.02	Cum SA (acres)	19.64	5.01	12.30

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 3454.54

INPUT
Description: B
Station Elevation Data num= 121

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-106.13	826.76	-105.83	826.61	-105.52	826.46	-104.57	826	-104.45	825.95
-104.42	825.93	-103.35	825.44	-102.97	825.27	-102.28	824.95	-101.55	824.59
-101.24	824.44	-100.37	824	-100.19	823.91	-99.27	823.46	-98.9	823.29
-98.27	822.98	-97.55	822.65	-97.23	822.49	-96.16	822	-96.15	821.99

-96.14	821.99	-94.96	821.48	-94.61	821.32	-93.85	820.99	-93.19	820.71
-92.79	820.53	-91.86	820.13	-91.79	820.1	-91.59	820	-90.51	819.47
-90.04	819.26	-89.22	818.86	-88.25	818.41	-87.98	818.28	-87.37	818
-87.36	818	-87.35	818	-87.19	817.14	-86.99	814.66	-83.41	814.33
-78.27	814.15	-64.45	812.92	-42.91	811.21	-42.79	809.16	-42.41	809.13
-42.01	809.09	-41.6	809.06	-41.18	809.02	-40.66	808.97	-40.11	808.93
-39.53	808.88	-37.2	808.63	-36.6	808.56	-35.97	808.48	-35.28	808.4
-32.94	808.07	-32.49	808	-31.34	807.77	-31	807.7	-29.05	807.31
-28.01	807.09	-26.05	806.67	-25.06	806.46	-22.96	806	-22.17	805.82
-21.82	805.74	-19.4	805.19	-17.82	804.84	-16.67	804.58	-14.08	804.38
-13.68	804.38	-6.61	804.38	0	804.38	17.4	804.38	17.52	804.38
23.35	805.7	24.35	806	28.89	807.47	30.57	808	37.14	809.7
38.3	810	39.73	810.36	46.16	812	52.62	813.62	54.12	814
61.82	815.78	62.8	816	62.86	816	62.93	816	62.98	816
63.03	816	63.08	816	63.12	816	63.16	816	63.2	816
63.43	816	72.23	816	72.53	816	77.56	816	88.82	816
92.29	816	92.47	816	93.12	816	93.64	816	96.03	816
98.64	816	99.53	816	101.36	816	103.41	816	105.44	816
108.77	817.27	110.92	818	112.2	819.74	112.38	820	113.85	822
113.85	822.01	115.45	823.6	115.85	824	116.26	824.42	117.85	826
118.35	826.5								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-106.13	.05	-42.79	.035	30.57	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-42.79	30.57	52	50	50	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	814.88	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.97	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	813.90	Reach Len. (ft)	52.00	50.00	50.00
Crit W.S. (ft)		Flow Area (sq ft)	45.48	601.96	67.96
E.G. Slope (ft/ft)	0.002242	Area (sq ft)	45.48	601.96	67.96
Q Total (cfs)	5150.00	Flow (cfs)	76.57	4881.51	191.92
Top Width (ft)	129.24	Top Width (ft)	32.71	73.36	23.17
Vel Total (ft/s)	7.20	Avg. Vel. (ft/s)	1.68	8.11	2.82
Max Chl Dpth (ft)	9.52	Hydr. Depth (ft)	1.39	8.21	2.93
Conv. Total (cfs)	108753.0	Conv. (cfs)	1617.0	103083.2	4052.8
Length Wtd. (ft)	50.03	Wetted Per. (ft)	34.75	74.31	23.91
Min Ch El (ft)	804.38	Shear (lb/sq ft)	0.18	1.13	0.40
Alpha	1.21	Stream Power (lb/ft s)	118.35	0.00	0.00
Frctn Loss (ft)	0.12	Cum Volume (acre-ft)	79.83	54.27	55.92
C & E Loss (ft)	0.02	Cum SA (acres)	19.62	4.91	12.28

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CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 3404.54

INPUT
Description: C
Station Elevation Data num= 120

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-130.31	819.94	-130.16	819.85	-127.95	818.4	-127.34	818	-124.36	816.46
-123.5	816	-122.92	815.91	-122.44	815.86	-122.09	815.81	-121.89	815.78
-121.74	815.75	-121.45	815.71	-121.31	815.69	-121.19	815.68	-121.09	815.66
-121	815.65	-120.93	815.64	-120.86	815.64	-120.81	815.63	-120.78	815.51
-118.73	815.9	-118.62	815.92	-118.37	815.95	-117.79	815.59	-115.95	814.65
-112.35	813.89	-102.14	815.26	-94.41	813.55	-93.69	813.6	-93.3	813.59
-91.7	813.84	-89.86	814.09	-85.86	814.99	-84.7	814.77	-82.96	814.52
-77.51	814.54	-69.06	813.8	-67.38	813.67	-52.48	812.03	-42.72	810.75
-39.01	809.99	-38.2	809.83	-38.11	809.8	-37.46	809.6	-37.3	809.57
-37.12	809.53	-36.94	809.5	-36.74	809.46	-36.53	809.42	-35.73	809.24
-35.55	809.2	-35.23	809.14	-34.89	809.07	-34.51	809	-34.1	808.92
-33.65	808.83	-33.15	808.73	-32.59	808.62	-31.98	808.5	-31.02	808.31
-30.29	808.16	-29.54	808	-29.5	808	-28.02	807.66	-20.74	806
-15	804.51	-12.96	804.32	-3.54	804.32	0	804.32	4.45	804.32
15.59	804.32	24.88	805.99	24.9	806	29.51	807.42	31.4	808
35.16	808.93	39.43	810	41.01	810.41	47.1	812	50.37	812.89
54.45	814	59.19	815.18	62.48	816	62.51	816	62.55	816
62.56	816	63.15	816	63.19	816	63.22	816	63.23	816
63.24	816	63.25	816	63.26	816	63.27	816	63.28	816
73.18	816	75.76	816	76.08	816	82.98	816	89.81	816
92.74	816	96.15	815.99	98.06	815.99	99.09	815.99	104.95	816
110.42	817.6	111.76	818	112.3	818.75	113.18	820	113.8	820.86
114.59	822	115.75	823.64	116.01	824	117.38	825.93	117.43	826
117.52	826.13	118.81	828	119.32	828.72	120.21	830	120.39	830.24

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-130.31	.05	-39.01	.035	31.4	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-39.01	31.4	55	50	50	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	814.74	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.13	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	813.60	Reach Len. (ft)	55.00	50.00	50.00
Crit W.S. (ft)		Flow Area (sq ft)	44.90	555.30	61.71
E.G. Slope (ft/ft)	0.002768	Area (sq ft)	44.90	555.30	61.71
Q Total (cfs)	5150.00	Flow (cfs)	96.01	4863.90	190.09
Top Width (ft)	121.22	Top Width (ft)	29.22	70.41	

21.60								
* Vel Total (ft/s)	* 7.78	* Avg. Vel. (ft/s)	* 2.14	* 8.76	* 3.08	*		
* Max Chl Dpth (ft)	* 9.28	* Hydr. Depth (ft)	* 1.54	* 7.89	* 2.86	*		
* Conv. Total (cfs)	* 97895.3	* Conv. (cfs)	* 1825.0	* 92456.9	* 3613.3	*		
* Length Wtd. (ft)	* 50.29	* Wetted Per. (ft)	* 29.47	* 71.50	* 22.31	*		
* Min Ch El (ft)	* 804.32	* Shear (lb/sq ft)	* 0.26	* 1.34	* 0.48	*		
* Alpha	* 1.20	* Stream Power (lb/ft s)	* 120.39	* 0.00	* 0.00	*		
* Frctn Loss (ft)	* 0.12	* Cum Volume (acre-ft)	* 79.78	* 53.61	* 55.85	*		
* C & E Loss (ft)	* 0.10	* Cum SA (acres)	* 19.58	* 4.83	* 12.26	*		

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Warning: Divided flow computed for this cross-section.

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 3354.54

INPUT
Description: D
Station Elevation Data num= 109

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-161.95	820.72	-159	819.1	-154.74	817.2	-151.93	815.9	-147.17	813.71
-145.77	813.06	-126.21	812.54	-124.87	812.51	-123.36	812.51	-123.07	812.53
-122.06	812.55	-122.03	812.53	-115.94	812.57	-115.14	812.59	-114.95	812.57
-103.12	812.35	-88.28	812.14	-82.76	812.08	-54.87	809.98	-52.64	809.81
-41.07	809.2	-39.11	809.06	-36.85	808.62	-36.78	808.61	-36.71	808.61
-36.64	808.6	-36.56	808.59	-36.14	808.54	-35.65	808.48	-35.49	808.45
-35.3	808.43	-35.09	808.4	-34.83	808.36	-34.53	808.32	-34.16	808.27
-33.7	808.2	-33.12	808.12	-32.28	808.01	-32.21	808	-31.45	807.84
-22.89	806	-21.17	805.62	-18.11	804.96	-15.26	804.34	-13.7	804.25
-13.63	804.25	-13.6	804.25	-13.5	804.25	-.57	804.25	0	804.25
4.84	804.25	8.21	804.25	16.71	804.25	17.49	804.25	26.48	806
31.46	807.35	33.9	808	38.76	809.37	40.95	810	46.89	811.73
47.8	812	48.18	812.11	54.65	814	57.78	814.8	62.56	816
62.6	816	62.66	816	62.67	816	62.73	816	62.74	816
62.91	816	63.02	816	63.12	816	63.22	816	63.3	816
63.38	816	63.45	816	63.52	816	63.58	816	63.63	816
63.69	816	63.74	816	63.78	816	63.83	816	64.54	816
66.78	816.01	67.1	816.01	67.7	816.01	68.02	816.01	68.26	816.01
71.84	816.01	73.95	816.01	74.22	816.01	85.96	816	89.03	815.99
91.01	815.98	96.63	815.95	100.33	815.97	106.93	816	112.68	817.78
113.29	818	113.56	818.18	115.15	820	116.54	821.58	116.9	822
118.58	823.91	118.65	824	118.98	824.38	119.3	824.8		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-161.95	.05	-36.56	.035	33.9	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-36.56	33.9	35	50	50	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	814.52	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.81	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	813.71	Reach Len. (ft)	35.00	50.00	50.00
Crit W.S. (ft)		Flow Area (sq ft)	230.58	588.21	56.91
E.G. Slope (ft/ft)	0.001957	Area (sq ft)	230.58	588.21	56.91
Q Total (cfs)	5150.00	Flow (cfs)	493.69	4508.94	147.37
Top Width (ft)	200.85	Top Width (ft)	110.62	70.46	19.77
Vel Total (ft/s)	5.88	Avg. Vel. (ft/s)	2.14	7.67	2.59
Max Chl Dpth (ft)	9.46	Hydr. Depth (ft)	2.08	8.35	2.88
Conv. Total (cfs)	116424.6	Conv. (cfs)	11160.7	101932.3	3331.6
Length Wtd. (ft)	48.51	Wetted Per. (ft)	110.93	71.33	20.58
Min Ch El (ft)	804.25	Shear (lb/sq ft)	0.25	1.01	0.34
Alpha	1.51	Stream Power (lb/ft s)	119.30	0.00	0.00
Frctn Loss (ft)	0.10	Cum Volume (acre-ft)	79.60	52.95	55.78
C & E Loss (ft)	0.01	Cum SA (acres)	19.49	4.75	12.23

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 3304.54

INPUT
Description: E
Station Elevation Data num= 112

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-193.15	818.45	-183.47	814.34	-183.16	814.28	-176.73	813.26	-163.3	813.13
-138.32	812.35	-120.78	812.28	-86.53	811.72	-71.47	811.24	-56.51	810.18
-43	809.27	-36.76	808.75	-36.03	808.62	-36	808.61	-35.97	808.61
-35.94	808.6	-35.9	808.6	-35.86	808.59	-35.82	808.58	-35.77	808.58
-35.72	808.57	-35.67	808.56	-35.62	808.55	-35.57	808.54	-35.45	808.52
-35.38	808.51	-35.31	808.49	-35.22	808.47	-35.13	808.45	-35.02	808.43
-34.88	808.4	-34.73	808.37	-34.53	808.33	-34.3	808.28	-33.99	808.22
-33.59	808.13	-33.11	808.03	-32.95	808	-29.62	807.39	-22.04	806
-15.25	804.68	-11.71	804.25	-11.66	804.25	0	804.25	11.43	804.25
12.59	804.25	14.93	804.25	22.78	805.33	26.75	806	35.39	807.94
35.56	807.97	35.68	808	36.05	808.12	42.24	810	48.06	811.81
48.44	811.93	48.47	811.94	48.67	812	48.97	812.09	55.11	814
58.52	814.76	64.02	816	64.05	816	64.06	816	64.11	816
64.12	816	64.16	816	64.18	816	64.21	816	64.23	816
64.27	816	64.29	816	64.51	816	64.55	816	64.59	816

64.63	816	64.66	816	64.7	816	64.72	816	64.98	816
65.48	816	65.86	816	66.57	816	71.47	816.01	72.7	816.02
72.75	816.02	73.29	816.02	74.51	816.02	75.35	816.02	84.84	816
93.89	815.84	94	815.84	95.83	815.82	98.76	815.86	102.88	815.92
106.57	816	109.76	817.28	111.63	818	113.65	818.64	117.46	820
123.18	821.49	124.76	821.91	125.09	822	125.17	822	125.18	822
125.45	822.01	125.65	822.02	126.04	822.04	126.82	822.08	127.57	822.09
152.93	822.56	166.8	822.78						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-193.15	.05	-36.76	.035	35.39	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-36.76	35.39	55	50	47	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	814.42	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.79	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	813.63	Reach Len. (ft)	55.00	50.00	47.00
Crit W.S. (ft)		Flow Area (sq ft)	265.27	589.59	53.22
E.G. Slope (ft/ft)	0.001975	Area (sq ft)	265.27	589.59	53.22
Q Total (cfs)	5150.00	Flow (cfs)	530.30	4481.92	137.78
Top Width (ft)	233.00	Top Width (ft)	142.31	72.15	18.54
Vel Total (ft/s)	5.67	Avg. Vel. (ft/s)	2.00	7.60	2.59
Max Chl Dpth (ft)	9.38	Hydr. Depth (ft)	1.86	8.17	2.87
Conv. Total (cfs)	115880.1	Conv. (cfs)	11932.3	100847.5	3100.3
Length Wtd. (ft)	50.64	Wetted Per. (ft)	142.46	72.91	19.39
Min Ch El (ft)	804.25	Shear (lb/sq ft)	0.23	1.00	0.34
Alpha	1.58	Stream Power (lb/ft s)	166.80	0.00	0.00
Frctn Loss (ft)	0.08	Cum Volume (acre-ft)	79.40	52.28	55.72
C & E Loss (ft)	0.07	Cum SA (acres)	19.39	4.67	12.21

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 3254.54

INPUT
Description: F
Station Elevation Data num= 117

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

-240.13	819.89	-227.21	814.66	-216.19	812.98	-198.11	812.16	-175.25	811.94
-165.06	811.8	-160.59	811.79	-152.22	811.82	-122.44	811.41	-109.35	811.26
-104.94	811.11	-102.58	811.05	-67.55	810.05	-42.46	809.03	-36.68	808.81
-36.67	808.63	-36.63	808.62	-36.6	808.62	-36.56	808.61	-36.51	808.6
-36.47	808.59	-36.42	808.58	-36.36	808.57	-36.3	808.56	-36.24	808.55
-36.18	808.54	-36.1	808.52	-35.72	808.43	-35.62	808.41	-35.52	808.39
-35.41	808.37	-35.28	808.34	-35.14	808.31	-34.99	808.27	-34.82	808.23
-34.63	808.18	-34.4	808.13	-34.14	808.06	-33.88	808	-31.55	807.56
-23.17	806	-20.88	805.53	-17.84	804.92	-15.28	804.39	-13.32	804.12
-7.98	804.12	-6.03	804.12	-.01	804.12	0	804.12	4.38	804.12
7.24	804.12	15.16	804.12	15.2	804.12	15.21	804.12	15.81	804.12
16.56	804.21	16.72	804.23	28.47	806	32.29	806.81	35.63	807.52
37.86	808	42.77	809.48	44.49	810	46.47	810.68	50.28	812
53.04	812.93	56.3	814	60.48	814.91	63.23	815.52	63.61	815.59
64.3	815.74	65.6	816	65.65	816	65.74	816	65.87	816
65.99	816	66.12	816	66.23	816	66.36	816	66.47	816
66.61	816	66.72	816	66.85	816	66.96	816	67.1	816
67.21	816	67.34	816	67.45	816	67.55	816	67.63	816
67.97	816	68.02	816	68.06	816	68.1	816	68.14	816
68.72	816	68.76	816	69.87	816.02	70.51	816.02	71.52	816.02
71.91	816.03	77.35	816	78.14	816	85.05	814.92	90.53	814.08
91.07	814	91.75	814	98.34	814	102.59	815.16	106.43	816
110.08	817.66	110.84	818	113.36	819.15	115.21	820	116.17	820.22
116.63	820.29	122.85	821.87						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-240.13	.05	-36.68	.035	37.86	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-36.68	37.86	43	50	52	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	814.26	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.54	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	813.72	Reach Len. (ft)	43.00	50.00	52.00
Crit W.S. (ft)		Flow Area (sq ft)	459.42	625.53	51.49
E.G. Slope (ft/ft)	0.001416	Area (sq ft)	459.42	625.53	51.49
Q Total (cfs)	5150.00	Flow (cfs)	943.94	4092.12	113.94
Top Width (ft)	276.50	Top Width (ft)	184.37	74.54	17.59
Vel Total (ft/s)	4.53	Avg. Vel. (ft/s)	2.05	6.54	2.21
Max Chl Dpth (ft)	9.60	Hydr. Depth (ft)	2.49	8.39	2.93
Conv. Total (cfs)	136850.4	Conv. (cfs)	25083.3	108739.4	3027.7
Length Wtd. (ft)	48.61	Wetted Per. (ft)	184.49	75.50	18.50
Min Ch El (ft)	804.12	Shear (lb/sq ft)	0.22	0.73	0.25
Alpha	1.70	Stream Power (lb/ft s)	122.85	0.00	0.00

* Frctn Loss (ft)	* 0.07	* Cum Volume (acre-ft)	* 78.95	* 51.58	* 55.66 *
* C & E Loss (ft)	* 0.02	* Cum SA (acres)	* 19.18	* 4.58	* 12.19 *

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CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 3204.54

INPUT
Description: G
Station Elevation Data num= 99

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-283.58	819.8	-266.29	814.14	-266.24	814.12	-266.23	814.12	-266.09	814.11
-217.5	811.93	-217.38	811.93	-173.11	811.45	-163.78	811.46	-160.93	811.43
-155.76	811.36	-150	811.26	-144.17	811.18	-124.33	810.91	-109.74	810.72
-100.63	810.59	-93.13	810.46	-70.42	809.9	-50.46	809.14	-38.7	808.69
-33.59	808.48	-31.92	807.96	-31.88	807.94	-31.83	807.93	-31.78	807.91
-31.73	807.89	-31.68	807.88	-31.63	807.86	-31.57	807.84	-31.51	807.81
-31.44	807.79	-31.37	807.77	-31.29	807.74	-31.2	807.71	-31.1	807.69
-30.89	807.62	-30.78	807.58	-30.66	807.54	-30.52	807.5	-30.38	807.45
-30.22	807.4	-29.76	807.22	-29.6	807.16	-29.42	807.08	-29.23	807
-28.94	806.91	-28.61	806.8	-28.23	806.67	-27.79	806.53	-27.29	806.36
-26.69	806.17	-26.19	806	-21.56	805.01	-18.47	804.35	-16.86	804.05
-8.24	804.05	-2.99	804.05	0	804.05	3.37	804.05	15.21	804.05
15.24	804.05	16.56	804.21	27.88	806	30.45	806.52	37.81	808
39.9	808.63	44.4	810	47.91	811.09	50.79	812	54.71	813.27
56.99	814	57.54	814.1	57.74	814.13	60.08	814.54	62.07	814.88
63.39	815.06	64.64	815.27	69.51	816	69.65	816	69.72	816
69.9	816	69.98	816	70.07	816	70.16	816	70.17	816
70.18	816	70.19	816	70.2	816	71.28	816	71.34	816
71.39	816	71.44	816	71.49	816	88.72	817.7	91.55	818
96.32	818.82	102.84	820	107.71	820.7	116.72	821.98		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-283.58	.05	-33.59	.035	37.81	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-33.59	37.81	44	50	51	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

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* E.G. Elev (ft)	* 814.18	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.48	* Wt. n-Val.	* 0.050	* 0.035	* 0.050 *
* W.S. Elev (ft)	* 813.70	* Reach Len. (ft)	* 44.00	* 50.00	* 51.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 583.99	* 615.11	* 52.75 *
* E.G. Slope (ft/ft)	*0.001265	* Area (sq ft)	* 583.99	* 615.11	* 52.75 *
* Q Total (cfs)	* 5150.00	* Flow (cfs)	* 1171.24	* 3869.05	* 109.71 *
* Top Width (ft)	* 313.03	* Top Width (ft)	* 223.39	* 71.40	*

18.25										
* Vel Total (ft/s)	*	4.11	* Avg. Vel. (ft/s)	*	2.01	*	6.29	*	2.08	*
* Max Ch1 Dpth (ft)	*	9.65	* Hydr. Depth (ft)	*	2.61	*	8.62	*	2.89	*
* Conv. Total (cfs)	*144780.5		* Conv. (cfs)	*	32926.7	*108769.5		*	3084.2	*
* Length Wtd. (ft)	*	48.43	* Wetted Per. (ft)	*	223.47	*	72.36	*	19.12	*
* Min Ch El (ft)	*	804.05	* Shear (lb/sq ft)	*	0.21	*	0.67	*	0.22	*
* Alpha	*	1.82	* Stream Power (lb/ft s)	*	116.72	*	0.00	*	0.00	*
* Frctn Loss (ft)	*	0.05	* Cum Volume (acre-ft)	*	78.43	*	50.87	*	55.60	*
* C & E Loss (ft)	*	0.04	* Cum SA (acres)	*	18.98	*	4.50	*	12.17	*

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CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 3154.54

INPUT
Description: H
Station Elevation Data num= 177

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-344.059	820.1742	-276	812	-233.73	811	-233.422	810.9995	-232.367	810.9977
-231.316	810.996	-230.269	810.9942	-229.227	810.9925	-228.188	810.9907	-227.154	810.989
-226.123	810.9873	-225.097	810.9855	-224.074	810.9838	-223.056	810.9821	-222.041	810.9804
-221.031	810.9787	-220.024	810.977	-219.021	810.9753	-218.022	810.9737	-217.026	810.972
-216.035	810.9703	-215.047	810.9687	-214.063	810.967	-213.083	810.9654	-212.107	810.9638
-211.134	810.9621	-210.165	810.9605	-209.199	810.9589	-208.237	810.9573	-207.279	810.9557
-206.324	810.9541	-205.373	810.9525	-204.425	810.9509	-203.481	810.9493	-202.558	810.9488
-201.636	810.9483	-200.715	810.9478	-199.795	810.9473	-198.876	810.9468	-197.958	810.9463
-197.041	810.9458	-196.126	810.9453	-195.211	810.9448	-194.297	810.9443	-193.385	810.9438
-192.474	810.9433	-191.563	810.9428	-190.654	810.9423	-189.746	810.9418	-188.839	810.9413
-187.933	810.9408	-187.028	810.9403	-186.124	810.9399	-185.221	810.9394	-184.319	810.9389
-183.419	810.9384	-182.523	810.9385	-181.626	810.9387	-180.729	810.9388	-179.832	810.939
-178.935	810.9392	-178.037	810.9393	-177.139	810.9395	-176.241	810.9396	-175.342	810.9398
-174.443	810.9399	-173.544	810.9401	-172.644	810.9402	-171.764	810.9412	-170.881	810.9422
-169.996	810.9432	-169.1	810.9442	-168.221	810.9452	-167.33	810.9461	-166.437	810.9471
-165.542	810.9481	-164.644	810.9491	-163.745	810.9501	-162.844	810.9511	-161.94	810.9521
-161.034	810.9532	-160.126	810.9542	-159.216	810.9552	-158.392	810.9569	-157.565	810.9586
-156.734	810.9603	-155.98	810.9621	-155.063	810.9638	-154.222	810.9656	-153.378	810.9673
-152.53	810.9691	-151.679	810.9709	-150.824	810.9726	-149.966	810.9744	-149.104	810.9762
-148.239	810.978	-147.444	810.9802	-147.136	810.9811	-146.35	810.9849	-145.054	810.9912
-143.739	810.9976	-143.248	811	-117.297	810.4725	-103.715	810.2897	-98.636	810.209
-79.3063	809.6655	-63.2191	809.3247	-54.0162	808.8551	-34.0768	808.0181	-31.2363	807.1288
-30.9273	807.0409	-30.8414	807.0158	-30.7502	806.9892	-30.6532	806.9609	-30.5499	806.9307
-30.4397	806.8986	-30.3217	806.8642	-30.1953	806.8273	-30.0593	806.7876	-29.9128	806.7448
-27.3848	806	-27.3735	806	-27.3603	806	-27.3445	806	-27.3289	806
-18.8746	803.9613	-18.5725	803.8886	-17.4389	803.8889	0	803.8934	14.1956	803.8975
17.2907	804.4282	26.4701	806	26.4791	806	26.4892	806	26.4988	806
26.5088	806	26.5154	806	26.5202	806	26.5237	806	26.5265	806
26.5287	806	26.5306	806	35.3699	807.8136	36.2567	808	41.9487	809.7472
42.7622	810	43.8619	810.3592	48.8192	812	51.4033	812.8017	55.2662	814
56.44	814.251	58.8339	814.7573	62.7922	815.5976	64.7093	816	64.8061	816
65.0649	816	65.1853	816	65.2252	816	65.342	816	66.3269	816

66.6861 816 71.0049 816 71.4615 816 71.8249 816 76.4812816.7695
77.5302816.8576 80.5573817.1385 83.2005817.4613 87.7055817.8559 89.1837817.9905
89.2698 818 89.464818.0333100.7036 820108.6336 821.173115.1603 822
115.5092822.0006115.5785822.0007

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-344.059	.05	-34.0768	.035	35.3699	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-34.0768	35.3699	48	50	52	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	814.09	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.36	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	813.73	Reach Len. (ft)	48.00	50.00	52.00
Crit W.S. (ft)		Flow Area (sq ft)	788.17	613.40	57.33
E.G. Slope (ft/ft)	0.000995	Area (sq ft)	788.17	613.40	57.33
Q Total (cfs)	5150.00	Flow (cfs)	1561.64	3479.66	108.70
Top Width (ft)	344.81	Top Width (ft)	256.33	69.45	19.03
Vel Total (ft/s)	3.53	Avg. Vel. (ft/s)	1.98	5.67	1.90
Max Chl Dpth (ft)	9.84	Hydr. Depth (ft)	3.07	8.83	3.01
Conv. Total (cfs)	163266.1	Conv. (cfs)	49507.4	110312.8	3445.9
Length Wtd. (ft)	49.40	Wetted Per. (ft)	256.50	70.36	19.93
Min Ch El (ft)	803.89	Shear (lb/sq ft)	0.19	0.54	0.18
Alpha	1.85	Stream Power (lb/ft s)	115.58	0.00	0.00
Frctn Loss (ft)	0.05	Cum Volume (acre-ft)	77.74	50.16	55.54
C & E Loss (ft)	0.02	Cum SA (acres)	18.74	4.42	12.15

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 3104.54

INPUT
Description: I
Station Elevation Data num= 401

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-399.585	824	-399.171	823.8804	-397.808	823.4862	-396.758	23.1802	-395.856	822.9069
-395.143	822.6888	-394.561	822.5107	-394.209	822.4138	-393.692	822.2568	-393.304	822.15
-392.911	822.0421	-392.421	821.8948	-391.998	821.7786	-391.557	821.6466	-391.009	821.5418

-390.604821.4236 -390.03821.2507-389.657821.1417-389.057820.9611-388.712820.8601
-388.09820.6727 -387.77820.5787-387.128820.3853 -386.83820.2976 -386.17820.0988
-385.505819.8985-385.225819.8085-384.543819.6032-384.281819.5195-384.046819.4441
-383.832819.3758-383.638819.3137-383.074819.1756 -382.52 819.04-382.317 818.976
-382.185818.9461-382.068818.9066-381.898818.8993-381.702818.8382-381.021818.7333
-380.826818.6737-380.145818.5676-379.951818.5095-379.269818.4023-379.075818.3454
-378.392818.2373 -378.2818.1815-377.516818.0725-376.844817.9652 -376.65817.9053
-375.976 817.797-375.784817.7383-375.207817.6537-374.637817.5701-374.438 817.511
-373.866817.4264 -373.67817.3688-373.096817.2834-372.902817.2273 -372.3817.1397
-368.54815.9701-367.817815.8509 -367.1815.7328 -366.39815.6157-365.687815.4997
-364.989815.3847-364.298815.2708-363.612815.1578-362.933815.0566 -362.26814.9563
-361.557814.9164 -360.86814.8768-360.169814.8375-359.485814.7986-358.805 814.76
-358.132814.7217-357.464814.6838-357.184814.6643-356.933 814.654-356.267814.6523
-355.607814.6505-354.952814.6488-336.343812.5585-335.732812.5399-335.067812.5196
-334.34812.4975-333.543812.4732-332.666812.4464-331.694812.4168-330.613812.3838
-329.402812.3469-328.036812.3053-326.485 812.258-324.707812.2038-322.649 812.141
-320.312812.0681-318.128 812-317.454811.6674 -316.1 811-315.497810.9961
-314.513810.9897-313.542810.9834-312.586810.9771-311.643 810.971-310.713 810.965
-309.796 810.959-308.891810.9531-307.999810.9473-307.118810.9416 -306.25810.9359
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 26.2935     806 26.3035     806  26.312     806 26.3193     806 26.3257     806
 26.3312     806 26.3365     806 26.3412     806 26.3453     806 26.4083     806
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 36.0835     808 36.1174     808 36.1252     808 36.1504     808 38.7415808.7551
 42.9987     810 46.9051811.4124 48.5301     812 53.6113813.6134 54.8342     814
 54.9704814.0319 55.0582814.0495 64.0713     816 64.3719     816 64.4719     816
 64.7779     816 64.8276     816 64.8319     816 64.8545     816 64.8579     816
  64.861     816 64.8811     816 68.8129     816 71.7207     816 73.1196     816
 74.2338     816 84.1697817.6394 87.0029     818 87.1283     818 91.9278818.7752
 99.3505     820104.3684820.6705104.4133820.6757115.2562     822115.5895822.0008
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151.5665822.3858

Manning's n Values          num=        3
     Sta   n Val      Sta   n Val      Sta   n Val
*********************************************
-399.585     .05 -34.673    .035 36.1174     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       -34.673 36.1174                 22      50      48            .1      .3

CROSS SECTION OUTPUT  Profile #100-Year
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***********
* E.G. Elev (ft)         *  814.03  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.30  * Wt. n-Val.            *   0.050  *   0.035  *
  0.050  *
* W.S. Elev (ft)         *  813.73  * Reach Len. (ft)       *   22.00  *   50.00  *
  48.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     *  944.09  *  632.49  *
  52.32  *
* E.G. Slope (ft/ft)     *0.000856  * Area (sq ft)          *  944.09  *  632.49  *
  52.32  *
* Q Total (cfs)          * 5150.00  * Flow (cfs)           * 1715.69  * 3344.16  *
  90.15  *
* Top Width (ft)         *  400.70  * Top Width (ft)       *  312.06  *   70.79  *
  17.85  *
* Vel Total (ft/s)       *    3.16  * Avg. Vel. (ft/s)     *    1.82  *    5.29  *
   1.72  *
* Max Chl Dpth (ft)      *   10.26  * Hydr. Depth (ft)     *    3.03  *    8.93  *
   2.93  *
* Conv. Total (cfs)      *176039.0  * Conv. (cfs)          * 58646.2  *114311.1  *
 3081.7  *
* Length Wtd. (ft)       *   40.55  * Wetted Per. (ft)     *  312.40  *   72.01  *
  18.75  *
* Min Ch El (ft)         *  803.47  * Shear (lb/sq ft)     *    0.16  *    0.47  *
   0.15  *
* Alpha                  *    1.93  * Stream Power (lb/ft s) *  151.57  *    0.00  *
   0.00  *
* Frctn Loss (ft)        *    0.03  * Cum Volume (acre-ft)  *   76.78  *   49.45  *
  55.47  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)        *   18.43  *    4.34  *
  12.13  *
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CROSS SECTION
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RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 3054.54

INPUT
Description: J
Station Elevation Data num= 468

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-429.242	826.482	6-429.078	826.438	6-428.125	826.183	2-427.163	825.924	8-426.189	825.663
-425.204	825.399	2-424.207	825.131	9-423.199	824.861	4-422.179	824.587	7-421.185	824.297
-420.178	824.003	4-420.166	824	-419.312	823.748	1 -419.29	823.744	9-418.455	823.501
-418.413	823.495	6-417.605	823.263	4 -417.54	823.254	1-402.153	818.488	3-401.882	818.443
-401.613	818.399	8-401.347	818.356	2-401.083	818.313	1-400.822	818.270	3-400.562	818.227
-400.306	818.185	8-400.051	818.148	3-399.799	818.111	-399.536	818.096	4-399.276	818.081
-399.017	818.067	6-398.761	818.053	3-398.508	818.039	2-398.256	818.025	2-398.007	818.011
-397.902	818.004	2-397.808	818.000	5 -397.56	818.000	2-397.313	817.999	9-397.069	817.999
-371.755	815.183	6-370.314	814.954	6-368.728	814.702	8-367.008	814.423	2-365.095	814.112	5
-362.957	813.765	-360.551	813.374	-357.822	812.930	6-354.703	812.423	7-352.095	812
-350.471	811.189	-350.093	811	-350.016	810.999	5-350.015	810.999	5-348.742	810.991	8
-348.738	10.991	7-347.467	810.984	1-347.444	810.984	-346.192	810.976	5-346.157	810.976	4
-344.915	810.969	-344.869	810.968	9-343.637	810.961	6 -343.58	810.961	5-342.358	810.954	3
-342.291	810.954	2-341.079	810.947	1-339.946	810.940	1-338.832	810.933	3-337.735	810.926	5
-336.657	810.919	9-335.595	810.913	4-334.911	810.909	2-334.647	810.907	6-333.891	810.903	
-333.144	810.898	5-332.405	810.894	-331.675	810.889	6-330.952	810.885	2-330.238	810.880	9
-329.531	810.876	6-328.832	810.872	4-328.183	810.868	2-327.541	810.864	-326.906	810.859	8
-326.278	810.855	8-325.656	810.851	7-325.041	810.847	7-324.433	810.843	7-323.831	810.839	8
-323.235	810.835	9-322.646	810.832	1-322.062	810.828	3-321.485	810.824	5-320.914	810.820	8
-320.348	810.817	1 -319.83	810.813	5-319.317	810.809	8 -318.81	810.806	2-318.308	810.802	7
-317.81	810.799	1-317.318	810.795	6 -316.83	810.792	2-316.347	810.788	8 -315.87	810.785	4
-315.396	810.782	-314.928	810.778	7-314.463	810.775	4-314.004	810.772	2-313.549	810.768	9
-312.709	810.767	7-311.873	810.766	4 -311.04	810.765	2-310.211	810.763	9-309.384	810.762	7
-308.56	810.761	4 -307.74	810.760	2-306.922	810.759	-306.108	810.757	8-305.296	810.756	5
-304.488	810.755	3-303.682	810.754	1 -302.88	810.752	9 -302.08	810.751	7-301.284	810.750	5
-300.49	810.749	3-299.699	810.748	1-298.911	810.746	9-298.126	810.745	8-297.344	810.744	6
-296.565	810.743	4-295.788	810.742	3-295.014	810.741	1-294.244	810.739	9-293.475	810.738	8
-292.71	810.737	6-291.947	810.736	5-291.188	810.735	3 -290.43	810.734	2-289.676	810.733	1
-288.924	810.731	9-288.175	810.730	8-287.429	810.729	7-286.685	810.728	6-285.944	810.727	5
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-274.433	810.710	2-273.734	810.709	1-273.038	810.708	1-272.345	810.707	-271.654	810.706	
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-254.518	810.683	9-253.891	810.683	6-253.263	810.683	4-252.637	810.683	2 -252.01	810.683	
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27.0606 806 27.0858 806 27.1093 806 27.1312 806 27.1517 806
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Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-429.242	.05	-35.1026	.035	38.6032	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-35.1026	38.6032	23	50	53	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

* E.G. Elev (ft)	* 813.98	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.27	* Wt. n-Val.	* 0.050	* 0.035	* 0.050 *
* W.S. Elev (ft)	* 813.72	* Reach Len. (ft)	* 23.00	* 50.00	* 53.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 1005.12	* 664.66	* 46.81 *
* E.G. Slope (ft/ft)	*0.000769	* Area (sq ft)	* 1005.12	* 664.66	* 46.81 *
* Q Total (cfs)	* 5150.00	* Flow (cfs)	* 1747.98	* 3329.71	* 72.30 *

* Top Width (ft)	*	418.71	* Top Width (ft)	*	327.55	*	73.71	*	17.46	*
* Vel Total (ft/s)	*	3.00	* Avg. Vel. (ft/s)	*	1.74	*	5.01	*	1.54	*
* Max Chl Dpth (ft)	*	10.68	* Hydr. Depth (ft)	*	3.07	*	9.02	*	2.68	*
* Conv. Total (cfs)	*	185690.3	* Conv. (cfs)	*	63025.9	*	120057.4	*	2607.0	*
* Length Wtd. (ft)	*	40.01	* Wetted Per. (ft)	*	327.94	*	75.74	*	18.24	*
* Min Ch El (ft)	*	803.03	* Shear (lb/sq ft)	*	0.15	*	0.42	*	0.12	*
* Alpha	*	1.92	* Stream Power (lb/ft s)	*	110.84	*	0.00	*	0.00	*
* Frctn Loss (ft)	*	0.03	* Cum Volume (acre-ft)	*	76.29	*	48.70	*	55.42	*
* C & E Loss (ft)	*	0.02	* Cum SA (acres)	*	18.26	*	4.26	*	12.11	*

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CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 3004.54

INPUT
Description: K
Station Elevation Data num= 243

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-509.903	833.6188	-504.233	831.8805	-500.693	830.707	-500.425	830.5712	-499.518	830.273
-499.391	830.2083	-498.477	829.9087	-498.355	829.8472	-497.434	829.5463	-497.319	829.488
-493.516	828.2504	-490.631	827.2383	-490.562	827.2038	-489.576	826.859	-489.515	826.8283
-488.519	826.4814	-488.466	826.4545	-487.461	826.1057	-486.402	825.7317	-485.34	825.3596
-484.277	824.9894	-482.156	824.2609	-481.45	824	-480.463	823.6072	-480.021	823.4281
-477.363	822.3647	-475.522	821.6143	-474.272	821.1113	-471.561	820	-470.105	819.7127
-469.513	819.5927	-458.173	817.3376	-452.756	816.232	-446.506	814.9795	-436.423	812.9052
-435.101	812.6383	-432.022	812	-430.014	811	-429.381	810.9946	-428.154	810.9844
-426.927	810.9743	-425.698	810.9644	-425.648	810.9643	-424.469	810.9547	-424.405	810.9545
-423.239	810.9451	-423.161	810.9449	-422.008	810.9356	-421.917	810.9354	-420.776	810.9263
-420.672	810.9261	-419.543	810.9172	-415.788	810.9066	-414.356	810.8969	-414.168	810.8963
-412.754	810.8867	-412.547	810.8861	-411.151	810.8767	-410.926	810.876	-409.547	810.8668
-409.305	810.866	-407.943	810.8569	-407.683	810.8561	-406.338	810.8472	-406.06	810.8463
-404.733	810.8377	-404.437	810.8367	-403.327	810.8296	-403.12	810.8294	-402.251	810.8241
-402.037	810.8239	-391.958	810.7609	-391.694	810.7609	-390.998	810.7564	-390.729	810.7564
-390.037	810.7521	-389.764	810.7521	-389.076	810.7478	-388.798	810.7478	-388.114	810.7435
-387.832	810.7435	-387.152	810.7393	-386.865	810.7393	-386.19	810.7352	-384.146	810.7352
-383.479	810.731	-383.182	810.731	-382.519	810.7269	-382.218	810.7269	-381.559	810.7229
-381.253	810.7229	-380.598	810.7189	-380.288	810.7189	-379.638	810.7149	-379.323	810.7149
-378.676	810.711	-378.358	810.711	-377.715	810.7072	-377.392	810.7072	-376.752	810.7034
-376.425	810.7034	-375.79	810.6996	-375.459	810.6996	-374.827	810.6959	-374.492	810.6959
-373.864	810.6923	-373.525	810.6923	-372.9	810.6887	-372.557	810.6887	-371.936	810.6851
-371.589	810.6851	-352.621	810.5622	-313.301	810.4981	-299.279	810.4947	-287.81	810.5129
-249.788	810.6427	-249.393	810.6427	-248.795	810.6451	-248.403	810.6451	-247.802	810.6475
-247.413	810.6475	-246.809	810.6499	-246.423	810.6499	-245.817	810.6523	-245.433	810.6523
-244.824	810.6548	-244.443	810.6548	-243.831	810.6573	-243.453	810.6573	-242.838	810.6598
-242.463	810.6598	-241.846	810.6624	-241.473	810.6624	-240.853	810.6649	-240.483	810.6649
-239.86	810.6675	-239.493	810.6675	-238.868	810.6701	-238.504	810.6701	-237.875	810.6727
-234.337	810.6718	-233.732	810.6744	-233.388	810.6742	-232.78	810.6769	-232.438	810.6767
-231.829	810.6794	-231.489	810.6792	-230.877	810.6819	-230.54	810.6817	-229.925	810.6845
-229.591	810.6843	-228.973	810.6871	-228.642	810.6869	-228.022	810.6897	-227.693	810.6895

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 -227.07810.6924-226.744810.6922-220.197810.7222-219.903810.7222-219.215810.7254
-218.924810.7254-218.232810.7286-217.945810.7287 -217.25810.7319-216.966810.7319
-216.266810.7352-215.986810.7352-215.283810.7385-215.006810.7385-214.299810.7418
-214.026810.7419-213.315810.7452-213.045810.7452 -212.33810.7487-212.064810.7487
-211.346810.7521-211.083810.7521-200.211810.8046-199.997810.8048-199.157810.8089
-198.948810.8091-198.102810.8132-197.898810.8135-197.047810.8176-196.847810.8179
 -195.99810.8221-195.795810.8223-194.933810.8265-194.743810.8268-193.875810.8311
-192.557810.8327-184.523810.8289-179.003810.8308-160.809810.6698-133.048 810.198
-130.808810.1378-120.987809.9386-113.784 809.928-103.128809.9743-93.6906809.9222
-67.9457809.5217-52.4544809.0391-45.1149808.8495-35.4741808.6677-31.5021808.2487
 -31.267808.2068-30.5366808.1101  -29.89     808-29.7044     808-29.3771807.8605
-25.9192     806-23.6712     806 -9.9748802.1821  9.6949802.2008 28.5975     806
 35.4929807.5061 37.7505     808 47.2015     810 53.4198811.4191 55.9956     812
 58.2252812.3911  59.059812.5283  61.475 812.945 63.4736 813.268 64.6669813.4742
 68.0019     814 68.1664     814 74.5187814.6943 78.8149 815.152 86.2841     816
 88.2358816.5667 94.4104     818101.0546     820106.6153821.5971 108.044     822
110.6534822.4649119.9053823.9363120.2831     824128.6806 824.014131.3656824.0242
132.1644824.0253141.5183824.1893144.2918824.2316

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
**********************************************
-509.903     .05-35.4741    .035 35.4929     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      -35.4741 35.4929                36      50      48             .1      .3

CROSS SECTION OUTPUT  Profile #100-Year
*************************************************************************************
***********
* E.G. Elev (ft)        *  813.93  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)         *    0.19  * Wt. n-Val.            *   0.050  *   0.035  *
  0.050  *
* W.S. Elev (ft)        *  813.74  * Reach Len. (ft)       *   36.00  *   50.00  *
  48.00  *
* Crit W.S. (ft)        *          * Flow Area (sq ft)     * 1334.10  *  663.95  *
  91.39  *
* E.G. Slope (ft/ft)    *0.000566  * Area (sq ft)          * 1334.10  *  663.95  *
  91.39  *
* Q Total (cfs)         * 5150.00  * Flow (cfs)            * 2085.98  * 2932.68  *
 131.34  *
* Top Width (ft)        *  506.88  * Top Width (ft)        *  405.03  *   70.97  *
  30.89  *
* Vel Total (ft/s)      *    2.46  * Avg. Vel. (ft/s)      *    1.56  *    4.42  *
   1.44  *
* Max Chl Dpth (ft)     *   11.56  * Hydr. Depth (ft)      *    3.29  *    9.36  *
   2.96  *
* Conv. Total (cfs)     *216536.7  * Conv. (cfs)           * 87707.1  *123307.5  *
 5522.1  *
* Length Wtd. (ft)      *   44.24  * Wetted Per. (ft)      *  405.47  *   72.57  *
  31.52  *
* Min Ch El (ft)        *  802.18  * Shear (lb/sq ft)      *    0.12  *    0.32  *
   0.10  *
* Alpha                 *    2.00  * Stream Power (lb/ft s) *  144.29  *    0.00  *
   0.00  *
* Frctn Loss (ft)       *    0.03  * Cum Volume (acre-ft)  *   75.67  *   47.94  *
  55.33  *
* C & E Loss (ft)       *    0.00  * Cum SA (acres)        *   18.07  *    4.17  *
  12.08  *
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CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 2954.54

INPUT
Description: L
Station Elevation Data num= 243

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-509.9	838	-504.2	838	31.8	805	-500.693	830.707	-500.4	258
30.571	2	-499.5	18	30.208	3	-498.4	778	29.908	7
-498.3	558	29.847	2	-497.4	348	29.546	3	-497.3	198
29.488	3	-493.5	168	28.250	4	-490.6	318	27.238	3
-490.5	628	27.203	8	-489.5	768	26.859	-489.5	158	26.828
3	-488.5	198	26.481	4	-488.4	668	26.454	5	-487.4
618	26.105	7	-486.4	028	25.731	7	-485.3	48	25.359
6	-484.2	778	24.989	4	-482.1	568	24.260	9	-481.45
824	-480.4	638	23.607	2	-480.0	218	23.428	1	-477.3
638	22.364	7	-475.5	228	21.614	3	-474.2	728	21.111
3	-471.5	618	20.710	5	-469.5	138	19.592	7	-458.1
738	17.337	6	-452.7	568	16.232	-446.5	068	14.979	5
-436.4	238	13.905	2	-435.1	018	12.638	3	-432.022	812
-430.0	148	11.811	-429.3	818	10.994	6	-428.1	548	10.984
4	-426.9	278	10.974	3	-425.6	488	10.964	4	-424.4
698	10.954	3	-423.2	398	10.945	1	-423.1	618	10.944
9	-422.0	088	10.935	6	-421.9	178	10.935	4	-420.7
768	10.926	3	-420.6	728	10.926	1	-419.5	438	10.917
2	-415.7	888	10.906	6	-414.3	568	10.896	9	-414.1
688	10.896	3	-412.7	548	10.886	1	-412.5	478	10.886
1	-411.1	518	10.876	7	-410.9	26	10.876	-409.5	478
10.866	-409.3	05	10.866	-407.9	438	10.856	9	-407.6	838
10.856	1	-406.3	388	10.847	2	-406.0	638	10.846	3
-404.7	338	10.837	7	-404.4	378	10.836	7	-403.3	278
10.829	6	-403.1	28	10.829	4	-402.2	518	10.824	1
-402.0	378	10.823	9	-391.9	588	10.760	9	-391.6	948
10.760	9	-390.9	988	10.756	4	-390.7	298	10.756	4
-390.0	378	10.752	1	-389.7	648	10.752	1	-389.0	768
10.747	8	-388.7	98	10.747	8	-388.1	148	10.743	5
-387.8	328	10.743	5	-387.1	528	10.739	3	-386.8	658
10.739	3	-386.1	98	10.735	2	-384.1	468	10.735	2
-383.4	79	10.731	-383.1	82	10.731	-382.5	198	10.726	9
-382.2	188	10.726	9	-381.5	598	10.722	9	-381.2	538
10.722	9	-380.5	988	10.718	9	-380.2	888	10.718	9
-379.6	388	10.714	9	-379.3	238	10.714	9	-378.6	76
10.711	-378.3	58	10.711	-377.7	158	10.707	2	-377.3	928
10.707	2	-376.7	528	10.703	4	-376.4	258	10.703	4
-375.7	98	10.699	6	-375.4	598	10.699	6	-374.8	278
10.695	9	-374.4	928	10.695	9	-373.8	648	10.692	3
-373.5	258	10.692	3	-372.9	81	10.688	7	-372.5	578
10.688	7	-371.9	368	10.685	1	-371.5	898	10.685	1
-352.6	218	10.562	2	-313.3	018	10.498	1	-299.2	798
10.494	7	-287.8	18	10.512	9	-249.7	888	10.642	7
-249.3	938	10.642	7	-248.7	958	10.645	1	-248.4	038
10.645	1	-247.8	028	10.647	5	-247.4	138	10.647	5
-246.8	098	10.649	9	-246.4	238	10.649	9	-245.8	178
10.652	3	-245.4	338	10.652	3	-244.8	248	10.654	8
-244.4	438	10.654	8	-243.8	318	10.657	3	-243.4	538
10.657	3	-242.8	388	10.659	8	-242.4	638	10.659	8
-241.8	468	10.662	4	-241.4	738	10.662	4	-240.8	538
10.664	9	-240.4	838	10.664	9	-239.8	68	10.667	5
-239.4	938	10.667	5	-238.8	688	10.670	1	-238.5	048
10.670	1	-237.8	758	10.672	7	-234.3	378	10.671	8
-233.7	328	10.674	4	-233.3	888	10.674	4	-232.7	88
10.676	9	-232.4	388	10.676	9	-231.8	298	10.679	4
-231.4	898	10.679	4	-230.8	778	10.681	9	-230.5	48
10.681	9	-229.9	258	10.684	3	-229.5	918	10.684	3
-228.9	738	10.686	8	-228.6	428	10.686	8	-228.0	228
10.689	2	-227.6	938	10.689	2	-227.0	78	10.691	7
-226.7	448	10.691	7	-220.1	978	10.722	2	-219.9	038
10.722	2	-219.2	158	10.725	4	-218.9	248	10.725	4
-218.2	328	10.728	6	-217.9	458	10.728	7	-217.2	58
10.731	9	-216.9	668	10.735	2	-216.2	668	10.735	2
-215.9	868	10.735	2	-215.2	838	10.738	5	-215.0	068
10.738	5	-214.2	998	10.741	8	-214.0	268	10.741	8
-213.3	158	10.745	2	-213.0	458	10.745	2	-212.3	38
10.748	7	-212.0	648	10.748	7	-211.3	468	10.752	1
-211.0	838	10.752	1	-200.2	118	10.804	6	-199.9	978
10.804	8	-199.1	578	10.808	9	-198.9	488	10.809	1
-198.1	028	10.813	2	-197.8	988	10.813	5	-197.0	478
10.817	6	-196.8	478	10.817	9	-195.9	98	10.822	1
-195.7	958	10.822	3	-194.9	338	10.826	5	-194.7	438
10.826	8	-193.8	758	10.831	1	-192.5	578	10.832	7
-184.5	238	10.828	9	-179.0	038	10.830	8	-160.8	098
10.669	8	-133.0	48	10.819	8	-130.8	088	10.137	8
-120.9	878	9.3861	-113.7	84	9.928	-103.1	288	9.7439	-93.69
068	9.9222	-67.94	578	9.5217	-52.45	448	9.0391	-45.11	498
8.8495	-35.47	418	8.6677	-31.50	218	8.2487	-31.26	78	8.2068
-30.53	668	8.1101	-29.89	808	-29.70	44	808	-29.37	718
7.8605	-25.91	92	806	-23.67	12	806	-9.974	8802.1	821
9.6949	802.20	08	28.597	5	806	35.492	9807.5	061	37.7505
808	47.201	5	810	53.419	8811.4	191	55.995	6	812
58.225	2812.3	911	59.059	812.52	83	61.475	812.94	5	63.4736
813.26	8	64.6669	813.47	42	68.0019	814	68.166	4	814
74.518	7814.6	943	78.814	9	815.152	86.284	1	816	88.2358
816.56	67	94.4104	818	101.05	46	820	106.61	53	821.5971
108.044	822	110.653	4822.4	649	119.9053	823.9	363	120.28	31
824	128.68	06	824.014	131.36	56	824.024	2	132.164	4824.025
3	141.51	83	824.189	3	144.291	8824.2	316		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val

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*********************************************
-509.903     .05-31.5021    .035 35.4929     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      -31.5021 35.4929                 36      50      48            .1      .3

CROSS SECTION OUTPUT  Profile #100-Year
*************************************************************************************
***********
* E.G. Elev (ft)         *  813.91  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.20  * Wt. n-Val.            *   0.050  *   0.035  *
  0.050  *
* W.S. Elev (ft)         *  813.71  * Reach Len. (ft)       *   36.00  *   50.00  *
  48.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     * 1341.62  *  640.75  *
  90.37  *
* E.G. Slope (ft/ft)     *0.000579  * Area (sq ft)          * 1341.62  *  640.75  *
  90.37  *
* Q Total (cfs)          * 5150.00  * Flow (cfs)           * 2116.24  * 2902.79  *
 130.97  *
* Top Width (ft)         *  506.51  * Top Width (ft)       *  408.84  *   67.00  *
  30.68  *
* Vel Total (ft/s)       *    2.48  * Avg. Vel. (ft/s)     *    1.58  *    4.53  *
   1.45  *
* Max Chl Dpth (ft)      *   11.53  * Hydr. Depth (ft)     *    3.28  *    9.56  *
   2.95  *
* Conv. Total (cfs)      *214102.6  * Conv. (cfs)          * 87979.2  *120678.6  *
 5444.7  *
* Length Wtd. (ft)       *   44.32  * Wetted Per. (ft)     *  409.30  *   68.57  *
  31.31  *
* Min Ch El (ft)         *  802.18  * Shear (lb/sq ft)     *    0.12  *    0.34  *
   0.10  *
* Alpha                  *    2.05  * Stream Power (lb/ft s) *  144.29  *    0.00  *
   0.00  *
* Frctn Loss (ft)        *    0.02  * Cum Volume (acre-ft)  *   74.57  *   47.19  *
  55.23  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)        *   17.73  *    4.09  *
  12.04  *
*************************************************************************************
***********

CROSS SECTION


RIVER: Buckeye Creek
REACH: Buckeye Creek       RS: 2904.54

INPUT
Description: M
Station Elevation Data    num=     308
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*************************************************************************************
-555.077838.3043-554.438838.0518-554.048837.8585-553.254837.5453-552.874837.3569
-552.068837.0398-551.329 836.674-547.962835.3571-545.342834.2702-545.039834.1206
-544.127833.7434-543.836833.5998 -542.91833.2173-542.631833.0799-541.689832.6921
-541.158832.4306-540.212832.0429 -539.96831.9189-538.999831.5259 -538.76831.4084
-535.739830.1766-532.623  828.83-532.465828.7525-531.376828.2823-531.234828.2128
-530.124 827.735-529.999827.6736-528.869827.1881 -528.76 827.135 -527.61826.6416
-527.519826.5969-526.347826.0954-526.273826.0595-522.565 824.476-521.512     824
-515.538820.9192-513.764     820 -511.25819.2109-510.888819.1086-510.408 818.971
-507.069817.9474-505.972817.6361-503.285816.8208-501.597816.3469-499.534815.7273
 -497.28815.1012-495.814814.6656-493.017813.8968-492.124813.6342-488.807812.7317
```

-488.464812.6318-486.117 812-483.961 811 -483.85810.9986-481.858810.9732
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-471.56810.8774-452.603810.6778-443.785810.6798-443.389810.6793 -442.7810.6733
-442.297810.6727-441.616810.6669-441.204810.6663 -440.53810.6606-440.111 810.66
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-436.83810.6417-436.184810.6364-435.735810.6359-435.096810.6306 -434.64810.6301
-434.025810.6251-433.623810.6252-433.077 810.621-432.671810.6211 -432.13 810.617
-431.719810.6171-431.182810.6131-430.767810.6132-430.234810.6092-429.815810.6093
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-400.308810.5156-399.758810.5154-399.307810.5125-398.754810.5124-398.306810.5095
-397.749810.5094-397.305810.5066-396.745810.5064-396.303810.5037 -395.74810.5035
-395.301810.5008-394.734810.5007-394.299 810.498-390.302 810.497-389.872810.4943
-389.297810.4942-388.869810.4915-388.291810.4914-387.867810.4888-387.285810.4886
-386.864 810.486-386.279810.4859-385.861810.4833-385.273810.4832-384.858810.4807
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-379.231810.4677-378.831810.4654-378.223810.4653-377.826 810.463-377.215810.4628
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-320.624810.3605 -302.84810.4212 -302.21810.4211-301.862810.4224-301.234810.4223
-300.884810.4237-300.257810.4235-299.906810.4249-299.281810.4248-298.928810.4261
-298.304 810.426 -297.95810.4274-297.328810.4273-296.972810.4287-296.351810.4285
-295.994810.4299-295.375810.4298-295.017810.4312-294.398810.4311-294.039810.4325
-293.422810.4324-293.061810.4339-292.445810.4337-292.083810.4352-291.469810.4351
-291.105810.4365-285.092810.4335-284.744 810.435-284.154810.4345-283.805 810.436
-283.216810.4355-282.866 810.437-282.277810.4366-281.926810.4381-281.339810.4376
-280.987810.4391-280.401810.4386-280.048810.4402-279.463810.4397-279.109810.4412
-278.525810.4407-278.169810.4423-277.587810.4418-273.866810.4583-273.301810.4582
-272.911810.4599-272.348810.4598-271.956810.4616-271.394810.4614-271.001810.4632
-270.441810.4631-270.045810.4649-269.487810.4648 -269.09810.4666-268.533810.4665
-268.134810.4683-267.579810.4682-267.178 810.47-266.625810.4699-266.222810.4717
-265.671810.4716-265.266810.4735-264.717810.4734-258.612810.5018-258.076810.5023
-257.606810.5045-257.073 810.505-256.599810.5072-256.069810.5077-255.592810.5099
-255.065810.5104-254.584810.5127 -254.06810.5132-253.576810.5155-253.055 810.516
-252.568810.5183-248.876810.5218-226.021810.5045-224.924810.5058-209.968810.5057
-208.274810.4657-187.092810.7253-185.085810.5888 -179.54810.5655-153.514 809.975
-147.037809.8034-131.449809.6711-109.404809.5732-105.863 809.47-105.737809.4686
-73.3714 809.038-65.7976808.9717-57.7747808.7756-50.4755808.9131-36.4198808.8592
-35.582808.4987-32.2459807.9257-29.1328806.2954-28.0566 806-18.3251803.4421
-18.1922803.4073-16.2441 802 11.766 801.999 22.4064 804 37.5183807.5304
37.6267807.5526 39.9395808.0259 42.2284808.5271 42.4045 808.567 42.6108 808.613
42.7621808.6472 42.949808.6888 43.0799808.7183 43.2504 808.756 43.3646808.7818
43.521808.8163 43.6213808.8388 43.8748 808.865 47.8291 809.651 49.2248809.9467
49.4608 810 58.6678 812 59.3609 812.09 59.6504 812.126 63.6793812.6427
65.8111 812.905 68.2284813.2112 72.3729813.7153 73.0182813.7961 74.7134 814
79.3169814.5994 82.9284815.0906 86.0325815.5027 89.6137 816 89.6846 816
93.22817.0201 96.648 818 102.448 820108.8773 822113.4186823.1671
116.7403 824116.8913 824117.0715 824.013

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-555.077	.05	-36.4198	.035	42.2284	.05

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

	-36.4198	42.2284		42	49.96	51	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
-555.077	-407	815	T

CROSS SECTION OUTPUT Profile #100-Year

* E.G. Elev (ft)	*	813.88	* Element	*	Left OB	*	Channel	*	Right OB	*	
* Vel Head (ft)	*	0.17	* Wt. n-Val.	*	0.050	*	0.035	*	0.050	*	
* W.S. Elev (ft)	*	813.71	* Reach Len. (ft)	*	42.00	*	49.96	*	51.00	*	
* Crit W.S. (ft)	*		* Flow Area (sq ft)	*	1342.26	*	750.38	*	68.69	*	
* E.G. Slope (ft/ft)	*	0.000466	* Area (sq ft)	*	1583.25	*	750.38	*	68.69	*	
* Q Total (cfs)	*	5150.00	* Flow (cfs)	*	2031.87	*	3042.50	*	75.63	*	
* Top Width (ft)	*	564.71	* Top Width (ft)	*	455.96	*	78.65	*	30.10	*	
* Vel Total (ft/s)	*	2.38	* Avg. Vel. (ft/s)	*	1.51	*	4.05	*	1.10	*	
* Max Chl Dpth (ft)	*	11.71	* Hydr. Depth (ft)	*	3.62	*	9.54	*	2.28	*	
* Conv. Total (cfs)	*	238446.1	* Conv. (cfs)	*	94076.1	*	140868.4	*	3501.7	*	
* Length Wtd. (ft)	*	46.81	* Wetted Per. (ft)	*	370.61	*	80.70	*	30.57	*	
* Min Ch El (ft)	*	802.00	* Shear (lb/sq ft)	*	0.11	*	0.27	*	0.07	*	
* Alpha	*	1.87	* Stream Power (lb/ft s)	*	117.07	*	0.00	*	0.00	*	
* Frctn Loss (ft)	*	0.02	* Cum Volume (acre-ft)	*	73.36	*	46.39	*	55.14	*	
* C & E Loss (ft)	*	0.01	* Cum SA (acres)	*	17.38	*	4.01	*	12.01	*	

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 2854.58

INPUT
Description: N
Station Elevation Data num= 352

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-604.736	838.893	-604.254	838.665	-603.622	838.357	-603.012	838.068	-601.784	837.4712
-601.165	837.1786	-600.57	836.889	-598.555	835.9383	-597.142	835.2325	-596.614	834.9755
-595.865	834.6012	-595.358	834.3542	-594.583	833.9669	-594.097	833.7302	-593.296	833.3292
-592.832	833.1035	-592.003	832.6881	-591.563	832.4738	-590.704	832.0433	-590.288	831.8409
-589.398	831.3945	-588.623	831.017	-587.722	830.5646	-587.364	830.3901	-586.431	829.9208
-586.101	829.7599	-585.132	829.2727	-575.22	824.4399	-574.318	824	-572.305	822.9246
-560.798	816.865	-556.921	815.2296	-549.147	812	-546.909	811	-546.068	810.9812
-542.679	810.9072	-542.558	810.9064	-541.532	810.8843	-541.382	810.8834	-540.384	810.8624
-540.205	810.8613	-539.235	810.8412	-539.029	810.84	-538.086	810.8209	-537.854	810.8195
-536.937	810.8013	-536.679	810.7998	-535.786	810.7824	-535.504	810.7808	-534.636	810.7641
-534.33	810.7624	-533.485	810.7465	-533.156	810.7447	-532.333	810.7294	-531.982	810.7276
-531.181	810.713	-530.809	810.7111	-530.028	810.6971	-529.635	810.6951	-528.876	810.6816
-528.463	810.6796	-527.722	810.6667	-527.29	810.6646	-526.569	810.6523	-526.118	810.6501
-519.589	810.5393	-512.669	810.5279	-512.14	810.5205	-511.516	810.518	-510.998	810.5108
-510.361	810.5082	-509.855	810.5014	-509.206	810.4988	-508.711	810.4921	-508.05	810.4895

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-500.597810.4282-499.925810.4273-499.556810.4225-498.877810.4216-498.161810.4124
-497.471810.4115-497.124810.4071-496.428810.4062-496.087 810.402-495.385810.4011
-495.049810.3969-494.341 810.396-494.011 810.392-493.297810.3911-492.972810.3872
-490.083810.3836-489.764810.3798-489.033810.3789 -488.72810.3751-478.308810.3494
-477.977 810.346-477.093 810.343-471.135810.2801 -464.42810.2811-453.203810.3057
-452.467 810.306-452.256810.3042-451.519810.3045 -451.31810.3028-450.571810.3031
-450.363810.3014-449.623810.3017-449.416   810.3-448.675810.3003 -448.47810.2987
-447.727 810.299-447.523810.2974-446.778810.2976-446.576810.2961 -445.83810.2963
-445.629810.2948-444.881 810.295-444.681810.2935-443.933810.2938-443.734810.2923
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-416.936810.2733-416.726 810.272-415.827810.2708-415.621810.2695-414.719810.2683
-414.515 810.267 -413.61810.2658-413.409810.2646-412.501810.2634-412.303810.2622
-411.392 810.261-411.197810.2598-410.283810.2586-410.091810.2575-409.174810.2563
-408.985810.2551-408.065 810.254-405.889810.2403-405.039810.2402-404.889810.2392
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-388.871810.2286-388.733810.2278-387.868810.2277-387.732810.2268-386.866810.2267
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-377.421810.1996-376.864810.1956-374.033810.1907-371.273 810.186-369.997810.1838
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-364.043810.1832-363.717810.1838-363.315810.1847-358.944 810.198-355.766 810.21
-354.901810.2099 -354.78810.2104-353.916810.2103-353.795810.2108-352.931810.2107
-352.809810.2112-351.946810.2111-351.824810.2116-350.961810.2115-350.839 810.212
-349.976810.2119-349.853810.2124-348.991810.2123-348.868810.2128-348.006810.2127
-347.882810.2132-347.021810.2131-346.897810.2136-346.036810.2135-345.912 810.214
-345.051810.2139-344.926810.2144-344.066810.2143-343.941810.2148 -335.51810.2115
-335.393810.2121-334.565810.2115-334.448 810.212-333.619810.2114-333.503810.2119
-332.674810.2113-332.557810.2119-331.729810.2113-331.612810.2118-330.783810.2112
-330.667810.2117-329.838810.2111-329.721810.2116-328.893810.2111-328.776810.2116
-327.947 810.211 -326.73810.2165-325.907810.2164-325.779 810.217-324.957810.2169
-324.829810.2175-324.006810.2174-323.878 810.218-323.056810.2179-322.927810.2185
-322.106810.2185-321.976810.2191-321.155 810.219-321.024810.2196-320.205810.2196
-320.073810.2202-319.254810.2201-319.122810.2207-318.303810.2206-318.171810.2213
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-222.623810.0285-219.087810.1081-207.987810.2564-195.766810.2024 -192.67809.8149
-189.741809.7583-188.932809.7938-181.113809.8744-161.127809.8559-148.165809.6384
-131.759809.2684-129.319809.2373-116.915809.1186-99.4682808.9868-99.2691808.9861
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-62.2512 808.895-35.5519808.8988-34.2843808.3459-33.7188808.0886-31.2742806.1623
-27.7951804.3303-27.6707 804.301-26.3993   804-23.2795   802 14.5318 801.999
 25.9117   804 26.9071804.2343 27.0817804.2879 27.5957804.4456 28.5343804.7168
 29.0037 804.821 29.3941804.9141 29.5998804.9662 31.4995805.4345 33.1854805.8392
 34.3107806.1165 38.7884807.2484 45.445808.9091 57.7097811.9625 57.8613   812
 67.8845   814 68.2466   814 87.5647815.6933 88.396815.7638 90.9881   816
 94.5349817.2262 96.7543   818 102.359   820108.1161   822109.7894822.4529
115.5642   824115.8879824.0389

Manning's n Values   num=   3
     Sta   n Val   Sta   n Val   Sta   n Val
****
-604.736   .05-35.5519   .035 45.445   .05

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

-35.5519 45.445 40 50.04 52 .1 .3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
-604.736	-400	815	T

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	813.85	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	813.71	Reach Len. (ft)	40.00	50.04	52.00
Crit W.S. (ft)		Flow Area (sq ft)	1426.47	807.60	47.65
E.G. Slope (ft/ft)	0.000383	Area (sq ft)	1918.61	807.60	47.65
Q Total (cfs)	5150.00	Flow (cfs)	2060.86	3042.03	47.11
Top Width (ft)	619.66	Top Width (ft)	517.70	81.00	20.96
Vel Total (ft/s)	2.26	Avg. Vel. (ft/s)	1.44	3.77	0.99
Max Chl Dpth (ft)	11.71	Hydr. Depth (ft)	3.91	9.97	2.27
Conv. Total (cfs)	263081.0	Conv. (cfs)	105276.3	155398.2	2406.6
Length Wtd. (ft)	45.79	Wetted Per. (ft)	364.50	83.70	21.51
Min Ch El (ft)	802.00	Shear (lb/sq ft)	0.09	0.23	0.05
Alpha	1.81	Stream Power (lb/ft s)	115.89	0.00	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	71.67	45.50	55.08
C & E Loss (ft)	0.01	Cum SA (acres)	16.91	3.92	11.98

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 2804.54

INPUT
Description: O
Station Elevation Data num= 240

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-636.987	838.7235	-606.703	824	-605.625	823.3852	-605.201	823.1453	-604.042	822.4859
-603.614	822.2436	-602.688	821.7176	-602.182	1.3848	-601.368	20.9643	-600.641	820.5576
-600.051	820.2226	-599.223	819.7545	-598.757	819.4899	-597.838	818.97	-597.476	818.7645
-596.478	818.2003	-596.204	818.045	-595.138	817.4425	-594.948	17.3305	-593.815	816.6945
-593.684	816.62	-592.506	815.9545	-592.433	815.9129	-590.602	814.8785	-578.012	810.785
-577.534	810.7694	-573.154	810.6263	-573.011	810.6218	-571.729	810.5803	-559.709	810.3858
-558.903	810.3782	-558.538	10.3693	-557.703	810.3617	-557.353	810.3535	-556.506	810.3458
-556.177	810.3382	-555.318	10.3305	-555.002	810.3236	-554.116	810.3159	-553.828	810.3095
-552.925	810.3017	-552.162	810.2851	-551.243	810.2797	-551.017	810.2748	-550.085	810.2694
-549.871	810.2649	-548.927	810.2596	-548.726	810.2554	-547.769	810.2501	-547.588	10.2463
-546.611	810.2409	-546.433	810.2374	-545.454	810.2321	-545.287	810.2289	-544.296	810.2237

```
 -544.14810.2207-543.139810.2155-542.993810.2127-541.982810.2076-541.846810.2051
-540.825   810.2-540.699810.1977-539.669810.1926-539.551810.1905-538.512810.1855
-538.404810.1836-537.355810.1786-537.256810.1768-536.199810.1719-536.108810.1703
-535.043810.1654-534.556810.1573 -534.38810.1542-534.272810.1524 -521.67810.1341
-520.512810.1292-519.354810.1244-518.195810.1197-517.036810.1151-516.982810.1144
-515.918810.1126-514.871810.1111-513.823810.1096-512.776810.1082-511.729810.1068
-510.681810.1055-509.634810.1041-508.583810.1028-507.537810.1016 -506.49810.1004
-506.157   810.1-505.507810.1007-504.553810.1017-503.599810.1028-502.644 810.104
 -501.69810.1053-500.736810.1066-499.781 810.108-498.827810.1094-497.873810.1109
-496.918810.1125-495.964810.1141-495.009810.1157-494.054810.1174-483.756810.1023
 -483.26   810.1-469.575   810.1-462.348810.1173-461.425810.1178-460.484810.1182
-459.543810.1186-458.602810.1189-457.661810.1193 -456.72810.1196-455.779810.1199
-454.838810.1203-453.898810.1206-452.957810.1209-452.016810.1212-451.075810.1215
-450.135810.1218-449.194810.1221 -422.65810.1119-421.558810.1105-420.465810.1091
-419.373810.1078-418.281810.1065-417.189810.1052-416.097810.1039-415.005810.1026
-413.912810.1014 -412.82810.1001-391.001810.1004-387.028810.1004-386.978810.1003
-342.006   810.1-335.359810.1081-260.595810.0985-228.988810.0627-228.492810.0613
-227.673810.0604-227.147810.0589-226.361 810.058-225.804810.0563-223.747810.0528
-200.274     810 -200.18     810-197.841809.2267-197.639809.2227-194.219 809.365
 -191.11809.3932-177.255809.3636-170.323809.2832-164.299809.0079-153.821808.7031
-139.837808.7103-132.125808.6016-123.317808.2173-121.921808.1472-120.944808.1348
 -107.12808.0688-104.813 808.042-97.0939807.9286 -90.229807.9581 -83.614808.0933
-65.8281808.2918-65.4665 808.313-61.6056808.3927-41.9515809.2029-35.5267 809.404
 -34.227808.9734-33.6291808.7464-31.1961806.8302-29.5857 805.692  -25.99 803.675
-25.9346 803.606-25.8522803.5034 -25.794803.4308-25.7506803.3767-25.7029803.3173
-23.6212802.0015 18.5413 801.999 18.7539802.0498 19.3256802.1863 19.5923802.2501
 20.2122802.3981 20.3665 802.435 20.5493802.4786 20.6323802.4985 20.7477 802.526
 20.8866802.5592 20.9505802.5745 21.0844802.6065 21.1467802.6213 21.2343802.6422
 21.2892802.6554 21.3415802.6679 21.4155802.6855 21.4847802.7021 21.5903802.7273
 21.6486802.7412 21.7035802.7543 21.7552802.7667 21.9115 802.804 23.5297803.1243
 23.6961 803.163  23.816803.1909 24.8125805.0473 25.5506 805.323 26.1391805.5283
 37.0336807.8949 42.6095809.5152  47.892809.7858 48.2907809.8641 49.5623810.1475
  50.265810.3244 52.1755810.7354  52.898810.8977 54.4693811.2677 55.9742811.5269
 58.1803     812 66.0015813.3501 69.7107     814 85.6449815.5015 87.9039815.6751
   88.33815.7136 90.9113815.9081 91.0322815.9188 92.1299     816  93.669816.3348
 94.4327816.5342 96.3891816.9881 98.8833817.6784 99.3292817.7893 100.045     818
105.5791819.8989111.6718     822117.6776823.9213117.9246     824124.8011825.9156

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
**********************************************
-636.987     .05-35.5267    .035 42.6095     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      -35.5267 42.6095                 87      50      60             .1      .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
-636.987    -400     815        T

CROSS SECTION OUTPUT  Profile #100-Year
**********************************************************************************
***********
* E.G. Elev (ft)         *  813.83  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.12  * Wt. n-Val.            *   0.050  *   0.035  *
  0.050  *
* W.S. Elev (ft)         *  813.70  * Reach Len. (ft)       *   87.00  *   50.00  *
  60.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     * 1554.76  *  770.02  *
  58.46  *
* E.G. Slope (ft/ft)     *0.000364  * Area (sq ft)          * 2195.03  *  770.02  *
  58.46  *
* Q Total (cfs)          * 5150.00  * Flow (cfs)           * 2319.05  * 2773.72  *
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  57.23  *
* Top Width (ft)         *  654.99  * Top Width (ft)         *  551.46  *   78.14  *
  25.40  *
* Vel Total (ft/s)       *    2.16  * Avg. Vel. (ft/s)       *    1.49  *    3.60  *
   0.98  *
* Max Chl Dpth (ft)      *   11.70  * Hydr. Depth (ft)       *    4.27  *    9.85  *
   2.30  *
* Conv. Total (cfs)      *269802.8  * Conv. (cfs)            *121492.3  *145312.3  *
 2998.3  *
* Length Wtd. (ft)       *   67.59  * Wetted Per. (ft)       *  364.65  *   82.17  *
  25.79  *
* Min Ch El (ft)         *  802.00  * Shear (lb/sq ft)       *    0.10  *    0.21  *
   0.05  *
* Alpha                  *    1.71  * Stream Power (lb/ft s) *  124.80  *    0.00  *
   0.00  *
* Frctn Loss (ft)        *    0.02  * Cum Volume (acre-ft)   *   69.78  *   44.59  *
  55.01  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *   16.42  *    3.83  *
  11.95  *
*******************************************************************************
***********

CROSS SECTION


RIVER: Buckeye Creek
REACH: Buckeye Creek      RS: 2754.54

INPUT
Description: P
Station Elevation Data    num=     327
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
-698.226841.9414-698.063841.9427-697.799841.9434-697.042841.9495-696.775841.9501
-696.021841.9562-695.752841.9568-694.999841.9629-694.728841.9635-693.978841.9695
-693.704841.9701-692.957841.9761-692.681841.9768-691.936841.9827-691.657841.9834
-690.915841.9893-690.634  841.99-689.894841.9958 -689.61841.9965-688.873842.0024
-688.586 842.003-687.851842.0088-687.563842.0095 -686.83842.0153-686.539 842.016
-685.809842.0217-685.516842.0224-684.788842.0281-684.492842.0288-683.767842.0345
-683.468842.0352-682.746842.0409-682.445842.0415-681.724842.0472-681.421842.0479
-680.703842.0535-680.398842.0542-679.682842.0598-679.374842.0604-678.661 842.066
 -678.35842.0667 -677.64842.0722-631.165842.2919-629.336842.2944-629.223842.2947
-627.508842.2969-627.409842.2971 -622.02842.3042-621.105842.3053 -620.19842.3065
-619.275842.3076-618.359842.3088-617.568842.3097-612.621844.3489-610.148844.3626
-605.201842.3766-604.268841.9787-602.585841.2597-602.523841.2328-600.902840.5401
  -600.8840.4958-599.219839.8201-599.077839.7584-597.535839.0994-597.354839.0204
-595.852838.3783-595.631838.2818-594.169837.6566-593.908837.5427-592.487836.9344
-592.185 836.803-590.804836.2116-590.462836.0628-589.121835.4883-588.739835.3221
-587.438834.7645-587.017834.5807-585.756834.0401-585.294833.8389-584.073833.3152
-583.572833.0965-582.391832.5898-581.849832.3535-580.708831.8638-580.127  831.61
-579.026831.1373-578.405830.8659-577.344830.4103-576.682830.1213-575.662829.6827
 -574.96829.3762 -573.98828.9546-573.238828.6305-572.298 828.226-571.516827.8842
-570.616827.4968-569.794827.1374-568.934826.7671-568.072  826.39-567.252826.0368
-566.351825.6421-565.571 825.306-564.629824.8936-563.889824.5747-562.907824.1446
-562.207823.8429-561.186 823.395-560.526823.1105-559.464822.6449-558.845822.3775
-557.743821.8942-557.163821.6441-556.021 821.143-555.482820.9101  -554.3820.3912
-553.801820.1755-552.579819.6389 -552.12819.4405-550.858 818.886-550.439818.7049
-549.137818.1325-548.758817.9687-547.416817.3785-547.077 817.232-545.695 816.624
-545.396816.4948-543.974815.8689-543.716 815.757-542.253815.1132-542.035815.0187
-540.533 814.357-540.355814.2799-538.812813.6003-538.674813.5405-537.092 812.843
-536.994812.8006-535.371812.0851-535.314812.0601 -532.91     811-472.294810.1809
 -471.39810.1655-471.335810.1655-470.426810.1498-469.461 810.134-468.496810.1179
-467.531810.1016-466.566810.0852  -465.6810.0684-464.634810.0515-463.668810.0343
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-462.739810.0176-461.371     810-461.315810.1302-459.286810.3092-458.733810.3466
-458.449811.0515-456.779811.3758-455.503811.5508-455.111  811.51-454.797811.5506
-454.431811.5214 -454.09811.5632-453.745 811.542-453.384811.5846-453.054811.5691
-452.677811.6122-446.406 813.327-393.302821.9837 -392.25822.1551-392.174822.1675
-372.316     822-342.803     810-342.534810.0984-341.608810.0953-340.672810.0909
-340.586 810.091-339.734 810.087 -339.61810.0871-338.795810.0834-338.637810.0835
-337.854810.0802-337.665810.0802-336.912810.0772-336.695810.0773-335.969810.0744
-335.726810.0745-335.025810.0719-334.757 810.072-334.081810.0695 -333.79810.0696
-333.135810.0673-332.824810.0674-332.189810.0653-331.858810.0654-331.242810.0634
-330.893810.0635-330.295810.0616-329.929810.0617-329.347  810.06-328.965810.0601
-328.399810.0584-328.002810.0585 -327.45810.0569-327.039 810.057-326.501810.0555
-326.077810.0556-325.552810.0542-325.115810.0543-324.602810.0529-324.153 810.053
-323.652810.0518-323.192810.0519-322.702810.0506-322.231810.0507-321.752810.0496
 -321.27810.0497-320.801810.0486 -320.31810.0487 -319.85810.0476 -319.35810.0477
-318.899810.0467 -318.39810.0468-317.947810.0458 -317.43810.0459-316.996 810.045
-316.471810.0451-316.044810.0442-315.511810.0442-315.093810.0434-314.552810.0435
-314.141810.0426-313.593810.0427-313.189810.0419-312.634 810.042-312.236810.0413
-311.676810.0414-311.284810.0406-310.717810.0407-310.332  810.04-309.759810.0401
-309.379810.0394-308.223810.0396-307.842810.0389 -307.26 810.039-306.884810.0383
-306.296810.0384-305.926810.0378-305.333810.0379-304.968810.0373 -304.37810.0373
 -304.01810.0367-301.483810.0359-301.137810.0353-300.521810.0354-294.753 810.033
-294.457810.0325-249.981     810 -231.53   810.1-231.273 810.099  -207.6     810
-203.839809.8348-200.097809.6971-196.859809.5963-195.319809.5555-178.485807.8836
-177.882807.8541-177.821807.8517-164.453807.3352-162.672807.3324 -155.89807.2773
-155.317806.9757  -153.6807.5658-151.859807.5773-135.536807.5074-132.753807.1575
-130.024806.8548-126.996 806.747 -124.24806.5739-118.497 806.533 -110.43805.9446
-108.289805.3677 -106.35805.0299-104.765805.0111-102.174805.1389-99.6943805.7559
-99.0571805.8713-98.9614805.8636-98.4248805.9173-84.5903807.4658 -83.072807.5113
-82.2557807.5257-68.9956807.6225-59.0251807.7611-50.9111807.9707-37.8387808.5202
-37.4955808.6329 -35.613808.1348-29.1409805.3689-23.5207803.7736-22.8061802.8698
-22.7429802.7802-22.3534802.2274-22.2857802.1699-22.0074     802 21.1772 801.999
 21.4069802.0533 21.5523802.0877 21.7759802.1407 21.8887802.1673 25.8581802.9461
 25.9323802.9632 28.3155807.3663 28.4648807.4223 28.5328807.4473 28.6625807.4929
 31.4404808.1063 45.6867812.3118 49.9796813.6223 59.5651813.6229 74.9051     814
 99.3176     816102.7834816.8379107.5409     818124.9406     824131.3215     826
136.2069827.3358138.3847827.9149

Manning's n Values         num=       3
     Sta   n Val      Sta   n Val      Sta   n Val
*********************************************
-698.226     .05-37.4955    .035 28.6625     .05

Bank Sta: Left   Right     Lengths: Left Channel   Right      Coeff Contr.    Expan.
      -37.4955 28.6625                109       50       58             .1       .3
Ineffective Flow      num=       1
   Sta L    Sta R     Elev  Permanent
-698.226     -475      815        T

CROSS SECTION OUTPUT  Profile #100-Year
*************************************************************************************
***********
* E.G. Elev (ft)         *  813.80  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.12  * Wt. n-Val.             *   0.050  *   0.035  *
  0.050  *
* W.S. Elev (ft)         *  813.68  * Reach Len. (ft)        *  109.00  *   50.00  *
  58.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      * 1634.58  *  702.62  *
  69.50  *
* E.G. Slope (ft/ft)     *0.000340  * Area (sq ft)           * 1820.67  *  702.62  *
  69.50  *
* Q Total (cfs)          * 5150.00  * Flow (cfs)             * 2545.51  * 2543.36  *
  61.13  *
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* Top Width (ft)	*	508.56	* Top Width (ft)	*	409.13	*	66.16	*	33.28	*	
* Vel Total (ft/s)	*	2.14	* Avg. Vel. (ft/s)	*	1.56	*	3.62	*	0.88	*	
* Max Chl Dpth (ft)	*	11.68	* Hydr. Depth (ft)	*	4.74	*	10.62	*	2.09	*	
* Conv. Total (cfs)	*	279476.2	* Conv. (cfs)	*	138137.8	*	138021.1	*	3317.3	*	
* Length Wtd. (ft)	*	78.36	* Wetted Per. (ft)	*	347.42	*	70.59	*	34.15	*	
* Min Ch El (ft)	*	802.00	* Shear (lb/sq ft)	*	0.10	*	0.21	*	0.04	*	
* Alpha	*	1.68	* Stream Power (lb/ft s)	*	138.38	*	0.00	*	0.00	*	
* Frctn Loss (ft)	*	0.03	* Cum Volume (acre-ft)	*	65.77	*	43.75	*	54.92	*	
* C & E Loss (ft)	*	0.00	* Cum SA (acres)	*	15.46	*	3.75	*	11.91	*	

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Warning: Divided flow computed for this cross-section.

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 2704.54

INPUT
Description: Q
Station Elevation Data num= 135

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-789.49	842.7376	-788.886	842.7425	-788.702	842.745	-787.695	842.7532	-787.517	842.7555
-786.503	842.7637	-786.332	842.766	-785.311	842.7742	-785.148	842.7764	-784.12	842.7847
-783.963	842.7867	-782.928	842.795	-782.779	842.797	-781.736	842.8053	-781.594	842.8072
-780.544	842.8155	-780.409	842.8173	-779.353	842.8257	-779.225	842.8273	-778.161	842.8357
-778.04	842.8373	-776.969	842.8457	-776.855	842.8472	-775.777	842.8556	-775.671	842.857
-774.586	842.8655	-774.486	842.8668	-773.394	842.8753	-773.301	842.8765	-772.202	842.885
-772.116	842.8861	-771.01	842.8946	-770.932	842.8956	-769.819	842.9042	-769.747	842.9051
-768.627	842.9137	-768.562	842.9145	-767.435	842.9231	-767.377	842.9238	-766.243	842.9325
-766.192	842.9331	-765.052	842.9417	-763.86	842.9509	-762.668	842.9601	-761.476	842.9692
-760.285	842.9782	-759.093	842.9871	-757.901	842.996	-757.356	843	-756.731	843.0031
-754.428	843.0147	-753.277	843.0204	-752.126	843.0262	-750.974	843.032	-749.823	843.0377
-745.217	843.0608	-745.146	843.0612	-595.414	843.7927	-569.521	843.7222	-568.895	843.72
-564.742	845.7771	-562.666	845.7824	-558.513	843.746	-558.336	843.6615	-516.253	823.5
-515.927	823.497	-515.127	823.4896	-514.327	823.4822	-359.704	822	-334.656	810
-334.454	810.0639	-334.339	810.1	-332.677	810.0981	-234.256	810	-216.119	810.1
-192.077	810	-187.274	809.6716	-186.594	809.6215	-185.468	809.5438	-184.524	809.4735
-183.667	809.4138	-182.454	809.3226	-181.871	809.2815	-180.383	809.1686	-180.079	809.147
-178.313	809.0115	-178.162	809	-177.385	809	-170.268	808.2212	-165.511	807.9977
-152.109	807.9255	-132.87	807.6868	-126.238	807.6922	-97.976	807.1075	-95.1594	807.0927
-80.4781	807.6606	-65.0183	808.1661	-61.5435	808.1143	-40.154	808.5172	-33.9359	808.2279
-32.1415	808.1547	-31.2754	808.027	-31.0274	807.9788	-30.3644	807.8913	-29.977	807.715
-28.0211	805.8766	-27.7985	805.8057	-27.6924	805.7734	-27.392	805.6662	-18.4272	802
18.5876	801.999	24.5382	803.2154	24.6103	803.2302	24.6945	803.2474	24.7589	803.2605
24.8098	803.2709	24.863	803.2818	25.1247	803.3355	29.994	808.068	30.0754	808.2154
30.781	808.4304	49.103	815.0883	58.9423	814.7796	66.3416	814.5678	78.5	814.238
86.3234	814	114.4039	816	114.6999	816	115.246	816.1567	121.5692	818
127.8107	820	133.8438	822	139.9815	824	152.4644	828	161.879	829.9497

Manning's n Values num= 3

```
     Sta   n Val      Sta   n Val      Sta   n Val
*******************************************
 -789.49     .05-33.9359    .035  29.994     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.    Expan.
      -33.9359  29.994                 52   43.25      43             .1       .3

CROSS SECTION OUTPUT  Profile #100-Year
*************************************************************************************
***********
* E.G. Elev (ft)         *  813.77  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.16  * Wt. n-Val.            *   0.050  *   0.035  *
  0.050  *
* W.S. Elev (ft)         *  813.61  * Reach Len. (ft)       *   52.00  *   43.25  *
  43.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     * 1408.78  *  667.69  *
  41.11  *
* E.G. Slope (ft/ft)     *0.000431  * Area (sq ft)          * 1408.78  *  667.69  *
  41.11  *
* Q Total (cfs)          * 5150.00  * Flow (cfs)           * 2390.04  * 2712.51  *
  47.45  *
* Top Width (ft)         *  387.23  * Top Width (ft)       *  308.26  *   63.93  *
  15.04  *
* Vel Total (ft/s)       *    2.43  * Avg. Vel. (ft/s)     *    1.70  *    4.06  *
   1.15  *
* Max Chl Dpth (ft)      *   11.61  * Hydr. Depth (ft)     *    4.57  *   10.44  *
   2.73  *
* Conv. Total (cfs)      *247927.4  * Conv. (cfs)          *115059.5  *130583.5  *
 2284.5  *
* Length Wtd. (ft)       *   47.27  * Wetted Per. (ft)     *  309.22  *   67.53  *
  16.08  *
* Min Ch El (ft)         *  802.00  * Shear (lb/sq ft)     *    0.12  *    0.27  *
   0.07  *
* Alpha                  *    1.70  * Stream Power (lb/ft s) *  161.88  *    0.00  *
   0.00  *
* Frctn Loss (ft)        *    0.02  * Cum Volume (acre-ft)  *   61.73  *   42.96  *
  54.85  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)        *   14.56  *    3.67  *
  11.88  *
*************************************************************************************
***********

CROSS SECTION


RIVER: Buckeye Creek
REACH: Buckeye Creek       RS: 2661.29

INPUT
Description: R
Station Elevation Data    num=      92
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*************************************************************************************
 -845.31843.4885-754.834843.9405-754.766843.9409-751.358843.9579-749.041843.9695
-745.565843.9869-744.406843.9927-743.247843.9984-742.095844.0042-740.945844.0099
-739.795844.0157-738.645844.0214-737.496844.0272-730.597844.0616-651.707844.4557
-558.317844.2196-557.609 844.217-556.844844.2143-556.205844.2119-552.086846.2798
-550.027846.2844-545.908844.2346-503.011   823.5-502.073823.4909 -347.88     822
-323.074     810-322.695   810.1-212.035 810.002-209.545     810-194.544   810.1
-173.378     810-172.472809.9308-172.286809.9174-170.231809.7619-169.594809.7165
-167.987809.5962-166.908809.5199-165.742809.4334-164.229809.3276-163.494809.2736
-161.558809.1394-161.245809.1166-159.546     809-152.101     809-136.763808.0827
```

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 -110.75808.0982-105.686807.9993-98.0146808.1491-77.0102808.0576-66.0628807.7445
-50.9927807.6148-35.6977807.3684-28.3477806.4554-25.9995808.0128-21.7614804.9491
-15.7224804.2221-15.1995803.4603-14.9518803.3135-14.9119803.2489 -14.864803.1711
-14.7317802.9567-14.5784802.7081  -14.51802.5971-14.4289802.4657-14.1418     802
 20.5996 801.999 27.8733802.5717 31.6672806.6741 33.4613808.3498 46.3526812.6313
 47.4211 812.945  50.625813.4845 56.0379813.6537 57.8606813.7543101.7169813.9339
 107.532     814  109.42814.1465113.0363814.4337 117.698  814.79121.0464815.0566
124.8414815.3434126.6667815.4871132.0211815.8872132.3361815.9117133.5305     816
136.3648816.6059137.9396816.9616139.7655817.3599 142.536     818147.7013819.6387
155.2016     822158.6744823.1105

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
**********************************************
 -845.31     .05-28.3477    .035 31.6672     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      -28.3477 31.6672               53      58      63             .1      .3

CROSS SECTION OUTPUT  Profile #100-Year
*************************************************************************************
***********
* E.G. Elev (ft)         *  813.74  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.18  * Wt. n-Val.            *   0.050  *   0.035  *
  0.050  *
* W.S. Elev (ft)         *  813.57  * Reach Len. (ft)       *   53.00  *   58.00  *
  63.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     * 1326.73  *  633.39  *
  52.57  *
* E.G. Slope (ft/ft)     *0.000495  * Area (sq ft)          * 1326.73  *  633.39  *
  52.57  *
* Q Total (cfs)          * 5150.00  * Flow (cfs)           * 2347.04  * 2742.68  *
  60.28  *
* Top Width (ft)         *  383.68  * Top Width (ft)       *  302.10  *   60.01  *
  21.57  *
* Vel Total (ft/s)       *    2.56  * Avg. Vel. (ft/s)     *    1.77  *    4.33  *
   1.15  *
* Max Chl Dpth (ft)      *   11.57  * Hydr. Depth (ft)     *    4.39  *   10.55  *
   2.44  *
* Conv. Total (cfs)      *231524.7  * Conv. (cfs)          *105514.2  *123300.5  *
 2710.1  *
* Length Wtd. (ft)       *   56.37  * Wetted Per. (ft)     *  303.06  *   64.51  *
  23.01  *
* Min Ch El (ft)         *  802.00  * Shear (lb/sq ft)     *    0.14  *    0.30  *
   0.07  *
* Alpha                  *    1.75  * Stream Power (lb/ft s) *  158.67  *    0.00  *
   0.00  *
* Frctn Loss (ft)        *    0.03  * Cum Volume (acre-ft) *   60.10  *   42.32  *
  54.80  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)       *   14.20  *    3.61  *
  11.86  *
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CROSS SECTION


RIVER: Buckeye Creek
REACH: Buckeye Creek      RS: 2603.43

INPUT
Description: S
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Station Elevation Data num= 97

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-903.573	844.179	-745.605	844.9257	-745.521	844.926	-733.108	844.9847	-731.972	844.9901
-730.836	844.9955	-729.701	845.0008	-728.57	845.0062	-727.448	845.0115	-726.318	845.0169
-724.049	845.0276	-720.657	845.0437	-715.191	845.0696	-679.355	844.999	-678.338	844.997
-677.321	844.995	-676.304	844.993	-675.286	844.991	-674.269	844.989	-673.252	844.987
-672.235	844.985	-671.217	844.983	-670.2	844.981	-669.183	844.979	-668.165	844.9771
-667.148	844.9751	-665.114	844.9711	-664.096	844.9691	-663.079	844.9671	-660.027	844.9611
-647.82	844.9371	-644.768	844.9311	-644.697	844.931	-643.75	844.9291	-643.678	844.929
-638.664	844.9191	-128.477	808.6032	-126.501	808.3951	-112.751	808.4086	-101.835	808.2237
-87.8674	808.4236	-79.4643	808.5704	-70.7329	808.1227	-56.5808	807.6348	-41.4981	806.7601
-35.357	806.5115	-33.0014	806.3751	-27.2437	806.6698	-26.4302	806.5328	-25.5223	805.9817
-22.0566	802.875	-21.9314	802.7991	-21.2061	802.1151	-21.1268	802.0691	-21.0587	802.0297
-21.0085	802.0005	19.9085	801.999	27.6902	802.9704	28.4661	803.0672	28.5329	803.0756
28.6988	803.0963	28.8267	803.1122	28.9283	803.1249	28.9851	803.132	29.0351	803.1383
29.1189	803.1487	29.3668	803.2115	29.7621	803.3273	29.8799	803.3575	35.8005	806.621
35.8619	806.6379	36.083	806.6804	46.8116	807.5441	52.5605	807.9344	59.2187	809.2258
65.9637	809.9047	80.3513	811.8202	80.7888	811.8732	94.071	812.9133	95.3145	813.0314
98.7494	813.2353	107.942	813.9176	114.808	814.0893	117.150	814.3288	128.414	814.9563
128.953	814.9583	139.376	815.3008	141.4143	815.611	145.305	815.5387	148.603	815.5297
151.330	815.5512	160.123	815.5688	160.947	815.5762	165.750	815.0369	166.667	814.9487
167.292	815.1598	171.811	816.5918						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-903.573	.05	-26.4302	.035	35.8005	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-26.4302	35.8005	68 48.89	51	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	813.70	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.28	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	813.43	Reach Len. (ft)	68.00	48.89	51.00
Crit W.S. (ft)		Flow Area (sq ft)	731.17	674.49	213.86
E.G. Slope (ft/ft)	0.000614	Area (sq ft)	731.17	674.49	213.86
Q Total (cfs)	5150.00	Flow (cfs)	1423.57	3381.39	345.05
Top Width (ft)	297.59	Top Width (ft)	169.82	62.23	65.54
Vel Total (ft/s)	3.18	Avg. Vel. (ft/s)	1.95	5.01	1.61
Max Chl Dpth (ft)	11.43	Hydr. Depth (ft)	4.31	10.84	3.26
Conv. Total (cfs)	207834.5	Conv. (cfs)	57449.8	136459.9	13924.8
Length Wtd. (ft)	53.95	Wetted Per. (ft)	170.08	64.84	65.94
Min Ch El (ft)	802.00	Shear (lb/sq ft)	0.16	0.40	0.12
Alpha	1.75	Stream Power (lb/ft s)	171.81	0.00	0.00
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	58.85	41.44	54.61

* C & E Loss (ft) * 0.02 * Cum SA (acres) * 13.91 * 3.53 * 11.80 *

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CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 2554.54

INPUT
Description: T
Station Elevation Data num= 411

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-980.714	845.055	6-808.897	845.900	5-710.302	845.764	4-624.262	845.277	2-623.855	845.2768
-622.685	845.272	9-621.872	845.272	-620.675	845.502	6-618.647	845.4984	-617.48	845.4985
-616.662	845.496	9-615.496	845.496	9-614.677	845.495	2-613.513	845.495	3-612.693	845.4936
-611.53	845.493	7-610.708	845.492	-609.546	845.493	2-603.502	845.481	9-602.354	845.4818
-601.516	845.48	-600.378	845.4798	-599.53	845.478	-598.385	845.477	9-597.544	845.4761
-596.48	845.475	9-595.557	845.474	1-594.415	845.473	9-593.571	845.472	1-592.431	845.4719
-534.039	845.338	6-532.684	845.334	3-532.563	845.334	1-531.936	845.332	-531.826	845.3318
-531.188	845.329	6-531.088	845.329	4-530.441	845.327	3-530.351	845.327	1-528.944	845.3224
-528.878	845.322	3-528.196	845.319	9-528.142	845.319	8-527.447	845.317	4-526.698	845.3149
-525.949	845.312	3-525.321	845.310	1-521.225	847.404	-519.177	847.408	1-515.081	845.3302
-470.185	823.5	-316.698	22.0073	-315.942	822	-291.263	810	-290.725	810.1
-286.843	810.096	7-278.538	810.1	-278.435	810.099	1-277.459	810.090	9-277.364	810.0905
-276.48	810.083	4-276.307	810.082	6-275.499	810.076	3-275.252	810.075	3-274.515	810.0697
-274.28	810.068	4-273.529	810.063	5-273.151	810.062	-272.542	810.057	7-272.103	810.056
-271.553	810.052	3-271.058	810.050	4-270.562	810.047	1-270.014	810.045	2 -269.57	810.0423
-268.972	810.040	2-268.576	810.037	7-267.932	810.035	5-267.581	810.033	4-266.893	810.0311
-266.586	810.029	3-265.855	810.026	9-265.589	810.025	4-264.818	810.023	-264.591	810.0217
-263.782	810.019	2-263.592	810.018	2-262.748	810.015	6-262.593	810.014	8-261.714	810.0122
-261.593	810.011	6-260.681	810.009	-260.592	810.008	5-259.649	810.005	9 -259.59	810.0056
-258.617	810.003	-257.587	810.000	1-257.531	810	-256.571	810.004	5-255.556	810.0092
-254.541	810.014	-253.526	810.018	9-252.511	810.023	7-251.496	810.028	6-249.466	810.0384
-248.451	810.043	4-247.435	810.048	4 -246.42	810.053	4-246.366	810.053	8-245.405	810.0584
-245.345	810.058	9 -244.39	810.063	5-244.325	810.064	-243.375	810.068	6-243.304	810.0692
-242.359	810.073	8-242.284	810.074	3-241.344	810.078	9-241.263	810.079	6-240.329	810.0841
-240.243	810.084	8-239.313	810.089	4-239.222	810.090	1-238.298	810.094	6-238.201	810.0954
-237.283	810.099	9 -237.18	810.100	7-236.267	810.105	2-236.159	810.106	1-235.252	810.1106
-235.138	810.111	5-234.236	810.116	-234.117	810.116	9-233.221	810.121	4-233.096	810.1224
-232.205	810.126	9-232.075	810.127	9 -231.19	810.132	4-231.054	810.133	5-230.174	810.1379
-230.033	810.139	-229.159	810.143	5-229.011	810.144	6-228.143	810.149	1 -227.99	810.1503
-227.127	810.154	7-226.968	810.156	-226.112	810.160	3-225.947	810.161	7-225.096	810.166
-224.925	810.167	4 -224.08	810.171	8-223.904	810.173	2-223.064	810.177	6-222.882	810.1791
-222.048	810.183	4 -221.86	810.184	9-221.033	810.189	2-220.838	810.190	8-220.017	810.1951
-219.816	810.196	8-219.001	810.201	-218.794	810.202	7-217.985	810.207	-217.772	810.2088
-216.969	810.213	-216.758	810.214	8-215.953	810.219	-215.728	810.220	9-214.937	810.2251
-214.706	810.227	-213.921	810.231	2-213.683	810.233	2-212.905	810.237	4-212.661	810.2394
-211.888	810.243	6-211.638	810.245	7-210.872	810.249	8-210.616	810.252	-209.856	810.2561
-209.593	810.258	3 -208.84	810.262	4 -208.57	810.264	7-207.823	810.268	7-207.547	810.2711
-206.807	810.275	1-206.524	810.277	6-205.791	810.281	6-205.501	810.284	1-204.774	810.2881
-204.478	810.290	7-203.758	810.294	6-203.455	810.297	3-202.741	810.301	2-202.432	810.3039
-201.725	810.307	8-201.409	810.310	6-200.708	810.314	5-200.385	810.317	3-199.692	810.3212
-199.362	810.324	1-198.675	810.327	9-198.338	810.330	9-197.659	810.334	7-197.314	810.3378
-196.642	810.341	6-196.291	810.344	7-195.625	810.348	5-195.267	810.351	7-194.608	810.3554
-194.243	810.358	7-193.592	810.362	4-193.219	810.365	8-192.575	810.369	5-192.195	810.3729
-191.558	810.376	6-191.171	810.380	1-190.541	810.383	7-190.146	810.387	3-189.524	810.3909
-189.122	810.394	6-188.507	810.398	1-188.097	810.401	9 -187.49	810.405	4-187.073	810.4093
-186.473	810.412	8-186.048	810.416	7 -184.87	810.423	6-184.438	810.427	6 -183.86	810.431
-183.421	810.435	1 -182.85	810.438	5-182.404	810.442	7-181.841	810.446	-181.386	810.4503

-180.831810.4536-180.369 810.458-179.821810.4612-179.351810.4657-178.812810.4689
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-168.156810.5546-167.706810.5573-167.138 810.563-166.697810.5658 -166.12810.5715
-165.687810.5742-165.102810.5801-164.678810.5828-164.084810.5887-163.668810.5914
-163.066810.5975-162.659 810.6-162.047810.6062 -161.65810.6088-161.029810.6151
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-157.973 810.642-157.612810.6444-156.955810.6512-156.602810.6535-155.936810.6604
-155.593810.6626-154.917810.6697-154.584810.6718-153.898 810.679-153.574810.6811
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-137.588810.8396-137.426810.8407-136.568810.8504-136.417810.8514-135.548810.8612
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-132.487810.8944-132.381810.8952-131.467810.9057-131.372810.9063-130.446 810.917
-130.363810.9176-129.426810.9285-129.354 810.929-128.405 810.94-128.345810.9404
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-123.247 811-122.296811.0049 -120.29811.0151-119.286811.0202-118.283811.0252
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-105.311 811.259-98.5423811.2156-75.4457810.6033-68.7899810.4425-65.8179810.3032
-51.6759 809.756-46.8879809.3135-43.8746809.0462-34.1601808.1427-31.7464807.9712
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-4.7644801.3158 -4.0603801.3572 -3.0663801.3598 -2.9957 801.362 -2.7825801.3688
13.6846801.6804 21.2014803.7411 26.5955805.1217 29.7326806.0035 30.9819806.1775
37.7533807.7236 41.9721808.6869 42.9244807.7571 45.1515807.8632 51.2689808.0101
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123.7355810.8951152.2869815.3185160.7152815.7585161.0792815.7386161.1765815.7419
161.3898815.7515161.9802815.7654171.1025815.9568171.8637815.9449183.2176 815.727
183.7018815.7308184.3173815.7321184.4593815.7334188.6501815.6781189.9823815.5514
191.7179815.4153192.0987815.4212192.4515815.5578 192.969815.9204 193.463816.1872
198.192817.6119

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-980.714	.05	-30.758	.035	37.7533	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-30.758	37.7533	83	59.92	60	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

* E.G. Elev (ft)	* 813.65	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.22	* Wt. n-Val.	* 0.050	* 0.035	* 0.050 *
* W.S. Elev (ft)	* 813.44	* Reach Len. (ft)	* 83.00	* 59.92	* 60.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 820.74	* 711.08	* 418.27 *
* E.G. Slope (ft/ft)	*0.000532	* Area (sq ft)	* 820.74	* 711.08	* 418.27 *
* Q Total (cfs)	* 5150.00	* Flow (cfs)	* 1185.11	* 3235.75	* 729.14 *
* Top Width (ft)	* 438.48	* Top Width (ft)	* 267.58	* 68.51	* 102.40 *
* Vel Total (ft/s)	* 2.64	* Avg. Vel. (ft/s)	* 1.44	* 4.55	*

```
   1.74  *
* Max Chl Dpth (ft)      *   12.45  * Hydr. Depth (ft)       *    3.07  *   10.38  *
   4.08  *
* Conv. Total (cfs)      *223224.8  * Conv. (cfs)            * 51368.2  *140252.3  *
31604.3  *
* Length Wtd. (ft)       *   62.58  * Wetted Per. (ft)       *  268.54  *   71.01  *
 103.17  *
* Min Ch El (ft)         *  800.98  * Shear (lb/sq ft)       *    0.10  *    0.33  *
   0.13  *
* Alpha                  *    2.00  * Stream Power (lb/ft s) *  198.19  *    0.00  *
   0.00  *
* Frctn Loss (ft)        *    0.06  * Cum Volume (acre-ft)   *   57.64  *   40.67  *
  54.24  *
* C & E Loss (ft)        *    0.14  * Cum SA (acres)         *   13.57  *    3.45  *
  11.70  *
*******************************************************************************
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Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 2494.62

INPUT
Description: U
Station Elevation Data num= 370

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     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
-901.346847.4363-836.621847.0528-831.459846.9436-831.393846.9422-831.323846.9408
-831.133846.9369 -830.77846.9295-830.666846.9274-830.611846.9262-830.436846.9227
-823.051846.7716-821.401846.7263-820.776846.7137-819.234 846.672-818.494846.6573
-817.058 846.619-816.204846.6024-814.874846.5674-813.906846.5488-811.573846.4883
-810.481 846.468-809.466 846.442-808.272846.4201-807.351846.3969-806.056846.3736
-805.228 846.353-803.831846.3282-803.096846.3102-801.599 846.284-800.956846.2685
 -799.36 846.241-798.807846.2279-797.113846.1992-796.645846.1922-794.853846.1617
-794.477 846.156-792.589846.1238-792.304846.1195 -790.32846.0855-790.125846.0825
-788.047846.0467-787.941846.0451-785.769846.0075-785.334     846-770.926845.4318
-769.408845.3719-747.426844.5902-744.936844.4828-740.915844.3031-736.893844.1157
-732.872843.9206 -728.85843.7179-724.829843.5075-720.808843.2894-716.786843.0636
-712.765842.8301-708.744 842.589-704.722842.3401-700.701842.0836 -696.68841.8195
-692.658841.5476-688.637 841.268-684.616840.9808-680.594840.6859-676.573840.3833
 -534.07829.3013-483.764825.3764-481.769 825.221-479.785825.0665-439.063821.8955
-425.528820.8432-421.511820.5401-417.495820.2454-413.479 819.959-409.971819.7157
-405.446819.4113 -401.43  819.15-397.413818.8971-393.397818.6525-389.381818.4163
-385.365818.1884-381.348 817.969-377.332817.7579-373.316817.5551-369.299817.3607
-365.283817.1747-363.275817.0848-359.258816.9114-355.242816.7463-351.226816.5895
 -347.21816.4411-343.193816.3011-339.177816.1695-335.161816.0462-331.144815.9313
-327.128815.8247 -325.12815.7746-323.112815.7265-319.061 815.636-316.249815.5784
-298.909     814-298.789 813.997-297.812813.9728-296.834813.9492-296.782813.9486
-295.855813.9262 -295.78813.9254-294.875813.9039-294.778813.9028-293.894 813.882
-293.775813.8808-292.913813.8607-292.773813.8593-291.931  813.84-291.769813.8383
-290.948813.8197-290.766813.8179-289.964   813.8-289.763813.7979 -288.98813.7807
-288.759813.7785-287.995813.7618-287.755813.7595 -287.01813.7434-286.751813.7409
-286.024813.7254-285.747813.7227-285.037813.7078-284.742 813.705 -284.05813.6906
-283.738813.6877-283.062813.6738-282.733813.6707-282.074813.6573-281.728813.6542
-281.085813.6412-280.723 813.638-280.096813.6255-279.718813.6221-279.106  813.61
```

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-278.713813.6066-278.116813.5949-277.707813.5914-277.125813.5802-276.702813.5765
-276.134813.5657-275.696813.5619-275.142813.5515 -274.69813.5477-274.151813.5376
-273.684813.5337-273.158 813.524-272.678  813.52-272.166813.5106-271.672813.5066
-271.172813.4975-270.666813.4934-270.179813.4847-269.659813.4805-269.185813.4721
-268.653813.4678-268.191813.4597-267.646813.4554-267.197813.4476 -266.64813.4432
-266.202813.4357-265.633813.4312-265.207 813.424-264.626813.4195-264.211813.4125
-263.619 813.408-263.216813.4012-262.612813.3967 -262.22813.3902-261.605813.3856
-261.224813.3793-260.598813.3747-260.227813.3686 -259.59 813.364 -259.23813.3581
-258.583813.3534-258.233813.3478-257.575813.3431-257.236813.3377-256.568813.3329
-256.238813.3277-209.921     813-209.167812.9956-208.173812.9899-207.179812.9843
-206.185812.9787-205.191812.9732-204.197812.9678-203.202812.9624-202.208812.9571
-201.214812.9519-200.219812.9467-200.166812.9467-199.225812.9416-199.167812.9416
-198.231812.9365-198.167812.9365-197.236812.9315-197.168812.9315-196.242812.9265
-196.168812.9266-195.247812.9216-195.169812.9217-194.252812.9168-194.169812.9168
-193.258 812.912 -193.17 812.912-192.263812.9073-192.171812.9073-191.268812.9026
-191.171812.9026-190.274812.8979-190.172 812.898-189.279812.8934-189.173812.8934
-188.284812.8888-188.173812.8888-187.289812.8843-187.174812.8844-186.295812.8799
-186.175812.8799  -185.3812.8755-185.175812.8755-184.305812.8711-184.176812.8712
 -183.31812.8668-183.177812.8669-182.315812.8626-182.178812.8626 -181.32812.8584
-181.179812.8584-180.325812.8542-180.179812.8542 -179.33812.8501 -179.18812.8501
-178.335 812.846-178.181 812.846 -177.34812.8419-177.182 812.842-176.344812.8379
-176.183 812.838-175.349 812.834-175.184 812.834-174.354812.8301-174.184812.8301
-173.359812.8262-173.185812.8262-172.364812.8223-172.186812.8224-171.368812.8185
-171.187812.8186-170.373812.8148-170.188812.8148-169.378 812.811-169.189812.8111
-168.382812.8073 -168.19812.8074-167.387812.8037-167.191812.8037-166.392   812.8
-166.192812.8001-165.396812.7964-165.193812.7965-164.401812.7929-164.194812.7929
-163.405812.7894-163.195812.7894 -162.41812.7859-162.196812.7859-161.414812.7824
-161.197812.7825-160.419 812.779-160.198 812.779-159.423812.7756-159.199812.7756
-158.428812.7722  -158.2812.7723-157.432812.7689-157.202 812.769-156.436812.7656
-156.203812.7657-155.441812.7623-155.204812.7624-154.445812.7591-154.205812.7591
 -153.45812.7559-153.206812.7559-152.454812.7527-152.207812.7527-151.458812.7495
-151.208812.7496-150.462812.7464-150.209812.7465-149.467812.7433-149.211812.7434
-148.471812.7402-136.918812.7428-129.635812.4975-109.677812.3703 -95.697812.2534
-91.8632812.2213 -69.559811.8671-68.9604811.8613-66.8785811.8385-64.4253811.7533
-59.9696811.5598-52.4704811.1648-37.5674810.1524-35.2155809.6779-24.9612807.0798
-20.9421 804.262-14.7282 800.235-13.4684799.9998 -6.9696799.1708  -.3557799.4035
       0799.3951  2.3861799.3627  7.8469799.9675 11.9346800.1588 12.4143800.4501
 18.4139802.8389 21.8537805.1499 24.5919 805.515 32.0065807.8306 33.1188808.3991
 33.7917808.6509 34.7785808.6784 36.6923808.9019 48.5334811.7483  50.458 811.831
 59.9173810.5317 61.6561810.4747 75.3647808.3478 91.3172 808.483107.3711808.4704
128.2759808.4015135.2047808.4372140.9842808.4016144.4597808.5574 161.003809.2307
164.1028809.3934164.5519809.4513190.5529814.5012192.9669815.0001 193.649815.2744
197.2077815.4264 197.281815.4289197.3614815.4324204.1324815.6381209.8108815.7755
210.7397815.7906211.1137815.9021217.1187815.6872223.4711815.5269226.6801815.1591
226.8887815.1425226.9449815.1872226.9973815.1471228.7611816.2309228.8321816.2627
229.6951816.5385 229.786816.5716229.8566816.5989229.9388816.6282233.0298817.6449

Manning's n Values         num=       3
     Sta   n Val      Sta   n Val      Sta   n Val
*********************************************
-901.346     .05-35.2155    .035 32.0065     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      -35.2155 32.0065              170   76.77      86             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
-901.346   -25.4     812        T
   21.09233.0298     812        T

CROSS SECTION OUTPUT  Profile #100-Year
*********************************************************************************
***********
* E.G. Elev (ft)         *  813.45  * Element                *  Left OB *  Channel *
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Right OB									
Vel Head (ft)		1.66	Wt. n-Val.				0.035		
W.S. Elev (ft)		811.79	Reach Len. (ft)		19.58		19.58		19.58
Crit W.S. (ft)		808.32	Flow Area (sq ft)				498.76		
E.G. Slope (ft/ft)		0.002739	Area (sq ft)		25.11		592.60		375.39
Q Total (cfs)		5150.00	Flow (cfs)				5150.00		
Top Width (ft)		240.86	Top Width (ft)		30.28		67.22		143.36
Vel Total (ft/s)		10.33	Avg. Vel. (ft/s)				10.33		
Max Chl Dpth (ft)		12.62	Hydr. Depth (ft)				10.73		
Conv. Total (cfs)		98400.9	Conv. (cfs)				98400.9		
Length Wtd. (ft)		19.58	Wetted Per. (ft)				49.79		
Min Ch El (ft)		799.17	Shear (lb/sq ft)				1.71		
Alpha		1.00	Stream Power (lb/ft s)		233.03		0.00		0.00
Frctn Loss (ft)			Cum Volume (acre-ft)		56.83		39.77		53.70
C & E Loss (ft)			Cum SA (acres)		13.28		3.36		11.53

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BRIDGE

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 2460.04

INPUT
Description:
Distance from Upstream XS = 19.58
Deck/Roadway Width = 30
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 7

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
-167.99	812 0	-50.53	812 0	-21.32	812 0
-21.32	812 809.83	17.88	812 809.83	17.88	812 0
99.43	812 0				

Upstream Bridge Cross Section Data
Station Elevation Data num= 213

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-901.346	860.086	-834.88	860.631	-834.483	860.636	-833.635	860.639	-801.532	860.807
-801.242	860.812	-800.092	860.821	-799.803	860.826	-799.229	860.83	-798.939	860.835
-798.366	860.84	-798.074	860.844	-797.503	860.849	-797.21	860.854	-796.64	860.858
-796.345	860.863	-795.778	860.868	-795.481	860.873	-794.915	860.877	-794.616	860.882
-794.052	860.887	-793.752	860.892	-793.189	860.896	-792.887	860.901	-792.326	860.905
-792.023	860.911	-791.463	860.915	-791.158	860.92	-790.601	860.925	-790.293	860.93
-789.738	860.934	-789.429	860.94	-788.875	860.944	-788.564	860.949	-788.012	860.954
-787.699	860.959	-787.149	860.963	-786.834	860.969	-786.287	860.973	-785.97	860.979

-785.424	860.983	-785.105	860.988	-784.561	860.993	-784.24	860.998	-783.699	861.003		
-783.375	861.008	-782.836	861.012	-782.51	861.018	-781.973	861.022	-781.645	861.028		
-781.111	861.032	-780.78	861.039	-780.248	861.043	-779.915	861.049	-779.386	861.053		
-779.05	861.059	-778.523	861.063	-778.185	861.069	-777.66	861.073	-777.32	861.079		
-776.798	861.083	-776.455	861.09	-775.935	861.094	-775.589	861.1	-775.073	861.104		
-774.724	861.111	-774.211	861.115	-773.859	861.121	-773.348	861.125	-772.993	861.132		
-772.486	861.136	-772.128	861.143	-763.748	861.256	-728.288	862	-712.595	862.156		
-711.745	862.165	-711.222	862.064	-710.205	861.868	-709.189	861.672	-598.823	840.399		
-568.981	834.339	-559.738	832.462	-558.711	832.254	-557.685	832.045	-551.526	830.795		
-549.473	830.378	-548.447	830.169	-546.395	829.753	-545.369	829.544	-544.342	829.336		
-543.316	829.128	-542.29	828.919	-541.747	828.809	-541.276	828.751	-540.273	828.627		
-539.271	828.503	-538.269	828.379	-536.265	828.132	-535.262	828.008	-534.26	827.885		
-532.256	827.637	-531.254	827.513	-531.199	827.507	-527.246	827.019	-527.169	827.01		
-525.241	826.772	-525.155	826.761	-523.237	826.524	-523.14	826.513	-514.22	825.413		
-514.075	825.395	-510.213	824.919	-510.046	824.898	-502.198	823.931	-439.328	816.195		
-438.688	816.118	-401.4	815.76	-386.25	815.51	-373.26	815.48	-338.72	815.07		
-334.28	815	-307.86	814.49	-304.35	814.41	-304.01	814.45	-292.77	814.29		
-291.75	814.28	-289.24	814.25	-239.27	813.37	-229.33	813.16	-224.65	813.15		
-224.32	813.11	-219.31	812.98	-213.16	812.98	-212.61	812.99	-211.09	813.02		
-185.27	813.13	-169.91	812.83	-165.7	812.79	-151.41	812.7	-129.64	812.5		
-109.68	812.37	-109.31	812.37	-108.95	812.36	-108.22	812.36	-107.85	812.35		
-106.76	812.35	-106.4	812.34	-105.67	812.34	-105.31	812.33	-104.59	812.33		
-104.23	812.32	-103.15	812.32	-102.79	812.31	-102.08	812.31	-101.72	812.3		
-101	812.3	-100.65	812.29	-99.58	812.29	-99.23	812.28	-98.52	812.28		
-98.16	812.27	-97.11	812.27	-96.75	812.26	-96.05	812.26	-95.7	812.25		
-95	812.25	-94.65	812.24	-93.6	812.24	-93.25	812.23	-92.56	812.23		
-92.21	812.22	-91.87	812.22	-68.96	811.86	-68.67	811.86	-68.37	811.85		
-67.77	811.85	-67.48	811.84	-66.88	811.84	-64.43	811.75	-59.97	811.56		
-52.47	811.16	-40.27	810.34	-37.57	810.15	-35.22	809.68	-24.96	807.08		
-20.95	804.26	-14.73	800.24	-13.47	800	-6.97	799.17	-.36	799.4		
0	799.4	2.38	799.36	7.84	799.97	11.93	800.16	12.41	800.45		
18.41	802.84	21.85	805.15	24.59	805.51	32	807.83	33.12	808.4		
33.79	808.65	34.78	808.68	36.69	808.9	48.53	811.75	50.46	811.83		
176.11	811.85	190.55	814.5	192.96	815	193.65	815.27	197.2	815.43		
197.36	815.43	204.13	815.64	209.81	815.78						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-901.346	.035	-35.22	.035	32	.05

Bank Sta: Left Right Coeff Contr. Expan.

