August 2014

NATIONWIDE 49 PERMIT APPLICATION
KDNR PERMIT NO. 897-0587
USACE ID NO. LRL-2010-490

Prepared for:

ICG HAZARD, LLC
1021 Tori Drive
Hazard, KY 41701

Prepared by:

Summit Engineering, Inc.
131 Summit Drive, Ste. 200
Pikeville, KY 41501
Telephone: (606) 432-1447

ENGR 4345

U.S. ARMY CORPS OF ENGINEERS

APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT

(33 CFR 325)

OMB APPROVAL NO. 0710-0003
EXPIRES: 31 AUGUST 2012

Public reporting for this collection of information is estimated to average 11 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of the collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters, Executive Services and Communications Directorate, Information Management Division and to the Office of Management and Budget, Paperwork Reduction Project (0710-0003). Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. Please DO NOT RETURN your form to either of those addresses. Completed applications must be submitted to the District Engineer having jurisdiction over the location of the proposed activity.

PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and/or instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned.

(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED	4. DATE APPLICATION COMPLETE

(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. APPLICANT'S NAME First - Middle - Last - Company - ICG Hazard, LLC E-mail Address - dgibson@pinebranchmining.com	8. AUTHORIZED AGENT'S NAME AND TITLE (agent is not required) First - Ashlie Middle - Last - Childers Company - Summit Engineering, Inc. E-mail Address - achilders@summit-engr.com
6. APPLICANT'S ADDRESS: Address- 3228 Summit Sqare Place, Ste. 180 City - Lexington State - KY Zip - 40509 Country - US	9. AGENT'S ADDRESS: Address- 131 Summit Drive City - Pikeville State - KY Zip - 41501 Country - US
7. APPLICANT'S PHONE NOs. w/AREA CODE a. Residence b. Business (606) 435-7722 c. Fax	10. AGENTS PHONE NOs. w/AREA CODE a. Residence b. Business (606) 432-1447 c. Fax

STATEMENT OF AUTHORIZATION

11. I hereby authorize, Summit Engineering, Inc. to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

SIGNATURE OF APPLICANT DATE 8/28/14

NAME, LOCATION, AND DESCRIPTION OF PROJECT OR ACTIVITY

12. PROJECT NAME OR TITLE (see instructions)
KDNR Permit Nos. 897-0587

13. NAME OF WATERBODY, IF KNOWN (if applicable) Sam Campbell Branch	14. PROJECT STREET ADDRESS (if applicable) Address
15. LOCATION OF PROJECT Latitude: °N 37.323323 Longitude: °W -83.281266	City - State- Zip-

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN (see instructions)
State Tax Parcel ID Municipality
Section - Township - Range -

17. DIRECTIONS TO THE SITE

Approximately 3.5 miles west of the intersection of Sam Campbell Branch Road and KY 15 in the Krypton 7.5 minute quadrangle.

18. Nature of Activity (Description of project, include all features)

See attached Block 18.

19. Project Purpose (Describe the reason or purpose of the project, see instructions)

See attached Block 19.

USE BLOCKS 20-23 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

20. Reason(s) for Discharge

See attached Block 20.

21. Type(s) of Material Being Discharged and the Amount of Each Type in Cubic Yards:

Type Amount in Cubic Yards	Type Amount in Cubic Yards	Type Amount in Cubic Yards

See attached Block 21.

22. Surface Area in Acres of Wetlands or Other Waters Filled (see instructions)

Acres See attached Block 22.

or

Linear Feet

23. Description of Avoidance, Minimization, and Compensation (see instructions)

See attached Block 23.

24. Is Any Portion of the Work Already Complete? ☐ Yes ☒ No IF YES, DESCRIBE THE COMPLETED WORK

25. Addresses of Adjoining Property Owners, Lessees, Etc., Whose Property Adjoins the Waterbody (if more than can be entered here, please attach a supplemental list).

a. Address- See attached Block 25.

City - State - Zip -

b. Address-

City - State - Zip -

c. Address-

City - State - Zip -

d. Address-

City - State - Zip -

e. Address-

City - State - Zip -

26. List of Other Certificates or Approvals/Denials received from other Federal, State, or Local Agencies for Work Described in This Application.

AGENCY	TYPE APPROVAL*	IDENTIFICATION NUMBER	DATE APPLIED	DATE APPROVED	DATE DENIED
KDNR	SMCRA	897-0587	August 2014	Pending	
KDOW	KPDES	KYG046506	2012-01-09	2012-04-03	
KDNR	401 WQC	Pending	August 2014	Pending	

* Would include but is not restricted to zoning, building, and flood plain permits

27. Application is hereby made for permit or permits to authorize the work described in this application. I certify that this information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.

SIGNATURE OF APPLICANT DATE 8/20/14 SIGNATURE OF AGENT DATE

The Application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in block 11 has been filled out and signed.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both.

ACTION BY THE SOLE MEMBER OF
ICG HAZARD, LLC

March 3, 2014

The undersigned, being the sole member of ICG HAZARD, LLC, a Delaware limited liability corporation ("Corporation"), hereby consents to the following action as an action of the sole member of the Corporation pursuant to the Limited Liability Company Agreement of the Corporation:

> RESOLVED, that D. Edward Brown, Vice President- Engineering of the Company ("Brown") is duly authorized by the Member, on behalf of the Company, to execute and file all applications, documents, instruments, and papers as may be necessary for the Company to comply with requirements of any federal or state mining regulatory agency or regulations promulgated by any federal or state mining regulatory agency.
>
> RESOLVED, that all authority conferred by these resolutions shall be deemed retroactive and any and all acts permitted or authorized hereunder but performed prior to the adoption of these resolutions are hereby ratified, affirmed and approved.

IN WITNESS WHEREOF, the undersigned has executed this written action to be effective as of the date first set forth above.

PINE BRANCH MINING, LLC

John M. Potter, CEO

COMMONWEALTH OF KENTUCKY
COUNTY OF Fayette

This is to certify that the foregoing instrument was acknowledged before me on this 3rd day of March, 2014, by John M. Potter, CEO, of Pine Branch Mining, LLC, the Member of ICG Hazard, LLC, on behalf of Pine Branch Mining, LLC.

My commission expires: 6/17/15.

Laurel J. Unseld #445176
NOTARY PUBLIC

BLOCKS 18 AND 19

ICG Hazard, LLC (ICG) is proposing to develop a new surface mining operation in Perry County, Kentucky, near Dunraven. The new surface mining project is pending under KDNR Permit No. 897-0587 Revision 1. This project proposes area mining of the Hazard 7, Hazard 8, and Hazard 9 coal reserves situated along Roseanne Branch, Clear Fork, and unnamed tributaries of Grapevine Creek, as well as Abes Branch and unnamed tributaries of Sam Campbell Branch. The project proposed contour mining of the Hazard 5A coal reserves along unnamed tributaries of Sam Campbell Branch; however, the 5A seam (the lowest seam), will only be mined in a few areas where practicable and not in the entire proposed area.

The federal action being considered is the issuance of a Clean Water Act Section 404 Nationwide Permit 49 by the U.S. Army Corps of Engineers (USACE) to authorize the placement of one hollow fill resulting from on-site excavation, a sediment control pond, and one mine-through area within the waters of the United States. Impacts to waters of the United States more specifically include Hollow Fill 1, Pond 1, drainage corridor, pond maintenance area, and one mine-through impact area.

The Section 404(b)(1) Guidelines make a distinction between basic and overall project purpose (40 CFR 230.10(a)). For this project, the basic project purpose is defined as bituminous coal recovery. The overall project purpose, which is used as the basis for the alternatives analysis, is the recovery of the Hazard No. 5A, Hazard No. 7, Hazard No. 8, and Hazard No. 9 coal reserves along Roseanne Branch, Clear Fork, Sugar Camp Branch, Ground Hog Hollow, and unnamed tributaries of Grapevine Creek, as well as Abes Branch and unnamed tributaries of Sam Campbell Branch.

In order to mitigate for the impacts associated with this project, ICG proposes to submit an in-lieu fee payment to the Kentucky Department of Fish and Wildlife Resources Wetland and Stream Fee-in-Lieu-of (FILO) Mitigation Program, as well as the Troublesome Creek Environmental Authority. A total of $1,310,463 will be paid in order to offset impacts to jurisdictional waters impacted by this project. Of this total, 25% ($327,615) will be paid to the Troublesome Creek Environmental Authority.

The proposed construction date for the project is immediately upon issuance of all required federal and state authorizations. The expected life of the project is 5 years.

BLOCK 20

Overburden material generated during the mining operation is projected to swell 25% of its original volume upon excavation. The entirety of the swelled material cannot be placed solely on mining areas and still comply with applicable safety factors for backfilled material. Therefore, a portion of the overburden material must be placed off the mining area. The only practicable alternative for the permanent storage of this excess material is the construction of one hollow fill. The location of this hollow fill is dictated by the mining plan, which is affected by how the coal reserves lay within the project area, access to the property, quality of coal throughout the property, and the ratio of the total cubic yards of overburden to the total recoverable tons of coal extracted to that coal seam.

In order to provide sediment and drainage control for the proposed project, ICG must construct an embankment pond downstream of the proposed hollow fill. ICG will excavate the pool area of the ponds and use this material to construct the embankment of the proposed pond. A rock check dam and pond maintenance area are also proposed in association with the proposed pond.

BLOCKS 21 AND 22

IMPACTS TO JURISDICTIONAL WATERS

Structure	Permanent Impacts		Temporary Impacts	
	Intermittent ft/EIUs	Ephemeral ft/EIUs	Intermittent ft/EIUs	Ephemeral ft/EIUs
Pond SS-1	0/0	0/0	448/246.4	0/0
Rock Check Dam	180/99	0/0	0/0	0/0
Pond SS-1 Maintenance Area	0/0	0/0	261/143.55	0/0
Hollow Fill #1	2,183/1,200.65	120/66	0/0	0/0
Mine-Through Impact 1st Right of UT of Sam Campbell Branch	0/0	63/34.65	0/0	0/0
TOTAL	**2,363/1,299.65**	**183/100.65**	**709/389.95**	**0/0**
	2,546/1,400.3		**709/389.95**	
	3,255/1,790.25			

SUMMARY OF IN-STREAM ACTIVITIES

Impact	Volume Filled Below Ordinary High Water Mark (Cubic Yards)	Volume Excavated Below Ordinary High Water Mark (Cubic Yards)
Pond SS-1	6.1	43.0
Rock Check Dam	19.7	---
Pond SS-1 Maintenance Area	28.61	---
Hollow Fill #1	255.0	---
Mine-Through Impact 1st Right of 1st Left UT of Sam Campbell Branch	---	6.9
TOTAL	**309.41**	**49.9**

BLOCK 23

Avoidance, Minimization, and Compensation

In an effort to avoid and reduce impacts to jurisdictional waters, ICG will use on-bench sediment and drainage control as is practicable. This will prevent construction of additional in-stream ponds. Only one in-stream pond is proposed on KDNR Permit 897-0587. This pond will be removed once the project is complete and the stream will be restored using natural channel design techniques.

Excess spoil is being used to reclaim pre-law highwalls that would otherwise be placed in hollow fills. Reclamation of these highwalls will reduce the amount of spoil required to be placed in Hollow Fill #1, as well as improve the aquatic environment in the vicinity of the project.

In order to reduce the amount of excess spoil, the Hazard 7 seam is only being area mined in a few select locations. By not area mining the entire Hazard 7 seam in the project area, the size of Hollow Fill #1 has been reduced and the impacts to jurisdictional waters have been reduced.

Portions of the Hazard 5A seam which were originally intended to be contour mined have been removed from the plan in order to reduce impacts to jurisdicational waters.

The crest elevation of Hollow Fill #1 has been raised above the lowest seam to be mined in order to store additional excess overburden in the same footprint area. This will minimize impacts to jurisdictional waters.

In order to construct Hollow Fill #1, all drainage will be directed away from the fill construction zone. Once the fill construction zone is cleared and grubbed, durable sandstone will be placed in the old stream bed to form an underdrain. The material used in the underdrain will be comprised of the cleanest durable sandstone available on the site. The underdrain will be wrapped with filter fabric to prevent clogging. As spoil placement begins, care will be taken to insure the spoil material is clear of any strata that is thought to be a contributor of high conductivity levels. Particular attention will be given to material located near the coal seam. This material will be placed away from the fill area in other storage areas on the permit. Material used in the construction of the fill will be placed in lifts and compacted with rubber tired vehicles. The front face of the fill will be graded. Upon completion of the spoil placement into the fill, final grading will be completed to quickly shed water off the top of the fill and into the constructed side drains. Finally, revegetation of the face of the fill will be completed promptly after the final grading.

Temporary sediment control such as silt fences, straw bales, rock checks, dikes, and/or channel barriers would be used, as necessary, to prevent the transportation of sediment downstream during pond construction. Any disturbed areas would be seeded as is practicable after being brought to final grade.

Construction of the in-stream pond will take place in periods of low flow to minimize the transport of sediment to downstream areas.

The hollow fill and mining areas will be reclaimed and re-vegetated after mining to prevent transportation of sediment downstream. Additionally, the mining area will be restored to AOC, which reduces the hollow fill storage requirements and impacts to jurisdictional waters.

ICG has demonstrated compliance with the RAM 145 model for this project. The RAM 145 process for the proposed project allows the construction of hollow fills to impact 5,204 linear feet of stream and to cause the loss of 2,364 EIUs. ICG's proposed hollow fill impacts (not including sediment structures, rock check dam, pond maintenance area, and mine-through impact) total approximately 2,303 linear feet of stream and results in the loss of approximately 1,267 EIU's. Therefore, ICG's proposed mine plan complies with the requirements of RAM 145.

In addition to the avoidance, minimization, and mitigation measures described above, ICG will implement the following Best Management Practices (BMPs) in an effort to protect the quality of downstream aquatic resources:

- The backfill will be placed and compacted as necessary to ensure stability, prevent mass movement, and reduce infiltration of precipitation and surface runoff into the fill;
- Any coal seam materials that must be placed in the backfill will not be exposed to drainage and will be covered with a minimum of 4 feet of non-toxic, non-combustible material;
- ICG will implement field testing procedures to identify excessive TDS and sulfate-producing materials, which will then be stored in areas of the mine outside of drainage paths;
- Sediment and erosion control measures will be inspected by a qualified individual appointed by ICG's management at least once per quarter to ensure the structures and measures are functioning properly and to identify any required maintenance;
- ICG will follow SMCRA's progressive clearing and grubbing recommendations;
- ICG will use chemical flocculants designed for reduction of total suspended solids, total dissolved solids, and conductivity in in-stream embankment ponds upon the identification of high levels of these parameters by EPA or other agency and approval to use by the Kentucky Division of Water;
- Existing vegetation will be retained to the extent practicable between the mining area and surrounding waterways;
- Topsoil or topsoil substitute, as approved by the Kentucky Department for Natural Resources in the SMCRA permit for this project, will be stockpiled and managed so that re-graded areas can be covered with a layer of topsoil or topsoil substitute as quickly as practicable to avoid exposure of the fractured overburden material to surface water runoff;
- Sumps and secondary sediment control measures (i.e., berms, silt fences, straw bales, check dams, multiple sediment ponds in-series, diversion channels) will be established and used as practicable and necessary to supplement primary sediment control structures;
- Runoff will be diverted away from disturbed areas to the extent practicable;
- Contemporaneous reclamation techniques will be used to the extent practicable to reduce the area of disturbed acreage;
- Vegetation will be established in the re-graded areas of the mine as quickly as practicable to reduce erosion;
- Chemical treatment of the sediment pond will be used, if necessary and practicable, to cause precipitation and settling of chemical species;
- Aeration will be used, if necessary and practicable, to facilitate precipitation and settling of species;
- Roads will be constructed with appropriate sediment control, as is necessary and practicable;
- Any temporarily impacted channels will be restored using natural stream channel design techniques upon removal of the temporary structure;

- To the extent practicable, ICG will use weathered strata for surfaces to be in direct contact with runoff and drainage paths;
- To the extent practicable, ICG will generate larger rock fragments through the blasting process so as to reduce the surface area available for water contact in the backfill areas;
- Acidic and toxic material encountered during the mining operation will be handled in accordance with the approved Toxic Materials Handling Plan from the SMCRA permit; and
- Diversion channels will be constructed to pass flows as dictated by the SMCRA regulations so as to prevent additional erosion and sediment transport from disturbed areas.

BLOCK 24

SUMMARY OF SURACE OWNERS

KDNR Permit No. 897-0507	
Owner	**Address**
ACIN, LLC	1209 Orange St., Wilmington, DE 19801
James & Opal Neace	Route 1, Box 464, Hazard, KY 41701
Mountain Properties, Inc.	122 Campbell Dr., Hazard, KY 41701
Donnie R. Spencer	PO Box 1129, Hazard, KY 41701
Elisha Hughes Heirs (c/o Taylor Ray Hughes)	553 Clear Fork Branch, Hazard, KY 41701

SUPPLEMENTAL INFORMATION

1. DETAILED DESCRIPTION OF THE MINING ACTIVITY

ICG Hazard, LLC (ICG) is proposing to develop a new surface mining operation in Perry County, Kentucky, near Dunraven. The new surface mining project is pending under KDNR Permit No. 897-0587 Revision 1. This project proposes area mining of the Hazard 7, Hazard 8, and Hazard 9 coal reserves situated along Roseanne Branch, Clear Fork, and unnamed tributaries of Grapevine Creek, as well as Abes Branch and unnamed tributaries of Sam Campbell Branch. The project proposed contour mining of the Hazard 5A coal reserves along unnamed tributaries of Sam Campbell Branch; however, the 5A seam (the lowest seam), will only be mined in a few areas where practicable and not in the entire proposed area.

The federal action being considered is the issuance of a Clean Water Act Section 404 Nationwide Permit 49 by the U.S. Army Corps of Engineers (USACE) to authorize the placement of one hollow fill resulting from on-site excavation, a sediment control pond, and one mine-through area within the waters of the United States. Impacts to waters of the United States more specifically include Hollow Fill 1, Pond 1, drainage corridor, pond maintenance area, and one mine-through impact area.

The Section 404(b)(1) Guidelines make a distinction between basic and overall project purpose (40 CFR 230.10(a)). For this project, the basic project purpose is defined as bituminous coal recovery. The overall project purpose, which is used as the basis for the alternatives analysis, is the recovery of the Hazard No. 5A, Hazard No. 7, Hazard No. 8, and Hazard No. 9 coal reserves along Roseanne Branch, Clear Fork, Sugar Camp Branch, Ground Hog Hollow, and unnamed tributaries of Grapevine Creek, as well as Abes Branch and unnamed tributaries of Sam Campbell Branch.

In order to mitigate for the impacts associated with this project, ICG proposes to submit an in-lieu fee payment to the Kentucky Department of Fish and Wildlife Resources Wetland and Stream Fee-in-Lieu-of (FILO) Mitigation Program, as well as the Troublesome Creek Environmental Authority. A total of $1,310,463 will be paid in order to offset impacts to jurisdictional waters impacted by this project. Of this total, 25% ($327,615) will be paid to the Troublesome Creek Environmental Authority.

The proposed construction date for the project is immediately upon issuance of all required federal and state authorizations. The expected life of the project is 5 years.

a. Proposed Impacts to Jurisdictional Waters

Proposed impacts to jurisdictional waters are summarized in the Tables contained in Blocks 21 and 22 of the Department of the Army application.

The jurisdictional waters proposed to be impacted have been delineated by Summit Engineering, Inc. and the US Army Corps of Engineers (USACE) personnel. An Approved Preliminary Jurisdictional Determination form was received from USACE on January 6, 2011 (LRL-2010-490), which covers the impacts proposed on KDNR Permit No. 897-0587. A separate preliminary jurisdictional determination was issued for an unnamed tributary of Grapevine Creek on August 9, 2011 under LRL-2011-385. These letters are attached in Appendix C.

b. Work Activity

The project area (KDNR Permit No. 897-0587) includes coal removal areas and the construction of necessary support facilities, including: one hollow fill, one embankment pond, dugouts, a pond maintenance area, and a haul/access road. The hollow fill, mine-through impact, and rock check dam are permanent structures, while the pond, pond maintenance area, and dugouts are necessary only for the life of the project.

The hollow fill will receive excess overburden generated during the coal removal process not able to be stored in the backfill. This material will consist of sandstone and shales. Impacts associated with the ponds include construction of the embankment and excavation of the pool area. The volume of material to be placed below the ordinary high water mark of the channel is shown in the tables below. Work in the project area will commence upon receipt of applicable state and federal authorizations.

SUMMARY OF IN-STREAM ACTIVITIES

Impact	Volume Filled Below Ordinary High Water Mark (Cubic Yards)	Volume Excavated Below Ordinary High Water Mark (Cubic Yards)
Pond SS-1	6.1	43.0
Rock Check Dam	19.7	---
Pond SS-1 Maintenance Area	28.61	---
Hollow Fill #1	255.0	---
Mine-Through Impact 1st Right of 1st Left UT of Sam Campbell Branch	---	6.9
TOTAL	**309.41**	**49.9**

2. DEMONSTRATION OF COMPLIANCE WITH NATIONWIDE PERMIT 49

The proposed surface mine project to be located along Sam Campbell Branch is characterized by several areas of past mining. The Hazard 7 seam has been extensively deep mined in the project area. There is a total of 208.06 acres of previously mined surface area within the project area. These past surface mining activities have included area and contour mining operations. Additionally, the past mining areas are either not-reclaimed or partially reclaimed contour mining benches in the Hazard 5A seam or area mining with exposed highwall in the Hazard 7 seam and above.

Details and extents of the previous mining were obtained from the Mining and Reclamation Plan (MRP) map, permit overlay maps obtained from the Kentucky Department for Natural Resources, and the Krypton USGS topographic map. Exhibits are attached in Appendix G detailing the current flight mapping of the project area, as well as the proposed backfill plan for these permits.

The NWP 49 language states, "The total area disturbed by new mining must not exceed 40 percent of the total acreage covered by both the remined area and the additional area necessary to carry out the reclamation of the previously mined area."

In order to prove that the proposed project qualifies for NWP 49, it is first necessary to determine the acreage of new mining required to reclaim the previously mined areas. Based on volume calculations, it was determined that a portion of the previous mined acreage (208.06 acres) required approximately 1,272,837 cubic yards of material to reclaim it to its Approximate Original Contour (AOC). From the volume calculations, it was determined that mining of an additional 63.4 acres would be required to generate sufficient material to reclaim the previously mined acreage and the newly mined acreage to AOC.

From the language of NWP 49, an additional 40 percent of this summed acreage (208.06 acres + 63.4 acres = 271.46 acres), which is 108.58 acres, can be mined as part of the NWP 49 authorization. Therefore, a total of 380.04 acres of coal mining could be permitted and qualify for authorization under NWP 49. The KDNR permit applications for these projects only seek permitting of 377.4 acres of coal mining.

In addition to the acreage restrictions, NWP 49 states there must be demonstration that "the overall mining plan will result in a net increase in aquatic resource functions." As indicated further in the sediment loading calculations section of this report, the proposed mining plan will reduce the current ground conditions sediment load going into the watersheds within the project area by approximately 23 percent, with just the Sam Campbell Branch watershed being reduced by 32.4%. This will result in a net increase in aquatic resource functions.

Surrounding watersheds, beyond the Sam Campbell Branch watershed, have been previously impacted and will benefit by the reclamation of these areas. The Clear Fork watershed shows extensive pre-law mining areas (see exhibit in Appendix G). An aquatic biologic survey was completed within the Clear Fork watershed (included in Appendix B) in 2010 which resulted in an MBI score of 28.3 and an MBI rating of "poor" and the conductivity taken during this biological survey was 1,186 μS. Reclamation of these pre-law areas within the Clear Fork watershed should reduce sediment loading and subsequently improve both the MBI score and conductivity.

Several of the jurisdictional waters within the project area have been degraded by pre-law pond construction, the use of channels as sediment corridors, filling of the floodplain areas, channelization, etc. As a result, the channels have deviated from their natural stream channel configuration and characteristics. This has led to areas of increased erosion along stream banks, aggradation of sediment in the channel or degradation of the stream channel by down-cutting depending on the altered configuration of the channel, widening or narrowing of the stream channel, etc. Primarily, sedimentation has become a major concern in Sam Campbell Branch. The culvert located at the mouth of the channel is no longer functioning properly and a pattern of sedimentation and ponding has developed. The following photos depict some of these problem areas.

Photograph 2-1. Existing conditions of culvert inlet at the mouth of Sam Campbell Branch.

Photograph 2-2. Existing conditions of culvert inlet at the mouth of Sam Campbell Branch.

Photograph 2-3. Existing conditions of Sam Campbell Branch.

The Sediment Load Calculations section, which follows, shows how backfilling and reclaiming the previously mined areas will reduce the sediment load going into Sam Campbell and its associated tributaries. This will improve the conditions of Sam Campbell Branch as depicted in the photos and, thus, result in a net increase in aquatic resource functions.

The proposed reclamation plan will return the entire permitted area to AOC and establish fish and wildlife habitat throughout the KDNR permit area. This reclamation will require elimination of all exposed highwalls and planting of trees and shrubs throughout a portion of the area, which will reduce runoff volumes, thereby reducing sediment and other chemical loading of aquatic resources receiving drainage from the project area. Elimination of the highwalls will lead to reduced sedimentation and a gradual improvement in water quality and aquatic habitat.

Surface water data has been collected as required by the SMCRA permit. Conductivity data collected at points SW-2, SW-3, and SW-4 is shown on the following table for the last three quarters. The location of these stations can be found on the MRP.

Station	4th Quarter 2013 Conductivity (µS)	1st Quarter 2014 Conductivity (µS)	2nd Quarter 2014 Conductivity (µS)
SW-2	638	n/a	478
SW-3	1,127	1,006	580
SW-4	2,114	1,560	851

Additionally, ICG will be required to remove any in-stream ponds constructed as part of this project under the SMCRA regulations providing a natural stream channel in the location of the ponds. The streams will be restored using natural stream channel design techniques (Rosgen design techniques) that will provide the channel with its appropriate pattern, profile, and dimension, which are dependent on stream and valley type.

Further, because the project will cause impacts to jurisdictional waters, mitigation will be required as part of the NWP 49 authorization. ICG proposes in-lieu fees to compensate for the proposed impacts to jurisdictional waters. The off-site mitigation that will be conducted by KDFWR using the in-lieu fees will provide higher functioning aquatic resources with increased aquatic habitat scores in previously impacted or degraded watersheds. In addition, 25% of the in-lieu fees calculated ($327,615) will be paid to the Troublesome Creek Environmental Authority. The Troublesome Creek Environmental Authority uses such funds to construct wastewater treatment facilities and reduce the use of straight pipes in the Troublesome Creek watershed. A straight-pipe disposes raw sewage directly into receiving streams. By reducing the use of straight pipes, water quality will improve and risk to public and environmental health will decrease. Thus, the re-mining activities proposed by ICG will not only eliminate sources of sediment and other chemical species in this watershed, but also provide mitigation and/or funds for improvement of aquatic resources in other previously impacted watersheds.

Sediment Load Calculations

A. Purpose for Calculations

ICG is proposing to conduct coal remining activities in the Sam Campbell Branch and Grapevine Creek watersheds of Perry County, Kentucky, and seeks approval through a Nationwide Permit 49 by the USACE. As detailed in other sections of this report, the total area to be disturbed by new mining will not exceed 40 percent of the total acreage covered by both the re-mined area and the additional area necessary to carry out the reclamation of the previously mined area.

As part of the project, the permittee may conduct new coal mining activities in conjunction with the re-mining activities when it is clearly demonstrated to the district engineer that the overall mining plan will result in a net increase in aquatic resource functions. In order establish such a demonstration, ICG is providing a Sediment, Erosion, and Discharge by Computer Aided Design (SEDCAD) model of the watershed area. SEDCAD, created by Pamela J. Schwab and Richard C. Warner of the University of Kentucky, was developed to aid consultants, industry and agency personnel in the study, design, management, planning and review or permitting of stormwater management, erosion, and sediment control systems. In particular, an analysis of the sediment loading and total rainwater discharge was completed for both existing ground conditions and proposed post-mining conditions for Sam Campbell Branch and Grapevine Creek watersheds. These analyses are provided to demonstrate that the proposed reclamation of previously mined lands will result in a decreased sediment load expected to discharge into these watersheds.

Following such activities as road construction, forest harvest, and mining, watersheds often see an increase in suspended solids (Binkley and Brown 1993). The proposed project area within the aforementioned watersheds contain unreclaimed highwalls and haul roads which contribute to the addition of sediment to the stream below. Sediment, and associated increases in suspended solids and conductivity, have been recognized as non-point source pollution in streams in North America (Waters 1995) and contributing factors to the impairment of Kentucky streams. The pollutant which is limiting to benthic and fish populations around partially reclaimed mine areas is inorganic silt (Hill 1972). However, sediments can transport nutrients which themselves have an impact on aquatic communities. A complete reclamation reduces siltation and the resulting turbidity, allowing for the recovery of aquatic communities over time (Hill 1972). Increases in sediment load to streams may impact the function of aquatic communities through a variety of direct and indirect manners including nutrient loading, decreased light penetration, increased temperature, decreased dissolved oxygen, increased Biological Oxygen Demand (BOD), increased sediment deposition, interstitial niche reduction, alteration to stream flow, and the introduction of absorbed pollutants (European Inland Fisheries Advisory Commission 1965; Oschwald 1972; Appleby and Scarratt 1989; Graham 1990; Hicks and Griffith 1992; Quinn et al. 1992; Wood and Armitage 1997; Suren and Jowett 2001; Wetzel 2001; Newman and Unger 2003).

Sediment loading affects aquatic communities at each trophic level. Sediment washed into streams can increase nutrient loads to lentic systems and this increase in available nitrate-N and phosphate may lead to an initial increase in plant productivity. Periphyton communities initially experience excessive growth due to this nutrient influx (Yamada and Nakamura 2002). However, additional sediment particles can increase the scattering of light, measured as turbidity. The decreased penetration of light and the deposition of sediments may result in lower productivity among phytoplankton and higher levels of aquatic plants (Wetzel and McGreggor 1968; Wetzel 1973-1974; Marzolf and Arruda 1980; McCubbin et al 1990; Persuad and Jaagumagi 1995) and lead to increased levels of non-living periphyton coating benthic substrates (Yamada and Nakamura 2002; Schofield et al. 2004). As a result of the scattering of light, sediments cause waters to absorb heat which, in turn, reduces the capacity for oxygen diffusion (Marcus et al. 1990). Additionally, the covering and filling of benthic substrate by sediment reduces the diffusion of oxygen into the streambed (Everest et al. 1987; Macdonald et al. 1991). The combination of increased temperature, reduced dissolved oxygen, and the decreased photosynthetic production of oxygen by aquatic plants can create a high BOD.

Sediment and suspended solids affect benthic macroinvertebrate communities in a number of ways. In addition to reducing the concentration of dissolved oxygen, suspended solids clog the devices used by macroinvertebrates for respiration, feeding, and digestion. This can lead to an increase in avoidance behaviors and reduced benthic macroinvertebrate density, as well as alterations to community structure (Tebo 1955; Gammon 1970; Hill 1972; Bjornn et al 1974; Rosenberg and Weins 1978; Forbes, Magnusson and Harrell 1981; Bowlby et al 1987). Furthermore, sediment deposition can impede the development of macroinvertebrate llarvae (Appleby and Scaratt 1989). Interstitial spaces within the substrate may be filled, reducing the available benthic habitat and its value to certain types of benthic macroinvertebrates such as clingers (Doudoroff 1957; Peters 1965; Paustian and Beschta 1979; Lemly 1982; Mcquinn et al 1983; Ventiling-Schwank and Livingstone 1994; Suren and Jowett 2001; Connolly and Pearson 2007). If an increase in the sediment load is sufficient, the entire bed of a stream may be covered in silt, eliminating much of the available benthic habitat (Forschage and Carter 1973).

As with benthic macroinvertebrates, sediments impact fish populations by decreasing dissolved oxygen, clogging gills, and impeding egg incubation and larval development (Peters 1965; Macdonald et al 1991; Newcombe 1994). Feeding efficiency is impeded as a result of reduced benthic macroinvertebrate population density and growth as well as the impaired ability of predaceous fish to locate prey in turbid waters (Gardner 1981; Miller and Menzel 1986). Therefore, increased sediment can lead to the avoidance of turbid waters by fish (Hill 1972; Mcleay et al. 1984; Paragamian 1991).

If sediments continue to accumulate without being flushed from a stream reach, they can not only cover and eliminate benthic habitat, but may even lead to increased bar formation, thereby altering stream flow characteristics. This can lead to reductions in stream flow, which can further limit sediment flushing.

Sediments may bring with them pollutants like nutrients, pesticides, or metals as they are washed into a stream during rain events. These pollutants may contribute to further water quality degradation though such mechanisms as eutrophication resulting from increased nitrate-N (Newman and Unger 2003 Lemly 1982), changes in pH due to the oxidation of exposed iron sulfides (Murty 1986; Persuad and Jaagumagi 1995), or they may be directly toxic to the stream community, as in the case of heavy metals which are adsorbed to clay particles making them more bioavailable (Sorensen et al. 1977; Newman and Unger 2003).

Increased sediment loads affect aquatic habitats through a number of mechanisms and may negatively impact aquatic communities by reducing habitat, population density, community structure, individual health, and reproduction. ICG proposes to increase aquatic resource function in the project area by reducing sediment loading through the reclamation of previously mined lands.

Shown below is a description of the parameters used in the SEDCAD model which compares the total sediment load and rainwater discharge during a rainstorm event for both the existing watershed conditions and for the proposed post-mining conditions. This model examines a 25 year-24 hour rainstorm event, which is a typical storm frequency and duration used when analyzing drainage and sediment control structures in a SMCRA permit.

B. Parameter Descriptions

Network Parameters

Null Structure – Unless a pond is pre-existing (as shown on the Existing Ground Conditions Map) the hydrologic and sedimentologic measuring points within this property were defined as null structures. Null Structures (as opposed to a pond, ditch, or other designed structure to handle the rainwater and sediment runoff during a storm event) are particularly useful in the development of a watershed run. Once a null structure is located within a watershed, it may be utilized to evaluate the varying effects existing and proposed land uses and routing parameters will have at that point in the watershed. When a null structure is specified in the subwatershed parameters, the SEDCAD program will return the composite hydrologic and sedimentologic information going into and out of the null structure.

Ponds are not shown on the Post-Mining Exhibit Map (Appendix C). None of the proposed sediment storage structures (ponds, ditches, etc.) in this watershed are permanent structures; therefore, ponds or ditches should not exist post-mining.

Subwatershed – A subwatershed is any land section of similar hydrologic and sediment response or land usage. Subdivision of a watershed into subwatersheds is done for greater precision and design insight. The dissection of a large watershed into a system of subwatersheds requires consideration of land use conditions, amount of proposed disturbance, and alternative plans. The hydrologic and sediment response for a highly disturbed area is quite different from that of a forested or reclaimed area. Subwatershed boundaries for each null structure in the Sam Campbell Branch analysis are shown in the exhibit maps (Appendix D).

Network – SEDCAD is designed to allow spatial variability within the watershed to be modeled. The first step in setting up the model input parameters is to separate the watershed into a series of junctions, structures and subwatersheds. These basic networking items are used to route and sum the hydrologic and sedimentologic data through the watershed system. In this model, for example, the network was set up to model the water and sediment flowing from both point 2 and point 6 into point 7. Point 7 then flows through point 8 and point 9 to point 10. Point 10 and point 14 then flow into the mouth of Sam Campbell Branch at point 15.

Storm Hydrology

Storm Type – The storm type represents the temporal storm pattern. The Soil Conservation Service (SCS) Type I and Type II storm curves are based on the Depth-Duration-Frequency method. Type I storms are applicable to Alaska, Hawaii, and the west coast of the United States. Type II storms (as used in this model) are generally applicable to the rest of the United States.

Storm Duration and Frequency – The storm duration is the duration (in hours) for the specified designed storm. The storm frequency is how often a storm of a certain magnitude is expected to occur. For example, for a 25 year-24 hour storm the duration is 24 hours and the frequency is once every 25 years. This model examines a 25 year-24 hour rainstorm event.

Rainfall Depth – The rainfall depth is the amount of rainfall (in inches) to be expected for a design storm, for example a 25 year-24 hour storm. The rainfall depth used in this analysis was taken from the Division of Water/Kentucky Department for Natural Resources Engineering Memorandum No. 2, which specifies the rainfall depth for Perry County in a 25 year-24 hour event is 5.0 inches.

Subwatershed Hydrology Parameters

Area – The area of the subwatershed is input in acres. This can be readily calculated in AutoCAD.
Time of Concentration (T_c) – The time of concentration is determined from the hydraulically longest flow path to the subwatershed outlet. The land use parameters are applied along segments of this flow path, typically beginning in a land use 1 (forest with heavy ground litter) or 3 (short grass pasture) and as the flow path progresses this changes to a land use 8 (large gullies or diversion ditches) or 9 (small streams). The data input for each land use along the flow path include any two of the following three parameters: change in elevation (ΔV), change in horizontal distance (ΔH), and percent slope. Note once two parameters are input the program automatically calculates the third parameter.

Muskingum K and X (M_k and M_x) – The subwatershed Muskingum K and X are the routing parameters used to model the flow path from the subwatershed outlet to the subwatershed structure. The land use parameters and data input are similar to that for the time of concentration. For example, for subwatershed N5-1 of null structure 5, the time of concentration would be the land flow from the top of subwatershed N5-1 to the boundary between N5-1 to N5-2. The Muskingum K and X is the route this water and sediment would then flow through N5-2 to null structure 5. Note the Muskingum K and X values for subwatershed N5-2 would be zero (0), because no routing takes place between the subwatershed outlet and the null structure as they are the same point.

Curve Number – The curve number of a subwatershed represents the runoff potential for the area. This can range from 1 to 100. A curve number of 100 represents an impervious surface with no rainfall or runoff abstractions (100% runoff). It is based on the land use and treatment conditions, and the four hydrologic soil groups: A, B, C or D. The Soil Conservation Service has classified thousands of soils into one of these four groups. Curve numbers utilized in this analysis are those typically found in SMCRA permit applications accepted by Kentucky DNR when modeling bare, active/partially disturbed, partially reclaimed, fully reclaimed, and undisturbed ground conditions.

Hydrograph Response – The hydrograph response shapes are used to predict the runoff response from a watershed. These are specified as F (fast or type 1), M (medium or type 2) or S (slow or type 3) which corresponds to the response shape of each subwatershed. A slow response shape would correspond to a forested area or an area with a lot of obstructions, while a fast response shape would correspond to an un-vegetated or poorly protected area.

<u>Subwatershed Sedimentology Parameters</u>

Soil Parameter (K) – The local Soil Conservation Service will have K values for most soil classes of topsoil or subsoil. Typical undisturbed forest land in this project area has a K factor of 0.17. Disturbed soils have a K factor of 0.22.

Slope Length (L) – The representative slope length (in feet) is defined as the typical slope length found on the subwatershed. It is the distance from the point of origin of overland flow until the point that the slope decreases such that the significant deposition occurs or until the flow enters a defined channel. This is not to be confused with the time of concentration length (which is a longer length) because time of concentration will include the length of the flow in a defined channel.

Average Slope (S %) – The average slope is entered in percent, and is the typical or representative slope for overland flow for each subwatershed.

Control Practice Factor (CP or C) – The control practice factor is defined as the ratio of sediment loss from an area with a given cover and conservation practice to that of a field in continuous fallow. It is entered for each subwatershed. The Soil Conservation Service has published C factors for a wide variety of land use conditions, including bare soil/spoil conditions (.8 to .9), to those with varying grades of vegetative covers (0-2 months of vegetative growth is typically .14 in this project area, 2-12 months is .05, previously mined is .01) to undisturbed forested areas (.003).

Particle Size Distribution number (PS #) – The particle size distribution curves will differ between disturbed and undisturbed areas. Note in this model two particle size distribution curves were

entered. The first curve applies to undisturbed (forested) areas and the second curve applies to all disturbed areas.

C. Results and Conclusions

After inputting the above referenced parameters into the SEDCAD program, the peak discharge and sediment tons discharged into each watershed during a 25 year-24 hour rain storm event were calculated. As shown in the SEDCAD models, as well as the current ground and post-mining subwatershed maps, the peak discharge and sediment tons discharged into each watershed is lowered by the remining and subsequent post-mining land use and vegetative cover plan.

The results for each null structure measuring point are displayed on the exhibit maps. The data for the null structure at the mouth of each watershed can be found in Appendix D. The overall total of all watersheds is summarized in the table below.

Sediment Loading Results

	Existing Site Conditions	Post-Mining Conditions	Percent Reduction
Peak Sediment Concentration (mg/l)	104,692	80,664	23%
Sediment Tons Discharged (tons)	5,537.9	5,290.9	4.5%
Peak Sediment Discharge Rate (cfs)	4,558.6	3,216.01	29.4%

The above data shows that the post-mining plan sediment load, during a 25 year-24 hour rainstorm event when totaled for all watersheds in the project area will be reduced by 23% as compared to the sediment load if the same storm occurred in the watershed with current ground conditions. Sam Campbell Branch itself had a drop of 32.4% in the peak sediment concentration. The peak discharge rate and peak sediment concentration numbers also are lower in the post-mining model than in the current ground configuration.

Therefore the proposed mine plan lowers the sediment load in the project area, and the overall mining plan will result in a net increase in aquatic resource functions.

3. ASSESSMENT INFORMATION

a. General Description of the Affected Environment

Habitat assessments of the channels proposed to be impacted were conducted using EPA's widely-accepted Rapid Bioassessment Protocol. The data obtained from the assessments and conductivity data were then used in the Eastern Kentucky Stream Assessment Protocol (EKSAP) for High Gradient Streams. The habitat sheets are contained in Appendix B. Refer to the table below for information regarding the existing habitat and Ecological Integrity Indices (EIIs) and Ecological Integrity Units (EIUs).

Assessment Area	**Stream Length (feet)**	**Flow Regime**	**Normalized Values**		**Ecological Integrity Index (EII)**	**Ecological Integrity Units Lost (EIUs)**
			Stream Habitat	**Specific Conductivity (μmhos)**		
Pond SS-1	448	Intermittent	142	304	0.55	246.4
Rock Check Dam	180	Intermittent	142	304	0.55	99.0
Pond SS-1 Maintenance Area	261	Intermittent	142	304	0.55	143.55
Hollow Fill #1	120	Ephemeral	142	304	0.55	66.0
	2,183	Intermittent				1200.65
Mine Through Impact 1st Right of UT of Sam Campbell Branch	63	Ephemeral	142	304	0.55	34.65
TOTALS	**3,255**					**1790.25**

All impacts listed would occur within the same UT of Sam Campbell Branch. The following photos depict the existing conditions of this unnamed tributary.

Photograph 3-1. Existing conditions of UT of Sam Campbell Branch

Photograph 3-2. Undercut Bank along UT of Sam Campbell Branch.

Photograph 3-3. Sediment deposits along UT of Sam Campbell Branch.

In addition to habitat assessments, a survey of the existing stream channel and a pebble count were conducted in the proposed location of the embankment ponds.

Existing Channel Material

Site ID	D16 (mm)	D35 (mm)	D50 (mm)	D65 (mm)	D84 (mm)	D95 (mm)
Pond SS-1	23	51	80	104	143	191

Existing Channel Characteristics
Pond SS-1

Section	Bankfull Width (ft)	Mean Depth (ft)	Bankfull X-Sec. Area (ft^2)	Width Depth Ratio	Max. Depth (ft)	Width of Flood Prone Area (ft)	Entrenchment Ratio
Section 1	5.73	0.29	1.64	19.76	0.53	7.69	1.34
Section 2	6.90	0.40	2.77	17.25	0.66	10.93	1.58
Section 3	8.08	0.62	4.98	13.03	0.91	23.21	2.87
Section 4	7.62	0.34	2.58	22.41	0.56	12.54	1.65
Section 5	6.63	0.45	2.98	14.73	0.78	14.79	2.23
Average	6.99	0.42	2.99	17.44	0.69	13.83	1.93

b. Delineation/Assessment Information.

The jurisdictional waters proposed to be impacted have been delineated by Summit Engineering, Inc. and the US Army Corps of Engineers (USACE) personnel. An Approved Preliminary Jurisdictional Determination form was received from USACE on January 6, 2011 (LRL-2010-490), which covers the impacts proposed on KDNR Permit No. 897-0587. A separate preliminary jurisdictional determination was issued for an unnamed tributary of Grapevine Creek on August 9, 2011 under LRL-2011-385. These letters are attached in Appendix C.

Using EPA's widely accepted Rapid Bioassessment Protocol, Summit Engineering, Inc. personnel assessed the habitats within the project area on March 30th, 2009. Habitat assessment sheets are included in Appendix B.

c. Summary of Impacts to the Aquatic Resources

An aquatic survey was not conducted for this project.

Using EPA's widely accepted Rapid Bioassessment Protocol, each of the sites were scored as marginal or suboptimal. The Sam Campbell Branch and Grapevine Creek watersheds, in which the proposed project is located, has been previously disturbed by oil/gas wells, hay/pasture/cultivated crops, urban development, logging, mining, and roads.

4. ALTERNATIVES ANALYSIS

a. Project Purpose

Section 404(b)(1) guidelines state that "no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the jurisdictional waters" (40 CFR 230.10(a)). Following is an Alternatives Analysis as required under the Section 404(b)(1) guidelines that was conducted in order to compare the practicability and environmental impacts of the identified alternatives with the ultimate goal of identifying the least environmentally damaging, practicable alternative.

The Section 404(b)(1) Guidelines make a distinction between basic and overall project purpose (40 CFR 230.10(a)). For this project, the basic project purpose is defined as bituminous coal recovery. The overall project purpose, which is used as the basis for the alternatives analysis, is the recovery of the Hazard No. 5A, Hazard No. 7, Hazard No. 8, and Hazard No. 9 coal reserves along Roseanne Branch, Clear Fork, Sugar Camp Branch, Ground Hog Hollow, and unnamed tributaries of Grapevine Creek, as well as Abes Branch and unnamed tributaries of Sam Campbell Branch.

Considerations to determine the project's consistency with Section 404(b)(1) Guidelines are:

1. Whether all appropriate and practicable steps have been taken to reduce the potential adverse impacts of the discharge on the jurisdictional waters.
2. Whether the proposed project represents the least environmentally damaging, practicable alternative to the jurisdictional waters, so long as the alternative does not have other significant environmental consequences.
3. Whether all state and/or federal environmental criteria will be met.
4. Whether the project will result or contribute to significant degradation of the aquatic environment.

Under Section 404(b)(1) Guidelines, the least environmentally damaging practicable alternative must be chosen. An alternative is practicable if it is available to the applicant and capable of being done after taking into consideration cost, existing technology, and logistics in light of the project purpose (40 CFR 230.3(q)). Based on this requirement, all practicable alternatives that are available and capable of being completed after taking into consideration cost, existing technology, and logistics in light of the proposed project purpose must be examined (40 CFR 230.3(q)).

The practicable Alternative Analysis on the proposed project considers the following: (i) the No Action Alternative; (ii) Alternate Project Locations; (iii) Mining or Action Alternatives including Underground Mining or Surface Mining Alternatives (Contour Mining only, Contour and Highwall Mining, and Area Mining). After reviewing these mining methods to determine the preferred alternative, fill placement alternatives are examined.

b. Proposed Action and Alternatives

This Alternatives Analysis will examine a "No Action" alternative, Alternate Project Locations, Mining Method Alternatives, and Fill Placement Alternatives.

<u>No Action Alternative</u>

The No Action Alternative is used in this document as a basis to which the Preferred Alternative is compared. The No Action Alternative is not considered identical to existing or baseline conditions of the impacted environment. The project area watersheds have been impacted in the past by by oil/gas wells, hay/pasture/cultivated crops, urban development, logging, mining, and roads. It is likely these activities will continue in the future regardless of the fate of this application. While the No Action Alternative is often described as "the future without the project," the land will still likely be impacted in the future regardless of this project. This alternative was eliminated as it fails to meet the project purpose.

Selection of the No Action Alternative would not result in the proposed project area remaining unaltered or unimpacted, but would prevent the recovery of over 5.5 million raw tons of coal reserves from the Hazard No. 5A, No. 7, No. 8, and No. 9 coal seams (see Table 1C) proposed by the project as well as prohibit the acquisition of the associated revenue by the applicant and the natural resource owner. Also, the No Action Alternative would result in the loss of employee jobs, as well as the loss of tax revenues to the local, state, and federal agencies which would be generated by coal recovery.

Alternate Project Locations

While coal is generally persistent through much of central Appalachia, individual seams vary in thickness, quality and depth beneath the surface and these characteristics, along with topography and other factors, determine the mineability of a specific coal reserve. Property ownership, existing land uses, proximity to infrastructure and other criteria largely determine the availability of a coal reserve for mining. A company typically selects the best available coal reserve that satisfies the requirements of its customers as the next project location.

The subject property area meets the described criteria and has been determined to be a practicable location for recovery of the Hazard No. 5A, No. 7, No. 8, and No. 9 coal seams. Therefore, the company must mine in the location of the coal reserves. Other potential sites do not compare favorably in terms of mineability or are not available for mining by the applicant, thus those sites do not satisfy the project location requirements.

Mining Method Alternatives

The first step in the process of developing the proposed project's least environmentally damaging practicable alternative or the Preferred Alternative was to evaluate the coal reserves in the proposed project's mining area, based on: available geologic information such as seam thickness from coreholes; mine maps; experience in seam recovery; strata competency; seam separation; aerial extent of the seam; and other available information. The seams evaluated were the Hazard No. 5A, No. 7, No. 8, and No. 9 coal seams. Summarized in Tables 1A, 1B, and 1C below are the data for this project area.

Table 1A: Average Seam Thickness (in feet) from Corehole Data

Seam	SC-06-09	SC-07-09	SC-08-09	**Average**
Hazard 9 (Top Split)	2.71	1.94	1.10	**1.92**
Hazard 9 (Bottom Split)	1.70	1.70	0.90	**1.43**
Hazard 8	1.45	2.85	3.05	**2.45**
Hazard 7	3.58	6.17	3.58	**4.44**
Hazard 5A	3.15			**3.15**

Table 1B: Average Seam Parting (in feet) from Corehole Data

Seam	SC-06-09	SC-07-09	SC-08-09	**Average**
Hazard 9 (Top Split)	0.20	0.26	0.50	**0.32**
Hazard 9 (Bottom Split)	0.75	0.00	0.00	**0.25**
Hazard 8	1.65	0.98	0.95	**1.19**
Hazard 7	0.02	0.03	0.03	**0.03**
Hazard 5A	0.35			**0.35**

Table 1C: Estimated Tons In-Place

Seam	Area (acres)	Thickness (inches)	In-Place Tons
Hazard 9 (Top)	172.0	23	574,511
Hazard 9 (Bottom)	172.0	17	429,560
Hazard 8	301.4	29	1,286,640
Hazard 7	55.0	53	425,814
Hazard 5A	513.0	38	2,815,631
		Total:	5,532,156

The area for each coal seam in Table 1C was calculated from the attached seam maps. The total estimated resource tons of coal within the project area is about 5.5 million tons. This quantity will be used as a basis for comparison within the mining alternatives.

Underground Mining

Mining in the project area is proposed for the Hazard No. 5A, No. 7, No. 8, and No. 9 coal seams only. ICG has established minimum criteria for an area of coal in this specific project site to be considered practicable for underground mining. To be considered as an underground mineable reserve, the reserve area typically has to meet all of the following control criteria which are characteristic for the mining industry with some site specific modifications. These criteria are:

i) Minimum coal height of 30 inches;
ii) Minimum clean tons per foot (CTPF) of 2.0;
iii) Parting height of less than 24 inches;
iv) Ability to mine at least 50% of the in-place tonnage with a continuous miner;
v) Minimum of 40' of competent rock to another mineable seam;
vi) Minimum cover thickness of 100 feet;
vii) Minimum underground mining reserve base (areas where top surface elevation is more than 100' above the coal seam elevation) of 500,000 tons; and
viii) Minimize potential for re-disturbance of the land by maximizing overall seam recovery in the project.

A summary of the underground mining criteria as applied to each seam within the project area is provided in Table 2.

Table 2
Underground Mining Criteria

Seam	Coal Ht. > 30"	CTPF ≥ 2.0	Parting Ht. < 24"	50% Recovery	> 40' to Mineable Seam	Cover > 100'	> 500,000 tons	% Seam Recovery	Min. Re-disturbance
Hazard 9 (Top)	No	No	Yes	Yes	No	Yes	No	0%	No
Hazard 9 (Bottom)	No	No	Yes	Yes	No	Yes	No	0%	No
Hazard 8	No	No	Yes	Yes	Yes	Yes	No	0%	No
Hazard 7	Yes	Yes	Yes	Yes	Yes	Yes	No	0%	No
Hazard 5A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	40%	No
							Overall Project:	**20%**	**No**

Hazard No. 9

The Hazard No. 9 seam consists of two splits. The top split lies at an approximate elevation of 1320 feet with an average thickness of 23 inches. The bottom split lies just below the top split at an approximate elevation of 1310 feet with an average thickness of 17 inches. The bottom split is 60 feet above the Hazard No. 8 seam. The estimated underground mining reserve base for the top split is 137,258 tons, and for the bottom split is 102,645 tons.

Both of these splits fail to meet underground mining criteria i) minimum coal height of 30 inches, ii) minimum CTPF of 2.0, v) minimum of 40' of competent rock to another mineable seam and vii) minimum underground mining reserve base of 500,000 tons. As a result of failing to meet all criteria, no underground mining can be done in this seam and underground mining is therefore eliminated as a practicable alternative for this seam.

Hazard No. 8

The Hazard No. 8 seam is located approximately 60 feet above the Hazard No. 7 seam, and 60 feet below the Hazard No. 9 seam, at an at an approximate elevation of 1250 feet. This seam has an average thickness of approximately 29 inches and has an estimated underground mining reserve base of 102,645 tons.

This seam fails to meet underground mining criteria i) minimum coal height of 30 inches, ii) minimum CTPF of 2.0, and vii) minimum underground mining reserve base of 500,000 tons. As a result of failing to meet all criteria, no underground mining can be done in this seam and underground mining is therefore eliminated as a practicable alternative for this seam.

Hazard No. 7

The Hazard No. 7 seam is located approximately 80 feet above the Hazard No. 5A seam, and 60 feet below the Hazard No. 8 seam, at an approximate elevation of 1190 feet. This seam has an

average thickness of approximately 53 inches and has an estimated underground mining reserve base of 0 tons.

This seam fails to meet underground mining criteria ii) minimum CTPF of 2.0, and vii) minimum underground mining reserve base of 500,000 tons. As a result of failing to meet all criteria, underground mining is eliminated as a practicable alternative for this seam.

Hazard No. 5A

The Hazard No. 5A seam is the lowest in elevation in the project area at approximately 1110 feet, 80 feet below the Hazard No. 7 seam. This seam has an average thickness of approximately 38 inches, with an estimated underground mining reserve base of 2,240,430 tons.

This meets criteria i) through vii) for underground mining. However, this method has a percent seam recovery of only 40%. Thus it is likely that future re-disturbance would occur, which violates criteria viii) minimize potential for re-disturbance of the land. As a result of failing to meet all criteria, underground mining is eliminated as a practicable alternative for this seam.

Conclusion

As shown in Table 2 above, the overall project recovery of reserves is approximately 20%. Further, as described above, underground mining in each of the seams within the project area has been eliminated as a practicable alternative for failure to meet all the criteria. Therefore the underground mining method has been eliminated as a practicable alternative for this project area.

Contour Surface Mining (stand-alone method)

ICG has established minimum criteria for practicable contour mining of this specific project site. To be considered as a contour surface mining reserve, the reserve area has to meet all of the following control criteria which are characteristic for the mining industry with some site specific modifications. These criteria are:

i) Minimum individual seam thickness of 9 inches;
ii) Maximum cumulative mining ratio (bank cubic yards of overburden per clean recoverable tons of coal) of 16:1*;
iii) Ground slope ≤ 60% to allow for re-grade without increasing the cumulative mining ratio;
iv) Individual seam reserve base should have ≥ 500,000 clean recoverable tons;
v) Minimum 90% pit recovery; and
vi) Minimize potential for re-disturbance of the land by maximizing overall seam recovery in the project.

*Mining Ratio as defined above is dependent on market conditions as of the date of this report.

A summary of the contour surface mining criteria as applied to each seam within the project area is provided in Table 3.

Table 3
Contour Surface Mining (Stand-Alone) Criteria

Seam	Coal Ht. > 9"	Ratio ≤ 16:1	Ground Slope ≤ 60%	≥ 500,000 tons	Min. 90% Recovery	% Seam Recovery	Minimize Re-disturbance
Hazard 9**	Yes	Yes	Yes	No	Yes	0%	No
Hazard 8	Yes	Yes	Yes	Yes	Yes	39%	No
Hazard 7	Yes	No	Yes	No	Yes	0%	No
Hazard 5A	Yes	Yes	Yes	No	Yes	0%	No
					Overall Project:	**9%**	**No**

**Note both splits of the Hazard 9 seam can be taken in one contour cut and therefore calculated together.

Hazard No. 9

The Hazard No. 9 seam consists of two splits. The top split lies at an approximate elevation of 1320 feet with an average thickness of 23 inches. The bottom split lies just below the top split at an approximate elevation of 1310 feet with an average thickness of 17 inches. The bottom split is 60 feet above the Hazard No. 8 seam. The contour mining reserve base for both splits is 451,378 tons.

This fails to meets criteria iv) individual seam should have ≥ 500,000 clean recoverable tons above for stand-alone contour mining. As a result of failing to meet all criteria, no stand-alone contour mining can be done in this seam and is eliminated as a practicable alternative for this seam.

Hazard No. 8

The Hazard No. 8 seam is approximately 60 feet above the Hazard No. 7 seam, and 60 feet below the Hazard No. 9 seam, at an approximate elevation of 1250 feet. This seam has an average thickness of approximately 29 inches and has an estimated contour mining reserve base of 594,442 tons.

This meets criteria i) through v) above for stand-alone contour mining. However, this method has a percent seam recovery of only 38%. Thus it is likely that future re-disturbance would occur, which violates criteria vi) minimize potential for re-disturbance of the land. As a result of failing to meet all criteria, stand-alone contour mining is eliminated as a practicable alternative for this seam.

Hazard No. 7

The Hazard No. 7 seam is approximately 80 feet above the Hazard No. 5A seam, and 60 feet below the Hazard No. 8 seam, at an approximate elevation of 1190 feet. This seam has an average thickness of approximately 53 inches and has an estimated contour mining reserve base of 0 tons.

This fails to meets criteria iv) individual seam should have ≥ 500,000 clean recoverable tons above for stand-alone contour mining. As a result of failing to meet all criteria, no stand-alone contour mining can be done in this seam and is eliminated as a practicable alternative for this seam.

Hazard No. 5A

The Hazard No. 5A seam is the lowest in elevation in the project area at approximately 1110 feet, 80 feet below the Hazard No. 7 seam. This seam has an average thickness of approximately 38 inches, with an estimated contour mining reserve base of 417,131 tons.

This fails to meets criteria iv) individual seam should have ≥ 500,000 clean recoverable tons above for stand-alone contour mining. As a result of failing to meet all criteria, no stand-alone contour mining can be done in this seam and is eliminated as a practicable alternative for this seam.

Conclusion

As shown in Table 3 above, the overall project area recovery of reserves is approximately 9%. This small project area recovery does not minimize potential for re-disturbance of the land. Further, as described above, stand-alone contour mining in each of the seams within the project area has been eliminated as a practicable alternative for failure to meet all the criteria.

Contour Surface Mining with Highwall/Auger Mining (a combined method)

The addition of highwall/auger mining to contour surface mining would incrementally increase the reserve recovery. This combined method of mining utilizes contour surface mining to provide seam access and operational area for the highwall/auger machinery to work. A combination of contour and highwall/auger mining must meet the same criteria as stand-alone contour mining in addition to the following criteria to be considered practicable. ICG has established minimum criteria for practicable highwall/auger mining of this specific project site. These criteria are:

i) Total seam height ≥ 24 inches;
ii) Minimum 500,000 in-place tons within the contour and highwall/auger area;
iii) Maximum in-seam parting thickness of 18 inches for shale, 5 inches for sandstone;
iv) Highwall mining areas have 45% recovery of in-place resource;
v) Cumulative mining ratio (bank cubic yards of overburden per clean recoverable tons of surface and auger/highwall mined coal) less than or equal to 16:1*; and
vi) Minimize potential for re-disturbance of the land by maximizing overall seam recovery in the project.

*Mining Ratio as defined above is dependent on market conditions as of the date of this report.

A summary of the contour and highwall/auger mining criteria as applied to each seam within the project area is provided in Table 4.

Table 4
Contour and Highwall/Auger Mining Criteria

Seam	Seam Ht. ≥ 24"	≥ 500,000 tons	In-Seam Parting <18"/<5"	80% - 90% Recovery	Cumulative Ratio ≤ 16:1	% Seam Recovery - Contour & HW/A Mining	Minimize Re-disturbance
Hazard 9 (Top)	No	No	Yes	Yes	Yes	0%	No
Hazard 9 (Bottom)	No	No	Yes	Yes	Yes	0%	No
Hazard 8	Yes	Yes	Yes	Yes	Yes	64%	No
Hazard 7	Yes	No	Yes	Yes	Yes	0%	No
Hazard 5A	Yes	Yes	Yes	Yes	Yes	51%	Yes
					Overall Project:	**41%**	**No**

Hazard No. 9

The Hazard No. 9 seam consists of two splits. The top split lies at an approximate elevation of 1320 feet with an average thickness of 23 inches. The bottom split lies just below it at an elevation of about 1310 feet with an average thickness of 17 inches. The bottom split is 60 feet above the Hazard No. 8 seam. The contour and highwall/auger mining in-place reserve base for the top split is 775,000 tons, and for the bottom split is 106,428 tons.

Both the top split and bottom split fail to meet criteria i) minimum coal height of 24 inches and criteria iv) individual seam should have ≥ 500,000 clean recoverable tons above for stand-alone contour mining.. As a result of failing to meet all criteria, no highwall/auger mining can be done in either split of this seam and is eliminated as a practicable alternative for this seam.

Hazard No. 8

The Hazard No. 8 seam is approximately 60 feet above the Hazard No. 7 seam, and 60 feet below the Hazard No. 9 seam, at an approximate elevation of 1250 feet. This seam has an average thickness of approximately 29 inches and has an estimated in-place contour and highwall/auger mining reserve base of 696,254 tons.

This meets criteria i) through v) above for contour and highwall/auger mining. However, this method has a percent seam recovery of only 63%. Thus it is likely that future re-disturbance would occur, which violates criteria vi) minimize potential for re-disturbance of the land. As a result of failing to meet all criteria, contour and highwall/auger mining is eliminated as a practicable alternative for this seam.

Hazard No. 7

The Hazard No. 7 seam is approximately 80 feet above the Hazard No. 5A seam, and 60 feet below the Hazard No. 8 seam, at an approximate elevation of 1190 feet. This seam has an average thickness of approximately 53 inches and has an estimated in-place contour and highwall/auger mining reserve base of 0 tons.

This fails to meets criteria iv) individual seam should have ≥ 500,000 clean recoverable tons above for stand-alone contour mining. As a result of failing to meet all criteria, no stand-alone contour mining can be done in this seam and is eliminated as a practicable alternative for this seam.

Hazard No. 5A

The Hazard No. 5A seam is the lowest in elevation in the project area at approximately 1110 feet, 80 feet below the Hazard No. 7 seam. This seam has an average thickness of approximately 38 inches, with an estimated in-place contour and highwall/auger mining reserve base of 1,080,066 tons.

This meets criteria i) through v) above for contour and highwall/auger mining. Furthermore, this method has a percent seam recovery of 51%. Thus this method also meets criteria vi) minimize potential for re-disturbance of the land. As a result of meeting all criteria, contour and highwall/auger mining is the practicable alternative for this seam.

Conclusion

As described in the seam descriptions above, contour and highwall/auger mining in each of the seams within the project area (with the exception of the Hazard No. 5A seam) has been eliminated as a practicable alternative because they fail to meet all criteria. The Hazard No. 5A seam, however, meets all criteria. Therefore contour and highwall/auger mining is the practicable alternative for the Hazard No. 5A seam.

Area Mining (stand alone method)

ICG has established minimum criteria, all of which must be met, in order for area mining to be considered practicable on this specific project site. These criteria are:

i) Total seam height ≥ 12 inches;
ii) Minimum 100,000 clean recoverable tons within the resource area;
iii) Pit recovery of 90%;
iv) Maximum cumulative mining ratio (bank cubic yards of overburden per clean recoverable tons of coal) of 20:1[(1)], and
v) Minimize potential for re-disturbance of the land by maximizing overall seam recovery in the project.

(1) Mining Ratio as defined above is dependent on market conditions as of the date of this report.

A summary of the area mining (stand alone method) criteria as applied to each seam within the project area is provided in Table 5 and 6.

Table 5
Area Mining Criteria

Seam	Seam Ht. ≥ 12"	≥ 100,000 tons	90% Pit Recovery	Cumulative[1] Ratio ≤ 20:1	% Seam Recovery	Minimize Re-disturbance
Hazard 9 (Top)	Yes	Yes	Yes	No	90%	Yes
Hazard 9 (Bot)	Yes	Yes	Yes	No	90%	Yes
Hazard 8	Yes	Yes	Yes	No	90%	Yes
Hazard 7	Yes	Yes	Yes	Yes	90%	Yes
Hazard 5A	Yes	Yes	Yes	No	0%	No
				Overall Project:	**44%**	**No**

(1) Note: It is assumed that when all area mining criteria are met for a seam, all seams above it are mined. Therefore the % seam recovery is also calculated for all seams above a seam that meets the area mining criteria.

Table 6: Cumulative Ratio Calculations - Area Mining

Seam	Overburden (cubic yards)	Recoverable Reserve (Tons)	Cumulative Ratio[2]
Hazard 9	18,925,041	858,132	20.05
Hazard 8	41,915,667	1,157,976	20.79
Hazard 7	46,526,021	383,232	19.39
Hazard 5A	145,364,001	2,488,228	29.74

(2) Note: The cumulative mining ratio is the ratio of the total cubic yards of overburden for the seam listed to the total recoverable tons of coal extracted to that coal seam. For example, the cumulative ratio of the Hazard 7 seam is (46,526,021 yd^3)/(383,232 +1157,976 +858,132 tons), or 19.39.

Hazard No. 9 – area mining

The Hazard No. 9 seam consists of two splits. The top split lies at an approximate elevation of 1320 feet with an average thickness of 23 inches. The bottom split lies just below it at an approximate elevation of 1310 feet with an average thickness of 17 inches. The bottom split is 60 feet above the Hazard No. 8 seam. The area mining recoverable reserve base for the top split is 545,524 tons, and for the bottom split is 407,957 tons.

As shown by Table 6 above, this fails to meet criteria iv) maximum cumulative mining ratio of 16:1. As a result of failing to meet all criteria, area mining the Hazard No. 9 seam is eliminated as a practicable alternative for this seam.

Hazard No. 8 and above – area mining

The Hazard No. 8 seam is approximately 60 feet above the Hazard No. 7 seam, and 60 feet below the Hazard No. 9 seam, at an approximate elevation of 1250 feet. This seam has an average thickness of approximately 29 inches and has an estimated area mining recoverable reserve base of 1,286,640 tons.

As shown by Table 6 above, this fails to meet criteria iv) maximum cumulative mining ratio of 16:1. As a result of failing to meet all criteria, area mining the Hazard No. 8 seam and above is eliminated as a practicable alternative for this seam.

Hazard No. 7 and above – area mining

The Hazard No. 7 seam is approximately 80 feet above the Hazard No. 5A seam, and 60 feet below the Hazard No. 8 seam, at an approximate elevation of 1190 feet. This seam has an average thickness of approximately 53 inches and has an estimated area mining recoverable reserve base of 425,814 tons.

This meets all the criteria above for area mining. Area mining the Hazard No. 7 seam (Box Cut) and above (including the Hazard No. 8 and Hazard No. 9 seams) maximizes resource recovery of the Hazard No. 7 seam and above. As a result of maximizing resource recovery, the surface area above these seams will not be disturbed again for the purposes of coal removal, which minimizes the potential for re-disturbing the land. As a result of meeting all criteria, area mining is considered the practicable alternative for the Hazard No. 7 seam and above.

Hazard No. 5A and above – area mining

The Hazard No. 5A seam is the lowest in elevation in the project area at approximately 1110 feet, 80 feet below the Hazard No. 7 seam. This seam has an average thickness of approximately 38 inches, with an estimated area mining recoverable reserve base of 2,764,697 tons.

As shown by Table 6 above, this fails to meet all the criteria for area mining and is eliminated as a practicable alternative.

Conclusion

As shown in Table 5 above, the overall project recovery of reserves is approximately 44%. This overall project recovery does not minimize potential for re-disturbance of the land. Further, as described above, area mining all of the seams within the project area (the Hazard No. 5A seam and above) has been eliminated as a practicable alternative.

However, area mining the Hazard No. 7 seam and above meets all area mining criteria. Therefore, area mining of the Hazard No. 7 seam and above is considered a practicable alternative for the Hazard No. 7 seam and above.

Fill Placement Alternatives

Potential excess overburden disposal locations that were contiguous with the mining area were identified and analyzed in the Fill Placement Optimization Process (FPOP). The FPOP document is attached for reference in Appendix E.

Hollow A (as referred to in the FPOP document) is the location of Hollow Fill #1 in KDNR Permit No. 897-0587. This hollow is the only location analyzed in the FPOP that was used in the project. This fill location provides sufficient storage of excess overburden. By using only one fill in the project, rather than several small fills, fewer watersheds are impacted. The location of this hollow fill is dictated by the mining plan, which is affected by how the coal reserves lay within the project area, access to the property, quality of coal throughout the property, and the ratio of the total cubic yards of overburden to the total recoverable tons of coal extracted to that coal seam.

Hollow Fill #1 complies with the Fill Placement Optimization Process (FPOP) as described in KDNR's issued Reclamation Advisory Memorandum (RAM) #145. The FPOP analysis is provided in Appendix E. The RAM 145 process for the proposed project allows the construction of hollow fills to impact 5,204 linear feet of stream and to cause the loss of approximately 2,364 EIUs. ICG's proposed hollow fill impacts (not including sediment structures, rock check dam, pond maintenance area, and mine-through impact) total 2,303 linear feet of stream and results in the loss of approximately 1,267 EIU's. Therefore, ICG's proposed mine plan complies with the requirements of RAM 145.

c. Preferred Alternative

The preferred alternative is a combination of the practicable alternatives stated above. The preferred alternative meets the basic project purpose to recover 3.88 million tons of bituminous coal within the project area. The preferred alternative as applied to each specific mineable seam results in the following:

Table 7
Preferred Alternative

Seam	Method	% Seam Recovery	Minimize Re-disturbance
Hazard 9	Area	90%	Yes
Hazard 8	Area	90%	Yes
Hazard 7	Area	90%	Yes
Hazard 5A	Contour and HW/Auger	51%	Yes
	Total Project Area:	**70%**	**Yes**

- The Hazard No. 7, the Hazard No 8, and the Hazard 9 will be area mined to maximize the amount of coal recovered in the project area and minimize the potential for future re-disturbance of the seams.

- The Hazard No. 5A seam will be contour and highwall/auger mined to maximize the amount of coal recovered within the project area. As shown in Table 7 above, approximately 51% of the seam will be recovered. However, this method does minimize the potential for re-disturbance the seam. The Hazard No. 5A cannot be area mined because the mining ratio is greater than 20:1, cannot be stand-alone contour mined because the stand-alone contour reserve base is less than 500,000 tons nor can it be underground mined because the percent seam recovery is only 40%.

5. ENDANGERED SPECIES AND CULTURAL RESOURCES

a. Endangered Species

On behalf of ICG, an Indiana Bat summer mist net survey and winter habitat assessment was conducted by Appalachian Technical Services, Inc. in the summer of 2009 for KDNR Permit No. 897-0587 (formerly KDNR Permit No. 897-0507). No Indiana bats were captured and no potential Indiana bat winter habitats were identified within the proposed project area. Based upon a review of the survey finding, the US Fish and Wildlife Service found the survey acceptable. This is noted in an attached email (see Appendix F) dated September 10, 2009 from Carrie Lona Allison (USFWS) to David Baldridge (USACE).

Because this survey was completed over 5 years ago, another survey is currently being completed. Once the results of this survey are received, they will be forwarded to USACE and KDNR.

b. Cultural Resources

On behalf of ICG, a cultural resource survey was completed by Cultural Resource Analysts, Inc. for KDNR Permit No. 897-0587 (formerly KDNR Permit No. 897-0507). During the survey, one historic cemetery was recorded and one previously recorded cemetery was revisited. Both cemetaries are shown on the MRP with 100 ft buffer zones and will not be impacted by the mining project. A letter from the Critical Resources Review Section of the Division of Mine Permits is attached for reference (see Appendix F).

6. AVOIDANCE, MINIMIZATION, AND MITIGATION

In an effort to avoid and reduce impacts to jurisdictional waters, ICG will use on-bench sediment and drainage control as is practicable. This will prevent construction of additional in-stream ponds. Only one in-stream pond is proposed on KDNR Permit 897-0587. This pond will be removed once the project is complete and the stream will be restored using natural channel design techniques.

Excess spoil is being used to reclaim pre-law highwalls that would otherwise be placed in hollow fills. Reclamation of these highwalls will reduce the amount of spoil required to be placed in Hollow Fill #1, as well as improve the aquatic environment in the vicinity of the project.

In order to reduce the amount of excess spoil, the Hazard 7 seam is only being area mined in a few select locations. By not area mining the entire Hazard 7 seam in the project area, the size of Hollow Fill #1 has been reduced and the impacts to jurisdictional waters have been reduced.

Portions of the Hazard 5A seam which were originally intended to be contour mined have been removed from the plan in order to reduce impacts to jurisdicational waters.

The crest elevation of Hollow Fill #1 has been raised above the lowest seam to be mined in order to store additional excess overburden in the same footprint area. This will minimize impacts to jurisdictional waters.

In order to construct Hollow Fill #1, all drainage will be directed away from the fill construction zone. Once the fill construction zone is cleared and grubbed, durable sandstone will be placed in the old stream bed to form an underdrain. The material used in the underdrain will be comprised of the cleanest durable sandstone available on the site. The underdrain will be wrapped with filter fabric to prevent clogging. As spoil placement begins, care will be taken to insure the spoil material is clear of any strata that is thought to be a contributor of high conductivity levels. Particular attention will be given to material located near the coal seam. This material will be placed away from the fill area in other storage areas on the permit. Material used in the construction of the fill will be placed in lifts and compacted with rubber tired vehicles. The front face of the fill will be graded. Upon completion of the spoil placement into the fill, final grading will be completed to quickly shed water off the top of the fill and into the constructed side drains. Finally, revegetation of the face of the fill will be completed promptly after the final grading.

Temporary sediment control such as silt fences, straw bales, rock checks, dikes, and/or channel barriers would be used, as necessary, to prevent the transportation of sediment downstream during pond construction. Any disturbed areas would be seeded as is practicable after being brought to final grade.

Construction of the in-stream pond will take place in periods of low flow to minimize the transport of sediment to downstream areas.

The hollow fill and mining areas will be reclaimed and re-vegetated after mining to prevent transportation of sediment downstream. Additionally, the mining area will be restored to AOC, which reduces the hollow fill storage requirements and impacts to jurisdictional waters.

ICG has demonstrated compliance with the RAM 145 model for this project. The RAM 145 process for the proposed project allows the construction of hollow fills to impact 5,204 linear feet of stream and to cause the loss of 2,364 EIUs. ICG's proposed hollow fill impacts (not including sediment structures, rock check dam, pond maintenance area, and mine-through impact) total approximately 2,303 linear feet of stream and results in the loss of approximately 1,267 EIU's. Therefore, ICG's proposed mine plan complies with the requirements of RAM 145.

In addition to the avoidance, minimization, and mitigation measures described above, ICG will implement the following Best Management Practices (BMPs) in an effort to protect the quality of downstream aquatic resources:

- The backfill will be placed and compacted as necessary to ensure stability, prevent mass movement, and reduce infiltration of precipitation and surface runoff into the fill;
- Any coal seam materials that must be placed in the backfill will not be exposed to drainage and will be covered with a minimum of 4 feet of non-toxic, non-combustible material;
- ICG will implement field testing procedures to identify excessive TDS and sulfate-producing materials, which will then be stored in areas of the mine outside of drainage paths;
- Sediment and erosion control measures will be inspected by a qualified individual appointed by ICG's management at least once per quarter to ensure the structures and measures are functioning properly and to identify any required maintenance;
- ICG will follow SMCRA's progressive clearing and grubbing recommendations;
- ICG will use chemical flocculants designed for reduction of total suspended solids, total dissolved solids, and conductivity in in-stream embankment ponds upon the identification of high levels of these parameters by EPA or other agency and approval to use by the Kentucky Division of Water;
- Existing vegetation will be retained to the extent practicable between the mining area and surrounding waterways;
- Topsoil or topsoil substitute, as approved by the Kentucky Department for Natural Resources in the SMCRA permit for this project, will be stockpiled and managed so that re-graded areas can be covered with a layer of topsoil or topsoil substitute as quickly as practicable to avoid exposure of the fractured overburden material to surface water runoff;
- Sumps and secondary sediment control measures (i.e., berms, silt fences, straw bales, check dams, multiple sediment ponds in-series, diversion channels) will be established and used as practicable and necessary to supplement primary sediment control structures;
- Runoff will be diverted away from disturbed areas to the extent practicable;
- Contemporaneous reclamation techniques will be used to the extent practicable to reduce the area of disturbed acreage;
- Vegetation will be established in the re-graded areas of the mine as quickly as practicable to reduce erosion;
- Chemical treatment of the sediment pond will be used, if necessary and practicable, to cause precipitation and settling of chemical species;
- Aeration will be used, if necessary and practicable, to facilitate precipitation and settling of species;
- Roads will be constructed with appropriate sediment control, as is necessary and practicable;
- Any temporarily impacted channels will be restored using natural stream channel design techniques upon removal of the temporary structure;
- To the extent practicable, ICG will use weathered strata for surfaces to be in direct contact with runoff and drainage paths;
- To the extent practicable, ICG will generate larger rock fragments through the blasting process so as to reduce the surface area available for water contact in the backfill areas;
- Acidic and toxic material encountered during the mining operation will be handled in accordance with the approved Toxic Materials Handling Plan from the SMCRA permit; and
- Diversion channels will be constructed to pass flows as dictated by the SMCRA regulations so as to prevent additional erosion and sediment transport from disturbed areas.

7. CUMULATIVE IMPACT ASSESSMENT

The proposed mining operation is located in both the Sam Campbell watershed (HUC #05100201100180) and the Grapevine Creek watershed (HUC #05100201110010). The proposed project area is located specifically in tributaries of Roseanne Branch, Clear Fork, Sugar Camp Branch, Ground Hog Hollow, and unnamed tributaries of Grapevine Creek, as well as Abes Branch and unnamed tributaries of Sam Campbell Branch.

In evaluating this project, the boundaries of the area subjected to USACE's consideration of individual and cumulative adverse impacts were limited to the "waters of the United States" and both the Sam Campbell watershed (HUC #05100201100180) and the Grapevine Creek watershed (HUC #05100201110010). All impacted "waters of the United States" and the proposed permit area is located in these two HUCs. The Sam Campbell watershed is 1,467.8 acres while the Grapevine Creek watershed is 6,452.6 acres. The combined acreage of the HUCs used in this analysis is 7920.4 acres.

The Sam Campbell and Grapevine Creek watersheds within the project area have been impacted by oil/gas wells, hay/pasture/cultivated crops, urban development, logging, mining, and roads. The proposed post-mining land use is fish and wildlife habitat. The proposed impacts associated with this project include Hollow Fill 1, Pond 1, drainage corridor, pond maintenance area, and one mine-through impact area.

No special aquatic sites were identified within the project area based on site surveys conducted by Summit Engineering, Inc. personnel.

Environmental impacts on the watershed include by oil/gas wells, hay/pasture/cultivated crops, urban development, logging, mining, and roads. The following table provides a summary of the past, present, and reasonably foreseeable future impacts in the aforementioned watersheds.

In the following table, the past impacts of mining and logging are not carried forward to the "Total Past and Present Impacts" row or to the "Total Past, Present, and Future Impacts" row. Gas/oil wells that have been abandoned or plugged were not carried forward to those sections, either. The only categories of past impacts currently impacting the watershed or that will impact the watershed in the future are the classifications of hay/pasture/cultivated crops, urban development, and railroads/roads. Therefore, only the acreage from these categories will be carried forward to the "Total Past and Present Impacts" and "Total Past, Present, and Future Impacts" sections.

It should be noted acreages below are obtained from several different independent sources (cited in the footnotes). Because of this, there could be some overlapped acreages that are counted in two different categories. Thus, the acreages and percentages in the following table could be a slight overestimation.

PAST, PRESENT, & REASONABLY FORESEEABLE FUTURE IMPACTS IN THE SAM CAMPBELL AND GRAPEVINE CREEK HUCS

Past Impacts		
Description	**Acreage**	**% of Watershed**
Gas/Oil Wells[1]	9.0	0.1
Hay/Pasture/Cultivated Crops[2]	131.8	1.7
Urban Development[3]	644.2	8.1
Logging[4]	14.5	0.2
Railroads/Roads[5]	80.3	1.0
Previous Mining[6]	2119.6	26.8
Subtotal Past Impacts	*2999.4*	*37.9*
Present Impacts		
Gas/Oil Wells[1]	8.0	0.1
Active Mining[6]	1827.0	23.1
Subtotal Present Impacts	*1835.0*	*23.2*
Total Past and Present Impacts	*2691.3*	*34.0*
Future Impacts		
KDNR Permit 898-0508 (w/in these HUCs)	236.3	2.9
KDNR Permit 897-0587	555.3	7.0
KDNR Permit 897-0543 Amendment 2 (w/in these HUCs)	138.75	1.8
Subtotal Future Impacts	*930.75*	*11.7*
Total Past, Present, and Future Impacts	*3,622.05*	*45.7*

[1] Data obtained from Kentucky Geological Survey. Assumed 1 acre/well.
[2] Data obtained from 2006 National Land Cover Database (Hay/Pasture and Cultivated Crops categories).
[3] Data obtained from 2006 National Land Cover Database (Developed – Open Space, Developed – Low Intensity, Developed – Medium Intensity, and Developed – High Intensity categories).
[4] Data obtained from KY GAP Analysis Land Cover Map (Early Successional Deciduous Forest category).
[5] Data obtained from KYTC GIS layers. Assumed 20' width.
[6] Data obtained from Division of Mine Permits Cumulative Hydrologic Impact Assessment.

8. MITIGATION

In order to mitigate for the impacts associated with this project, ICG proposes to submit an in-lieu fee payment to the Kentucky Department of Fish and Wildlife Resources Wetland and Stream Fee-in-Lieu-of (FILO) Mitigation Program, as well as the Troublesome Creek Environmental Authority. A total of $1,310,463 will be paid in order to offset impacts to jurisdictional waters impacted by this project. Of this total, 25% ($327,615) will be paid to the Troublesome Creek Environmental Authority.

IMPACT SITE	IN-LIEU FEE
Pond SS-1	$180,364.80
Rock Check Dam	$72,468.00
Pond SS-1 Maintenance Area	$105,078.60
Hollow Fill #1	$927,187.80
Mine-Through Impact 1st Right of UT of Sam Campbell Branch	$25,363.80
TOTAL	**$1,310,463.00**

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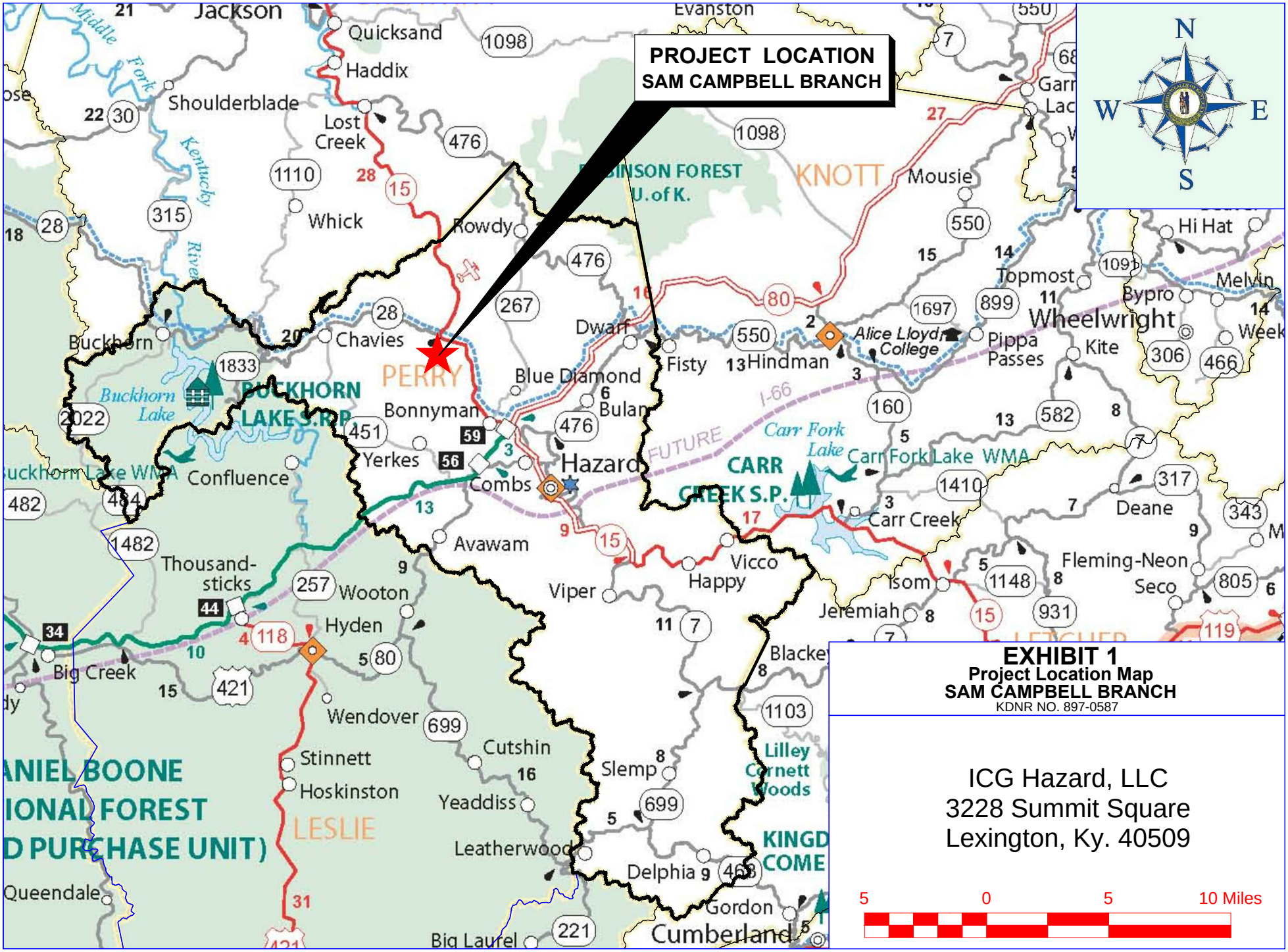
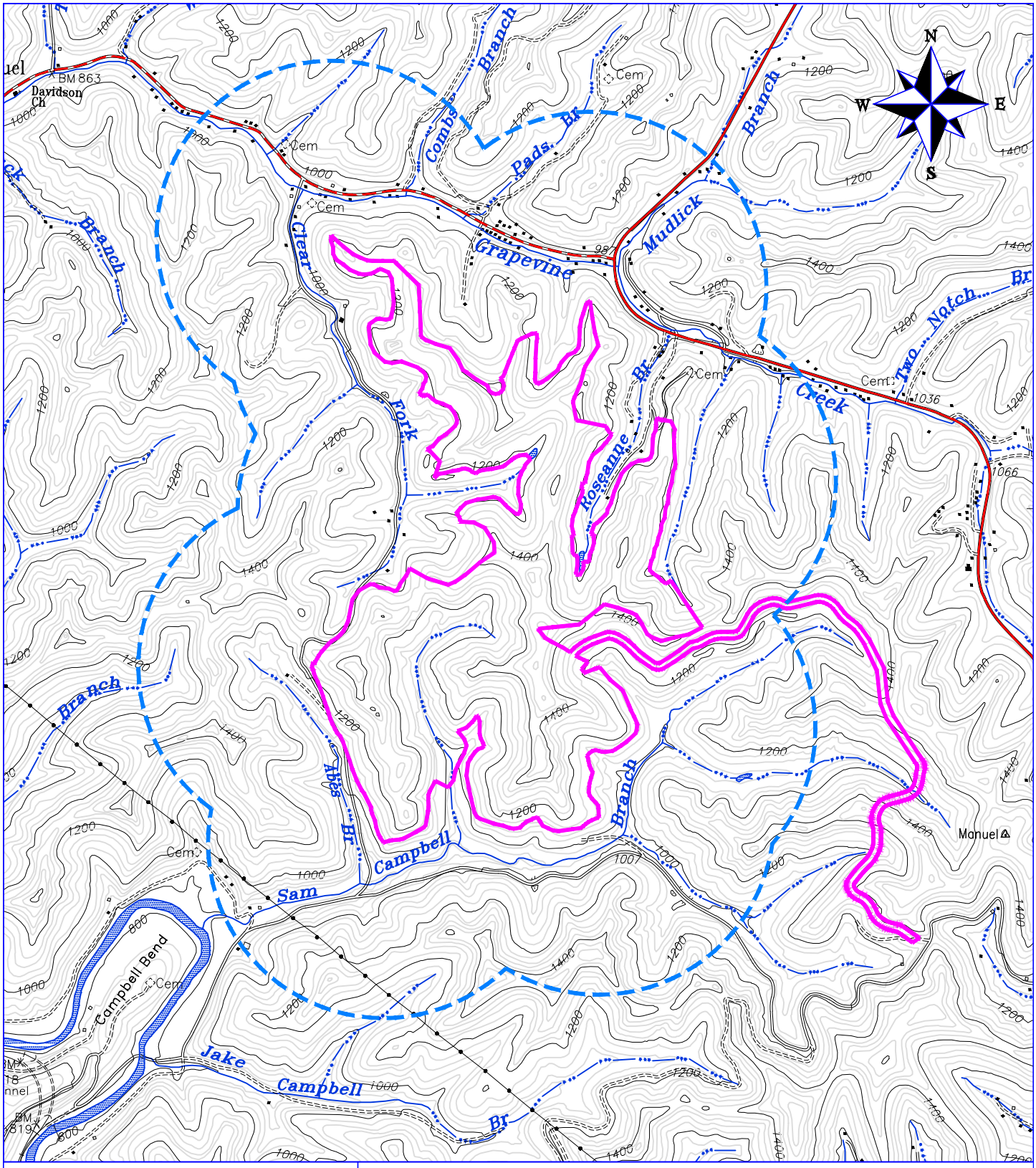
APPENDIX A

Maps


PROJECT LOCATION
SAM CAMPBELL BRANCH
N
W
E
S
Jackson
Quicksand
Haddix
Shoulderblade
Lost Creek
Whick
Rowdy
Evanston
KNOTT
Mousie
Hi Hat
Topmost
Melvin
Bypro
Wheelwright
Kite
Pippa Passes
Alice Lloyd College
Hindman
Fisty
Dwarf
Blue Diamond
Bulan
Bonnyman
Chavies
Buckhorn
PERRY
BUCKHORN LAKE S.RP
Buckhorn Lake
Buckhorn Lake WMA
Confluence
Yerkes
Combs
Hazard
Avawam
Thousand-sticks
Wooton
Hyden
Big Creek
Wendover
Stinnett
Hoskinston
Cutshin
Yeaddiss
Leatherwood
Slemp
Delphia
Gordon
Cumberland
Big Laurel
Queendale
LESLIE
Viper
Happy
Vicco
Carr Creek
Carr Fork Lake
Carr Fork Lake WMA
CARR CREEK S.P.
Isom
Jeremiah
Fleming-Neon
Seco
Deane
Blackey
Lilley Cornett Woods
KINGDOM COME
I-66
FUTURE
DANIEL BOONE NATIONAL FOREST (PURCHASE UNIT)
EXHIBIT 1
Project Location Map
SAM CAMPBELL BRANCH
KDNR NO. 897-0587
ICG Hazard, LLC
3228 Summit Square
Lexington, Ky. 40509
5 0 5 10 Miles



LEGEND

897-0587 PERMIT BOUNDARY

HALF MILE RADIUS

EXHIBIT 2
SAM CAMPBELL BRANCH

DATE: 03/31/09	SCALE: 1"=2000'
DRAWN BY: D.HANNAH	

ICG HAZARD, LLC
3228 SUMMIT SQUARE, SUITE 180
LEXINGTON, KY. 40509

STUDY AREA MAP
SAM CAMPBELL BRANCH
PERMIT NO. 897-0587

SUMMIT ENGINEERING, INC.
131 Summit Drive
Pikeville, Ky. 41501
(606) 432-1447
Lexington, Ky • Henderson, Ky.
South Charleston, WV • Bridgeport, WV

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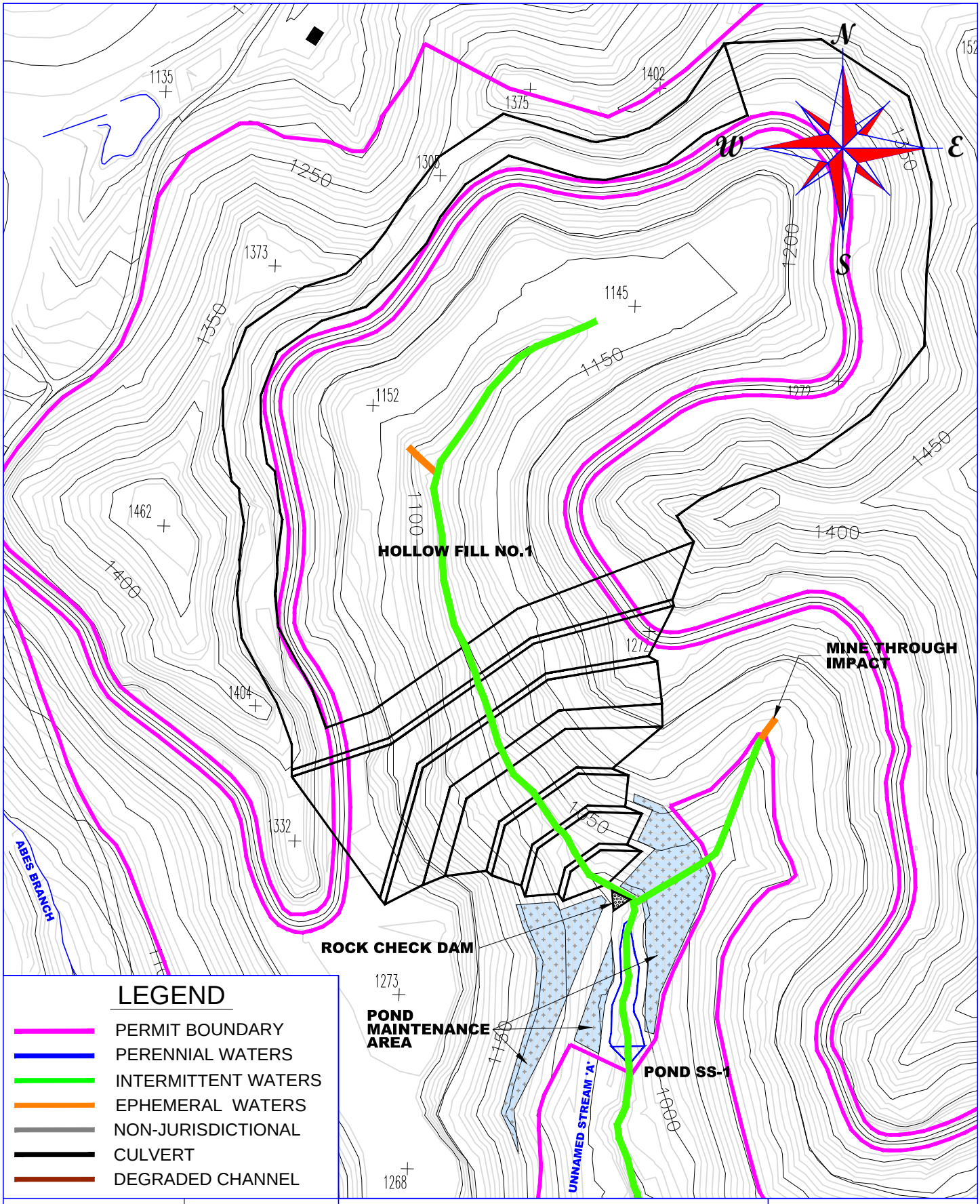

DATE: 08/08/2014	SCALE: 1" = 400'
DRAWN BY: D.HANNAH	

ICG HAZARD, LLC
3228 SUMMIT SQUARE, SUITE 180
LEXINGTON, KY. 40509

IMPACT LOCATION MAP
SAM CAMPBELL BRANCH
PERMIT NO. 897-0587

SUMMIT ENGINEERING, INC.
131 Summit Drive
Pikeville, Ky. 41501
(606) 432-1447

Lexington, Ky • Henderson, Ky.
South Charleston, WV • Bridgeport, WV

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SUMMIT ENGINEERING, INC.

Hazard, Kentucky | Charleston, West Virginia | Pikeville, Kentucky | Lexington, Kentucky | Big Rock, Virginia | Chapmanville, West Virginia | Bridgeport, West Virginia | Wise, Virginia

COMPANY NAME ICG HAZARD, LLC
ADDRESS 3228 Summit Square Place, Suite 180, Lexington, KY 40509
APPLICATION NO. 897-0587 TYPE Minor Revision 1 COUNTY Perry
QUADRANGLE Krypton MAP SCALE 1"=400' CONTOUR INT. 10'&40'
LATITUDE 37° 18' 55" LONGITUDE 83° 15' 22"
LOCATION Abes Br. of Sam Campbell Br./West of the intersection of KY 15 and Sam Campbell Br. Road

ICG International Coal Group, Inc.

MINING AND RECLAMATION PLAN & ENVIRONMENTAL RESOURCES INFORMATION MAP

DIVERSIONS
SLOPE (IN DEGREES)
CULVERT
NONEXISTENT BUILDING
OCCUPIED BUILDING
UNOCCUPIED BUILDING
EXISTING SURFACE DISTURBANCE
PROPERTY LINE (MINERAL / SURFACE / FEE)
WATER DISCHARGE MONITORING POINT
GROUND WATER MONITORING POINT
SURFACE WATER MONITORING POINT
CORE HOLE LOCATION
EXPLOSIVE STORAGE
ROCK CHECK DAM(S)
UTILITY LINE (SPECIFY TYPE)
WELLS (SPECIFY TYPE)
POWER POLES
ELECTRIC LINES(AEP)
UNIMPROVED ROADS
PERMIT BOUNDARY
REVISED PERMIT BOUNDARY
1000' BLAST RADIUS
1/2 MILE BLAST RADIUS
WATERSHED BOUNDARY
H5A SEAM OUTCROP
H7 SEAM OUTCROP
H8 SEAM OUTCROP
H9 SEAM OUTCROP
ABANDONED H7 SEAM U.G. MINE WORKINGS FILE #50111-1&08385-11 BLUE DIAMOND & RVER PROCESSING
ABANDONED H8 SEAM U.G. MINE RIVER PROCESSING FILE #08385-8
BUFFER OR NO MINING ZONES
NO BLASTING ZONE(S)

SEAM/MINING METHOD/ELEV.	CURRENT	RECLASS: RV#1	TOTAL
Haz.#5A Contour Mining Avg. Elev. 1110'	48.9		48.9
Haz.#8 thru Haz.#9 & Up Area Mining Avg. Elev. 1190' thru 1310'	388.9	-142.5	246.4
Haz.#7 thru Haz.#9 & Up Area Mining Avg. Elev. 1190' thru 1310'		+55.0	+55.0
STORAGE AREAS			
Hollowfill #1 (Includes 27.1 ac. of Hazard 5A Contour Mining)	87.9		87.9
Spoil Storage Areas #1 and #2 To be deleted by RV #1	Included in Mining area		
SILT STRUCTURES			
EMBANKMENT(S) Sediment Structure#1(SS#1)	2.0		2.0
DUG-OUT(S) BP#3 THRU BP#30	Included in Mining area		
ROADS Note: All silt structures are temporary.			
TEMPORARY HAUL ROADS			
Haul Road #1 80' x 11,090' Proposed New Road by this application	20.4		20.4
Haul Road #7 45' x 14,375' Existing Road proposed by this application 14.9 acres	Included in Mining area.		
PROPOSED NEW TEMPORARY ACCESS ROADS			
Pond Access Road #1 50' x 990'	1.1		1.1
OTHER			
Pond Maintenance Area	6.1		6.1
Reclamation Stabilization Area		+44.4	44.4
Reclamation Stabilization Area		+43.1	43.1
TOTAL SURFACE AREA	555.3	0.0	555.3
UNDERGROUND MINING AREA		0.0	
TOTAL AUGER/HIGHWALL MINING AREA	* 431.9	0.0	* 431.9
5A Seam TOTAL UNDERGROUND AREA	* 431.9	0.0	* 431.9
* TOTAL PERMITTED ACREAGE	555.3	0.0	555.3

Note: 431.9 acres of Auger/Highwall Mining Area underlies the proposed area mining & hollowfill acreage. The 431.9 acres of Auger/Highwall Mining are not included in the total permitted acreage.

TOPSOIL & ALTERNATE TOPSOIL STORAGE AREAS ARE LOCATED OVER THE ENTIRE PERMITTED MINING AREA.

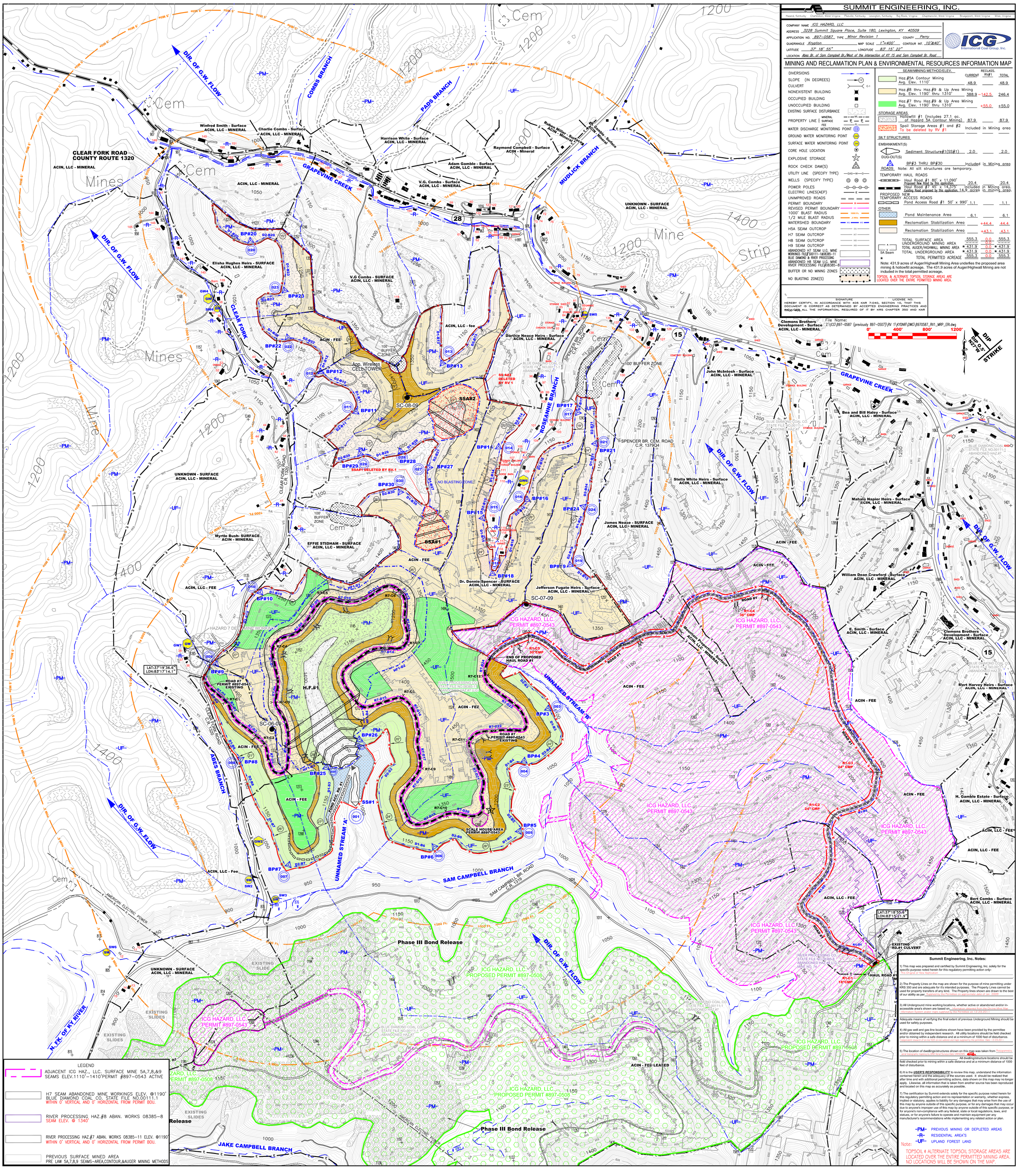
SIGNATURE LICENSE NO.

HEREBY CERTIFY, IN ACCORDANCE WITH 405 KAR 7:040, SECTION 10, THAT THIS DOCUMENT IS CORRECT AS DETERMINED BY ACCEPTED ENGINEERING PRACTICES AND INCLUDES ALL THE INFORMATION, REQUIRED OF IT BY KRS CHAPTER 350 AND KAR TITLE 405.

File Name: Z:\ICG\897-0587 (previously 897-0507)\RV 1\KYDNR\DWG\8970587_RV1_MRP_ERI.dwg

0' 400' 800' 1200'

DIP 0.5° 127°W STRIKE



LEGEND

ADJACENT ICG HAZ., LLC. SURFACE MINE 5A,7,8,&9 SEAMS ELEV.1110'–1410'PERMIT #897–0543 ACTIVE

H7 SEAM ABANDONED MINE WORKINGS ELEV. @1190' BLUE DIAMOND COAL CO. STATE FILE NO.00111.1 WITHIN 0' VERTICAL AND 0' HORIZONTAL FROM PERMIT BOU.

RIVER PROCESSING HAZ.#8 ABAN. WORKS 08385–8 SEAM ELEV. @ 1340'

RIVER PROCESSING HAZ.#7 ABAN. WORKS 08385–11 ELEV. @1190' WITHIN 0' VERTICAL AND 0' HORIZONTAL FROM PERMIT BOU.

PREVIOUS SURFACE MINED AREA PRE LAW 5A,7,8,9 SEAMS–AREA,CONTOUR,&AUGER MINING METHODS

Summit Engineering, Inc. Notes:

1) This map was prepared and certified by Summit Engineering, Inc. solely for the specific purpose noted herein for this regulatory permitting action only– This Original or Note Application

2) The Property Lines on the map are shown for the purpose of mine permitting under KRS 350 and are adequate for it's intended purposes. The Property Lines cannot be used for property transfers of any kind. The Property lines shown are drawn to the best of our ability as per Supplied by the Permittee on Surface Area of Jan. 2020

3) All Underground mine working locations, whether active or abandoned and/or inaccessible area's shown are based on Information Obtained from the Deep Mine Map Version Provided and/or sales supplied by the Permittee on 12-23-2021

Adequate means of verifying the final extent of previous Underground Mining should be used for safety purposes.

4) All gas well and gas line locations shown have been provided by the permittee and/or obtained by independent research. All utility locations should be field checked prior to mining within a safe distance and at a minimum of 1000 feet of disturbance. Independent research of on-line KDS on-line website and maps supplied by the permittee. Date: 12-23-2021

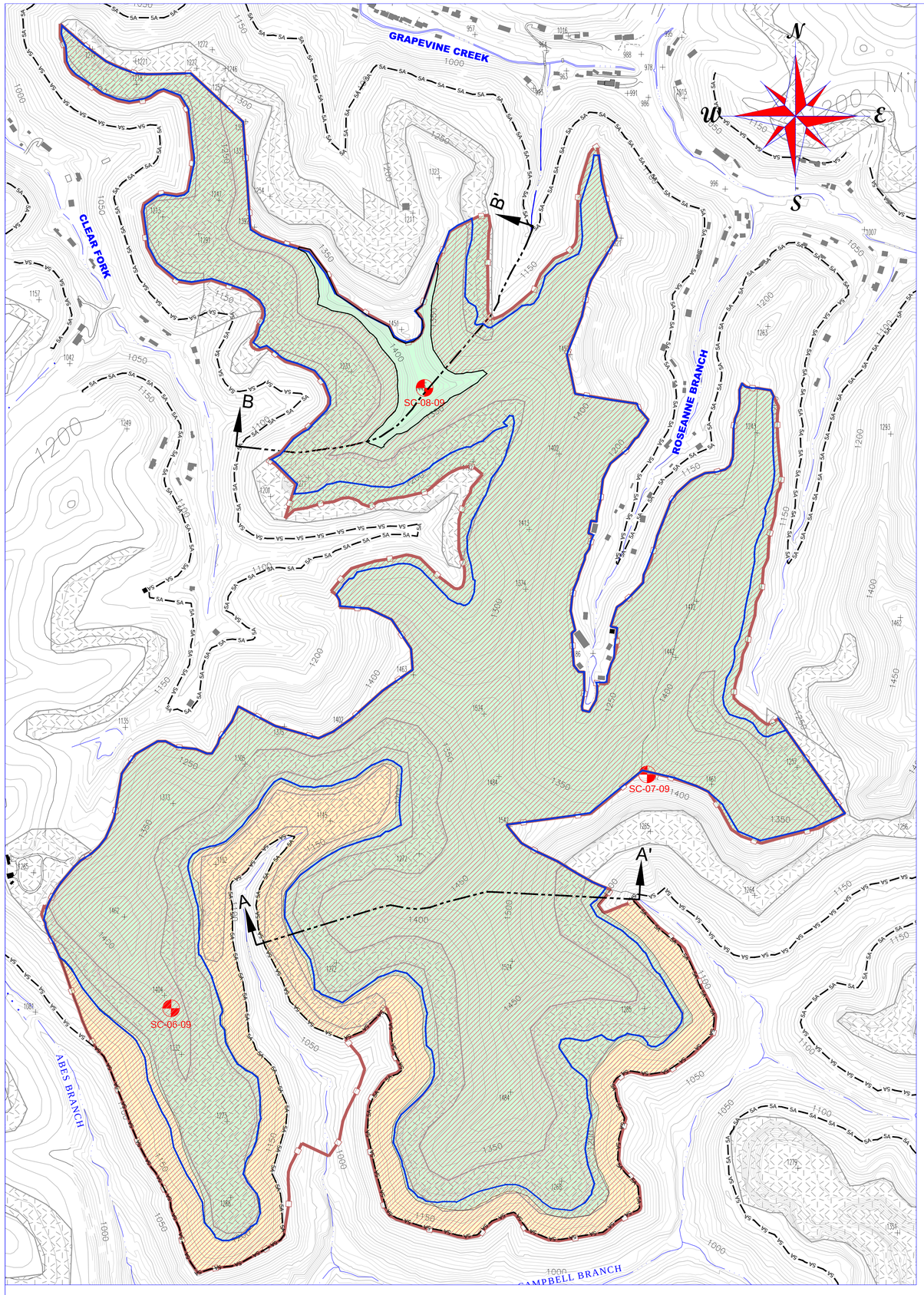
5) The location of dwellings/structures shown on this map was taken from Photogrametric aerial topographic survey by JRM Aerial Services dated 10/8/2019 All dwelling/structure locations should be field checked prior to mining within a safe distance and at a minimum distance of 1000 feet of disturbance.

6) It is the ***USER'S RESPONSIBILITY*** to review this map, understand the information contained herein and the adequacy of the sources used. It should be realized that after time and with additional permitting actions, data shown on this map may no longer apply. Likewise, all information that is taken from another source has been reproduced and located on this map as accurately as possible.

7) The certification by Summit extends solely for the specific purpose noted herein for this regulatory permitting action and no representation or warranty, whether express, implied or statutory, applies to liability for any damages that may arise from the use of this map by anyone outside of this specific purpose, or for any damages that may occur due to anyone's improper use of this map by anyone outside of this specific purpose, or for anyone's non-compliance with any federal, state or local regulations, laws, and statues, or for anyone's failure to operate and maintain equipment per any manufacturer's recommendations while implementing any related action or plan.

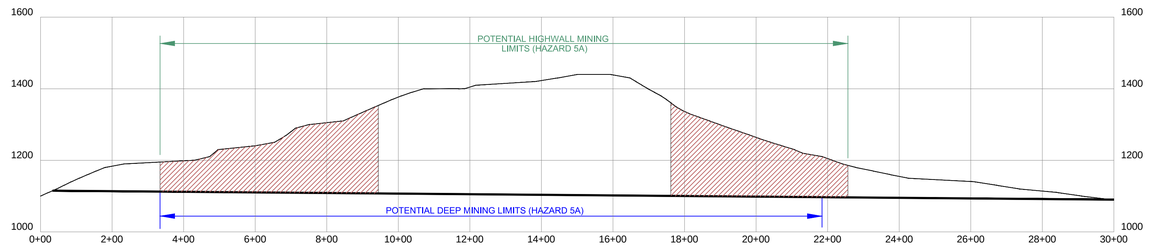
-PM- PREVIOUS MINING OR DEPLETED AREAS
-R- RESIDENTIAL AREA'S
-UF- UPLAND FOREST LAND

Note: TOPSOIL & ALTERNATE TOPSOIL STORAGE AREAS ARE LOCATED OVER THE ENTIRE PERMITTED MINING AREA. NO LOCATIONS WILL BE SHOWN ON THE MAP.



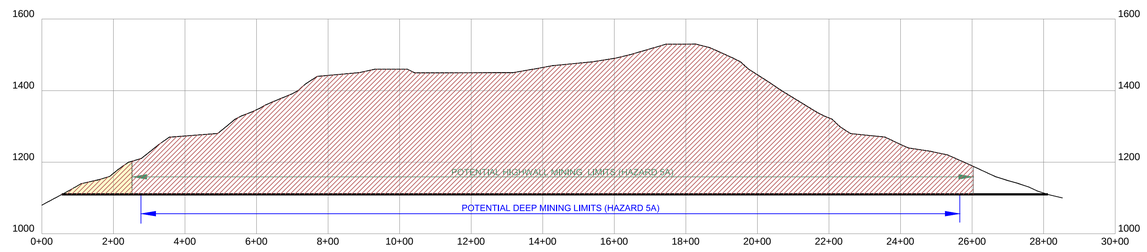
PLAN VIEW - HAZARD 5A SEAM

SCALE : 1" = 400'



CROSS SECTION B-B' (HAZARD 5A SEAM)

SCALE : 1" = 200'



CROSS SECTION A-A' (HAZARD 5A SEAM)

SCALE : 1" = 200'

LEGEND

- COREHOLE LOCATION
- PROJECT BOUNDARY
- 5A — HAZARD 5A COAL SEAM
- POTENTIAL CONTOUR MINING
- AREA MINING (MOUNTAINTOP REMOVAL AREA)
- POTENTIAL HIGHWALL / AUGER MINING
- POTENTIAL DEEP MINING
- PREVIOUSLY MINED AREA

DRAWN BY: D.HANNAH	**ICG HAZARD, LLC** 3228 SUMMIT SQUARE PLACE, SUITE 180 LEXINGTON, KY. 40509	**SUMMIT ENGINEERING,INC.** 131 Summit Drive Pikeville, Ky. 41501 (606) 432-1447	SCALE: NOTED
CHECKED BY: A.CHILDERS			DATE: 08/11/2014
APPROVED BY: A.CHILDERS	**MINING ALTERNATIVES** HAZARD 5A SEAM SAM CAMPBELL BRANCH PERMIT NO. 897-0587		ATTACHMENT:
PER. NO: 897-0587		Lexington,Ky • Henderson, Ky. South Charleston,WV • Bridgeport, WV	SHEET:
Plot Date: 29 AUGUST 2014 – 3:28 PM			OF:

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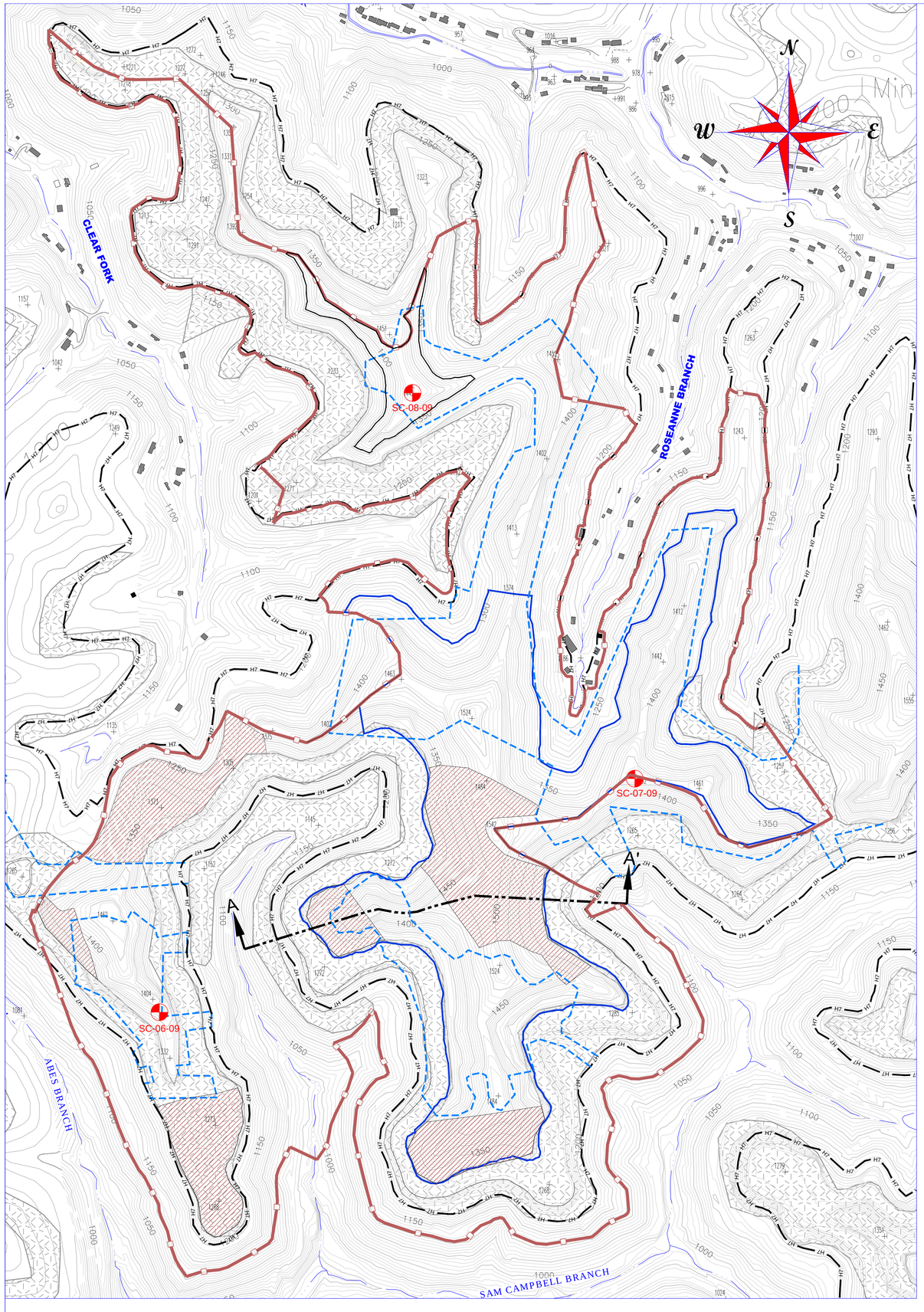
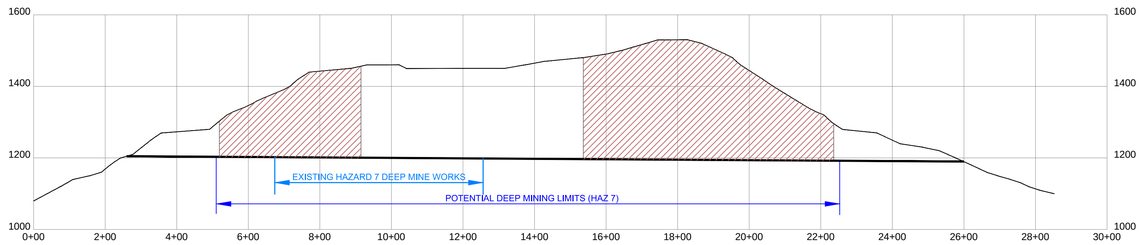


PLAN VIEW - HAZARD 7 SEAM

SCALE : 1" = 400'



CROSS SECTION A-A' (HAZARD 7 SEAM)

SCALE : 1" = 200'

LEGEND

- COREHOLE LOCATION
- PROJECT BOUNDARY
- HAZARD 7 COAL SEAM
- EXISTING HAZARD 7 DEEP MINE WORKS
- POTENTIAL CONTOUR MINING
- AREA MINING (MOUNTAINTOP REMOVAL AREA)
- POTENTIAL HIGHWALL / AUGER MINING
- POTENTIAL DEEP MINING
- PREVIOUSLY MINED AREA

DRAWN BY: D.HANNAH	**ICG HAZARD, LLC** 3228 SUMMIT SQUARE PLACE, SUITE 180 LEXINGTON, KY. 40509	**SUMMIT ENGINEERING,INC.** 131 Summit Drive Pikeville, Ky. 41501 (606) 432-1447	SCALE: NOTED
CHECKED BY: A.CHILDERS			DATE: 08/11/2014
APPROVED BY: A.CHILDERS	**MINING ALTERNATIVES** HAZARD 7 SEAM SAM CAMPBELL BRANCH PERMIT NO. 897-0587		ATTACHMENT:
PER. NO: 897-0587		Lexington,Ky • Henderson, Ky. South Charleston,WV • Bridgeport, WV	SHEET:
Plot Date: 29 AUGUST 2014 – 3:29 PM			OF:

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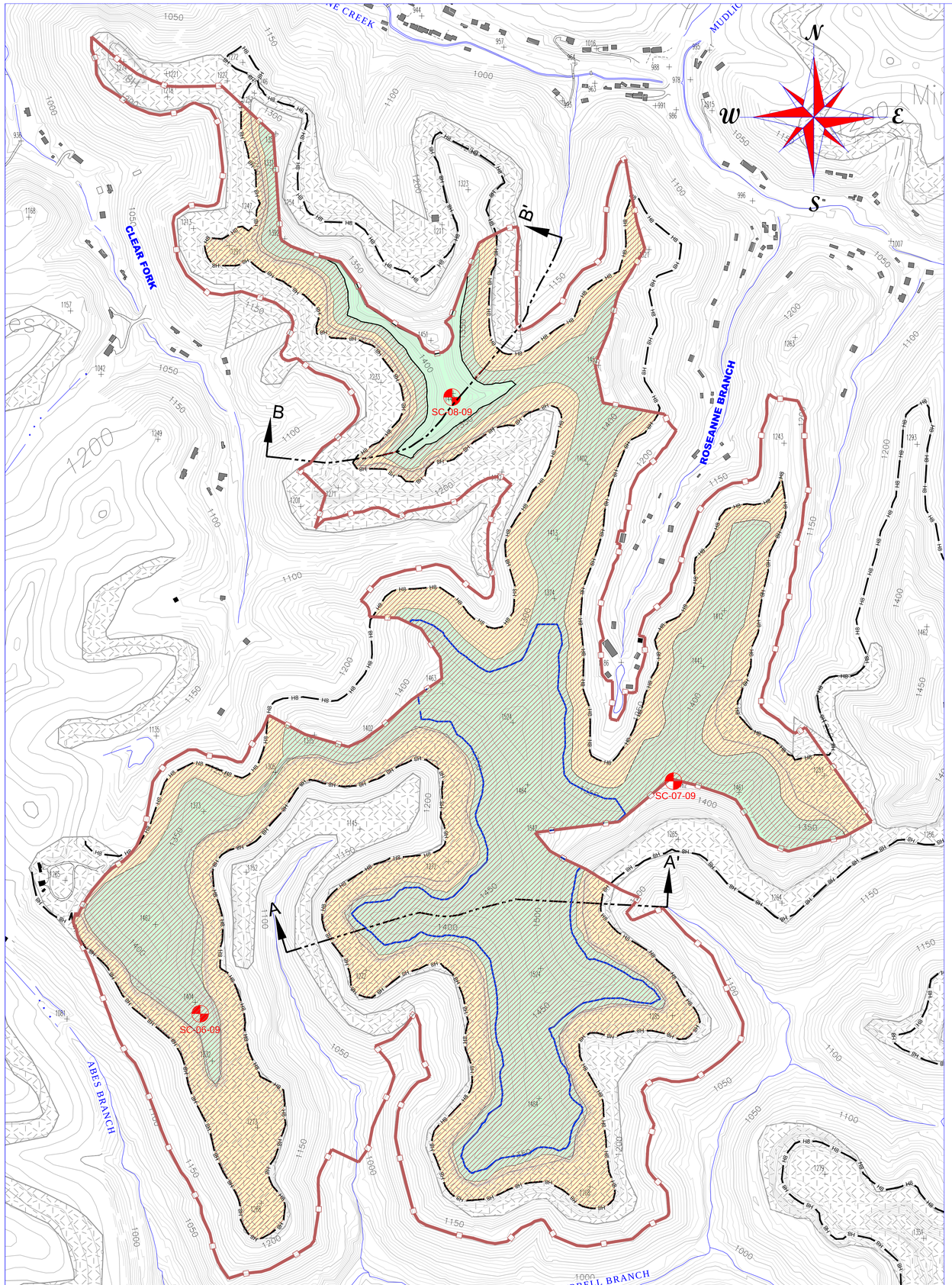
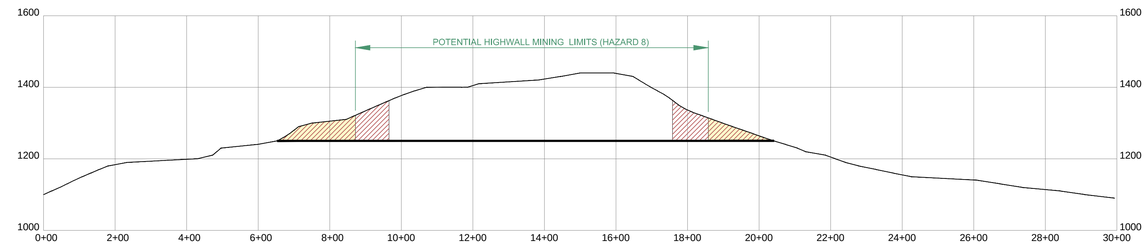


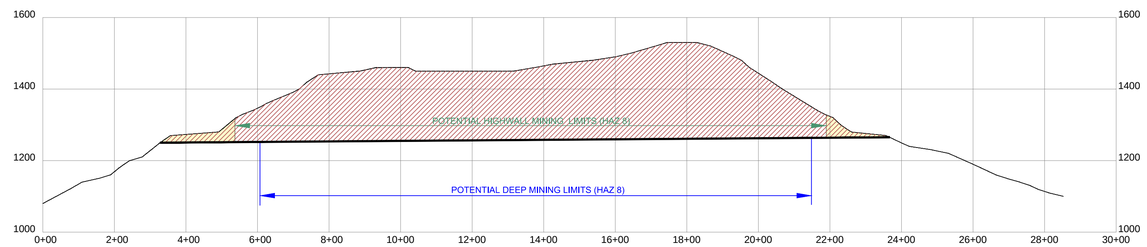
PLAN VIEW - HAZARD 8 SEAM

SCALE : 1" = 400'



CROSS SECTION B-B' (HAZARD 8 SEAM)

SCALE : 1" = 200'



CROSS SECTION A-A' (HAZARD 8 SEAM)

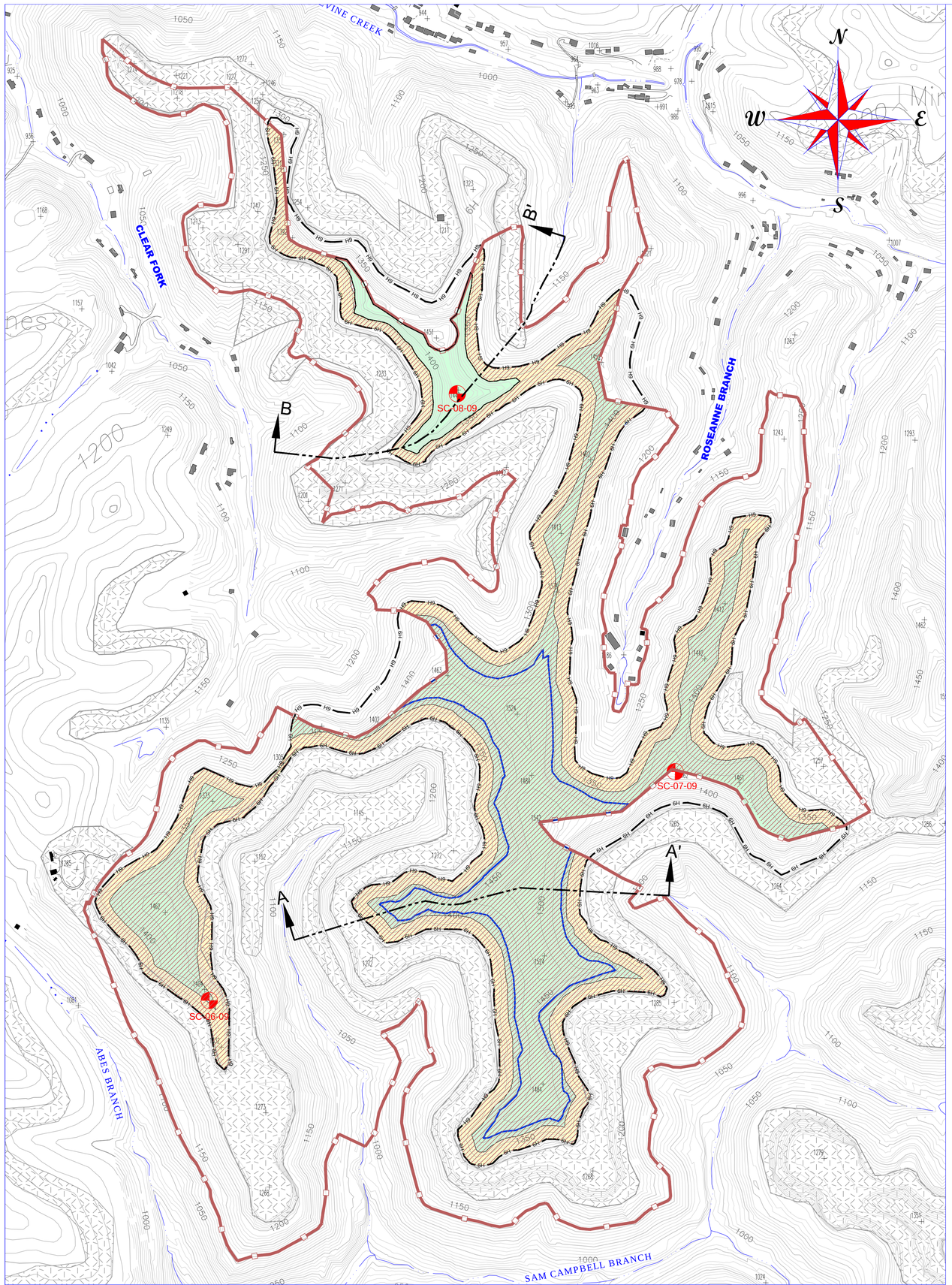
SCALE : 1" = 200'

LEGEND

- COREHOLE LOCATION
- PROJECT BOUNDARY
- H7 — HAZARD 7 COAL SEAM
- EXISTING HAZARD 7 DEEP MINE WORKS
- POTENTIAL CONTOUR MINING
- AREA MINING (MOUNTAINTOP REMOVAL AREA)
- POTENTIAL HIGHWALL / AUGER MINING
- POTENTIAL DEEP MINING
- PREVIOUSLY MINED AREA

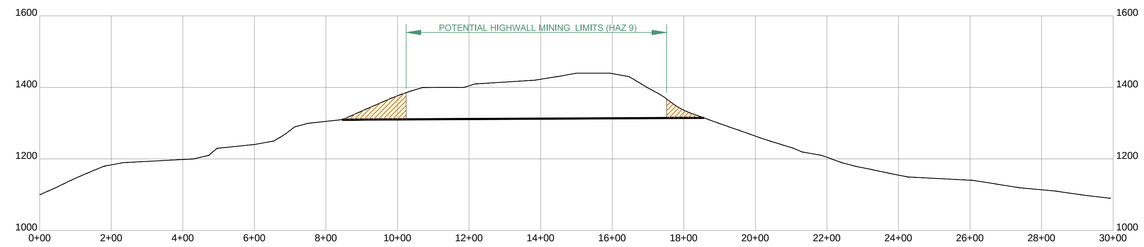
DRAWN BY: D.HANNAH	**ICG HAZARD, LLC** 3228 SUMMIT SQUARE PLACE, SUITE 180 LEXINGTON, KY. 40509	SUMMIT ENGINEERING,INC. 131 Summit Drive Pikeville, Ky. 41501 (606) 432-1447	SCALE: NOTED
CHECKED BY: A.CHILDERS			DATE: 08/11/2014
APPROVED BY: A.CHILDERS	**MINING ALTERNATIVES** HAZARD 8 SEAM SAM CAMPBELL BRANCH PERMIT NO. 897-0587	Lexington,Ky • Henderson, Ky. South Charleston,WV • Bridgeport, WV	ATTACHMENT:
PER. NO: 897-0587			SHEET:
Plot Date: 29 AUGUST 2014 – 3:29 PM			OF:

Z:\ICG\897-0587 (previously 897-0507)\Alt_Analysis\0587-ALT-ANALYSIS.dwg



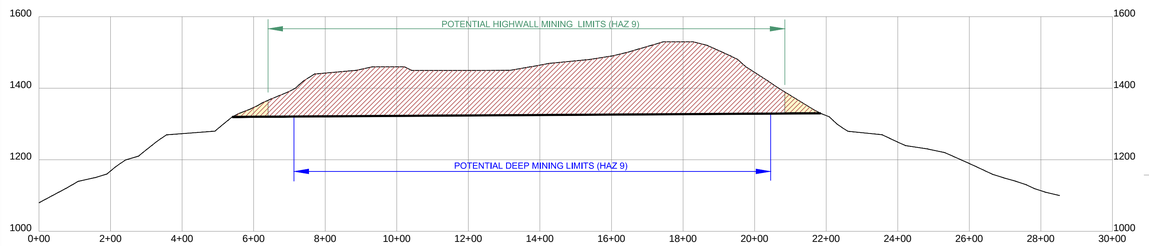
PLAN VIEW - 9 SEAM

SCALE : 1" = 400'



CROSS SECTION B-B' (HAZARD 9 SEAM)

SCALE : 1" = 200'



CROSS SECTION A-A' (HAZARD 9 SEAM)

SCALE : 1" = 200'

LEGEND

- COREHOLE LOCATION
- PROJECT BOUNDARY
- H7 — HAZARD 7 COAL SEAM
- EXISTING HAZARD 7 DEEP MINE WORKS
- POTENTIAL CONTOUR MINING
- AREA MINING (MOUNTAINTOP REMOVAL AREA)
- POTENTIAL HIGHWALL / AUGER MINING
- POTENTIAL DEEP MINING
- PREVIOUSLY MINED AREA

DRAWN BY: D.HANNAH	**ICG HAZARD, LLC** 3228 SUMMIT SQUARE PLACE, SUITE 180 LEXINGTON, KY. 40509	**SUMMIT ENGINEERING,INC.** 131 Summit Drive Pikeville, Ky. 41501 (606) 432-1447	SCALE: NOTED
CHECKED BY: A.CHILDERS			DATE: 08/11/2014
APPROVED BY: A.CHILDERS	**MINING ALTERNATIVES** HAZARD 9 SEAM PERMIT NO. 897-0587		ATTACHMENT:
PER. NO: 897-0587		Lexington,Ky • Henderson, Ky. South Charleston,WV • Bridgeport, WV	SHEET:
Plot Date: 29 AUGUST 2014 – 3:30 PM			OF:

Z:\ICG\897-0587 (previously 897-0507)\Alt_Analysis\0587-ALT-ANALYSIS.dwg

APPENDIX B

Habitat Assessment Sheets, EII Calculations, and Benthic Survey

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (VERSION 2002.6)
****(Genus/species Level Taxonomy - Riffle Only Sample)****

Project ID:	**ICG**	**897-0507**
Stream/Reach:	**1L UT of Sam Campbell Branch (Drain 6)**	
Assessment Objectives:		

NA	**Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)**
0.55	**Ecological Integrity Index (Habitat Integrity + Conductivity)**

>>>>>>>

Enter quantitative or categorical measure from Field Data Sheet in shaded cells

Variables	Measure	Units
RBP Habitat Parameters		
1. Epifaunal Substrate	15	no units (0-20)
2. Embeddedness	13	no units (0-20)
3. Velocity/Depth Regime	10	no units (0-20)
4. Sediment Deposition	15	no units (0-20)
5. Channel Flow Status	14	no units (0-20)
6. Channel Alteration	11	no units (0-20)
7. Freq. Of Riffles (bends)	18	no units (0-20)
8. Bank stability (both combined)	16	no units (0-20)
9. Veg. Protection (both combined)	14	no units (0-20)
10. Riparian Width (both combined)	16	no units (0-20)
Total Habitat Score	**142**	no units
Habitat Integrity		
Macroinvertebrate Data - *Genus/species Level*		
11. Genus/species Taxa Richness		# of taxa sampled
12. Genus/species EPT Richness		# of EPT species sampled
13. % Ephemeroptera		% Mayflies (0-100)
14. % Chironomidae & Oligochaeta		% Midges & Worms (0-100)
15. % Clingers		% Clingers (0-100)
16. mHBI		no units
Macroinvertebrate Bioassessment	**NA**	no units
Conductivity	**304**	microMHOs

	Subindex
Habitat Integrity	**0.53**
Macroinvertebrate Bioassessment	**NA**
Conductivity	**0.56**

Insert Photo Here

High Gradient Stream Data Sheet

Stream Name: Drain 6	Location: ~~[illegible]~~ : MT of Sam Campbell Branch
Station No.: Mile :	Basin / Watershed : North Fork of KY river
Lat. : Long. :	County : Perry USGS 7.5 Topo : Keyston
Date : 3/30/09 Time: 17 ☐ am ☐ pm	Investigators : CK & T.M.

SAMPLE TYPE: θ PHYSICAL CHEMISTRY θ MACROINVERTEBRATE θ FISH θ BACTERIA

WEATHER:

Now	Past 24 hours	
θ	θ	Heavy rain
θ	θ	Steady rain
θ	(θ)	Intermittent showers
(θ)	θ	Clear/sunny

Has there been a heavy rain in the last 7 days? θ Yes θ No

Inches rainfall in past 24 hours 1 in.

30% % Cloud Cover

Air Temperature : 53 °C.

P-Chem: Temp(°C) _____ D.O. (mg/l) _____ %Saturation _____ pH(S.U.) _____ Conductivity 304 θ Grab

INSTREAM WATERSHED FEATURES:

Stream Width 3 ft

Range of Depth .1 ~~[illegible]~~ -.5 ft

Average Velocity 4-8 ft/s

Discharge _____ cfs

Est. Reach Length _____ ft

LOCAL WATERSHED FEATURES:

Predominant Surrounding Land Use:

(θ) Surface Mining	θ Construction	(θ) Forest
θ Deep Mining	θ Commercial	θ Pasture/Grazing
θ Oil Wells	θ Industrial	θ Silviculture
θ Land Disposal	θ Row Crops	θ Urban Runoff/Storm Sewers

Hydraulic Structures:

θ Dams θ Bridge Abutments

θ Island θ Waterfalls

θ Other

Stream Flow:

θ Dry θ Pooled θ Low (θ) Normal

θ High θ Very Rapid or Torrential

Stream Type:

θ Perennial (θ) Intermittent

(θ) Ephemeral θ Seep

Riparian Vegetation: Dom. Tree/Shrub Taxa

Dominant Type:

(θ) Trees θ Shrubs

θ Grasses (θ) Herbaceous

Number of strata _____

Sycamore, Oak, beech

Canopy Cover:

θ Fully Exposed (0-25%)

θ Partially Exposed (25-50%)

θ Partially Shaded (50-75%)

(θ) Fully Shaded (75-100%)

Channel Alterations:

θ Dredging

(θ) Channelization

(θ Full (θ) Partial)

Substrate θEst. θP.C.		Riffle : 90%	Run : %	Pool : 10 %
Silt/Clay	(<0.06 mm)	~~[illegible]~~ 15		20
Sand	(0.06 – 2 mm)	~~[illegible]~~ 15		20
Gravel	(2-64 mm)	~~[illegible]~~ 20		20
Cobble	(64 – 256 mm)	30		15
Boulders	(>256 mm)	20		5
Bedrock				

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate / Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity / Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently, pools almost absent due to substantial sediment deposition
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ____ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ____ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ____ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ____ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ____ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ____ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 142

NOTES/COMMENTS:

INTENSIVE SURVEY MONITORING REPORT
For KPDES 402 Permit Requirements
KDNR PERMIT NO. 897-0587

ICG Hazard, LLC

Prepared:
July 10, 2014

Prepared by: RCR

Aquatic Resources Management
2265 Harrodsburg Rd., Suite 100
Lexington, KY 40504
(859) 388-9595

AQUATIC RESOURCES MANAGEMENT, LLC

July 10, 2014

John Brumley
Kentucky Division of Environmental Protection
Division of Water
200 Fair Oaks Lane, Fourth Floor
Frankfort, KY 40601

RE: Biological Sampling Intensive Survey Report (KDNR Permit # 897-0587)

Dear Mr. Brumley,

Please find enclosed the necessary information to satisfy the reporting requirements for intensive biological surveys for the representative macroinvertebrate sample completed in association with KDNR permit 897-0587. The site location was determined to be representative for the aforementioned permit as outlined in the General Permit (*Kentucky Pollutant Discharge Elimination System Permit to Discharge Treated Wastewater into Waters of the Commonwealth July 1, 2009*). As stated in the General Permit, these results represent a required one-time benthic macroinvertebrate assessment immediately downstream of an outfall in each 14-digit HUC watershed impacted by mining operations.

Per reporting guidance, ICG Hazard, LLC has no outstanding water quality violations. This report is to satisfy the baseline biological study requirement.

Per the other requirements of the reporting guidance, a few small yet previously acceptable discrepancies exist as described below:

- No QAQC results are reported here as Aquatic Resources Management submits an end-of-the-year report for all collected biological samples and their respective processing.

All required information summarized below is included within this package:

- MBI templates with MBI results and narrative ratings for each station
- Macroinvertebrate species list with numbers of individuals of each species for each station including notations of which were collected in the semi-quantitative sample and which were collected in the multi-habitat sample
- Habitat assessment sheets
- Photos of the stations
- Summary charts showing specific conductivity levels vs. %EPT, %Ephem (in headwaters) and MBI scores for each station over time

2265 Harrodsburg Road • Suite 100 • Lexington • Kentucky • 40504
Office 859.388.9595 • Web www.aquaticresources.us

- Summary charts showing sediment deposition vs. %EPT, and MBI scores for each station over time
- Summary charts showing embeddedness vs. %EPT, and MBI scores for each station over time
- Summary charts showing total habitat score vs. %EPT and MBI scores for each station over time

Please contact me if there any questions regarding this package.

Sincerely,

Tony Miller
Senior Ecologist

Josh Howard
President

CC: Don Gibson
Director, Permitting and Regulatory Affairs

Macroinvertebrate Species List with Metrics and MBI Score

BioRegion: Mountain (East Ky.)

Station: M030-1

Sample Dates: 1/1/2010 - 7/10/2014

Coleoptera

Taxon	QUANT	QUAL	Habitat	TV
Optioservus sp	4		clinger	2.36
Stenelmis sp	1		clinger	5.10

Decapoda

Taxon	QUANT	QUAL	Habitat	TV
Orconectes sp		X		5.49

Diptera

Taxon	QUANT	QUAL	Habitat	TV
Cricotopus/Orthocladius gp	95	X		7.10
Cryptochironomus sp	1			6.40
Parametriocnemus sp	96	X	clinger	3.65
Phaenopsectra sp	1	X	clinger	6.50
Thienemannimyia gp	3	X		5.90
Tipula sp	1			7.33

Ephemeroptera

Taxon	QUANT	QUAL	Habitat	TV
Eurylophella sp	1		clinger	4.34

Megaloptera

Taxon	QUANT	QUAL	Habitat	TV
Sialis sp		X	burrower	7.17

Odonata

Taxon	QUANT	QUAL	Habitat	TV
Boyeria sp		X		6.00
Calopteryx sp		X		7.80

Plecoptera

Taxon	QUANT	QUAL	Habitat	TV
Leuctra sp	1		sprawler	0.67

Trichoptera

Taxon	QUANT	QUAL	Habitat	TV

Macroinvertebrate Species List with Metrics and MBI Score

BioRegion: Mountain (East Ky.)

Station: M030-1

Sample Dates: 1/1/2010 - 7/10/2014

Trichoptera

Taxon	QUANT	QUAL	Habitat	TV
Cheumatopsyche sp	11		clinger	6.22
Diplectrona sp	2			4.00
Hydropsyche sp	5	X	clinger	4.00
Rhyacophila sp	1		clinger	0.80

Total # of Individuals:	223
Genus Taxa Richness:	18
EPT:	6
m% EPT:	4.48430
mHBI:	5.16402
% Clingers:	53.81166
% Chironomids + Oligochaetes:	87.89238
% Ephemeroptera:	0.44843
MBI Score:	28.2705
MBI Rating:	Poor

Drainage Area in Sq Miles:	0.83
	Headwater

Macroinvertebrate Bench Sheet

Station ID: M030-1 **Stream:** Clear Fork

Location: M030 **County:**

Collectors: NB, GP **Method:** DOWSOP03018

% SubSample: FullPick **Date Collected:** 3/30/2010

Final ID	Quant	Qual	Comments	ID By
Boyeria sp		X		Robert Oney
Calopteryx sp		X		Robert Oney
Cheumatopsyche sp	11			Robert Oney
Cricotopus/Orthocladius gp	95	X		Robert Oney
Cryptochironomus sp	1			Robert Oney
Diplectrona sp	2			Robert Oney
Eurylophella sp	1			Robert Oney
Hydropsyche sp	5	X		Robert Oney
Leuctra sp	1			Robert Oney
Optioservus sp	4			Robert Oney
Orconectes sp		X		Robert Oney
Parametriocnemus sp	96	X		Robert Oney
Phaenopsectra sp	1	X		Robert Oney
Rhyacophila sp	1			Robert Oney
Sialis sp		X		Robert Oney
Stenelmis sp	1			Robert Oney
Thienemannimyia gp	3	X		Robert Oney
Tipula sp	1			Robert Oney

Taxa Count: 18 Total Quant: 223

ATTACHMENT 7a

High Gradient Stream Data Sheet

897-0507

STREAM NAME: Clear Fork | LOCATION: M030-1

STATION: Existing Condition | DRAINAGE AREA (AC): | BASIN/WATERSHED: N. Fork

LAT: ° ' " | LONG: ° ' " | COUNTY: Perry | USGS 7.5 TOPO:

DATE: 12-30-10 | TIME: 1:30 ☐ AM ☑ PM | INVESTIGATORS: NB GP

TYPE SAMPLE: ☐ P-CHEM ☑ Macroinvertebrate ☐ FISH ☐ BACT.

WEATHER:

Now	Past 24 hours	Has there been a heavy rain in the last 7 days?
☐	☐ Heavy rain	☐ Yes ☑ No
☐	☐ Steady rain	Air temperature 43 °F. Inches rainfall in past 24 hours ____ in
☐	☑ Intermittent showers	80 % Cloud Cover
☑	☐ Clear/sunny	

P-Chem: Temp (°C) 9.6 D.O. (mg/l) 11.05 % Saturation 98.4 pH(S.U.) ____ Cond. 1186 µS * ☐ Grab

INSTREAM WATERSHED FEATURES

Stream Width 6 ft
Range of Depth 1 ft
Average Velocity ____ ft/s
Est. Reach Length ____ ft

LOCAL WATERSHED FEATURES:

Predominant Surrounding Land Use:

☑ Surface Mining	☐ Construction	☑ Forest
☐ Deep Mining	☐ Commercial	☐ Pasture/Grazing
☐ Oil Wells	☐ Industrial	☐ Silviculture
☐ Land Disposal	☐ Row Crops	☐ Urban Runoff/Storm Sewers

Hydraulic Structures: ☐ Dams ☐ Bridge Abutments ☐ Island ☐ Waterfalls ☐ Other ☐ Culverts

Stream Flow; ☐ Dry ☐ Pooled ☐ Low ☑ Normal ☐ High ☐ Very Rapid or Torrential

Stream Type; ☑ Perennial ☐ Intermittent ☐ Ephemeral ☐ Seep

Riparian Vegetation: Dom. Tree/Shrub Taxa
Dominate Type: ☑ Trees ☑ Shrubs ☑ Grasses ☐ Herbaceous
Number of Strata ____

Canopy Cover; ☑ Fully Exposed (0-25%) ☐ Partially Exposed (25-50%) ☐ Partially Shaded (50-75%) ☐ Fully Shaded (75-100%)

Channel Alterations; ☐ Dredging ☐ Channelization (☐ Full ☐ Partial)

Substrate ☐ Est. ☑ P.C	Riffle ____ %	Run ____ %	Pool ____ %
Silt/Clay (<0.06 mm)			
Sand (0.06-2 mm)			
Gravel (2-64 mm)			
Cobble (64-256 mm)			
Boulders (>256 mm)			
Bedrock			

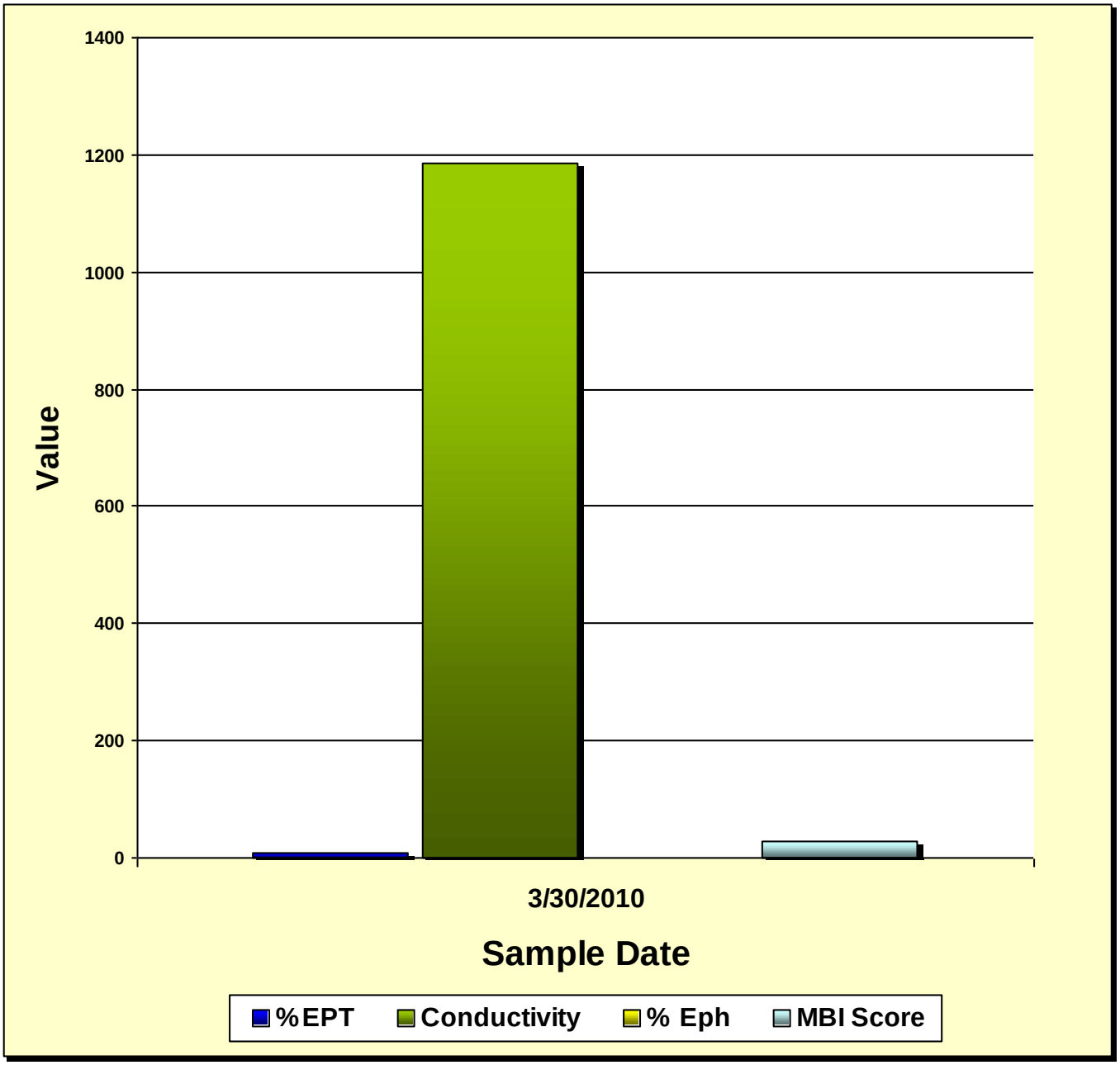
Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient.	40-70% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20-% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE =	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE =	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow. Deep > 1.5 feet.	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes)	Only 2 of the 4 habitat regimes present (if fast-shallow or slow shallow are missing, score low)	Dominated by 1 velocity/depth regime.
SCORE =	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0

ATTACHMENT 7b

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE =	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE =	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE =	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7 Frequency of Riffles	Occurrence of riffles relatively frequent; spacing between riffles 5 to 7 stream widths. Variety of habitat is key. In streams where riffles are continuous, boulders or logs are important.	Occurrence of riffles infrequent; distance between riffles divided by stream width is between 7 to 15.	Occasional riffle or bend: bottom contours provide some habitat; distance between riffles divided by stream width is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by stream width is > than 25.
SCORE =	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB) =	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB) =	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB) =	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB) =	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE (LB) =	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB) =	Right Bank 10 9	8 7 6	5 4 3	2 1 0
TOTAL SCORE =				

Sp. Conductance %EPT, %Ephemeroptera, and MBI Score Chart

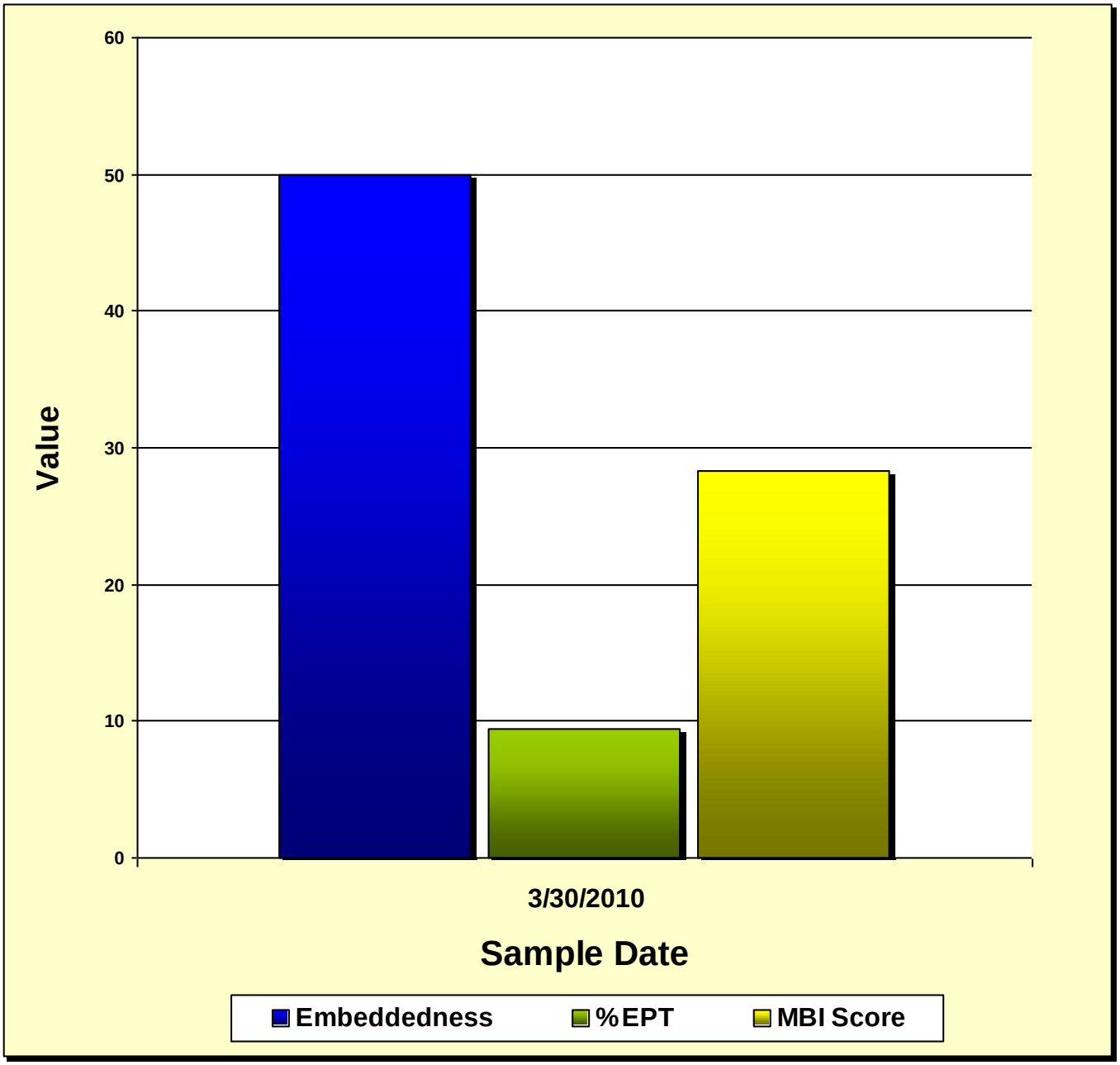
Sample: M030-1



Sample	Sample Date	Sp. Conductance	% EPT	% Eph	MBI Score
M030-1	3/30/2010	1186	9.417	0.448	28.27046

Embeddedness, %EPT, and MBI Score Chart

Sample: M030-1

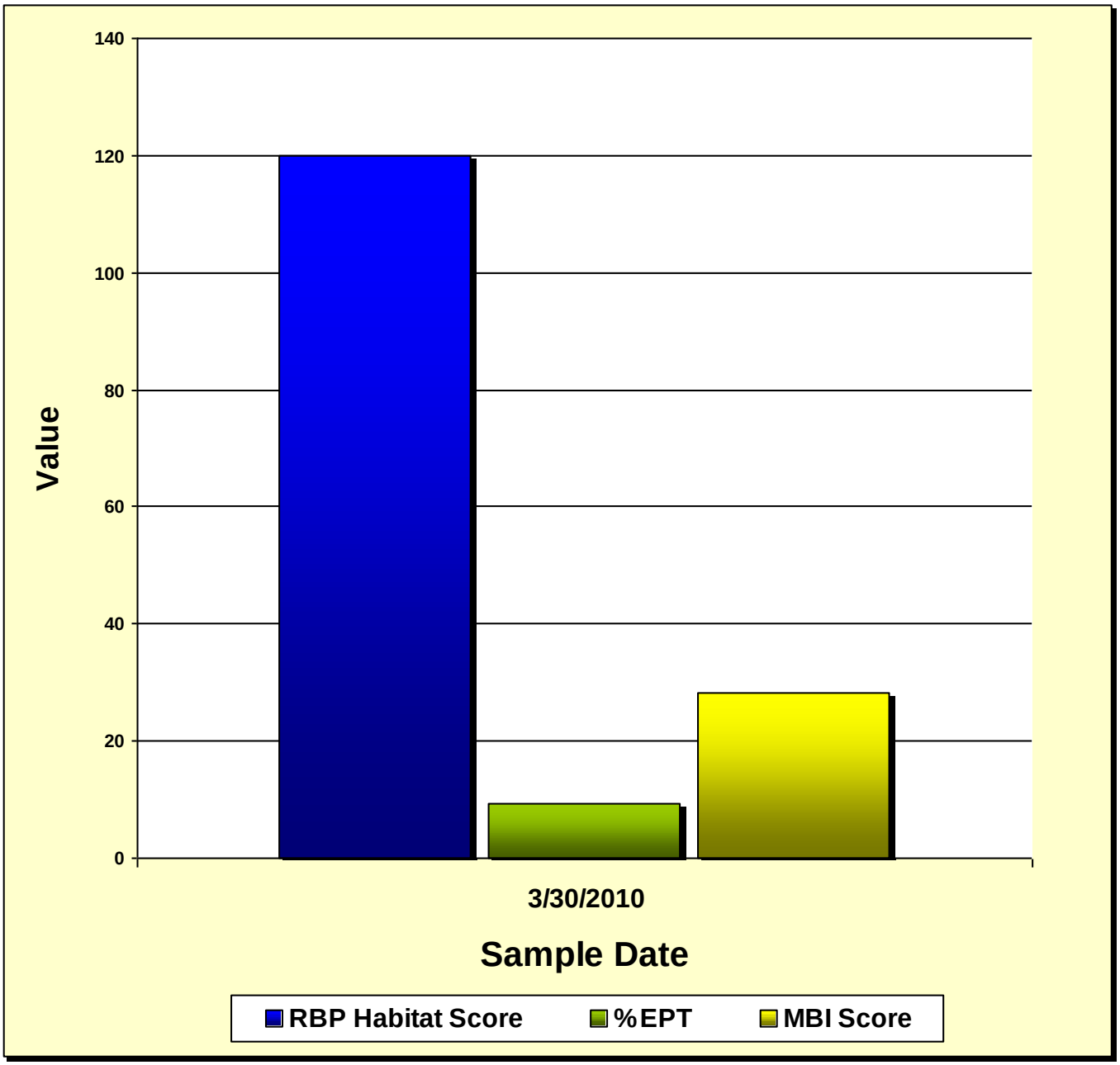


Sample	Sample Date	Embeddedness	% EPT	MBI Score
M030-1	3/30/2010	50	9.42	28.27046

7/10/2014 8:59:38 AM

Total Habitat Score, %EPT, and MBI Score Chart

Sample: M030-1

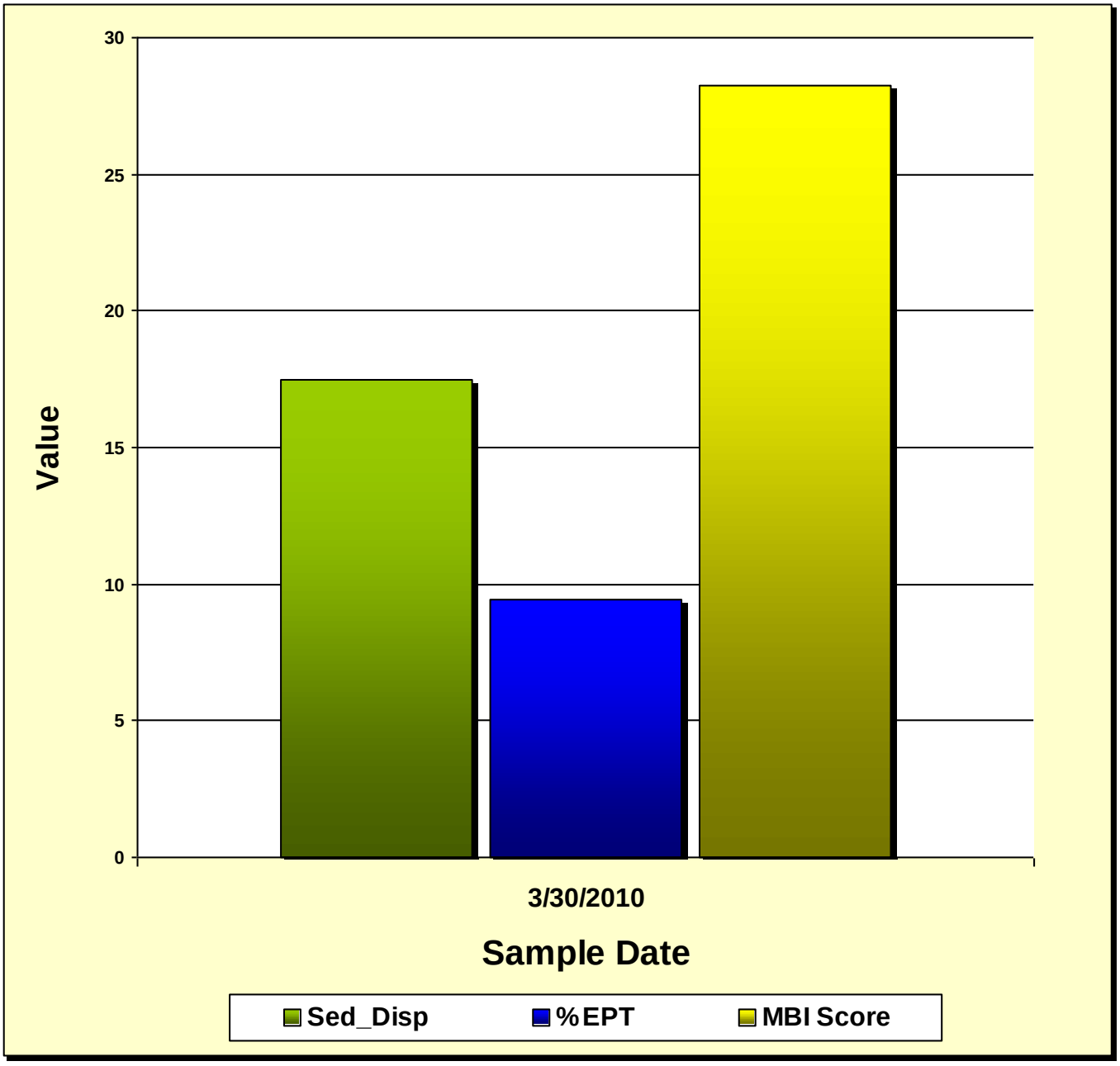


Sample	Sample Date	Habitat Score	% EPT	MBI Score
M030-1	3/30/2010	120	9.42	28.27046

7/10/2014 9:00:01 AM

Sediment Deposition, %EPT, and MBI Score Chart

Sample: M030-1



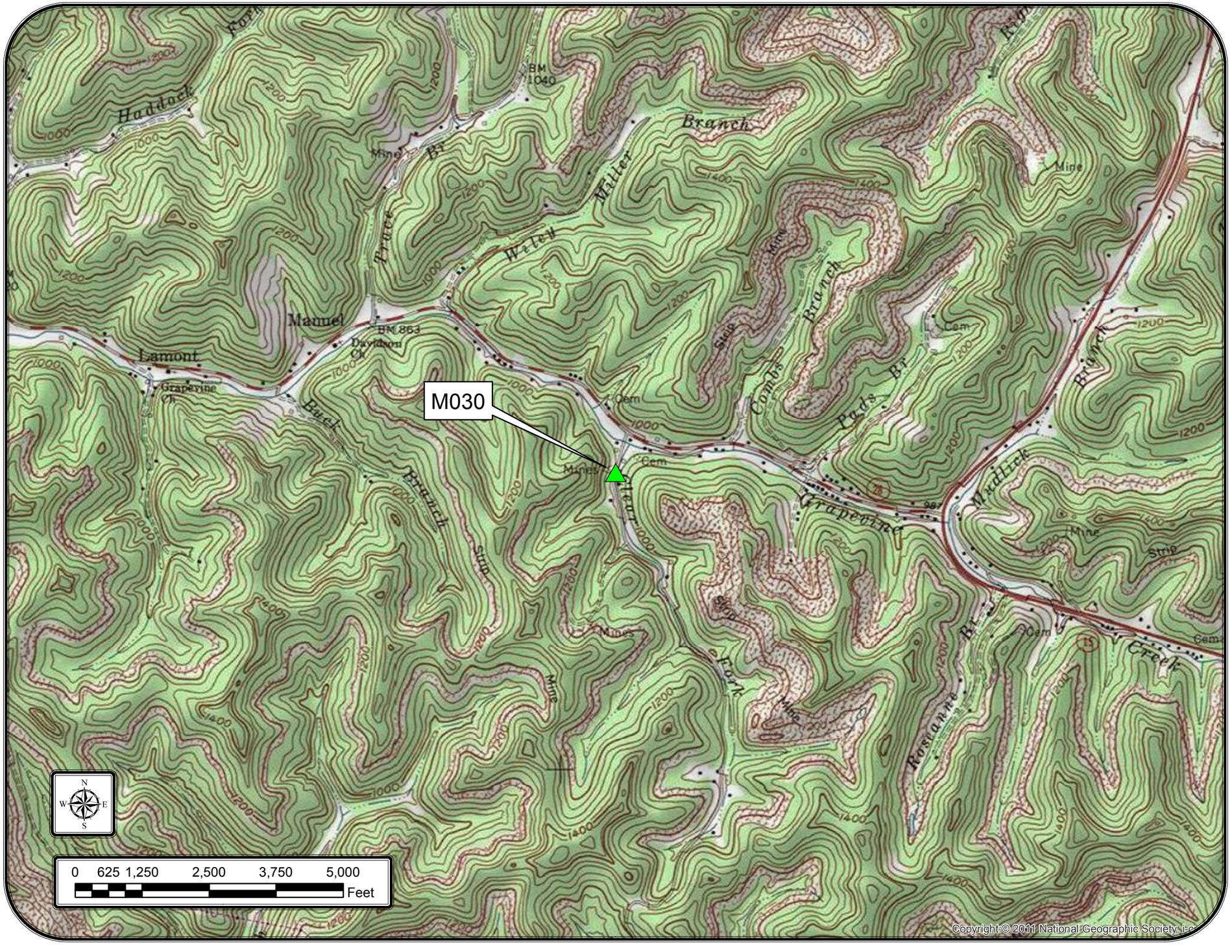
Sample	Sample Date	Sediment Deposition	% EPT	MBI Score
M030-1	3/30/2010	17.5	9.42	28.27046

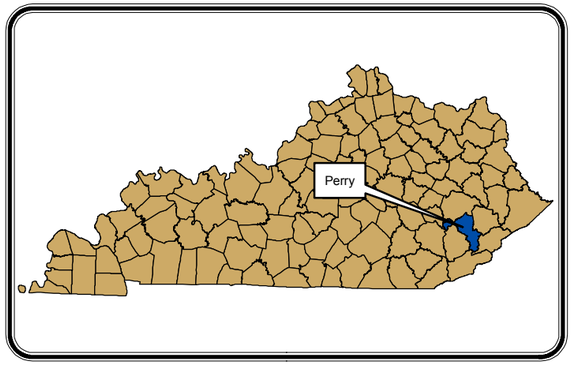
M030-1 Upstream

M030-1 Downstream

M030-1 Substrate

Topo Location Map 897-0587 Site M030





ICG Hazard, LLC

897-0587

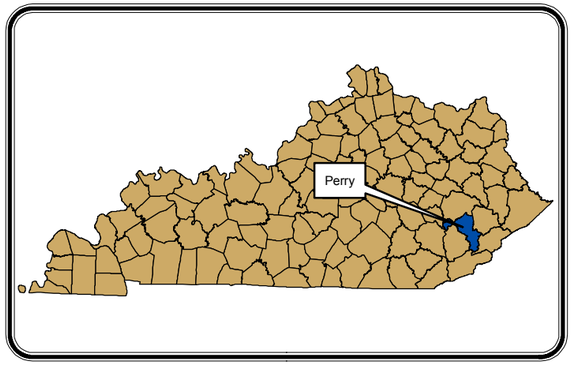
Address: HWY 28 P.O. Box 246
Chavies, KY 41727

Date: 8/6/2014 Drawn By: RR

ARM Project #: 007-534

Aquatic Resources Management
2265 Harrodsburg Rd., Suite 100
Lexington, KY 40504
(859) 388-9595

Aerial Location Map 897-0587 Site M030



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APPENDIX C

Jurisdictional Determination

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, LOUISVILLE
CORPS OF ENGINEERS
EASTERN KENTUCKY REGULATORY OFFICE
845 SASSAFRAS CREEK ROAD
SASSAFRAS, KY 41759-8806

http://www.lrl.usace.army.mil/

January 6, 2011

Operations Division
Regulatory Branch (South)
ID No. LRL-2010-490

Misty Hamilton
Summit Engineering, Inc.
131 Summit Drive
Pikeville, Kentucky 41501

Dear Ms. Hamilton:

This is in regard to your proposed stream delineation for Sam Campbell Branch associated with KDNR Permit No. 897-0507 in Perry County, Kentucky.

Representatives from this office inspected the site on October 12, 2010. Based on a review of the submitted information, we have determined that the streams referred to as Drains 1, 2, 3, 6, and 7 are considered to be a "water of the United States," including jurisdictional wetlands. This determination is based on the presence of (1) a navigable waterway; (2) wetlands adjacent to navigable or interstate waters, or that eventually drain or flow into navigable or interstate waters through a tributary system that may include man-made conveyances such as ditches or channelized streams; (3) one or more tributaries (stream channels, man-made conveyances, lakes, ponds, rivers) that eventually drain or flow into navigable or interstate waters; (4) other waters such as isolated lakes, ponds, wetlands or abandoned mining pits, the use, degradation or destruction of which could affect interstate or foreign commerce. Drains 4 and 5 were considered to be upland areas and non-jurisdictional. Furthermore, this preliminary jurisdictional determination is valid for a period of two years from the date of this letter unless new information warrants revision of the determination before the expiration date.

This letter contains a preliminary jurisdictional determination for your subject site, and an approved jurisdictional

determination for the upland areas visited and referenced above. If you object to the approved jurisdictional determination, you may request an administrative appeal under Corps regulations at 33 CFR Part 331. Enclosed you will find a Notification of Appeal Process (NAP) fact sheet and Request for Appeal (RFA) form. If you request to appeal this determination you must submit a completed RFA form to the Lakes and Rivers Division Office at the following address:

Ms. Pauline D. Thorndike
U.S. Army Engineer Division,
Great Lakes and Ohio River
550 Main Street - Room 10032
Cincinnati, Ohio 45202-3222
(513) 684-6212

In order for an RFA to be accepted by the Corps, the Corps must determine that it is complete, that it meets the criteria for appeal under 33 CFR Part 331.5, and that it has been received by the Division Office within 60 days of the date of the NAP. Should you decide to submit an RFA form, it must be received at the above address by March 7, 2001.

It is not necessary to submit an RFA form to the Division office if you do not object to the determination in this letter.

If you have any questions concerning this matter, please contact this office at the above address, ATTN: CELRL-OP-FS, or by calling Adam Fannin at 606-642-4064. Any correspondence should reference the assigned ID Number indicated above.

Sincerely,

Adam Fannin
Project Manager
Regulatory Branch

Enclosure

CELRL-OP-FS/concurrence.doc
CELRL-OP-FS

APPROVED JURISDICTIONAL DETERMINATION FORM
U.S. Army Corps of Engineers

This form should be completed by following the instructions provided in Section IV of the JD Form Instructional Guidebook.

SECTION I: BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR APPROVED JURISDICTIONAL DETERMINATION (JD): 7 December 2010

B. DISTRICT OFFICE, FILE NAME, AND NUMBER:LRL-2010-490

C. PROJECT LOCATION AND BACKGROUND INFORMATION:

AEF 1/6/11

State:KY County/parish/borough: Perry City: Dunraven
Center coordinates of site (lat/long in degree decimal format): Lat. 37-20-17° N, Long. 83-17-01° E.
Universal Transverse Mercator:
Name of nearest waterbody: UT of Abbes Branch - Drain 4 and Drain 5
Name of nearest Traditional Navigable Water (TNW) into which the aquatic resource flows:
Name of watershed or Hydrologic Unit Code (HUC): 5100201

- ☒ Check if map/diagram of review area and/or potential jurisdictional areas is/are available upon request.
- ☐ Check if other sites (e.g., offsite mitigation sites, disposal sites, etc…) are associated with this action and are recorded on a different JD form.

D. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):

- ☐ Office (Desk) Determination. Date:
- ☒ Field Determination. Date(s): 12 October 2010

SECTION II: SUMMARY OF FINDINGS

A. RHA SECTION 10 DETERMINATION OF JURISDICTION.

There **Are no** "*navigable waters of the U.S.*" within Rivers and Harbors Act (RHA) jurisdiction (as defined by 33 CFR part 329) in the review area. [*Required*]

- ☐ Waters subject to the ebb and flow of the tide.
- ☐ Waters are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. Explain: .

B. CWA SECTION 404 DETERMINATION OF JURISDICTION.

There **Are no** "*waters of the U.S.*" within Clean Water Act (CWA) jurisdiction (as defined by 33 CFR part 328) in the review area. [*Required*]

1. **Waters of the U.S.**
   a. **Indicate presence of waters of U.S. in review area (check all that apply):** [1]
   - ☐ TNWs, including territorial seas
   - ☐ Wetlands adjacent to TNWs
   - ☐ Relatively permanent waters[2] (RPWs) that flow directly or indirectly into TNWs
   - ☐ Non-RPWs that flow directly or indirectly into TNWs
   - ☐ Wetlands directly abutting RPWs that flow directly or indirectly into TNWs
   - ☐ Wetlands adjacent to but not directly abutting RPWs that flow directly or indirectly into TNWs
   - ☐ Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs
   - ☐ Impoundments of jurisdictional waters
   - ☐ Isolated (interstate or intrastate) waters, including isolated wetlands

   b. **Identify (estimate) size of waters of the U.S. in the review area:**
   Non-wetland waters: linear feet: width (ft) and/or acres.
   Wetlands: acres.

   c. **Limits (boundaries) of jurisdiction** based on: **Established by OHWM.**
   Elevation of established OHWM (if known): .

2. **Non-regulated waters/wetlands (check if applicable):**[3]
   - ☐ Potentially jurisdictional waters and/or wetlands were assessed within the review area and determined to be not jurisdictional. Explain: .

---

[1] Boxes checked below shall be supported by completing the appropriate sections in Section III below.
[2] For purposes of this form, an RPW is defined as a tributary that is not a TNW and that typically flows year-round or has continuous flow at least "seasonally" (e.g., typically 3 months).
[3] Supporting documentation is presented in Section III.F.

SECTION III: CWA ANALYSIS

A. TNWs AND WETLANDS ADJACENT TO TNWs

The agencies will assert jurisdiction over TNWs and wetlands adjacent to TNWs. If the aquatic resource is a TNW, complete Section III.A.1 and Section III.D.1. only; if the aquatic resource is a wetland adjacent to a TNW, complete Sections III.A.1 and 2 and Section III.D.1.; otherwise, see Section III.B below.

1. **TNW**
   Identify TNW: .

   Summarize rationale supporting determination: .

2. **Wetland adjacent to TNW**
   Summarize rationale supporting conclusion that wetland is "adjacent": .

B. CHARACTERISTICS OF TRIBUTARY (THAT IS NOT A TNW) AND ITS ADJACENT WETLANDS (IF ANY):

This section summarizes information regarding characteristics of the tributary and its adjacent wetlands, if any, and it helps determine whether or not the standards for jurisdiction established under *Rapanos* have been met.

The agencies will assert jurisdiction over non-navigable tributaries of TNWs where the tributaries are "relatively permanent waters" (RPWs), i.e. tributaries that typically flow year-round or have continuous flow at least seasonally (e.g., typically 3 months). A wetland that directly abuts an RPW is also jurisdictional. If the aquatic resource is not a TNW, but has year-round (perennial) flow, skip to Section III.D.2. If the aquatic resource is a wetland directly abutting a tributary with perennial flow, skip to Section III.D.4.

A wetland that is adjacent to but that does not directly abut an RPW requires a significant nexus evaluation. Corps districts and EPA regions will include in the record any available information that documents the existence of a significant nexus between a relatively permanent tributary that is not perennial (and its adjacent wetlands if any) and a traditional navigable water, even though a significant nexus finding is not required as a matter of law.

If the waterbody[4] is not an RPW, or a wetland directly abutting an RPW, a JD will require additional data to determine if the waterbody has a significant nexus with a TNW. If the tributary has adjacent wetlands, the significant nexus evaluation must consider the tributary in combination with all of its adjacent wetlands. This significant nexus evaluation that combines, for analytical purposes, the tributary and all of its adjacent wetlands is used whether the review area identified in the JD request is the tributary, or its adjacent wetlands, or both. If the JD covers a tributary with adjacent wetlands, complete Section III.B.1 for the tributary, Section III.B.2 for any onsite wetlands, and Section III.B.3 for all wetlands adjacent to that tributary, both onsite and offsite. The determination whether a significant nexus exists is determined in Section III.C below.

1. **Characteristics of non-TNWs that flow directly or indirectly into TNW**

   (i) General Area Conditions:
   Watershed size: **Pick List**
   Drainage area: **Pick List**
   Average annual rainfall: inches
   Average annual snowfall: inches

   (ii) Physical Characteristics:
   (a) Relationship with TNW:
   ☐ Tributary flows directly into TNW.
   ☐ Tributary flows through **Pick List** tributaries before entering TNW.

   Project waters are **Pick List** river miles from TNW.
   Project waters are **Pick List** river miles from RPW.
   Project waters are **Pick List** aerial (straight) miles from TNW.
   Project waters are **Pick List** aerial (straight) miles from RPW.
   Project waters cross or serve as state boundaries. Explain: .

   Identify flow route to TNW[5]: .
   Tributary stream order, if known: .

---

[4] Note that the Instructional Guidebook contains additional information regarding swales, ditches, washes, and erosional features generally and in the arid West.

[5] Flow route can be described by identifying, e.g., tributary a, which flows through the review area, to flow into tributary b, which then flows into TNW.

(b) General Tributary Characteristics (check all that apply):

Tributary is: ☐ Natural
☐ Artificial (man-made). Explain: .
☐ Manipulated (man-altered). Explain: .

Tributary properties with respect to top of bank (estimate):
Average width: feet
Average depth: feet
Average side slopes: **Pick List.**

Primary tributary substrate composition (check all that apply):

☐ Silts	☐ Sands	☐ Concrete
☐ Cobbles	☐ Gravel	☐ Muck
☐ Bedrock	☐ Vegetation. Type/% cover:	
☐ Other. Explain: .		

Tributary condition/stability [e.g., highly eroding, sloughing banks]. Explain: .
Presence of run/riffle/pool complexes. Explain: .
Tributary geometry: **Pick List**
Tributary gradient (approximate average slope): %

(c) Flow:
Tributary provides for: **Pick List**
Estimate average number of flow events in review area/year: **Pick List**
Describe flow regime: .
Other information on duration and volume: .

Surface flow is: **Pick List.** Characteristics: .

Subsurface flow: **Pick List**. Explain findings: .
☐ Dye (or other) test performed: .