Left	Right	Coeff Contr.	Expan.
-35.22	32	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-901.346	-25.4	812	T
21.09	209.81	812	T

Downstream Deck/Roadway Coordinates num= 8

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-420	816	0	-276	814	0	-23.04	812	0
-23.04	812	809.83	16.16	812	809.83	16.16	812	0
99.43	812	0	164.68	812	0			

Downstream Bridge Cross Section Data

Station Elevation Data num= 168

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-477.653	831.341	-476.723	830.863	-437.449	830.649	-437.043	830.647	-426.887	827.59
-426.68	827.634	-426.599	827.651	-417.714	829.554	-417.213	829.526	-415.765	829.444
-415.696	829.44	-383.534	827.586	-382.957	827.552	-382.427	827.36	-328.369	807.782

-327.199	807.358	-326.17	807.36	-325.5	807.37	-323.36	807.43	-320.98	807.49
-319.25	807.53	-318.33	807.56	-317.38	807.58	-316.39	807.61	-315.36	807.63
-312	807.72	-309.5	807.78	-308.17	807.82	-306.77	807.85	-303.76	807.93
-300.44	808.01	-296.75	808.11	-294.75	808.16	-294.61	808.16	-291.67	808.2
-291.57	808.2	-288.52	808.25	-288.31	808.25	-285.37	808.29	-285.05	808.29
-282.23	808.33	-281.79	808.34	-279.09	808.37	-278.53	808.38	-275.96	808.41
-275.27	808.42	-269.71	808.49	-268.76	808.5	-266.59	808.53	-263.48	808.56
-262.25	808.57	-260.37	808.6	-257	808.64	-254.17	808.7	-251.68	808.76
-250.54	808.79	-248.46	808.83	-247.5	808.86	-246.15	808.86	-245.27	808.88
-243.84	808.89	-243.04	808.91	-241.53	808.92	-240.81	808.93	-239.21	808.94
-238.58	808.95	-236.88	808.96	-236.35	808.97	-234.55	808.98	-234.11	808.99
-232.22	808.99	-231.87	809	-229.88	809	-229.63	809.01	-224.18	809.01
-222.72	809	-220.7	808.98	-217.89	808.96	-216.87	808.95	-216.02	808.94
-215.31	808.94	-214.7	808.93	-214.17	808.93	-213.71	808.92	-212.62	808.92
-212.33	808.91	-211.41	808.91	-211.22	808.9	-209.11	808.9	-208.41	808.91
-206.39	808.91	-205.65	808.92	-125.39	811.11	-124.94	811.11	-124.48	811.13
-124.02	811.12	-123.56	811.14	-123.11	811.13	-122.65	811.15	-122.19	811.16
-121.73	811.16	-121.27	811.17	-119.9	811.17	-119.43	811.16	-117.53	811.16
-117.06	811.15	-113.73	811.15	-113.26	811.14	-109.94	811.14	-109.46	811.13
-106.14	811.13	-105.65	811.12	-102.34	811.12	-101.85	811.11	-99.49	811.11
-99	811.1	-95.69	811.1	-95.2	811.09	-92.84	811.09	-92.34	811.08
-89.04	811.08	-88.54	811.07	-86.19	811.07	-85.69	811.06	-83.35	811.06
-82.83	811.05	-80.5	811.05	-79.98	811.04	-76.7	811.04	-76.17	811.03
-73.85	811.03	-73.32	811.02	-72.37	811.02	-72.05	810.91	-53.17	810.86
-48.44	810.69	-37.84	809.07	-30	808.33	-25.59	807.53	-22.23	806.22
-16.85	802.25	-15.05	800.91	-13.8	799.95	-13.33	799.82	-8.16	798.5
-6.82	798.57	-.39	798.8	0	798.79	1.29	798.75	6.69	799.12
8.2	799.53	13.28	800.39	15.02	801.97	21.15	805.17	21.66	805.28
26.21	805.85	26.67	805.91	30.12	807.2	37.5	809.93	37.87	810.04
38.14	810.11	39	810.16	69.62	812.05	85.89	812.92	93.96	813.4
98.67	813.65	100.06	813.69	126.28	814.65				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-477.653	.035	-22.23	.035	21.15	.05

Bank Sta: Left Right Coeff Contr. Expan.

Left	Right	Coeff Contr.	Expan.
-22.23	21.15	.3	.5

Ineffective Flow num= 3

Sta L	Sta R	Elev	Permanent
-394.24	-126.25	812.82	F
-50	-27	811.25	T
25	50	811.25	T

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

Number of Bridge Coefficient Sets = 1

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

High Flow Method
Pressure and Weir flow
Submerged Inlet Cd =
Submerged Inlet + Outlet Cd = .8

Max Low Cord =

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

BRIDGE OUTPUT Profile #100-Year

E.G. US. (ft)	813.45	Element	Inside BR US		
W.S. US. (ft)	811.79	E.G. Elev (ft)	813.45	813.45	
Q Total (cfs)	5150.00	W.S. Elev (ft)	811.79	811.79	
Q Bridge (cfs)	3705.44	Crit W.S. (ft)	808.47	808.45	
Q Weir (cfs)	1444.56	Max Chl Dpth (ft)	12.62	13.29	
Weir Sta Lft (ft)	-243.59	Vel Total (ft/s)	5.97	7.83	
Weir Sta Rgt (ft)	184.81	Flow Area (sq ft)	862.31	657.40	
Weir Submerg	0.00	Froude # Chl	0.69	0.67	
Weir Max Depth (ft)	1.45	Specif Force (cu ft)	4738.96	4811.78	
Min El Weir Flow (ft)	812.01	Hydr Depth (ft)			
Min El Prs (ft)	809.83	W.P. Total (ft)	92.80	92.18	
Delta EG (ft)	0.52	Conv. Total (cfs)			
Delta WS (ft)	0.75	Top Width (ft)			
BR Open Area (sq ft)	371.68	Frctn Loss (ft)			
BR Open Vel (ft/s)	9.97	C & E Loss (ft)			
Coef of Q		Shear Total (lb/sq ft)			
Br Sel Method	Press/Weir	Power Total (lb/ft s)	-901.35	-477.65	

Note: The downstream water surface is above the minimum elevation required for orifice flow. The orifice flow equation was used for pressure flow.
Note: For the cross section inside the bridge at the upstream end, the water surface and energy have been projected from the upstream cross section. The selected bridge modeling method does not compute answers inside the bridge.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note: For the cross section inside the bridge at the downstream end, the water surface and energy have been projected from the downstream cross section. The selected bridge modeling method does not compute answers inside the bridge.

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 2417.85

INPUT
Description: V
Station Elevation Data num= 338

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-477.653	851.84	-477.198	851.7516	-475.323	851.3575	-474.485	851.1864	-472.713	850.7946
-471.765	850.5919	-467.082	849.4559	-465.492	849.0421	-464.516	848.8253	-464.284	848.7413
-462.984	848.3916	-461.939	848.1691	-461.743	848.1226	-460.116	847.6726	-459.358	847.4874
-457.699	847.0177	-456.748	846.7801	-455.089	846.2951	-454.131	846.0471	-452.473	845.5492
-451.499	845.2884	-449.852	844.781	-448.852	844.5043	-448.25	844.3157	-447.181	844.01
-446.374	843.7541	-446.188	843.6948	-445.777	843.5748	-444.206	843.0667	-443.641	842.9002
-443.507	842.8603	-442.294	842.4918	-440.811	842.0012	-439.505	841.5936	-438.099	841.1182
-436.677	840.6623	-435.373	840.2122	-433.805	839.6967	-432.634	839.2843	-430.886	838.6956
-429.886	838.336	-427.918	837.6576	-427.138	837.3691	-424.896	836.5814	-424.649	836.4896
-423.489	836.0737	-423.294	836.0008	-423.276	835.994	-423.272	835.9924	-421.958	835.5138
-421.814	835.4643	-421.782	835.4525	-421.586	835.3783	-420.148	834.8491	-418.869	834.6789
-418.675	834.6551	-418.406	834.6223	-415.467	834.2407	-413.309	833.9612	-412.189	833.8281
-410.464	833.6082	-408.833	833.4175	-407.574	833.2593	-405.397	833.0088	-404.635	832.9147
-401.873	832.6023	-400.422	832.4387	-398.64	832.2378	-398.254	832.1979	-397.933	832.1647
-396.053	831.9583	-394.194	831.7544	-393.179	831.643	-391.994	831.513	-390.901	831.393
-388.833	831.1662	-384.787	830.7223	-384.311	830.67	-382.957	830.5215	-376.483	831.5994
-372.56	832.2526	-369.471	832.7668	-367.598	832.5575	-367.239	832.5175	-366.801	832.4685
-366.254	832.4074	-365.551	832.3289	-364.614	832.2242	-363.708	832.123	-362.944	832.0377
-362.596	831.9988	-354.518	828.4032	-348.146	825.567	-333.928	819.2384	-313.197	810.0107
-308.178	807.8151	-306.772	807.8507	-305.306	807.8879	-303.767	807.9271	-302.149	807.9682
-300.446	808.0115	-298.651	808.0571	-296.757	808.1053	-294.755	808.1562	-294.613	808.1598
-291.675	808.2016	-291.573	808.2027	-288.524	808.2457	-288.31	808.2479	-285.377	808.2888
-285.049	808.2921	-282.234	808.331	-281.788	808.3353	-279.096	808.3722	-278.529	808.3776
-275.962	808.4123	-275.272	808.4187	-272.833	808.4514	-272.016	808.4588	-269.709	808.4893
-268.761	808.4977	-266.591	808.5261	-265.509	808.5354	-263.478	808.5616	-262.257	808.5718
-260.378	808.5959	-258.623	808.6181	-257.001	808.6388	-255.539	808.6722	-254.178	808.7034
-252.886	808.7328	-251.679	808.7603	-250.542	808.7863	-249.471	808.8108	-248.458	808.8339
-247.58	808.8558	-246.153	808.8648	-245.274	808.8845	-243.843	808.8932	-243.046	808.9106
-241.529	808.9188	-240.816	808.9341	-239.218	808.9417	-238.584	808.9548	-236.886	808.9616
-236.349	808.9726	-234.557	808.9784	-234.112	808.9873	-232.223	808.992	-231.873	808.9989
-229.882	809.0023	-229.631	809.0071	-227.536	809.009	-227.386	809.0118	-225.184	809.0121
-225.138	809.0129	-224.185	809.0122	-222.726	809	-220.703	808.9831	-219.137	808.97
-217.889	808.9596	-216.872	808.951	-216.026	808.944	-215.312	808.938	-214.701	808.9329
-214.172	808.9285	-213.718	808.9246	-213.303	808.9212	-212.942	808.9182	-212.619	808.9155
-212.328	808.9131	-212.066	808.9109	-211.827	808.9089	-211.609	808.907	-211.418	808.9054
-211.227	808.9038	-211.057	808.9024	-210.901	808.9011	-210.349	808.9023	-209.754	808.9035
-209.111	808.9048	-208.414	808.9062	-207.656	808.9078	-206.828	808.9095	-206.396	808.9103
-205.657	808.9241	-125.396	811.114	-124.948	811.1118	-124.482	811.1253	-124.025	811.123
-123.567	811.1365	-123.109	811.1342	-122.652	811.1478	-122.192	811.1614	-121.737	811.159
-121.278	811.1726	-120.822	811.1701	-120.362	811.1676	-119.98	811.1651	-119.433	811.1626
-118.964	811.16	-118.484	811.16	-118.013	811.1575	-117.535	811.1575	-117.063	811.1549
-116.585	811.1549	-116.113	811.1523	-115.636	811.1523	-115.162	811.1497	-114.686	811.1497
-114.212	811.1471	-113.737	811.1471	-113.261	811.1445	-112.787	811.1445	-112.311	811.1419
-111.838	811.1419	-111.368	811.1392	-110.888	811.1393	-110.418	811.1366	-109.938	811.1367
-109.459	811.1339	-108.989	811.134	-108.509	811.1313	-108.039	811.1313	-107.558	811.1286
-107.098	811.1287	-106.608	811.1259	-106.14	811.126	-105.657	811.1232	-105.191	811.1233
-104.706	811.1205	-104.241	811.1206	-103.756	811.1178	-103.292	811.1179	-102.805	811.115
-102.342	811.1151	-101.854	811.1123	-101.392	811.1124	-100.904	811.1095	-100.443	811.1096
-99.953	811.1067	-99.493	811.1068	-99.002	811.1039	-98.543	811.1041	-98.051	811.1011
-97.594	811.1013	-97.101	811.0983	-96.644	811.0984	-96.150	811.0955	-95.695	811.0956
-95.199	811.0926	-94.745	811.0928	-94.248	811.0898	-93.795	811.0899	-93.297	811.0869
-92.845	811.087	-92.346	811.084	-91.896	811.0841	-91.395	811.0811	-90.946	811.0812

```
-90.4447811.0781-89.9968811.0783-89.4937811.0752-89.0471811.0754-88.5427811.0722
-88.0973811.0724-87.5916811.0692-87.1476811.0694-86.6405811.0662-86.1978811.0664
-85.6894811.0632 -85.248811.0634-84.7382811.0602-84.2983811.0604 -83.787811.0571
-83.3485811.0573-82.8358 811.054-82.3986811.0543-81.8845 811.051-81.4488811.0512
-80.9332811.0478 -80.499811.0481-79.9819811.0447-79.5491811.0449-79.0305811.0415
-78.5992811.0418-78.0791811.0384-77.6494811.0386-77.1276811.0352-76.6995811.0354
-76.1762811.0319-75.7495811.0322-75.2246811.0287-74.7996 811.029-74.2731811.0254
-73.8497811.0257-73.3215811.0221-72.8997811.0224-72.3698811.0188-72.0533810.9106
-56.9076810.8725-53.1707810.8556-48.4451810.6946-37.8414809.0657-30.0034808.3301
-25.5903807.5344-22.2309806.2235-16.8548802.2477-15.0521 800.911-13.8054799.9538
-13.3289799.8222 -8.1627798.5049 -6.8247798.5661  -.3887 798.802       0798.7903
  1.2826798.7523  6.6822799.1166  8.1927799.5283 13.2728800.3898 15.0219801.9666
 21.1486805.1697 21.6563 805.279 21.6693 805.279 26.2096805.8533 26.6684805.9054
 30.1146807.2018 37.4924809.9259 37.8707810.0444 38.1409810.1106 38.4724810.1328
 39.0005810.1578 69.6202 812.052 85.8869812.9165 93.9588813.3987 98.6689813.6517
100.0556813.6939126.2744814.6473126.4369812.5979

Manning's n Values          num=        3
     Sta   n Val      Sta   n Val      Sta   n Val
*********************************************
-477.653     .05-22.2309    .035 21.1486     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.    Expan.
      -22.2309 21.1486                 91   63.32      62             .3       .5
Ineffective Flow      num=        3
   Sta L   Sta R    Elev  Permanent
 -394.24 -126.25  812.82        F
     -50     -27  811.25        T
      25      50  811.25        T

CROSS SECTION OUTPUT  Profile #100-Year
*************************************************************************************
***********
* E.G. Elev (ft)         *  812.93  * Element              *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.89  * Wt. n-Val.           *   0.050  *   0.035  *
  0.050  *
* W.S. Elev (ft)         *  811.04  * Reach Len. (ft)      *   91.00  *   63.32  *
  62.00  *
* Crit W.S. (ft)         *  808.30  * Flow Area (sq ft)    *   22.38  *  452.52  *
  21.82  *
* E.G. Slope (ft/ft)     *0.003377  * Area (sq ft)         *  405.28  *  452.52  *
  71.60  *
* Q Total (cfs)          * 5150.00  * Flow (cfs)           *   30.19  * 5040.19  *
  79.62  *
* Top Width (ft)         *  317.85  * Top Width (ft)       *  242.41  *   43.38  *
  32.06  *
* Vel Total (ft/s)       *   10.37  * Avg. Vel. (ft/s)     *    1.35  *   11.14  *
   3.65  *
* Max Chl Dpth (ft)      *   12.53  * Hydr. Depth (ft)     *    0.70  *   10.43  *
   3.09  *
* Conv. Total (cfs)      * 88618.4  * Conv. (cfs)          *   519.5  * 86728.7  *
 1370.1  *
* Length Wtd. (ft)       *   66.37  * Wetted Per. (ft)     *   32.42  *   47.18  *
   7.10  *
* Min Ch El (ft)         *  798.50  * Shear (lb/sq ft)     *    0.15  *    2.02  *
   0.65  *
* Alpha                  *    1.13  * Stream Power (lb/ft s) *  126.44  *    0.00  *
   0.00  *
* Frctn Loss (ft)        *    0.11  * Cum Volume (acre-ft)  *   56.70  *   39.04  *
  53.59  *
* C & E Loss (ft)        *    0.74  * Cum SA (acres)        *   13.20  *    3.33  *
  11.49  *
```

****

Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 2354.53

INPUT
Description: W
Station Elevation Data num= 74

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-500.98	855.4376	-448.883	855.0307	-447.284	855.0183	-445.684	855.0058	-444.314	854.9951
-433.789	854.9129	-402.683	854.67	-364.418	854.3712	-364.338	854.3705	-362.758	854.3582
-360.335	854.3393	-359.387	853.9572	-357.631	853.25	-327.484	841.0708	-325.724	840.3956
-324.488	839.8715	-323.626	839.514	-322.845	839.1896	-321.508	838.636	-320.388	838.1766
-319.842	837.9534	-319.09	837.6482	-317.742	837.1056	-316.739	836.706	-316.393	836.5691
-315.438	836.1895	-251.037	810.9159	-249.426	810.2834	-248.551	809.9401	-245.632	808.6103
-202.915	808.8992	-198.953	808.9112	-198.601	808.913	-189.036	808.9598	-159.161	809.153
-149.928	809.2054	-143.837	809.1386	-84.1397	809.0752	-72.9043	809.0783	-53.6371	808.8263
-53.2997	808.8257	-42.9252	808.7942	-36.8441	808.1252	-23.4695	806.9243	-19.5108	804.1616
-12.7904	800.0458	-10.7755	799.143	-7.5001	798.0664	-3.1583	797.9512	-.2278	798.1291
4.6575	798.6936	7.7659	799.0391	12.7572	799.5347	14.5277	799.987	19.1215	802.8479
22.1048	804.8423	29.4284	805.4501	40.125	805.8212	47.5191	806.5576	48.0546	806.5883
49.6806	806.8411	53.1362	806.9178	59.0609	807.2285	74.023	807.9641	88.0653	809.4916
111.457	811.6815	126.8306	812.7461	130.8785	812.8646	132.2161	812.9832	148.0103	813.8953
183.3557	815.2389	188.3437	815.3945	195.3474	815.5652	196.0429	814.6846		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-500.98	.05	-23.4695	.035	22.104	.05

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
-23.4695 22.104 144 48.15 69 .1 .3

CROSS SECTION OUTPUT Profile #100-Year
****

E.G. Elev (ft)	812.08	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.42	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	811.66	Reach Len. (ft)	144.00	48.15	69.00
Crit W.S. (ft)		Flow Area (sq ft)	627.82	512.43	334.27
E.G. Slope (ft/ft)	0.000990	Area (sq ft)	627.82	512.43	334.27
Q Total (cfs)	5150.00	Flow (cfs)	1146.30	3250.77	752.93
Top Width (ft)	364.18	Top Width (ft)	229.47	45.57	

```
  89.14  *
* Vel Total (ft/s)       *    3.49  * Avg. Vel. (ft/s)       *    1.83  *    6.34  *
   2.25  *
* Max Chl Dpth (ft)      *   13.71  * Hydr. Depth (ft)       *    2.74  *   11.24  *
   3.75  *
* Conv. Total (cfs)      *163640.9  * Conv. (cfs)            * 36423.6  *103292.9  *
23924.4  *
* Length Wtd. (ft)       *   74.04  * Wetted Per. (ft)       *  230.18  *   49.53  *
  89.44  *
* Min Ch El (ft)         *  797.95  * Shear (lb/sq ft)       *    0.17  *    0.64  *
   0.23  *
* Alpha                  *    2.20  * Stream Power (lb/ft s) *  196.04  *    0.00  *
   0.00  *
* Frctn Loss (ft)        *    0.07  * Cum Volume (acre-ft)   *   55.62  *   38.34  *
  53.30  *
* C & E Loss (ft)        *    0.03  * Cum SA (acres)         *   12.71  *    3.27  *
  11.40  *
*************************************************************************************
***********

CROSS SECTION


RIVER: Buckeye Creek
REACH: Buckeye Creek       RS: 2306.38

INPUT
Description: X
Station Elevation Data    num=      52
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*************************************************************************************
    -600856.8431-503.774856.0213-501.874 856.005-388.004855.0363-387.935855.0358
-384.146855.0035-309.223854.3662-307.964853.7698-214.531809.5109-194.049808.3949
-190.811808.4011-189.496808.4301-176.683808.6248-165.821 808.851-160.608808.8834
-67.7908807.9351-53.6968807.9577-46.5256 807.871  -44.59808.0565-42.0698807.8316
-25.4022806.9952-23.5287805.7657-14.9812799.8893-14.3127799.5885-10.3938798.3447
 -9.5263798.3959 -4.3358798.4414  2.3702798.9325  3.3267799.0391    3.92799.1947
  9.6565800.2629  13.119 802.379 17.8383805.0083 36.4525805.2385 44.5825806.3892
 58.7944806.6417 63.0846806.7386 90.1904807.5374 99.1646807.8627114.6756808.3031
122.1126808.5803141.5209810.5836154.1839 811.627158.7893812.0657163.3973812.3713
166.8315  812.49196.4205813.7803207.1489814.2815209.9329814.3594240.2808815.2782
244.7171813.9527245.2754813.8718

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
    -600     .05-25.4022    .035 17.8383     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.    Expan.
      -25.4022 17.8383               90   51.84      42             .1       .3

CROSS SECTION OUTPUT  Profile #100-Year
*************************************************************************************
***********
* E.G. Elev (ft)         *  811.98  * Element              *  Left OB  *  Channel  *
Right OB  *
* Vel Head (ft)          *    0.31  * Wt. n-Val.           *   0.050   *   0.035   *
  0.050  *
* W.S. Elev (ft)         *  811.67  * Reach Len. (ft)      *   90.00   *   51.84   *
  42.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)    *  631.91   *  472.23   *
 550.01  *
* E.G. Slope (ft/ft)     *0.000859  * Area (sq ft)         *  631.91   *  472.23   *
```

```
 550.01  *
* Q Total (cfs)          * 5150.00  * Flow (cfs)              * 1208.45  * 2731.77  *
1209.79  *
* Top Width (ft)         *  373.73  * Top Width (ft)          *  193.69  *   43.24  *
 136.81  *
* Vel Total (ft/s)       *    3.11  * Avg. Vel. (ft/s)       *    1.91  *    5.78  *
   2.20  *
* Max Chl Dpth (ft)      *   13.33  * Hydr. Depth (ft)       *    3.26  *   10.92  *
   4.02  *
* Conv. Total (cfs)      *175704.1  * Conv. (cfs)            * 41229.0  * 93200.5  *
41274.6  *
* Length Wtd. (ft)       *   58.20  * Wetted Per. (ft)       *  194.25  *   47.11  *
 137.07  *
* Min Ch El (ft)         *  798.34  * Shear (lb/sq ft)       *    0.17  *    0.54  *
   0.22  *
* Alpha                  *    2.04  * Stream Power (lb/ft s) *  245.28  *    0.00  *
   0.00  *
* Frctn Loss (ft)        *    0.05  * Cum Volume (acre-ft)   *   53.53  *   37.80  *
  52.60  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *   12.01  *    3.22  *
  11.22  *
*************************************************************************************
***********
```

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 2254.54

INPUT
Description: Y
Station Elevation Data num= 63

```
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*************************************************************************************
-710.797858.0407-710.722  858.04-708.992 858.026-707.261 858.012-705.537 857.998
 -703.85857.9844-698.789857.9435-698.693857.9428-584.121857.0185-582.411857.0047
-580.719 856.991-579.036856.9773-577.353856.9636-577.291 856.963-462.952856.0316
-461.245856.0176-459.539856.0037-457.833855.9899-344.703855.0079 -291.95 854.542
-291.455854.5376-197.449809.1175-197.398809.0929-181.982808.4025-176.295808.4268
-167.706808.6167-50.3516807.5145-46.8231807.9527-46.6265807.9777-45.6756807.7253
-26.2108806.9466-22.6479804.8408-15.4084799.8747-12.6774798.8086  -11.48798.5337
 -7.8194799.0468 -5.4502799.3421  -.2654799.8483  1.7897799.9136  8.4412800.1726
 10.3931800.2718  12.019801.5318  18.582  804.69 33.4484805.0779 33.6437  805.09
 33.7488805.1074  41.591806.4869 61.2959806.7423 63.8458806.7804 69.7239806.8029
  99.429807.4535 99.9445807.4667126.4316807.8658140.9553 808.401142.3949808.4277
163.6221 809.251176.1942810.4698193.4249812.1763214.4868813.3653221.2331813.7598
 226.101814.1188234.2384814.5563 253.919815.1719
```

Manning's n Values num= 3

```
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
-710.797     .05-26.2108    .035  18.582     .05
```

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      -26.2108  18.582               90      50      45             .1       .3
```

CROSS SECTION OUTPUT Profile #100-Year

```
*************************************************************************************
***********
* E.G. Elev (ft)         *  811.91  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.26  * Wt. n-Val.            *   0.050  *   0.035  *
```

0.050								
* W.S. Elev (ft)	* 811.66	* Reach Len. (ft)	* 90.00	* 50.00	* 45.00			
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 620.87	* 473.57	* 676.89			
* E.G. Slope (ft/ft)	*0.000774	* Area (sq ft)	* 620.87	* 473.57	* 676.89			
* Q Total (cfs)	* 5150.00	* Flow (cfs)	* 1184.17	* 2559.38	* 1406.45			
* Top Width (ft)	* 390.89	* Top Width (ft)	* 176.50	* 44.79	* 169.60			
* Vel Total (ft/s)	* 2.91	* Avg. Vel. (ft/s)	* 1.91	* 5.40	* 2.08			
* Max Chl Dpth (ft)	* 13.12	* Hydr. Depth (ft)	* 3.52	* 10.57	* 3.99			
* Conv. Total (cfs)	*185126.4	* Conv. (cfs)	* 42567.2	* 92001.7	* 50557.5			
* Length Wtd. (ft)	* 57.79	* Wetted Per. (ft)	* 177.18	* 48.38	* 169.89			
* Min Ch El (ft)	* 798.53	* Shear (lb/sq ft)	* 0.17	* 0.47	* 0.19			
* Alpha	* 1.96	* Stream Power (lb/ft s)	* 253.92	* 0.00	* 0.00			
* Frctn Loss (ft)	* 0.04	* Cum Volume (acre-ft)	* 52.24	* 37.23	* 52.01			
* C & E Loss (ft)	* 0.01	* Cum SA (acres)	* 11.63	* 3.17	* 11.08			

****

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 2204.54

INPUT
Description: Z
Station Elevation Data num= 60

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-920.098	860.3368	-884.376	860.024	-882.298	860.0058	-880.236	859.9877	-767.171	858.9977
-765.103	858.9796	-655.548	858.0202	-653.442	858.0017	-538.698	856.9904	-429.704	856.0109
-427.483	855.991	-316.626	855.0004	-279.781	854.6712	-185.277	808.7498	-173.638	807.8966
-170.78	807.8892	-159.894	807.7003	-148.148	807.5367	-117.319	807.282	-93.6954	807.4792
-78.2267	807.8078	-46.4613	808.1542	-36.0501	807.7259	-24.3907	806.8884	-16.8644	802.5595
-12.2913	799.9043	-10.8274	799.5689	-3.5956	798.8111	-.6606	799.1814	5.4712	799.5824
7.6528	799.6541	9.4763	799.7478	15.487	800.0867	17.161	801.3591	19.9491	804.352
25.2016	804.7045	29.7843	804.9912	36.454	806.0841	39.8887	806.6316	55.2763	806.9155
59.826	806.887	85.877	806.8092	100.954	807.1086	118.078	807.5563	134.443	807.7868
136.608	808.8536	149.158	807.7566	170.324	809.8081	189.319	808.4679	190.528	808.4935
191.3024	808.572	191.946	808.6472	200.959	809.3809	215.2994	810.832	226.774	812.0523
229.066	1812.329	4231.061	7 812.534	233.553	8812.839	6257.978	1814.320	2265.358	4814.8523

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-920.098	.05	-24.3907	.035	19.9491	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-24.3907	19.9491	74	50	44	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	811.86	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.21	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	811.65	Reach Len. (ft)	74.00	50.00	44.00
Crit W.S. (ft)		Flow Area (sq ft)	646.90	481.08	821.51
E.G. Slope (ft/ft)	0.000637	Area (sq ft)	646.90	481.08	821.51
Q Total (cfs)	5150.00	Flow (cfs)	1193.74	2393.65	1562.61
Top Width (ft)	414.24	Top Width (ft)	166.86	44.34	203.05
Vel Total (ft/s)	2.64	Avg. Vel. (ft/s)	1.85	4.98	1.90
Max Chl Dpth (ft)	12.84	Hydr. Depth (ft)	3.88	10.85	4.05
Conv. Total (cfs)	204076.5	Conv. (cfs)	47303.9	94852.1	61920.6
Length Wtd. (ft)	53.01	Wetted Per. (ft)	167.60	48.07	203.38
Min Ch El (ft)	798.81	Shear (lb/sq ft)	0.15	0.40	0.16
Alpha	1.92	Stream Power (lb/ft s)	265.36	0.00	0.00
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	50.93	36.69	51.23
C & E Loss (ft)	0.02	Cum SA (acres)	11.27	3.11	10.88

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 2154.54

INPUT
Description: AA
Station Elevation Data num= 60

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-1050.24	861.8468	-955.01	861.0004	-952.86	860.9813	-843.303	860.0076	-841.128	859.9883
-730.65	859.0065	-728.461	858.987	-726.283	858.9677	-726.212	858.967	-617.411	858
-615.252	857.9809	-506.889	857.0021	-398.11	856.0051	-267.407	854.8147	-172.71	808.3911
-153.542	807.658	-139.194	807.4931	-77.0224	808.0715	-43.9268	808.018	-37.148	807.5327
-21.6816	806.2423	-11.0093	799.7369	-10.6865	799.5388	-10.5861	799.521	-5.5609	798.6043
-5.2883	798.618	3.3559	798.8336	3.5411	798.817	12.3665	799.2995	12.6887	799.2809
17.2305	800.1533	17.5655	800.2084	18.0848	800.5117	22.0618	801.8801	28.8444	804.5007
30.2089	804.6811	31.0087	804.8097	38.2124	806.5039	53.5284	806.895	56.0074	806.889
83.272	805.561	90.1643	805.8939	97.7176	805.3488	98.094	805.3298	98.4147	805.3111
119.578	805.4867	134.354	805.6575	139.081	805.1484	140.474	805.0657	145.720	805.7018
173.743	807.1308	185.906	807.6709	200.697	808.1702	219.310	808.9561	227.190	809.4411
230.219	809.9624	238.423	9810.976	8255.449	7812.859	9266.705	9813.736	7275.065	4814.3312

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-1050.24	.05	-21.6816	.035	38.2124	.05

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
-21.6816 38.2124 63 48.8 47 .1 .3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	811.81	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.15	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	811.66	Reach Len. (ft)	63.00	48.80	47.00
Crit W.S. (ft)		Flow Area (sq ft)	600.49	615.48	970.45
E.G. Slope (ft/ft)	0.000447	Area (sq ft)	600.49	615.48	970.45
Q Total (cfs)	5150.00	Flow (cfs)	916.56	2524.59	1708.85
Top Width (ft)	424.01	Top Width (ft)	157.70	59.89	206.41
Vel Total (ft/s)	2.36	Avg. Vel. (ft/s)	1.53	4.10	1.76
Max Chl Dpth (ft)	13.06	Hydr. Depth (ft)	3.81	10.28	4.70
Conv. Total (cfs)	243637.1	Conv. (cfs)	43360.7	119433.9	80842.5
Length Wtd. (ft)	50.85	Wetted Per. (ft)	158.55	62.98	206.78
Min Ch El (ft)	798.60	Shear (lb/sq ft)	0.11	0.27	0.13
Alpha	1.75	Stream Power (lb/ft s)	275.07	0.00	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	49.87	36.06	50.33
C & E Loss (ft)	0.01	Cum SA (acres)	11.00	3.06	10.68

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 2105.74

INPUT
Description: BB
Station Elevation Data num= 106

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-1272.85	850.6046	-1201.31	850.7292	-1172.62	850.7376	-1171.08	851.4443	-1170.94	851.5094
-1168.86	852.4676	-1168.51	852.6271	-1166.63	853.492	-1166.08	853.7458	-1164.41	854.5175
-1163.66	854.8658	-1162.19	855.544	-1161.23	855.9869	-1159.96	856.5716	-1158.81	857.1091
-1157.74	857.6003	-1156.38	858.2325	-1155.52	858.63	-1153.95	859.3571	-1153.38	859.6608
-1151.53	860.4828	-1151.07	860.6926	-1149.18	861.6097	-1148.85	861.7256	-1146.68	862.7377
-1146.11	863	-1024.94	862.0215	-1024.88	862.021	-1022.45	862.0011	-915.016	861.0126
-912.481	860.9893	-804.547	859.9961	-802.012	859.9728	-801.941	859.9722	-478.505	857.0033
-476.004	856.9802	-475.954	856.9797	-261.814	855.0021	-261.754	855.0015	-261.701	855.001
-261.604	855.0002	-261.538	854.9995	-255.417	854.9432	-160.214	808.0625	-153.791	808
-143.09	808	-134.159	807.8547	-134.091	807.8531	-127.272	807.7473	-115.548	807.7548
-111.914	807.8122	-109.058	807.8755	-101.073	807.9148	-90.8527	807.9424	-89.102	807.9447
-77.287	807.9914	-57.2664	807.9935	-55.0687	807.8205	-38.2277	806.8073	-35.1947	806.6109

-34.5477806.5983-34.2909806.5551-33.8193806.5375-29.8083806.2726-19.9781805.6033
-18.997805.0315-11.8032800.1455 -7.7092799.5036 -5.1681799.1867 1.3984799.1079
4.008798.9182 10.2212798.0272 12.5317797.8391 16.9716798.0973 18.4643798.1686
19.5414798.4014 23.5998799.5046 26.3871 801.644 29.6783803.9307 34.4235805.9044
38.2303806.0684 42.7389806.2992 47.0928806.2199 62.7785806.1326 63.2675806.1245
63.6208806.1198 64.4391806.1487 83.4425806.1548 91.2344806.6305 94.7178806.7987
100.5236806.8279132.4237807.2531 132.773807.2585132.8629 807.262133.0531807.2709
173.3862808.6601193.4528809.4525210.9188809.3833236.8361810.0419248.4917810.0844
253.0622810.2701259.0292 810.448272.2232811.9454279.3731812.6825292.0712813.7938
296.1686814.1195

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-1272.85	.05	-19.9781	.035	34.4235	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-19.9781	34.4235	190	202.35	215	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	811.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.21	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	811.57	Reach Len. (ft)	190.00	202.35	215.00
Crit W.S. (ft)		Flow Area (sq ft)	565.14	614.04	814.86
E.G. Slope (ft/ft)	0.000539	Area (sq ft)	565.14	614.04	814.86
Q Total (cfs)	5150.00	Flow (cfs)	951.24	2909.71	1289.05
Top Width (ft)	436.22	Top Width (ft)	147.35	54.40	234.46
Vel Total (ft/s)	2.58	Avg. Vel. (ft/s)	1.68	4.74	1.58
Max Chl Dpth (ft)	13.73	Hydr. Depth (ft)	3.84	11.29	3.48
Conv. Total (cfs)	221888.4	Conv. (cfs)	40984.4	125365.4	55538.7
Length Wtd. (ft)	204.40	Wetted Per. (ft)	148.25	58.22	234.62
Min Ch El (ft)	797.84	Shear (lb/sq ft)	0.13	0.35	0.12
Alpha	2.07	Stream Power (lb/ft s)	296.17	0.00	0.00
Frctn Loss (ft)	0.10	Cum Volume (acre-ft)	49.03	35.37	49.37
C & E Loss (ft)	0.01	Cum SA (acres)	10.78	2.99	10.44

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 1903.41

INPUT
Description: CC

Station Elevation Data num= 260

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-1413.07	849.4344	-1398.84	849.5893	-1398.03	849.5964	-1397.78	849.5997	-1396.96	849.6068
-1396.71	849.61	-1395.89	849.6172	-1395.65	849.6203	-1394.82	849.6275	-1394.58	849.6306
-1393.75	849.6378	-1393.52	849.6408	-1392.68	849.648	-1392.46	849.651	-1391.62	849.6583
-1391.39	849.6612	-1390.55	849.6684	-1390.33	849.6713	-1389.48	849.6785	-1389.26	849.6813
-1388.41	849.6886	-1388.28	849.6913	-1387.34	849.6986	-1387.13	849.7013	-1386.27	849.7086
-1386.07	849.7112	-1385.28	849.7186	-1385.01	849.7211	-1384.13	849.7285	-1383.94	849.7309
-1383.06	849.7383	-1382.88	849.7407	-1381.99	849.7481	-1381.81	849.7504	-1380.92	849.7578
-1380.75	849.7601	-1379.85	849.7675	-1379.68	849.7697	-1378.78	849.7772	-1378.62	849.7792
-1377.71	849.7867	-1377.55	849.7888	-1376.64	849.7963	-1376.49	849.7982	-1375.57	849.8058
-1375.42	849.8076	-1374.58	849.8152	-1374.36	849.817	-1373.43	849.8246	-1373.38	849.8263
-1372.36	849.8339	-1372.23	849.8355	-1371.29	849.8431	-1371.17	849.8447	-1370.21	849.8523
-1370.18	849.8538	-1369.14	849.8615	-1369.04	849.8629	-1368.07	849.8706	-1367.97	849.8719
-1367	849.8796	-1366.91	849.8808	-1365.93	849.8886	-1365.84	849.8897	-1364.86	849.8975
-1364.78	849.8985	-1363.79	849.9063	-1363.71	849.9073	-1362.72	849.9151	-1362.65	849.916
-1361.65	849.9238	-1361.58	849.9246	-1360.57	849.9324	-1360.52	849.9332	-1359.5	849.941
-1358.43	849.9495	-1357.36	849.958	-1356.29	849.9663	-1355.21	849.9746	-1354.14	849.9829
-1352	849.9991	-1324.05	850.2	-1295.88	849.9975	-1294.45	849.9872	-1293.01	849.9769
-1197.71	849.2918	-1160.16	849.2804	-1053.24	849.4924	-1051.38	850.4173	-1051.23	850.4954
-1049.38	851.4572	-1048.97	851.6229	-1047.22	852.498	-1046.71	852.7515	-1045.14	853.5397
-1044.46	853.8812	-1043.06	854.5825	-1042.28	855.0119	-1040.98	855.6262	-1039.95	856.1437
-1038.89	856.6709	-1037.69	857.2765	-1036.81	857.7166	-1035.44	858.4104	-1034.73	858.7633
-1033.18	859.5453	-1032.65	859.811	-1030.93	860.6813	-1030.57	860.8596	-1028.67	861.8183
-1028.49	861.9092	-1026.42	862.9564	-1026.33	863	-1024.14	862.9818	-910.225	862.0189
-907.98	861.9989	-905.566	861.9777	-905.513	861.9772	-800.635	861.0253	-800.576	861.0247
-798.252	861.0036	-690.931	860.0295	-689.354	860.0152	-688.554	860.008	-687.746	860.0006
-685.508	859.9803	-577.934	859.004	-576.877	858.9944	-469.217	858.0171	-469.157	858.0167
-468.211	858.008	-467.335	858	-466.458	857.9969	-465.448	857.9931	-465.383	857.9927
-464.438	857.9892	-464.341	857.9886	-463.426	857.9851	-463.299	857.9843	-462.414	857.9808
-462.259	857.9799	-406.859	857.5662	-406.513	857.5623	-405.874	857.5583	-405.524	857.5544
-404.89	857.5504	-404.535	857.5464	-403.905	857.5424	-403.546	857.5383	-402.921	857.5344
-402.557	857.5302	-401.936	857.5263	-401.567	857.5221	-400.952	857.5182	-400.578	857.5138
-399.967	857.51	-399.588	857.5056	-398.982	857.5018	-398.598	857.4973	-397.998	857.4935
-397.608	857.4889	-397.013	857.4852	-396.618	857.4805	-396.029	857.4768	-395.628	857.472
-395.044	857.4683	-394.637	857.4634	-394.06	857.4598	-393.647	857.4547	-393.075	857.4511
-392.656	857.446	-392.098	857.4425	-391.665	857.4372	-391.106	857.4337	-390.673	857.4284
-390.121	857.4249	-389.682	857.4194	-389.137	857.416	-388.698	857.4103	-388.152	857.407
-387.698	857.4012	-387.168	857.3979	-386.706	857.3919	-386.183	857.3886	-298.635	856.5485
-244.487	855.9774	-231.478	855.8591	-231.159	855.8563	-231.089	855.8557	-230.148	855.4225
-227.839	854.3346	-227.549	854.2087	-227.106	854.0054	-226.632	853.7837	-226.472	853.7494
-226.281	853.6598	-222.596	851.8915	-216.644	848.9466	-210.664	845.9064	-135.818	808.5673
-122.409	808.5258	-103.555	808	-61.3134	808	-61.1352	807.9921	-59.9432	808
-57.8691	807.9751	-57.2445	807.6799	-56.2135	807.7072	-40.7358	807.9586	-40.5618	807.8838
-39.4789	807.9332	-39.3109	807.9035	-38.3883	807.8356	-31.5937	806.9142	-23.0336	804.6204
-18.3833	802.7155	-15.3075	799.6838	-13.6039	799.1396	-11.1439	798.5894	-8.7039	798.6045
-4.8733	798.8183	-2.2412	798.9124	2.7737	799.5852	5.3671	799.7429	15.858	800.7775
19.2096	801.0701	25.9828	801.3891	28.1325	801.6995	34.8587	801.7809	40.9867	802.2243
64.9079	803.6868	67.6885	803.7594	85.9215	804.3052	102.910	806.3563	107.148	804.4077
109.559	804.6311	123.368	806.8653	124.997	806.9214	138.393	807.0363	154.022	807.9754
175.381	808.8288	193.460	809.7691	211.274	810.1282	232.800	810.0184	248.613	809.8363
261.984	809.7484	286.405	809.6644	312.773	809.7873	322.374	809.8595	329.267	809.7849
332.458	809.8225	341.591	809.7223	361.965	7 809.561	373.323	7809.628	4394.06	94809.508
398.943	7 809.448	403.056	8809.935	5 422.39	4812.193	2432.80	74813.02	48439.57	13813.4604

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-1413.07	.05	-18.3833	.035	28.1325	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-18.3833	28.1325	233 99.41	34	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	811.67	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.18	Wt. n-Val.	0.050	0.035	0.050	
W.S. Elev (ft)	811.49	Reach Len. (ft)	233.00	99.41	34.00	
Crit W.S. (ft)		Flow Area (sq ft)	452.79	533.04	1339.32	
E.G. Slope (ft/ft)	0.000480	Area (sq ft)	452.79	533.04	1339.32	
Q Total (cfs)	5150.00	Flow (cfs)	695.85	2465.32	1988.83	
Top Width (ft)	558.03	Top Width (ft)	123.28	46.52	388.23	
Vel Total (ft/s)	2.21	Avg. Vel. (ft/s)	1.54	4.62	1.48	
Max Chl Dpth (ft)	12.90	Hydr. Depth (ft)	3.67	11.46	3.45	
Conv. Total (cfs)	235127.7	Conv. (cfs)	31769.8	112556.2	90801.7	
Length Wtd. (ft)	98.06	Wetted Per. (ft)	124.81	48.06	388.69	
Min Ch El (ft)	798.59	Shear (lb/sq ft)	0.11	0.33	0.10	
Alpha	2.33	Stream Power (lb/ft s)	439.57	0.00	0.00	
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	46.81	32.70	44.05	
C & E Loss (ft)	0.01	Cum SA (acres)	10.19	2.76	8.90	

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 1804

INPUT
Description: DD
Station Elevation Data num= 499

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-1396.08	849.1244	-1383.75	849.0437	-1383.69	849.0434	-1370.49	848.957	-1370.44	848.9567
-1234.66	848.0686	-1234.57	848.0681	-1230.66	848.0425	-1230.61	848.0422	-1224.16	848
-1216.18	847.9836	-1216.12	847.9834	-1213.94	847.9788	-1213.87	847.9785	-1212.82	847.9763
-1212.74	847.976	-1211.78	847.9738	-1211.61	847.9735	-1210.58	847.9714	-1210.21	847.97
-1205.76	847.96	-1205.64	847.9596	-1204.62	847.9574	-1204.5	847.957	-1203.49	847.9548
-1203.36	847.9543	-1153.12	847.8071	-1152.24	847.8063	-1049.68	848.0947	-1048.98	848.099
-1048.59	848.1003	-1047.88	848.1086	-1011.12	848.2293	-1010.97	848.2296	-1010.32	848.2323
-1010.19	848.2326	-1009.53	848.2353	-1009.48	848.2356	-1008.73	848.2383	-1008.62	848.2386
-1007.93	848.2415	-1007.83	848.2417	-1007.13	848.2446	-1007.04	848.2448	-1006.33	848.2478
-1006.26	848.248	-1003.2	848.261	-1000.46	849.8188	-1000.17	849.9847	-997.983	851.2272
-997.43	851.5431	-995.506	852.6367	-994.69	853.1028	-993.029	854.0475	-991.951	854.6637
-990.552	855.4594	-989.212	856.226	-978.933	862.0892	-977.583	862.8726	-977.218	862.8167
-977.168	862.812	-888.53	852.599	-886.828	852.4788	-883.741	852.3676	-880.571	852.3558
-877.431	852.4428	-874.43	852.6219	-817.895	860.3012	-817.778	860.3115	-815.039	860.5943
-813.74	859.9982	-813.608	859.9365	-813.324	859.8061	-791.733	849.6623	-789.165	848.462

-787.68847.7711-786.954847.4359-786.873 847.399-786.285847.1292-785.248846.6577
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Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-1396.08	.05	-19.5913	.035	28.1516	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-19.5913	28.1516	279 199.46	52	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
-1396.08	-240	812	F

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	811.61	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.13	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	811.48	Reach Len. (ft)	279.00	199.46	52.00
Crit W.S. (ft)	805.91	Flow Area (sq ft)	797.54	570.87	1383.55
E.G. Slope (ft/ft)	0.000356	Area (sq ft)	3290.03	570.87	1383.55
Q Total (cfs)	5150.00	Flow (cfs)	1044.05	2327.95	1778.00
Top Width (ft)	1067.34	Top Width (ft)	621.61	47.74	397.99
Vel Total (ft/s)	1.87	Avg. Vel. (ft/s)	1.31	4.08	1.29
Max Chl Dpth (ft)	13.71	Hydr. Depth (ft)	3.62	11.96	3.48
Conv. Total (cfs)	272923.5	Conv. (cfs)	55329.4	123369.5	94224.6
Length Wtd. (ft)	184.75	Wetted Per. (ft)	223.60	49.71	398.82
Min Ch El (ft)	797.78	Shear (lb/sq ft)	0.08	0.26	0.08
Alpha	2.41	Stream Power (lb/ft s)	449.49	0.00	0.00

* Frctn Loss (ft)	*	0.04	* Cum Volume (acre-ft)	*	36.80	*	31.44	*	42.99	*
* C & E Loss (ft)	*	0.02	* Cum SA (acres)	*	8.19	*	2.65	*	8.60	*

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Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 1604.54

INPUT
Description: EE
Station Elevation Data num= 120

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-254.5	820.31	-253.81	820	-249.36	818.13	-249.04	818	-248.71	817.86
-244.27	816	-241.75	814.97	-239.41	814	-235.77	812.52	-234.46	812
-232.56	811.25	-229.43	810	-228.2	809.57	-224.74	808.38	-223.94	808.1
-223.65	808	-223.48	808	-221.86	808	-221.07	808	-220.61	808.01
-220.31	808.01	-220.09	808.01	-219.93	808.01	-219.8	808.01	-219.7	808.01
-219.62	808.01	-219.56	808.01	-219.5	808.01	-219.45	808.01	-219.42	808.01
-219.4	808.01	-219.38	808.01	-219.31	808.01	-219.29	808.01	-219.27	808.01
-219.26	808.01	-219.22	808.01	-219.21	808.01	-219.2	808.01	-219.19	808.01
-219.18	808.01	-219.17	808.01	-219.17	808.05	-218.46	808.05	-218.07	808.25
-208.9	807.97	-202.66	807.8	-202.47	807.73	-199.15	806.81	-197.39	806.65
-185.15	805.67	-168.49	805.12	-165.13	805.01	-163.48	805.02	-161.69	805.03
-150.76	805.17	-148.36	804.05	-144.6	801.99	-144.14	801.94	-143.94	801.8
-140.03	799.92	-137.84	799.77	-137.23	799.58	-137.01	799.73	-134.93	801.41
-134.51	801.43	-126.72	801.94	-117.53	801.92	-102.19	801.63	-88	801.53
-78.33	801.45	-66.67	801.3	-53.5	801.47	-51.58	801.47	-36.89	801.33
-18.11	800.66	-15.8	800.56	-15.31	800.44	-11.66	798.9	-2.59	797.82
-2.27	797.8	-1.95	797.77	0	797.54	4.56	797	9.86	796.53
9.89	796.53	14.62	798.12	14.69	798.14	14.81	798.26	20.33	807.16
23.78	807.16	38.24	807.17	53.5	807.14	57.16	807.14	70.39	807.14
74	807.13	112.25	806.72	127.42	806.39	151.27	806.51	160.35	807.08
183.69	807.64	190.99	807.66	210.11	808.16	216.56	808.05	241.85	807.55
242.96	807.5	249.5	807.18	265.56	806.74	289.15	808.84	301.45	809.04
322.56	809.76	342.42	809.63	360.59	809.45	381.97	809.41	400.9	809.43
411.27	809.32	419.05	810.3	430.18	811.75	441.82	812.55	451.46	813.19

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-254.5	.05	-15.8	.035	20.33	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-15.8	20.33	149 184.82	41	.1	.3

CROSS SECTION OUTPUT Profile #100-Year
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* E.G. Elev (ft)	*	811.54	* Element	*	Left OB	*	Channel	*	Right OB	*
* Vel Head (ft)	*	0.05	* Wt. n-Val.	*	0.050	*	0.035	*		

0.050						
W.S. Elev (ft)	811.49	Reach Len. (ft)	149.00	184.82	41.00	
Crit W.S. (ft)		Flow Area (sq ft)	1744.43	464.86	1416.93	
E.G. Slope (ft/ft)	0.000165	Area (sq ft)	1744.43	464.86	1416.93	
Q Total (cfs)	5150.00	Flow (cfs)	2646.95	1262.50	1240.55	
Top Width (ft)	661.40	Top Width (ft)	217.38	36.13	407.89	
Vel Total (ft/s)	1.42	Avg. Vel. (ft/s)	1.52	2.72	0.88	
Max Chl Dpth (ft)	14.96	Hydr. Depth (ft)	8.02	12.87	3.47	
Conv. Total (cfs)	400763.5	Conv. (cfs)	205981.0	98245.5	96537.1	
Length Wtd. (ft)	126.83	Wetted Per. (ft)	220.26	41.85	408.20	
Min Ch El (ft)	796.53	Shear (lb/sq ft)	0.08	0.11	0.04	
Alpha	1.57	Stream Power (lb/ft s)	451.46	0.00	0.00	
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	20.67	29.07	41.32	
C & E Loss (ft)	0.00	Cum SA (acres)	5.51	2.46	8.12	

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CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 1419.72

INPUT
Description: FF
Station Elevation Data num= 82

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-133.24	824.56	-130.81	824	-124.37	822.44	-122.58	822	-118.66	821.04
-114.37	820	-112.36	819.49	-106.45	818	-101.64	816.16	-98.65	815.34
-97.21	814.61	-89.43	814.27	-83.42	814	-82.62	813.97	-80.92	813.88
-75.91	810	-75.9	810	-72.82	810.28	-72.74	810.29	-71.16	810.43
-60.51	809.88	-58.71	809.82	-58.63	809.84	-57.68	809.87	-55.63	809.3
-52.04	808.3	-48.95	808.06	-43.9	807.61	-33.31	807.36	-29.68	807.31
-18.8	797.35	-18.51	797.15	-18.37	797.12	-9.34	796.76	-8.3	796.83
-1.89	796.37	-.01	796.51	0	796.51	5.24	797.45	10.42	797.23
15.88	797.82	25.35	798.02	28.91	797.99	35.53	800.94	37.02	801.47
37.8	801.6	46.24	803.46	74.68	805.31	77.76	805.47	79.29	805.55
80.95	805.57	112.25	806.16	129.82	806.8	146.42	807.27	181.61	807.14
183.67	807.12	193.95	807.06	228.2	806.84	237.5	806.83	265.27	806.79
281.86	806.66	304.04	806.21	331.38	805.94	344.68	806.3	350.86	806.46
385.2	806.66	387.18	806.61	399.69	807.42	427.18	809.24	432.84	809.27
465.47	809.54	480.67	809.4	493.5	809.13	509.05	808.96	518.95	808.89
532.2	808.89	549.9	809.02	555.9	809.02	563.05	809.83	577.38	811.63
584.8	812.16	599.7	813.15						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-133.24	.05	-29.68	.035	46.24	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-29.68	46.24	173 185.67	44	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	811.52	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	811.44	Reach Len. (ft)	173.00	185.67	44.00
Crit W.S. (ft)		Flow Area (sq ft)	123.51	952.70	2170.47
E.G. Slope (ft/ft)	0.000183	Area (sq ft)	123.51	952.70	2170.47
Q Total (cfs)	5150.00	Flow (cfs)	92.02	2827.34	2230.65
Top Width (ft)	653.60	Top Width (ft)	48.08	75.92	529.60
Vel Total (ft/s)	1.59	Avg. Vel. (ft/s)	0.75	2.97	1.03
Max Chl Dpth (ft)	15.07	Hydr. Depth (ft)	2.57	12.55	4.10
Conv. Total (cfs)	381216.7	Conv. (cfs)	6811.3	209286.8	165118.5
Length Wtd. (ft)	124.67	Wetted Per. (ft)	48.86	80.94	529.94
Min Ch El (ft)	796.37	Shear (lb/sq ft)	0.03	0.13	0.05
Alpha	2.11	Stream Power (lb/ft s)	599.70	0.00	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	17.48	26.06	39.63
C & E Loss (ft)	0.01	Cum SA (acres)	5.05	2.22	7.67

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 1234.05

INPUT
Description: GG
Station Elevation Data num= 125

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-206.29	819.46	-200.65	818	-197.84	817.3	-192.78	816	-189.46	815.12
-185.16	814	-177.52	812.02	-177.45	812	-177.24	811.95	-169.56	810
-163.3	808.42	-161.62	808	-160.3	807.77	-150.98	806	-149.55	805.99
-141.69	805.98	-141.5	805.98	-140.88	805.98	-133.89	805.95	-130.64	805.94
-129.27	805.94	-125.41	805.92	-125.27	805.92	-119.66	805.91	-119.47	805.91
-113.88	805.9	-113.72	805.9	-113.55	805.9	-109.15	805.89	-108.89	805.89
-108.61	805.89	-79.16	805.07	-45.36	804.14	-44.53	804.12	-43.45	804.1
-40.44	804.07	-38.68	804.06	-38.54	804.07	-38.37	804.07	-37.77	804.01
-37.24	804.01	-37.19	804	-30.78	802.5	-29.84	802	-26.29	800.22
-25.87	800	-25.24	799.69	-24.32	799.25	-21.9	798	-21.56	798
-18.9	798	-18.8	798	-18.64	798	-17.59	798	-6.79	798
-.56	798	0	798	12.11	798	12.88	798	16.74	798

19.43	799.16	21.39	800	22.15	800.53	22.62	800.82	24.24	801.82
24.53	802	24.55	802.01	24.8	802.16	25.01	802.28	25.19	802.38
25.35	802.48	25.49	802.56	25.62	802.63	25.72	802.69	25.82	802.75
25.91	802.8	25.99	802.85	26.06	802.9	26.13	802.94	26.19	802.97
26.24	803.01	26.29	803.04	26.34	803.07	26.39	803.09	26.43	803.12
26.47	803.14	26.5	803.16	26.54	803.18	26.57	803.2	26.6	803.22
26.63	803.24	26.66	803.24	54.23	804.14	56.94	804.2	74.1	806.44
77.21	806.52	80.14	806.6	85.51	806.59	126.38	806.77	130.45	806.77
167.98	806.63	179.11	806.59	180.44	806.58	215.96	806.5	220.86	806.45
248.62	806.24	255.71	806.16	256.04	806.17	276.79	805.61	282.15	805.6
287.71	805.65	319.14	806.74	339.94	807.72	355.88	808.41	377.43	808.5
408.02	808.34	427.41	808.18	441.89	808.29	466.55	808.44	473.08	808.48
487.87	810.16	499.3	811.52	507.36	812.1	507.64	812.12	523.13	813.21

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-206.29	.05	-37.19	.035	26.66	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-37.19	26.66	117	131.34	192.99	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	811.49	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.06	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	811.43	Reach Len. (ft)	117.00	131.34	192.99
Crit W.S. (ft)		Flow Area (sq ft)	769.18	780.03	2103.95
E.G. Slope (ft/ft)	0.000156	Area (sq ft)	769.18	780.03	2103.95
Q Total (cfs)	5150.00	Flow (cfs)	895.46	2138.46	2116.08
Top Width (ft)	673.76	Top Width (ft)	138.01	63.85	471.90
Vel Total (ft/s)	1.41	Avg. Vel. (ft/s)	1.16	2.74	1.01
Max Chl Dpth (ft)	13.43	Hydr. Depth (ft)	5.57	12.22	4.46
Conv. Total (cfs)	411983.7	Conv. (cfs)	71633.7	171070.3	169279.6
Length Wtd. (ft)	151.49	Wetted Per. (ft)	138.65	66.44	472.30
Min Ch El (ft)	798.00	Shear (lb/sq ft)	0.05	0.11	0.04
Alpha	1.90	Stream Power (lb/ft s)	523.13	0.00	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	15.71	22.37	37.47
C & E Loss (ft)	0.00	Cum SA (acres)	4.68	1.92	7.17

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 1102.70

INPUT
Description: HH
Station Elevation Data num= 117

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-289.51	823.17	-284.72	822.19	-283.86	822	-283.27	821.86	-274.9	820
-267.4	818.33	-265.91	818	-264.06	817.59	-257.15	816	-249.19	814.26
-248.06	814	-239.53	812.19	-238.72	812	-237.74	811.8	-228.6	810
-224.13	809.14	-217.49	808	-212.35	807.38	-210.24	807.28	-205.93	806.82
-205.12	806.75	-199.07	806.63	-196.69	806.46	-195.3	806.37	-195.04	806.35
-193.44	806.27	-192.41	806.23	-183.22	806.24	-178.07	806.21	-172.74	806.18
-171.92	806.16	-171.25	806.15	-161.2	806.03	-158.18	806.03	-156.25	806.02
-151.54	806.03	-151.43	806.03	-146.32	806.01	-146.26	806.01	-142.51	806
-133.64	805.85	-132.12	805.82	-129.94	805.78	-114.43	805.52	-102.78	805.34
-97.86	805.26	-93.46	805.2	-90.78	805.15	-87.77	805.1	-80.07	804.98
-73.86	804.89	-67.18	804.76	-58.77	804.6	-42.37	804.25	-31.66	804.01
-31.15	804.01	-29.92	804.01	-28.29	804	-27.99	804	-27.33	804
-26.85	804	-25.69	803.66	-25.11	803.49	-22.2	802	-19.2	800.47
-18.27	800	-17.41	799.56	-14.62	798	-7.66	798	0	798
1.73	798	17.37	798	17.58	798	18.13	798	18.51	798.19
22.22	800	24.75	801.24	26.32	802	28.22	802.93	31	804
31.94	804	41.11	804.07	45.61	804.3	54.04	804.54	83.33	805.28
91.06	805.49	94.01	805.59	95.91	805.61	132.94	806.3	136.29	806.33
139.49	806.35	164.42	806.54	183.4	806.63	186.37	806.61	231.26	806.05
238.05	806.05	275.37	806.2	280.92	806.2	282.25	806.21	307.77	807.46
324.8	809.33	330.91	809.81	335.5	810.13	336.15	810.18	372.12	812.23
372.24	812.18	373.78	812.33	375.76	812.44	382.54	812.44	392.23	812.55
401.64	812.64	414.95	812.72	417.44	812.75	433.14	812.79	442.12	812.72
464.37	812.83	472.75	812.9						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-289.51	.05	-25.69	.035	31	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-25.69	31	138.99	130.59	147.99	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	811.47	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.06	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	811.40	Reach Len. (ft)	138.99	130.59	147.99
Crit W.S. (ft)		Flow Area (sq ft)	1155.14	687.27	1591.89
E.G. Slope (ft/ft)	0.000173	Area (sq ft)	1155.14	687.27	1591.89
Q Total (cfs)	5150.00	Flow (cfs)	1403.20	1960.96	1785.85
Top Width (ft)	593.36	Top Width (ft)	210.04	56.69	326.63
Vel Total (ft/s)	1.50	Avg. Vel. (ft/s)	1.21	2.85	1.12
Max Chl Dpth (ft)	13.40	Hydr. Depth (ft)	5.50	12.12	4.87
Conv. Total (cfs)	391978.9	Conv. (cfs)	106800.9	149253.0	135925.0
Length Wtd. (ft)	138.23	Wetted Per. (ft)	210.51	59.40	

326.87	*									
* Min Ch El (ft)	*	798.00	*	Shear (lb/sq ft)	*	0.06	*	0.12	*	
0.05	*									
* Alpha	*	1.75	*	Stream Power (lb/ft s)	*	472.75	*	0.00	*	
0.00	*									
* Frctn Loss (ft)	*	0.03	*	Cum Volume (acre-ft)	*	13.12	*	20.16	*	
29.28	*									
* C & E Loss (ft)	*	0.00	*	Cum SA (acres)	*	4.22	*	1.74	*	
5.40	*									

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CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 972.12

INPUT
Description: II
Station Elevation Data num= 163

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-326.96	813.78	-325.06	813.78	-324.62	813.77	-312.1	813.79	-311.71	813.79
-311.3	813.78	-310.79	813.77	-310.71	813.77	-310.04	813.76	-309.09	813.74
-299.86	813.58	-299.5	813.58	-299.13	813.57	-296.5	813.51	-289.07	813.22
-281.87	812.99	-279.84	812.9	-276.56	812.81	-272.63	812.68	-270.91	812.59
-269.58	812.52	-264.51	812.38	-258.25	812.17	-257.11	812.12	-253.96	812.01
-252.79	812	-247.85	811.77	-247.06	811.74	-246.01	811.7	-235.69	811.04
-234.51	810.98	-230.45	810.9	-224.77	810.76	-217.17	810.53	-213.54	810.36
-203.45	810	-201.81	809.91	-179	808.59	-178.36	808.56	-174.95	808.41
-168.88	808	-168.86	807.99	-167.73	807.99	-167.72	807.99	-166.02	807.98
-162.03	807.97	-158.82	807.97	-157.81	807.96	-156.68	807.96	-153.18	807.93
-152.17	807.93	-147.01	807.71	-124.98	806.82	-98.36	806.05	-98.02	806.03
-96.39	806	-96.31	806	-91.58	805.99	-90.9	805.99	-90.29	805.98
-88.68	805.98	-87.34	805.98	-85.9	805.97	-82.63	805.96	-80.47	805.95
-78.95	805.94	-77.59	805.94	-55.94	805.33	-51.01	805.29	-46.29	805.27
-42.91	805.22	-39.87	805.19	-36.91	805.19	-33.31	804.55	-30.41	804.02
-30.31	804.02	-30.21	804	-28.09	802.54	-27.19	802	-25.5	801.1
-22.96	800	-18.37	797.56	-17.49	797.56	-17.43	797.56	-17.42	797.56
-13.96	797.56	0	797.56	1.22	797.56	14.24	797.56	17.93	797.56
20.45	798	26.11	799.94	26.31	800	32.11	801.03	32.83	802
49.01	803.35	49.44	803.36	55.53	803.3	55.72	803.39	56.74	803.46
60.16	803.53	85.01	805.01	113.83	805.2	119.81	805.24	126.8	805.29
131.99	805.27	139.45	805.25	147.43	805.3	150.86	805.04	162.7	804.62
166.24	804.54	176.45	805.43	177.27	805.48	179.3	805.58	201.26	806.42
208.15	807.25	223.45	808.52	236.82	809.7	252.78	811.09	252.86	811.07
252.99	811.08	255.67	811.11	272.38	811.61	292.88	811.69	300.43	811.78
310.06	811.68	312.5	811.63	314.79	811.65	317.61	811.73	317.72	811.84
317.8	811.83	320.16	811.81	334.73	811.83	341.58	811.8	343.41	811.9
345.47	811.78	346.96	811.81	348.55	811.78	352.07	811.8	367.83	811.79
370.45	811.82	383.76	811.8	383.94	811.82	395.49	811.86	398.25	811.88
398.32	812.08	398.42	811.98	398.86	812.41	408.62	812.42	418.24	812.27
427.48	812.07	437.72	811.84	443.56	811.77	454.65	811.84	466.98	811.99
475.86	812.18	480.39	812.38	482.7	812.57	490.96	812.47	496.51	812.45
496.72	812.45	505.62	812.64	511.92	812.78				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-326.96	.05	-30.21	.035	32.83	.05

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

-30.21 32.83 168 161.32 108 .1 .3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	811.44	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.10	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	811.34	Reach Len. (ft)	168.00	161.32	108.00
Crit W.S. (ft)		Flow Area (sq ft)	796.28	803.15	1238.90
E.G. Slope (ft/ft)	0.000215	Area (sq ft)	796.28	803.15	1238.90
Q Total (cfs)	5150.00	Flow (cfs)	842.45	2653.28	1654.27
Top Width (ft)	503.54	Top Width (ft)	210.11	63.04	230.39
Vel Total (ft/s)	1.81	Avg. Vel. (ft/s)	1.06	3.30	1.34
Max Chl Dpth (ft)	13.78	Hydr. Depth (ft)	3.79	12.74	5.38
Conv. Total (cfs)	351379.6	Conv. (cfs)	57479.5	181031.0	112869.1
Length Wtd. (ft)	141.54	Wetted Per. (ft)	210.35	65.65	230.82
Min Ch El (ft)	797.56	Shear (lb/sq ft)	0.05	0.16	0.07
Alpha	1.94	Stream Power (lb/ft s)	511.92	0.00	0.00
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	10.01	17.93	24.47
C & E Loss (ft)	0.00	Cum SA (acres)	3.55	1.56	4.45

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 810.82

INPUT
Description: JJ
Station Elevation Data num= 159

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-216.91	814	-209.47	814	-201.74	814	-195.8	813.64	-188.84	813.23
-185.45	813.15	-179.25	812.94	-152.13	813.27	-151.81	813.26	-149.47	813.17
-146.37	813.02	-146.36	813.01	-146.32	813.02	-140.6	812.84	-136.23	812.99
-129.02	812.75	-127.18	812.76	-123.2	812.8	-119.29	812.67	-118.82	812.66
-111.87	812.43	-109.55	812.36	-100.54	812.03	-99.84	812	-98.62	811.93
-97.8	811.89	-83.42	811.14	-76.85	810.72	-74.41	810.56	-73.74	810.51
-71.49	810.36	-66.78	810	-61.45	809.65	-58.64	809.44	-52.08	808.96
-50.37	808.85	-41.46	808	-38.34	807.75	-37.59	807.68	-36.09	807.5
-24.8	806	-20.35	804.6	-18.41	804	-18.33	803.94	-15.01	802
-12.97	800.82	-11.05	800	-10.24	799.15	-8.85	797.3	0	797.3
3.17	797.3	10.08	797.3	17.92	797.3	24.85	797.3	27.53	798
27.87	801.86	28.46	802.53	32.36	803.16	42.61	804.76	59.3	804.95
77.03	805.06	103.24	805.26	119.26	805.35	128.03	805.42	149.59	805.57
160.78	805.68	192.07	805.53	197.51	805.48	238.72	804.72	239.38	804.7

240.47	804.67	256.38	804.26	262.57	804.13	266.56	804.18	293.85	808.49
296.89	808.94	300.24	809.22	329.56	811.43	333.28	811.66	333.32	811.67
333.59	811.64	340.57	811.73	344.49	811.76	350.15	811.95	362.33	812.32
365.48	812.39	381.25	812.44	388.26	812.42	396.23	812.36	413.4	812.25
424.49	812.31	455.96	812.46	456.15	812.5	459.79	812.5	467.99	812.4
475.02	812.37	475.36	812.37	475.71	812.37	476.06	812.37	486.93	812.37
487.23	812.37	487.54	812.37	487.85	812.37	488.18	812.37	488.5	812.37
488.83	812.37	489.17	812.37	489.52	812.38	497.79	812.49	497.9	812.49
498.02	812.49	498.14	812.49	498.28	812.49	498.41	812.49	498.56	812.48
498.71	812.48	498.87	812.48	499.04	812.48	499.21	812.48	499.39	812.48
499.57	812.48	499.76	812.48	499.96	812.48	500.17	812.48	500.38	812.49
500.59	812.49	500.81	812.49	501.04	812.49	501.11	812.49	501.27	812.49
501.51	812.49	501.75	812.49	501.99	812.49	502.24	812.49	502.49	812.49
502.74	812.49	503	812.49	503.25	812.49	503.51	812.49	503.76	812.49
504.02	812.49	504.27	812.5	504.52	812.5	504.78	812.5	505.02	812.5
505.27	812.5	505.51	812.5	505.75	812.51	505.98	812.51	506.21	812.51
506.43	812.51	506.65	812.52	506.86	812.52	507.07	812.52	507.27	812.52
507.46	812.53	507.64	812.53	507.82	812.53	524.88	812.93		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-216.91	.05	-20.35	.035	42.61	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-20.35	42.61	200 178.48	258	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
256	524.88	812	T

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	811.39	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.13	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	811.26	Reach Len. (ft)	200.00	178.48	258.00
Crit W.S. (ft)		Flow Area (sq ft)	162.85	734.06	1291.56
E.G. Slope (ft/ft)	0.000323	Area (sq ft)	162.85	734.06	1543.54
Q Total (cfs)	5150.00	Flow (cfs)	159.11	2698.58	2292.31
Top Width (ft)	413.11	Top Width (ft)	65.42	62.96	284.73
Vel Total (ft/s)	2.35	Avg. Vel. (ft/s)	0.98	3.68	1.77
Max Chl Dpth (ft)	13.96	Hydr. Depth (ft)	2.49	11.66	6.05
Conv. Total (cfs)	286381.7	Conv. (cfs)	8847.9	150062.9	127471.0
Length Wtd. (ft)	210.48	Wetted Per. (ft)	65.88	69.47	213.41
Min Ch El (ft)	797.30	Shear (lb/sq ft)	0.05	0.21	0.12
Alpha	1.54	Stream Power (lb/ft s)	524.88	0.00	0.00
Frctn Loss (ft)	0.07	Cum Volume (acre-ft)	8.16	15.08	21.02
C & E Loss (ft)	0.00	Cum SA (acres)	3.01	1.33	3.81

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CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 604.54

INPUT
Description: KK
Station Elevation Data num= 137

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-233.174	813.9989	-232.973	813.9986	-232.289	813.998	-231.372	813.9967	-229.742	813.9959
-227.549	813.9948	-224.264	813.9931	-217.088	813.9857	-215.696	813.986	-206.841	813.9821
-205.84	813.9816	-204.788	813.9822	-194.697	813.9858	-163.173	813.9706	-158.177	813.9686
-152.634	813.9633	-146.756	813.9707	-144.861	813.9692	-139.535	813.9726	-138.593	813.9692
-138.165	813.9688	-136.98	813.9694	-134.88	813.9683	-127.788	813.9744	-125.894	813.9731
-121.272	813.9631	-116.236	813.979	-115.182	813.9735	-115.18	813.9735	-115.167	813.9735
-113.579	813.9705	-103.054	813.9802	-102.552	813.9802	-96.4396	813.9981	-96.401	813.9979
-96.3151	813.9976	-96.2548	813.9974	-92.5949	813.9698	-89.1202	813.9893	-89.1197	813.9893
-89.1062	813.9893	-88.8719	813.9877	-88.464	813.9854	-77.6346	814	-76.1722	814.0249
-76.0396	814.0221	-75.0491	814	-72.8004	813.9924	-71.5339	814	-68.2925	814.0181
-67.6241	814.0067	-67.0655	814	-63.1362	813.7822	-62.6167	813.7158	-62.4306	813.6903
-57.7437	813.2075	-57.278	813.1659	-52.1821	812.7736	-48.0318	812	-43.2092	810.5039
-41.7271	810	-40.1871	809.4608	-37.426	808	-35.5978	807.0706	-33.6275	806
-31.7005	804.9172	-29.9081	804	-27.7012	802.7315	-26.2969	802	-22.6626	800.1067
-22.4577	800	-22.1053	799.8164	-21.6579	799.6041	-20.9944	799.3084	-19.2176	798.4878
-18.3229	798	-17.8143	797.6355	-17.5169	797.3152	-17.4144	797.2048	-17.204	797.0948
-17.1312	797.0568	-17.0443	796.977	-16.9643	796.977	-14.1492	796.9754	-9.7049	796.9728
0	796.967	4.2277	796.965	12.9554	796.9608	14.5202	797.5832	15.5712	798
16.3983	798.2266	37.016	804.3448	47.4816	805.4643	49.6993	805.631	55.0464	805.9267
68.7324	806.0243	86.0689	805.9349	99.4712	805.9324	103.3756	805.7535	123.5639	805.9815
131.9284	806.3031	155.0962	806.4489	176.922	806.1908	200.2351	806.2999	221.5017	806.4881
244.6688	806.7242	248.5308	807.8514	258.2769	812.7261	258.4187	812.7971	261.5289	812.5223
261.5634	812.5192	261.7296	812.5045	262.1173	812.4703	262.9216	812.4098	263.0118	812.3647
263.9222	812.8204	267.3872	812.9276	287.8372	812.528	7.8808	812.7176	287.9373	813
333.0358	813	388.0003	813	391.4382	812.9313	394.5044	812.8	7394.5516	812.634
394.6045	812.3	7411.0339	812.0647	414.517	812	425.7311	811.9713	453.5416	811.6129
515.7445	812.4399	529.7005	812.704	529.7651	812.2784	529.9	812.2744	537.8269	812.4352
544.9871	812.5818	545.6321	812.595						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-233.174	.05	-52.1821	.035	37.016	.05	258.2769	.01

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-52.1821	37.016	239	198.36	80	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	811.32	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.17	Wt. n-Val.		0.035	0.050
W.S. Elev (ft)	811.15	Reach Len. (ft)	239.00	198.36	80.00
Crit W.S. (ft)		Flow Area (sq ft)		860.93	1068.53
E.G. Slope (ft/ft)	0.000393	Area (sq ft)		860.93	

1068.53										
* Q Total (cfs)	*	5150.00	*	Flow (cfs)	*		*	3340.75	*	
1809.25										
* Top Width (ft)	*	300.41	*	Top Width (ft)	*		*	82.31	*	
218.11										
* Vel Total (ft/s)	*	2.67	*	Avg. Vel. (ft/s)	*		*	3.88	*	
1.69										
* Max Chl Dpth (ft)	*	14.19	*	Hydr. Depth (ft)	*		*	10.46	*	
4.90										
* Conv. Total (cfs)	*	259915.9	*	Conv. (cfs)	*		*	168604.7	*	
91311.2										
* Length Wtd. (ft)	*	157.00	*	Wetted Per. (ft)	*		*	86.90	*	
219.14										
* Min Ch El (ft)	*	796.96	*	Shear (lb/sq ft)	*		*	0.24	*	
0.12										
* Alpha	*	1.51	*	Stream Power (lb/ft s)	*	545.63	*	0.00	*	
0.00										
* Frctn Loss (ft)	*	0.05	*	Cum Volume (acre-ft)	*	7.79	*	11.81	*	
13.29										
* C & E Loss (ft)	*	0.01	*	Cum SA (acres)	*	2.86	*	1.03	*	
2.33										

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CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 433.99

INPUT
Description: LL
Station Elevation Data num= 118

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-229.278	815.194	8-223.929	814	-216.007	812.282	8-214.672	812	-213.644	811.854
-199.654	810	-199.475	809.998	1-199.284	809.996	4-197.876	809.990	8-194.245	809.958
1-194.224	809.958	-190.378	809.952	9-185.589	809.931	5-178.386	809.930	2-174.759	809.913
7-173.858	809.910	5-173.104	809.910	2-135.756	808.847	6-130.784	808.723	6-124.612	808.569
2-120.208	808.478	9-106.084	808.189	-104.618	808.163	6-97.0655	808.005	7-96.2081	808
-91.3966	807.999	9-90.6109	807.999	9-90.6089	807.999	9-79.6388	807.528	4 -70.249	807.220
9-64.0023	807.016	8 -57.822	806.787	7 -47.763	806.399	8-45.2924	806.3	-42.521	806.207
2-41.0271	806.161	7-37.6188	806.011	3-36.9622	806.011	9-36.9558	806	-33.5286	804.271
9-32.9893	804	-30.1013	802.543	8-28.8812	802	-28.6284	801.883	5-24.4607	800
8-22.4598	799.074	2-20.1381	798	-17.3289	797.007	6-16.8149	796.869	-16.1607	796.692
7-15.7715	796.692	8-15.4168	796.692	8 -3.3365	796.693	9	0	796.694	2 9.7926
796.695	2 11.9538	797.860	5 12.2195	798	15.1308	799.302	1 16.691	800	17.3669
800.244	8 22.5249	802	22.6644	802	22.9157	802	22.9325	802	22.9367
802	25.4797	802.903	25.8093	802.980	9 28.1877	803.484	5 28.2949	803.546	2 28.3699
802.289	3 28.3834	802.568	9 28.3837	802.285	9 28.3984	802.282	4 28.4141	802.278	6 35.2887
802.756	2 46.9655	803.001	8 49.0686	803.478	1 55.3207	804.730	2 65.6319	804.457	75.1428
804.304	5 82.191	804.931	5 83.7642	805.009	7 94.6426	805.484	3107.930	1 805.055	115.018
3805.144	4 115.986	6805.191	2132.955	9805.865	4140.416	2806.118	1179.168	8805.807	7186.102
6805.747	2 218.995	8805.952	9 229.195	806.555	1235.542	4809.714	6239.695	5811.781	8 242.019
811.913	1 242.659	5811.949	3243.110	3811.974	8243.339	7811.987	8243.450	2 811.994	244.228
1811.990	3 245.160	4811.528	1245.235	3811.565	4248.818	6811.606	3308.700	8812.283	1323.800
4812.292	8 339.717	812.303	1342.292	9812.259	3414.306	3811.661	6424.550	3811.529	5436.108
1811.437	5 504.488	4812.683	8512.709	8812.763	1512.771	5811.978	1513.144	1811.937	1513.835
4811.860	9 522.287	1812.041	6528.922	7812.183	4531.677	9812.242	3			

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val

-229.278 .05-36.9558 .035 28.3834 .05244.2281 .01

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
-36.9558 28.3834 150.99 144.27 75.99 .1 .3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	811.25	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.12	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	811.13	Reach Len. (ft)	150.99	144.27	75.99
Crit W.S. (ft)		Flow Area (sq ft)	449.14	780.13	1208.66
E.G. Slope (ft/ft)	0.000285	Area (sq ft)	449.14	780.13	1208.66
Q Total (cfs)	5150.00	Flow (cfs)	428.22	2785.14	1936.65
Top Width (ft)	446.54	Top Width (ft)	171.21	65.34	210.00
Vel Total (ft/s)	2.11	Avg. Vel. (ft/s)	0.95	3.57	1.60
Max Chl Dpth (ft)	14.44	Hydr. Depth (ft)	2.62	11.94	5.76
Conv. Total (cfs)	305174.5	Conv. (cfs)	25375.0	165039.4	114760.1
Length Wtd. (ft)	121.30	Wetted Per. (ft)	171.35	70.13	211.65
Min Ch El (ft)	796.69	Shear (lb/sq ft)	0.05	0.20	0.10
Alpha	1.78	Stream Power (lb/ft s)	531.68	0.00	0.00
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	6.55	8.08	11.20
C & E Loss (ft)	0.00	Cum SA (acres)	2.39	0.69	1.93

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 289.71

INPUT
Description: MM
Station Elevation Data num= 155

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-348.33	816.56	53-348.235	816.54	15-347.808	816.44	03 -345.95	816	-342.839	815.3611
-339.644	814.72	35-336.018	814	-328.134	813.426	-322.177	813.05	37-305.646	812
-302.142	811.76	16-298.258	811.43	23 -280.91	810	-279.28	809.93	07-246.448	808.5454
-235.553	808	-235.466	808	-231.892	808	-230.118	808	-225.754	808
-220.809	808	-220.768	808	-216.444	808	-211.332	808	-195.516	808
-194.468	808	-194.454	808	-184.644	808	-182.425	808	-178.883	808.053
-178.723	808.05	31-178.426	808.05	64-178.095	808.06	02-172.713	808.19	94-168.017	808.3072
-160.86	808.552	-144.308	808.09	64-141.523	808.019	-137.87	808.02	13-133.466	808.025
-127.349	808.03	01-116.669	808.04	29-91.6986	808.03	23-68.9424	808.02	43-63.0255	808.0244
-59.0143	808.01	81-55.8818	808.01	72-55.7621	808.017	-55.732	808.017	-53.313	808.0137
-52.544	808.01	32 -49.338	808.00	86-47.1399	808.00	84-46.1119	808.00	84-43.6887	808.0055

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-42.0291808.0053-41.1561808.0041-36.4646     808-36.1814807.9566-34.8363807.8192
-34.0096807.4486-33.8803 807.414-30.4972     806-28.5897805.2013-25.7211     804
-24.0556803.1286-22.2662     802 -20.716801.0714-18.7465     800-17.1794799.0814
-15.3985     798-13.0501797.1292-12.7532 797.032-12.3825796.9105-11.9065796.7546
-11.2731796.5471-10.9952 796.456 -7.9143796.4575 -7.2259796.4578  -3.158796.4597
 -1.4076796.4605       0796.4611  1.4687796.4618   4.015796.4629  7.8806796.4646
  9.2977796.4652 14.5191796.4676 14.5599796.4676  14.716796.4677 17.9075797.5041
 19.4744     798 19.9491798.4592 20.4581798.9271 20.7128799.1612 20.8656799.3017
 20.9675799.3954 21.0475799.4596 21.1082799.5084 21.1559799.5467 21.1943799.5775
 21.2259799.6029  21.692799.8711 21.6972799.8665  24.373800.3763  35.606802.3776
 50.2237802.6272 53.8781802.6899 63.0236802.9127 78.8004802.5273 78.9881802.5313
 82.8144802.6459 94.0213803.0176100.6857804.0538109.9492805.3044112.5614805.3683
144.0924805.3716153.0878805.3079168.3875806.3945175.6583809.9223181.6704812.8394
183.2006812.8684 183.588812.8757183.6582 812.877185.1161812.9047185.3791812.9097
185.4694812.9114 185.638812.9146185.6928812.9156185.7405812.9165186.2816812.9359
186.3443812.9052187.3064812.4335194.7764   812.5226.1436   812.5226.1763812.6594
226.2461     813247.5277     813308.2245     813308.8389 812.988314.8853  812.87
 314.893812.8322314.9877  812.37319.4487812.2891335.3799     812 359.907811.8694
380.5365811.7259413.8427811.9358460.5469812.1524460.6901811.7319461.2702811.4858
461.4552811.4073463.3615811.4487466.3753 811.514 476.785811.7398490.5626812.0386

Manning's n Values         num=        4
     Sta   n Val      Sta   n Val      Sta   n Val      Sta   n Val
*************************************************************
 -348.33      .05-34.8363     .035  35.606      .05181.6704      .01

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.    Expan.
      -34.8363  35.606               142  180.45     179              .1       .3

CROSS SECTION OUTPUT  Profile #100-Year
*************************************************************************************
***********
* E.G. Elev (ft)         *  811.22  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.12  * Wt. n-Val.             *   0.050  *   0.035  *
  0.050  *
* W.S. Elev (ft)         *  811.10  * Reach Len. (ft)        *  142.00  *  180.45  *
 179.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      *  709.47  *  820.06  *
 951.68  *
* E.G. Slope (ft/ft)     *0.000270  * Area (sq ft)           *  709.47  *  820.06  *
 951.68  *
* Q Total (cfs)          * 5150.00  * Flow (cfs)             *  677.07  * 2835.48  *
1637.46  *
* Top Width (ft)         *  472.28  * Top Width (ft)         *  259.37  *   70.44  *
 142.47  *
* Vel Total (ft/s)       *    2.08  * Avg. Vel. (ft/s)       *    0.95  *    3.46  *
   1.72  *
* Max Chl Dpth (ft)      *   14.64  * Hydr. Depth (ft)       *    2.74  *   11.64  *
   6.68  *
* Conv. Total (cfs)      *313583.2  * Conv. (cfs)            * 41226.6  *172651.9  *
99704.7  *
* Length Wtd. (ft)       *  173.23  * Wetted Per. (ft)       *  259.48  *   74.26  *
 143.78  *
* Min Ch El (ft)         *  796.46  * Shear (lb/sq ft)       *    0.05  *    0.19  *
   0.11  *
* Alpha                  *    1.77  * Stream Power (lb/ft s) *  490.56  *    0.00  *
   0.00  *
* Frctn Loss (ft)        *    0.06  * Cum Volume (acre-ft)   *    4.55  *    5.43  *
   9.31  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *    1.65  *    0.47  *
   1.63  *
*************************************************************************************
```

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CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 109.26

INPUT
Description: NN
Station Elevation Data num= 85

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-420.57	814.39	-419.2	814	-407.77	813.42	-407.7	813.42	-379.04	812
-378.22	811.99	-334.8	811.11	-302.12	810.46	-279.5	810	-278.77	810
-199.19	808.01	-198.67	808	-196.73	808	-196.71	808	-160.16	807.18
-150.67	806.97	-143.98	806.83	-123.71	806.44	-101.58	806	-100.78	806
-92.21	805.99	-80.49	805.97	-77.36	805.97	-69.5	805.98	-53.95	806
-46.87	806	-41.13	806	-38.95	806	-35.79	806	-33.95	804.99
-32.14	804	-29.75	802.69	-28.49	802	-26.52	800.92	-25.03	800
-24.55	799.7	-20.63	798	-13.87	796.17	-7.1	796.17	-6.45	796.17
-5.34	796.17	-3.06	796.17	0	796.17	9.83	796.17	10.32	798
11.65	798	12.28	798	15.39	799.59	16.21	800	18.42	801.13
20.26	802	23.7	803.6	24.16	803.84	24.46	804	25.31	804.27
25.55	804.34	26.05	804.45	33.05	806	33.29	806	34.24	806
36.49	805.83	40.87	805.6	49.87	805.76	78.79	805.59	114.93	804.96
121.77	804.87	141.12	804.61	165.89	804.29	192.3	804.3	201.03	804.39
211.75	804.67	229.66	805	247.1	805.46	263.63	805.77	272.64	805.95
279.01	806.31	286.81	806.72	289.32	807.18	307.42	809.78	309.29	809.95
325.74	811.48	328.02	811.69	328.25	811.72	328.26	811.72	328.83	811.89

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-420.57	.05	-35.79	.035	33.05	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-35.79	33.05	105.99	109.26	120	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
92	328.83	812	T

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	811.15	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.20	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	810.95	Reach Len. (ft)	105.99	109.26	120.00
Crit W.S. (ft)		Flow Area (sq ft)	889.34	785.16	312.26
E.G. Slope (ft/ft)	0.000443	Area (sq ft)	889.34	785.16	1539.73
Q Total (cfs)	5150.00	Flow (cfs)	1172.05	3384.46	593.48
Top Width (ft)	646.59	Top Width (ft)	290.80	68.84	286.96
Vel Total (ft/s)	2.59	Avg. Vel. (ft/s)	1.32	4.31	1.90
Max Chl Dpth (ft)	14.78	Hydr. Depth (ft)	3.06	11.41	5.30

* Conv. Total (cfs)	*244651.5	* Conv. (cfs)	* 55678.6	*160779.3	28193.6	*
* Length Wtd. (ft)	* 111.47	* Wetted Per. (ft)	* 290.85	* 74.12	58.97	*
* Min Ch El (ft)	* 796.17	* Shear (lb/sq ft)	* 0.08	* 0.29	0.15	*
* Alpha	* 1.94	* Stream Power (lb/ft s)	* 328.83	* 0.00	0.00	*
* Frctn Loss (ft)	* 0.03	* Cum Volume (acre-ft)	* 1.94	* 2.10	4.19	*
* C & E Loss (ft)	* 0.04	* Cum SA (acres)	* 0.75	* 0.18	0.74	*

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

CROSS SECTION

RIVER: Buckeye Creek
REACH: Buckeye Creek RS: 0

INPUT
Description: OO
Station Elevation Data num= 115

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-417.03	813.82	-412.45	812.94	-406.81	812	-406.1	812	-405.22	812
-395.28	811.74	-380.91	811.39	-371.41	811.15	-364.68	810.99	-359.42	810.86
-355.34	810.77	-345.4	810.64	-340.02	810.54	-336.02	810.47	-325.13	810.34
-312.35	810.19	-297.14	810.01	-296.43	810	-296.02	810	-295.59	810
-285.2	809.91	-274.56	809.84	-274.54	809.84	-273.77	809.83	-272.94	809.82
-262.55	809.73	-253.03	809.67	-251.8	809.66	-250.49	809.65	-241.36	809.57
-232.98	809.51	-230.33	809.49	-227.4	809.46	-224.11	809.42	-220.35	809.37
-208.38	809.22	-174.4	808.34	-171.28	808.24	-167.82	808.24	-159.55	808.19
-158.48	808.19	-156.58	808.18	-145.99	808.1	-143.06	808.1	-141.48	808.1
-141.47	808.1	-141.45	808.1	-141.41	808.1	-139.97	808.09	-136.44	808.09
-134.24	808.08	-131.11	808.06	-127.77	808.05	-120.4	808.02	-118.91	808.01
-118.39	808.01	-117.91	808.01	-117.81	808.01	-115.67	808	-113.81	807.99
-106.61	807.86	-105.72	807.84	-104.61	807.82	-104.57	807.82	-102.61	807.78
-99.96	807.71	-94.79	807.56	-82.5	807.22	-39.63	806	-38.69	806
-32.64	804.46	-31.48	804	-29.07	802.86	-27.45	802	-25.43	800.91
-24.71	800.57	-23.51	800	-21.41	799	-19.3	798	-10.6	796
-.12	796	-.06	796	0	796	11.36	796	20.55	798
22.64	798.89	25.23	800	25.29	800.03	25.3	800.03	29.05	802
30.21	802.61	33.02	804	35.92	804.98	37.94	804.98	38.95	804.98
39.77	804.98	55.66	804.9	86.81	804.9	121.46	804.49	134.69	804.4
178.19	803.99	181.7	803.96	182	803.96	184.59	803.99	228.44	804.47
248.69	805.15	255.51	805.29	257.89	805.39	258.14	805.47	259.94	805.87
277.19	809.69	294.63	811.77	300.3	812.2	300.82	812.43	300.99	812.54

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-417.03	.05	-38.69	.035	35.92	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
-38.69	35.92	0	0	.1	.3

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	811.08	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	811.00	Reach Len. (ft)			
Crit W.S. (ft)	803.91	Flow Area (sq ft)	705.56	889.77	1504.49
E.G. Slope (ft/ft)	0.000191	Area (sq ft)	705.56	889.77	1504.49
Q Total (cfs)	5150.00	Flow (cfs)	484.14	2637.88	2027.98
Top Width (ft)	653.27	Top Width (ft)	326.41	74.61	252.25
Vel Total (ft/s)	1.66	Avg. Vel. (ft/s)	0.69	2.96	1.35
Max Chl Dpth (ft)	15.00	Hydr. Depth (ft)	2.16	11.93	5.96
Conv. Total (cfs)	372848.1	Conv. (cfs)	35050.7	190976.4	146821.0
Length Wtd. (ft)		Wetted Per. (ft)	326.46	78.27	252.83
Min Ch El (ft)	796.00	Shear (lb/sq ft)	0.03	0.14	0.07
Alpha	1.91	Stream Power (lb/ft s)	300.99	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

SUMMARY OF MANNING'S N VALUES

River:Buckeye Creek

Reach	River Sta.	n1	n2	n3	n4
Buckeye Creek	3504.54	.05	.035	.05	
Buckeye Creek	3454.54	.05	.035	.05	
Buckeye Creek	3404.54	.05	.035	.05	
Buckeye Creek	3354.54	.05	.035	.05	
Buckeye Creek	3304.54	.05	.035	.05	
Buckeye Creek	3254.54	.05	.035	.05	
Buckeye Creek	3204.54	.05	.035	.05	
Buckeye Creek	3154.54	.05	.035	.05	
Buckeye Creek	3104.54	.05	.035	.05	
Buckeye Creek	3054.54	.05	.035	.05	
Buckeye Creek	3004.54	.05	.035	.05	
Buckeye Creek	2954.54	.05	.035	.05	
Buckeye Creek	2904.54	.05	.035	.05	
Buckeye Creek	2854.58	.05	.035	.05	
Buckeye Creek	2804.54	.05	.035	.05	
Buckeye Creek	2754.54	.05	.035	.05	
Buckeye Creek	2704.54	.05	.035	.05	
Buckeye Creek	2661.29	.05	.035	.05	
Buckeye Creek	2603.43	.05	.035	.05	
Buckeye Creek	2554.54	.05	.035	.05	

*Buckeye Creek	*	2494.62	*	.05*	.035*	.05*	*
*Buckeye Creek	*	2460.04	*Bridge	*	*	*	*
*Buckeye Creek	*	2417.85	*	.05*	.035*	.05*	*
*Buckeye Creek	*	2354.53	*	.05*	.035*	.05*	*
*Buckeye Creek	*	2306.38	*	.05*	.035*	.05*	*
*Buckeye Creek	*	2254.54	*	.05*	.035*	.05*	*
*Buckeye Creek	*	2204.54	*	.05*	.035*	.05*	*
*Buckeye Creek	*	2154.54	*	.05*	.035*	.05*	*
*Buckeye Creek	*	2105.74	*	.05*	.035*	.05*	*
*Buckeye Creek	*	1903.41	*	.05*	.035*	.05*	*
*Buckeye Creek	*	1804	*	.05*	.035*	.05*	*
*Buckeye Creek	*	1604.54	*	.05*	.035*	.05*	*
*Buckeye Creek	*	1419.72	*	.05*	.035*	.05*	*
*Buckeye Creek	*	1234.05	*	.05*	.035*	.05*	*
*Buckeye Creek	*	1102.70	*	.05*	.035*	.05*	*
*Buckeye Creek	*	972.12	*	.05*	.035*	.05*	*
*Buckeye Creek	*	810.82	*	.05*	.035*	.05*	*
*Buckeye Creek	*	604.54	*	.05*	.035*	.05*	.01*
*Buckeye Creek	*	433.99	*	.05*	.035*	.05*	.01*
*Buckeye Creek	*	289.71	*	.05*	.035*	.05*	.01*
*Buckeye Creek	*	109.26	*	.05*	.035*	.05*	*
*Buckeye Creek	*	0	*	.05*	.035*	.05*	*

SUMMARY OF REACH LENGTHS

River: Buckeye Creek

Reach	River Sta.	Left	Channel	Right
*Buckeye Creek	3504.54	50*	50*	50*
*Buckeye Creek	3454.54	52*	50*	50*
*Buckeye Creek	3404.54	55*	50*	50*
*Buckeye Creek	3354.54	35*	50*	50*
*Buckeye Creek	3304.54	55*	50*	47*
*Buckeye Creek	3254.54	43*	50*	52*
*Buckeye Creek	3204.54	44*	50*	51*
*Buckeye Creek	3154.54	48*	50*	52*
*Buckeye Creek	3104.54	22*	50*	48*
*Buckeye Creek	3054.54	23*	50*	53*
*Buckeye Creek	3004.54	36*	50*	48*
*Buckeye Creek	2954.54	36*	50*	48*
*Buckeye Creek	2904.54	42*	49.96*	51*
*Buckeye Creek	2854.58	40*	50.04*	52*
*Buckeye Creek	2804.54	87*	50*	60*
*Buckeye Creek	2754.54	109*	50*	58*
*Buckeye Creek	2704.54	52*	43.25*	43*
*Buckeye Creek	2661.29	53*	58*	63*
*Buckeye Creek	2603.43	68*	48.89*	51*
*Buckeye Creek	2554.54	83*	59.92*	60*
*Buckeye Creek	2494.62	170*	76.77*	86*
*Buckeye Creek	2460.04	*Bridge	*	*
*Buckeye Creek	2417.85	91*	63.32*	62*
*Buckeye Creek	2354.53	144*	48.15*	69*
*Buckeye Creek	2306.38	90*	51.84*	42*
*Buckeye Creek	2254.54	90*	50*	45*
*Buckeye Creek	2204.54	74*	50*	44*
*Buckeye Creek	2154.54	63*	48.8*	47*
*Buckeye Creek	2105.74	190*	202.35*	215*
*Buckeye Creek	1903.41	233*	99.41*	34*
*Buckeye Creek	1804	279*	199.46*	52*

*Buckeye Creek	*	1604.54	* 149*	184.82*	41*
*Buckeye Creek	*	1419.72	* 173*	185.67*	44*
*Buckeye Creek	*	1234.05	* 117*	131.34*	192.99*
*Buckeye Creek	*	1102.70	* 138.99*	130.59*	147.99*
*Buckeye Creek	*	972.12	* 168*	161.32*	108*
*Buckeye Creek	*	810.82	* 200*	178.48*	258*
*Buckeye Creek	*	604.54	* 239*	198.36*	80*
*Buckeye Creek	*	433.99	* 150.99*	144.27*	75.99*
*Buckeye Creek	*	289.71	* 142*	180.45*	179*
*Buckeye Creek	*	109.26	* 105.99*	109.26*	120*
*Buckeye Creek	*	0	* 0*	0*	0*

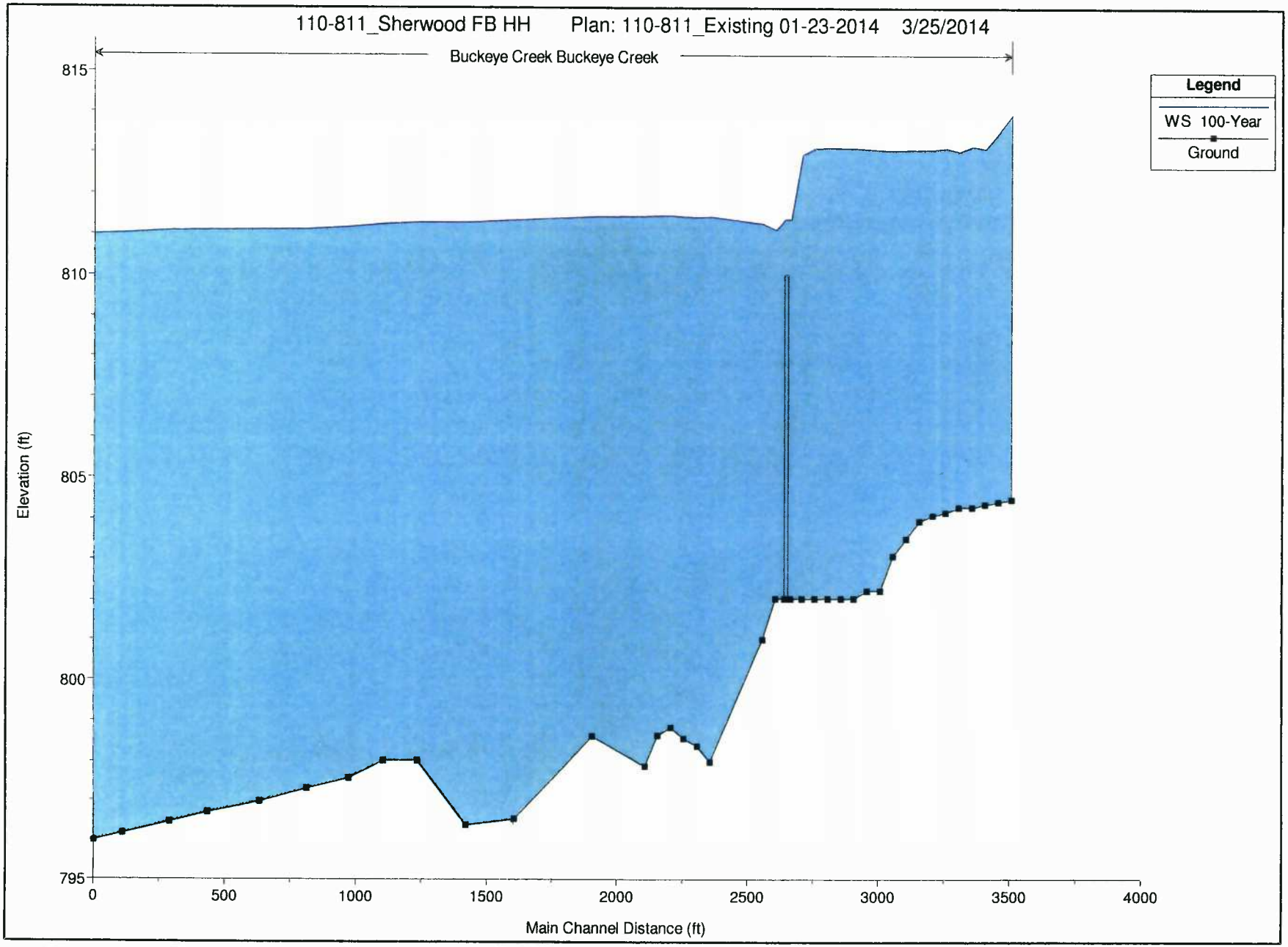
SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Buckeye Creek

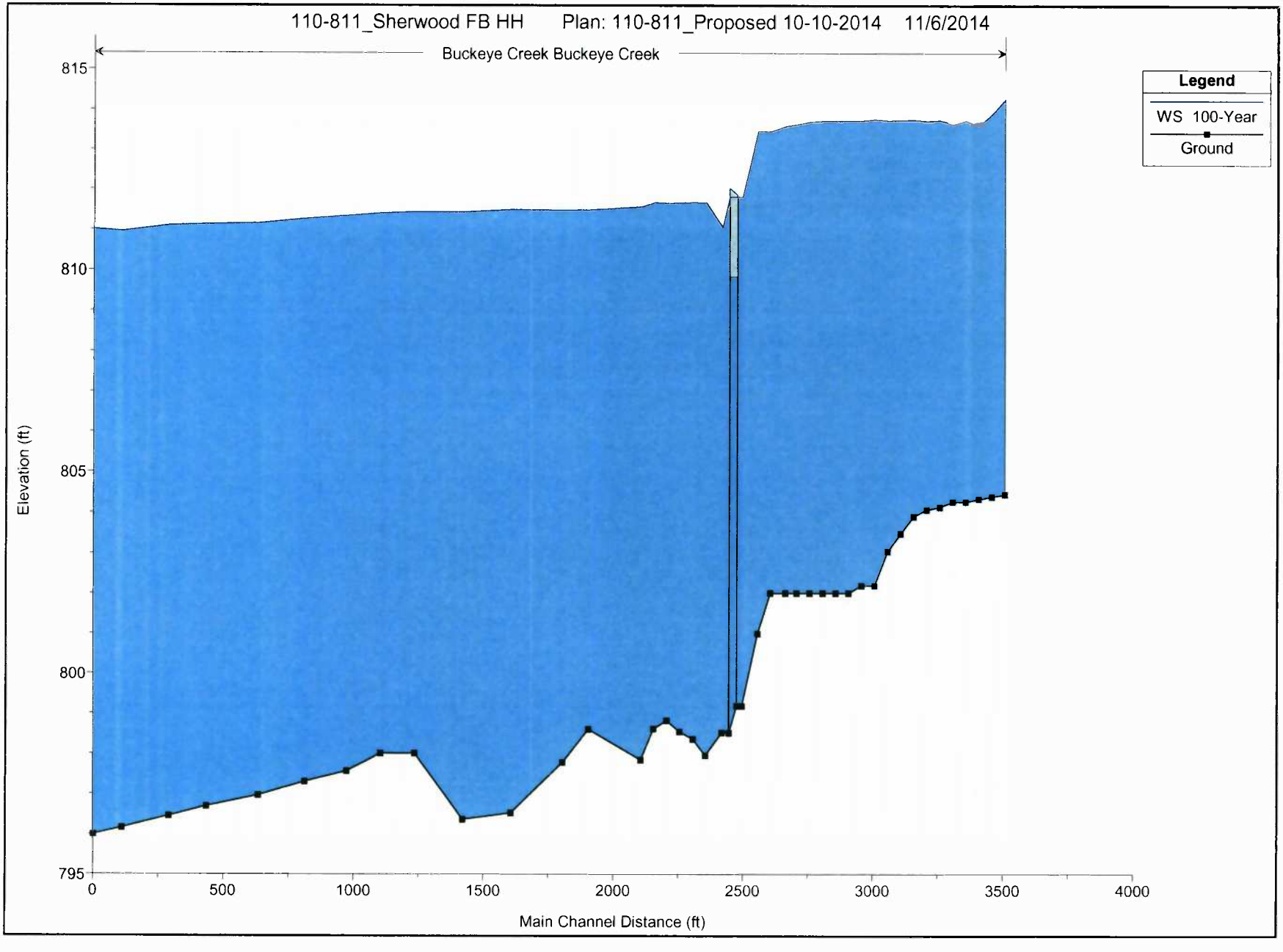
Reach	River Sta.	Contr.	Expan.
*Buckeye Creek	* 3504.54	* .1*	.3*
*Buckeye Creek	* 3454.54	* .1*	.3*
*Buckeye Creek	* 3404.54	* .1*	.3*
*Buckeye Creek	* 3354.54	* .1*	.3*
*Buckeye Creek	* 3304.54	* .1*	.3*
*Buckeye Creek	* 3254.54	* .1*	.3*
*Buckeye Creek	* 3204.54	* .1*	.3*
*Buckeye Creek	* 3154.54	* .1*	.3*
*Buckeye Creek	* 3104.54	* .1*	.3*
*Buckeye Creek	* 3054.54	* .1*	.3*
*Buckeye Creek	* 3004.54	* .1*	.3*
*Buckeye Creek	* 2954.54	* .1*	.3*
*Buckeye Creek	* 2904.54	* .1*	.3*
*Buckeye Creek	* 2854.58	* .1*	.3*
*Buckeye Creek	* 2804.54	* .1*	.3*
*Buckeye Creek	* 2754.54	* .1*	.3*
*Buckeye Creek	* 2704.54	* .1*	.3*
*Buckeye Creek	* 2661.29	* .1*	.3*
*Buckeye Creek	* 2603.43	* .1*	.3*
*Buckeye Creek	* 2554.54	* .1*	.3*
*Buckeye Creek	* 2494.62	* .3*	.5*
*Buckeye Creek	* 2460.04	*Bridge *	*
*Buckeye Creek	* 2417.85	* .3*	.5*
*Buckeye Creek	* 2354.53	* .1*	.3*
*Buckeye Creek	* 2306.38	* .1*	.3*
*Buckeye Creek	* 2254.54	* .1*	.3*
*Buckeye Creek	* 2204.54	* .1*	.3*
*Buckeye Creek	* 2154.54	* .1*	.3*
*Buckeye Creek	* 2105.74	* .1*	.3*
*Buckeye Creek	* 1903.41	* .1*	.3*
*Buckeye Creek	* 1804	* .1*	.3*
*Buckeye Creek	* 1604.54	* .1*	.3*
*Buckeye Creek	* 1419.72	* .1*	.3*
*Buckeye Creek	* 1234.05	* .1*	.3*
*Buckeye Creek	* 1102.70	* .1*	.3*
*Buckeye Creek	* 972.12	* .1*	.3*
*Buckeye Creek	* 810.82	* .1*	.3*
*Buckeye Creek	* 604.54	* .1*	.3*
*Buckeye Creek	* 433.99	* .1*	.3*
*Buckeye Creek	* 289.71	* .1*	.3*
*Buckeye Creek	* 109.26	* .1*	.3*
*Buckeye Creek	* 0	* .1*	.3*

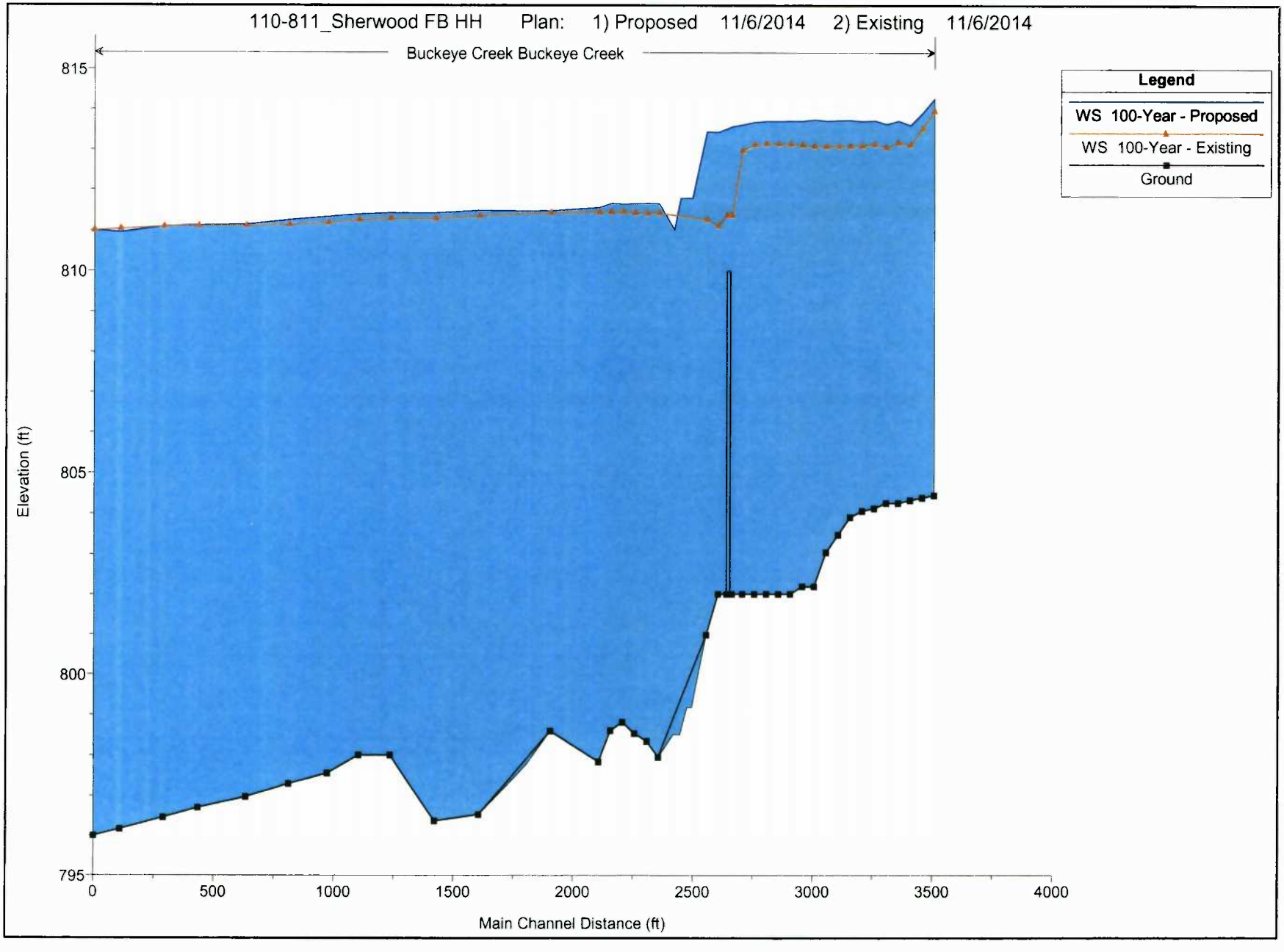
****

APPENDIX D

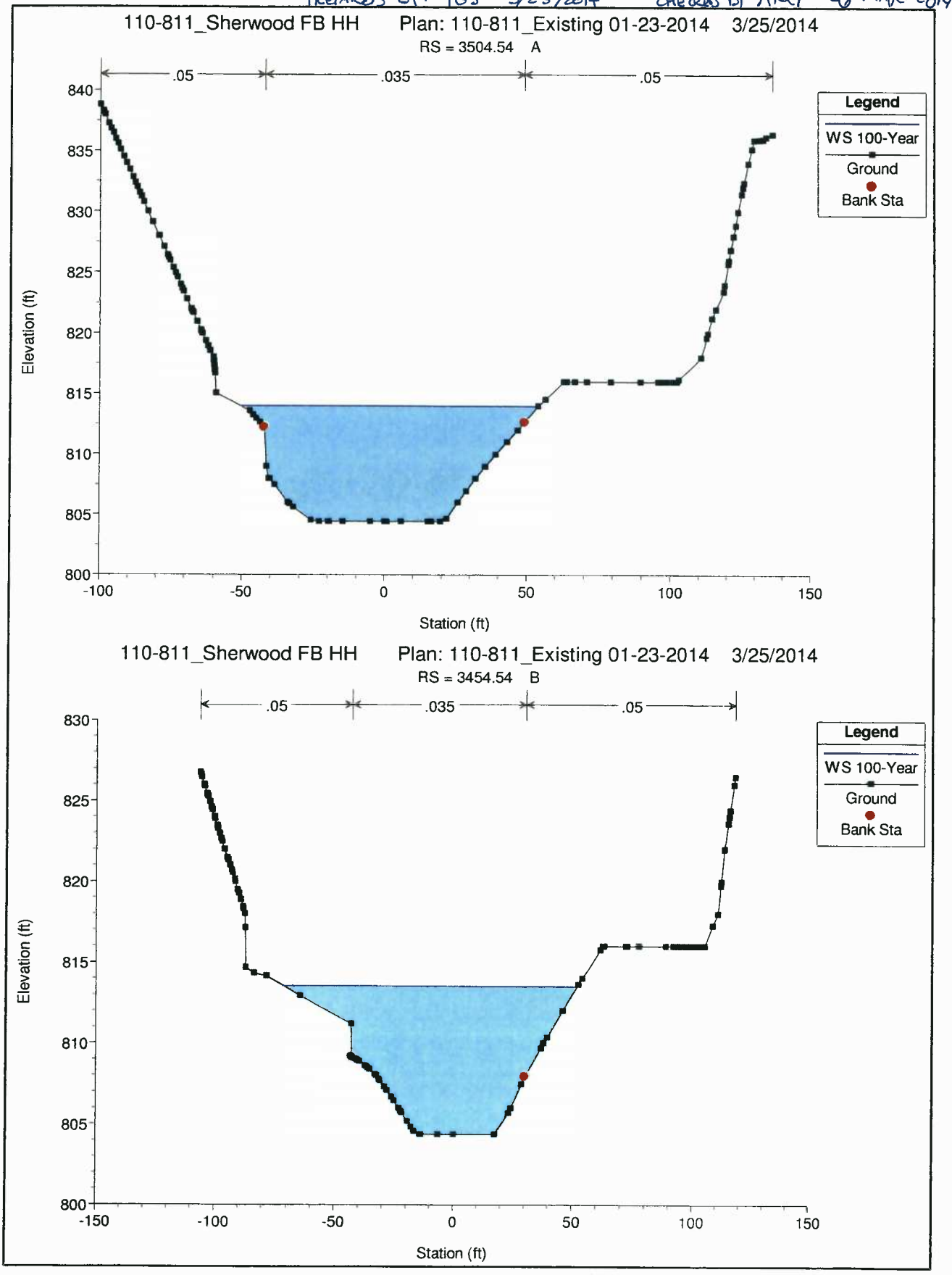
EXISTING AND PROPOSED FLOODWAY MAP, WATER SURFACE PROFILES, AND CROSS SECTION OUTPUT

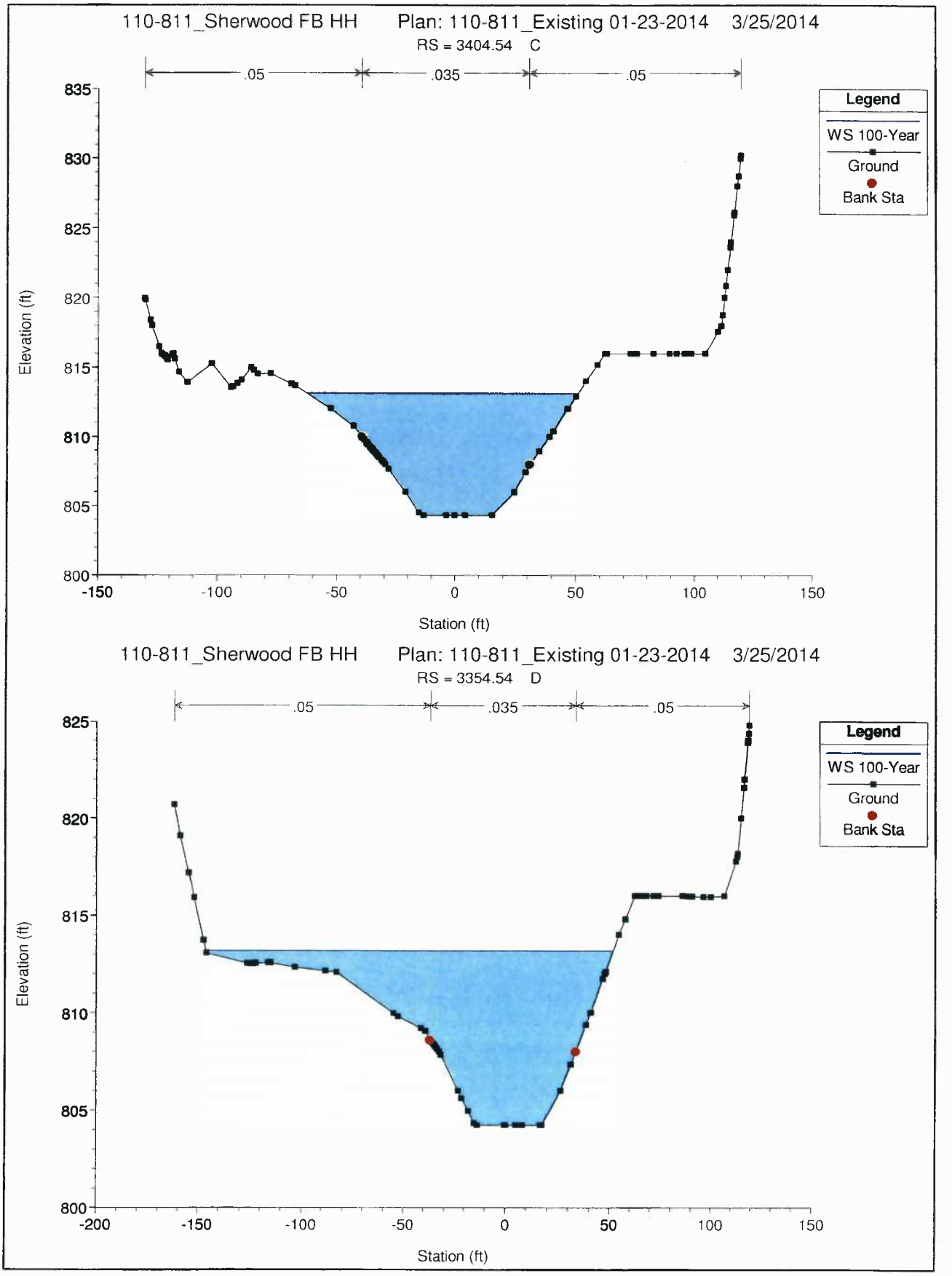

110-811_Sherwood FB HH Plan: 110-811_Existing 01-23-2014 3/25/2014
Buckeye Creek Buckeye Creek
Legend
WS 100-Year
Ground
Elevation (ft)
815
810
805
800
795
0
500
1000
1500
2000
2500
3000
3500
4000
Main Channel Distance (ft)


110-811_Sherwood FB HH Plan: 110-811_Proposed 10-10-2014 11/6/2014
Buckeye Creek Buckeye Creek
Legend
WS 100-Year
Ground
Elevation (ft)
815
810
805
800
795
0
500
1000
1500
2000
2500
3000
3500
4000
Main Channel Distance (ft)


110-811_Sherwood FB HH Plan: 1) Proposed 11/6/2014 2) Existing 11/6/2014
Buckeye Creek Buckeye Creek
Legend
WS 100-Year - Proposed
WS 100-Year - Existing
Ground
Elevation (ft)
815
810
805
800
795
0
500
1000
1500
2000
2500
3000
3500
4000
Main Channel Distance (ft)

PREPARED BY: TGJ 3/25/2014 CHECKED BY: ARG 26-MAR-2014




110-811_Sherwood FB HH
Plan: 110-811_Existing 01-23-2014
3/25/2014
RS = 3404.54 C
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
835
830
825
820
815
810
805
800
-150
-100
-50
0
50
100
150
Station (ft)
110-811_Sherwood FB HH
Plan: 110-811_Existing 01-23-2014
3/25/2014
RS = 3354.54 D
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
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820
815
810
805
800
-200
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-100
-50
0
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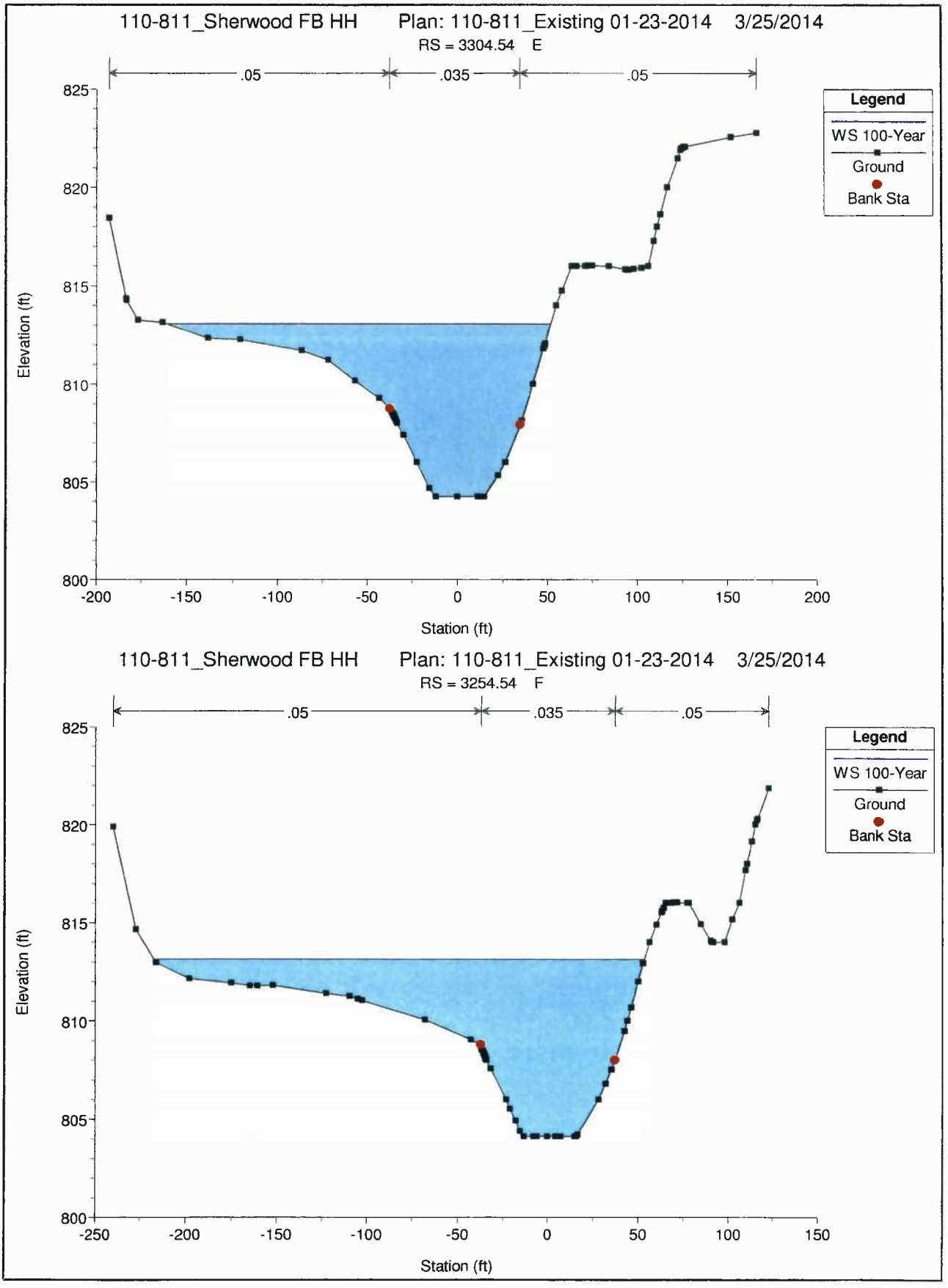
100
150
Station (ft)