Tributary has (check all that apply):
☐ Bed and banks
☐ OHWM[6] (check all indicators that apply):

☐ clear, natural line impressed on the bank	☐ the presence of litter and debris
☐ changes in the character of soil	☐ destruction of terrestrial vegetation
☐ shelving	☐ the presence of wrack line
☐ vegetation matted down, bent, or absent	☐ sediment sorting
☐ leaf litter disturbed or washed away	☐ scour
☐ sediment deposition	☐ multiple observed or predicted flow events
☐ water staining	☐ abrupt change in plant community
☐ other (list):	

☐ Discontinuous OHWM.[7] Explain: .

If factors other than the OHWM were used to determine lateral extent of CWA jurisdiction (check all that apply):

☒ High Tide Line indicated by:	☒ Mean High Water Mark indicated by:
☐ oil or scum line along shore objects	☐ survey to available datum;
☐ fine shell or debris deposits (foreshore)	☐ physical markings;
☐ physical markings/characteristics	☐ vegetation lines/changes in vegetation types.
☐ tidal gauges	
☐ other (list):	

(iii) Chemical Characteristics:
Characterize tributary (e.g., water color is clear, discolored, oily film; water quality; general watershed characteristics, etc.).
Explain: .
Identify specific pollutants, if known: .

---

[6]A natural or man-made discontinuity in the OHWM does not necessarily sever jurisdiction (e.g., where the stream temporarily flows underground, or where the OHWM has been removed by development or agricultural practices). Where there is a break in the OHWM that is unrelated to the waterbody's flow regime (e.g., flow over a rock outcrop or through a culvert), the agencies will look for indicators of flow above and below the break.
[7]Ibid.

(iv) Biological Characteristics. Channel supports (check all that apply):

- ☐ Riparian corridor. Characteristics (type, average width): .
- ☐ Wetland fringe. Characteristics: .
- ☐ Habitat for:
  - ☐ Federally Listed species. Explain findings: .
  - ☐ Fish/spawn areas. Explain findings: .
  - ☐ Other environmentally-sensitive species. Explain findings: .
  - ☐ Aquatic/wildlife diversity. Explain findings: .

2. Characteristics of wetlands adjacent to non-TNW that flow directly or indirectly into TNW

(i) Physical Characteristics:

(a) General Wetland Characteristics:

Properties:

Wetland size: acres

Wetland type. Explain: .

Wetland quality. Explain: .

Project wetlands cross or serve as state boundaries. Explain: .

(b) General Flow Relationship with Non-TNW:

Flow is: **Pick List**. Explain: .

Surface flow is: **Pick List**

Characteristics: .

Subsurface flow: **Pick List**. Explain findings: .

- ☐ Dye (or other) test performed: .

(c) Wetland Adjacency Determination with Non-TNW:

- ☐ Directly abutting
- ☐ Not directly abutting
  - ☐ Discrete wetland hydrologic connection. Explain: .
  - ☐ Ecological connection. Explain: .
  - ☐ Separated by berm/barrier. Explain: .

(d) Proximity (Relationship) to TNW

Project wetlands are **Pick List** river miles from TNW.

Project waters are **Pick List** aerial (straight) miles from TNW.

Flow is from: **Pick List**.

Estimate approximate location of wetland as within the **Pick List** floodplain.

(ii) Chemical Characteristics:

Characterize wetland system (e.g., water color is clear, brown, oil film on surface; water quality; general watershed characteristics; etc.). Explain: .

Identify specific pollutants, if known: .

(iii) Biological Characteristics. Wetland supports (check all that apply):

- ☐ Riparian buffer. Characteristics (type, average width): .
- ☐ Vegetation type/percent cover. Explain: .
- ☐ Habitat for:
  - ☐ Federally Listed species. Explain findings: .
  - ☐ Fish/spawn areas. Explain findings: .
  - ☐ Other environmentally-sensitive species. Explain findings: .
  - ☐ Aquatic/wildlife diversity. Explain findings: .

3. Characteristics of all wetlands adjacent to the tributary (if any)

All wetland(s) being considered in the cumulative analysis: **Pick List**

Approximately ( ) acres in total are being considered in the cumulative analysis.

For each wetland, specify the following:

Directly abuts? (Y/N)	Size (in acres)	Directly abuts? (Y/N)	Size (in acres)

Summarize overall biological, chemical and physical functions being performed: .

C. SIGNIFICANT NEXUS DETERMINATION

A significant nexus analysis will assess the flow characteristics and functions of the tributary itself and the functions performed by any wetlands adjacent to the tributary to determine if they significantly affect the chemical, physical, and biological integrity of a TNW. For each of the following situations, a significant nexus exists if the tributary, in combination with all of its adjacent wetlands, has more than a speculative or insubstantial effect on the chemical, physical and/or biological integrity of a TNW. Considerations when evaluating significant nexus include, but are not limited to the volume, duration, and frequency of the flow of water in the tributary and its proximity to a TNW, and the functions performed by the tributary and all its adjacent wetlands. It is not appropriate to determine significant nexus based solely on any specific threshold of distance (e.g. between a tributary and its adjacent wetland or between a tributary and the TNW). Similarly, the fact an adjacent wetland lies within or outside of a floodplain is not solely determinative of significant nexus.

Draw connections between the features documented and the effects on the TNW, as identified in the *Rapanos* Guidance and discussed in the Instructional Guidebook. Factors to consider include, for example:

- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to carry pollutants or flood waters to TNWs, or to reduce the amount of pollutants or flood waters reaching a TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), provide habitat and lifecycle support functions for fish and other species, such as feeding, nesting, spawning, or rearing young for species that are present in the TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to transfer nutrients and organic carbon that support downstream foodwebs?
- Does the tributary, in combination with its adjacent wetlands (if any), have other relationships to the physical, chemical, or biological integrity of the TNW?

Note: the above list of considerations is not inclusive and other functions observed or known to occur should be documented below:

1. **Significant nexus findings for non-RPW that has no adjacent wetlands and flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary itself, then go to Section III.D: .

2. **Significant nexus findings for non-RPW and its adjacent wetlands, where the non-RPW flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D: .

3. **Significant nexus findings for wetlands adjacent to an RPW but that do not directly abut the RPW.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D: .

D. DETERMINATIONS OF JURISDICTIONAL FINDINGS. THE SUBJECT WATERS/WETLANDS ARE (CHECK ALL THAT APPLY):

1. **TNWs and Adjacent Wetlands.** Check all that apply and provide size estimates in review area:
   - ☐ TNWs: linear feet width (ft), Or, acres.
   - ☐ Wetlands adjacent to TNWs: acres.

2. **RPWs that flow directly or indirectly into TNWs.**
   - ☐ Tributaries of TNWs where tributaries typically flow year-round are jurisdictional. Provide data and rationale indicating that tributary is perennial: .
   - ☐ Tributaries of TNW where tributaries have continuous flow "seasonally" (e.g., typically three months each year) are jurisdictional. Data supporting this conclusion is provided at Section III.B. Provide rationale indicating that tributary flows seasonally: .

Provide estimates for jurisdictional waters in the review area (check all that apply):
☐ Tributary waters: linear feet width (ft).
☐ Other non-wetland waters: acres.
Identify type(s) of waters: .

3. **Non-RPWs[8] that flow directly or indirectly into TNWs.**
☐ Waterbody that is not a TNW or an RPW, but flows directly or indirectly into a TNW, and it has a significant nexus with a TNW is jurisdictional. Data supporting this conclusion is provided at Section III.C.

Provide estimates for jurisdictional waters within the review area (check all that apply):
☐ Tributary waters: linear feet width (ft).
☐ Other non-wetland waters: acres.
Identify type(s) of waters: .

4. **Wetlands directly abutting an RPW that flow directly or indirectly into TNWs.**
☐ Wetlands directly abut RPW and thus are jurisdictional as adjacent wetlands.
☐ Wetlands directly abutting an RPW where tributaries typically flow year-round. Provide data and rationale indicating that tributary is perennial in Section III.D.2, above. Provide rationale indicating that wetland is directly abutting an RPW: .

☐ Wetlands directly abutting an RPW where tributaries typically flow "seasonally." Provide data indicating that tributary is seasonal in Section III.B and rationale in Section III.D.2, above. Provide rationale indicating that wetland is directly abutting an RPW: .

Provide acreage estimates for jurisdictional wetlands in the review area: acres.

5. **Wetlands adjacent to but not directly abutting an RPW that flow directly or indirectly into TNWs.**
☐ Wetlands that do not directly abut an RPW, but when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisidictional. Data supporting this conclusion is provided at Section III.C.

Provide acreage estimates for jurisdictional wetlands in the review area: acres.

6. **Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs.**
☐ Wetlands adjacent to such waters, and have when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisdictional. Data supporting this conclusion is provided at Section III.C.

Provide estimates for jurisdictional wetlands in the review area: acres.

7. **Impoundments of jurisdictional waters.[9]**
As a general rule, the impoundment of a jurisdictional tributary remains jurisdictional.
☐ Demonstrate that impoundment was created from "waters of the U.S.," or
☐ Demonstrate that water meets the criteria for one of the categories presented above (1-6), or
☐ Demonstrate that water is isolated with a nexus to commerce (see E below).

E. **ISOLATED [INTERSTATE OR INTRA-STATE] WATERS, INCLUDING ISOLATED WETLANDS, THE USE, DEGRADATION OR DESTRUCTION OF WHICH COULD AFFECT INTERSTATE COMMERCE, INCLUDING ANY SUCH WATERS (CHECK ALL THAT APPLY):[10]**
☐ which are or could be used by interstate or foreign travelers for recreational or other purposes.
☐ from which fish or shellfish are or could be taken and sold in interstate or foreign commerce.
☐ which are or could be used for industrial purposes by industries in interstate commerce.
☐ Interstate isolated waters. Explain: .
☐ Other factors. Explain: .

Identify water body and summarize rationale supporting determination: .

---

[8] See Footnote # 3.
[9] To complete the analysis refer to the key in Section III.D.6 of the Instructional Guidebook.
[10] **Prior to asserting or declining CWA jurisdiction based solely on this category, Corps Districts will elevate the action to Corps and EPA HQ for review consistent with the process described in the Corps/EPA *Memorandum Regarding CWA Act Jurisdiction Following Rapanos.***

Provide estimates for jurisdictional waters in the review area (check all that apply):
- ☐ Tributary waters: linear feet width (ft).
- ☐ Other non-wetland waters: acres.
  - Identify type(s) of waters: .
- ☐ Wetlands: acres.

F. NON-JURISDICTIONAL WATERS, INCLUDING WETLANDS (CHECK ALL THAT APPLY):
- ☐ If potential wetlands were assessed within the review area, these areas did not meet the criteria in the 1987 Corps of Engineers Wetland Delineation Manual and/or appropriate Regional Supplements.
- ☐ Review area included isolated waters with no substantial nexus to interstate (or foreign) commerce.
  - ☐ Prior to the Jan 2001 Supreme Court decision in "*SWANCC*," the review area would have been regulated based solely on the "Migratory Bird Rule" (MBR).
- ☐ Waters do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction. Explain: .
- ☐ Other: (explain, if not covered above): .

Provide acreage estimates for non-jurisdictional waters in the review area, where the sole potential basis of jurisdiction is the MBR factors (i.e., presence of migratory birds, presence of endangered species, use of water for irrigated agriculture), using best professional judgment (check all that apply):
- ☐ Non-wetland waters (i.e., rivers, streams): linear feet width (ft).
- ☐ Lakes/ponds: acres.
- ☐ Other non-wetland waters: acres. List type of aquatic resource: .
- ☐ Wetlands: acres.

Provide acreage estimates for non-jurisdictional waters in the review area that do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction (check all that apply):
- ☐ Non-wetland waters (i.e., rivers, streams): linear feet, width (ft).
- ☐ Lakes/ponds: acres.
- ☐ Other non-wetland waters: acres. List type of aquatic resource: .
- ☐ Wetlands: acres.

SECTION IV: DATA SOURCES.

A. SUPPORTING DATA. Data reviewed for JD (check all that apply - checked items shall be included in case file and, where checked and requested, appropriately reference sources below):
- ☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: .
- ☒ Data sheets prepared/submitted by or on behalf of the applicant/consultant.
  - ☒ Office concurs with data sheets/delineation report.
  - ☐ Office does not concur with data sheets/delineation report.
- ☐ Data sheets prepared by the Corps: .
- ☐ Corps navigable waters' study: .
- ☐ U.S. Geological Survey Hydrologic Atlas: .
  - ☐ USGS NHD data.
  - ☐ USGS 8 and 12 digit HUC maps.
- ☒ U.S. Geological Survey map(s). Cite scale & quad name: 1:24000 Krypton.
- ☐ USDA Natural Resources Conservation Service Soil Survey. Citation: .
- ☐ National wetlands inventory map(s). Cite name: .
- ☐ State/Local wetland inventory map(s): .
- ☐ FEMA/FIRM maps: .
- ☐ 100-year Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)
- ☒ Photographs: ☐ Aerial (Name & Date): .
  - or ☒ Other (Name & Date):2-23-2009.
- ☐ Previous determination(s). File no. and date of response letter: .
- ☐ Applicable/supporting case law: .
- ☐ Applicable/supporting scientific literature: .
- ☐ Other information (please specify): .

B. ADDITIONAL COMMENTS TO SUPPORT JD: .

AEF 1/6/11

ATTACHMENT

PRELIMINARY JURISDICTIONAL DETERMINATION FORM

BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR PRELIMINARY JURISDICTIONAL DETERMINATION (JD): 2/25/2009

B. NAME AND ADDRESS OF PERSON REQUESTING PRELIMINARY JD:
ICG Hazard, LLC
1021 Tori Drive
Hazard, KY 41701

C. DISTRICT OFFICE, FILE NAME, AND NUMBER: LRL-2010-490

D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION:
(USE THE ATTACHED TABLE TO DOCUMENT MULTIPLE WATERBODIES AT DIFFERENT SITES)

State: **Kentucky** County/parish/borough: **Perry**
City: **Dunraven**
Center coordinates of site (lat/long in degree decimal format):
Lat. **37.3299°N**, Long. **83.2760° W**.

Universal Transverse Mercator:

Name of nearest waterbody: **Sam Campbell Branch**

Identify (estimate) amount of waters in the review area:

Non-wetland waters: **8,418** linear feet: **5.3** width (ft) and/or acres.
Cowardin Class: **Riverine**
Stream Flow: **Intermittent & Ephemeral**
Wetlands: 0 acres.
Cowardin Class:

Name of any water bodies on the site that have been identified as Section 10 waters:

Tidal:

Non-Tidal:

E. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):

☐ Office (Desk) Determination. Date:
☒ Field Determination. Date(s): February 23-25, 2009

1. The Corps of Engineers believes that there may be jurisdictional waters of the United States on the subject site, and the permit applicant or other affected party who requested this preliminary JD is hereby advised of his or her option to request and obtain an approved jurisdictional determination (JD) for that site. Nevertheless, the permit applicant or other person who requested this preliminary JD has declined to exercise the option to obtain an approved JD in this instance and at this time.

2. In any circumstance where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring "pre-construction notification" (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an approved JD for the activity, the permit applicant is hereby made aware of the following: (1) the permit applicant has elected to seek a permit authorization based on a preliminary JD, which does not make an official determination of jurisdictional waters; (2) that the applicant has the option to request an approved JD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an approved JD could possibly result in less compensatory mitigation being required or different special conditions; (3) that the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization; (4) that the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the Corps has determined to be necessary; (5) that undertaking any activity in reliance upon the subject permit authorization without requesting an approved JD constitutes the applicant's acceptance of the use of the preliminary JD, but that either form of JD will be processed as soon as is practicable; (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of Corps permit authorization based on a preliminary JD constitutes agreement that all wetlands and other water bodies on the site affected in any way by that activity are jurisdictional waters of the United States, and precludes any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any administrative appeal or in any Federal court; and (7) whether the applicant elects to use either an approved JD or a preliminary JD, that JD will be processed as soon as is practicable. Further, an approved JD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can be administratively appealed pursuant to 33 C.F.R. Part 331, and that in any administrative appeal, jurisdictional issues can be raised (see 33 C.F.R. 331.5(a)(2)). If, during that administrative appeal, it becomes necessary to make an official determination whether CWA jurisdiction exists over a site, or to provide an official delineation of jurisdictional waters on the site, the Corps will provide an approved JD to accomplish that result, as soon as is practicable. This preliminary JD finds that there *"may be"* waters of the United States on the subject project site, and identifies all aquatic features on the site that could be affected by the proposed activity, based on the following information:

SUPPORTING DATA. Data reviewed for preliminary JD (check all that apply - checked items should be included in case file and, where checked and requested, appropriately reference sources below):

☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: Jurisdictional Determination Map.

☐ Data sheets prepared/submitted by or on behalf of the applicant/consultant.

- ☐ Office concurs with data sheets/delineation report.
- ☐ Office does not concur with data sheets/delineation report.

☐ Data sheets prepared by the Corps: .

☐ Corps navigable waters' study: .

☐ U.S. Geological Survey Hydrologic Atlas: .

- ☐ USGS NHD data.
- ☐ USGS 8 and 12 digit HUC maps.

☐ U.S. Geological Survey map(s). Cite scale & quad name: .

☐ USDA Natural Resources Conservation Service Soil Survey. Citation:.

☐ National wetlands inventory map(s). Cite name: .

☐ State/Local wetland inventory map(s): .

☐ FEMA/FIRM maps: .

☐ 100-year Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)

☒ Photographs: ☐ Aerial (Name & Date): .
or ☒ Other (Name & Date):Field photographs taken on February 23-25, 2009.

☐ Previous determination(s). File no. and date of response letter: .

☐ Other information (please specify):

<u>IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.</u>

6 Jan. 2010

Signature and date of
Regulatory Project Manager
(REQUIRED)

Signature and date of
person requesting preliminary JD
(REQUIRED, unless obtaining
the signature is impracticable)

Site number	Latitude Beginning	Longitude Beginning	Cowardin Class	Estimated amount of aquatic resource in review area	Class of aquatic resource
Drain 1	37°19'57"	-83°16'56"	Riverine / Ephemeral	380 linear feet/ Ephemeral	non-section 10 – non-wetland
Drain 2	37°20'02"	-83°16'58"	Riverine/ Ephemeral	1966 linear feet Intermittent 150 Linear Ephemeral	non-section 10 – non-wetland
Drain 3	37°20'11"	-83°16'58"	Riverine	620 linear feet	non-section 10 – non-wetland
Drain 6	37°19'10"	-83°16'49"	Riverine/ Ephemeral	4520- Intermittent 80- Ephemeral	non-section 10 – non-wetland
Drain 7	37°19'36"	-83°16'19"	Riverine/ Ephemeral	420-Intermittent 282- Ephemeral	non-section 10 – non-wetland

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant:	File Number:	Date:
Attached is:		See Section below
	INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)	A
	PROFFERED PERMIT (Standard Permit or Letter of permission)	B
	PERMIT DENIAL	C
	APPROVED JURISDICTIONAL DETERMINATION	D
	PRELIMINARY JURISDICTIONAL DETERMINATION	E

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at http://www.usace.army.mil/CECW/Pages/reg_materials.aspx or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- OBJECT: If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- APPEAL: If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- ACCEPT: You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- APPEAL: If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT

REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

POINT OF CONTACT FOR QUESTIONS OR INFORMATION:

If you have questions regarding this decision and/or the appeal process you may contact:	If you only have questions regarding the appeal process you may also contact: Pauline Thorndike U.S. Army Corps of Engineers Great Lakes and Ohio River Division 550 Main Street, Room 10032 Cincinnati, OH 45202-3222 TEL (513) 684-6212; FAX (513) 684-2460 pauline.d.thorndike@usace.army.mil

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.

_____ Signature of appellant or agent.	Date:	Telephone number:

ATTACHMENT

PRELIMINARY JURISDICTIONAL DETERMINATION FORM

BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR PRELIMINARY JURISDICTIONAL DETERMINATION (JD): 5/25/12

B. NAME AND ADDRESS OF PERSON REQUESTING PRELIMINARY JD:
ICG Hazard, LLC
1021 Tori Drive
Hazard, KY 41701

C. DISTRICT OFFICE, FILE NAME, AND NUMBER: LRL-2012-835

D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION:
(USE THE ATTACHED TABLE TO DOCUMENT MULTIPLE WATERBODIES AT DIFFERENT SITES)

State: **Kentucky** County/parish/borough: **Perry**
City: **Dunraven**
Center coordinates of site (lat/long in degree decimal format):
Lat. **37.3435°N**, Long. **83.2740° W**.

Universal Transverse Mercator:

Name of nearest waterbody: **Grapevine Creek**

Identify (estimate) amount of waters in the review area:

Non-wetland waters: **2,390** linear feet: **4.9** width (ft) and/or acres.
Cowardin Class: **Riverine**
Stream Flow: **Perennial**, **Intermittent & Ephemeral**
Wetlands: 0 acres.
Cowardin Class:

Name of any water bodies on the site that have been identified as Section 10 waters:

Tidal:

Non-Tidal:

E. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):

☐ Office (Desk) Determination. Date:
☒ Field Determination. Date(s): May 25, 2012 and 9-14-12

1. The Corps of Engineers believes that there may be jurisdictional waters of the United States on the subject site, and the permit applicant or other affected party who requested this preliminary JD is hereby advised of his or her option to request and obtain an approved jurisdictional determination (JD) for that site. Nevertheless, the permit applicant or other person who requested this preliminary JD has declined to exercise the option to obtain an approved JD in this instance and at this time.

2. In any circumstance where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring "pre-construction notification" (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an approved JD for the activity, the permit applicant is hereby made aware of the following: (1) the permit applicant has elected to seek a permit authorization based on a preliminary JD, which does not make an official determination of jurisdictional waters; (2) that the applicant has the option to request an approved JD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an approved JD could possibly result in less compensatory mitigation being required or different special conditions; (3) that the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization; (4) that the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the Corps has determined to be necessary; (5) that undertaking any activity in reliance upon the subject permit authorization without requesting an approved JD constitutes the applicant's acceptance of the use of the preliminary JD, but that either form of JD will be processed as soon as is practicable; (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of Corps permit authorization based on a preliminary JD constitutes agreement that all wetlands and other water bodies on the site affected in any way by that activity are jurisdictional waters of the United States, and precludes any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any administrative appeal or in any Federal court; and (7) whether the applicant elects to use either an approved JD or a preliminary JD, that JD will be processed as soon as is practicable. Further, an approved JD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can be administratively appealed pursuant to 33 C.F.R. Part 331, and that in any administrative appeal, jurisdictional issues can be raised (see 33 C.F.R. 331.5(a)(2)). If, during that administrative appeal, it becomes necessary to make an official determination whether CWA jurisdiction exists over a site, or to provide an official delineation of jurisdictional waters on the site, the Corps will provide an approved JD to accomplish that result, as soon as is practicable. This preliminary JD finds that there *"may be"* waters of the United States on the subject project site, and identifies all aquatic features on the site that could be affected by the proposed activity, based on the following information:

SUPPORTING DATA. Data reviewed for preliminary JD (check all that apply - checked items should be included in case file and, where checked and requested, appropriately reference sources below):

☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: Jurisdictional Determination Map.

☐ Data sheets prepared/submitted by or on behalf of the applicant/consultant.

- ☒ Office concurs with data sheets/delineation report.
- ☐ Office does not concur with data sheets/delineation report.

☐ Data sheets prepared by the Corps: .

☐ Corps navigable waters' study: .

☐ U.S. Geological Survey Hydrologic Atlas: .

- ☐ USGS NHD data.
- ☐ USGS 8 and 12 digit HUC maps.

☐ U.S. Geological Survey map(s). Cite scale & quad name: .

☐ USDA Natural Resources Conservation Service Soil Survey. Citation:.

☐ National wetlands inventory map(s). Cite name: .

☐ State/Local wetland inventory map(s): .

☐ FEMA/FIRM maps: .

☐ 100-year Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)

☒ Photographs: ☐ Aerial (Name & Date): .
or ☒ Other (Name & Date):Field photographs taken on May25, 2012

☐ Previous determination(s). File no. and date of response letter: .

☐ Other information (please specify):

<u>IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.</u>

David Saldanha 9/24/12

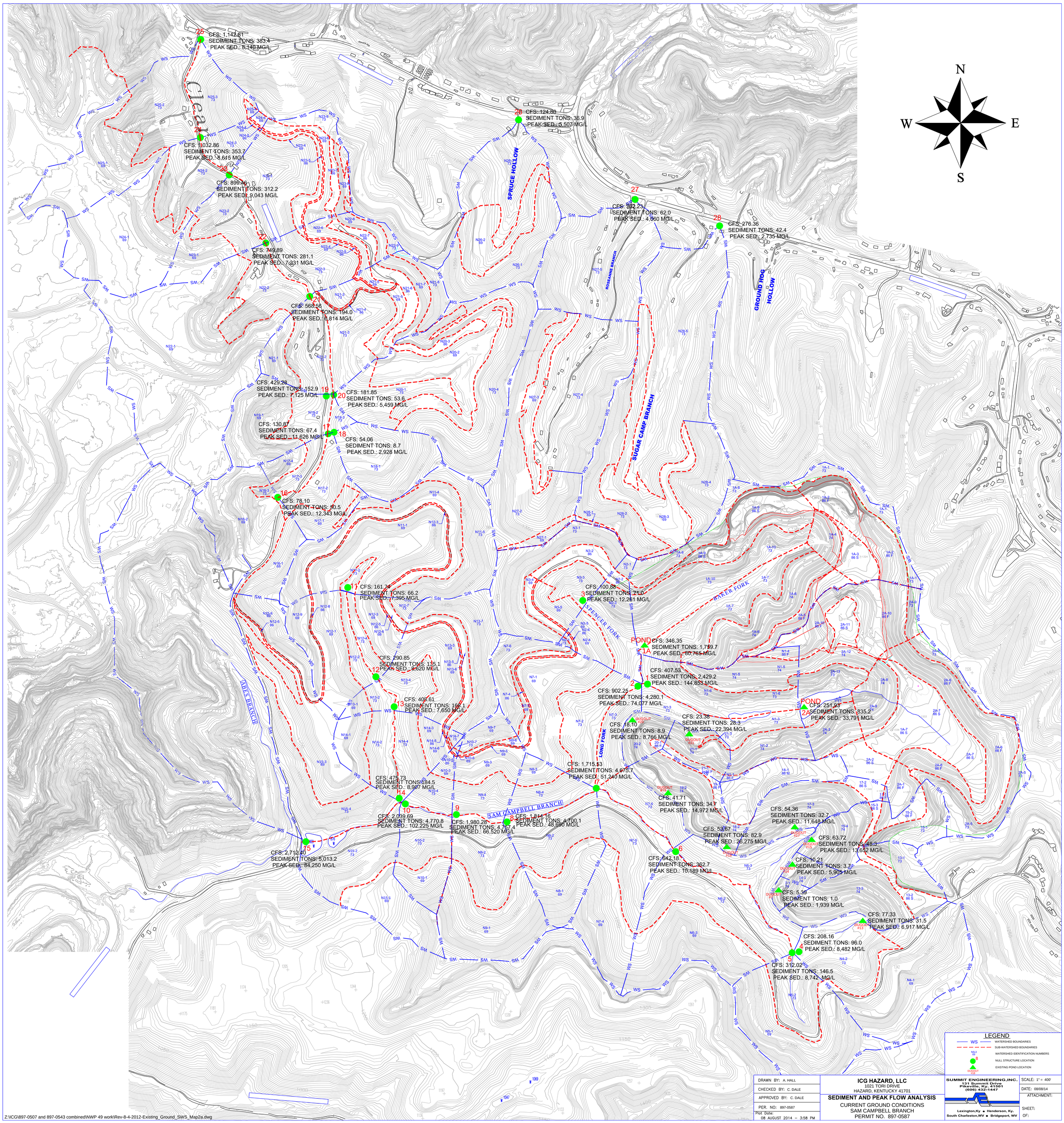
Signature and date of
Regulatory Project Manager
(REQUIRED)

Signature and date of
person requesting preliminary JD
(REQUIRED, unless obtaining
the signature is impracticable)

Site number	Latitude Beginning	Longitude Ending	Cowardin Class	Estimated amount of aquatic resource in review area	Class of aquatic resource
Drain 8	37.3435 83.2740	37.3398 83.2747	Riverine	1350 linear feet-Perennial	non-section 10 – non-wetland
	37.3398 83.2747	37.3394 83.2751	Riverine	195 linear feet-Intermittent	non-section 10 – non-wetland
	37.3394 83.2751	37.3387 83.2756	Riverine	315 linear feet-Ephemeral	non-section 10 – non-wetland
1L of Drain 8	37.3408 83.2745	37.3407 83.2740	Riverine	150 linear feet-Intermittent	non-section 10 – non-wetland
2L of Drain 8	37.3404 83.2746	37.3401 83.2739	Riverine	236 linear feet-Intermittent	non-section 10 – non-wetland
	37.3401 83.2739	37.3400 83.2738	Riverine	54 linear feet Ephemeral	non-section 10 – non-wetland
1R of 2L of Drain 8	37.3403 83.2743	37.3400 83.2741	Riverine	90 linear feet Ephemeral	non-section 10 – non-wetland

APPENDIX D

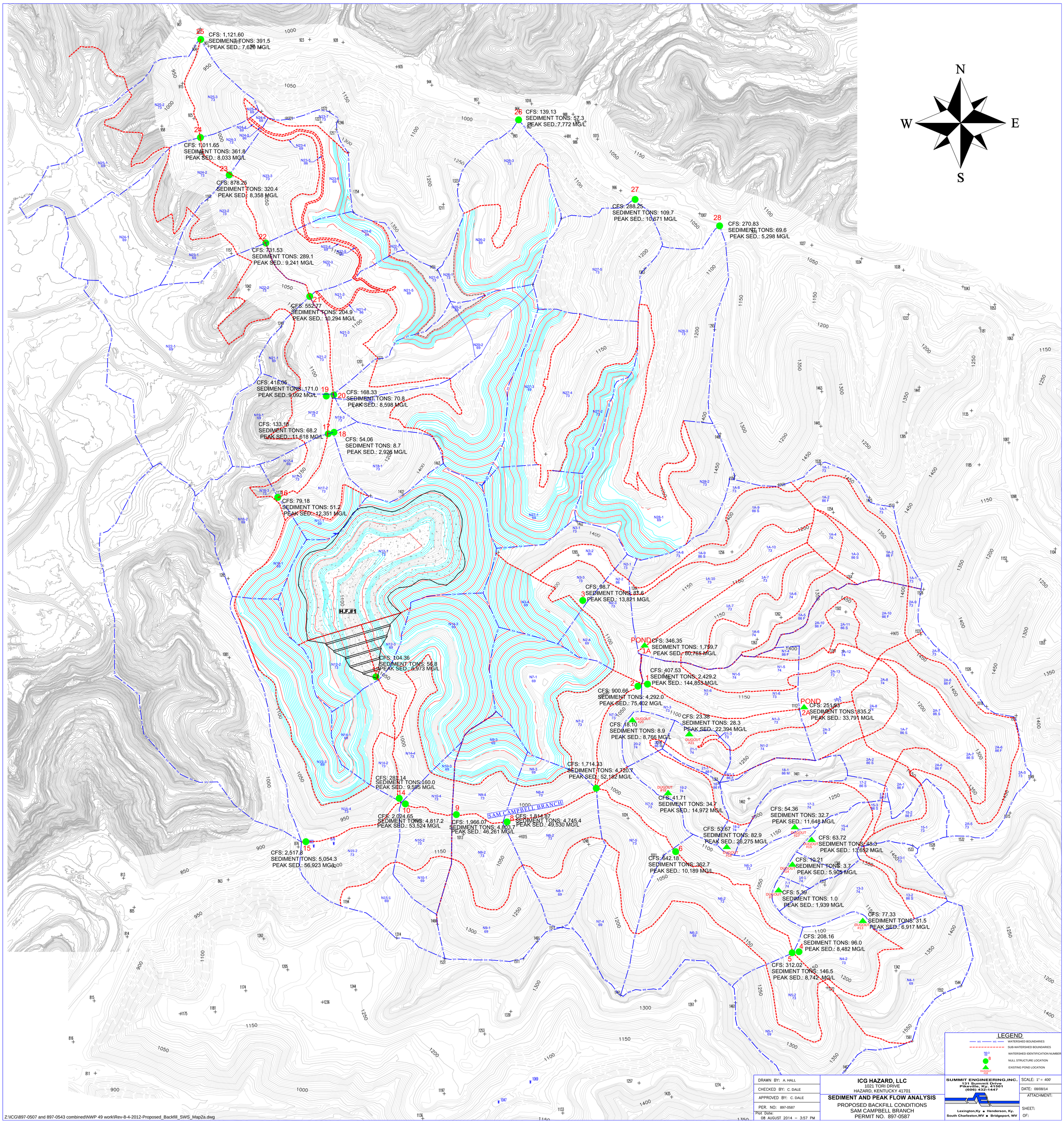
Sediment Load Calculation Exhibits



DRAWN BY: A. HALL	**ICG HAZARD, LLC** 1021 TORI DRIVE HAZARD, KENTUCKY 41701	**SUMMIT ENGINEERING, INC.** 131 Summit Drive Pikeville, Ky. 41501 (606) 432-1447
CHECKED BY: C. DALE		SCALE: 1" = 400'
APPROVED BY: C. DALE	**SEDIMENT AND PEAK FLOW ANALYSIS**	DATE: 08/08/14
PER. NO: 897-0587	CURRENT GROUND CONDITIONS SAM CAMPBELL BRANCH PERMIT NO. 897-0587	ATTACHMENT:
Plot Date: 08 AUGUST 2014 – 3:58 PM		SHEET:
		OF:

Lexington,Ky ● Henderson, Ky. South Charleston,WV ● Bridgeport, WV

Z:\ICG\897-0507 and 897-0543 combined\NWP 49 work\Rev-8-4-2012-Existing_Ground_SWS_Map2a.dwg



DRAWN BY: A. HALL	**ICG HAZARD, LLC** 1021 TORI DRIVE HAZARD, KENTUCKY 41701	**SUMMIT ENGINEERING,INC.** 131 Summit Drive Pikeville, KY. 41501 (606) 432-1447	SCALE: 1" = 400'
CHECKED BY: C. DALE			DATE: 08/08/14
APPROVED BY: C. DALE	**SEDIMENT AND PEAK FLOW ANALYSIS**		ATTACHMENT:
PER. NO: 897-0587	PROPOSED BACKFILL CONDITIONS SAM CAMPBELL BRANCH PERMIT NO. 897-0587	Lexington,Ky ● Henderson, Ky. South Charleston,WV ● Bridgeport, WV	SHEET: OF:
Plot Date: 08 AUGUST 2014 – 3:57 PM			

Z:\ICG\897-0507 and 897-0543 combined\NWP 49 work\Rev-8-4-2012-Proposed_Backfill_SWS_Map2a.dwg

Copyright 1998 -2010 Pamela J. Schwab

897-0587

Existing Area Sediment Load Sam Campbell Branch

Tyler Hall

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	25 yr - 24 hr
Rainfall Depth:	5.000 inches

Particle Size Distribution:

Size (mm)	Disturbed	Undisturbed
3.0000	100.000%	100.000%
2.0000	93.000%	99.900%
1.0000	86.000%	98.000%
0.5000	78.000%	92.000%
0.3000	73.000%	87.000%
0.2000	67.000%	80.000%
0.1000	55.000%	70.000%
0.0500	44.000%	60.000%
0.0300	35.000%	50.000%
0.0200	27.000%	42.000%
0.0100	18.000%	32.000%
0.0050	14.000%	21.000%
0.0030	9.000%	15.000%
0.0010	3.000%	4.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	#16	0.034	0.390	Pond 13
Pond	#3	==>	#18	0.060	0.443	Pond 7
Pond	#4	==>	#18	0.071	0.453	Pond 14
Pond	#5	==>	#18	0.043	0.459	Pond 15
Pond	#6	==>	#18	0.048	0.459	Pond 17
Pond	#7	==>	#18	0.068	0.413	Pond 18
Pond	#8	==>	#19	0.065	0.349	Pond 19
Null	#9	==>	#15	0.001	0.421	Null Structure 1
Pond	#10	==>	#9	0.055	0.430	Pond 20
Pond	#11	==>	#9	0.075	0.427	Pond 21
Pond	#12	==>	#9	0.029	0.460	Pond 2A
Pond	#13	==>	#15	0.007	0.454	Pond 1A
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Null	#15	==>	#19	0.034	0.440	Null Structure 2
Null	#16	==>	#17	0.001	0.421	Null Structure 4
Null	#17	==>	#18	0.074	0.444	Null Structure 5
Null	#18	==>	#19	0.031	0.442	Null Structure 6
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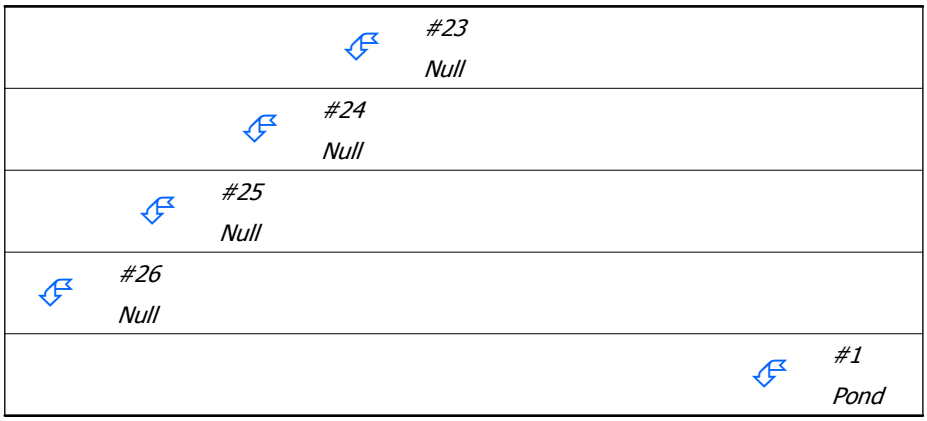

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		#21 *Null*					
	#22 *Null*						
#27 *Null*							

Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	4.00	30.00	750.00	6.00	0.034
#1	**Muskingum K:**					**0.034**
#3	1. Forest with heavy ground litter	45.00	90.00	200.00	1.69	0.032
	9. Small streams flowing bankfull	2.67	40.00	1,500.03	14.69	0.028
#3	**Muskingum K:**					**0.060**
#4	1. Forest with heavy ground litter	45.00	140.00	311.11	1.69	0.051
	9. Small streams flowing bankfull	4.83	70.00	1,450.02	19.77	0.020
#4	**Muskingum K:**					**0.071**
#5	1. Forest with heavy ground litter	45.00	45.00	100.00	1.69	0.016
	9. Small streams flowing bankfull	5.00	100.00	2,000.00	20.12	0.027
#5	**Muskingum K:**					**0.043**
#6	1. Forest with heavy ground litter	45.00	60.00	133.33	1.69	0.021
	9. Small streams flowing bankfull	5.00	100.00	2,000.00	20.12	0.027
#6	**Muskingum K:**					**0.048**
#7	1. Forest with heavy ground litter	45.00	150.00	333.33	1.69	0.054
	9. Small streams flowing bankfull	1.67	10.00	600.02	11.61	0.014
#7	**Muskingum K:**					**0.068**
#8	1. Forest with heavy ground litter	45.00	175.00	388.88	1.69	0.063
	9. Small streams flowing bankfull	2.00	2.00	100.00	12.72	0.002
#8	**Muskingum K:**					**0.065**
#9	9. Small streams flowing bankfull	1.00	0.50	50.00	9.00	0.001
#9	**Muskingum K:**					**0.001**
#10	1. Forest with heavy ground litter	45.00	130.00	288.88	1.69	0.047
	9. Small streams flowing bankfull	3.00	15.00	500.00	15.58	0.008
#10	**Muskingum K:**					**0.055**
#11	1. Forest with heavy ground litter	45.00	150.00	333.33	1.69	0.054
	9. Small streams flowing bankfull	2.00	20.00	1,000.00	12.72	0.021
#11	**Muskingum K:**					**0.075**
#12	9. Small streams flowing bankfull	4.76	100.00	2,100.00	19.63	0.029
#12	**Muskingum K:**					**0.029**
#13	9. Small streams flowing bankfull	3.50	15.00	428.57	16.83	0.007
#13	**Muskingum K:**					**0.007**
#14	9. Small streams flowing bankfull	5.93	80.00	1,350.00	21.90	0.017
#14	**Muskingum K:**					**0.017**
#15	9. Small streams flowing bankfull	1.94	30.00	1,550.06	12.52	0.034
#15	**Muskingum K:**					**0.034**
#16	9. Small streams flowing bankfull	1.00	0.50	50.00	9.00	0.001
#16	**Muskingum K:**					**0.001**
#17	9. Small streams flowing bankfull	2.22	80.00	3,600.03	13.41	0.074
#17	**Muskingum K:**					**0.074**

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#18	9. Small streams flowing bankfull	2.07	30.00	1,450.04	12.94	0.031
#18	**Muskingum K:**					**0.031**
#19	9. Small streams flowing bankfull	3.46	45.00	1,300.00	16.74	0.021
#19	**Muskingum K:**					**0.021**
#20	9. Small streams flowing bankfull	2.21	15.00	680.02	13.36	0.014
#20	**Muskingum K:**					**0.014**
#21	9. Small streams flowing bankfull	2.86	20.00	700.01	15.21	0.012
#21	**Muskingum K:**					**0.012**
#22	9. Small streams flowing bankfull	1.00	0.50	50.00	9.00	0.001
#22	**Muskingum K:**					**0.001**
#23	9. Small streams flowing bankfull	4.03	50.00	1,242.02	18.05	0.019
#23	**Muskingum K:**					**0.019**
#24	9. Small streams flowing bankfull	6.00	30.00	500.00	22.04	0.006
#24	**Muskingum K:**					**0.006**
#25	9. Small streams flowing bankfull	5.14	90.00	1,750.01	20.40	0.023
#25	**Muskingum K:**					**0.023**
#26	9. Small streams flowing bankfull	1.03	15.00	1,450.11	9.15	0.044
#26	**Muskingum K:**					**0.044**

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#23		72.800	72.800	161.74	12.72	66.2	7,395	4.63	2.39
#24		57.900	130.700	290.85	22.53	135.1	8,620	5.45	2.78
#25		50.400	181.100	408.61	31.61	168.1	7,650	4.81	2.45
#26		28.600	209.700	475.73	36.75	184.5	8,907	5.59	2.32
#1	In	32.100	32.100	84.34	6.69	163.6	33,111	21.13	11.36
	Out			77.33	6.69	31.5	6,917	0.37	0.19
#16		57.800	89.900	208.16	16.63	96.0	8,482	3.77	1.88
#17		46.300	136.200	312.02	24.51	146.5	8,742	4.46	2.24
#7	In	16.900	16.900	54.41	4.66	322.1	88,455	56.32	31.46
	Out			53.67	4.66	82.9	26,275	6.02	2.97
#6	In	20.940	20.940	55.16	4.37	117.7	37,181	23.78	12.52
	Out			54.36	4.37	32.7	11,648	3.25	1.53
#5	In	24.400	24.400	64.97	5.18	181.9	44,634	28.51	16.24
	Out			63.72	5.18	48.3	13,652	3.46	1.73
#4	In	4.300	4.300	10.88	0.85	25.0	40,738	26.05	13.74
	Out			10.21	0.85	3.7	5,905	0.01	0.00
#3	In	2.600	2.600	6.58	0.51	11.0	29,689	18.99	10.00
	Out			5.39	0.51	1.0	1,939	0.00	0.00
#18		71.000	276.340	642.18	52.84	362.7	10,189	4.09	2.03
#14		39.900	39.900	100.88	7.94	71.0	12,261	7.60	4.06
#13	In	140.800	140.800	384.91	31.49	7,297.0	276,843	176.99	99.27
	Out			346.35	31.49	1,759.7	80,765	16.46	8.43
#12	In	135.200	135.200	360.02	32.23	4,233.8	181,013	114.79	58.07
	Out			251.93	32.23	835.2	33,791	1.83	1.06
#11	In	8.900	8.900	23.77	1.90	115.5	76,638	49.01	27.93
	Out			23.38	1.90	28.3	22,394	4.77	2.32
#10	In	7.330	7.330	18.89	1.48	50.5	44,876	28.70	15.80
	Out			18.10	1.48	8.9	8,766	0.14	0.07
#9		50.700	202.130	407.53	45.56	2,429.2	144,853	58.79	15.84
#15		19.800	402.630	902.25	88.71	4,280.1	74,077	24.14	11.65
#8	In	16.800	16.800	44.03	3.48	171.1	62,876	40.21	22.65
	Out			41.71	3.48	34.7	14,972	1.42	0.71
#19		57.160	752.930	1,715.53	155.36	4,675.7	51,240	16.83	7.40
#20		42.100	795.030	1,814.16	162.91	4,700.1	48,690	16.07	7.13
#21		72.500	867.530	1,980.28	175.58	4,757.4	66,520	22.19	6.78
#22		25.200	892.730	2,039.69	180.12	4,770.8	102,225	34.19	6.65
#27		101.800	1,204.230	2,712.40	233.33	5,013.2	84,250	29.34	5.64

The 24 hour Arithmetic Average (24AA) is under review. It is anticipated that the 24AA will be replaced by the peak settleable solids concentration (ml/l) with the addition of new sediment input factor values.

The 24AA is provided for your convenience during this transition period.

		24AA (ml/l)
#23		0.66
#24		0.75
#25		0.67
#26		0.63
#1	In	3.13
	Out	0.05
#16		0.50
#17		0.57
#7	In	8.39
	Out	0.59
#6	In	3.23
	Out	0.28
#5	In	4.95
	Out	0.31
#4	In	3.33
	Out	0.00
#3	In	2.42
	Out	0.00
#18		0.52
#14		1.38
#13	In	31.04
	Out	2.27
#12	In	17.26
	Out	0.43
#11	In	8.55
	Out	0.43
#10	In	4.80
	Out	0.02
#9		5.35
#15		3.57
#8	In	7.31
	Out	0.18
#19		2.41
#20		2.35
#21		2.28
#22		2.25
#27		2.03

Particle Size Distribution(s) at Each Structure

Structure #23 (Null Structure 11):

Size (mm)	In/Out
3.0000	100.000%
2.0000	93.890%
1.0000	87.541%
0.5000	79.796%
0.3000	74.796%
0.2000	68.667%
0.1000	56.922%
0.0500	46.048%
0.0300	36.920%
0.0200	28.919%
0.0100	19.790%
0.0050	14.896%
0.0030	9.767%
0.0010	3.128%

Structure #24 (Null Structure 12):

Size (mm)	In/Out
3.0000	100.000%
2.0000	93.519%
1.0000	86.895%
0.5000	79.042%
0.3000	74.041%
0.2000	67.967%
0.1000	56.113%
0.0500	45.185%
0.0300	36.111%
0.0200	28.110%
0.0100	19.035%
0.0050	14.518%
0.0030	9.444%
0.0010	3.074%

Structure #25 (Null Structure 13):

Size (mm)	In/Out
3.0000	100.000%
2.0000	93.756%
1.0000	87.307%
0.5000	79.522%
0.3000	74.522%
0.2000	68.413%
0.1000	56.628%
0.0500	45.735%
0.0300	36.625%
0.0200	28.625%
0.0100	19.515%
0.0050	14.758%
0.0030	9.650%
0.0010	3.108%

Structure #26 (Null Structure 14):

Size (mm)	In/Out
3.0000	100.000%
2.0000	93.857%
1.0000	87.478%
0.5000	79.721%
0.3000	74.720%
0.2000	68.597%
0.1000	56.839%
0.0500	45.960%
0.0300	36.836%
0.0200	28.835%
0.0100	19.712%
0.0050	14.857%
0.0030	9.734%
0.0010	3.123%

Structure #1 (Pond 13):

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	93.095%	100.000%
1.0000	86.164%	100.000%
0.5000	78.192%	100.000%

Size (mm)	In	Out
0.3000	73.192%	100.000%
0.2000	67.178%	100.000%
0.1000	55.205%	100.000%
0.0500	44.219%	100.000%
0.0300	35.205%	100.000%
0.0200	27.205%	100.000%
0.0100	18.191%	94.588%
0.0050	14.096%	73.292%
0.0030	9.082%	47.223%
0.0010	3.014%	15.670%

Structure #16 (Null Structure 4):

Size (mm)	In/Out
3.0000	100.000%
2.0000	95.634%
1.0000	91.175%
0.5000	85.893%
0.3000	82.531%
0.2000	78.447%
0.1000	70.475%
0.0500	63.126%
0.0300	57.025%
0.0200	51.645%
0.0100	43.774%
0.0050	33.766%
0.0030	21.815%
0.0010	7.200%

Structure #17 (Null Structure 5):

Size (mm)	In/Out
3.0000	100.000%
2.0000	94.861%
1.0000	89.626%
0.5000	83.447%
0.3000	79.520%
0.2000	74.757%
0.1000	65.437%
0.0500	56.850%
0.0300	49.731%
0.0200	43.449%

Size (mm)	In/Out
0.0100	35.170%
0.0050	27.096%
0.0030	17.518%
0.0010	5.773%

Structure #7 (Pond 18):

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	93.190%	100.000%
1.0000	86.329%	100.000%
0.5000	78.384%	100.000%
0.3000	73.384%	100.000%
0.2000	67.356%	100.000%
0.1000	55.411%	100.000%
0.0500	44.438%	100.000%
0.0300	35.410%	100.000%
0.0200	27.410%	100.000%
0.0100	18.383%	71.477%
0.0050	14.191%	55.180%
0.0030	9.164%	35.632%
0.0010	3.027%	11.771%

Structure #6 (Pond 17):

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	93.001%	100.000%
1.0000	86.001%	100.000%
0.5000	78.001%	100.000%
0.3000	73.001%	100.000%
0.2000	67.001%	100.000%
0.1000	55.001%	100.000%
0.0500	44.000%	100.000%
0.0300	35.000%	100.000%
0.0200	27.000%	97.318%
0.0100	18.000%	64.878%
0.0050	14.000%	50.461%
0.0030	9.000%	32.439%
0.0010	3.000%	10.813%

Structure #5 (Pond 15):

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	93.050%	100.000%
1.0000	86.084%	100.000%
0.5000	78.097%	100.000%
0.3000	73.097%	100.000%
0.2000	67.090%	100.000%
0.1000	55.103%	100.000%
0.0500	44.109%	100.000%
0.0300	35.102%	100.000%
0.0200	27.102%	100.000%
0.0100	18.095%	68.170%
0.0050	14.048%	52.923%
0.0030	9.041%	34.060%
0.0010	3.007%	11.328%

Structure #4 (Pond 14):

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	93.000%	100.000%
1.0000	86.000%	100.000%
0.5000	78.000%	100.000%
0.3000	73.000%	100.000%
0.2000	67.000%	100.000%
0.1000	55.000%	100.000%
0.0500	44.000%	100.000%
0.0300	35.000%	100.000%
0.0200	27.000%	100.000%
0.0100	18.000%	100.000%
0.0050	14.000%	94.911%
0.0030	9.000%	61.015%
0.0010	3.000%	20.338%

Structure #3 (Pond 7):

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	93.000%	100.000%
1.0000	86.000%	100.000%
0.5000	78.000%	100.000%

Size (mm)	In	Out
0.3000	73.000%	100.000%
0.2000	67.000%	100.000%
0.1000	55.000%	100.000%
0.0500	44.000%	100.000%
0.0300	35.000%	100.000%
0.0200	27.000%	100.000%
0.0100	18.000%	100.000%
0.0050	14.000%	100.000%
0.0030	9.000%	98.105%
0.0010	3.000%	32.702%

Structure #18 (Null Structure 6):

Size (mm)	In/Out
3.0000	100.000%
2.0000	97.233%
1.0000	94.360%
0.5000	90.875%
0.3000	88.631%
0.2000	85.885%
0.1000	80.604%
0.0500	75.719%
0.0300	71.626%
0.0200	67.795%
0.0100	49.565%
0.0050	38.450%
0.0030	24.942%
0.0010	8.227%

Structure #14 (Null Structure 3):

Size (mm)	In/Out
3.0000	100.000%
2.0000	94.375%
1.0000	88.389%
0.5000	80.786%
0.3000	75.786%
0.2000	69.587%
0.1000	57.984%
0.0500	47.183%
0.0300	37.984%
0.0200	29.983%

Size (mm)	In/Out
0.0100	20.784%
0.0050	15.392%
0.0030	10.193%
0.0010	3.199%

Structure #13 (Pond 1A):

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	93.022%	100.000%
1.0000	86.031%	100.000%
0.5000	78.034%	100.000%
0.3000	73.033%	100.000%
0.2000	67.031%	100.000%
0.1000	55.033%	100.000%
0.0500	44.034%	100.000%
0.0300	35.031%	100.000%
0.0200	27.031%	100.000%
0.0100	18.028%	74.758%
0.0050	14.014%	58.115%
0.0030	9.012%	37.371%
0.0010	3.002%	12.449%

Structure #12 (Pond 2A):

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	93.618%	100.000%
1.0000	87.209%	100.000%
0.5000	79.880%	100.000%
0.3000	75.298%	100.000%
0.2000	69.360%	100.000%
0.1000	56.943%	100.000%
0.0500	45.559%	100.000%
0.0300	36.243%	100.000%
0.0200	27.963%	100.000%
0.0100	18.647%	94.519%
0.0050	14.498%	73.491%
0.0030	9.322%	47.254%
0.0010	3.106%	15.745%

Structure #11 (Pond 21):

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	93.009%	100.000%
1.0000	86.010%	100.000%
0.5000	78.010%	100.000%
0.3000	73.010%	100.000%
0.2000	67.009%	100.000%
0.1000	55.009%	100.000%
0.0500	44.008%	100.000%
0.0300	35.007%	100.000%
0.0200	27.007%	100.000%
0.0100	18.006%	73.567%
0.0050	14.003%	57.214%
0.0030	9.003%	36.782%
0.0010	3.001%	12.260%

Structure #10 (Pond 20):

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	93.003%	100.000%
1.0000	86.003%	100.000%
0.5000	78.002%	100.000%
0.3000	73.002%	100.000%
0.2000	67.002%	100.000%
0.1000	55.002%	100.000%
0.0500	44.001%	100.000%
0.0300	35.001%	100.000%
0.0200	27.001%	100.000%
0.0100	18.001%	100.000%
0.0050	14.000%	79.783%
0.0030	9.000%	51.289%
0.0010	3.000%	17.096%

Structure #9 (Null Structure 1):

Size (mm)	In/Out
3.0000	100.000%
2.0000	97.324%
1.0000	94.173%
0.5000	89.570%

Size (mm)	In/Out
0.3000	86.365%
0.2000	82.258%
0.1000	75.090%
0.0500	68.302%
0.0300	62.272%
0.0200	57.144%
0.0100	48.924%
0.0050	37.033%
0.0030	24.203%
0.0010	7.804%

Structure #15 (Null Structure 2):

Size (mm)	In/Out
3.0000	100.000%
2.0000	98.362%
1.0000	96.448%
0.5000	93.673%
0.3000	91.748%
0.2000	89.284%
0.1000	84.969%
0.0500	80.886%
0.0300	77.267%
0.0200	74.186%
0.0100	58.948%
0.0050	45.240%
0.0030	29.319%
0.0010	9.616%

Structure #8 (Pond 19):

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	93.005%	100.000%
1.0000	86.005%	100.000%
0.5000	78.004%	100.000%
0.3000	73.004%	100.000%
0.2000	67.004%	100.000%
0.1000	55.003%	100.000%
0.0500	44.003%	100.000%
0.0300	35.002%	100.000%
0.0200	27.002%	100.000%

Size (mm)	In	Out
0.0100	18.001%	88.722%
0.0050	14.001%	69.006%
0.0030	9.001%	44.361%
0.0010	3.000%	14.787%

Structure #19 (Null Structure 7):

Size (mm)	In/Out
3.0000	100.000%
2.0000	99.051%
1.0000	97.028%
0.5000	94.159%
0.3000	92.183%
0.2000	89.666%
0.1000	85.215%
0.0500	81.014%
0.0300	77.312%
0.0200	74.132%
0.0100	58.625%
0.0050	45.027%
0.0030	29.182%
0.0010	9.575%

Structure #20 (Null Structure 8):

Size (mm)	In/Out
3.0000	100.000%
2.0000	99.033%
1.0000	96.991%
0.5000	94.096%
0.3000	92.104%
0.2000	89.568%
0.1000	85.080%
0.0500	80.844%
0.0300	77.113%
0.0200	73.907%
0.0100	58.433%
0.0050	44.876%
0.0030	29.085%
0.0010	9.542%

Structure #21 (Null Structure 9):

Size (mm)	In/Out
3.0000	100.000%
2.0000	98.969%
1.0000	96.871%
0.5000	93.916%
0.3000	91.888%
0.2000	89.309%
0.1000	84.732%
0.0500	80.415%
0.0300	76.619%
0.0200	73.356%
0.0100	57.958%
0.0050	44.510%
0.0030	28.849%
0.0010	9.464%

Structure #22 (Null Structure 10):

Size (mm)	In/Out
3.0000	100.000%
2.0000	98.960%
1.0000	96.852%
0.5000	93.884%
0.3000	91.848%
0.2000	89.258%
0.1000	84.661%
0.0500	80.326%
0.0300	76.514%
0.0200	73.237%
0.0100	57.857%
0.0050	44.430%
0.0030	28.797%
0.0010	9.447%

Structure #27:

Size (mm)	In/Out
3.0000	100.000%
2.0000	98.749%
1.0000	96.467%
0.5000	93.301%

Size (mm)	In/Out
0.3000	91.139%
0.2000	88.399%
0.1000	83.443%
0.0500	78.771%
0.0300	74.684%
0.0200	71.163%
0.0100	56.066%
0.0050	43.037%
0.0030	27.901%
0.0010	9.148%

Structure Detail:

Structure #23 (Null)

Null Structure 11

Structure #24 (Null)

Null Structure 12

Structure #25 (Null)

Null Structure 13

Structure #26 (Null)

Null Structure 14

Structure #1 (Pond)

Pond 13

Pond Inputs:

Initial Pool Elev:	1,098.50 ft
Initial Pool:	0.69 ac-ft
*Sediment Storage:	4.66 ac-ft
Dead Space:	0.00 %

**Sediment capacity was entered by user*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
1,098.50	6.00	2.00:1	2.00:1	15.00

Pond Results:

Peak Elevation:	1,099.86 ft
H'graph Detention Time:	0.38 hrs
Pond Model:	CSTRS
Dewater Time:	0.63 days
Trap Efficiency:	80.77 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
1,097.50	0.669	0.000	0.000		Top of Sed. Storage
1,098.00	0.690	0.339	0.000		
1,098.50	0.711	0.690	0.000		Spillway #1
1,099.00	0.733	1.051	7.738	14.10	
1,099.50	0.755	1.422	44.878	1.00	
1,099.86	0.771	1.695	77.332	0.10	Peak Stage
1,100.00	0.777	1.805	90.497		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
1,097.50	0.000	0.000
1,098.00	0.000	0.000
1,098.50	0.000	0.000
1,099.00	7.738	7.738
1,099.50	44.878	44.878
1,100.00	90.497	90.497

Structure #16 (Null)

Null Structure 4

Structure #17 (Null)

Null Structure 5

Structure #7 (Pond)

Pond 18

Pond Inputs:

Initial Pool Elev:	1,123.50 ft
Initial Pool:	0.17 ac-ft
*Sediment Storage:	0.61 ac-ft
Dead Space:	0.00 %

**Sediment capacity was entered by user*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
1,123.50	10.00	2.00:1	2.00:1	9.00

Pond Results:

Peak Elevation:	1,124.96 ft
H'graph Detention Time:	0.26 hrs
Pond Model:	CSTRS
Dewater Time:	0.63 days
Trap Efficiency:	74.28 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
1,122.50	0.157	0.000	0.000		Top of Sed. Storage
1,123.00	0.166	0.081	0.000		
1,123.50	0.176	0.166	0.000		Spillway #1
1,124.00	0.186	0.257	1.880	11.40	
1,124.50	0.196	0.352	25.996	3.55	
1,124.96	0.206	0.446	53.669	0.05	Peak Stage
1,125.00	0.207	0.453	55.858		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
1,122.50	0.000	0.000
1,123.00	0.000	0.000
1,123.50	0.000	0.000
1,124.00	1.880	1.880
1,124.50	25.996	25.996
1,125.00	55.858	55.858

Structure #6 (Pond)

Pond 17

Pond Inputs:

Initial Pool Elev:	1,118.50 ft
Initial Pool:	0.10 ac-ft
*Sediment Storage:	0.44 ac-ft
Dead Space:	0.00 %

**Sediment capacity was entered by user*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
1,118.50	10.00	2.00:1	2.00:1	9.00

Pond Results:

Peak Elevation:	1,119.97 ft
H'graph Detention Time:	0.16 hrs
Pond Model:	CSTRS
Dewater Time:	0.58 days
Trap Efficiency:	72.26 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
1,117.50	0.098	0.000	0.000		Top of Sed. Storage
1,117.50	0.098	0.000	0.000		
1,118.00	0.102	0.050	0.000		
1,118.50	0.105	0.102	0.000		Spillway #1
1,119.00	0.109	0.156	1.880	9.25	
1,119.50	0.113	0.211	25.996	4.50	
1,119.97	0.117	0.266	54.359	0.05	Peak Stage
1,120.00	0.117	0.269	55.858		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
1,117.50	0.000	0.000
1,117.50	0.000	0.000
1,118.00	0.000	0.000
1,118.50	0.000	0.000
1,119.00	1.880	1.880
1,119.50	25.996	25.996
1,120.00	55.858	55.858

Structure #5 (Pond)

Pond 15

Pond Inputs:

Initial Pool Elev:	1,118.50 ft
Initial Pool:	0.15 ac-ft
*Sediment Storage:	0.70 ac-ft
Dead Space:	0.00 %

**Sediment capacity was entered by user*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
1,118.50	15.00	2.00:1	2.00:1	12.00

Pond Results:

Peak Elevation:	1,119.95 ft
H'graph Detention Time:	0.20 hrs
Pond Model:	CSTRS
Dewater Time:	0.60 days
Trap Efficiency:	73.46 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
1,117.50	0.146	0.000	0.000		Top of Sed. Storage
1,118.00	0.154	0.074	0.000		
1,118.50	0.162	0.153	0.000		Spillway #1
1,119.00	0.171	0.237	2.339	10.70	
1,119.50	0.180	0.324	31.829	3.55	
1,119.95	0.188	0.408	63.719	0.05	Peak Stage
1,120.00	0.189	0.417	67.042		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
1,117.50	0.000	0.000
1,118.00	0.000	0.000
1,118.50	0.000	0.000
1,119.00	2.339	2.339
1,119.50	31.829	31.829
1,120.00	67.042	67.042

Structure #4 (Pond)

Pond 14

Pond Inputs:

Initial Pool Elev:	1,118.50 ft
Initial Pool:	0.18 ac-ft
*Sediment Storage:	0.58 ac-ft
Dead Space:	0.00 %

**Sediment capacity was entered by user*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
1,118.50	10.00	2.00:1	2.00:1	6.00

Pond Results:

Peak Elevation:	1,119.26 ft
H'graph Detention Time:	0.65 hrs
Pond Model:	CSTRS
Dewater Time:	0.64 days
Trap Efficiency:	85.25 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
1,117.50	0.164	0.000	0.000		Top of Sed. Storage
1,117.50	0.164	0.000	0.000		
1,118.00	0.176	0.085	0.000		
1,118.50	0.188	0.176	0.000		Spillway #1

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
1,119.00	0.202	0.274	1.268	14.75	
1,119.26	0.209	0.328	10.208	0.65	Peak Stage
1,119.50	0.215	0.378	18.368		
1,120.00	0.229	0.489	40.598		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
1,117.50	0.000	0.000
1,117.50	0.000	0.000
1,118.00	0.000	0.000
1,118.50	0.000	0.000
1,119.00	1.268	1.268
1,119.50	18.368	18.368
1,120.00	40.598	40.598

Structure #3 (Pond)

Pond 7

Pond Inputs:

Initial Pool Elev:	1,118.50 ft
Initial Pool:	0.23 ac-ft
*Sediment Storage:	0.92 ac-ft
Dead Space:	0.00 %

**Sediment capacity was entered by user*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
1,118.50	10.00	2.00:1	2.00:1	6.00

Pond Results:

Peak Elevation:	1,119.12 ft
H'graph Detention Time:	1.02 hrs
Pond Model:	CSTRS
Dewater Time:	0.66 days
Trap Efficiency:	90.83 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
1,117.50	0.219	0.000	0.000		Top of Sed. Storage
1,118.00	0.229	0.112	0.000		
1,118.50	0.240	0.229	0.000		Spillway #1
1,119.00	0.251	0.351	1.268	15.25	
1,119.12	0.253	0.382	5.389	0.50	Peak Stage
1,119.50	0.262	0.479	18.368		
1,120.00	0.273	0.613	40.598		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
1,117.50	0.000	0.000
1,118.00	0.000	0.000
1,118.50	0.000	0.000
1,119.00	1.268	1.268
1,119.50	18.368	18.368
1,120.00	40.598	40.598

Structure #18 (Null)

Null Structure 6

Structure #14 (Null)

Null Structure 3

Structure #13 (Pond)

Pond 1A

Pond Inputs:

Initial Pool Elev:	1,020.67 ft
Initial Pool:	0.69 ac-ft
*Sediment Storage:	2.29 ac-ft
Dead Space:	0.00 %

**Sediment capacity was entered by user*

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
24.00	80.00	1.50	0.0200	1,020.67	0.90	0.00

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
1,025.65	30.00	2.00:1	2.00:1	9.00

Pond Results:

Peak Elevation:	1,029.69 ft
H'graph Detention Time:	0.89 hrs
Pond Model:	CSTRS
Dewater Time:	1.04 days
Trap Efficiency:	75.88 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
1,019.17	0.419	0.000	0.000		Top of Sed. Storage
1,019.35	0.428	0.076	0.000		
1,019.85	0.454	0.297	0.000		
1,020.35	0.481	0.531	0.000		
1,020.67	0.499	0.688	0.000		Spillway #1
1,020.85	0.509	0.778	0.566	9.20	
1,021.35	0.537	1.040	2.353	2.50	
1,021.85	0.567	1.316	5.373	0.90	
1,022.35	0.597	1.607	9.123	4.40	
1,022.85	0.627	1.913	13.480	1.80	
1,023.35	0.659	2.234	17.378	0.90	
1,023.85	0.691	2.572	19.938	0.65	
1,024.35	0.724	2.926	21.775	0.60	
1,024.85	0.758	3.296	23.428	0.55	
1,025.35	0.793	3.684	24.978	0.65	
1,025.65	0.814	3.925	25.854	0.50	Spillway #2
1,025.85	0.828	4.089	29.455	0.35	
1,026.35	0.865	4.513	38.367	0.70	
1,026.85	0.902	4.954	59.569	0.45	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
1,027.35	0.939	5.414	89.635	0.25	
1,027.85	0.978	5.894	126.600	0.25	
1,028.35	1.017	6.392	174.322	0.05	
1,028.85	1.057	6.911	232.787	0.05	
1,029.35	1.098	7.450	301.376	0.05	
1,029.69	1.126	7.828	346.350	0.05	Peak Stage
1,029.70	1.127	7.839	347.642		

Detailed Discharge Table

Elevation (ft)	Straight Pipe (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
1,019.17	0.000	0.000	0.000
1,019.35	0.000	0.000	0.000
1,019.85	0.000	0.000	0.000
1,020.35	0.000	0.000	0.000
1,020.67	0.000	0.000	0.000
1,020.85	(3)>0.566	0.000	0.566
1,021.35	(3)>2.353	0.000	2.353
1,021.85	(3)>5.373	0.000	5.373
1,022.35	(3)>9.123	0.000	9.123
1,022.85	(3)>13.480	0.000	13.480
1,023.35	(5)>17.378	0.000	17.378
1,023.85	(6)>19.938	0.000	19.938
1,024.35	(6)>21.775	0.000	21.775
1,024.85	(6)>23.428	0.000	23.428
1,025.35	(6)>24.978	0.000	24.978
1,025.65	(6)>25.854	0.000	25.854
1,025.85	(6)>26.437	3.018	29.455
1,026.35	(6)>27.802	10.565	38.367
1,026.85	(6)>29.118	30.451	59.569
1,027.35	(6)>30.380	59.254	89.635
1,027.85	(6)>31.576	95.023	126.600
1,028.35	(6)>32.749	141.573	174.322
1,028.85	(6)>33.860	198.926	232.787
1,029.35	(6)>34.951	266.425	301.376
1,029.70	(6)>35.686	311.956	347.642

Structure #12 (Pond)

Pond 2A

Pond Inputs:

Initial Pool Elev:	1,101.14 ft
Initial Pool:	2.74 ac-ft
*Sediment Storage:	5.16 ac-ft
Dead Space:	0.00 %

**Sediment capacity was entered by user*

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
24.00	50.00	1.00	0.0240	1,101.14	0.90	0.00

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
1,102.97	15.00	2.00:1	2.00:1	15.00

Pond Results:

Peak Elevation:	1,105.67 ft
H'graph Detention Time:	2.18 hrs
Pond Model:	CSTRS
Dewater Time:	1.47 days
Trap Efficiency:	80.27 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
1,099.50	1.439	0.000	0.000		Top of Sed. Storage
1,099.50	1.439	0.000	0.000		
1,100.00	1.575	0.753	0.000		
1,100.50	1.718	1.577	0.000		
1,101.00	1.867	2.473	0.000		
1,101.14	1.910	2.737	0.000		Spillway #1
1,101.50	1.932	3.429	3.111	17.30	
1,102.00	1.964	4.403	4.814	3.00	
1,102.50	1.995	5.393	6.212	2.20	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
1,102.97	2.025	6.337	9.167	4.45	Spillway #2
1,103.00	2.027	6.398	9.583	0.30	
1,103.50	2.059	7.419	16.487	4.70	
1,104.00	2.091	8.457	55.266	2.40	
1,104.50	2.124	9.511	100.022	0.45	
1,105.00	2.156	10.581	156.693	0.25	
1,105.50	2.189	11.667	225.068	0.20	
1,105.67	2.201	12.037	251.932	0.10	Peak Stage
1,106.00	2.223	12.770	305.208		
1,106.50	2.256	13.890	397.294		
1,107.00	2.290	15.026	501.567		

Detailed Discharge Table

Elevation (ft)	Straight Pipe (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
1,099.50	0.000	0.000	0.000
1,099.50	0.000	0.000	0.000
1,100.00	0.000	0.000	0.000
1,100.50	0.000	0.000	0.000
1,101.00	0.000	0.000	0.000
1,101.14	0.000	0.000	0.000
1,101.50	(1)>3.111	0.000	3.111
1,102.00	(1)>4.814	0.000	4.814
1,102.50	(1)>6.212	0.000	6.212
1,102.97	(1)>9.167	0.000	9.167
1,103.00	(1)>9.418	0.165	9.583
1,103.50	(1)>13.574	2.913	16.487
1,104.00	(6)>16.182	39.083	55.266
1,104.50	(6)>18.476	81.546	100.022
1,105.00	(6)>20.506	136.186	156.693
1,105.50	(6)>22.345	202.723	225.068
1,106.00	(6)>24.042	281.166	305.208
1,106.50	(6)>25.630	371.664	397.294
1,107.00	(6)>27.133	474.434	501.567

Structure #11 (Pond)

Pond 21

Pond Inputs:

Initial Pool Elev:	1,143.50 ft
Initial Pool:	0.10 ac-ft
*Sediment Storage:	0.29 ac-ft
Dead Space:	0.00 %

**Sediment capacity was entered by user*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
1,143.50	15.00	2.00:1	2.00:1	9.00

Pond Results:

Peak Elevation:	1,144.47 ft
H'graph Detention Time:	0.20 hrs
Pond Model:	CSTRS
Dewater Time:	0.56 days
Trap Efficiency:	75.52 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
1,142.49	0.092	0.000	0.000		Top of Sed. Storage
1,142.50	0.092	0.000	0.000		
1,143.00	0.095	0.047	0.000		
1,143.50	0.098	0.096	0.000		Spillway #1
1,144.00	0.101	0.145	1.764	12.00	
1,144.47	0.104	0.194	23.384	1.50	Peak Stage
1,144.50	0.104	0.197	24.578		
1,145.00	0.107	0.249	52.555		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
1,142.49	0.000	0.000
1,142.50	0.000	0.000
1,143.00	0.000	0.000
1,143.50	0.000	0.000

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
1,144.00	1.764	1.764
1,144.50	24.578	24.578
1,145.00	52.555	52.555

Structure #10 (Pond)

Pond 20

Pond Inputs:

Initial Pool Elev:	1,138.50 ft
Initial Pool:	0.22 ac-ft
*Sediment Storage:	1.03 ac-ft
Dead Space:	0.00 %

**Sediment capacity was entered by user*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
1,138.50	10.00	2.00:1	2.00:1	9.00

Pond Results:

Peak Elevation:	1,139.34 ft
H'graph Detention Time:	0.48 hrs
Pond Model:	CSTRS
Dewater Time:	0.63 days
Trap Efficiency:	82.45 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
1,137.50	0.216	0.000	0.000		Top of Sed. Storage
1,138.00	0.221	0.109	0.000		
1,138.50	0.227	0.221	0.000		Spillway #1
1,139.00	0.232	0.336	1.880	14.10	
1,139.34	0.236	0.415	18.097	1.00	Peak Stage
1,139.50	0.238	0.454	25.996		
1,140.00	0.244	0.574	55.858		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
1,137.50	0.000	0.000
1,138.00	0.000	0.000
1,138.50	0.000	0.000
1,139.00	1.880	1.880
1,139.50	25.996	25.996
1,140.00	55.858	55.858

Structure #9 (Null)

Null Structure 1

Structure #15 (Null)

Null Structure 2

Structure #8 (Pond)

Pond 19

Pond Inputs:

Initial Pool Elev:	1,133.50 ft
Initial Pool:	0.31 ac-ft
*Sediment Storage:	0.99 ac-ft
Dead Space:	0.00 %

**Sediment capacity was entered by user*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
1,133.50	15.00	2.00:1	2.00:1	9.00

Pond Results:

Peak Elevation:	1,134.81 ft
H'graph Detention Time:	0.55 hrs
Pond Model:	CSTRS
Dewater Time:	0.74 days
Trap Efficiency:	79.71 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
1,132.50	0.307	0.000	0.000		Top of Sed. Storage
1,132.50	0.307	0.000	0.000		
1,133.00	0.314	0.155	0.000		
1,133.50	0.322	0.315	0.000		Spillway #1
1,134.00	0.330	0.477	1.764	14.10	
1,134.50	0.337	0.644	24.578	3.50	
1,134.81	0.342	0.749	41.711	0.05	Peak Stage
1,135.00	0.345	0.815	52.555		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
1,132.50	0.000	0.000
1,132.50	0.000	0.000
1,133.00	0.000	0.000
1,133.50	0.000	0.000
1,134.00	1.764	1.764
1,134.50	24.578	24.578
1,135.00	52.555	52.555

Structure #19 (Null)

Null Structure 7

Structure #20 (Null)

Null Structure 8

Structure #21 (Null)

Null Structure 9

Structure #22 (Null)

Null Structure 10

Structure #27 (Null)

Null Structure 15

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#23	1	28.400	0.039	0.004	0.470	69.000	S	61.48	4.627
	2	1.700	0.005	0.000	0.000	73.000	S	4.18	0.323
	3	1.900	0.017	0.043	0.453	86.000	F	6.33	0.548
	4	19.500	0.019	0.062	0.448	69.000	S	42.21	3.177
	5	21.300	0.055	0.064	0.443	73.000	S	52.34	4.044
	Σ	**72.800**						**161.74**	**12.719**
#24	1	13.100	0.018	0.019	0.459	69.000	S	28.36	2.134
	2	4.100	0.019	0.000	0.000	73.000	S	10.08	0.778
	3	7.000	0.015	0.020	0.458	69.000	S	15.15	1.140
	4	3.900	0.020	0.000	0.000	73.000	S	9.58	0.740
	5	0.300	0.025	0.035	0.452	86.000	F	1.00	0.086
	6	1.200	0.011	0.086	0.408	69.000	S	2.60	0.195
	7	1.600	0.053	0.032	0.473	73.000	S	3.93	0.304
	8	0.700	0.017	0.037	0.452	86.000	F	2.33	0.201
	9	26.000	0.013	0.037	0.471	69.000	S	56.28	4.236
	Σ	**130.700**						**290.85**	**22.534**
#25	1	1.800	0.036	0.018	0.443	69.000	S	3.90	0.293
	2	2.400	0.018	0.000	0.000	73.000	S	5.90	0.455
	3	15.000	0.020	0.018	0.443	69.000	S	32.47	2.444
	4	7.200	0.018	0.000	0.000	73.000	S	17.69	1.367
	5	0.900	0.017	0.038	0.432	86.000	F	3.00	0.259
	6	4.900	0.007	0.055	0.431	69.000	S	10.61	0.798
	7	18.200	0.063	0.034	0.443	73.000	S	44.72	3.455
	Σ	**181.100**						**408.61**	**31.606**
#26	1	6.900	0.029	0.012	0.468	69.000	S	14.94	1.124
	2	8.300	0.012	0.000	0.000	73.000	S	20.40	1.576
	3	4.100	0.012	0.011	0.468	69.000	S	8.88	0.668
	4	8.300	0.011	0.000	0.000	73.000	S	20.40	1.576
	5	0.200	0.017	0.023	0.463	86.000	F	0.67	0.056
	6	0.200	0.012	0.038	0.463	69.000	S	0.43	0.029
	7	0.600	0.028	0.056	0.444	73.000	S	1.47	0.114
	Σ	**209.700**						**475.73**	**36.749**
#1	1	7.800	0.066	0.014	0.452	73.000	S	19.17	1.481
	2	4.600	0.004	0.010	0.455	86.000	F	15.33	1.328
	3	19.700	0.010	0.000	0.000	74.000	S	49.84	3.877

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	Σ	**32.100**						**84.34**	**6.686**
#16	1	38.300	0.053	0.026	0.453	69.000	S	82.91	6.240
	2	19.500	0.026	0.000	0.000	73.000	S	47.92	3.702
	Σ	**89.900**						**208.16**	**16.628**
#17	1	33.900	0.031	0.014	0.469	69.000	S	73.39	5.523
	2	12.400	0.014	0.000	0.000	73.000	S	30.47	2.354
	Σ	**136.200**						**312.02**	**24.505**
#7	1	14.500	0.102	0.005	0.459	86.000	S	48.34	4.186
	2	2.400	0.005	0.000	0.000	74.000	M	6.07	0.472
	Σ	**16.900**						**54.41**	**4.658**
#6	1	0.240	0.003	0.069	0.436	86.000	F	0.80	0.068
	2	2.500	0.053	0.016	0.451	86.000	S	8.33	0.722
	3	18.200	0.016	0.000	0.000	74.000	M	46.04	3.582
	Σ	**20.940**						**55.16**	**4.372**
#5	1	8.500	0.064	0.040	0.440	73.000	S	20.89	1.614
	2	3.500	0.018	0.022	0.447	86.000	F	11.67	1.010
	3	1.300	0.004	0.018	0.450	86.000	S	4.33	0.375
	4	11.100	0.018	0.000	0.000	74.000	M	28.08	2.185
	Σ	**24.400**						**64.97**	**5.183**
#4	1	4.300	0.030	0.000	0.000	74.000	M	10.88	0.846
	Σ	**4.300**						**10.88**	**0.846**
#3	1	2.600	0.030	0.000	0.000	74.000	M	6.58	0.512
	Σ	**2.600**						**6.58**	**0.512**
#18	1	26.500	0.022	0.030	0.454	69.000	S	57.37	4.318
	2	25.500	0.030	0.000	0.000	73.000	S	62.66	4.841
	3	19.000	0.048	0.000	0.000	73.000	S	46.69	3.607
	Σ	**276.340**						**642.18**	**52.842**
#14	1	21.000	0.046	0.037	0.442	73.000	S	51.60	3.987
	2	5.500	0.028	0.009	0.453	86.000	F	18.33	1.588
	3	6.600	0.009	0.000	0.000	73.000	S	16.22	1.253
	4	2.300	0.010	0.007	0.460	69.000	S	4.98	0.375
	5	4.500	0.007	0.000	0.000	69.000	S	9.74	0.733
	Σ	**39.900**						**100.88**	**7.935**
#13	1	16.200	0.040	0.086	0.429	73.000	S	39.81	3.075
	2	16.000	0.017	0.069	0.432	86.000	F	53.34	4.619
	3	6.100	0.047	0.022	0.447	86.000	S	20.33	1.761

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	4	4.800	0.022	0.000	0.000	74.000	M	12.14	0.945
	5	6.200	0.008	0.029	0.440	86.000	F	20.67	1.790
	6	19.400	0.020	0.013	0.444	74.000	M	49.08	3.818
	7	19.200	0.013	0.000	0.000	73.000	S	47.18	3.645
	8	9.900	0.039	0.045	0.436	73.000	S	24.33	1.879
	9	18.200	0.030	0.015	0.449	86.000	S	60.67	5.254
	10	24.800	0.015	0.000	0.000	73.000	S	60.94	4.708
	Σ	**140.800**						**384.91**	**31.494**
#12	1	4.400	0.025	0.041	0.436	86.000	F	14.67	1.270
	2	6.100	0.032	0.007	0.456	86.000	S	20.33	1.761
	3	7.600	0.004	0.003	0.456	74.000	M	19.23	1.496
	4	1.800	0.003	0.000	0.000	73.000	S	4.42	0.342
	5	14.800	0.050	0.111	0.419	73.000	S	36.37	2.810
	6	27.400	0.111	0.222	0.317	86.000	F	91.34	7.910
	7	25.200	0.133	0.011	0.451	86.000	S	45.23	4.911
	8	8.800	0.011	0.000	0.000	74.000	M	22.26	1.732
	9	2.400	0.025	0.065	0.429	73.000	S	5.90	0.455
	10	21.200	0.009	0.043	0.428	86.000	F	70.67	6.120
	11	4.500	0.035	0.008	0.453	86.000	S	15.00	1.299
	12	5.000	0.002	0.006	0.455	74.000	M	12.65	0.984
	13	6.000	0.006	0.000	0.000	73.000	S	14.74	1.139
	Σ	**135.200**						**360.02**	**32.228**
#11	1	1.600	0.003	0.035	0.357	86.000	F	5.33	0.462
	2	6.900	0.019	0.016	0.328	74.000	M	17.46	1.358
	3	0.400	0.016	0.000	0.000	73.000	S	0.98	0.076
	Σ	**8.900**						**23.77**	**1.895**
#10	1	0.430	0.009	0.033	0.365	86.000	F	1.43	0.123
	2	6.900	0.033	0.000	0.000	74.000	M	17.46	1.358
	Σ	**7.330**						**18.89**	**1.481**
#9	1	0.400	0.010	0.043	0.457	86.000	F	1.33	0.115
	2	9.300	0.018	0.025	0.461	74.000	M	23.53	1.830
	3	12.300	0.025	0.000	0.000	73.000	S	30.23	2.335
	4	1.500	0.008	0.100	0.443	86.000	F	5.00	0.433
	5	10.900	0.040	0.047	0.453	74.000	M	27.57	2.145
	6	16.300	0.047	0.000	0.000	73.000	S	40.05	3.094
	Σ	**202.130**						**407.53**	**45.557**
#15	1	1.400	0.049	0.019	0.453	73.000	S	3.44	0.266
	2	1.100	0.015	0.004	0.462	86.000	F	3.67	0.317
	3	11.600	0.004	0.037	0.406	73.000	S	28.51	2.202

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	4	5.300	0.014	0.052	0.400	69.000	S	11.47	0.864
	5	0.300	0.012	0.068	0.401	69.000	S	0.65	0.049
	6	0.100	0.017	0.051	0.402	86.000	F	0.33	0.024
	Σ	**402.630**						**902.25**	**88.707**
#8	1	1.900	0.006	0.039	0.390	86.000	F	6.33	0.548
	2	14.900	0.081	0.000	0.000	74.000	M	37.69	2.933
	Σ	**16.800**						**44.03**	**3.481**
#19	1	19.740	0.021	0.031	0.448	69.000	S	42.73	3.216
	2	15.720	0.031	0.000	0.000	73.000	S	38.63	2.984
	3	8.500	0.068	0.000	0.000	73.000	S	20.89	1.614
	4	0.900	0.017	0.086	0.409	86.000	F	3.00	0.259
	5	3.000	0.007	0.111	0.409	69.000	S	6.49	0.489
	6	9.300	0.059	0.122	0.413	73.000	S	22.85	1.766
	Σ	**752.930**						**1,715.53**	**155.358**
#20	1	12.900	0.022	0.024	0.458	69.000	S	27.93	2.102
	2	16.800	0.024	0.000	0.000	73.000	S	41.28	3.189
	3	3.600	0.029	0.012	0.458	69.000	S	7.79	0.586
	4	8.800	0.012	0.000	0.000	73.000	S	21.62	1.671
	Σ	**795.030**						**1,814.16**	**162.906**
#21	1	27.500	0.030	0.035	0.447	69.000	S	59.53	4.481
	2	17.200	0.035	0.000	0.000	73.000	S	42.27	3.265
	3	13.500	0.016	0.018	0.453	69.000	S	29.22	2.200
	4	8.300	0.024	0.000	0.000	73.000	S	20.40	1.576
	5	0.400	0.017	0.034	0.445	86.000	F	1.33	0.115
	6	1.000	0.005	0.051	0.445	69.000	S	2.16	0.163
	7	4.600	0.047	0.044	0.454	73.000	S	11.30	0.873
	Σ	**867.530**						**1,980.28**	**175.578**
#22	1	7.200	0.028	0.019	0.448	69.000	S	15.59	1.173
	2	10.700	0.019	0.000	0.000	73.000	S	26.29	2.031
	3	1.600	0.015	0.017	0.452	69.000	S	3.46	0.261
	4	5.300	0.017	0.000	0.000	73.000	S	13.02	1.006
	5	0.100	0.017	0.032	0.444	86.000	F	0.33	0.024
	6	0.100	0.005	0.049	0.443	69.000	S	0.22	0.012
	7	0.200	0.027	0.043	0.453	73.000	S	0.49	0.034
	Σ	**892.730**						**2,039.69**	**180.118**
#27	1	15.600	0.050	0.011	0.459	69.000	S	33.77	2.542
	2	20.300	0.011	0.000	0.000	73.000	S	49.88	3.854
	3	28.300	0.130	0.031	0.445	69.000	S	28.94	3.114

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	4	27.000	0.031	0.000	0.000	73.000	S	66.35	5.126
	5	0.800	0.017	0.087	0.425	86.000	F	2.67	0.230
	6	9.800	0.019	0.106	0.436	69.000	S	21.21	1.597
	Σ	**1,204.230**						**2,712.40**	**233.329**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#23	1	0.220	100.00	30.00	0.0100	1.0000	1	26.4	8,204	5.25	2.67
	2	0.170	25.00	10.00	0.0030	1.0000	2	0.0	170	0.09	0.05
	3	0.220	20.00	1.00	0.9000	1.0000	1	3.3	7,911	5.06	2.79
	4	0.220	100.00	50.00	0.0100	1.0000	1	28.1	12,993	8.31	4.15
	5	0.170	100.00	50.00	0.0030	1.0000	2	8.4	3,002	1.62	0.82
	Σ							**66.2**	**7,395**	**4.63**	**2.39**
#24	1	0.220	100.00	50.00	0.0100	1.0000	1	18.0	12,137	7.76	3.95
	2	0.170	50.00	30.00	0.0030	1.0000	2	0.5	976	0.53	0.27
	3	0.220	100.00	50.00	0.0100	1.0000	1	8.9	11,262	7.20	3.67
	4	0.170	50.00	30.00	0.0030	1.0000	2	0.5	970	0.52	0.27
	5	0.220	20.00	1.00	0.9000	1.0000	1	0.4	6,353	4.06	2.26
	6	0.220	100.00	10.00	0.0100	1.0000	1	0.2	1,519	0.97	0.15
	7	0.170	100.00	50.00	0.0030	1.0000	2	0.5	2,147	1.16	0.60
	8	0.220	20.00	1.00	0.9000	1.0000	1	1.1	7,023	4.49	2.48
	9	0.220	100.00	50.00	0.0100	1.0000	1	38.8	13,172	8.42	4.29
	Σ							**135.1**	**8,620**	**5.45**	**2.78**
#25	1	0.220	100.00	40.00	0.0100	1.0000	1	1.6	7,832	5.01	2.55
	2	0.170	50.00	15.00	0.0030	1.0000	2	0.1	417	0.22	0.12
	3	0.220	100.00	50.00	0.0100	1.0000	1	21.0	12,335	7.89	4.02
	4	0.170	50.00	30.00	0.0030	1.0000	2	1.0	1,044	0.56	0.29
	5	0.220	20.00	1.00	0.9000	1.0000	1	1.4	7,236	4.63	2.55
	6	0.220	80.00	10.00	0.0100	1.0000	1	0.8	1,518	0.97	0.50
	7	0.170	100.00	50.00	0.0030	1.0000	2	7.1	2,873	1.55	0.81
	Σ							**168.1**	**7,650**	**4.81**	**2.45**
#26	1	0.220	100.00	50.00	0.0100	1.0000	1	8.8	11,242	7.19	3.66
	2	0.170	100.00	30.00	0.0030	1.0000	2	1.8	1,609	0.87	0.45
	3	0.220	100.00	30.00	0.0100	1.0000	1	3.0	6,508	4.16	2.12
	4	0.170	100.00	40.00	0.0030	1.0000	2	2.4	2,138	1.15	0.60

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	5	0.220	20.00	1.00	0.9000	1.0000	1	0.3	6,066	3.88	2.18
	6	0.220	50.00	2.00	0.0100	1.0000	1	0.0	178	0.11	0.06
	7	0.170	100.00	50.00	0.0030	1.0000	2	0.2	1,915	1.03	0.54
	Σ							**184.5**	**8,907**	**5.59**	**2.32**
#1	1	0.170	100.00	40.00	0.0030	1.0000	2	2.2	2,122	1.14	0.60
	2	0.220	50.00	5.00	0.9000	1.0000	1	44.4	43,903	28.08	15.52
	3	0.220	100.00	33.00	0.0500	1.0000	1	116.9	41,514	26.55	14.00
	Σ							**163.6**	**33,111**	**21.13**	**11.36**
#16	1	0.220	100.00	50.00	0.0100	1.0000	1	59.9	13,796	8.82	4.50
	2	0.170	100.00	30.00	0.0030	1.0000	2	4.7	1,782	0.96	0.50
	Σ							**96.0**	**8,482**	**3.77**	**1.88**
#17	1	0.220	100.00	45.00	0.0100	1.0000	1	47.6	12,395	7.93	4.04
	2	0.170	100.00	30.00	0.0030	1.0000	2	2.8	1,688	0.91	0.47
	Σ							**146.5**	**8,742**	**4.46**	**2.24**
#7	1	0.220	100.00	7.00	0.9000	1.0000	1	313.3	96,099	61.46	34.12
	2	0.220	50.00	40.00	0.0500	1.0000	2	8.8	25,825	13.91	7.33
	Σ							**322.1**	**88,455**	**56.32**	**31.46**
#6	1	0.220	50.00	10.00	0.9000	1.0000	1	3.6	70,007	44.77	24.25
	2	0.220	50.00	2.00	0.9000	1.0000	1	10.4	19,148	12.25	6.76
	3	0.220	100.00	32.00	0.0500	1.0000	1	103.7	39,891	25.51	13.45
	Σ							**117.7**	**37,181**	**23.78**	**12.52**
#5	1	0.170	50.00	30.00	0.0030	1.0000	2	1.2	1,065	0.57	0.30
	2	0.220	50.00	15.00	0.9000	1.0000	1	119.9	148,971	95.27	53.15
	3	0.220	50.00	2.00	0.9000	1.0000	1	5.0	17,714	11.33	6.25
	4	0.220	100.00	30.00	0.0500	1.0000	1	55.8	35,258	22.55	11.88
	Σ							**181.9**	**44,634**	**28.51**	**16.24**
#4	1	0.220	100.00	39.00	0.0500	1.0000	1	25.0	40,738	26.05	13.74
	Σ							**25.0**	**40,738**	**26.05**	**13.74**
#3	1	0.220	100.00	30.00	0.0500	1.0000	1	11.0	29,689	18.99	10.00
	Σ							**11.0**	**29,689**	**18.99**	**10.00**
#18	1	0.220	100.00	45.00	0.0100	1.0000	1	36.1	12,036	7.70	3.92
	2	0.170	100.00	30.00	0.0030	1.0000	2	6.3	1,841	0.99	0.52
	3	0.170	100.00	35.00	0.0030	1.0000	2	5.3	2,076	1.12	0.58
	Σ							**362.7**	**10,189**	**4.09**	**2.03**
#14	1	0.170	100.00	58.00	0.0030	1.0000	2	9.4	3,306	1.78	0.93

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	2	0.220	50.00	5.00	0.9000	1.0000	1	54.3	44,837	28.67	15.85
	3	0.170	100.00	30.00	0.0030	1.0000	2	1.4	1,565	0.84	0.44
	4	0.220	100.00	50.00	0.0100	1.0000	1	2.6	9,859	6.31	3.21
	5	0.220	100.00	30.00	0.0100	1.0000	2	3.3	6,581	3.55	1.80
	Σ							**71.0**	**12,261**	**7.60**	**4.06**
#13	1	0.170	50.00	35.00	0.0030	1.0000	2	2.9	1,430	0.77	0.12
	2	0.220	100.00	35.00	0.9000	1.0000	1	2,556.1	586,352	374.98	212.26
	3	0.220	25.00	5.00	0.9000	1.0000	1	43.1	32,266	20.63	11.39
	4	0.170	100.00	30.00	0.0500	1.0000	1	16.9	24,742	15.82	8.33
	5	0.220	50.00	30.00	0.9000	1.0000	1	499.2	324,051	207.24	117.52
	6	0.220	50.00	25.00	0.0500	1.0000	1	56.7	20,630	13.19	6.94
	7	0.220	50.00	20.00	0.0030	1.0000	1	2.5	977	0.62	0.33
	8	0.220	100.00	50.00	0.0030	1.0000	2	4.6	3,455	1.86	0.97
	9	0.220	100.00	50.00	0.9000	1.0000	1	4,109.5	736,425	470.96	279.25
	10	0.170	100.00	30.00	0.0030	1.0000	2	6.1	1,834	0.99	0.52
	Σ							**7,297.0**	**276,843**	**176.99**	**99.27**
#12	1	0.220	100.00	22.00	0.9000	1.0000	1	369.0	335,755	214.72	121.91
	2	0.220	100.00	2.00	0.9000	1.0000	1	34.9	26,163	16.73	9.23
	3	0.220	100.00	35.00	0.0500	1.0000	1	42.7	39,300	25.13	13.25
	4	0.170	50.00	35.00	0.0030	1.0000	2	0.3	1,033	0.56	0.29
	5	0.170	100.00	30.00	0.0030	1.0000	2	3.4	1,709	0.92	0.49
	6	0.220	50.00	15.00	0.9000	1.0000	1	1,201.4	190,941	122.11	67.21
	7	0.220	100.00	6.00	0.9000	1.0000	1	355.0	96,881	56.27	30.02
	8	0.220	100.00	27.00	0.0500	1.0000	1	38.5	30,762	19.67	10.36
	9	0.170	50.00	47.00	0.0030	1.0000	2	0.5	1,441	0.78	0.40
	10	0.220	100.00	22.00	0.9000	1.0000	1	2,147.3	394,467	252.27	144.05
	11	0.220	50.00	2.50	0.9000	1.0000	1	24.6	25,011	16.00	8.83
	12	0.220	100.00	22.00	0.0500	1.0000	1	16.4	23,059	14.75	7.76
	13	0.170	50.00	34.00	0.0030	1.0000	2	0.9	1,159	0.62	0.33
	Σ							**4,233.8**	**181,013**	**114.79**	**58.07**
#11	1	0.220	25.00	32.00	0.9000	1.0000	1	77.2	204,780	130.96	73.47
	2	0.220	100.00	35.00	0.0500	1.0000	1	38.3	38,854	24.85	13.10
	3	0.170	25.00	40.00	0.0030	1.0000	2	0.0	648	0.35	0.18
	Σ							**115.5**	**76,638**	**49.01**	**27.93**
#10	1	0.220	25.00	32.00	0.9000	1.0000	1	17.7	177,142	113.29	63.72
	2	0.220	100.00	30.00	0.0500	1.0000	1	32.8	33,329	21.31	11.23
	Σ							**50.5**	**44,876**	**28.70**	**15.80**
#9	1	0.220	50.00	35.00	0.0030	1.0000	1	0.1	1,044	0.67	0.37

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	2	0.220	100.00	30.00	0.9000	1.0000	1	823.9	503,241	321.83	179.02
	3	0.170	25.00	50.00	0.9000	1.0000	2	594.2	313,377	168.83	91.30
	4	0.220	100.00	30.00	0.0030	1.0000	1	0.5	1,590	1.02	0.56
	5	0.220	50.00	6.00	0.9000	1.0000	1	96.0	61,149	39.11	20.67
	6	0.170	50.00	30.00	0.0500	1.0000	2	42.2	19,048	10.26	5.37
	Σ							**2,429.2**	**144,853**	**58.79**	**15.84**
#15	1	0.170	100.00	53.00	0.0030	1.0000	2	0.4	2,220	1.20	0.62
	2	0.220	50.00	5.00	0.9000	1.0000	1	9.0	37,083	23.72	13.12
	3	0.170	100.00	50.00	0.0030	1.0000	2	4.3	2,722	1.47	0.77
	4	0.220	100.00	50.00	0.0100	1.0000	1	6.5	10,735	6.87	3.55
	5	0.220	50.00	10.00	0.0100	1.0000	2	0.0	881	0.47	0.24
	6	0.220	20.00	1.00	0.9000	1.0000	1	0.1	5,826	3.73	2.37
	Σ							**4,280.1**	**74,077**	**24.14**	**11.65**
#8	1	0.220	25.00	32.00	0.9000	1.0000	1	93.5	208,687	133.46	74.88
	2	0.220	100.00	30.00	0.0500	1.0000	1	77.6	36,507	23.35	12.31
	Σ							**171.1**	**62,876**	**40.21**	**22.65**
#19	1	0.220	100.00	50.00	0.0100	1.0000	1	28.5	12,746	8.15	4.15
	2	0.170	100.00	20.00	0.0030	1.0000	2	2.4	1,117	0.60	0.31
	3	0.170	100.00	25.00	0.0030	1.0000	2	1.5	1,330	0.72	0.37
	4	0.220	20.00	1.00	0.9000	1.0000	1	1.4	7,694	4.92	2.55
	5	0.220	50.00	25.00	0.0100	1.0000	2	1.2	3,369	1.81	0.94
	6	0.170	100.00	25.00	0.0030	1.0000	2	1.7	1,360	0.73	0.38
	Σ							**4,675.7**	**51,240**	**16.83**	**7.40**
#20	1	0.220	100.00	45.00	0.0100	1.0000	1	16.1	11,045	7.06	3.60
	2	0.170	100.00	30.00	0.0030	1.0000	2	4.0	1,751	0.94	0.49
	3	0.220	100.00	30.00	0.0100	1.0000	1	2.6	6,407	4.10	2.09
	4	0.170	100.00	30.00	0.0030	1.0000	2	1.9	1,620	0.87	0.46
	Σ							**4,700.1**	**48,690**	**16.07**	**7.13**
#21	1	0.220	100.00	45.00	0.0100	1.0000	1	37.7	12,090	7.73	3.94
	2	0.170	100.00	15.00	0.0030	1.0000	2	1.9	800	0.43	0.23
	3	0.220	100.00	40.00	0.0100	1.0000	1	15.2	9,965	6.37	3.25
	4	0.170	100.00	10.00	0.0030	1.0000	2	0.5	412	0.22	0.12
	5	0.220	20.00	1.00	0.9000	1.0000	1	0.6	6,571	4.20	2.33
	6	0.220	50.00	10.00	0.0100	1.0000	1	0.1	984	0.63	0.32
	7	0.170	100.00	50.00	0.0030	1.0000	2	1.5	2,436	1.31	0.69
	Σ							**4,757.4**	**66,520**	**22.19**	**6.78**
#22	1	0.220	100.00	45.00	0.0100	1.0000	1	8.4	10,301	6.59	3.36

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	2	0.170	100.00	30.00	0.0030	1.0000	2	2.4	1,659	0.89	0.47
	3	0.220	100.00	45.00	0.0100	1.0000	1	1.6	8,606	5.50	2.80
	4	0.170	100.00	30.00	0.0030	1.0000	2	1.1	1,525	0.82	0.43
	5	0.220	20.00	1.00	0.9000	1.0000	1	0.1	5,808	3.71	2.37
	6	0.220	50.00	10.00	0.0100	1.0000	1	0.0	836	0.53	0.35
	7	0.220	100.00	50.00	0.0030	1.0000	2	0.1	2,217	1.19	0.67
	Σ							**4,770.8**	**102,225**	**34.19**	**6.65**
#27	1	0.220	100.00	25.00	0.0100	1.0000	1	11.1	6,300	4.03	2.05
	2	0.170	100.00	45.00	0.0030	1.0000	2	7.3	2,653	1.43	0.75
	3	0.220	50.00	50.00	0.0100	1.0000	1	18.5	8,358	4.74	2.47
	4	0.170	100.00	30.00	0.0030	1.0000	2	6.8	1,853	1.00	0.52
	5	0.220	20.00	1.00	0.9000	1.0000	1	1.2	7,632	4.88	0.94
	6	0.220	100.00	50.00	0.0100	1.0000	1	13.0	11,550	7.39	3.82
	Σ							**5,013.2**	**84,250**	**29.34**	**5.64**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	41.03	160.00	390.00	1.620	0.066
#1	**1**	**Time of Concentration:**					**0.066**
#1	2	8. Large gullies, diversions, and low flowing streams	5.00	5.00	100.00	6.700	0.004
#1	**2**	**Time of Concentration:**					**0.004**
#1	3	8. Large gullies, diversions, and low flowing streams	33.33	220.00	660.00	17.320	0.010
#1	**3**	**Time of Concentration:**					**0.010**
#3	1	3. Short grass pasture	32.50	130.00	400.00	4.560	0.024
		8. Large gullies, diversions, and low flowing streams	2.00	2.00	100.00	4.240	0.006
#3	**1**	**Time of Concentration:**					**0.030**
#4	1	3. Short grass pasture	38.40	180.00	468.75	4.950	0.026
		8. Large gullies, diversions, and low flowing streams	5.00	5.00	100.00	6.700	0.004
#4	**1**	**Time of Concentration:**					**0.030**
#5	1	1. Forest with heavy ground litter	28.57	90.00	315.00	1.350	0.064
#5	**1**	**Time of Concentration:**					**0.064**
#5	2	5. Nearly bare and untilled, and alluvial valley fans	15.00	25.00	166.66	3.870	0.011
		8. Large gullies, diversions, and low flowing streams	15.00	50.00	333.33	11.610	0.007

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#5	**2**	**Time of Concentration:**					**0.018**
#5	3	8. Large gullies, diversions, and low flowing streams	2.00	1.50	75.00	4.240	0.004
#5	**3**	**Time of Concentration:**					**0.004**
#5	4	8. Large gullies, diversions, and low flowing streams	30.67	230.00	750.00	16.610	0.012
		8. Large gullies, diversions, and low flowing streams	2.00	2.00	100.00	4.240	0.006
#5	**4**	**Time of Concentration:**					**0.018**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	50.00	45.00	90.00	7.070	0.003
#6	**1**	**Time of Concentration:**					**0.003**
#6	2	5. Nearly bare and untilled, and alluvial valley fans	3.00	10.00	333.33	1.730	0.053
#6	**2**	**Time of Concentration:**					**0.053**
#6	3	8. Large gullies, diversions, and low flowing streams	30.67	230.00	750.00	16.610	0.012
		8. Large gullies, diversions, and low flowing streams	2.00	1.50	75.00	4.240	0.004
#6	**3**	**Time of Concentration:**					**0.016**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	6.67	20.00	300.00	2.580	0.032
		8. Large gullies, diversions, and low flowing streams	2.50	30.00	1,200.00	4.740	0.070
#7	**1**	**Time of Concentration:**					**0.102**
#7	2	8. Large gullies, diversions, and low flowing streams	40.00	140.00	350.00	18.970	0.005
#7	**2**	**Time of Concentration:**					**0.005**
#8	1	5. Nearly bare and untilled, and alluvial valley fans	32.00	40.00	125.00	5.650	0.006
#8	**1**	**Time of Concentration:**					**0.006**
#8	2	3. Short grass pasture	40.00	140.00	350.00	5.050	0.019
		5. Nearly bare and untilled, and alluvial valley fans	5.00	25.00	500.00	2.230	0.062
#8	**2**	**Time of Concentration:**					**0.081**
#9	1	5. Nearly bare and untilled, and alluvial valley fans	16.67	25.00	150.00	4.080	0.010
#9	**1**	**Time of Concentration:**					**0.010**
#9	2	3. Short grass pasture	37.74	100.00	265.00	4.910	0.014
		8. Large gullies, diversions, and low flowing streams	35.00	100.00	285.71	17.740	0.004
#9	**2**	**Time of Concentration:**					**0.018**
#9	3	8. Large gullies, diversions, and low flowing streams	35.00	75.00	214.28	17.740	0.003
		9. Small streams flowing bankfull	5.00	80.00	1,600.00	20.120	0.022
#9	**3**	**Time of Concentration:**					**0.025**
#9	4	5. Nearly bare and untilled, and alluvial valley fans	25.00	40.00	160.00	5.000	0.008

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#9	**4**	**Time of Concentration:**					**0.008**
#9	5	8. Large gullies, diversions, and low flowing streams	6.32	70.00	1,107.59	7.540	0.040
#9	**5**	**Time of Concentration:**					**0.040**
#9	6	8. Large gullies, diversions, and low flowing streams	12.82	125.00	975.03	10.740	0.025
		9. Small streams flowing bankfull	5.00	80.00	1,600.00	20.120	0.022
#9	**6**	**Time of Concentration:**					**0.047**
#10	1	5. Nearly bare and untilled, and alluvial valley fans	20.00	30.00	150.00	4.470	0.009
#10	**1**	**Time of Concentration:**					**0.009**
#10	2	3. Short grass pasture	35.71	125.00	350.00	4.780	0.020
		8. Large gullies, diversions, and low flowing streams	2.00	4.00	200.00	4.240	0.013
#10	**2**	**Time of Concentration:**					**0.033**
#11	1	5. Nearly bare and untilled, and alluvial valley fans	31.25	25.00	80.00	5.590	0.003
#11	**1**	**Time of Concentration:**					**0.003**
#11	2	3. Short grass pasture	34.85	115.00	330.00	4.720	0.019
#11	**2**	**Time of Concentration:**					**0.019**
#11	3	1. Forest with heavy ground litter	46.15	30.00	65.00	1.710	0.010
		8. Large gullies, diversions, and low flowing streams	2.00	2.00	100.00	4.240	0.006
#11	**3**	**Time of Concentration:**					**0.016**
#12	1	5. Nearly bare and untilled, and alluvial valley fans	21.18	90.00	425.00	4.600	0.025
#12	**1**	**Time of Concentration:**					**0.025**
#12	2	8. Large gullies, diversions, and low flowing streams	2.00	10.00	500.00	4.240	0.032
#12	**2**	**Time of Concentration:**					**0.032**
#12	3	8. Large gullies, diversions, and low flowing streams	35.00	100.00	285.71	17.740	0.004
#12	**3**	**Time of Concentration:**					**0.004**
#12	4	8. Large gullies, diversions, and low flowing streams	35.00	75.00	214.28	17.740	0.003
#12	**4**	**Time of Concentration:**					**0.003**
#12	5	1. Forest with heavy ground litter	30.00	75.00	249.99	1.380	0.050
#12	**5**	**Time of Concentration:**					**0.050**
#12	6	5. Nearly bare and untilled, and alluvial valley fans	20.00	40.00	200.00	4.470	0.012
		8. Large gullies, diversions, and low flowing streams	9.23	300.00	3,250.05	9.110	0.099
#12	**6**	**Time of Concentration:**					**0.111**
#12	7	5. Nearly bare and untilled, and alluvial valley fans	5.88	29.40	500.00	2.420	0.057
		8. Large gullies, diversions, and low flowing streams	3.33	50.00	1,500.01	5.470	0.076

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#12	**7**	**Time of Concentration:**					**0.133**
#12	8	8. Large gullies, diversions, and low flowing streams	26.92	175.00	650.00	15.560	0.011
#12	**8**	**Time of Concentration:**					**0.011**
#12	9	1. Forest with heavy ground litter	46.88	75.00	160.00	1.730	0.025
#12	**9**	**Time of Concentration:**					**0.025**
#12	10	8. Large gullies, diversions, and low flowing streams	21.05	100.00	475.00	13.760	0.009
#12	**10**	**Time of Concentration:**					**0.009**
#12	11	8. Large gullies, diversions, and low flowing streams	2.50	15.00	600.00	4.740	0.035
#12	**11**	**Time of Concentration:**					**0.035**
#12	12	8. Large gullies, diversions, and low flowing streams	21.74	25.00	115.00	13.980	0.002
#12	**12**	**Time of Concentration:**					**0.002**
#12	13	8. Large gullies, diversions, and low flowing streams	33.33	125.00	375.00	17.320	0.006
#12	**13**	**Time of Concentration:**					**0.006**
#13	1	1. Forest with heavy ground litter	34.88	75.00	215.00	1.490	0.040
#13	**1**	**Time of Concentration:**					**0.040**
#13	2	5. Nearly bare and untilled, and alluvial valley fans	33.78	125.00	370.00	5.810	0.017
		8. Large gullies, diversions, and low flowing streams	33.78	20.26	59.97	17.430	0.000
#13	**2**	**Time of Concentration:**					**0.017**
#13	3	8. Large gullies, diversions, and low flowing streams	3.16	15.00	475.01	5.330	0.024
		8. Large gullies, diversions, and low flowing streams	8.28	60.00	725.00	8.630	0.023
#13	**3**	**Time of Concentration:**					**0.047**
#13	4	8. Large gullies, diversions, and low flowing streams	33.73	140.00	415.00	17.420	0.006
		9. Small streams flowing bankfull	2.00	15.00	750.00	12.720	0.016
#13	**4**	**Time of Concentration:**					**0.022**
#13	5	5. Nearly bare and untilled, and alluvial valley fans	21.43	30.00	140.00	4.620	0.008
#13	**5**	**Time of Concentration:**					**0.008**
#13	6	3. Short grass pasture	20.00	40.00	200.00	3.570	0.015
		8. Large gullies, diversions, and low flowing streams	26.32	75.00	285.00	15.380	0.005
#13	**6**	**Time of Concentration:**					**0.020**
#13	7	8. Large gullies, diversions, and low flowing streams	26.32	50.00	189.96	15.390	0.003
		9. Small streams flowing bankfull	2.00	10.00	500.00	12.720	0.010
#13	**7**	**Time of Concentration:**					**0.013**
#13	8	1. Forest with heavy ground litter	50.00	125.00	250.00	1.780	0.039
#13	**8**	**Time of Concentration:**					**0.039**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#13	9	5. Nearly bare and untilled, and alluvial valley fans	60.00	150.00	249.99	7.740	0.008
		8. Large gullies, diversions, and low flowing streams	8.57	60.00	700.11	8.780	0.022
#13	**9**	**Time of Concentration:**					**0.030**
#13	10	8. Large gullies, diversions, and low flowing streams	34.67	130.00	375.00	17.660	0.005
		9. Small streams flowing bankfull	2.00	10.00	500.00	12.720	0.010
#13	**10**	**Time of Concentration:**					**0.015**
#14	1	1. Forest with heavy ground litter	58.46	190.00	325.00	1.930	0.046
#14	**1**	**Time of Concentration:**					**0.046**
#14	2	5. Nearly bare and untilled, and alluvial valley fans	2.86	5.00	175.00	1.690	0.028
#14	**2**	**Time of Concentration:**					**0.028**
#14	3	8. Large gullies, diversions, and low flowing streams	29.57	170.00	575.00	16.310	0.009
#14	**3**	**Time of Concentration:**					**0.009**
#14	4	3. Short grass pasture	6.67	5.00	75.00	2.060	0.010
#14	**4**	**Time of Concentration:**					**0.010**
#14	5	8. Large gullies, diversions, and low flowing streams	30.00	90.00	300.00	16.430	0.005
		9. Small streams flowing bankfull	6.67	15.00	224.88	23.240	0.002
#14	**5**	**Time of Concentration:**					**0.007**
#15	1	1. Forest with heavy ground litter	52.31	170.00	325.00	1.820	0.049
#15	**1**	**Time of Concentration:**					**0.049**
#15	2	5. Nearly bare and untilled, and alluvial valley fans	4.35	5.00	115.00	2.080	0.015
#15	**2**	**Time of Concentration:**					**0.015**
#15	3	8. Large gullies, diversions, and low flowing streams	48.65	180.00	370.00	20.920	0.004
#15	**3**	**Time of Concentration:**					**0.004**
#15	4	3. Short grass pasture	53.33	160.00	300.00	5.840	0.014
#15	**4**	**Time of Concentration:**					**0.014**
#15	5	3. Short grass pasture	2.00	1.00	50.00	1.130	0.012
#15	**5**	**Time of Concentration:**					**0.012**
#15	6	5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.02	0.310	0.017
#15	**6**	**Time of Concentration:**					**0.017**
#16	1	3. Short grass pasture	50.00	200.00	400.00	5.650	0.019
		3. Short grass pasture	1.00	1.00	100.00	0.800	0.034
#16	**1**	**Time of Concentration:**					**0.053**
#16	2	8. Large gullies, diversions, and low flowing streams	23.81	250.00	1,050.00	14.630	0.019
		9. Small streams flowing bankfull	4.76	25.00	525.00	19.630	0.007
#16	**2**	**Time of Concentration:**					**0.026**
#17	1	3. Short grass pasture	44.00	220.00	500.00	5.300	0.026

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	35.71	125.00	350.00	17.920	0.005
#17	**1**	**Time of Concentration:**					**0.031**
#17	2	8. Large gullies, diversions, and low flowing streams	29.09	80.00	275.00	16.180	0.004
		9. Small streams flowing bankfull	9.52	100.00	1,050.00	27.770	0.010
#17	**2**	**Time of Concentration:**					**0.014**
#18	1	3. Short grass pasture	57.14	200.00	350.00	6.040	0.016
		8. Large gullies, diversions, and low flowing streams	33.33	50.00	150.00	17.320	0.002
		8. Large gullies, diversions, and low flowing streams	5.00	5.00	100.00	6.700	0.004
#18	**1**	**Time of Concentration:**					**0.022**
#18	2	8. Large gullies, diversions, and low flowing streams	37.33	140.00	375.00	18.330	0.005
		9. Small streams flowing bankfull	3.33	50.00	1,500.01	16.430	0.025
#18	**2**	**Time of Concentration:**					**0.030**
#18	3	1. Forest with heavy ground litter	40.00	50.00	125.00	1.600	0.021
		9. Small streams flowing bankfull	5.00	100.00	2,000.00	20.120	0.027
#18	**3**	**Time of Concentration:**					**0.048**
#19	1	3. Short grass pasture	39.47	150.00	380.00	5.020	0.021
#19	**1**	**Time of Concentration:**					**0.021**
#19	2	8. Large gullies, diversions, and low flowing streams	18.46	120.00	650.00	12.890	0.014
		9. Small streams flowing bankfull	3.08	30.00	975.00	15.780	0.017
#19	**2**	**Time of Concentration:**					**0.031**
#19	3	1. Forest with heavy ground litter	35.71	100.00	280.00	1.510	0.051
		9. Small streams flowing bankfull	3.64	40.00	1,100.01	17.160	0.017
#19	**3**	**Time of Concentration:**					**0.068**
#19	4	5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.00	0.310	0.017
#19	**4**	**Time of Concentration:**					**0.017**
#19	5	3. Short grass pasture	12.50	10.00	80.00	2.820	0.007
#19	**5**	**Time of Concentration:**					**0.007**
#19	6	1. Forest with heavy ground litter	50.00	190.00	380.00	1.780	0.059
#19	**6**	**Time of Concentration:**					**0.059**
#20	1	3. Short grass pasture	50.00	175.00	350.00	5.650	0.017
		8. Large gullies, diversions, and low flowing streams	44.44	100.00	225.00	19.990	0.003
		8. Large gullies, diversions, and low flowing streams	6.25	5.00	80.00	7.500	0.002
#20	**1**	**Time of Concentration:**					**0.022**
#20	2	8. Large gullies, diversions, and low flowing streams	33.13	275.00	830.00	17.260	0.013
		9. Small streams flowing bankfull	4.85	40.00	825.01	19.810	0.011
#20	**2**	**Time of Concentration:**					**0.024**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#20	3	3. Short grass pasture	37.50	75.00	200.00	4.890	0.011
		3. Short grass pasture	6.67	5.00	75.00	2.060	0.010
		3. Short grass pasture	45.00	75.00	166.66	5.360	0.008
#20	**3**	**Time of Concentration:**					**0.029**
#20	4	8. Large gullies, diversions, and low flowing streams	40.00	160.00	400.00	18.970	0.005
		9. Small streams flowing bankfull	4.00	20.00	500.00	18.000	0.007
#20	**4**	**Time of Concentration:**					**0.012**
#21	1	3. Short grass pasture	48.00	240.00	500.00	5.540	0.025
		8. Large gullies, diversions, and low flowing streams	46.67	70.00	150.00	20.490	0.002
		8. Large gullies, diversions, and low flowing streams	7.37	7.00	95.00	8.140	0.003
#21	**1**	**Time of Concentration:**					**0.030**
#21	2	8. Large gullies, diversions, and low flowing streams	21.96	280.00	1,275.01	14.050	0.025
		9. Small streams flowing bankfull	2.73	15.00	550.01	14.860	0.010
#21	**2**	**Time of Concentration:**					**0.035**
#21	3	3. Short grass pasture	49.23	160.00	325.00	5.610	0.016
#21	**3**	**Time of Concentration:**					**0.016**
#21	4	8. Large gullies, diversions, and low flowing streams	31.25	200.00	640.00	16.770	0.010
		9. Small streams flowing bankfull	3.00	15.00	500.00	15.580	0.008
#21	**4**	**Time of Concentration:**					**0.024**
#21	5	5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.00	0.310	0.017
#21	**5**	**Time of Concentration:**					**0.017**
#21	6	3. Short grass pasture	10.00	5.00	50.00	2.520	0.005
#21	**6**	**Time of Concentration:**					**0.005**
#21	7	1. Forest with heavy ground litter	59.70	200.00	335.00	1.950	0.047
#21	**7**	**Time of Concentration:**					**0.047**
#22	1	3. Short grass pasture	58.14	250.00	430.00	6.090	0.019
		3. Short grass pasture	7.14	5.00	70.00	2.130	0.009
#22	**1**	**Time of Concentration:**					**0.028**
#22	2	8. Large gullies, diversions, and low flowing streams	22.47	200.00	890.00	14.220	0.017
		9. Small streams flowing bankfull	3.33	5.00	150.00	16.430	0.002
#22	**2**	**Time of Concentration:**					**0.019**
#22	3	3. Short grass pasture	48.70	150.00	308.00	5.580	0.015
#22	**3**	**Time of Concentration:**					**0.015**
#22	4	8. Large gullies, diversions, and low flowing streams	44.44	200.00	450.00	19.990	0.006
		9. Small streams flowing bankfull	1.90	10.00	525.01	12.420	0.011
#22	**4**	**Time of Concentration:**					**0.017**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#22	5	5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.00	0.310	0.017
#22	**5**	**Time of Concentration:**					**0.017**
#22	6	3. Short grass pasture	10.00	5.00	50.00	2.520	0.005
#22	**6**	**Time of Concentration:**					**0.005**
#22	7	1. Forest with heavy ground litter	54.35	100.00	184.00	1.860	0.027
#22	**7**	**Time of Concentration:**					**0.027**
#23	1	3. Short grass pasture	55.83	115.00	206.00	5.970	0.009
		3. Short grass pasture	5.15	10.00	194.00	1.810	0.029
		8. Large gullies, diversions, and low flowing streams	37.50	30.00	80.00	18.370	0.001
#23	**1**	**Time of Concentration:**					**0.039**
#23	2	8. Large gullies, diversions, and low flowing streams	20.00	10.00	50.00	13.410	0.001
		9. Small streams flowing bankfull	8.89	40.00	450.00	26.830	0.004
#23	**2**	**Time of Concentration:**					**0.005**
#23	3	5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.00	0.310	0.017
#23	**3**	**Time of Concentration:**					**0.017**
#23	4	3. Short grass pasture	55.56	100.00	180.00	5.960	0.008
		3. Short grass pasture	10.00	10.00	100.00	2.520	0.011
#23	**4**	**Time of Concentration:**					**0.019**
#23	5	1. Forest with heavy ground litter	30.70	70.00	228.00	1.400	0.045
		3. Short grass pasture	55.56	100.00	180.00	5.960	0.008
		8. Large gullies, diversions, and low flowing streams	10.00	10.00	100.00	9.480	0.002
		8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#23	**5**	**Time of Concentration:**					**0.055**
#24	1	3. Short grass pasture	47.22	170.00	360.00	5.490	0.018
#24	**1**	**Time of Concentration:**					**0.018**
#24	2	8. Large gullies, diversions, and low flowing streams	40.00	60.00	150.00	18.970	0.002
		9. Small streams flowing bankfull	4.35	50.00	1,150.03	18.760	0.017
#24	**2**	**Time of Concentration:**					**0.019**
#24	3	3. Short grass pasture	51.52	170.00	330.00	5.740	0.015
#24	**3**	**Time of Concentration:**					**0.015**
#24	4	8. Large gullies, diversions, and low flowing streams	37.50	75.00	200.00	18.370	0.003
		9. Small streams flowing bankfull	4.35	50.00	1,150.03	18.760	0.017
#24	**4**	**Time of Concentration:**					**0.020**
#24	5	5. Nearly bare and untilled, and alluvial valley fans	0.05	0.01	20.04	0.220	0.025
#24	**5**	**Time of Concentration:**					**0.025**
#24	6	3. Short grass pasture	10.00	10.00	100.00	2.520	0.011

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#24	**6**	**Time of Concentration:**					**0.011**
#24	7	1. Forest with heavy ground litter	50.00	170.00	340.00	1.780	0.053
#24	**7**	**Time of Concentration:**					**0.053**
#24	8	5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.00	0.310	0.017
#24	**8**	**Time of Concentration:**					**0.017**
#24	9	3. Short grass pasture	60.00	180.00	300.00	6.190	0.013
#24	**9**	**Time of Concentration:**					**0.013**
#25	1	3. Short grass pasture	40.00	200.00	500.00	5.050	0.027
		8. Large gullies, diversions, and low flowing streams	50.00	50.00	100.00	21.210	0.001
		8. Large gullies, diversions, and low flowing streams	6.25	5.00	80.00	7.500	0.002
		8. Large gullies, diversions, and low flowing streams	34.48	150.00	435.00	17.610	0.006
#25	**1**	**Time of Concentration:**					**0.036**
#25	2	8. Large gullies, diversions, and low flowing streams	18.57	130.00	700.00	12.920	0.015
		9. Small streams flowing bankfull	2.63	5.00	190.00	14.590	0.003
#25	**2**	**Time of Concentration:**					**0.018**
#25	3	3. Short grass pasture	40.54	150.00	370.00	5.090	0.020
#25	**3**	**Time of Concentration:**					**0.020**
#25	4	8. Large gullies, diversions, and low flowing streams	18.31	130.00	710.00	12.830	0.015
		9. Small streams flowing bankfull	2.63	5.00	190.00	14.590	0.003
#25	**4**	**Time of Concentration:**					**0.018**
#25	5	5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.00	0.310	0.017
#25	**5**	**Time of Concentration:**					**0.017**
#25	6	3. Short grass pasture	12.50	10.00	80.00	2.820	0.007
#25	**6**	**Time of Concentration:**					**0.007**
#25	7	1. Forest with heavy ground litter	30.00	90.00	300.00	1.380	0.060
		8. Large gullies, diversions, and low flowing streams	45.83	110.00	240.00	20.310	0.003
#25	**7**	**Time of Concentration:**					**0.063**
#26	1	3. Short grass pasture	53.33	120.00	225.00	5.840	0.010
		3. Short grass pasture	3.33	2.50	75.00	1.460	0.014
		3. Short grass pasture	60.00	60.00	99.99	6.190	0.004
		8. Large gullies, diversions, and low flowing streams	50.00	70.00	140.00	21.210	0.001
#26	**1**	**Time of Concentration:**					**0.029**
#26	2	8. Large gullies, diversions, and low flowing streams	41.18	140.00	340.00	19.250	0.004
		9. Small streams flowing bankfull	8.97	70.00	780.00	26.960	0.008
#26	**2**	**Time of Concentration:**					**0.012**
#26	3	3. Short grass pasture	58.18	160.00	275.00	6.100	0.012

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#26	**3**	**Time of Concentration:**					**0.012**
#26	4	8. Large gullies, diversions, and low flowing streams	42.86	120.00	280.00	19.630	0.003
		9. Small streams flowing bankfull	8.97	70.00	780.00	26.960	0.008
#26	**4**	**Time of Concentration:**					**0.011**
#26	5	5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.02	0.310	0.017
#26	**5**	**Time of Concentration:**					**0.017**
#26	6	3. Short grass pasture	2.00	1.00	50.00	1.130	0.012
#26	**6**	**Time of Concentration:**					**0.012**
#26	7	1. Forest with heavy ground litter	52.63	100.00	190.00	1.830	0.028
#26	**7**	**Time of Concentration:**					**0.028**
#27	1	3. Short grass pasture	33.68	160.00	475.00	4.640	0.028
		8. Large gullies, diversions, and low flowing streams	20.62	100.00	485.00	13.620	0.009
		8. Large gullies, diversions, and low flowing streams	3.64	10.00	275.00	5.720	0.013
#27	**1**	**Time of Concentration:**					**0.050**
#27	2	8. Large gullies, diversions, and low flowing streams	48.00	300.00	625.00	20.780	0.008
		9. Small streams flowing bankfull	2.50	5.00	200.00	14.230	0.003
#27	**2**	**Time of Concentration:**					**0.011**
#27	3	3. Short grass pasture	0.50	1.00	200.00	0.560	0.099
		3. Short grass pasture	60.00	60.00	99.99	6.190	0.004
		3. Short grass pasture	1.00	0.75	75.00	0.800	0.026
		8. Large gullies, diversions, and low flowing streams	50.00	50.00	100.00	21.210	0.001
#27	**3**	**Time of Concentration:**					**0.130**
#27	4	8. Large gullies, diversions, and low flowing streams	37.50	225.00	600.00	18.370	0.009
		9. Small streams flowing bankfull	1.25	10.00	800.00	10.060	0.022
#27	**4**	**Time of Concentration:**					**0.031**
#27	5	5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.00	0.310	0.017
#27	**5**	**Time of Concentration:**					**0.017**
#27	6	3. Short grass pasture	47.37	180.00	380.00	5.500	0.019
#27	**6**	**Time of Concentration:**					**0.019**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	5.00	5.00	100.00	6.700	0.004

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	33.33	220.00	660.00	17.320	0.010
#1	**1**	**Muskingum K:**					**0.014**
#1	2	8. Large gullies, diversions, and low flowing streams	33.33	220.00	660.00	17.320	0.010
#1	**2**	**Muskingum K:**					**0.010**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	15.00	25.00	166.66	3.870	0.011
		8. Large gullies, diversions, and low flowing streams	15.00	50.00	333.33	11.610	0.007
		8. Large gullies, diversions, and low flowing streams	2.00	1.50	75.00	4.240	0.004
		8. Large gullies, diversions, and low flowing streams	30.67	230.00	749.91	16.610	0.012
		8. Large gullies, diversions, and low flowing streams	2.00	2.00	100.00	4.240	0.006
#5	**1**	**Muskingum K:**					**0.040**
#5	2	8. Large gullies, diversions, and low flowing streams	2.00	1.50	75.00	4.240	0.004
		8. Large gullies, diversions, and low flowing streams	30.67	230.00	750.00	16.610	0.012
		8. Large gullies, diversions, and low flowing streams	2.00	2.00	100.00	4.240	0.006
#5	**2**	**Muskingum K:**					**0.022**
#5	3	8. Large gullies, diversions, and low flowing streams	30.67	230.00	750.00	16.610	0.012
		8. Large gullies, diversions, and low flowing streams	2.00	2.00	100.00	4.240	0.006
#5	**3**	**Muskingum K:**					**0.018**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	3.00	10.00	333.33	1.730	0.053
		8. Large gullies, diversions, and low flowing streams	30.67	230.00	750.00	16.610	0.012
		8. Large gullies, diversions, and low flowing streams	2.00	1.50	75.00	4.240	0.004
#6	**1**	**Muskingum K:**					**0.069**
#6	2	8. Large gullies, diversions, and low flowing streams	30.67	230.00	750.00	16.610	0.012
		8. Large gullies, diversions, and low flowing streams	2.00	1.50	75.00	4.240	0.004
#6	**2**	**Muskingum K:**					**0.016**
#7	1	8. Large gullies, diversions, and low flowing streams	40.00	140.00	350.00	18.970	0.005
#7	**1**	**Muskingum K:**					**0.005**
#8	1	3. Short grass pasture	40.00	140.00	350.00	5.050	0.019
		8. Large gullies, diversions, and low flowing streams	5.00	25.00	500.00	6.700	0.020
#8	**1**	**Muskingum K:**					**0.039**
#9	1	3. Short grass pasture	37.74	100.00	265.00	4.910	0.014

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	35.00	175.00	500.00	17.740	0.007
		9. Small streams flowing bankfull	5.00	80.00	1,600.00	20.120	0.022
#9	**1**	**Muskingum K:**					**0.043**
#9	2	8. Large gullies, diversions, and low flowing streams	35.00	75.00	214.28	17.740	0.003
		9. Small streams flowing bankfull	5.00	80.00	1,600.00	20.120	0.022
#9	**2**	**Muskingum K:**					**0.025**
#9	4	3. Short grass pasture	33.33	75.00	225.00	4.610	0.013
		8. Large gullies, diversions, and low flowing streams	6.32	70.00	1,108.34	7.530	0.040
		8. Large gullies, diversions, and low flowing streams	12.82	125.00	975.00	10.740	0.025
		9. Small streams flowing bankfull	5.00	80.00	1,600.00	20.120	0.022
#9	**4**	**Muskingum K:**					**0.100**
#9	5	8. Large gullies, diversions, and low flowing streams	12.82	125.00	975.03	10.740	0.025
		9. Small streams flowing bankfull	5.00	80.00	1,600.00	20.120	0.022
#9	**5**	**Muskingum K:**					**0.047**
#9	6	9. Small streams flowing bankfull	2.50	40.00	1,600.00	14.230	0.031
#9	**6**	**Muskingum K:**					**0.000**
#10	1	3. Short grass pasture	35.71	125.00	350.00	4.780	0.020
		8. Large gullies, diversions, and low flowing streams	2.00	4.00	200.00	4.240	0.013
#10	**1**	**Muskingum K:**					**0.033**
#11	1	3. Short grass pasture	34.85	115.00	330.00	4.720	0.019
		1. Forest with heavy ground litter	46.15	30.00	65.00	1.710	0.010
		8. Large gullies, diversions, and low flowing streams	2.00	2.00	100.00	4.240	0.006
#11	**1**	**Muskingum K:**					**0.035**
#11	2	1. Forest with heavy ground litter	46.15	30.00	65.00	1.710	0.010
		8. Large gullies, diversions, and low flowing streams	2.00	2.00	100.00	4.240	0.006
#11	**2**	**Muskingum K:**					**0.016**
#12	1	8. Large gullies, diversions, and low flowing streams	2.00	10.00	500.00	4.240	0.032
		8. Large gullies, diversions, and low flowing streams	35.00	100.00	285.71	17.740	0.004
		8. Large gullies, diversions, and low flowing streams	35.00	113.75	325.00	17.740	0.005
#12	**1**	**Muskingum K:**					**0.041**
#12	2	8. Large gullies, diversions, and low flowing streams	35.00	100.00	285.71	17.740	0.004
		8. Large gullies, diversions, and low flowing streams	35.00	75.00	214.28	17.740	0.003
#12	**2**	**Muskingum K:**					**0.007**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#12	3	8. Large gullies, diversions, and low flowing streams	35.00	75.00	214.28	17.740	0.003
#12	**3**	**Muskingum K:**					**0.003**
#12	5	5. Nearly bare and untilled, and alluvial valley fans	20.00	40.00	200.00	4.470	0.012
		8. Large gullies, diversions, and low flowing streams	9.23	300.00	3,250.05	9.110	0.099
#12	**5**	**Muskingum K:**					**0.111**
#12	6	5. Nearly bare and untilled, and alluvial valley fans	5.88	100.00	1,700.01	2.420	0.195
		3. Short grass pasture	36.84	175.00	475.00	4.850	0.027
#12	**6**	**Muskingum K:**					**0.222**
#12	7	8. Large gullies, diversions, and low flowing streams	26.92	175.00	650.00	15.560	0.011
#12	**7**	**Muskingum K:**					**0.011**
#12	9	5. Nearly bare and untilled, and alluvial valley fans	25.00	60.00	240.00	5.000	0.013
		8. Large gullies, diversions, and low flowing streams	21.05	100.00	475.00	13.760	0.009
		8. Large gullies, diversions, and low flowing streams	2.50	15.00	600.00	4.740	0.035
		8. Large gullies, diversions, and low flowing streams	21.74	25.00	115.00	13.980	0.002
		8. Large gullies, diversions, and low flowing streams	33.33	125.00	375.00	17.320	0.006
#12	**9**	**Muskingum K:**					**0.065**
#12	10	8. Large gullies, diversions, and low flowing streams	2.50	15.00	600.00	4.740	0.035
		8. Large gullies, diversions, and low flowing streams	21.74	25.00	115.00	13.980	0.002
		8. Large gullies, diversions, and low flowing streams	33.33	125.00	375.00	17.320	0.006
#12	**10**	**Muskingum K:**					**0.043**
#12	11	8. Large gullies, diversions, and low flowing streams	21.74	25.00	115.00	13.980	0.002
		8. Large gullies, diversions, and low flowing streams	33.33	125.00	375.00	17.320	0.006
#12	**11**	**Muskingum K:**					**0.008**
#12	12	8. Large gullies, diversions, and low flowing streams	33.33	125.00	375.00	17.320	0.006
#12	**12**	**Muskingum K:**					**0.006**
#13	1	5. Nearly bare and untilled, and alluvial valley fans	33.78	125.00	370.00	5.810	0.017
		8. Large gullies, diversions, and low flowing streams	33.78	20.26	59.97	17.430	0.000
		8. Large gullies, diversions, and low flowing streams	3.16	15.00	475.01	5.330	0.024
		8. Large gullies, diversions, and low flowing streams	8.28	60.00	725.00	8.630	0.023

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	33.73	140.00	415.00	17.420	0.006
		9. Small streams flowing bankfull	2.00	15.00	750.00	12.720	0.016
#13	**1**	**Muskingum K:**					**0.086**
#13	2	8. Large gullies, diversions, and low flowing streams	3.16	15.00	475.01	5.330	0.024
		8. Large gullies, diversions, and low flowing streams	8.28	60.00	725.00	8.630	0.023
		8. Large gullies, diversions, and low flowing streams	33.73	140.00	415.00	17.420	0.006
		9. Small streams flowing bankfull	2.00	15.00	750.00	12.720	0.016
#13	**2**	**Muskingum K:**					**0.069**
#13	3	8. Large gullies, diversions, and low flowing streams	33.73	140.00	415.00	17.420	0.006
		9. Small streams flowing bankfull	2.00	15.00	750.00	12.720	0.016
#13	**3**	**Muskingum K:**					**0.022**
#13	5	3. Short grass pasture	40.00	80.00	200.00	5.050	0.011
		8. Large gullies, diversions, and low flowing streams	26.32	125.00	475.00	15.380	0.008
		9. Small streams flowing bankfull	2.00	10.00	500.00	12.720	0.010
#13	**5**	**Muskingum K:**					**0.029**
#13	6	8. Large gullies, diversions, and low flowing streams	26.32	50.00	189.96	15.390	0.003
		9. Small streams flowing bankfull	2.00	10.00	500.00	12.720	0.010
#13	**6**	**Muskingum K:**					**0.013**
#13	8	5. Nearly bare and untilled, and alluvial valley fans	60.00	150.00	249.99	7.740	0.008
		8. Large gullies, diversions, and low flowing streams	8.57	60.00	700.00	8.780	0.022
		8. Large gullies, diversions, and low flowing streams	34.67	130.00	375.00	17.660	0.005
		9. Small streams flowing bankfull	2.00	10.00	500.00	12.720	0.010
#13	**8**	**Muskingum K:**					**0.045**
#13	9	8. Large gullies, diversions, and low flowing streams	34.67	130.00	375.00	17.660	0.005
		9. Small streams flowing bankfull	2.00	10.00	500.00	12.720	0.010
#13	**9**	**Muskingum K:**					**0.015**
#14	1	5. Nearly bare and untilled, and alluvial valley fans	2.86	5.00	175.00	1.690	0.028
		8. Large gullies, diversions, and low flowing streams	29.57	170.00	575.00	16.310	0.009
#14	**1**	**Muskingum K:**					**0.037**
#14	2	8. Large gullies, diversions, and low flowing streams	29.57	170.00	575.00	16.310	0.009
#14	**2**	**Muskingum K:**					**0.009**
#14	4	8. Large gullies, diversions, and low flowing streams	30.00	90.00	300.00	16.430	0.005

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		9. Small streams flowing bankfull	6.67	15.00	224.88	23.240	0.002
#14	**4**	**Muskingum K:**					**0.007**
#15	1	5. Nearly bare and untilled, and alluvial valley fans	4.35	5.00	115.00	2.080	0.015
		8. Large gullies, diversions, and low flowing streams	48.65	180.00	370.00	20.920	0.004
#15	**1**	**Muskingum K:**					**0.019**
#15	2	8. Large gullies, diversions, and low flowing streams	48.65	180.00	370.00	20.920	0.004
#15	**2**	**Muskingum K:**					**0.004**
#15	3	8. Large gullies, diversions, and low flowing streams	6.67	40.00	600.00	7.740	0.021
		8. Large gullies, diversions, and low flowing streams	5.00	20.00	400.00	6.700	0.016
#15	**3**	**Muskingum K:**					**0.037**
#15	4	1. Forest with heavy ground litter	50.00	50.00	100.00	1.780	0.015
		8. Large gullies, diversions, and low flowing streams	6.67	40.00	600.00	7.740	0.021
		8. Large gullies, diversions, and low flowing streams	5.00	20.00	400.00	6.700	0.016
#15	**4**	**Muskingum K:**					**0.052**
#15	5	5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.00	0.310	0.017
		3. Short grass pasture	53.33	160.00	300.00	5.840	0.014
		8. Large gullies, diversions, and low flowing streams	6.67	40.00	600.00	7.740	0.021
		8. Large gullies, diversions, and low flowing streams	5.00	20.00	400.00	6.700	0.016
#15	**5**	**Muskingum K:**					**0.068**
#15	6	3. Short grass pasture	53.33	160.00	300.00	5.840	0.014
		8. Large gullies, diversions, and low flowing streams	6.67	40.00	600.00	7.740	0.021
		8. Large gullies, diversions, and low flowing streams	5.00	20.00	400.00	6.700	0.016
#15	**6**	**Muskingum K:**					**0.051**
#16	1	8. Large gullies, diversions, and low flowing streams	23.81	250.00	1,050.00	14.630	0.019
		9. Small streams flowing bankfull	4.76	25.00	525.00	19.630	0.007
#16	**1**	**Muskingum K:**					**0.026**
#17	1	8. Large gullies, diversions, and low flowing streams	29.09	80.00	275.00	16.180	0.004
		9. Small streams flowing bankfull	9.52	100.00	1,050.00	27.770	0.010
#17	**1**	**Muskingum K:**					**0.014**
#18	1	8. Large gullies, diversions, and low flowing streams	37.33	140.00	375.00	18.330	0.005
		9. Small streams flowing bankfull	3.33	50.00	1,500.01	16.430	0.025
#18	**1**	**Muskingum K:**					**0.030**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#19	1	8. Large gullies, diversions, and low flowing streams	18.46	120.00	650.00	12.890	0.014
		9. Small streams flowing bankfull	3.08	30.00	975.00	15.780	0.017
#19	**1**	**Muskingum K:**					**0.031**
#19	4	3. Short grass pasture	39.47	150.00	380.00	5.020	0.021
		8. Large gullies, diversions, and low flowing streams	18.46	120.00	650.00	12.890	0.014
		8. Large gullies, diversions, and low flowing streams	3.08	30.00	975.00	5.260	0.051
#19	**4**	**Muskingum K:**					**0.086**
#19	5	5. Nearly bare and untilled, and alluvial valley fans	0.05	0.01	20.00	0.220	0.025
		3. Short grass pasture	39.47	150.00	380.00	5.020	0.021
		8. Large gullies, diversions, and low flowing streams	18.46	120.00	650.00	12.890	0.014
		8. Large gullies, diversions, and low flowing streams	3.08	30.00	975.00	5.260	0.051
#19	**5**	**Muskingum K:**					**0.111**
#19	6	3. Short grass pasture	12.50	10.00	80.00	2.820	0.007
		5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.00	0.310	0.017
		8. Large gullies, diversions, and low flowing streams	43.75	70.00	160.00	19.840	0.002
		8. Large gullies, diversions, and low flowing streams	1.00	3.40	340.00	3.000	0.031
		8. Large gullies, diversions, and low flowing streams	18.46	120.00	650.00	12.890	0.014
		8. Large gullies, diversions, and low flowing streams	3.08	30.00	975.00	5.260	0.051
#19	**6**	**Muskingum K:**					**0.122**
#20	1	8. Large gullies, diversions, and low flowing streams	33.13	275.00	830.00	17.260	0.013
		9. Small streams flowing bankfull	4.85	40.00	825.01	19.810	0.011
#20	**1**	**Muskingum K:**					**0.024**
#20	3	8. Large gullies, diversions, and low flowing streams	40.00	160.00	400.00	18.970	0.005
		9. Small streams flowing bankfull	4.00	20.00	500.00	18.000	0.007
#20	**3**	**Muskingum K:**					**0.012**
#21	1	8. Large gullies, diversions, and low flowing streams	21.96	280.00	1,275.01	14.050	0.025
		9. Small streams flowing bankfull	2.73	15.00	550.01	14.860	0.010
#21	**1**	**Muskingum K:**					**0.035**
#21	3	8. Large gullies, diversions, and low flowing streams	31.25	200.00	640.00	16.770	0.010
		9. Small streams flowing bankfull	3.00	15.00	500.00	15.580	0.008
#21	**3**	**Muskingum K:**					**0.018**
#21	5	3. Short grass pasture	49.23	160.00	325.00	5.610	0.016

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	31.25	200.00	640.00	16.770	0.010
		9. Small streams flowing bankfull	3.00	15.00	500.00	15.580	0.008
#21	**5**	**Muskingum K:**					**0.034**
#21	6	5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.00	0.310	0.017
		3. Short grass pasture	49.23	160.00	325.00	5.610	0.016
		8. Large gullies, diversions, and low flowing streams	31.25	200.00	640.00	16.770	0.010
		9. Small streams flowing bankfull	3.00	15.00	500.00	15.580	0.008
#21	**6**	**Muskingum K:**					**0.051**
#21	7	3. Short grass pasture	10.00	5.00	50.00	2.520	0.005
		5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.00	0.310	0.017
		8. Large gullies, diversions, and low flowing streams	37.50	360.00	960.00	18.370	0.014
		9. Small streams flowing bankfull	3.00	15.00	500.00	15.580	0.008
#21	**7**	**Muskingum K:**					**0.044**
#22	1	8. Large gullies, diversions, and low flowing streams	22.47	200.00	890.00	14.220	0.017
		9. Small streams flowing bankfull	3.33	5.00	150.00	16.430	0.002
#22	**1**	**Muskingum K:**					**0.019**
#22	3	8. Large gullies, diversions, and low flowing streams	44.44	200.00	450.00	19.990	0.006
		9. Small streams flowing bankfull	1.90	10.00	525.01	12.420	0.011
#22	**3**	**Muskingum K:**					**0.017**
#22	5	3. Short grass pasture	48.70	150.00	308.00	5.580	0.015
		8. Large gullies, diversions, and low flowing streams	44.44	200.00	450.00	19.990	0.006
		9. Small streams flowing bankfull	1.90	10.00	525.00	12.420	0.011
#22	**5**	**Muskingum K:**					**0.032**
#22	6	5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.00	0.310	0.017
		3. Short grass pasture	48.70	150.00	308.00	5.580	0.015
		8. Large gullies, diversions, and low flowing streams	44.44	200.00	450.00	19.990	0.006
		9. Small streams flowing bankfull	1.90	10.00	525.00	12.420	0.011
#22	**6**	**Muskingum K:**					**0.049**
#22	7	3. Short grass pasture	10.00	5.00	50.00	2.520	0.005
		5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.00	0.310	0.017
		8. Large gullies, diversions, and low flowing streams	46.17	350.00	758.00	20.380	0.010
		9. Small streams flowing bankfull	1.90	10.00	525.00	12.420	0.011
#22	**7**	**Muskingum K:**					**0.043**
#23	1	9. Small streams flowing bankfull	8.89	40.00	450.00	26.830	0.004

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#23	**1**	**Muskingum K:**					**0.004**
#23	3	3. Short grass pasture	55.83	115.00	206.00	5.970	0.009
		3. Short grass pasture	5.15	10.00	194.00	1.810	0.029
		8. Large gullies, diversions, and low flowing streams	37.50	30.00	80.00	18.370	0.001
		9. Small streams flowing bankfull	8.89	40.00	450.00	26.830	0.004
#23	**3**	**Muskingum K:**					**0.043**
#23	4	5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.02	0.310	0.017
		8. Large gullies, diversions, and low flowing streams	43.48	100.00	230.00	19.780	0.003
		8. Large gullies, diversions, and low flowing streams	2.90	20.00	690.01	5.100	0.037
		8. Large gullies, diversions, and low flowing streams	37.50	30.00	80.00	18.370	0.001
		9. Small streams flowing bankfull	8.89	40.00	450.00	26.830	0.004
#23	**4**	**Muskingum K:**					**0.062**
#23	5	3. Short grass pasture	55.56	100.00	180.00	5.960	0.008
		3. Short grass pasture	10.00	10.00	100.00	2.520	0.011
		8. Large gullies, diversions, and low flowing streams	43.48	100.00	230.00	19.780	0.003
		8. Large gullies, diversions, and low flowing streams	2.90	20.00	690.00	5.100	0.037
		8. Large gullies, diversions, and low flowing streams	37.50	30.00	80.00	18.370	0.001
		9. Small streams flowing bankfull	8.89	40.00	450.00	26.830	0.004
#23	**5**	**Muskingum K:**					**0.064**
#24	1	8. Large gullies, diversions, and low flowing streams	40.00	60.00	150.00	18.970	0.002
		9. Small streams flowing bankfull	4.35	50.00	1,150.03	18.760	0.017
#24	**1**	**Muskingum K:**					**0.019**
#24	3	8. Large gullies, diversions, and low flowing streams	37.50	75.00	200.00	18.370	0.003
		9. Small streams flowing bankfull	4.35	50.00	1,150.03	18.760	0.017
#24	**3**	**Muskingum K:**					**0.020**
#24	5	3. Short grass pasture	51.52	170.00	330.00	5.740	0.015
		8. Large gullies, diversions, and low flowing streams	37.50	75.00	200.00	18.370	0.003
		9. Small streams flowing bankfull	4.35	50.00	1,150.00	18.760	0.017
#24	**5**	**Muskingum K:**					**0.035**
#24	6	5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.00	0.310	0.017
		3. Short grass pasture	51.52	170.00	330.00	5.740	0.015
		8. Large gullies, diversions, and low flowing streams	37.50	75.00	200.00	18.370	0.003
		8. Large gullies, diversions, and low flowing streams	4.35	50.00	1,150.00	6.250	0.051

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#24	**6**	**Muskingum K:**					**0.086**
#24	7	3. Short grass pasture	10.00	10.00	100.00	2.520	0.011
		9. Small streams flowing bankfull	44.55	245.00	550.00	60.060	0.002
		9. Small streams flowing bankfull	3.48	40.00	1,150.00	16.780	0.019
#24	**7**	**Muskingum K:**					**0.032**
#24	8	3. Short grass pasture	44.44	160.00	360.00	5.330	0.018
		8. Large gullies, diversions, and low flowing streams	40.00	60.00	150.00	18.970	0.002
		9. Small streams flowing bankfull	4.35	50.00	1,150.00	18.760	0.017
#24	**8**	**Muskingum K:**					**0.037**
#24	9	5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.00	0.310	0.017
		9. Small streams flowing bankfull	27.36	145.00	530.00	47.070	0.003
		9. Small streams flowing bankfull	4.35	50.00	1,150.00	18.760	0.017
#24	**9**	**Muskingum K:**					**0.037**
#25	1	8. Large gullies, diversions, and low flowing streams	18.57	130.00	700.00	12.920	0.015
		9. Small streams flowing bankfull	2.63	5.00	190.00	14.590	0.003
#25	**1**	**Muskingum K:**					**0.018**
#25	3	8. Large gullies, diversions, and low flowing streams	18.31	130.00	710.00	12.830	0.015
		9. Small streams flowing bankfull	2.63	5.00	190.00	14.590	0.003
#25	**3**	**Muskingum K:**					**0.018**
#25	5	3. Short grass pasture	40.54	150.00	370.00	5.090	0.020
		8. Large gullies, diversions, and low flowing streams	18.31	130.00	710.00	12.830	0.015
		9. Small streams flowing bankfull	2.63	5.00	190.00	14.590	0.003
#25	**5**	**Muskingum K:**					**0.038**
#25	6	5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.00	0.310	0.017
		3. Short grass pasture	40.54	150.00	370.00	5.090	0.020
		8. Large gullies, diversions, and low flowing streams	18.31	130.00	710.00	12.830	0.015
		9. Small streams flowing bankfull	2.63	5.00	190.00	14.590	0.003
#25	**6**	**Muskingum K:**					**0.055**
#25	7	8. Large gullies, diversions, and low flowing streams	16.67	20.00	120.00	12.240	0.002
		8. Large gullies, diversions, and low flowing streams	23.93	280.00	1,170.00	14.670	0.022
		8. Large gullies, diversions, and low flowing streams	2.63	5.00	190.00	4.860	0.010
#25	**7**	**Muskingum K:**					**0.034**
#26	1	8. Large gullies, diversions, and low flowing streams	41.18	140.00	340.00	19.250	0.004
		9. Small streams flowing bankfull	8.97	70.00	780.00	26.960	0.008
#26	**1**	**Muskingum K:**					**0.012**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#26	3	8. Large gullies, diversions, and low flowing streams	42.86	120.00	280.00	19.630	0.003
		9. Small streams flowing bankfull	8.97	70.00	780.00	26.960	0.008
#26	**3**	**Muskingum K:**					**0.011**
#26	5	3. Short grass pasture	58.18	160.00	275.00	6.100	0.012
		8. Large gullies, diversions, and low flowing streams	42.86	120.00	280.00	19.630	0.003
		9. Small streams flowing bankfull	8.97	70.00	780.00	26.960	0.008
#26	**5**	**Muskingum K:**					**0.023**
#26	6	5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.00	0.310	0.017
		5. Nearly bare and untilled, and alluvial valley fans	58.18	160.00	275.00	7.620	0.010
		8. Large gullies, diversions, and low flowing streams	42.86	120.00	280.00	19.630	0.003
		9. Small streams flowing bankfull	8.97	70.00	780.00	26.960	0.008
#26	**6**	**Muskingum K:**					**0.038**
#26	7	3. Short grass pasture	4.00	2.00	50.00	1.600	0.008
		5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.00	0.310	0.017
		8. Large gullies, diversions, and low flowing streams	50.45	280.00	555.00	21.300	0.007
		8. Large gullies, diversions, and low flowing streams	8.97	70.00	780.00	8.980	0.024
#26	**7**	**Muskingum K:**					**0.056**
#27	1	8. Large gullies, diversions, and low flowing streams	48.00	300.00	625.00	20.780	0.008
		9. Small streams flowing bankfull	2.50	5.00	200.00	14.230	0.003
#27	**1**	**Muskingum K:**					**0.011**
#27	3	8. Large gullies, diversions, and low flowing streams	37.50	225.00	600.00	18.370	0.009
		9. Small streams flowing bankfull	1.25	10.00	800.00	10.060	0.022
#27	**3**	**Muskingum K:**					**0.031**
#27	5	1. Forest with heavy ground litter	46.67	70.00	150.00	1.720	0.024
		3. Short grass pasture	25.00	30.00	120.00	4.000	0.008
		8. Large gullies, diversions, and low flowing streams	50.00	60.00	120.00	21.210	0.001
		8. Large gullies, diversions, and low flowing streams	10.82	210.00	1,940.00	9.870	0.054
#27	**5**	**Muskingum K:**					**0.087**
#27	6	5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.00	0.310	0.017
		9. Small streams flowing bankfull	42.11	80.00	190.00	58.390	0.000
		8. Large gullies, diversions, and low flowing streams	7.78	210.00	2,700.00	8.360	0.089
#27	**6**	**Muskingum K:**					**0.106**

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897-0587

Proposed Backfill Sediment Load Sam Campbell Branch

Tyler Hall

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	25 yr - 24 hr
Rainfall Depth:	5.000 inches

Particle Size Distribution:

Size (mm)	Disturbed	Undisturbed
3.0000	100.000%	100.000%
2.0000	93.000%	99.900%
1.0000	86.000%	98.000%
0.5000	78.000%	92.000%
0.3000	73.000%	87.000%
0.2000	67.000%	80.000%
0.1000	55.000%	70.000%
0.0500	44.000%	60.000%
0.0300	35.000%	50.000%
0.0200	27.000%	42.000%
0.0100	18.000%	32.000%
0.0050	14.000%	21.000%
0.0030	9.000%	15.000%
0.0010	3.000%	4.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	#16	0.034	0.390	Pond 13
Pond	#3	==>	#18	0.060	0.443	Pond 7
Pond	#4	==>	#18	0.071	0.453	Pond 14
Pond	#5	==>	#18	0.043	0.459	Pond 15
Pond	#6	==>	#18	0.048	0.459	Pond 17
Pond	#7	==>	#18	0.068	0.413	Pond 18
Pond	#8	==>	#19	0.065	0.349	Pond 19
Null	#9	==>	#15	0.001	0.421	Null Structure 1
Pond	#10	==>	#9	0.055	0.430	Pond 20
Pond	#11	==>	#9	0.075	0.427	Pond 21
Pond	#12	==>	#9	0.029	0.460	Pond 2A
Pond	#13	==>	#15	0.007	0.454	Pond 1A
Null	#14	==>	#15	0.017	0.464	Null Structure 3
Null	#15	==>	#19	0.034	0.440	Null Structure 2
Null	#16	==>	#17	0.001	0.421	Null Structure 4
Null	#17	==>	#18	0.074	0.444	Null Structure 5
Null	#18	==>	#19	0.031	0.442	Null Structure 6
Null	#19	==>	#20	0.021	0.454	Null Structure 7
Null	#20	==>	#21	0.014	0.444	Null Structure 8
Null	#21	==>	#22	0.012	0.450	Null Structure 9
Null	#22	==>	#27	0.001	0.421	Null Structure 10
Null	#23	==>	#26	0.019	0.457	Null Structure 12
Null	#26	==>	#27	0.044	0.422	Null Structure 14
Null	#27	==>	End	0.000	0.000	Null Structure 15

	#23 Null				
#26 Null					
					#1 Pond
				#16 Null	
			#17 Null		
			#7 Pond		

						#6 Pond	
						#5 Pond	
						#4 Pond	
						#3 Pond	
					#18 Null		
						#14 Null	
						#13 Pond	
							#12 Pond
							#11 Pond
							#10 Pond
						#9 Null	
					#15 Null		
					#8 Pond		
				#19 Null			
			#20 Null				
		#21 Null					
	#22 Null						
#27 Null							

Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	4.00	30.00	750.00	6.00	0.034
#1	**Muskingum K:**					**0.034**
#3	1. Forest with heavy ground litter	45.00	90.00	200.00	1.69	0.032
	9. Small streams flowing bankfull	2.67	40.00	1,500.03	14.69	0.028
#3	**Muskingum K:**					**0.060**
#4	1. Forest with heavy ground litter	45.00	140.00	311.11	1.69	0.051
	9. Small streams flowing bankfull	4.83	70.00	1,450.02	19.77	0.020
#4	**Muskingum K:**					**0.071**
#5	1. Forest with heavy ground litter	45.00	45.00	100.00	1.69	0.016
	9. Small streams flowing bankfull	5.00	100.00	2,000.00	20.12	0.027
#5	**Muskingum K:**					**0.043**
#6	1. Forest with heavy ground litter	45.00	60.00	133.33	1.69	0.021
	9. Small streams flowing bankfull	5.00	100.00	2,000.00	20.12	0.027
#6	**Muskingum K:**					**0.048**
#7	1. Forest with heavy ground litter	45.00	150.00	333.33	1.69	0.054
	9. Small streams flowing bankfull	1.67	10.00	600.02	11.61	0.014
#7	**Muskingum K:**					**0.068**
#8	1. Forest with heavy ground litter	45.00	175.00	388.88	1.69	0.063
	9. Small streams flowing bankfull	2.00	2.00	100.00	12.72	0.002
#8	**Muskingum K:**					**0.065**
#9	9. Small streams flowing bankfull	1.00	0.50	50.00	9.00	0.001
#9	**Muskingum K:**					**0.001**
#10	1. Forest with heavy ground litter	45.00	130.00	288.88	1.69	0.047
	9. Small streams flowing bankfull	3.00	15.00	500.00	15.58	0.008
#10	**Muskingum K:**					**0.055**
#11	1. Forest with heavy ground litter	45.00	150.00	333.33	1.69	0.054
	9. Small streams flowing bankfull	2.00	20.00	1,000.00	12.72	0.021
#11	**Muskingum K:**					**0.075**
#12	9. Small streams flowing bankfull	4.76	100.00	2,100.00	19.63	0.029
#12	**Muskingum K:**					**0.029**
#13	9. Small streams flowing bankfull	3.50	15.00	428.57	16.83	0.007
#13	**Muskingum K:**					**0.007**
#14	9. Small streams flowing bankfull	5.93	80.00	1,350.00	21.90	0.017
#14	**Muskingum K:**					**0.017**
#15	9. Small streams flowing bankfull	1.94	30.00	1,550.06	12.52	0.034
#15	**Muskingum K:**					**0.034**
#16	9. Small streams flowing bankfull	1.00	0.50	50.00	9.00	0.001
#16	**Muskingum K:**					**0.001**
#17	9. Small streams flowing bankfull	2.22	80.00	3,600.03	13.41	0.074
#17	**Muskingum K:**					**0.074**
#18	9. Small streams flowing bankfull	2.07	30.00	1,450.04	12.94	0.031
#18	**Muskingum K:**					**0.031**

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#19	9. Small streams flowing bankfull	3.46	45.00	1,300.00	16.74	0.021
#19	**Muskingum K:**					**0.021**
#20	9. Small streams flowing bankfull	2.21	15.00	680.02	13.36	0.014
#20	**Muskingum K:**					**0.014**
#21	9. Small streams flowing bankfull	2.86	20.00	700.01	15.21	0.012
#21	**Muskingum K:**					**0.012**
#22	9. Small streams flowing bankfull	1.00	0.50	50.00	9.00	0.001
#22	**Muskingum K:**					**0.001**
#23	9. Small streams flowing bankfull	4.03	50.00	1,242.02	18.05	0.019
#23	**Muskingum K:**					**0.019**
#26	9. Small streams flowing bankfull	1.03	15.00	1,450.11	9.15	0.044
#26	**Muskingum K:**					**0.044**

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#23		107.900	107.900	104.36	12.97	56.8	6,973	3.92	1.80
#26		79.500	187.400	281.14	26.35	160.0	9,595	5.83	2.71
#1	In	32.100	32.100	84.34	6.69	163.6	33,111	21.13	11.36
	Out			77.33	6.69	31.5	6,917	0.37	0.19
#16		57.800	89.900	208.16	16.63	96.0	8,482	3.77	1.88
#17		46.300	136.200	312.02	24.51	146.5	8,742	4.46	2.24
#7	In	16.900	16.900	54.41	4.66	322.1	88,455	56.32	31.46
	Out			53.67	4.66	82.9	26,275	6.02	2.97
#6	In	20.940	20.940	55.16	4.37	117.7	37,181	23.78	12.52
	Out			54.36	4.37	32.7	11,648	3.25	1.53
#5	In	24.400	24.400	64.97	5.18	181.9	44,634	28.51	16.24
	Out			63.72	5.18	48.3	13,652	3.46	1.73
#4	In	4.300	4.300	10.88	0.85	25.0	40,738	26.05	13.74
	Out			10.21	0.85	3.7	5,905	0.01	0.00
#3	In	2.600	2.600	6.58	0.51	11.0	29,689	18.99	10.00
	Out			5.39	0.51	1.0	1,939	0.00	0.00
#18		71.000	276.340	642.18	52.84	362.7	10,189	4.09	2.03
#14		40.500	40.500	98.70	7.71	81.6	13,821	8.74	4.90
#13	In	140.800	140.800	384.91	31.49	7,297.0	276,843	176.99	99.27
	Out			346.35	31.49	1,759.7	80,765	16.46	8.43
#12	In	135.200	135.200	360.02	32.23	4,233.8	181,013	114.79	58.07
	Out			251.93	32.23	835.2	33,791	1.83	1.06
#11	In	8.900	8.900	23.77	1.90	115.5	76,638	49.01	27.93
	Out			23.38	1.90	28.3	22,394	4.77	2.32
#10	In	7.330	7.330	18.89	1.48	50.5	44,876	28.70	15.80
	Out			18.10	1.48	8.9	8,766	0.14	0.07
#9		50.700	202.130	407.53	45.56	2,429.2	144,853	58.79	15.84
#15		20.200	403.630	900.66	88.53	4,292.0	75,402	24.66	11.73
#8	In	16.800	16.800	44.03	3.48	171.1	62,876	40.21	22.65
	Out			41.71	3.48	34.7	14,972	1.42	0.71
#19		57.800	754.570	1,714.33	154.91	4,720.7	52,182	17.29	7.55
#20		42.900	797.470	1,814.87	162.60	4,745.4	49,530	16.49	7.27
#21		66.400	863.870	1,966.07	174.10	4,803.7	46,261	15.57	6.95
#22		24.900	888.770	2,024.65	178.59	4,817.2	53,524	18.06	6.81
#27		94.000	1,170.170	2,517.80	221.45	5,054.3	56,923	19.95	5.85

The 24 hour Arithmetic Average (24AA) is under review. It is anticipated that the 24AA will be replaced by the

peak settleable solids concentration (ml/l) with the addition of new sediment input factor values.

The 24AA is provided for your convenience during this transition period.

		24AA (ml/l)
#23		0.54
#26		0.72
#1	In	3.13
	Out	0.05
#16		0.50
#17		0.57
#7	In	8.39
	Out	0.59
#6	In	3.23
	Out	0.28
#5	In	4.95
	Out	0.31
#4	In	3.33
	Out	0.00
#3	In	2.42
	Out	0.00
#18		0.52
#14		1.62
#13	In	31.04
	Out	2.27
#12	In	17.26
	Out	0.43
#11	In	8.55
	Out	0.43
#10	In	4.80
	Out	0.02
#9		5.35
#15		3.60
#8	In	7.31
	Out	0.18
#19		2.46
#20		2.39
#21		2.32
#22		2.29
#27		2.09

Particle Size Distribution(s) at Each Structure

Structure #23 (Null Structure 12):

Size (mm)	In/Out
3.0000	100.000%
2.0000	97.298%
1.0000	94.596%
0.5000	91.509%
0.3000	89.579%
0.2000	87.263%
0.1000	82.285%
0.0500	68.707%
0.0300	54.653%
0.0200	42.161%
0.0100	28.107%
0.0050	21.861%
0.0030	14.054%
0.0010	4.685%

Structure #26 (Null Structure 14):

Size (mm)	In/Out
3.0000	100.000%
2.0000	94.715%
1.0000	89.377%
0.5000	83.173%
0.3000	79.261%
0.2000	74.541%
0.1000	65.085%
0.0500	53.197%
0.0300	42.377%
0.0200	32.783%
0.0100	21.963%
0.0050	16.978%
0.0030	10.954%
0.0010	3.625%

Structure #1 (Pond 13):

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	93.095%	100.000%
1.0000	86.164%	100.000%
0.5000	78.192%	100.000%
0.3000	73.192%	100.000%
0.2000	67.178%	100.000%
0.1000	55.205%	100.000%
0.0500	44.219%	100.000%
0.0300	35.205%	100.000%
0.0200	27.205%	100.000%
0.0100	18.191%	94.588%
0.0050	14.096%	73.292%
0.0030	9.082%	47.223%
0.0010	3.014%	15.670%

Structure #16 (Null Structure 4):

Size (mm)	In/Out
3.0000	100.000%
2.0000	95.634%
1.0000	91.175%
0.5000	85.893%
0.3000	82.531%
0.2000	78.447%
0.1000	70.475%
0.0500	63.126%
0.0300	57.025%
0.0200	51.645%
0.0100	43.774%
0.0050	33.766%
0.0030	21.815%
0.0010	7.200%

Structure #17 (Null Structure 5):

Size (mm)	In/Out
3.0000	100.000%
2.0000	94.861%
1.0000	89.626%
0.5000	83.447%

Size (mm)	In/Out
0.3000	79.520%
0.2000	74.757%
0.1000	65.437%
0.0500	56.850%
0.0300	49.731%
0.0200	43.449%
0.0100	35.170%
0.0050	27.096%
0.0030	17.518%
0.0010	5.773%

Structure #7 (Pond 18):

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	93.190%	100.000%
1.0000	86.329%	100.000%
0.5000	78.384%	100.000%
0.3000	73.384%	100.000%
0.2000	67.356%	100.000%
0.1000	55.411%	100.000%
0.0500	44.438%	100.000%
0.0300	35.410%	100.000%
0.0200	27.410%	100.000%
0.0100	18.383%	71.477%
0.0050	14.191%	55.180%
0.0030	9.164%	35.632%
0.0010	3.027%	11.771%

Structure #6 (Pond 17):

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	93.001%	100.000%
1.0000	86.001%	100.000%
0.5000	78.001%	100.000%
0.3000	73.001%	100.000%
0.2000	67.001%	100.000%
0.1000	55.001%	100.000%
0.0500	44.000%	100.000%
0.0300	35.000%	100.000%
0.0200	27.000%	97.318%

Size (mm)	In	Out
0.0100	18.000%	64.878%
0.0050	14.000%	50.461%
0.0030	9.000%	32.439%
0.0010	3.000%	10.813%

Structure #5 (Pond 15):

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	93.050%	100.000%
1.0000	86.084%	100.000%
0.5000	78.097%	100.000%
0.3000	73.097%	100.000%
0.2000	67.090%	100.000%
0.1000	55.103%	100.000%
0.0500	44.109%	100.000%
0.0300	35.102%	100.000%
0.0200	27.102%	100.000%
0.0100	18.095%	68.170%
0.0050	14.048%	52.923%
0.0030	9.041%	34.060%
0.0010	3.007%	11.328%

Structure #4 (Pond 14):

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	93.000%	100.000%
1.0000	86.000%	100.000%
0.5000	78.000%	100.000%
0.3000	73.000%	100.000%
0.2000	67.000%	100.000%
0.1000	55.000%	100.000%
0.0500	44.000%	100.000%
0.0300	35.000%	100.000%
0.0200	27.000%	100.000%
0.0100	18.000%	100.000%
0.0050	14.000%	94.911%
0.0030	9.000%	61.015%
0.0010	3.000%	20.338%

Structure #3 (Pond 7):

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	93.000%	100.000%
1.0000	86.000%	100.000%
0.5000	78.000%	100.000%
0.3000	73.000%	100.000%
0.2000	67.000%	100.000%
0.1000	55.000%	100.000%
0.0500	44.000%	100.000%
0.0300	35.000%	100.000%
0.0200	27.000%	100.000%
0.0100	18.000%	100.000%
0.0050	14.000%	100.000%
0.0030	9.000%	98.105%
0.0010	3.000%	32.702%

Structure #18 (Null Structure 6):

Size (mm)	In/Out
3.0000	100.000%
2.0000	97.233%
1.0000	94.360%
0.5000	90.875%
0.3000	88.631%
0.2000	85.885%
0.1000	80.604%
0.0500	75.719%
0.0300	71.626%
0.0200	67.795%
0.0100	49.565%
0.0050	38.450%
0.0030	24.942%
0.0010	8.227%

Structure #14 (Null Structure 3):

Size (mm)	In/Out
3.0000	100.000%
2.0000	93.493%
1.0000	86.855%
0.5000	78.997%

Size (mm)	In/Out
0.3000	73.997%
0.2000	67.926%
0.1000	56.068%
0.0500	45.138%
0.0300	36.067%
0.0200	28.067%
0.0100	18.996%
0.0050	14.498%
0.0030	9.427%
0.0010	3.071%

Structure #13 (Pond 1A):

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	93.022%	100.000%
1.0000	86.031%	100.000%
0.5000	78.034%	100.000%
0.3000	73.033%	100.000%
0.2000	67.031%	100.000%
0.1000	55.033%	100.000%
0.0500	44.034%	100.000%
0.0300	35.031%	100.000%
0.0200	27.031%	100.000%
0.0100	18.028%	74.758%
0.0050	14.014%	58.115%
0.0030	9.012%	37.371%
0.0010	3.002%	12.449%

Structure #12 (Pond 2A):

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	93.618%	100.000%
1.0000	87.209%	100.000%
0.5000	79.880%	100.000%
0.3000	75.298%	100.000%
0.2000	69.360%	100.000%
0.1000	56.943%	100.000%
0.0500	45.559%	100.000%
0.0300	36.243%	100.000%
0.0200	27.963%	100.000%

Size (mm)	In	Out
0.0100	18.647%	94.519%
0.0050	14.498%	73.491%
0.0030	9.322%	47.254%
0.0010	3.106%	15.745%

Structure #11 (Pond 21):

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	93.009%	100.000%
1.0000	86.010%	100.000%
0.5000	78.010%	100.000%
0.3000	73.010%	100.000%
0.2000	67.009%	100.000%
0.1000	55.009%	100.000%
0.0500	44.008%	100.000%
0.0300	35.007%	100.000%
0.0200	27.007%	100.000%
0.0100	18.006%	73.567%
0.0050	14.003%	57.214%
0.0030	9.003%	36.782%
0.0010	3.001%	12.260%

Structure #10 (Pond 20):

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	93.003%	100.000%
1.0000	86.003%	100.000%
0.5000	78.002%	100.000%
0.3000	73.002%	100.000%
0.2000	67.002%	100.000%
0.1000	55.002%	100.000%
0.0500	44.001%	100.000%
0.0300	35.001%	100.000%
0.0200	27.001%	100.000%
0.0100	18.001%	100.000%
0.0050	14.000%	79.783%
0.0030	9.000%	51.289%
0.0010	3.000%	17.096%

Structure #9 (Null Structure 1):

Size (mm)	In/Out
3.0000	100.000%
2.0000	97.324%
1.0000	94.173%
0.5000	89.570%
0.3000	86.365%
0.2000	82.258%
0.1000	75.090%
0.0500	68.302%
0.0300	62.272%
0.0200	57.144%
0.0100	48.924%
0.0050	37.033%
0.0030	24.203%
0.0010	7.804%

Structure #15 (Null Structure 2):

Size (mm)	In/Out
3.0000	100.000%
2.0000	98.334%
1.0000	96.395%
0.5000	93.602%
0.3000	91.668%
0.2000	89.197%
0.1000	84.856%
0.0500	80.752%
0.0300	77.121%
0.0200	74.026%
0.0100	58.807%
0.0050	45.140%
0.0030	29.251%
0.0010	9.595%

Structure #8 (Pond 19):

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	93.005%	100.000%
1.0000	86.005%	100.000%
0.5000	78.004%	100.000%

Size (mm)	In	Out
0.3000	73.004%	100.000%
0.2000	67.004%	100.000%
0.1000	55.003%	100.000%
0.0500	44.003%	100.000%
0.0300	35.002%	100.000%
0.0200	27.002%	100.000%
0.0100	18.001%	88.722%
0.0050	14.001%	69.006%
0.0030	9.001%	44.361%
0.0010	3.000%	14.787%

Structure #19 (Null Structure 7):

Size (mm)	In/Out
3.0000	100.000%
2.0000	99.009%
1.0000	96.940%
0.5000	94.021%
0.3000	92.016%
0.2000	89.465%
0.1000	84.942%
0.0500	80.675%
0.0300	76.921%
0.0200	73.694%
0.0100	58.248%
0.0050	44.737%
0.0030	28.994%
0.0010	9.513%

Structure #20 (Null Structure 8):

Size (mm)	In/Out
3.0000	100.000%
2.0000	98.991%
1.0000	96.903%
0.5000	93.960%
0.3000	91.939%
0.2000	89.368%
0.1000	84.808%
0.0500	80.507%
0.0300	76.724%
0.0200	73.471%

Size (mm)	In/Out
0.0100	58.057%
0.0050	44.587%
0.0030	28.898%
0.0010	9.481%

Structure #21 (Null Structure 9):

Size (mm)	In/Out
3.0000	100.000%
2.0000	98.925%
1.0000	96.779%
0.5000	93.775%
0.3000	91.718%
0.2000	89.105%
0.1000	84.455%
0.0500	80.073%
0.0300	76.226%
0.0200	72.916%
0.0100	57.579%
0.0050	44.220%
0.0030	28.660%
0.0010	9.403%

Structure #22 (Null Structure 10):

Size (mm)	In/Out
3.0000	100.000%
2.0000	98.916%
1.0000	96.760%
0.5000	93.744%
0.3000	91.678%
0.2000	89.054%
0.1000	84.385%
0.0500	79.985%
0.0300	76.122%
0.0200	72.798%
0.0100	57.478%
0.0050	44.140%
0.0030	28.609%
0.0010	9.386%

Structure #27:

Size (mm)	In/Out
3.0000	100.000%
2.0000	98.711%
1.0000	96.394%
0.5000	93.206%
0.3000	91.037%
0.2000	88.293%
0.1000	83.365%
0.0500	78.629%
0.0300	74.465%
0.0200	70.872%
0.0100	55.788%
0.0050	42.839%
0.0030	27.767%
0.0010	9.108%

Structure Detail:

Structure #23 (Null)

Null Structure 12

Structure #26 (Null)

Null Structure 14

Structure #1 (Pond)

Pond 13

Pond Inputs:

Initial Pool Elev:	1,098.50 ft
Initial Pool:	0.69 ac-ft
*Sediment Storage:	4.66 ac-ft
Dead Space:	0.00 %

**Sediment capacity was entered by user*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
1,098.50	6.00	2.00:1	2.00:1	15.00

Pond Results:

Peak Elevation:	1,099.86 ft
H'graph Detention Time:	0.38 hrs
Pond Model:	CSTRS
Dewater Time:	0.63 days
Trap Efficiency:	80.77 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
1,097.50	0.669	0.000	0.000		Top of Sed. Storage
1,098.00	0.690	0.339	0.000		
1,098.50	0.711	0.690	0.000		Spillway #1
1,099.00	0.733	1.051	7.738	14.10	
1,099.50	0.755	1.422	44.878	1.00	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
1,099.86	0.771	1.695	77.332	0.10	Peak Stage
1,100.00	0.777	1.805	90.497		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
1,097.50	0.000	0.000
1,098.00	0.000	0.000
1,098.50	0.000	0.000
1,099.00	7.738	7.738
1,099.50	44.878	44.878
1,100.00	90.497	90.497

Structure #16 (Null)

Null Structure 4

Structure #17 (Null)

Null Structure 5

Structure #7 (Pond)

Pond 18

Pond Inputs:

Initial Pool Elev:	1,123.50 ft
Initial Pool:	0.17 ac-ft
*Sediment Storage:	0.61 ac-ft
Dead Space:	0.00 %

**Sediment capacity was entered by user*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
1,123.50	10.00	2.00:1	2.00:1	9.00

Pond Results:

Peak Elevation:	1,124.96 ft
H'graph Detention Time:	0.26 hrs

Pond Model:	CSTRS
Dewater Time:	0.63 days
Trap Efficiency:	74.28 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
1,122.50	0.157	0.000	0.000		Top of Sed. Storage
1,123.00	0.166	0.081	0.000		
1,123.50	0.176	0.166	0.000		Spillway #1
1,124.00	0.186	0.257	1.880	11.40	
1,124.50	0.196	0.352	25.996	3.55	
1,124.96	0.206	0.446	53.669	0.05	Peak Stage
1,125.00	0.207	0.453	55.858		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
1,122.50	0.000	0.000
1,123.00	0.000	0.000
1,123.50	0.000	0.000
1,124.00	1.880	1.880
1,124.50	25.996	25.996
1,125.00	55.858	55.858

Structure #6 (Pond)

Pond 17

Pond Inputs:

Initial Pool Elev:	1,118.50 ft
Initial Pool:	0.10 ac-ft
*Sediment Storage:	0.44 ac-ft
Dead Space:	0.00 %

**Sediment capacity was entered by user*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
1,118.50	10.00	2.00:1	2.00:1	9.00

Pond Results:

Peak Elevation:	1,119.97 ft
H'graph Detention Time:	0.16 hrs
Pond Model:	CSTRS
Dewater Time:	0.58 days
Trap Efficiency:	72.26 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
1,117.50	0.098	0.000	0.000		Top of Sed. Storage
1,117.50	0.098	0.000	0.000		
1,118.00	0.102	0.050	0.000		
1,118.50	0.105	0.102	0.000		Spillway #1
1,119.00	0.109	0.156	1.880	9.25	
1,119.50	0.113	0.211	25.996	4.50	
1,119.97	0.117	0.266	54.359	0.05	Peak Stage
1,120.00	0.117	0.269	55.858		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
1,117.50	0.000	0.000
1,117.50	0.000	0.000
1,118.00	0.000	0.000
1,118.50	0.000	0.000
1,119.00	1.880	1.880
1,119.50	25.996	25.996
1,120.00	55.858	55.858

Structure #5 (Pond)

Pond 15

Pond Inputs:

Initial Pool Elev:	1,118.50 ft
Initial Pool:	0.15 ac-ft
*Sediment Storage:	0.70 ac-ft
Dead Space:	0.00 %

**Sediment capacity was entered by user*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
1,118.50	15.00	2.00:1	2.00:1	12.00

Pond Results:

Peak Elevation:	1,119.95 ft
H'graph Detention Time:	0.20 hrs
Pond Model:	CSTRS
Dewater Time:	0.60 days
Trap Efficiency:	73.46 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
1,117.50	0.146	0.000	0.000		Top of Sed. Storage
1,118.00	0.154	0.074	0.000		
1,118.50	0.162	0.153	0.000		Spillway #1
1,119.00	0.171	0.237	2.339	10.70	
1,119.50	0.180	0.324	31.829	3.55	
1,119.95	0.188	0.408	63.719	0.05	Peak Stage
1,120.00	0.189	0.417	67.042		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
1,117.50	0.000	0.000
1,118.00	0.000	0.000
1,118.50	0.000	0.000
1,119.00	2.339	2.339
1,119.50	31.829	31.829
1,120.00	67.042	67.042

Structure #4 (Pond)

Pond 14

Pond Inputs:

Initial Pool Elev:	1,118.50 ft
Initial Pool:	0.18 ac-ft
*Sediment Storage:	0.58 ac-ft
Dead Space:	0.00 %

**Sediment capacity was entered by user*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
1,118.50	10.00	2.00:1	2.00:1	6.00

Pond Results:

Peak Elevation:	1,119.26 ft
H'graph Detention Time:	0.65 hrs
Pond Model:	CSTRS
Dewater Time:	0.64 days
Trap Efficiency:	85.25 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
1,117.50	0.164	0.000	0.000		Top of Sed. Storage
1,117.50	0.164	0.000	0.000		
1,118.00	0.176	0.085	0.000		
1,118.50	0.188	0.176	0.000		Spillway #1

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
1,119.00	0.202	0.274	1.268	14.75	
1,119.26	0.209	0.328	10.208	0.65	Peak Stage
1,119.50	0.215	0.378	18.368		
1,120.00	0.229	0.489	40.598		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
1,117.50	0.000	0.000
1,117.50	0.000	0.000
1,118.00	0.000	0.000
1,118.50	0.000	0.000
1,119.00	1.268	1.268
1,119.50	18.368	18.368
1,120.00	40.598	40.598

Structure #3 (Pond)

Pond 7

Pond Inputs:

Initial Pool Elev:	1,118.50 ft
Initial Pool:	0.23 ac-ft
*Sediment Storage:	0.92 ac-ft
Dead Space:	0.00 %

**Sediment capacity was entered by user*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
1,118.50	10.00	2.00:1	2.00:1	6.00

Pond Results:

Peak Elevation:	1,119.12 ft
H'graph Detention Time:	1.02 hrs
Pond Model:	CSTRS
Dewater Time:	0.66 days
Trap Efficiency:	90.83 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
1,117.50	0.219	0.000	0.000		Top of Sed. Storage
1,118.00	0.229	0.112	0.000		
1,118.50	0.240	0.229	0.000		Spillway #1
1,119.00	0.251	0.351	1.268	15.25	
1,119.12	0.253	0.382	5.389	0.50	Peak Stage
1,119.50	0.262	0.479	18.368		
1,120.00	0.273	0.613	40.598		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
1,117.50	0.000	0.000
1,118.00	0.000	0.000
1,118.50	0.000	0.000
1,119.00	1.268	1.268
1,119.50	18.368	18.368
1,120.00	40.598	40.598

Structure #18 (Null)

Null Structure 6

Structure #14 (Null)

Null Structure 3

Structure #13 (Pond)

Pond 1A

Pond Inputs:

Initial Pool Elev:	1,020.67 ft
Initial Pool:	0.69 ac-ft
*Sediment Storage:	2.29 ac-ft
Dead Space:	0.00 %

**Sediment capacity was entered by user*

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
24.00	80.00	1.50	0.0200	1,020.67	0.90	0.00

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
1,025.65	30.00	2.00:1	2.00:1	9.00

Pond Results:

Peak Elevation:	1,029.69 ft
H'graph Detention Time:	0.89 hrs
Pond Model:	CSTRS
Dewater Time:	1.04 days
Trap Efficiency:	75.88 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
1,019.17	0.419	0.000	0.000		Top of Sed. Storage
1,019.35	0.428	0.076	0.000		
1,019.85	0.454	0.297	0.000		
1,020.35	0.481	0.531	0.000		
1,020.67	0.499	0.688	0.000		Spillway #1
1,020.85	0.509	0.778	0.566	9.20	
1,021.35	0.537	1.040	2.353	2.50	
1,021.85	0.567	1.316	5.373	0.90	
1,022.35	0.597	1.607	9.123	4.40	
1,022.85	0.627	1.913	13.480	1.80	
1,023.35	0.659	2.234	17.378	0.90	
1,023.85	0.691	2.572	19.938	0.65	
1,024.35	0.724	2.926	21.775	0.60	
1,024.85	0.758	3.296	23.428	0.55	
1,025.35	0.793	3.684	24.978	0.65	
1,025.65	0.814	3.925	25.854	0.50	Spillway #2
1,025.85	0.828	4.089	29.455	0.35	
1,026.35	0.865	4.513	38.367	0.70	
1,026.85	0.902	4.954	59.569	0.45	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
1,027.35	0.939	5.414	89.635	0.25	
1,027.85	0.978	5.894	126.600	0.25	
1,028.35	1.017	6.392	174.322	0.05	
1,028.85	1.057	6.911	232.787	0.05	
1,029.35	1.098	7.450	301.376	0.05	
1,029.69	1.126	7.828	346.350	0.05	Peak Stage
1,029.70	1.127	7.839	347.642		