110-811_Sherwood FB HH Plan: 110-811_Existing 01-23-2014 3/25/2014
RS = 3304.54 E
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
825
820
815
810
805
800
-200
-150
-100
-50
0
50
100
150
200
Station (ft)
110-811_Sherwood FB HH Plan: 110-811_Existing 01-23-2014 3/25/2014
RS = 3254.54 F
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
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820
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810
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-100
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100
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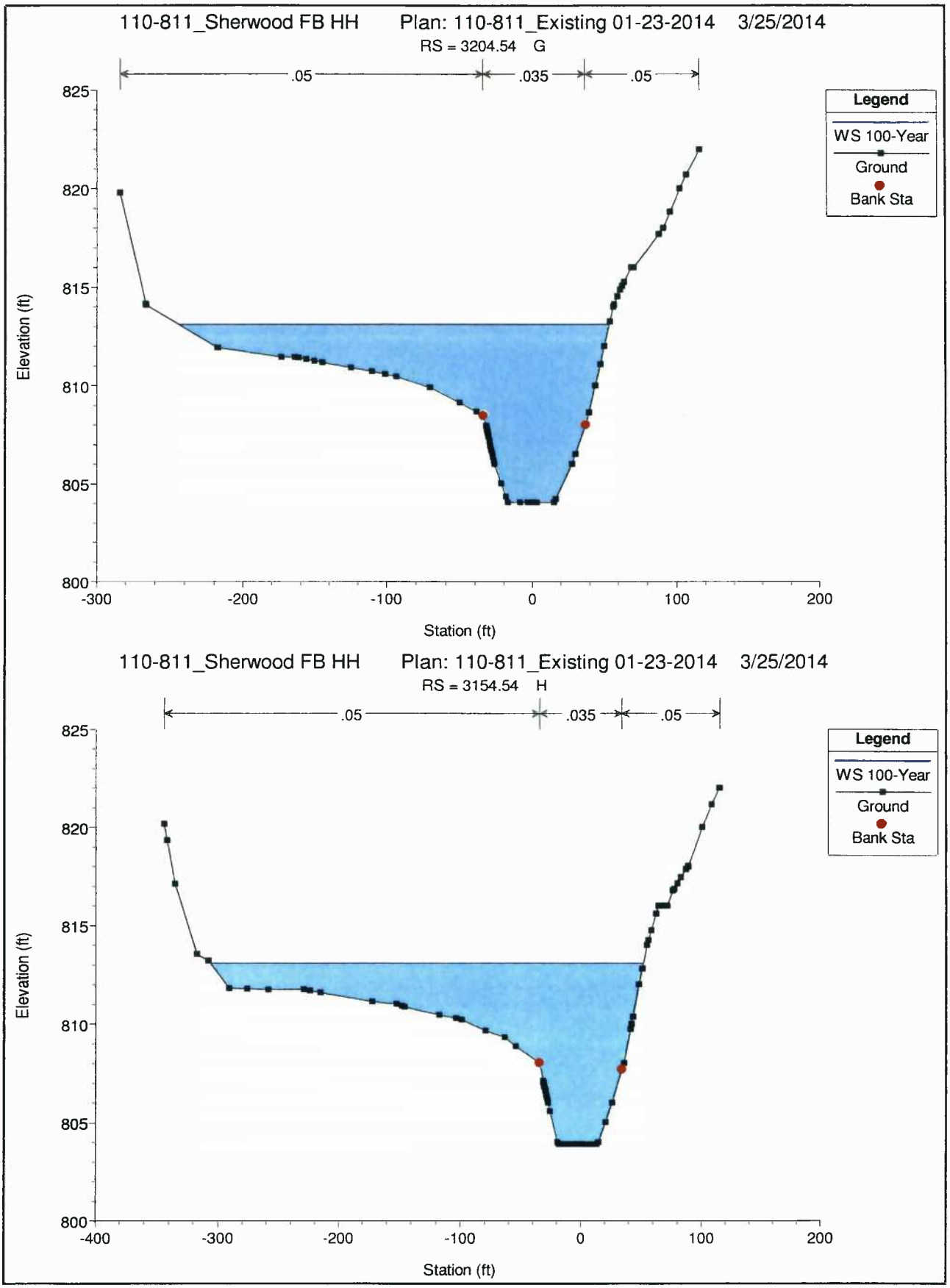
Station (ft)


110-811_Sherwood FB HH
Plan: 110-811_Existing 01-23-2014
3/25/2014
RS = 3204.54 G
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.035
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Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
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820
815
810
805
800
-300
-200
-100
0
100
200
Station (ft)
110-811_Sherwood FB HH
Plan: 110-811_Existing 01-23-2014
3/25/2014
RS = 3154.54 H
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
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820
815
810
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-200
-100
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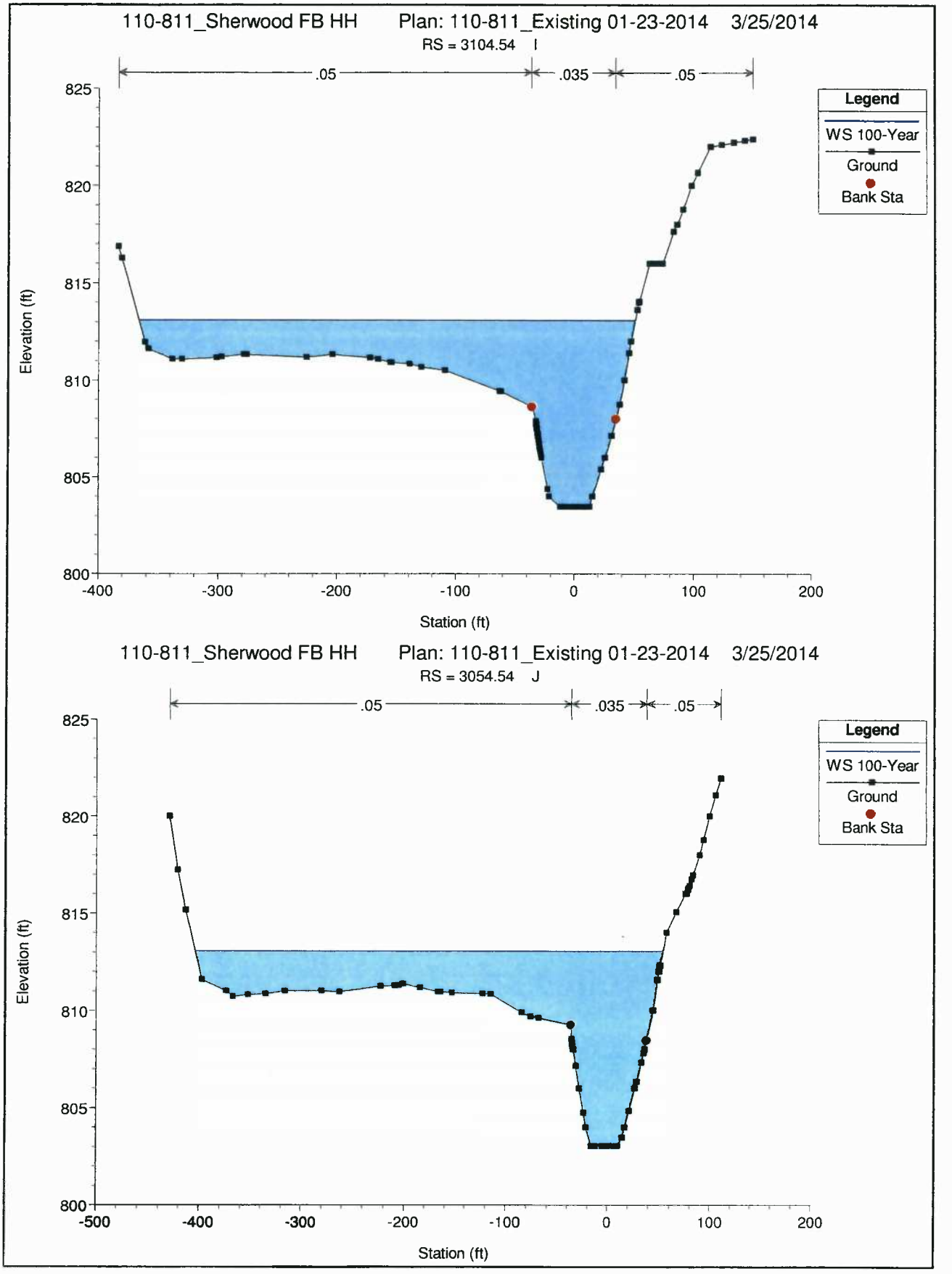
Station (ft)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Legend
WS 100-Year
Ground
Bank Sta
825
820
815
810
805
800
Elevation (ft)
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-300
-200
-100
0
100
200
Station (ft)
110-811_Sherwood FB HH Plan: 110-811_Existing 01-23-2014 3/25/2014
RS = 3054.54 J
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
825
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805
800
Elevation (ft)
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-400
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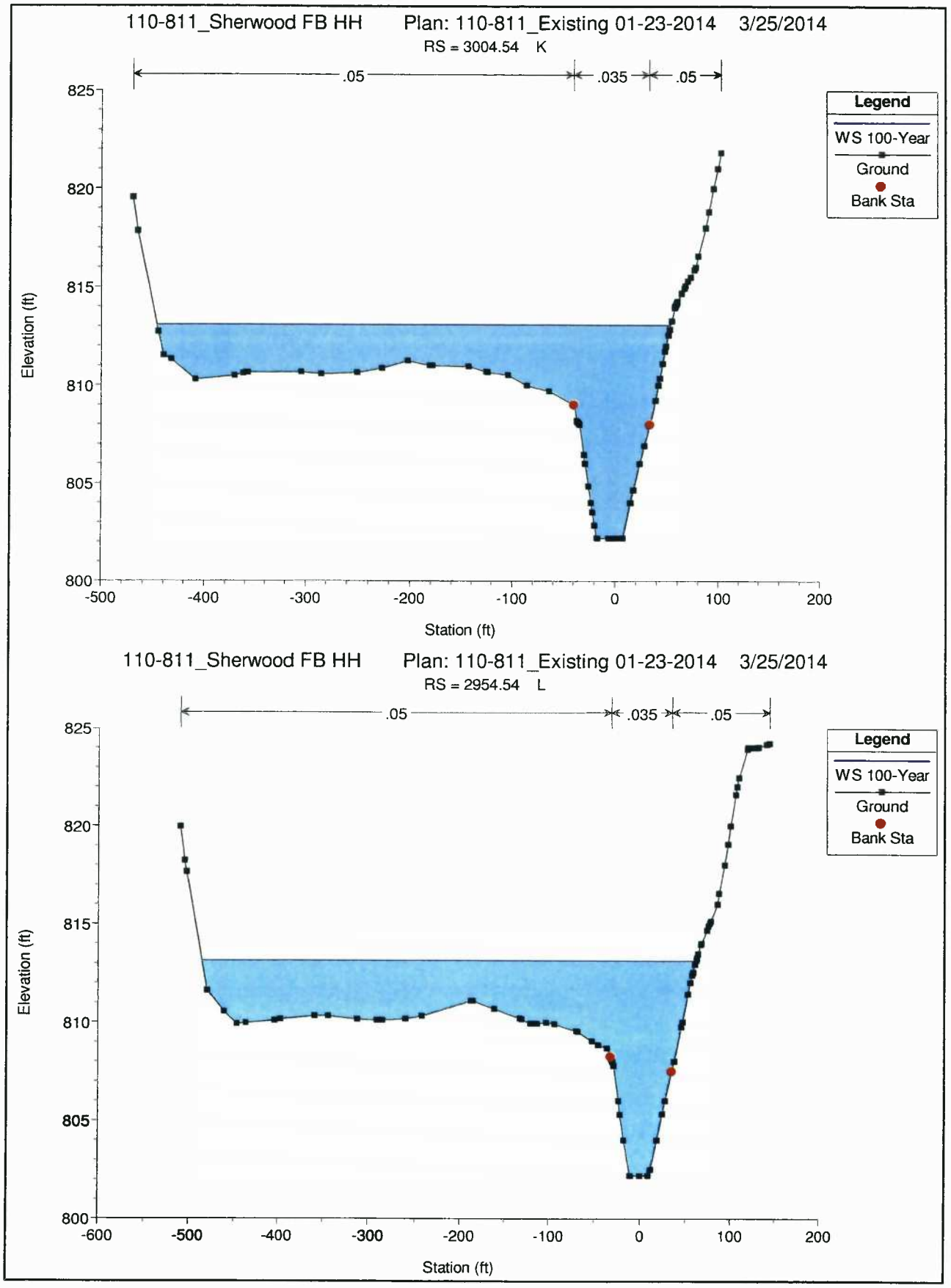
Station (ft)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Plan: 110-811_Existing 01-23-2014
3/25/2014
RS = 3004.54 K
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.035
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Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
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820
815
810
805
800
-500
-400
-300
-200
-100
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100
200
Station (ft)
110-811_Sherwood FB HH
Plan: 110-811_Existing 01-23-2014
3/25/2014
RS = 2954.54 L
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
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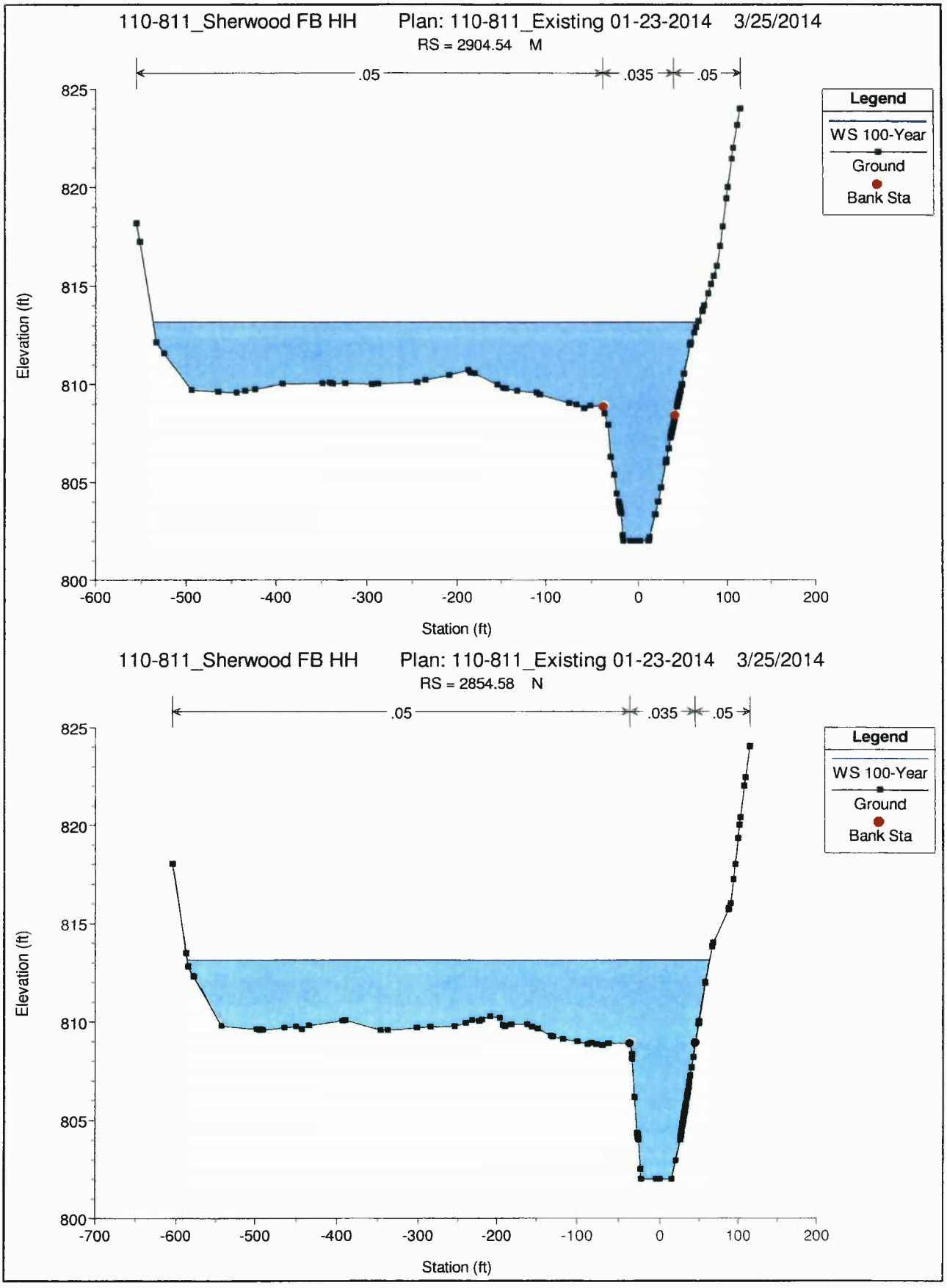
Station (ft)


110-811_Sherwood FB HH Plan: 110-811_Existing 01-23-2014 3/25/2014
RS = 2904.54 M
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
825
820
815
810
805
800
-600
-500
-400
-300
-200
-100
0
100
200
Station (ft)
110-811_Sherwood FB HH Plan: 110-811_Existing 01-23-2014 3/25/2014
RS = 2854.58 N
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
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800
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-100
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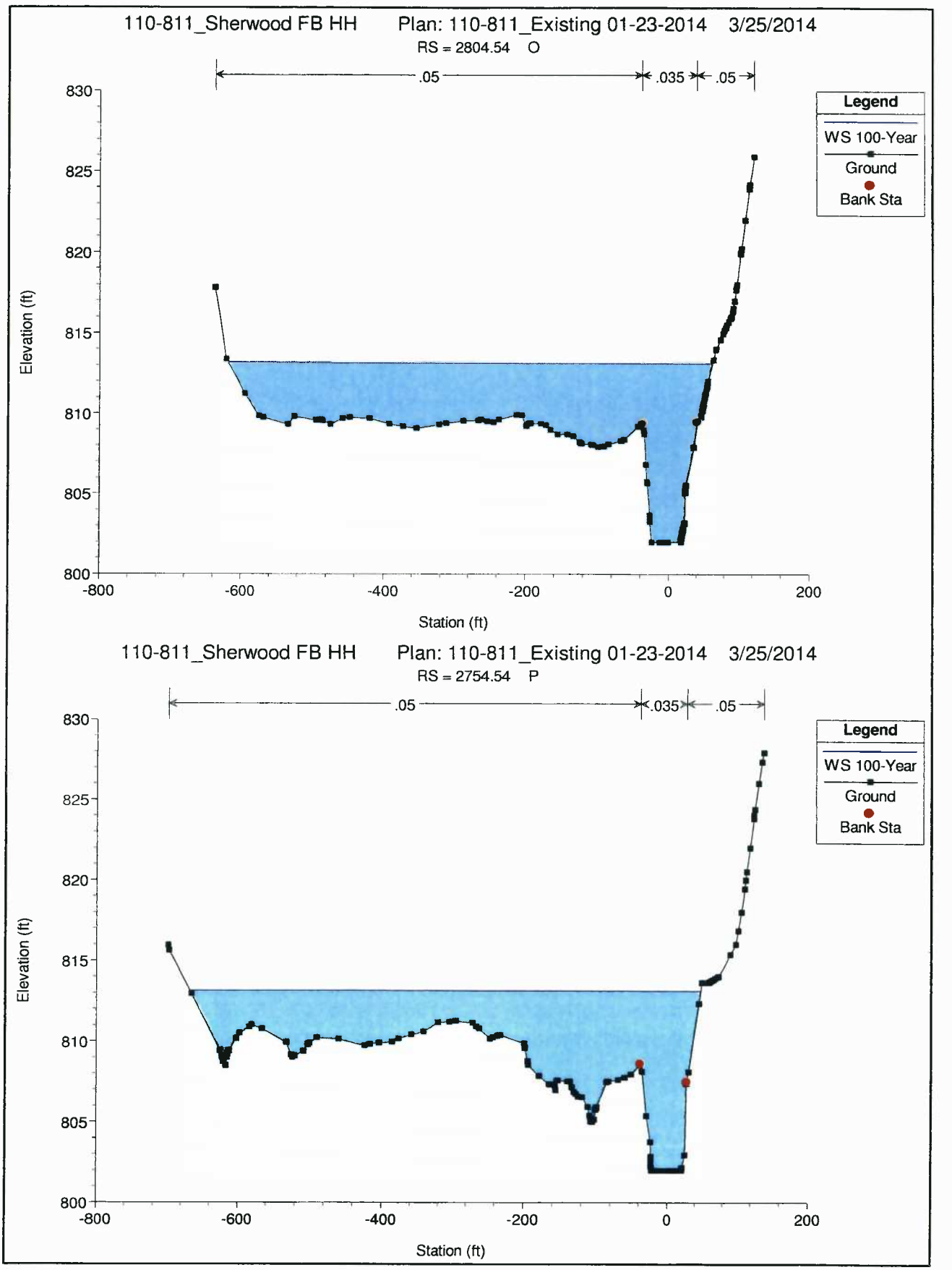
100
200
Station (ft)


110-811_Sherwood FB HH
Plan: 110-811_Existing 01-23-2014
3/25/2014
RS = 2804.54 O
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
830
825
820
815
810
805
800
-800
-600
-400
-200
0
200
Station (ft)
110-811_Sherwood FB HH
Plan: 110-811_Existing 01-23-2014
3/25/2014
RS = 2754.54 P
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
830
825
820
815
810
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800
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-600
-400
-200
0
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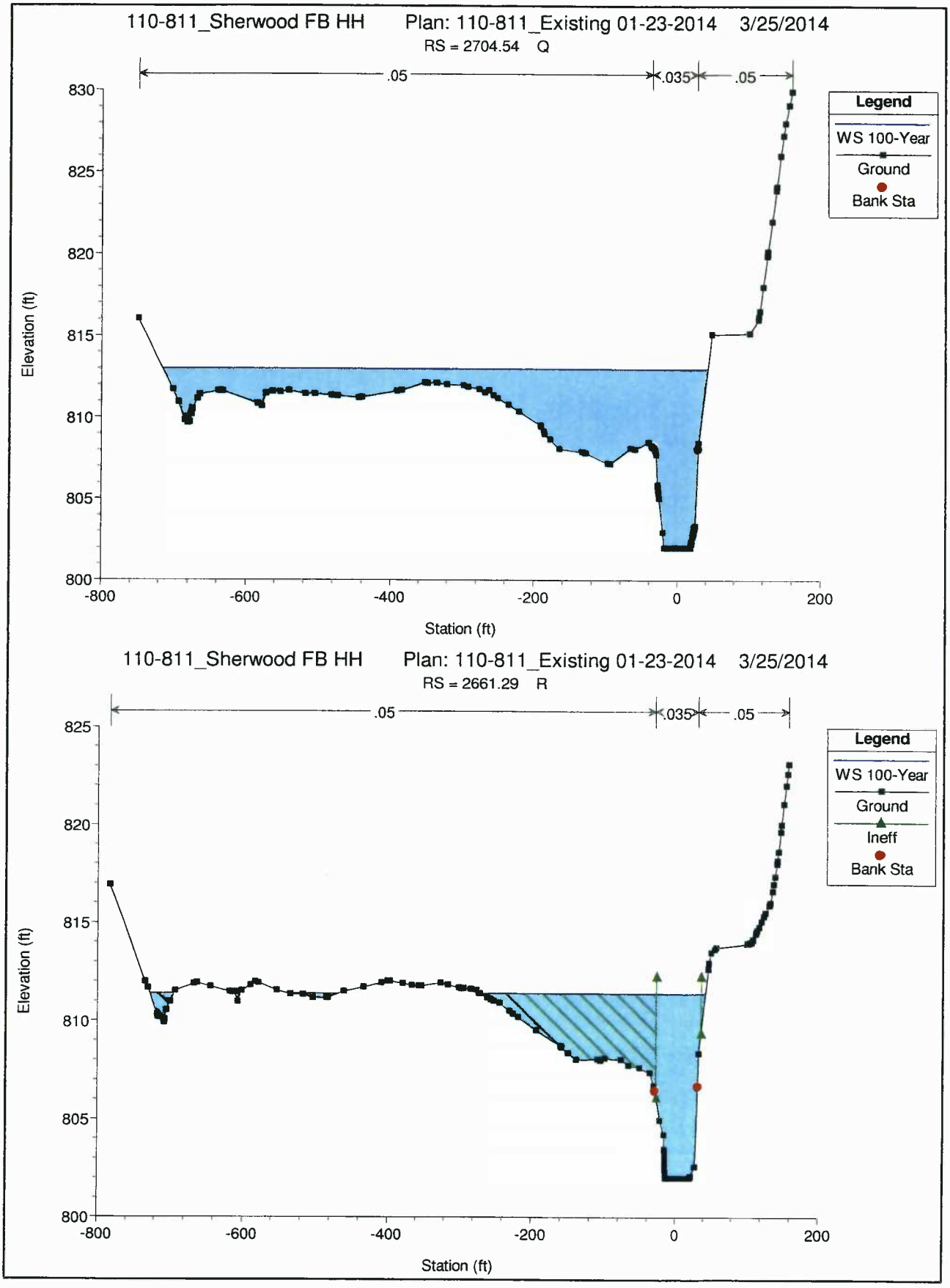
Station (ft)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RS = 2704.54 Q
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.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
830
825
820
815
810
805
800
-800
-600
-400
-200
0
200
Station (ft)
110-811_Sherwood FB HH Plan: 110-811_Existing 01-23-2014 3/25/2014
RS = 2661.29 R
.05
.035
.05
Legend
WS 100-Year
Ground
Ineff
Bank Sta
Elevation (ft)
825
820
815
810
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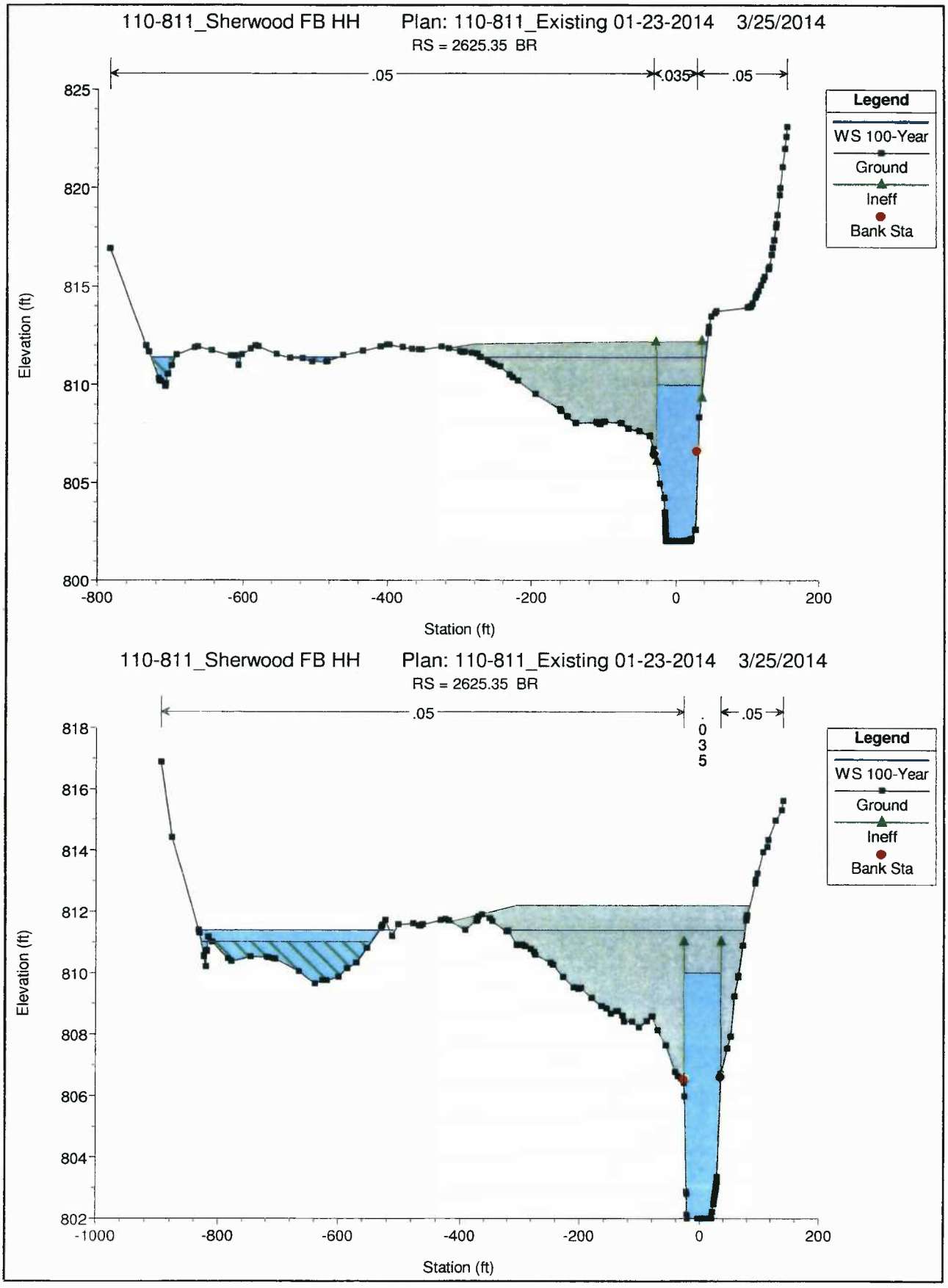
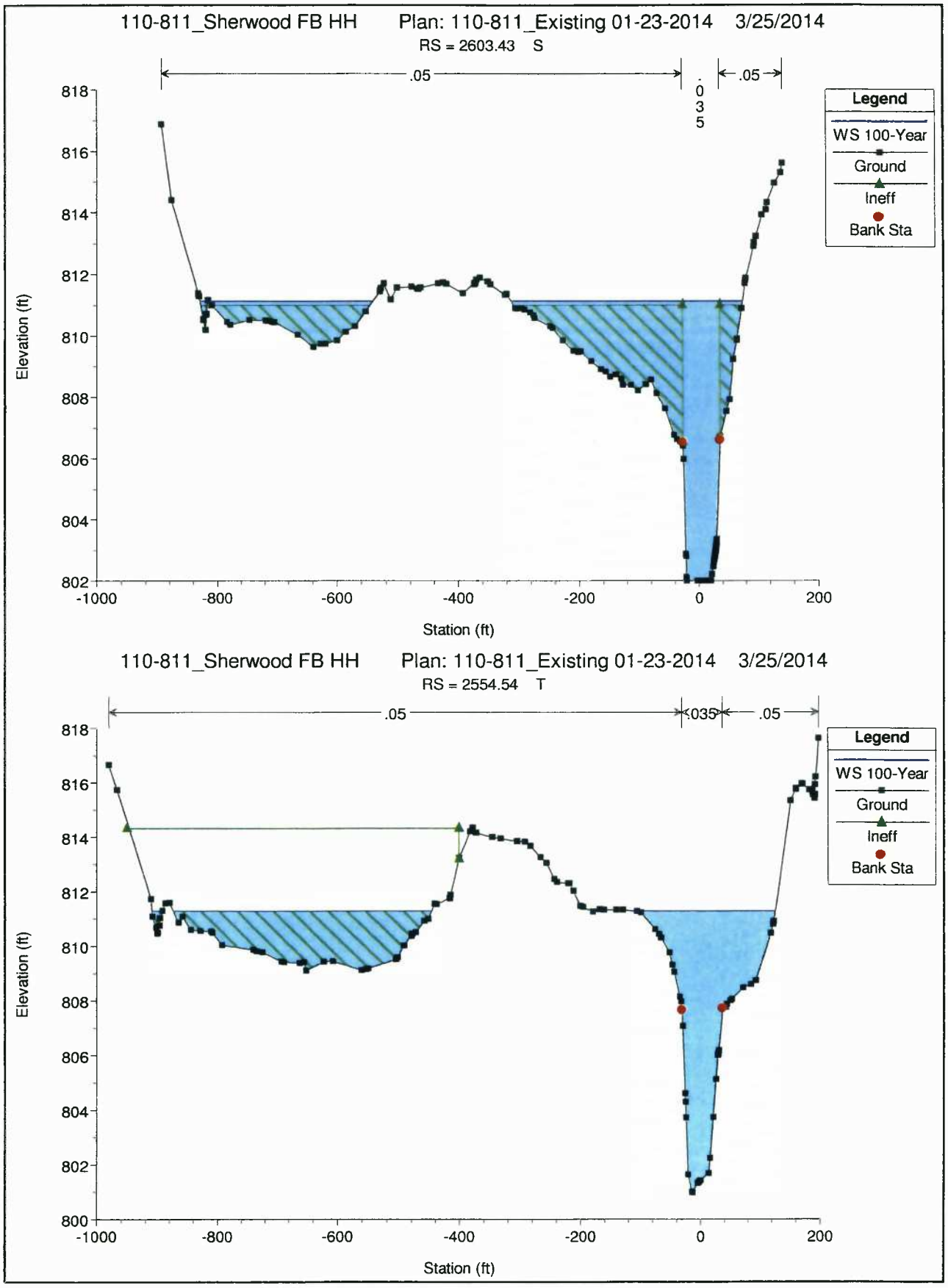
800
-800
-600
-400
-200
0
200
Station (ft)


110-811_Sherwood FB HH Plan: 110-811_Existing 01-23-2014 3/25/2014
RS = 2625.35 BR
.05
.035
.05
Legend
WS 100-Year
Ground
Ineff
Bank Sta
Elevation (ft)
825
820
815
810
805
800
-800
-600
-400
-200
0
200
Station (ft)
110-811_Sherwood FB HH Plan: 110-811_Existing 01-23-2014 3/25/2014
RS = 2625.35 BR
.05
.035
.05
Legend
WS 100-Year
Ground
Ineff
Bank Sta
Elevation (ft)
818
816
814
812
810
808
806
804
802
-1000
-800
-600
-400
-200
0
200
Station (ft)


110-811_Sherwood FB HH Plan: 110-811_Existing 01-23-2014 3/25/2014
RS = 2603.43 S
.05
.035
.05
Legend
WS 100-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
110-811_Sherwood FB HH Plan: 110-811_Existing 01-23-2014 3/25/2014
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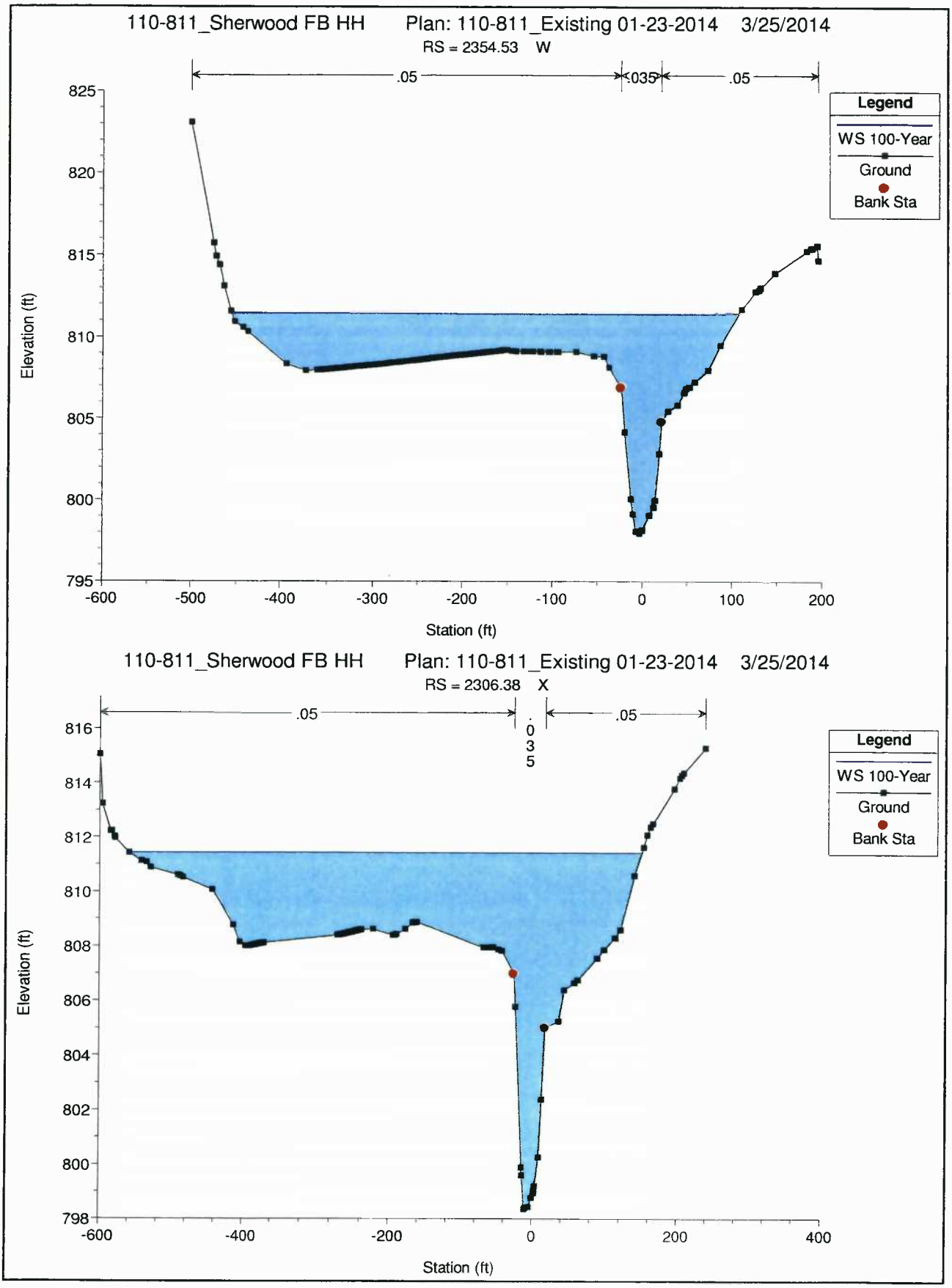
.035
.05
Legend
WS 100-Year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


110-811_Sherwood FB HH
Plan: 110-811_Existing 01-23-2014
3/25/2014
RS = 2354.53 W
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
825
820
815
810
805
800
795
-600
-500
-400
-300
-200
-100
0
100
200
Station (ft)
110-811_Sherwood FB HH
Plan: 110-811_Existing 01-23-2014
3/25/2014
RS = 2306.38 X
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
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812
810
808
806
804
802
800
798
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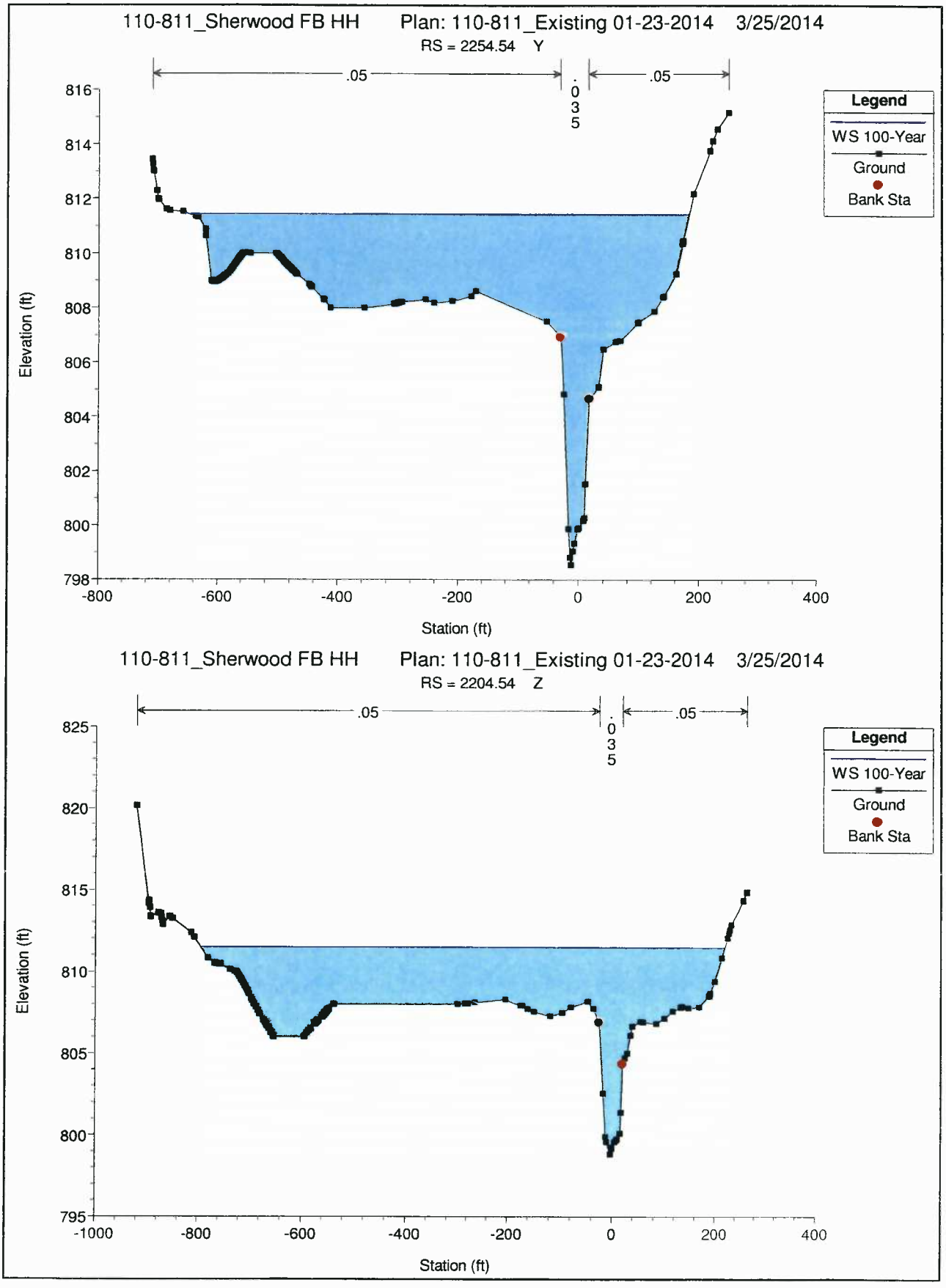
-400
-200
0
200
400
Station (ft)


110-811_Sherwood FB HH
Plan: 110-811_Existing 01-23-2014
3/25/2014
RS = 2254.54 Y
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
816
814
812
810
808
806
804
802
800
798
-800
-600
-400
-200
0
200
400
Station (ft)
110-811_Sherwood FB HH
Plan: 110-811_Existing 01-23-2014
3/25/2014
RS = 2204.54 Z
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
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815
810
805
800
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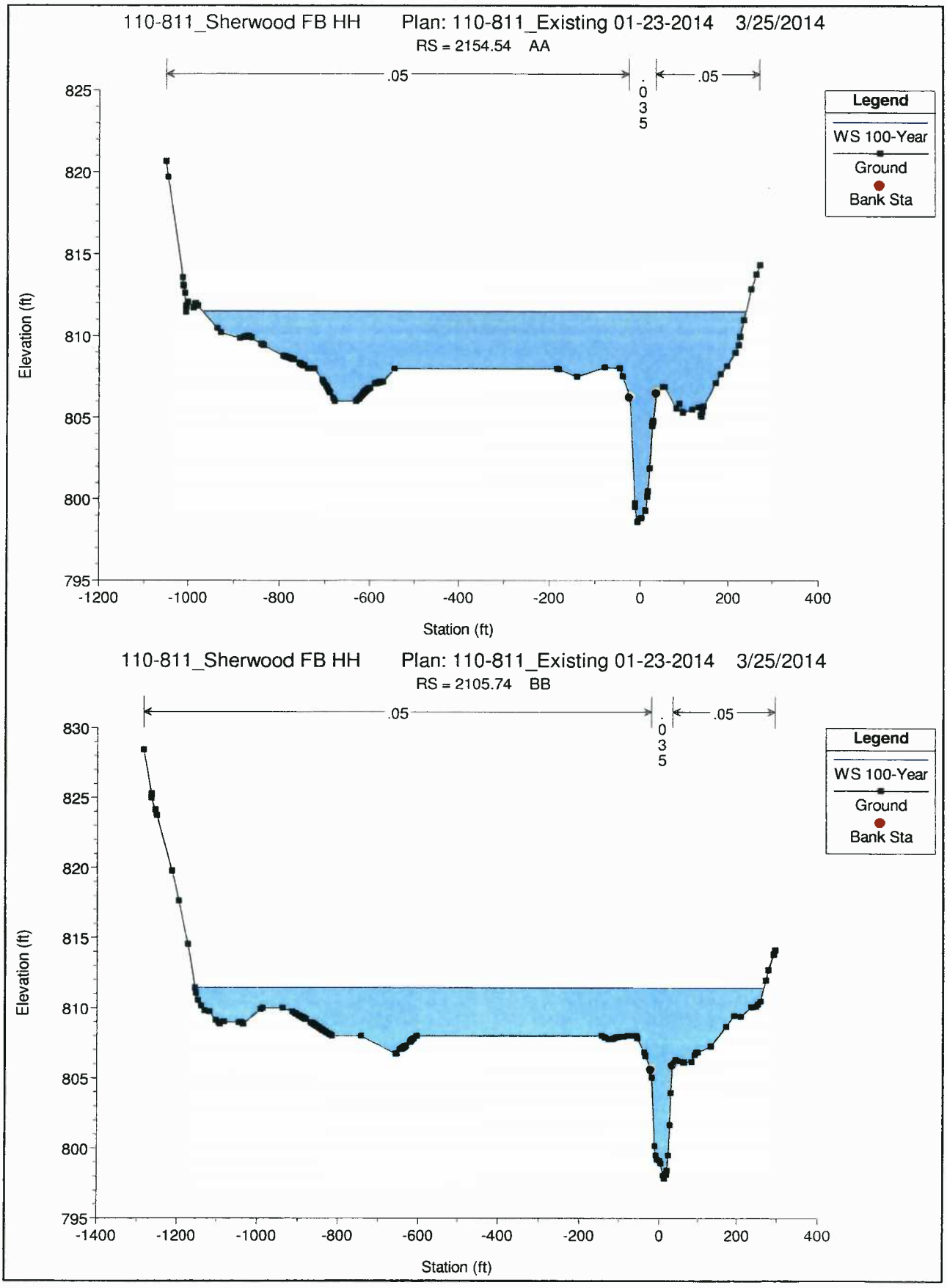
-600
-400
-200
0
200
400
Station (ft)


110-811_Sherwood FB HH Plan: 110-811_Existing 01-23-2014 3/25/2014
RS = 2154.54 AA
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.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
825
820
815
810
805
800
795
-1200
-1000
-800
-600
-400
-200
0
200
400
Station (ft)
110-811_Sherwood FB HH Plan: 110-811_Existing 01-23-2014 3/25/2014
RS = 2105.74 BB
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
830
825
820
815
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-1400
-1200
-1000
-800
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-400
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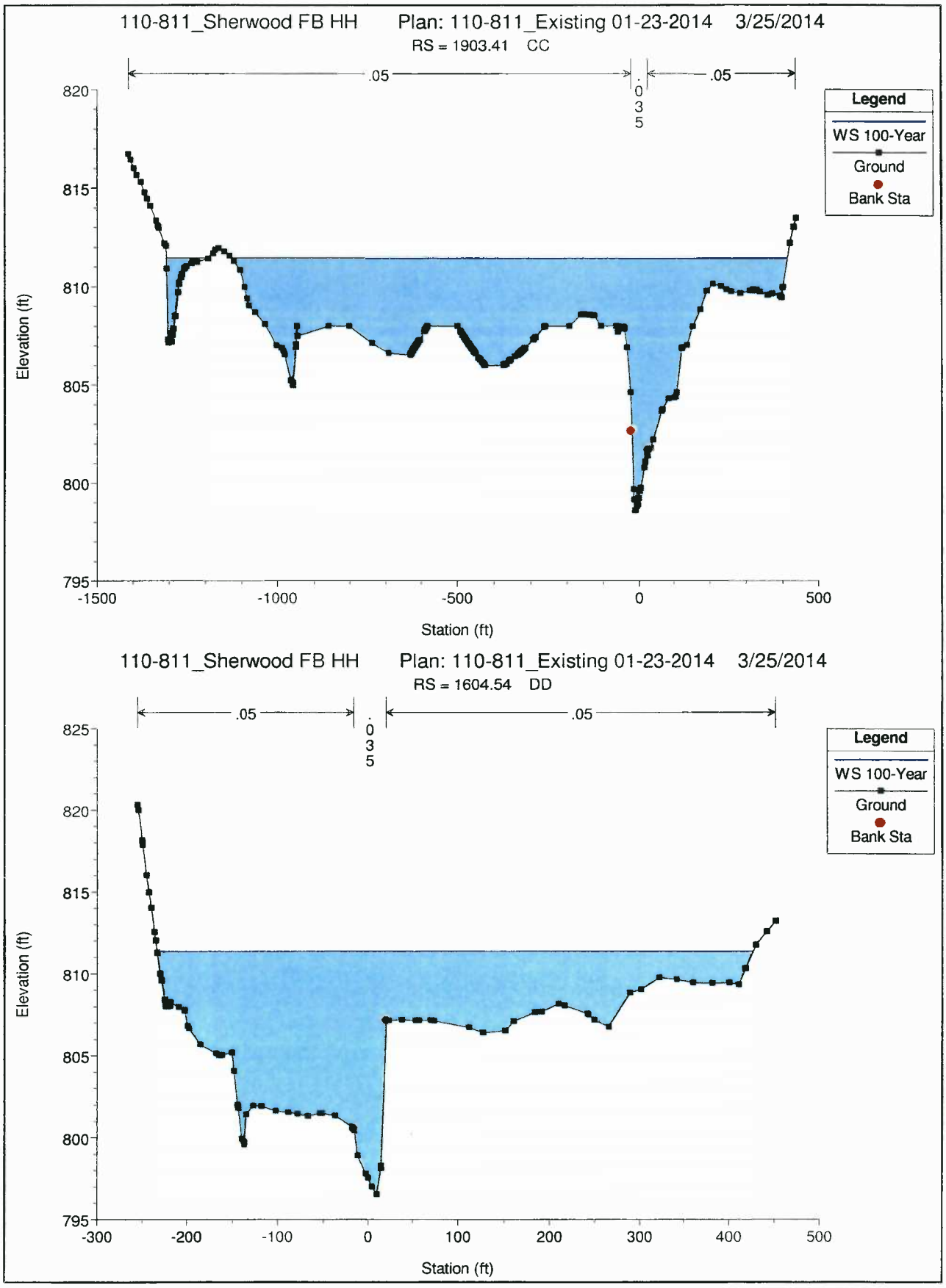
400
Station (ft)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RS = 1903.41 CC
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.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
820
815
810
805
800
795
-1500
-1000
-500
0
500
Station (ft)
110-811_Sherwood FB HH Plan: 110-811_Existing 01-23-2014 3/25/2014
RS = 1604.54 DD
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
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800
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-300
-200
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0
100
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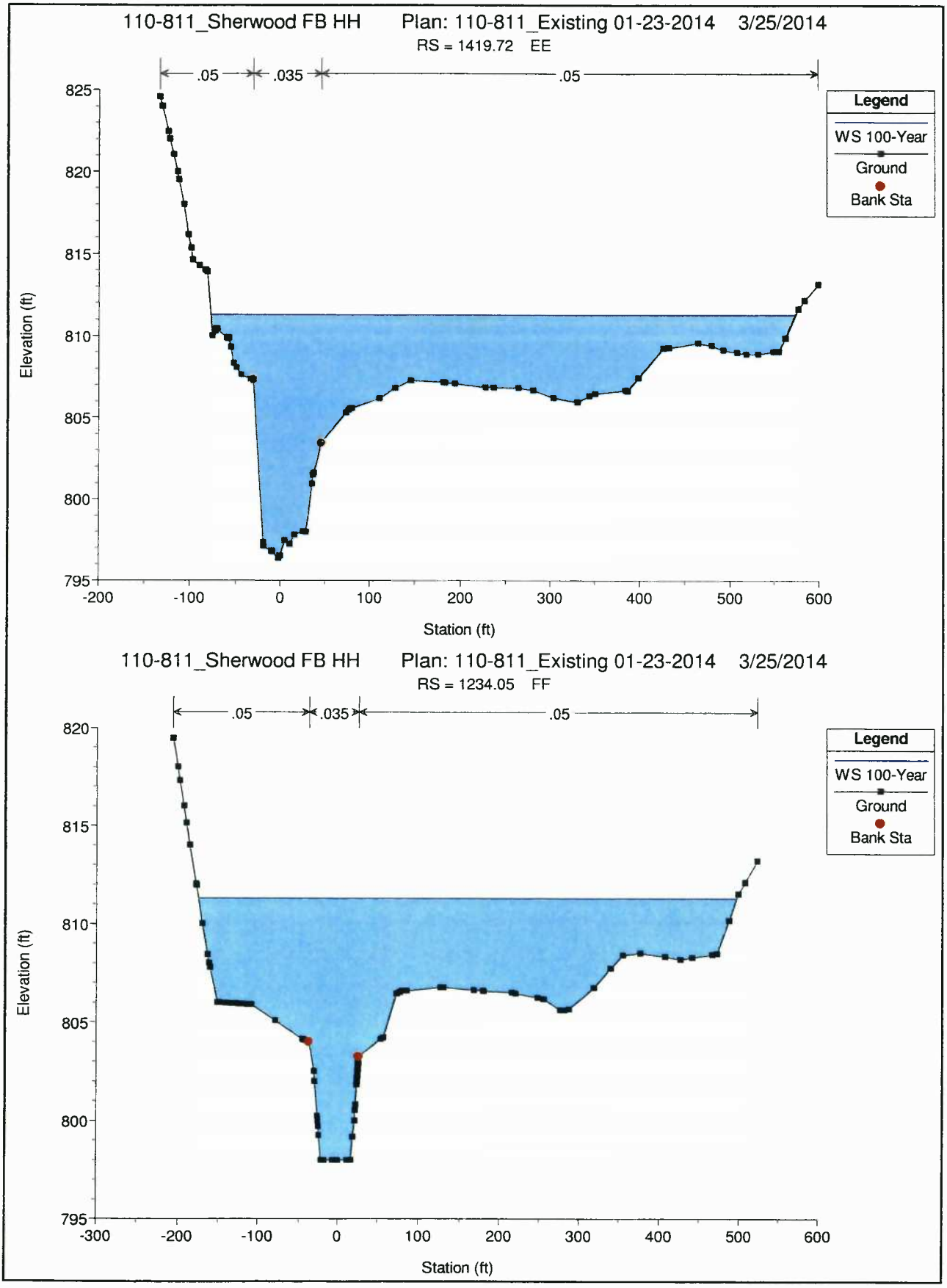
300
400
500
Station (ft)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Plan: 110-811_Existing 01-23-2014
3/25/2014
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.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
825
820
815
810
805
800
795
-200
-100
0
100
200
300
400
500
600
Station (ft)
110-811_Sherwood FB HH
Plan: 110-811_Existing 01-23-2014
3/25/2014
RS = 1234.05 FF
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
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-200
-100
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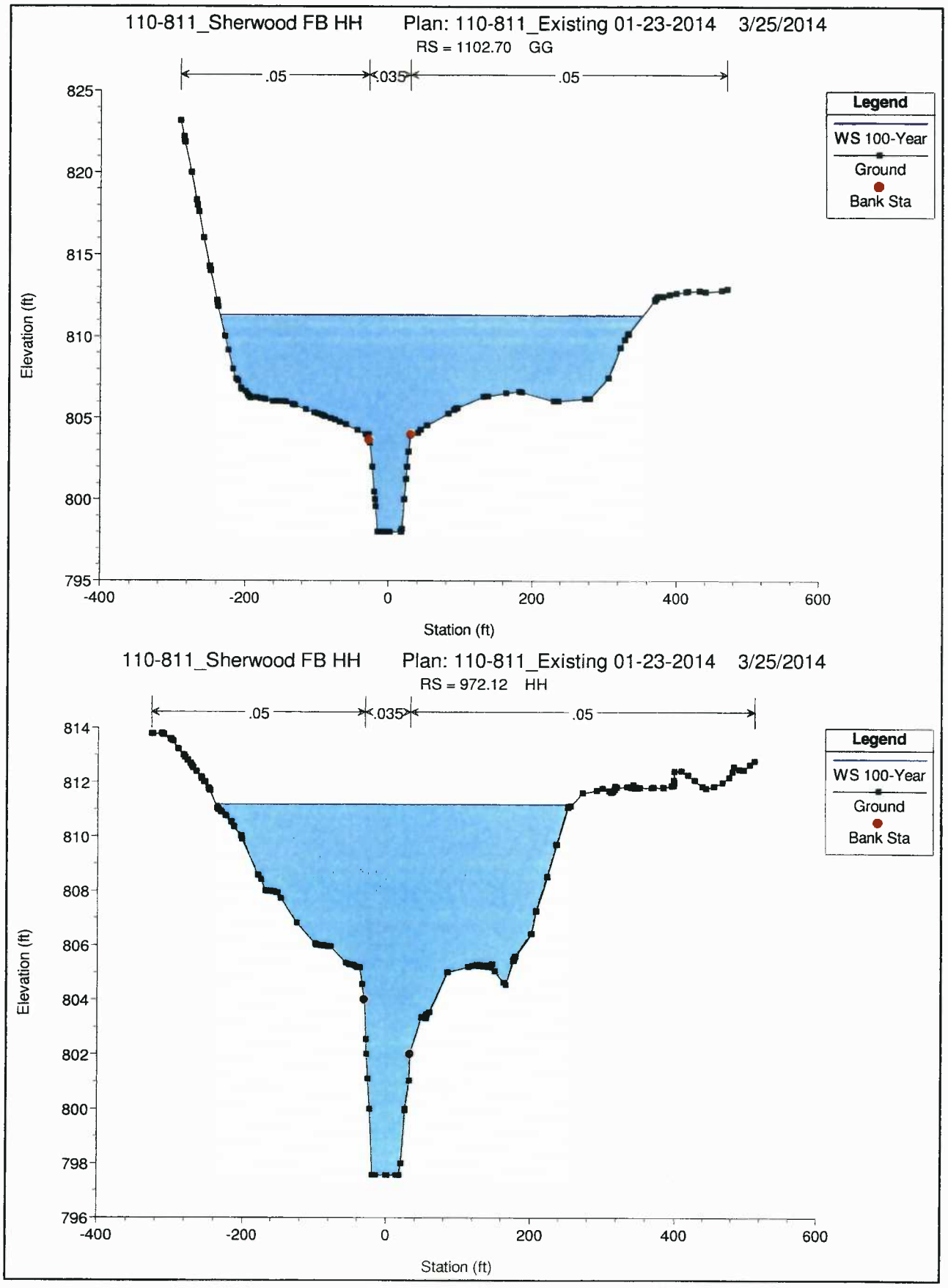
100
200
300
400
500
600
Station (ft)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RS = 1102.70 GG
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.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
825
820
815
810
805
800
795
-400
-200
0
200
400
600
Station (ft)
110-811_Sherwood FB HH Plan: 110-811_Existing 01-23-2014 3/25/2014
RS = 972.12 HH
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
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806
804
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-200
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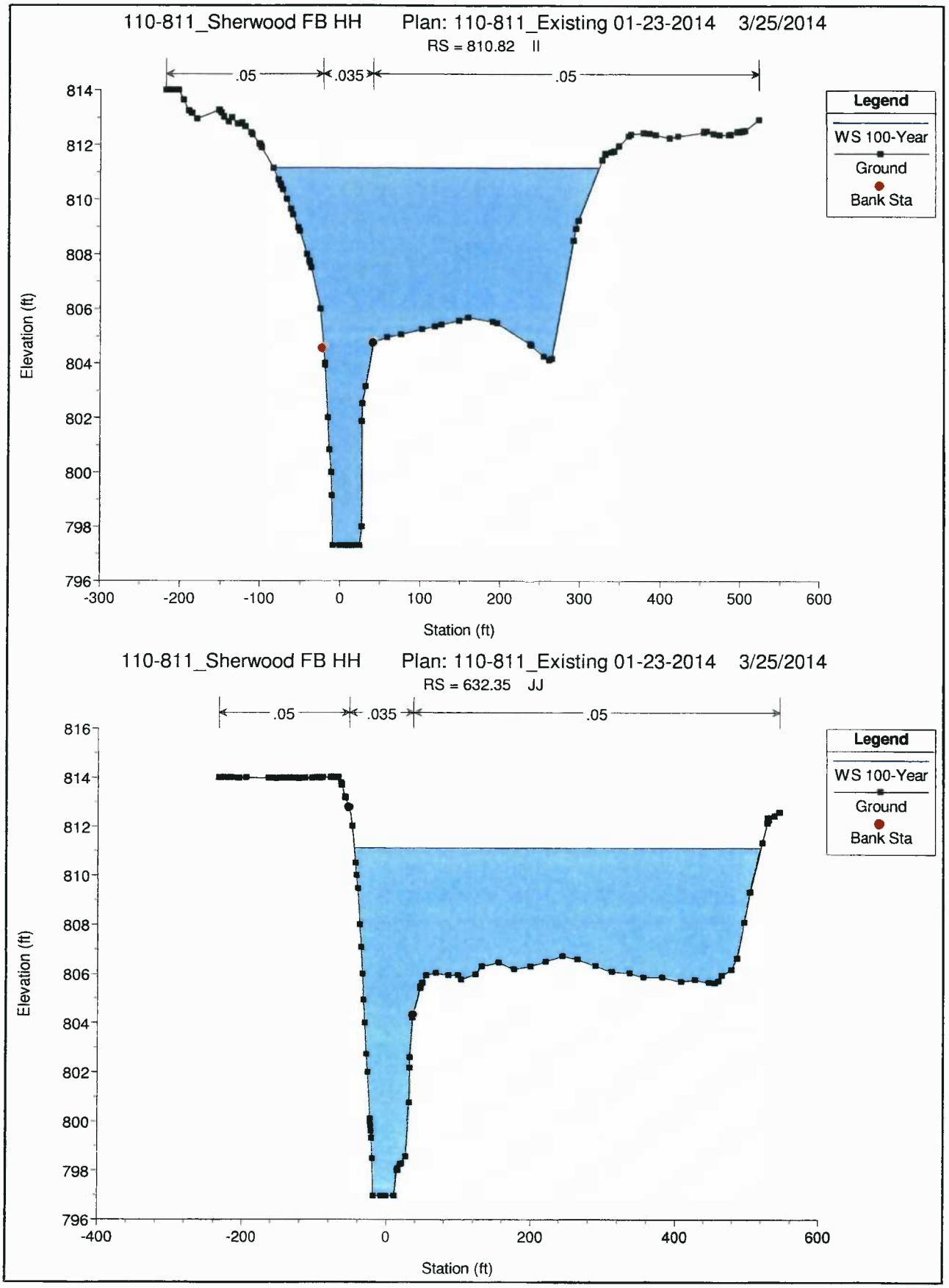
400
600
Station (ft)


110-811_Sherwood FB HH Plan: 110-811_Existing 01-23-2014 3/25/2014
RS = 810.82 II
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.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
814
812
810
808
806
804
802
800
798
796
-300
-200
-100
0
100
200
300
400
500
600
Station (ft)
110-811_Sherwood FB HH Plan: 110-811_Existing 01-23-2014 3/25/2014
RS = 632.35 JJ
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
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802
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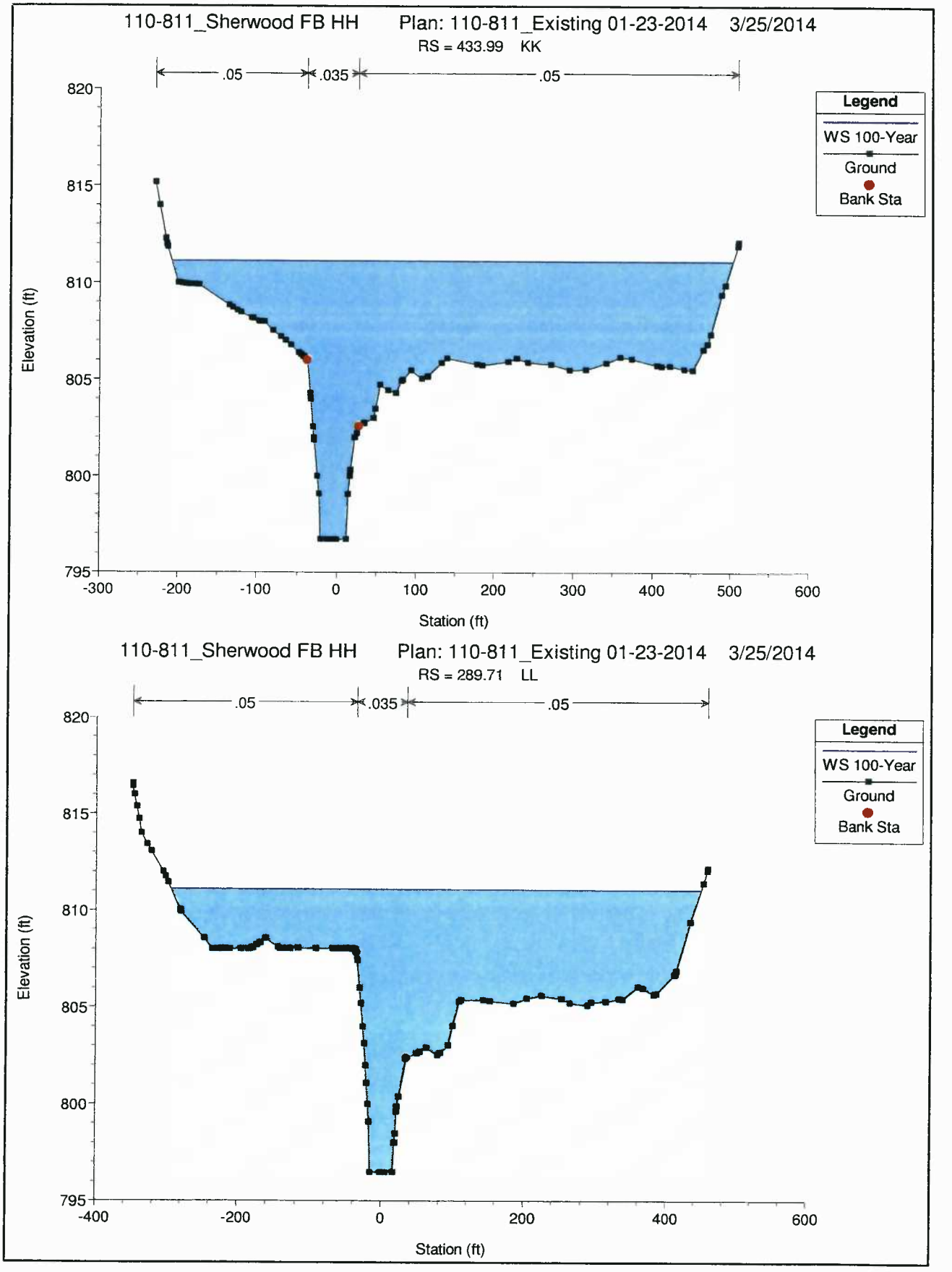
600
Station (ft)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Plan: 110-811_Existing 01-23-2014
3/25/2014
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.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
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815
810
805
800
795
-300
-200
-100
0
100
200
300
400
500
600
Station (ft)
110-811_Sherwood FB HH
Plan: 110-811_Existing 01-23-2014
3/25/2014
RS = 289.71 LL
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
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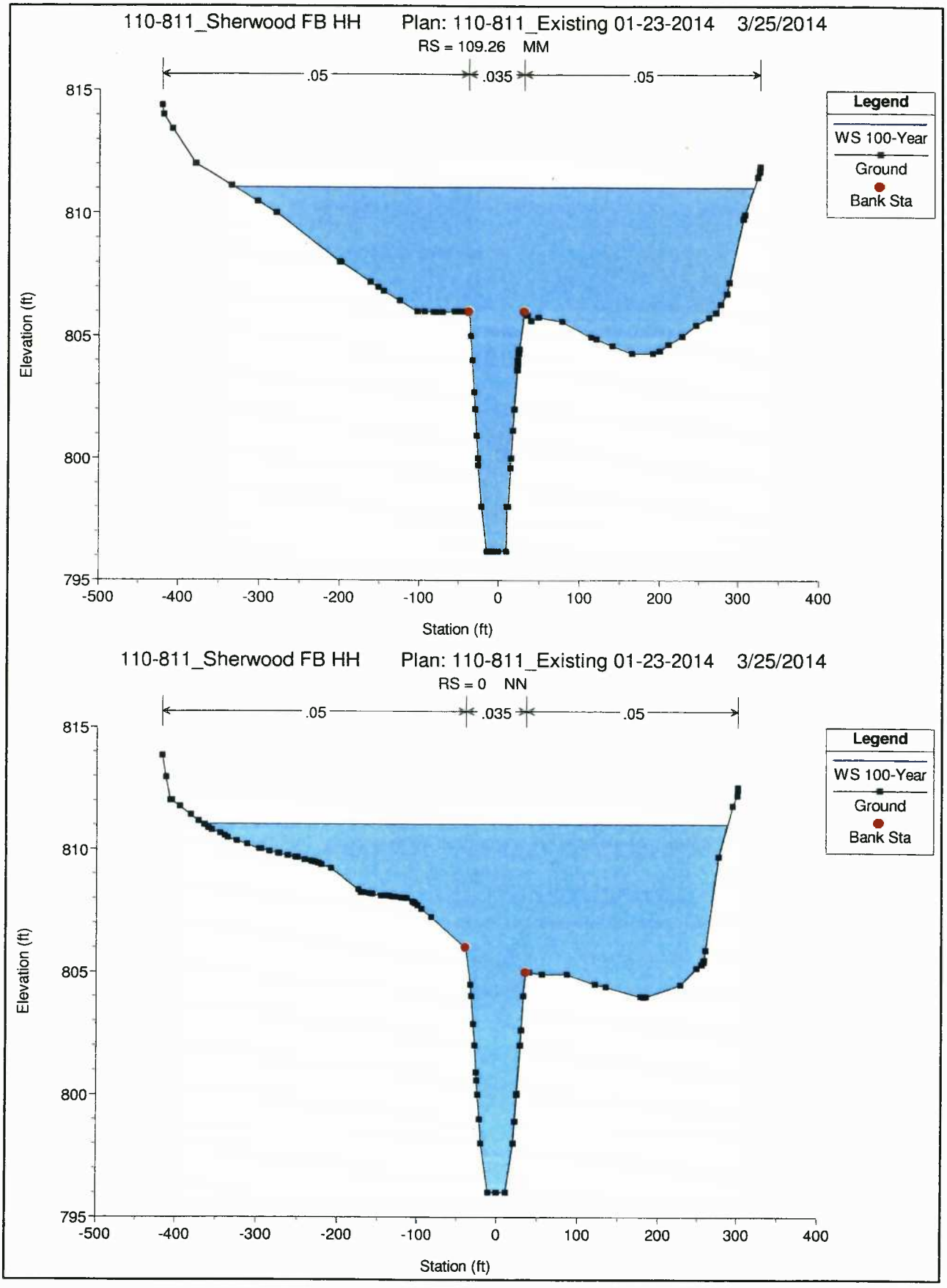
400
600
Station (ft)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Plan: 110-811_Existing 01-23-2014
3/25/2014
RS = 109.26 MM
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.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
815
810
805
800
795
-500
-400
-300
-200
-100
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100
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300
400
Station (ft)
110-811_Sherwood FB HH
Plan: 110-811_Existing 01-23-2014
3/25/2014
RS = 0 NN
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
815
810
805
800
795
-500
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-200
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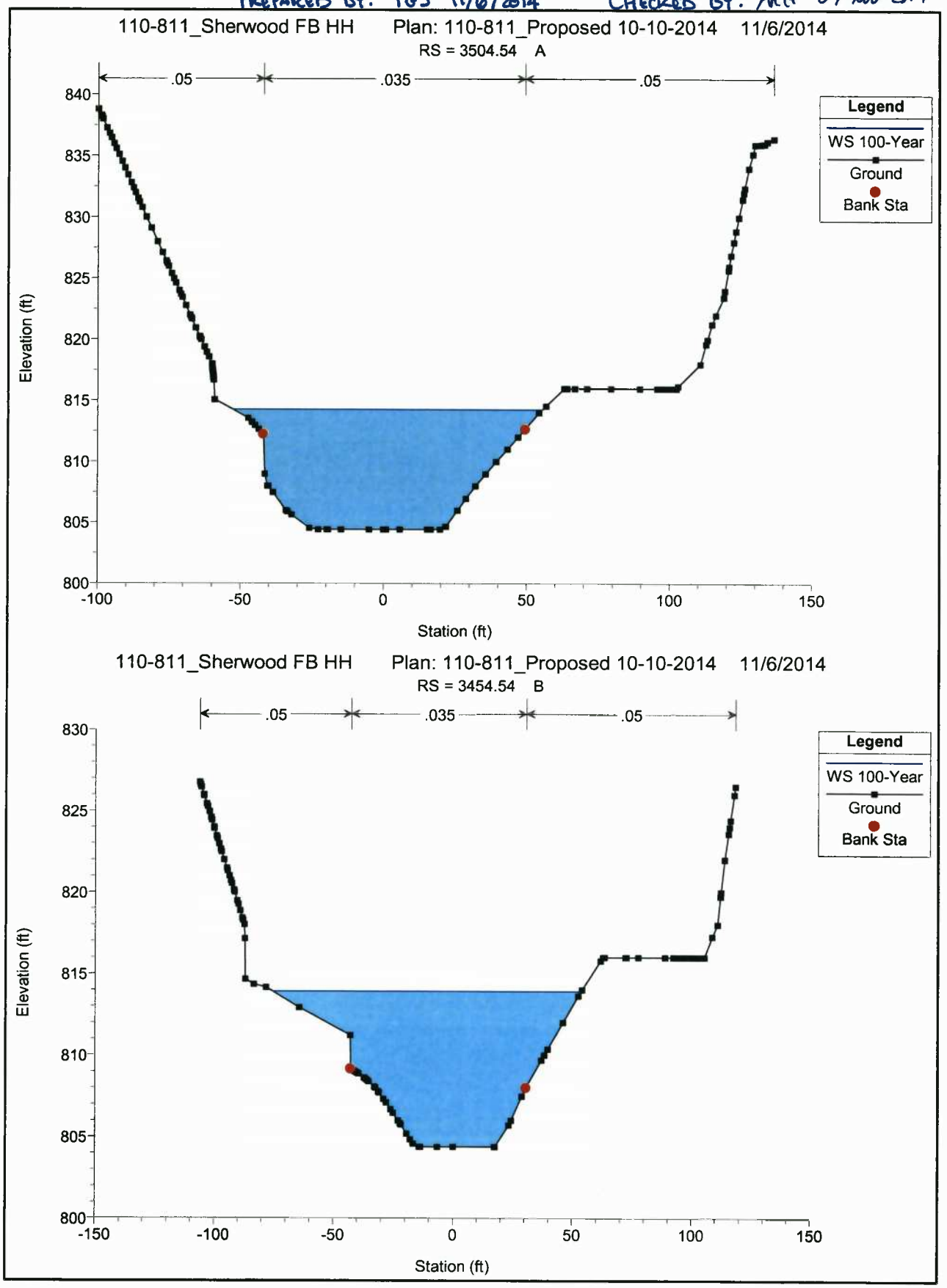
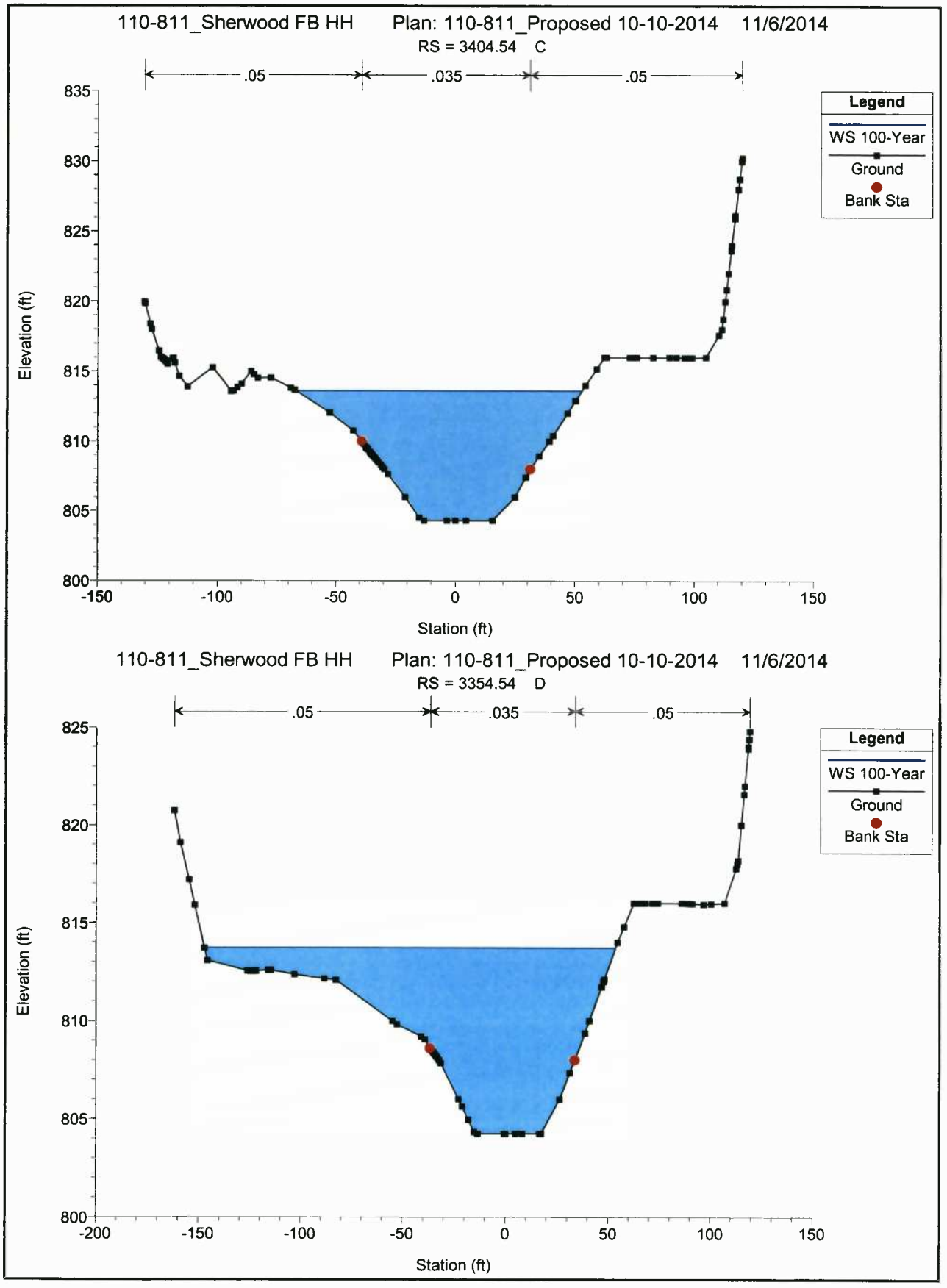
100
200
300
400
Station (ft)

PREPARED BY: TGJ 11/6/2014 CHECKED BY: AMG 07-NOV-2014




110-811_Sherwood FB HH Plan: 110-811_Proposed 10-10-2014 11/6/2014
RS = 3404.54 C
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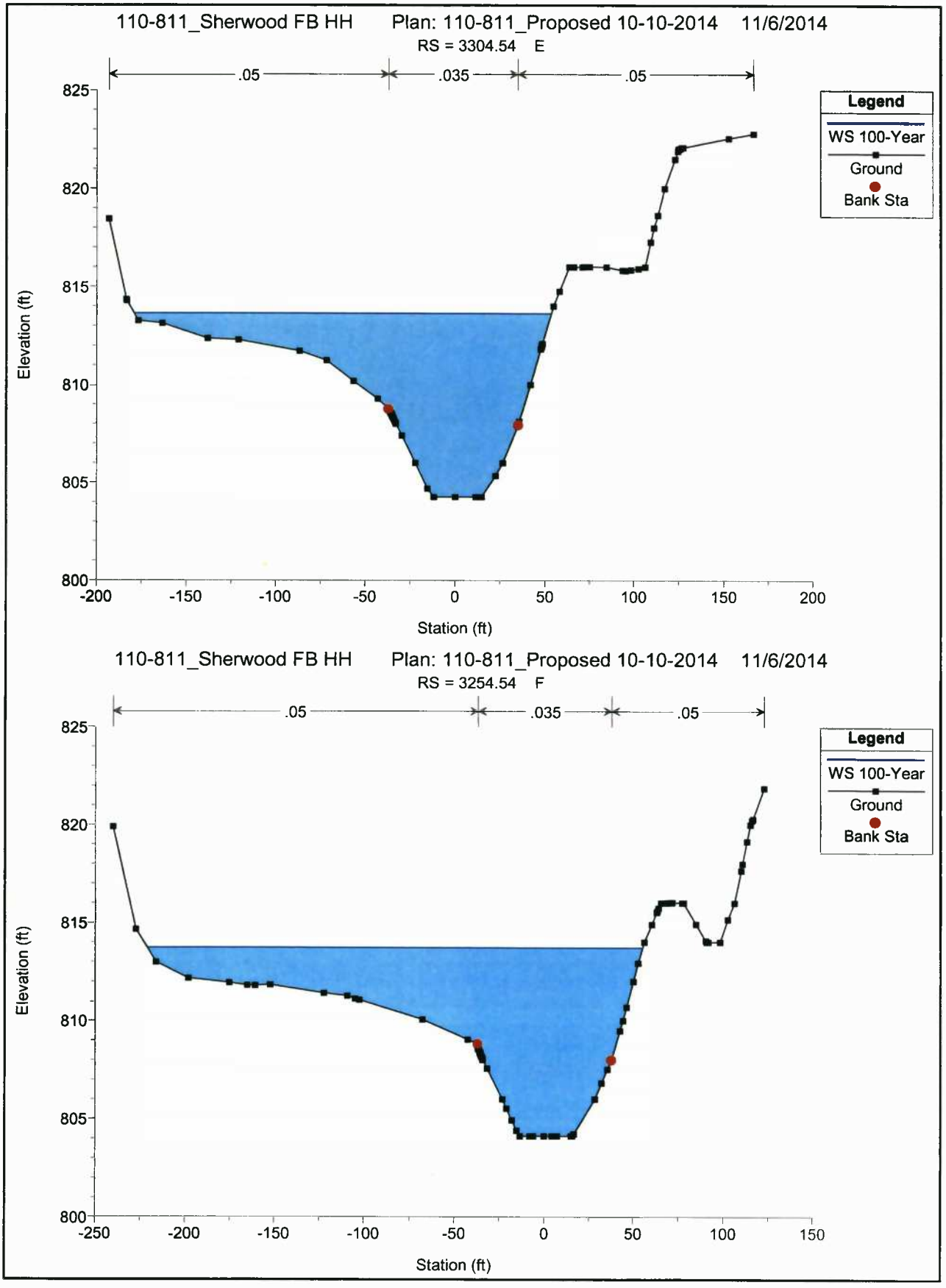
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
835
830
825
820
815
810
805
800
-150
-100
-50
0
50
100
150
Station (ft)
110-811_Sherwood FB HH Plan: 110-811_Proposed 10-10-2014 11/6/2014
RS = 3354.54 D
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
825
820
815
810
805
800
-200
-150
-100
-50
0
50
100
150
Station (ft)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Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
825
820
815
810
805
800
-200
-150
-100
-50
0
50
100
150
200
Station (ft)
110-811_Sherwood FB HH Plan: 110-811_Proposed 10-10-2014 11/6/2014
RS = 3254.54 F
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
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820
815
810
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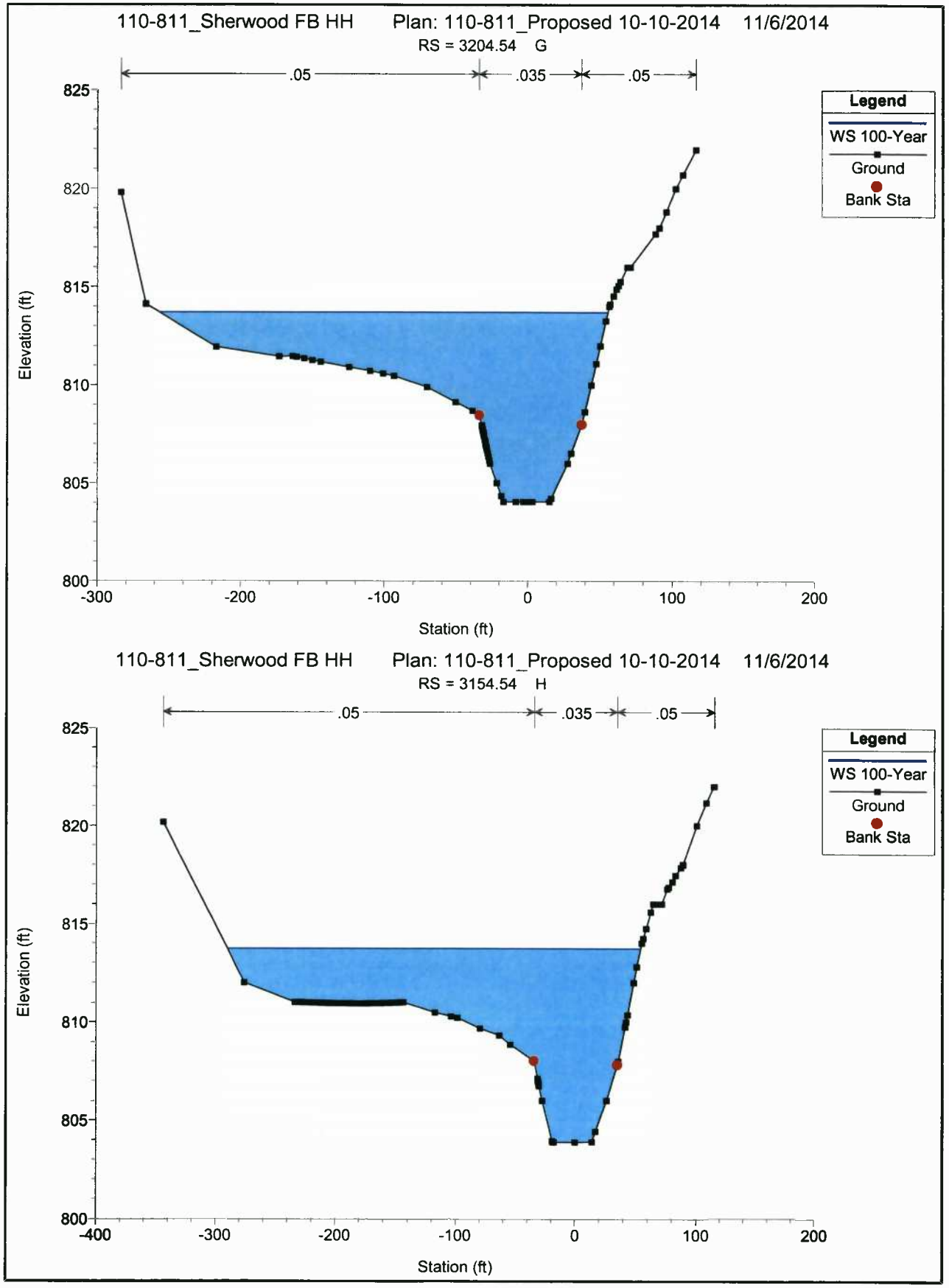
800
-250
-200
-150
-100
-50
0
50
100
150
Station (ft)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11/6/2014
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Ground
Bank Sta
Elevation (ft)
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820
815
810
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800
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-200
-100
0
100
200
Station (ft)
110-811_Sherwood FB HH
Plan: 110-811_Proposed 10-10-2014
11/6/2014
RS = 3154.54 H
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.05
Legend
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Ground
Bank Sta
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-200
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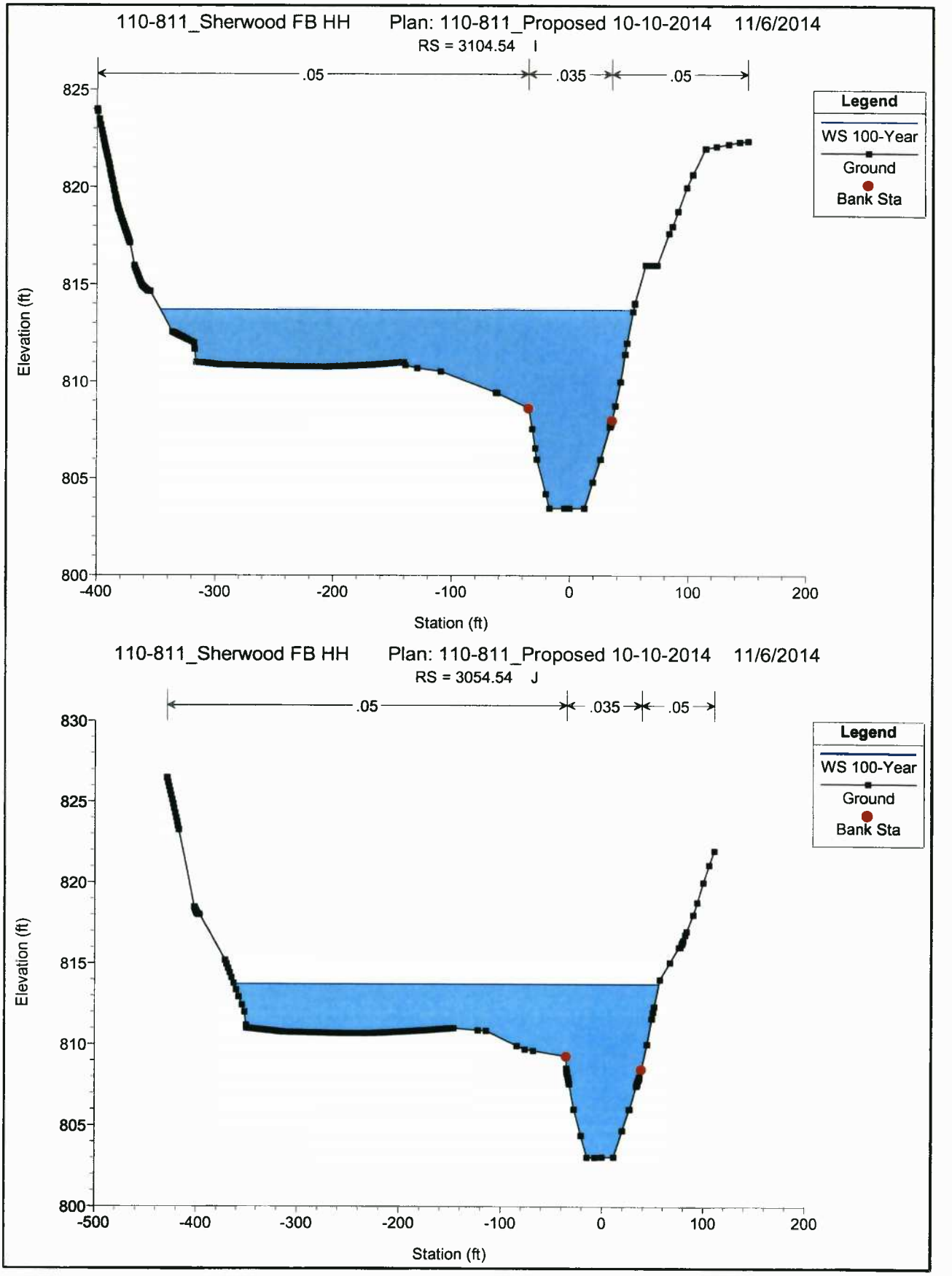
0
100
200
Station (ft)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-200
-100
0
100
200
Station (ft)
110-811_Sherwood FB HH Plan: 110-811_Proposed 10-10-2014 11/6/2014
RS = 3054.54 J
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.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
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-200
-100
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100
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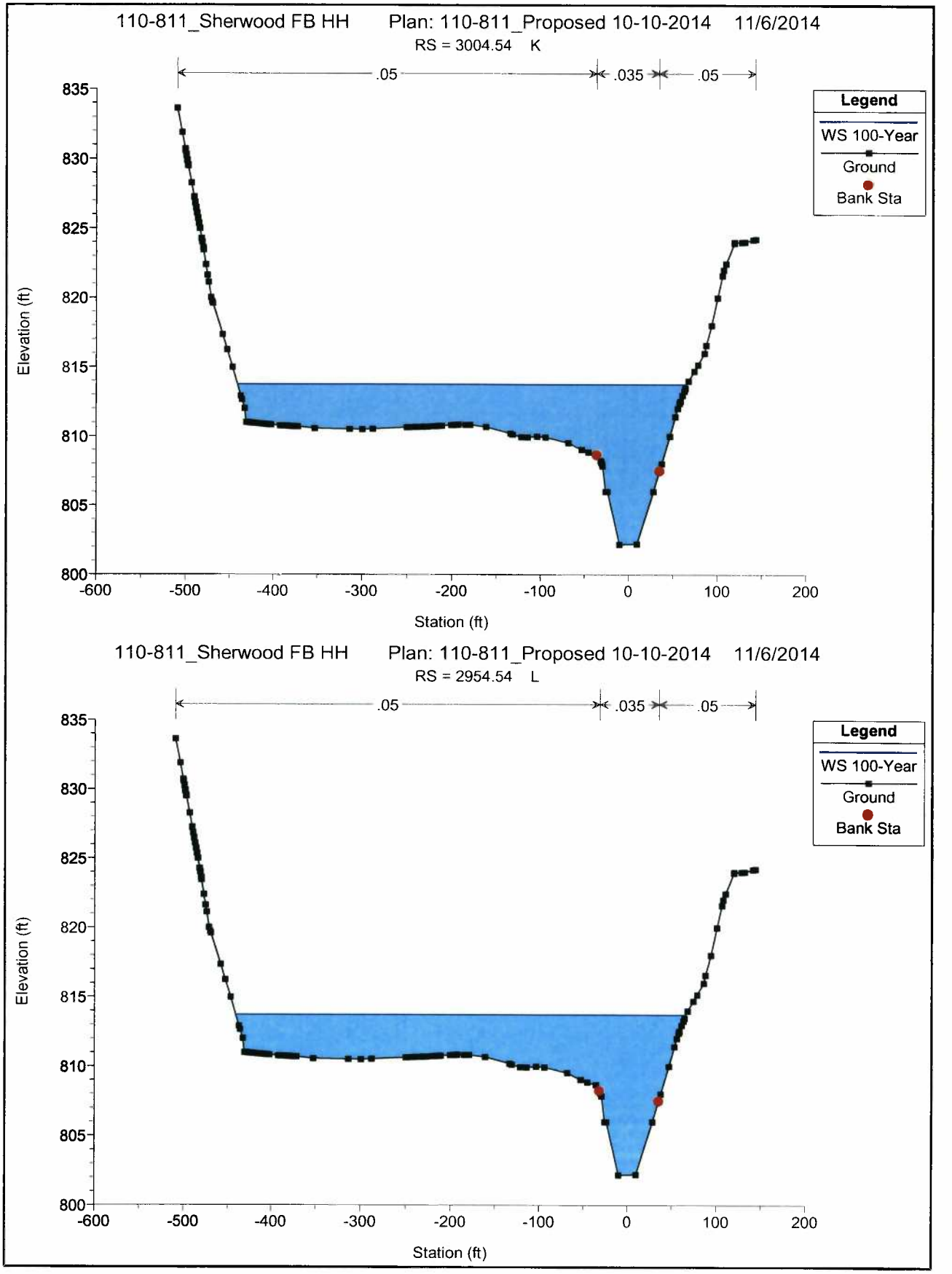
Station (ft)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800
-600
-500
-400
-300
-200
-100
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100
200
Station (ft)
110-811_Sherwood FB HH Plan: 110-811_Proposed 10-10-2014 11/6/2014
RS = 2954.54 L
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.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
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830
825
820
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800
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-100
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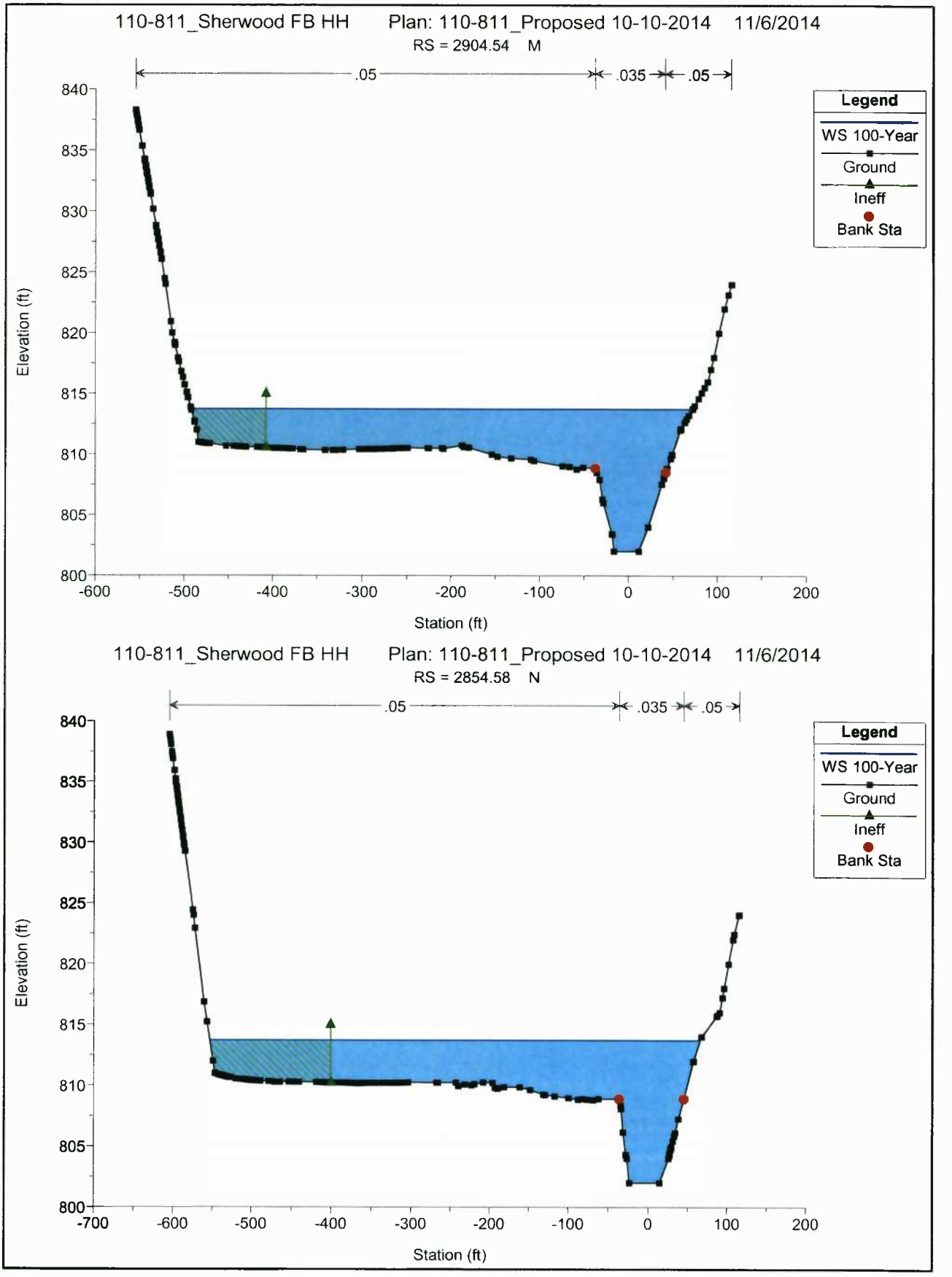
Station (ft)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Ground
Ineff
Bank Sta
Elevation (ft)
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835
830
825
820
815
810
805
800
-600
-500
-400
-300
-200
-100
0
100
200
Station (ft)
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.05
.035
.05
Legend
WS 100-Year
Ground
Ineff
Bank Sta
Elevation (ft)
840
835
830
825
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810
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800
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-200
-100
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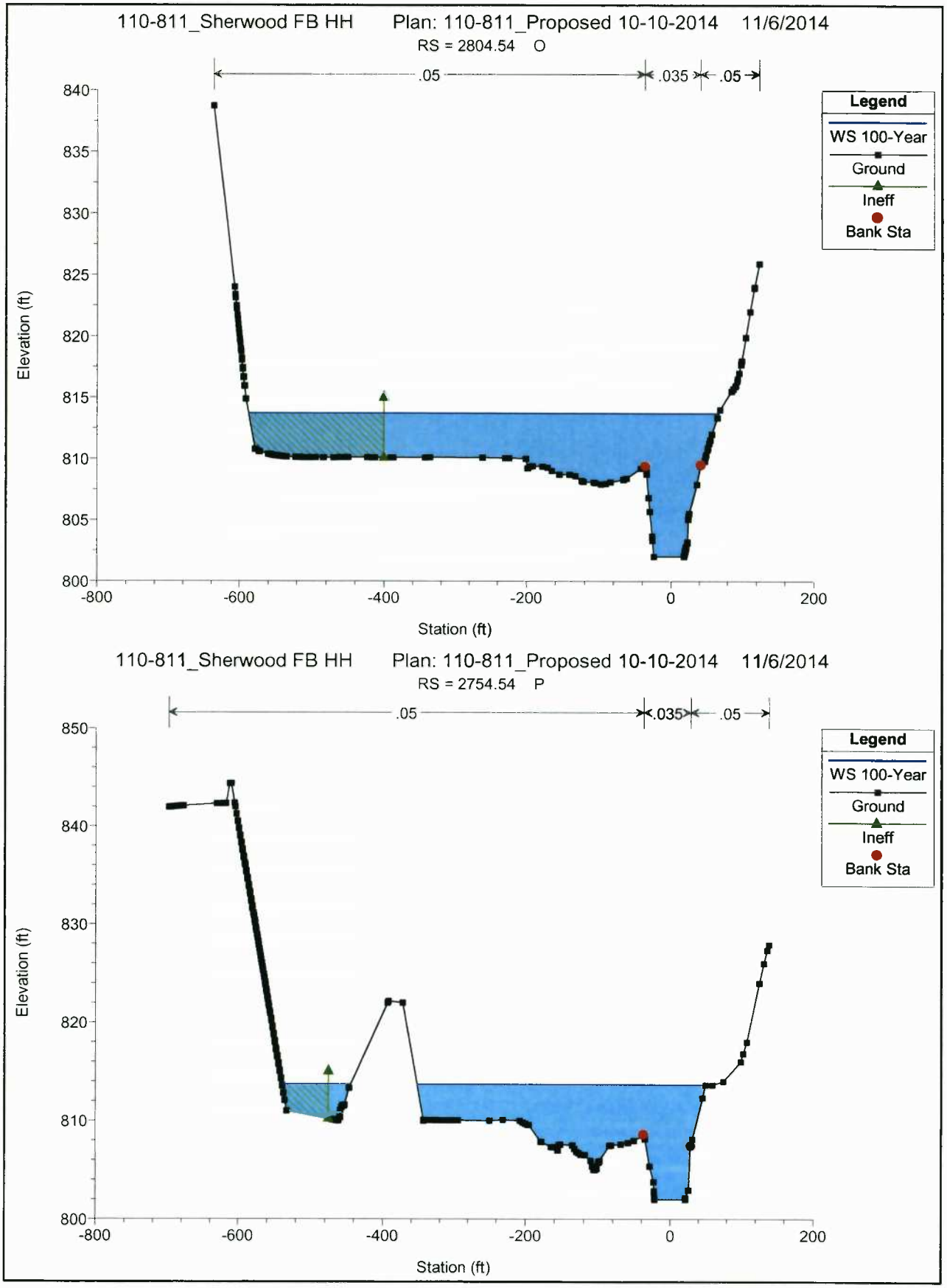
200
Station (ft)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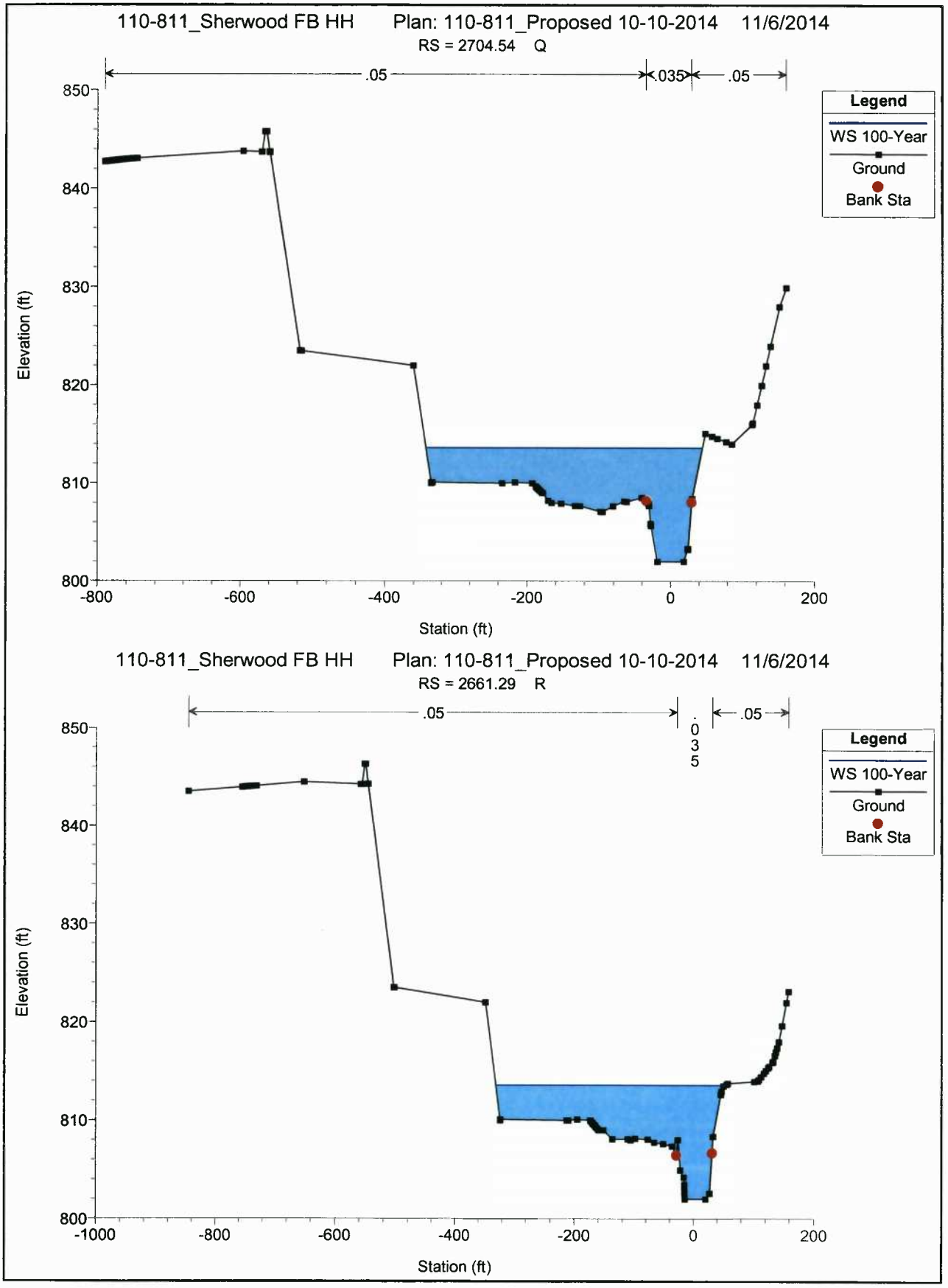
.035
.05
Legend
WS 100-Year
Ground
Ineff
Bank Sta
Elevation (ft)
840
835
830
825
820
815
810
805
800
-800
-600
-400
-200
0
200
Station (ft)
110-811_Sherwood FB HH Plan: 110-811_Proposed 10-10-2014 11/6/2014
RS = 2754.54 P
.05
.035
.05
Legend
WS 100-Year
Ground
Ineff
Bank Sta
Elevation (ft)
850
840
830
820
810
800
-800
-600
-400
-200
0
200
Station (ft)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RS = 2704.54 Q
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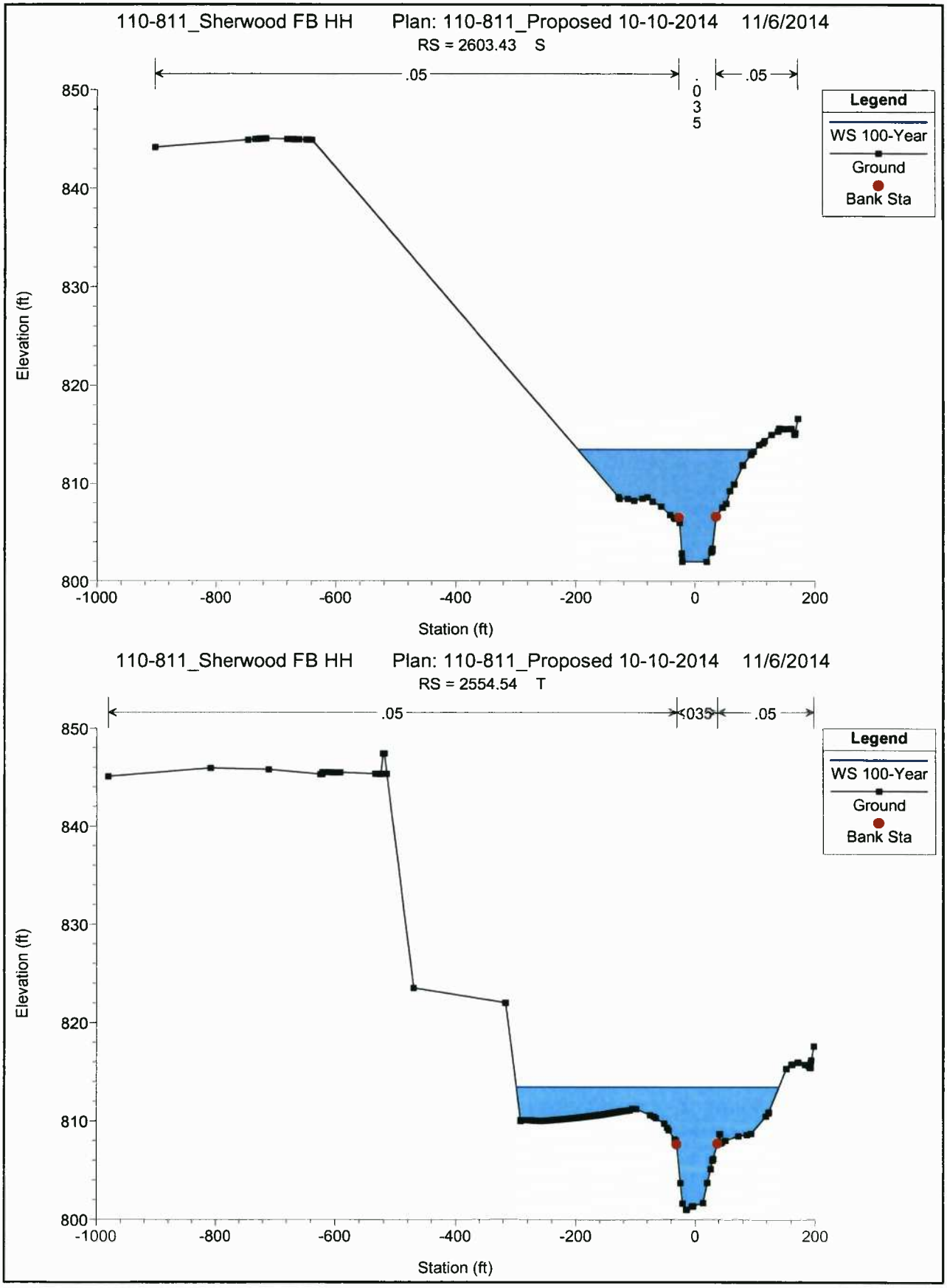
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
850
840
830
820
810
800
-800
-600
-400
-200
0
200
Station (ft)
110-811_Sherwood FB HH Plan: 110-811_Proposed 10-10-2014 11/6/2014
RS = 2661.29 R
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
850
840
830
820
810
800
-1000
-800
-600
-400
-200
0
200
Station (ft)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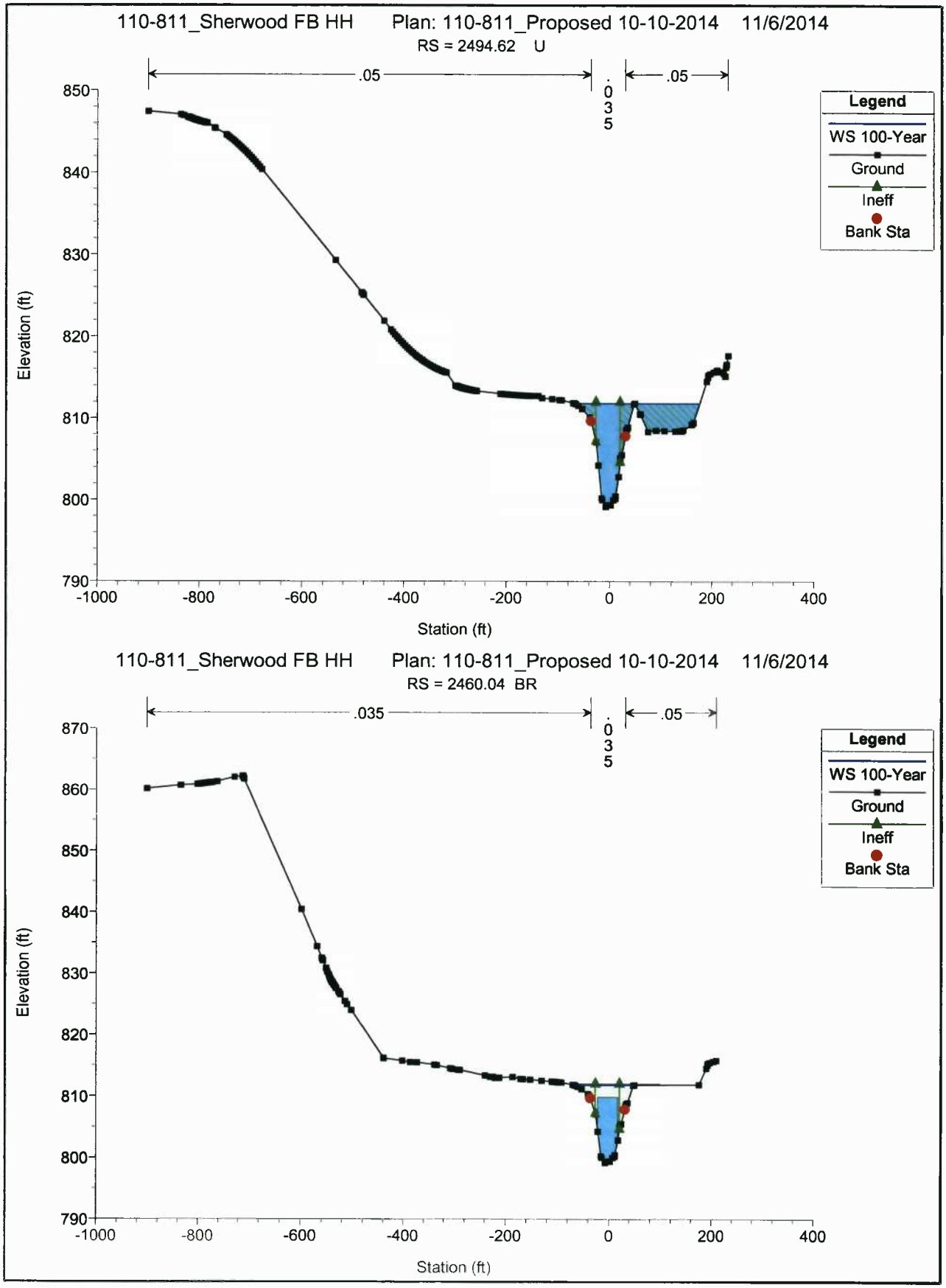
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
850
840
830
820
810
800
-1000
-800
-600
-400
-200
0
200
Station (ft)
110-811_Sherwood FB HH Plan: 110-811_Proposed 10-10-2014 11/6/2014
RS = 2554.54 T
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
850
840
830
820
810
800
-1000
-800
-600
-400
-200
0
200
Station (ft)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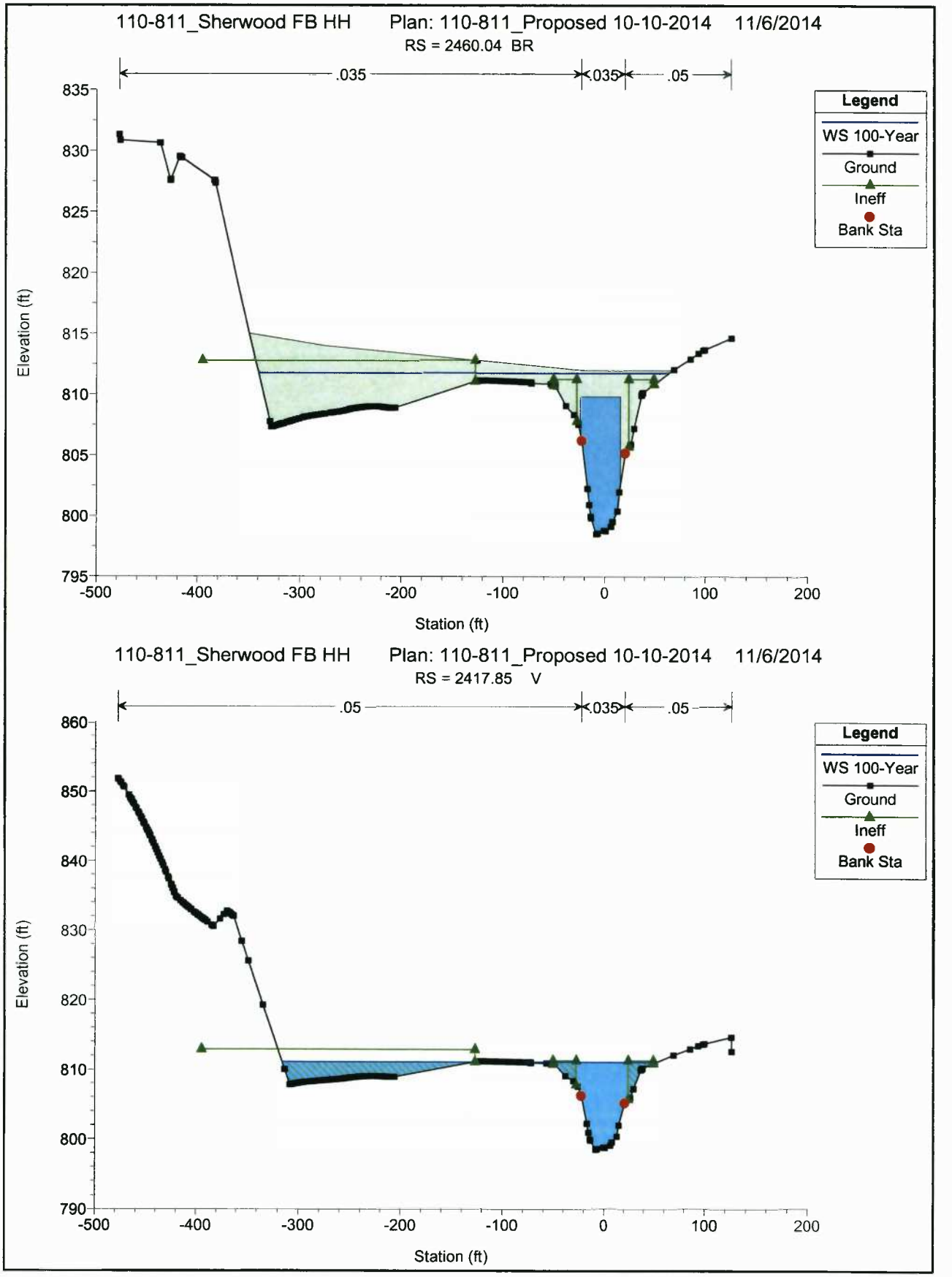
RS = 2494.62 U
.05
.035
.05
Legend
WS 100-Year
Ground
Ineff
Bank Sta
Elevation (ft)
850
840
830
820
810
800
790
-1000
-800
-600
-400
-200
0
200
400
Station (ft)
110-811_Sherwood FB HH Plan: 110-811_Proposed 10-10-2014 11/6/2014
RS = 2460.04 BR
.035
.05
Legend
WS 100-Year
Ground
Ineff
Bank Sta
Elevation (ft)
870
860
850
840
830
820
810
800
790
-1000
-800
-600
-400
-200
0
200
400
Station (ft)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RS = 2460.04 BR
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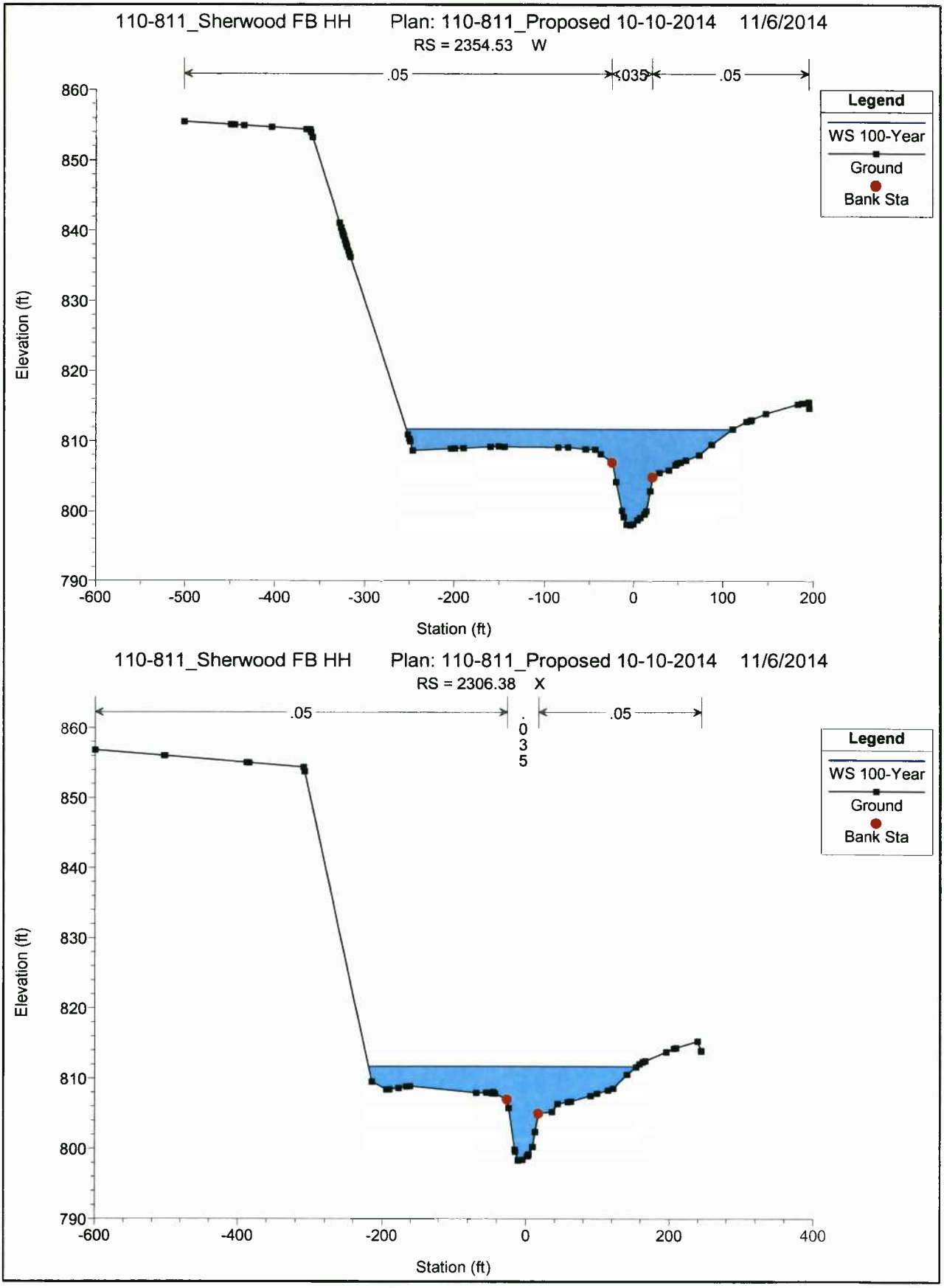
.035
.05
Legend
WS 100-Year
Ground
Ineff
Bank Sta
Elevation (ft)
835
830
825
820
815
810
805
800
795
-500
-400
-300
-200
-100
0
100
200
Station (ft)
110-811_Sherwood FB HH Plan: 110-811_Proposed 10-10-2014 11/6/2014
RS = 2417.85 V
.05
.035
.05
Legend
WS 100-Year
Ground
Ineff
Bank Sta
Elevation (ft)
860
850
840
830
820
810
800
790
-500
-400
-300
-200
-100
0
100
200
Station (ft)