Detailed Discharge Table

Elevation (ft)	Straight Pipe (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
1,019.17	0.000	0.000	0.000
1,019.35	0.000	0.000	0.000
1,019.85	0.000	0.000	0.000
1,020.35	0.000	0.000	0.000
1,020.67	0.000	0.000	0.000
1,020.85	(3)>0.566	0.000	0.566
1,021.35	(3)>2.353	0.000	2.353
1,021.85	(3)>5.373	0.000	5.373
1,022.35	(3)>9.123	0.000	9.123
1,022.85	(3)>13.480	0.000	13.480
1,023.35	(5)>17.378	0.000	17.378
1,023.85	(6)>19.938	0.000	19.938
1,024.35	(6)>21.775	0.000	21.775
1,024.85	(6)>23.428	0.000	23.428
1,025.35	(6)>24.978	0.000	24.978
1,025.65	(6)>25.854	0.000	25.854
1,025.85	(6)>26.437	3.018	29.455
1,026.35	(6)>27.802	10.565	38.367
1,026.85	(6)>29.118	30.451	59.569
1,027.35	(6)>30.380	59.254	89.635
1,027.85	(6)>31.576	95.023	126.600
1,028.35	(6)>32.749	141.573	174.322
1,028.85	(6)>33.860	198.926	232.787
1,029.35	(6)>34.951	266.425	301.376
1,029.70	(6)>35.686	311.956	347.642

Structure #12 (Pond)

Pond 2A

Pond Inputs:

Initial Pool Elev:	1,101.14 ft
Initial Pool:	2.74 ac-ft
*Sediment Storage:	5.16 ac-ft
Dead Space:	0.00 %

**Sediment capacity was entered by user*

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
24.00	50.00	1.00	0.0240	1,101.14	0.90	0.00

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
1,102.97	15.00	2.00:1	2.00:1	15.00

Pond Results:

Peak Elevation:	1,105.67 ft
H'graph Detention Time:	2.18 hrs
Pond Model:	CSTRS
Dewater Time:	1.47 days
Trap Efficiency:	80.27 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
1,099.50	1.439	0.000	0.000		Top of Sed. Storage
1,099.50	1.439	0.000	0.000		
1,100.00	1.575	0.753	0.000		
1,100.50	1.718	1.577	0.000		
1,101.00	1.867	2.473	0.000		
1,101.14	1.910	2.737	0.000		Spillway #1
1,101.50	1.932	3.429	3.111	17.30	
1,102.00	1.964	4.403	4.814	3.00	
1,102.50	1.995	5.393	6.212	2.20	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
1,102.97	2.025	6.337	9.167	4.45	Spillway #2
1,103.00	2.027	6.398	9.583	0.30	
1,103.50	2.059	7.419	16.487	4.70	
1,104.00	2.091	8.457	55.266	2.40	
1,104.50	2.124	9.511	100.022	0.45	
1,105.00	2.156	10.581	156.693	0.25	
1,105.50	2.189	11.667	225.068	0.20	
1,105.67	2.201	12.037	251.932	0.10	Peak Stage
1,106.00	2.223	12.770	305.208		
1,106.50	2.256	13.890	397.294		
1,107.00	2.290	15.026	501.567		

Detailed Discharge Table

Elevation (ft)	Straight Pipe (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
1,099.50	0.000	0.000	0.000
1,099.50	0.000	0.000	0.000
1,100.00	0.000	0.000	0.000
1,100.50	0.000	0.000	0.000
1,101.00	0.000	0.000	0.000
1,101.14	0.000	0.000	0.000
1,101.50	(1)>3.111	0.000	3.111
1,102.00	(1)>4.814	0.000	4.814
1,102.50	(1)>6.212	0.000	6.212
1,102.97	(1)>9.167	0.000	9.167
1,103.00	(1)>9.418	0.165	9.583
1,103.50	(1)>13.574	2.913	16.487
1,104.00	(6)>16.182	39.083	55.266
1,104.50	(6)>18.476	81.546	100.022
1,105.00	(6)>20.506	136.186	156.693
1,105.50	(6)>22.345	202.723	225.068
1,106.00	(6)>24.042	281.166	305.208
1,106.50	(6)>25.630	371.664	397.294
1,107.00	(6)>27.133	474.434	501.567

Structure #11 (Pond)

Pond 21

Pond Inputs:

Initial Pool Elev:	1,143.50 ft
Initial Pool:	0.10 ac-ft
*Sediment Storage:	0.29 ac-ft
Dead Space:	0.00 %

**Sediment capacity was entered by user*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
1,143.50	15.00	2.00:1	2.00:1	9.00

Pond Results:

Peak Elevation:	1,144.47 ft
H'graph Detention Time:	0.20 hrs
Pond Model:	CSTRS
Dewater Time:	0.56 days
Trap Efficiency:	75.52 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
1,142.49	0.092	0.000	0.000		Top of Sed. Storage
1,142.50	0.092	0.000	0.000		
1,143.00	0.095	0.047	0.000		
1,143.50	0.098	0.096	0.000		Spillway #1
1,144.00	0.101	0.145	1.764	12.00	
1,144.47	0.104	0.194	23.384	1.50	Peak Stage
1,144.50	0.104	0.197	24.578		
1,145.00	0.107	0.249	52.555		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
1,142.49	0.000	0.000
1,142.50	0.000	0.000
1,143.00	0.000	0.000
1,143.50	0.000	0.000

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
1,144.00	1.764	1.764
1,144.50	24.578	24.578
1,145.00	52.555	52.555

Structure #10 (Pond)

Pond 20

Pond Inputs:

Initial Pool Elev:	1,138.50 ft
Initial Pool:	0.22 ac-ft
*Sediment Storage:	1.03 ac-ft
Dead Space:	0.00 %

**Sediment capacity was entered by user*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
1,138.50	10.00	2.00:1	2.00:1	9.00

Pond Results:

Peak Elevation:	1,139.34 ft
H'graph Detention Time:	0.48 hrs
Pond Model:	CSTRS
Dewater Time:	0.63 days
Trap Efficiency:	82.45 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
1,137.50	0.216	0.000	0.000		Top of Sed. Storage
1,138.00	0.221	0.109	0.000		
1,138.50	0.227	0.221	0.000		Spillway #1
1,139.00	0.232	0.336	1.880	14.10	
1,139.34	0.236	0.415	18.097	1.00	Peak Stage
1,139.50	0.238	0.454	25.996		
1,140.00	0.244	0.574	55.858		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
1,137.50	0.000	0.000
1,138.00	0.000	0.000
1,138.50	0.000	0.000
1,139.00	1.880	1.880
1,139.50	25.996	25.996
1,140.00	55.858	55.858

Structure #9 (Null)

Null Structure 1

Structure #15 (Null)

Null Structure 2

Structure #8 (Pond)

Pond 19

Pond Inputs:

Initial Pool Elev:	1,133.50 ft
Initial Pool:	0.31 ac-ft
*Sediment Storage:	0.99 ac-ft
Dead Space:	0.00 %

**Sediment capacity was entered by user*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
1,133.50	15.00	2.00:1	2.00:1	9.00

Pond Results:

Peak Elevation:	1,134.81 ft
H'graph Detention Time:	0.55 hrs
Pond Model:	CSTRS
Dewater Time:	0.74 days
Trap Efficiency:	79.71 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
1,132.50	0.307	0.000	0.000		Top of Sed. Storage
1,132.50	0.307	0.000	0.000		
1,133.00	0.314	0.155	0.000		
1,133.50	0.322	0.315	0.000		Spillway #1
1,134.00	0.330	0.477	1.764	14.10	
1,134.50	0.337	0.644	24.578	3.50	
1,134.81	0.342	0.749	41.711	0.05	Peak Stage
1,135.00	0.345	0.815	52.555		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
1,132.50	0.000	0.000
1,132.50	0.000	0.000
1,133.00	0.000	0.000
1,133.50	0.000	0.000
1,134.00	1.764	1.764
1,134.50	24.578	24.578
1,135.00	52.555	52.555

Structure #19 (Null)

Null Structure 7

Structure #20 (Null)

Null Structure 8

Structure #21 (Null)

Null Structure 9

Structure #22 (Null)

Null Structure 10

Structure #27 (Null)

Null Structure 15

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#23	1	85.700	0.282	0.018	0.452	69.000	S	71.44	9.353
	2	15.600	0.030	0.000	0.000	69.000	S	33.77	2.542
	3	6.600	0.019	0.043	0.453	69.000	S	14.29	1.075
	Σ	**107.900**						**104.36**	**12.970**
#26	1	15.200	0.032	0.008	0.470	69.000	S	32.90	2.477
	2	5.000	0.047	0.000	0.000	73.000	S	12.29	0.949
	3	48.300	0.033	0.031	0.461	69.000	S	104.56	7.870
	4	11.000	0.070	0.000	0.000	73.000	S	27.03	2.088
	Σ	**187.400**						**281.14**	**26.353**
#1	1	7.800	0.066	0.014	0.452	73.000	S	19.17	1.481
	2	4.600	0.004	0.010	0.455	86.000	F	15.33	1.328
	3	19.700	0.010	0.000	0.000	74.000	S	49.84	3.877
	Σ	**32.100**						**84.34**	**6.686**
#16	1	38.300	0.053	0.026	0.453	69.000	S	82.91	6.240
	2	19.500	0.026	0.000	0.000	73.000	S	47.92	3.702
	Σ	**89.900**						**208.16**	**16.628**
#17	1	33.900	0.031	0.014	0.469	69.000	S	73.39	5.523
	2	12.400	0.014	0.000	0.000	73.000	S	30.47	2.354
	Σ	**136.200**						**312.02**	**24.505**
#7	1	14.500	0.102	0.005	0.459	86.000	S	48.34	4.186
	2	2.400	0.005	0.000	0.000	74.000	M	6.07	0.472
	Σ	**16.900**						**54.41**	**4.658**
#6	1	0.240	0.003	0.069	0.436	86.000	F	0.80	0.068
	2	2.500	0.053	0.016	0.451	86.000	S	8.33	0.722
	3	18.200	0.016	0.000	0.000	74.000	M	46.04	3.582
	Σ	**20.940**						**55.16**	**4.372**
#5	1	8.500	0.064	0.040	0.440	73.000	S	20.89	1.614
	2	3.500	0.018	0.022	0.447	86.000	F	11.67	1.010
	3	1.300	0.004	0.018	0.450	86.000	S	4.33	0.375
	4	11.100	0.018	0.000	0.000	74.000	M	28.08	2.185
	Σ	**24.400**						**64.97**	**5.183**
#4	1	4.300	0.030	0.000	0.000	74.000	M	10.88	0.846
	Σ	**4.300**						**10.88**	**0.846**

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#3	1	2.600	0.030	0.000	0.000	74.000	M	6.58	0.512
	Σ	**2.600**						**6.58**	**0.512**
#18	1	26.500	0.022	0.030	0.454	69.000	S	57.37	4.318
	2	25.500	0.030	0.000	0.000	73.000	S	62.66	4.841
	3	19.000	0.048	0.000	0.000	73.000	S	46.69	3.607
	Σ	**276.340**						**642.18**	**52.842**
#14	1	10.700	0.046	0.037	0.442	73.000	S	26.29	2.031
	2	5.100	0.028	0.009	0.453	86.000	F	17.00	1.472
	3	6.600	0.009	0.000	0.000	73.000	S	16.22	1.253
	4	18.100	0.027	0.007	0.460	69.000	S	39.18	2.949
	Σ	**40.500**						**98.70**	**7.705**
#13	1	16.200	0.040	0.086	0.429	73.000	S	39.81	3.075
	2	16.000	0.017	0.069	0.432	86.000	F	53.34	4.619
	3	6.100	0.047	0.022	0.447	86.000	S	20.33	1.761
	4	4.800	0.022	0.000	0.000	74.000	M	12.14	0.945
	5	6.200	0.008	0.029	0.440	86.000	F	20.67	1.790
	6	19.400	0.020	0.013	0.444	74.000	M	49.08	3.818
	7	19.200	0.013	0.000	0.000	73.000	S	47.18	3.645
	8	9.900	0.039	0.045	0.436	73.000	S	24.33	1.879
	9	18.200	0.030	0.015	0.449	86.000	S	60.67	5.254
	10	24.800	0.015	0.000	0.000	73.000	S	60.94	4.708
	Σ	**140.800**						**384.91**	**31.494**
#12	1	4.400	0.025	0.041	0.436	86.000	F	14.67	1.270
	2	6.100	0.032	0.007	0.456	86.000	S	20.33	1.761
	3	7.600	0.004	0.003	0.456	74.000	M	19.23	1.496
	4	1.800	0.003	0.000	0.000	73.000	S	4.42	0.342
	5	14.800	0.050	0.111	0.419	73.000	S	36.37	2.810
	6	27.400	0.111	0.222	0.317	86.000	F	91.34	7.910
	7	25.200	0.133	0.011	0.451	86.000	S	45.23	4.911
	8	8.800	0.011	0.000	0.000	74.000	M	22.26	1.732
	9	2.400	0.025	0.065	0.429	73.000	S	5.90	0.455
	10	21.200	0.009	0.043	0.428	86.000	F	70.67	6.120
	11	4.500	0.035	0.008	0.453	86.000	S	15.00	1.299
	12	5.000	0.002	0.006	0.455	74.000	M	12.65	0.984
	13	6.000	0.006	0.000	0.000	73.000	S	14.74	1.139
	Σ	**135.200**						**360.02**	**32.228**
#11	1	1.600	0.003	0.035	0.357	86.000	F	5.33	0.462
	2	6.900	0.019	0.016	0.328	74.000	M	17.46	1.358
	3	0.400	0.016	0.000	0.000	73.000	S	0.98	0.076

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	Σ	**8.900**						**23.77**	**1.895**
#10	1	0.430	0.009	0.033	0.365	86.000	F	1.43	0.123
	2	6.900	0.033	0.000	0.000	74.000	M	17.46	1.358
	Σ	**7.330**						**18.89**	**1.481**
#9	1	0.400	0.010	0.043	0.457	86.000	F	1.33	0.115
	2	9.300	0.018	0.025	0.461	74.000	M	23.53	1.830
	3	12.300	0.025	0.000	0.000	73.000	S	30.23	2.335
	4	1.500	0.008	0.100	0.443	86.000	F	5.00	0.433
	5	10.900	0.040	0.047	0.453	74.000	M	27.57	2.145
	6	16.300	0.047	0.000	0.000	73.000	S	40.05	3.094
	Σ	**202.130**						**407.53**	**45.557**
#15	1	1.100	0.049	0.019	0.453	73.000	S	2.70	0.209
	2	1.100	0.015	0.004	0.462	86.000	F	3.67	0.317
	3	11.600	0.004	0.037	0.406	73.000	S	28.51	2.202
	4	6.400	0.020	0.052	0.400	69.000	S	13.85	1.043
	Σ	**403.630**						**900.66**	**88.527**
#8	1	1.900	0.006	0.039	0.390	86.000	F	6.33	0.548
	2	14.900	0.081	0.000	0.000	74.000	M	37.69	2.933
	Σ	**16.800**						**44.03**	**3.481**
#19	1	34.100	0.038	0.031	0.448	69.000	S	73.82	5.556
	2	15.200	0.031	0.000	0.000	73.000	S	37.35	2.886
	3	8.500	0.068	0.000	0.000	73.000	S	20.89	1.614
	Σ	**754.570**						**1,714.33**	**154.905**
#20	1	12.900	0.022	0.024	0.458	69.000	S	27.93	2.102
	2	16.800	0.024	0.000	0.000	73.000	S	41.28	3.189
	3	3.800	0.029	0.012	0.458	69.000	S	8.23	0.619
	4	9.400	0.012	0.000	0.000	73.000	S	23.10	1.784
	Σ	**797.470**						**1,814.87**	**162.600**
#21	1	27.500	0.030	0.035	0.447	69.000	S	59.53	4.481
	2	17.200	0.035	0.000	0.000	73.000	S	42.27	3.265
	3	13.400	0.018	0.018	0.453	69.000	S	29.01	2.183
	4	8.300	0.024	0.000	0.000	73.000	S	20.40	1.576
	Σ	**863.870**						**1,966.07**	**174.105**
#22	1	7.200	0.028	0.019	0.448	69.000	S	15.59	1.173
	2	10.700	0.019	0.000	0.000	73.000	S	26.29	2.031
	3	1.700	0.015	0.017	0.452	69.000	S	3.68	0.277
	4	5.300	0.017	0.000	0.000	73.000	S	13.02	1.006

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	Σ	**888.770**						**2,024.65**	**178.592**
#27	1	15.600	0.050	0.011	0.459	69.000	S	33.77	2.542
	2	20.300	0.011	0.000	0.000	73.000	S	49.88	3.854
	3	34.300	0.040	0.065	0.426	69.000	S	74.25	5.589
	4	23.800	0.071	0.000	0.000	73.000	S	58.48	4.518
	Σ	**1,170.170**						**2,517.80**	**221.447**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#23	1	0.220	100.00	20.00	0.0100	1.0000	1	34.2	4,949	2.69	1.46
	2	0.220	100.00	50.00	0.0100	1.0000	1	21.9	12,393	7.93	4.04
	3	0.220	100.00	50.00	0.0100	1.0000	1	8.4	11,183	7.15	3.64
	Σ							**56.8**	**6,973**	**3.92**	**1.80**
#26	1	0.220	100.00	50.00	0.0100	1.0000	1	21.3	12,355	7.90	4.03
	2	0.170	100.00	30.00	0.0030	1.0000	2	1.0	1,514	0.82	0.43
	3	0.220	100.00	50.00	0.0100	1.0000	1	77.7	14,183	9.07	4.62
	4	0.170	100.00	40.00	0.0030	1.0000	2	3.3	2,211	1.19	0.62
	Σ							**160.0**	**9,595**	**5.83**	**2.71**
#1	1	0.170	100.00	40.00	0.0030	1.0000	2	2.2	2,122	1.14	0.60
	2	0.220	50.00	5.00	0.9000	1.0000	1	44.4	43,903	28.08	15.52
	3	0.220	100.00	33.00	0.0500	1.0000	1	116.9	41,514	26.55	14.00
	Σ							**163.6**	**33,111**	**21.13**	**11.36**
#16	1	0.220	100.00	50.00	0.0100	1.0000	1	59.9	13,796	8.82	4.50
	2	0.170	100.00	30.00	0.0030	1.0000	2	4.7	1,782	0.96	0.50
	Σ							**96.0**	**8,482**	**3.77**	**1.88**
#17	1	0.220	100.00	45.00	0.0100	1.0000	1	47.6	12,395	7.93	4.04
	2	0.170	100.00	30.00	0.0030	1.0000	2	2.8	1,688	0.91	0.47
	Σ							**146.5**	**8,742**	**4.46**	**2.24**
#7	1	0.220	100.00	7.00	0.9000	1.0000	1	313.3	96,099	61.46	34.12
	2	0.220	50.00	40.00	0.0500	1.0000	2	8.8	25,825	13.91	7.33
	Σ							**322.1**	**88,455**	**56.32**	**31.46**
#6	1	0.220	50.00	10.00	0.9000	1.0000	1	3.6	70,007	44.77	24.25
	2	0.220	50.00	2.00	0.9000	1.0000	1	10.4	19,148	12.25	6.76

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	3	0.220	100.00	32.00	0.0500	1.0000	1	103.7	39,891	25.51	13.45
	Σ							**117.7**	**37,181**	**23.78**	**12.52**
#5	1	0.170	50.00	30.00	0.0030	1.0000	2	1.2	1,065	0.57	0.30
	2	0.220	50.00	15.00	0.9000	1.0000	1	119.9	148,971	95.27	53.15
	3	0.220	50.00	2.00	0.9000	1.0000	1	5.0	17,714	11.33	6.25
	4	0.220	100.00	30.00	0.0500	1.0000	1	55.8	35,258	22.55	11.88
	Σ							**181.9**	**44,634**	**28.51**	**16.24**
#4	1	0.220	100.00	39.00	0.0500	1.0000	1	25.0	40,738	26.05	13.74
	Σ							**25.0**	**40,738**	**26.05**	**13.74**
#3	1	0.220	100.00	30.00	0.0500	1.0000	1	11.0	29,689	18.99	10.00
	Σ							**11.0**	**29,689**	**18.99**	**10.00**
#18	1	0.220	100.00	45.00	0.0100	1.0000	1	36.1	12,036	7.70	3.92
	2	0.170	100.00	30.00	0.0030	1.0000	2	6.3	1,841	0.99	0.52
	3	0.170	100.00	35.00	0.0030	1.0000	2	5.3	2,076	1.12	0.58
	Σ							**362.7**	**10,189**	**4.09**	**2.03**
#14	1	0.170	100.00	58.00	0.0030	1.0000	2	4.4	3,049	1.64	0.86
	2	0.220	50.00	5.00	0.9000	1.0000	1	49.9	44,440	28.42	15.71
	3	0.170	100.00	30.00	0.0030	1.0000	2	1.4	1,565	0.84	0.44
	4	0.220	100.00	50.00	0.0100	1.0000	1	25.9	12,615	8.07	4.11
	Σ							**81.6**	**13,821**	**8.74**	**4.90**
#13	1	0.170	50.00	35.00	0.0030	1.0000	2	2.9	1,430	0.77	0.12
	2	0.220	100.00	35.00	0.9000	1.0000	1	2,556.1	586,352	374.98	212.26
	3	0.220	25.00	5.00	0.9000	1.0000	1	43.1	32,266	20.63	11.39
	4	0.170	100.00	30.00	0.0500	1.0000	1	16.9	24,742	15.82	8.33
	5	0.220	50.00	30.00	0.9000	1.0000	1	499.2	324,051	207.24	117.52
	6	0.220	50.00	25.00	0.0500	1.0000	1	56.7	20,630	13.19	6.94
	7	0.220	50.00	20.00	0.0030	1.0000	1	2.5	977	0.62	0.33
	8	0.220	100.00	50.00	0.0030	1.0000	2	4.6	3,455	1.86	0.97
	9	0.220	100.00	50.00	0.9000	1.0000	1	4,109.5	736,425	470.96	279.25
	10	0.170	100.00	30.00	0.0030	1.0000	2	6.1	1,834	0.99	0.52
	Σ							**7,297.0**	**276,843**	**176.99**	**99.27**
#12	1	0.220	100.00	22.00	0.9000	1.0000	1	369.0	335,755	214.72	121.91
	2	0.220	100.00	2.00	0.9000	1.0000	1	34.9	26,163	16.73	9.23
	3	0.220	100.00	35.00	0.0500	1.0000	1	42.7	39,300	25.13	13.25
	4	0.170	50.00	35.00	0.0030	1.0000	2	0.3	1,033	0.56	0.29
	5	0.170	100.00	30.00	0.0030	1.0000	2	3.4	1,709	0.92	0.49
	6	0.220	50.00	15.00	0.9000	1.0000	1	1,201.4	190,941	122.11	67.21

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	7	0.220	100.00	6.00	0.9000	1.0000	1	355.0	96,881	56.27	30.02
	8	0.220	100.00	27.00	0.0500	1.0000	1	38.5	30,762	19.67	10.36
	9	0.170	50.00	47.00	0.0030	1.0000	2	0.5	1,441	0.78	0.40
	10	0.220	100.00	22.00	0.9000	1.0000	1	2,147.3	394,467	252.27	144.05
	11	0.220	50.00	2.50	0.9000	1.0000	1	24.6	25,011	16.00	8.83
	12	0.220	100.00	22.00	0.0500	1.0000	1	16.4	23,059	14.75	7.76
	13	0.170	50.00	34.00	0.0030	1.0000	2	0.9	1,159	0.62	0.33
	Σ							**4,233.8**	**181,013**	**114.79**	**58.07**
#11	1	0.220	25.00	32.00	0.9000	1.0000	1	77.2	204,780	130.96	73.47
	2	0.220	100.00	35.00	0.0500	1.0000	1	38.3	38,854	24.85	13.10
	3	0.170	25.00	40.00	0.0030	1.0000	2	0.0	648	0.35	0.18
	Σ							**115.5**	**76,638**	**49.01**	**27.93**
#10	1	0.220	25.00	32.00	0.9000	1.0000	1	17.7	177,142	113.29	63.72
	2	0.220	100.00	30.00	0.0500	1.0000	1	32.8	33,329	21.31	11.23
	Σ							**50.5**	**44,876**	**28.70**	**15.80**
#9	1	0.220	50.00	35.00	0.0030	1.0000	1	0.1	1,044	0.67	0.37
	2	0.220	100.00	30.00	0.9000	1.0000	1	823.9	503,241	321.83	179.02
	3	0.170	25.00	50.00	0.9000	1.0000	2	594.2	313,377	168.83	91.30
	4	0.220	100.00	30.00	0.0030	1.0000	1	0.5	1,590	1.02	0.56
	5	0.220	50.00	6.00	0.9000	1.0000	1	96.0	61,149	39.11	20.67
	6	0.170	50.00	30.00	0.0500	1.0000	2	42.2	19,048	10.26	5.37
	Σ							**2,429.2**	**144,853**	**58.79**	**15.84**
#15	1	0.170	100.00	53.00	0.0030	1.0000	2	0.3	2,156	1.16	0.61
	2	0.220	50.00	5.00	0.9000	1.0000	1	9.0	37,083	23.72	13.12
	3	0.170	100.00	50.00	0.0030	1.0000	2	4.3	2,722	1.47	0.77
	4	0.220	100.00	50.00	0.0100	1.0000	1	8.1	10,979	7.02	3.63
	Σ							**4,292.0**	**75,402**	**24.66**	**11.73**
#8	1	0.220	25.00	32.00	0.9000	1.0000	1	93.5	208,687	133.46	74.88
	2	0.220	100.00	30.00	0.0500	1.0000	1	77.6	36,507	23.35	12.31
	Σ							**171.1**	**62,876**	**40.21**	**22.65**
#19	1	0.220	100.00	50.00	0.0100	1.0000	1	52.6	13,606	8.70	4.43
	2	0.170	100.00	40.00	0.0030	1.0000	2	4.7	2,299	1.24	0.65
	3	0.220	100.00	50.00	0.0100	1.0000	2	13.0	11,273	6.07	3.17
	Σ							**4,720.7**	**52,182**	**17.29**	**7.55**
#20	1	0.220	100.00	45.00	0.0100	1.0000	1	16.1	11,045	7.06	3.60
	2	0.170	100.00	30.00	0.0030	1.0000	2	4.0	1,751	0.94	0.49
	3	0.220	100.00	30.00	0.0100	1.0000	1	2.8	6,449	4.12	2.10

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	4	0.170	100.00	30.00	0.0030	1.0000	2	2.1	1,633	0.88	0.46
	Σ							**4,745.4**	**49,530**	**16.49**	**7.27**
#21	1	0.220	100.00	45.00	0.0100	1.0000	1	37.7	12,090	7.73	3.94
	2	0.170	100.00	15.00	0.0030	1.0000	2	1.9	800	0.43	0.23
	3	0.220	100.00	50.00	0.0100	1.0000	1	18.5	12,170	7.78	3.96
	4	0.170	100.00	10.00	0.0030	1.0000	2	0.5	412	0.22	0.12
	Σ							**4,803.7**	**46,261**	**15.57**	**6.95**
#22	1	0.220	100.00	45.00	0.0100	1.0000	1	8.4	10,301	6.59	3.36
	2	0.170	100.00	30.00	0.0030	1.0000	2	2.4	1,659	0.89	0.47
	3	0.220	100.00	50.00	0.0100	1.0000	1	1.8	9,510	6.08	3.10
	4	0.170	100.00	30.00	0.0030	1.0000	2	1.1	1,525	0.82	0.43
	Σ							**4,817.2**	**53,524**	**18.06**	**6.81**
#27	1	0.220	100.00	25.00	0.0100	1.0000	1	11.1	6,300	4.03	2.05
	2	0.170	100.00	45.00	0.0030	1.0000	2	7.3	2,653	1.43	0.75
	3	0.220	100.00	50.00	0.0100	1.0000	1	52.9	13,897	8.89	4.44
	4	0.170	100.00	30.00	0.0030	1.0000	2	5.9	1,825	0.98	0.51
	Σ							**5,054.3**	**56,923**	**19.95**	**5.85**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	41.03	160.00	390.00	1.620	0.066
#1	**1**	**Time of Concentration:**					**0.066**
#1	2	8. Large gullies, diversions, and low flowing streams	5.00	5.00	100.00	6.700	0.004
#1	**2**	**Time of Concentration:**					**0.004**
#1	3	8. Large gullies, diversions, and low flowing streams	33.33	220.00	660.00	17.320	0.010
#1	**3**	**Time of Concentration:**					**0.010**
#3	1	3. Short grass pasture	32.50	130.00	400.00	4.560	0.024
		8. Large gullies, diversions, and low flowing streams	2.00	2.00	100.00	4.240	0.006
#3	**1**	**Time of Concentration:**					**0.030**
#4	1	3. Short grass pasture	38.40	180.00	468.75	4.950	0.026
		8. Large gullies, diversions, and low flowing streams	5.00	5.00	100.00	6.700	0.004
#4	**1**	**Time of Concentration:**					**0.030**
#5	1	1. Forest with heavy ground litter	28.57	90.00	315.00	1.350	0.064
#5	**1**	**Time of Concentration:**					**0.064**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#5	2	5. Nearly bare and untilled, and alluvial valley fans	15.00	25.00	166.66	3.870	0.011
		8. Large gullies, diversions, and low flowing streams	15.00	50.00	333.33	11.610	0.007
#5	**2**	**Time of Concentration:**					**0.018**
#5	3	8. Large gullies, diversions, and low flowing streams	2.00	1.50	75.00	4.240	0.004
#5	**3**	**Time of Concentration:**					**0.004**
#5	4	8. Large gullies, diversions, and low flowing streams	30.67	230.00	750.00	16.610	0.012
		8. Large gullies, diversions, and low flowing streams	2.00	2.00	100.00	4.240	0.006
#5	**4**	**Time of Concentration:**					**0.018**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	50.00	45.00	90.00	7.070	0.003
#6	**1**	**Time of Concentration:**					**0.003**
#6	2	5. Nearly bare and untilled, and alluvial valley fans	3.00	10.00	333.33	1.730	0.053
#6	**2**	**Time of Concentration:**					**0.053**
#6	3	8. Large gullies, diversions, and low flowing streams	30.67	230.00	750.00	16.610	0.012
		8. Large gullies, diversions, and low flowing streams	2.00	1.50	75.00	4.240	0.004
#6	**3**	**Time of Concentration:**					**0.016**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	6.67	20.00	300.00	2.580	0.032
		8. Large gullies, diversions, and low flowing streams	2.50	30.00	1,200.00	4.740	0.070
#7	**1**	**Time of Concentration:**					**0.102**
#7	2	8. Large gullies, diversions, and low flowing streams	40.00	140.00	350.00	18.970	0.005
#7	**2**	**Time of Concentration:**					**0.005**
#8	1	5. Nearly bare and untilled, and alluvial valley fans	32.00	40.00	125.00	5.650	0.006
#8	**1**	**Time of Concentration:**					**0.006**
#8	2	3. Short grass pasture	40.00	140.00	350.00	5.050	0.019
		5. Nearly bare and untilled, and alluvial valley fans	5.00	25.00	500.00	2.230	0.062
#8	**2**	**Time of Concentration:**					**0.081**
#9	1	5. Nearly bare and untilled, and alluvial valley fans	16.67	25.00	150.00	4.080	0.010
#9	**1**	**Time of Concentration:**					**0.010**
#9	2	3. Short grass pasture	37.74	100.00	265.00	4.910	0.014
		8. Large gullies, diversions, and low flowing streams	35.00	100.00	285.71	17.740	0.004
#9	**2**	**Time of Concentration:**					**0.018**
#9	3	8. Large gullies, diversions, and low flowing streams	35.00	75.00	214.28	17.740	0.003

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		9. Small streams flowing bankfull	5.00	80.00	1,600.00	20.120	0.022
#9	**3**	**Time of Concentration:**					**0.025**
#9	4	5. Nearly bare and untilled, and alluvial valley fans	25.00	40.00	160.00	5.000	0.008
#9	**4**	**Time of Concentration:**					**0.008**
#9	5	8. Large gullies, diversions, and low flowing streams	6.32	70.00	1,107.59	7.540	0.040
#9	**5**	**Time of Concentration:**					**0.040**
#9	6	8. Large gullies, diversions, and low flowing streams	12.82	125.00	975.03	10.740	0.025
		9. Small streams flowing bankfull	5.00	80.00	1,600.00	20.120	0.022
#9	**6**	**Time of Concentration:**					**0.047**
#10	1	5. Nearly bare and untilled, and alluvial valley fans	20.00	30.00	150.00	4.470	0.009
#10	**1**	**Time of Concentration:**					**0.009**
#10	2	3. Short grass pasture	35.71	125.00	350.00	4.780	0.020
		8. Large gullies, diversions, and low flowing streams	2.00	4.00	200.00	4.240	0.013
#10	**2**	**Time of Concentration:**					**0.033**
#11	1	5. Nearly bare and untilled, and alluvial valley fans	31.25	25.00	80.00	5.590	0.003
#11	**1**	**Time of Concentration:**					**0.003**
#11	2	3. Short grass pasture	34.85	115.00	330.00	4.720	0.019
#11	**2**	**Time of Concentration:**					**0.019**
#11	3	1. Forest with heavy ground litter	46.15	30.00	65.00	1.710	0.010
		8. Large gullies, diversions, and low flowing streams	2.00	2.00	100.00	4.240	0.006
#11	**3**	**Time of Concentration:**					**0.016**
#12	1	5. Nearly bare and untilled, and alluvial valley fans	21.18	90.00	425.00	4.600	0.025
#12	**1**	**Time of Concentration:**					**0.025**
#12	2	8. Large gullies, diversions, and low flowing streams	2.00	10.00	500.00	4.240	0.032
#12	**2**	**Time of Concentration:**					**0.032**
#12	3	8. Large gullies, diversions, and low flowing streams	35.00	100.00	285.71	17.740	0.004
#12	**3**	**Time of Concentration:**					**0.004**
#12	4	8. Large gullies, diversions, and low flowing streams	35.00	75.00	214.28	17.740	0.003
#12	**4**	**Time of Concentration:**					**0.003**
#12	5	1. Forest with heavy ground litter	30.00	75.00	249.99	1.380	0.050
#12	**5**	**Time of Concentration:**					**0.050**
#12	6	5. Nearly bare and untilled, and alluvial valley fans	20.00	40.00	200.00	4.470	0.012
		8. Large gullies, diversions, and low flowing streams	9.23	300.00	3,250.05	9.110	0.099
#12	**6**	**Time of Concentration:**					**0.111**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#12	7	5. Nearly bare and untilled, and alluvial valley fans	5.88	29.40	500.00	2.420	0.057
		8. Large gullies, diversions, and low flowing streams	3.33	50.00	1,500.01	5.470	0.076
#12	**7**	**Time of Concentration:**					**0.133**
#12	8	8. Large gullies, diversions, and low flowing streams	26.92	175.00	650.00	15.560	0.011
#12	**8**	**Time of Concentration:**					**0.011**
#12	9	1. Forest with heavy ground litter	46.88	75.00	160.00	1.730	0.025
#12	**9**	**Time of Concentration:**					**0.025**
#12	10	8. Large gullies, diversions, and low flowing streams	21.05	100.00	475.00	13.760	0.009
#12	**10**	**Time of Concentration:**					**0.009**
#12	11	8. Large gullies, diversions, and low flowing streams	2.50	15.00	600.00	4.740	0.035
#12	**11**	**Time of Concentration:**					**0.035**
#12	12	8. Large gullies, diversions, and low flowing streams	21.74	25.00	115.00	13.980	0.002
#12	**12**	**Time of Concentration:**					**0.002**
#12	13	8. Large gullies, diversions, and low flowing streams	33.33	125.00	375.00	17.320	0.006
#12	**13**	**Time of Concentration:**					**0.006**
#13	1	1. Forest with heavy ground litter	34.88	75.00	215.00	1.490	0.040
#13	**1**	**Time of Concentration:**					**0.040**
#13	2	5. Nearly bare and untilled, and alluvial valley fans	33.78	125.00	370.00	5.810	0.017
		8. Large gullies, diversions, and low flowing streams	33.78	20.26	59.97	17.430	0.000
#13	**2**	**Time of Concentration:**					**0.017**
#13	3	8. Large gullies, diversions, and low flowing streams	3.16	15.00	475.01	5.330	0.024
		8. Large gullies, diversions, and low flowing streams	8.28	60.00	725.00	8.630	0.023
#13	**3**	**Time of Concentration:**					**0.047**
#13	4	8. Large gullies, diversions, and low flowing streams	33.73	140.00	415.00	17.420	0.006
		9. Small streams flowing bankfull	2.00	15.00	750.00	12.720	0.016
#13	**4**	**Time of Concentration:**					**0.022**
#13	5	5. Nearly bare and untilled, and alluvial valley fans	21.43	30.00	140.00	4.620	0.008
#13	**5**	**Time of Concentration:**					**0.008**
#13	6	3. Short grass pasture	20.00	40.00	200.00	3.570	0.015
		8. Large gullies, diversions, and low flowing streams	26.32	75.00	285.00	15.380	0.005
#13	**6**	**Time of Concentration:**					**0.020**
#13	7	8. Large gullies, diversions, and low flowing streams	26.32	50.00	189.96	15.390	0.003

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		9. Small streams flowing bankfull	2.00	10.00	500.00	12.720	0.010
#13	**7**	**Time of Concentration:**					**0.013**
#13	8	1. Forest with heavy ground litter	50.00	125.00	250.00	1.780	0.039
#13	**8**	**Time of Concentration:**					**0.039**
#13	9	5. Nearly bare and untilled, and alluvial valley fans	60.00	150.00	249.99	7.740	0.008
		8. Large gullies, diversions, and low flowing streams	8.57	60.00	700.11	8.780	0.022
#13	**9**	**Time of Concentration:**					**0.030**
#13	10	8. Large gullies, diversions, and low flowing streams	34.67	130.00	375.00	17.660	0.005
		9. Small streams flowing bankfull	2.00	10.00	500.00	12.720	0.010
#13	**10**	**Time of Concentration:**					**0.015**
#14	1	1. Forest with heavy ground litter	58.46	190.00	325.00	1.930	0.046
#14	**1**	**Time of Concentration:**					**0.046**
#14	2	5. Nearly bare and untilled, and alluvial valley fans	2.86	5.00	175.00	1.690	0.028
#14	**2**	**Time of Concentration:**					**0.028**
#14	3	8. Large gullies, diversions, and low flowing streams	29.57	170.00	575.00	16.310	0.009
#14	**3**	**Time of Concentration:**					**0.009**
#14	4	3. Short grass pasture	50.00	250.00	500.00	5.650	0.024
		8. Large gullies, diversions, and low flowing streams	48.00	120.00	250.00	20.780	0.003
#14	**4**	**Time of Concentration:**					**0.027**
#15	1	1. Forest with heavy ground litter	52.31	170.00	325.00	1.820	0.049
#15	**1**	**Time of Concentration:**					**0.049**
#15	2	5. Nearly bare and untilled, and alluvial valley fans	4.35	5.00	115.00	2.080	0.015
#15	**2**	**Time of Concentration:**					**0.015**
#15	3	8. Large gullies, diversions, and low flowing streams	48.65	180.00	370.00	20.920	0.004
#15	**3**	**Time of Concentration:**					**0.004**
#15	4	3. Short grass pasture	53.33	230.00	431.25	5.840	0.020
#15	**4**	**Time of Concentration:**					**0.020**
#16	1	3. Short grass pasture	50.00	200.00	400.00	5.650	0.019
		3. Short grass pasture	1.00	1.00	100.00	0.800	0.034
#16	**1**	**Time of Concentration:**					**0.053**
#16	2	8. Large gullies, diversions, and low flowing streams	23.81	250.00	1,050.00	14.630	0.019
		9. Small streams flowing bankfull	4.76	25.00	525.00	19.630	0.007
#16	**2**	**Time of Concentration:**					**0.026**
#17	1	3. Short grass pasture	44.00	220.00	500.00	5.300	0.026
		8. Large gullies, diversions, and low flowing streams	35.71	125.00	350.00	17.920	0.005
#17	**1**	**Time of Concentration:**					**0.031**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#17	2	8. Large gullies, diversions, and low flowing streams	29.09	80.00	275.00	16.180	0.004
		9. Small streams flowing bankfull	9.52	100.00	1,050.00	27.770	0.010
#17	**2**	**Time of Concentration:**					**0.014**
#18	1	3. Short grass pasture	57.14	200.00	350.00	6.040	0.016
		8. Large gullies, diversions, and low flowing streams	33.33	50.00	150.00	17.320	0.002
		8. Large gullies, diversions, and low flowing streams	5.00	5.00	100.00	6.700	0.004
#18	**1**	**Time of Concentration:**					**0.022**
#18	2	8. Large gullies, diversions, and low flowing streams	37.33	140.00	375.00	18.330	0.005
		9. Small streams flowing bankfull	3.33	50.00	1,500.01	16.430	0.025
#18	**2**	**Time of Concentration:**					**0.030**
#18	3	1. Forest with heavy ground litter	40.00	50.00	125.00	1.600	0.021
		9. Small streams flowing bankfull	5.00	100.00	2,000.00	20.120	0.027
#18	**3**	**Time of Concentration:**					**0.048**
#19	1	3. Short grass pasture	51.11	230.00	450.00	5.710	0.021
		8. Large gullies, diversions, and low flowing streams	3.33	10.00	300.00	5.470	0.015
		8. Large gullies, diversions, and low flowing streams	50.00	90.00	180.00	21.210	0.002
#19	**1**	**Time of Concentration:**					**0.038**
#19	2	8. Large gullies, diversions, and low flowing streams	18.46	120.00	650.00	12.890	0.014
		9. Small streams flowing bankfull	3.08	30.00	975.00	15.780	0.017
#19	**2**	**Time of Concentration:**					**0.031**
#19	3	1. Forest with heavy ground litter	35.71	100.00	280.00	1.510	0.051
		9. Small streams flowing bankfull	3.64	40.00	1,100.01	17.160	0.017
#19	**3**	**Time of Concentration:**					**0.068**
#20	1	3. Short grass pasture	50.00	175.00	350.00	5.650	0.017
		8. Large gullies, diversions, and low flowing streams	44.44	100.00	225.00	19.990	0.003
		8. Large gullies, diversions, and low flowing streams	6.25	5.00	80.00	7.500	0.002
#20	**1**	**Time of Concentration:**					**0.022**
#20	2	8. Large gullies, diversions, and low flowing streams	33.13	275.00	830.00	17.260	0.013
		9. Small streams flowing bankfull	4.85	40.00	825.01	19.810	0.011
#20	**2**	**Time of Concentration:**					**0.024**
#20	3	3. Short grass pasture	37.50	75.00	200.00	4.890	0.011
		3. Short grass pasture	6.67	5.00	75.00	2.060	0.010
		3. Short grass pasture	45.00	75.00	166.66	5.360	0.008
#20	**3**	**Time of Concentration:**					**0.029**
#20	4	8. Large gullies, diversions, and low flowing streams	40.00	160.00	400.00	18.970	0.005

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		9. Small streams flowing bankfull	4.00	20.00	500.00	18.000	0.007
#20	**4**	**Time of Concentration:**					**0.012**
#21	1	3. Short grass pasture	48.00	240.00	500.00	5.540	0.025
		8. Large gullies, diversions, and low flowing streams	46.67	70.00	150.00	20.490	0.002
		8. Large gullies, diversions, and low flowing streams	7.37	7.00	95.00	8.140	0.003
#21	**1**	**Time of Concentration:**					**0.030**
#21	2	8. Large gullies, diversions, and low flowing streams	21.96	280.00	1,275.01	14.050	0.025
		9. Small streams flowing bankfull	2.73	15.00	550.01	14.860	0.010
#21	**2**	**Time of Concentration:**					**0.035**
#21	3	3. Short grass pasture	50.00	180.00	360.00	5.650	0.017
		9. Small streams flowing bankfull	48.72	190.00	390.00	62.810	0.001
#21	**3**	**Time of Concentration:**					**0.018**
#21	4	8. Large gullies, diversions, and low flowing streams	31.25	200.00	640.00	16.770	0.010
		9. Small streams flowing bankfull	3.00	15.00	500.00	15.580	0.008
#21	**4**	**Time of Concentration:**					**0.024**
#22	1	3. Short grass pasture	58.14	250.00	430.00	6.090	0.019
		3. Short grass pasture	7.14	5.00	70.00	2.130	0.009
#22	**1**	**Time of Concentration:**					**0.028**
#22	2	8. Large gullies, diversions, and low flowing streams	22.47	200.00	890.00	14.220	0.017
		9. Small streams flowing bankfull	3.33	5.00	150.00	16.430	0.002
#22	**2**	**Time of Concentration:**					**0.019**
#22	3	3. Short grass pasture	48.70	150.00	308.00	5.580	0.015
#22	**3**	**Time of Concentration:**					**0.015**
#22	4	8. Large gullies, diversions, and low flowing streams	44.44	200.00	450.00	19.990	0.006
		9. Small streams flowing bankfull	1.90	10.00	525.01	12.420	0.011
#22	**4**	**Time of Concentration:**					**0.017**
#23	1	3. Short grass pasture	50.00	150.00	300.00	5.650	0.014
		8. Large gullies, diversions, and low flowing streams	1.24	40.00	3,225.00	3.340	0.268
#23	**1**	**Time of Concentration:**					**0.282**
#23	2	3. Short grass pasture	42.86	180.00	420.00	5.230	0.022
		8. Large gullies, diversions, and low flowing streams	30.00	150.00	500.00	16.430	0.008
#23	**2**	**Time of Concentration:**					**0.030**
#23	3	3. Short grass pasture	42.31	110.00	260.00	5.200	0.013
		8. Large gullies, diversions, and low flowing streams	36.59	150.00	410.00	18.140	0.006
#23	**3**	**Time of Concentration:**					**0.019**
#26	1	3. Short grass pasture	40.00	170.00	425.00	5.050	0.023

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	45.95	170.00	370.00	20.330	0.005
		9. Small streams flowing bankfull	5.00	15.00	300.00	20.120	0.004
#26	**1**	**Time of Concentration:**					**0.032**
#26	2	1. Forest with heavy ground litter	42.86	120.00	280.00	1.650	0.047
			11.32	60.00	530.00	0.000	0.000
#26	**2**	**Time of Concentration:**					**0.047**
#26	3	3. Short grass pasture	50.00	250.00	500.00	5.650	0.024
		8. Large gullies, diversions, and low flowing streams	32.14	180.00	560.00	17.000	0.009
#26	**3**	**Time of Concentration:**					**0.033**
#26	4	1. Forest with heavy ground litter	39.47	150.00	380.00	1.580	0.066
		9. Small streams flowing bankfull	13.21	70.00	530.00	32.700	0.004
#26	**4**	**Time of Concentration:**					**0.070**
#27	1	3. Short grass pasture	33.68	160.00	475.00	4.640	0.028
		8. Large gullies, diversions, and low flowing streams	20.62	100.00	485.00	13.620	0.009
		8. Large gullies, diversions, and low flowing streams	3.64	10.00	275.00	5.720	0.013
#27	**1**	**Time of Concentration:**					**0.050**
#27	2	8. Large gullies, diversions, and low flowing streams	48.00	300.00	625.00	20.780	0.008
		9. Small streams flowing bankfull	2.50	5.00	200.00	14.230	0.003
#27	**2**	**Time of Concentration:**					**0.011**
#27	3	3. Short grass pasture	50.00	250.00	500.00	5.650	0.024
		8. Large gullies, diversions, and low flowing streams	14.49	100.00	690.00	11.420	0.016
#27	**3**	**Time of Concentration:**					**0.040**
#27	4	1. Forest with heavy ground litter	48.28	140.00	290.00	1.750	0.046
		8. Large gullies, diversions, and low flowing streams	9.47	80.00	845.00	9.230	0.025
#27	**4**	**Time of Concentration:**					**0.071**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	5.00	5.00	100.00	6.700	0.004
		8. Large gullies, diversions, and low flowing streams	33.33	220.00	660.00	17.320	0.010
#1	**1**	**Muskingum K:**					**0.014**
#1	2	8. Large gullies, diversions, and low flowing streams	33.33	220.00	660.00	17.320	0.010
#1	**2**	**Muskingum K:**					**0.010**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#5	1	5. Nearly bare and untilled, and alluvial valley fans	15.00	25.00	166.66	3.870	0.011
		8. Large gullies, diversions, and low flowing streams	15.00	50.00	333.33	11.610	0.007
		8. Large gullies, diversions, and low flowing streams	2.00	1.50	75.00	4.240	0.004
		8. Large gullies, diversions, and low flowing streams	30.67	230.00	749.91	16.610	0.012
		8. Large gullies, diversions, and low flowing streams	2.00	2.00	100.00	4.240	0.006
#5	**1**	**Muskingum K:**					**0.040**
#5	2	8. Large gullies, diversions, and low flowing streams	2.00	1.50	75.00	4.240	0.004
		8. Large gullies, diversions, and low flowing streams	30.67	230.00	750.00	16.610	0.012
		8. Large gullies, diversions, and low flowing streams	2.00	2.00	100.00	4.240	0.006
#5	**2**	**Muskingum K:**					**0.022**
#5	3	8. Large gullies, diversions, and low flowing streams	30.67	230.00	750.00	16.610	0.012
		8. Large gullies, diversions, and low flowing streams	2.00	2.00	100.00	4.240	0.006
#5	**3**	**Muskingum K:**					**0.018**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	3.00	10.00	333.33	1.730	0.053
		8. Large gullies, diversions, and low flowing streams	30.67	230.00	750.00	16.610	0.012
		8. Large gullies, diversions, and low flowing streams	2.00	1.50	75.00	4.240	0.004
#6	**1**	**Muskingum K:**					**0.069**
#6	2	8. Large gullies, diversions, and low flowing streams	30.67	230.00	750.00	16.610	0.012
		8. Large gullies, diversions, and low flowing streams	2.00	1.50	75.00	4.240	0.004
#6	**2**	**Muskingum K:**					**0.016**
#7	1	8. Large gullies, diversions, and low flowing streams	40.00	140.00	350.00	18.970	0.005
#7	**1**	**Muskingum K:**					**0.005**
#8	1	3. Short grass pasture	40.00	140.00	350.00	5.050	0.019
		8. Large gullies, diversions, and low flowing streams	5.00	25.00	500.00	6.700	0.020
#8	**1**	**Muskingum K:**					**0.039**
#9	1	3. Short grass pasture	37.74	100.00	265.00	4.910	0.014
		8. Large gullies, diversions, and low flowing streams	35.00	175.00	500.00	17.740	0.007
		9. Small streams flowing bankfull	5.00	80.00	1,600.00	20.120	0.022
#9	**1**	**Muskingum K:**					**0.043**
#9	2	8. Large gullies, diversions, and low flowing streams	35.00	75.00	214.28	17.740	0.003

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		9. Small streams flowing bankfull	5.00	80.00	1,600.00	20.120	0.022
#9	**2**	**Muskingum K:**					**0.025**
#9	4	3. Short grass pasture	33.33	75.00	225.00	4.610	0.013
		8. Large gullies, diversions, and low flowing streams	6.32	70.00	1,108.34	7.530	0.040
		8. Large gullies, diversions, and low flowing streams	12.82	125.00	975.00	10.740	0.025
		9. Small streams flowing bankfull	5.00	80.00	1,600.00	20.120	0.022
#9	**4**	**Muskingum K:**					**0.100**
#9	5	8. Large gullies, diversions, and low flowing streams	12.82	125.00	975.03	10.740	0.025
		9. Small streams flowing bankfull	5.00	80.00	1,600.00	20.120	0.022
#9	**5**	**Muskingum K:**					**0.047**
#9	6	9. Small streams flowing bankfull	2.50	40.00	1,600.00	14.230	0.031
#9	**6**	**Muskingum K:**					**0.000**
#10	1	3. Short grass pasture	35.71	125.00	350.00	4.780	0.020
		8. Large gullies, diversions, and low flowing streams	2.00	4.00	200.00	4.240	0.013
#10	**1**	**Muskingum K:**					**0.033**
#11	1	3. Short grass pasture	34.85	115.00	330.00	4.720	0.019
		1. Forest with heavy ground litter	46.15	30.00	65.00	1.710	0.010
		8. Large gullies, diversions, and low flowing streams	2.00	2.00	100.00	4.240	0.006
#11	**1**	**Muskingum K:**					**0.035**
#11	2	1. Forest with heavy ground litter	46.15	30.00	65.00	1.710	0.010
		8. Large gullies, diversions, and low flowing streams	2.00	2.00	100.00	4.240	0.006
#11	**2**	**Muskingum K:**					**0.016**
#12	1	8. Large gullies, diversions, and low flowing streams	2.00	10.00	500.00	4.240	0.032
		8. Large gullies, diversions, and low flowing streams	35.00	100.00	285.71	17.740	0.004
		8. Large gullies, diversions, and low flowing streams	35.00	113.75	325.00	17.740	0.005
#12	**1**	**Muskingum K:**					**0.041**
#12	2	8. Large gullies, diversions, and low flowing streams	35.00	100.00	285.71	17.740	0.004
		8. Large gullies, diversions, and low flowing streams	35.00	75.00	214.28	17.740	0.003
#12	**2**	**Muskingum K:**					**0.007**
#12	3	8. Large gullies, diversions, and low flowing streams	35.00	75.00	214.28	17.740	0.003
#12	**3**	**Muskingum K:**					**0.003**
#12	5	5. Nearly bare and untilled, and alluvial valley fans	20.00	40.00	200.00	4.470	0.012
		8. Large gullies, diversions, and low flowing streams	9.23	300.00	3,250.05	9.110	0.099

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#12	**5**	**Muskingum K:**					**0.111**
#12	6	5. Nearly bare and untilled, and alluvial valley fans	5.88	100.00	1,700.01	2.420	0.195
		3. Short grass pasture	36.84	175.00	475.00	4.850	0.027
#12	**6**	**Muskingum K:**					**0.222**
#12	7	8. Large gullies, diversions, and low flowing streams	26.92	175.00	650.00	15.560	0.011
#12	**7**	**Muskingum K:**					**0.011**
#12	9	5. Nearly bare and untilled, and alluvial valley fans	25.00	60.00	240.00	5.000	0.013
		8. Large gullies, diversions, and low flowing streams	21.05	100.00	475.00	13.760	0.009
		8. Large gullies, diversions, and low flowing streams	2.50	15.00	600.00	4.740	0.035
		8. Large gullies, diversions, and low flowing streams	21.74	25.00	115.00	13.980	0.002
		8. Large gullies, diversions, and low flowing streams	33.33	125.00	375.00	17.320	0.006
#12	**9**	**Muskingum K:**					**0.065**
#12	10	8. Large gullies, diversions, and low flowing streams	2.50	15.00	600.00	4.740	0.035
		8. Large gullies, diversions, and low flowing streams	21.74	25.00	115.00	13.980	0.002
		8. Large gullies, diversions, and low flowing streams	33.33	125.00	375.00	17.320	0.006
#12	**10**	**Muskingum K:**					**0.043**
#12	11	8. Large gullies, diversions, and low flowing streams	21.74	25.00	115.00	13.980	0.002
		8. Large gullies, diversions, and low flowing streams	33.33	125.00	375.00	17.320	0.006
#12	**11**	**Muskingum K:**					**0.008**
#12	12	8. Large gullies, diversions, and low flowing streams	33.33	125.00	375.00	17.320	0.006
#12	**12**	**Muskingum K:**					**0.006**
#13	1	5. Nearly bare and untilled, and alluvial valley fans	33.78	125.00	370.00	5.810	0.017
		8. Large gullies, diversions, and low flowing streams	33.78	20.26	59.97	17.430	0.000
		8. Large gullies, diversions, and low flowing streams	3.16	15.00	475.01	5.330	0.024
		8. Large gullies, diversions, and low flowing streams	8.28	60.00	725.00	8.630	0.023
		8. Large gullies, diversions, and low flowing streams	33.73	140.00	415.00	17.420	0.006
		9. Small streams flowing bankfull	2.00	15.00	750.00	12.720	0.016
#13	**1**	**Muskingum K:**					**0.086**
#13	2	8. Large gullies, diversions, and low flowing streams	3.16	15.00	475.01	5.330	0.024

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	8.28	60.00	725.00	8.630	0.023
		8. Large gullies, diversions, and low flowing streams	33.73	140.00	415.00	17.420	0.006
		9. Small streams flowing bankfull	2.00	15.00	750.00	12.720	0.016
#13	**2**	**Muskingum K:**					**0.069**
#13	3	8. Large gullies, diversions, and low flowing streams	33.73	140.00	415.00	17.420	0.006
		9. Small streams flowing bankfull	2.00	15.00	750.00	12.720	0.016
#13	**3**	**Muskingum K:**					**0.022**
#13	5	3. Short grass pasture	40.00	80.00	200.00	5.050	0.011
		8. Large gullies, diversions, and low flowing streams	26.32	125.00	475.00	15.380	0.008
		9. Small streams flowing bankfull	2.00	10.00	500.00	12.720	0.010
#13	**5**	**Muskingum K:**					**0.029**
#13	6	8. Large gullies, diversions, and low flowing streams	26.32	50.00	189.96	15.390	0.003
		9. Small streams flowing bankfull	2.00	10.00	500.00	12.720	0.010
#13	**6**	**Muskingum K:**					**0.013**
#13	8	5. Nearly bare and untilled, and alluvial valley fans	60.00	150.00	249.99	7.740	0.008
		8. Large gullies, diversions, and low flowing streams	8.57	60.00	700.00	8.780	0.022
		8. Large gullies, diversions, and low flowing streams	34.67	130.00	375.00	17.660	0.005
		9. Small streams flowing bankfull	2.00	10.00	500.00	12.720	0.010
#13	**8**	**Muskingum K:**					**0.045**
#13	9	8. Large gullies, diversions, and low flowing streams	34.67	130.00	375.00	17.660	0.005
		9. Small streams flowing bankfull	2.00	10.00	500.00	12.720	0.010
#13	**9**	**Muskingum K:**					**0.015**
#14	1	5. Nearly bare and untilled, and alluvial valley fans	2.86	5.00	175.00	1.690	0.028
		8. Large gullies, diversions, and low flowing streams	29.57	170.00	575.00	16.310	0.009
#14	**1**	**Muskingum K:**					**0.037**
#14	2	8. Large gullies, diversions, and low flowing streams	29.57	170.00	575.00	16.310	0.009
#14	**2**	**Muskingum K:**					**0.009**
#14	4	8. Large gullies, diversions, and low flowing streams	30.00	90.00	300.00	16.430	0.005
		9. Small streams flowing bankfull	6.67	15.00	224.88	23.240	0.002
#14	**4**	**Muskingum K:**					**0.007**
#15	1	5. Nearly bare and untilled, and alluvial valley fans	4.35	5.00	115.00	2.080	0.015
		8. Large gullies, diversions, and low flowing streams	48.65	180.00	370.00	20.920	0.004

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#15	**1**	**Muskingum K:**					**0.019**
#15	2	8. Large gullies, diversions, and low flowing streams	48.65	180.00	370.00	20.920	0.004
#15	**2**	**Muskingum K:**					**0.004**
#15	3	8. Large gullies, diversions, and low flowing streams	6.67	40.00	600.00	7.740	0.021
		8. Large gullies, diversions, and low flowing streams	5.00	20.00	400.00	6.700	0.016
#15	**3**	**Muskingum K:**					**0.037**
#15	4	1. Forest with heavy ground litter	50.00	50.00	100.00	1.780	0.015
		8. Large gullies, diversions, and low flowing streams	6.67	40.00	600.00	7.740	0.021
		8. Large gullies, diversions, and low flowing streams	5.00	20.00	400.00	6.700	0.016
#15	**4**	**Muskingum K:**					**0.052**
#16	1	8. Large gullies, diversions, and low flowing streams	23.81	250.00	1,050.00	14.630	0.019
		9. Small streams flowing bankfull	4.76	25.00	525.00	19.630	0.007
#16	**1**	**Muskingum K:**					**0.026**
#17	1	8. Large gullies, diversions, and low flowing streams	29.09	80.00	275.00	16.180	0.004
		9. Small streams flowing bankfull	9.52	100.00	1,050.00	27.770	0.010
#17	**1**	**Muskingum K:**					**0.014**
#18	1	8. Large gullies, diversions, and low flowing streams	37.33	140.00	375.00	18.330	0.005
		9. Small streams flowing bankfull	3.33	50.00	1,500.01	16.430	0.025
#18	**1**	**Muskingum K:**					**0.030**
#19	1	8. Large gullies, diversions, and low flowing streams	18.46	120.00	650.00	12.890	0.014
		9. Small streams flowing bankfull	3.08	30.00	975.00	15.780	0.017
#19	**1**	**Muskingum K:**					**0.031**
#20	1	8. Large gullies, diversions, and low flowing streams	33.13	275.00	830.00	17.260	0.013
		9. Small streams flowing bankfull	4.85	40.00	825.01	19.810	0.011
#20	**1**	**Muskingum K:**					**0.024**
#20	3	8. Large gullies, diversions, and low flowing streams	40.00	160.00	400.00	18.970	0.005
		9. Small streams flowing bankfull	4.00	20.00	500.00	18.000	0.007
#20	**3**	**Muskingum K:**					**0.012**
#21	1	8. Large gullies, diversions, and low flowing streams	21.96	280.00	1,275.01	14.050	0.025
		9. Small streams flowing bankfull	2.73	15.00	550.01	14.860	0.010
#21	**1**	**Muskingum K:**					**0.035**
#21	3	8. Large gullies, diversions, and low flowing streams	31.25	200.00	640.00	16.770	0.010
		9. Small streams flowing bankfull	3.00	15.00	500.00	15.580	0.008
#21	**3**	**Muskingum K:**					**0.018**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#22	1	8. Large gullies, diversions, and low flowing streams	22.47	200.00	890.00	14.220	0.017
		9. Small streams flowing bankfull	3.33	5.00	150.00	16.430	0.002
#22	**1**	**Muskingum K:**					**0.019**
#22	3	8. Large gullies, diversions, and low flowing streams	44.44	200.00	450.00	19.990	0.006
		9. Small streams flowing bankfull	1.90	10.00	525.01	12.420	0.011
#22	**3**	**Muskingum K:**					**0.017**
#23	1	8. Large gullies, diversions, and low flowing streams	28.30	300.00	1,060.00	15.950	0.018
#23	**1**	**Muskingum K:**					**0.018**
#23	3	3. Short grass pasture	55.83	115.00	206.00	5.970	0.009
		3. Short grass pasture	5.15	10.00	194.00	1.810	0.029
		8. Large gullies, diversions, and low flowing streams	37.50	30.00	80.00	18.370	0.001
		9. Small streams flowing bankfull	8.89	40.00	450.00	26.830	0.004
#23	**3**	**Muskingum K:**					**0.043**
#26	1	9. Small streams flowing bankfull	9.04	75.00	830.00	27.050	0.008
#26	**1**	**Muskingum K:**					**0.008**
#26	3	8. Large gullies, diversions, and low flowing streams	18.57	130.00	700.00	12.920	0.015
		9. Small streams flowing bankfull	7.04	100.00	1,420.00	23.880	0.016
#26	**3**	**Muskingum K:**					**0.031**
#27	1	8. Large gullies, diversions, and low flowing streams	48.00	300.00	625.00	20.780	0.008
		9. Small streams flowing bankfull	2.50	5.00	200.00	14.230	0.003
#27	**1**	**Muskingum K:**					**0.011**
#27	3	8. Large gullies, diversions, and low flowing streams	10.53	240.00	2,280.00	9.730	0.065
#27	**3**	**Muskingum K:**					**0.065**

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897-0587

EXISTING AREA SEDIMENT LOAD SUGAR CAMP BRANCH OF GRAPEVINE CREEK

Keith Spears

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	25 yr - 24 hr
Rainfall Depth:	5.000 inches

Particle Size Distribution:

Size (mm)	DISTURBED	UNDISTURBED
3.0000	100.000%	100.000%
2.0000	93.000%	99.900%
1.0000	86.000%	98.000%
0.5000	78.000%	92.000%
0.3000	73.000%	87.000%
0.2000	67.000%	80.000%
0.1000	55.000%	70.000%
0.0500	44.000%	60.000%
0.0300	35.000%	50.000%
0.0200	27.000%	42.000%
0.0100	18.000%	32.000%
0.0050	14.000%	21.000%
0.0030	9.000%	15.000%
0.0010	3.000%	4.000%
0.0001	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	NULL STRUCTURE #28

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	117.900	117.900	276.55	21.73	42.4	2,735	1.49	0.78

The 24 hour Arithmetic Average (24AA) is under review. It is anticipated that the 24AA will be replaced by the peak settleable solids concentration (ml/l) with the addition of new sediment input factor values.

The 24AA is provided for your convenience during this transition period.

	24AA (ml/l)
#1	0.19

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In/Out
3.0000	100.000%
2.0000	99.446%
1.0000	97.206%
0.5000	91.073%
0.3000	86.073%
0.2000	79.139%
0.1000	69.006%
0.0500	58.939%
0.0300	49.005%
0.0200	41.005%
0.0100	31.071%
0.0050	20.536%
0.0030	14.602%
0.0010	3.934%
0.0001	0.000%

Structure Detail:

Structure #1 (Null)

NULL STRUCTURE #28

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	0.600	0.002	0.092	0.455	69.000	S	1.30	0.098
	2	19.700	0.031	0.061	0.457	73.000	S	48.41	3.740
	3	23.800	0.040	0.051	0.458	69.000	S	51.52	3.878
	4	16.100	0.068	0.051	0.464	73.000	S	39.56	3.056
	5	57.700	0.113	0.000	0.000	73.000	S	141.79	10.954
	Σ	**117.900**						**276.55**	**21.726**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.220	50.00	40.00	0.0100	1.0000	1	0.3	4,898	3.13	0.47
	2	0.170	100.00	50.00	0.0030	1.0000	2	7.7	2,965	1.60	0.82
	3	0.220	100.00	5.00	0.0100	1.0000	1	2.5	926	0.59	0.30
	4	0.170	100.00	50.00	0.0030	1.0000	2	6.2	2,810	1.51	0.80
	5	0.170	100.00	50.00	0.0030	1.0000	2	25.7	3,299	1.78	0.93
	Σ							**42.4**	**2,735**	**1.49**	**0.78**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	25.00	10.00	40.00	4.000	0.002
#1	**1**	**Time of Concentration:**					**0.002**
#1	2	1. Forest with heavy ground litter	61.90	130.00	210.00	1.990	0.029
		8. Large gullies, diversions, and low flowing streams	35.71	50.00	140.00	17.920	0.002
#1	**2**	**Time of Concentration:**					**0.031**
#1	3	3. Short grass pasture	3.13	5.00	160.00	1.410	0.031
		8. Large gullies, diversions, and low flowing streams	22.00	110.00	500.00	14.070	0.009
#1	**3**	**Time of Concentration:**					**0.040**
#1	4	1. Forest with heavy ground litter	52.27	230.00	440.00	1.820	0.067
		8. Large gullies, diversions, and low flowing streams	40.00	40.00	100.00	18.970	0.001
#1	**4**	**Time of Concentration:**					**0.068**
#1	5	1. Forest with heavy ground litter	52.38	220.00	420.00	1.830	0.063

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		9. Small streams flowing bankfull	4.19	140.00	3,340.00	18.420	0.050
#1	**5**	**Time of Concentration:**					**0.113**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	61.90	130.00	210.00	1.990	0.029
		8. Large gullies, diversions, and low flowing streams	35.71	50.00	140.00	17.920	0.002
		8. Large gullies, diversions, and low flowing streams	10.00	20.00	200.00	9.480	0.005
		8. Large gullies, diversions, and low flowing streams	31.43	110.00	350.00	16.810	0.005
		9. Small streams flowing bankfull	4.23	145.00	3,425.00	18.510	0.051
#1	**1**	**Muskingum K:**					**0.092**
#1	2	8. Large gullies, diversions, and low flowing streams	10.00	20.00	200.00	9.480	0.005
		8. Large gullies, diversions, and low flowing streams	31.43	110.00	350.00	16.810	0.005
		9. Small streams flowing bankfull	4.23	145.00	3,425.00	18.510	0.051
#1	**2**	**Muskingum K:**					**0.061**
#1	3	9. Small streams flowing bankfull	4.23	145.00	3,425.00	18.510	0.051
#1	**3**	**Muskingum K:**					**0.051**
#1	4	8. Large gullies, diversions, and low flowing streams	14.29	20.00	140.00	11.330	0.003
		9. Small streams flowing bankfull	25.96	135.00	520.00	45.850	0.003
		9. Small streams flowing bankfull	4.03	120.00	2,980.00	18.060	0.045
#1	**4**	**Muskingum K:**					**0.051**

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897-0587

PROPOSED BACKFILL SEDIMENT LOAD SUGAR CAMP BRANCH OF GRAPEVINE CREEK

Keith Spears

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	25 yr - 24 hr
Rainfall Depth:	5.000 inches

Particle Size Distribution:

Size (mm)	DISTURBED	UNDISTURBED
3.0000	100.000%	100.000%
2.0000	93.000%	99.900%
1.0000	86.000%	98.000%
0.5000	78.000%	92.000%
0.3000	73.000%	87.000%
0.2000	67.000%	80.000%
0.1000	55.000%	70.000%
0.0500	44.000%	60.000%
0.0300	35.000%	50.000%
0.0200	27.000%	42.000%
0.0100	18.000%	32.000%
0.0050	14.000%	21.000%
0.0030	9.000%	15.000%
0.0010	3.000%	4.000%
0.0001	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	NULL STRUCTURE #28

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	117.800	117.800	270.83	21.18	69.6	5,298	3.15	1.43

The 24 hour Arithmetic Average (24AA) is under review. It is anticipated that the 24AA will be replaced by the peak settleable solids concentration (ml/l) with the addition of new sediment input factor values.

The 24AA is provided for your convenience during this transition period.

	24AA (ml/l)
#1	0.35

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In/Out
3.0000	100.000%
2.0000	96.166%
1.0000	91.500%
0.5000	84.415%
0.3000	79.415%
0.2000	72.956%
0.1000	61.871%
0.0500	51.328%
0.0300	41.869%
0.0200	33.869%
0.0100	24.410%
0.0050	17.205%
0.0030	11.747%
0.0010	3.458%
0.0001	0.000%

Structure Detail:

Structure #1 (Null)

NULL STRUCTURE #28

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	44.000	0.035	0.051	0.458	69.000	S	95.25	7.169
	2	16.100	0.031	0.051	0.464	73.000	S	39.56	3.056
	3	57.700	0.110	0.000	0.000	73.000	S	141.79	10.954
	Σ	**117.800**						**270.83**	**21.179**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.220	50.00	40.00	0.0100	1.0000	1	37.7	7,510	4.80	2.47
	2	0.170	100.00	50.00	0.0030	1.0000	2	6.2	2,810	1.51	0.80
	3	0.170	100.00	50.00	0.0030	1.0000	2	25.7	3,299	1.78	0.93
	Σ							**69.6**	**5,298**	**3.15**	**1.43**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	47.22	170.00	360.00	5.490	0.018
		8. Large gullies, diversions, and low flowing streams	16.67	130.00	780.00	12.240	0.017
#1	**1**	**Time of Concentration:**					**0.035**
#1	2	1. Forest with heavy ground litter	61.90	130.00	210.00	1.990	0.029
		8. Large gullies, diversions, and low flowing streams	35.71	50.00	140.00	17.920	0.002
#1	**2**	**Time of Concentration:**					**0.031**
#1	3	1. Forest with heavy ground litter	3.13	5.00	160.00	0.440	0.101
		8. Large gullies, diversions, and low flowing streams	22.00	110.00	500.00	14.070	0.009
#1	**3**	**Time of Concentration:**					**0.110**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	9. Small streams flowing bankfull	4.23	145.00	3,425.06	18.510	0.051
#1	**1**	**Muskingum K:**					**0.051**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	2	8. Large gullies, diversions, and low flowing streams	10.00	20.00	200.00	9.480	0.005
		8. Large gullies, diversions, and low flowing streams	31.43	110.00	350.00	16.810	0.005
		9. Small streams flowing bankfull	4.23	145.00	3,425.00	18.510	0.051
#1	**2**	**Muskingum K:**					**0.051**
#1	3	9. Small streams flowing bankfull	4.23	145.00	3,425.00	18.510	0.051
#1	**3**	**Muskingum K:**					**0.000**

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897-0587

EXISTING AREA SEDIMENT LOAD ROSEANNE BRANCH OF GRAPEVINE CREEK

Keith Spears

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	25 yr - 24 hr
Rainfall Depth:	5.000 inches

Particle Size Distribution:

Size (mm)	DISTURBED	UNDISTURBED
3.0000	100.000%	100.000%
2.0000	93.000%	99.900%
1.0000	86.000%	98.000%
0.5000	78.000%	92.000%
0.3000	73.000%	87.000%
0.2000	67.000%	80.000%
0.1000	55.000%	70.000%
0.0500	44.000%	60.000%
0.0300	35.000%	50.000%
0.0200	27.000%	42.000%
0.0100	18.000%	32.000%
0.0050	14.000%	21.000%
0.0030	9.000%	15.000%
0.0010	3.000%	4.000%
0.0001	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	NULL STRUCTURE #27

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	126.300	126.300	302.23	23.67	62.0	4,060	2.28	1.08

The 24 hour Arithmetic Average (24AA) is under review. It is anticipated that the 24AA will be replaced by the peak settleable solids concentration (ml/l) with the addition of new sediment input factor values.

The 24AA is provided for your convenience during this transition period.

	24AA (ml/l)
#1	0.27

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Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In/Out
3.0000	100.000%
2.0000	98.438%
1.0000	95.451%
0.5000	89.025%
0.3000	84.024%
0.2000	77.237%
0.1000	66.810%
0.0500	56.596%
0.0300	46.808%
0.0200	38.807%
0.0100	29.019%
0.0050	19.510%
0.0030	13.723%
0.0010	3.787%
0.0001	0.000%

Structure Detail:

Structure #1 (Null)

NULL STRUCTURE #27

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	2.300	0.006	0.064	0.461	69.000	S	4.98	0.375
	2	32.600	0.066	0.055	0.462	73.000	S	80.11	6.189
	3	9.000	0.007	0.077	0.457	69.000	S	19.48	1.466
	4	40.700	0.036	0.048	0.462	73.000	S	100.01	7.727
	5	41.700	0.101	0.000	0.000	73.000	S	102.47	7.916
	Σ	**126.300**						**302.23**	**23.673**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.220	50.00	40.00	0.0100	1.0000	1	1.4	5,491	3.51	1.73
	2	0.170	100.00	50.00	0.0030	1.0000	2	13.6	3,098	1.67	0.87
	3	0.220	100.00	50.00	0.0100	1.0000	1	11.8	12,272	7.85	1.16
	4	0.170	100.00	50.00	0.0030	1.0000	2	17.4	3,164	1.70	0.89
	5	0.170	100.00	50.00	0.0030	1.0000	2	17.9	3,173	1.71	0.89
	Σ							**62.0**	**4,060**	**2.28**	**1.08**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	50.00	70.00	140.00	5.650	0.006
#1	**1**	**Time of Concentration:**					**0.006**
#1	2	1. Forest with heavy ground litter	52.38	220.00	420.00	1.830	0.063
		8. Large gullies, diversions, and low flowing streams	23.53	40.00	170.00	14.550	0.003
#1	**2**	**Time of Concentration:**					**0.066**
#1	3	3. Short grass pasture	48.28	70.00	145.00	5.550	0.007
#1	**3**	**Time of Concentration:**					**0.007**
#1	4	1. Forest with heavy ground litter	65.22	150.00	230.00	2.040	0.031
		8. Large gullies, diversions, and low flowing streams	30.00	90.00	300.00	16.430	0.005
#1	**4**	**Time of Concentration:**					**0.036**
#1	5	1. Forest with heavy ground litter	51.02	250.00	490.00	1.800	0.075
		8. Large gullies, diversions, and low flowing streams	39.08	170.00	435.00	18.750	0.006

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		9. Small streams flowing bankfull	3.33	40.00	1,200.00	16.430	0.020
#1	**5**	**Time of Concentration:**					**0.101**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	28.09	150.00	534.00	15.890	0.009
		9. Small streams flowing bankfull	5.17	210.00	4,060.00	20.460	0.055
#1	**1**	**Muskingum K:**					**0.064**
#1	3	1. Forest with heavy ground litter	33.33	50.00	150.00	1.460	0.028
		9. Small streams flowing bankfull	4.46	150.00	3,360.00	19.010	0.049
#1	**3**	**Muskingum K:**					**0.077**
#1	4	9. Small streams flowing bankfull	5.28	190.00	3,600.00	20.670	0.048
#1	**4**	**Muskingum K:**					**0.048**

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897-0587

PROPOSED BACKFILL SEDIMENT LOAD ROSEANNE BRANCH OF GRAPEVINE CREEK

Keith Spears

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	25 yr - 24 hr
Rainfall Depth:	5.000 inches

Particle Size Distribution:

Size (mm)	DISTURBED	UNDISTURBED
3.0000	100.000%	100.000%
2.0000	93.000%	99.900%
1.0000	86.000%	98.000%
0.5000	78.000%	92.000%
0.3000	73.000%	87.000%
0.2000	67.000%	80.000%
0.1000	55.000%	70.000%
0.0500	44.000%	60.000%
0.0300	35.000%	50.000%
0.0200	27.000%	42.000%
0.0100	18.000%	32.000%
0.0050	14.000%	21.000%
0.0030	9.000%	15.000%
0.0010	3.000%	4.000%
0.0001	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	NULL STRUCTURE #27

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	127.000	127.000	288.25	22.63	109.7	10,671	6.39	2.13

The 24 hour Arithmetic Average (24AA) is under review. It is anticipated that the 24AA will be replaced by the peak settleable solids concentration (ml/l) with the addition of new sediment input factor values.

The 24AA is provided for your convenience during this transition period.

	24AA (ml/l)
#1	0.53

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In/Out
3.0000	100.000%
2.0000	95.802%
1.0000	90.863%
0.5000	83.670%
0.3000	78.670%
0.2000	72.265%
0.1000	61.071%
0.0500	50.474%
0.0300	41.069%
0.0200	33.067%
0.0100	23.662%
0.0050	16.832%
0.0030	11.427%
0.0010	3.405%
0.0001	0.000%

Structure Detail:

Structure #1 (Null)

NULL STRUCTURE #27

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	24.200	0.026	0.055	0.462	69.000	S	52.39	3.943
	2	10.500	0.066	0.055	0.462	69.000	S	22.73	1.711
	3	20.400	0.014	0.097	0.458	69.000	S	44.16	3.324
	4	30.200	0.036	0.048	0.462	73.000	S	74.21	5.733
	5	41.700	0.101	0.000	0.000	73.000	S	102.47	7.916
	Σ	**127.000**						**288.25**	**22.627**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.220	100.00	50.00	0.0100	1.0000	1	35.8	13,128	8.40	4.26
	2	0.220	100.00	50.00	0.0100	1.0000	2	14.1	11,882	6.40	3.24
	3	0.220	100.00	50.00	0.0100	1.0000	1	29.6	13,909	8.89	1.26
	4	0.170	100.00	50.00	0.0030	1.0000	2	12.4	3,053	1.64	0.86
	5	0.170	100.00	50.00	0.0030	1.0000	2	17.9	3,173	1.71	0.89
	Σ							**109.7**	**10,671**	**6.39**	**2.13**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	57.14	200.00	350.00	6.040	0.016
		8. Large gullies, diversions, and low flowing streams	26.67	160.00	600.00	15.490	0.010
#1	**1**	**Time of Concentration:**					**0.026**
#1	2	1. Forest with heavy ground litter	52.38	220.00	420.00	1.830	0.063
		8. Large gullies, diversions, and low flowing streams	23.53	40.00	170.00	14.550	0.003
#1	**2**	**Time of Concentration:**					**0.066**
#1	3	3. Short grass pasture	60.32	190.00	315.00	6.210	0.014
#1	**3**	**Time of Concentration:**					**0.014**
#1	4	1. Forest with heavy ground litter	65.22	150.00	230.00	2.040	0.031
		8. Large gullies, diversions, and low flowing streams	30.00	90.00	300.00	16.430	0.005
#1	**4**	**Time of Concentration:**					**0.036**
#1	5	1. Forest with heavy ground litter	51.02	250.00	490.00	1.800	0.075

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	39.08	170.00	435.00	18.750	0.006
		9. Small streams flowing bankfull	3.33	40.00	1,200.00	16.430	0.020
#1	**5**	**Time of Concentration:**					**0.101**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	9. Small streams flowing bankfull	5.17	210.00	4,060.01	20.460	0.055
#1	**1**	**Muskingum K:**					**0.055**
#1	3	1. Forest with heavy ground litter	34.62	90.00	260.00	1.480	0.048
		9. Small streams flowing bankfull	4.86	170.00	3,500.00	19.830	0.049
#1	**3**	**Muskingum K:**					**0.097**
#1	4	9. Small streams flowing bankfull	5.28	190.00	3,600.05	20.670	0.048
#1	**4**	**Muskingum K:**					**0.048**

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897-0587

EXISTING AREA SEDIMENT LOAD

SPRUCE HOLLOW OF GRAPEVINE CREEK

Keith Spears

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	25 yr - 24 hr
Rainfall Depth:	5.000 inches

Particle Size Distribution:

Size (mm)	DISTURBED	UNDISTURBED
3.0000	100.000%	100.000%
2.0000	93.000%	99.900%
1.0000	86.000%	98.000%
0.5000	78.000%	92.000%
0.3000	73.000%	87.000%
0.2000	67.000%	80.000%
0.1000	55.000%	70.000%
0.0500	44.000%	60.000%
0.0300	35.000%	50.000%
0.0200	27.000%	42.000%
0.0100	18.000%	32.000%
0.0050	14.000%	21.000%
0.0030	9.000%	15.000%
0.0010	3.000%	4.000%
0.0001	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	NULL STRUCTURE #26

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	53.100	53.100	124.80	9.71	36.9	5,507	3.30	1.67

The 24 hour Arithmetic Average (24AA) is under review. It is anticipated that the 24AA will be replaced by the peak settleable solids concentration (ml/l) with the addition of new sediment input factor values.

The 24AA is provided for your convenience during this transition period.

	24AA (ml/l)
#1	0.41

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In/Out
3.0000	100.000%
2.0000	95.762%
1.0000	90.797%
0.5000	83.595%
0.3000	78.594%
0.2000	72.195%
0.1000	60.992%
0.0500	50.390%
0.0300	40.990%
0.0200	32.990%
0.0100	23.590%
0.0050	16.795%
0.0030	11.396%
0.0010	3.399%
0.0001	0.000%

Structure Detail:

Structure #1 (Null)

NULL STRUCTURE #26

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	18.700	0.042	0.050	0.433	73.000	S	45.95	3.550
	2	13.800	0.034	0.041	0.430	69.000	S	29.87	2.248
	3	20.600	0.063	0.014	0.429	73.000	S	50.62	3.911
	Σ	**53.100**						**124.80**	**9.709**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.170	100.00	45.00	0.0030	1.0000	2	6.6	2,595	1.40	0.74
	2	0.220	100.00	60.00	0.0100	1.0000	1	22.2	14,180	9.07	4.62
	3	0.170	100.00	50.00	0.0030	1.0000	2	8.1	2,916	1.57	0.82
	Σ							**36.9**	**5,507**	**3.30**	**1.67**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	48.15	130.00	270.00	1.750	0.042
#1	**1**	**Time of Concentration:**					**0.042**
#1	2	3. Short grass pasture	80.00	160.00	200.00	7.150	0.007
		3. Short grass pasture	6.25	10.00	160.00	2.000	0.022
		3. Short grass pasture	40.00	40.00	100.00	5.050	0.005
#1	**2**	**Time of Concentration:**					**0.034**
#1	3	1. Forest with heavy ground litter	40.54	150.00	370.00	1.610	0.063
#1	**3**	**Time of Concentration:**					**0.063**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	13.50	270.00	2,000.00	11.020	0.050
#1	**1**	**Muskingum K:**					**0.050**
#1	2	8. Large gullies, diversions, and low flowing streams	12.26	190.00	1,550.00	10.500	0.041
#1	**2**	**Muskingum K:**					**0.041**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	3	8. Large gullies, diversions, and low flowing streams	11.54	60.00	520.00	10.190	0.014
#1	**3**	**Muskingum K:**					**0.014**

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897-0587

PROPOSED BACKFILL SEDIMENT LOAD SPRUCE HOLLOW OF GRAPEVINE CREEK

Keith Spears

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	25 yr - 24 hr
Rainfall Depth:	5.000 inches

Particle Size Distribution:

Size (mm)	DISTURBED	UNDISTURBED
3.0000	100.000%	100.000%
2.0000	93.000%	99.900%
1.0000	86.000%	98.000%
0.5000	78.000%	92.000%
0.3000	73.000%	87.000%
0.2000	67.000%	80.000%
0.1000	55.000%	70.000%
0.0500	44.000%	60.000%
0.0300	35.000%	50.000%
0.0200	27.000%	42.000%
0.0100	18.000%	32.000%
0.0050	14.000%	21.000%
0.0030	9.000%	15.000%
0.0010	3.000%	4.000%
0.0001	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	NULL STRUCTURE #26

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	60.570	60.570	139.13	10.69	57.3	7,772	4.81	2.43

The 24 hour Arithmetic Average (24AA) is under review. It is anticipated that the 24AA will be replaced by the peak settleable solids concentration (ml/l) with the addition of new sediment input factor values.

The 24AA is provided for your convenience during this transition period.

	24AA (ml/l)
#1	0.59

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In/Out
3.0000	100.000%
2.0000	94.420%
1.0000	88.462%
0.5000	80.870%
0.3000	75.869%
0.2000	69.664%
0.1000	58.072%
0.0500	47.275%
0.0300	38.070%
0.0200	30.069%
0.0100	20.864%
0.0050	15.432%
0.0030	10.227%
0.0010	3.205%
0.0001	0.000%

Structure Detail:

Structure #1 (Null)

NULL STRUCTURE #26

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	9.970	0.030	0.053	0.440	73.000	S	24.50	1.893
	2	30.000	0.031	0.044	0.430	69.000	S	64.94	4.888
	3	20.600	0.063	0.014	0.429	73.000	S	50.62	3.911
	Σ	**60.570**						**139.13**	**10.691**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.170	100.00	50.00	0.0030	1.0000	2	3.6	2,651	1.43	0.75
	2	0.220	100.00	50.00	0.0100	1.0000	1	45.6	13,399	8.57	4.37
	3	0.170	100.00	50.00	0.0030	1.0000	2	8.1	2,916	1.57	0.82
	Σ							**57.3**	**7,772**	**4.81**	**2.43**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	43.24	80.00	185.00	1.660	0.030
#1	**1**	**Time of Concentration:**					**0.030**
#1	2	3. Short grass pasture	58.33	140.00	240.00	6.110	0.010
		3. Short grass pasture	21.43	60.00	280.00	3.700	0.021
#1	**2**	**Time of Concentration:**					**0.031**
#1	3	1. Forest with heavy ground litter	40.54	150.00	370.00	1.610	0.063
#1	**3**	**Time of Concentration:**					**0.063**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	17.23	410.00	2,380.00	12.450	0.053
#1	**1**	**Muskingum K:**					**0.053**
#1	2	8. Large gullies, diversions, and low flowing streams	12.05	200.00	1,660.00	10.410	0.044

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	**2**	**Muskingum K:**					**0.044**
#1	3	8. Large gullies, diversions, and low flowing streams	11.54	60.00	520.00	10.190	0.014
#1	**3**	**Muskingum K:**					**0.014**

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897-0587

EXISTING AREA SEDIMENT LOAD

CLEAR FORK WATERSHED

Keith Spears

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General Information

Storm Information:

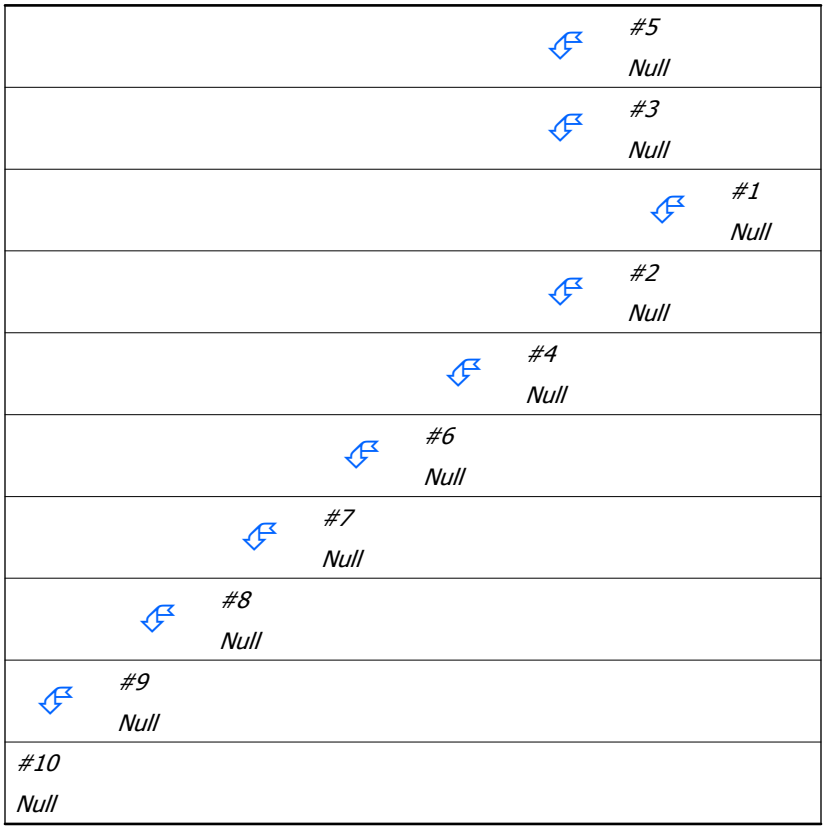
Storm Type:	NRCS Type II
Design Storm:	25 yr - 24 hr
Rainfall Depth:	5.000 inches

Particle Size Distribution:

Size (mm)	DISTURBED	UNDISTURBED
3.0000	100.000%	100.000%
2.0000	93.000%	99.900%
1.0000	86.000%	98.000%
0.5000	78.000%	92.000%
0.3000	73.000%	87.000%
0.2000	67.000%	80.000%
0.1000	55.000%	70.000%
0.0500	44.000%	60.000%
0.0300	35.000%	50.000%
0.0200	27.000%	42.000%
0.0100	18.000%	32.000%
0.0050	14.000%	21.000%
0.0030	9.000%	15.000%
0.0010	3.000%	4.000%
0.0001	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#2	0.051	0.393	Null Structure #16
Null	#2	==>	#4	0.006	0.466	Null Structure #17
Null	#3	==>	#4	0.027	0.444	Null Structure #18
Null	#4	==>	#6	0.016	0.452	Null Structure #19
Null	#5	==>	#4	0.018	0.453	Null Structure #20
Null	#6	==>	#7	0.010	0.456	Null Structure #21
Null	#7	==>	#8	0.027	0.444	Null Structure #22
Null	#8	==>	#9	0.000	0.000	Null Structure #23
Null	#9	==>	#10	0.000	0.000	Null Structure #24
Null	#10	==>	End	0.000	0.000	Null Structure #25



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	4.35	50.00	1,150.00	6.25	0.051
#1	**Muskingum K:**					**0.051**
#2	9. Small streams flowing bankfull	6.73	35.00	520.00	23.34	0.006
#2	**Muskingum K:**					**0.006**
#3	9. Small streams flowing bankfull	2.24	30.00	1,340.00	13.46	0.027
#3	**Muskingum K:**					**0.027**
#4	9. Small streams flowing bankfull	3.13	30.00	960.00	15.90	0.016
#4	**Muskingum K:**					**0.016**
#5	9. Small streams flowing bankfull	3.27	35.00	1,070.00	16.27	0.018
#5	**Muskingum K:**					**0.018**
#6	9. Small streams flowing bankfull	3.88	25.00	645.00	17.71	0.010
#6	**Muskingum K:**					**0.010**
#7	9. Small streams flowing bankfull	2.24	30.00	1,340.00	13.46	0.027
#7	**Muskingum K:**					**0.027**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#5	80.500	80.500	181.85	14.81	53.6	5,459	3.29	1.60
#3	22.000	22.000	54.06	4.18	8.7	2,928	1.57	0.82
#1	35.900	35.900	78.10	5.88	50.5	12,343	7.88	4.01
#2	24.200	60.100	130.87	10.22	67.4	11,626	7.34	3.05
#4	27.600	190.200	429.28	33.96	152.9	7,125	4.39	2.03
#6	57.100	247.300	568.56	44.93	194.0	6,814	4.19	1.95
#7	132.100	379.400	749.89	62.80	281.1	7,331	4.41	1.98
#8	62.400	441.800	899.46	74.40	312.2	9,043	5.44	1.85
#9	58.800	500.600	1,032.86	84.55	353.7	8,615	5.21	1.86
#10	62.300	562.900	1,142.81	94.17	383.4	8,140	4.89	1.79

The 24 hour Arithmetic Average (24AA) is under review. It is anticipated that the 24AA will be replaced by the peak settleable solids concentration (ml/l) with the addition of new sediment input factor values.

The 24AA is provided for your convenience during this transition period.

	24AA (ml/l)
#5	0.49
#3	0.20
#1	0.97
#2	0.74
#4	0.59
#6	0.59
#7	0.65
#8	0.62
#9	0.61
#10	0.60

Particle Size Distribution(s) at Each Structure

Structure #5 (Null Structure #20):

Size (mm)	In/Out
3.0000	100.000%
2.0000	95.588%
1.0000	90.487%
0.5000	83.231%
0.3000	78.230%
0.2000	71.856%
0.1000	60.600%
0.0500	49.971%
0.0300	40.596%
0.0200	32.595%
0.0100	23.221%
0.0050	16.611%
0.0030	11.238%
0.0010	3.373%
0.0001	0.000%

Structure #3 (Null Structure #18):

Size (mm)	In/Out
3.0000	100.000%
2.0000	100.000%
1.0000	98.357%
0.5000	92.335%
0.3000	87.317%
0.2000	80.292%
0.1000	70.255%
0.0500	60.219%
0.0300	50.182%
0.0200	42.153%
0.0100	32.117%
0.0050	21.077%
0.0030	15.055%

Size (mm)	In/Out
0.0010	4.015%
0.0001	0.000%

Structure #1 (Null Structure #16):

Size (mm)	In/Out
3.0000	100.000%
2.0000	93.052%
1.0000	86.089%
0.5000	78.103%
0.3000	73.103%
0.2000	67.096%
0.1000	55.110%
0.0500	44.117%
0.0300	35.110%
0.0200	27.110%
0.0100	18.102%
0.0050	14.051%
0.0030	9.044%
0.0010	3.007%
0.0001	0.000%

Structure #2 (Null Structure #17):

Size (mm)	In/Out
3.0000	100.000%
2.0000	93.574%
1.0000	86.988%
0.5000	79.150%
0.3000	74.149%
0.2000	68.067%
0.1000	56.228%
0.0500	45.308%
0.0300	36.225%
0.0200	28.224%
0.0100	19.142%
0.0050	14.572%
0.0030	9.489%
0.0010	3.082%
0.0001	0.000%

Structure #4 (Null Structure #19):

Size (mm)	In/Out
3.0000	100.000%
2.0000	94.649%
1.0000	88.867%
0.5000	81.337%
0.3000	76.335%
0.2000	70.097%
0.1000	58.565%
0.0500	47.798%
0.0300	38.558%
0.0200	30.555%
0.0100	21.316%
0.0050	15.660%
0.0030	10.422%
0.0010	3.237%
0.0001	0.000%

Structure #6 (Null Structure #21):

Size (mm)	In/Out
3.0000	100.000%
2.0000	94.711%
1.0000	88.971%
0.5000	81.459%
0.3000	76.457%
0.2000	70.210%
0.1000	58.696%
0.0500	47.938%
0.0300	38.689%
0.0200	30.687%
0.0100	21.439%
0.0050	15.721%
0.0030	10.474%
0.0010	3.246%
0.0001	0.000%

Structure #7 (Null Structure #22):

Size (mm)	In/Out
3.0000	100.000%
2.0000	95.994%

Size (mm)	In/Out
1.0000	91.610%
0.5000	85.801%
0.3000	81.914%
0.2000	77.043%
0.1000	64.495%
0.0500	52.419%
0.0300	42.165%
0.0200	33.232%
0.0100	22.978%
0.0050	17.072%
0.0030	11.283%
0.0010	3.555%
0.0001	0.000%

Structure #8 (Null Structure #23):

Size (mm)	In/Out
3.0000	100.000%
2.0000	95.967%
1.0000	91.518%
0.5000	85.568%
0.3000	81.569%
0.2000	76.547%
0.1000	64.130%
0.0500	52.200%
0.0300	42.031%
0.0200	33.192%
0.0100	23.024%
0.0050	17.036%
0.0030	11.288%
0.0010	3.539%
0.0001	0.000%

Structure #9 (Null Structure #24):

Size (mm)	In/Out
3.0000	100.000%
2.0000	95.742%
1.0000	91.085%
0.5000	84.930%
0.3000	80.814%
0.2000	75.660%

Size (mm)	In/Out
0.1000	63.327%
0.0500	51.523%
0.0300	41.474%
0.0200	32.733%
0.0100	22.683%
0.0050	16.805%
0.0030	11.126%
0.0010	3.493%
0.0001	0.000%

Structure #10:

Size (mm)	In/Out
3.0000	100.000%
2.0000	96.065%
1.0000	91.698%
0.5000	85.808%
0.3000	81.835%
0.2000	76.833%
0.1000	64.415%
0.0500	52.465%
0.0300	42.264%
0.0200	33.404%
0.0100	23.202%
0.0050	17.139%
0.0030	11.368%
0.0010	3.556%
0.0001	0.000%

Structure Detail:

Structure #5 (Null)

Null Structure #20

Structure #3 (Null)

Null Structure #18

Structure #1 (Null)

Null Structure #16

Structure #2 (Null)

Null Structure #17

Structure #4 (Null)

Null Structure #19

Structure #6 (Null)

Null Structure #21

Structure #7 (Null)

Null Structure #22

Structure #8 (Null)

Null Structure #23

Structure #9 (Null)

Null Structure #24

Structure #10 (Null)

Null Structure #25

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#5	1	13.500	0.089	0.001	0.441	73.000	S	33.17	2.563
	2	28.500	0.026	0.067	0.401	69.000	S	61.70	4.644
	3	3.000	0.021	0.103	0.406	86.000	F	10.00	0.866
	4	35.500	0.058	0.093	0.409	73.000	S	87.24	6.739
	Σ	**80.500**						**181.85**	**14.812**
#3	1	22.000	0.076	0.021	0.434	73.000	S	54.06	4.177
	Σ	**22.000**						**54.06**	**4.177**
#1	1	8.400	0.020	0.024	0.435	69.000	S	18.18	1.369
	2	26.200	0.030	0.001	0.424	69.000	S	56.72	4.269
	3	1.300	0.025	0.000	0.000	73.000	S	3.19	0.247
	Σ	**35.900**						**78.10**	**5.884**
#2	1	6.300	0.020	0.019	0.452	69.000	S	13.64	1.026
	2	9.800	0.064	0.010	0.455	73.000	S	24.08	1.860
	3	4.800	0.041	0.010	0.455	73.000	S	11.80	0.911
	4	3.300	0.012	0.053	0.455	69.000	S	7.14	0.538
	Σ	**60.100**						**130.87**	**10.220**
#4	1	18.200	0.039	0.022	0.435	69.000	S	39.40	2.965
	2	7.600	0.089	0.000	0.000	73.000	S	18.68	1.443
	3	1.800	0.069	0.003	0.458	73.000	S	4.42	0.342
	Σ	**190.200**						**429.28**	**33.957**
#6	1	5.500	0.019	0.025	0.441	69.000	S	11.91	0.896
	2	12.400	0.092	0.000	0.000	73.000	S	30.47	2.354
	3	19.000	0.052	0.000	0.000	73.000	S	46.69	3.607
	4	0.800	0.017	0.026	0.440	86.000	F	2.67	0.230
	5	4.800	0.011	0.027	0.442	69.000	S	10.39	0.782
	6	4.700	0.027	0.038	0.437	86.000	F	15.67	1.357
	7	5.000	0.007	0.081	0.419	69.000	S	10.82	0.815
	8	4.900	0.032	0.064	0.437	73.000	S	12.04	0.930
	Σ	**247.300**						**568.56**	**44.928**
#7	1	91.600	0.149	0.029	0.420	69.000	S	93.68	10.078
	2	14.900	0.059	0.000	0.000	73.000	S	36.61	2.829
	3	13.800	0.100	0.000	0.000	73.000	S	33.91	2.620
	4	0.800	0.061	0.000	0.000	69.000	S	1.73	0.130
	5	0.600	0.017	0.061	0.444	86.000	F	2.00	0.172
	6	3.500	0.006	0.045	0.452	69.000	S	7.58	0.570

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	7	2.500	0.020	0.022	0.471	86.000	F	8.33	0.722
	8	3.000	0.005	0.074	0.447	69.000	S	6.49	0.489
	9	1.400	0.031	0.058	0.449	73.000	S	3.44	0.266
	Σ	**379.400**						**749.89**	**62.803**
#8	1	9.100	0.040	0.029	0.440	69.000	S	19.70	1.483
	2	12.100	0.078	0.000	0.000	73.000	S	29.73	2.297
	3	22.800	0.071	0.000	0.000	73.000	S	56.03	4.328
	4	3.500	0.004	0.061	0.464	69.000	S	7.58	0.570
	5	1.000	0.017	0.075	0.421	86.000	F	3.33	0.288
	6	5.400	0.004	0.025	0.447	69.000	S	11.69	0.880
	7	2.000	0.014	0.029	0.445	86.000	F	6.67	0.577
	8	2.200	0.002	0.043	0.443	69.000	S	4.76	0.358
	9	4.300	0.017	0.045	0.442	73.000	S	10.57	0.816
	Σ	**441.800**						**899.46**	**74.401**
#9	1	37.000	0.103	0.024	0.439	69.000	S	80.10	6.028
	2	14.400	0.079	0.000	0.000	73.000	S	35.39	2.734
	3	6.500	0.060	0.000	0.000	73.000	S	15.97	1.234
	4	0.200	0.001	0.060	0.434	69.000	S	0.43	0.029
	5	0.100	0.017	0.061	0.433	86.000	F	0.33	0.024
	6	0.600	0.008	0.078	0.432	69.000	S	1.30	0.098
	Σ	**500.600**						**1,032.86**	**84.548**
#10	1	27.400	0.147	0.045	0.432	69.000	S	28.02	3.015
	2	21.100	0.086	0.000	0.000	73.000	S	51.85	4.006
	3	13.300	0.101	0.000	0.000	73.000	S	32.68	2.525
	4	0.500	0.007	0.142	0.368	69.000	S	1.08	0.081
	Σ	**562.900**						**1,142.81**	**94.174**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#5	1	0.170	100.00	50.00	0.0030	1.0000	2	5.1	2,772	1.49	0.78
	2	0.220	100.00	30.00	0.0100	1.0000	1	26.5	8,343	5.34	2.67
	3	0.220	50.00	1.00	0.9000	1.0000	1	7.2	11,056	7.07	3.87
	4	0.170	100.00	50.00	0.0030	1.0000	2	14.9	3,318	1.79	0.29
	Σ							**53.6**	**5,459**	**3.29**	**1.60**
#3	1	0.170	100.00	50.00	0.0030	1.0000	2	8.7	2,939	1.58	0.83

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	Σ							**8.7**	**2,928**	**1.57**	**0.82**
#1	1	0.220	100.00	50.00	0.0100	1.0000	1	11.0	11,510	7.36	3.75
	2	0.220	100.00	50.00	0.0100	1.0000	1	39.1	13,184	8.43	4.30
	3	0.170	100.00	50.00	0.0030	1.0000	2	0.4	2,094	1.13	0.59
	Σ							**50.5**	**12,343**	**7.88**	**4.01**
#2	1	0.220	100.00	50.00	0.0100	1.0000	1	7.9	11,121	7.11	3.62
	2	0.170	100.00	50.00	0.0030	1.0000	2	3.5	2,667	1.44	0.75
	3	0.170	100.00	50.00	0.0030	1.0000	2	1.6	2,449	1.32	0.69
	4	0.220	100.00	50.00	0.0100	1.0000	1	3.8	10,256	6.56	3.35
	Σ							**67.4**	**11,626**	**7.34**	**3.05**
#4	1	0.220	100.00	40.00	0.0100	1.0000	1	21.3	10,328	6.60	3.36
	2	0.170	100.00	30.00	0.0030	1.0000	2	1.6	1,592	0.86	0.45
	3	0.170	100.00	30.00	0.0030	1.0000	2	0.3	1,339	0.72	0.38
	Σ							**152.9**	**7,125**	**4.39**	**2.03**
#6	1	0.220	100.00	30.00	0.0100	1.0000	1	4.2	6,741	4.31	2.19
	2	0.170	100.00	40.00	0.0030	1.0000	2	3.8	2,243	1.21	0.63
	3	0.170	100.00	40.00	0.0030	1.0000	2	6.1	2,361	1.27	0.66
	4	0.220	20.00	1.00	0.9000	1.0000	1	1.2	7,135	4.56	2.52
	5	0.220	80.00	25.00	0.0100	1.0000	1	2.6	4,786	3.06	1.56
	6	0.220	100.00	1.00	0.9000	1.0000	1	14.6	14,257	9.12	5.03
	7	0.220	100.00	60.00	0.0100	1.0000	1	7.1	13,193	8.44	1.26
	8	0.170	100.00	50.00	0.0030	1.0000	2	1.6	2,512	1.35	0.69
	Σ							**194.0**	**6,814**	**4.19**	**1.95**
#7	1	0.220	200.00	20.00	0.0100	1.0000	1	62.6	8,738	4.95	2.58
	2	0.170	100.00	50.00	0.0030	1.0000	2	5.6	2,805	1.51	0.79
	3	0.170	100.00	40.00	0.0030	1.0000	2	4.2	2,272	1.22	0.64
	4	0.220	40.00	40.00	0.0100	1.0000	1	0.4	4,107	2.63	1.34
	5	0.220	20.00	1.00	0.9000	1.0000	1	0.9	7,031	4.50	2.44
	6	0.220	80.00	30.00	0.0100	1.0000	1	2.2	5,587	3.57	1.82
	7	0.220	80.00	1.00	0.9000	1.0000	1	6.7	12,370	7.91	4.36
	8	0.220	100.00	60.00	0.0100	1.0000	1	4.0	12,389	7.92	1.19
	9	0.170	100.00	50.00	0.0030	1.0000	2	0.4	2,135	1.15	0.59
	Σ							**281.1**	**7,331**	**4.41**	**1.98**
#8	1	0.220	100.00	20.00	0.0100	1.0000	1	4.7	4,606	2.95	1.50
	2	0.170	100.00	40.00	0.0030	1.0000	2	3.7	2,237	1.20	0.63
	3	0.170	100.00	40.00	0.0030	1.0000	2	7.4	2,413	1.30	0.68
	4	0.220	50.00	30.00	0.0100	1.0000	1	1.7	4,318	2.76	1.37

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	5	0.220	20.00	1.00	0.9000	1.0000	1	1.6	7,669	4.90	2.59
	6	0.220	80.00	30.00	0.0100	1.0000	1	3.6	5,885	3.76	1.92
	7	0.220	80.00	1.00	0.9000	1.0000	1	5.2	12,045	7.70	4.25
	8	0.220	70.00	60.00	0.0100	1.0000	1	2.3	9,203	5.89	3.00
	9	0.170	80.00	40.00	0.0030	1.0000	2	1.0	1,728	0.93	0.49
	Σ							**312.2**	**9,043**	**5.44**	**1.85**
#9	1	0.220	200.00	20.00	0.0100	1.0000	1	34.5	8,250	5.28	2.69
	2	0.170	100.00	40.00	0.0030	1.0000	2	4.4	2,284	1.23	0.64
	3	0.170	100.00	40.00	0.0030	1.0000	2	1.8	2,076	1.12	0.58
	4	0.220	30.00	20.00	0.0100	1.0000	1	0.0	1,476	0.94	0.52
	5	0.220	20.00	1.00	0.9000	1.0000	1	0.1	5,905	3.78	2.37
	6	0.220	100.00	40.00	0.0100	1.0000	1	0.5	7,213	4.61	0.72
	Σ							**353.7**	**8,615**	**5.21**	**1.86**
#10	1	0.220	200.00	20.00	0.0100	1.0000	1	16.2	7,564	4.29	2.24
	2	0.170	100.00	50.00	0.0030	1.0000	2	8.3	2,924	1.58	0.82
	3	0.170	100.00	50.00	0.0030	1.0000	2	5.0	2,767	1.49	0.78
	4	0.220	50.00	40.00	0.0100	1.0000	1	0.3	4,515	2.89	1.45
	Σ							**383.4**	**8,140**	**4.89**	**1.79**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	47.50	190.00	400.00	5.510	0.020
#1	**1**	**Time of Concentration:**					**0.020**
#1	2	3. Short grass pasture	45.71	160.00	350.00	5.400	0.018
		8. Large gullies, diversions, and low flowing streams	21.09	135.00	640.00	13.770	0.012
#1	**2**	**Time of Concentration:**					**0.030**
#1	3	1. Forest with heavy ground litter	43.33	65.00	150.00	1.660	0.025
#1	**3**	**Time of Concentration:**					**0.025**
#2	1	3. Short grass pasture	43.59	170.00	390.00	5.280	0.020
#2	**1**	**Time of Concentration:**					**0.020**
#2	2	1. Forest with heavy ground litter	31.82	105.00	330.00	1.420	0.064
#2	**2**	**Time of Concentration:**					**0.064**
#2	3	1. Forest with heavy ground litter	34.09	75.00	220.00	1.470	0.041
#2	**3**	**Time of Concentration:**					**0.041**
#2	4	3. Short grass pasture	41.67	100.00	240.00	5.160	0.012
#2	**4**	**Time of Concentration:**					**0.012**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	1	1. Forest with heavy ground litter	52.00	260.00	500.00	1.820	0.076
#3	**1**	**Time of Concentration:**					**0.076**
#4	1	3. Short grass pasture	12.96	35.00	270.00	2.880	0.026
		8. Large gullies, diversions, and low flowing streams	35.14	130.00	370.00	17.780	0.005
		8. Large gullies, diversions, and low flowing streams	9.26	25.00	270.00	9.120	0.008
#4	**1**	**Time of Concentration:**					**0.039**
#4	2	1. Forest with heavy ground litter	25.00	90.00	360.00	1.260	0.079
		8. Large gullies, diversions, and low flowing streams	13.79	40.00	290.00	11.140	0.007
		9. Small streams flowing bankfull	4.17	10.00	240.00	18.370	0.003
#4	**2**	**Time of Concentration:**					**0.089**
#4	3	1. Forest with heavy ground litter	27.27	90.00	330.00	1.320	0.069
#4	**3**	**Time of Concentration:**					**0.069**
#5	1	1. Forest with heavy ground litter	42.86	60.00	140.00	1.650	0.023
		8. Large gullies, diversions, and low flowing streams	5.00	80.00	1,600.00	6.700	0.066
#5	**1**	**Time of Concentration:**					**0.089**
#5	2	3. Short grass pasture	7.14	10.00	140.00	2.130	0.018
		8. Large gullies, diversions, and low flowing streams	17.95	70.00	390.00	12.700	0.008
#5	**2**	**Time of Concentration:**					**0.026**
#5	3	5. Nearly bare and untilled, and alluvial valley fans	1.18	1.00	85.00	1.080	0.021
#5	**3**	**Time of Concentration:**					**0.021**
#5	4	1. Forest with heavy ground litter	53.85	210.00	390.00	1.850	0.058
#5	**4**	**Time of Concentration:**					**0.058**
#6	1	3. Short grass pasture	33.33	110.00	330.00	4.610	0.019
			0.00	0.00	0.00	0.000	0.000
#6	**1**	**Time of Concentration:**					**0.019**
#6	2	1. Forest with heavy ground litter	42.42	140.00	330.00	1.640	0.055
		8. Large gullies, diversions, and low flowing streams	5.15	35.00	680.00	6.800	0.027
		9. Small streams flowing bankfull	2.00	10.00	500.00	12.720	0.010
#6	**2**	**Time of Concentration:**					**0.092**
#6	3	1. Forest with heavy ground litter	39.13	90.00	230.00	1.580	0.040
		9. Small streams flowing bankfull	12.93	75.00	580.00	32.360	0.004
		9. Small streams flowing bankfull	2.25	9.00	400.00	13.500	0.008
#6	**3**	**Time of Concentration:**					**0.052**
#6	4	5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.00	0.310	0.017
#6	**4**	**Time of Concentration:**					**0.017**
#6	5	3. Short grass pasture	25.00	40.00	160.00	4.000	0.011
#6	**5**	**Time of Concentration:**					**0.011**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#6	6	5. Nearly bare and untilled, and alluvial valley fans	1.00	1.00	100.00	1.000	0.027
#6	**6**	**Time of Concentration:**					**0.027**
#6	7	3. Short grass pasture	66.67	120.00	180.00	6.530	0.007
#6	**7**	**Time of Concentration:**					**0.007**
#6	8	1. Forest with heavy ground litter	45.00	90.00	200.00	1.690	0.032
#6	**8**	**Time of Concentration:**					**0.032**
#7	1	3. Short grass pasture	8.13	65.00	800.00	2.280	0.097
		8. Large gullies, diversions, and low flowing streams	9.12	155.00	1,700.00	9.050	0.052
#7	**1**	**Time of Concentration:**					**0.149**
#7	2	1. Forest with heavy ground litter	38.10	80.00	210.00	1.560	0.037
		8. Large gullies, diversions, and low flowing streams	18.28	85.00	465.00	12.820	0.010
		9. Small streams flowing bankfull	3.67	29.00	790.00	17.240	0.012
#7	**2**	**Time of Concentration:**					**0.059**
#7	3	1. Forest with heavy ground litter	30.26	115.00	380.00	1.390	0.075
		8. Large gullies, diversions, and low flowing streams	7.29	35.00	480.00	8.100	0.016
		9. Small streams flowing bankfull	1.43	5.00	350.00	10.750	0.009
#7	**3**	**Time of Concentration:**					**0.100**
#7	4	3. Short grass pasture	37.50	15.00	40.00	4.890	0.002
		1. Forest with heavy ground litter	38.10	80.00	210.00	1.560	0.037
		8. Large gullies, diversions, and low flowing streams	18.28	85.00	465.00	12.820	0.010
		9. Small streams flowing bankfull	3.67	29.00	790.00	17.240	0.012
#7	**4**	**Time of Concentration:**					**0.061**
#7	5	5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.00	0.310	0.017
#7	**5**	**Time of Concentration:**					**0.017**
#7	6	3. Short grass pasture	36.36	40.00	110.00	4.820	0.006
#7	**6**	**Time of Concentration:**					**0.006**
#7	7	5. Nearly bare and untilled, and alluvial valley fans	1.25	1.00	80.00	1.110	0.020
		3. Short grass pasture	0.00	0.00	0.00	0.000	0.000
#7	**7**	**Time of Concentration:**					**0.020**
#7	8	3. Short grass pasture	80.00	120.00	150.00	7.150	0.005
#7	**8**	**Time of Concentration:**					**0.005**
#7	9	1. Forest with heavy ground litter	50.00	100.00	200.00	1.780	0.031
#7	**9**	**Time of Concentration:**					**0.031**
#8	1	3. Short grass pasture	14.29	60.00	420.00	3.020	0.038
		8. Large gullies, diversions, and low flowing streams	23.08	30.00	130.00	14.410	0.002
#8	**1**	**Time of Concentration:**					**0.040**
#8	2	1. Forest with heavy ground litter	36.76	125.00	340.00	1.530	0.061

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	18.39	80.00	435.00	12.860	0.009
		9. Small streams flowing bankfull	2.30	10.00	435.00	13.640	0.008
#8	**2**	**Time of Concentration:**					**0.078**
#8	3	1. Forest with heavy ground litter	45.45	150.00	330.00	1.700	0.053
		8. Large gullies, diversions, and low flowing streams	14.84	95.00	640.00	11.550	0.015
		9. Small streams flowing bankfull	2.78	5.00	180.00	14.990	0.003
#8	**3**	**Time of Concentration:**					**0.071**
#8	4	3. Short grass pasture	25.00	15.00	60.00	4.000	0.004
#8	**4**	**Time of Concentration:**					**0.004**
#8	5	5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.02	0.310	0.017
#8	**5**	**Time of Concentration:**					**0.017**
#8	6	3. Short grass pasture	37.50	30.00	80.00	4.890	0.004
#8	**6**	**Time of Concentration:**					**0.004**
#8	7	5. Nearly bare and untilled, and alluvial valley fans	2.50	2.00	80.00	1.580	0.014
#8	**7**	**Time of Concentration:**					**0.014**
#8	8	3. Short grass pasture	66.67	40.00	60.00	6.530	0.002
#8	**8**	**Time of Concentration:**					**0.002**
#8	9	1. Forest with heavy ground litter	40.00	40.00	100.00	1.600	0.017
#8	**9**	**Time of Concentration:**					**0.017**
#9	1	3. Short grass pasture	5.41	20.00	370.00	1.850	0.055
		3. Short grass pasture	60.00	60.00	100.00	6.190	0.004
		8. Large gullies, diversions, and low flowing streams	2.98	20.00	670.00	5.180	0.035
		8. Large gullies, diversions, and low flowing streams	26.85	145.00	540.00	15.540	0.009
#9	**1**	**Time of Concentration:**					**0.103**
#9	2	1. Forest with heavy ground litter	37.84	140.00	370.00	1.550	0.066
		8. Large gullies, diversions, and low flowing streams	20.00	90.00	450.00	13.410	0.009
		9. Small streams flowing bankfull	2.27	5.00	220.00	13.560	0.004
#9	**2**	**Time of Concentration:**					**0.079**
#9	3	1. Forest with heavy ground litter	44.83	130.00	290.00	1.690	0.047
		8. Large gullies, diversions, and low flowing streams	27.18	140.00	515.00	15.640	0.009
		9. Small streams flowing bankfull	2.27	5.00	220.00	13.560	0.004
#9	**3**	**Time of Concentration:**					**0.060**
#9	4	3. Short grass pasture	57.14	20.00	35.00	6.040	0.001
#9	**4**	**Time of Concentration:**					**0.001**
#9	5	5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.00	0.310	0.017
#9	**5**	**Time of Concentration:**					**0.017**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#9	6	3. Short grass pasture	35.71	50.00	140.00	4.780	0.008
#9	**6**	**Time of Concentration:**					**0.008**
#10	1	3. Short grass pasture	29.63	40.00	135.00	4.350	0.008
		3. Short grass pasture	2.68	15.00	560.00	1.300	0.119
		8. Large gullies, diversions, and low flowing streams	22.44	230.00	1,025.00	14.210	0.020
#10	**1**	**Time of Concentration:**					**0.147**
#10	2	1. Forest with heavy ground litter	58.62	170.00	290.00	1.930	0.041
		8. Large gullies, diversions, and low flowing streams	7.64	55.00	720.00	8.290	0.024
		9. Small streams flowing bankfull	2.01	20.00	995.00	12.750	0.021
#10	**2**	**Time of Concentration:**					**0.086**
#10	3	1. Forest with heavy ground litter	46.00	230.00	500.00	1.710	0.081
		9. Small streams flowing bankfull	40.74	55.00	135.00	57.440	0.000
		9. Small streams flowing bankfull	2.04	19.00	930.00	12.860	0.020
#10	**3**	**Time of Concentration:**					**0.101**
#10	4	3. Short grass pasture	50.00	80.00	160.00	5.650	0.007
#10	**4**	**Time of Concentration:**					**0.007**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	14.43	140.00	970.00	11.390	0.023
		8. Large gullies, diversions, and low flowing streams	10.00	5.00	50.00	9.480	0.001
#1	**1**	**Muskingum K:**					**0.024**
#1	2	8. Large gullies, diversions, and low flowing streams	10.00	5.00	50.00	9.480	0.001
#1	**2**	**Muskingum K:**					**0.001**
#2	1	8. Large gullies, diversions, and low flowing streams	21.28	100.00	470.00	13.830	0.009
		9. Small streams flowing bankfull	3.73	25.00	670.00	17.380	0.010
#2	**1**	**Muskingum K:**					**0.019**
#2	2	9. Small streams flowing bankfull	3.73	25.00	670.00	17.380	0.010
#2	**2**	**Muskingum K:**					**0.010**
#2	3	9. Small streams flowing bankfull	3.73	25.00	670.00	17.380	0.010
#2	**3**	**Muskingum K:**					**0.010**
#2	4	1. Forest with heavy ground litter	30.00	60.00	200.00	1.380	0.040
		9. Small streams flowing bankfull	5.10	50.00	980.00	20.320	0.013
#2	**4**	**Muskingum K:**					**0.053**
#3	1	8. Large gullies, diversions, and low flowing streams	13.79	120.00	870.00	11.140	0.021

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	**1**	**Muskingum K:**					**0.021**
#4	1	8. Large gullies, diversions, and low flowing streams	7.76	45.00	580.00	8.350	0.019
		9. Small streams flowing bankfull	4.17	10.00	240.00	18.370	0.003
#4	**1**	**Muskingum K:**					**0.022**
#4	3	9. Small streams flowing bankfull	4.17	10.00	240.00	18.370	0.003
#4	**3**	**Muskingum K:**					**0.003**
#5	1	9. Small streams flowing bankfull	2.00	1.00	50.00	12.720	0.001
#5	**1**	**Muskingum K:**					**0.001**
#5	2	8. Large gullies, diversions, and low flowing streams	5.00	80.00	1,600.00	6.700	0.066
		9. Small streams flowing bankfull	2.00	1.00	50.00	12.720	0.001
#5	**2**	**Muskingum K:**					**0.067**
#5	3	3. Short grass pasture	13.33	40.00	300.00	2.920	0.028
		8. Large gullies, diversions, and low flowing streams	17.95	70.00	390.00	12.700	0.008
		8. Large gullies, diversions, and low flowing streams	5.00	80.00	1,600.00	6.700	0.066
		9. Small streams flowing bankfull	2.00	1.00	50.00	12.720	0.001
#5	**3**	**Muskingum K:**					**0.103**
#5	4	3. Short grass pasture	7.14	10.00	140.00	2.130	0.018
		8. Large gullies, diversions, and low flowing streams	17.95	70.00	390.00	12.700	0.008
		8. Large gullies, diversions, and low flowing streams	5.00	80.00	1,600.00	6.700	0.066
		9. Small streams flowing bankfull	2.00	1.00	50.00	12.720	0.001
#5	**4**	**Muskingum K:**					**0.093**
#6	1	8. Large gullies, diversions, and low flowing streams	23.08	60.00	260.00	14.410	0.005
		8. Large gullies, diversions, and low flowing streams	15.91	70.00	440.00	11.960	0.010
		9. Small streams flowing bankfull	2.00	10.00	500.00	12.720	0.010
#6	**1**	**Muskingum K:**					**0.025**
#6	4	8. Large gullies, diversions, and low flowing streams	21.88	70.00	320.00	14.030	0.006
		8. Large gullies, diversions, and low flowing streams	11.36	50.00	440.00	10.110	0.012
		9. Small streams flowing bankfull	2.25	9.00	400.00	13.500	0.008
#6	**4**	**Muskingum K:**					**0.026**
#6	5	8. Large gullies, diversions, and low flowing streams	27.69	90.00	325.00	15.780	0.005
		8. Large gullies, diversions, and low flowing streams	12.93	75.00	580.00	10.780	0.014
		9. Small streams flowing bankfull	2.25	9.00	400.00	13.500	0.008
#6	**5**	**Muskingum K:**					**0.027**
#6	6	3. Short grass pasture	25.00	40.00	160.00	4.000	0.011

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	27.69	90.00	325.00	15.780	0.005
		8. Large gullies, diversions, and low flowing streams	12.93	75.00	580.00	10.780	0.014
		9. Small streams flowing bankfull	2.25	9.00	400.00	13.500	0.008
#6	**6**	**Muskingum K:**					**0.038**
#6	7	5. Nearly bare and untilled, and alluvial valley fans	1.00	1.00	100.00	1.000	0.027
		3. Short grass pasture	26.80	130.00	485.00	4.140	0.032
		8. Large gullies, diversions, and low flowing streams	12.93	75.00	580.00	10.780	0.014
		9. Small streams flowing bankfull	2.25	9.00	400.00	13.500	0.008
#6	**7**	**Muskingum K:**					**0.081**
#6	8	3. Short grass pasture	66.67	120.00	180.00	6.530	0.007
		5. Nearly bare and untilled, and alluvial valley fans	1.00	1.00	100.00	1.000	0.027
		8. Large gullies, diversions, and low flowing streams	26.80	130.00	485.00	15.530	0.008
		8. Large gullies, diversions, and low flowing streams	12.93	75.00	580.00	10.780	0.014
		9. Small streams flowing bankfull	2.25	9.00	400.00	13.500	0.008
#6	**8**	**Muskingum K:**					**0.064**
#7	1	8. Large gullies, diversions, and low flowing streams	6.90	40.00	580.00	7.870	0.020
		9. Small streams flowing bankfull	1.43	5.00	350.00	10.750	0.009
#7	**1**	**Muskingum K:**					**0.029**
#7	5	3. Short grass pasture	37.50	15.00	40.00	4.890	0.002
		1. Forest with heavy ground litter	38.10	80.00	210.00	1.560	0.037
		8. Large gullies, diversions, and low flowing streams	18.28	85.00	465.00	12.820	0.010
		9. Small streams flowing bankfull	3.67	29.00	790.00	17.240	0.012
#7	**5**	**Muskingum K:**					**0.061**
#7	6	3. Short grass pasture	0.10	0.02	20.00	0.250	0.022
		3. Short grass pasture	37.50	15.00	40.00	4.890	0.002
		8. Large gullies, diversions, and low flowing streams	28.70	165.00	575.00	16.070	0.009
		9. Small streams flowing bankfull	3.67	29.00	790.00	17.240	0.012
#7	**6**	**Muskingum K:**					**0.045**
#7	7	3. Short grass pasture	36.36	40.00	110.00	4.820	0.006
		9. Small streams flowing bankfull	24.44	165.00	675.00	44.490	0.004
		9. Small streams flowing bankfull	3.67	29.00	790.00	17.240	0.012
#7	**7**	**Muskingum K:**					**0.022**
#7	8	5. Nearly bare and untilled, and alluvial valley fans	1.00	1.00	100.00	1.000	0.027
		3. Short grass pasture	36.36	40.00	110.00	4.820	0.006

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.00	0.310	0.017
		8. Large gullies, diversions, and low flowing streams	24.44	165.00	675.00	14.830	0.012
		9. Small streams flowing bankfull	3.67	29.00	790.00	17.240	0.012
#7	**8**	**Muskingum K:**					**0.074**
#7	9	3. Short grass pasture	63.64	70.00	110.00	6.380	0.004
		5. Nearly bare and untilled, and alluvial valley fans	1.00	1.00	100.00	1.000	0.027
		8. Large gullies, diversions, and low flowing streams	27.78	250.00	900.00	15.810	0.015
		9. Small streams flowing bankfull	3.67	29.00	790.00	17.240	0.012
#7	**9**	**Muskingum K:**					**0.058**
#8	1	8. Large gullies, diversions, and low flowing streams	15.56	140.00	900.00	11.830	0.021
		9. Small streams flowing bankfull	2.30	10.00	435.00	13.640	0.008
#8	**1**	**Muskingum K:**					**0.029**
#8	4	1. Forest with heavy ground litter	45.45	150.00	330.00	1.700	0.053
		9. Small streams flowing bankfull	14.84	95.00	640.00	34.670	0.005
		9. Small streams flowing bankfull	2.78	5.00	180.00	14.990	0.003
#8	**4**	**Muskingum K:**					**0.061**
#8	5	3. Short grass pasture	25.00	15.00	60.00	4.000	0.004
		1. Forest with heavy ground litter	45.45	150.00	330.00	1.700	0.053
		8. Large gullies, diversions, and low flowing streams	14.84	95.00	640.00	11.550	0.015
		9. Small streams flowing bankfull	2.78	5.00	180.00	14.990	0.003
#8	**5**	**Muskingum K:**					**0.075**
#8	6	8. Large gullies, diversions, and low flowing streams	22.57	255.00	1,130.00	14.250	0.022
		9. Small streams flowing bankfull	2.78	5.00	180.00	14.990	0.003
#8	**6**	**Muskingum K:**					**0.025**
#8	7	3. Short grass pasture	37.50	30.00	80.00	4.890	0.004
		8. Large gullies, diversions, and low flowing streams	22.57	255.00	1,130.00	14.250	0.022
		9. Small streams flowing bankfull	2.78	5.00	180.00	14.990	0.003
#8	**7**	**Muskingum K:**					**0.029**
#8	8	5. Nearly bare and untilled, and alluvial valley fans	2.50	2.00	80.00	1.580	0.014
		3. Short grass pasture	37.50	30.00	80.00	4.890	0.004
		8. Large gullies, diversions, and low flowing streams	22.57	255.00	1,130.00	14.250	0.022
		9. Small streams flowing bankfull	2.78	5.00	180.00	14.990	0.003
#8	**8**	**Muskingum K:**					**0.043**
#8	9	3. Short grass pasture	66.67	40.00	60.00	6.530	0.002
		5. Nearly bare and untilled, and alluvial valley fans	2.50	2.00	80.00	1.580	0.014

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		3. Short grass pasture	37.50	30.00	80.00	4.890	0.004
		8. Large gullies, diversions, and low flowing streams	22.57	255.00	1,130.00	14.250	0.022
		9. Small streams flowing bankfull	2.78	5.00	180.00	14.990	0.003
#8	**9**	**Muskingum K:**					**0.045**
#9	1	8. Large gullies, diversions, and low flowing streams	15.91	140.00	880.00	11.960	0.020
		9. Small streams flowing bankfull	2.27	5.00	220.00	13.560	0.004
#9	**1**	**Muskingum K:**					**0.024**
#9	4	1. Forest with heavy ground litter	44.83	130.00	290.00	1.690	0.047
		8. Large gullies, diversions, and low flowing streams	27.18	140.00	515.00	15.640	0.009
		9. Small streams flowing bankfull	2.27	5.00	220.00	13.560	0.004
#9	**4**	**Muskingum K:**					**0.060**
#9	5	3. Short grass pasture	57.14	20.00	35.00	6.040	0.001
		1. Forest with heavy ground litter	44.83	130.00	290.00	1.690	0.047
		8. Large gullies, diversions, and low flowing streams	27.18	140.00	515.00	15.640	0.009
		9. Small streams flowing bankfull	2.27	5.00	220.00	13.560	0.004
#9	**5**	**Muskingum K:**					**0.061**
#9	6	5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.00	0.310	0.017
		3. Short grass pasture	57.14	20.00	35.00	6.040	0.001
		1. Forest with heavy ground litter	44.83	130.00	290.00	1.690	0.047
		8. Large gullies, diversions, and low flowing streams	27.18	140.00	515.00	15.640	0.009
		9. Small streams flowing bankfull	2.27	5.00	220.00	13.560	0.004
#9	**6**	**Muskingum K:**					**0.078**
#10	1	8. Large gullies, diversions, and low flowing streams	7.64	55.00	720.00	8.290	0.024
		9. Small streams flowing bankfull	2.01	20.00	995.00	12.750	0.021
#10	**1**	**Muskingum K:**					**0.045**
#10	4	1. Forest with heavy ground litter	46.00	230.00	500.00	1.710	0.081
		8. Large gullies, diversions, and low flowing streams	40.74	55.00	135.00	19.140	0.001
		8. Large gullies, diversions, and low flowing streams	2.04	19.00	930.00	4.280	0.060
#10	**4**	**Muskingum K:**					**0.142**

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897-0587

PROPOSED BACKFILL SEDIMENT LOAD

CLEAR FORK WATERSHED

Keith Spears

General Information

Storm Information:

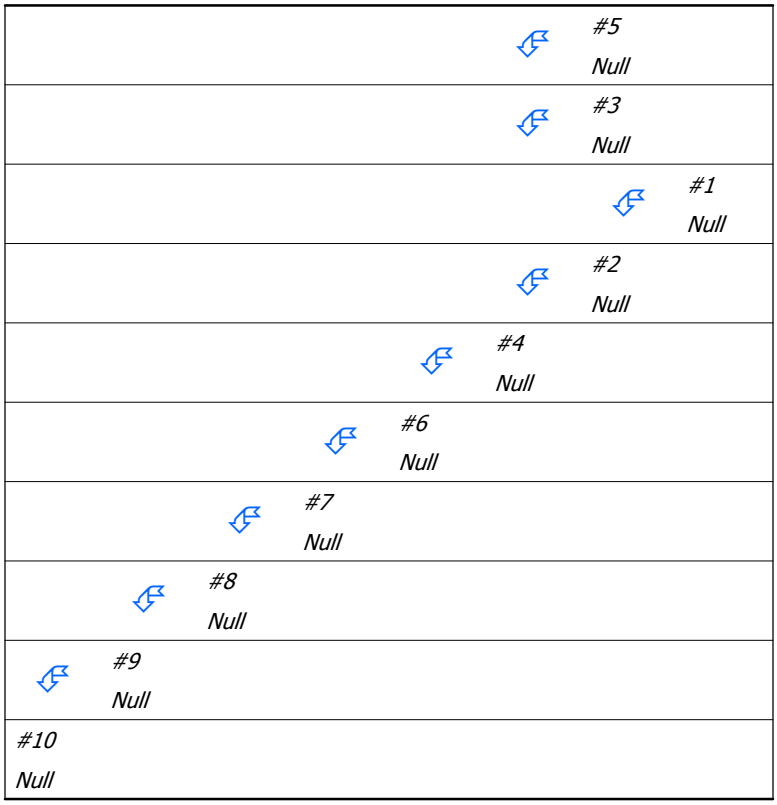
Storm Type:	NRCS Type II
Design Storm:	25 yr - 24 hr
Rainfall Depth:	5.000 inches

Particle Size Distribution:

Size (mm)	DISTURBED	UNDISTURBED
3.0000	100.000%	100.000%
2.0000	93.000%	99.900%
1.0000	86.000%	98.000%
0.5000	78.000%	92.000%
0.3000	73.000%	87.000%
0.2000	67.000%	80.000%
0.1000	55.000%	70.000%
0.0500	44.000%	60.000%
0.0300	35.000%	50.000%
0.0200	27.000%	42.000%
0.0100	18.000%	32.000%
0.0050	14.000%	21.000%
0.0030	9.000%	15.000%
0.0010	3.000%	4.000%
0.0001	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#2	0.051	0.393	Null Structure #16
Null	#2	==>	#4	0.006	0.466	Null Structure #17
Null	#3	==>	#4	0.027	0.444	Null Structure #18
Null	#4	==>	#6	0.016	0.452	Null Structure #19
Null	#5	==>	#4	0.018	0.453	Null Structure #20
Null	#6	==>	#7	0.010	0.456	Null Structure #21
Null	#7	==>	#8	0.027	0.444	Null Structure #22
Null	#8	==>	#9	0.000	0.000	Null Structure #23
Null	#9	==>	#10	0.000	0.000	Null Structure #24
Null	#10	==>	End	0.000	0.000	Null Structure #25



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	4.35	50.00	1,150.00	6.25	0.051

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	**Muskingum K:**					**0.051**
#2	9. Small streams flowing bankfull	6.73	35.00	520.00	23.34	0.006
#2	**Muskingum K:**					**0.006**
#3	9. Small streams flowing bankfull	2.24	30.00	1,340.00	13.46	0.027
#3	**Muskingum K:**					**0.027**
#4	9. Small streams flowing bankfull	3.13	30.00	960.00	15.90	0.016
#4	**Muskingum K:**					**0.016**
#5	9. Small streams flowing bankfull	3.27	35.00	1,070.00	16.27	0.018
#5	**Muskingum K:**					**0.018**
#6	9. Small streams flowing bankfull	3.88	25.00	645.00	17.71	0.010
#6	**Muskingum K:**					**0.010**
#7	9. Small streams flowing bankfull	2.24	30.00	1,340.00	13.46	0.027
#7	**Muskingum K:**					**0.027**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#5	79.650	79.650	168.33	13.41	70.8	8,598	5.43	2.45
#3	22.000	22.000	54.06	4.18	8.7	2,928	1.57	0.82
#1	36.400	36.400	79.18	5.97	51.2	12,351	7.89	4.02
#2	24.700	61.100	133.16	10.40	68.2	11,618	7.33	3.03
#4	27.600	190.350	418.05	32.74	171.0	9,092	5.69	2.40
#6	57.000	247.350	552.77	43.08	204.9	10,294	6.41	2.18
#7	132.100	379.450	731.53	60.63	289.1	9,241	5.62	2.13
#8	62.300	441.750	878.25	71.93	320.4	8,358	5.08	1.99
#9	58.800	500.550	1,011.65	82.08	361.8	8,033	4.89	1.97
#10	62.300	562.850	1,121.60	91.70	391.5	7,620	4.61	1.90

The 24 hour Arithmetic Average (24AA) is under review. It is anticipated that the 24AA will be replaced by the peak settleable solids concentration (ml/l) with the addition of new sediment input factor values.

The 24AA is provided for your convenience during this transition period.

	24AA (ml/l)
#5	0.60
#3	0.20
#1	0.97
#2	0.74
#4	0.59
#6	0.58
#7	0.63
#8	0.59
#9	0.58
#10	0.57

Particle Size Distribution(s) at Each Structure

Structure #5 (Null Structure #20):

Size (mm)	In/Out
3.0000	100.000%
2.0000	93.590%
1.0000	87.013%
0.5000	79.179%
0.3000	74.178%
0.2000	68.094%
0.1000	56.258%
0.0500	45.339%
0.0300	36.255%
0.0200	28.253%
0.0100	19.169%
0.0050	14.585%
0.0030	9.501%
0.0010	3.084%
0.0001	0.000%

Structure #3 (Null Structure #18):

Size (mm)	In/Out
3.0000	100.000%
2.0000	100.000%
1.0000	98.357%
0.5000	92.335%
0.3000	87.317%
0.2000	80.292%
0.1000	70.255%
0.0500	60.219%
0.0300	50.182%
0.0200	42.153%
0.0100	32.117%
0.0050	21.077%
0.0030	15.055%
0.0010	4.015%
0.0001	0.000%

Structure #1 (Null Structure #16):

Size (mm)	In/Out
3.0000	100.000%
2.0000	93.051%
1.0000	86.088%
0.5000	78.102%
0.3000	73.102%
0.2000	67.094%
0.1000	55.109%
0.0500	44.116%
0.0300	35.108%
0.0200	27.108%
0.0100	18.101%
0.0050	14.050%
0.0030	9.043%
0.0010	3.007%
0.0001	0.000%

Structure #2 (Null Structure #17):

Size (mm)	In/Out
3.0000	100.000%
2.0000	93.591%
1.0000	87.019%
0.5000	79.186%
0.3000	74.185%
0.2000	68.100%
0.1000	56.266%
0.0500	45.349%
0.0300	36.264%
0.0200	28.263%
0.0100	19.178%
0.0050	14.589%
0.0030	9.505%
0.0010	3.084%
0.0001	0.000%

Structure #4 (Null Structure #19):

Size (mm)	In/Out
3.0000	100.000%
2.0000	93.918%
1.0000	87.595%
0.5000	79.853%

Size (mm)	In/Out
0.3000	74.852%
0.2000	68.719%
0.1000	56.976%
0.0500	46.103%
0.0300	36.969%
0.0200	28.967%
0.0100	19.833%
0.0050	14.918%
0.0030	9.786%
0.0010	3.132%
0.0001	0.000%

Structure #6 (Null Structure #21):

Size (mm)	In/Out
3.0000	100.000%
2.0000	94.145%
1.0000	87.987%
0.5000	80.311%
0.3000	75.309%
0.2000	69.144%
0.1000	57.466%
0.0500	46.626%
0.0300	37.460%
0.0200	29.457%
0.0100	20.291%
0.0050	15.147%
0.0030	9.982%
0.0010	3.164%
0.0001	0.000%

Structure #7 (Null Structure #22):

Size (mm)	In/Out
3.0000	100.000%
2.0000	95.572%
1.0000	90.864%
0.5000	84.896%
0.3000	80.978%
0.2000	76.125%
0.1000	63.494%
0.0500	51.398%
0.0300	41.228%

Size (mm)	In/Out
0.0200	32.321%
0.0100	22.151%
0.0050	16.642%
0.0030	10.924%
0.0010	3.491%
0.0001	0.000%

Structure #8 (Null Structure #23):

Size (mm)	In/Out
3.0000	100.000%
2.0000	95.580%
1.0000	90.836%
0.5000	84.743%
0.3000	80.719%
0.2000	75.717%
0.1000	63.220%
0.0500	51.268%
0.0300	41.175%
0.0200	32.356%
0.0100	22.263%
0.0050	16.643%
0.0030	10.958%
0.0010	3.480%
0.0001	0.000%

Structure #9 (Null Structure #24):

Size (mm)	In/Out
3.0000	100.000%
2.0000	95.405%
1.0000	90.490%
0.5000	84.214%
0.3000	80.078%
0.2000	74.945%
0.1000	62.539%
0.0500	50.713%
0.0300	40.728%
0.0200	32.003%
0.0100	22.017%
0.0050	16.462%
0.0030	10.838%
0.0010	3.442%

Size (mm)	In/Out
0.0001	0.000%

Structure #10:

Size (mm)	In/Out
3.0000	100.000%
2.0000	95.746%
1.0000	91.136%
0.5000	85.128%
0.3000	81.133%
0.2000	76.148%
0.1000	63.664%
0.0500	51.697%
0.0300	41.558%
0.0200	32.715%
0.0100	22.576%
0.0050	16.815%
0.0030	11.097%
0.0010	3.507%
0.0001	0.000%

Structure Detail:

Structure #5 (Null)

Null Structure #20

Structure #3 (Null)

Null Structure #18

Structure #1 (Null)

Null Structure #16

Structure #2 (Null)

Null Structure #17

Structure #4 (Null)

Null Structure #19

Structure #6 (Null)

Null Structure #21

Structure #7 (Null)

Null Structure #22

Structure #8 (Null)

Null Structure #23

Structure #9 (Null)

Null Structure #24

Structure #10 (Null)

Null Structure #25

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#5	1	14.100	0.089	0.001	0.441	73.000	S	34.65	2.677
	2	63.550	0.057	0.067	0.401	69.000	S	137.57	10.354
	3	2.000	0.009	0.101	0.413	73.000	S	4.91	0.380
	Σ	**79.650**						**168.33**	**13.411**
#3	1	22.000	0.076	0.021	0.434	73.000	S	54.06	4.177
	Σ	**22.000**						**54.06**	**4.177**
#1	1	8.900	0.020	0.024	0.435	69.000	S	19.27	1.450
	2	26.200	0.030	0.001	0.424	69.000	S	56.72	4.269
	3	1.300	0.025	0.000	0.000	73.000	S	3.19	0.247
	Σ	**36.400**						**79.18**	**5.965**
#2	1	6.200	0.020	0.019	0.452	69.000	S	13.42	1.010
	2	10.400	0.064	0.010	0.455	73.000	S	25.56	1.974
	3	4.800	0.041	0.010	0.455	73.000	S	11.80	0.911
	4	3.300	0.012	0.053	0.455	69.000	S	7.14	0.538
	Σ	**61.100**						**133.16**	**10.399**
#4	1	18.200	0.039	0.022	0.435	69.000	S	39.40	2.965
	2	7.600	0.089	0.000	0.000	73.000	S	18.68	1.443
	3	1.800	0.069	0.003	0.458	73.000	S	4.42	0.342
	Σ	**190.350**						**418.05**	**32.735**
#6	1	5.500	0.019	0.025	0.441	69.000	S	11.91	0.896
	2	12.400	0.092	0.000	0.000	73.000	S	30.47	2.354
	3	19.000	0.052	0.000	0.000	73.000	S	46.69	3.607
	4	0.800	0.017	0.026	0.440	86.000	F	2.67	0.230
	5	15.200	0.016	0.031	0.439	69.000	S	32.90	2.477
	6	4.100	0.023	0.047	0.435	73.000	S	10.08	0.778
	Σ	**247.350**						**552.77**	**43.078**
#7	1	91.600	0.149	0.029	0.420	69.000	S	93.68	10.078
	2	14.900	0.059	0.000	0.000	73.000	S	36.61	2.829
	3	13.800	0.100	0.000	0.000	73.000	S	33.91	2.620
	4	0.800	0.061	0.000	0.000	69.000	S	1.73	0.130
	5	0.600	0.017	0.061	0.444	86.000	F	2.00	0.172
	6	9.400	0.018	0.027	0.451	69.000	S	20.35	1.532
	7	1.000	0.007	0.067	0.445	73.000	S	2.46	0.190
	Σ	**379.450**						**731.53**	**60.627**
#8	1	9.100	0.040	0.029	0.440	69.000	S	19.70	1.483
	2	12.100	0.078	0.000	0.000	73.000	S	29.73	2.297

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	3	22.800	0.071	0.000	0.000	73.000	S	56.03	4.328
	4	3.500	0.004	0.061	0.464	69.000	S	7.58	0.570
	5	1.000	0.017	0.075	0.421	86.000	F	3.33	0.288
	6	10.500	0.021	0.022	0.447	69.000	S	22.73	1.711
	7	3.300	0.069	0.025	0.447	73.000	S	8.11	0.626
	Σ	**441.750**						**878.25**	**71.931**
#9	1	37.000	0.103	0.024	0.439	69.000	S	80.10	6.028
	2	14.400	0.079	0.000	0.000	73.000	S	35.39	2.734
	3	6.500	0.060	0.000	0.000	73.000	S	15.97	1.234
	4	0.200	0.001	0.060	0.434	69.000	S	0.43	0.029
	5	0.100	0.017	0.061	0.433	86.000	F	0.33	0.024
	6	0.600	0.008	0.078	0.432	69.000	S	1.30	0.098
	Σ	**500.550**						**1,011.65**	**82.078**
#10	1	27.400	0.147	0.045	0.432	69.000	S	28.02	3.015
	2	21.100	0.086	0.000	0.000	73.000	S	51.85	4.006
	3	13.300	0.101	0.000	0.000	73.000	S	32.68	2.525
	4	0.500	0.007	0.142	0.368	69.000	S	1.08	0.081
	Σ	**562.850**						**1,121.60**	**91.704**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#5	1	0.170	100.00	50.00	0.0030	1.0000	2	5.3	2,786	1.50	0.78
	2	0.220	100.00	30.00	0.0100	1.0000	1	65.0	9,183	5.87	2.94
	3	0.170	100.00	50.00	0.0030	1.0000	2	0.6	2,188	1.18	0.62
	Σ							**70.8**	**8,598**	**5.43**	**2.45**
#3	1	0.170	100.00	50.00	0.0030	1.0000	2	8.7	2,939	1.58	0.83
	Σ							**8.7**	**2,928**	**1.57**	**0.82**
#1	1	0.220	100.00	50.00	0.0100	1.0000	1	11.7	11,590	7.41	3.78
	2	0.220	100.00	50.00	0.0100	1.0000	1	39.1	13,184	8.43	4.30
	3	0.170	100.00	50.00	0.0030	1.0000	2	0.4	2,094	1.13	0.59
	Σ							**51.2**	**12,351**	**7.89**	**4.02**
#2	1	0.220	100.00	50.00	0.0100	1.0000	1	7.8	11,100	7.10	3.62
	2	0.170	100.00	50.00	0.0030	1.0000	2	3.8	2,686	1.45	0.76
	3	0.170	100.00	50.00	0.0030	1.0000	2	1.6	2,449	1.32	0.69
	4	0.220	100.00	50.00	0.0100	1.0000	1	3.8	10,256	6.56	3.35

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	Σ							**68.2**	**11,618**	**7.33**	**3.03**
#4	1	0.220	100.00	40.00	0.0100	1.0000	1	21.3	10,328	6.60	3.36
	2	0.170	100.00	30.00	0.0030	1.0000	2	1.6	1,592	0.86	0.45
	3	0.170	100.00	30.00	0.0030	1.0000	2	0.3	1,339	0.72	0.38
	Σ							**171.0**	**9,092**	**5.69**	**2.40**
#6	1	0.220	100.00	30.00	0.0100	1.0000	1	4.2	6,741	4.31	2.19
	2	0.170	100.00	40.00	0.0030	1.0000	2	3.8	2,243	1.21	0.63
	3	0.170	100.00	40.00	0.0030	1.0000	2	6.1	2,361	1.27	0.66
	4	0.220	20.00	1.00	0.9000	1.0000	1	1.2	7,135	4.56	2.52
	5	0.220	100.00	40.00	0.0100	1.0000	1	17.4	10,108	6.46	3.29
	6	0.170	100.00	50.00	0.0030	1.0000	2	1.3	2,403	1.29	0.68
	Σ							**204.9**	**10,294**	**6.41**	**2.18**
#7	1	0.220	200.00	20.00	0.0100	1.0000	1	62.6	8,738	4.95	2.58
	2	0.170	100.00	50.00	0.0030	1.0000	2	5.6	2,805	1.51	0.79
	3	0.170	100.00	40.00	0.0030	1.0000	2	4.2	2,272	1.22	0.64
	4	0.220	40.00	40.00	0.0100	1.0000	1	0.4	4,107	2.63	1.34
	5	0.220	20.00	1.00	0.9000	1.0000	1	0.9	7,031	4.50	2.44
	6	0.220	100.00	40.00	0.0100	1.0000	1	10.2	9,543	6.10	3.11
	7	0.170	100.00	50.00	0.0030	1.0000	2	0.3	2,097	1.13	0.57
	Σ							**289.1**	**9,241**	**5.62**	**2.13**
#8	1	0.220	100.00	20.00	0.0100	1.0000	1	4.7	4,606	2.95	1.50
	2	0.170	100.00	40.00	0.0030	1.0000	2	3.7	2,237	1.20	0.63
	3	0.170	100.00	40.00	0.0030	1.0000	2	7.4	2,413	1.30	0.68
	4	0.220	50.00	30.00	0.0100	1.0000	1	1.7	4,318	2.76	1.37
	5	0.220	20.00	1.00	0.9000	1.0000	1	1.6	7,669	4.90	2.59
	6	0.220	100.00	40.00	0.0100	1.0000	1	11.5	9,671	6.18	3.15
	7	0.170	80.00	40.00	0.0030	1.0000	2	0.7	1,674	0.90	0.47
	Σ							**320.4**	**8,358**	**5.08**	**1.99**
#9	1	0.220	200.00	20.00	0.0100	1.0000	1	34.5	8,250	5.28	2.69
	2	0.170	100.00	40.00	0.0030	1.0000	2	4.4	2,284	1.23	0.64
	3	0.170	100.00	40.00	0.0030	1.0000	2	1.8	2,076	1.12	0.58
	4	0.220	30.00	20.00	0.0100	1.0000	1	0.0	1,476	0.94	0.52
	5	0.220	20.00	1.00	0.9000	1.0000	1	0.1	5,905	3.78	2.37
	6	0.220	100.00	40.00	0.0100	1.0000	1	0.5	7,213	4.61	0.72
	Σ							**361.8**	**8,033**	**4.89**	**1.97**
#10	1	0.220	200.00	20.00	0.0100	1.0000	1	16.2	7,564	4.29	2.24
	2	0.170	100.00	50.00	0.0030	1.0000	2	8.3	2,924	1.58	0.82
	3	0.170	100.00	50.00	0.0030	1.0000	2	5.0	2,767	1.49	0.78
	4	0.220	50.00	40.00	0.0100	1.0000	1	0.3	4,515	2.89	1.45

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	Σ							**391.5**	**7,620**	**4.61**	**1.90**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	47.50	190.00	400.00	5.510	0.020
#1	**1**	**Time of Concentration:**					**0.020**
#1	2	3. Short grass pasture	45.71	160.00	350.00	5.400	0.018
		8. Large gullies, diversions, and low flowing streams	21.09	135.00	640.00	13.770	0.012
#1	**2**	**Time of Concentration:**					**0.030**
#1	3	1. Forest with heavy ground litter	43.33	65.00	150.00	1.660	0.025
#1	**3**	**Time of Concentration:**					**0.025**
#2	1	3. Short grass pasture	43.59	170.00	390.00	5.280	0.020
#2	**1**	**Time of Concentration:**					**0.020**
#2	2	1. Forest with heavy ground litter	31.82	105.00	330.00	1.420	0.064
#2	**2**	**Time of Concentration:**					**0.064**
#2	3	1. Forest with heavy ground litter	34.09	75.00	220.00	1.470	0.041
#2	**3**	**Time of Concentration:**					**0.041**
#2	4	3. Short grass pasture	41.67	100.00	240.00	5.160	0.012
#2	**4**	**Time of Concentration:**					**0.012**
#3	1	1. Forest with heavy ground litter	52.00	260.00	500.00	1.820	0.076
#3	**1**	**Time of Concentration:**					**0.076**
#4	1	3. Short grass pasture	12.96	35.00	270.00	2.880	0.026
		8. Large gullies, diversions, and low flowing streams	35.14	130.00	370.00	17.780	0.005
		8. Large gullies, diversions, and low flowing streams	9.26	25.00	270.00	9.120	0.008
#4	**1**	**Time of Concentration:**					**0.039**
#4	2	1. Forest with heavy ground litter	25.00	90.00	360.00	1.260	0.079
		8. Large gullies, diversions, and low flowing streams	13.79	40.00	290.00	11.140	0.007
		9. Small streams flowing bankfull	4.17	10.00	240.00	18.370	0.003
#4	**2**	**Time of Concentration:**					**0.089**
#4	3	1. Forest with heavy ground litter	27.27	90.00	330.00	1.320	0.069
#4	**3**	**Time of Concentration:**					**0.069**
#5	1	1. Forest with heavy ground litter	42.86	60.00	140.00	1.650	0.023
		8. Large gullies, diversions, and low flowing streams	5.00	80.00	1,600.00	6.700	0.066
#5	**1**	**Time of Concentration:**					**0.089**
#5	2	3. Short grass pasture	48.28	140.00	290.00	5.550	0.014
		8. Large gullies, diversions, and low flowing streams	24.39	100.00	410.00	14.810	0.007

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	2.50	10.00	400.00	4.740	0.023
		8. Large gullies, diversions, and low flowing streams	13.46	70.00	520.00	11.000	0.013
#5	**2**	**Time of Concentration:**					**0.057**
#5	3	3. Short grass pasture	44.44	80.00	180.00	5.330	0.009
#5	**3**	**Time of Concentration:**					**0.009**
#6	1	3. Short grass pasture	33.33	110.00	330.00	4.610	0.019
			0.00	0.00	0.00	0.000	0.000
#6	**1**	**Time of Concentration:**					**0.019**
#6	2	1. Forest with heavy ground litter	42.42	140.00	330.00	1.640	0.055
		8. Large gullies, diversions, and low flowing streams	5.15	35.00	680.00	6.800	0.027
		9. Small streams flowing bankfull	2.00	10.00	500.00	12.720	0.010
#6	**2**	**Time of Concentration:**					**0.092**
#6	3	1. Forest with heavy ground litter	39.13	90.00	230.00	1.580	0.040
		9. Small streams flowing bankfull	12.93	75.00	580.00	32.360	0.004
		9. Small streams flowing bankfull	2.25	9.00	400.00	13.500	0.008
#6	**3**	**Time of Concentration:**					**0.052**
#6	4	5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.00	0.310	0.017
#6	**4**	**Time of Concentration:**					**0.017**
#6	5	3. Short grass pasture	60.00	120.00	199.99	6.190	0.008
		8. Large gullies, diversions, and low flowing streams	5.13	10.00	195.00	6.790	0.007
		8. Large gullies, diversions, and low flowing streams	33.33	40.00	120.00	17.320	0.001
#6	**5**	**Time of Concentration:**					**0.016**
#6	6	1. Forest with heavy ground litter	51.61	80.00	155.00	1.810	0.023
#6	**6**	**Time of Concentration:**					**0.023**
#7	1	3. Short grass pasture	8.13	65.00	800.00	2.280	0.097
		8. Large gullies, diversions, and low flowing streams	9.12	155.00	1,700.00	9.050	0.052
#7	**1**	**Time of Concentration:**					**0.149**
#7	2	1. Forest with heavy ground litter	38.10	80.00	210.00	1.560	0.037
		8. Large gullies, diversions, and low flowing streams	18.28	85.00	465.00	12.820	0.010
		9. Small streams flowing bankfull	3.67	29.00	790.00	17.240	0.012
#7	**2**	**Time of Concentration:**					**0.059**
#7	3	1. Forest with heavy ground litter	30.26	115.00	380.00	1.390	0.075
		8. Large gullies, diversions, and low flowing streams	7.29	35.00	480.00	8.100	0.016
		9. Small streams flowing bankfull	1.43	5.00	350.00	10.750	0.009
#7	**3**	**Time of Concentration:**					**0.100**
#7	4	3. Short grass pasture	37.50	15.00	40.00	4.890	0.002
		1. Forest with heavy ground litter	38.10	80.00	210.00	1.560	0.037

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	18.28	85.00	465.00	12.820	0.010
		9. Small streams flowing bankfull	3.67	29.00	790.00	17.240	0.012
#7	**4**	**Time of Concentration:**					**0.061**
#7	5	5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.02	0.310	0.017
#7	**5**	**Time of Concentration:**					**0.017**
#7	6	3. Short grass pasture	35.71	100.00	280.00	4.780	0.016
		8. Large gullies, diversions, and low flowing streams	38.89	70.00	180.00	18.700	0.002
#7	**6**	**Time of Concentration:**					**0.018**
#7	7	5. Nearly bare and untilled, and alluvial valley fans	1.25	1.00	80.00	1.110	0.020
		3. Short grass pasture	0.00	0.00	0.00	0.000	0.000
#7	**7**	**Time of Concentration:**					**0.007**
#8	1	3. Short grass pasture	14.29	60.00	420.00	3.020	0.038
		8. Large gullies, diversions, and low flowing streams	23.08	30.00	130.00	14.410	0.002
#8	**1**	**Time of Concentration:**					**0.040**
#8	2	1. Forest with heavy ground litter	36.76	125.00	340.00	1.530	0.061
		8. Large gullies, diversions, and low flowing streams	18.39	80.00	435.00	12.860	0.009
		9. Small streams flowing bankfull	2.30	10.00	435.00	13.640	0.008
#8	**2**	**Time of Concentration:**					**0.078**
#8	3	1. Forest with heavy ground litter	45.45	150.00	330.00	1.700	0.053
		8. Large gullies, diversions, and low flowing streams	14.84	95.00	640.00	11.550	0.015
		9. Small streams flowing bankfull	2.78	5.00	180.00	14.990	0.003
#8	**3**	**Time of Concentration:**					**0.071**
#8	4	3. Short grass pasture	25.00	15.00	60.00	4.000	0.004
#8	**4**	**Time of Concentration:**					**0.004**
#8	5	5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.02	0.310	0.017
#8	**5**	**Time of Concentration:**					**0.017**
#8	6	3. Short grass pasture	50.00	100.00	200.00	5.650	0.009
		3. Short grass pasture	30.00	60.00	200.00	4.380	0.012
#8	**6**	**Time of Concentration:**					**0.021**
#8	7	1. Forest with heavy ground litter	18.18	40.00	220.00	1.070	0.057
		3. Short grass pasture	23.53	40.00	170.00	3.880	0.012
#8	**7**	**Time of Concentration:**					**0.069**
#9	1	3. Short grass pasture	5.41	20.00	370.00	1.850	0.055
		3. Short grass pasture	60.00	60.00	100.00	6.190	0.004
		8. Large gullies, diversions, and low flowing streams	2.98	20.00	670.00	5.180	0.035
		8. Large gullies, diversions, and low flowing streams	26.85	145.00	540.00	15.540	0.009
#9	**1**	**Time of Concentration:**					**0.103**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#9	2	1. Forest with heavy ground litter	37.84	140.00	370.00	1.550	0.066
		8. Large gullies, diversions, and low flowing streams	20.00	90.00	450.00	13.410	0.009
		9. Small streams flowing bankfull	2.27	5.00	220.00	13.560	0.004
#9	**2**	**Time of Concentration:**					**0.079**
#9	3	1. Forest with heavy ground litter	44.83	130.00	290.00	1.690	0.047
		8. Large gullies, diversions, and low flowing streams	27.18	140.00	515.00	15.640	0.009
		9. Small streams flowing bankfull	2.27	5.00	220.00	13.560	0.004
#9	**3**	**Time of Concentration:**					**0.060**
#9	4	3. Short grass pasture	57.14	20.00	35.00	6.040	0.001
#9	**4**	**Time of Concentration:**					**0.001**
#9	5	5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.00	0.310	0.017
#9	**5**	**Time of Concentration:**					**0.017**
#9	6	3. Short grass pasture	35.71	50.00	140.00	4.780	0.008
#9	**6**	**Time of Concentration:**					**0.008**
#10	1	3. Short grass pasture	29.63	40.00	135.00	4.350	0.008
		3. Short grass pasture	2.68	15.00	560.00	1.300	0.119
		8. Large gullies, diversions, and low flowing streams	22.44	230.00	1,025.00	14.210	0.020
#10	**1**	**Time of Concentration:**					**0.147**
#10	2	1. Forest with heavy ground litter	58.62	170.00	290.00	1.930	0.041
		8. Large gullies, diversions, and low flowing streams	7.64	55.00	720.00	8.290	0.024
		9. Small streams flowing bankfull	2.01	20.00	995.00	12.750	0.021
#10	**2**	**Time of Concentration:**					**0.086**
#10	3	1. Forest with heavy ground litter	46.00	230.00	500.00	1.710	0.081
		9. Small streams flowing bankfull	40.74	55.00	135.00	57.440	0.000
		9. Small streams flowing bankfull	2.04	19.00	930.00	12.860	0.020
#10	**3**	**Time of Concentration:**					**0.101**
#10	4	3. Short grass pasture	50.00	80.00	160.00	5.650	0.007
#10	**4**	**Time of Concentration:**					**0.007**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	14.43	140.00	970.00	11.390	0.023
		8. Large gullies, diversions, and low flowing streams	10.00	5.00	50.00	9.480	0.001
#1	**1**	**Muskingum K:**					**0.024**
#1	2	8. Large gullies, diversions, and low flowing streams	10.00	5.00	50.00	9.480	0.001
#1	**2**	**Muskingum K:**					**0.001**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	8. Large gullies, diversions, and low flowing streams	21.28	100.00	470.00	13.830	0.009
		9. Small streams flowing bankfull	3.73	25.00	670.00	17.380	0.010
#2	**1**	**Muskingum K:**					**0.019**
#2	2	9. Small streams flowing bankfull	3.73	25.00	670.00	17.380	0.010
#2	**2**	**Muskingum K:**					**0.010**
#2	3	9. Small streams flowing bankfull	3.73	25.00	670.00	17.380	0.010
#2	**3**	**Muskingum K:**					**0.010**
#2	4	1. Forest with heavy ground litter	30.00	60.00	200.00	1.380	0.040
		9. Small streams flowing bankfull	5.10	50.00	980.00	20.320	0.013
#2	**4**	**Muskingum K:**					**0.053**
#3	1	8. Large gullies, diversions, and low flowing streams	13.79	120.00	870.00	11.140	0.021
#3	**1**	**Muskingum K:**					**0.021**
#4	1	8. Large gullies, diversions, and low flowing streams	7.76	45.00	580.00	8.350	0.019
		9. Small streams flowing bankfull	4.17	10.00	240.00	18.370	0.003
#4	**1**	**Muskingum K:**					**0.022**
#4	3	9. Small streams flowing bankfull	4.17	10.00	240.00	18.370	0.003
#4	**3**	**Muskingum K:**					**0.003**
#5	1	9. Small streams flowing bankfull	2.00	1.00	50.00	12.720	0.001
#5	**1**	**Muskingum K:**					**0.001**
#5	2	8. Large gullies, diversions, and low flowing streams	5.00	80.00	1,600.00	6.700	0.066
		9. Small streams flowing bankfull	2.00	1.00	50.00	12.720	0.001
#5	**2**	**Muskingum K:**					**0.067**
#5	3	3. Short grass pasture	66.67	110.00	165.00	6.530	0.007
		8. Large gullies, diversions, and low flowing streams	13.92	60.00	431.00	11.190	0.010
		8. Large gullies, diversions, and low flowing streams	13.33	70.00	525.00	10.950	0.013
		8. Large gullies, diversions, and low flowing streams	4.38	70.00	1,600.00	6.270	0.070
		9. Small streams flowing bankfull	2.00	1.00	50.00	12.720	0.001
#5	**3**	**Muskingum K:**					**0.101**
#6	1	8. Large gullies, diversions, and low flowing streams	23.08	60.00	260.00	14.410	0.005
		8. Large gullies, diversions, and low flowing streams	15.91	70.00	440.00	11.960	0.010
		9. Small streams flowing bankfull	2.00	10.00	500.00	12.720	0.010
#6	**1**	**Muskingum K:**					**0.025**
#6	4	8. Large gullies, diversions, and low flowing streams	21.88	70.00	320.00	14.030	0.006
		8. Large gullies, diversions, and low flowing streams	11.36	50.00	440.00	10.110	0.012
		9. Small streams flowing bankfull	2.25	9.00	400.00	13.500	0.008
#6	**4**	**Muskingum K:**					**0.026**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#6	5	8. Large gullies, diversions, and low flowing streams	42.11	80.00	190.00	19.460	0.002
		8. Large gullies, diversions, and low flowing streams	10.27	75.00	730.00	9.610	0.021
		9. Small streams flowing bankfull	2.25	9.00	399.99	13.500	0.008
#6	**5**	**Muskingum K:**					**0.031**
#6	6	3. Short grass pasture	60.00	120.00	200.00	6.190	0.008
		8. Large gullies, diversions, and low flowing streams	5.13	10.00	195.00	6.790	0.007
		8. Large gullies, diversions, and low flowing streams	33.33	40.00	120.00	17.320	0.001
		8. Large gullies, diversions, and low flowing streams	42.11	80.00	190.00	19.460	0.002
		8. Large gullies, diversions, and low flowing streams	10.27	75.00	730.00	9.610	0.021
		9. Small streams flowing bankfull	2.25	9.00	400.00	13.500	0.008
#6	**6**	**Muskingum K:**					**0.047**
#7	1	8. Large gullies, diversions, and low flowing streams	6.90	40.00	580.00	7.870	0.020
		9. Small streams flowing bankfull	1.43	5.00	350.00	10.750	0.009
#7	**1**	**Muskingum K:**					**0.029**
#7	5	3. Short grass pasture	37.50	15.00	40.00	4.890	0.002
		1. Forest with heavy ground litter	38.10	80.00	210.00	1.560	0.037
		8. Large gullies, diversions, and low flowing streams	18.28	85.00	465.00	12.820	0.010
		9. Small streams flowing bankfull	3.67	29.00	790.01	17.240	0.012
#7	**5**	**Muskingum K:**					**0.061**
#7	6	8. Large gullies, diversions, and low flowing streams	21.43	165.00	770.00	13.880	0.015
		9. Small streams flowing bankfull	3.67	29.00	790.01	17.240	0.012
#7	**6**	**Muskingum K:**					**0.027**
#7	7	3. Short grass pasture	36.36	40.00	110.00	4.820	0.006
		9. Small streams flowing bankfull	24.44	165.00	675.00	44.490	0.004
		9. Small streams flowing bankfull	3.67	29.00	790.00	17.240	0.012
#7	**7**	**Muskingum K:**					**0.067**
#8	1	8. Large gullies, diversions, and low flowing streams	15.56	140.00	900.00	11.830	0.021
		9. Small streams flowing bankfull	2.30	10.00	435.00	13.640	0.008
#8	**1**	**Muskingum K:**					**0.029**
#8	4	1. Forest with heavy ground litter	45.45	150.00	330.00	1.700	0.053
		9. Small streams flowing bankfull	14.84	95.00	640.00	34.670	0.005
		9. Small streams flowing bankfull	2.78	5.00	180.00	14.990	0.003
#8	**4**	**Muskingum K:**					**0.061**
#8	5	3. Short grass pasture	25.00	15.00	60.00	4.000	0.004
		1. Forest with heavy ground litter	45.45	150.00	330.00	1.700	0.053
		8. Large gullies, diversions, and low flowing streams	14.84	95.00	640.00	11.550	0.015
		9. Small streams flowing bankfull	2.78	5.00	180.00	14.990	0.003

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#8	**5**	**Muskingum K:**					**0.075**
#8	6	8. Large gullies, diversions, and low flowing streams	22.82	235.00	1,030.00	14.320	0.019
		9. Small streams flowing bankfull	2.78	5.00	180.00	14.990	0.003
#8	**6**	**Muskingum K:**					**0.022**
#8	7	8. Large gullies, diversions, and low flowing streams	22.57	255.00	1,130.00	14.250	0.022
		9. Small streams flowing bankfull	2.78	5.00	180.00	14.990	0.003
#8	**7**	**Muskingum K:**					**0.025**
#9	1	8. Large gullies, diversions, and low flowing streams	15.91	140.00	880.00	11.960	0.020
		9. Small streams flowing bankfull	2.27	5.00	220.00	13.560	0.004
#9	**1**	**Muskingum K:**					**0.024**
#9	4	1. Forest with heavy ground litter	44.83	130.00	290.00	1.690	0.047
		8. Large gullies, diversions, and low flowing streams	27.18	140.00	515.00	15.640	0.009
		9. Small streams flowing bankfull	2.27	5.00	220.00	13.560	0.004
#9	**4**	**Muskingum K:**					**0.060**
#9	5	3. Short grass pasture	57.14	20.00	35.00	6.040	0.001
		1. Forest with heavy ground litter	44.83	130.00	290.00	1.690	0.047
		8. Large gullies, diversions, and low flowing streams	27.18	140.00	515.00	15.640	0.009
		9. Small streams flowing bankfull	2.27	5.00	220.00	13.560	0.004
#9	**5**	**Muskingum K:**					**0.061**
#9	6	5. Nearly bare and untilled, and alluvial valley fans	0.10	0.02	20.00	0.310	0.017
		3. Short grass pasture	57.14	20.00	35.00	6.040	0.001
		1. Forest with heavy ground litter	44.83	130.00	290.00	1.690	0.047
		8. Large gullies, diversions, and low flowing streams	27.18	140.00	515.00	15.640	0.009
		9. Small streams flowing bankfull	2.27	5.00	220.00	13.560	0.004
#9	**6**	**Muskingum K:**					**0.078**
#10	1	8. Large gullies, diversions, and low flowing streams	7.64	55.00	720.00	8.290	0.024
		9. Small streams flowing bankfull	2.01	20.00	995.00	12.750	0.021
#10	**1**	**Muskingum K:**					**0.045**
#10	4	1. Forest with heavy ground litter	46.00	230.00	500.00	1.710	0.081
		8. Large gullies, diversions, and low flowing streams	40.74	55.00	135.00	19.140	0.001
		8. Large gullies, diversions, and low flowing streams	2.04	19.00	930.00	4.280	0.060
#10	**4**	**Muskingum K:**					**0.142**

APPENDIX E

Fill Placement Optimization Process

(FPOP)

ICG Hazard, LLC
KDNR Permit No. 897-0587
USACE ID No. LRL-2010-490

Summary of Key FPOP Minimization Values	
FPOP Excess Spoil Volume	26,951,075 yd^3
FPOP Backfill Volume	35,991,182
FPOP Total Swelled Overburden (minus coal volume)	62,942,257 yd^3
Maximum Stream Impact	5,204 linear ft
Optimized EIU Impact	2,364
SMCRA Stream Impact	2,303 linear ft
SMCRA EIU Impact	1,267
Target Fill Volume	29,596,752 yd^3
Existing Fills	None
Fills Considered for Optimization	A, B, C, F, H
Fills to be Approved	Hollow Fill 1 (same as Hollow A in FPOP)
Final Fill Design against Maximum Stream Length	2,303/5,204 = 0.4
Stream Length Reduction	2,901 linear ft
EIU Reduction	1,097

	SMCRA Design	**FPOP Design**	**Final Design**
Accumulated Overburden (with coal volume)	54,928,989 yd^3	54,928,989 yd^3	54,928,989 yd^3
Overburden (minus coal volume)	50,354,456 yd^3	50,354,456 yd^3	50,354,456 yd^3
Swell Volume	12,588,452 yd^3	12,588,452 yd^3	12,588,452 yd^3
Total Swelled Overburden Volume (Total Material)	62,942,257 yd^3	62,942,257 yd^3	62,942,257 yd^3
Total Backfill Volume	49,947,035 yd^3	35,991,182 yd^3	49,947,035 yd^3
Excess Spoil Volume	12,995,222 yd^3	26,951,075 yd^3	12,995,222 yd^3
Total Stream Impact	2,303 linear ft	5,204 linear ft	2,303 linear ft
Total EIU Impact	1,267	2,364	1,267

ICG HAZARD, LLC
KDNR PERMIT NO. 897-0587
USACE ID NO. LRL-2010-490

FILL PLACEMENT OPTIMIZATION PROCESS

August 2014

ICG Hazard, LLC (ICG) is proposing to develop a new surface mining operation in Perry County, Kentucky, near Dunraven. The new surface mining project is under KDNR Permit No. 897-0587. This project proposes area mining of the Hazard 7, Hazard 8, and Hazard 9 coal reserves situated along Roseanne Branch, Clear Fork, and unnamed tributaries of Grapevine Creek, as well as Abes Branch and unnamed tributaries of Sam Campbell Branch. The project proposed contour mining of the Hazard 5A coal reserves along unnamed tributaries of Sam Campbell Branch; however, the 5A seam (the lowest seam), will only be mined in a few areas where practicable and not in the entire proposed area. The entire project area is bound to the north by Grapevine Creek, to the west by Clear Fork and Abes Branch, to the east by an unnamed tributary of Grapevine Creek, and to the south by Sam Campbell Branch. Grapevine Creek and Sam Campbell Branch are tributaries of the North Fork of the Kentucky River.

The federal action being considered is the issuance of a Clean Water Act Section 404 Nationwide Permit 49 by the U.S. Army Corps of Engineers (COE) to authorize the placement of one hollow fill resulting from on-site excavation and a sediment control pond within the waters of the United States. Impacts to waters of the United States include Hollow Fill 1, Pond 1, drainage corridor, pond maintenance area, and one mine-through impact area.

On December 16, 2009, the Kentucky Energy and Environmental Cabinet's Department for Natural Resources issued Reclamation Advisory Memorandum (RAM) #145, which provides guidelines for the Fill Placement Optimization Process. This process is intended to provide an objective process for achieving Approximate Original Contour (AOC) while also minimizing the amount of excess overburden placed in storage sites, such as hollow fills.

This document details the Fill Placement Optimization Process as it was applied to the proposed project. Details of each step in the process are provided.

Step 1 – Determination of Overburden / Interburden Quantity

The boundaries of the Hazard 5A, Hazard 7, Hazard 8, and Hazard 9 coal seams can be seen on the attached Mining Methods and Extent map. The lowest coal seam to be mined varies throughout the project area, with the Hazard 5A coal seam the lowest seam in the southern portion, and the Hazard 7 or 8 coal seam the lowest throughout the rest of the project. The primary method of coal recovery throughout the project is area mining of the Hazard 7, Hazard 8, and Hazard 9 coal seams, with contour mining also proposed in the Hazard 5A seam in some areas. As previously mentioned, this

5A seam will only be mined a portion of the proposed contour mining area where practicable. See the attached Plan View and Cross-sections for details. See Tables 1 and 2 for overburden and coal volumes, respectively.

Table 1. Overburden Volumes

	Volume of Overburden (yd^3)
Total	54,928,989

Table 2. Coal Volume

Seam	**Volume of Coal (yd^3)**
Coal Volume of Hazard 5A, Hazard 7, Hazard 8, And Hazard 9 seams	4,575,183
Total	4,575,183

Step 2 – Determination of Anticipated Swell Factor

A swell factor of 25% was used for the proposed project. The calculation for total swelled overburden volume can be seen below. See the attached Overburden Balance for details.

$$\textit{Total Excavation Volume} - \textit{Coal Volume} = \textit{Overburden Volume}$$

$$\textit{Overburden Volume} \times 25\% = \textit{Swell Volume}$$

$$\textit{Overburden Volume} + \textit{Swell Volume} = \textit{Total Swelled Overburden Volume}$$

Total Swelled Overburden Volume = 62,942,257 yd^3

Step 3 – Initial Backfill

The following conditions have been set in the determination of the initial backfill:

- Total setbacks from the outcrop of the lowest seam range from 55.4 - 64.7 feet to allow for drainage, natural berms, and access roads.
- All berms are offset by 15 feet from the lowest seam to be mined in each area.
- All perimeter access roads have a width of 20 feet.
- Drainage control design has been determined as prescribed in RAM #145, resulting in a width ranging from 20.4 to 29.7 feet for all structures for drainage control. This, added to the 35-foot setback for berms and perimeter access roads, means that the overall offset width will range from 55.4 - 64.7 feet.

- Because the Hazard 5A seam will only be mined in some practicable areas and not the entire proposed contour mining area, offsets for drainage, berms, and access roads were taken from the Hazard 7 seams. The area between the Hazard 5A and 7 seam was taken back to AOC.

- Backfill calculations and cross-sections use a 2.4H:1V slope configuration on all areas for which reclamation of the highwall was feasible. On contour areas, steeper slopes were used in order to reclaim the highwall.

- Backfill elevations do not exceed pre-mining elevations along the pre-mining watershed boundary within each watershed.

- For all contour or point removal areas, the backfill eliminates all highwall.

The backfill volume has been calculated to be 35,991,182 yd^3. See the attached Backfill Plan for plan view and cross-sections of the proposed backfill configuration.

Step 4 – Determination of Excess Spoil Volume

The calculation for excess overburden volume can be seen below.

Total Swelled Overburden Volume – Backfill Volume = Excess Overburden Volume

62,942,257 yd^3 – 35,991,182 yd^3 = 26,951,075 yd^3

Excess Overburden Volume = 26,951,075 yd^3

Step 5 – Excess Spoil Disposal Locations

Potential excess overburden disposal locations that were contiguous with the mining area were identified. See the attached Excess Overburden Disposal Locations map for details of potential locations and factors that limit fill placement. The following site-specific criteria were used to assess the potential for overburden placement, and to determine the maximum downstream toe location for each potential fill:

Ability to construct a stable fill
Sufficient acreage for sediment and drainage control below a fill
Surface rights, including avoidance of residences and cemetery displacement
Gas well and gas line placement

The following disposal locations were analyzed:

Hollow A, an Unnamed Tributary of Sam Campbell Branch, is an acceptable excess overburden storage location. A stable fill could be constructed in this location, with sufficient acreage for sediment and drainage control below the fill.

Hollow B, an Unnamed Tributary of Clear Fork, is an acceptable excess overburden storage location. A stable fill could be constructed in this location, with sufficient acreage for sediment and drainage control below the fill.

Hollow C, an Unnamed Tributary of Clear Fork, is an acceptable excess overburden storage location. A stable fill could be constructed in this location, with sufficient acreage for sediment and drainage control below the fill.

Hollow D, an Unnamed Tributary of Clear Fork, is not an acceptable excess overburden storage location. While a stable fill could be constructed in this location, it would not allow sufficient acreage for sediment and drainage control below the fill.

Hollow E, an Unnamed Tributary of Clear Fork, is not an acceptable excess overburden storage location. The displacement of existing residences would be required, and, therefore, this hollow was not considered.

Hollow F, an Unnamed Tributary of Grapevine Creek, is an acceptable excess overburden storage location. A stable fill could be constructed in this location, with sufficient acreage for sediment and drainage control below the fill.

Hollow G, Roseanne Branch, is not an acceptable excess overburden storage location. The displacement of existing residences would be required, and, therefore, this hollow was not considered.

Hollow H, Sugar Camp Branch, is an acceptable excess overburden storage location. A stable fill could be constructed in this location, with sufficient acreage for sediment and drainage control below the fill.

Hollow I, an Unnamed Tributary of Sam Campbell Branch, is not an acceptable excess overburden storage location. An existing haul road with access to the scale house area and adjacent permit 897-0543 is located within the hollow, and, therefore, it was not considered.

Hollow J, an Unnamed Tributary of Sam Campbell Branch, is not an acceptable excess overburden storage location. An existing haul road with access to the scale house area and adjacent permit 897-0543 is located within the hollow, and, therefore, it was not considered.

Step 6 – Valley Fill Volumetrics – Non-optimized (Trial 1)

See the attached 'Valley Fill Volumetrics Trial 1 – Non-Optimized' maps for details of each potential fill, along with the jurisdictional stream reaches included within the footprint of each fill. The initial fill segment is located directly upstream of the 'maximum upstream toe location.' The toe of each of the remaining fill segments is located 200 feet downstream of the previous toe location. The volume

of each fill segment can be found on the corresponding Valley Fill Volumetrics map and on the attached Valley Fill Volumetrics tables, which also include the stream length impacted by each segment and the volume of overburden per linear foot of stream impact.

A volume matrix was developed using the overburden volume per impacted stream foot, and hollow fill segments were chosen based on the highest ratio of overburden volume per stream foot, with those segments that had no jurisdictional streams within the footprint of the fill (noted as NJS) chosen first. Segments were intended to be chosen until the potential hollow fill volume exceeded the Excess Overburden Volume calculated in Step 4 (26,951,075 yd^3). However, this was not possible, as the potential hollow fill volume (18,076,296 yd^3) did not exceed the Excess Overburden Volume, resulting in the use of all potential hollow fill segments. The volume matrix can be found in the following table.

Table 3. Valley Fill Volumetrics – Trial 1 (Non-optimized) – Volume Matrix

Hollow A	Hollow B	Hollow C	Hollow F	Hollow H
NJD	1,027	6,131	792	690
NJD	803	1,502	1,032	936
NJD	1,990		1,428	1,166
1,266	2,310		853	1,342
2,098	1,837			1,917
2,183	2,145			1,746
2,184	2,298			1,494
2,992				1,857
3,057				
3,084				
3,046				
2,760				
3,374				
3,608				
1,938				
7,751				
7,468				

NJD – indicates that no jurisdictional streams were located within the footprint of the potential fill slice.

After slices were chosen, the corresponding stream impact and EIU loss were determined. The attached tables illustrate the storage volume in each potential hollow fill, the total SMCRA Stream Impact, and SMCRA EIU Impact. Trial 1 (non-optimized) would result in the use of all of the potential hollow fills identified, which would impact 8,154 linear feet of jurisdictional stream and cause a loss of 2,958 EIUs. However, the use of all of the potential hollow fills would not be sufficient to contain the Excess Overburden calculated in Step 4 (26,951,075 yd^3). A summary can be found in the table below.