110-811_Sherwood FB HH Plan: 110-811_Proposed 10-10-2014 11/6/2014
RS = 2354.53 W
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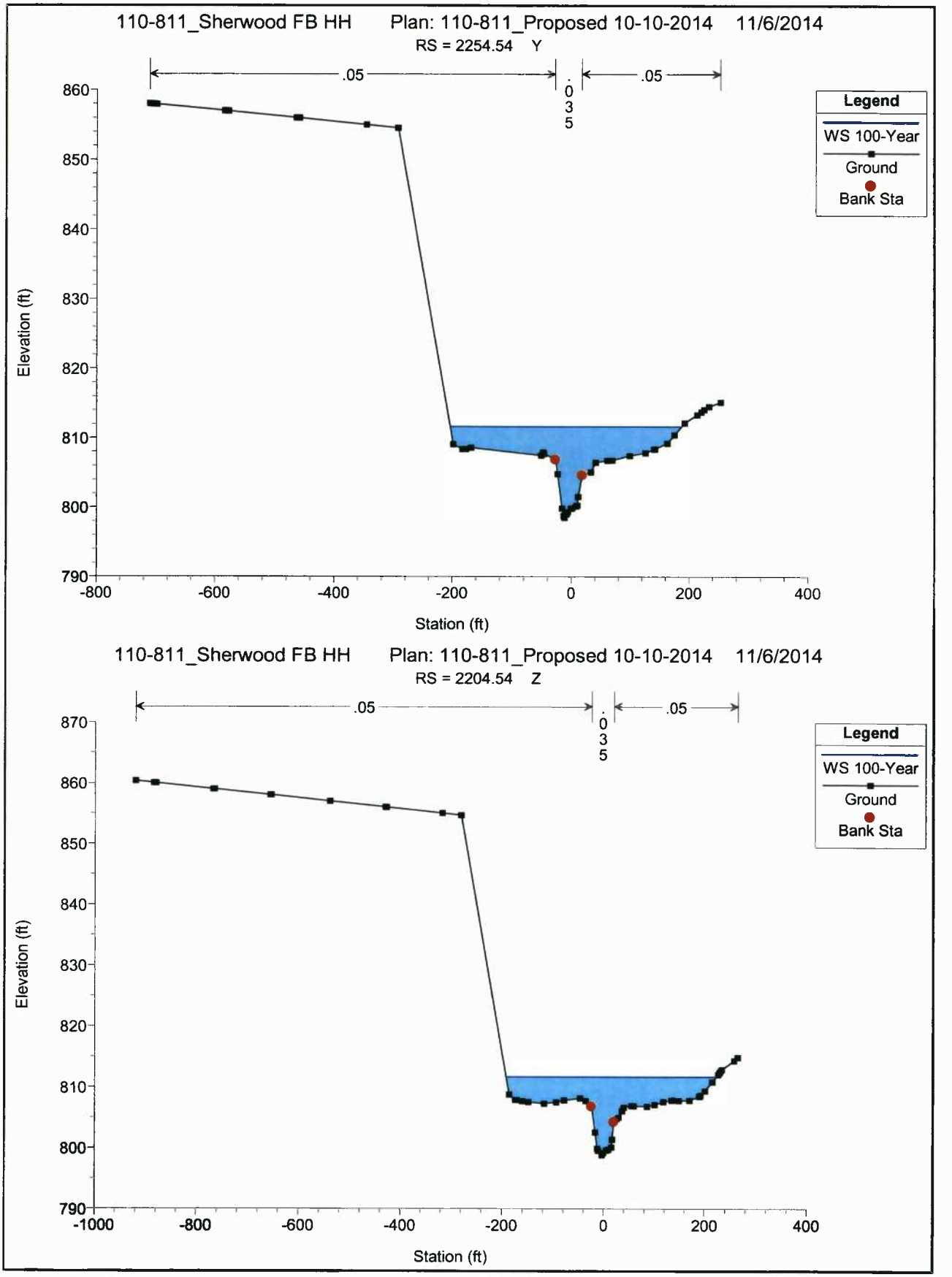
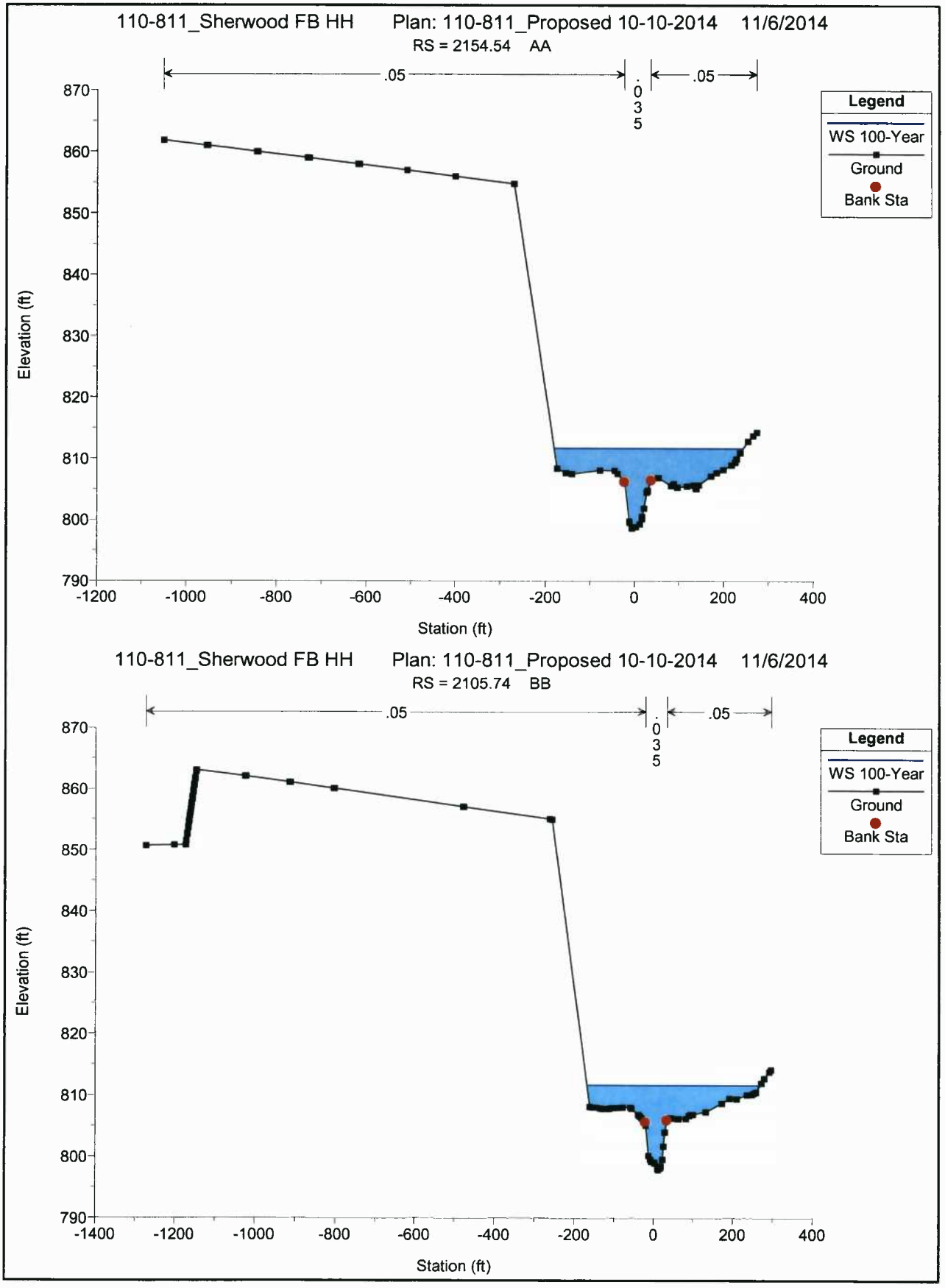
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
860
850
840
830
820
810
800
790
-600
-500
-400
-300
-200
-100
0
100
200
Station (ft)
110-811_Sherwood FB HH Plan: 110-811_Proposed 10-10-2014 11/6/2014
RS = 2306.38 X
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
860
850
840
830
820
810
800
790
-600
-400
-200
0
200
400
Station (ft)


110-811_Sherwood FB HH Plan: 110-811_Proposed 10-10-2014 11/6/2014
RS = 2254.54 Y
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
860
850
840
830
820
810
800
790
-800
-600
-400
-200
0
200
400
Station (ft)
110-811_Sherwood FB HH Plan: 110-811_Proposed 10-10-2014 11/6/2014
RS = 2204.54 Z
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
870
860
850
840
830
820
810
800
790
-1000
-800
-600
-400
-200
0
200
400
Station (ft)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RS = 2154.54 AA
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.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
870
860
850
840
830
820
810
800
790
-1200
-1000
-800
-600
-400
-200
0
200
400
Station (ft)
110-811_Sherwood FB HH Plan: 110-811_Proposed 10-10-2014 11/6/2014
RS = 2105.74 BB
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
870
860
850
840
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-1400
-1200
-1000
-800
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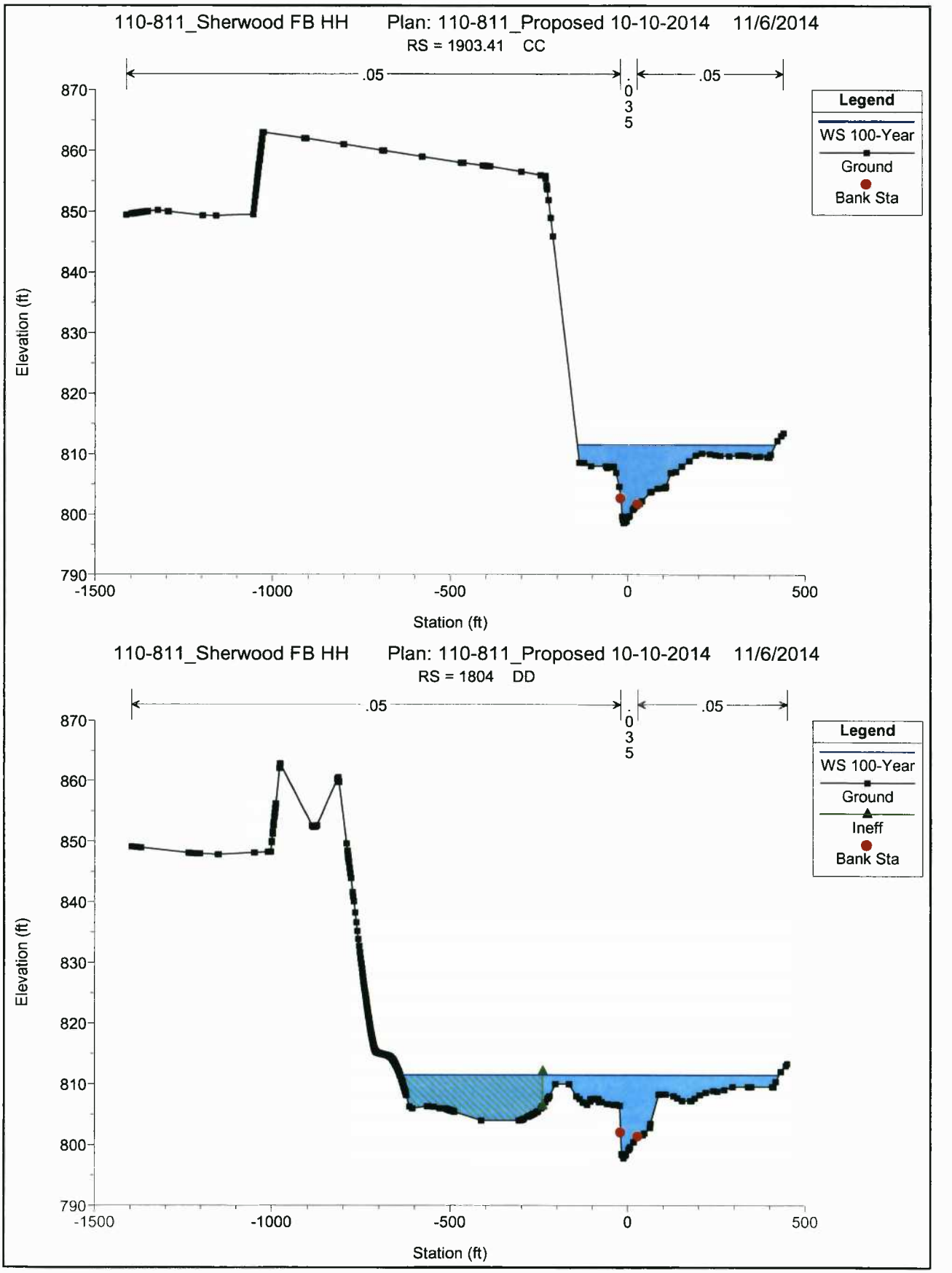
-400
-200
0
200
400
Station (ft)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Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
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860
850
840
830
820
810
800
790
-1500
-1000
-500
0
500
Station (ft)
110-811_Sherwood FB HH Plan: 110-811_Proposed 10-10-2014 11/6/2014
RS = 1804 DD
.05
.05
.035
Legend
WS 100-Year
Ground
Ineff
Bank Sta
Elevation (ft)
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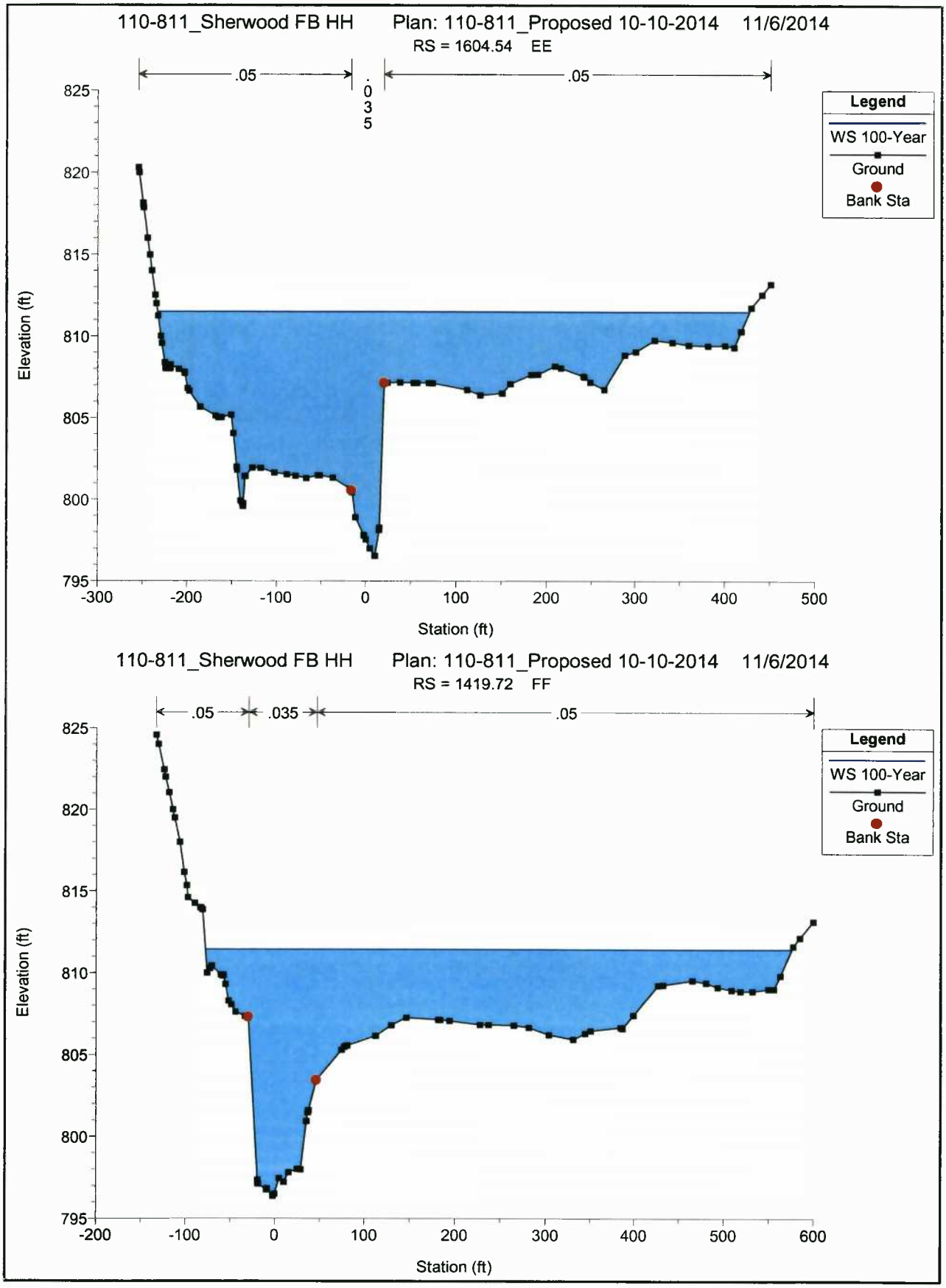
850
840
830
820
810
800
790
-1500
-1000
-500
0
500
Station (ft)


110-811_Sherwood FB HH Plan: 110-811_Proposed 10-10-2014 11/6/2014
RS = 1604.54 EE
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.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
825
820
815
810
805
800
795
-300
-200
-100
0
100
200
300
400
500
Station (ft)
110-811_Sherwood FB HH Plan: 110-811_Proposed 10-10-2014 11/6/2014
RS = 1419.72 FF
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
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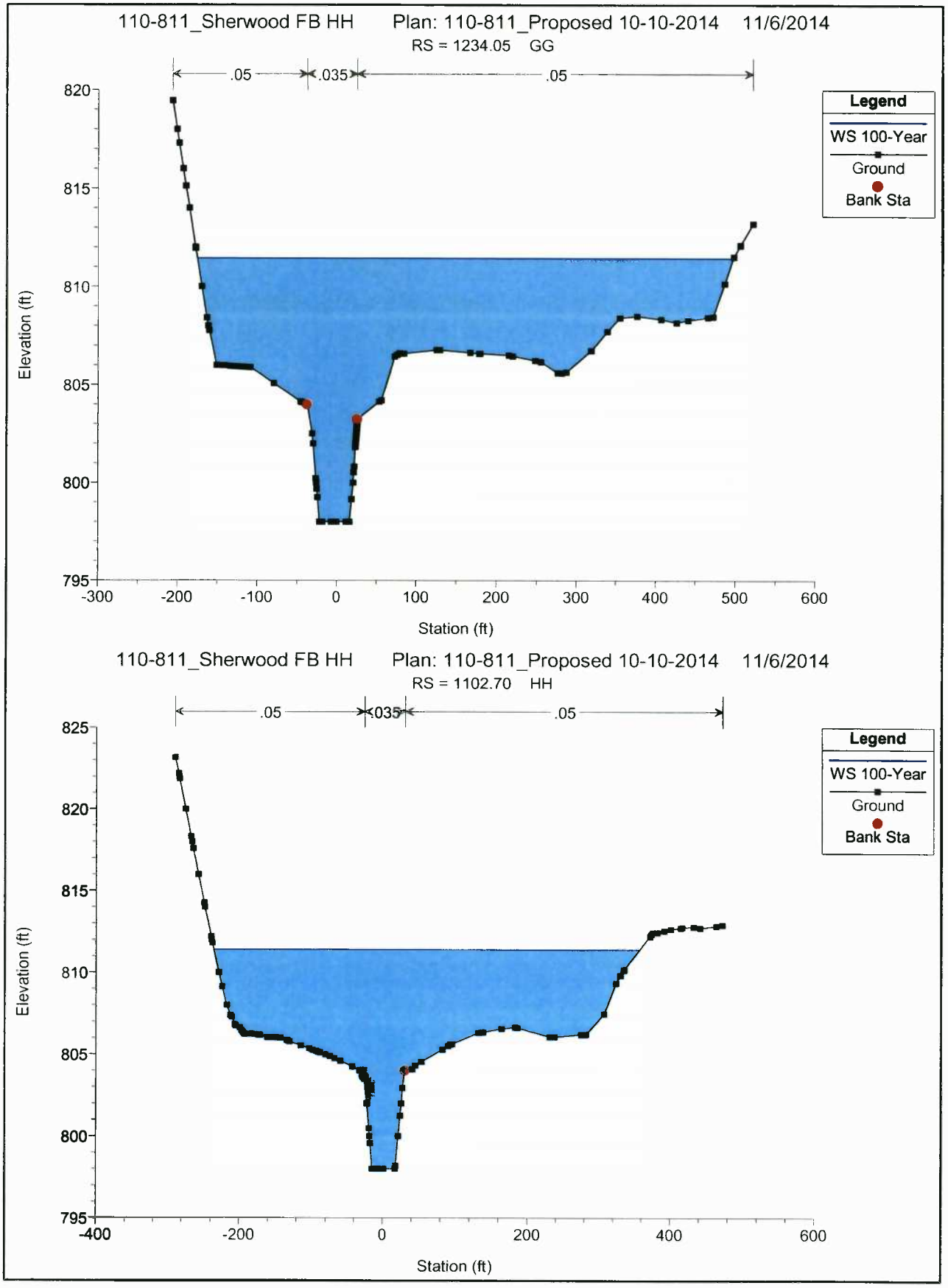
820
815
810
805
800
795
-200
-100
0
100
200
300
400
500
600
Station (ft)


110-811_Sherwood FB HH Plan: 110-811_Proposed 10-10-2014 11/6/2014
RS = 1234.05 GG
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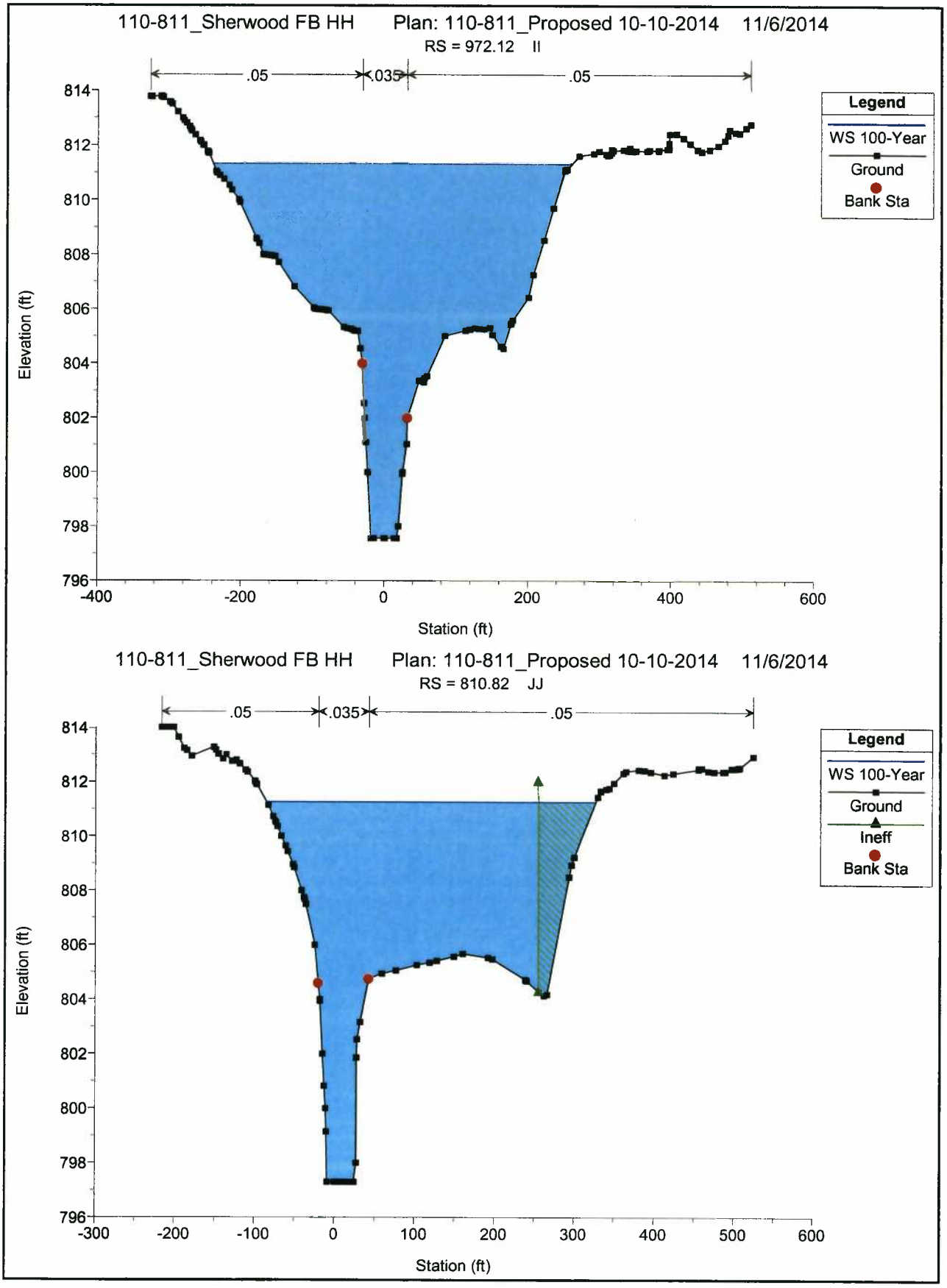
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
820
815
810
805
800
795
-300
-200
-100
0
100
200
300
400
500
600
Station (ft)
110-811_Sherwood FB HH Plan: 110-811_Proposed 10-10-2014 11/6/2014
RS = 1102.70 HH
.05
.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
825
820
815
810
805
800
795
-400
-200
0
200
400
600
Station (ft)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RS = 972.12 II
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Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
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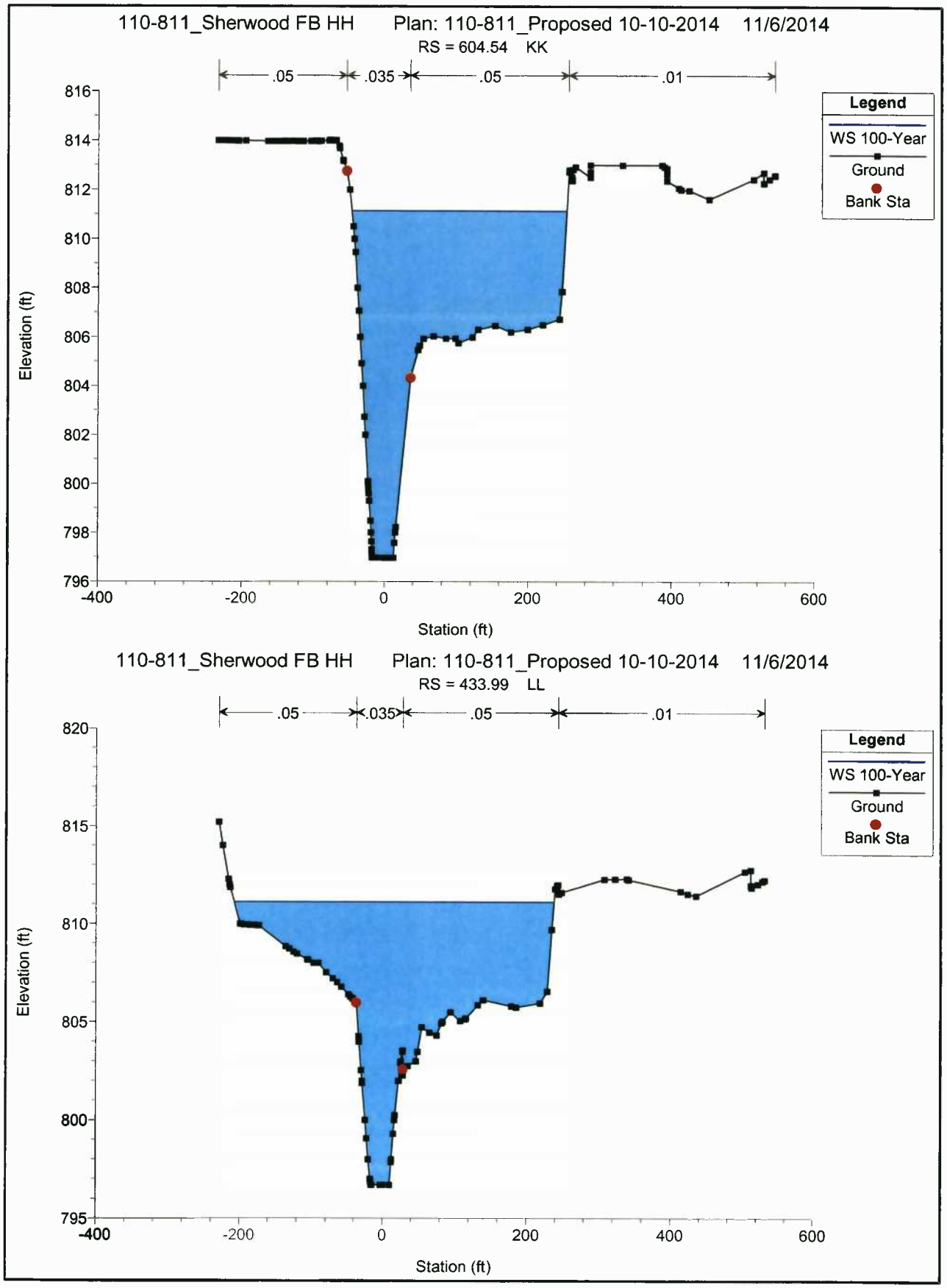
812
810
808
806
804
802
800
798
796
-400
-200
0
200
400
600
Station (ft)
110-811_Sherwood FB HH Plan: 110-811_Proposed 10-10-2014 11/6/2014
RS = 810.82 JJ
.05
.035
.05
Legend
WS 100-Year
Ground
Ineff
Bank Sta
Elevation (ft)
814
812
810
808
806
804
802
800
798
796
-300
-200
-100
0
100
200
300
400
500
600
Station (ft)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RS = 604.54 KK
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.05
.01
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
816
814
812
810
808
806
804
802
800
798
796
-400
-200
0
200
400
600
Station (ft)
110-811_Sherwood FB HH Plan: 110-811_Proposed 10-10-2014 11/6/2014
RS = 433.99 LL
.05
.035
.05
.01
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
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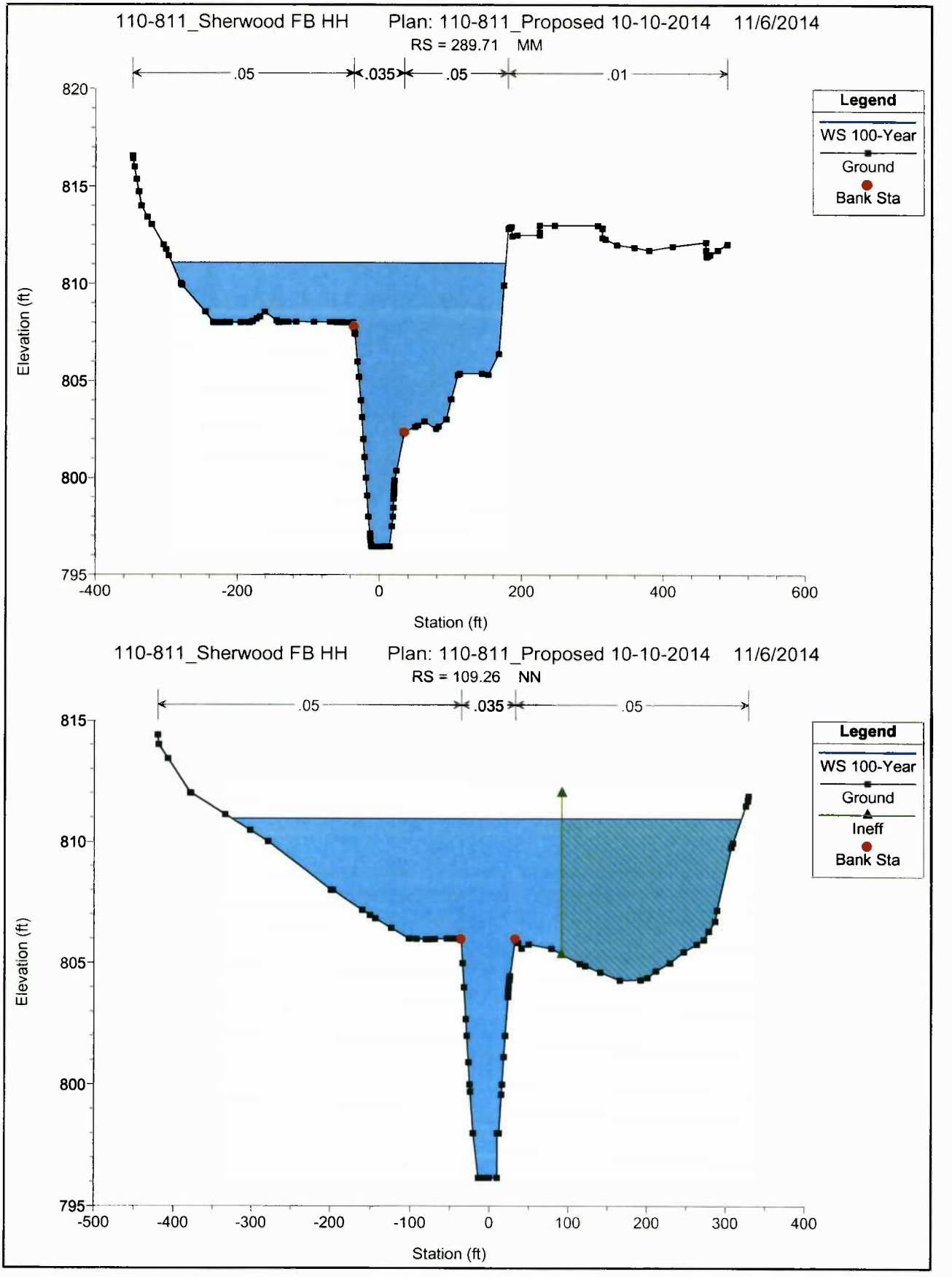
815
810
805
800
795
-400
-200
0
200
400
600
Station (ft)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Plan: 110-811_Proposed 10-10-2014
11/6/2014
RS = 289.71 MM
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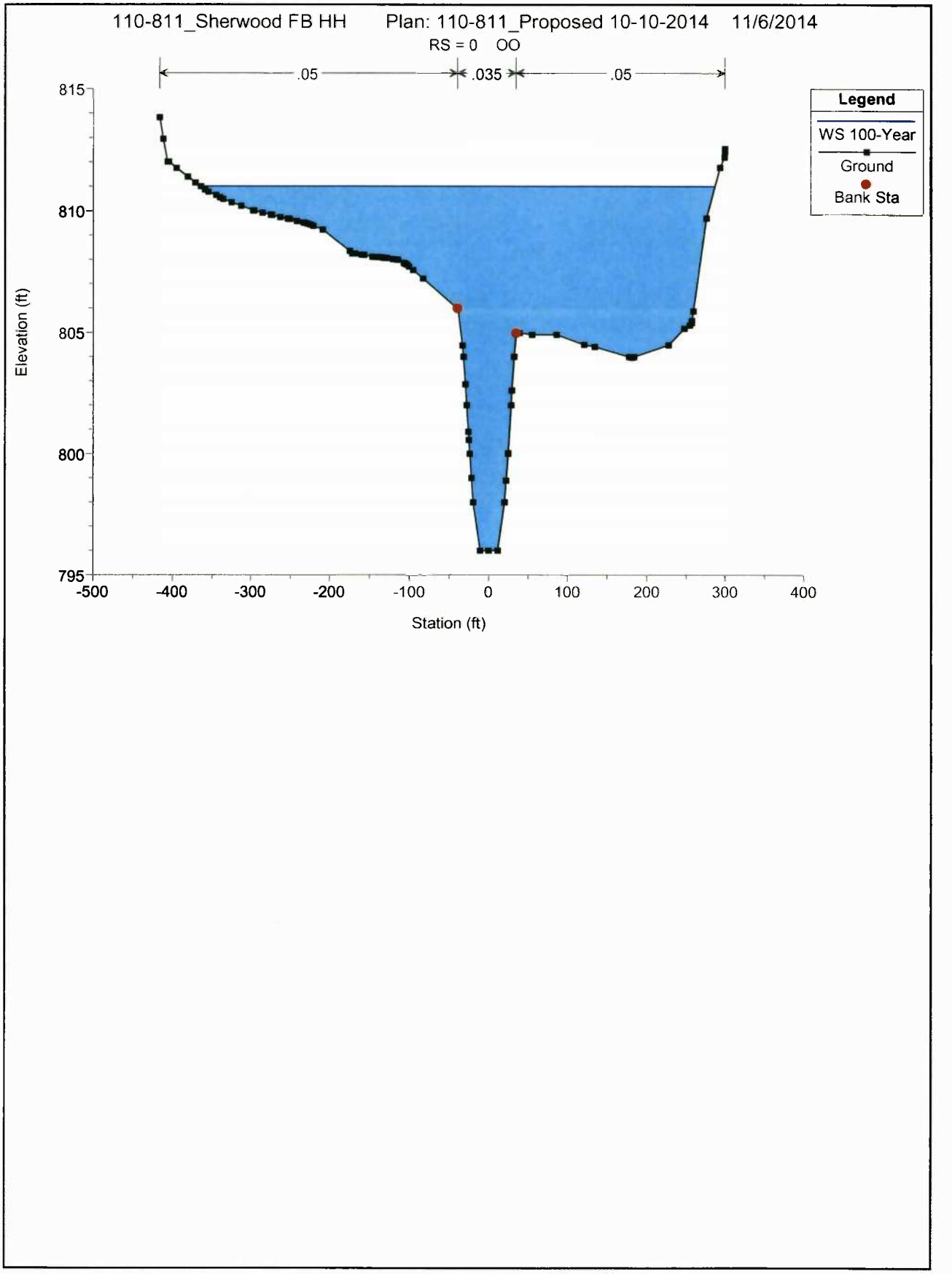
.035
.05
.01
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
820
815
810
805
800
795
-400
-200
0
200
400
600
Station (ft)
110-811_Sherwood FB HH
Plan: 110-811_Proposed 10-10-2014
11/6/2014
RS = 109.26 NN
.05
.035
.05
Legend
WS 100-Year
Ground
Ineff
Bank Sta
Elevation (ft)
815
810
805
800
795
-500
-400
-300
-200
-100
0
100
200
300
400
Station (ft)


110-811_Sherwood FB HH
Plan: 110-811_Proposed 10-10-2014
11/6/2014
RS = 0 OO
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.035
.05
Legend
WS 100-Year
Ground
Bank Sta
Elevation (ft)
815
810
805
800
795
-500
-400
-300
-200
-100
0
100
200
300
400
Station (ft)

APPENDIX E

HEC-RAS SUMMARY OF EXISTING AND PROPOSED HYDRAULIC CALCULATIONS

HEC-RAS Plan: Existing River: Buckeye Creek Reach: Buckeye Creek Profile: 100-Year

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)	
Buckeye Creek	3504.54	100 Year	5150.00	804.44	813.96		814.76	0.001962	7.17	726.12	104.68	0.45
Buckeye Creek	3454.54	100 Year	5150.00	804.38	813.52		814.61	0.002677	8.58	666.37	123.34	0.54
Buckeye Creek	3404.54	100 Year	5150.00	804.32	813.11		814.44	0.003501	9.44	604.30	113.48	0.61
Buckeye Creek	3354.54	100 Year	5150.00	804.25	813.17		814.19	0.002626	8.49	767.38	197.82	0.54
Buckeye Creek	3304.54	100 Year	5150.00	804.25	813.04		814.06	0.002738	8.51	773.91	212.43	0.54
Buckeye Creek	3254.54	100 Year	5150.00	804.12	813.13		813.86	0.002015	7.43	973.78	270.79	0.47
Buckeye Creek	3204.54	100 Year	5150.00	804.05	813.09		813.74	0.001817	7.18	1064.85	297.47	0.45
Buckeye Creek	3154.54	100 Year	5150.00	803.90	813.08		813.63	0.001571	6.78	1217.48	358.66	0.42
Buckeye Creek	3104.54	100 Year	5150.00	803.47	813.07		813.53	0.001327	6.27	1374.43	418.07	0.38
Buckeye Creek	3054.54	100 Year	5150.00	803.04	813.07		813.46	0.001149	5.86	1491.17	457.49	0.36
Buckeye Creek	3004.54	100 Year	5150.00	802.19	813.08		813.39	0.000931	5.40	1683.27	500.68	0.32
Buckeye Creek	2954.54	100 Year	5150.00	802.19	813.10		813.33	0.000725	4.86	1983.21	548.18	0.29
Buckeye Creek	2904.54	100 Year	5150.00	802.00	813.13		813.28	0.000495	4.02	2346.54	604.95	0.24
Buckeye Creek	2854.58	100 Year	5150.00	802.00	813.13		813.25	0.000374	3.58	2651.69	649.77	0.21
Buckeye Creek	2804.54	100 Year	5150.00	802.00	813.14		813.23	0.000319	3.24	2937.14	682.42	0.19
Buckeye Creek	2754.54	100 Year	5150.00	802.00	813.11		813.21	0.000334	3.46	2940.37	716.03	0.19
Buckeye Creek	2704.54	100 Year	5150.00	802.00	812.97		813.17	0.000629	4.70	2284.41	757.90	0.26
Buckeye Creek	2681.29	100 Year	5150.00	802.00	811.37	809.07	812.98	0.003540	10.22	513.70	416.99	0.61
Buckeye Creek	2625.35		Bridge									
Buckeye Creek	2603.43	100 Year	5150.00	802.00	811.11	808.56	812.55	0.003137	9.65	601.68	672.15	0.58
Buckeye Creek	2554.54	100 Year	5150.00	800.98	811.27	809.13	812.14	0.002231	7.97	861.91	686.37	0.49
Buckeye Creek	2354.53	100 Year	5150.00	797.95	811.43		811.70	0.000761	5.48	1958.87	564.25	0.29
Buckeye Creek	2306.38	100 Year	5150.00	798.34	811.42		811.61	0.000648	4.95	2332.46	710.67	0.27
Buckeye Creek	2254.54	100 Year	5150.00	798.53	811.43		811.56	0.000476	4.18	2824.02	832.81	0.23
Buckeye Creek	2204.54	100 Year	5150.00	798.81	811.46		811.51	0.000236	3.00	3956.71	1014.95	0.16
Buckeye Creek	2154	100 Year	5150.00	798.60	811.46		811.50	0.000163	2.44	4714.72	1211.03	0.14
Buckeye Creek	2105.74	100 Year	5150.00	797.84	811.45		811.49	0.000161	2.57	4984.39	1422.68	0.14
Buckeye Creek	1903.41	100 Year	5150.00	798.59	811.44		811.46	0.000097	2.08	6304.55	1658.44	0.11
Buckeye Creek	1604.54	100 Year	5150.00	796.53	811.35		811.40	0.000177	2.79	3531.91	659.94	0.14
Buckeye Creek	1319.72	100 Year	5150.00	796.37	811.29		811.38	0.000197	3.06	3150.05	652.23	0.15
Buckeye Creek	1234.05	100 Year	5150.00	798.00	811.28		811.35	0.000169	2.82	3553.28	671.93	0.14
Buckeye Creek	1102.70	100 Year	5150.00	798.00	811.25		811.32	0.000185	2.93	3345.53	589.97	0.15
Buckeye Creek	972.12	100 Year	5150.00	797.56	811.18		811.29	0.000228	3.38	2761.62	496.01	0.17
Buckeye Creek	810.92	100 Year	5150.00	797.30	811.13		811.25	0.000312	3.58	2385.42	408.81	0.19
Buckeye Creek	632.35	100 Year	5150.00	796.97	811.11		811.18	0.000189	2.72	3224.53	564.55	0.15
Buckeye Creek	433.99	100 Year	5150.00	796.70	811.10		811.15	0.000148	2.61	3762.86	712.65	0.13
Buckeye Creek	289.71	100 Year	5150.00	796.46	811.09		811.14	0.000137	2.45	3910.40	744.61	0.13
Buckeye Creek	109.26	100 Year	5150.00	796.17	811.03		811.10	0.000200	2.91	3270.82	651.91	0.15
Buckeye Creek	0	100 Year	5150.00	796.00	811.00	803.91	811.08	0.000191	2.96	3099.82	653.27	0.15

PREPARED BY: 3/25/2014 TGJ

CHECKED BY: APG 26-MAR-2014

HEC-RAS Plan: Proposed River: Buckeye Creek Reach: Buckeye Creek Profile: 100-Year

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)	
Buckeye Creek	3504.54	100-Year	5150.00	804.44	814.26		815.00	0.001726	6.90	758.34	108.39	0.43
Buckeye Creek	3454.54	100-Year	5150.00	804.38	813.90		814.88	0.002242	8.11	715.40	129.24	0.50
Buckeye Creek	3404.54	100-Year	5150.00	804.32	813.60		814.74	0.002768	8.76	661.90	121.22	0.55
Buckeye Creek	3354.54	100-Year	5150.00	804.25	813.71		814.52	0.001957	7.67	875.70	200.85	0.47
Buckeye Creek	3304.54	100-Year	5150.00	804.25	813.63		814.42	0.001975	7.60	908.08	233.00	0.47
Buckeye Creek	3254.54	100-Year	5150.00	804.12	813.72		814.26	0.001416	6.54	1136.44	276.50	0.40
Buckeye Creek	3204.54	100-Year	5150.00	804.05	813.70		814.18	0.001265	6.29	1251.85	313.03	0.38
Buckeye Creek	3154.54	100-Year	5150.00	803.89	813.73		814.09	0.000995	5.67	1458.91	344.81	0.34
Buckeye Creek	3104.54	100-Year	5150.00	803.47	813.73		814.03	0.000856	5.29	1628.91	400.70	0.31
Buckeye Creek	3054.54	100-Year	5150.00	803.03	813.72		813.98	0.000769	5.01	1716.58	418.71	0.29
Buckeye Creek	3004.54	100-Year	5150.00	802.18	813.74		813.93	0.000566	4.42	2089.44	506.88	0.25
Buckeye Creek	2954.54	100-Year	5150.00	802.18	813.71		813.91	0.000579	4.53	2072.73	506.51	0.26
Buckeye Creek	2904.54	100-Year	5150.00	802.00	813.71		813.88	0.000466	4.05	2161.33	564.71	0.23
Buckeye Creek	2854.58	100-Year	5150.00	802.00	813.71		813.85	0.000383	3.77	2281.72	619.66	0.21
Buckeye Creek	2804.54	100-Year	5150.00	802.00	813.70		813.83	0.000364	3.60	2383.24	654.99	0.20
Buckeye Creek	2754.54	100-Year	5150.00	802.00	813.68		813.80	0.000340	3.62	2406.70	508.56	0.20
Buckeye Creek	2704.54	100-Year	5150.00	802.00	813.61		813.77	0.000431	4.06	2117.57	387.23	0.22
Buckeye Creek	2661.29	100-Year	5150.00	802.00	813.57		813.74	0.000495	4.33	2012.70	383.68	0.23
Buckeye Creek	2603.43	100-Year	5150.00	802.00	813.43		813.70	0.000614	5.01	1619.52	297.59	0.27
Buckeye Creek	2554.54	100-Year	5150.00	800.98	813.44		813.65	0.000532	4.55	1950.09	438.48	0.25
Buckeye Creek	2494.62	100-Year	5150.00	799.17	811.79	808.32	813.45	0.002739	10.33	498.76	240.86	0.56
Buckeye Creek	2460.04		Bridge									
Buckeye Creek	2417.85	100-Year	5150.00	798.50	811.04	808.30	812.93	0.003377	11.14	496.72	317.85	0.61
Buckeye Creek	2354.53	100-Year	5150.00	797.95	811.66		812.08	0.000990	6.34	1474.53	364.18	0.33
Buckeye Creek	2306.38	100-Year	5150.00	798.34	811.67		811.98	0.000859	5.78	1654.15	373.73	0.31
Buckeye Creek	2254.54	100-Year	5150.00	798.53	811.66		811.91	0.000774	5.40	1771.33	390.89	0.29
Buckeye Creek	2204.54	100-Year	5150.00	798.81	811.65		811.86	0.000637	4.98	1949.49	414.24	0.27
Buckeye Creek	2154.54	100-Year	5150.00	798.60	811.66		811.81	0.000447	4.10	2186.42	424.01	0.23
Buckeye Creek	2105.74	100-Year	5150.00	797.84	811.57		811.78	0.000539	4.74	1994.04	436.22	0.25
Buckeye Creek	1903.41	100-Year	5150.00	798.59	811.49		811.67	0.000480	4.62	2325.15	558.03	0.24
Buckeye Creek	1804	100-Year	5150.00	797.78	811.48	805.91	811.61	0.000356	4.08	2751.96	1067.34	0.21
Buckeye Creek	1604.54	100-Year	5150.00	796.53	811.49		811.54	0.000165	2.72	3626.22	661.40	0.13
Buckeye Creek	1419.72	100-Year	5150.00	796.37	811.44		811.52	0.000183	2.97	3246.69	653.60	0.15
Buckeye Creek	1234.05	100-Year	5150.00	798.00	811.43		811.49	0.000156	2.74	3653.16	673.76	0.14
Buckeye Creek	1102.70	100-Year	5150.00	798.00	811.40		811.47	0.000173	2.85	3434.30	593.36	0.14
Buckeye Creek	972.12	100-Year	5150.00	797.56	811.34		811.44	0.000215	3.30	2838.34	503.54	0.16
Buckeye Creek	810.82	100-Year	5150.00	797.30	811.26		811.39	0.000323	3.68	2188.47	413.11	0.19
Buckeye Creek	604.54	100-Year	5150.00	796.96	811.15		811.32	0.000393	3.88	1929.46	300.41	0.21
Buckeye Creek	433.99	100-Year	5150.00	796.69	811.13		811.25	0.000285	3.57	2437.93	446.54	0.18
Buckeye Creek	289.71	100-Year	5150.00	796.46	811.10		811.22	0.000270	3.46	2481.21	472.28	0.18
Buckeye Creek	109.26	100-Year	5150.00	796.17	810.95		811.15	0.000443	4.31	1986.76	646.59	0.22
Buckeye Creek	0	100-Year	5150.00	796.00	811.00	803.91	811.08	0.000191	2.96	3099.82	653.27	0.15

Buckeye Creek
Existing vs. Proposed HEC-RAS Models
100-Year Water Surface Elevations Summary
Sherwood Gas Processing Plant - Doddridge County, WV
Project: 110-811.5001

PREPARED BY: TGJ
DATE: 11/7/2014
CHECKED: AMG
DATE: 07-Nov-2014

ID	River Station	100-Year Peak Flow (cfs)	Water Surface Elevations Existing	Water Surface Elevations Proposed	Water Surface Elevations Existing vs. Proposed
A	35+04.54	5150	813.96	814.26	0.30
B	34+54.54	5150	813.52	813.90	0.38
C	34+04.54	5150	813.11	813.60	0.49
D	33+54.54	5150	813.17	813.71	0.54
E	33+04.54	5150	813.04	813.63	0.59
F	32+54.54	5150	813.13	813.72	0.59
G	32+04.54	5150	813.09	813.70	0.61
H	31+54.54	5150	813.08	813.73	0.65
I	31+04.54	5150	813.07	813.73	0.66
J	30+54.54	5150	813.07	813.72	0.65
K	30+04.54	5150	813.08	813.74	0.66
L	29+54.54	5150	813.10	813.71	0.61
M	29+04.54	5150	813.13	813.71	0.58
N	28+54.58	5150	813.13	813.71	0.58
O	28+04.54	5150	813.14	813.70	0.56
P	27+54.54	5150	813.11	813.68	0.57
Q	27+04.54	5150	812.97	813.61	0.64
R	26+61.29	5150	811.37	813.57	2.20
		Existing Bridge			
S	26+03.43	5150	811.11	813.43	2.32
T	25+54.54	5150	811.27	813.44	2.17
U	24+94.62	5150	-	811.79	N/A
		New Bridge			
V	24+17.85	5150	-	811.04	N/A
W	23+54.53	5150	811.43	811.66	0.23
X	23+06.38	5150	811.42	811.67	0.25
Y	22+54.54	5150	811.43	811.66	0.23
Z	22+04.54	5150	811.46	811.65	0.19
AA	21+54.54	5150	811.46	811.66	0.20
BB	21+05.74	5150	811.45	811.57	0.12
CC	19+03.41	5150	811.44	811.49	0.05
DD	18+04.00	5150	-	811.48	N/A
EE	16+04.54	5150	811.35	811.49	0.14
FF	14+19.72	5150	811.29	811.44	0.15
GG	12+34.05	5150	811.28	811.43	0.15
HH	11+02.70	5150	811.25	811.40	0.15
II	9+72.12	5150	811.18	811.34	0.16
JJ	8+10.82	5150	811.13	811.26	0.13
KK	6+04.54	5150	811.11	811.15	0.04
LL	433.99	5150	811.10	811.13	0.03
MM	289.71	5150	811.09	811.10	0.01
NN	109.26	5150	811.03	810.95	-0.08
OO	0	5150	811.00	811.00	0.00

APPENDIX F

DODDRIDGE COUNTY FLOODPLAIN PERMITS

DODDRIDGE COUNTY
FLOODPLAIN DEVELOPMENT PERMIT APPLICATION

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

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

APPLICANT'S SIGNATURE_____

DATE_____

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

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

APPLICANT'S NAME: MARKWEST LIBERTY

ADDRESS: 218 SWISHER LANE, WEST UNION, WV 26456

TELEPHONE NUMBER: 724-574-4319

BUILDER'S NAME: ANDERSON EXCAVATING, LLC
ADDRESS: 343 WILLIAMS ROAD, MORGANTOWN, WV 26501
TELEPHONE NUMBER: 304-983-2296

ENGINEER'S NAME: CIVIL & ENVIRONMENTAL CONSULTANTS, INC. - ANDREW GILLIONE
ADDRESS: 333 BALDWIN ROAD, PITTSBURGH, PA 15205
TELEHONE NUMBER: 412-429-2324

PROJECT LOCATION:

NAME OF SURFACE OWNER/OWNERS (IF NOT THE APPLICANT) DENNIS H. POWELL
ADDRESS OF SURFACE OWNER/OWNERS (IF NOT THE APPLICANT)
216 SWISHER LANE, WEST UNION, WV 26456
DISTRICT: GRANT
DATE/FROM WHOM PROPERTY
PURCHASED: 8/8/1986 FROM ILA POWELL
LAND BOOK DESCRIPTION:
DEED BOOK REFERENCE: OBV 200 PAGE 532
TAX MAP REFERENCE: SHEET 19 LOT 32
EXISTING BUILDINGS/USES OF PROPERTY: SHED/FARMLAND
NAME OF AT LEAST ONE ADULT RESIDING IN EACH RESIDENCE LOCATED UPON THE SUBJECT PROPERTY DENNY H. POWELL
ADDRESS OF AT LEAST ONE ADULT RESIDING IN EACH RESIDENCE LOCATED UPON THE SUBJECT PROPERTY 216 SWISHER LANE, WEST UNION, WV 26456

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

DESCRIPTION OF WORK (CHECK ALL APPLICABLE BOXES)

A. STRUCTURAL DEVELOPMENT

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

B. OTHER DEVEOPLMENT ACTIVITIES:

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

C. STANDARD SITE PLAN OR SKETCH

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

ACTUAL TOTAL CONSTRUCTION COSTS OF THE COMPLETE DEVELOPMENT IRRESPECTIVE OF WHETHER ALL OR ANY PART OF THE SUBJECT PROPOSED CONSTRUCTION PROJECT IS WITHIN THE FLOODPLAIN $ 3,000,000

D. ADJACENT AND/OR AFFECTED LANDOWNERS:

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

NAME:_____ NAME:_____
ADDRESS:_____ ADDRESS:_____
_____ _____

NAME:_____ NAME:_____
ADDRESS:_____ ADDRESS:_____
_____ _____

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

NAME:_____ NAME:_____
ADDRESS:_____ ADDRESS:_____
_____ _____

NAME:_____ NAME:_____
ADDRESS:_____ ADDRESS:_____
_____ _____

N/A PROPOSED IMPACTS ARE WITHIN SUBJECT PROPERTY

E. CONFIRMATION FORM

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

(A) PERSONAL SERVICE OF PROCESS BY THE DODDRIDGE COUNTY SHERIFF AT THE RATES PERMITTED BY LAW FOR SUCH SERVICE.
(B) SERVICE BY CERTIFIED MAIL RETURN RECEIPT REQUESTED.
(C) PUBLICATION.

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

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

NAME (PRINT):_____

SIGNATURE:_____ **DATE:**_____

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

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

THE PROPOSED DEVELOPMENT:

THE PROPOSED DEVELOPMENT IS LOCATED ON:

FIRM Panel:_____

Dated:_____

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

[] Is located in Special Flood Hazard Area.

FIRM zone designation_____

100-Year flood elevation is:_____NGVD (MSL)

[] Unavailable

[] The proposed development is located in a floodway.

FBFM Panel No._____ Dated_____

[] See section 4 for additional instructions.

SIGNED_____ DATE_____

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

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

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

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

_____

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

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

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

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

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

[] Other:

_____

_____

_____

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

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

SIGNED_____DATE_____

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

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

CONDITIONS:_____

_____

_____

_____

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

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

COMPLETE 1 OR 2 BELOW:

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

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

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

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

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

INSPECTIONS:

DATE:_____ **BY:**_____

DEFICIENCIES ? **Y/N**

COMMENTS_____

_____

_____

_____

_____

_____

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

Certificate of Compliance issued: DATE:_____ BY:_____

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

PERMIT NUMBER:_____

PERMIT DATE:_____

PURPOSE –

CONSTRUCTION LOCATION:_____

OWNER'S ADDRESS:_____

_____

_____

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

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

SIGNED_____DATE_____

Sherwood Master Plan - Doddridge County, WV
Opinion of Probable Construction Costs - Construction in the Floodplain
Project #: 110-811.5001
November 2014

Item	Units	Quantity	Unit Cost	Total Cost
Earth Work	CY	20000	$ 3.00	$ 60,000.00
Erosion Control Blanket	SY	1080	$ 2.00	$ 2,160.00
Silt Fence	LF	850	$ 3.00	$ 2,550.00
Concrete Sidewalk	SY	130	$ 112.00	$ 14,560.00
Concrete Curb	LF	1100	$ 90.00	$ 99,000.00
Bituminous Asphalt Paving	SY	8850	$ 35.00	$ 309,750.00
Admin. Building and Warehouse	Lump Sum	-	-	$ 2,511,980.00
Total	-	-	-	$ 3,000,000.00

PERMIT NO. 13-055

DODDRIDGE COUNTY

FLOODPLAIN DEVELOPMENT

PERMIT

PURPOSE FOR PERMIT: FILL & GRADING

ISSUED TO MARKWEST LIBERTY

ADDRESS: 218 SWISHER LANE
WEST UNION, WV 26456

PROJECT ADDRESS: SAME
SHERWOOD FACILITY

ISSUED BY: Dan Williams

DATE: 08/28/2013

THE PERMIT EXPIRES 180 DAYS FROM THIS DATE

THIS PERMIT MUST BE POSTED ON THE PREMISES IN A CONSPICUOUS PLACE SO AS TO BE CLEARLY VISIBLE FROM THE STREET.

Permit # 13-055

Hydraulic Study of
Buckeye Creek

DODDRIDGE COUNTY
FLOODPLAIN DEVELOPMENT PERMIT APPLICATION

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

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

APPLICANT'S SIGNATURE _____
(AGENT)

DATE 07-08-13

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

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

APPLICANT'S NAME: MarkWest Liberty - Kevin Sturgill
ADDRESS: 218 Swisher Lane, West Union, WV 26456
TELEPHONE NUMBER: ~~724-514-4319~~

BUILDER'S NAME: ANDERSON EXCAVATING, LLC
ADDRESS: 343 WILLIAMS ROAD, MORGANTOWN, WV 26501
TELEPHONE NUMBER: 304-983-2296

ENGINEER'S NAME: CIVIL & ENVIRONMENTAL CONSULTANTS - ANDREW GULLONE
ADDRESS: 333 BALDWIN ROAD, PITTSBURGH, PA 15205
TELEHONE NUMBER: 412-249-2114

PROJECT LOCATION:

NAME OF SURFACE OWNER/OWNERS (IF NOT THE APPLICANT): DENNIS H. POWELL

ADDRESS OF SURFACE OWNER/OWNERS (IF NOT THE APPLICANT)
216 SWISHER LANE, WEST UNION, WV 26456
DISTRICT: GRANT DISTRICT
DATE/FROM WHOM PROPERTY
PURCHASED: 8/8/1986 FROM ILA. POWELL
LAND BOOK DESCRIPTION:
DEED BOOK REFERENCE: DBV 200 PAGE 532
TAX MAP REFERENCE: SHEET 19 LOT 32
EXISTING BUILDINGS/USES OF PROPERTY: SHED / FARM LAND
NAME OF AT LEAST ONE ADULT RESIDING IN EACH RESIDENCE LOCATED UPON THE SUBJECT PROPERTY DENNY H. POWELL
ADDRESS OF AT LEAST ONE ADULT RESIDING IN EACH RESIDENCE LOCATED UPON THE SUBJECT PROPERTY 216 SWISHER LANE, WEST UNION, WV 26456

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

DESCRIPTION OF WORK (CHECK ALL APPLICABLE BOXES)

A. STRUCTURAL DEVELOPMENT

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

PERMIT NUMBER:_____
PERMIT DATE:_____

PURPOSE –

CONSTRUCTION LOCATION:_____

OWNER'S ADDRESS:_____
_____
_____

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

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

SIGNED_____DATE_____

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

B. OTHER DEVEOPLMENT ACTIVITIES:

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

C. STANDARD SITE PLAN OR SKETCH

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

ACTUAL TOTAL CONSTRUCTION COSTS OF THE COMPLETE DEVELOPMENT IRRESPECTIVE OF WHETHER ALL OR ANY PART OF THE SUBJECT PROPOSED CONSTRUCTION PROJECT IS WITHIN THE FLOODPLAIN $ 0.00 .... NO CONSTRUCTION FILL PLACEMENT ONLY

D. ADJACENT AND/OR AFFECTED LANDOWNERS:

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

NAME:_____ NAME:_____
ADDRESS:_____ ADDRESS:_____
_____ _____

NAME:_____ NAME:_____
ADDRESS:_____ ADDRESS:_____
_____ _____

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

NAME:_____ NAME:_____
ADDRESS:_____ ADDRESS:_____
_____ _____

NAME:_____ NAME:_____
ADDRESS:_____ ADDRESS:_____
_____ _____

N/A PROPOSED IMPACTS ARE WITHIN THE SUBJECT PROPERTY.

E. CONFIRMATION FORM

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

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

(B) SERVICE BY CERTIFIED MAIL RETURN RECEIPT REQUESTED.

(C) PUBLICATION.

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

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

NAME (PRINT):_____

SIGNATURE:_____ DATE:_____

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

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

THE PROPOSED DEVELOPMENT:

THE PROPOSED DEVELOPMENT IS LOCATED ON:

FIRM Panel: ~~80~~ 145

Dated: 10/04/2011

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

[X] Is located in Special Flood Hazard Area.

FIRM zone designation A & AE

100-Year flood elevation is: +0.31' to 811.7 NGVD ~~(MSL)~~

[] Unavailable

[] The proposed development is located in a floodway.

FBFM Panel No._____ Dated_____

[] See section 4 for additional instructions.

SIGNED Dan Williams DATE 08/28/2013

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

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

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

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

_____

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

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

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

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

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

Sherwood 4+5

X Other: Must submit an itemized cost breakdown of total construction costs located within the designated floodplain. Estimate of $90,000 is not sufficient! 6T/25/13

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

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

SIGNED _____ DATE 08/28/2013

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

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

CONDITIONS: _____

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

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

PERMIT NO. #13-103

DODDRIDGE COUNTY

FLOODPLAIN DEVELOPMENT

PERMIT

PURPOSE FOR PERMIT: MARK WEST SHERWOOD PLANT 4+5

ISSUED TO MARK WEST

ADDRESS: 218 SWISHER LANE WEST UNION WV 26456

PROJECT ADDRESS: 218 SWISHER LANE WEST UNION WV 26456

ISSUED BY: Ralph Saunders

DATE: 3-4-14

CONSTRUCTION MUST START WITHIN 180 DAYS FROM ISSUED DATE. PERMIT EXPIRES IN 12 MONTHS FROM ISSUED DATE. IF EXTENTION IS NEEDED A REQUEST MUST BE MADE IN WRITING STATING A REASON FOR THE EXTENTION.

THIS PERMIT MUST BE POSTED ON THE PREMISES IN A CONSPICUOUS PLACE SO AS TO BE CLEARLY VISIBLE FROM THE STREET.

BUILDER'S NAME: ANDERSON EXCAVATING, LLC
ADDRESS: 343 WILLIAMS ROAD, MORGANTOWN, WV 26501
TELEPHONE NUMBER: 304-983-2296

ENGINEER'S NAME: CIVIL & ENVIRONMENTAL CONSULTANTS, INC - ANDREW GUILIONE
ADDRESS: 333 BALDWIN ROAD, PITTSBURGH, PA 15205
TELEHONE NUMBER: 412-429-2324

PROJECT LOCATION:

NAME OF SURFACE OWNER/OWNERS (IF NOT THE APPLICANT) DENNIS H. POWELL
ADDRESS OF SURFACE OWNER/OWNERS (IF NOT THE APPLICANT)
216 SWISHER LANE, WEST UNION, WV 26456
DISTRICT: GRANT DISTRICT
DATE/FROM WHOM PROPERTY
PURCHASED: 8/8/1986 FROM: ILA POWELL
LAND BOOK DESCRIPTION:
DEED BOOK REFERENCE: DBV 200 PAGE 532
TAX MAP REFERENCE: SHEET 19 LOT 32
EXISTING BUILDINGS/USES OF PROPERTY: SHED / FARM LAND
NAME OF AT LEAST ONE ADULT RESIDING IN EACH RESIDENCE LOCATED UPON THE SUBJECT PROPERTY DENNY H. POWELL
ADDRESS OF AT LEAST ONE ADULT RESIDING IN EACH RESIDENCE LOCATED UPON THE SUBJECT PROPERTY 216 SWISHER LANE, WEST UNION, WV 26456

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

DESCRIPTION OF WORK (CHECK ALL APPLICABLE BOXES)

A. STRUCTURAL DEVELOPMENT

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

B. OTHER DEVEOPLMENT ACTIVITIES:

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

C. STANDARD SITE PLAN OR SKETCH

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

ACTUAL TOTAL CONSTRUCTION COSTS OF THE COMPLETE DEVELOPMENT IRRESPECTIVE OF WHETHER ALL OR ANY PART OF THE SUBJECT PROPOSED CONSTRUCTION PROJECT IS WITHIN THE FLOODPLAIN $ 203,000

D. ADJACENT AND/OR AFFECTED LANDOWNERS:

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

NAME:_____ NAME:_____
ADDRESS:_____ ADDRESS:_____
_____ _____

NAME:_____ NAME:_____
ADDRESS:_____ ADDRESS:_____
_____ _____

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

NAME:_____ NAME:_____
ADDRESS:_____ ADDRESS:_____
_____ _____

NAME:_____ NAME:_____
ADDRESS:_____ ADDRESS:_____
_____ _____

N/A PROPOSED IMPACTS ARE WITHIN THE SUBJECT PROPERTY

E. CONFIRMATION FORM

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

(A) PERSONAL SERVICE OF PROCESS BY THE DODDRIDGE COUNTY SHERIFF AT THE RATES PERMITTED BY LAW FOR SUCH SERVICE.
(B) SERVICE BY CERTIFIED MAIL RETURN RECEIPT REQUESTED.
(C) PUBLICATION.

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

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

NAME (PRINT): RICHARD R. CREMOR
(AGENT)

SIGNATURE: _____ DATE: 12-6-13

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

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

THE PROPOSED DEVELOPMENT:

THE PROPOSED DEVELOPMENT IS LOCATED ON:

FIRM Panel: _____

Dated: _____

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

[] Is located in Special Flood Hazard Area.

FIRM zone designation _____

100-Year flood elevation is: _____ NGVD (MSL)

[] Unavailable

[] The proposed development is located in a floodway.

FBFM Panel No. _____ Dated _____

[] See section 4 for additional instructions.

SIGNED_____ DATE_____

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

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

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

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

_____

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

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

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

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

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

#13-103
MarkWest - Sherwood Processing Plant 4-5

FILED
2013 DEC 10 PM 1:53
DODDRIDGE COUNTY, WV
B. A. ROGERS
COUNTY CLERK

DODDRIDGE COUNTY
FLOODPLAIN DEVELOPMENT PERMIT APPLICATION

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

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

APPLICANT'S SIGNATURE (AGENT) _____

DATE 12-6-13

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

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

APPLICANT'S NAME: MarkWest Liberty - Kevin Sturgill

ADDRESS: 218 Swisher Lane, West Union, WV 26456

TELEPHONE NUMBER: 724-514-4319

FLOODPLAIN DEVELOPMENT

PERMIT

PURPOSE FOR PERMIT: Final Plan

ISSUED TO MarkWest

ADDRESS: 218 Slusher Lane; West Union, WV 26456

PROJECT ADDRESS: Sherwood Facility

ISSUED BY: [signature]

DATE: 4/24/14

CONSTRUCTION MUST START WITHIN 180 DAYS FROM ISSUED DATE. PERMIT EXPIRES IN 12 MONTHS FROM ISSUED DATE. IF EXTENTION IS NEEDED A REQUEST MUST BE MADE IN WRITING STATING A REASON FOR THE EXTENTION.

THIS PERMIT MUST BE POSTED ON THE PREMISES IN A CONSPICUOUS PLACE SO AS TO BE CLEARLY VISIBLE FROM THE STREET.

DODDRIDGE COUNTY
FLOODPLAIN DEVELOPMENT PERMIT APPLICATION

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

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

APPLICANT'S SIGNATURE _____

DATE 01/25/14

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

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

APPLICANT'S NAME: Mark West Liberty -

ADDRESS: 218 Swisher Lane, West Union, WV 26456

TELEPHONE NUMBER: 724-514-4319

BUILDER'S NAME: ANDERSON EXCAVATING, LLC
ADDRESS: 343 WILLIAMS ROAD, MORGANTOWN, WV 26501
TELEPHONE NUMBER: 304-983-2296

ENGINEER'S NAME: CIVIL & ENVIRONMENTAL CONSULTANTS, INC. - ANDREW GULLONE
ADDRESS: 333 BALDWIN ROAD, PITTSBURGH, PA 15205
TELEHONE NUMBER: 412-429-2324

PROJECT LOCATION:

NAME OF SURFACE OWNER/OWNERS (IF NOT THE APPLICANT) DENNIS H. POWELL

ADDRESS OF SURFACE OWNER/OWNERS (IF NOT THE APPLICANT)
216 SWISHER LANE, WEST UNION, WV 26456
DISTRICT: GRANT DISTRICT
DATE/FROM WHOM PROPERTY
PURCHASED: 8/8/1986 FROM ILA POWELL
LAND BOOK DESCRIPTION:
DEED BOOK REFERENCE: DBV 200 PAGE 532
TAX MAP REFERENCE: SHEET 19 LOT 32
EXISTING BUILDINGS/USES OF PROPERTY: SHED / FARM LAND
NAME OF AT LEAST ONE ADULT RESIDING IN EACH RESIDENCE LOCATED UPON THE SUBJECT PROPERTY DENNY H. POWELL
ADDRESS OF AT LEAST ONE ADULT RESIDING IN EACH RESIDENCE LOCATED UPON THE SUBJECT PROPERTY 216 SWISHER LANE, WEST UNION, WV 26456

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

DESCRIPTION OF WORK (CHECK ALL APPLICABLE BOXES)

A. STRUCTURAL DEVELOPMENT

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

B. OTHER DEVEOPLMENT ACTIVITIES:

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

C. STANDARD SITE PLAN OR SKETCH

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

ACTUAL TOTAL CONSTRUCTION COSTS OF THE COMPLETE DEVELOPMENT IRRESPECTIVE OF WHETHER ALL OR ANY PART OF THE SUBJECT PROPOSED CONSTRUCTION PROJECT IS WITHIN THE FLOODPLAIN $ 2,290,200.00

D. ADJACENT AND/OR AFFECTED LANDOWNERS:

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

NAME:_____ NAME:_____
ADDRESS:_____ ADDRESS:_____
_____ _____

NAME:_____ NAME:_____
ADDRESS:_____ ADDRESS:_____
_____ _____

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

NAME:_____ NAME:_____
ADDRESS:_____ ADDRESS:_____
_____ _____

NAME:_____ NAME:_____
ADDRESS:_____ ADDRESS:_____
_____ _____

N/A PROPOSED IMPACTS ARE WITHIN SUBJECT PROPERTY

E. CONFIRMATION FORM

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

(A) PERSONAL SERVICE OF PROCESS BY THE DODDRIDGE COUNTY SHERIFF AT THE RATES PERMITTED BY LAW FOR SUCH SERVICE.
(B) SERVICE BY CERTIFIED MAIL RETURN RECEIPT REQUESTED.
(C) PUBLICATION.

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

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

NAME (PRINT): Rick Lowry

SIGNATURE: _____ DATE: 04/29/14

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

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

THE PROPOSED DEVELOPMENT:

THE PROPOSED DEVELOPMENT IS LOCATED ON:

FIRM Panel: _____

Dated: _____

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

[] Is located in Special Flood Hazard Area.

FIRM zone designation _____

100-Year flood elevation is: _____ NGVD (MSL)

[] Unavailable

[] The proposed development is located in a floodway.

FBFM Panel No. _____ Dated _____

[] See section 4 for additional instructions.

SIGNED_____ DATE_____

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

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

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

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

_____

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

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

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

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

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

[] Other:

_____

_____

_____

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

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

SIGNED_____DATE_____

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

APPEALS: Appealed to the County Commission of Doddridge County? [] Yes [] No

Hearing Date:_____

County Commission Decision - Approved [] Yes [] No

CONDITIONS:_____

_____

_____

_____

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

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

COMPLETE 1 OR 2 BELOW:

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

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

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

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

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

INSPECTIONS:

DATE:_____ **BY:**_____

DEFICIENCIES ? Y/N

COMMENTS_____

_____

_____

_____

_____

_____

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

Certificate of Compliance issued: DATE:_____ BY:_____

Civil & Environmental Consultants, Inc.
333 Baldwin Road | Pittsburgh, PA 15205

TIM
Johnston

OXF 157 SITE PLAN
EQT PRODUCTION COMPANY

(PROPOSED WELLS NO. WV 513144, WV 513145, WV 513146, WV 513147, WV 513148, WV 513149, WV 514089 & WV 514090)

SITUATE ON THE WATERS OF BLUESTONE CREEK IN WEST UNION DISTRICT, DODDRIDGE COUNTY, WEST VIRGINIA.

PROJECT INFORMATION

PROJECT NAME: OXF 157 H1-H8

TAX PARCEL:
WEST UNION DISTRICT
MAP 6-1

SURFACE OWNER:
JUSTIN L. HENDERSON
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV
TOTAL PROPERTY AREA: 1,602.9 ± ACRES

OIL AND GAS ROYALTY OWNER:
LEEMAN MAXWELL HRS
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV
TOTAL PROPERTY AREA: 2,164 ± ACRES

SITE LOCATION:
THE OXF 157 SITE IS WEST OF MAXWELL RIDGE ALONG BLUESTONE CREEK OFF COUNTY ROUTE 13. THE ENTRANCE TO THE SITE IS APPROXIMATELY 3/4 MILE SOUTHWEST OF THE CO. RT. 13 AND CO. RT. 13/3 INTERSECTION.

LOCATION COORDINATES

OXF 157 SITE ENTRANCE
LATITUDE: 39.227701 LONGITUDE: -80.758964 (NAD 83)

OXF 157 H1-H8 WELL PAD ENTRANCE
LATITUDE: 39.234468 LONGITUDE: -80.764983 (NAD 83)

OXF 157 H1-H8 WELL PAD
LATITUDE: 39.236047 LONGITUDE: -80.766261 (NAD 83)

OXF 157 ASSOCIATED PIT
LATITUDE: 39.238452 LONGITUDE: -80.764291 (NAD 83)

SITE DISTURBANCE COMPUTATIONS

ROAD A PHASE I= 11.7 ± ACRES (ROAD A PHASE I & STOCKPILES A-D)
WELL PAD AREA = 9.7 ± ACRES (PAD, PORTION OF ROAD B & STOCKPILES E-F)
ASSOCITATED PIT AREA = 3.2 ± ACRES (PIT, ROAD D & STOCKPILE G)
ACCESS ROAD = 12.7 ± ACRES (ROADS B, C & STOCKPILE H)
TOTAL SITE DISTURBANCE = 37.3 ± ACRES

ENTRANCE PERMIT

EQT PRODUCTION COMPANY WILL OBTAIN AN ENCROACHMENT PERMIT (FORM MM-109) FROM THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS, PRIOR TO COMMENCEMENT OF CONSTRUCTION ACTIVITIES.

MISS UTILITY STATEMENT

MISS UTILITY OF WEST VIRGINIA WAS NOTIFIED FOR THE LOCATING OF UTILITIES PRIOR TO THIS PROJECT DESIGN; TICKET #1328176253. IN ADDITION, MISS UTILITY WILL BE CONTACTED PRIOR TO START OF THE PROJECT.

FLOODPLAIN NOTE

THE PROPOSED LIMITS OF DISTURBANCE FOR THIS PROJECT IS LOCATED IN FEMA FLOOD ZONE X and A, PER THE FLOOD INSURANCE RATE MAP (FIRM) NUMBER 54017C0225C, DATED OCTOBER 4, 2011.

ENVIRONMENTAL NOTES

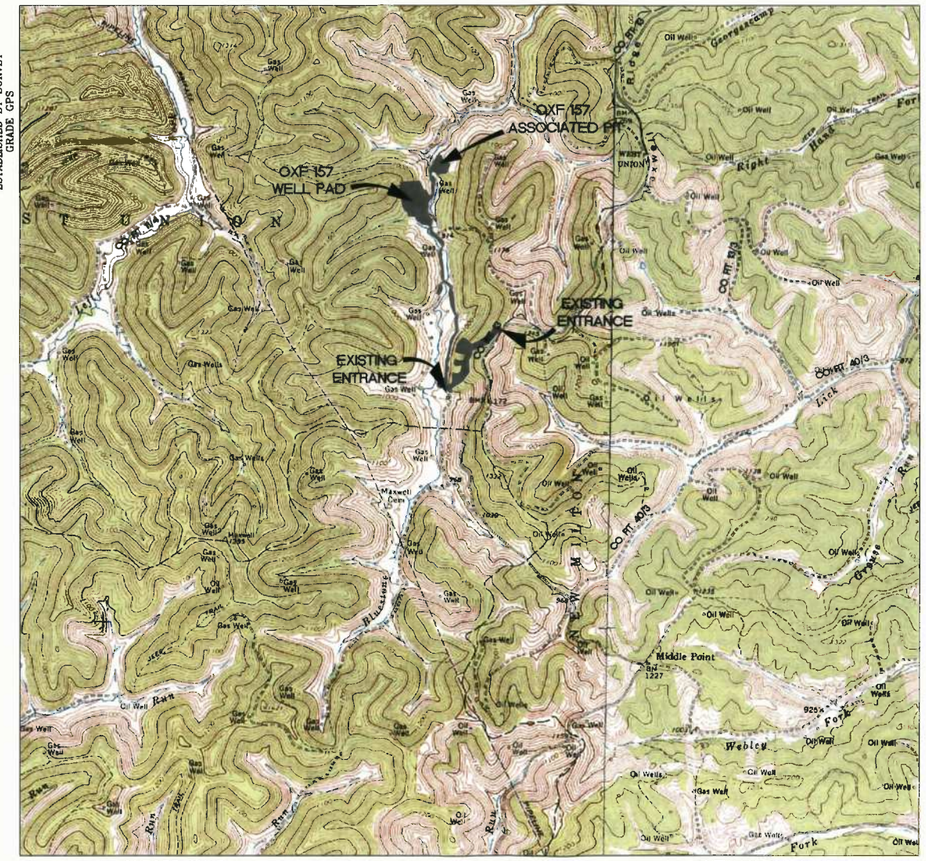
A WETLAND DELINEATION WAS PERFORMED ON APRIL 25-26, 2013 BY POTESTA AND ASSOCIATES, INC. TO REVIEW THE SITE FOR WATERS AND WETLANDS THAT ARE MOST LIKELY WITHIN THE REGULATORY PURVIEW OF THE U.S. ARMY CORPS OF ENGINEERS (USACE) AND/OR THE WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION (WVDEP). THE MAY 29, 2013 REPORT PROJECT # 0101-11-147-15701 WAS PREPARED BY POTESTA AND ASSOCIATES, INC. SUMMARIZES THE RESULTS OF THE FIELD DELINEATION. THE REPORT DOES NOT, IN ANY WAY, REPRESENT A JURISDICTIONAL DETERMINATION OF THE LANDWARD LIMITS OF WATERS AND WETLANDS WHICH MAY BE REGULATED BY THE USACE OR THE WVDEP. IT IS STRONGLY RECOMMENDED THAT THE AFOREMENTIONED AGENCIES BE CONSULTED IN AN EFFORT TO GAIN WRITTEN CONFIRMATION OF THE DELINEATION DESCRIBED BY THIS REPORT PRIOR TO ENGAGING CONSTRUCTION ON THE PROPERTY DESCRIBED HEREIN. THE DEVELOPER SHALL OBTAIN THE APPROPRIATE PERMITS FROM THE FEDERAL AND/OR STATE REGULATORY AGENCIES PRIOR TO ANY PROPOSED IMPACTS TO WATERS OF THE U.S., INCLUDING WETLAND FILLS AND STREAM CROSSINGS.

GENERAL DESCRIPTION

THE WELL PAD & ASSOCIATED PIT IS BEING CONSTRUCTED TO AID IN THE DEVELOPMENT OF INDIVIDUAL MARCELLUS SHALE GAS WELLS.

MISS Utility of West Virginia
1-800-245-4848
West Virginia State Law
(Section XIV: Chapter 24-C)
Requires that you call two business days before you dig in the state of West Virginia.
IT'S THE LAW!!

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



2000 0 2000
SCALE: 1" = 2000'

LIST OF DRAWINGS

LEGEND

EX. INDEX CONTOUR 700	PROP. INDEX CONTOUR 700
EX. INTERMEDIATE CONTOUR	PROP. INTERMEDIATE CONTOUR
EX. BOUNDARY LINE	PROP. GRADING LIMITS
EX. ROAD EDGE OF GRAVEL/DIRT	PROP. LIMITS OF DISTURBANCE
EX. ROAD EDGE OF PAVEMENT	PROP. WELL PAD
EX. ROAD CENTERLINE	PROP. WELL HEAD
EX. DITCHLINE	PROP. 4" PVC DRAIN PIPE
EX. CULVERT	PROP. SUMP DRAIN
EX. GUARDRAIL	PROP. CONTAINMENT BERM
EX. FENCELINE	PROP. PIT/IMPOUNDMENT CL
EX. GATE	PROP. PERIMETER SAFETY FENCE
EX. OVERHEAD UTILITY	PROP. ACCESS GATE WITH EMERGENCY LIFELINE
EX. OVERHEAD UTILITY R/W	
EX. POWER POLE	
EX. GUY WIRE	
EX. GASLINE G	PROP. ROCK CONSTRUCTION ENTRANCE
EX. GASLINE R/W	
EX. WATERLINE	PROP. ROAD EDGE OF GRAVEL
EX. WATER WELL	PROP. ROAD CENTERLINE
EX. GAS WELL	PROP. V-DITCH W/ CHECK DAMS
EX. TREELINE	PROP. DITCH RELIEF CULVERT (DRC)
EX. REFERENCE TREE	PROP. RIP-RAP OUTLET PROTECTION
EX. DELINEATED STREAM	PROP. GUARDRAIL
EX. DELINEATED WETLAND	PROP. ROCK LEVEL SPREADER
EX. BUILDING	PROP. EARTHEN DIVERSION BERM
EX. BRIDGE	PROP. ORANGE SAFETY FENCE
100' WETLAND/STREAM BUFFER	PROP. SUPER SILT FENCE - SSF - SSF -
	PROP. COMPOST FILTER SOCK x
	PROP. COMPOST SOCK DIVERSION x
	PROP. GROUNDWATER DEWATERING TRENCH
	PROP. GROUNDWATER DEWATERING PIPE
	SECTION LINE "A" 0+00 "A" 0+50
	MATCHLINE
	X-SECTION GRID INDEX
	X-SECTION GRID INTERMEDIATE
	X-SECTION PROPOSED GRADE
	X-SECTION EXISTING GRADE
	X-SECTION WATER SURFACE
	SPOT ELEVATION 1000.0
	CENTER OF PAD +

OPERATOR

EQT PRODUCTION COMPANY
OPERATOR ID: 306686
115 PROFESSIONAL PLACE
P.O. BOX 280
BRIDGEPORT, WV 26330
PHONE: (304) 348-3870

ENGINEER

NAVITUS ENGINEERING, INC.
151 WINDY HILL LANE
WINCHESTER, VA 22602
PHONE: (888) 662-4185

SURVEYOR

SMITH LAND SURVEYING, INC.
226 WEST MAIN STREET
P.O. BOX 150
GLENVILLE, WV 26351
PHONE: (304) 462-5634

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

Professional Energy Consultants
A DIVISION OF SMITH LAND SURVEYING
SURVEYORS PROJECT READY.
ENGINEERS ENVIRONMENTAL
SLS
3585 Elkins Bottom Road Beckley, WV 25801 (FAX) 571-0811
226 West Main St. P.O. Box 150 Glenville, WV 26351 (304) 462-5634
HONESTY. INTEGRITY. QUALITY.

CRUIS S. KIMES REGISTERED 19578 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER
9/24/2013

THIS DOCUMENT WAS PREPARED BY:
NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

COVER SHEET
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: 1" = 2000'
DESIGNED BY: CSK
FILE NO. 7889
SHEET 1 OF 31

CONSTRUCTION NOTES:

1. METHODS AND MATERIALS USED IN THE CONSTRUCTION OF THE IMPROVEMENTS HEREIN SHALL CONFORM TO THE CURRENT COUNTY CONSTRUCTION STANDARDS AND SPECIFICATIONS AND/OR CURRENT WVDEP EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE MANUAL STANDARDS AND SPECIFICATIONS.

2. MEASURES TO CONTROL EROSION AND SILTATION, INCLUDING DETENTION PONDS SERVING AS SILT BASINS DURING CONSTRUCTION, MUST BE PROVIDED PRIOR TO ISSUANCE OF THE SITE DEVELOPMENT PERMIT. THE APPROVAL OF THESE PLANS IN NO WAY RELIEVES THE DEVELOPER OR HIS AGENT OF THE RESPONSIBILITIES CONTAINED IN THE WVDEP EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE MANUAL.

3. AN APPROVED SET OF PLANS AND ALL APPLICABLE PERMITS MUST BE AVAILABLE AT THE CONSTRUCTION SITE. ALSO, A REPRESENTATIVE OF THE DEVELOPER MUST BE AVAILABLE AT ALL TIMES.

4. THE CONTRACTOR SHALL PROVIDE ADEQUATE MEANS OF CLEANING MUD FROM TRUCKS AND/OR OTHER EQUIPMENT PRIOR TO ENTERING PUBLIC STREETS, AND IT IS THE CONTRACTOR'S RESPONSIBILITY TO CLEAN STREETS, ALLAY DUST, AND TO TAKE WHATEVER MEASURES ARE NECESSARY TO INSURE THAT THE STREETS ARE MAINTAINED IN A CLEAN, MUD AND DUST FREE CONDITION AT ALL TIMES.

5. NOTIFICATION SHALL BE GIVEN TO THE APPROPRIATE UTILITY COMPANY PRIOR TO CONSTRUCTION OF WATER AND/OR GAS PIPE LINES. INFORMATION SHOULD ALSO BE OBTAINED FROM THE APPROPRIATE AUTHORITY CONCERNING PERMITS, CUT SHEETS, AND CONNECTIONS TO EXISTING LINES.

6. THE LOCATION OF EXISTING UTILITIES SHOWN IN THESE PLANS ARE FROM FIELD LOCATIONS. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO VERIFY THE EXACT HORIZONTAL AND VERTICAL LOCATION OF ALL EXISTING UTILITIES AS NEEDED PRIOR TO CONSTRUCTION. THE CONTRACTOR SHALL INFORM THE ENGINEER OF ANY CONFLICTS ARISING FROM HIS EXISTING UTILITY VERIFICATION AND THE PROPOSED CONSTRUCTION.

7. THE DEVELOPER WILL BE RESPONSIBLE FOR ANY DAMAGE TO THE EXISTING STREETS AND UTILITIES WHICH OCCURS AS A RESULT OF HIS CONSTRUCTION PROJECT WITHIN OR CONTIGUOUS TO THE EXISTING RIGHT-OF-WAY.

8. WHEN GRADING IS PROPOSED WITHIN EASEMENTS OF UTILITIES, LETTERS OF PERMISSION FROM ALL INVOLVED COMPANIES MUST BE OBTAINED PRIOR TO GRADING AND/OR SITE DEVELOPMENT.

9. THE DEVELOPER WILL BE RESPONSIBLE FOR THE RELOCATION OF ANY UTILITIES WHICH IS REQUIRED AS A RESULT OF HIS PROJECT. THE RELOCATION SHOULD BE DONE PRIOR TO CONSTRUCTION.

10. THESE PLANS IDENTIFY THE LOCATION OF ALL KNOWN GRAVESITES. GRAVESITES SHOWN ON THIS PLAN WILL BE PROTECTED IN ACCORDANCE WITH STATE LAW. IN THE EVENT GRAVESITES ARE DISCOVERED DURING CONSTRUCTION, THE OWNER AND ENGINEER MUST BE NOTIFIED IMMEDIATELY.

11. THE CONTRACTOR IS TO VERIFY FIELD CONDITIONS PRIOR TO AND DURING CONSTRUCTION AND NOTIFY NAVITUS ENGINEERING AT (888) 662-4185 OR SMITH LAND SURVEYING AT (304) 462-5634 IMMEDIATELY OF ANY DISCREPANCIES BETWEEN ACTUAL FIELD CONDITIONS AND THE APPROVED PLAN.

12. CONTRACTORS SHALL NOTIFY OPERATORS WHO MAINTAIN UNDERGROUND UTILITY LINES IN THE AREA OF PROPOSED EXCAVATING OR BLASTING AT LEAST TWO (2) WORKING DAYS, BUT NOT MORE THAN TEN (10) WORKING DAYS, PRIOR TO COMMENCEMENT OF EXCAVATION OR DEMOLITION.

13. CONTRACTOR TO CONTACT OPERATOR AND ENGINEER IF GROUNDWATER IS ENCOUNTERED DURING CONSTRUCTION.

14. ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE MAINTAINED BY THE CONTRACTOR DAILY AND CHECKED AFTER EVERY RAINFALL. ALL DRAIN INLETS SHALL BE FREE OF SILTATION AND DEBRIS. INEFFECTIVE MEASURES SHALL BE REPLACED, AS NECESSARY.

15. THE CONTRACTOR SHALL SCHEDULE A PRE-CONSTRUCTION MEETING WITH THE EROSION AND SEDIMENT CONTROL INSPECTOR, 2 DAYS PRIOR TO THE START OF CONSTRUCTION.

FLOODPLAIN NOTES

1. NO FILL SHALL BE PERMITTED IN THE FLOODWAY.

2. ALL FILL PLACED IN FLOODPLAIN AREAS SHALL MEET OR EXCEED THE FOLLOWING STANDARDS:

   2.1. FILL SHALL BE USED ONLY TO THE EXTENT TO WHICH IT DOES NOT ADVERSELY AFFECT THE CAPACITY OF CHANNELS OR FLOODWAYS OF ANY TRIBUTARY TO THE MAIN STREAM, DRAINAGE DITCH, OR ANY OTHER DRAINAGE FACILITY OR SYSTEM.
   2.2. FILLED SITE MUST BE CONTOURED TO DRAIN PROPERLY (AVOID PONDING).
   2.3. FILL SHALL EXTEND BEYOND A STRUCTURE FOR A SUFFICIENT DISTANCE TO PROVIDE ACCEPTABLE ACCESS. FOR NONRESIDENTIAL STRUCTURES, FILL SHALL BE PLACE TO PROVIDE ACCESS ACCEPTABLE FOR INTENDED USE.
   2.4. AT GRADE ACCESS, WITH FILL EXTENDING LATERALLY FIFTEEN (15) FEET BEYOND THE BUILDING LINE SHALL BE PROVIDED TO A MINIMUM OF TWENTY-FIVE (25) PERCENT OF THE PERIMETER OF A NONRESIDENTIAL STRUCTURE.
   2.5. FILL SHALL CONSIST OF SOIL OR ROCK MATERIAL ONLY. NO TRASH OR WOODY DEBRIS SHALL BE BURIED ON SITE.
   2.6. FILL MATERIAL SHALL BE COMPACTED TO PROVIDE THE NECESSARY STABILITY AND RESISTANCE TO EROSION, SCOURING, OR SETTLING. FILL COMPACTION STANDARDS MUST BE APPROPRIATE TO PROPOSED POST FILL USE, PARTICULAR ATTENTION IS NECESSARY WHEN FILL IS BEING USED TO ELEVATE A STRUCTURE.
   2.7. FILL SLOPES SHALL BE NO STEEPER THAN (1) VERTICAL ON TWO (2) HORIZONTAL, UNLESS SUBSTANTIATING DATA JUSTIFYING STEEPER SLOPES ARE SUBMITTED TO AND APPROVED BY THE FLOODPLAIN ADMINISTRATOR.
   2.8. FILL SITE AND FILL MUST BE PROTECTED FROM EROSION. EROSION CONTROL BLANKETS OR OTHER ARMORING MATERIALS SHALL BE USED ALONG ALL EMBANKMENTS LOCATED BELOW THE 100-YR FLOODPLAIN.

3. ALL STORAGE TANKS LOCATED AT OR BELOW THE BASE FLOOD ELEVATION SHALL BE FIRMLY ANCHORED TO RESIST FLOTATION.

4. NO MATERIALS THAT ARE BUOYANT, FLAMMABLE, EXPLOSIVE, OR IN TIMES OF FLOODING COULD BE INJURIOUS TO HUMAN, ANIMAL, OR PLANT LIFE, SHALL BE STORED BELOW BASE FLOOD ELEVATION.

5. ALL EXISTING CULVERTS WITHIN LIMITS OF DISTURBANCE SHALL BE REMOVED UNLESS OTHERWISE NOTED.

CONSTRUCTION SEQUENCE

THE BMP'S SHALL BE IMPLEMENTED, MAINTAINED, AND OPERATED IN THE FOLLOWING GENERAL SEQUENCE OF CONSTRUCTION TO MITIGATE THE HAZARD OF ACCELERATED EROSION AND SEDIMENTATION TO ACCEPTABLE LEVELS. MINOR DEVIATIONS FROM THIS SEQUENCE SHALL BE EXECUTED BY THE PROJECT'S FOREMAN AS NEEDED TO ELIMINATE ANY POTENTIAL EROSIVE CONDITION THAT MAY ARISE FOR THE DURATION OF THE PROJECT. THE WVDEP OFFICE OF OIL AND GAS SHALL BE NOTIFIED OF ANY AND ALL SUCH DEVIATIONS FROM THE APPROVED PLANS.

1) STAKE THE LIMITS OF CONSTRUCTION.

2) INSTALL THE ROCK CONSTRUCTION ENTRANCE AS SHOWN ON THE PLANS.

3) INSTALL ALL ORANGE SAFETY FENCE AS SHOWN AROUND ANY DELINEATED STREAMS AND WETLANDS TO CLEARLY IDENTIFY THOSE AREAS THAT ARE NOT TO BE DISTURBED.

4) INSTALL ALL BMP'S (SUPER SILT FENCE, REINFORCED SILT FENCE, SEDIMENT TRAPS, ETC) AS SHOWN ON THE PLANS AND DETAILS.

5) CLEAR AND GRUB THE ACCESS ROAD AND PAD AND PIT AREA. ALL WOODY MATERIAL, BRUSH, TREES, STUMPS, LARGE ROOTS, BOULDERS, AND DEBRIS SHALL BE CLEARED FROM THE SITE AREA AND KEPT TO THE MINIMUM NECESSARY FOR PROPER CONSTRUCTION, INCLUDING THE INSTALLATION OF NECESSARY SEDIMENT CONTROLS. TREES SIX INCHES IN DIAMETER AND LARGER SHALL BE CUT AND LOGS STACKED. SMALLER TREES, BRUSH, & STUMPS SHALL BE CUT AND OR GRUBBED AND WINDROWED IN APPROPRIATE AREAS FOR USE AS SEDIMENT BARRIERS AT WATER DRAINAGE OUTLETS, WINDROWED BELOW THE WELL SITE, USED FOR WILDLIFE HABITAT, BURNED (AS PER WV FOREST FIRE LAWS), REMOVED FROM SITE, OR DISPOSED OF BY OTHER METHODS APPROVED BY DEP.

6) INSTALL ANY WETLAND OR STREAM CROSSINGS AS SHOWN ON THE PLANS.

7) CONVEY UPSLOPE DRAINAGE AROUND THE ACCESS ROAD AND PAD AND PIT AREA BY CONSTRUCTING ALL DIVERSION BERM(S) AS SHOWN ON THE PLANS.

8) CONSTRUCT THE ACCESS ROAD. DITCH RELIEF CULVERTS SHALL BE INSTALLED AT A GRADE OF 1-8% TO MINIMIZE OUTLET VELOCITIES TO THE EXTENT POSSIBLE. INSTALL OUTLET PROTECTION AS SHOWN ON PLANS. STABILIZE THE ROAD WITH STONE AND SIDE SLOPES AS SPECIFIED WITH PERMANENT SEEDING. STOCKPILE AND STABILIZE TOPSOIL ALONG THE ACCESS ROAD, AS NEEDED.

9) STRIP THE TOPSOIL FROM THE PAD AND PIT AREA. TOPSOIL SHALL BE STOCKPILED AND IMMEDIATELY STABILIZED.

10) GRADE THE PAD AND PIT AREA AS SHOWN ON THE PLAN. IMMEDIATELY STABILIZE THE OUTER AREAS OF THE PIT, AS WELL AS THE WELL PAD AND ANY TURNAROUND AREAS WITH STONE AND THE SIDE SLOPES WITH EROSION CONTROL BLANKETING WHEN SLOPES ARE 3:1 OR GREATER. APPLY SEED AND MULCH ALL DISTURBED AREAS. THIS SHALL INCLUDE ALL AREAS THAT WILL NOT BE SUBJECT TO REGULAR TRAFFIC ACTIVITY (TO BE STABILIZED WITH STONE), OR ANY DISTURBED AREA THAT WILL NOT BE RE-DISTURBED BEFORE SITE RECLAMATION BEGINS.

11) INSTALL THE PIT LINER SYSTEM AND PERIMETER SAFETY FENCE W/GATE AND EMERGENCY LIFE LINE AS SHOWN ON THE PLANS.

12) PREVIOUSLY DISTURBED AREAS AND IMMEDIATE DOWN SLOPE AREAS SHALL BE INSPECTED AFTER EACH RAINFALL STORM EVENT AND MONITORED WEEKLY FOR SIGNS OF ACCELERATED EROSION. IMPLEMENT ADDITIONAL BMP'S AS DEEMED NECESSARY. THESE INSPECTIONS SHALL CONTINUE DURING THE DURATION OF THE PROJECT AND SUBSEQUENT SITE RECLAMATION.

13) ONCE THE PIT HAS BEEN COMPLETED, SUBMIT THE AS-BUILT CERTIFICATION FOR EACH PIT/IMPOUNDMENT FACILITY TO THE WVDEP OFFICE OF OIL AND GAS, PRIOR TO PLACING FLUIDS IN EITHER STRUCTURE.

14) COMMENCE THE DRILLING ACTIVITY.

15) ONCE DISTURBED AREAS HAVE BEEN RE-VEGETATED AND STABILIZED FOLLOWING RECLAMATION, THE TEMPORARY BMP'S IN THOSE AREAS MAY BE REMOVED. CONTINUE TO MONITOR THESE AREAS TO ENSURE A UNIFORM RATE OF 70% VEGETATIVE COVERAGE IS MAINTAINED. ANY AREAS FOUND TO BE DEFICIENT SHALL BE RE-SEEDED AND MULCHED.

SITE CLEANUP & RECYCLE PROGRAM

1. GARBAGE, FUELS OR ANY SUBSTANCE HARMFUL TO HUMAN, AQUATIC OR FISH LIFE, WILL BE PREVENTED FROM ENTERING SPRINGS, STREAMS, PONDS, LAKES, WETLANDS OR ANY WATER COURSE OR WATER BODY.

2. OILS, FUELS, LUBRICANTS AND COOLANTS WILL BE PLACED IN SUITABLE CONTAINERS AND DISPOSED PROPERLY.

3. ALL TRASH AND GARBAGE WILL BE COLLECTED AND DISPOSED PROPERLY.

4. ALL SEDIMENT REMOVED FROM SEDIMENT CAPTURING DEVICES SHALL BE PLACED ON THE TOPSOIL STOCKPILE, THEN SEEDED AND MULCHED, AS NECESSARY. ALTERNATIVELY, THE REMOVED SEDIMENT CAN BE TRANSPORTED TO A SITE WITH AN APPROVED PERMIT.

MAINTENANCE PROGRAM

1. BMP'S WILL BE INSPECTED ON A WEEKLY BASIS AND AFTER EACH MEASURABLE RAINFALL EVENT DURING THE ACTIVE CONSTRUCTION PHASE OF THE PROJECT.

2. ALL REVEGETATED ACCESS ROADS AND FACILITIES ARE TO BE MAINTAINED THROUGHOUT THE LIFE OF EACH STRUCTURE.

3. CULVERTS, ROAD DITCHES, BROAD-BASED DIPS, DIVERSION DITCHES, AND ROCK CHECK DAMS MUST BE MAINTAINED IN PROPER WORKING ORDER AND WILL BE CLEANED OUT, REPAIRED, OR REPLACED AS NECESSARY.

4. FILTER STRIPS AND/OR SILT FENCE WILL BE MAINTAINED.

5. ALL AREAS OF EARTH DISTURBANCE WILL BE REPAIRED WHERE SIGNS OF ACCELERATED EROSION ARE DETECTED.

6. SEEDING AND MULCHING WILL BE REPEATED IN THOSE AREAS THAT APPEAR TO BE FAILING OR HAVE FAILED.

ASSOCIATED PIT CONSTRUCTION STANDARD NOTES

THE DESIGN, CONSTRUCTION, AND REMOVAL OF EMBANKMENTS ASSOCIATED WITH ASSOCIATED PITS FOR OIL AND GAS WELLS MUST BE ACCOMPLISHED IN SUCH A MANNER AS TO PROTECT THE HEALTH AND SAFETY OF THE PEOPLE, THE NATURAL RESOURCES, AND ENVIRONMENT OF THE STATE. THE PIT EMBANKMENTS SHALL BE DESIGNED, CONSTRUCTED, AND MAINTAINED TO BE STRUCTURALLY SOUND AND REASONABLY PROTECTED FROM UNAUTHORIZED ACTS OF THIRD PARTIES.

1. THE FOUNDATION FOR A ASSOCIATED PIT EMBANKMENT MUST BE STRIPPED AND GRUBBED TO A MINIMUM DEPTH OF 2 FEET PRIOR TO PLACEMENT AND COMPACTION OF EARTHEN FILL MATERIAL. NO EMBANKMENT FILL SHALL BE PLACED ON FROZEN MATERIAL.

2. ANY SPRINGS ENCOUNTERED WITHIN THE FOUNDATION AREA SHALL BE DRAINED TO THE OUTSIDE/DOWNSTREAM TOE OF EMBANKMENT. CONSTRUCTED DRAIN SECTION SHALL BE AN EXCAVATED 2' x 2' TRENCH AND BACK FILLED WITH TYPE A SAND, COMPACTED BY HAND TAMPER. NO GEOTEXTILES SHALL BE USED TO LINE TRENCH. THE LAST 3' OF DRAIN AT THE DOWNSTREAM END SHALL BE CONSTRUCTED WITH AASHTO #8 MATERIAL.

3. SOILS FOR EARTHEN EMBANKMENT CONSTRUCTION SHALL BE LIMITED TO TYPES GC, GM, SC, SM, CL, OR ML (ASTMD-2487 - UNIFIED SOILS CLASSIFICATION). SOILS MUST CONTAIN A MINIMUM OF 20% OF PLUS NO. 200 SIEVE AND BE "WELL GRADED" MATERIAL WITH NO COBBLES OR BOULDER SIZE MATERIAL MIXED WITH THE CLAY. A MINIMUM OF THREE SAMPLES SHALL BE CLASSIFIED.

4. THE EARTHEN EMBANKMENT SHALL BE COMPACTED BY A VIBRATING SHEEPSFOOT ROLLER. THE LIFTS MUST BE IN HORIZONTAL LAYERS WITH A MAXIMUM LOOSE LIFT THICKNESS 12" AND MAXIMUM PARTICLE SIZE LESS THAN 6".

5. THE PLACEMENT OF ALL FILL MATERIAL SHALL BE FREE OF WOOD, STUMPS AND ROOTS, LARGE ROCKS AND BOULDERS, AND ANY OTHER NONCOMPACTABLE SOIL MATERIAL. THE EMBANKMENT SHALL BE COMPACTED TO A MINIMUM OF VISIBLE NON-MOVEMENT, HOWEVER, THE COMPACTION EFFORT SHALL NOT EXCEED THE OPTIMUM MOISTURE LIMITS.

6. THE EMBANKMENT TOP SHALL BE A MINIMUM OF 12' IN WIDTH.

7. THE MINIMUM INSIDE AND OUTSIDE SIDESLOPES SHALL BE 2H:1V, UNLESS OTHERWISE SPECIFIED.

8. ALL EXPOSED EMBANKMENT SLOPES, NOT COVERED BY COMPACTED ROCKFILL OR RIPRAP SHALL BE LIMED, FERTILIZED, SEEDED AND MULCHED. PERMANENT VEGETATIVE GROUND COVER IN COMPLIANCE WITH THE WVDEP EROSION AND SEDIMENT CONTROL FIELD MANUAL MUST BE ESTABLISHED UPON THE COMPLETION OF THE IMPOUNDMENT/PIT CONSTRUCTION. EMBANKMENTS SHALL BE MAINTAINED WITH A GRASSY VEGETATIVE COVER AND FREE OF BRUSH AND/OR TREES.

9. A MINIMUM OF 2' OF FREEBOARD SHALL BE MAINTAINED AT ALL TIMES DURING THE OPERATION OF THE IMPOUNDMENT.

10. ALL EMBANKMENT CONSTRUCTION AND COMPACTION TESTING SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.

ASSOCIATED PIT LINER SYSTEM NOTES:

THE DESIGNED PIT FACILITY SHALL BE FULLY LINED WITH A GEOSYNTHETIC LINER SYSTEM. LINERS SHALL BE INSTALLED IN ACCORDANCE TO MANUFACTURER'S SPECIFICATIONS.

1. THE SUB-BASE SHALL BEAR THE WEIGHT OF THE LINER SYSTEM, WATER, AND EQUIPMENT OPERATING ON THE PIT WITHOUT CAUSING OR ALLOWING A FAILURE OF THE LINER SYSTEM.

2. THE SUB-BASE SHALL BE COMPACTED TO ACCOMMODATE POTENTIAL SETTLEMENT WITHOUT DAMAGE TO THE LINER SYSTEM.

3. THE UPPER 6" OF THE SUB-BASE SHALL BE COMPACTED TO A STANDARD PROCTOR DENSITY OF AT LEAST 95%.

4. THE SUB-BASE SHALL BE HARD, UNIFORM, SMOOTH AND FREE OF DEBRIS, ROCK FRAGMENTS, PLANT MATERIAL AND OTHER FOREIGN MATERIAL.

5. THE SUB-BASE SHALL BE COVERED WITH NON-WOVEN GEOTEXTILE FABRIC TO CUSHION THE PRIMARY LINER AND ALLOW FOR ADEQUATE VENTING BETWEEN THE PRIMARY LINER AND THE SUB-BASE TO PREVENT THE ENTRAPMENT OF GASES BENEATH THE LINER SYSTEM.

6. THE PIT AREA SHALL BE DRAINED AND COMPLETELY DRY PRIOR TO THE PLACEMENT OF THE PRIMARY LINER. THE PRIMARY LINER SHALL MEET ALL WV DEP GUIDELINES FOR MINIMUM THICKNESS AND SHALL PREVENT THE MIGRATION OF WATER THROUGH THE LINER TO THE GREATEST DEGREE THAT IS TECHNOLOGICALLY POSSIBLE.

7. THE PRIMARY LINER SHALL FULLY COVER THE BOTTOM AND SIDEWALLS OF THE PIT.

8. AN ANCHOR TRENCH SHALL BE EXCAVATED COMPLETELY AROUND THE PERIMETER OF THE PIT AREA AT THE PLANNED ELEVATION OF THE TOP OF THE LINING. THE TRENCH SHALL BE A MINIMUM 36 INCHES DEEP AND 24 INCHES WIDE.

9. ALL ELEMENTS OF THE LINER SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS. ALL SEAMS AND SEALS AROUND ANY PROJECTIONS SHALL BE SEALED AND TESTED IN A METHOD APPROVED BY THE MANUFACTURER.

10. GAS RELIEF VENTS SHALL BE PROVIDED ALONG THE TOP OF THE LINER AND WITHIN ONE FOOT OF THE PERIMETER OF THE IMPOUNDMENT TO ALLOW GASES TO ESCAPE FROM UNDER THE GEOMEMBRANE. MAXIMUM SPACING FOR VENTS SHALL BE 30 FEET.

11. WATER LEVEL MARKINGS SHALL BE CLEARLY PAINTED (1' INCREMENTS) ON THE LINER SYSTEM TO IDENTIFY THE WATER SURFACE ELEVATION.

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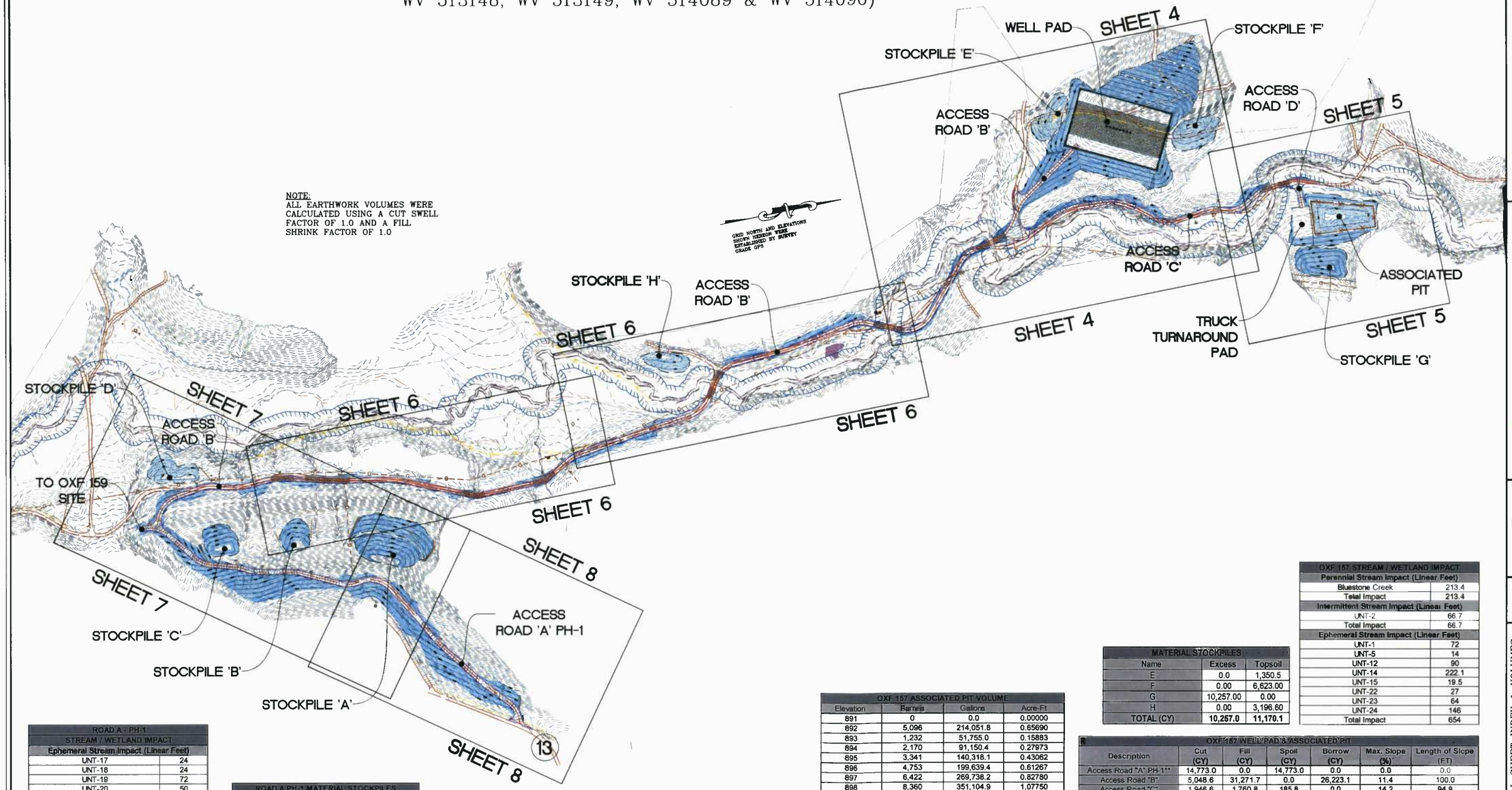
THIS DOCUMENT WAS PREPARED BY:
NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

NOTES
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7889
SHEET 2 OF 31

OVERALL SHEET INDEX & VOLUMES

(PROPOSED WELLS NO. WV 513144, WV 513145, WV 513146, WV 513147, WV 513148, WV 513149, WV 514089 & WV 514090)



NOTE:
ALL EARTHWORK VOLUMES WERE CALCULATED USING A CUT SWELL FACTOR OF 1.0 AND A FILL SHRINK FACTOR OF 1.0

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

ROAD A - PH-1 STREAM / WETLAND IMPACT	
Ephemeral Stream Impact (Linear Feet)	
UNT-17	24
UNT-18	24
UNT-19	72
UNT-20	50
UNT-21	18
Total Impact	188
Ephemeral Pool Impact (Square Feet)	
POOL - 1	95
POOL - 2	389
Total Area	484

ROAD A PH-1 MATERIAL STOCKPILES		
Name	**Excess**	**Topsoil**
A	21,038.60	0.00
B	4,030.10	0.00
C	4,152.00	0.00
D	0.00	3,673.10
TOTAL (CY)	**29,220.7**	**3,673.1**

OXF 159 ACCESS ROAD "A" PHASE 1						
Description	**Cut (CY)**	**Fill (CY)**	**Spoil (CY)**	**Borrow (CY)**	**Max. Slope (%)**	**Length of Slope (FT)**
Access Road "A" Ph-1	31,492.1	3,205.3	28,286.8	0.0	0.0	0.0
Stripped Topsoil (6")	3,500.7	0.0	3,500.7	0.0	n/a	n/a
Material Stockpiles	0.0	32,893.8	0.0	32,893.8	n/a	n/a
Totals	34,992.8	36,099.1	31,787.5	32,893.8	n/a	n/a
	TOTAL SPOIL (CY) =		**-1,106.3**			

OXF 157 ASSOCIATED PIT VOLUME			
Elevation	**Barrels**	**Gallons**	**Acre-Ft**
891	0	0.0	0.00000
892	5,096	214,051.8	0.65690
893	1,232	51,755.0	0.15883
894	2,170	91,150.4	0.27973
895	3,341	140,318.1	0.43062
896	4,753	199,639.4	0.61267
897	6,422	269,738.2	0.82780
898	8,360	351,104.9	1.07750
899	10,582	444,425.5	1.36389
900	13,097	550,079.5	1.68813
901	15,922	668,741.6	2.05229
902	19,066	800,757.0	2.45743
903	22,546	946,927.4	2.90601
904 Storage	26,371	1,107,591.7	3.39907
905	30,559	1,283,466.8	3.93881
906	35,131	1,475,497.5	4.52813

Incised Elev. = 898.0

MATERIAL STOCKPILES		
Name	**Excess**	**Topsoil**
E	0.0	1,350.5
F	0.00	6,623.00
G	10,257.00	0.00
H	0.00	3,196.60
TOTAL (CY)	**10,257.0**	**11,170.1**

OXF 157 STREAM / WETLAND IMPACT	
Perennial Stream Impact (Linear Feet)	
Bluestone Creek	213.4
Total Impact	213.4
Intermittent Stream Impact (Linear Feet)	
UNT-2	66.7
Total Impact	66.7
Ephemeral Stream Impact (Linear Feet)	
UNT-1	72
UNT-5	14
UNT-12	90
UNT-14	222.1
UNT-15	19.5
UNT-22	27
UNT-23	64
UNT-24	146
Total Impact	654

OXF 157 WELL PAD & ASSOCIATED PIT						
Description	**Cut (CY)**	**Fill (CY)**	**Spoil (CY)**	**Borrow (CY)**	**Max. Slope (%)**	**Length of Slope (FT)**
Access Road "A" PH-1**	14,773.0	0.0	14,773.0	0.0	0.0	0.0
Access Road "B"	5,048.6	31,271.7	0.0	26,223.1	11.4	100.0
Access Road "C"	1,946.6	1,760.8	185.8	0.0	14.2	94.9
Access Road "D"	10.0	381.5	0.0	371.5	0.0	0.0
Well Pad	66,659.0	55,022.3	11,636.7	0.0	n/a	n/a
Well Pad Containment Berm	0.0	373.0	0.0	373.0	n/a	n/a
Associated Pit	13,513.5	2,615.1	10,898.4	0.0	n/a	n/a
Truck Turnaround Pad	2,853.4	72.2	2,781.2	0.0	n/a	n/a
Stripped Topsoil (6")	11,075.3	0.0	11,075.3	0.0	n/a	n/a
Material Stockpiles	0.0	21,427.1	0.0	21,427.1	n/a	n/a
Totals	115,879.4	112,923.7	51,350.4	48,394.7	n/a	n/a
	TOTAL SPOIL (CY) =		**2,955.7**			

**NOTE:
MATERIAL SHALL BE BORROWED FROM THE ACCESS ROAD "A" PH-1 IN ORDER TO CONSTRUCT THE ACCESS ROAD "B" TO THE OXF 157 WELL PAD.

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PROFESSIONAL ENGINEER

THIS DOCUMENT WAS PREPARED BY:
NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

OVERALL SHEET INDEX & VOLUMES
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: 1" = 100'
DESIGNED BY: CSK
FILE NO. 7889
SHEET 3 OF 31

WELL PAD, ACCESS ROAD & STOCKPILE DETAILS

(PROPOSED WELLS NO. WV 513144, WV 513145, WV 513146, WV 513147, WV 513148, WV 513149, WV 514089 & WV 514090)

NOTE:
1. ALL PROPOSED DRAINAGE CULVERTS AND DRAIN PIPES SHALL HAVE ADEQUATE OUTLET PROTECTION (RIP-RAP) AS SHOWN ON THESE PLANS.
2. ALL FILL AREAS SHALL BE "KEYED IN" AND COMPACTED IN 12" LIFTS (9" RECOMMENDED) WITH A VIBRATING SHEEPSFOOT ROLLER TO 95% COMPACTION PER STANDARD PROCTOR.
3. TOPSOIL SHALL BE STRIPPED FROM ALL STOCKPILE AREAS PRIOR TO CONSTRUCTING STOCKPILES. AFTER STOCKPILES ARE CONSTRUCTED TOPSOIL IS TO BE REAPPLIED AT A DEPTH OF 6". SLOPES SHALL BE TRACKED BY RUNNING TRACKED MACHINERY UP AND DOWN THE SLOPE, LEAVING TREAD MARKS PARALLEL TO THE CONTOUR.
4. ALL ACCESS ROAD IMPROVEMENTS SHALL BE KEPT WITHIN THE LIMITS OF THE EXISTING ACCESS ROAD.
5. STONE SHALL BE APPLIED IN A MANNER TO MAINTAIN ALL EXISTING FARM ROAD APPROACHES THAT ORIGINATE OFF THE EXISTING ACCESS ROAD ROAD.
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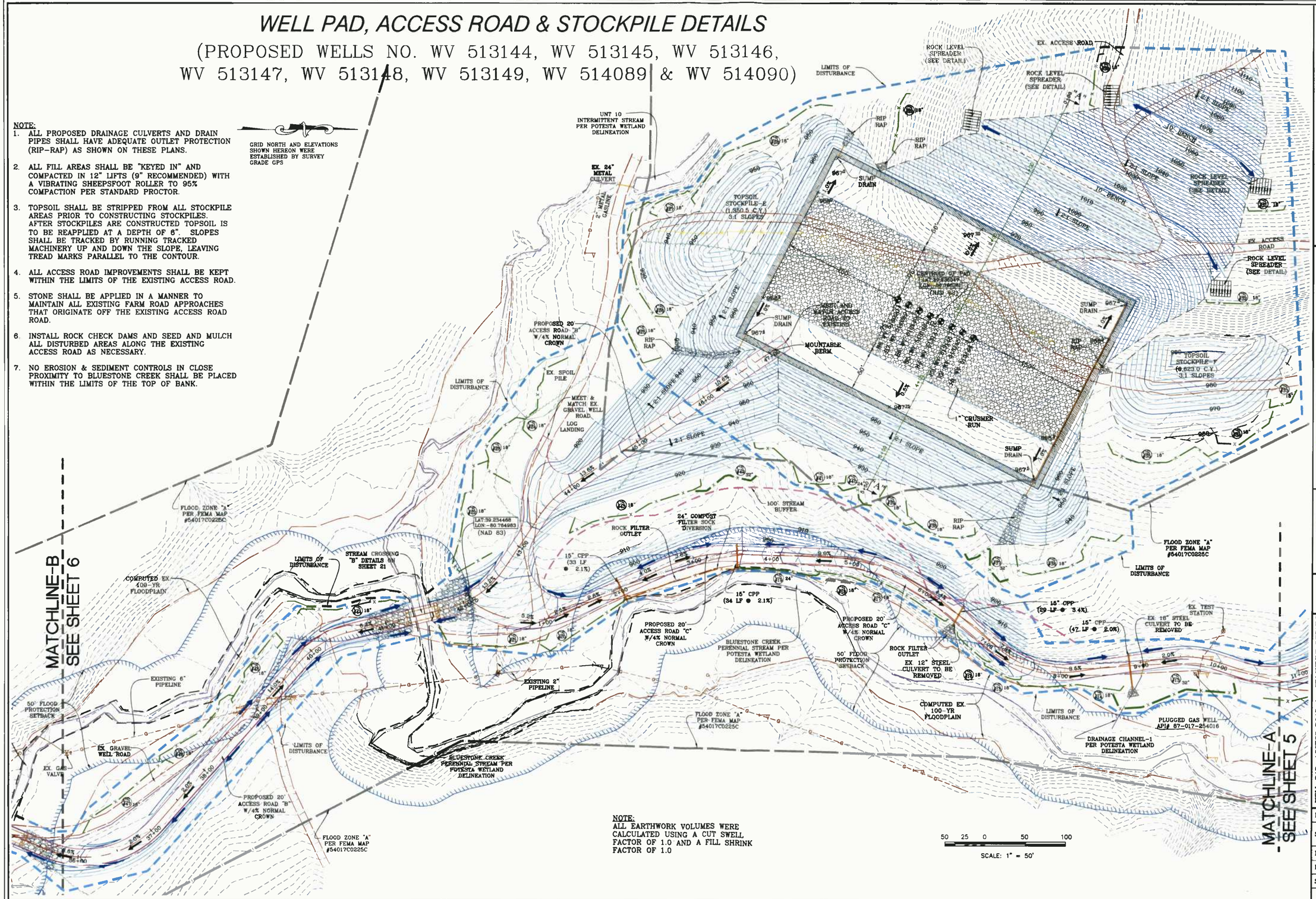
7. NO EROSION & SEDIMENT CONTROLS IN CLOSE PROXIMITY TO BLUESTONE CREEK SHALL BE PLACED WITHIN THE LIMITS OF THE TOP OF BANK.