Table 4. Valley Fill Volumetrics – Trial 1 (Non-optimized) – Summary

Hollow	Overburden Volume Contained (cubic yards)	Stream Impact (linear feet)	EIU Impact (EIUs)
A	11,240,373	3,565	1,960.8
B	2,920,931	1,580	742.6
C	515,196	229	36.6
F	1,160,390	1,180	944.0
H	2,239,406	1,600	480.0
I	377,753	1,078	636.0
Total	18,076,296	8,154	4,164

Step 7 – Identification of Off-site Disposal Options

Potential excess overburden storage sites within one-half mile of the project area were reviewed for their suitability as off-site excess overburden storage locations. Sites already analyzed in Step 5 were not included this this analysis. The following site-specific criteria were used to assess potential hollows:

Ability to construct a stable fill
Sufficient acreage for sediment and drainage control below a fill
Surface rights, including avoidance of residences and cemetery displacement
Gas well and gas line placement
No filling of sites needed for other infrastructure
Feasible Hauling distance

See the attached Off-site Disposal Locations Map to see site locations. The following sites were analyzed for potential off-site disposal:

Sites A, an unnamed tributary of Abes Branch, and B, Abes Branch, are located within one-half mile of the project area and a stable fill could be constructed in each of these sites; however, surface rights issues and a road that runs along Abes Branch prevent these sites from being considered as potential off-site disposal locations.

Site C, in the head of Clear Fork, is located within one-half mile of the project area and a stable fill could be constructed in the site; however, Clear Fork Road runs through this hollow. Therefore, this site is eliminated as a potential off-site disposal location.

Sites D, E, and F, unnamed tributaries of Clear Fork, are all within one-half mile of the project area and a stable fill could be constructed in these sites; however, ICG does not control surface rights in these locations. Residences are located within the sites that would have to be relocated if these hollows were used for off-site disposal. Therefore, these sites were eliminated as potential off-site disposal locations.

Site G, an unnamed tributary of Grapevine Creek, is located within one-half mile of the project area and a stable fill could be constructed in this location; however, ICG does not control the surface rights in this area and residences would have to be relocated. This site was, therefore, eliminated as a potential off-site disposal location.

Site H, an unnamed tributary of Sam Campbell Branch, is located within one-half mile of the project area and a stable fill could be constructed in this site; however, an existing haul road used in this permit and ICG KDNR Permit No. 897-0543 is located within this hollow and eliminates the site from being considered as a potential off-site disposal location.

Sites I, in the head of Sam Campbell Branch, and J, an unnamed tributary of Sam Campbell Branch, are located within one-half mile of the project area and a stable fill could be constructed in these sites; however, this site is currently utilized by ICG KDNR Permit No. 897-0543 for spoil storage and was, therefore, eliminated as a potential off-site disposal location.

Site K, an unnamed tributary of Grapevine Creek, is located within one-half mile of the project area and a stable fill could be constructed in this location; however, because of how the coal reserves lay within the project area, access to the property, quality of coal throughout the property, and the ratio of the total cubic yards of overburden to the total recoverable tons of coal, ICG must begin mining in the southwestern end of the project. Hauling spoil to the northeast area of the project is not feasible and would require hauling on public roads. This site was, therefore, eliminated as a potential off-site disposal location.

None of the off-site disposal locations were deemed as feasible options. Thus, the Excess Overburden Volume will remain the same. Excess overburden volume is calculated as follows:

Excess Overburden Volume – (Off-site Disposal Volume x (Excess Overburden Volume/Total Swelled Overburden Volume)) = New Excess Overburden Volume

$$26{,}951{,}075\ yd^3 - (0\ yd^3 \times (26{,}951{,}075\ yd^3/62{,}942{,}257\ yd^3)) = 26{,}951{,}075\ yd^3$$

New Excess Overburden Volume = 26,951,075 yd^3

Step 8 – Adjusted Fill Deck Elevation

For each watershed in which a potential fill was located, the adjusted fill deck elevation was calculated depending on the predominant mining method, area or contour, within that location. For all locations considered on this project, the predominant method was area mining and, therefore, the adjusted fill deck elevation was calculated as follows.

The average difference in elevation from the highwall or ridgeline (dependent upon the method of coal recovery) to the lowest coal seam to be mined was calculated. The attached exhibits include profile views of each potential fill location, as well as a plan view of the watershed and tables containing the details of the adjusted fill deck elevation calculation. The equation for calculation of the adjusted fill deck elevation is included below, in addition to an example from Hollow A of the proposed project.

Adjusted Fill Deck Elevation = ((Average Ridgeline Elevation – Average Elevation of the Lowest Coal Seam) x 0.25) + Average Elevation of the Lowest Coal Seam

Adjusted Fill Deck Elevation (Hollow A) = ((1410 ft – 1254 ft) x 0.25) + 1254 ft)

Adjusted Fill Deck Elevation (Hollow A) = 1293 ft

See the table below for a summary of initial fill deck elevations and adjusted fill deck elevations for each potential hollow fill.

Table 5. Fill Deck Elevation

Site	Adjusted Fill Deck Elevation (ft)
A	1293
B	1285
C	1275
F	1277
H	1279

Step 9 – Valley Fill Volumetrics – Optimized (Trial 2)

See the attached 'Valley Fill Volumetrics Trial 2 – Optimized' maps for details of each potential fill, along with the jurisdictional stream reaches included within the footprint of each fill. The initial fill segment is located directly upstream of the 'maximum upstream toe location.' The toe of each of the remaining fill segments is located 200 feet downstream of the previous toe location. The Adjusted Fill Deck Elevation has been used in the design of each fill. In addition, the toe of the adjacent backfill has been moved to a location vertically above the outcrop of the lowest seam to be mined when possible.

The volume of each fill segment can be found on the corresponding Valley Fill Volumetrics map and on the attached Valley Fill Volumetrics tables, which also include the stream length impacted by each segment and the volume of overburden per linear foot of stream impact. A volume matrix was developed using the overburden volume per impacted stream foot.

Step 10 – Valley Fill Selection

Hollow fill segments were chosen based on the highest ratio of overburden volume per stream foot, with those segments that had no jurisdictional streams within the footprint of the fill (noted as NJD) chosen first. Segments were supposed to be chosen until the potential hollow fill volume exceeded the Adjusted Excess Overburden Volume calculated in Step 7 (26,951,075 yd^3). The volume matrix can be found in the following table.

Table 6. Valley Fill Volumetrics – Trial 2 (Optimized) – Volume Matrix

Hollow A	Hollow B	Hollow C	Hollow F	Hollow H
NJD	5,733	10,967	1,939	2,730
NJD	1,818	2,350	2,237	4,332
NJD	4,901		1,446	4,134
2,276	7,124		347	2,839
5,730	3,970			3,268
4,849	4,527			3,867
4,365	4,424			2,826
5,259				3,251
6,916				
13,955				
8,432				
5,659				
6,126				
7,053				
4,772				
12,374				
10,831				

NJD – indicates that no jurisdictional streams were located within the footprint of the potential fill slice.

After slices were chosen, the corresponding stream impact and EIU loss were determined. The attached tables illustrate the storage volume in each potential hollow fill required to contain the Adjusted Excess Overburden calculated in Step 7 (26,951,075 yd^3), the Maximum Stream Impact, and the Optimized EIU Impact.

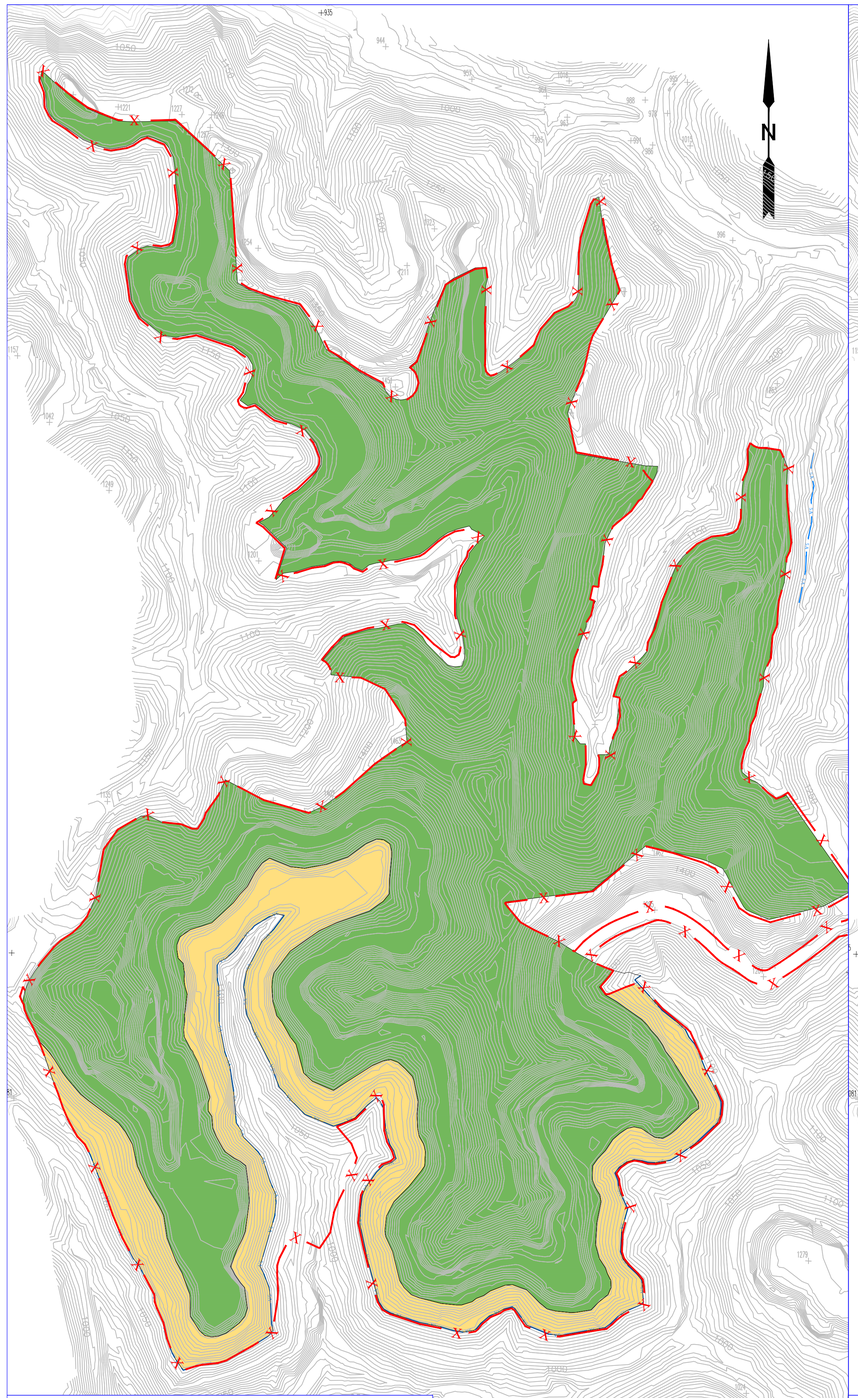
Table 7. Valley Fill Volumetrics – Trial 2 (Optimized) – Summary

Hollow	Overburden Volume Contained (cubic yards)	Stream Impact (linear feet)	EIU Impact (EIUs)
A	22,658,372	3,263	1794.7
B	642,125	112	52.6
C	857,066	229	36.6
F	0	0	0.0
H	5,439,189	1,600	480.0
Total	29,596,752	5,204	2,364

Step 11 – Mine Design

The RAM 145 process for the proposed project allows the construction of hollow fills to impact 5,204 linear feet of stream and to cause the loss of 2,364 EIUs. ICG's proposed mine plan, impacts 2,303 linear feet of stream and results in the loss of 1,267 EIU's. Therefore, ICG's proposed mine plan complies with the requirements of RAM 145.

STEP 1 ATTACHMENTS



HAZARD 5A SEAM

SCALE: 1" = 500'

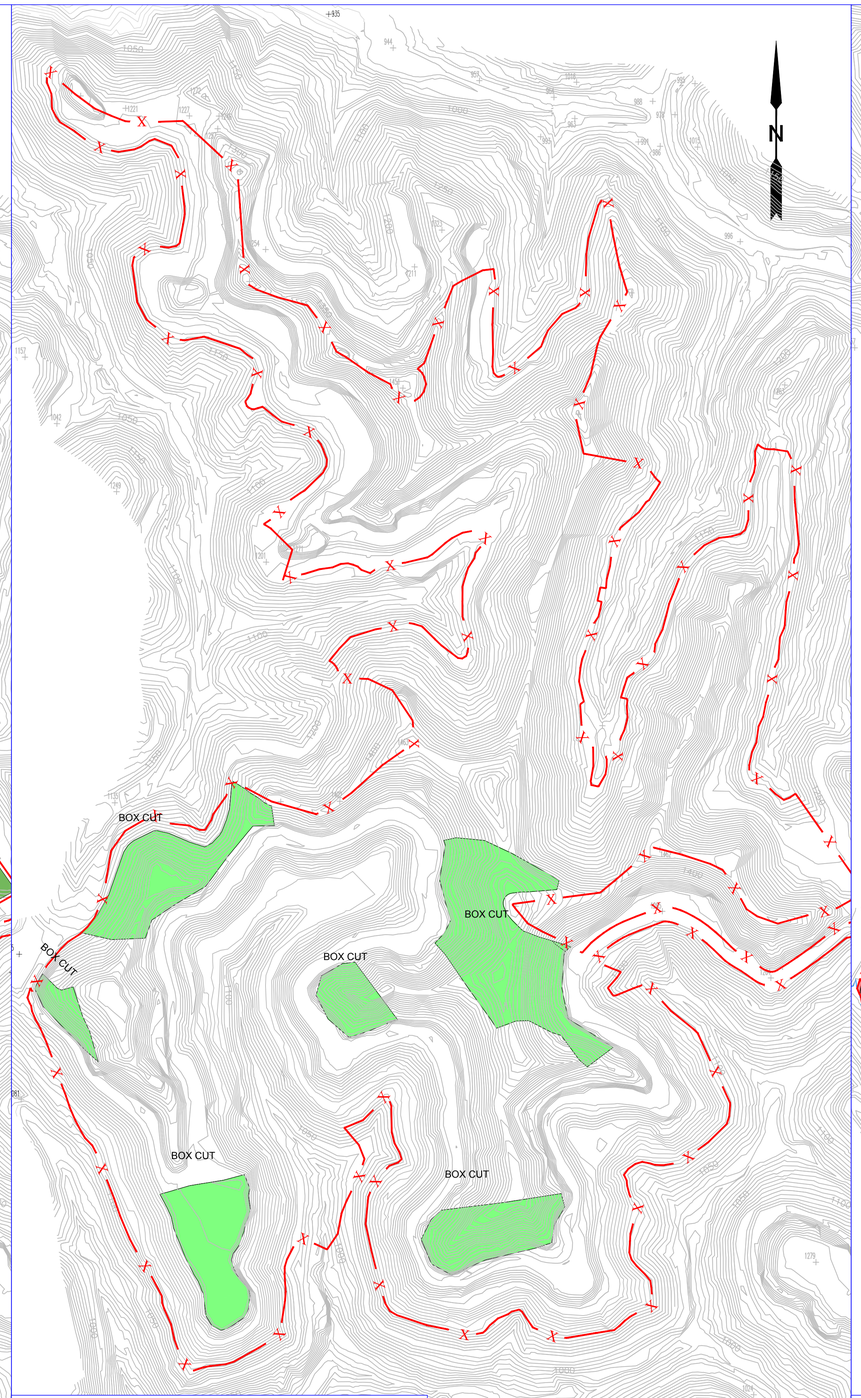
Scale in Feet

0 500 1000 1500

PROPOSED CONTOUR MINING

PROPOSED HIGHWALL MINING

PERMIT BOUNDARY



HAZARD 7 SEAM

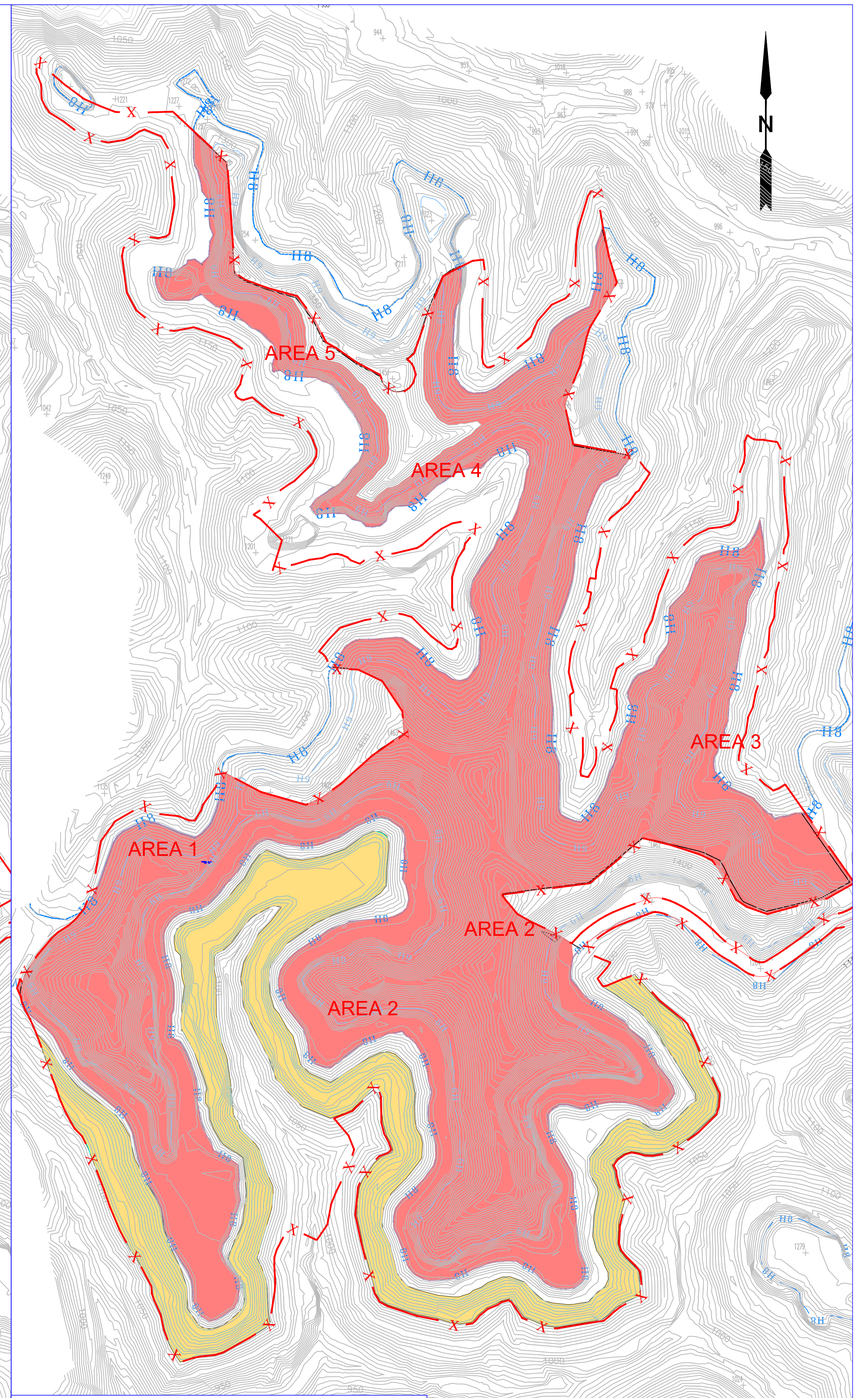
SCALE: 1" = 500'

Scale in Feet

0 500 1000 1500

PROPOSED BOX CUTS

PERMIT BOUNDARY



HAZARD 8 SEAM AND ABOVE

SCALE: 1" = 500'

Scale in Feet

0 500 1000 1500

8 SEAM AND ABOVE AREA MINING

PERMIT BOUNDARY

ICG

ICG HAZARD, LLC

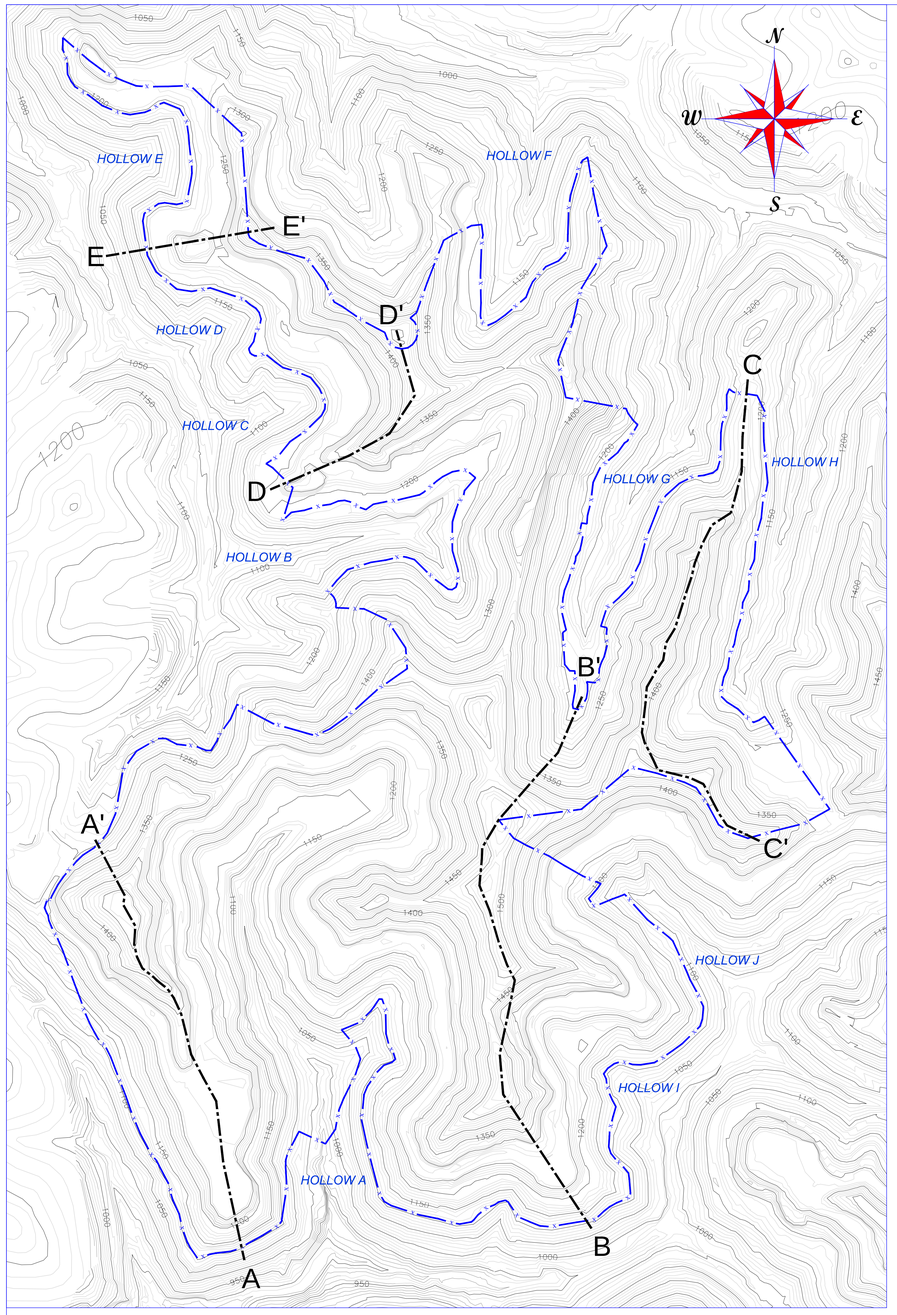
MINE SEAM DETAILS

PERMIT NO. 897-0587

SCALE: 1"=500'	DRAWN BY: S.SAYRE	CHK BY: C.DALE	APPRVD. BY: C.DALE
PLOT DATE: 08 AUGUST 2014 - 5:50 PM	F.E. NAME: Z:\ICG\897-0587 (previously 897-0507)\PROP\PROP-ICG-897-0587-AUGUST 2014\ICG-0587-MINING SEAM DETAILS.dwg		

SUMMIT ENGINEERING, INC.

Pikeville, Ky
Lexington, Ky
Henderson, Ky
Bridgeport, Wv
South Charleston, Wv



EXISTING CONFIGURATION

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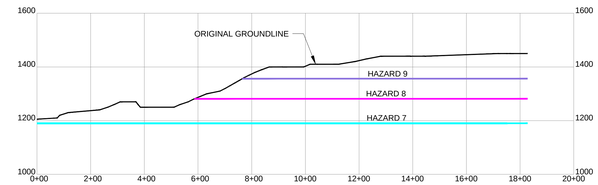

SECTION D-D'

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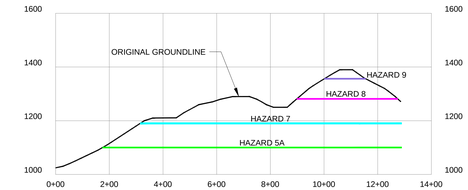

SECTION E-E'

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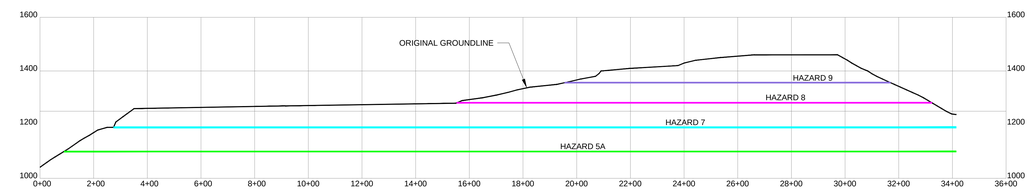

SECTION A-A'

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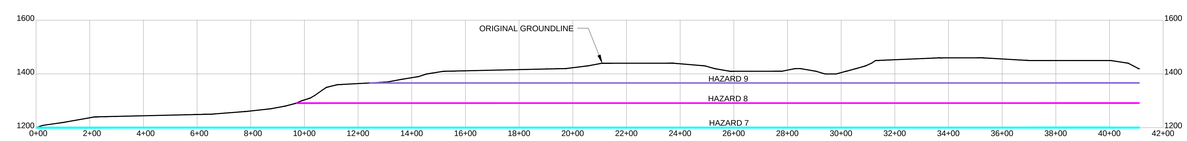
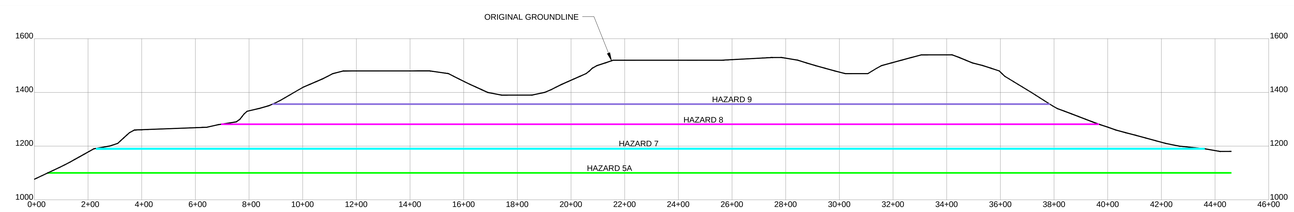


SECTION C-C'

SCALE: 1" = 200'



SECTION B-B'

SCALE: 1" = 200'

DRAWN BY: D.HANNAH	**ICG HAZARD, LLC** 3228 SUMMIT SQUARE, SUITE 180 LEXINGTON, KY. 40509	SUMMIT ENGINEERING,INC. 131 Summit Drive, Prestonsburg, Ky. 41653 (606) 439-1449	SCALE: NOTED
CHECKED BY: A.CHILDERS			DATE: 08/08/14
APPROVED BY: A.CHILDERS	**ORIGINAL PLAN VIEW AND SECTIONS** SAM CAMPBELL BRANCH PERMIT NO. 897-0587	Lexington,Ky • Hazard,Ky • Big Rock,Va Charleston,Wv • Chapmanville,Wv Bridgeport, Wv • Wise, Va	ATTACHMENT:
PER. NO: 897-0587			SHEET:
Plot Date: 08 AUGUST 2014 – 5:20 PM			OF:

Z:\ICG\897-0587 (previously 897-0507)\FPOP\FPOP-ICG-897-0587-AUGUST 2014\ORIGINAL PLAN-SECTIONS.dwg

STEP 2 ATTACHMENTS

ICG Hazard, LLC							
PERMIT NO. 897-0587							
ORIGINAL SURFACE MINE PLAN - OVERBURDEN BALANCE - SMCRA PERMIT BALANCE							
AREA	Bank Cubic Yards			Swell Volume	Total Excavation	Backfill Volume	Excess Spoil
	Accumulated Overburden	Minus Coal Removal	Overburden Excavated	Cubic Yards	Cubic Yards	Cubic Yards	Cubic Yards
TOTAL AREA	54,928,989	4,575,183	50,354,456	12,588,452	62,942,257	49,947,035	12,995,222
Total	54,928,989	4,575,183	50,354,456	12,588,452	62,942,257	49,947,035	12,995,222

ICG Hazard, LLC							
PERMIT NO. 897-0587							
MINIMIZED SURFACE MINE PLAN - OVERBURDEN BALANCE - RAM #145 BACKFILL							
AREA	Bank Cubic Yards			Swell Volume	Total Excavation	Backfill Volume	Excess Spoil
	Accumulated Overburden	Minus Coal Removal	Overburden Excavated	Cubic Yards	Cubic Yards	Cubic Yards	Cubic Yards
TOTAL AREA	54,928,989	4,575,183	50,354,456	12,588,452	62,942,257	35,991,182	26,951,075
Total	54,928,989	4,575,183	50,354,456	12,588,452	62,942,257	35,991,182	26,951,075

STEP 3 ATTACHMENTS

WV SEDIMENT CHANNEL DESIGN

ICG HAZARD, LLC

Application # 897-0587

CHANNEL NUMBER Hollow A

PERRY COUNTY

10 YR / 24 HR.	3.92 INCHES	188.83 CFS
STORM EVENT	RAINFALL AMOUNT	FLOW

SPILLWAY DESIGN:

FLOW DEPTH:	0.5	FT.	TOP WIDTH @ FLOW DEPTH:	175.0	FT.
FREEBOARD:	0	FT.	BOT. WIDTH:	173.0	FT.
TOTAL DEPTH:	0.5	FT.	TOP WIDTH @ FREEBOARD DEPTH	175.0	FT.

STORAGE DESIGN:

ACRES DISTURBED:	96.34	AC.	AC / FT REQUIRED:	12.04	AC / FT

TYPICAL SEDIMENT CELL DIMENSION AT SEDIMENT POOL LEVEL

LINEAL FEET OF STRUCTURE AVAILABLE	DEPTH AT SED. LEVEL	POND WIDTH AT BOTTOM	POND WIDTH AT SEDIMENT LEVEL	SIDE SLOPES	CROSS-SECTIONAL AREA AT SED. LEVEL
(FT.)	(FT.)	(FT.)	(FT.)	(H : 1 V)	(SQ. FT.)
9850	2.5	16.3	26.3	2.00	53.26

TYPICAL SEDIMENT CELL DIMENSION AT TOP WITH FREEBOARD

LINEAL FEET OF STRUCTURE AVAILABLE	DEPTH AT TOP	POND WIDTH AT BOTTOM	POND WIDTH AT TOP	SIDE SLOPES	60 % CLEAN OUT LEVEL
(FT.)	(FT.)	(FT.)	(FT.)	(H : 1 V)	(FT.)
9850	3	16.3	28.3	2.00	1.6

CELL LENGTH:	19	AT	500	FEET	AND
	1	AT	350	FEET	

POND WIDTH AT BOTTOM

	SIDE SLOPES (H : 1V)				
DEPTHS @ SED. LEVEL	0.25	0.5	1	2	4
5.5	8.3	6.9	4.2		
4.5	10.7	9.6	7.3	2.8	
3.5	14.3	13.5	11.7	8.2	1.2
2.5	20.7	20.1	18.8	16.3	11.3
1.5	35.1	34.8	34.0	32.5	29.5
0.5	106.4	106.3	106.0	105.5	104.5
-0.5					

WV SEDIMENT CHANNEL DESIGN

ICG HAZARD, LLC

Application # 897-0587

CHANNEL NUMBER **Hollow B**

PERRY COUNTY

10 YR / 24 HR.	3.92 INCHES	71.05 CFS
STORM EVENT	RAINFALL AMOUNT	FLOW

SPILLWAY DESIGN:

FLOW DEPTH:	0.5	FT.	TOP WIDTH @ FLOW DEPTH:	67.1	FT.
FREEBOARD:	0	FT.	BOT. WIDTH:	65.1	FT.
TOTAL DEPTH:	0.5	FT.	TOP WIDTH @ FREEBOARD DEPTH	67.1	FT.

STORAGE DESIGN:

ACRES DISTURBED:	36.25	AC.	AC / FT REQUIRED:	4.53	AC / FT

TYPICAL SEDIMENT CELL DIMENSION AT SEDIMENT POOL LEVEL

LINEAL FEET OF STRUCTURE AVAILABLE	DEPTH AT SED. LEVEL	POND WIDTH AT BOTTOM	POND WIDTH AT SEDIMENT LEVEL	SIDE SLOPES	CROSS-SECTIONAL AREA AT SED. LEVEL
(FT.)	(FT.)	(FT.)	(FT.)	(H : 1 V)	(SQ. FT.)
4655	2.5	12.0	22.0	2.00	42.40

TYPICAL SEDIMENT CELL DIMENSION AT TOP WITH FREEBOARD

LINEAL FEET OF STRUCTURE AVAILABLE	DEPTH AT TOP	POND WIDTH AT BOTTOM	POND WIDTH AT TOP	SIDE SLOPES	60 % CLEAN OUT LEVEL
(FT.)	(FT.)	(FT.)	(FT.)	(H : 1 V)	(FT.)
4655	3	12.0	24.0	2.00	1.7

CELL LENGTH:	9	AT	500	FEET	AND
	1	AT	155	FEET	

POND WIDTH AT BOTTOM

	SIDE SLOPES (H : 1V)				
DEPTHS @ SED. LEVEL	0.25	0.5	1	2	4
5.5	6.3	5.0	2.2		
4.5	8.3	7.2	4.9	0.4	
3.5	11.2	10.4	8.6	5.1	
2.5	16.3	15.7	14.5	12.0	7.0
1.5	27.9	27.5	26.8	25.3	22.3
0.5	84.7	84.6	84.3	83.8	82.8
-0.5					

WV SEDIMENT CHANNEL DESIGN

ICG HAZARD, LLC

Application # 897-0587

CHANNEL NUMBER **Hollow C**

PERRY COUNTY

10 YR / 24 HR.	3.92 INCHES	18.44 CFS
STORM EVENT	RAINFALL AMOUNT	FLOW

SPILLWAY DESIGN:

FLOW DEPTH:	0.5	FT.	TOP WIDTH @ FLOW DEPTH:	18.9	FT.
FREEBOARD:	0	FT.	BOT. WIDTH:	16.9	FT.
TOTAL DEPTH:	0.5	FT.	TOP WIDTH @ FREEBOARD DEPTH	18.9	FT.

STORAGE DESIGN:

ACRES DISTURBED:	9.41	AC.	AC / FT REQUIRED:	1.18	AC / FT

TYPICAL SEDIMENT CELL DIMENSION AT SEDIMENT POOL LEVEL

LINEAL FEET OF STRUCTURE AVAILABLE	DEPTH AT SED. LEVEL	POND WIDTH AT BOTTOM	POND WIDTH AT SEDIMENT LEVEL	SIDE SLOPES	CROSS-SECTIONAL AREA AT SED. LEVEL
(FT.)	(FT.)	(FT.)	(FT.)	(H : 1 V)	(SQ. FT.)
1427	2.5	9.4	19.4	2.00	35.91

TYPICAL SEDIMENT CELL DIMENSION AT TOP WITH FREEBOARD

LINEAL FEET OF STRUCTURE AVAILABLE	DEPTH AT TOP	POND WIDTH AT BOTTOM	POND WIDTH AT TOP	SIDE SLOPES	60 % CLEAN OUT LEVEL
(FT.)	(FT.)	(FT.)	(FT.)	(H : 1 V)	(FT.)
1427	3	9.4	21.4	2.00	1.7

CELL LENGTH:	2	AT	500	FEET	AND
	1	AT	427	FEET	

POND WIDTH AT BOTTOM

	SIDE SLOPES (H : 1V)				
DEPTHS @ SED. LEVEL	0.25	0.5	1	2	4
5.5	5.2	3.8	1.0		
4.5	6.9	5.7	3.5		
3.5	9.4	8.5	6.8	3.3	
2.5	13.7	13.1	11.9	9.4	4.4
1.5	23.6	23.2	22.4	20.9	17.9
0.5	71.7	71.6	71.3	70.8	69.8
-0.5					

WV SEDIMENT CHANNEL DESIGN

ICG HAZARD, LLC

Application # 897-0587

CHANNEL NUMBER **Hollow F**

PERRY COUNTY

10 YR / 24 HR.	3.92 INCHES	35.95 CFS
STORM EVENT	RAINFALL AMOUNT	FLOW

SPILLWAY DESIGN:

FLOW DEPTH:	0.5	FT.	TOP WIDTH @ FLOW DEPTH:	34.9	FT.
FREEBOARD:	0	FT.	BOT. WIDTH:	32.9	FT.
TOTAL DEPTH:	0.5	FT.	TOP WIDTH @ FREEBOARD DEPTH	34.9	FT.

STORAGE DESIGN:

ACRES DISTURBED:	18.34	AC.	AC / FT REQUIRED:	2.29	AC / FT

TYPICAL SEDIMENT CELL DIMENSION AT SEDIMENT POOL LEVEL

LINEAL FEET OF STRUCTURE AVAILABLE	DEPTH AT SED. LEVEL	POND WIDTH AT BOTTOM	POND WIDTH AT SEDIMENT LEVEL	SIDE SLOPES	CROSS-SECTIONAL AREA AT SED. LEVEL
(FT.)	(FT.)	(FT.)	(FT.)	(H : 1 V)	(SQ. FT.)
2987	2.5	8.4	18.4	2.00	33.43

TYPICAL SEDIMENT CELL DIMENSION AT TOP WITH FREEBOARD

LINEAL FEET OF STRUCTURE AVAILABLE	DEPTH AT TOP	POND WIDTH AT BOTTOM	POND WIDTH AT TOP	SIDE SLOPES	60 % CLEAN OUT LEVEL
(FT.)	(FT.)	(FT.)	(FT.)	(H : 1 V)	(FT.)
2987	3	8.4	20.4	2.00	1.7

CELL LENGTH:	5	AT	500	FEET	AND
	1	AT	487	FEET	

POND WIDTH AT BOTTOM

	SIDE SLOPES (H : 1V)				
DEPTHS @ SED. LEVEL	0.25	0.5	1	2	4
5.5	4.7	3.3	0.6		
4.5	6.3	5.2	2.9		
3.5	8.7	7.8	6.1	2.6	
2.5	12.7	12.1	10.9	8.4	3.4
1.5	21.9	21.5	20.8	19.3	16.3
0.5	66.7	66.6	66.4	65.9	64.9
-0.5					

WV SEDIMENT CHANNEL DESIGN

ICG HAZARD, LLC

Application # 897-0587

CHANNEL NUMBER **Hollow H**

PERRY COUNTY

10 YR / 24 HR.	4.3 INCHES	121.67 CFS
STORM EVENT	RAINFALL AMOUNT	FLOW

SPILLWAY DESIGN:

FLOW DEPTH:	0.5	FT.	TOP WIDTH @ FLOW DEPTH:	113.5	FT.
FREEBOARD:	0	FT.	BOT. WIDTH:	111.5	FT.
TOTAL DEPTH:	0.5	FT.	TOP WIDTH @ FREEBOARD DEPTH	113.5	FT.

STORAGE DESIGN:

ACRES DISTURBED:	56.59	AC.	AC / FT REQUIRED:	7.07	AC / FT

TYPICAL SEDIMENT CELL DIMENSION AT SEDIMENT POOL LEVEL

LINEAL FEET OF STRUCTURE AVAILABLE	DEPTH AT SED. LEVEL	POND WIDTH AT BOTTOM	POND WIDTH AT SEDIMENT LEVEL	SIDE SLOPES	CROSS-SECTIONAL AREA AT SED. LEVEL
(FT.)	(FT.)	(FT.)	(FT.)	(H : 1 V)	(SQ. FT.)
5430	2.5	17.7	27.7	2.00	56.75

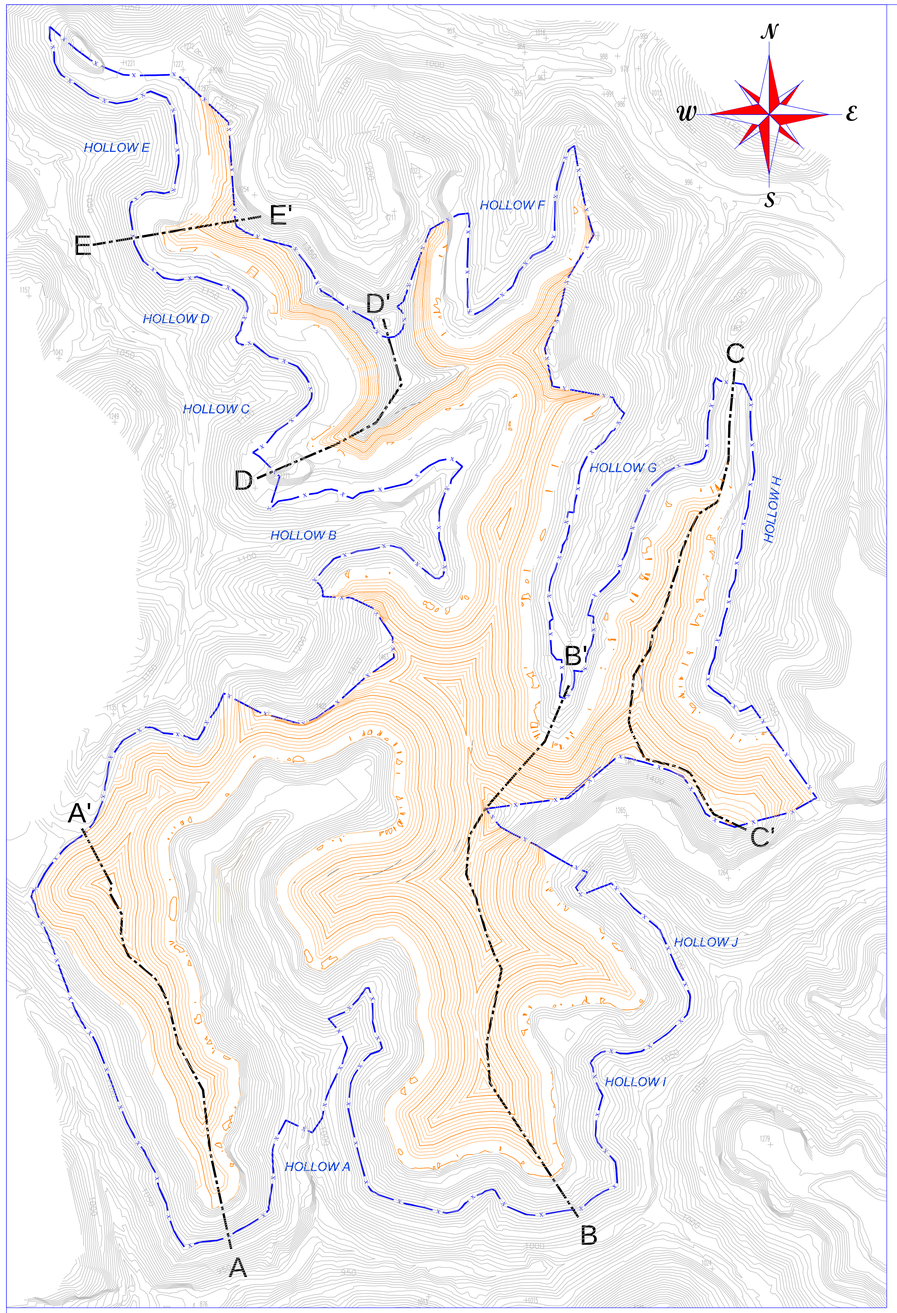
TYPICAL SEDIMENT CELL DIMENSION AT TOP WITH FREEBOARD

LINEAL FEET OF STRUCTURE AVAILABLE	DEPTH AT TOP	POND WIDTH AT BOTTOM	POND WIDTH AT TOP	SIDE SLOPES	60 % CLEAN OUT LEVEL
(FT.)	(FT.)	(FT.)	(FT.)	(H : 1 V)	(FT.)
5430	3	17.7	29.7	2.00	1.6

CELL LENGTH:	10	AT	500	FEET	AND
	1	AT	430	FEET	

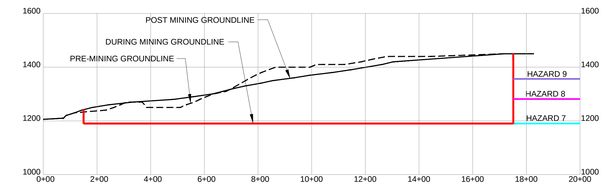
POND WIDTH AT BOTTOM

	SIDE SLOPES (H : 1V)				
DEPTHS @ SED. LEVEL	0.25	0.5	1	2	4
5.5	8.9	7.6	4.8		
4.5	11.5	10.4	8.1	3.6	
3.5	15.3	14.5	12.7	9.2	2.2
2.5	22.1	21.4	20.2	17.7	12.7
1.5	37.5	37.1	36.3	34.8	31.8
0.5	113.4	113.2	113.0	112.5	111.5
-0.5					



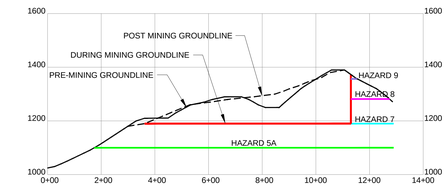
PROPOSED CONFIGURATION

SCALE : 1" = 400'



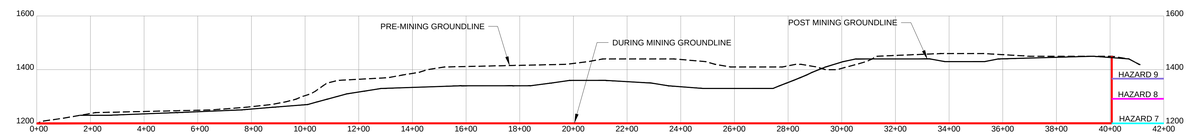
SECTION D-D'

SCALE: 1" = 200'



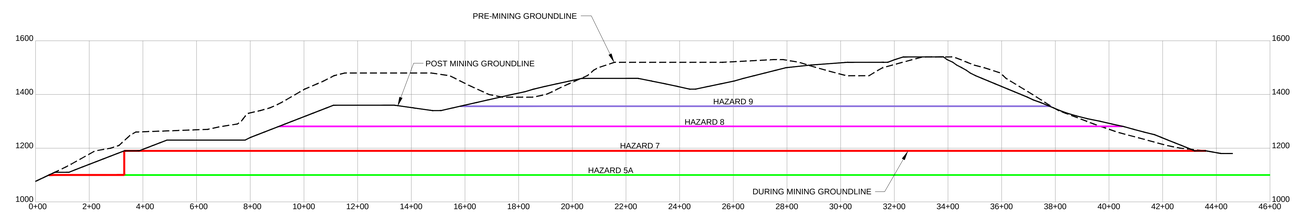
SECTION E-E'

SCALE: 1" = 200'



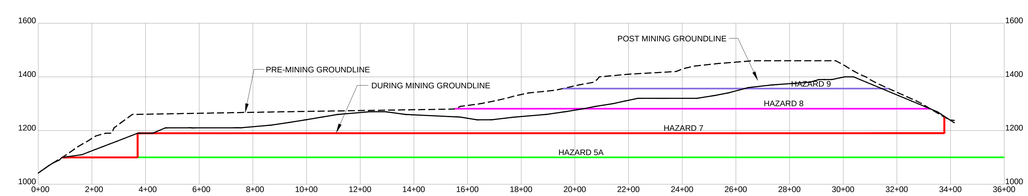
SECTION C-C'

SCALE: 1" = 200'



SECTION B-B'

SCALE: 1" = 200'



SECTION A-A'

SCALE: 1" = 200'

DRAWN BY: D.HANNAH	**ICG HAZARD, LLC** 3228 SUMMIT SQUARE, SUITE 180 LEXINGTON, KY. 40509	**SUMMIT ENGINEERING,INC.** 131 Summit Drive Pikeville, Ky. 41501 (606) 432-1447	SCALE: NOTED
CHECKED BY: A.CHILDERS			DATE: 08/08/14
APPROVED BY: A.CHILDERS	**BACKFILL PLAN VIEW AND SECTIONS** SAM CAMPBELL BRANCH PERMIT NO. 897-0587	Lexington,Ky ● Henderson, Ky. South Charleston,WV ● Bridgeport, WV	ATTACHMENT:
PER. NO: 897-0587			SHEET:
Plot Date: 08 AUGUST 2014 – 5:18 PM			OF:

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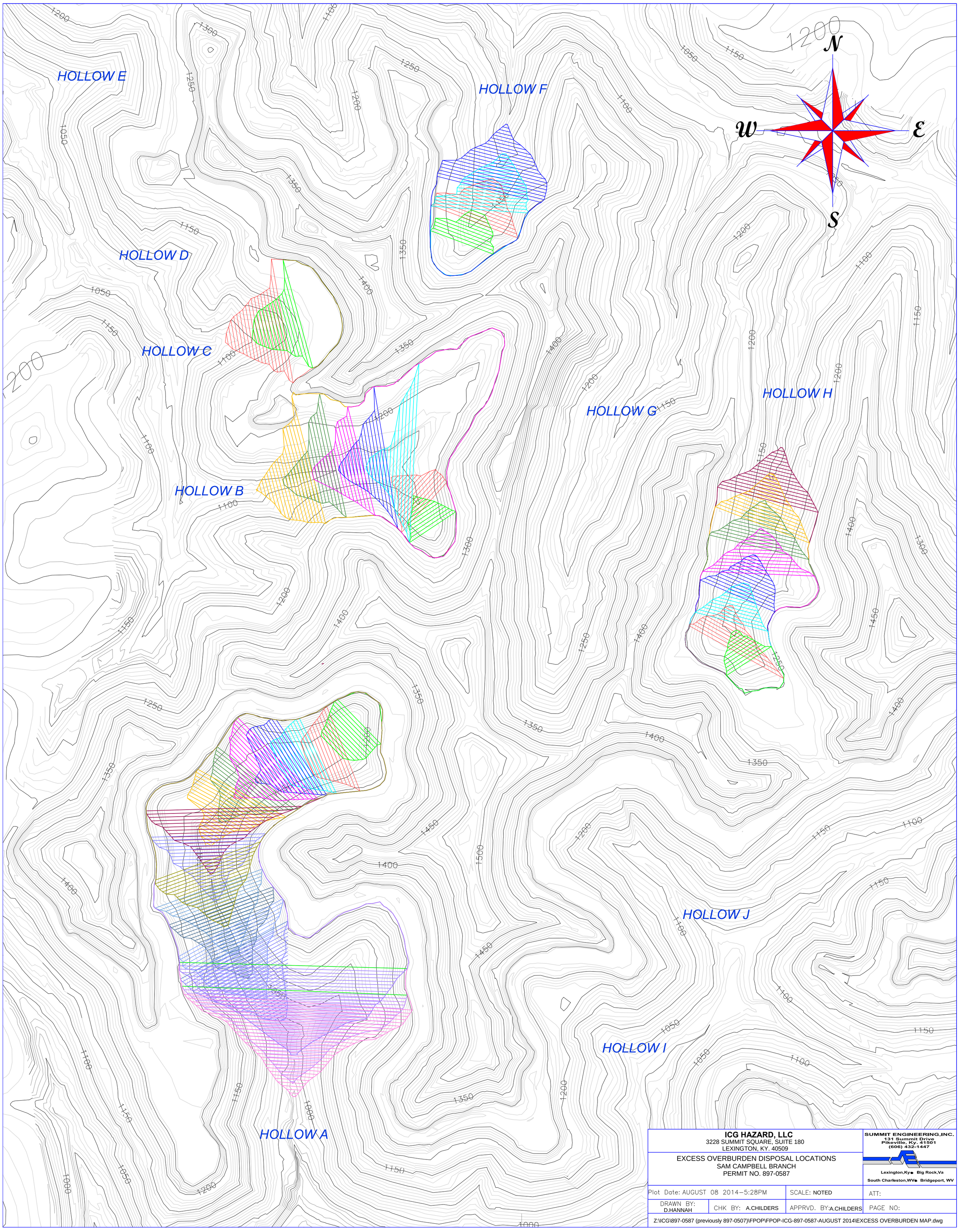
STEP 5 ATTACHMENTS



ICG HAZARD, LLC
3228 SUMMIT SQUARE, SUITE 180
LEXINGTON, KY. 40509

EXCESS OVERBURDEN DISPOSAL LOCATIONS
SAM CAMPBELL BRANCH
PERMIT NO. 897-0587

SUMMIT ENGINEERING,INC.
131 Summit Drive
Pikeville, Ky. 41501
(606) 432-1447
Lexington,Ky● Big Rock,Va
South Charleston,WV● Bridgeport, WV

Plot Date: AUGUST 08 2014–5:28PM		SCALE: NOTED	ATT:
DRAWN BY: D.HANNAH	CHK BY: A.CHILDERS	APPRVD. BY: A.CHILDERS	PAGE NO:

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STEP 6 ATTACHMENTS

ICG Hazard, LLC - KDNR Permit No. 897-0587
Valley Fill Volumetrics Trial 1- Non-Optimized
Excess Overburden Volume = 26,951,075 cubic yards

Hollow A - EII = 0.55							
Station	Fill Slice Volume (cubic yards)	Stream Length (linear feet)	Overburden Volume / Linear Foot	Fill Slice Required (yes / no)	Overburden Volume Required (cubic yards)	Stream Length Impacted (linear feet)	EIUs Lost
0+00	219,833	0	NJD	yes	219,833	0	0.0
2+00	373,191	0	NJD	yes	373,191	0	0.0
4+00	350,341	0	NJD	yes	350,341	0	0.0
6+00	243,102	192	1,266	yes	243,102	192	105.6
8+00	396,456	189	2,098	yes	396,456	189	104.0
10+00	449,715	206	2,183	yes	449,715	206	113.3
12+00	421,607	193	2,184	yes	421,607	193	106.2
14+00	613,347	205	2,992	yes	613,347	205	112.8
16+00	611,365	200	3,057	yes	611,365	200	110.0
18+00	576,625	187	3,084	yes	576,625	187	102.9
20+00	642,635	211	3,046	yes	642,635	211	116.1
22+00	543,783	197	2,760	yes	543,783	197	108.4
24+00	691,757	205	3,374	yes	691,757	205	112.8
26+00	681,936	189	3,608	yes	681,936	189	104.0
28+00	2,110,227	1,089	1,938	yes	2,110,227	1,089	599.0
30+00	1,619,890	209	7,751	yes	1,619,890	209	115.0
32+00	694,563	93	7,468	yes	694,563	93	51.2
				Total	11,240,373	3,565	1960.8

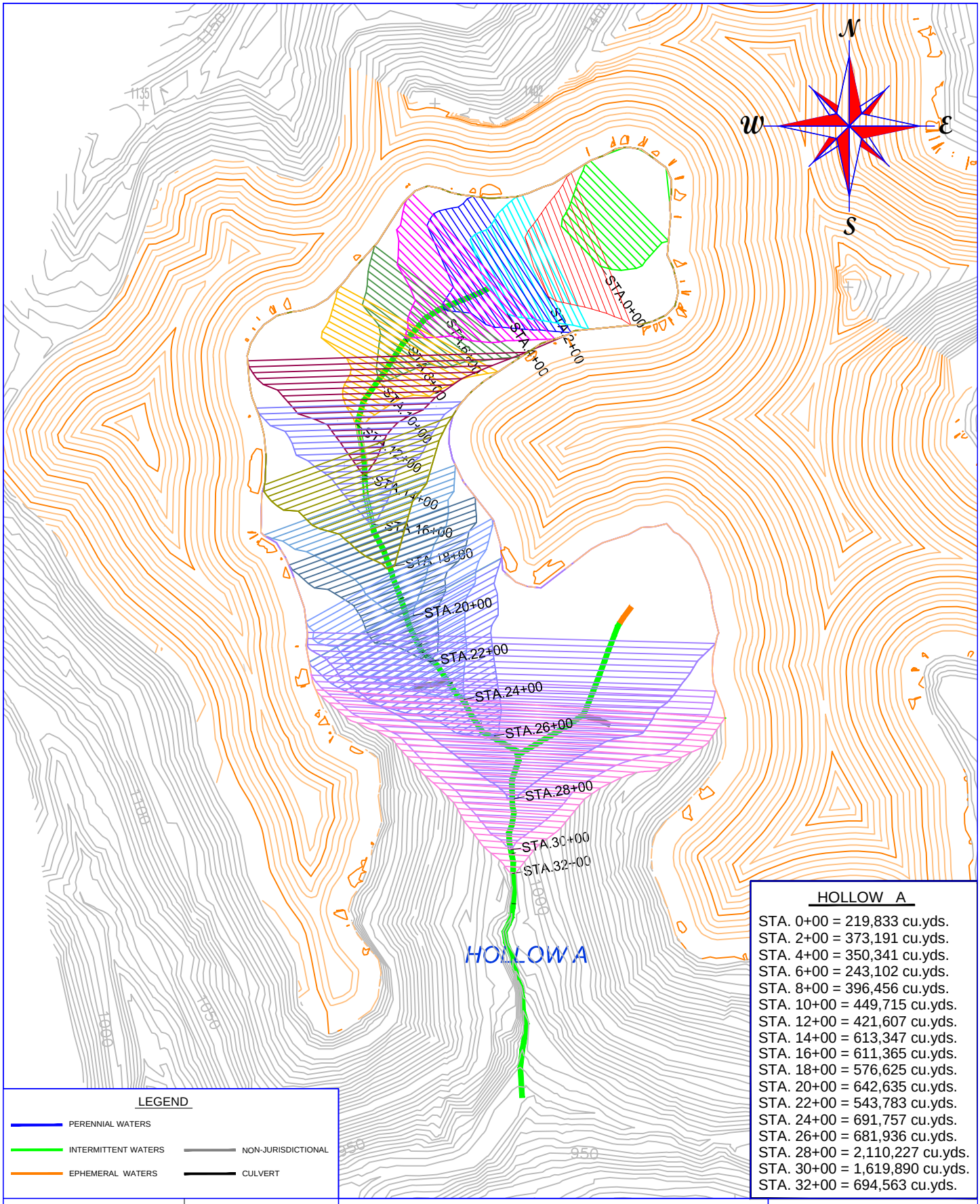
Hollow B - EII = 0.47							
Station	Fill Slice Volume (cubic yards)	Stream Length (linear feet)	Overburden Volume / Linear Foot	Fill Slice Required (yes / no)	Overburden Volume Required (cubic yards)	Stream Length Impacted (linear feet)	EIUs Lost
0+00	114,992	112	1,027	yes	114,992	112	52.6
2+00	162,120	202	803	yes	162,120	202	94.9
4+00	933,157	469	1,990	yes	933,157	469	220.4
6+00	462,085	200	2,310	yes	462,085	200	94.0
8+00	369,322	201	1,837	yes	369,322	201	94.5
10+00	428,932	200	2,145	yes	428,932	200	94.0
12+00	450,323	196	2,298	yes	450,323	196	92.1
				Total	2,920,931	1,580	742.6

Hollow C - EII = 0.16							
Station	Fill Slice Volume (cubic yards)	Stream Length (linear feet)	Overburden Volume / Linear Foot	Fill Slice Required (yes / no)	Overburden Volume Required (cubic yards)	Stream Length Impacted (linear feet)	EIUs Lost
0+00	226,836	37	6,131	yes	226,836	37	5.9
2+00	288,360	192	1,502	yes	288,360	192	30.7
				Total	515,196	229	36.6

Hollow F - EII = 0.8							
Station	Fill Slice Volume (cubic yards)	Stream Length (linear feet)	Overburden Volume / Linear Foot	Fill Slice Required (yes / no)	Overburden Volume Required (cubic yards)	Stream Length Impacted (linear feet)	EIUs Lost
0+00	164,804	208	792	yes	164,804	208	166.4
2+00	269,277	261	1,032	yes	269,277	261	208.8
4+00	297,091	208	1,428	yes	297,091	208	166.4
6+00	429,218	503	853	yes	429,218	503	402.4
				Total	1,160,390	1,180	944.0

Hollow H - EII = 0.3							
Station	Fill Slice Volume (cubic yards)	Stream Length (linear feet)	Overburden Volume / Linear Foot	Fill Slice Required (yes / no)	Overburden Volume Required (cubic yards)	Stream Length Impacted (linear feet)	EIUs Lost
0+00	134,617	195	690	yes	134,617	195	58.5
2+00	179,666	192	936	yes	179,666	192	57.6
4+00	231,946	199	1,166	yes	231,946	199	59.7
6+00	269,793	201	1,342	yes	269,793	201	60.3
8+00	379,477	198	1,917	yes	379,477	198	59.4
10+00	352,780	202	1,746	yes	352,780	202	60.6
12+00	312,349	209	1,494	yes	312,349	209	62.7
14+00	378,778	204	1,857	yes	378,778	204	61.2
				Total	2,239,406	1,600	480.0

Total Overburden Volume Required (cubic yards)	Total Stream Length Impacted (linear ft)	Total EIU Impact
18,076,296	8,154	4,164



HOLLOW A

STA. 0+00 = 219,833 cu.yds.
STA. 2+00 = 373,191 cu.yds.
STA. 4+00 = 350,341 cu.yds.
STA. 6+00 = 243,102 cu.yds.
STA. 8+00 = 396,456 cu.yds.
STA. 10+00 = 449,715 cu.yds.
STA. 12+00 = 421,607 cu.yds.
STA. 14+00 = 613,347 cu.yds.
STA. 16+00 = 611,365 cu.yds.
STA. 18+00 = 576,625 cu.yds.
STA. 20+00 = 642,635 cu.yds.
STA. 22+00 = 543,783 cu.yds.
STA. 24+00 = 691,757 cu.yds.
STA. 26+00 = 681,936 cu.yds.
STA. 28+00 = 2,110,227 cu.yds.
STA. 30+00 = 1,619,890 cu.yds.
STA. 32+00 = 694,563 cu.yds.

LEGEND

- PERENNIAL WATERS
- INTERMITTENT WATERS
- NON-JURISDICTIONAL
- EPHEMERAL WATERS
- CULVERT

DATE: 08/08/2014	SCALE: 1"=500'
DRAWN BY: D.HANNAH	

ICG HAZARD, LLC
3228 SUMMIT SQUARE, SUITE 180
LEXINGTON, KY. 40509

VALLEY FILL VOLUMETRICS
TRIAL 1-NON-OPTIMZED
HOLLOW-A

SUMMIT ENGINEERING,INC.
131 Summit Drive
Pikeville, Ky. 41501
(606) 432-1447
Lexington,Ky. Henderson, Ky.
South Charleston,WV. Bridgeport, WV

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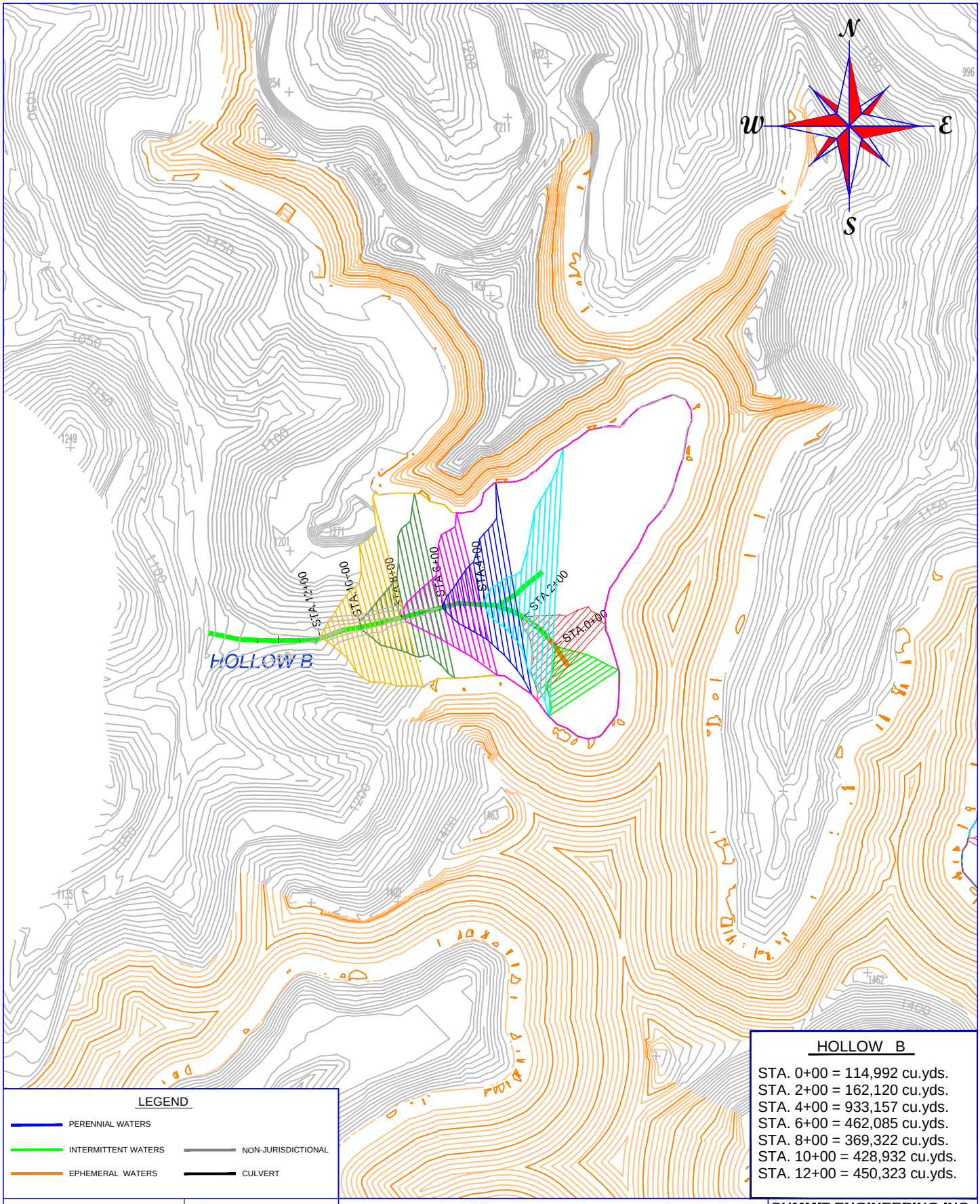

HOLLOW B

STA. 0+00 = 114,992 cu.yds.
STA. 2+00 = 162,120 cu.yds.
STA. 4+00 = 933,157 cu.yds.
STA. 6+00 = 462,085 cu.yds.
STA. 8+00 = 369,322 cu.yds.
STA. 10+00 = 428,932 cu.yds.
STA. 12+00 = 450,323 cu.yds.

LEGEND

- PERENNIAL WATERS
- INTERMITTENT WATERS
- NON-JURISDICTIONAL
- EPHEMERAL WATERS
- CULVERT

DATE: 08/08/2014	SCALE: 1"=500'
DRAWN BY: D.HANNAH	

ICG HAZARD, LLC
3228 SUMMIT SQUARE, SUITE 180
LEXINGTON, KY. 40509

VALLEY FILL VOLUMETRICS
TRIAL 1-NON-OPTIMZED
HOLLOW-B

SUMMIT ENGINEERING,INC.
131 Summit Drive
Pikeville, Ky. 41501
(606) 432-1447

Lexington,Ky • Hazard,Ky
Big Rock,Va • Wise, Va
Charleston,WV • Bridgeport, WV

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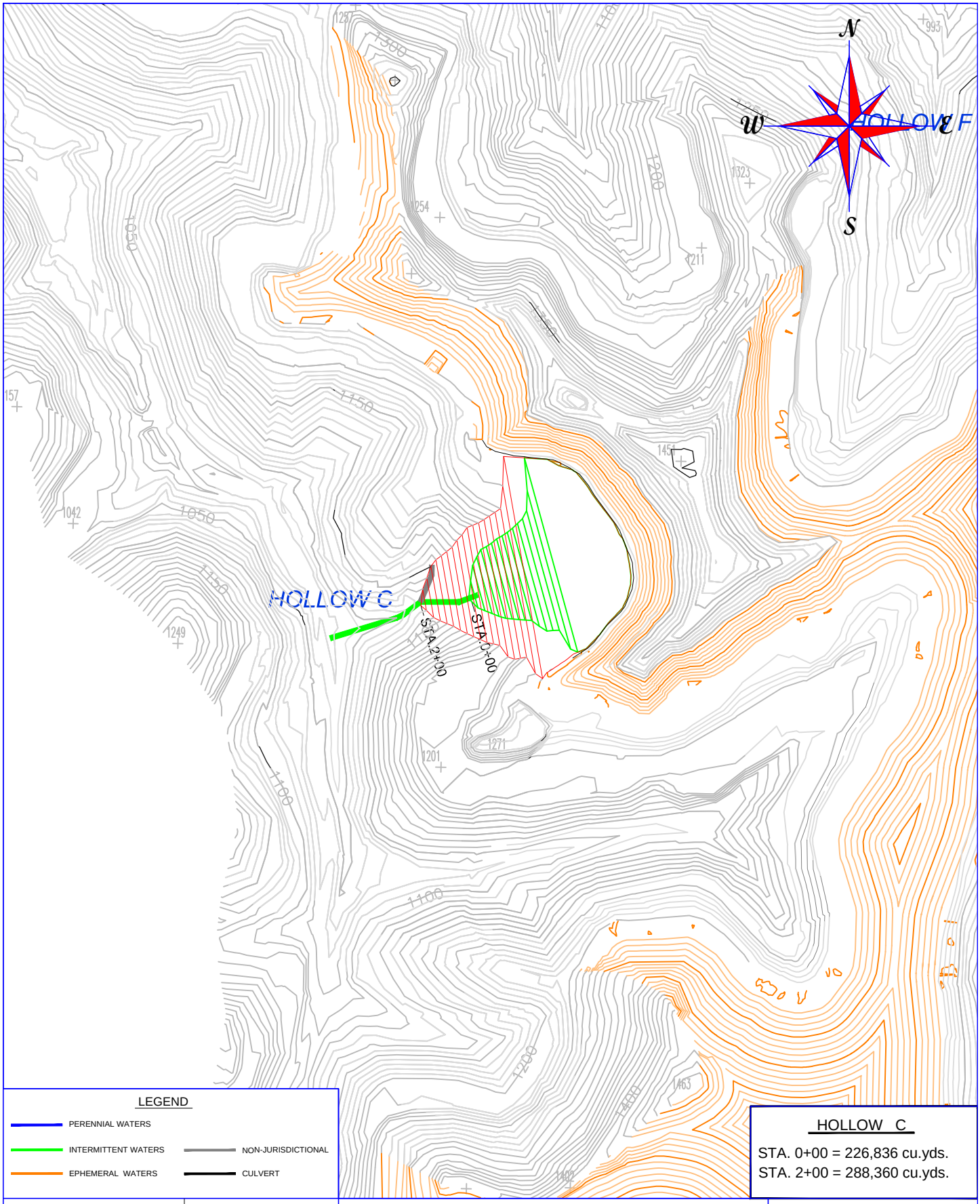

LEGEND

- PERENNIAL WATERS
- INTERMITTENT WATERS
- EPHEMERAL WATERS
- NON-JURISDICTIONAL
- CULVERT

HOLLOW C

STA. 0+00 = 226,836 cu.yds.
STA. 2+00 = 288,360 cu.yds.

DATE: 08/08/2014	SCALE: 1"=500'
DRAWN BY: D.HANNAH	

ICG HAZARD, LLC
3228 SUMMIT SQUARE, SUITE 180
LEXINGTON, KY. 40509

VALLEY FILL VOLUMETRICS
TRIAL 1-NON-OPTIMZED
HOLLOW-C

SUMMIT ENGINEERING,INC.
131 Summit Drive
Pikeville, Ky. 41501
(606) 432-1447
Lexington,Ky. Henderson, Ky.
South Charleston,WV. Bridgeport, WV

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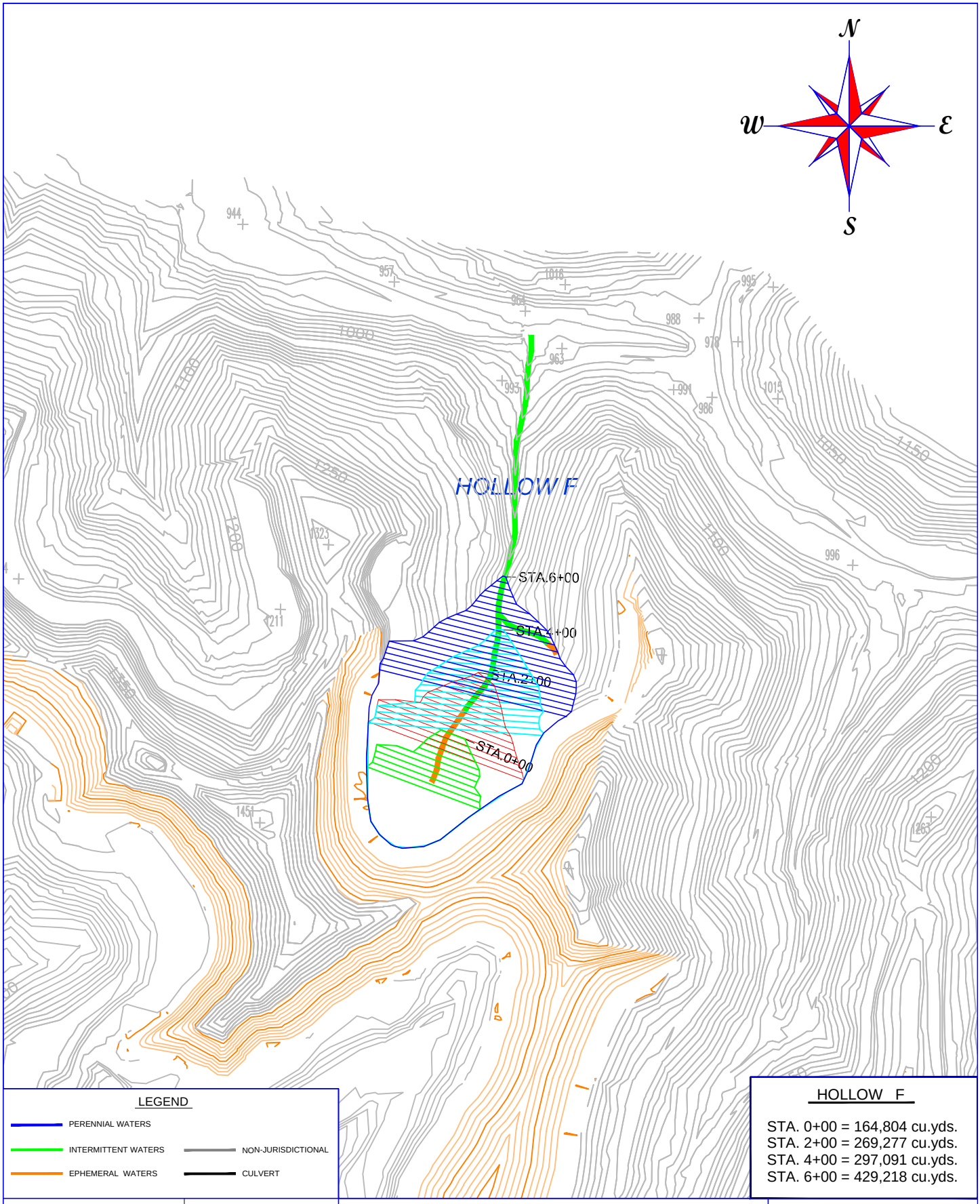

LEGEND

- PERENNIAL WATERS
- INTERMITTENT WATERS
- EPHEMERAL WATERS
- NON-JURISDICTIONAL
- CULVERT

HOLLOW F

STA. 0+00 = 164,804 cu.yds.
STA. 2+00 = 269,277 cu.yds.
STA. 4+00 = 297,091 cu.yds.
STA. 6+00 = 429,218 cu.yds.

DATE: 08/08/2014	SCALE: 1"=500'
DRAWN BY: D.HANNAH	

ICG HAZARD, LLC
3228 SUMMIT SQUARE, SUITE 180
LEXINGTON, KY. 40509

VALLEY FILL VOLUMETRICS
TRIAL 1-NON-OPTIMZED
HOLLOW-F

SUMMIT ENGINEERING,INC.
131 Summit Drive
Pikeville, Ky. 41501
(606) 432-1447
Lexington,Ky. Henderson, Ky.
South Charleston,WV. Bridgeport, WV

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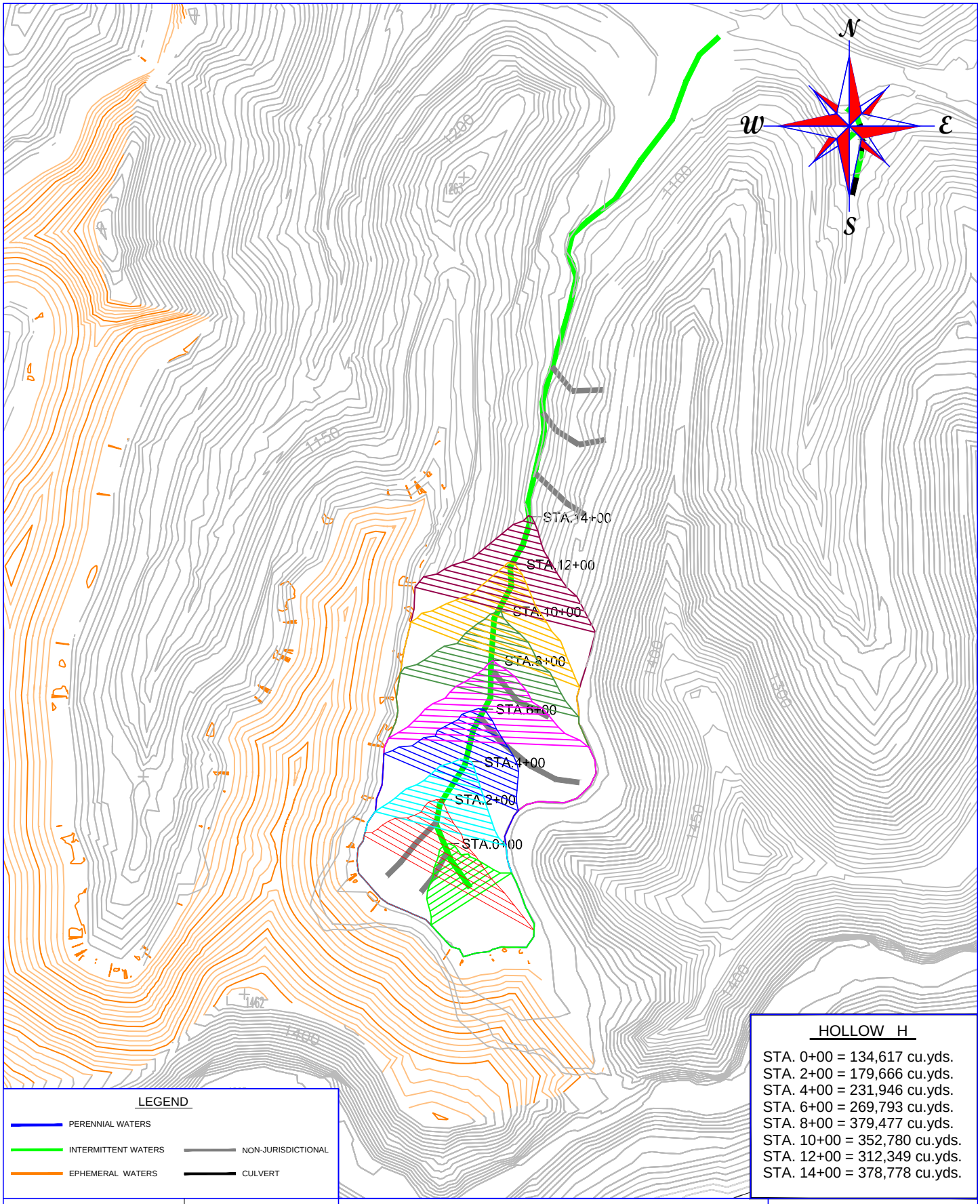

HOLLOW H

STA. 0+00 = 134,617 cu.yds.
STA. 2+00 = 179,666 cu.yds.
STA. 4+00 = 231,946 cu.yds.
STA. 6+00 = 269,793 cu.yds.
STA. 8+00 = 379,477 cu.yds.
STA. 10+00 = 352,780 cu.yds.
STA. 12+00 = 312,349 cu.yds.
STA. 14+00 = 378,778 cu.yds.