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



NOTE:
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50 25 0 50 100
SCALE: 1" = 50'

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HORIZONTAL ACCURACY 0.1'

CYRUS S. KUHN
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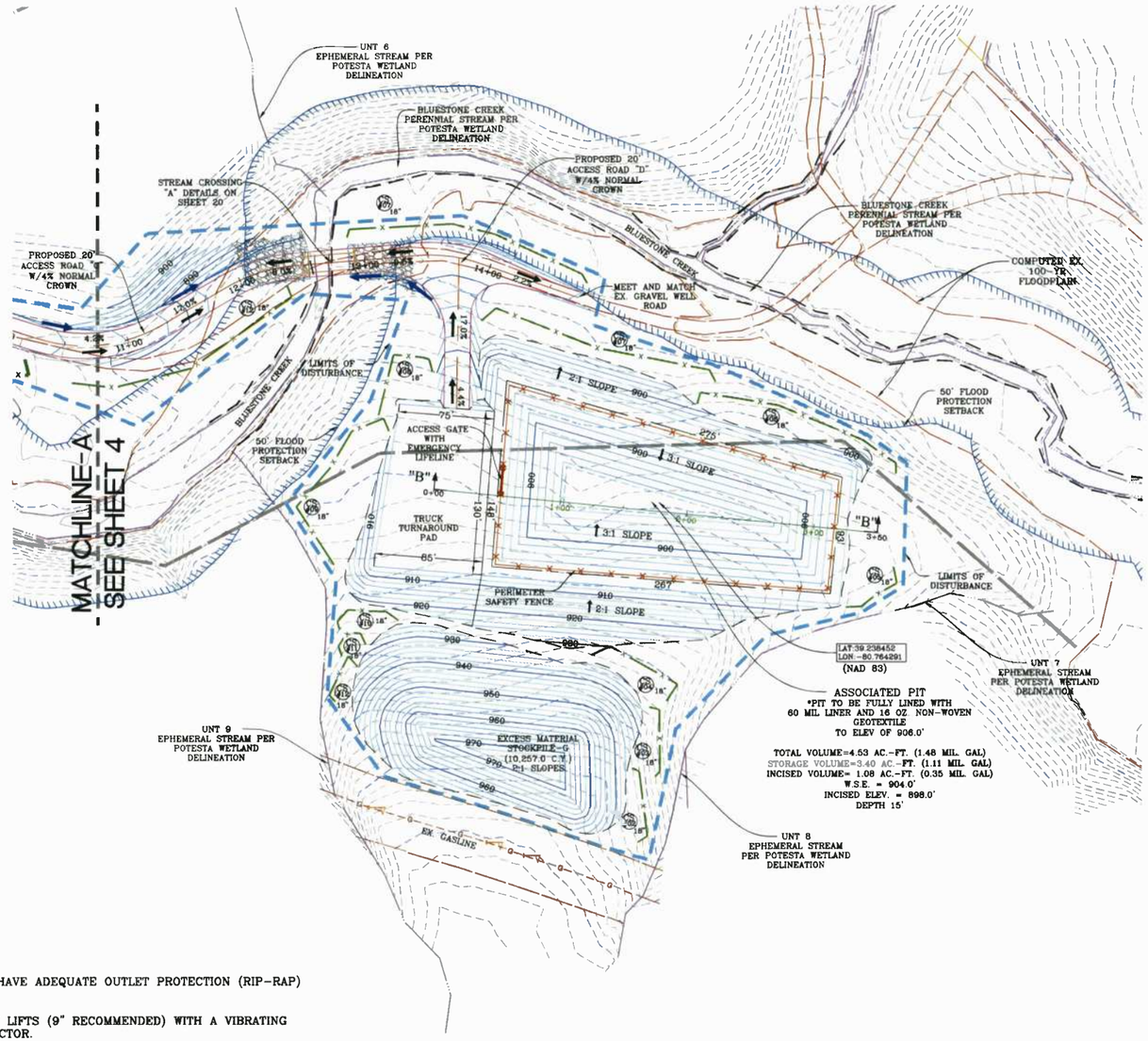
THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

WELL PAD, ACCESS ROAD & STOCKPILE DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: 1" = 50'
DESIGNED BY: CSK
FILE NO. 7889
SHEET 4 OF 31

ASSOCIATED PIT, ACCESS ROAD & STOCKPILE DETAILS

(PROPOSED WELLS NO. WV 513144, WV 513145, WV 513146, WV 513147, WV 513148, WV 513149, WV 514089 & WV 514090)



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THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

PIT, ACCESS ROAD & STOCKPILE DETAILS

OXF 157

WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: 1" = 50'
DESIGNED BY: CSK
FILE NO. 7889
SHEET 5 OF 31

ACCESS ROAD DETAILS

(PROPOSED WELLS NO. WV 513144, WV 513145, WV 513146, WV 513147, WV 513148, WV 513149, WV 514089 & WV 514090)

MATCHLINE-D SEE SHEET 7

UNT 15A EPHEMERAL STREAM PER POTESTA WETLAND DELINEATION
UNT 15 EPHEMERAL STREAM PER POTESTA WETLAND DELINEATION
UNT 25A EPHEMERAL STREAM PER POTESTA WETLAND DELINEATION
UNT 13 EPHEMERAL STREAM PER POTESTA WETLAND DELINEATION
UNT 23 EPHEMERAL STREAM PER POTESTA WETLAND DELINEATION
UNT 25 EPHEMERAL STREAM PER POTESTA WETLAND DELINEATION
UNT 26 EPHEMERAL STREAM PER POTESTA WETLAND DELINEATION
STREAM CROSSING "I" DETAILS ON SHEET 25
PROPOSED 20' ACCESS ROAD "B" W/4% NORMAL CROWN
EX 12" METAL CULVERT TO BE REMOVED
EX 8" METAL CULVERT TO BE REMOVED
2 EX 8" METAL CULVERT INVERTS (OPPOSITE ENDS BURIED)
STREAM CROSSING "H" DETAILS ON SHEET 25
STREAM CROSSING "G" DETAILS ON SHEET 24
UNT 14 EPHEMERAL STREAM PER POTESTA WETLAND DELINEATION
EX 2" GASLINE
EXCESS MATERIAL STOCKPILE-B (4,039 C.Y.) 2:1 SLOPES
EXCESS MATERIAL STOCKPILE-A (13,506 C.Y.) 2:1 SLOPES
EPHEMERAL POOL-1 PER POTESTA WETLAND DELINEATION
UNT 1 EPHEMERAL STREAM PER POTESTA WETLAND DELINEATION
LIMITS OF DISTURBANCE
50' FLOOD PROTECTION SETBACK
FLOOD ZONE "A" PER FEMA MAP #54017C0225C
COMPUTED EX 100-YR FLOODPLAIN
GRID NORTH AND ELEVATIONS SHOWN HEREON WERE ESTABLISHED BY SURVEY GRADE GPS
15" CPP (37 LF @ 3.8%)
STREAM CROSSING "F" DETAILS ON SHEET 24
15" CPP (35 LF @ 2.6%)
EX 6" METAL CULVERT TO BE REMOVED
EX 8" METAL CULVERT TO BE REMOVED
EX GAS VALVES
15" CPP (32 LF @ 2.2%)
STREAM CROSSING "E" DETAILS ON SHEET 24
EX 22" METAL CULVERT
EX 10" METAL CULVERT TO BE REMOVED
EX 2" PIPELINE TO BE RELOCATED AS NECESSARY
UNT 2 INTERMITTANT STREAM PER POTESTA WETLAND DELINEATION

MATCHLINE-C SEE BELOW

MATCHLINE-C SEE ABOVE

TOPSOIL STOCKPILE-H (3,196.8 C.Y.) 3:1 SLOPES
EX 14" METAL CULVERT
STREAM CROSSING "D" DETAILS ON SHEET 23
COMPUTED EX 100-YR FLOODPLAIN
50' FLOOD PROTECTION SETBACK
BLUESTONE CREEK PERENNIAL STREAM PER POTESTA WETLAND DELINEATION
GAS WELL
LIMITS OF DISTURBANCE
EXISTING 6" PIPELINE
EX 2" PIPELINE TO BE RELOCATED AS NECESSARY
PROPOSED 20' ACCESS ROAD "B" W/4% NORMAL CROWN
15" CPP (31 LF @ 3.2%)
UNT 5 EPHEMERAL STREAM PER POTESTA WETLAND DELINEATION
15" CPP (31 LF @ 2.3%)
EX 2" PIPELINE TO BE RELOCATED AS NECESSARY
EX 8" METAL CULVERT TO BE REMOVED
WETLAND-1 PER POTESTA WETLAND DELINEATION
FLOOD ZONE "A" PER FEMA MAP #54017C0225C
PROPOSED 20' ACCESS ROAD "B" W/4% NORMAL CROWN
BLUESTONE CREEK PERENNIAL STREAM PER POTESTA WETLAND DELINEATION
EXISTING 6" PIPELINE
EX WELL API# 47-017-02413
EX GAS VALVE
STREAM CROSSING "C" DETAILS ON SHEET 22
UNT 11 EPHEMERAL STREAM PER POTESTA WETLAND DELINEATION
GRID NORTH AND ELEVATIONS SHOWN HEREON WERE ESTABLISHED BY SURVEY GRADE GPS

MATCHLINE-B SEE SHEET 4

50 25 0 50 100
SCALE: 1" = 50'

NOTE:
ALL EARTHWORK VOLUMES WERE CALCULATED USING A CUT SWELL FACTOR OF 1.0 AND A FILL SHRINK FACTOR OF 1.0

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Bridgeport Office: 228 West Main St. P.O. Box 150 Bridgeport, WV 26330 (304) 842-5568
HORIZONTAL INTEGRITY QUALITY

CRAIG B. KUNZ
REGISTERED
9578
STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER

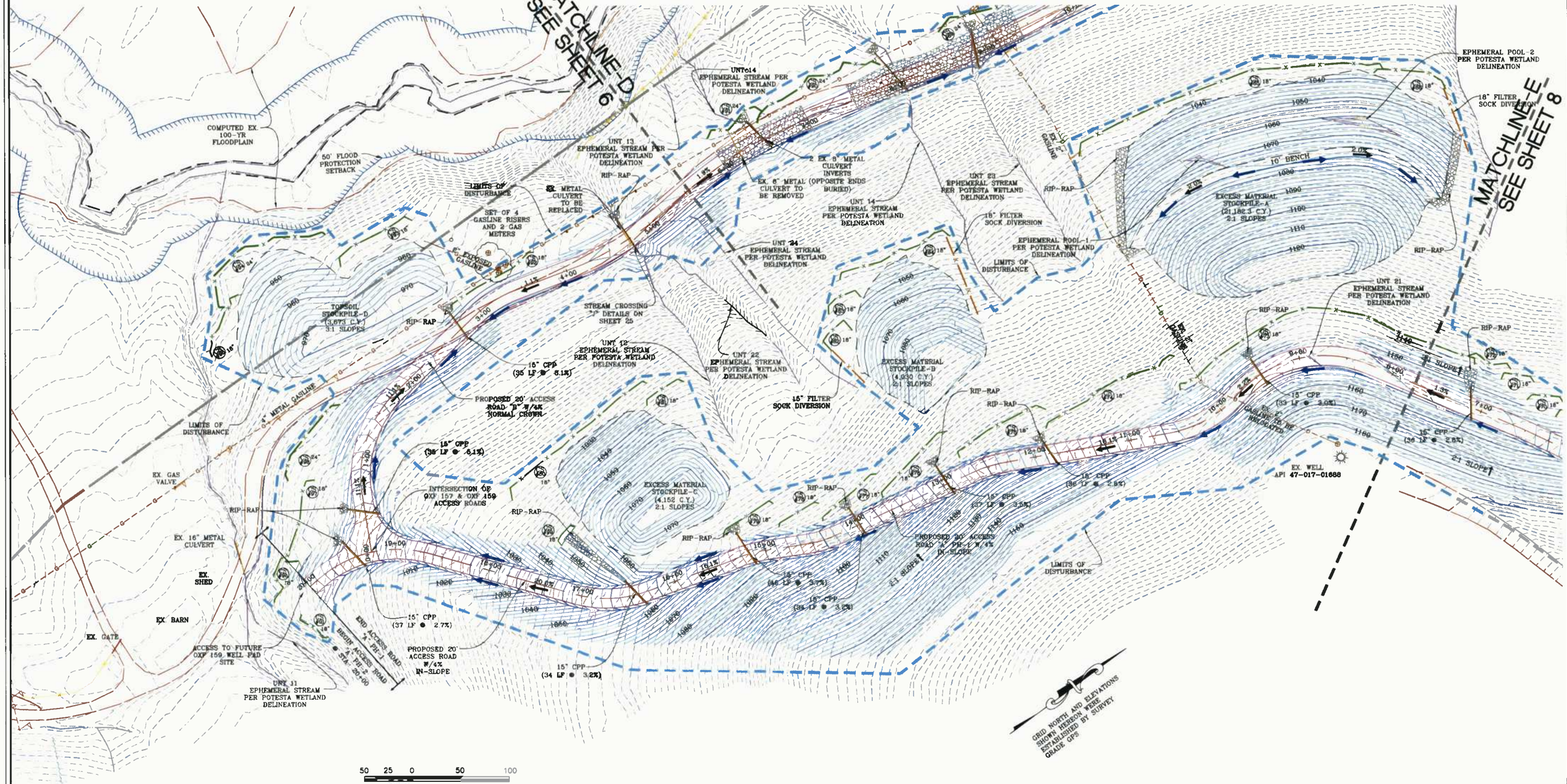
THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

ACCESS ROAD DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: 1" = 50'
DESIGNED BY: CSK
FILE NO. 7889
SHEET 6 OF 31

ACCESS ROAD AND STOCKPILE DETAILS

(PROPOSED WELLS NO. WV 513144, WV 513145, WV 513146,
WV 513147, WV 513148, WV 513149, WV 514089 & WV 514090)



50 25 0 50 100

SCALE: 1" = 50'

NOTE:
ALL EARTHWORK VOLUMES WERE CALCULATED USING A CUT SWELL FACTOR OF 1.0 AND A FILL SHRINK FACTOR OF 1.0

NOTE:

1. ALL PROPOSED DRAINAGE CULVERTS AND DRAIN PIPES SHALL HAVE ADEQUATE OUTLET PROTECTION (RIP-RAP) AS SHOWN ON THESE PLANS.
2. ALL FILL AREAS SHALL BE "KEYED IN" AND COMPACTED IN 12" LIFTS (9" RECOMMENDED) WITH A VIBRATING SHEEPSFOOT ROLLER TO 95% COMPACTION PER STANDARD PROCTOR.
3. TOPSOIL SHALL BE STRIPPED FROM ALL STOCKPILE AREAS PRIOR TO CONSTRUCTING STOCKPILES. AFTER STOCKPILES ARE CONSTRUCTED TOPSOIL IS TO BE REAPPLIED AT A DEPTH OF 6". SLOPES SHALL BE TRACKED BY RUNNING TRACKED MACHINERY UP AND DOWN THE SLOPE, LEAVING TREAD MARKS PARALLEL TO THE CONTOUR.
4. ALL ACCESS ROAD IMPROVEMENTS SHALL BE KEPT WITHIN THE LIMITS OF THE EXISTING ACCESS ROAD.
5. STONE SHALL BE APPLIED IN A MANNER TO MAINTAIN ALL EXISTING FARM ROAD APPROACHES THAT ORIGINATE OFF THE EXISTING ACCESS ROAD ROAD.
6. INSTALL ROCK CHECK DAMS AND SEED AND MULCH ALL DISTURBED AREAS ALONG THE EXISTING ACCESS ROAD AS NECESSARY.
7. NO EROSION & SEDIMENT CONTROLS IN CLOSE PROXIMITY TO BLUESTONE CREEK SHALL BE PLACED WITHIN THE LIMITS OF THE TOP OF BANK.

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LOUIS S. KLIMEK
CIVIL
0578
STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER

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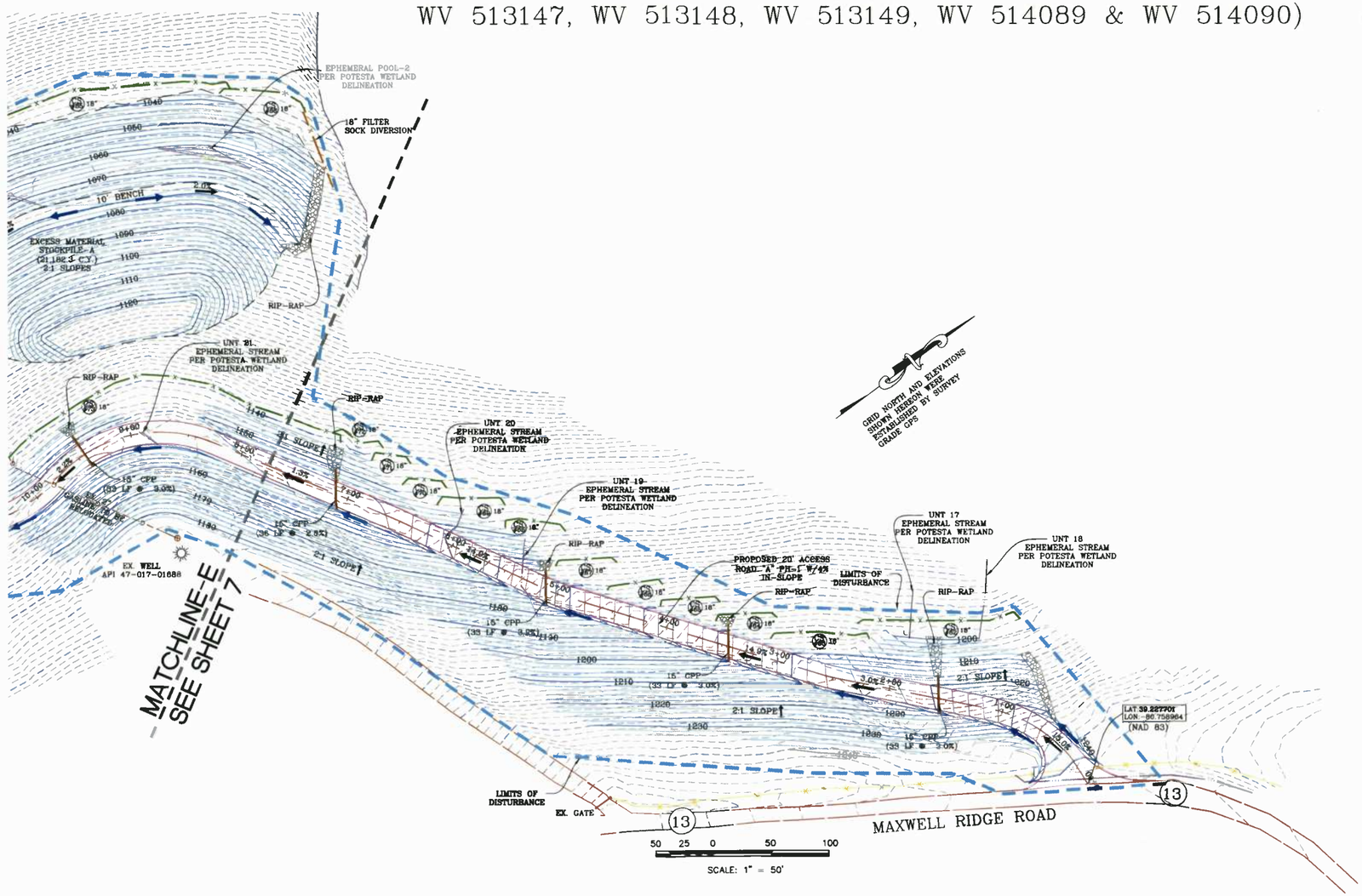
ACCESS ROAD & STOCKPILE DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: 1" = 50'
DESIGNED BY: CSK
FILE NO. 7889
SHEET 7 OF 31

ACCESS ROAD DETAILS

(PROPOSED WELLS NO. WV 513144, WV 513145, WV 513146, WV 513147, WV 513148, WV 513149, WV 514089 & WV 514090)



NOTE:

1. ALL PROPOSED DRAINAGE CULVERTS AND DRAIN PIPES SHALL HAVE ADEQUATE OUTLET PROTECTION (RIP-RAP) AS SHOWN ON THESE PLANS.
2. ALL FILL AREAS SHALL BE "KEYED IN" AND COMPACTED IN 12" LIFTS (9" RECOMMENDED) WITH A VIBRATING SHEEPSFOOT ROLLER TO 95% COMPACTION PER STANDARD PROCTOR.
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4. ALL ACCESS ROAD IMPROVEMENTS SHALL BE KEPT WITHIN THE LIMITS OF THE EXISTING ACCESS ROAD.
5. STONE SHALL BE APPLIED IN A MANNER TO MAINTAIN ALL EXISTING FARM ROAD APPROACHES THAT ORIGINATE OFF THE EXISTING ACCESS ROAD ROAD.
6. INSTALL ROCK CHECK DAMS AND SEED AND MULCH ALL DISTURBED AREAS ALONG THE EXISTING ACCESS ROAD AS NECESSARY.
7. NO EROSION & SEDIMENT CONTROLS IN CLOSE PROXIMITY TO BLUESTONE CREEK SHALL BE PLACED WITHIN THE LIMITS OF THE TOP OF BANK.

NOTE:
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5944 Dietz Station Road Weston, WV 26452 (740) 671-2011
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CHRIS S. KIDD REGISTERED PROFESSIONAL ENGINEER STATE OF WEST VIRGINIA

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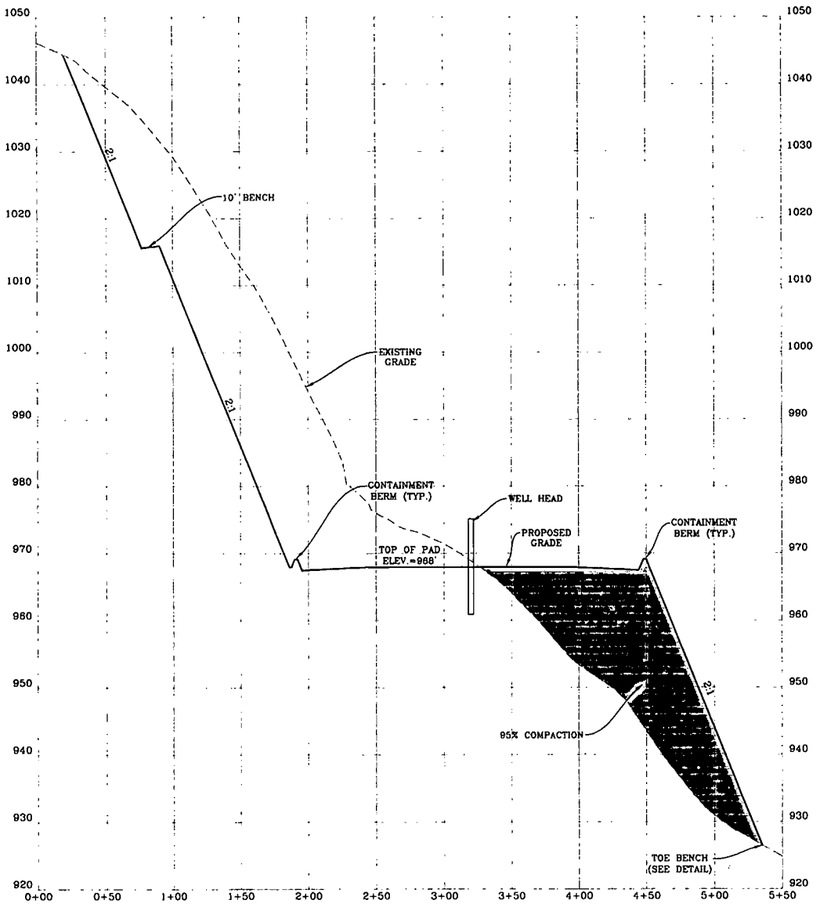
ACCESS ROAD DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

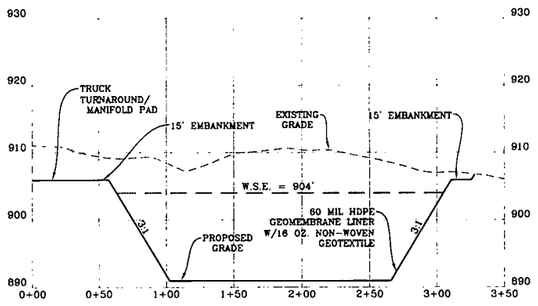
DATE: 11/04/2013
SCALE: 1" = 50'
DESIGNED BY: CSK
FILE NO. 7659
SHEET 8 OF 31

WELL PAD & ASSOCIATED PIT SECTIONS



WELL PAD CROSS-SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

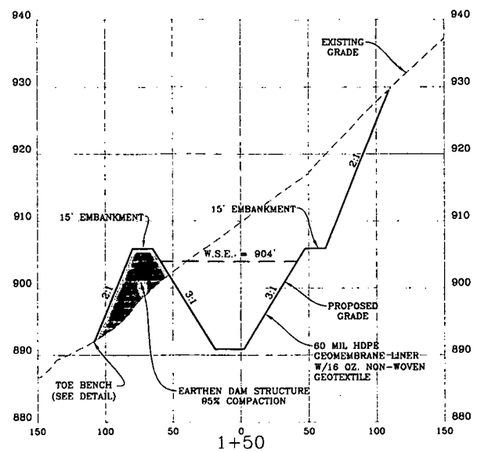


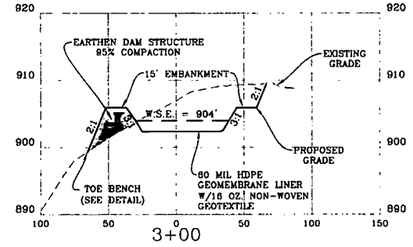
ASSOCIATED PIT CROSS-SECTION "B-B"

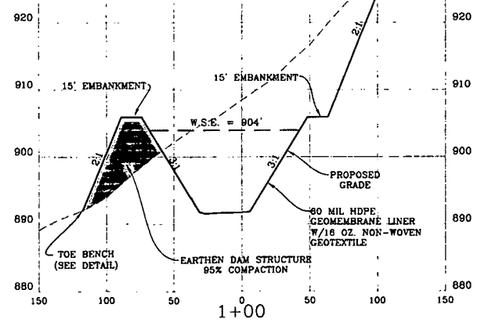
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

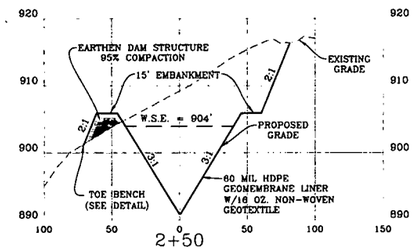
ASSOCIATED PIT CROSS-SECTIONS ALONG BASELINE "B-B"

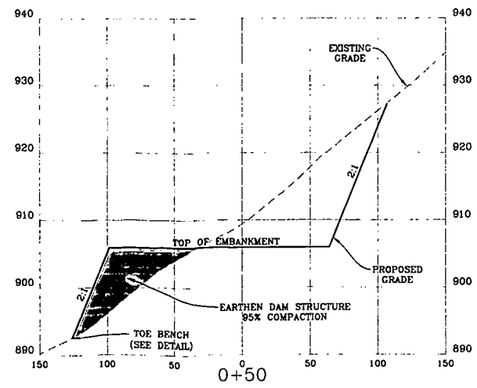
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

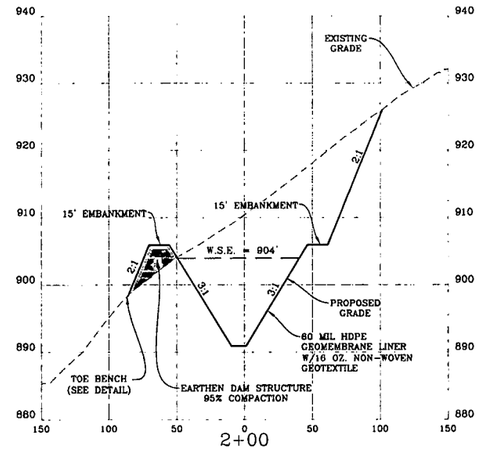












NOTE:
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CRUSE B. KUHN
REGISTERED
9578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
11/04/2013

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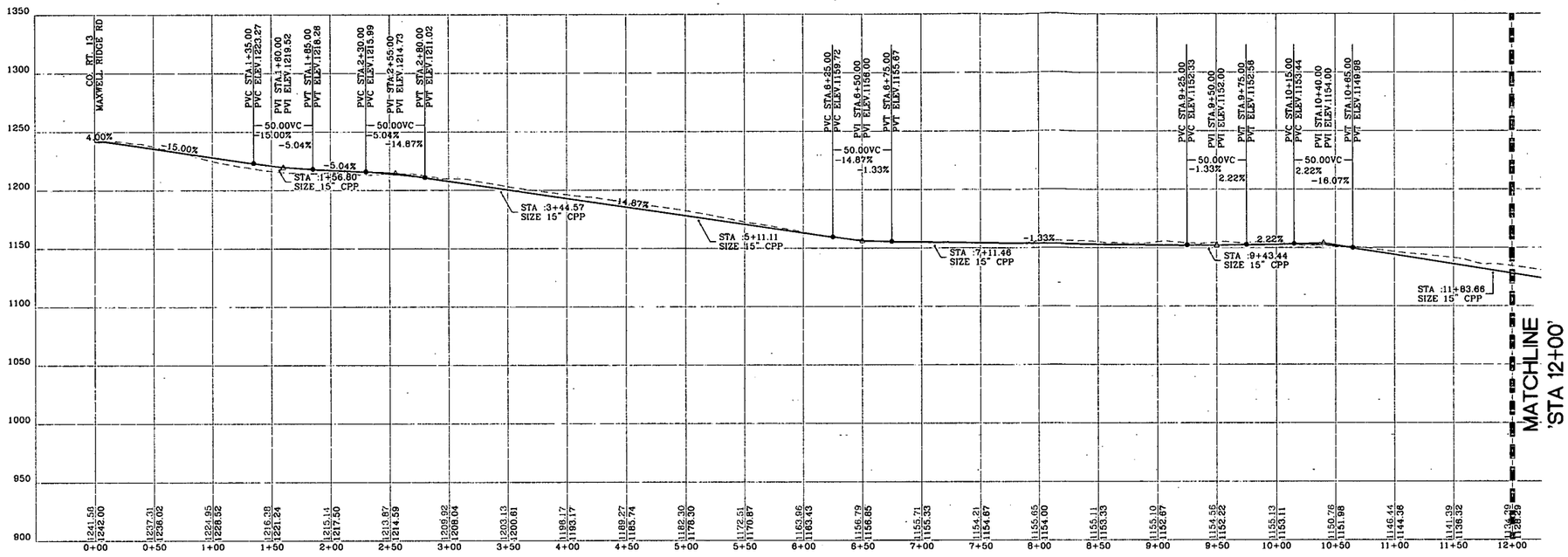
FOR: EQT PRODUCTION COMPANY

WELL PAD & ASSOCIATED PIT SECTIONS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

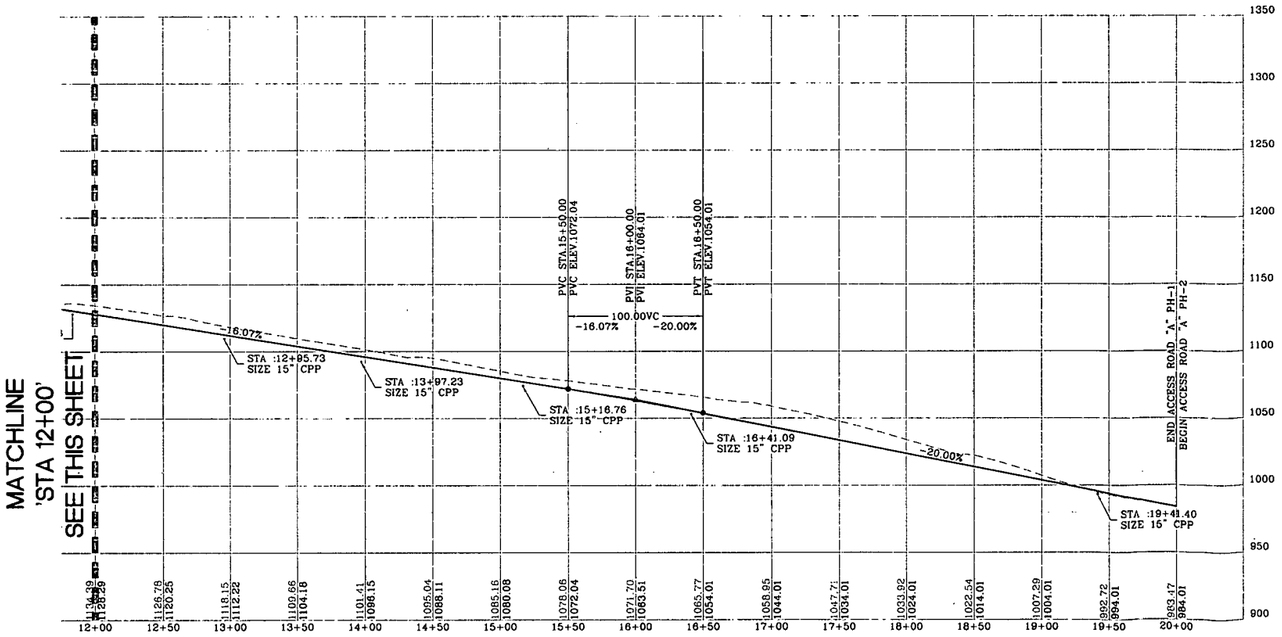
DATE:	11/04/2013
SCALE:	1" = 50'
DESIGNED BY:	CSK
FILE NO.	7889
SHEET	9 OF 31

ACCESS ROAD "A" PH-1 PROFILE



ACCESS ROAD "A" PH-1 PROFILE

SCALE: HORIZ. 1" = 50' VERT. 1" = 50'



50 25 0 50 100

SCALE: 1" = 50'

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JONAS B. KLINE
REGISTERED
No. 2376
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

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FOR: EQT PRODUCTION COMPANY

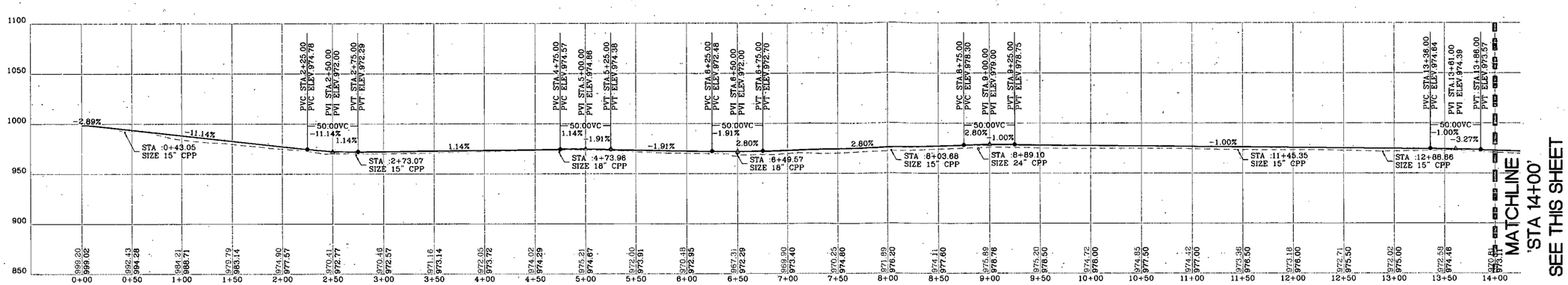
ACCESS ROAD "A" PH-1 PROFILE

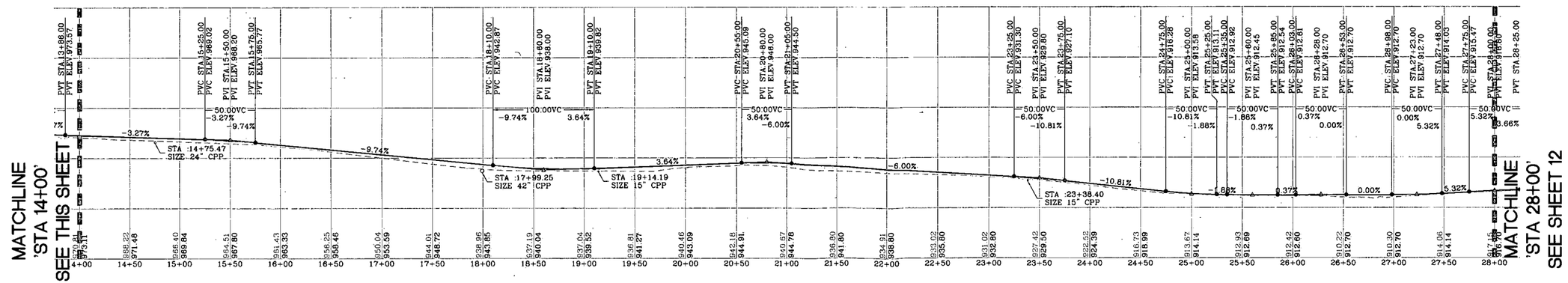
OXF 157

WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE:	11/04/2013
SCALE:	1" = 50'
DESIGNED BY:	CSK
FILE NO.	7889
SHEET	10 OF 31

ACCESS ROAD "B" PROFILE





ACCESS ROAD "B" PROFILE

SCALE: HORIZ. 1" = 50' VERT. 1" = 50'

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JOSHUA B. KUHN
REGISTERED
19570
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

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FOR: EQT PRODUCTION COMPANY

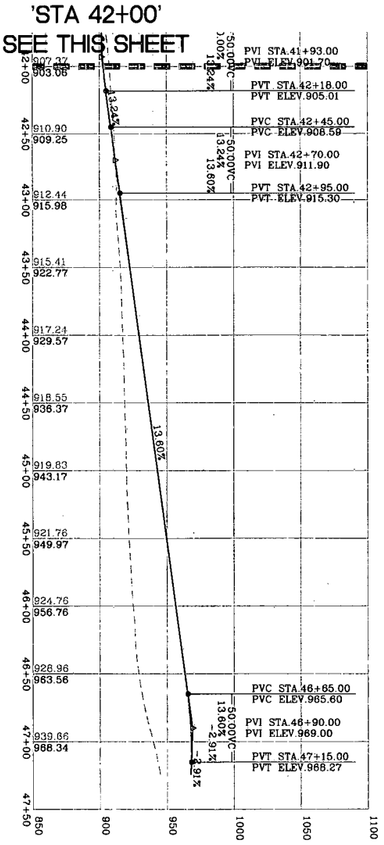
ACCESS ROAD "B" PROFILE

OXF 157

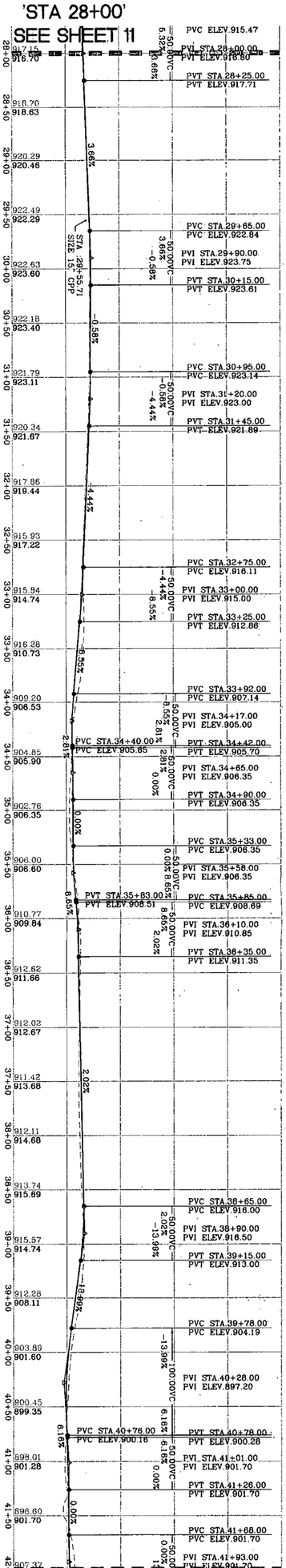
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: 1" = 50'
DESIGNED BY: CSK
FILE NO. 7889
SHEET 11 OF 31

MATCHLINE
'STA 42+00'
SEE THIS SHEET



MATCHLINE
'STA 28+00'
SEE SHEET 11



MATCHLINE
'STA 42+00'
SEE THIS SHEET

ACCESS ROAD "B" PROFILE

SHEET	12 OF 31
FILE NO.	7089
DESIGNED BY	CSK
SCALE	1" = 50'
DATE	11/04/2013

ACCESS ROAD "B" PROFILE

OXF 157

WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

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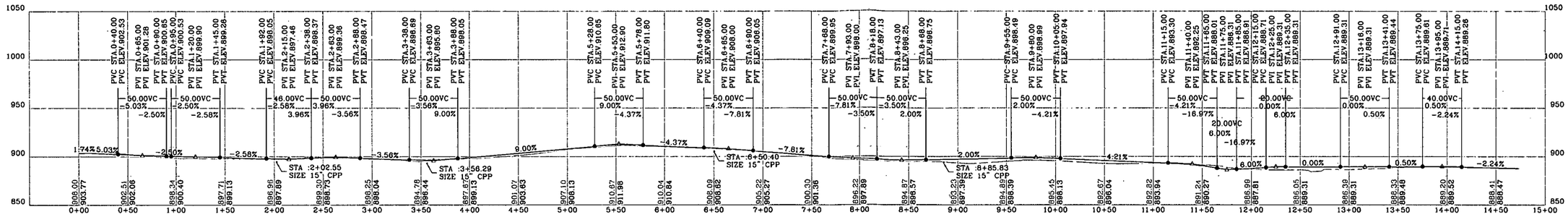
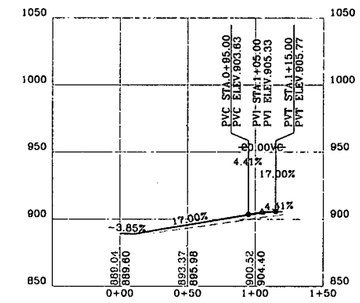
ACCESS ROADS "C" & "D" PROFILE



ACCESS ROAD "C" PROFILE

SCALE: HORIZ. 1" = 50' VERT. 1" = 50'



ACCESS ROAD "D" PROFILE

SCALE: HORIZ. 1" = 50' VERT. 1" = 50'

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Clarksburg, WV 26301
(304) 623-3555
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THIS DOCUMENT WAS PREPARED BY:
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FOR: EQT PRODUCTION COMPANY

ACCESS ROADS "C" & "D" PROFILE

OXF 157

WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013

SCALE: 1" = 50'

DESIGNED BY: CSK

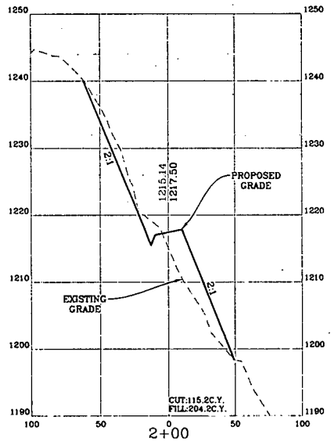
FILE NO. 7889

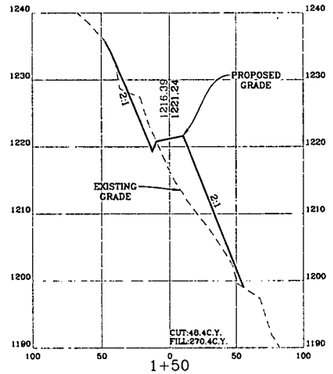
SHEET 13 OF 31

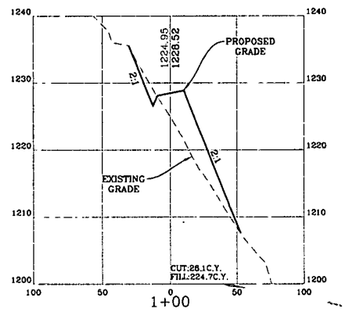
ROAD SECTIONS

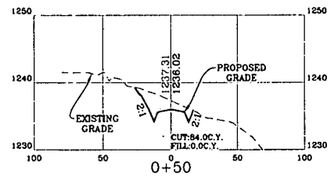
ACCESS ROAD "A" PH-1 CROSS-SECTIONS

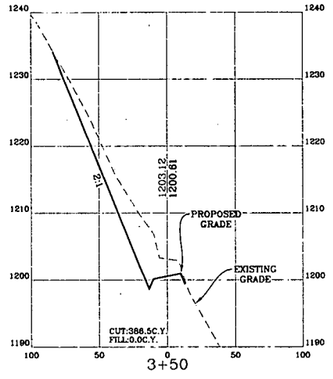
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

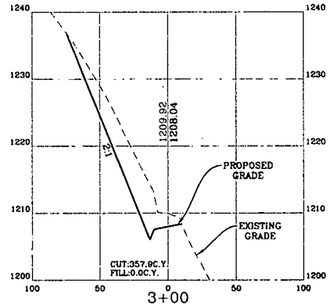


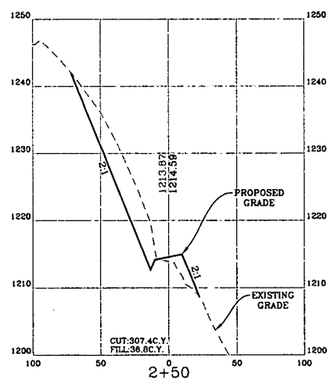


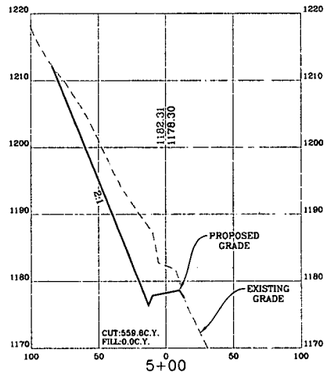


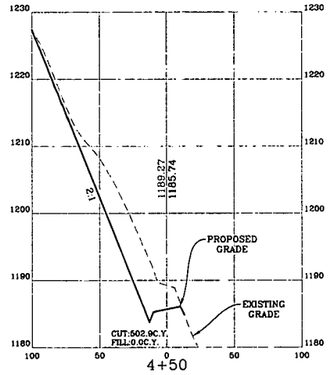


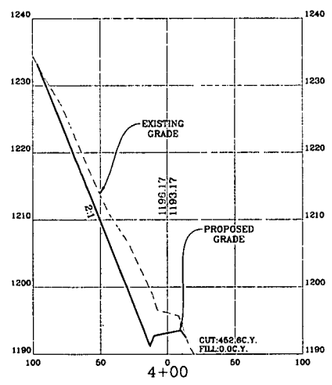


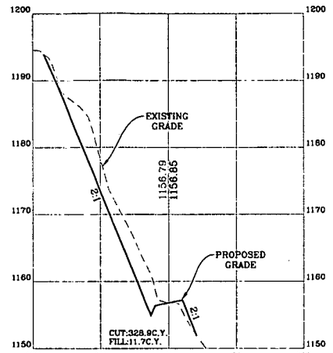


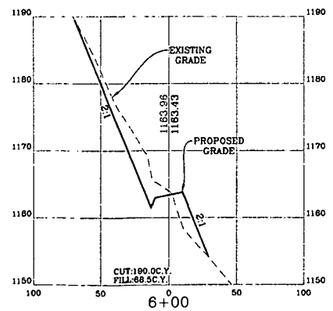


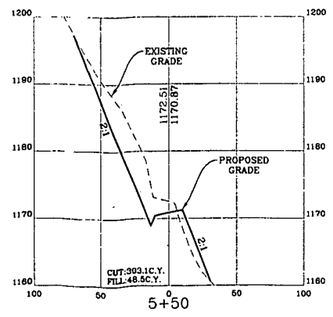


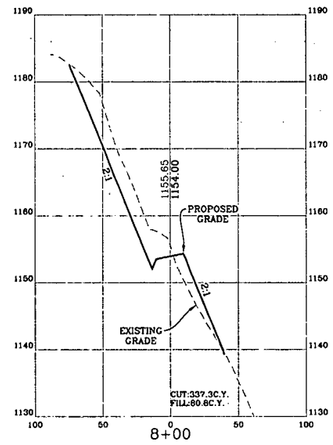


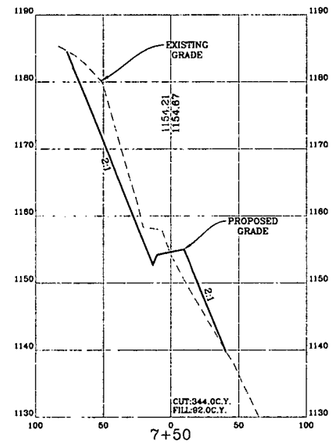


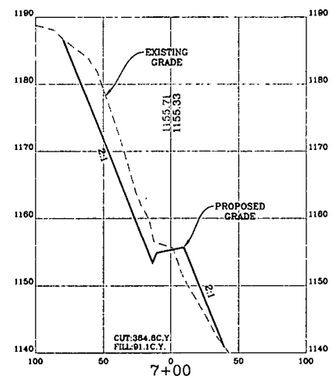


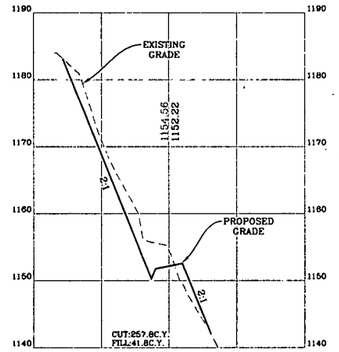


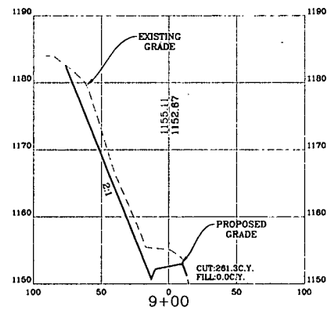


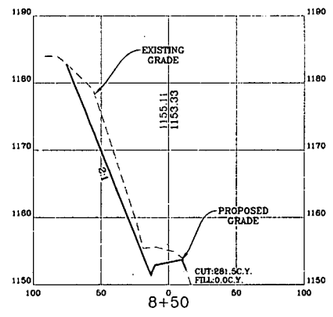












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HONESTY. INTEGRITY. QUALITY.

CHRIS S. KUNZ
REGISTERED
9576
STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER
11/04/2013

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

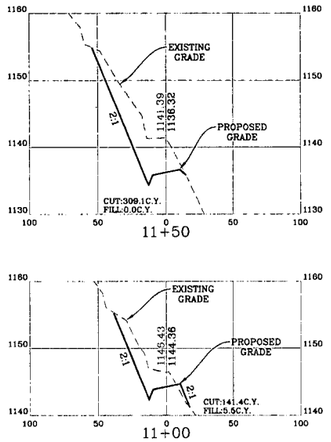
ROAD SECTIONS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: 1" = 50'
DESIGNED BY: CSK
FILE NO. 7889
SHEET 14 OF 31

ROAD SECTIONS

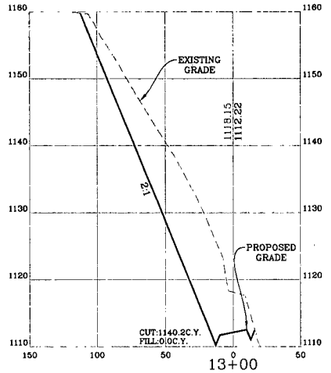
ACCESS ROAD "A" PH-1 CROSS-SECTIONS

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



11+50

11+00



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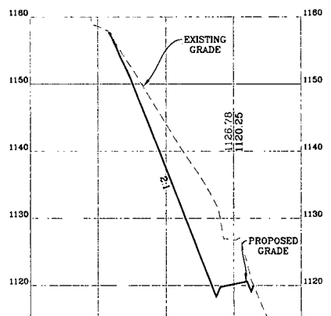

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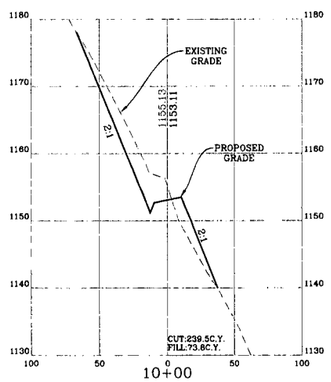

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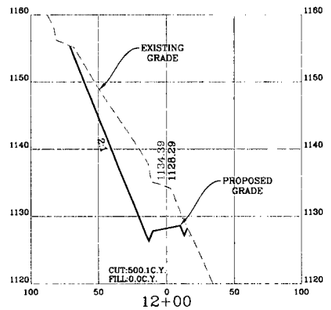

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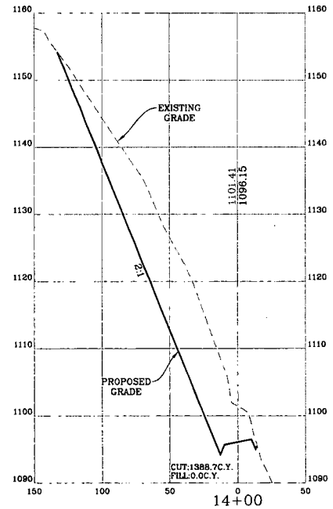

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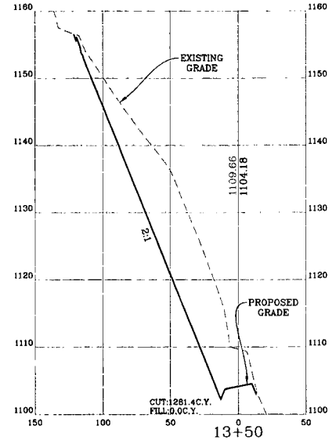

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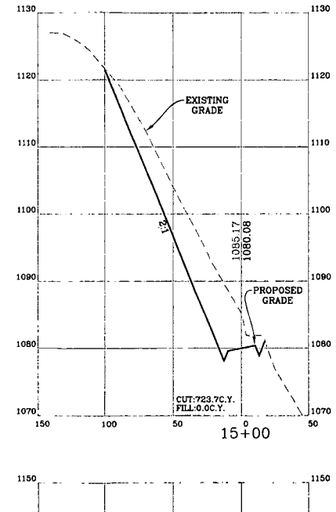

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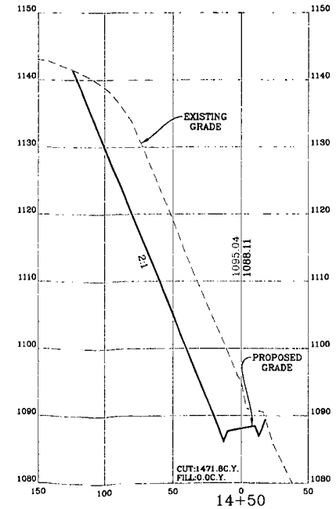

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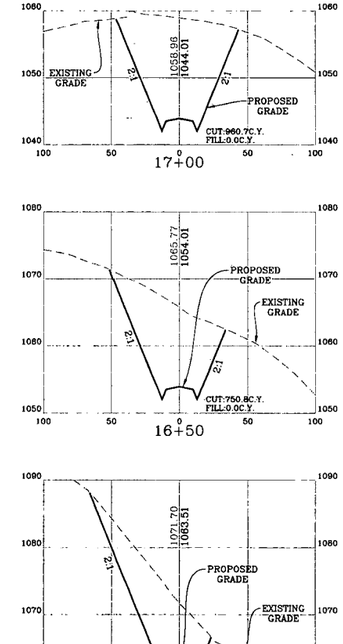

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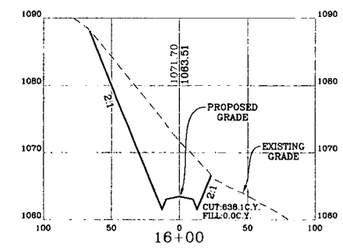
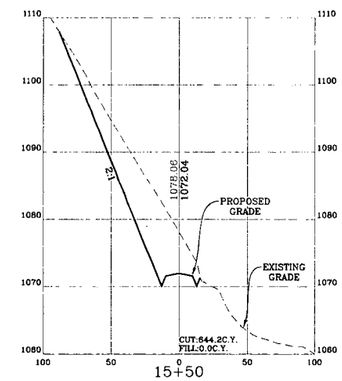


16+00



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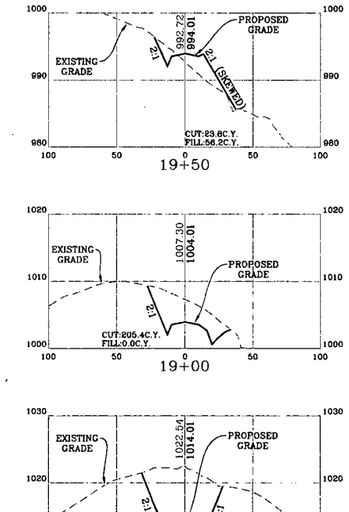

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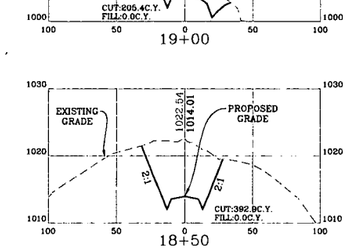
19+00



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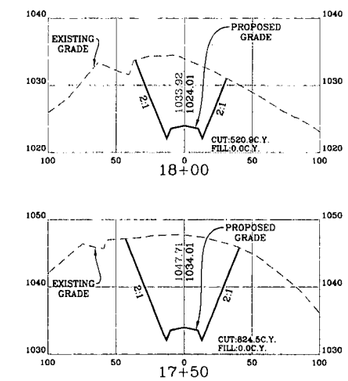

18+00

17+50

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5065 Dille Bottom Road Suite 1 Flatwoods, KY 41139 (740) 971-9911
HONESTY. INTEGRITY. QUALITY

CERTIFICATE NO. 19576 — PHILIP G. KAY — REGISTERED PROFESSIONAL ENGINEER — STATE OF WEST VIRGINIA

11/04/2013

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

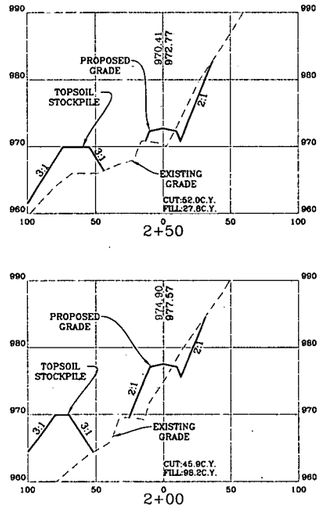
ROAD SECTIONS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

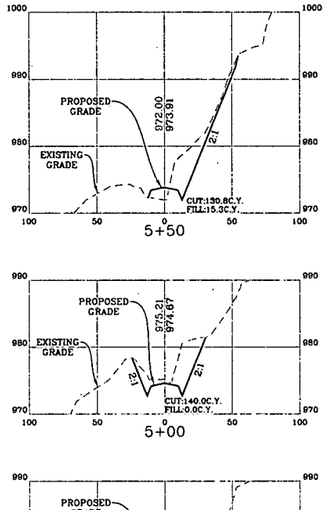
DATE:	11/04/2013
SCALE:	1" = 50'
DESIGNED BY:	CSK
FILE NO.	7689
SHEET	15 OF 31

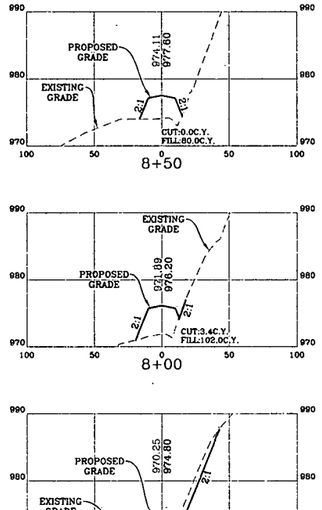
ROAD SECTIONS

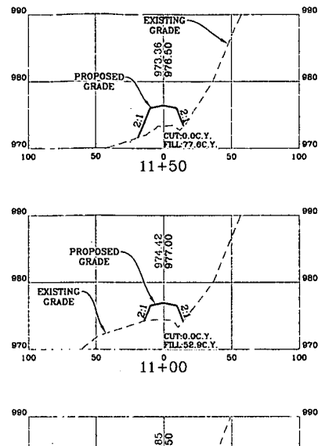
ACCESS ROAD "B" CROSS-SECTIONS

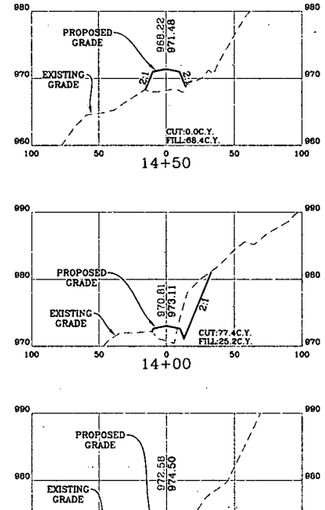
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

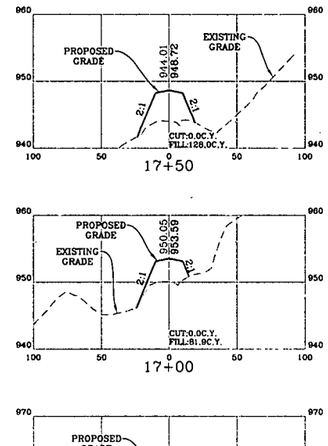


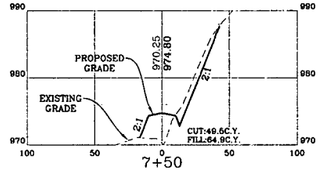


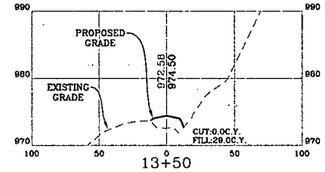


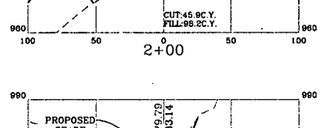


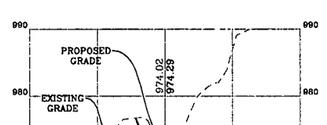


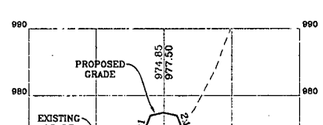


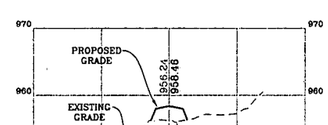


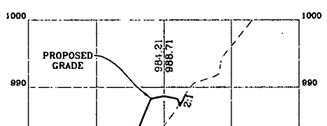


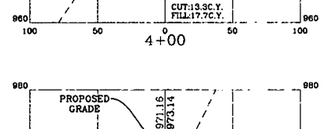


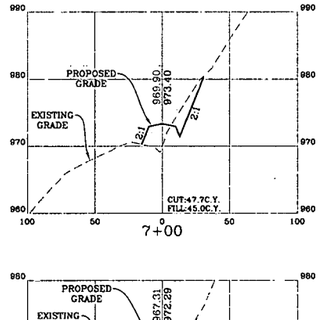


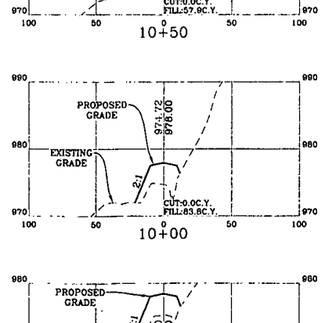


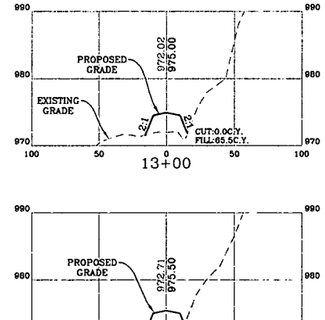


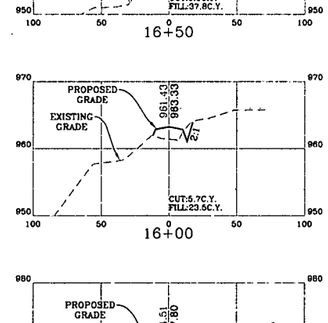


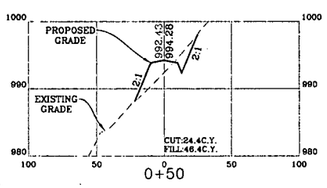


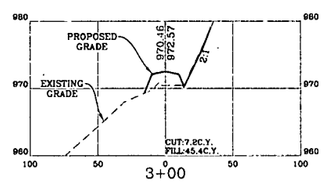


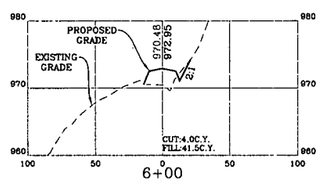


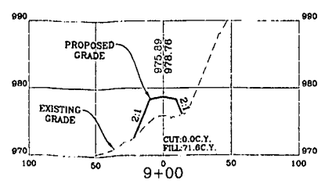


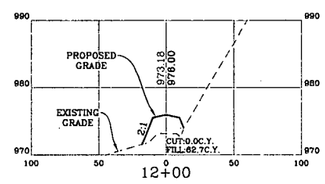


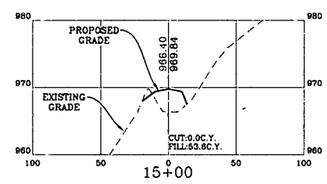












Engineering Survey Environmental GIS

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CHAD S. KING
REGISTERED
19576
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

11/04/2013

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

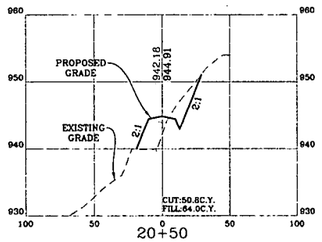
ROAD SECTIONS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

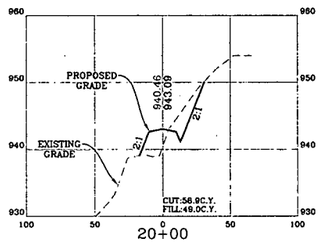
DATE:	11/04/2013
SCALE:	1" = 50'
DESIGNED BY:	CSK
FILE NO.	7889
SHEET	16 OF 31

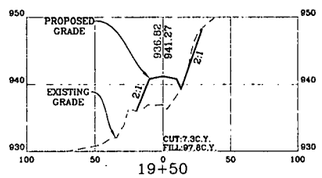
ROAD SECTIONS

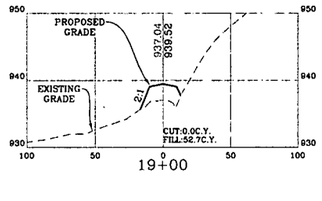
ACCESS ROAD "B" CROSS-SECTIONS

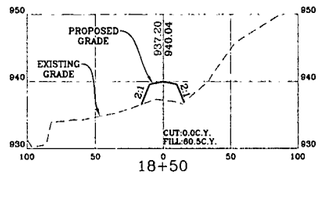
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

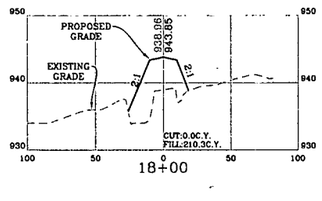


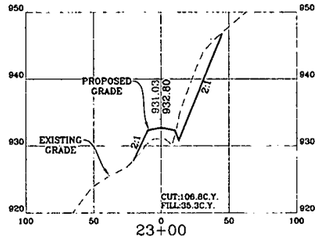


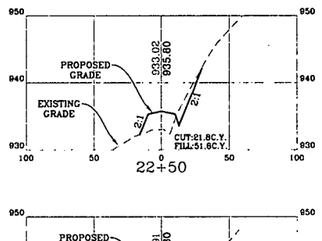


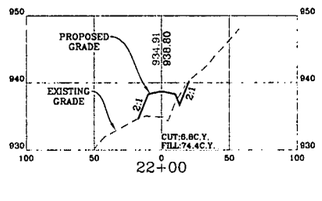


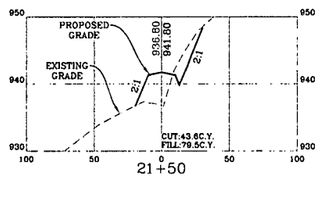


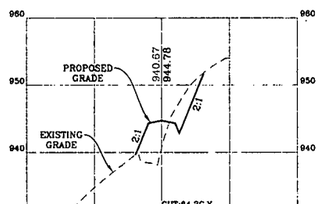


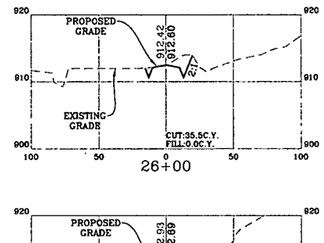


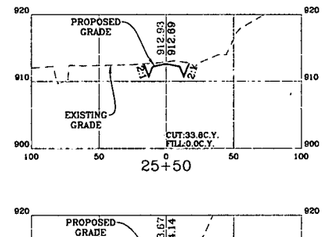


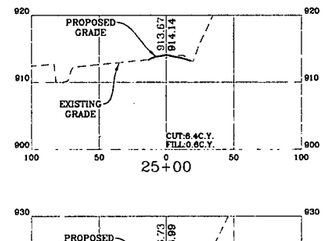


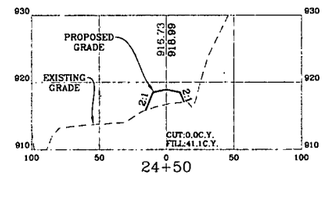


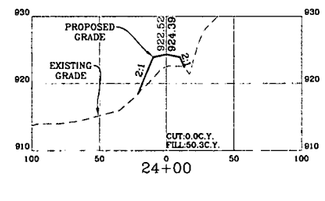


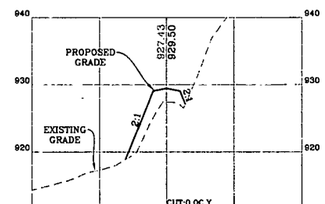


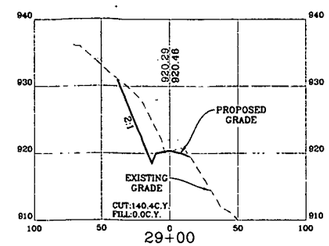


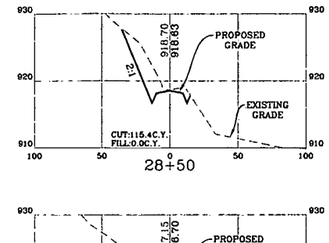


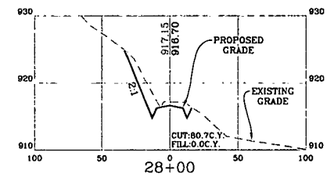


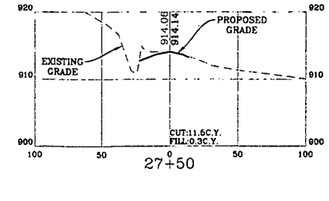


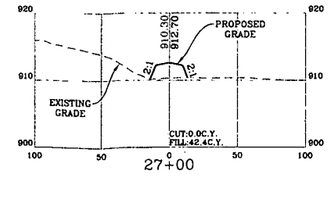


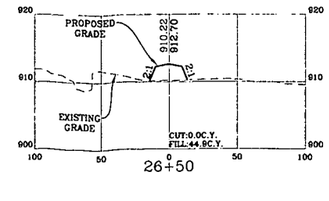


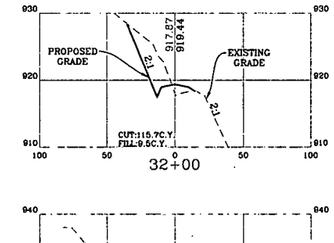


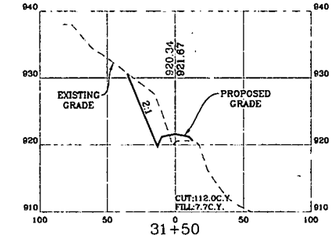


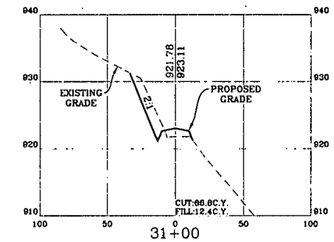


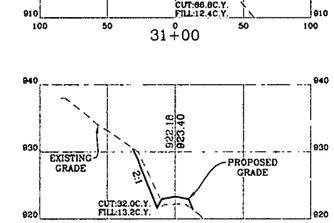


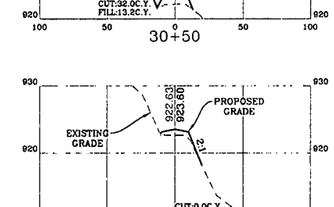


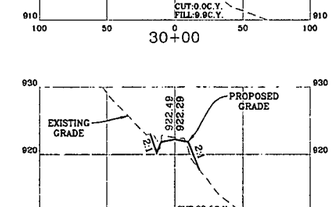


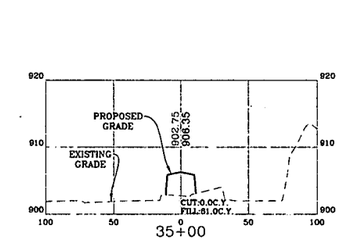


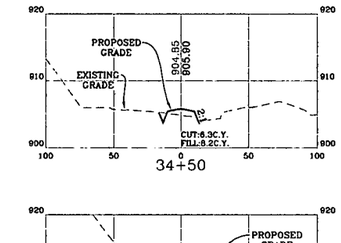


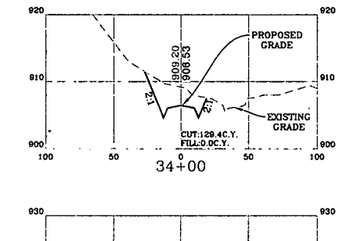


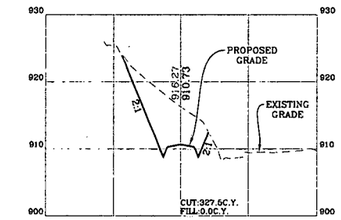


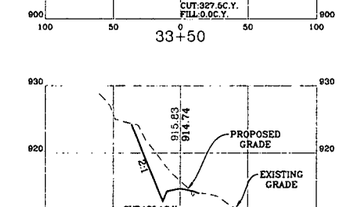


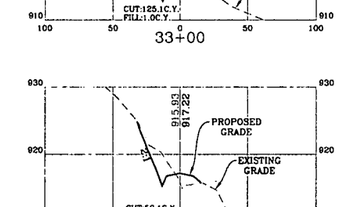












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PROFESSIONAL ENGINEER
11/04/2013

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FOR: EQT PRODUCTION COMPANY

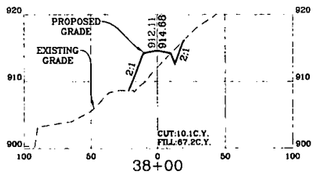
ROAD SECTIONS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: 1" = 50'
DESIGNED BY: CSK
FILE NO. 7889
SHEET 17 OF 31

ROAD SECTIONS

ACCESS ROAD "B" CROSS-SECTIONS

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



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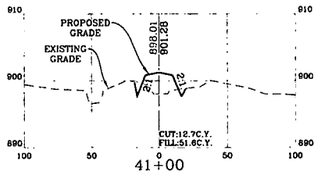

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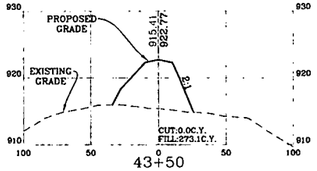

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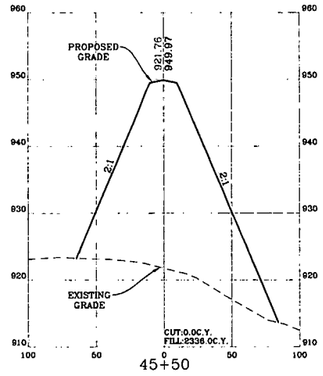

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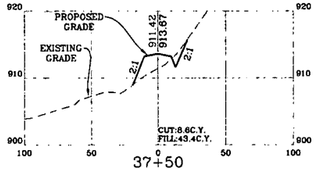

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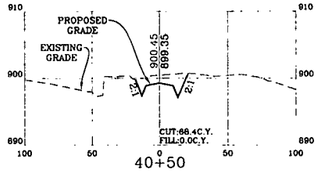

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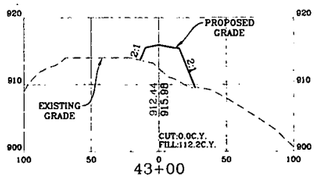

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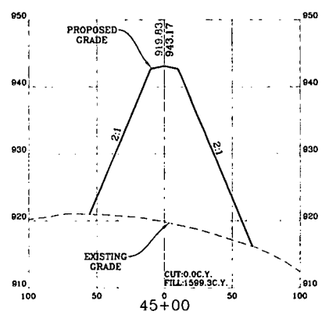

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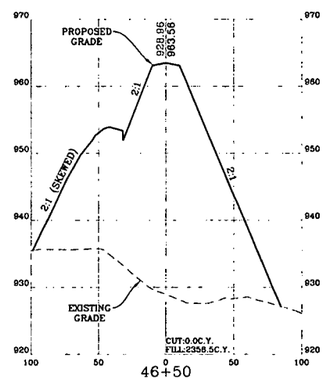

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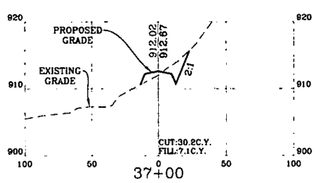

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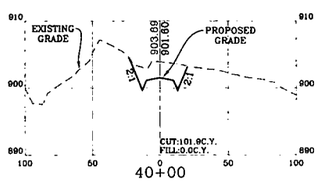

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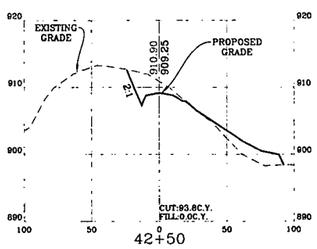

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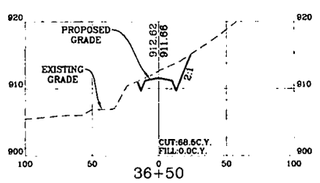

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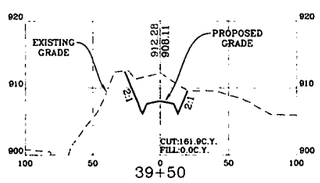

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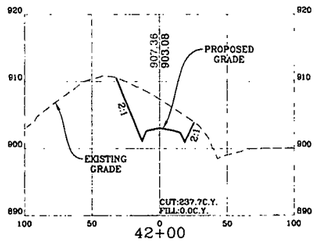

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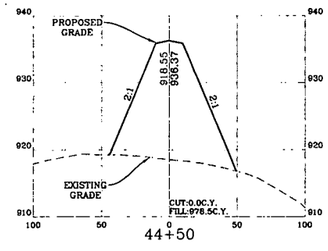

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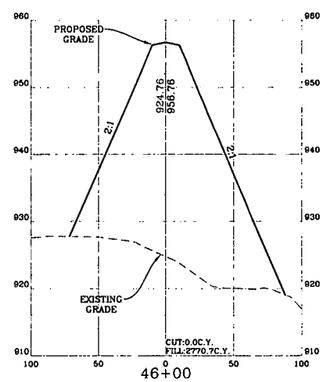

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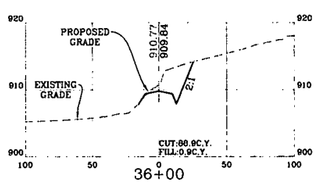

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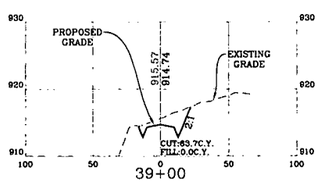

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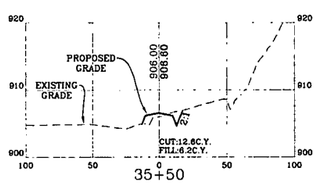

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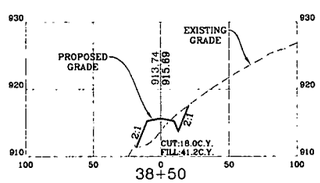

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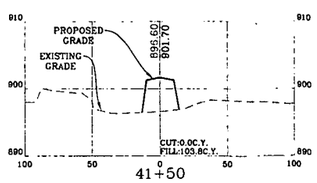

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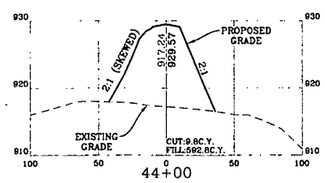

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PROFESSIONAL ENGINEER
11/04/2013

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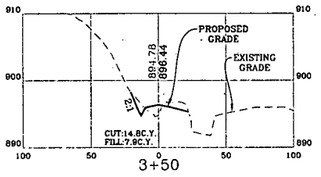
ROAD SECTIONS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: 1" = 50'
DESIGNED BY: CSK
FILE NO. 7869
SHEET 18 OF 31

ROAD SECTIONS

ACCESS ROAD "C" CROSS-SECTIONS

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



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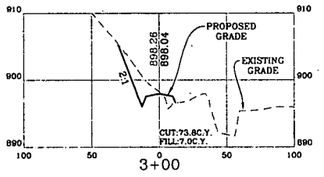

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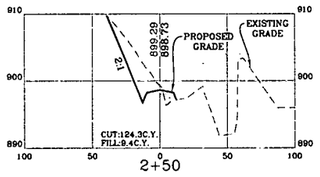

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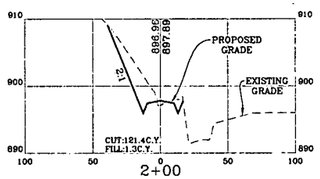

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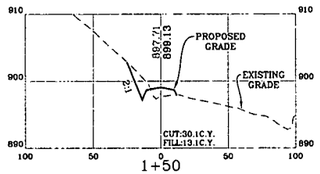

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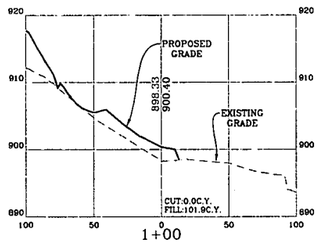

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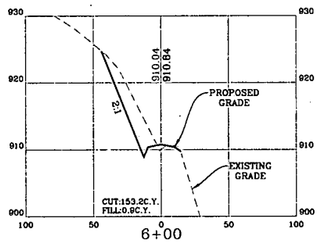

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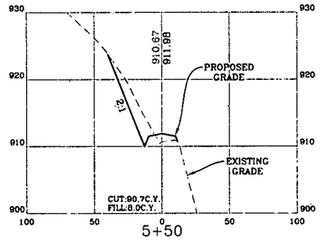

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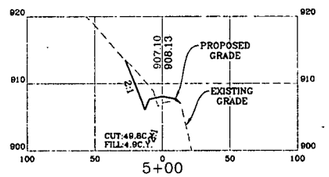

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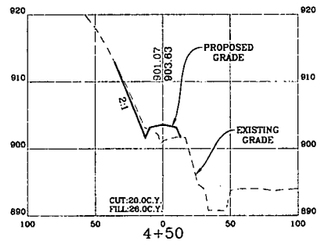

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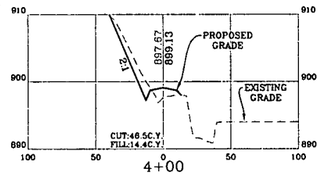

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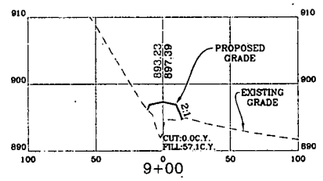

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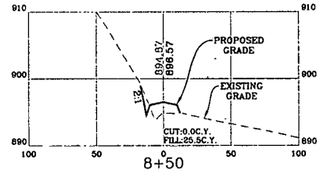

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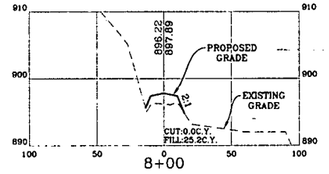

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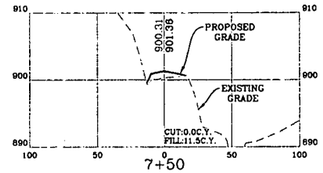

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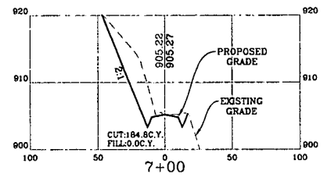

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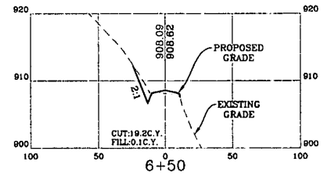

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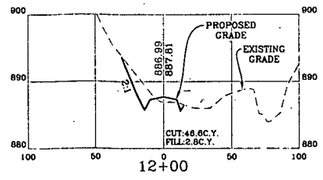

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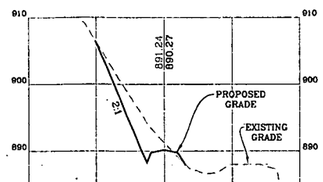

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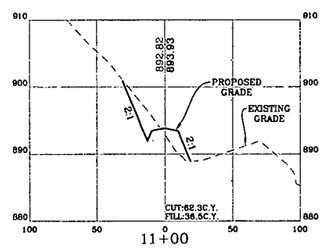

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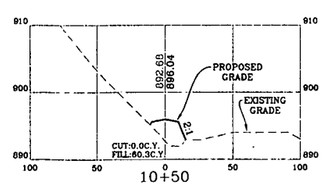

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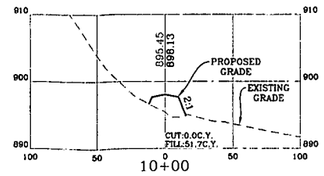

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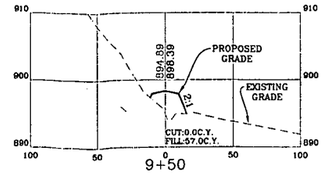

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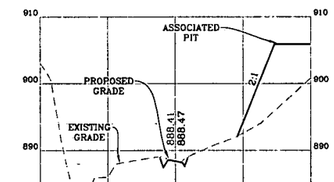

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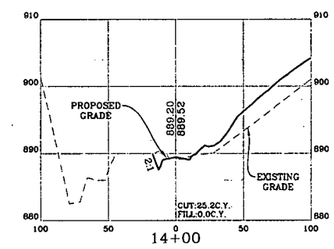

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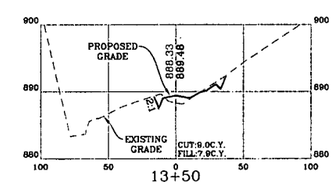

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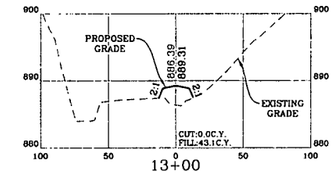

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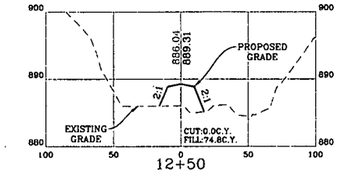
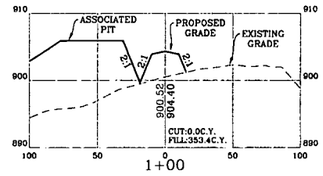


12+50

ACCESS ROAD "D" CROSS-SECTIONS

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



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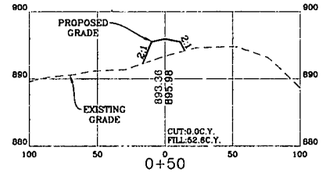

0+50

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CRUS S. KUHN
REGISTERED
9578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
11/04/2013

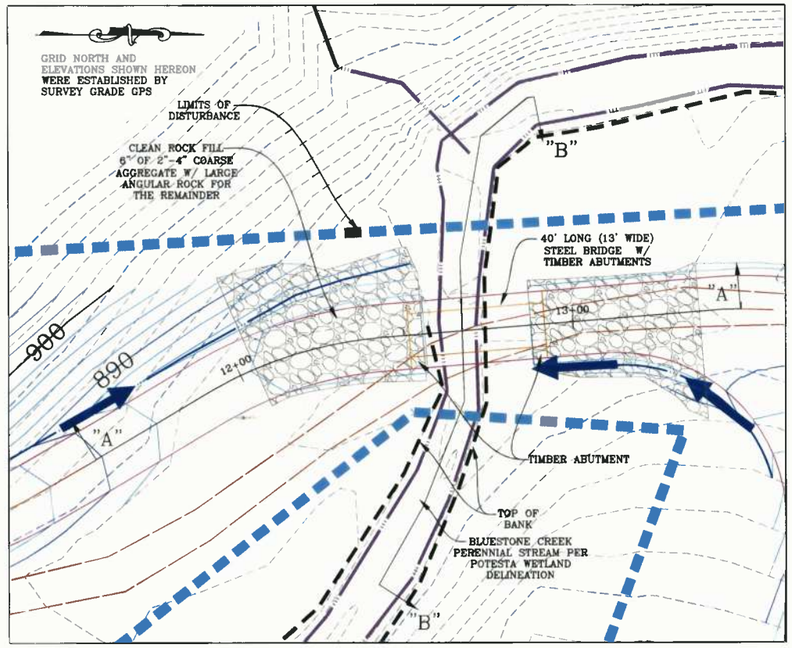
THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

ROAD SECTIONS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: 1" = 50'
DESIGNED BY: CSK
FILE NO. 7889
SHEET 19 OF 31

TEMPORARY STREAM CROSSING DETAILS

STREAM CROSSING "A" DETAILS

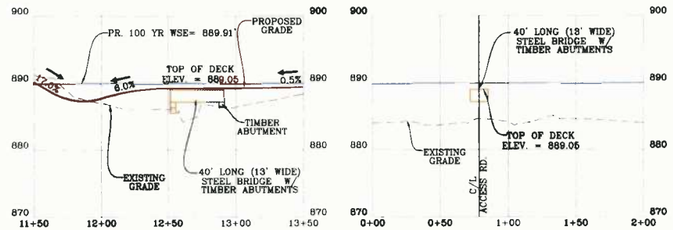


20 10 0 20 40

SCALE: 1" = 20'

NOTE:
1) SEE STREAM CROSSING REPORT BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATATIONS.
2) EQT SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "A".

STREAM CROSSING "A" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

CROSS SECTION "B-B"

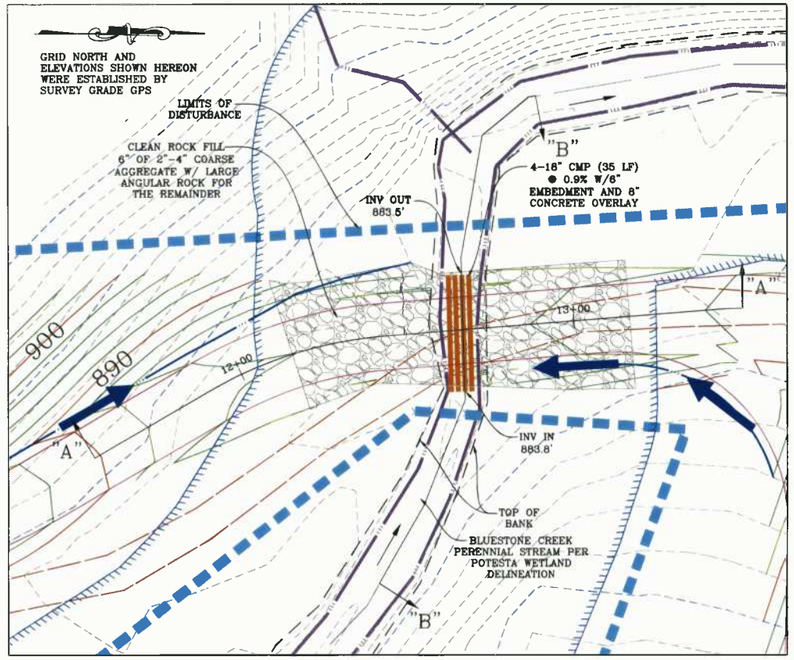
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL STREAM CROSSING NOTES:

1) 2" TO 4" COARSE AGGREGATE OR LARGER SHALL BE USED TO FORM THE FIRST 6" OF FILL FOR THE CROSSING, THE REMAINDER OF MATERIAL SHALL BE ONLY LARGE ANGULAR DURABLE ROCK. "DO NOT USE ERODIBLE MATERIAL FOR CONSTRUCTION OF THE CROSSING."
2) DEPTH OF STONE COVER OVER THE CULVERTS SHALL BE EQUAL TO ONE-HALF THE CULVERT DIAMETER OR 12 INCHES, WHICHEVER IS GREATER.
3) IF MULITPLE CULVERTS ARE USED, THEY SHALL BE SEPARATED BY AT LEAST 12 INCHES OF COMPACTED AGGREGATE FILL.
4) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
5) FILTER CLOTH SHALL BE PLACED ON THE STREAM BED AND STREAM BANKS PRIOR TO PLACEMENT OF THE PIPE CULVERTS AND AGGREGATE. THE FILTER CLOTH SHALL COVER THE STREAMBED AND EXTEND A MINIMUM OF SIX INCHES AND A MAXIMUM OF ONE FOOT BEYOND THE END OF THE CULVERTS AND BEDDING MATERIAL.
6) A WATER DIVERTING SWALE OR PUMP AROUND SYSTEM SHALL BE CONSTRUCTED ACROSS THE ROADWAY ON EITHER SIDE OF THE STREAM CROSSING AS DIRECTED.
7) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
8) TIMBER ABUTMENTS ON THE UPSTREAM AND DOWNSTREAM SIDE OF THE CULVERT INSTALLATION SHALL BE INSTALLED TO REDUCE STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
9) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
10) GREEN CONCRETE SHALL NOT BE PLACED IN CONTACT WITH FLOWING WATER.
11) WHEN THE CROSSING HAS SERVED ITS PURPOSE, ALL STRUCTURES INCLUDING CULVERTS, BEDDING, AND FILTER CLOTH SHALL BE REMOVED. REMOVAL OF THE STRUCTURE AND CLEAN UP OF THE AREA SHOULD BE ACCOMPLISHED WITHOUT CONSTRUCTION EQUIPMENT WORKING IN THE WATERWAY CHANNEL. UPON REMOVAL OF THE STRUCTURE, THE STREAM BANK SHALL IMMEDIATELY BE STABILIZED.
12) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
13) THE CROSSING MUST BE INSPECTED AFTER EVERY RAIN EVENT OF 0.5 INCHES OR MORE AND ONCE A WEEK TO ENSURE THAT THE CULVERTS, STREAMBED, AND STREAM BANKS ARE MAINTAINED AND NOT DAMAGED. NEVER ALLOW THE CULVERTS TO BECOME CLOGGED WITH DEBRIS AND REMOVE ANY OBSTRUCTIONS IMMEDIATELY.
14) FLUSHING IS NOT AN APPROVED METHOD TO BE UTILIZED FOR CULVERT CLEANOUT.
15) ALL CROSSING STRUCTURES SHALL BE ANCHORED IN ACCORDANCE WITH THE DODDRIDGE COUNTY FLOODPLAIN ORDINANCE.

PERMANENT STREAM CROSSING DETAILS

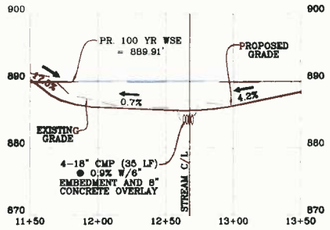
STREAM CROSSING "A" DETAILS



20 10 0 20 40

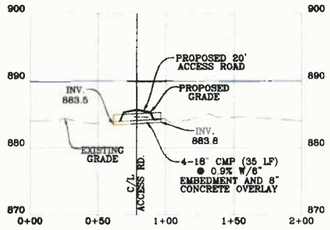
SCALE: 1" = 20'

STREAM CROSSING "A" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

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(740) 671-0011
MORGANTOWN, BUTLER, CLARKSBURG

CHRIS S. KUHL
REGISTERED
9578
STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER

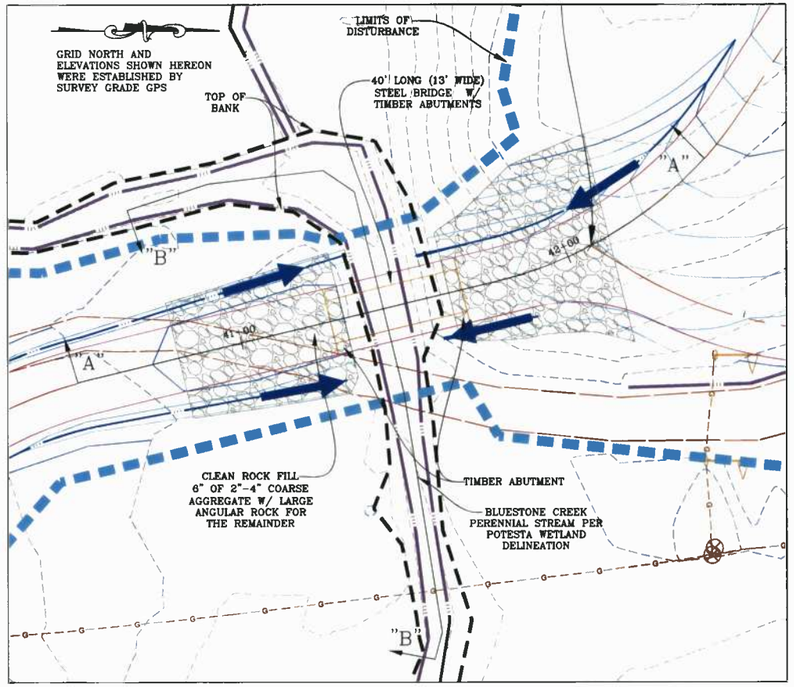
THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

STREAM CROSSING DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7889
SHEET 20 OF 31

TEMPORARY STREAM CROSSING DETAILS

STREAM CROSSING "B" DETAILS

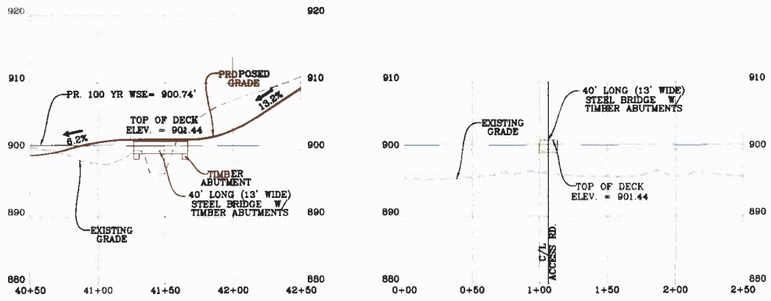


20 10 0 20 40

SCALE: 1" = 20'

NOTE:
1) SEE STREAM CROSSING REPORT BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATATIONS.
2) EQT SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "B".

STREAM CROSSING "B" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

CROSS SECTION "B-B"

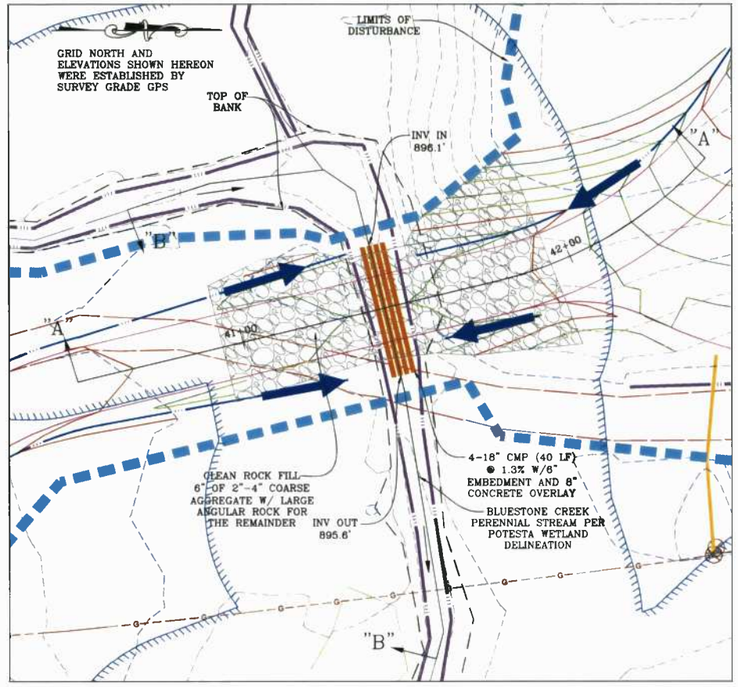
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL STREAM CROSSING NOTES:

1) 2" TO 4" COARSE AGGREGATE OR LARGER SHALL BE USED TO FORM THE FIRST 6" OF FILL FOR THE CROSSING, THE REMAINDER OF MATERIAL SHALL BE ONLY LARGE ANGULAR DURABLE ROCK. "DO NOT USE ERODIBLE MATERIAL FOR CONSTRUCTION OF THE CROSSING."
2) DEPTH OF STONE COVER OVER THE CULVERTS SHALL BE EQUAL TO ONE-HALF THE CULVERT DIAMETER OR 12 INCHES, WHICHEVER IS GREATER.
3) IF MULTIPLE CULVERTS ARE USED, THEY SHALL BE SEPARATED BY AT LEAST 12 INCHES OF COMPACTED AGGREGATE FILL.
4) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
5) FILTER CLOTH SHALL BE PLACED ON THE STREAM BED AND STREAM BANKS PRIOR TO PLACEMENT OF THE PIPE CULVERTS AND AGGREGATE. THE FILTER CLOTH SHALL COVER THE STREAMBED AND EXTEND A MINIMUM OF SIX INCHES AND A MAXIMUM OF ONE FOOT BEYOND THE END OF THE CULVERTS AND BEDDING MATERIAL.
6) A WATER DIVERTING SWALE OR PUMP AROUND SYSTEM SHALL BE CONSTRUCTED ACROSS THE ROADWAY ON EITHER SIDE OF THE STREAM CROSSING AS DIRECTED.
7) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
8) TIMBER ABUTMENTS ON THE UPSTREAM AND DOWNSTREAM SIDE OF THE CULVERT INSTALLATION SHALL BE INSTALLED TO REDUCE STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
9) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
10) GREEN CONCRETE SHALL NOT BE PLACED IN CONTACT WITH FLOWING WATER.
11) WHEN THE CROSSING HAS SERVED ITS PURPOSE, ALL STRUCTURES INCLUDING CULVERTS, BEDDING, AND FILTER CLOTH SHALL BE REMOVED. REMOVAL OF THE STRUCTURE AND CLEAN UP OF THE AREA SHOULD BE ACCOMPLISHED WITHOUT CONSTRUCTION EQUIPMENT WORKING IN THE WATERWAY CHANNEL. UPON REMOVAL OF THE STRUCTURE, THE STREAM BANK SHALL IMMEDIATELY BE STABILIZED.
12) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
13) THE CROSSING MUST BE INSPECTED AFTER EVERY RAIN EVENT OF 0.5 INCHES OR MORE AND ONCE A WEEK TO ENSURE THAT THE CULVERTS, STREAMBED, AND STREAM BANKS ARE MAINTAINED AND NOT DAMAGED. NEVER ALLOW THE CULVERTS TO BECOME CLOGGED WITH DEBRIS AND REMOVE ANY OBSTRUCTIONS IMMEDIATELY.
14) FLUSHING IS NOT AN APPROVED METHOD TO BE UTILIZED FOR CULVERT CLEANOUT.
15) ALL CROSSING STRUCTURES SHALL BE ANCHORED IN ACCORDANCE WITH THE DODDRIDGE COUNTY FLOODPLAIN ORDINANCE.

PERMANENT STREAM CROSSING DETAILS

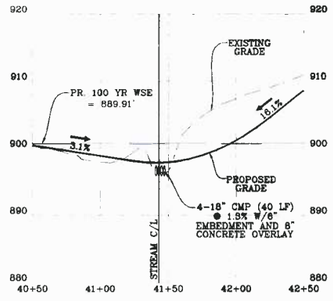
STREAM CROSSING "B" DETAILS



20 10 0 20 40

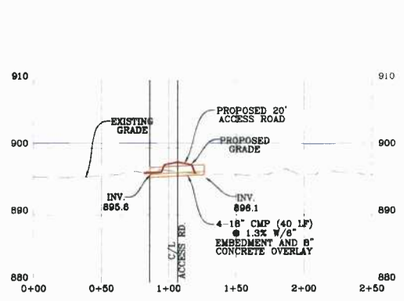
SCALE: 1" = 20'

STREAM CROSSING "B" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

NAVITUS ENGINEERING INC.
Engineering Survey Environmental GIS
151 Windy Hill Lane Westover, WV 26501
Telephone: (888) 662-4185
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SURVEYORS ENGINEERS ENVIRONMENTAL
PROJECT MGMT.
SLS
735 West Main St. P.O. Box 1247 Bridgeport, WV 26330 (304) 842-5820
3645 Dirkin Ridge Road Suite 201 Buckhannon, WV 26201 (740) 371-4911
HONESTY, INTEGRITY, QUALITY

CHRIS B. KUHN REGISTERED 19578 STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC. FOR: EQT PRODUCTION COMPANY

STREAM CROSSING DETAILS

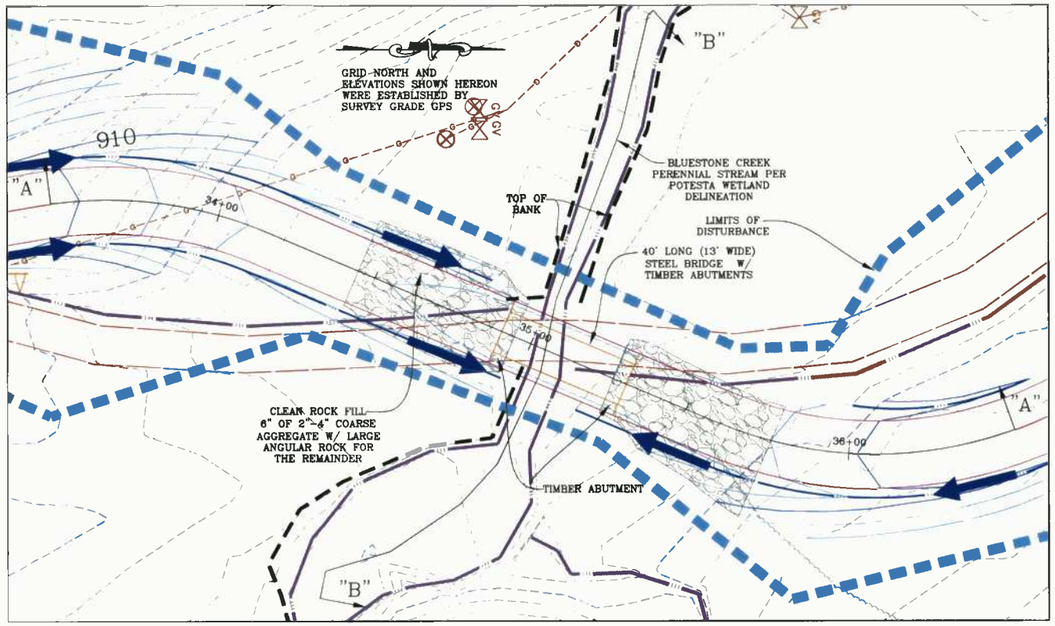
OXF 157

WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE:	11/04/2013
SCALE:	N/A
DESIGNED BY:	CSK
FILE NO.	7889
SHEET	21 OF 31

TEMPORARY STREAM CROSSING DETAILS

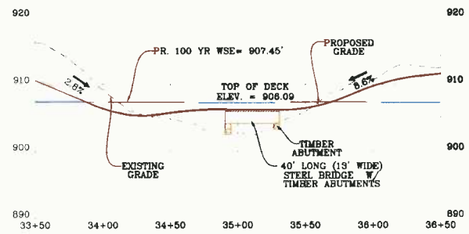
STREAM CROSSING "C" DETAILS



20 10 0 20 40

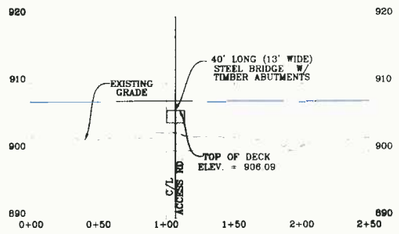
SCALE: 1" = 20'

STREAM CROSSING "C" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

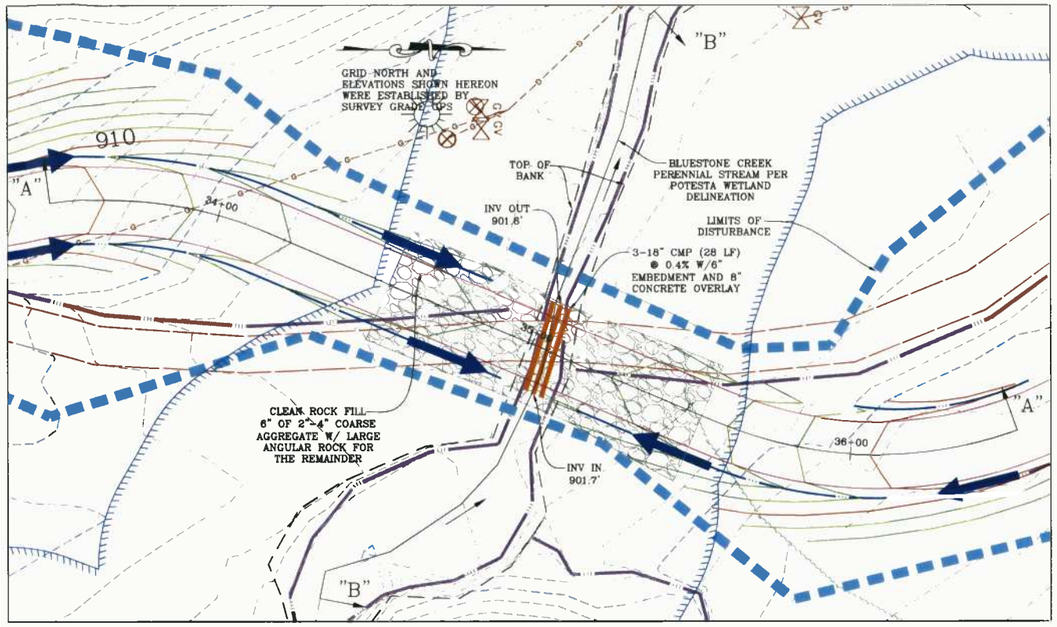
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL STREAM CROSSING NOTES:

1) 2" TO 4" COARSE AGGREGATE OR LARGER SHALL BE USED TO FORM THE FIRST 6" OF FILL FOR THE CROSSING, THE REMAINDER OF MATERIAL SHALL BE ONLY LARGE ANGULAR DURABLE ROCK. "DO NOT USE ERODIBLE MATERIAL FOR CONSTRUCTION OF THE CROSSING."
2) DEPTH OF STONE COVER OVER THE CULVERTS SHALL BE EQUAL TO ONE-HALF THE CULVERT DIAMETER OR 12 INCHES, WHICHEVER IS GREATER.
3) IF MULTIPLE CULVERTS ARE USED, THEY SHALL BE SEPARATED BY AT LEAST 12 INCHES OF COMPACTED AGGREGATE FILL.
4) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
5) FILTER CLOTH SHALL BE PLACED ON THE STREAM BED AND STREAM BANKS PRIOR TO PLACEMENT OF THE PIPE CULVERTS AND AGGREGATE. THE FILTER CLOTH SHALL COVER THE STREAMBED AND EXTEND A MINIMUM OF SIX INCHES AND A MAXIMUM OF ONE FOOT BEYOND THE END OF THE CULVERTS AND BEDDING MATERIAL.
6) A WATER DIVERTING SWALE OR PUMP AROUND SYSTEM SHALL BE CONSTRUCTED ACROSS THE ROADWAY ON EITHER SIDE OF THE STREAM CROSSING AS DIRECTED.
7) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
8) TIMBER ABUTMENTS ON THE UPSTREAM AND DOWNSTREAM SIDE OF THE CULVERT INSTALLATION SHALL BE INSTALLED TO REDUCE STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
9) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
10) GREEN CONCRETE SHALL NOT BE PLACED IN CONTACT WITH FLOWING WATER.
11) WHEN THE CROSSING HAS SERVED ITS PURPOSE, ALL STRUCTURES INCLUDING CULVERTS, BEDDING, AND FILTER CLOTH SHALL BE REMOVED. REMOVAL OF THE STRUCTURE AND CLEAN UP OF THE AREA SHOULD BE ACCOMPLISHED WITHOUT CONSTRUCTION EQUIPMENT WORKING IN THE WATERWAY CHANNEL. UPON REMOVAL OF THE STRUCTURE, THE STREAM BANK SHALL IMMEDIATELY BE STABILIZED.
12) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
13) THE CROSSING MUST BE INSPECTED AFTER EVERY RAIN EVENT OF 0.5 INCHES OR MORE AND ONCE A WEEK TO ENSURE THAT THE CULVERTS, STREAMBED, AND STREAM BANKS ARE MAINTAINED AND NOT DAMAGED. NEVER ALLOW THE CULVERTS TO BECOME CLOGGED WITH DEBRIS AND REMOVE ANY OBSTRUCTIONS IMMEDIATELY.
14) FLUSHING IS NOT AN APPROVED METHOD TO BE UTILIZED FOR CULVERT CLEANOUT.
15) ALL CROSSING STRUCTURES SHALL BE ANCHORED IN ACCORDANCE WITH THE DODDRIDGE COUNTY FLOODPLAIN ORDINANCE.

PERMANENT STREAM CROSSING DETAILS

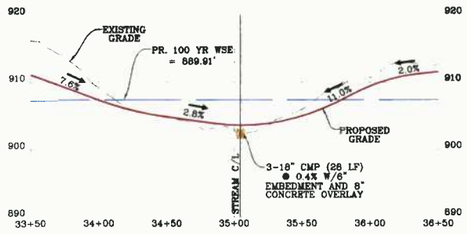
STREAM CROSSING "C" DETAILS



20 10 0 20 40

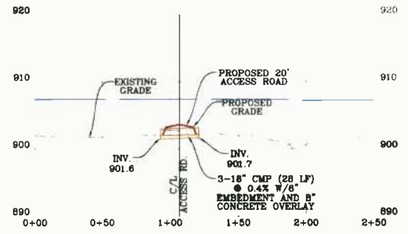
SCALE: 1" = 20'

STREAM CROSSING "C" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

NOTE:

1) SEE STREAM CROSSING REPORT BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATATIONS.
2) EQT SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "C".

Engineering · Survey · Environmental · GIS

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NORTHEAST · APPALACHIA · OHANTY

CYRUS B. KING
REGISTERED
19578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

STREAM CROSSING DETAILS

OXF 157

WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013

SCALE: N/A

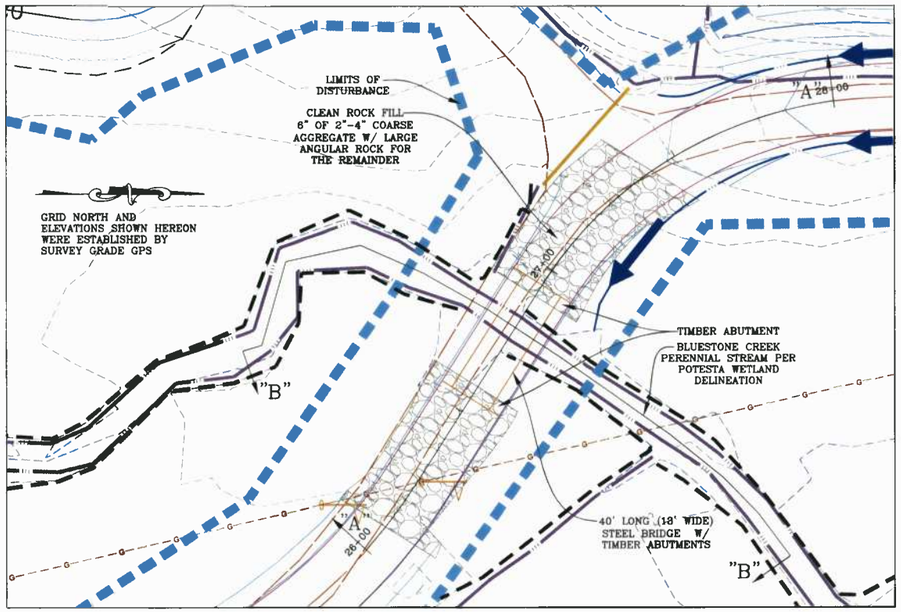
DESIGNED BY: CSK

FILE NO. 7889

SHEET 22 OF 31

TEMPORARY STREAM CROSSING DETAILS

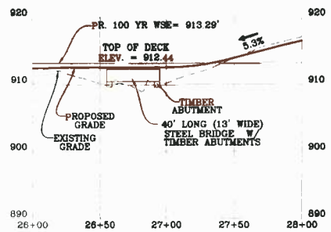
STREAM CROSSING "D" DETAILS



20 10 0 20 40

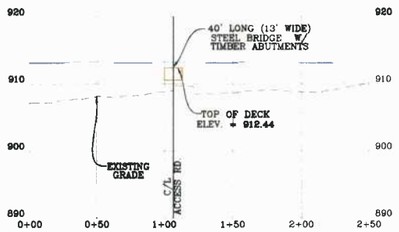
SCALE: 1" = 20'

STREAM CROSSING "D" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL STREAM CROSSING NOTES:

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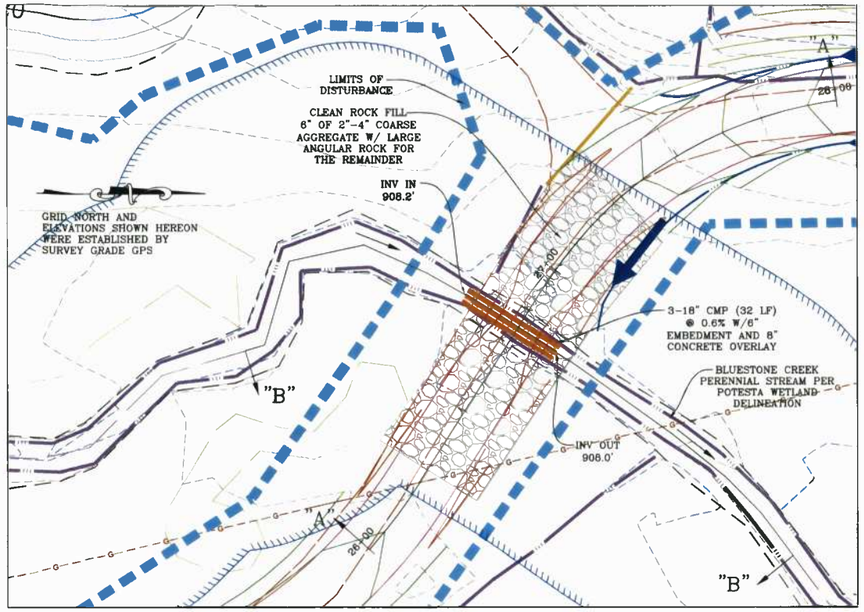
PERMANENT STREAM CROSSING DETAILS

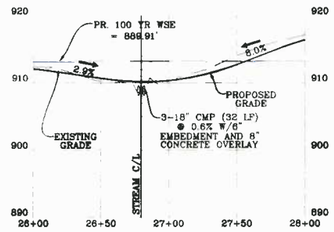
STREAM CROSSING "D" DETAILS



20 10 0 20 40

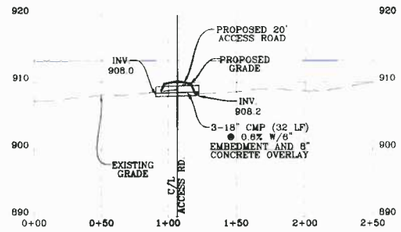
SCALE: 1" = 20'

STREAM CROSSING "D" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

NOTE:

1) SEE STREAM CROSSING REPORT BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATATIONS.
2) EQT SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "D".

Engineering Survey Environmental GIS

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CHRIS S. KUHN
REGISTERED
9578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

STREAM CROSSING DETAILS

OXF 157

WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013

SCALE: N/A

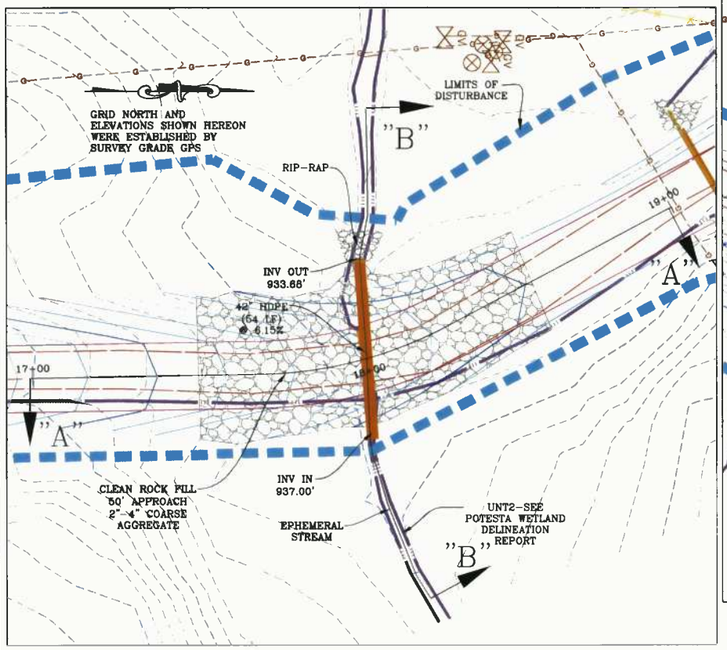
DESIGNED BY: CSK

FILE NO. 7889

SHEET 23 OF 31

STREAM CROSSING DETAILS

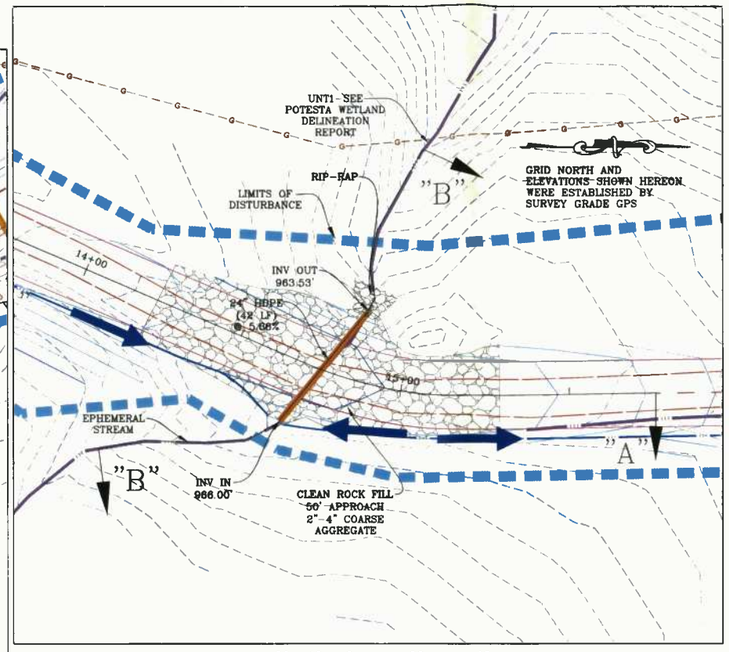
STREAM CROSSING "E" DETAILS



20 10 0 20 40

SCALE: 1" = 20'

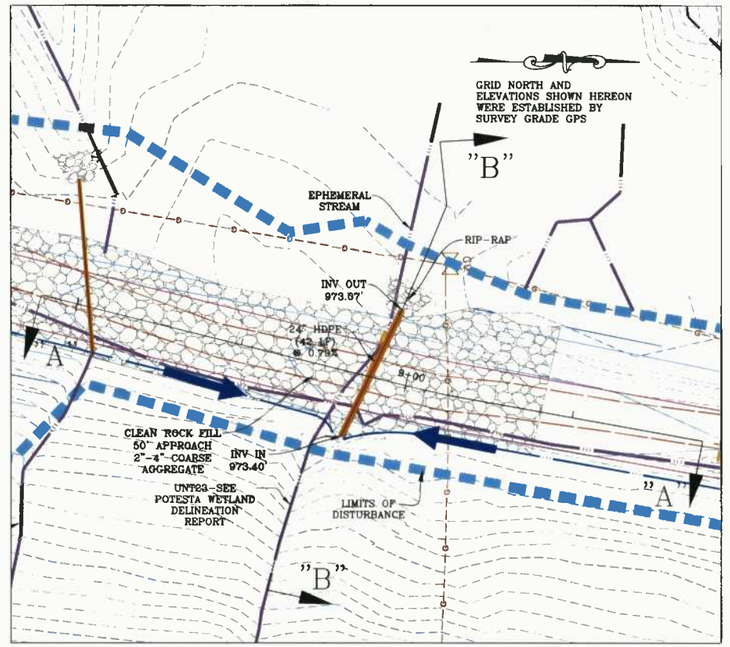
STREAM CROSSING "F" DETAILS



20 10 0 20 40

SCALE: 1" = 20'

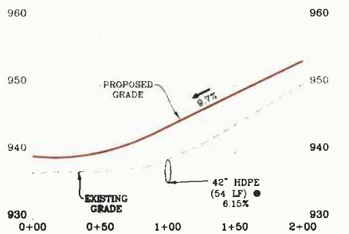
STREAM CROSSING "G" DETAILS



20 10 0 20 40

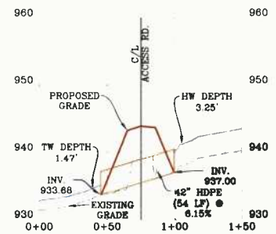
SCALE: 1" = 20'

STREAM CROSSING "E" SECTIONS



CROSS SECTION "A-A"

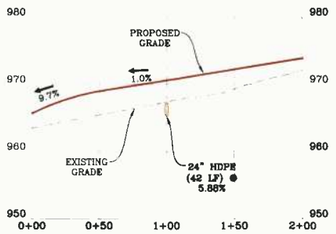
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

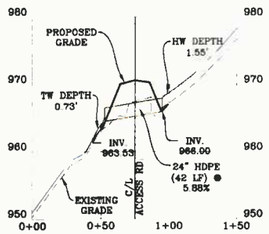
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

STREAM CROSSING "F" SECTIONS



CROSS SECTION "A-A"

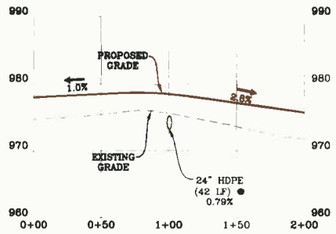
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

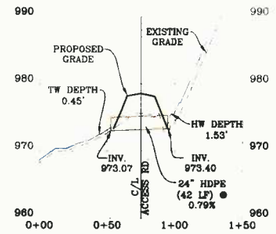
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

STREAM CROSSING "G" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

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GENERAL STREAM CROSSING NOTES:

1) 2" TO 4" COARSE AGGREGATE OR LARGER SHALL BE USED TO FORM THE FIRST 6" OF FILL FOR THE CROSSING, THE REMAINDER OF MATERIAL SHALL BE ONLY LARGE ANGULAR DURABLE ROCK. "DO NOT USE ERODIBLE MATERIAL FOR CONSTRUCTION OF THE CROSSING."
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NOTE:

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Engineering • Survey • Environmental • GIS

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Cameron, WV 26033
(740) 917-9911

CHRIS S. KUNZ
REGISTERED
9578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

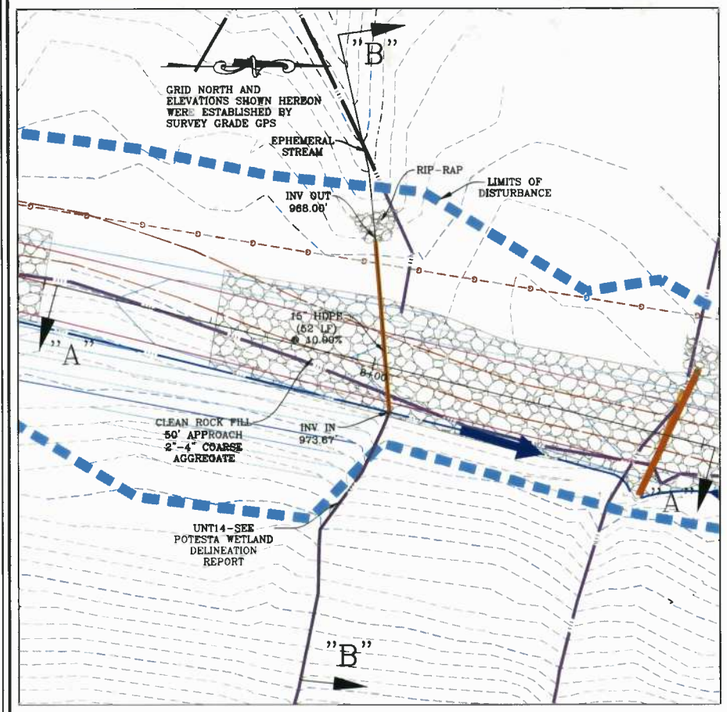
THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

STREAM CROSSING DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7889
SHEET 24 OF 31

STREAM CROSSING DETAILS

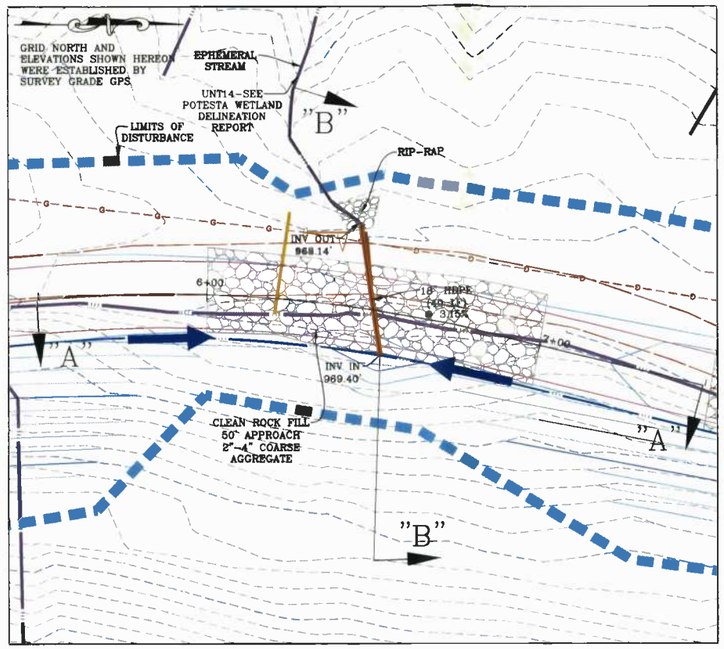
STREAM CROSSING "E" DETAILS



20 10 0 20 40

SCALE: 1" = 20'

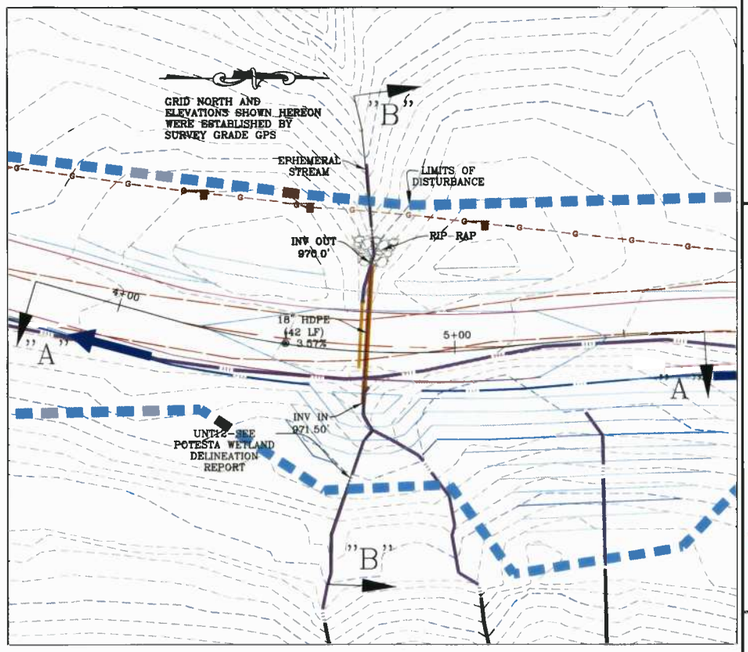
STREAM CROSSING "F" DETAILS



20 10 0 20 40

SCALE: 1" = 20'

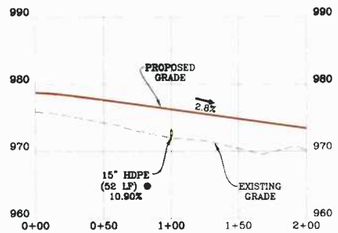
STREAM CROSSING "G" DETAILS



20 10 0 20 40

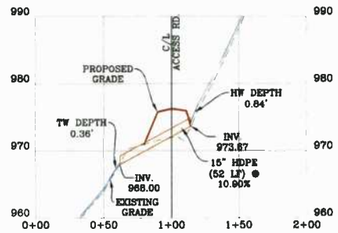
SCALE: 1" = 20'

STREAM CROSSING "H" SECTIONS



CROSS SECTION "A-A"

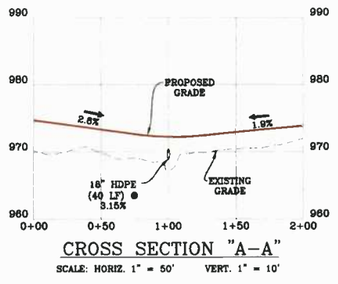
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

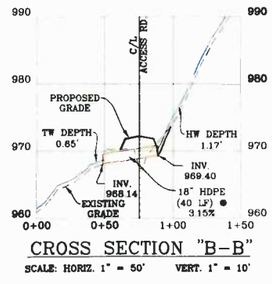
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

STREAM CROSSING "I" SECTIONS



CROSS SECTION "A-A"

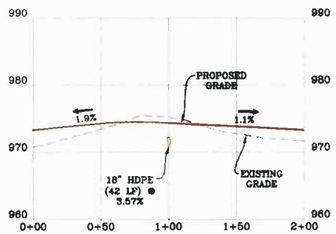
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

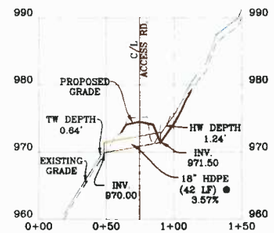
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

STREAM CROSSING "J" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL STREAM CROSSING NOTES:

1) 2" TO 4" COARSE AGGREGATE OR LARGER SHALL BE USED TO FORM THE FIRST 6" OF FILL FOR THE CROSSING, THE REMAINDER OF MATERIAL SHALL BE ONLY LARGE ANGULAR DURABLE ROCK. "DO NOT USE ERODIBLE MATERIAL FOR CONSTRUCTION OF THE CROSSING."
2) DEPTH OF STONE COVER OVER THE CULVERTS SHALL BE EQUAL TO ONE-HALF THE CULVERT DIAMETER OR 12 INCHES, WHICHEVER IS GREATER.
3) IF MULTIPLE CULVERTS ARE USED, THEY SHALL BE SEPARATED BY AT LEAST 12 INCHES OF COMPACTED AGGREGATE FILL.
4) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
5) FILTER CLOTH SHALL BE PLACED ON THE STREAM BED AND STREAM BANKS PRIOR TO PLACEMENT OF THE PIPE CULVERTS AND AGGREGATE. THE FILTER CLOTH SHALL COVER THE STREAMBED AND EXTEND A MINIMUM OF SIX INCHES AND A MAXIMUM OF ONE FOOT BEYOND THE END OF THE CULVERTS AND BEDDING MATERIAL.
6) A WATER DIVERTING SWALE OR PUMP AROUND SYSTEM SHALL BE CONSTRUCTED ACROSS THE ROADWAY ON EITHER SIDE OF THE STREAM CROSSING AS DIRECTED.
7) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
8) TIMBER ABUTMENTS ON THE UPSTREAM AND DOWNSTREAM SIDE OF THE CULVERT INSTALLATION SHALL BE INSTALLED TO REDUCE STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
9) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
10) GREEN CONCRETE SHALL NOT BE PLACED IN CONTACT WITH FLOWING WATER.
11) WHEN THE CROSSING HAS SERVED ITS PURPOSE, ALL STRUCTURES INCLUDING CULVERTS, BEDDING, AND FILTER CLOTH SHALL BE REMOVED. REMOVAL OF THE STRUCTURE AND CLEAN UP OF THE AREA SHOULD BE ACCOMPLISHED WITHOUT CONSTRUCTION EQUIPMENT WORKING IN THE WATERWAY CHANNEL. UPON REMOVAL OF THE STRUCTURE, THE STREAM BANK SHALL IMMEDIATELY BE STABILIZED.
12) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
13) THE CROSSING MUST BE INSPECTED AFTER EVERY RAIN EVENT OF 0.5 INCHES OR MORE AND ONCE A WEEK TO ENSURE THAT THE CULVERTS, STREAMBED, AND STREAM BANKS ARE MAINTAINED AND NOT DAMAGED. NEVER ALLOW THE CULVERTS TO BECOME CLOGGED WITH DEBRIS AND REMOVE ANY OBSTRUCTIONS IMMEDIATELY.
14) FLUSHING IS NOT AN APPROVED METHOD TO BE UTILIZED FOR CULVERT CLEANOUT.
15) ALL CROSSING STRUCTURES SHALL BE ANCHORED IN ACCORDANCE WITH THE DODDRIDGE COUNTY FLOODPLAIN ORDINANCE.

NOTE:

1) SEE STREAM CROSSING REPORT BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATATIONS.
2) EQT SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "H", "I" & "J".

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CYRUS B. FLOWER
REGISTERED
9578
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

STREAM CROSSING DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE:	11/04/2013
SCALE:	N/A
DESIGNED BY:	CSK
FILE NO.	7889
SHEET	25 OF 31

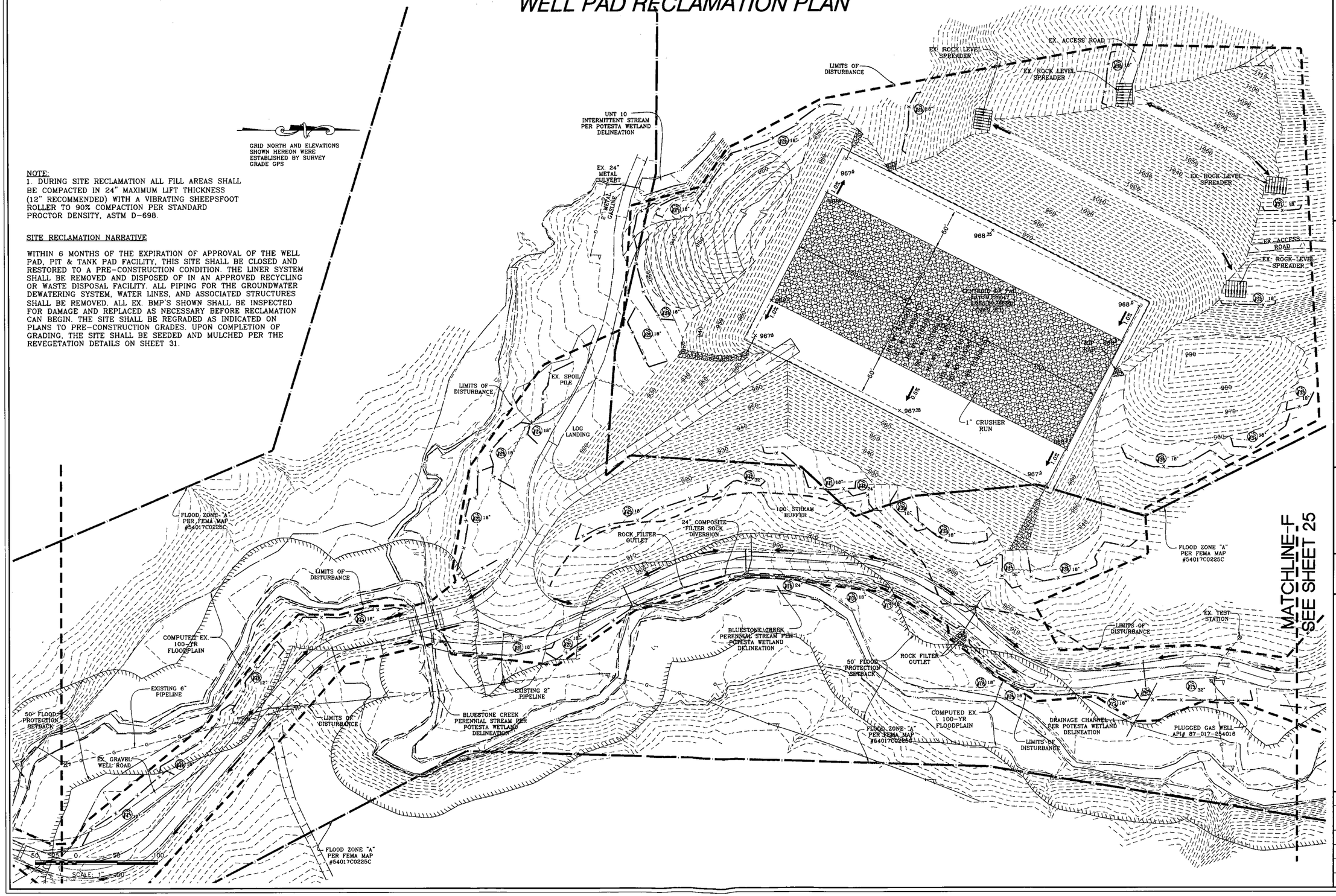
WELL PAD RECLAMATION PLAN

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

NOTE:
1. DURING SITE RECLAMATION ALL FILL AREAS SHALL BE COMPACTED IN 24" MAXIMUM LIFT THICKNESS (12" RECOMMENDED) WITH A VIBRATING SHEEPSFOOT ROLLER TO 90% COMPACTION PER STANDARD PROCTOR DENSITY, ASTM D-698.

SITE RECLAMATION NARRATIVE

WITHIN 6 MONTHS OF THE EXPIRATION OF APPROVAL OF THE WELL PAD, PIT & TANK PAD FACILITY, THIS SITE SHALL BE CLOSED AND RESTORED TO A PRE-CONSTRUCTION CONDITION. THE LINER SYSTEM SHALL BE REMOVED AND DISPOSED OF IN AN APPROVED RECYCLING OR WASTE DISPOSAL FACILITY. ALL PIPING FOR THE GROUNDWATER DEWATERING SYSTEM, WATER LINES, AND ASSOCIATED STRUCTURES SHALL BE REMOVED. ALL EX. BMP'S SHOWN SHALL BE INSPECTED FOR DAMAGE AND REPLACED AS NECESSARY BEFORE RECLAMATION CAN BEGIN. THE SITE SHALL BE REGRADED AS INDICATED ON PLANS TO PRE-CONSTRUCTION GRADES. UPON COMPLETION OF GRADING, THE SITE SHALL BE SEEDED AND MULCHED PER THE REVEGETATION DETAILS ON SHEET 31.



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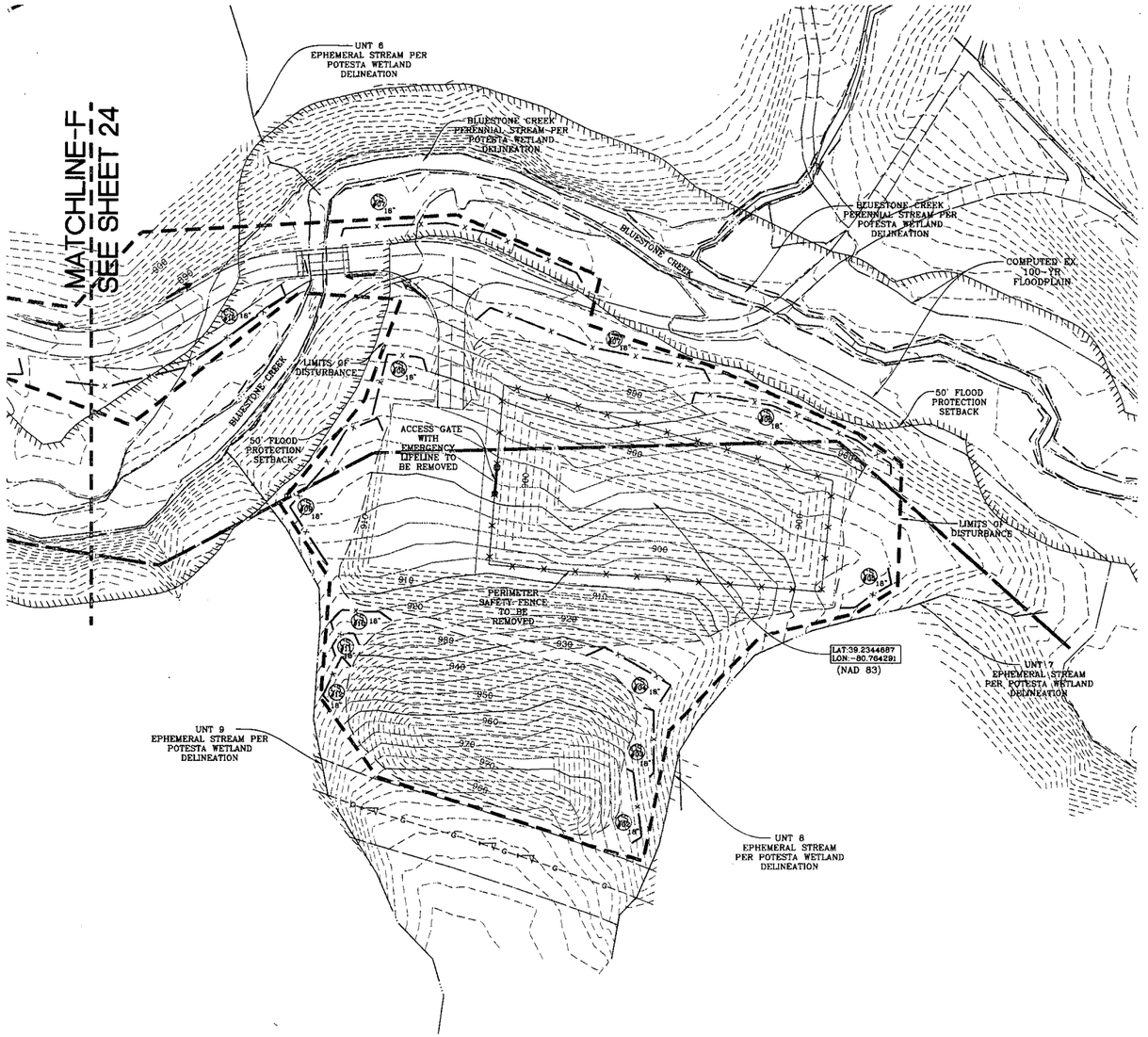
CERTIFIED PROFESSIONAL ENGINEER
CHRIS S. LUCI
REGISTERED
19578
STATE OF WEST VIRGINIA
11/04/2013

THIS DOCUMENT WAS PREPARED BY:
NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

WELL PAD RECLAMATION PLAN
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: 1" = 50'
DESIGNED BY: CSK
FILE NO. 7889
SHEET 26 OF 31

ASSOCIATED PIT RECLAMATION PLAN



NOTE:
1. DURING SITE RECLAMATION ALL FILL AREAS SHALL BE COMPACTED IN 24" MAXIMUM LIFT THICKNESS (12" RECOMMENDED) WITH A VIBRATING SHEEPSFOOT ROLLER TO 90% COMPACTION PER STANDARD PROCTOR DENSITY, ASTM D-698.

SITE RECLAMATION NARRATIVE

WITHIN 6 MONTHS OF THE EXPIRATION OF APPROVAL OF THE WELL PAD, PIT, & TANK PAD FACILITY, THIS SITE SHALL BE CLOSED AND RESTORED TO A PRE-CONSTRUCTION CONDITION. THE LINER SYSTEM SHALL BE REMOVED AND DISPOSED OF IN AN APPROVED RECYCLING OR WASTE DISPOSAL FACILITY. ALL PIPING FOR THE GROUNDWATER DEWATERING SYSTEM, WATER LINES, AND ASSOCIATED STRUCTURES SHALL BE REMOVED. ALL EX. BMP'S SHOWN SHALL BE INSPECTED FOR DAMAGE AND REPLACED AS NECESSARY BEFORE RECLAMATION CAN BEGIN. THE SITE SHALL BE REGRADED AS INDICATED ON PLANS TO PRE-CONSTRUCTION GRADES. UPON COMPLETION OF GRADING, THE SITE SHALL BE SEEDED AND MULCHED PER THE REVEGETATION DETAILS ON SHEET 31.

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STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER
11/04/2013

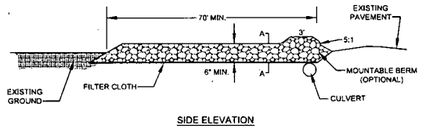
THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

ASSOCIATED PIT RECLAMATION PLAN
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

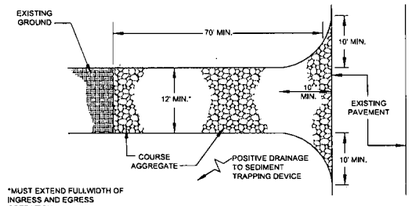
DATE: 11/04/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7689
SHEET 27 OF 31

FIGURE 3.02.1

STONE CONSTRUCTION ENTRANCE

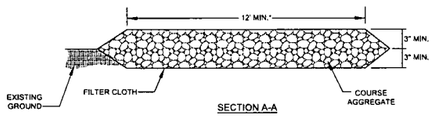


SIDE ELEVATION



*MUST EXTEND FULLWIDTH OF INGRESS AND EGRESS OPERATION

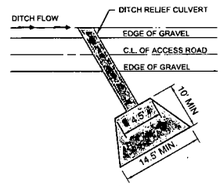
PLAN VIEW



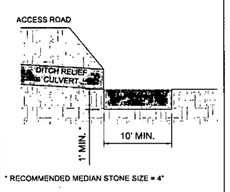
SECTION A-A

SOURCE: ADAPTED from the 1983 Maryland Standards for Soil Erosion and Sediment Control Via: DSWC

TYPICAL DITCH RELIEF CULVERT OUTLET TREATMENT



PLAN VIEW
NTS



* RECOMMENDED MEDIAN STONE SIZE = 4"

SECTION VIEW
NTS

NOTE:
ALL DITCH LINE PROTECTION SHALL BE INSTALLED AS RECOMMENDED IN THE WEST VIRGINIA EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE (BMP) MANUAL. DITCH LINE PROTECTION SHALL BE BASED ON THE FOLLOWING GRADES:

1. LESS THAN 3% – GRASSED
2. 3–8% – GRASS WITH ROLLED EROSION CONTROL PRODUCTS (RECP)
3. GREATER THAN 9% – RIPRAP OR EQUIVALENT GEOTEXTILE

IF HIGH EROSIVE SOILS ARE ENCOUNTERED DURING CONSTRUCTION, THE ENGINEER SHOULD BE CONTACTED FOR FURTHER EVALUATION.

Modified Figure 3.1 – Typical Roadside Ditch Section Sump at Ditch Relief Culvert

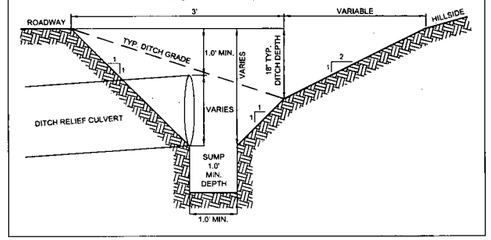
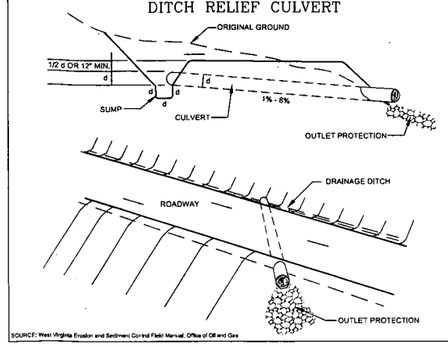


FIGURE II-4

DITCH RELIEF CULVERT



SOURCE: West Virginia Erosion and Sediment Control Field Manual, Office of Oil and Gas

Table II-5

Pipe Sizes for Culverts Across Roads		
Drainage Area (Ac)	Pipe Diameter (In)	Pipe Capacity (Cfs)
10	15	5
20	18	9
30	21	12
50	24	18
80	27	24
100	30	28
300	36	60
500	42	85

Table II-6

Spacing of Culverts	
Road Grade %	Distance (Ft)
2-5	500-300
6-10	300-200
11-15	200-100
16-20	100

FIGURE 3.05.1

ROCK CHECK DAM

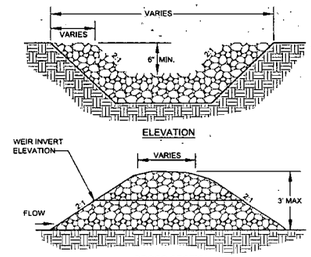
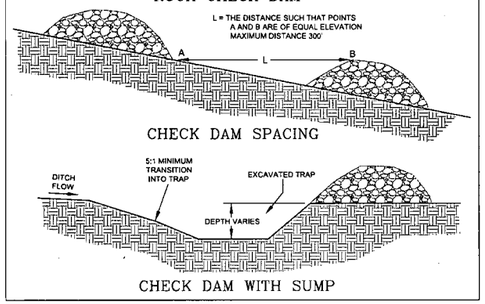
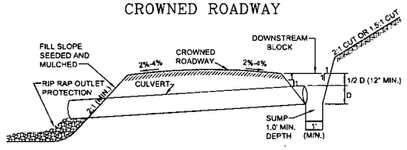


FIGURE 3.05.2

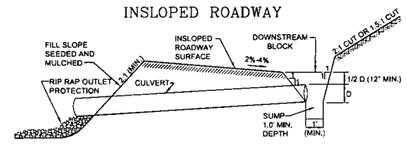
ROCK CHECK DAM



CROWNED ROADWAY



INSLOPED ROADWAY



Cut and fill slopes shall be stabilized immediately upon completion of roadway grading. These areas shall be blanketed wherever they are located within 50 feet of a surface water or within 100 feet of a surface water where a suitable vegetative filter strip does not exist.

A durable top dressing shall be provided for soils having low strength.

Roadside ditches shall be provided with adequate protective lining.

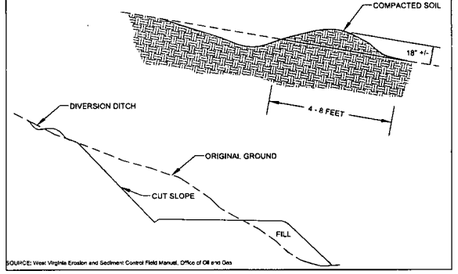
Adequately sized culverts or other suitable cross drains shall be provided at all seeps, springs, and drainageways.

Roadway shall be inspected weekly and after each runoff event. Damaged roadways, ditches, or cross drains shall be repaired immediately.

SOURCE: PA DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF OIL AND GAS MANAGEMENT, 5800-FM-OGM0111 APPENDIX A BMP CONSTRUCTION DETAILS (MODIFIED)

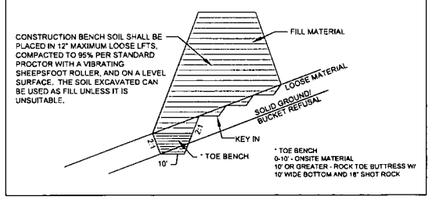
FIGURE II-3

DIVERSION DITCH – TEMPORARY



SOURCE: West Virginia Erosion and Sediment Control Field Manual, Office of Oil and Gas

TOE BENCH DETAIL



TURNOUT

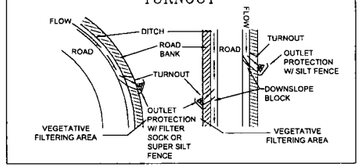
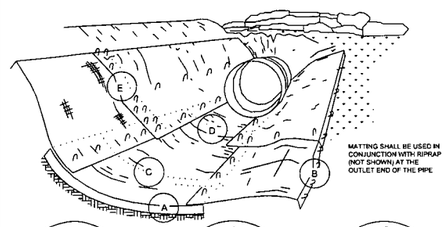
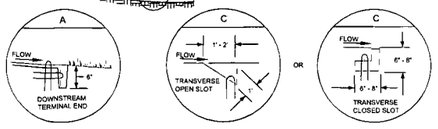


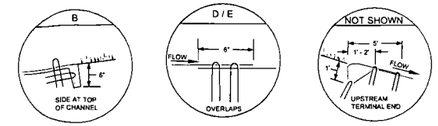
FIGURE 3.13.1

TYPICAL RECP CHANNEL INSTALLATION





THESE CONFIGURATIONS ARE EXAMPLES ONLY ALWAYS INSTALL PER MANUFACTURER'S RECOMMENDATIONS

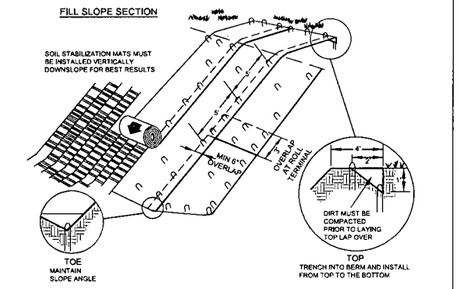


SOURCE: VA DCR-DSWC AND NORTH AMERICAN GREEN

FIGURE 3.13.2

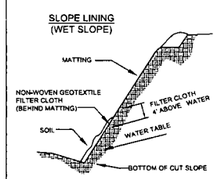
ROLLED EROSION CONTROL PRODUCTS

FILL SLOPE SECTION

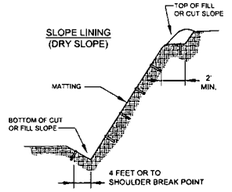


NOTE: SLOPE SURFACE MUST BE SMOOTH AND FREE OF ROCKS, LUMPS, GRASS AND STICKS. MATS MUST BE PLACED FLAT ON SURFACE FOR PROPER SOIL CONTACT.

SLOPE LINING (WET SLOPE)



SLOPE LINING (DRY SLOPE)



SOURCE: VDOT STANDARDS AND VA DCR-DSWC

Engineering Survey Environmental GIS

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STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

11/04/2013

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CONSTRUCTION DETAILS

OXF 157

WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013

SCALE: N/A

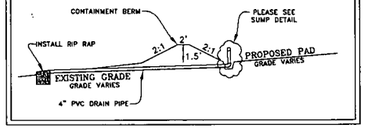
DESIGNED BY: CSK

FILE NO. 7889

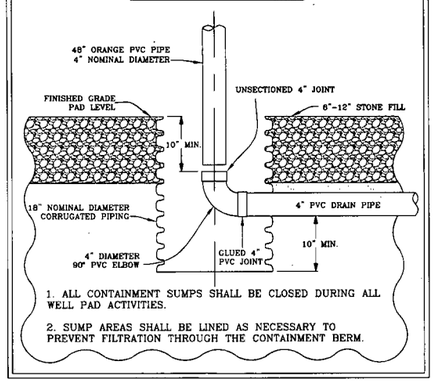
SHEET 28 OF 31

BERM TYPICAL

NOT TO SCALE

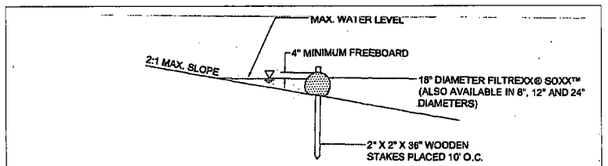


SUMP TYPICAL

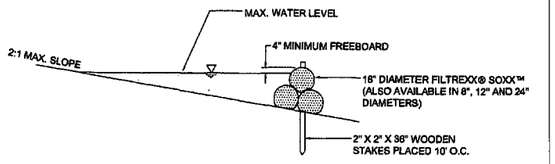


1. ALL CONTAINMENT SUMPS SHALL BE CLOSED DURING ALL WELL PAD ACTIVITIES.

2. SUMP AREAS SHALL BE LINED AS NECESSARY TO PREVENT FILTRATION THROUGH THE CONTAINMENT BERM.



SINGLE INSTALLATION SECTION
NTS

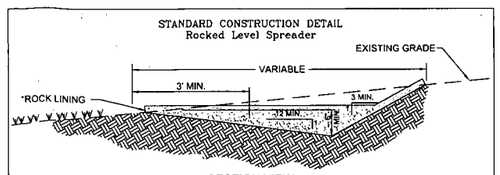


PYRAMID INSTALLATION SECTION
NTS

FILTREXX® RUNOFF DIVERSION SECTIONS

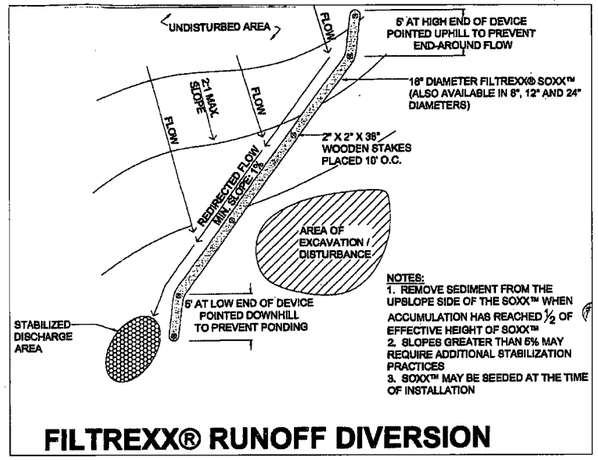
NTS

STANDARD CONSTRUCTION DETAIL
Rocked Level Spreader



SECTION VIEW
NTS

*All Level Spreader rock shall be a minimum of R4.

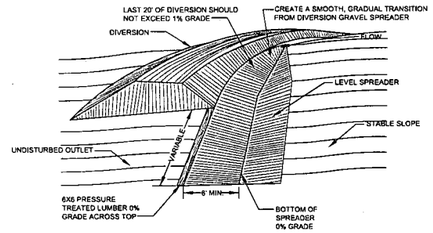


NOTES:
1. REMOVE SEDIMENT FROM THE UPSLOPE SIDE OF THE SOXX™ WHEN ACCUMULATION HAS REACHED ½ OF EFFECTIVE HEIGHT OF SOXX™
2. SLOPES GREATER THAN 5% MAY REQUIRE ADDITIONAL STABILIZATION PRACTICES
3. SOXX™ MAY BE SEEDED AT THE TIME OF INSTALLATION

FILTREXX® RUNOFF DIVERSION

FIGURE 3.02.1

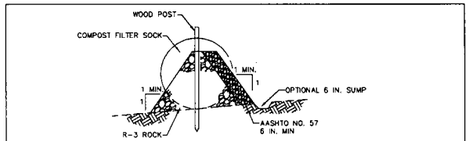
LEVEL SPREADER



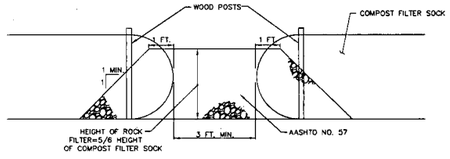
PERSPECTIVE VIEW

NOTE: ALL TEMPORARY BERMS, SWALES AND LEVEL SPREADER DITCHES MUST RECEIVE TEMPORARY SEEDING AND MULCHING AFTER INSTALLATION

SOURCE: ADAPTED FROM N.C. DAS Control Planning and Design Manual and VA DCSCI



OUTLET CROSS-SECTION



UP-SLOPE FACE

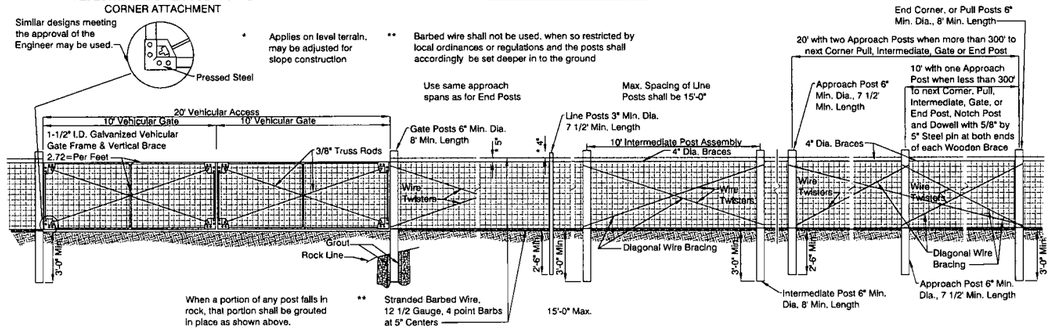
NOTES:

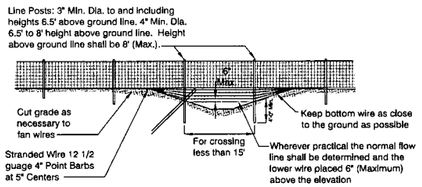
A ROCK FILTER OUTLET SHALL BE INSTALLED WHERE FAILURE OF A COMPOST FILTER SOCK HAS OCCURRED DUE TO CONCENTRATED FLOW.

SEDIMENT SHALL BE REMOVED WHEN ACCUMULATIONS REACH 1/3 THE HEIGHT OF THE OUTLET.

ROCK FILTER OUTLET
(MODIFIED FROM PA DEP)
NOT TO SCALE

CONSTRUCTION DETAIL
TYPICAL FENCE SECTION





DETAIL SHOWING TYPICAL SECTION AT MINOR DEPRESSIONS AND WET WEATHER CROSSINGS

NOTES:

Posts and braces may be either round or square shaped. Dimensions shown on the plans are for round posts and braces only. When square posts are used, line posts shall be 3" square (min.);braces 4" square (min.); corner, end, pull, gate, approach, and intermediate posts 6" square (min.).
The positioning of the fence fabric and barbed wire on the posts, as shown on the "Typical Fence Section" detail, applies for level and gentle sloping terrain. For fence erected on slopes, the positioning may be adjusted to meet the slope conditions as long as the adjustment is continued from post to post in a uniform manner. Trenching on slopes may be warranted. On slopes, posts will continue to be erected vertically, unless otherwise directed, and the ends of the fencing fabric shall be cut on a skew as may be necessary for proper connection to the posts.

Dumped rock channel protection will be used at channel crossings when called for on the plans.

Install drainage structure terminal installation as called for on the plans and/or as shown on typical fence details.

Unless otherwise specified, or directed by the Engineer, the farm field fence may be installed with the fence fabric and barbed wire positioned on either side of the fence posts.

Hardware and miscellaneous fittings, not specifically designated herein as to type or dimensions, shall conform to the applicable requirements of Section 608 of the Specifications and shall be of good quality commercial design acceptable to the Engineer.

In lieu of the barbed wire detailed herein, the following additional types are acceptable, provided they retain the "4-point barb at 5-inch centers" requirement and provided they meet or exceed the strength and coating requirements for the standard, 12 1/2 gauge, barbed wire as called for in 712.10 of the Specifications.
(a) stranded, 15 1/2 gauge, high carbon steel barbed wire
(b) one strand, 12 gauge, steel barbed wire

Vehicular gate frames (and vertical braces) may be either galvanized steel pipe members as shown herein or may be triple-coated steel pipe members meeting the requirements specified on Standard Sheet F2. All other metal components of the gate shall be galvanized, with the exception of the die-cast aluminum corner fittings, or pressed steel corner fittings.

BRUSH PILE SEDIMENT BARRIER
FIGURE II-10

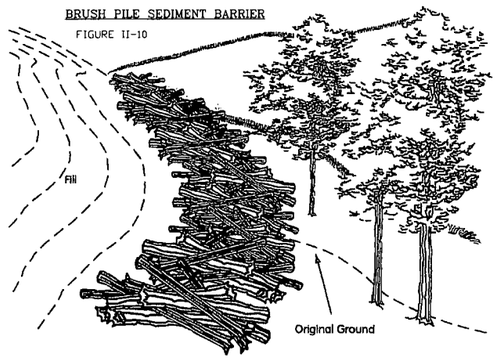
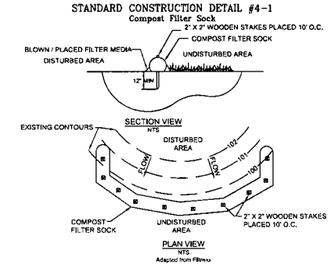


Table 4.1
Compost Sock Fabric Minimum Specifications

Material Type	3 mil HDPE	5 mil HDPE	5 mil HDPE	Multi-Filament Polypropylene (MFPP)	Heavy Duty Multi-Filament Polypropylene (HDMFPP)
Material Characteristics	Photo-degradable	Photo-degradable	Bio-degradable	Photo-degradable	Photo-degradable
Sock Diameters	12" 18"	12" 18" 24" 32"	12" 18" 24" 32"	12" 18" 24" 32"	12" 18" 24" 32"
Mesh Opening	3/8"	3/8"	3/8"	3/8"	1/8"
Textile Strength		28 psi	28 psi	44 psi	202 psi
Ultraviolet Stability % Original Strength (ASTM G-155)	23% at 1000 hr.	23% at 1000 hr.		100% at 1000 hr.	100% at 1000 hr.
Minimum Functional Longevity	6 months	9 months	6 months	1 year	2 years
Two-ply systems					
Inner Containment Netting				HDPE biaxial net	
				Continuously wound	
				Fusion-welded junctures	
				3/4" x 3/4" Max. aperture size	
Outer Filtration Mesh				Composite Polypropylene Fabric (Woven layer & non-woven fleece mechanically fused via needle punch)	
				3/16" Max. aperture size	
Sock fabrics composed of burlap may be used on projects lasting 6 months or less.					

STANDARD CONSTRUCTION DETAIL #4-1
Compost Filter Sock



PLAN VIEW
Adapted from Filtrexx

Sock fabric shall meet standards of Table 4.1. Compost shall meet the following standards:

Organic Matter Content	80% -100% (dry weight basis)
Organic Portion	Fibrous and elongated
pH	5.5-8.0
Moisture Content	35%-55%
Particle Size	98% pass through 1" screen
Soluble Salt Concentration	5.0 dS Maximum

Compost Filter Sock shall be placed at existing level grade. Both ends of the sock shall be extended at least 8 feet up the slope at 45 degrees to the main sock alignment. Maximum slope length above any sock shall not exceed manufacturer's maximum permissible slope length.

Traffic shall not be permitted to cross filter socks.

Accumulated Sediment shall be removed when it reaches 1/2 the above ground height of the sock and disposed in the manner described elsewhere in the plan.

Socks shall be inspected weekly and after each runoff event. Damaged socks shall be repaired according to manufacturer's specifications or replaced within 24 hours of inspection.

Biodegradable filter socks shall be replaced after 6 months; photodegradable socks after 1 year. Polypropylene socks shall be replaced according to manufacturer's recommendations.

Upon stabilization of the area tributary to the sock, stakes shall be removed. The sock may be left in place and vegetated or removed. In the latter case, the mesh shall be cut open and the mulch spread as a soil supplement.

In the event the ground is frozen, #5 rebar with safety caps shall be used instead of wooden stakes to anchor the filter sock. Once the ground thaws the rebar anchors shall be removed and replaced with 2" x 2" wooden stakes and installed as shown in the detail above.

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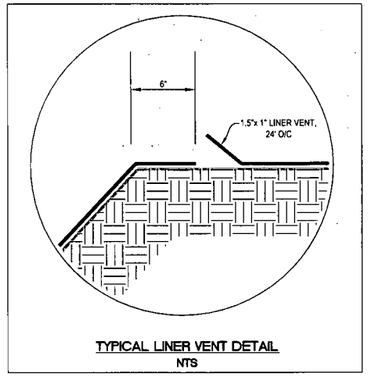
JOSHUA B. KINCAID
19578
STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER
11/4/2013

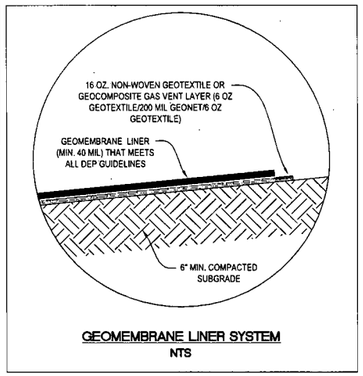
THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

CONSTRUCTION DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

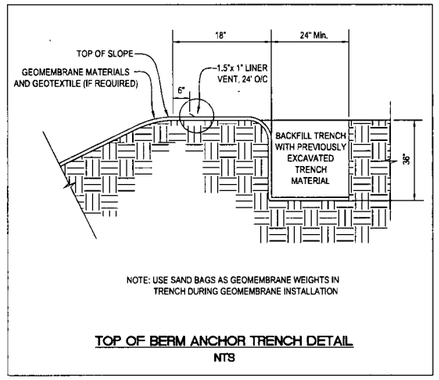
DATE: 11/04/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7889
SHEET 29 OF 31



TYPICAL LINER VENT DETAIL
NTS

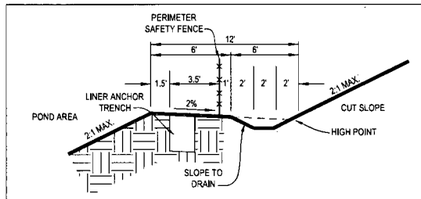


GEOMEMBRANE LINER SYSTEM
NTS

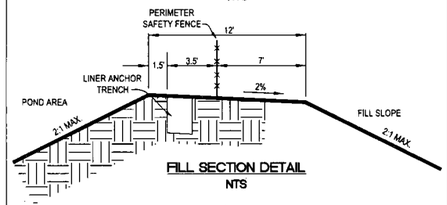


NOTE: USE SAND BAGS AS GEOMEMBRANE WEIGHTS IN TRENCH DURING GEOMEMBRANE INSTALLATION

TOP OF BERM ANCHOR TRENCH DETAIL
NTS



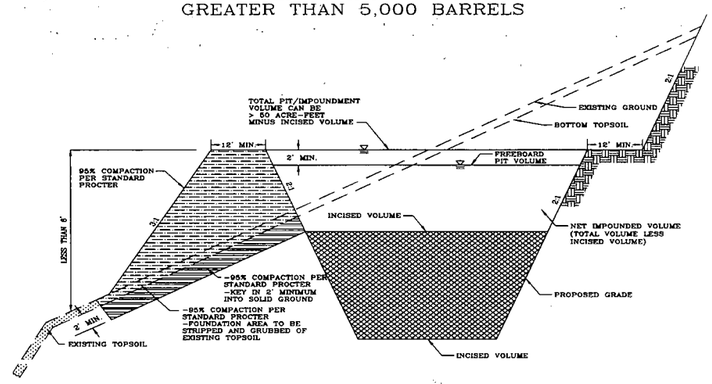
CUT SECTION DETAIL
NTS



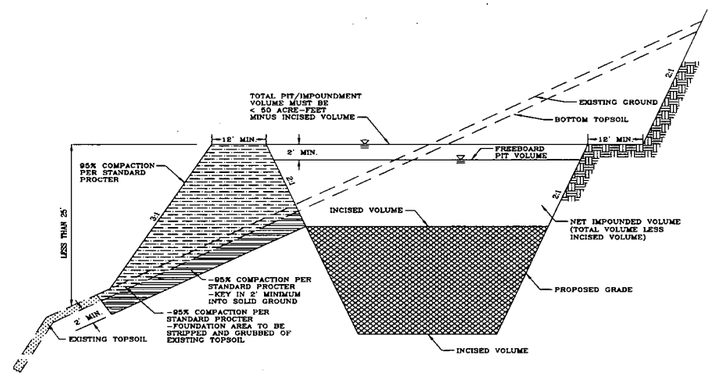
FILL SECTION DETAIL
NTS

IMPOUNDMENT/PIT BENCH DETAIL
NTS

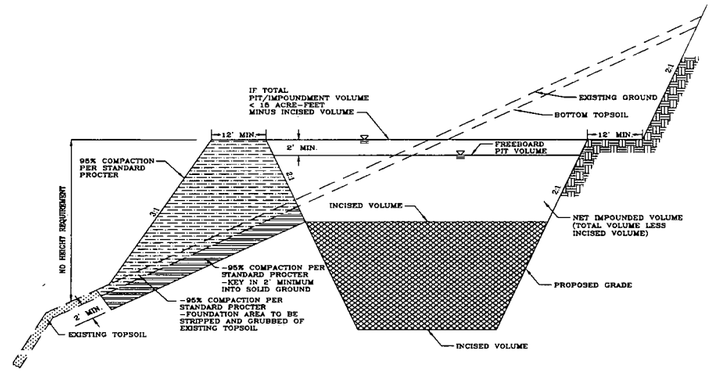
WEST VIRGINIA CODE 35 CSR 4
DESIGN AND CONSTRUCTION REQUIREMENTS FOR ASSOCIATED PITS, ASSOCIATED IMPOUNDMENTS, & CENTRALIZED IMPOUNDMENTS GREATER THAN 5,000 BARRELS



SECTION VIEW



SECTION VIEW



SECTION VIEW

NOTES:
1. ALL FILL SHOULD BE KEYED IN TO ORIGINAL GROUND EVERY 2-5 VERTICAL FEET DEPENDING ON EXISTING GROUND SLOPE

2. MINIMUM OUTSIDE AND INSIDE EMBANKMENT (FILL) SLOPES SHALL BE 2H:1V. THE INSIDE AND OUTSIDE SLOPES MUST ADD UP TO 5H:1V.

NTS

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HONESTY, INTEGRITY, QUALITY

CHRIS S. KING
REGISTERED
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STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
11/04/2013

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

CONSTRUCTION DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
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DESIGNED BY: CSK
FILE NO. 7889
SHEET 30 OF 31

REVEGETATION

Taken from the
West Virginia Erosion and Sediment Control Field Manual
West Virginia Division of Environmental Protection Office of Oil and Gas
Charleston, W.Va.
Section IV

Temporary Seeding

a.General Conditions Where Practice Applies
Where exposed soil surfaces are not to be fine-graded or worked for periods longer than 21 days. Temporary vegetative cover with sediment controls must be established where runoff will go directly into a stream. Immediately upon construction of the site (site includes road and location), vegetation must be established on road bank and location slopes. A permanent vegetative cover shall be applied to areas that will be left un-worked for a period of more than six months.

b.Seed Mixtures and Planting Dates
Refer to Tables 2 through 4 for recommended dates to establish vegetative cover and the approved lists of temporary and permanent plant species, and planting rates. Table 3 gives recommended types of temporary vegetation, rates of application, and optimum seeding dates. In situations where another cover is desired, contact the local soil conservation district for seeding recommendations.

c.Seed Application
Apply seed by broadcasting, drilling, or by hydroseed according to the rates indicates in Table IV-3. Perform all planting operations at right angles to the slope. Necessary site preparation and roughening of the soil surface should be done just prior to seeding. Seedbed preparation may not be required on newly disturbed areas.

Permanent Seeding

a.General
Permanent vegetative cover will be established where no further soil disturbance is anticipated or needed. Soil fertility and pH level should be tested and adjusted according to seed species planted. Planting of permanent vegetative covers must be performed on all disturbed areas after completion of the drilling process. Any site that contains significant amounts of topsoil shall have the topsoil removed and stockpiled when feasible. Topsoil should not be added to slopes steeper than 2:1 unless a good bonding to the sub-layer can be achieved. After proper grading and seedbed preparation, the vegetation will reestablish ground cover for the control of surface water runoff erosion.
All required seedbed preparation and loosening of soil by disking or dozer tracking should be performed just prior to seeding. If seedbed preparation is not feasible, 50% more seed shall be added to the recommended rates shown in Tables IV-3 and IV-4.
When hydroseeding, seedbed preparation may not be necessary if adequate site preparation was performed. Incorporate the appropriate amount of lime and/or fertilizer in the slurry mix when hydroseeding.
When hydroseeding, first mix the lime, fertilizer, and hydro-mulch in the recommended amount of water. Mix the seed and inoculants together within one hour prior to planting, and add to the slurry just before seeding. Apply the slurry uniformly over the prepared site. Assure that agitation is continuous throughout the seeding operation and the mix is applied within one hour of initial mixing.

b.Lime and Fertilizer
1. Lime shall be applied to all permanent seedings. The pH of the soil is to be determined and lime applied accordingly. Once the pH is known, select the amount of lime to be applied from Table IV-5.
2. Fertilizer shall be applied in all permanent seedings. Apply the equivalent for 500 lbs. minimum 10-20-20 fertilizer per acre or use the amount of fertilizer and lime recommended by a certified soil test.
3. Application: For best results and maximum benefits, the lime and fertilizer are to be applied at the time of seedbed preparation.

c.Permanent Seed Mixtures
Planners should take into consideration the species makeup of the existing pasture and the landowner's future pasture management plans when recommending seed mixtures. Selection: From Tables IV 4a and b, Permanent Seeding Mixtures Suitable for Establishment in West Virginia.
Notes:
1. All legumes must be planted with the proper inoculants prior to seeding.
2. 'Lathco' Flatpea is potentially poisonous to some livestock.
3. Only endophyte free varieties of Tall Fescue should be used. Tall Fescue and Crownvetch are also very invasive species, non-native to WV.
4. For unprepared seedbeds or seeding outside the optimum timeframes, add 50% more seed to the specified rate. Mixtures in Table 4b are more wildlife and farm friendly; those listed in bold are suitable for use in shaded woodland settings. Mixtures in italic are suitable for use in filter strips.

d.Seeding for Wildlife Habitat
Consider the use of the native plants or locally adapted plants when selecting cover types and species for wildlife habitat. Wildlife friendly species or mixes that have multiple values should be considered. See wildlife friendly species/mixtures in Table IV-4b. Consider selecting no or low maintenance long-lived plants adaptable to sites which may be difficult to maintain with equipment.

Mulching

a.General Organic Mulches
The application of straw, hay or other suitable materials to the soil surface to prevent erosion. Straw made from wheat or oats is the preferred mulch, the use of hay is permissible, but not encouraged due to the risk of spreading invasive species. Mulch must be applied to all temporary and permanent seeding on all disturbed areas. Depending on site conditions, in critical areas such as waterways or steep slopes, additional or substitute soil protective measures may be used if deemed necessary. Examples include jute mesh and soil stabilization blankets or erosion control matting.
Areas that have been temporarily or permanently seeded should be mulched immediately following seeding. Mulches conserve desirable soil properties, reduce soil moisture loss, prevent crusting and sealing of the soil surface and provide a suitable microclimate for seed germination.
Areas that cannot be seeded because of the season should be mulched to provide some protection to the soil surface. An organic mulch, straw or hay should be used and the area then seeded as soon as weather or seasonal conditions permit. Do not use fiber mulch (cellulose-hydroseed) alone for this practice; at normal application rates it will not give the soil protection of other types of mulch.
Wood cellulose fiber mulch is used in hydroseeding operations and applied as part of the slurry. It creates the best seed-soil contact when applied over the top of (as a separate operation) newly seeded areas. Fiber mulch does not alone provide sufficient protection on highly erodible soils, or during less than favorable growing conditions. Fiber mulch should not be used alone during the dry summer months or when used for late fall mulch cover. Use straw mulch during these periods and fiber mulch may be used to tack (anchor) the straw mulch. Fiber mulch is well suited for steep slopes, critical areas and areas susceptible to wind.

b.Chemical Mulches, Soil Binders and Tackifiers
A wide range of synthetic spray on materials are marketed to stabilize and protect the soil surface. These are mixed with water and sprayed over the mulch and to the soil. They may be used alone in some cases as temporary stabilizers, or in conjunction with fiber mulch, straw or hay.
When used alone most chemical mulches do not have the capability to insulate the soil or retain soil moisture that organic mulches have.

c.Specifications
From Table IV-6 select the type of mulch and rate of application that will best suit the conditions at the site.

d.Anchoring
Depending on the field situation, mulch may not stay in place because of wind action or rapid water runoff. In such cases, mulch is to be anchored mechanically or with mulch netting.
1. Mechanical Anchoring
Apply mulch and pull mulch anchoring tool over the mulch. When a disk is used set the disk straight and pull across slope. Mulch material should be tucked into the soil about three inches.
2. Mulch netting
Follow manufacturer's recommendation when positioning and stapling the mulch netting in the soil.

Table IV-1
Recommended Seeding Dates

Planting Dates	Suitability
March 1 - April 15 and August 1 - October 1	Best Seeding Periods
April 15 - August 1	HIGH RISK - moisture stress likely
October 1 - December 1	HIGH RISK - freeze damage to young seedlings
December 1 - March 1	Good seeding period. Dormant seeding

Table 2
Acceptable Fertilization Recommendation

Species	N (lbs/ac)	P2O5 (lbs/ac)	Example Rec. (per acre)
Cool Season Grass	40	80	400 lbs. 10-20-20
CS Grass & Legume	30	60	300 lbs. 10-20-20
Temporary Cover	40	40	200 lbs. 19-19-19

Table 3
Temporary Cover

Species	Seeding Rate (lbs/acre)	Optimum Seeding Dates	Drainage	pH Range
Annual Ryegrass	40	3/1 - 6/15 or 8/15 - 9/15	Well - Poorly	5.5 - 7.5
Field Bromegrass	40	3/1 - 6/15 or 8/15 - 9/15	Well - Mod. Well	6.0 - 7.0
Spring Oats	96	3/1 - 6/15	Well - Poorly	5.5 - 7.0
Sundangrass	40	5/15 - 8/15	Well - Poorly	5.5 - 7.5
Winter Rye	168	8/15 - 10/15	Well - Poorly	5.5 - 7.5
Winter Wheat	180	8/15 - 11/15	Well - Mod. Well	5.5 - 7.0
Japanese Millet	30	6/15 - 8/15	Well	4.5 - 7.0
Redtop	5	3/1 - 6/15	Well	4.0 - 7.5
Annual Ryegrass	26	3/1 - 6/15	Well - Poorly	5.5 - 7.5
Spring Oats	64	3/1 - 6/15	Well - Poorly	5.5 - 7.5

NOTE: *These rates should be increased by 50% if planted April 15 - August 1 and October 1 - March 1.*

Table 4a
Permanent Seeding Mixture

Species/Mixture	Seeding Rate (lbs/acre)	Soil Drainage preference	pH Range
Crownvetch /	10 - 15	Well - Mod. Well	5.0 - 7.5
Tall Fescue	30		
Crownvetch /	10 - 15	Well - Mod. Well	5.0 - 7.5
Perennial Ryegrass	20		
Flatpea or Perennial Pea /	20	Well - Mod. Well	4.0 - 8.0
Tall Fescue	15		
Ladino Clover /	30		
Serecia Lespedeza /	25	Well - Mod. Well	4.5 - 7.5
Tall Fescue	2		
Tall Fescue /	*40*		
Ladino Clover /	*3*	*Well - Mod. Well*	*5.0 - 7.5*
Redtop	*3*		
Crownvetch /	10		
Tall Fescue /	20	Well - Mod. Well	5.0 - 7.5
Redtop	3		
Tall Fescue /	40		
Birdsfoot Trefoil /	10	Well - Mod. Well	5.0 - 7.5
Redtop	3		
Serecia Lespedeza /	25		
Tall Fescue /	30	Well - Mod. Well	4.5 - 7.5
Redtop	3		
Redtop /	30		
Tall Fescue /	3	Well - Mod. Well	5.0 - 7.5
Creeping Red	50		
Tall Fescue	*50*	*Well - Poorly*	*4.5 - 7.5*
Perennial Ryegrass /	10		
Tall Fescue /	15	Well -Poorly	5.8 - 8.0
Lathco Flatpea *	20		

** 'Lathco' Flatpea is potentially poisonous to some livestock. All legumes should be planted with proper inoculants prior to seeding. For unprepared seedbeds or seeding outside the optimum timeframe, add 50% more seed to the specified rate.*
Mixtures listed in bold are suitable for use in shaded woodland settings; those in italics are suitable for use in filter strips.

Table 4b
Wildlife and Farm Friendly Seed Mixtures

Species/Mixture	Seeding Rate (lbs/acre)	Soil Drainage preference	pH Range
KY Bluegrass /	20		
Redtop /	3	Well - Mod. Well	5.5 - 7.5
Ladino Clover or Birdsfoot Trefoil	2 / 10		
Timothy /	5	Well - Mod. Well	6.5 - 8.0
Alfalfa	12		
Timothy /	5	Well - Poorly	5.5 - 7.5
Birdsfoot Trefoil	8		
Orchardgrass /	*10*		
Ladino Clover /	*2*	*Well - Mod. Well*	*5.5 - 7.5*
Redtop	*3*		
Orchardgrass /	*10*	*Well - Mod. Well*	*5.5 - 7.5*
Ladino Clover	*2*		
Orchardgrass /	*20*	*Well - Mod. Well*	*5.5 - 7.5*
Perennial Ryegrass	*10*		
Creeping Red Fescue /	30	Well - Mod. Well	5.5 - 7.5
Perennial Ryegrass	10		
Orchardgrass or KY Bluegrass	20	Well - Mod. Well	6.0 - 7.5
Birdsfoot Trefoil /	10		
Redtop /	5	Well - Mod. Well	5.5 - 7.5
Orchardgrass	20		
Lathco Flatpea */	30	Well - Mod. Well	5.5 - 7.5
Perennial Ryegrass	20		
Lathco Flatpea */	30	Well - Mod. Well	5.5 - 7.5
Orchardgrass	20		

** 'Lathco' Flatpea is potentially poisonous to some livestock. All legumes should be planted with proper inoculants prior to seeding. For unprepared seedbeds or seeding outside the optimum timeframe, add 50% more seed to the specified rate.*

Mixtures listed in bold are suitable for use in shaded woodland settings; those in italics are suitable for use in filter strips.

Table IV-5
Lime and Fertilizer Application Table

pH of Soil	Lime in Tons per Acre	Fertilizer, Lbs. per Acre (10-20-20 or Equivalent)
Above 6.0	2	500
5.0 to 6.0	3	500
Below 5.0	4	500

The pH can be determined with a portable pH testing kit or by sending the soil samples to a soil testing laboratory. When 4 tons of lime per acre are applied it must be incorporated into the soil by disking, backblading or tracking up and down the slope.

Table IV-6
Mulch Materials Rates and Uses

Material	Minimum Rates per acre	Coverage	Remarks
Hay or Straw	2 to 3 Tons	Cover 75% to 90%	Subject to wind blowing or washing unless
	100 to 150 bales	of Surface	tied down
Wood Fiber	1000 to 1500 lbs	Cover all	For hydroseeding
Pulp Fiber		Disturbed Areas	
Wood - Cellulose			
Recirculated Paper			

Tables IV 1-4 taken from Natural Resources Conservation Service Manual 'Critical Area Planting'

NAVITUS ENGINEERING INC.
Engineering Survey Environmental GIS
151 Windy Hill Lane
Winchester, VA. 22602
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Professional Energy Consultants
A DIVISION OF SMITH LAND SURVEYING
ENGINEERS ENVIRONMENTAL SURVEYORS PROJECT MGMT.
SLS
228 West Main St.
P.O. Box 190
Salem, WV 26351
(304) 782-1624
2000 17th Avenue Road
Shadyside, OH 43947
(740) 671-0911
HONESTY. INTEGRITY. QUALITY.

CHRIS S. KUHN
REGISTERED
1978
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

THIS DOCUMENT WAS PREPARED BY:
NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

CONSTRUCTION DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7889
SHEET 31 OF 31

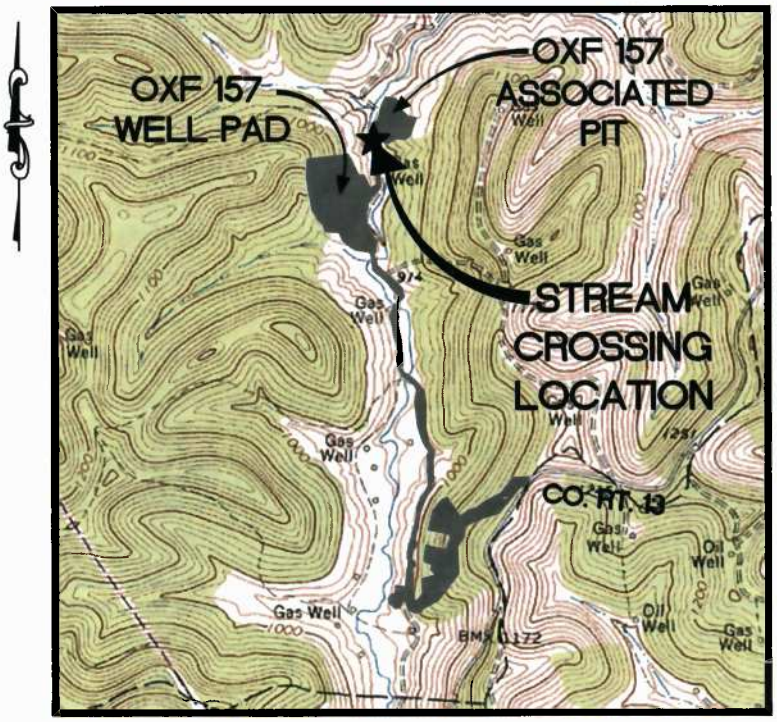
OXFORD 157 Stream Crossing Computations in Flood Zone (A-D)

1 of 2

STREAM CROSSING "A"
STORMWATER COMPUTATIONS

A

OXF 157 WELL PAD



VICINITY MAP
1" = 2,000'

NAVITUS
ENERGY ENGINEERING
Telephone: (888) 662-4185 | www.NavitusEng.com

Prepared For:
EQT Production Company
115 Professional Place
P.O. Box 280
Bridgeport, WV 26330

Contact:
Victoria J. Roark
Permitting Supervisor
(304) 848-0076

Designed By:
Navitus Engineering Inc.

Project Manager:
Chandler Pearson
cpearson@navituseng.com

MARK D. SMITH
REGISTERED
No. 11709
WEST VIRGINIA
PROFESSIONAL ENGINEER

Date: June 3, 2014

Surface Owner (s)
Justin L. Henderson

Tax Parcel:
Map 6 Parcel 1

Location:
West Union District, Doddridge County
West Virginia

FN# 7889

OXF 157 WELL PAD

STREAM CROSSING "A"

STORMWATER COMPUTATIONS

Sections

SECTION 1

Overview

The intent of this project is to construct a gravel access road to a gas well pad site and associated facilities. This project will include a temporary stream crossing. Bluestone Creek, which has been classified as a perennial stream per the wetlands report conducted by Potesta Engineers and Environmental Consultants dated May 29, 2013, will be crossed at station 12+67.356 of the proposed access road.

Drainage Narrative

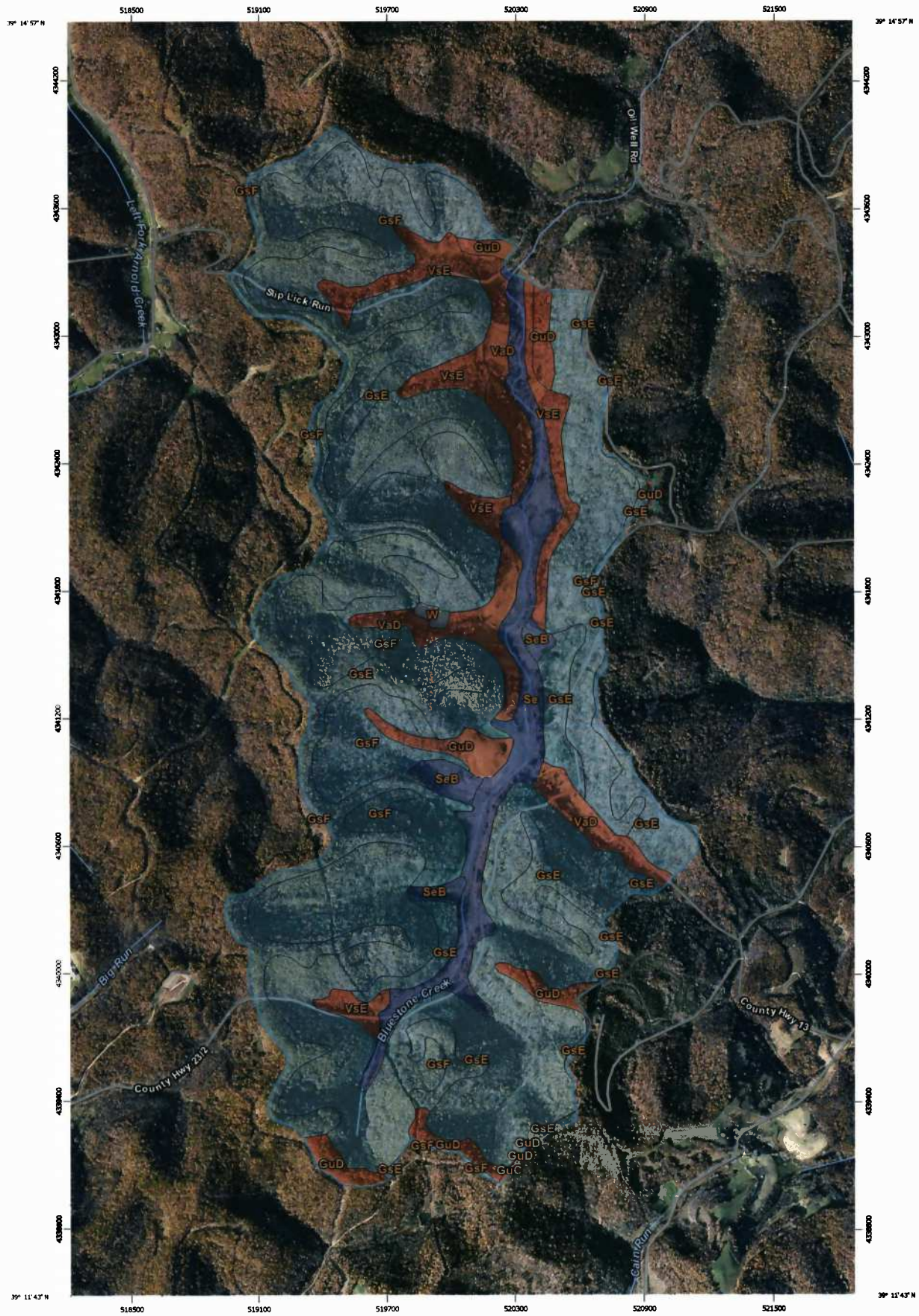
Using the SCS Method, with HEC-HMS, we determined the 1, 10, and 100-year rainfall events at the stream crossing study point. We then used HEC-RAS to design the crossings and to determine the base flow water surface elevation for each rainfall event. Stream Crossing "A" has a drainage area of 1,692.5 Acres. Design flows are shown as the downstream junction, provided in the drainage calculations in Section 3.

A 40 ft long steel bridge with timber abutments will be used to cross the stream channel. Disturbance to the stream channel will be limited to minor excavation at or near the stream bank, there will be no disturbance to the stream bed or flow. The bridge and abutments will be removed within 6 months when the associated facilities it serves are reclaimed. The crossing area will be restored to existing conditions upon removal.

SECTION 2

NRCS Soils Report

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



Map Scale: 1:16,800 if printed on B portrait (11" x 17") sheet.

N

0 200 400 800 1200 Meters

0 500 1000 2000 3000 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

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

Soils

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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

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

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 8, 2011—Oct 25, 2011

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Doddridge County, West Virginia (WV017)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
GsE	Gilpin-Peabody complex, 15 to 35 percent slopes, very stony	C	399.4	23.6%
GsF	Gilpin-Peabody complex, 35 to 70 percent slopes, very stony	C	930.6	55.0%
GuC	Gilpin-Upshur complex, 8 to 15 percent slopes	D	1.0	0.1%
GuD	Gilpin-Upshur complex, 15 to 25 percent slopes	D	60.3	3.6%
Se	Sensabaugh silt loam	B	113.3	6.7%
SeB	Sensabaugh silt loam, 3 to 8 percent slopes, rarely flooded	B	20.2	1.2%
VaD	Vandalia silt loam, 15 to 25 percent slopes	D	84.6	5.0%
VsE	Vandalia silt loam, 15 to 35 percent slopes, very stony	D	79.8	4.7%
W	Water		3.1	0.2%
Totals for Area of Interest			**1,692.5**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

SECTION 3

HEC-HMS
Drainage Computations

Project: OXF 157 Simulation Run: Existing

Start of Run:	04Sep2013, 00:00	Basin Model:	Existing
End of Run:	05Sep2013, 00:05	Meteorologic Model:	100 YR
Compute Time:	04Sep2013, 15:18	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Bluestone	0.882	443.8	04Sep2013, 12:55	95.5
Upper1 Bluestone	0.17	221.9	04Sep2013, 12:10	20.3
Junction-1	1.052	482.7	04Sep2013, 12:50	115.8
Reach-1	1.052	482.7	04Sep2013, 13:00	115.4
Middle1 Bluestone	0.252	189.6	04Sep2013, 12:30	28.7
Junction-2	1.304	601.9	04Sep2013, 12:50	144.1
Reach-2	1.304	601	04Sep2013, 13:10	143.1
Middle Bluestone	0.363	303	04Sep2013, 12:25	41.4
Junction-3	1.667	763.6	04Sep2013, 12:40	184.5
Reach-3	1.667	762	04Sep2013, 13:00	183.2
Lower Bluestone	0.286	238.7	04Sep2013, 12:20	31.4
Junction-4	1.953	855.6	04Sep2013, 13:00	214.6
Reach-4	1.953	853.6	04Sep2013, 13:05	214.2
Lower1 Bluestone	0.078	130	04Sep2013, 12:00	9
Junction-5	2.031	865	04Sep2013, 13:05	223.1
Reach-5	2.031	865	04Sep2013, 13:10	222.7
Lower2 Bluestone	0.188	175.7	04Sep2013, 12:20	22.3
Junction-6	2.219	914.4	04Sep2013, 13:10	245
Reach-6	2.219	910.4	04Sep2013, 13:25	243.8
Lower3 Bluestone	0.425	337.3	04Sep2013, 12:30	50.2
Downstream	2.644	1021.2	04Sep2013, 13:20	294

Project: OXF 157 Simulation Run: Existing

Start of Run:	04Sep2013, 00:00	Basin Model:	Existing
End of Run:	05Sep2013, 00:05	Meteorologic Model:	10 YR
Compute Time:	04Sep2013, 15:18	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Bluestone	0.882	189.7	04Sep2013, 13:00	44.7
Upper1 Bluestone	0.17	101.9	04Sep2013, 12:10	9.8
Junction-1	1.052	208.9	04Sep2013, 12:55	54.5
Reach-1	1.052	208.9	04Sep2013, 13:05	54.3
Middle1 Bluestone	0.252	83.2	04Sep2013, 12:30	13.7
Junction-2	1.304	259.4	04Sep2013, 12:55	67.9
Reach-2	1.304	259.3	04Sep2013, 13:10	67.4
Middle Bluestone	0.363	133.4	04Sep2013, 12:25	19.7
Junction-3	1.667	326.8	04Sep2013, 12:40	87.1
Reach-3	1.667	326.6	04Sep2013, 13:00	86.4
Lower Bluestone	0.286	102.3	04Sep2013, 12:25	14.7
Junction-4	1.953	371.5	04Sep2013, 13:00	101.1
Reach-4	1.953	369.7	04Sep2013, 13:05	100.8
Lower1 Bluestone	0.078	57.7	04Sep2013, 12:00	4.3
Junction-5	2.031	375.8	04Sep2013, 13:05	105.1
Reach-5	2.031	375.8	04Sep2013, 13:10	104.9
Lower2 Bluestone	0.188	79	04Sep2013, 12:20	10.8
Junction-6	2.219	400.9	04Sep2013, 13:10	115.7
Reach-6	2.219	399.6	04Sep2013, 13:25	115
Lower3 Bluestone	0.425	152.3	04Sep2013, 12:30	24.3
Downstream	2.644	453	04Sep2013, 13:25	139.3

Project: OXF 157 Simulation Run: Existing

Start of Run:	04Sep2013, 00:00	Basin Model:	Existing
End of Run:	05Sep2013, 00:05	Meteorologic Model:	1 YR
Compute Time:	04Sep2013, 15:18	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Bluestone	0.882	38.4	04Sep2013, 13:10	12.3
Upper1 Bluestone	0.17	22.4	04Sep2013, 12:10	2.9
Junction-1	1.052	43.9	04Sep2013, 13:05	15.3
Reach-1	1.052	43.9	04Sep2013, 13:15	15.2
Middle1 Bluestone	0.252	17.3	04Sep2013, 12:35	3.9
Junction-2	1.304	55	04Sep2013, 13:05	19.1
Reach-2	1.304	55	04Sep2013, 13:25	18.9
Middle Bluestone	0.363	27.6	04Sep2013, 12:30	5.7
Junction-3	1.667	68.2	04Sep2013, 13:05	24.6
Reach-3	1.667	68.2	04Sep2013, 13:25	24.3
Lower Bluestone	0.286	19.5	04Sep2013, 12:30	4.1
Junction-4	1.953	78.9	04Sep2013, 13:05	28.4
Reach-4	1.953	78.8	04Sep2013, 13:10	28.3
Lower1 Bluestone	0.078	12.9	04Sep2013, 12:05	1.2
Junction-5	2.031	80.8	04Sep2013, 13:10	29.5
Reach-5	2.031	80.8	04Sep2013, 13:15	29.4
Lower2 Bluestone	0.188	17.6	04Sep2013, 12:25	3.2
Junction-6	2.219	88	04Sep2013, 13:15	32.7
Reach-6	2.219	87.6	04Sep2013, 13:30	32.4
Lower3 Bluestone	0.425	34.2	04Sep2013, 12:35	7.3
Downstream	2.644	104.1	04Sep2013, 13:25	39.7

SECTION 4

HEC-RAS Culvert Analysis Report and Sections

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

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

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PROJECT DATA
Project Title: OXF 157-159 Bridges
Project File : OXF157-159Bridges.prj
Run Date and Time: 5/29/2014 12:53:55 PM

Project in English units

BRIDGE

RIVER: Bluestone Creek
REACH: Lower RS: 2862.727

BRIDGE OUTPUT Profile #PF 1

E.G. US. (ft)	890.63	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	890.07	E.G. Elev (ft)	890.62	890.62
Q Total (cfs)	1021.20	W.S. Elev (ft)	890.07	890.07
Q Bridge (cfs)	282.18	Crit W.S. (ft)	890.09	890.08
Q Weir (cfs)	739.02	Max Chl Dpth (ft)	5.43	5.63
Weir Sta Lft (ft)	64.92	Vel Total (ft/s)	4.05	4.16
Weir Sta Rgt (ft)	179.02	Flow Area (sq ft)	252.08	245.28
Weir Submerg	0.54	Froude # Chl	0.54	0.50
Weir Max Depth (ft)	2.81	Specif Force (cu ft)	501.37	503.33
Min El Weir Flow (ft)	888.30	Hydr Depth (ft)	2.30	2.14
Min El Prs (ft)	887.21	W.P. Total (ft)	161.07	181.74
Delta EG (ft)	0.37	Conv. Total (cfs)		
Delta WS (ft)	0.32	Top Width (ft)	109.69	114.59
BR Open Area (sq ft)	46.87	Frctn Loss (ft)		
BR Open Vel (ft/s)	6.02	C & E Loss (ft)		
Coef of Q		Shear Total (lb/sq ft)		

* Br Sel Method	* Press/Weir	* Power Total (lb/ft s)	* 0.00	* 0.00	*

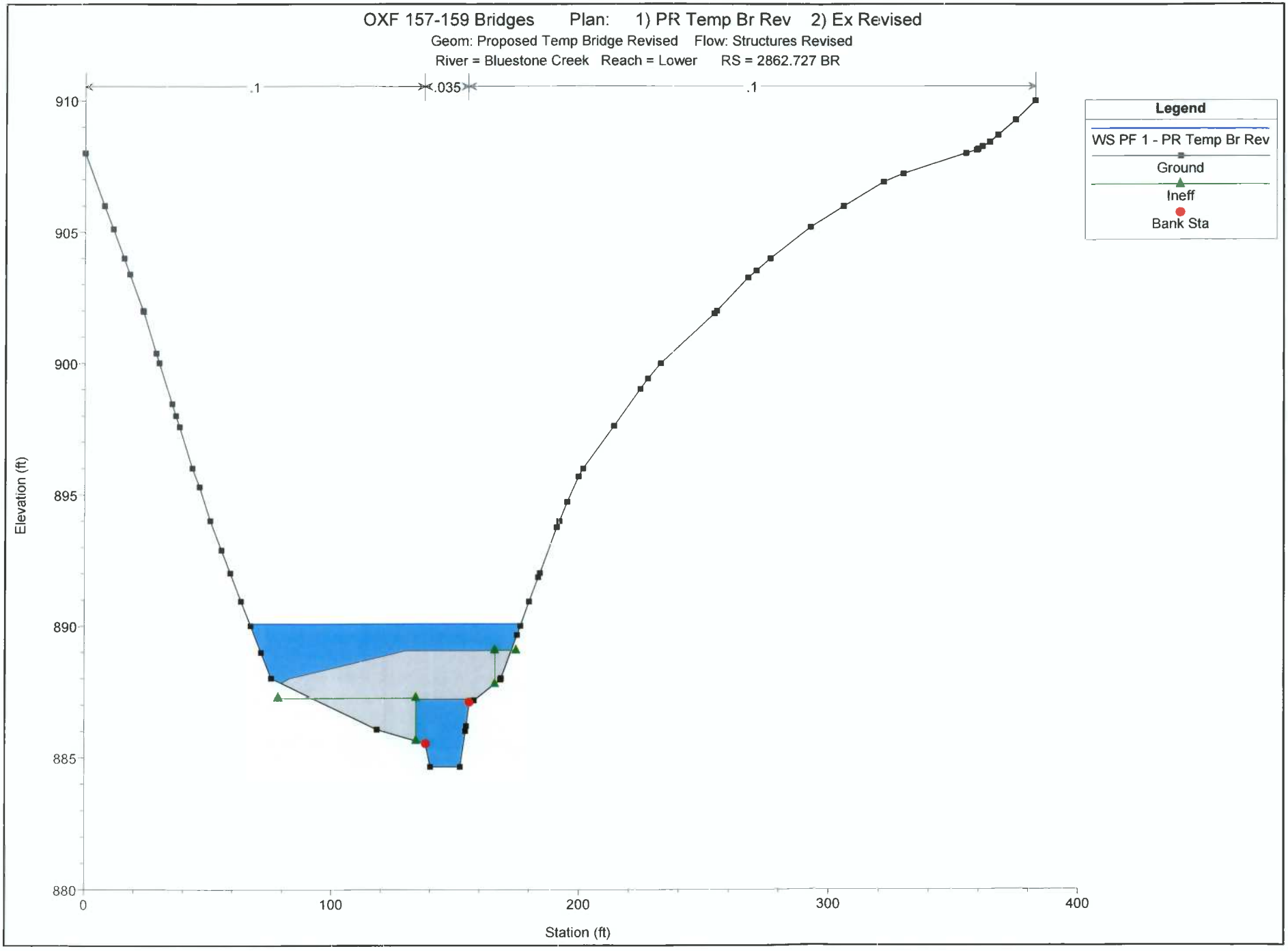
Note: The downstream water surface is above the minimum elevation required for orifice flow. The orifice flow equation was used for pressure flow.

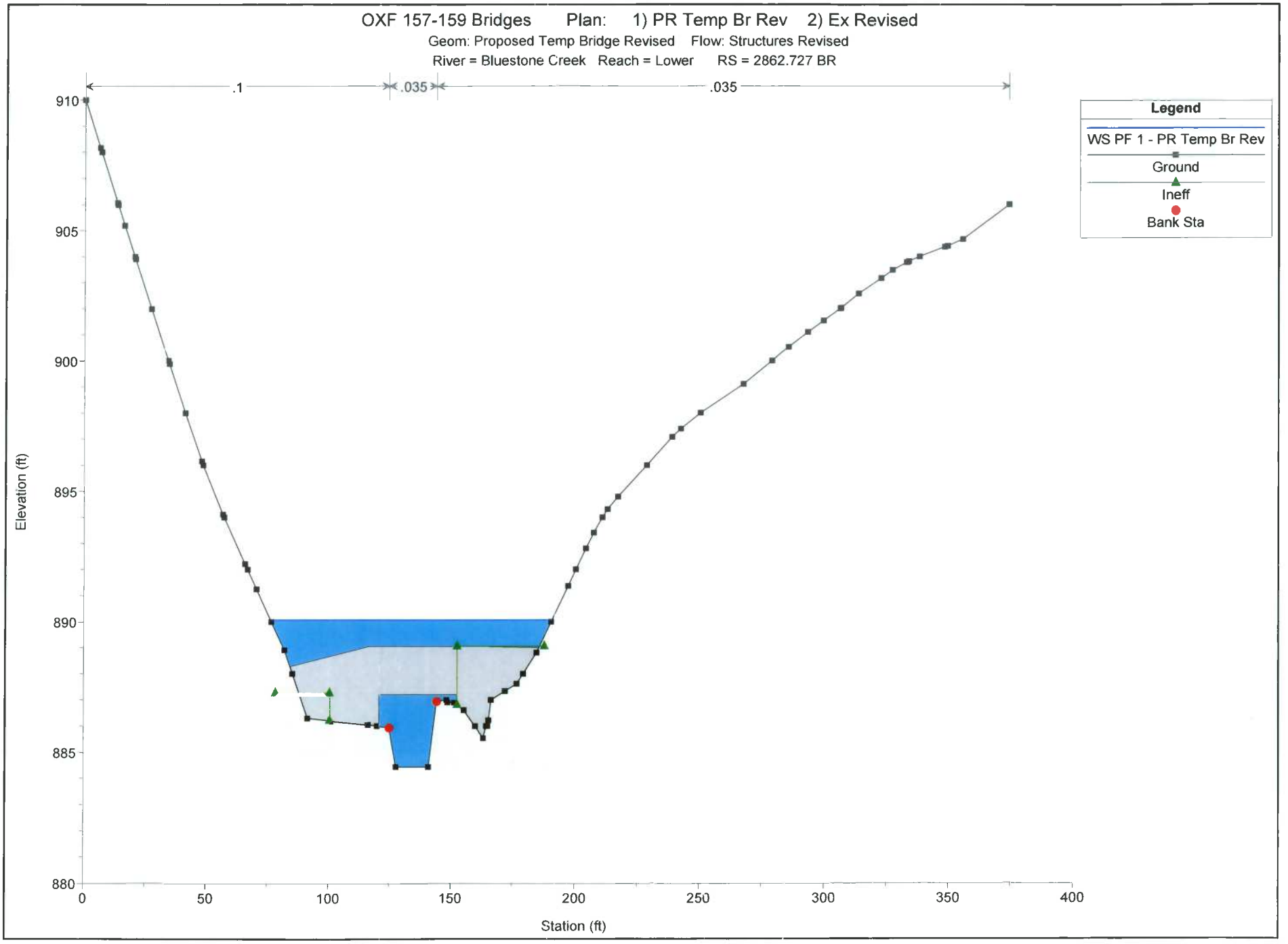
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

Note: For the cross section inside the bridge at the upstream end, the water surface and energy have been projected from the upstream cross section. The selected bridge modeling method does not compute answers inside the bridge.

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

Note: For the cross section inside the bridge at the downstream end, the water surface and energy have been projected from the downstream cross section. The selected bridge modeling method does not compute answers inside the bridge.


OXF 157-159 Bridges Plan: 1) PR Temp Br Rev 2) Ex Revised
Geom: Proposed Temp Bridge Revised Flow: Structures Revised
River = Bluestone Creek Reach = Lower RS = 2862.727 BR
.1
.035
.1
Legend
WS PF 1 - PR Temp Br Rev
Ground
Ineff
Bank Sta
Elevation (ft)
910
905
900
895
890
885
880
0
100
200
300
400
Station (ft)

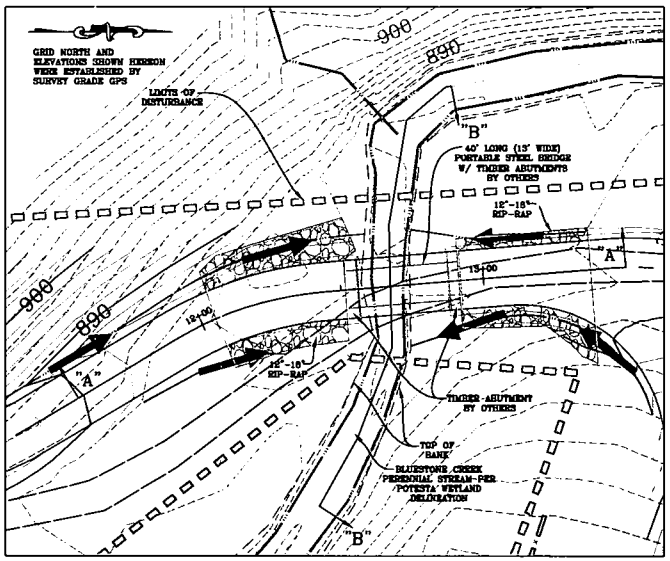

OXF 157-159 Bridges Plan: 1) PR Temp Br Rev 2) Ex Revised
Geom: Proposed Temp Bridge Revised Flow: Structures Revised
River = Bluestone Creek Reach = Lower RS = 2862.727 BR
.1
.035
.035
Legend
WS PF 1 - PR Temp Br Rev
Ground
Ineff
Bank Sta
Elevation (ft)
910
905
900
895
890
885
880
0
50
100
150
200
250
300
350
400
Station (ft)

SECTION 5

Stream Crossing "A" Details

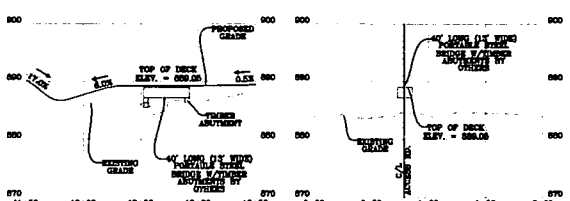
TEMPORARY STREAM CROSSING DETAILS

STREAM CROSSING "A" DETAILS



NOTE:
1) SEE STREAM CROSSING REPORT BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATATIONS.
2) EQT SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "A".

STREAM CROSSING "A" SECTIONS



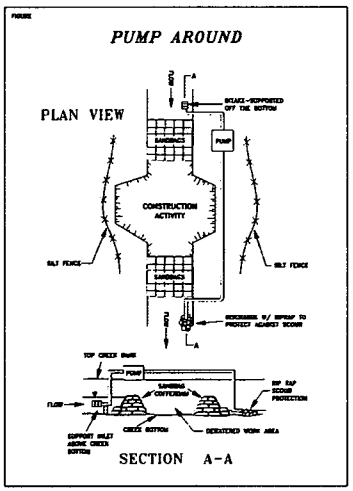
CROSS SECTION "A-A"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

CROSS SECTION "B-B"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL TEMPORARY STREAM CROSSING NOTES:

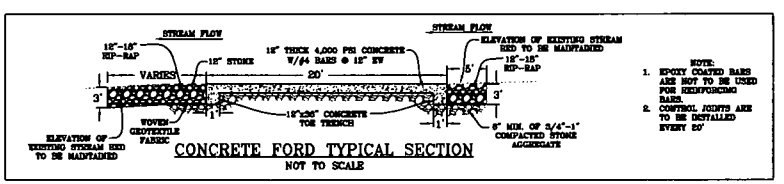
1) DO NOT USE ERODIBLE MATERIAL FOR CONSTRUCTION OF THE CROSSING.
2) CLEARING AND EXCAVATION OF THE STREAM BANKS SHALL BE KEPT TO A MINIMUM.
3) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
4) TIMBER ABUTMENTS FOR THE BRIDGE INSTALLATION SHALL BE INSTALLED TO REDUCE STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
5) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
6) DURING RIGHT OF WAY MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
7) THE TEMPORARY BRIDGE SHALL BE ANCHORED AS REQUIRED PER THE DODDRIDGE COUNTY FLOODPLAIN ORDINANCE.

PUMP AROUND



PUMP AROUND NOTES:

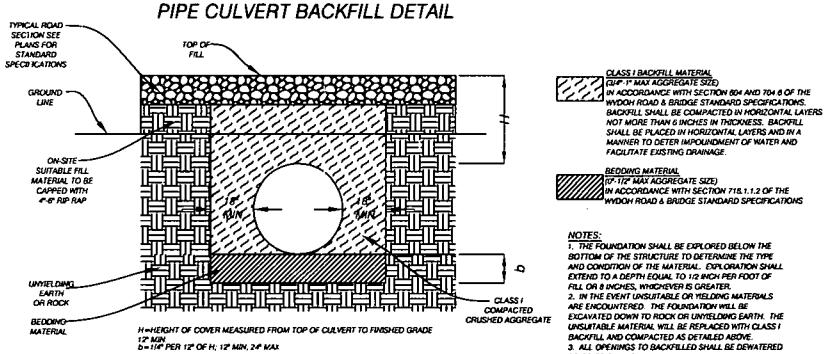
1) CONSTRUCTION SHOULD BE PERFORMED DURING LOW FLOW PERIODS.
2) PUMP(S) SHOULD BE SUFFICIENTLY LARGE TO PUMP THE ENTIRE STREAM FLOW AROUND THE SITE.
3) THE COFFERDAM CONSTRUCTED MUST BE IMPERVIOUS TO WATER.
4) THE INLET OF THE PUMP(S) IS TO BE SUSPENDED ABOVE THE STREAMBED IN ORDER TO PREVENT SUCKING MUD AND SEDIMENT.
5) THE DISCHARGE POINT MUST BE STABILIZED WITH ROCK TO DISPERSE THE ENERGY AND PREVENT EROSION.



CONCRETE FORD TYPICAL SECTION
NOT TO SCALE

NOTE:
1. EPOXY COATED BARS ARE NOT TO BE USED FOR REINFORCING BARS.
2. CONTROL JOINTS ARE TO BE INSTALLED EVERY 20'

PIPE CULVERT BACKFILL DETAIL



H=HEIGHT OF COVER MEASURED FROM TOP OF CULVERT TO FINISHED GRADE
12" MIN
D=1/4" PER 12" OF H; 12" MIN, 24" MAX

NOTES:
1. THE FOUNDATION SHALL BE EXPLORED BELOW THE BOTTOM OF THE STRUCTURE TO DETERMINE THE TYPE AND CONDITION OF THE MATERIAL. EXPLORATION SHALL EXTEND TO A DEPTH EQUAL TO 1/2 INCH PER FOOT OF FILL OR 8 INCHES, WHICHEVER IS GREATER.
2. IN THE EVENT UNSUITABLE OR YIELDING MATERIALS ARE ENCOUNTERED, THE FOUNDATION WILL BE EXCAVATED DOWN TO ROCK OR UNYIELDING EARTH. THE UNSUITABLE MATERIAL WILL BE REPLACED WITH CLASS I BACKFILL AND COMPACTED AS DETAILED ABOVE.
3. ALL OPENINGS TO BACKFILLED SHALL BE DEWATERED PRIOR TO FILLING.

NAVITUS ENERGY ENGINEERING
Telephone: (888) 662-4185 | www.NavitusEng.com
Professional Energy Consultants
A DIVISION OF SMITH LAND SURVEYING, INC.
SURVEYORS ENGINEERS ENVIRONMENTAL PROJECT MGMT.
(304) 462-5634 WWW.SLSSURVEYS.COM

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC. FOR: EQT PRODUCTION COMPANY

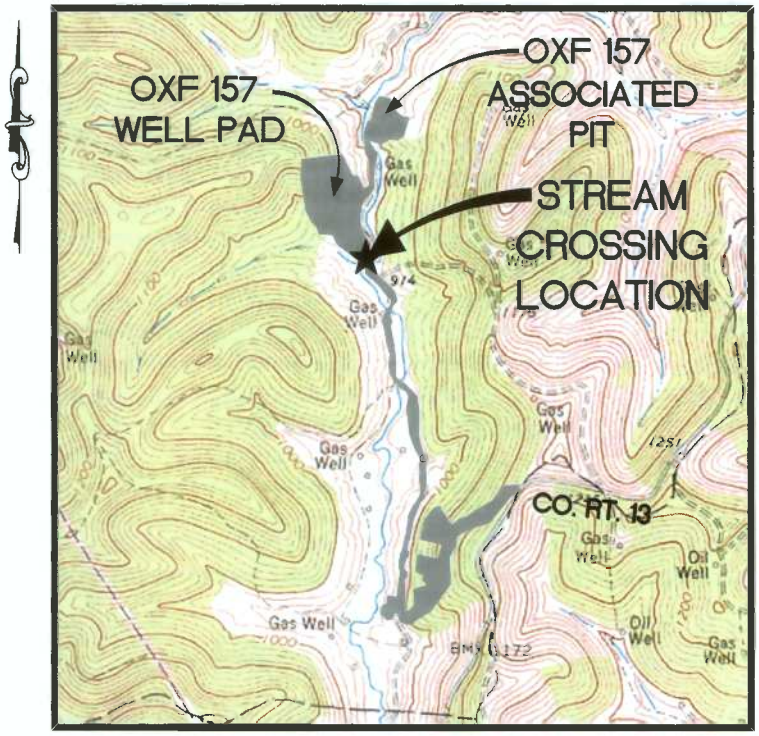
MAJOR STREAM CROSSING DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7589
SHEET 21 OF 32
REV: 06/03/2014

STREAM CROSSING "B"
STORMWATER COMPUTATIONS

OXF 157 WELL PAD

B



VICINITY MAP
1" = 2,000'

NAVITUS
ENERGY ENGINEERING
Telephone: (888) 662-4185 | www.NavitusEng.com

Prepared For:
EQT Production Company
115 Professional Place
P.O. Box 280
Bridgeport, WV 26330

Contact:
Victoria J. Roark
Permitting Supervisor
(304) 848-0076

Designed By:
Navitus Engineering Inc.

Project Manager:
Chandler Pearson
cpearson@navituseng.com

MARK D. SMITH
REGISTERED
No. 11709
WEST VIRGINIA
PROFESSIONAL ENGINEER

Date: June 3, 2014

Surface Owner (s)
Justin L. Henderson

Tax Parcel:
Map 6 Parcel 1

Location:
West Union District, Doddridge County
West Virginia

FN# 7889

OXF 157 WELL PAD

STREAM CROSSING "B"

STORMWATER COMPUTATIONS

Sections

SECTION 1

Overview

The intent of this project is to construct a gravel access road to a gas well pad site and associated facilities. This project will include a permanent stream crossing. Bluestone Creek, which has been classified as a perennial stream per the wetlands report conducted by Potesta Engineers and Environmental Consultants dated May 29, 2013, will be crossed at station 41+44.952 of the proposed access road.

Drainage Narrative

Using the SCS Method, with HEC-HMS, we determined the 1, 10, and 100-year rainfall events at the stream crossing study point. We then used HEC-RAS to design the crossings and to determine the base flow water surface elevation for each rainfall event. Stream Crossing "B" has a drainage area of 1,420.2 Acres. Design flows are shown as Junction-6 in the drainage calculations in Section 3.

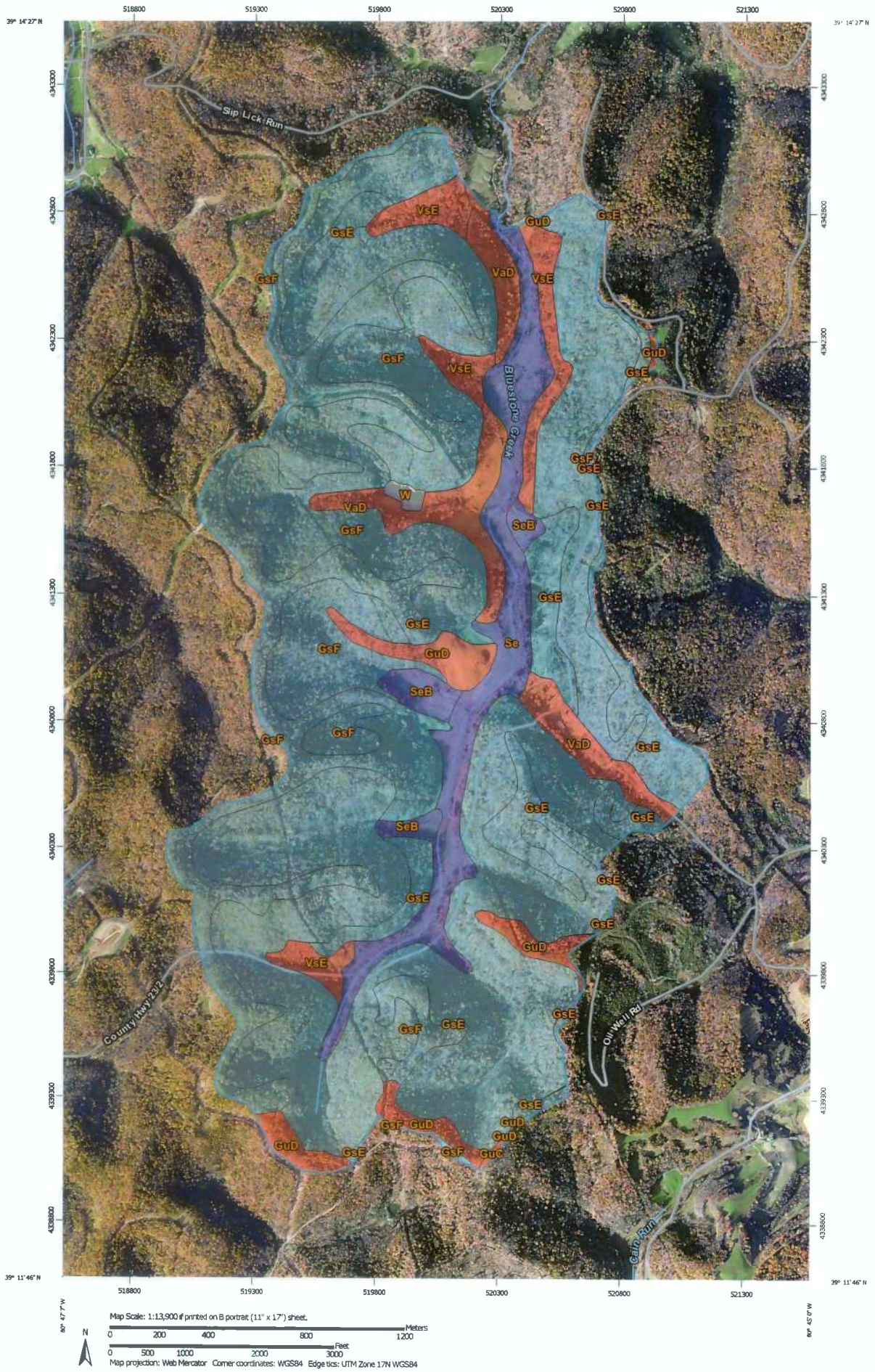
Stream Crossing "B" is to be a "low water ford crossing" which is designed to handle the base flow. The stream crossing was designed as a permanent structure in accordance with the U.S. Army Corps of Engineering Nationwide 14 Permit. The concrete ford will be installed at the existing elevation of the stream bed, the ford will be 20 ft. wide by 8 in. thick and reinforced with welded wire fabric. At the upstream and downstream end of the ford there will be a 5' wide by 18" thick rip-rap apron. At no point during construction will the normal flow of the stream be exposed to "green" concrete. Stream diversions, temporary cofferdams, and pump-arounds will be utilized during construction to shield the stream flow from concrete placement and sediment disturbance. The 1-yr, 10-yr and 100-yr flood elevations are passed over the ford without creating an adverse raise to the 100-yr base flood elevations. Stream Crossing "B" will have a permanent disturbance of 42.0 ft.

Prior to the construction of the "low water crossing" a 40 ft long steel bridge with timber abutments will be used to cross the stream channel. Disturbance to the stream channel will be limited to minor excavation at or near the stream bank, there will be no disturbance to the stream bed or flow.

SECTION 2

NRCS Soils Report

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



Map Scale: 1:13,900 if printed on B portrait (11" x 17") sheet.

Meters: 0 200 400 800 1200

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

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

Soils

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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

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

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 8, 2011—Oct 25, 2011

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Doddridge County, West Virginia (WV017)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
GsE	Gilpin-Peabody complex, 15 to 35 percent slopes, very stony	C	345.8	24.3%
GsF	Gilpin-Peabody complex, 35 to 70 percent slopes, very stony	C	778.6	54.8%
GuC	Gilpin-Upshur complex, 8 to 15 percent slopes	D	1.0	0.1%
GuD	Gilpin-Upshur complex, 15 to 25 percent slopes	D	46.6	3.3%
Se	Sensabaugh silt loam	B	102.8	7.2%
SeB	Sensabaugh silt loam, 3 to 8 percent slopes, rarely flooded	B	20.2	1.4%
VaD	Vandalia silt loam, 15 to 25 percent slopes	D	70.0	4.9%
VsE	Vandalia silt loam, 15 to 35 percent slopes, very stony	D	52.0	3.7%
W	Water		3.1	0.2%
Totals for Area of Interest			**1,420.2**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

SECTION 3

HEC-HMS
Drainage Computations

Project: OXF 157 Simulation Run: Existing

Start of Run:	04Sep2013, 00:00	Basin Model:	Existing
End of Run:	05Sep2013, 00:05	Meteorologic Model:	100 YR
Compute Time:	04Sep2013, 15:18	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Bluestone	0.882	443.8	04Sep2013, 12:55	95.5
Upper1 Bluestone	0.17	221.9	04Sep2013, 12:10	20.3
Junction-1	1.052	482.7	04Sep2013, 12:50	115.8
Reach-1	1.052	482.7	04Sep2013, 13:00	115.4
Middle1 Bluestone	0.252	189.6	04Sep2013, 12:30	28.7
Junction-2	1.304	601.9	04Sep2013, 12:50	144.1
Reach-2	1.304	601	04Sep2013, 13:10	143.1
Middle Bluestone	0.363	303	04Sep2013, 12:25	41.4
Junction-3	1.667	763.6	04Sep2013, 12:40	184.5
Reach-3	1.667	762	04Sep2013, 13:00	183.2
Lower Bluestone	0.286	238.7	04Sep2013, 12:20	31.4
Junction-4	1.953	855.6	04Sep2013, 13:00	214.6
Reach-4	1.953	853.6	04Sep2013, 13:05	214.2
Lower1 Bluestone	0.078	130	04Sep2013, 12:00	9
Junction-5	2.031	865	04Sep2013, 13:05	223.1
Reach-5	2.031	865	04Sep2013, 13:10	222.7
Lower2 Bluestone	0.188	175.7	04Sep2013, 12:20	22.3
Junction-6	2.219	914.4	04Sep2013, 13:10	245
Reach-6	2.219	910.4	04Sep2013, 13:25	243.8
Lower3 Bluestone	0.425	337.3	04Sep2013, 12:30	50.2
Downstream	2.644	1021.2	04Sep2013, 13:20	294

Project: OXF 157 Simulation Run: Existing

Start of Run:	04Sep2013, 00:00	Basin Model:	Existing
End of Run:	05Sep2013, 00:05	Meteorologic Model:	10 YR
Compute Time:	04Sep2013, 15:18	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Bluestone	0.882	189.7	04Sep2013, 13:00	44.7
Upper1 Bluestone	0.17	101.9	04Sep2013, 12:10	9.8
Junction-1	1.052	208.9	04Sep2013, 12:55	54.5
Reach-1	1.052	208.9	04Sep2013, 13:05	54.3
Middle1 Bluestone	0.252	83.2	04Sep2013, 12:30	13.7
Junction-2	1.304	259.4	04Sep2013, 12:55	67.9
Reach-2	1.304	259.3	04Sep2013, 13:10	67.4
Middle Bluestone	0.363	133.4	04Sep2013, 12:25	19.7
Junction-3	1.667	326.8	04Sep2013, 12:40	87.1
Reach-3	1.667	326.6	04Sep2013, 13:00	86.4
Lower Bluestone	0.286	102.3	04Sep2013, 12:25	14.7
Junction-4	1.953	371.5	04Sep2013, 13:00	101.1
Reach-4	1.953	369.7	04Sep2013, 13:05	100.8
Lower1 Bluestone	0.078	57.7	04Sep2013, 12:00	4.3
Junction-5	2.031	375.8	04Sep2013, 13:05	105.1
Reach-5	2.031	375.8	04Sep2013, 13:10	104.9
Lower2 Bluestone	0.188	79	04Sep2013, 12:20	10.8
Junction-6	2.219	400.9	04Sep2013, 13:10	115.7
Reach-6	2.219	399.6	04Sep2013, 13:25	115
Lower3 Bluestone	0.425	152.3	04Sep2013, 12:30	24.3
Downstream	2.644	453	04Sep2013, 13:25	139.3

Project: OXF 157 Simulation Run: Existing

Start of Run:	04Sep2013, 00:00	Basin Model:	Existing
End of Run:	05Sep2013, 00:05	Meteorologic Model:	1 YR
Compute Time:	04Sep2013, 15:18	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Bluestone	0.882	38.4	04Sep2013, 13:10	12.3
Upper1 Bluestone	0.17	22.4	04Sep2013, 12:10	2.9
Junction-1	1.052	43.9	04Sep2013, 13:05	15.3
Reach-1	1.052	43.9	04Sep2013, 13:15	15.2
Middle1 Bluestone	0.252	17.3	04Sep2013, 12:35	3.9
Junction-2	1.304	55	04Sep2013, 13:05	19.1
Reach-2	1.304	55	04Sep2013, 13:25	18.9
Middle Bluestone	0.363	27.6	04Sep2013, 12:30	5.7
Junction-3	1.667	68.2	04Sep2013, 13:05	24.6
Reach-3	1.667	68.2	04Sep2013, 13:25	24.3
Lower Bluestone	0.286	19.5	04Sep2013, 12:30	4.1
Junction-4	1.953	78.9	04Sep2013, 13:05	28.4
Reach-4	1.953	78.8	04Sep2013, 13:10	28.3
Lower1 Bluestone	0.078	12.9	04Sep2013, 12:05	1.2
Junction-5	2.031	80.8	04Sep2013, 13:10	29.5
Reach-5	2.031	80.8	04Sep2013, 13:15	29.4
Lower2 Bluestone	0.188	17.6	04Sep2013, 12:25	3.2
Junction-6	2.219	88	04Sep2013, 13:15	32.7
Reach-6	2.219	87.6	04Sep2013, 13:30	32.4
Lower3 Bluestone	0.425	34.2	04Sep2013, 12:35	7.3
Downstream	2.644	104.1	04Sep2013, 13:25	39.7

SECTION 4

HEC-RAS In-Line Structure Analysis Report and Sections

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

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

****

PROJECT DATA
Project Title: OXF 157-159 Bridges
Project File : OXF157-159Bridges.prj
Run Date and Time: 5/29/2014 2:49:29 PM

Project in English units

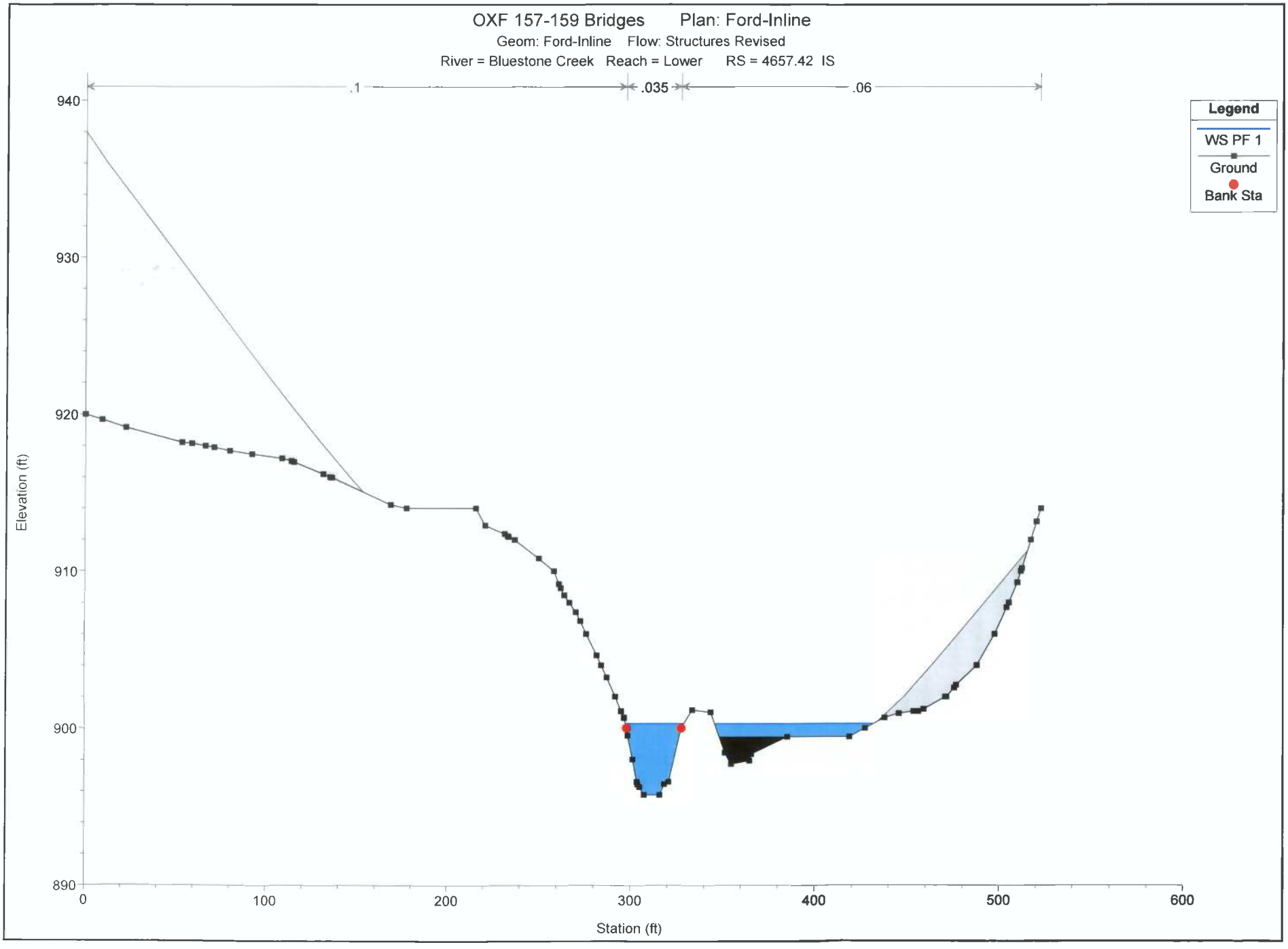
INLINE STRUCTURE

RIVER: Bluestone Creek
REACH: Lower RS: 4657.42

INLINE STRUCTURE OUTPUT Profile #PF 1 Inl Struct:

E.G. Elev (ft)	901.17	Q Gates (cfs)		
W.S. Elev (ft)	900.31	Q Gate Group (cfs)	0.00	
Q Total (cfs)	914.40	Gate Open Ht (ft)	899.72	
Q Weir (cfs)	914.40	Gate #Open		
Weir Flow Area (sq ft)	277.48	Gate Area (sq ft)	1.00	
Weir Sta Lft (ft)	294.69	Gate Submerg	0.00	
Weir Sta Rgt (ft)	440.64	Gate Invert (ft)	0.00	
Weir Max Depth (ft)	5.42	Gate Weir Coef	0.000	
Weir Avg Depth (ft)	1.90			
Weir Coef (ft^1/2)	2.600	Q Breach (cfs)		
Weir Submerg	0.45	Breach Avg Velocity (ft/s)		
Min El Weir Flow (ft)	895.76	Breach Flow Area (sq ft)		
Wr Top Wdth (ft)	145.95			

Warning: Critical depth in the cross section upstream of the inline structure produced too much flow past the inline structure. This
means there is not a valid subcritical answer. The upstream cross section defaulted to critical depth.