LEGEND

- PERENNIAL WATERS
- INTERMITTENT WATERS
- EPHEMERAL WATERS
- NON-JURISDICTIONAL
- CULVERT

DATE: 08/08/2014	SCALE: 1"=500'
DRAWN BY: D.HANNAH	

ICG HAZARD, LLC
3228 SUMMIT SQUARE, SUITE 180
LEXINGTON, KY. 40509

VALLEY FILL VOLUMETRICS
TRIAL 1-NON-OPTIMZED
HOLLOW-H

SUMMIT ENGINEERING,INC.
131 Summit Drive
Pikeville, Ky. 41501
(606) 432-1447
Lexington,Ky. Henderson, Ky.
South Charleston,WV. Bridgeport, WV

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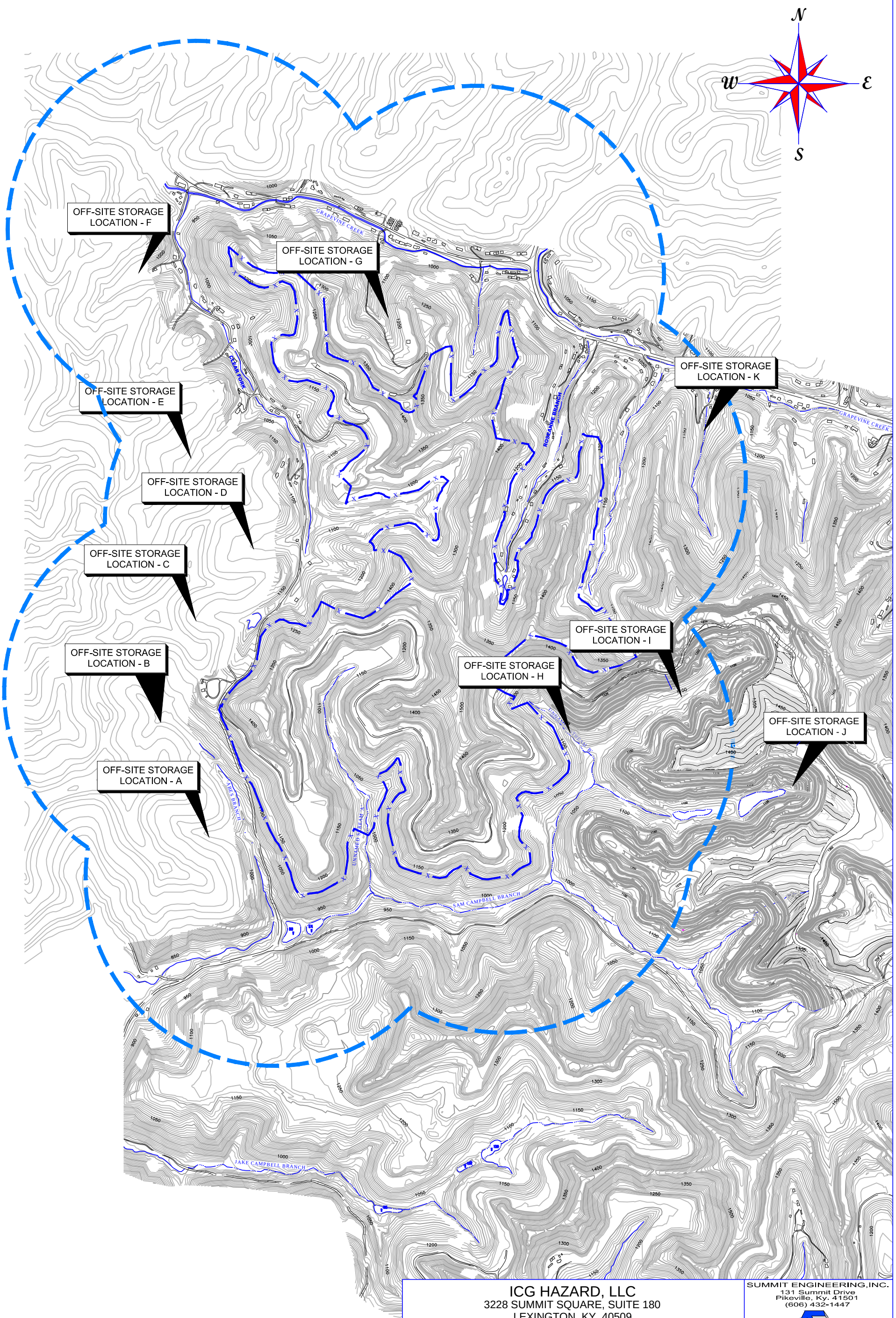
STEP 7 ATTACHMENTS



LEGEND

X 897-0587 PERMIT BOUNDARY

HALF MILE RADIUS

ICG HAZARD, LLC
3228 SUMMIT SQUARE, SUITE 180
LEXINGTON, KY. 40509

OFF-SITE DISPOSAL LOCATIONS MAP
SAM CAMBELL BRANCH
PERMIT NO. 897-0587

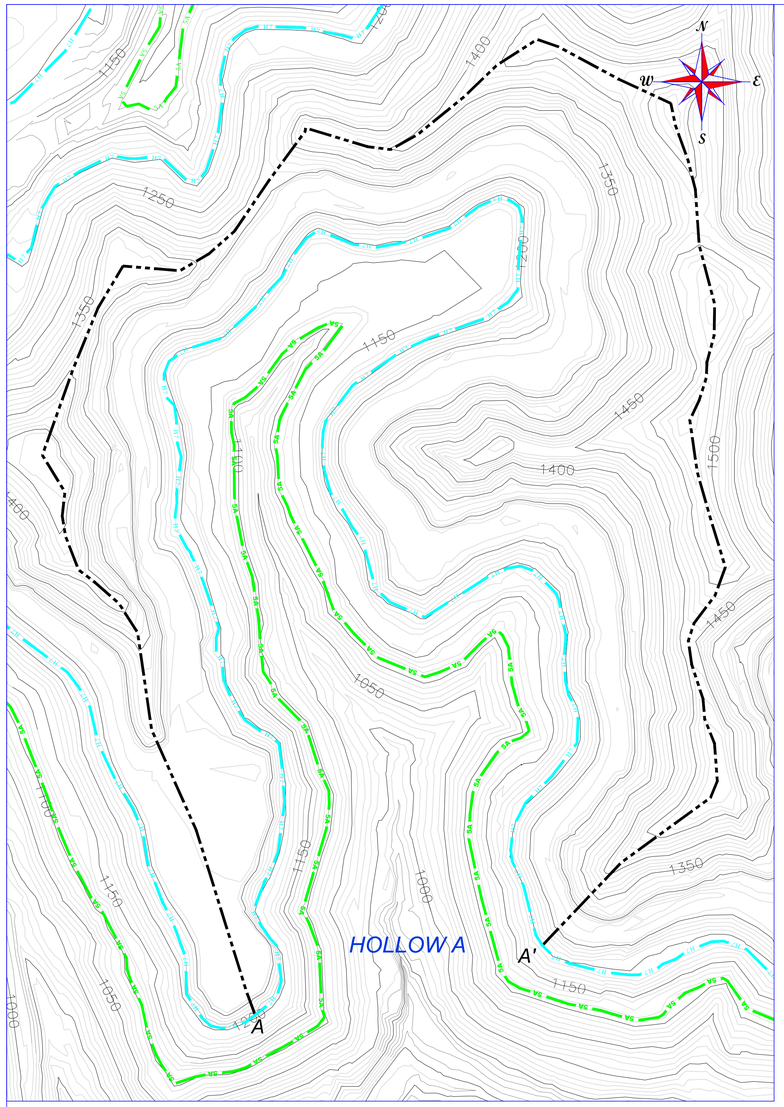
SUMMIT ENGINEERING, INC.
131 Summit Drive
Pikeville, Ky. 41501
(606) 432-1447

Lexington, Ky • Hazard, Ky
Big Rock, Va • Wise, Va
Charleston, WV • Bridgeport, WV

Scale: 1" = 1250'	Drawn By: D.HANNAH	Chk By: A.CHILDERS	Apprvd. By: A.CHILDERS	PER. NO: 897-0587
Plot Date: 08 AUGUST 2014 – 5:33 PM				ATT:

File Name: Z:\ICG\897-0587 (previously 897-0507)\FPOP\FPOP-ICG-897-0587-AUGUST 2014\0507-0543-FPOP_OFF_SITE.dwg

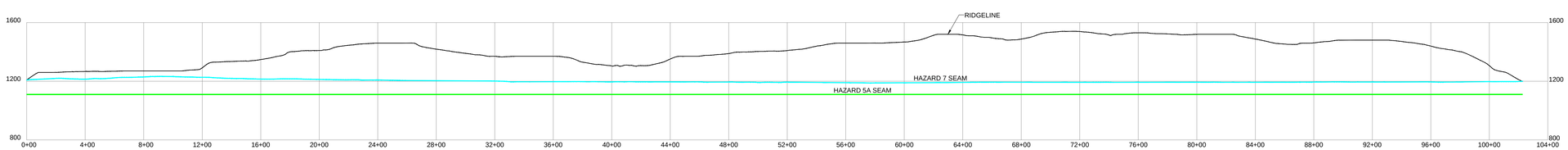
STEP 8 ATTACHMENTS



HOLLOW - A WATERSHED AREA

SCALE: 1" = 300'

AVERAGE WATERSHED ELEVATION	-	AVERAGE COAL SEAM ELEVATION	X	SWELL (25%)	+	AVERAGE COAL SEAM ELEVATION	=	ADJUSTED FILL DECK ELEVATION
1410.00	-	1254.24	X	0.25	+	1254.24	=	1293

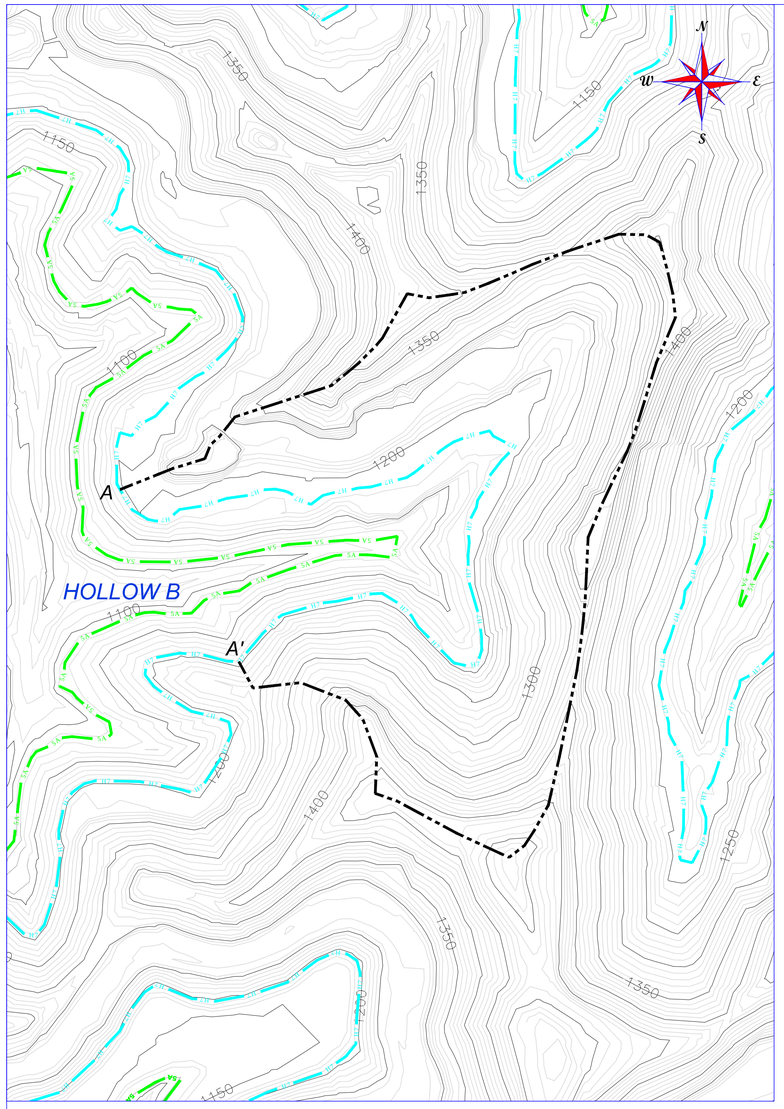


PROFILE A-A' ALONG WATERSHED BOUNDARY - HOLLOW A

SCALE : 1" = 400'

DRAWN BY: D.HANNAH	**ICG HAZARD, LLC** 3228 SUMMIT SQUARE, SUITE 180 LEXINGTON, KY. 40509	**SUMMIT ENGINEERING,INC.** 131 Summit Drive Pikeville, Ky. 41501 (606) 432-1447	SCALE: NOTED
CHECKED BY: A.CHILDERS			DATE: 08/08/2014
APPROVED BY: A.CHILDERS	**ADJUSTED FILL DECK** HOLLOW-A SAM CAMPBELL BRANCH PERMIT NO. 897-0587	Lexington,Ky • Henderson, Ky. South Charleston,WV • Bridgeport, WV	ATTACHMENT:
PER. NO: 897-0587			SHEET:
Plot Date: 08 AUGUST 2014 – 5:13 PM			OF:

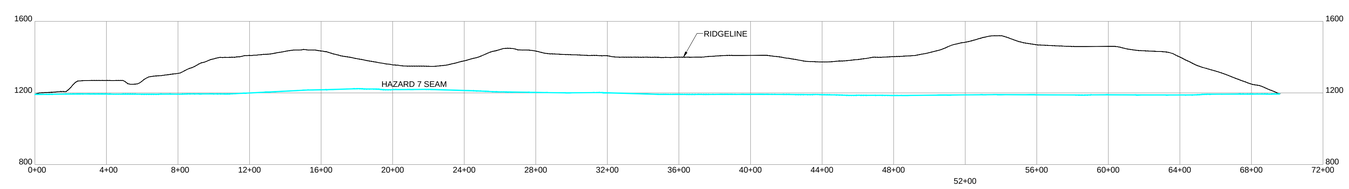
Z:\ICG\897-0587 (previously 897-0507)\FPOP\FPOP-ICG-897-0587-AUGUST 2014\ADJUSTED FILL DECK.dwg



HOLLOW - B WATERSHED AREA

SCALE: 1" = 300'

AVERAGE WATERSHED ELEVATION	-	AVERAGE COAL SEAM ELEVATION	X	SWELL (25%)	+	AVERAGE COAL SEAM ELEVATION	=	ADJUSTED FILL DECK ELEVATION
1386.00	-	1251.05	X	0.25	+	1251.05	=	1285



PROFILE A-A' ALONG WATERSHED BOUNDARY - HOLLOW B

SCALE : 1" = 400'

DRAWN BY: D.HANNAH	**ICG HAZARD, LLC** 3228 SUMMIT SQUARE, SUITE 180 LEXINGTON, KY. 40509	**SUMMIT ENGINEERING,INC.** 131 Summit Drive Pikeville, Ky. 41501 (606) 432-1447	SCALE: NOTED
CHECKED BY: A.CHILDERS			DATE: 08/08/2014
APPROVED BY: A.CHILDERS	**ADJUSTED FILL DECK** HOLLOW-B SAM CAMPBELL BRANCH PERMIT NO. 897-0587		ATTACHMENT:
PER. NO: 897-0587		Lexington,Ky • Henderson, Ky. South Charleston,WV • Bridgeport, WV	SHEET:
Plot Date: 08 AUGUST 2014 – 5:13 PM			OF:

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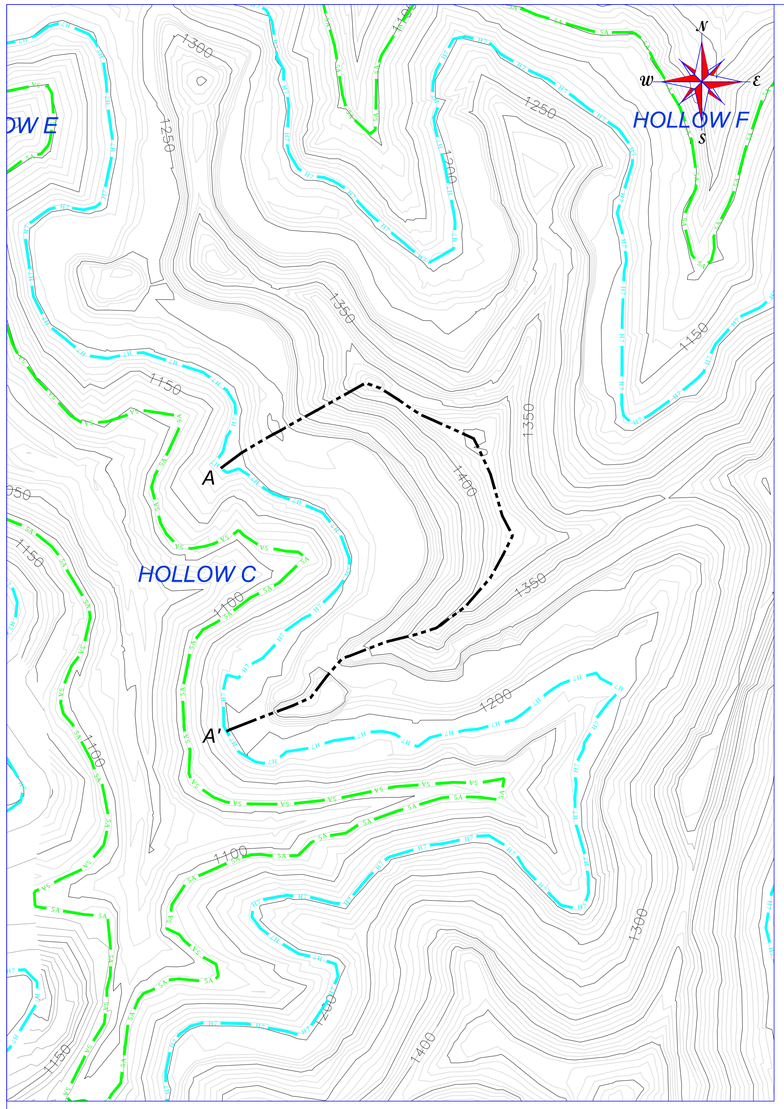
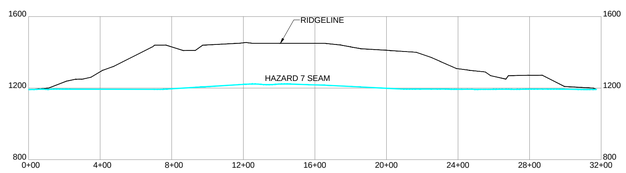


HOLLOW - C WATERSHED AREA

SCALE: 1" = 300'

AVERAGE WATERSHED ELEVATION	-	AVERAGE COAL SEAM ELEVATION	X	SWELL (25%)	+	AVERAGE COAL SEAM ELEVATION	=	ADJUSTED FILL DECK ELEVATION
1351.00	-	1249.19	X	0.25	+	1249.19	=	1275



PROFILE A-A' ALONG WATERSHED BOUNDARY - HOLLOW C

SCALE : 1" = 400'

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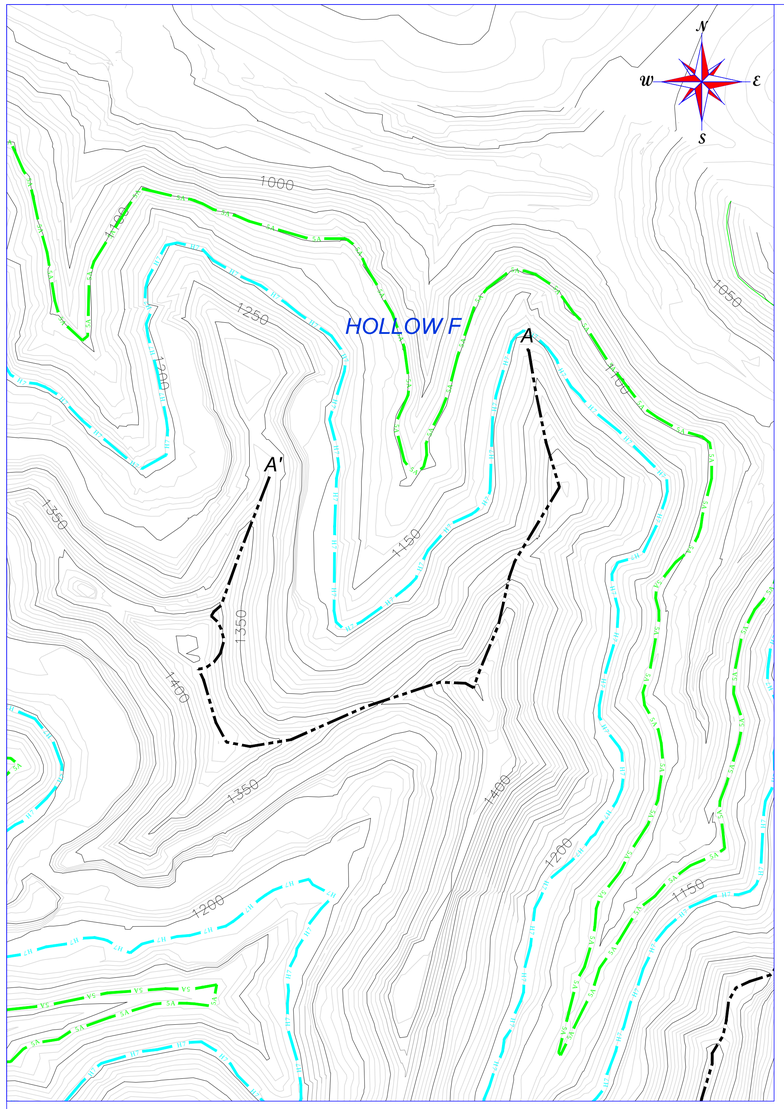
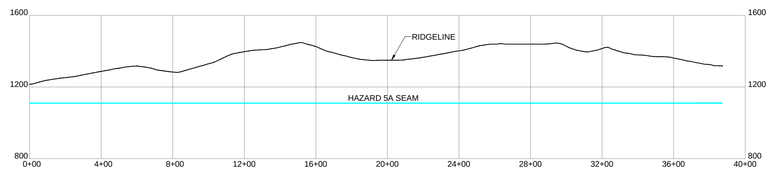
DRAWN BY: D.HANNAH	**ICG HAZARD, LLC** 3228 SUMMIT SQUARE, SUITE 180 LEXINGTON, KY. 40509	**SUMMIT ENGINEERING,INC.** 131 Summit Drive Pikeville, Ky. 41501 (606) 432-1447	SCALE: NOTED
CHECKED BY: A.CHILDERS			DATE: 08/08/2014
APPROVED BY: A.CHILDERS	**ADJUSTED FILL DECK** HOLLOW-C SAM CAMPBELL BRANCH PERMIT NO. 897-0587		ATTACHMENT:
PER. NO: 897-0587		Lexington,Ky • Henderson, Ky. South Charleston,WV • Bridgeport, WV	SHEET:
Plot Date: 08 AUGUST 2014 – 5:13 PM			OF:



HOLLOW - F WATERSHED AREA

SCALE: 1" = 300'

AVERAGE WATERSHED ELEVATION	-	AVERAGE COAL SEAM ELEVATION	X	SWELL (25%)	+	AVERAGE COAL SEAM ELEVATION	=	ADJUSTED FILL DECK ELEVATION
1362.57	-	1248.98	X	0.25	+	1248.98	=	1277



PROFILE A-A' ALONG WATERSHED BOUNDARY - HOLLOW F

SCALE : 1" = 400'

DRAWN BY: D.HANNAH	**ICG HAZARD, LLC** 3228 SUMMIT SQUARE, SUITE 180 LEXINGTON, KY. 40509	SUMMIT ENGINEERING,INC. 131 Summit Drive Pikeville, Ky. 41501 (606) 432-1447	SCALE: NOTED
CHECKED BY: A.CHILDERS			DATE: 08/08/2014
APPROVED BY: A.CHILDERS	**ADJUSTED FILL DECK** HOLLOW-F SAM CAMPBELL BRANCH PERMIT NO. 897-0587	Lexington,Ky • Henderson, Ky. South Charleston,WV • Bridgeport, WV	ATTACHMENT:
PER. NO: 897-0587			SHEET:
Plot Date: 08 AUGUST 2014 – 5:14 PM			OF:

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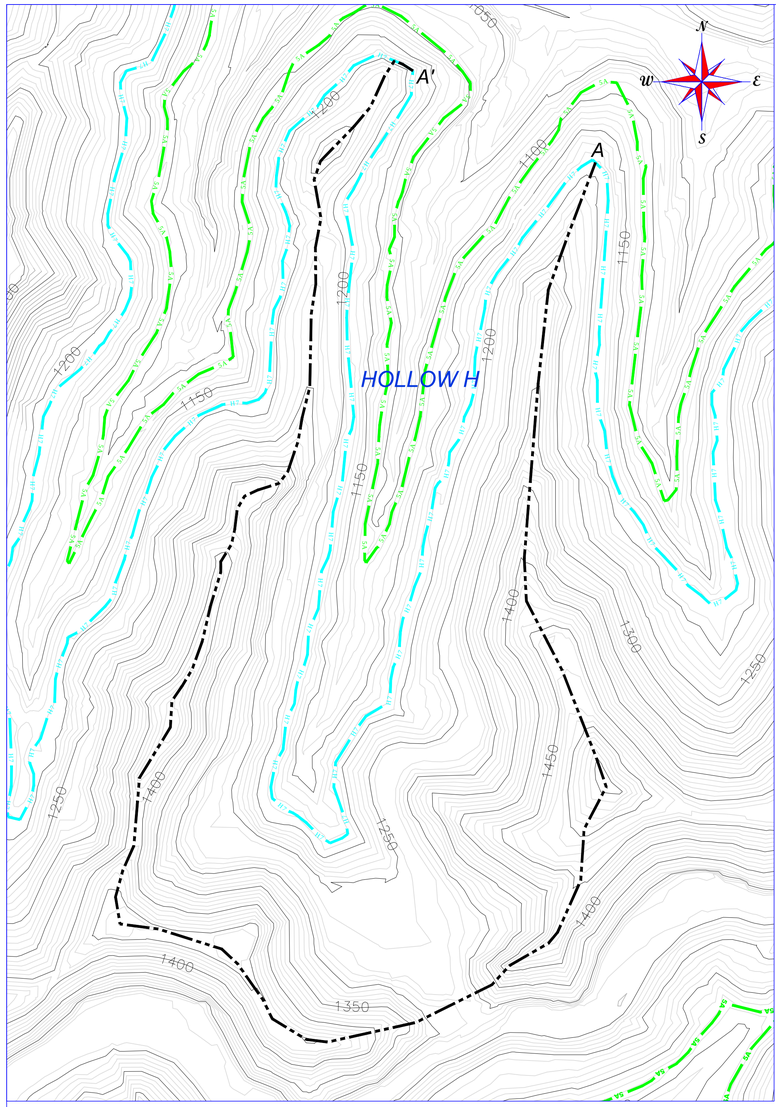
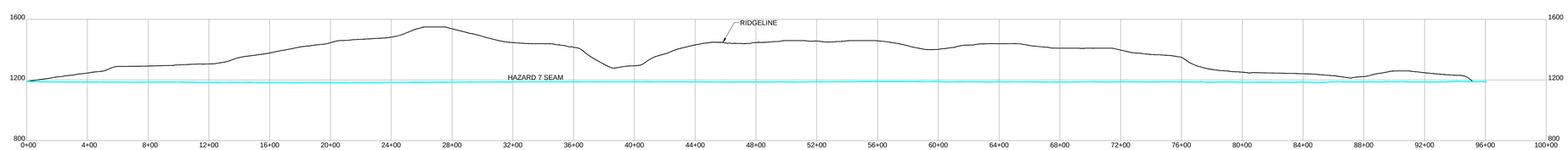


HOLLOW - H WATERSHED AREA

SCALE: 1" = 300'

AVERAGE WATERSHED ELEVATION	-	AVERAGE COAL SEAM ELEVATION	X	SWELL (25%)	+	AVERAGE COAL SEAM ELEVATION	=	ADJUSTED FILL DECK ELEVATION
1365.00	-	1250.58	X	0.25	+	1250.58	=	1279



PROFILE ALONG WATERSHED BOUNDARY - HOLLOW H

SCALE : 1" = 400'

DRAWN BY: D.HANNAH	**ICG HAZARD, LLC** 3228 SUMMIT SQUARE, SUITE 180 LEXINGTON, KY. 40509	**SUMMIT ENGINEERING,INC.** 131 Summit Drive Pikeville, Ky. 41501 (606) 432-1447	SCALE: NOTED
CHECKED BY: A.CHILDERS			DATE: 08/08/2014
APPROVED BY: A.CHILDERS	**ADJUSTED FILL DECK** HOLLOW-H SAM CAMPBELL BRANCH PERMIT NO. 897-0587	Lexington,Ky ◆ Henderson, Ky. South Charleston,WV ◆ Bridgeport, WV	ATTACHMENT:
PER. NO: 897-0587			SHEET:
Plot Date: 08 AUGUST 2014 – 5:14 PM			OF:

Z:\ICG\897-0587 (previously 897-0507)\FPOP\FPOP-ICG-897-0587-AUGUST 2014\ADJUSTED FILL DECK.dwg

STEP 9 ATTACHMENTS

ICG Hazard, LLC - KDNR Permit No. 897-0587
Valley Fill Volumetrics Trial 2- Optimized
Excess Overburden Volume = 26,951,075 cubic yards

Hollow A - EII = 0.55							
Station	Fill Slice Volume (cubic yards)	Stream Length (linear feet)	Overburden Volume / Linear Foot	Fill Slice Required (yes / no)	Overburden Volume Required (cubic yards)	Stream Length Impacted (linear feet)	EIUs Lost
0+00	1,162,865	0	NJD	yes	1,162,865	0	0.0
2+00	1,436,553	0	NJD	yes	1,436,553	0	0.0
4+00	947,752	0	NJD	yes	947,752	0	0.0
6+00	436,944	192	2,276	yes	436,944	192	105.6
8+00	1,083,022	189	5,730	yes	1,083,022	189	104.0
10+00	998,951	206	4,849	yes	998,951	206	113.3
12+00	842,391	193	4,365	yes	842,391	193	106.2
14+00	1,078,185	205	5,259	yes	1,078,185	205	112.8
16+00	1,383,131	200	6,916	yes	1,383,131	200	110.0
18+00	2,609,547	187	13,955	yes	2,609,547	187	102.9
20+00	1,779,160	211	8,432	yes	1,779,160	211	116.1
22+00	1,114,737	197	5,659	yes	1,114,737	197	108.4
24+00	1,255,826	205	6,126	yes	1,255,826	205	112.8
26+00	1,332,958	189	7,053	yes	1,332,958	189	104.0
28+00	5,196,350	1089	4,772	yes	5,196,350	1,089	599.0
30+00	2,586,125	209	12,374	no			
32+00	1,007,313	93	10,831	no			
				Total	22,658,372	3,263	1794.7

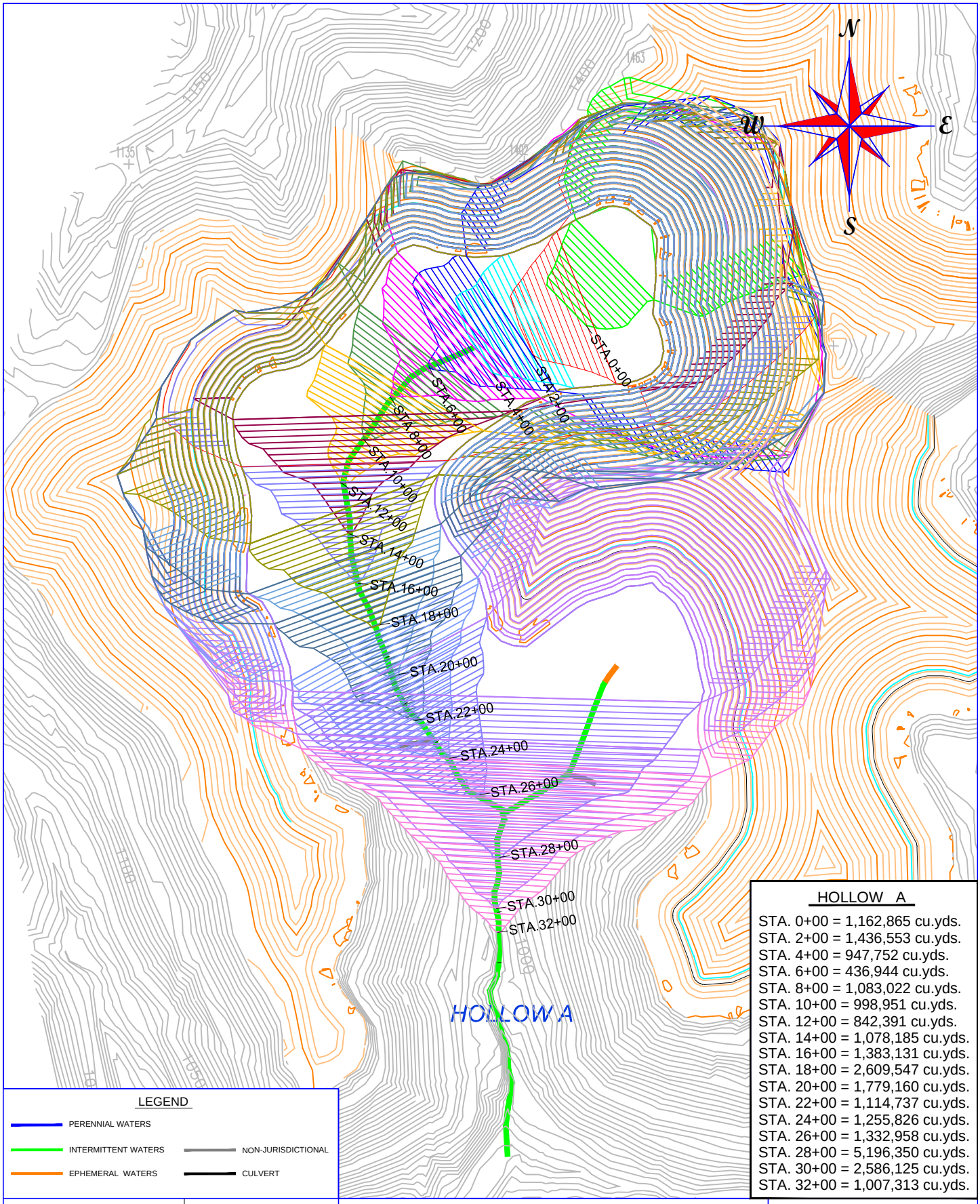
Hollow B - EII = 0.47							
Station	Fill Slice Volume (cubic yards)	Stream Length (linear feet)	Overburden Volume / Linear Foot	Fill Slice Required (yes / no)	Overburden Volume Required (cubic yards)	Stream Length Impacted (linear feet)	EIUs Lost
0+00	642,125	112	5,733	yes	642,125	112	52.6
2+00	367,311	202	1,818	no			
4+00	2,298,795	469	4,901	no			
6+00	1,424,720	200	7,124	no			
8+00	797,922	201	3,970	no			
10+00	905,385	200	4,527	no			
12+00	867,044	196	4,424	no			
				Total	642,125	112	52.6

Hollow C - EII = 0.16							
Station	Fill Slice Volume (cubic yards)	Stream Length (linear feet)	Overburden Volume / Linear Foot	Fill Slice Required (yes / no)	Overburden Volume Required (cubic yards)	Stream Length Impacted (linear feet)	EIUs Lost
0+00	405,782	37	10,967	yes	405,782	37	5.9
2+00	451,284	192	2,350	yes	451,284	192	30.7
				Total	857,066	229	36.6

Hollow F - EII = 0.8							
Station	Fill Slice Volume (cubic yards)	Stream Length (linear feet)	Overburden Volume / Linear Foot	Fill Slice Required (yes / no)	Overburden Volume Required (cubic yards)	Stream Length Impacted (linear feet)	EIUs Lost
0+00	403,309	208	1,939	no			
2+00	583,802	261	2,237	no			
4+00	300,786	208	1,446	no			
6+00	174,672	503	347	no			
				Total	0	0	0.0

Hollow H - EII = 0.3							
Station	Fill Slice Volume (cubic yards)	Stream Length (linear feet)	Overburden Volume / Linear Foot	Fill Slice Required (yes / no)	Overburden Volume Required (cubic yards)	Stream Length Impacted (linear feet)	EIUs Lost
0+00	532,389	195	2,730	yes	532,389	195	58.5
2+00	831,680	192	4,332	yes	831,680	192	57.6
4+00	822,594	199	4,134	yes	822,594	199	59.7
6+00	570,650	201	2,839	yes	570,650	201	60.3
8+00	647,117	198	3,268	yes	647,117	198	59.4
10+00	781,062	202	3,867	yes	781,062	202	60.6
12+00	590,585	209	2,826	yes	590,585	209	62.7
14+00	663,112	204	3,251	yes	663,112	204	61.2
				Total	5,439,189	1,600	480.0

Total Overburden Volume Required (cubic yards)	Total Stream Length Impacted (linear ft)	Total EIU Impact
29,596,752	5,204	2,364



HOLLOW A

STA. 0+00 = 1,162,865 cu.yds.
STA. 2+00 = 1,436,553 cu.yds.
STA. 4+00 = 947,752 cu.yds.
STA. 6+00 = 436,944 cu.yds.
STA. 8+00 = 1,083,022 cu.yds.
STA. 10+00 = 998,951 cu.yds.
STA. 12+00 = 842,391 cu.yds.
STA. 14+00 = 1,078,185 cu.yds.
STA. 16+00 = 1,383,131 cu.yds.
STA. 18+00 = 2,609,547 cu.yds.
STA. 20+00 = 1,779,160 cu.yds.
STA. 22+00 = 1,114,737 cu.yds.
STA. 24+00 = 1,255,826 cu.yds.
STA. 26+00 = 1,332,958 cu.yds.
STA. 28+00 = 5,196,350 cu.yds.
STA. 30+00 = 2,586,125 cu.yds.
STA. 32+00 = 1,007,313 cu.yds.

LEGEND

- PERENNIAL WATERS
- INTERMITTENT WATERS
- EPHEMERAL WATERS
- NON-JURISDICTIONAL
- CULVERT

DATE: 08/08/2014	SCALE: 1"=500'
DRAWN BY: D.HANNAH	

ICG HAZARD, LLC
3228 SUMMIT SQUARE, SUITE 180
LEXINGTON, KY. 40509

VALLEY FILL VOLUMETRICS
TRIAL 2-OPTIMZED
HOLLOW-A

SUMMIT ENGINEERING,INC.
131 Summit Drive
Pikeville, Ky. 41501
(606) 432-1447

Lexington,Ky. Henderson, Ky.
South Charleston,WV. Bridgeport, WV

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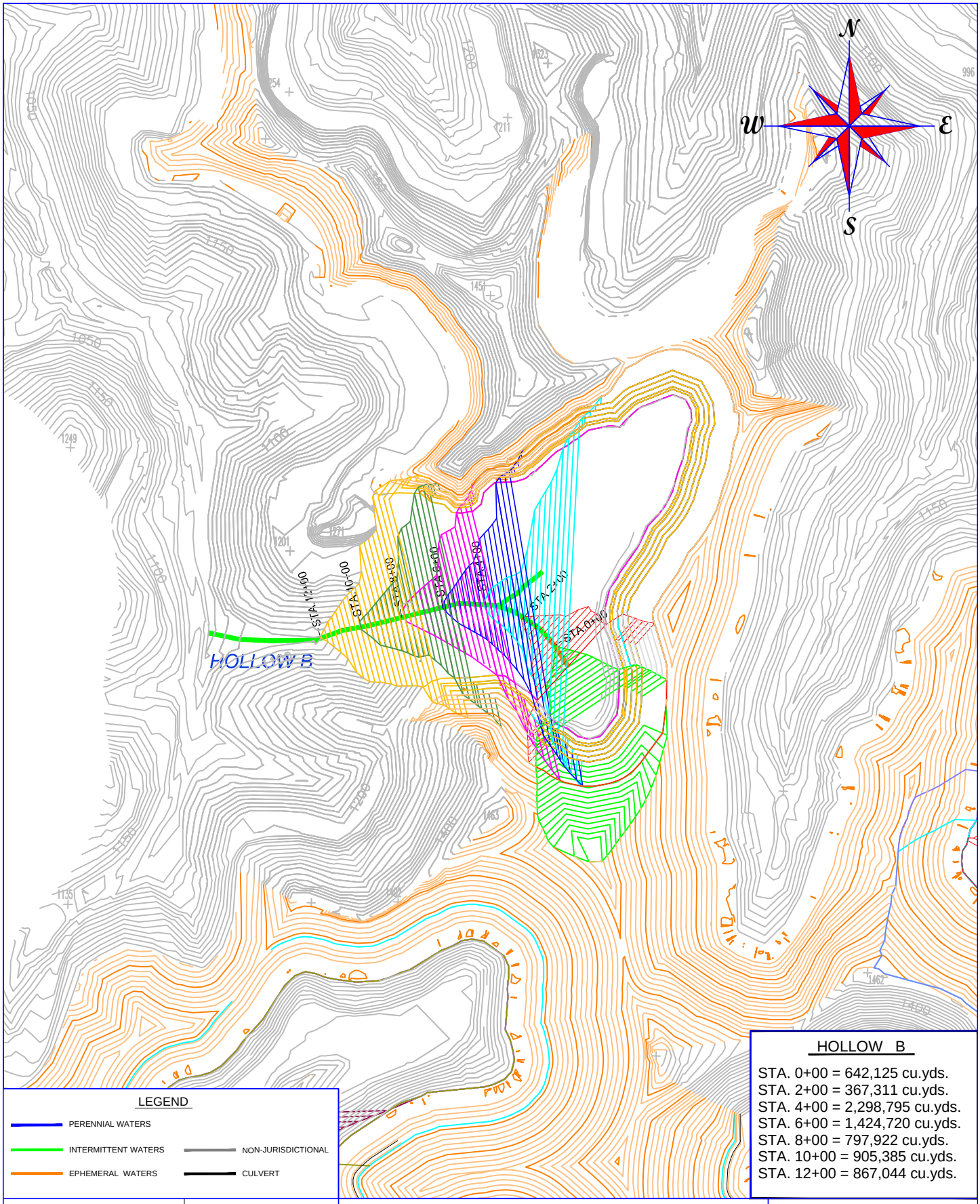

HOLLOW B

STA. 0+00 = 642,125 cu.yds.
STA. 2+00 = 367,311 cu.yds.
STA. 4+00 = 2,298,795 cu.yds.
STA. 6+00 = 1,424,720 cu.yds.
STA. 8+00 = 797,922 cu.yds.
STA. 10+00 = 905,385 cu.yds.
STA. 12+00 = 867,044 cu.yds.

LEGEND

- PERENNIAL WATERS
- INTERMITTENT WATERS
- EPHEMERAL WATERS
- NON-JURISDICTIONAL
- CULVERT

DATE: 08/08/2014	SCALE: 1"=500'
DRAWN BY: D.HANNAH	

ICG HAZARD, LLC
3228 SUMMIT SQUARE, SUITE 180
LEXINGTON, KY. 40509

VALLEY FILL VOLUMETRICS
TRIAL 2-OPTIMZED
HOLLOW-B

SUMMIT ENGINEERING, INC.
131 Summit Drive
Pikeville, Ky. 41501
(606) 432-1447
Lexington, Ky. Henderson, Ky.
South Charleston, WV Bridgeport, WV

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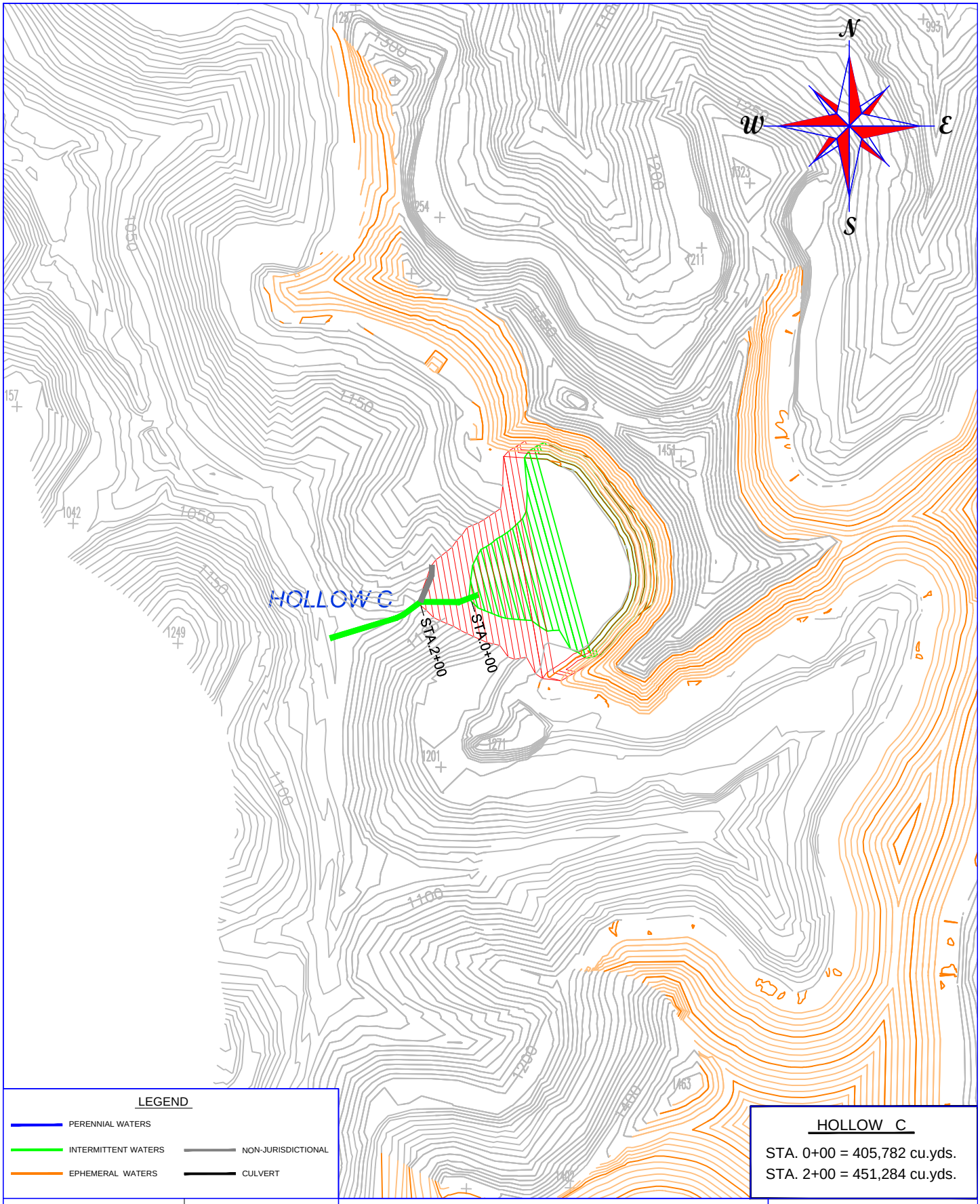

LEGEND

- PERENNIAL WATERS
- INTERMITTENT WATERS
- EPHEMERAL WATERS
- NON-JURISDICTIONAL
- CULVERT

HOLLOW C

STA. 0+00 = 405,782 cu.yds.

STA. 2+00 = 451,284 cu.yds.

DATE: 08/08/2014	SCALE: 1"=500'
DRAWN BY: D.HANNAH	

ICG HAZARD, LLC
3228 SUMMIT SQUARE, SUITE 180
LEXINGTON, KY. 40509

VALLEY FILL VOLUMETRICS
TRIAL 2-OPTIMZED
HOLLOW-C

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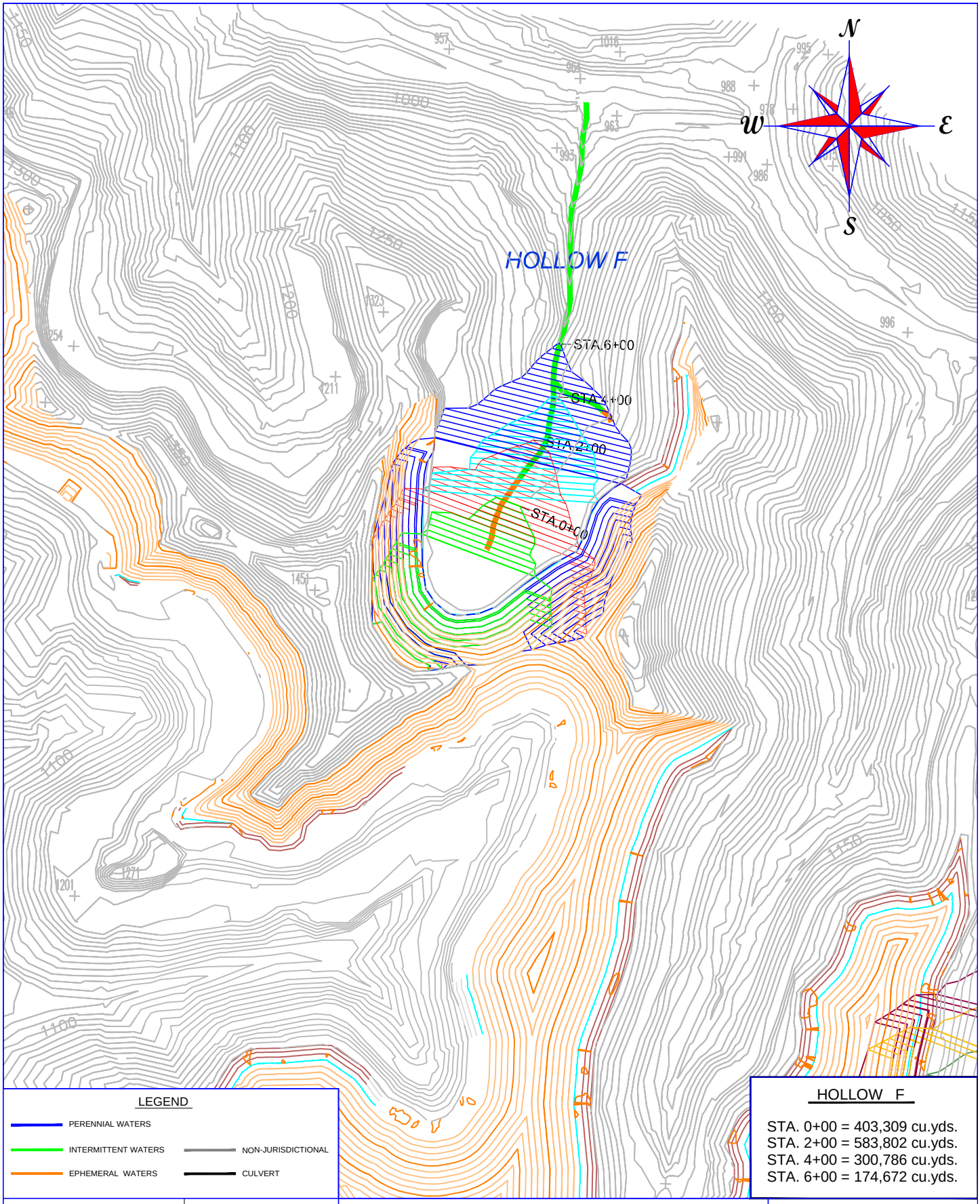
South Charleston,WV. Bridgeport, WV

Z:\ICG\897-0587 (previously 897-0507)\FPOP\FPOP-ICG-897-0587-AUGUST 2014\TRIAL-2\TRIAL-2 HOLLOW-C.dwg



LEGEND

- PERENNIAL WATERS
- INTERMITTENT WATERS
- EPHEMERAL WATERS
- NON-JURISDICTIONAL
- CULVERT

HOLLOW F

STA. 0+00 = 403,309 cu.yds.
STA. 2+00 = 583,802 cu.yds.
STA. 4+00 = 300,786 cu.yds.
STA. 6+00 = 174,672 cu.yds.

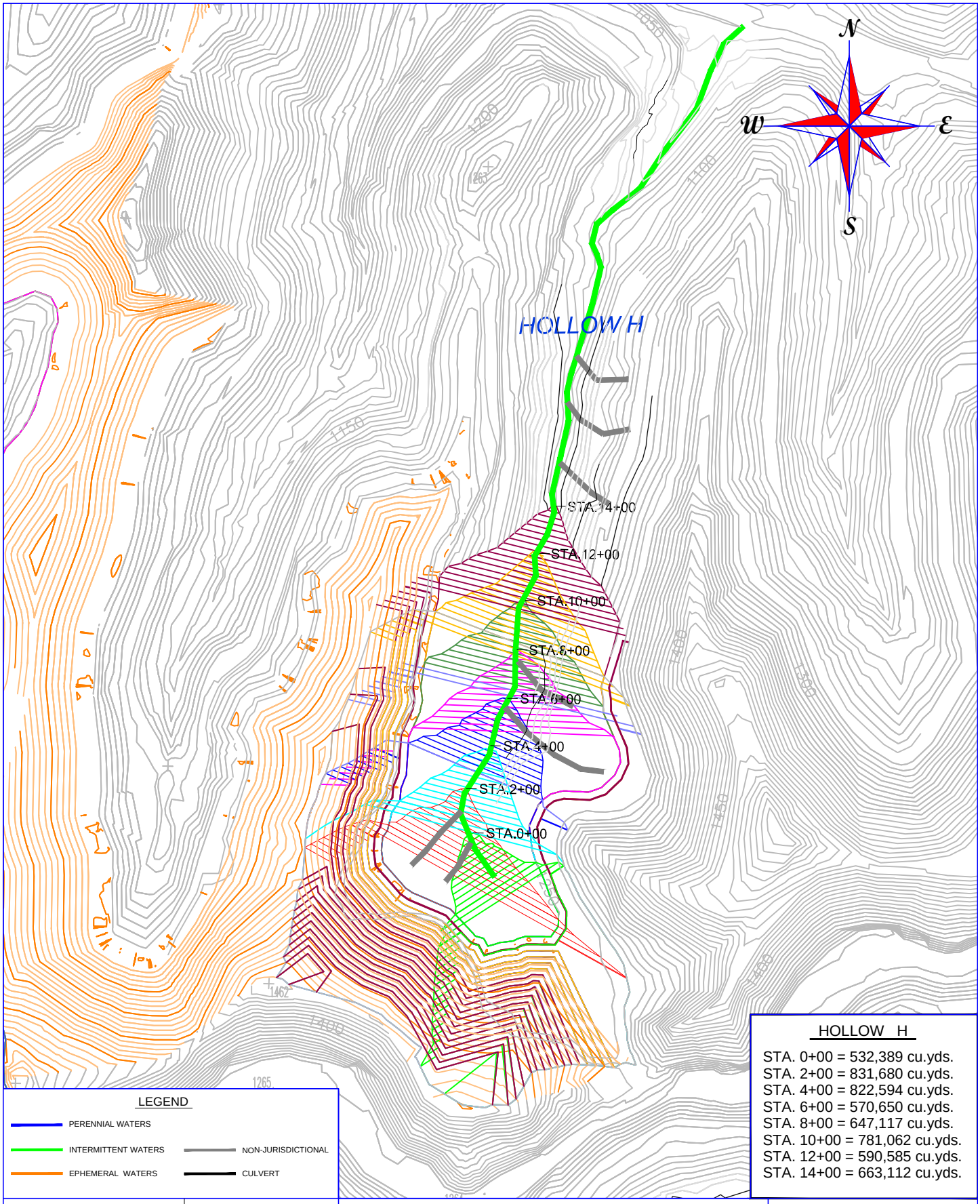
DATE: 06-2012	SCALE: 1"=500'
DRAWN BY: D.HANNAH	

ICG HAZARD, LLC
1021 TORI DRIVE
HAZARD, KY. 41701

VALLEY FILL VOLUMETRICS
TRIAL 2-OPTIMZED
HOLLOW-F

SUMMIT ENGINEERING,INC.
131 Summit Drive
Pikeville, Ky. 41501
(606) 432-1447
Lexington,Ky. Henderson, Ky.
South Charleston,WV. Bridgeport, WV

Z:\ICG\897-0587 (previously 897-0507)\FPOP\FPOP-ICG-897-0587-AUGUST 2014\TRIAL-2\TRIAL-2 HOLLOW-F.dwg



HOLLOW H

STA. 0+00 = 532,389 cu.yds.
STA. 2+00 = 831,680 cu.yds.
STA. 4+00 = 822,594 cu.yds.
STA. 6+00 = 570,650 cu.yds.
STA. 8+00 = 647,117 cu.yds.
STA. 10+00 = 781,062 cu.yds.
STA. 12+00 = 590,585 cu.yds.
STA. 14+00 = 663,112 cu.yds.

LEGEND

- PERENNIAL WATERS
- INTERMITTENT WATERS
- EPHEMERAL WATERS
- NON-JURISDICTIONAL
- CULVERT

DATE: 06-2012	SCALE: 1"=500'
DRAWN BY: D.HANNAH	

ICG HAZARD, LLC
1021 TORI DRIVE
HAZARD, KY. 41701

VALLEY FILL VOLUMETRICS
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HIGH GRADIENT STREAM DATA SHEETS AND EII CALCULATIONS

The High Gradient Stream Data Sheets and EII Calculations used in the FPOP document are attached. To eliminate any confusion, please note the differences in how the hollows/drains are referred to in the field notes, SMCRA application, and FPOP document. These labels correlate in the following manner.

FPOP	SMCRA	Field Notes/Jurisdictional Determination
Hollow A	Hollow Fill 1	Drain 6
Hollow B	n/a	Drain 2
Hollow C	n/a	Drain 3
Hollow F	n/a	UT of Grapevine Creek
Hollow H	n/a	Sugar Camp Br.

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (VERSION 2002.6)
****(Genus/species Level Taxonomy - Riffle Only Sample)****

Project ID:	**ICG**	**897-0507**
Stream/Reach:	**2R UT of Clear Fork (Drain 2)**	
Assessment Objectives:		

NA	**Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)**
0.47	**Ecological Integrity Index (Habitat Integrity + Conductivity)**

>>>>>>>

Enter quantitative or categorical measure from Field Data Sheet in shaded cells

Variables	Measure	Units
RBP Habitat Parameters		
1. Epifaunal Substrate	9	no units (0-20)
2. Embeddedness	10	no units (0-20)
3. Velocity/Depth Regime	7	no units (0-20)
4. Sediment Deposition	8	no units (0-20)
5. Channel Flow Status	6	no units (0-20)
6. Channel Alteration	10	no units (0-20)
7. Freq. Of Riffles (bends)	9	no units (0-20)
8. Bank stability (both combined)	11	no units (0-20)
9. Veg. Protection (both combined)	11	no units (0-20)
10. Riparian Width (both combined)	14	no units (0-20)
Total Habitat Score	**95**	no units
Habitat Integrity		
Macroinvertebrate Data - *Genus/species Level*		
11. Genus/species Taxa Richness		# of taxa sampled
12. Genus/species EPT Richness		# of EPT species sampled
13. % Ephemeroptera		% Mayflies (0-100)
14. % Chironomidae & Oligochaeta		% Midges & Worms (0-100)
15. % Clingers		% Clingers (0-100)
16. mHBI		no units
Macroinvertebrate Bioassessment	**NA**	no units
Conductivity	**205**	microMHOs

	Subindex
Habitat Integrity	**0.10**
Macroinvertebrate Bioassessment	**NA**
Conductivity	**0.84**

Insert Photo Here

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (VERSION 2002.6)
****(Genus/species Level Taxonomy - Riffle Only Sample)****

Project ID:	**ICG**	**897-0507**
Stream/Reach:	**3R UT of Clear Fork (Drain 3)**	
Assessment Objectives:		

NA	**Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)**
0.16	**Ecological Integrity Index (Habitat Integrity + Conductivity)**

>>>>>>>

Enter quantitative or categorical measure from Field Data Sheet in shaded cells

Variables	Measure	Units
RBP Habitat Parameters		
1. Epifaunal Substrate	10	no units (0-20)
2. Embeddedness	11	no units (0-20)
3. Velocity/Depth Regime	8	no units (0-20)
4. Sediment Deposition	10	no units (0-20)
5. Channel Flow Status	7	no units (0-20)
6. Channel Alteration	13	no units (0-20)
7. Freq. Of Riffles (bends)	8	no units (0-20)
8. Bank stability (both combined)	16	no units (0-20)
9. Veg. Protection (both combined)	12	no units (0-20)
10. Riparian Width (both combined)	14	no units (0-20)
Total Habitat Score	**109**	no units
Habitat Integrity		
Macroinvertebrate Data - *Genus/species Level*		
11. Genus/species Taxa Richness		# of taxa sampled
12. Genus/species EPT Richness		# of EPT species sampled
13. % Ephemeroptera		% Mayflies (0-100)
14. % Chironomidae & Oligochaeta		% Midges & Worms (0-100)
15. % Clingers		% Clingers (0-100)
16. mHBI		no units
Macroinvertebrate Bioassessment	**NA**	no units
Conductivity	**491**	microMHOs

	Subindex
Habitat Integrity	**0.19**
Macroinvertebrate Bioassessment	**NA**
Conductivity	**0.12**

Insert Photo Here

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (VERSION 2002.6)
****(Genus/species Level Taxonomy - Riffle Only Sample)****

Project ID:	**ICG**	**897-0507**
Stream/Reach:	**1L UT of Sam Campbell Branch (Drain 6)**	
Assessment Objectives:		

NA	**Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)**
0.55	**Ecological Integrity Index (Habitat Integrity + Conductivity)**

>>>>>>>

Enter quantitative or categorical measure from Field Data Sheet in shaded cells

Variables	Measure	Units
RBP Habitat Parameters		
1. Epifaunal Substrate	15	no units (0-20)
2. Embeddedness	13	no units (0-20)
3. Velocity/Depth Regime	10	no units (0-20)
4. Sediment Deposition	15	no units (0-20)
5. Channel Flow Status	14	no units (0-20)
6. Channel Alteration	11	no units (0-20)
7. Freq. Of Riffles (bends)	18	no units (0-20)
8. Bank stability (both combined)	16	no units (0-20)
9. Veg. Protection (both combined)	14	no units (0-20)
10. Riparian Width (both combined)	16	no units (0-20)
Total Habitat Score	**142**	no units
Habitat Integrity		
Macroinvertebrate Data - *Genus/species Level*		
11. Genus/species Taxa Richness		# of taxa sampled
12. Genus/species EPT Richness		# of EPT species sampled
13. % Ephemeroptera		% Mayflies (0-100)
14. % Chironomidae & Oligochaeta		% Midges & Worms (0-100)
15. % Clingers		% Clingers (0-100)
16. mHBI		no units
Macroinvertebrate Bioassessment	**NA**	no units
Conductivity	**304**	microMHOs

	Subindex
Habitat Integrity	**0.53**
Macroinvertebrate Bioassessment	**NA**
Conductivity	**0.56**

Insert Photo Here

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (Version 2002.6)
****(Family Level Taxonomy - All Habitats)****

Project ID: ICG 897-0543 A2

Stream/Reach: Sugarcamp Br - Hollow H

Assessment Objectives:

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.30	Ecological Integrity Index (Habitat Integrity + Conductivity)

>>>>>>>

Enter quantitative or categorical measure from Field Data Sheet in shaded cells

Variables	Measure	Units	Subindex
RBP Habitat Parameters			
1. Epifaunal Substrate	16	no units	
2. Embeddedness	10	no units	
3. Velocity/Depth Regime	13	no units	
4. Sediment Deposition	8	no units	
5. Channel Flow Status	13	no units	
6. Channel Alteration	18	no units	
7. Freq. Of Riffles (bends)	17	no units	
8. Bank stability (both combined)	10	no units	
9. Veg. Protection (both combined)	18	no units	
10. Riparian Width (both combined)	16	no units	
Total Habitat Score	**139**	no units	**Subindex**
Habitat Integrity Index			**0.49**
Macroinvertebrate Data - Family Level (All Habitats)			
11. Family Taxa Richness		# of taxa sampled	
12. Family EPT Richness		# of EPT species sampled	
13. % Ephemeroptera		% Mayflies (0-100)	
14. % Chironomidae & Oligochaeta		% Midges & Worms (0-100)	
15. mFBI		no units	
Macroinvertebrate Bioassessment	**NA**	no units	**NA**
Conductivity	**904**	microMHOs	**0.10**

Insert Photo Here

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (Version 2002.6)
****(Family Level Taxonomy - All Habitats)****

Project ID: ICG 897-0543 A2

Stream/Reach: UT of Grapevine - Hollow F

Assessment Objectives:

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.80	Ecological Integrity Index (Habitat Integrity + Conductivity)

>>>>>>>

Enter quantitative or categorical measure from Field Data Sheet in shaded cells

Variables	Measure	Units	Subindex
RBP Habitat Parameters			
1. Epifaunal Substrate	20	no units	
2. Embeddedness	15	no units	
3. Velocity/Depth Regime	15	no units	
4. Sediment Deposition	12	no units	
5. Channel Flow Status	16	no units	
6. Channel Alteration	20	no units	
7. Freq. Of Riffles (bends)	17	no units	
8. Bank stability (both combined)	20	no units	
9. Veg. Protection (both combined)	20	no units	
10. Riparian Width (both combined)	20	no units	
Total Habitat Score	175	no units	
Habitat Integrity Index			1.00
Macroinvertebrate Data - Family Level (All Habitats)			
11. Family Taxa Richness		# of taxa sampled	
12. Family EPT Richness		# of EPT species sampled	
13. % Ephemeroptera		% Mayflies (0-100)	
14. % Chironomidae & Oligochaeta		% Midges & Worms (0-100)	
15. mFBI		no units	
Macroinvertebrate Bioassessment	NA	no units	NA
Conductivity	293	microMHOs	0.59

Insert Photo Here

High Gradient Stream Data Sheet

Stream Name: ut of ~~Clear~~ Clear Fork (Drain 2)	Location: Perry County / Clear Fk.
Station No.: Mile:	Basin / Watershed: Clear FK
Lat.: 37-20-02 Long.: 83-16-57	County: Perry USGS 7.5 Topo: Krypton
Date: 2/24/09 Time: 1:30 ☐ am ☑ pm	Investigators: CR & TM

SAMPLE TYPE: θ PHYSICAL CHEMISTRY θ MACROINVERTEBRATE θ FISH θ BACTERIA

WEATHER: Now / Past 24 hours
- θ / θ Heavy rain
- θ / θ Steady rain
- θ / θ Intermittent showers
- ~~θ~~ / ~~θ~~ Clear/sunny

Has there been a heavy rain in the last 7 days? θ Yes ~~θ No~~
Inches rainfall in past 24 hours _____ in. 1-2in snow
10 % Cloud Cover
Air Temperature: 40 °F °C.

P-Chem: Temp(°C) _____ D.O. (mg/l) _____ %Saturation _____ pH(S.U.) _____ Conductivity 205 θ Grab

INSTREAM WATERSHED FEATURES:

Stream Width	5 ft
Range of Depth	1.5-2.5 ft
Average Velocity	0.6/5 ft/s
Discharge	_____ cfs
Est. Reach Length	100 ft

LOCAL WATERSHED FEATURES:
Predominant Surrounding Land Use:

~~θ~~ Surface Mining	θ Construction	~~θ~~ Forest
~~θ~~ Deep Mining	θ Commercial	θ Pasture/Grazing
θ Oil Wells	θ Industrial	~~θ~~ Silviculture
θ Land Disposal	θ Row Crops	θ Urban Runoff/Storm Sewers

Hydraulic Structures: θ Dams θ Bridge Abutments θ Island θ Waterfalls θ Other

Stream Flow: θ Dry θ Pooled ~~θ~~ Low ~~θ~~ Normal θ High θ Very Rapid or Torrential

Stream Type: θ Perennial ~~θ~~ Intermittent ~~θ~~ Ephemeral θ Seep

Riparian Vegetation: Dom. Tree/Shrub Taxa
Dominant Type: ~~θ~~ Trees ~~θ~~ Shrubs ~~θ~~ Grasses θ Herbaceous
Number of strata 0

Canopy Cover: θ Fully Exposed (0-25%) θ Partially Exposed (25-50%) ~~θ~~ Partially Shaded (50-75%) θ Fully Shaded (75-100%)

Channel Alterations: θ Dredging θ Channelization (θ Full θ Partial)

Substrate θEst. θP.C.		Riffle: 65%	Run: %	Pool: 35%
Silt/Clay	(<0.06 mm)	20		30
Sand	(0.06 – 2 mm)	25		25
Gravel	(2-64 mm)	15		20
Cobble	(64 – 256 mm)	20		15
Boulders	(>256 mm)	20		10
Bedrock		0		0

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate / Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0
3. Velocity / Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ____ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ____ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ____(LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ____(RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ____(LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ____(RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score

NOTES/COMMENTS:

High Gradient Stream Data Sheet

Stream Name: Drain 3 (UT of Clear Fork)	Location: Perry County
Station No.: 0450 Mile:	Basin / Watershed: Clear Fork
Lat.: 37-20-12 Long.: 83-16-58	County: Perry USGS 7.5 Topo:
Date: 2/24/09 Time: 1:15 ☐ am ☒ pm	Investigators: TM + CR

SAMPLE TYPE: θ PHYSICAL CHEMISTRY θ MACROINVERTEBRATE θ FISH θ BACTERIA

WEATHER:

Now	Past 24 hours	
θ	θ	Heavy rain
θ	θ	Steady rain
θ	θ	Intermittent showers
θ	θ	Clear/sunny

Has there been a heavy rain in the last 7 days? θ Yes θ No

Inches rainfall in past 24 hours _____ in.

10 % Cloud Cover

Air Temperature: 40 °C.

1-2 in snow

P-Chem: Temp(°C) _____ D.O. (mg/l) _____ %Saturation _____ pH(S.U.) _____ Conductivity 491 θ Grab

INSTREAM WATERSHED FEATURES:

Stream Width 3.5 ft
Range of Depth 0.25-0.5 ft
Average Velocity too little flow ft/s
Discharge _____ cfs
Est. Reach Length 100 ft

LOCAL WATERSHED FEATURES:
Predominant Surrounding Land Use:

(θ) Surface Mining	θ Construction	(θ) Forest
(θ) Deep Mining	θ Commercial	θ Pasture/Grazing
θ Oil Wells	θ Industrial	θ Silviculture
θ Land Disposal	θ Row Crops	θ Urban Runoff/Storm Sewers

Hydraulic Structures:
θ Dams θ Bridge Abutments
θ Island θ Waterfalls
θ Other

Stream Flow:
θ Dry θ Pooled θ Low (θ) Normal
θ High θ Very Rapid or Torrential

Stream Type:
θ Perennial (θ) Intermittent
θ Ephemeral θ Seep

Riparian Vegetation:
Dominant Type:
(θ) Trees (θ) Shrubs
θ Grasses θ Herbaceous
Number of strata 0

Dom. Tree/Shrub Taxa
Sycamore
oak
hemlock

Canopy Cover:
θ Fully Exposed (0-25%)
θ Partially Exposed (25-50%)
θ Partially Shaded (50-75%)
(θ) Fully Shaded (75-100%)

Channel Alterations:
θ Dredging
θ Channelization
(θ Full θ Partial)

Substrate θEst. θP.C.		Riffle: 25 %	Run: %	Pool: 75 %
Silt/Clay	(<0.06 mm)	15		15
Sand	(0.06 – 2 mm)	15		20
Gravel	(2-64 mm)	25		30
Cobble	(64 – 256 mm)	35		20
Boulders	(>256 mm)	10		15
Bedrock		0		0

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate / Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
3. Velocity / Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ____ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ____ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ____(LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ____(RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ____(LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ____(RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score

NOTES/COMMENTS:

High Gradient Stream Data Sheet

Stream Name: Drain 6	Location: ~~[illegible]~~ : MT of Sam Campbell Branch
Station No.: Mile :	Basin / Watershed : North Fork of KY river
Lat. : Long. :	County : Perry USGS 7.5 Topo : Keyston
Date : 3/30/09 Time: 17 ☐ am ☐ pm	Investigators : CK & T.M.

SAMPLE TYPE: θ PHYSICAL CHEMISTRY θ MACROINVERTEBRATE θ FISH θ BACTERIA

WEATHER:

Now	Past 24 hours	
θ	θ	Heavy rain
θ	θ	Steady rain
θ	(θ)	Intermittent showers
(θ)	θ	Clear/sunny

Has there been a heavy rain in the last 7 days? θ Yes θ No

Inches rainfall in past 24 hours 1 in.

30% % Cloud Cover

Air Temperature : 53 °C.

P-Chem: Temp(°C) _____ D.O. (mg/l) _____ %Saturation _____ pH(S.U.) _____ Conductivity 304 θ Grab

INSTREAM WATERSHED FEATURES:

Stream Width 3 ft

Range of Depth .1 ~~[illegible]~~ -.5 ft

Average Velocity 4-8 ft/s

Discharge _____ cfs

Est. Reach Length _____ ft

LOCAL WATERSHED FEATURES:

Predominant Surrounding Land Use:

(θ) Surface Mining	θ Construction	(θ) Forest
θ Deep Mining	θ Commercial	θ Pasture/Grazing
θ Oil Wells	θ Industrial	θ Silviculture
θ Land Disposal	θ Row Crops	θ Urban Runoff/Storm Sewers

Hydraulic Structures:

θ Dams θ Bridge Abutments

θ Island θ Waterfalls

θ Other

Stream Flow:

θ Dry θ Pooled θ Low (θ) Normal

θ High θ Very Rapid or Torrential

Stream Type:

θ Perennial (θ) Intermittent

(θ) Ephemeral θ Seep

Riparian Vegetation: Dom. Tree/Shrub Taxa

Dominant Type:

(θ) Trees θ Shrubs

θ Grasses (θ) Herbaceous

Number of strata _____

Sycamore, Oak, beech

Canopy Cover:

θ Fully Exposed (0-25%)

θ Partially Exposed (25-50%)

θ Partially Shaded (50-75%)

(θ) Fully Shaded (75-100%)

Channel Alterations:

θ Dredging

(θ) Channelization

(θ Full (θ) Partial)

Substrate θEst. θP.C.		Riffle : 90%	Run : %	Pool : 10 %
Silt/Clay	(<0.06 mm)	~~[illegible]~~ 15		20
Sand	(0.06 – 2 mm)	~~[illegible]~~ 15		20
Gravel	(2-64 mm)	~~[illegible]~~ 20		20
Cobble	(64 – 256 mm)	30		15
Boulders	(>256 mm)	20		5
Bedrock				

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate / Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity / Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently, pools almost absent due to substantial sediment deposition
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ____ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ____ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
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SCORE ____ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ____ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ____ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 142

NOTES/COMMENTS:

High Gradient Stream Data Sheet

STREAM NAME: UT of ~~Bedelvein~~ Grapevine Creek	LOCATION: ~~Bedelvein~~ Grapevine Creek/Rt 28
STATION #: 500 MILE:	BASIN/WATERSHED:
LAT.: 37-20-36.4 LONG.: 83-16-26.4	COUNTY: USGS 7.5 TOPO:
DATE: 5/25/12 TIME: 1700 ☐AM ☒PM	INVESTIGATORS:
TYPE OF SAMPLE Macroinvertebrate FISH BACT.	

WEATHER: Sunny

Now	Past 24 hours
☐	☐Heavy rain
☐	☐Steady rain
☐	☐Intermittent showers
☒	☒Clear/sunny

Has there been a heavy rain in the last 7 days? ☒Yes ☐No

Air Temperature 82 °F. Inches rainfall in past 24 hours 0 in.

10 % Cloud Cover

P-Chem: ☐Temp(°C) 16.1 ☐D.O. 9.44 ☐%Saturation NA ☐pH(S.U.) 9.0 ☐Cond. 293 Grab ☒

INSTREAM WATERSHED FEATURES:

Stream Width	5 ft
Range of Depth	.85-1.2 ft
Average Velocity	.5 ft/s
Discharge	cfs
Est. Reach Length	100 ft

LOCAL WATERSHED FEATUREES:

Predominant Surrounding Land Use:

☒Surface Mining ☐Construction ☒Forest
☐Deep Mining ☐Commercial ☐Pasture/Grazing
☐Oil or Gas Wells ☐Industrial ☐Silviculture
☐Land Disposal ☐Row Crops ☒Urban Runoff/Storm Sewers

Hydraulic Structures:
☐Dams ☐Bridge Abutments
☐Island ☐Waterfalls
☐Other

Stream Flow:
☐Dry ☐Pooled ☐Low ☒Normal
☐High ☐Very Rapid or Torrential

Stream Type:
☐Perennial ☒Intermittent
☐Ephemeral ☐Seep

Riparian Vegetation:
Dominate Type:
☒Trees ☒Shrubs
☐Grasses ☒Herbaceous
Number of strata ____

Dom. Tree/Shrub Taxa: eastern Hemlock, southern running pine, Am Beech, Ironwood, Umbrella tree, Bl. walnut, Sugar maple, Tulip tree, Nettlewood, Christmas fern, Spice bush, red maple, maple

Canopy Cover:
Fully Exposed (0-25%)
Partially Exposed (25-50%)
Partially Shaded (50-75%)
Fully Shaded (75-100%)

Channel Alterations:
☐Dredging
☐Channelization
(☐Full ☐Partial)

Substrate Est. P.C.	Riffle 60 %	Run 30 %	Pool 10 %
Silt/Clay (<0.06 mm)	20	Ø	75
Sand (0.06 – 2 mm)	10	Ø	10
Gravel (2-64 mm)	10	Ø	10
Cobble (64 – 256 mm)	5	5	5
Boulders (>256 mm)	5	5	Ø
Bedrock	50	90	Ø

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
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2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
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SCORE	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
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SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
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SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
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SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
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SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score **NOTES/COMMENTS:**

SUMMIT ENGINEERING, INC.
FIELD DATA SHEET AND RBP FOR HIGH GRADIENT STREAMS

Stream Name	UT of Grapevine Creek	**Client**	ICG
Site Number	Sugar Camp 18	**Project Name**	0543
Latitude (dd-mm-ss)	37-20-22 @ confluence.	**County**	Perry
Longitude (dd-mm-ss)	83-15-55	**Quadrangle**	
General Location	US residential home.	**Field Technician(s)**	CAR / PJ
Reach Length	100ft	**Date & Time**	6-4-12 – 12:00pm

WEATHER CONDITIONS

Weather Now	☑ Sunny	☐ Steady Rain	**Weather Past 24 Hours**	☑ Sunny	☐ Steady Rain	**Weather Last 7 Days**	☑ Sunny	☐ Steady Rain
	☐ Cloudy	☐ Heavy Rain		☐ Cloudy	☐ Heavy Rain		☐ Cloudy	☐ Heavy Rain
	☐ Showers	☐ Temp: 75 °F		☐ Showers	☐ Snow		☑ Showers	☐ Snow

FIELD WATER CHEMISTRY DATA & PHOTOS

pH (S.U.)	Temperature (°C)	Dissolved O_2 (mg/L)	Conductivity (µS)	Velocity (ft/s)	Picture #
5.2	16.7	8.68	904	2.25	112-5401-03

STREAM CLASSIFICATION

Stream Subsystem	☐ Ephemeral	☑ Intermittent	☐ Perennial		
Stream Type	√ **High-Gradient**	☑ Headwater	☐ Wadeable	☐ Warm-water	☐ Cold-water
Odors	☑ None	☐ Sewage	☐ Petroleum	☑ Fishy (sulfur)	☐ Chemical
Surface Oils	☑ None	☐ Slick	☐ Sheen	☐ Globs	☐ Flecks
Turbidity	☑ Clear	☐ Slightly turbid	☐ Turbid	☐ Opaque	☐ Stained

CROSS-SECTION DATA & FLOW

Across (ft)	0	.5	1	1.5	2								
Depth (in)	0	1.0	1.0	1.0	0								

Stream Flow Observed	☐ Dry	☐ Pooled	☐ Low	☑ Normal	**Area (sq. ft)**	
	☐ High	☐ Very Rapid			**Flow (cfs)**	

PHYSICAL DESCRIPTIONS

Immediate Land Use & Structures	☑ Heavy Forest ☐ Partial Forest ☐ Field ☐ Logging ☐ Agricultural ☑ Residential ☐ Commercial ☐ Industrial			
	☐ Bridge ☐ Culvert ☐ Dam ☐ Other:			
Vegetation Assessment	☑ Trees	☐ Fully Exposed (0-25%)	**Vegetative Species**	
	☐ Grasses	☐ Partially Exposed (25-50%)	umbrella, beech, s. maple, spice bush	
	☐ Shrubs	☐ Partially Shaded (50-75%)	yellow poplar, hemlock, r. maple,	
	☑ Herbaceous	☑ Fully Shaded (75-100%)	hornbeam, nettleweed, xmas fern	
Describe Substrate/ Riffle Variability	good: cobble & gravel. Some heavy silt depo. Little sand. few boulders.		**Riffle** 60 % **Pool** 20 % **Run** 20 %	

AQUATIC LIFE		ADDITIONAL COMMENTS		HABITAT SAMPLED	AMOUNT
Salamanders	☐	• water gliders	☐	**Undercut/Root** (6 jabs & 1 for roots)	
Crayfish	☐	• strong sulfur smell	☐	**Aquatic Vegetation/Justicia** (3 jabs)	
Frogs	☐		☐	**Woody Debris** [H=2-4 m, W=3-6 m]	
Mollusks	☐		☐	**Rocks Picks** [H=5 (pools), W=15]	
Fishes	☑		☐	**Sieved Sediments** [3 (1 from ea regime)]	
Beaver Damage	☐		☐	**Bedrock** [3 sweeps (pool/run)]	
Algae/Periphyton	☐		☐	**Leaf Packs** [9 (3 from ea regime)]	
Aquatic Vegetation	☐		☐	**Aufwuchs** (3 jabs)	

Stream Name	UT	Site Number	

HIGH GRADIENT RAPID BIOASSESSMENT PROTOCOL DATA SHEET

Parameter	Optimal	Suboptimal	Marginal	Poor
Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new-fall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Embeddedness *RIFFLES///*	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow).	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Sediment Deposition *POOLS///*	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging.	Channelization may be extensive; embankments or shoring structures present on both banks	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In-stream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Riffle Frequency (or bends)	Occurrence of riffles relatively frequent; variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Vegetative Protection (score each bank)	More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the stream bank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the stream bank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score:

APPENDIX F

Endangered Species and Cultural Resources Letters

Gibson, Don

From: Travis N. Lowe [tlowe@atsone.com]
Sent: Thursday, September 10, 2009 10:09 AM
To: Gibson, Don
Subject: FW: ATS Indiana Bat Survey Reports

FYI

From: Carrie_Lona@fws.gov [mailto:Carrie_Lona@fws.gov]
Sent: Thursday, September 10, 2009 10:01 AM
To: david.e.baldridge2@usace.army.mil
Cc: Travis N. Lowe
Subject: ATS Indiana Bat Survey Reports

Mr. David Baldridge
U.S. Army Corps of Engineers

Dear Mr. Baldridge:

The Fish and Wildlife Service (Service) has reviewed the following Indiana Bat Summer Mist Net Survey and Winter Habitat Assessment reports submitted by Appalachian Technical Services, Inc. on behalf of ICG Hazard, LLC. At this time, we do not have COE reference numbers, so projects are listed by their SMCRA application number.

DNR 813-0294, AM-1 for ICG Hazard, LLC in Breathitt County (FWS 2007-B-0133)
DNR 813-0315 for ICG Hazard, LLC in Breathitt County (FWS 2007-B-0150)
DNR 897-0486, AM-1 for ICG Hazard in Perry County (FWS 2009-B-1045)
DNR 813-0331 for ICG Hazard, LLC in Breathitt County (FWS 2009-B-0126)
DNR 897-0507 for ICG Hazard, LLC in Perry County (FWS 2009-B-0237)
DNR 897-0508 for ICG Hazard, LLC in Perry County (FWS 2009-B-0238)
DNR 866-5149 for ICG Hazard, LLC in Leslie County (FWS 2009-B-0279)
DNR 813-5028 for ICG Hazard, LLC in Breathitt County (FWS 2009-B-0657)
DNR 813-5029 for ICG Hazard, LLC in Breathitt County (FWS 2009-B-0397)
DNR 866-0281, AM-9 for ICG Hazard, LLC in Leslie County (FWS 2009-B-0062)

We find the surveys acceptable. No Indiana bats were captured and no potential Indiana bat winter habitat was identified onsite. Therefore, we believe that any potential effects to summer and/or winter habitat of the Indiana bat would not be attributable to the COE permitting process and the requirements of Section 7 have been satisfied. The comments provided above have been submitted electronically (e-mail) to expedite the COE processing of the subject application(s). These comments have been discussed and approved by Mr. Virgil Lee Andrews, Jr., Field Supervisor and therefore should be considered the comments of the Service and Kentucky Field Office. We appreciate the opportunity to provide input on the proposed project(s). If you have any questions on this comment letter or its contents, please contact me at (502) 695-0468, Ext. 103.

Carrie L. Lona
U.S. Fish and Wildlife Service
330 W. Broadway, Rm. 265
Frankfort, KY 40601
502-695-0468 ext. 103
"In wilderness is the preservation of the world."
~Henry David Thoreau

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Appalachian Technical Services, Inc., P.O. Box 3537, Wise, VA 24293, USA, www.atsone.com

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Kentucky Ecological Services Field Office
330 West Broadway, Suite 265
Frankfort, Kentucky 40601
(502) 695-0468

Indiana Bat Summer Survey and Winter Habitat Assessment Report For Surface Mining Projects

Date: 9/15/2011

Project Information

KYFO No: 2011-B-0556

Project Name: ICG Hazard, DNR 897-0543, AM-2

Location: Perry County, KY

Acreage: 138.75

Mist Net Sites: 2

Surveyor: ATS

On Behalf of: ICG Hazard

Exp. Date: July 17, 2016

The U.S. Fish and Wildlife Service's Kentucky Field Office (KYFO) has reviewed an Indiana Bat Summer Mist Net Survey and Winter Habitat Assessment report for the above-referenced project. No Indiana bats were captured and no potential Indiana bat winter habitat was identified onsite. We find the survey acceptable and believe that any potential effects to summer and/or winter habitat of the Indiana bat would not be attributable to the Kentucky Department of Natural Resources (DNR) or the U.S. Army Corps of Engineers (COE) permitting process. Pursuant to the Range-wide Indiana Bat Protection and Enhancement Plan Guidelines (2009), the results of this survey are valid for a period of five years. These comments have been discussed and approved by Mr. Virgil Lee Andrews, Jr., Field Supervisor and therefore should be considered the comments of the KYFO. If you have any questions regarding this letter, please contact me at (502) 695-0468, Ext. 103.

Sincerely,

CLAllison

Carrie L. Allison
Fish and Wildlife Biologist

SCANNED

08-1008

ENERGY AND ENVIRONMENT CABINET
DEPARTMENT FOR NATURAL RESOURCES

Steven L. Beshear
Governor

Division of Mine Permits
2 Hudson Hollow
Frankfort, Kentucky 40601
Phone (502) 564-2320
Fax (502) 564-6764
www.minepermits.ky.gov

Leonard K. Peters
Secretary

Carl E. Campbell
Commissioner

August 12, 2009

STEPHEN R. TACKETT
SUMMIT ENGINEERING, INC.
P.O. BOX 1035
HAZARD, KENTUCKY 41701

RE: ICG Hazard, LLC
Application # 897-0507, NW

Dear Mr. Tackett:

This office recently received the report, "A Cultural Resource Survey of the Proposed ICG Hazard, LLC, Coal Mine Operation Along Abes Branch in Perry County, Kentucky (Permit Application Number 897-0507)," prepared by Geroge C. Arnold of Cultural Resource Analysts, Inc. This report presents the results of a preliminary reconnaissance survey of the above referenced permit application.

During the course of the archaeological investigation, one historic cemetery, 15Pe230, was recorded and a previously recorded cemetery, 15Pe207, was revisited. Both cemeteries are shown on the comprehensive MRP with 100-foot buffer zones. As long as the cemeteries are protected, no sites eligible for listing in the National Register of Historic Places will be impacted by the proposed mining operation. Therefore, the investigator has **recommended that no additional work be conducted within this area**. Division of Mine Permits personnel and the State Historic Preservation Officer have reviewed the author's methodology and conclusions, and concur with this recommendation. A copy of the SHPO comments is attached for your information.

The Department now considers the applicant to have successfully completed the permitting requirement to consider and protect significant cultural resources for the subject permit application. If you have any questions concerning this matter, please contact the Critical Resources Review Section at (502) 564-2320.

Sincerely,

Davie R. Ransdell

Davie Ransdell, Supervisor
Critical Resources Review Section
Division of Mine Permits

c: Rose Moore (e)
Permit File Darcie Jarman (e)
Cultural Resource Analysts, Inc., 151 Walton Ave.,
Lexington, KY 40508
Mark Dennen, SHPO (e)

10-1033

ENERGY AND ENVIRONMENT CABINET
DEPARTMENT FOR NATURAL RESOURCES

Steven L. Beshear
Governor

Division of Mine Permits
2 Hudson Hollow
Frankfort, Kentucky 40601
Phone (502) 564-2320
Fax (502) 564-6764
www.minepermits.ky.gov

Leonard K. Peters
Secretary

Carl E. Campbell
Commissioner

November 28, 2011

STEPHEN R. TACKETT
SUMMIT ENGINEERING, INC.
P. O. BOX 1035
HAZARD, KENTUCKY 41703

RE: ICG Hazard, LLC
Application # 897-0543 AM 2

Dear Mr. Tackett,

This office recently received the report, "A Cultural Resource Survey of a Proposed Amendment to the Existing ICG Hazard, LLC, Coal Mine Operation along Sam Campbell Branch in Perry County, Kentucky," prepared by George C. Arnold of Cultural Resource Analysts, Inc. This report presents the results of a preliminary reconnaissance survey of the above referenced permit application.

During the course of the archaeological investigation, no cultural properties were found. It was determined that no sites eligible for listing in the National Register of Historic Places exist within the proposed permit area. Therefore, the investigator has **recommended that no additional work be conducted within this area**. Division of Mine Permits personnel and the State Historic Preservation Officer have reviewed the author's methods and conclusions, and **concur with this recommendation**. A copy of the SHPO comments is attached for your information.

The Department now considers the applicant to have **successfully completed the permitting requirement** to consider and protect significant cultural resources for the subject permit application. If you have any questions concerning this matter, please contact me at the Critical Resources Review Section, at (502) 564-2320.

Sincerely,

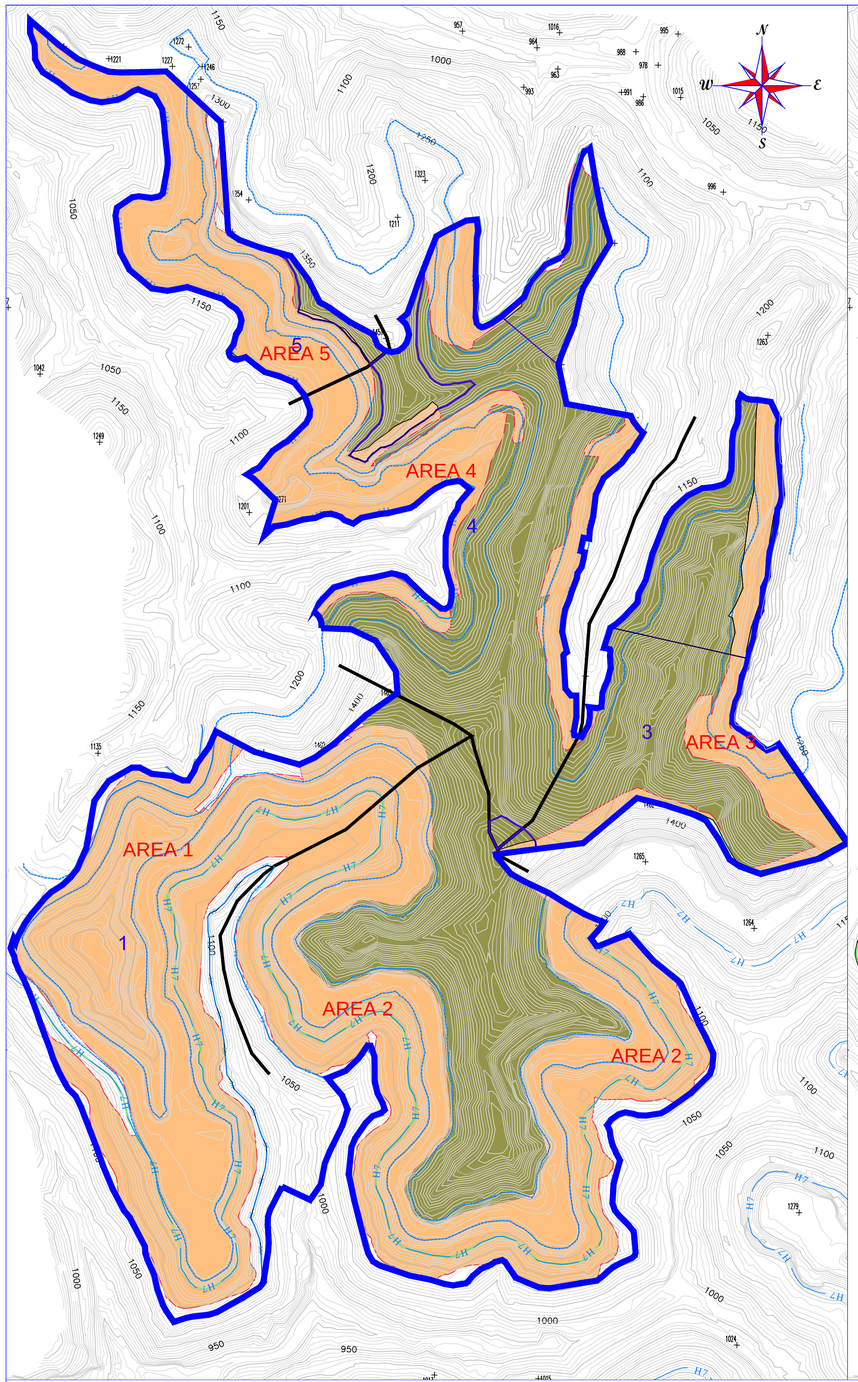
Davie R. Ransdell

Ms. Davie Ransdell, Supervisor
Critical Resources Review Section
Division of Mine Permits

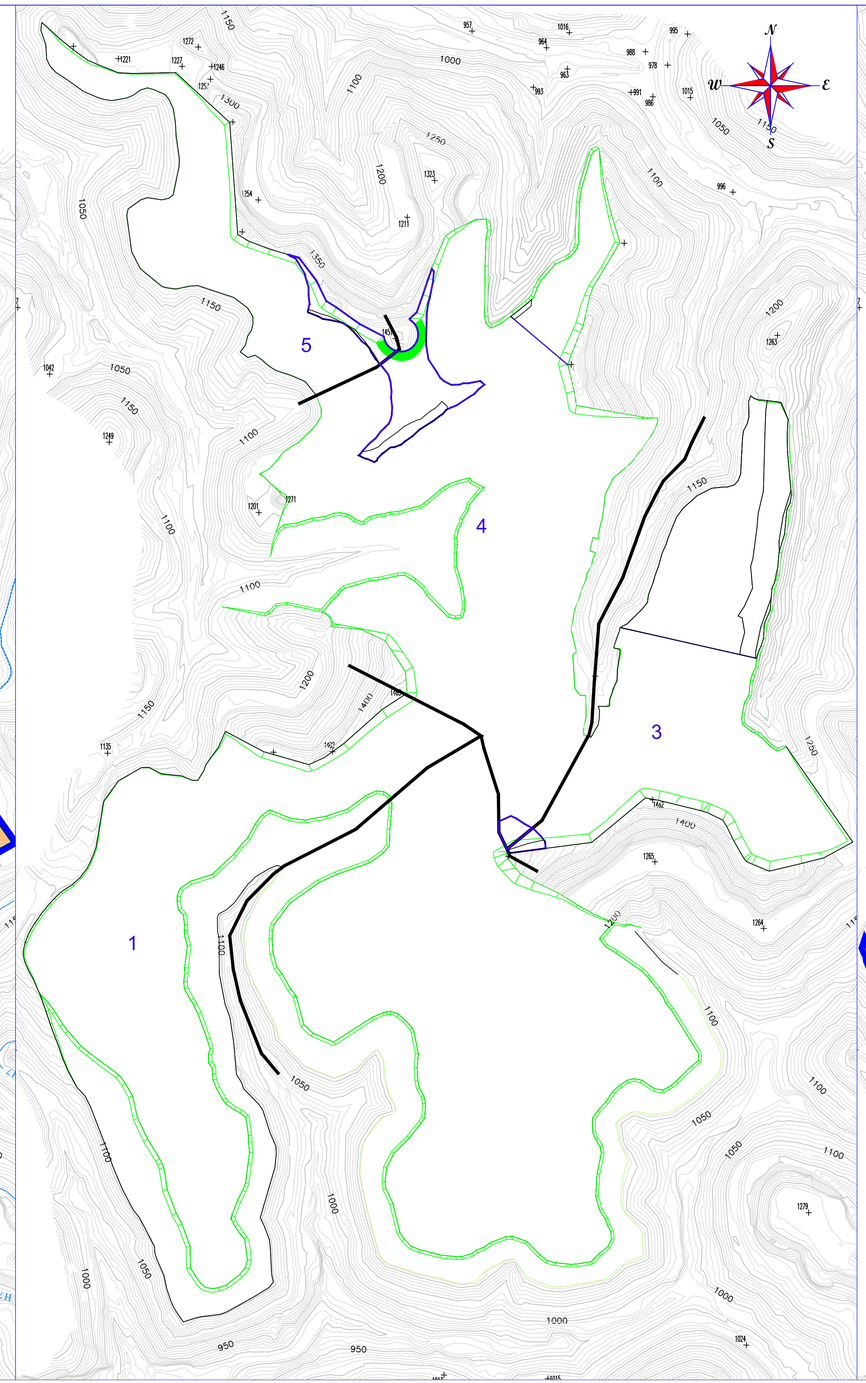
c: Permit File Janice Zimmer (e)
Charles Niquette, CRAI
Lindy Casebier, SHPO (e)

APPENDIX G

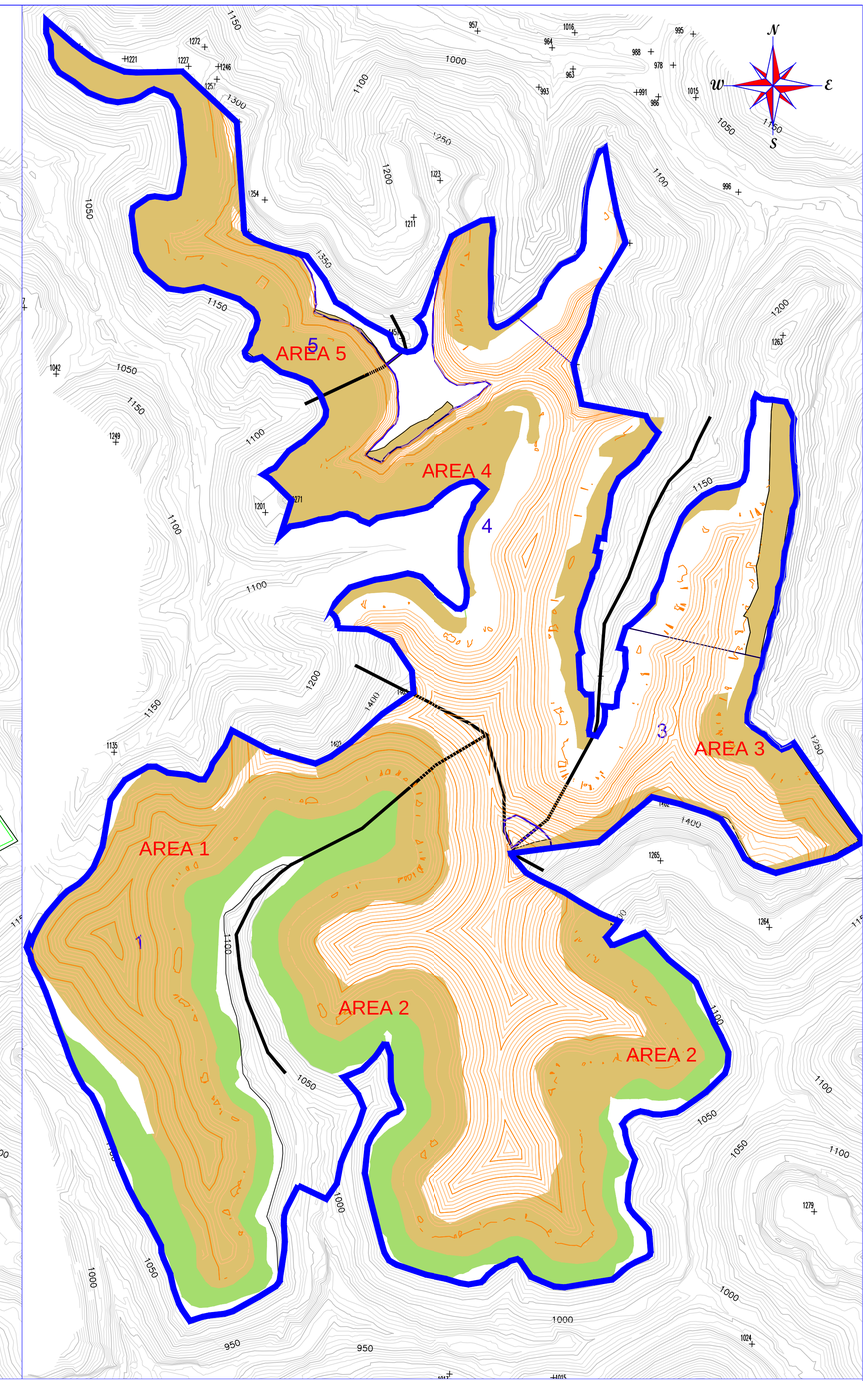
Nationwide 49 Permit Calculation Exhibit



EXISTING PLAN VIEW



PROPOSED EXCAVATION PLAN VIEW



PROPOSED BACKFILL PLAN VIEW WITH PREVIOUS MINED AREAS

PREVIOUSLY MINED AREAS (AREA TO BE RECLAIMED)

REMAINING AREA TO BE MINED

5 SEAM PREVIOULSY MINED AREA

7 SEAM AND ABOVE PREVIOUSLY MINED AREA

DRAWN BY: D.HANNAH	ICG HAZARD, LLC 3228 SUMMIT SQUARE PLACE, SUITE 180 LEXINGTON, KY. 40509	SUMMIT ENGINEERING,INC. 131 Summit Drive Pikeville, Ky. 41501 (606) 432-1447	SCALE: 1" = 400'
CHECKED BY: A.CHILDERS			DATE: 08/08/2014
APPROVED BY: A.CHILDERS	NATIONWIDE 49 EXHIBIT MAP SAM CAMPBELL BRANCH PERMIT NO. 897-0587	Lexington,Ky ● Henderson, Ky. South Charleston,W● Bridgeport, WV	ATTACHMENT:
PER. NO: 897-0587			SHEET:
Plot Date: 29 AUGUST 2014 – 2:23 PM			OF:

Z:\ICG\897-0587 (previously 897-0507)\Corps of Engineers\DWG\8970587_NW49_SITE-8-11-14.dwg