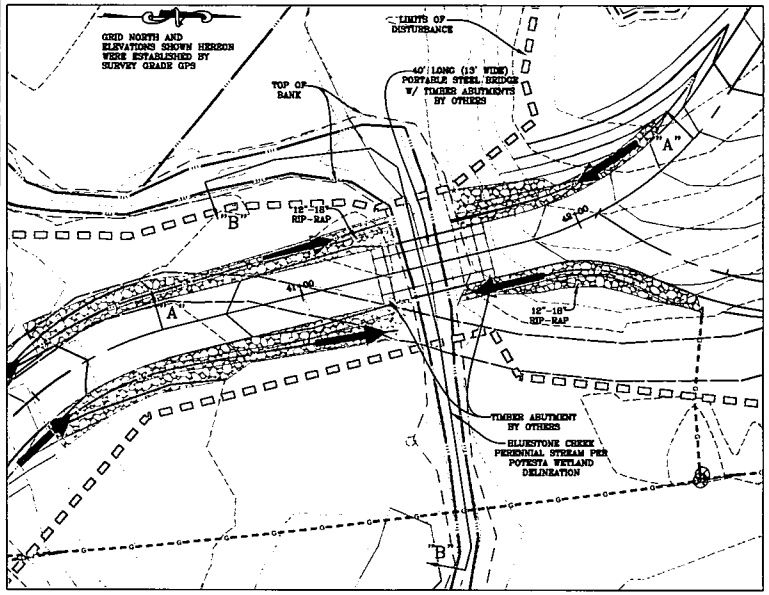

OXF 157-159 Bridges Plan: Ford-Inline
Geom: Ford-Inline Flow: Structures Revised
River = Bluestone Creek Reach = Lower RS = 4657.42 IS
.1
.035
.06
Legend
WS PF 1
Ground
Bank Sta
940
930
920
910
900
890
Elevation (ft)
0
100
200
300
400
500
600
Station (ft)

SECTION 5

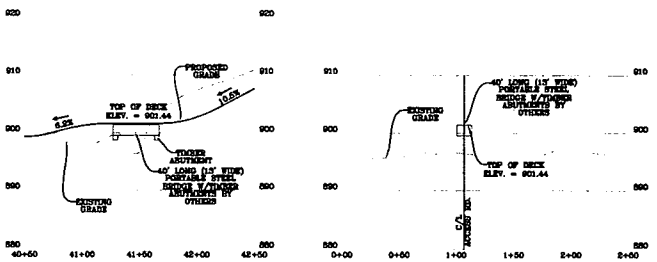
Stream Crossing "B" Details

TEMPORARY STREAM CROSSING DETAILS

STREAM CROSSING "B" DETAILS



STREAM CROSSING "B" SECTIONS



CROSS SECTION "A-A"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

CROSS SECTION "B-B"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL TEMPORARY STREAM CROSSING NOTES:

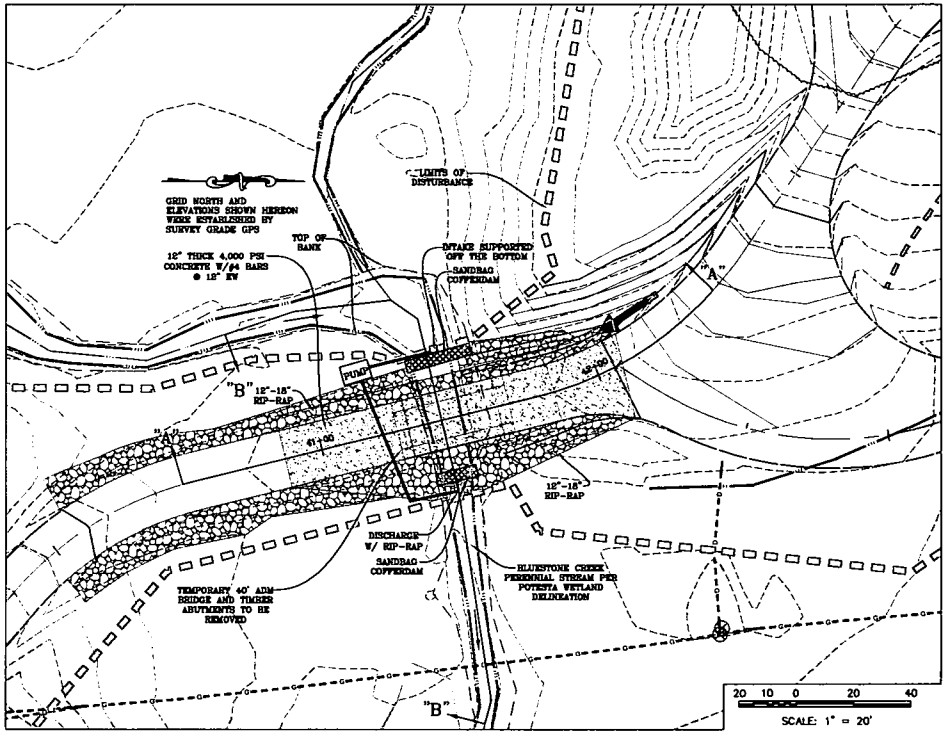
1) DO NOT USE ERODIBLE MATERIAL FOR CONSTRUCTION OF THE CROSSING.
2) CLEARING AND EXCAVATION OF THE STREAM BANKS SHALL BE KEPT TO A MINIMUM.
3) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
4) TIMBER ABUTMENTS FOR THE BRIDGE INSTALLATION SHALL BE INSTALLED TO REDUCE STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
5) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
6) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
7) THE TEMPORARY BRIDGE SHALL BE ANCHORED AS REQUIRED PER THE DODDRIDGE COUNTY FLOODPLAIN ORDINANCE.

NOTE:

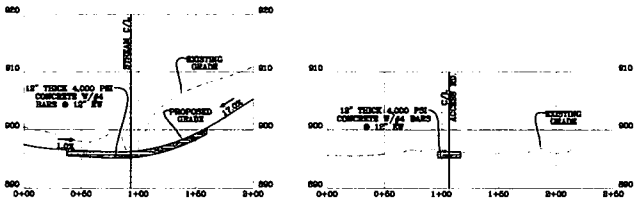
1) SEE SHEET 21 FOR PUMP AROUND NOTES AND DETAILS
2) SEE STREAM CROSSING REPORT BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATIONS.
3) EQT SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "B".

PERMANENT STREAM CROSSING DETAILS

STREAM CROSSING "B" DETAILS



STREAM CROSSING "B" SECTIONS



CROSS SECTION "A-A"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

CROSS SECTION "B-B"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL STREAM CROSSING NOTES:

1) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
2) STREAM BED WILL BE MONITORED DURING CONSTRUCTION. ALL GROUNDWATER SEEPAGE NEEDS TO REMOVED PRIOR TO STRUCTURAL BASE MATERIAL AND CONCRETE BEING EMPLACED.
3) SOIL BEARING CAPACITY TO BE FIELD VERIFIED PRIOR TO CONSTRUCTION. MINIMUM SOIL BEARING CAPACITY IS 4,000 PSF.
4) IF UNSUITABLE MATERIAL IS ENCOUNTERED DURING CONSTRUCTION, THE MATERIAL IS TO BE REMOVED, AND ADDITIONAL 3/4"-1" STONE IS TO BE EMPLACED.
5) FILTER CLOTH SHALL BE PLACED ON THE STREAMBED AND STREAM BANKS PRIOR TO PLACEMENT OF THE CONCRETE AND AGGREGATE. THE FILTER CLOTH SHALL COVER THE STREAMBED AND EXTEND A MINIMUM OF SIX INCHES AND A MAXIMUM OF ONE FOOT BEYOND THE END OF THE FORD AND BEDDING MATERIAL.
6) A PUMP AROUND SYSTEM SHALL BE CONSTRUCTED ACROSS THE ROADWAY ON EITHER SIDE OF THE STREAM CROSSING AS DIRECTED DURING CROSSING CONSTRUCTION.
10) AT NO POINT DURING CONSTRUCTION SHALL THE CONCRETE FORD BE EXPOSED TO THE NORMAL FLOW OF THE STREAM, ONLY UNTIL AFTER THE CONCRETE HAS HARDENED AND CURED SHALL THE PUMP AROUND SYSTEM BE REMOVED AND NORMAL FLOW RESTORED.
11) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
12) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
13) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
14) THE CROSSING MUST BE INSPECTED AFTER EVERY RAIN EVENT OF 0.5 INCHES OR MORE AND ONCE A WEEK TO ENSURE THAT THE FORD, STREAMBED, AND STREAM BANKS ARE MAINTAINED AND NOT DAMAGED. NEVER ALLOW THE FORD TO BECOME CLOGGED WITH DEBRIS AND REMOVE ANY OBSTRUCTIONS IMMEDIATELY.
15) GEOTEXTILE FABRIC SHALL MEETS THE TENSILE STRENGTH REQUIREMENTS OF 180 LBS PER ASTM D 4632, MULLEN BURSTING REQUIREMENTS OF 320 PSI PER ASTM D 3786, AND PUNCTURE TEST REQUIREMENTS OF 80 LBS PER ASTM D 4833.
16) ACCESS ROAD DITCHES SHALL BE MAINTAINED AND EXCAVATED AS NECESSARY FOR THE EMPLACEMENT OF RIP-RAP ARMORING.
17) CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4,000 PSI AT 28 DAYS.
18) STORM RUNOFF MAY DEPOSIT DEBRIS AT THE CROSSING LOCATION WHICH WILL NEED TO BE REMOVED.

NAVITUS ENERGY ENGINEERING
Telephone: (888) 662-4185 | www.NavitusEng.com

Professional Energy Consultants
A DIVISION OF SMITHLAND SURVEYING, INC.
SLS SURVEYORS ENGINEERS ENVIRONMENTAL PROJECT MGMT.
WWW.SLSSURVEYS.COM
(304) 452-5604

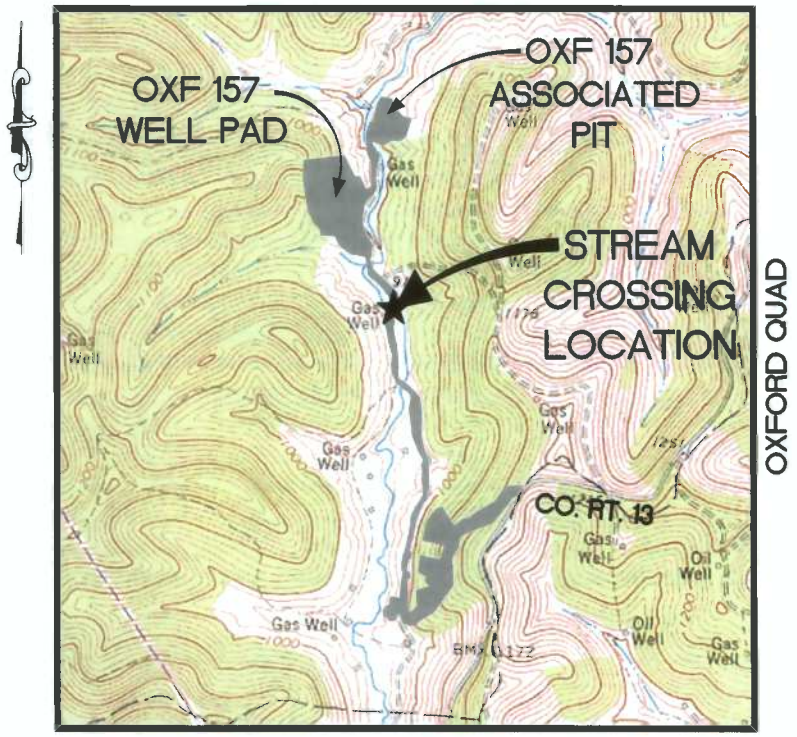
No. 11705 WEST VIRGINIA PROFESSIONAL ENGINEER

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC. FOR: EQT PRODUCTION COMPANY

MAJOR STREAM CROSSING DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE:	11/04/2013
SCALE:	N/A
DESIGNED BY:	CSK
FILE NO.	7689
SHEET	22 OF 32
REV:	06/03/2014

STREAM CROSSING "C"
STORMWATER COMPUTATIONS
OXF 157 WELL PAD



VICINITY MAP
1" = 2,000'

NAVITUS
ENERGY ENGINEERING
Telephone: (888) 662-4185 | www.NavitusEng.com

Prepared For:
EQT Production Company
115 Professional Place
P.O. Box 280
Bridgeport, WV 26330

Contact:
Victoria J. Roark
Permitting Supervisor
(304) 848-0076

Designed By:
Navitus Engineering Inc.

Project Manager:
Chandler Pearson
cpearson@navituseng.com

MARK D. SMITH
REGISTERED
No. 11709
WEST VIRGINIA
PROFESSIONAL ENGINEER

Date: June 3, 2014

Surface Owner (s)
Justin L. Henderson

Tax Parcel:
Map 6 Parcel 1

Location:
West Union District, Doddridge County
West Virginia

FN# 7889

OXF 157 WELL PAD

STREAM CROSSING "C"

STORMWATER COMPUTATIONS

Sections

SECTION 1

Overview

The intent of this project is to construct a gravel access road to a gas well pad site and associated facilities. This project will include a permanent stream crossing. Bluestone Creek, which has been classified as a perennial stream per the wetlands report conducted by Potesta Engineers and Environmental Consultants dated May 29, 2013, will be crossed at station 35+06.795 of the proposed access road.

Drainage Narrative

Using the SCS Method, with HEC-HMS, we determined the 1, 10, and 100-year rainfall events at the stream crossing study point. We then used HEC-RAS to design the crossings and to determine the base flow water surface elevation for each rainfall event. Stream Crossing "C" has a drainage area of 1,299.9 Acres. Design flows are shown as Junction-5 in the drainage calculations in Section 3.

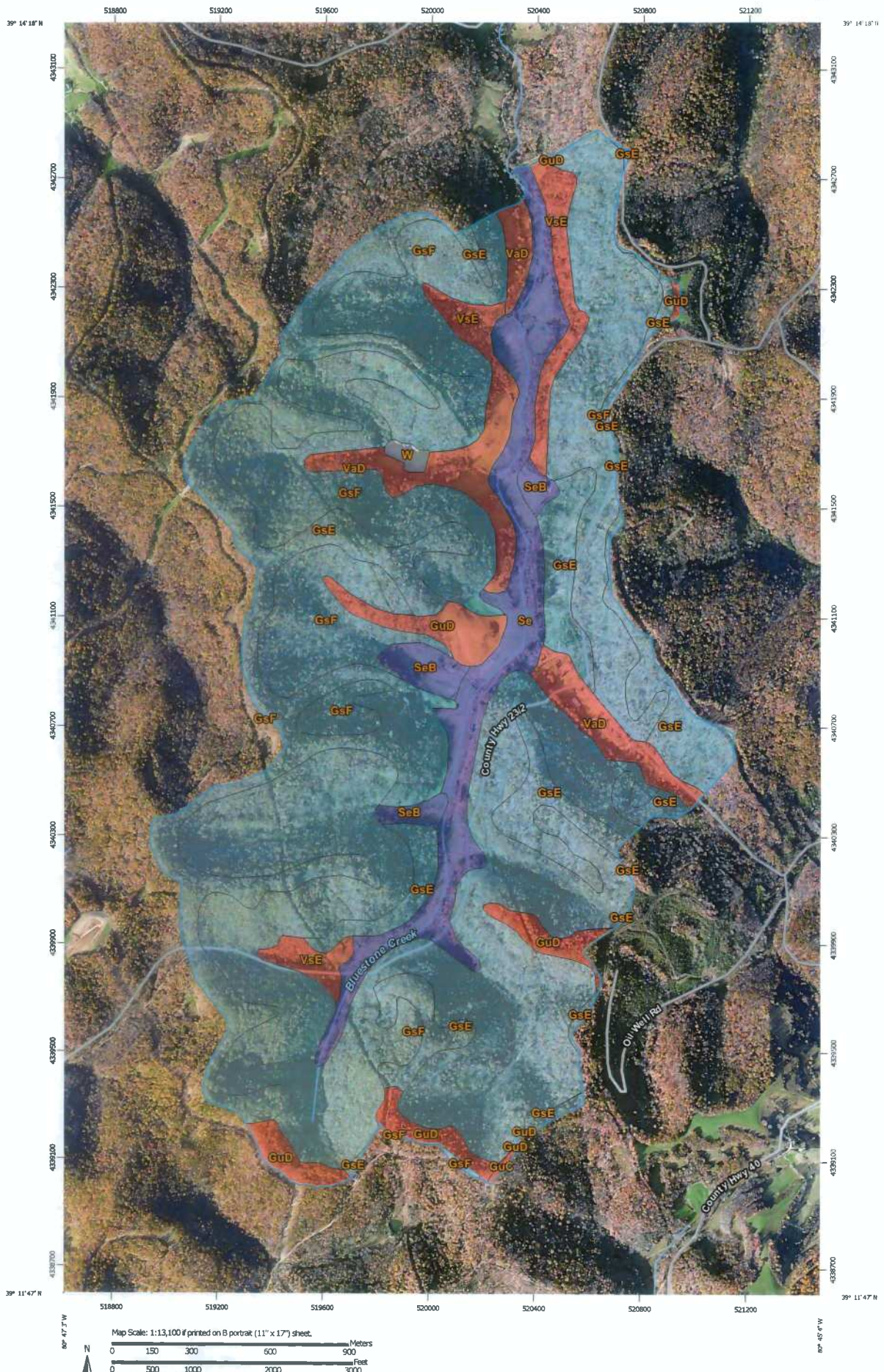
Stream Crossing "C" is to be a "low water ford crossing" which is designed to handle the base flow. The stream crossing was designed as a permanent structure in accordance with the U.S. Army Corps of Engineering Nationwide 14 Permit. The concrete ford will be installed at the existing elevation of the stream bed, the ford will be 20 ft. wide by 8 in. thick and reinforced with welded wire fabric. At the upstream and downstream end of the ford there will be a 5' wide by 18" thick rip-rap apron. At no point during construction will the normal flow of the stream be exposed to "green" concrete. Stream diversions, temporary cofferdams, and pump-arounds will be utilized during construction to shield the stream flow from concrete placement and sediment disturbance. The 1-yr, 10-yr and 100-yr flood elevations are passed over the ford without creating an adverse raise to the 100-yr base flood elevations. Stream Crossing "C" will have a permanent disturbance of 40.0 ft.

Prior to the construction of the "low water crossing" a 40 ft long steel bridge with timber abutments will be used to cross the stream channel. Disturbance to the stream channel will be limited to minor excavation at or near the stream bank, there will be no disturbance to the stream bed or flow.

SECTION 2

NRCS Soils Report

Hydrologic Soil Group—Doddridge County, West Virginia
(CROSSING C)



Map Scale: 1:13,100 if printed on B portrait (11" x 17") sheet.

N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

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

Soils

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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

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

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 8, 2011—Oct 25, 2011

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Doddridge County, West Virginia (WV017)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
GsE	Gilpin-Peabody complex, 15 to 35 percent slopes, very stony	C	316.0	24.3%
GsF	Gilpin-Peabody complex, 35 to 70 percent slopes, very stony	C	710.4	54.6%
GuC	Gilpin-Upshur complex, 8 to 15 percent slopes	D	1.0	0.1%
GuD	Gilpin-Upshur complex, 15 to 25 percent slopes	D	46.6	3.6%
Se	Sensabaugh silt loam	B	101.2	7.8%
SeB	Sensabaugh silt loam, 3 to 8 percent slopes, rarely flooded	B	20.2	1.6%
VaD	Vandalia silt loam, 15 to 25 percent slopes	D	62.9	4.8%
VsE	Vandalia silt loam, 15 to 35 percent slopes, very stony	D	38.4	3.0%
W	Water		3.1	0.2%
Totals for Area of Interest			**1,299.9**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

SECTION 3

HEC-HMS
Drainage Computations

Project: OXF 157 Simulation Run: Existing

Start of Run:	04Sep2013, 00:00	Basin Model:	Existing
End of Run:	05Sep2013, 00:05	Meteorologic Model:	100 YR
Compute Time:	04Sep2013, 15:18	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Bluestone	0.882	443.8	04Sep2013, 12:55	95.5
Upper1 Bluestone	0.17	221.9	04Sep2013, 12:10	20.3
Junction-1	1.052	482.7	04Sep2013, 12:50	115.8
Reach-1	1.052	482.7	04Sep2013, 13:00	115.4
Middle1 Bluestone	0.252	189.6	04Sep2013, 12:30	28.7
Junction-2	1.304	601.9	04Sep2013, 12:50	144.1
Reach-2	1.304	601	04Sep2013, 13:10	143.1
Middle Bluestone	0.363	303	04Sep2013, 12:25	41.4
Junction-3	1.667	763.6	04Sep2013, 12:40	184.5
Reach-3	1.667	762	04Sep2013, 13:00	183.2
Lower Bluestone	0.286	238.7	04Sep2013, 12:20	31.4
Junction-4	1.953	855.6	04Sep2013, 13:00	214.6
Reach-4	1.953	853.6	04Sep2013, 13:05	214.2
Lower1 Bluestone	0.078	130	04Sep2013, 12:00	9
Junction-5	2.031	865	04Sep2013, 13:05	223.1
Reach-5	2.031	865	04Sep2013, 13:10	222.7
Lower2 Bluestone	0.188	175.7	04Sep2013, 12:20	22.3
Junction-6	2.219	914.4	04Sep2013, 13:10	245
Reach-6	2.219	910.4	04Sep2013, 13:25	243.8
Lower3 Bluestone	0.425	337.3	04Sep2013, 12:30	50.2
Downstream	2.644	1021.2	04Sep2013, 13:20	294

Project: OXF 157 Simulation Run: Existing

Start of Run:	04Sep2013, 00:00	Basin Model:	Existing
End of Run:	05Sep2013, 00:05	Meteorologic Model:	10 YR
Compute Time:	04Sep2013, 15:18	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Bluestone	0.882	189.7	04Sep2013, 13:00	44.7
Upper1 Bluestone	0.17	101.9	04Sep2013, 12:10	9.8
Junction-1	1.052	208.9	04Sep2013, 12:55	54.5
Reach-1	1.052	208.9	04Sep2013, 13:05	54.3
Middle1 Bluestone	0.252	83.2	04Sep2013, 12:30	13.7
Junction-2	1.304	259.4	04Sep2013, 12:55	67.9
Reach-2	1.304	259.3	04Sep2013, 13:10	67.4
Middle Bluestone	0.363	133.4	04Sep2013, 12:25	19.7
Junction-3	1.667	326.8	04Sep2013, 12:40	87.1
Reach-3	1.667	326.6	04Sep2013, 13:00	86.4
Lower Bluestone	0.286	102.3	04Sep2013, 12:25	14.7
Junction-4	1.953	371.5	04Sep2013, 13:00	101.1
Reach-4	1.953	369.7	04Sep2013, 13:05	100.8
Lower1 Bluestone	0.078	57.7	04Sep2013, 12:00	4.3
Junction-5	2.031	375.8	04Sep2013, 13:05	105.1
Reach-5	2.031	375.8	04Sep2013, 13:10	104.9
Lower2 Bluestone	0.188	79	04Sep2013, 12:20	10.8
Junction-6	2.219	400.9	04Sep2013, 13:10	115.7
Reach-6	2.219	399.6	04Sep2013, 13:25	115
Lower3 Bluestone	0.425	152.3	04Sep2013, 12:30	24.3
Downstream	2.644	453	04Sep2013, 13:25	139.3

Project: OXF 157 Simulation Run: Existing

Start of Run:	04Sep2013, 00:00	Basin Model:	Existing
End of Run:	05Sep2013, 00:05	Meteorologic Model:	1 YR
Compute Time:	04Sep2013, 15:18	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Bluestone	0.882	38.4	04Sep2013, 13:10	12.3
Upper1 Bluestone	0.17	22.4	04Sep2013, 12:10	2.9
Junction-1	1.052	43.9	04Sep2013, 13:05	15.3
Reach-1	1.052	43.9	04Sep2013, 13:15	15.2
Middle1 Bluestone	0.252	17.3	04Sep2013, 12:35	3.9
Junction-2	1.304	55	04Sep2013, 13:05	19.1
Reach-2	1.304	55	04Sep2013, 13:25	18.9
Middle Bluestone	0.363	27.6	04Sep2013, 12:30	5.7
Junction-3	1.667	68.2	04Sep2013, 13:05	24.6
Reach-3	1.667	68.2	04Sep2013, 13:25	24.3
Lower Bluestone	0.286	19.5	04Sep2013, 12:30	4.1
Junction-4	1.953	78.9	04Sep2013, 13:05	28.4
Reach-4	1.953	78.8	04Sep2013, 13:10	28.3
Lower1 Bluestone	0.078	12.9	04Sep2013, 12:05	1.2
Junction-5	2.031	80.8	04Sep2013, 13:10	29.5
Reach-5	2.031	80.8	04Sep2013, 13:15	29.4
Lower2 Bluestone	0.188	17.6	04Sep2013, 12:25	3.2
Junction-6	2.219	88	04Sep2013, 13:15	32.7
Reach-6	2.219	87.6	04Sep2013, 13:30	32.4
Lower3 Bluestone	0.425	34.2	04Sep2013, 12:35	7.3
Downstream	2.644	104.1	04Sep2013, 13:25	39.7

SECTION 4

HEC-RAS In-Line Structure Analysis Report and Sections

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

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

****

PROJECT DATA
Project Title: OXF 157-159 Bridges
Project File : OXF157-159Bridges.prj
Run Date and Time: 5/29/2014 2:49:29 PM

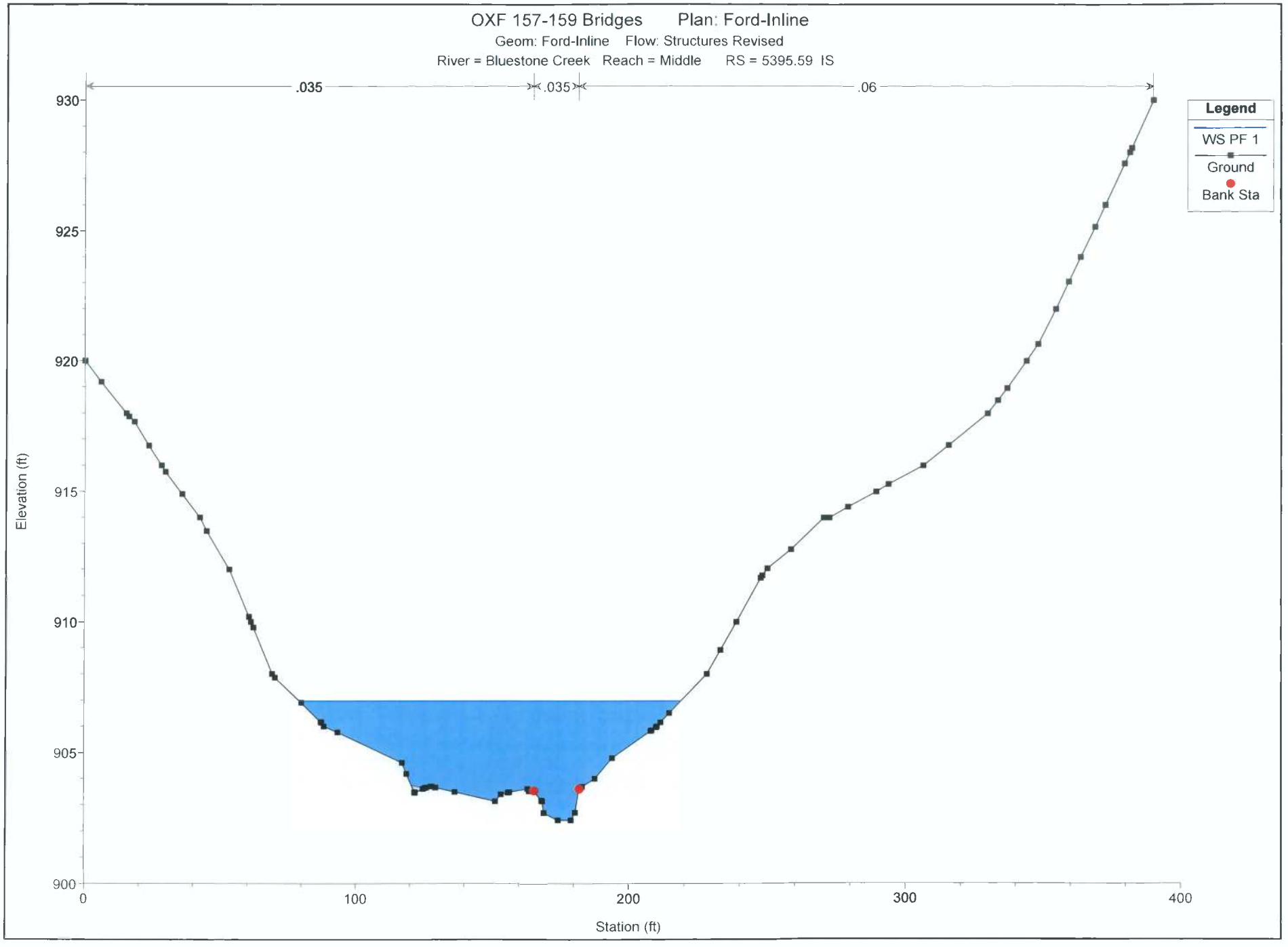
Project in English units

INLINE STRUCTURE

RIVER: Bluestone Creek
REACH: Middle RS: 5395.59

INLINE STRUCTURE OUTPUT Profile #PF 1 Inl Struct:

E.G. Elev (ft)	907.09	Q Gates (cfs)		
W.S. Elev (ft)	906.98	Q Gate Group (cfs)	0.00	
Q Total (cfs)	865.00	Gate Open Ht (ft)	906.96	
Q Weir (cfs)	865.00	Gate #Open		
Weir Flow Area (sq ft)	368.91	Gate Area (sq ft)	1.00	
Weir Sta Lft (ft)	78.09	Gate Submerg	0.00	
Weir Sta Rgt (ft)	219.89	Gate Invert (ft)	0.00	
Weir Max Depth (ft)	4.67	Gate Weir Coef	0.000	
Weir Avg Depth (ft)	2.60			
Weir Coef (ft^1/2)	2.600	Q Breach (cfs)		
Weir Submerg	0.98	Breach Avg Velocity (ft/s)		
Min El Weir Flow (ft)	902.43	Breach Flow Area (sq ft)		
Wr Top Wdth (ft)	141.80			

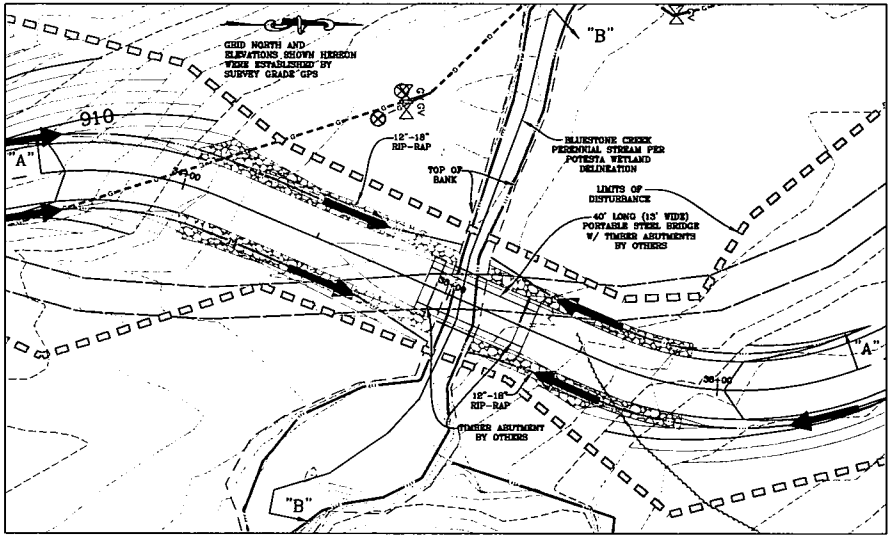

OXF 157-159 Bridges Plan: Ford-Inline
Geom: Ford-Inline Flow: Structures Revised
River = Bluestone Creek Reach = Middle RS = 5395.59 IS
.035
.035
.06
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
930
925
920
915
910
905
900
0
100
200
300
400
Station (ft)

SECTION 5

Stream Crossing "C" Details

TEMPORARY STREAM CROSSING DETAILS

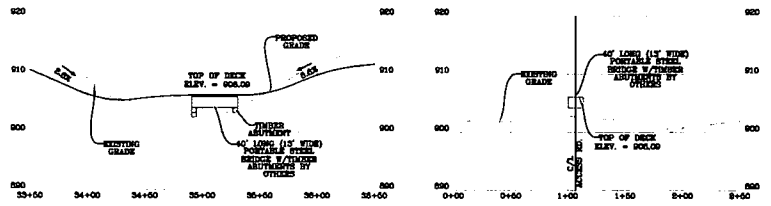
STREAM CROSSING "C" DETAILS



20 10 0 20 40

SCALE: 1" = 20'

STREAM CROSSING "C" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

CROSS SECTION "B-B"

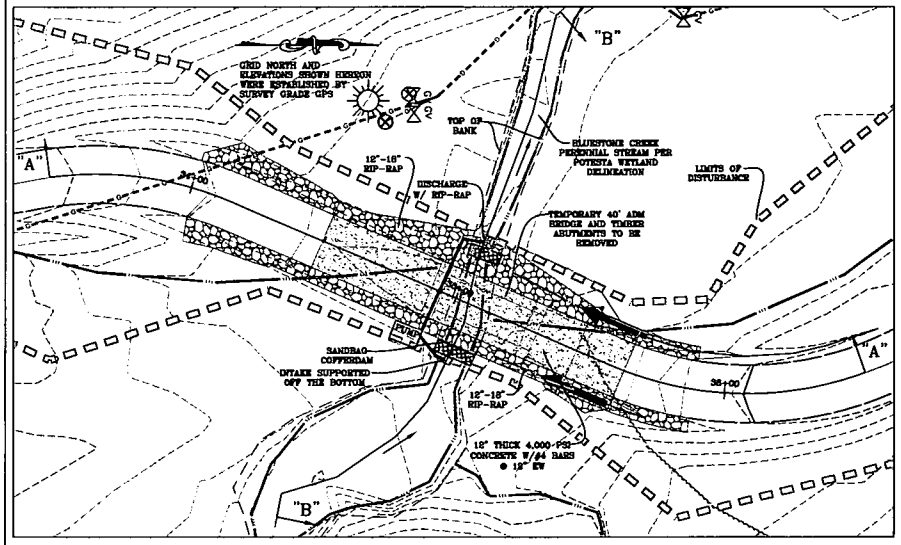
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL TEMPORARY STREAM CROSSING NOTES:

1) DO NOT USE ERODIBLE MATERIAL FOR CONSTRUCTION OF THE CROSSING.
2) CLEARING AND EXCAVATION OF THE STREAM BANKS SHALL BE KEPT TO A MINIMUM.
3) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
4) TIMBER ABUTMENTS FOR THE BRIDGE INSTALLATION SHALL BE INSTALLED TO REDUCE STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
5) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
6) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
7) THE TEMPORARY BRIDGE SHALL BE ANCHORED AS REQUIRED PER THE DODDRIDGE COUNTY FLOODPLAIN ORDINANCE.

PERMANENT STREAM CROSSING DETAILS

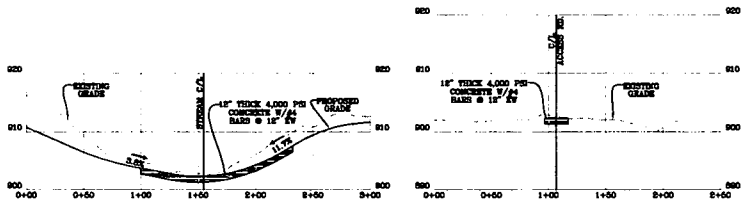
STREAM CROSSING "C" DETAILS



20 10 0 20 40

SCALE: 1" = 20'

STREAM CROSSING "C" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

CROSS SECTION "B-B"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL STREAM CROSSING NOTES:

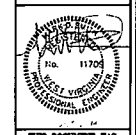
1) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
2) STREAM BED WILL BE MONITORED DURING CONSTRUCTION. ALL GROUNDWATER SEEPAGE NEEDS TO REMOVED PRIOR TO STRUCTURAL BASE MATERIAL AND CONCRETE BEING EMPLACED.
3) SOIL BEARING CAPACITY TO BE FIELD VERIFIED PRIOR TO CONSTRUCTION. MINIMUM SOIL BEARING CAPACITY IS 4,000 PSF.
4) IF UNSUITABLE MATERIAL IS ENCOUNTERED DURING CONSTRUCTION, THE MATERIAL IS TO BE REMOVED, AND ADDITIONAL 3/4"-1" STONE IS TO BE EMPLACED.
5) FILTER CLOTH SHALL BE PLACED ON THE STREAMBED AND STREAM BANKS PRIOR TO PLACEMENT OF THE CONCRETE AND AGGREGATE. THE FILTER CLOTH SHALL COVER THE STREAMBED AND EXTEND A MINIMUM OF SIX INCHES AND A MAXIMUM OF ONE FOOT BEYOND THE END OF THE FORD AND BEDDING MATERIAL.
6) A PUMP AROUND SYSTEM SHALL BE CONSTRUCTED ACROSS THE ROADWAY ON EITHER SIDE OF THE STREAM CROSSING AS DIRECTED DURING CROSSING CONSTRUCTION.
10) AT NO POINT DURING CONSTRUCTION SHALL THE CONCRETE FORD BE EXPOSED TO THE NORMAL FLOW OF THE STREAM. ONLY UNTIL AFTER THE CONCRETE HAS HARDENED AND CURED SHALL THE PUMP AROUND SYSTEM BE REMOVED AND NORMAL FLOW RESTORED.
11) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
12) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
13) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
14) THE CROSSING MUST BE INSPECTED AFTER EVERY RAIN EVENT OF 0.5 INCHES OR MORE AND ONCE A WEEK TO ENSURE THAT THE FORD, STREAMBED, AND STREAM BANKS ARE MAINTAINED AND NOT DAMAGED. NEVER ALLOW THE FORD TO BECOME CLOGGED WITH DEBRIS AND REMOVE ANY OBSTRUCTIONS IMMEDIATELY.
15) GEOTEXTILE FABRIC SHALL MEETS THE TENSILE STRENGTH REQUIREMENTS OF 180 LBS PER ASTM D 4632, MULLEN BURSTING REQUIREMENTS OF 320 PSI PER ASTM D 3786, AND PUNCTURE TEST REQUIREMENTS OF 80 LBS PER ASTM D 4833.
16) ACCESS ROAD DITCHES SHALL BE MAINTAINED AND EXCAVATED AS NECESSARY FOR THE EMPLACEMENT OF RIP-RAP ARMORING.
17) CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4,000 PSI AT 28 DAYS.
18) STORM RUNOFF MAY DEPOSIT DEBRIS AT THE CROSSING LOCATION WHICH WILL NEED TO BE REMOVED.

NOTE:

1) SEE SHEET 21 FOR PUMP AROUND NOTES AND DETAILS
2) SEE STREAM CROSSING REPORT BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATIONS.
3) EQT SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "C".

NAVITUS ENERGY ENGINEERING
Telephone: (888) 562-4185 | www.NavitusEng.com

Professional Energy Consultants
A DIVISION OF SMITHLAND SURVEYING, INC.
SLS SURVEYORS ENGINEERS ENVIRONMENTAL PROJECT MGMT.
(304) 452-5634 WWW.SLSSURVEYS.COM



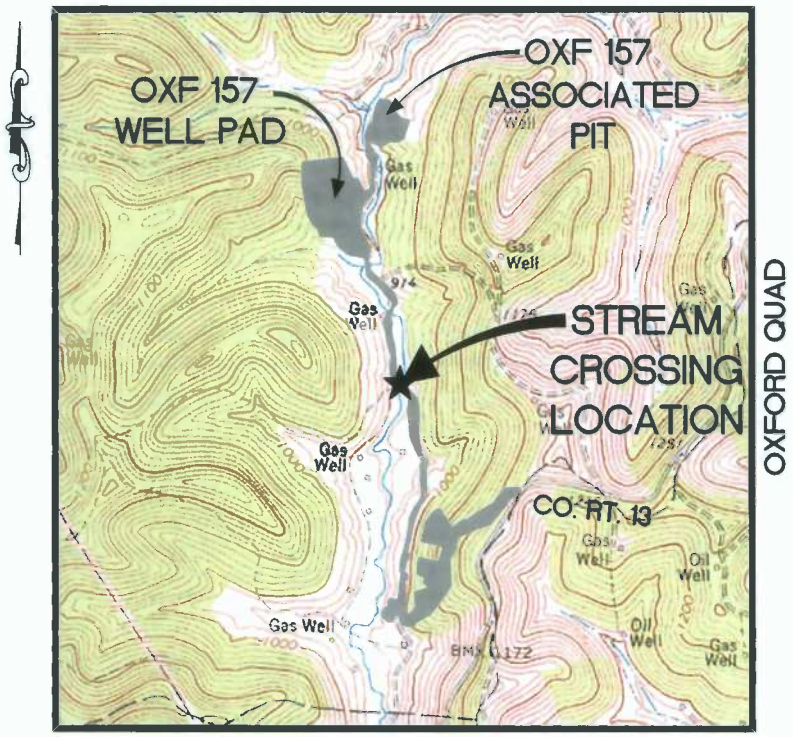
THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

MAJOR STREAM CROSSING DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7000
SHEET 23 OF 32
REV: 08/03/2014

STREAM CROSSING "D"
STORMWATER COMPUTATIONS
OXF 157 WELL PAD

D



VICINITY MAP
1" = 2,000'

NAVITUS
ENERGY ENGINEERING
Telephone: (888) 662-4185 | www.NavitusEng.com

Prepared For:
EQT Production Company
115 Professional Place
P.O. Box 280
Bridgeport, WV 26330

Contact:
Victoria J. Roark
Permitting Supervisor
(304) 848-0076

Designed By:
Navitus Engineering Inc.

Project Manager:
Chandler Pearson
cpearson@navituseng.com

Date: June 3, 2014

Surface Owner (s)
Justin L. Henderson

Tax Parcel:
Map 6 Parcel 1

Location:
West Union District, Doddridge County
West Virginia

FN# 7889

OXF 157 WELL PAD

STREAM CROSSING "D"

STORMWATER COMPUTATIONS

Sections

SECTION 1

Overview

The intent of this project is to construct a gravel access road to a gas well pad site and associated facilities. This project will include a permanent stream crossing. Bluestone Creek, which has been classified as a perennial stream per the wetlands report conducted by Potesta Engineers and Environmental Consultants dated May 29, 2013, will be crossed at station 26+81.854 of the proposed access road.

Drainage Narrative

Using the SCS Method, with HEC-HMS, we determined the 1, 10, and 100-year rainfall events at the stream crossing study point. We then used HEC-RAS to design the crossings and to determine the base flow water surface elevation for each rainfall event. Stream Crossing "D" has a drainage area of 1,249.9 Acres. Design flows are shown as Junction-4 in the drainage calculations in Section 3.

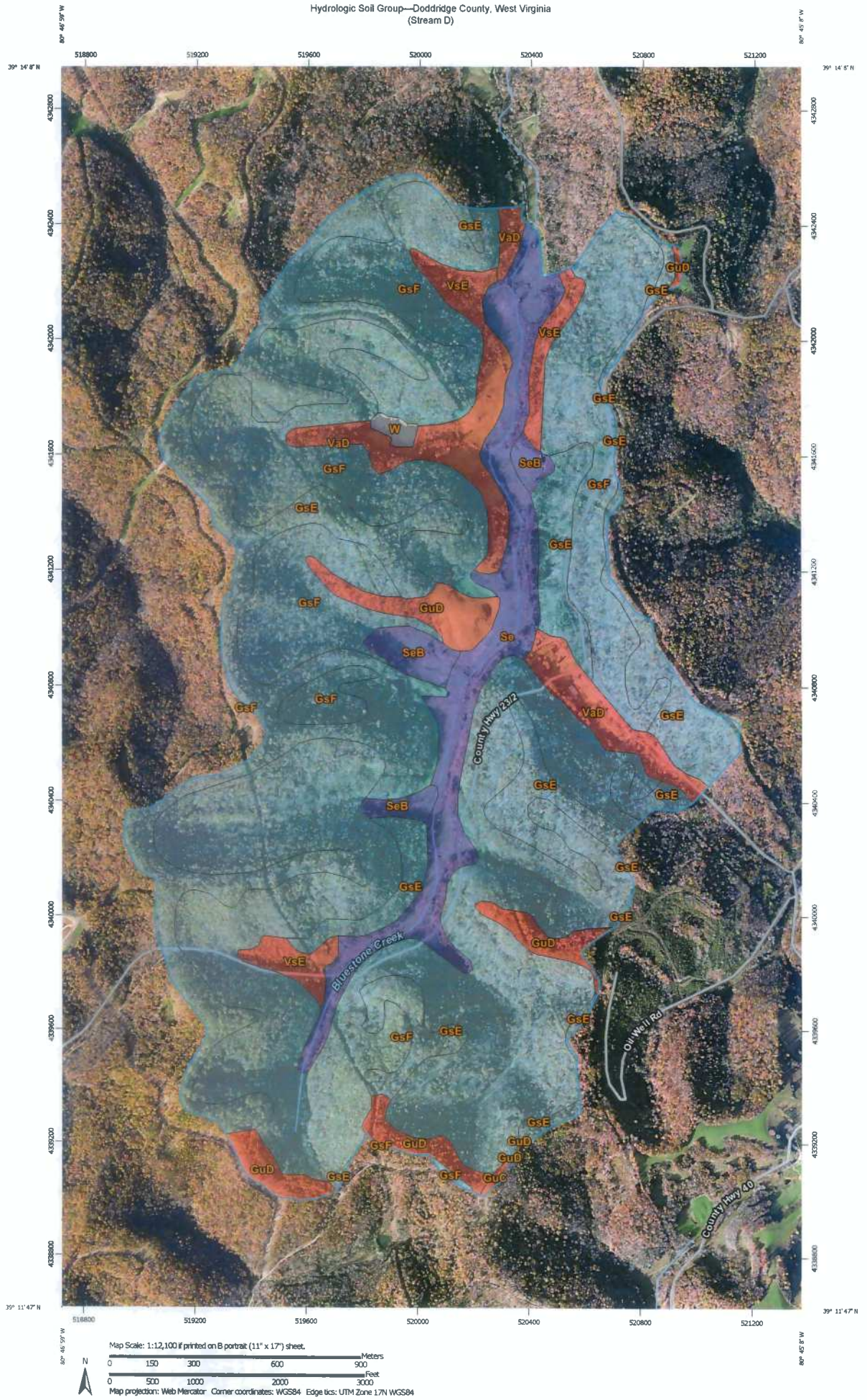
Stream Crossing "D" is to be a "low water ford crossing" which is designed to handle the base flow. The stream crossing was designed as a permanent structure in accordance with the U.S. Army Corps of Engineering Nationwide 14 Permit. The concrete ford will be installed at the existing elevation of the stream bed, the ford will be 20 ft. wide by 8 in. thick and reinforced with welded wire fabric. At the upstream and downstream end of the ford there will be a 5' wide by 18" thick rip-rap apron. At no point during construction will the normal flow of the stream be exposed to "green" concrete. Stream diversions, temporary cofferdams, and pump-arounds will be utilized during construction to shield the stream flow from concrete placement and sediment disturbance. The 1-yr, 10-yr and 100-yr flood elevations are passed over the ford without creating an adverse raise to the 100-yr base flood elevations. Stream Crossing "D" will have a permanent disturbance of 43.0 ft.

Prior to the construction of the "low water crossing" a 40 ft long steel bridge with timber abutments will be used to cross the stream channel. Disturbance to the stream channel will be limited to minor excavation at or near the stream bank, there will be no disturbance to the stream bed or flow.

SECTION 2

NRCS Soils Report

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



Map Scale: 1:12,100 if printed on B portrait (11" x 17") sheet.

N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

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

Soils

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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

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

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 8, 2011—Oct 25, 2011

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Doddridge County, West Virginia (WV017)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
GsE	Gilpin-Peabody complex, 15 to 35 percent slopes, very stony	C	314.8	25.2%
GsF	Gilpin-Peabody complex, 35 to 70 percent slopes, very stony	C	684.0	54.7%
GuC	Gilpin-Upshur complex, 8 to 15 percent slopes	D	1.0	0.1%
GuD	Gilpin-Upshur complex, 15 to 25 percent slopes	D	46.4	3.7%
Se	Sensabaugh silt loam	B	93.6	7.5%
SeB	Sensabaugh silt loam, 3 to 8 percent slopes, rarely flooded	B	20.2	1.6%
VaD	Vandalia silt loam, 15 to 25 percent slopes	D	58.9	4.7%
VsE	Vandalia silt loam, 15 to 35 percent slopes, very stony	D	27.9	2.2%
W	Water		3.1	0.2%
Totals for Area of Interest			**1,249.9**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

SECTION 3

HEC-HMS
Drainage Computations

Project: OXF 157 Simulation Run: Existing

Start of Run:	04Sep2013, 00:00	Basin Model:	Existing
End of Run:	05Sep2013, 00:05	Meteorologic Model:	100 YR
Compute Time:	04Sep2013, 15:18	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Bluestone	0.882	443.8	04Sep2013, 12:55	95.5
Upper1 Bluestone	0.17	221.9	04Sep2013, 12:10	20.3
Junction-1	1.052	482.7	04Sep2013, 12:50	115.8
Reach-1	1.052	482.7	04Sep2013, 13:00	115.4
Middle1 Bluestone	0.252	189.6	04Sep2013, 12:30	28.7
Junction-2	1.304	601.9	04Sep2013, 12:50	144.1
Reach-2	1.304	601	04Sep2013, 13:10	143.1
Middle Bluestone	0.363	303	04Sep2013, 12:25	41.4
Junction-3	1.667	763.6	04Sep2013, 12:40	184.5
Reach-3	1.667	762	04Sep2013, 13:00	183.2
Lower Bluestone	0.286	238.7	04Sep2013, 12:20	31.4
Junction-4	1.953	855.6	04Sep2013, 13:00	214.6
Reach-4	1.953	853.6	04Sep2013, 13:05	214.2
Lower1 Bluestone	0.078	130	04Sep2013, 12:00	9
Junction-5	2.031	865	04Sep2013, 13:05	223.1
Reach-5	2.031	865	04Sep2013, 13:10	222.7
Lower2 Bluestone	0.188	175.7	04Sep2013, 12:20	22.3
Junction-6	2.219	914.4	04Sep2013, 13:10	245
Reach-6	2.219	910.4	04Sep2013, 13:25	243.8
Lower3 Bluestone	0.425	337.3	04Sep2013, 12:30	50.2
Downstream	2.644	1021.2	04Sep2013, 13:20	294

Project: OXF 157 Simulation Run: Existing

Start of Run:	04Sep2013, 00:00	Basin Model:	Existing
End of Run:	05Sep2013, 00:05	Meteorologic Model:	10 YR
Compute Time:	04Sep2013, 15:18	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Bluestone	0.882	189.7	04Sep2013, 13:00	44.7
Upper1 Bluestone	0.17	101.9	04Sep2013, 12:10	9.8
Junction-1	1.052	208.9	04Sep2013, 12:55	54.5
Reach-1	1.052	208.9	04Sep2013, 13:05	54.3
Middle1 Bluestone	0.252	83.2	04Sep2013, 12:30	13.7
Junction-2	1.304	259.4	04Sep2013, 12:55	67.9
Reach-2	1.304	259.3	04Sep2013, 13:10	67.4
Middle Bluestone	0.363	133.4	04Sep2013, 12:25	19.7
Junction-3	1.667	326.8	04Sep2013, 12:40	87.1
Reach-3	1.667	326.6	04Sep2013, 13:00	86.4
Lower Bluestone	0.286	102.3	04Sep2013, 12:25	14.7
Junction-4	1.953	371.5	04Sep2013, 13:00	101.1
Reach-4	1.953	369.7	04Sep2013, 13:05	100.8
Lower1 Bluestone	0.078	57.7	04Sep2013, 12:00	4.3
Junction-5	2.031	375.8	04Sep2013, 13:05	105.1
Reach-5	2.031	375.8	04Sep2013, 13:10	104.9
Lower2 Bluestone	0.188	79	04Sep2013, 12:20	10.8
Junction-6	2.219	400.9	04Sep2013, 13:10	115.7
Reach-6	2.219	399.6	04Sep2013, 13:25	115
Lower3 Bluestone	0.425	152.3	04Sep2013, 12:30	24.3
Downstream	2.644	453	04Sep2013, 13:25	139.3

Project: OXF 157 Simulation Run: Existing

Start of Run:	04Sep2013, 00:00	Basin Model:	Existing
End of Run:	05Sep2013, 00:05	Meteorologic Model:	1 YR
Compute Time:	04Sep2013, 15:18	Control Specifications:	Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Upper Bluestone	0.882	38.4	04Sep2013, 13:10	12.3
Upper1 Bluestone	0.17	22.4	04Sep2013, 12:10	2.9
Junction-1	1.052	43.9	04Sep2013, 13:05	15.3
Reach-1	1.052	43.9	04Sep2013, 13:15	15.2
Middle1 Bluestone	0.252	17.3	04Sep2013, 12:35	3.9
Junction-2	1.304	55	04Sep2013, 13:05	19.1
Reach-2	1.304	55	04Sep2013, 13:25	18.9
Middle Bluestone	0.363	27.6	04Sep2013, 12:30	5.7
Junction-3	1.667	68.2	04Sep2013, 13:05	24.6
Reach-3	1.667	68.2	04Sep2013, 13:25	24.3
Lower Bluestone	0.286	19.5	04Sep2013, 12:30	4.1
Junction-4	1.953	78.9	04Sep2013, 13:05	28.4
Reach-4	1.953	78.8	04Sep2013, 13:10	28.3
Lower1 Bluestone	0.078	12.9	04Sep2013, 12:05	1.2
Junction-5	2.031	80.8	04Sep2013, 13:10	29.5
Reach-5	2.031	80.8	04Sep2013, 13:15	29.4
Lower2 Bluestone	0.188	17.6	04Sep2013, 12:25	3.2
Junction-6	2.219	88	04Sep2013, 13:15	32.7
Reach-6	2.219	87.6	04Sep2013, 13:30	32.4
Lower3 Bluestone	0.425	34.2	04Sep2013, 12:35	7.3
Downstream	2.644	104.1	04Sep2013, 13:25	39.7

SECTION 4

HEC-RAS In-Line Structure Analysis Report and Sections

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

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

****

PROJECT DATA
Project Title: OXF 157-159 Bridges
Project File : OXF157-159Bridges.prj
Run Date and Time: 5/29/2014 2:49:29 PM

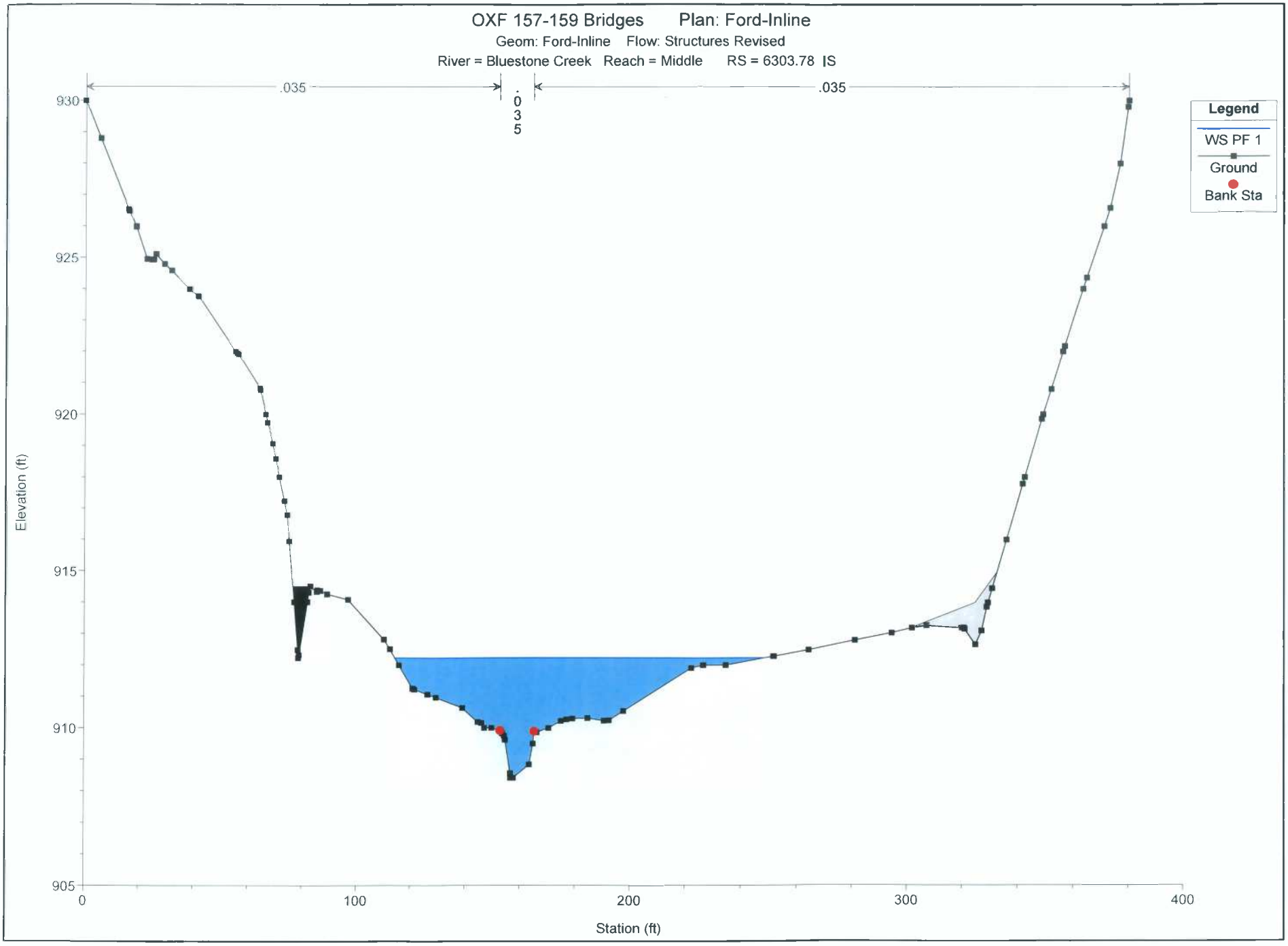
Project in English units

INLINE STRUCTURE

RIVER: Bluestone Creek
REACH: Middle RS: 6303.78

INLINE STRUCTURE OUTPUT Profile #PF 1 Inl Struct:

E.G. Elev (ft)	912.64	Q Gates (cfs)		
W.S. Elev (ft)	912.23	Q Gate Group (cfs)	0.00	
Q Total (cfs)	855.60	Gate Open Ht (ft)	912.12	
Q Weir (cfs)	855.60	Gate #Open		
Weir Flow Area (sq ft)	250.62	Gate Area (sq ft)	1.00	
Weir Sta Lft (ft)	111.67	Gate Submerg	0.00	
Weir Sta Rgt (ft)	272.65	Gate Invert (ft)	0.00	
Weir Max Depth (ft)	4.23	Gate Weir Coef	0.000	
Weir Avg Depth (ft)	1.56			
Weir Coef (ft^1/2)	2.600	Q Breach (cfs)		
Weir Submerg	0.82	Breach Avg Velocity (ft/s)		
Min El Weir Flow (ft)	908.42	Breach Flow Area (sq ft)		
Wr Top Wdth (ft)	160.97			

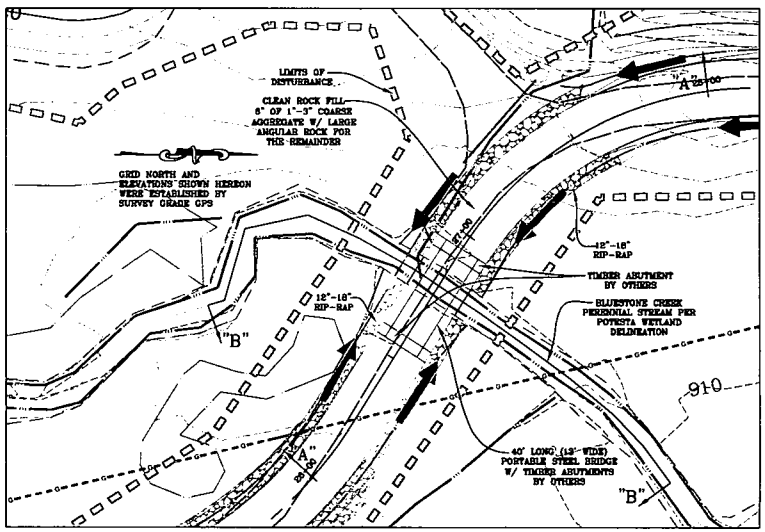

OXF 157-159 Bridges Plan: Ford-Inline
Geom: Ford-Inline Flow: Structures Revised
River = Bluestone Creek Reach = Middle RS = 6303.78 IS
.035
.035
.035
Legend
WS PF 1
Ground
Bank Sta
930
925
920
915
910
905
Elevation (ft)
0
100
200
300
400
Station (ft)

SECTION 5

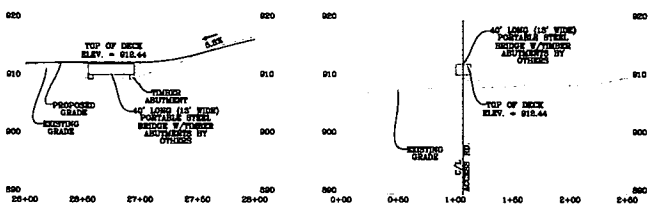
Stream Crossing "D" Details

TEMPORARY STREAM CROSSING DETAILS

STREAM CROSSING "D" DETAILS



STREAM CROSSING "D" SECTIONS



CROSS SECTION "A-A"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

CROSS SECTION "B-B"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL TEMPORARY STREAM CROSSING NOTES:

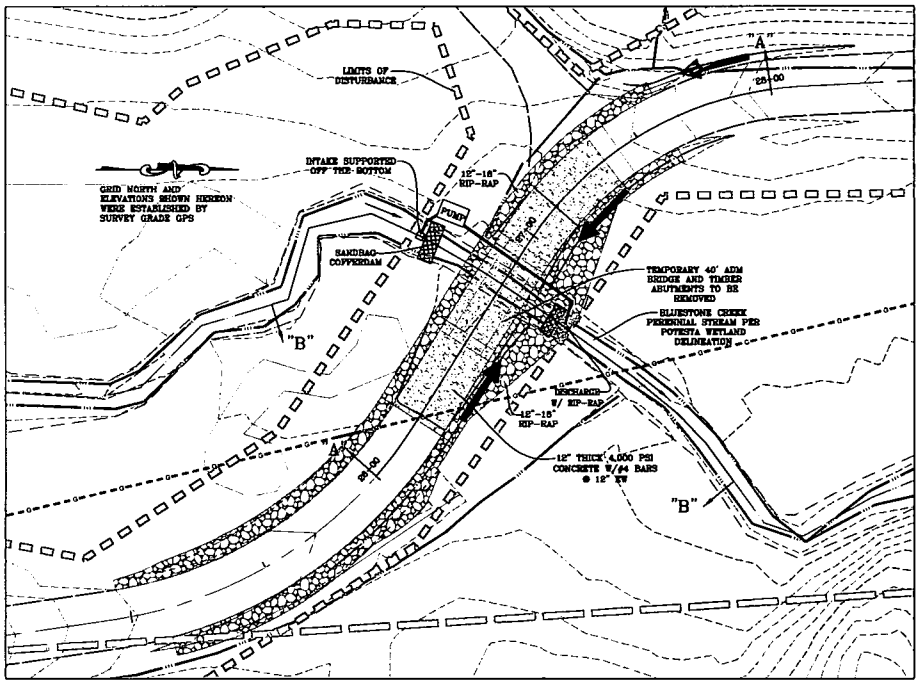
1) DO NOT USE ERODIBLE MATERIAL FOR CONSTRUCTION OF THE CROSSING.
2) CLEARING AND EXCAVATION OF THE STREAM BANKS SHALL BE KEPT TO A MINIMUM.
3) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
4) TIMBER ABUTMENTS FOR THE BRIDGE INSTALLATION SHALL BE INSTALLED TO REDUCE STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
5) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
6) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
7) THE TEMPORARY BRIDGE SHALL BE ANCHORED AS REQUIRED PER THE DODDRIDGE COUNTY FLOODPLAIN ORDINANCE.

NOTE:

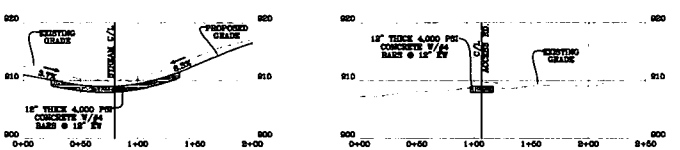
1) SEE SHEET 21 FOR PUMP AROUND NOTES AND DETAILS
2) SEE STREAM CROSSING REPORT BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATIONS.
3) EQT SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "D".

PERMANENT STREAM CROSSING DETAILS

STREAM CROSSING "D" DETAILS



STREAM CROSSING "D" SECTIONS



CROSS SECTION "A-A"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

CROSS SECTION "B-B"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL STREAM CROSSING NOTES:

1) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
2) STREAM BED WILL BE MONITORED DURING CONSTRUCTION. ALL GROUNDWATER SEEPAGE NEEDS TO REMOVED PRIOR TO STRUCTURAL BASE MATERIAL AND CONCRETE BEING EMPLACED.
3) SOIL BEARING CAPACITY TO BE FIELD VERIFIED PRIOR TO CONSTRUCTION. MINIMUM SOIL BEARING CAPACITY IS 4,000 PSF.
4) IF UNSUITABLE MATERIAL IS ENCOUNTERED DURING CONSTRUCTION, THE MATERIAL IS TO BE REMOVED, AND ADDITIONAL 3/4"-1" STONE IS TO BE EMPLACED.
5) FILTER CLOTH SHALL BE PLACED ON THE STREAMBED AND STREAM BANKS PRIOR TO PLACEMENT OF THE CONCRETE AND AGGREGATE. THE FILTER CLOTH SHALL COVER THE STREAMBED AND EXTEND A MINIMUM OF SIX INCHES AND A MAXIMUM OF ONE FOOT BEYOND THE END OF THE FORD AND BEDDING MATERIAL.
6) A PUMP AROUND SYSTEM SHALL BE CONSTRUCTED ACROSS THE ROADWAY ON EITHER SIDE OF THE STREAM CROSSING AS DIRECTED DURING CROSSING CONSTRUCTION.
10) AT NO POINT DURING CONSTRUCTION SHALL THE CONCRETE FORD BE EXPOSED TO THE NORMAL FLOW OF THE STREAM, ONLY UNTIL AFTER THE CONCRETE HAS HARDENED AND CURED SHALL THE PUMP AROUND SYSTEM BE REMOVED AND NORMAL FLOW RESTORED.
11) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
12) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
13) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
14) THE CROSSING MUST BE INSPECTED AFTER EVERY RAIN EVENT OF 0.5 INCHES OR MORE AND ONCE A WEEK TO ENSURE THAT THE FORD, STREAMBED, AND STREAM BANKS ARE MAINTAINED AND NOT DAMAGED. NEVER ALLOW THE FORD TO BECOME CLOGGED WITH DEBRIS AND REMOVE ANY OBSTRUCTIONS IMMEDIATELY.
15) GEOTEXTILE FABRIC SHALL MEETS THE TENSILE STRENGTH REQUIREMENTS OF 180 LBS PER ASTM D 4632, MULLEN BURSTING REQUIREMENTS OF 320 PSI PER ASTM D 3786, AND PUNCTURE TEST REQUIREMENTS OF 80 LBS PER ASTM D 4833.
16) ACCESS ROAD DITCHES SHALL BE MAINTAINED AND EXCAVATED AS NECESSARY FOR THE EMPLACEMENT OF RIP-RAP ARMORING.
17) CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4,000 PSI AT 28 DAYS.
18) STORM RUNOFF MAY DEPOSIT DEBRIS AT THE CROSSING LOCATION WHICH WILL NEED TO BE REMOVED.

NAVITUS ENERGY ENGINEERING
Telephone: (888) 662-4185 | www.NavitusEng.com

Professional Energy Consultants
A DIVISION OF SMITH LAND SURVEYING, INC.
SLS SURVEYORS ENGINEERS ENVIRONMENTAL PROJECT MGMT.
www.SLSSURVEY.COM (304) 455-5054

LICENSED PROFESSIONAL ENGINEER No. 11705 WEST VIRGINIA

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC.
FOR: EQT PRODUCTION COMPANY

MAJOR STREAM CROSSING DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

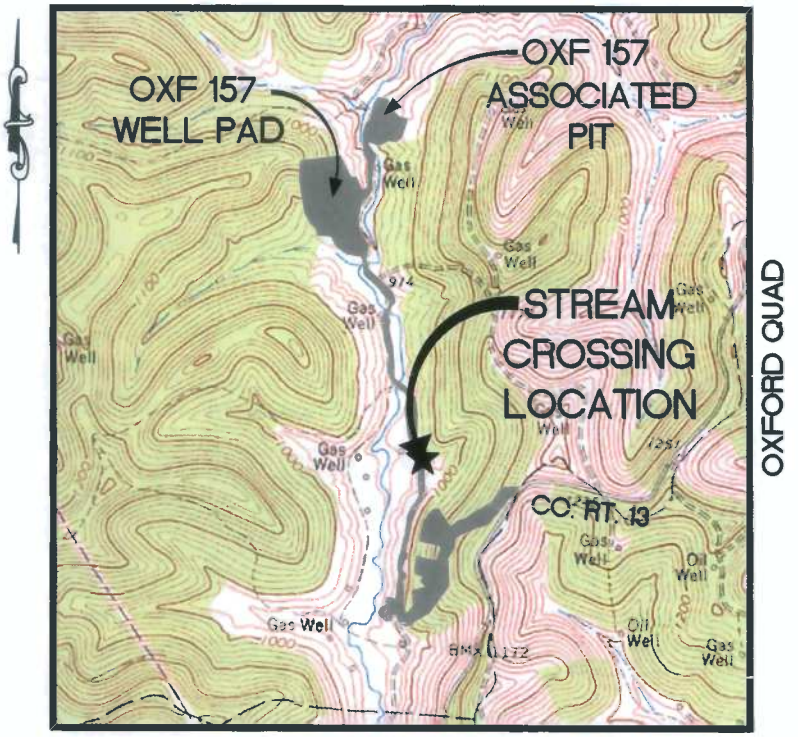
DATE: 11/04/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7859
SHEET 24 OF 32
REV: 06/03/2014

OXFORD 157 Stream Crossing Computations not in Flood Zone (E-J)

2 of 2

STREAM CROSSING "E"
STORMWATER COMPUTATIONS
OXF 157 WELL PAD

E



VICINITY MAP
1" = 2,000'

NAVITUS
ENERGY ENGINEERING
Telephone: (888) 662-4185 | www.NavitusEng.com

Prepared For:
EQT Production Company
115 Professional Place
P.O. Box 280
Bridgeport, WV 26330

Contact:
Victoria J. Roark
Permitting Supervisor
(304) 848-0076

Designed By:
Navitus Engineering Inc.

Project Manager:
Chandler Pearson
cpearson@navituseng.com

MARK D. SMITH
REGISTERED
No. 11709
WEST VIRGINIA
PROFESSIONAL ENGINEER

Date: June 3, 2014

Surface Owner (s)
Justin L. Henderson

Tax Parcel:
Map 6 Parcel 1

Location:
West Union District, Doddridge County
West Virginia

FN# 7889

OXF 157 WELL PAD

STREAM CROSSING "E"

STORMWATER COMPUTATIONS

Sections

SECTION 1

Overview

The intent of this project is to construct a gravel access road to a gas well pad site and associated facilities. This project will include a permanent stream crossing. UNT 2, which has been classified as a intermittent stream per the wetlands report conducted by Potesta Engineers and Environmental Consultants dated May 29, 2013, will be crossed at station 17+99.255 of the proposed access road.

Drainage Narrative

Using the SCS Method, we determined the 1, 10, and 100-year rainfall events at the stream crossing study point. We then used HY-8 to design the culvert and to determine the base flow water surface elevation for each rainfall event. Stream Crossing "E" has a drainage area of 33.50 Acres. Design flows are provided in the drainage calculations in Section 3.

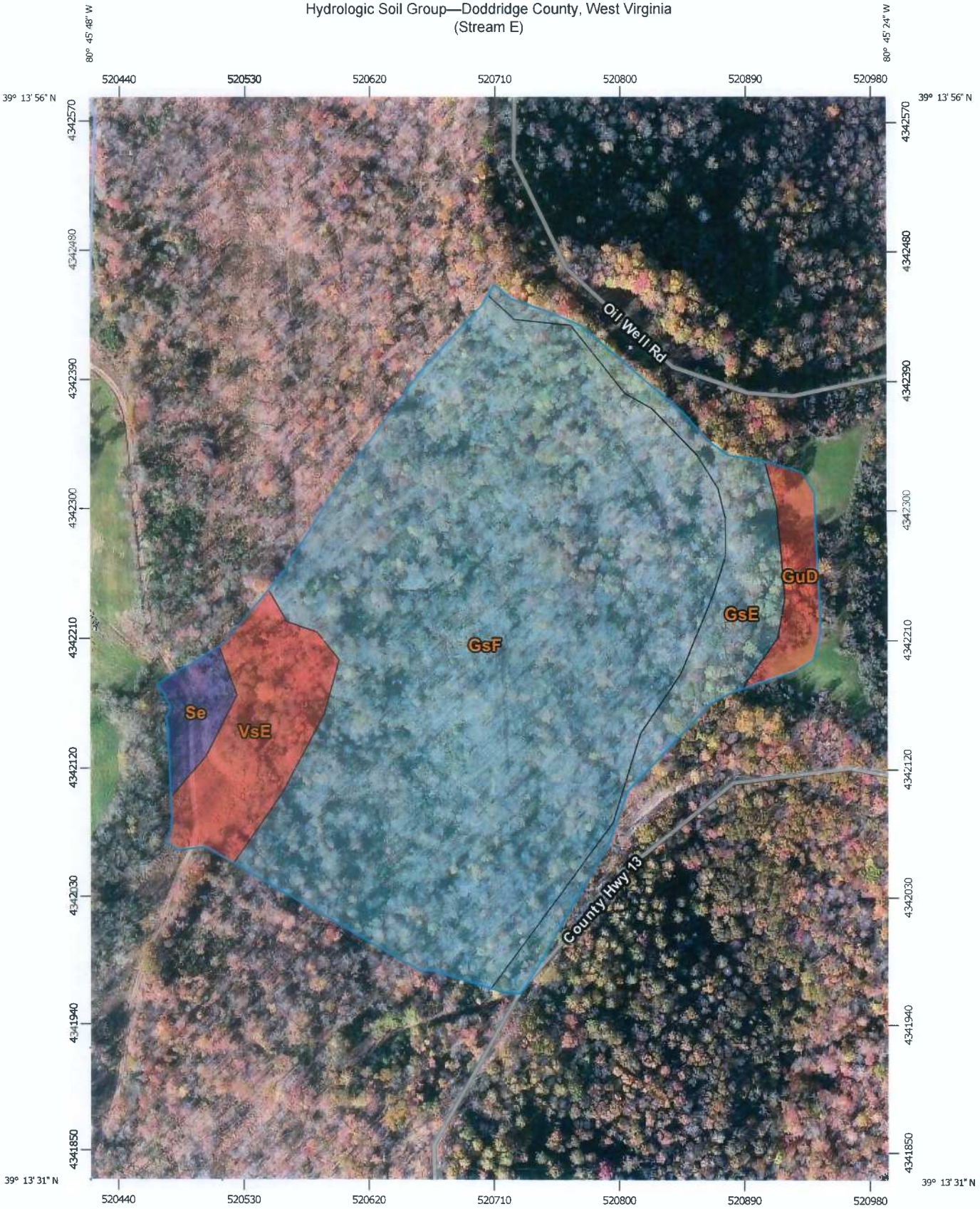
The permanent stream crossing was designed per the West Virginia Department of Environmental Protection Erosion and Sediment Control Best Management Practice Manual 2006 edition, Section 3.21-21. Per this manual, any structure that will remain in place 6 months or longer shall be large enough to convey the flow from a 10-year frequency, 24 hour duration storm. This culvert is sized to handle the computed 10-year storm event flow of 41.59 cfs.

The stream crossing was also designed as a permanent structure in accordance with the U.S. Army Corps of Engineering Nationwide 14 Permit. The structure is a 42 inch high-density polyethylene pipe culvert. The culvert is 54.00 LF with a slope of 6.15%. The stream crossing will contain clean rock fill made of 2-4" aggregate 50 feet on each side of the culvert for the first 6" of fill, the remainder of material shall be only large angular rock. No erodible material or green concrete shall be used in the crossing. The permanent stream crossing will impact 70.6' of the intermittent stream, UNT 2.

SECTION 2

NRCS Soils Report

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



Map Scale: 1:3,690 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

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

Soils

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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

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

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 8, 2011—Oct 25, 2011

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Doddridge County, West Virginia (WV017)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
GsE	Gilpin-Peabody complex, 15 to 35 percent slopes, very stony	C	3.3	10.0%
GsF	Gilpin-Peabody complex, 35 to 70 percent slopes, very stony	C	25.5	76.2%
GuD	Gilpin-Upshur complex, 15 to 25 percent slopes	D	1.0	3.1%
Se	Sensabaugh silt loam	B	0.8	2.3%
VsE	Vandalia silt loam, 15 to 35 percent slopes, very stony	D	2.9	8.5%
Totals for Area of Interest			**33.5**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

SECTION 3

SCS TR-55
Drainage Computations

Runoff Curve Number (CN)

Cover Description	CN	Soil Group	Area (Acre)
Meadow (Good)	58	B	0.00
Meadow (Good)	78	D	0.00
Woods (Good)	55	B	0.80
Woods (Good)	70	C	28.80
Woods (Good)	77	D	3.90
CN (weighted):	70		
Total Area:	33.50	Acre(s)	

Time of Concentration (SCS)

Curve Number:	70	
Length of Flow:	1744.39	ft
Average Land Slope:	22.97	%
Time of Concentration:	0.224	hrs

Runoff Hydrograph: SCS Method

Input Data:		
Drainage Area	33.50	Acre(s)
Runoff Curve Number, CN	70	
Time of Concentration	0.224	hrs
Base Flow	0.00	cfs
Antecendent Moisture Condition	Type II	
Rainfall Distribution Type	Type II	24 hr
Rainfall Depth, 1-year	2.15	in
Rainfall Depth, 10-year	3.54	in
Rainfall Depth, 100-year	5.17	in
Peak Rate Factor	484	

Computed Results, 1 year:		
Time to Peak	12.20	hrs
Peak Discharge, 1-year	8.75	cfs
Runoff Volume, 1-year	0.85	acre-ft

Computed Results, 10 year:		
Time to Peak	12.20	hrs
Peak Discharge	41.59	cfs
Runoff Volume	2.92	acre-ft

Computed Results, 100 year:		
Time to Peak	12.20	hrs
Peak Discharge	90.82	cfs
Runoff Volume	6.11	acre-ft

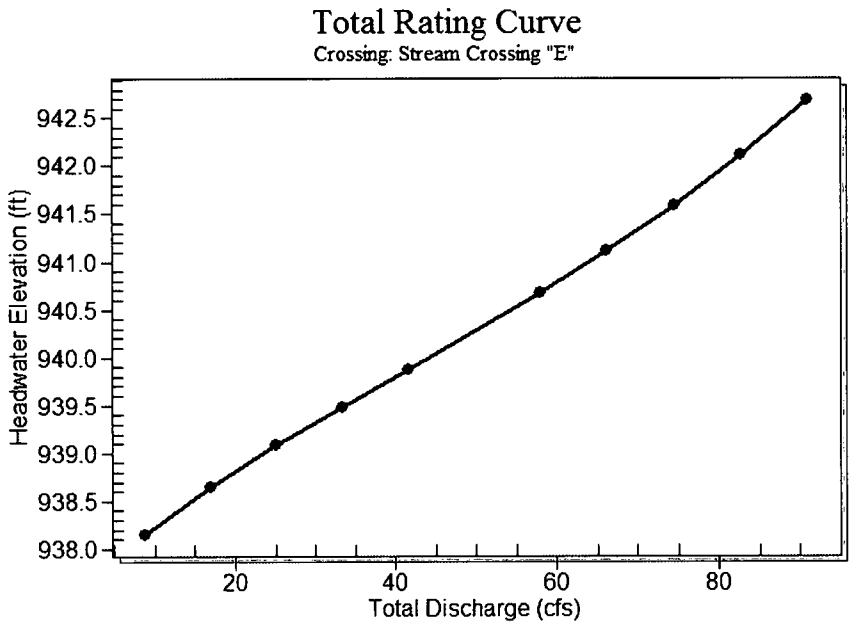
SECTION 4

HY-8 Culvert Analysis Report and Sections

HY-8 Culvert Analysis Report

Headwater Elevation (ft)	Total Discharge (cfs)	Stream Crossing E Discharge (cfs)	Roadway Discharge (cfs)	Iterations
938.16	8.75	8.75	0.00	1
938.65	16.96	16.96	0.00	1
939.08	25.16	25.16	0.00	1
939.49	33.37	33.37	0.00	1
939.87	41.58	41.58	0.00	1
939.87	41.59	41.59	0.00	1
940.67	57.99	57.99	0.00	1
941.11	66.20	66.20	0.00	1
941.59	74.41	74.41	0.00	1
942.11	82.61	82.61	0.00	1
942.69	90.82	90.82	0.00	1
943.92	105.98	105.98	0.00	Overtopping

Table 1 - Summary of Culvert Flows at Crossing: Stream Crossing "E"



Rating Curve Plot for Crossing: Stream Crossing "E"

Table 2 - Culvert Summary Table: Stream Crossing "E"

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
8.75	8.75	938.16	1.157	0.0*	1-S2n	0.580	0.877	0.587	0.573	8.031	5.548
16.96	16.96	938.65	1.648	0.0*	1-S2n	0.822	1.246	0.836	0.754	9.526	6.689
25.16	25.16	939.08	2.083	0.0*	1-S2n	1.018	1.535	1.025	0.891	10.701	7.452
33.37	33.37	939.49	2.486	0.0*	1-S2n	1.176	1.786	1.176	1.005	11.721	8.039
41.58	41.58	939.87	2.873	0.0*	1-S2n	1.326	2.001	1.333	1.103	12.336	8.522
41.59	41.59	939.87	2.874	0.0*	1-S2n	1.326	2.002	1.333	1.103	12.337	8.522
57.99	57.99	940.67	3.670	0.0*	5-S2n	1.596	2.380	1.605	1.270	13.469	9.300
66.20	66.20	941.11	4.108	0.0*	5-S2n	1.726	2.542	1.773	1.343	13.534	9.626
74.41	74.41	941.59	4.586	0.0*	5-S2n	1.851	2.691	1.907	1.411	13.887	9.923
82.61	82.61	942.11	5.113	0.0*	5-S2n	1.974	2.828	2.037	1.475	14.219	10.195
90.82	90.82	942.69	5.694	0.0*	5-S2n	2.098	2.933	2.168	1.535	14.522	10.447

* theoretical depth is impractical. Depth reported is corrected.

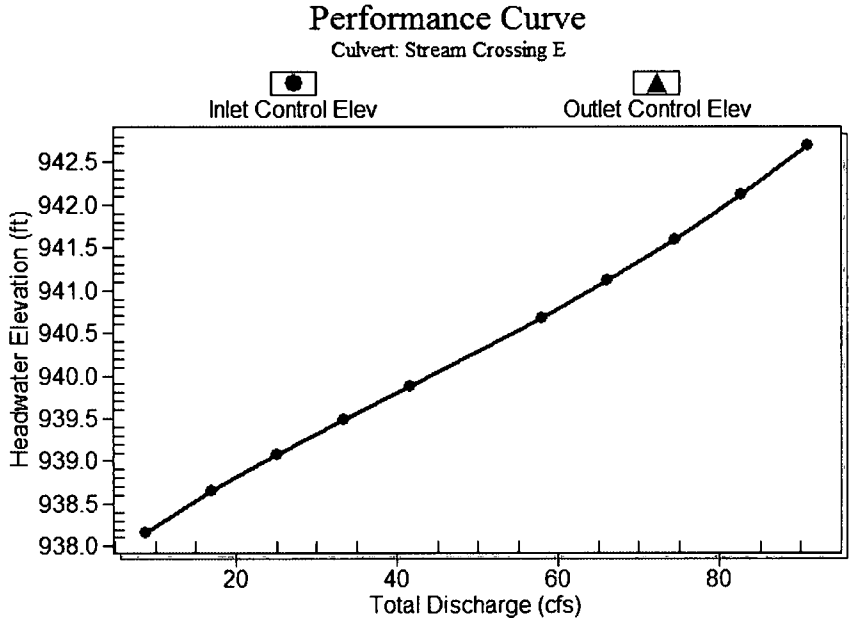
****

Inlet Elevation (invert): 937.00 ft, Outlet Elevation (invert): 933.68 ft

Culvert Length: 54.10 ft, Culvert Slope: 0.0615

****

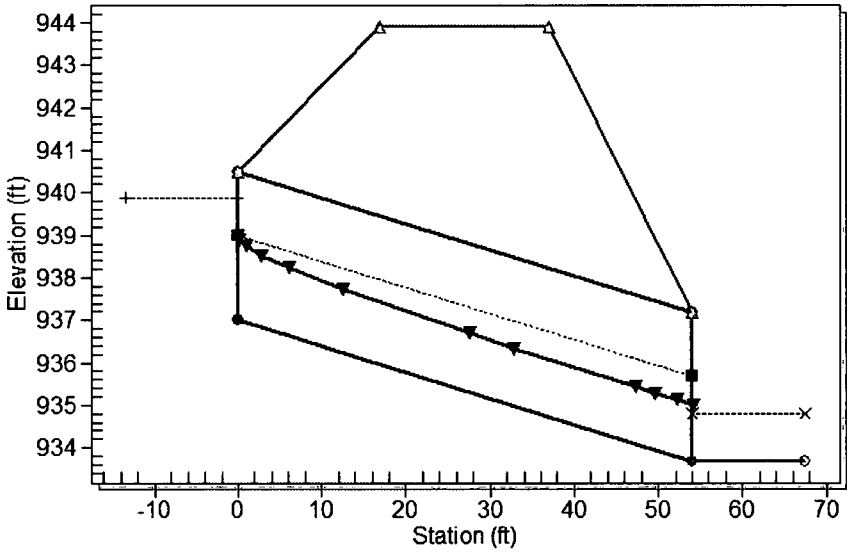
Culvert Performance Curve Plot: Stream Crossing "E"



Water Surface Profile Plot for Culvert: Stream Crossing "E"

Crossing - Stream Crossing "E" , Design Discharge - 41.6 cfs

Culvert - Stream Crossing E, Culvert Discharge - 41.6 cfs



Site Data - Stream Crossing "E"

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 937.00 ft

Outlet Station: 54.00 ft

Outlet Elevation: 933.68 ft

Number of Barrels: 1

Culvert Data Summary - Stream Crossing "E"

Barrel Shape: Circular

Barrel Diameter: 3.50 ft

Barrel Material: Corrugated PE

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Inlet Type: Conventional

Inlet Edge Condition: Square Edge with Headwall

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: Stream Crossing "E")

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
8.75	934.25	0.57	5.55	2.79	1.70
16.96	934.43	0.75	6.69	3.67	1.78
25.16	934.57	0.89	7.45	4.34	1.82
33.37	934.68	1.00	8.04	4.89	1.86
41.58	934.78	1.10	8.52	5.37	1.88
41.59	934.78	1.10	8.52	5.37	1.88
57.99	934.95	1.27	9.30	6.18	1.92
66.20	935.02	1.34	9.63	6.54	1.94
74.41	935.09	1.41	9.92	6.87	1.95
82.61	935.15	1.47	10.19	7.18	1.96
90.82	935.21	1.53	10.45	7.47	1.98

Tailwater Channel Data - Stream Crossing "E"

Tailwater Channel Option: Irregular Channel

Channel Slope: 0.0780

User Defined Channel Cross-Section:

Coord No.	Station (ft)	Elevation (ft)	Manning's n
1	0.00	940.00	0.0350
2	5.60	938.00	0.0350
3	11.00	936.00	0.0350
4	16.70	934.00	0.0350
5	18.60	933.68	0.0350
6	20.10	934.00	0.0350
7	25.30	936.00	0.0350
8	30.40	938.00	0.0350
9	34.90	940.00	0.0000

Roadway Data for Crossing: Stream Crossing "E"

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

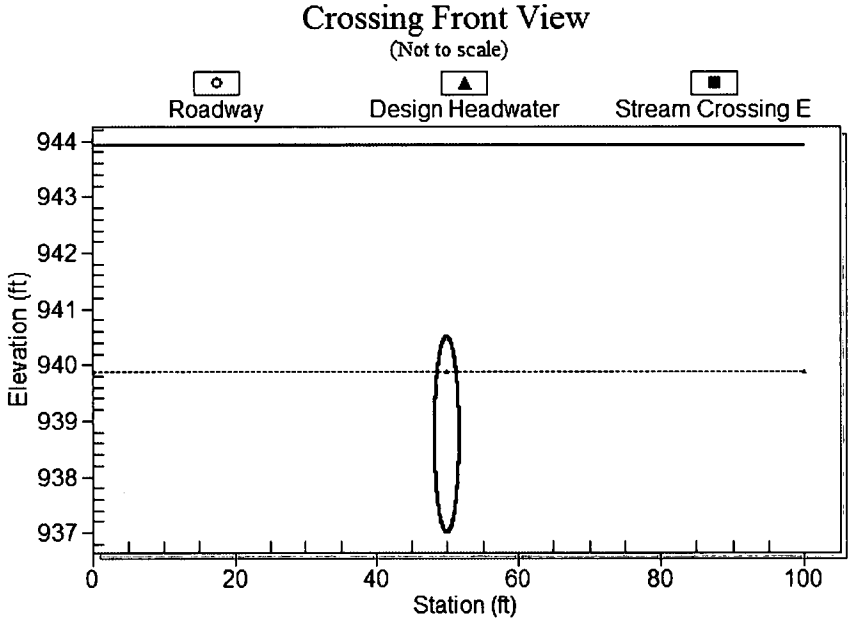
Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	943.92
1	50.00	943.92
2	100.00	943.92

Roadway Surface: Gravel

Roadway Top Width: 20.00 ft

Crossing Front View (Roadway Profile): Stream Crossing "E"

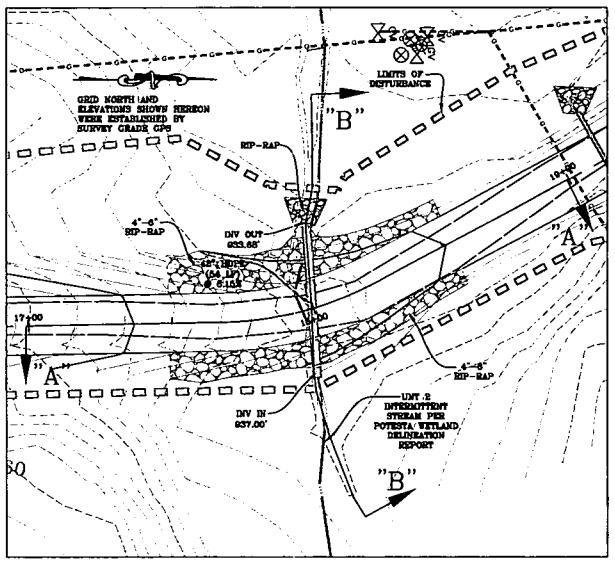


SECTION 5

Stream Crossing "E" Details

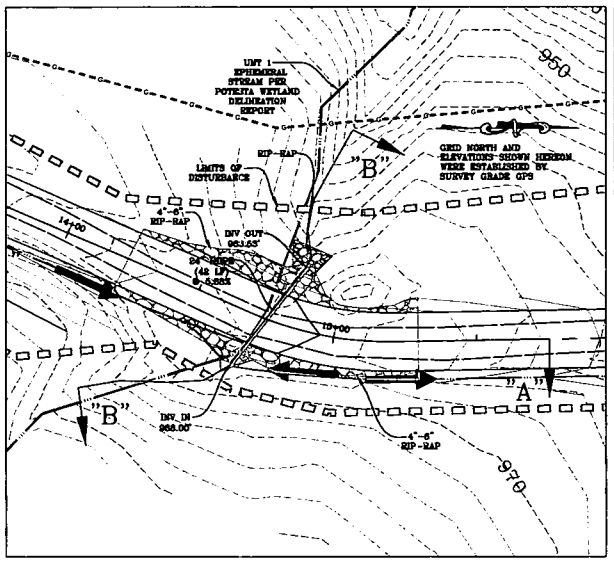
STREAM CROSSING DETAILS

STREAM CROSSING "E" DETAILS



20 10 0 20 40
SCALE: 1" = 20'

STREAM CROSSING "F" DETAILS



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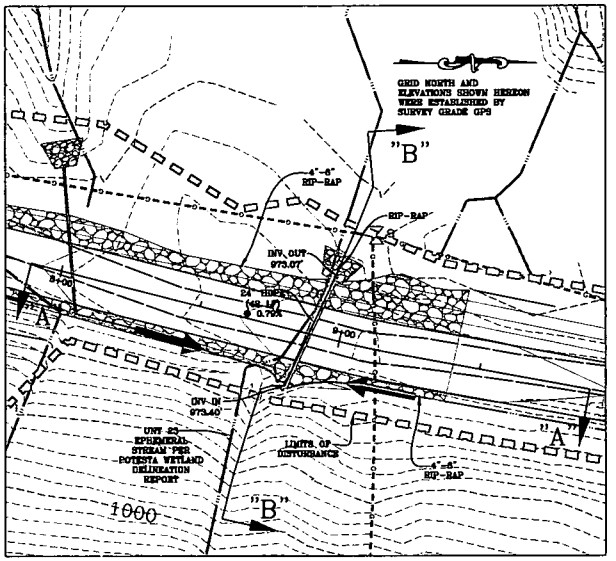
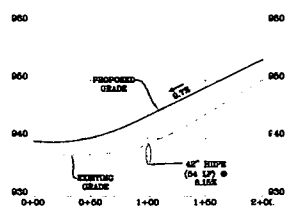
SCALE: 1" = 20'

STREAM CROSSING "G" DETAILS

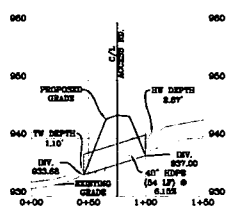


20 10 0 20 40
SCALE: 1" = 20'

STREAM CROSSING "E" SECTIONS

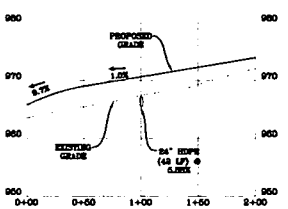


CROSS SECTION "A-A"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

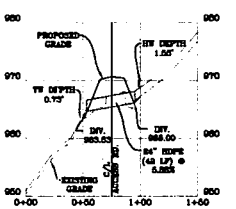


CROSS SECTION "B-B"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

STREAM CROSSING "F" SECTIONS

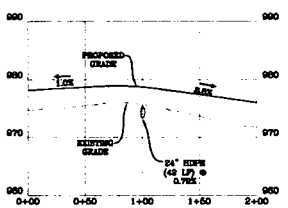


CROSS SECTION "A-A"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

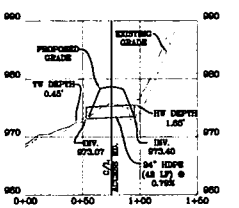


CROSS SECTION "B-B"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

STREAM CROSSING "G" SECTIONS



CROSS SECTION "A-A"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL STREAM CROSSING NOTES:

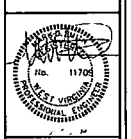
1) IF MULTIPLE CULVERTS ARE USED, THEY SHALL BE SEPARATED BY AT LEAST 12 INCHES OF COMPACTED AGGREGATE FILL.
2) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
3) FILTER CLOTH SHALL BE PLACED ON THE STREAMBED AND STREAMBANKS PRIOR TO PLACEMENT OF THE PIPE CULVERTS AND AGGREGATE. THE FILTER CLOTH SHALL COVER THE STREAMBED AND EXTEND A MINIMUM OF SIX INCHES AND A MAXIMUM OF ONE FOOT BEYOND THE END OF THE CULVERTS AND BEDDING MATERIAL.
4) A WATER DIVERTING SWALE SHALL BE CONSTRUCTED ACROSS THE ROADWAY ON EITHER SIDE OF THE STREAM CROSSING.
5) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
6) CROSS CHIRRING OF THE DOWNSTREAM SIDE OF THE CULVERT INSTALLATIONS MAY BE NEEDED TO AID IN REDUCING STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
7) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
8) GREEN CONCRETE SHALL NOT BE PLACED IN CONTACT WITH FLOWING WATER.
9) WHEN THE CROSSING HAS SERVED ITS PURPOSES, ALL STRUCTURES INCLUDING CULVERTS, BEDDING, AND FILTER CLOTH SHALL BE REMOVED. REMOVAL OF THE STRUCTURE AND CLEAN UP OF THE AREA SHOULD BE ACCOMPLISHED WITHOUT CONSTRUCTION EQUIPMENT WORKING IN THE WATERWAY CHANNEL. UPON REMOVAL OF THE STRUCTURE, THE STREAM BANK SHALL IMMEDIATELY BE STABILIZED.
10) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
11) THE CROSSING MUST BE INSPECTED AFTER EVERY RAIN EVENT OF 0.5 INCHES OR MORE AND ONCE A WEEK TO ENSURE THAT THE CULVERTS, STREAMBED, AND STREAM BANKS ARE MAINTAINED AND NOT DAMAGED. NEVER ALLOW THE CULVERTS TO BECOME CLOGGED WITH DEBRIS AND REMOVE ANY OBSTRUCTIONS IMMEDIATELY.
12) FLUSHING IS NOT AN APPROVED METHOD TO BE UTILIZED FOR CULVERT CLEANOUT.

NOTE:

1) SEE STREAM CROSSING REPORT BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATIONS.
2) EQT SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "E", "F" & "G".

NAVITUS ENERGY ENGINEERING
Telephone: (888) 662-4185 | www.NavitusEng.com

Professional Energy Consultants
A DIVISION OF SMITH LAND SURVEYING, INC.
SLS
SURVEYORS ENGINEERS ENVIRONMENTAL PROJECT MGMT.
WWW.SLSSURVEYS.COM (304) 457-2004



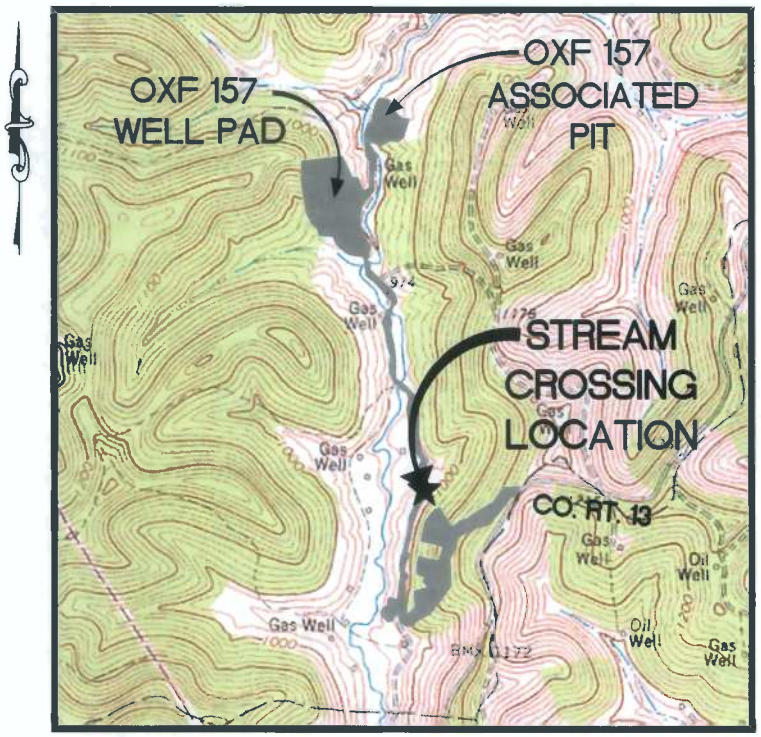
THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC. FOR: EQT PRODUCTION COMPANY

MINOR STREAM CROSSING DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7589
SHEET 25 OF 32
REV: 06/03/2014

STREAM CROSSING "F"
STORMWATER COMPUTATIONS
OXF 157 WELL PAD

F



VICINITY MAP
1" = 2,000'

NAVITUS
ENERGY ENGINEERING
Telephone: (888) 662-4185 | www.NavitusEng.com

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Bridgeport, WV 26330

Contact:
Victoria J. Roark
Permitting Supervisor
(304) 848-0076

Designed By:
Navitus Engineering Inc.

Project Manager:
Chandler Pearson
cpearson@navituseng.com

MARK D. SMITH
REGISTERED
No. 11709
WEST VIRGINIA
PROFESSIONAL ENGINEER

Date: June 3, 2014

Surface Owner (s)
Justin L. Henderson

Tax Parcel:
Map 6 Parcel 1

Location:
West Union District, Doddridge County
West Virginia

FN# 7889

OXF 157 WELL PAD

STREAM CROSSING "F"

STORMWATER COMPUTATIONS

Sections

SECTION 1

Overview

The intent of this project is to construct a gravel access road to a gas well pad site and associated facilities. This project will include a permanent stream crossing. UNT 1, which has been classified as a ephemeral stream per the wetlands report conducted by Potesta Engineers and Environmental Consultants dated May 29, 2013, will be crossed at station 14+75.465 of the proposed access road.

Drainage Narrative

Using the SCS Method, we determined the 1, 10, and 100-year rainfall events at the stream crossing study point. We then used HY-8 to design the culvert and to determine the base flow water surface elevation for each rainfall event. Stream Crossing "F" has a drainage area of 5.10 Acres. Design flows are provided in the drainage calculations in Section 3.

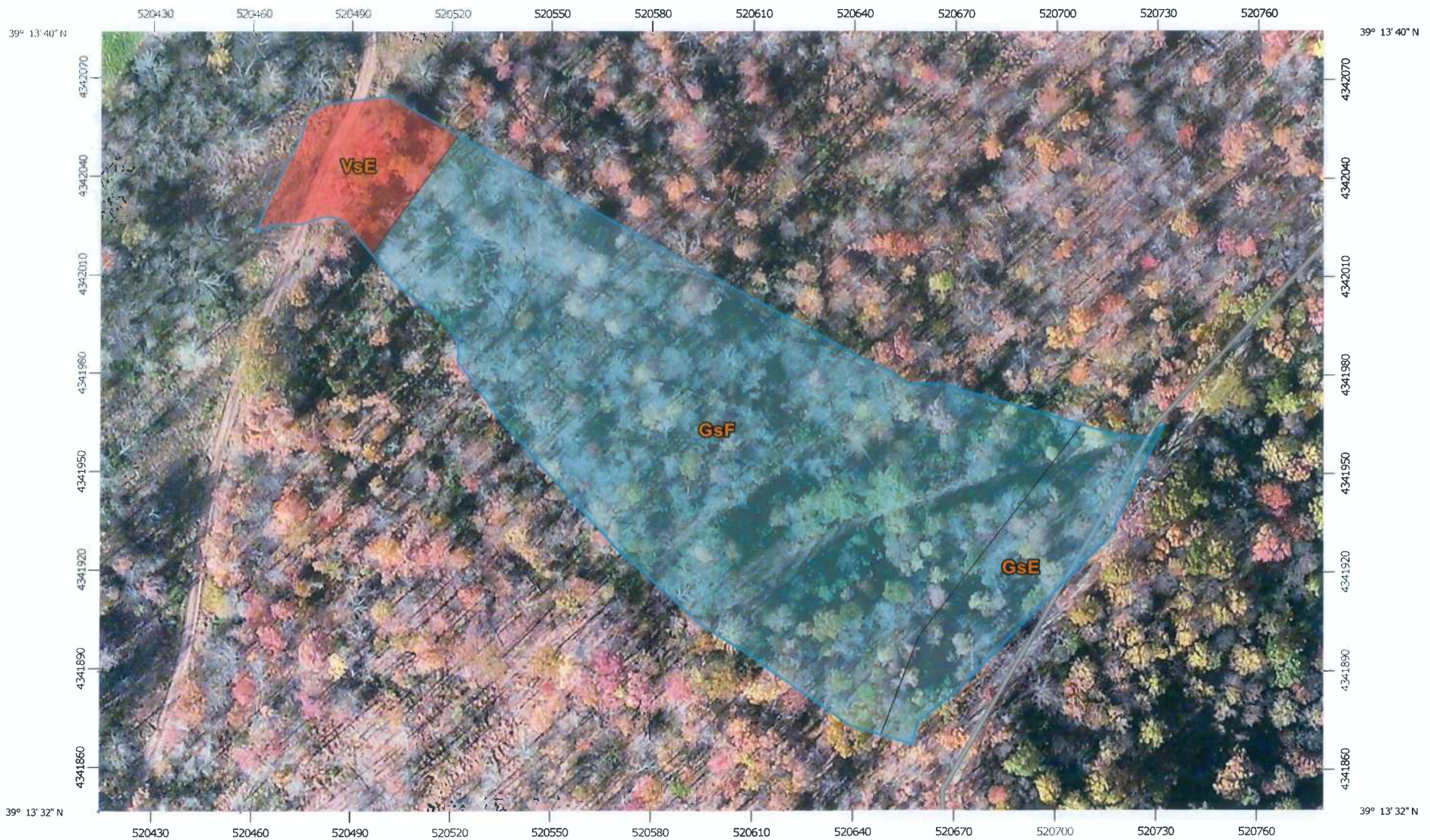
The permanent stream crossing was designed per the West Virginia Department of Environmental Protection Erosion and Sediment Control Best Management Practice Manual 2006 edition, Section 3.21-21. Per this manual, any structure that will remain in place 6 months or longer shall be large enough to convey the flow from a 10-year frequency, 24 hour duration storm. This culvert is sized to handle the computed 10-year storm event flow of 8.23 cfs.

The stream crossing was also designed as a permanent structure in accordance with the U.S. Army Corps of Engineering Nationwide 14 Permit. The structure is a 24 inch high-density polyethylene pipe culvert. The culvert is 42.00 LF with a slope of 5.88%. The stream crossing will contain clean rock fill made of 2-4" aggregate 50 feet on each side of the culvert for the first 6" of fill, the remainder of material shall be only large angular rock. No erodible material or green concrete shall be used in the crossing. The permanent stream crossing will impact 72.3' of the ephemeral stream, UNT 1.

SECTION 2

NRCS Soils Report

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



MAP LEGEND

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

Soils

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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

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

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 8, 2011—Oct 25, 2011

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Doddridge County, West Virginia (WV017)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
GsE	Gilpin-Peabody complex, 15 to 35 percent slopes, very stony	C	0.6	11.9%
GsF	Gilpin-Peabody complex, 35 to 70 percent slopes, very stony	C	4.1	80.2%
VsE	Vandalia silt loam, 15 to 35 percent slopes, very stony	D	0.4	8.0%
Totals for Area of Interest			**5.1**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

SECTION 3

SCS TR-55
Drainage Computations

Runoff Curve Number (CN)

Cover Description	CN	Soil Group	Area (Acre)
Meadow (Good)	58	B	0.00
Meadow (Good)	78	D	0.00
Woods (Good)	55	B	0.00
Woods (Good)	70	C	4.70
Woods (Good)	77	D	0.40
CN (weighted):	71		
Total Area:	5.10	Acre(s)	

Time of Concentration (SCS)

Curve Number:	71	
Length of Flow:	1005.41	ft
Average Land Slope:	30.14	%
Time of Concentration:	0.126	hrs

Runoff Hydrograph: SCS Method

Input Data:		
Drainage Area	5.10	Acre(s)
Runoff Curve Number, CN	71	
Time of Concentration	0.126	hrs
Base Flow	0.00	cfs
Antecendent Moisture Condition	Type II	
Rainfall Distribution Type	Type II	24 hr
Rainfall Depth, 1-year	2.15	in
Rainfall Depth, 10-year	3.54	in
Rainfall Depth, 100-year	5.17	in
Peak Rate Factor	484	

Computed Results, 1 year:		
Time to Peak	12.20	hrs
Peak Discharge, 1-year	2.25	cfs
Runoff Volume, 1-year	0.14	acre-ft

Computed Results, 10 year:		
Time to Peak	12.20	hrs
Peak Discharge	8.23	cfs
Runoff Volume	0.46	acre-ft

Computed Results, 100 year:		
Time to Peak	12.20	hrs
Peak Discharge	16.75	cfs
Runoff Volume	0.95	acre-ft

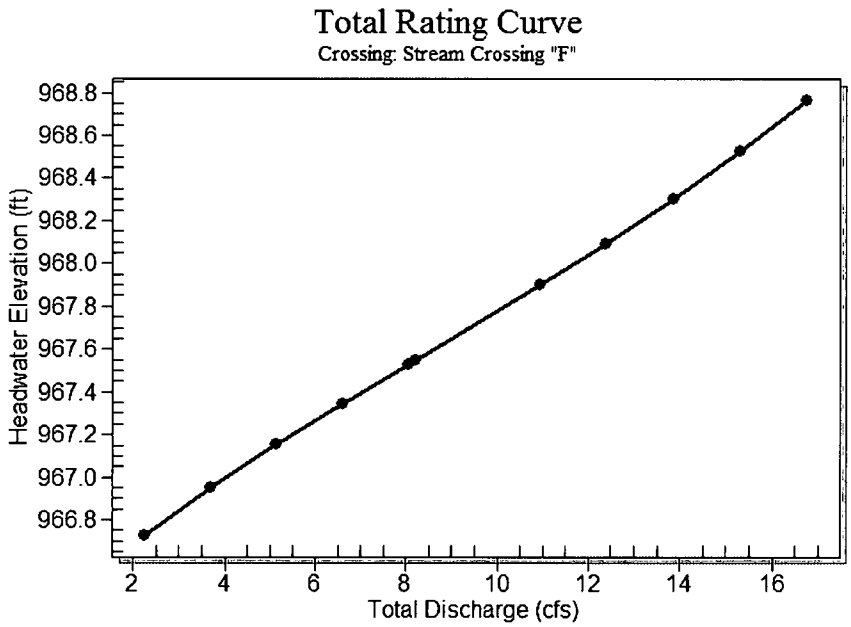
SECTION 4

HY-8 Culvert Analysis Report and Sections

HY-8 Culvert Analysis Report

Headwater Elevation (ft)	Total Discharge (cfs)	Stream Crossing F Discharge (cfs)	Roadway Discharge (cfs)	Iterations
966.73	2.25	2.25	0.00	1
966.95	3.70	3.70	0.00	1
967.15	5.15	5.15	0.00	1
967.34	6.60	6.60	0.00	1
967.53	8.05	8.05	0.00	1
967.55	8.23	8.23	0.00	1
967.90	10.95	10.95	0.00	1
968.09	12.40	12.40	0.00	1
968.30	13.85	13.85	0.00	1
968.52	15.30	15.30	0.00	1
968.77	16.75	16.75	0.00	1
970.64	25.08	25.08	0.00	Overtopping

Table 1 - Summary of Culvert Flows at Crossing: Stream Crossing "F"



Rating Curve Plot for Crossing: Stream Crossing "F"

Table 2 - Culvert Summary Table: Stream Crossing "F"

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
2.25	2.25	966.73	0.729	0.0*	1-S2n	0.364	0.512	0.371	0.447	5.533	6.872
3.70	3.70	966.95	0.952	0.0*	1-S2n	0.468	0.668	0.477	0.538	6.384	7.782
5.15	5.15	967.15	1.153	0.0*	1-S2n	0.558	0.800	0.559	0.610	7.139	8.453
6.60	6.60	967.34	1.344	0.0*	1-S2n	0.637	0.905	0.644	0.669	7.592	8.994
8.05	8.05	967.53	1.528	0.0*	1-S2n	0.706	1.009	0.708	0.721	8.061	9.452
8.23	8.23	967.55	1.551	0.0*	1-S2n	0.714	1.020	0.719	0.727	8.073	9.504
10.95	10.95	967.90	1.897	0.0*	1-S2n	0.838	1.185	0.839	0.809	8.772	10.207
12.40	12.40	968.09	2.092	0.0*	5-S2n	0.897	1.262	0.901	0.847	9.024	10.530
13.85	13.85	968.30	2.300	0.0*	5-S2n	0.957	1.336	0.959	0.883	9.294	10.825
15.30	15.30	968.52	2.524	0.0*	5-S2n	1.016	1.409	1.017	0.917	9.538	11.098
16.75	16.75	968.77	2.767	0.0*	5-S2n	1.073	1.470	1.079	0.949	9.695	11.352

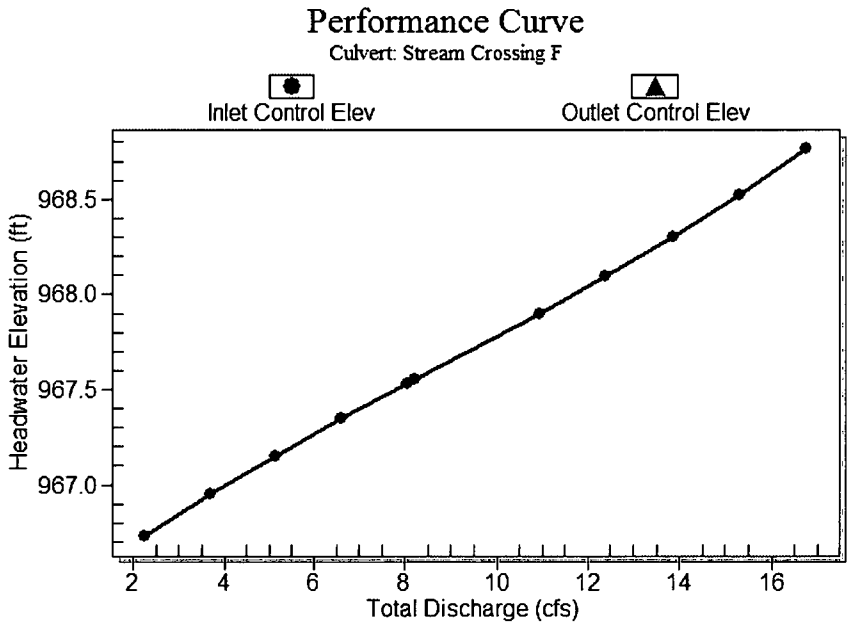
* theoretical depth is impractical. Depth reported is corrected.

****

Inlet Elevation (invert): 966.00 ft, Outlet Elevation (invert): 963.53 ft

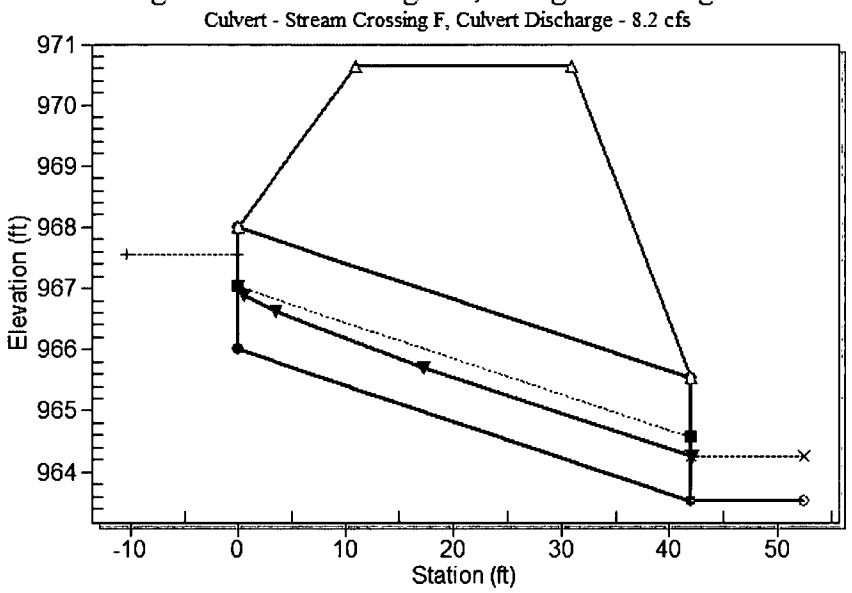
Culvert Length: 42.07 ft, Culvert Slope: 0.0588

****



Culvert Performance Curve Plot: Stream Crossing "F"

Water Surface Profile Plot for Culvert: Stream Crossing "F"



Site Data - Stream Crossing "F"

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 966.00 ft

Outlet Station: 42.00 ft

Outlet Elevation: 963.53 ft

Number of Barrels: 1

Culvert Data Summary - Stream Crossing "F"

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Corrugated PE

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Inlet Type: Conventional

Inlet Edge Condition: Thin Edge Projecting

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: Stream Crossing "F")

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
2.25	963.98	0.45	6.87	6.66	2.56
3.70	964.07	0.54	7.78	8.03	2.64
5.15	964.14	0.61	8.45	9.09	2.70
6.60	964.20	0.67	8.99	9.98	2.74
8.05	964.25	0.72	9.45	10.75	2.77
8.23	964.26	0.73	9.50	10.84	2.78
10.95	964.34	0.81	10.21	12.06	2.83
12.40	964.38	0.85	10.53	12.64	2.85
13.85	964.41	0.88	10.82	13.17	2.87
15.30	964.45	0.92	11.10	13.68	2.89
16.75	964.48	0.95	11.35	14.15	2.90

Tailwater Channel Data - Stream Crossing "F"

Tailwater Channel Option: Irregular Channel

Channel Slope: 0.2390

User Defined Channel Cross-Section:

Coord No.	Station (ft)	Elevation (ft)	Manning's n
1	0.00	968.00	0.0350
2	5.50	966.00	0.0350
3	10.00	963.53	0.0350
4	13.60	966.00	0.0350
5	18.10	968.00	0.0350

Roadway Data for Crossing: Stream Crossing "F"

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

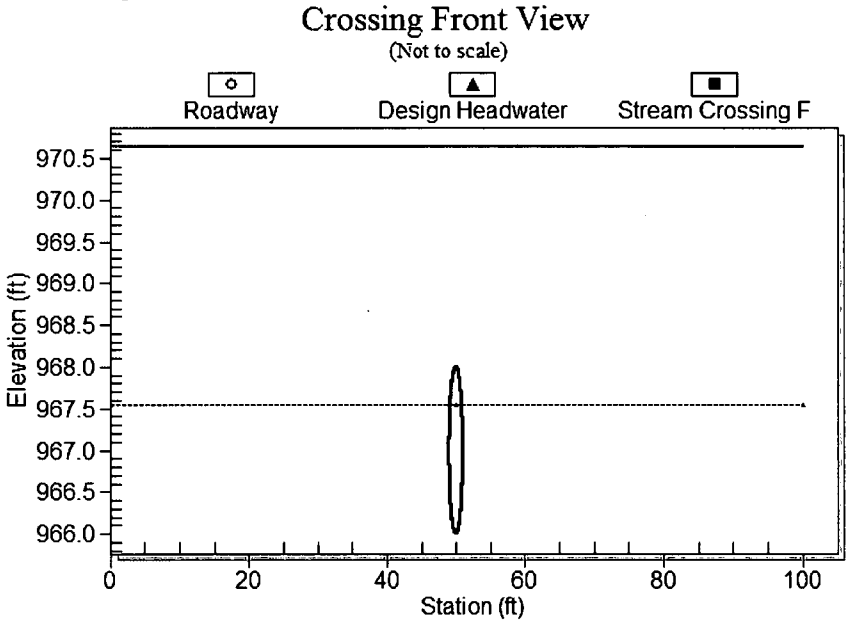
Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	970.64
1	50.00	970.64
2	100.00	970.64

Roadway Surface: Gravel

Roadway Top Width: 20.00 ft

Crossing Front View (Roadway Profile): Stream Crossing "F"

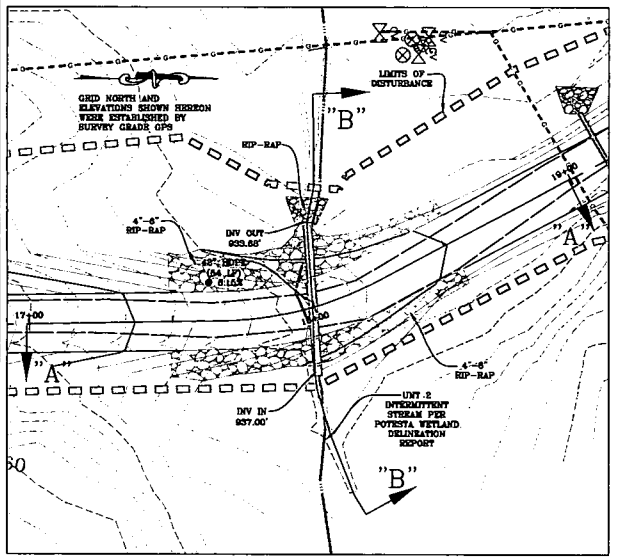


SECTION 5

Stream Crossing "F" Details

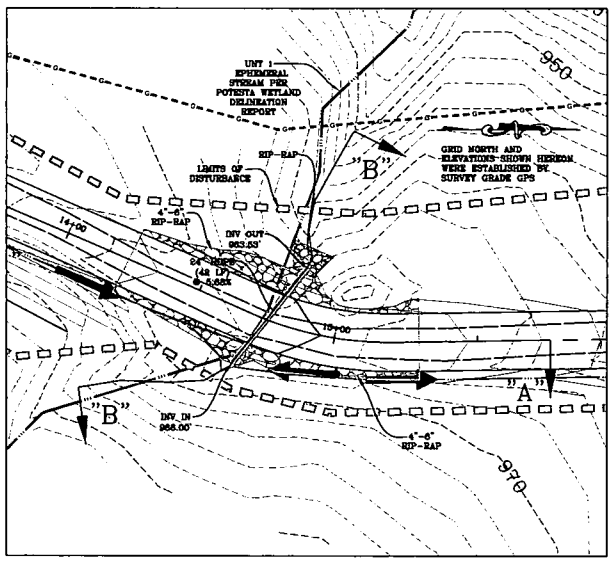
STREAM CROSSING DETAILS

STREAM CROSSING "E" DETAILS



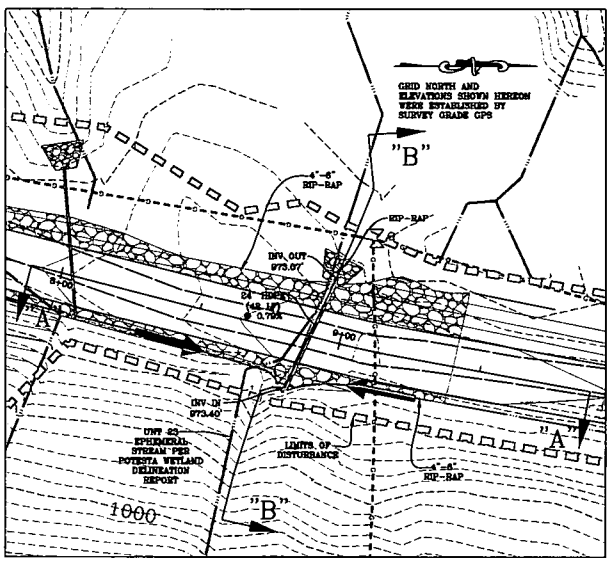
20 10 0 20 40
SCALE: 1" = 20'

STREAM CROSSING "F" DETAILS



20 10 0 20 40
SCALE: 1" = 20'

STREAM CROSSING "G" DETAILS



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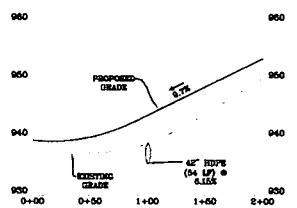
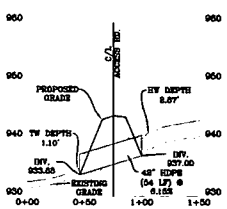
SCALE: 1" = 20'

STREAM CROSSING "E" SECTIONS

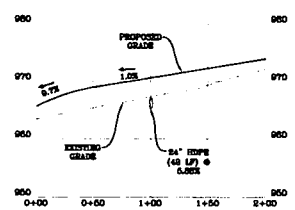


CROSS SECTION "A-A"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

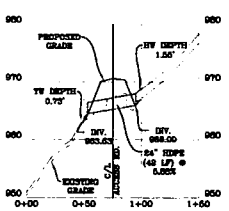


CROSS SECTION "B-B"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

STREAM CROSSING "F" SECTIONS

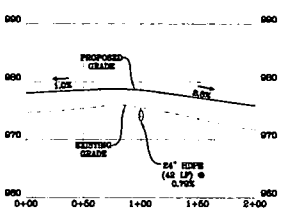


CROSS SECTION "A-A"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

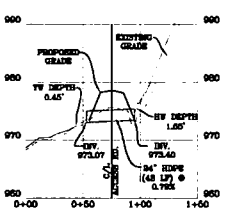


CROSS SECTION "B-B"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

STREAM CROSSING "G" SECTIONS



CROSS SECTION "A-A"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL STREAM CROSSING NOTES:

1) IF MULTIPLE CULVERTS ARE USED, THEY SHALL BE SEPARATED BY AT LEAST 12 INCHES OF COMPACTED AGGREGATE FILL.
2) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
3) FILTER CLOTH SHALL BE PLACED ON THE STREAMBED AND STREAMBANKS PRIOR TO PLACEMENT OF THE PIPE CULVERTS AND AGGREGATE. THE FILTER CLOTH SHALL COVER THE STREAMBED AND EXTEND A MINIMUM OF SIX INCHES AND A MAXIMUM OF ONE FOOT BEYOND THE END OF THE CULVERTS AND BEDDING MATERIAL.
4) A WATER DIVERTING SWALE SHALL BE CONSTRUCTED ACROSS THE ROADWAY ON EITHER SIDE OF THE STREAM CROSSING.
5) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
6) CROSS CRIBBING OF THE DOWNSTREAM SIDE OF THE CULVERT INSTALLATIONS MAY BE NEEDED TO AID IN REDUCING STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
7) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
8) GREEN CONCRETE SHALL NOT BE PLACED IN CONTACT WITH FLOWING WATER.
9) WHEN THE CROSSING HAS SERVED ITS PURPOSE, ALL STRUCTURES INCLUDING CULVERTS, BEDDING, AND FILTER CLOTH SHALL BE REMOVED. REMOVAL OF THE STRUCTURE AND CLEAN UP OF THE AREA SHOULD BE ACCOMPLISHED WITHOUT CONSTRUCTION EQUIPMENT WORKING IN THE WATERWAY CHANNEL. UPON REMOVAL OF THE STRUCTURE, THE STREAM BANK SHALL IMMEDIATELY BE STABILIZED.
10) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
11) THE CROSSING MUST BE INSPECTED AFTER EVERY RAIN EVENT OF 0.5 INCHES OR MORE AND ONCE A WEEK TO ENSURE THAT THE CULVERTS, STREAMBED, AND STREAM BANKS ARE MAINTAINED AND NOT DAMAGED. NEVER ALLOW THE CULVERTS TO BECOME CLOGGED WITH DEBRIS AND REMOVE ANY OBSTRUCTIONS IMMEDIATELY.
12) FLUSHING IS NOT AN APPROVED METHOD TO BE UTILIZED FOR CULVERT CLEANOUT.

NOTE:

1) SEE STREAM CROSSING REPORT BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATIONS.
2) EQT SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "E", "F" & "G".

NAVITUS ENERGY ENGINEERING
Telephone: (888) 662-4105 | www.NavitusEng.com
Professional Energy Consultants
SURVEYORS LAND AGENTS ENVIRONMENTAL PROJECT MGMT.
SLS
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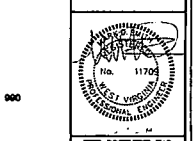
(304) 420-5834



THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC. FOR: EQT PRODUCTION COMPANY

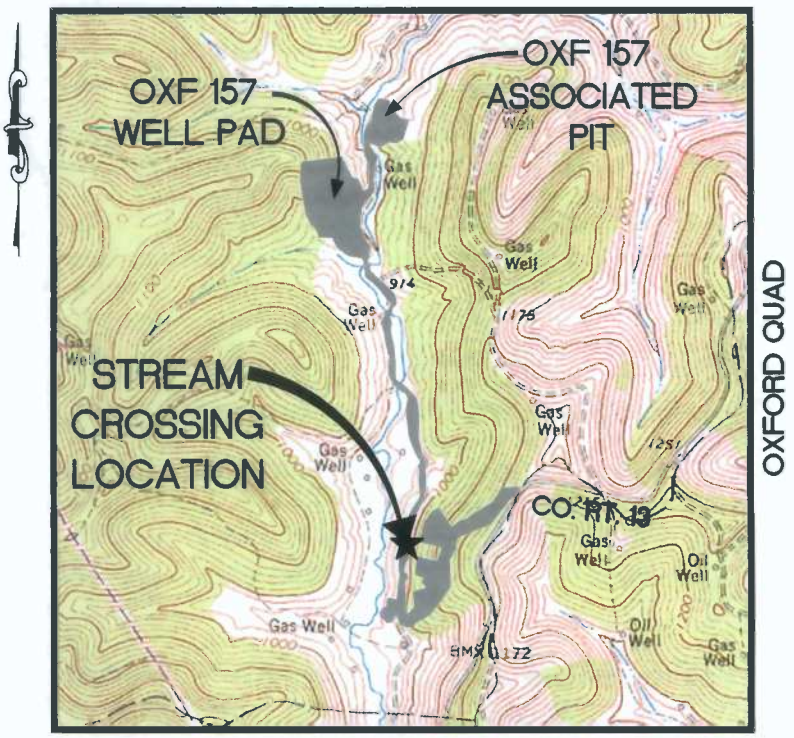
MINOR STREAM CROSSING DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7689
SHEET 25 OF 32
REV: 06/03/2014

STREAM CROSSING "G"
STORMWATER COMPUTATIONS

G

OXF 157 WELL PAD



VICINITY MAP
1" = 2,000'

NAVITUS
ENERGY ENGINEERING
Telephone: (888) 662-4185 | www.NavitusEng.com

Prepared For:
EQT Production Company
115 Professional Place
P.O. Box 280
Bridgeport, WV 26330

Contact:
Victoria J. Roark
Permitting Supervisor
(304) 848-0076

Designed By:
Navitus Engineering Inc.

Project Manager:
Chandler Pearson
cpearson@navituseng.com

MARK D. SMITH
REGISTERED
No. 11709
WEST VIRGINIA
PROFESSIONAL ENGINEER

Date: June 3, 2014

Surface Owner (s)
Justin L. Henderson

Tax Parcel:
Map 6 Parcel 1

Location:
West Union District, Doddridge County
West Virginia

FN# 7889

OXF 157 WELL PAD

STREAM CROSSING "G"

STORMWATER COMPUTATIONS

Sections

SECTION 1

Overview

The intent of this project is to construct a gravel access road to a gas well pad site and associated facilities. This project will include a permanent stream crossing. UNT 23, which has been classified as a ephemeral stream per the wetlands report conducted by Potesta Engineers and Environmental Consultants dated May 29, 2013, will be crossed at station 08+89.104 of the proposed access road.

Drainage Narrative

Using the SCS Method, we determined the 1, 10, and 100-year rainfall events at the stream crossing study point. We then used HY-8 to design the culvert and to determine the base flow water surface elevation for each rainfall event. Stream Crossing "G" has a drainage area of 5.20 Acres. Design flows are provided in the drainage calculations in Section 3.

The permanent stream crossing was designed per the West Virginia Department of Environmental Protection Erosion and Sediment Control Best Management Practice Manual 2006 edition, Section 3.21-21. Per this manual, any structure that will remain in place 6 months or longer shall be large enough to convey the flow from a 10-year frequency, 24 hour duration storm. This culvert is sized to handle the computed 10-year storm event flow of 7.65 cfs.

The stream crossing was also designed as a permanent structure in accordance with the U.S. Army Corps of Engineering Nationwide 14 Permit. The structure is a 24 inch high-density polyethylene pipe culvert. The culvert is 42.00 LF with a slope of 0.79%. The stream crossing will contain clean rock fill made of 2-4" aggregate 50 feet on each side of the culvert for the first 6" of fill, the remainder of material shall be only large angular rock. No erodible material or green concrete shall be used in the crossing. The permanent stream crossing will impact 68.8' of the ephemeral stream, UNT 23.

SECTION 2

NRCS Soils Report

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

Map Scale: 1:1,510 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 20 40 80 120

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

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

Soils

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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

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

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 8, 2011—Oct 25, 2011

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Doddridge County, West Virginia (WV017)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
GsE	Gilpin-Peabody complex, 15 to 35 percent slopes, very stony	C	0.0	0.6%
GsF	Gilpin-Peabody complex, 35 to 70 percent slopes, very stony	C	4.2	80.9%
VsE	Vandalia silt loam, 15 to 35 percent slopes, very stony	D	1.0	18.5%
Totals for Area of Interest			**5.2**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

SECTION 3

SCS TR-55
Drainage Computations

Runoff Curve Number (CN)

Cover Description	CN	Soil Group	Area (Acre)
Meadow (Good)	58	B	0.00
Meadow (Good)	78	D	0.00
Woods (Good)	55	B	0.00
Woods (Good)	70	C	4.20
Woods (Good)	77	D	1.00
CN (weighted):	71		
Total Area:	5.20	Acre(s)	

Time of Concentration (SCS)

Curve Number:	71	
Length of Flow:	865.42	ft
Average Land Slope:	34.20	%
Time of Concentration:	0.105	hrs

Runoff Hydrograph: SCS Method

Input Data:		
Drainage Area	5.20	Acre(s)
Runoff Curve Number, CN	71	
Time of Concentration	0.105	hrs
Base Flow	0.00	cfs
Antecendent Moisture Condition	Type II	
Rainfall Distribution Type	Type II	24 hr
Rainfall Depth, 1-year	2.15	in
Rainfall Depth, 10-year	3.54	in
Rainfall Depth, 100-year	5.17	in
Peak Rate Factor	484	

Computed Results, 1 year:		
Time to Peak	12.20	hrs
Peak Discharge, 1-year	2.13	cfs
Runoff Volume, 1-year	0.13	acre-ft

Computed Results, 10 year:		
Time to Peak	12.20	hrs
Peak Discharge	7.65	cfs
Runoff Volume	0.42	acre-ft

Computed Results, 100 year:		
Time to Peak	12.20	hrs
Peak Discharge	15.48	cfs
Runoff Volume	0.86	acre-ft

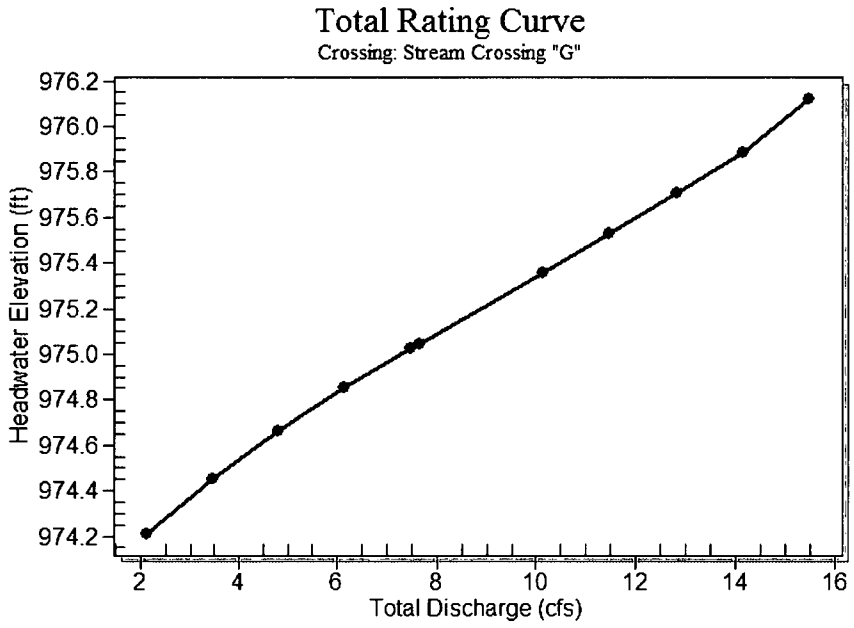
SECTION 4

HY-8 Culvert Analysis Report and Sections

HY-8 Culvert Analysis Report

Headwater Elevation (ft)	Total Discharge (cfs)	Stream Crossing G Discharge (cfs)	Roadway Discharge (cfs)	Iterations
974.21	2.13	2.13	0.00	1
974.45	3.46	3.46	0.00	1
974.66	4.80	4.80	0.00	1
974.85	6.14	6.14	0.00	1
975.02	7.47	7.47	0.00	1
975.05	7.65	7.65	0.00	1
975.36	10.14	10.14	0.00	1
975.53	11.48	11.48	0.00	1
975.70	12.81	12.81	0.00	1
975.88	14.15	14.15	0.00	1
976.12	15.48	15.48	0.00	1
978.61	25.08	25.08	0.00	Overtopping

Table 1 - Summary of Culvert Flows at Crossing: Stream Crossing "G"



Rating Curve Plot for Crossing: Stream Crossing "G"

Table 2 - Culvert Summary Table: Stream Crossing "G"

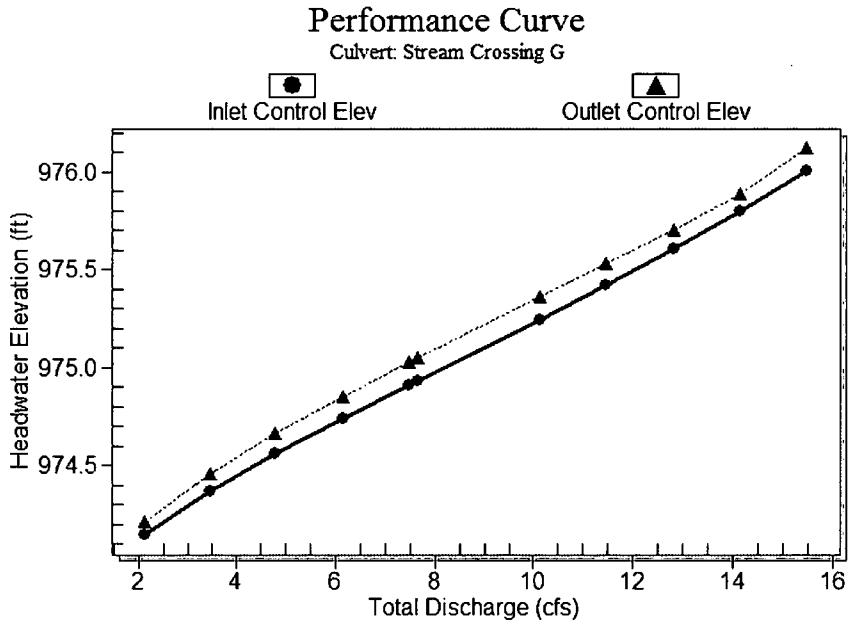
Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
2.13	2.13	974.21	0.744	0.813	2-M2c	0.600	0.498	0.506	0.280	3.407	5.248
3.46	3.46	974.45	0.970	1.054	2-M2c	0.774	0.646	0.651	0.337	3.905	5.927
4.80	4.80	974.66	1.156	1.261	2-M2c	0.928	0.768	0.771	0.380	4.298	6.430
6.14	6.14	974.85	1.335	1.450	2-M2c	1.074	0.872	0.876	0.417	4.635	6.837
7.47	7.47	975.02	1.506	1.625	2-M2c	1.218	0.969	0.971	0.449	4.937	7.182
7.65	7.65	975.05	1.529	1.647	2-M2c	1.238	0.982	0.983	0.453	4.975	7.225
10.14	10.14	975.36	1.843	1.958	2-M2c	1.535	1.136	1.140	0.503	5.484	7.752
11.48	11.48	975.53	2.018	2.128	2-M2c	1.774	1.215	1.216	0.527	5.741	7.996
12.81	12.81	975.70	2.201	2.304	2-M2c	2.000	1.283	1.287	0.550	5.994	8.219
14.15	14.15	975.88	2.395	2.482	2-M2c	2.000	1.352	1.355	0.570	6.246	8.425
15.48	15.48	976.12	2.604	2.724	7-M2c	2.000	1.416	1.418	0.590	6.498	8.617

****

Inlet Elevation (invert): 973.40 ft, Outlet Elevation (invert): 973.07 ft

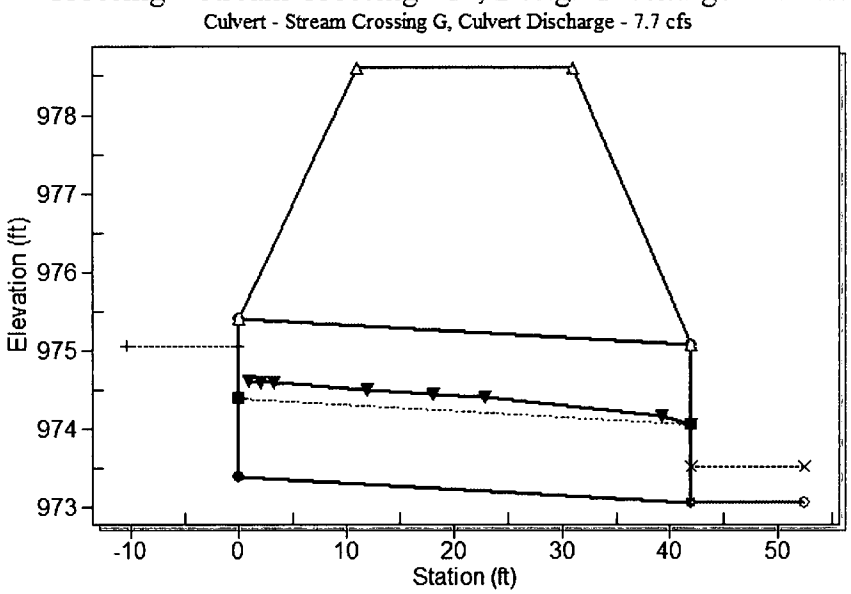
Culvert Length: 42.00 ft, Culvert Slope: 0.0079

****



Culvert Performance Curve Plot: Stream Crossing "G"

Water Surface Profile Plot for Culvert: Stream Crossing "G"



Site Data - Stream Crossing "G"

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 973.40 ft

Outlet Station: 42.00 ft

Outlet Elevation: 973.07 ft

Number of Barrels: 1

Culvert Data Summary - Stream Crossing "G"

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Corrugated PE

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Inlet Type: Conventional

Inlet Edge Condition: Thin Edge Projecting

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: Stream Crossing "G")

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
2.13	973.35	0.28	5.25	3.76	2.47
3.46	973.41	0.34	5.93	4.52	2.55
4.80	973.45	0.38	6.43	5.10	2.60
6.14	973.49	0.42	6.84	5.59	2.64
7.47	973.52	0.45	7.18	6.02	2.67
7.65	973.52	0.45	7.22	6.08	2.68
10.14	973.57	0.50	7.75	6.75	2.72
11.48	973.60	0.53	8.00	7.07	2.74
12.81	973.62	0.55	8.22	7.37	2.76
14.15	973.64	0.57	8.42	7.65	2.78
15.48	973.66	0.59	8.62	7.91	2.80

Tailwater Channel Data - Stream Crossing "G"

Tailwater Channel Option: Irregular Channel

Channel Slope: 0.2150

User Defined Channel Cross-Section:

Coord No.	Station (ft)	Elevation (ft)	Manning's n
1	0.00	976.00	0.0350
2	6.30	974.00	0.0350
3	11.30	973.07	0.0350
4	15.90	974.00	0.0350
5	21.40	976.00	0.0350

Roadway Data for Crossing: Stream Crossing "G"

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

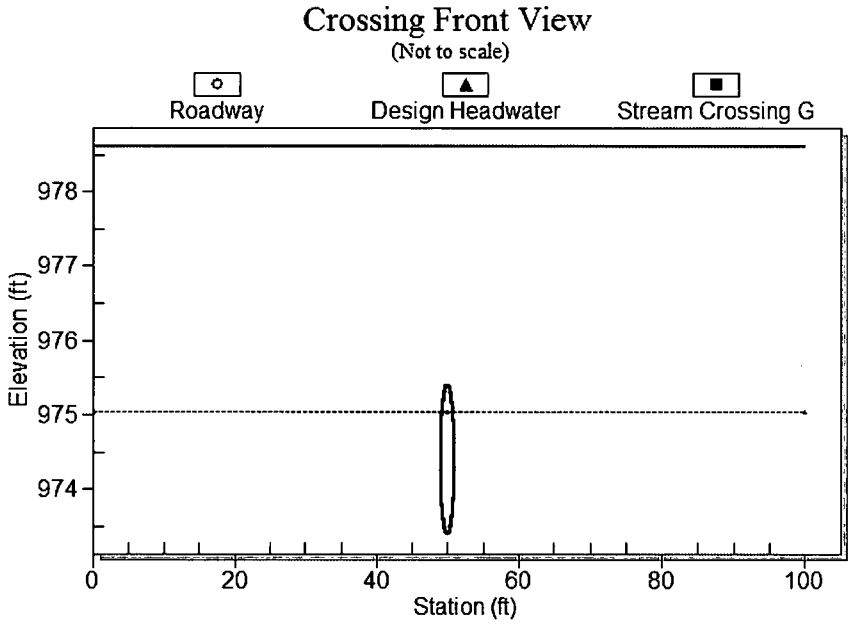
Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	978.61
1	50.00	978.61
2	100.00	978.61

Roadway Surface: Gravel

Roadway Top Width: 20.00 ft

Crossing Front View (Roadway Profile): Stream Crossing "G"

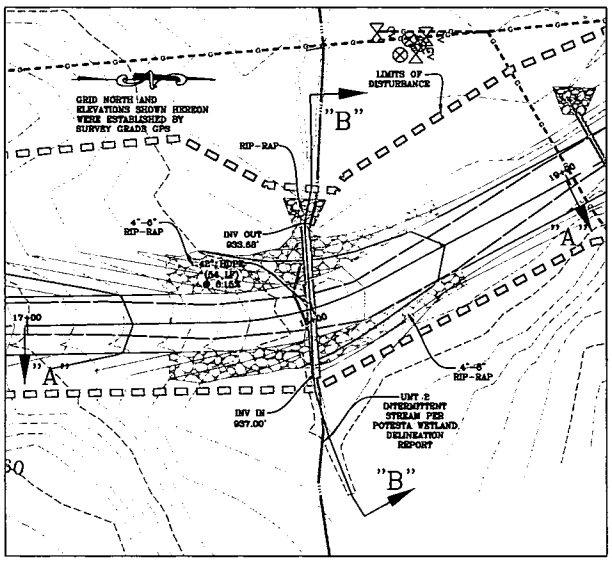


SECTION 5

Stream Crossing "G" Details

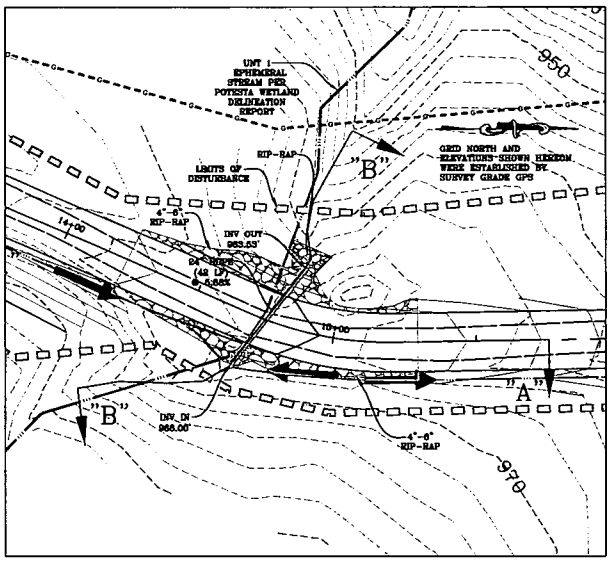
STREAM CROSSING DETAILS

STREAM CROSSING "E" DETAILS



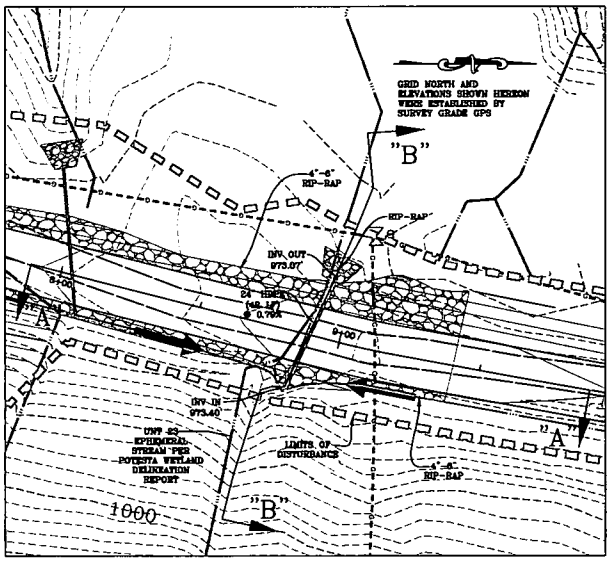
20 10 0 20 40
SCALE: 1" = 20'

STREAM CROSSING "F" DETAILS



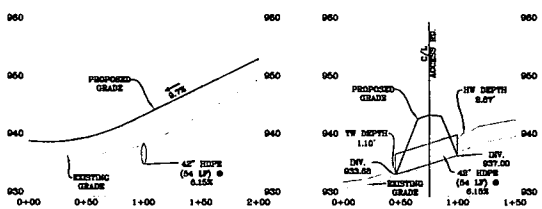
20 10 0 20 40
SCALE: 1" = 20'

STREAM CROSSING "G" DETAILS



20 10 0 20 40
SCALE: 1" = 20'

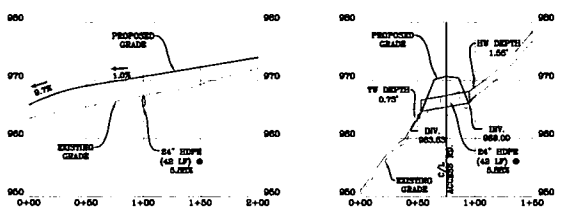
STREAM CROSSING "E" SECTIONS



CROSS SECTION "A-A"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

CROSS SECTION "B-B"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

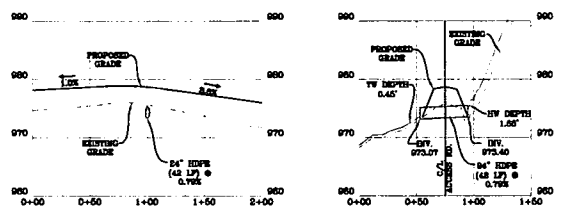
STREAM CROSSING "F" SECTIONS



CROSS SECTION "A-A"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

CROSS SECTION "B-B"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

STREAM CROSSING "G" SECTIONS



CROSS SECTION "A-A"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

CROSS SECTION "B-B"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL STREAM CROSSING NOTES:

1) IF MULTIPLE CULVERTS ARE USED, THEY SHALL BE SEPARATED BY AT LEAST 12 INCHES OF COMPACTED AGGREGATE FILL.
2) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
3) FILTER CLOTH SHALL BE PLACED ON THE STREAMBED AND STREAMBANKS PRIOR TO PLACEMENT OF THE PIPE CULVERTS AND AGGREGATE. THE FILTER CLOTH SHALL COVER THE STREAMBED AND EXTEND A MINIMUM OF SIX INCHES AND A MAXIMUM OF ONE FOOT BEYOND THE END OF THE CULVERTS AND BEDDING MATERIAL.
4) A WATER DIVERTING SWALE SHALL BE CONSTRUCTED ACROSS THE ROADWAY ON EITHER SIDE OF THE STREAM CROSSING.
5) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
6) CROSS CHEERING OF THE DOWNSTREAM SIDE OF THE CULVERT INSTALLATIONS MAY BE NEEDED TO AID IN REDUCING STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
7) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
8) GREEN CONCRETE SHALL NOT BE PLACED IN CONTACT WITH FLOWING WATER.
9) WHEN THE CROSSING HAS SERVED ITS PURPOSE, ALL STRUCTURES INCLUDING CULVERTS, BEDDING, AND FILTER CLOTH SHALL BE REMOVED. REMOVAL OF THE STRUCTURE AND CLEAN UP OF THE AREA SHOULD BE ACCOMPLISHED WITHOUT CONSTRUCTION EQUIPMENT WORKING IN THE WATERWAY CHANNEL. UPON REMOVAL OF THE STRUCTURE, THE STREAM BANK SHALL IMMEDIATELY BE STABILIZED.
10) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
11) THE CROSSING MUST BE INSPECTED AFTER EVERY RAIN EVENT OF 0.5 INCHES OR MORE AND ONCE A WEEK TO ENSURE THAT THE CULVERTS, STREAMBED, AND STREAM BANKS ARE MAINTAINED AND NOT DAMAGED. NEVER ALLOW THE CULVERTS TO BECOME CLOGGED WITH DEBRIS AND REMOVE ANY OBSTRUCTIONS IMMEDIATELY.
12) FLUSHING IS NOT AN APPROVED METHOD TO BE UTILIZED FOR CULVERT CLEANOUT.

NOTE:
1) SEE STREAM CROSSING REPORT BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATIONS.
2) EQT SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "E", "F" & "G".

NAVITUS ENERGY ENGINEERING
Telephone: (888) 562-4185 | www.NavitusEng.com

Professional Energy Consultants
A DIVISION OF SMITH LAND SURVEYING INC.
SURVEYORS ENGINEERS ENVIRONMENTAL PROJECT MGMT.
SLS
(304) 420-4084 www.SLSSURVEYS.com

WEST VIRGINIA No. 11705 PROFESSIONAL ENGINEER

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC. FOR: EQT PRODUCTION COMPANY

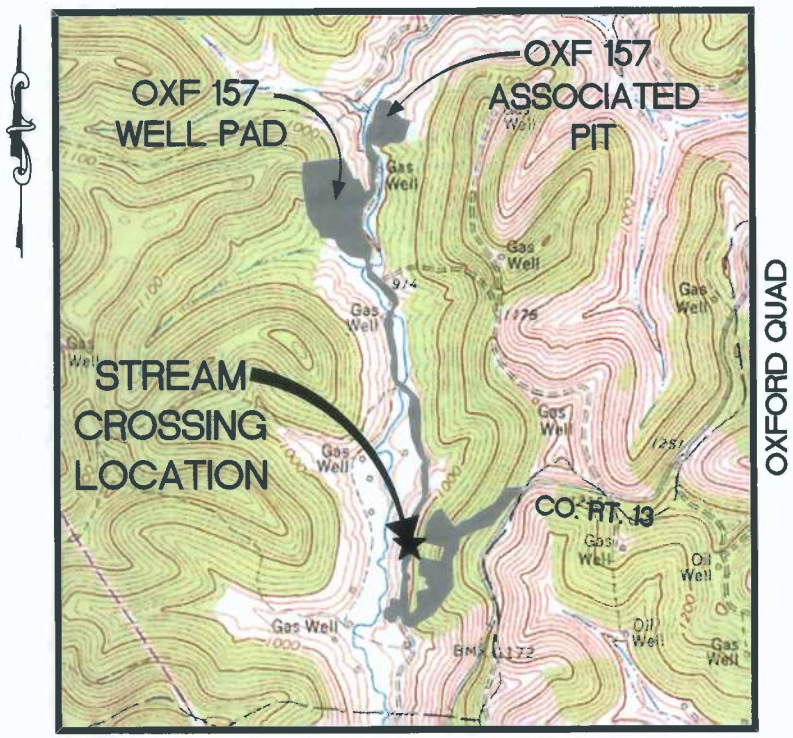
MINOR STREAM CROSSING DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7659
SHEET 25 OF 32
REV: 06/03/2014

STREAM CROSSING "H"
STORMWATER COMPUTATIONS

H

OXF 157 WELL PAD



VICINITY MAP
1" = 2,000'

NAVITUS
ENERGY ENGINEERING
Telephone: (888) 662-4185 | www.NavitusEng.com

Prepared For:
EQT Production Company
115 Professional Place
P.O. Box 280
Bridgeport, WV 26330

Contact:
Victoria J. Roark
Permitting Supervisor
(304) 848-0076

Designed By:
Navitus Engineering Inc.

Project Manager:
Chandler Pearson
cpearson@navituseng.com

Date: June 3, 2014

Surface Owner (s)
Justin L. Henderson

Tax Parcel:
Map 6 Parcel 1

Location:
West Union District, Doddridge County
West Virginia

FN# 7889

OXF 157 WELL PAD

STREAM CROSSING "H"

STORMWATER COMPUTATIONS

Sections

SECTION 1

Overview

The intent of this project is to construct a gravel access road to a gas well pad site and associated facilities. This project will include a permanent stream crossing. UNT 15, which has been classified as a ephemeral stream per the wetlands report conducted by Potesta Engineers and Environmental Consultants dated May 29, 2013, will be crossed at station 08+03.679 of the proposed access road.

Drainage Narrative

Using the SCS Method, we determined the 1, 10, and 100-year rainfall events at the stream crossing study point. We then used HY-8 to design the culvert and to determine the base flow water surface elevation for each rainfall event. Stream Crossing "H" has a drainage area of 1.40 Acres. Design flows are provided in the drainage calculations in Section 3.

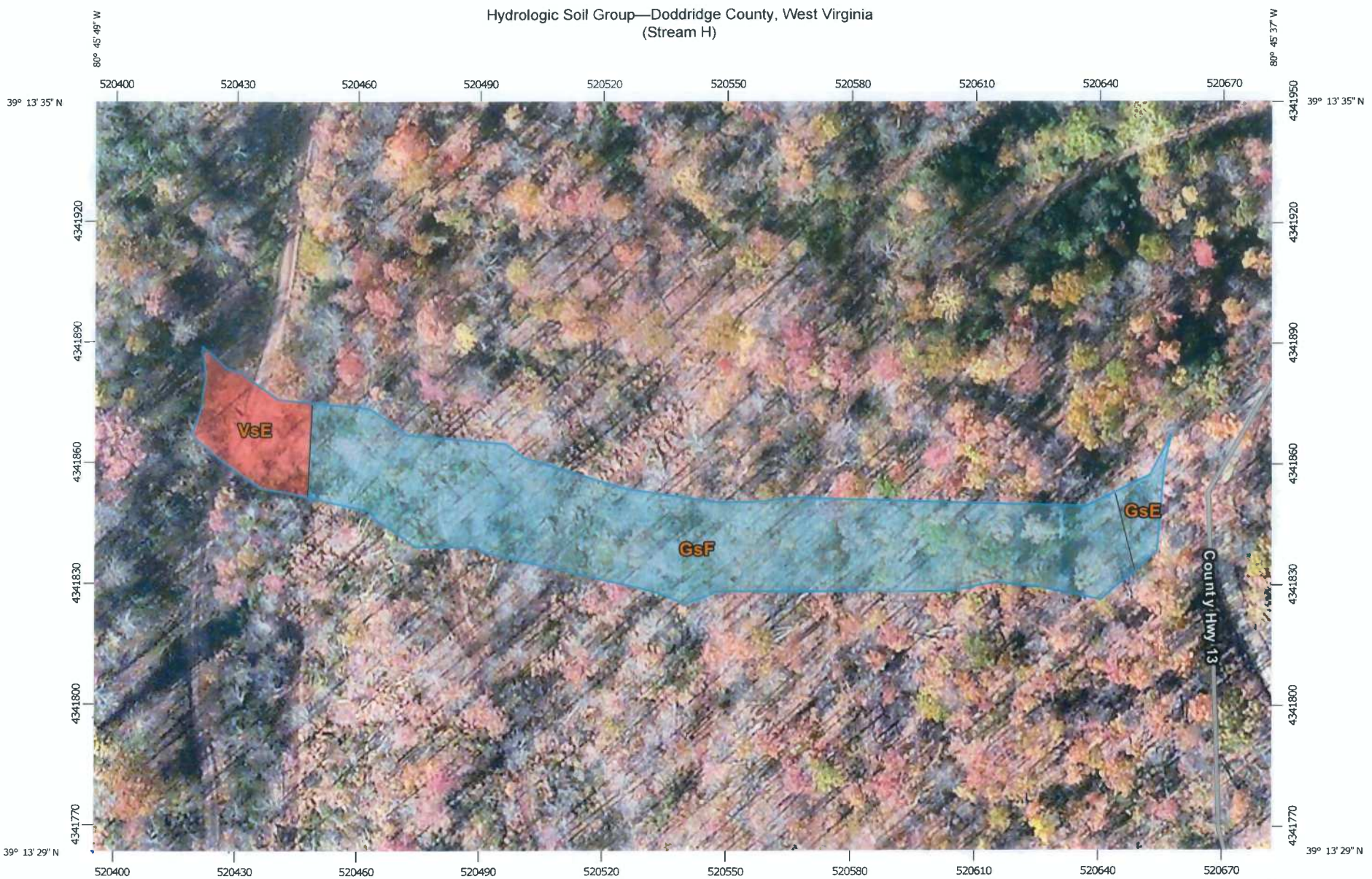
The permanent stream crossing was designed per the West Virginia Department of Environmental Protection Erosion and Sediment Control Best Management Practice Manual 2006 edition, Section 3.21-21. Per this manual, any structure that will remain in place 6 months or longer shall be large enough to convey the flow from a 10-year frequency, 24 hour duration storm. This culvert is sized to handle the computed 10-year storm event flow of 2.14 cfs.

The stream crossing was also designed as a permanent structure in accordance with the U.S. Army Corps of Engineering Nationwide 14 Permit. The structure is a 15 inch high-density polyethylene pipe culvert. The culvert is 52.00 LF with a slope of 10.90%. The stream crossing will contain clean rock fill made of 2-4" aggregate 50 feet on each side of the culvert for the first 6" of fill, the remainder of material shall be only large angular rock. No erodible material or green concrete shall be used in the crossing. The permanent stream crossing will impact 39.5' of the ephemeral stream, UNT 15.

SECTION 2

NRCS Soils Report

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



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Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

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GsF	Gilpin-Peabody complex, 35 to 70 percent slopes, very stony	C	1.2	84.8%
VsE	Vandalia silt loam, 15 to 35 percent slopes, very stony	D	0.2	11.7%
Totals for Area of Interest			**1.4**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

SECTION 3

SCS TR-55
Drainage Computations

Runoff Curve Number (CN)

Cover Description	CN	Soil Group	Area (Acre)
Meadow (Good)	58	B	0.00
Meadow (Good)	78	D	0.00
Woods (Good)	55	B	0.00
Woods (Good)	70	C	1.20
Woods (Good)	77	D	0.20
CN (weighted):	71		
Total Area:	1.40	Acre(s)	

Time of Concentration (SCS)

Curve Number:	71	
Length of Flow:	900.45	ft
Average Land Slope:	32.89	%
Time of Concentration:	0.110	hrs

Runoff Hydrograph: SCS Method

Input Data:		
Drainage Area	1.40	Acre(s)
Runoff Curve Number, CN	71	
Time of Concentration	0.110	hrs
Base Flow	0.00	cfs
Antecendent Moisture Condition	Type II	
Rainfall Distribution Type	Type II	24 hr
Rainfall Depth, 1-year	2.15	in
Rainfall Depth, 10-year	3.54	in
Rainfall Depth, 100-year	5.17	in
Peak Rate Factor	484	
Computed Results, 1 year:		
Time to Peak	12.20	hrs
Peak Discharge, 1-year	0.59	cfs
Runoff Volume, 1-year	0.04	acre-ft
Computed Results, 10 year:		
Time to Peak	12.20	hrs
Peak Discharge	2.14	cfs
Runoff Volume	0.12	acre-ft
Computed Results, 100 year:		
Time to Peak	12.20	hrs
Peak Discharge	4.34	cfs
Runoff Volume	0.24	acre-ft

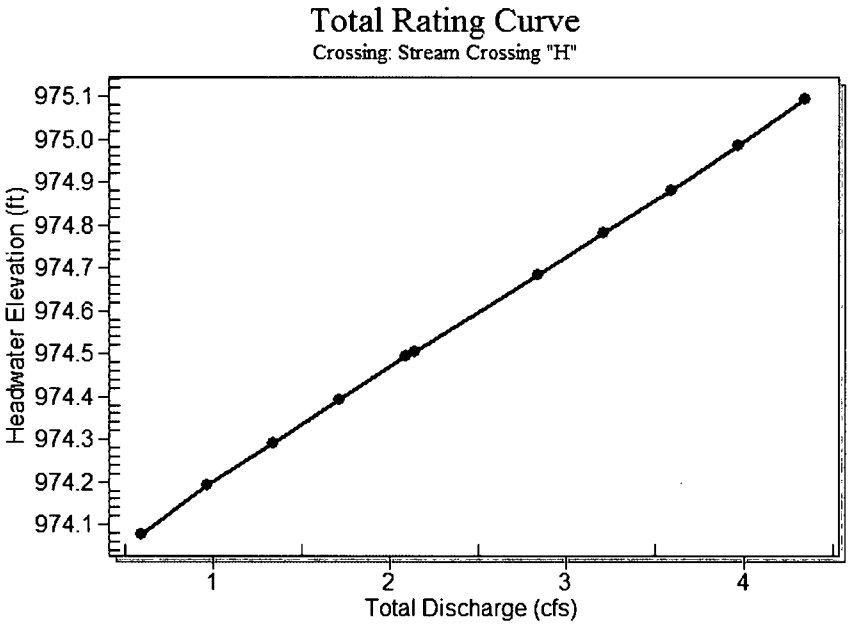
SECTION 4

HY-8 Culvert Analysis Report and Sections

HY-8 Culvert Analysis Report

Headwater Elevation (ft)	Total Discharge (cfs)	Stream Crossing H Discharge (cfs)	Roadway Discharge (cfs)	Iterations
974.08	0.59	0.59	0.00	1
974.19	0.96	0.96	0.00	1
974.29	1.34	1.34	0.00	1
974.39	1.71	1.71	0.00	1
974.49	2.09	2.09	0.00	1
974.51	2.14	2.14	0.00	1
974.68	2.84	2.84	0.00	1
974.78	3.21	3.21	0.00	1
974.88	3.59	3.59	0.00	1
974.98	3.96	3.96	0.00	1
975.10	4.34	4.34	0.00	1
976.30	7.31	7.31	0.00	Overtopping

Table 1 - Summary of Culvert Flows at Crossing: Stream Crossing "H"



Rating Curve Plot for Crossing: Stream Crossing "H"

Table 2 - Culvert Summary Table: Stream Crossing "H"

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.59	0.59	974.08	0.409	0.0*	1-S2n	0.181	0.294	0.184	0.211	5.079	5.160
0.96	0.96	974.19	0.521	0.0*	1-S2n	0.242	0.385	0.244	0.253	5.711	5.835
1.34	1.34	974.29	0.620	0.0*	1-S2n	0.283	0.454	0.284	0.287	6.550	6.334
1.71	1.71	974.39	0.723	0.0*	1-S2n	0.320	0.518	0.327	0.314	6.645	6.737
2.09	2.09	974.49	0.822	0.0*	1-S2n	0.357	0.573	0.358	0.339	7.162	7.078
2.14	2.14	974.51	0.835	0.0*	1-S2n	0.362	0.581	0.363	0.342	7.217	7.120
2.84	2.84	974.68	1.014	0.0*	1-S2n	0.419	0.674	0.423	0.380	7.852	7.642
3.21	3.21	974.78	1.111	0.0*	1-S2n	0.447	0.720	0.449	0.398	8.076	7.883
3.59	3.59	974.88	1.210	0.0*	1-S2n	0.476	0.764	0.478	0.415	8.300	8.104
3.96	3.96	974.98	1.315	0.0*	5-S2n	0.504	0.803	0.505	0.431	8.545	8.307
4.34	4.34	975.10	1.425	0.0*	5-S2n	0.529	0.842	0.532	0.445	8.746	8.497

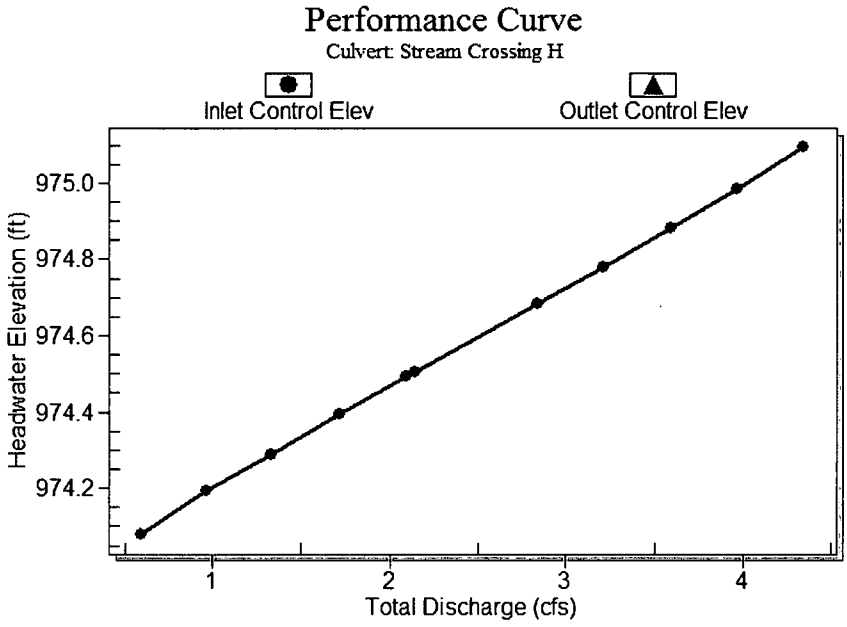
* theoretical depth is impractical. Depth reported is corrected.

****

Inlet Elevation (invert): 973.67 ft, Outlet Elevation (invert): 968.00 ft

Culvert Length: 52.31 ft, Culvert Slope: 0.1090

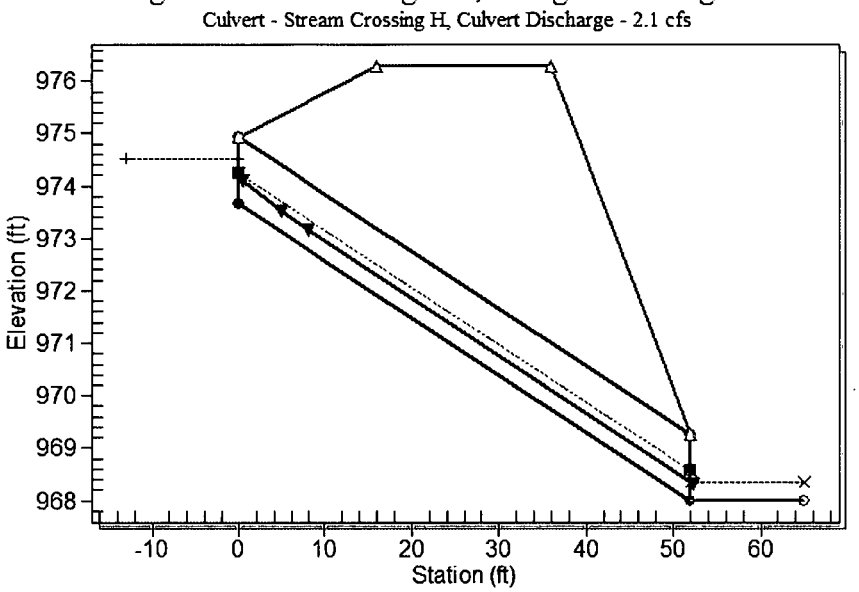
****



Culvert Performance Curve Plot: Stream Crossing "H"

Water Surface Profile Plot for Culvert: Stream Crossing "H"

Crossing - Stream Crossing "H", Design Discharge - 2.1 cfs



Site Data - Stream Crossing "H"

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 973.67 ft

Outlet Station: 52.00 ft

Outlet Elevation: 968.00 ft

Number of Barrels: 1

Culvert Data Summary - Stream Crossing "H"

Barrel Shape: Circular

Barrel Diameter: 1.25 ft

Barrel Material: Corrugated PE

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Inlet Type: Conventional

Inlet Edge Condition: Thin Edge Projecting

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: Stream Crossing "H")

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.59	968.21	0.21	5.16	4.29	2.80
0.96	968.25	0.25	5.83	5.16	2.89
1.34	968.29	0.29	6.33	5.83	2.95
1.71	968.31	0.31	6.74	6.40	2.99
2.09	968.34	0.34	7.08	6.89	3.03
2.14	968.34	0.34	7.12	6.95	3.04
2.84	968.38	0.38	7.64	7.73	3.09
3.21	968.40	0.40	7.88	8.10	3.11
3.59	968.41	0.41	8.10	8.44	3.14
3.96	968.43	0.43	8.31	8.76	3.16
4.34	968.45	0.45	8.50	9.06	3.17

Tailwater Channel Data - Stream Crossing "H"

Tailwater Channel Option: Irregular Channel

Channel Slope: 0.3260

User Defined Channel Cross-Section:

Coord No.	Station (ft)	Elevation (ft)	Manning's n
1	0.00	972.00	0.0350
2	14.70	970.00	0.0350
3	20.20	968.00	0.0350
4	25.00	970.00	0.0350
5	43.20	972.00	0.0350

Roadway Data for Crossing: Stream Crossing "H"

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

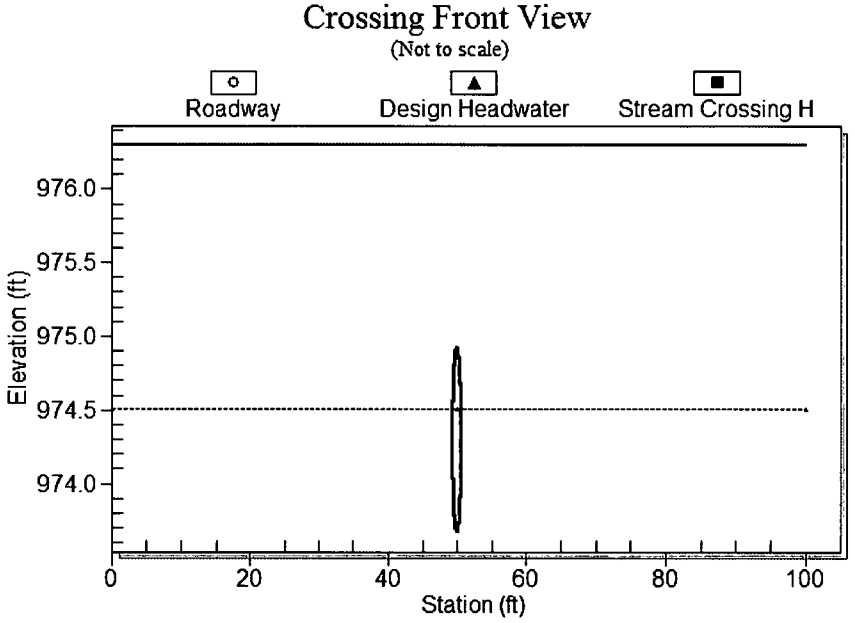
Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	976.30
1	50.00	976.30
2	100.00	976.30

Roadway Surface: Gravel

Roadway Top Width: 20.00 ft

Crossing Front View (Roadway Profile): Stream Crossing "H"

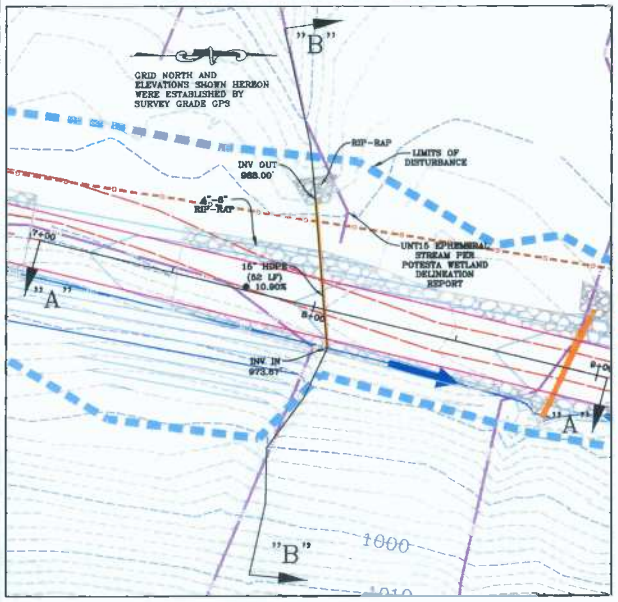


SECTION 5

Stream Crossing "H" Details

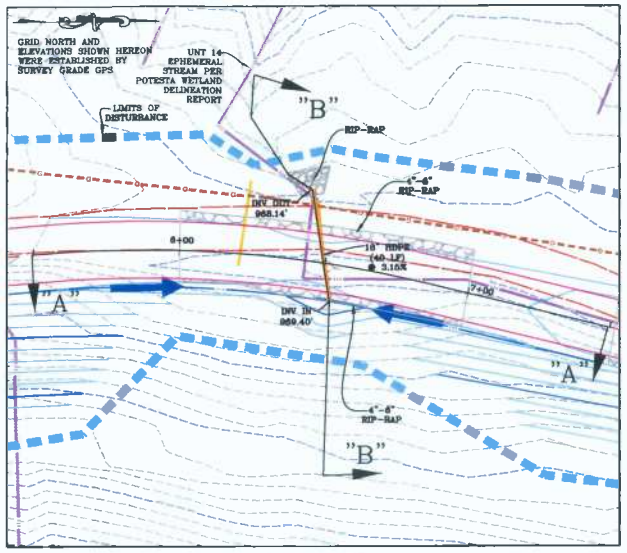
STREAM CROSSING DETAILS

STREAM CROSSING "H" DETAILS



20 10 0 20 40
SCALE: 1" = 20'

STREAM CROSSING "I" DETAILS



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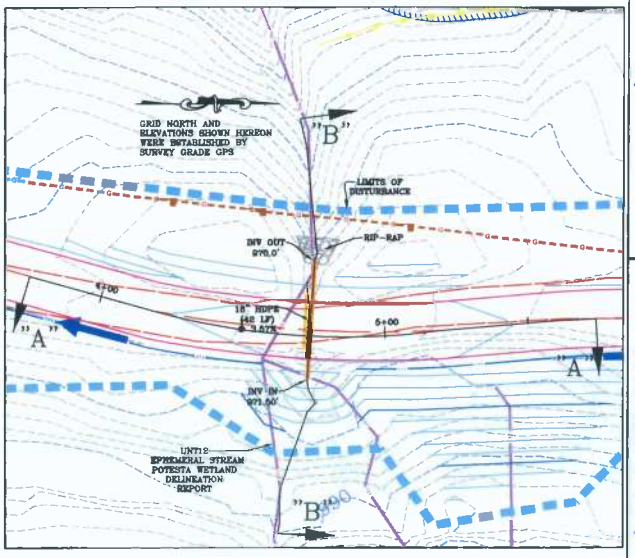
SCALE: 1" = 20'

STREAM CROSSING "J" DETAILS



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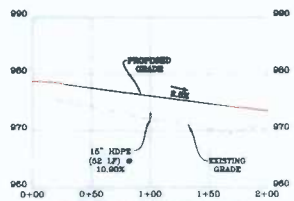
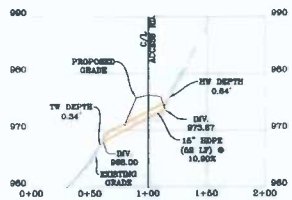
SCALE: 1" = 20'

STREAM CROSSING "H" SECTIONS

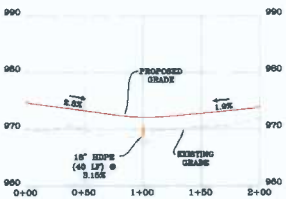


CROSS SECTION "A-A"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

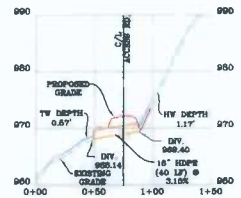


CROSS SECTION "B-B"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

STREAM CROSSING "I" SECTIONS

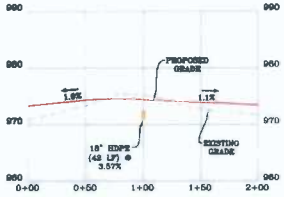


CROSS SECTION "A-A"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

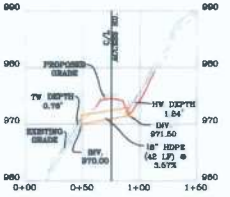


CROSS SECTION "B-B"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

STREAM CROSSING "J" SECTIONS



CROSS SECTION "A-A"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL STREAM CROSSING NOTES:

1) IF MULTIPLE CULVERTS ARE USED, THEY SHALL BE SEPARATED BY AT LEAST 12 INCHES OF COMPACTED AGGREGATE FILL.
2) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
3) FILTER CLOTH SHALL BE PLACED ON THE STREAMBED AND STREAMBANKS PRIOR TO PLACEMENT OF THE PIPE CULVERTS AND AGGREGATE. THE FILTER CLOTH SHALL COVER THE STREAMBED AND EXTEND A MINIMUM OF SIX INCHES AND A MAXIMUM OF ONE FOOT BEYOND THE END OF THE CULVERTS AND BEDDING MATERIAL.
4) A WATER DIVERTING SWALE SHALL BE CONSTRUCTED ACROSS THE ROADWAY ON EITHER SIDE OF THE STREAM CROSSING.
5) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
6) CROSS CRIBBING OF THE DOWNSTREAM SIDE OF THE CULVERT INSTALLATIONS MAY BE NEEDED TO AID IN REDUCING STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
7) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
8) GREEN CONCRETE SHALL NOT BE PLACED IN CONTACT WITH FLOWING WATER.
9) WHEN THE CROSSING HAS SERVED ITS PURPOSE, ALL STRUCTURES INCLUDING CULVERTS, BEDDING, AND FILTER CLOTH SHALL BE REMOVED. REMOVAL OF THE STRUCTURE AND CLEAN UP OF THE AREA SHOULD BE ACCOMPLISHED WITHOUT CONSTRUCTION EQUIPMENT WORKING IN THE WATERWAY CHANNEL. UPON REMOVAL OF THE STRUCTURE, THE STREAM BANK SHALL IMMEDIATELY BE STABILIZED.
10) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
11) THE CROSSING MUST BE INSPECTED AFTER EVERY RAIN EVENT OF 0.5 INCHES OR MORE AND ONCE A WEEK TO ENSURE THAT THE CULVERTS, STREAMBED, AND STREAM BANKS ARE MAINTAINED AND NOT DAMAGED. NEVER ALLOW THE CULVERTS TO BECOME CLOGGED WITH DEBRIS AND REMOVE ANY OBSTRUCTIONS IMMEDIATELY.
12) FLUSHING IS NOT AN APPROVED METHOD TO BE UTILIZED FOR CULVERT CLEANOUT.

NOTE:
1) SEE STREAM CROSSING REPORT BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATIONS.
2) EQT SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "H", "I" & "J".

NAVITUS ENERGY ENGINEERING
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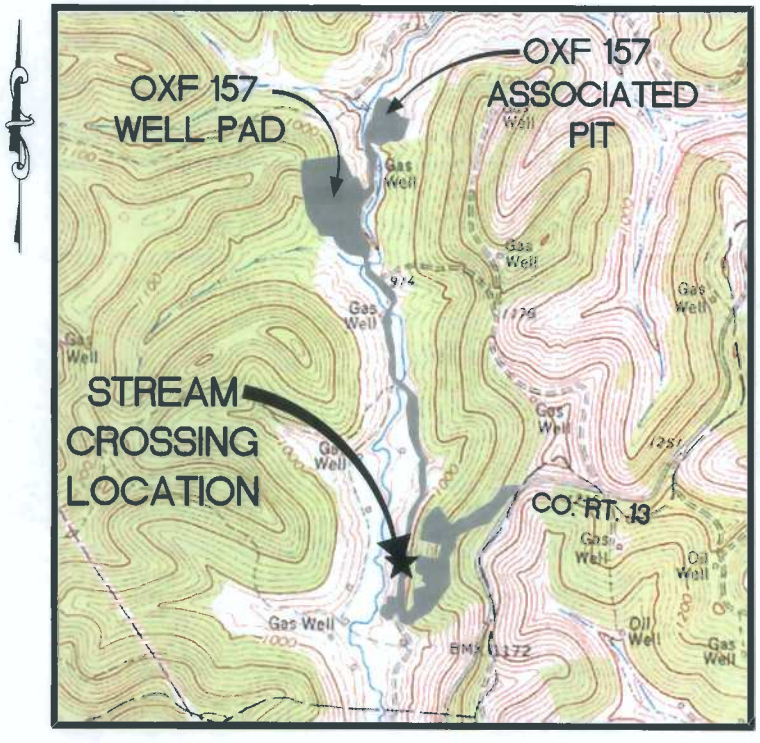
WWW.SLSSURVEYS.COM (304) 485-3834

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC. FOR: EQT PRODUCTION COMPANY

MINOR STREAM CROSSING DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7859
SHEET 26 OF 32
REV: 06/03/2014

STREAM CROSSING "I"
STORMWATER COMPUTATIONS
OXF 157 WELL PAD



VICINITY MAP
1" = 2,000'

NAVITUS
ENERGY ENGINEERING
Telephone: (888) 662-4185 | www.NavitusEng.com

Prepared For:
EQT Production Company
115 Professional Place
P.O. Box 280
Bridgeport, WV 26330

Contact:
Victoria J. Roark
Permitting Supervisor
(304) 848-0076

Designed By:
Navitus Engineering Inc.

Project Manager:
Chandler Pearson
cpearson@navituseng.com

MARK O. SMITH
REGISTERED
No. 11709
WEST VIRGINIA
PROFESSIONAL ENGINEER

Date: June 3, 2014

Surface Owner (s)
Justin L. Henderson

Tax Parcel:
Map 6 Parcel 1

Location:
West Union District, Doddridge County
West Virginia

FN# 7889

OXF 157 WELL PAD

STREAM CROSSING "I"

STORMWATER COMPUTATIONS

Sections

SECTION 1

Overview

The intent of this project is to construct a gravel access road to a gas well pad site and associated facilities. This project will include a permanent stream crossing. UNT 14, which has been classified as a ephemeral stream per the wetlands report conducted by Potesta Engineers and Environmental Consultants dated May 29, 2013, will be crossed at station 06+49.563 of the proposed access road.

Drainage Narrative

Using the SCS Method, we determined the 1, 10, and 100-year rainfall events at the stream crossing study point. We then used HY-8 to design the culvert and to determine the base flow water surface elevation for each rainfall event. Stream Crossing "I" has a drainage area of 2.40 Acres. Design flows are provided in the drainage calculations in Section 3.

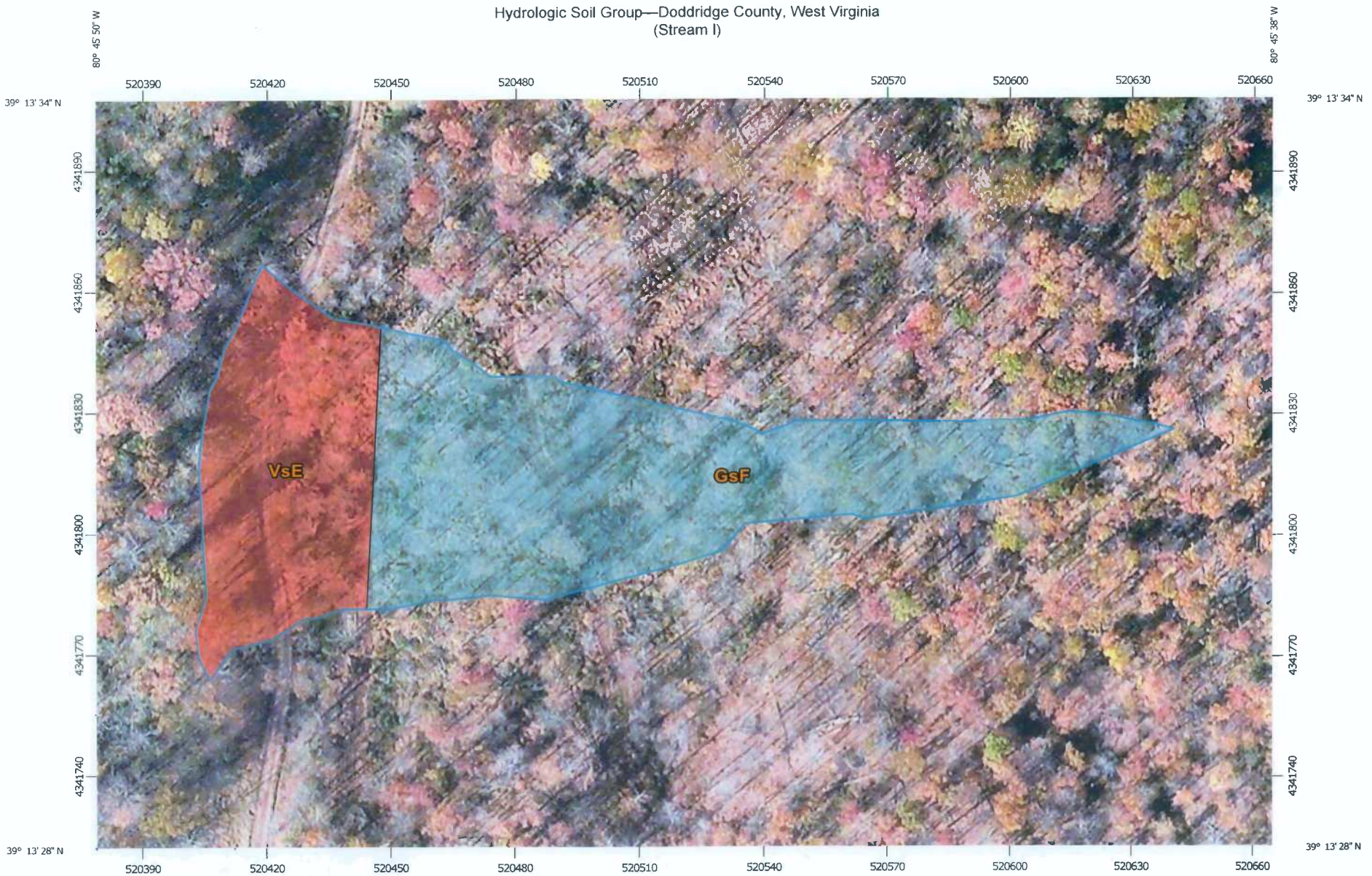
The permanent stream crossing was designed per the West Virginia Department of Environmental Protection Erosion and Sediment Control Best Management Practice Manual 2006 edition, Section 3.21-21. Per this manual, any structure that will remain in place 6 months or longer shall be large enough to convey the flow from a 10-year frequency, 24 hour duration storm. This culvert is sized to handle the computed 10-year storm event flow of 3.94 cfs.

The stream crossing was also designed as a permanent structure in accordance with the U.S. Army Corps of Engineering Nationwide 14 Permit. The structure is a 18 inch high-density polyethylene pipe culvert. The culvert is 40.00 LF with a slope of 3.15%. The stream crossing will contain clean rock fill made of 2-4" aggregate 50 feet on each side of the culvert for the first 6" of fill, the remainder of material shall be only large angular rock. No erodible material or green concrete shall be used in the crossing. The permanent stream crossing will impact 222.13' of the ephemeral stream, UNT 14.

SECTION 2

NRCS Soils Report

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



Map Scale: 1:1,310 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 15 30 60 90

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

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

Soils

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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

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

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 8, 2011—Oct 25, 2011

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Doddridge County, West Virginia (WV017)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
GsF	Gilpin-Peabody complex, 35 to 70 percent slopes, very stony	C	1.6	66.4%
VsE	Vandalia silt loam, 15 to 35 percent slopes, very stony	D	0.8	33.6%
Totals for Area of Interest			**2.4**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

SECTION 3

SCS TR-55
Drainage Computations

Runoff Curve Number (CN)

Cover Description	CN	Soil Group	Area (Acre)
Meadow (Good)	58	B	0.00
Meadow (Good)	78	D	0.00
Woods (Good)	55	B	0.00
Woods (Good)	70	C	1.60
Woods (Good)	77	D	0.80
CN (weighted):	72		
Total Area:	2.40	Acre(s)	

Time of Concentration (SCS)

Curve Number:	72	
Length of Flow:	929.95	ft
Average Land Slope:	30.85	%
Time of Concentration:	0.114	hrs

Runoff Hydrograph: SCS Method

Input Data:		
Drainage Area	2.40	Acre(s)
Runoff Curve Number, CN	72	
Time of Concentration	0.114	hrs
Base Flow	0.00	cfs
Antecendent Moisture Condition	Type II	
Rainfall Distribution Type	Type II	24 hr
Rainfall Depth, 1-year	2.15	in
Rainfall Depth, 10-year	3.54	in
Rainfall Depth, 100-year	5.17	in
Peak Rate Factor	484	
Computed Results, 1 year:		
Time to Peak	12.20	hrs
Peak Discharge, 1-year	1.16	cfs
Runoff Volume, 1-year	0.07	acre-ft
Computed Results, 10 year:		
Time to Peak	12.20	hrs
Peak Discharge	3.94	cfs
Runoff Volume	0.22	acre-ft
Computed Results, 100 year:		
Time to Peak	12.20	hrs
Peak Discharge	7.85	cfs
Runoff Volume	0.44	acre-ft

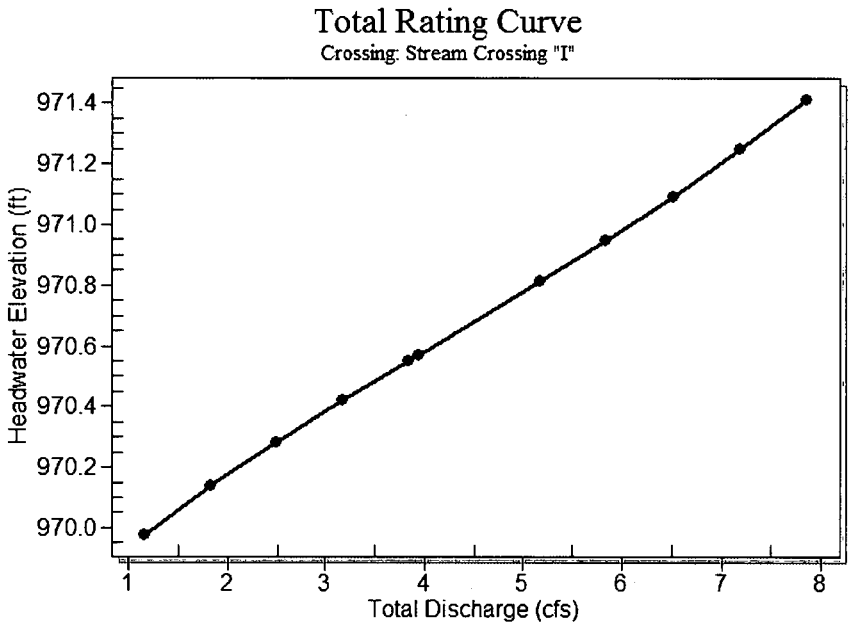
SECTION 4

HY-8 Culvert Analysis Report and Sections

HY-8 Culvert Analysis Report

Headwater Elevation (ft)	Total Discharge (cfs)	Stream Crossing I Discharge (cfs)	Roadway Discharge (cfs)	Iterations
969.98	1.16	1.16	0.00	1
970.14	1.83	1.83	0.00	1
970.28	2.50	2.50	0.00	1
970.42	3.17	3.17	0.00	1
970.55	3.84	3.84	0.00	1
970.57	3.94	3.94	0.00	1
970.81	5.17	5.17	0.00	1
970.95	5.84	5.84	0.00	1
971.09	6.51	6.51	0.00	1
971.25	7.18	7.18	0.00	1
971.41	7.85	7.85	0.00	1
972.29	10.68	10.68	0.00	Overtopping

Table 1 - Summary of Culvert Flows at Crossing: Stream Crossing "I"



Rating Curve Plot for Crossing: Stream Crossing "I"

Table 2 - Culvert Summary Table: Stream Crossing "I"

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1.16	1.16	969.98	0.578	0.0*	1-S2n	0.338	0.396	0.345	0.358	3.867	4.426
1.83	1.83	970.14	0.738	0.0*	1-S2n	0.429	0.504	0.433	0.425	4.309	4.960
2.50	2.50	970.28	0.883	0.0*	1-S2n	0.504	0.598	0.507	0.478	4.734	5.362
3.17	3.17	970.42	1.019	0.0*	1-S2n	0.574	0.674	0.576	0.522	5.065	5.690
3.84	3.84	970.55	1.150	0.0*	1-S2n	0.639	0.749	0.640	0.561	5.352	5.969
3.94	3.94	970.57	1.170	0.0*	1-S2n	0.648	0.759	0.649	0.567	5.401	6.009
5.17	5.17	970.81	1.411	0.0*	1-S2n	0.760	0.874	0.760	0.627	5.756	6.432
5.84	5.84	970.95	1.548	0.0*	5-S2n	0.818	0.931	0.821	0.657	5.907	6.631
6.51	6.51	971.09	1.693	0.0*	5-S2n	0.875	0.984	0.876	0.684	6.081	6.813
7.18	7.18	971.25	1.847	0.0*	5-S2n	0.934	1.037	0.934	0.710	6.200	6.982
7.85	7.85	971.41	2.014	0.0*	5-S2n	0.994	1.082	0.995	0.734	6.314	7.139

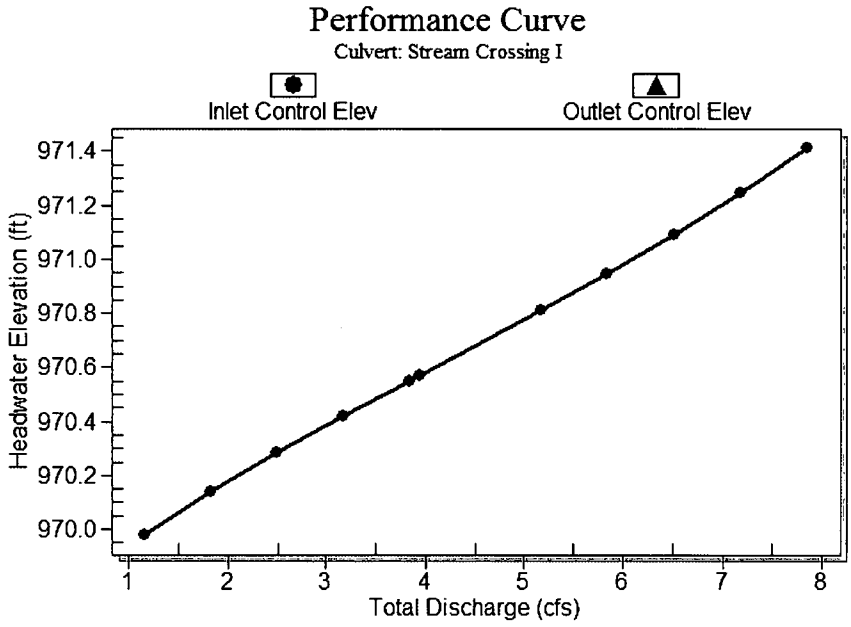
* theoretical depth is impractical. Depth reported is corrected.

****

Inlet Elevation (invert): 969.40 ft, Outlet Elevation (invert): 968.14 ft

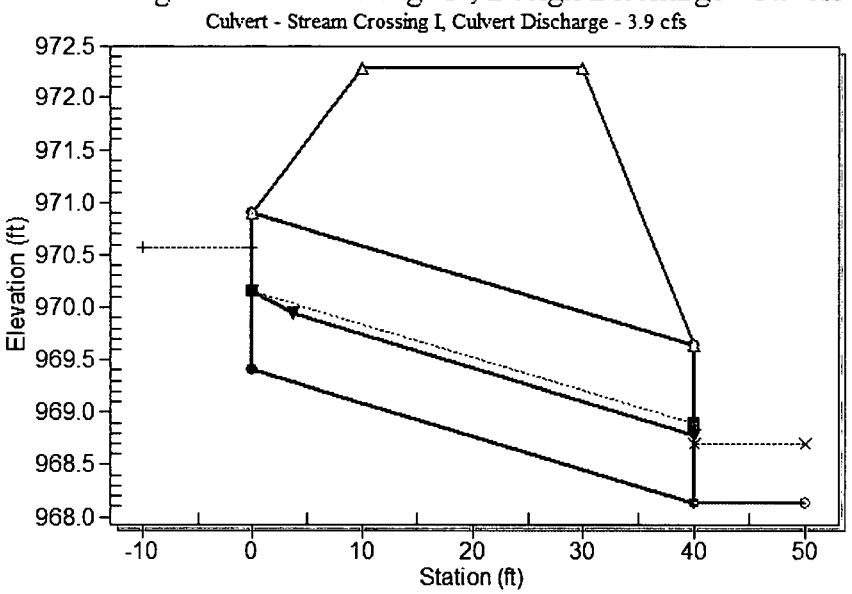
Culvert Length: 40.02 ft, Culvert Slope: 0.0315

****



Culvert Performance Curve Plot: Stream Crossing "I"

Water Surface Profile Plot for Culvert: Stream Crossing "I"



Site Data - Stream Crossing "I"

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 969.40 ft

Outlet Station: 40.00 ft

Outlet Elevation: 968.14 ft

Number of Barrels: 1

Culvert Data Summary - Stream Crossing "I"

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Corrugated PE

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Inlet Type: Conventional

Inlet Edge Condition: Thin Edge Projecting

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: Stream Crossing "I")

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
1.16	968.50	0.36	4.43	2.79	1.84
1.83	968.56	0.42	4.96	3.31	1.90
2.50	968.62	0.48	5.36	3.72	1.93
3.17	968.66	0.52	5.69	4.07	1.96
3.84	968.70	0.56	5.97	4.37	1.99
3.94	968.71	0.57	6.01	4.42	1.99
5.17	968.77	0.63	6.43	4.89	2.02
5.84	968.80	0.66	6.63	5.12	2.04
6.51	968.82	0.68	6.81	5.34	2.05
7.18	968.85	0.71	6.98	5.53	2.07
7.85	968.87	0.73	7.14	5.72	2.08

Tailwater Channel Data - Stream Crossing "I"

Tailwater Channel Option: Irregular Channel

Channel Slope: 0.1250

User Defined Channel Cross-Section:

Coord No.	Station (ft)	Elevation (ft)	Manning's n
1	0.00	972.00	0.0350
2	15.80	970.00	0.0350
3	18.70	968.14	0.0350
4	23.40	970.00	0.0350
5	40.20	972.00	0.0350

Roadway Data for Crossing: Stream Crossing "I"

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

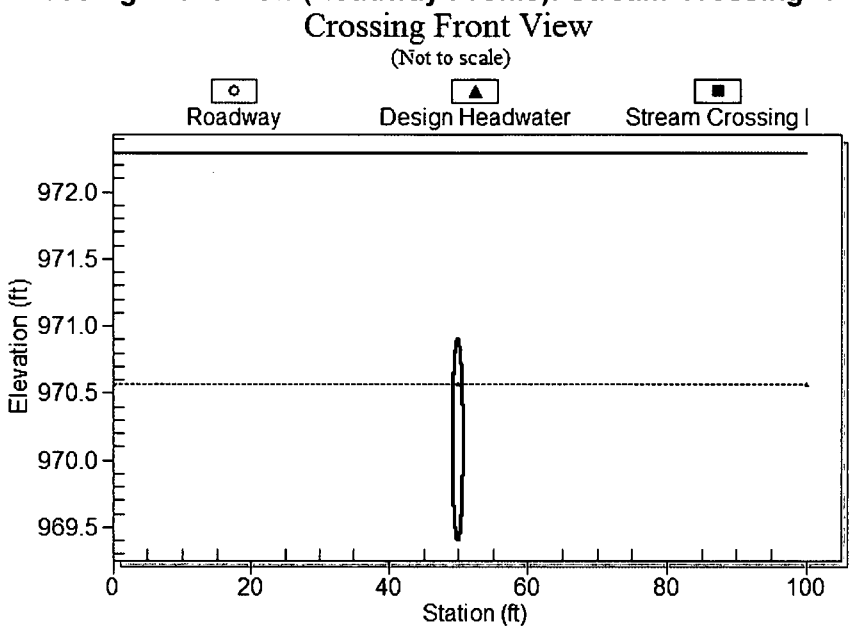
Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	972.29
1	50.00	972.29
2	100.00	972.29

Roadway Surface: Gravel

Roadway Top Width: 20.00 ft

Crossing Front View (Roadway Profile): Stream Crossing "I"

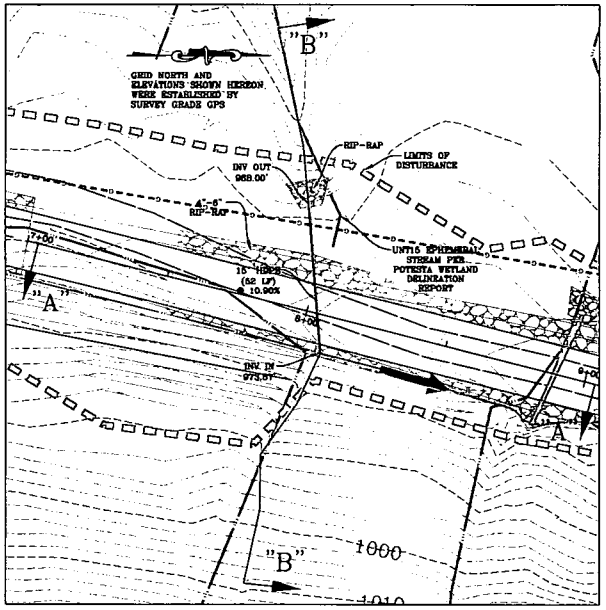


SECTION 5

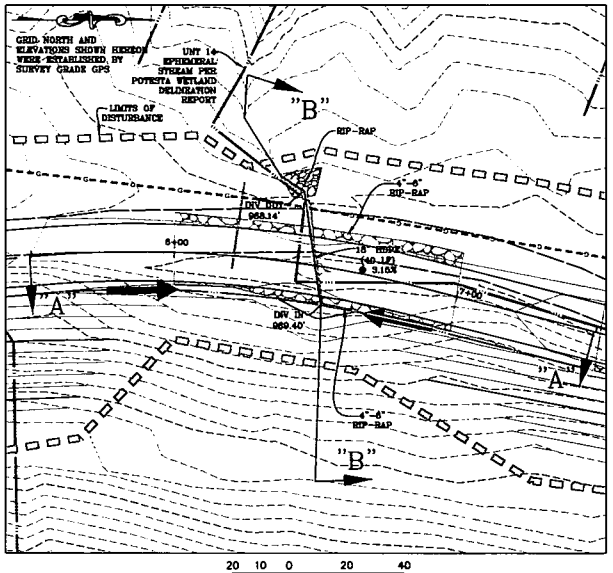
Stream Crossing "I" Details

STREAM CROSSING DETAILS

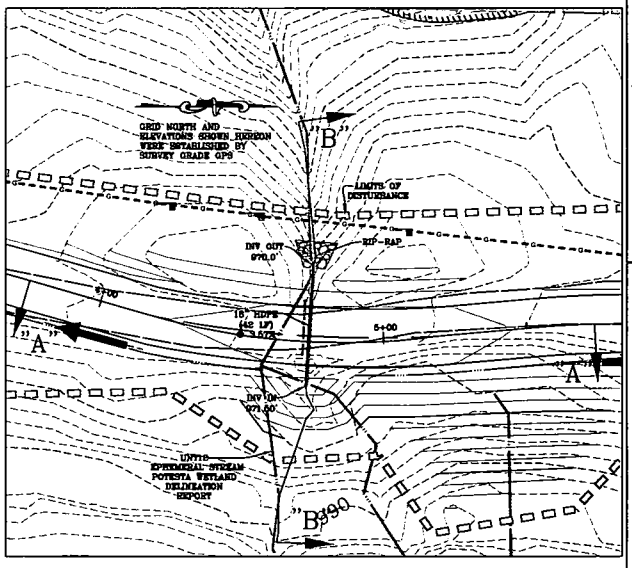
STREAM CROSSING "H" DETAILS



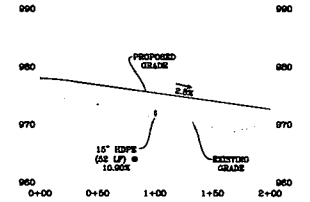
STREAM CROSSING "I" DETAILS



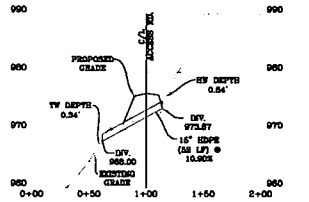
STREAM CROSSING "J" DETAILS



STREAM CROSSING "H" SECTIONS

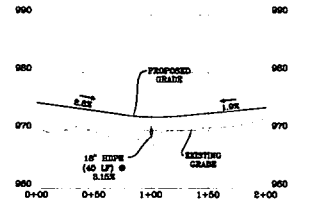


CROSS SECTION "A-A"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

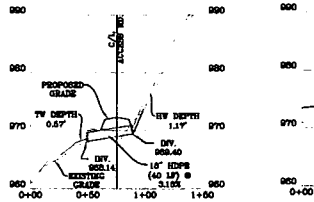


CROSS SECTION "B-B"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

STREAM CROSSING "I" SECTIONS

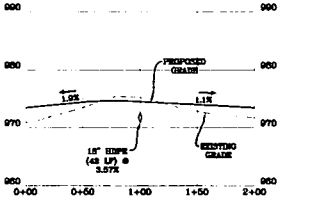


CROSS SECTION "A-A"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

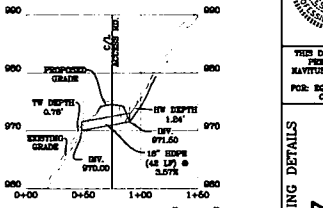


CROSS SECTION "B-B"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

STREAM CROSSING "J" SECTIONS



CROSS SECTION "A-A"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL STREAM CROSSING NOTES:

1) IF MULTIPLE CULVERTS ARE USED, THEY SHALL BE SEPARATED BY AT LEAST 12 INCHES OF COMPACTED AGGREGATE FILL.
2) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
3) FILTER CLOTH SHALL BE PLACED ON THE STREAMBED AND STREAMBANKS PRIOR TO PLACEMENT OF THE PIPE CULVERTS AND AGGREGATE. THE FILTER CLOTH SHALL COVER THE STREAMBED AND EXTEND A MINIMUM OF SIX INCHES AND A MAXIMUM OF ONE FOOT BEYOND THE END OF THE CULVERTS AND BEDDING MATERIAL.
4) A WATER DIVERTING SWALE SHALL BE CONSTRUCTED ACROSS THE ROADWAY ON EITHER SIDE OF THE STREAM CROSSING.
5) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
6) CROSS CRIBBING OF THE DOWNSTREAM SIDE OF THE CULVERT INSTALLATIONS MAY BE NEEDED TO AID IN REDUCING STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
7) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
8) GREEN CONCRETE SHALL NOT BE PLACED IN CONTACT WITH FLOWING WATER.
9) WHEN THE CROSSING HAS SERVED ITS PURPOSE, ALL STRUCTURES INCLUDING CULVERTS, BEDDING, AND FILTER CLOTH SHALL BE REMOVED. REMOVAL OF THE STRUCTURE AND CLEAN UP OF THE AREA SHOULD BE ACCOMPLISHED WITHOUT CONSTRUCTION EQUIPMENT WORKING IN THE WATERWAY CHANNEL. UPON REMOVAL OF THE STRUCTURE, THE STREAM BANK SHALL IMMEDIATELY BE STABILIZED.
10) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
11) THE CROSSING MUST BE INSPECTED AFTER EVERY RAIN EVENT OF 0.5 INCHES OR MORE AND ONCE A WEEK TO ENSURE THAT THE CULVERTS, STREAMBED, AND STREAM BANKS ARE MAINTAINED AND NOT DAMAGED. NEVER ALLOW THE CULVERTS TO BECOME CLOGGED WITH DEBRIS AND REMOVE ANY OBSTRUCTIONS IMMEDIATELY.
12) FLUSHING IS NOT AN APPROVED METHOD TO BE UTILIZED FOR CULVERT CLEANOUT.

NOTE:

1) SEE STREAM CROSSING REPORT BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATIONS.
2) EQT SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "H", "I" & "J".

NAVITUS ENERGY ENGINEERING
Telephone: (888) 662-4185 | www.NavitusEng.com

Professional Energy Consultants
ADVISORS OF SOUTHLAND SURVEYING, INC.
SLS SURVEYORS ENGINEERS ENVIRONMENTAL PROJECT MGMT.
WWW.SLSSURVEYS.COM (304) 420-5004

WEST VIRGINIA No. 11705 PROFESSIONAL ENGINEER

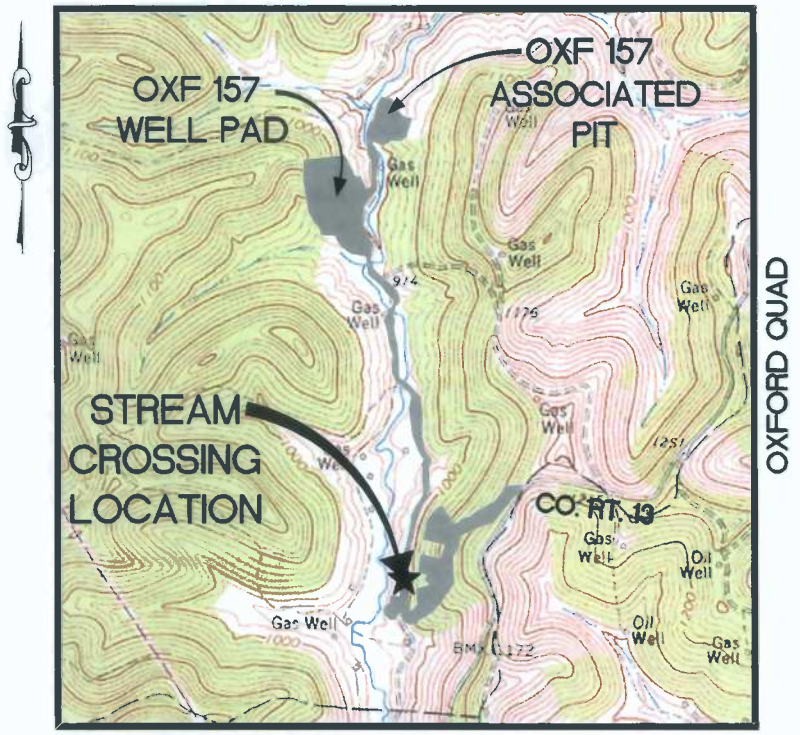
THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC. FOR: EQT PRODUCTION COMPANY

MINOR STREAM CROSSING DETAILS
OXF 157
WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: N/A
DESIGNED BY: CSX
FILE NO. 7689
SHEET 25 OF 32
REV: 06/03/2014

STREAM CROSSING "J"
STORMWATER COMPUTATIONS
OXF 157 WELL PAD

J



VICINITY MAP
1" = 2,000'

NAVITUS
ENERGY ENGINEERING
Telephone: (888) 662-4185 | www.NavitusEng.com

Prepared For:
EQT Production Company
115 Professional Place
P.O. Box 280
Bridgeport, WV 26330

Contact:
Victoria J. Roark
Permitting Supervisor
(304) 848-0076

Designed By:
Navitus Engineering Inc.

Project Manager:
Chandler Pearson
cpearson@navituseng.com

Date: June 3, 2014

Surface Owner (s)
Justin L. Henderson

Tax Parcel:
Map 6 Parcel 1

Location:
West Union District, Doddridge County
West Virginia

FN# 7889

OXF 157 WELL PAD

STREAM CROSSING "J"

STORMWATER COMPUTATIONS

Sections

SECTION 1

Overview

The intent of this project is to construct a gravel access road to a gas well pad site and associated facilities. This project will include a permanent stream crossing. UNT 12, which has been classified as a ephemeral stream per the wetlands report conducted by Potesta Engineers and Environmental Consultants dated May 29, 2013, will be crossed at station 04+73.962 of the proposed access road.

Drainage Narrative

Using the SCS Method, we determined the 1, 10, and 100-year rainfall events at the stream crossing study point. We then used HY-8 to design the culvert and to determine the base flow water surface elevation for each rainfall event. Stream Crossing "J" has a drainage area of 2.70 Acres. Design flows are provided in the drainage calculations in Section 3.

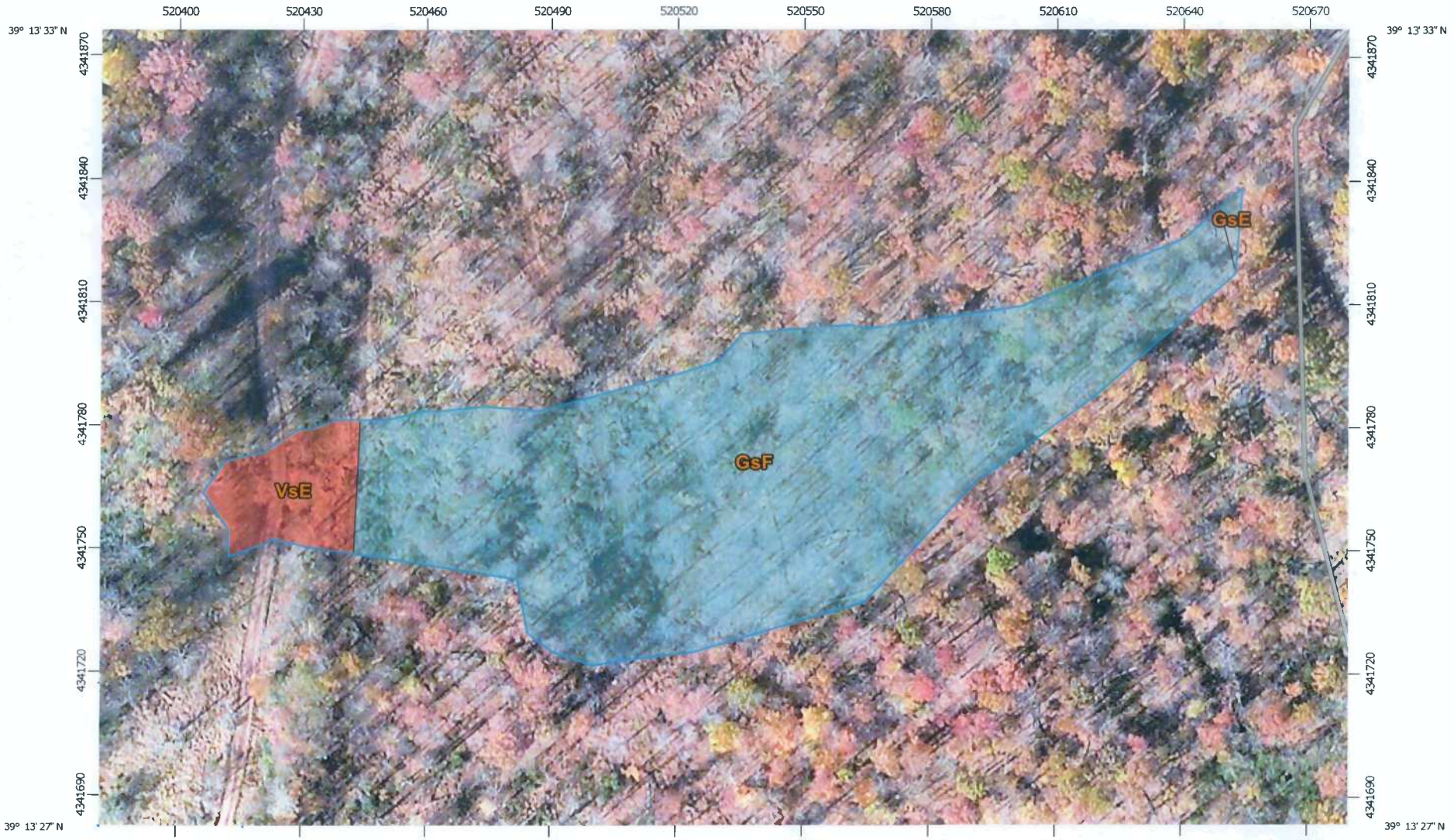
The permanent stream crossing was designed per the West Virginia Department of Environmental Protection Erosion and Sediment Control Best Management Practice Manual 2006 edition, Section 3.21-21. Per this manual, any structure that will remain in place 6 months or longer shall be large enough to convey the flow from a 10-year frequency, 24 hour duration storm. This culvert is sized to handle the computed 10-year storm event flow of 4.34 cfs.

The stream crossing was also designed as a permanent structure in accordance with the U.S. Army Corps of Engineering Nationwide 14 Permit. The structure is a 18 inch high-density polyethylene pipe culvert. The culvert is 42.00 LF with a slope of 3.57%. The stream crossing will contain clean rock fill made of 2-4" aggregate 50 feet on each side of the culvert for the first 6" of fill, the remainder of material shall be only large angular rock. No erodible material or green concrete shall be used in the crossing. The permanent stream crossing will impact 90.3' of the ephemeral stream, UNT 12.

SECTION 2

NRCS Soils Report

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



Map Scale: 1:1,360 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 20 40 80 120

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

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

Soils

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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

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

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 8, 2011—Oct 25, 2011

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Doddridge County, West Virginia (WV017)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
GsE	Gilpin-Peabody complex, 15 to 35 percent slopes, very stony	C	0.0	0.5%
GsF	Gilpin-Peabody complex, 35 to 70 percent slopes, very stony	C	2.5	91.5%
VsE	Vandalia silt loam, 15 to 35 percent slopes, very stony	D	0.2	8.0%
Totals for Area of Interest			**2.7**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

SECTION 3

SCS TR-55

Drainage Computations

Runoff Curve Number (CN)

Cover Description	CN	Soil Group	Area (Acre)
Meadow (Good)	58	B	0.00
Meadow (Good)	78	D	0.00
Woods (Good)	55	B	0.00
Woods (Good)	70	C	2.50
Woods (Good)	77	D	0.20
CN (weighted):	71		
Total Area:	2.70	Acre(s)	

Time of Concentration (SCS)

Curve Number:	71	
Length of Flow:	973.07	ft
Average Land Slope:	29.93	%
Time of Concentration:	0.123	hrs

Runoff Hydrograph: SCS Method

Input Data:		
Drainage Area	2.70	Acre(s)
Runoff Curve Number, CN	71	
Time of Concentration	0.123	hrs
Base Flow	0.00	cfs
Antecendent Moisture Condition	Type II	
Rainfall Distribution Type	Type II	24 hr
Rainfall Depth, 1-year	2.15	in
Rainfall Depth, 10-year	3.54	in
Rainfall Depth, 100-year	5.17	in
Peak Rate Factor	484	

Computed Results, 1 year:		
Time to Peak	12.20	hrs
Peak Discharge, 1-year	1.19	cfs
Runoff Volume, 1-year	0.07	acre-ft

Computed Results, 10 year:		
Time to Peak	12.20	hrs
Peak Discharge	4.34	cfs
Runoff Volume	0.24	acre-ft

Computed Results, 100 year:		
Time to Peak	12.20	hrs
Peak Discharge	8.81	cfs
Runoff Volume	0.50	acre-ft

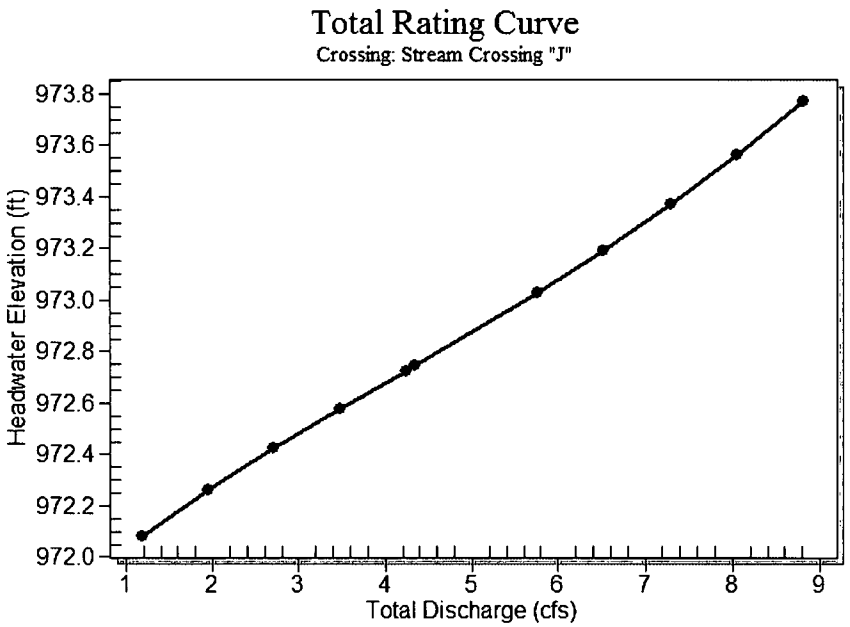
SECTION 4

HY-8 Culvert Analysis Report and Sections

HY-8 Culvert Analysis Report

Headwater Elevation (ft)	Total Discharge (cfs)	Stream Crossing J Discharge (cfs)	Roadway Discharge (cfs)	Iterations
972.08	1.19	1.19	0.00	1
972.26	1.95	1.95	0.00	1
972.42	2.71	2.71	0.00	1
972.58	3.48	3.48	0.00	1
972.72	4.24	4.24	0.00	1
972.74	4.34	4.34	0.00	1
973.03	5.76	5.76	0.00	1
973.19	6.52	6.52	0.00	1
973.37	7.29	7.29	0.00	1
973.56	8.05	8.05	0.00	1
973.77	8.81	8.81	0.00	1
976.00	14.23	14.23	0.00	Overtopping

Table 1 - Summary of Culvert Flows at Crossing: Stream Crossing "J"



Rating Curve Plot for Crossing: Stream Crossing "J"

Table 2 - Culvert Summary Table: Stream Crossing J

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1.19	1.19	972.08	0.584	0.0*	1-S2n	0.332	0.402	0.332	0.467	4.163	5.169
1.95	1.95	972.26	0.762	0.0*	1-S2n	0.430	0.522	0.431	0.562	4.638	5.850
2.71	2.71	972.42	0.924	0.0*	1-S2n	0.510	0.623	0.513	0.636	5.067	6.352
3.48	3.48	972.58	1.077	0.0*	1-S2n	0.585	0.708	0.587	0.698	5.415	6.757
4.24	4.24	972.72	1.225	0.0*	1-S2n	0.652	0.786	0.655	0.752	5.706	7.101
4.34	4.34	972.74	1.244	0.0*	1-S2n	0.661	0.796	0.665	0.758	5.734	7.143
5.76	5.76	973.03	1.528	0.0*	5-S2n	0.780	0.924	0.780	0.843	6.204	7.668
6.52	6.52	973.19	1.692	0.0*	5-S2n	0.842	0.985	0.844	0.884	6.376	7.909
7.29	7.29	973.37	1.869	0.0*	5-S2n	0.904	1.045	0.905	0.921	6.539	8.131
8.05	8.05	973.56	2.062	0.0*	5-S2n	0.968	1.095	0.969	0.956	6.674	8.336
8.81	8.81	973.77	2.274	0.0*	5-S2n	1.032	1.145	1.035	0.989	6.781	8.526

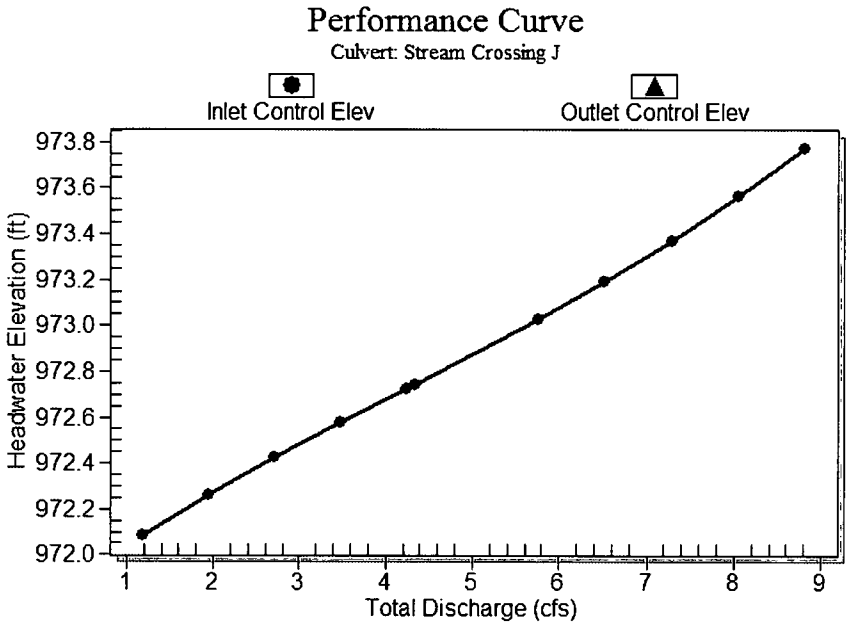
* theoretical depth is impractical. Depth reported is corrected.

****

Inlet Elevation (invert): 971.50 ft, Outlet Elevation (invert): 970.00 ft

Culvert Length: 42.03 ft, Culvert Slope: 0.0357

****

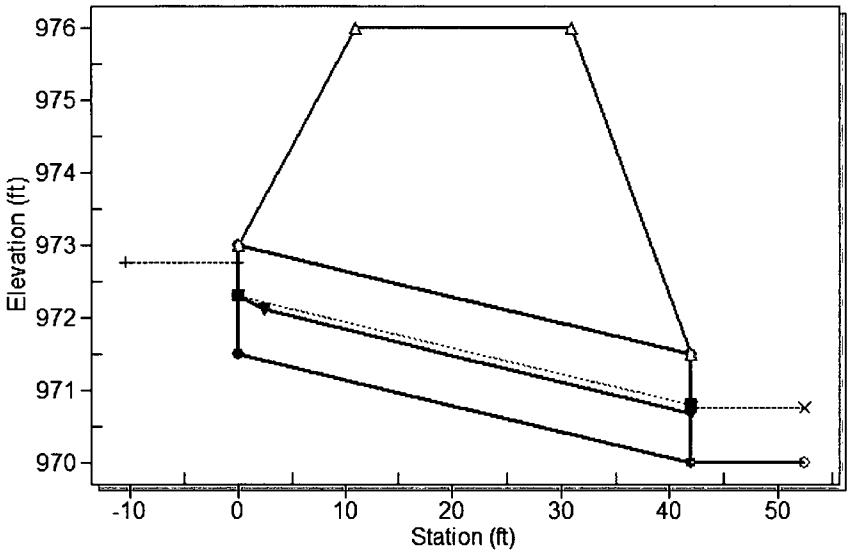


Culvert Performance Curve Plot: Stream Crossing J

Water Surface Profile Plot for Culvert: Stream Crossing J

Crossing - Stream Crossing "J", Design Discharge - 4.3 cfs

Culvert - Stream Crossing J, Culvert Discharge - 4.3 cfs



Site Data - Stream Crossing J

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 971.50 ft

Outlet Station: 42.00 ft

Outlet Elevation: 970.00 ft

Number of Barrels: 1

Culvert Data Summary - Stream Crossing J

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Corrugated PE

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Inlet Type: Conventional

Inlet Edge Condition: Thin Edge Projecting

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: Stream Crossing "J")

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
1.19	970.47	0.47	5.17	4.60	1.89
1.95	970.56	0.56	5.85	5.54	1.94
2.71	970.64	0.64	6.35	6.27	1.99
3.48	970.70	0.70	6.76	6.88	2.02
4.24	970.75	0.75	7.10	7.41	2.04
4.34	970.76	0.76	7.14	7.48	2.04
5.76	970.84	0.84	7.67	8.32	2.08
6.52	970.88	0.88	7.91	8.71	2.10
7.29	970.92	0.92	8.13	9.08	2.11
8.05	970.96	0.96	8.34	9.43	2.12
8.81	970.99	0.99	8.53	9.75	2.14

Tailwater Channel Data - Stream Crossing "J"

Tailwater Channel Option: Irregular Channel

Channel Slope: 0.1580

User Defined Channel Cross-Section:

Coord No.	Station (ft)	Elevation (ft)	Manning's n
1	0.00	974.00	0.0350
2	4.15	970.00	0.0350
3	8.45	974.00	0.0350

Roadway Data for Crossing: Stream Crossing "J"

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

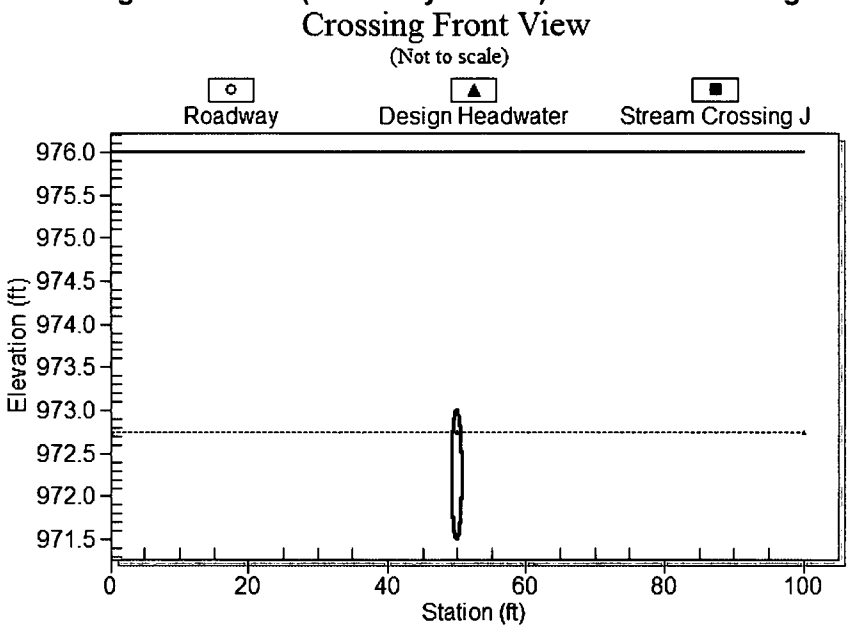
Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	976.00
1	50.00	976.00
2	100.00	976.00

Roadway Surface: Gravel

Roadway Top Width: 20.00 ft

Crossing Front View (Roadway Profile): Stream Crossing "J"

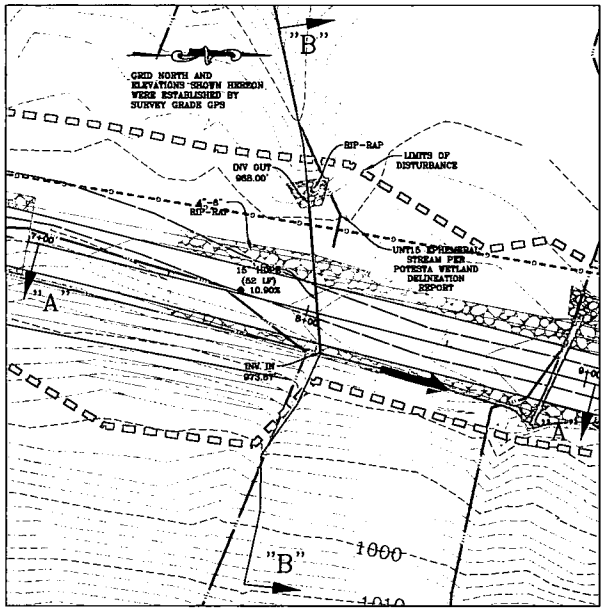


SECTION 5

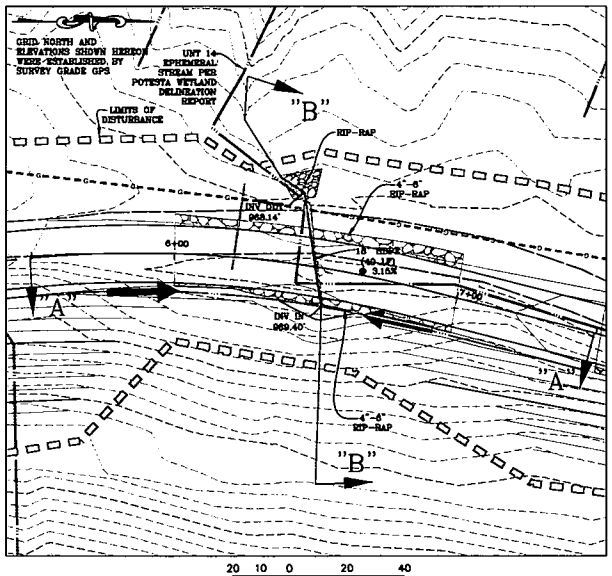
Stream Crossing "J" Details

STREAM CROSSING DETAILS

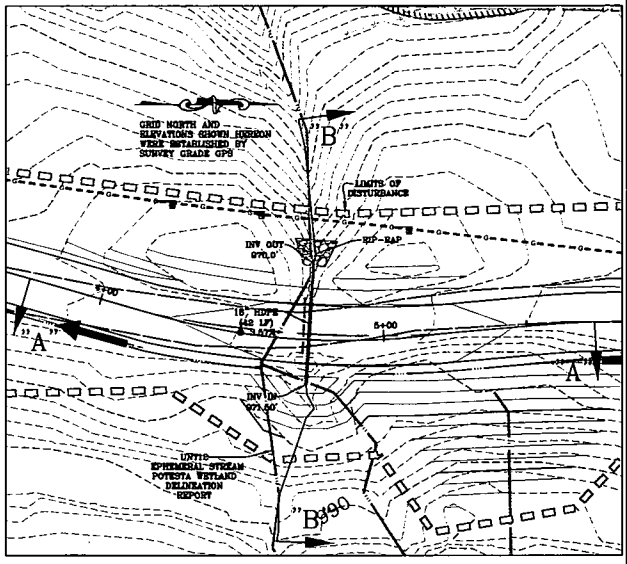
STREAM CROSSING "H" DETAILS



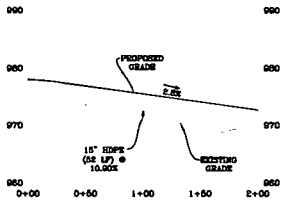
STREAM CROSSING "I" DETAILS



STREAM CROSSING "J" DETAILS

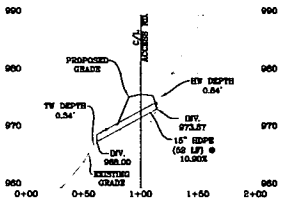


STREAM CROSSING "H" SECTIONS



CROSS SECTION "A-A"

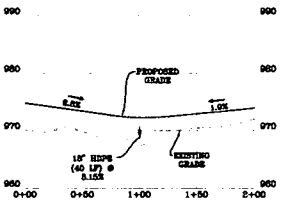
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

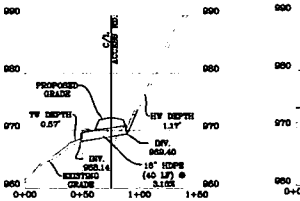
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

STREAM CROSSING "I" SECTIONS



CROSS SECTION "A-A"

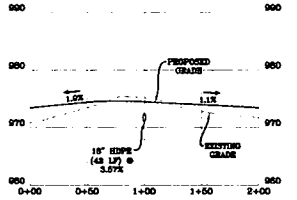
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

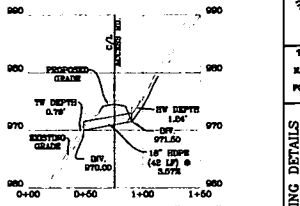
SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

STREAM CROSSING "J" SECTIONS



CROSS SECTION "A-A"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'



CROSS SECTION "B-B"

SCALE: HORIZ. 1" = 50' VERT. 1" = 10'

GENERAL STREAM CROSSING NOTES:

1) IF MULTIPLE CULVERTS ARE USED, THEY SHALL BE SEPARATED BY AT LEAST 12 INCHES OF COMPACTED AGGREGATE FILL.
2) CLEARING AND EXCAVATION OF THE STREAMBED AND BANKS SHALL BE KEPT TO A MINIMUM.
3) FILTER CLOTH SHALL BE PLACED ON THE STREAMBED AND STREAMBANKS PRIOR TO PLACEMENT OF THE PIPE CULVERTS AND AGGREGATE. THE FILTER CLOTH SHALL COVER THE STREAMBED AND EXTEND A MINIMUM OF SIX INCHES AND A MAXIMUM OF ONE FOOT BEYOND THE END OF THE CULVERTS AND BEDDING MATERIAL.
4) A WATER DIVERTING SWALE SHALL BE CONSTRUCTED ACROSS THE ROADWAY ON EITHER SIDE OF THE STREAM CROSSING.
5) APPROPRIATE PERIMETER CONTROLS SUCH AS COMPOST FILTER SOCK, SUPER SILT FENCE AND/OR SEDIMENT TRAPS SHALL BE EMPLOYED ALONG THE BANKS AND PARALLEL TO THE STREAMBED.
5) CROSS CRIBBING OF THE DOWNSTREAM SIDE OF THE CULVERT INSTALLATIONS MAY BE NEEDED TO AID IN REDUCING STRUCTURAL DAMAGE DURING HIGH VELOCITY WATER OVERFLOW PERIODS.
7) STREAMBED MATERIAL IS NOT TO BE USED AS FILL.
8) GREEN CONCRETE SHALL NOT BE PLACED IN CONTACT WITH FLOWING WATER.
9) WHEN THE CROSSING HAS SERVED ITS PURPOSE, ALL STRUCTURES INCLUDING CULVERTS, BEDDING, AND FILTER CLOTH SHALL BE REMOVED. REMOVAL OF THE STRUCTURE AND CLEAN UP OF THE AREA SHOULD BE ACCOMPLISHED WITHOUT CONSTRUCTION EQUIPMENT WORKING IN THE WATERWAY CHANNEL UPON REMOVAL OF THE STRUCTURE, THE STREAM BANK SHALL IMMEDIATELY BE STABILIZED.
10) DURING ROUTINE MAINTENANCE DO NOT GRADE MUD AND DEBRIS OVER THE SIDES OF THE CROSSING INTO THE STREAM.
11) THE CROSSING MUST BE INSPECTED AFTER EVERY RAIN EVENT OF 0.5 INCHES OR MORE AND ONCE A WEEK TO ENSURE THAT THE CULVERTS, STREAMBED, AND STREAM BANKS ARE MAINTAINED AND NOT DAMAGED. NEVER ALLOW THE CULVERTS TO BECOME CLOGGED WITH DEBRIS AND REMOVE ANY OBSTRUCTIONS IMMEDIATELY.
12) FLUSHING IS NOT AN APPROVED METHOD TO BE UTILIZED FOR CULVERT CLEANOUT.

NOTE:
1) SEE STREAM CROSSING REPORT BY NAVITUS ENGINEERING FOR CULVERT AND DRAINAGE COMPUTATIONS.
2) EQT SHALL OBTAIN A STREAM ACTIVITY PERMIT THROUGH THE PUBLIC LAND CORPORATION OFFICE OF LAND AND STREAMS FOR STREAM CROSSING "H", "I" & "J".

NAVITUS ENERGY ENGINEERING
Telephone: (888) 662-4185 | www.NavitusEng.com
Professional Energy Consultants
A DIVISION OF SMITHLAND SURVEYING, INC.
SLS SURVEYORS ENGINEERS ENVIRONMENTAL PROJECT MGMT.
WWW.SLSSURVEYS.COM (304) 425-3054

WEST VIRGINIA No. 11705 PROFESSIONAL ENGINEER

THIS DOCUMENT WAS PREPARED BY: NAVITUS ENGINEERING INC. FOR: EQT PRODUCTION COMPANY

MINOR STREAM CROSSING DETAILS

OXF 157

WEST UNION DISTRICT
DODDRIDGE COUNTY, WV

DATE: 11/04/2013
SCALE: N/A
DESIGNED BY: CSK
FILE NO. 7589
SHEET 26 OF 32
REV: 06/03/2014

NORTH

10+00 – OO
1+09.26 – NN
2+89.71 – MM
4+33.99 – LL
6+04.54 – KK
8+10.82 – JJ
9+72.12 – II
11+02.70 – HH
12+34.05 – GG
14+19.72 – FF
16+04.54 – EE
18+04 – DD
19+03.41 – CC
21+05.74 – BB
21+54.54 – M
22+04.54 – Z
22+54.54 – Y
23+06.38 – X
23+54.54 – W
24+17.65 – V
24+34.62 – U
25+54.54 – T
26+01.39 – S
26+81.29 – R
27+04.54 – Q
27+54.54 – P
28+04.54 – O
28+54.58 – N
29+04.54 – M
29+54.54 – L
30+04.54 – K
30+54.54 – J
31+04.54 – I
31+54.54 – H
32+04.54 – G
32+54.54 – F
33+04.54 – E
33+54.54 – D
34+04.54 – C
34+54.54 – B
35+04.54 – A

FIRM STUDY FLOODPLAIN LIMITS ZONE AE
FIRM STUDY FLOODPLAIN LIMITS ZONE AE
PROPOSED ADMINISTRATION BUILDING AND WAREHOUSE FACILITY
PROPOSED TRUCK UNLOADING AREA
PROPOSED CONDITIONS FLOODPLAIN LIMITS
EXISTING CONDITIONS FLOODPLAIN LIMITS
EXISTING CONDITIONS FLOODPLAIN LIMITS
PROPOSED CONDITIONS FLOODPLAIN LIMITS
NEW BRIDGE
EXISTING BRIDGE (REMOVED ON NOVEMBER 13, 2013)
FIRM STUDY FLOODPLAIN LIMITS ZONE AE
US ROUTE 50
BUCKEYE CREEK
EXISTING CONDITIONS FLOODPLAIN LIMITS
PROPOSED CONDITIONS FLOODPLAIN LIMITS
SHERWOOD GAS PROCESSING PLANT
FIRM STUDY FLOODPLAIN LIMITS ZONE A

LEGEND

- APPROXIMATE STREAM CENTERLINE
- 303+04.54 – K — HEC-RAS CROSS SECTION
- 100-YEAR FLOODPLAIN LIMITS, CURRENT CONDITIONS
- 100-YEAR FLOODPLAIN LIMITS, PROPOSED CONDITIONS
- FIRM STUDY FLOODPLAIN LIMITS ZONE AE
- FIRM STUDY FLOODPLAIN LIMITS ZONE A
- PROPERTY LINE
- 900 — EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOUR
- 900 — PROPOSED INDEX CONTOUR
- PROPOSED INTERMEDIATE CONTOUR

REFERENCE

1. EXISTING TOPOGRAPHY DEVELOPED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. (CEC) USING CEC SURVEY DATA AND DIGITAL ELEVATION MODELS (USGS 3-METER), 2003 OF THE u.s. GEOLOGICAL SURVEY (USGS) AND WEST VIRGINIA STATEWISE ADDRSSING & MAPPING BOARD (WVSAMB).
2. STREAM LOCATIONS DELINEATED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC.
3. IMAGE PROVIDED BY GOOGLE EARTH © 2012.

SCALE IN FEET
0 150 300

* HAND SIGNATURE ON FILE

P:\2011\110-811-0000\DWG\BASE SHEET PLANS 8 AND 7\110-811.5001 - SP01.DWG[SP-01] LS(TOMASTON - 11/7/2014 12:36:16 PM) - LS 11/10/2014 1:02:28 PM

REVISION RECORD

NO.	DATE	DESCRIPTION
1	2/26/2014	REVISED PER DODDRIDGE COUNTY REVIEW
2	10/29/2014	REVISED PER US ARMY CORPS OF ENGINEERS REVIEW
3	11/07/2014	REVISED FOR PLANT, ADMINISTRATION BUILDING, AND WAREHOUSE GRADING CHANGES

Civil & Environmental Consultants, Inc.
4274 Glendale-Milford Road · Cincinnati, OH 45242
513-985-0226 · 800-759-5614
www.cecinc.com

MARKWEST LIBERTY MIDSTREAM & RESOURCES, LLC.
SHERWOOD GAS PROCESSING PLANT
DODDRIDGE COUNTY, WEST VIRGINIA

EXISTING AND FINAL PROPOSED GRADING 100-YEAR FLOODPLAIN MAP

DATE:	1/29/2013
DRAWN BY:	TGJ
DWG SCALE:	1" = 150'
CHECKED BY:	ARG
PROJECT NO:	110-811.5001
APPROVED BY:	*RPC

DRAWING NO.:
SP01